# Status of forward spectators detectors at BM@N

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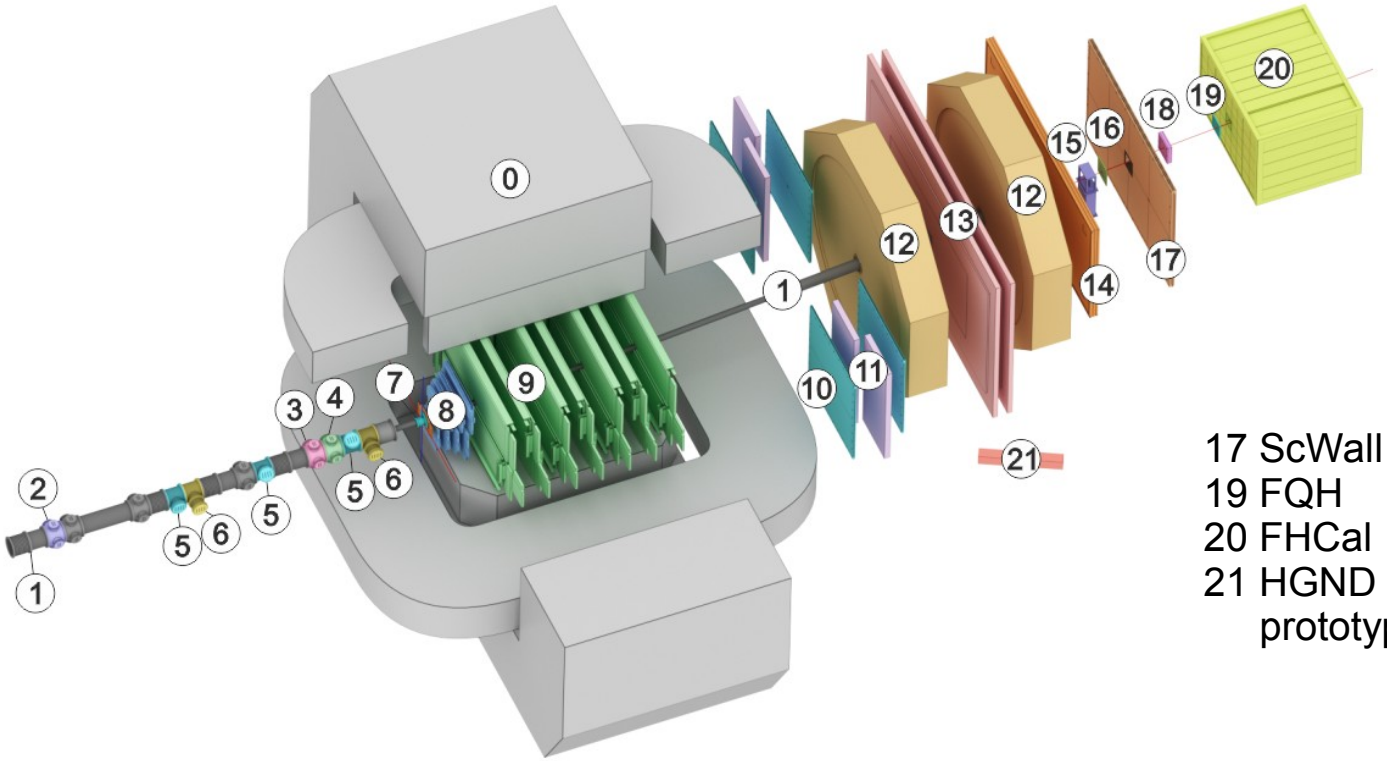
on behalf of INR RAS, Moscow






17 ScWall
19 FQH
20 FHCal
21 HGND prototype

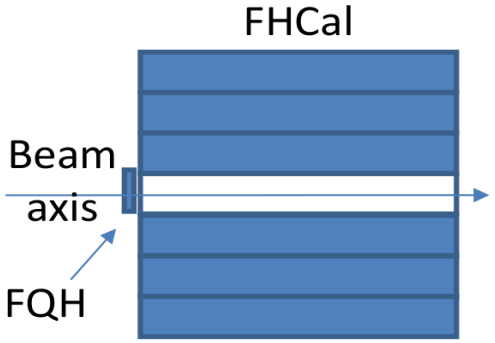
Forward detectors:

- **FQH** (**F**orward **Q**uarz **Hodo**scope)
- **FHCal** (**F**orward **H**adron **Cal**orimeter)
- **ScWall** (**Sc**intillation **W**all)
- prototype of neutron detector **HGND**

Can measure:

- charge distributions of spectator fragments
- centrality determination
- reaction plane orientation
- measurement of neutrons from ion collisions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 36 | 1 | 2 | 3 | 4 | 5 | 45 | 46 |
| | | 6 | 7 | 8 | 9 | 10 | | |
| 37 | 38 | 11 | 12 | 13 | 14 | 15 | 47 | 48 |
| 39 | 40 | 16 | 17 | | 18 | 19 | 49 | 50 |
| 41 | 42 | 20 | 21 | 22 | 23 | 24 | 51 | 52 |
| | | 25 | 26 | 27 | 28 | 29 | | |
| 43 | 44 | 30 | 31 | 32 | 33 | 34 | 53 | 54 |



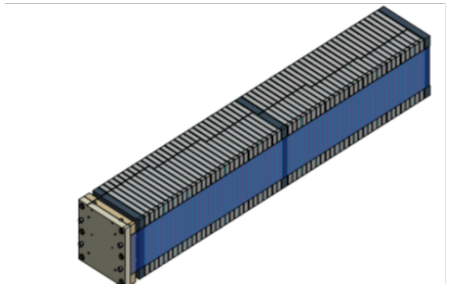

**FHCal - (Forward Hadron Calorimeter):**

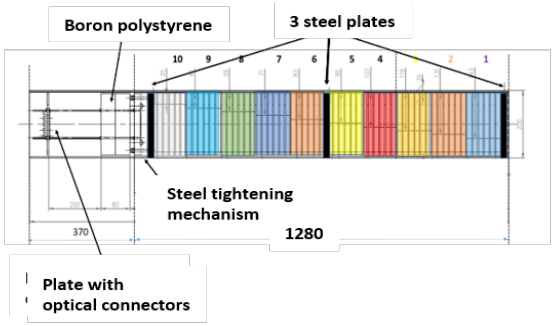
20 modules with 10 longitudinal sections (PSD CBM), transverse size 20x20cm$^2$, length – 5.6 $\lambda_{int}$.

34 modules with 7 longitudinal sections ( FHCal MPD like) – 15x15cm$^2$ (– 4.0 $\lambda_{int}$).

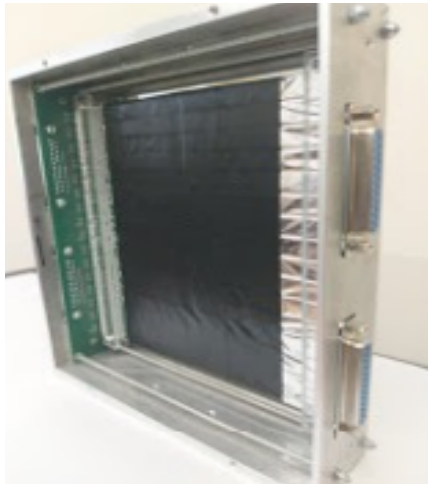
Hamamatsu MPPC S12572-010P, 3 x 3 мм$^2$.

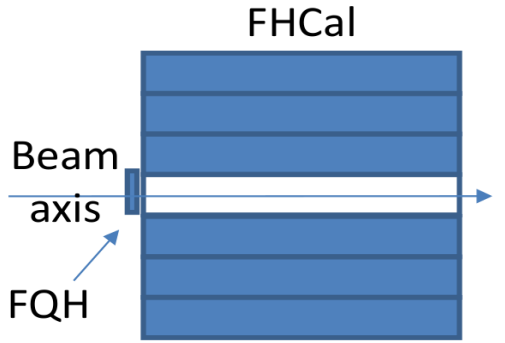
434 readout channels.



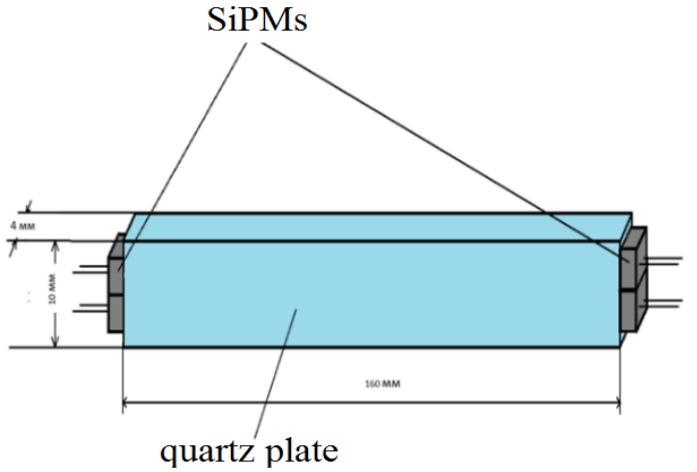



# Forward Quartz Hodoscope (FQH)





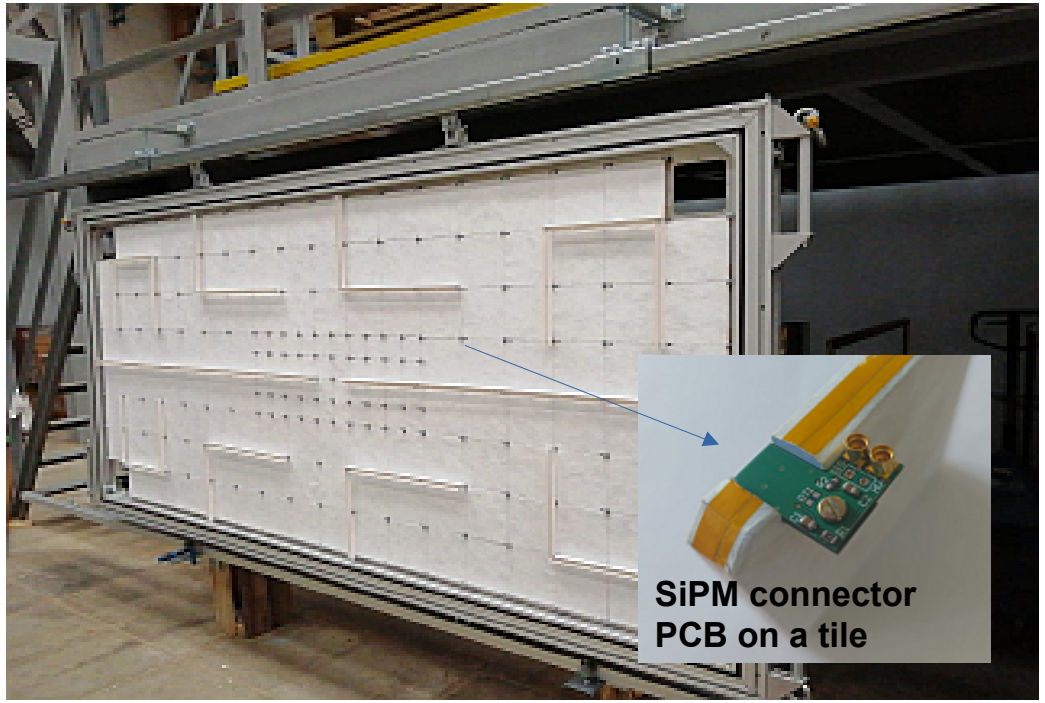

**FQH - (Forward Quartz hodoscope):**
16 quartz strips 160x10x4mm$^3$,
2+2 MPPCs per strip,
Hamamatsu MPPC S14160-3015PS, 3 x 3 мм$^2$,
64 readout channels (low gain, high gain)



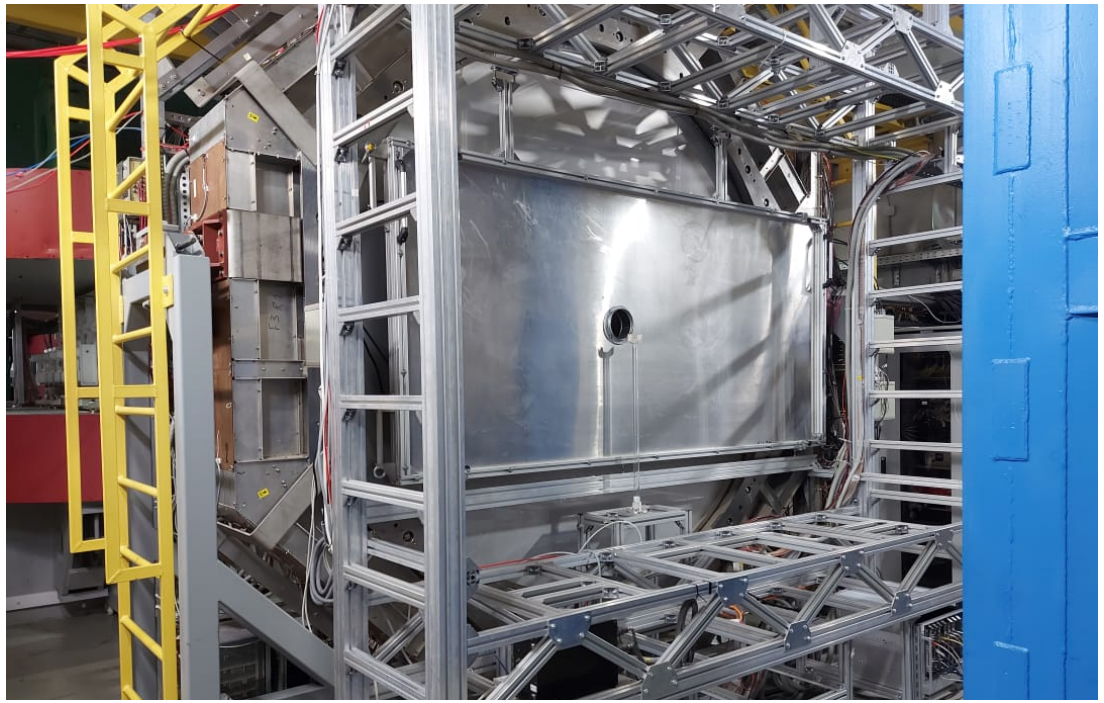

FHCal + FQH → collision centrality estimation, reaction plane

# Scintillating Wall (ScWall)

ScWall view inside during production



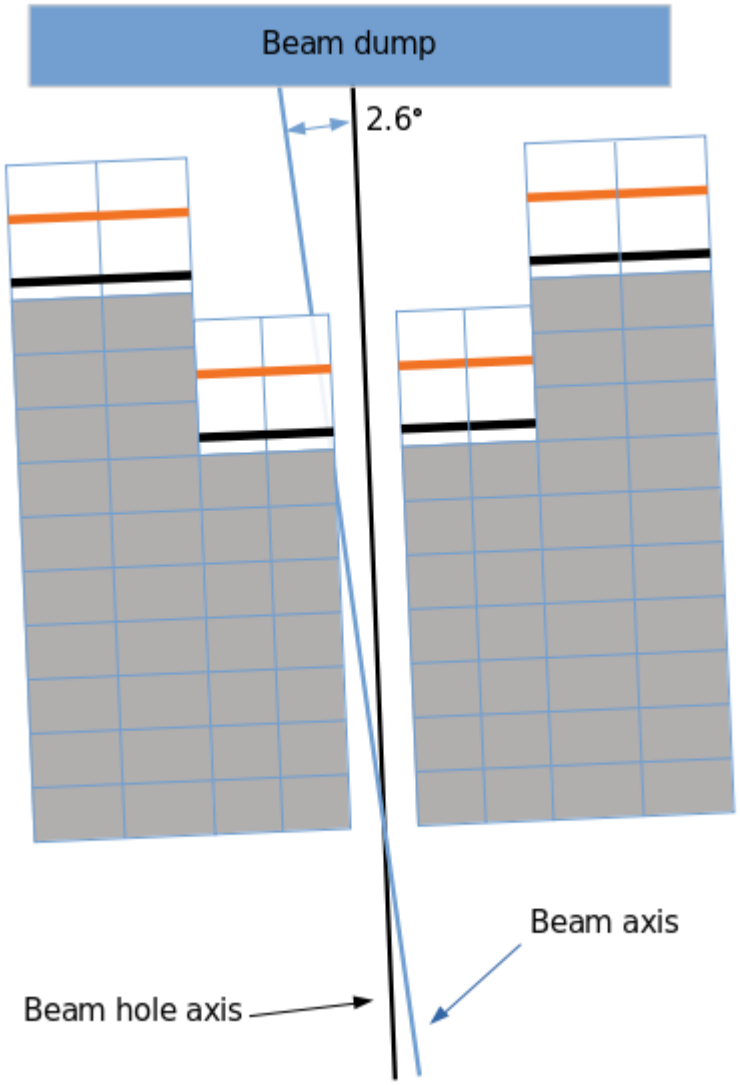

ScWall mounted on the frame during Run8 run



Charge spectators detection
→ fragmentation model parameters

+ collision centrality
+ reaction plane

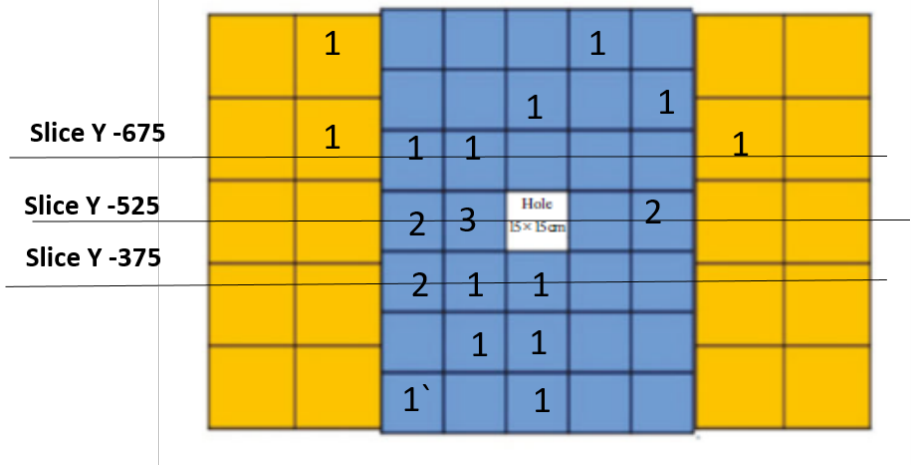
# FHCal position relative to the beam axis



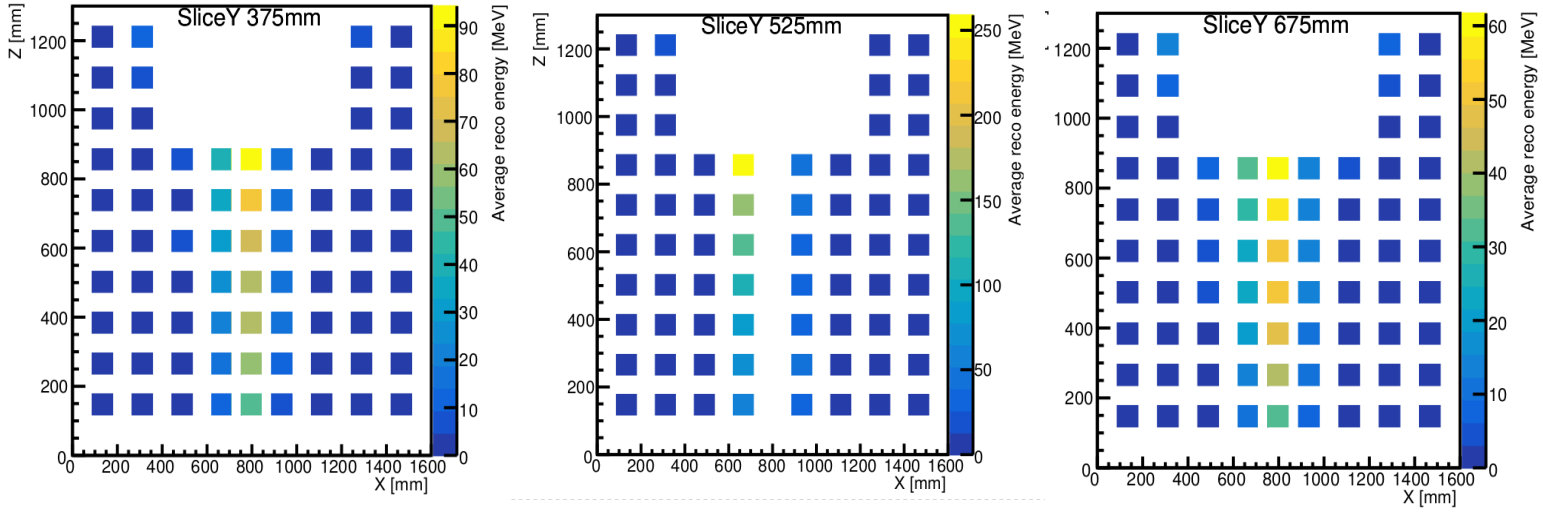

1) after run 8 FHCal was rotated and is now aligned to beam axis

2) beam dump upgrade (?)

## Number of failures of FHCal modules during Run8

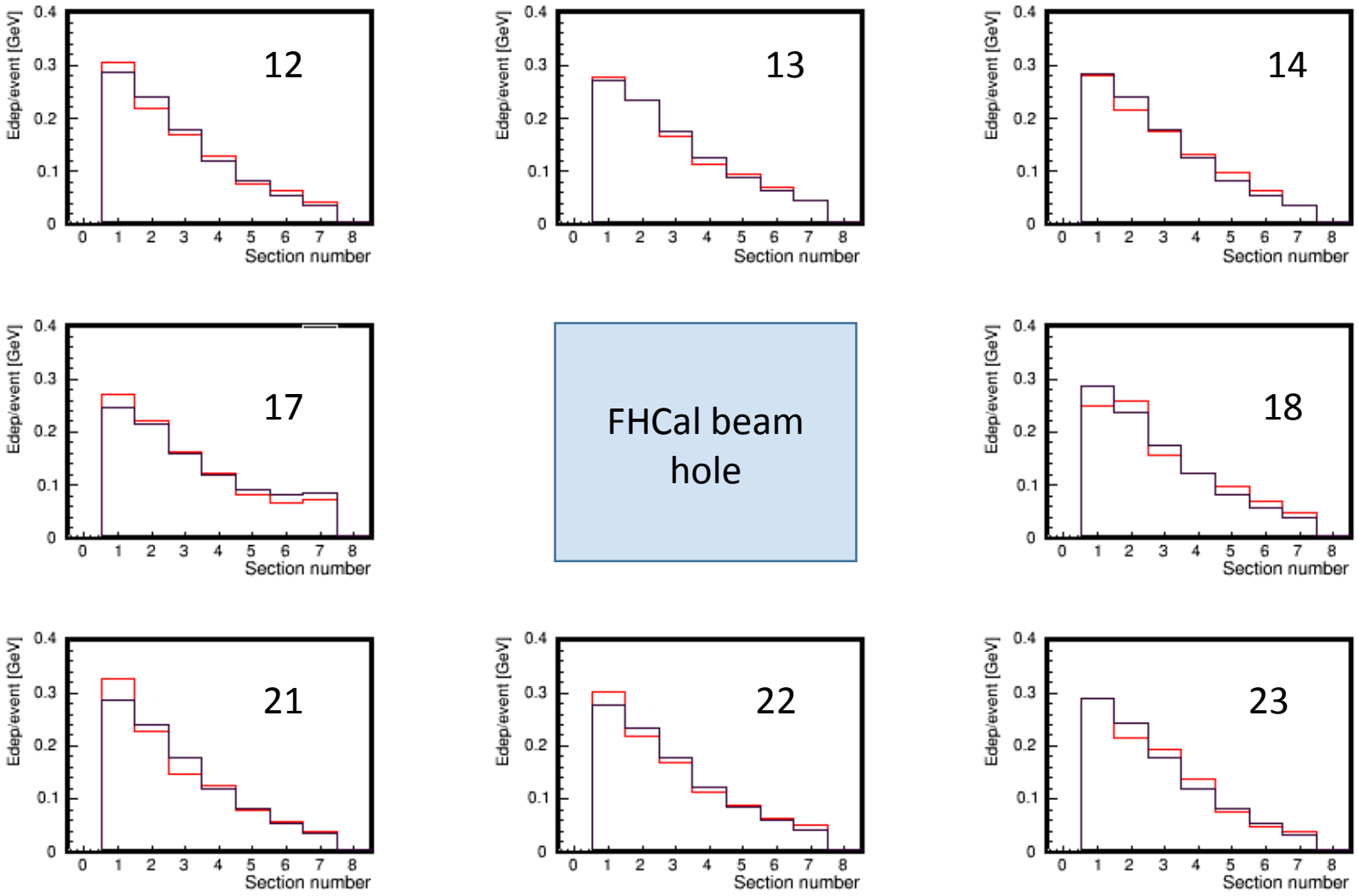



## Energy distribution in calorimeter sections. Beam trigger BT



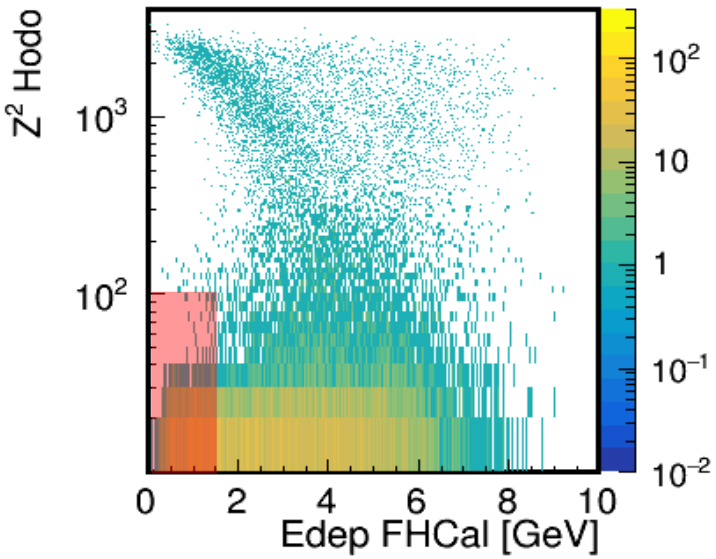
# Energy profiles in FHCal modules around the beam hole: comparison with simulation

Modules

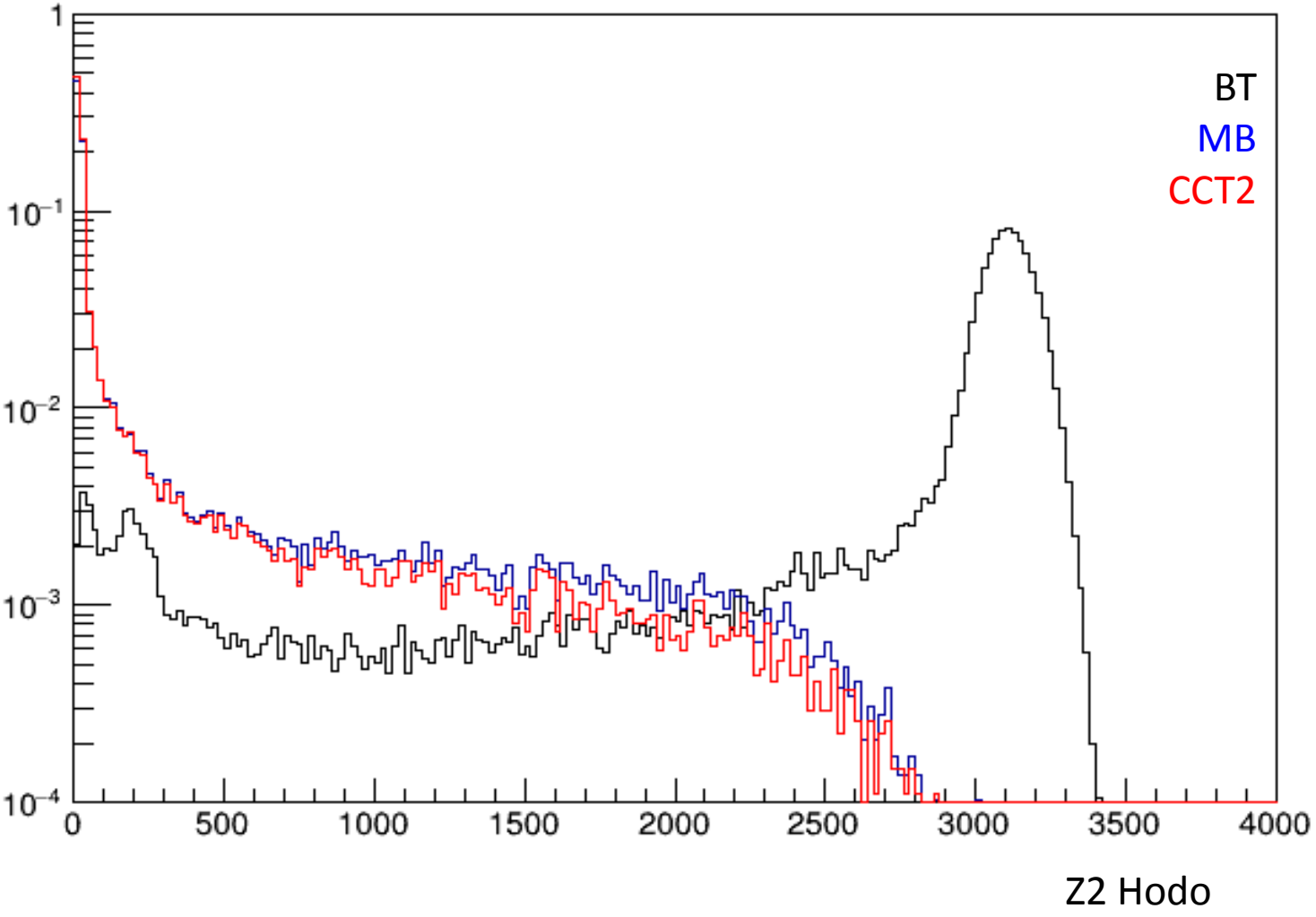



*Run 7821 MBT trigger 3.8 AGeV*
*Central events:*
*FHCal Edep < 1.4 GeV && $Z^2$ < 100*

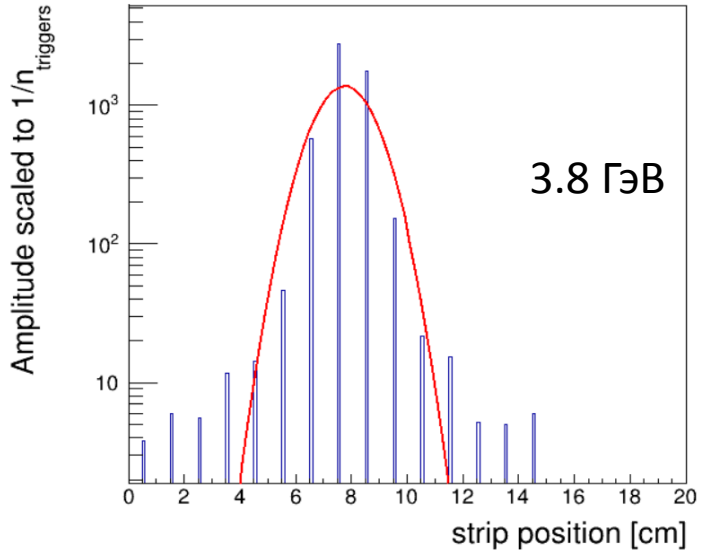
*Simulation Xe+CsI@3.26 AGeV cms*
*DCM-QGSM-SMM (UNIGEN)*
*all BMN detectors*
*Central events:*
*FHCal Edep < 1.4 GeV && $Z^2$ < 100*

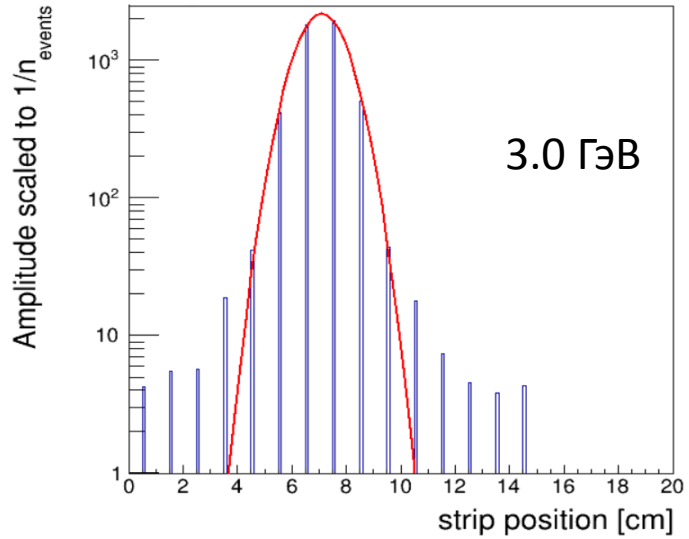


# Fragments charge distribution in FQH



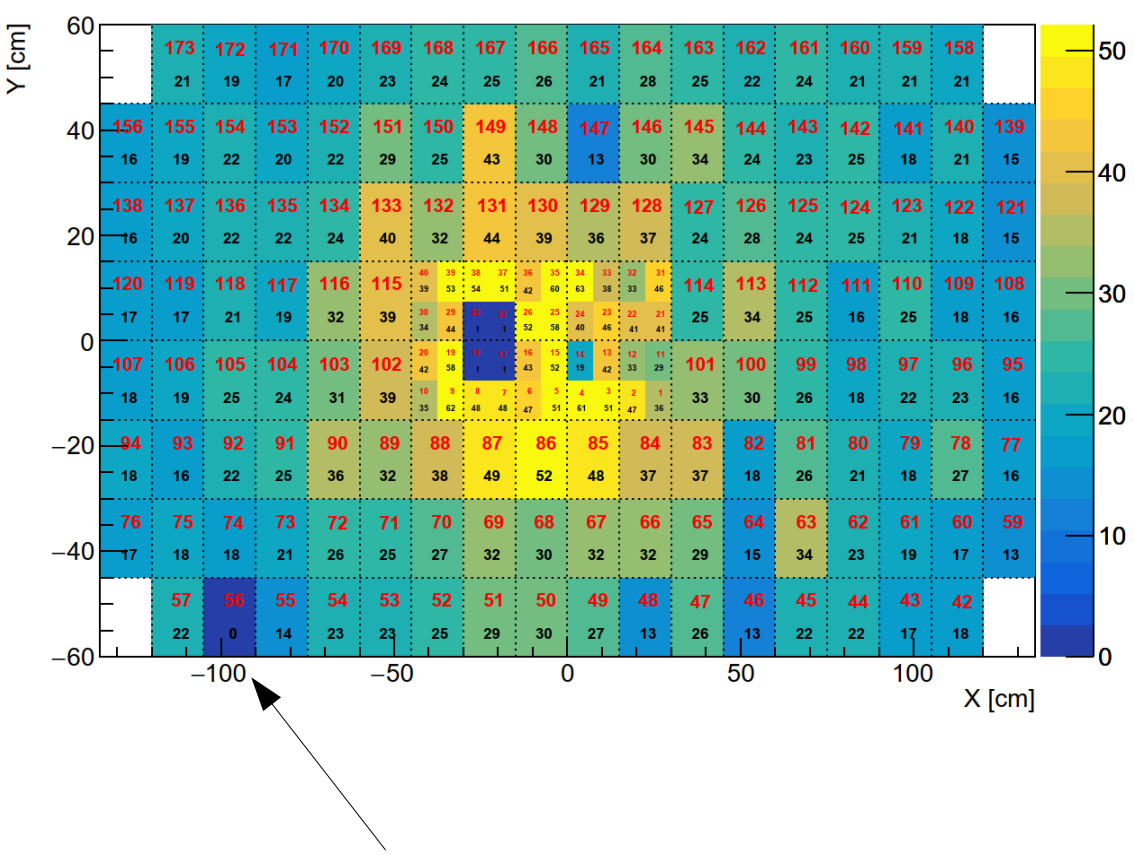

## Beam profile. BT



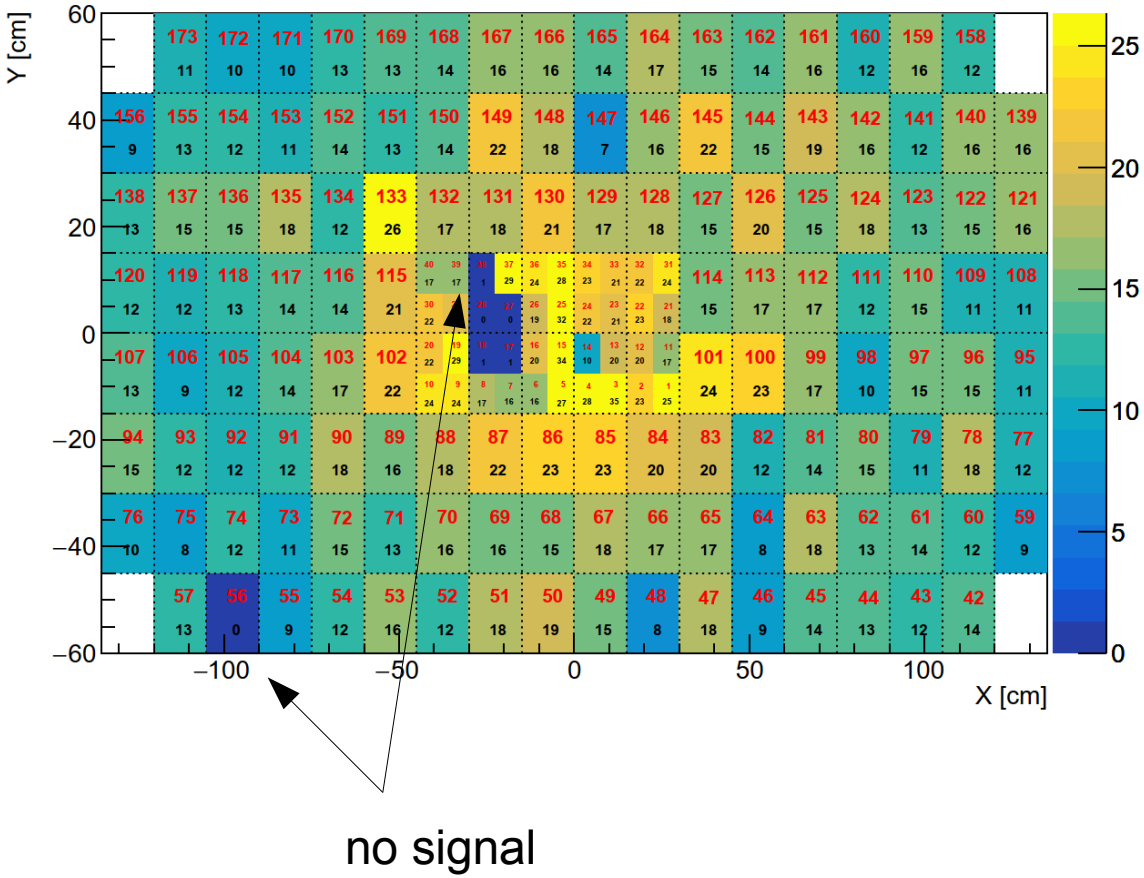



# ScWall average Z2 distribution with CsI(2%) target, Xe, CCT2

## 3A GeV




## 3.8A GeV




1) No signal: bad contacts in connectors, fixed after the Run8

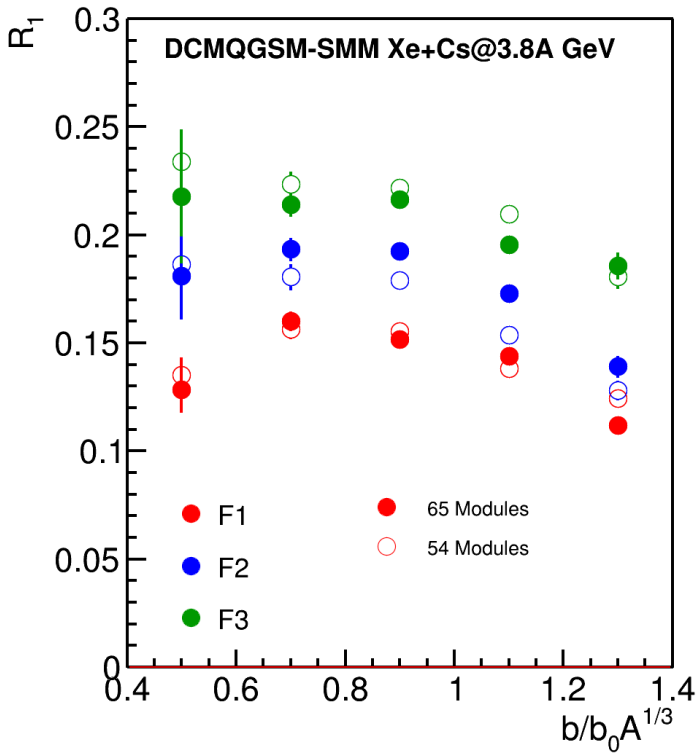
2) ScWall is now moving to new place, after the movement all cells will be checked again

- Do we need to re-arrange modules of FHCal?

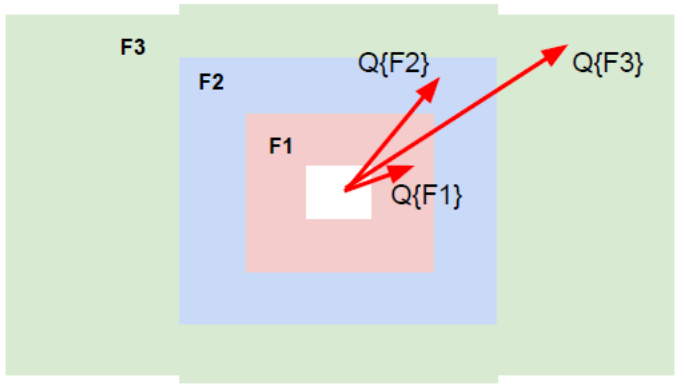
The idea: 64 small (15x15) modules in total.

Check: do we have any improvements in flow analysis?

MC results:



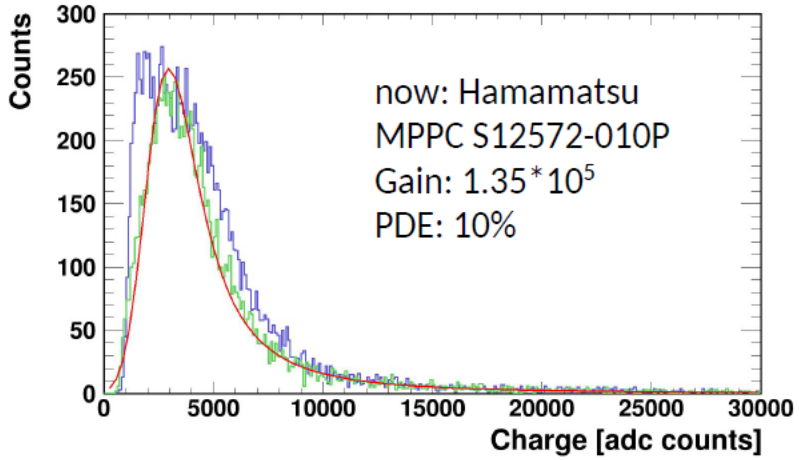

54 modules

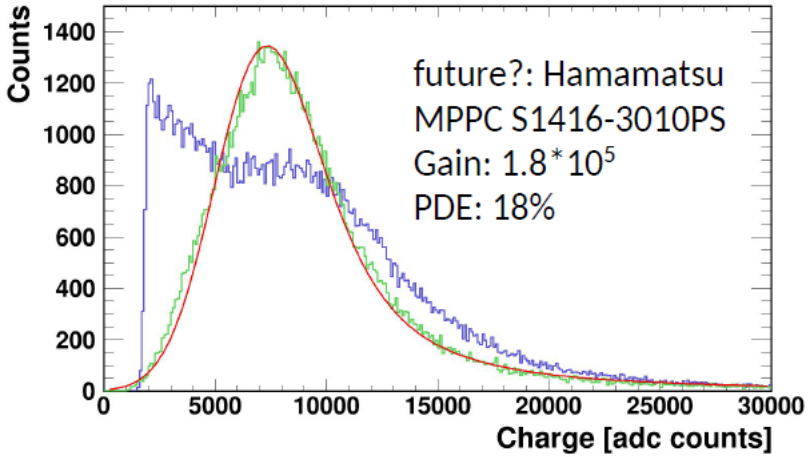



65 modules (only small 15x15)

Conclusion: keep the current small + large modules configuration.

- Do we need to exchange photodiodes in FHCal?



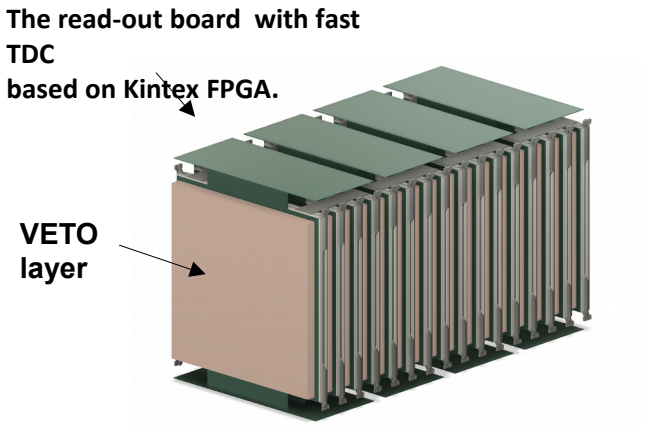

Pro: more visible MIP peak → more accurate calibrations (?)
Contra: less dynamic range with ADC64 board

These points need to be discussed and cross-checked with new cosmic calibrations + MC

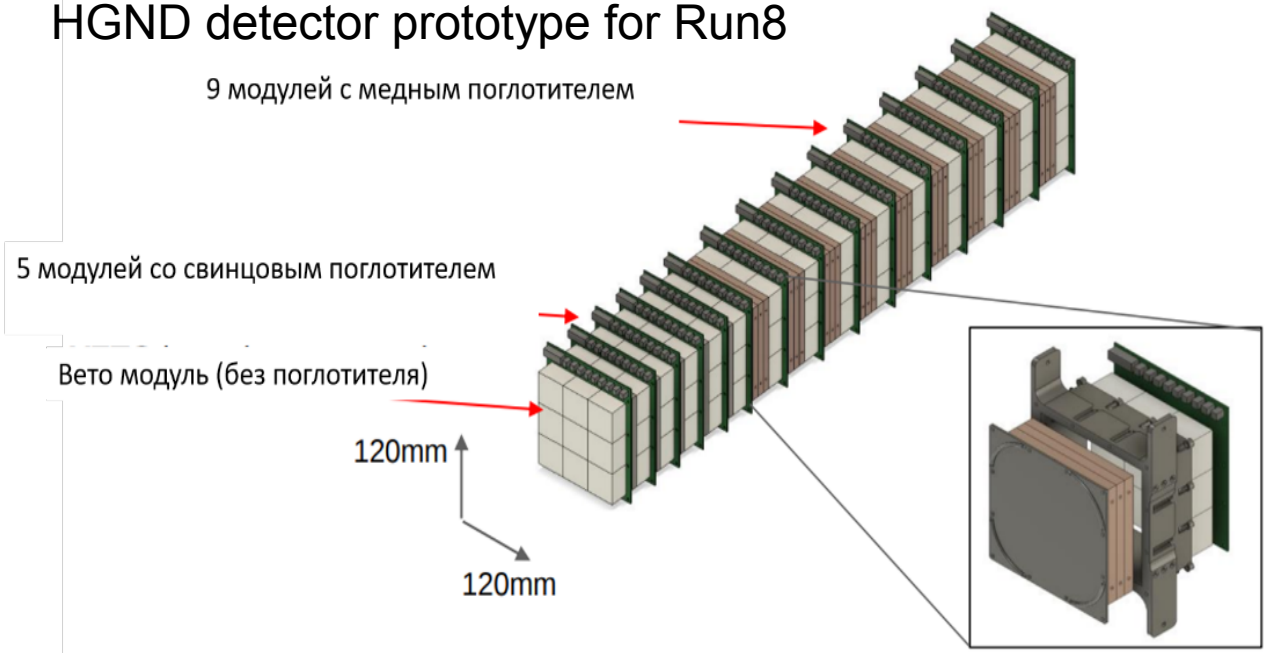
- we are looking for the d beam in summer to check FHCal calibrations with pure beam of particles

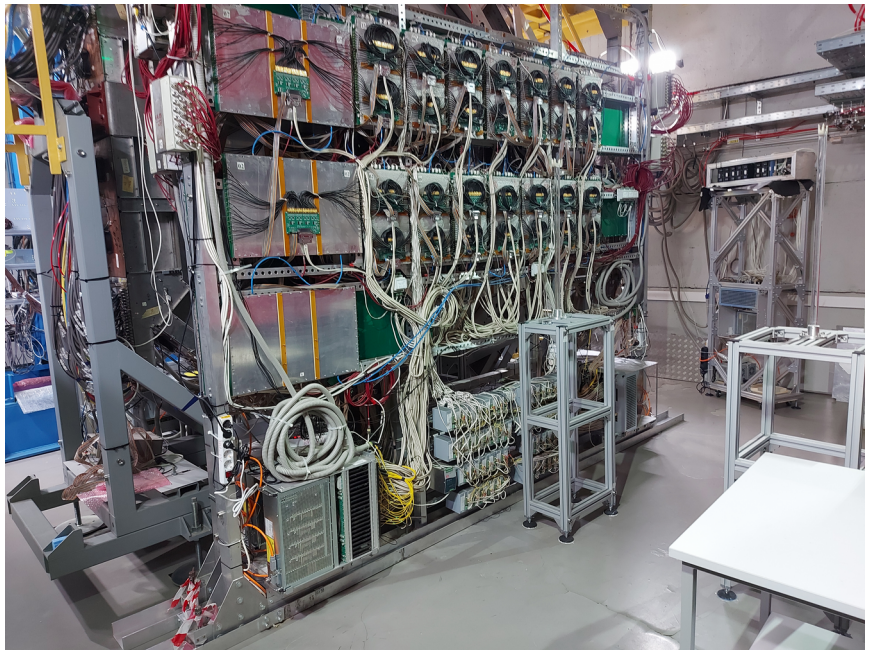
# HGND neutron detector prototype in Run8

## Future full-scale HGND detector



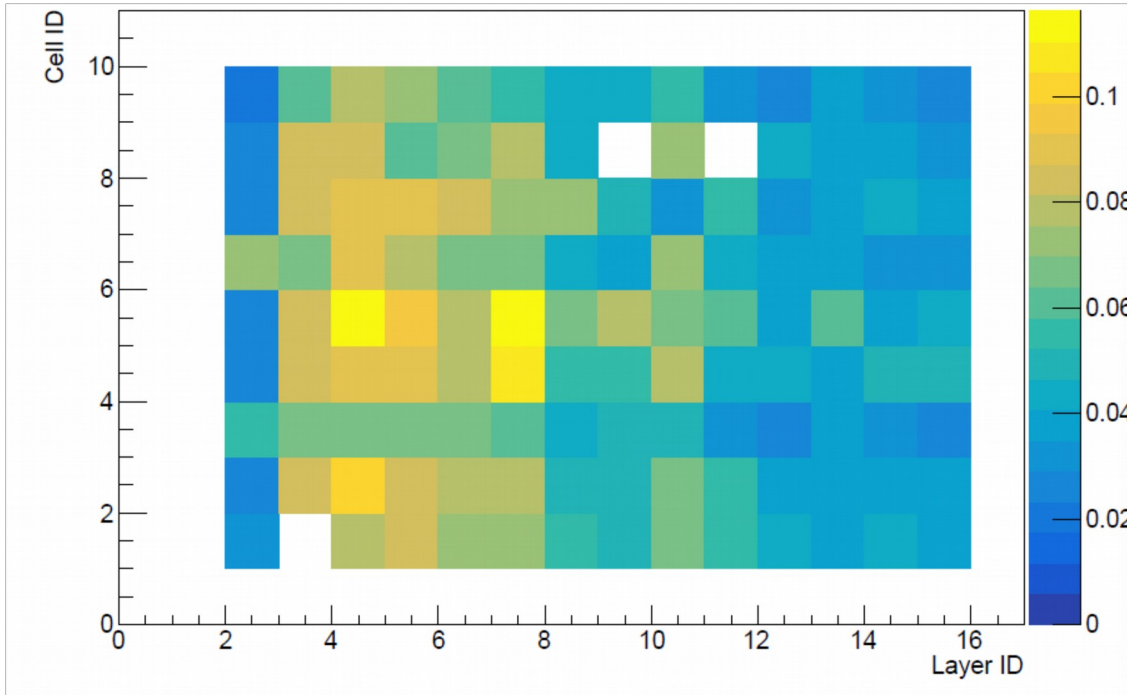

## HGND detector prototype for Run8



# HGND neutron detector prototype in Run8

- no signal in several channels: fixed after Run8




- new LED flash calibration system: is under development in INR RAS and ITEP + JINR