Current Status of the ESS Active Cells Facility

Hotlab 2015 Conference, Leuven
Magnus Göhran – 30 September 2015

www.europeanspallationsource.se
30 September 2015
Outline

• Current construction update
• Novel Concept - Recap
• Monolith components
• The Active Cells Layout
• Current Developments on
  – Stainless Steel Liner
  – Electrical Conduits and Junction Boxes
  – Confinement Penetrations
  – Waste Logistics
  – Visualization and Control
A view of the southwest in 2025

- MAX IV – a national research facility, under construction, opens up in 2016
- Science City – a new part of town
- ESS – an international research facility
- Budget 1843 M€

Malmö (309 000)
Lund (115,968)
Copenhagen (1,200,000)
ESS – Orthophoto

AUGUST 2015
Current Target Station Piling Activities
• The Active Cells Facility is really 1 large hot cell 30x12x15 meters
• All windows are removed
• Placement of through wall manipulators depending on task, not position of window
• Cameras used for operation with additional features like Augmented Reality and Virtual Reality
• All in-cell operations are done from a central controlroom
The ESS Target Station Layout

Isometric View

130 m
High bay
22 m
37 m

Transport hall
Active cells
Utilities block
Target monolith
Accelerator – Target interface
Monolith components

- Proton beam instrumentation plug
- Proton beam window
- Proton beam entering
- Neutron beam extraction
- Light shutters
- Target monitoring plug
- Target wheel
- Upper and lower moderator and reflector
Target wheel

- Tungsten slabs in 36 sectors
- Helium coolant
  - Mass flow 3 kg/s
  - Pressure 1,0 Mpa
  - Inlet temperature 20 °C
  - Outlet temperature 220 °C
- Rotational speed 25,5 rpm
- Wheel diameter 2,6 m
- Shaft length > 5 m
Moderator & 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

- **Cut-outs**
  - For the view path to the beam extraction
  - For the target wheel
The Active Cells Layout

- **Process cell** – Introduction of radiated components from the high bay, processing of components and preparation for interim storage and shipment as well as refurbishment in specific cases.
- **Maintenance cell** – Maintenance of equipment and logistical hub for transfer inside the active cells.
- **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 maintenance cells.
- **Transfer area** – For off-site shipment of casks, control and decontamination of shipment cask surfaces.

**Size:**
- Height 15 m
- Length 30 m
- Width 12 m
Process Cell details

- HEPA Filters
- Saw
- Power Manipulator
- Through Wall Manipulators
- Cameras
- El. and I&C
- Anchor Plates
- Liner Beams
- Rotating Tables
- Work Tables
Stainless Steel Liner

- Liner Beams 120x70
- Plates 4 mm on floor 2 mm on wall and roof
- Anchor plates combined with liner beams to ensure alignment
- Storage pits – prefabricated
- First Items on-site in March 2016 – Finished Sept 2017
Stainless Steel Liner, Current status

• Testing folding accuracy
• Filling degree of concrete underneath the beams – test casting with high density concrete
• Will perform bending and pull out tests
• Diameter 114 mm
• Pipe routing from cold to hot side to avoid weak spots in the walls
• 1 meter bend radius
Confinement Penetrations - Layout
Confinement Penetrations

- Stainless Steel
- Straight pipe, without step
- Oversized flanges
- 254 mm diameter
- In total 40-50

- Evenly distributed
- One size – increase flexibility
- Min. 2.7 meters from floor
- Tight tolerances between tube and plug
Active Cells waste logistics
Shipment of waste containers

- Top View
- Cut view of transport
- View from Maintenance Cell

- ATB 1T or 4K
- BFA tanks
- 50, 100, 150 or 200 mm
- 120 tons transport
- Flexible to-cell interface
Control Architecture “ProgrESS”
Summary / Conclusions

• Piles are driven into ground and concrete is poured
• Novel Concept presented at Hotlab2014 pursued and developed
• Detailed design of cast in items progressing fast
• Liner beam test specimens are produced and will be tested
• Interfaces in all areas elaborated