Irradiation of prototype tungsten blocks for test of Halogen Release Fraction from the future ESS Helium cooled Tungsten Target

INTC proposal

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ESS = European Spallation Source

- Next generation neutron source, build in Lund, Sweden
- First neutrons 2020 … (we hope !)

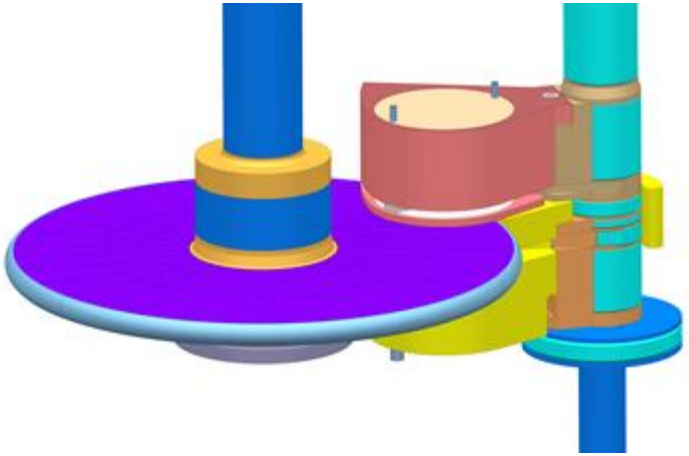
ESS has a new target concept

- 5 MW average power
- 2 GeV protons as 2.86 ms pulses (14 Hz)
- Rotating Helium Cooled Tungsten Target

- Target to last for 5 years.
- Closed loop helium recirculation

The target wheel

2.5 meter diameter 4000 kg tungsten as 7000 bricks



Build by ESS-Bilbao (Spain)

A tungsten brick is 10 x 20 x 80 mm

Target release fractions

- Over 5 years , the target blocks will accumulate activity and damage
- > 1E15 Bq - dominated by H-3 and Ta, Hf, W,…
- Target designed to operate below 550 deg C.
- What is in the helium loop? (normal and accident)

Release calculated

- Release driven by diffusion and recoil.
- Diffusion term: the Arrhenius equations
- Diffusion data exists for allmost all relevant elements,- except the halogens
- The iodine is radiologically important,.. And in focus of authorities.

Experimental data for iodine needed

Do a full size block activation of the actual block material
Uniform seeding óf activity by spallation
Measure the radioactivity release ás function of temperature
measure offline- at DTU in Denmark

Proposal

- Irradiate 1 or 2 blocks of tungsten (transversing 10 or 20 mm tungsten
- Irradiate inside an empty and sealed ion source assembly
- Assembly filled to underpressure (0.2 bar absolute) helium.
- Cooled by clamping onto the water cooled base
- 1e18 protons (24 h or 3 shifts)
- **Irradiate whenever it suits ISOLDE schedule**
- Cool for 3 weeks, then transport- cooling can be exetended….
- Use certified Swiss transport company , having transported Isolde target assemblies before.
- Road transport, single item, type B.

- Hevesy Lab/DTU takes all responsibility when assembly leaves CERN (transport, handling, waste)