Preparation of forward detectors for beam runs

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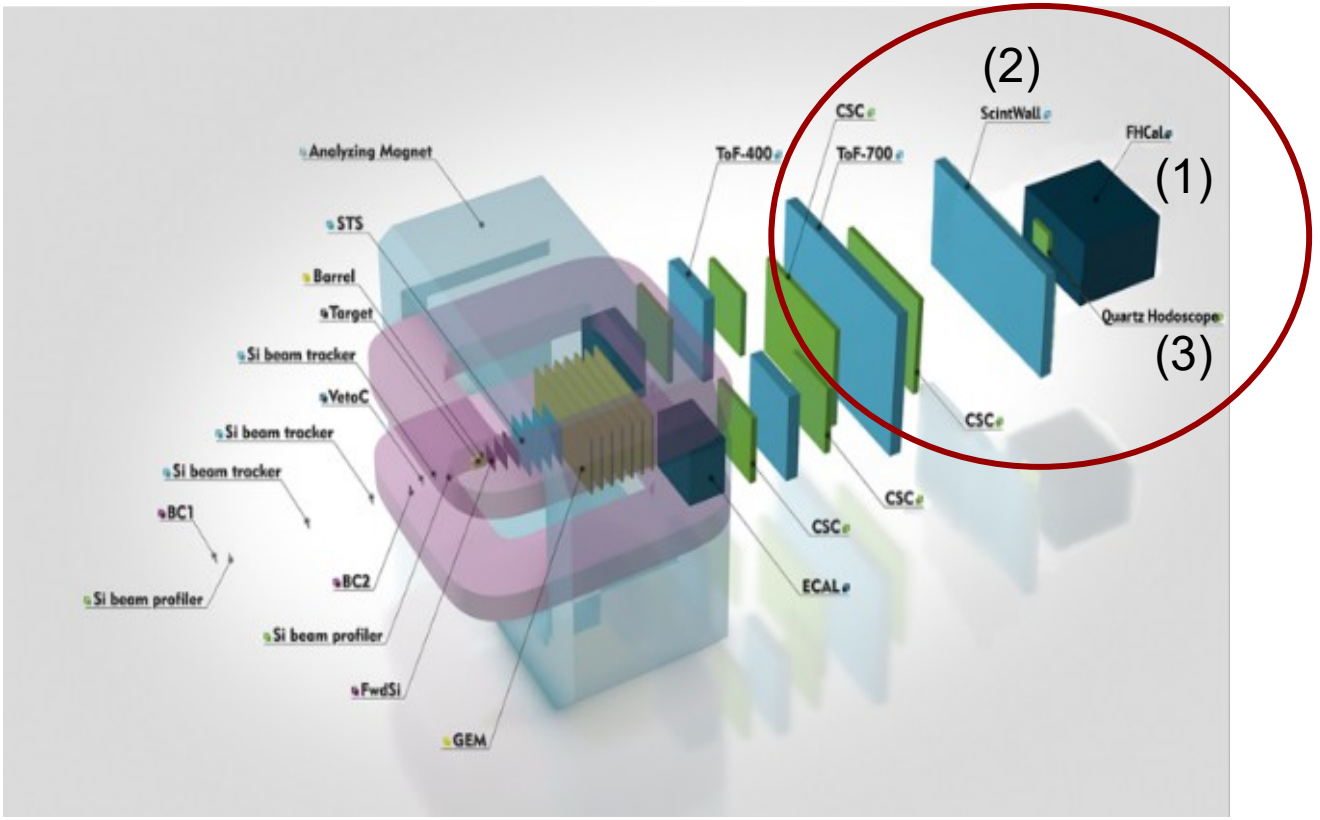
on behalf of INR RAS, Moscow

Forward detectors at BM@N:

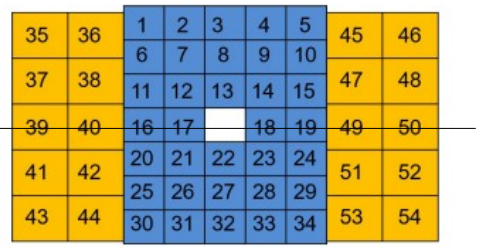
(1) FHCal (Forward **H**adron **Cal**orimeter)

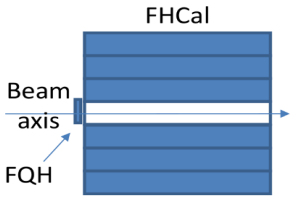
(2) ScWall (**Sc**intillation **W**all)

(3) FQH (**F**orward **Q**uarz **Hodo**scope)



Forward Hadron Calorimeter (FHCal)





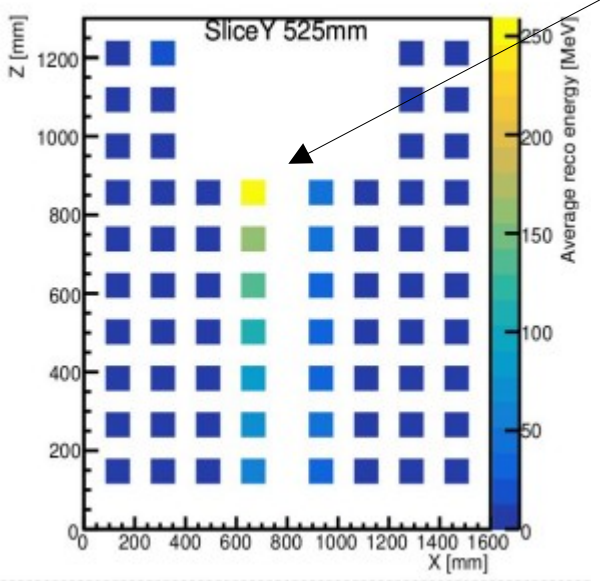
FHCal - (Forward Hadron Calorimeter):

34 modules (MPD-like) – 15x15cm^2; 7 sections; length – 4.0 λ_{int}.

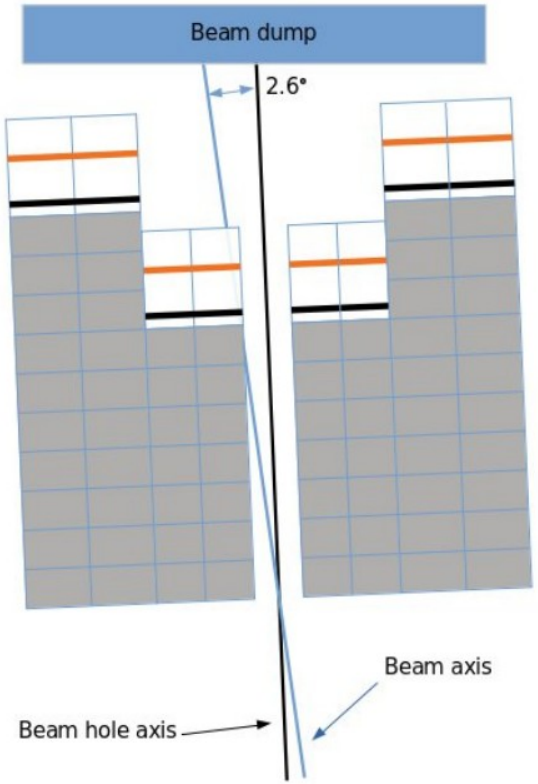
20 modules (CBM-like) – 20x20cm^2; 10 sections; length – 5.6 λ_{int}.

Hamamatsu MPPC S12572-010P, 3x3 мм^2.

434 readout channels.

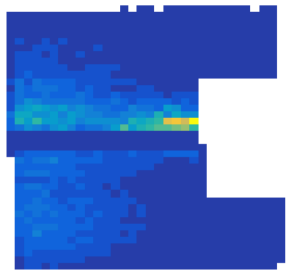


beam and
heavy fragments
hit last sections of
mod#17

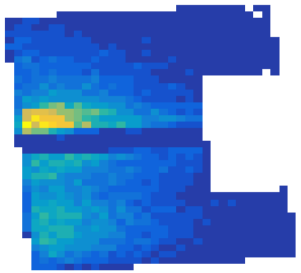


after run 8 FHCal was rotated
and is now aligned to beam axis

Check in simulation
Xe+CsI 3.8AGeV



before rotation

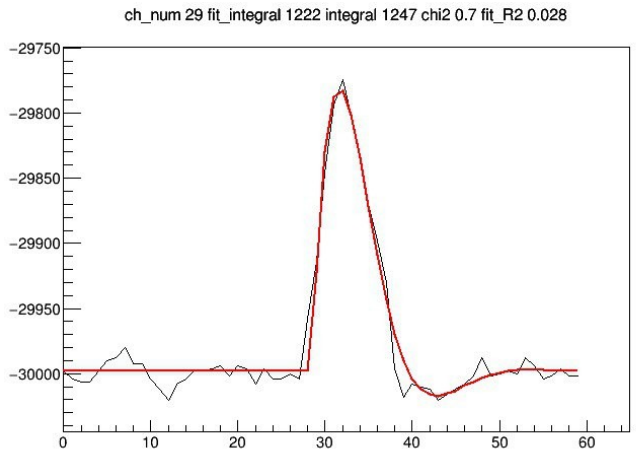


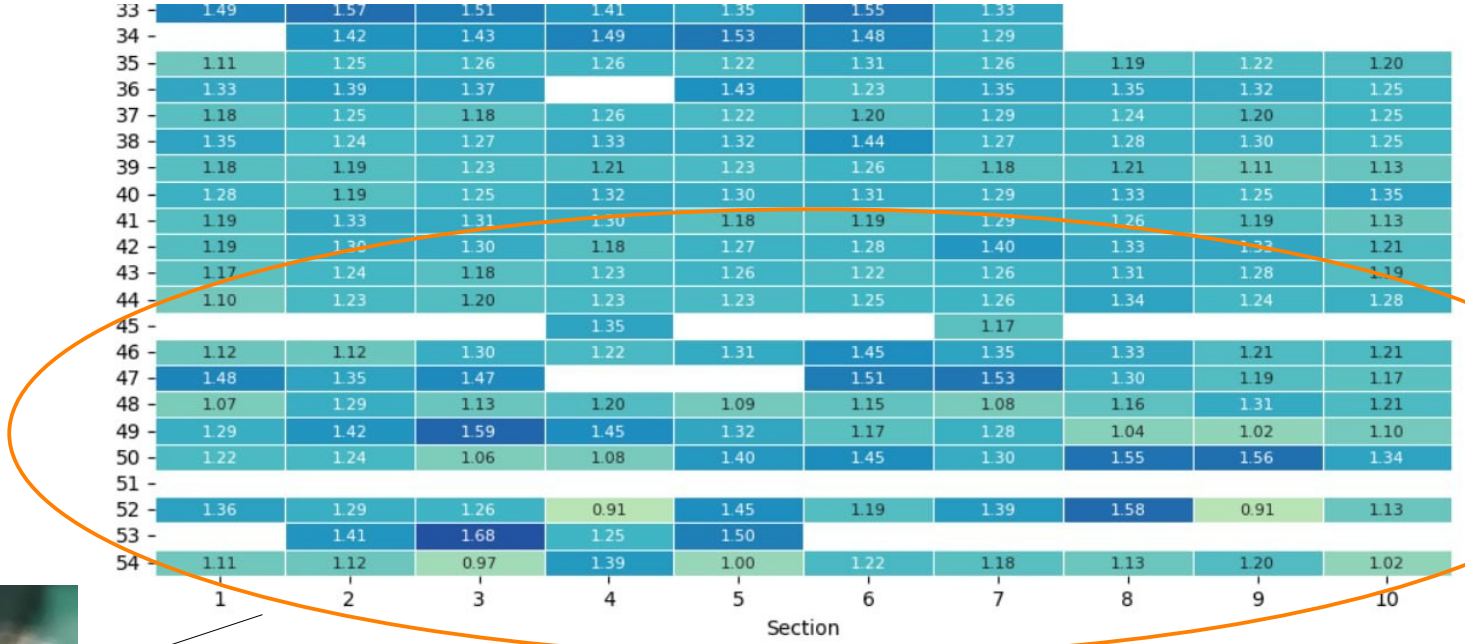
after rotation

Forward Hadron Calorimeter (FHCal)

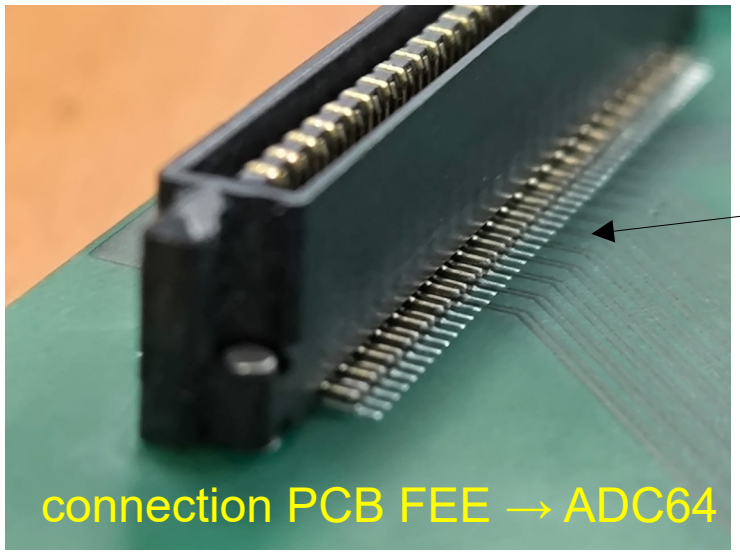
Calibration on cosmics in March 2025 has been done

example of signal





no signal visible in several sections in modules



some contacts “fly” under the PCB

The connector has been resoldered, all channels are live now.
Recalibration on cosmics is in progress..

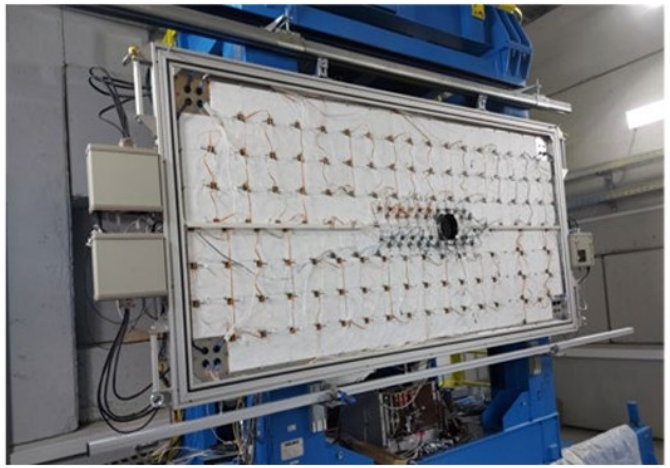
In addition: The FHCal slowControl box has been repaired (somehow the configuration was dropped to factory default values – corrected).

Scintillation Wall (ScWall)

ScWall view inside during production

SiPM connector PCB on a tile

ScWall mounted on FHCal frame



ScWall at BM@N now

- ScWall operation was good in run8

- new proposal upgrade is under development now (see next slide)

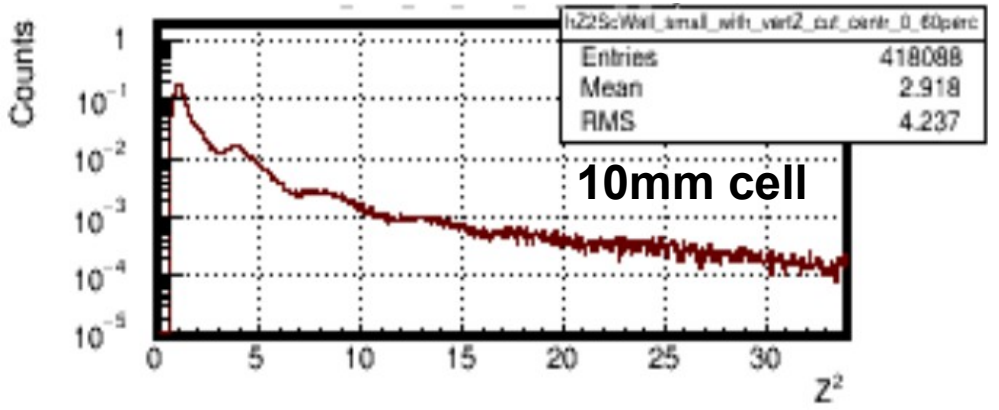
Scintillation Wall (ScWall)

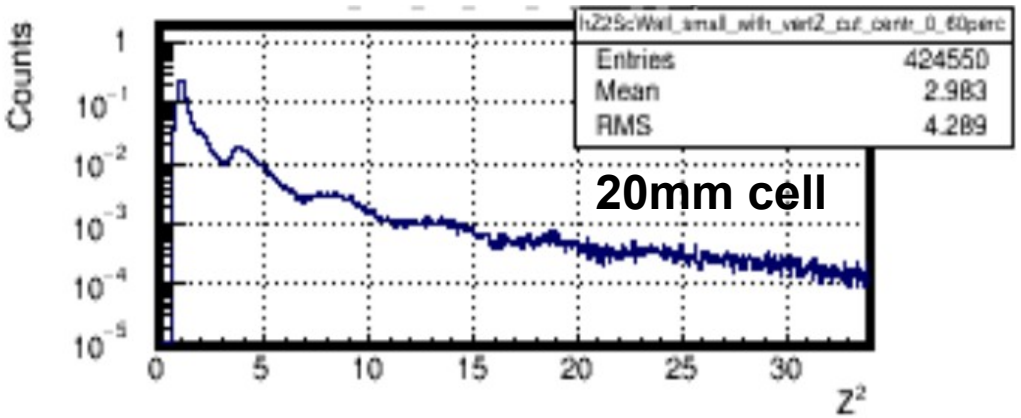
ScWall cell thickness upgrade

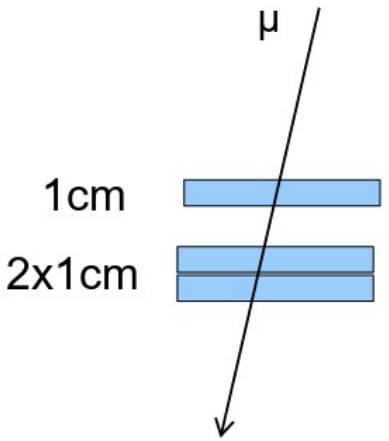
Simulation

ScWall Z^2 distributions **XeCs@3.26AGeV**

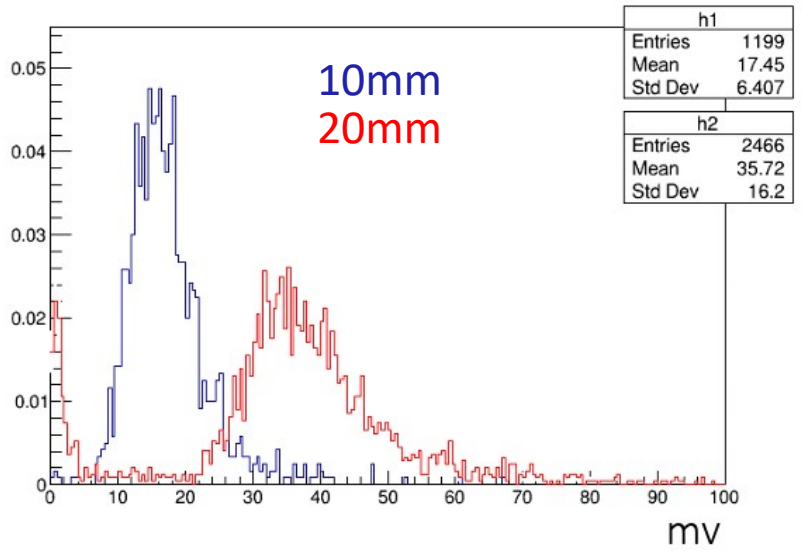
DCM-QGSM-SMM



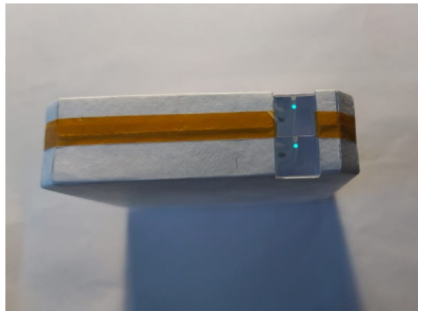


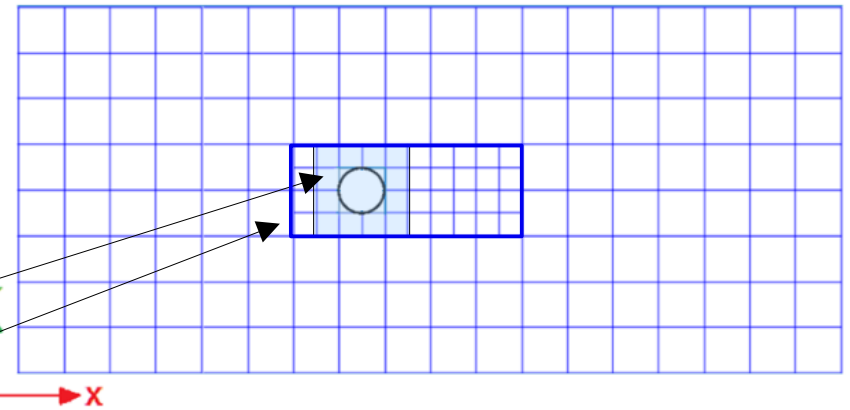


Cosmic tests



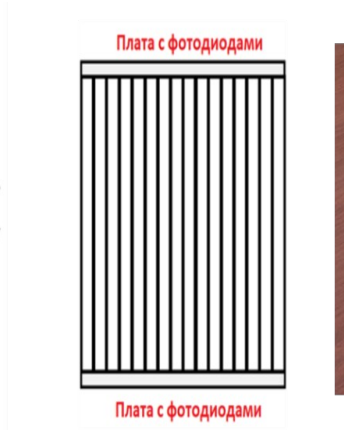
- new 20mm thickness cell (40 pc produced)
- 12 cells are equipped with SiPMs

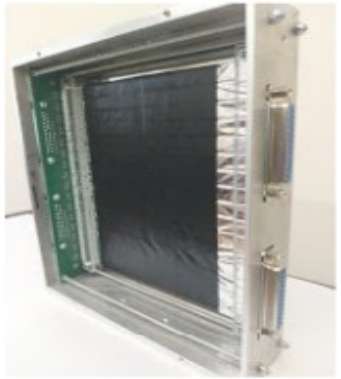


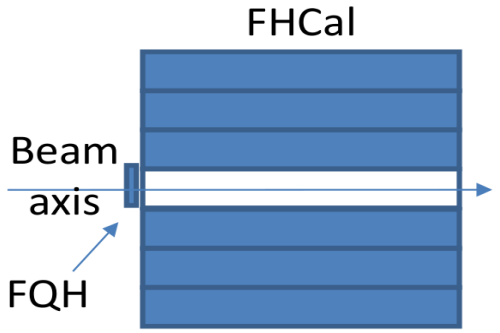


- ScWall center 12 tiles have been replaced, signals are checked.
- fully SiPM equipped tiles (40 pc in total) will be replaced later

Forward Quartz Hodoscope (FQH)







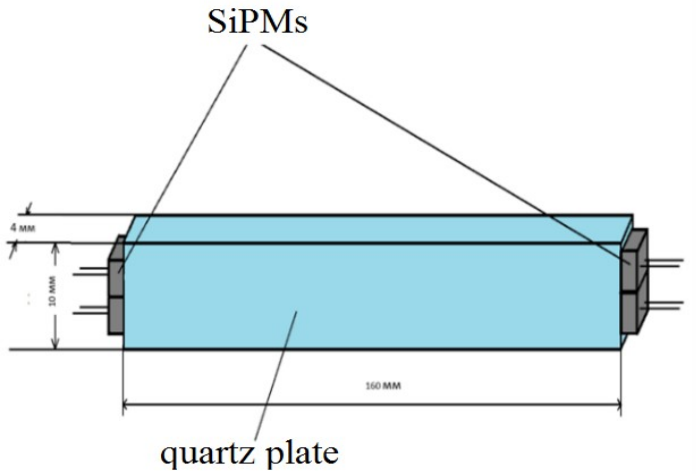
FQH - (Forward Quartz hodoscope):

16 quartz strips 160x10x4mm^3,

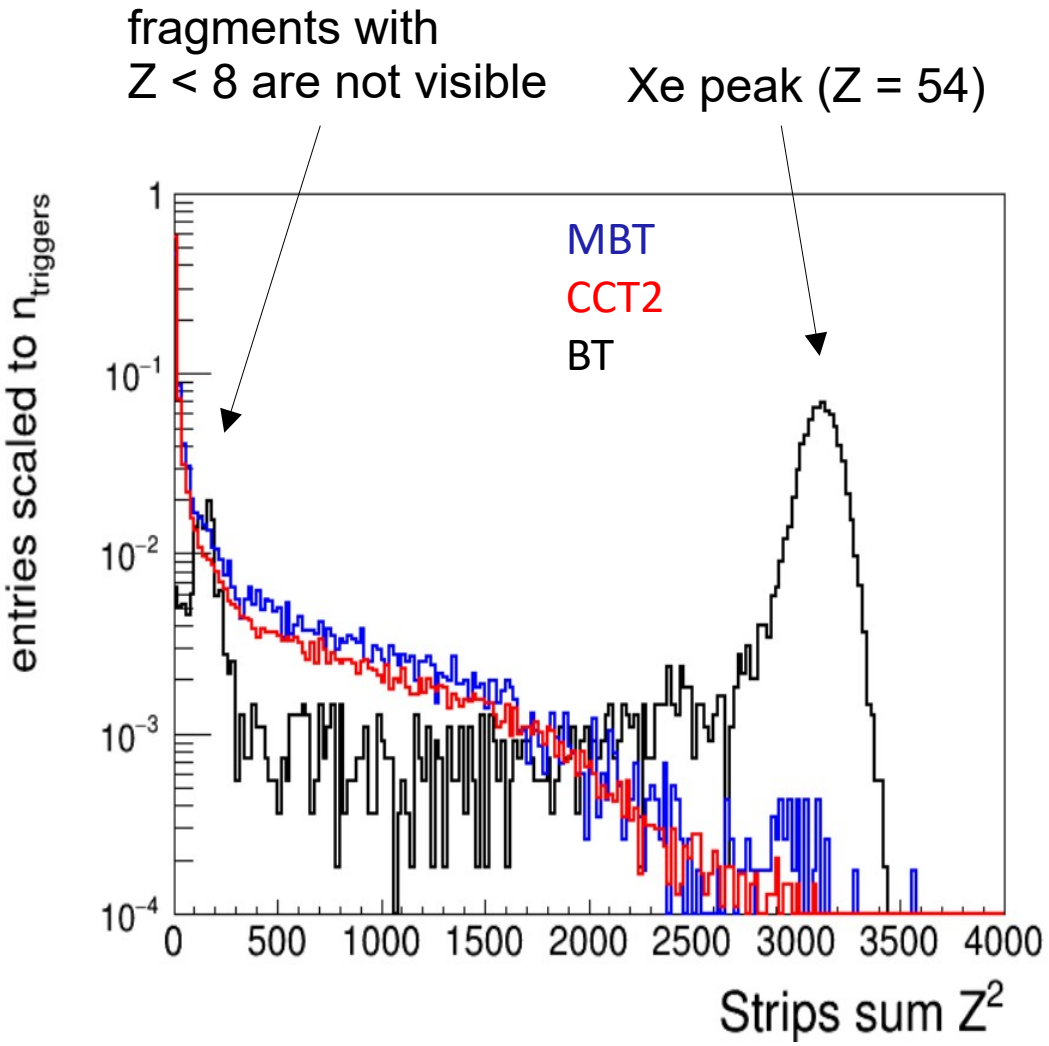
2+2 MPPCs per strip,

Hamamatsu MPPC S14160-3015PS, 3 x 3 мм^2,

64 readout channels (low gain, high gain)

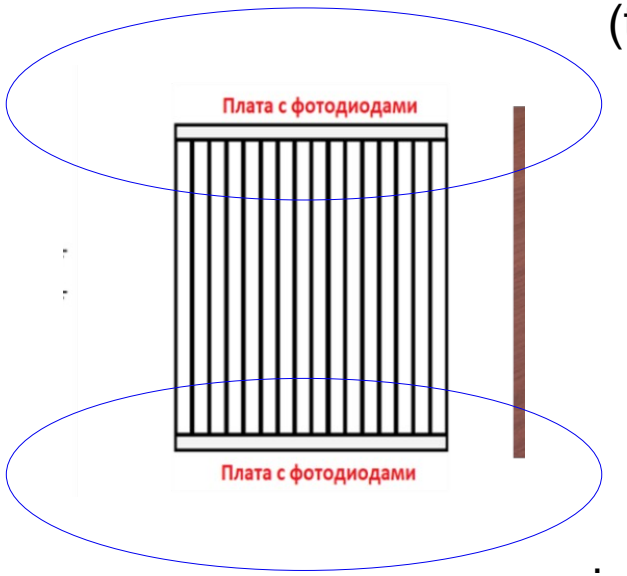


Forward Quartz Hodoscope (FQH)



The idea is: to increase dynamic range of registered Z

reduced HV for Xe peak
(the same as in run8)

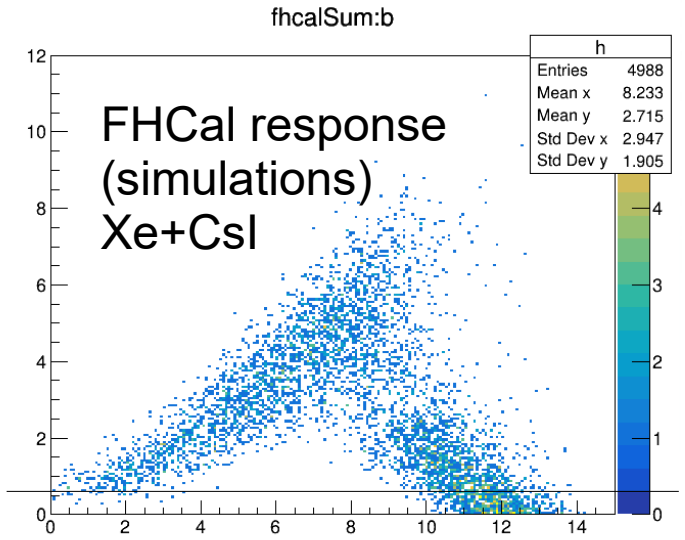


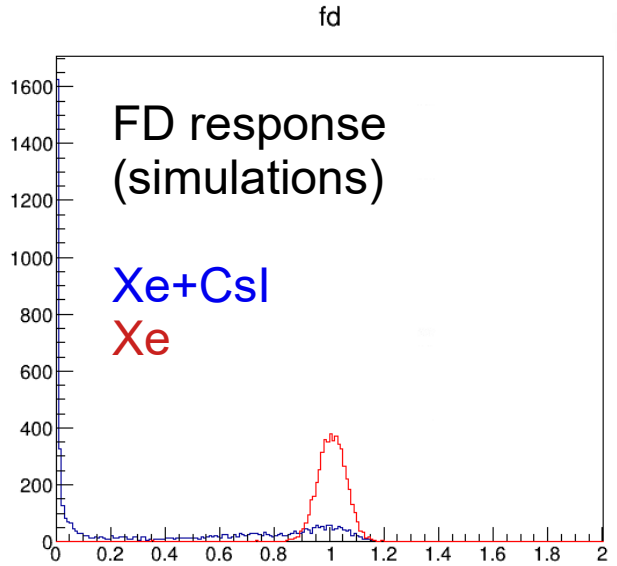
nominal HV for low Z visible

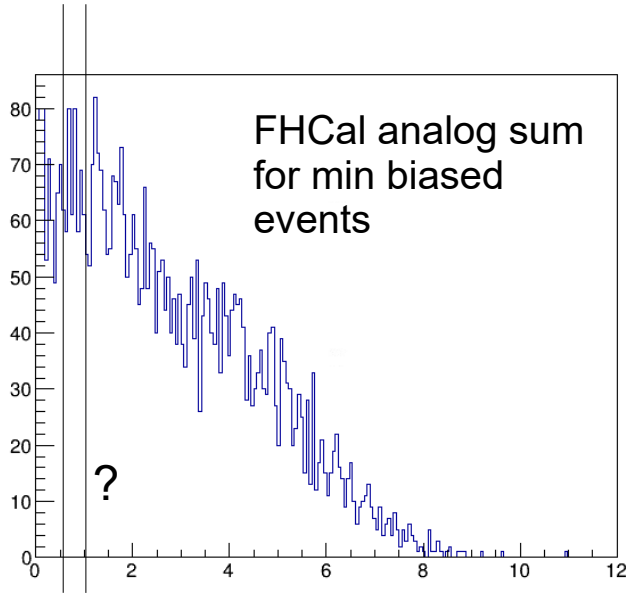
Tuning of HV will be done during start of run (ion beam needed). Takes ~ 2-3 h of time.

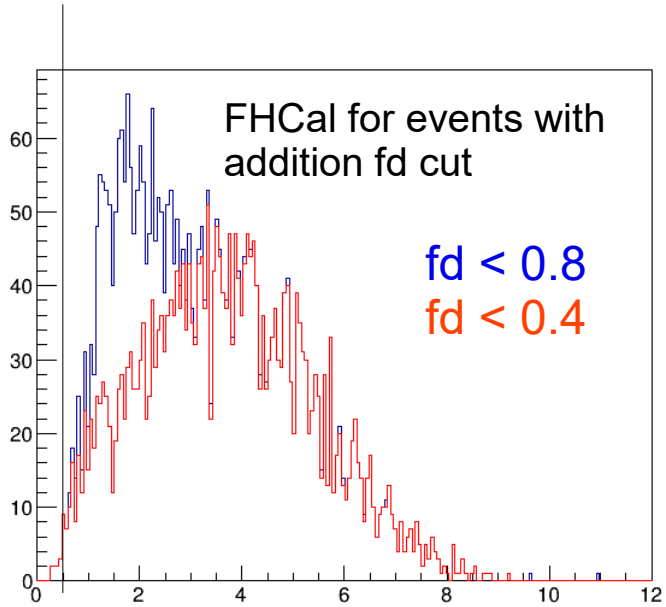
Forward Hadron Calorimeter (FHCal)

Using the FHCal in trigger









Using the FHCal in trigger

- FHCal has analog sum on each module and analog sum boards to combine all modules

- idea: use fast analog sum in trigger for better efficiency

The plan during start of run9:

- take events with cut(s) on FD
- analyse the FHCal response
- choose the cut value on FHCal
- take events with FHCal cut and cross-check the FD

Summary:

FHCal:
- rotated to avoid beam
- analog sum signals will be used in trigger
- calibration with cosmics is done
- connectors on PCB FEE → ADC64 board is repaired, slowControl box is back in operation
- calibration on Xe beam is expected (time, FHCal movement..) !

ScWall:
- new 20mm (2x10mm) thick tiles are ready (40 pc)
- 12 central tiles has been replaced in March 2025, signals are checked
- control and readout box for ScWall section “D,F,H,L” is repaired (STM32 was broken)
- calibration with cosmics is expected before run period

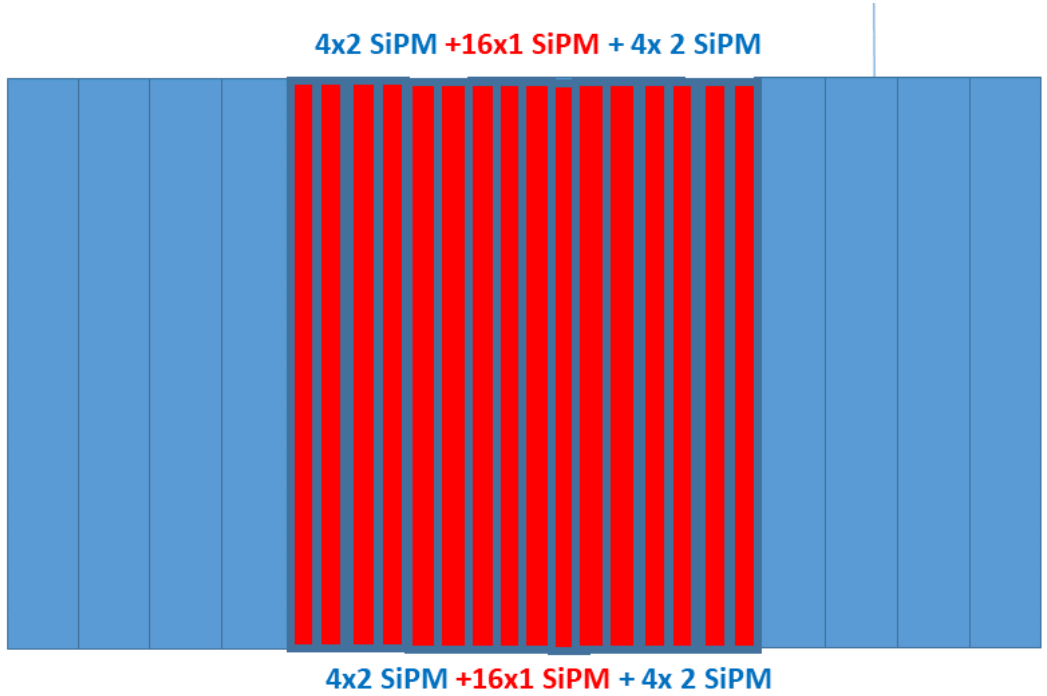
FQH:
- reduced HV on one side and nominal HV on the other side (increase of dynamic range and make low Z fragments visible)

DCS:
- slow control systems for all forward detectors are ready

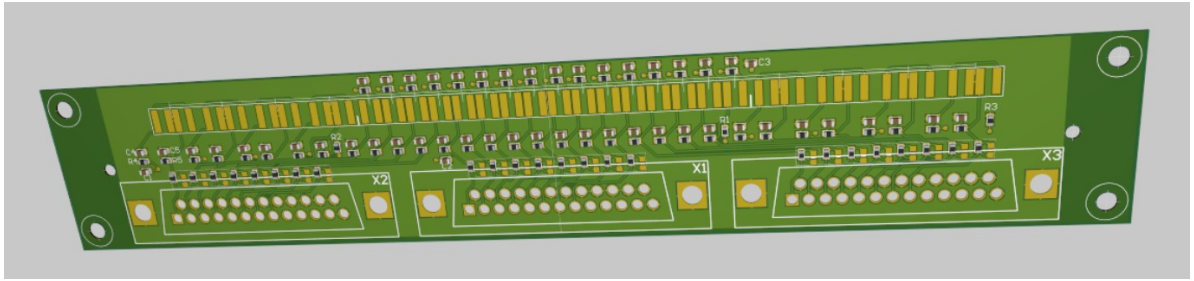
Backup slides

Forward Quartz Hodoscope (FQH)

Future upgrade of FQH (is under development at INR RAS) - not planned for May-June 2025 run



New PCB for SiPM is under production

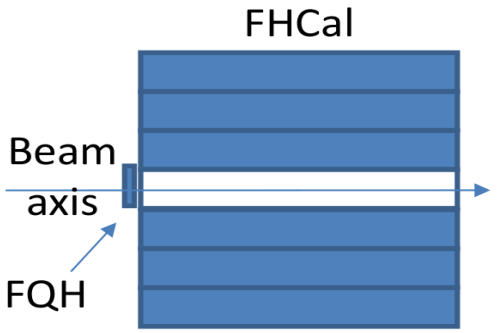


- new PCB is designed, produced

- new SiPMs are delivered

- mechanical design is the same (we will use 2nd FQH box – which was previously used with scint. plates)

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



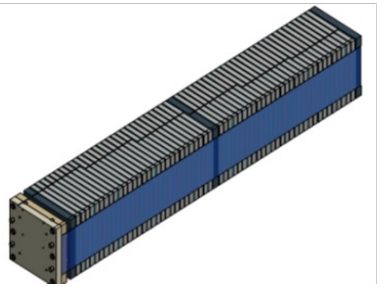
FHCal - (Forward Hadron Calorimeter):

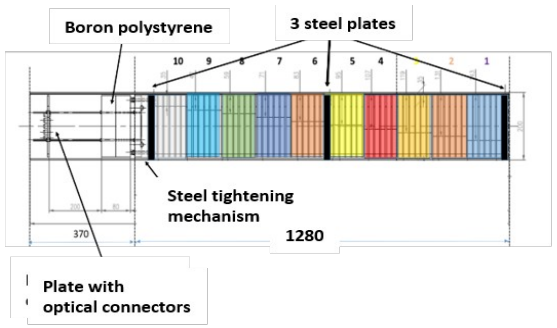
20 modules with 10 longitudinal sections (PSD CBM), transverse size 20x20cm^2, length – 5.6 λ_{int}.

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

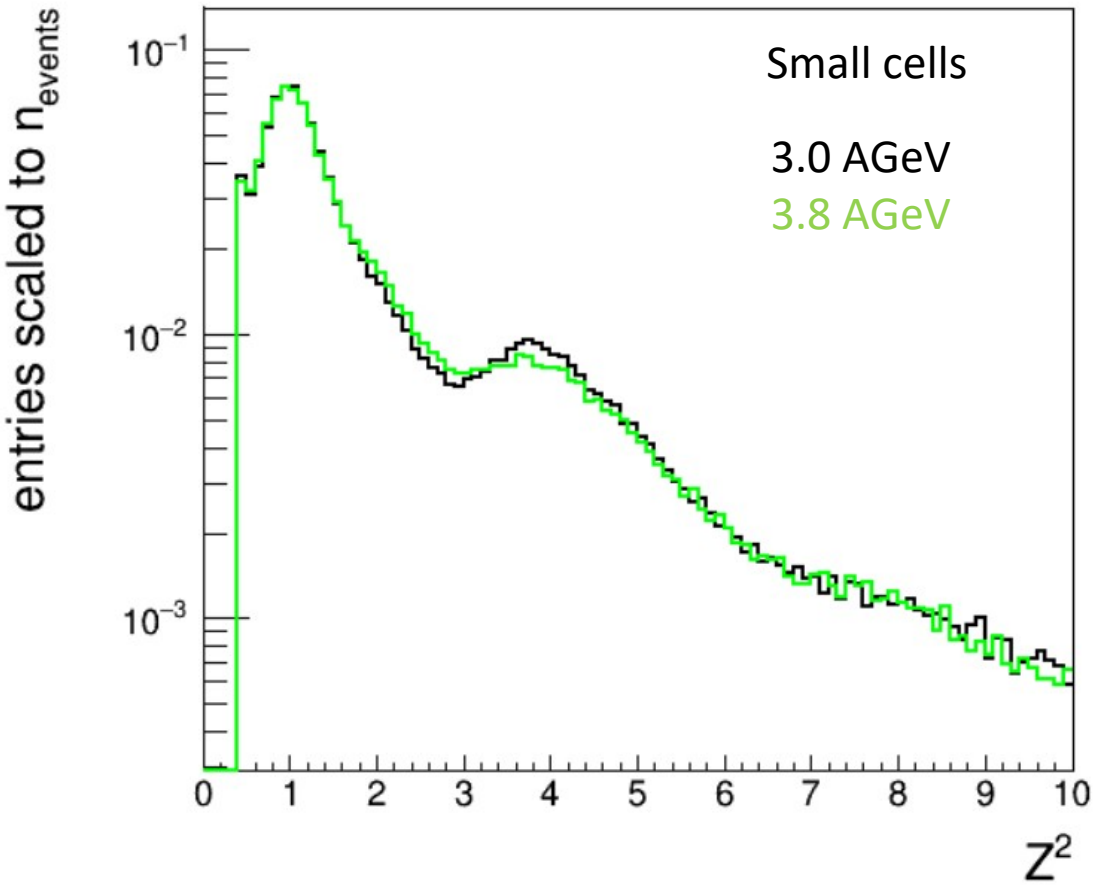
Hamamatsu MPPC S12572-010P, 3 x 3 мм^2.

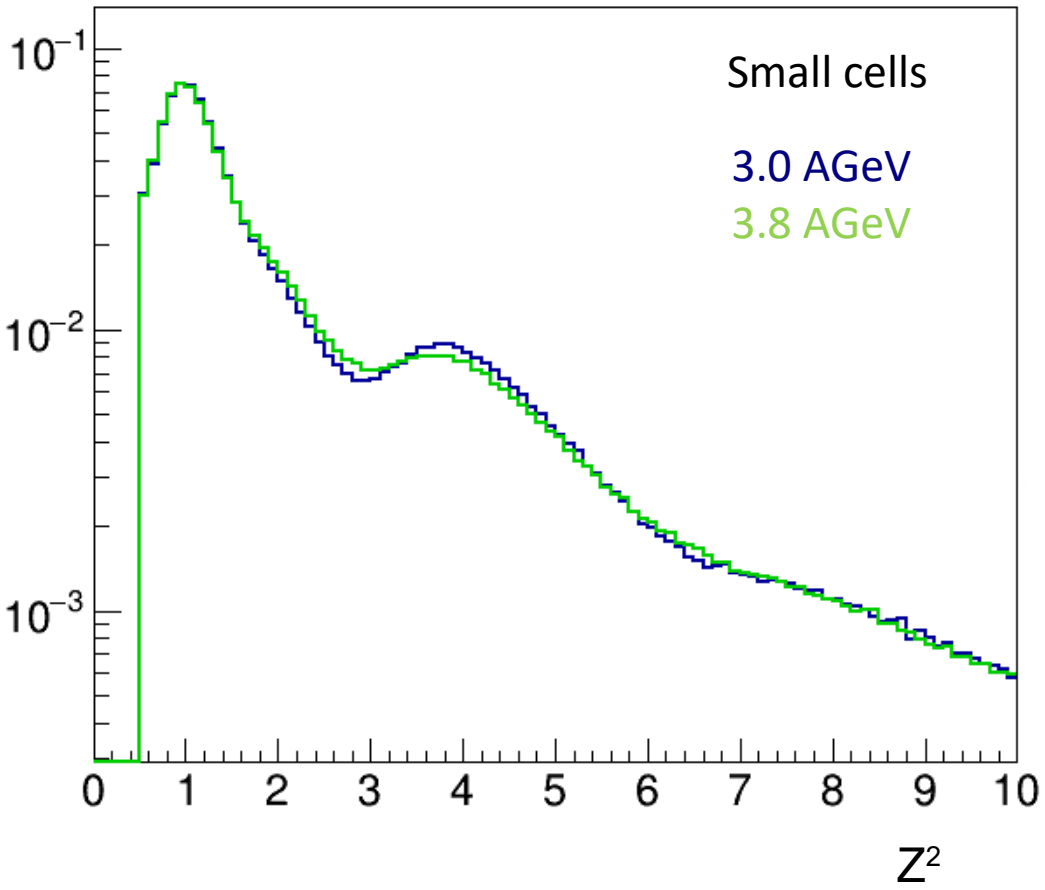
434 readout channels.





new bmnroot experimental data production train





- Comparison of the charge distributions over the scintillation wall for the two energies at 3.0 and 3.8 GeV for the CCT2 trigger.
- The two cell types (small and big) are presented separately.