Status of FHCal and forward charged fragments hodoscopes

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on behalf of INR RAS, Moscow

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Forward hadron calorimeter FHCal for BM@N:

1) status of FHCal assembling

2) front-end electronics and read-out electronics installation

3) DCS (slowControl) development

4) first results from calibration on cosmic muons and LED

Forward quartz/scintillator hodoscope development:

1) new forward hodoscope for BM@N

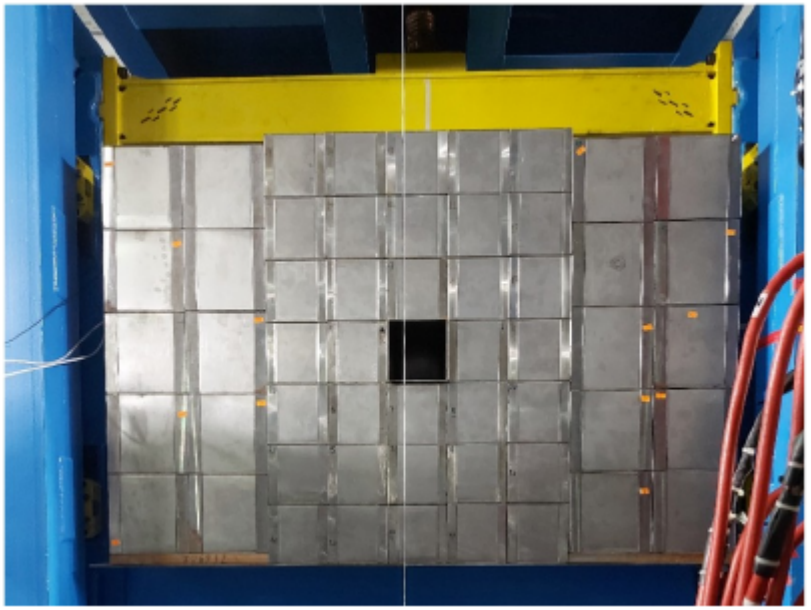
2) test on “Pakhra” electron beam

Scintillation wall hodoscope for fragments detection:

1) scintillation wall development

2) plans for the incoming beam data taking

FHCal assembled and installed in the BM@N area



- 34 central small modules of 15cmx15cm (constructed for MPD experiment)

- 20 side large modules of 20cmx20cm (constructed for CMB experiment)

- longitudinal segmentation with 7 sections (small modules) and 10 sections (large modules), each section has an individual read-out with one MPPC (Hamamatsu)

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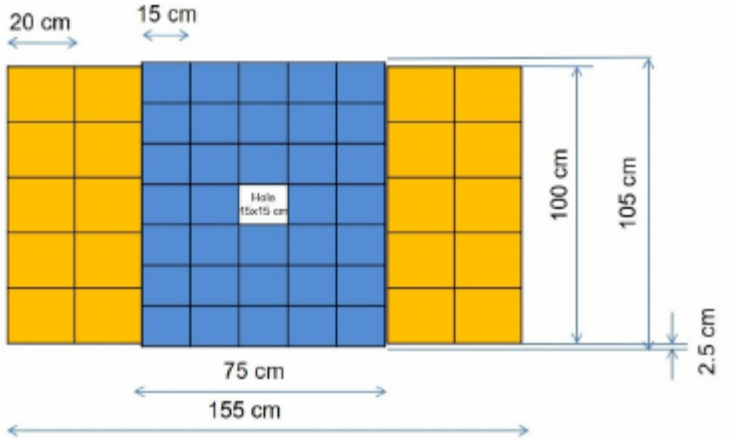
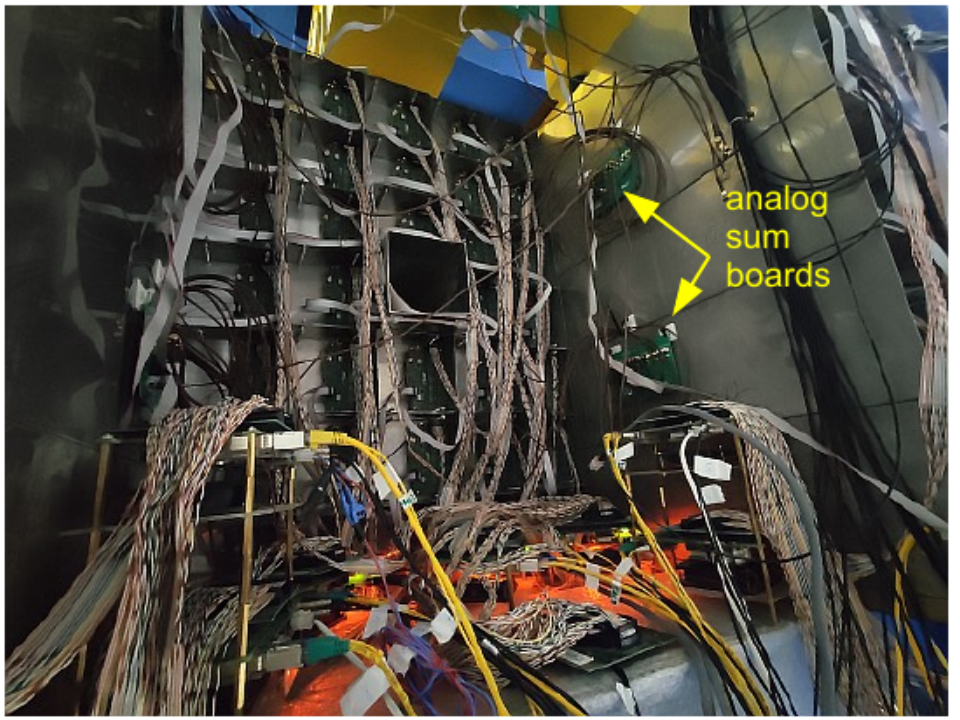
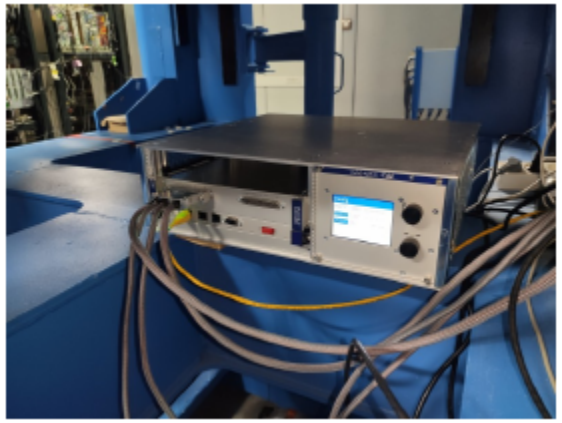


20 PSD CBM modules (20 cm x 20 cm)
34 FHCAL MPD modules (15 cm x 15 cm)

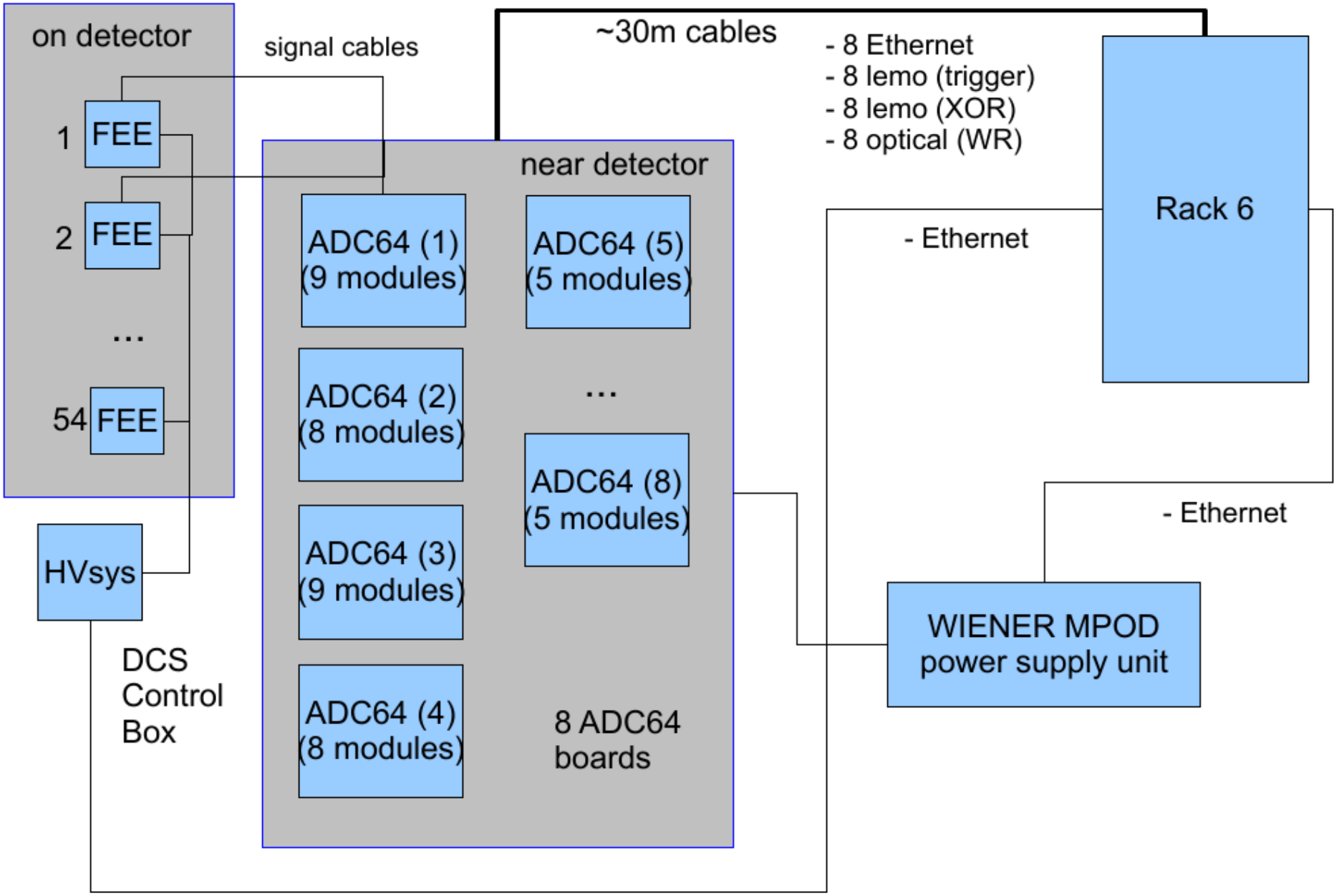




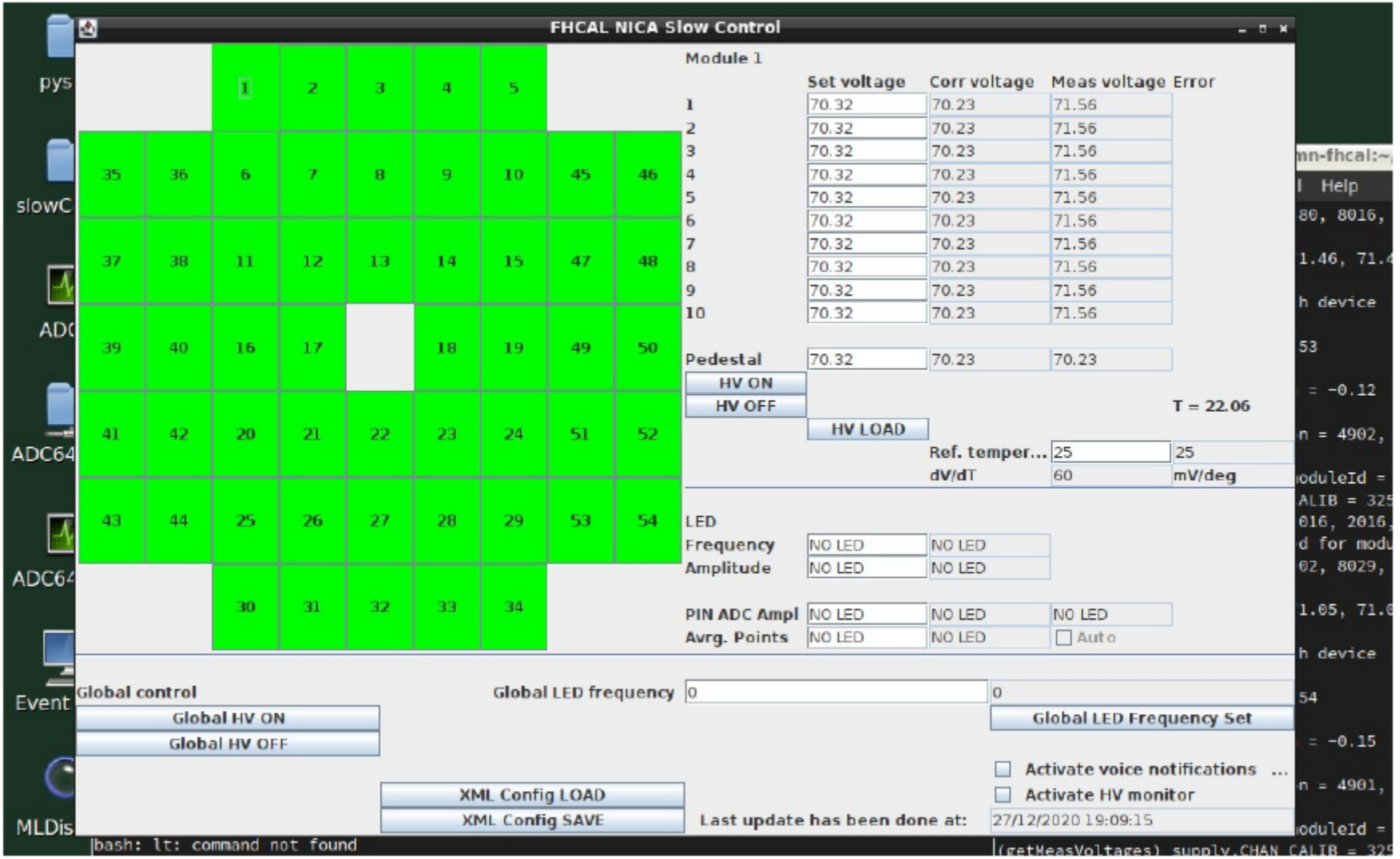
New WIENER MPOD power supply unit has been installed

- 54 FEE boards have been connected and tested
- 8 ADC64s2 board are in places, tested, connected with New cables (yellow on foto) to Rack 6 + WR optical fibers
- 6 analog sum boards are connected to FEEs
- new power supply (WIENER MPOD) has been tested

Schematic view of connections at FHCal

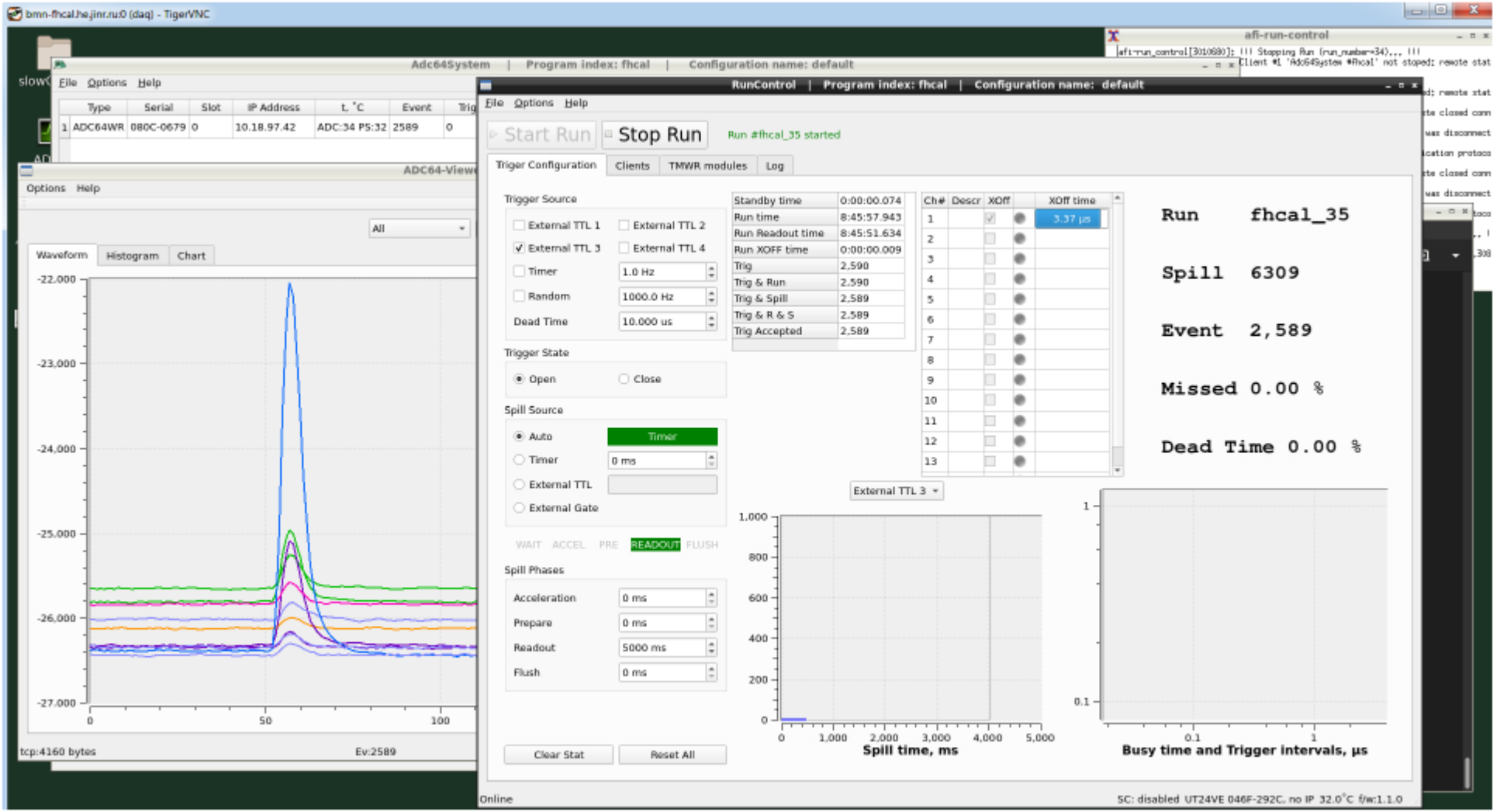


DCS for FHCal (Java version):
- control HV on MPPCs and correct it with temperature changing to maintain the gain

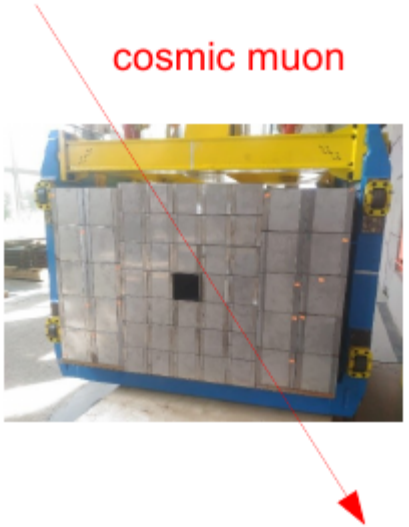


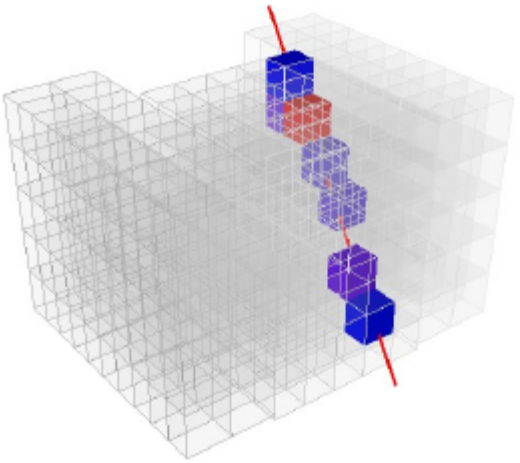
- the new version on python is under development

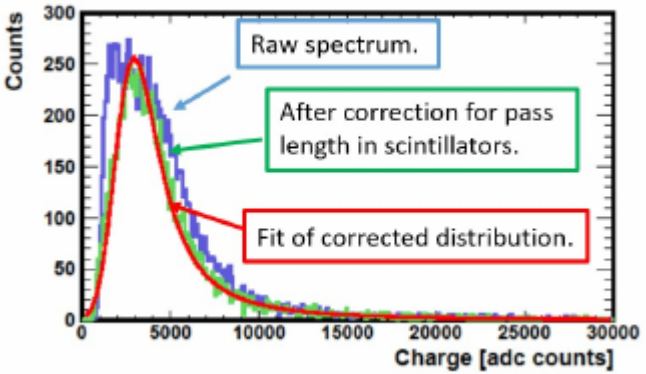
Tests of 8 ADC64 read-out system (on fhcal-bmn virtual mashine at BM@N computing node)



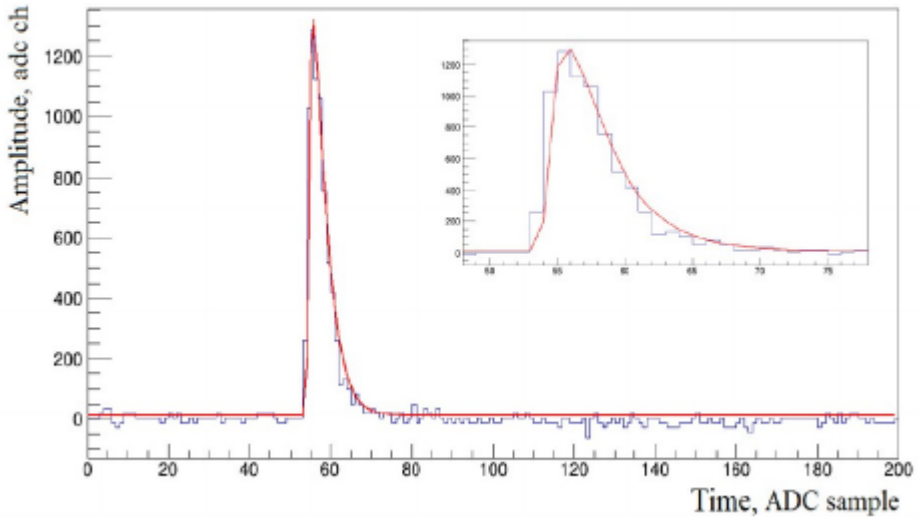
New cosmic muon calibration procedure based on 3D tracking with transverse and longitudinal granulation of FHCal has been developed and is under testing on cosmics with FHCal (remotely from INR)



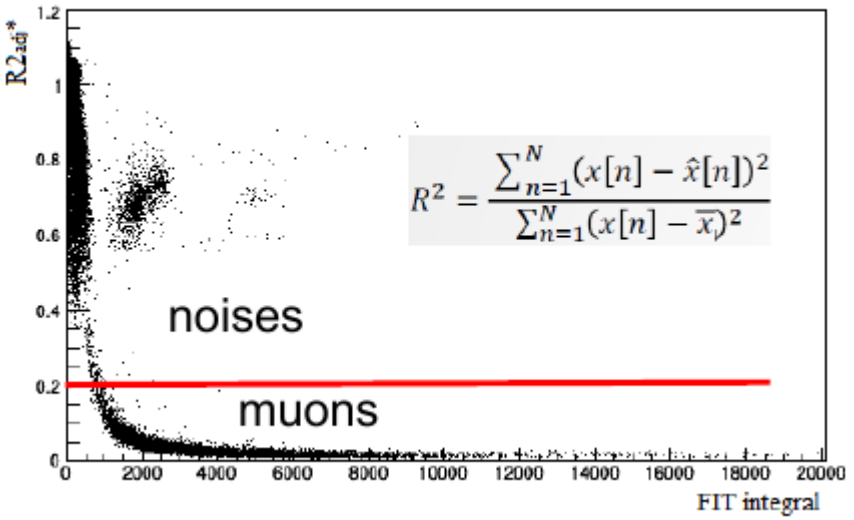




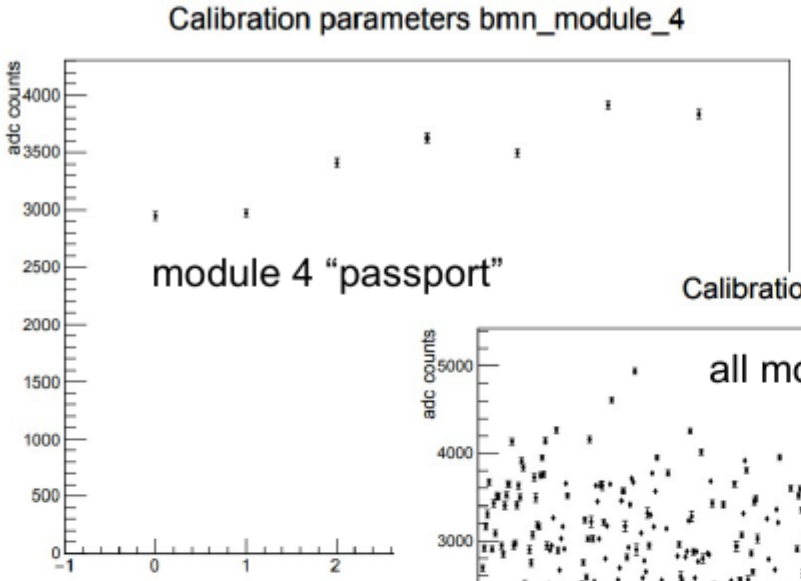
Fit signal by composition of exponents

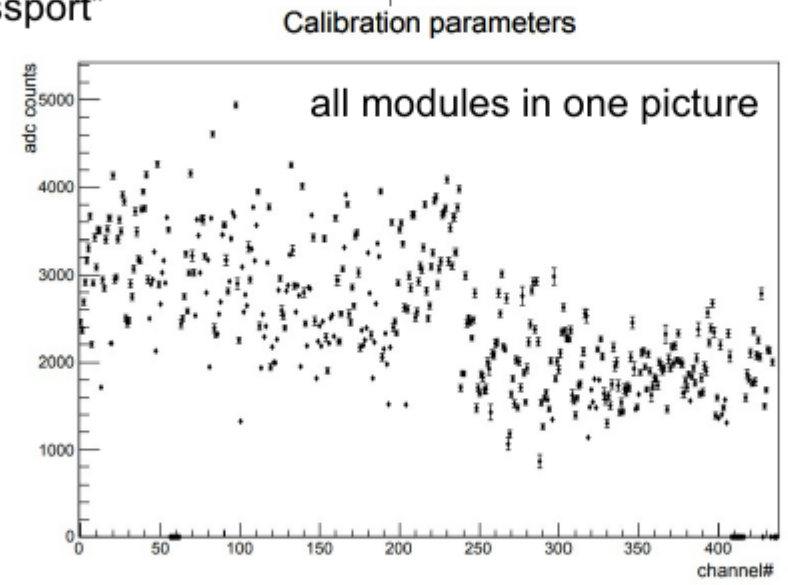


Rejection of noises with fit quality par.



Tests of 8 ADC64 read-out system (on fhcal-bmn virtual mashine at BM@N computing node)





Cosmic muon calibration results

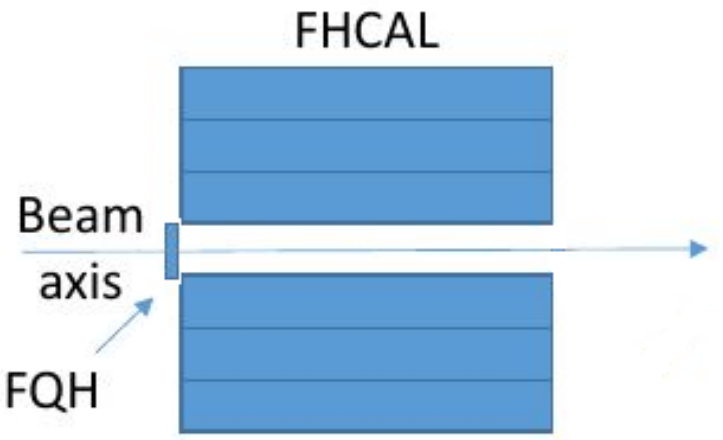
some problems?

(wrong mapping - fixed)

- the final goal: prepare “the quality passport” for each module of FHCal

(bad FEE to ADC board connection- fixed)

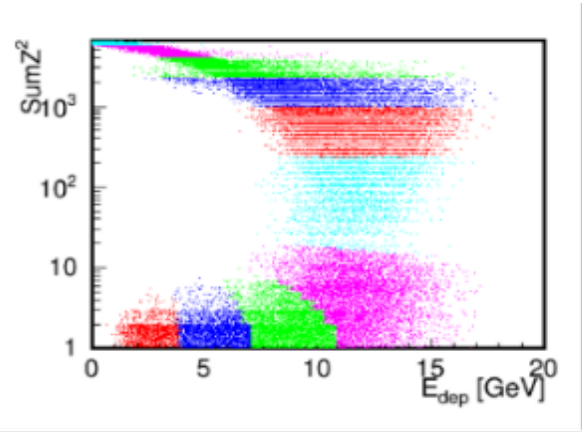
The use of the Forward Quartz Hodoscope (FQH) to measure fragments charges in the FHCal beam hole.

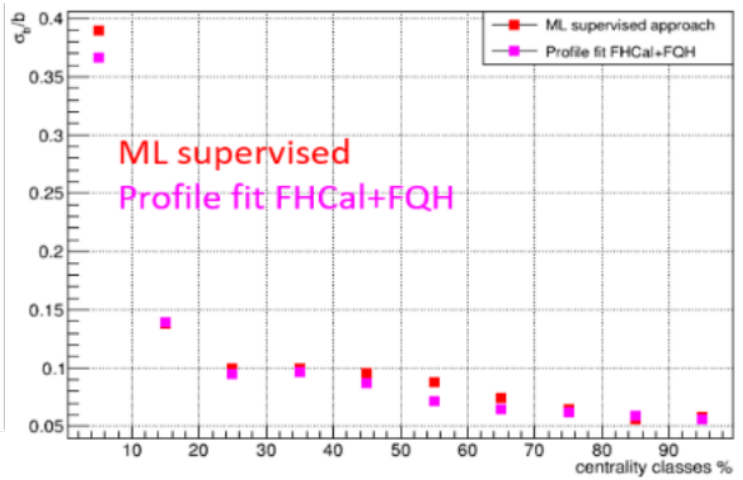


- Forward Quartz Hodoscope (FQH) is ready (2 variations – with scintillator and with quartz plates)

- TQDC board planned to use for read-out is under testing now with new FEE (at INR)

16 strips (160 x 10 x 4 mm^3) with 2-side MPPC read-out



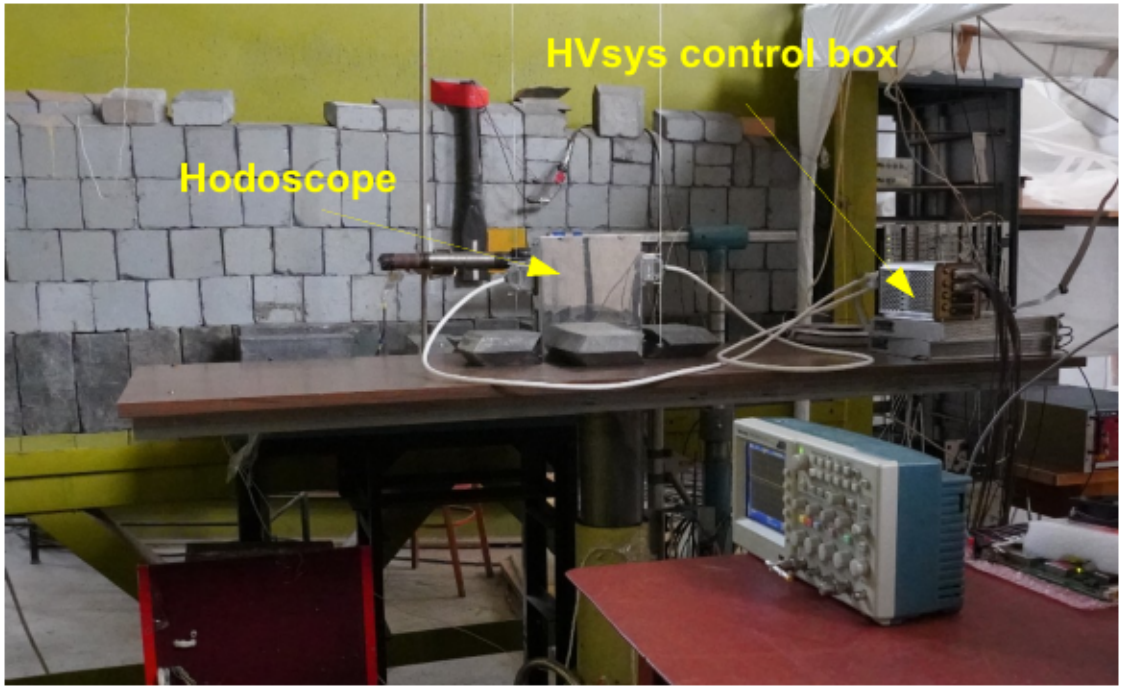


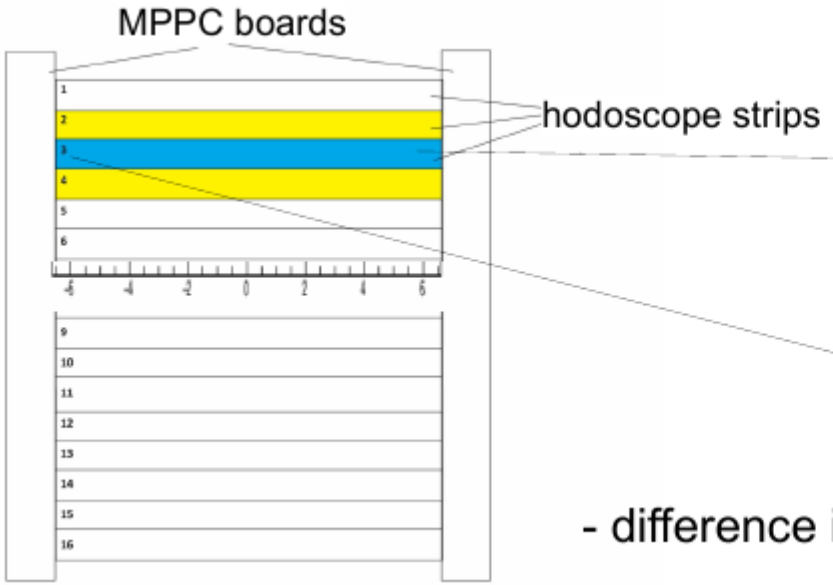
- the impact parameter resolution is slightly better when FQH+FHCal are used

- FQH will allow to measure charge fragments in the FHCal beam FHCal hole:

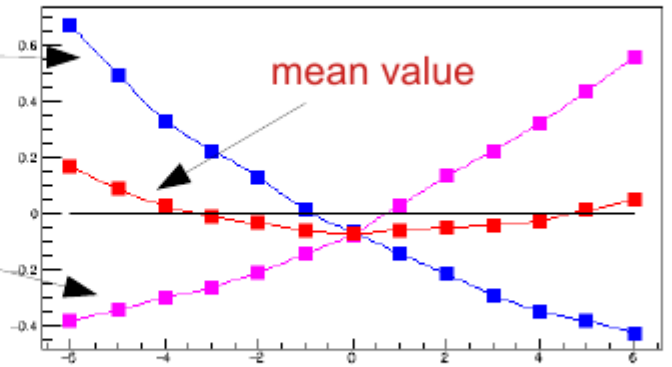
- can be useful to tune fragments models in event generators

Hodoscope's tests has been performed on "PAKHRA" synchrotron at LPI (Troitsk)

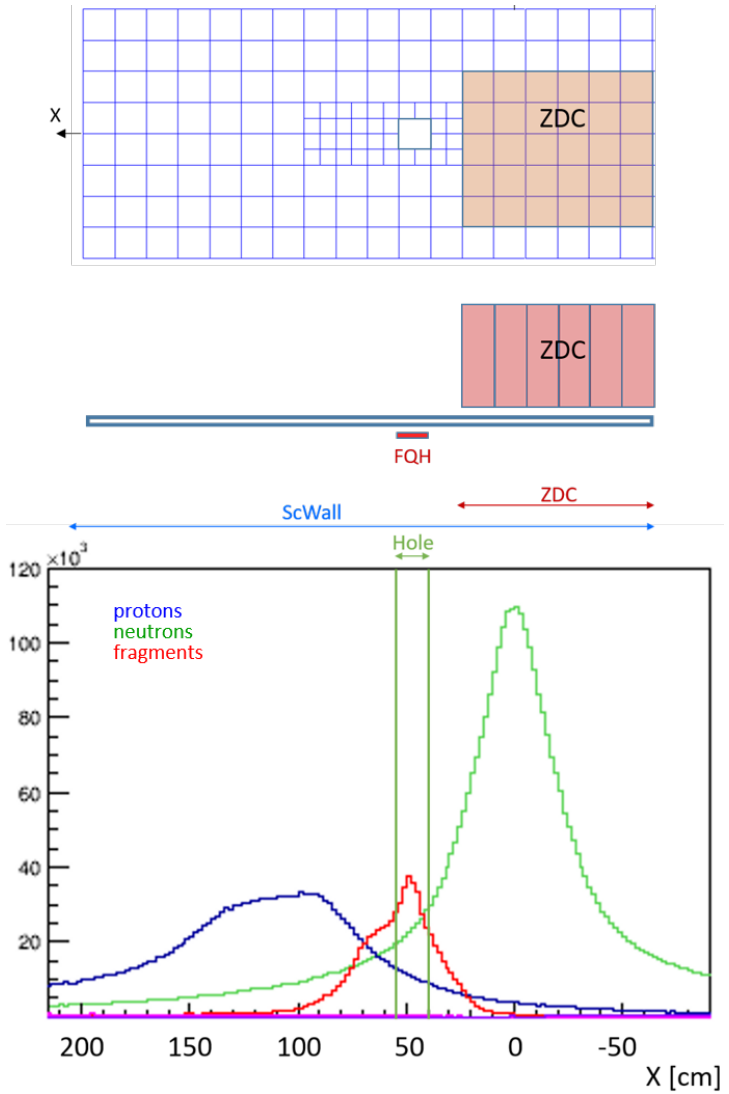




non-uniformity of response



- difference is not more then ~20% with dual side read-out



Proposal of new fragment registration

Additional **segmented scintillation wall** is planned:

- FHCal (36 MPD modules 15 x 15cm2) to measure neutron spectators

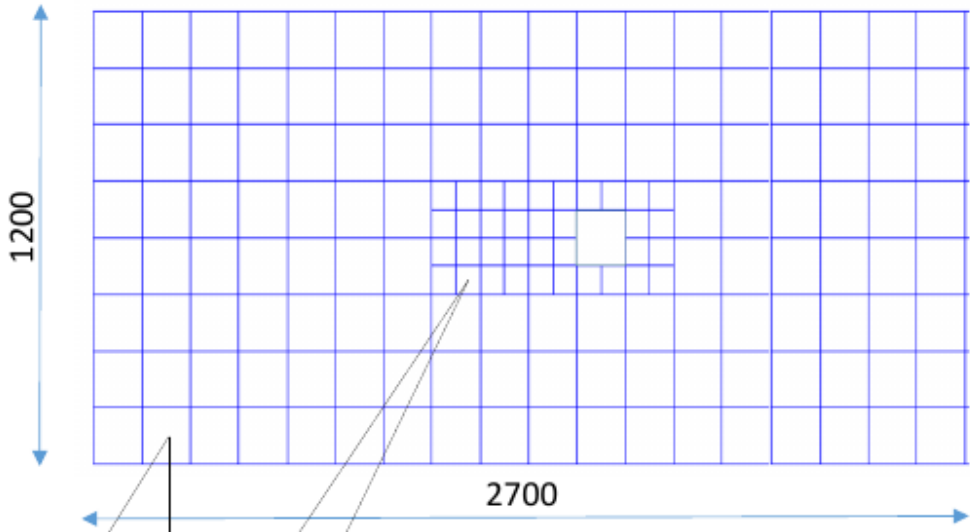
- Scint. Wall: 36 cells (75 x 75 x 10 mm 3)
+ 134 cells (150 x 150 x 10 mm 3)

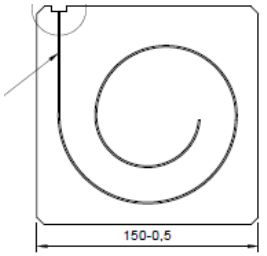
- FQH (16 quartz strips 160 x 10 x 4 mm 3) to measure heavy fragments

The main goal: separate measurements of the neutron, proton and fragments with this detector system.

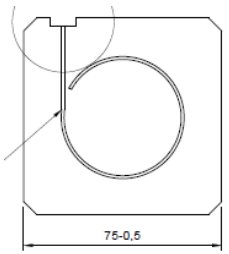
- large spatial separation between the proton and neutron spectators on the plane located at 9m from the target for Au+Au @4.5 AGeV with different event generators.

Schematic view of new BN@N Forward Scintillator Hodoscope (FScH)

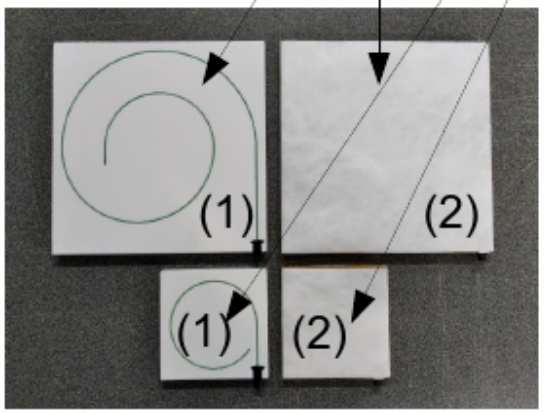




large cells



small cell



Already constructed samples of scintillator cells for tests.

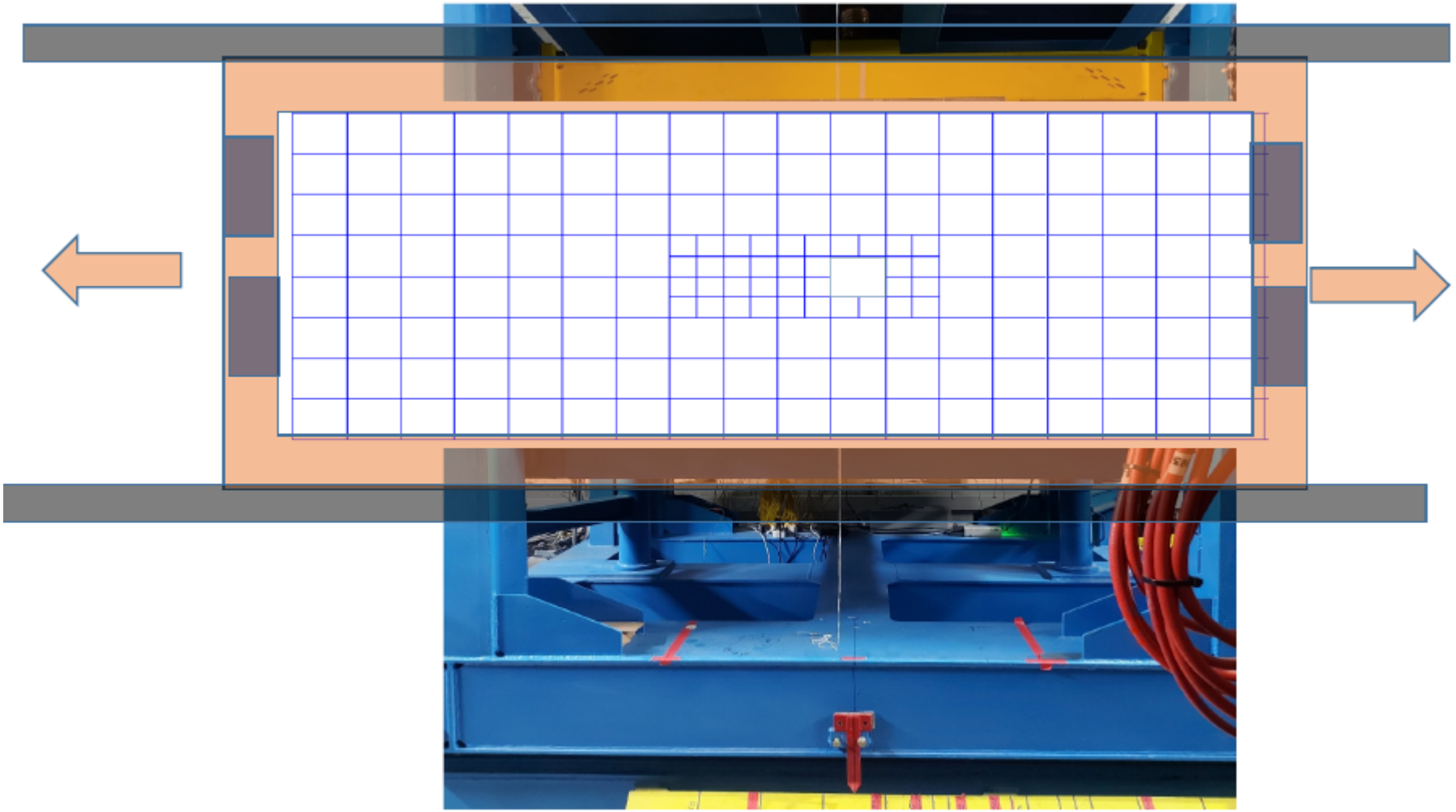
Tests have been done at “PAKHRA” synchrotron, LPI (Troitsk)

- uniformity of light collection w.r.t. beam spot

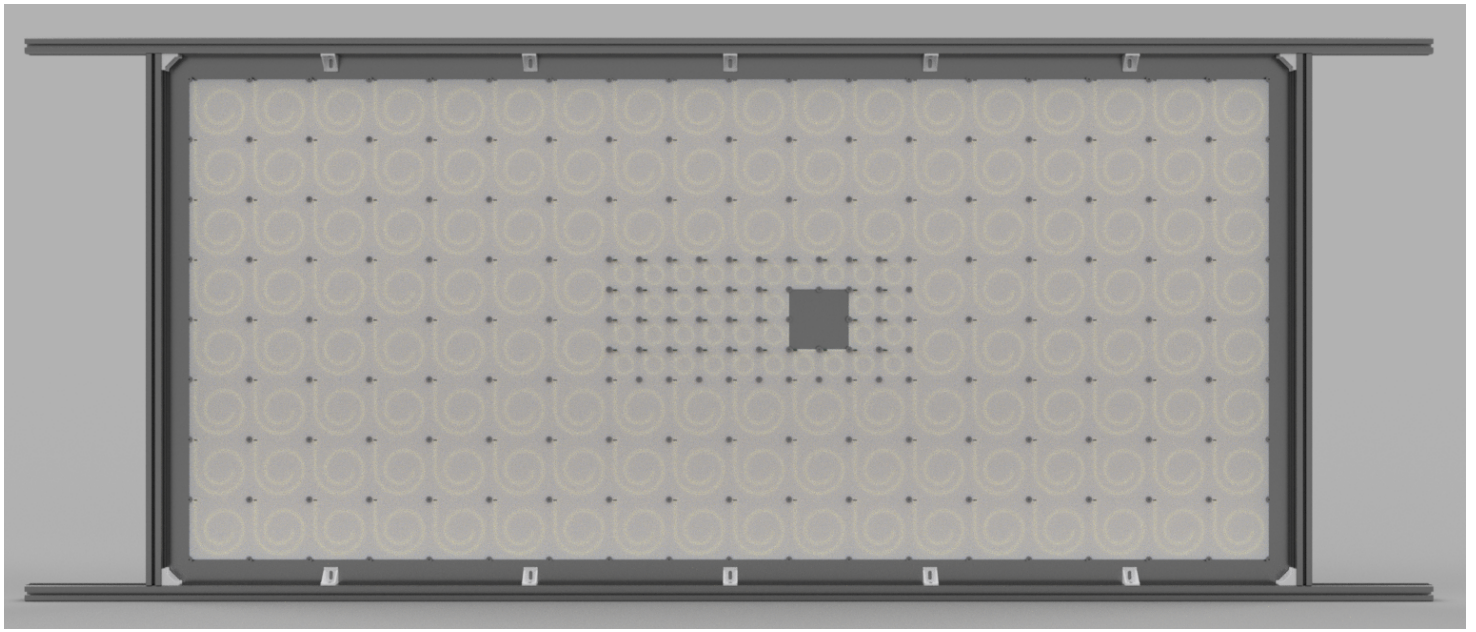
1) chemical prepared “foam” type reflection coating
2) tyvek’s coated plates

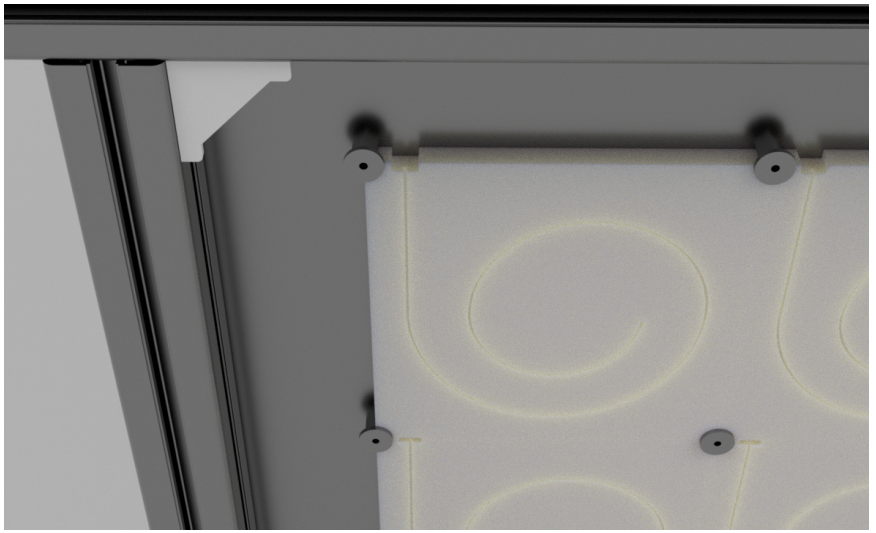
(results show tyvek coated plates to be better..)

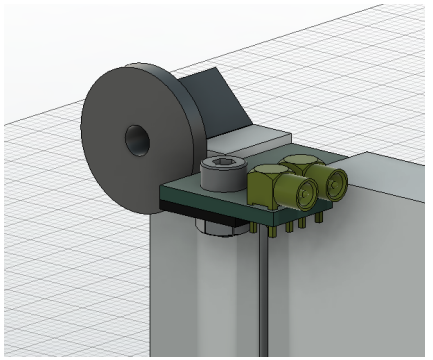
The scintillation wall hodoscope frame will be fixed to the ZDC moving platform frame



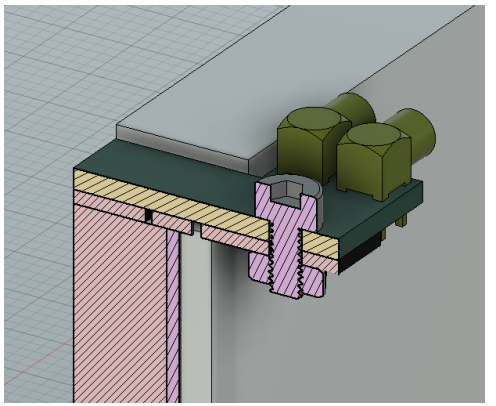
Schematic views of scintillation wall design







MPPC mounting
with small PCB



Summary:

- FHCal has been assembled at BM@N

- first cosmic calibration has been done using BM@N DAQ

- beam quartz/scintillator hodoscopes were assembled and tested on electron beam, ready to install on BM@N

- new DCS is under development (preliminary version is ready)

Plans for the future:

- installation of beam quartz/scintillator hodoscopes – May-June 2021

- FHCal module calibration and HV tuning – Summer 2021 (can be done remotely)

- installation of new scintillation wall hodoscope – before beam test in 2021