Status Update for the SoNDe collaboration

SONNIG/ESS

European Spallation Source ERIC

SoNDe Retreat 29-31 of August 2017

Presentation Overview

EUROPEAN SPALLATION SOURCE

- Strategic Approach.
- Building a Knowledge Base
- SoNDe-Module
- Integration with ESS
- Near- to Mid- Term Plans

Strategic Approach

EUROPEAN SPALLATION SOURCE

Full Scale SoNDe detector

Strategic Approach

Building a knowledge base:

- MaPMT characterisation
- 6Li-Glass Characterisation
- Detection Efficiency
- Position resolution
- System Optimisation

Dedicated space at LU.
VME based electronics.
Source-based Test facility
Neutron sources:
(AmBe, AmPu, Cf-252)
Laser-Scan Testing facility.

Full Scale SoNDe detector

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→ - Response map
- g/neutron Disc. Threshold
- Tested Patterns

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SoNDe-Module (MaPMT+6Li-Glass Scintillator+ROSMAP):

- Can we get the same detection efficiency?
- Assess count-rate capability
- Assess position sensitivity
- Establish a Quality Assurance procedure

LUND UNIVERSITY

LUND UNIVERSITY EUROPEAN SPALLATION SOURCE

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ESS Integration:
- 2x2 prototype
- ESS Event formation
- Define TCP/UDP protocols
- Communicate with SoNDe Module
- Integration requirements

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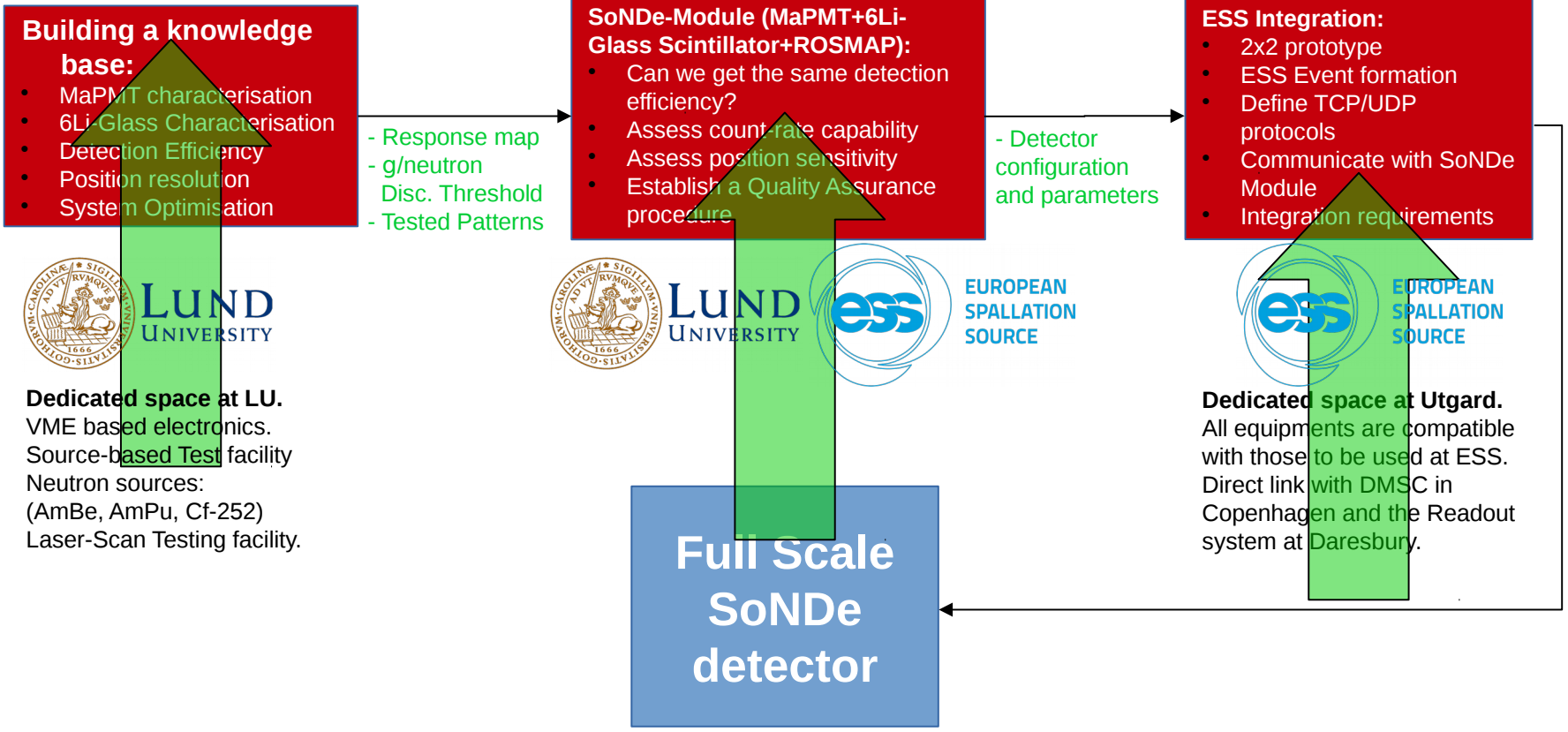
Dedicated space at Utgard.
All equipments are compatible with those to be used at ESS.
Direct link with DMSC in Copenhagen and the Readout system at Daresbury.

Full Scale SoNDe detector

Strategic Approach

Full Frontal assault!



Strategic Approach

EUROPEAN SPALLATION SOURCE

Full Frontal assault!

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Dedicated space at LU.
VME based electronics.
Source-based Test facility

Kevin Fissum (LU)
Hanno Perry (LU)
Emil Rofors (LU)
Amanda Jalgen (LU)
Richard Hall-Wilton (ESS)
Nicholai Mauritzson (ESS)
Ramsey Al Jebali (ESS)

LUND UNIVERSITY

EUROPEAN SPALLATION SOURCE

Emil Rofors (LU)
Ramsey Al Jebali (ESS)
Richard Hall-Wilton (ESS)

detector

EUROPEAN SPALLATION SOURCE

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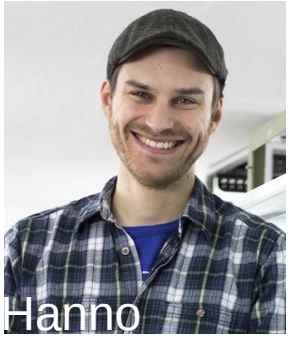
Richard Hall-Wilton (ESS)
Kalliopi Kanaki (ESS)
Ramsey Al Jebali (ESS)
Scott Koyla (ESS)
Emil Rofors (LU)

Strategic Approach

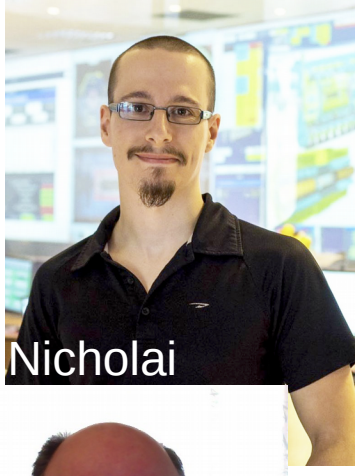
EUROPEAN SPALLATION SOURCE

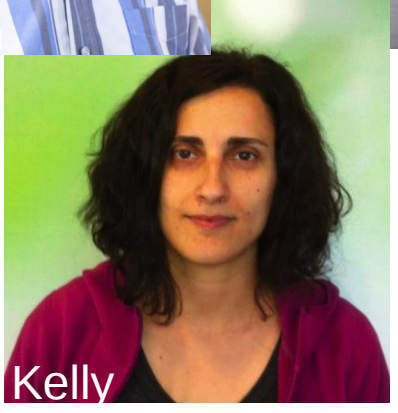
Kevin

Richard

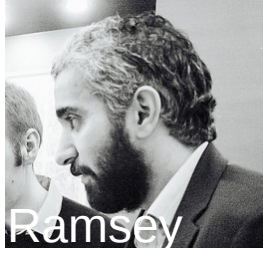

Hanno

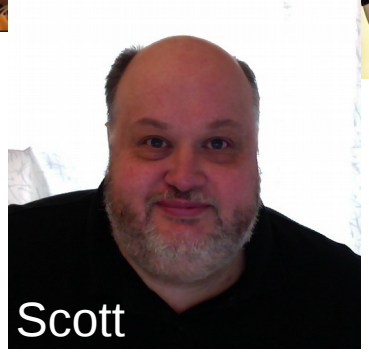
Emil


Nicholai


Kelly

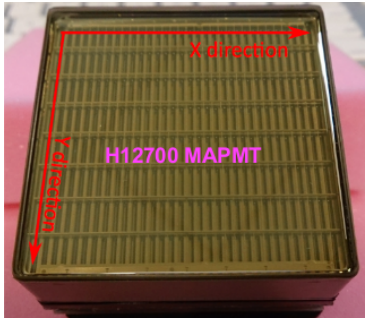
Amanda

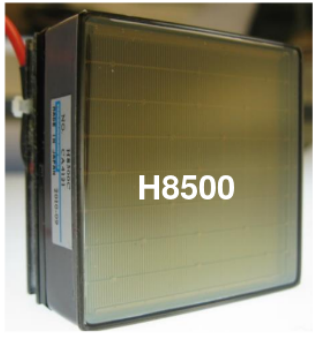

Ramsey


Scott

Building a Knowledge base
MaPMT Characterisation

MaPMT characterisation is being done in close collaboration with the University of Glasgow in Scotland where expertise was gained from working many years on the CLAS12* RICH** detector at Jefferson Lab in the USA and the Glasgow Muon Tomography System for the Nuclear Decommissioning Authority in the UK.

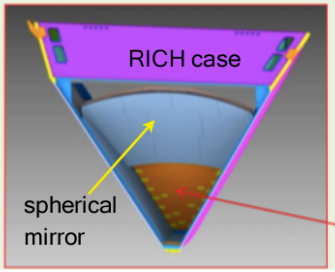




* CEBA Large acceptance Spectrometer
** Ring Imaging CHerenkov

Building a Knowledge base
MaPMT Characterisation

EUROPEAN SPALLATION SOURCE

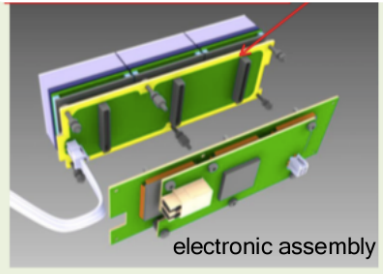


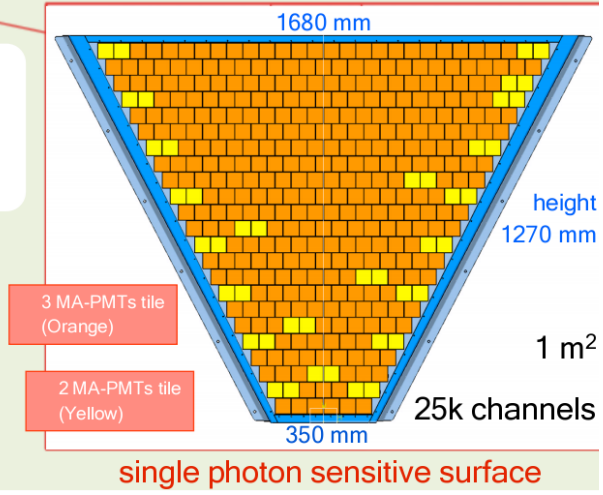
Tessellation approach: 2 or 3 MA-PMT tiles

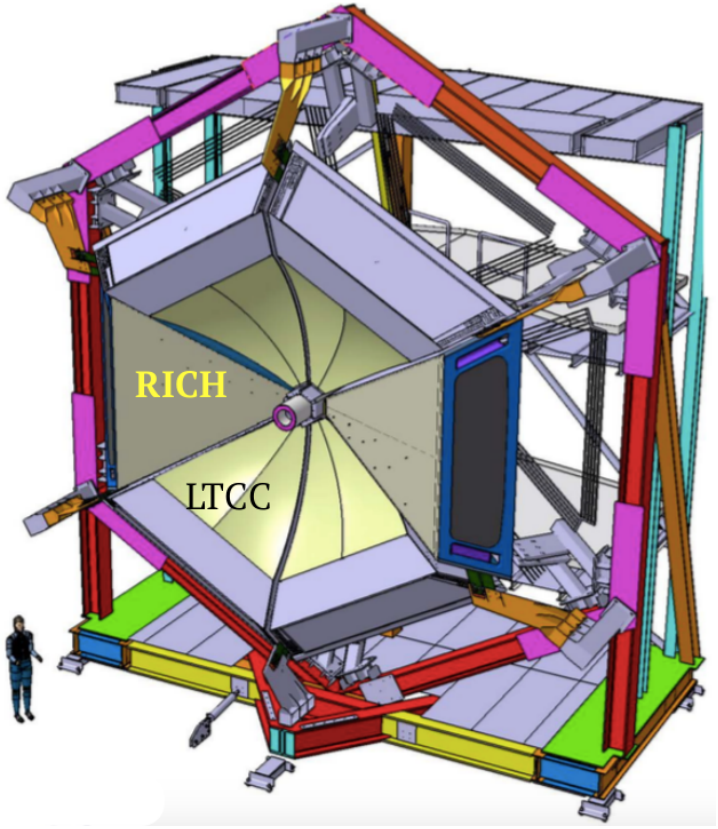
Services out of acceptance (lateral loglines)

400 Hamamatsu MA-PMTs

H8500 and H12700

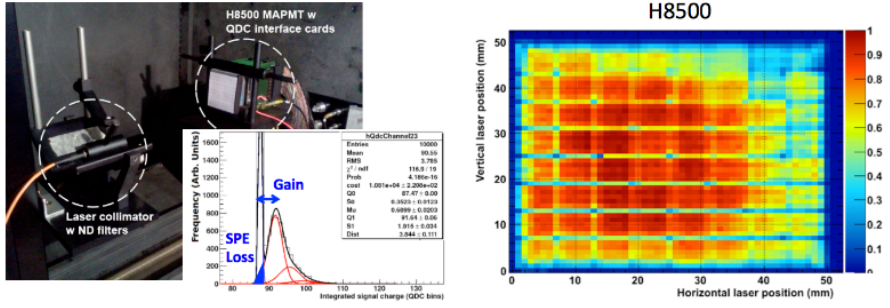




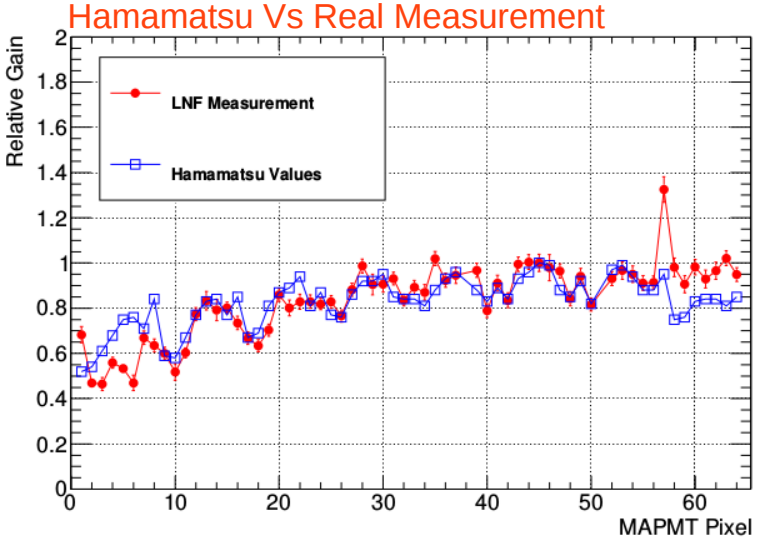


Building a Knowledge base
MaPMT Characterisation

Glasgow main focus within the CLAS12 collaboration was to characterise and investigate the Hamamatsu H8500 phototubes as single photon detectors. Using a carefully adjusted laser intensity to match that of SPE

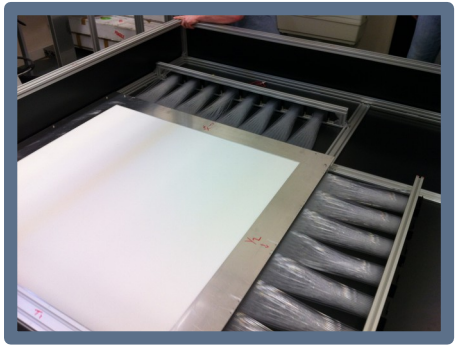


Left: Laser-Scan Test facility. Right: Detailed efficiency map of the H8500 at SPE level.

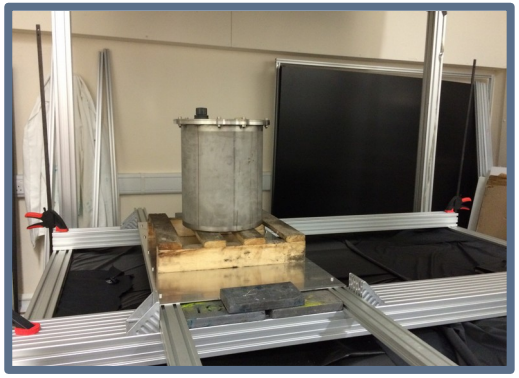


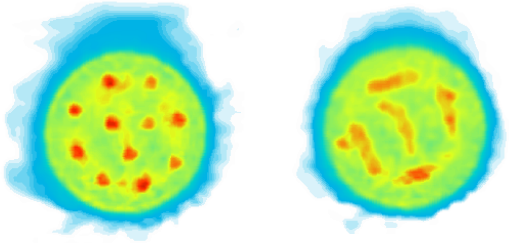
Building a Knowledge base
MaPMT Characterisation

The Glasgow Full-Scale Muon Tomography system



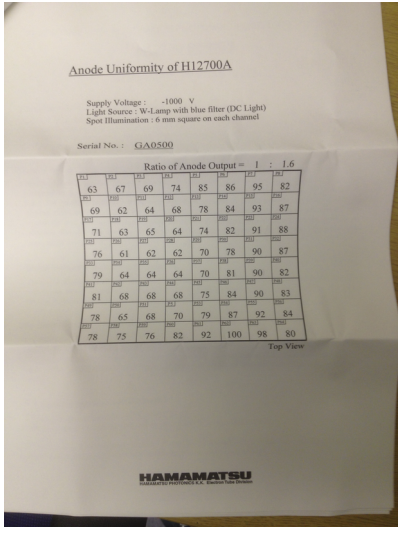
64xH8500 MaPMTs. Same apparatus that was used for the RICH detector investigations but with a laser intensity that matches the real muon signal strenght).

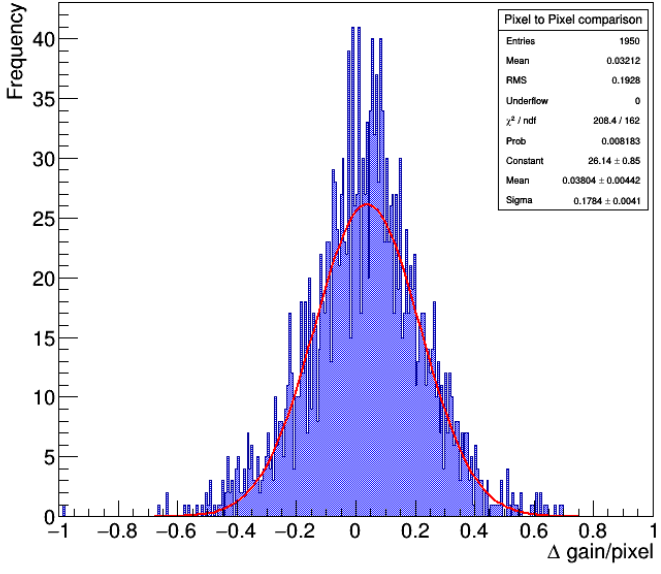




1cm horizontal slices through the Top hat in the region of the Tungsten pennies (left) and steel bars (right)

Building a Knowledge base
MaPMT Characterisation



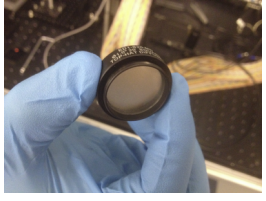


We noticed gain variation between Hamamatsu data sheet gain maps and those measured at Laser intensity equivalent to ~10 PE. System stability was measured to be -/+ 3%. Figure on the right is for 32 MaPMTs

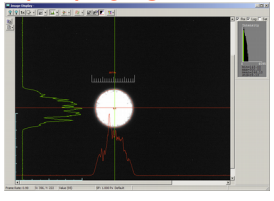
Building a Knowledge base
MaPMT Characterisation

Transport that knowledge/expertise to Lund started by both Kevin Fissum and Hanno Perry and later Julius Scherzinger in 2016. Elog: https://stf02.nuclear.lu.se/MAPMT+Mapping
Detailed characterisation with different settings: Laser Intensities, applied HV voltages, mm Scan and central scans mainly.

3/5/2016

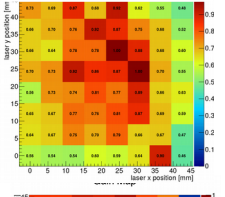


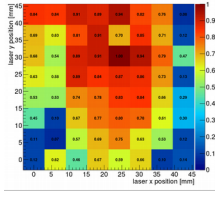
2/12/2015



3/5/2016

6/5/2016





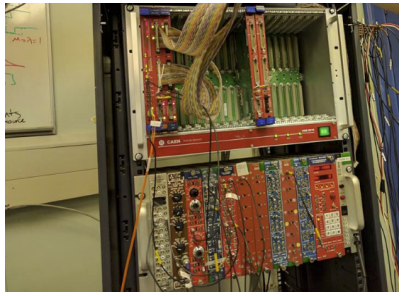
Building a Knowledge base
6Li-Glass Scintillator Characterisation

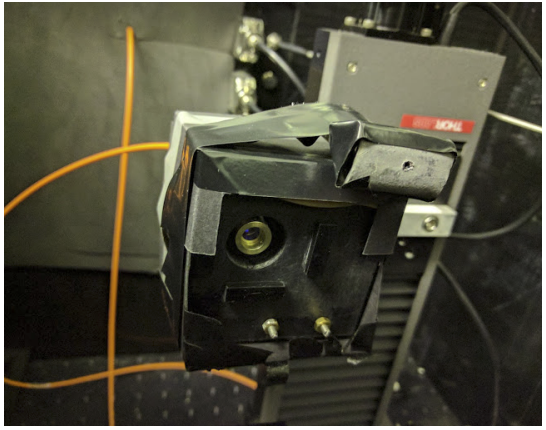
- 1mm thin ungrooved 6Li-Glass Scintillator was acquired in Lund in April 2017.
- Measurements campaign with an Alpha source started in Glasgow the same month (Amanda Jalgen thesis).
- Neutron Irradiation at LU started in July 2017.

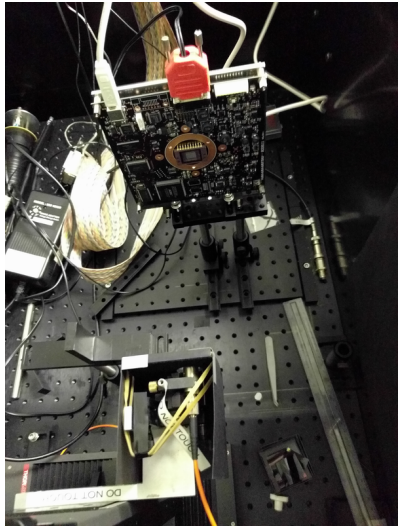
Building a Knowledge base

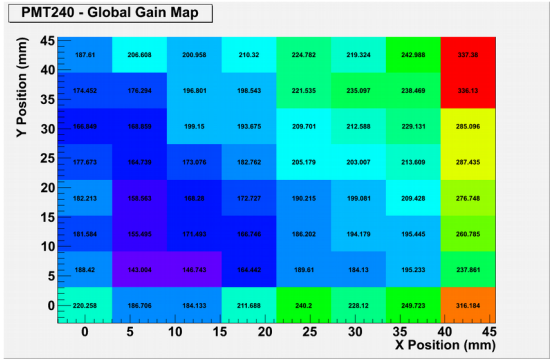
6Li-Glass Scintillator Characterisation

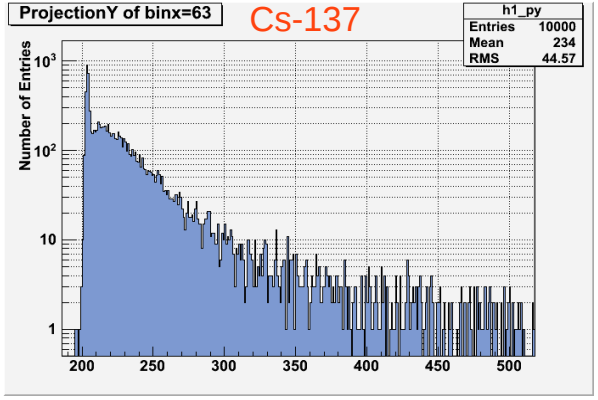
EUROPEAN SPALLATION SOURCE

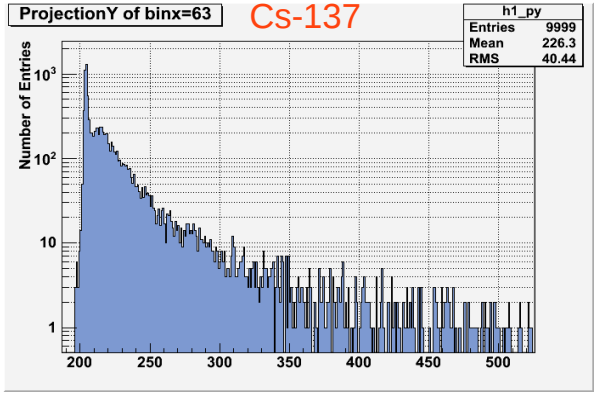








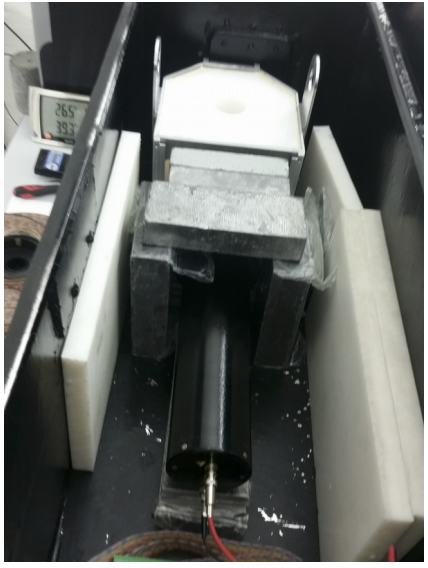


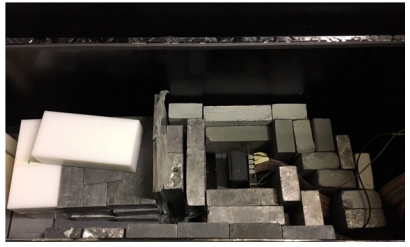


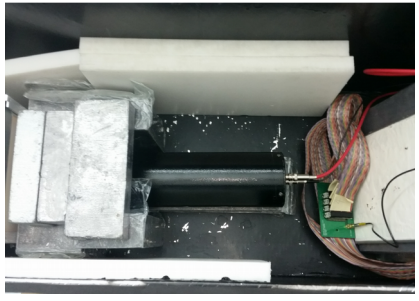
Building a Knowledge base
6Li-Glass Scintillator Characterisation

EUROPEAN SPALLATION SOURCE

Dedicated space at LU was established in August 2017 for Neutron Irradiation measurements.

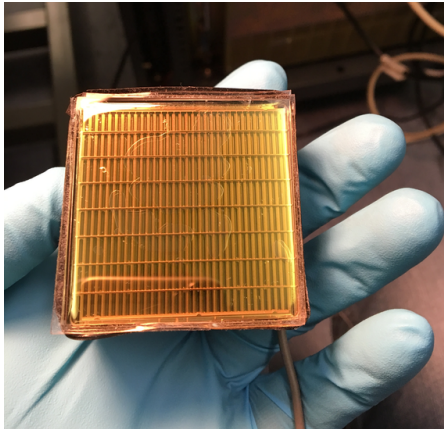


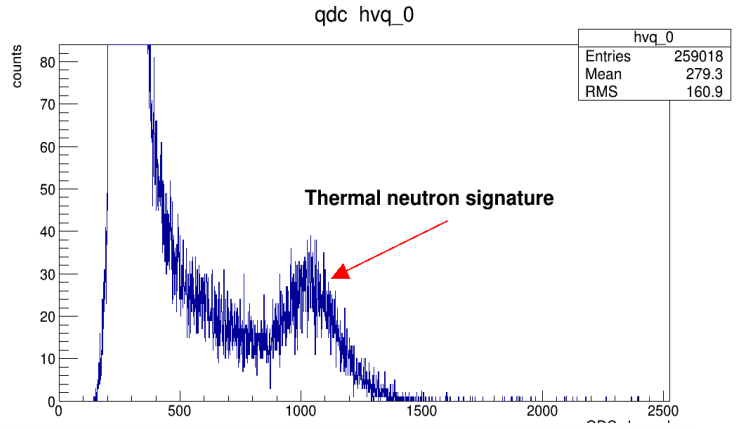


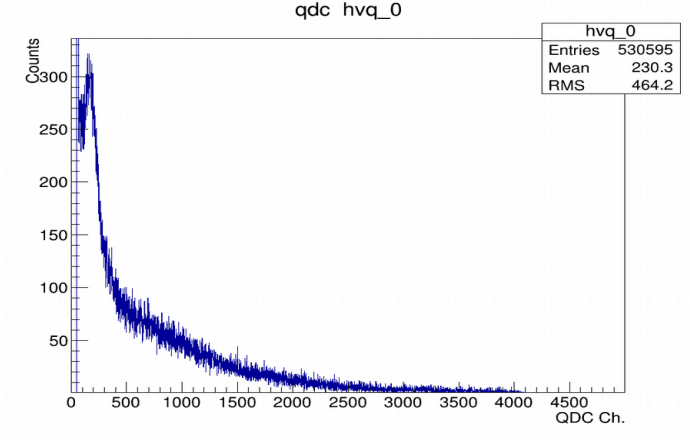


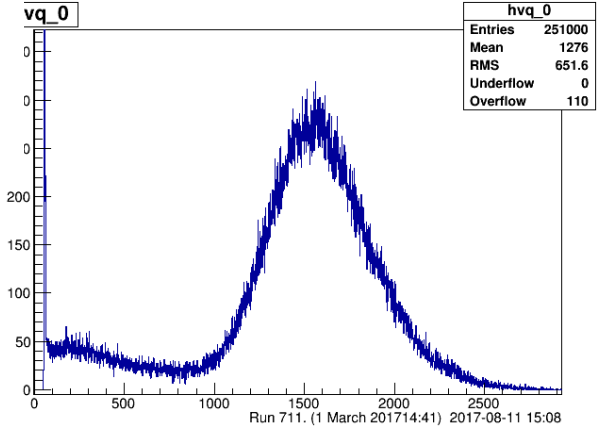
Building a Knowledge base
6Li-Glass Scintillator Characterisation

EUROPEAN SPALLATION SOURCE



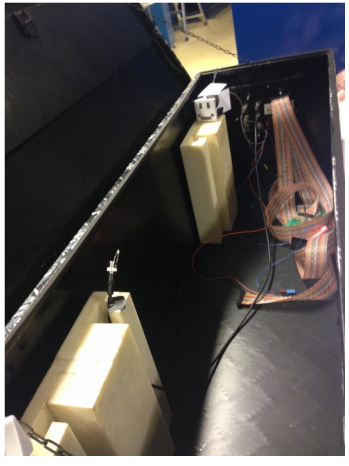


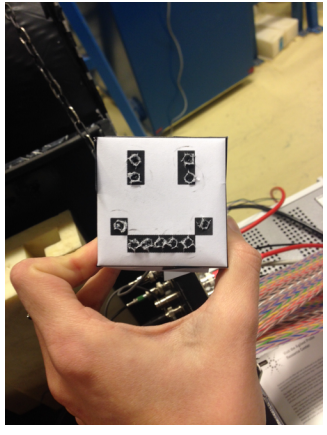


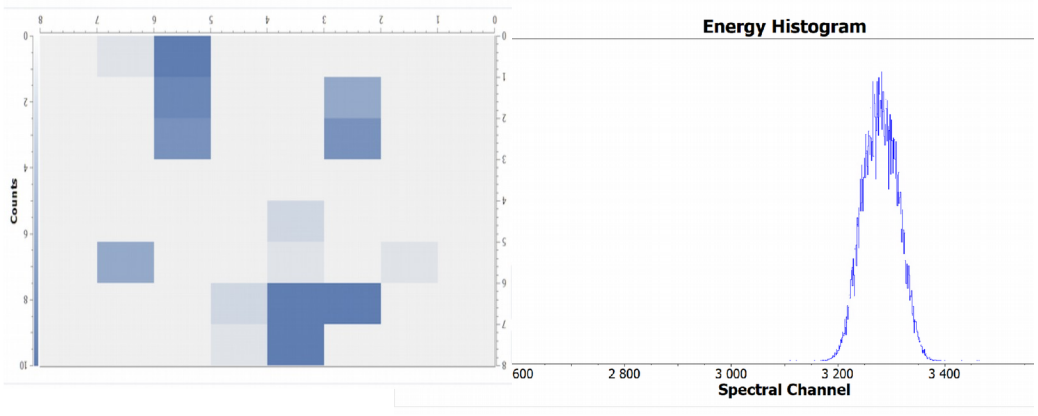


SoNDe-Module

- Rosmap module was acquired in Lund at the end of February 2017.
- Initial setup and testing was done in March and April.
- Currently on Hold, but not for so long!







Outreach

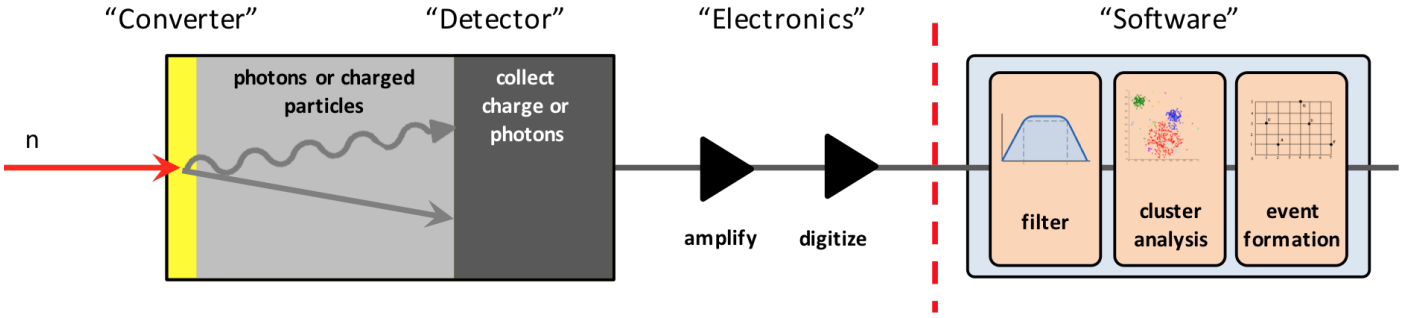
UNIVERSITET
2018

SOLID STATE
NEUTRON DETECTOR
For High-Flux Applications

ESS Integration

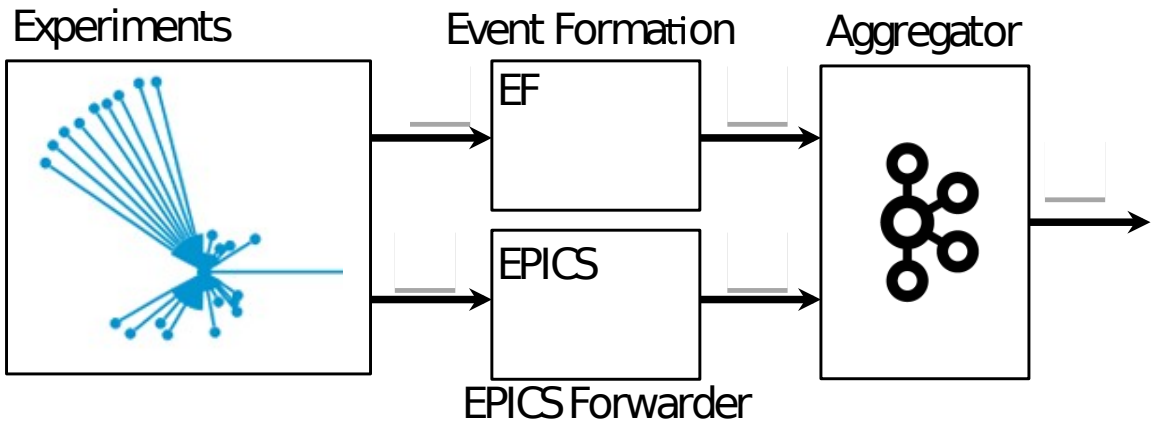
- In the process of building a 2x2 Prototype to be base of our integration efforts.
- Thoughts and discussions are underway.
- Plan to run the DMSC Event formation with the SoNDe-Module ASAP (Top priority).

ESS Integration



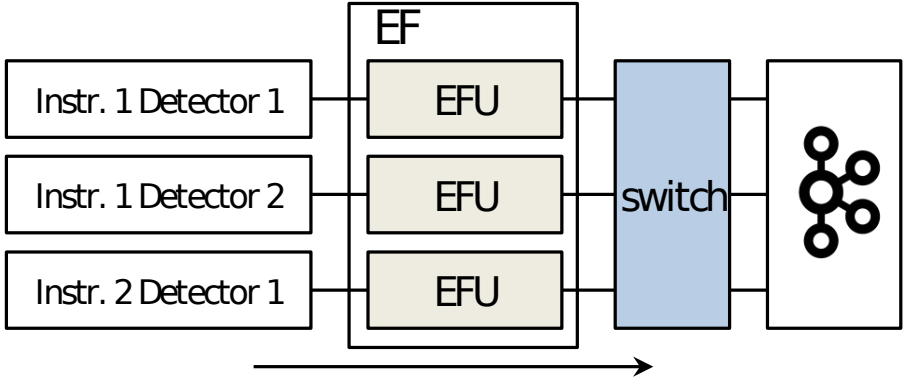
The dotted red line is the physical interface between the Detector and the Data Management domains. A clear and unambiguous definition of this interface is the prerequisite for efficient implementations and usable results. The interface is based on Ethernet. The current EFU hardware uses 10G optical Ethernet, potential upgrade to 100G optical.

ESS Integration
Data Acquisition Overview



- Two data streams per instrument: Detector Data / EPICS Data
- Event Formation processes Detector data
- Events are streamed to Aggregator (kafka) for later filewriting to persistent storage

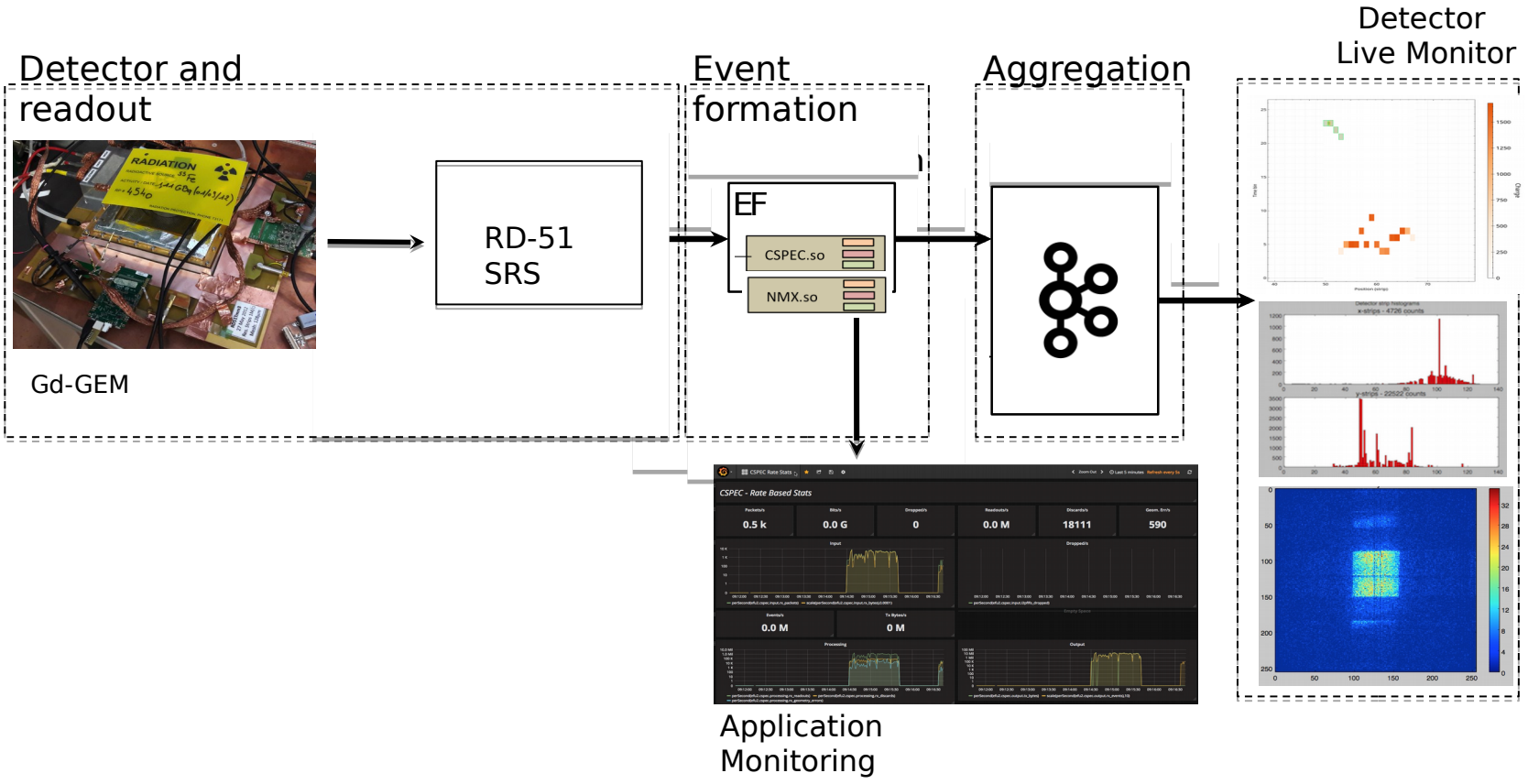
ESS Integration
Data Acquisition Overview



- One EFU per detector panel
- Direct fiber connection (10G)
- EFU is pure multi core software processing (if possible)
- Switched Ethernet on the output side

ESS Integration
Live Data Monitoring

EUROPEAN SPALLATION SOURCE



In the Horizon

- Two dedicated spaces for SoNDe project: Utgard at ESS (for ESS/SoNDe interface) and STF at LU (for Characterisation and building knowledge base).
- Couple DMSC software with the SoNDe-Module: September 2017.
- 2x2 Prototype to be used for SoNDe-ESS integration: November 17. Components Ordered: Expected Delivery October 2017.
- Laser-Scan Testing Facility in Lund: Autumn 2017. Components ordered, expected Delivery October/November 2017.

Overall Summary

- We have been moving a little slow yes but very systematically.

- We have been running non-stop full speed for a number of months now.

- Clear vision/plan for the near future.

- Can not progress without necessary equipments: SoNDe-modules, 6Li-Glass scintillators…

Thank you!

EUROPEAN
SPALLATION
SOURCE