DMSC STAP

DetG Update

KEVIN FISSUM

2023-04-25

DetG Update

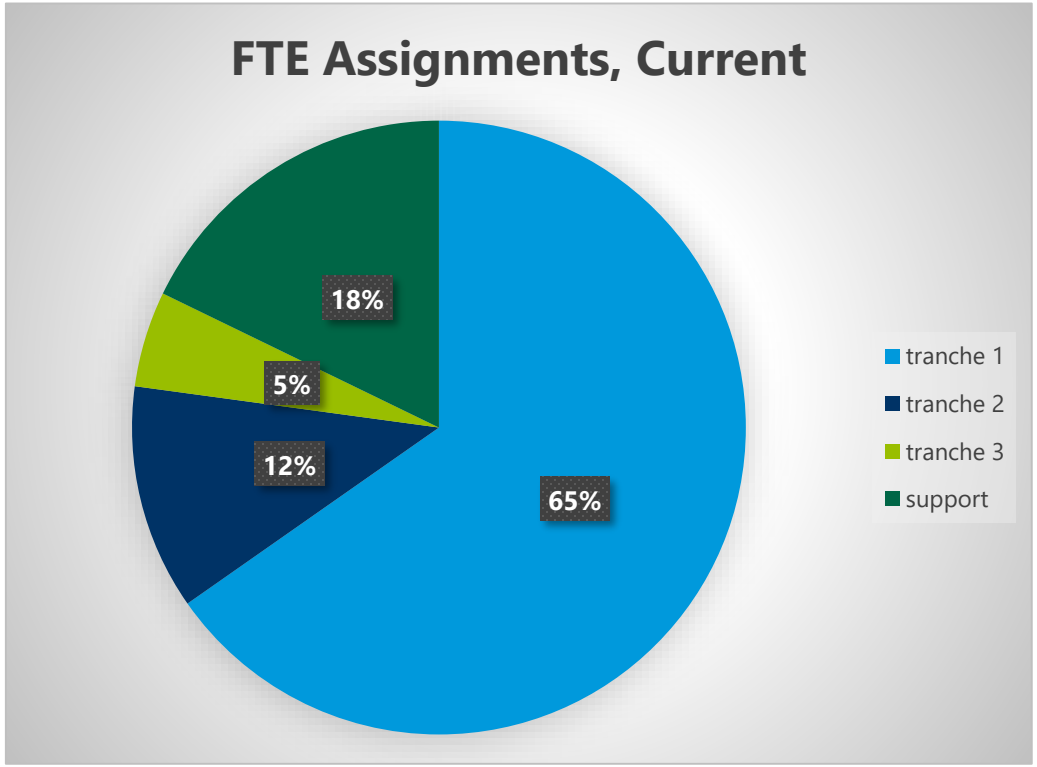
1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

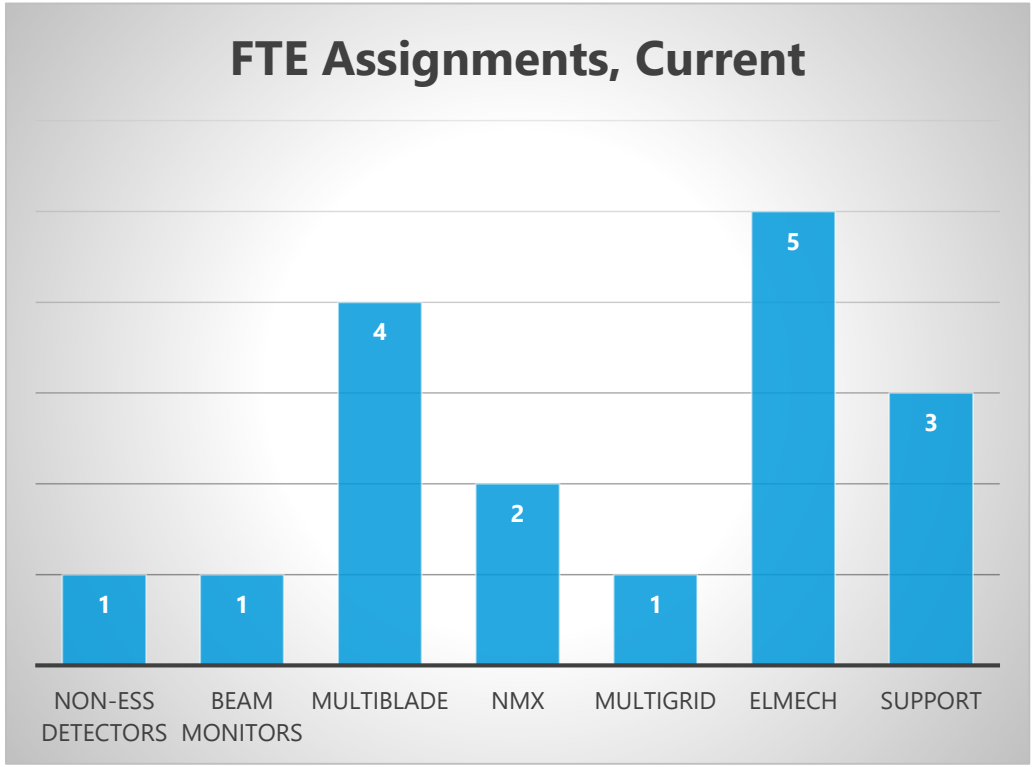
DetG Update

1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

Status DetG

2023-04-25





Changes within the DetG

Jack Segal, Technical Section Lead, 2023-06-01

- 30+ years ground-up experience with detector systems
- international profile built upon establishing Halls A and C at Jefferson Lab from a “green-swamp” site
- extensive detector-related technical skills: technician, technical coordinator, senior technical coordinator, engineering support manager
- skillset includes systematic diagnostics, reverse engineering, and demonstrated productivity under broadly stated objectives

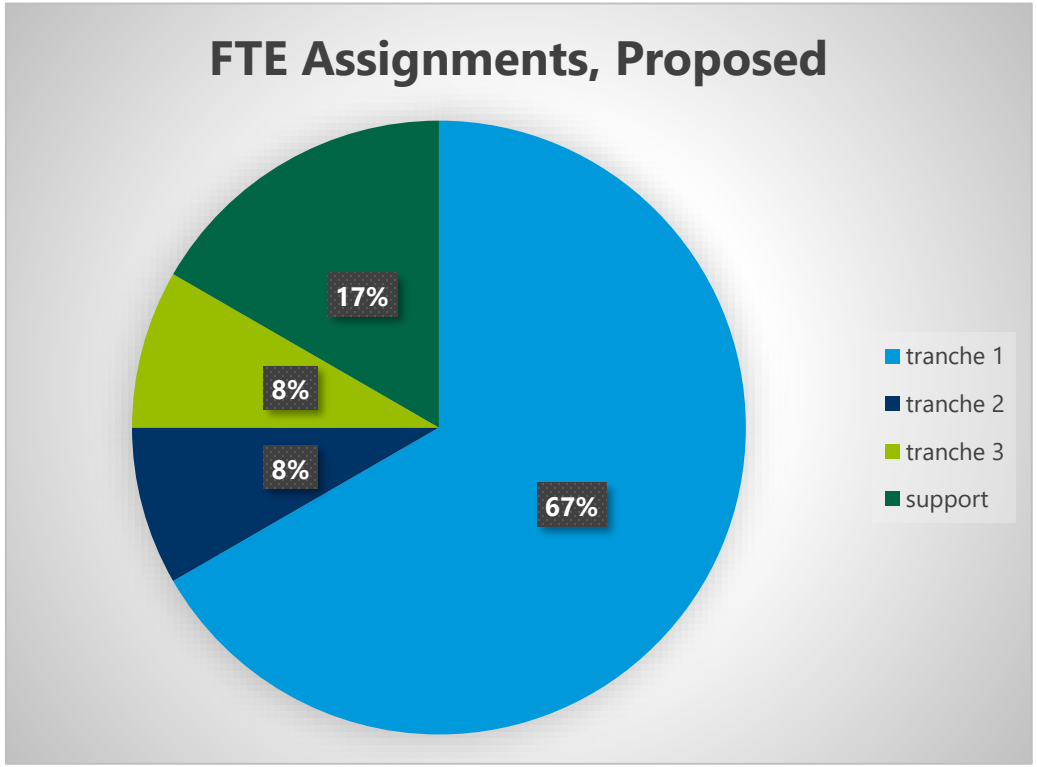
Changes within the DetG

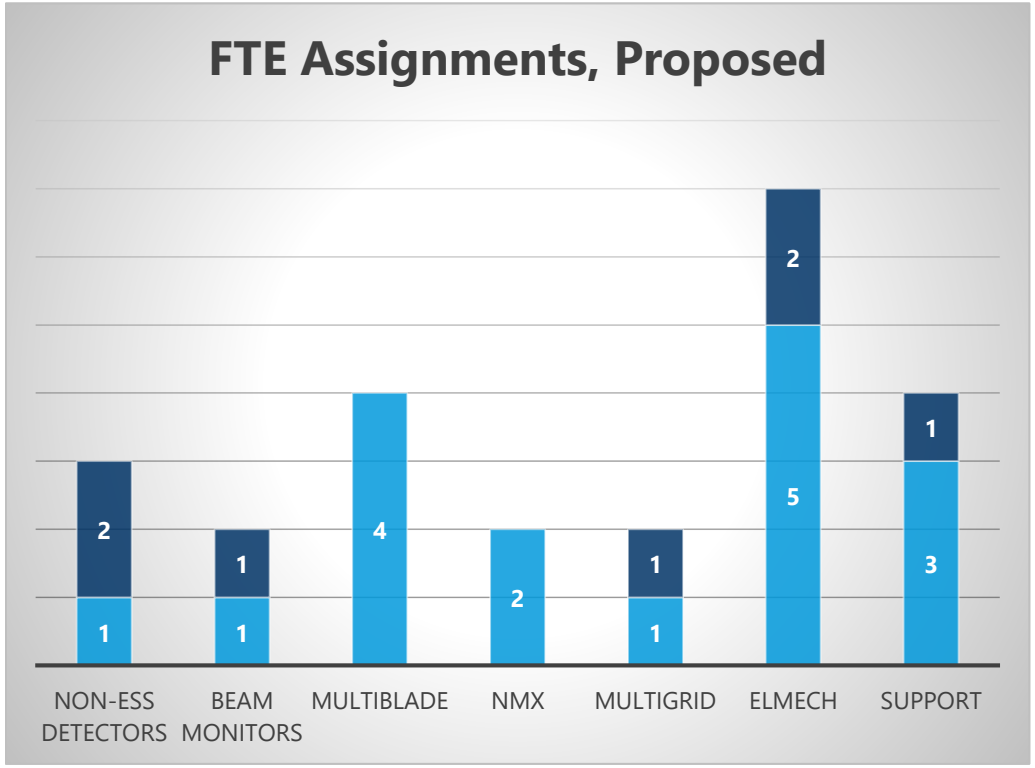
As of 2023-05-01

- Thomas Kittelmann to DMSC, Patrik Strindin end of contract, Ramsey Al Jebali on 6-month leave-of-absence
- Istvan Csakí (eplanning) back with us at 100%
- 4 entry level scientists (adverts live):
  - beam monitors ESD-29782
  - boron-10 based detectors ESD-29828 (envisioned TREX support)
  - installation and commissioning ESD-29829
  - signal processing ESD-29830
- 1 Detector Laboratory Workshop Technician ESD-26226 (live)
- 1 Mechanical Technician (approved)
- 3 summer students (likely approved this week)
- dimensioning for He-3 underway (envisioned CSPEC support)

Status DetG

Soon





Labs

Reorganizing…

- Coatings Lab Linköping: moving to site B02 (midsummer), will require access to LU NanoLab to ensure quality of coatings in the future. Losing 200 m^2.
- E04: borrowed by Motion Control, future of room uncertain. Losing 50 m^2.
- Utgård: we will lose this space at the end of 2025, we will likely need a year to plan a transition somewhere. Losing 800 m^2.
- request for annexes: for 12 X 12 m^2 on the Long Instrument Hall and 8 X 8 m^2 annex on the Short Instrument Hall (D04?), both radiation hardened. Potentially adding 200 m^2. Essential for CSPEC.
- Source-Testing Facility: budget approved by CCB and contract underway, access to neutron sources at LU guaranteed – huge step forward. Gaining 400 m^2.
- net loss of workspace: 400 m^2. Net loss of time to relocate? Where to relocate?

DetG Update

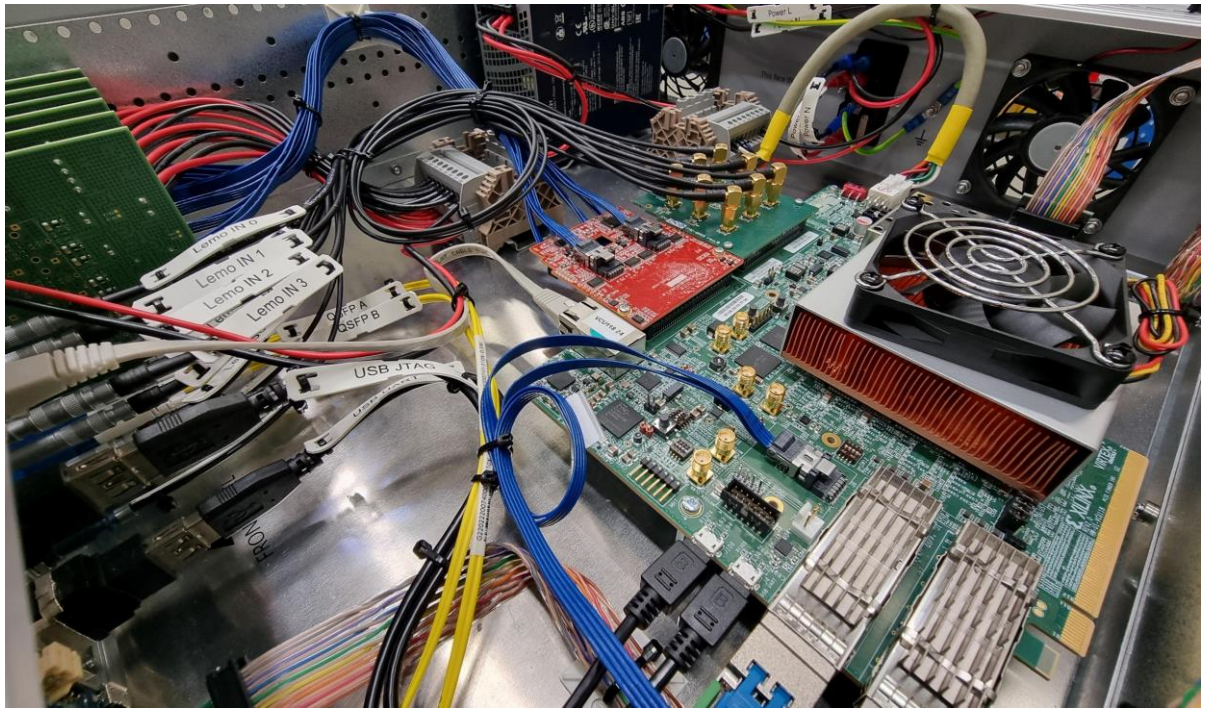
1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

DetG Update

1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

RMM

CDR (and CE) completed



European Spallation Source ERIC
Box 176
221 00 Lund, Sweden
ess.eu
info@ess.eu

CE
0640

Product:	Detector Readout Master Module
Type:	Detector Data Acquisition System Backend
Serial number:	DRMM22-01-01
Manufact. Year:	2022

Documentation…

Racks

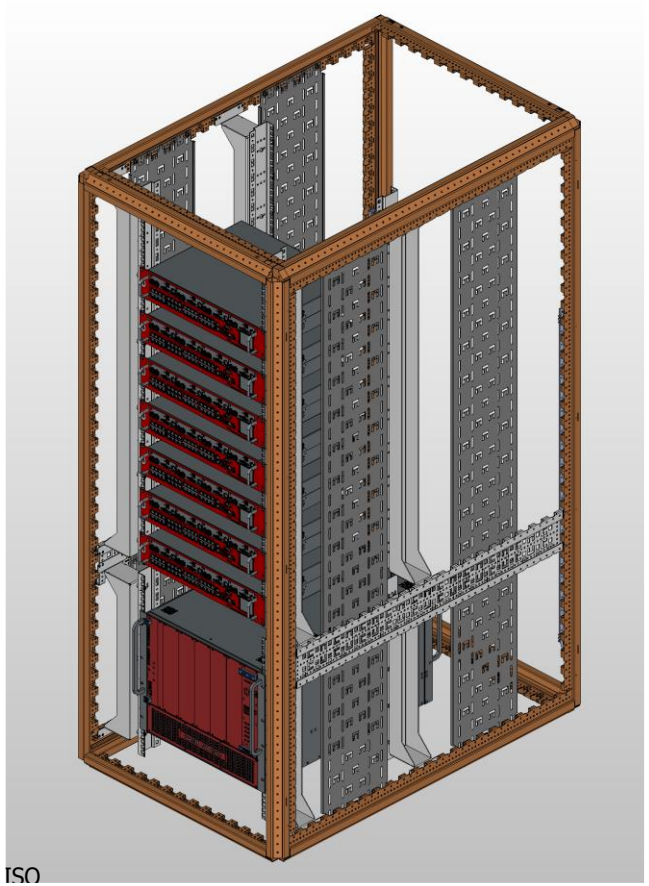
Gaining momentum…

courtesy ePlan designer Istvan Csaki

MASTER RACK 1 42U 2000H x 800W x 1200D (mm)	
U	Description
1	Network Copper/Fibre Hub
1	
1	
1	fiber patch panel rings
1	
1	MASTER Module
1	
1	
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Free
1	Monitor /keyboard
1	PC (moved as VM)
1	
1	Free
2	Rack/Detector Monitoring
1	Free
8	Wiener MPOD (LV and HV)
1	Free
1	Free
6	UPS

Assister RACK 1 42U 2000H x 800W x 1200D (mm)	
U	Description
1	Fibre Hub
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705
1	Free
1	KC705
1	KC705

NMX Detector rack layout



Detector rack in CATIA

Utgård 2023-03-06 (LOKI)

Racks

Gaining momentum…

- Focus is on the 5 LOKI detector racks, BIFROST is next
  - Documentation necessary to allow the eplanning by the CEP team is underway
  - Testing the assembly and cabling of LOKI slave rack 1 ongoing in Utgård.

EUROPEAN SPALLATION SOURCE

Document Type	Requirement Specification
Document Number	ESS-4969251
Date	Apr 13, 2023
Revision	1 (1)
State	Preliminary
Confidentiality Level	Internal
Page	1 (21)

ELECTRICAL REQUIREMENT SPECIFICATIONS FOR THE LOKI DETECTOR RACKS

	Name	Role/Title
Owner	Irina Stefanescu	Detector Scientist, Detector Group
Author	Irina Stefanescu	Detector Scientist, Detector Group
Reviewer	Kevin Fissum Clara Lopez Istvan Csaki	Group Leader, Detector Group LOKI integration engineer Electrical and I&C Engineering Group
Approver	Stuart Birch	Senior Engineer, NSS Technical Groups

EUROPEAN SPALLATION SOURCE

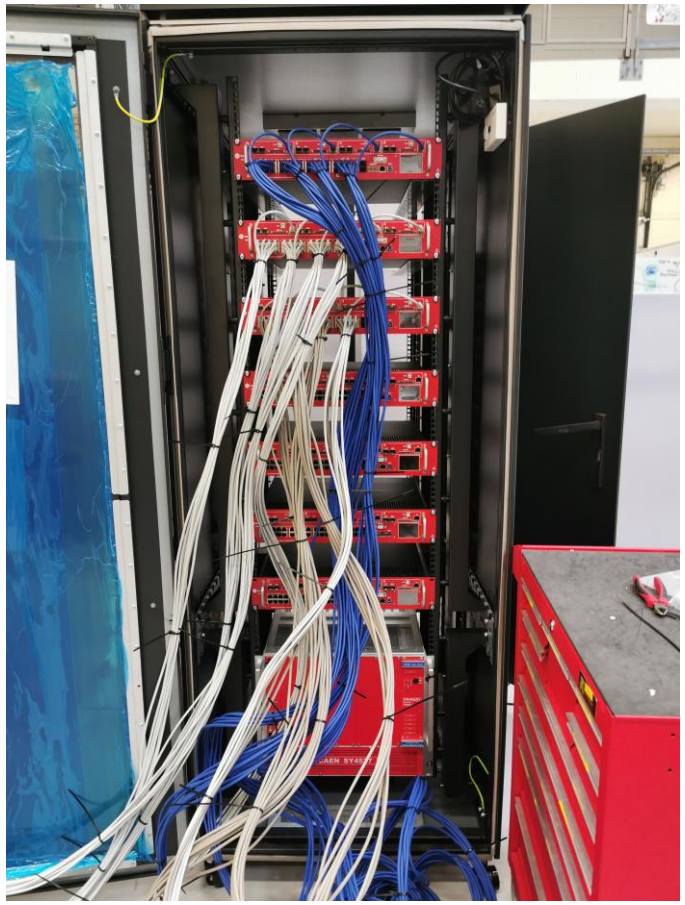
Document Type	Requirement Specification
Document Number	ESS-4970501
Date	Apr 21, 2023
Revision	1 (1)
State	Preliminary
Confidentiality Level	Internal
Page	1 (5)

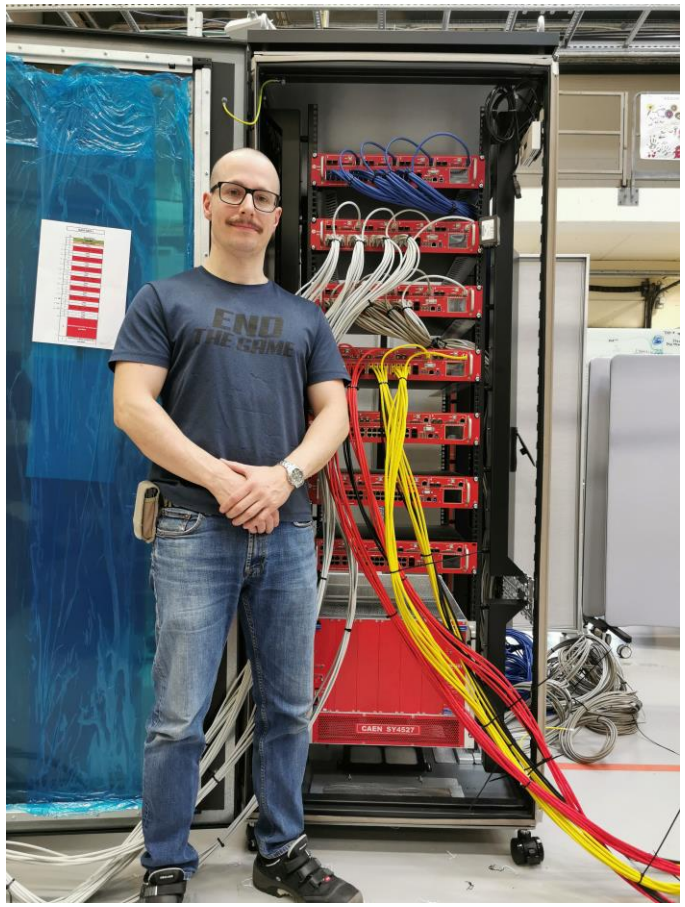
ELECTRICAL REQUIREMENTS FOR THE BIFROST DETECTOR RACKS

	Name	Role/Title
Owner	Irina Stefanescu	Detector Scientist, Detector Group
Author	Irina Stefanescu	Detector Scientist, Detector Group
Reviewer	Kevin Fissum Rasmus Toft-Petersen Liam Whitelegg Istvan Csaki	Group Leader, Detector Group BIFROST Instrument scientist, ESS BIFROST lead engineer, ESS Electrical and I&C Engineering Group
Approver	Stuart Birch	Senior Engineer, NSS Technical Groups

Racks

LOKI slave





Beam Monitors

Status

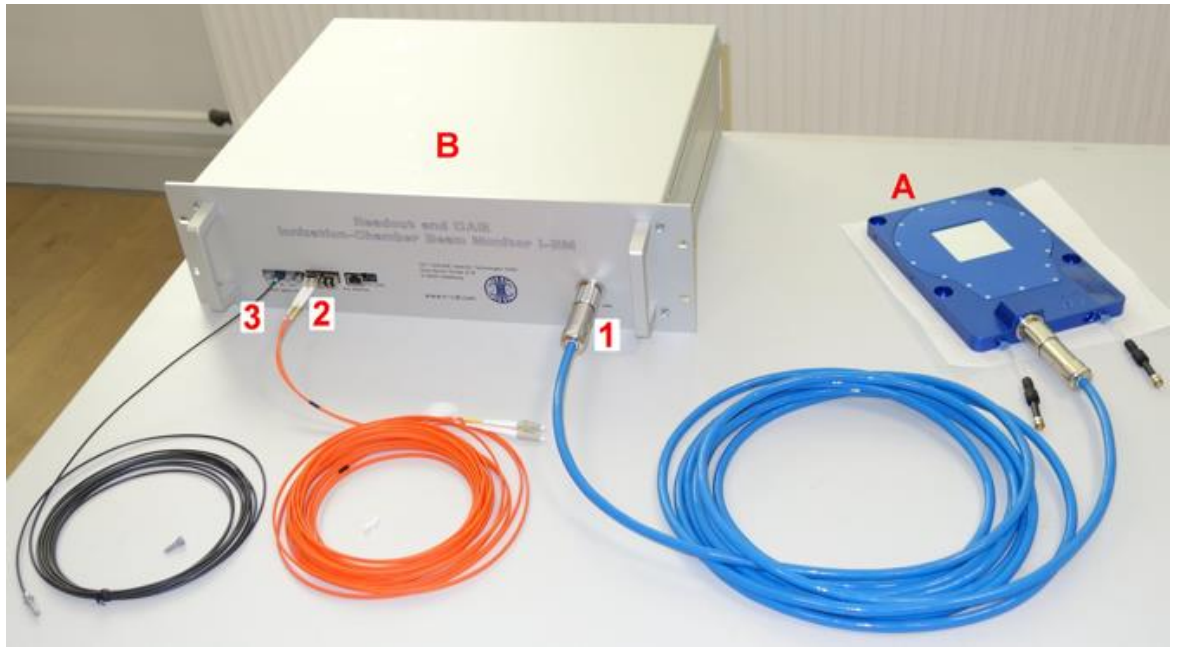
- Dialog with instrument scientists established
- Thorough review of BM requirements performed
- A long list of special BM requirements determined
  - Radiation hardness
  - Large dynamic range
  - Time resolution
  - 0D, 1D, 2D position resolution
  - In-vacuum operation
  - Very low attenuation
- Plan set: identify a bare minimum of very well-established technologies that satisfy the needs of as many monitoring points as possible
- then move on to (special) and (special, special) cases

Beam Monitors

Candidates (subset), in bunker

CDT Ionization Beam Monitor

- Compensation ionization chamber for gamma-ray discrimination
- Long purpose-made cable to connect monitor and amplifier outside of high radiation fields, avoid crossing grounding zones
- Large dynamic range, current-mode operation
- Low material budget for low beam attenuation
- Developed by ESS/CDT as an in-bunker monitor solution, ESS DAQ compatible

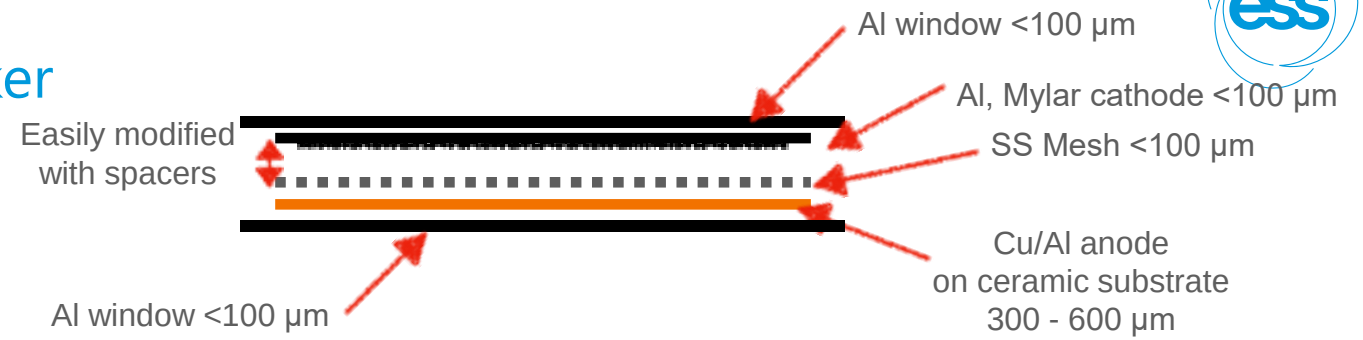


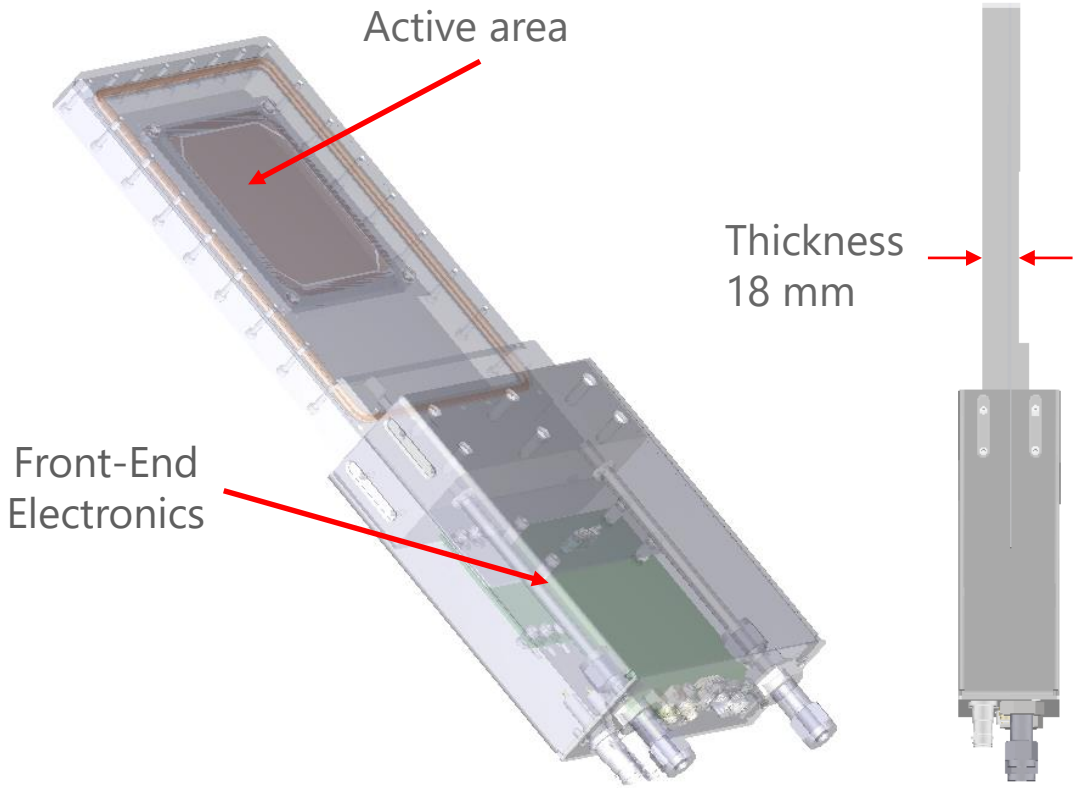
Beam Monitors

Candidates (subset), out-of-bunker

Micromegas

- developed at CEA Saclay, technology in use at ESS, nBLM
- adaptable from single event to 10^9 n·cm^{-2}s^{-1} via current mode
- 0D, 1D, 2D capable with reasonable rate capabilities and position resolutions
- form factor modifications, window changes, and gas variations will enable use at more challenging monitoring points





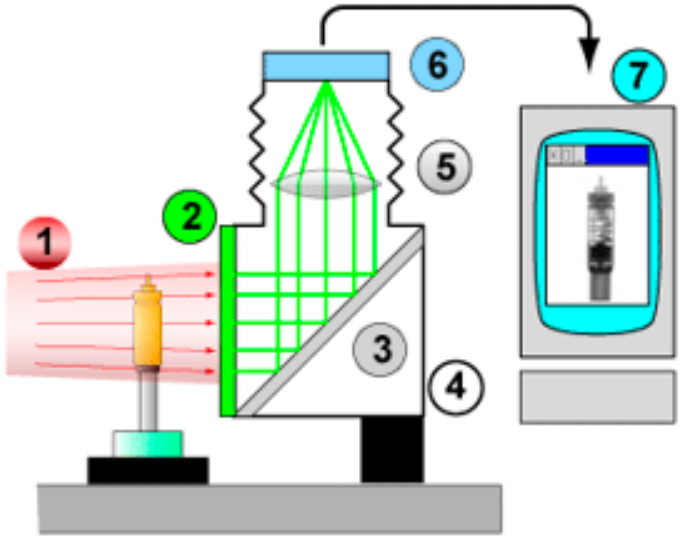
L. Segui et al., 2023 JINST 18 P01013 DOI 10.1088/1748-0221/18/01/P01013

Beam Monitors

Candidates (subset), downstream of sample

Cameras for transmission monitoring

- Off-the-shelf solution based on established, cost-effective technology
- Covers the needs of most instruments
- Pool being created by DetG to provide the service
  - 2 cameras in present inventory
  - More to be purchased
  - Ongoing discussions with instrument scientists



1. Point source of neutrons
2. Neutron to light converter
3. First surface mirror (45 degree)
4. Light tight box
5. Standard camera lens
6. Peltier cooled CCD chip
7. Computer

DetG Update

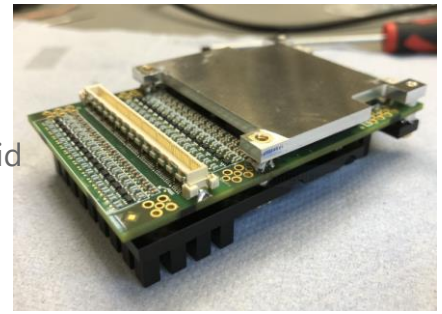
1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

DetG Update

1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

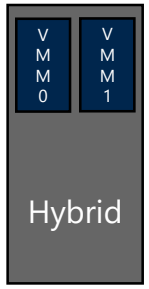
Readout chain

TBL, ESTIA, FREIA, NMX, TREX

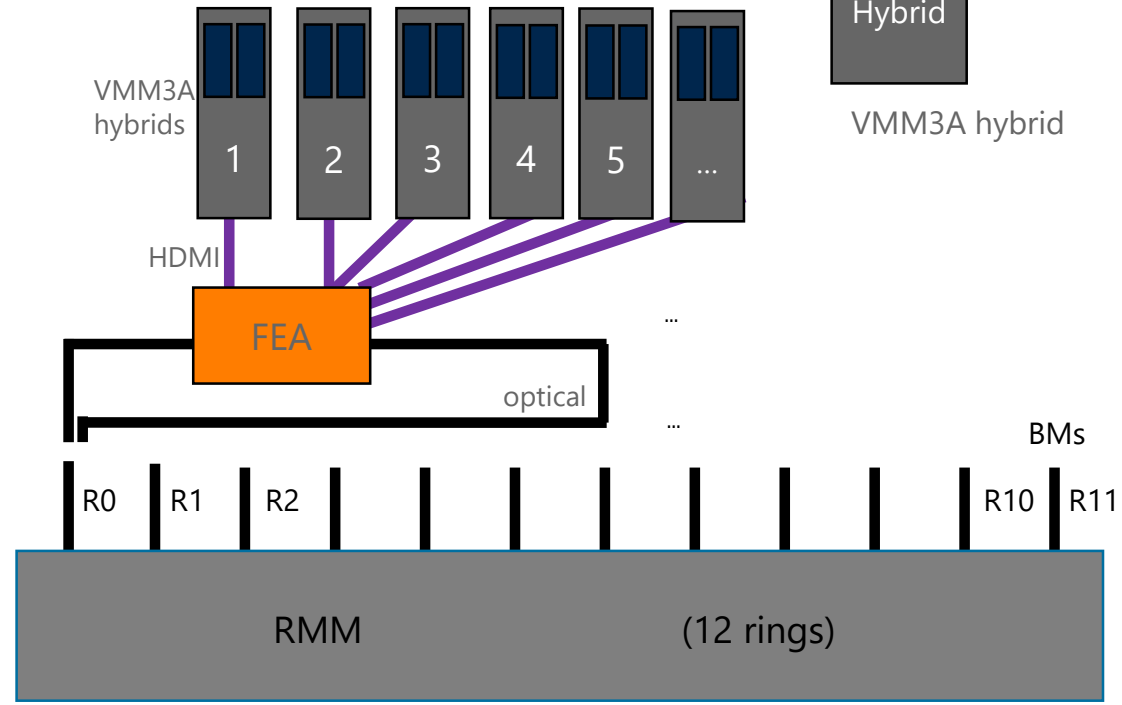


VMM3A hybrid

Hybrid = one board
with 2 VMMs = 128 ch

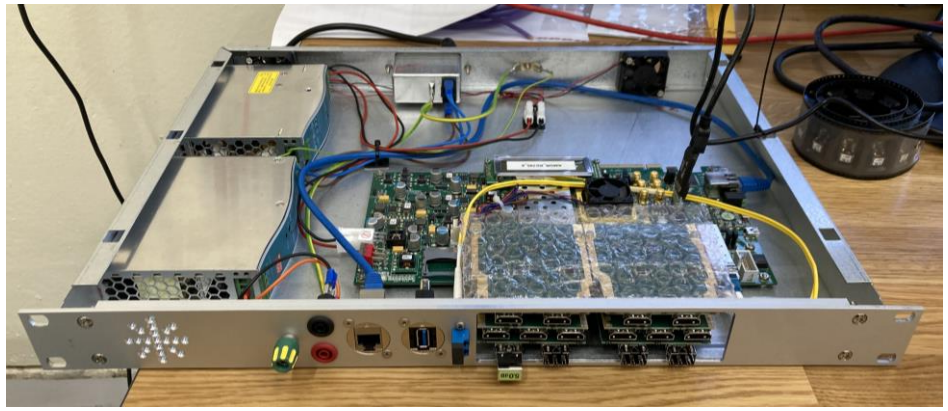


VMM3A hybrid

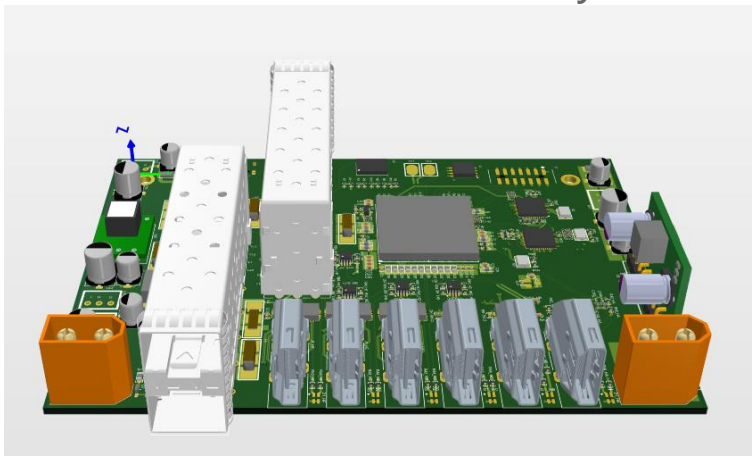


2 versions of the FEA under development:

- KC705 - 1U crate (1 FEA can read 5 or 10 hybrids)

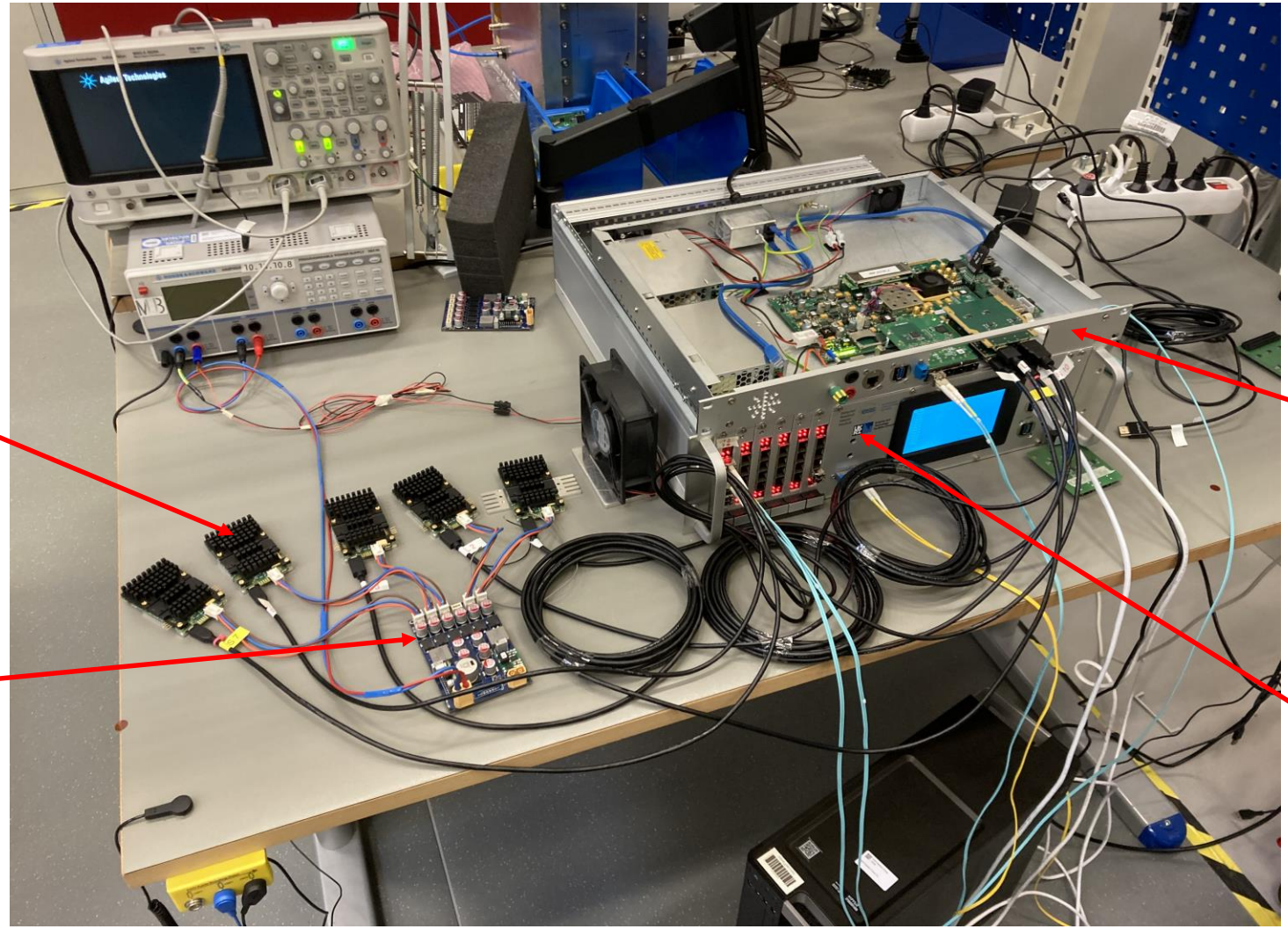


- Mini-Assister (1 FEA can read 6 hybrids)



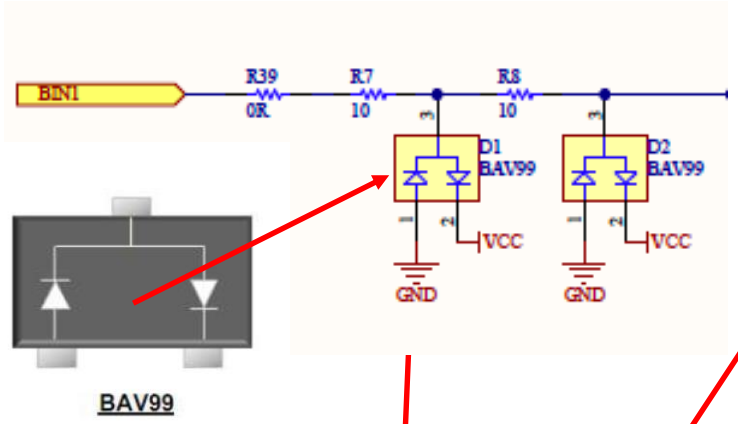
Readout chain

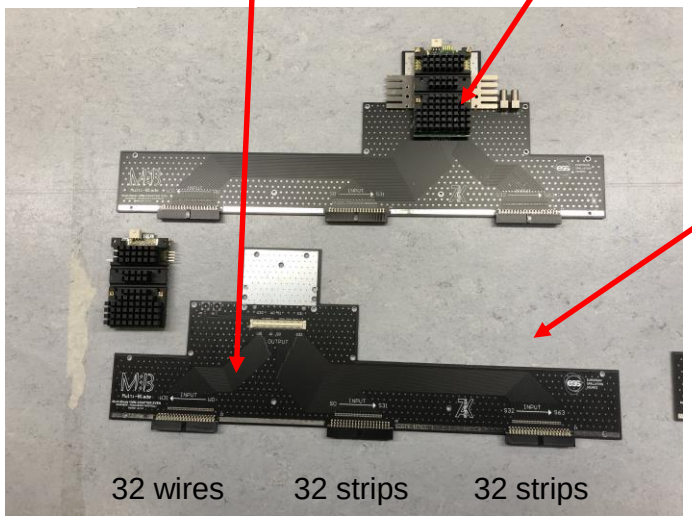
TBL, ESTIA, FREIA, NMX, TREX



MultiBlade, MultiGrid

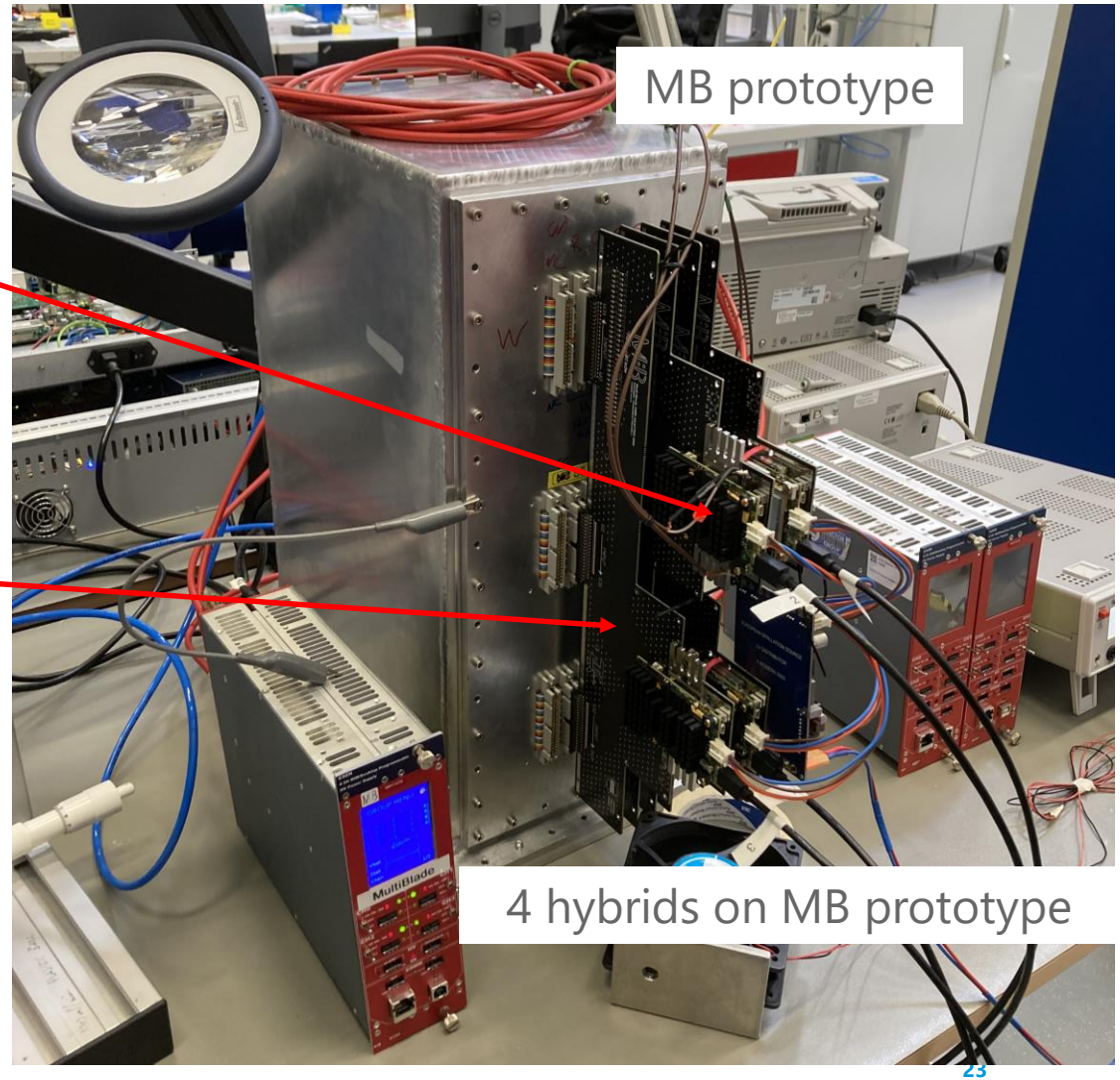
Protective circuit for VMM3A ASICS





VMM3A hybrid

MB adapter for VMM3A

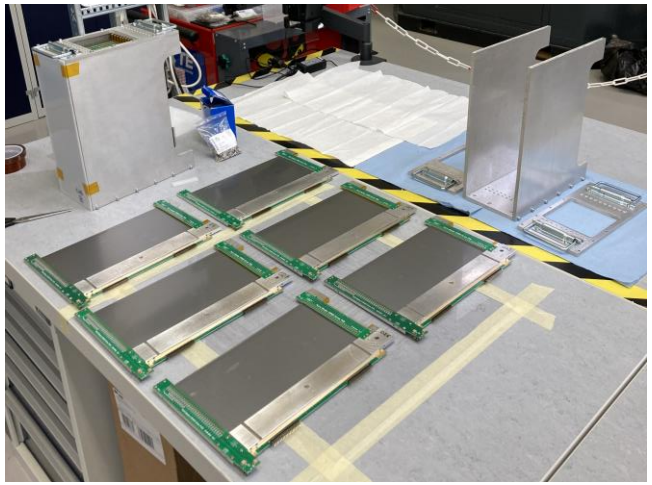


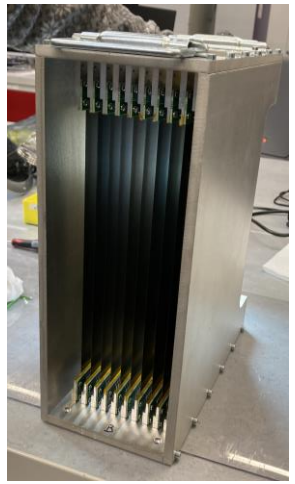
MultiBlade

Construction underway

On-going production of 150 blades for ESTIA (48), FREIA (32), TBL (14) plus spares for MultiBlade detectors

- 150 blades coated with $^{10}B_4C$
- 118 of 150 frames delivered
- 70 blades are assembled, 60 blades are being wired at CDT, 10 are wired
- Storage, testing, and shipment equipment is in place
- ESTIA and TBL detector vessels final design nearly finished

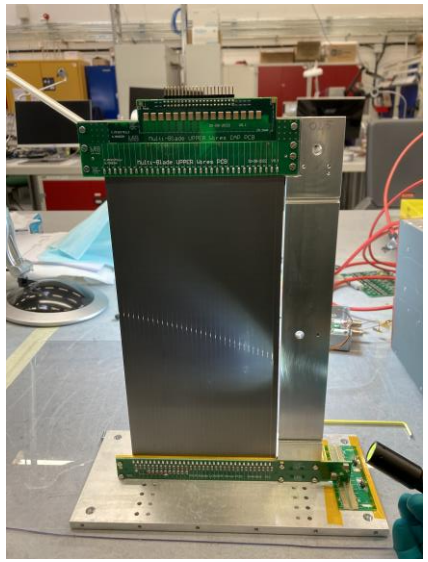


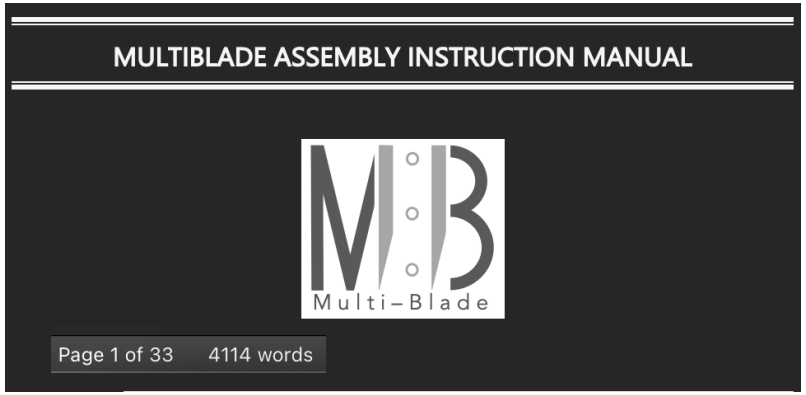


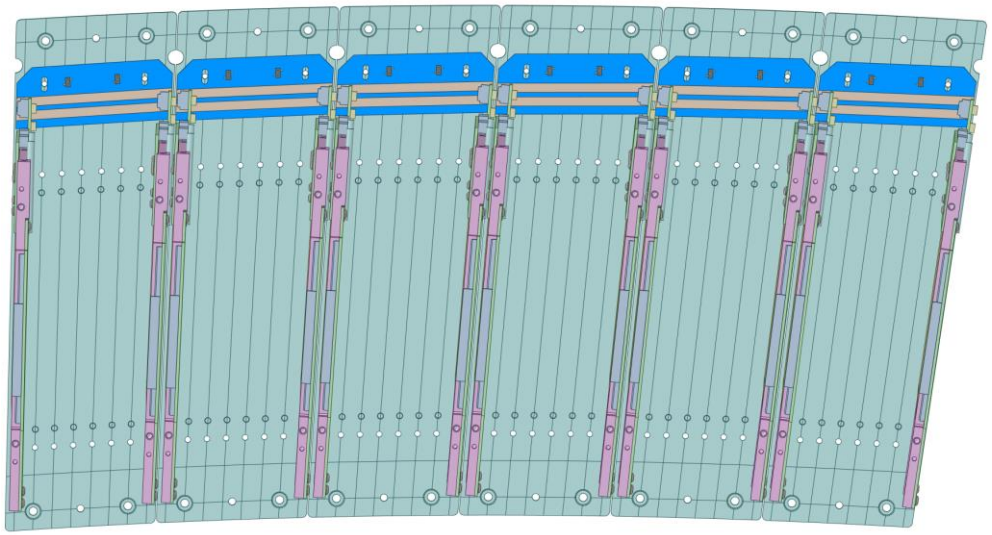
MultiBlade

Construction underway

- TBL and ESTIA internal mechanics are under production
- First sector for the ESTIA detector has been produced in Utgård
- Sectors are electrically and mechanically independent
- Blades are arranged around the sample at a 4 m radius with spacing 0.15°
- Documentation for CDR in preparation





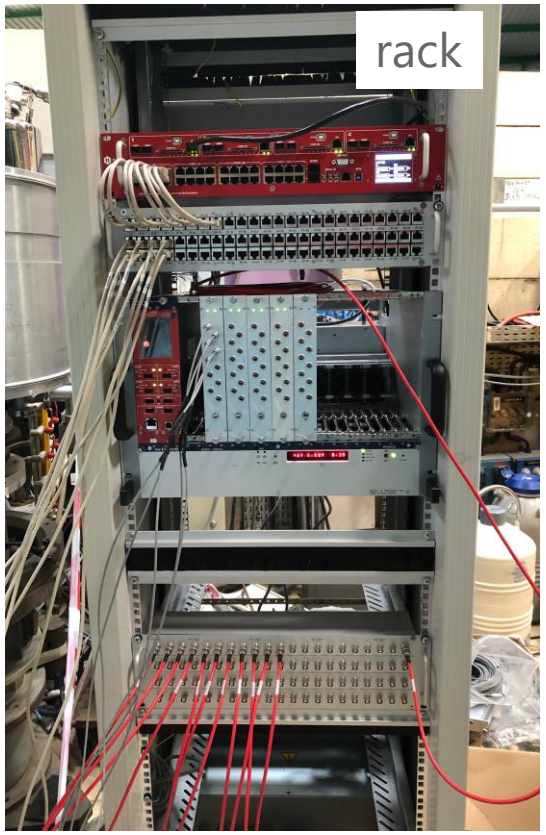


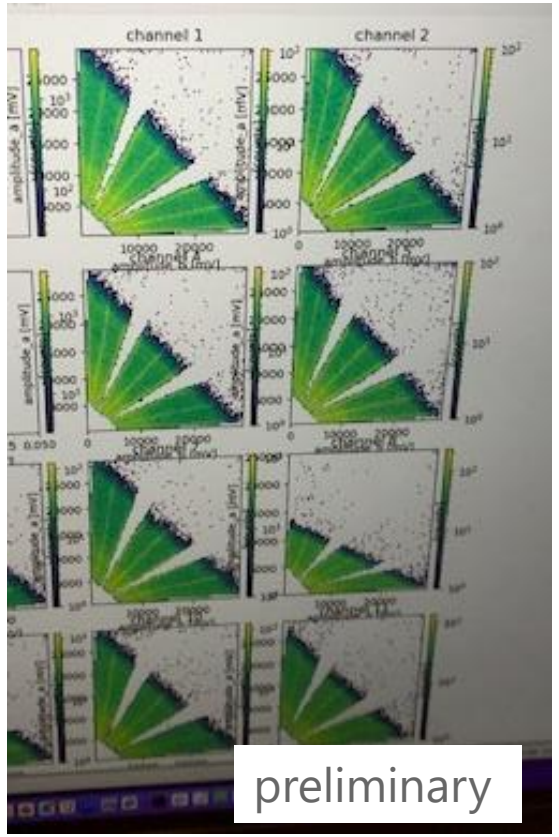
BIFROST

v16 2023, white spectra

- Unintegrated BIFROST detector test with a 37 GBq Am/Be source at CEA Saclay.

Triplets of triplets of 10 bar He-3 tubes

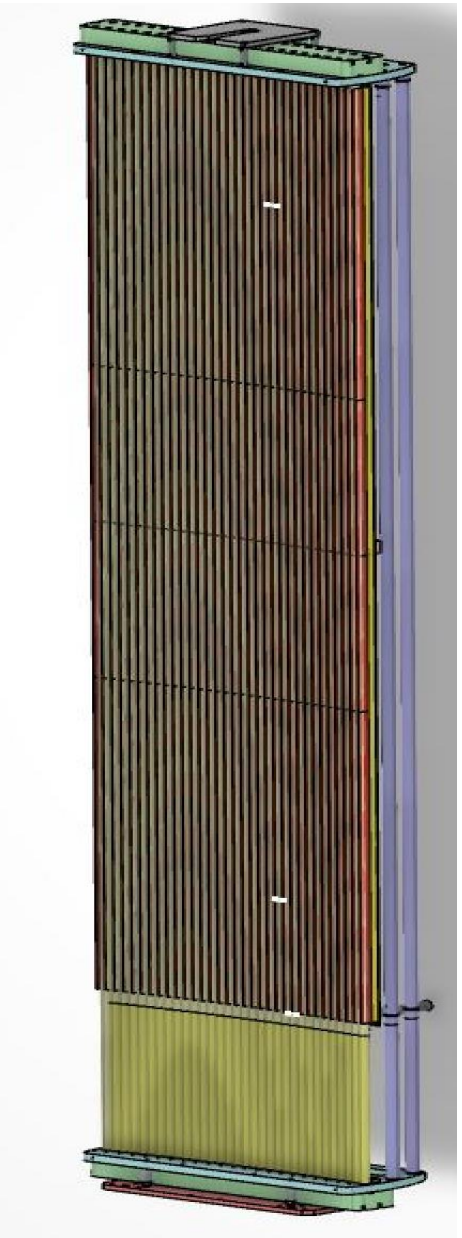




CSPEC

He-3 solution

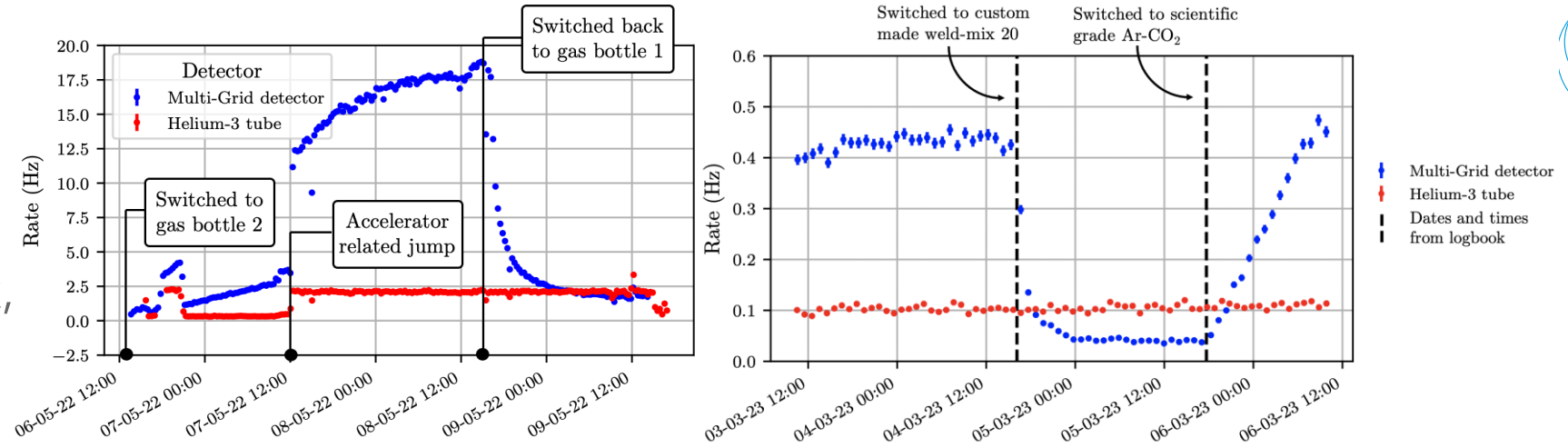
- Proposed ILL MultiTube solution is stabilizing
  - Favorable construction window from ILL side
  - ”No” risk associated with the modules
  - Trickledown into BMs
- IN5ish device to be provided
  - Includes the preamps
  - Add the standard CAEN 5560 digitizer system
- Scrutiny of the proposed costing has commenced
  - To be referenced against the existing CSPEC plan
  - He-3 is a driver, how many modules?
  - resulting CR should be a one-time event
- Approaches:
  - Plan A (all in), Plan B (absolute minimum)
  - Significant non-existing unplanned onsite support infrastructure (12 X 12 m^2 annex) required



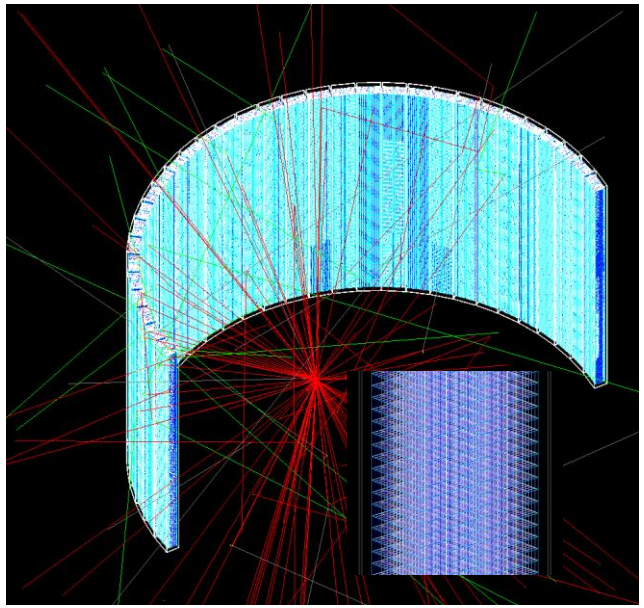
TREX

MultiGrid

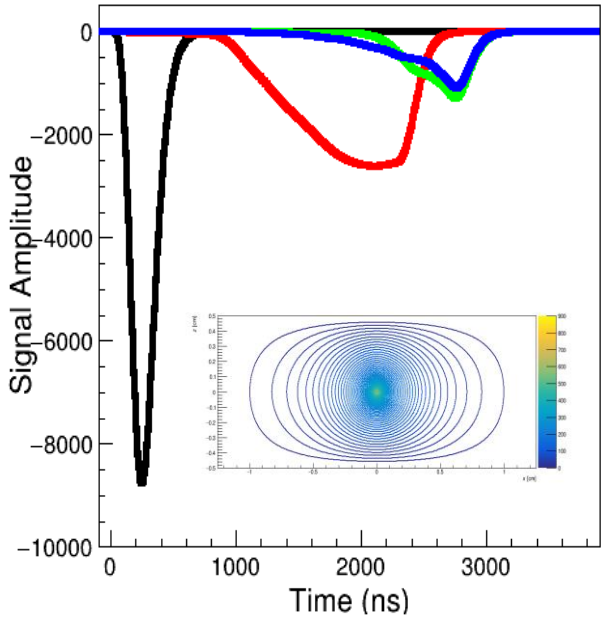
- Sanity check, Weldmix20



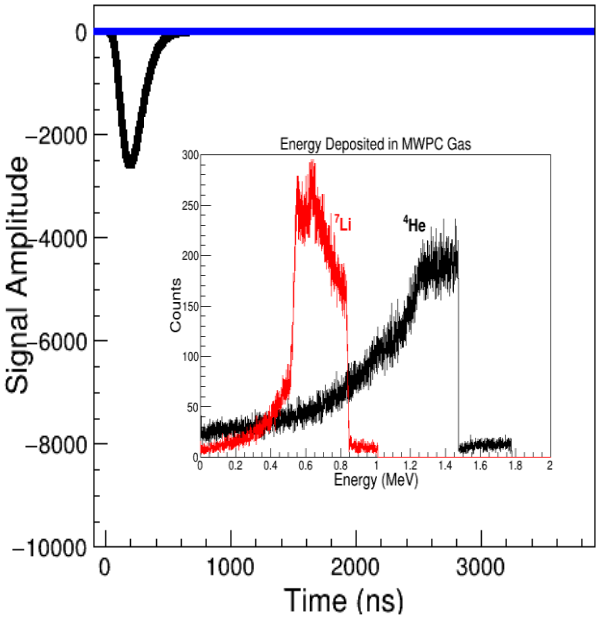
- Firebreak simulations



Ar-80%, CO_2-20%



Ar-78%, CO_2-20%, O_2-2%



DetG Update

1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

DetG Update

1. Changes within the DetG
2. Instrument-common efforts
3. Detector-related projects
4. Summary

Summary

- DetG bent during 2022, perhaps came close to breaking
  - Substantial personnel emigration
  - MultiGrid situation at ISIS
  - BM emergency
- Personnel situation still in flux, but the derivative is now positive
- Detector technologies:
  - MultiBlade is the onsite DetG R&D flagship
  - NMX is the offsite DetG R&D flagship
  - Solutions for CSPEC and TREX are in the works
  - Non-ESS detectors are starting to land
- Buckle up!


ESSDetector
roup