

4th INTERNATIONAL CONFERENCE 3D MEASUREMENT AND IMAGING

MEDZINÁRODNÁ KONFERENCIA 3D ZOBRAZOVANIE A MERANIE (4. ročník)

SEA
Agentúra pre vzdelanie a vedu

Abstracts and Presentations

Abstrakty a prednášky

16th - 17th OCTOBER, 2019
ODOBORÁRSKA 21, BRATISLAVA

ABSTRACTS AND PRESENTATIONS

4th INTERNATIONAL CONFERENCE **3D MEASUREMENT AND IMAGING**

16th-17th OCTOBER, 2019
ODOBORÁRSKA 21, BRATISLAVA

Expert Guarantors:

VÝSKUMNÉ CENTRUM ŽILINSKEJ UNIVERZITY V ŽILINE
RESEARCH FOR PEOPLE

International Laser Centre

Organized by:

SEA Agentúra pre vzdelanie a vedu

VISION SYSTEMS KVANT GROUP

KVANT®

Partners:

KVANT®

TESCAN PERFORMANCE IN NANOSPACE

EXPERT FOR 3D LANDSCAPE

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DETECTION AND MONITORING OF CAR AND PEOPLE USING 4D RADAR

Ing. Lukáš Maršík[1]
[1] CAMEA, spol. s r.o.

Abstract

S posunem radarů směrem k 60GHz jde ruku v ruce i miniaturizace antény a tím i celého řešení. Radary jsou často implementovány ve formě jednočipového řešení s výpočetní silou a malým příkonem, v případě některých variant navíc i s integrovanou anténou. Velkou výhodou je pak možnost skrytí takovýchto senzorů, které vidí přes neprůhledné kryty či dokonce zdi, nebo například plastové nárazníky automobilů. Oproti kamerám odpadá závislost na světle a radary jsou taktéž odolnější proti nepříznivým povětrnostním podmínkám. Díky tomu, že radarový senzor přímo poskytuje informaci o vzdálenosti, rychlosti a směru pohybu, lze jej vhodně použít pro vylepšenou detekci, sledování i klasifikaci chodců, cyklistů nebo automobilového provozu.



4D RADAR FOR PEOPLE DETECTION AND TRAFFIC MONITORING

Lukáš Maršík (l.marsik@camea.cz)

Technologická agentura České republiky

Centra kompetence

camea

CAMEA IMAGE & SIGNAL PROCESSING

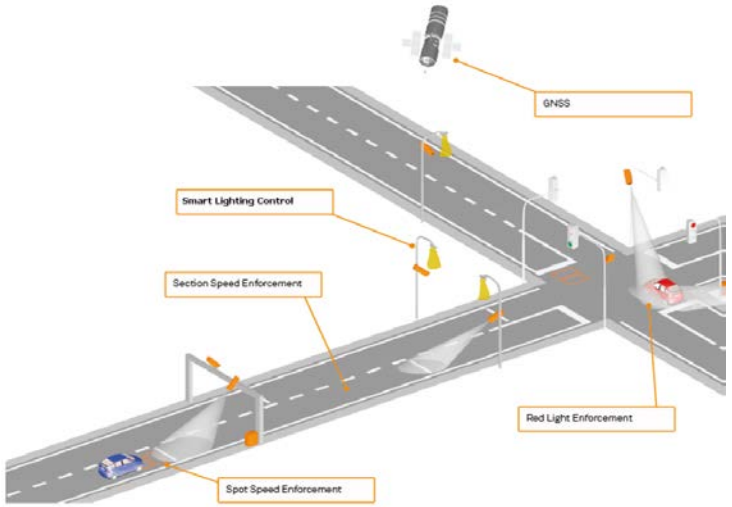
- Founded in 1995 by a group of researchers
- Located in BRNO (CZ), currently ~100 employees
- Focus on industrial and traffic applications
- R&D, manufacturing, selling, servicing, maintenance of components, systems, custom solution
- Has produced and deployed around the world hundreds of visual systems with thousands of video cameras and real-time processing units

CAMEA'S ITS SYSTEMS

- UNICAM platform
- Weigh-In-Motion
- Enforcement Systems
- Traffic Monitoring
- Vehicle Identification
- ITS Technologies

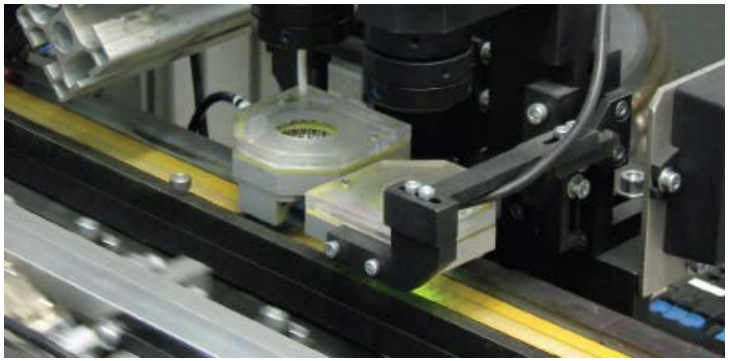




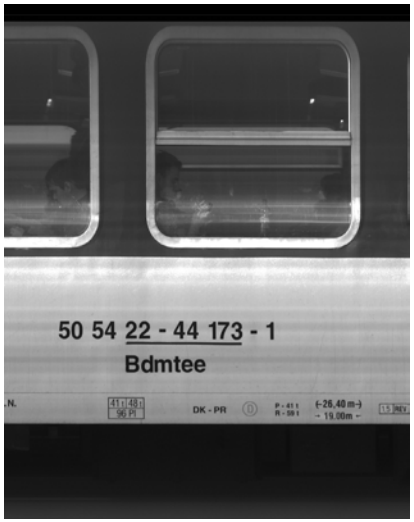


CAMEA'S INDUSTY SYSTEMS

- Web Inspection
- Bottle Inspection
- Component Inspection
- Laser Beam Deflector
- 3D reconstruction
- Label Inspection
- Automatic identification of railway carriages







RADAR IN CAMEA SYSTEMS

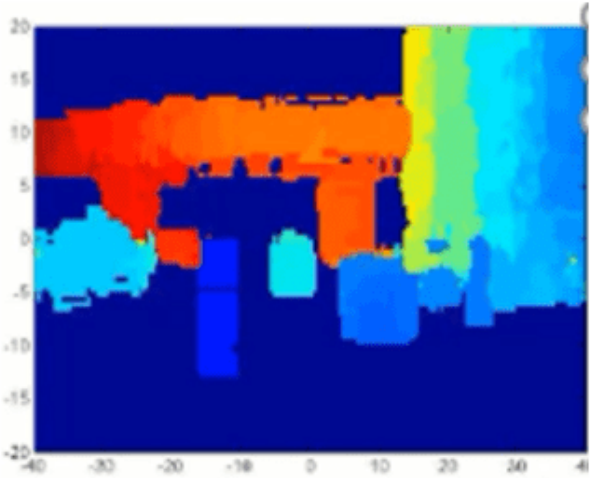
- Mobile multi-lane enforcement system
- Spot speed enforcement
- Camera triggering
- Vehicle presence detection
- Vehicle counting (statistics)
- Train speed recording
- Pedestrian/cyclist counting



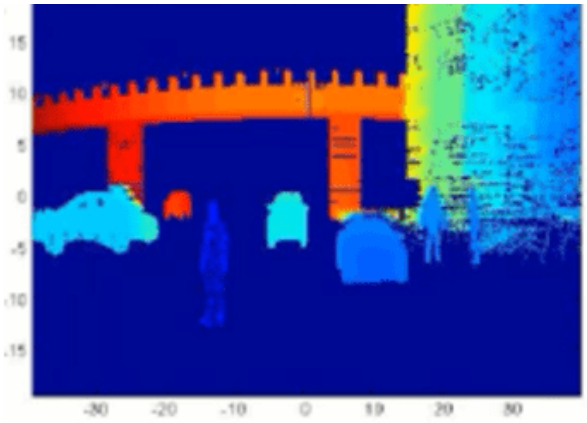


4D RADAR

- Range
  - FMCW - fast ramps (3D FFT)
- Azimuth
  - Rx antenna phased array
- Elevation
  - Tx switching or Rx phased array
- Velocity
  - Doppler – phase difference in time



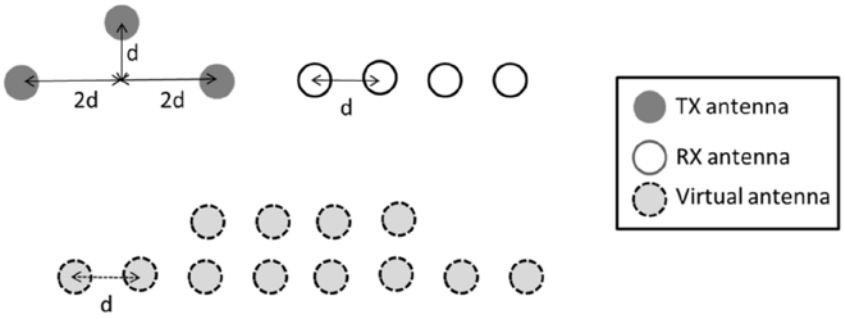
High Resolution Radar

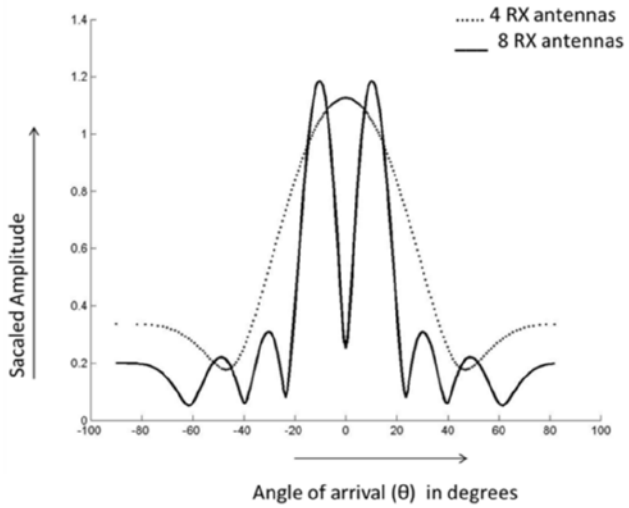


Lidar

MIMO VS BEAMFORMING

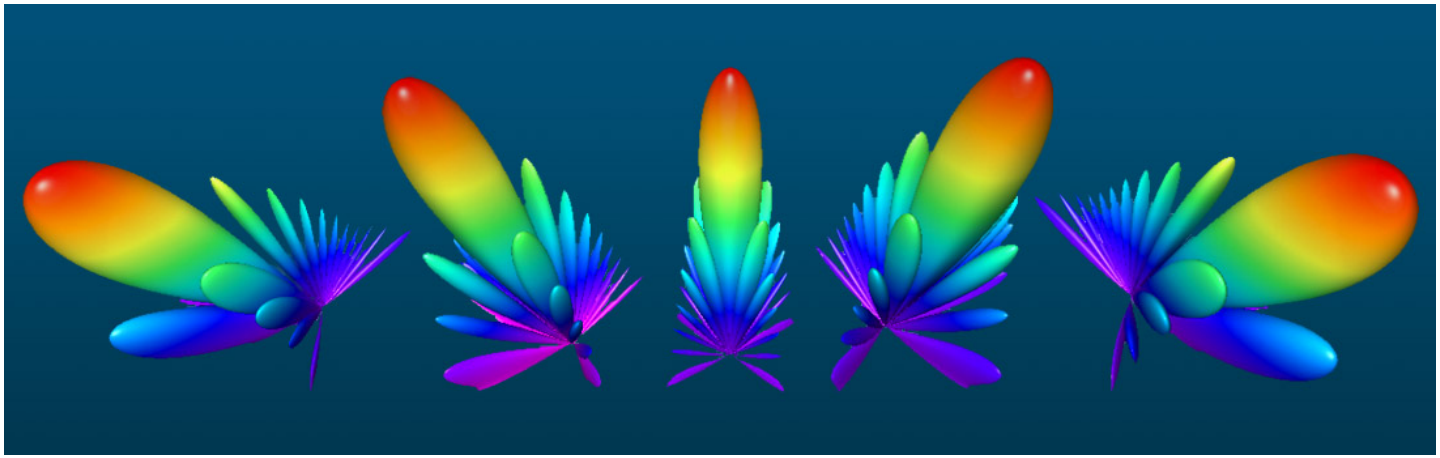
- MIMO (Multiple-Input Multiple-Output)
  - Better angular resolution
  - Short and medium range applications





MIMO VS BEAMFORMING

- Beamforming
  - Steering/focusing of transmitted beam
  - Medium and long range applications

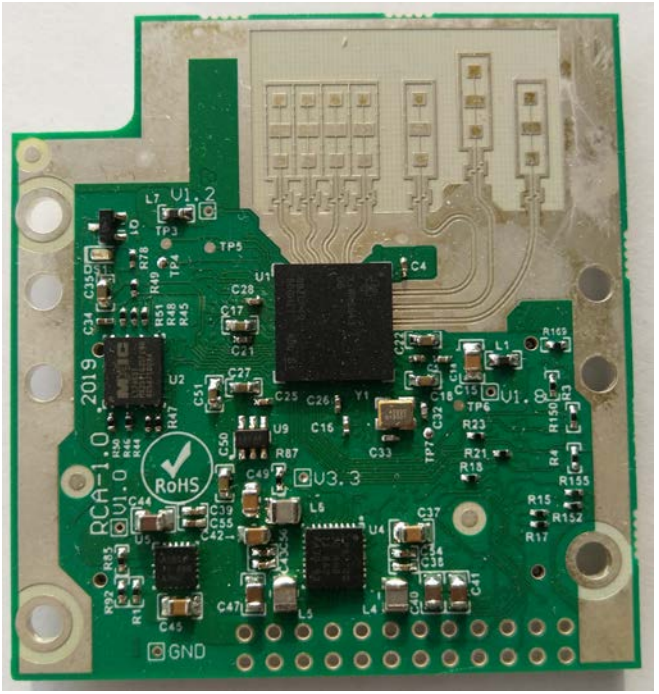


RADIO BAND

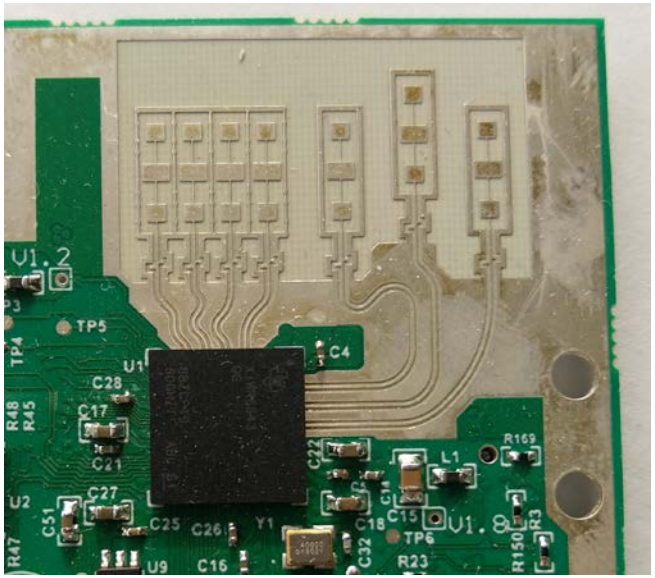
- 60-64GHz frequency band
  - Unlicensed in most countries
  - Mostly 1-2GHz bandwidth needed
  - Can be extended to 57-64GHz (wideband antenna)
- 76-77GHz and 77-81GHz as an alternative
  - Needs completely different antenna
  - Automotive frequencies

US-RCA

- CAMEA design based on Radar-on-Chip
- RF PCB with silver plating
  - Few manufacturers only
  - Design has to be tuned
- Various antenna topologies
- Most of computation done within the module



US-RCA



- 4Rx antennas
  - FOV 110° horiz. (40° vert.)
  - Azimuth angle resolution 30°
- 3Tx antennas
  - Improve azimuth resolution (15° with MIMO)
  - Allow elevation detection (res. 60° with MIMO)
  - Alternatively enables beam steering

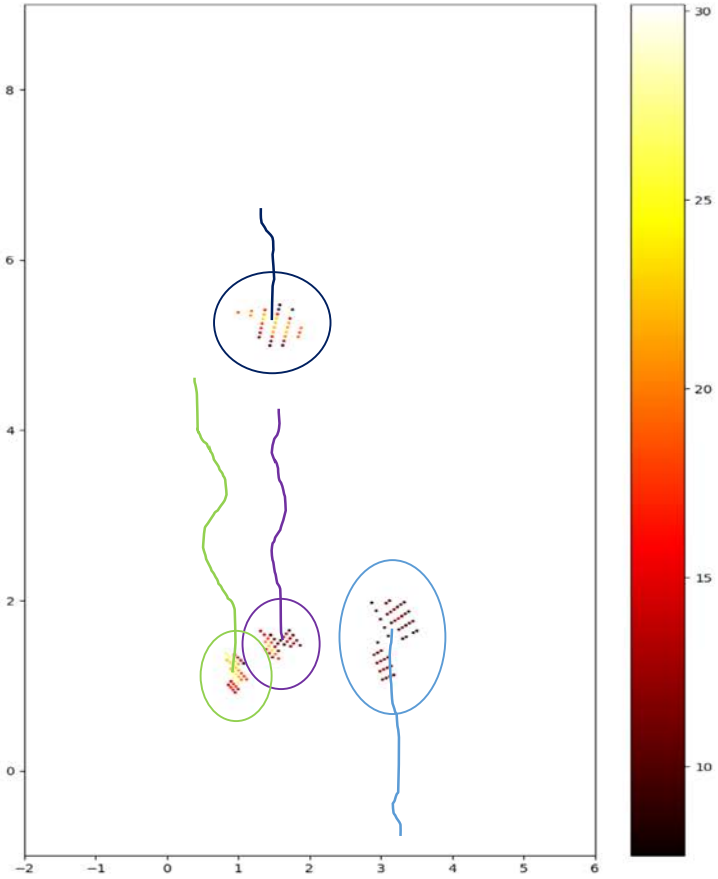
CONFIGURATION

- Configuring for target **range** (max./res.), **velocity** (max./res.) and **angular** resolution
- Limited by memory of platform (radar cube)
- Balancing requirements:
  - High max. range – lower range resolution
  - High max. velocity – worse angular resolution
  - …

TRACKING

- Rich point cloud
- Points are grouped
- 2D group tracking
  - Range + azimuth + Doppler
- 3D group tracking
  - Range + azimuth + Doppler + elevation

TRACKING

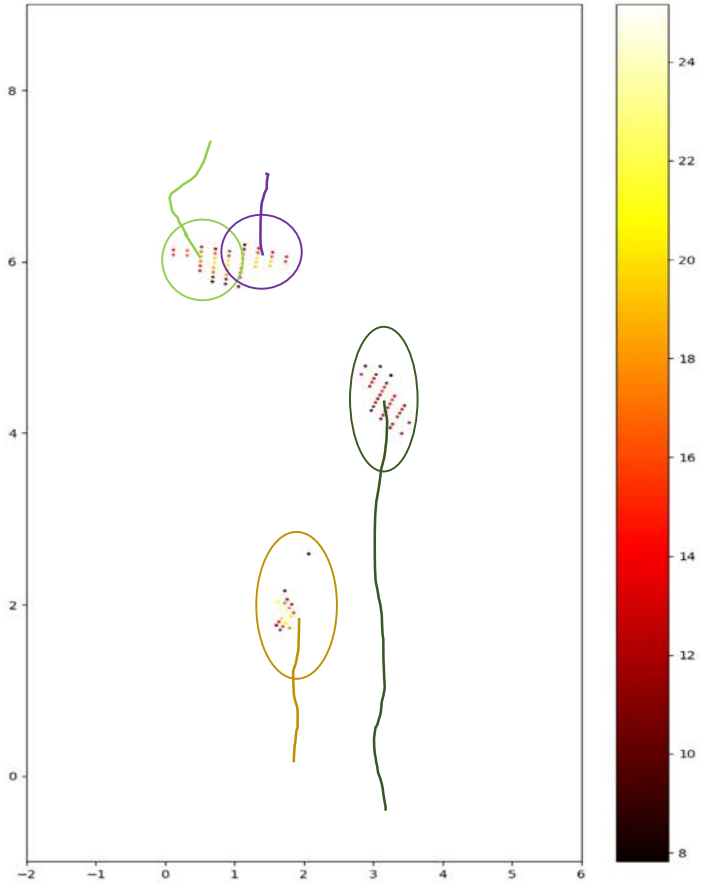

8
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15
10


PN-VY-P1 14:46:18 2019/05/19
0
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300
400
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100
200
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400
500
600

PEOPLE DETECTION

- Configured for:
  - Slower speed ~24kph
  - Shorter distance ~14m (longer range possible)
  - Fine range resolution ~12cm (bandwidth 1229MHz)
  - Velocity resolution ~0.4kph
  - Good angular resolution (15°)
  - Tracking in 2D or 3D
  - Up to 20 persons (counting **accuracy 93%**)
  - Measurement rate 20FPS

PEOPLE DETECTION





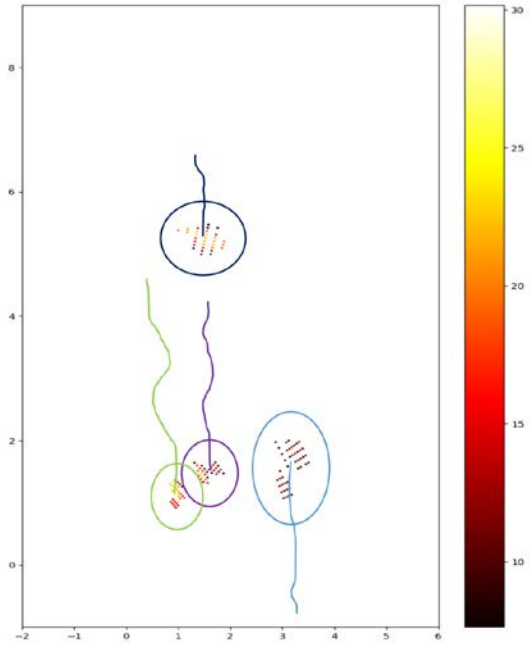
TRAFFIC MONITORING

- Configured for:
  - Faster speed ~65kph (can be extended 3x)
  - Longer distance ~185m
  - Fine range resolution ~80cm (bandwidth 186MHz)
  - Velocity resolution ~1kph
  - Fair angular resolution (30°)
  - Tracking in 2D or 3D
  - Up to 15 vehicles (counting **accuracy 96%**)
  - Measurement rate 20FPS

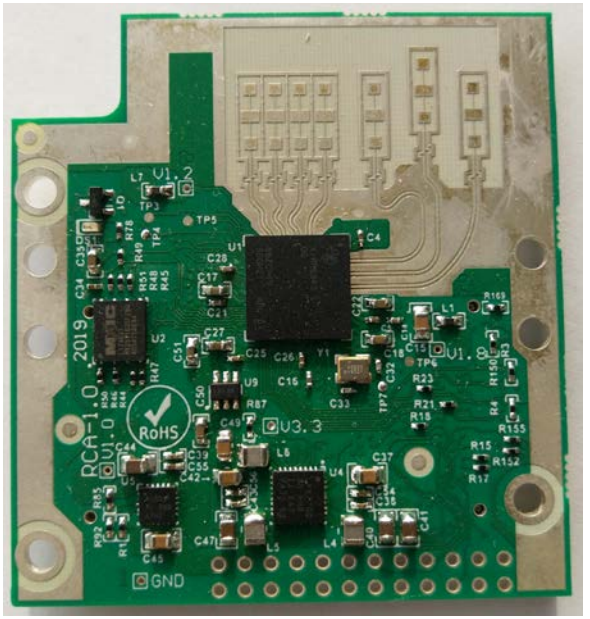
CHALLENGES

- Various object detection, tracking and classification
- Classification of objects based on AI (e.g. CNN)
- Novel applications – altimeter, vital sign detection, overhead human detection
- Reducing manufacturing costs

THANK YOU FOR YOUR ATTENTION







THE NEW ALVIUM CAMERA SERIES

Mr. Adrian Arndt[1]
[1] Allied Vision Technology

Allied Vision

member of the TKH Group

Allied Vision

member of the TKH Group



The New Alvium Camera Series

The revolutionary camera platform combining industrial performance and embedded vision.

Contents

- Introducing Alvium
- One Platform – Two Series
- Alvium and Embedded Ecosystems
- Alvium Camera Variants
- Conclusion

Allied Vision

Alvium Camera Series - More freedom than ever before

- Based on one revolutionary Allied Vision ASIC:
  The **Alvium Technology** platform
- Industrial-grade and single PCB design
- Various housings and lens mount options as standard
- Support of sensors up to 1.1” and 20MP
- Easy software integration by offering:
  - One driver for all CSI-2 models
  - A USB3 Vision compliant standard interface

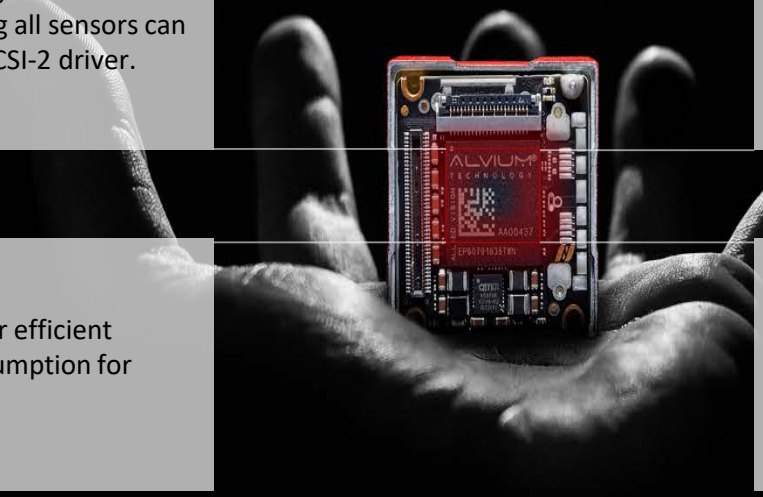


Allied Vision

Alvium Technology – The Powerhouse behind the Series

// ONE CHIP, UNLIMITED POSSIBILITIES
ALVIUM Technology supports a large choice of current and future sensors ensuring all sensors can be accessed with one shared MIPI CSI-2 driver.

// ENERGY-EFFICIENCY:
ALVIUM Technology allows a power efficient operation by disabling power consumption for unused functionalities



// ON-BOARD IMAGE-PREPROCESSING:
With the sophisticated integrate ISP, Alvium can shift image processing tasks from the board to the camera, increasing the performance or lowering system costs.

// FLEXIBLE CAMERA CONTROL
With the standardized interfaces and the provided drivers, Alvium cameras are easy to integrate and will save the engineer much time for a faster go-to-market.

Allied Vision

Allied Vision

member of the TKH Group

// ONE PLATFORM – TWO SERIES

Introducing Alvium

- Powered by ALVIUM Technology
- Robust industrial hardware
- Efficient power management
- On-board image processing (Advanced ISP)
- Long-term availability



Alvium 1500 Series – Embedded vision made easy

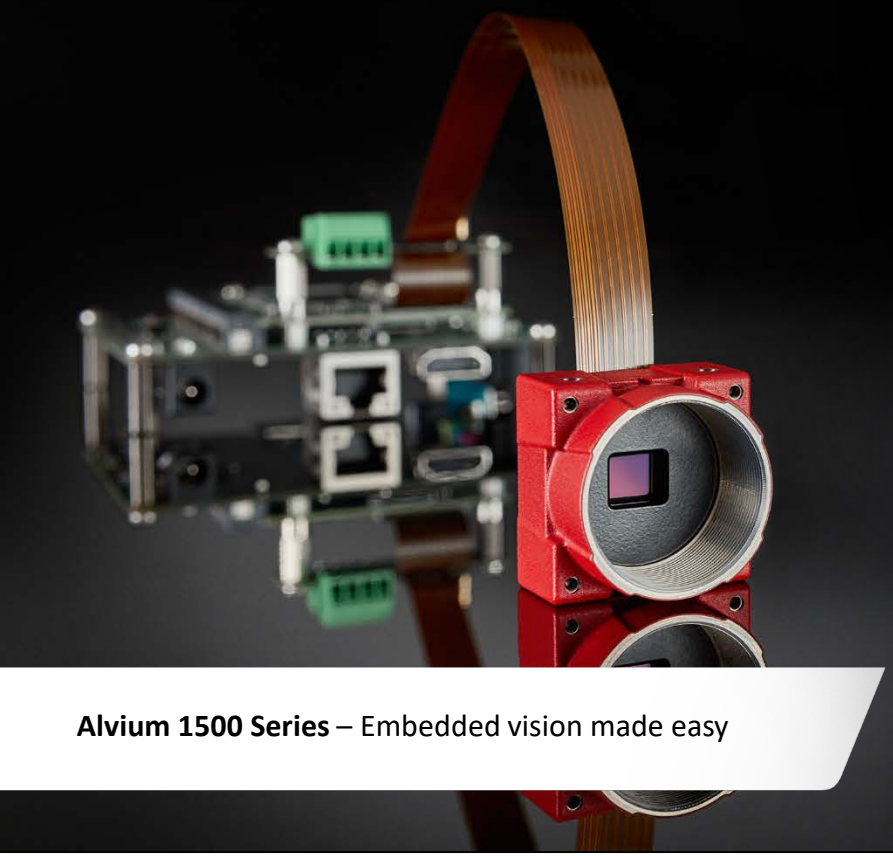
Alvium 1800 Series – Bridging embedded and machine vision

Allied Vision

member of the TKH Group

// ONE PLATFORM – TWO SERIES

Introducing Alvium



Alvium 1500 Series – Embedded vision made easy

- Powered by ALVIUM Technology
- Robust industrial hardware
- Efficient power management
- On-board image correction
- Long-term availability

- MIPI CSI-2 interface
- Video4Linux2 and Direct Register Access control
- One driver for all models
- Open source Vimba drivers available
- 3 sensors with up to 5 Megapixel

Allied Vision

member of the TKH Group

// ONE PLATFORM – TWO SERIES

Introducing Alvium

- Powered by ALVIUM Technology
- Robust industrial hardware
- Efficient power management,
- On-board image correction,
- Long-term availability

- USB3 Vision interface
- Additional closed housing variant
- Easy integration into embedded and PC-based systems
- with free Vimba software suite.
- Compatible with GenICam compliant image processing libraries
- Advanced triggering functions



Alvium 1800 Series – Bridging embedded and machine vision

// CONCEPT 1500 SERIES

The Embedded Camera Module

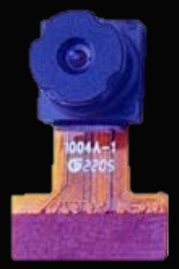
- Industrial grade camera module
- Validated drivers
- Highly aligned lens mounts with free choice of lens



Alvium 1500 Series – Embedded vision made easy

VS

- Consumer sensor module
- Half-baked reference implementations
- Integrated lens



// CONCEPT 1500 SERIES

The Embedded Camera Module

Industrial grade camera module

- Long-term availability
- Full camera control
- Full support and documentation

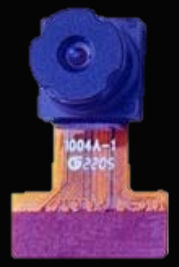


Alvium 1500 Series – Embedded vision made easy

VS

Consumer sensor module

- Out of production after short time
- Limited camera control
- Sparse support and documentation



// CONCEPT 1500 SERIES

The Embedded Camera Module

Validated drivers

- Thoroughly tested drivers and hardware
- Full functionality of camera
- One driver for all sensors

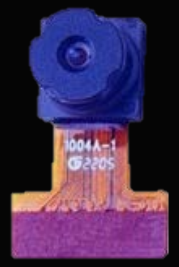


Alvium 1500 Series – Embedded vision made easy

VS

Half-baked reference implementations

- Lack of stability and documentation
- Only few functions supported
- Different drivers for every module



// CONCEPT 1500 SERIES

The Embedded Camera Module

Highly aligned lens mounts with free choice of lens

- Alignment in 6 DOF, accuracy of few microns
- 3 mounts to choose from
- any standard lens can be used

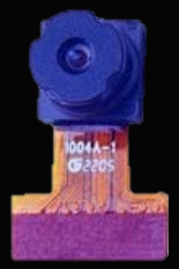


Alvium 1500 Series – Embedded vision made easy

VS

Integrated lens

- Limited choice of lens
- One type of lens per project (volume)



// CONCEPT 1800 SERIES

The Crossover Camera Series

Combination of the best of embedded and machine vision

Huge versatility

- Many sensors, housings, interface options
- Available with USB3 Vision and CSI-2* interface
- From single pieces to large volumes

A machine vision feature set for all

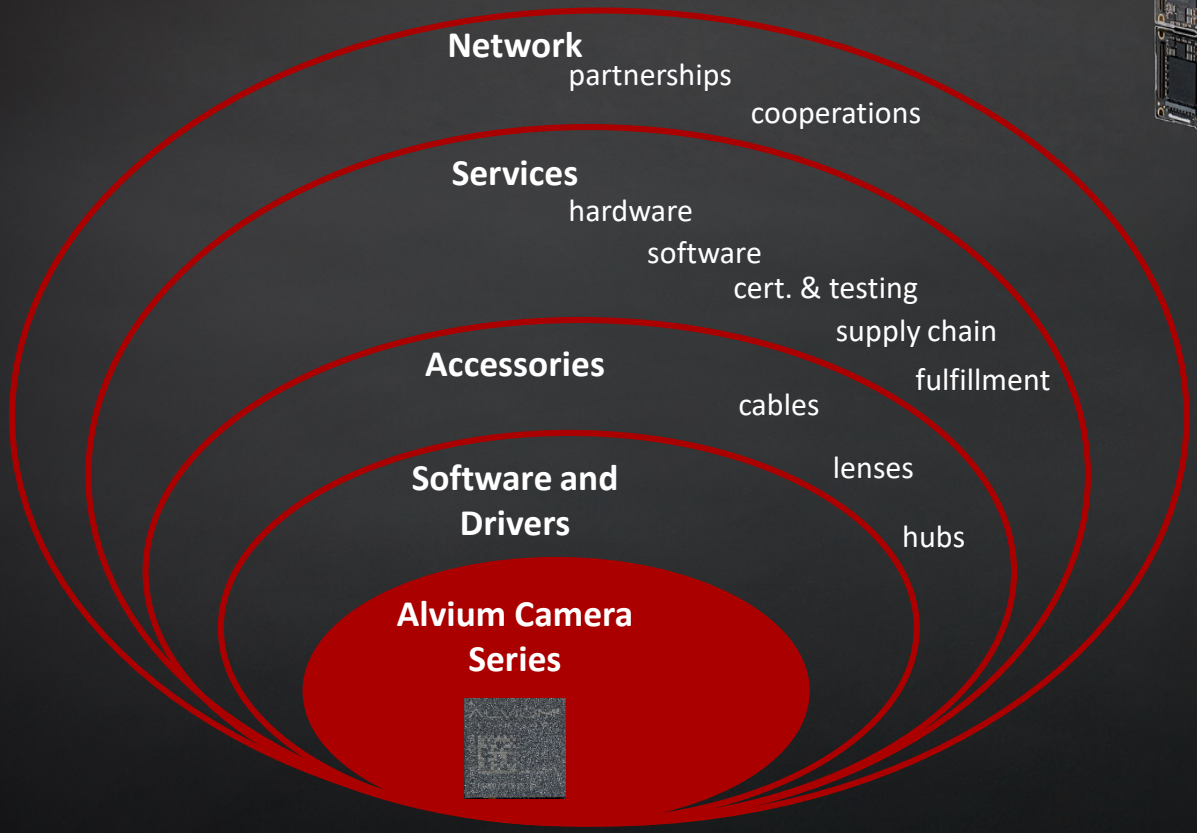
- Precise exposure control
- Configurable auto features
- Advanced triggering functionalities
- Simple I/O control



Alvium 1800 Series – Bridging embedded and machine vision

* available soon

Alvium Ecosystem



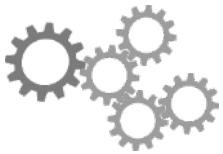


Allied Vision

Embedded Ecosystem

Customer





EMBEDDED SOLUTION

- Use Case
- Application
- SW Framework
- Camera API
- Rootfs + User libs
- Board Support Package
- Kernel
- Image source / Camera
- Custom hardware
- Carrier board
- System on Chip processor

- Customers and embedded system designers have to challenge very complex ecosystems for their solutions
- Other than in the machine vision world, most components lack standards and established technologies
- The variety is higher and technology develops faster
- Majority of customers have already specific R&D capabilities in house
- They will ask the market and search partners to compensate their lack of knowledge

Within the embedded market the right Partner Network is key

Alvium Camera Variants

1500 C Variants

// Mono / Color




// Bareboard, Open Housing




// S- (M12-), C-, or CS-mount





1800 U Variants

// Mono / Color



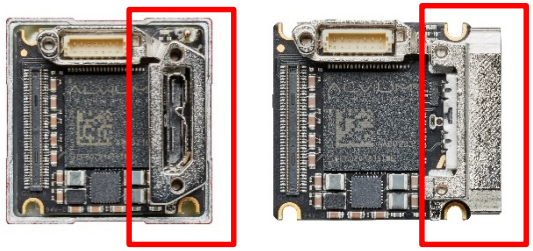
// Bareboard, Open Housing, Closed Housing



// S- (M12-), C-, or CS-mount



// Standard interface orientation /
90° side orientation



Conclusion

We believe Embedded Vision should be easy and fast

- The integrated ISP standardizes pre-processing independently of interface and host architecture
- Our stable and mature drivers and API enable a quick turnaround
- The large model line-up satifies most imaging requirements.

Thank you!
Discussion

Allied Vision

OPPORTUNITIES FOR DYNAMIC MICRO-CT IN THE LABORATORY

Vítězslav Ambrož [1]; Lars-Oliver Kautschor[2]
[1] TESCAN ORSAY HOLDING, a.s. ; [2] TESCAN XRE, Ghent, Belgium

Abstract

Time-resolved 3D imaging with X-rays has rapidly emerged as an essential technique to understand materials evolution, facilitating in situ investigations ranging from mechanical deformation to fluid flow in porous materials and beyond. Imaging of dynamic processes is one of the key applications at synchrotron facilities, pushing the time resolution more and more down with quite some success. However, access to those facilities is often limited and operational cost are quite high.

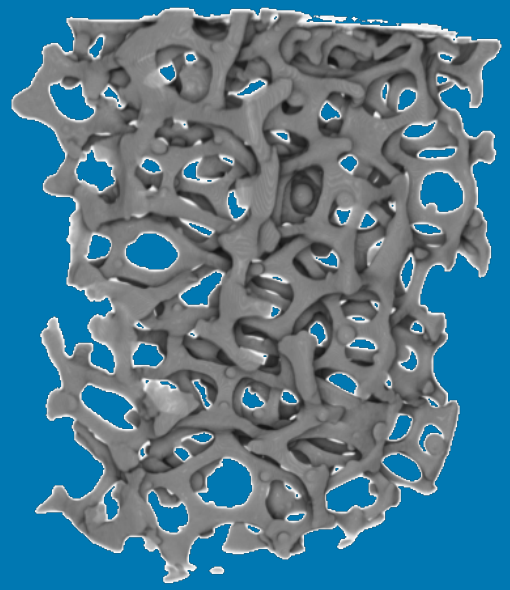
In the laboratory, image quality and spatial resolution have been significantly improved, often at a cost of temporal resolution however. Recent developments at TESCAN XRE have made it possible to visualize and inspect dynamic process in the laboratory with a temporal resolution below 10 seconds. In this study we explore the challenges and innovations that have led to this capability.

Dynamic acquisitions however, generate vast amounts of raw projection data, which need to be reconstructed, further post processed and eventually quantified. It is therefore essential to devise workflow strategies to quickly identify the interesting moments prior to reconstruction to optimize the amount of data that is generated, but also incorporate the added time dimension in the 3D analysis workflow to improve image quality. Challenges and possibilities in dynamic micro CT imaging will be demonstrated here across materials, life science and geomaterial applications.

TESCAN
PERFORMANCE IN NANOSPACE

TESCAN micro-CT

A new alternative in multidimensional X-ray imaging



Dr. Lars-Oliver Kautschor

Regional Product Manager TESCAN micro-CT

Lunchtime Lecture
Microscopy Conference 2019, Berlin
7 October, 2019

Micro-CT comes to TESCAN





GHENT UNIVERSITY UGCT

Centre for X-ray Tomography (UGCT)
Est. 2006

Ghent University
Center of Excellence

INSIDE MATTERS
INSIGHTS TO INNOVATE

Inside Matters NV
Est. 2008

Services and software solutions for tomography communities.

XRE
X-RAY ENGINEERING

X-ray Engineering bvba
Est. 2011

Developers of innovative micro-CT platforms

XRE

XRE NV
Est. 2017

A new alternative for 3D X-ray imaging
Dynamic solutions for your lab

TESCAN
PERFORMANCE IN NANOSPACE

XRE Joins TESCAN
March 2018

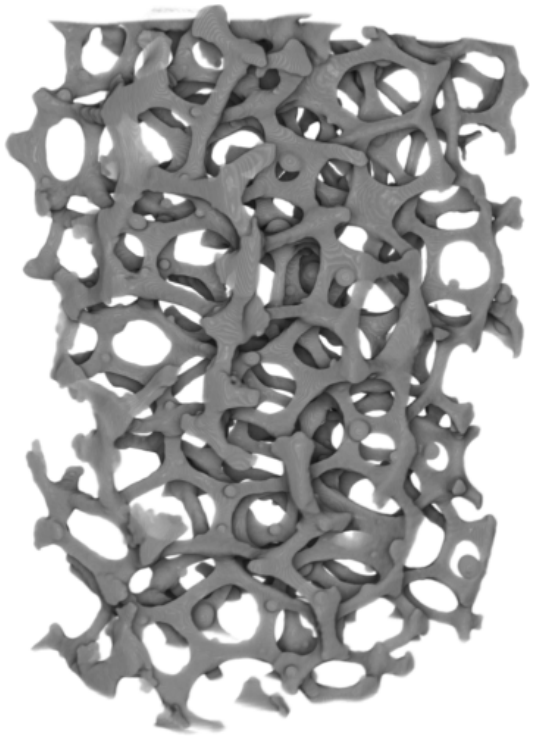
TESCAN XRE

A new alternative in 3D X-ray imaging

Dynamic solutions for your lab

Mission:

Through a collaborative spirit, facilitating advances in scientific and industrial research through innovative and dynamic X-ray imaging technologies.

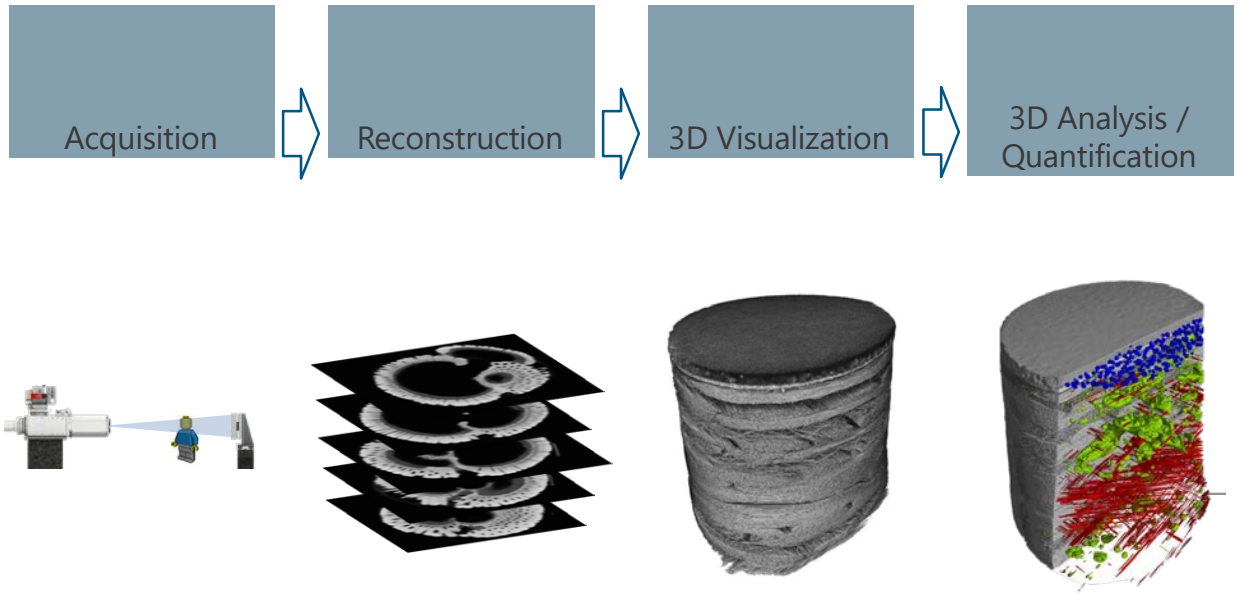


Compression of metal foam

But….before getting too deep into dynamic imaging…

Introduction to Micro-CT

Basic Elements of a micro-CT workflow



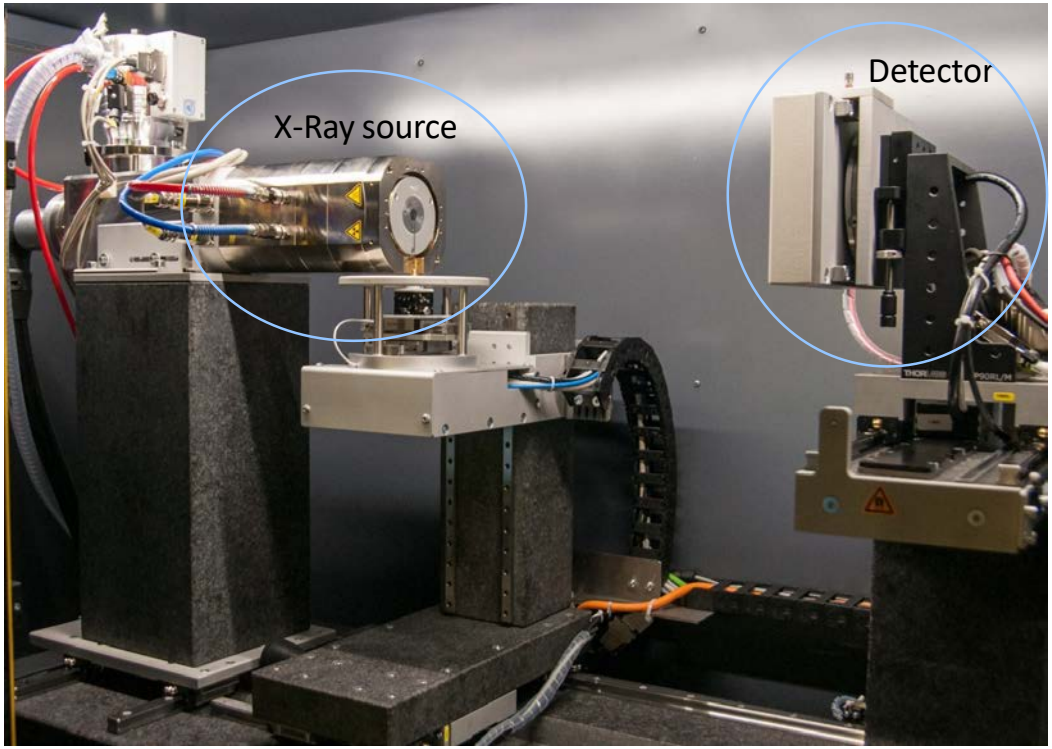
micro-CT Advantages

- Non-destructive & no Sample Preparation



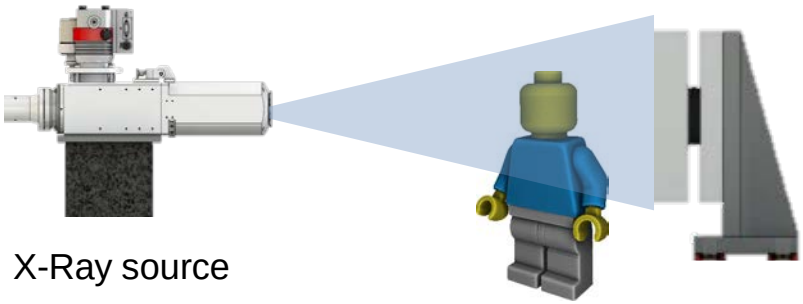


Basics of micro-CT imaging
X-Ray Imaging

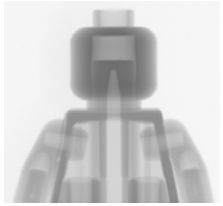


How does micro-CT work?

Acquisition



Reconstruction

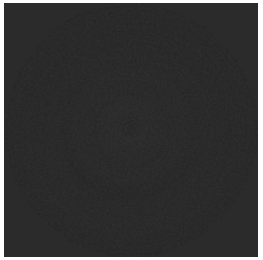


Set of 2D Projections

Visualization Analysis

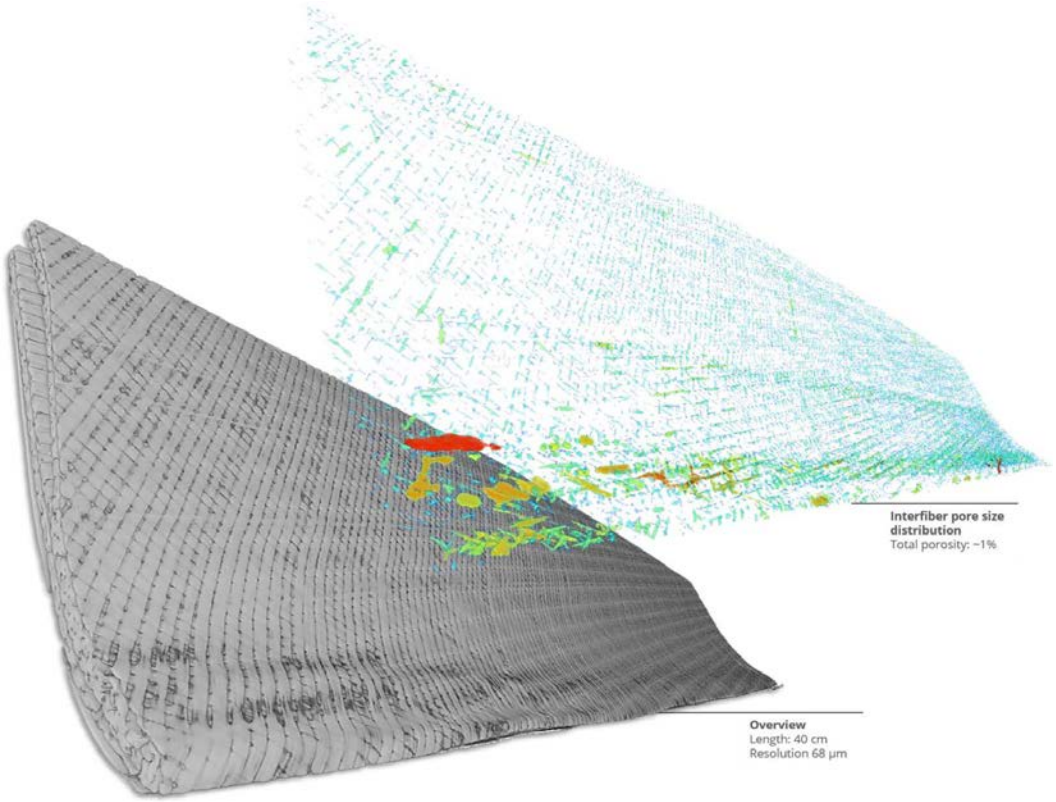


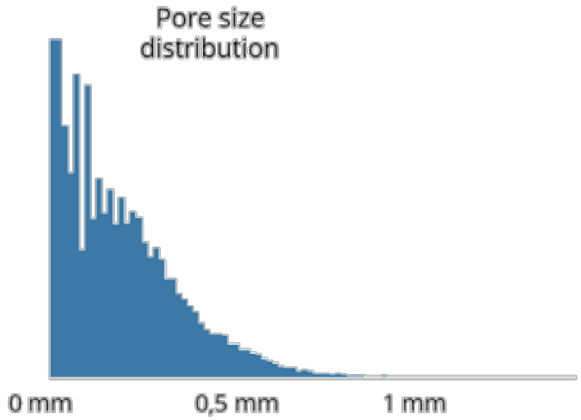
3D Rendering



Virtual 2D Cut

Composite – Wind Turbine

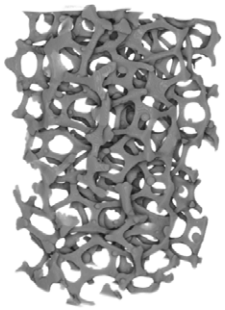






Applications for micro-CT

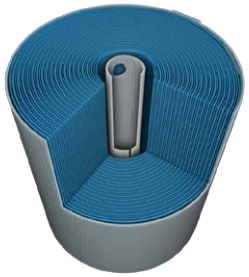
Materials Science



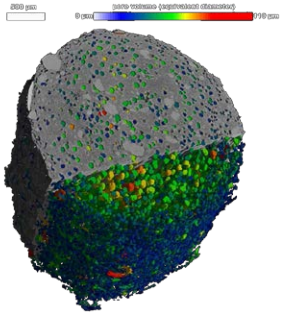
Life Science



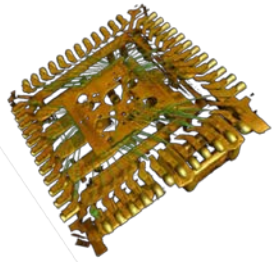
Batteries



Pharmaceuticals



Electronics



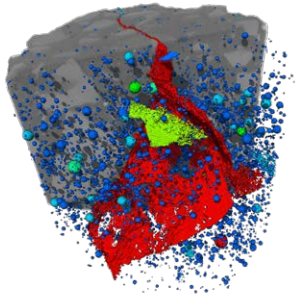
Geo Science



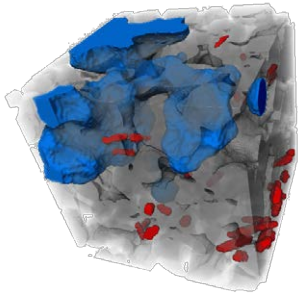
Oil & Gas



Building Materials



Mining



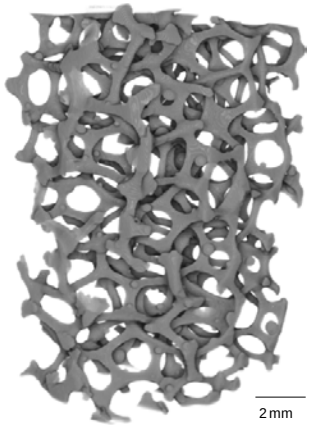
Packaging/Consumer Products



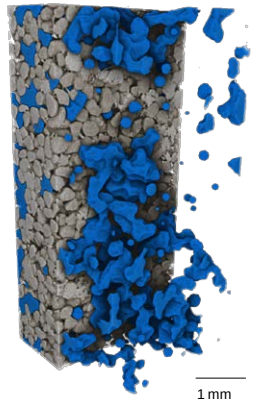
Back to the show…..

Dynamic Tomography

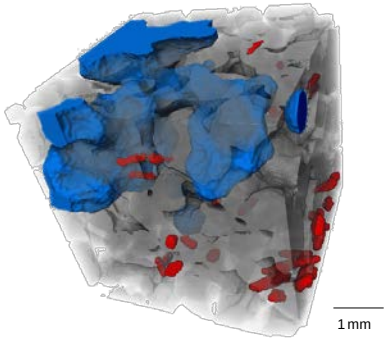
- Time—lapse X-ray imaging informs us of how materials **form**, **deform** and **perform**
- Why isn't it done more regularly?
  - It's hard! (and there are a finite number of PhD students…)
- Challenges at every step:
  - Acquisition
  - Reconstruction
  - Visualization
  - Analysis
- Many of the above are challenging enough in 3D!



Compression of metal foams

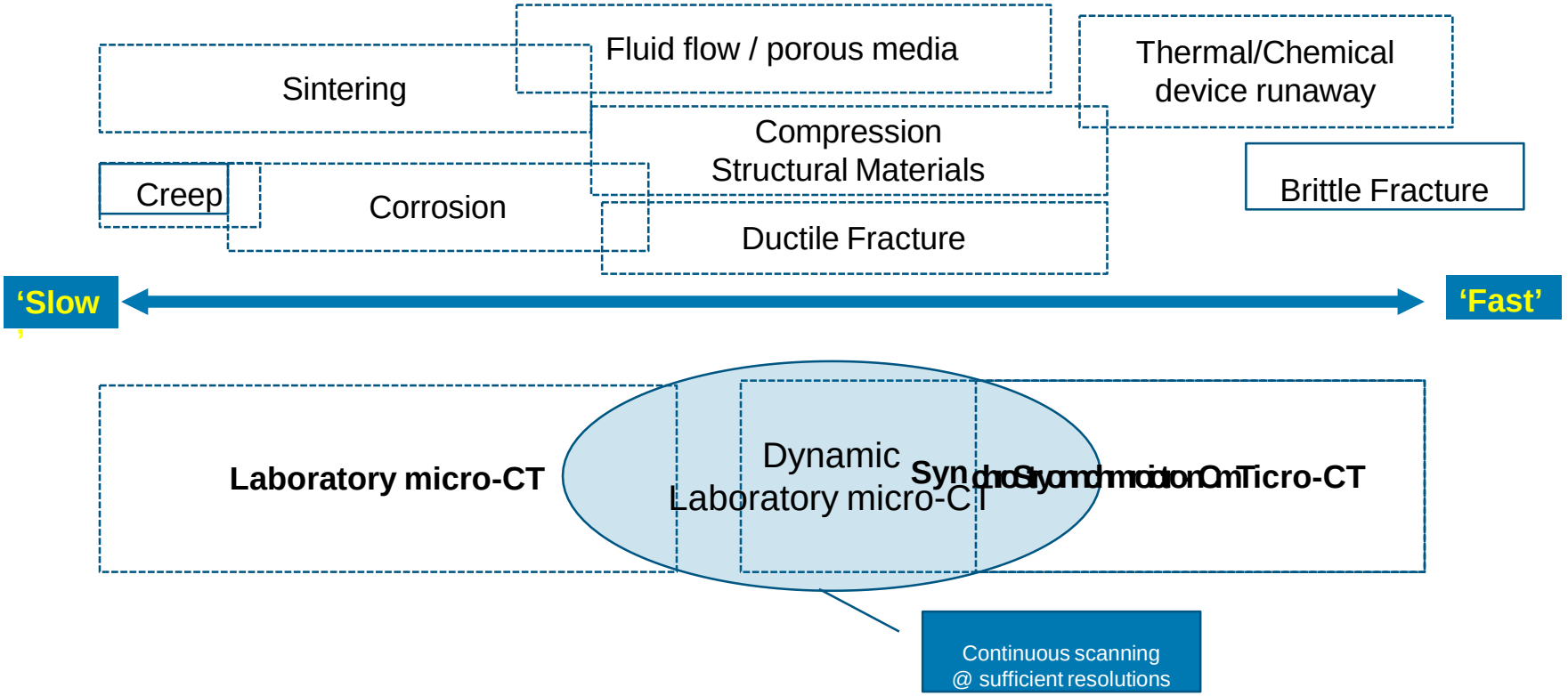


In situ Flow in Sandpack



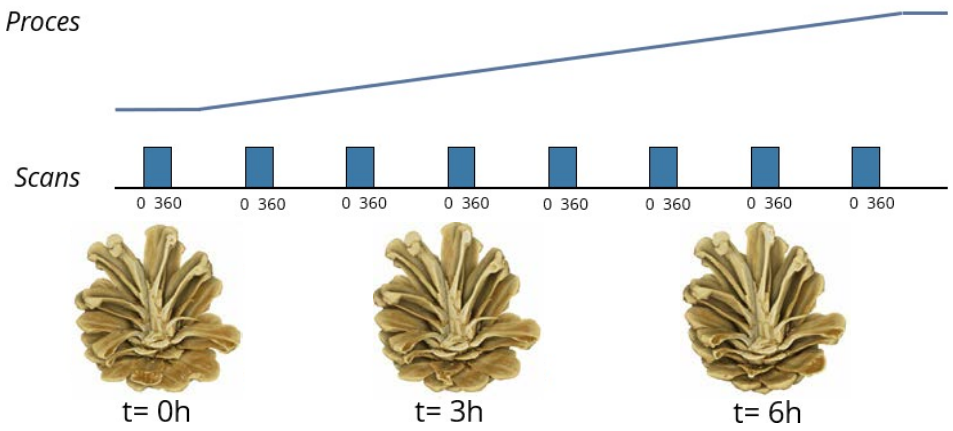
In situ mineralization

Aligning Time Scales to Physical Processes



Timelaps Tomography - Pinecone

2D 3D **4D** Dynamic

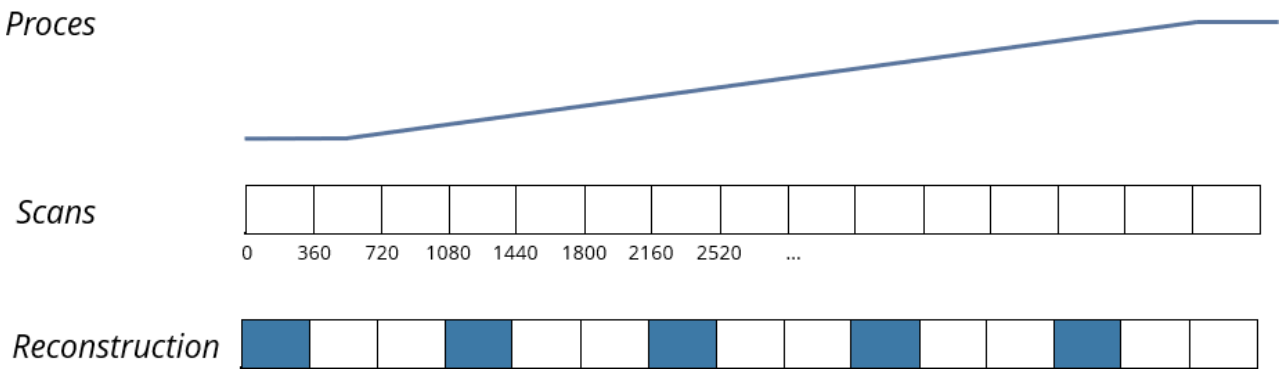


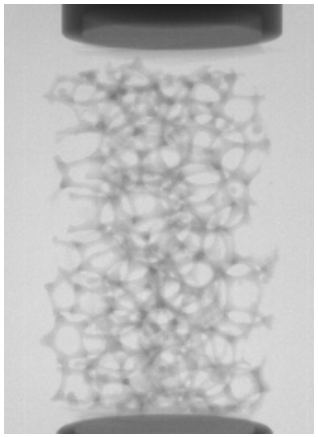


Dynamic CT – Continuous Tomography

Example “Metal Foam Compression”

2D 3D 4D **Dynamic**





TESCAN micro-CT Portfolio



TESCAN CoreTOM



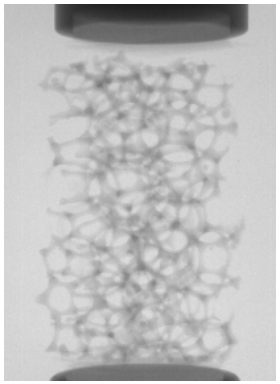
TESCAN DynaTOM

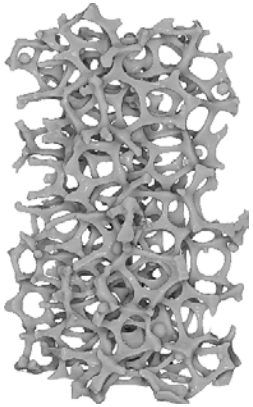


TESCAN UniTOM XL

TESCAN DynaTOM

The world's first dedicated **dynamic micro-CT** for your **in situ** experimental needs.









TESCAN DynaTOM

TESCAN DynaTOM

The world's first dedicated **dynamic micro-CT** for your **in situ** experimental needs.

- Unique gantry-based design
- Dedicated to dynamic tomography and time-lapse imaging
- Imaging of delicate samples and complex in situ set-ups
- Continuous scanning
- High throughput (< 10 sec per tomography)
- Dynamic screening for synchrotron beamtime



TESCAN DynaTOM

TESCAN CoreTOM

Micro-CT system optimized for rock core imaging

Fills gap between medical CT and high-resolution micro-CT



Key User Benefits:

- **Multi-scale imaging**
- Fast scanning & high sample throughput
- Up to **1m tall cores**
- Temporal resolutions **<10 seconds**
- Enables **in situ** experiments

From full size cores up to 1 m in length down to small microplugs or drill cuttings



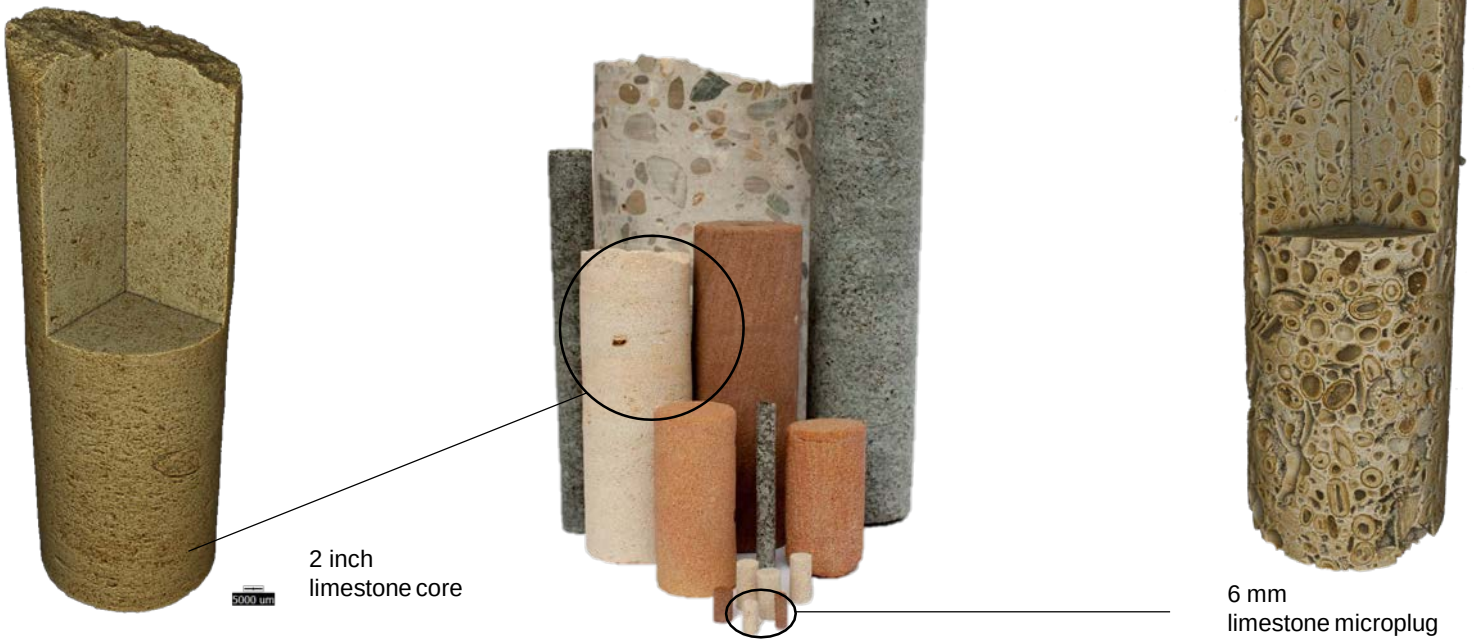
TESCAN CoreTOM

CoreTOM Typical Sample Ranges

TESCAN CoreTOM is a unique multiresolution micro-CT system designed to perform optimal imaging of full cores down to microplugs

From full size cores…
Length: up to 1 m
Diameter: up to 10 cm

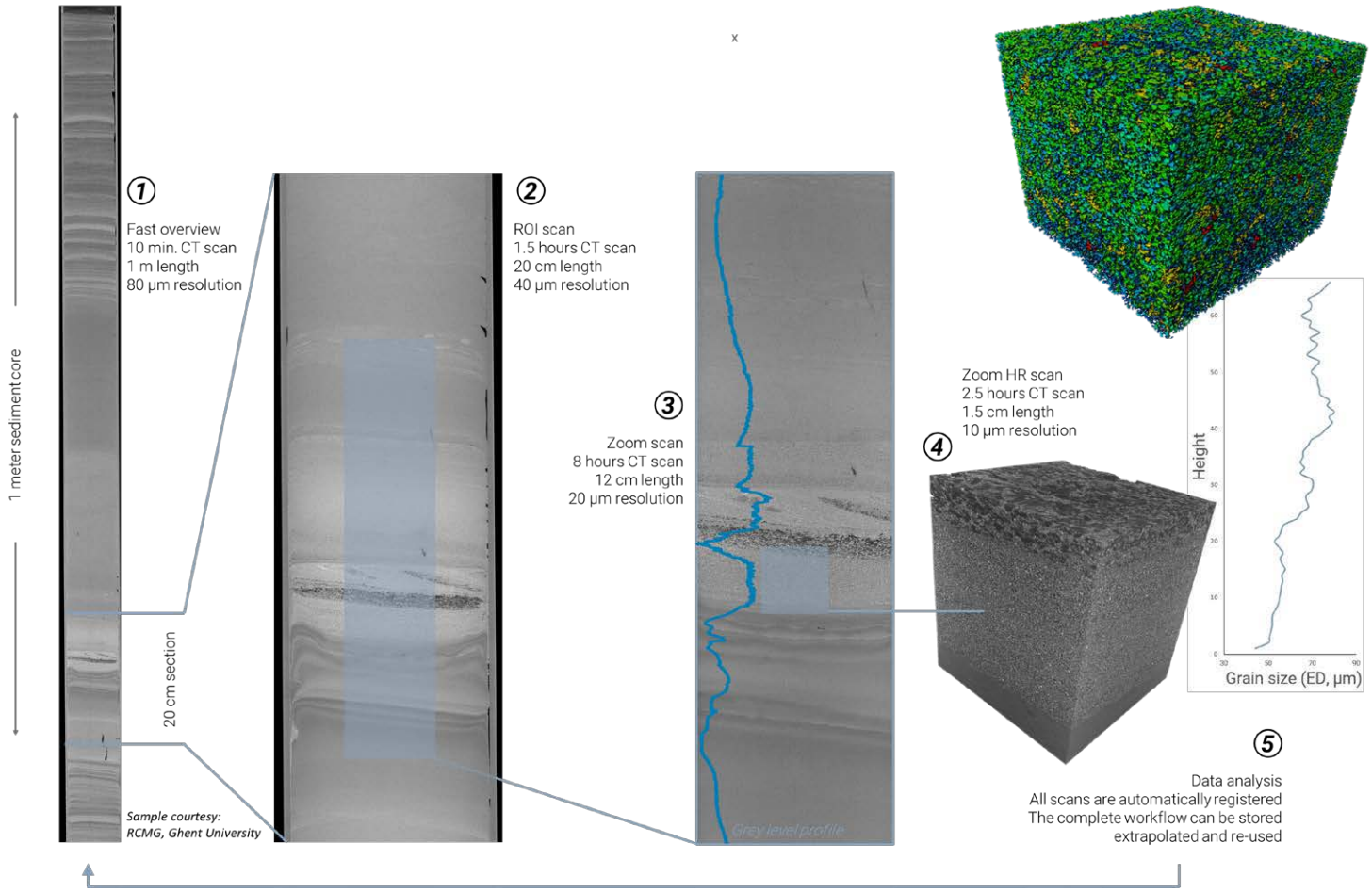
…Down to microplugs
Resolution down to 3 µm



2 inch
limestone core

6 mm
limestone microplug

Multi-scale imaging



TESCAN UniTOM XL



TESCAN UniTOM XL

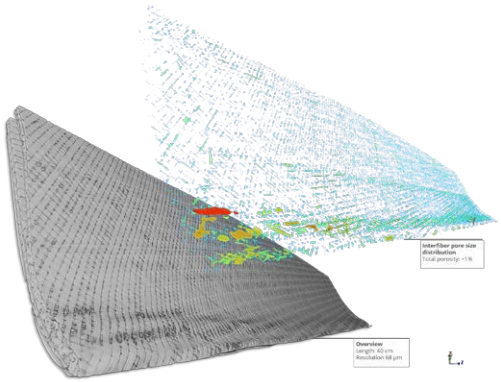
A **multi-resolution micro-CT** optimized for **high throughput**, diverse sample types and **flexibility** for your research.

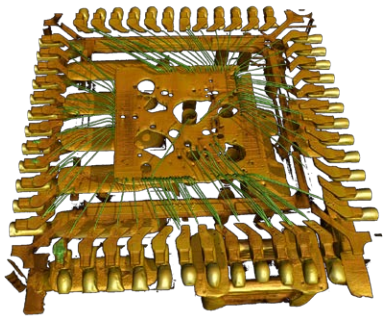
TESCAN UniTOM XL

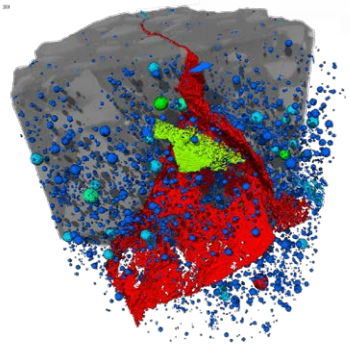
TESCAN UniTOM XL enables high-throughput non-destructive 3D imaging for **materials research**, **failure analysis** and **quality assurance**, including:

- Energy Conversion and Storage
- Consumer Products and Packaging
- Aerospace
- Automotive
- Medical Devices
- Pharmaceutical
- Building Materials
- Food Science
- Advanced Packaging in Electronics
- Metals













Key Features across systems

- Continuous imaging
- In situ integration option
- 4D SW tools
- Off axis VOI imaging
- Flexibility of SW and HW



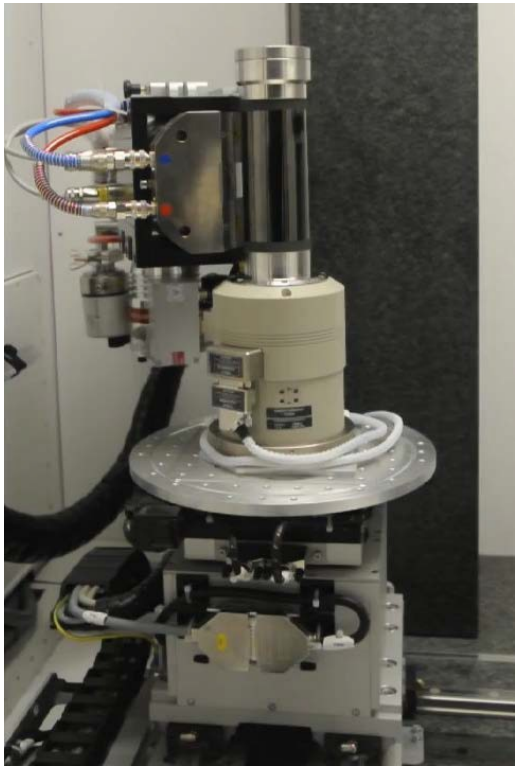




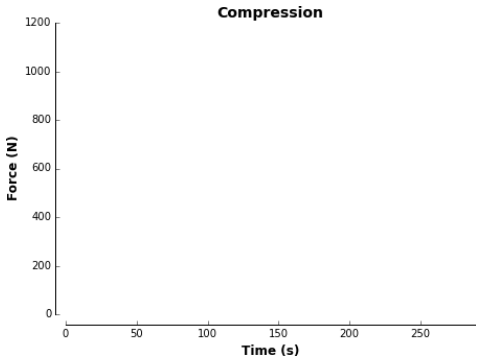
In situ integration kit

Hardware and software tools to control in situ experiment

- Advanced cable management to safely guide sensor, power, or fluid cables towards the rotation stage
- Serial interface (DB15) on top of the rotation stage through a slip ring connection enables **continuous rotation**





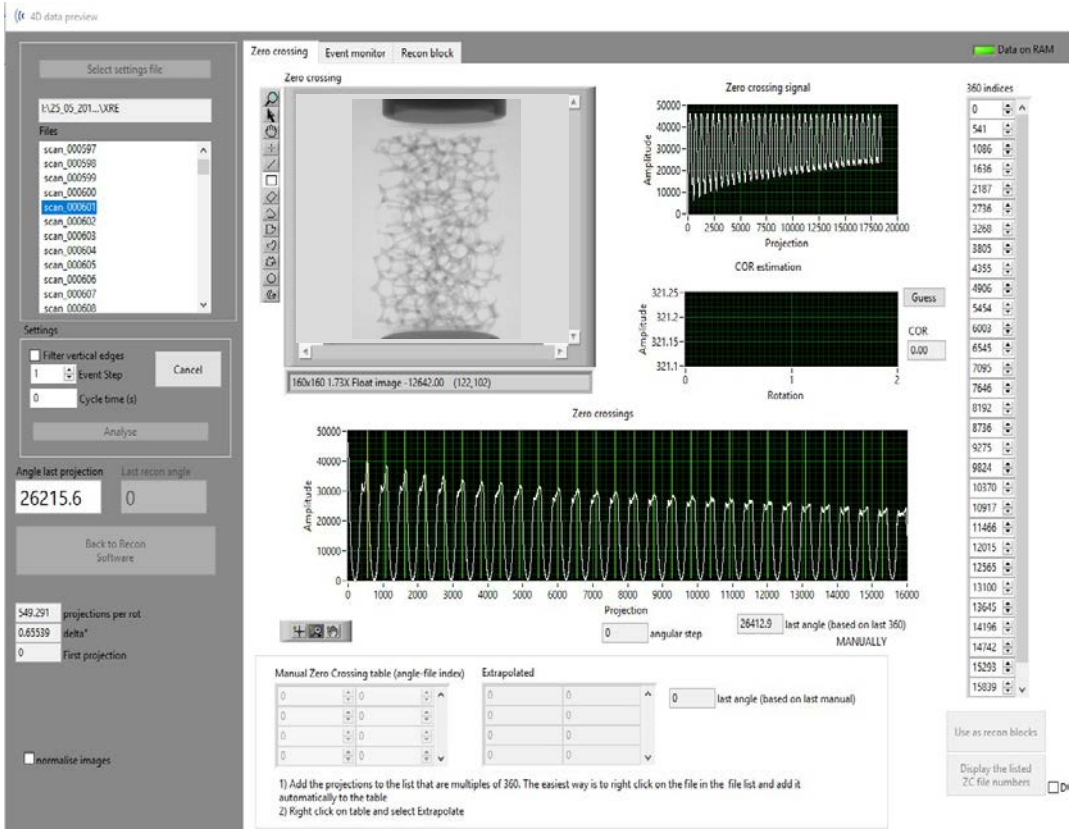


Software: Acquila XRE 4D Toolkit

- **Tools to facilitate time-lapse workflows:**
  - Acquisition
  - Reconstruction
  - Visualization
- **Quickly adjust alignment**
- **Detect sample variations**
- **Synchronize in situ sensor equipment**

Acquila

Modular acquisition framework
3D & 4D reconstruction

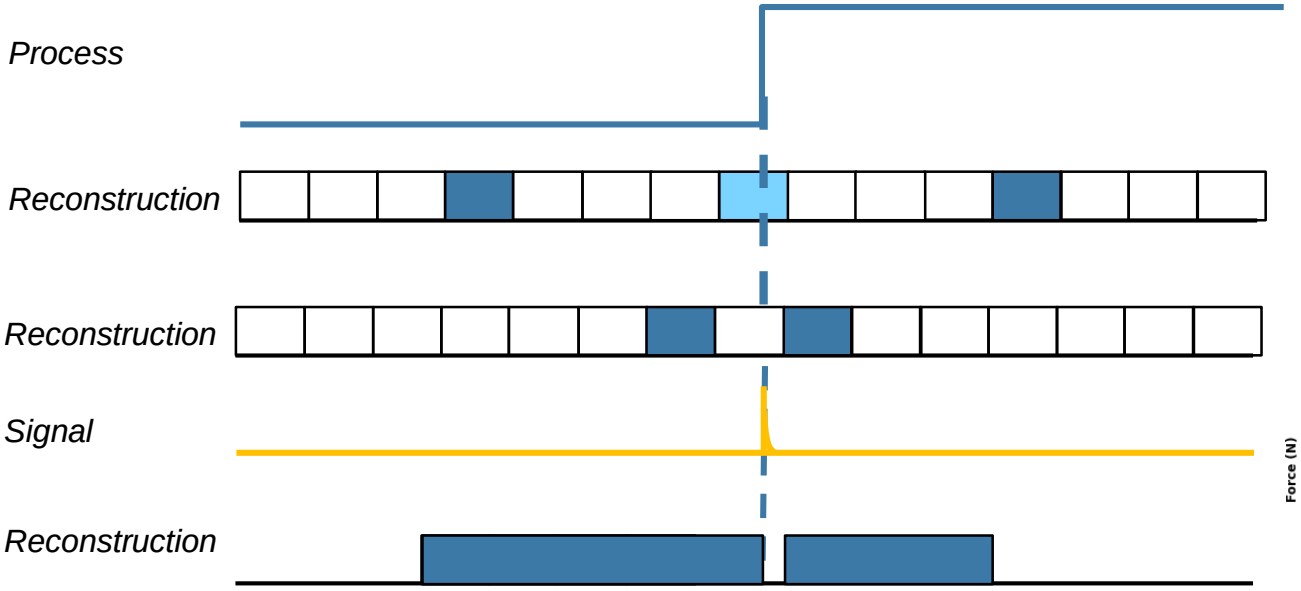


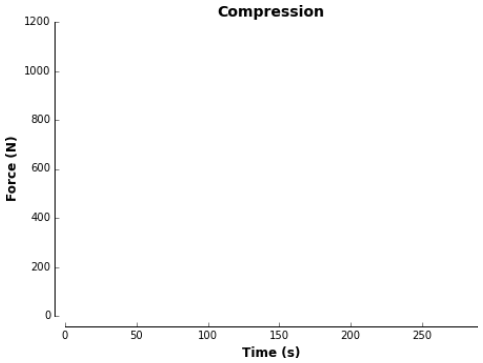
In collaboration with: UNIVERSITEIT GENT

Limestone Fracture:
Signal-aided recon optimization

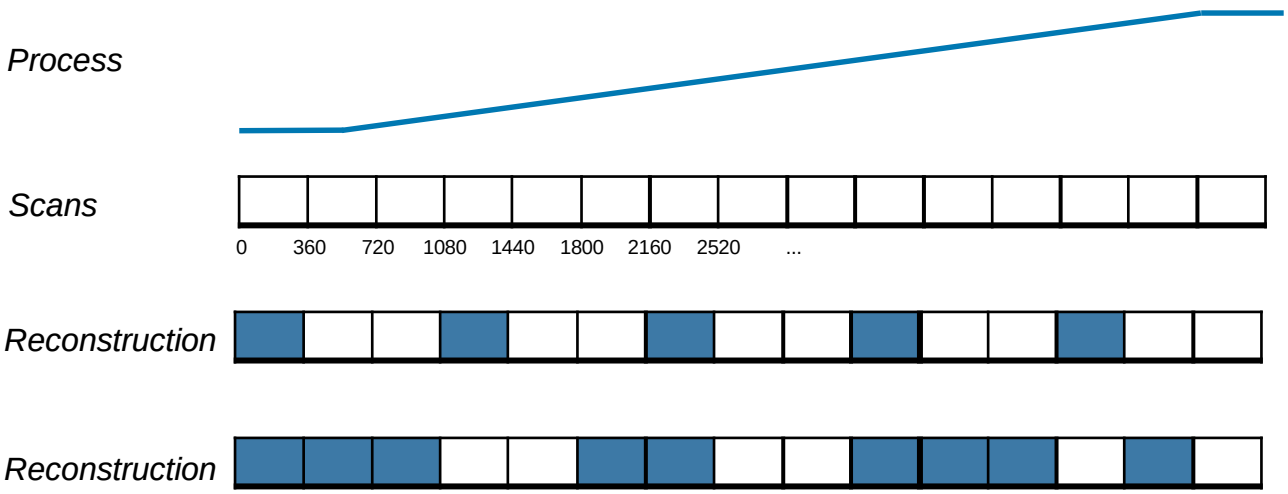
In-situ limestone fracture
Diameter: 9 mm
Scan Time: 4.8 minutes
Time/360°: 12 seconds
voxel size: 35 µm

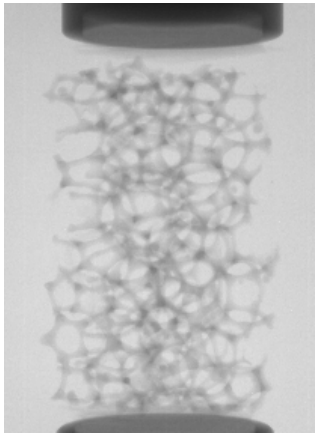






In situ - Continuous acquisition

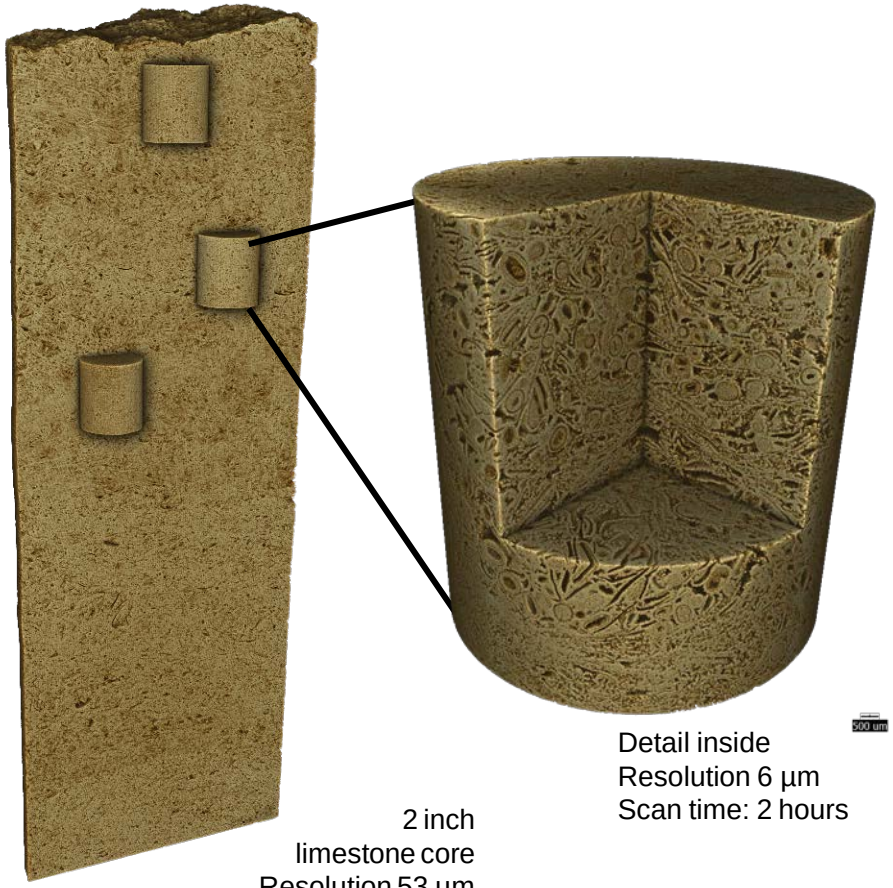




Flexible in reconstruction - Select and/or add reconstructions

Volume of Interest Scanning

- VOIS featured on a 2-inch carbonate core.
- Fully integrated workflow into Acquila and XRE Reconstructor
- On the reconstructed 3D image of an overview scan of the entire core (resolution 53 µm) interesting regions were selected.
- System automatically moves to these regions to perform a detailed high-resolution scan (resolution 6 µm).
- Can be automated / scripted with ease in Acquila.



Detail inside
Resolution 6 µm
Scan time: 2 hours

2 inch
limestone core
Resolution 53 µm
Scan time: 2 hours

Enabling routine *in situ* time-lapse studies

Hardware:

- Optimized CT Design: Source/Detectors/Geometry
- In situ stages (flow, mechanical, etc.)
- In situ interfaces (cabling)
- Slip rings
- Cable management

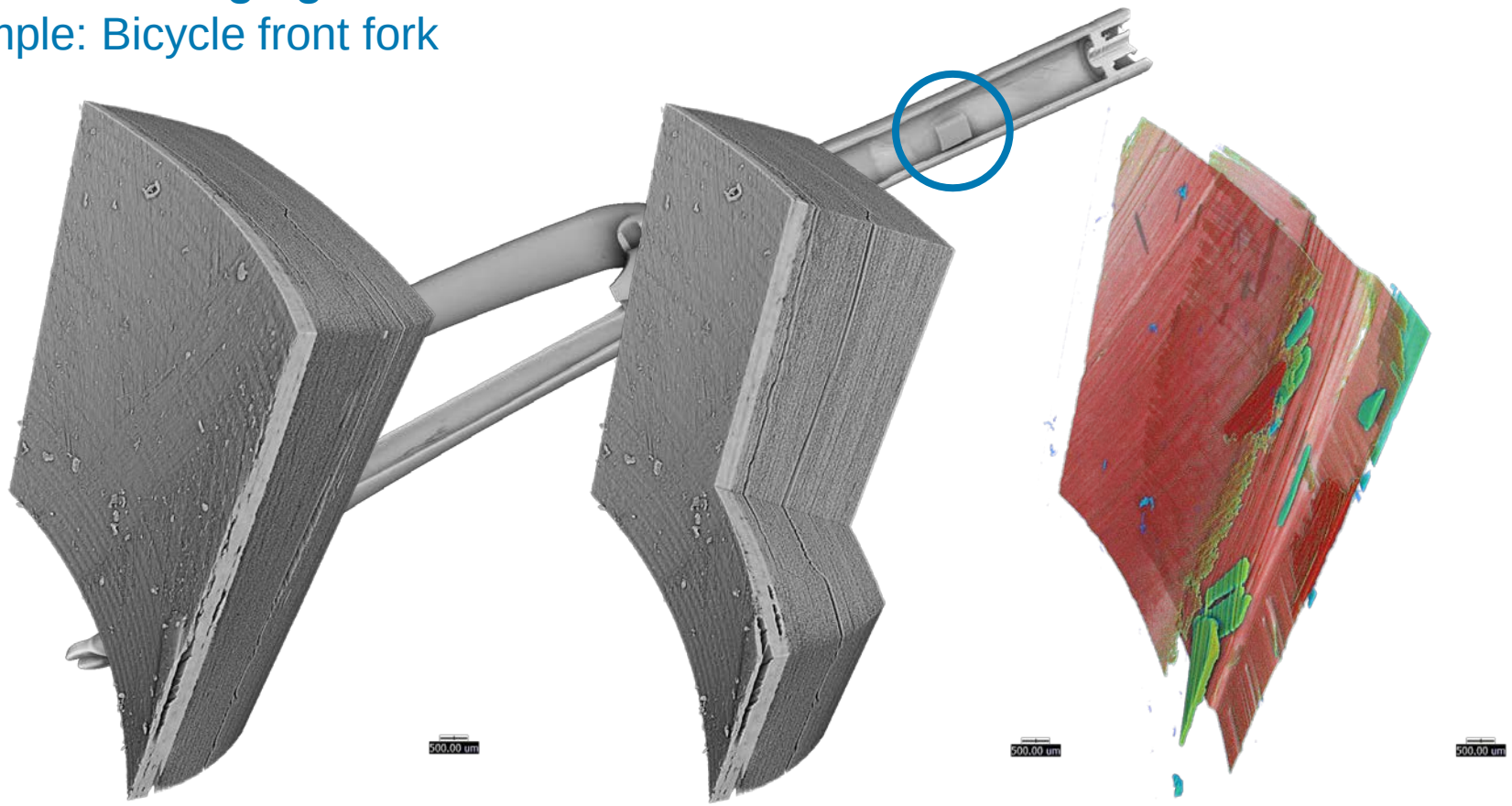
+

Software:

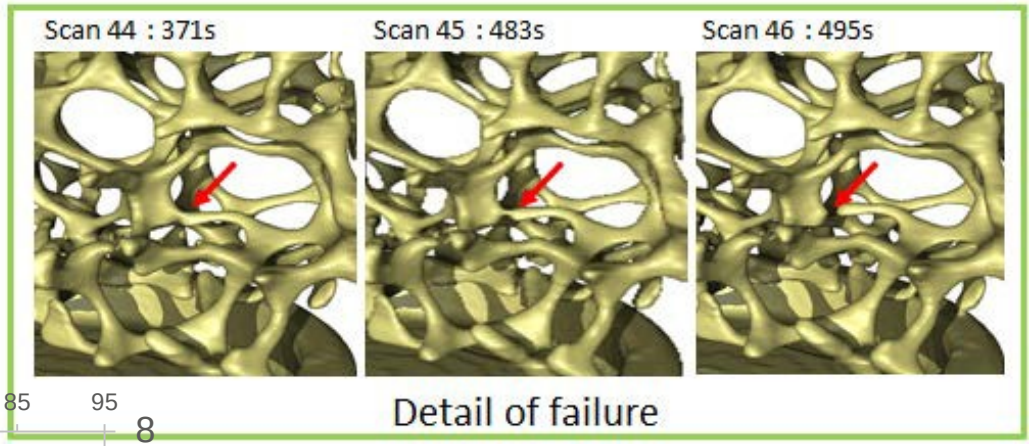
- 4D acquisition modes
- 4D reconstruction
- 4D visualization
- Open / Scriptable environment
- Stage/sensor coordination
- Custom acquisition routines

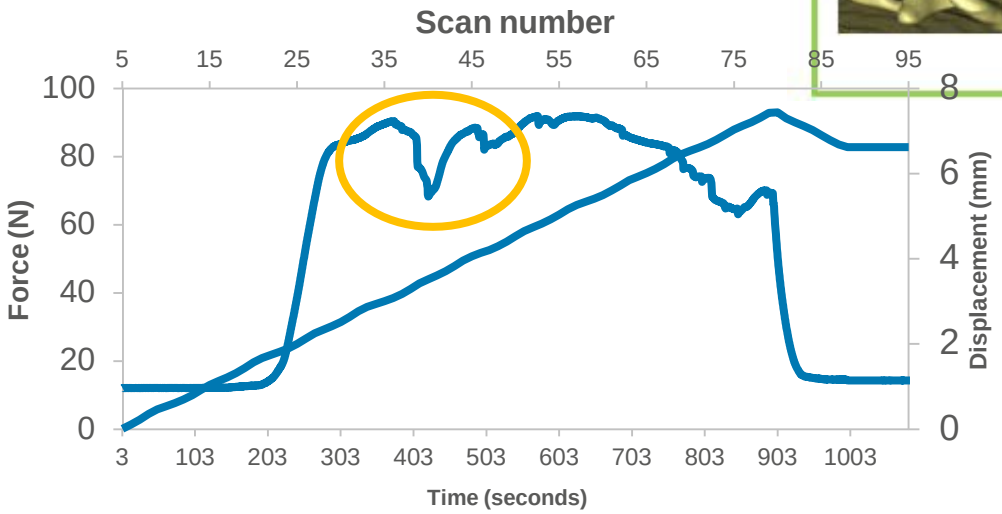
Multi-scale Imaging

Example: Bicycle front fork



Application Example - Compression of load-bearing Foam

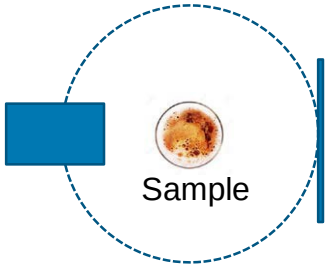




Experimental Approach

- DynaTOM - Dynamic laboratory CT (gantry based, fixed sample)

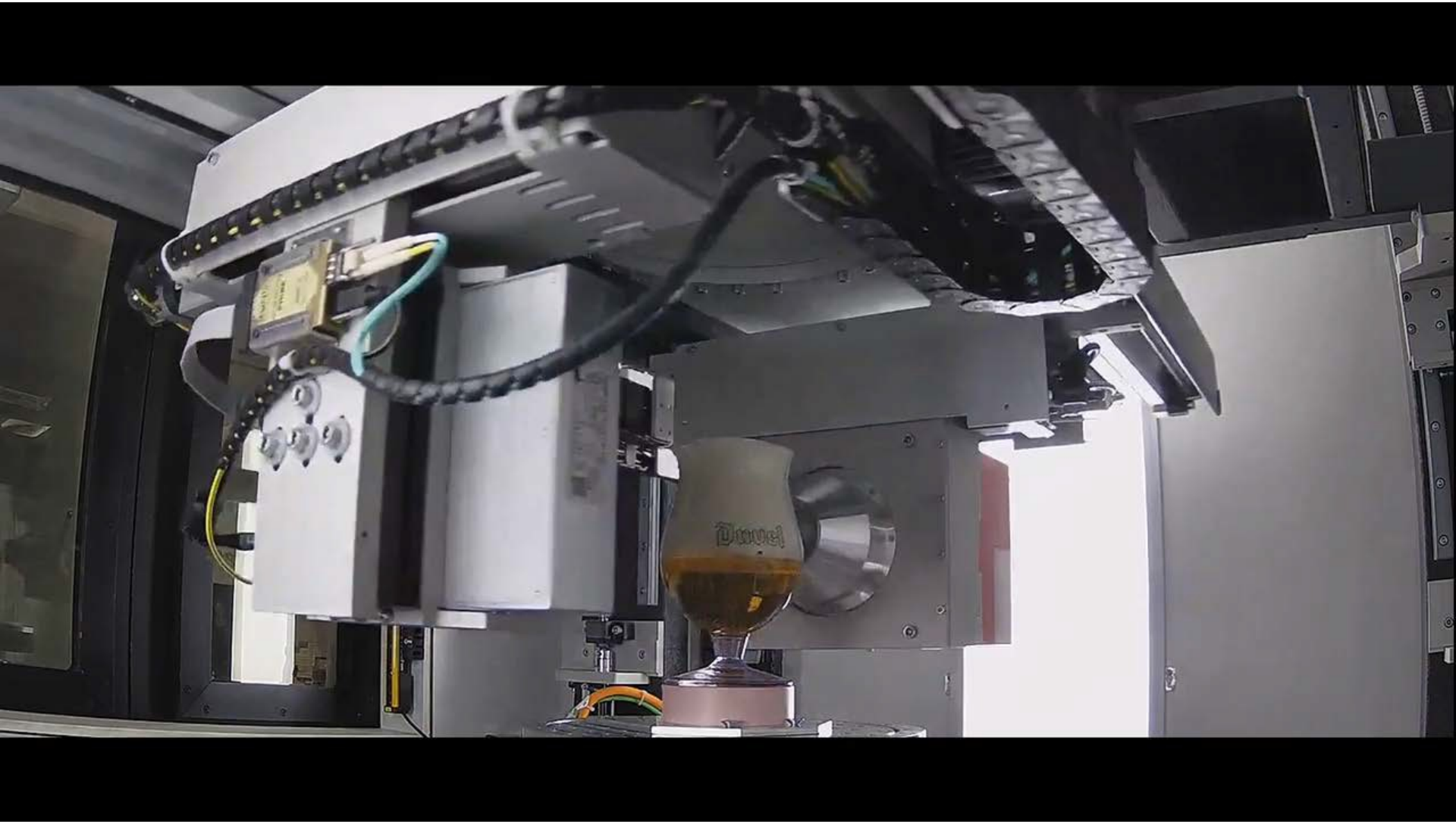
- Acquisition of complete tomographies on the order of seconds
  - Continuous rotation ~80 full rotations
  - 9 second acquisition time per rotation
  - ~10 min total (17ms exposures)
  - 150 µm voxel full-field acquisition
  - ~44 000 projections (640 x 540 pixels)
  - 28,800° total rotation angle
  - 40 GB raw data



9 seconds for a full 360° acquisition!

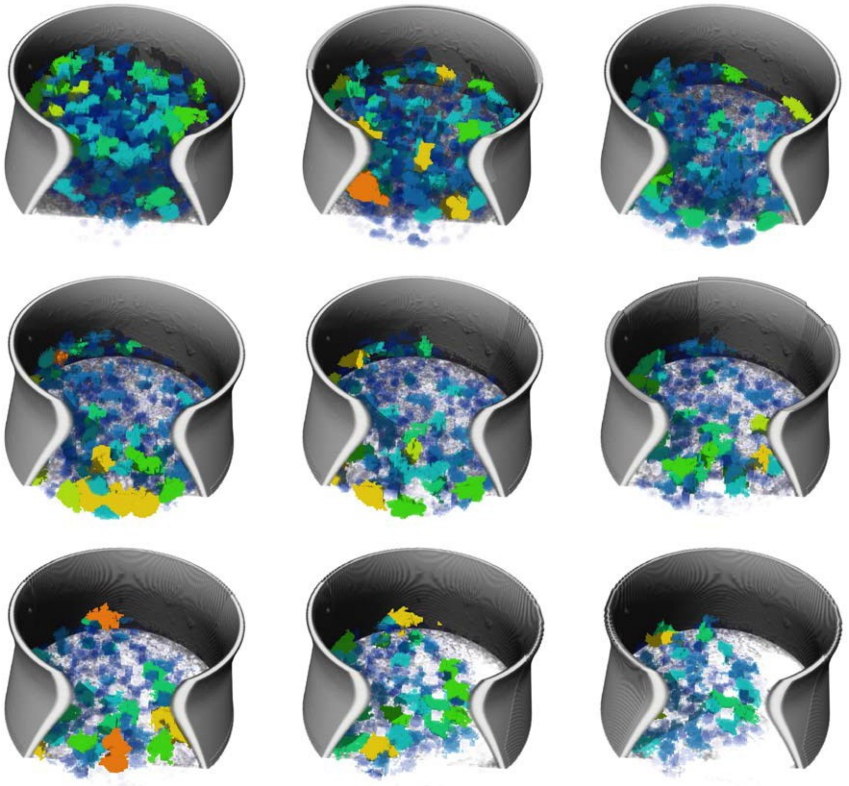
Foam collapse study
FOV ~ 10 cm





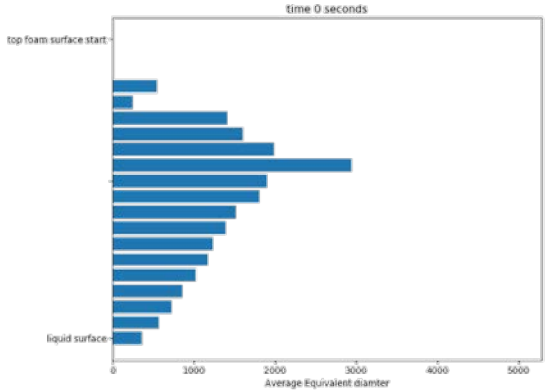
Analysis

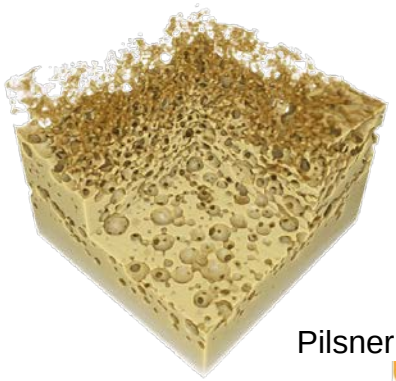
- Used 3rd party SW to quantify 4D recon volumes with batch analyses, including:
  - Filter, set mask, threshold, separation, label.
- Quantification:
  - **Average equivalent diameter** as function of height in glass
  - **Maximum equivalent diameter** as function of height in glass
- >3 million pores analyzed over all datasets



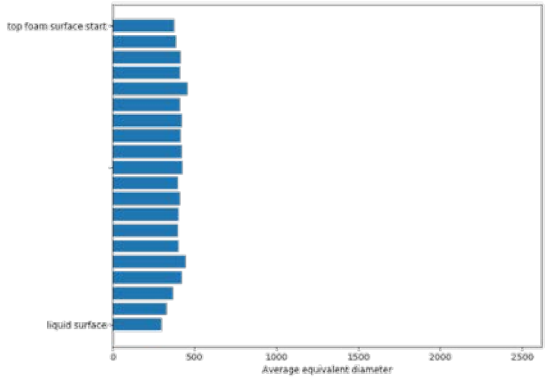
TESCAN CoreTOM – Foam Collapse Studies

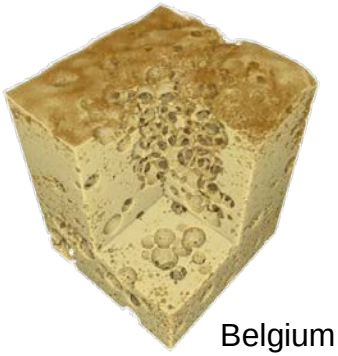
BPA foam shows greater stability and homogeneous bubble distribution compared to pilsner.





Pilsner





Belgium Pale Ale

Summary

- Our goal is to make dynamic CT imaging a commonplace and routine technique
- Our products, the DynaTOM, CoreTOM, and UniTOM XL, have been engineered with this goal in mind
- By coupling hardware, software, and know-how we can enable a new era of Dynamic CT imaging

TESCAN
PERFORMANCE IN NANOSPACE



Thank you!
Come and visit us in Ghent

AUTONOMOUS CLASSIFICATION OF VEHICLES

Ján Tomanovič[1]
[1] EEI s. r. o.

Abstract

Prezentácia v úvode vysvetľuje principiálnu spoločenskú otázku: „Prečo je autonómna klasifikácia druhov cestných vozidiel dôležitým technologickým prvkom pre súčasnú reguláciu dopravných tokov ?“. V modernom technologickom svete sa pre tento technologický prvok predpokladá riešenie pomocou osvetlenia laserovými svetelnými (resp. infračervenými) impulzami. Cieľom je vytvorenie pokiaľ možno verného a spoľahlivého obrazu snímanej scény, optimálne vo forme metricky zameraného pointcloudu, pohybujúceho sa vozidla na pozadí okolia cesty v ľubovoľných externých svetelných podmienkach. Vzhľadom k možnostiam svetového trhu technológií sa ukazuje vedecká potreba experimentálno-teoretického štúdia optických 3D profilometrických metód. Za týmto účelom bola podrobne testovaná nami vyvinutá metóda tzv. triangulačnej profilometrie. Realizovaný systém využíva osvetlenie objektu štruktúrovaným laserovým svetlom a dovoľuje s dostatočnou presnosťou vyhovujúcou príslušným normám meranie rýchlosti pohybu vozidiel a súčasne aj profilov karosérie prostredníctvom metricky definovaného 3D pointcloudu s dostatočným rozlíšením. Dosiahnuté rozlíšenie dokonca umožňuje určiť počet náprav vozidla v styku s vozovkou a identifikovať zaťažené resp. nezaťažené vozidlo. Boli získané výsledky, ktoré spolu s vyvinutým softvérovým zabezpečením potvrdili optimálnosť zvolenej koncepcie.



AUTONÓMNA KLASIFIKÁCIA VOZIDIEL

Základný nástroj funkčnosti emisných a mýtnych zón

PREČO MESTÁ A REGIÓNY OBMEDZUJÚ PRÍSTUP MOTOROVÝCH VOZIDIEL

310.000 predčasných úmrtí v Európe ročne zo znečistenia vzduchu

100 hodín ročne hľadania voľného parkovacieho miesta



SPÔSOBY RIEŠENIA

- Pešie zóny
- Parking manažment
- Emisné zóny



EMISNÉ ZÓNY V EURÓPE

Austria	2	Germany	83	Poland	1
Belgium	4	Greece	1	Portugal	1
Denmark	5	Italy	105	Spain	4
Finland	1	Netherlands	2	Sweden	8
France	5	Norway	2	United Kingdom	15



VYMOŽITEĽNOSŤ A FORMA KONTROLY

Autonómna klasifikácia vozidiel

3D model karosérie a identifikácia náprav v styku s vozovkou

Rozdielne pravidlá:

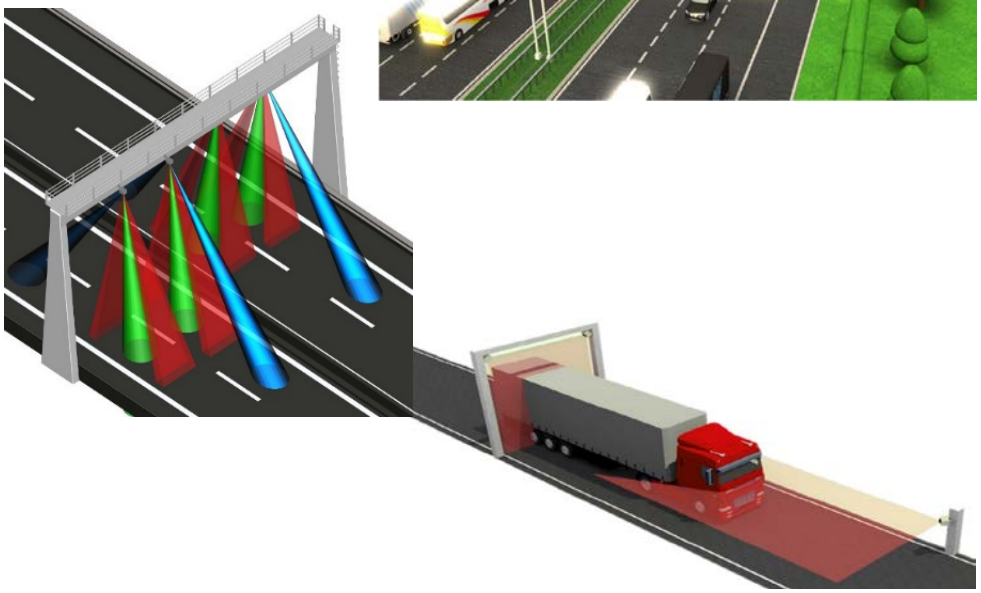
- cestná premávka
- emisné zóny
- mýto



FYZIKÁLNE PRINCÍPY

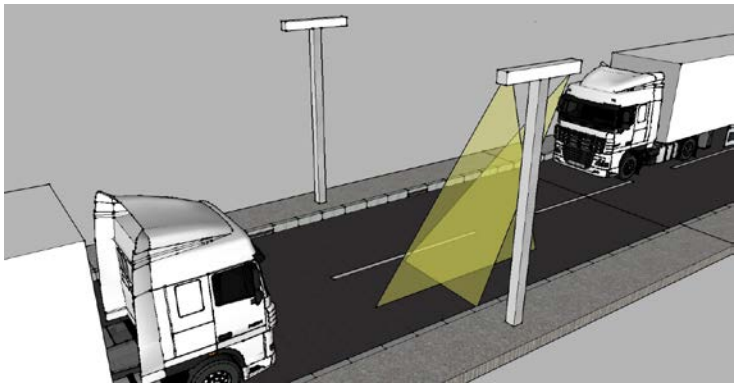
- Indukčné slučky
- Stereoskopia
- Mikrovlny
- LIDAR





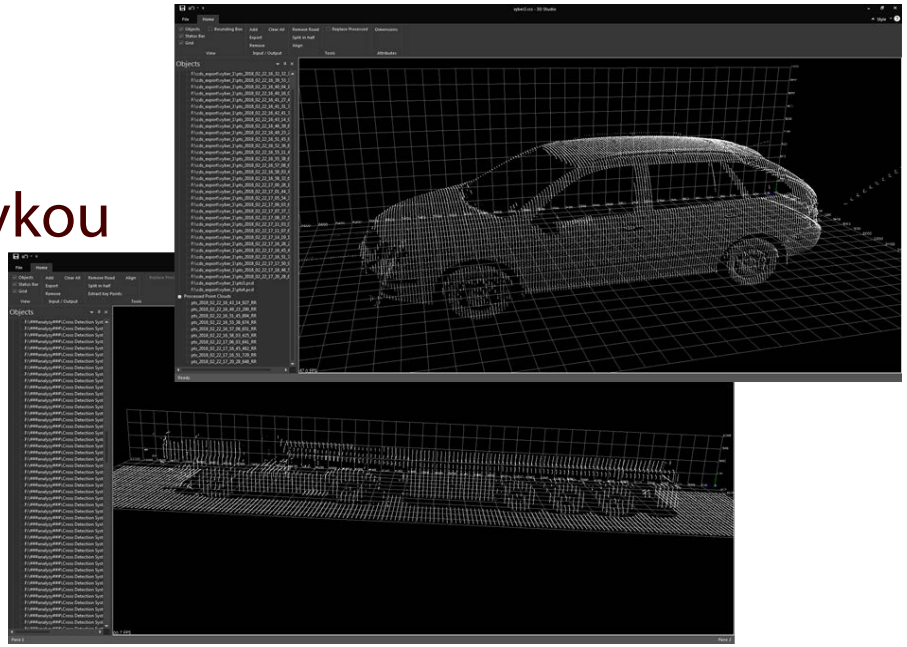
NOVÝ FYZIKÁLNY PRÍSTUP TLP 701 (Triangular Laser Profilometer)

Vyvinutý v rámci riešenia projektu „Výskum univerzálnej platformy pre sken dopravného toku“, ktorý je podporovaný Ministerstvom školstva, vedy, výskumu a športu SR v rámci poskytnutých stimulov pre výskum a vývoj zo štátneho rozpočtu v zmysle zákona č.185/2009 Z. z. o stimuloch pre výskum a vývoj a o doplnení zákona č. 595/2003 Z. z. o dani z príjmov v znení neskorších predpisov.



TLP 701 – KLASIFIKÁCIA VOZIDLA

- 30 štandardných kategórií
- voliteľné podkategórie
- nápravy v kontakte s vozovkou
- značka a model vozidla
- rýchlosť, rozmery, EČV
- 3D drôtený model
- prehľadová snímka

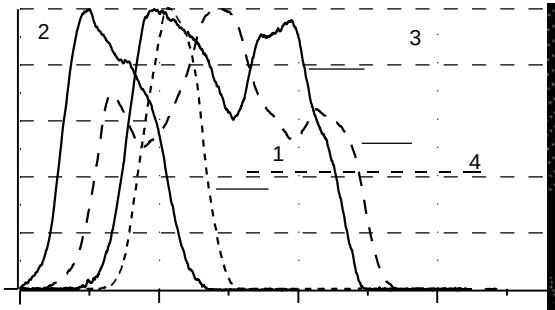


HODNOTENIE PRINCIPIÁLNYCH RIEŠENÍ

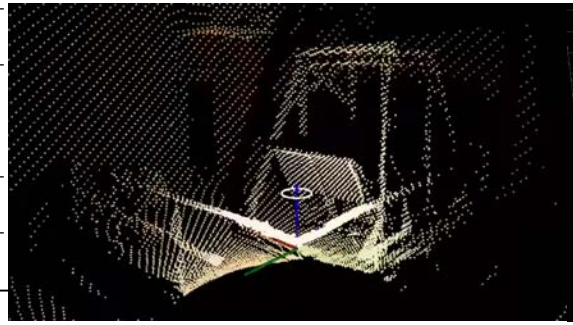
TLP 701 versus konvenčné riešenia

Zdrojové dáta

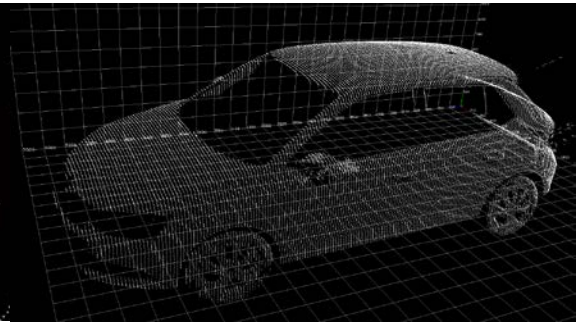
INDUKLCIA



LIDAR



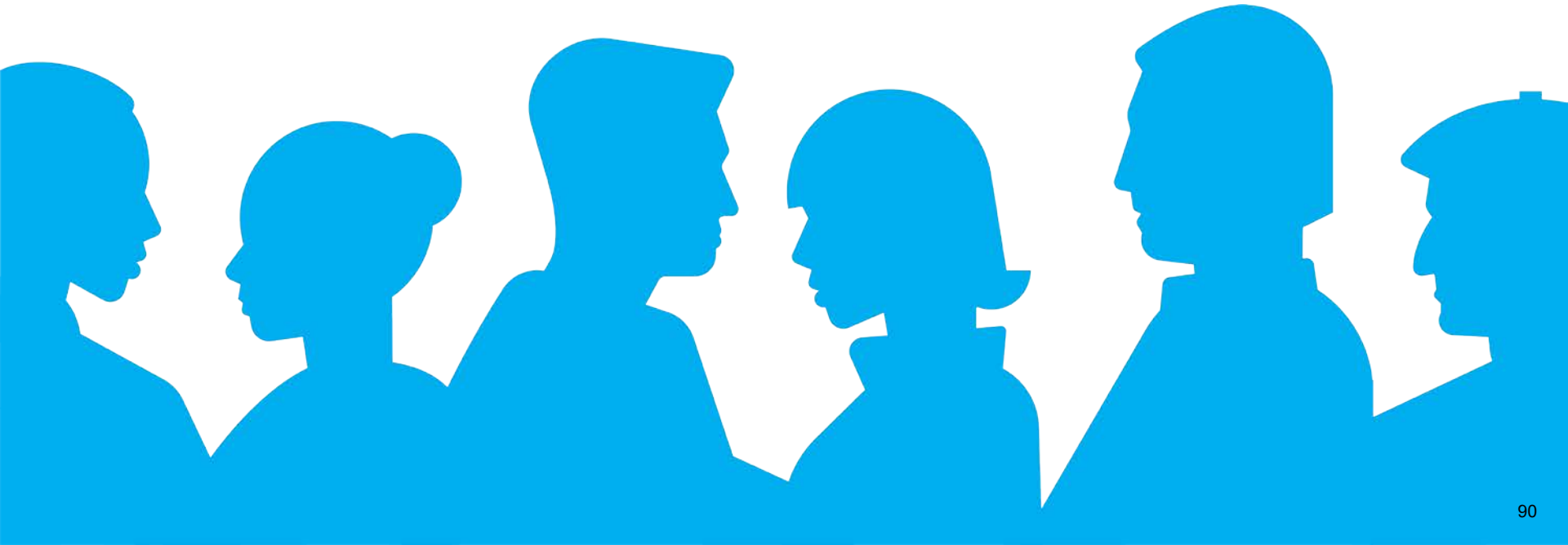
TLP



ĎAKUJEME ZA POZORNOSŤ

Uvedené informácie boli z:

- Projektu „Výskum univerzálnej platformy pre sken dopravného toku“, podporovaný Ministerstvom školstva, vedy, výskumu a športu SR.
- Projektu „Urban access regulations“, podporovaný Európskou komisiou.



ZEISS INDUSTRIAL QUALITY SOLUTION

Mgr. Marián Strážovský[1]
[1] Carl Zeiss spol. s r.o.

Abstract

ZEISS zabezpečuje štandardy kvality všade, kde sa vyžaduje maximálna presnosť.

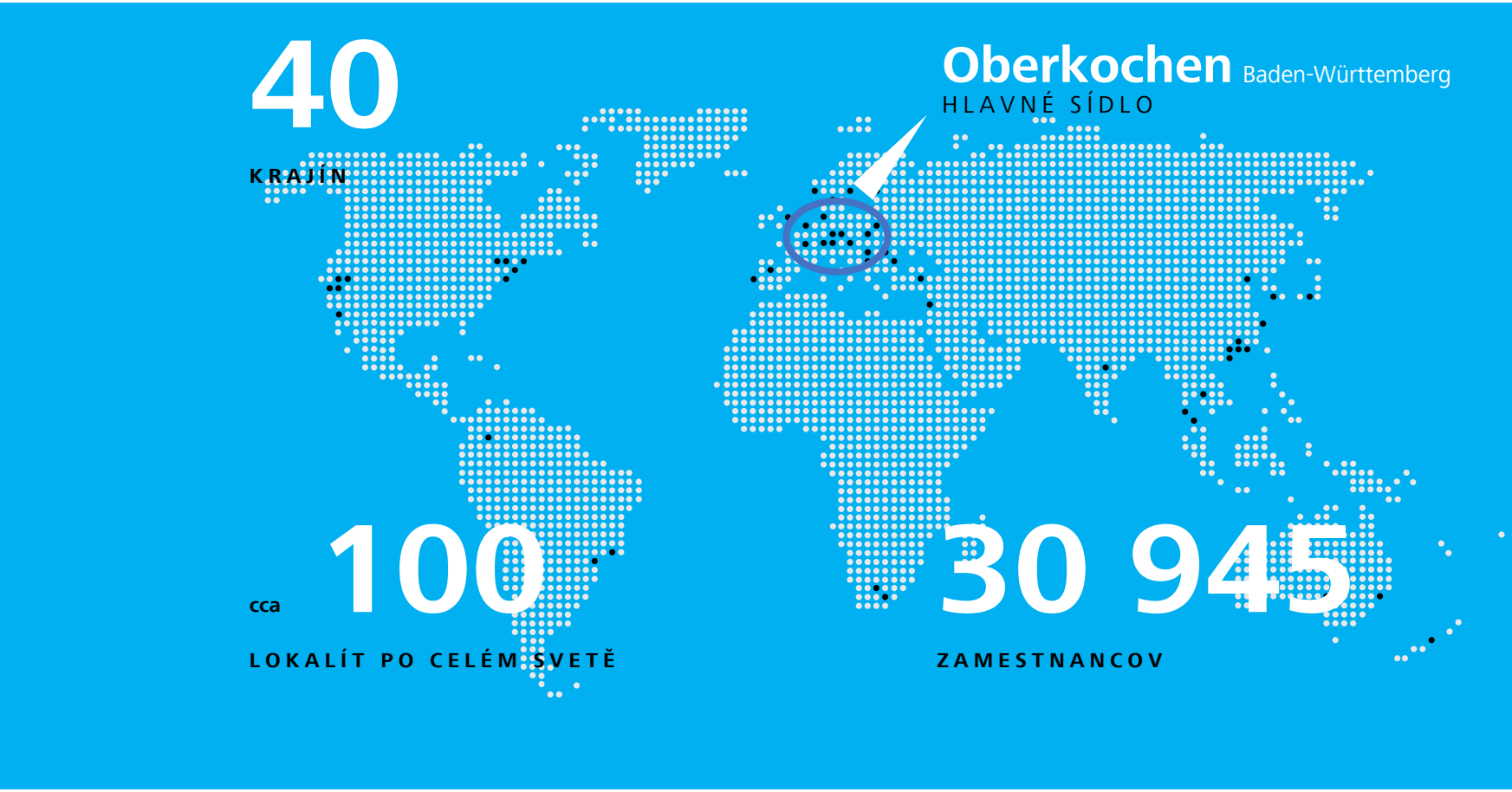
Pre rýchle a presné vyhodnotenie si predstavíme optický bezdotykový senozor DotScan.

Priemyselná tomografia je rýchla a efektívna pre kontrolu celých dielov, rozmerovej analýzy a vnútornej štruktúry materiálov.



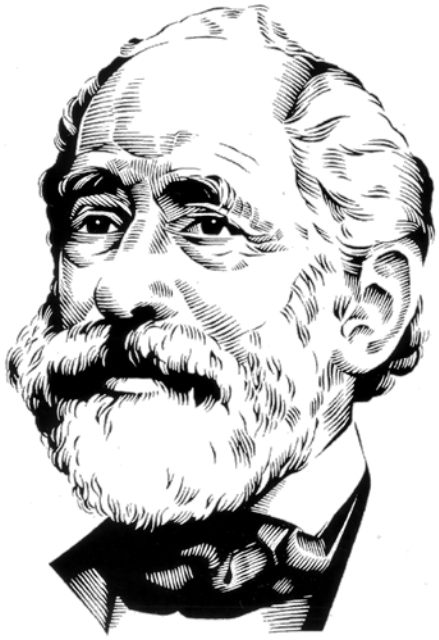
ZEISS RIEŠENIE PRIEMYSELNEJ KVALITY

Marián Strážovský, Juraj Vagovský


40
KRAJÍN
Oberkochen Baden-Württemberg
HLAVNÉ SÍDLO
cca 100
LOKALÍT PO CELÉM SVETĚ
30 945
ZAMESTNANCOV

ZAKLADATELIA SPOLOČNOSTI
CIELE A POSTOJE

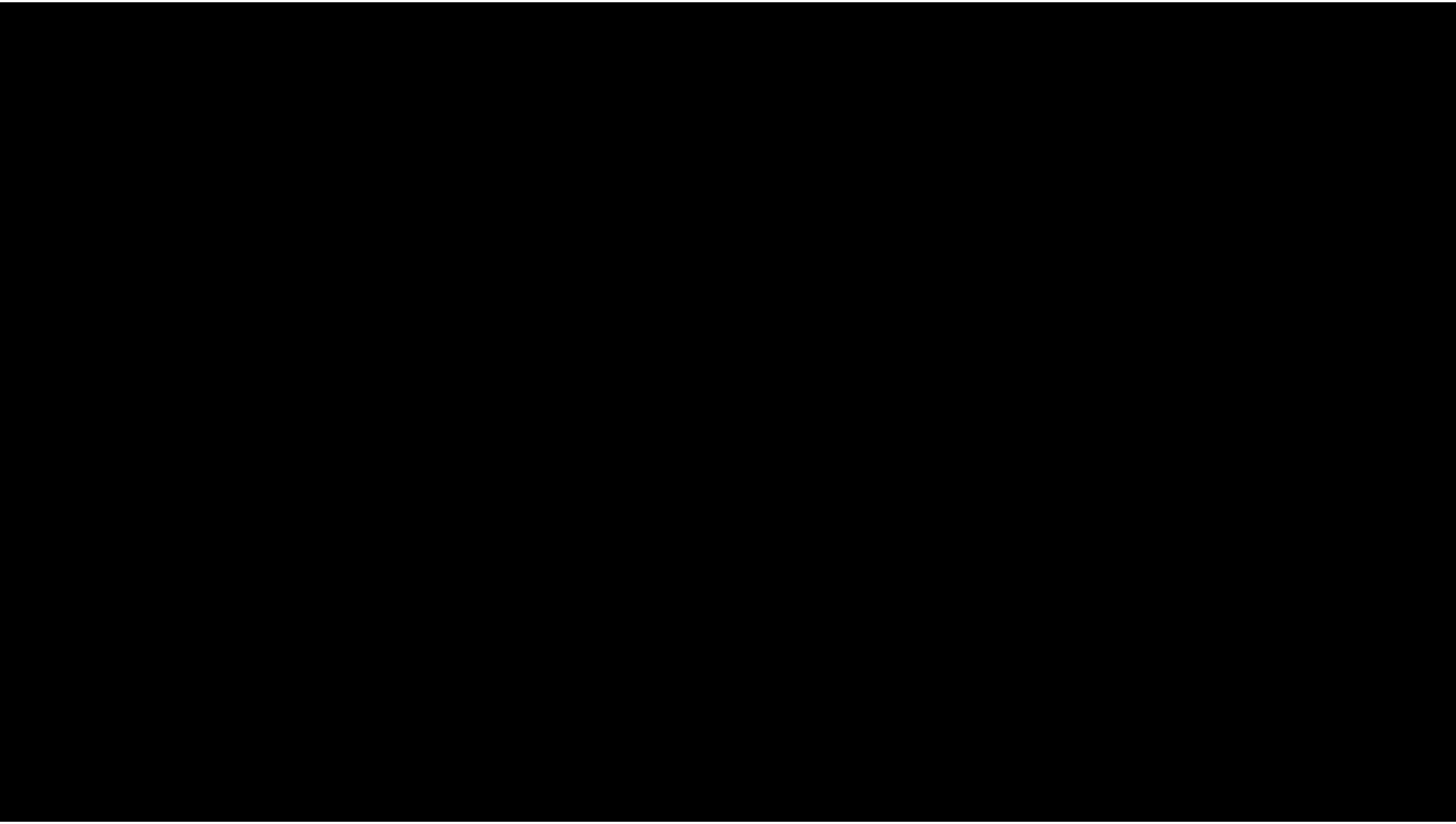
- Špičkový výskum
- Extrémna presnosť a maximálna kvalita
- Sociálna zodpovednosť
- Vytvorenie nadácie



CARL ZEISS



ERNST ABBE



CESTA NA MESIAC S OBJEKTÍVMI ZEISS
PRVÁ FAREBNÁ FOTOGRAFIA ZEME Z MESIACA



On 21 December 1968, Apollo 8 became the first manned expedition to leave the earth's orbit and travel toward to the moon.

This image, "Earthrise", of a small blue planet floating in the darkness of space, forever changed the world's perspective of the fragile, precious planet we call home.

Source: NASA

SEGMENTY SKUPINY ZEISS
2018/19



Semiconductor Manufacturing Technology

1,531 miliard eur obrat

3 438 zamestnancov





Research & Quality Technology

1,549 miliard eur obrat

6 773 zamestnancov



Medical Technology*

1,546 miliard eur obrat

4 889 zamestnancov





Vision Care / Consumer Optics

1,106 miliard eur obrat

10 544 zamestnancov

SEMICONDUCTOR TECHNOLOGY
BEYOND TOMORROW



MICROSCOPY
BEYOND TOMORROW



RESEARCH & QUALITY TECHNOLOGY
BEYOND TOMORROW



MEDICAL TECHNOLOGY
BEYOND TOMORROW



15 miliónov

operácia šedého zákalu
sa každoročne uskutočňuje na celom svete
pomocou chirurgických systémov ZEISS

VISION CARE
BEYOND TOMORROW



CONNECT TO PRODUCTIVITY

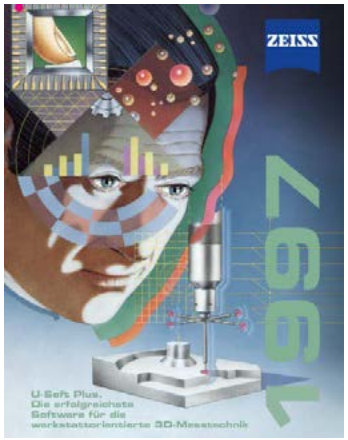
100 YEARS IS JUST THE START











Carl Zeiss Slovakia

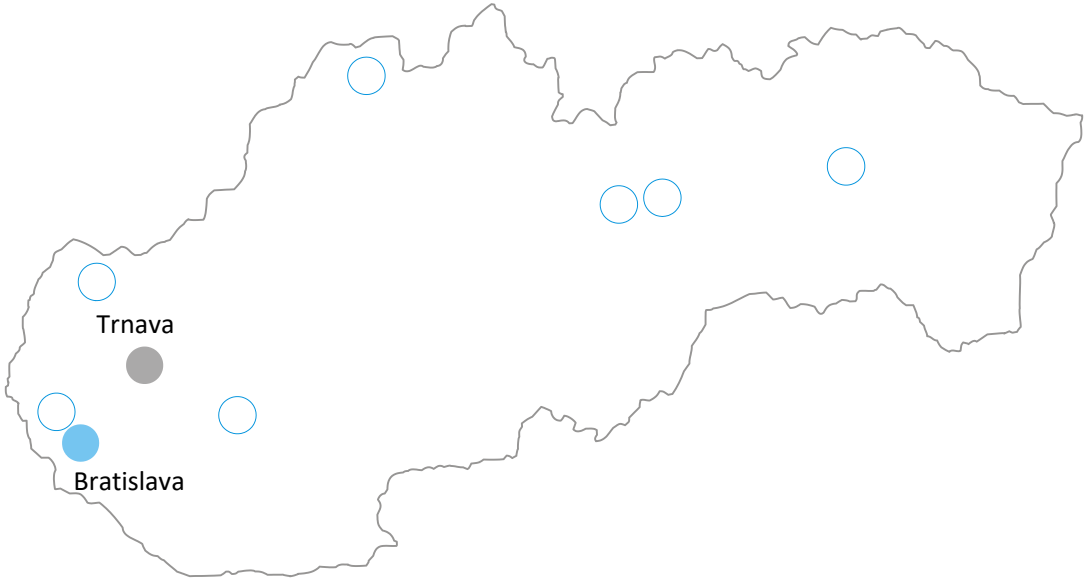
4 predaj

6 aplikačná podpora

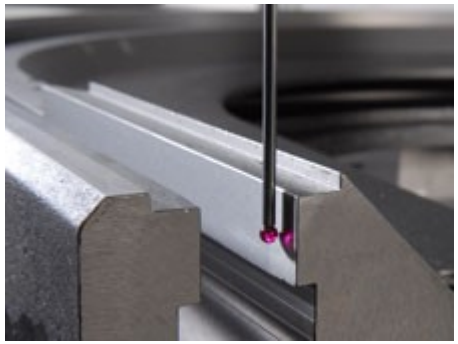
9 servis

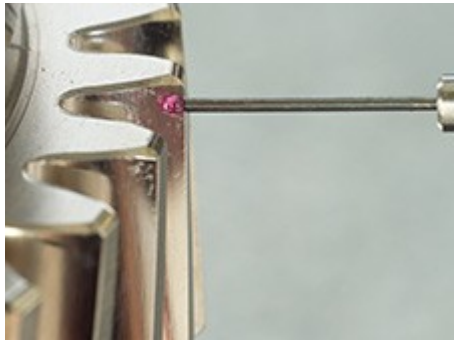
1 meracie a školiace centrum

- office
- Meracia a školiace centrum
- servisný bod



CARL ZEISS SLOVENSKO
MERACIE A ŠKOLIACE CENTRUM TRNAVA





Akreditované merania

Meracie a školiace centrum v Trnave
je akreditované laboratórium podľa
normy ISO IEC 17025:2005.
Svojím rozsahom je jediné na Slovensku.

ilac-MRA
SNAS
Reg. No. 438/S-321

Zabezpečujeme:

- analýzu meracích stratégií
- prípravu prehľadných a modulárnych CNC programov
  návrh a výrobu meracích prípravkov, školenie personálu
- samotné meranie dielov
- implementáciu projektu priamo u zákazníka

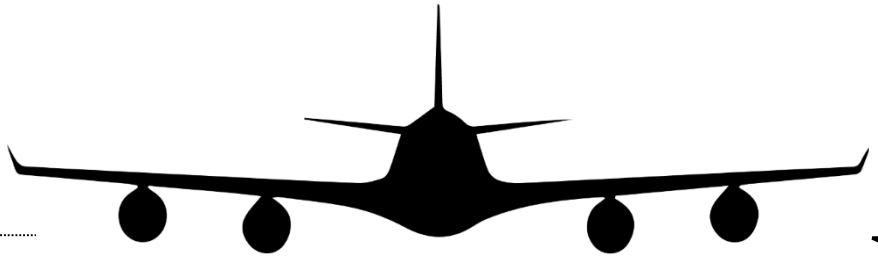
CARL ZEISS SLOVENSKO
AKTUÁLNE 405 MERACÍCH STROJOV



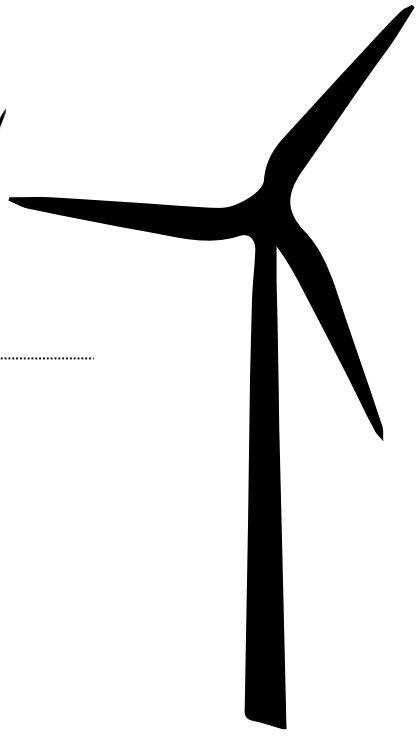
ZEISS INDUSTRIAL METROLOGY
RIEŠENIE PRE ŠIROKÚ ŠKÁLU APLIKÁCIÍ

veľké

LETECTVO



ENERGETIKA



AUTOMOBILOVÝ PRIEMYSEL



MIKROELEKTRONIKA



malé

ZEISS INDUSTRIAL METROLOGY
SÚRADNICOVÉ MERACIE STROJE



Portálové meracie stroje

CONTURA ACCURA MICURA PRISMO XENOS



Meracie stroje do výroby

CENTERMAX DURAMAX GAGEMAX

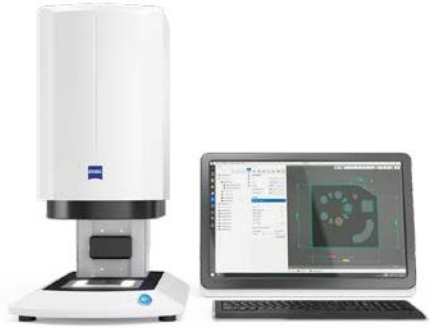


Veľké súradnicové meracie stroje

MMZ

ZEISS INDUSTRIAL METROLOGY
OPTICKÉ A MULTISENZOROVÉ MERACIE STROJE

Optické a multisenzorové meracie stroje



3D digitalizácia

COMET T-SCAN



ZEISS INDUSTRIAL METROLOGY
CAR BODY SOLUTIONS



In-line kontrola



At-line kontrola

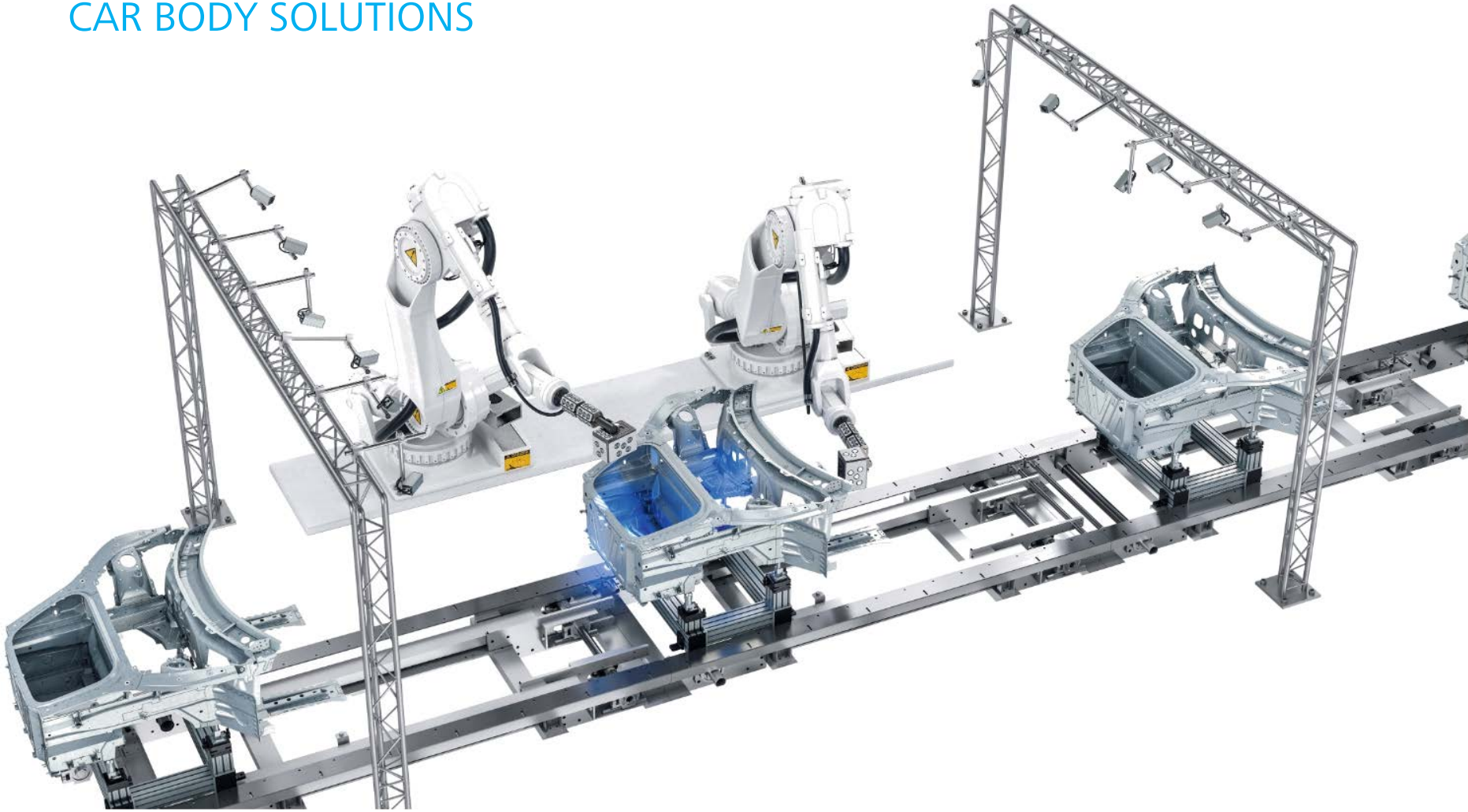
AIBox AIMax ABIS T-SCAN COMET

Offline meracia technika

CARMET PRO / PRO T advance
EagleEye ABIS T-SCAN COMET

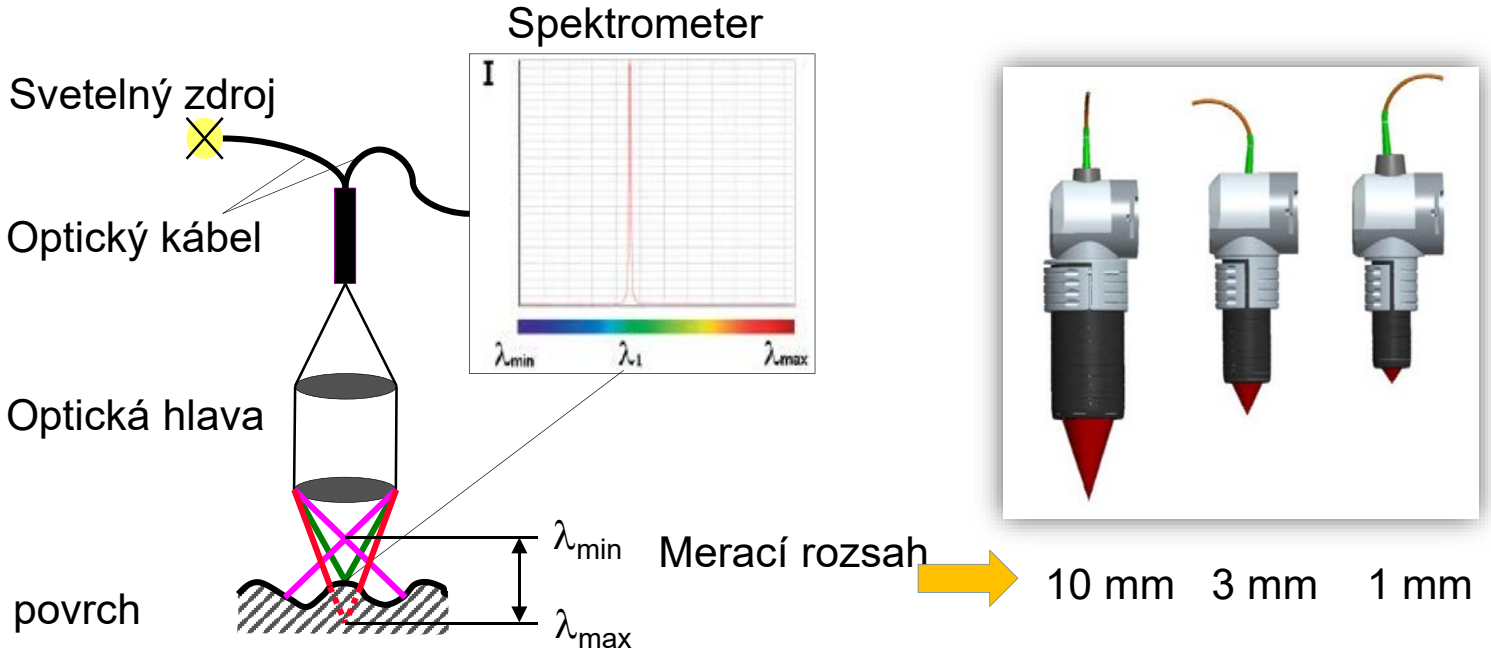


ZEISS INDUSTRIAL METROLOGY
CAR BODY SOLUTIONS

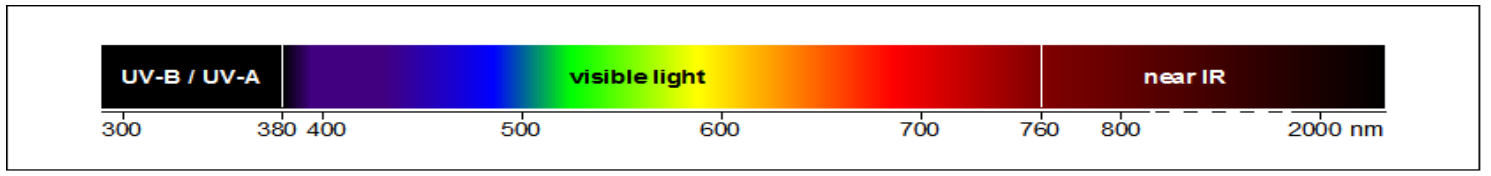


Optický senzor DotScan

TECHNOLÓGIA
MERACÍ PRINCÍP – MERANIE POVRCHU



- Polychromatické svetlo je zamerané na povrch objektu
- Svetlo sa odráža cez multiobjektív do sveteleného detektora
- Zo spektrálnej analýzy sa vypočíta vzdialenosť medzi objektívom a povrchom



SENZOR BIELEHO SVETLA DOTSCAN
PRIEHĽADNÉ OBJEKTY







sklo, šošovky, priehľadné plasty...

- Meranie povrchu
- Meranie hrúbky

Source of pictures: ZEISS, Internet (www.woodandmore.de ….)

SENZOR BIELEHO SVETLA DOTSCAN
PRIEHĽADNÉ OBJEKTY – MERANIE HRÚBKY



SENZOR BIELEHO SVETLA DOTSCAN
PRIEHĽADNÉ OBJEKTY – MERANIE HRÚBKY LAKU



SENZOR BIELEHO SVETLA DOTSCAN
PRIEHĽADNÉ OBJEKTY – MERANIE POVRCHU



SENZOR BIELEHO SVETLA DOTSCAN
MÄKKÉ MATERIÁLY







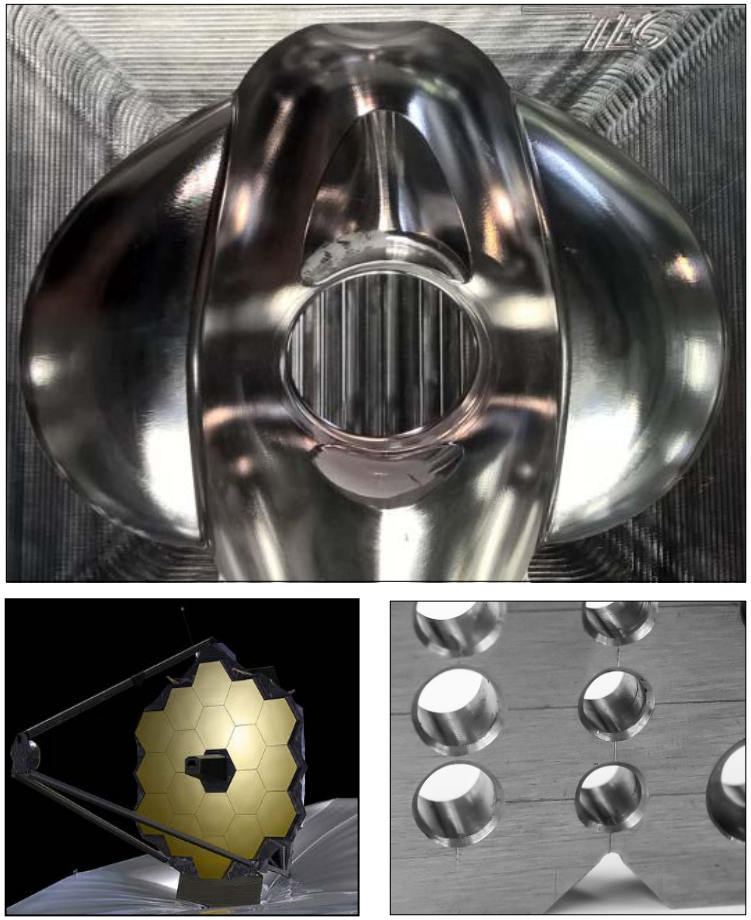
- Guma, plast, materiály, ktoré nie je možné merať dotykovo
- Žiadna deformácia
- Možnosť merať jemné štruktúry

Source of pictures: Internet (www.motorteile-online.de; www.gummi-formteile.eu)

SENZOR BIELEHO SVETLA DOTSCAN
MÄKKÉ MATERIÁLY



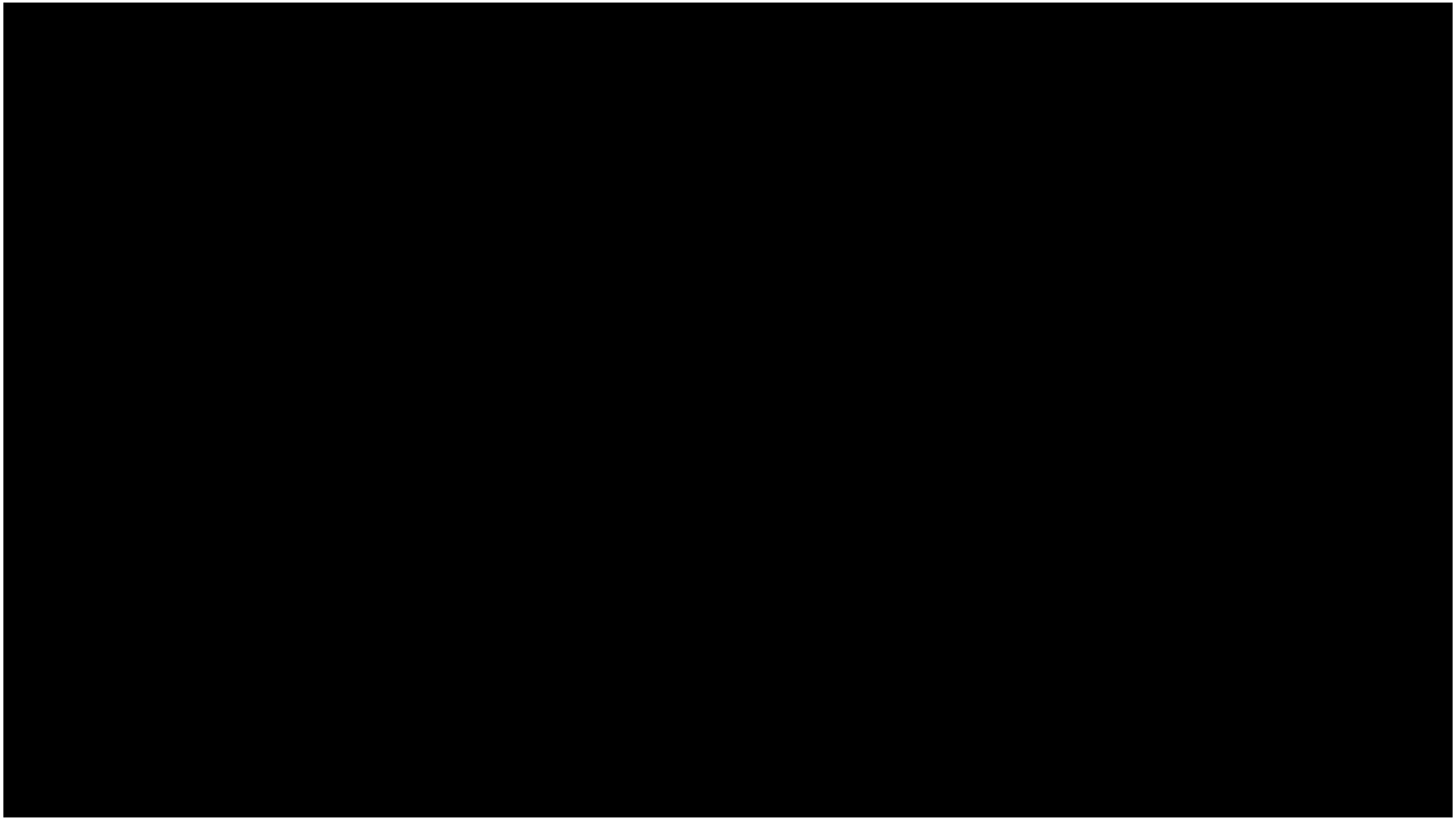
SENZOR BIELEHO SVETLA DOTSCAN
LESKLÉ MATERIÁLY



- Vysokoleštené kovy, priame reflexné odrazy
- Zrkadlo, pochrómované materiály, ktoré nie je možné merať dotykom ani kamerou

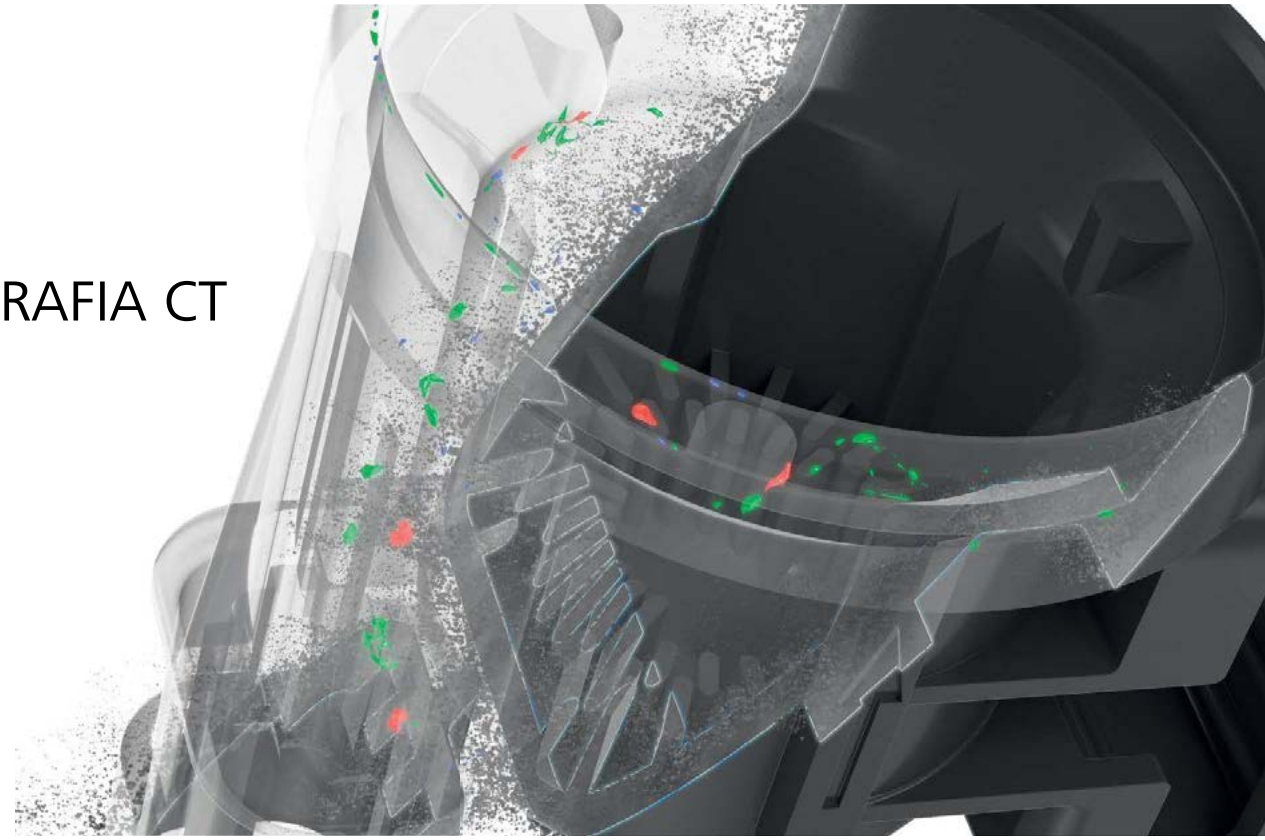
Source of pictures: ZEISS, Internet (www.welt.de; www.autoschrauber.de)

SENZOR BIELEHO SVETLA DOTSCAN
LESKLÉ MATERIÁLY

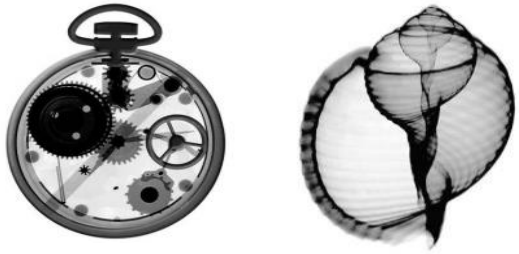


POČÍTAČOVÁ TOMOGRAFIA CT

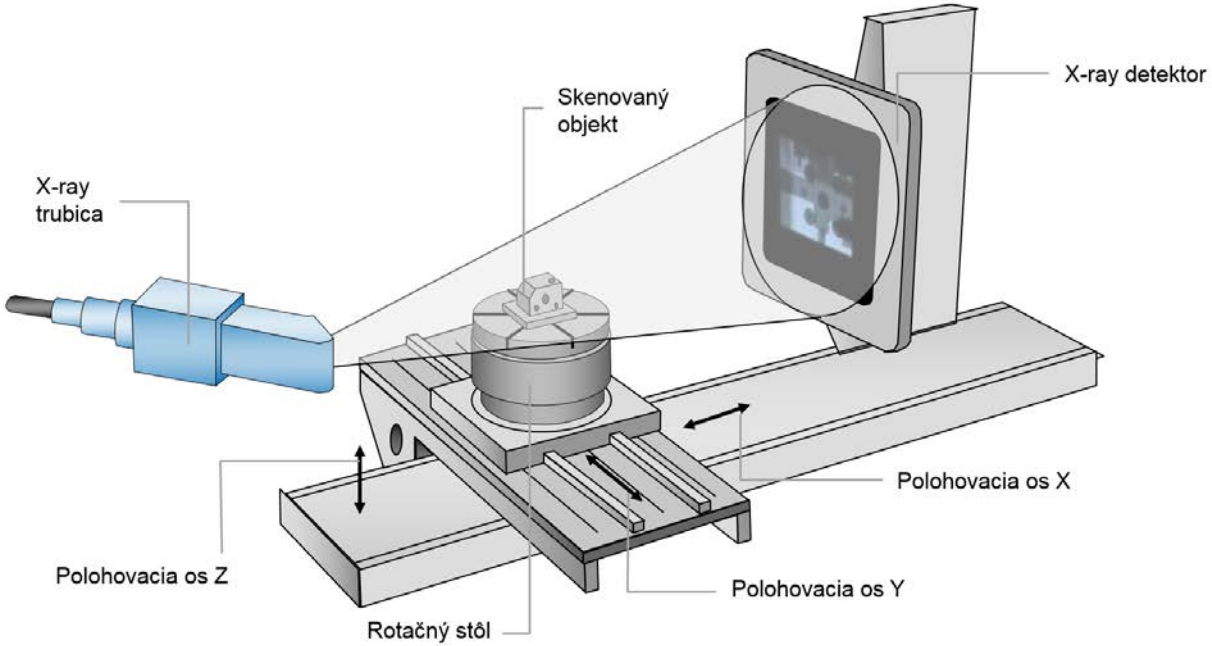
X-RAY

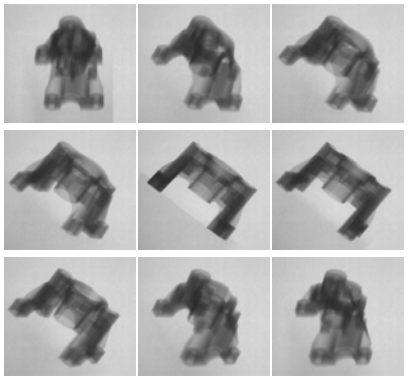


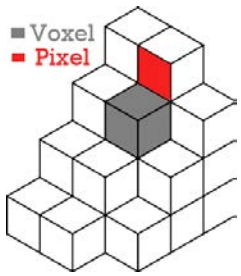
PRIEMYSELNÁ POČÍTAČOVÁ TOMOGRAFIA CT
METROLOGICKÁ TOMOGRAFIA – METROTOMOGRAFIA

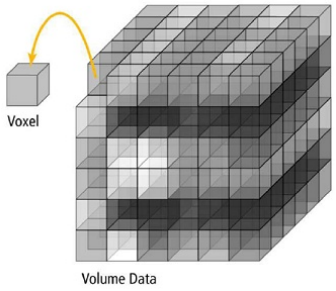
X-ray inšpekcia	Počítačová tomografia	Metrotomografia
		
- inšpekcia vnútorných častí - nedeštruktívne testovanie	- inšpekcia vnútorných častí - nedeštruktívne testovanie - 3D vizualizácia - virtuálne rezy - analýzy s nižšou geometrickou presnosťou	- inšpekcia vnútorných častí - nedeštruktívne testovanie - 3D vizualizácia - virtuálne rezy - meranie rozmerov a tvarov - porovnávanie geometrie - inšpekcia montážnych zostáv - analýza pórovitosti, resp. inklúzií - inšpekcia materiálov - reverzné inžinierstvo

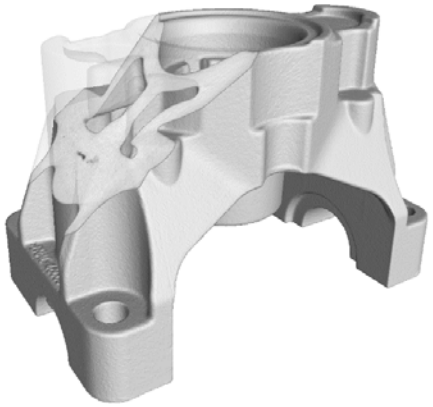
PRIEMYSELNÝ CT SYSTÉM
KONŠTRUKCIA A HLAVNÉ ČASTI – REKONŠTRUKCIA DÁT Z 2D DO 3D







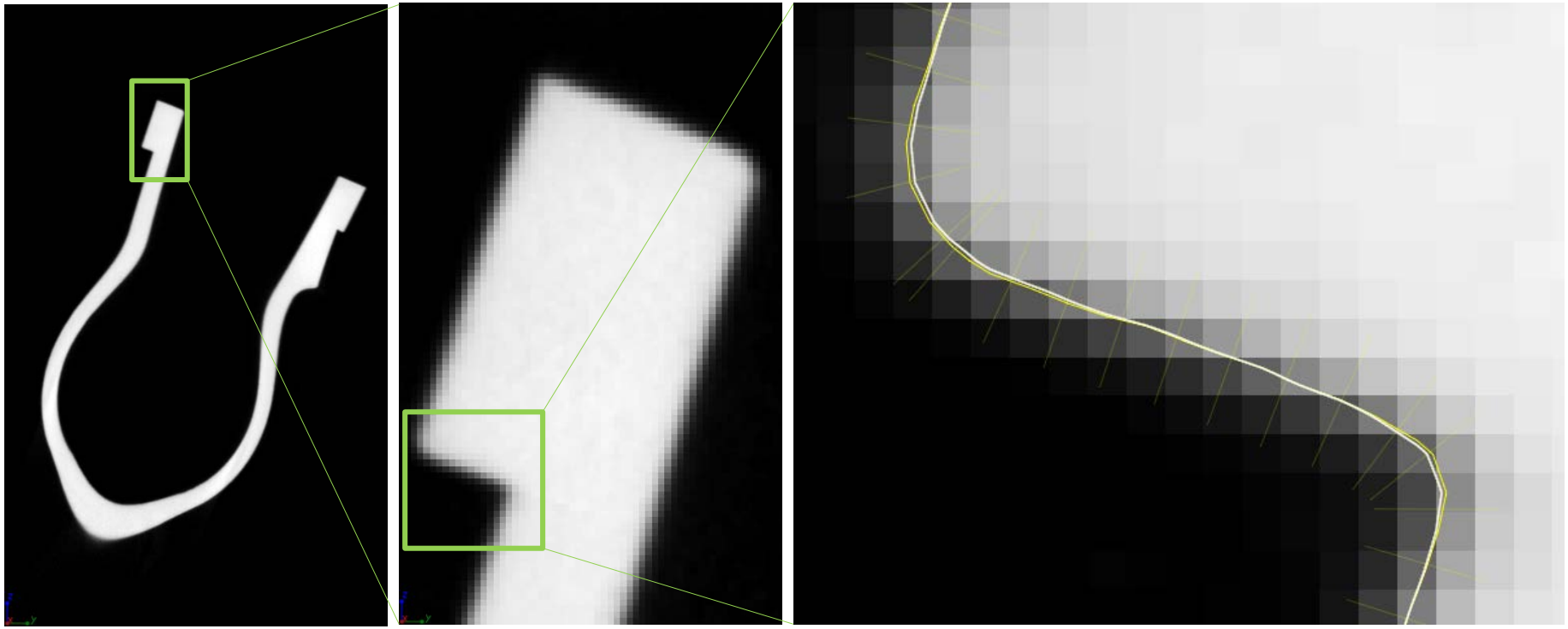




ZEISS Computed Tomography

CT technology

VOXEL A SUBVOXEL
DETERMINOVANIE POVRCHU S VYUŽITÍM MATEMATIKY



Jeden voxel (3D pixel) je nositeľom informácie o jednej z 65 536 možných hodnôt odtieňov medzi čiernou a bielou farbou, čo je dané absorpciou X-ray lúčov materiálom objektu v danom mieste. Vyššia absorpcia znamená svetlejší voxel. Preto je vzduch zobrazený ako veľmi tmavý a materiál ako svetlý.

Matematicky je možné rozdeliť voxel na menšie sub-voxely. Rozlíšenie môže byť teda vylepšené 5 až 10 krát, čo výrazne zvyšuje presnosť determinovania reálneho povrchu objektu.

X-RAY SYSTÉMY ZEISS
PORTFÓLIO ZARIADENÍ PRE ŠIROKÚ OBLASŤ APLIKÁCIÍ

LABORATÓRIÁ
METROLÓGIA, INŠPEKCIA & ANALÝZY



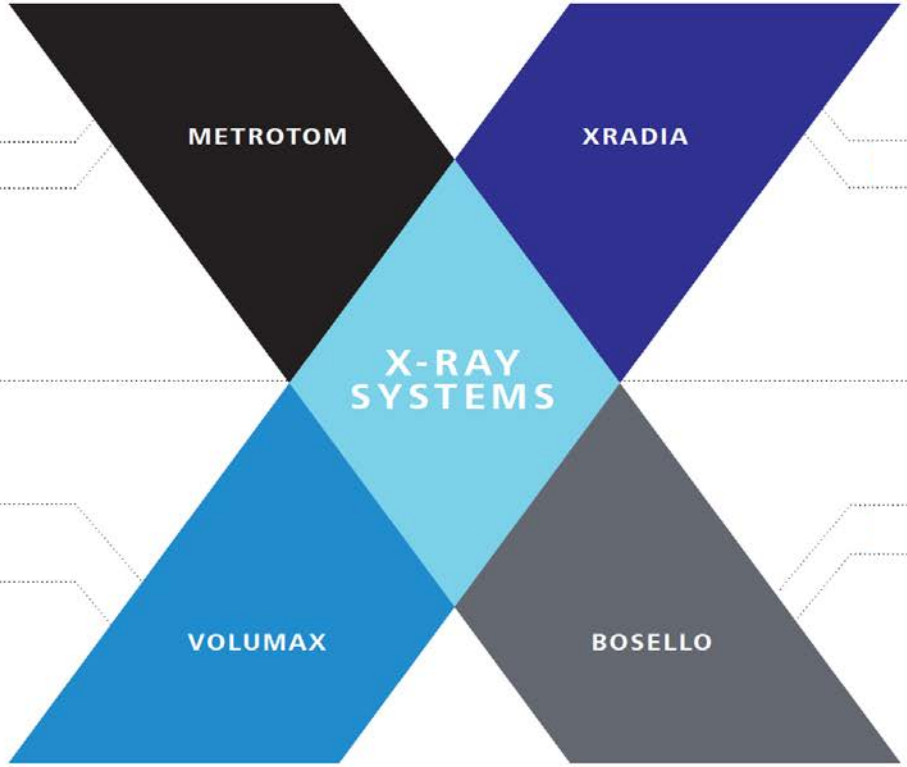
METROLÓGIA & INŠPEKCIA

METROTOM 800 130 kV
METROTOM 800 225 kV
METROTOM 800 225 kV (HR)
METROTOM 1500



ANALÝZY S VYSOKÝM ROZLÍŠENÍM

Xradia Context
Xradia 410 Versa
Xradia 510 Versa
Xradia 610 & 620 Versa
Xradia 800 & 810 Versa
Xradia 810 & 825 Synchrotron



VoluMax 400
VoluMax 800 130 kV
VoluMax 800 225 kV
VoluMax 1500

AUTOMATICKÁ 3D INŠPEKCIA & METROLÓGIA



BOSELLO WRE THUNDER
BOSELLO OMNIA
BOSELLO SRE MAX

AUTOMATICKÁ 2D INŠPEKCIA



VÝROBA
INŠPEKCIA & METROLÓGIA

PRIEMYSELNÝ CT SYSTÉM
METROTOM



	METROTOM 800/225 kV
X-ray trubica	225 kV / 500 W
Detektor	1024 x 1024 pixelov / 200 µm 1920 x 1536 pixelov / 127 µm (HR)
Merací objem	D x H 170 x 150 mm / 300 x 390 mm
MPE_{SD} MPE_{E}	4,0 µm + L/100 8,0 µm + L/100
Max. hmotnosť dielu	5 kg
Rozmery	3300 x 1900 x 2600 mm
Hmotnosť	5200 kg
Pohľad	Kamera-Monitor
Riadenie	Integrované

Vysoká presnosť
Laboratórny CT systém pre metrologické aplikácie

METROTOM 800/130 kV
METROTOM 800/225 kV – zákazkové meranie v ZEISS Metrologickom centre v Trnave
METROTOM 1500

PROCES VYHODNOCOVANIA CT DÁT
SPRACOVANIE DÁT KROK ZA KROKOM – SOFTVÉRY PRE CT



Načítanie referenčného modelu



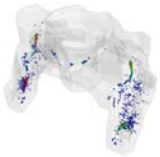
Načítanie CT skenu



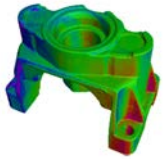
Definovanie povrchu



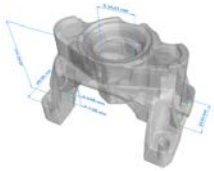
Vyrovnanie



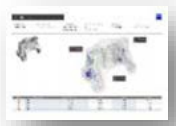
Analýza pórovitosti



Nominal-Actual porovnanie



Rozmerová analýza



Reportovanie

Metrotom OS
Skenovanie a rekonštrukcia dát
ZEISS



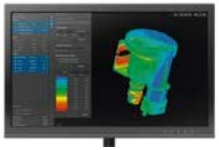
Calypso
Metrológia
ZEISS



NEO insights
Analýzy a metrológia
ZEISS



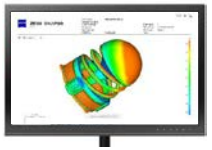
Reverse Engineering
RE a korekcia nástrojov
ZEISS



VGStudio Max
Analýzy a metrológia
Volume Graphics



PiWeb
Štatistika a reporting
ZEISS



Defect detection
In-line detekcia defektov
ZEISS

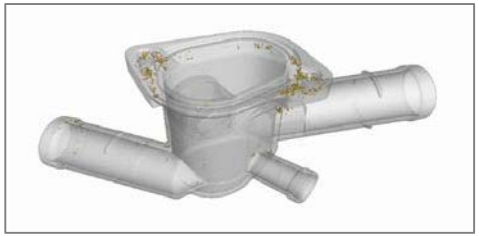


Projektovo riešená aplikácia
Špecializovaný softvér
ZEISS

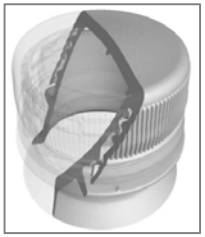
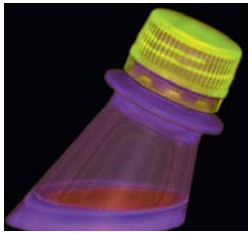


PRIEMYSELNÉ APLIKÁCIE
VÝHODY METROTOMOGRAFIE

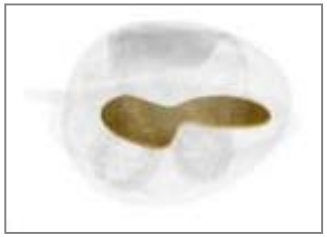
Analýza defektov



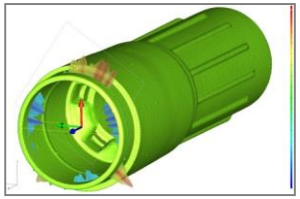
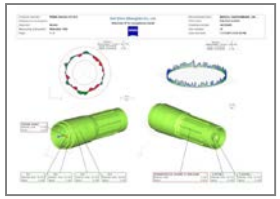

Inšpekcia montážnych zostáv

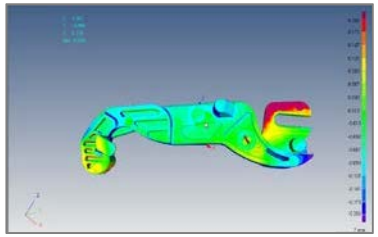
Separácia

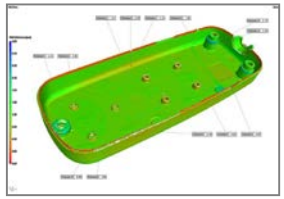
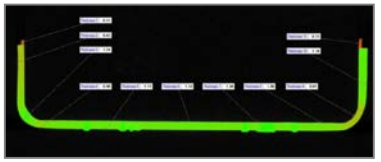
Rozmerová metrológia

Porovnanie Nominal-Actual

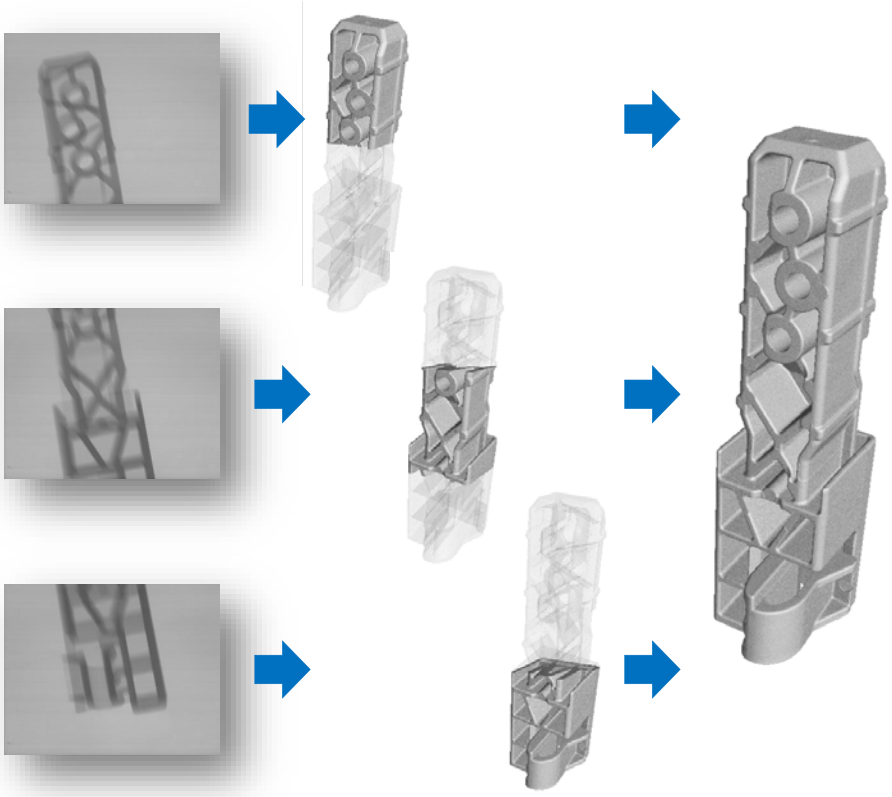


Analýza hrúbky steny

Reverzné inžinierstvo

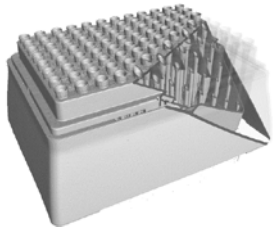
SPÁJANIE A ROZŠIROVANIE OBJEMOV
VERTIKÁLNE SPÁJANIE A HORIZONTÁLNE ROZŠÍRENIE



Vertikálne spájanie

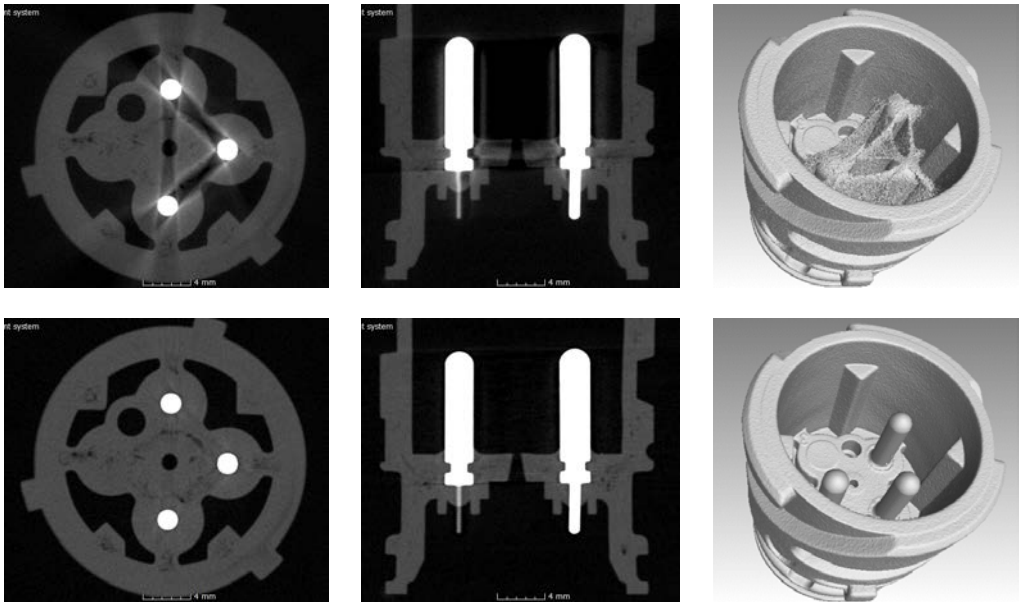


Virtuálne horizontálne rozšírenie detektora o 40%

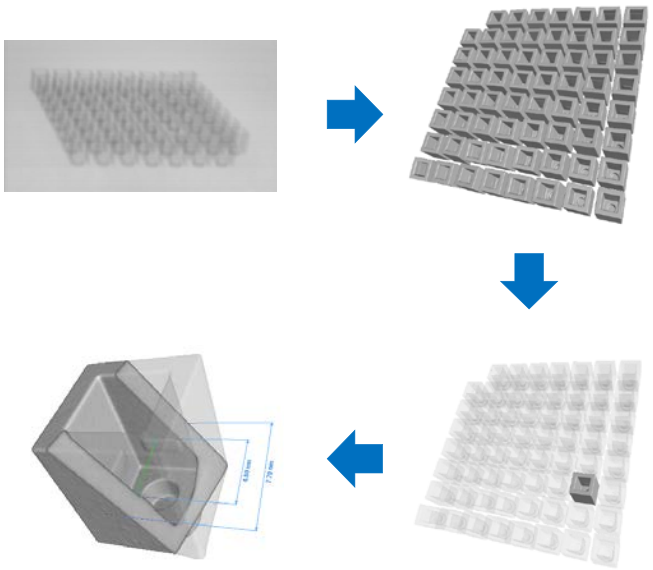


Kompletná súčiastka

REDUKCIA ARTEFAKTOV A SEPARÁCIA OBJEMOV
POKROČILÉ FUNKCIE

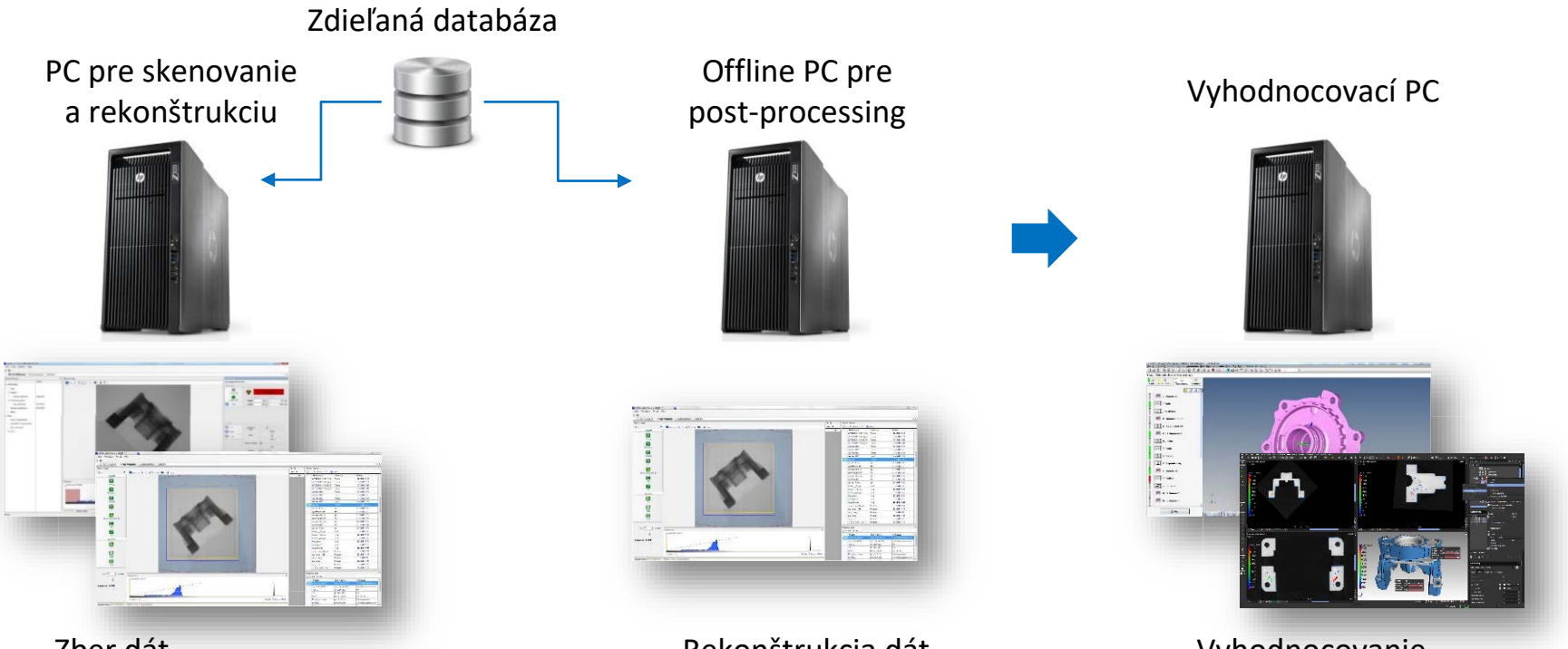


SRC – Scattered Radiation Correction
BHC – Beam Hardening Correction
AMMAR – Advanced Mixed Material Artifact Reduction



Automatické separovanie v METROTOM OS

ZVÝŠENIE PRODUKTIVITY
SAMOSTATNÝ PC PRE POST-PROCESSING DÁT



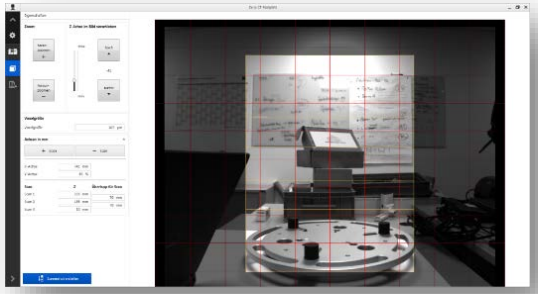
- Zber dát
- Rekonštrukcia dát
- Spájanie objemov, separácia
- SRC, BHC, AMMAR,…

- Rekonštrukcia dát
- Spájanie objemov, separácia
- SRC, BHC, AMMAR,…

- Vyhodnocovanie
- Reporting

DOPLNKY



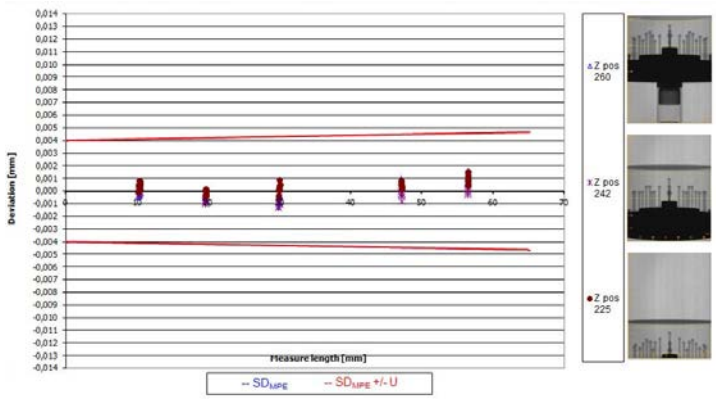


Fix Assist



Tomo Stage

PRESNOSŤ





- Opakovateľné merania pre celý merací objem
- Špecifikácie presnosti v zmysle VDI/VDE 2630

PRIEMYSELNÝ CT SYSTÉM
VOLUMAX



Vysoká rýchlosť
Automatizovaný InLine / AtLine (OffLine) CT systém

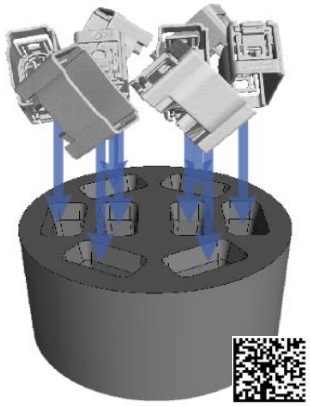
VoluMax 400
VoluMax 800 130 kV
VoluMax 800 225 kV
VoluMax 1500

- Veľmi rýchle vyhodnotenie v priebehu sekúnd
- 100% nedeštrukčná kontrola produkcie bez rizika odoslania zlého dielu
- Kompletná 3D inšpekcia objemu dielu namiesto 2D projekcií
- Kontrola produkcie bez vplyvu obsluhy s použitím inovatívnych softvérov
- Plne automatizovaná alebo polo automatizovaná činnosť
- Systém navrhovaný na konkrétne požiadavky zákazníka a integrovaný do výrobných liniek



PLNE AUTOMATIZOVANÝ PROCES SKENOVANIA A VYHODNOTENIA
OD VKLADANIA DIELOV DO CT AŽ PO REPORTOVANIE

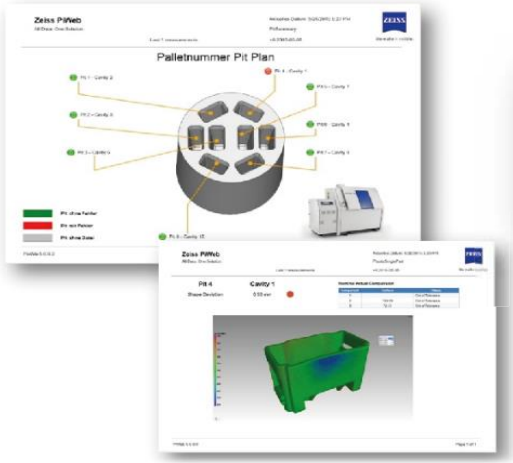
Vloženie dielov do prípravku



Automatizované skenovanie a post-processing



Online monitoring, reportovanie a štatistika

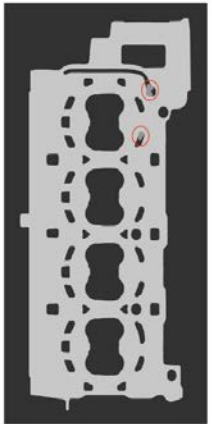




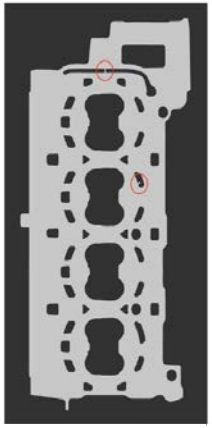


- Diely sú vložené do prípravku, ktorý je z materiálu s nízkou hustotou
- Prípravok s dielmi je manuálne alebo automaticky presunutý do CT
- Všetko ostatné vykoná VoluMax
- Na konci vyhodnotenia sa výsledky inšpekcie zobrazia v reportovacom a štatistickom softvéri PiWeb

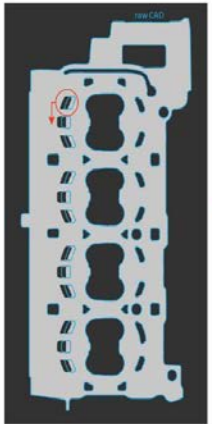
MOŽNOSTI INŠPEKCIE
PRE ODLIATKY Z KOVU, AKO AJ VÝLISKY Z PLASTU



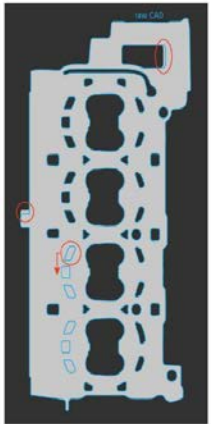
Zvyšky piesku



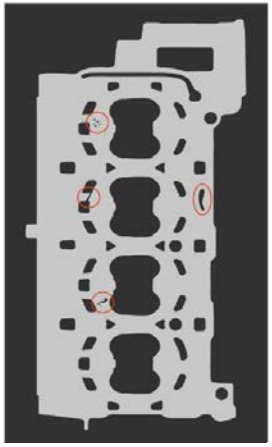
Poškodené jadro formy



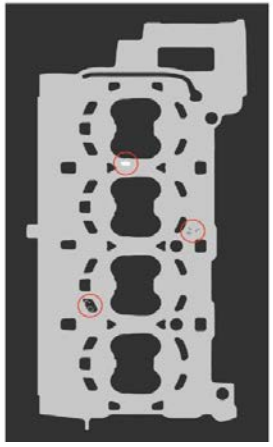
Jadro formy na zlom mieste voči CAD modelu odliatku



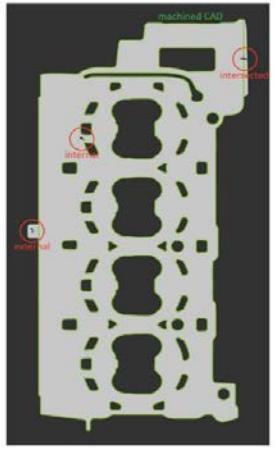
Výrazné odchýlky tvaru odliatku od CAD modelu odliatku alebo aj chýbajúce jadro formy



Póry, zrazeniny, trhliny



Vtrúseniny, čiastočky s vyššou alebo nižšou hustotou, hliníkové triesky



Klasifikácia defektov vo vzťahu ku CAD modelu obrobeného dielu

PRIEMYSELNÉ INŠPEKČNÉ X-RAY (RADIOSKOPICKÉ) SYSTÉMY
BOSELLO

BOSELLO HIGH TECHNOLOGY
A ZEISS company



Oblasti aplikácií priemyselných inšpekčných X-ray systémov Bosello:

Automobilový priemysel
- ✓ Bloky motorov
- ✓ Hlavy valcov
- ✓ Piesty
- ✓ Disky kolies
- ✓ Disky bŕzd
- ✓ Rámy
- ✓ Rôzne

Letecký priemysel
- ✓ Lopatky turbín
- ✓ Časti motorov
- ✓ Prevodovky
- ✓ Diely z kompozitov
- ✓ Rôzne

Zlievarenstvo
- ✓ Nádrže
- ✓ Časti mechanizmov
- ✓ Časti spotrebičov
- ✓ Rôzne

Výroba rúr
- ✓ Kontrola zvarov
- ✓ Kontrola zostáv
- ✓ Tesnenia
- ✓ Rôzne

BOSELLO GENERÁTORY
POUŽITIE NIELEN V ZARIADENIACH BOSELLO

Bosello vyvýja a vyrába vo svojom podniku široké portfólio X-ray a vysokonapäťových generátorov :

- Mono-block X-ray generátory
- Vysokonapäťové generátory pre X-ray trubice

Použitie je nielen v zariadeniach Bosello, ale aj v riešeniach OEM aplikácií v medicíne, potravinárskom priemysle, bezpečnosti a pod.





Mono-block X-ray generátory



Vysokonapäťové generátory pre X-ray trubice

BOSELLO X-RAY SYSTÉMY
ŠIROKÉ PORTFÓLIO ZARIADENÍ PRE INŠPEKCIU PRODUKCIE

X-ray aplikácie (možnosť CT) | **ADR aplikácie**

Priemysel, laboratóriá, R&D | **Veľkoobjemová výroba**



SRE HEX
Univerzálne
- 160 kV / 225 kV zdroj
- Manuálne, resp. automatické ovládanie
- Max. rozmery dielov 500x700 mm, 25 kg
- Možnosť CT (iba automatické ovládanie)



SRE MAX
Univerzálne
- 160 kV / 220 kV / 320 kV / 450 kV zdroj
- Automatické ovládanie
- Max. rozmery dielov až do 800x1500 mm, 250 kg
- Možnosť CT a ADR FARIS



ACRE 94
Inšpekcia piestov
- 160 kV zdroj
- Max. rozmery piestov Ø 50-170 mm, L 50-200 mm, 6,5 kg
- ADR FARIS



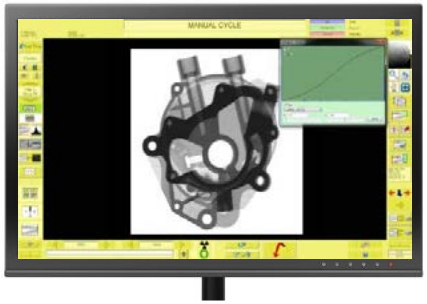
WRE Thunder 3
Inšpekcia diskov
- 160 kV zdroj
- Max. rozmer diskov 26“, 50 kg
- Kapacita až 145 diskov / hodina
- ADR FARIS



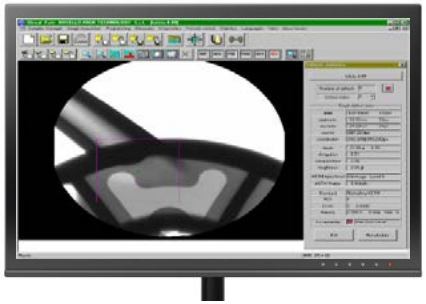
OMNIA
Veľkoobjemová inšpekcia
- 160 kV / 225 kV zdroj
- Rozmery nakladacej palety až do 1600x1000 mm, 25 kg
- Inšpekčný objem až do 1570x970x480 mm
- Možnosť rôznej modifikácie systému nakladania dielov (manuálne, robotické, s detekciou datamatrix kódov)
- ADR FARIS

BOSELLO SOFTVÉRY PRE X-RAY
NÁSTROJE PRE ZBER DÁT A VYHODNOCOVANIE

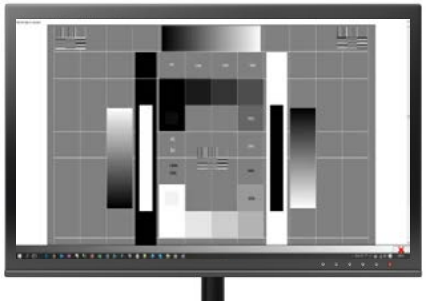
Image Processor BHT Extreme
Zber a post-processing dát



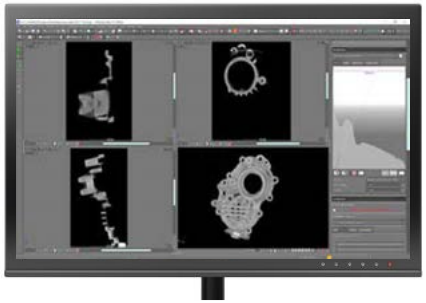
Visual FARIS (Fully Automatic Recognition Inspection System)
Automatická detekcia defektov



DDA (Digital Detector Array)
Vyhodnocovanie kvality X-ray dát



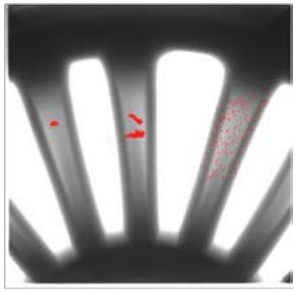
VGStudio Max
Analýzy a metrológia



TYPICKÉ APLIKÁCIE
ŠIROKÉ SPEKTRUM APLIKÁCIÍ

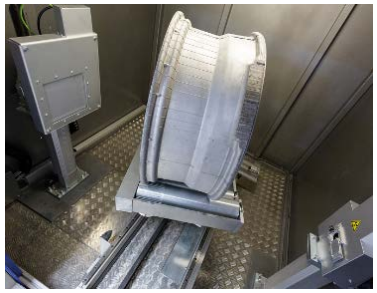
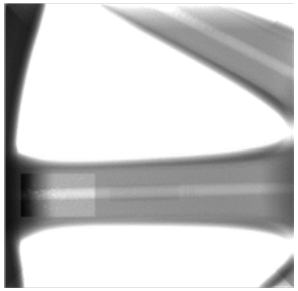
Disky kolies (100%)





Disky kolies (offline)



TYPICKÉ APLIKÁCIE
ŠIROKÉ SPEKTRUM APLIKÁCIÍ

Motorové diely

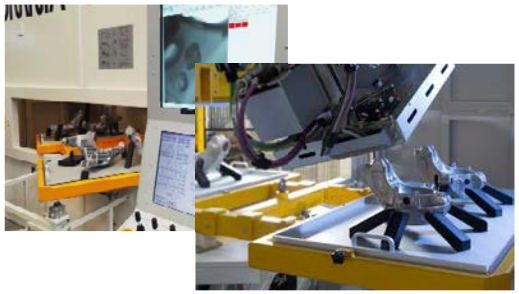


Rôzne diely v Automotive

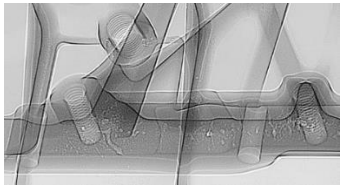
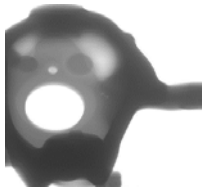
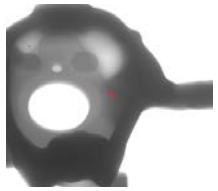


TYPICKÉ APLIKÁCIE
ŠIROKÉ SPEKTRUM APLIKÁCIÍ

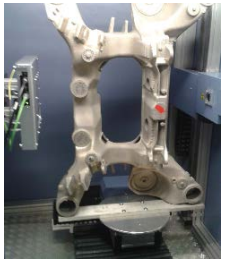
Nosné a závesné diely





Rámy







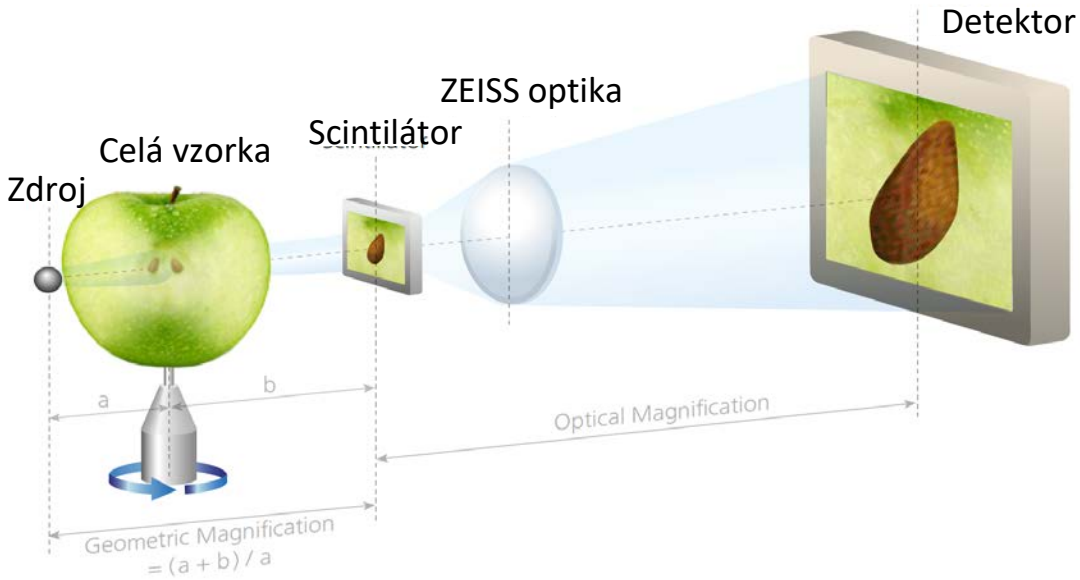



PRIEMYSELNÝ CT MIKROSKOP
XRADIA



Vysoké rozlíšenie
Laboratórny CT mikroskop pre výskumné aplikácie

Xradia Context
Xradia 410 Versa
Xradia 510 Versa
Xradia 610 & 620 Versa
Xradia 800 & 810 Versa
Xradia 810 & 825 Synchrotron



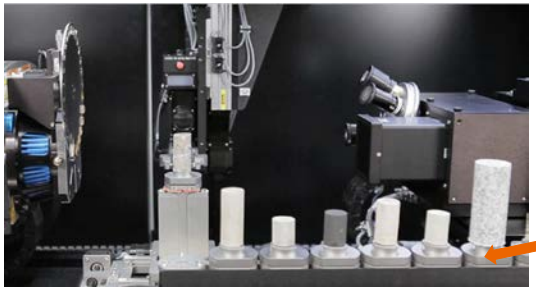
TECHNICKÉ MOŽNOSTI
SOFTWARE, AUTOLOADER, RAAD – RESOLUTION AT A DISTANCE

Scout-and-Scan
Zber dát a post-processing

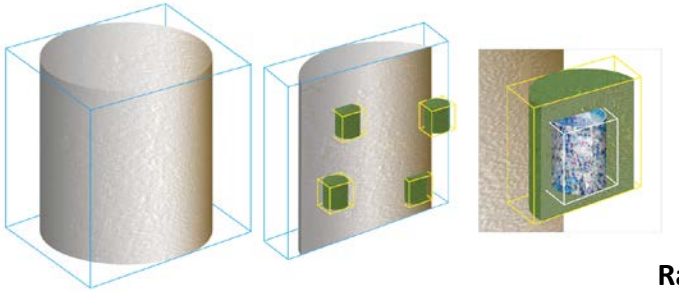


Dragonfly Pro
Vizualizácia a analýzy



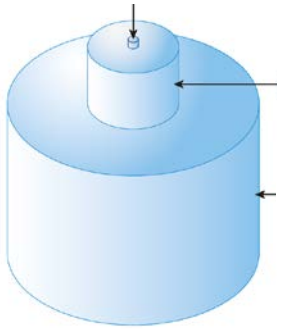


Autoloader
14 staníc pre uchytenie vzoriek



Resolution at a Distance
FPX Detector 3072 x 1944 pixelov

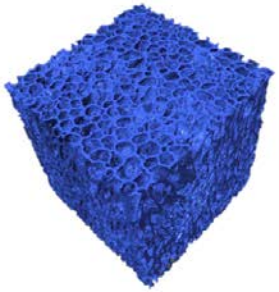
RaaD 4x
6,5 mm D x 6,5 mm h



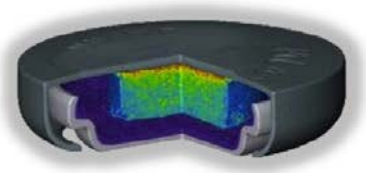
RaaD 0,4x
50 mm D x 50 mm h

FPX Flat Panel
140 mm D x 93 mm h

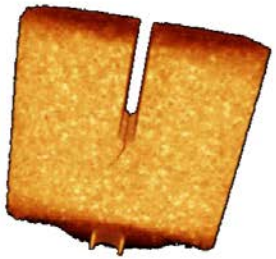
TYPICKÉ APLIKÁCIE
ŠIROKÉ SPEKTRUM APLIKÁCIÍ



Polyméry



Batérie, palivové články



Keramika



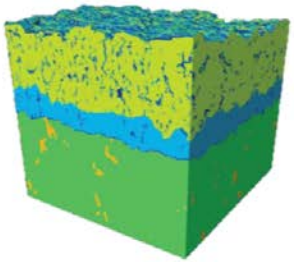
Kompozity



Organizmy



Kovy



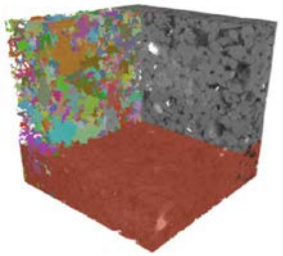
Povlaky



Sklo

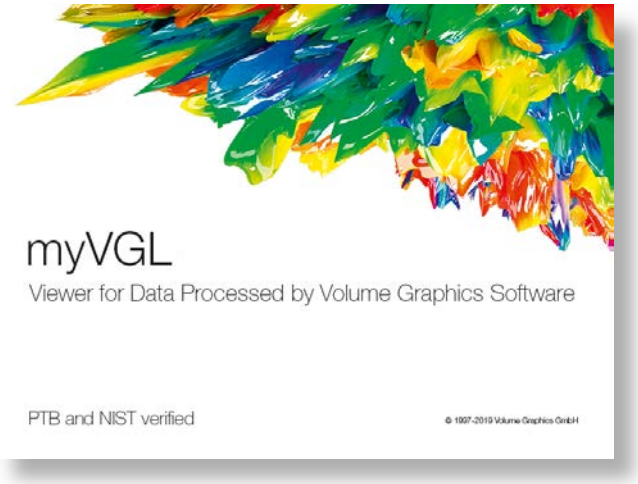


Betón

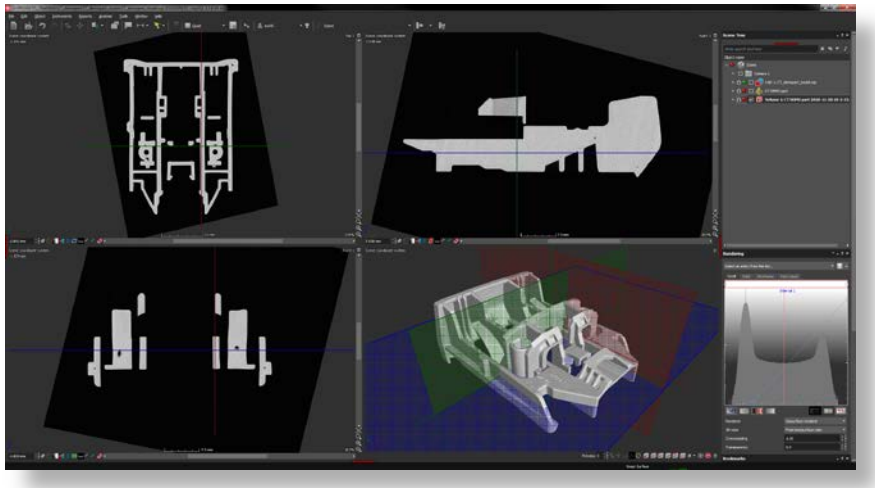


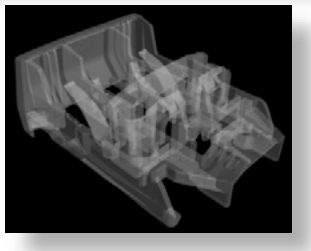
Horniny

PRIEMYSELNÁ POČÍTAČOVÁ TOMOGRAFIA CT
MYVGL – VOĽNE DOSTUPNÝ PREHLIADAČ EXPORTOVANÝCH CT SKENOV



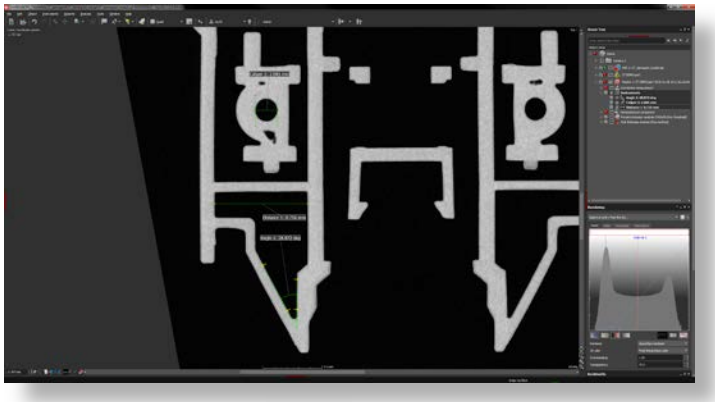
Z nasledujúcich možností analýz CT skenov poskytuje plné možnosti softvér VGStudio Max a NEO insights



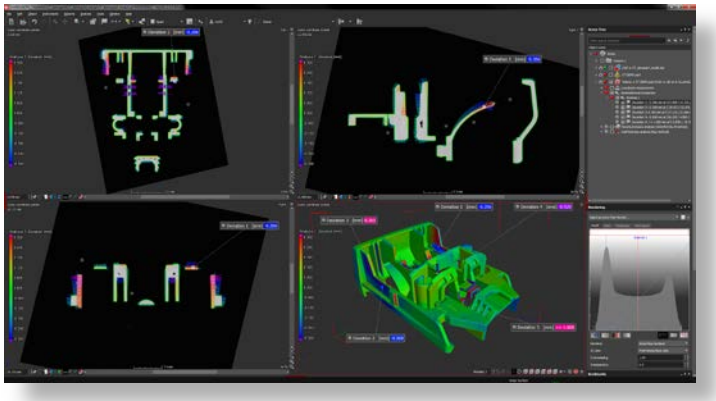


myVGL prezeranie CT skenu v ľubovoľných pohľadoch a rezoch, ako aj v transparentnom 3D zobrazení

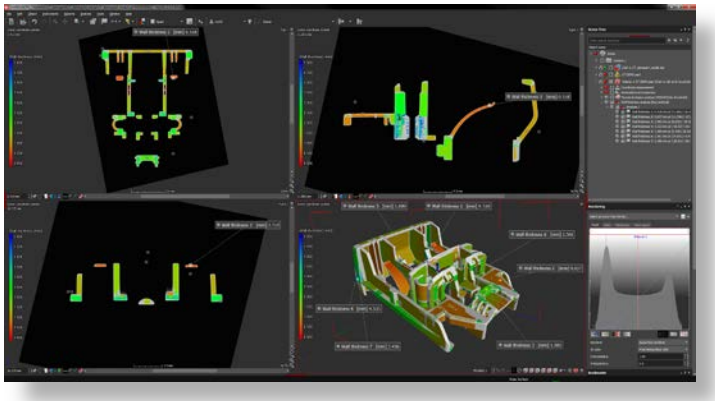
PRIEMYSELNÁ POČÍTAČOVÁ TOMOGRAFIA CT
MYVGL – VOĽNE DOSTUPNÝ PREHLIADAČ EXPORTOVANÝCH CT SKENOV



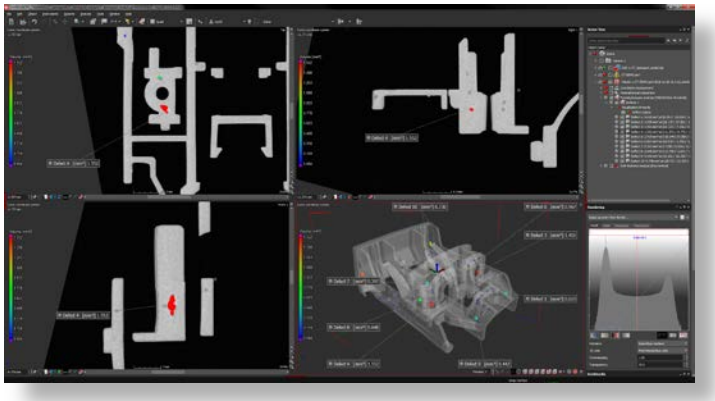
myVGL základné meracie funkcie (vzdialenosť bod-bod, uhol, a pod.)



myVGL grafická mapa odchýlok s použitím analýzy Nominal-Actual porovnania



myVGL analýza hrúbky steny



myVGL analýza pórovitosti, inklúzií, príp. prasklín v objeme

X-RAY ZEISS RIEŠENIA
KOMPLEXNÉ RIEŠENIA PRODUKTOV A SLUŽIEB



SYSTÉMY

2D radioskopia
Počítačová tomografia CT
CT mikroskopia

SOFTVÉRY

Zber dát
Vyhodnocovanie dát
Data Management &
Industry 4.0

ZEISS X-ray Series
Make the Invisible Visible

APLIKÁCIE

Aditívna výroba
Hliníkové odliatky
Batérie
Lopatky turbín
Elektronika
Oil & Gas
Plastové diely
Kompozity
Multimateriálové
diely
Zostavy
Materiálový výskum
Life sciences

SLUŽBY

Meracie služby
Aplikačná podpora
On-site školenia
Semináre
eLearning
Lokálna údržba
Sady náhradných dielov
Garantovaná doba prevádzky

DOPLNKY

Prípravky
Montážne stoly
Retrofit
Automatizácia

Carl Zeiss spol. s r.o.
Radlická 14/3201
150 00 Praha 5 – Smíchov
Česká Republika

Carl Zeiss Slovakia, s.r.o.
Račianska 12481/77/A
831 02 Bratislava
Slovenská Republika

ZEISS Centrum kvality
Botanická 49
917 08 Trnava
Slovenská Republika



Seeing beyond

HOW WE HAVE BUILT THE WORLD'S BEST 3D CAMERA

Ing. Ján Žižka[1]
[1] Photoneo s.r.o.

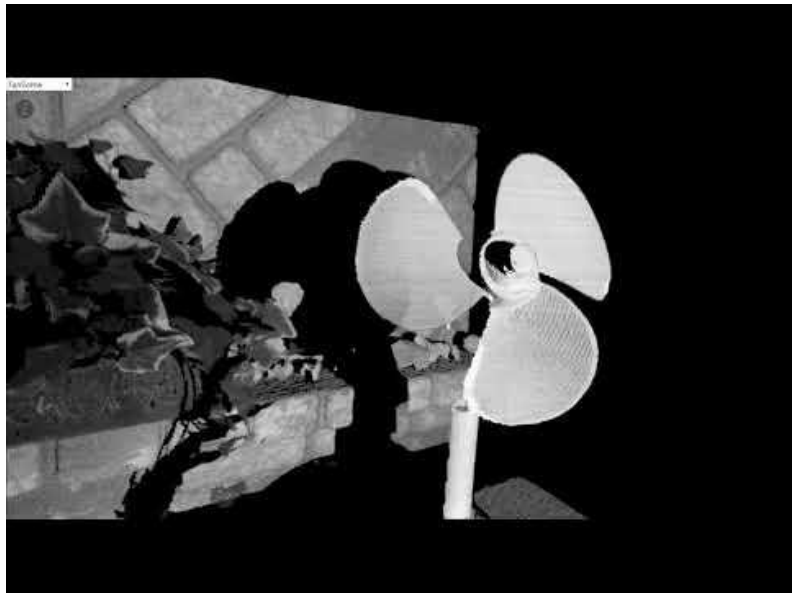


World's best 3D camera for robotics

Jan Zizka, Photoneo

World's best 3D camera for robotics

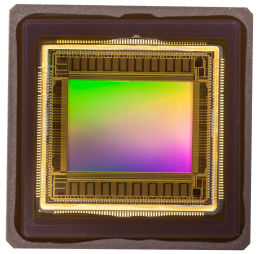
- Novel technology - Parallel Structured Light
  - Custom chip - CMOS image sensor IP
  - Rolling => Global => Mosaic Shutter
- **10x Higher Resolution & Accuracy**
- **No Motion Blur, Scanning in rapid motion**
- **Works Outdoors. Range: 1-10m**
- **Multiple Devices Simultaneously**
- Optimal Light Efficiency
- Rapid Acquisition - up to 60 FPS
- **Patented (US, EU, China)**

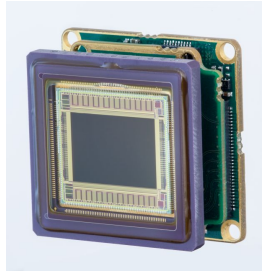


VISION AWARD 2018 Winner

Vision Systems DESIGN 2019 Innovators Awards PLATINUM

inVISION INNOVATI 2019

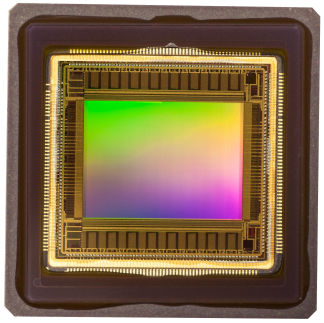


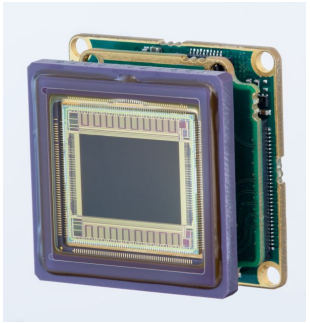




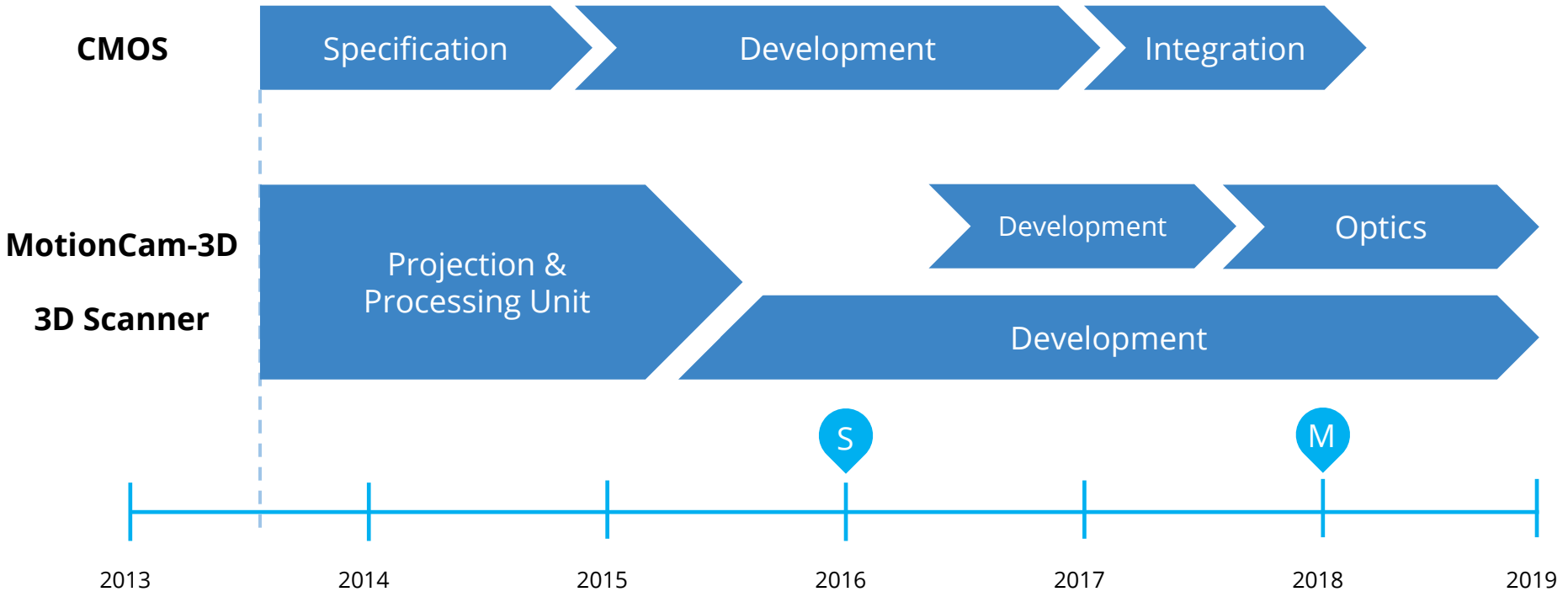
Computational Image Sensor

- Photoneo developed and patented a novel, ultimate IS for Computational Photography
- It fundamentally changes the way how the image is captured and thus reveals a novel valuable information.
- Broad applicability:
  - 3D Scanning
  - HDR video
  - Motion Tracking
  - Image Deblurring
  - Compressive sensing



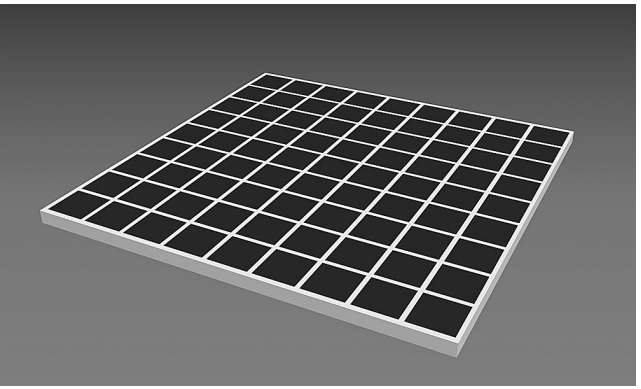


Timeline

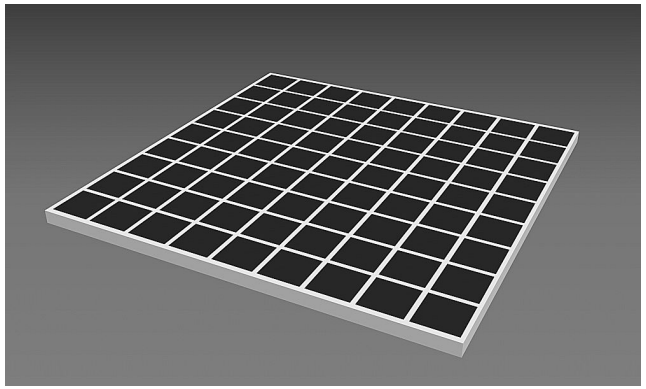

CMOS
Specification
Development
Integration
MotionCam-3D
3D Scanner
Projection &
Processing Unit
Development
Optics
Development
S
M
2013
2014
2015
2016
2017
2018
2019

Computational Image Sensor

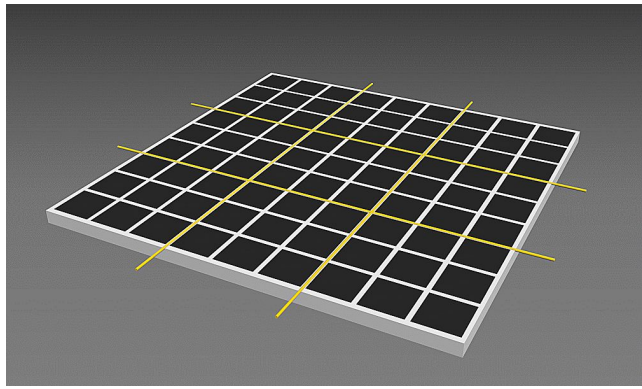
Rolling Shutter



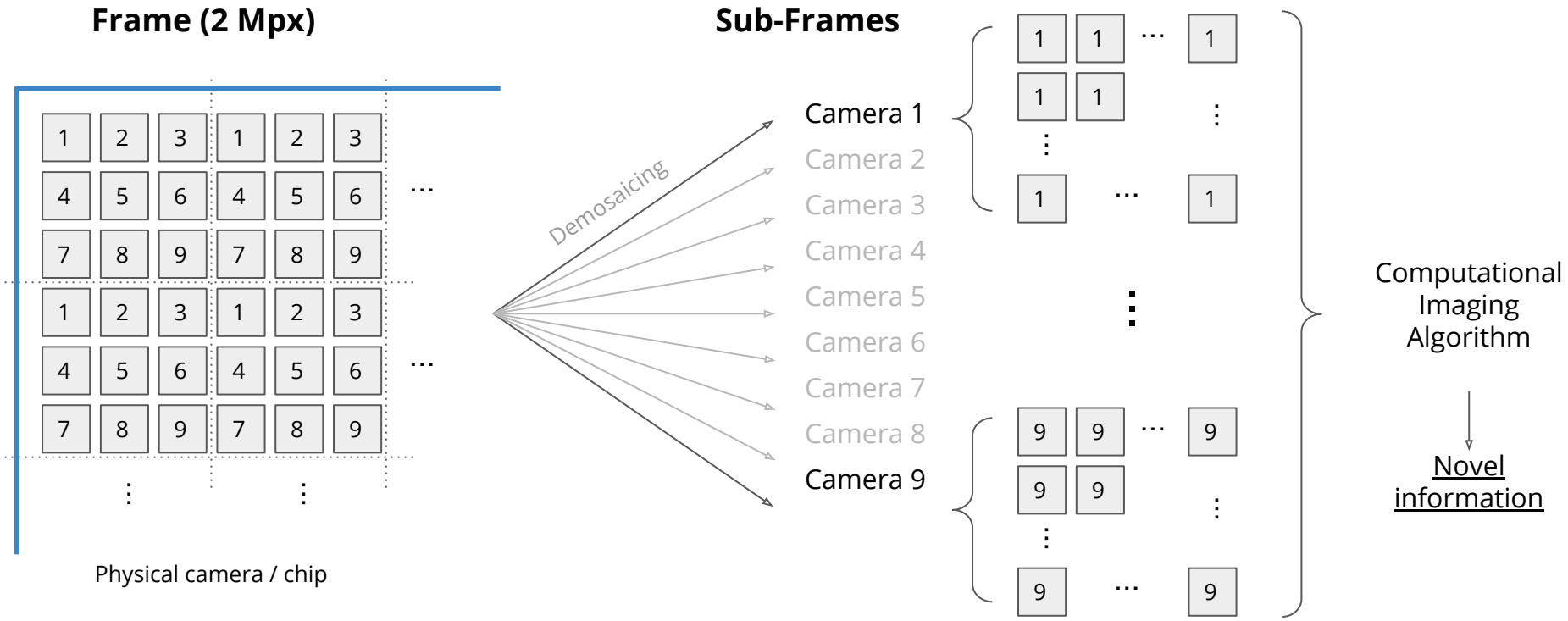
Global Shutter



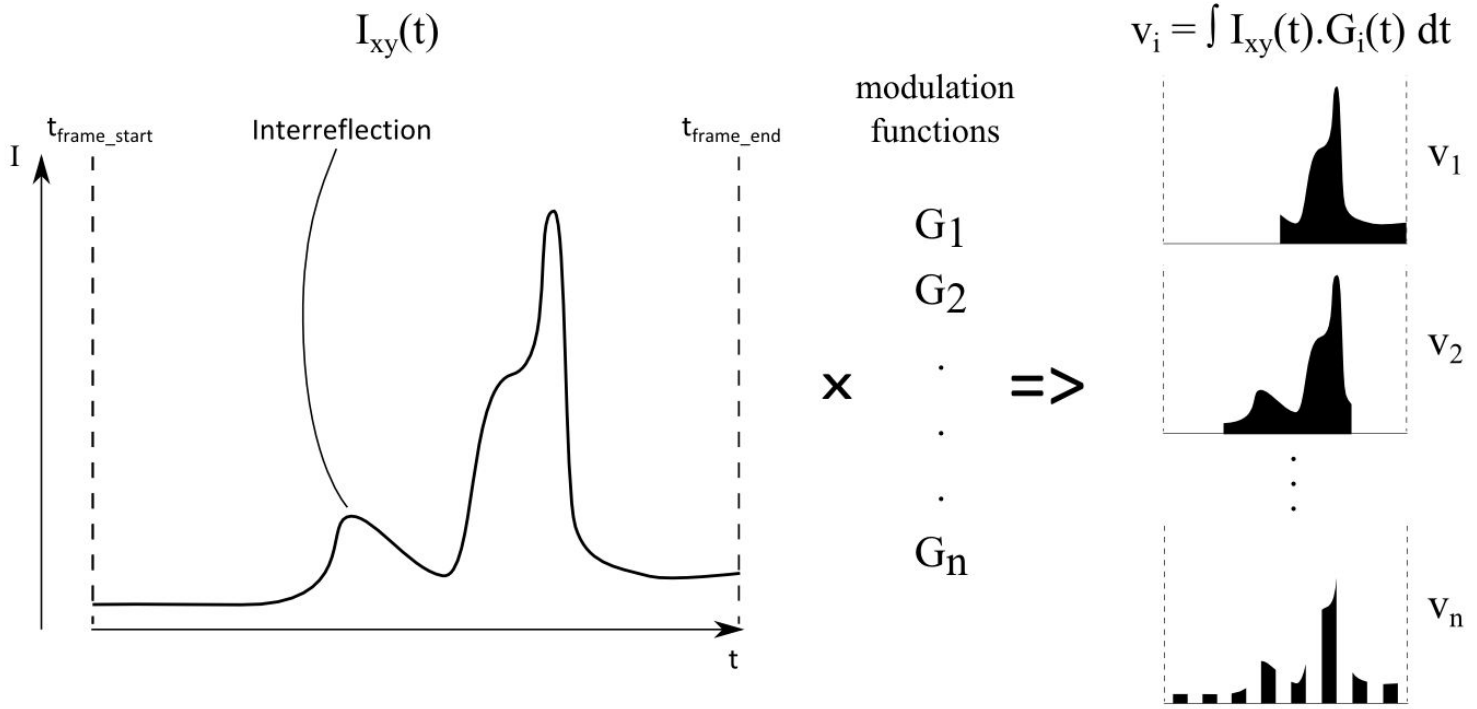
Mosaic/Matrix Shutter



9 independent cameras in one



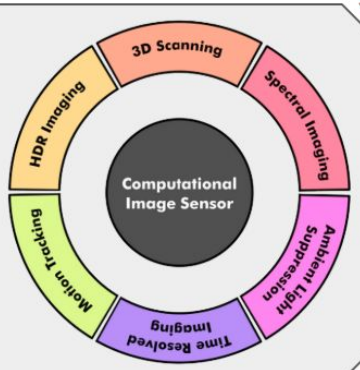
Powerful sampling



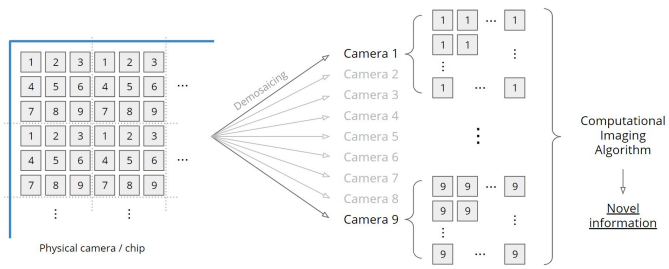
$$accumulated\ value = \int_{t_{frame\ start}}^{t_{frame\ end}} incoming\ light(t) \cdot modulation\ signal(t)\ dt$$

Basic principle

Multi frame
sensing approach



One frame
sensing approach



- 3D Video
- Speed Measurement
- HDR Video
- Ambient Light Suppression
- Photometric Stereo
- Depth Edges
- Motion Tracking
- Hyperspectral Imaging
- Time Gating
- Subsurface Scattering
- Light Field
- ...

Multiple images in one shot



Use cases - robot vision

Handling / Picking

CAD based matching
Oriented placing

Picking of unknown objects
Pretrained out-of-the-box









Industrial robotics
Manufacturing
Automotive

Logistics
E-commerce
Warehouses

Food industry

Universal
Depalletization
Logistics & E-com

Assembly

Inspection

Mobile robotics





Painting

Welding

PROCEDURE FOR DIGITIZING THE ASSEMBLY LINE AND INTERCONNECTION WITH I40 / DIGITAL TWIN TECHNOLOGY

Robin Mitana[1]
[1] SIDAT Digital s.r.o.



PROJECT: DIGITIZATION OF ASSEMBLY LINE + DIGITAL TWIN

Robin Mitana, SIDAT Digital Bratislava, Slovakia

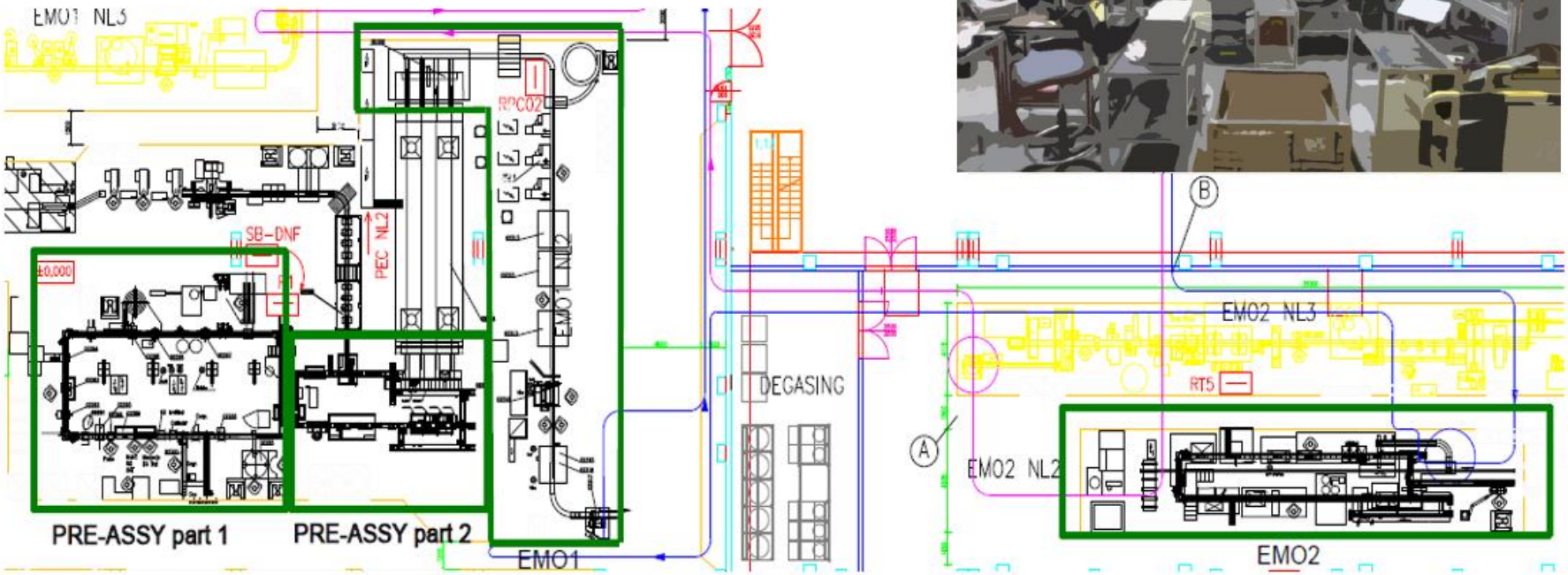
PROJECT: DIGITIZATION OF ASSEMBLY LINE + DIGITAL TWIN

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ALL RIGHTS ARE RESERVED.

TARGET OF THE PROJECT

INCREASING OF PRODUCTION ON COMPRESSOR ASSEMBLY LINE IN ZLATE MORAVCE (SLOVAKIA) PLANT BY +15%





HOW TO ACHIEVE IT ?

DIGITIZATION OF PRODUCTION PROCESSES WITH FUTURE AUTOMATED EVALUATION
ALGORITMIC IDENTIFIACTION OF BOTTLENCK(S) WITH STEP BY STEP ELIMINATION OF THEM

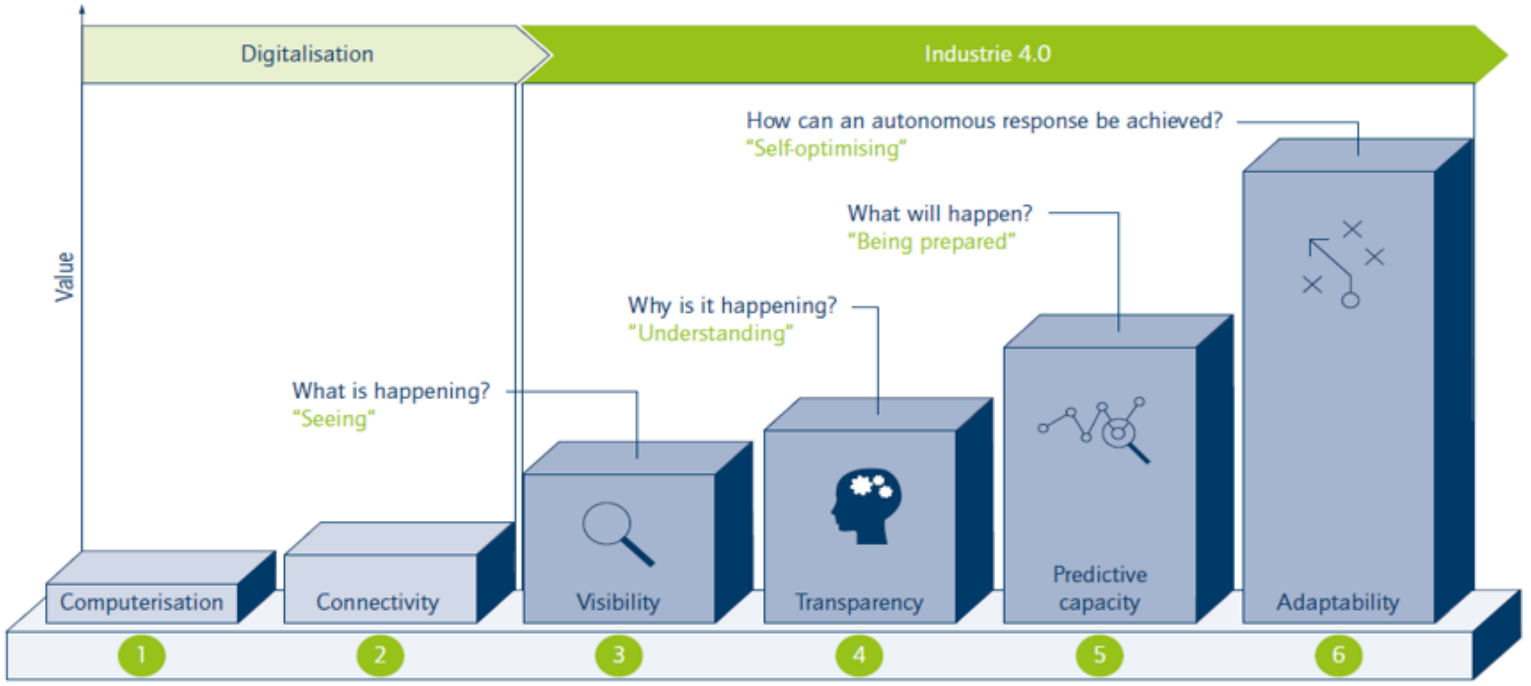
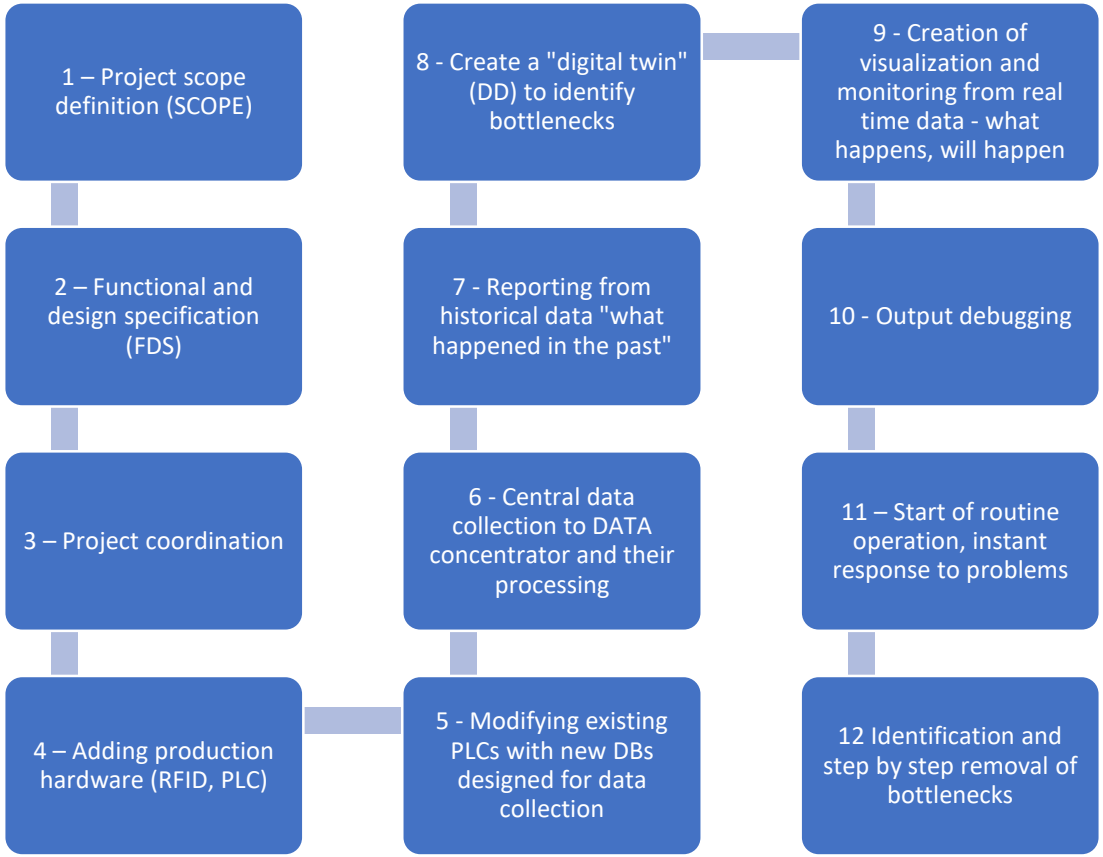


Figure 5: Stages in the Industrie 4.0 development path (source: FIR e. V. at RWTH Aachen University)

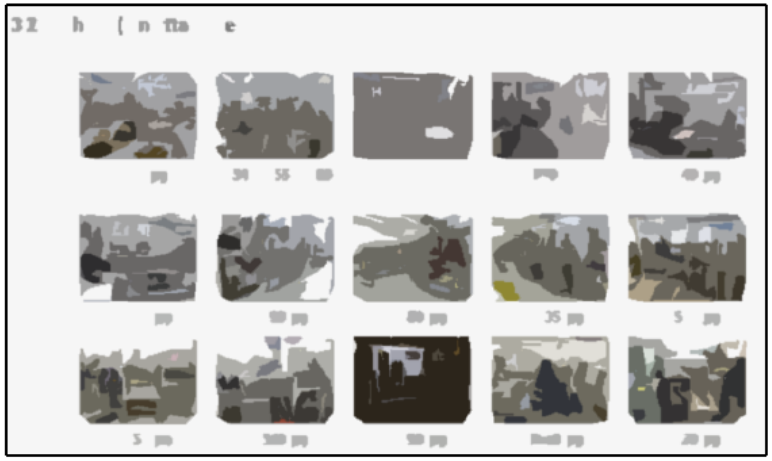
IMPLEMENTATION STEPS



STEP 1 – PROJECT SCOPE DEFINITION

THE DOCUMENT FOUNDING THE SCOPE OF THE PROJECT - CONTAINS THE FOLLOWING CHAPTERS

- TARGET(S)
- TYPE OF PRODUCTION
- CURRENT STATE
- NEW STATE
- INFRASTRUCTURE
- ROI



- Each process will be provided RFID reader (information about RFID NIDEC) – RFID reader will be connected to PLC
- Requested information will be collected directly from PLC
- STATOR is labeled from stator production line
  COMPRESSOR HOUSING is labeled after OP140, model, time of proc
- COMPRESSOR LABEL is sticker on OP580 with BAR code, model, tim

4.5 Reporting (via PC web browsers)

- Report 1 – OEE per selected period
  - Compare with previous period, trends
- Report 2 – Downtimes per selected period
  - Compare with previous period, trends

ATTACHMENT 1 – PROJECT SCOPE

1. TARGET

- Data collection, monitoring, reporting from the assembly line
- Deployment Industry 4.0 / Digital twin technology as digital optimization support

STEP 2 – FUNCTIONAL AND DESIGN SPECIFICATION (FDS)

FDS, CONTAINS THE FOLLOWING CHAPTERS

- REALISATION TEAM, RESPONSIBILITIES, CONTACTS
- DETAILED TECHNICAL DESCRIPTION OF FUTURE SOLUTION
- RESPONSIBILITY OF CLIENT
- EXPECTED COLABORATION OF CLIENT
- TIME SCHEDULE / PROJECT PLAN
- PROJECT SCOPE AS ATTACHMENT

1. REALISATION TEAM + CONTACTS:

COMPANY	NAME	ROLE	TEL	E-MAIL
SIDAT	Robin Mitana	Project coordination	+421 903 432 036	robin.mitana@sidatdigtal.sk
SIDAT	Zdeněk Šebek	PLC, Data acquisition, OEE	+420 739 592 009	zdenek.sebek@sidat.cz
SIDAT	Milam Lokšík	Digital manufacturing leader	+421 911 446 406	milan.loksik@sova.sk
SIDAT	Dušan Randuška	Digital manufacturing expert	+421 901 900 235	dusan.randuska@sova.sk
NIDEC	František Šlosiar	Project coordination	+421 914 384 217	Frantisek.slosiar@mail.nidec.com

2.3.3 Digital twin

Digital twin for processes PRE-ASSY1+2, EMO1+2 will be created. Following functionality of digital tween will be delivered ...

Creating of digital copy of production process (Digital tween – DT)

- Connection DT with physical line (via OEE SW)
- DT applications ...
  - Data collection
  - Real time process visualization + process rewind
  - Particular online pallets monitoring @ tracking
  - Evaluation of processes @ resources
  - Cycle time monitoring
  - Evaluation of historical data – OEE, Cycle time (CT)
  - Implementation of algorithm for down-times and micro down-times identification
  - Historical evaluation of processes/reasons which caused bottlenecks (+downtimes @ micro downtimes of bottleneck)

STEP 3 – PROJECT COORDINATION

PROJECT PLAN ONLINE – REGULAR UPDATE FROM BOTH SIDES, REGULAR CONTROL DAYS PLAN
KEY INFORMATION FROM CONTROL DAYS + MONITORING OF BUGS WITH ONLINE UPDATING

START DATE:	09.07.2018		PLANNED
TODAY	09.05.2019		DONE
END DATE (EST):	31.12.2018	100%	DELAYED
OVERAL PROGRESS	99%		

WHO	TASK	PROGRESS %	DATE CAL WEEK	9.7 28	16.7 29	23.7 30	30.7 31	6.8 32	13.8 33	20.8 34	27.8 35	3.9 36	10.9 37
									FACTORY HOLIDAY				
ALL	CONTROL DAYS						SKYPE 03.08.2018 12:00		SKYPE 17.08.2018 12:00		SKYPE 31.08.2018 12:00		ONSITE 14.09.2018 12:00
ALL	FDS	100%		100%					15.08.2018				
SIDAT	DELIVERY OF HW + SW	100%											
SIDAT	Data koncentrator assembling	100%										100%	
	DIGITALISATION OF ASSEMBLY LINE	99%											
NIDEC	List of planned changes on the line	100%					100%	01.08.2019					
NIDEC	List of processes/PLC	100%		100%		18.07.2019							
NIDEC	Needed PLC on LAN	100%											
NIDEC	HW integration into local infrastructure	100%											
NIDEC	Material preparation for local network	100%											14.09.2018
NIDEC	Order of all HW for local network	100%						100%	19.08.2019				
SIDAT	OEE installation plus cfg	100%											
SIDAT	LED visualisation	100%											
SIDAT	Reports prg creating	100%											
SIDAT	Reports testing	100%											
SIDAT	List of RFID processes	100%		100%		25.07.2018	Document "Operacie+CT_full.xlsx"						

AREA	WHAT	STATUS	INITIATED	PLAN TO RESOLVE	RESOLVED	WHO	COMMENT
PLC		Info only	30.07.2018	01.09.2018	30.08.2019	NIDEC	Solution in progress
Reports		In progress	30.07.2018	10.08.2018		SIDAT	Corrected
DigitalTwin		Solved	30.07.2018	10.08.2018	12.08.2018	SIDAT	Bad trigger

STEP 4 – ADDING OF NEW PRODUCTION HW

ADDING NEW PLC + RFID HW TO THE LINE/PROCESSES WHERE MISSED
NEW DIGITAL OUTPUTS WITH SPECIFIC SIGNALS
CONNECTION TO INDUSTRIAL LAN (PROFINET) – ALL PROCESSES (APPROX. 60)







STEP 5 – MODYFYING OF EXISTING PLC WITH NEW DATABLOCKS (DB)

Nidec Global Appliance Slovakia s.r.o.

Assembly Digitalization Project

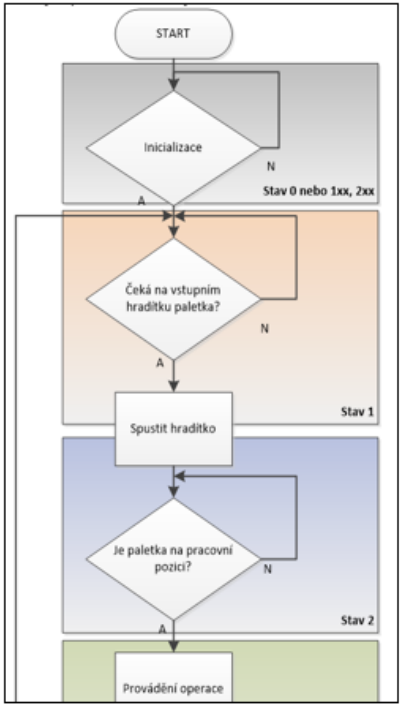
PLC Interface

4.1. Data block PLC2SIDAS

```
DATA_BLOCK "PLC2SIDAS"
TITLE =
VERSION : 0.1


  STRUCT
   STATUS : INT ;     //Stav stroje (operace)
   ID_LEN : INT ;     //počet platnych bytu v poli ID
   ID : ARRAY [0..19] OF BYTE;  //RFID tag
   RESULT : INT ;     //Vysledek operace (0 = OK)
   CNT_OK : INT ;     //Citac zpracovanych kusu (vysledek operace OK)
   CNT_NOK : INT ;    //Citac zpracovanych kusu (vysledek operace NOK)
   ART_NO : STRING[8];  //Číslo artiklu
   SPARE : ARRAY [0 .. 57] OF BYTE ;  //Rezerva
   PING_IN : INT ;    //PLC zapisuje 1,0,1…
   PING_OUT : INT ;   // SIDAS zapisuje kopii PING_IN
  END_STRUCT ;
BEGIN
END_DATA_BLOCK
```

Název	Datový typ (SIEMENS S7)	Popis
STATUS	INT	Stav stroje (pozice) 0 – neznámý nebo nedefinovaný stav 1 – čeká na příjezd paletky na vstupní hradítko 2 – paletka vjíždí pozici, čeká se na zahájení operace 3 – paletka na pozici, operace probíhá 4 – operace dokončena, čeká se na odjezd paletky 100 – údržba 101 - seřizování 200 – obecná porucha 2xx – poruchové stavy (pokud jsou definovány) Stavy >=100 jsou nepovinné a mohou být implementovány v závislosti na možnostech příslušného stroje.
ID_LEN	INT	Počet platných bytů v poli ID
ID	ARRAY [0..19] OF BYTE	Číslo RFID tagu (paletky). Platná hodnota musí být poskytována ve stavu 3 a 4. V ostatních stavech musí být nastaveno na prázdný řetězec (stačí nastavit pouze ID_LEN=0, obsah pole ID nemusí být nulován)
RESULT	INT	Výsledek operace: 0 – OK 1 – nespecifikovaná chyba (NOK) 2 – prázdná paleta 3 – paleta projíždí (výrobek NOK nebo stanice je vypnuta) >3 – individuální chybové kódy (pokud jsou definovány Platná hodnota musí být zapsána do pole RESULT před tím, než dojde k zápisu hodnoty 4 do pole STATUS
CNT_OK	INT	Počítadlo zpracovaných kusů (výsledek operace OK)
CNT_NOK	INT	Počítadlo zpracovaných kusů (výsledek operace NOK)
ART_NO	STRING[8]	Označení artiklu, prázdný řetězec pokud není relevantní (pozice mimo 30, 520, 140_2)
SPARE	ARRAY [0..57] OF BYTE	Rezerva
PING_IN	INT	PLC zapisuje cyklicky hodnoty 1,0,1,0....
PING_OUT	INT	SIDAS kopíruje hodnotu z PING_IN



STEP 6 – DATA CONCENTRATOR

IMPLEMENTATION OF „DATA CONCENTRATOR“ FOR PC@PLC DATA ACQUISITION
PROCESSING OF THE DATA VIA INDUSTRIAL SIMATIC S7 IPC AND TRANSFER TO SQL DATABASE
VIRTUAL SERVERS FOR APPLICATIONS (OEE, SQL)
GRAPHICAL WORKSTATION FOR DIGITAL TWIN











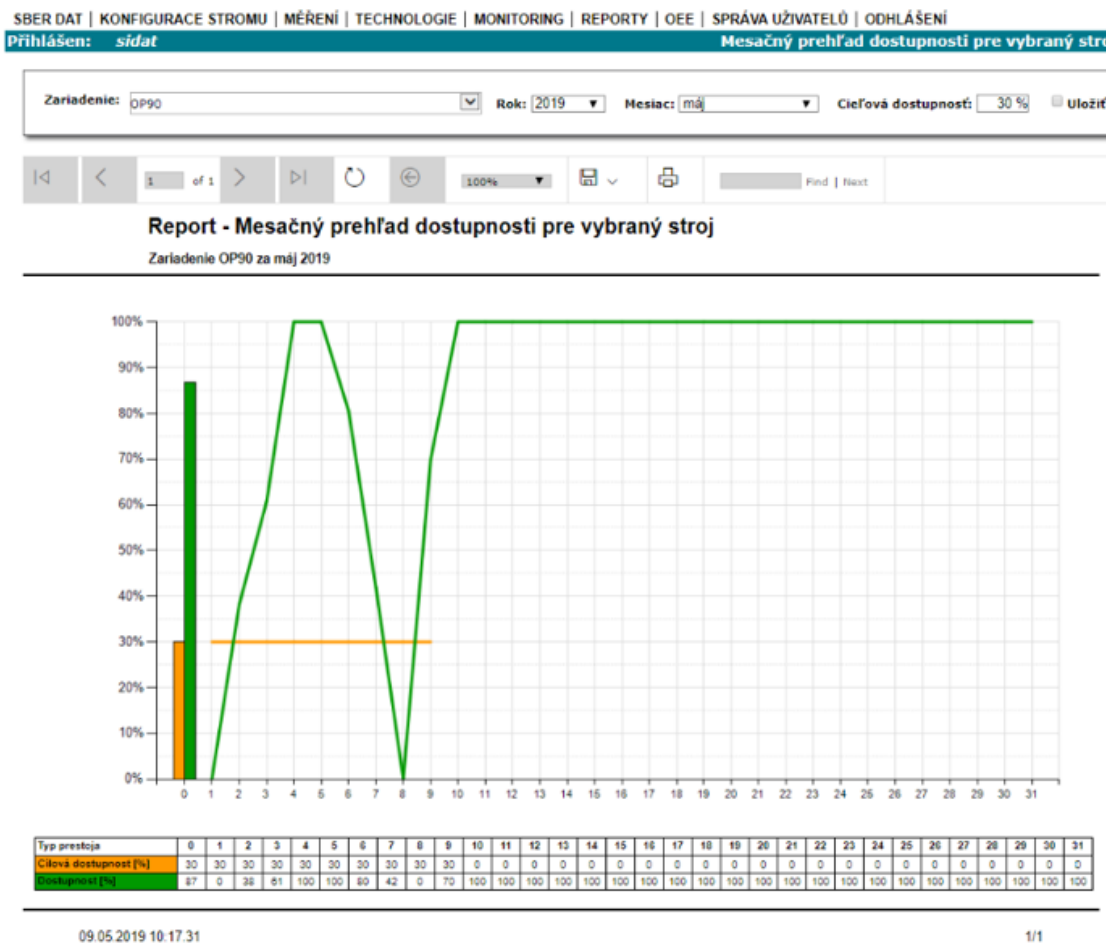
STEP 7 – REPORTS – VIEW TO THE PAST



MONTHLY OVERVIEW OF DOWNTIME FOR SELECTED PROCESS/MACHINE

OEE - Mesačný prehľad prestojov pre vybraný stroj
OEE - Report dostupnosti strojov
OEE - Detailný report mesačného OEE
OEE - Týždenný prehľad prestojov pre vybrané stroj
OEE - Denný prehľad prestojov pre vybraný stroj

STEP 7 – REPORTS – VIEW TO THE PAST



MONTHLY AVIALABILITY FOR SELECTED PROCESS/MACHINE

OEE - Mesačný prehľad prestojov pre vybraný stroj
OEE - Report dostupnosti strojov
OEE - Detailný report mesačného OEE
OEE - Týždenný prehľad prestojov pre vybrané stroj
OEE - Denný prehľad prestojov pre vybraný stroj

STEP 7 – REPORTS – VIEW TO THE PAST

Máj	Čeká na příjezd palety [%]	Čeká se na odjezd palety [%]	Údržba [%]	Seřizování [%]	Obecná porucha [%]	Čas výroby [h]	Plánovaná výroba [h]	Časové období [h]	Dostupnost [%]	Dostupnost obsluhy [%]	OEE [%]
OP30 - Otočný stůl	3.96	1.06	0.05	13.7	0.18	220.53	246.08	339.41	89.61	64.97	89.61
OP35	40.73	1.09		0.02	0.1	54.92	339.82	339.94	16.16	16.16	16.16
OP38	21.18	1.56		0.02	0.01	185.26	339.92	340.06	54.5	54.48	54.5
OP39	18.46	1.08		0.3	0.01	205.85	338.07	340.08	60.89	60.53	60.89
OP40	0	22.34		0.07	0.23	186.8	338.71	339.22	54.85	54.77	54.85
OP42	18.63	0.07				212.8	339.91	339.91	62.6	62.6	62.6
OP52	18.71	4.06				185.16	340.08	340.08	54.45	54.45	54.45
OP54	16.53	0.35			0.08	224.84	340.08	340.08	66.12	66.12	66.12
OP55	23.1	1.44				173.17	340.08	340.08	50.92	50.92	50.92
OP60	20.18	1.57				192.12	340.08	340.08	56.49	56.49	56.49
OP65	19.03	0.7		0.01	0.01	205.81	340.01	340.08	60.53	60.52	60.53
OP70	19.05	1.09		0.02	0.03	202.78	339.92	340.08	59.66	59.63	59.66
OP75	22.27	24.06		0.01		24.71	336.17	336.21	7.35	7.35	7.35
OP80	17.69	22.93		0.11	0.17	62.49	339.2	339.98	18.42	18.38	18.42
OP80_1	18.95	0		0.37		209.64	337.55	340.08	62.11	61.64	62.11
OP85	26.35	14.73		0	0.03	60.52	340.06	340.08	17.8	17.8	17.8
OP90	5.52	1.65		14.12	0.18	208.05	243.82	339.75	85.33	61.24	85.33
OP95	6.17	1.76									83.95
OP100 -	14.53	2.91									84.45

MONTHLY GLOBAL OEE

OEE - Mesačný prehľad prestojov pre vybraný stroj
OEE - Report dostupnosti strojov
OEE - Detailný report mesačného OEE
OEE - Týždenný prehľad prestojov pre vybrané stroj
OEE - Denný prehľad prestojov pre vybraný stroj

STEP 7 – REPORTS – VIEW TO THE PAST

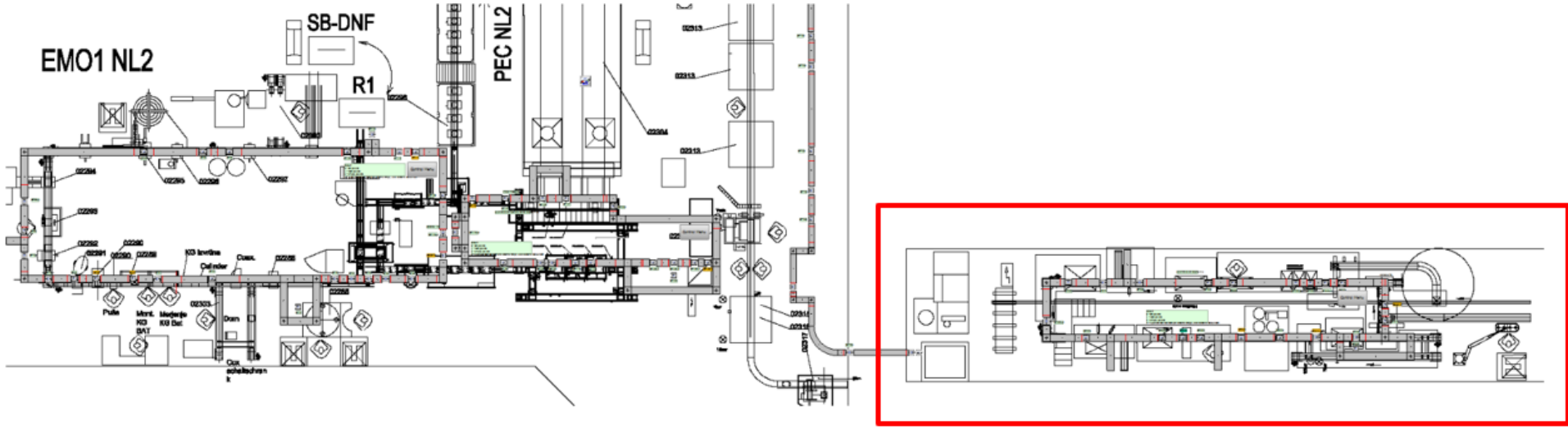


DOWNTIME + TYPE, WEEKLY OVERVIEW

OEE - Mesačný prehľad prestojov pre vybraný stroj
OEE - Report dostupnosti strojov
OEE - Detailný report mesačného OEE
OEE - Týždenný prehľad prestojov pre vybrané stroj
OEE - Denný prehľad prestojov pre vybraný stroj

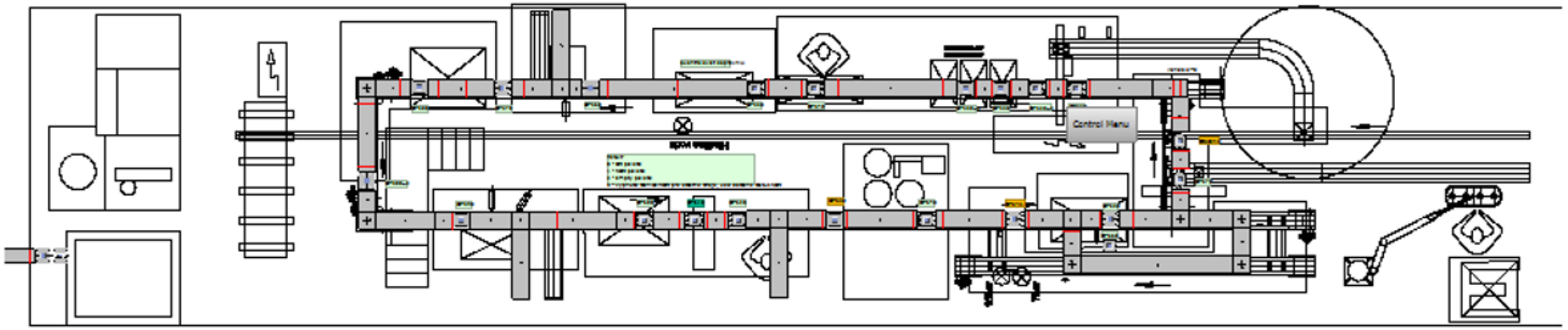
STEP 8 – CREATE OF DIGITAL TWIN FOR BOTTLENECKS IDENTIFICAT.

DIGITAL COPY OF REAL PRODUCTION SYSTEM
DIGITAL TWIN BEHAVIOUR AS PHYSICAL PRODUCTION SYSTEM
COLLECTING AND EVALUATION OF REAL TIME DATA OR ALGORITHMICAL EVALUATION OF HISTORICAL DATA



STEP 8 – CREATE OF DIGITAL TWIN FOR BOTTLENECKS IDENTIFICAT.

DIGITAL COPY OF REAL PRODUCTION SYSTEM
DIGITAL TWIN BEHAVIOUR AS PHYSICAL PRODUCTION SYSTEM
COLLECTING AND EVALUATION OF REAL TIME DATA OR ALGORITHMICAL EVALUATION OF HISTORICAL DATA

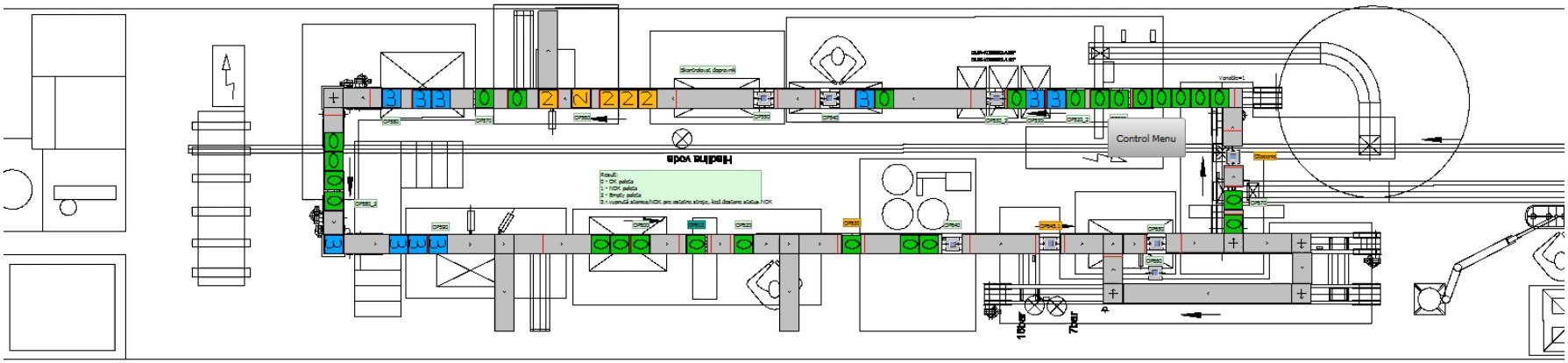


STEP 8 – CREATE OF DIGITAL TWIN FOR BOTTLENECKS IDENTIFICAT.

.Models.MU.Pallet:3.Trasovanie

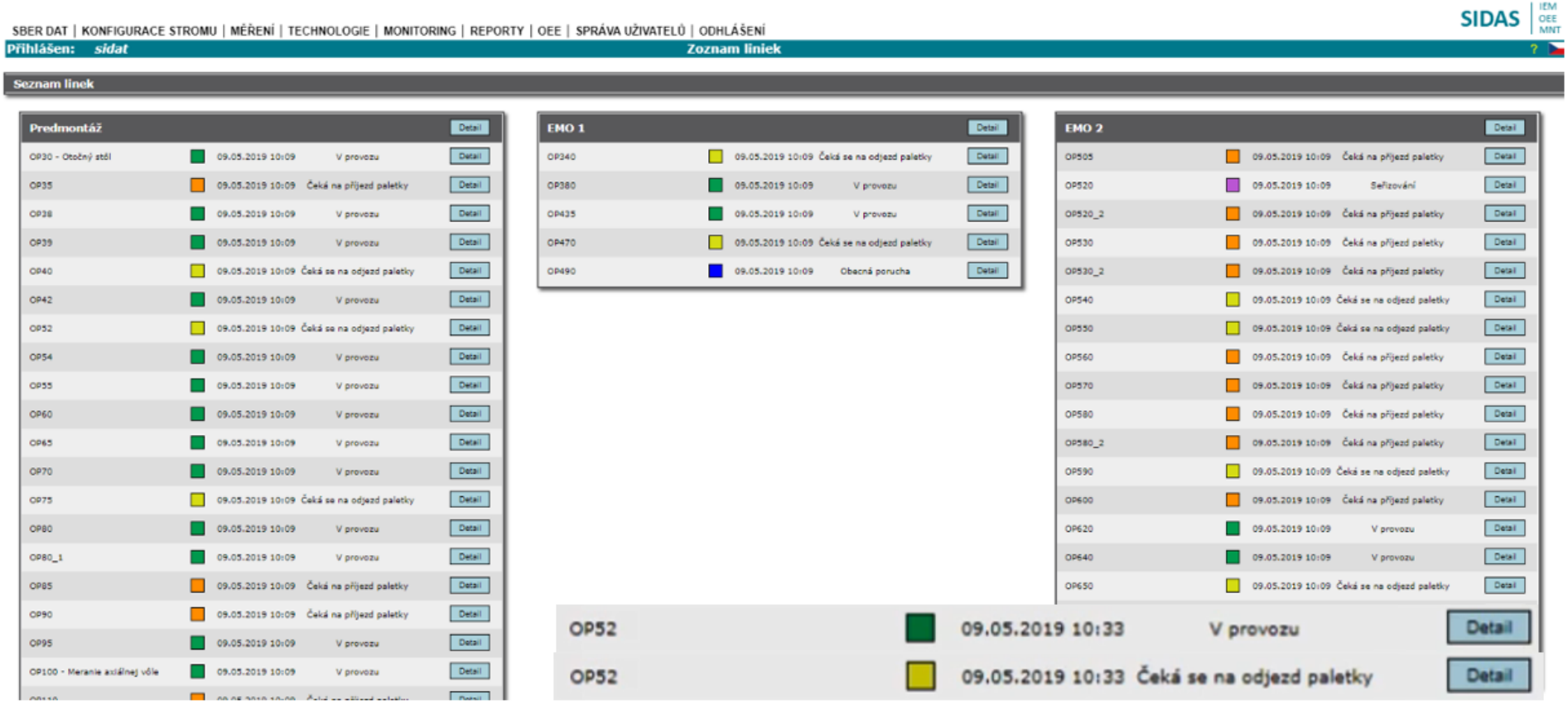
	string 1	string 2	string 3	datetime 4	datetime 5	datetime 6	string 7
string	Rfid	PalletId	OpName	T1	T2	T3	Status
1	E0040100A9142...	655254	600	2019/03/26 11:51:...	2019/03/26 11:51:30...	2019/03/26 11:51:32....	0
2	E0040100A9142...	655254	620	2019/03/26 11:51:...	2019/03/26 11:51:56...	2019/03/26 11:51:56....	0
3	E0040100A9142...	655254	640	2019/03/26 11:52:...	2019/03/26 11:52:12...	2019/03/26 11:52:12....	3

APPROX. 300-400 000 LINES PER SHIFT



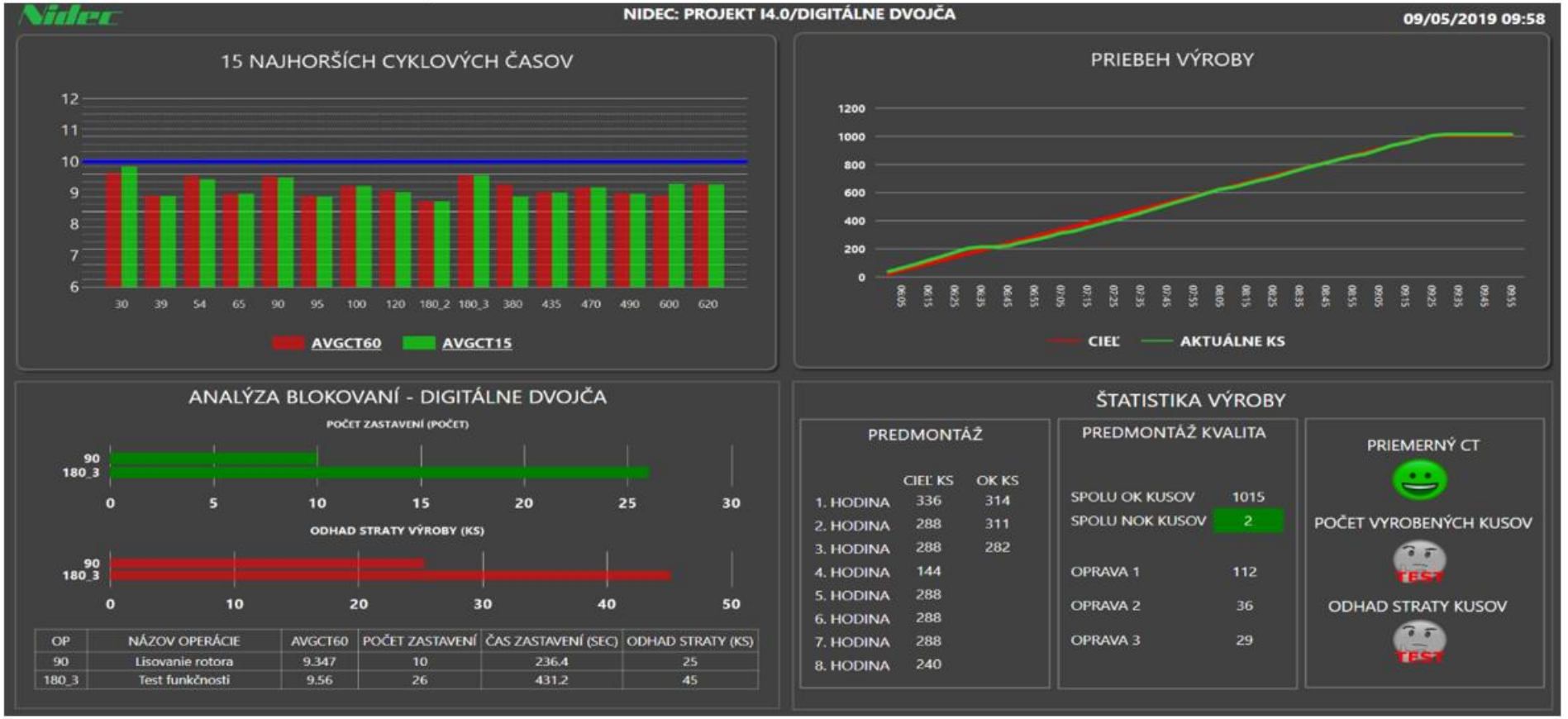
STEP 9 – VISIALIZATION – ON-LINE MONITORING

MONITORING BASED ON THE PLC SIGNAL STATUS - SUITABLE AS THE MAINTENANCE PANEL



STEP 9 – VISIALIZATION – KPI

COMBINED INPUTS FROM PLC, OEE ALGORITHMS, DIGITAL TWIN ALGORITHMS



OP	NÁZOV OPERÁCIE	AVGCT60	POČET ZASTAVENÍ	ČAS ZASTAVENÍ (SEC)	ODHAD STRATY (KS)
90	Lisovanie rotora	9.347	10	236.4	25
180_3	Test funkčnosti	9.56	26	431.2	45

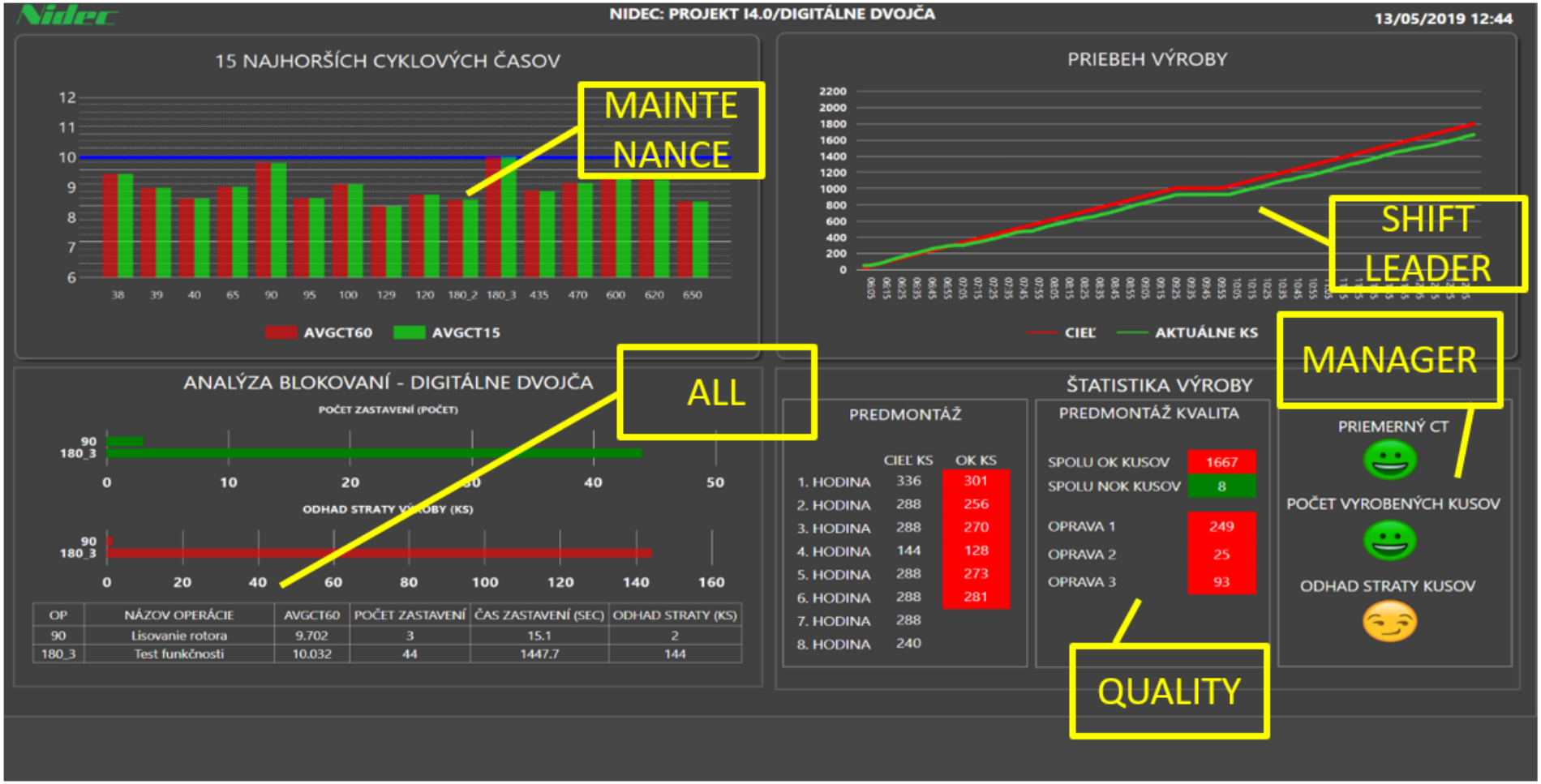
STEP 10 – OUTPUT DEBUGGING (FAT/SAT)

TIME VERY CONSUMABLE PROJECT STAGE
BUT VERY IMPORTANT FOR CORRECT RESULTS/OUTPUTS

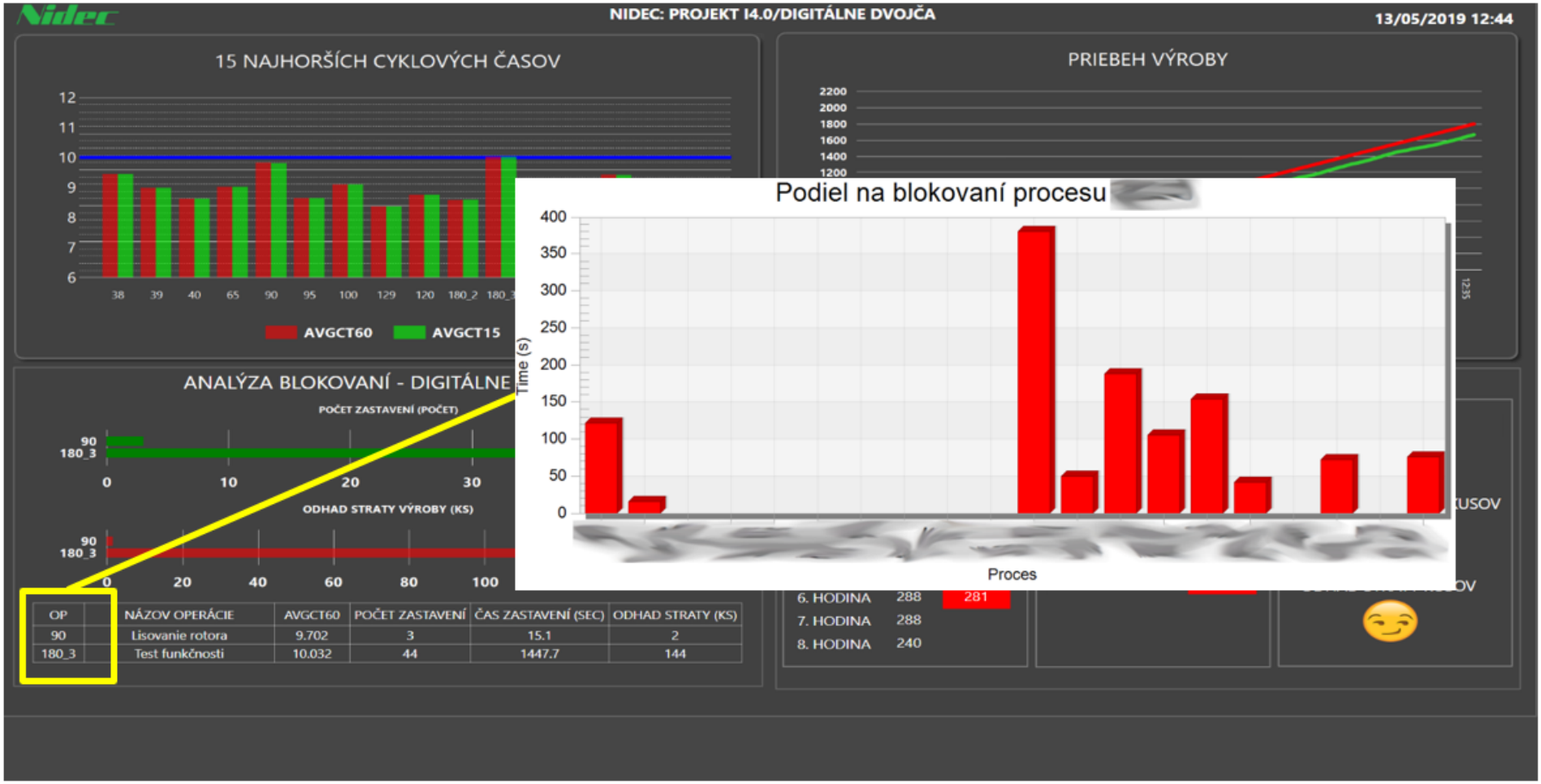




STEP 11 – START OF ROUTINE OPERATION, REAL TIME DATA



STEP 12–DIGITAL TWIN, BOTTLENCKS ID., REASONS FOR BLOCKING



THANK YOU

Radoslav Ondrejmiška, František Šlosiar – NIDEC GLOBAL APPLIANCES Zlaté Moravce
Robin Mitana, Milan Lokšík, Zdeněk Šebek – SIDAT Digital Bratislava, Slovakia
18.6.2019, Zlaté Moravce, Bratislava, Slovakia

3D IMAGING OF TRACE AMOUNTS BY IMS SPECTROMETRY - HOW TO SEE INVISIBLE

Dr. Martin Sabo[1]
[1] MaSaTECH s.r.o.

Abstract

We present a novel method for surface analysis by Ion mobility spectrometry. The Advance ion mobility spectrometer (AIMS) operated in subatmospheric pressure was used in this work. The capillary inlet was used for sample aspiration to reaction region of AIMS. The sample was desorbed from surface by laser diode module (figure 1a). This technique was successfully tested for detection of explosives and analysis of isomeric β-blockers (figure 1b).

The positioning stage allow us to scan TLC surface. This allows high resolution surface scanning and analysis of partially overlapped spots is achievable. The TLC surface can be scanned at different rates, which enables to reach a fast and sensitive analysis by adjusting the scanning rate. The method was successfully applied to analyze the TLC plates containing explosives, amino acids, nicotine and diphenylamine mixtures. Combination of TLC with AIMS technique offers additional separation dimension, allowing separation of overlapping TLC analytes.

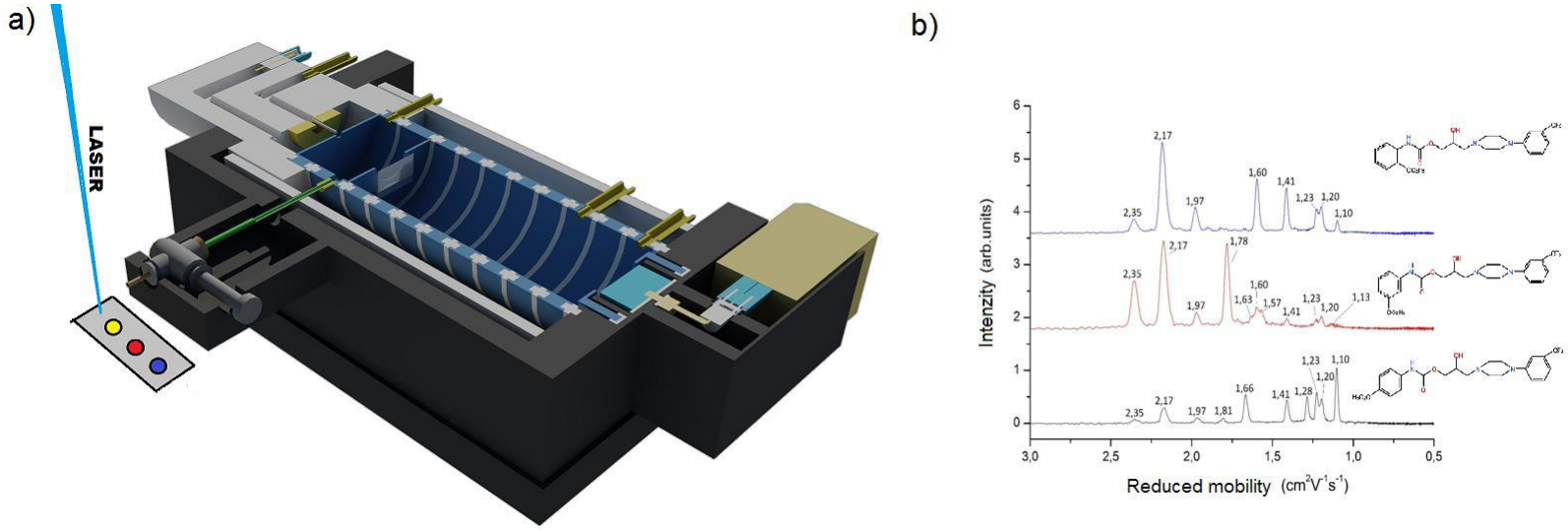


Figure 1

[1] M.Sabo; S.Matejcik, Analyst,2014, 139, 5112

[2] V.Ilbeigi; M.Sabo, S.Matejcik,m.Tabrizchi; J.Chrom.A., 2016;1459; 145-151

***Acknowledgements**: This work was supported by Slovak Research and Development Agency project nos. APVV-0733-11 and APVV-0259-12.*

MULTI-CAMERA AND LASER SCANNING SYSTEMS FOR MAPPING, REAL-TIME 3D TRACKING AND INVENTORYING

Ing. Marko Paško[1]
[1] X3D



MULTI-CAMERA AND LASER SCANNING SYSTEMS

for 3D mapping, 3D measuring of actual status, inspections and inventory

MULTIKAMEROVÉ A LASEROVÉ SKENOVACIE SYSTÉMY pre 3D mapovanie, 3D zameranie skutočného stavu, inšpekcie a inventarizáciu

Novinky z pohľadu autorizovaného distribútora 3D mapovacích technológii pre SR a ČR:

Expert_for_3D_Landscape, spol. s r.o., www.x3d.sk

* Digitálna fotogrametria
* Laserové skenovanie
* Hyperspektrálne skenovanie

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1. Východzí stav

Hnacím motorom zavádzania nových 3D technológii do života je budovanie 5G sietí. Tie umožnia rýchlu výmenu dát, **IoT**, reálne fungovanie **SmartCities, BIM** a infraštruktúrnych IS.

To si ale vyžaduje cielene zbierať, udržiavať a obnovovať presné 3D dáta. Budúce úlohy nám pomôžu riešiť **len presné a detailné dáta najvyššej kvality**.

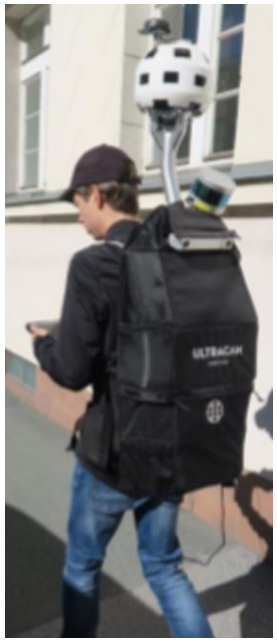
Dve metódy na presný zber 3D dát na úrovni do 1-10mm:
- **digitálna fotogrametria** (statické aj dynamické)
- **terestrické 3D laserové skenovanie** (len statické, nie v pohybe)

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Metódy zaručujúce presný zber 3D dát na úrovni do 1-10mm:

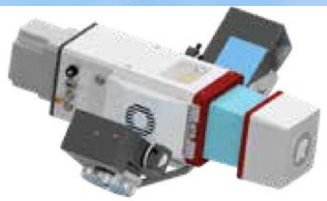
- digitálna fotogrametria (statické aj dynamické)

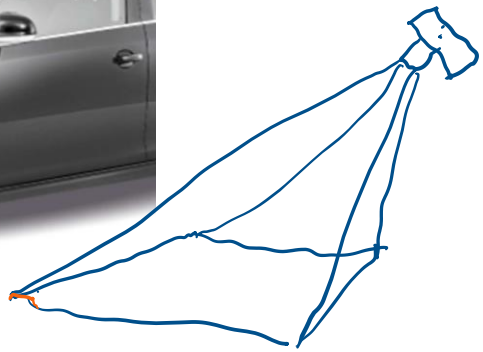
- terestrické 3D laserové skenovanie (len statické, nie v pohybe)

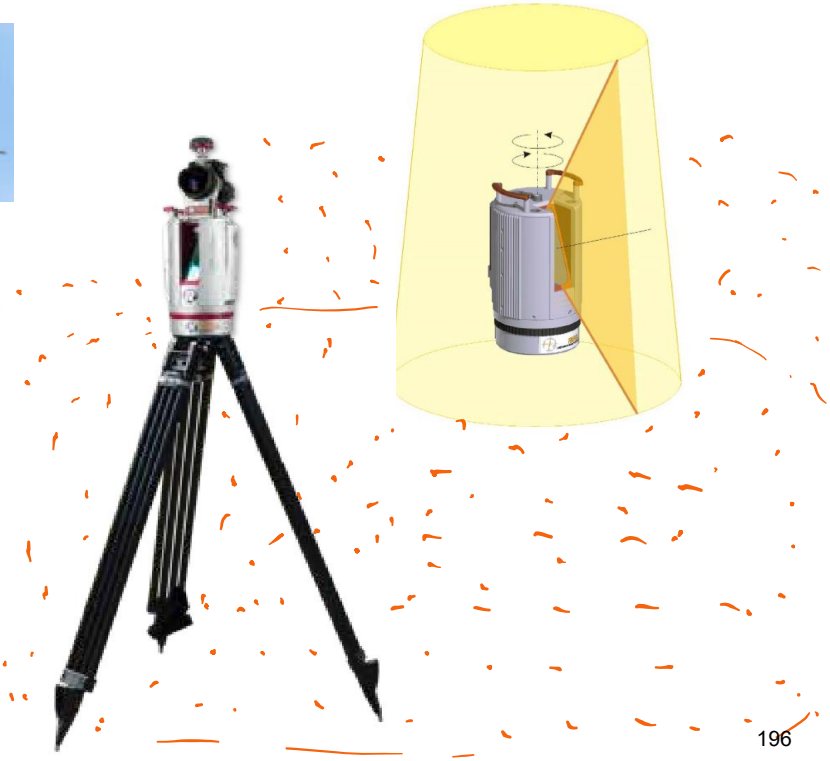










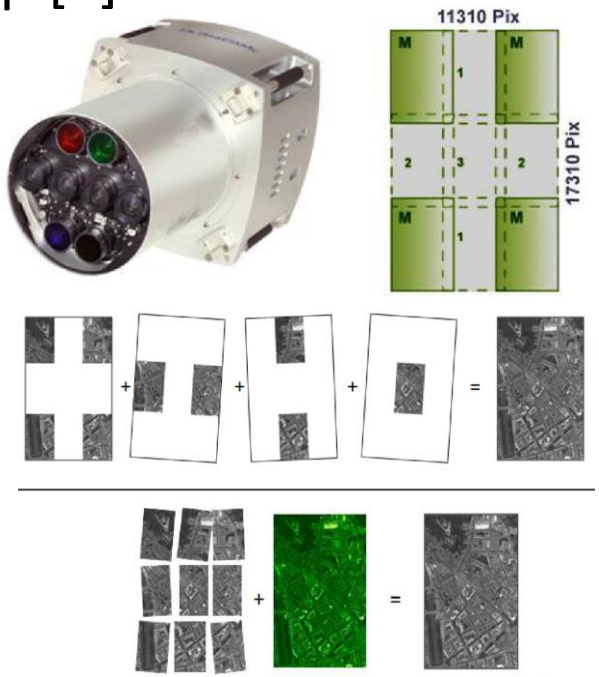


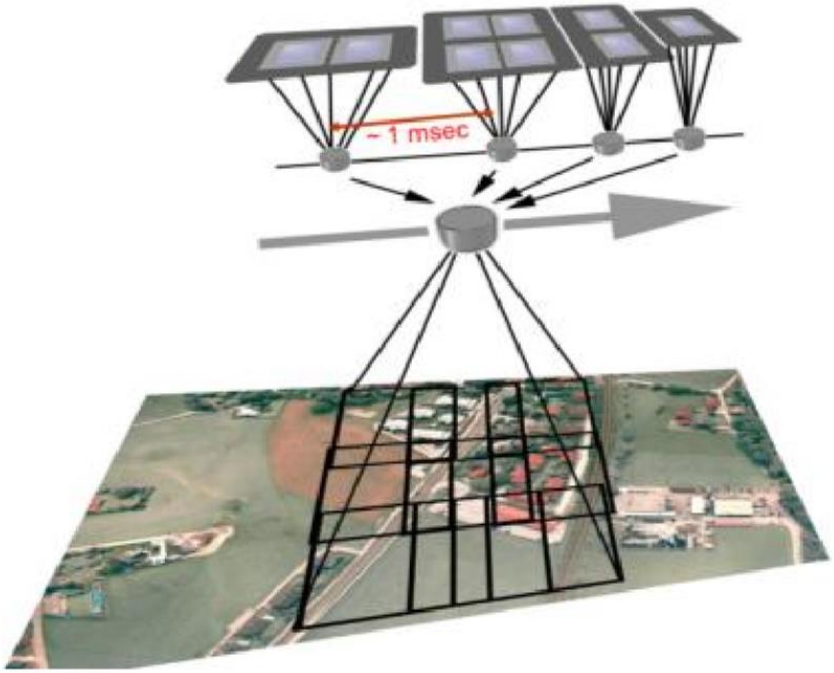
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VEXCEL IMAGING

Multikamerové systémy – distribuujeme ich a reálne skúsenosti zbierame **od roku 2004**

1. multikamerová digitálna letecké kamera UltraCamD a syntopický princíp [1]



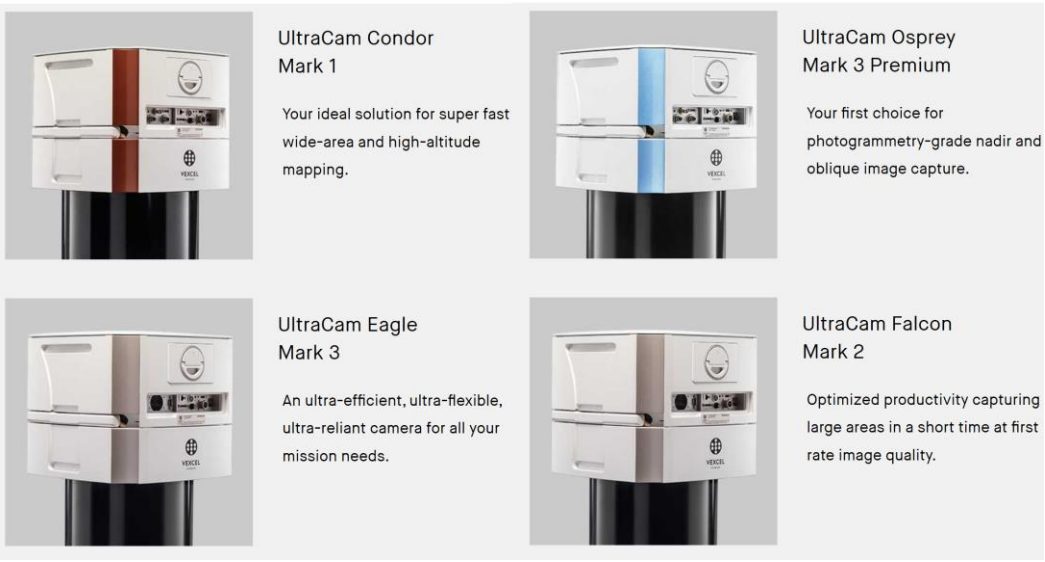


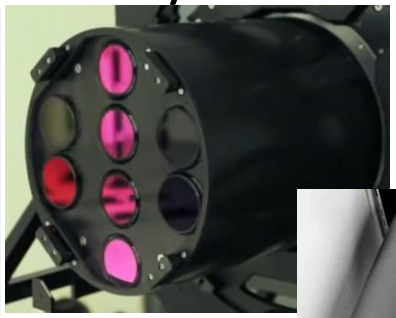
MULTIKAMEROVÉ A LASEROVÉ SKENOVACIE SYSTÉMY pre 3D mapovanie, 3D zameranie skutočného stavu, inšpekcie a inventarizáciu

VEXCEL IMAGING

Aktuálne portfólio – všetko multikamerové systémy s výhodami:

- rýchlejšie ukladanie dát
- lepšie rozlíšenie
- vzájomné prekryty umožňujú radiometrické vyrovnanie







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VEXCEL IMAGING

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- lepšie rozlíšenie
- vzájomné prekryty umožňujú radiometrické vyrovnanie





- jednotlivé neskreslené meračské snímky



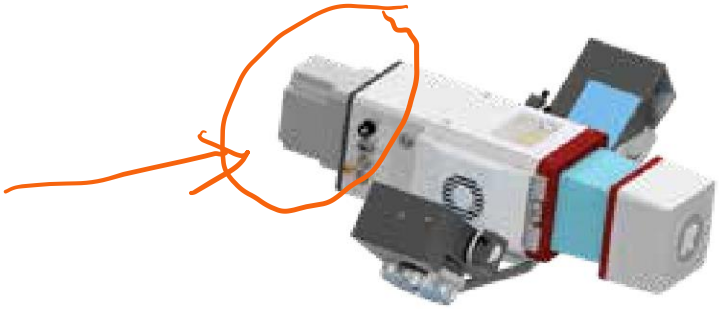
- snímkové panorámy



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RIEGL®

Mobilné a letecké laserové skenery sú integrovateľné s multikamerovými systémami. Súčasné snímkovanie je dôležité pre neskoršie spresnenie trajektórie pohybu mobilného alebo leteckého laserového skenera, ktorá je ináč 100% závislá od kvality GNSS/IMU a príjmu signálu zo satelitov.
IMU je pevne spojená s laserovým skenerom:



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RIEGL®

Aktuálne portfólio:

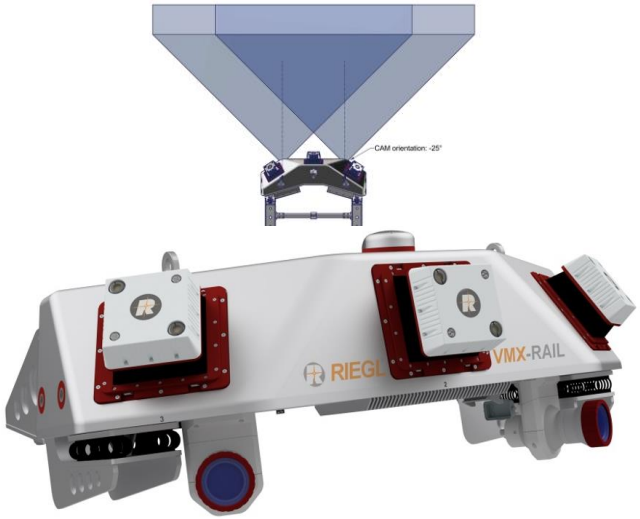
– MLS mobilné laserové skenovanie:



VMX-2HA

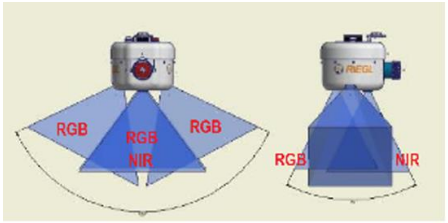


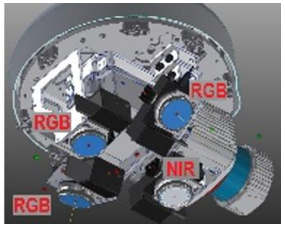
VMQ-1HA



VMX-RAIL

– ULS / ALS letecké laserové skenovanie:





VP-1 s VUX-1LR





alebo a VUX-240

MULTIKAMEROVÉ A LASEROVÉ SKENOVACIE SYSTÉMY pre 3D mapovanie, 3D zameranie skutočného stavu, inšpekcie a inventarizáciu

Odporúčaný softvér na spracovanie nazbieraných 3D dát:

* SW na management, extrakciu a publikovanie hromadného zberu 3D dát

* SW na analýzu mračien bodov

* SW na 3D vizualizáciu veľkých 3D dát

orbit GEOSPATIAL TECHNOLOGIES

LASERDATA

euclideon UNLIMITED.

* SW na 3D modelovanie z veľkého počtu laserových skenov a snímok:

CapturingReality

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Ďakujem za pozornosť. Viac na www.x3d.sk



Použitá literatúra:

[1] The UltraCam Story - Franz Leberl, Michael Gruber, Martin Ponticelli & Alexander Wiechert (2013 - Submitted to: Commission I, WG I/2 - LIDAR, SAR and Optical Sensors for Airborne and Spaceborne Platforms), https://www.vexcel-imaging.com/wp-content/uploads/2016/05/2012_TheUltraCamStory.pdf

ION-BEAM SYNTHESIS OF NOVEL NANOSTRUCTURES AND COMPOUNDS OF TRANSIENT METALS

Pavol Noga [1]
[1] ATRI MTF STU, Bratislava

Abstract

Noble metal nanoparticles such as Ag, Au, Pt and Pd have been subject of increasing attention in recent years due to their unique physical and chemical properties and prospective applications in different fields such as catalysts, data storage, sensors, optical and optoelectronic devices. In spite of many benefits, the applicability of single-component metal nanoparticles is restricted by their limited properties and the properties of heterogeneous bimetallic structures are far more attractive than those of single-component nanoparticles. The incorporation of a second metal into a nanoparticle structure influences and can potentially enhance the properties of the material and usually have better technological usefulness. By combining two different metals, three kinds of structures can be obtained: a mixture of monometallic particles, bimetallic alloys and core-shell structures, all of which possess quite different properties. Nevertheless, before the bimetallic nanoparticles reach their full application potential, careful control over their synthesis and stability has to be gained. Since many factors are involved in their formation, it is often not possible to determine a priori which type of particles a given preparation method will create. We are focusing on Au-Ag nanoparticles in various substrates and their resulting structure in order to control the process and engineer nanoparticles for particular purposes. Recent results on the synthesis of AuAg@Ag core-shell nanoparticles in titanium nitride and AuAg solid-solution alloy nanoparticles in monocrystalline silicon by means of sequential ion beam implantation are reported.

MEDZINÁRODNÁ KONFERENCIA

3D MERANIE A ZOBRAZOVANIE

4. ročník

ION-BEAM SYNTHESIS OF NOVEL NANOSTRUCTURES AND COMPOUNDS OF TRANSIENT METALS

Pavol Noga

Slovenská technická univerzita v Bratislave,
Materiálovotechnologická fakulta so sídlom v Trnave,
Advanced technologies research institute

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VINČA
INSTITUT ZA NUKLEARNE NAUKE

Maja Popović

Mirjana Novaković

Danilo Kisić

Miloš Nenadović

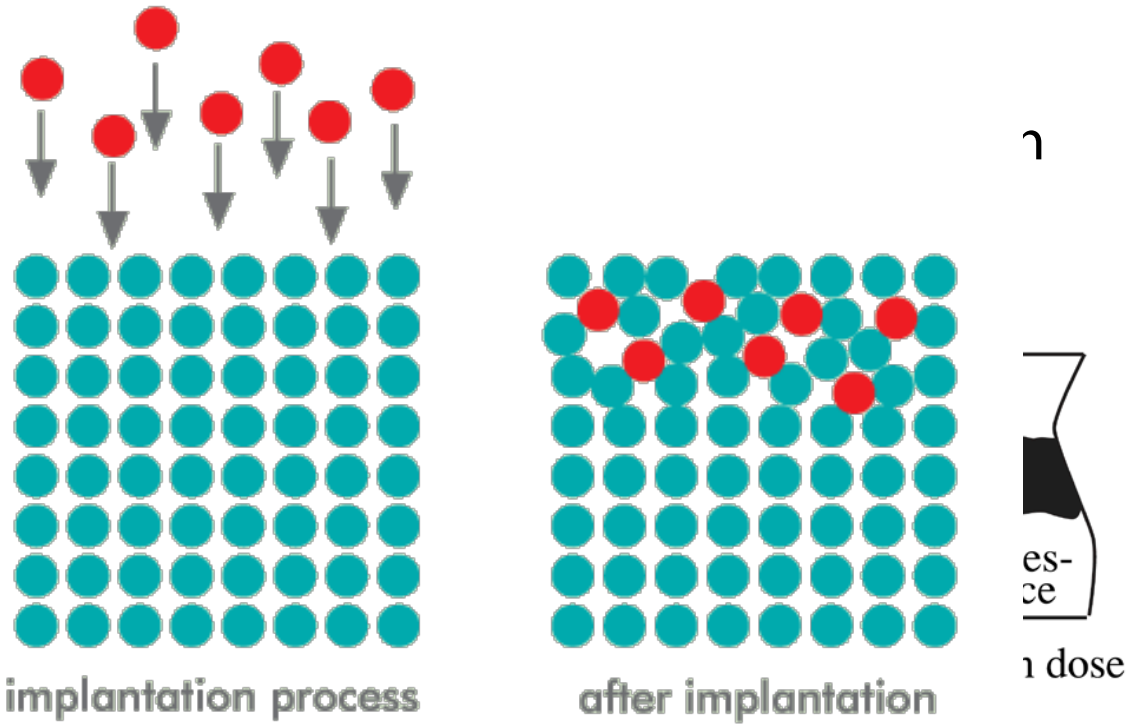
Zlatko Rakočević

OUTLINE

- **Ion beam synthesis**
- **Equipment**
- **Novel AuAg@Ag core-shell nanoparticles**
- **Fe-HDPE nanocomposites**
- **Au-C bond in HDPE**
- **Al-Co-Cu quasicrystals in nanolayers**

ION BEAM SYNTHESIS

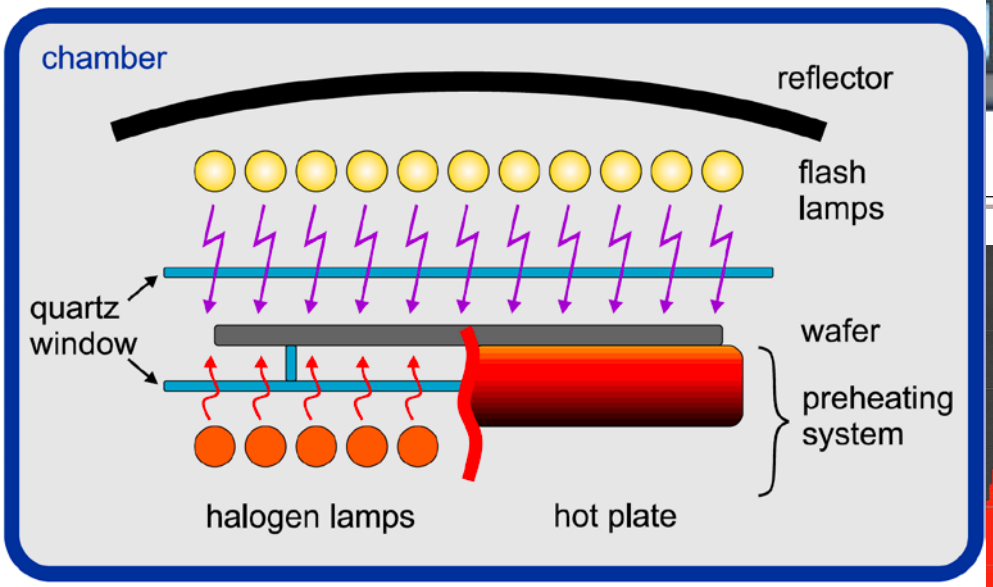
- Classical ion implantation
  - Low fluence (alias „dose“) – up to 10^{15} ions/cm^2
  - Dopant integrated („diluted“) in the substrate – no clustering
- **High fluen**
  - 10^{16} at/cr
  - Supersatu

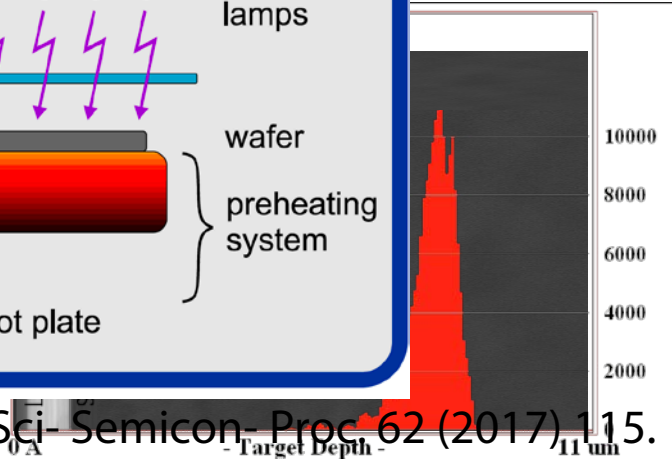


ION BEAM SYNTHESIS

- **Annealing**
  - Classical in a furnace
  - **Annealing effect of the ior** **n**
  - Rapid thermal annealing, fla
  - **High er**
    - 10+ M
    - Ion ra
    - Can g



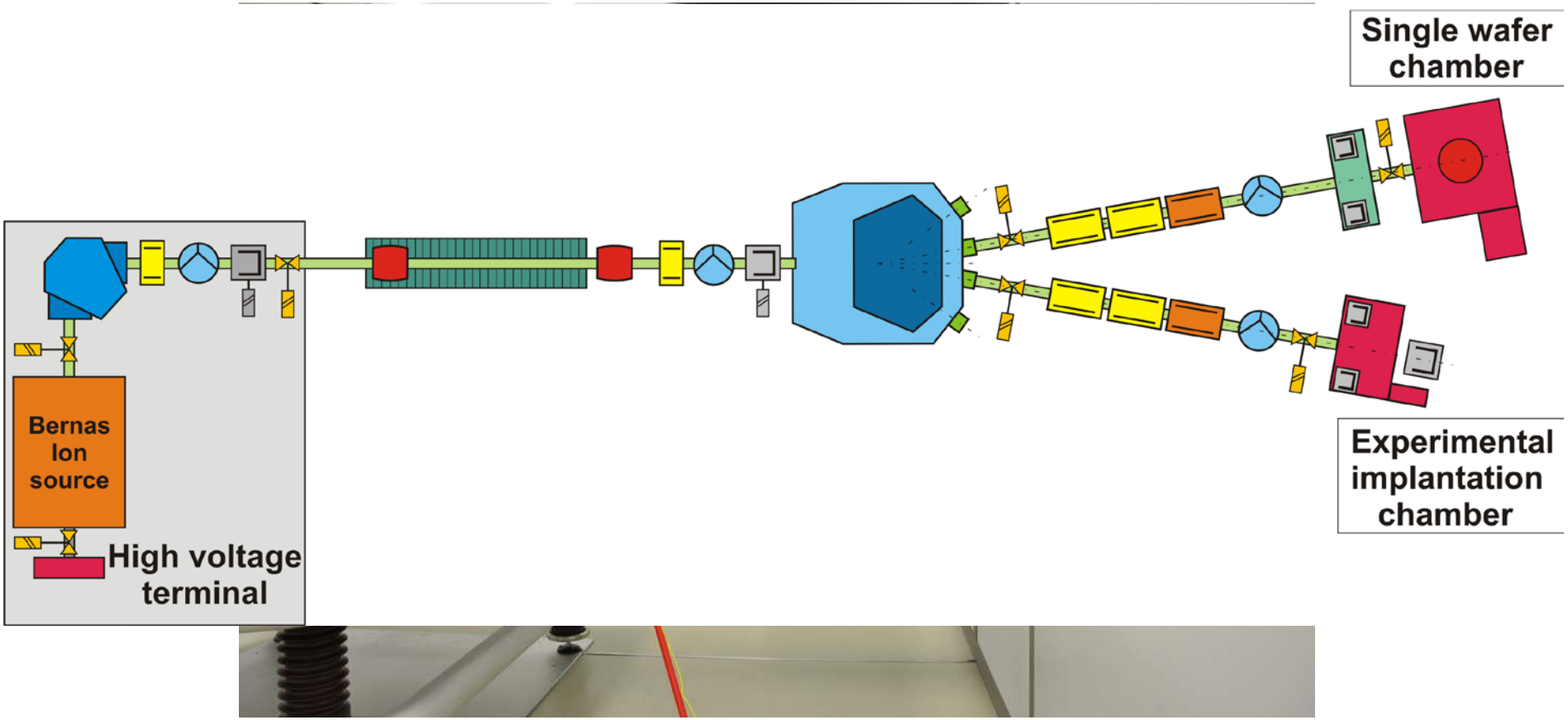




S. Prucnal, L. Rebohle, W. Skorupa, Mat. Sci- Semicon- Proc. 62 (2017) 115.

30 MeV Cu^{5+} ions in AlCoCu layer on Si

EQUIPMENT: ION IMPLANTER



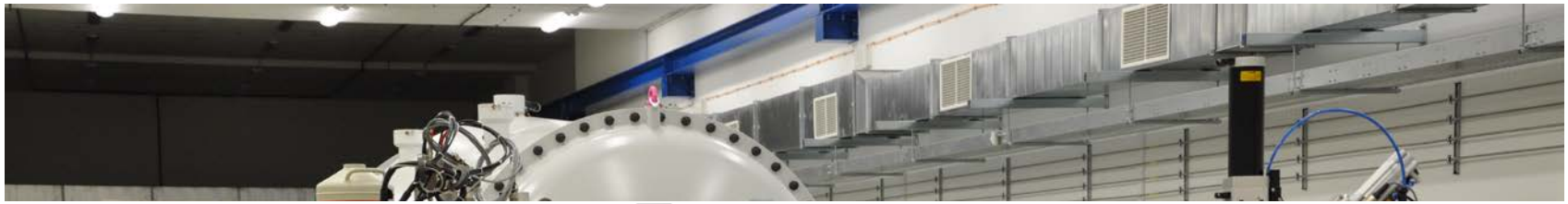
ION IMPLANTER END STATIONS

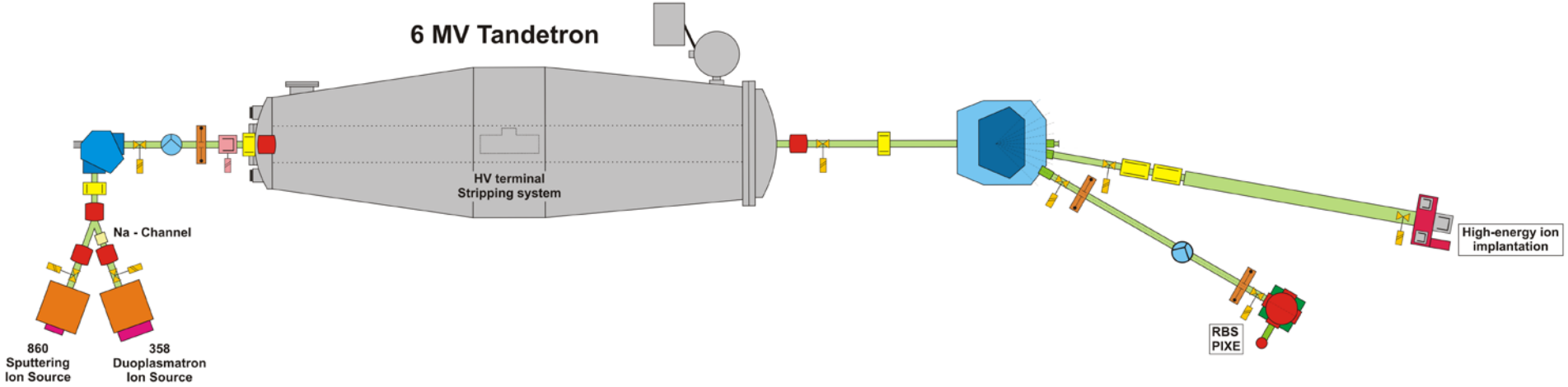


6 MV TANDEM ION ACCELERATOR



6 MV TANDEM ION ACCELERATOR





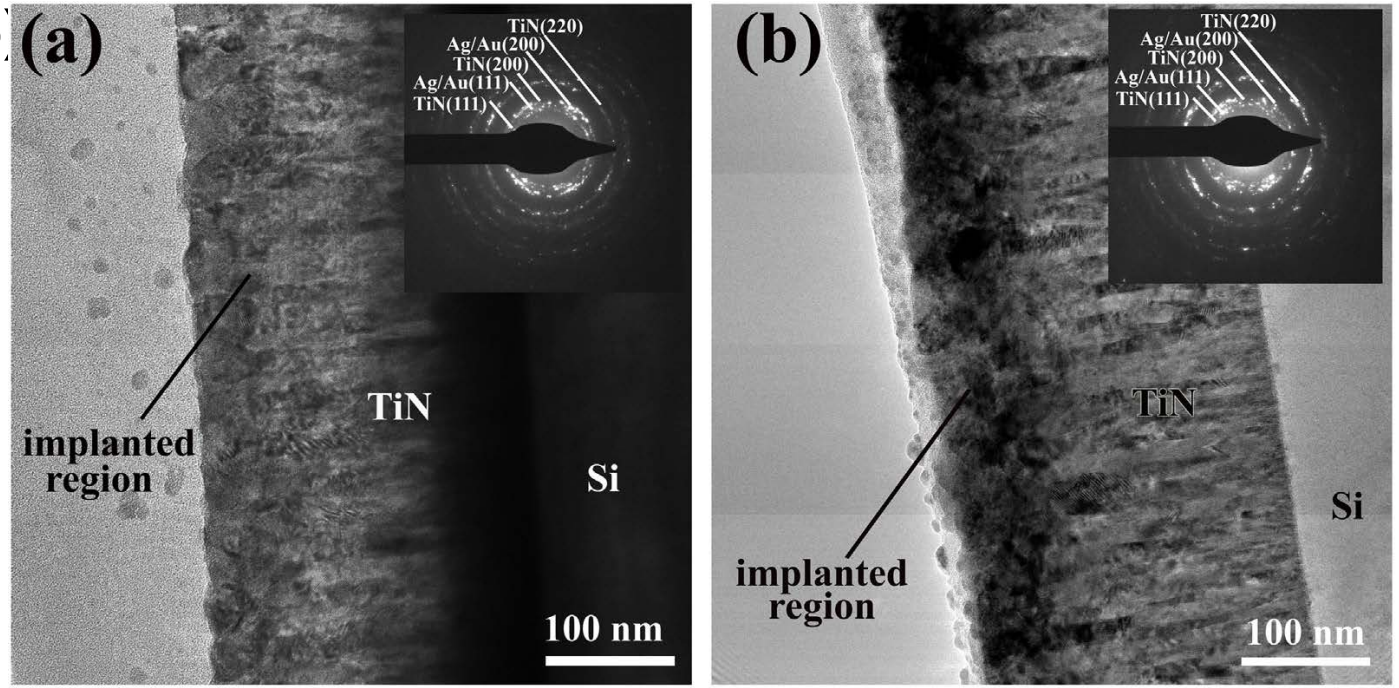


AuAg@Ag CORE-SHELL NANOPARTICLES

Sequential implantation of 200 keV Au and 150 keV Ag

a) Au 0.5×10^{16} ions/cm^2 and Ag 4.0×10^{16} ions/cm^2

b)

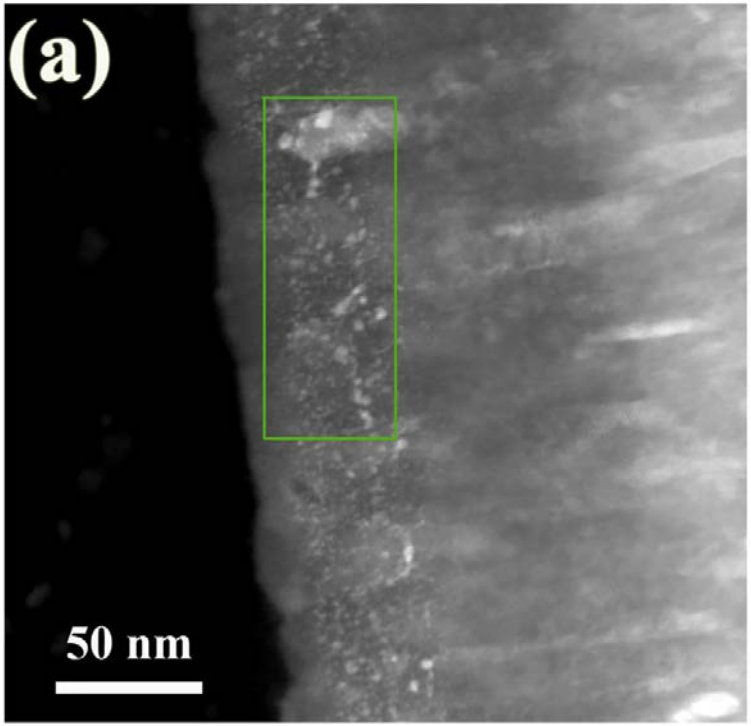


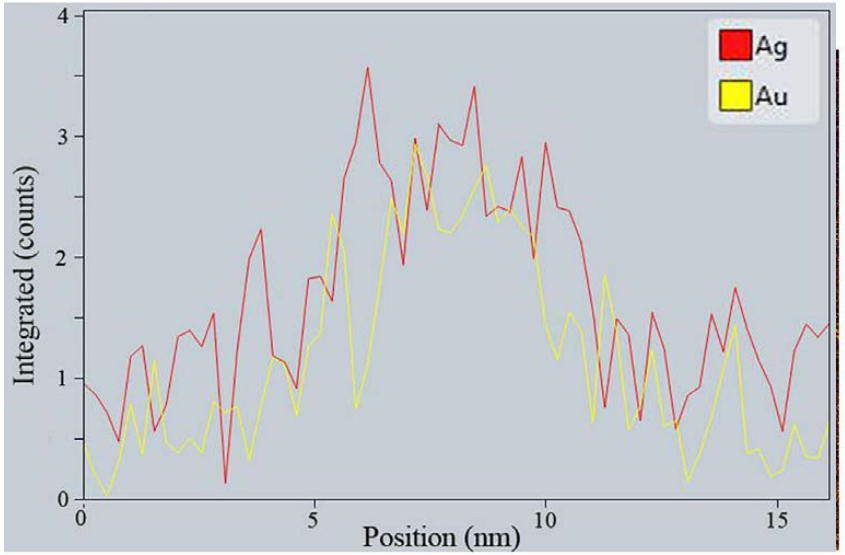
M. Popović et Al., Appl. Surf. Sci. 481, (2019) 1418.

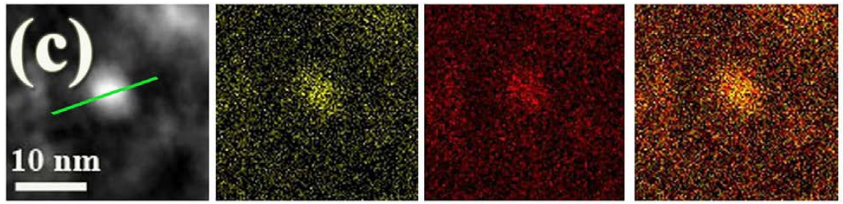
AuAg@Ag CORE-SHELL NANOPARTICLES

The case with less Au (0.5×10^{16} ions/cm^2)

Au-Ag solid solution alloy spherical nanoparticles (up to 10 nm in size)





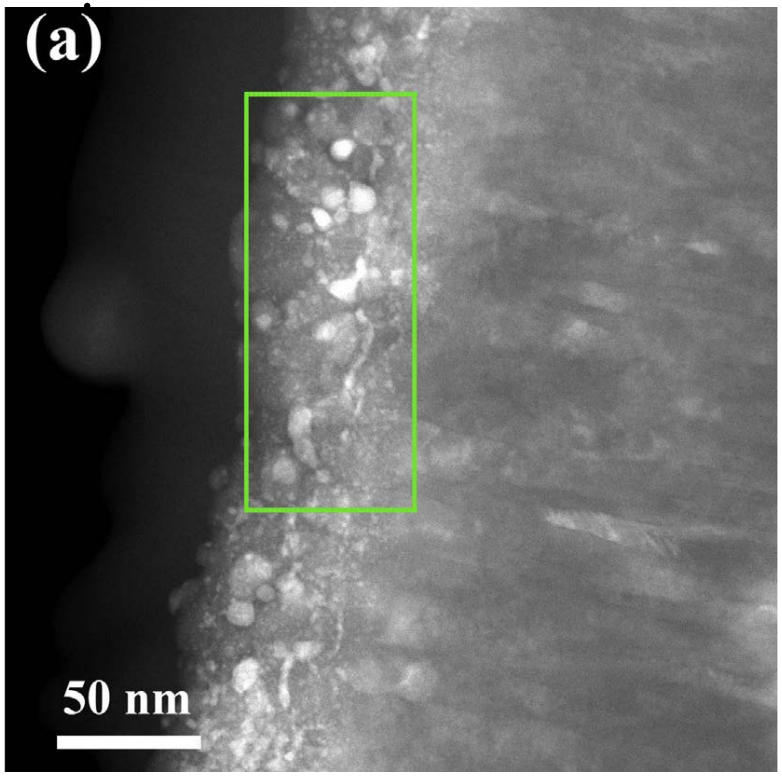


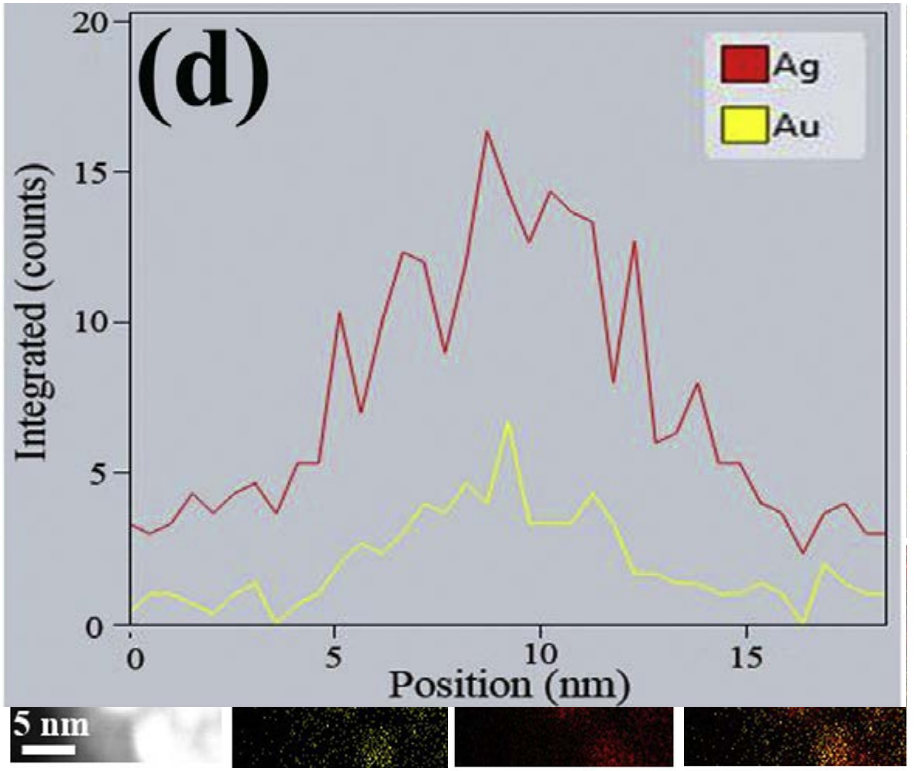
M. Popović et Al., Appl. Surf. Sci. 481, (2019) 1418.

AuAg@Ag CORE-SHELL NANOPARTICLES

The case with more Au (1.0×10^{16} ions/cm^2)

AuAg solid solution core and Ag shell spherical nanoparticles 5 nm in



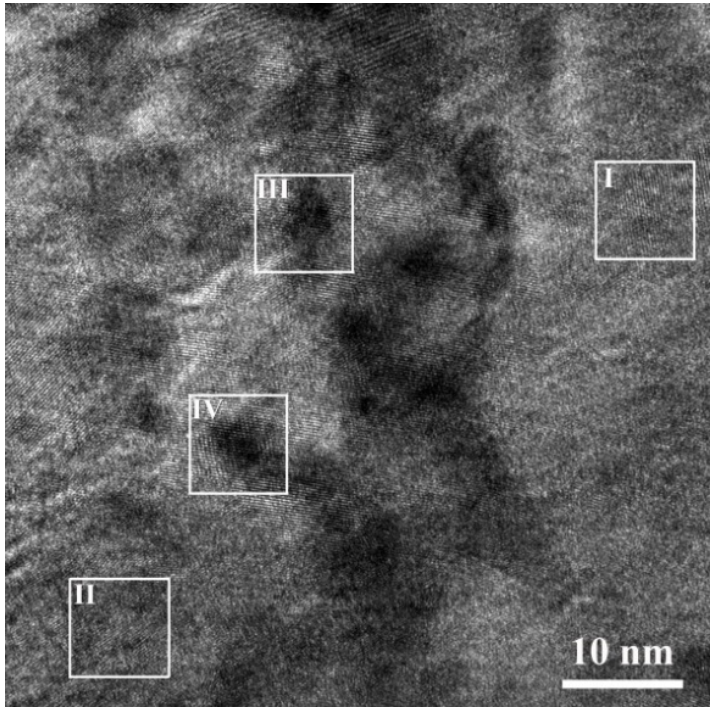


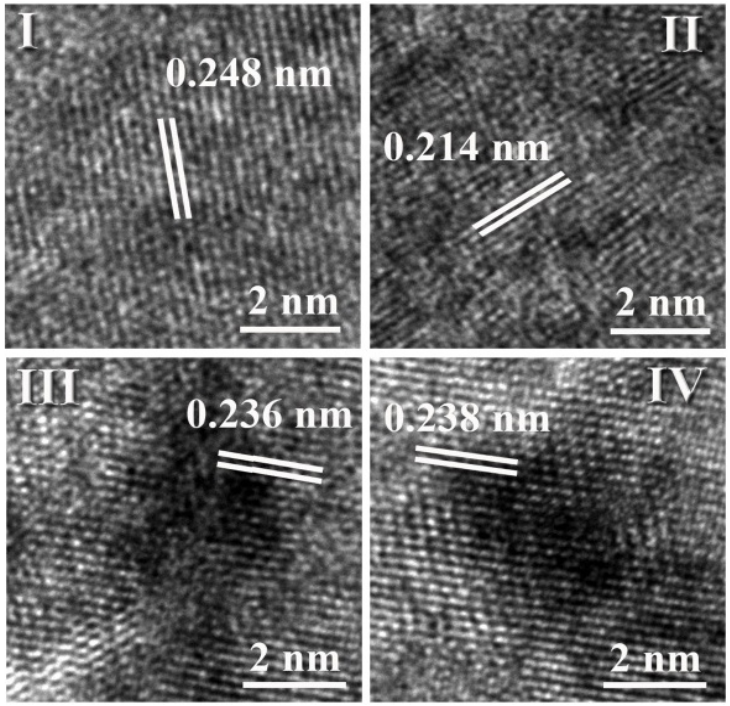
M. Popović et Al., Appl. Surf. Sci. 481, (2019) 1418.

AuAg@Ag CORE-SHELL NANOPARTICLES

The case with more Au (1.0×10^{16} ions/cm^2)

HRTEM clearly identifies the lattice spacing





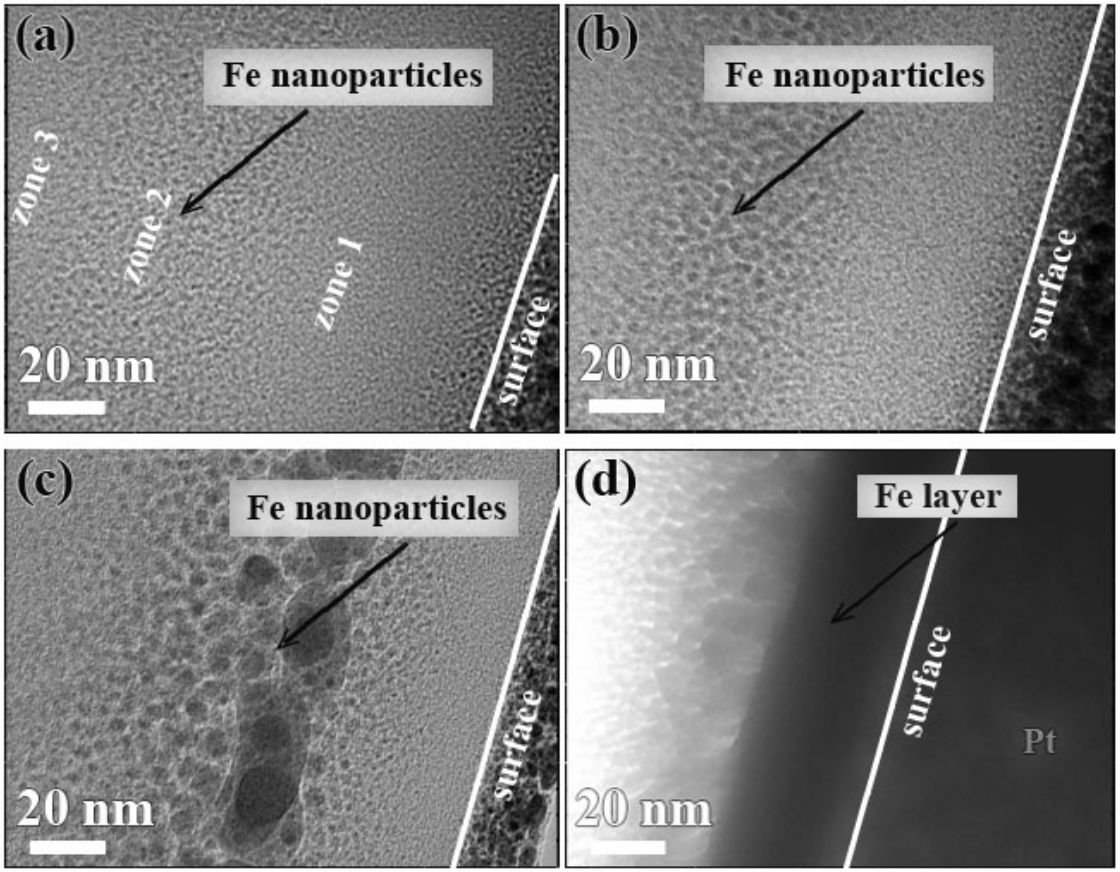
M. Popović et Al., Appl. Surf. Sci. 481, (2019) 1418.

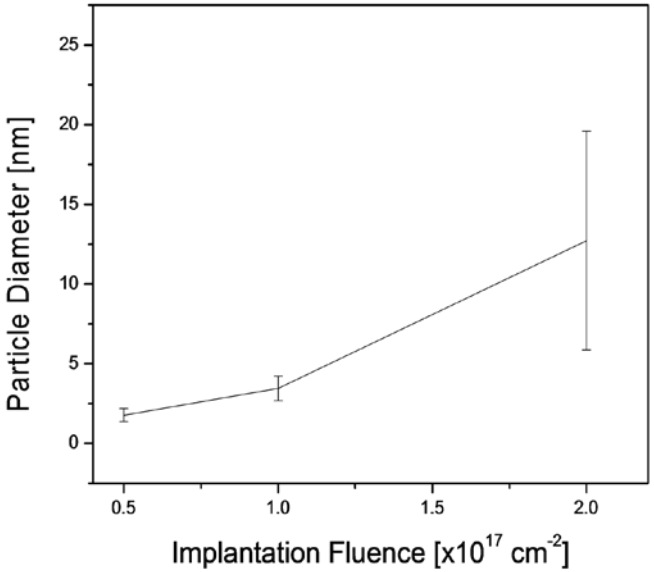
AuAg@Ag CORE-SHELL NANOPARTICLES

- **Why?**
  - Optics, optoelectronics
    - Titanium nitride (the substrate) exhibits intense surface plasmon resonance peaks when Ag nanoparticles are present
    - Different particle size and composition can tune this effect
  - More details in:
    - M. Popović et Al., Appl. Surf. Sci. 481, (2019) 1418.
    - M. Popović et Al. Opt. Mater. 72 (2017) 775.

Fe-HDPE NANOCOMPOSITES

95 keV Fe ion implantation into HDPE

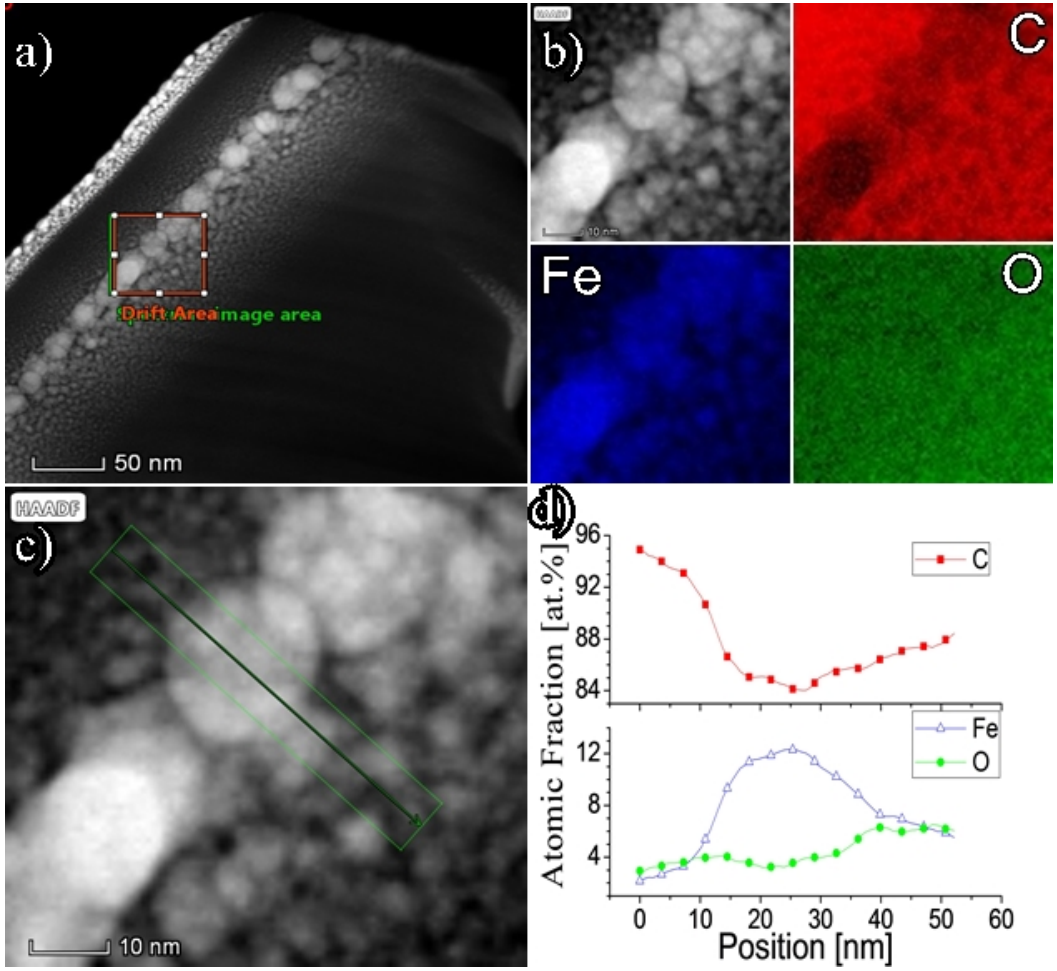




(a) 0.5×10^{17} ions/cm^2
(b) 1.0×10^{17} ions/cm^2
(c) 2.0×10^{17} ions/cm^2
(d) 5.0×10^{17} ions/cm^2

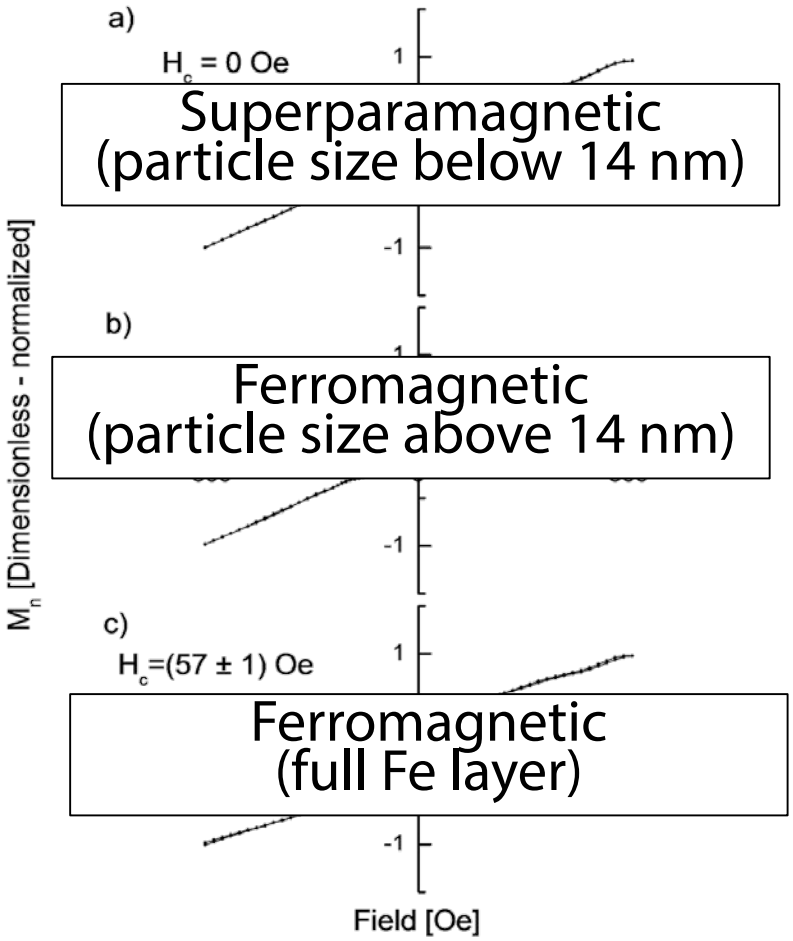
D. Kisić et Al., Vacuum, in Press (2019).

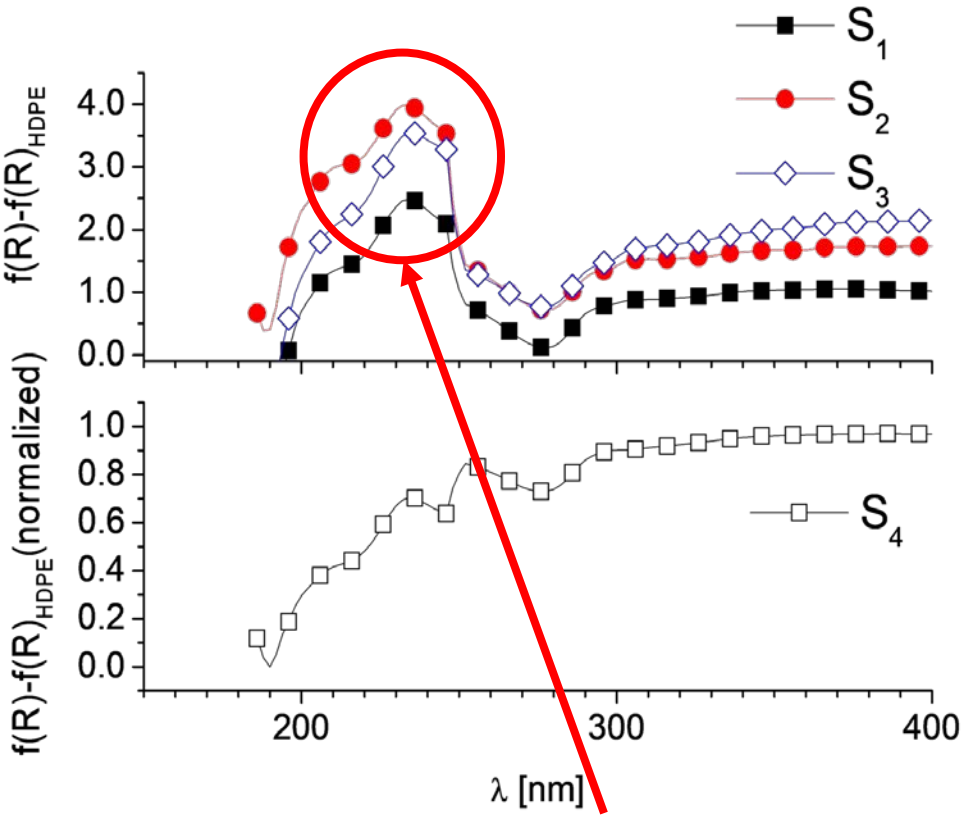
Fe-HDPE NANOCOMPOSITES



D. Kisić et Al., Vacuum, in Press (2019).

Fe-HDPE NANOCOMPOSITES





Localized Surface Plasmon Resonance effect suspected

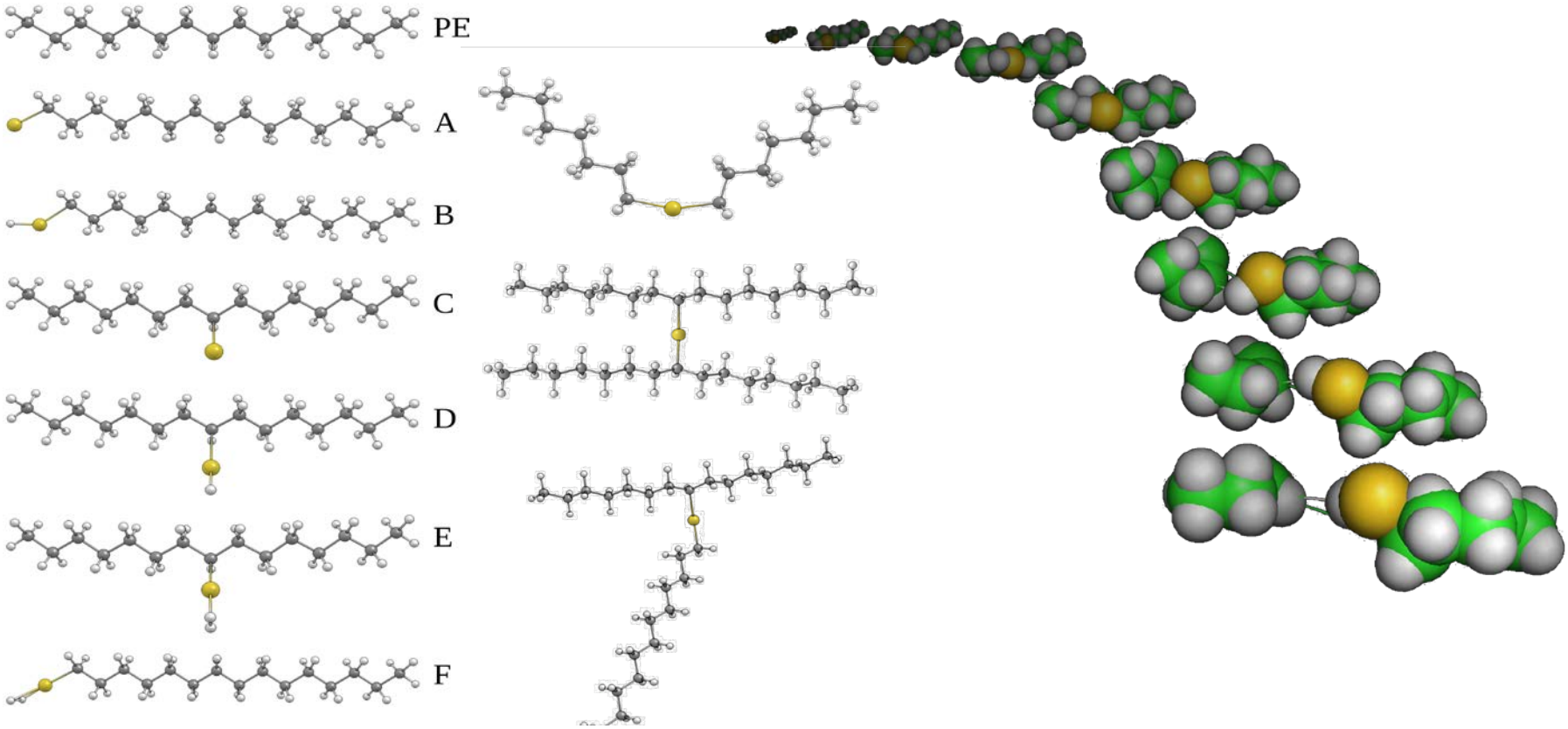
D. Kisić et Al., Vacuum, in Press (2019).

Fe-HDPE NANOCOMPOSITES

- **Why?**
  - Magnetic media, sensors, spintronics
    - Magnetic and optical response of polymer-metal nanocomposites strongly depend on the size and distribution of metallic nanoparticles
    - This study aimed to find correlations between fluence – morphology – size distribution, and as a consequence, changes in optical and magnetic response
  - More details in:
    - D. Kisić et Al., Vacuum (2019) in Press.
    - D. Kisić et Al., Nucl. Instrum. Meth. Phys. Res. B, under review.

Au-C BOND IN HDPE

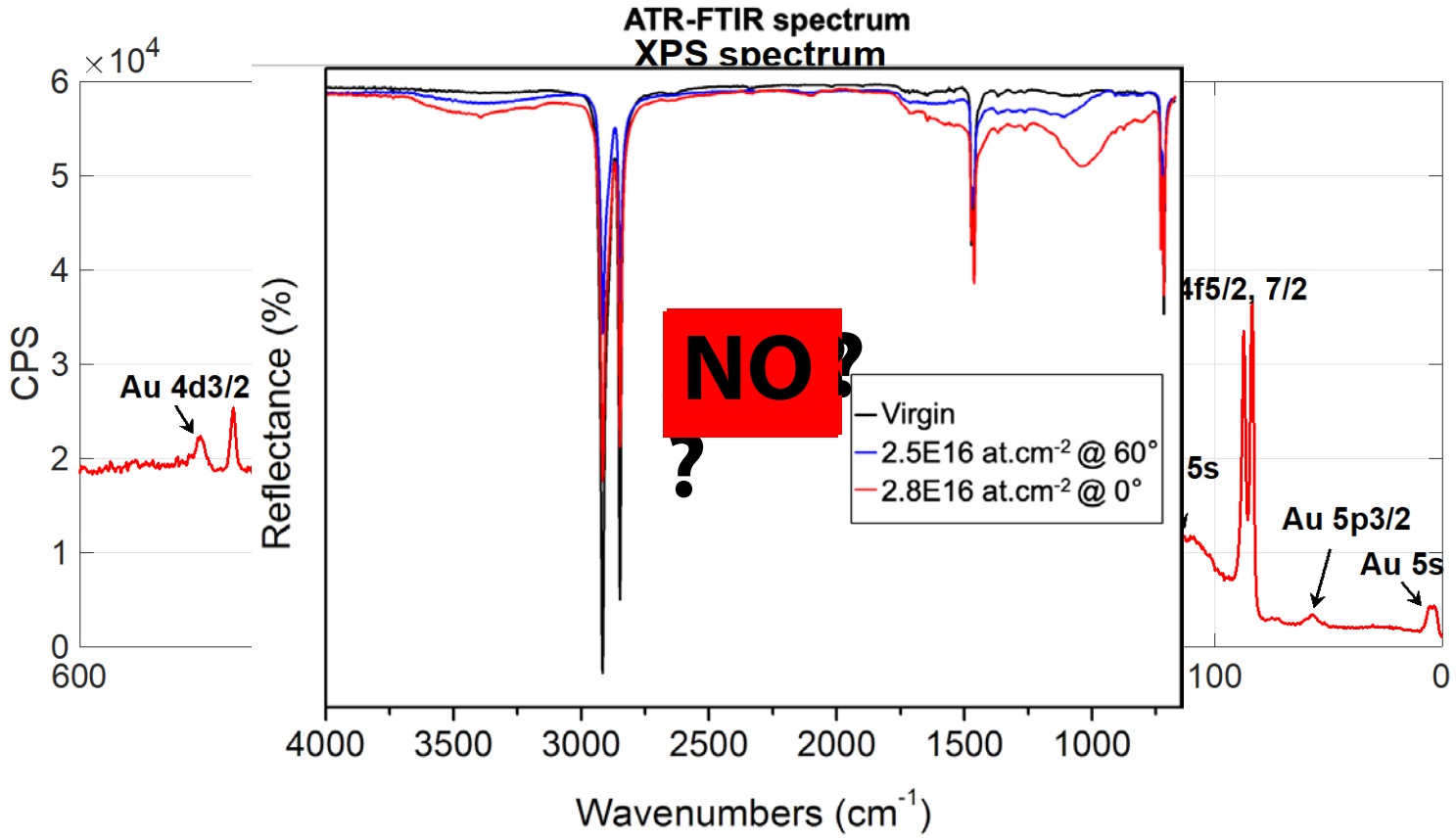
Simulations predicted stability and feasibility



A. Antušek et Al., Phys.Chem Chem. Phys. 19 (2017) 22897.

Au-C BOND IN HDPE

Quest for experimental proof



P. Noga et Al., Proceedings IBMM2018 (2018) 82.

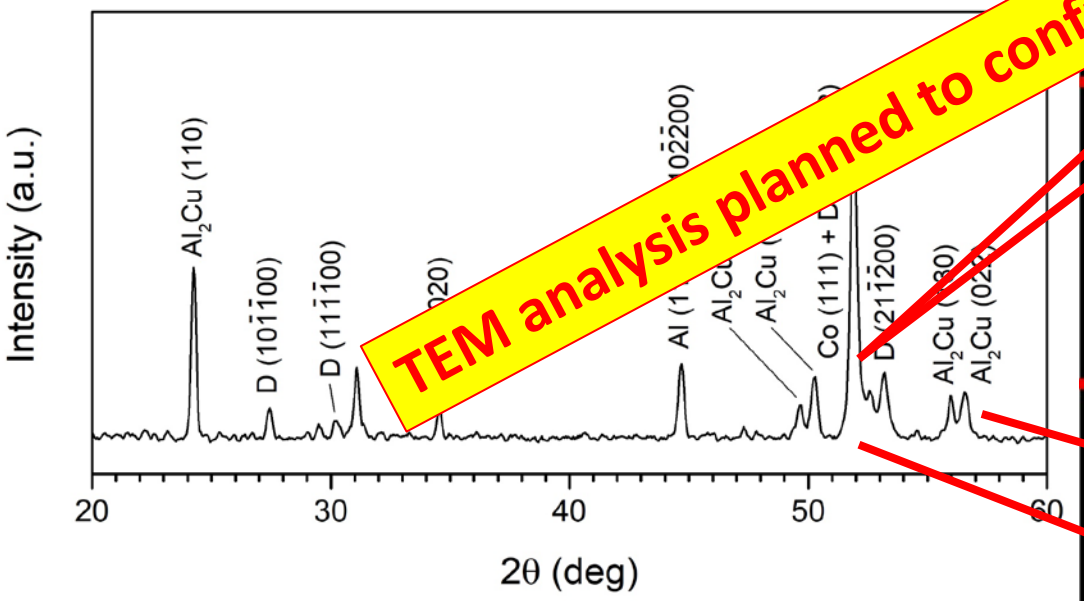
Au-C BOND IN HDPE

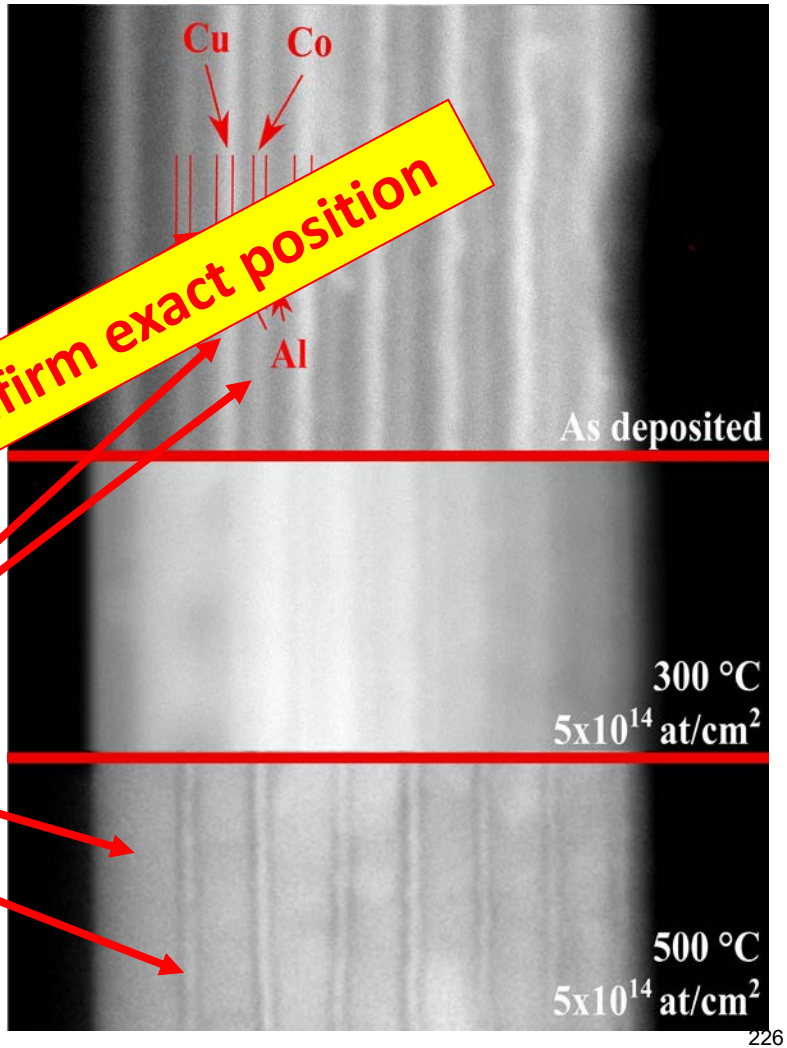
- **Why?**
  - Organometallic compounds
    - We study at the very basic level – if such a bond will persist and how?
    - Possible applications in bioactivity, molecular magnetism, catalysis tuning conductivity, non-linear optics, ferroelectrics, sensors
    - So the quest continues!
  - More details in:
    - A. Antušek et Al., Phys.Chem Chem. Phys. 19 (2017) 22897.
    - A. Winter and U. S. Schubert, Chem. Soc. Rev. 16 (2016) 5311.

Al-Co-Cu QUASICRYSTALS IN NANOLAYERS

- **Procedure**

1. Deposition of Al-Co-Al-Cu alternating layers (stack of 26) 1 μm thick





TEM analysis planned to confirm exact position

Al-Co-Cu QUASICRYSTALS IN NANOLAYERS

- **Why?**
  - Quasicrystals exhibit interesting surface properties
    - But are usually brittle and of poor strength. A thin functional layer of the quasicrystalline phase has applications in catalysis or bio-active materials, wear resistant and thermal coatings etc.
  - More details in:
    - J.M. Dubois, Chem. Soc. Rev. 41 (2012) 6760.
    - D. Rouxel, P. Pigeat, Prog. Surf. Sci. 81 (2006) 488.

ACKNOWLEDGMENT

This work was financially supported by:

- The European Regional Development Fund, Research and Development Operational Programme, project No. ITMS:26220220179,
- The Slovak Research and Development Agency under contracts No. APVV-15-0049, APVV-18-0168
- Grant Agency VEGA under contracts No. 1/0219/16, 1/0330/18
- Ministry of Education and Science of the Republic of Serbia (Project No. III 45005)

STU MTF

ATRI
Advanced Technologies Research Institute

THANK YOU FOR ATTENTION!



REAL-TIME DETERMINISTIC RECTANGULAR SHAPE RECOGNITION FROM LASER PROFILOMETER DATA

Dr. Andrej Mihálik, PhD [1]
[1] FMFI UK, Bratislava

Abstract

We present a new method for recognition of a rectangular shapes scanned by the laser profilometer.

We consider a problem of recognizing a particular 3D rectangular identifier with specific profile.

Such identifiers are meant to provide the information for the robotic systems about the position on the digital road or the state of the system. Identifiers placed in the particular positions are scanned by the profilometer sensor moving over the identifier in arbitrary horizontal direction and thus the 3D profile is obtained.

Profilometer produces laser beam that is projected onto surface as a single scan line. Scan line is captured by the profilometer sensor and 3D profile needs to be reconstructed from the set of scan lines.

We have encountered multiple problems associated with profile reconstruction. Such problems occurred by the rotational movements, scanner oscillation or non-perpendicular laser projection.

We have designed shapes of the identifiers profile to clearly distinguish the particular identifiers. Subsequently we have devised a robust and efficient algorithm for the recognition of these identifiers in real time.

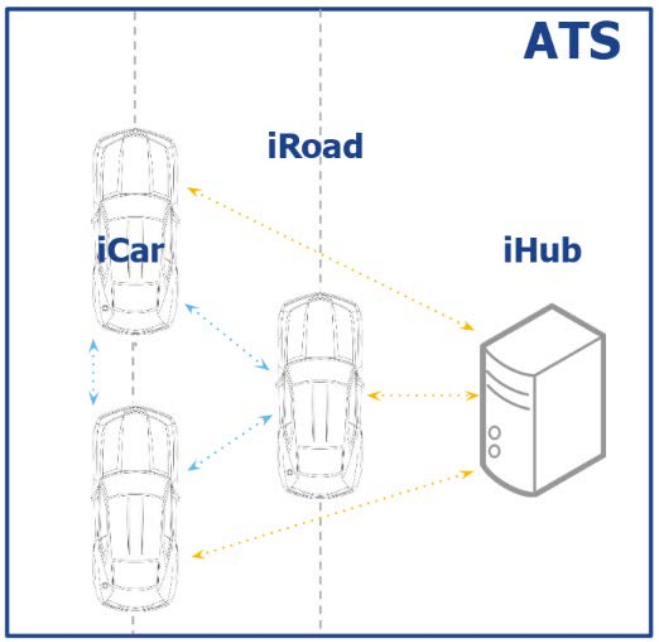
DETERMINISTICKÉ ROZPOZNÁVANIE PRAVOUHLÉHO TVARU V REÁLNOM ČASE Z ÚDAJOV LASEROVÉHO PROFILOMETRA

Dr. Andrej Mihálik, Prof. Branislav Sitár, DrSc.,
Prof. Roman Ďurikovič, Dr. Pavel Petrovič, Dr. Michal Mereš,
Ing. Peter Varga, Dr. Ľubomír Mach

FMFI, Univerzita Komenského, Bratislava

Autonómny Transportný Systém (ATS)

- ATS funguje na originálnej patentovanej technológii interakcie inteligentného vozidla s inteligentnou vozovkou
- Patentovaná technológia ATS je prispôsobená schopnostiam počítačov, ktoré riadia AGV, je „computer friendly“
- ATS je 10x presnejšie, 10x rýchlejšie, 10x lacnejšie
- Reakčný čas navigačného systému ATS je menej ako 0,1 s
- Schopnosť vyriešiť akúkoľvek dopravnú situáciu, križovatky, parkovanie
- Nízka cena navigačného systému ATS
- Nízka cena infraštruktúry ATS



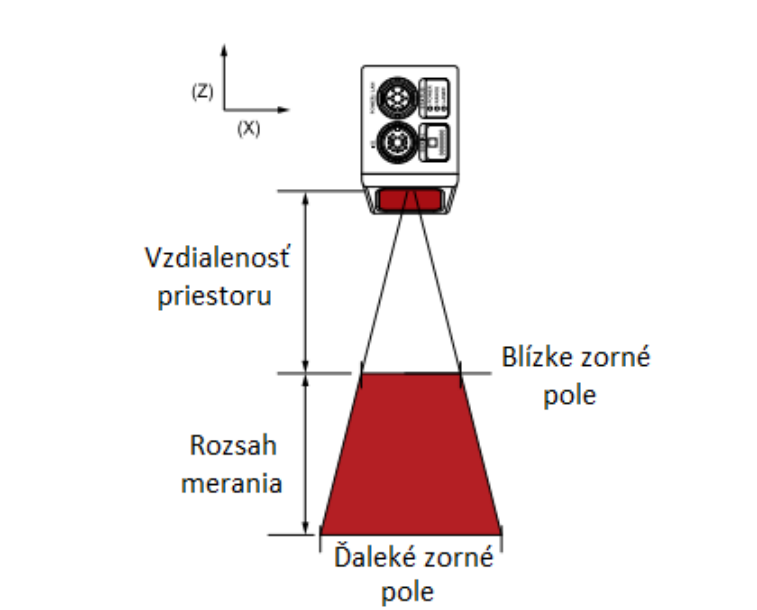
Technické vybavenie

- Laserovým profilometer



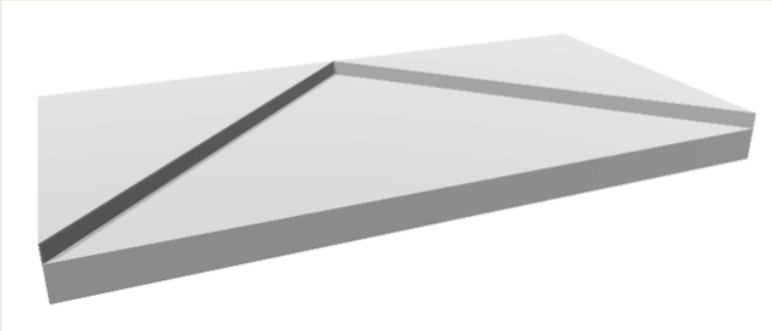
Výsledný laserový profil

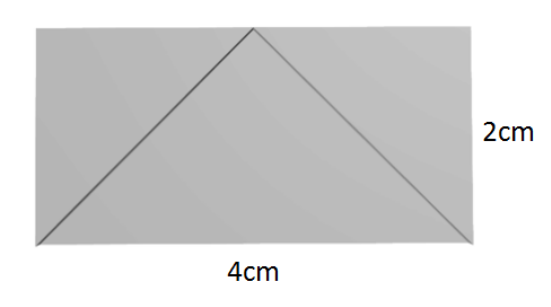
Laserovým profilometer



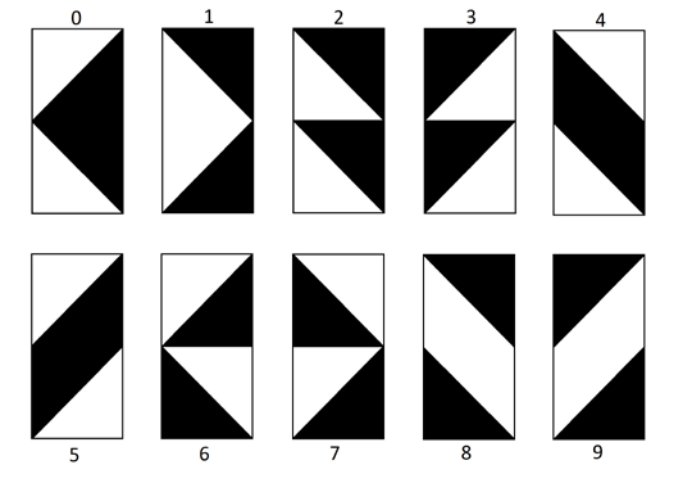


Dizajn značiek





Pôdorys

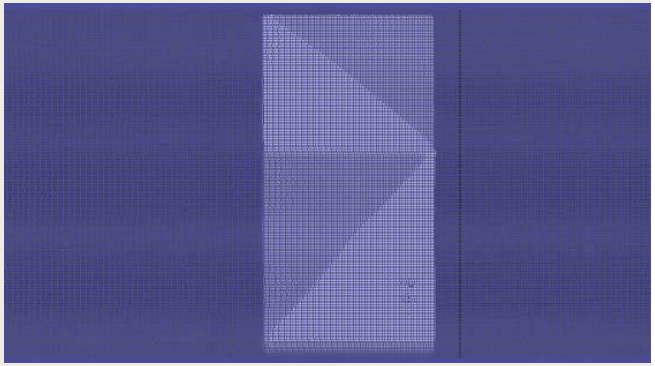


Séria 10 značiek pravouhlého tvaru

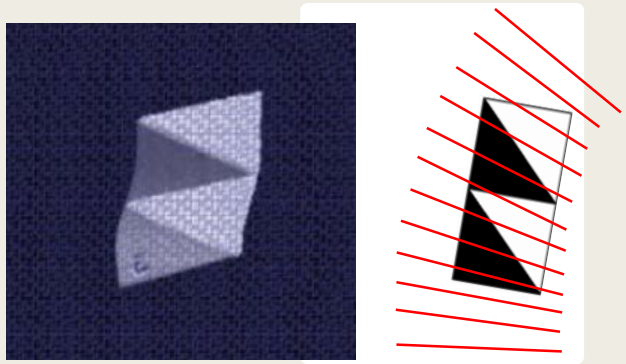


Bokorys

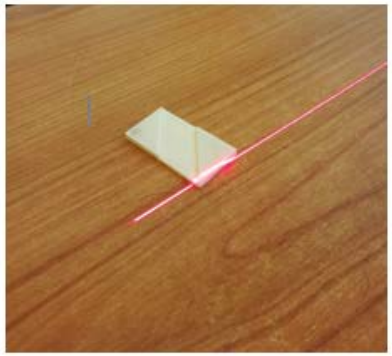
Vizualizácia nasnímaných dát

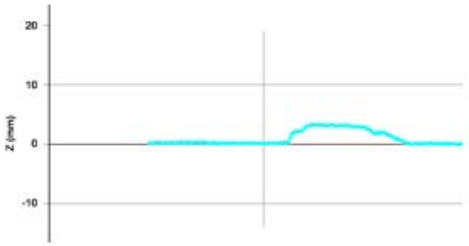


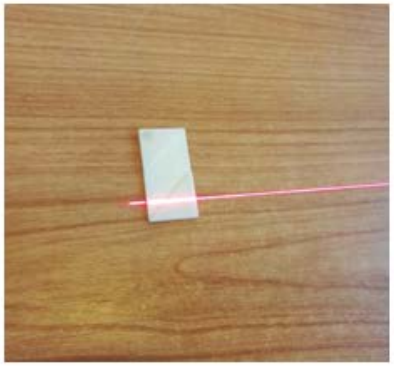
Vizualizácia značky pri jazde rovno

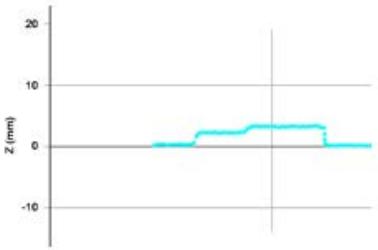


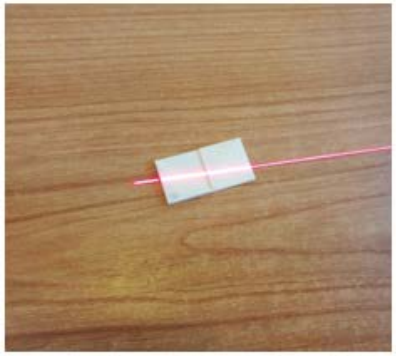
Deformácia značky v zákrute

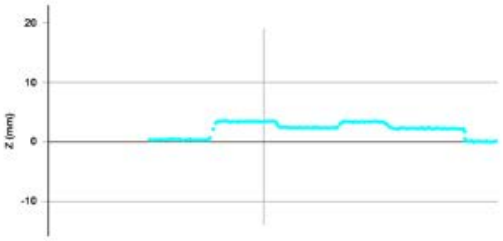


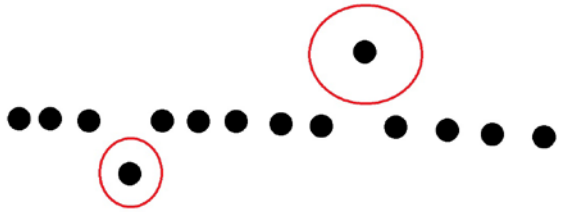

20
10
0
-10
Z (mm)




20
10
0
-10
Z (mm)

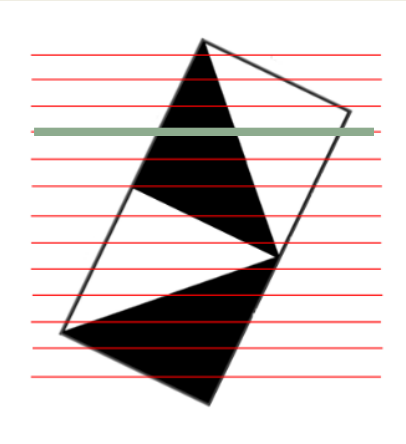



20
10
0
-10
Z (mm)



Rozpoznávanie značiek

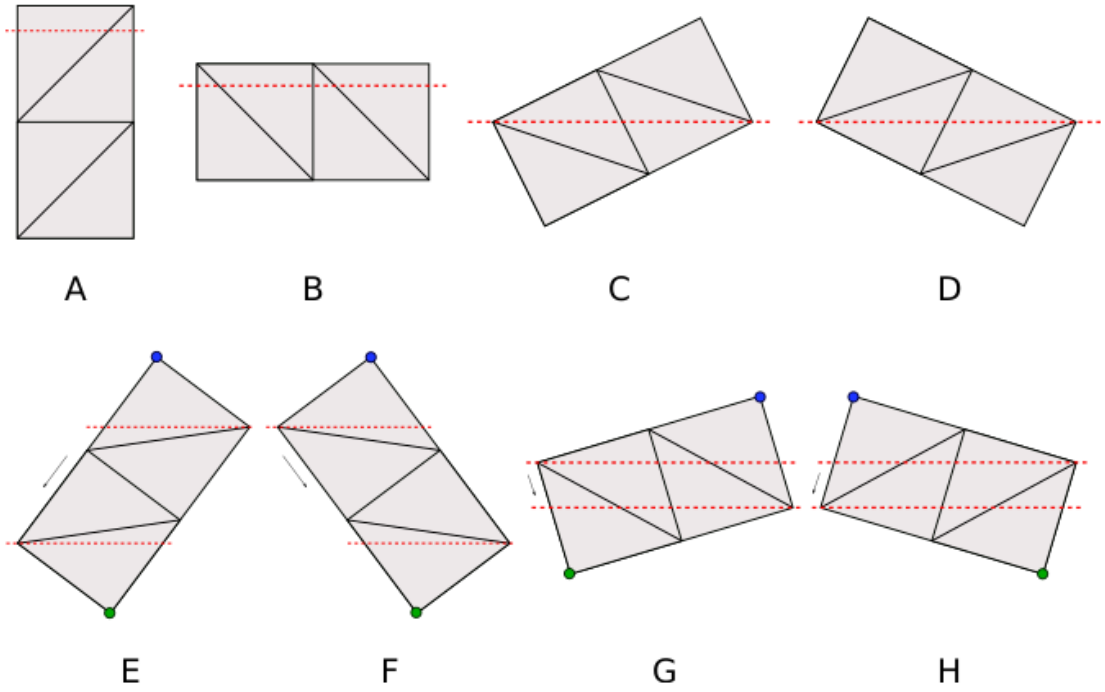
- Prvým krokom je nájsť v mračne bodov značku, ktorú budeme následne rozpoznávať. Nájdeme výškový skok pripomínajúci hranu značky.





Príklad jednej skenovacej čiary

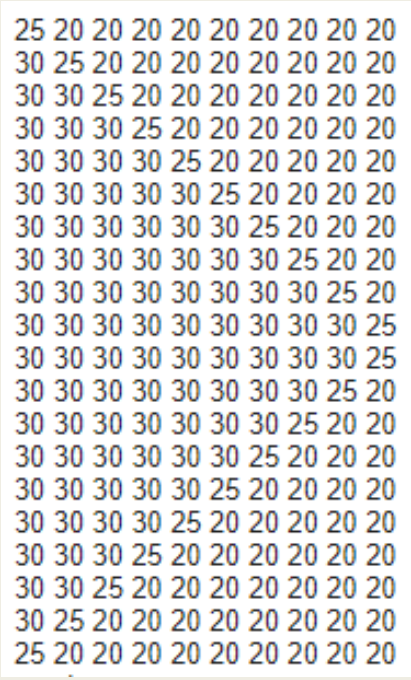
Nábeh na značku





Rozpoznávanie značiek

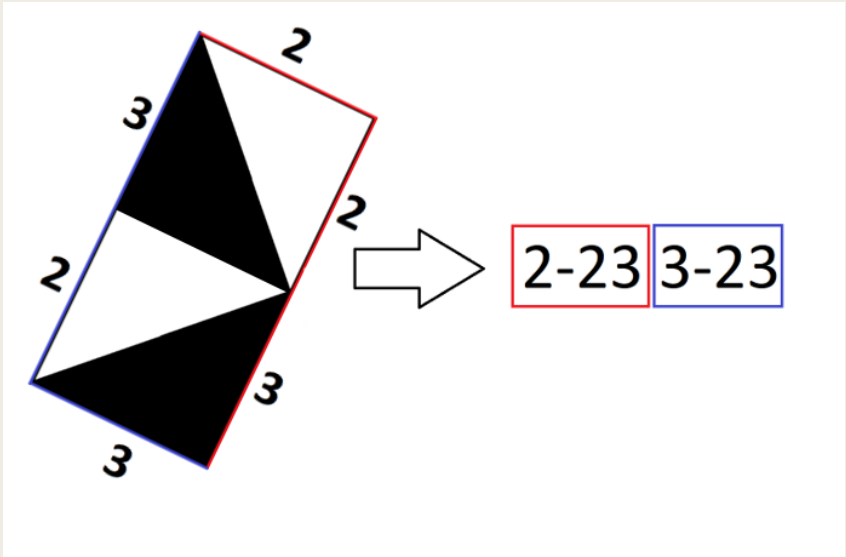
- Algoritmus s využitím bitmap
  - *Dáta sa zapíšu do vzorovej mriežky a porovnajú sa so vzorovými bitmapami 10-tich značiek*
- Algoritmus nie je odolný voči deformáciám značky. Zvlnenie a pretiahnutie značky spôsobí chybné vyplnenie mriežky.



Vyplnená bitmapová mriežka

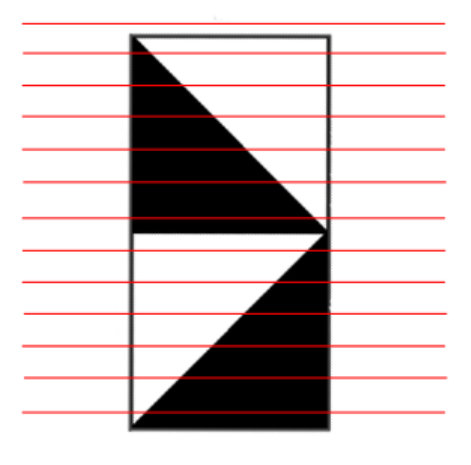
Rozpoznávanie značiek

- Algoritmus s využitím hrán
  - Algoritmus využíva iba vonkajšie okraje značky.

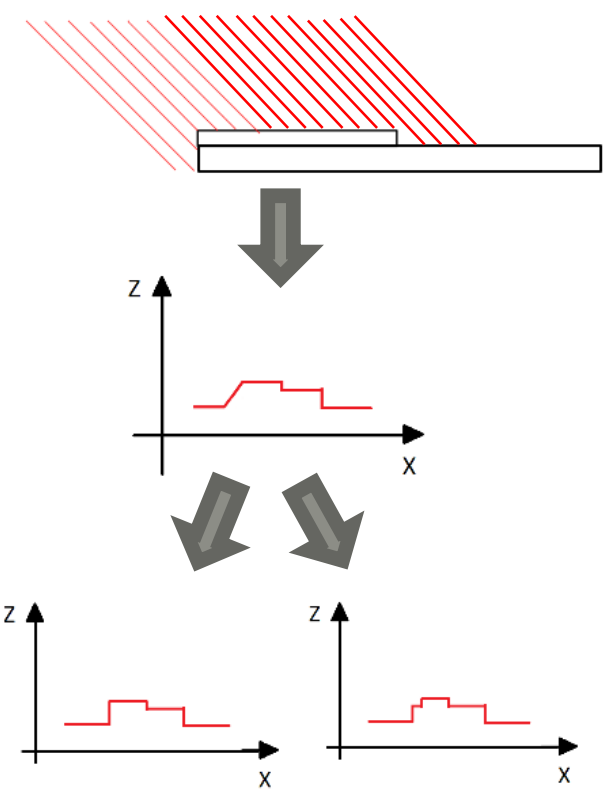




Problémy hranového algoritmu

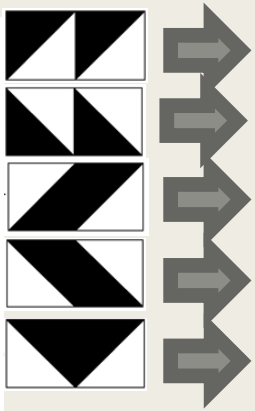


“rovno” žiadna skenovacia čiara nepretne hornú a dolnú hranu



Profilometer zachytáva bočné steny značky čo spôsobuje, že niektoré hrany môžu byť nesprávne vyhodnotené.

Výsledky



...

...

id	or	tilt	c_x	time[s]	lines	points	dir
2	3	-1.704	42.664	0.000	530	1534	169
3	3	-0.319	42.818	0.000	315	768	169
4	1	0.335	46.756	0.000	260	732	184
5	1	-0.107	50.016	0.000	257	614	190
0	3	0.000	54.718	0.000	178	449	199
1	3	-1.163	54.497	0.000	262	677	195
9	1	0.733	36.630	0.000	163	385	130
5	1	1.110	42.468	0.000	194	467	171
0	3	5.249	58.809	0.000	200	530	215
1	3	2.473	68.094	0.016	222	570	219
0	1	0.295	37.201	0.000	178	470	141
1	3	8.075	61.529	0.000	185	477	224
2	3	3.173	80.244	0.000	178	523	236

Ďakujem za pozornosť

Porovnanie LiDAR a ATS

ATS „i-cars on i-roads“ technológia

- cena ~ 10 000 EUR



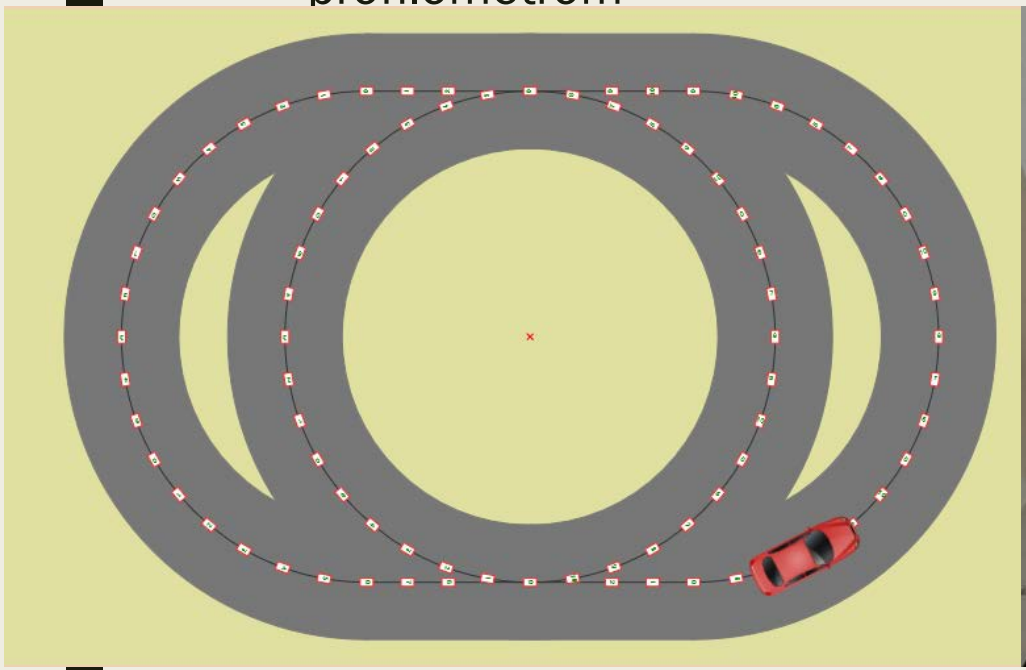
LIDAR technológia so superpočítačom

- cena ~ 100 000 – 200 000 EUR



Technické vybavenie

- RC model auta (mierka 1:10) s pripevneným laserovým profilometrom





3D RECONSTRUCTION AND MEASUREMENTS IN REALITYCAPTURE SOFTWARE

Ing. Zuzana Ďuríčková PhD. [1]
[1] Capturing Reality,s.r.o.

Abstract

RealityCapture je fotogrametrický softvér, ktorý je momentálne lídrom na svetovom trhu. Umožňuje kombinovať fotografie a laserové skeny automaticky v jednom kroku, a vytvárať tak fotorealistické a geometricky presné 3D modely. Inteligentný „out-of-core" algoritmus je optimalizovaný tak, aby bolo možné spracovávať obrovské množstvo dát bez nároku na operačnú pamäť. Vďaka tomu je možné vytvárať 3D vystupy niekoľko násobne rýchlejšie ako v konkurenčných softvéroch pri relatívne nízkom nároku na hardvérové vybavenie. Výsledná presnosť samotného 3D výstupu závisí od kvality a presnosti vstupných dát, vďaka čomu užívateľ dokáže dosiahnuť milimetrovú presnosť bez ohľadu na veľkosť skenovaného objektu alebo územia.

MEDZINÁRODNÁ KONFERENCIA

3D MERANIE A ZOBRAZOVANIE

4. ročník

3D REKONŠTRUKCIA A MERANIA V SOFTVÉRI REALITYCAPTURE

CapturingReality

Ing. Zuzana Ďuríčková, PhD.

KTO SME?

- Na začiatku 3 vedci s víziou a množstvom skúseností
- Spoločnosť založená v roku 2013
- Vývoj fotogrametrického softvéru RealityCapture
- Prvý oficiálny release – február 2016

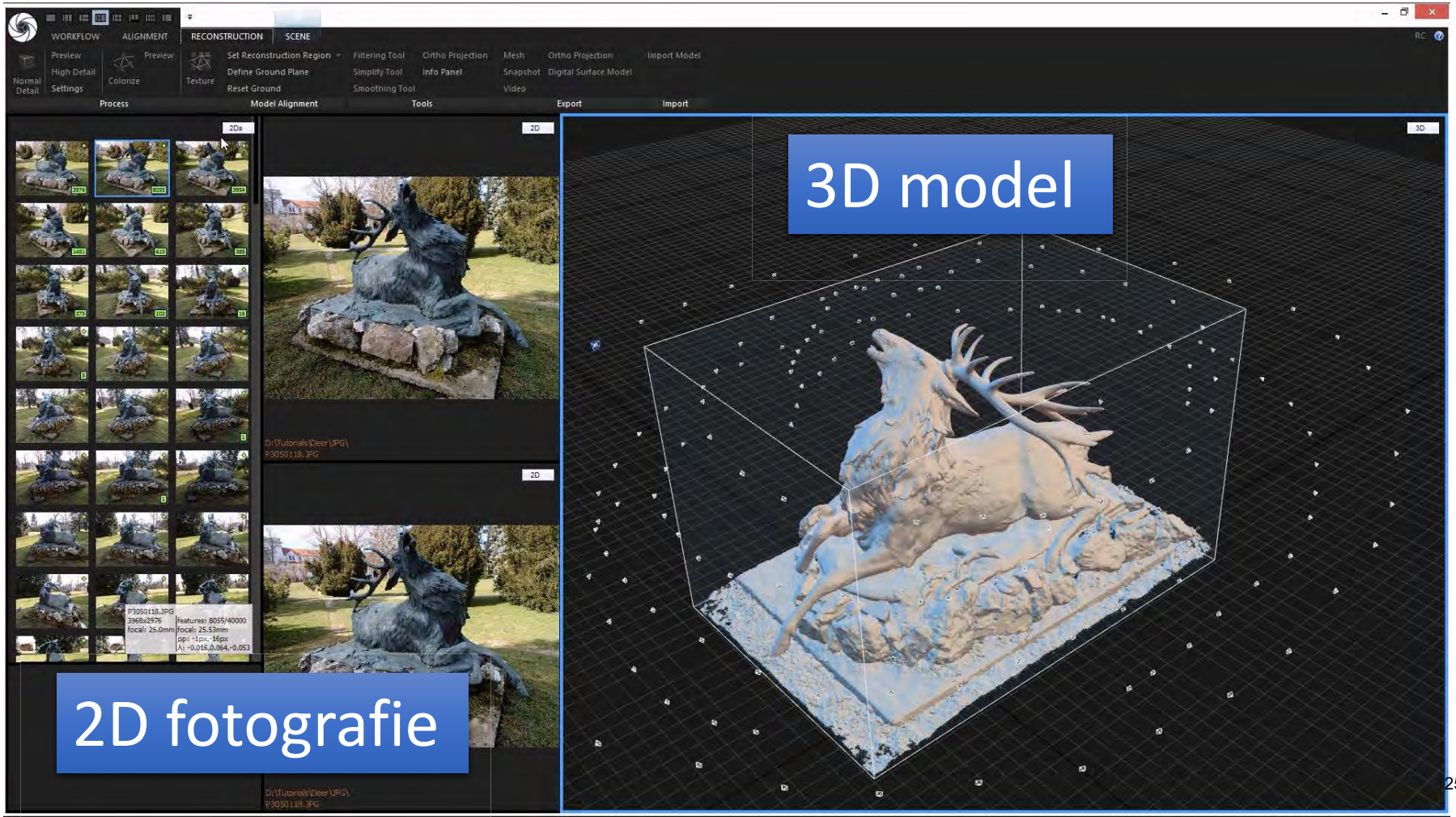
CapturingReality

ČO ROBÍME?

- fotogrametrický softvér RealityCapture, ktorý umožňuje vytvárať 3D modely z 2D fotografií a laser skenov
  - Pozemná fotografia
  - UAV
  - Video
  - Terestriálny laserový skener

CapturingReality

ČO ROBÍ NÁŠ SOFTVÉR?

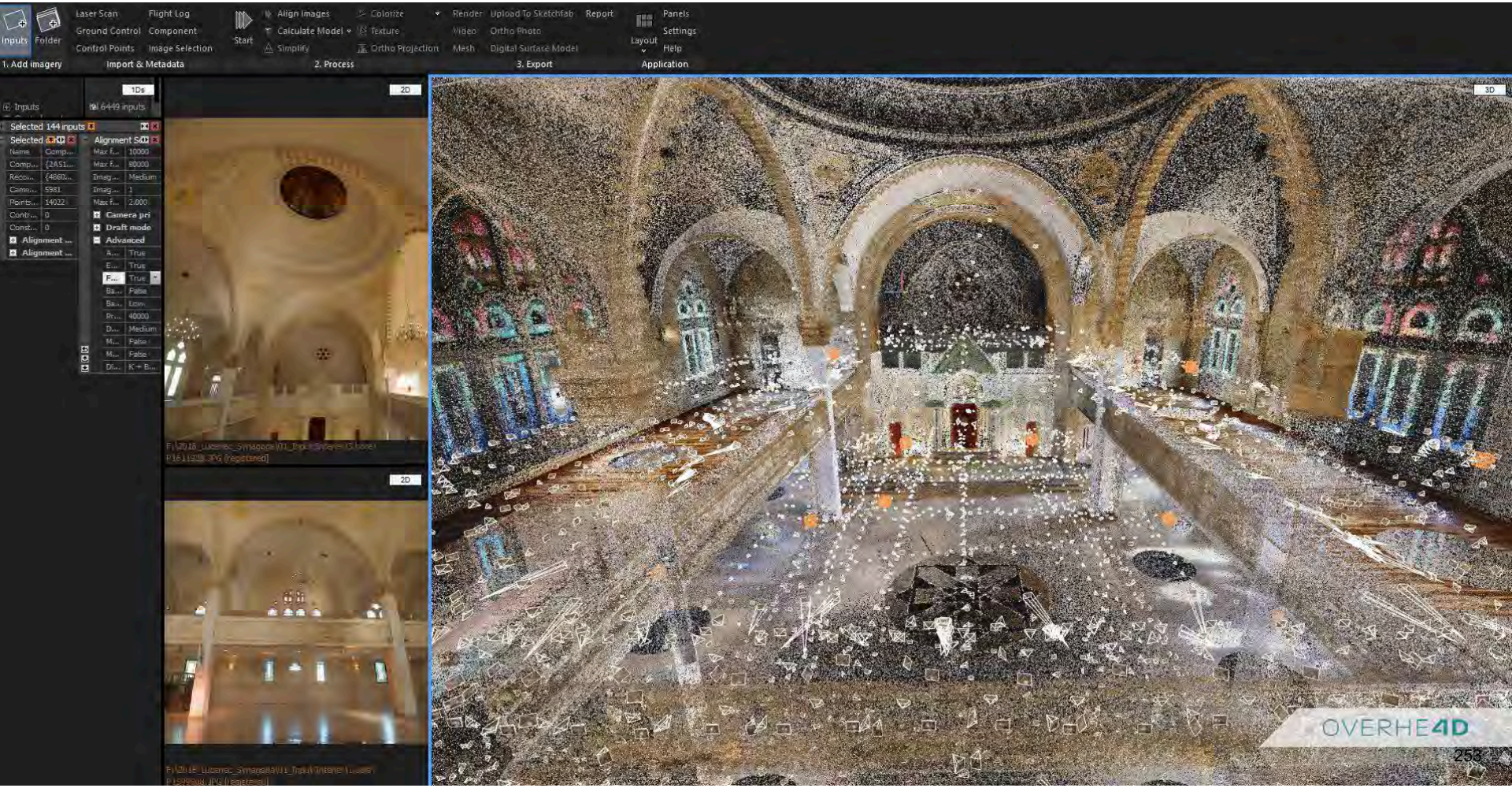


ČÍM SME VÝNIMOČNÍ?

- Registrácie fotiek a laser skenov v jednom kroku

CapturingReality

ČÍM SME VÝNIMOČNÍ?



ČÍM SME VÝNIMOČNÍ?



ČÍM SME VÝNIMOČNÍ?

- Registrácie fotiek a laser skenov v jednom kroku
- Najrýchlejší na trhu

CapturingReality

ČÍM SME VÝNIMOČNÍ?



RealityCapture

66 m =
~ 1 hod

1. SOFT

788 m =
~ 13 hod

2. SOFT

1372 m =
~ 22 hod

3. SOFT

2738 m =
~ 46 hod

4. SOFT

1385 m =
~ 23 hod

*Interné testovanie spracovania 3000 fotiek, rovnaký HW a nastavenia

ČÍM SME VÝNIMOČNÍ?

- Registrácie fotiek a laser skenov v jednom kroku
- Najrýchlejší na trhu
- Nízke nároky na HW (out-of-core algoritmus)
  - Odporúčaných 16GB RAM
  - NVIDIA, CUDA 2.0+
  - Laptop priamo na mieste

CapturingReality

ČÍM SME VÝNIMOČNÍ?

Laptop:

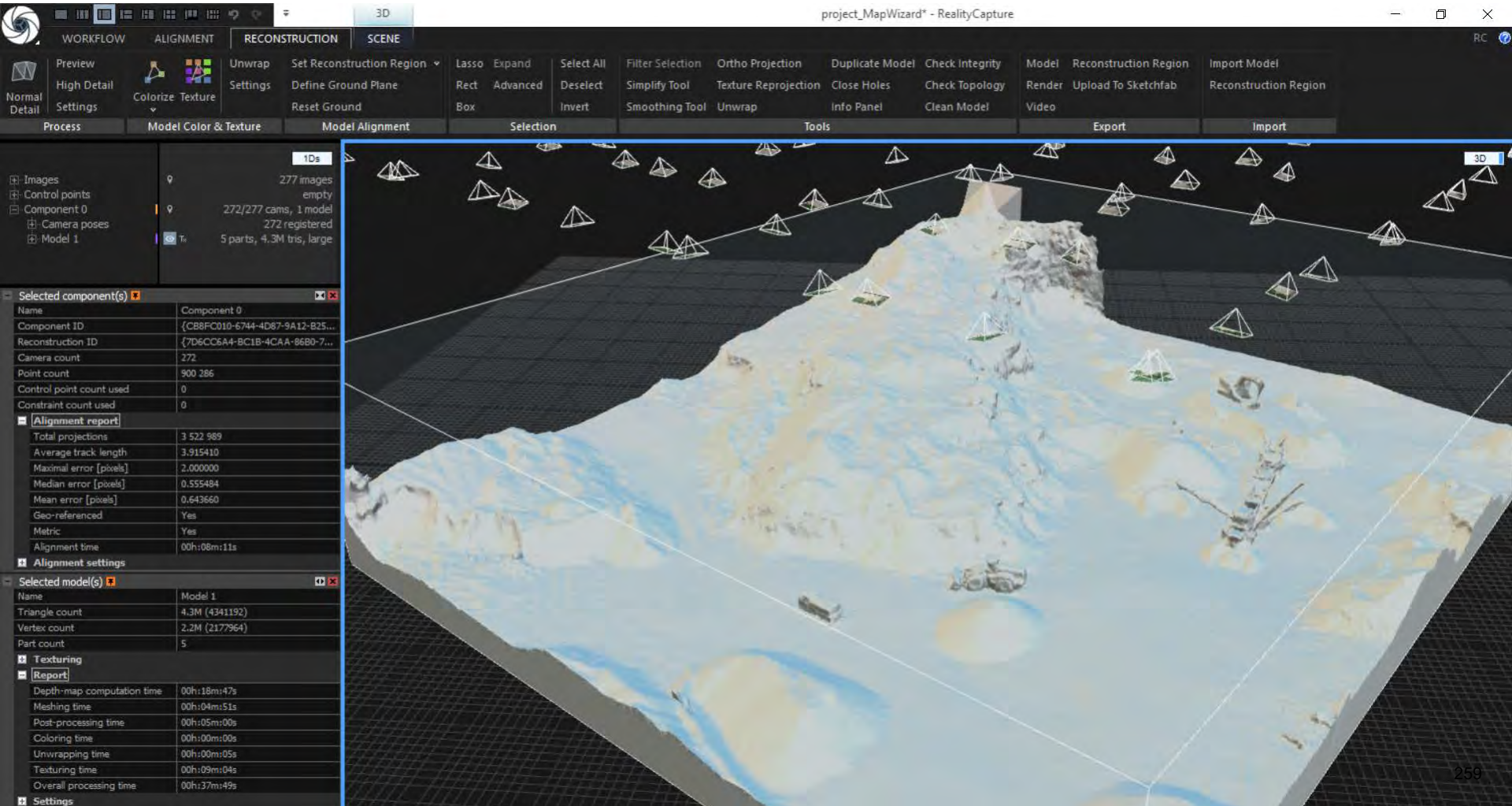
- 16 GB RAM
- Intel Core i7
- NVIDIA GeForce GTX 1060

Spracovanie:

- 300 fotiek
- Pozície kamier – 8 min
- Rekonštrukcia (normal) – 23 min

CapturingReality

ČÍM SME VÝNIMOČNÍ?



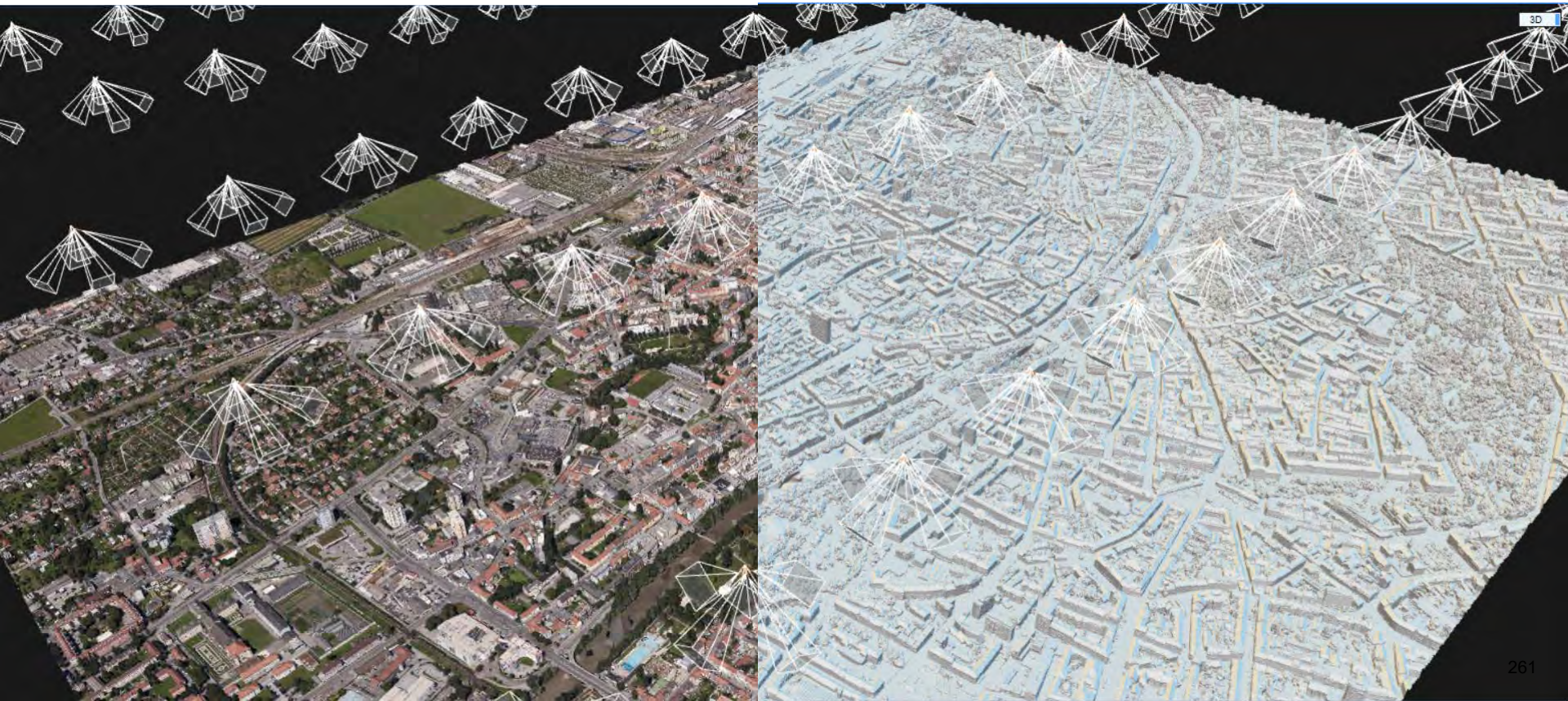
NA VEĽKOSTI NEZÁLEŽÍ

- Neobmedzené rozlíšenie
- Neobmedzený počet fotiek
- Neobmedzený detail
- Neobmedzená mierka

CapturingReality

- NEOBMEDZENÉ ROZLÍŠENIE

Vexcel UltraCam, Graz (Rakúsko)
1350 fotiek, 80 Mpx – 120 Mpx,

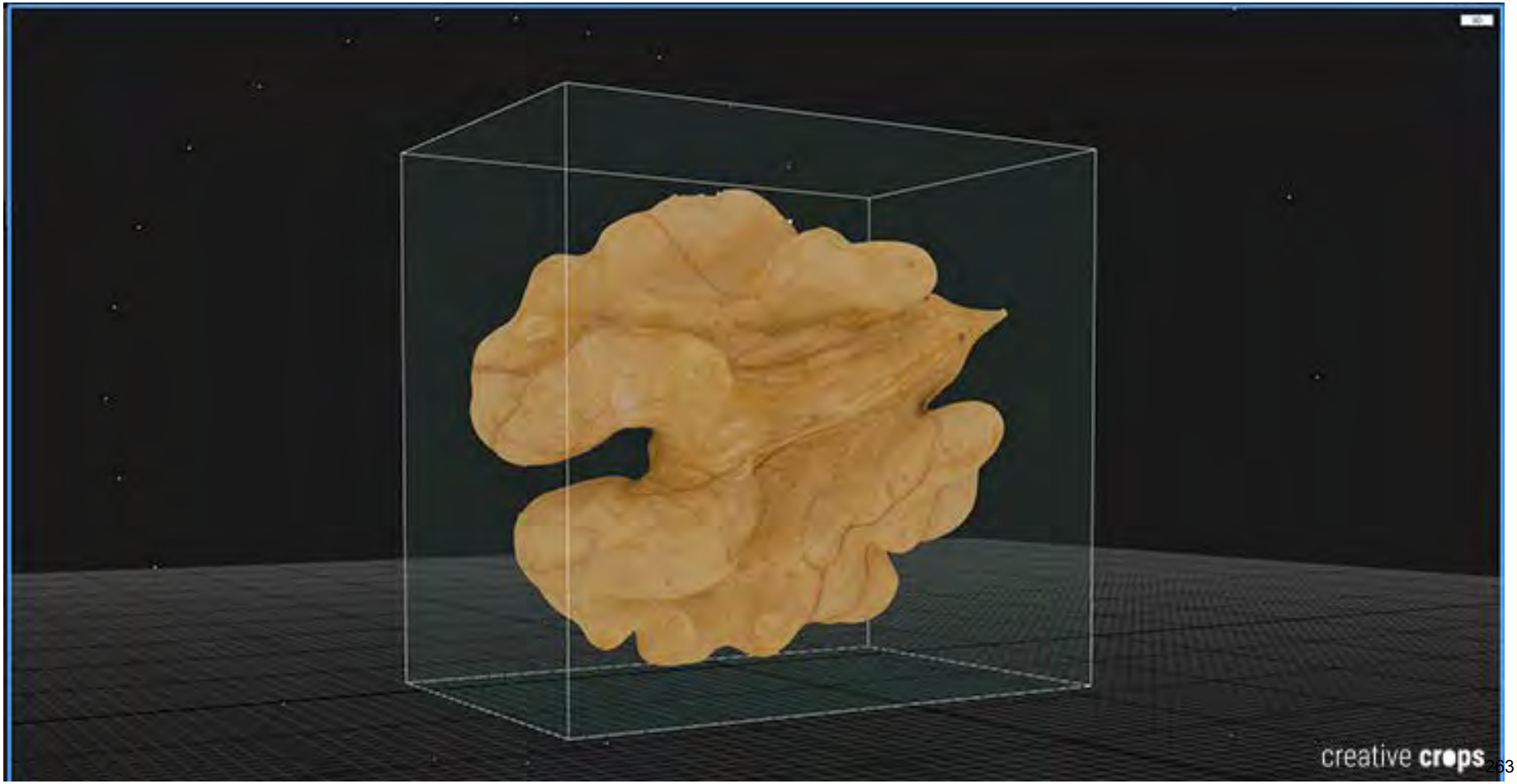


- NEOBMEDZENÝ POČET FOTIEK

Dóm sv. Alžbety
111000 fotiek, pôvodný model 6 biliónov trojuholníkov

- NEOBMEDZENÝ DETAIL

Viac ako 200 fotografií, 6 miliónov trojuholníkov



- NEOBMEDZENÝ DETAIL



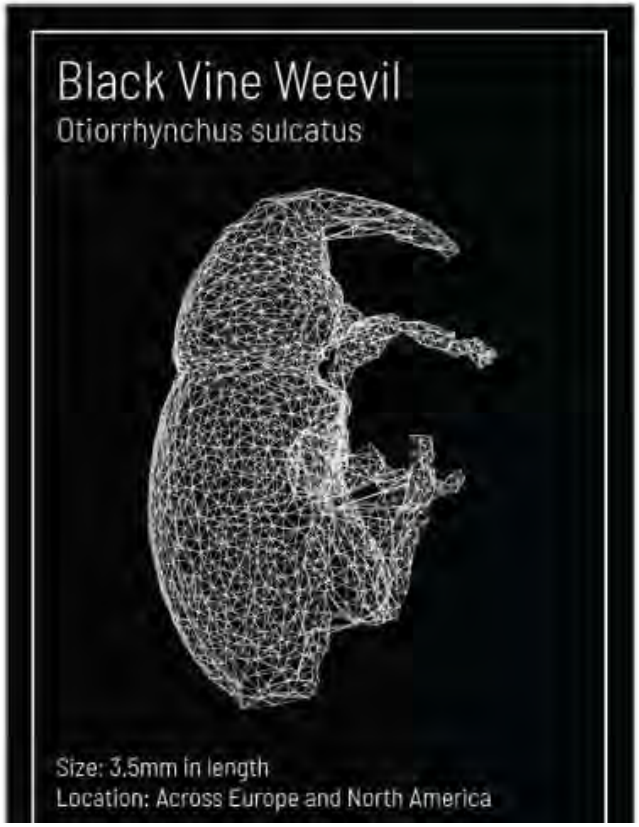


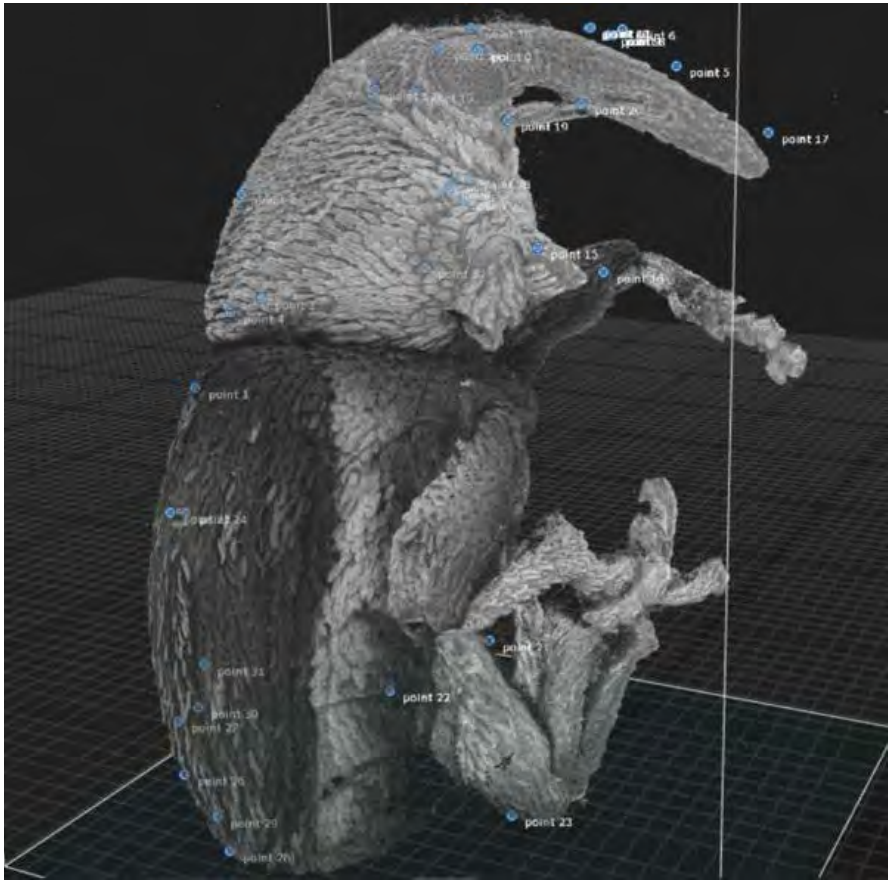
Credit: creative crops

- NEOBMEDZENÁ MIERKA

Fotky snímané elektrónovým mikroskopom

Veľkosť objektu 3.5 mm

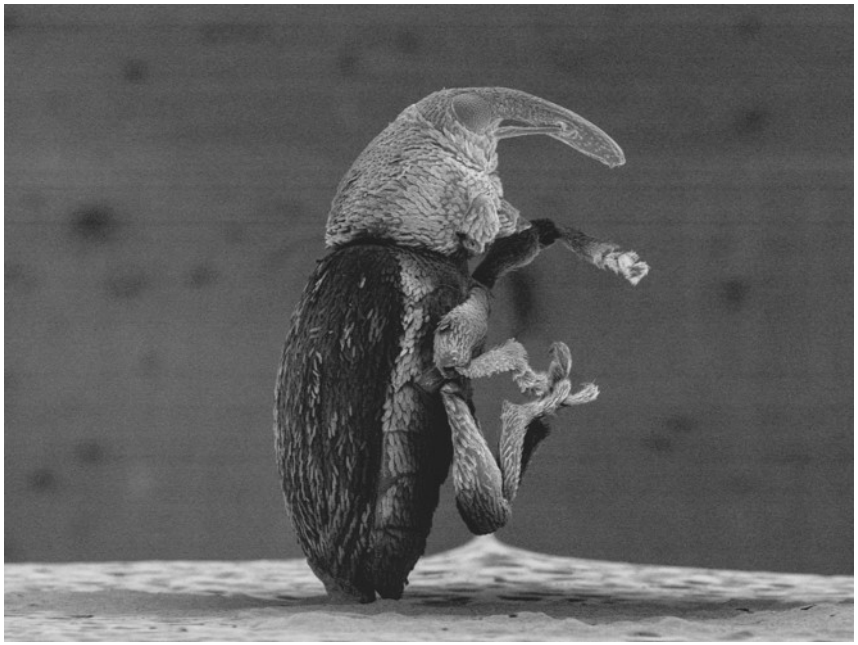


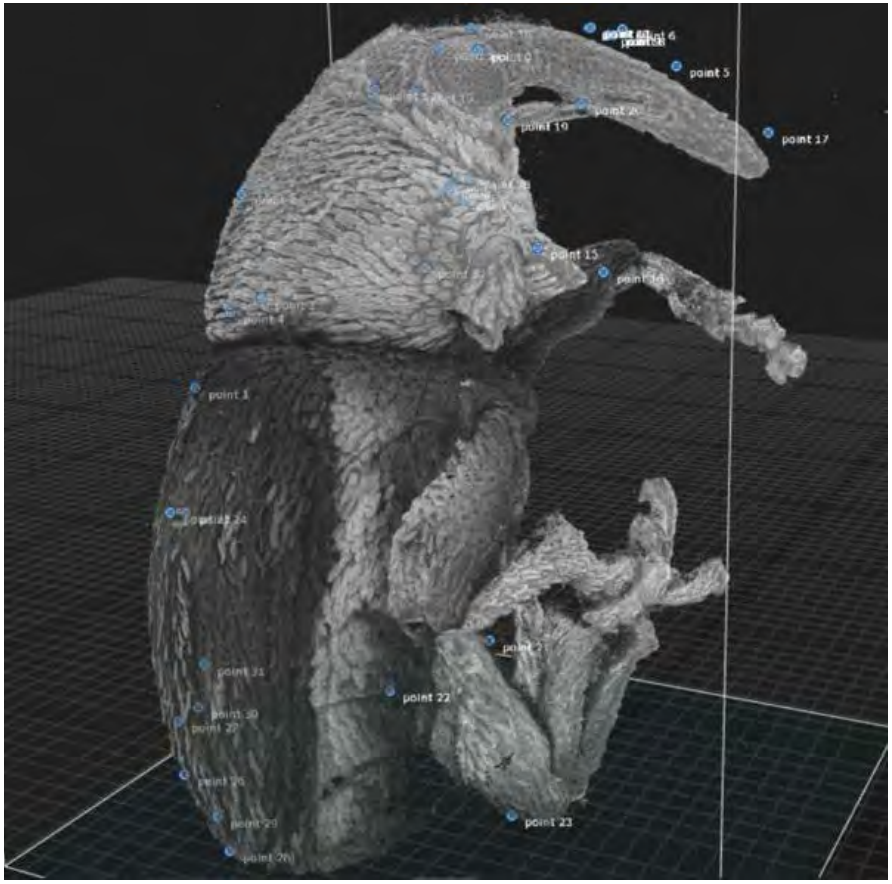


Credit: Ian Donelly

- NEOBMEDZENÁ MIERKA

Fotky snímané elektrónovým mikroskopom
Veľkosť objektu 3.5 mm





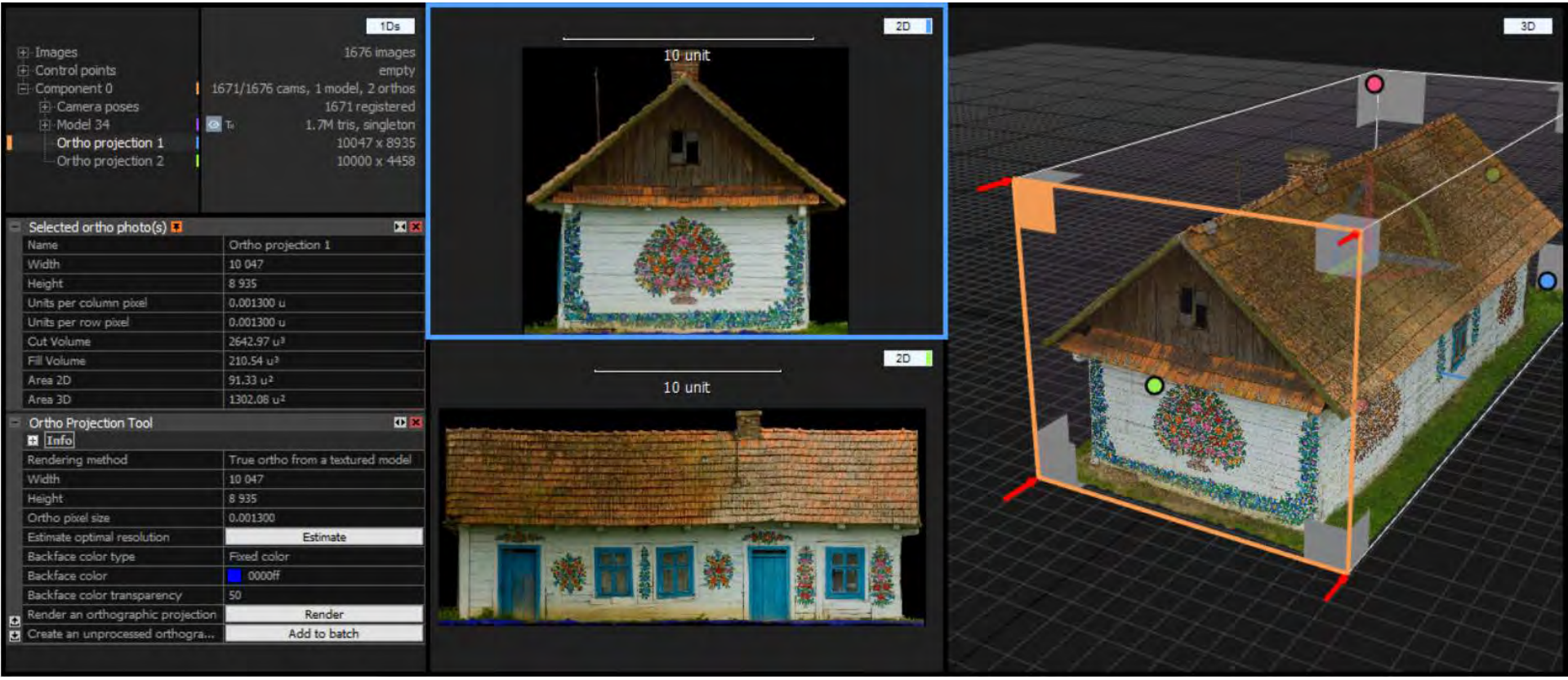
Credit: Ian Donelly

UNIVERZÁLNY NÁSTROJ

- Vytvorenie 3D textúrovaného modelu
- Vytváranie ľubovoľných ortoprojekcií a máp

CapturingReality

- # ĽUBOVOĽNÉ ORTOPROJEKCIE

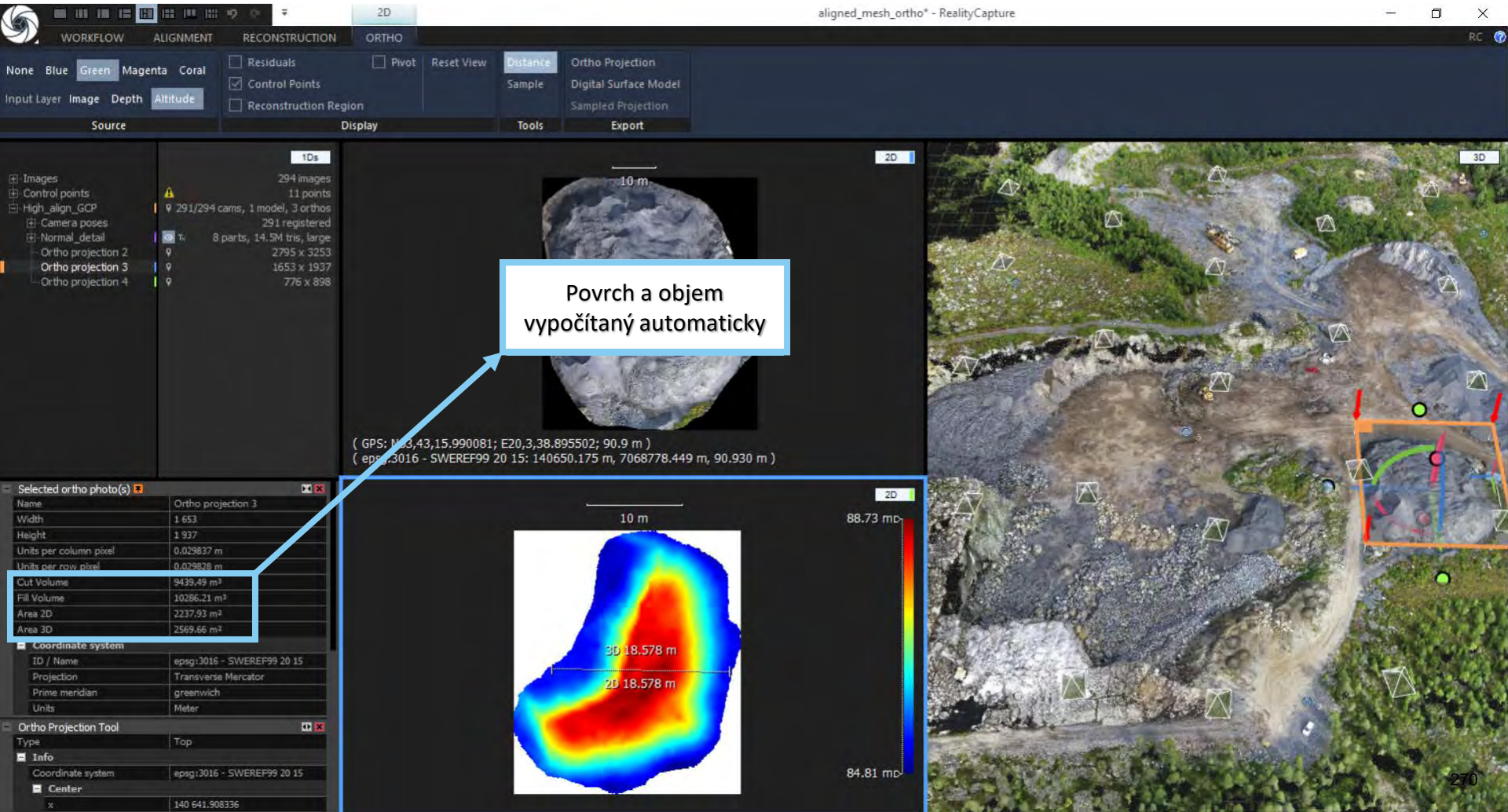


UNIVERZÁLNY NÁSTROJ

- Vytvorenie 3D textúrovaného modelu
- Vytváranie ľubovoľných ortoprojekcií a máp
- Škálovanie modelov
- Georeferencovanie scén a kombinácia súradnicových systémov
- Meranie vzdialeností, povrchov a objemov

CapturingReality

- # MERANIE VZDIALENOSTI, POVRCHU A OBJEMU



UNIVERZÁLNY NÁSTROJ

- Vytvorenie 3D textúrovaného modelu
- Vytváranie ľubovoľných ortoprojekcií a máp
- Škálovanie modelov
- Georeferencovanie scén a kombinácia súradnicových systémov
- Meranie vzdialeností, povrchov a objemov
- Reportovací systém (čoskoro na cloude)

CapturingReality

- REPORTOVACÍ SYSTÉM

Selected Component Report

Project: *aligned_mesh_ortho*

Fri, Oct 11, 2019 14:00:11

RealityCapture 1.0.3.9303 RC

Component name	High_align_GCP
Count of registered images	291 / 294
Points' count	346890
Count of used control points	11
Count of used constraints	0
Number of models	1

Alignment report

Total projections	983140
Average track length	2.8
Maximal reprojection error [pixels]	2.00
Median reprojection error [pixels]	0.80
Mean reprojection error [pixels]	0.84
Geo-referenced	True
Metric	True
Alignment time	00h:00m:58s

- REPORTOVACÍ SYSTÉM

Selected Component Report

Project: *ali*

Component name
Count of registered
Points' count
Count of used contr
Count of used const
Number of models

Alignment rep

Total projections
Average track lengt
Maximal reprojectio
Median reprojectio
Mean reprojection e
Geo-referenced
Metric
Alignment time

Control Points

Name	Type	Weight	Coordinate system	Imported coordinates	Actual position	# Images	Total deviation (Error X; Error Y; Error Z) [m]	Maximal projection error [pixels]
1	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140462.593 m y: 7068675.307 m z: 103.157 m	x: 140462.599 m y: 7068675.297 m z: 103.165 m	12	0.014 (0.006; -0.010; 0.008)	2.05
2	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140596.592 m y: 7068701.132 m z: 91.927 m	x: 140596.578 m y: 7068701.136 m z: 91.928 m	22	0.015 (-0.014; 0.004; 0.001)	3.72
3	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140717.801 m y: 7068761.112 m z: 83.211 m	x: 140717.795 m y: 7068761.104 m z: 83.212 m	19	0.010 (-0.006; -0.008; 0.001)	1.98
4	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140428.317 m y: 7068776.571 m z: 108.505 m	x: 140428.320 m y: 7068776.574 m z: 108.503 m	16	0.005 (0.003; 0.003; -0.002)	3.69
5	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140555.647 m y: 7068818.101 m z: 85.192 m	x: 140555.653 m y: 7068818.111 m z: 85.172 m	20	0.023 (0.006; 0.010; -0.020)	2.39
6	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140680.792 m y: 7068857.963 m z: 84.963 m	x: 140680.800 m y: 7068857.973 m z: 84.967 m	22	0.013 (0.008; 0.010; 0.004)	3.31
7	Ground control	10	epsg:3016 - SWEREF99 20 15	x: 140483.575 m y: 7068887.411 m	x: 140483.566 m y: 7068887.409 m	15	0.015 (-0.009; -0.002; 0.012)	1.63

- REPORTOVACÍ SYSTÉM

Selected Component Report

Project: *ali*

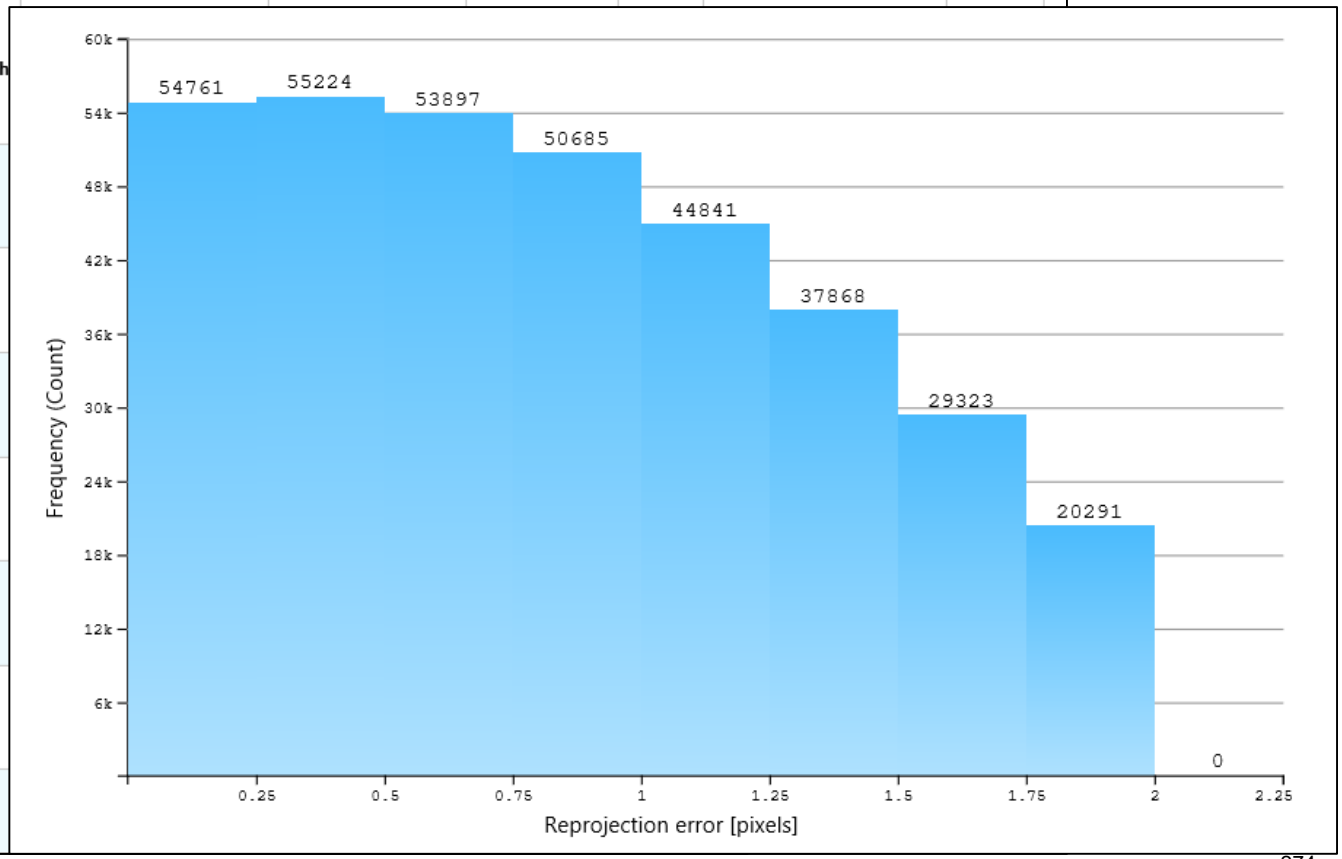
Component name	
Count of registered	
Points' count	
Count of used contr	
Count of used const	
Number of models	

Alignment rep

Total projections	
Average track lengt	
Maximal reprojectio	
Median reprojectio	
Mean reprojection e	
Geo-referenced	
Metric	
Alignment time	

Control Points

Name	Type	Weigh
1	Ground control	10
2	Ground control	10
3	Ground control	10
4	Ground control	10
5	Ground control	10
6	Ground control	10
7	Ground control	10





Ďakujem za pozornosť.

ZEISS DIMENSION LENSES FOR INDUSTRY

Michael Prouza[1]
[1] Carl Zeiss spol. s r.o.

Abstract

V této prezentaci si představíme nové objektivy ZEISS Dimension. Podíváme se na to jak zásadní a často opomíjenou roli hrají objektivy v celých systémech a jaký je jejich vliv na celkovou přesnost a spolehllivost. Řekneme si jak ZEISS reagoval na aktuální nároky a trendy v této kategorii a představíme několik unikátních vlastností této nové řady objektivů.

MEDZINÁRODNÁ KONFERENCIA

3D MERANIE A ZOBRAZOVANIE

4. ročník

ZEISS DIMENSION

Michael Prouza

ZEISS DIMENSION

Objektivy ZEISS Dimension pro průmysl



ZEISS DIMENSION

Preciznost pro vyšší efektivitu



ZEISS DIMENSION

Zcela nová řada objektivů pro průmysl

- C-mount
- Senzory až 4/3”, Line scan až 21,6mm
- Excelentní optika
- Robustní kostrukce
- Kompaktnost
- 2,8/8, 2/12,18,25,35,50

ZEISS DIMENSION

Patentovaný systém korekce vzdálenosti od snímače

Kompenzace nepřesnosti

Kompenzace teplot

Snímačové filtry

± 0.2 mm



ZEISS DIMENSION

Volná rotace po upevnění

360° rotace

Ideální poloha pro line scan

Snažší servis a ovládání



ZEISS DIMENSION

Integrované zubení

Clona i ostření

Možnost přidání servo motorů



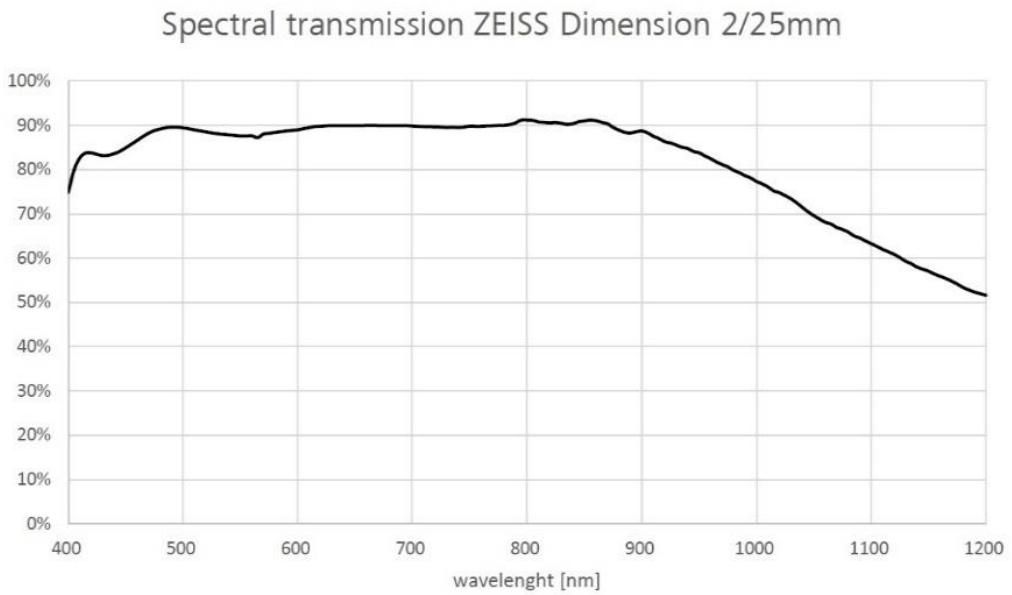
ZEISS DIMENSION

Speciální verze antireflexních vrstev T*

Přenosy 400-1200 nm

Umožňuje aplikace v NIR

- Inspekce solárních panelů
- food/waste processing
- Rozpoznávání chemikálií
- A mnoho dalšího…



ZEISS DIMENSION

Robustní a prémiové zpracování

Spolehlivost

Pracovní rozsah -20 až +50

Náraz až 100g/s

Vibrace 1,6g při 20-500Hz



ZEISS DIMENSION

Nerotující přední filtry

Polarizační filtry

Přesunití všech markerů



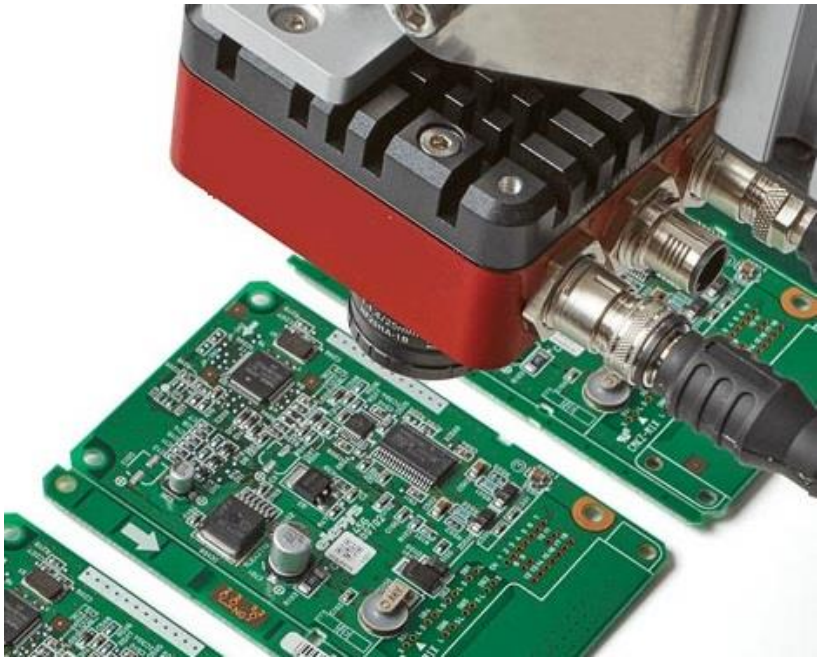
ZEISS DIMENSION

Nekompromisní obrazový výkon

Rozlišení

Vyšší efektivita

Menší tolerance



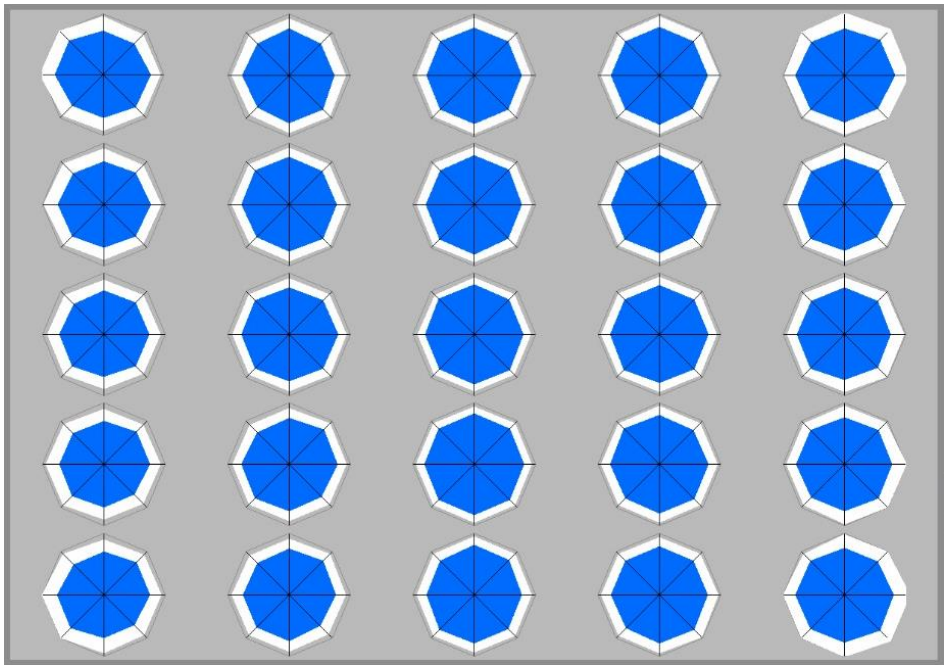
ZEISS DIMENSION

Nekompromisní obrazový výkon

Homogenita

Stálý výkon až ke krajům

Již od minimálních clon



ZEISS DIMENSION

Nekompromisní obrazový výkon

Zkreslení

Nízké zkreslení

Do 2%

Minimální odchylky



ZEISS DIMENSION

Michael Prouza
ZEISS camera lenses expert

DETECTION OF 3D SHAPE OF ROAD VEHICLES BY TOF METHOD

RNDr. Milan Držík, PhD.[1]
[1] Medzinárodné laserové centrum

Abstract

Metódu time-of-flight (TOF) s využitím osvetlenia pohybujúceho sa cestného objektu pomocou impulzného laserového zdroja možno aplikovať nielen na meranie rýchlosti objektu, ale aj na určenie jeho trojrozmerného tvaru. Prezentácia sa zaoberá analýzou základných predpokladov pre možnú aplikáciu takýchto meraní na identifikáciu druhu cestného vozidla.

V príspevku sa rozoberajú problémy spojené s ohraničeniami detekcie odrazených optických signálov na informatívnosť a spoľahlivosť zaznamenávaných signálov. Definujú sa základné problémy pri snímaní, zázname a spracovaní slabých odrazených optických signálov a poukazuje sa na perspektívnosť dnes už existujúcich fotodetektorov vytvorených maticou prvkov z lavínových (APD) fotodiód ako aj na výhodnosť takejto detekcie pri spracovaní signálov.



MOŽNOSTI DETEKCIE 3D TVARU CESTNÝCH VOZIDIEL METÓDOU TOF

M. Držík, J. Tomanovič, P. Varga

VYTVORENIE 3D TVARU OBJEKTU

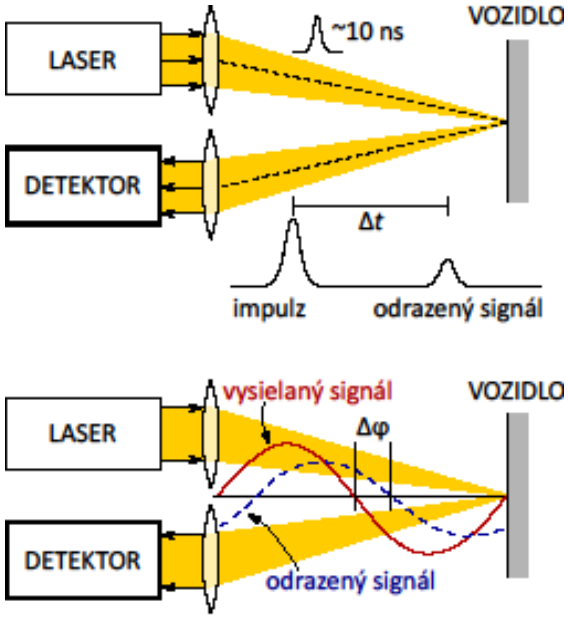
Jednokanálový systém s impulzným laserom a APD detektorom pracujúci na princípe TOF s jednotkou mechanického rozmietania pre tzv. skenovanie snímanej scény.	Viackanálový systém s impulzným osvetlením a snímaním pomocou multielementového riadkového alebo plošného APD detektora na báze TOF	Metóda laserovej triangulačnej profilometrie s korelačným vyhodnotením pohybu vozidla
Najbežnejšie riešenie na svetovom trhu. Napriek tomu, je z vedeckého pohľadu najmenej efektívnou a moderné poznatky ako aj vlastné experimenty a analýzy uprednostňujú druhé dva princípy, ktoré zatiaľ nie sú rozvinuté v priemyselnej praxi.	Multielementová detekcia na princípe TOF ponúka výhodu v simultánnom snímaní širokého zorného poľa bez potreby limitujúcej mechanickej zložky a umožňuje detail základnej klasifikácie vozidiel (v súlade s pravidlami cestnej premávky).	Laserová triangulačná profilometria je limitujúca pri veľmi rýchlych prejazdoch vozidiel nad 150 km/h, ponúka však vysokú mieru detailu vo veci klasifikácie vozidiel, a to až do úrovne detekcie náprav v styku s vozovkou,

Využitie svetelných impulzov (resp. infračervená oblasť - NIR) spolu s citlivými fotodiódovými detektormi

zjednodušenie úlohy merania rýchlosti
zvýšenie spoľahlivosti

Rýchlosť nie je možné určovať pomocou Dopplerovho efektu (radar)

Metóda **time-of-flight** (TOF)



merajú sa časové intervaly „letu“ svetelného impulzu k objektu a smerom naspäť po odraze.

Rýchlosť svetla c = 299 792 458 m/s
Svetlo smerom tam a naspäť na vzdialenosť každých 15 cm „letí“
1 nanosekundu, na vzdialenosť 30 m je to cca 200 nanosekúnd
Časy a frekvencie, ktoré dnešná elektronika bežne spracováva.

Zdroje svetelných zábleskov využívajú sa laserové diódy 905 nm (resp. LED)

- ľudské oko nevidí
- silne lokálne koncentrované žiarenie - bezpečnostné normy
- šírka impulzov 1 ns – 20 ns, výkon 100 W – 200 W

Detektory

Svetelný signál odrazený od vozidla je veľmi slabý – nutné sú vysokocitlivé detektory

- odraz laserového svetla od slabo odrážajúcich plôch (tmavý plastový nárazník
  čelné sklo sklonené pod uhlom a pod.)
- citlivosť fotodiódových detektorov musí byť vysoká, rýchlosť snímania v oblasti GHz. Používajú sa rýchle tzv. lavínové fotodiódy (APD).
- reálne dosiahnuteľné spoľahlivé merania - do 100 m až 200 m
- pri odraze od tabuľky EČV dostávame podstatne silnejší odrazený signál

Úloha klasifikácie druhov vozidiel

Systém musí spĺňať podmienky noriem EUR 5 a EUR 10 pre klasifikáciu druhu meraných vozidiel. Klasifikácia musí spĺňať rozdelenie podľa legislatívy SR v súlade so Zákonom 8/2009 Z.z. o cestnej premávke a o zmene a doplnení niektorých zákonov, príslušnou vykonávacou vyhláškou a Zákonom 25/2007 Z.z. o elektronickom výbere mýta za užívanie vymedzených úsekov pozemných komunikácií a o zmene a doplnení niektorých zákonov.

Existuje niekoľko štandardov klasifikácie vozidiel, napr. americká EFWA a európske klasifikácie EUR 13 resp. COST 323. COST 323, selektuje vozidlá iba do 8 kategórií. EUR 13 je podrobnejšia. Najselektívnejšia kategorizácia je podľa americkej FHWA (Federal Highway Adminisration). Rozlišuje aj viacnápravové vozidlá.

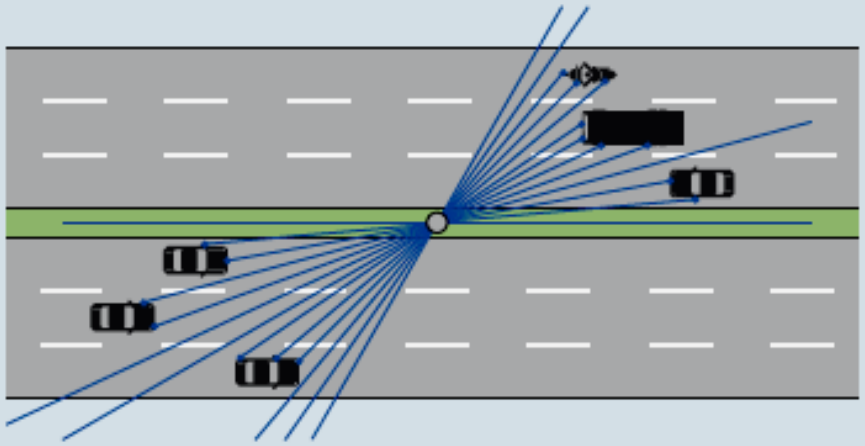
nutnosť identifikácie 3D tvaru vozidiel

Metóda TOF je využiteľná aj na snímanie **trojrozmernej (3D) scény**

t.j. celkového tvaru vozidla. V sofistikovanejších systémoch sa využíva mechanické skanovanie zorného poľa pomocou mechanického rozmietania osvetľujúceho laserového zväzku rotujúcim zrkadlovým hranolom. Perspektívne sú však maticové prvky.

VITRONIC MODEL

OPTOMECHANICKÉ SKANOVANIE



Three lanes can be monitored in each direction from the median strip.



MINISTERSTVO ŠKOLSTVA, VEDY, VÝSKUMU A ŠPORTU SLOVENSKEJ REPUBLIKY

Perspektíva:

- využitie viackanálových maticových štruktúr s integrovanými APD fotodetektormi

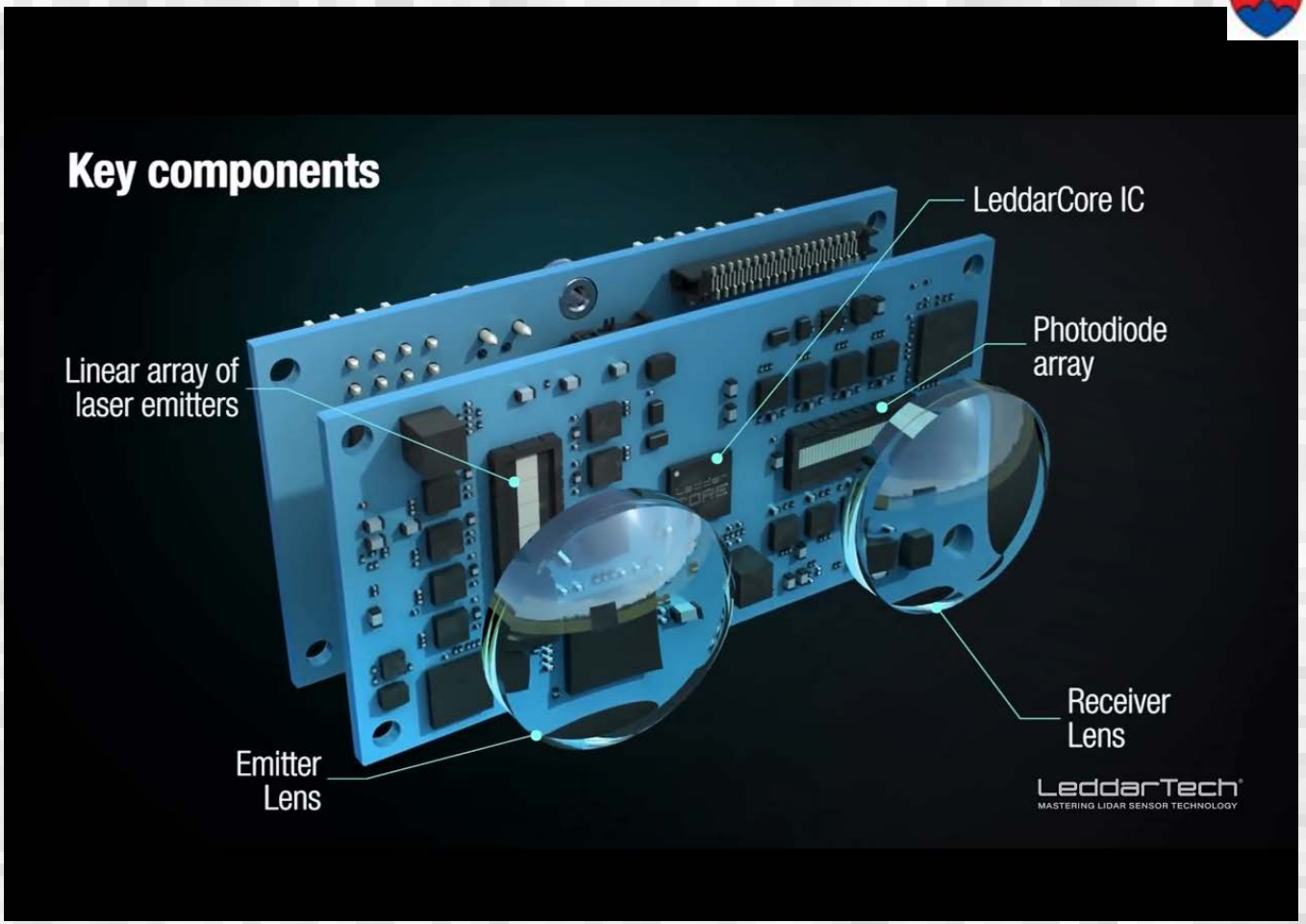
- Takáto maticová architektúra je dnes už v mikroelektronike realizovaná v podobe maticového poľa diskrétnych snímacích prvkov lavínových fotodiód (APD).
- Podobný systém merania rýchlostí vozidiel je založený na vysielacích a detekčných prvkoch fy Leddar Tech (Spec-Sheets-LeddarVu-4decembre2017-web).
- Leddar Sensor Modul - v jednom riadku kombinuje 16 vzájomne nezávislých aktívnych fotodiódových prvkov APD do jedného snímača. Riadková kamera bez mechanických pohyblivých častí môže byť využitá na diskrétne snímanie 3D scény osvetľovanej impulzným zdrojom v blízkej infraoblasti.
- Takáto riadková kamera môže byť využitá na diskrétne (plošne) snímanie 3D scény osvetľovanej impulzným zdrojom v blízkej infraoblasti (NIR). V realizovanej konštrukcii sa využil tzv. Beam Option 9°. Ten má reálne šírku zorného poľa 10° a výšku 1.6°.

Zariadenie Leddar M16 – LED

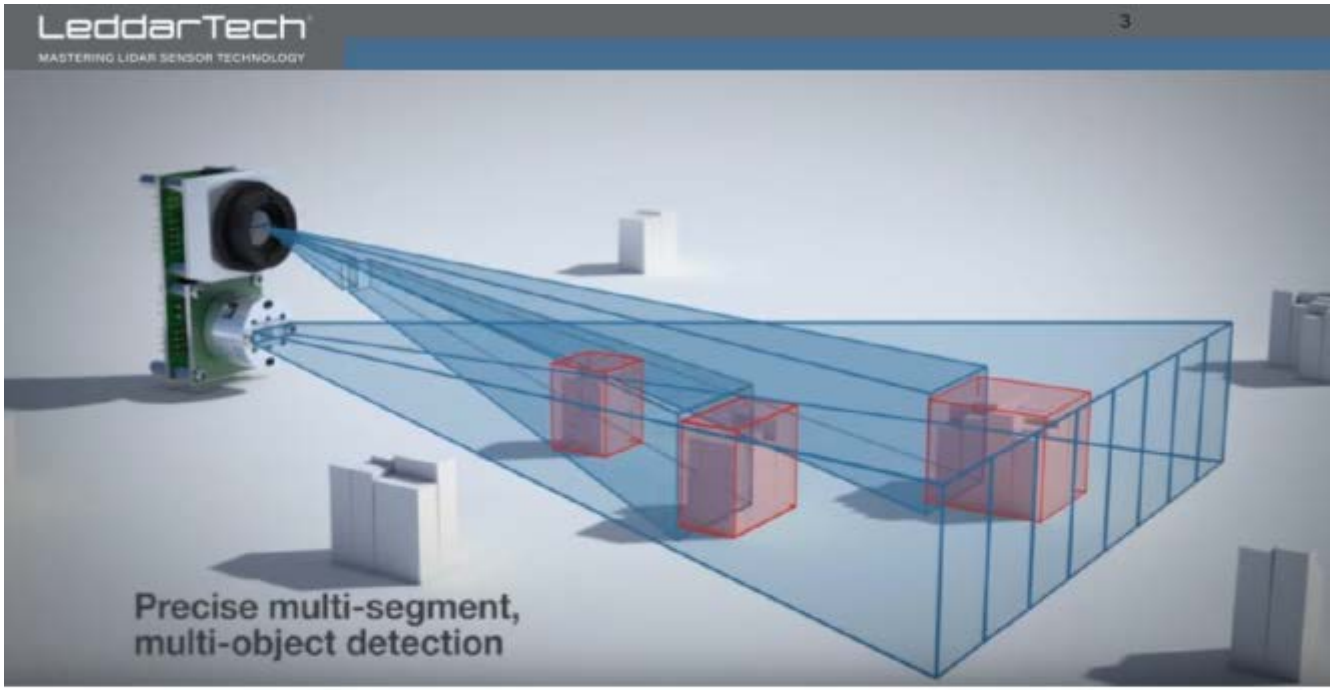
The LeddarTM M16 Sensor Module is an advanced solid-state
LiDAR that combines 16 independent active elements into
a single sensor, resulting in rapid, continuous and accurate
detection and ranging—including lateral discrimination
In the entire wide beam, without any moving parts.



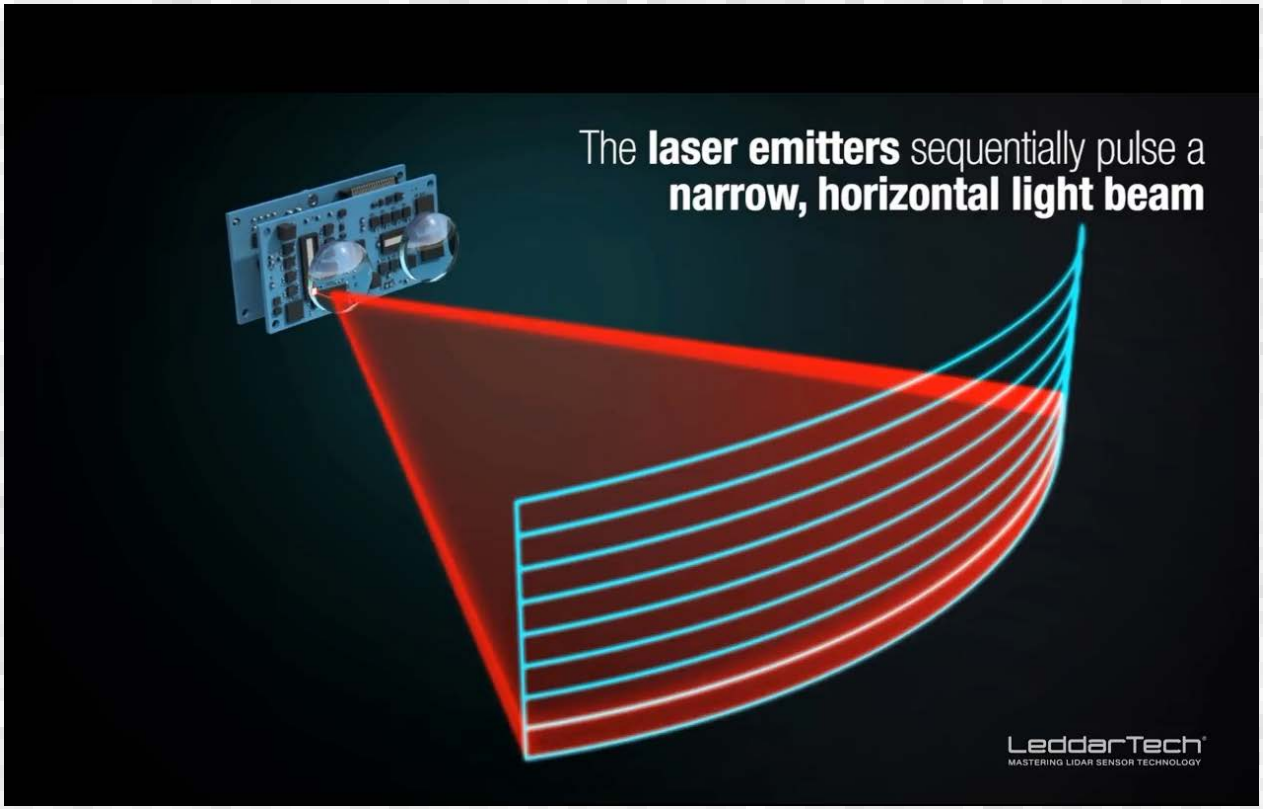



Key components
LeddarCore IC
Photodiode array
Linear array of laser emitters
Receiver Lens
Emitter Lens
LeddarTech
MASTERING LIDAR SENSOR TECHNOLOGY

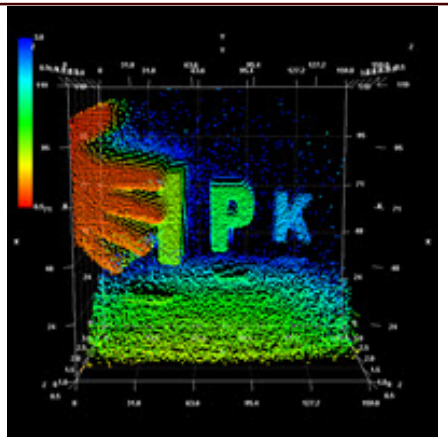
MINISTERSTVO ŠKOLSTVA, VEDY, VÝSKUMU A ŠPORTU SLOVENSKEJ REPUBLIKY



1. LEDDAR PRINCIPLES


The laser emitters sequentially pulse a
narrow, horizontal light beam
LeddarTech
MASTERING LIDAR SENSOR TECHNOLOGY

APD IMAGE SENSORS



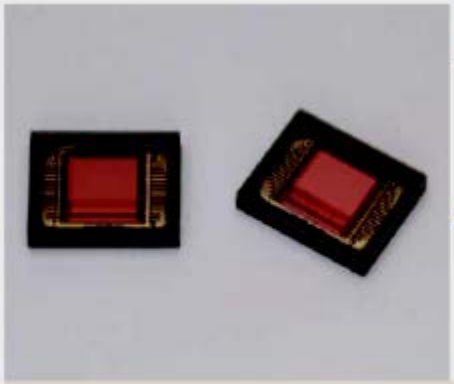
Hamamatsu S8550 4 x 8 APD array and First Sensor 16 element linear APD array.

HAMAMATSU
PHOTON IS OUR BUSINESS

NEW

Distance area image sensor

S11963-01CR



Measures the distance to an object by TOF (Time-Of-Flight) method

The distance image sensors are designed to measure the distance to an object by TOF method. When used in combination with a pulse modulated light source, this sensor outputs phase difference information on the timing that the light is emitted and received. The sensor output signals are arithmetically processed by an external signal processing circuit or a PC to obtain distance data.

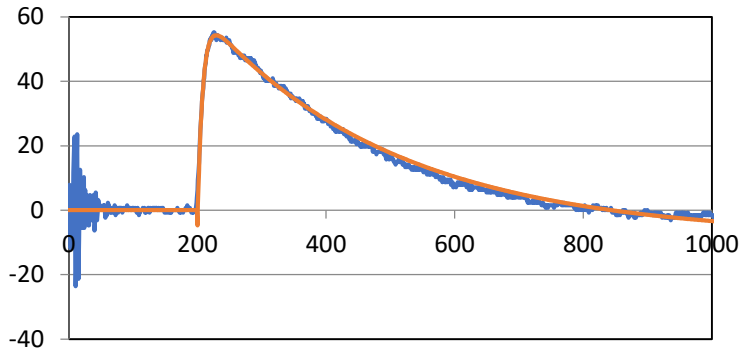
Klúčové problémy TOF detekcie

- Citlivosť systému má dramatický vplyv na jeho spoľahlivosť a presnosť. Osvetľujúce impulzné zdroje musia byť výkonovo limitované – bezpečnosť. Detektory TOF signálov - PIN fotodiódy alebo lavínové APD fotodiódy .

- Zaznamenávané priebehy signálov z APD fotodiódy nevyjadrujú reálny časový priebeh signálu. V Geigerovom móde je lavínová fotodióda zapojená v závernom smere s napätím, ktoré je blízke napätiu prierazu fotodiódy. Prieraz – lavínový tok elektrónov

Analýza tvaru impulzu

Ak poznáme matematický model signálu, môžeme ho vhodnými algoritmami vyhľadávať v nameranom priebehu signálu z fotodiódy.
Merania na pamäťovom osciloskope so vzorkovacou periódou 800 ps
Časové rozlíšenie zodpovedá rozlíšeniu vzdialenosti 12 cm, využitím znalosti tvaru môžeme využiť subpixelové algoritmy.
Nameraná séria dát pre rôzne vzdialenosti a metódou najmenších štvorcov a vyhľadával v signáli tvar podľa teoretického predpokladu.



Porovnanie nameraného signálu z APD fotodiódy a vypočítaného z matematického modelu. Modrá krivka: nameraný priebeh signálu z fotodiódy. Červená krivka: model impulzu, ktorého analytický tvar poznáme.

Korelačná analýza FPGA.

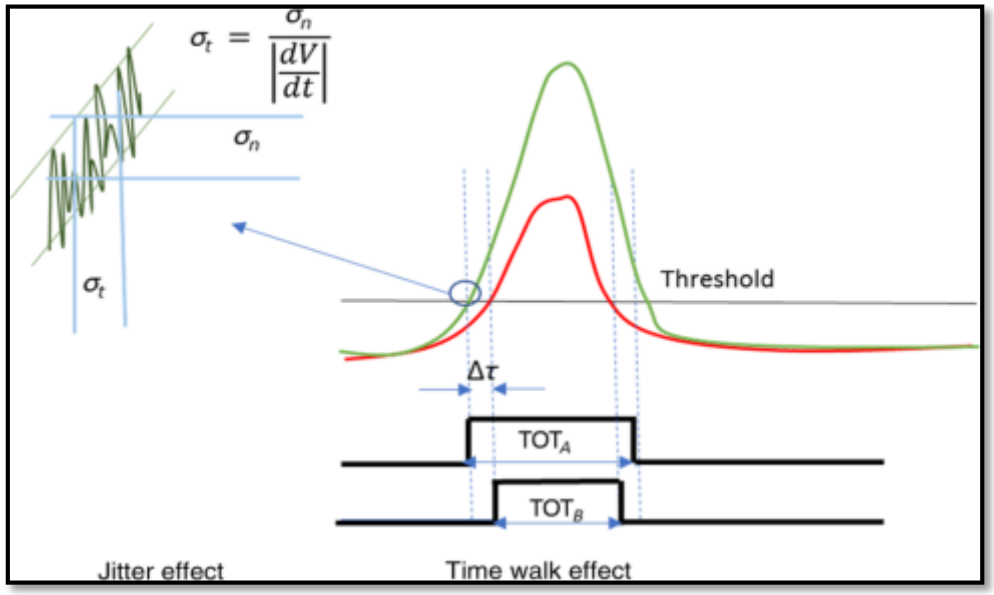
Jedna z implementácií je taká, že impulzy sa prevedú do frekvenčnej oblasti pomocou Fourierovej transformácie. Dostaneme tak sériu fourierovských koeficientov (spektrum) ako postupnosť komplexných čísel. Keď vydelíme spektrum nameraného impulzu spektrom referenčného impulzu v známej vzdialenosti a určíme závislosť fázy od frekvencie, dostaneme krivku s lineárnym úsekom. Jej sklon zodpovedá časovému oneskoreniu impulzu. Tento prístup má výhodu, že dokáže vyhodnotiť oneskorenie s vyššou citlivosťou ako je rozlišovacia schopnosť daná vzorkovacou frekvenciou.

Pri poklese bitového rozlíšenia a vzorkovacej frekvencie pod istú hranicu už metóda neposkytuje výhody oproti prahovaniu signálu. FPGA dokáže pri takýchto rýchlostiach v reálnom čase vypočítať iba niekoľko koeficientov spektra (4 až 8). Z toho vyplýva potreba použitia signálov s vyšším podielom energií na nízkych frekvenciách.
Predlžovanie impulzov ide však proti logike impulzných TOF zariadení smerom k princípom modulovaných TOF zariadení.

Systematická závislosť merania časového okamihu na amplitúde vstupného signálu - time walk efekt

MINISTERSTVO ŠKOLSTVA, VEDY, VÝSKUMU A ŠPORTU SLOVENSKEJ REPUBLIKY

Triggovanie signálu „thresholdovaním“

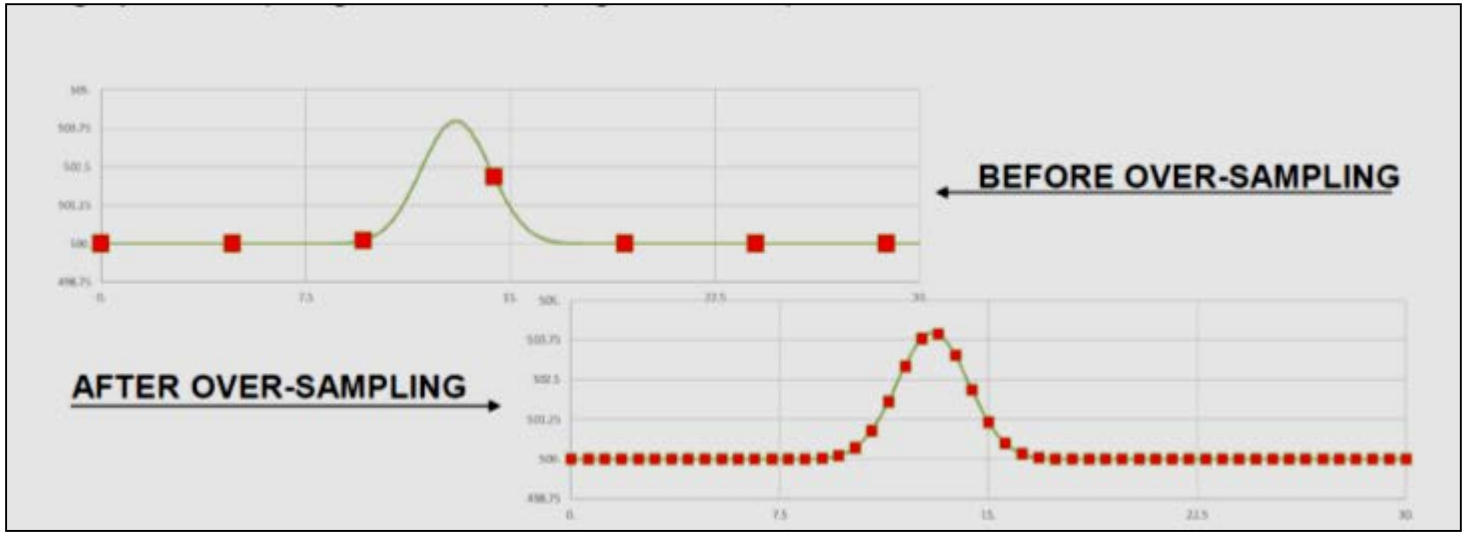




Spracovanie signálov „oversampling“.

Signály od objektu sa opakujú (sú vzájomne takmer identické tvarom i amplitúdou), možno použiť zdanlivé zhustenie vzorkovania „oversampling“. Pri vzorkovaní nasledujúcich signálov sa zavádza malý fázový posun. Kompletná časová závislosť z niekoľkých záznamov predstavuje tak časový priebeh signálu odrazeného impulzu navzorkovaný n-násobne zväčšenou rýchlosťou vzorkovania v porovnaní so základnou rýchlosťou použitou pri zázname jednotlivých impulzov.

Laser s vysokou opakovacou frekvenciou 100 kHz



Komplexnou analýzou podmienok záznamu a spracovania prijatého signálu, z hľadiska komplexnosti hardvéru sa najjednoduchším riešením kompenzácie „walk“ efektu zdá použiť prijímací modul lavínovej fotodiódy s čo najväčšou šírkou pásma. Tým sa zabezpečí ostrá nábežná hrana signálu a výborný kontrast oproti svetelnému pozadiu.

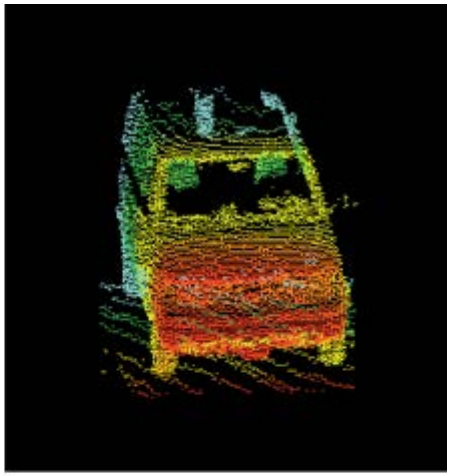
Aplikovaním impulzného osvetľovacieho zdroja s vyššou opakovacou frekvenciou (desiatky až stovky kHz) a použitím fotodiódového detektora s lineárnym zosilnením sa získa dostatok informácie pre metódu„oversamplingu“ a presné určenie intervalu TOF

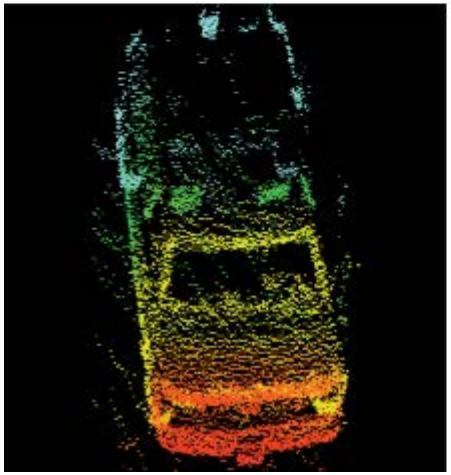
Aplikácia na vytvorenie 3D scény objektu vozidla

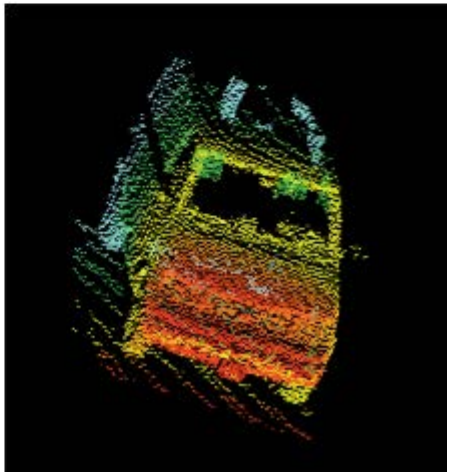
Limitácia

- počet prvkov maticového detektora
- citlivosť detekcie jednotlivých prvkov detektora (vyžarovaný výkon lasera je obmedzený bezpečnosťou)









AMOS - GLOBAL METEOR CAMERAS NETWORK

Juraj Tóth [1]
[1] FMFI UK, Bratislava

Abstract

AMOS (All-sky Meteor Orbit System) is an image-intensified all-sky video meteor system originally developed for the Slovak Video Meteor Network in 2007 at the Astronomical and Geophysical Observatory in Modra (AGO) of the Comenius University in Bratislava (Tóth et al., 2011, Zigo et al., 2013). Currently, five stations are operational in Slovakia and two on Canary Islands since March 2015 (Tóth et al., 2015). A pair of AMOS cameras were installed in Chile in March 2016 (Tóth et al., 2016) to monitor the meteor activity on the southern sky. Another pair of AMOS cameras were installed on Hawaiian Islands: atop of Haleakala and Mauna Kea in September 2018. We closely collaborate with KVANT software team led by P. Varga, J. Solcani and M. Schichman on meteor detection program called AMOS.



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Comenius University in Bratislava, Slovakia
Faculty of Mathematics, Physics and Informatics

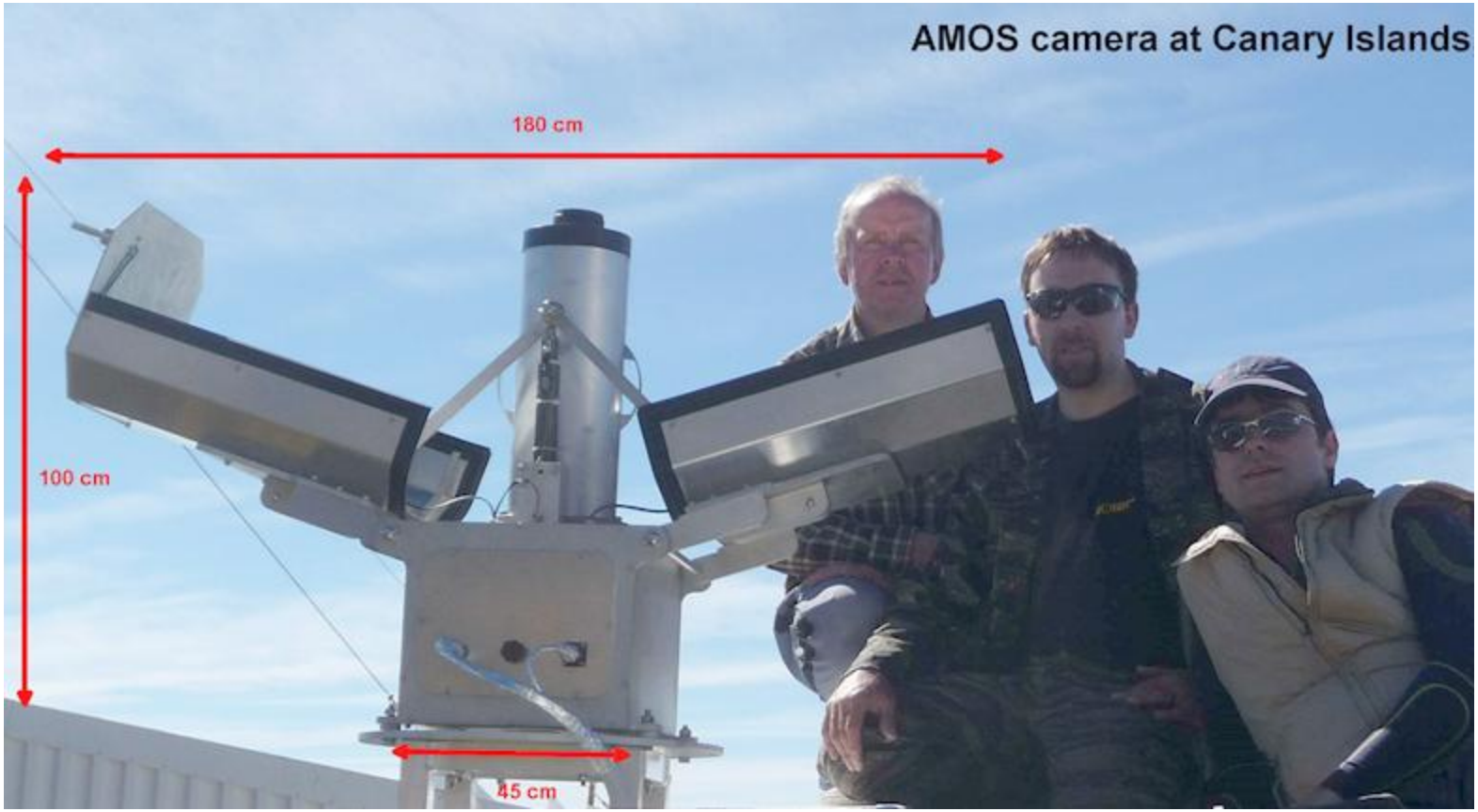
- The leading university institute for A&A (Master, PhD) in SR
- Astronomical and Geophysical Observatory in Modra
- Research, education and public outreach





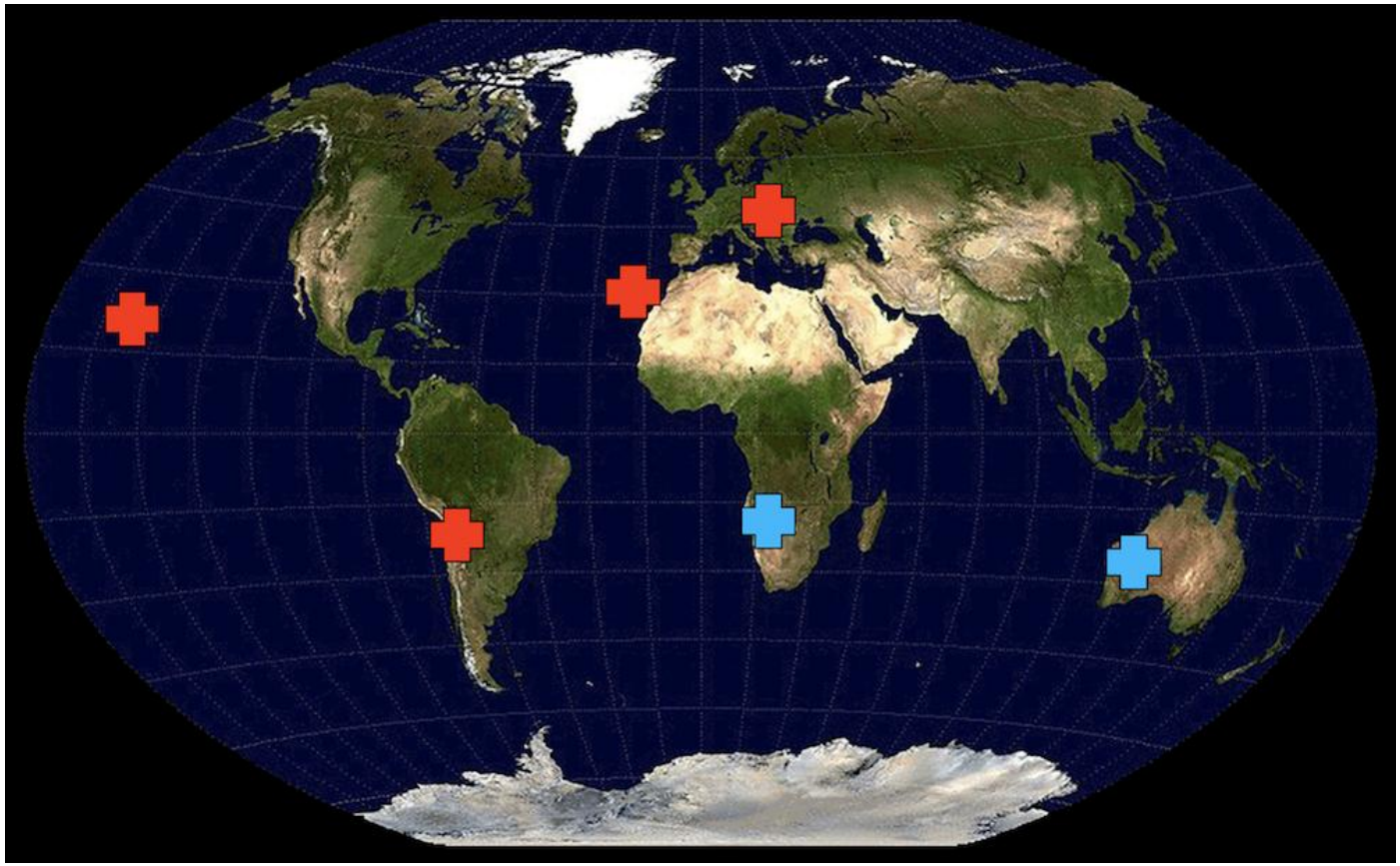
AMOS instrumentation:

- Autonomous intensified optical video system
- Field of view 180 x 140 deg
- Resolution 1600 x 1200, 20 fps
- Stellar limiting magnitude + 5.0



AMOS global network – 10 stations on 4 locations

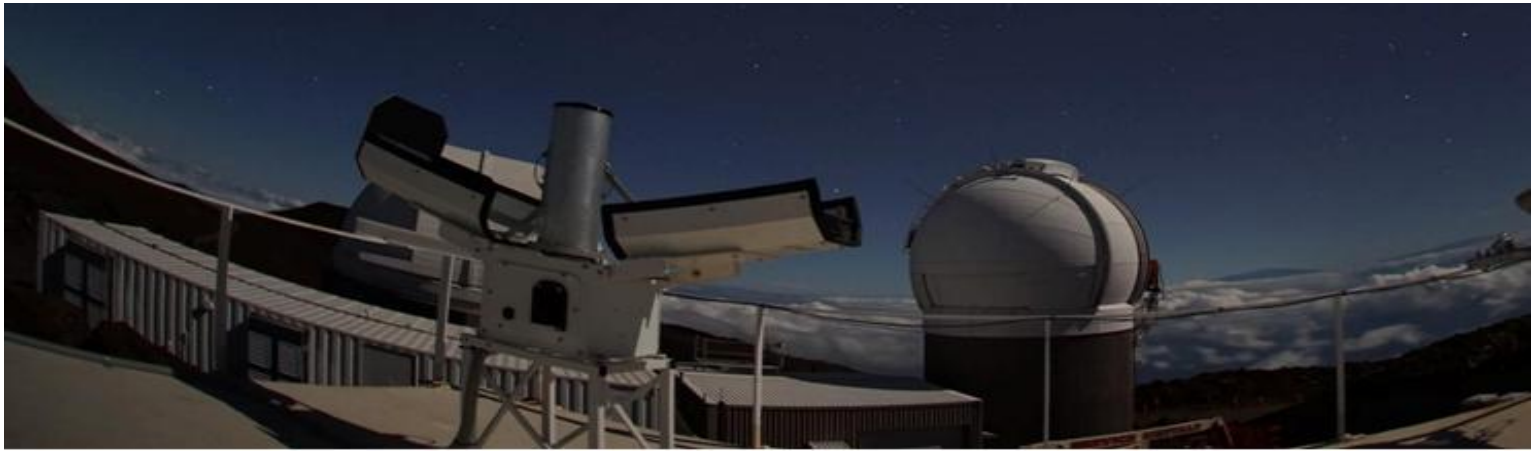
- Slovak Video Meteor Network 2009
- Canary Islands 2015
- Chile, Atacama 2016
- Hawaii, 2018



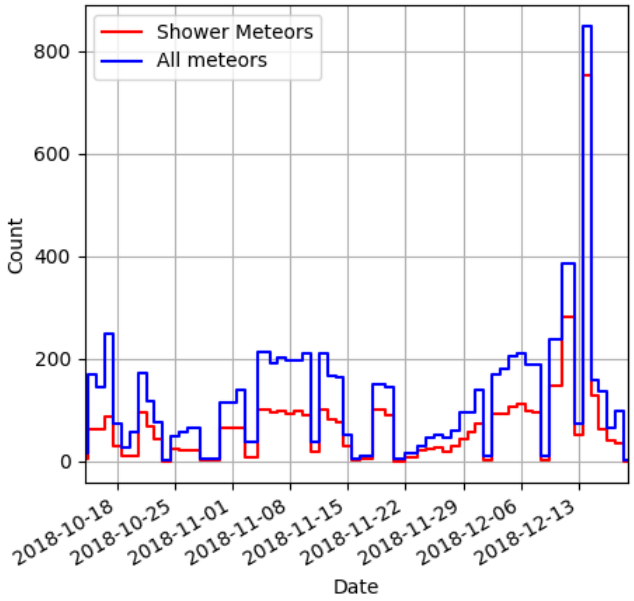
AMOS testing on AGO Modra

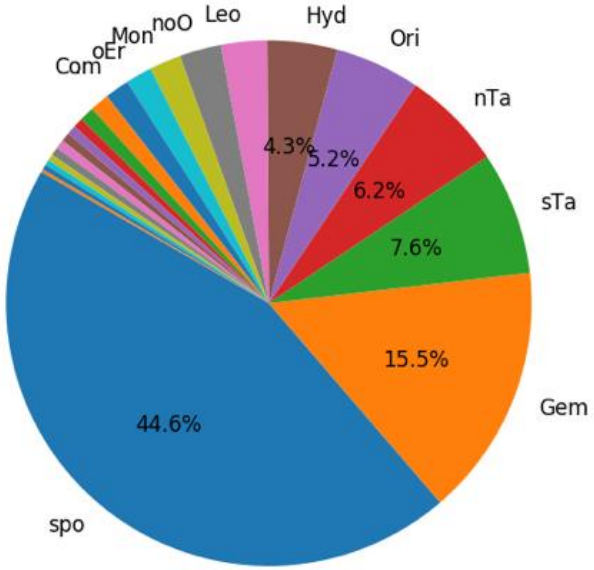


… just installed AMOS on Haleakala, Maui



Oct. 14 – Dec. 19, 2018 AMOS-HK detected 6,047 single-station video meteors.





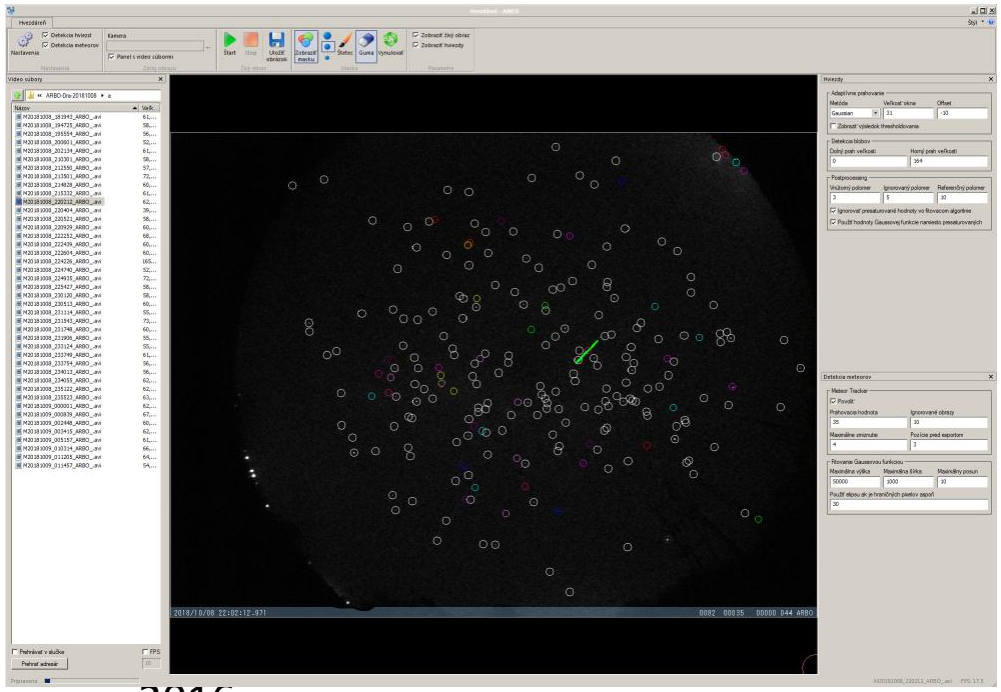
… just iced AMOS on Haleakala



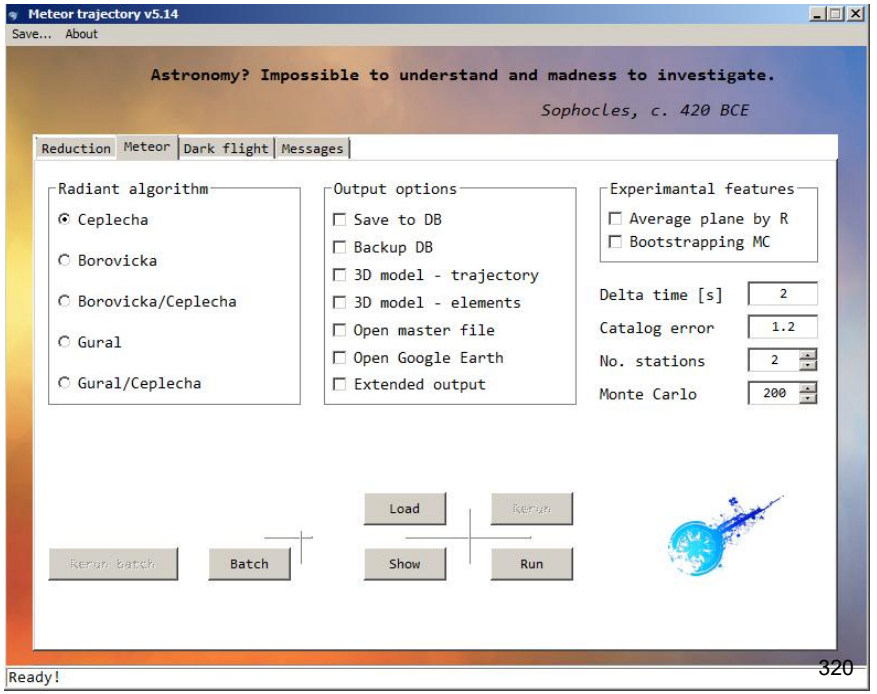


AMOS – software and analytical tool development

- development of detection software AMOS (with KVANT)
- own all-sky reduction tool RedSky (Borovička et al., 1995)
- own trajectory and orbit solver MT 5.14
- planned open database



2016



Fireball May 1, 2016 by AMOS, Chile, M_V=-9$^{mag.}$



Fireball May 1, 2016 by AMOS, Chile, M_V=-9$^{mag.}$



Fireball May 1, 2016 by AMOS, Chile, M_v=-9mag.

Trajectory

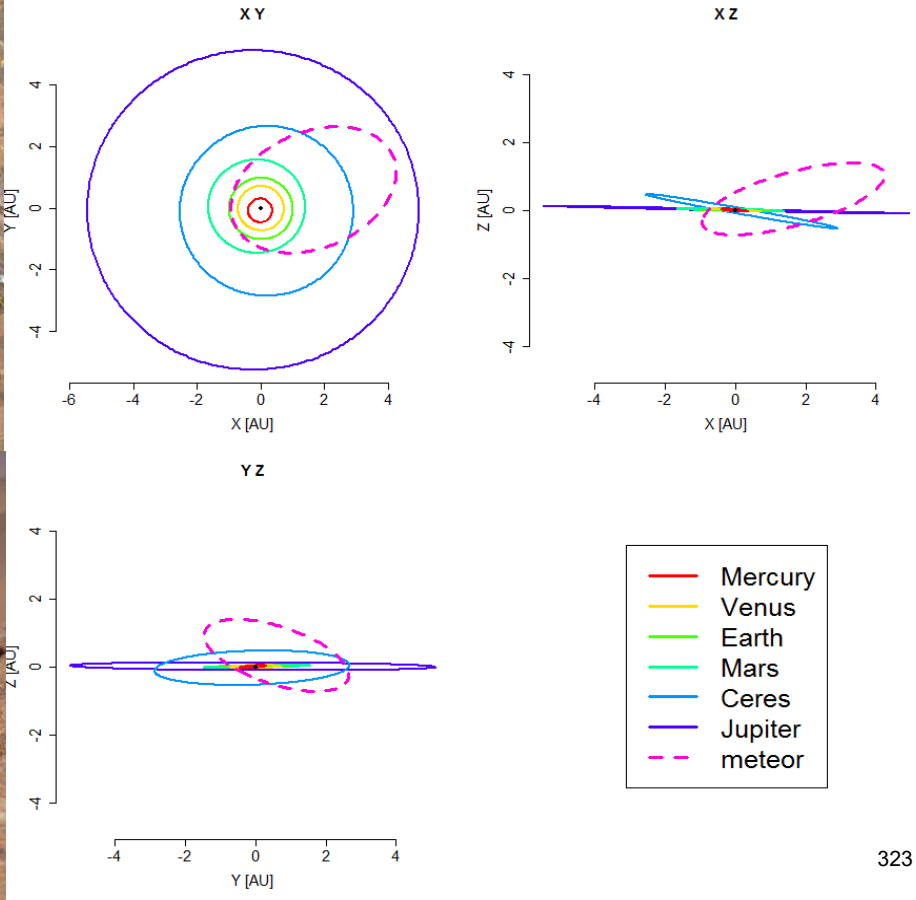
H_B = 90km, H_E = 43km

Orbit

a=2.85 AU, e=0.66, i=28.7°







The first European meteor observation airborne campaign



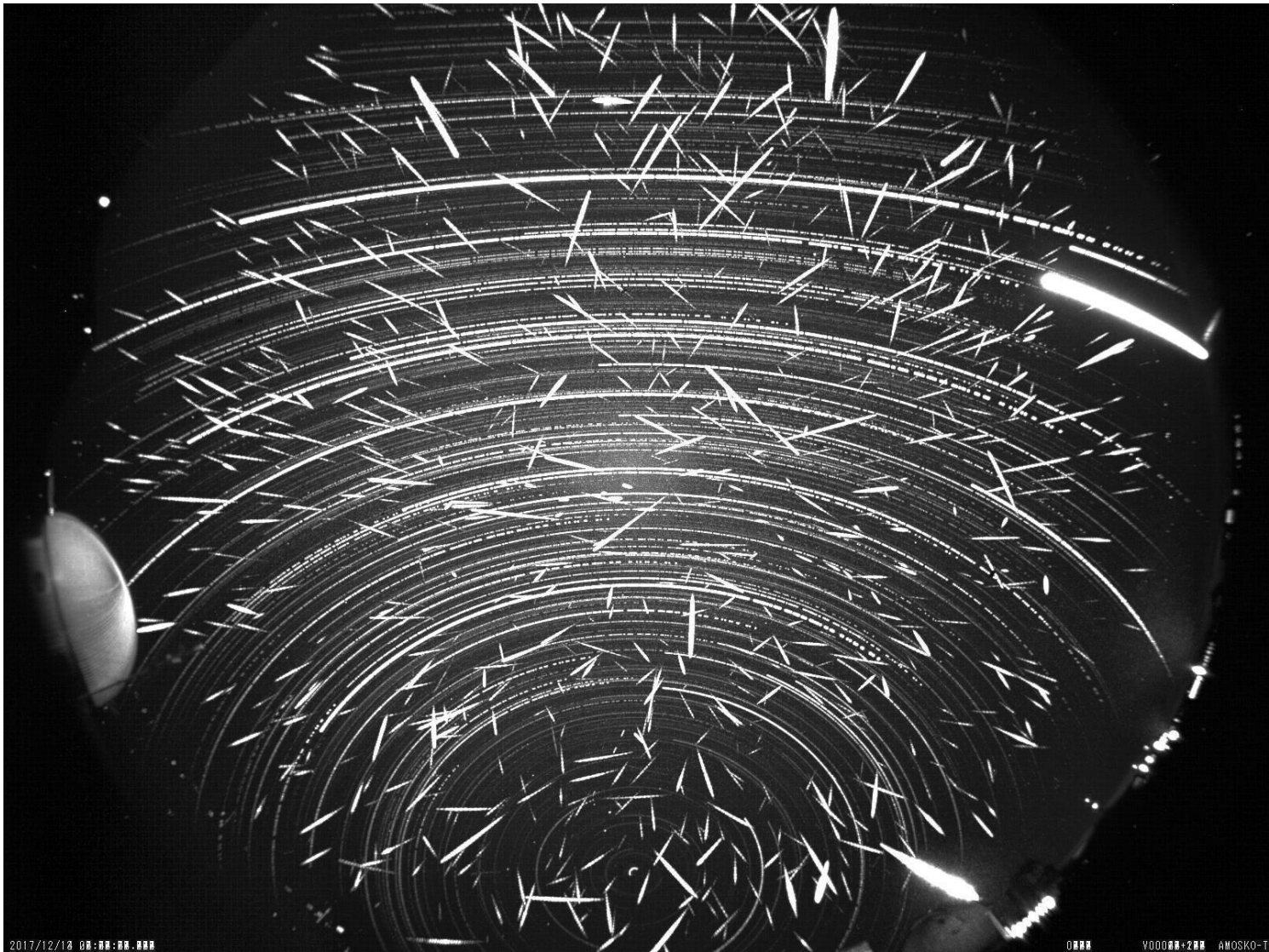
J. Vaubaillon (IMCCE, PI)
J. McAulliffe (INSA/ESA)
D. Mautet (USU)



SAFIRE
The atmosphere is our laboratory
AIRBORNE ENVIRONMENT RESEARCH SERVICE

P. Koten (Ondrejov obs, PI)
J. Zender (ESA)
J. Toth (Univ. Bratislava)

One thousand Geminids above Tenerife Dec.13/14, 2017



AMOS, Teide, IAC

Tóth et al., 2017

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