

Si-station based on STS modules

Dmitrii Dementev for STS team,

12th BM@N Collaboration Meeting, Almaty, Kazakhstan



Outline

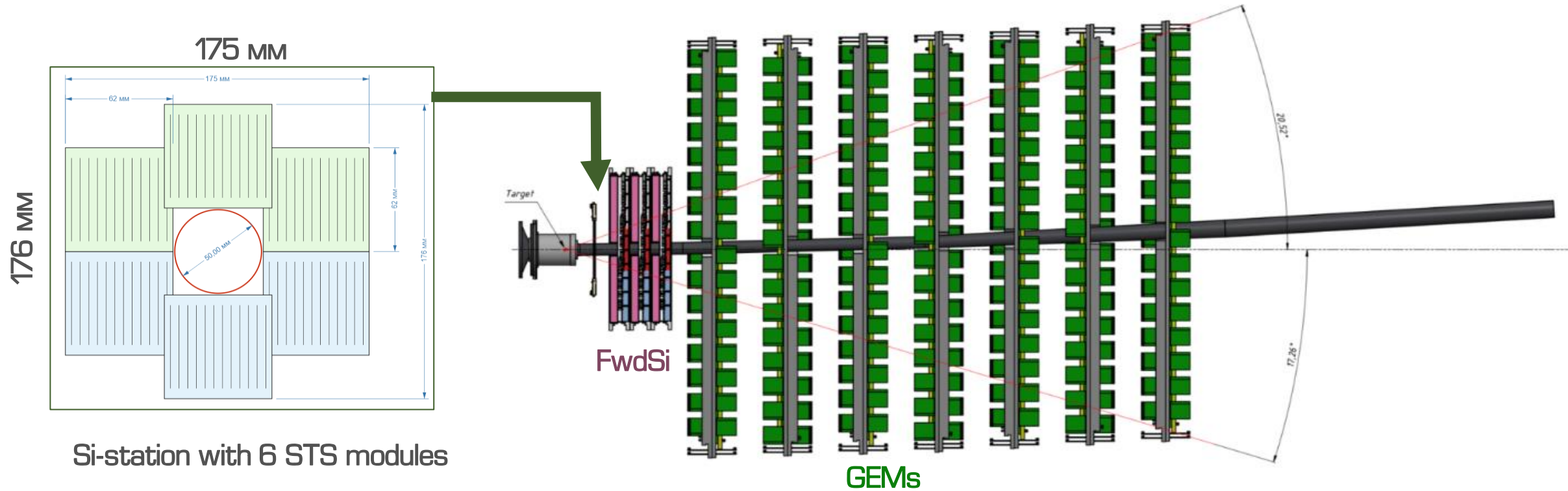
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- Mechanics
A. Sheremetev, D. Andreev, I. Gorelikov
- In-beam tests of the modules
R. A. Díaz, A. Kolozhvari, V. Leontyev, A. R. Alvarez, M. Shitenkov & D. Dementev
- DAQ integration
R. A. Díaz, A. Kolozhvari
- Timelines

Central Tracker of BM@N Experiment

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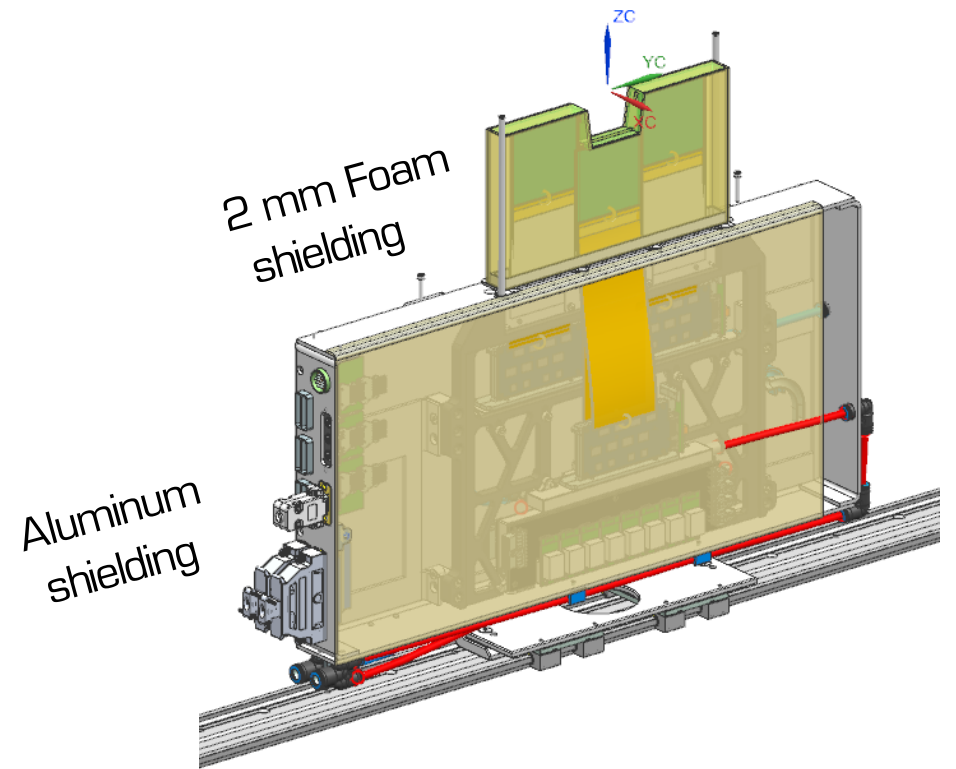
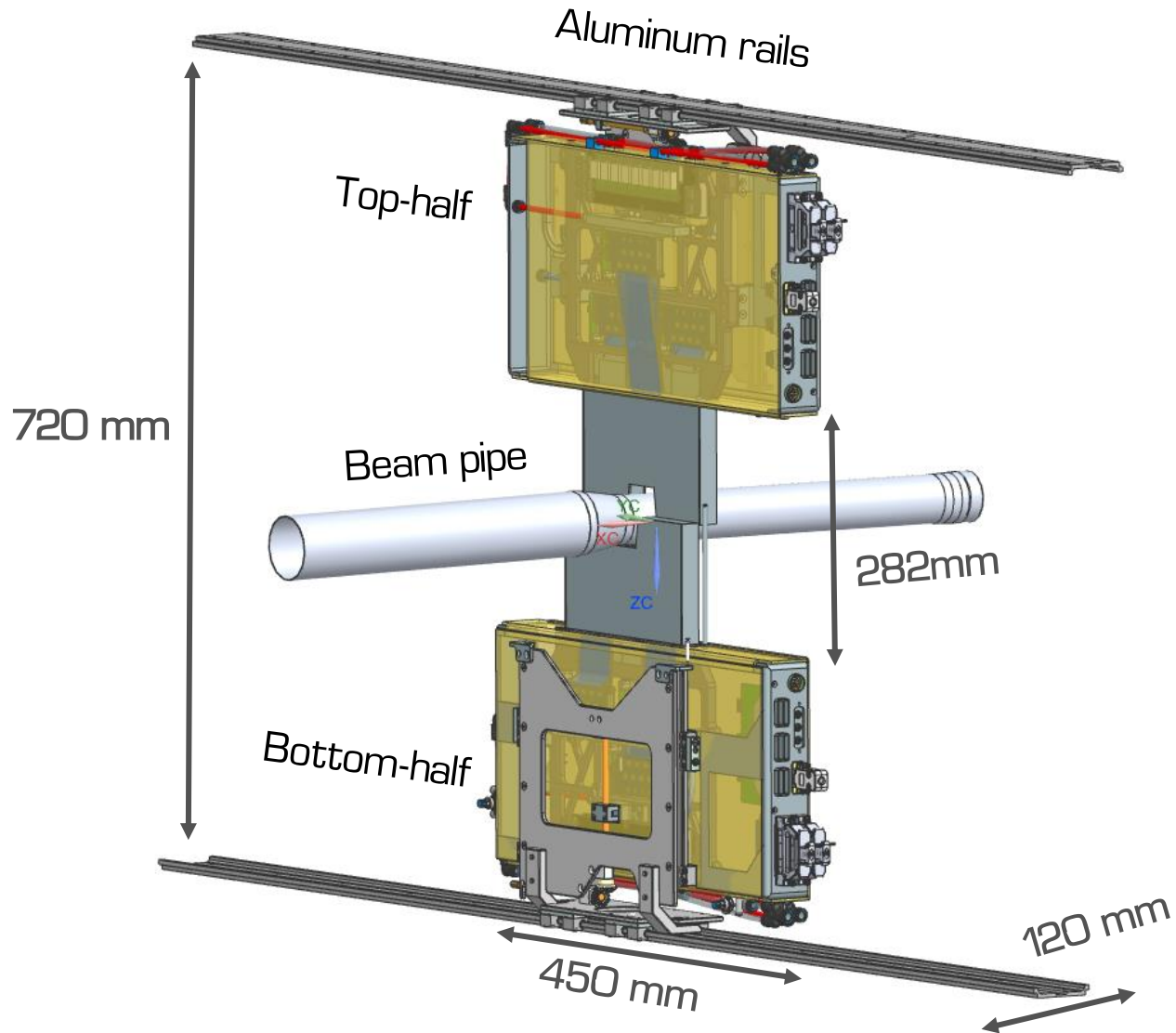


Size: $6 \times 6 \text{ cm}^2$;
Pitch: $58 \mu\text{m}$;
Stereo angle: 7.5 deg ;
Thickness: $320 \mu\text{m}$.

Exact position of the station along the beam pipe is not yet defined

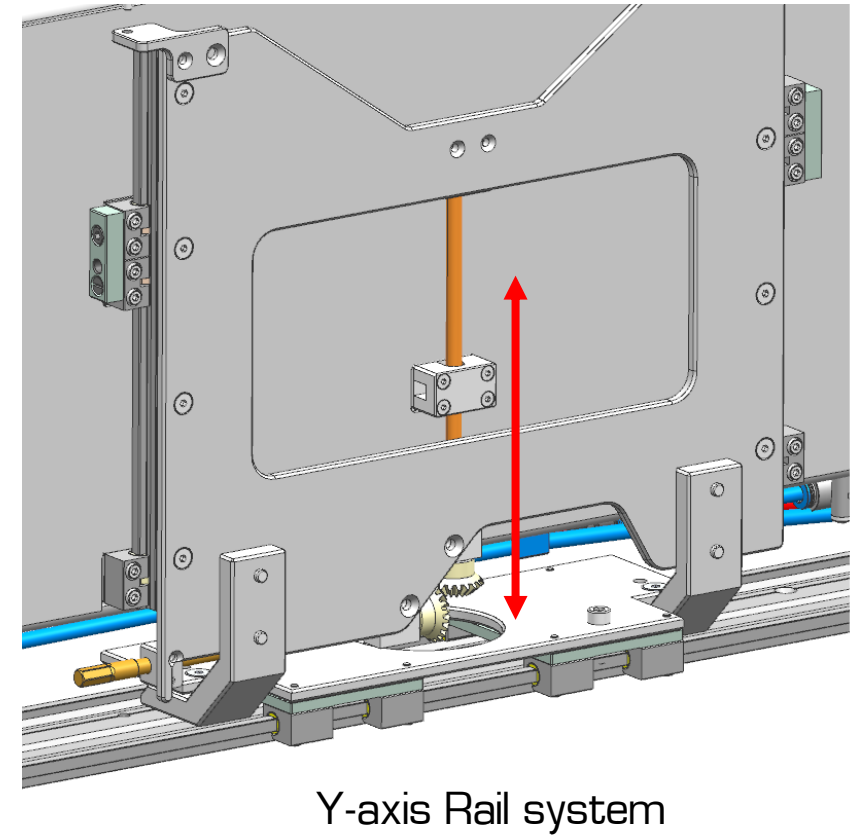
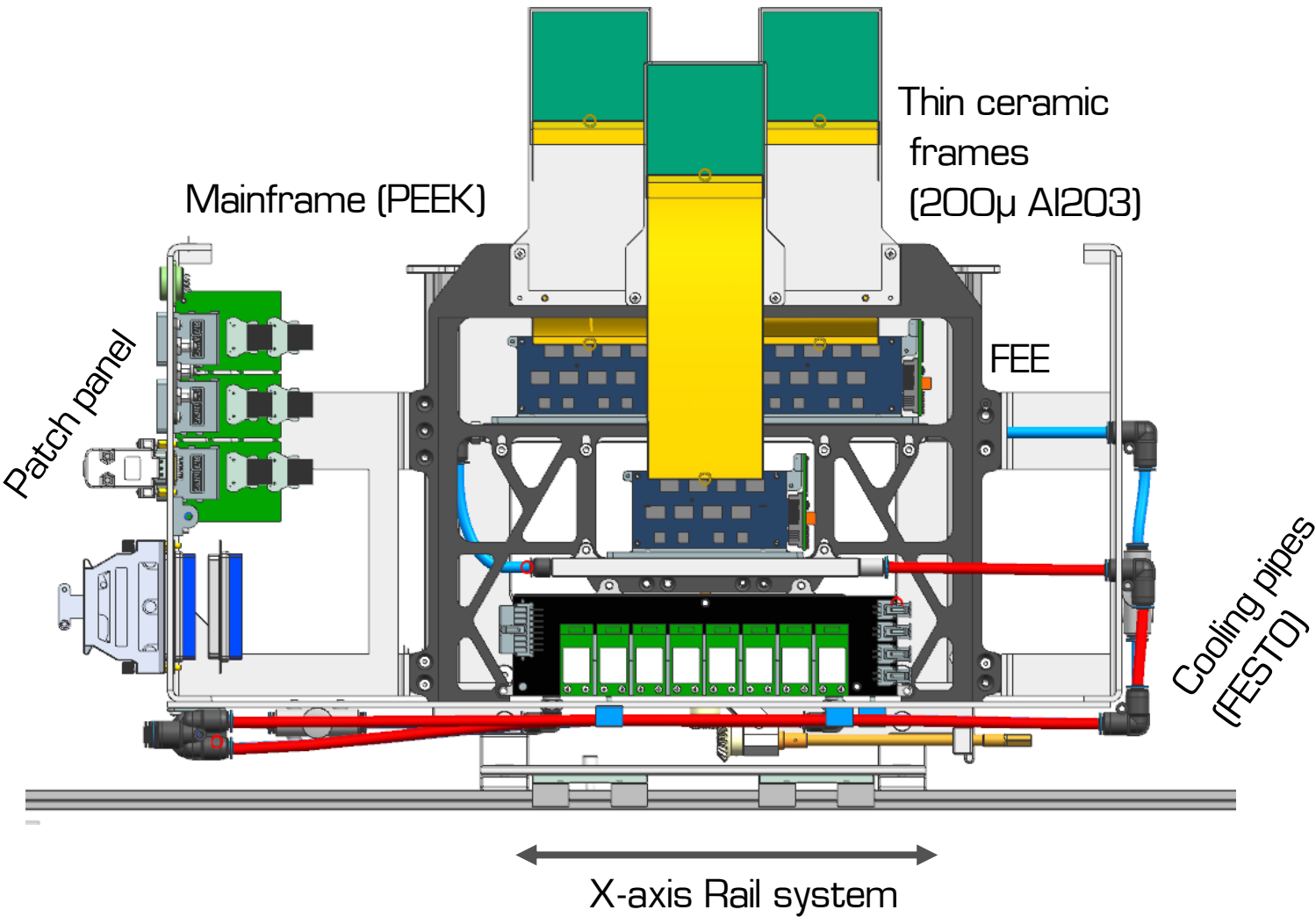
Si-plane with 6 STS modules

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Half-station

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System Components: Status

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Presented at Analysis and Detector Meeting (March)

	2024					
	March	April	May	June	July	Aug
STS modules	✓					
Mainframe	prototyping		final version			
Sensor-frames	production					
Heat-exch. FEE	production					
Rail System	delivery					
Heat-exch. PoB	✓					
Sheet-metal cover	production					
Foam box	production					
Connectors	✓					
Cables	✓					
PoB	✓					
LV & HV Power modules	✓					
Readout electronics	✓					
Chiller	✓					
FESTO Pipes & fittings	✓					
Rack	✓					

System Components: Status

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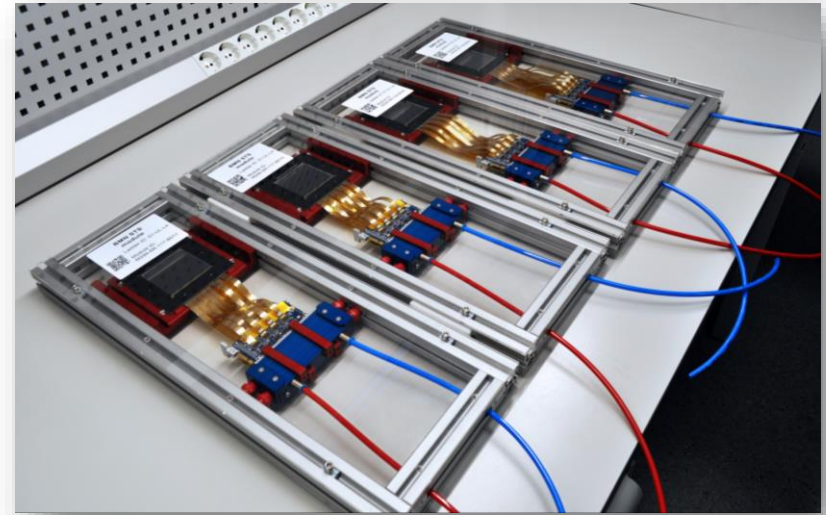


Updated

	2024			
	May	June	July	Aug
STS modules	✓			
Mainframe	deliv.	final version		
Sensor-frames	deliv.			
Heat-exch. FEE	prod.			
Rail System	✓			
Heat-exch. PoB	✓			
Sheet-metal cover	prod.			
Foam box	prod.			
Connectors	✓			
Cables	✓			
PoB	✓			
LV & HV Power modules	✓			
Readout electronics	✓			
Chiller	✓			
FESTO Pipes & fittings	✓			
Rack	✓			

STS Modules

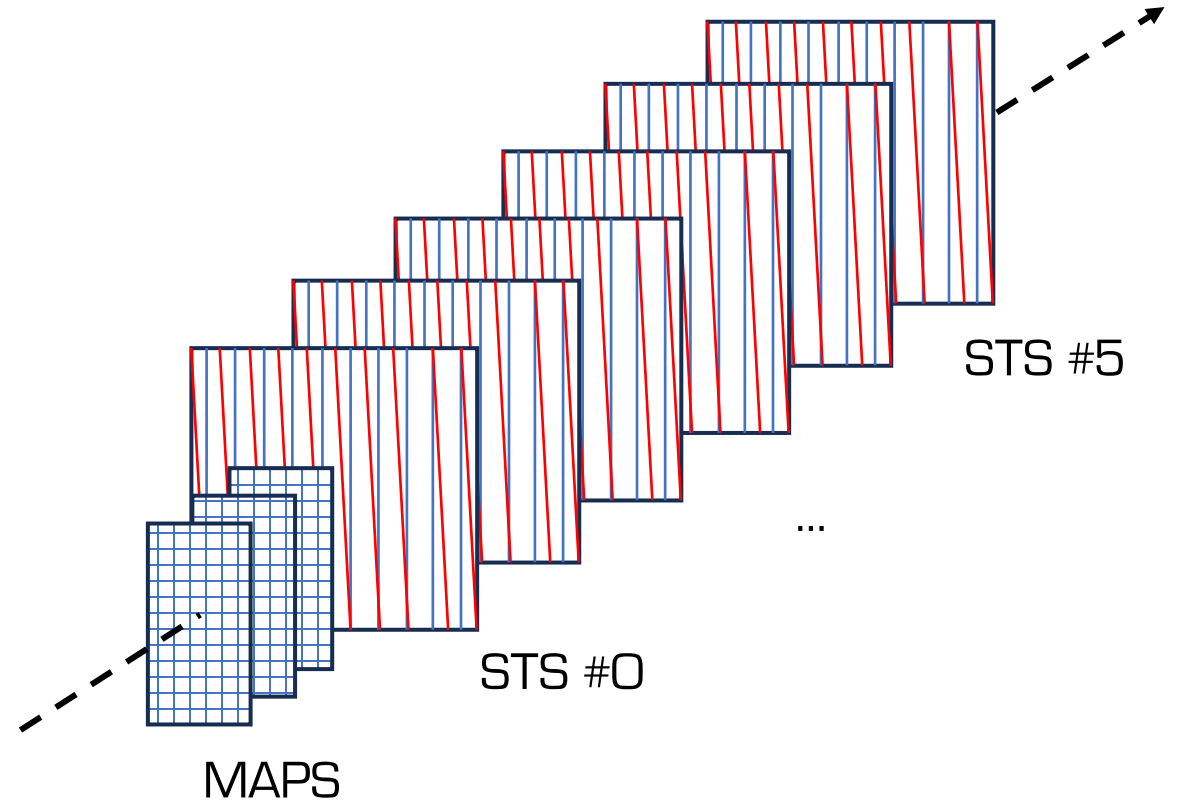
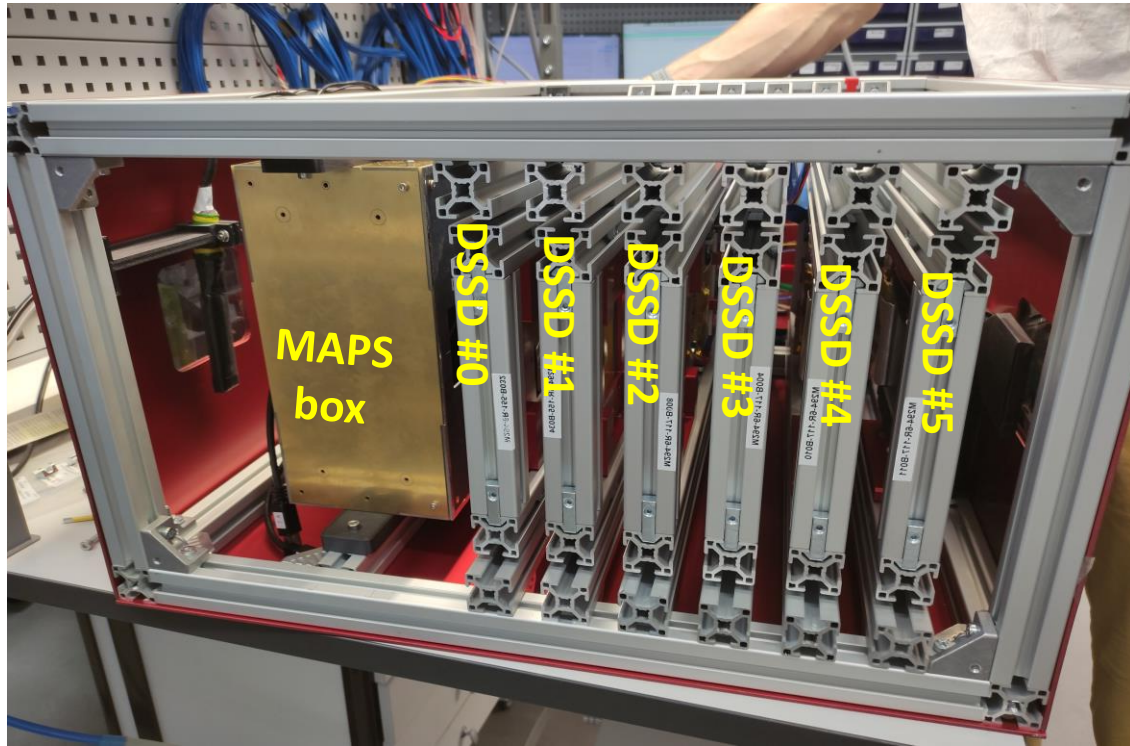
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module_ID	Cable length	NOK channels	Av. noise P-side	Av. noise N-side
M294-6R-117-B010	117	20	1184	1058
M294-6R-117-B011	117	14	1093	942
M294-6R-117-B004	117	28	945	865
M294-6R-117-B008	117	24	928	892
M294-6R-155-B034	155	19	1095	885
M294-6R-155-B032	155	56	1216	799

Beam telescope for the in-beam tests at PNPI

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Beam telescope with 3 layers of MAPS & 6 layers of DSSD sensors:

- 12 288 strips;
- 1 572 864 pixels.

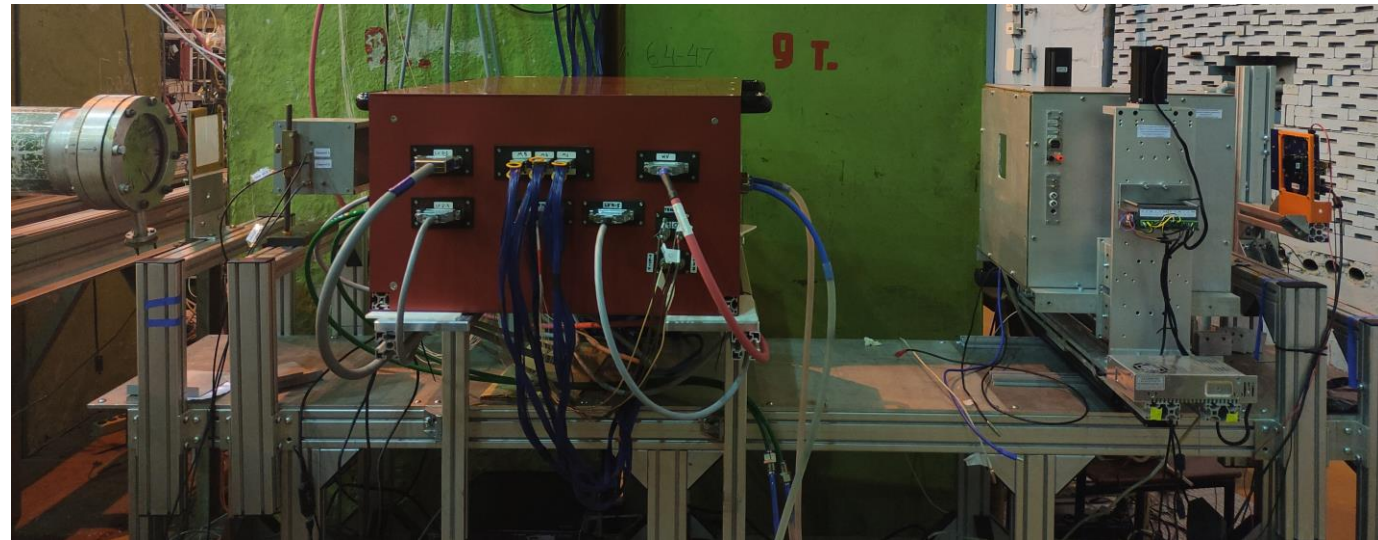
MAPS sensors were provided by SPbU group (V.Zgerbchevsky & team)

In-beam tests at Gatchina

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Study of:

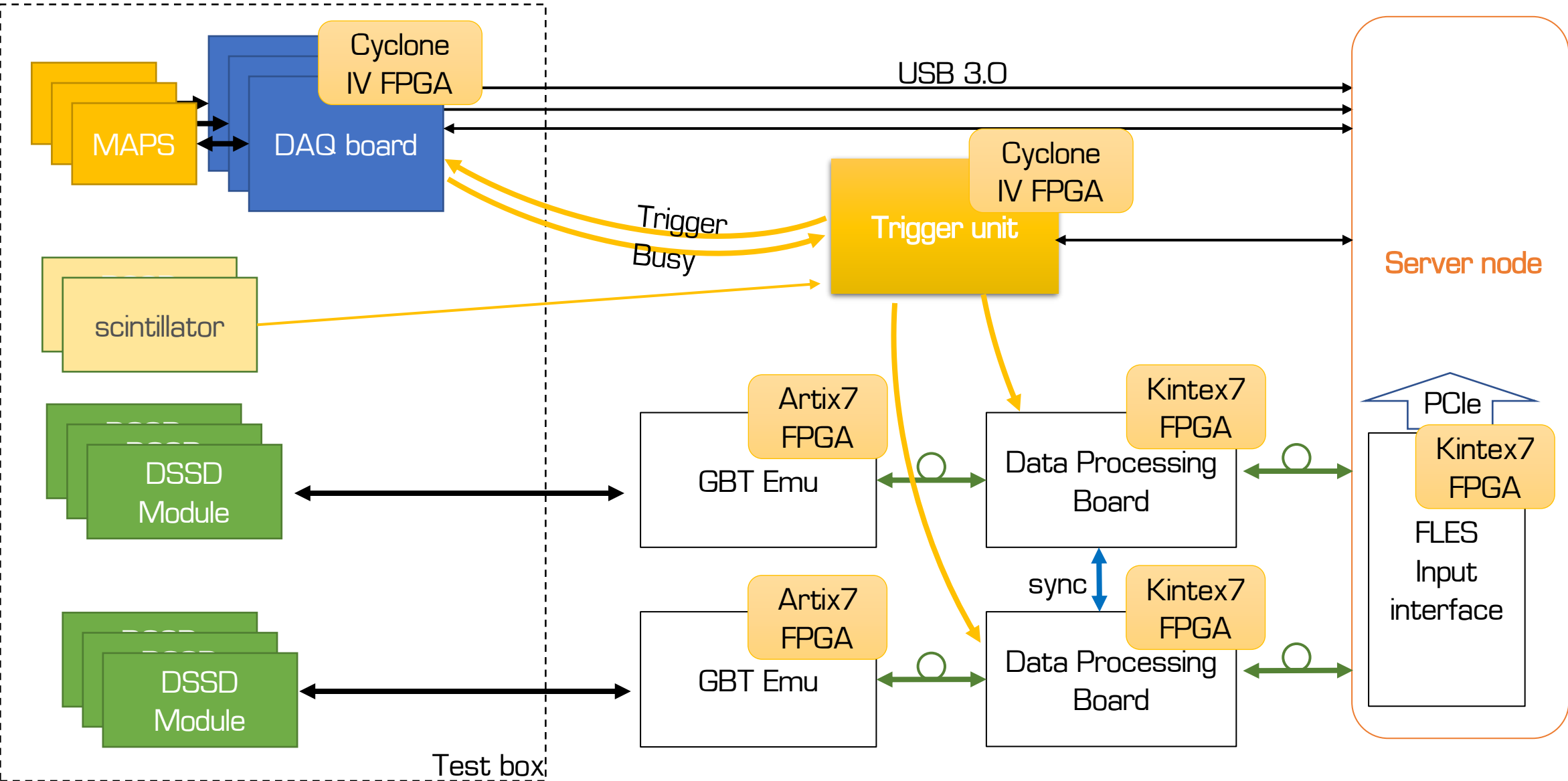
- Gain discrepancies;
- CCE;
- Efficiencies dependence on
 - Area of the sensor;
 - Bias voltage;
 - Threshold setting;



- 1 GeV protons with beam intensities $10^4 - 10^5 \frac{p}{\text{cm}^2 \cdot \text{s}}$
- 200 MeV protons with beam intensity $\sim 10^4 \frac{p}{\text{cm}^2 \cdot \text{s}}$

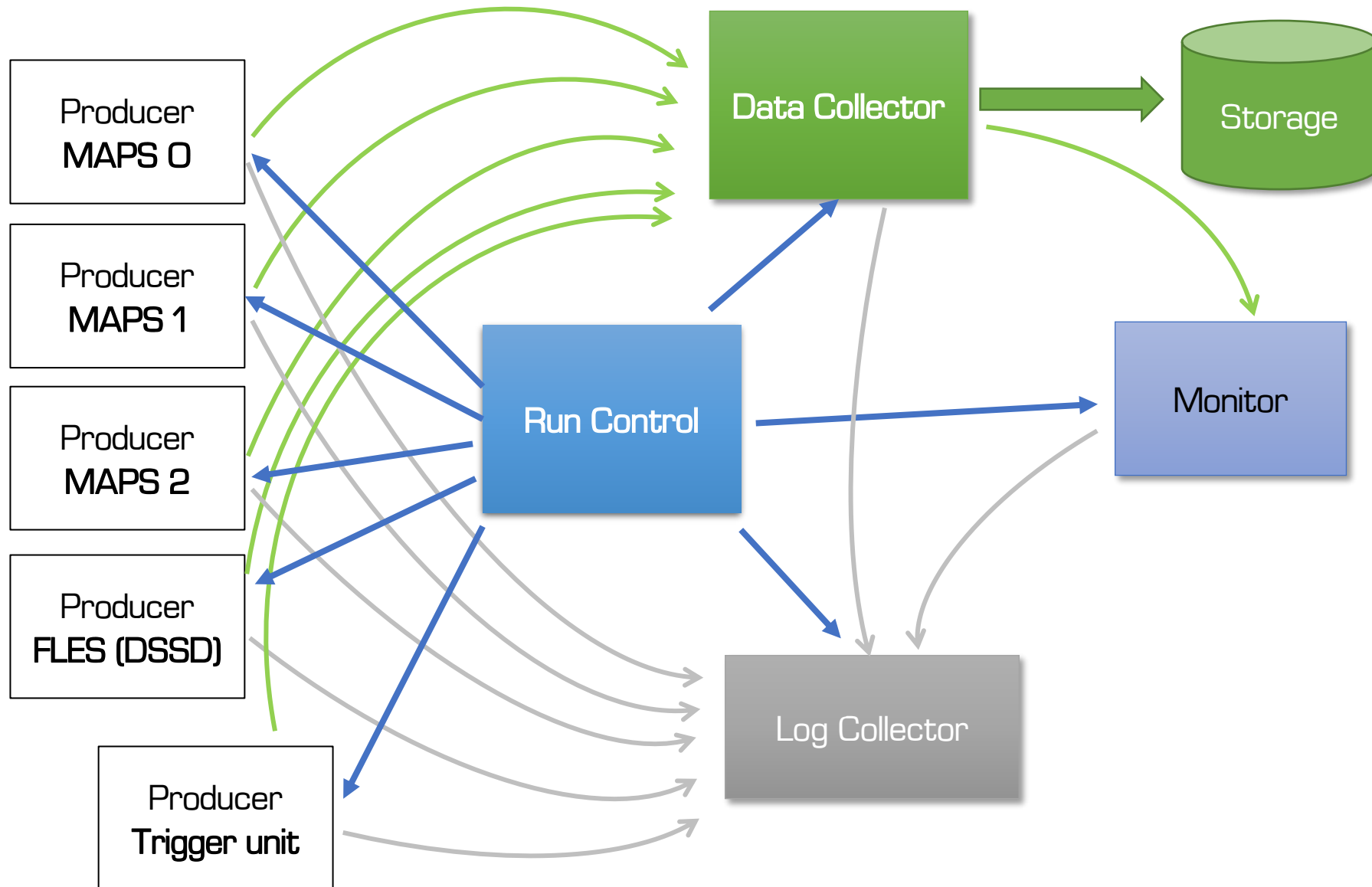
Data Acquisition

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Event Building

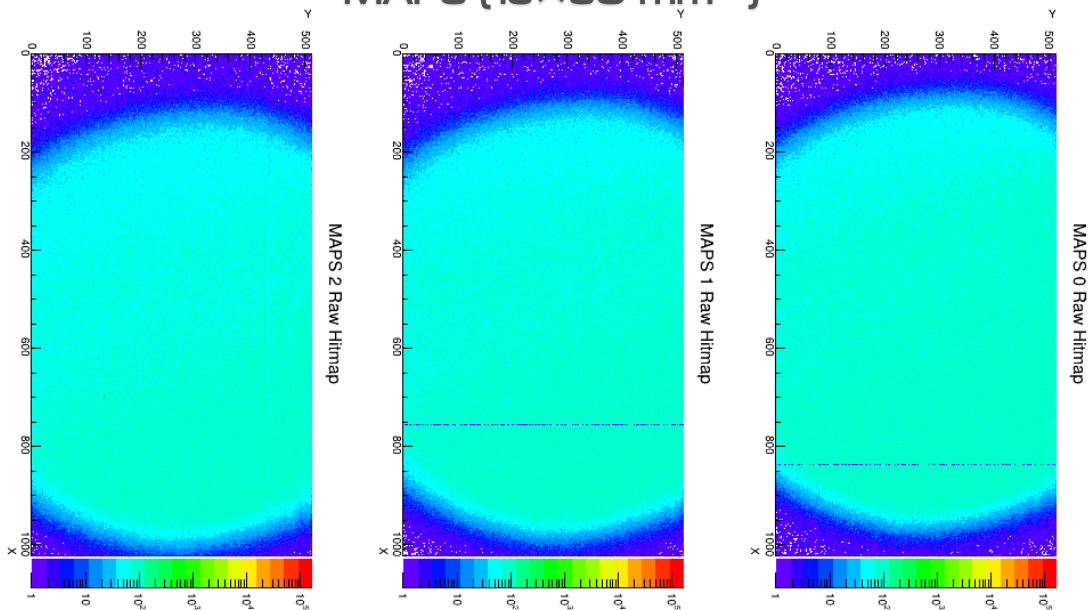
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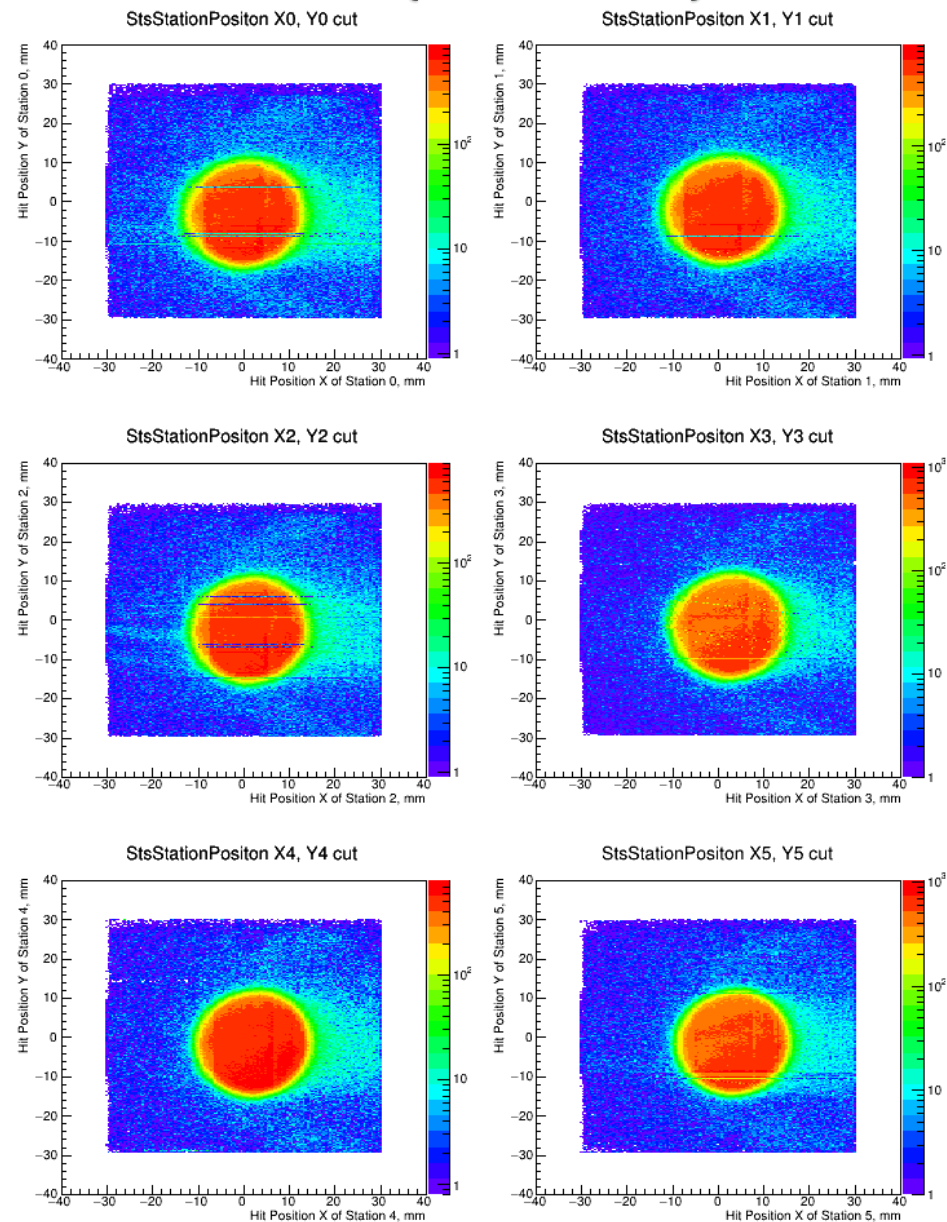
Beam profiles: 1 GeV beam

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MAPS (15×30 mm²)

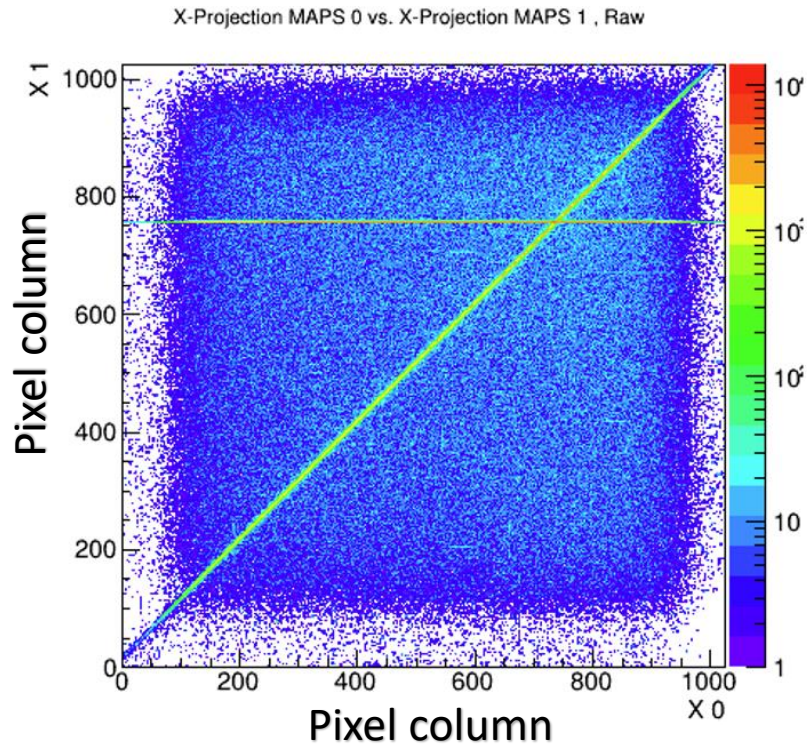


DSSD (60×60 mm²)

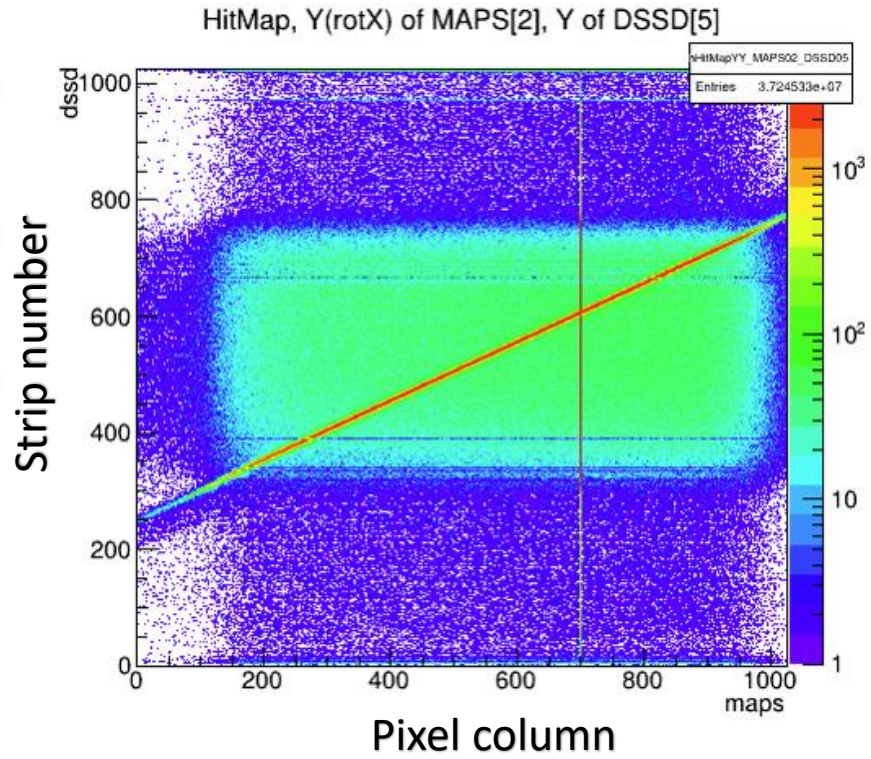


Space YY correlations

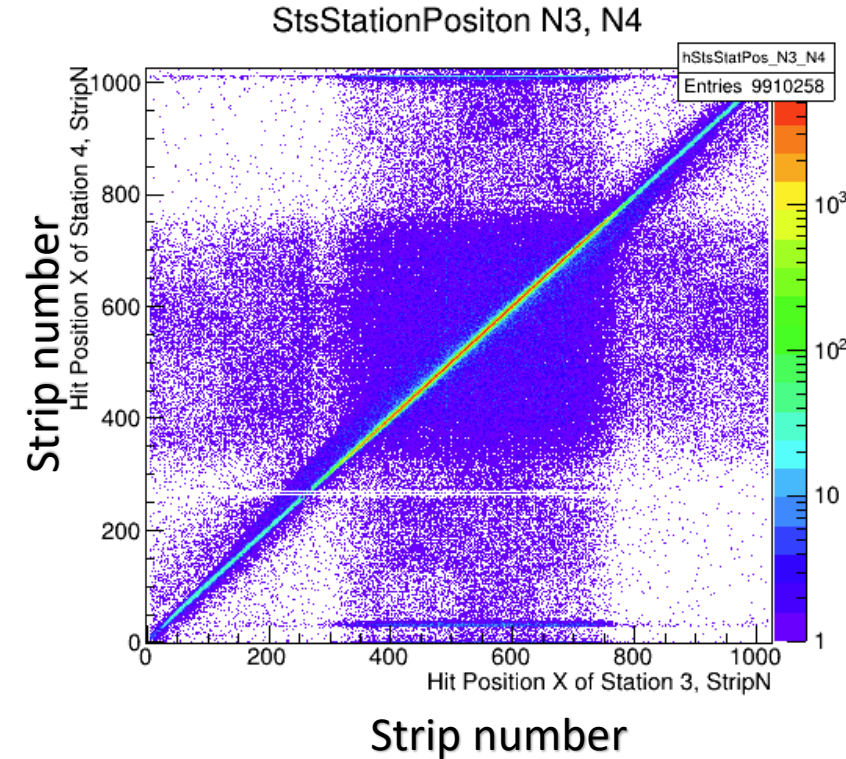
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MAPS & MAPS



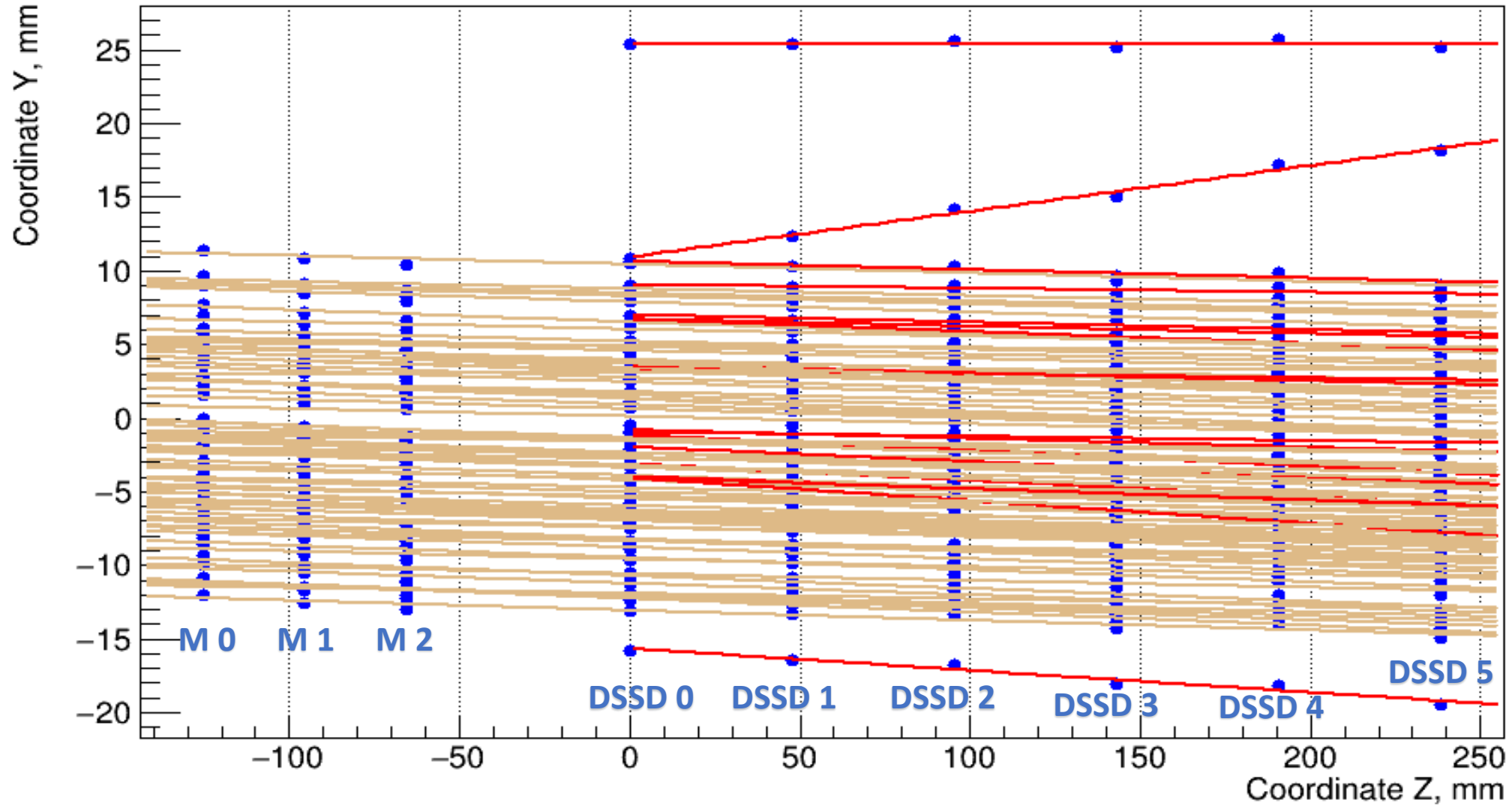
MAPS & DSSD



DSSD & DSSD

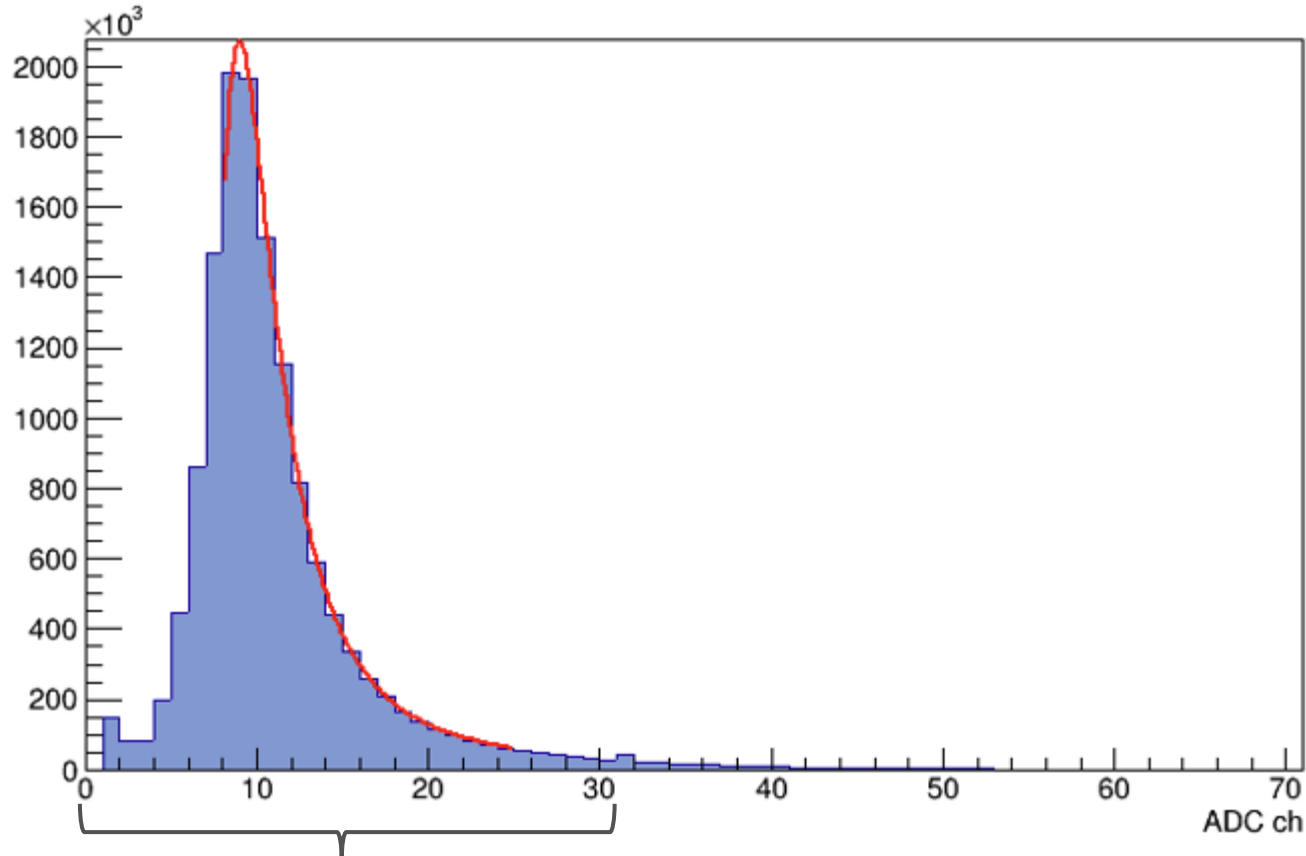
2D tracks

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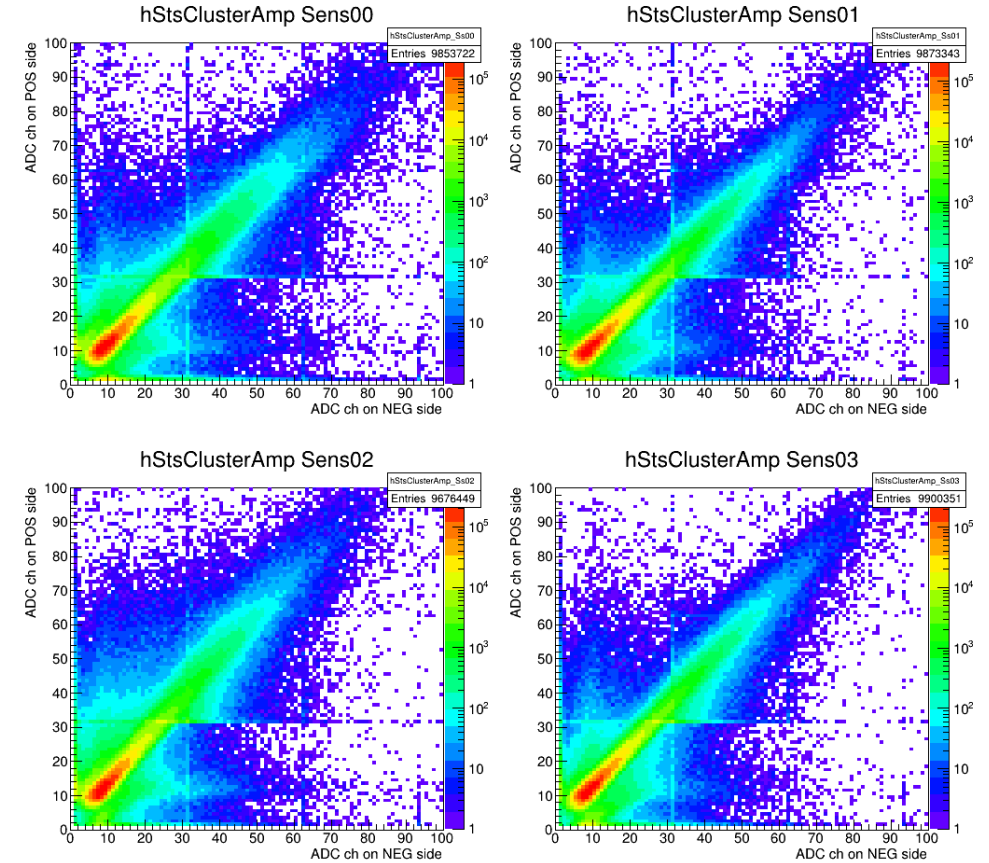


DSSD: Signal Amplitudes for 1 GeV beam

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Signal amplitude (ADC values)

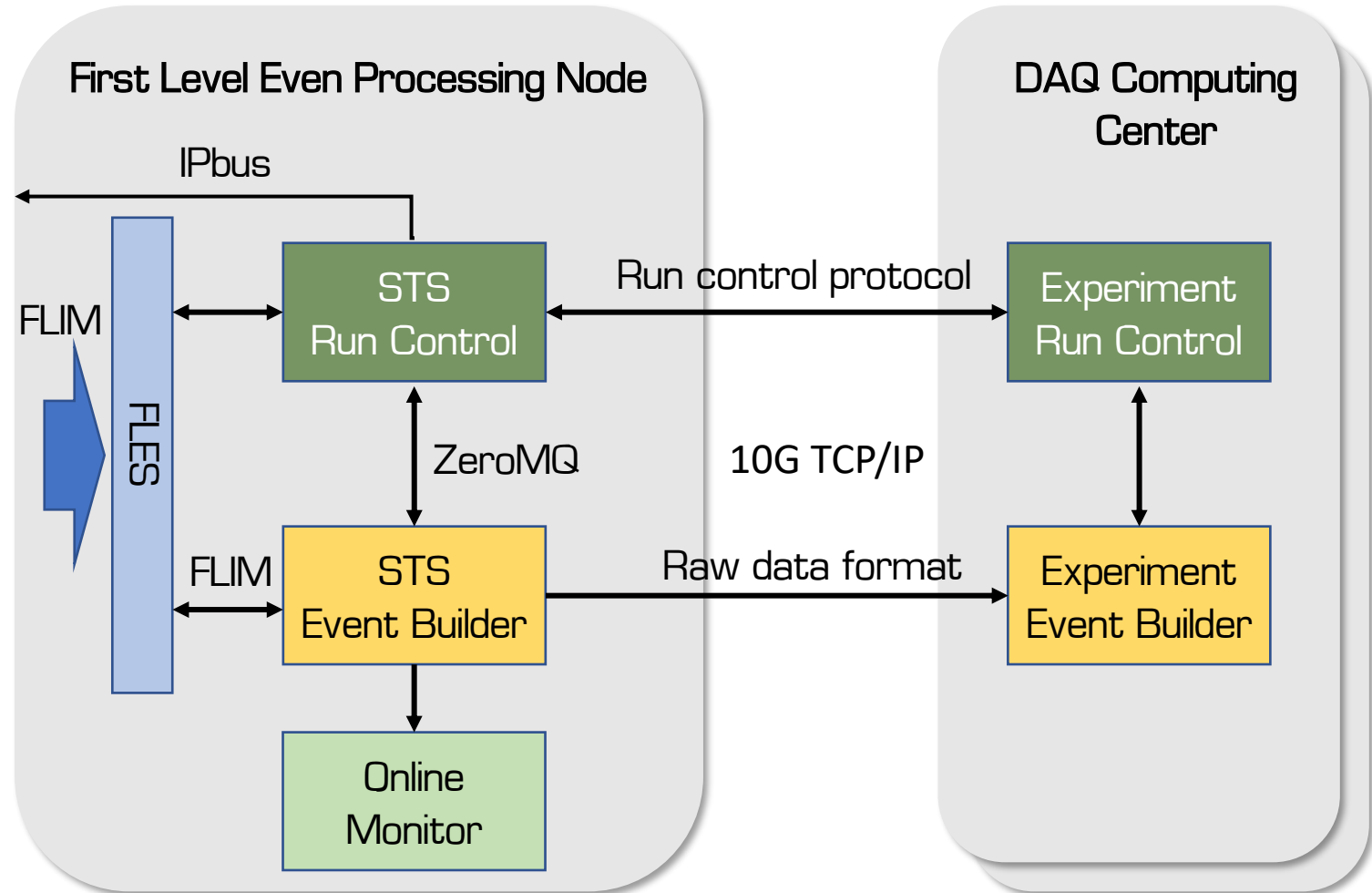


Correlation of signal amplitudes for p- and n- sides of the sensor

DAQ Integration

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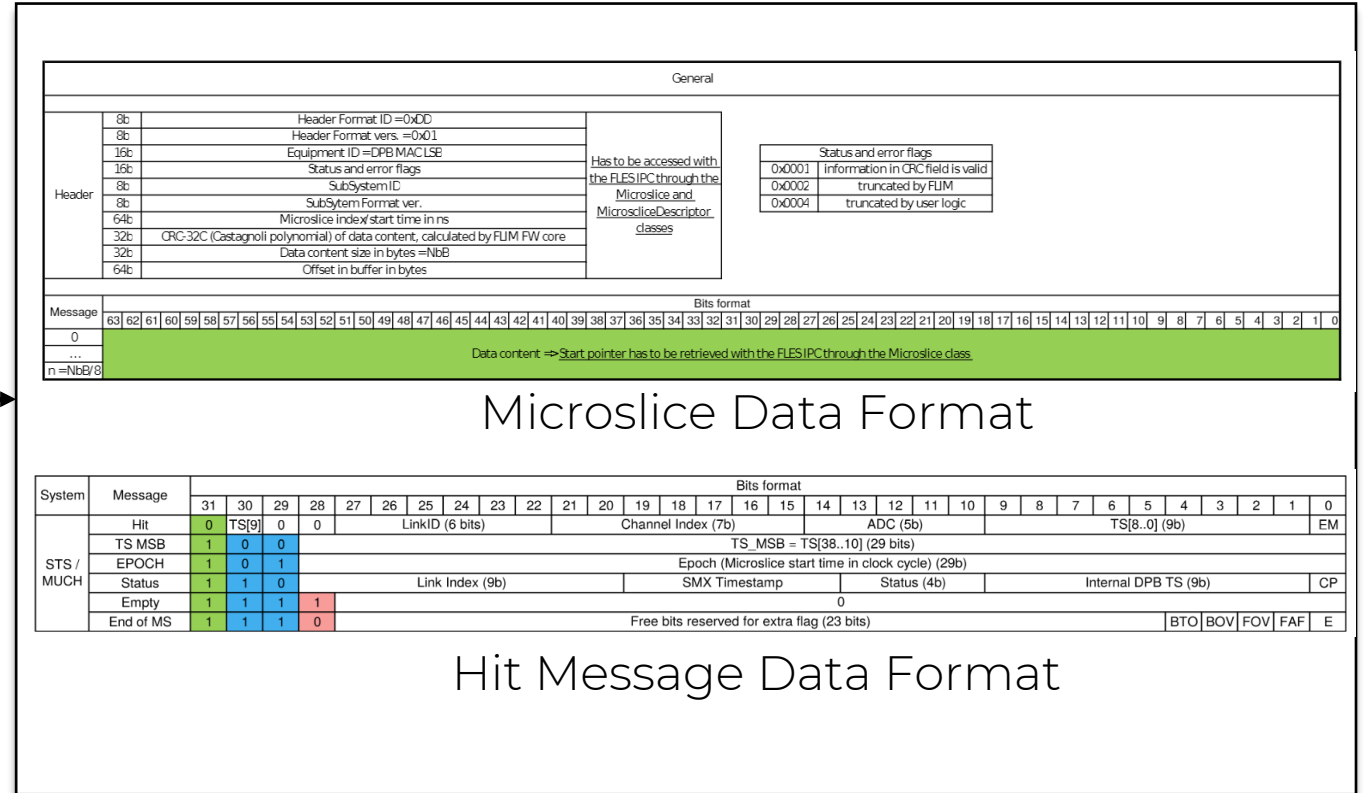
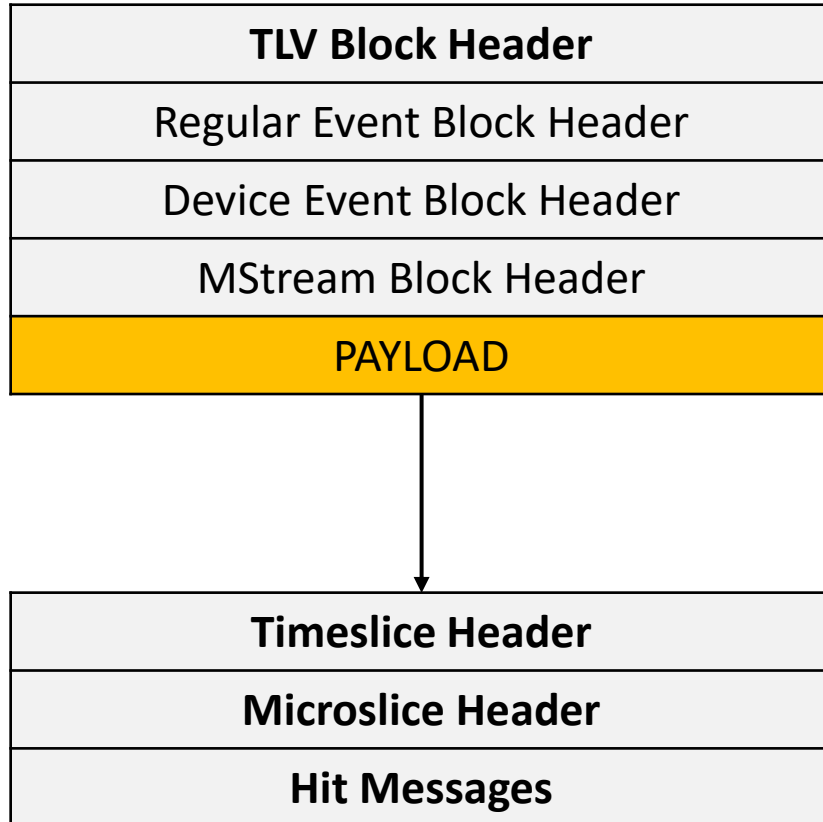
- Data messages:
 - Regular events;
 - Start/Stop run;
- Run Control Messages (Master->Slave):
 - RC_CMD_START;
 - RC_CMD_STOP;
 - RC_CMD_EV_NUM_CHECK;
- Run Control Messages (Slave->Master):
 - RC_CMD_FSM_STATE;
 - RC_CMD_EV_NUM_CHECK;
 - RC_CMD_ERROR



Based on the discussion with Ivan Filippov

Raw Data Format

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STS Payload Data Format

Conclusion & Timelines

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- 6 STS modules for the Si-station were tested with the proton beams in Gatchina (March 2024);
- Design of the Si-station is almost finished;
- DAQ integration was already started;
- Project timelines:

- **Spring 2024:** Production of the mechanical parts;
- **Summer 2024:** Assembling and tuning;
- **Fall of 2024:** Installation and integration in the test area.



*Thanks to **E. Martovitsky, S. Novogilov & S. Piyadin** for the installation of the STS rack*

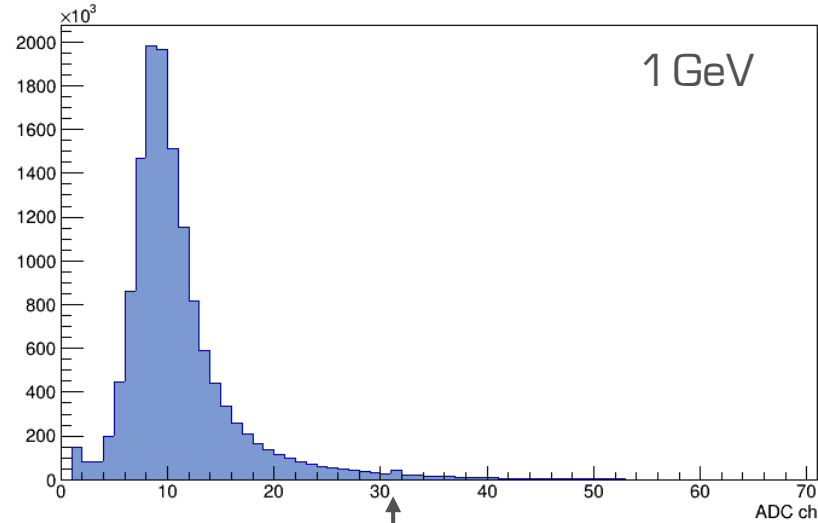
THANK YOU FOR YOUR ATTENTION!

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1 GeV & 200 MeV amplitudes comparison

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Saturation of the ADC
For 1-strip clusters

