



FERROTRON LaCam[®]

High Speed, High Resolution Scanners

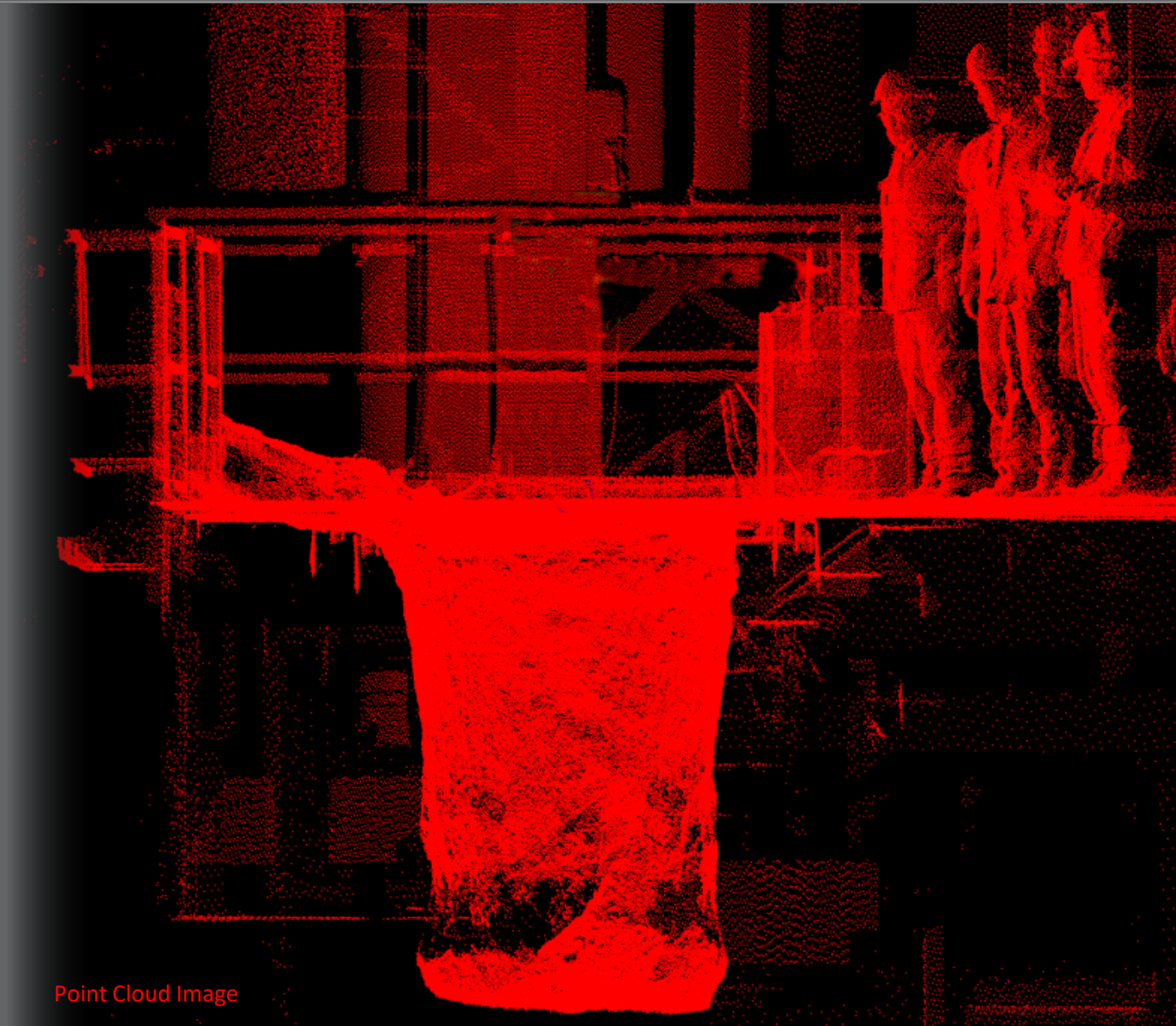


LaCam® High Temperature Laser Profile Measurement System based on the well known LiDAR^[1] technology in combination with a dual wavelength pyrometer.

It all starts with a laser **point cloud** for assessing the lining thickness of vessels

A wealth of KPI's are derived from the received signals.

^[1] Light Detection and Ranging



Point Cloud Image

LACAM® 5TH GEN.: WHY DOES SCANNING SPEED MATTER ?

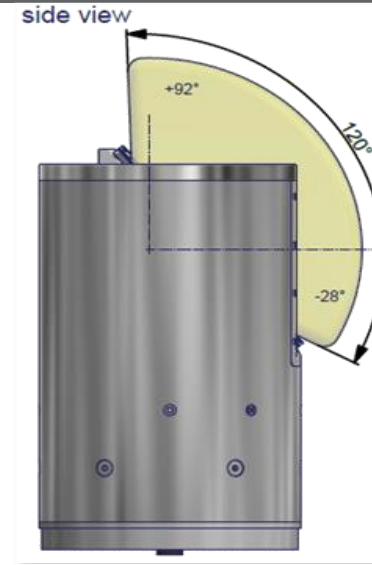
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Laser Scanner in a Water-Cooled Protective Housing



- Actual number of measuring points, > 21.600.000 @ 24 seconds
- measuring time per scan (120°/360°), > 14.400.000 @ 18 seconds
- speed mode 1.800kHz > 10.800.000 @ 12 seconds
- > 5.400.000 @ 6 seconds
- Scan Angle (selectable) Vert: 0-120 °, Hor: 0° - 360°
- 4 speed modes: 450, 600, 900, 1.800kHz
- Repeatability ± 2 mm
- Max. surface temperature 1700 °C / 3092°F

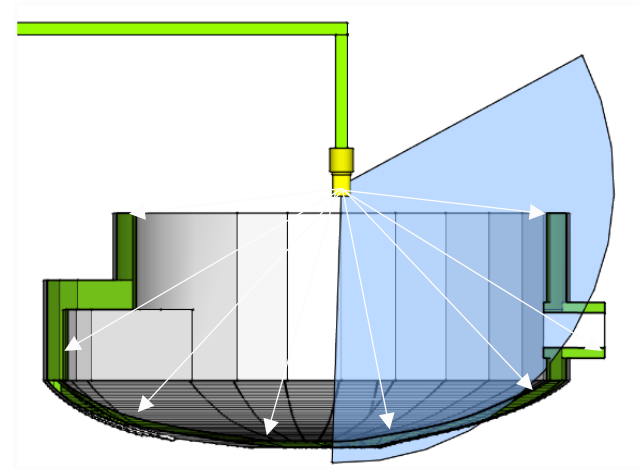
Scan triggering, 6s @ 1.800kHz = Scan **per heat** in **process time**



Vertical Scanning-Angle:
from -28° to +92°, in total 120°

Horizontal Scanning-Angle:
0° - 360°, adjustable

Non-immersed Scanner:



LACAM® 5th GENERATION – WHY DOES 5th GENERATION MATTER ?

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NEW

4 Speed Ranges:

- 450kHz
- 600kHz
- 900kHz
- 1800kHz

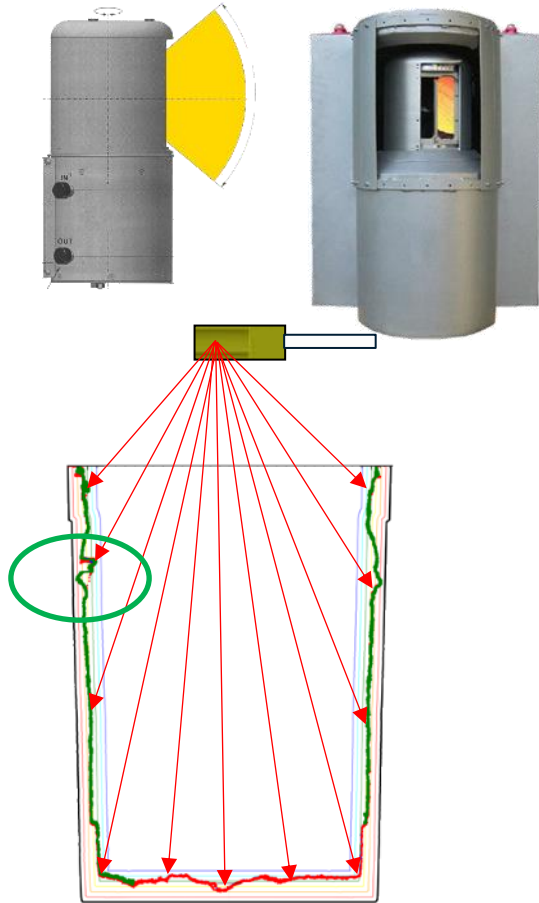
Speed is less than 12s for measuring more than 10M points in one movement.

Generation	3 rd	4 th	5 th
Measurement principle	time of flight measure	time of flight measure	time of flight measure
Measuring points per scan (typical)	200.000 (at 80°x80°)	>1.600.000 (at 110°x110°)	>10.800.000 (at 120°x360°)
Measurement range in hot environment	2-20m	0,5-25m	0,5-25m
Repeatability	± 5 mm	± 2 mm	± 2 mm
max. surface temperature	1.600°C	1.600°C	1.700°C
Scanning time	30sec	2 * 30sec as 2 scans needed: wall and bottom	6s, >5M pixel 12s, >10M pixel 24s, >21M pixel
Temperature measurement (only Fixed installed systems)	1 color pyrometer 600°-1600°C	1 color pyrometer 600°-1600°C	2 color pyrometer 600°-1700°C

- The scanner speed decides on the resulting resolution – the **point-cloud density**. **Details matter.**
- Fast high-resolution scans are a basis for **in-process, heat by heat** measurements for **image analysis**.

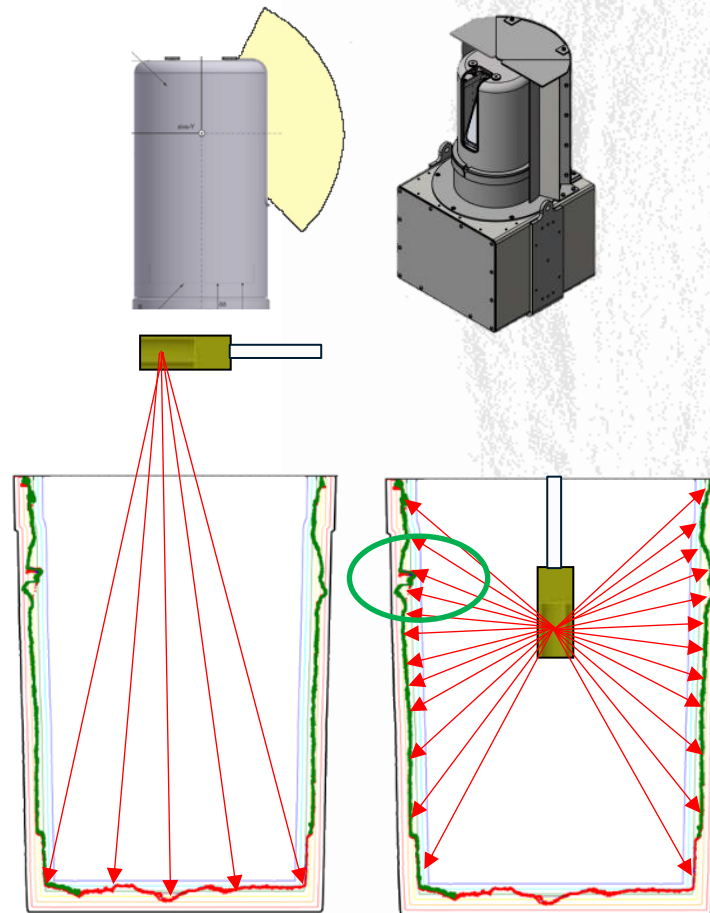


3th Generation



1 scan, but shadowing in slag area.
Lower resolution due to scan position.

4th Generation



2 scans needed.

No shadowing in
slag area

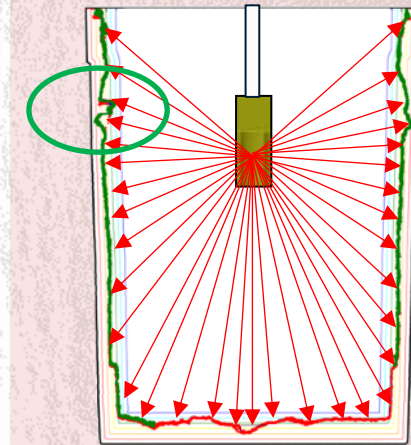
5th Generation

NEW

Comments:



120° * 360°
scanning range
represents
a full vessel in
great detail
within 12s,
producing almost
11M individual
points.



Only 1 scan needed,
optimal resolution

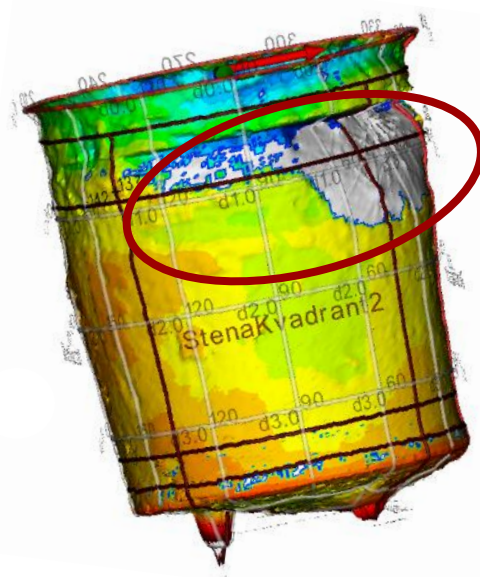
4th Generation
needed two
scans, combined
in one.
5th Gen. just one
scan, due to
immersion, at
optimal position
on slag-line !

Slag obstructs the view from top:

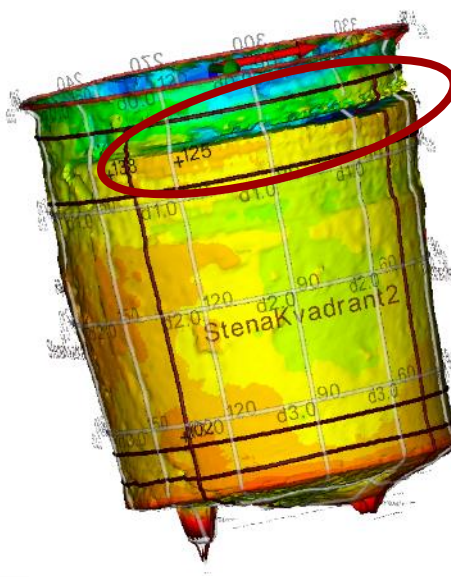


White points means „no information“:

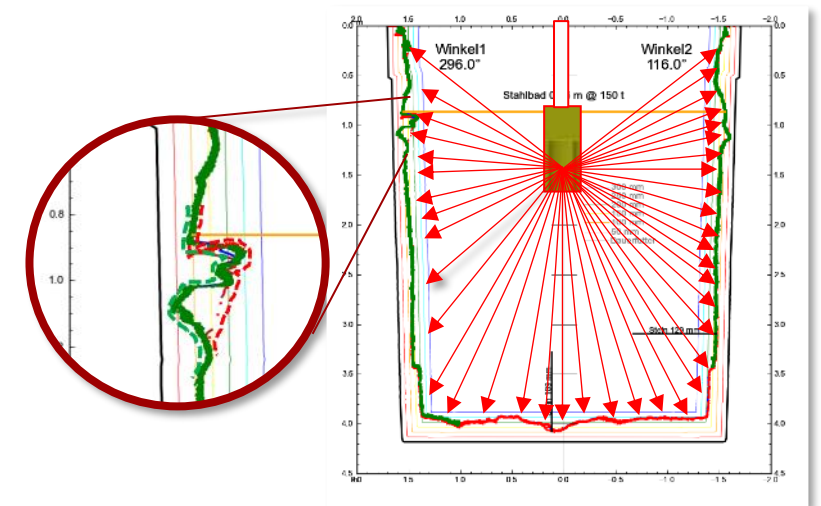
A



B



Immersion captures all areas:



Advantage

Refractory thickness measurement below shadowed slag-zone

- A – non-immersive: Non-captured area in slag zone visualized by **white** spots
- B – immersive: Fully captured slag zone presents dangerous thin lining

LaCam® DATA MATTERS: KPI'S FROM 3 CHANNELS: (TOF FOR DISTANCE, ENERGY FOR ABSORPTION, RADIATION FOR TEMP.)

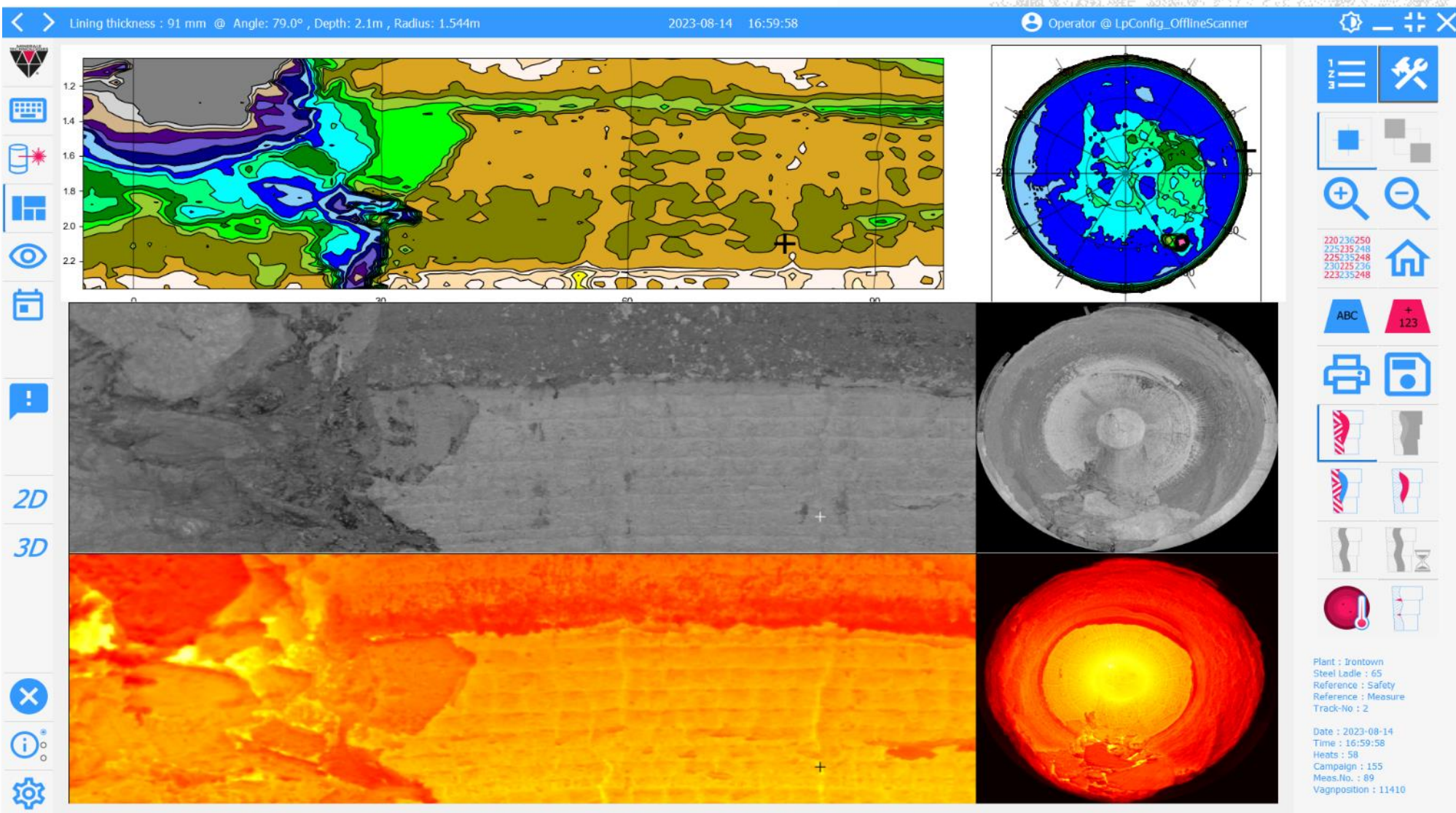
MiNTEQ

Comments:

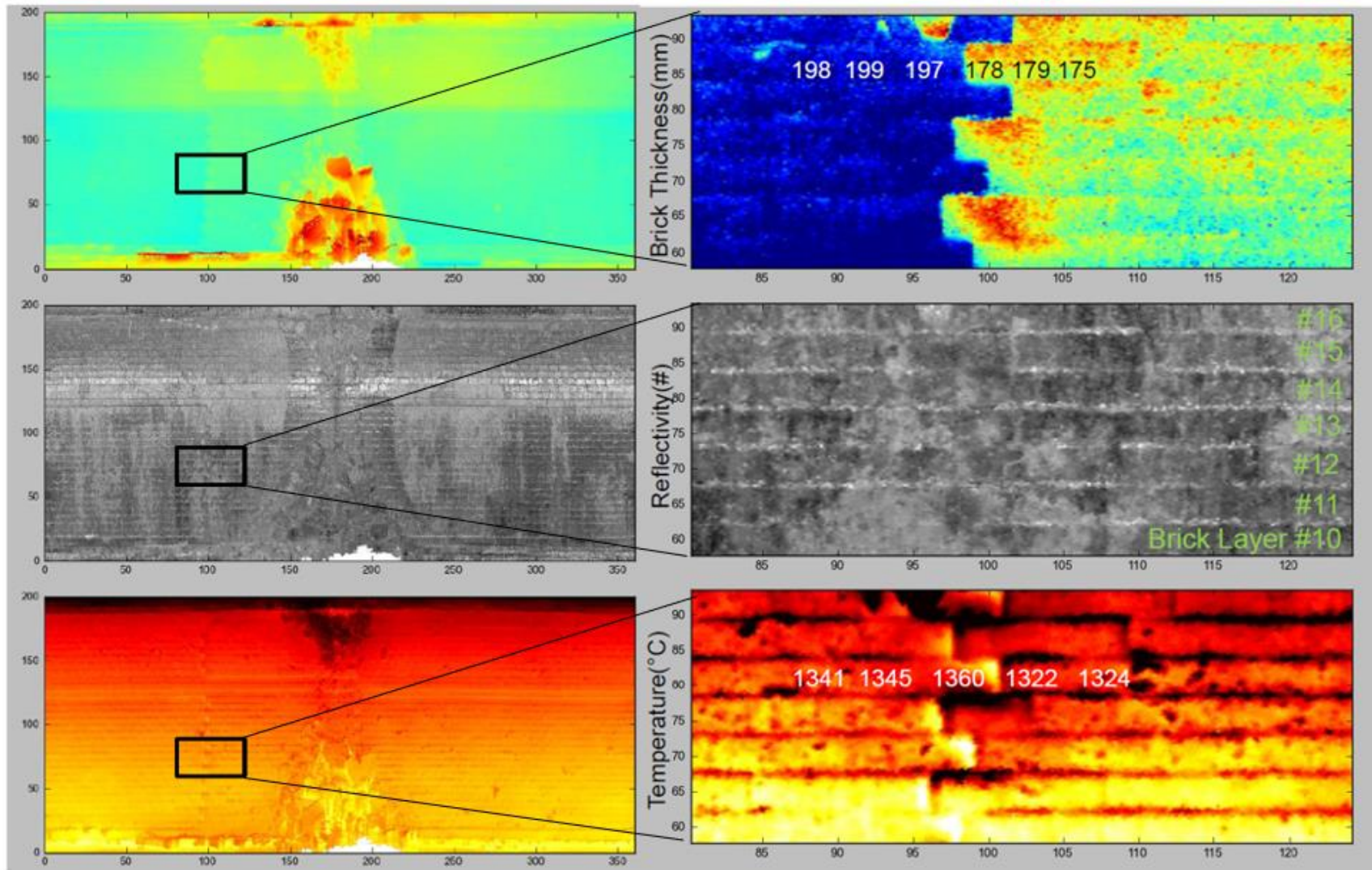
Color coded Distance
information
by time of flight

Absorption / Reflection
information
by reflected energy of
laser puls

Temperature
information
by infrared radiation
detection



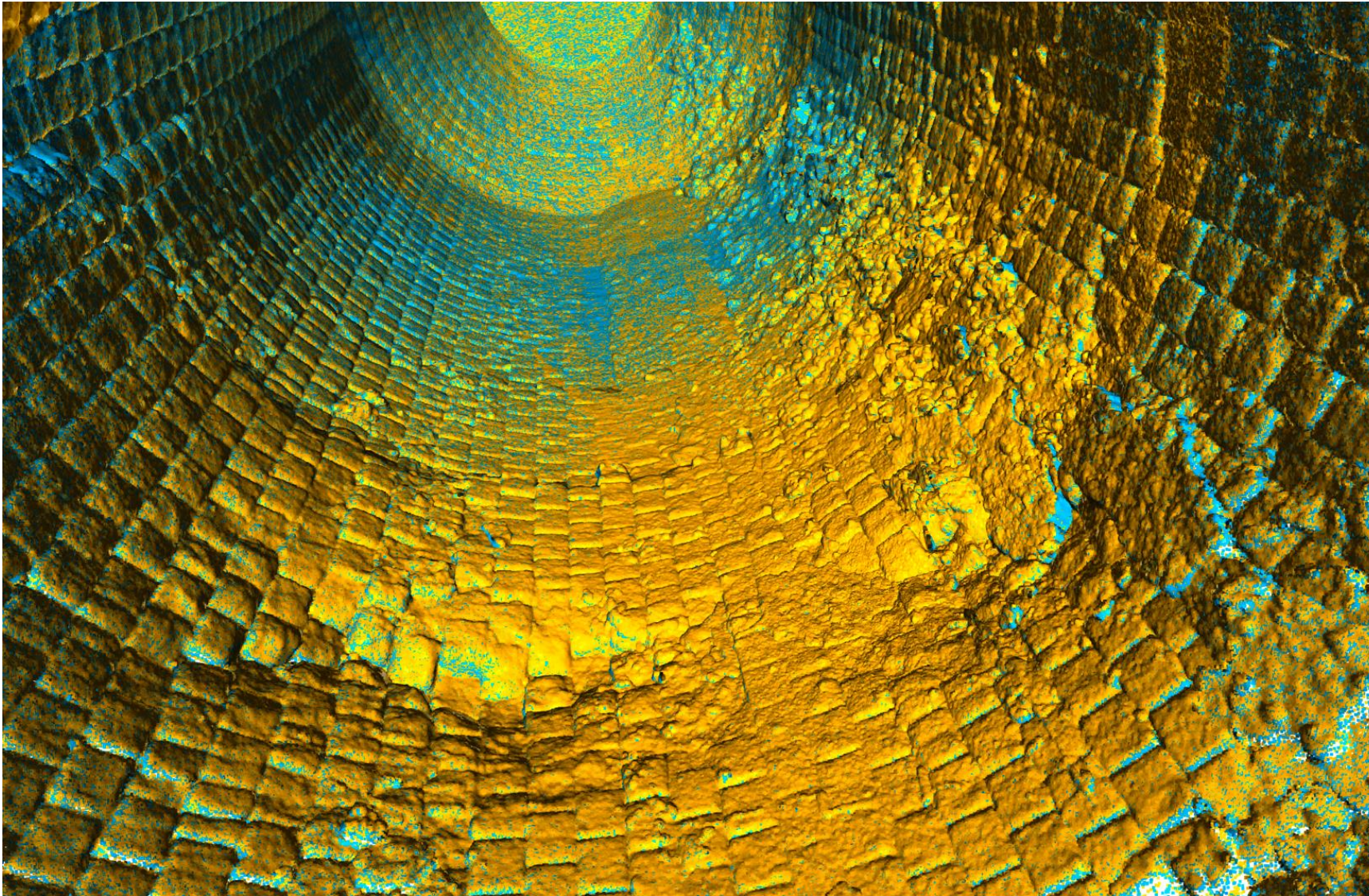
LaCam® : WHY DOES RESOLUTION MATTER ?



Brick Thickness
Wear (against New Lin.)
Wear Rate

Amplitude / Reflectivity
Slag detection / slag ration

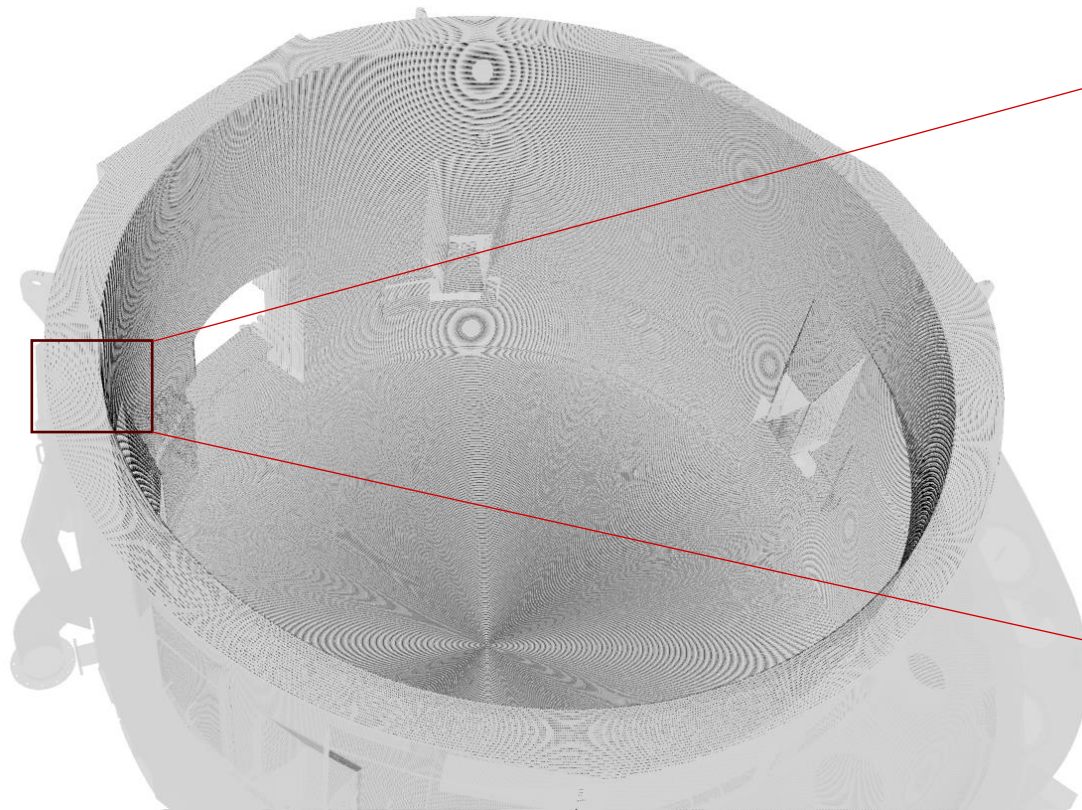
Temperature / Pyrometer
(Dual Wavelength)



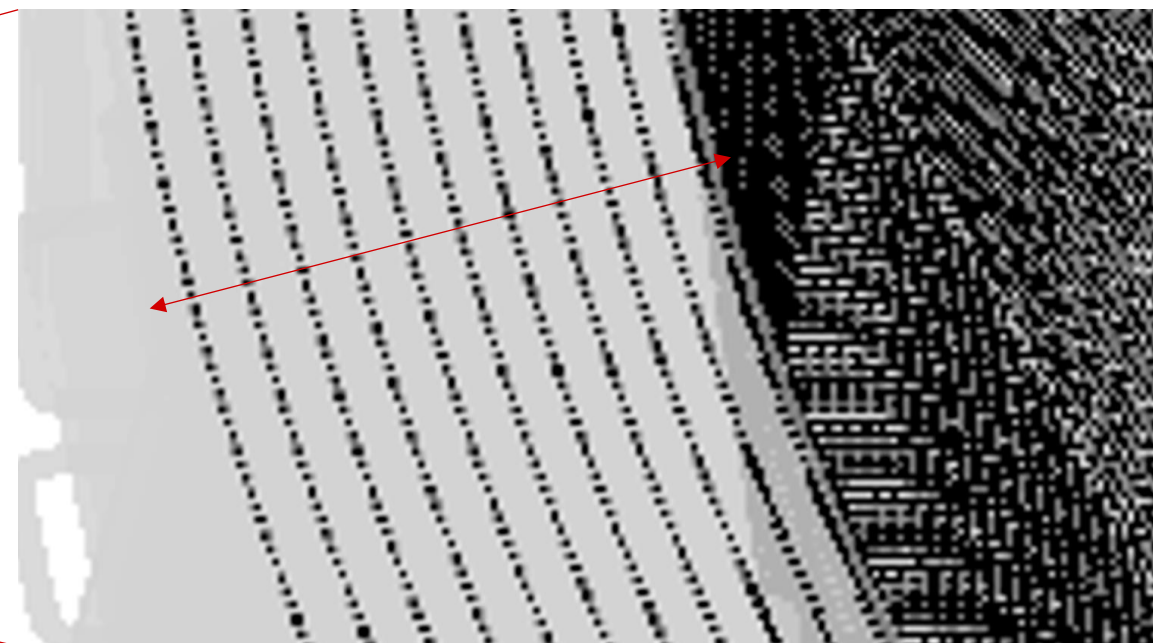
High resolution scans:

- Picture shows the inside of a torpedo which is a composite of two scans (blue & yellow)
- Details of the impact zone, brick wear and slag are visible
- With standardized 3D pictures reflecting distance, absorption and temperature information, KPI's for image processing are delivered
- Ultra-high resolution and short scanning times are required

LASER SCAN OF AN EAF USING 450KHZ, WITH 6S AND 0,9M PIXELS

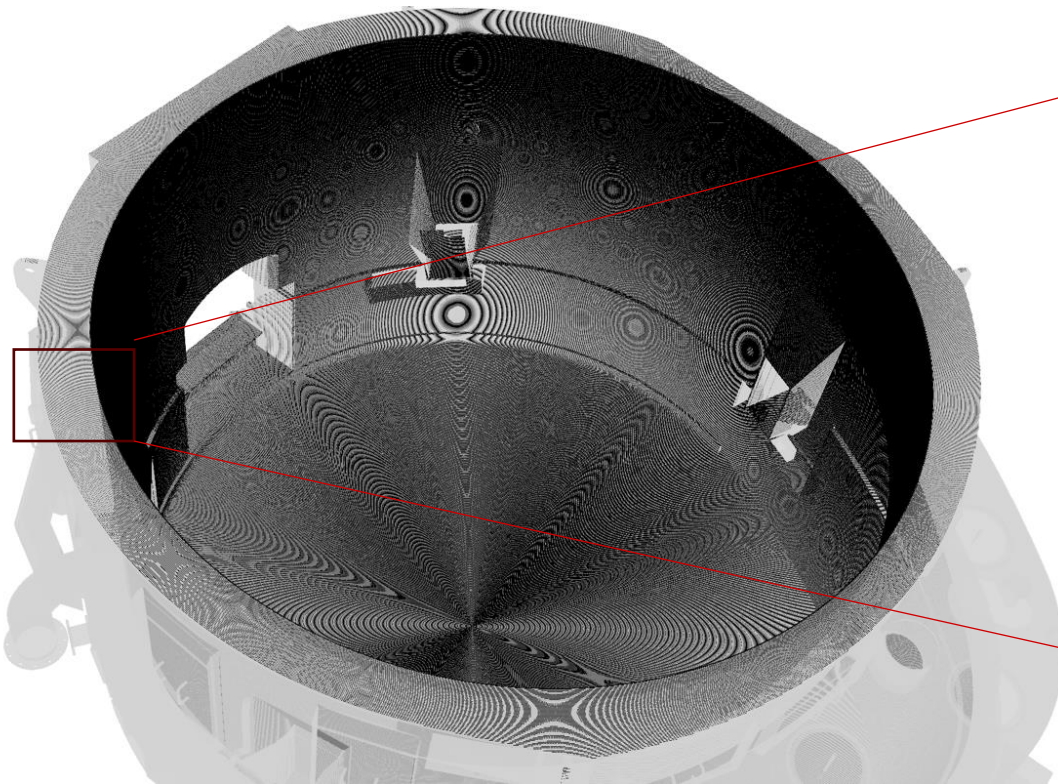


EAF diameter is 13m, scanner positioned 2m above EAF

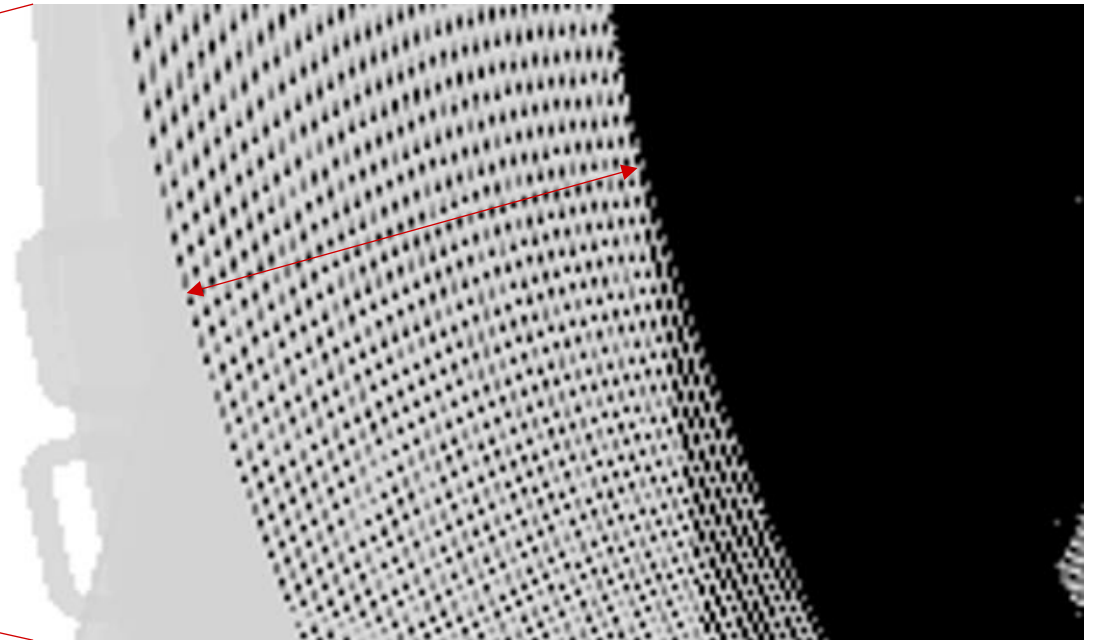


Picture shows magnified area:

- Width ca. 40cm
- 10 stripes measured with 40mm distance
- Pointsize ca. 5mm



EAF diameter is 13m, scanner positioned 2m above EAF



Picture shows magnified area:

- Width ca. 40cm
- 42 stripes measured with 5mm distance
- Pointsize ca. 5mm

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FERROTRON
A **MiNTEQ** DIVISION