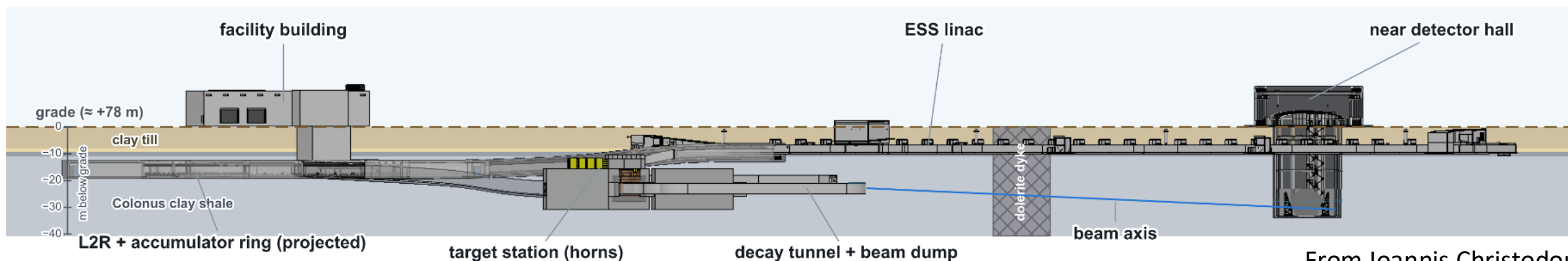
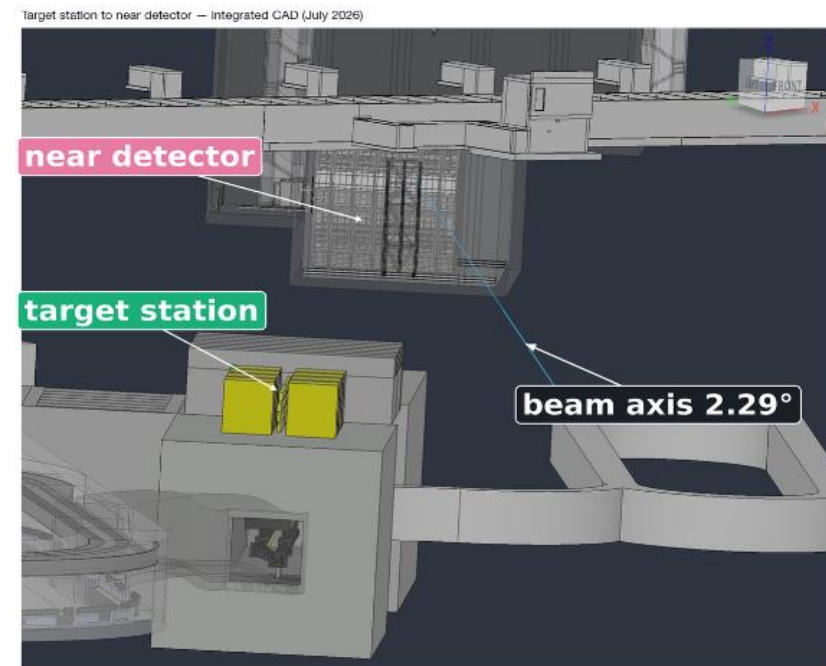
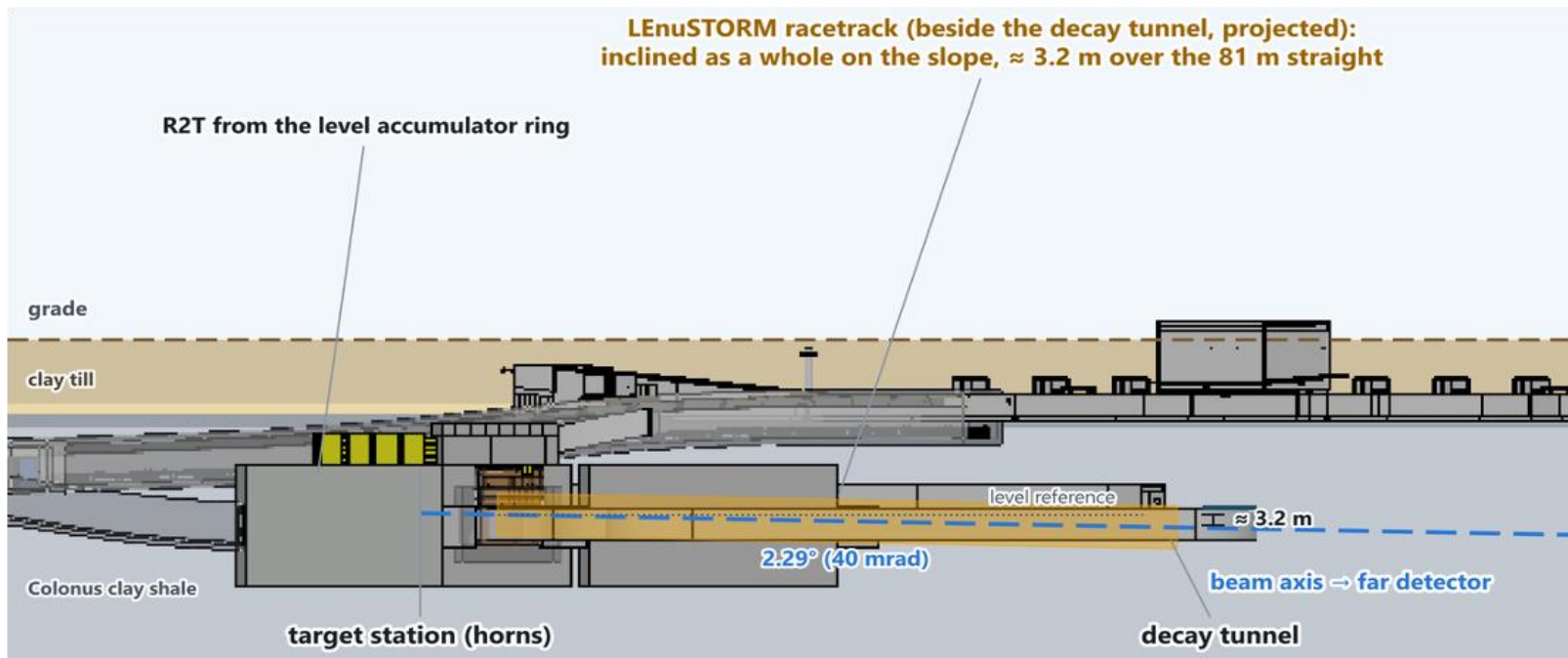


WP3 : Target Station and Pion Extraction

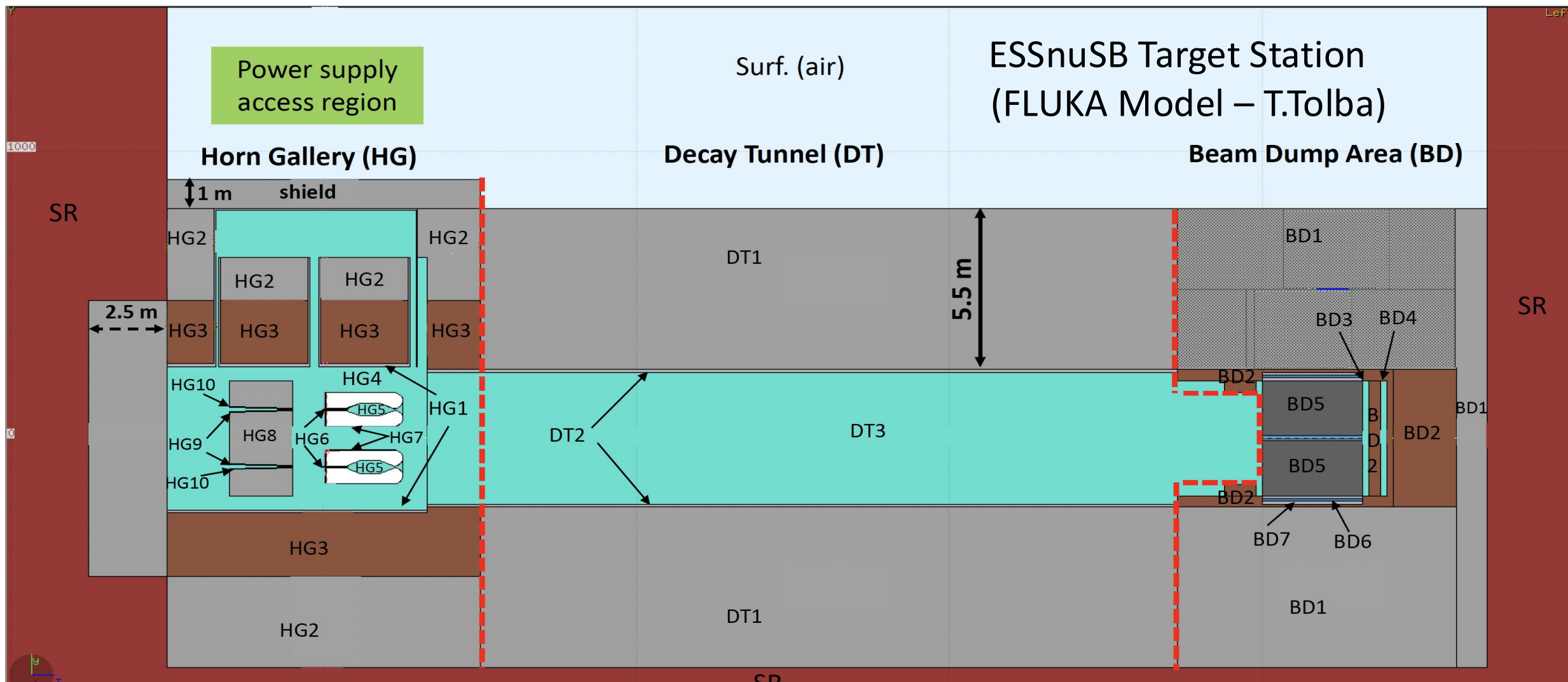
Target Station Facility

***ESSnuSB+
4th Annual Meeting
Wik Castle (5-9/10/2026)***

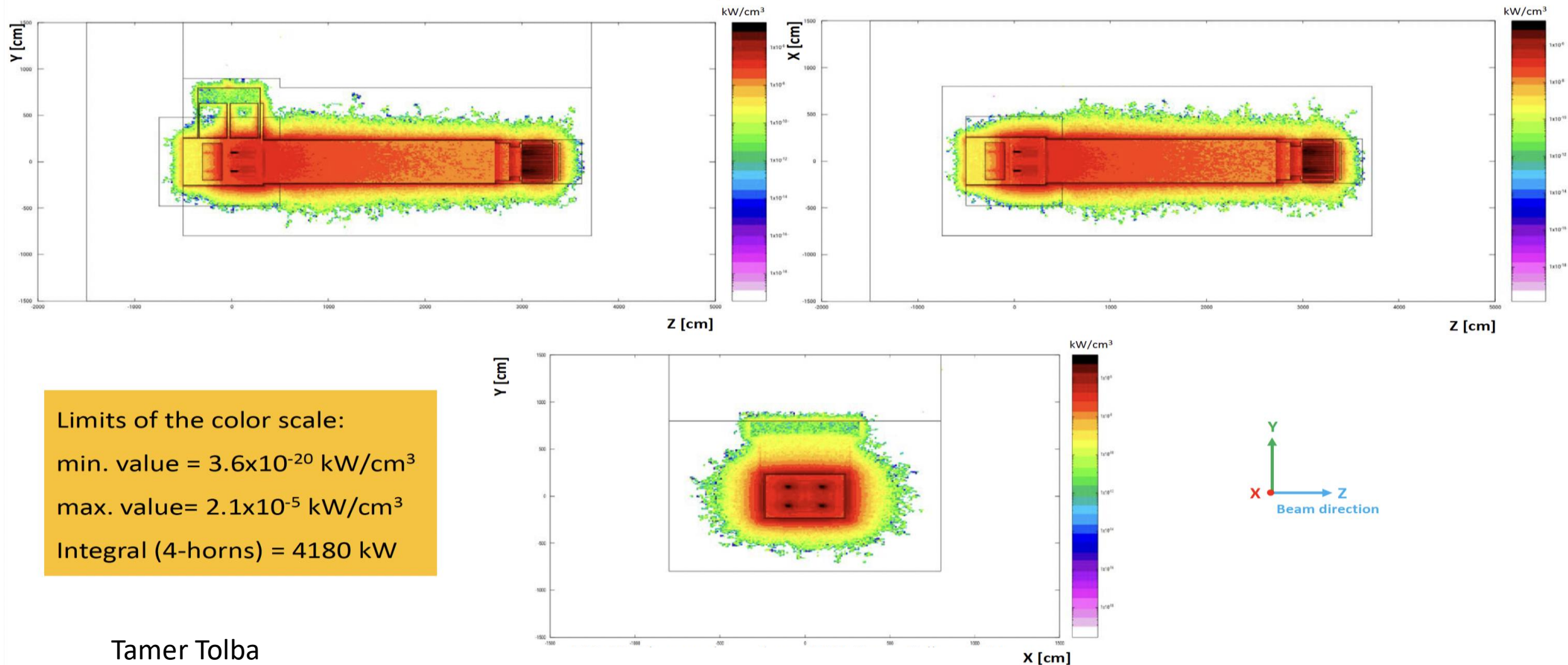




From Ioannis Christodoulou



Power-deposition distribution



Tamer Tolba

III ESSnuSB Target Station (5 MW)

Hot Cell

- Able to manipulate/repair Hadron collector.
- Work under radioactive environment.

Power Supply Unit

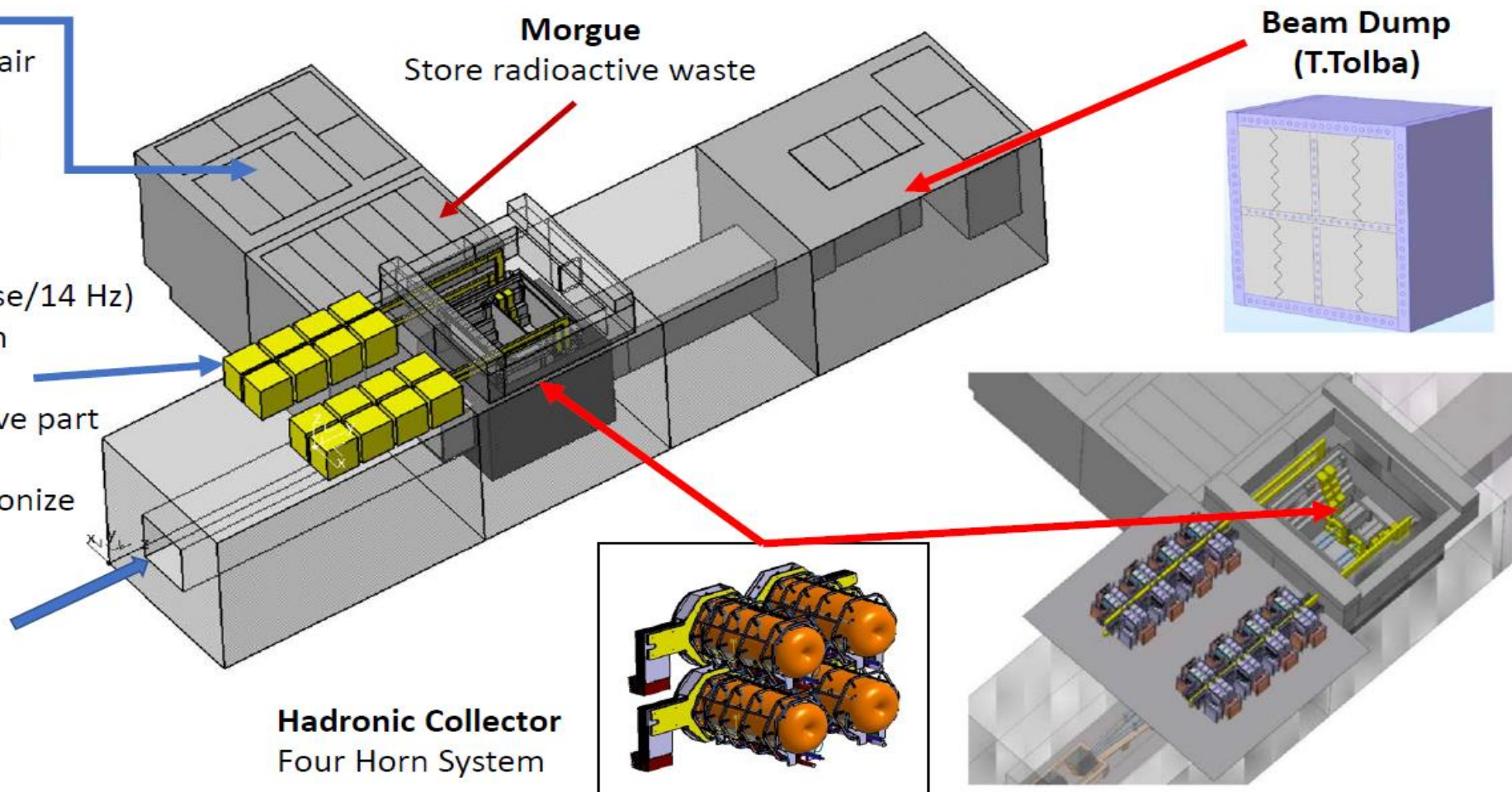
- 16 modules (350 kA pulse/14 Hz)
- Located above the beam switchyard
- Outside of the radioactive part of the facility
- Good position to synchronize with switchyard PSU

Proton Beam
4 x 1.25 MW

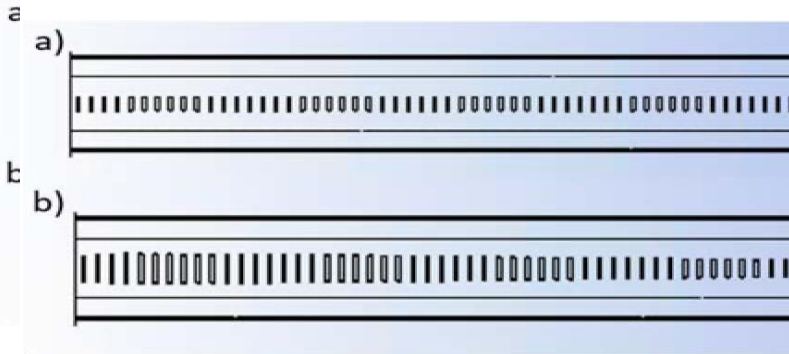
Hadronic Collector
Four Horn System

Morgue
Store radioactive waste

Beam Dump
(T.Tolba)

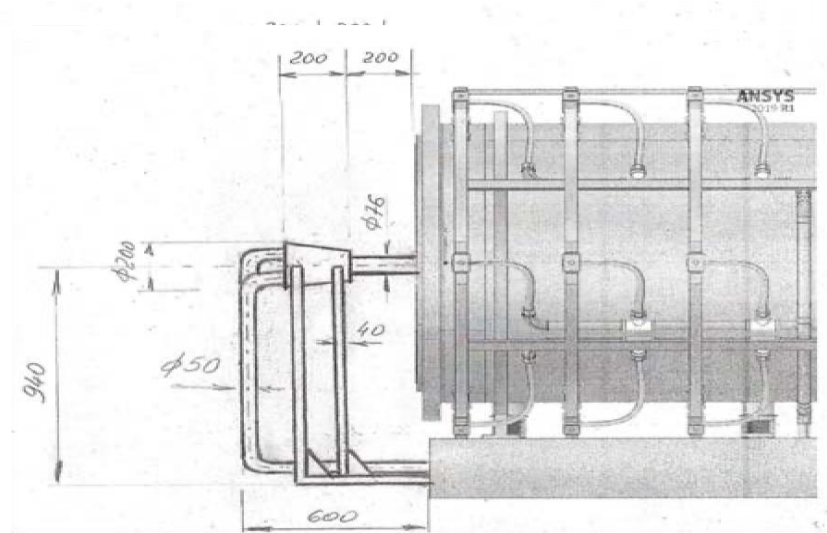


i Target Station

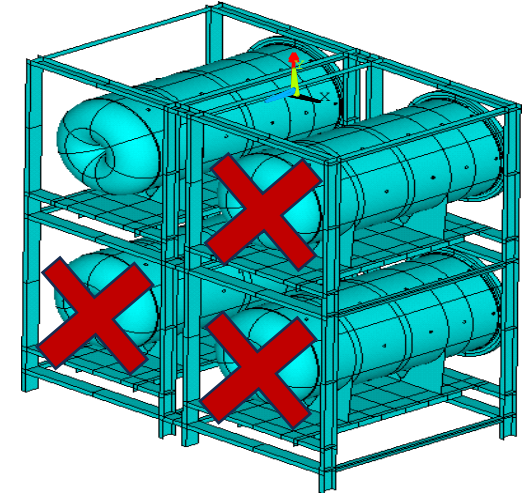


Packed Bed Target

Estimated Cost : 3.750 000



Target cooling



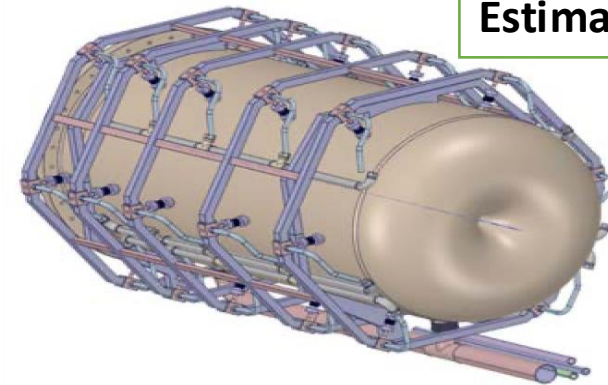
Support Structure

Estimated Cost : 2.000 000

i Horns

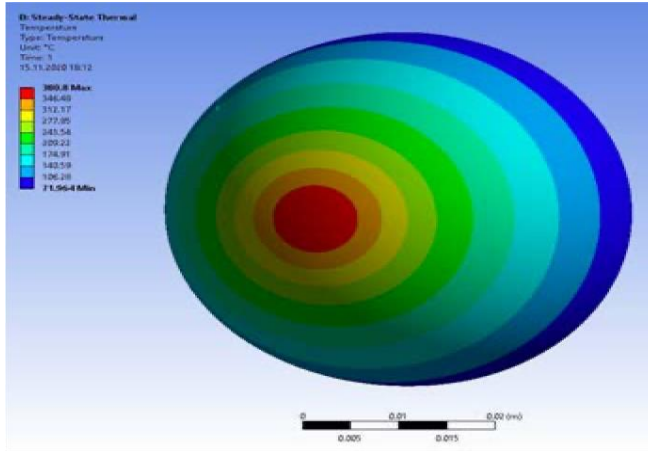
- Conductor shaping
- Water jet System
- Horn cooling System

Estimated Cost : 3.750 000



Horn Model +Water jet system

i Proton Beam Windows

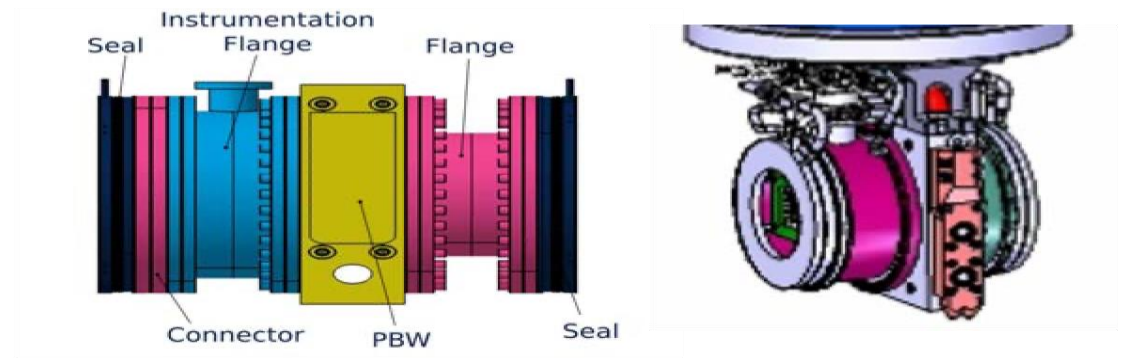


- i Water flow in a channel at the base of the beam window
- i Water temperature: 22°C
- i Convection: 1000 W/m²K
- i Results are close to analytical solution under the same conditions
- i R&D Necessary to check the simulation

i PBW System

- i Four PBW insuring transition between switchyard and Targets
- i Shielding chamber
- i Cooling circuits (Pumps, filters)
- i Sealing System Vacuum System
- i Secondary Instrumentations

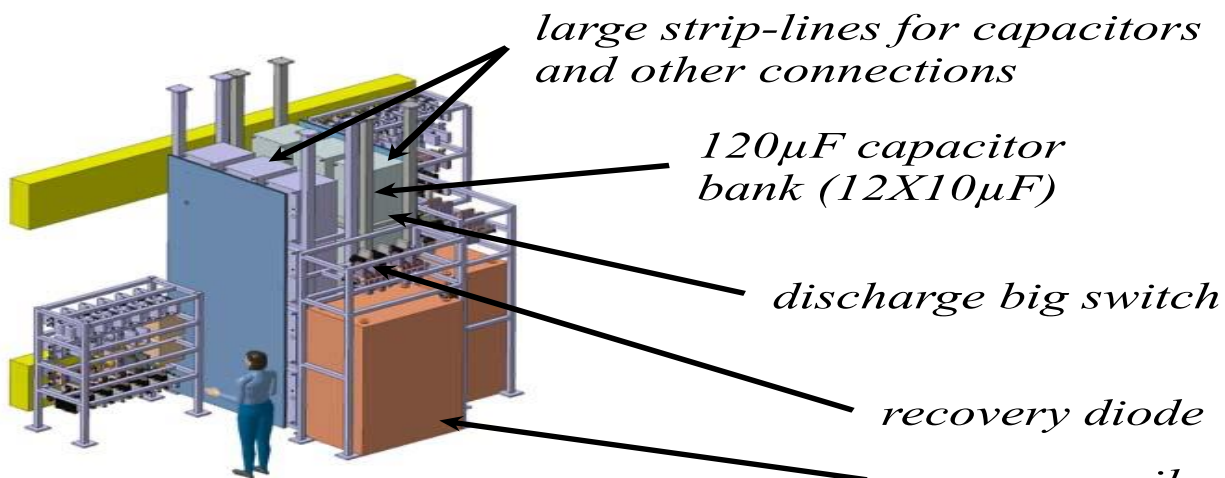
Estimated Cost : 1.300 000



ESS Proton Beam Windows (5MW/14Hz)

R. Vivanco et al 2018 J. Phys.: Conf. Ser. 1021 012065

i Power Supply Unit

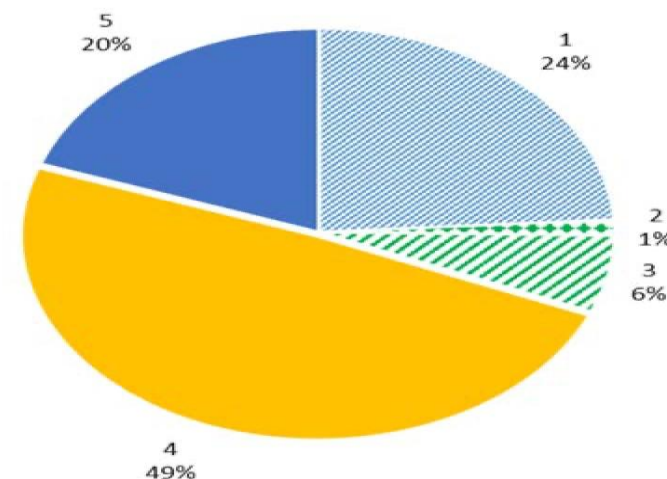
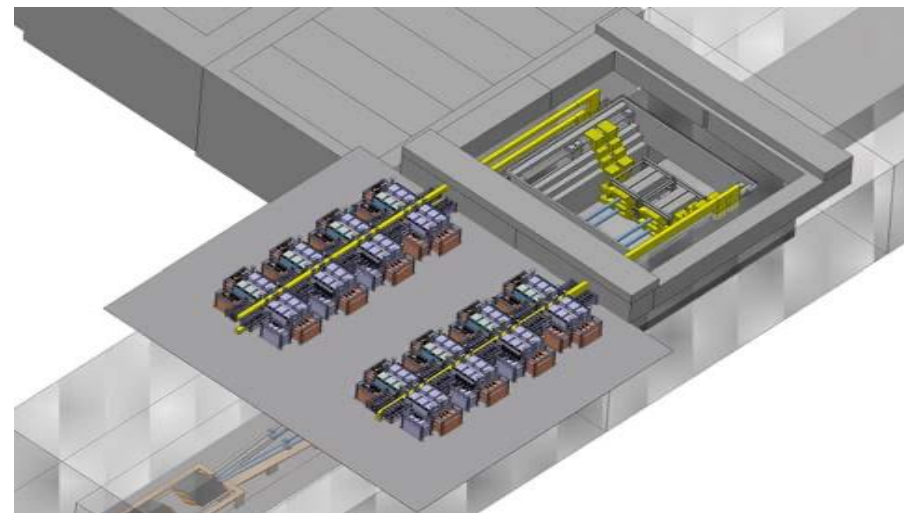


Component for one PSU module

- 1 : +12kV - 24kW Charger
- 2 : Recovery Diode
- 3 : Recovery Coil
- 4 : Big Switch
- 5 : Bench Capacitor

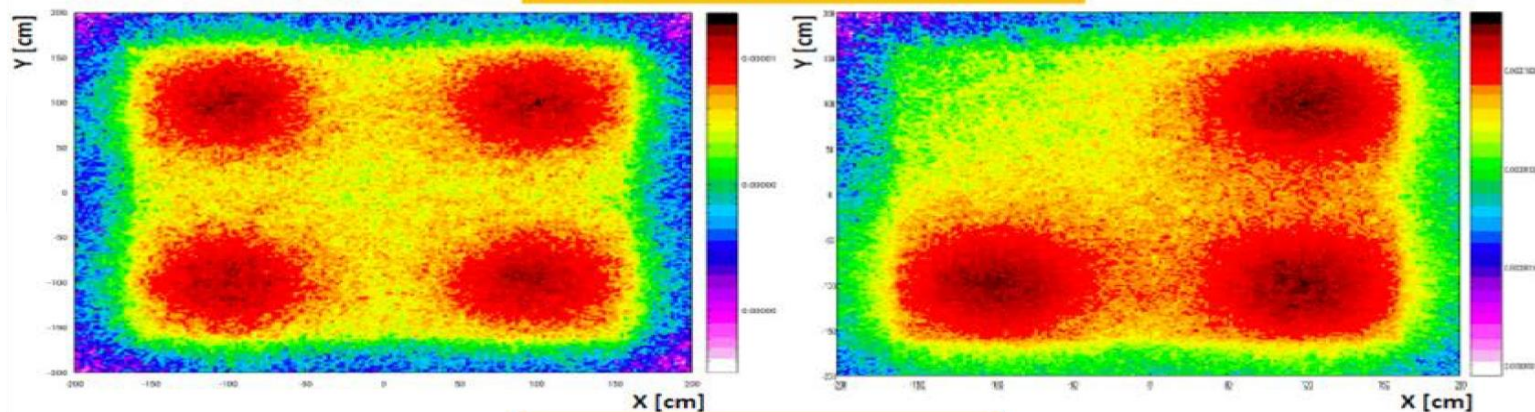
8 modules
+ striplines

Estimated Cost : 1.300 000



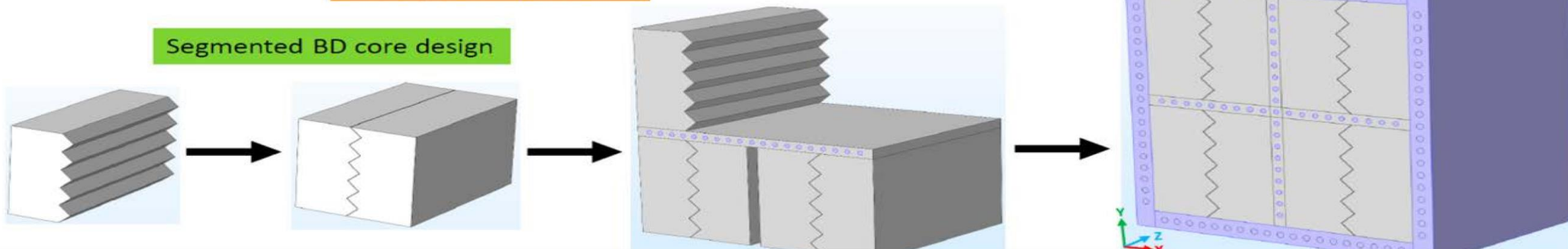
Beam dump core thermo-mechanical simulations

Beam axis view (XY-plane) of the dump core



Total P_{dep} (4-horns) = 826 kW

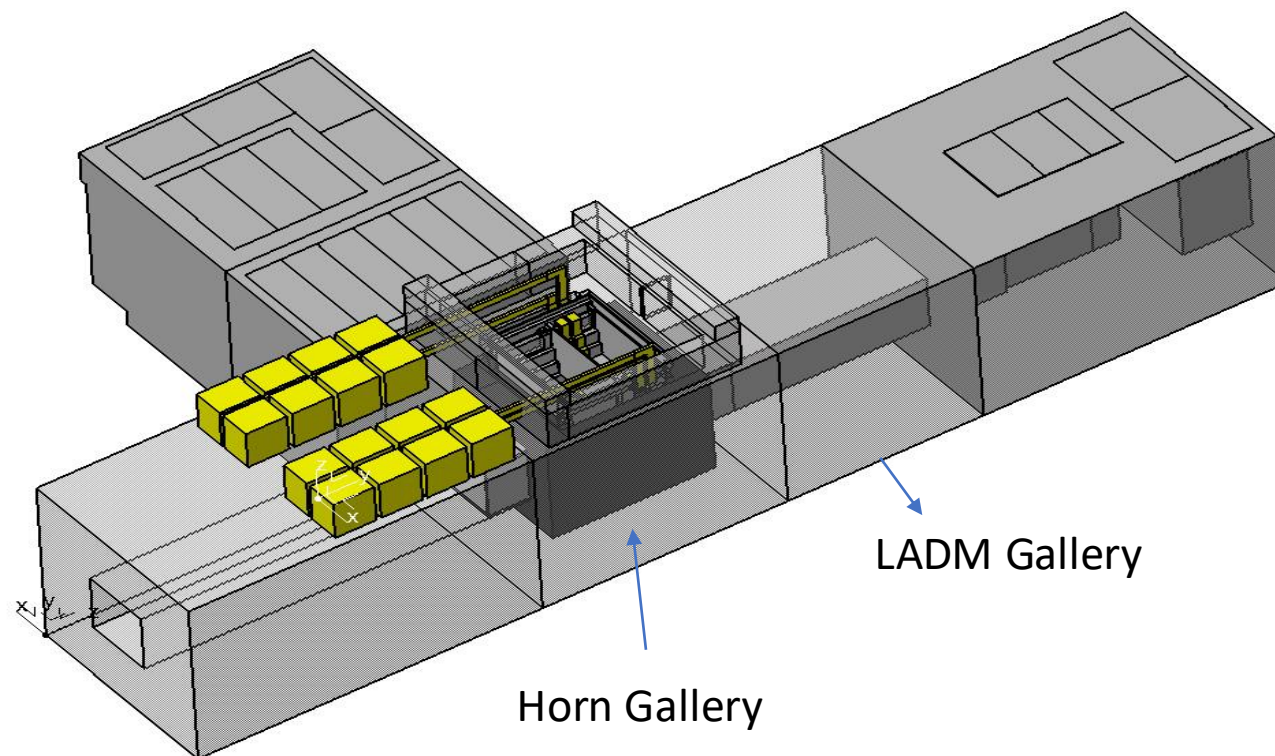
Segmented BD core design



Estimated Cost : 3 200 000

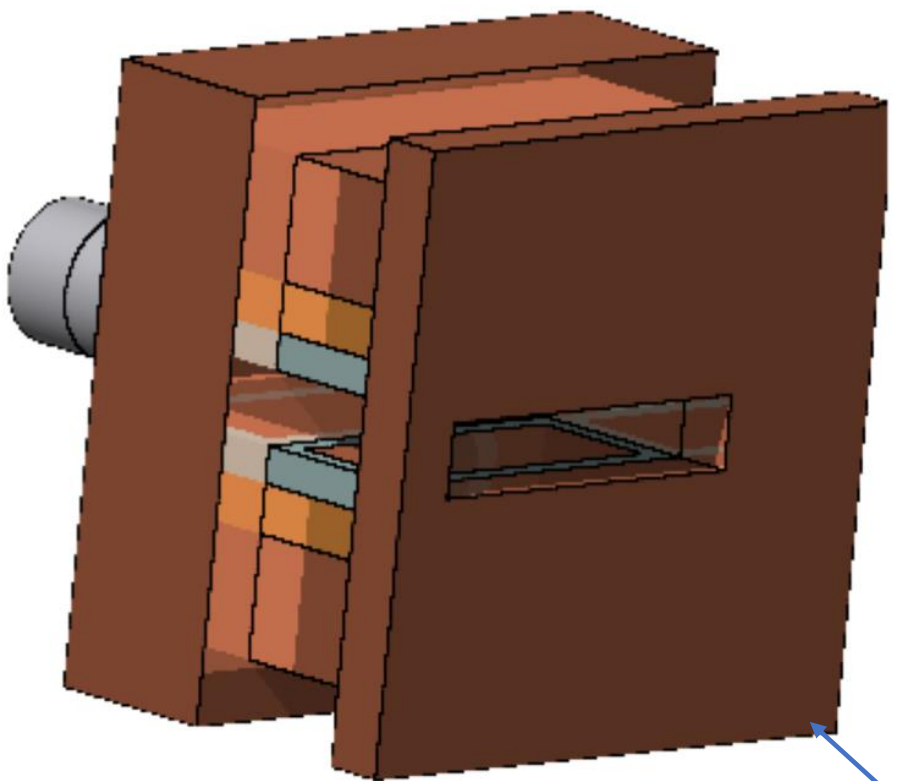
Parameter	Value
Projectile	Proton
E_{beam}	2.5 GeV
P_{beam}	1.25 MW (4-horns) / 1.66 MW (3-horns)
Beam-profile	Gaussian (FWHM = 0.94 cm)
Horn current	350 kA
BD core materials	Graphite core and Cu
Cooling system	Water, Cu plates (heat sink), $D_{\text{water tube}} = 10 \text{ cm}/8 \text{ cm}$, $T_{\text{inlet water}} = 288 \text{ K}$ $\text{flow rate}_{\text{tube}} = 30\text{-}50 \text{ l/min}$

Target Station Facility



PBS Name	Cost (Euros)
Target + Integration System	3 750 000
Hadronic Collector System	3 750 000
Horn Support Structure	2 000 000
Power Supply + Striplines	1 300 000
Proton beam window	1 300 000
Upstream shielding (ESSnuSB Beam Dump)	3 300 000
Target and Horn Replacement System	40.400 000
General Systems and Services	21 800 000
Facility Building Structure	20 724 000
Total	98 324 000

Large Aperture Dipole



PBS Name	Cost (Euros)
Dipole Iron Yoke	4 280
Dipole Core soft iron	6 040
Dipole Copper Conductor	109 174
Dipole Electrical Insulation (PEEK)	607 878
Power Supply	tbd
Cooling system	tbd
Shielding Iron	4 915
Shielding Tungsten	1 913 856
Total	2 646 143

Tungsten Material : 168 Euros/kg
Iron Material : 0,0844 Euros/kg

First estimation based on Tungsten Shielding to be updated with last results

Next Steps:

- First estimation of the total cost of ESSnuSB+ (without T2R elements) looks compatible with ESSnuSB total costs
- Estimation based old material prices to be updated
- New elements has to be implemented (T2R elements, ...) and services for the downstream part of the horn (Cooling, Power Supply, ...)