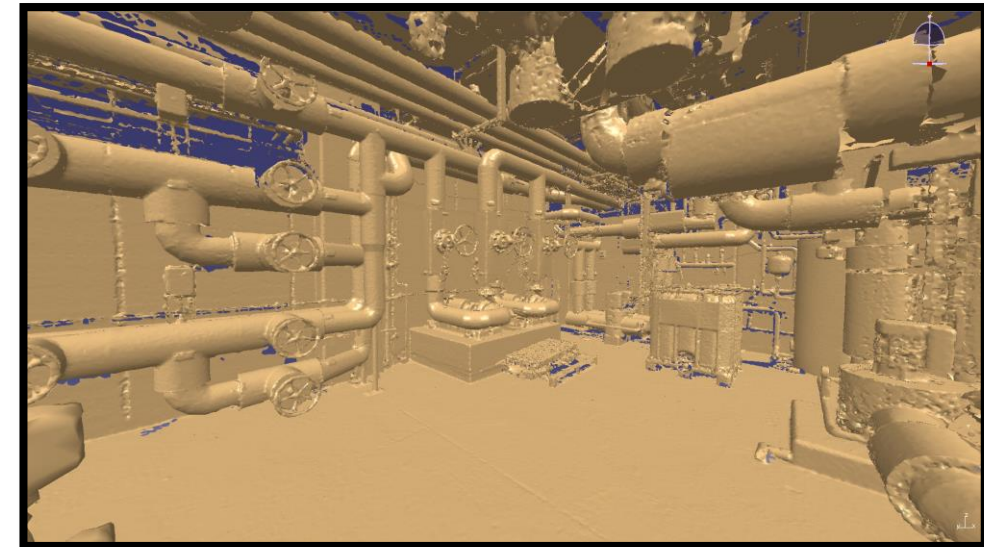


Scanning at CERN



EDMS: 2975140

Scanning at CERN

- **What?**

- Laser scanning is a process of acquiring accurate three-dimensional information about an object or environment from the real world, using a laser as a light source. By projecting laser light on the object, the scanner creates point clouds – millions of precisely measured XYZ points that define the object's position in space.



Scanning at CERN

- Process

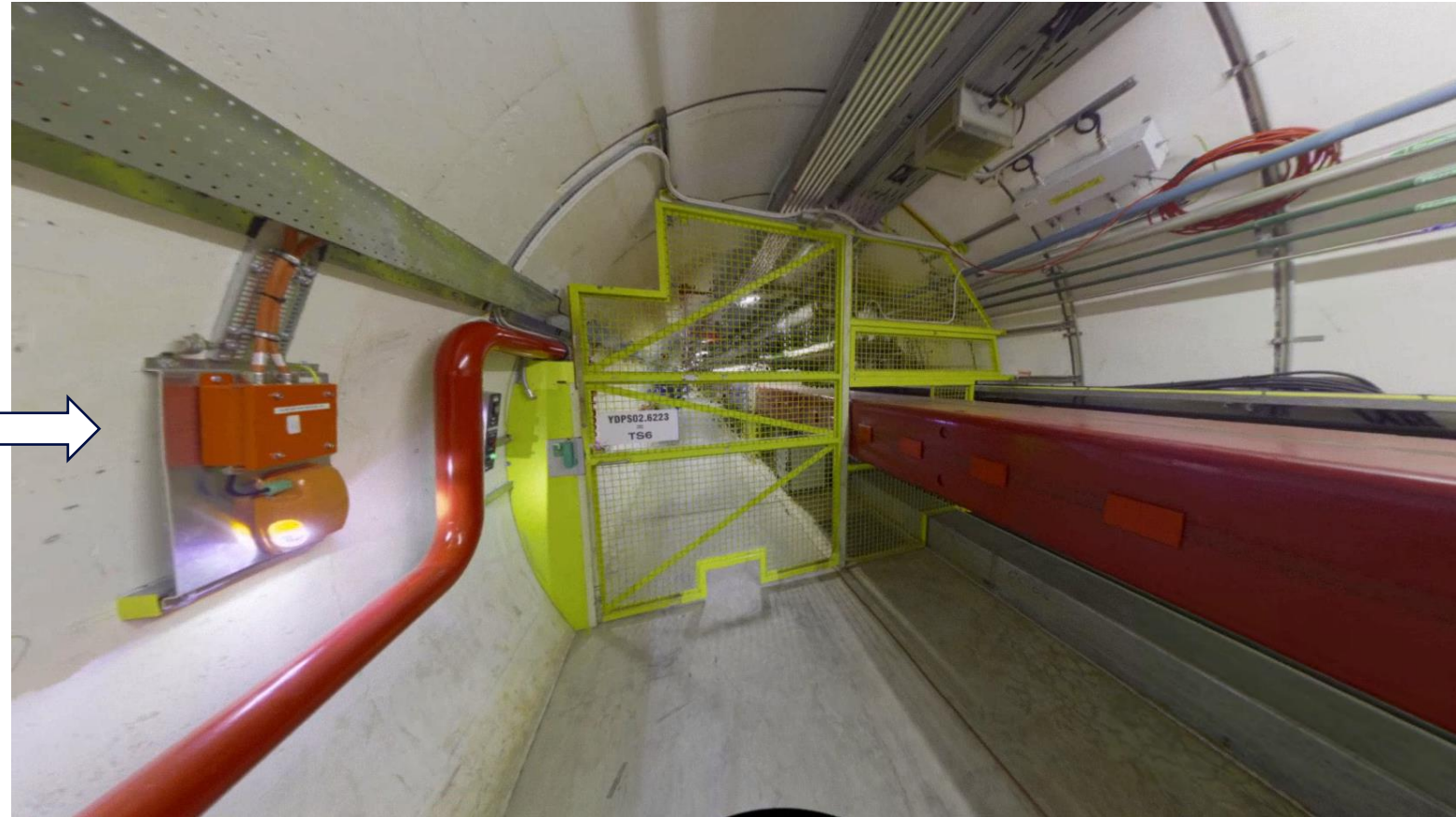
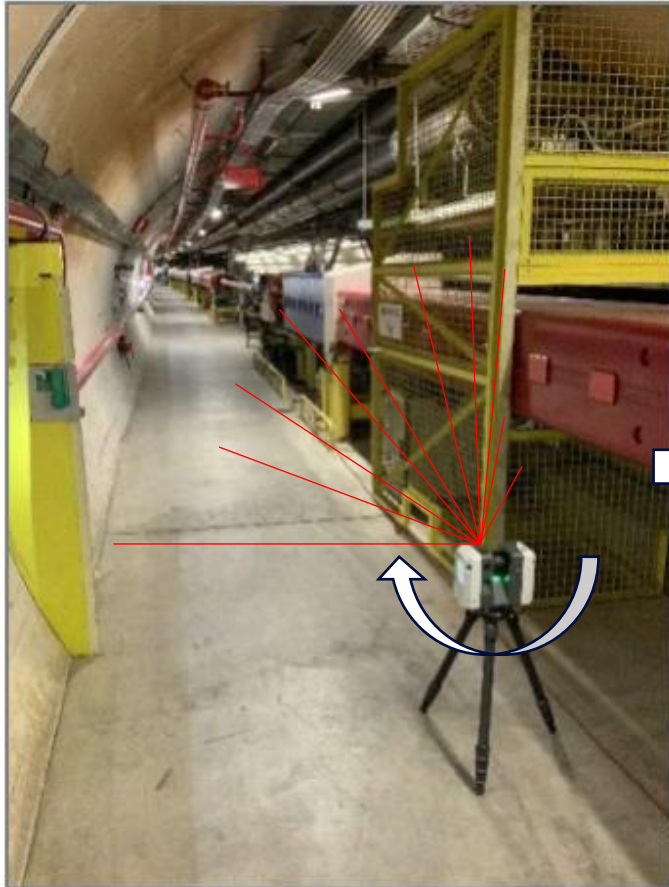
Acquiring the Point Cloud



Scanning at CERN

- Process

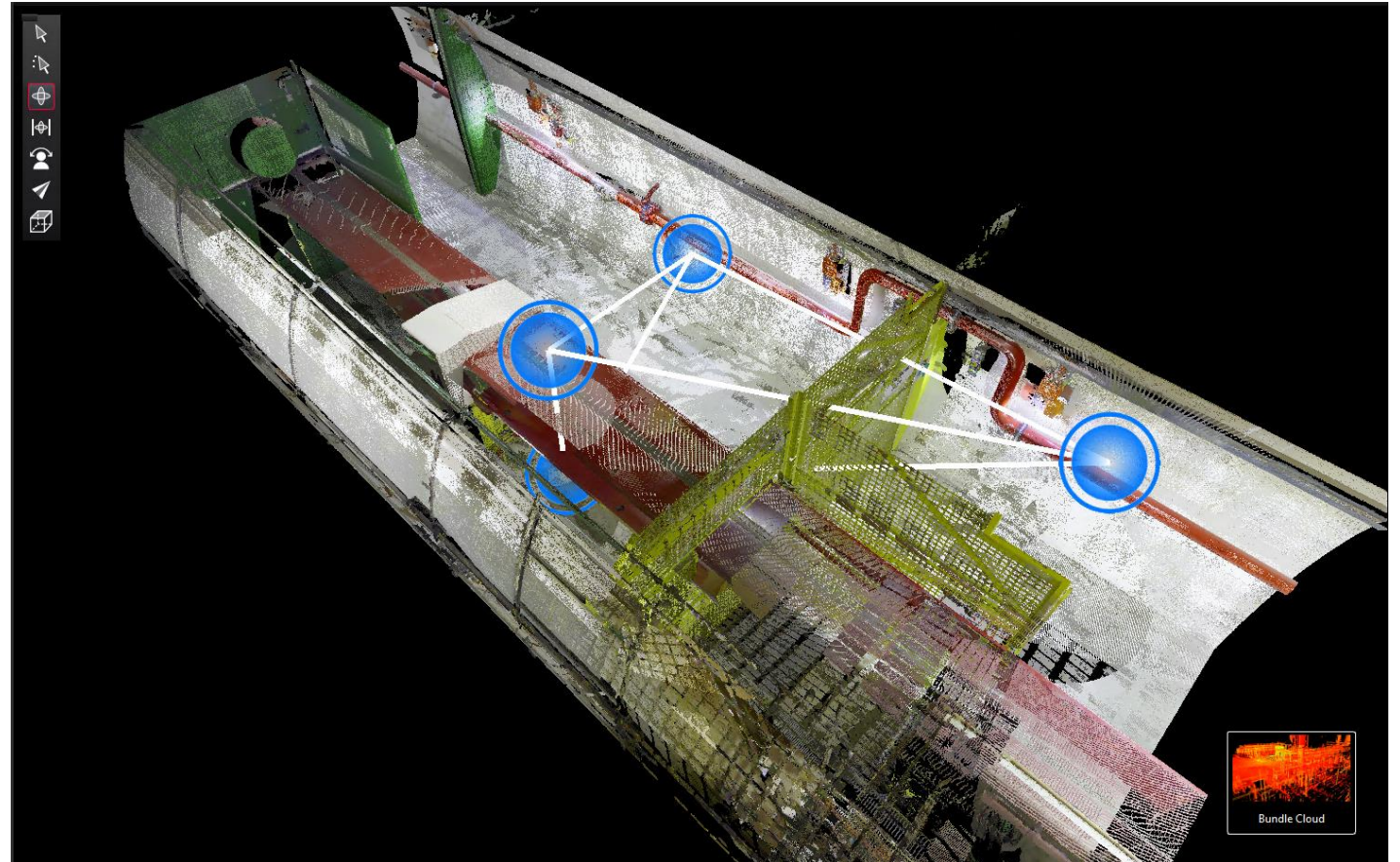
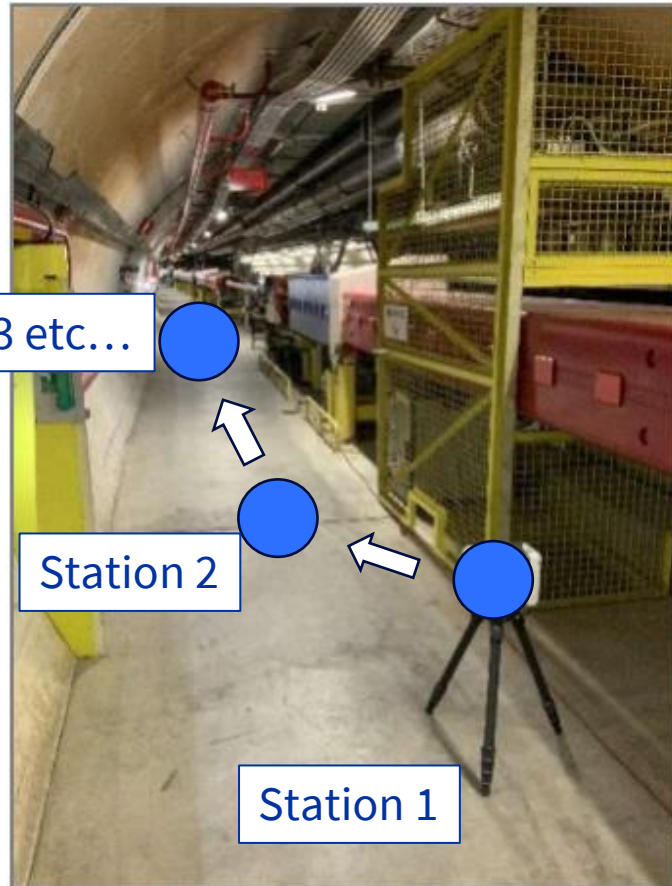
360° Photo Capture



Scanning at CERN

- Process

We perform several stations

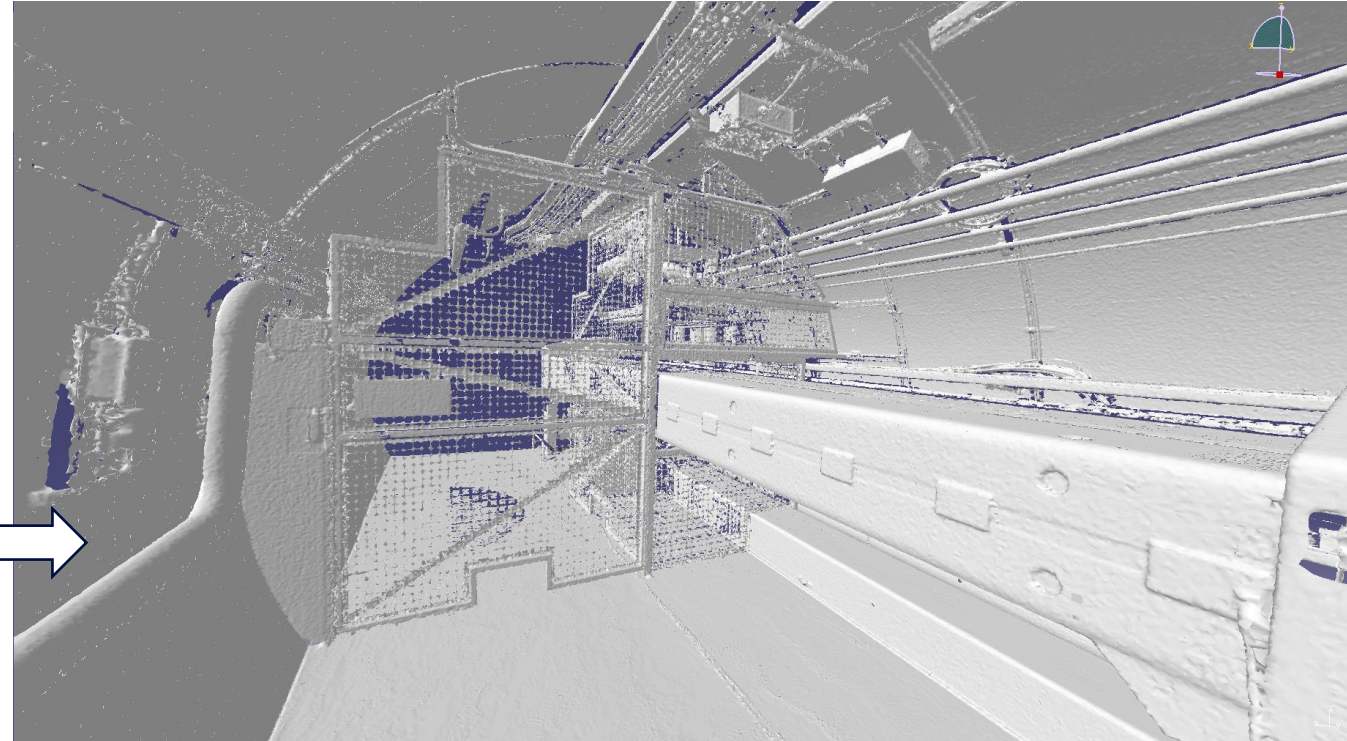
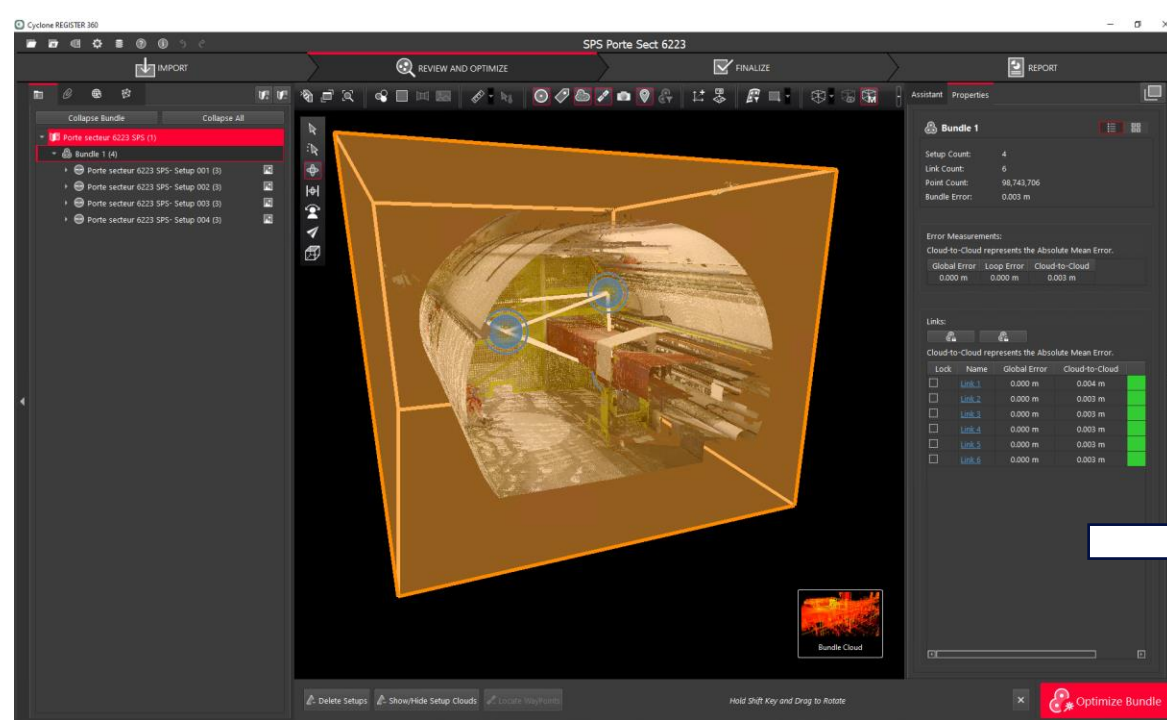


Scanning at CERN

- Process

Scan processing on Cyclone Register 360

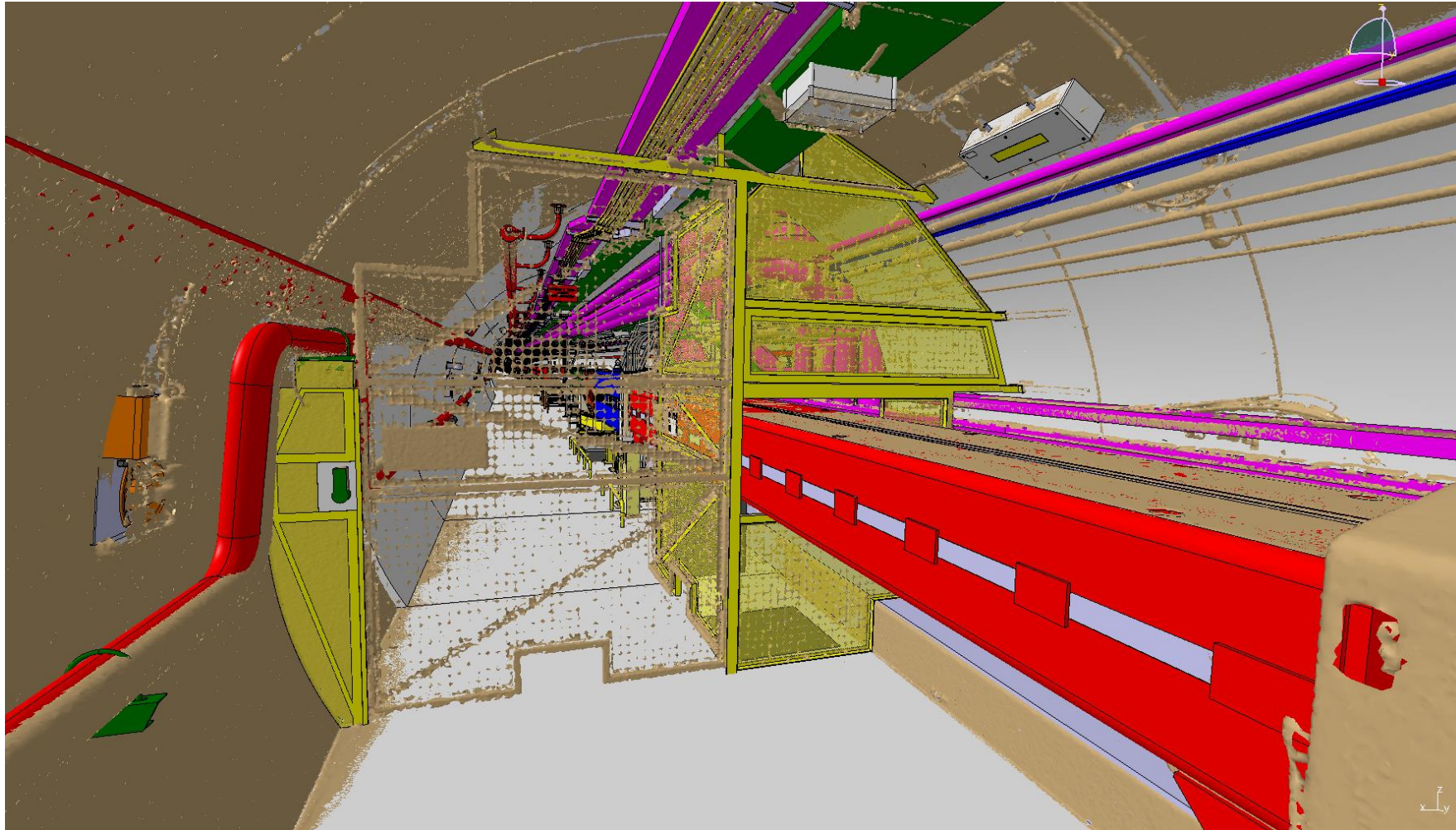
mesh on Catia



Scanning at CERN

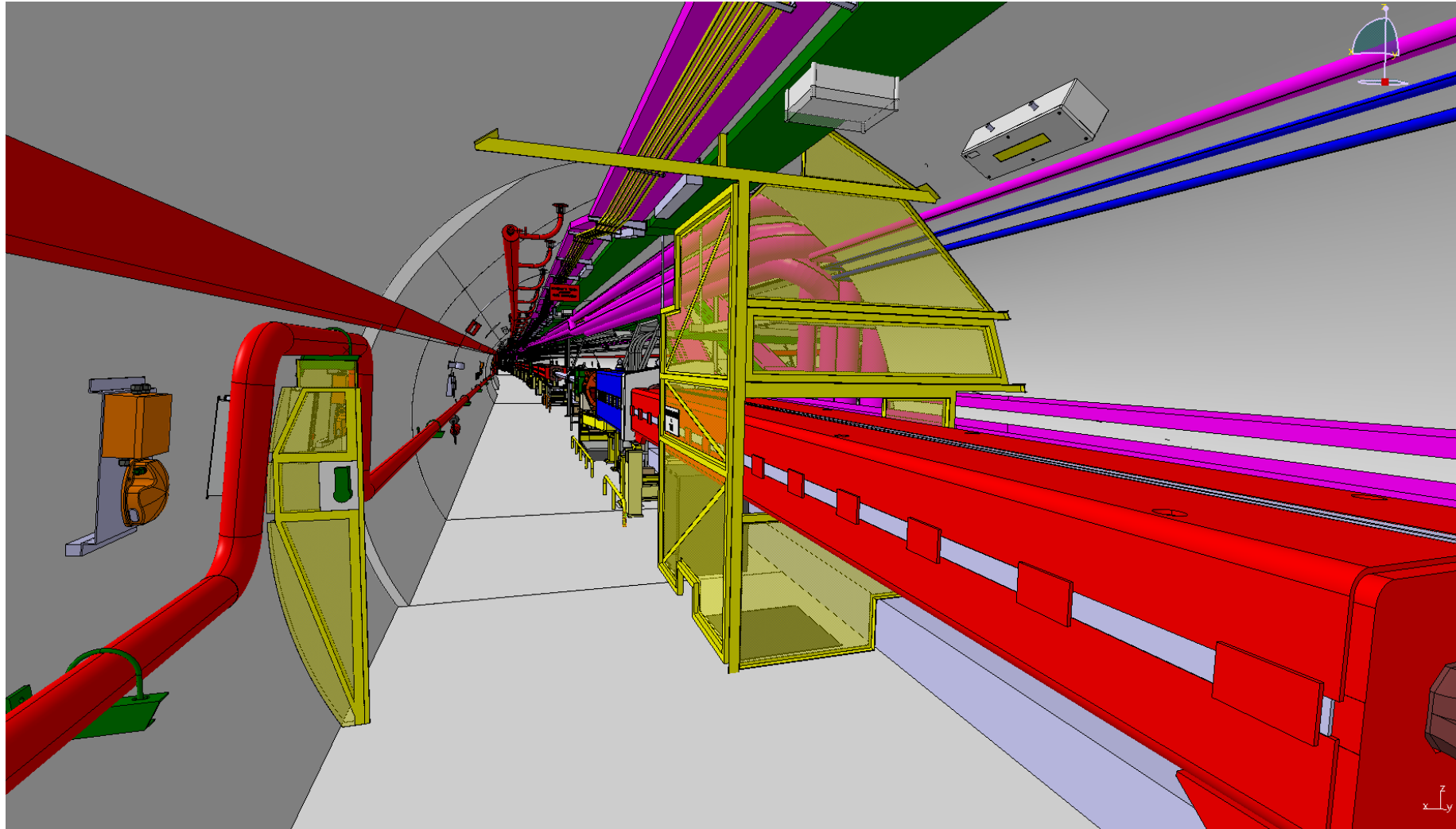
- Reverse Engineering – As built

Overlay the scan in the assembly



Scanning at CERN

- Reverse Engineering



Scanning at CERN

• Who?

Georeferenced
Survey Scans

Additional Scans
Non-georeferenced

BE/GM/ASG

- Scanner:
- Z+F imager 5016



Precision of a 3D point:

SCE/SAM/TG

- Scanner:
- BLK 360 1ere Gen



6 mm à 10 m

EN/ACE/INT

- Scanner:
- RTC 360



1,9 mm à 10 m

BE/EA/DC

- Scanner:
- BLK 360 1ere Gen



6 mm à 10 m

EN/CV/DO

- Scanner:
- BLK 360 2em Gen



4 mm à 10 m

Other?

- subcontractors managed by SCE/SAM



~ 15 mm

Scanning at CERN

- Georeferenced Survey Scans
- BE-GM-ASG



- Surveyors – Specialists
- Scans of large areas, with high accuracy
- Point Cloud Processing
- Delivery of the point cloud to the design offices in the form of boxes
- **Survey Scan Mesh Procedure:**
- <https://edms.cern.ch/document/1552431/1>
- Scan directly positioned in CCS in CATIA

- Additional Scans Non-georeferenced
- SCE/SAM, EN/ACE/INT, BE/EA/DC, EN/CV/DO

• Scanner:
• BLK 360 1ere
Gen



• Scanner:
• RTC 360



• Scanner:
• BLK 360 1ere
Gen



• Scanner:
• BLK 360 2em
Gen



- Design Office Technician
- Small Area Scans
- The design offices process their own point cloud
- **Additional Scan Mesh Procedure:**
- <https://edms.cern.ch/document/2539490/1>
- Scan to position manually in CATIA
- * Revit users directly use the point cloud

Scanning at CERN

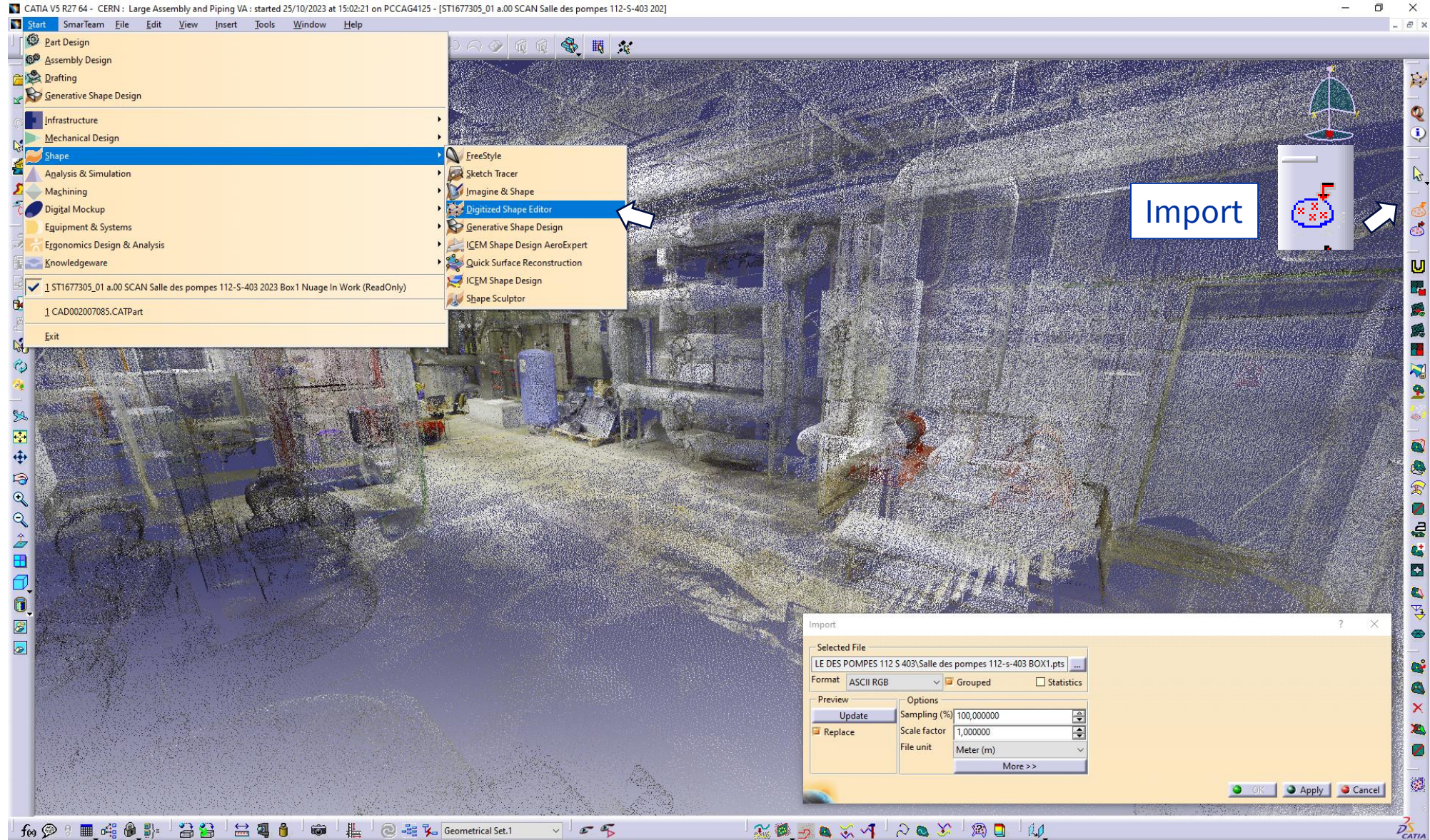
- Methodology

- .pts or .XYZ file

Salle des pompes 112-s-403 111g3
Salle des pompes 112-s-403 BOX1.pts
Salle des pompes 112-s-403 BOX2.pts

See:

- Survey Scan Mesh Procedure:
<https://edms.cern.ch/document/1552431/1>
- Additional Scan Mesh Procedure:
<https://edms.cern.ch/document/2539490/1>

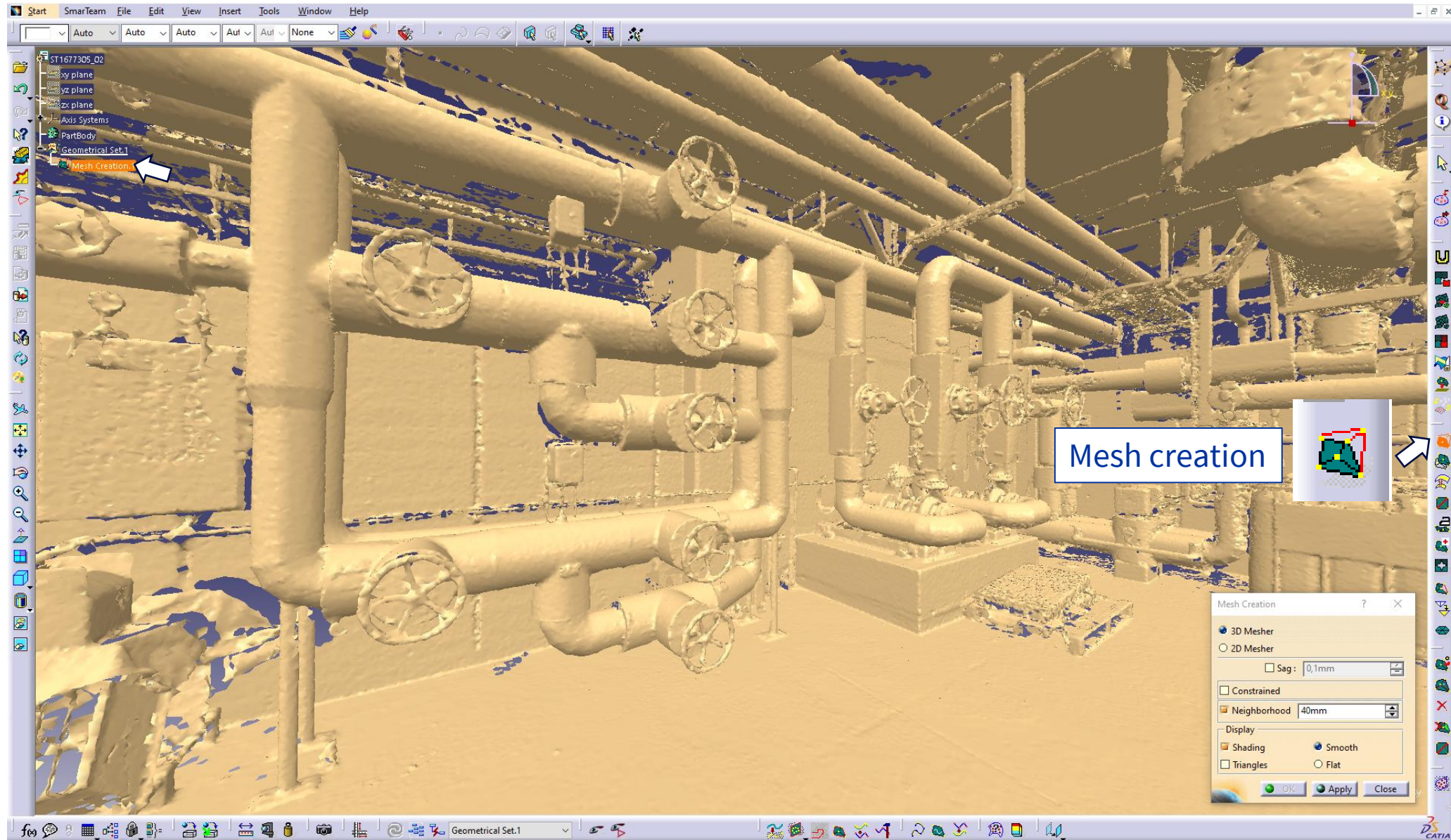


Scanning at CERN

- Methodology
- Detailed Mesh

See:

- Survey Scan Mesh Procedure:
<https://edms.cern.ch/document/1552431/1>
- Additional Scan Mesh Procedure:
<https://edms.cern.ch/document/2539490/1>

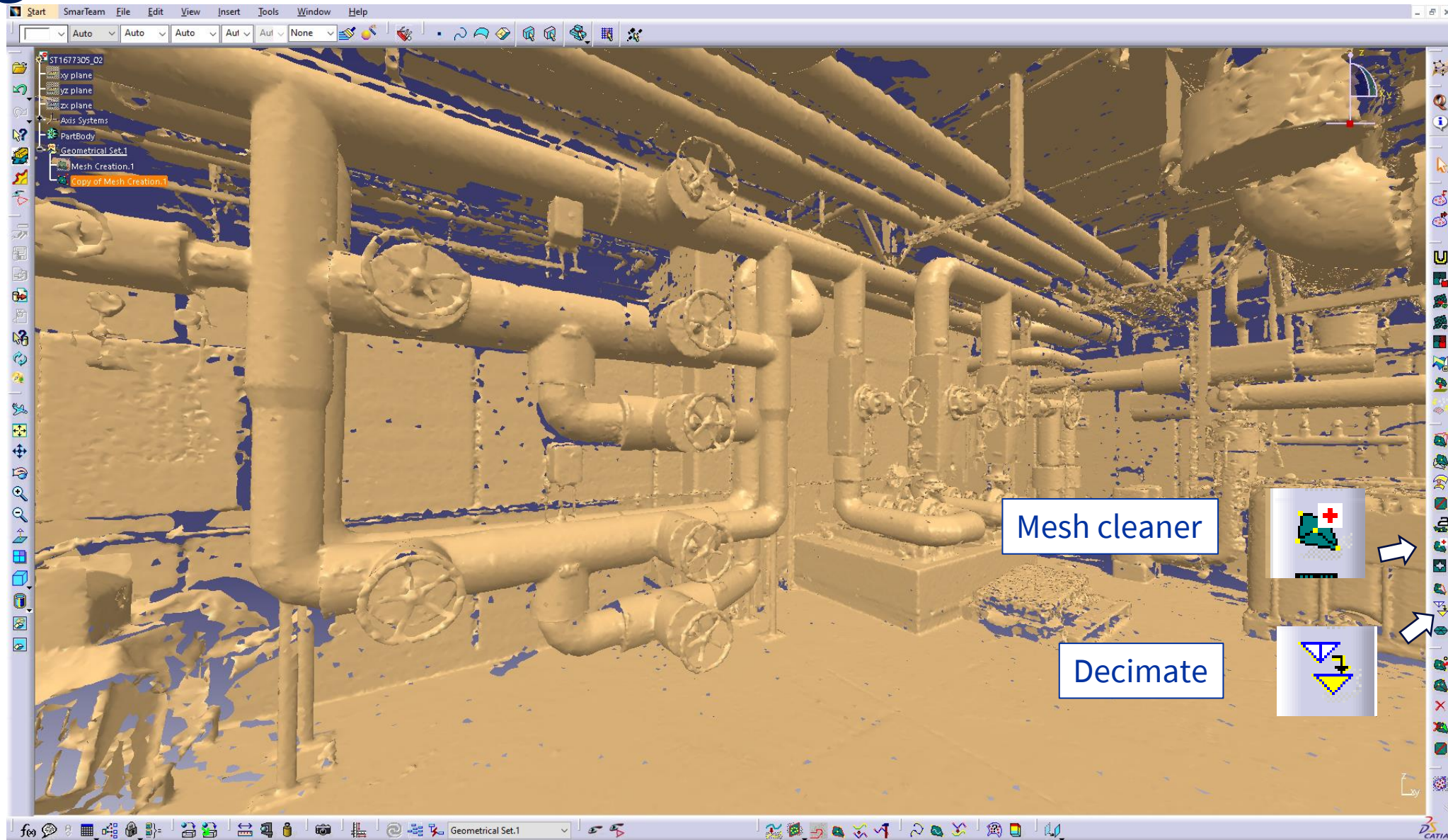


Scanning at CERN

- Methodology
- Simplified Mesh

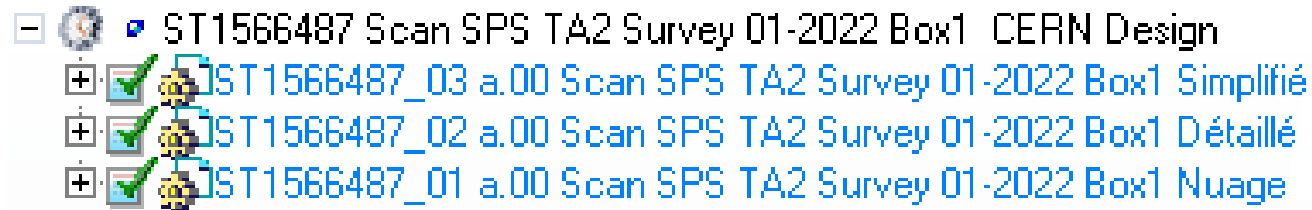
See:

- Survey Scan Mesh Procedure:
<https://edms.cern.ch/document/1552431/1>
- Additional Scan Mesh Procedure:
<https://edms.cern.ch/document/2539490/1>



Scanning at CERN

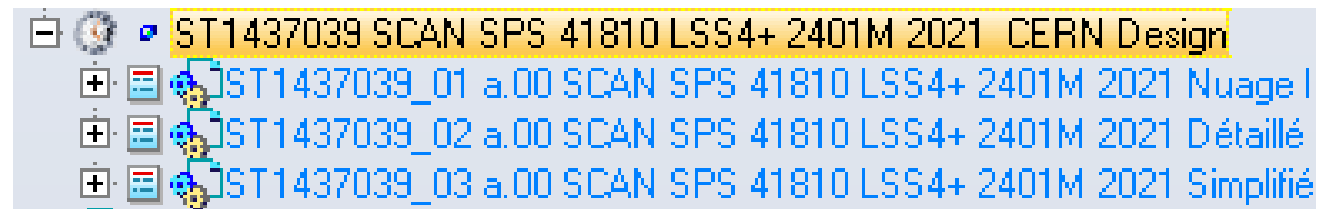
- Methodology
- Naming scans in the Smarteam directory:
 - Scan | Machine or Building Name | coordinate system (default Survey 0xyz) | Document Date | Document Name
- Example:



[-] [gear] [blue flag] ST1566487 Scan SPS TA2 Survey 01-2022 Box1 CERN Design

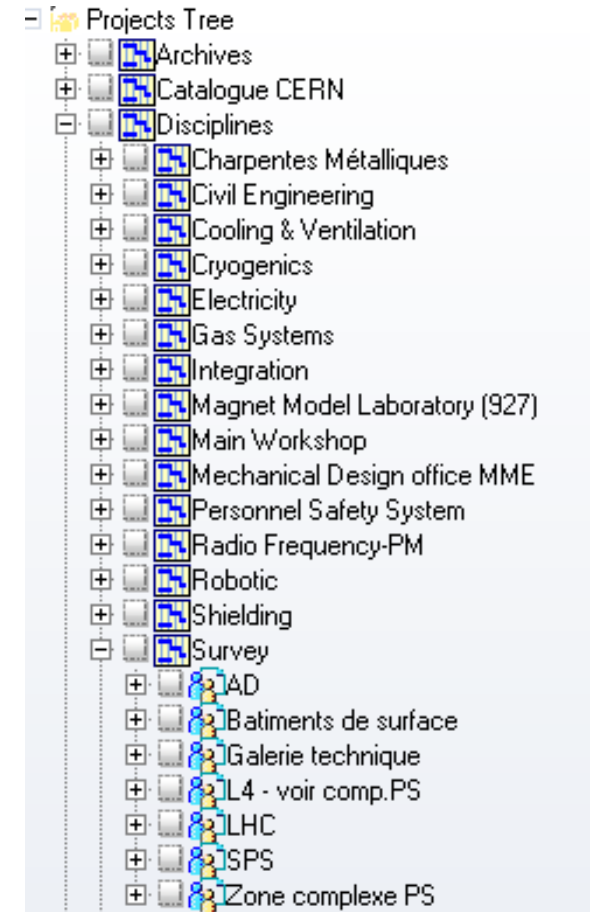
- [+] [checkmark] [globe] ST1566487_03 a.00 Scan SPS TA2 Survey 01-2022 Box1 Simplifié
- [+] [checkmark] [globe] ST1566487_02 a.00 Scan SPS TA2 Survey 01-2022 Box1 Détaillé
- [+] [checkmark] [globe] ST1566487_01 a.00 Scan SPS TA2 Survey 01-2022 Box1 Nuage

- For integration scans manually positioned in a georeferenced assembly, an "M" must be added after the coordinate system
- Example:



[-] [gear] [blue flag] ST1437039 SCAN SPS 41810 LSS4+ 2401M 2021 CERN Design

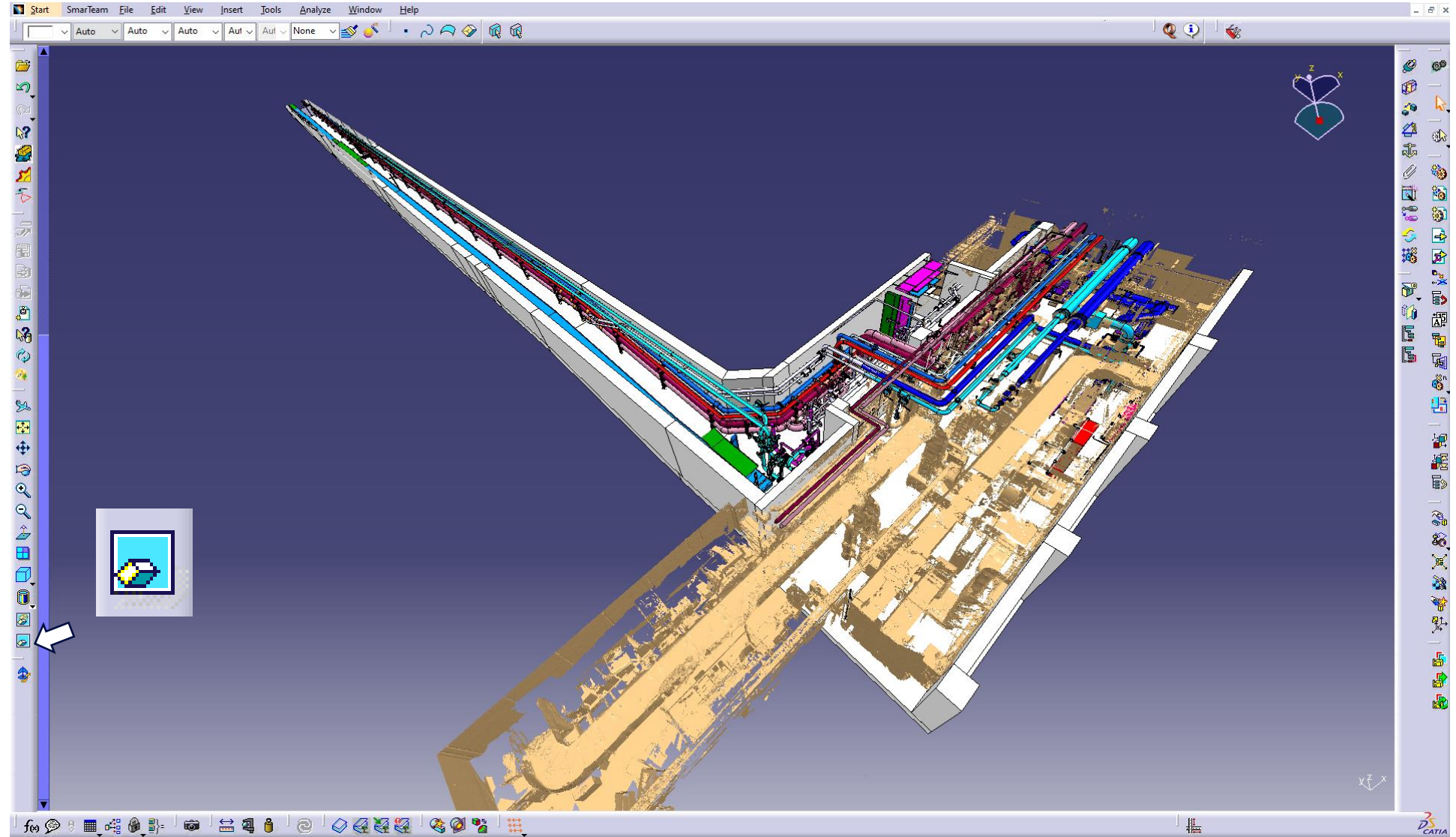
- [+] [checkmark] [globe] ST1437039_01 a.00 SCAN SPS 41810 LSS4+ 2401M 2021 Nuage |
- [+] [checkmark] [globe] ST1437039_02 a.00 SCAN SPS 41810 LSS4+ 2401M 2021 Détaillé
- [+] [checkmark] [globe] ST1437039_03 a.00 SCAN SPS 41810 LSS4+ 2401M 2021 Simplifié



Scanning at CERN

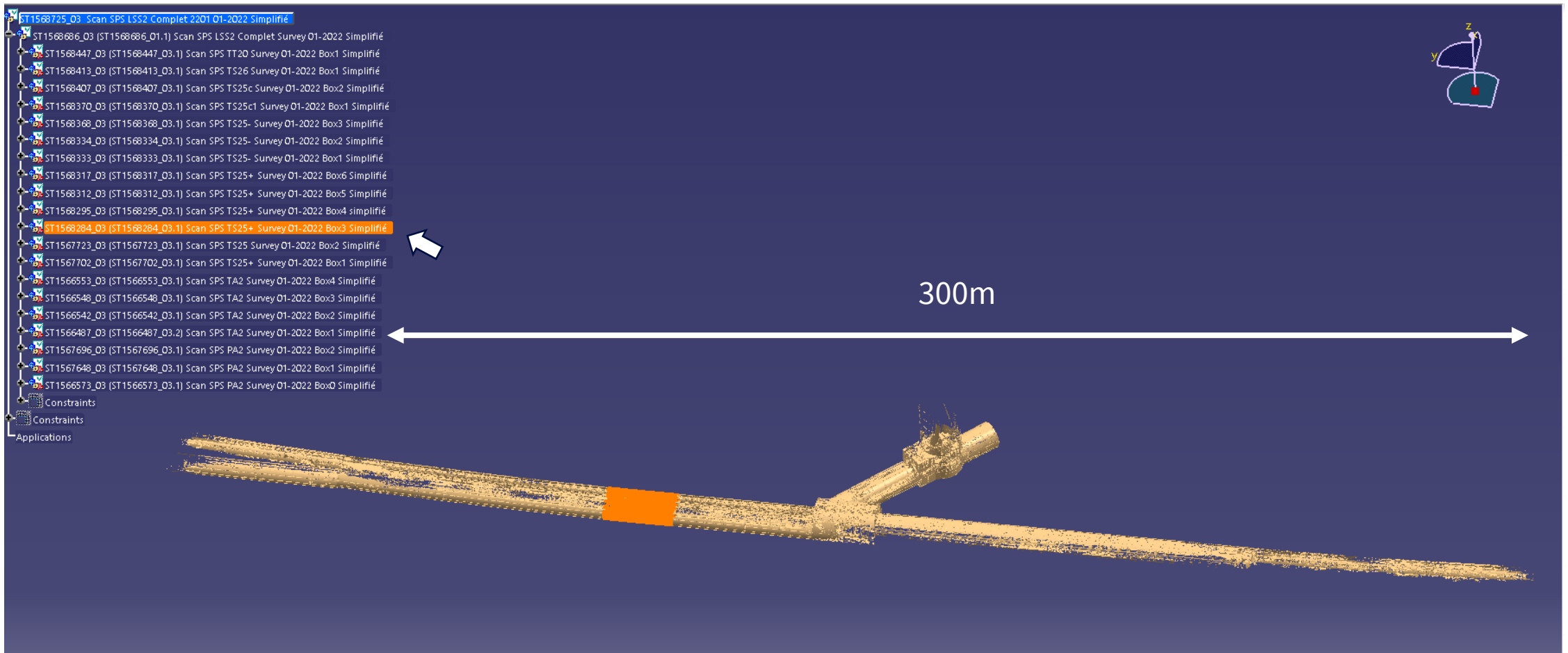
- Methodology
- Tip & Trick
- If you open a heavy scan or heavy mockup, 2x click on Swap visible space

this makes a more fluid navigation



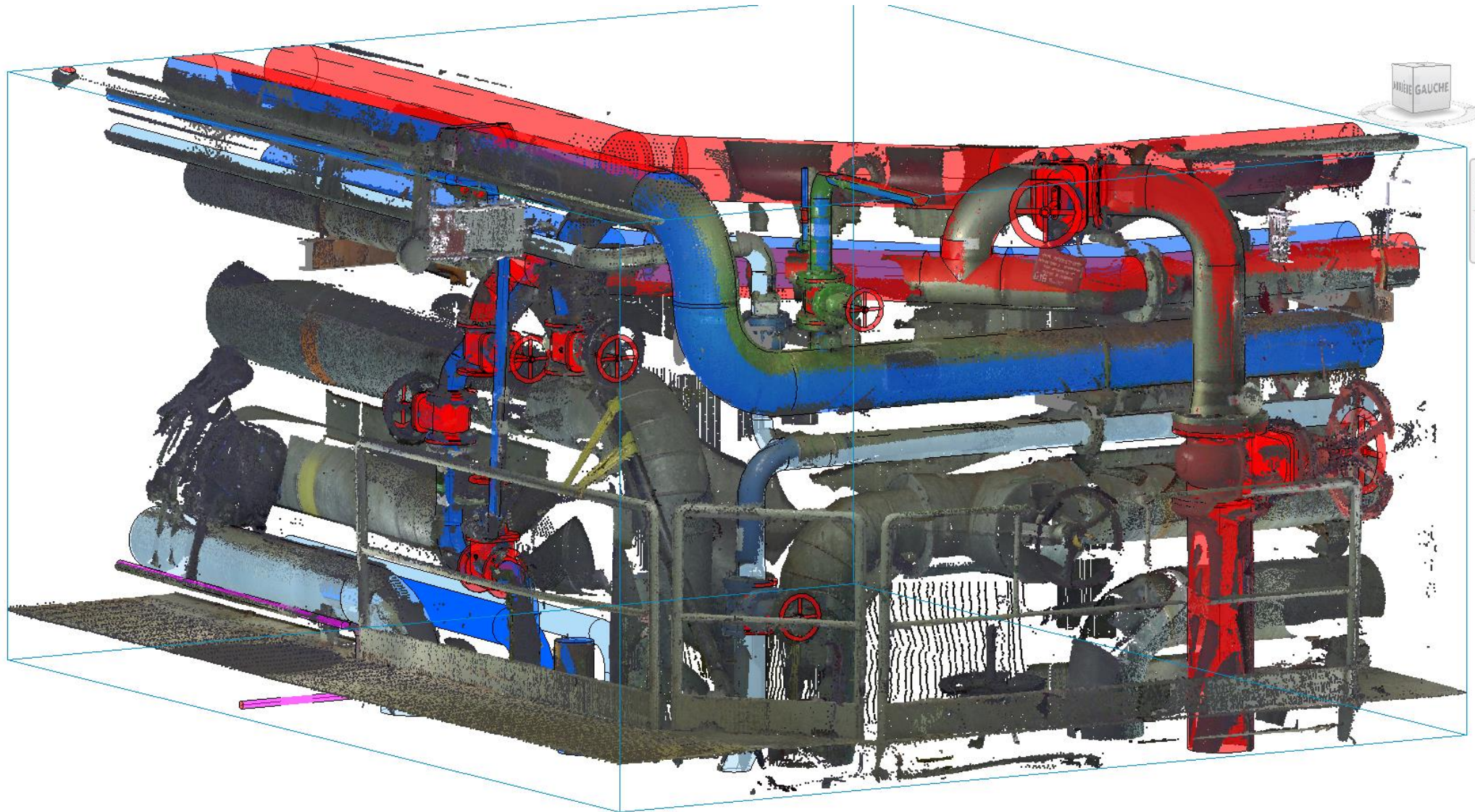
Scanning at CERN

- Methodology
- Tip & Trick
- The scans are assemblies cut into boxes, for more fluidity do not hesitate to hide the boxes that are not useful for your study



Scanning at CERN

- Methodology
- Revit
- Study directly with the point cloud



Scanning at CERN

- **Les Viewers**

- 360 photos + measurements

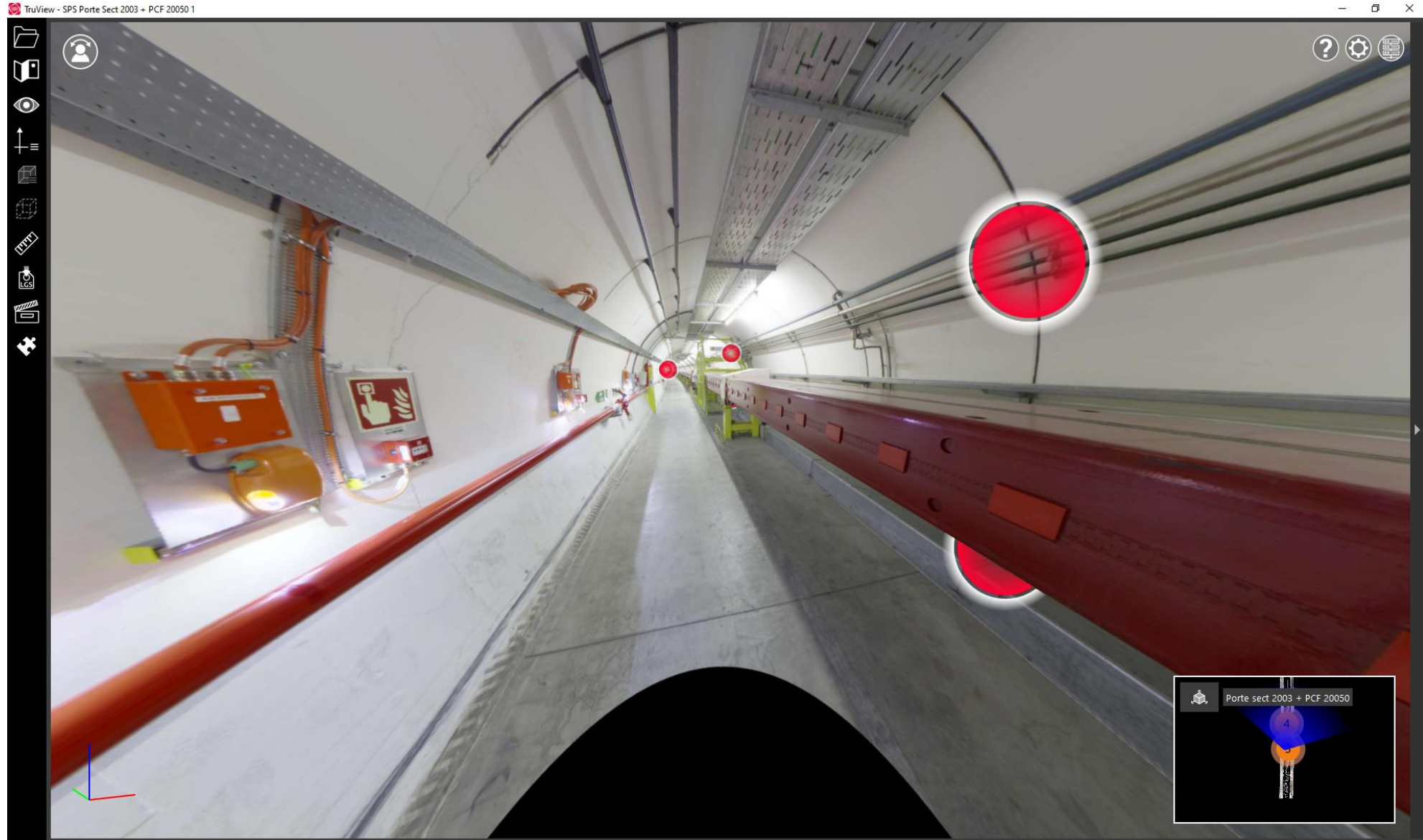
- Accessible to all

- See Methodology viewer survey:

- <https://edms.cern.ch/document/2665008/1>

- See Methodology viewer Truview:

- <https://edms.cern.ch/document/2665252/1>



Scanning at CERN

- **WG Scan mandated by the GUCC**
- **Participants: BE/GM/ASG - SCE/SAM/TG - EN/ACE/INT - BE/EA/DC - EN/CV/DO**
- Mandate:
 - Review of scanners and software used at CERN
 - Methodologies for using scanners and software
 - Point cloud storage methodology
 - The georeferencing process of point clouds will have to be explained
 - Point Cloud Processing Methodology Using CATIA V5
 - The storage of models in the future PLM will have to be studied
 - Methodology for importing point clouds into REVIT software

Scanning at CERN

- WG Scan mandated by the GUCC
- Centralize information with hardware and software methodologies: <https://edms.cern.ch/document/2922831/1>

The screenshot displays the CERN EDMS (Engineering Document Management System) interface. The top navigation bar includes 'EDMS', 'Home', 'Favourites', 'Inbox', and 'Caddie'. The main content area shows the document '2922831 v.1' titled 'GUCC WG#0 - Réalisation scans et traitements' by 'GUCC Steering'. The document is in 'In Work' status. The 'Details' section lists local administrators (CAEC), associated links, and equipment code (DOC-OWNER). The 'Files' section is currently empty. The 'More info' section includes a table of sub-documents.

#...	Id	Title	Files	Status	Created on	Author	Document type	Tags
10	2773962 v.1	Mandat groupe de travail realisation scans...	@ 1	Released	2022-01-17	Yvon Muttoni	Note	
20	2707223 v.1	Compte rendu 1ere reunion WG Réalisati...	@ 3	Released	2022-02-24	JEAN-BAPTISTE MA\	Presentation / Publ...	
30	2916431 v.1	Compte rendu 2eme reunion WG Réalisati...	@ 1	In Work	2023-07-14	JEAN-BAPTISTE MA\	Note	
40	2922705 v.0.1	Bilan WG Réalisation des scans au CERN	@ 1	Under Approval	2023-07-31	JEAN-BAPTISTE MA\	Presentation / Publ...	
50	2798521 v.1	Cibles Georef avec BLK360	@ 1	In Work	2022-11-15	JEAN-BAPTISTE MA\	Presentation / Publ...	
60	2539490 v.1	Protocole de maillage des scans realises ...	@ 1	In Work	2021-04-12	JEAN-BAPTISTE MA\	Presentation	
70	2558377 v.1	Tuto utilisation Cyclone Field	@ 2	In Work	2021-04-14	JEAN-BAPTISTE MA\	Presentation	
80	2593866 v.1	Tuto Utilisation Cyclone Register 360	@ 2	In Work	2021-06-08	JEAN-BAPTISTE MA\	Manual / Guideline	
90	2665008 v.1	Viewer des scans Survey	@ 1	In Work	2021-11-22	JEAN-BAPTISTE MA\	Manual / Guideline	
1...	2665252 v.1	Viewer des scans intégration Truview	@ 1	In Work	2021-11-23	JEAN-BAPTISTE MA\	Manual / Guideline	
1...	1552431 v.1	SCAN OF THE SURVEY	@ 1	Released	2015-10-09	Frederic LUIZ	Manual / Guideline	

Intégration




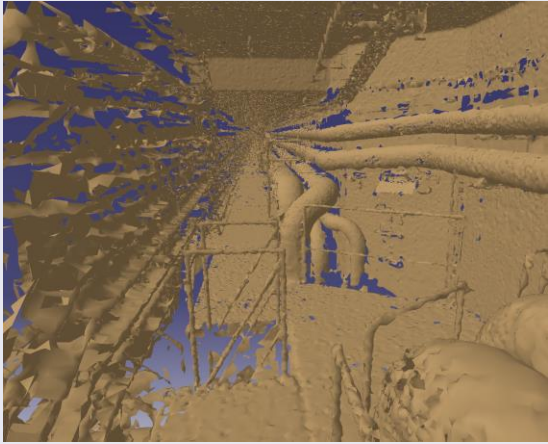
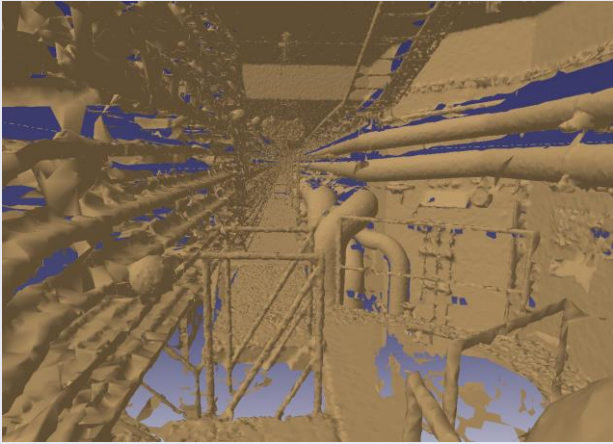
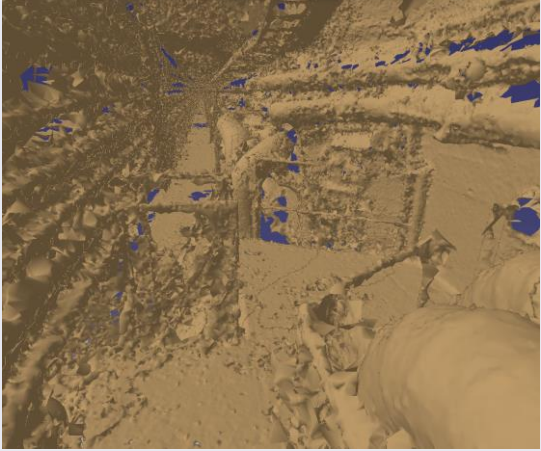
Protocole de maillage des scans réalisés par l'Intégration



Scanning at CERN

- **WG Scan mandated by the GUCC**

- Sharing information on tips and tricks of software, hardware, and technology watch
- Example: Testing scanners in the Technical gallery, these scans were performed by subcontractors managed by SCE/SAM
- This activity being new, the integration and the design offices participated in the selection and choice of scanners to be used.

Scanner	BLK2GO	Static Trimble	Photogrammetric Scanner
Conclusion	Perfect for completeness of piping, not taken by the static scanner	Optimal: Accuracy / Alignment /Quality / Noise / Resolution	Technology not precise enough for our needs
Photo			
Mesh			

Scanning at CERN

- **WG Scan mandated by the GUCC**

- Share the progress of R&D in the improvement of the processing of scans by each department and the exchange of different techniques.
- Exemple :
- To pass from point cloud to mesh on Catia, this operation takes a lot of time.
- BE-EA-DC has developed a meshing software (still prototype): <https://cernbox.cern.ch/s/AVKyTMEHqMZOMpG>

UI prototype - Point cloud to 3D mesh compiler



Select algorithm Parameters



4: Enter parameters as needed



Courtesy
Kevin Buffet
Jelle Metselaar

Scanning at CERN

- **WG Scan mandated by the GUCC**

- There is great interest in the future PLM in order to be able to store scans of all services in a common directory that is available to all services
- A methodology for managing scans in PLM will need to be drafted

The screenshot displays the PLM system interface for a part scan. The main content area is divided into several sections: General Information, System Information, Part Information Summary, Workflows, and Baselines. A red arrow points to the 'Make / Box' dropdown menu, which is set to 'CERN Design'. Below the main content, a table of CAD Documents is visible, with two rows highlighted in red.

Type	Document	Gen.	Is Cur.	Definition	CERN Drawing Refer...	State	Design Cod...	Responsibl...	Repr...	Material [...]	Mass ...	Catal...	Stand...	Created From...	Claimed By ...	Created By...	Froz...	Previous
Mechanical/Part	ST2218023_01	AA.01	1	✓	Scan LEIR Survey 2022 Box1 Cloud	In Pre...	ARASINTEG...		Other						Daniel del Al...	Daniel del ...		
Mechanical/Part	ST2218023_02	AA.01	1	✓	Scan LEIR Survey 2022 Box1 detailed	In Pre...	ARASINTEG...		Master		1122.73			ST2218023_0...	Daniel del Al...	Daniel del ...		

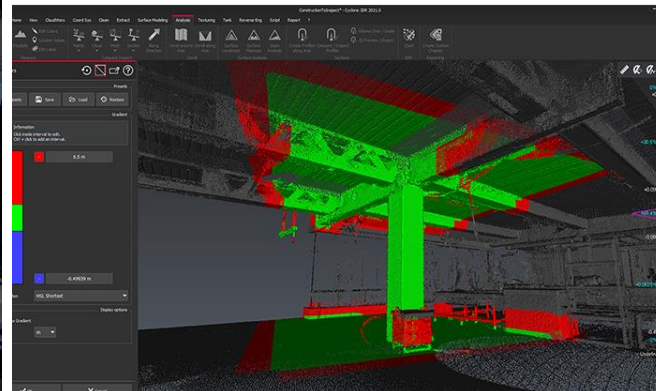
Courtesy
Daniel Del Alamo

- For the moment, we have shared the shortcuts of the scan folders of each service and the links in smarteam
- `\\eosproject-smb\eos\project\w\working-group-realisation-scans`

Scanning at CERN

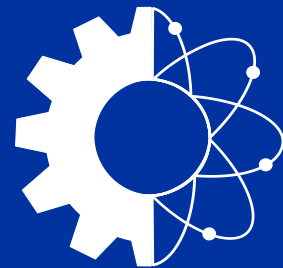
- **Other WG's recommendation:**

- Study software to create better quality meshes, faster and compatible with Catia
- Pooling orders for licenses and hardware could perhaps save money
- Technology watch
- For these reasons, the WG scan recommends keeping this WG alive in the GUCC by conducting one or more annual meetings



Thank you

Do you have questions?



**ENGINEERING
DEPARTMENT**



Jean-Baptiste MAYOLINI EN-ACE-INT - <https://edms.cern.ch/document/2975140/1>