Existing options for the in-beam tests of MICA chips, MICA HICs and their readout in Russia

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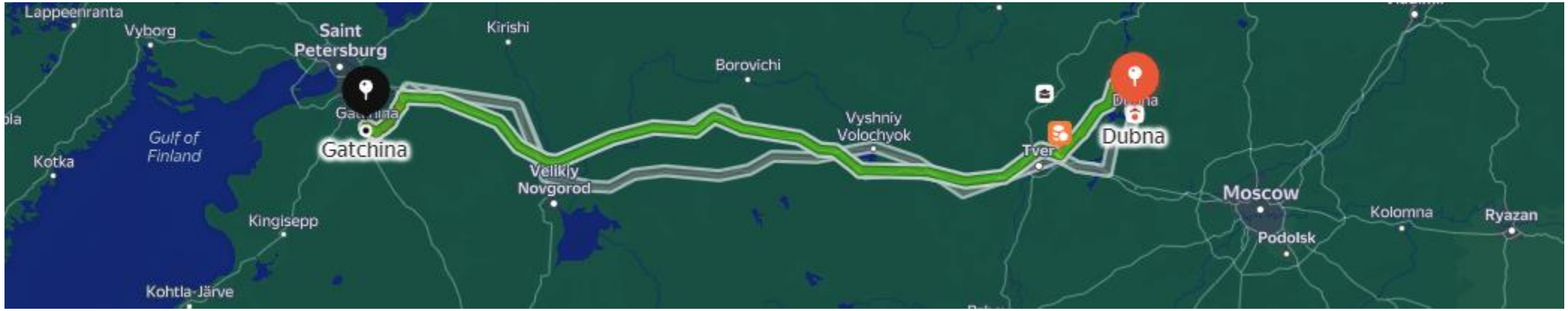
MICA tests

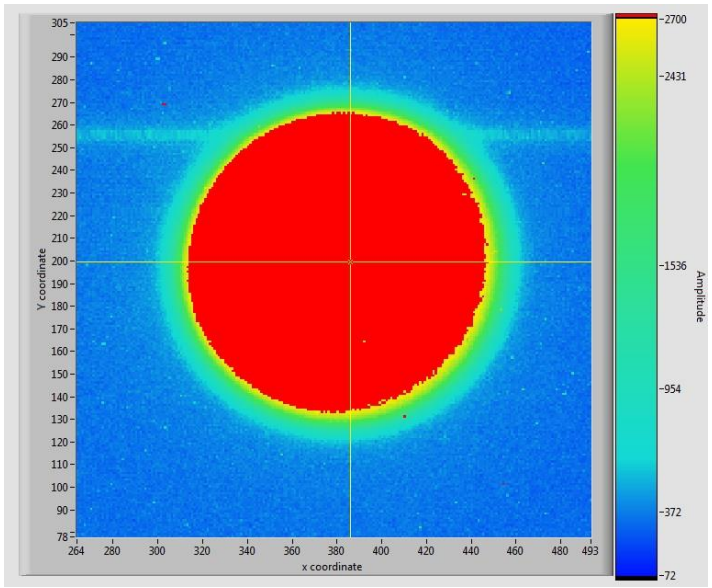
- Functional tests and characterization “on the table”;
- In-beam tests in the telescope mode: study of the efficiency, spatial resolution, etc;
- In-beam tests of the HICs: daisy chain readout;

We propose to use ***SC-1000*** accelerator (**Gatchina**) and ***Nuclotron*** (**Dubna**) for the in-beam tests of MICA chips and HICs



SC-1000 Accelerator at PNPI (Gatchina)

Synchrocyclotron SC-1000



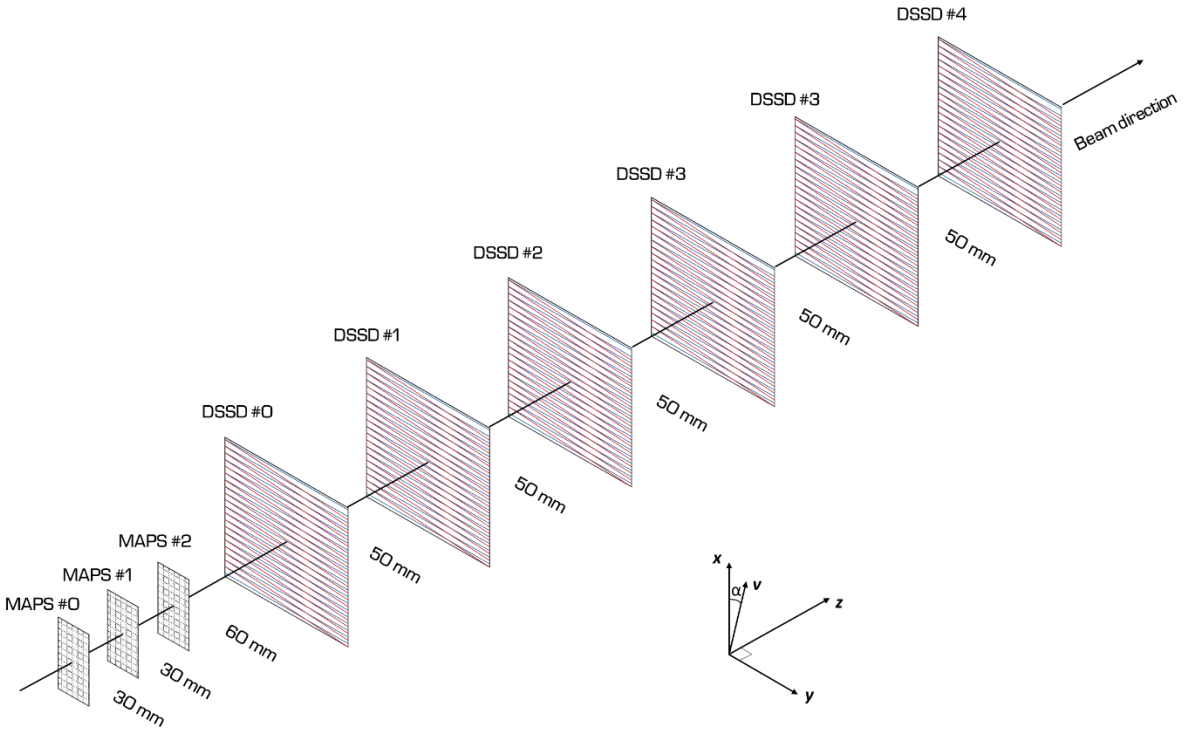
Beam profile (1 Gev protons)

Test bench

Beams of 100-1000 MeV protons, fluence $10^4 - 10^8\ cm^{-2}s^{-1}$, beam diam. 25 mm;

Could be used for the study of ***spatial resolution, efficiency, charge sharing*** **effects**, etc.

Beam telescope: tests at SC-1000 in 2024



DSSD

- Sensor size: 62×62 mm²;
- Strip pitch (P/N side): 58 µ/58 µm;
- Num. of strips per side: 1024;
- Stereo-angle: 7.5°;
- Thickness: 300 µm.

MAPS

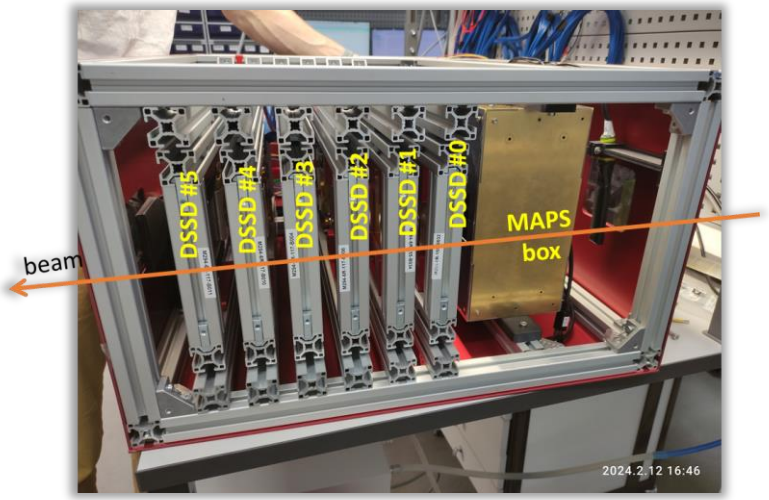
Provided by SPbU team

- Sensor size: 15×30 mm² (X×Y);
- Number of pixels: 1024 × 512 (X×Y);
- Pixel size: 29.24 µm × 26.88 µm (X×Y);
- Thickness: 50 µm.

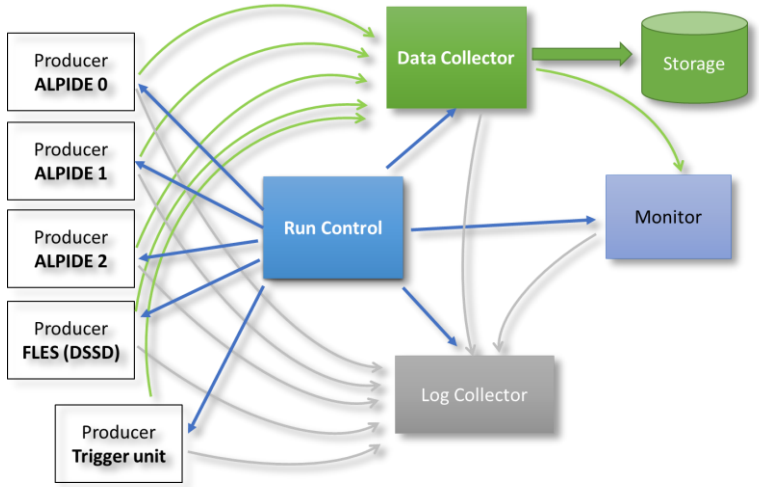
Tests with 1 GeV & 200 MeV proton beams at SC-1000:

- Study of the efficiency of DSSD sensors
- Merging of the data from two different subsystems

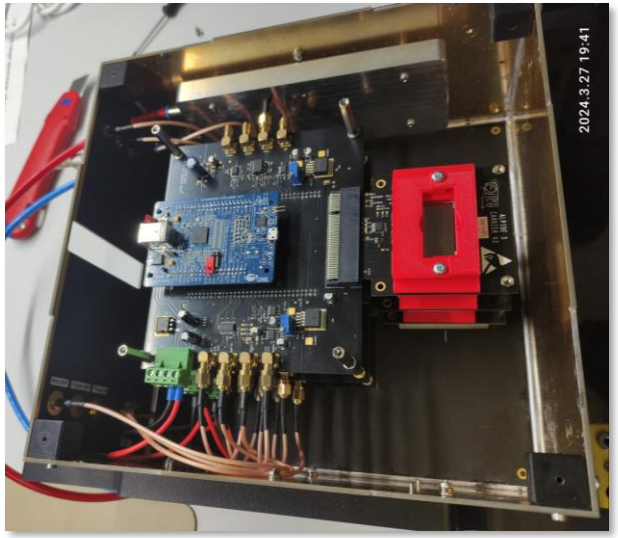
Beam telescope with MAPS & DSSD sensors



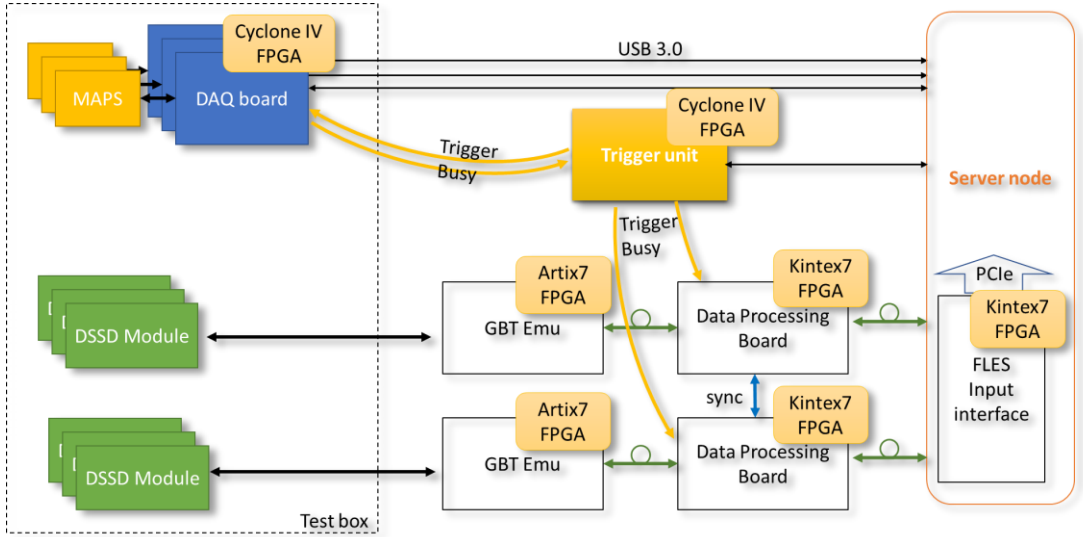
Telescope mechanics (A. Sheremetev)



Event builder based on EUDAQ (A. Kolozhvari, V. Leontyev)

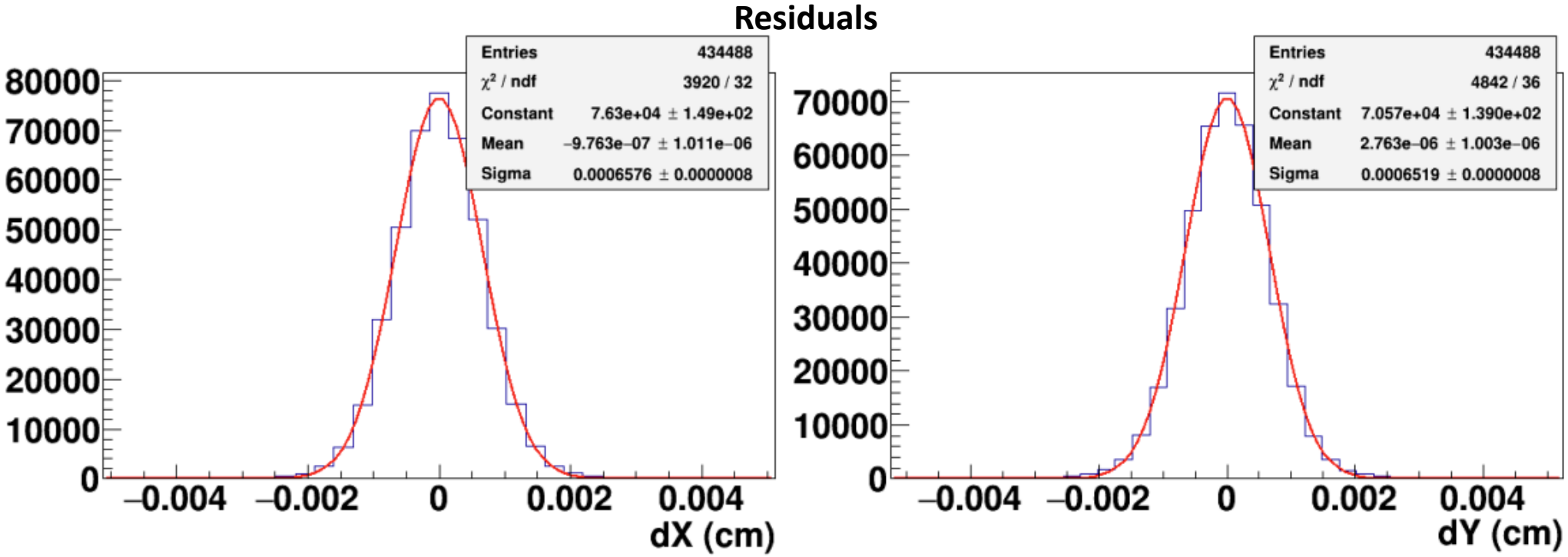


MAPS Readout (R.A. Diaz)



DAQ & Trigger system (M. Shitenkow, R.A. Diaz)

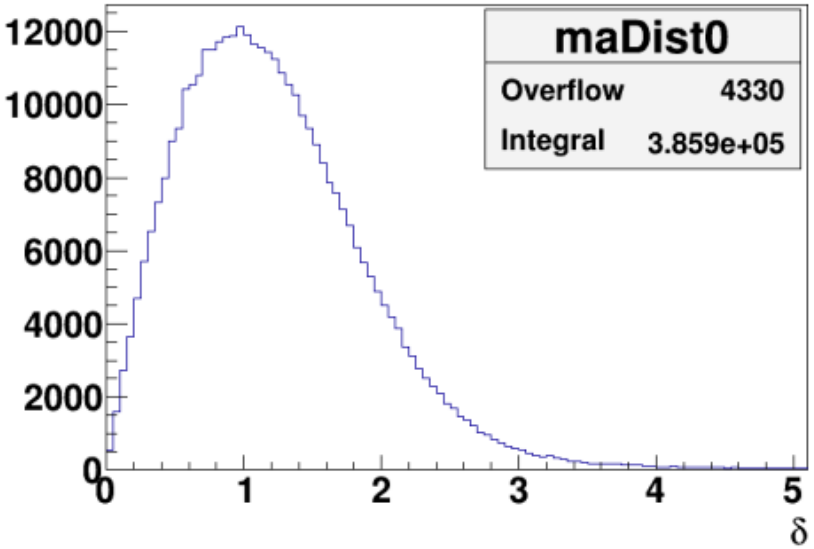
Spatial resolution of MAPS



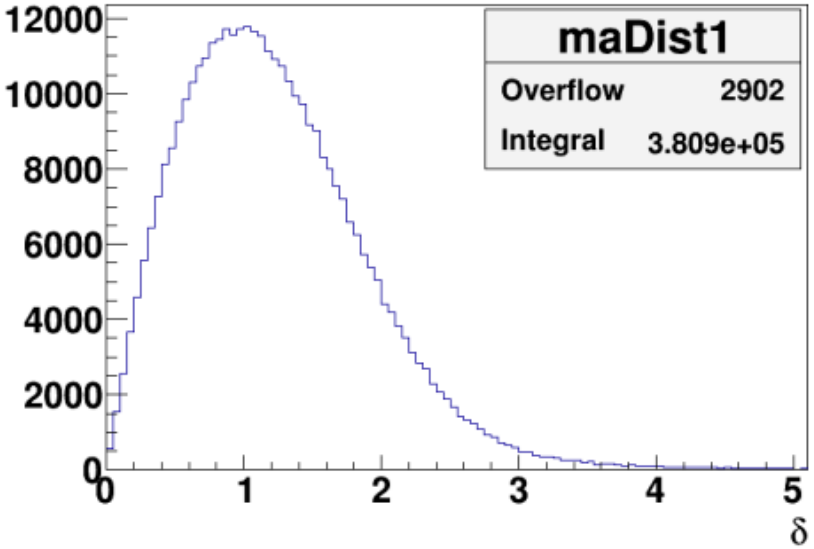
- Residual σ_x / σ_y = 6.58 um / 6.52 um;
- Spatial resolution X/Y = 5.0±0.4 um /4.9 ± 0.4 um;

Analysis made by I. Rufanov

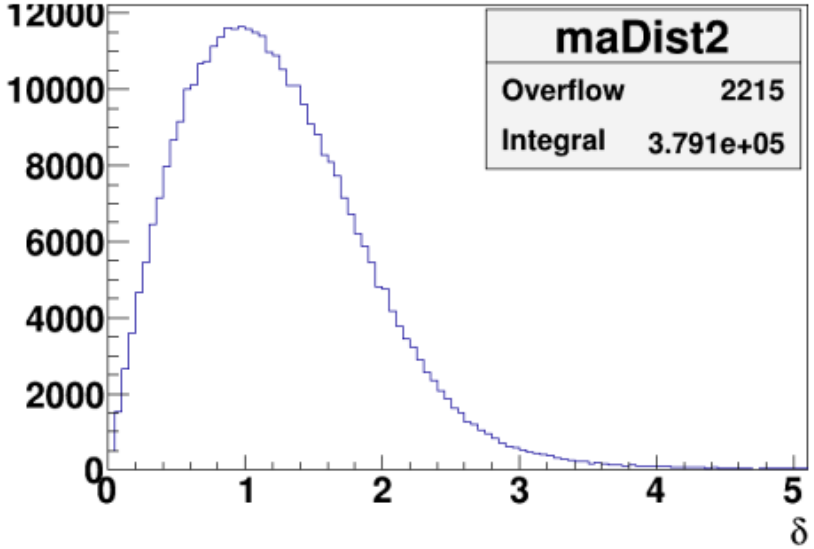
Detection efficiency of MAPS



MAPS 0



MAPS 1



MAPS 2

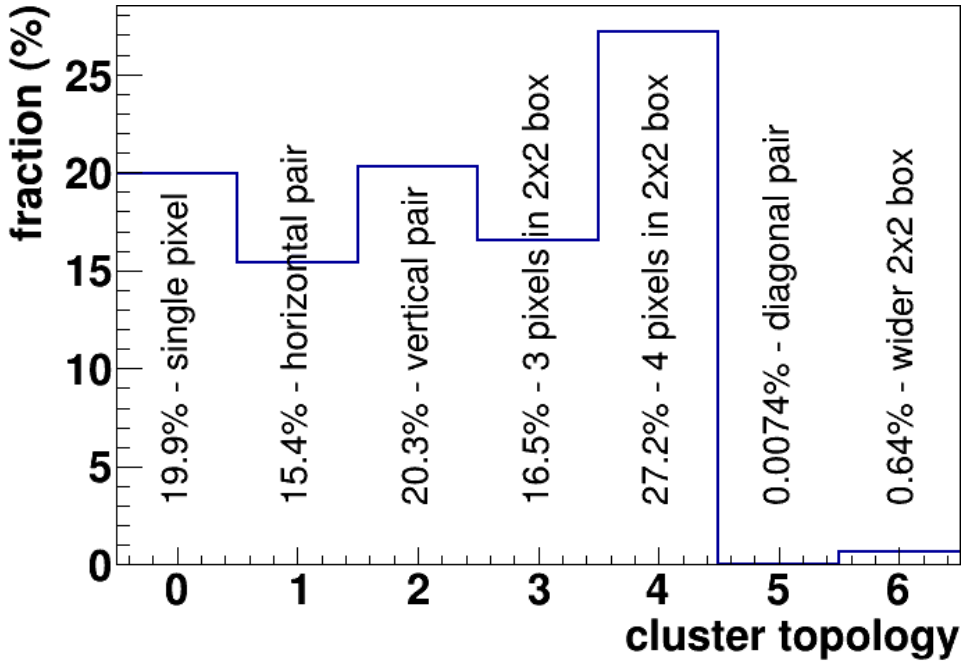
$$\delta = \frac{dx}{\sigma_x} \oplus \frac{dy}{\sigma_y}$$

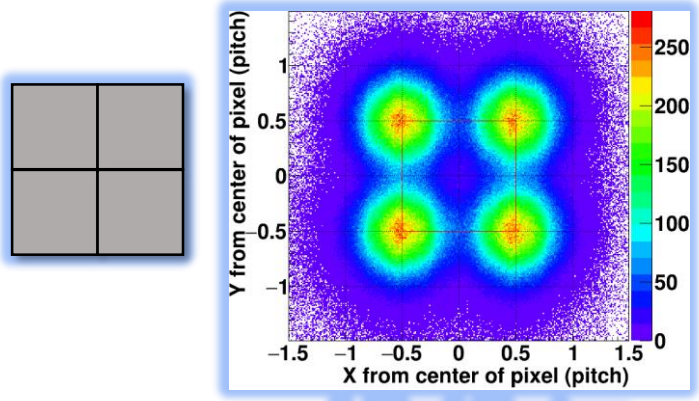
Tracks with $\sqrt{\chi^2/8} < 1$

Efficiency > 99 %

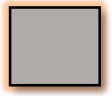
Analysis made by I. Rufanov

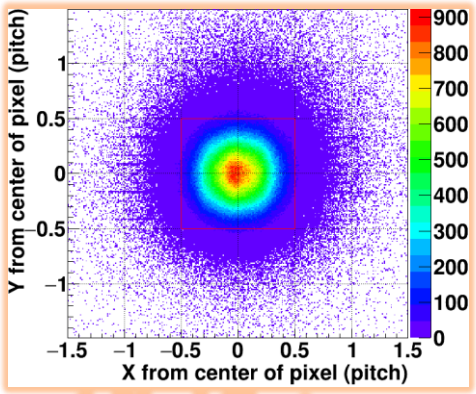
Cluster topology



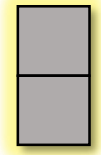


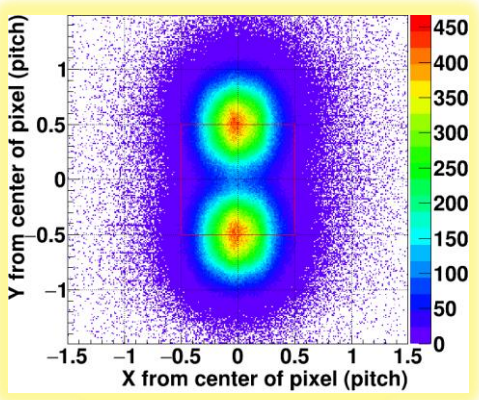
4-Pixel Clusters



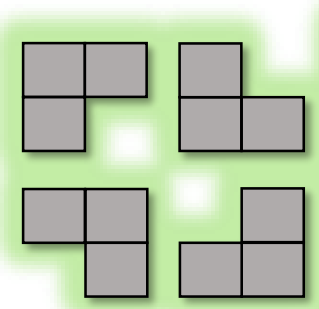


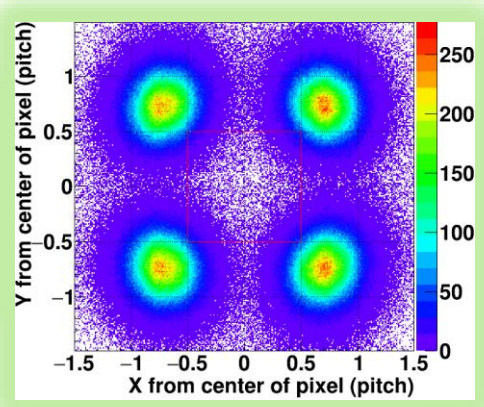
1-Pixel Clusters





2-Pixel Clusters

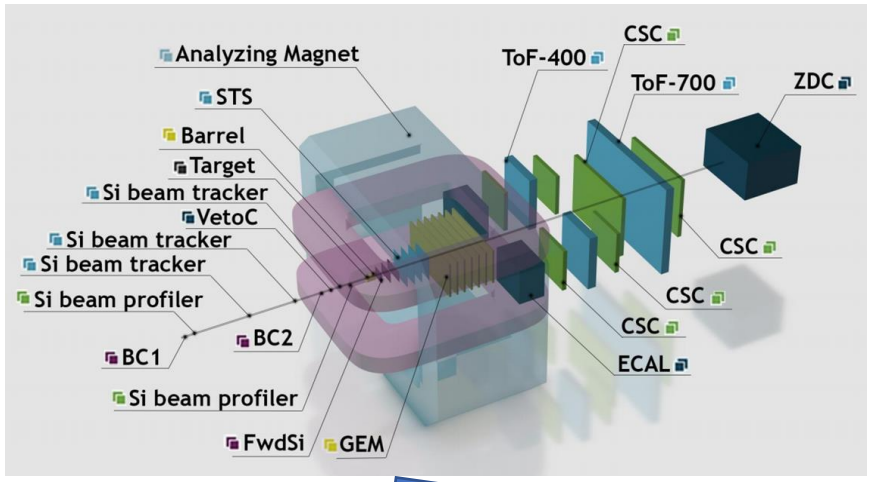


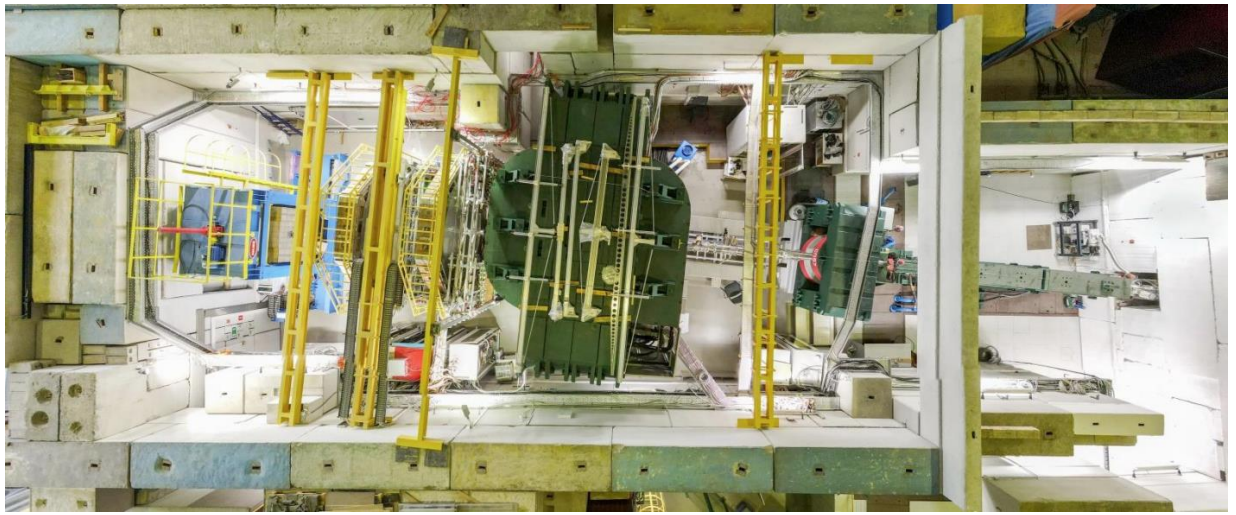


3-Pixel Clusters

Analysis made by I. Rufanov

BM@N Experiment at NICA



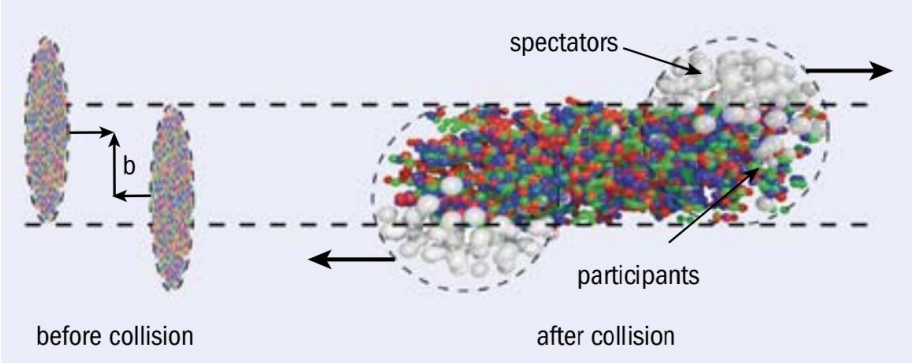


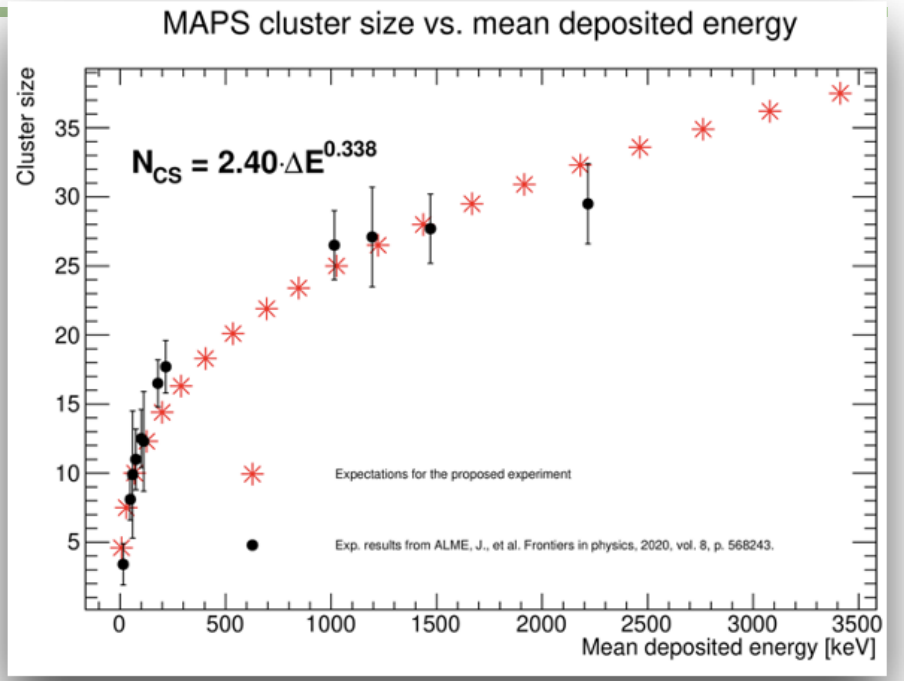
BM@N setup (Top view)

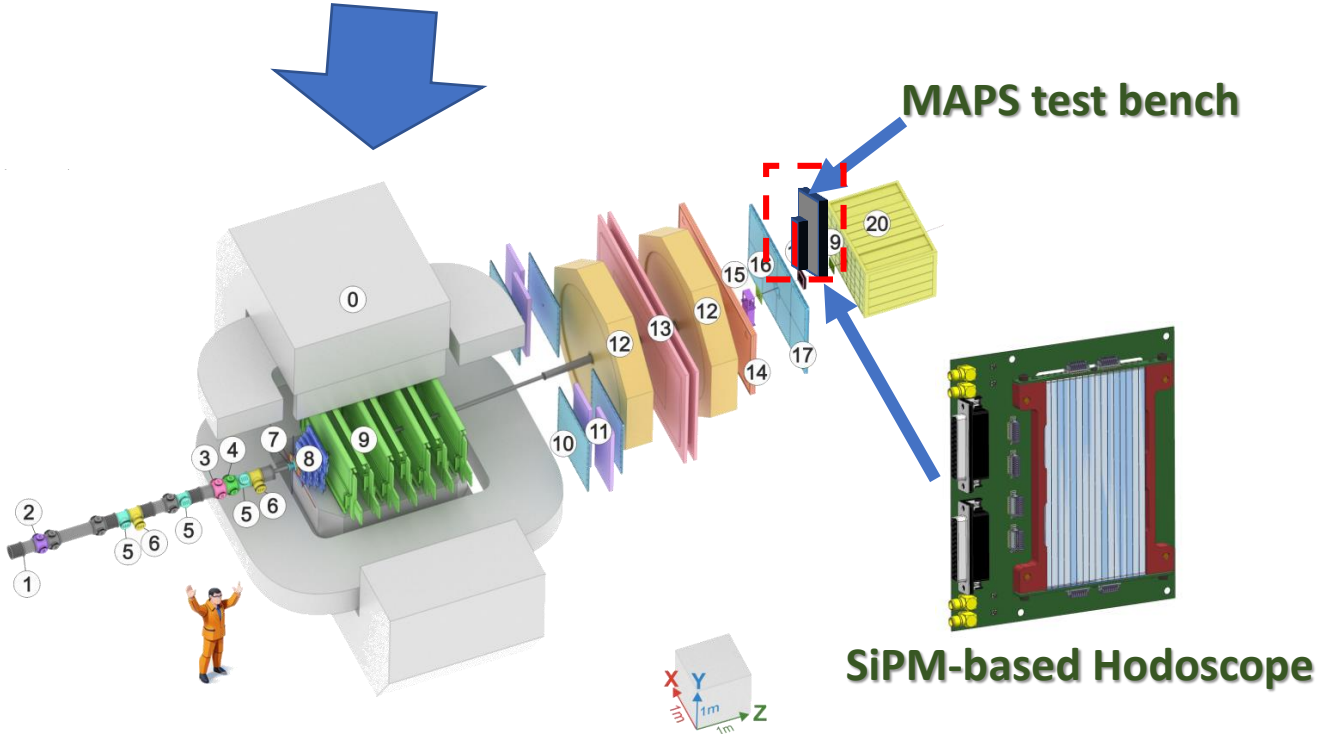
Plans for BM@N physics runs in 2024-2025:

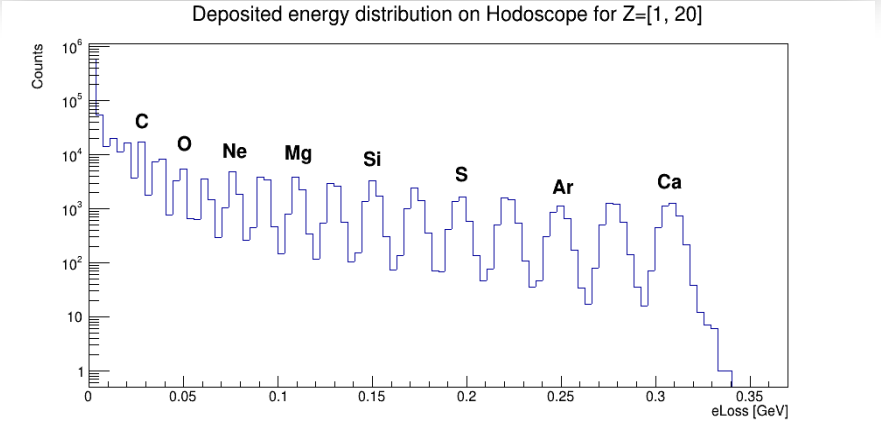
- Beams of ***Xe***: energy scan in the range of 2-3 AGeV
- Beams of ***Bi*** 3.9 AGeV

Measurements with Spectator Fragments



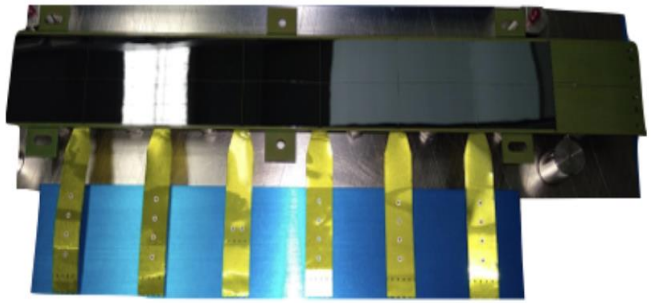




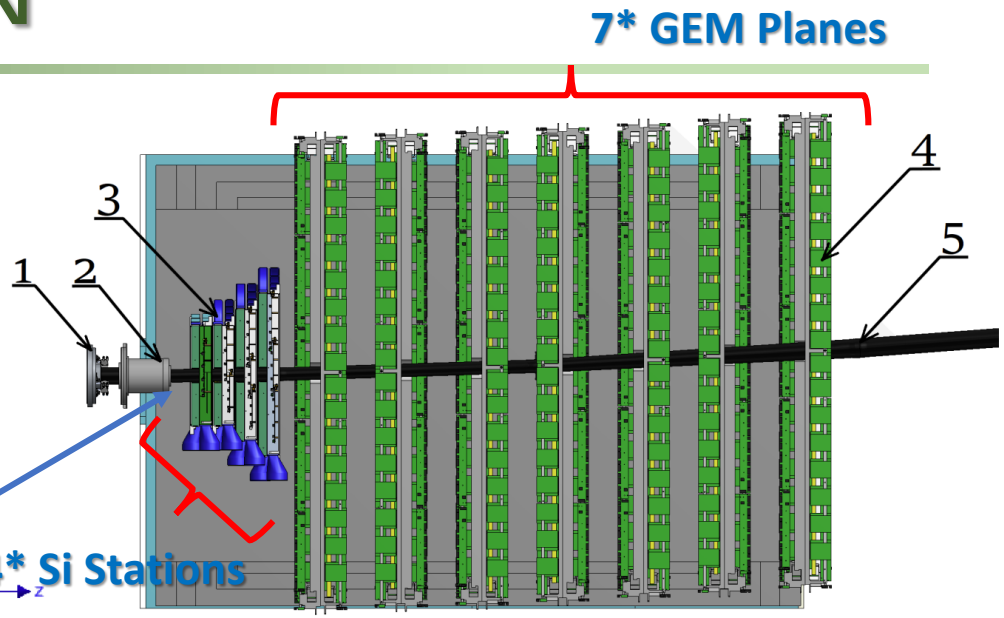


Simulation of the energy loss in the Hodoscope for diff. projectile-nuclei fragments (made by S. Reyes)

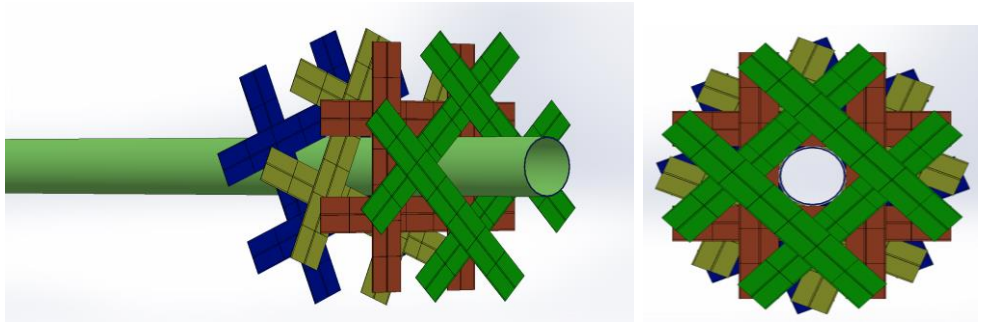
Tests of the HICs at BM@N



Hybrid Integrated Circuit (HIC): 7x2 MAPS installed on the FPC with a daisy-chain readout



BM@N Tracking system



Proposal for the possible upgrade of the existing tracking system of BM@N experiment:
Four planes consisting of 4 HICs, with a 30 degrees rotation from plane to plane.
Placed between the target and the silicon detectors.

Conclusion

- **Nuclotron@JINR** and **SC-1000@PNPI** could be used for the tests of MICA ASICs, HICs and readout electronics;
- Beam telescope with the full chain of ALPIDE readout and dedicated software was developed and successfully tested at SC-1000;
- Same mechanics and DAQ system could be used for the future tests of the MICA chips;

Man power for the in-beam tests:

DAQ developments:	R.A. Diaz, A. Kolozhvari, A. R. Rodriguez;
Tests:	M.Shitenkow, D. Dementev;
Data analysis:	V. Leontyev, I. Rufanov;
Simulations:	S. Reyes;

Thank you for your attention!