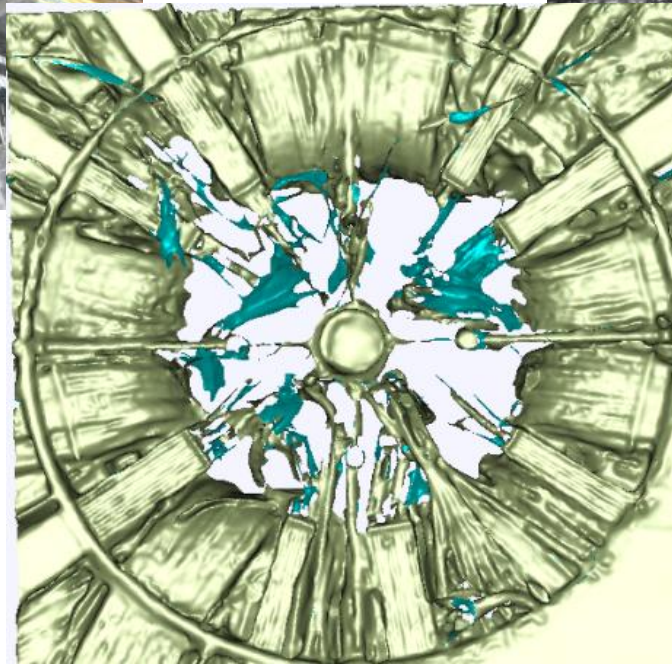
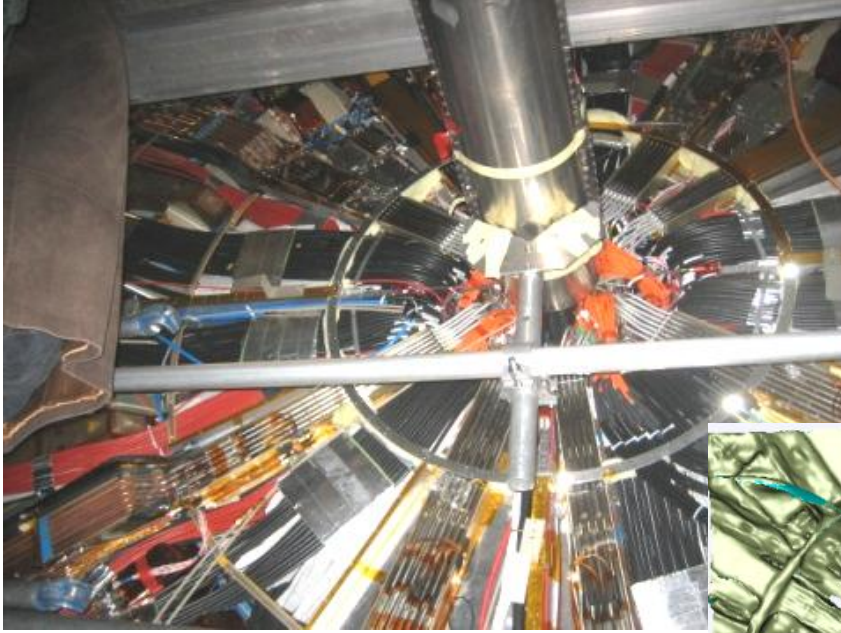


3D DIGITAL RECONSTRUCTION EDMS

FROM OBJECT...

...TO POINT CLOUD...



...TO 3D MODEL

SUMMARY

◆ MEASUREMENT

- Stations
- Hand systems
- Others instruments

◆ PROCESSING

- Pre processing
- CATIA Tests
- Points Filters
- Mesh
- Curves & NURBS
- Others Functions
- Our Reconstruction Difficulties

◆ EXAMPLES OF RECONSTRUCTIONS

- CMS Tracker Mock-Up
- Roman Pot Hall 187
- Wheel Hall 187
- Collimator Support & V-CMS
- ATLAS – Central Barrel Side A
- ATLAS – Central Barrel Side C

◆ CONCLUSIONS

MEASUREMENT STATIONS

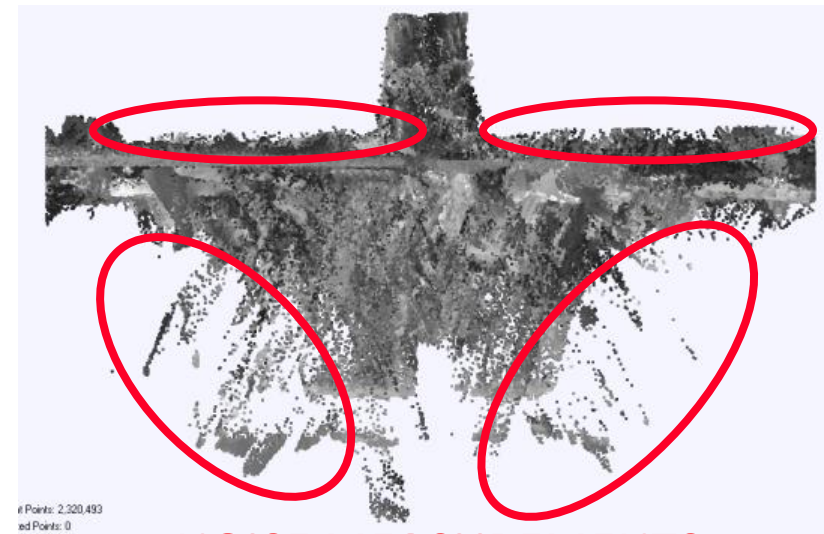
FARO PHOTON 80

SURPHASER

100 000 to 1 000 000 pts/s
Field of view : horizontal 360°; vertical 240°
Flight time or phase shift calculation
Easy to use, orientation on external targets
Sensitive to reflective surfaces

ACCURACY : 1-2mm

GOOD FOR LARGE SURFACES



NOISE MEASUREMENTS

4 Points: 2,320,493
Bad Points: 0

NOT TESTED
LEICA HDS 3000

LEICA HDS 6100

BE/ABP GROUP

QUICK MEASUREMENTS BUT TIME CONSUMING PROCESSING (NOISE)

MEASUREMENT HAND SYSTEMS

HANDYSCAN & MAXSCAN



LEICA T-SCAN



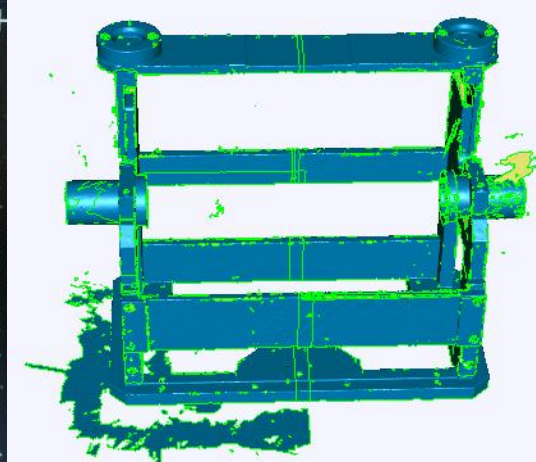
ASSOCIATED TO LASER TRACKER

NOOMEO



20 000 points per laser line of 10 cm
Field of view : 10 cm large; depth 10 cm
Orientation : HandyScan : Photogrammetry
Noomeo : On the object
T-Scan : By Laser Tracker
Sensitive to reflective surfaces, colors, matters

ACCURACY : 0.5 mm
GOOD FOR 1m² SURFACES



MEASUREMENTS

LONG MEASUREMENTS (CAMERA APERTURE) BUT QUICK PROCESSING

MEASUREMENT OTHERS INSTRUMENTS

CAMERA MOUNTED ON ROMER ARM
G-SCAN FARO SCAN & PROBE



Camera : 20 000 points per line of 10 cm
Optical systems : No information
Field of view : Camera : 10 cm large; depth 10 cm
Optical systems : 0.5 m² to 2 m²
Orientation : Photogrammetry, Romer Arms
Sensitive to reflective surfaces, colors, matters

ACCURACY : 0.1 mm
FOR OBJECTS IN GOOD ACCESS AREAS
(assembly hall, clean room)

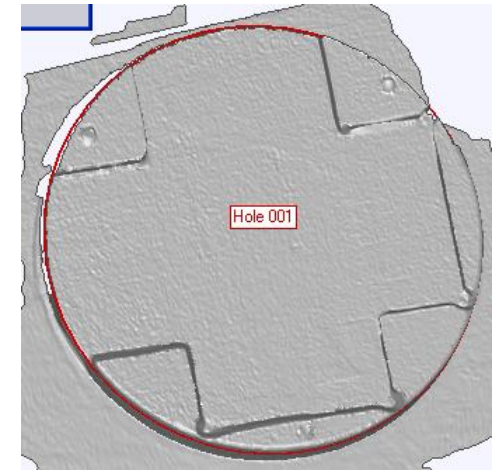
OPTICAL SYSTEMS
COGNITENS ATOS SYSTEM



STEINBICHLER



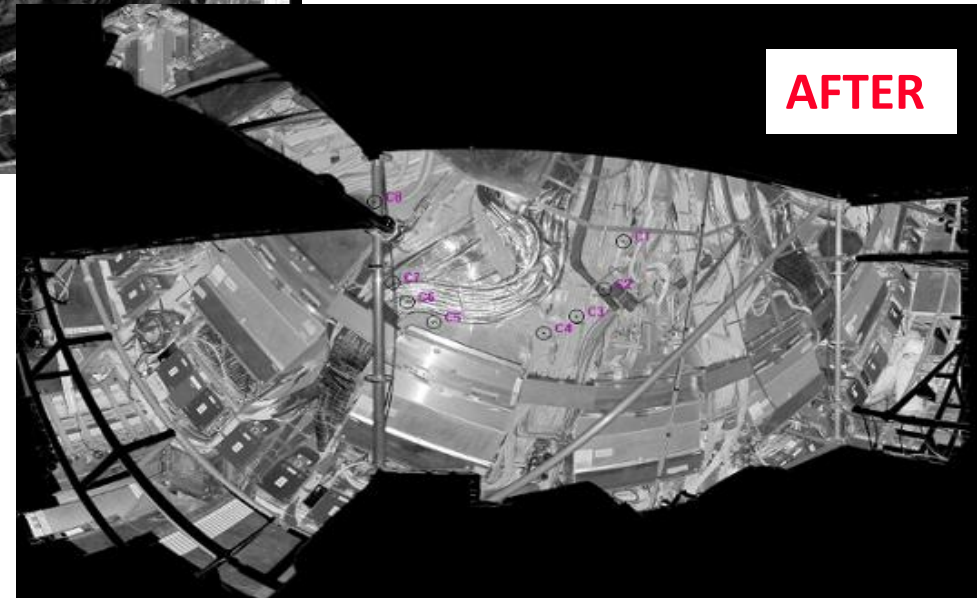
NOT TESTED



LONG MEASUREMENTS (CAMERA APERTURE) BUT QUICK PROCESSING

PROCESSING PRE PROCESSING

BY SPECIFIC PROGRAM ASSOCIATED TO THE INSTRUMENT



PROCESSING STEPS:

ASSEMBLY OF SCAN STATIONS
REDUCE DATA
EXPORT (xyz files)

CONTAIN FUNCTIONS FOR MEASUREMENTS AND TO CREATE GEOMETRICAL SETS

PROCESSING CATIA V5 PROCESSING TESTS

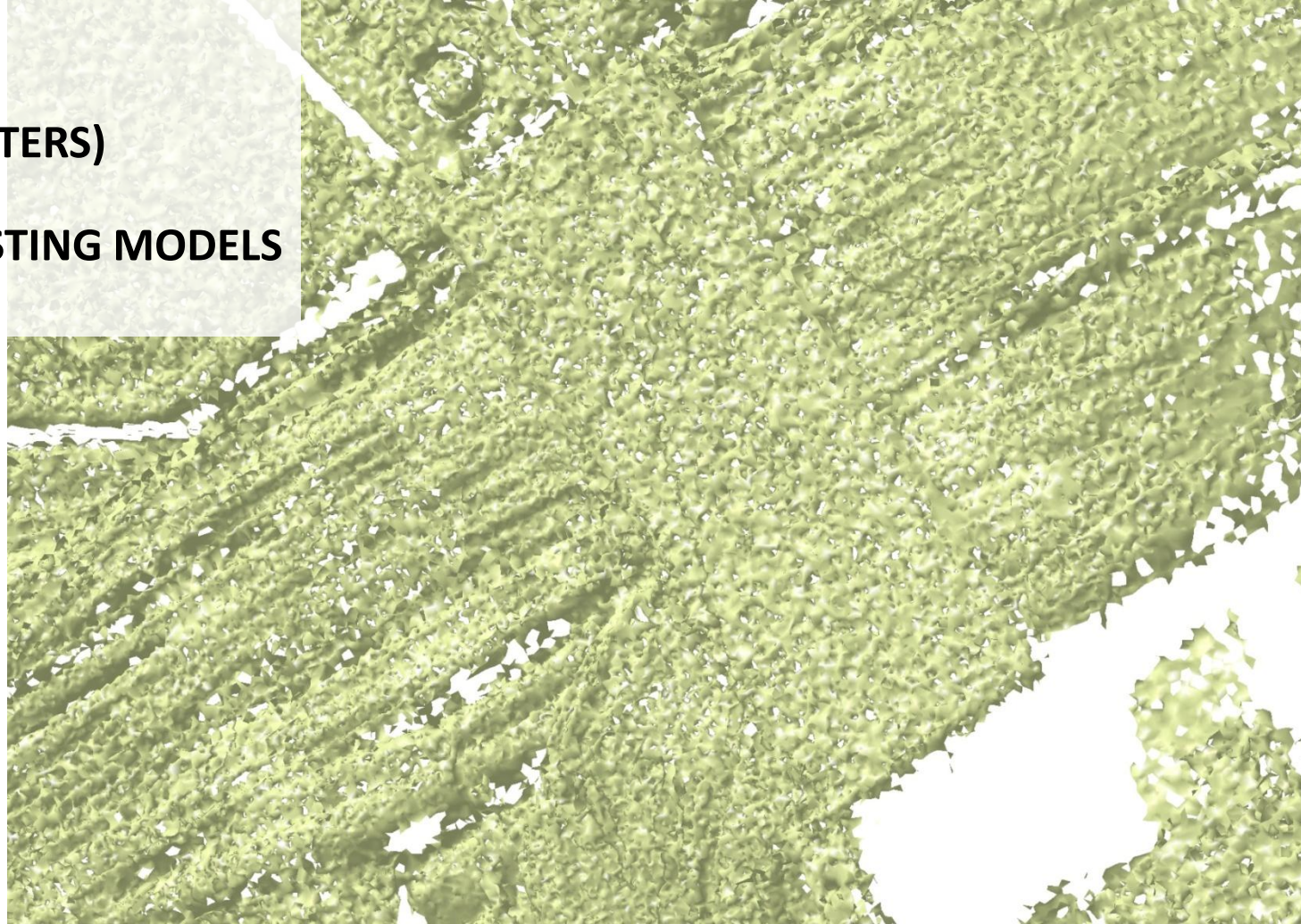
PROCESSING STEPS :

REDUCE DATA (POINTS FILTERS)

CREATE MESH

INTEGRATION IN CAD EXISTING MODELS

EXTRACT INFORMATION



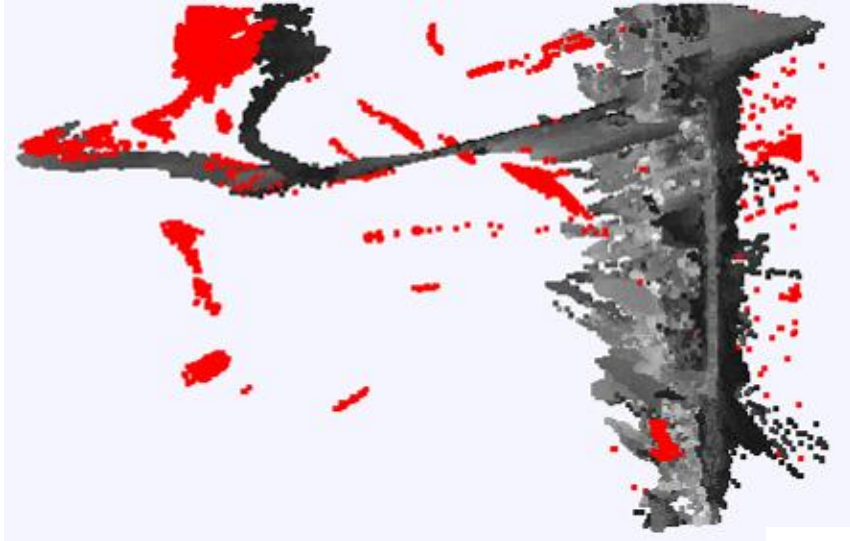
CATIA NOT ADAPTATED TO MESH POINT CLOUDS

→ ADAPTATED SOFTWARE (Geomagic, 3D Reshaper, Polyworks, RapidForm)

PROCESSING POINTS FILTERS

POINT CLOUD QUALITY DEPENDS OF THE INSTRUMENT.

DELETE WRONG POINTS



REDUCE THE NUMBER OF POINTS



BEFORE



AFTER

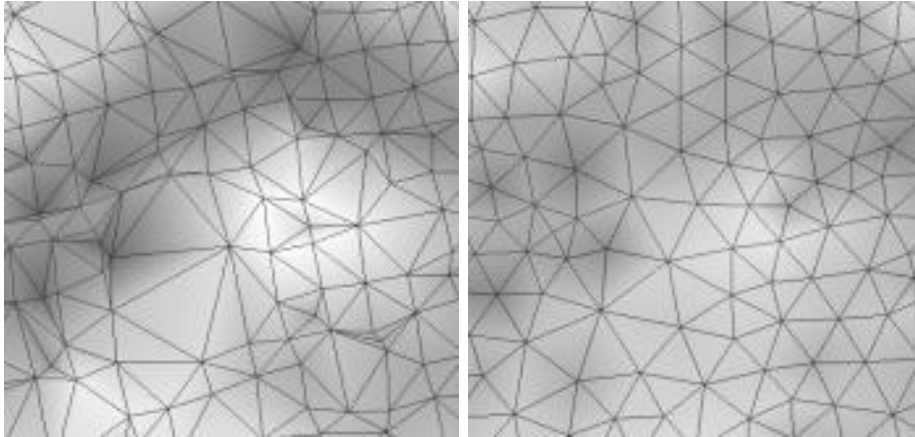


MOVE POINT TO BETTER PLACE

MESH RESULT DEPENDS OF THE FILTERING. FILTERING IS TIME CONSUMING.

PROCESSING MESH

IMPROVE MESH FORM



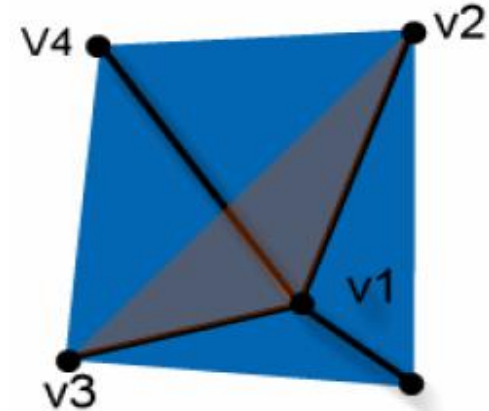
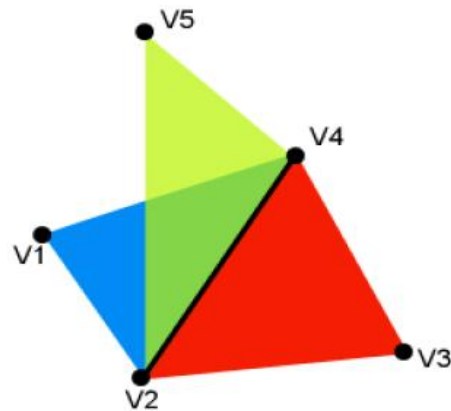
BEFORE

AFTER

FILL HOLES

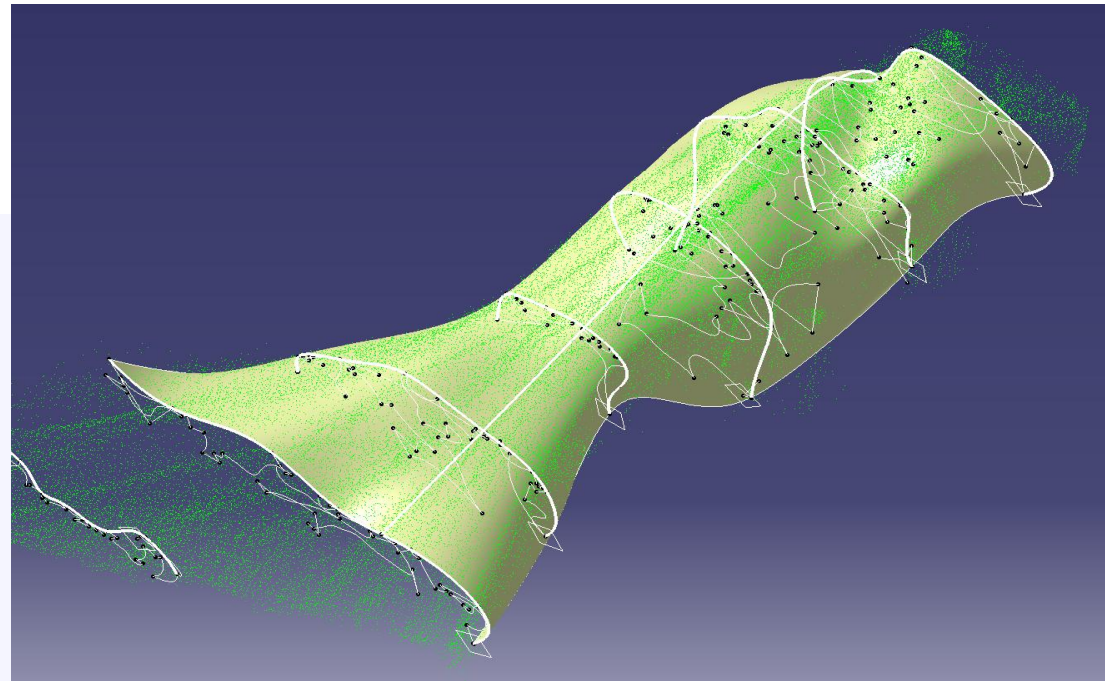
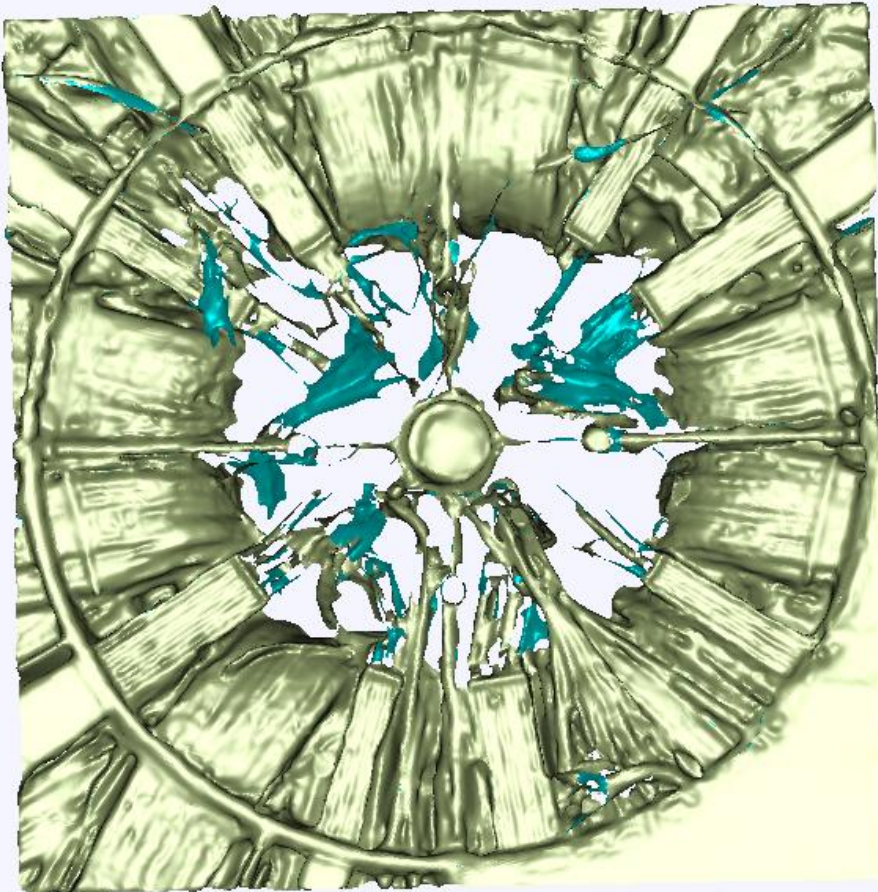


CHECK THE MESH



PROCESSING CURVES & NURBS

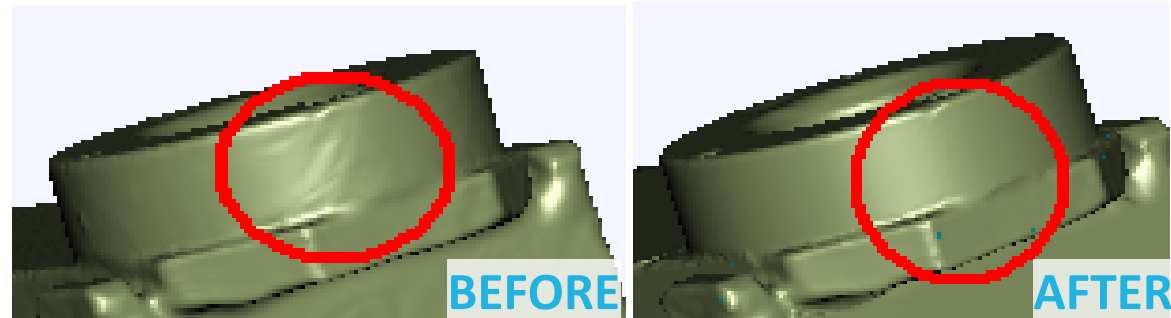
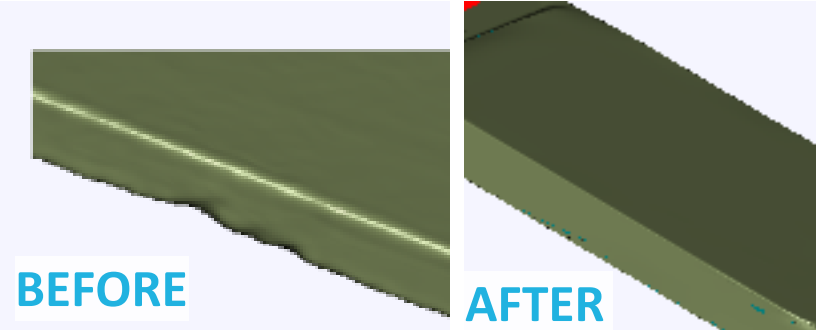
CURVES : CUT POINT CLOUDS BY
LINE TO CREATE 3D SURFACE



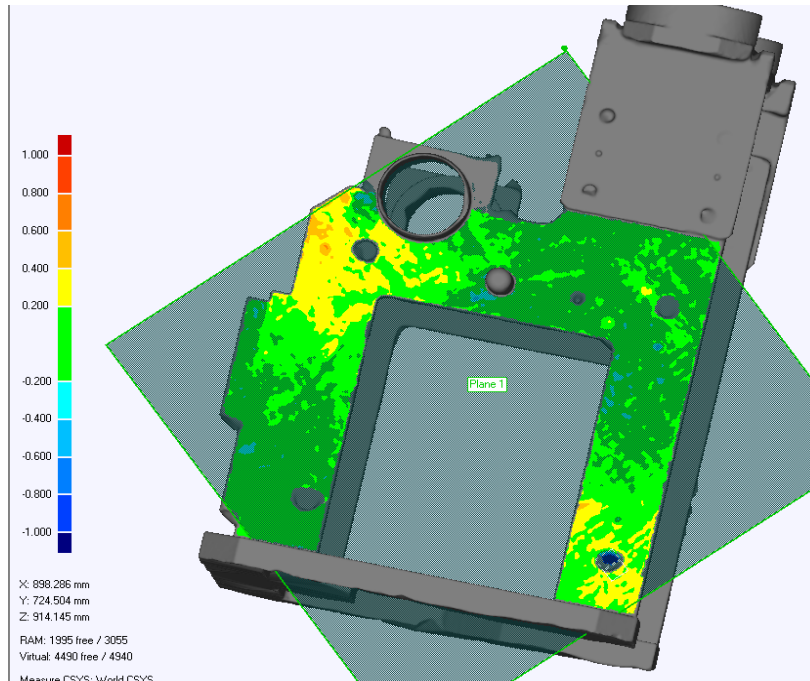
**NURBS SURFACES – NON UNIFORM
RATIONAL B-SPLINE SRFACE : USE
MESH TO OBTAIN LIGHTER 3D SURFACE**

PROCESSING OTHER FUNCTIONS

SMOOTHING - MODELING



PLANE CALCULATION



Parameters

Center

Normal

Principal

Length

Width

PLANE PARAMETERS

Deviations

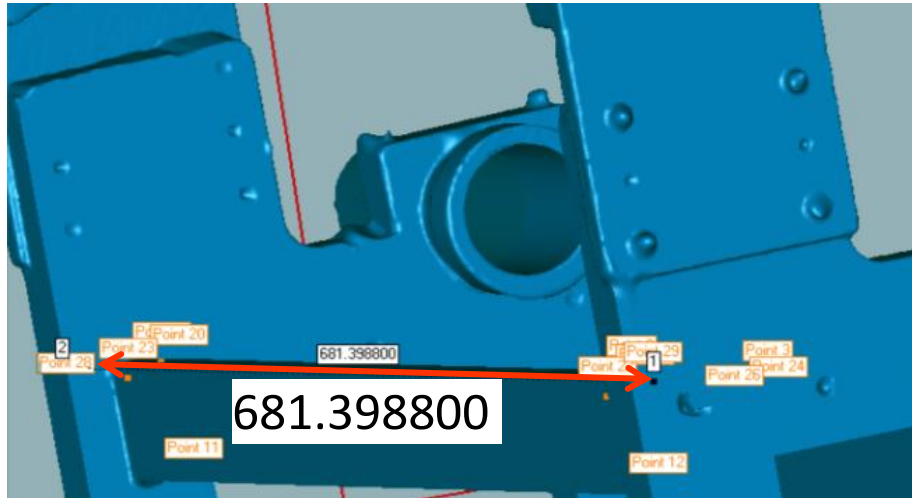
Maximum Distance:
positive: 0.633624 mm
negative: -4.068721 mm

Average Distance: 0.021846 mm
positive: 0.149155 mm
negative: -0.083743 mm

Standard Deviation: 0.170254 mm

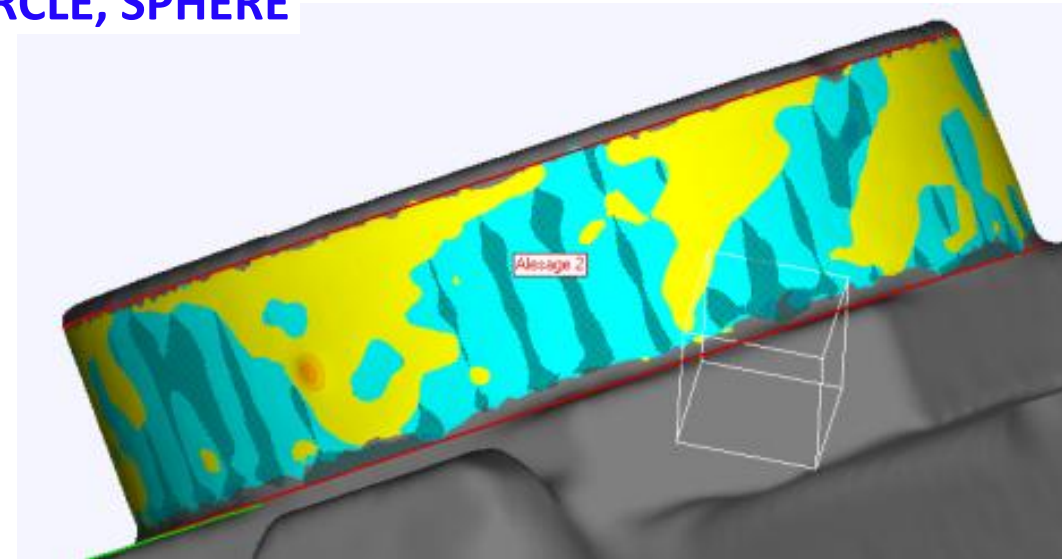
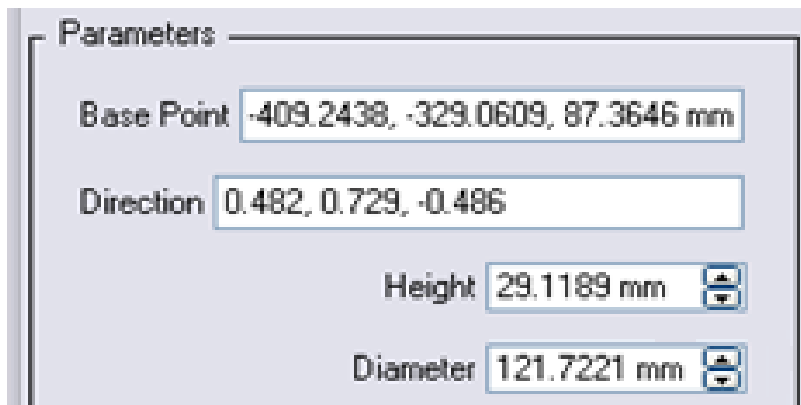
PROCESSING OTHER FUNCTIONS

POINT / PLANE DISTANCE MEASUREMENT



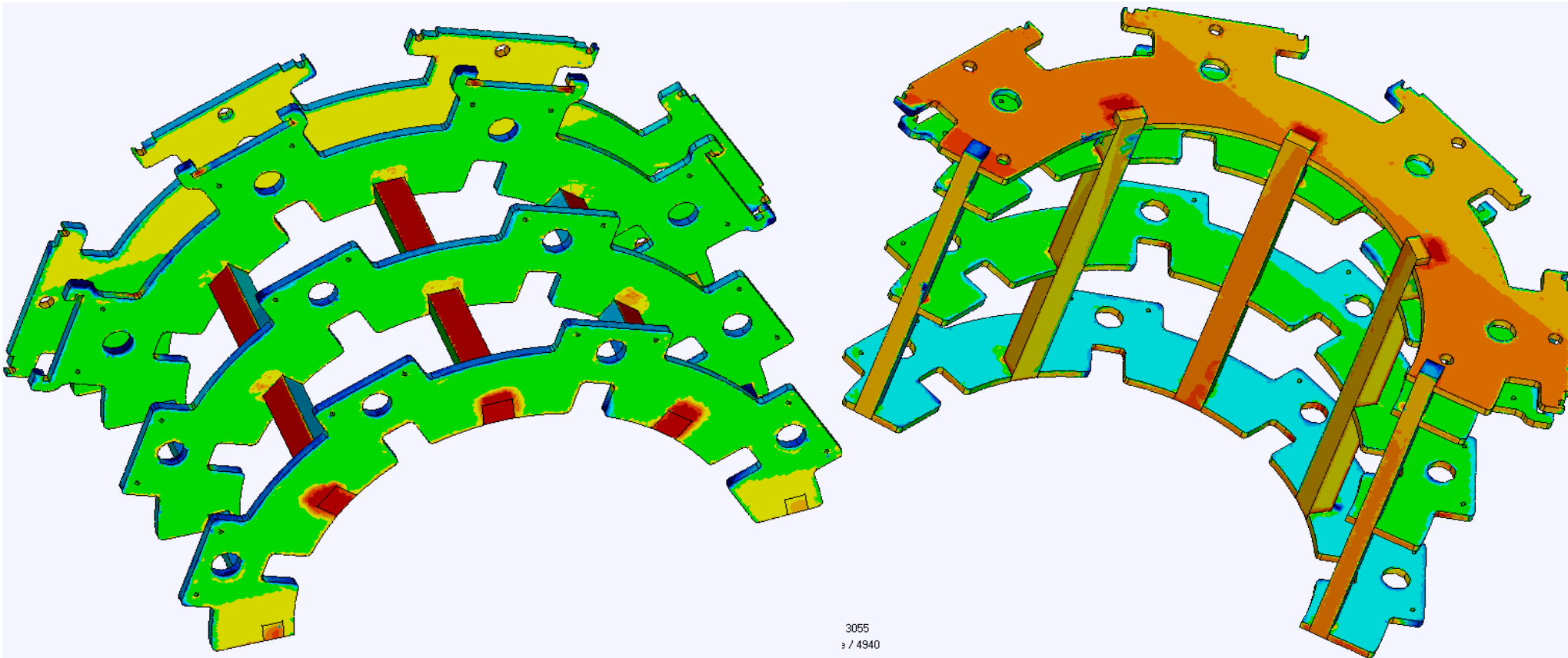
Distance	
Distance:	681.398800 mm
X-Distance:	482.938216 mm
Y-Distance:	0.380438 mm
Z-Distance:	480.702465 mm

DIAMETER MEASUREMENT – CYLINDER, CIRCLE, SPHERE



PROCESSING OTHER FUNCTIONS

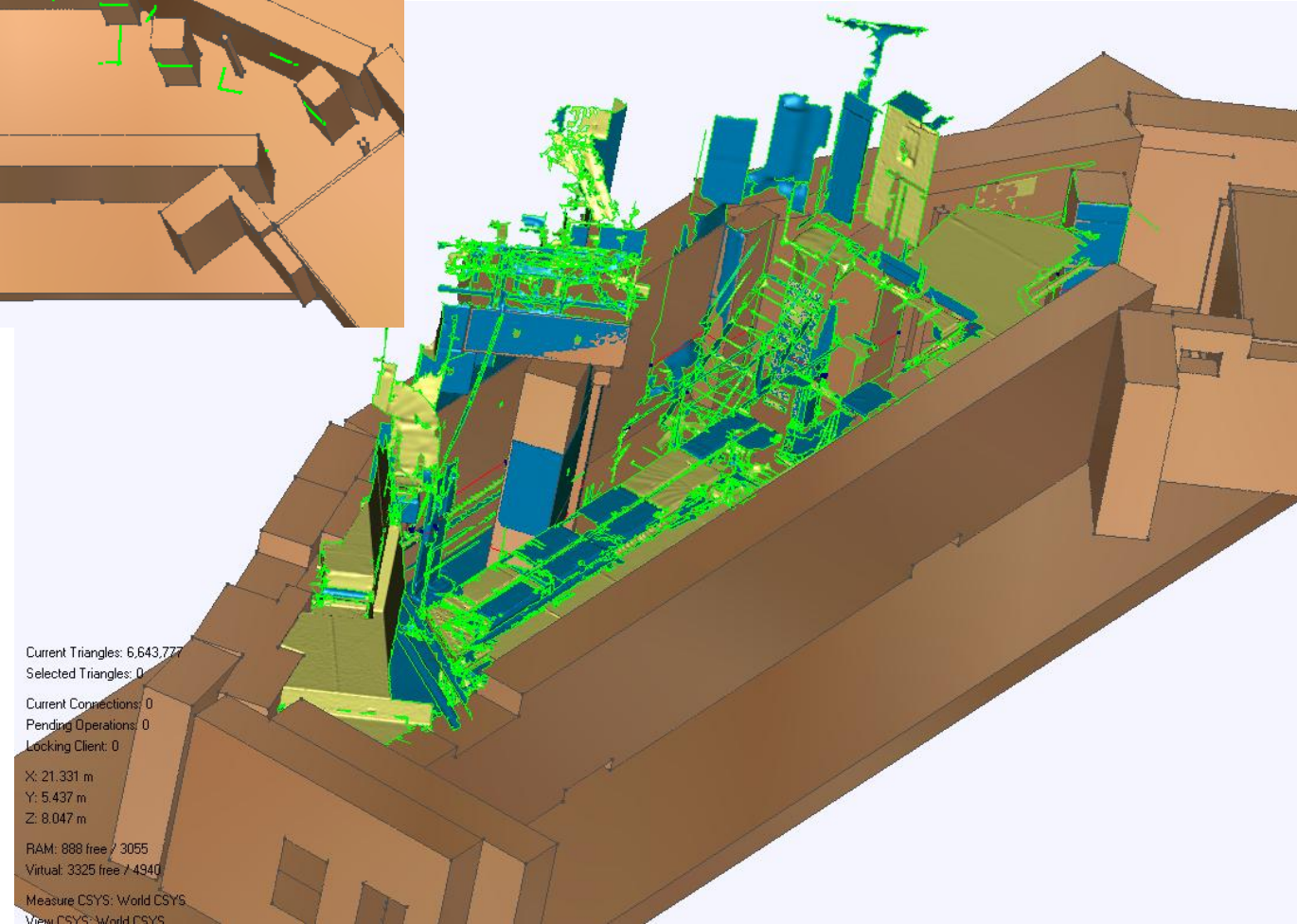
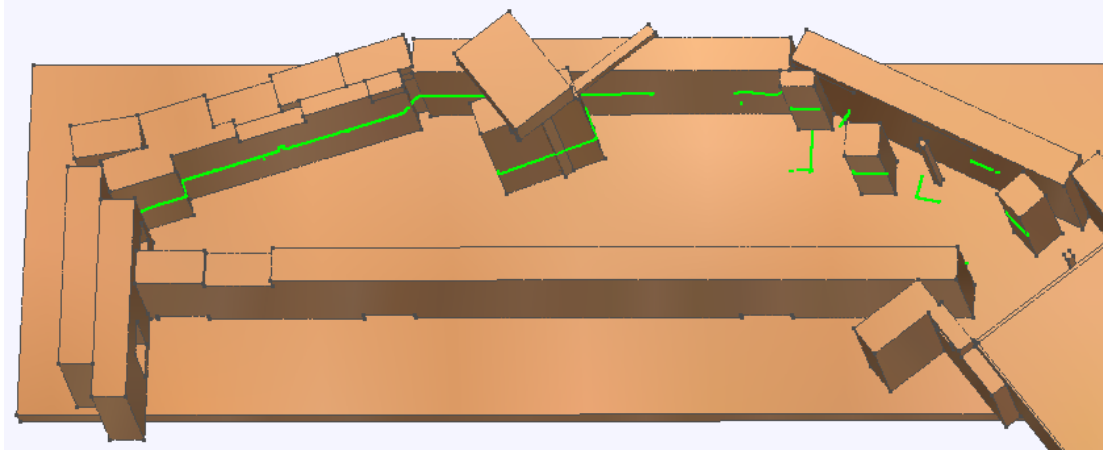
3D MODELS COMPARISON – THEORETICAL AND MEASURED MODELS



QUALITY CHECKING AND EVALUATION OF DEFECTS

PROCESSING OTHER FUNCTIONS

USE 3D MEASURED MODEL TO CREATE CAD MODEL WHEN NOTHING EXIST



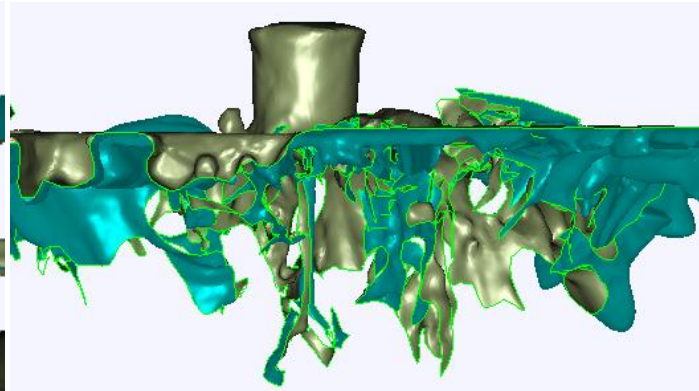
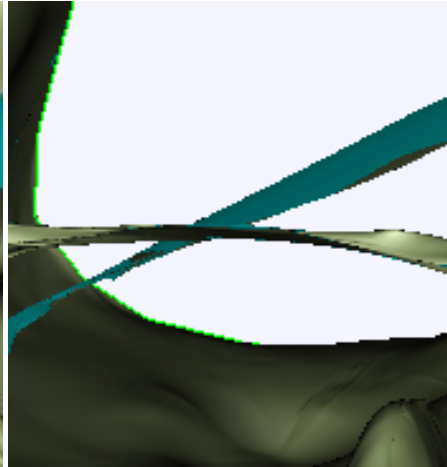
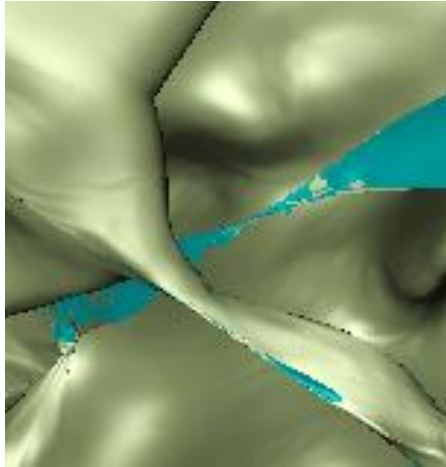
**HDS 3000
BE/ABP**

AEGIS AREA

Current Triangles: 6,643,777
Selected Triangles: 0
Current Connections: 0
Pending Operations: 0
Locking Client: 0
X: 21.331 m
Y: 5.437 m
Z: 8.047 m
RAM: 888 free / 3055
Virtual: 3325 free / 74940
Measure CSYS: World CSYS
View CSYS: World CSYS

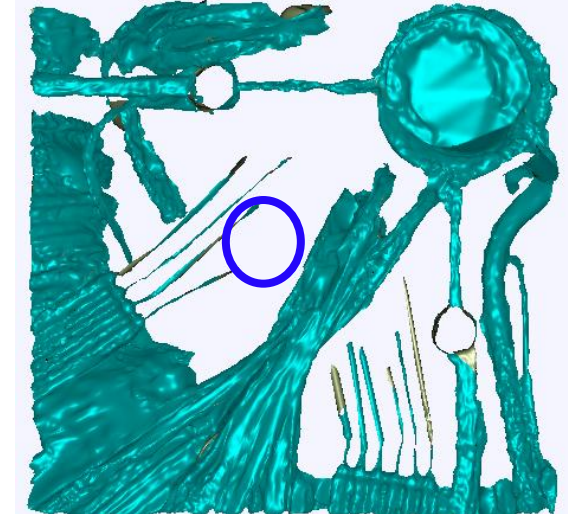
PROCESSING OUR RECONSTRUCTION DIFFICULTIES

ATLAS – CENTER A SIDE



RECONSTRUCT SUPERIMPOSED / ABOVE A HOLE OBJECTS

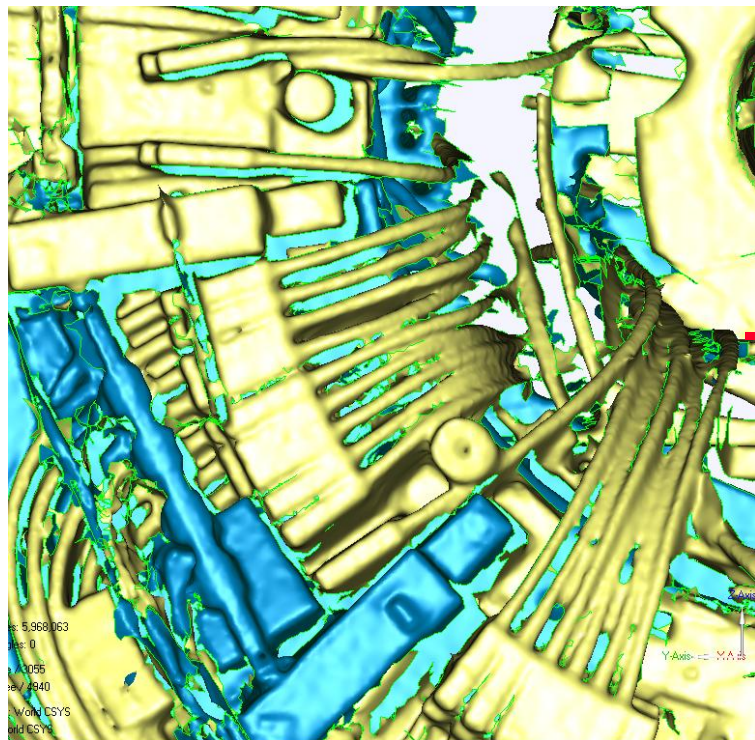
CLEANING OF REAR SIDE
PB: DEPTH MEASUREMENT



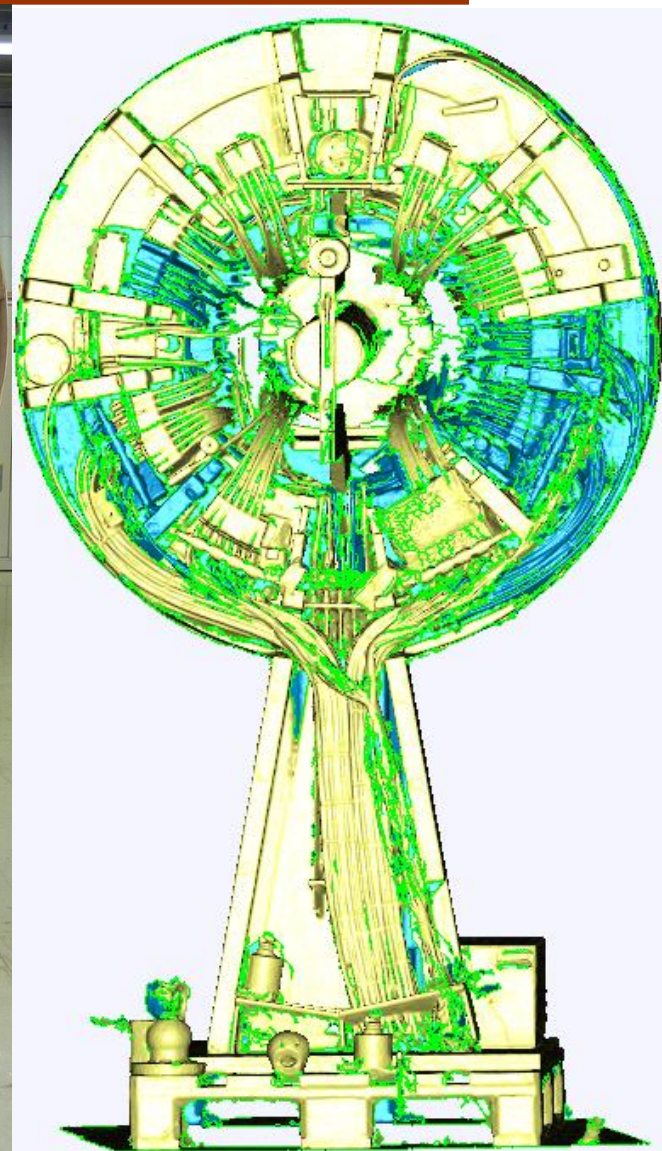
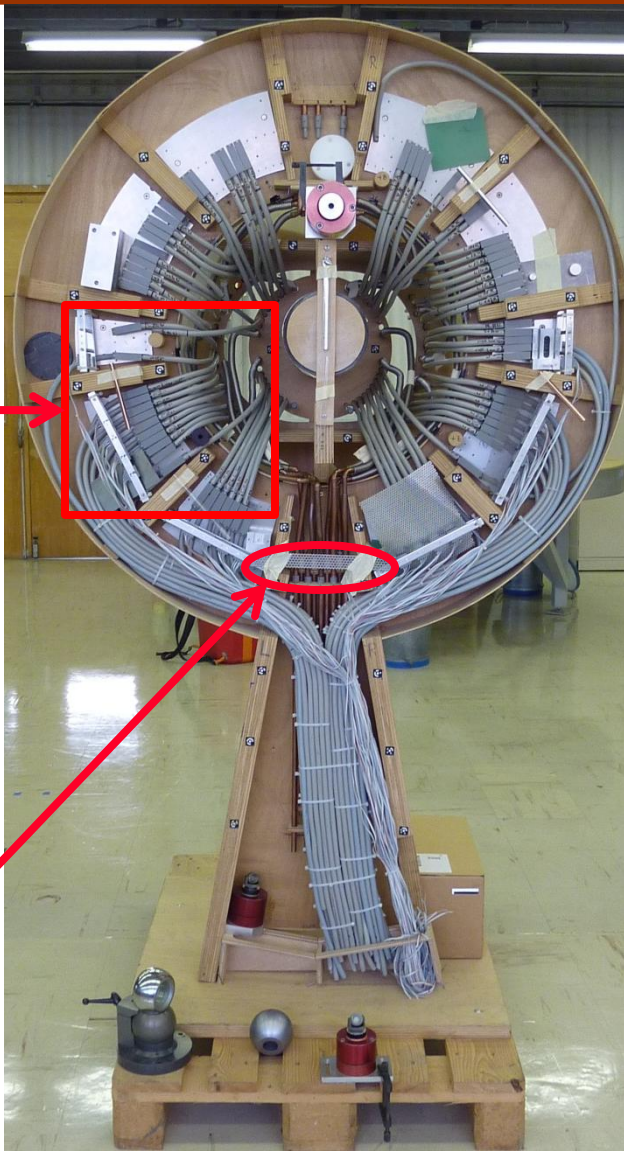
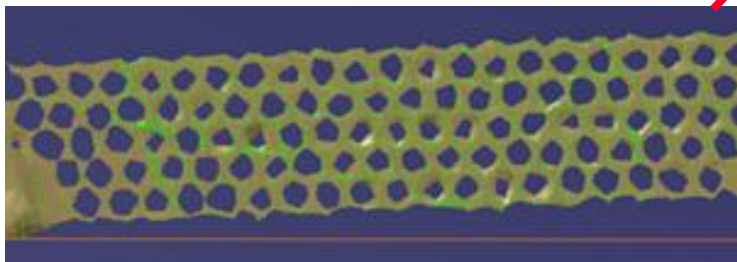
CONSTRUCT MESH ON SURFACES WITH A DIFFERENT DENSITY OF POINTS

EXAMPLES OF RECONSTRUCTIONS CMS TRACKER MOCK-UP

HDS 6100

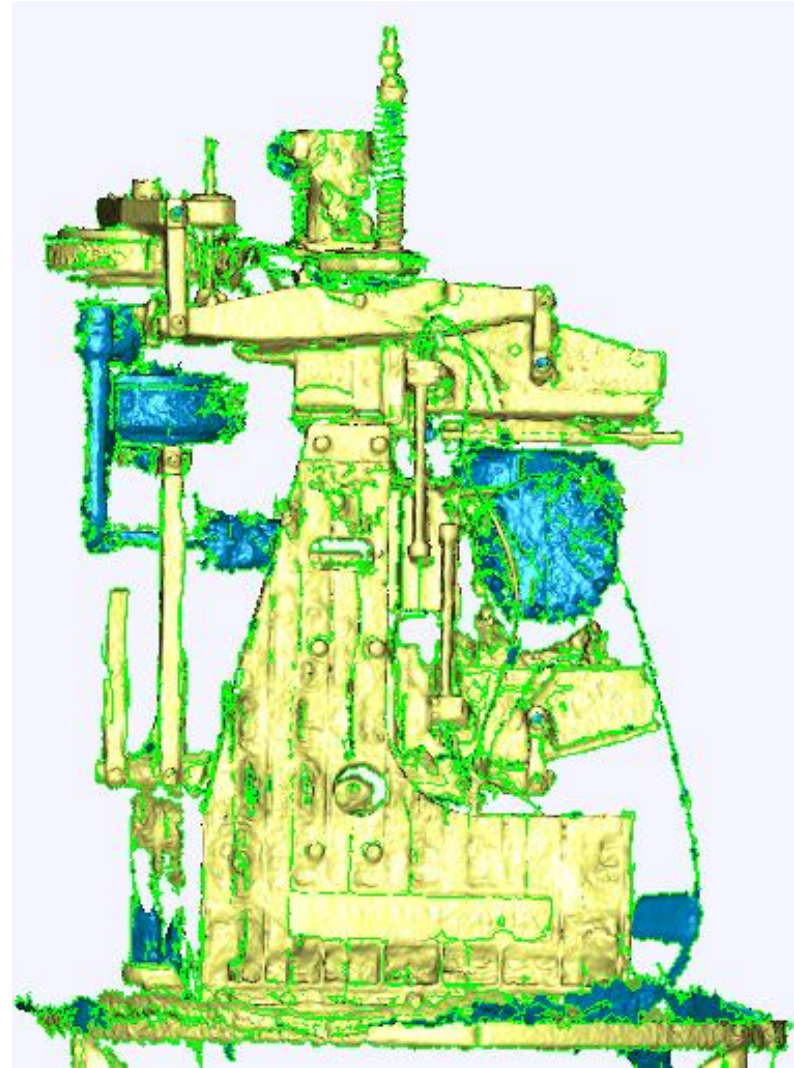
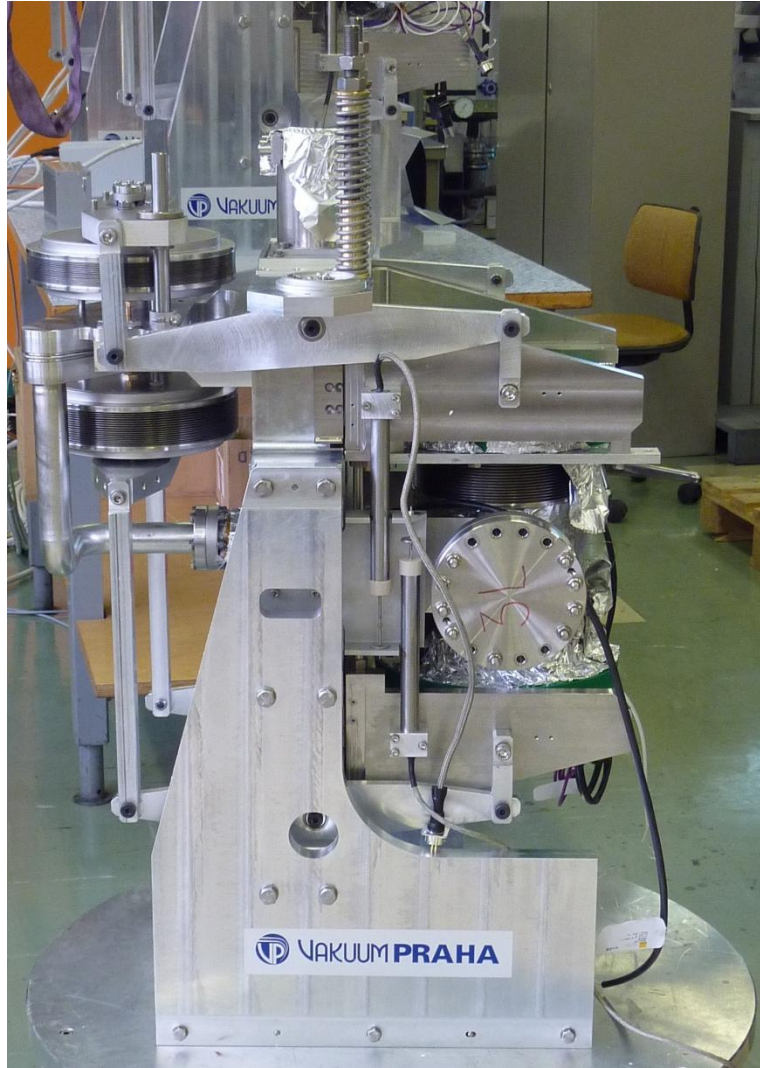


T-SCAN



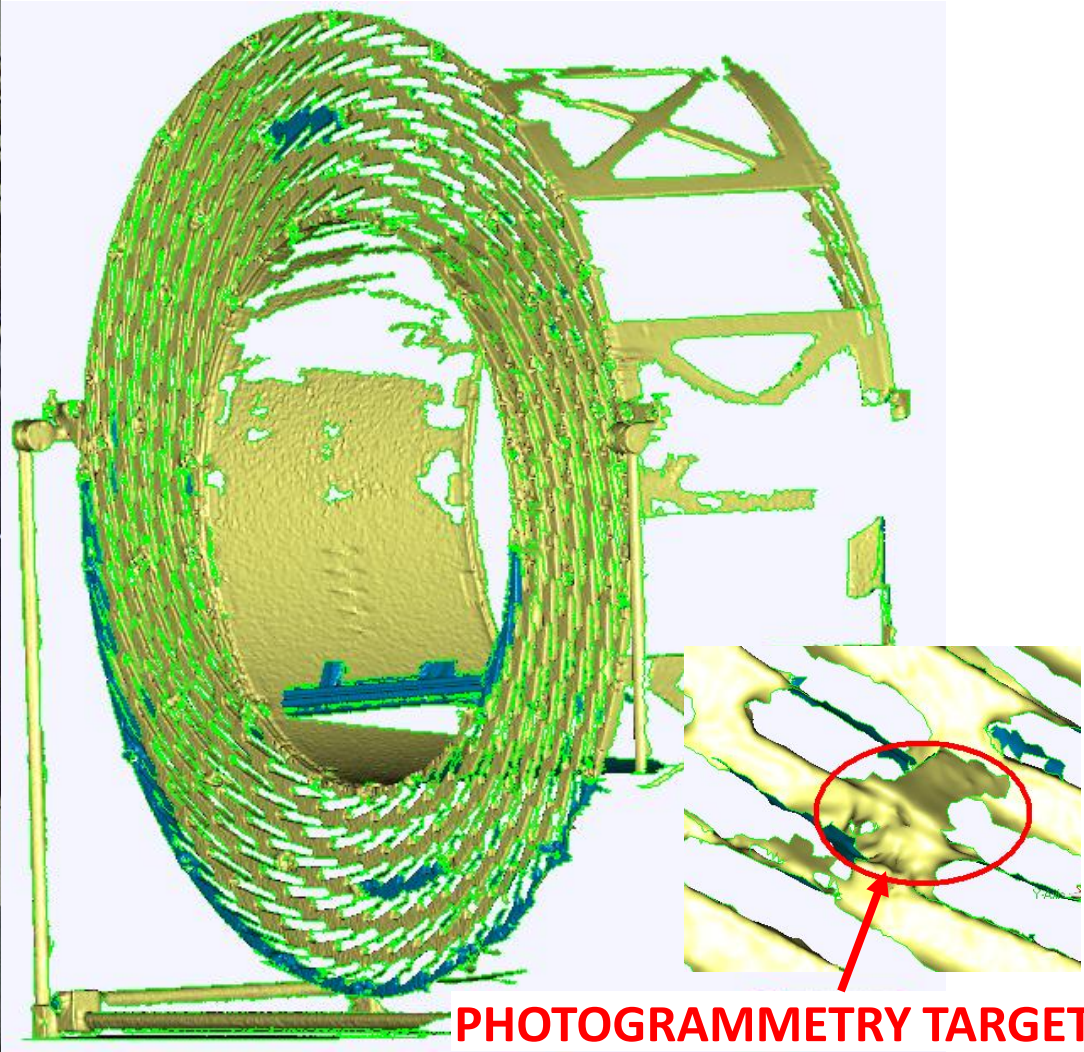
EXAMPLES OF RECONSTRUCTIONS ROMAN POT HALL 187

HDS 6100



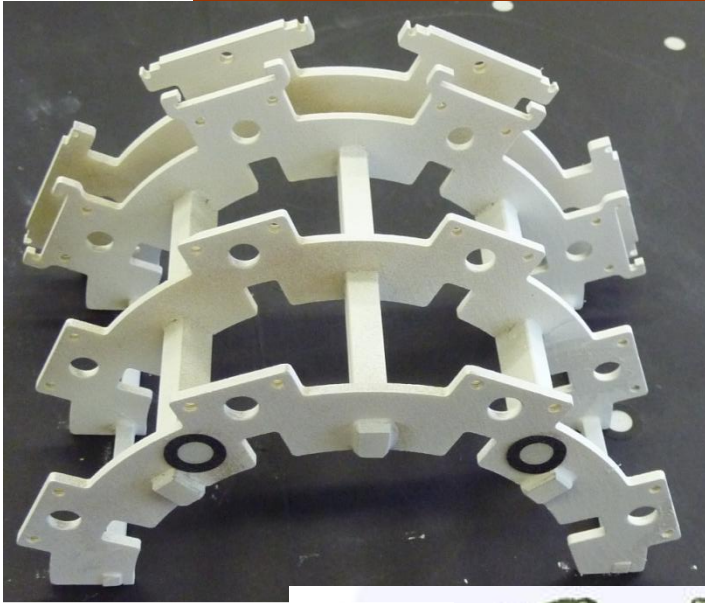
EXAMPLES OF RECONSTRUCTIONS WHEEL HALL 187

HDS 6100

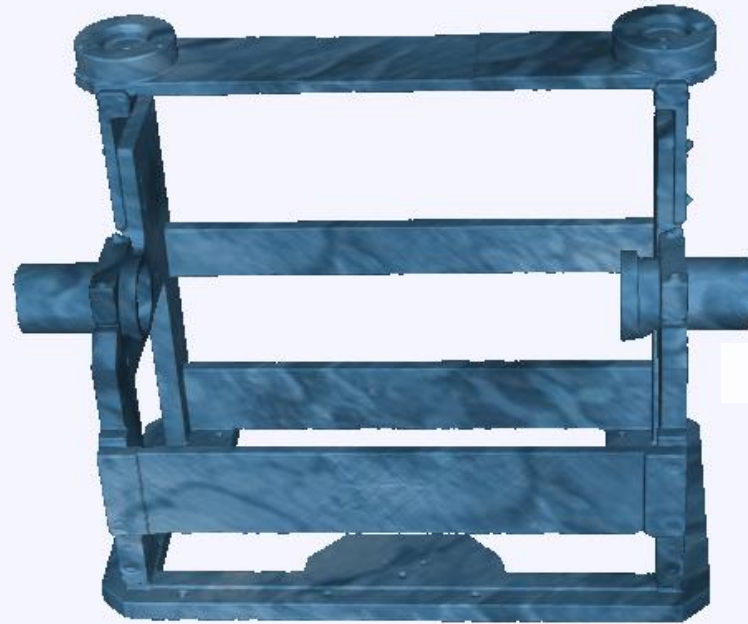


PHOTOGRAMMETRY TARGET

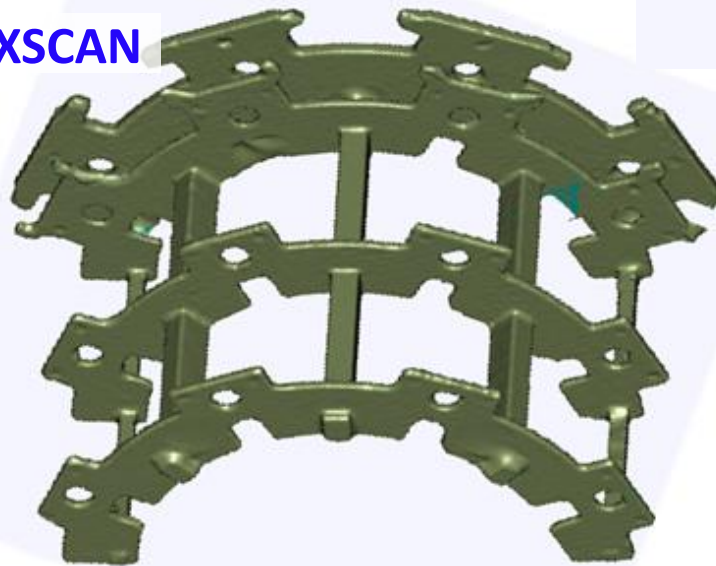
EXAMPLES OF RECONSTRUCTIONS COLLIMATOR SUPPORT & V-CMS



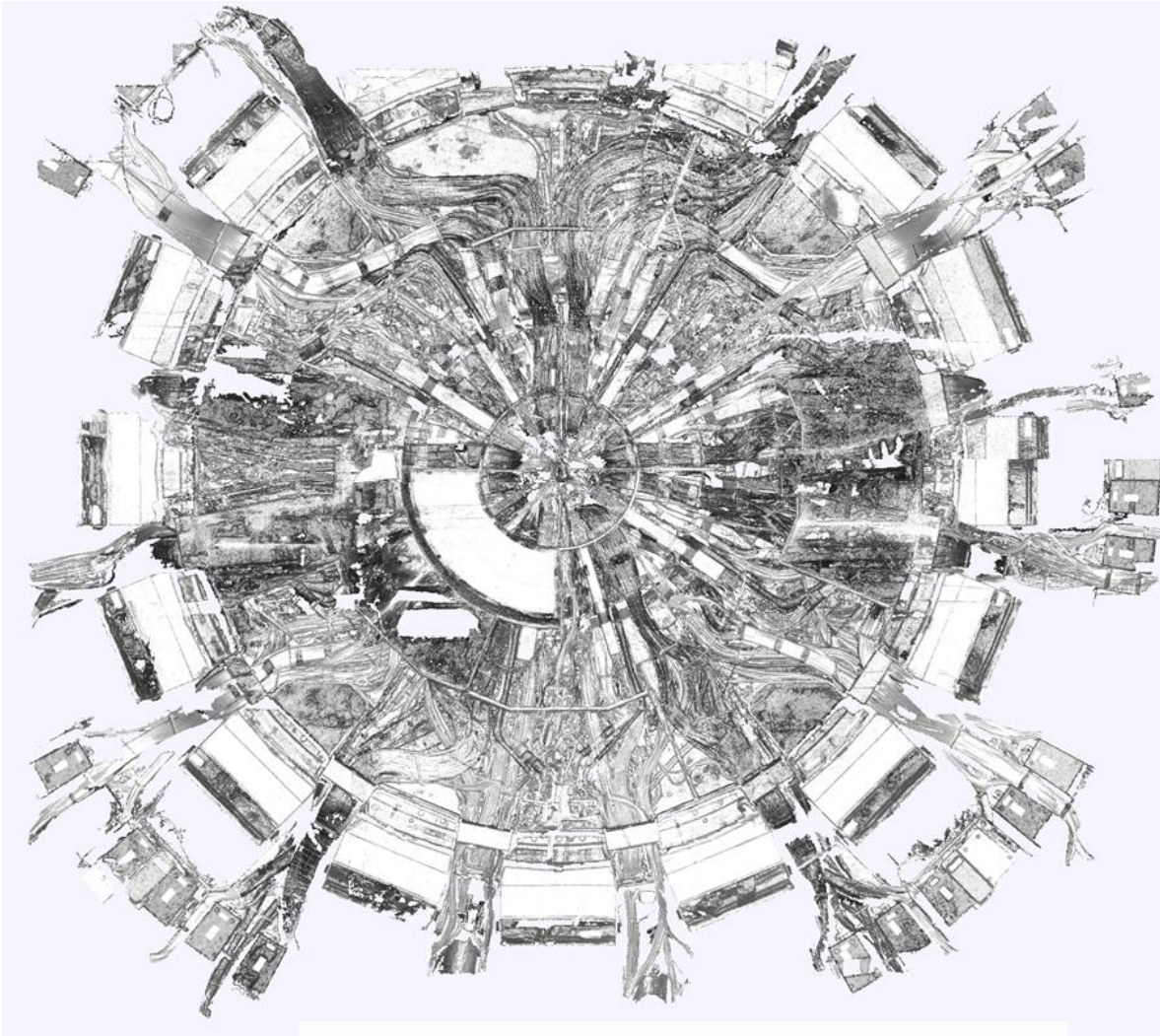
V-CMS – MAXSCAN



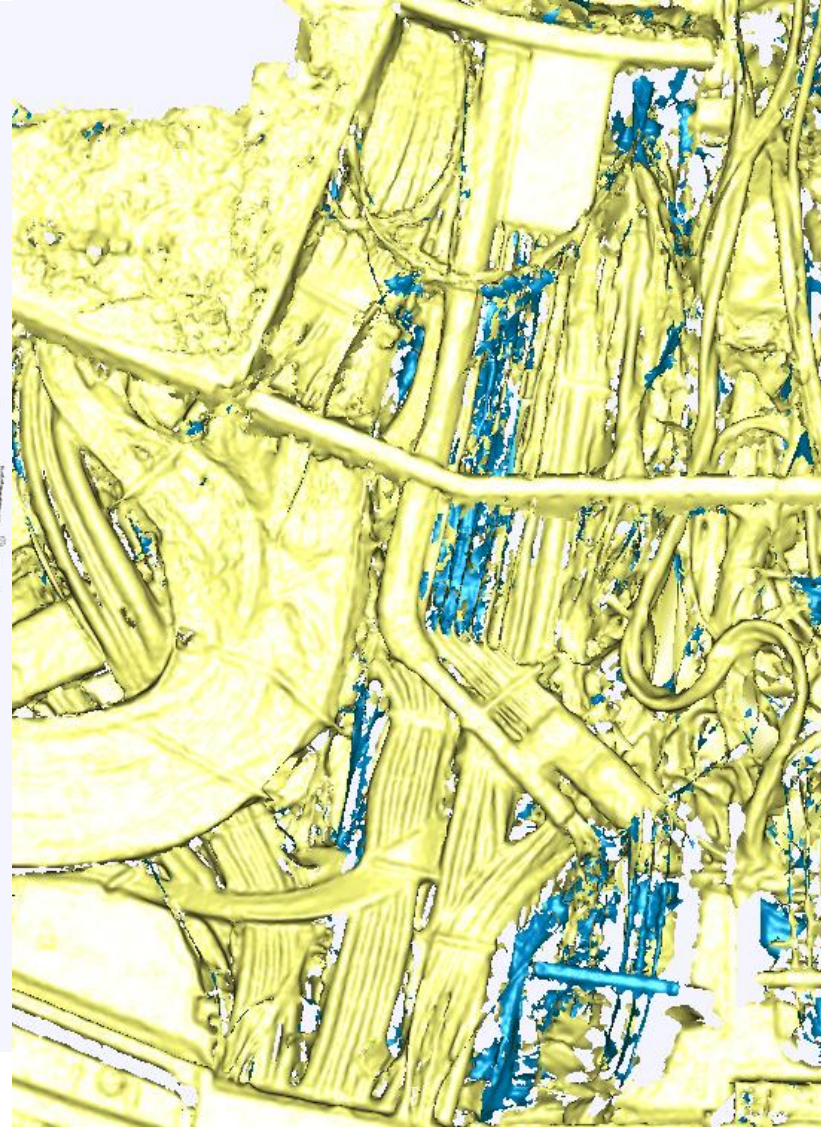
COLLIMATOR
SUPPORT
MAXSCAN



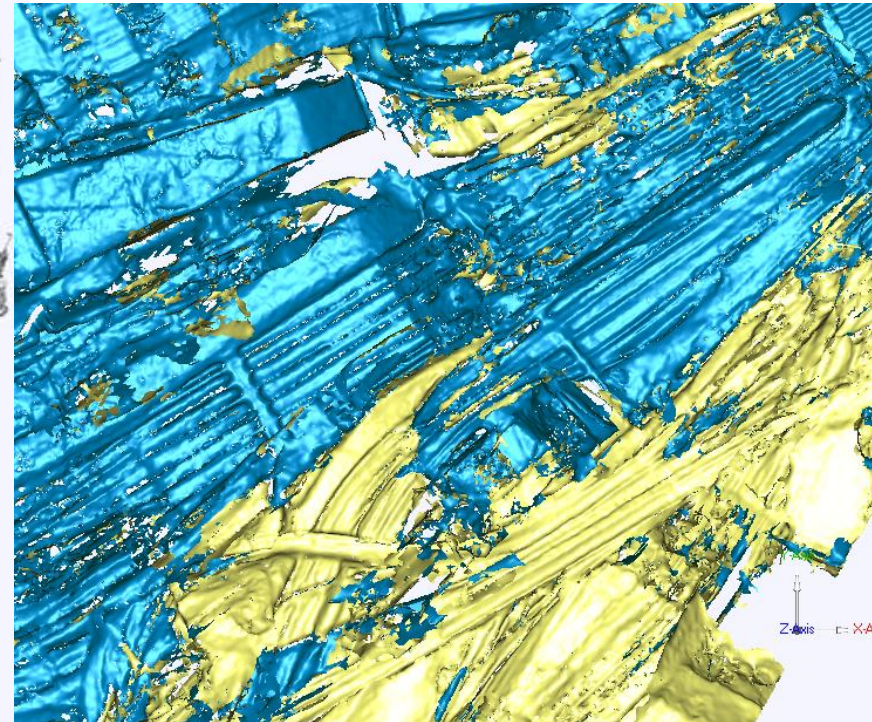
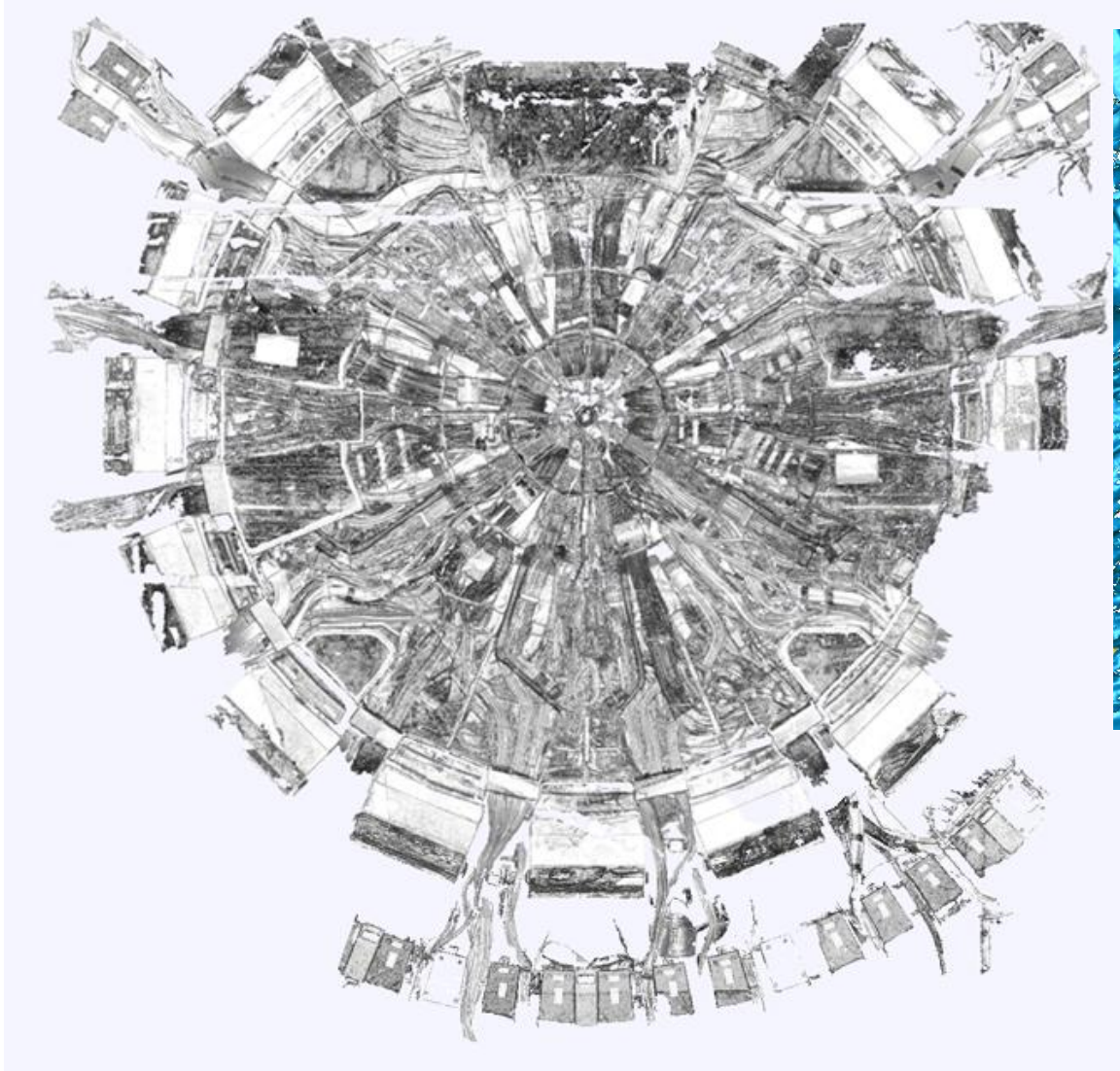
EXAMPLES OF RECONSTRUCTIONS ATLAS – CENTRAL BARREL SIDE A



FARO PHOTON



EXAMPLES OF RECONSTRUCTIONS ATLAS – CENTRAL BARREL SIDE C



FARO PHOTON

CONCLUSIONS

**WHAT YOU CAN MEASURE DEPEND ON
THE INSTRUMENT YOU CHOOSE**

**A SPECIFIC SOFTWARE IS NEEDED TO
OBTAIN THOSE RESULTS**

LASER SCANNING IS TIME CONSUMMING

**PICTURES ARE MANDATORY TO
INTERPRETATE CORRECTLY THE MESH**