System Acceptance Review meeting for LoKI

LoKI Neutron Detector System & Detector Electronics =ESS.NSS.H01.LOKI.B01.B01 & ESS.NSS.H01.LOKI.B01.C01

PRESENTED BY IRINA STEFANESCU

2025-09-15

LoKI SAR – Detector Report

System name	FBS	EPL	Operation manual	FAT	SAT	Compliance
Neutron Detector System	LOKI.B01.B01	ESS-3889954	ESS-5081614	ESS-5716335	ESS-5716334 (local) ESS-5818477 (integrated)	Not CE-marked. Resolved through derogation ESS-5485813
Neutron Detector Electronics	LOKI.B01.C01	ESS-4867646				All individual components are CE marked.

System purpose: detect the scattered neutrons coming from the sample

Day-1 scope:

InKind, ISIS, STFC, UK:

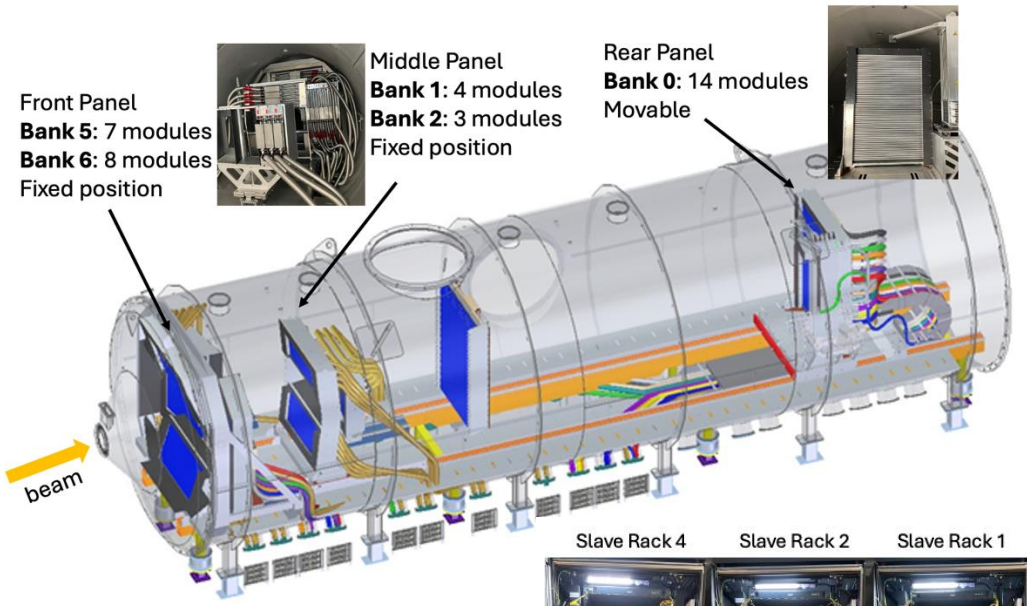
- 36 detector modules, cables (signal, HV, LV), patch panels
- 19 digitizers (CAEN)
- LV/HV power supply (CAEN)

Detector Group contribution, CR 13.07 (2020)

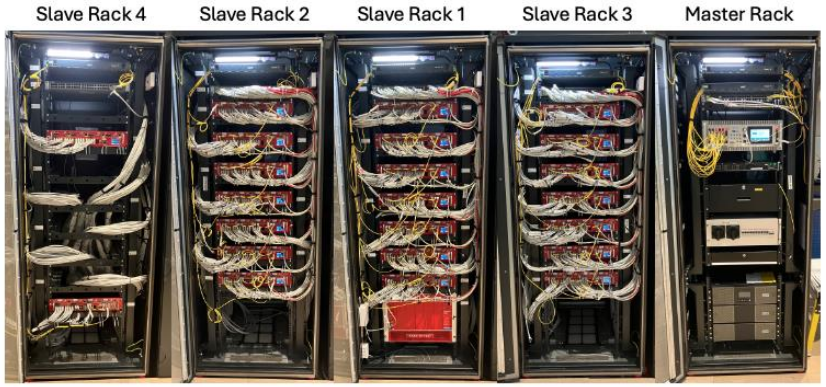
- 5 electrical cabinets (nVent)
- UPS (EATON)
- Readout Master Module (RMM)

Status:

Equipment delivered and installed ✅



5 detector banks in Day 1
(Full-Scope: 8 banks)



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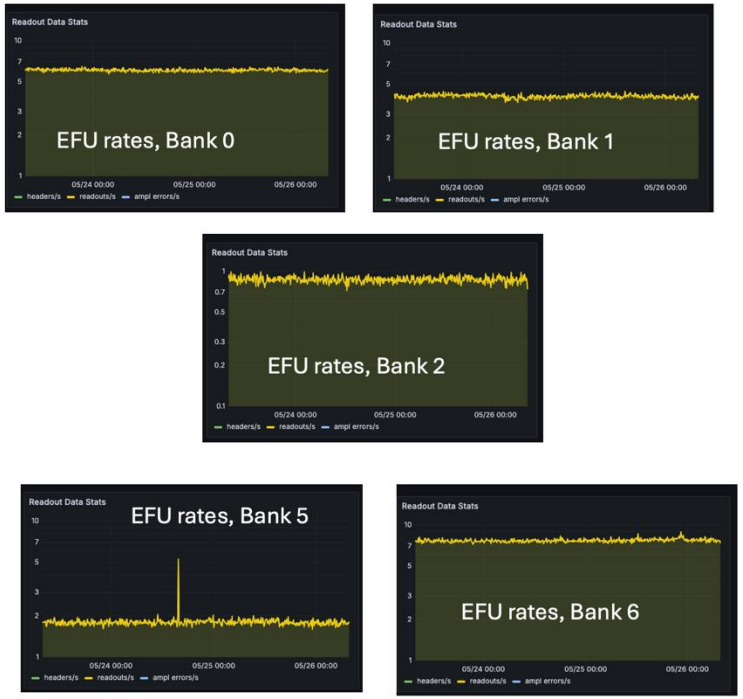
SAT1 performed in May & June 2025

- Test plan ESS-5716310

Test case		Pass/Fail	Note
1.	Verification of system document completeness	Pass	
2.	Inspections • Hardware installation • Cable connections as documented (2 x 648 signal, 36 HV, 36 LV) • Labelling of equipment and cables	Pass Pass Pass	The signals collected with the digitizers indicate that all detector modules operate normally at 1.1 kV.
3.	Interface for detector control and monitoring • Connectivity between the various parts of the readout system • EPICS modules for HV/LV and RMM • Data pipeline Detectors-Digitizers-RMM-EFU • Tools for visualisation and monitoring	Pass Pass Pass Pass	NIN connections Functionality, readiness RMM ring connectivity established, data format is as agreed in the ICD (ECDC). Grafana, Daqlite, Ar51, etc.



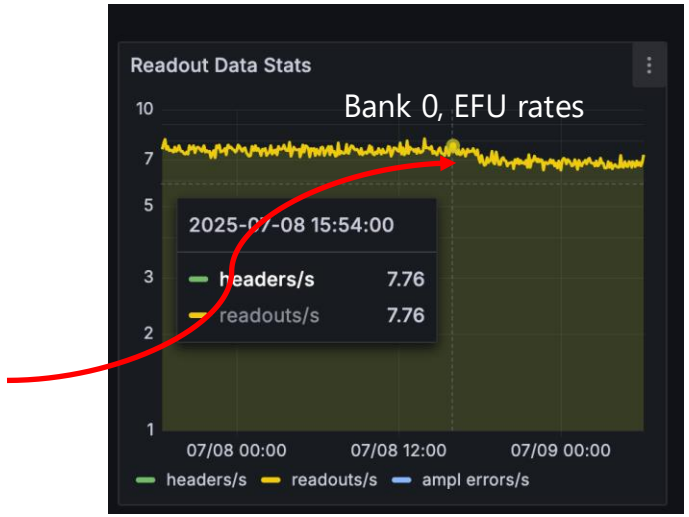
Grafana plots

- All tests were performed with cosmic background continuously counting for 3-4 days (weekends) with the detectors operating with vacuum and with air in the tank. Weekdays were used for testing activities by the other teams (e.g., MCA).
- No grounding issues observed (uniform detector rates across all banks and modules, see plots).
- Test report ESS-5716334 was released at the end of June. Detector & electronics systems deemed ready for integrated testing.

LoKI SAR – Detector Report

Observations after the detector local testing was completed

- The tank was closed on July 3 and pumping down started around lunch time.
- Module 9 in Bank 0 switched off by itself on July 8. Any attempt to power it up again failed as the measured leakage current raised above the maximum allowed value for safe operation (40 µA).
- Tank vented a few days later. Module 9 was fully operational at the nominal value of 1.1 kV ➔ we concluded that the module has a vacuum leak.



- All 5 O-rings that ensure the vacuum tightness of the detector module were changed by the Vacuum team on July 15. The problem persisted.

LoKI SAR – Detector Report

Observations after the detector local testing was completed

- Since the replacement of the O-rings did not solve the problem, the clamps connecting the cables hoses to the detectors were suspected of leaking, but the vacuum team could not detect any.

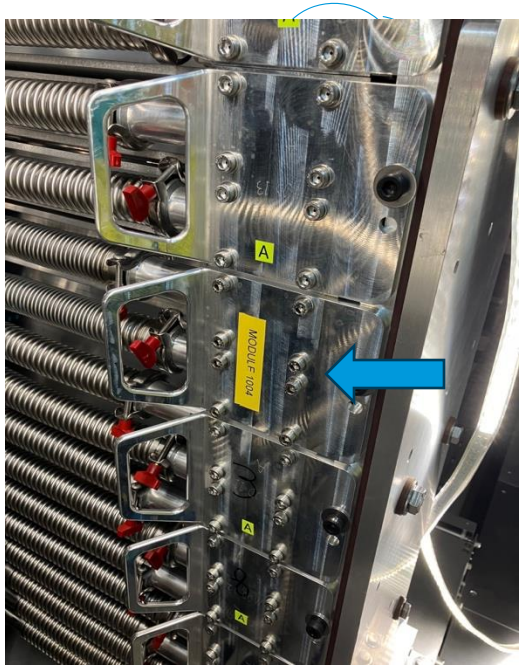
- On August 14, Module 9 was replaced with Module 1004 (ISIS ID), one of the modules delivered to ESS this summer to complete the Loki detector Full-Scope.

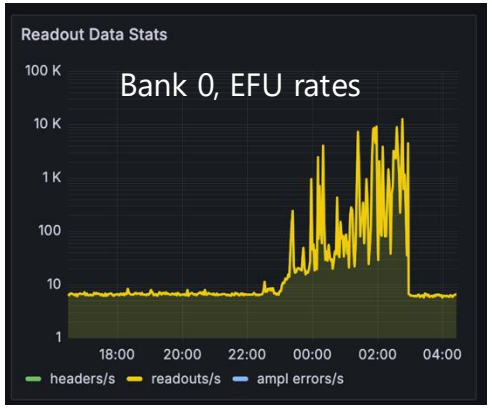
  https://jira.ess.eu/browse/NIT-225 (Bank 0/Module 9)

- Module 6 in Bank 0 tripped on August 28. Symptoms were similar to those observed for Module 0 → vacuum leak.

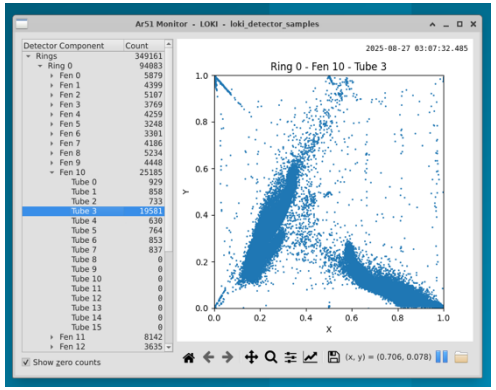
  https://jira.ess.eu/browse/NIT-309 (Bank 0/Module 6)

We suspect that the observed vacuum leaks are caused by the routing, movement and attachment of the long and heavy cable hoses to the detector modules.





(Grafana rates)



(Ar51 visualisation tool)

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Hot commissioning

Loki readout electronics is ready for hot commissioning.

Loki detector modules are not ready for hot-commissioning – the cause for the vacuum leaks of the modules must be understood.

Detector group planned activities for hot commissioning:

- Support the instrument team with detector-related activities

Displaced working hours or on-call support: as required.