ESS

The ESS Target Station Hot Cells, Planning and Development

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Accelerator Parameters

- Particle species: $p$
- Energy: 2.0 GeV
- Current: 62.5 mA
- Peak power: 125 MW
- Duty cycle: 4%
- Average power: 5 MW
- Pulse length: 2.86 ms
- Rep rate: 14 Hz
- Max cavity surface field: 45 MV/m
- Operating time: 5200 h/year
- Reliability (all facility): 95%

Top View
- Target
- Linear proton accelerator
- Neutron science systems
The ESS Target Station Layout

Iso View

- Active cells
- 133 m
- Utilities block
- Target monolith
- Accelerator – Target interface
- High bay

Dimensions:
- 22 m
- 37 m
Target Monolith Components

Vertical Cut View

- Safety valve
- Target drive housing
- Target monitoring plug
- Shutter
- Proton beam window
- Proton beam instrumentation plug
- Moderator and reflector plug
- Target wheel
- Neutron beam extraction
- Neutron beam window
Target Monolith Components cont.

**Moderator & Reflector Plug**
- Weight: 25 tons
- Materials: Be, Al, SS
- Dim: Ø 1.5 m x 2.8 m

**Proton Beam Window**
- Weight: 200 kg
- Materials: Al, SS
- Dim: 0.4 m x 0.4 m

**Target Wheel**
- Weight: 14.4 tons
- Materials: W, SS
- Dim: Ø 2.5 m x 5.3 m
Radioactive Materials Logistics

Component introduced in cask for removal from its operating position

Cask transported in the high bay

Component introduced in the hot cells for further processing
Hot Cell Functional Requirements

(Note: Active cells is the complete in-house facility for managing radioactive materials)

- The active cells shall receive identified radioactive and/or contaminated (including alpha emitters) components from the machine
- The active cells shall provide radiation protection for staff
- The active cells shall provide radiation protection for public
- The active cells shall prepare radioactive components for off-site shipment
- The active cells shall process and refurbish activated and/or contaminated components
- The active cells equipment shall be possible to service and repair
- Radioactive material in the active cells shall be identified and tracked
- The active cells shall be possible to decontaminate
- The active cells shall have capacity for intermediate/temporary storage
- Logistical solutions for shipment containers shall be suited for road transport within Sweden to radioactive waste disposal site
- The active cells shall provide PIE capabilities
Hot Cell Layout

- **Process cell** – Introduction of radiated components from the high bay, processing of components and preparation for intermediate storage and shipment as well as refurbishment in certain cases.
- **Maintenance cell** – Maintenance of equipment and logistical hub for transfer inside the active cells.
- **PIE cells** – Post Irradiation Examination of material samples from the plugs.
- **Storage pits** – Intermediate storage of vessels awaiting off-site shipment.
- **Technical galleries** – Contains the remote handling interfaces for active cell operations, component storage, PIE activities, human logistics around the cells and air locks for entrance into the processing and maintenance cells.
- **Transfer area** – For off-site shipment of casks, control and decontamination of shipment cask surfaces.
1. The component is introduced in the process cell. The process in question can be various methods of cutting, refurbishing or dismantling

2. Transfer to a welding station where a stainless steel lid is welded to the waste-basket

3. Transported to an interim storage pit

4. Storage until reaching the thresholds for off-site shipment in terms of heat and/or radioactivity

5. The basket is lifted from the pit to an off-site shipping container that is docked to the floor of the maintenance cell

6. The shipment cask is decontaminated and further truck transport off-site will be possible

Side view

38m

15m

Depth = 27m
Process Cell Equipment

- Shielded door
- Floor valves
- Baskets
- Shear cutting device
- 25T crane (x2)
- Power manipulator
- PIE cells
- Welding
- Working table
- Sawing machine
Process Cell Equipment cont.

- Spent PBW
- Shear cutting equipment
- Target grip and lifting
- Support Jaws
- Spent target
- Sawing equipment
- Stainless Steel Basket
- Working table
Thank You!