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Update on monitors for STAP

Work on beam monitors has restarted. A new permanent staff member joined the ESS DG on September 1st, 2022. Ioannis Katsioulas combines experimental and academic backgrounds, has demonstrated project management skills, and has an excellent understanding of detectors. His experience and independence will allow him to immediately undertake vital responsibilities. Ioannis is leading the Detector Group effort to put forward a new plan for the beam monitors at ESS. The work has resumed in a new setting, with the instrument scientists taking an active role. Daria Noferini (CSPEC instrument scientist) is supporting Ioannis in the interaction with the instruments, acting as a point of contact to concentrate information. Ioannis and Daria are working together to collect and understand the instruments' requirements as a whole. The project is being planned in the following manner:

1. Collecting and understanding requirements from instruments.
2. Testing untested (or partially tested) technologies for performance, particularly by establishing a standard testing procedure, to allow for comparison of the various technologies. PSI and ISIS will support ESS with test time on their instruments.
3. Testing radiation hardness. Ioannis is working on this to get the right setup and support. A new possibility for collaboration has been established.
4. Propose to implement a solution within the resources available and schedule.

The benefits and drawbacks of several monitor technologies are well understood. Additional technologies have been identified to possibly overcome the limitations of those technologies. Testing is critical to ensuring long-term beam monitoring for ESS. One main concern is also in-bunker monitors, where access is limited due to the high level of radiation in which components (including electronics) can degrade rapidly. Radiation hardness testing is important to make sure that parts that will be used in a bunker can work for a long time.

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Monitors at ESS

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Motivation for Beam Monitoring at ESS

Common Beam Monitor (BM) project principles

- The neutron intensity fluctuates with time in neutron spallation sources, depending on the characteristics of the proton beam to the neutron target.
- Multitude of beam line components for instruments at ESS, much greater than for existing neutron sources, implying a greater need for monitoring
- Neutron beam monitors can be permanently or temporarily placed in the neutron beam lines in order to:
 - Characterise moderator performance and in monolith optics
 - Perform chopper diagnostics
 - Spectral normalisation
 - Transmission measurements
 - Calibration of flight paths
- Continuous neutron beam monitoring with high precision is required to ensure correct operation of neutron instruments
 - Monitoring of neutrons in sub-pulse structure is required for instruments with time-of-flight design

Monitor positions and characteristics

BMs per instrument

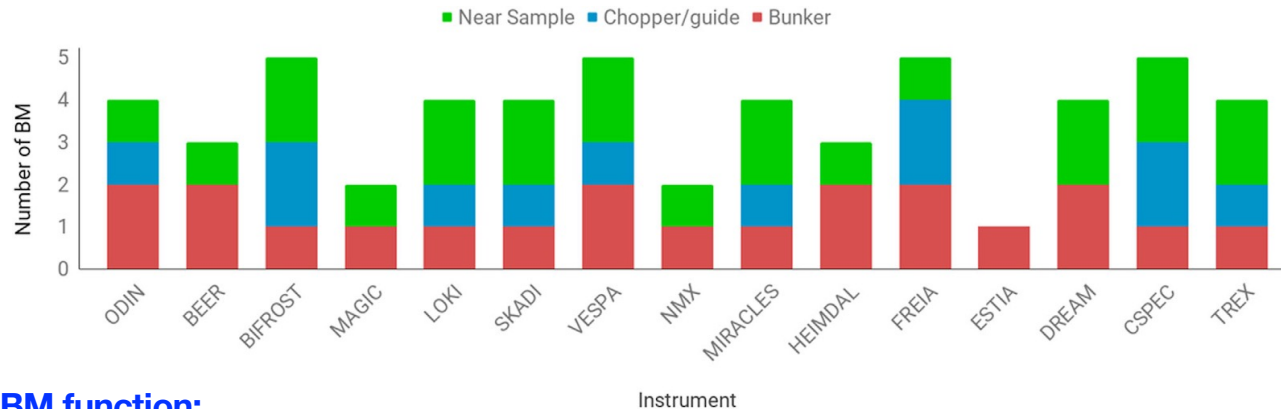
Beam monitors are going to be placed:

- Near the monolith
- Near choppers
- Near the sample position

Functional requirements will provide control over:

- Chopper systems
- Source
- Neutron guides
- Optic elements particular near the monolith
- Spectral calibration of experiments

For specific instruments a transmission monitor will be placed to measure the transmission of the beam through the sample



BM function:

- Detectors with sufficiently low efficiency so that beam remains intact
- Ensure that neutron flux, beam distribution, and pulse timing are as expected from an instrument's design
- Used to know the neutron flux at the sample in order to correctly interpret the scattering data

Location	BM desired features	Candidate BM technologies
Bunker	<ul style="list-style-type: none"> • Flux measurements • Timing capabilities • n/γ discrimination • Fast n discrimination 	<ul style="list-style-type: none"> • Fission chamber • Ionisation chamber • GEM
Guides & Choppers	<ul style="list-style-type: none"> • Flux measurements • Timing capabilities 	<ul style="list-style-type: none"> • Ionisation chamber • Quasi-parasitic V monitor • MicroMegas • GEM
Pre sample	<ul style="list-style-type: none"> • Flux measurements • Timing capabilities • Lowest attenuation/scattering • Time of Flight 	<ul style="list-style-type: none"> • MWPC • MicroMegas • GEM

BM common project update

Tentative action plan

- ▶ Produce summary on BM technologies and previous test results
- ▶ Produce activity schedule
- ▶ Update instrument requirements for each zone/position
- ▶ Performance tests of untested (*or partially tested*) technologies
 - ▶ Mandatory and optional tests defined to validate performance
- ▶ Radiation hardness tests
 - ▶ Mainly for bunker monitors and their electronics
- ▶ Present results and propose technologies solutions within available resources and schedule

