EUROPEAN SPALLATION SOURCE

The Target Station

Eric Pitcher
Deputy Head of Target Division

www.europeanspallationsource.se

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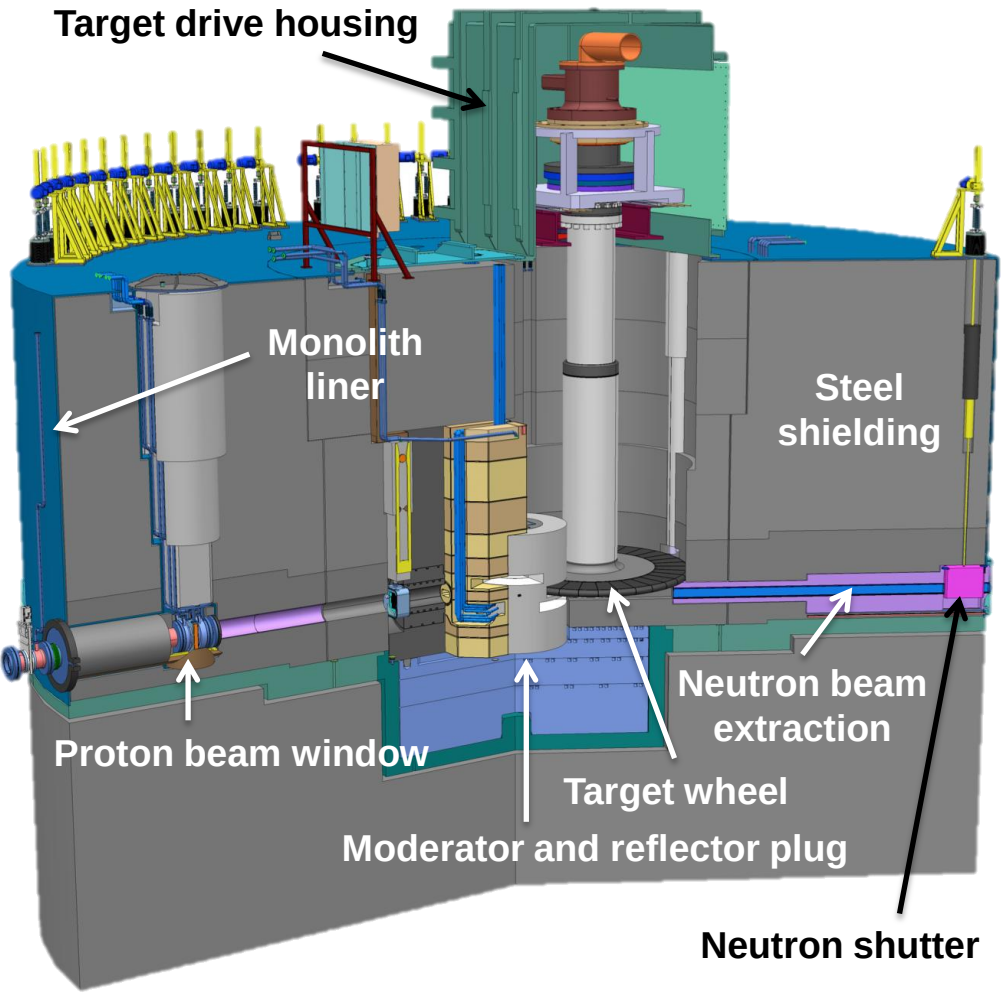
Target Station Scope – Monolith



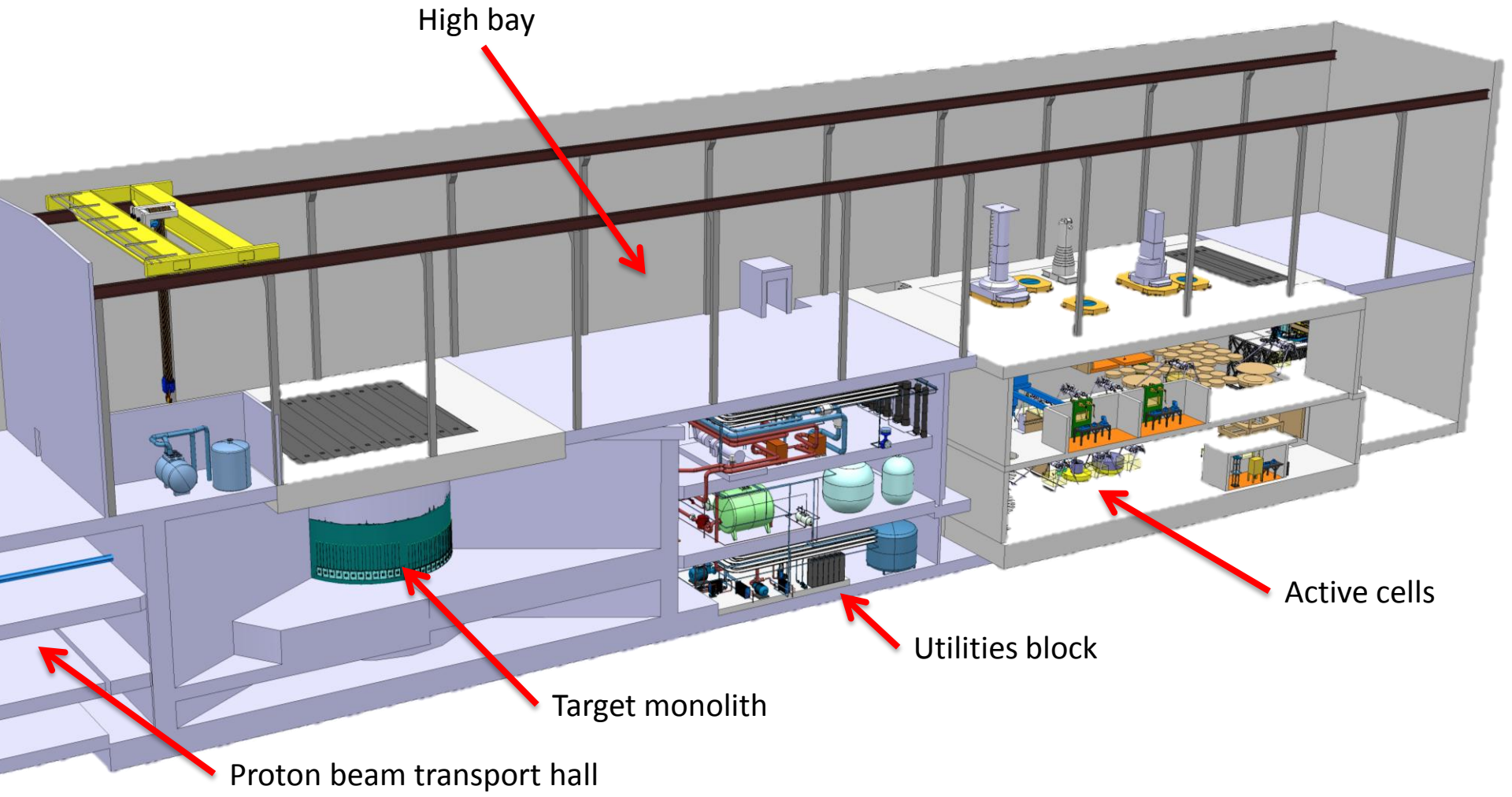
Requirements:

- Convert protons to neutrons
- Peak brightness at 5 MW: 2×10^{14} n/cm^2/s/sr (30 x ILL)
- Heat removal - 5 MW proton beam
- Confinement and shielding

Unique features:

- Rotating target
- He-cooled W target

Target Station Layout



General Comments on ESS Target Station Project Status and Plans

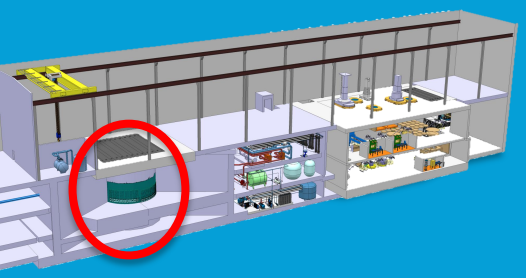
- Design concepts for Target Station systems have advanced since the TDR (issued in April 2013), but many remain to be fully optimized prior to completion of Preliminary Design
- Cost and schedule baseline established
  - Logically driven, resource loaded schedule used to establish funding needs, staffing plan, delivery dates, integration with rest of ESS, …
  - Focused on achieving beam-on-target by the end of 2019 with high confidence (adequate schedule float)
- Two biggest challenges for Target in 2014 are establishing in-kind partnerships and hiring needed staff
  - These two items are closely coupled

Possible In-Kind Contributions

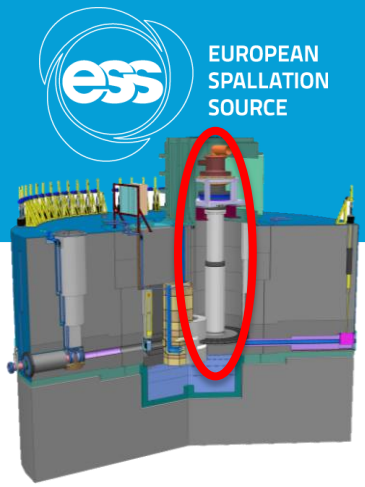
WBS	ID	Cost Book Value (€)	% IK possible	Possible IK (€)
12	**Target Station**	**155,250,000**	**70**	**108,675,000**
12.1	Management & Administration	**4,055,299**		
12.2	Target Systems	**19,149,931**	80	**15,319,945**
12.3	Moderator and Reflector Systems	**22,127,937**	89	**19,693,864**
12.4	Monolith Systems	**35,633,853**	69	**24,587,359**
12.5	Fluid Systems	**29,075,341**	78	**22,678,766**
12.6	Remote Handling Systems	**28,472,114**	94	**26,763,787**
12.7	Controls	**7,164,861**		
12.8	Physics	**5,450,664**		

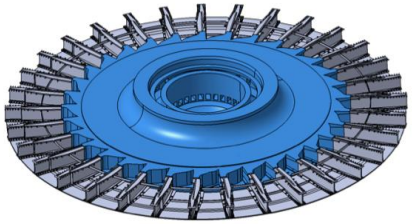
The only efforts that will be predominantly performed by the ESS AB team are:

- Management and integration (12.1.1, management of Work Packages, and neutronics analysis)
- Safety related work – Safety credited controls, shielding analysis, and interaction with ESS safety, licensing and waste management organization

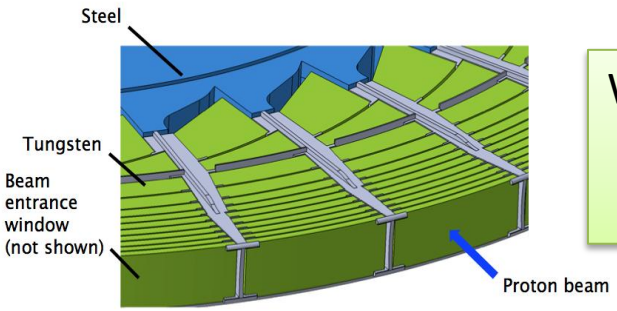


12.1.2 Target Systems

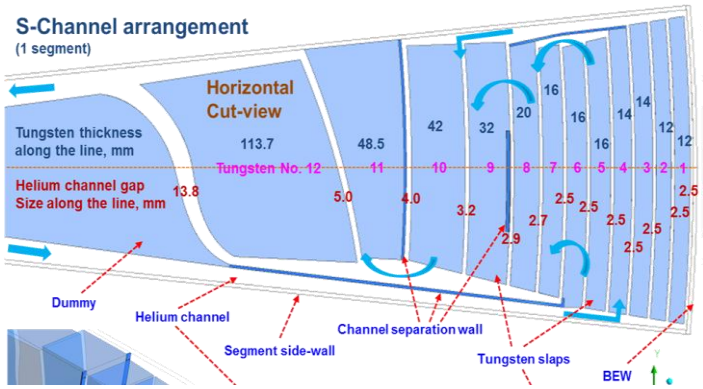


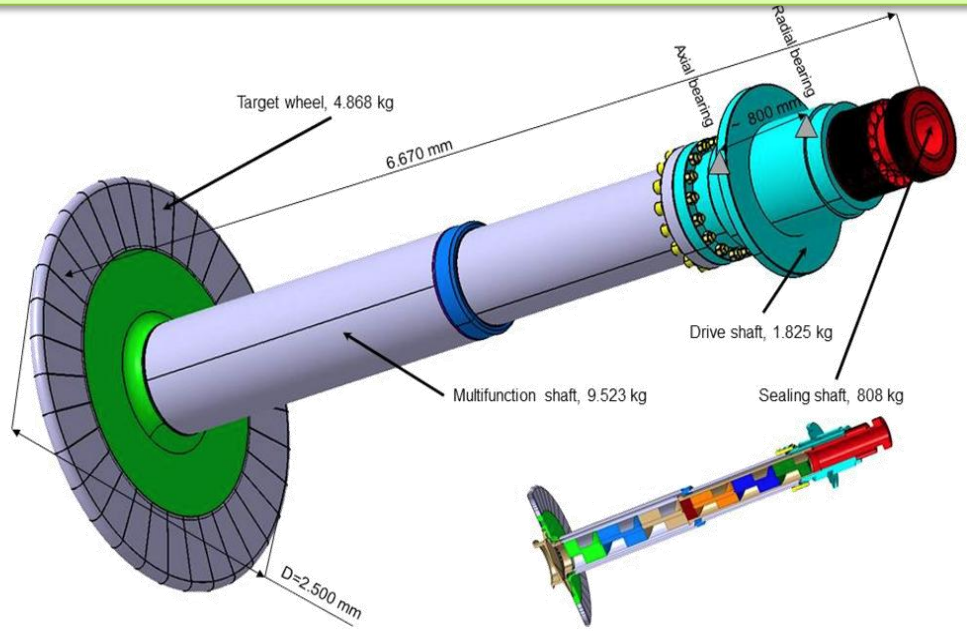


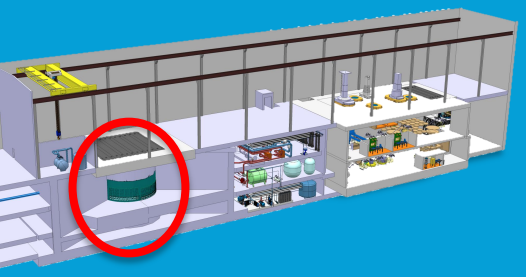
- He-cooled tungsten plates integrated in a wheel
- Rotational speed < 1/s
- Lifetime ~ 5 years (@ 5 MW)



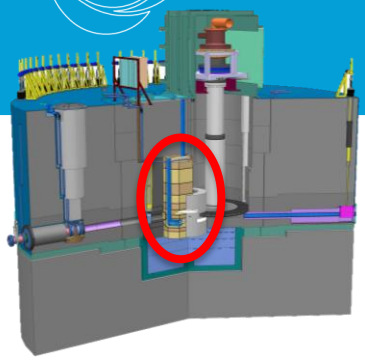
WP2: Total value of in-kind possibilities: 15 M€
- Target wheel including tungsten plates
- Target helium cooling

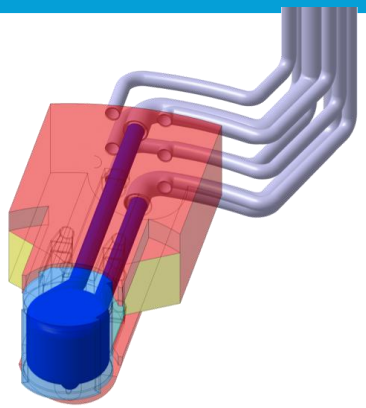


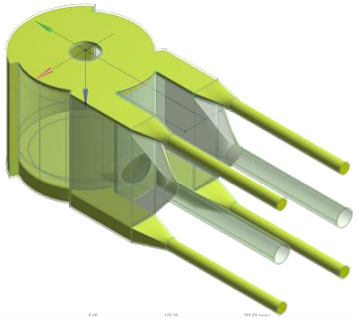


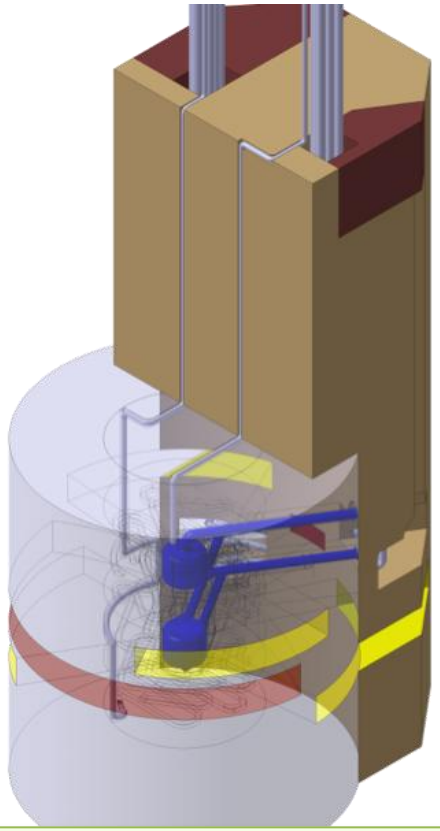


12.1.3 Moderator and Reflector Systems



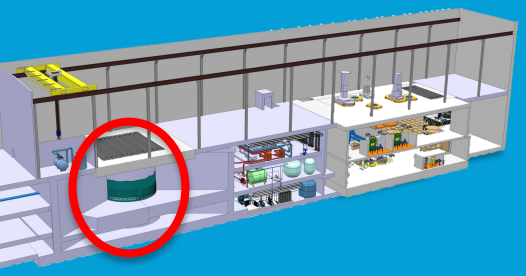






- Cold moderators
  - Supercritical hydrogen at 20 K
  - Cryogenic heat load is 20 kW
- Water moderators
- Inner reflector
  - Beryllium
- Outer reflector
  - Stainless steel

WP3: Total value of in-kind possibilities: 20 M€
- Moderator and Reflector Plug
- He cryoplant for cooling hydrogen
- Supercritical hydrogen loop



12.1.4 Monolith Systems

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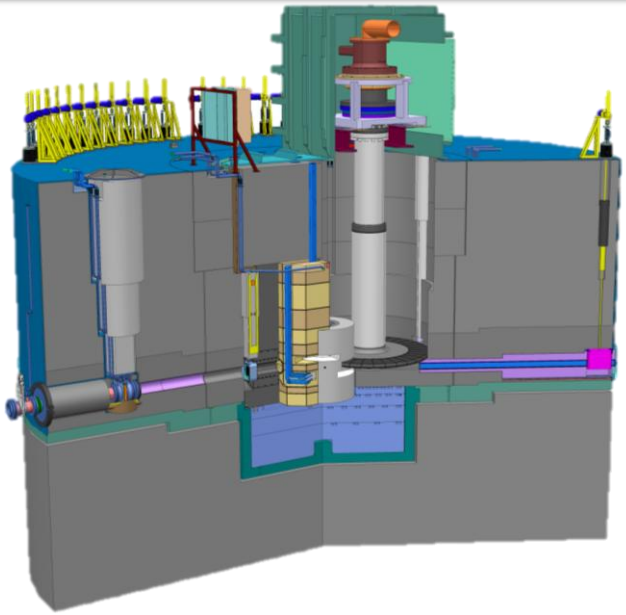
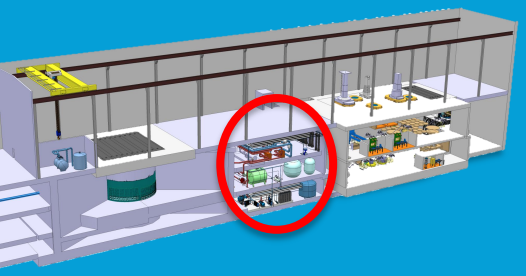
- Shielding systems
  - Steel shielding
- Confinement systems
  - Proton beam window
  - Monolith vessel
  - Neutron beam windows
  - Covers and penetrations
  - Helium atmosphere system
- Enabling systems
  - Target monitoring plug
  - Proton beam instrumentation plug
  - Irradiation module
  - Neutron beam extraction system
- Tuning beam dump

WP4: Total value of in-kind possibilities: 25 M€

- Steel shielding
- Monolith vessel
- Tuning Beam Dump
- Target monitoring and proton beam instrumentation plugs
- Monolith atmosphere system (He)
- Proton beam window



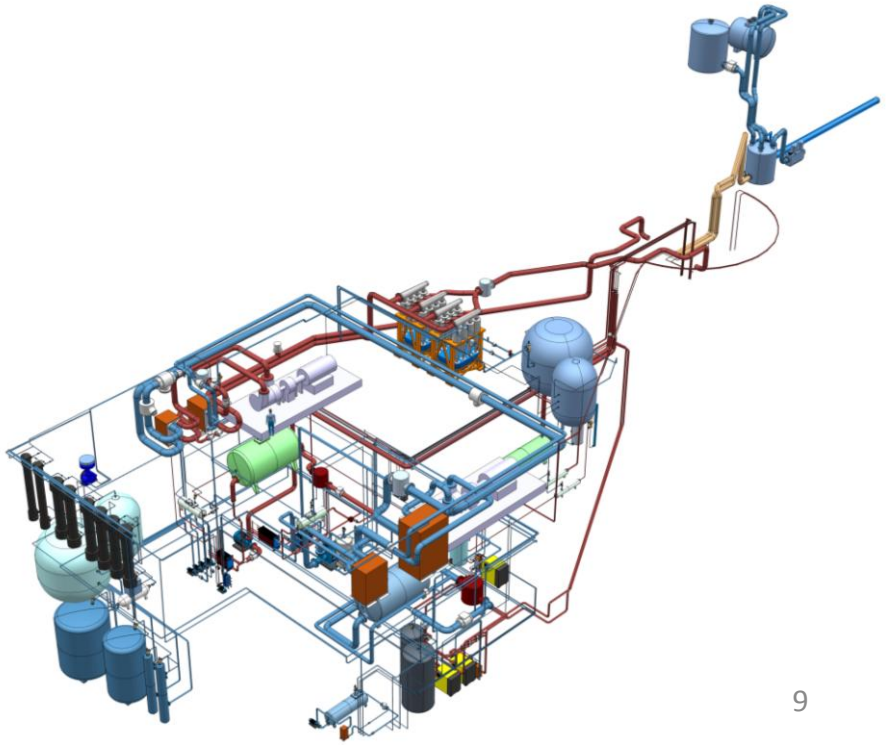


12.1.5 Fluid Systems

- Primary Water Cooling
  - Water moderators
  - Monolith shielding
- Intermediate Water Cooling
- Radioactive Gas Effluent & Confinement (RGEC):
  - Target Station Ventilation
  - Separation Gas for Primary Water
  - Radioactivity Monitoring
- Storage of activated water and helium
- Auxiliary Helium Systems
  - Proton Beam Window Cooling
  - Target Helium Purification
  - Monolith Helium Purification
- Vacuum, gas and water supplies

WP5: Total value of in-kind possibilities: 23 M€

- Radioactive Gas Effluent & Confinement
- Helium purification system
- Primary and secondary water loops
- Proton beam window (He) cooling



12.1.6 Remote Handling Systems

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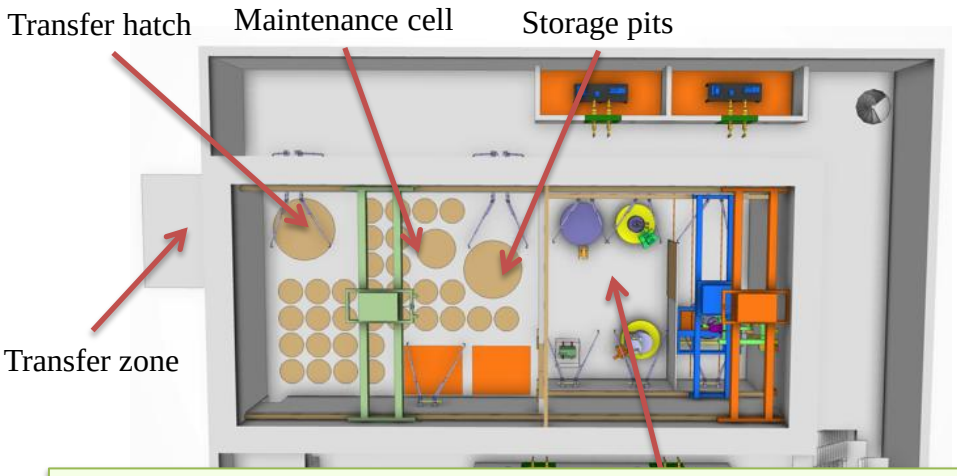
Active Cells: Top View

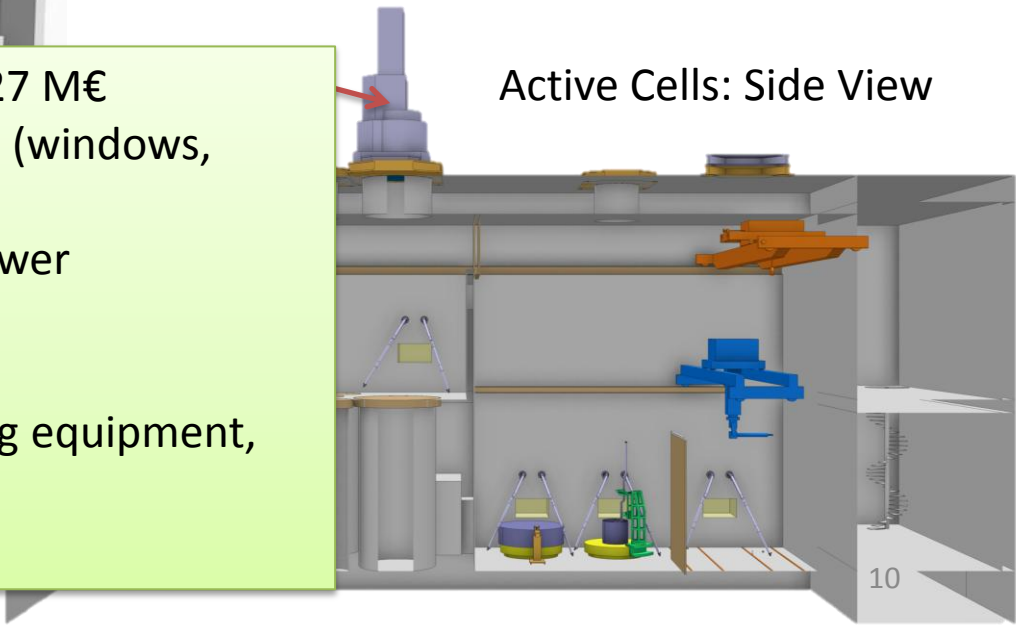


- Active Cells: Hot Cells with infrastructure and tooling
- Internal transport casks and associated handling devices for transport between monolith and active cells
- Mock-ups, test and training facility

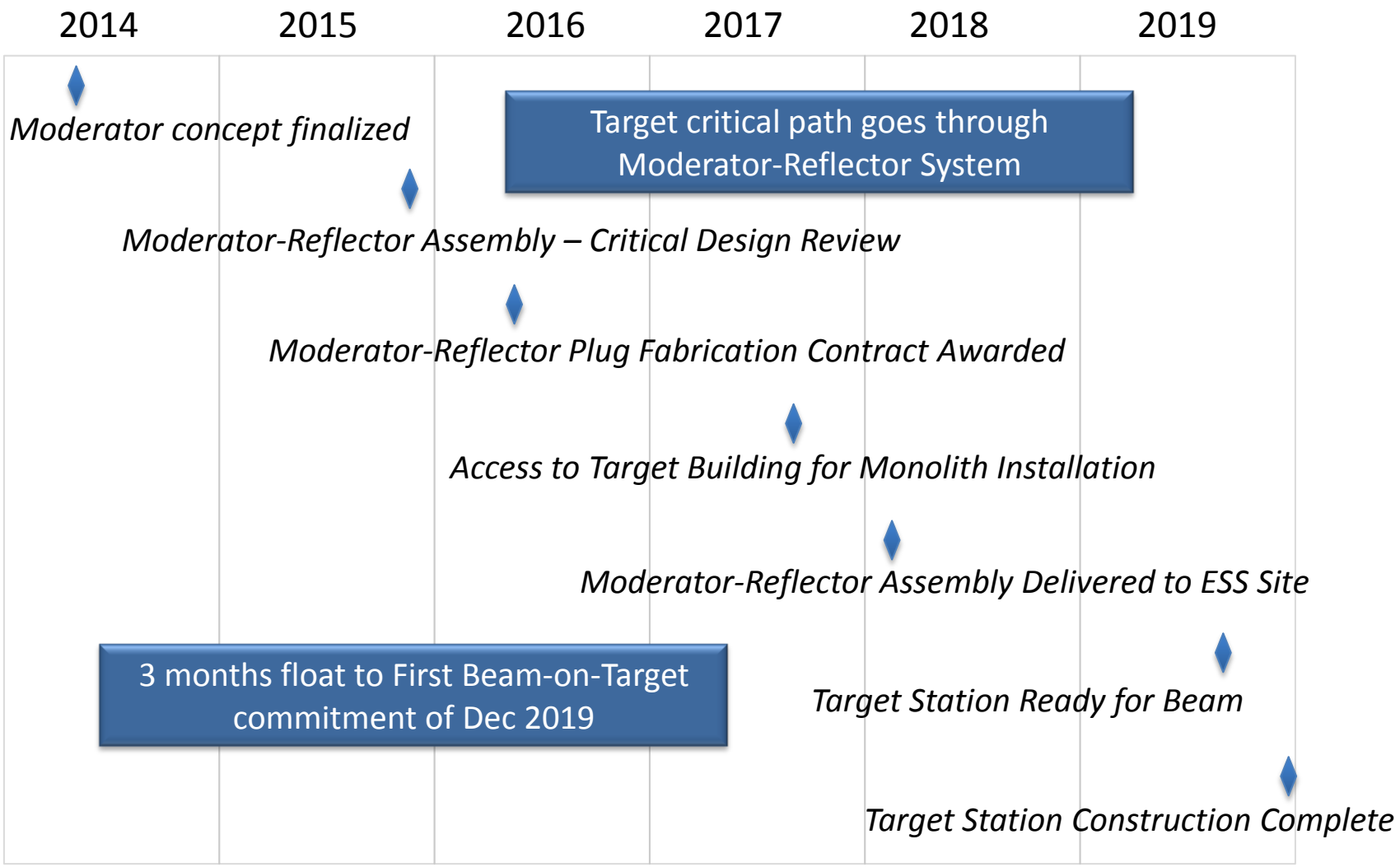
WP6: Total value for in-kind possibilities: 27 M€

- Confinement items for active cells (windows, doors, lids, hatches etc.)
- Handling items for active cells (power manipulator, tele-manipulators)
- Internal transport casks
- Equipment for active cells (welding equipment, saw, shear cutters, etc.)
- Test of handling procedure

Active Cells: Side View



Target Station Project Completion Planned for End of 2019



Concluding Remarks

- Target Station Project team is focused on 2019 completion date
  - For most of the target station components, Preliminary Design will be completed in 2014 and Final Design in 2015
- Most hardware systems and associated design and development efforts are identified as possible in-kind partnerships
- This is the ideal time to establish partnerships on the Target Station
  - Provides the partner the greatest and last opportunity to influence the vision and plan for the Target Station
  - Maximizes the in-kind efforts, while easing the issue of hiring large numbers of design staff at ESS-AB