Long Pulses Spallation Source

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[1)] CERN [2)] CEA Saclay [3)] ESS-Bilbao

Requirements

- Power: ~ 5 MW
- Energy: 1 - 8 GeV
- Rep. rate: 10 - 20 Hz
- Pulse: 2 -3 ms
- p^+ or H^-

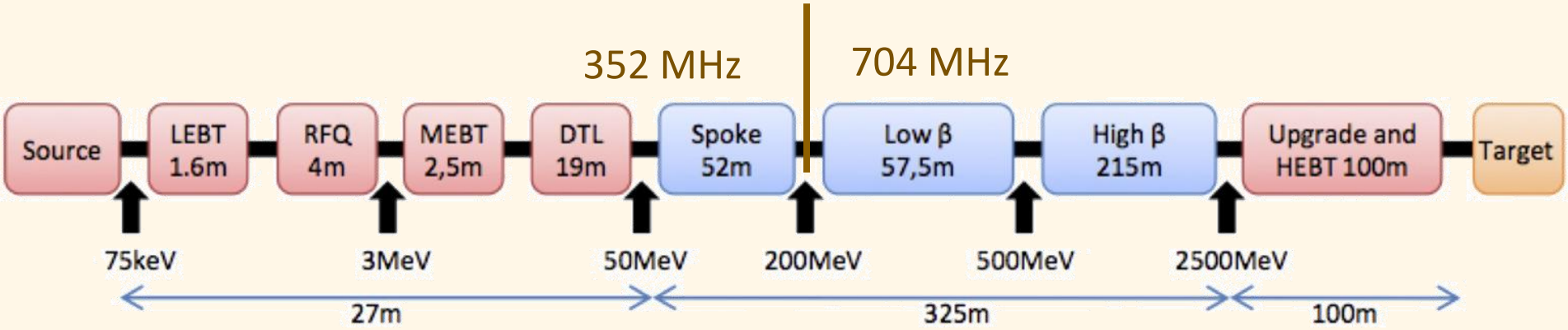
⇒ Current: I > 5MW / 8GeV / 20 Hz / 2 ms = 15.6 mA

⇒ **Linac**

⇒ **ESS**

ESS Outline

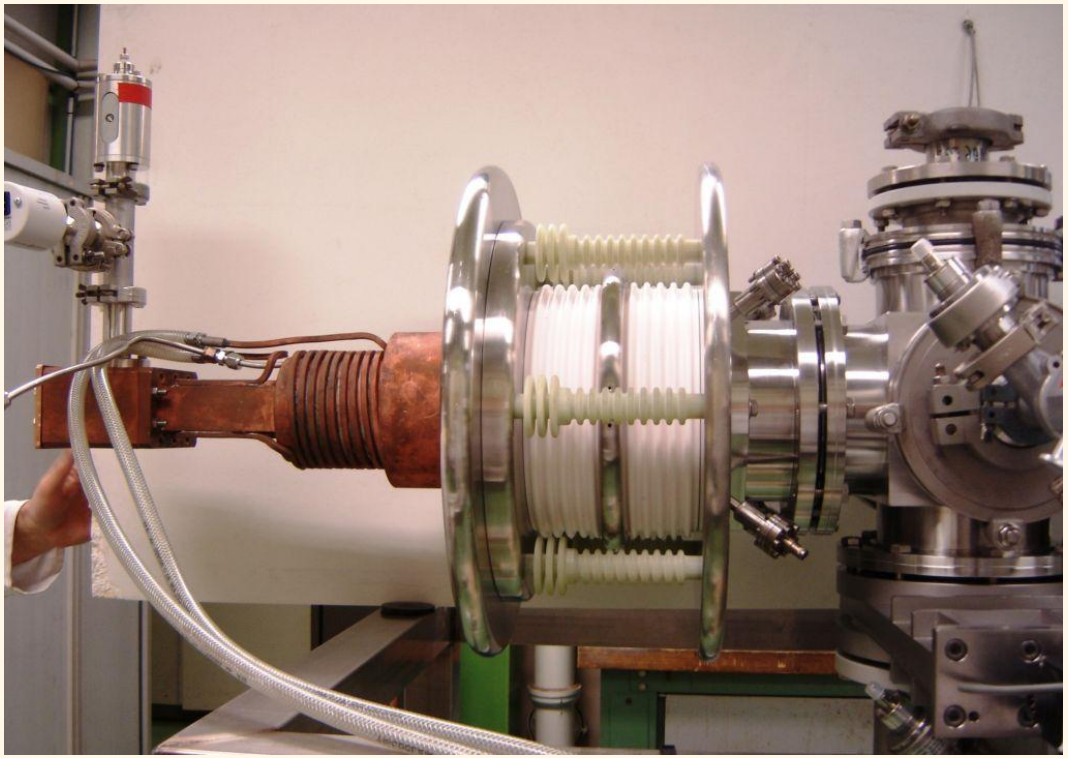
- Power: 5 MW
- Energy: 2.5 GeV
- Rep. rate: 14 Hz
- Pulse: 3 ms



S. Pegs et al "Plans for the ESS Linac", Proc. of LINAC 2010, Tsukuba, Japan, 2010

ECR source like SILHI

Current: ~ 50 – 60 mA



SILHI source @ CEA Saclay

RFQ (4 vanes)

Energy: ~ 3 MeV

Frequency: 352 MHz

(like ESS, Linac4, SPL)

Issues:

Longer RFQ ⇒ lower frequency required to fulfill $L \leq 4\lambda$

IPHI RFQ @ CEA Saclay

DTL @ low energies to account for rapid velocity changes

Energy: 50 MeV

(like ESS, ESS Bilbao)

Normal conducting to ease manufacturing

DTL of ESS Bilbao

Superconductive Linac

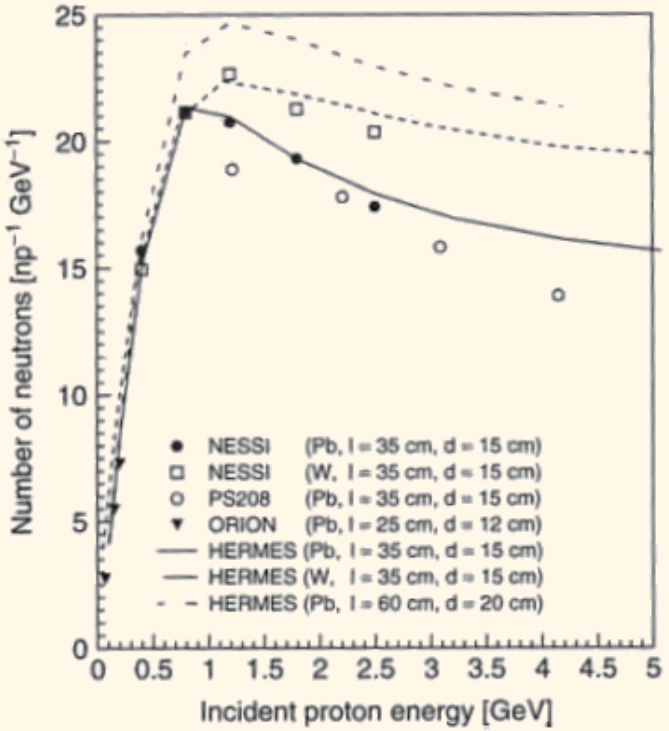
Frequency: 352 – 704 MHz

(like ESS, SPL)

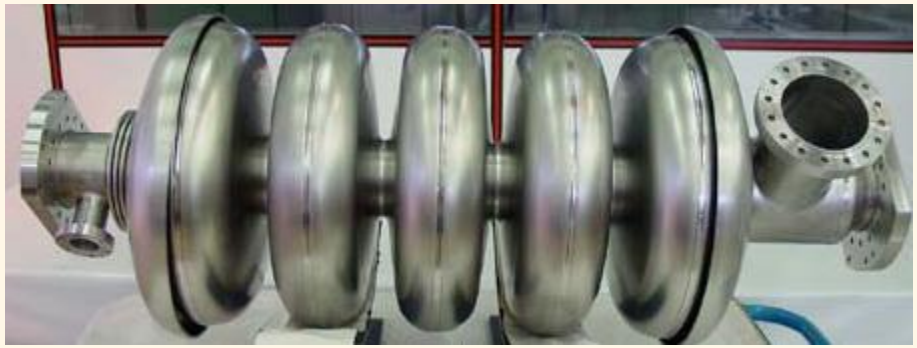
Optimum neutron yield at 1.5 GeV

High gradient high β cavities

⇒ **Energy: ≥ 2 GeV**



M. Wohlmuther, "Targets and beam dumps", CAS Bilbao 2011



Roger Ruber, "The European Spallation Source (ESS)" presentation

Issues:

- Klystrons
- Budget

Target Option 1

Liquid target

Jet target (Hg or LBE)
(like IFMIF, BNL E-951)

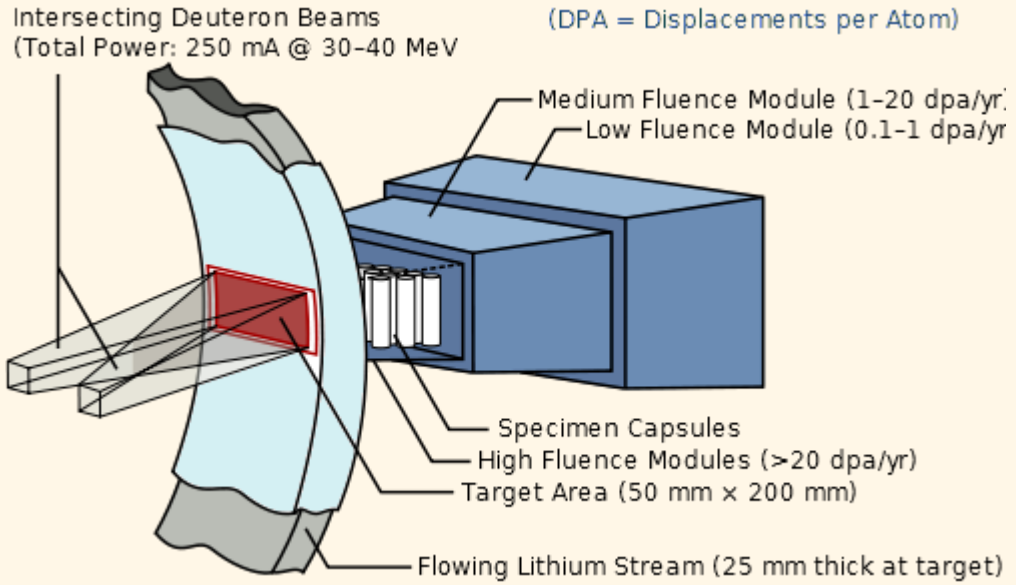
→ Reduced downtime

→ Increased reliability

Issues:

Bragg-peak depth: ~m

⇒ Energy ≈ 1 GeV



IFMIF liquid Li target mockup

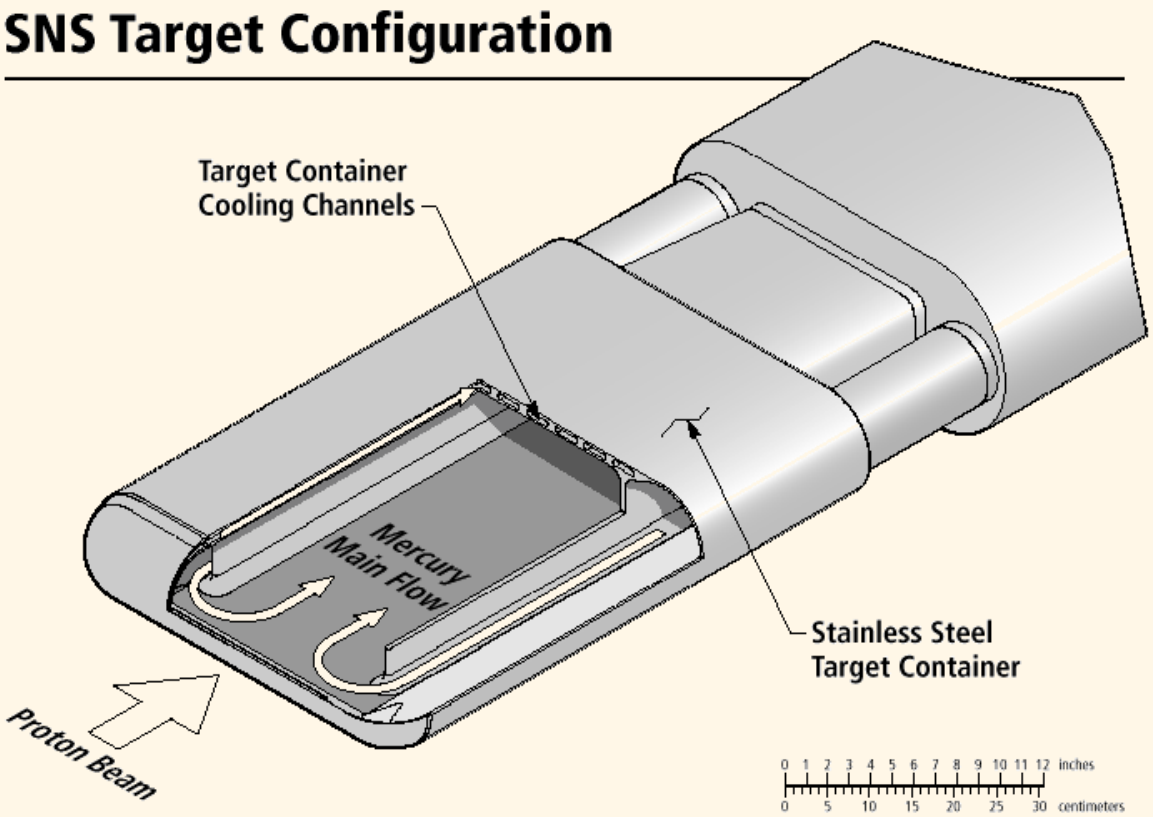
Target Option 2

Liquid target

(Hg or LBE)

Issues:

No 5 MW target existing so far…



B. W. Riemer “The SNS mercury Target”, presentation

NOT presented Issues

NOT presented Issues:

- Beam dynamics
- Diagnostics
- MPS / PPS
- Commissioning
- Cryostat
- Klystrons / power supplies
- Irradiation cells
- location
- etc...

Conclusion

ESS Outline

ECR source (e.g. SILHI)

→ ESS RFQ

→ ESS DTL

→ scLinac (> 2 GeV like ESS)

→ Hg Target (like SNS)

2 GeV, 50 mA, 20 Hz, 3 ms pulse ⇒ 6 MW

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