

PSI Center for Neutron and
Muon Sciences

BRAGI

Idea for PDF Instrument at ESS



Artur Glavic
PSI, 22 October 2025

- Limited capability for PDF at ESS due to maximum Q of initial Instrument suite
 - Require large Q-range coverage
 - DREAM $< 25 \text{ \AA}^{-1}$, HEIMDAL¹ $15 \text{ \AA}^{-1} < @ 0.6 \text{ \AA}$ wavelength

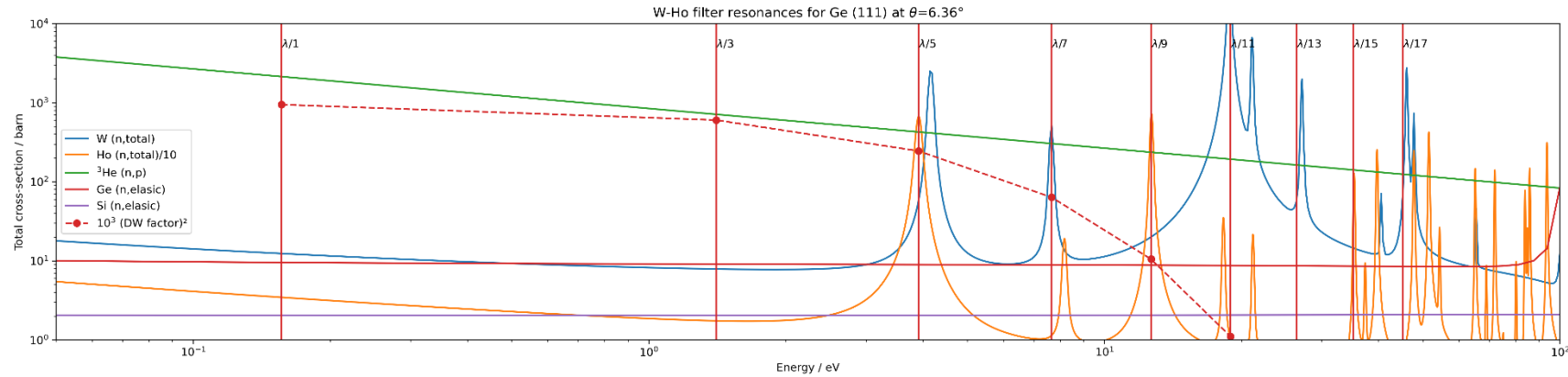
¹initial detector coverage

➔ Require shorter wavelength and broad band

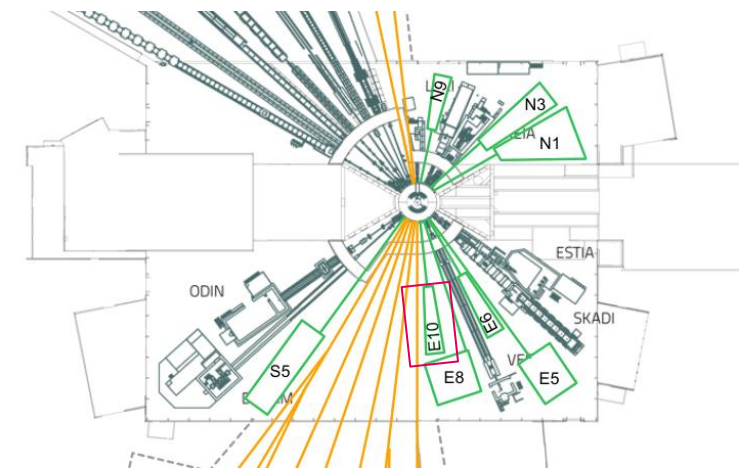
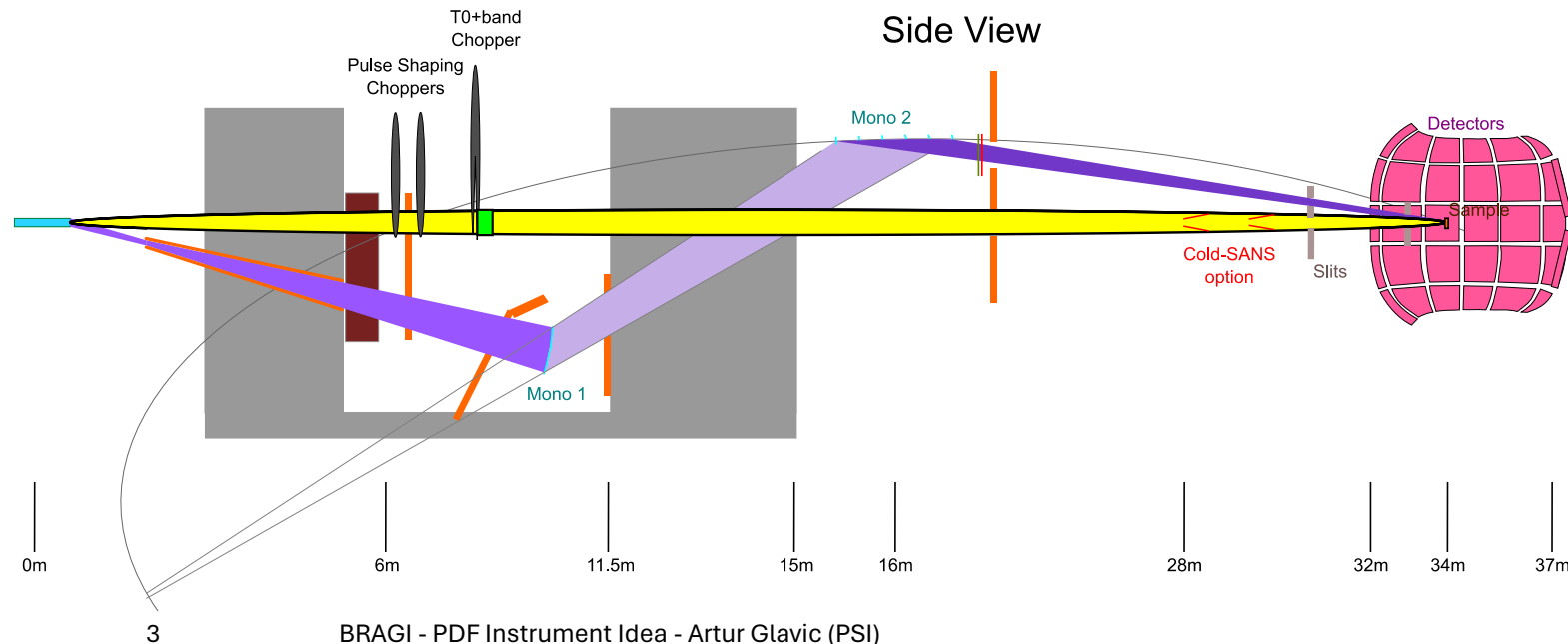
Technical Challenges at ESS

- Wavelength resolution required would need very short pulses for ToF
 - Need to generate 10-50 μ s pulse
 - Blocking fast neutrons
(for 10mm beam this requires a 1m radius T0-chopper at 200Hz)
- Minimal distance of instrument limited ➔ neutron guide needed
 - Usable divergence decreases towards shorter wavelength (m=4 @ 0.25 $\text{\AA}$ ➔ 0.1° reflection)

BRAGI Concept Layout

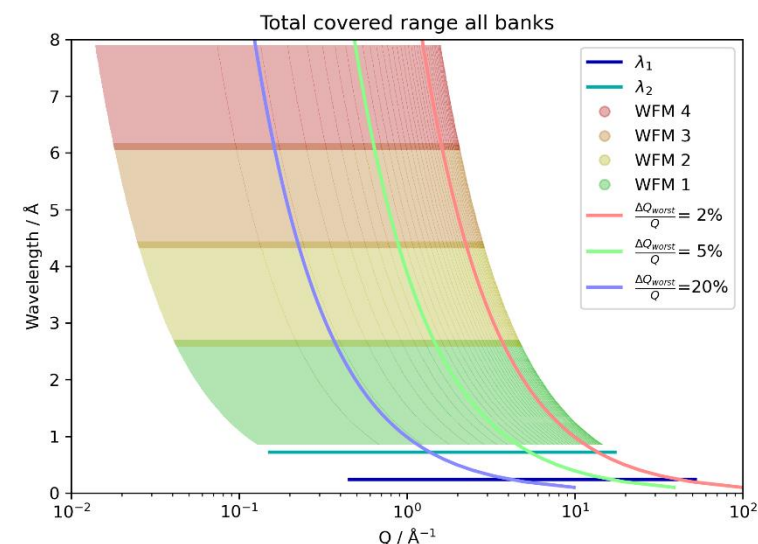
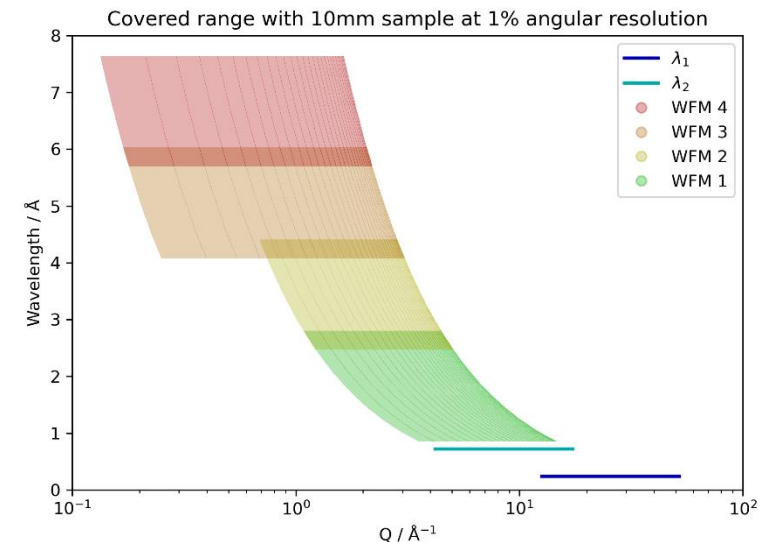
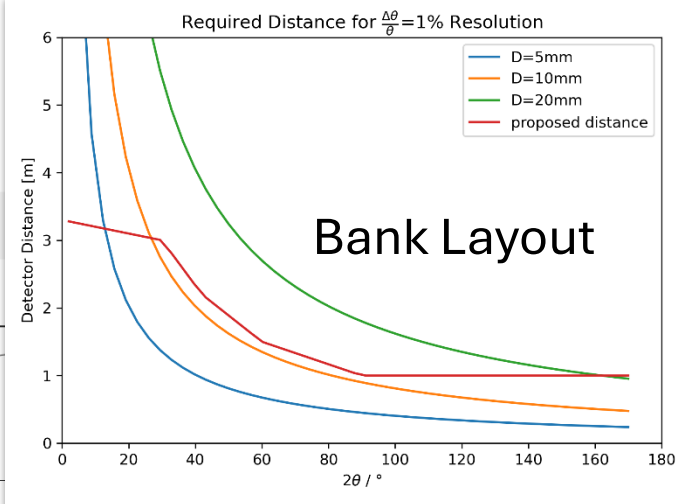
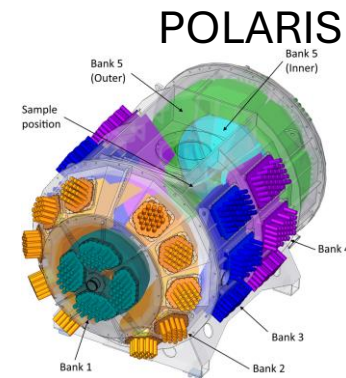
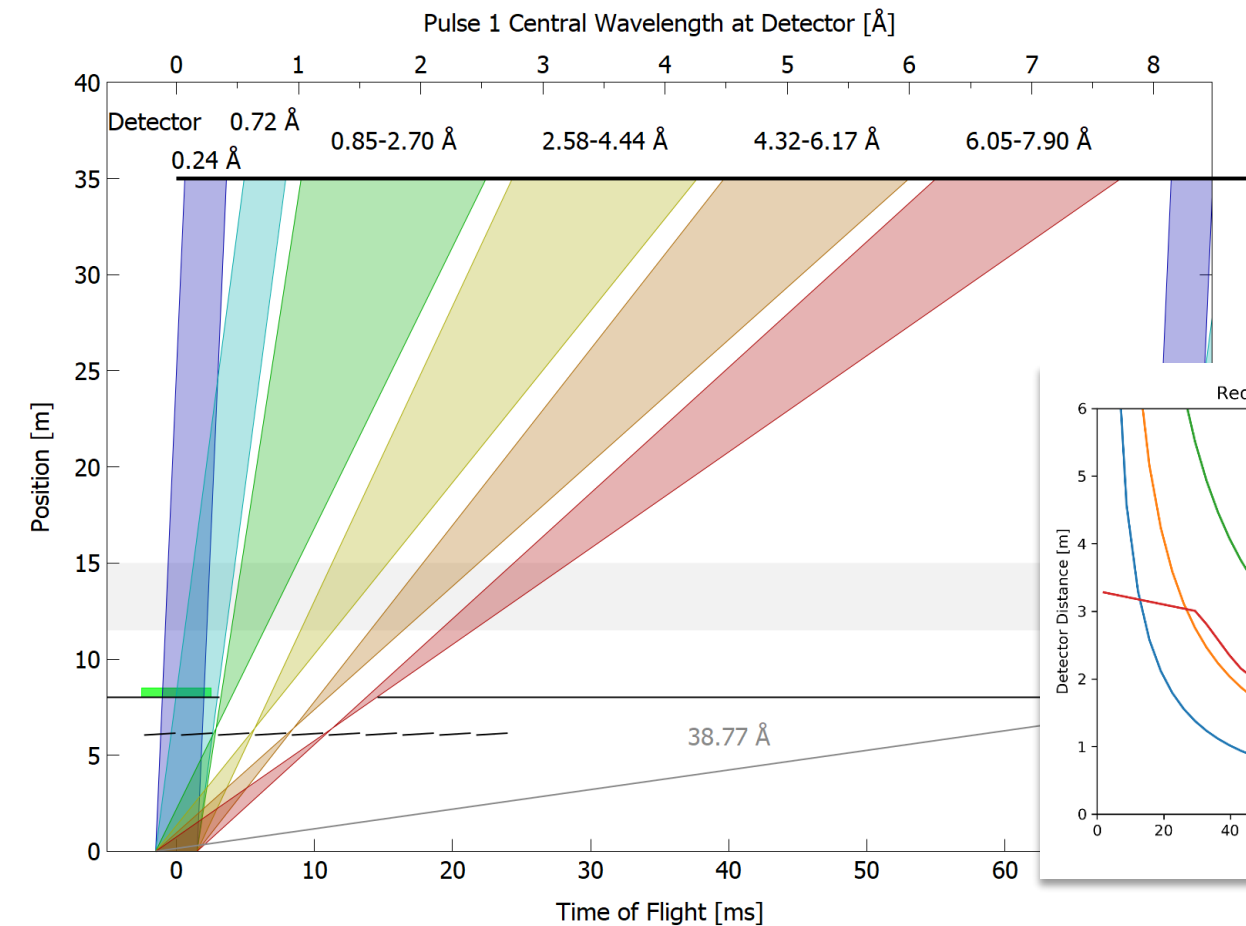


- Instrument in short hall
- Bi-spectral main beam with puls-shaping chopper pair
- Guide optimized for shorter wavelength
- Second beam using Ge monochromators to refocus on sample (e.g. $1^\circ \times 1^\circ$ divergence)
- 1st and 3rd order reflection gives $0.24 \text{ \AA} + 0.72 \text{ \AA}$
- Suppress higher orders using W+Ho filter resonances

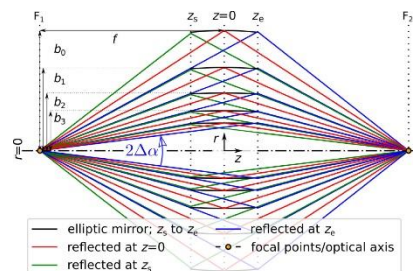
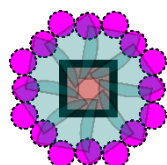


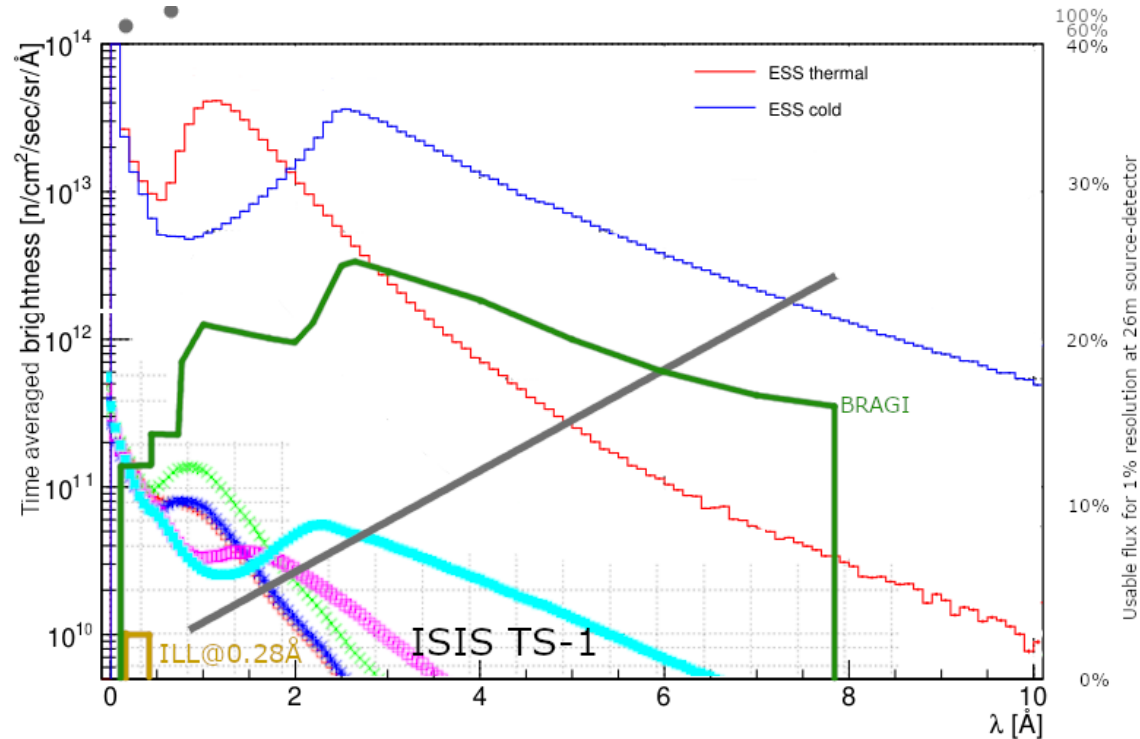
22.10.2025

Usable Wavelength Spectrum and Q-range



Extend low-Q using focus on detector with NMO for WFM 3+4





- Assuming ISIS instrument can use full average brightness
- BRAGI ToF for 1% cuts usable flux by ratio between natural and desired resolution at distance
- Monochromator wavelength averaged over range (0.2-0.5 $\text{\AA}$ / 0.5-0.8 $\text{\AA}$) and apply Debye-Waller factor twice for monochromator transmission
- Typical diffraction patterns become unresolved above 10-20 $\text{\AA}^{-1}$, the ToF wavelength and angular resolution could thus be increased to optimize information and collection time

A.C. Hannon / Nuclear Instruments and Methods in Physics Research A 551 (2005) 88–107

