ESS project update
&
working with Spatial integration

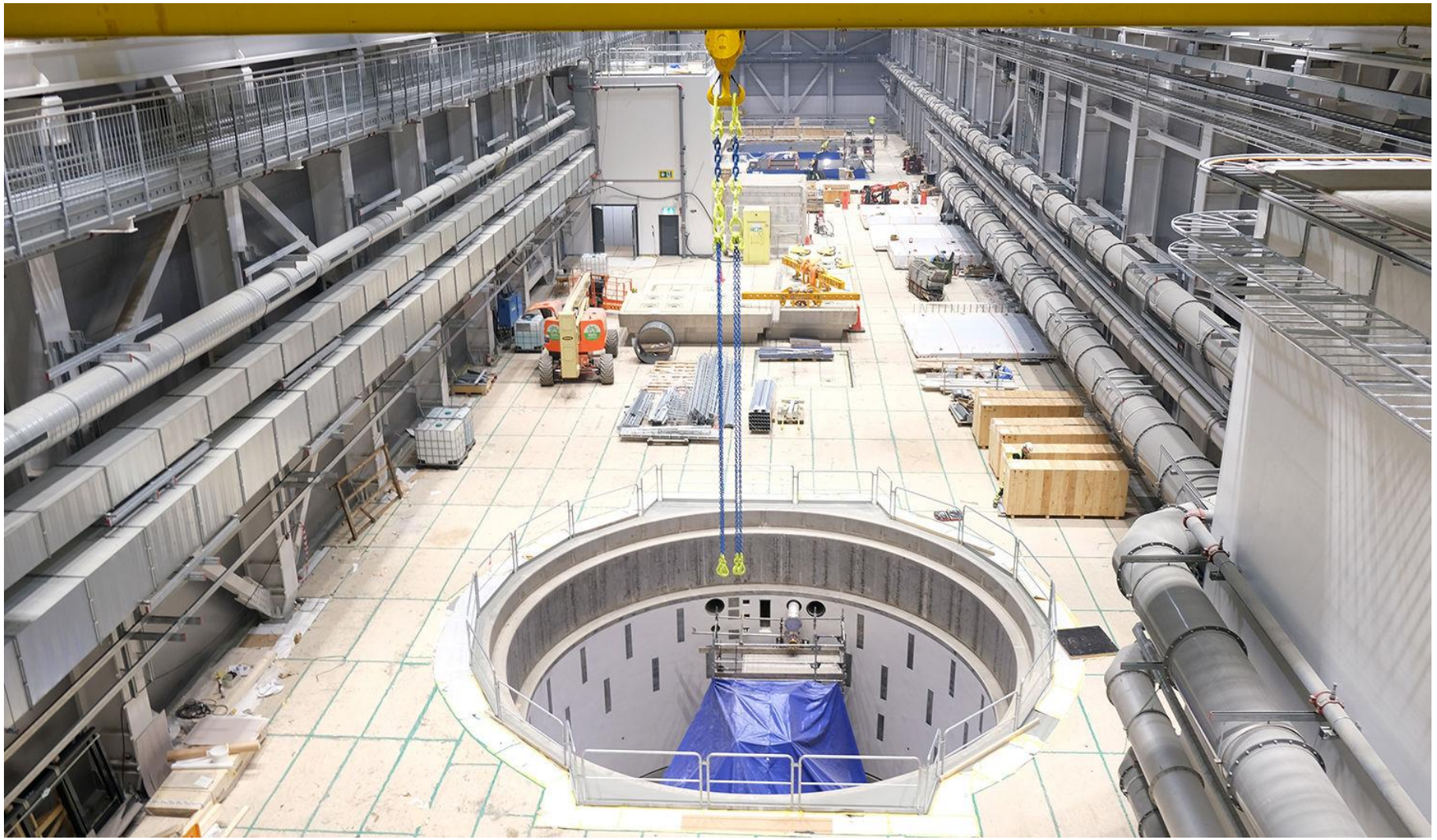
Henrik Lindblad

ESS project update

Pic from jan 2021

https://api.kaltura.nordu.net/index.php/extwidget/preview/partner_id/335/uiconf_id/23450475/entry_id/0_njqfo6ww/embed/iframe

ESS project update



ESS project update

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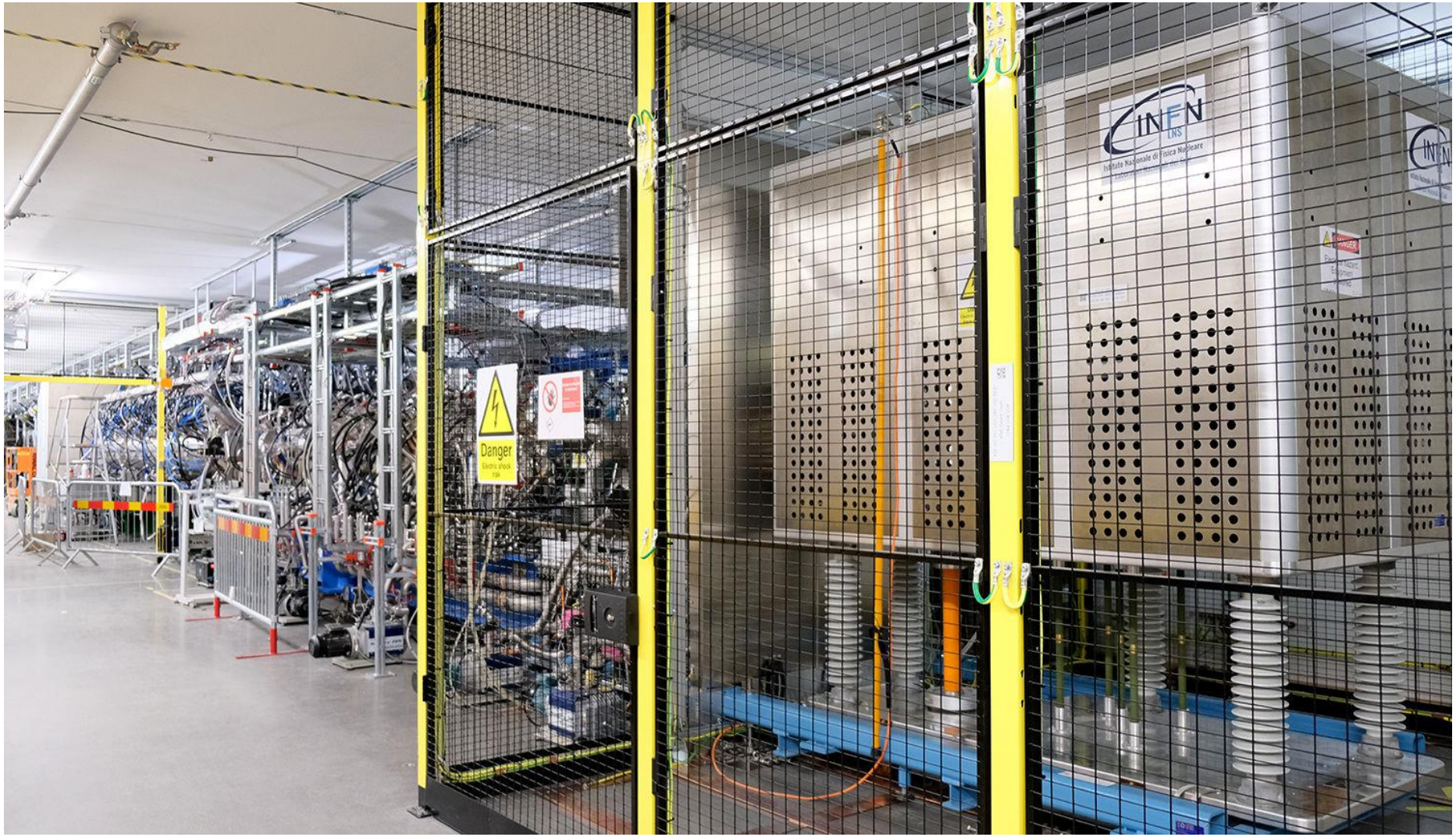

ESS project update

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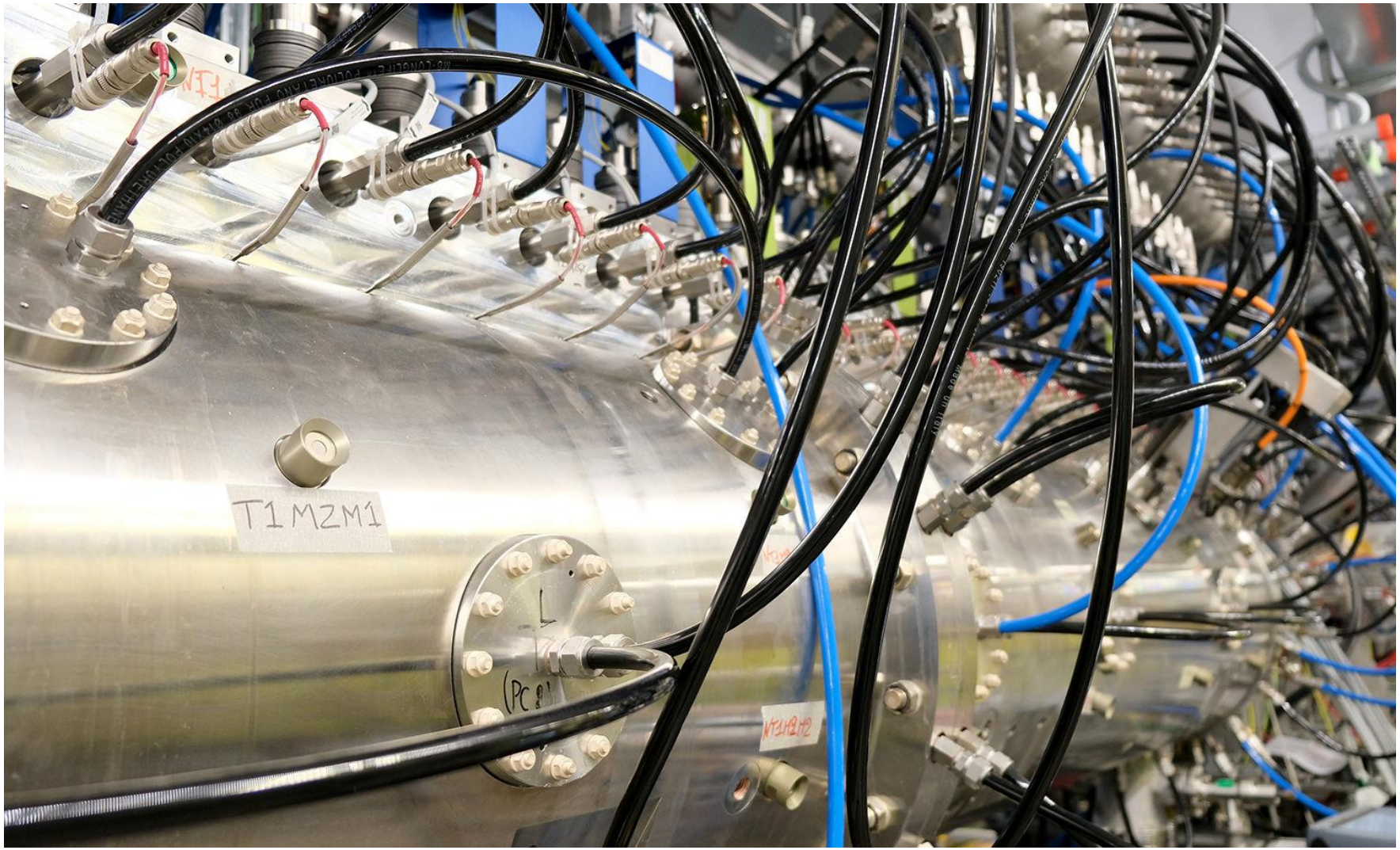


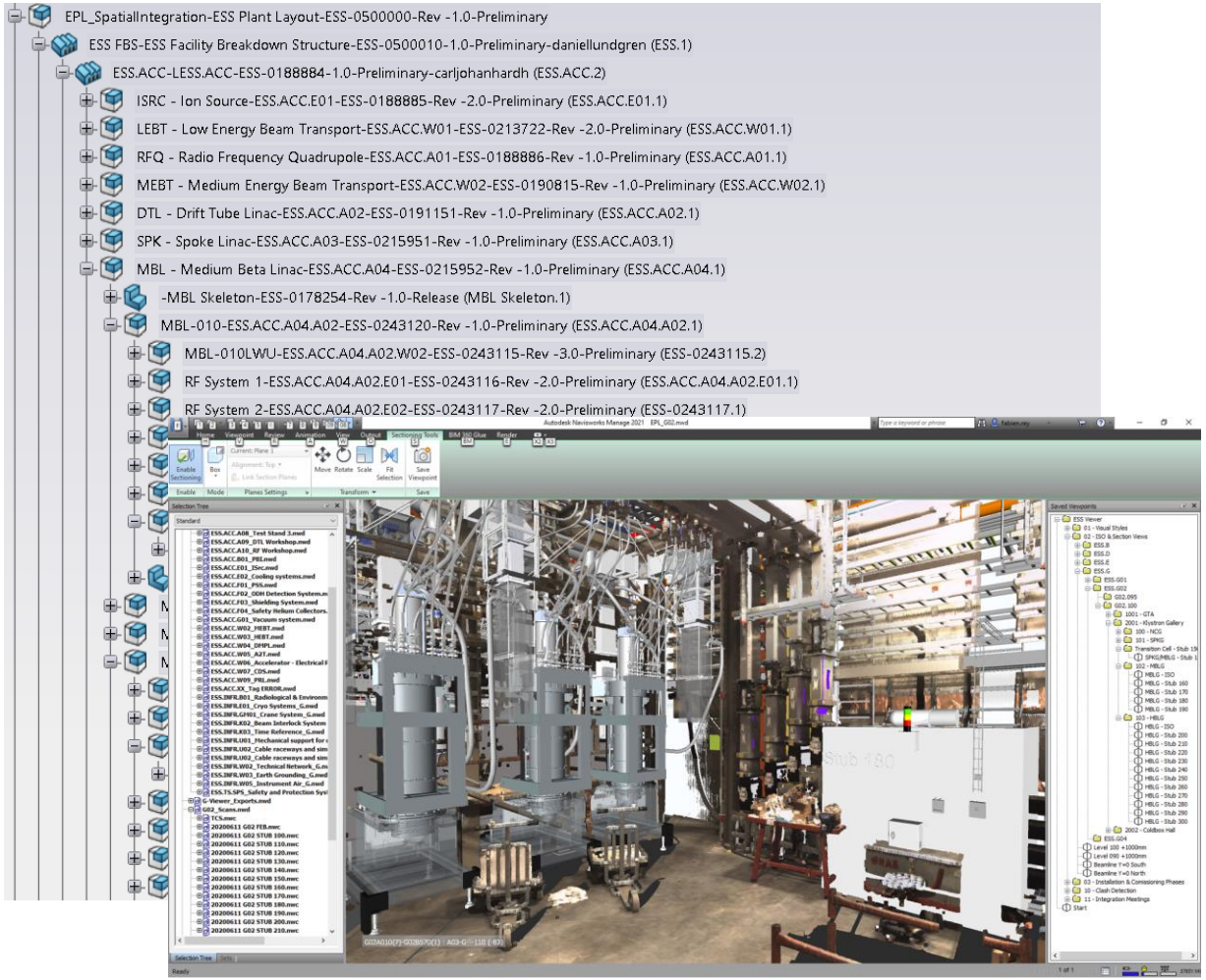
Spatial integration challenges and ways of working

Henrik Lindblad

Spatial integration

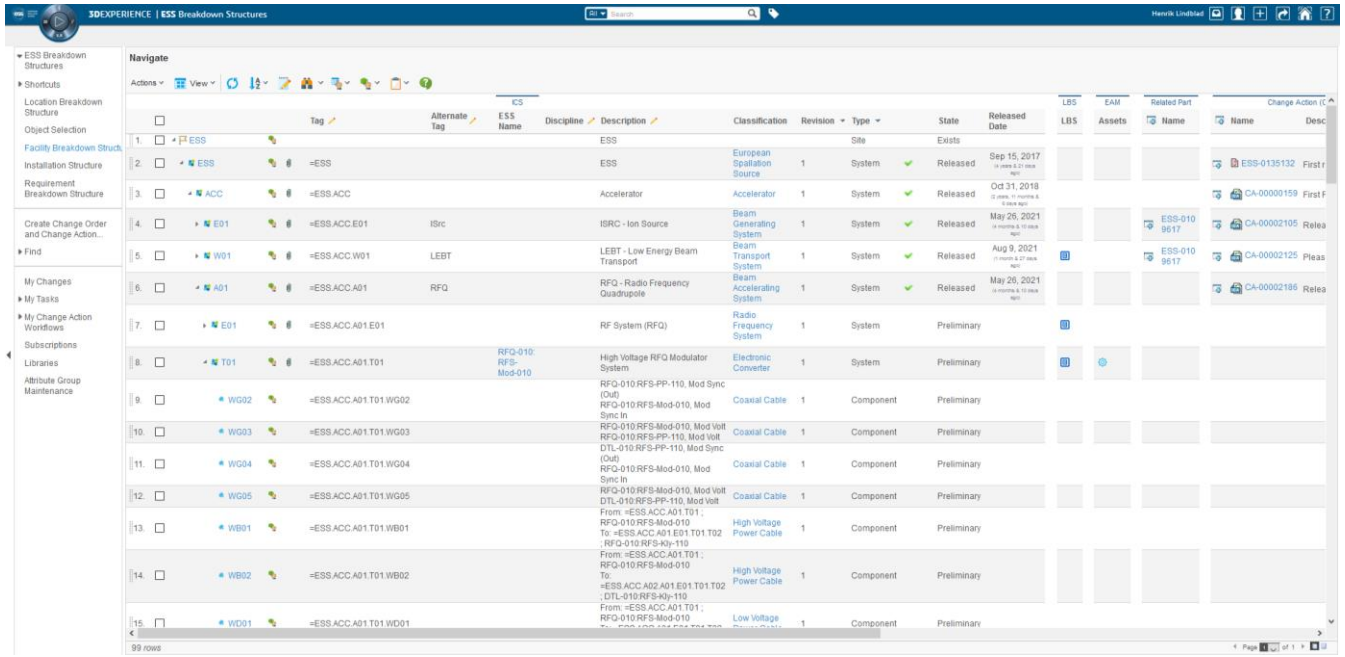
Challenges

- Combining design data from Catia, External design data in other formats, Aveva E3D and Navisworks in 3DExperience into ESS 3D master model
- Combining building models with mechanical and plant design models
- Combining models with scans enabling as built information.
- ESS is not using mBOM but rather a BOM based on Plant configuration information (EPL)
- EPL needs to be connected to asset information in Asset mgmt. system (InforEAM)

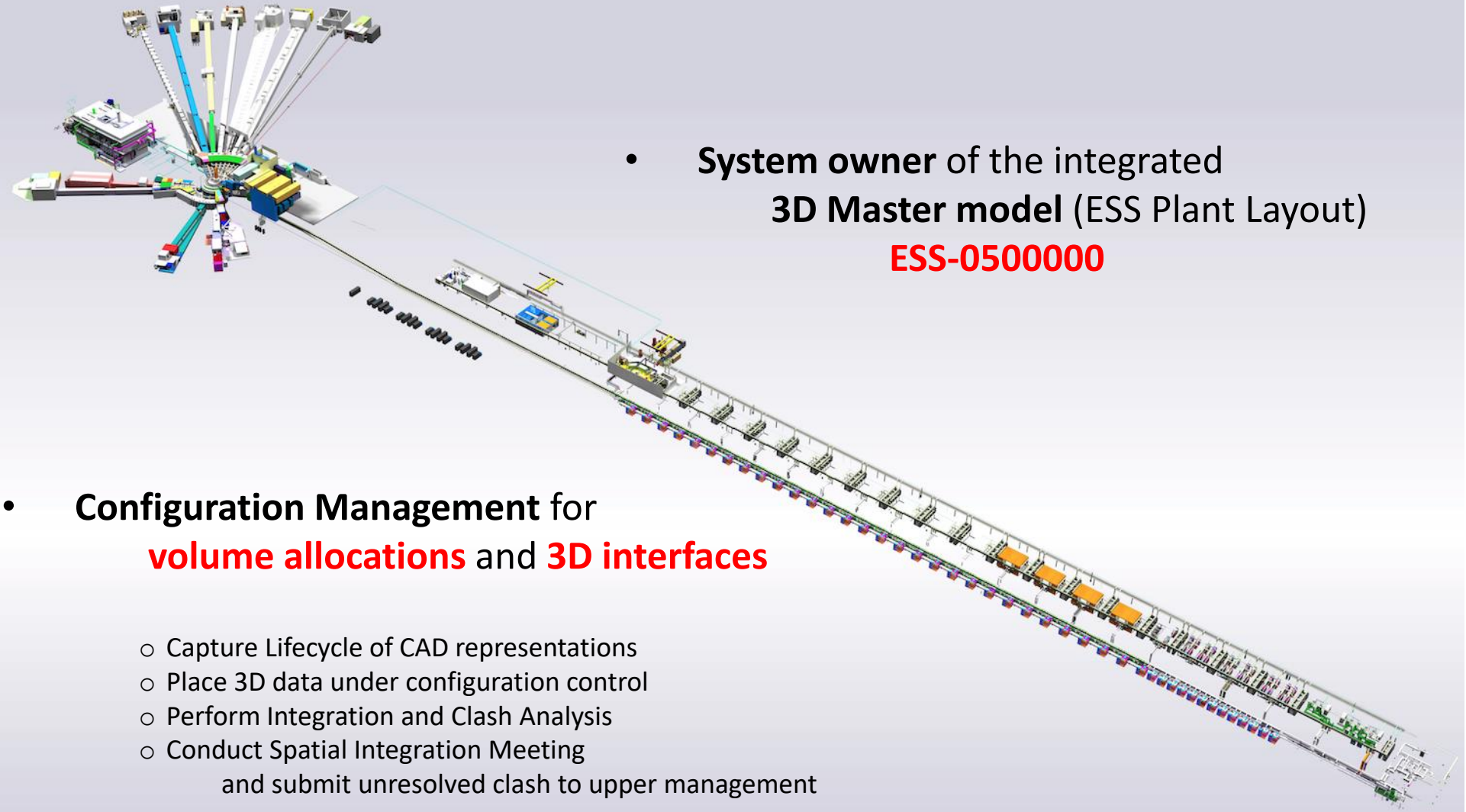


Spatial integration

- EPL is made up of plant items (PI) derived from design data and simplified to make them manageable.
- PI are connected to ESS Parts in the Facility break down structure (FBS)
- FBS is then linked to assets in the Enterprise Asset Mgmt. system (EAM)
- Positions in the facility is managed by spatial integration



Spatial integration mandate



- **System owner** of the integrated
  3D Master model (ESS Plant Layout)
  ESS-0500000

- **Configuration Management** for
  volume allocations and **3D interfaces**

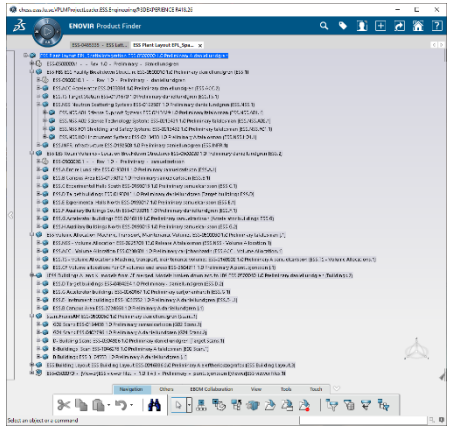
  - Capture Lifecycle of CAD representations
  - Place 3D data under configuration control
  - Perform Integration and Clash Analysis
  - Conduct Spatial Integration Meeting
    and submit unresolved clash to upper management

Spatial Integration
Responsibilities

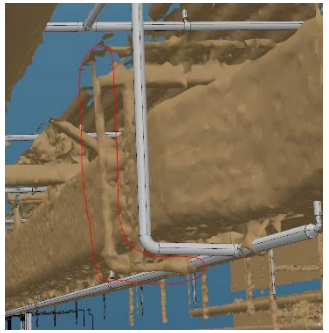
- *Capture the spatial requirements of ESS facility* – all CAD models of ESS systems/components shall be integrated into the EPL
  - *Capture Lifecycle of CAD representations* – Integration Level Of Maturity on Plant Items
  - *Place 3D data under configuration control* – Release CAD with correct status
  - *Perform Integration and Clash Analysis* – EPL is the master model containing all CAD and scan clouds of ESS facilities
  - *Communicate to ESS stakeholders* – JIRA/Confluence/Navisworks

- Spatial Integration (SI) engineer is responsible for the EPL structure down to the delivery (*technical interface*) from the system designer.
- The system designer is responsible of the CAD scope within the delivery (*technical interface*) to the EPL.

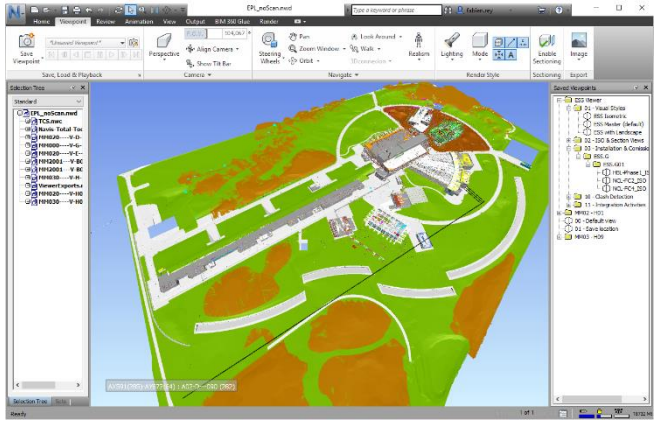
EPL, ESS-0500000, structure



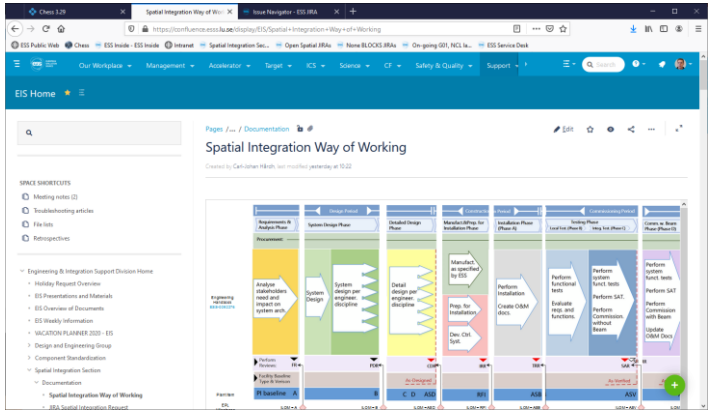
Scan vs CAD analysis



EPL Viewer file in Navisworks



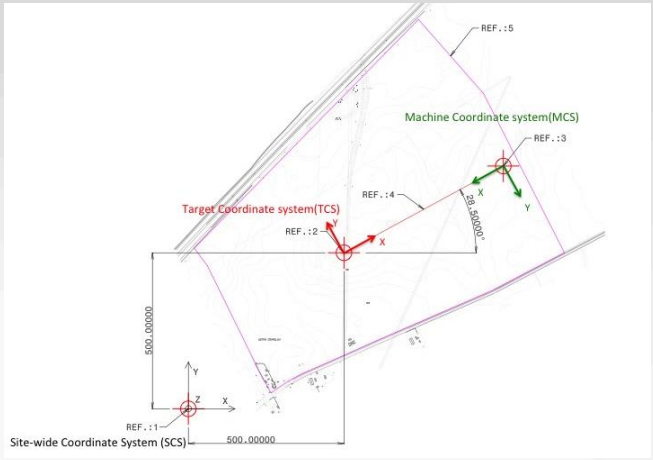
Spatial Integration Confluence page



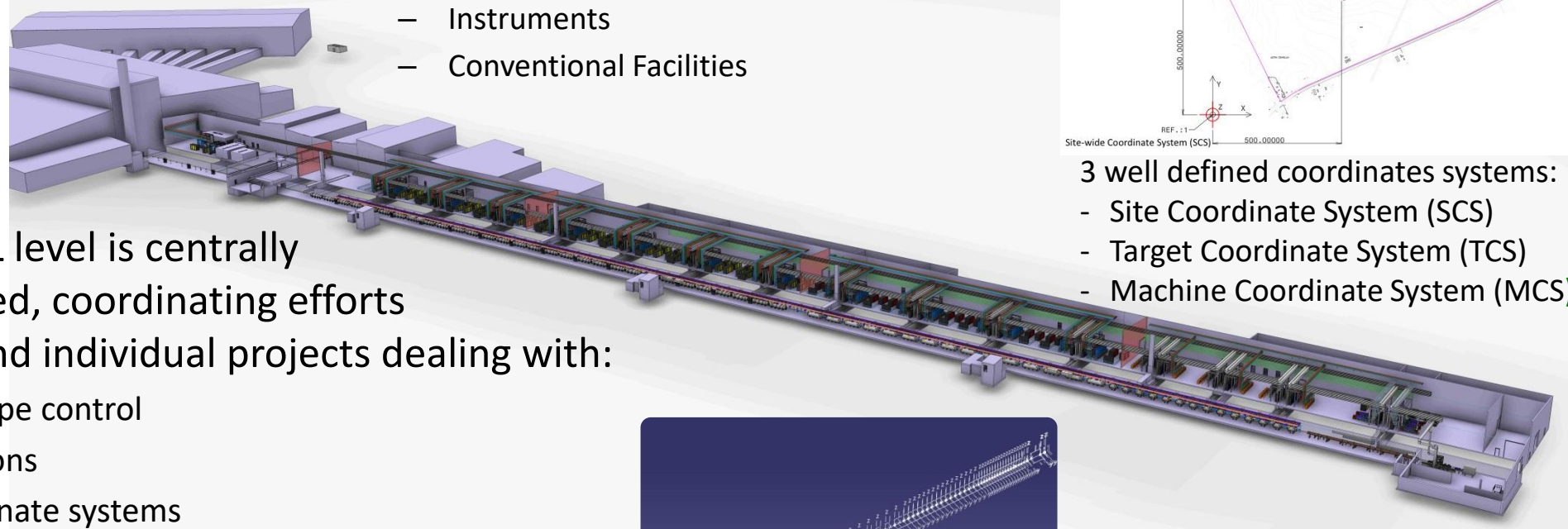
ESS 3D Master model

CAD model that integrates and arranges 3D models into one multidisciplinary master model. The master 3D model, EPL (ESS Plant Layout) contains models of:

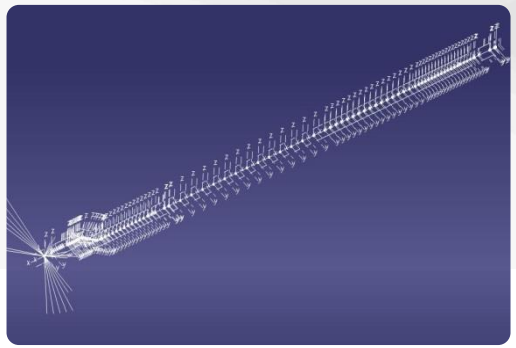
- Accelerator
- Target
- Instruments
- Conventional Facilities



3 well defined coordinates systems:
- Site Coordinate System (SCS)
- Target Coordinate System (TCS)
- Machine Coordinate System (MCS)

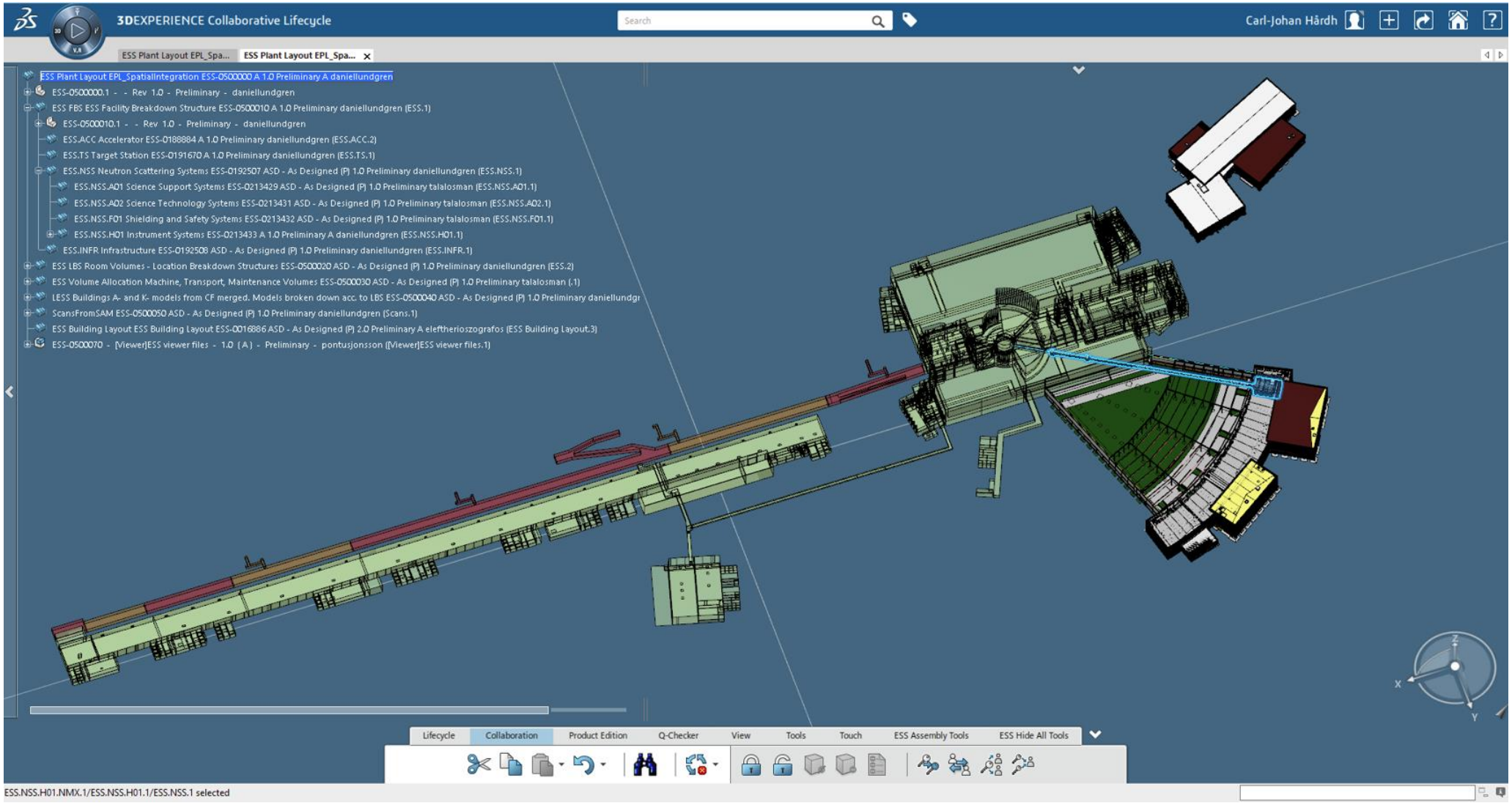


- The EPL level is centrally managed, coordinating efforts of CF and individual projects dealing with:
  - Envelope control
  - Skeletons
  - Coordinate systems
  - Integration
  - As built verification
  - Etc.



Spatial Integration

ESS Plant Layout, ESS-0500000 – single point of truth



Spatial Integration - ESS PLANT LAYOUT

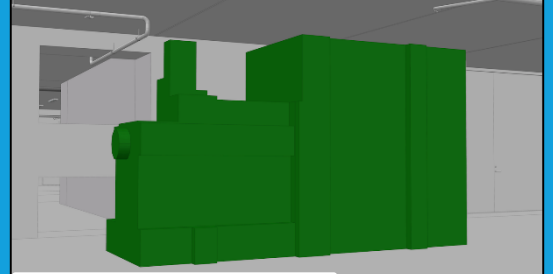
EUROPEAN SPALLATION SOURCE

		Top node assembly
ESS-0500000	ESS_EPL_SpatialIntegration- ESS Plant Layout- ESS-0500000- Rev - 1.0- Preliminary- daniellundgren - - - ESS-0500000.1- - - Rev - 1.0- - - Preliminary- - - daniellundgren	
ESS-0500010	ESS FBS- ESS Facility Breakdown Structure- ESS-0500010- Rev - 1.0- Preliminary- daniellundgren (ESS.1) - - - ESS-0500010.1- - - Rev - 1.0- - - Preliminary- - - daniellundgren ESS.ACC- LESS.ACC- ESS-0188884- Rev - 1.0- Preliminary- carljohanhardh (ESS.ACC.2) ESS.TS- LESS.TS- ESS-0191670- Rev - 1.0- Preliminary- daniellundgren (ESS.TS.1) ESS.NSS- LESS.NSS- ESS-0192507- Rev - 1.0- Preliminary- daniellundgren (ESS.NSS.1) ESS.INFR- LESS.INFR- ESS-0192508- Rev - 1.0- Preliminary- daniellundgren (ESS.INFR.1)	- **Only RELEASED data with Level of Maturity** - **Light/full** models of all **Mechanical / Electrical / Piping** - Following **Facility Breakdown Structure**
ESS-0500020	ESS LBS- Room Volumes - Location Breakdown Structures- ESS-0500020- Rev - 1.0- Preliminary- daniellundgren (ESS.2) ESS.A- Entire Lund site- ESS-0193011- Rev - 1.0- Preliminary- daniellundgren (ESS.A.1) ESS.B- Campus Area- ESS-0193012- Rev - 1.0- Preliminary- daniellundgren (ESS.B.1) ESS.C- Experimental Halls South- ESS-0193013- Rev - 1.0- Preliminary- daniellundgren (ESS.C.1) ESS.D- Target buildings- ESS-0193014- Rev - 1.0- Preliminary- daniellundgren (ESS.D.1) ESS.E- Experimental Halls North- ESS-0193017- Rev - 1.0- Preliminary- daniellundgren (ESS.E.1) ESS.F- Auxiliary Buildings South- ESS-0193015- Rev - 1.0- Preliminary- daniellundgren (ESS.F.1) ESS.G- Accelerator buildings- ESS-0246119- Rev - 1.0- Preliminary- daniellundgren (ESS.G.4) ESS.H- Auxiliary Buildings North- ESS-0193019- Rev - 1.0- Preliminary- daniellundgren (ESS.G.2)	- **Room volumes** - Used to perform **volumetric search** (load all data in this room) - Following **Location Breakdown Structure**
ESS-0500030	ESS Volume Allocation- Machine, Transport, Maintenance Volumes- ESS-0500030- Rev - 1.0- Preliminary- daniellundgren (.1) ESS.TS - Volume Allocation- ESS-0225701- Rev - 1.0- Preliminary- daniellundgren (ESS.TS - Volume Allocation.1) ESS.NSS - Volume Allocation- ESS-0225703- Rev - 1.0- Preliminary- daniellundgren (ESS.NSS - Volume Allocation.1) ESS.ACC - Volume Allocation- ESS-0238601- Rev - 1.0- Preliminary- daniellundgren (ESS.ACC - Volume Allocation.1)	- Released **Volume allocations / Space Claims** (Machine, Installation, Maintenance) - Following **Facility Breakdown Structure**
ESS-0500040	LESS Buildings- A- and K- models from CF merged. Models broken down acc. to LBS- ESS-0500040- Rev - 1.0- Preliminary- daniellu ESS.A- Entire Lund site- ESS-0193011- Rev - 1.0- Preliminary- daniellundgren (ESS.A.2) ESS.B- Campus Area- ESS-0193012- Rev - 1.0- Preliminary- daniellundgren (ESS.B.1) ESS.C- Experimental Halls South- ESS-0193013- Rev - 1.0- Preliminary- daniellundgren (ESS.C.1) ESS.D- Target buildings- ESS-0193014- Rev - 1.0- Preliminary- daniellundgren (ESS.D.1) ESS.E- Experimental Halls North- ESS-0193017- Rev - 1.0- Preliminary- daniellundgren (ESS.E.1) ESS.F- Auxiliary Buildings South- ESS-0193015- Rev - 1.0- Preliminary- daniellundgren (ESS.F.1) ESS.G- Accelerator buildings- ESS-0260167- Rev - 1.0- Preliminary- daniellundgren (ESS.G.1) ESS.H- Auxiliary Buildings North- ESS-0193019- Rev - 1.0- Preliminary- daniellundgren (ESS.H.1)	- Receiver for CF models modified to enable internal releasing: - models are **split** and **cleaned** - Redesigned based on **Laser Scanning** - produced when Building are built or handover. - Following **Location Breakdown Structure**
ESS-0500050	ScansFromSAM- ESS-0500050- Rev - 1.0- Preliminary- daniellundgren (Scans.1) G02 Scans- ESS-0194438- Rev - 1.0- Preliminary- pontusjonsson (G02 Scans.1) G01 Scans- ESS-0402796- Rev - 1.0- Preliminary- carljohanhardh (G01 Scans.2) D- Building Scans- ESS-0304926- Rev - 1.0- Preliminary- daniellundgren (Target Scans.1)	- **Point Clouds** / **Meshes** from **Laser Scanning** (SAM) organized by Buildings
ESS-0016886	ESS Building Layout- ESS Building Layout- ESS-0016886- Rev - 2.0- Preliminary- eleftherioszografos (ESS Building Layout.3) ESS Accelerator Building Layout- ESS Accelerator Building Layout- ESS-0017890- Rev - 2.0- Release- eleftherioszografos (ESS Acc ESS Accelerator Building K-Models- ESS Accelerator Building K-Models- ESS-0016703- Rev - 2.0- Release- eleftherioszografos (E ESS Accelerator Building Infrastructure- ESS Accelerator Building Infrastructure- ESS-0016706- Rev - 2.3- Release- eleftherioszog ESS Target Building Layout- ESS Target Building Layout- ESS-0017891- Rev - 2.5- Release- eleftherioszografos (ESS Target Buildi ESS Target Building K-Models- ESS Target Building K-Models- ESS-0016705- Rev - 2.7- Release- eleftherioszografos (ESS Target ESS Target Buildings Infrastructure- ESS Target Buildings Infrastructure- ESS-0030008- Rev - 2.5- Release- eleftherioszografos (E ESS Auxillary Buildings- ESS Auxillary Buildings- ESS-0016859- Rev - 2.4- Release- eleftherioszografos (ESS Auxillary Buildings.2) ESS Auxillary Buildings K-models- ESS Auxillary Buildings K-models- ESS-0011536- Rev - 1.66- Frozen- eleftherioszografos (ESS A ESS Auxillary Buildings Infrastructure- ESS Auxillary Buildings Infrastructure- ESS-0016707- Rev - 2.3- Release- eleftherioszografo	- Containing all **incoming CF models** - **No** Configuration Management - Organized by buildings and discipline : architectural, structural, infrastructure

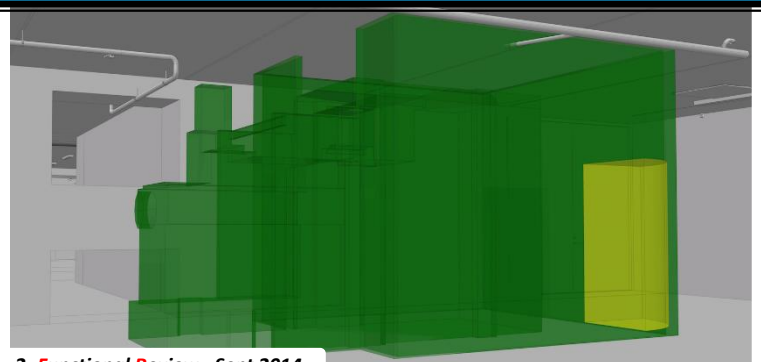
Spatial Integration Lifecycle

Ion Source - LEBT

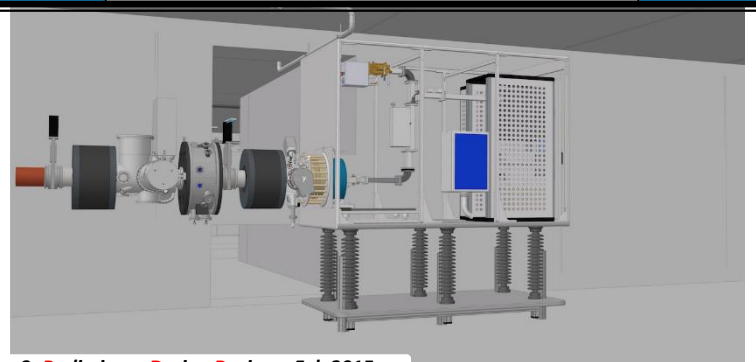
EUROPEAN SPALLATION SOURCE



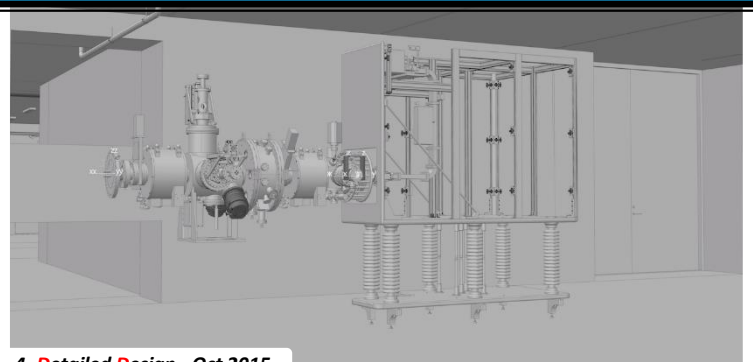
1- Initial Space Claim - Oct 2013



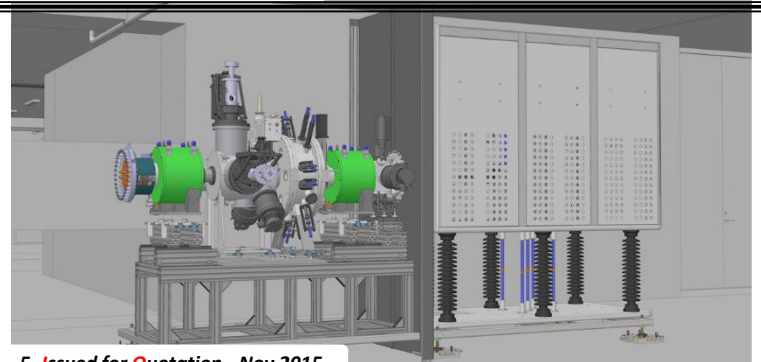
2- Functional Review - Sept 2014



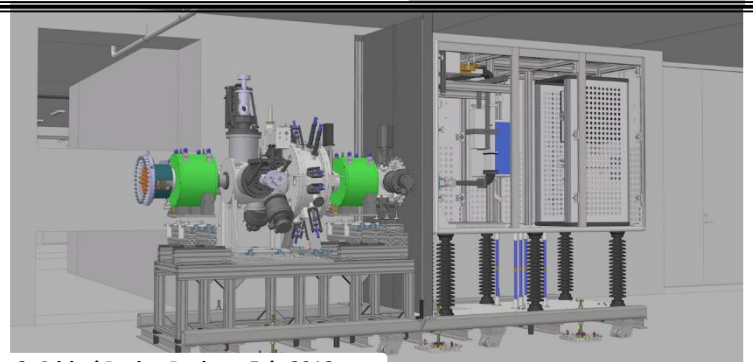
3- Preliminary Design Review - Feb 2015



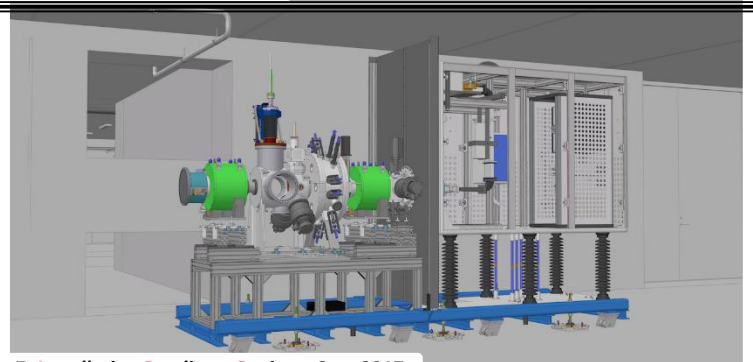
4- Detailed Design - Oct 2015



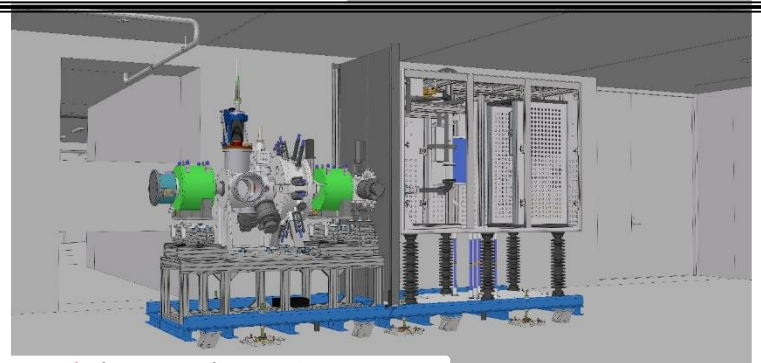
5- Issued for Quotation - Nov 2015



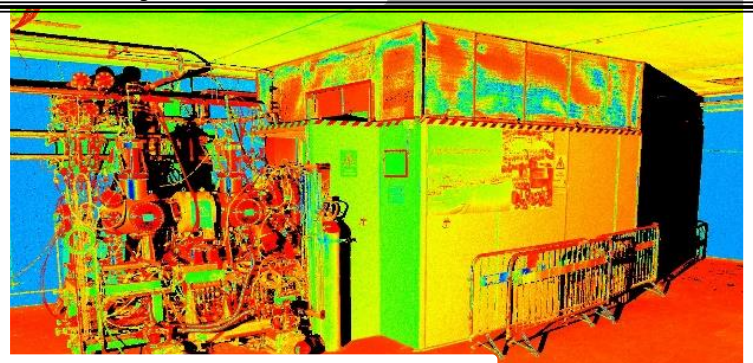
6- Critical Design Review - Feb 2016



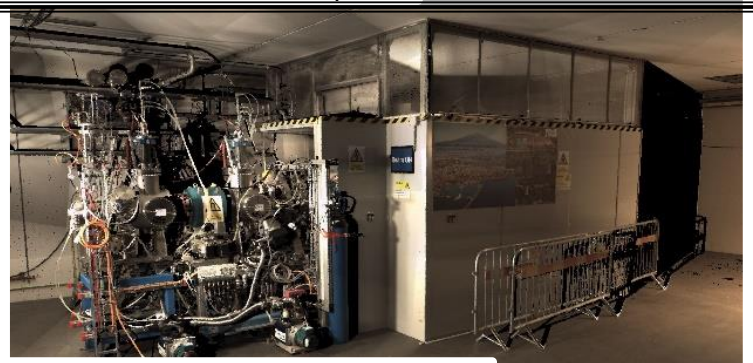
7- Installation Readiness Review - Sept 2017



8 - As-built - Test Readiness Review- May 2018



9 – As-Scanned Intensity 3D Point Clouds - Jan 2019

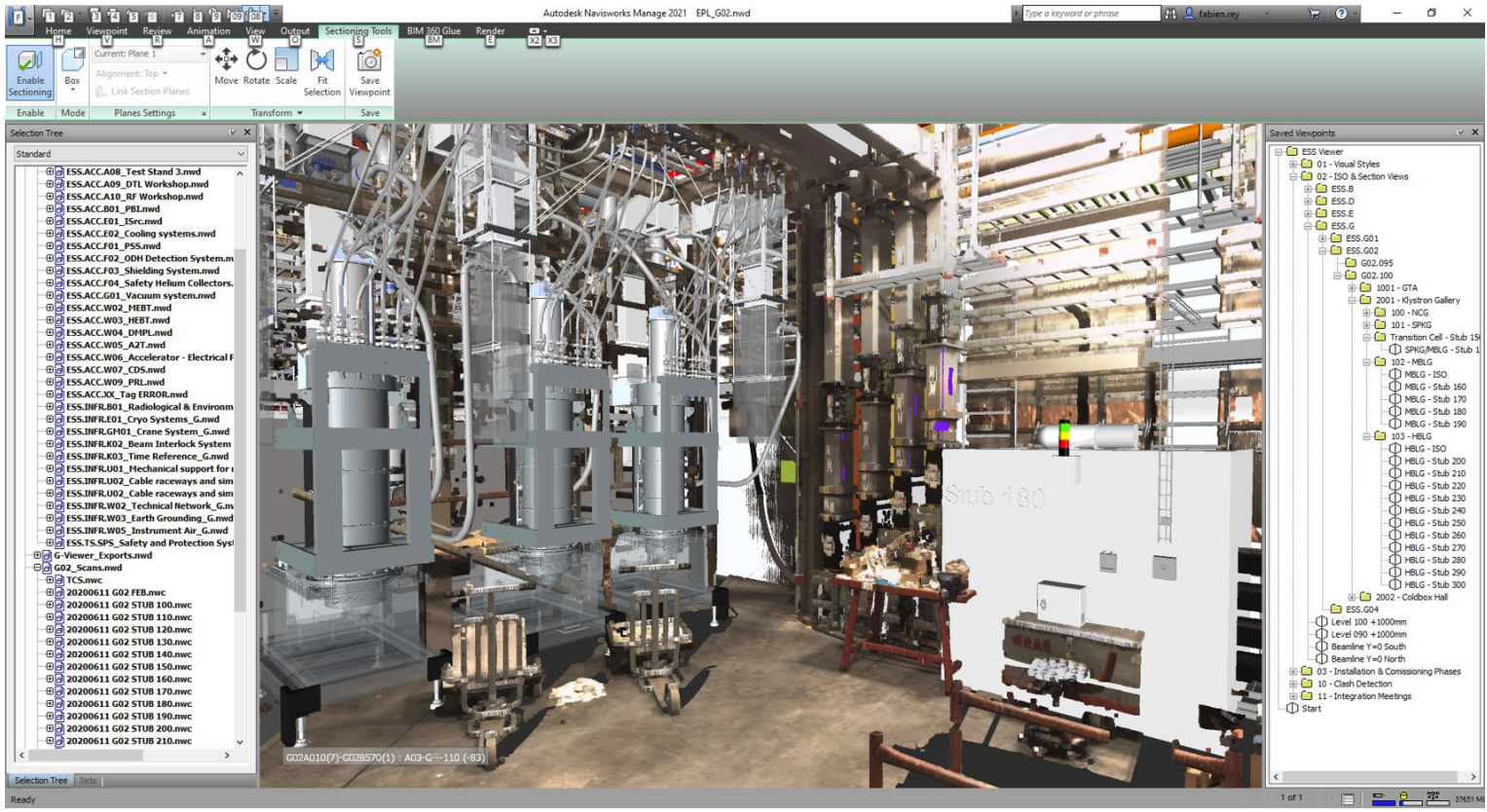


10 – As-Scanned Coloured 3D Point Clouds - Jan 2019

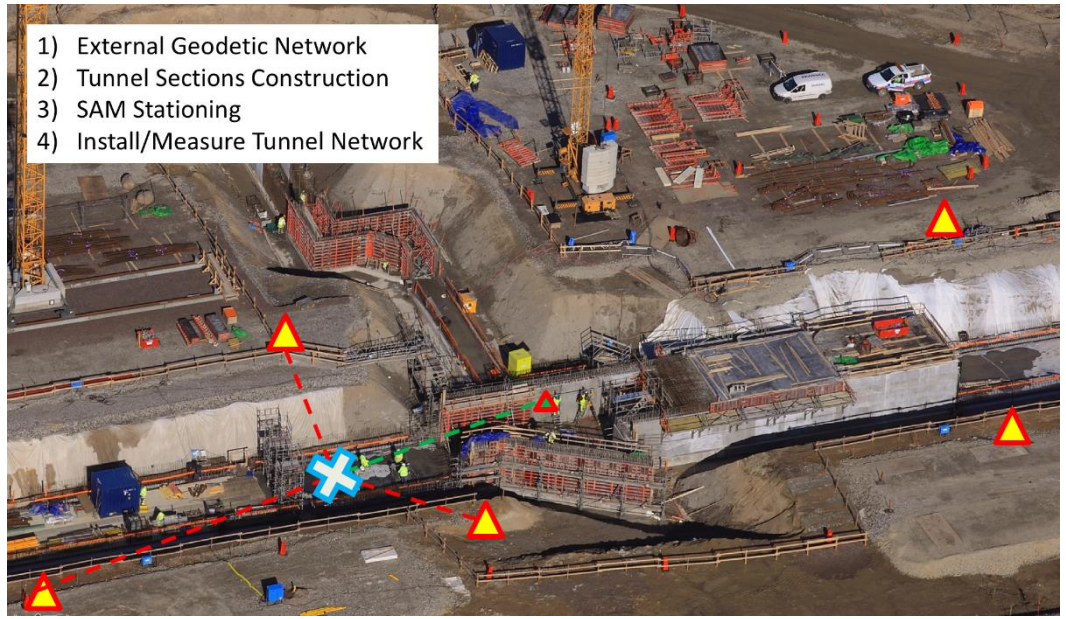
Spatial Integration

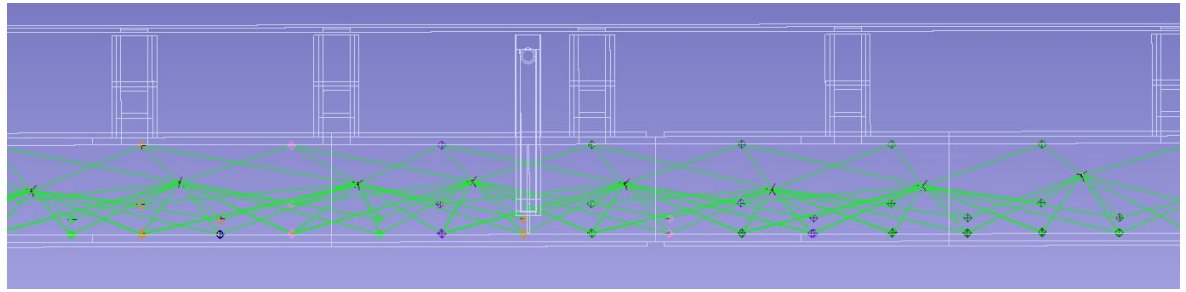
Challenges and development

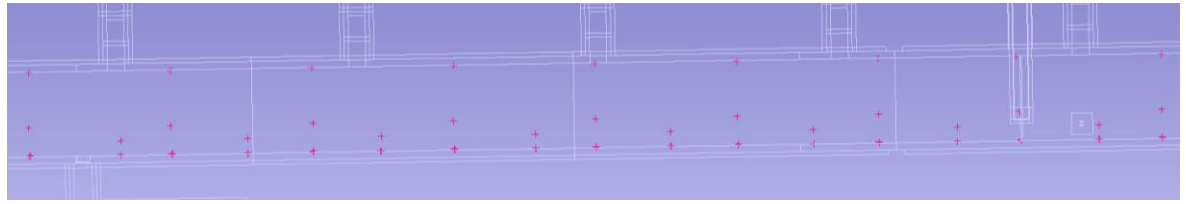
- EPL keeps growing
  - FBS (Facility Breakdown Structure)
  - LBS (Location Breakdown Structure)
  - Envelopes/space claims/tooling/other
  - Buildings/infrastructure
  - Scan clouds
- Exports – Navisworks
  - CAD and scan clouds
  - LBS based viewer files (per building)
- CHESS tool ”Collaborate with CATIA”
- Technical Interface to EPL defined
  - Rules apply to enter in the EPL
  - Plant Item

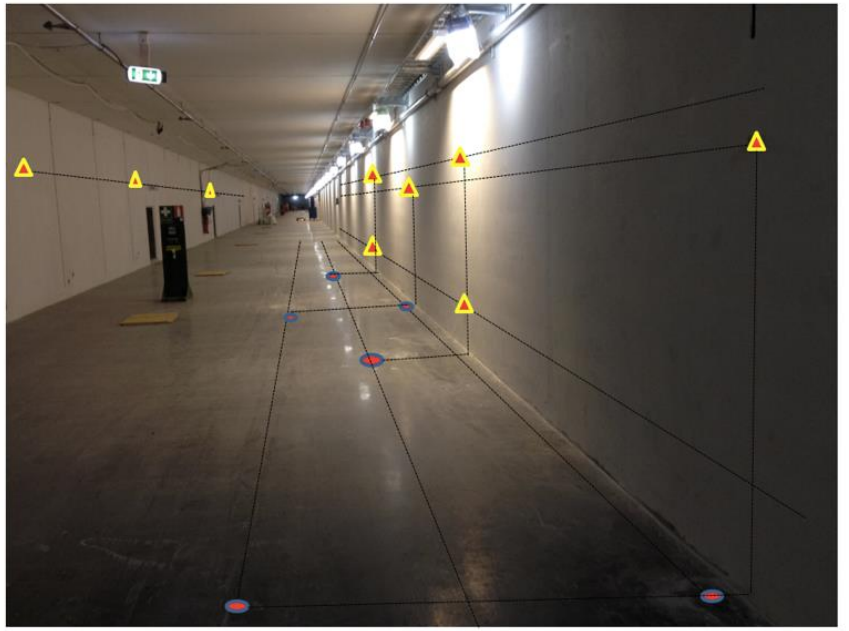


Network and Scanning



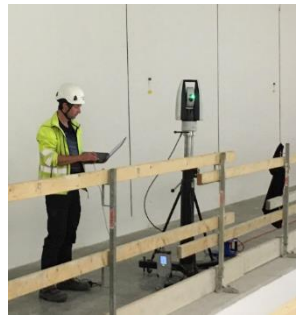






14

Network G01
Wall (250)
Ground (150)
60 Laser Tracker Stations
49 Levelling Stations



± 0.2 mm Internal Accuracy

Survey
Alignment
Metrology

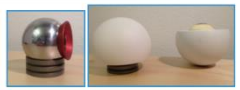
Network and Scanning

EUROPEAN SPALLATION SOURCE

Focus on 3D Scans

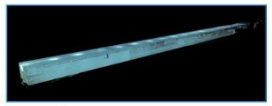
Raw data Acquisition

P30

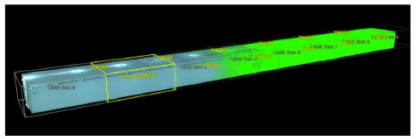


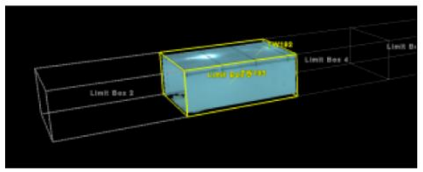
Concentric Spheres

Analysis in Cyclone



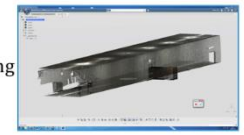
Data Cleaning
Orientation of Scans (registration)
Geometries created on demand





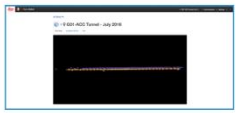
AVEVA EVERYTHING3D

CATIA V6
For Reverse Engineering and Integration



TruView Global

Non CAD users
Visualization/Simple measurments



28

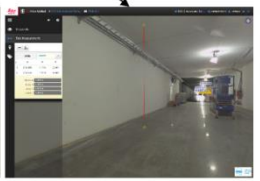
LASER SCANING
based on Network

32 Laser Scanner Stations
4300 Millions Points
± 2 mm internal accuracy

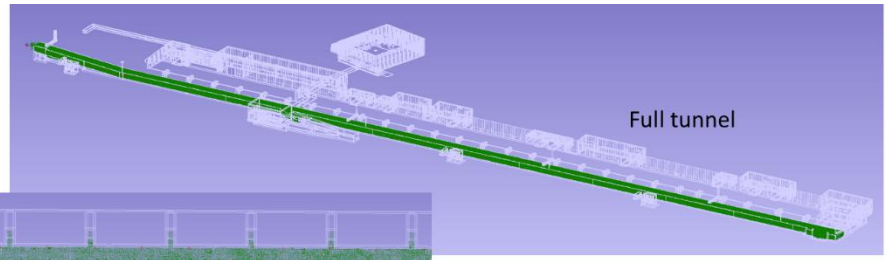
Export Pt Cloud

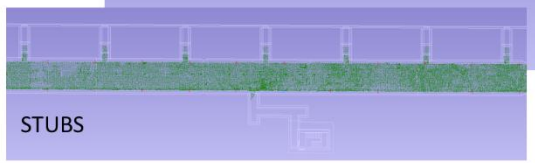
Truview

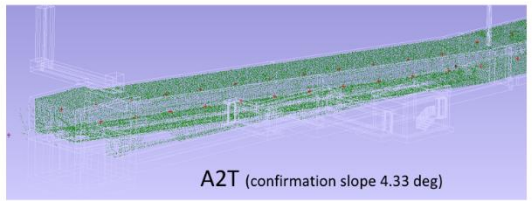
Reverse Engineering

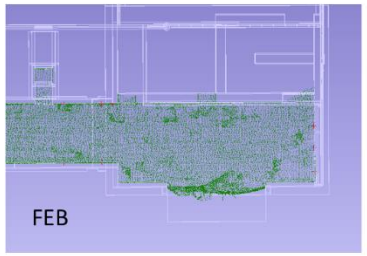


Simple Measurement





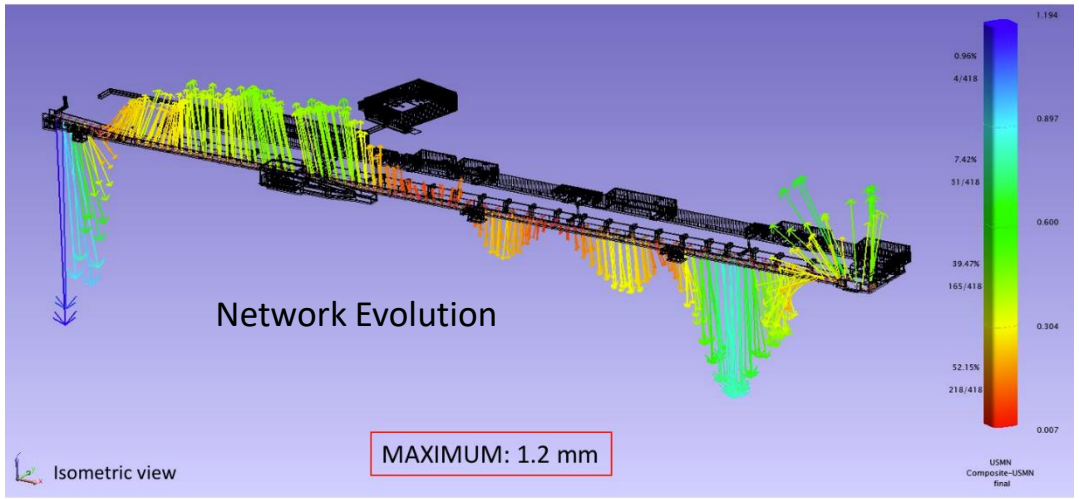




All OK ! Within ± 10mm

Reverse Engineering
for Concrete Works

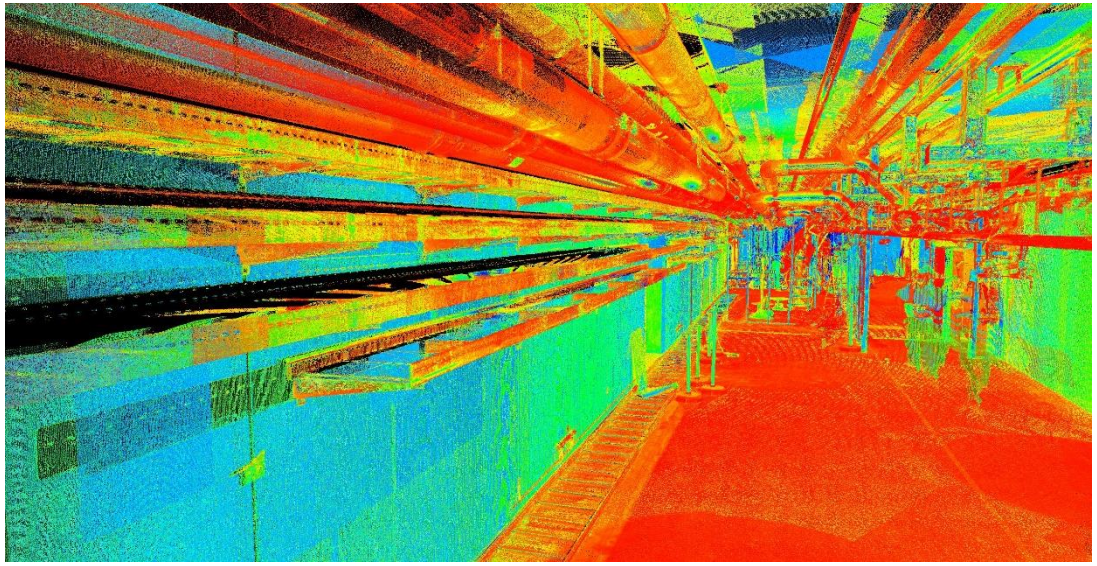
7

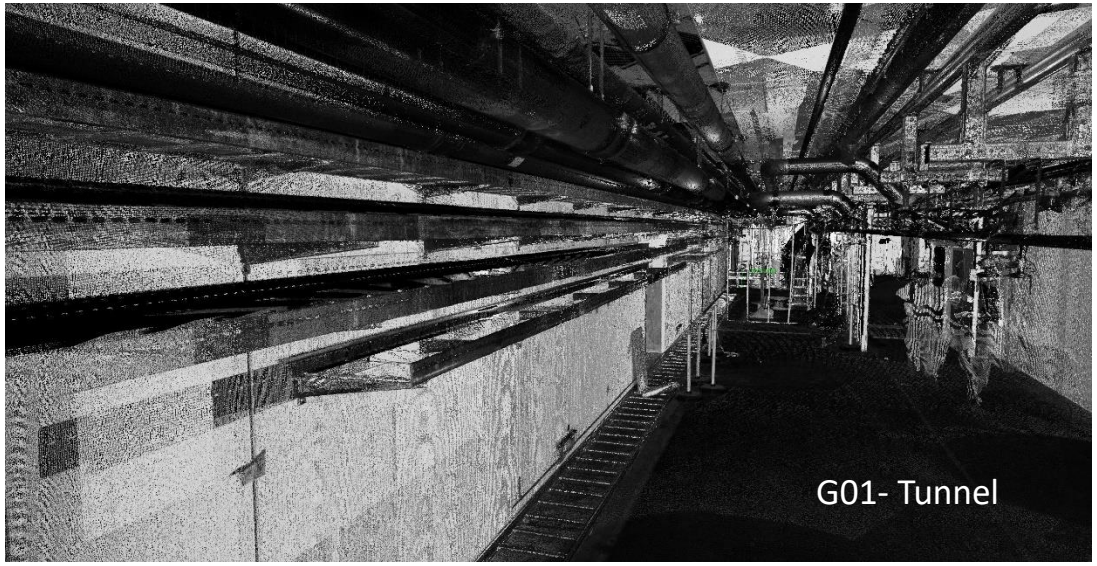


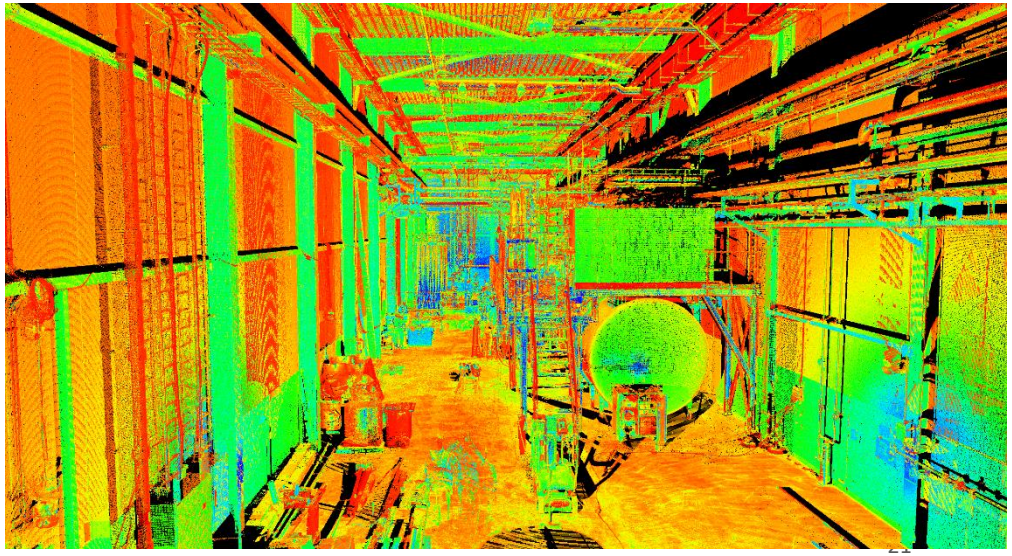
Survey
Alignment
Metrology

Scanning Utilities

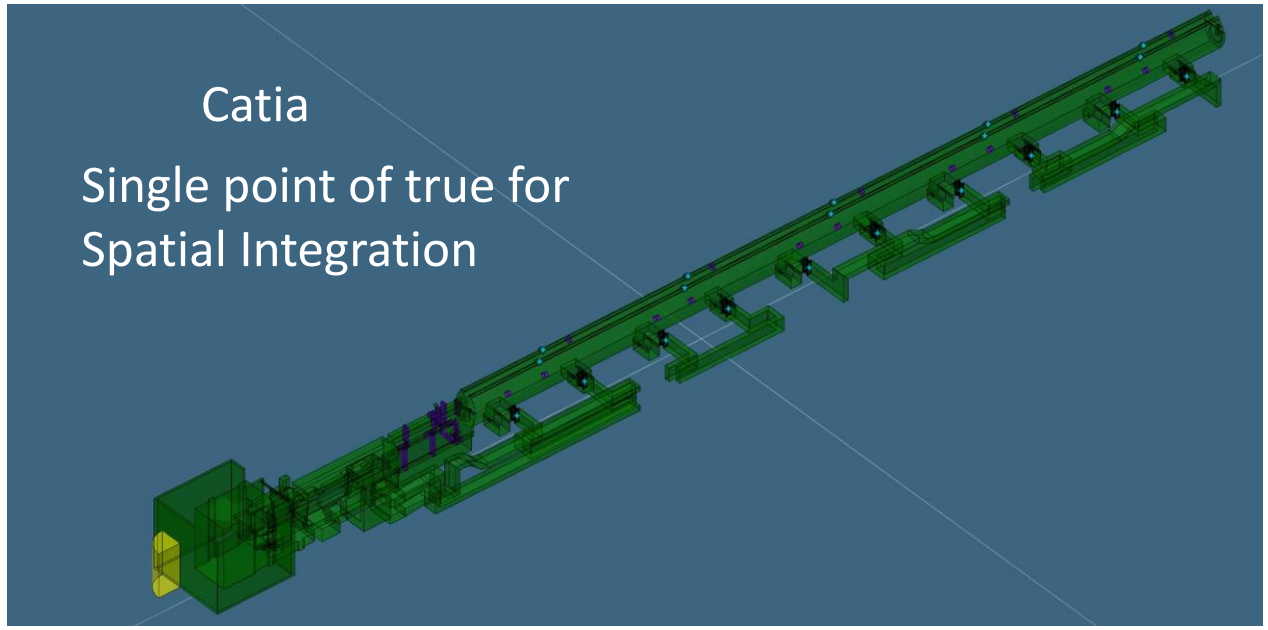
EUROPEAN SPALLATION SOURCE

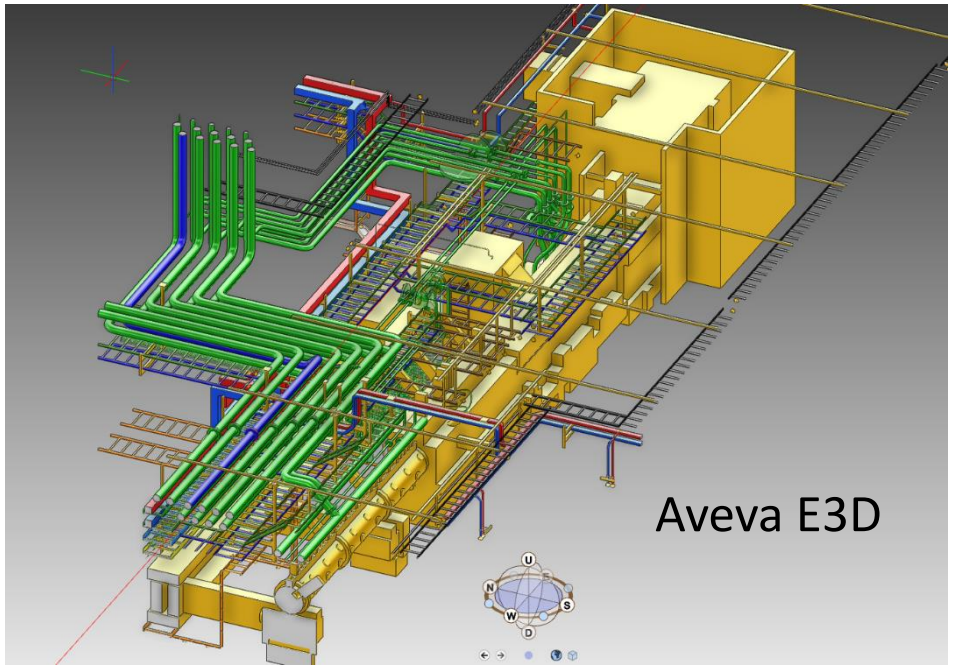






Exchange data with AVEVA E3D





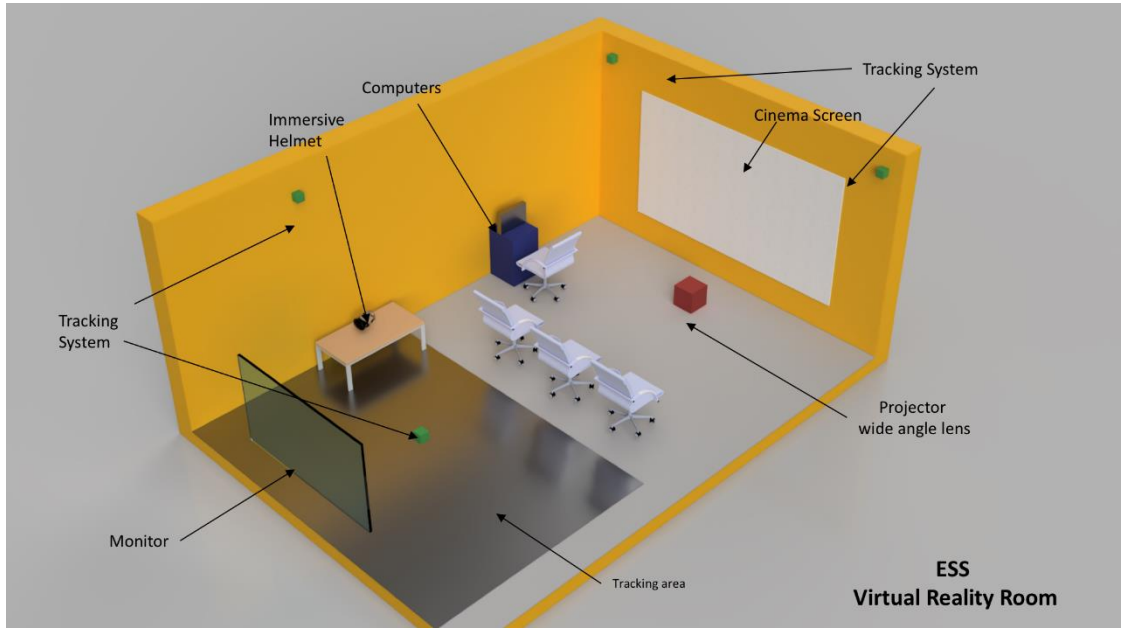
Space Claims
3D interfaces
Light models for
Mechanical

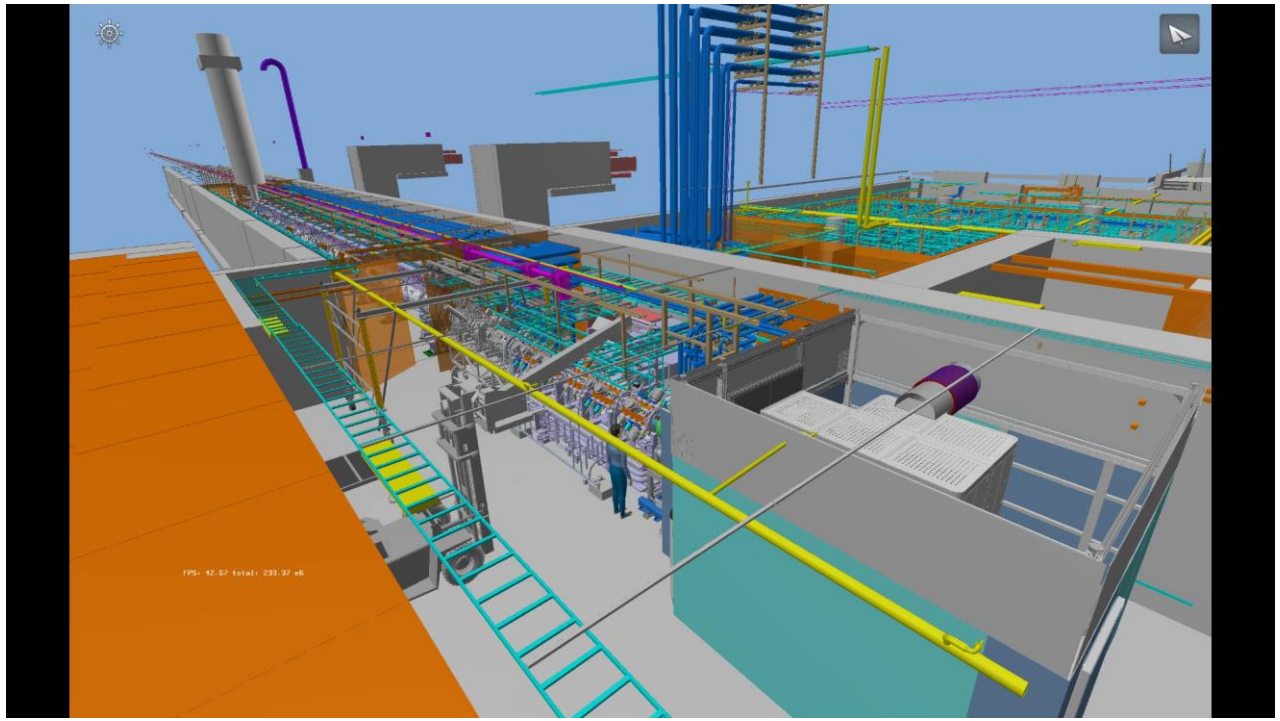
Automatic Import/Export

Week End

Detail design
Piping/Cabling

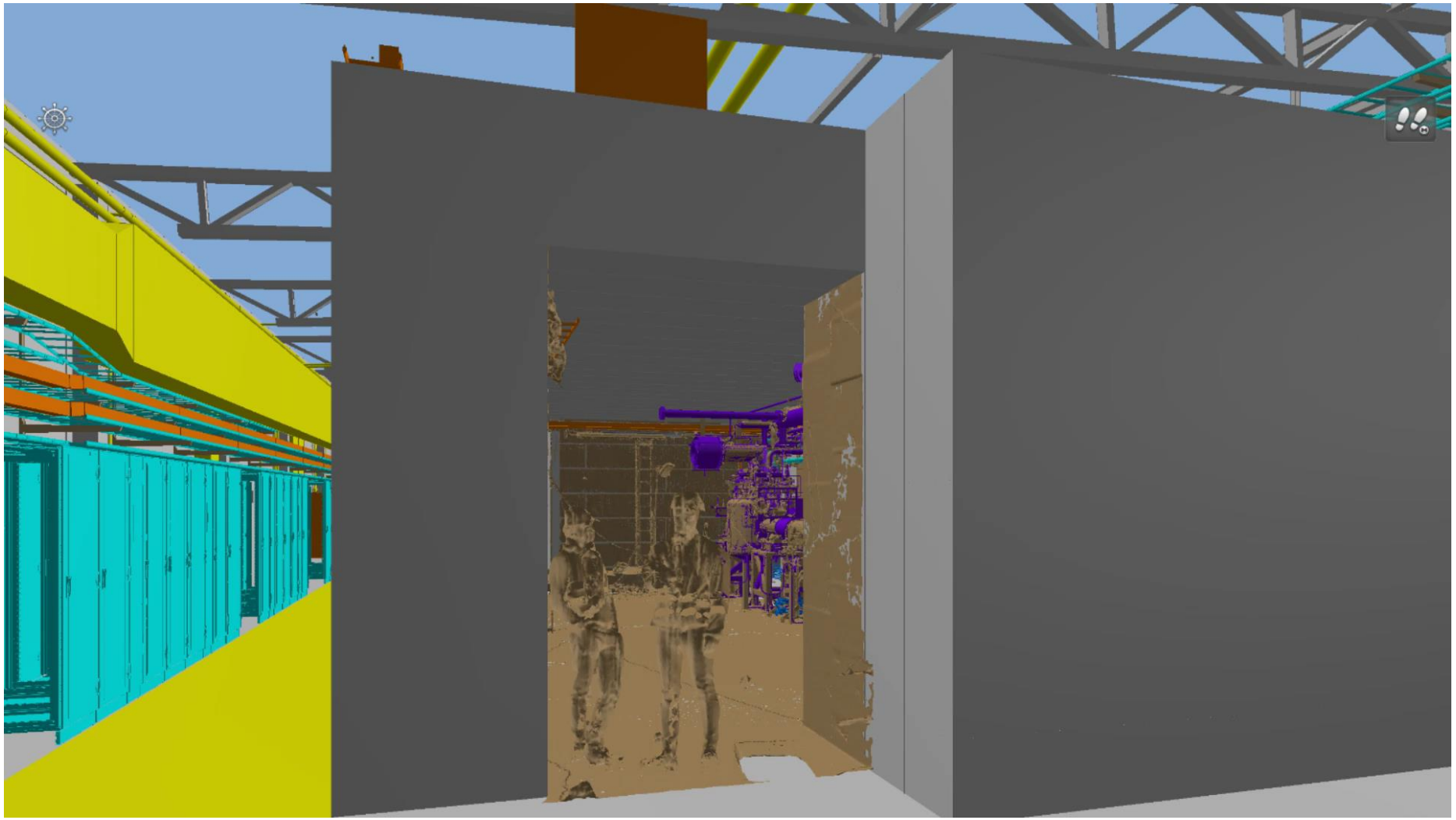
Virtual Reality





- Many engineering visualization with the teams : Design, Installation
- Spatial Integration Meeting
- REVIEWS
- Many external visits / Communication
- Training
- SSM

AS-Scanned



Thank you for listening

Questions?