SMB-SE-TOD

3D modelling/integration @ CERN for civil engineering

Agenda

- Presentation of the service in the CERN general organisation
- Activity of the Civil Engineering Design Office
- 3D Design
- Integration

CIVIL ENGINEERING INTERACTION WITH CERN DEPARTMENTS

Organisation at CERN (main participants in the integration process)

EN
Engineering

EP
Experimental Physics

BE
Beams

SE
TOD
TO

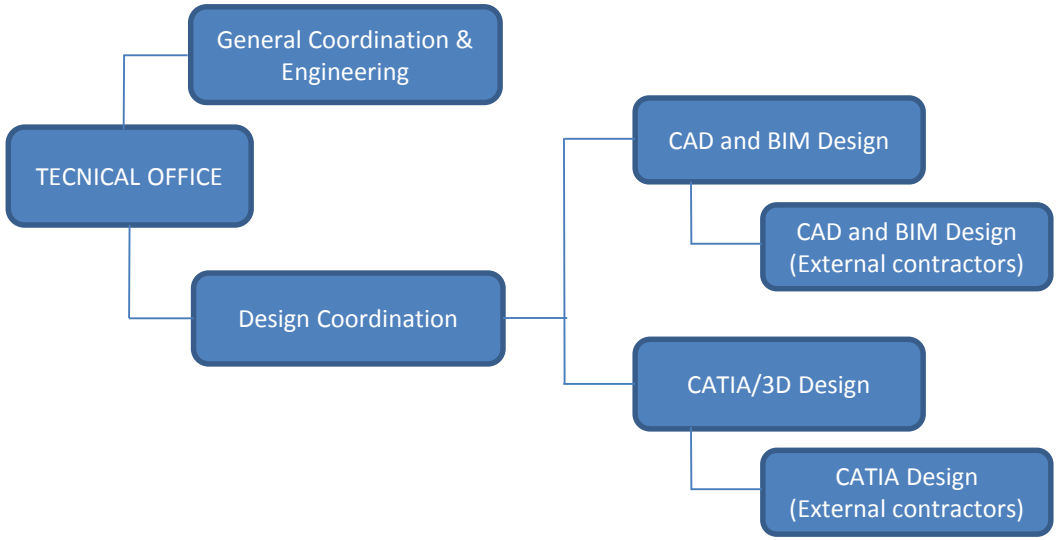
SMB
Site Management & Buildings

TE
Technology

TECHNICAL OFFICE MANDATE

- The modelling of structures in 3D
- The study and design of Civil Engineering works (underground, surface, special works, piping networks, roads and landscaping)
- The 2D integration
- The support to project managers and work requesters

ORGANIGRAM



TECHNICAL OFFICE ACTIVITY

Support for:

- Engineering design/calculation
- Future projects (*SMB-SE-FAS Future Accelerator Studies*)
- Feasibility studies
- Preliminary studies
- Project managers
- Site supervision / work request
- Interface with other CERN services / Integration
- Interface with external consultants

OBJECT OF CIVIL ENGINEERING 3D MODELLING

SMB-SE-TOD : Our level of intervention

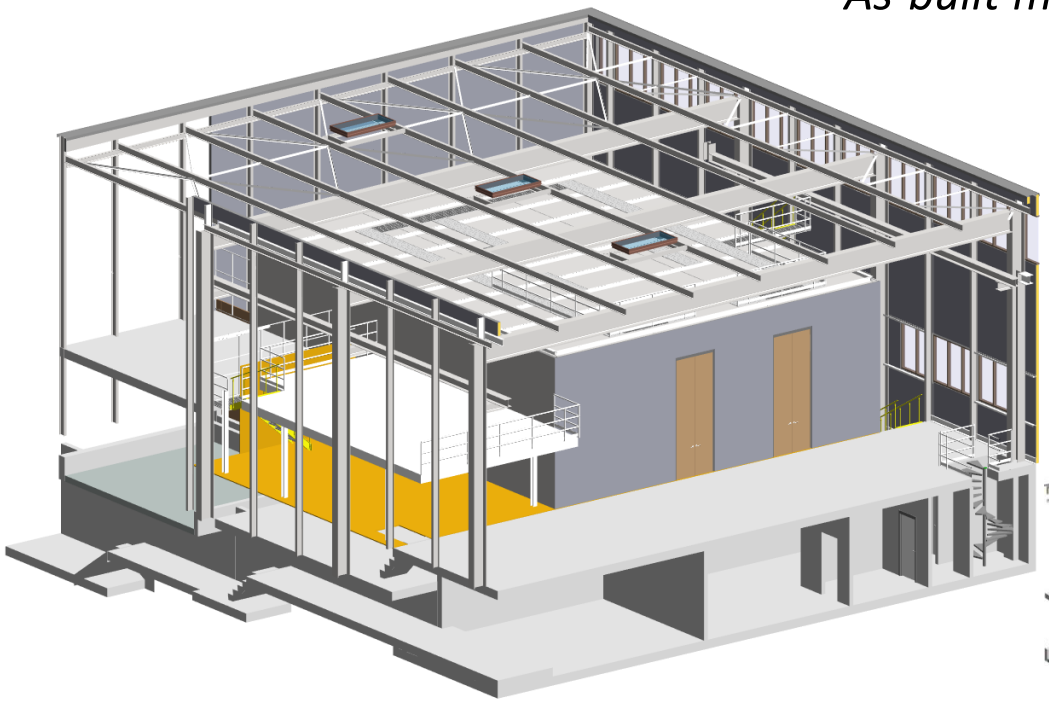
Type of element	Type of work	Project phases	Main tools
• Concrete structures • Steel structures • Buildings • Tunnels/galleries • Networks/landscaping	• New structures and buildings • Modification of existing structures • Total or partial refurbishment • Geometrical studies (networks, terrain, levels,….)	• Feasibility study • Preliminary design • Construction design • As-built	 

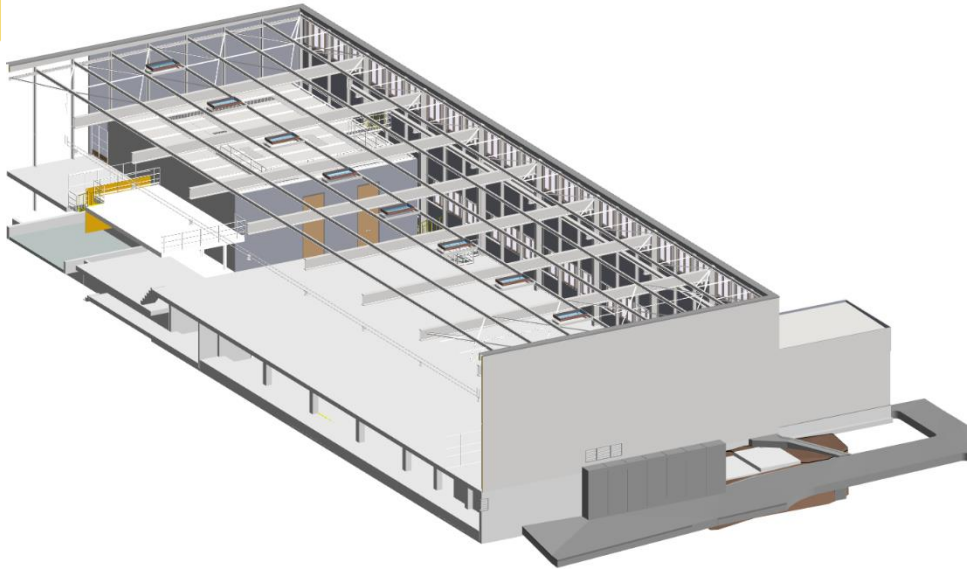
OBJECT OF CIVIL ENGINEERING 3D MODELLING - EXAMPLES

Surface structures

BUILDING 113

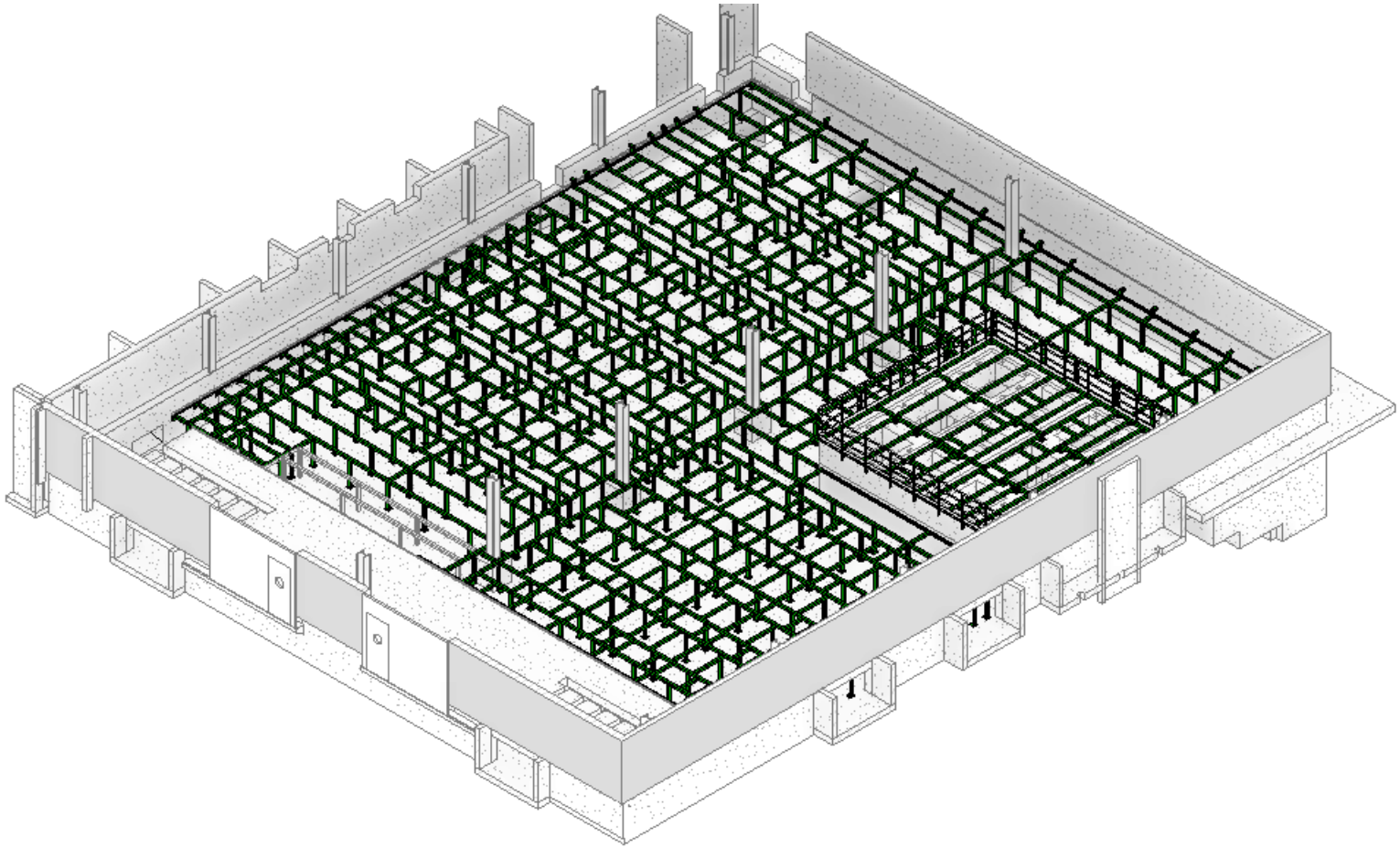
As-built model for HVAC





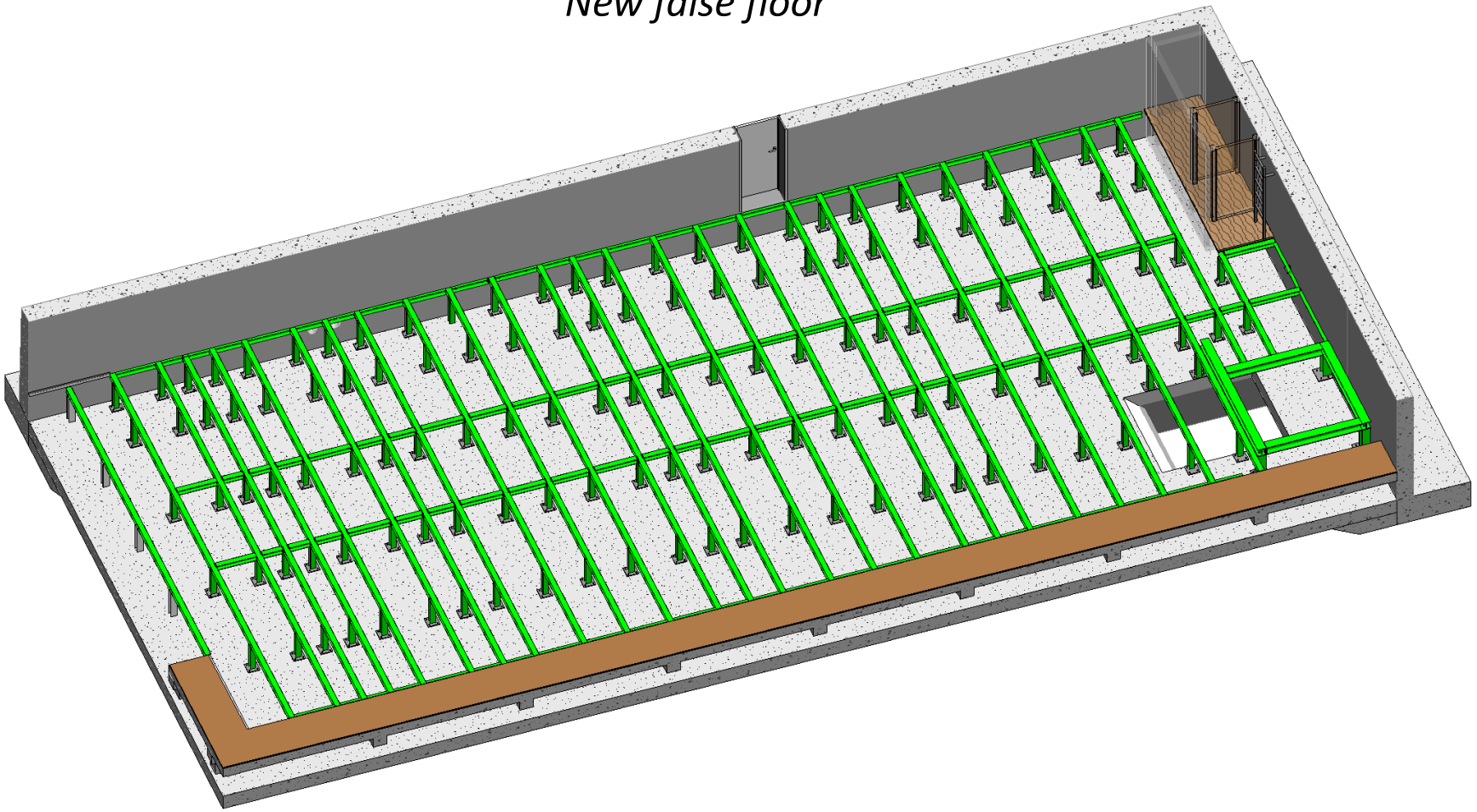
BUILDING 251

New false floor



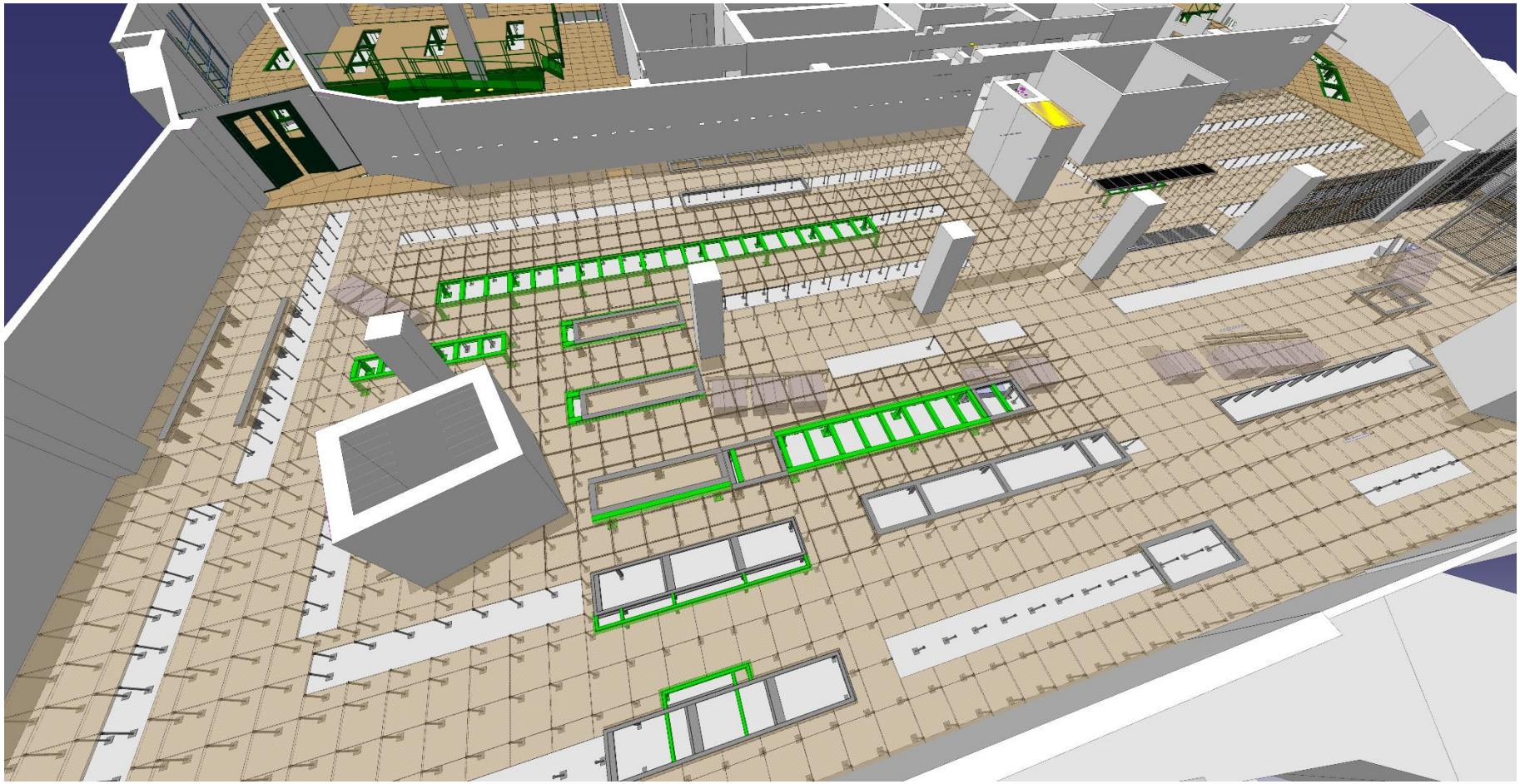
BUILDING 269

New false floor



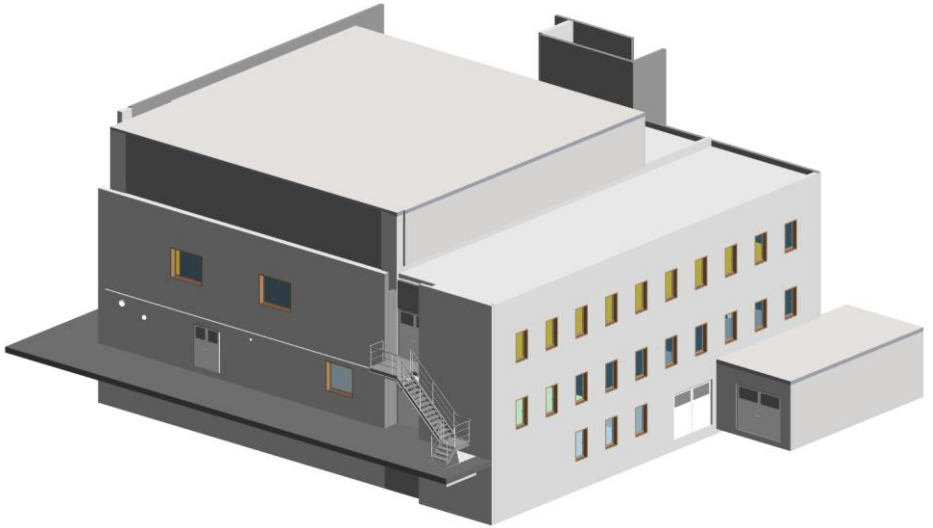
BUILDING 361

Modification of false floor



BUILDING 376

As-built model for refurbishment

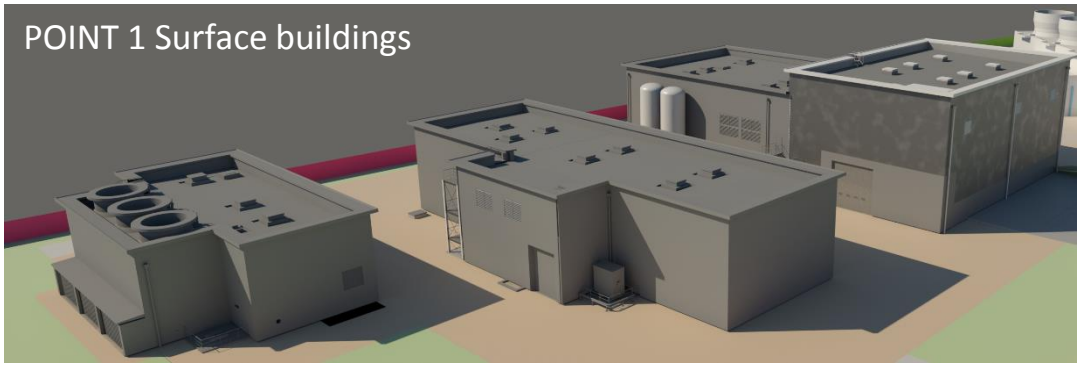


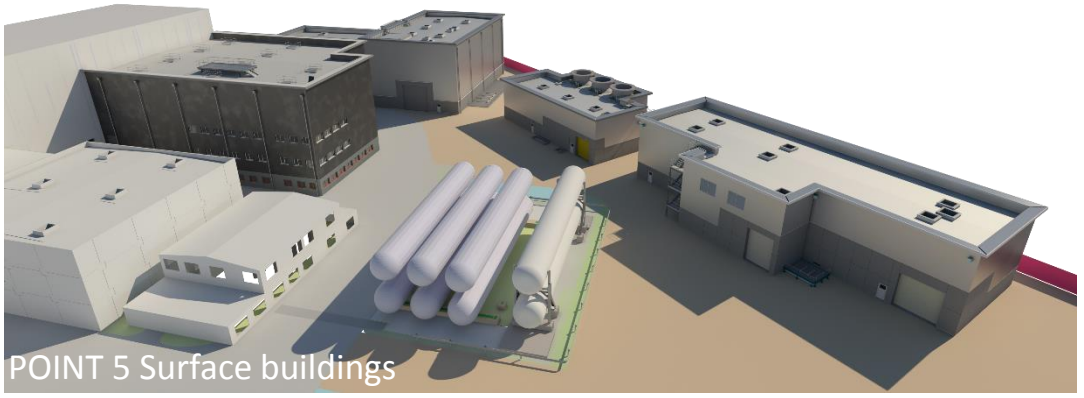
OBJECT OF CIVIL ENGINEERING 3D MODELLING - EXAMPLES

Surface structures

HL-LHC - HIGH LUMINOSITY

New infrastructures connected to LHC



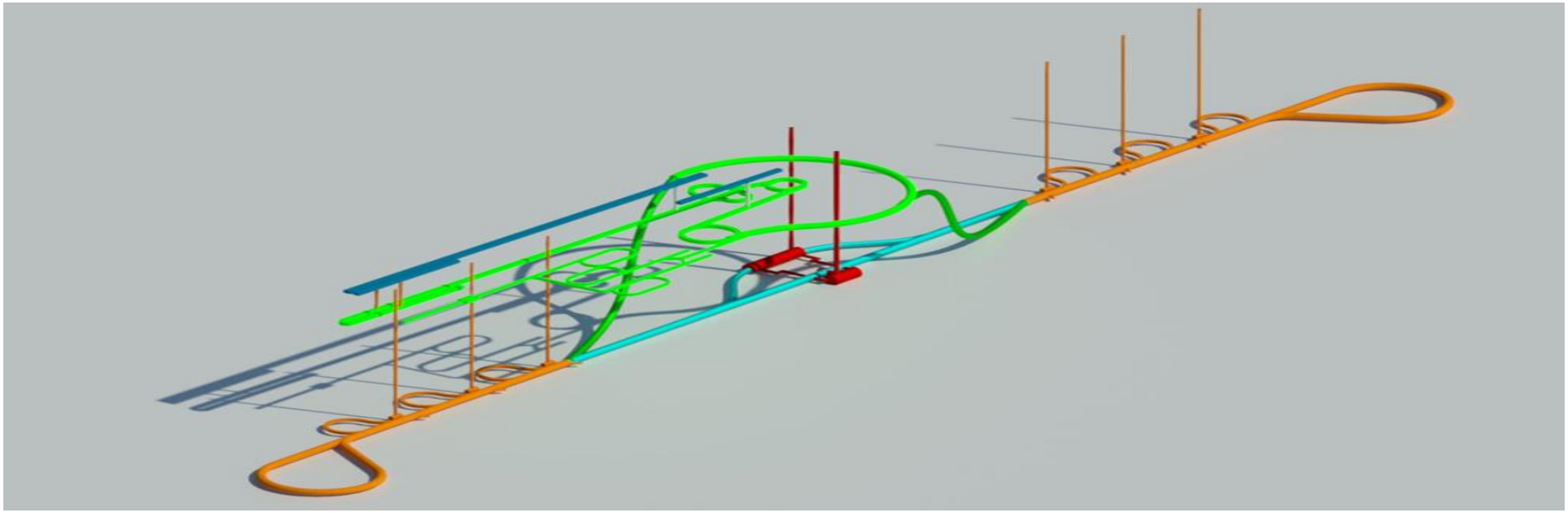


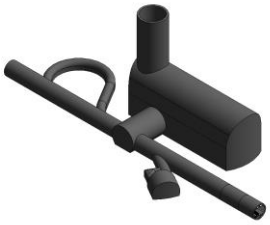
OBJECT OF CIVIL ENGINEERING 3D MODELLING - EXAMPLES

Underground structures

COMPACT LINEAR COLLIDER

Feasibility study





DRIVE BEAM LOOP AND BEAM DUMP

TYPICAL SECTION

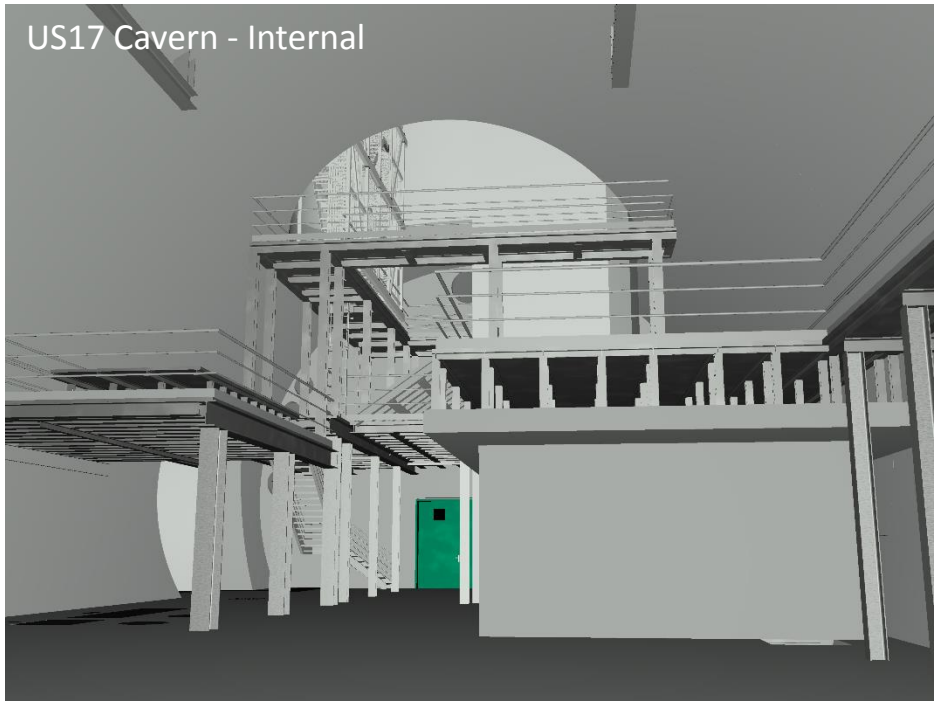
DETECTOR HALL AREA

OBJECT OF CIVIL ENGINEERING 3D MODELLING - EXAMPLES

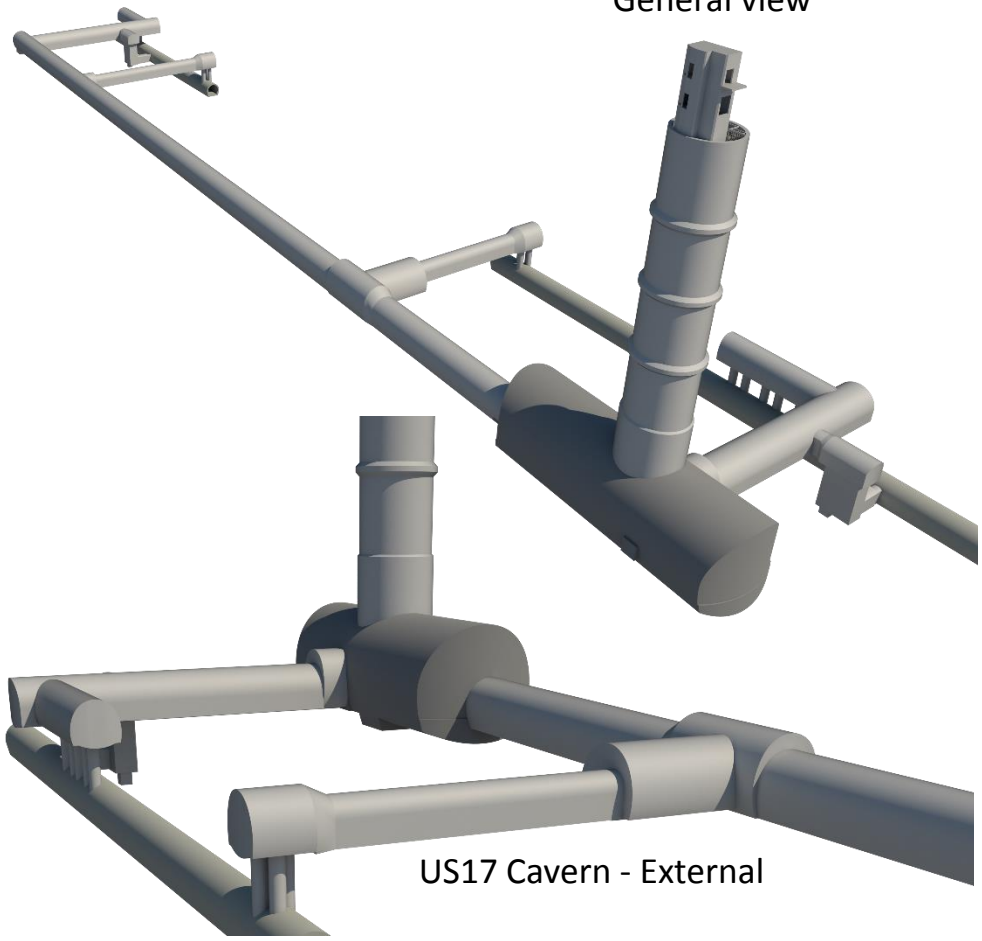
Underground structures

HL-LHC - HIGH LUMINOSITY

New infrastructures connected to LHC



General view



US17 Cavern - External

CIVIL ENGINEERING 3D MODELLING PROCESS

Process for civil engineering models

BASICS

Definition of Coordinate system and origin
Template for the 3D model

Foundation

Main structure

DEVELOPMENT

Interfaces with other disciplines

Envelope (Façade-Roof)

Secondary structures

DETAILS

Definition of the accuracy needed for each part/element

Details, Finishes

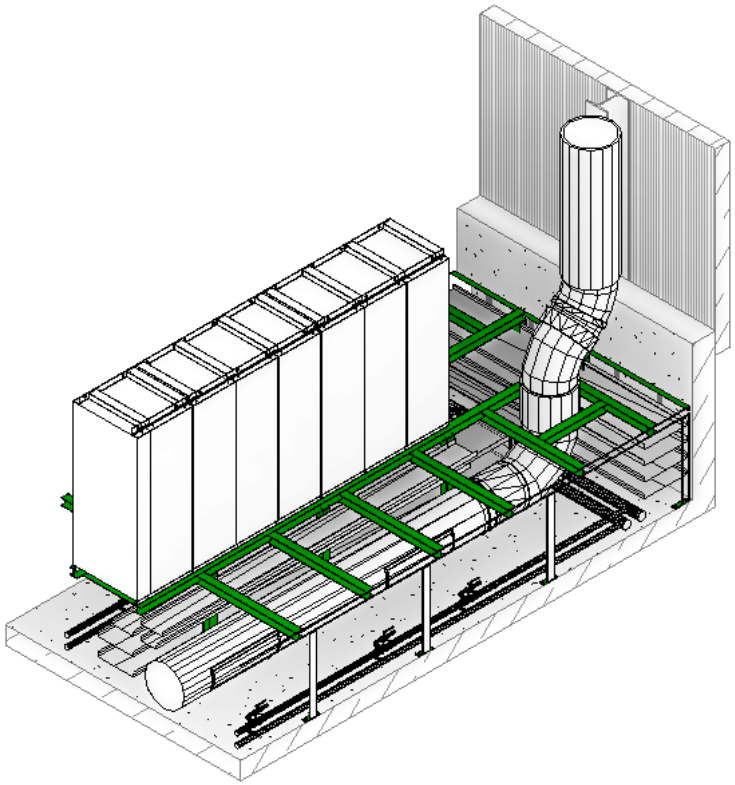
Check on site

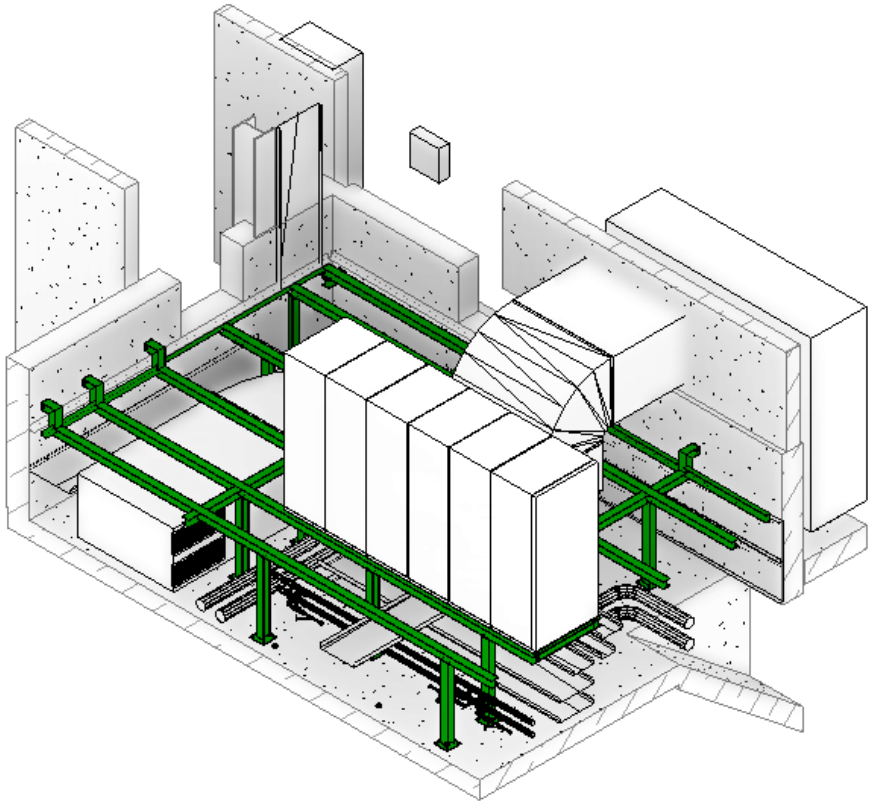
3D scan

BUILDING 251

New false floor

The new false floor structure has been defined according to the position of racks and ducts. Cable trays has been adapted to this new structure

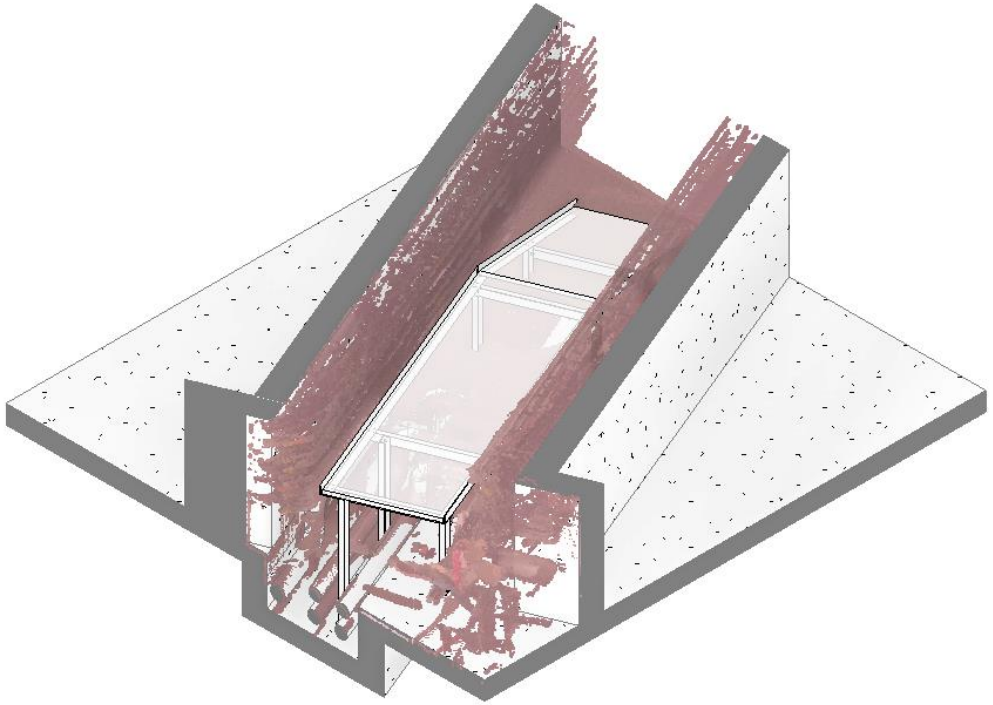


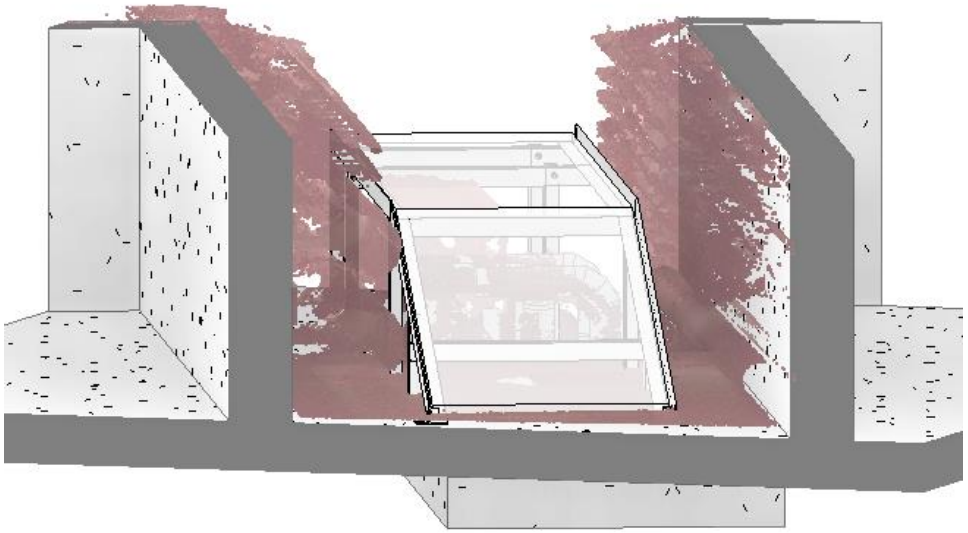


BUILDING 353

Details for ramp

New ducts were installed. The integration model was not acurate enough for the design of the new structure. It was needed a 3D scan to design a new structure with an error of less of 2-3 cm.

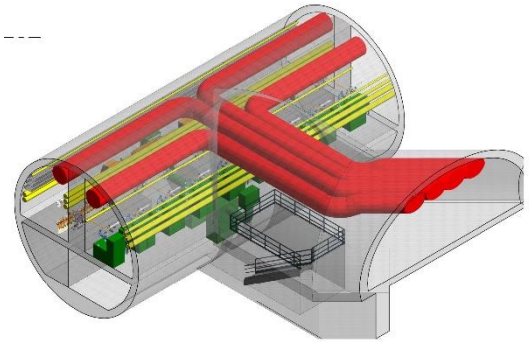


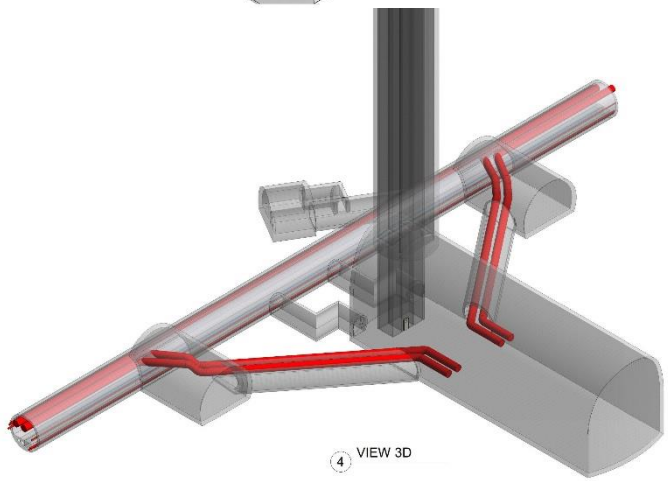


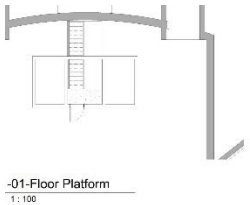
COMPACT LINEAR COLLIDER

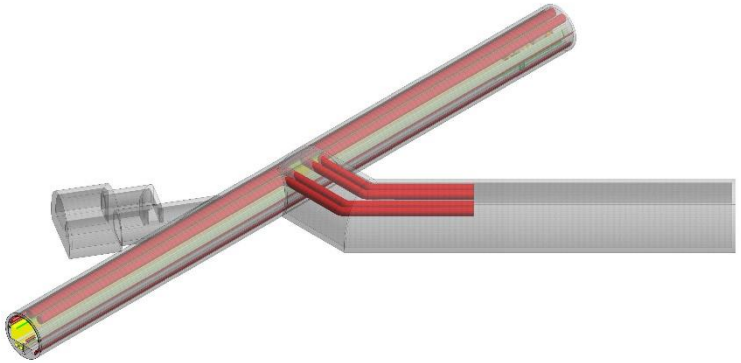
Feasibility study

Space verification with services









Oriented to work with external civil engineering consultants

AUTOCAD

AUTODESK CIVIL3D

RECAP

AUTODESK NAVISWORKS

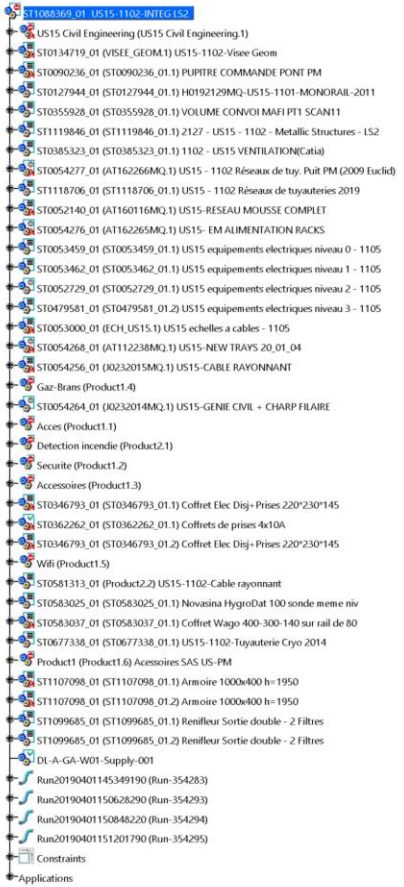
CATIA

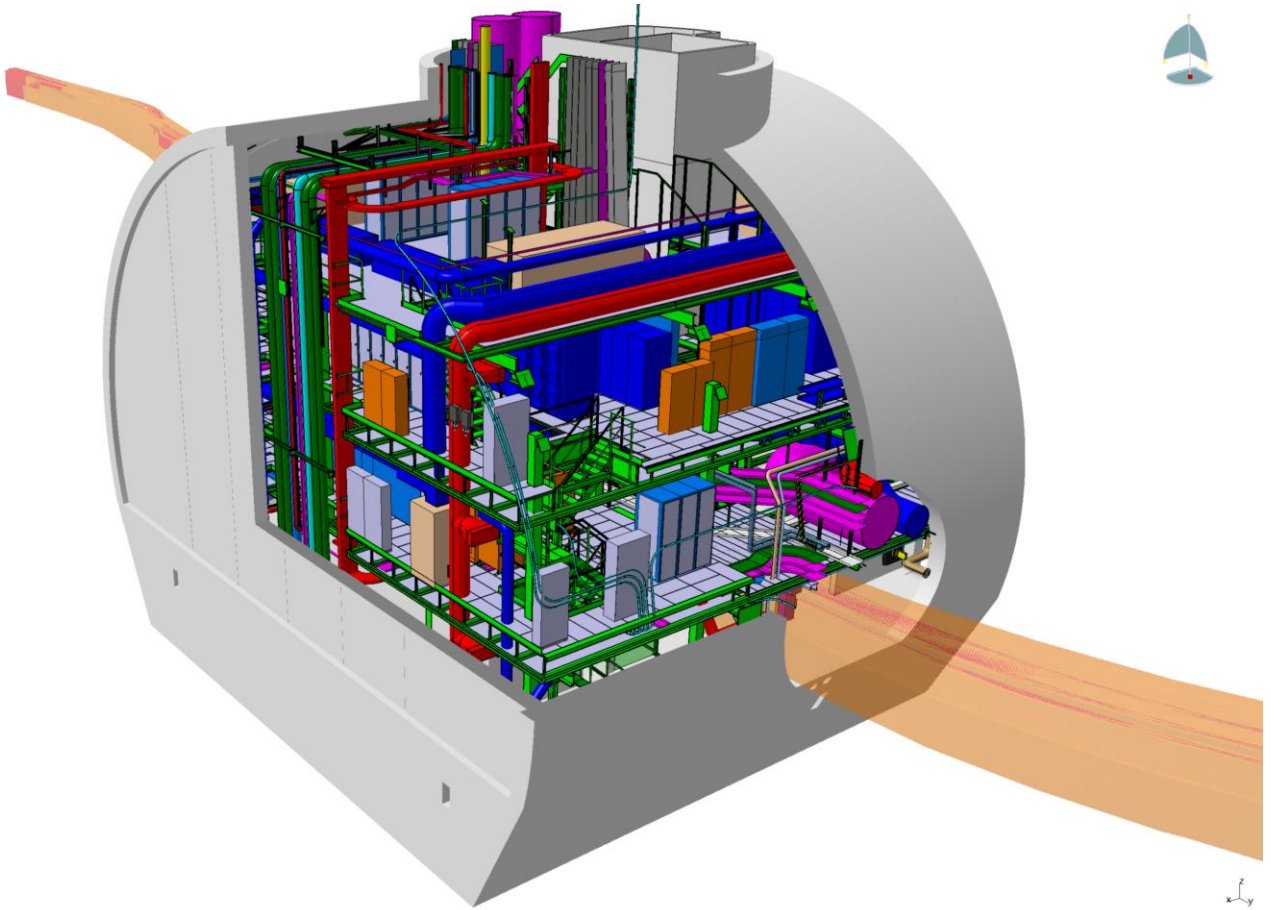
CERN Integration 3D models

Connection of the models of each discipline	Clash detection	Coordination Make decisions	Define new needs/tasks
⇩	⇩	⇩	⇩
One global model available to everybody	Anticipate problems	Global view for the whole project to select the best option	Any decision could need a complementary information

CATIA - Product structures

The arborescent of the model shows the different disciplines (CERN departments)



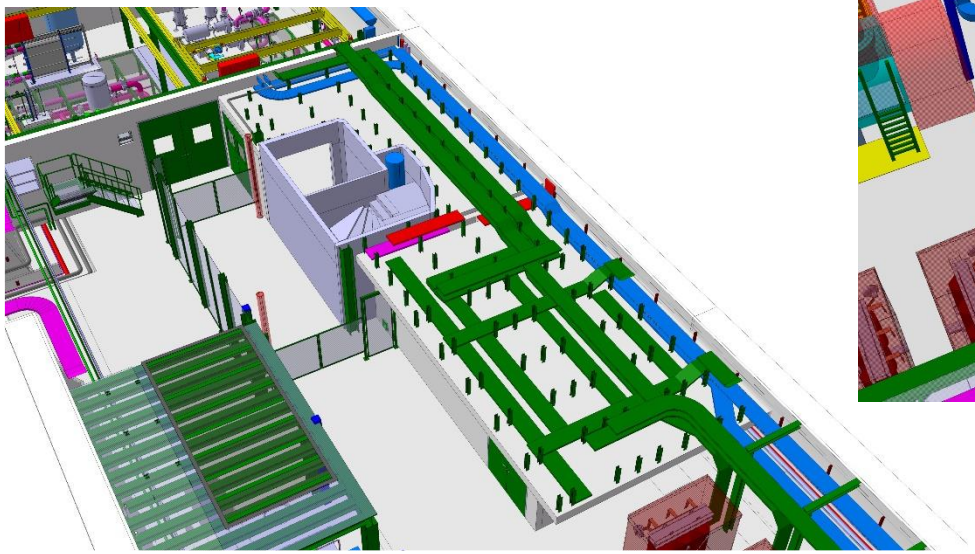


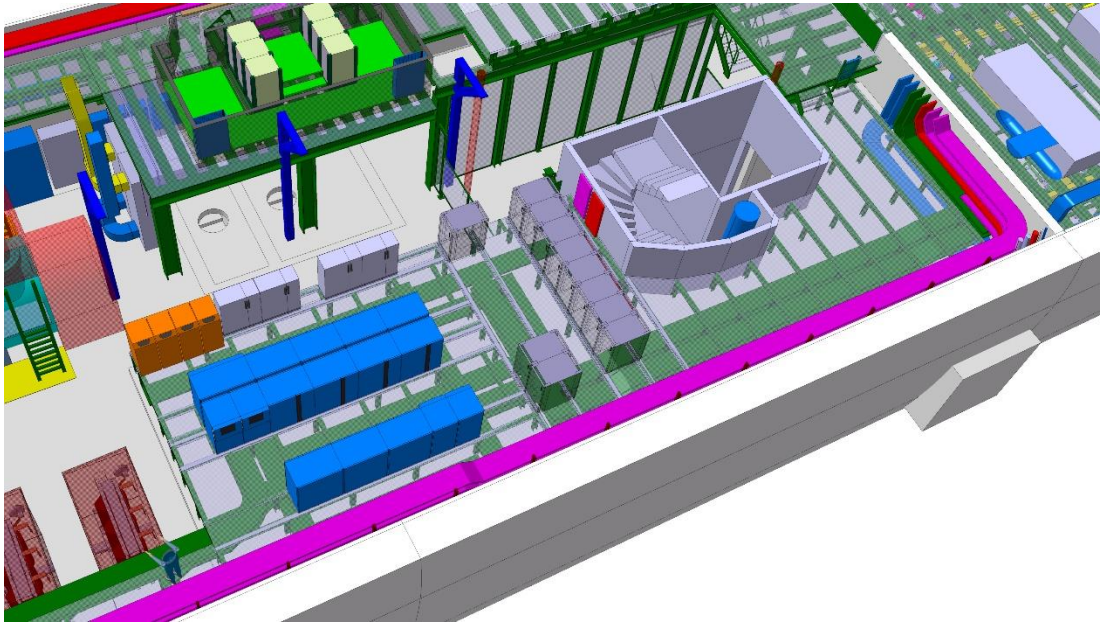
HL-LHC - HIGH LUMINOSITY

New infrastructures connected to LHC

ONE CATIA MODEL GATHERING ALL DISCIPLINES

- Solve the problems
- Make decisions (who modify what)



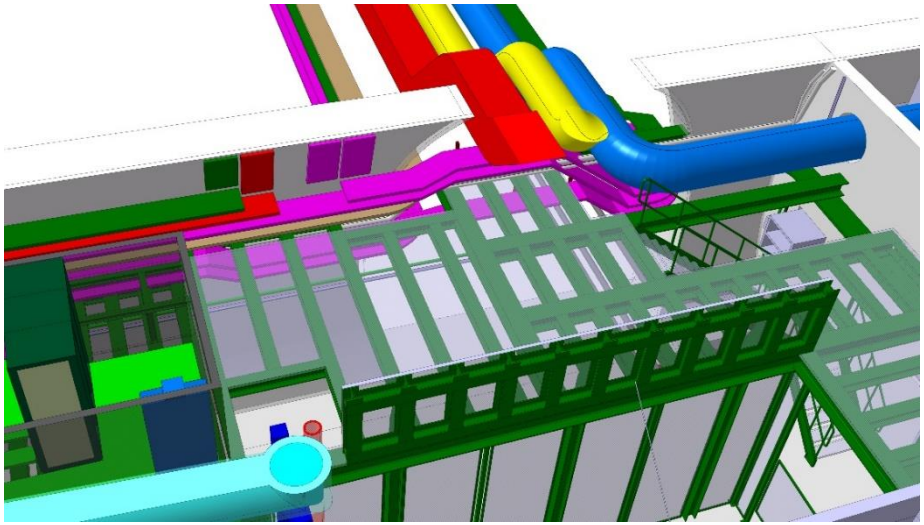


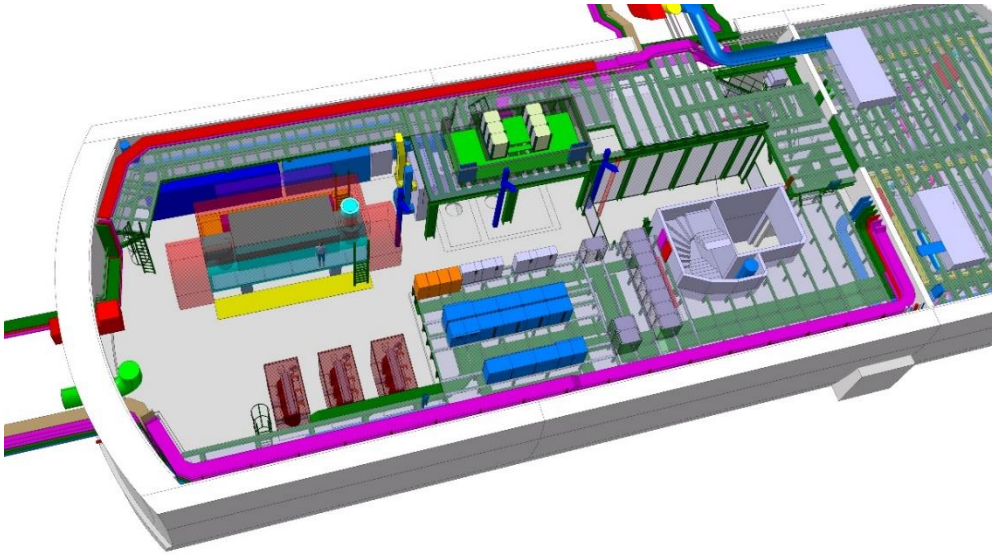
HL-LHC - HIGH LUMINOSITY

New infrastructures connected to LHC

ONE CATIA MODEL GATHERING ALL DISCIPLINES

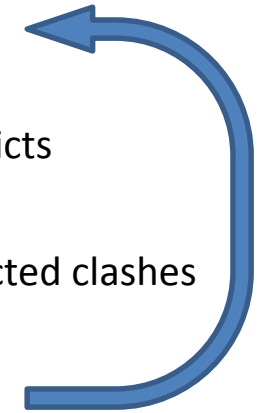
- Clash detection
- New models need new data-details





Process for CERN Integration models

- Definition of the platform and version for the coordination (Catia/Revit/Navisworks)
- Base Model ⇒ Civil Engineering/Architecture (transformation into a Catia/Revit/IFC or a compatible model)
- Addition of each discipline in the adequate format
- Check the information of each model
- Check the clash detection and generate a report of conflicts
- Coordination meeting ⇒ Propose a solution to the detected clashes
- Modification request ⇒ New models to be checked…



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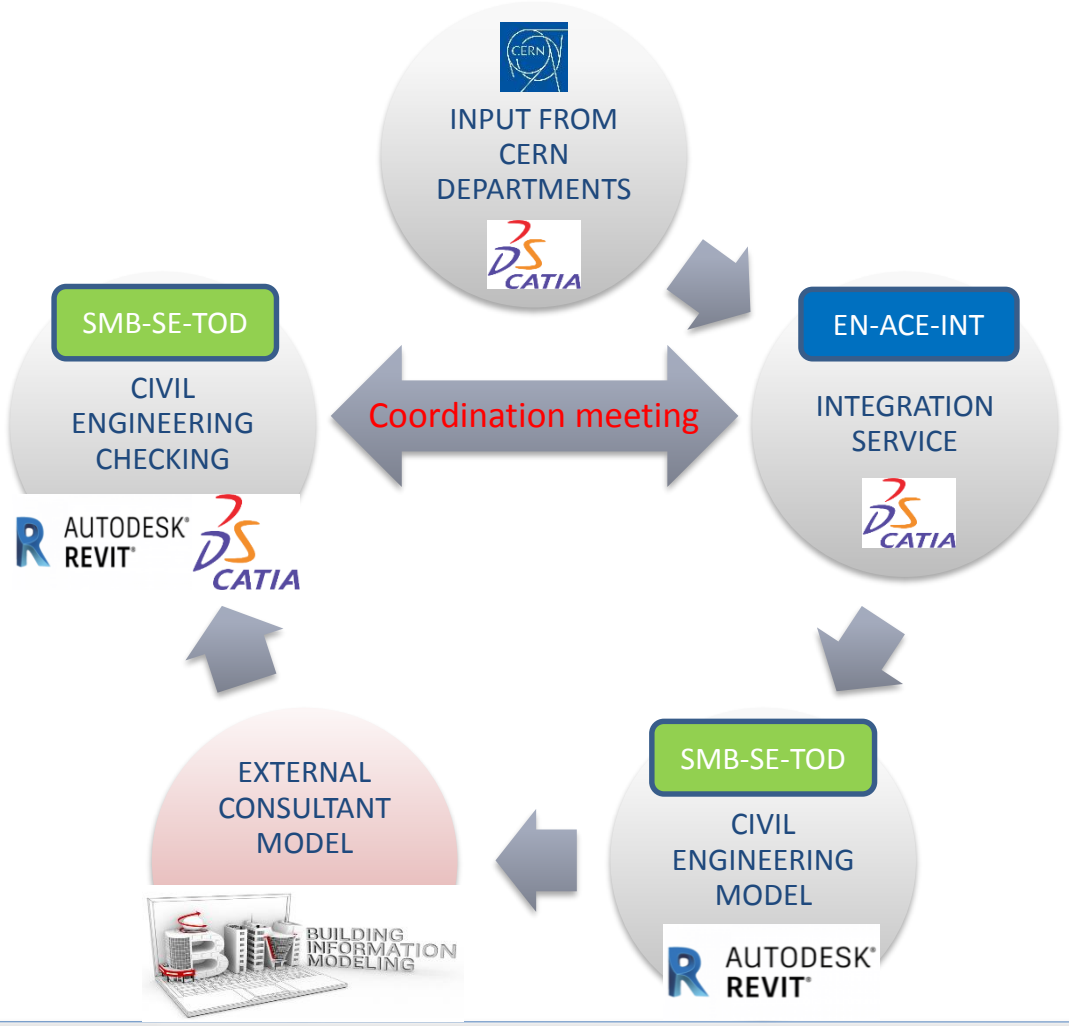
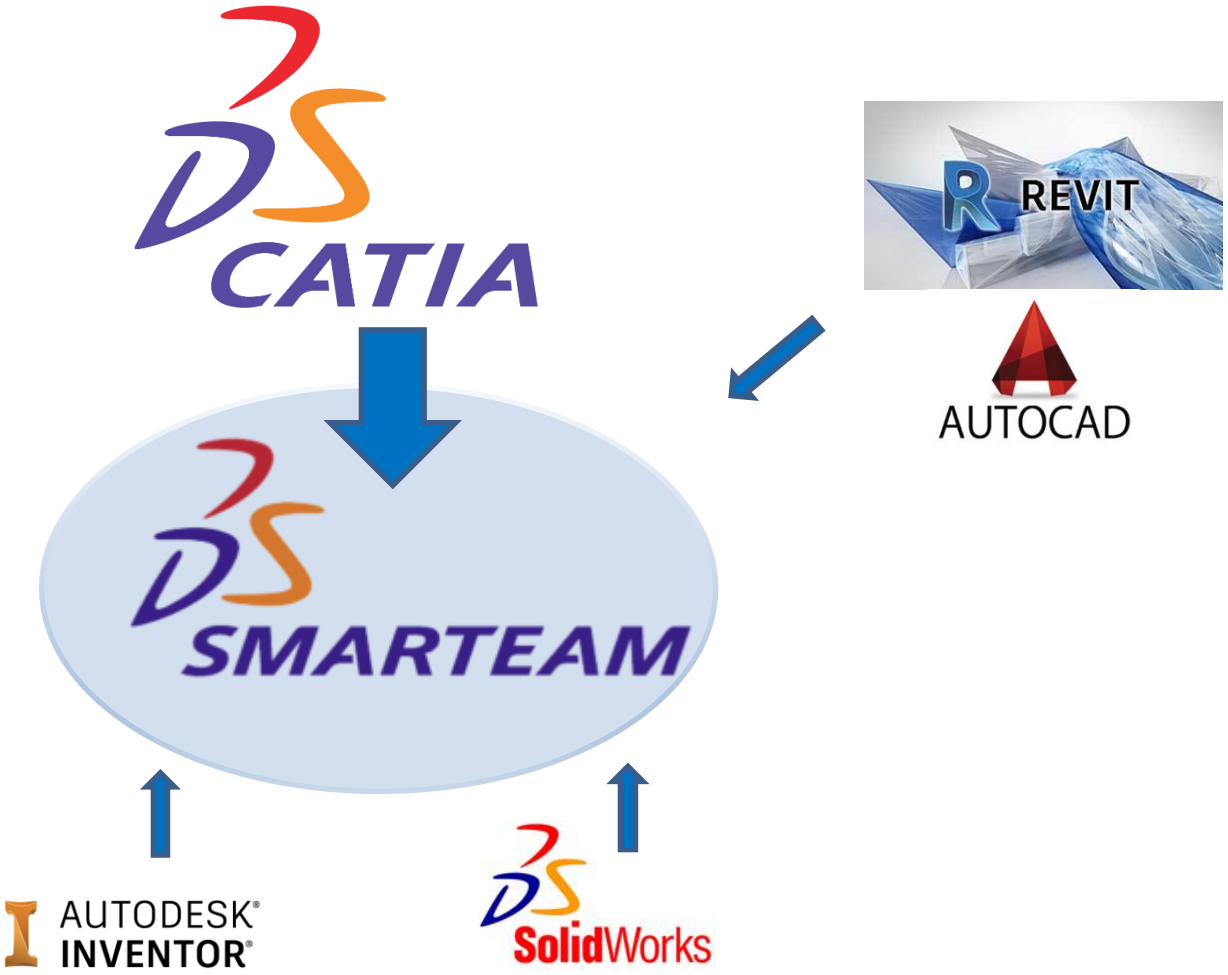


Oriented to work with internal CERN departments



Thanks for your attention!