

An overview of the European Spallation Source

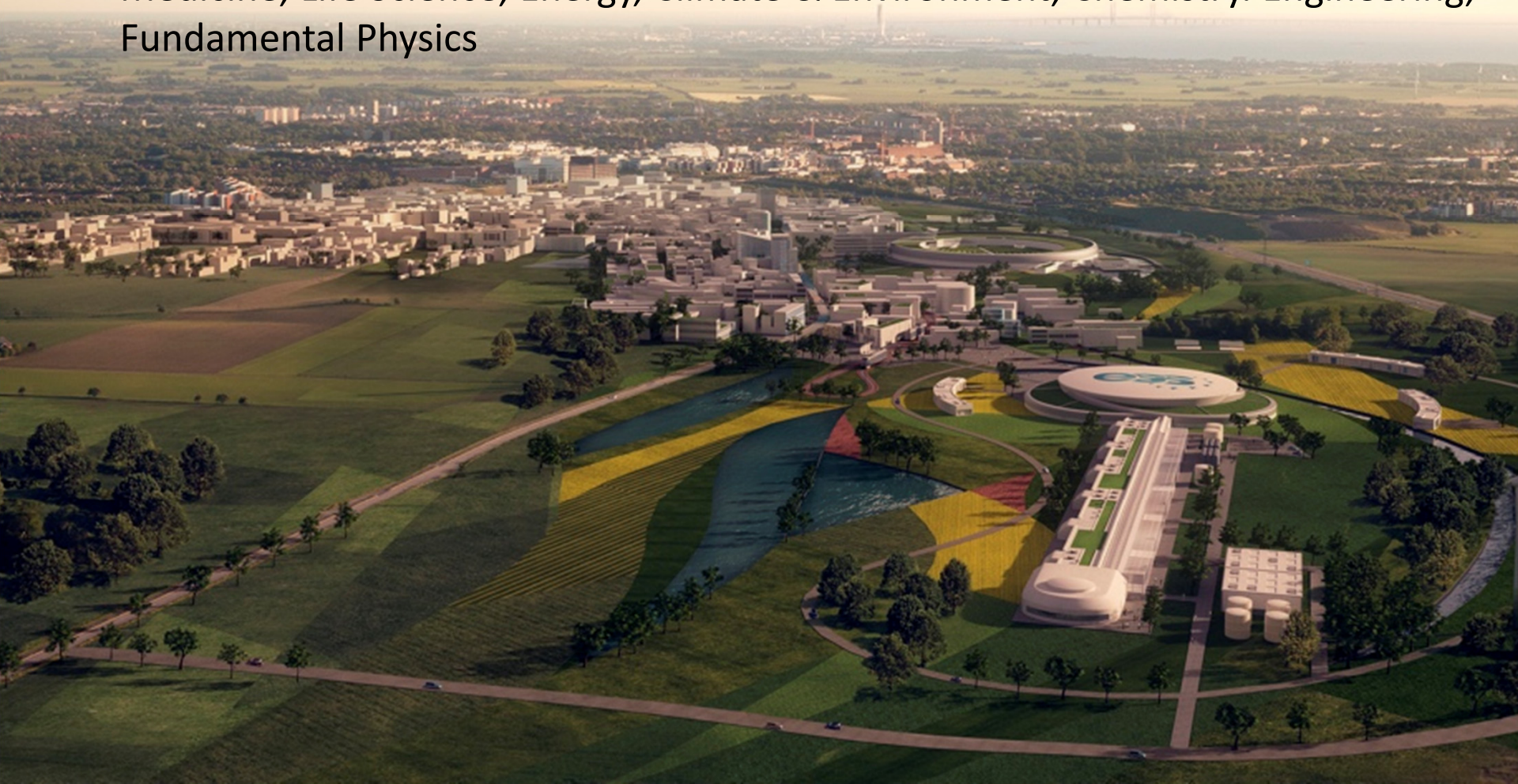
MEDSI 2016, Barcelona

Xavi Permanyer, Sept 13th, 2016

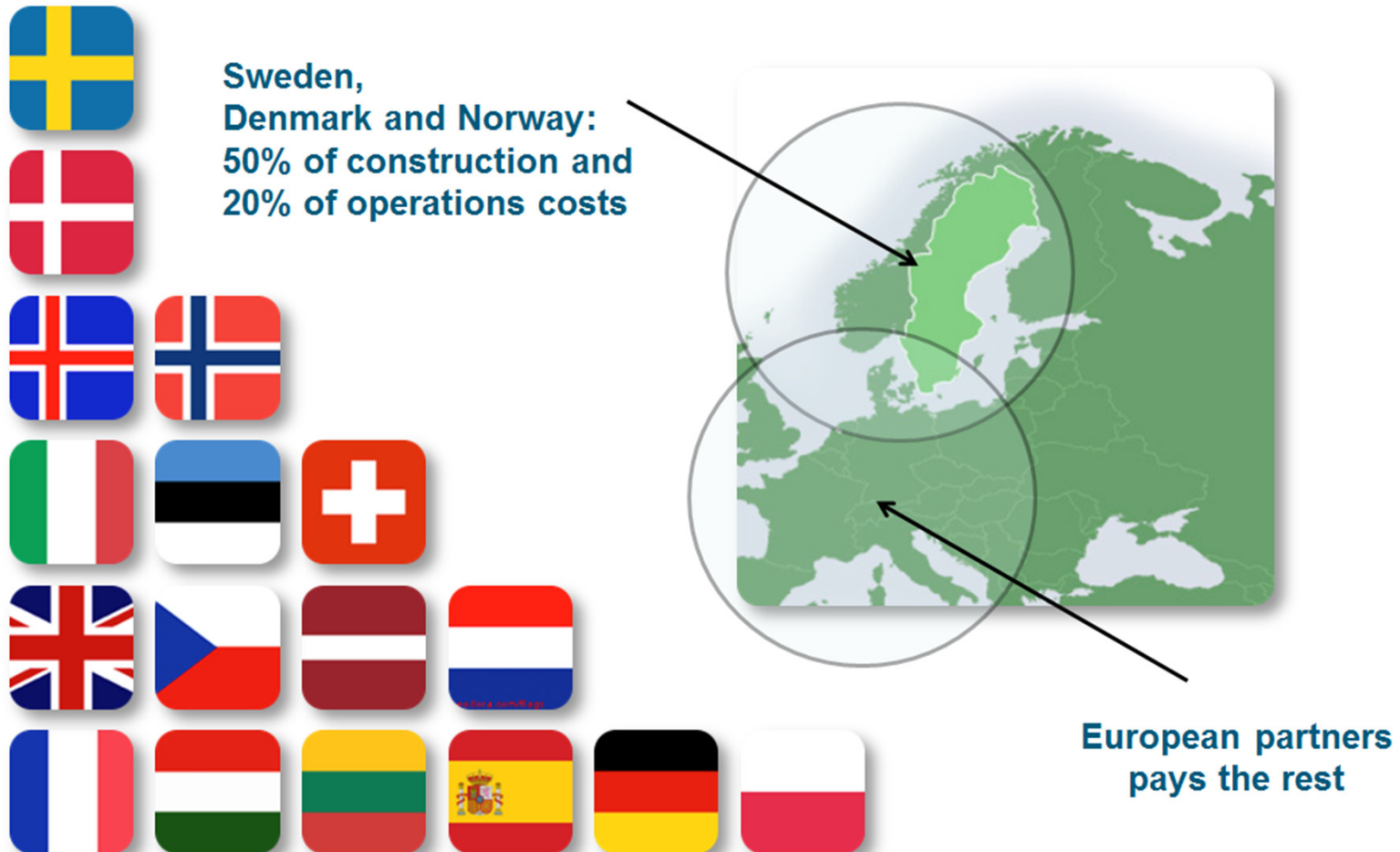
www.europeanspallationsource.se

The European Spallation Source

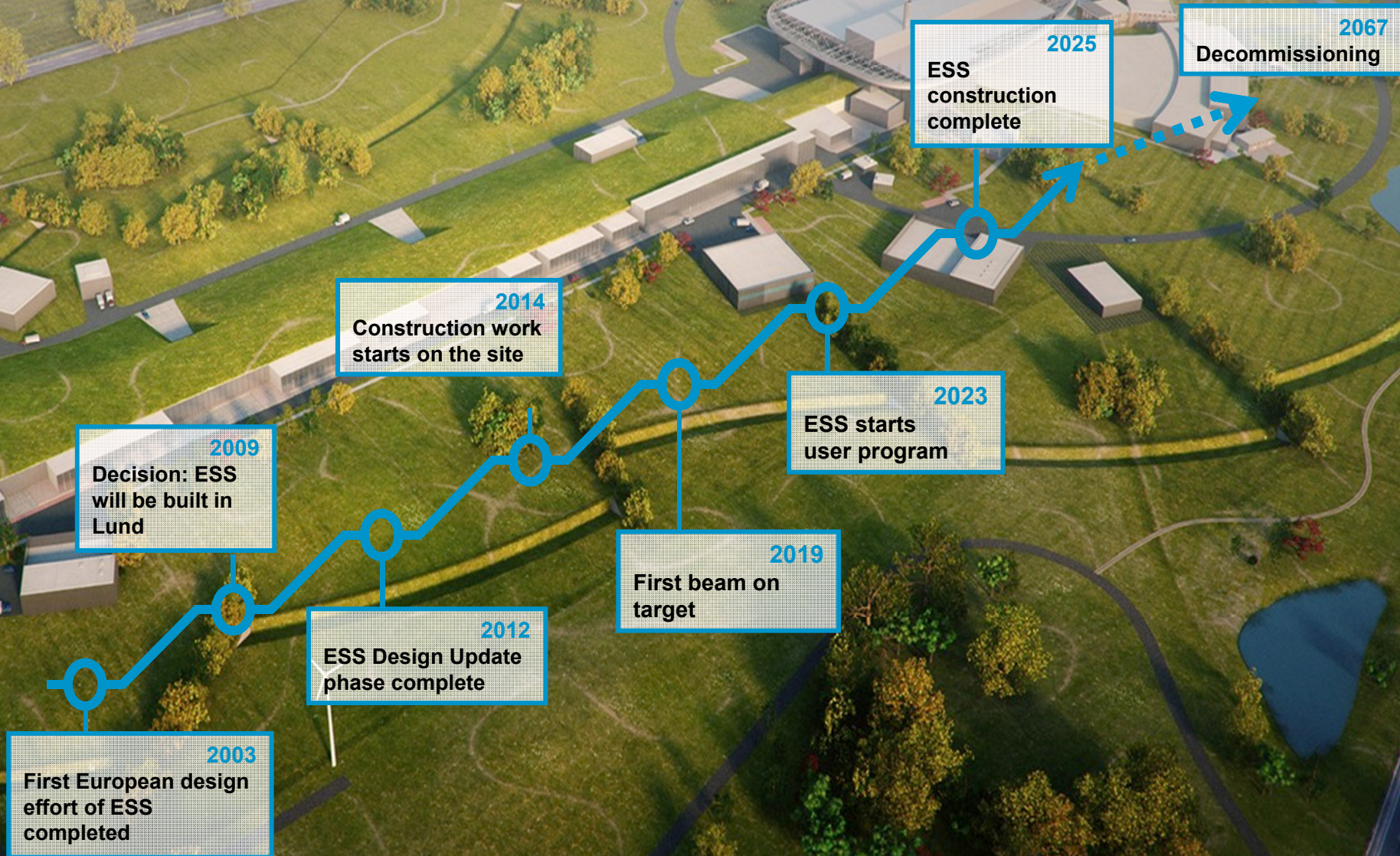
- A partnership of 17 European nations committed to the goal of collectively building and operating the worlds leading facility for research using neutrons by the second quarter of the 21st century
- Researchers using ESS will produce new knowledge within: Materials physics, Medicine, Life Science, Energy, Climate & Environment, Chemistry. Engineering, Fundamental Physics



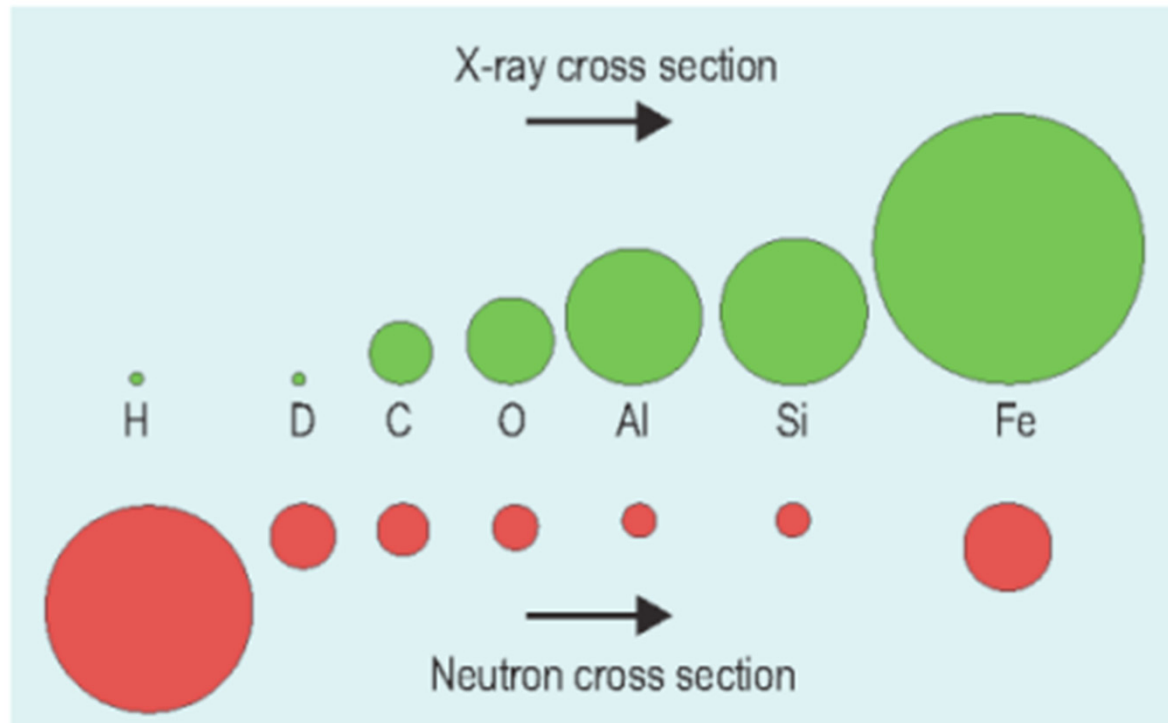
An International Collaboration



Timeline for the ESS facility



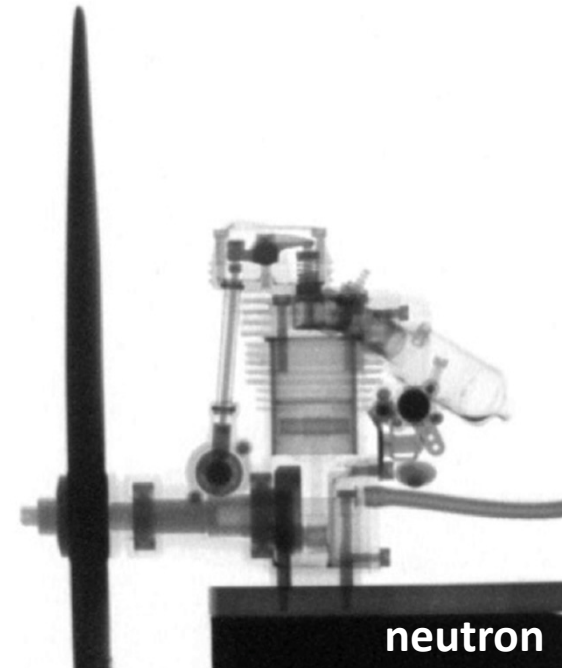
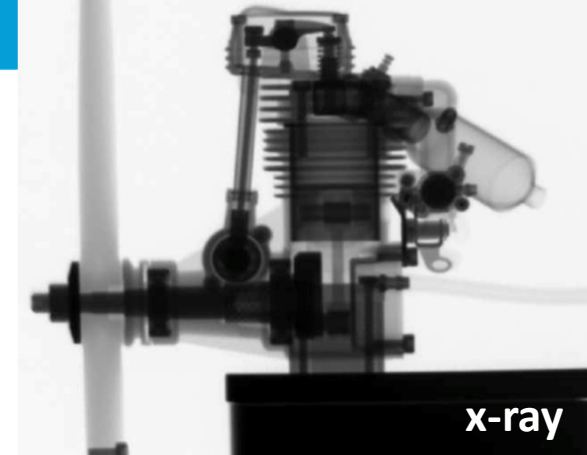
Neutrons see the light elements



Neutrons see the light elements



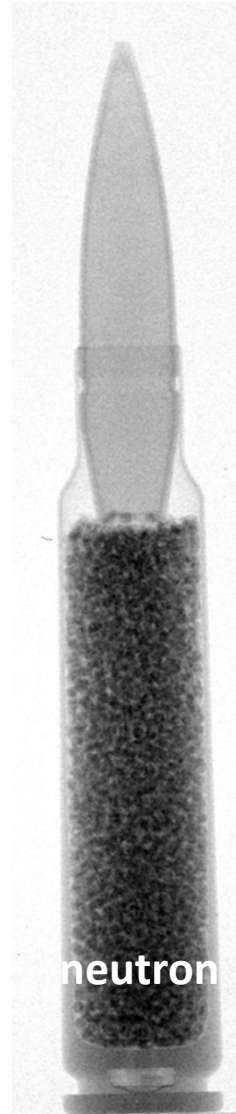
Images from the
NIAG group, PSI,
Switzerland.



Neutrons see the light elements

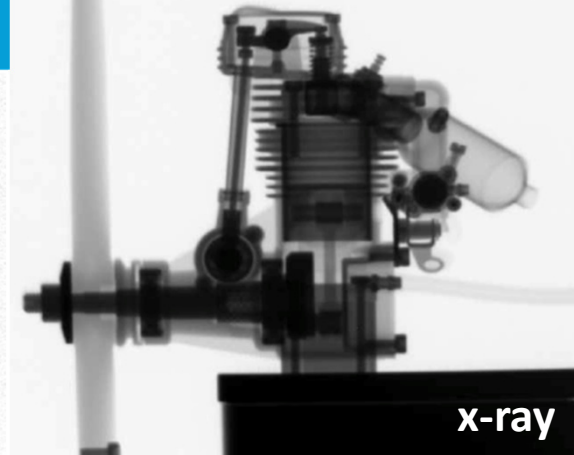


x-ray

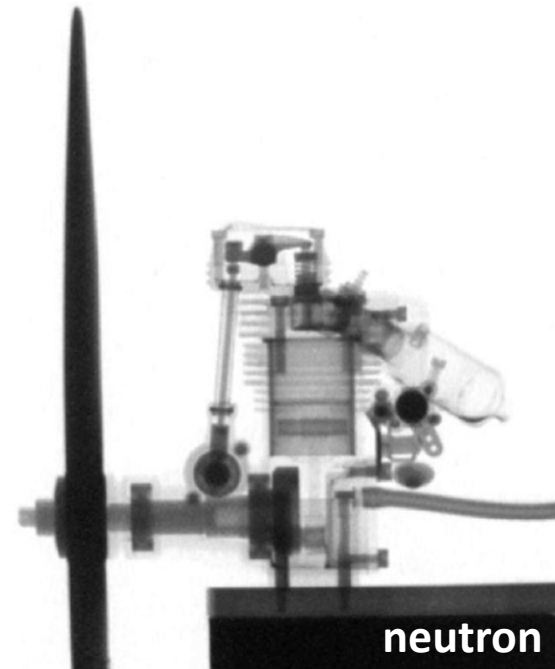


neutron

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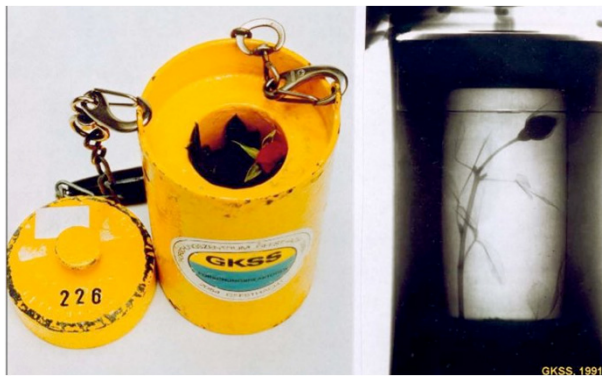
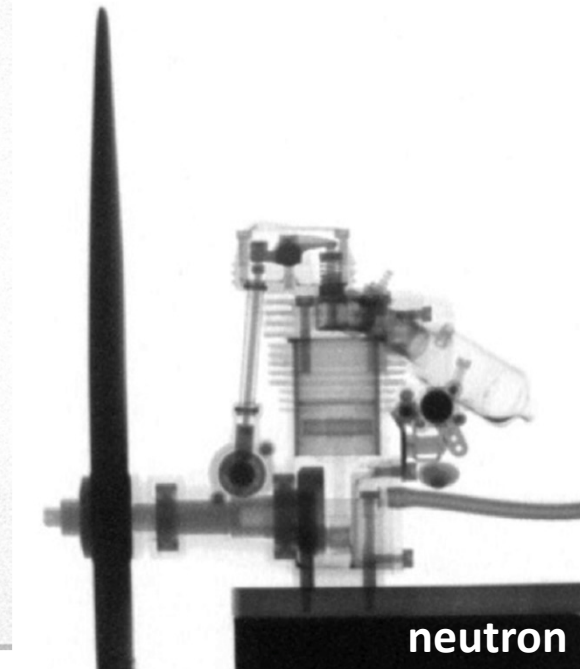
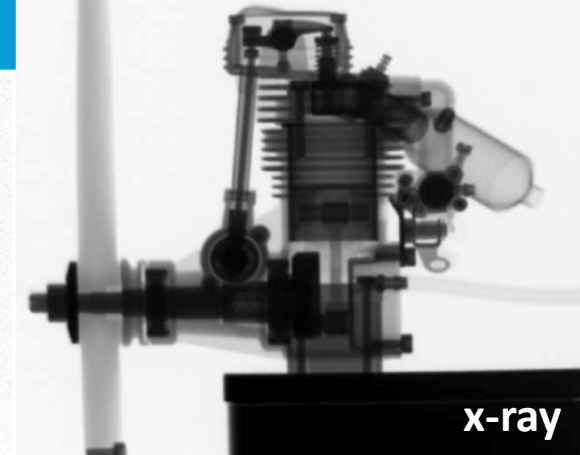
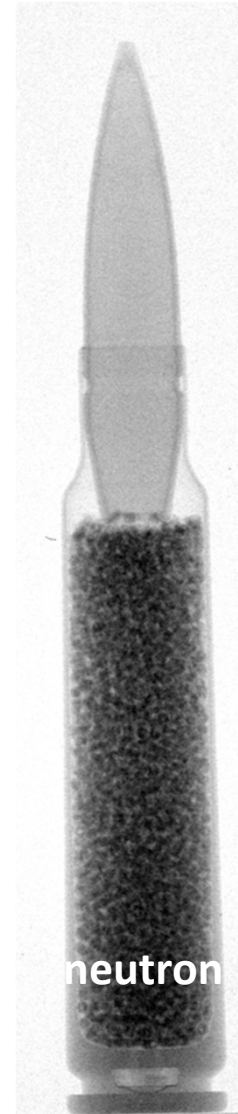
x-ray



neutron

Neutrons see the light elements

Images from the
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ESS is a pulsed neutron source

Target Station

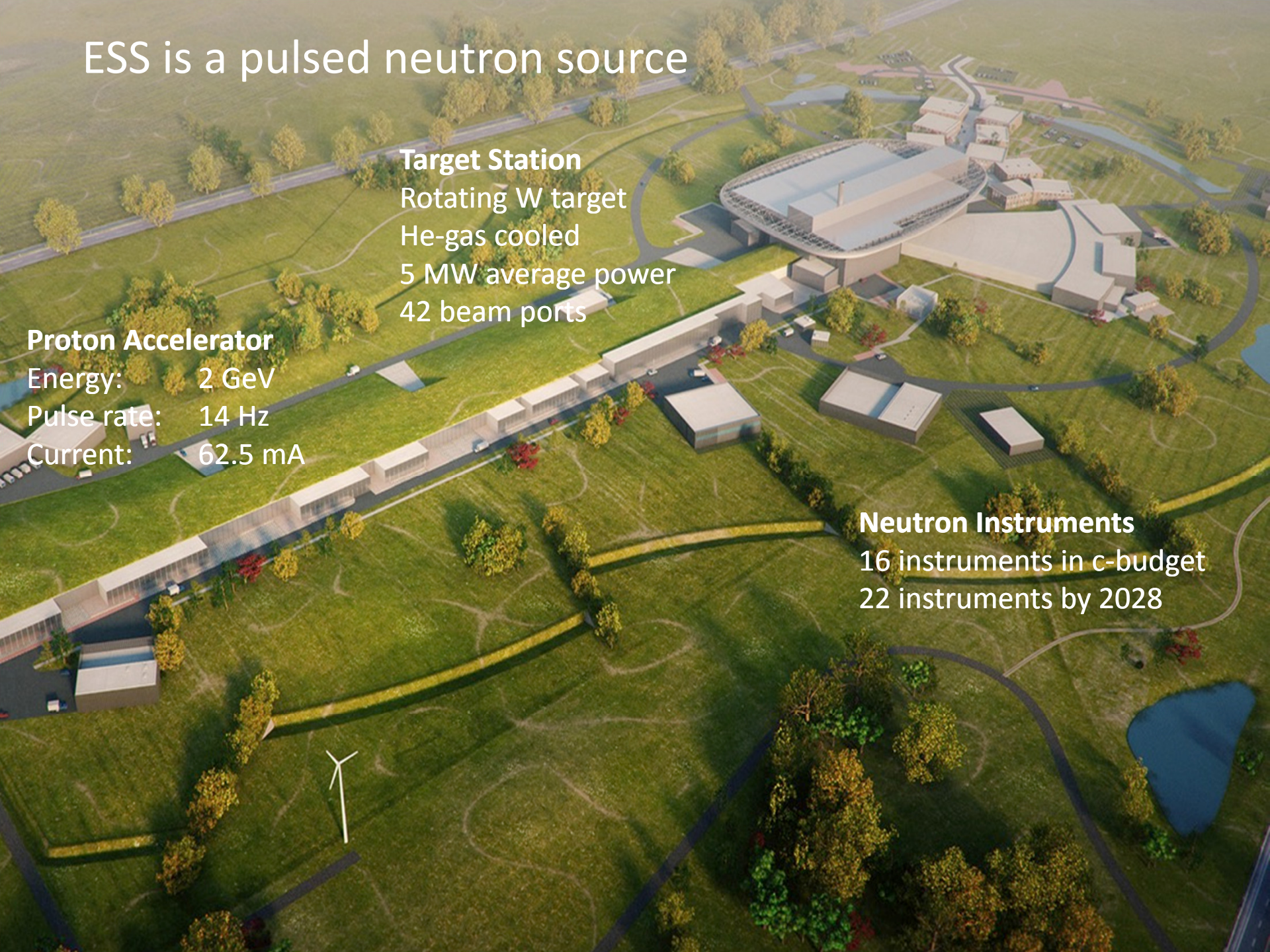
Rotating W target
He-gas cooled
5 MW average power
42 beam ports

Proton Accelerator

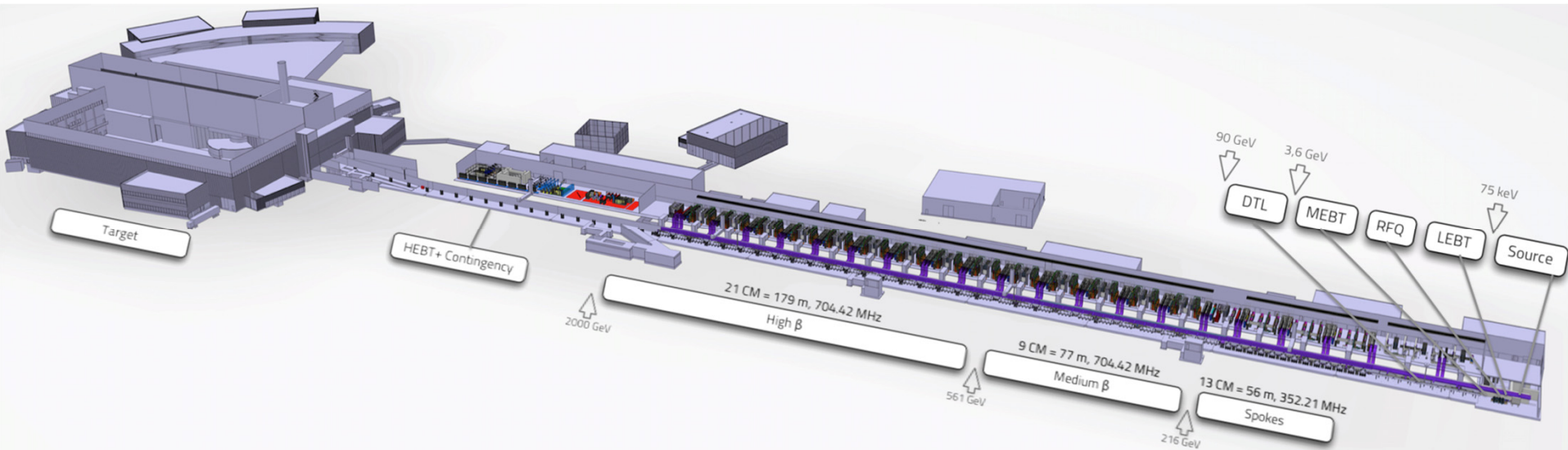
Energy: 2 GeV
Pulse rate: 14 Hz
Current: 62.5 mA

Neutron Instruments

16 instruments in c-budget
22 instruments by 2028



Accelerator

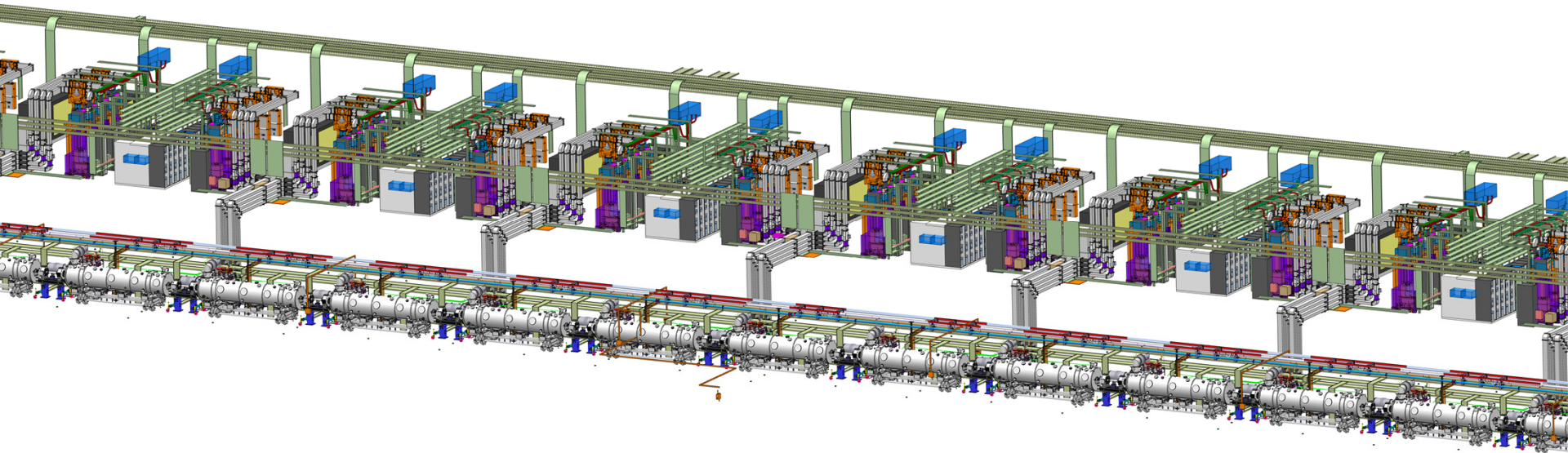


Key parameters

- Protons (H⁺)
- 5 MW
- 2.86 ms pulses
- 14 Hz
- 2 GeV
- 62.5 mA peak
- Low losses
- Minimize energy use
- Flexible design for future upgrades

	Length (m)	W _{in} (MeV)	F (MHz)	β Geometric	No. Sections	T (K)
LEBT	2.38	0.075	--	--	1	~300
RFQ	4.6	0.075	352.21	--	1	~300
MEBT	3.81	3.62	352.21	--	1	~300
DTL	38.9	3.62	352.21	--	5	~300
LEDP + Spoke	55.9	89.8	352.21	0.50 (Optimum)	13	~2
Medium Beta	76.7	216.3	704.42	0.67	9	~2
High Beta	178.9	571.5	704.42	0.86	21	~2
Contingency	241	2000	704.42	(0.86)	14	~300 / ~2

Accelerator

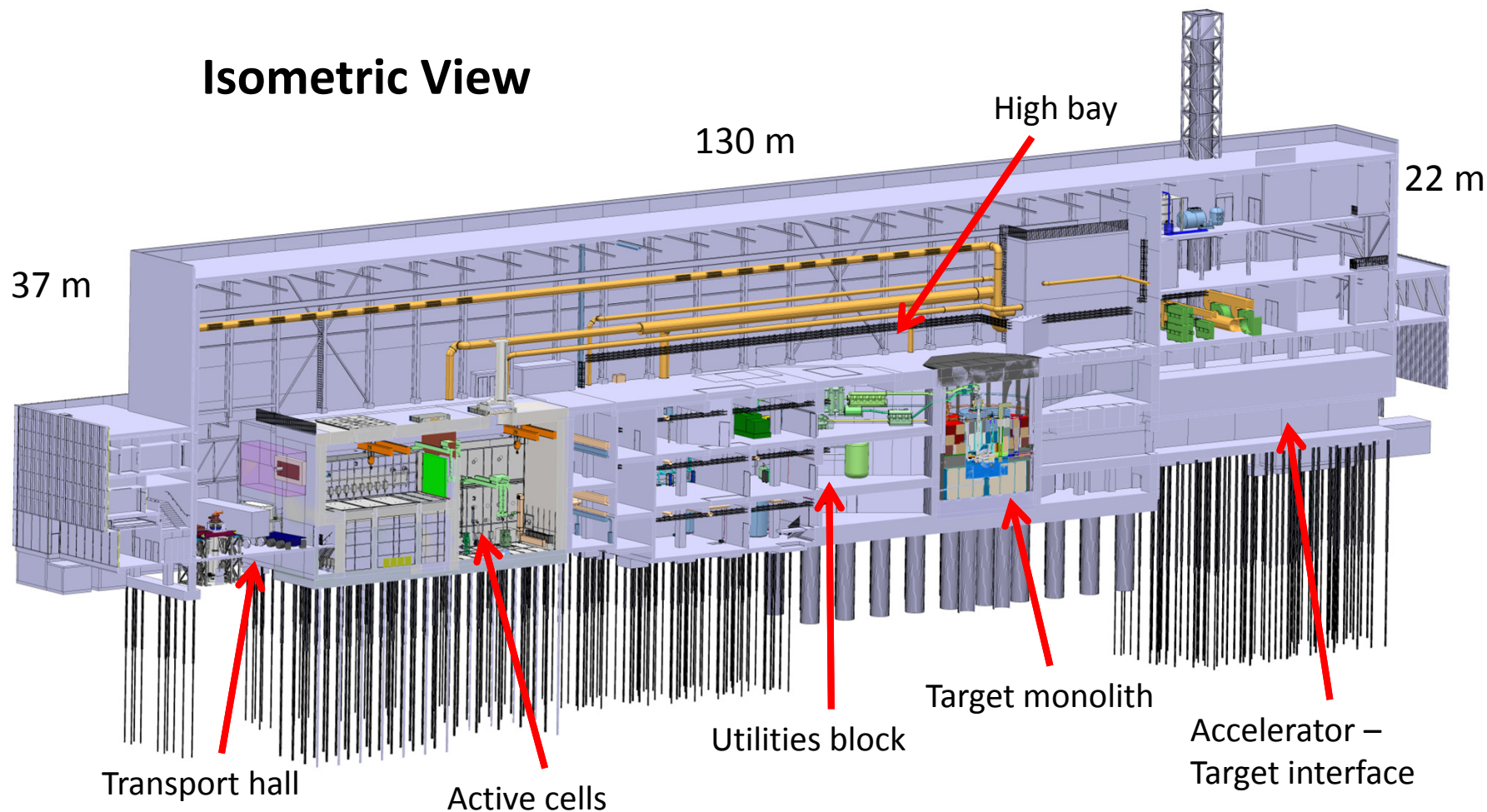


Key parameters

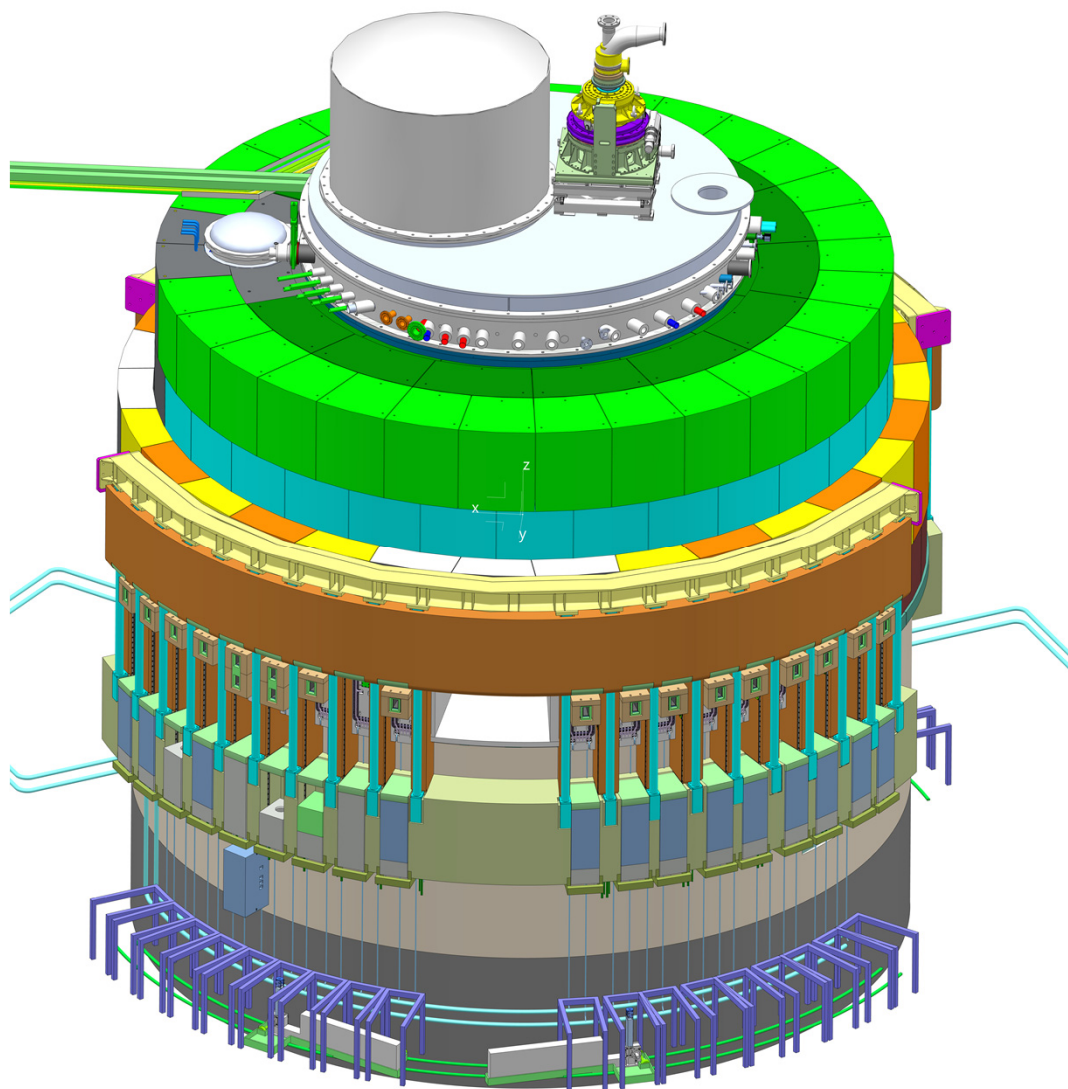
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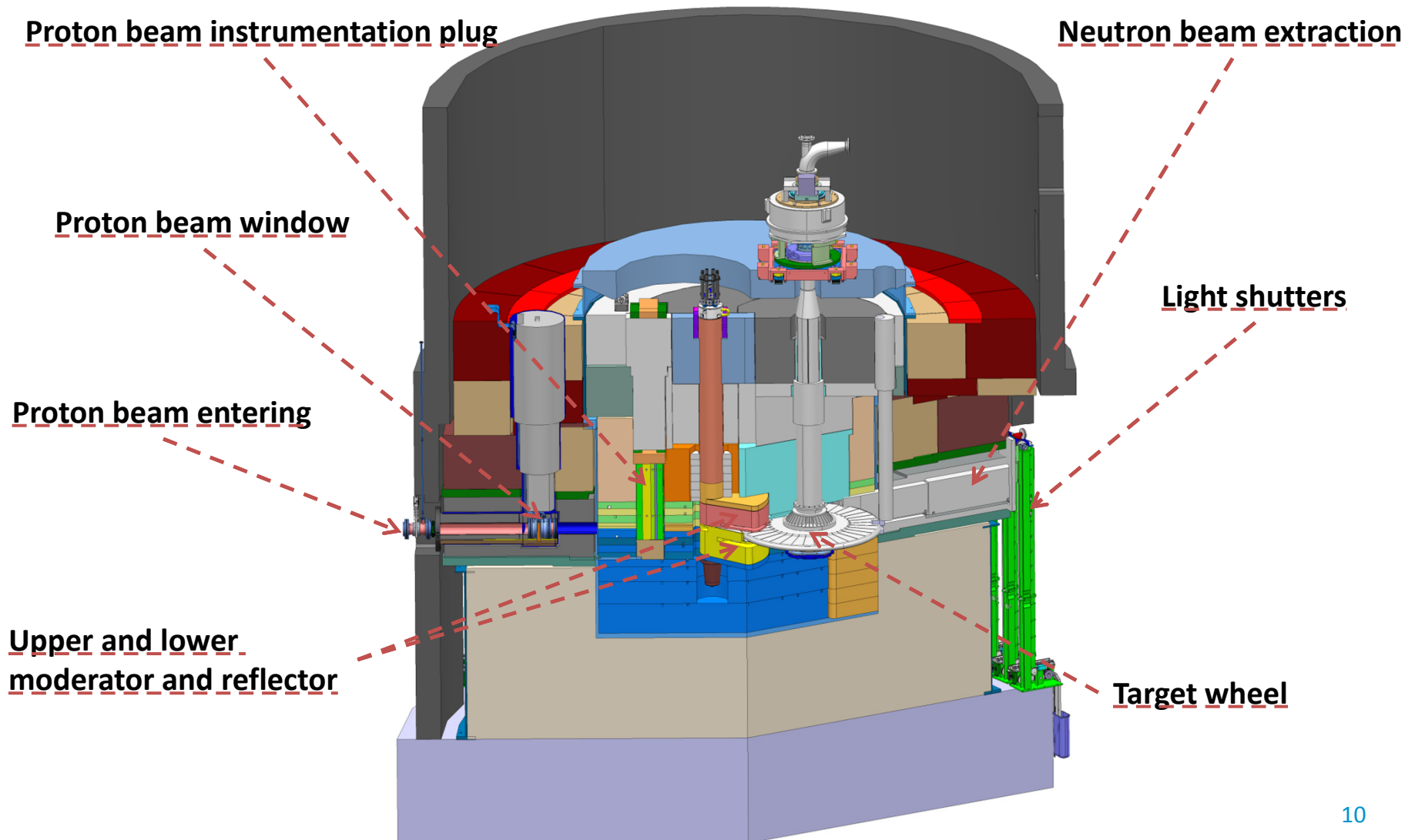
The ESS Target Station Layout



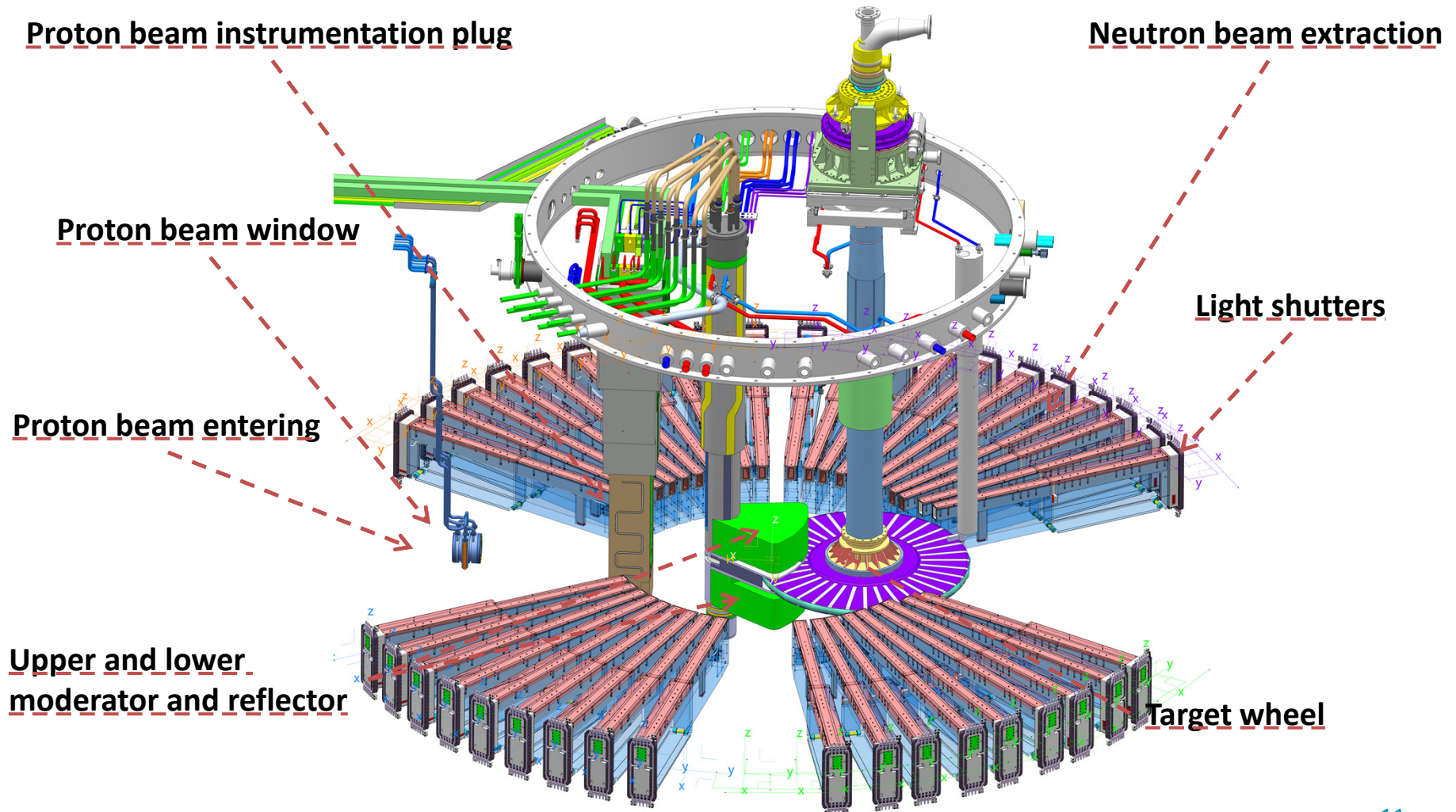
The Target Monolith



The Target Monolith Layout

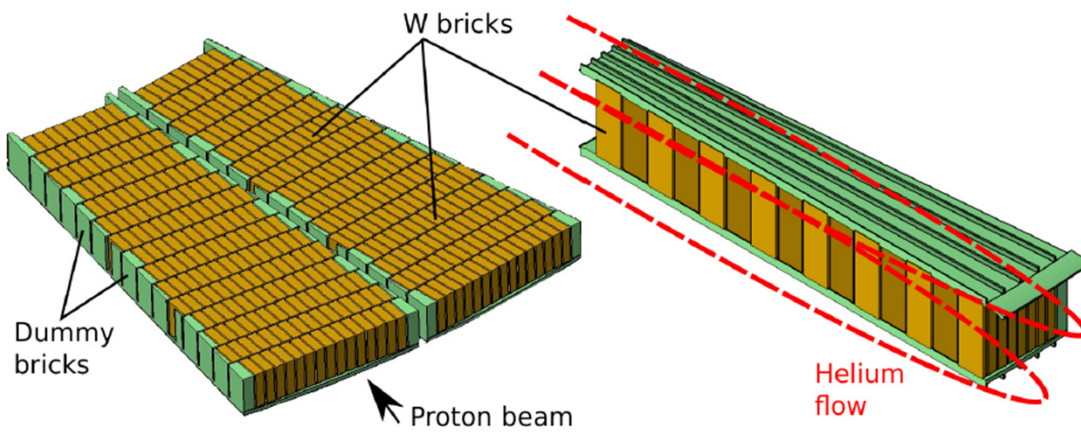
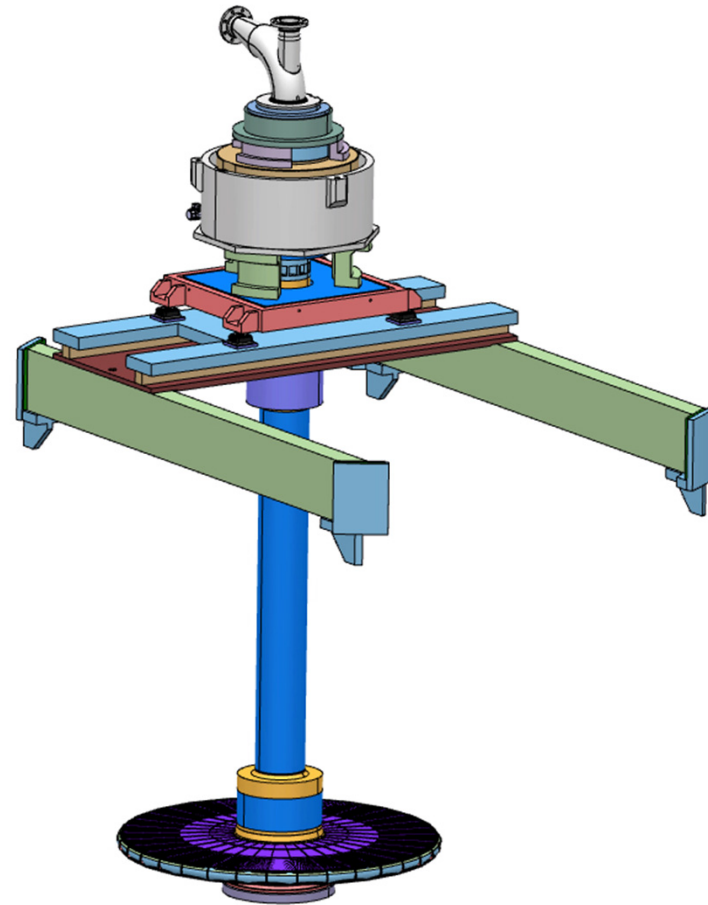


The Target Monolith Layout



The Target Wheel

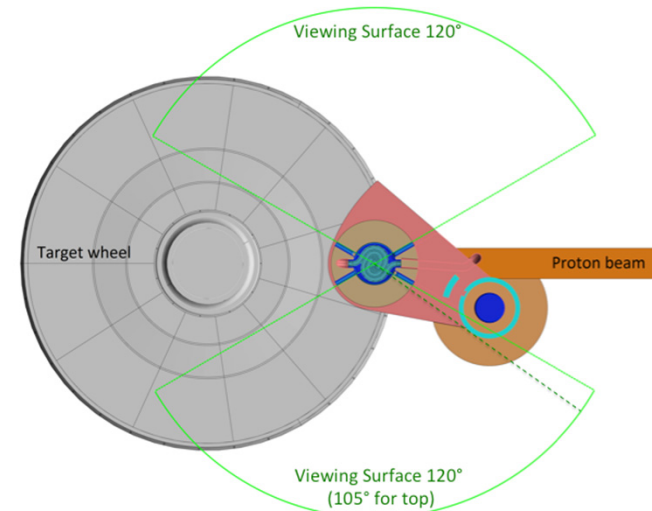
- Target wheel has 36 sectors of 10° each
- The beam pulse is 2.86 ms wide, and pulses 14 times per second
- Wheel rotation speed is 0.39 Hz
- Motors and bearings are mounted far away (5 meters) from the high radiation zone
- Wheel contains 3 tons of tungsten
- Helium removes 3 MW of heat deposited in the target by the 5-MW proton beam
- Expected lifetime of 5 years



The Target Moderator and Reflector

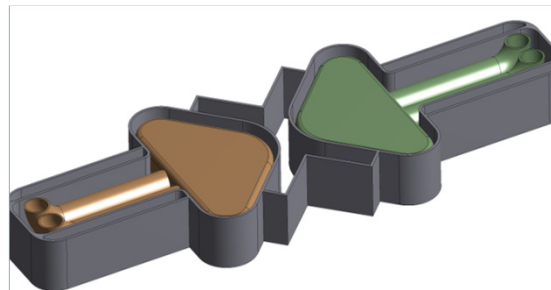
- **Cold moderators**

- Hydrogen at 20 K and 1.5 MPa (super-critical pressure)
- Vessel in aluminium alloy
- Expected lifetime in the order of one full power year
- Vacuum jacket for insulation



- **Water moderators**

- Thermal water
- Pre-moderator surrounding the cold moderator vessel
- Extended wings to facilitate thermal or bi-spectral beam extraction
- Expected lifetime in the order of one full power year

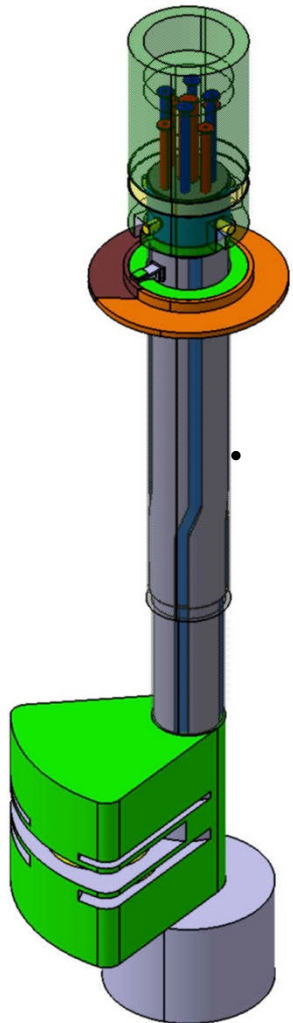


- **Inner reflector**

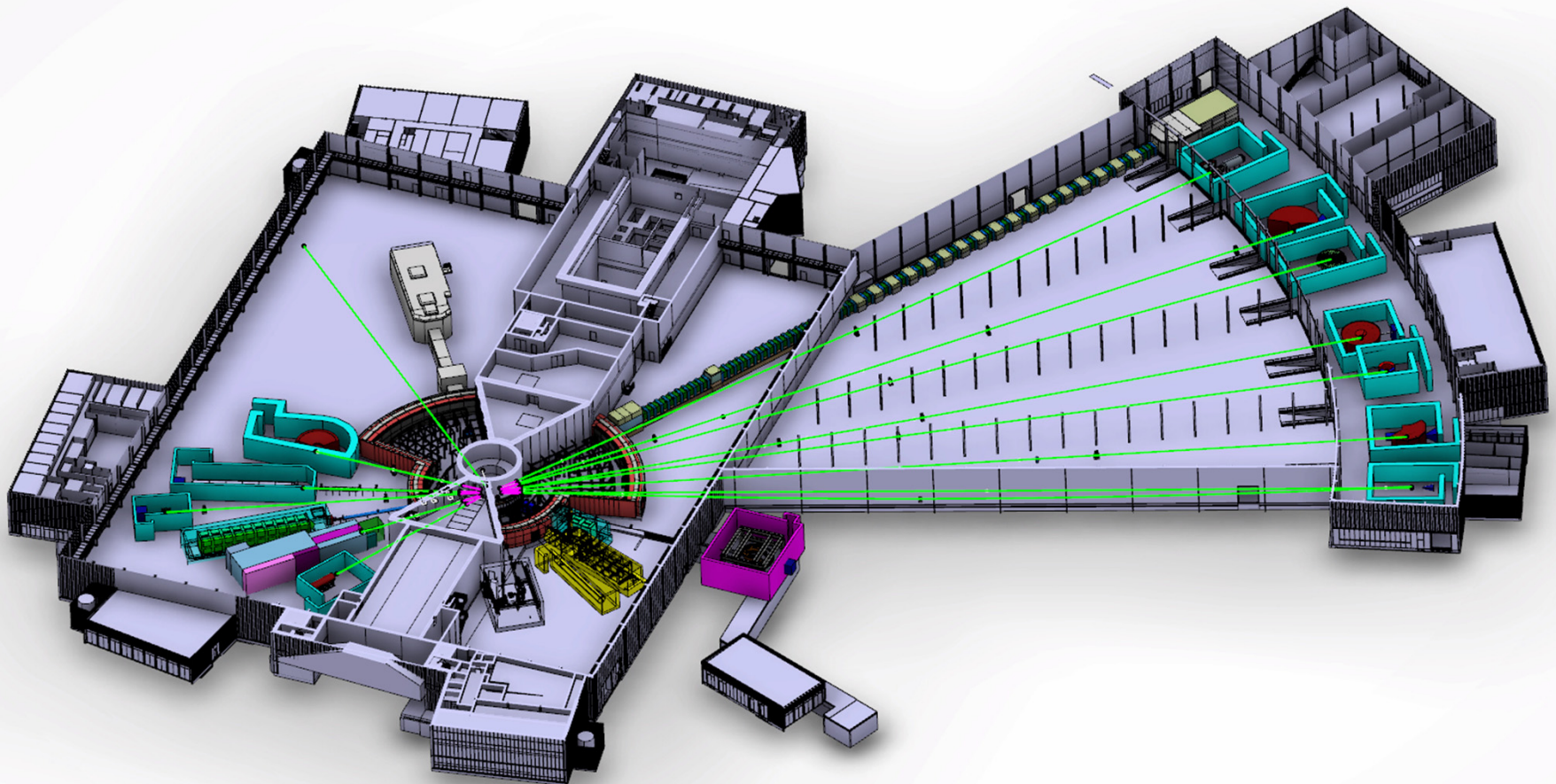
- Beryllium
- Water cooled

- **Outer reflector**

- Steel
- Water cooled



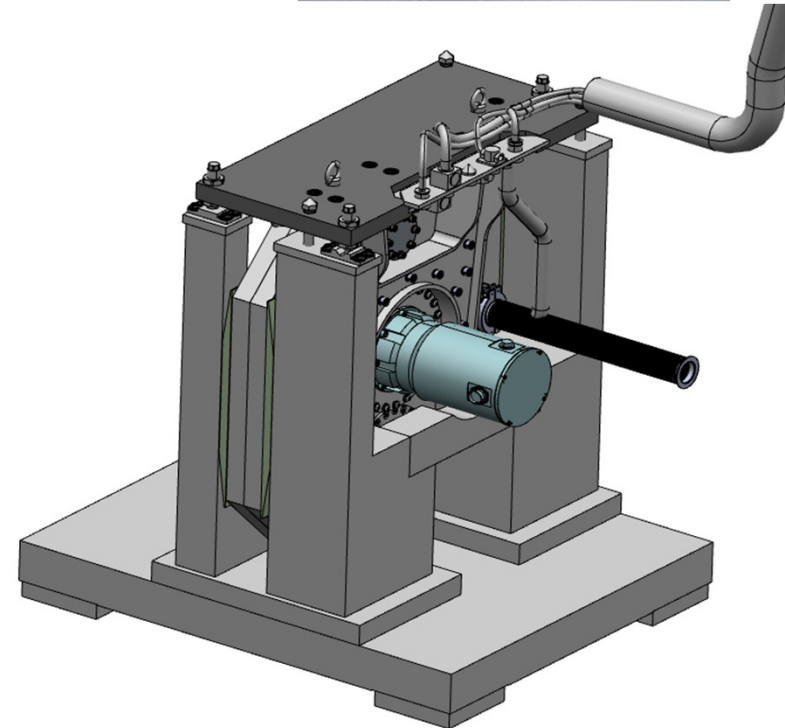
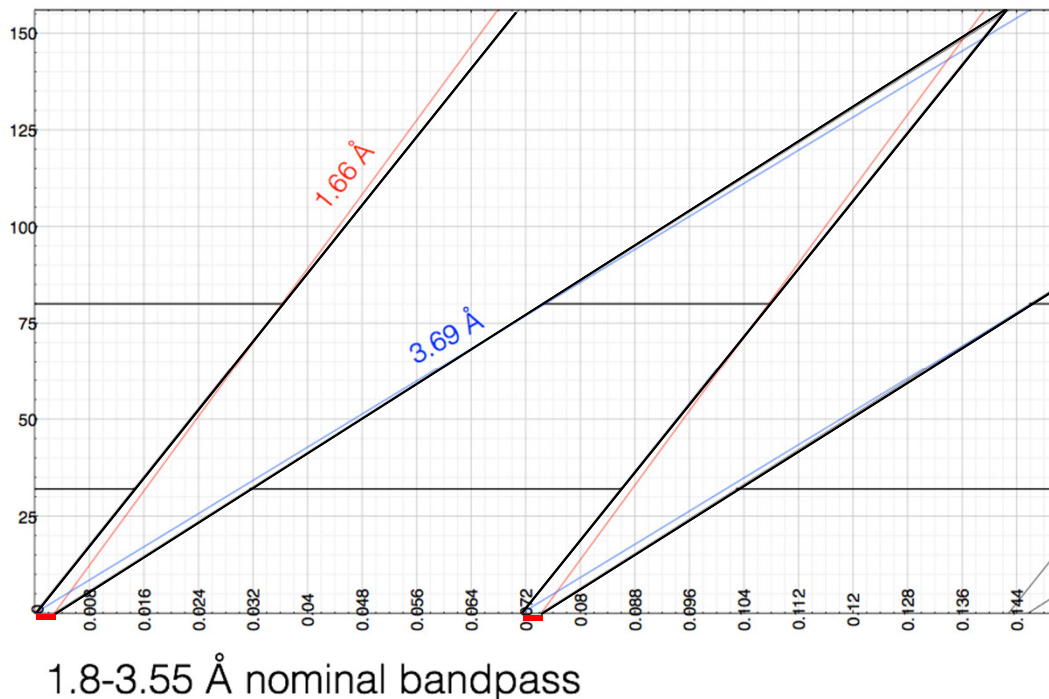
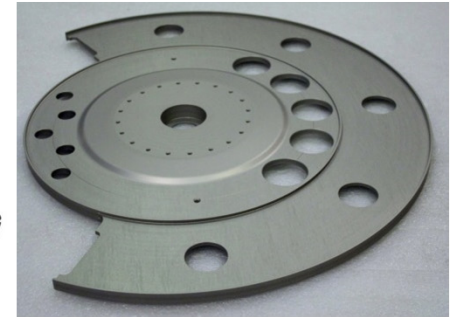
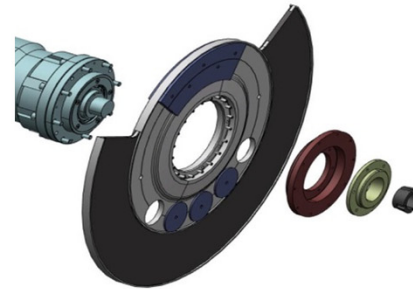
Neutron Instruments



Neutron Instruments

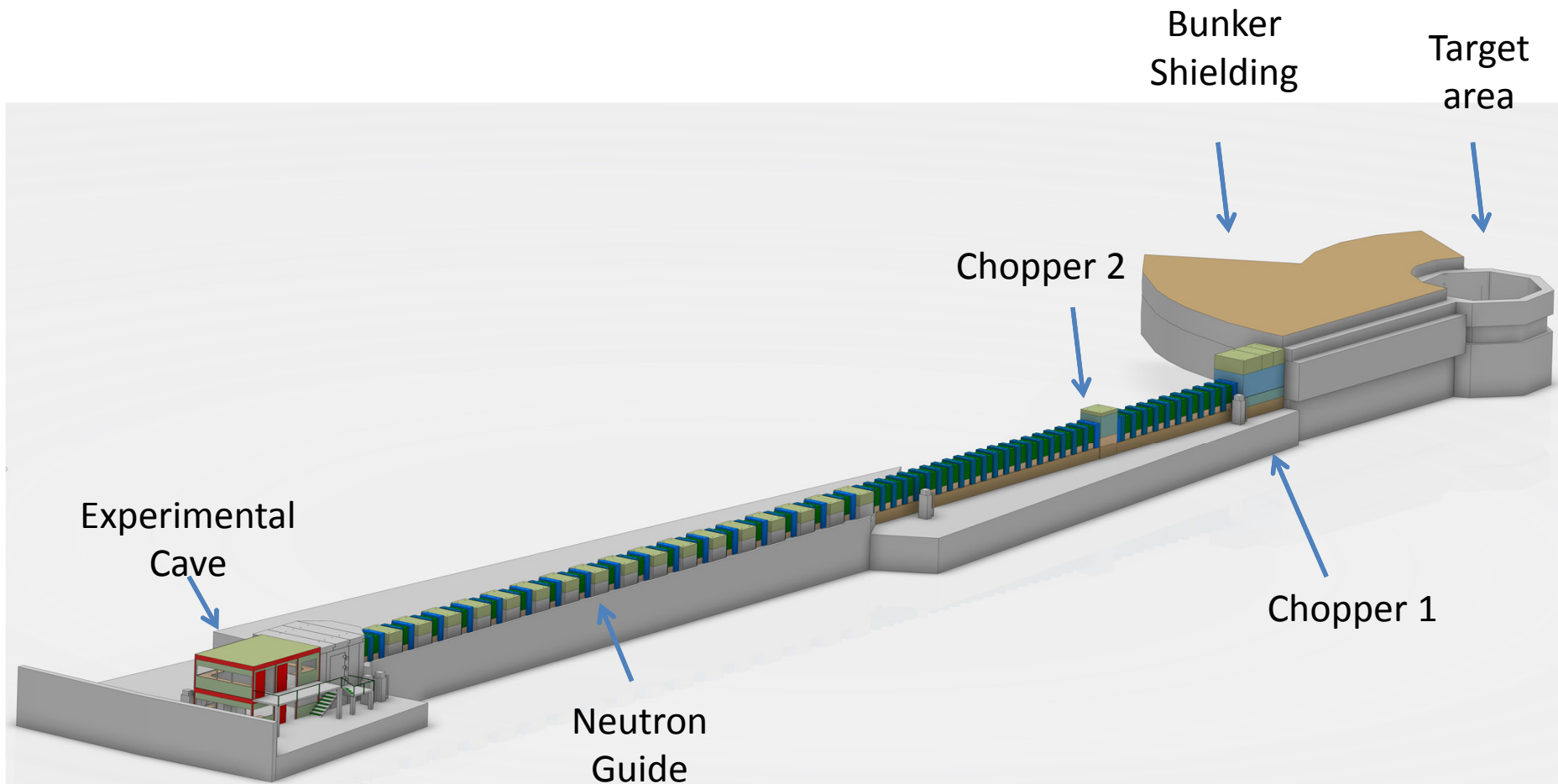
Wavelength Selection Choppers

- Disk diameter 700mm
- Rotating frequency 14 Hz
- B4C resin-epoxy coating.
- Single disk at 32m
- Double, co-rotating disk at 80m

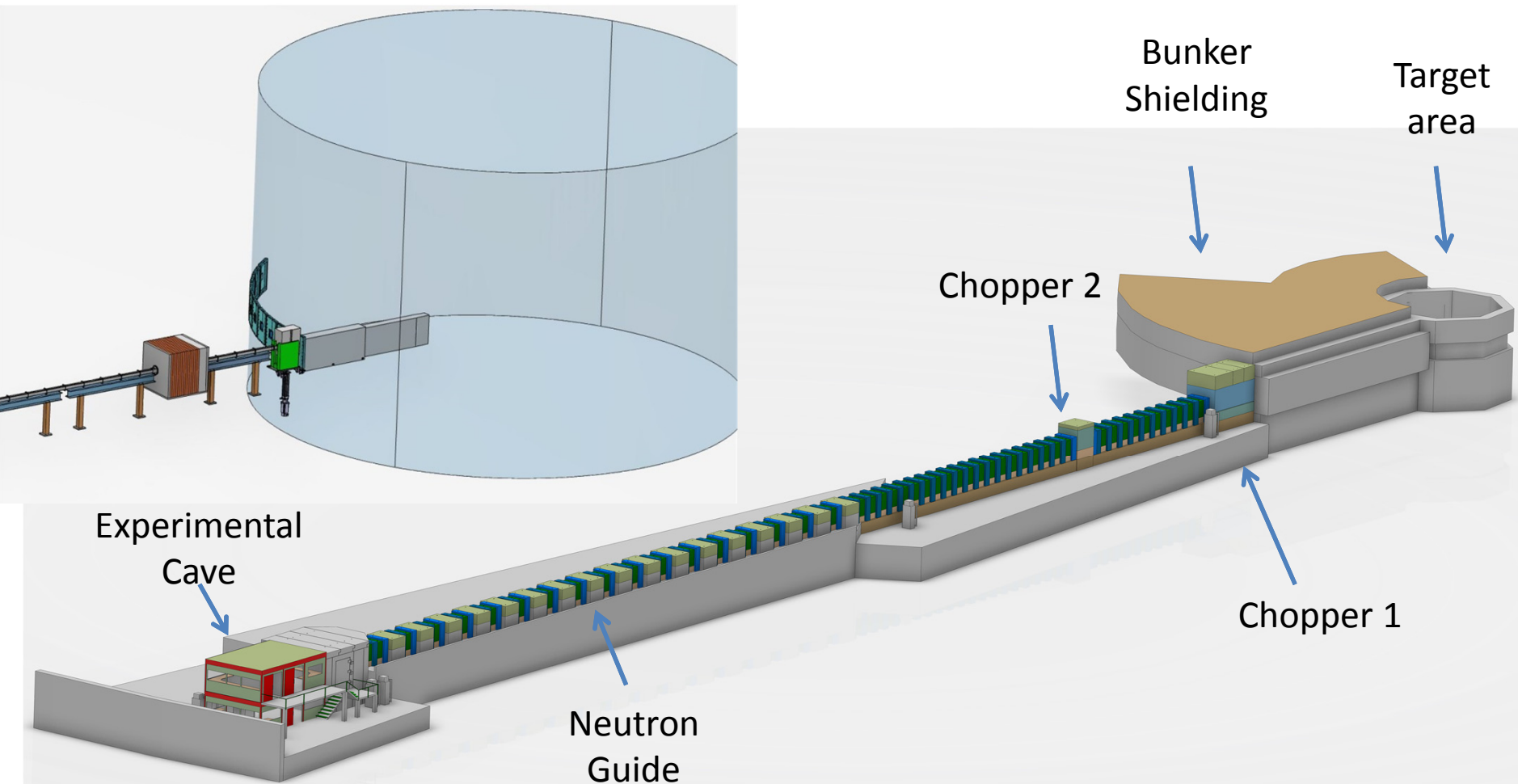


Courtesy of Markus Olsson NCG

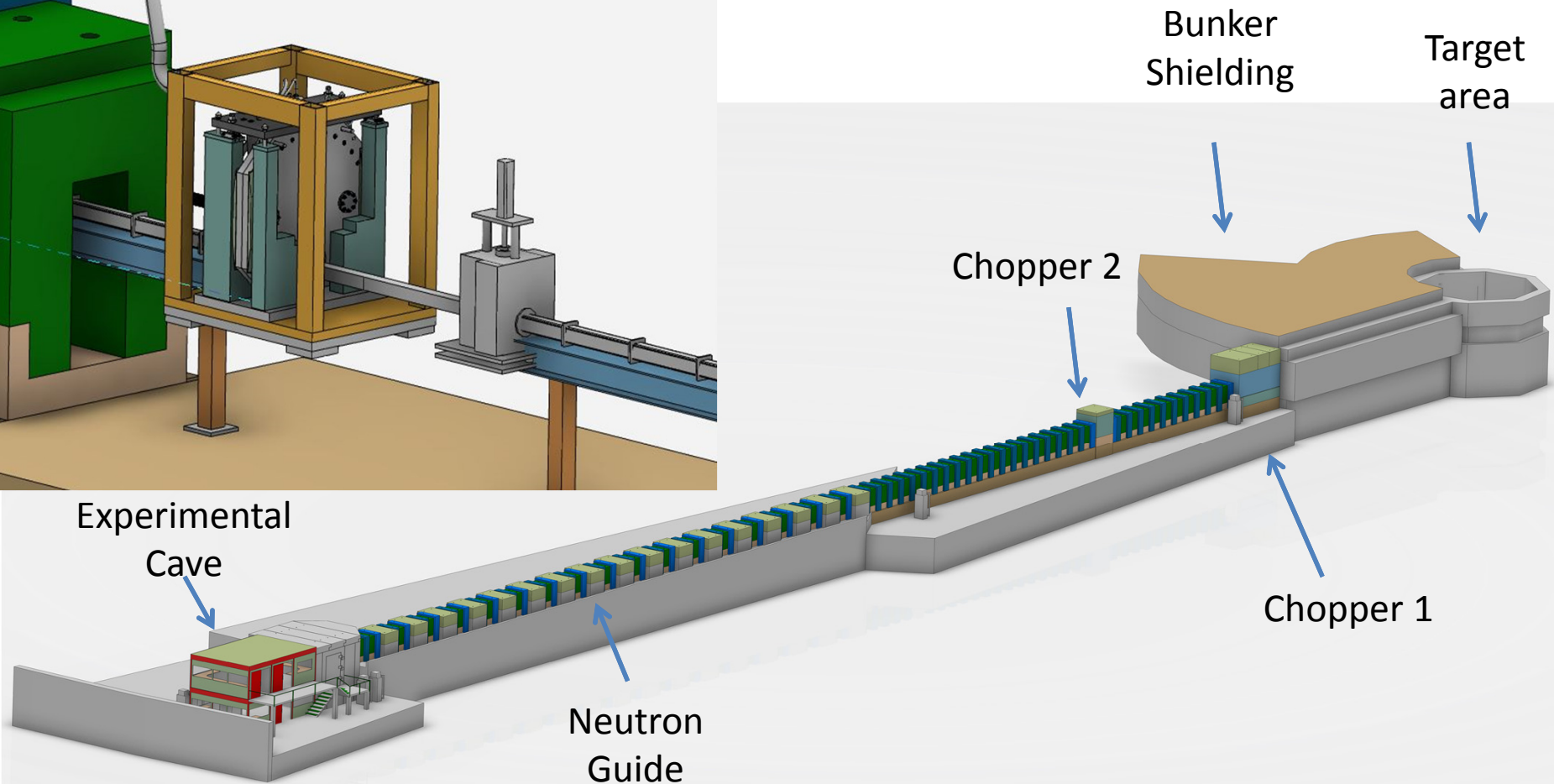
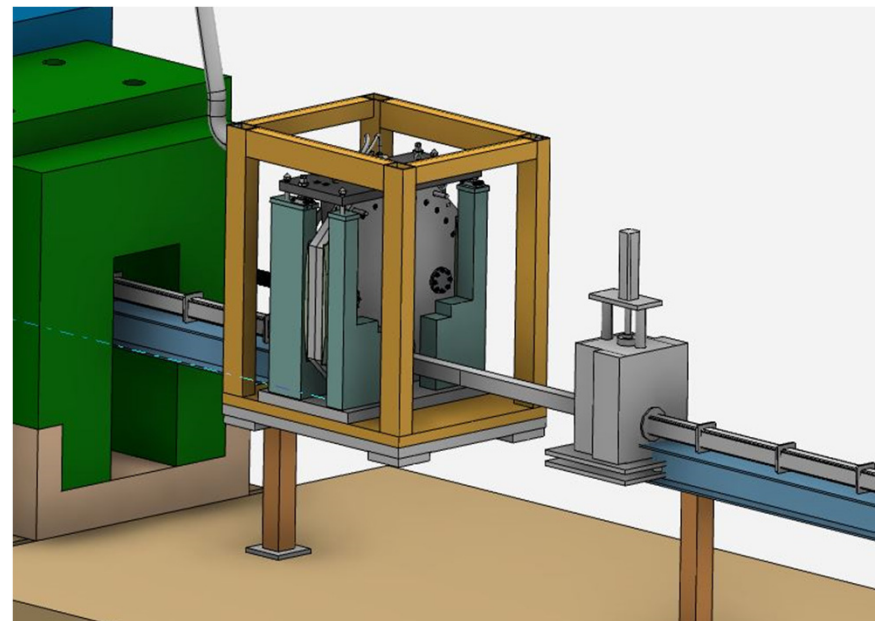
Neutron Instruments



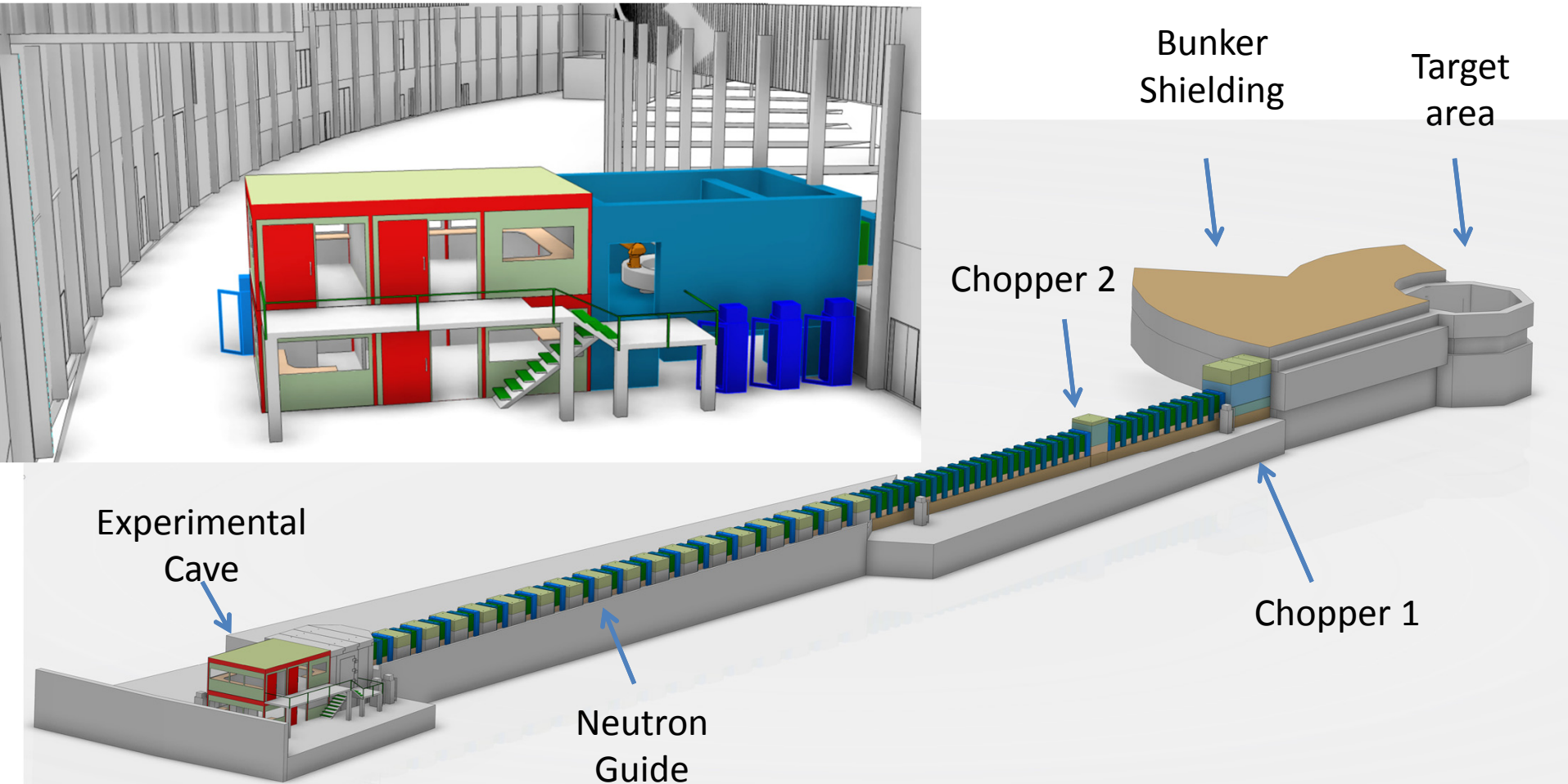
Neutron Instruments



Neutron Instruments

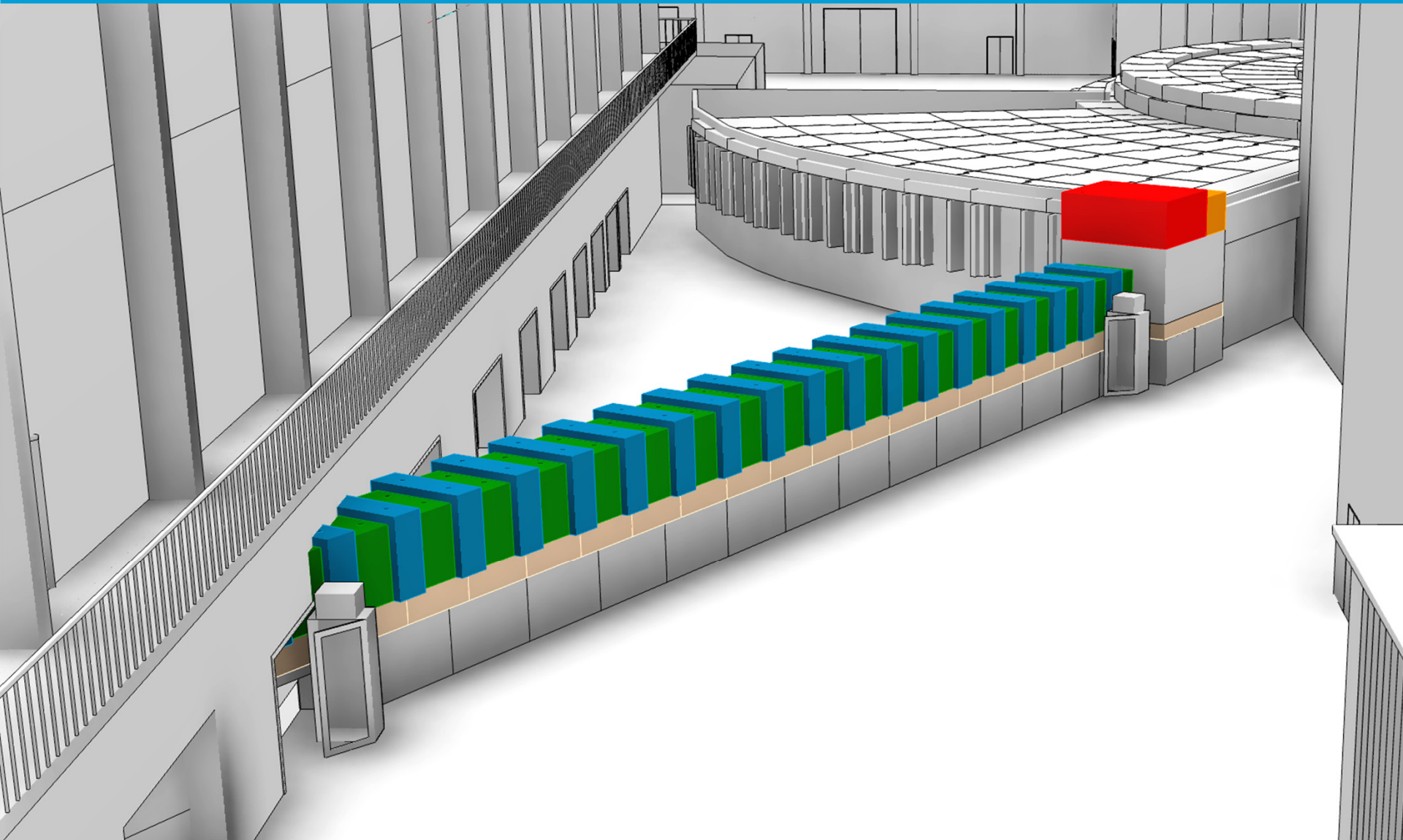


Neutron Instruments



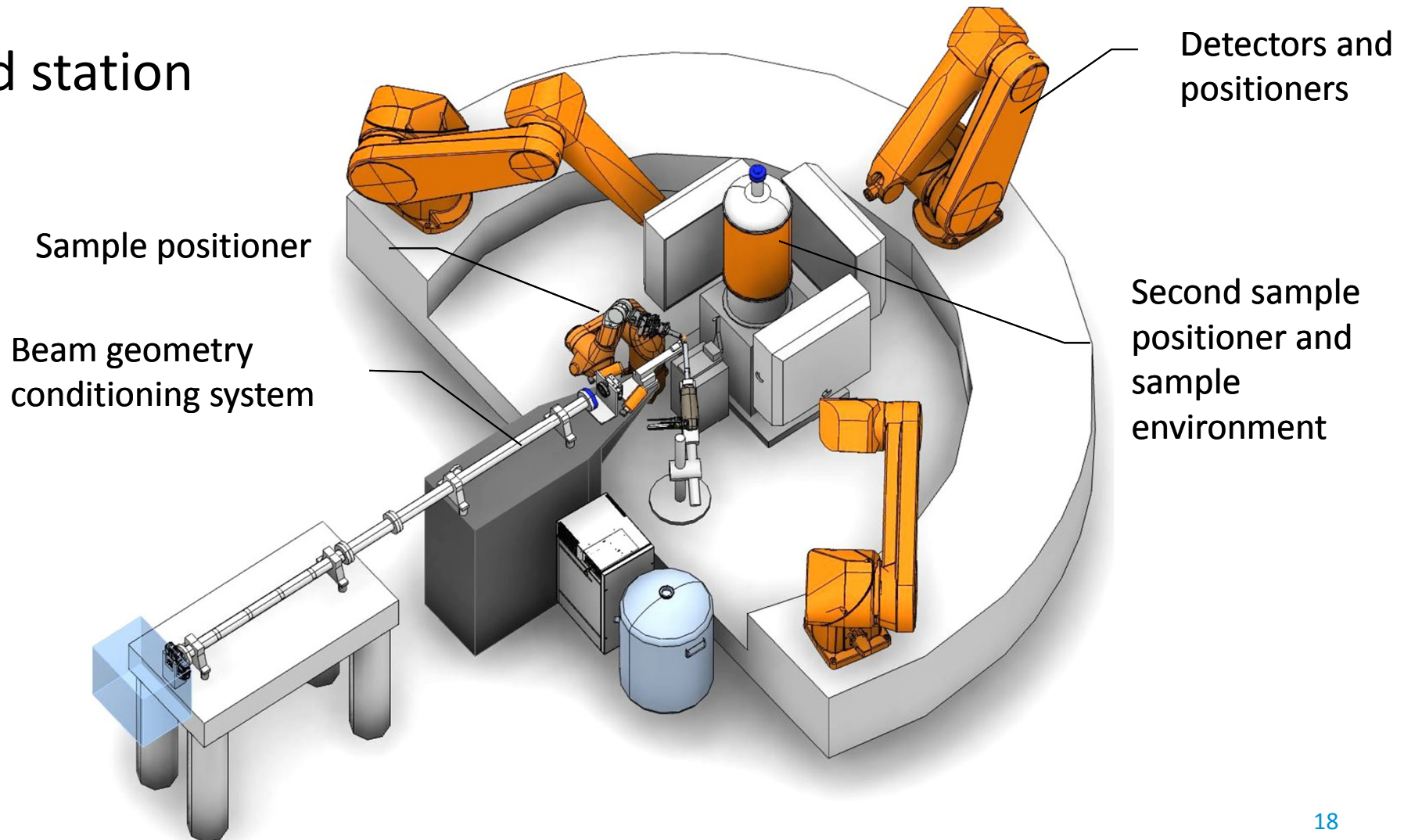
Neutron Instruments

Shielding, a lot of concrete....



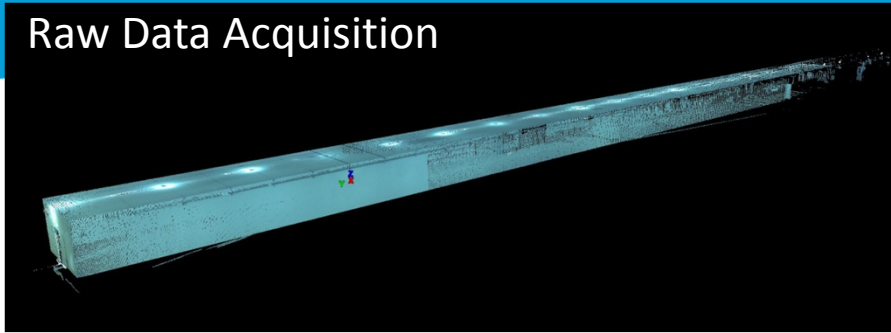
Neutron Instruments

End station

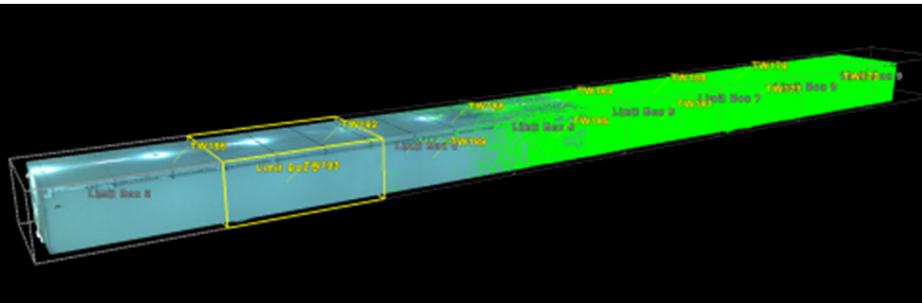


Engineering Projects – Laser Scanner

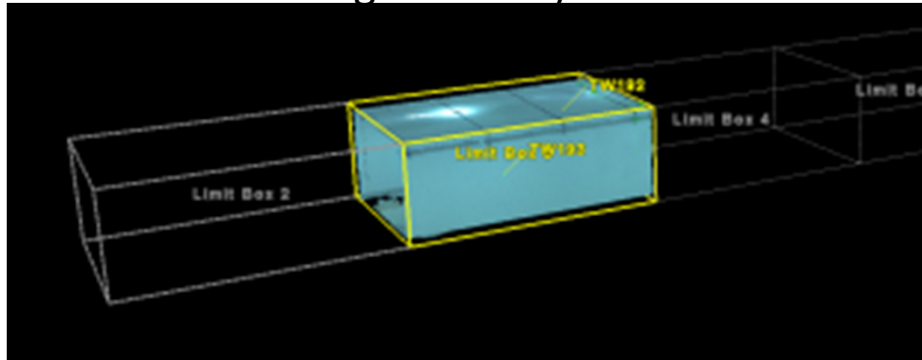
Raw Data Acquisition



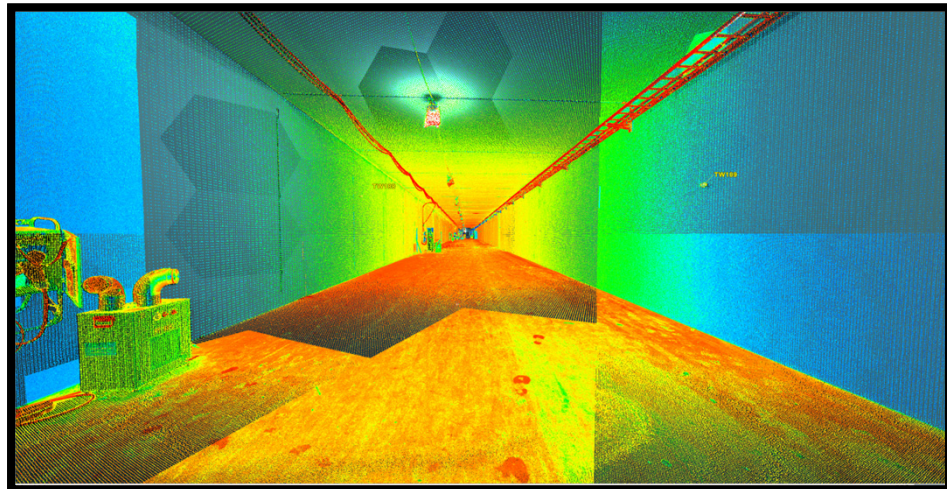
Data Cleaning
Orientation of Scans



Point cloud splitting according to LBS
Publishing in CHES/CATIA

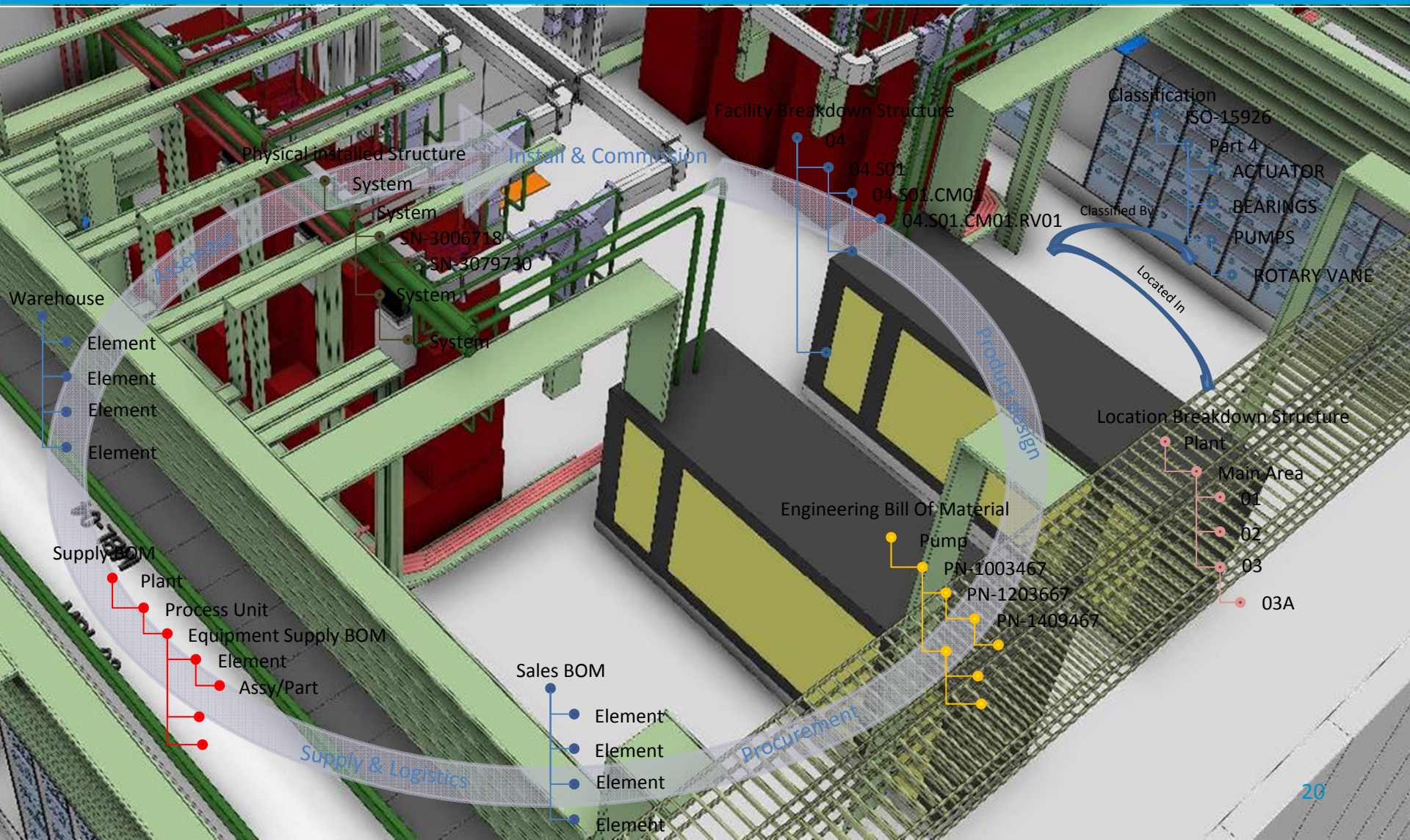


True View Inside Tunnel



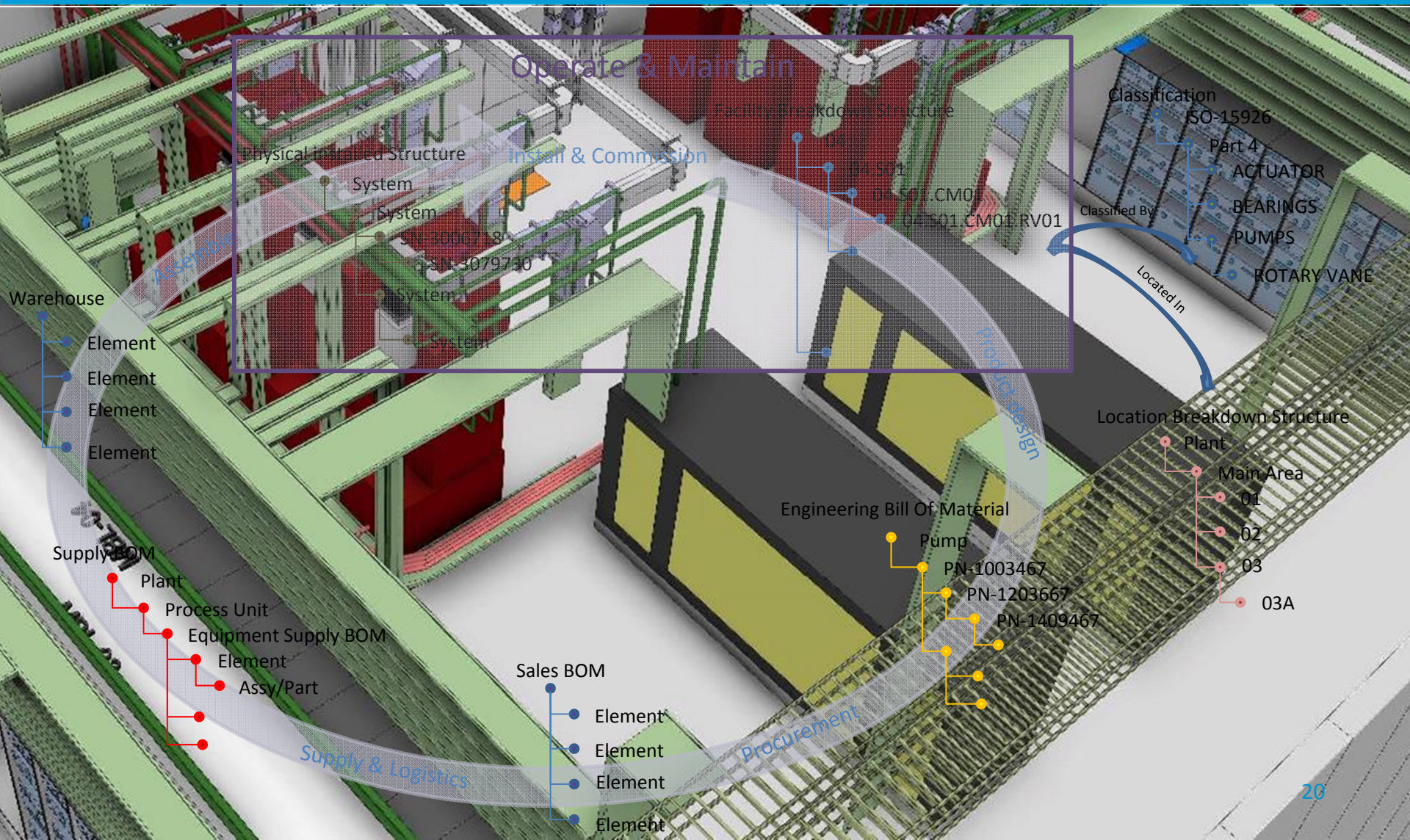
Engineering Projects

Information flow and different types of information



Engineering Projects

Information flow and different types of information



Construction Site - Status



Construction Site - Status



Construction Site - Status



An aerial photograph of a large-scale construction site in winter. The ground is covered in snow, with various construction materials, equipment, and partially completed structures visible. A large, curved concrete structure is prominent in the foreground. The background shows more industrial buildings and infrastructure.

THANK YOU VERY MUCH

Acknowledgments:

The entire ESS team. Special thanks to Giuseppe Aprigliano, Alexander Holmes, Peter Rådahl, Markus Andersson, Jesper Ringnér, Mohammed Eshraqi, Christine Darve, Fabien Rey, Pawel Garszka, Eleftherios Zografos, Marc Kickulies, Jens Harborn