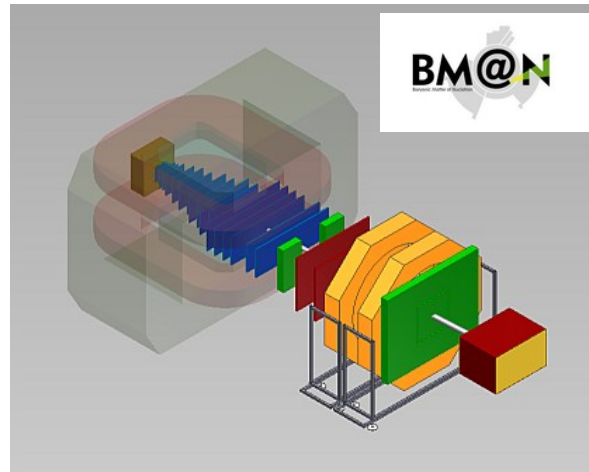


Status of the ZDC analysis in carbon run6 and preparation of the new FHCAL installation

F.Guber, M.Golubeva, A.Ivashkin, S.Morozov
on behalf of Institute for Nuclear Research RAS, Moscow



**Joint Institute for Nuclear
Research**

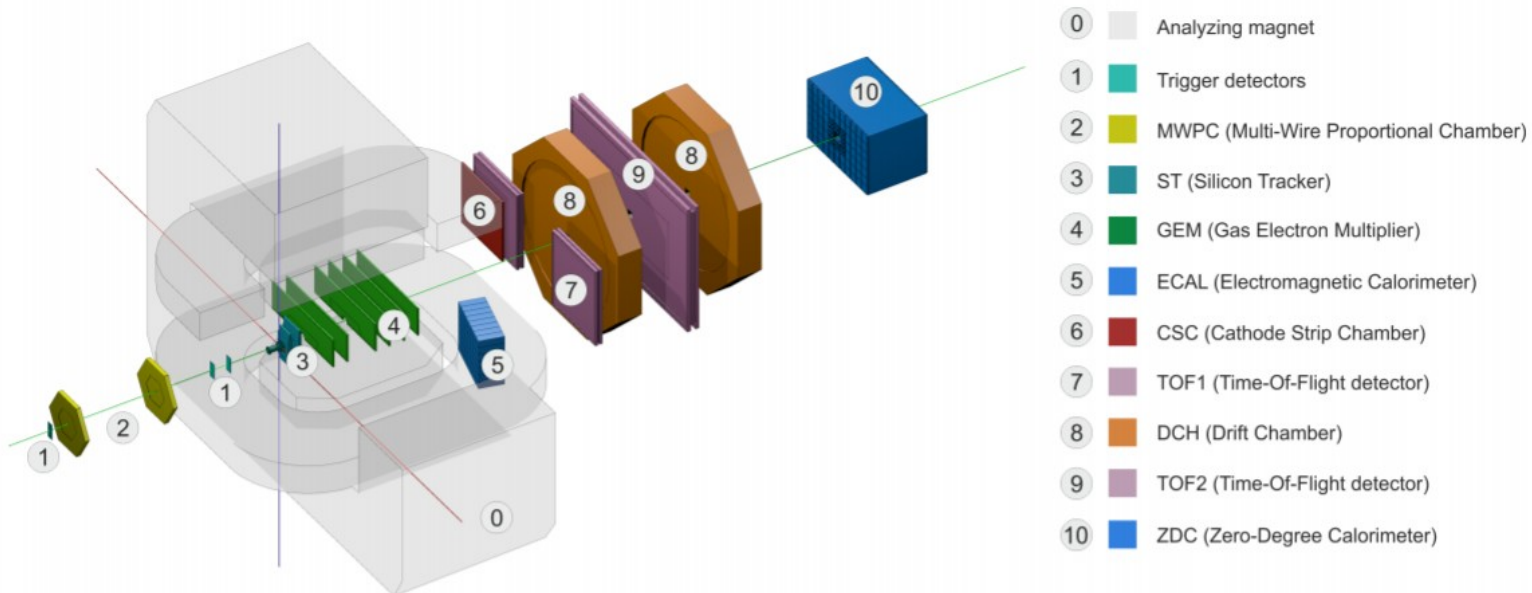
SCIENCE BRINGING NATIONS
TOGETHER

The 3rd collaboration meeting of the MPD and BM@N experiments at the NICA Facility
VBLHEP, JINR, Dubna, 16 – 17 April 2019

ZDC analysis in carbon run6

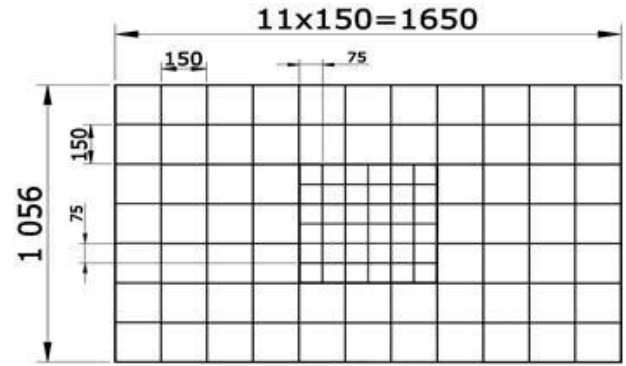
Outline:

- ZDC raw data converter in bmnroot framework development
- performance of ZDC in carbon run6 data taking
- merging of ZDC and tracking reconstructions
- ZDC and track multiplicity correlations as a first attempt for event centrality selection
- comparing data with MC simulations
- preparation of the new FHCAL installation

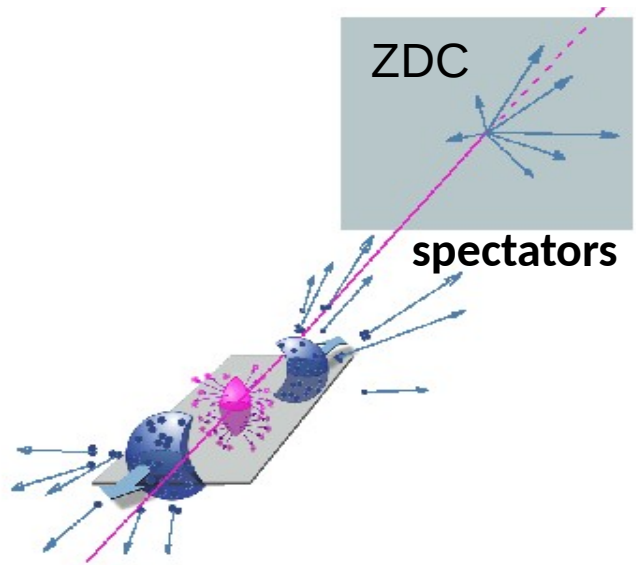
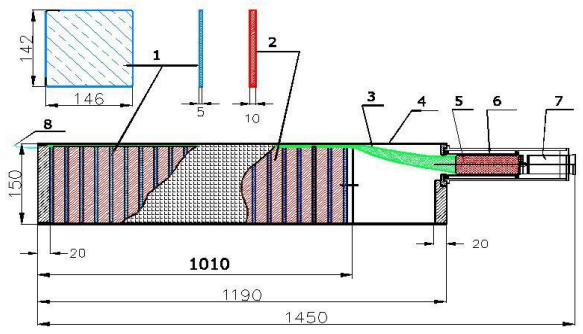


Preparation of the new FHCAL installation

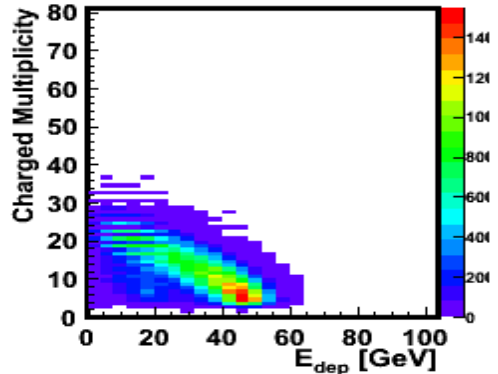
Current ZDC



Central part: 36 modules (7.5x7.5cm²)
 Outer part: 68 modules (15x15cm²)



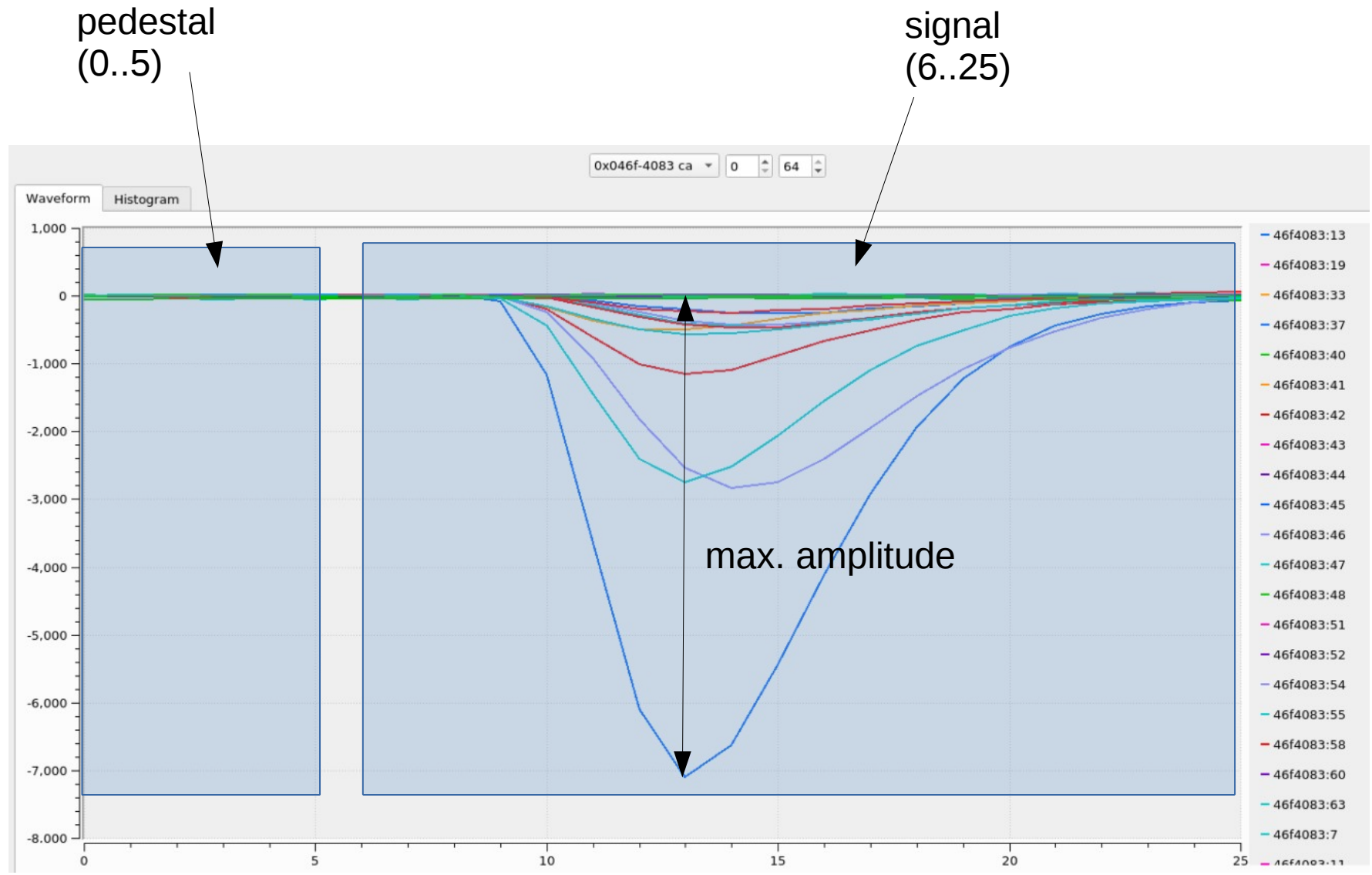
C+C @ 4AGeV simulations



64 layers (5mm (scint.)
 + 10mm (Pb))

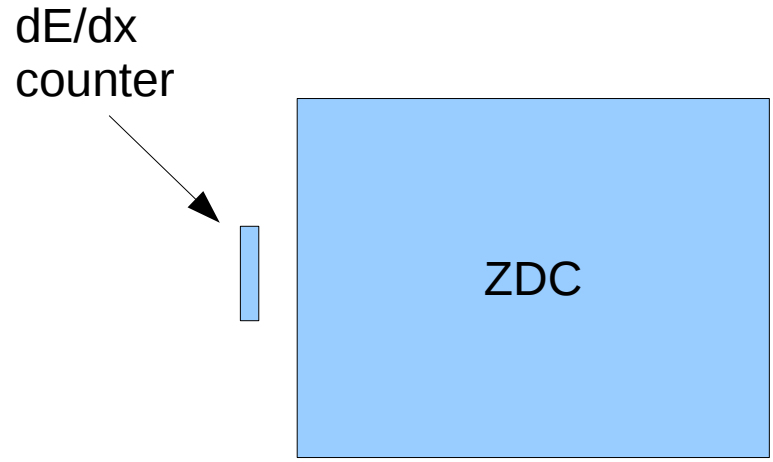
ZDC analysis in carbon run6

- bmnroot zdc reconstructor has been updated
- run6 ZDC calibration: from Oleg Gavrischuk
 <bmnroot>/parameters/zdc/zdc_muon_calibration_march_2017.txt

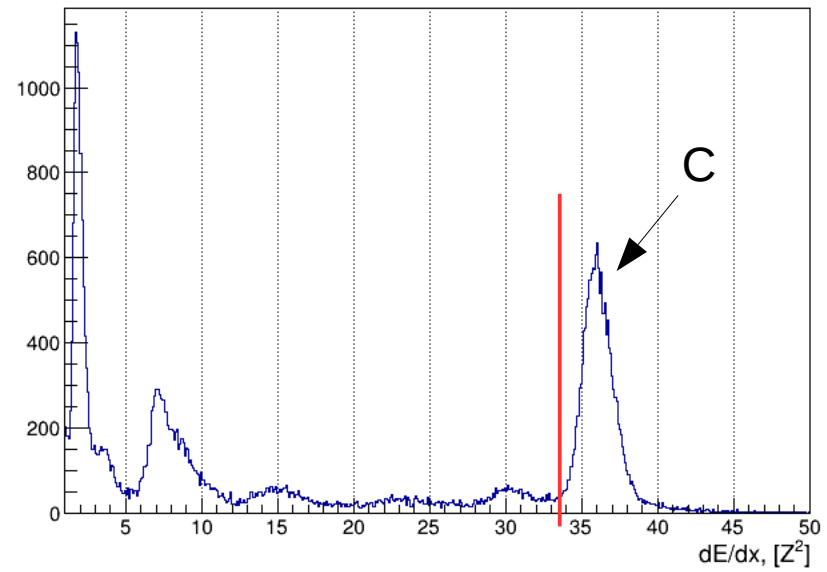


ZDC analysis in carbon run6

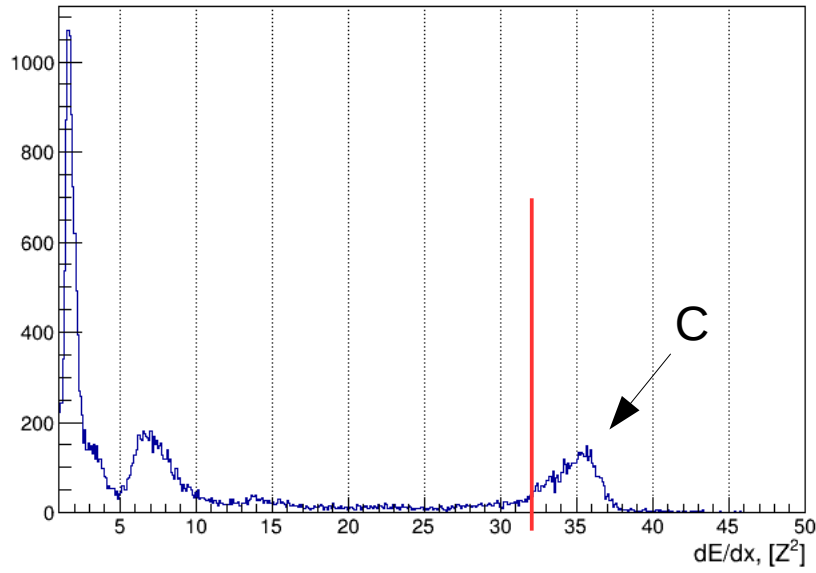
Carbon peak rejection with dE/dx counter before ZDC



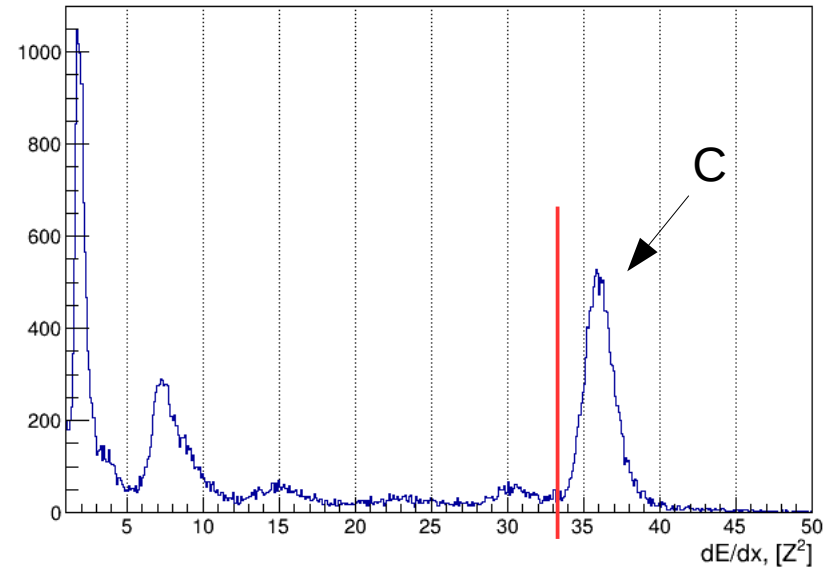
run 1546, C@4AGeV + C



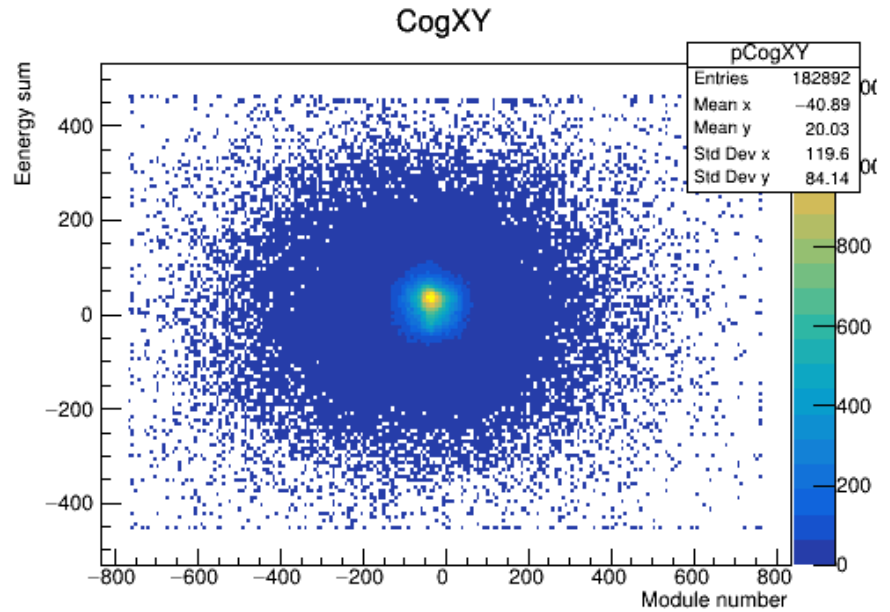
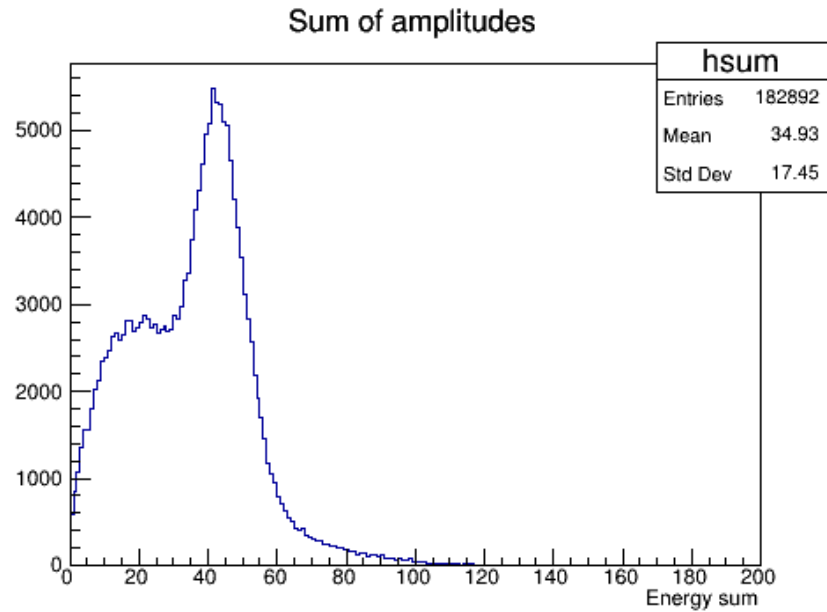
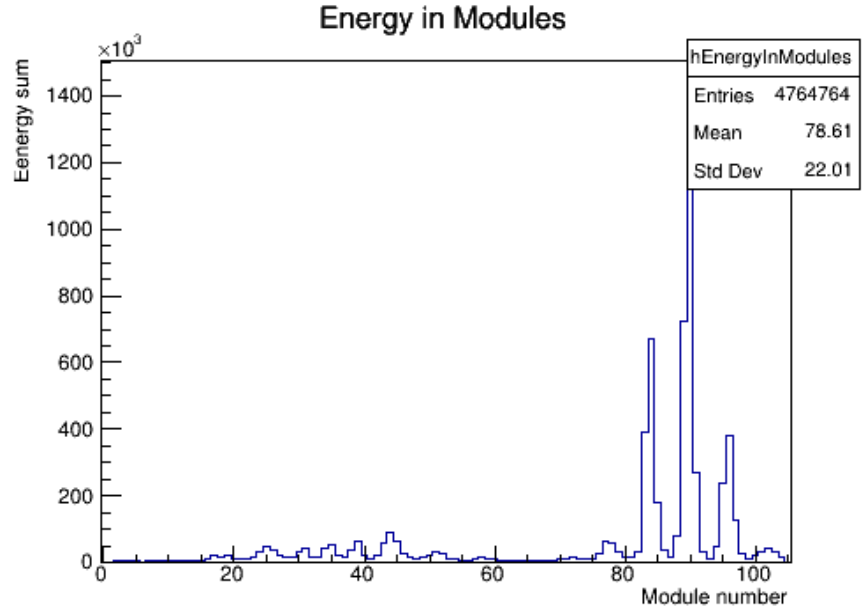
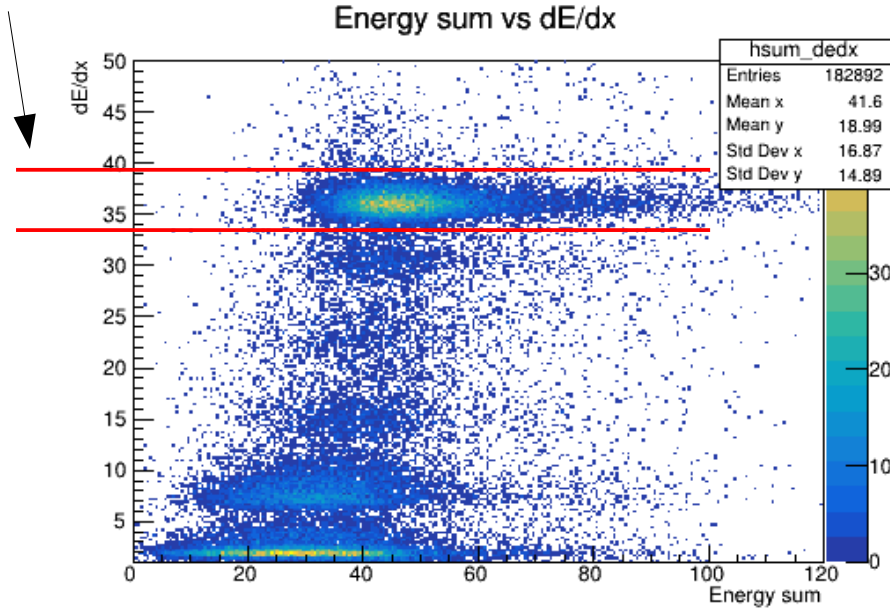
run 1415, C@4AGeV + Al



run 1587, C@4AGeV + Cu



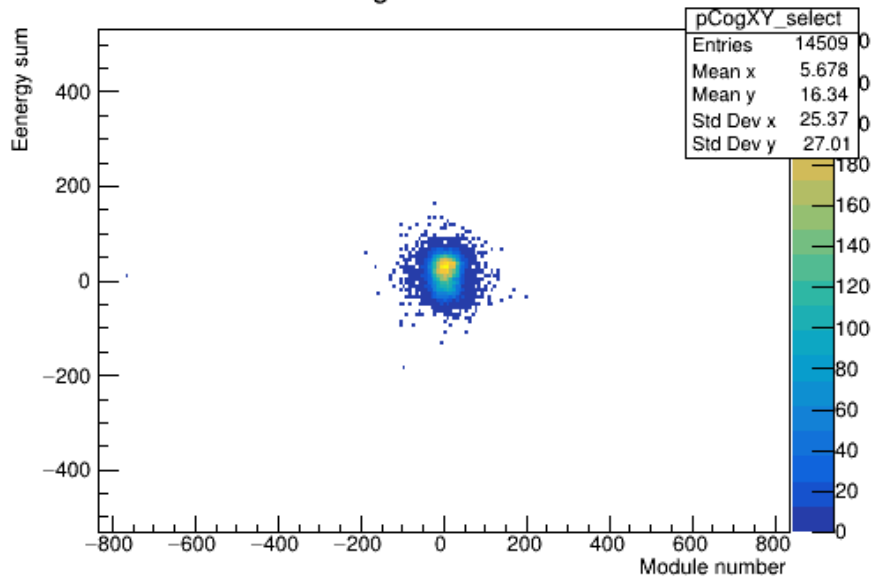
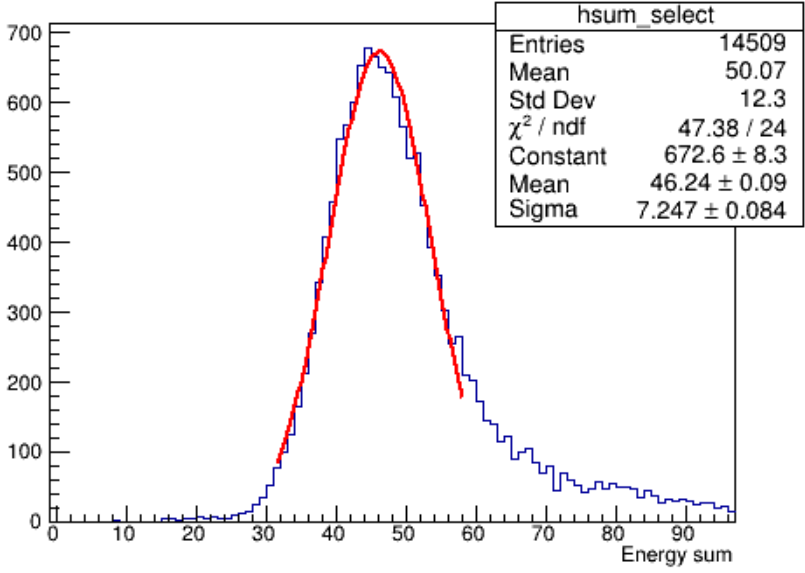
C ion selection cut



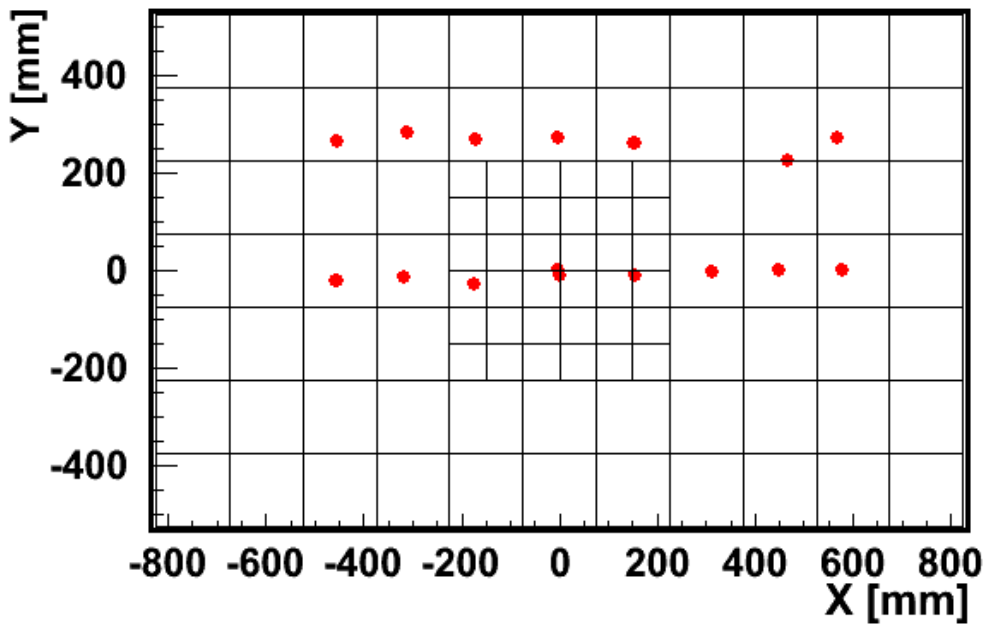
ZDC analysis in carbon run6

run 1546, C@4AGeV + C
only C ions selected

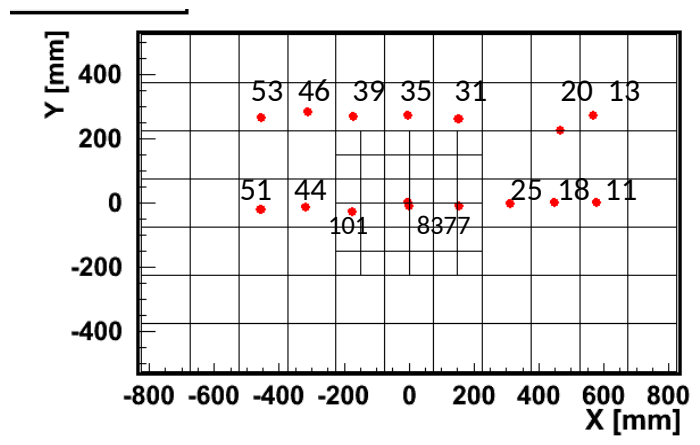
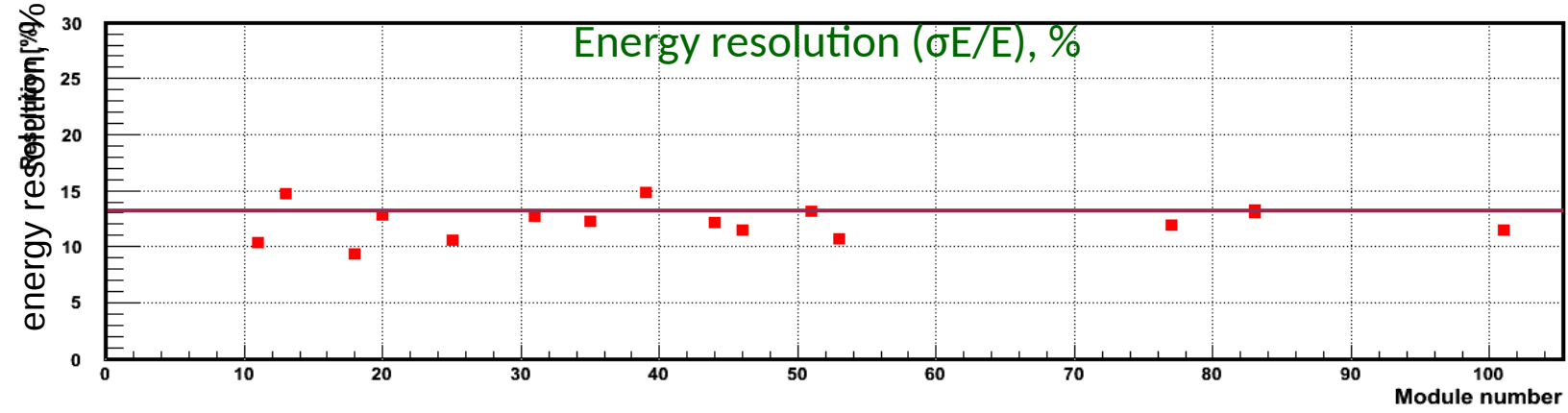
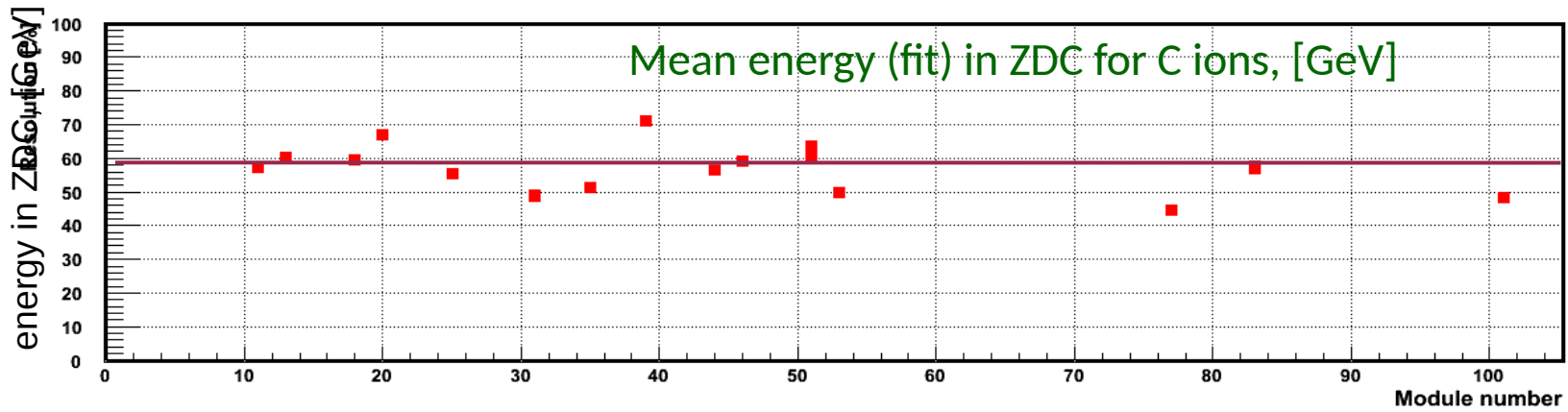
CogXY selected



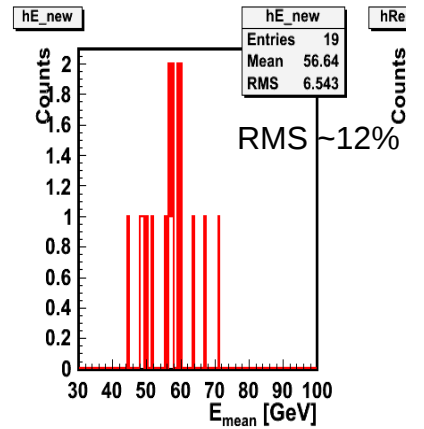
pXY_gravity_new



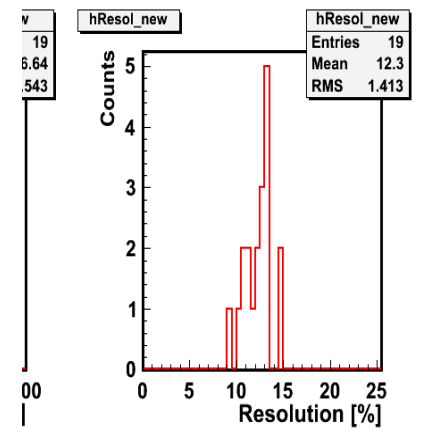
ZDC module scan
run6, C@4.5AGeV
Runs: 1770 - 1790



Mean energy variations



Energy resolution variations



ZDC performance

Trigger: beam trigger
+ BD>=2 (C+C, C+Al)
+ BD>=3 (C+Cu)

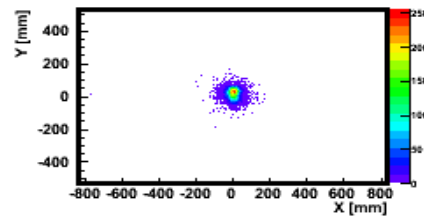
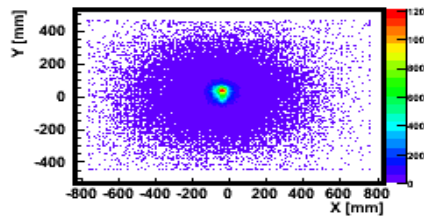
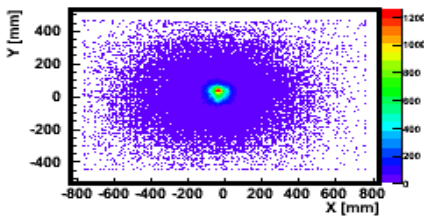
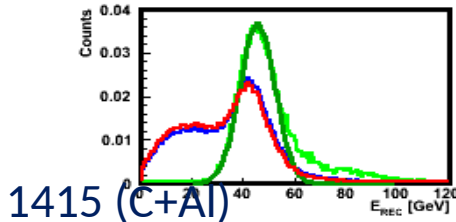
Energy in ZDC, [GeV]

all events
C rejected
C ions only

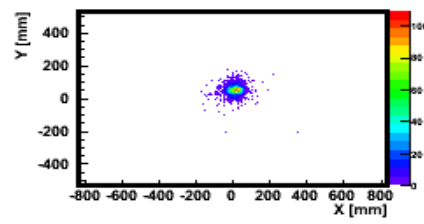
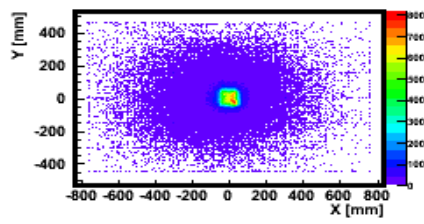
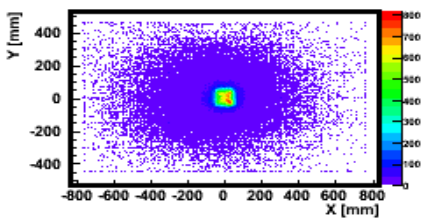
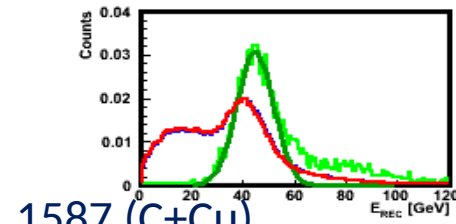
Center of gravity distributions

all events C rejected C ions only

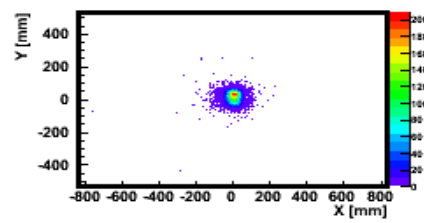
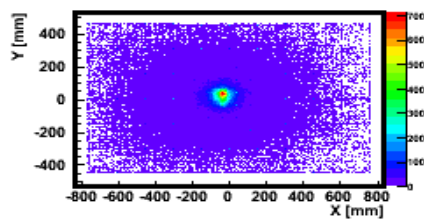
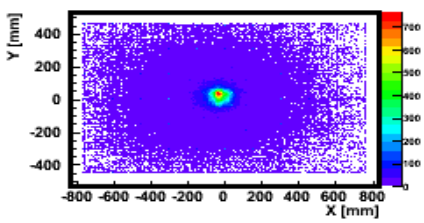
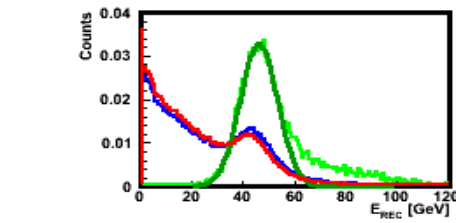
1546 (C+C)



1415 (C+Al)



1587 (C+Cu)



Merging files with ZDC and tracks:

- bmnroot digi files with ZDC reconstruction for run6 from Vasilisa Lenivenko:

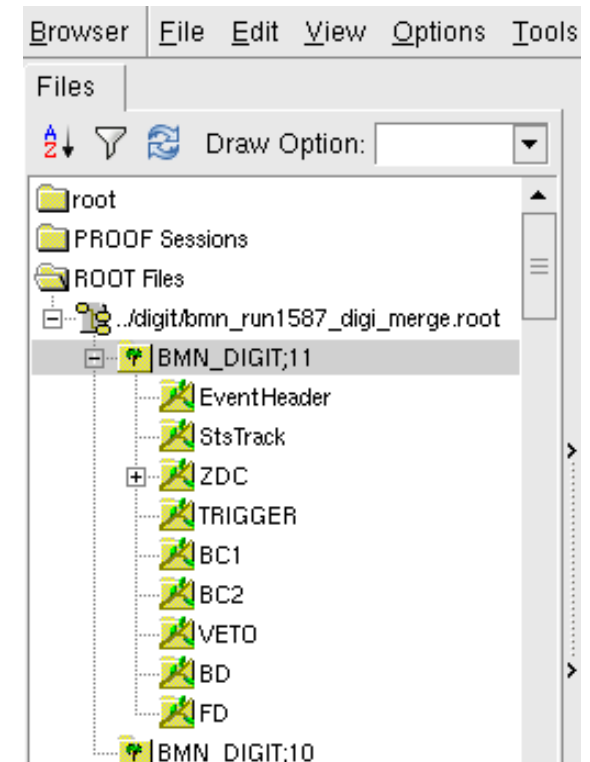
```
/bmndata5/bmn-group/lenivenko/run7/digit/bmn_run1546_digi_zdc.root  
/bmndata5/bmn-group/lenivenko/run7/digit/bmn_run1415_digi_zdc.root  
/bmndata5/bmn-group/lenivenko/run7/digit/bmn_run1587_digi_zdc.root
```

- stsTracks reconstructed: files provided by Gleb Pokatashkin:

```
/nica/user/p/pokat/bmnr6/reco_r6/1546_newBD.root  
/nica/user/p/pokat/bmnr6/reco_r6/1415_newBD.root  
/nica/user/p/pokat/bmnr6/reco_r6/1587_newBD.root
```

- simple merging event by event with eventID from EventHeader

Now StsTrack and ZDC are in one file!



ZDC analysis in carbon run6

Run1546 (C @4 AGeV + C)

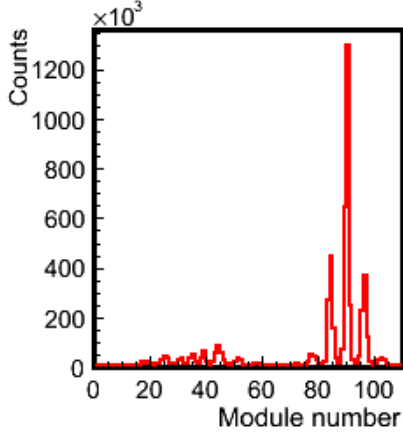
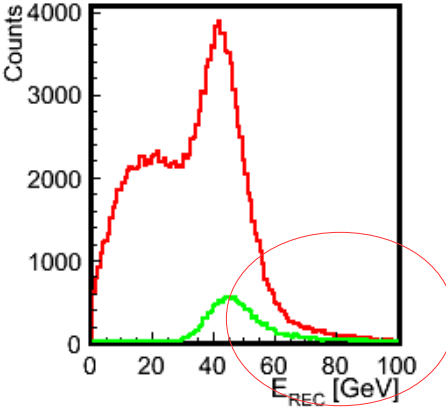
ZDC data analysis
run6, C@4AGeV

Trigger: beam trigger + BD>=2

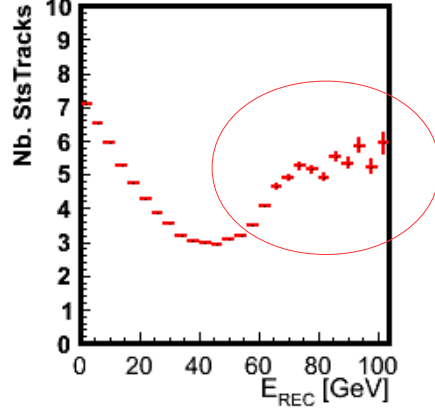
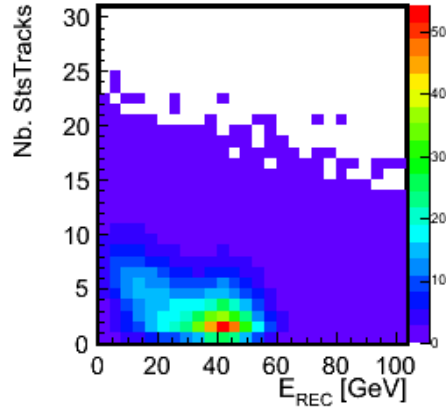
Reconstructed energy
in ZDC

Modules distribution

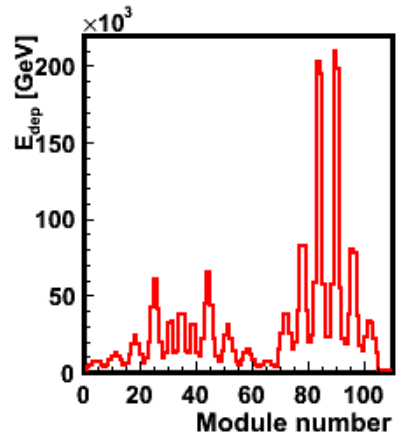
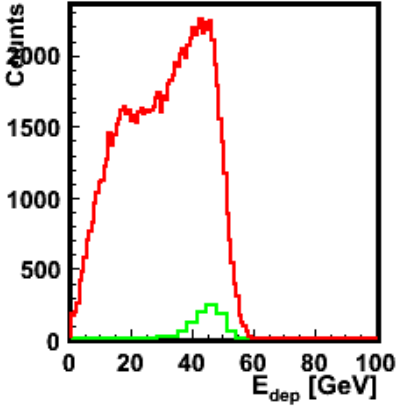
Experiment:



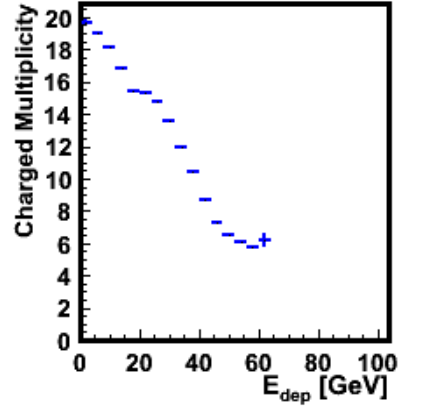
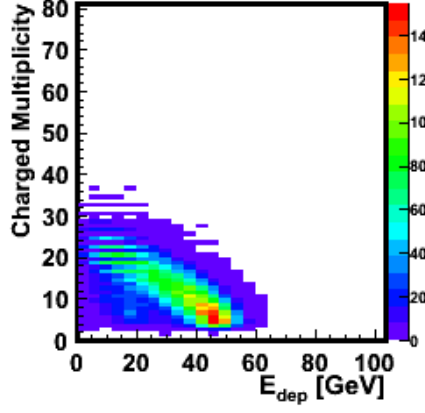
Reconstructed energy in ZDC vs nb of StsTracks



Simulations:



Charged particles multiplicity from generator
vs energy in ZDC



ZDC analysis in carbon run6

Run1415 (C @4 AGeV + Al)

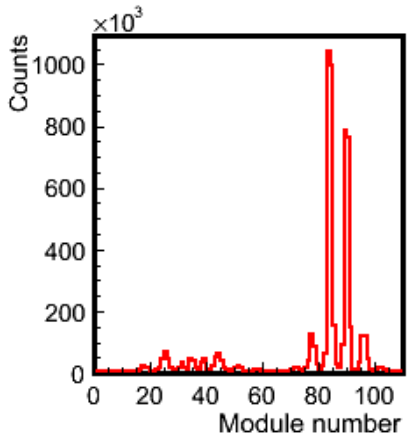
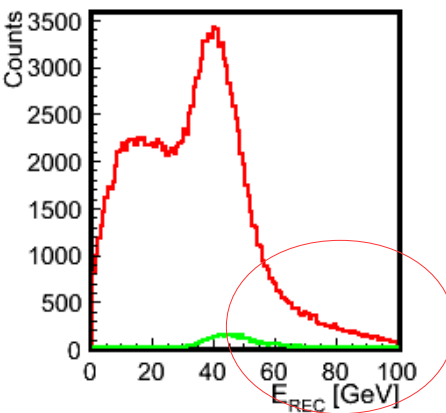
ZDC data analysis
run6, C@4AGeV

Trigger: beam trigger + $BD \geq 2$

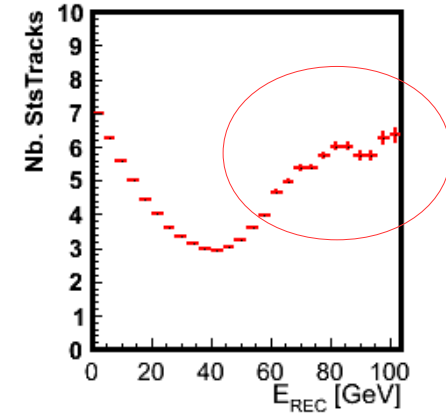
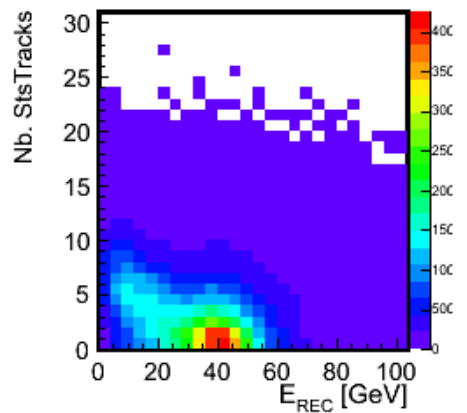
Reconstructed energy
in ZDC

Modules distribution

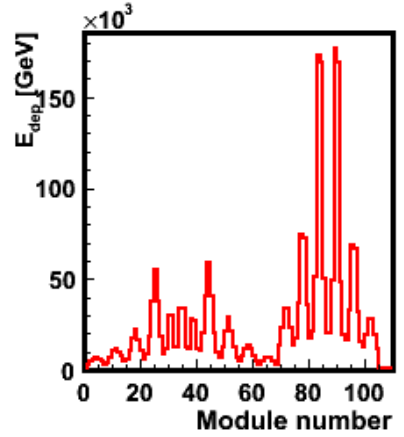
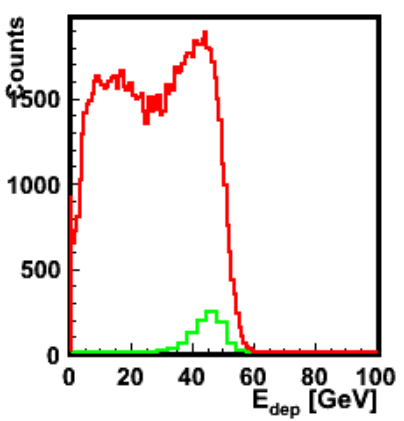
Experiment:



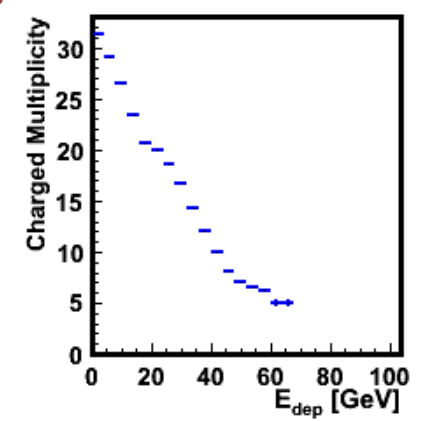
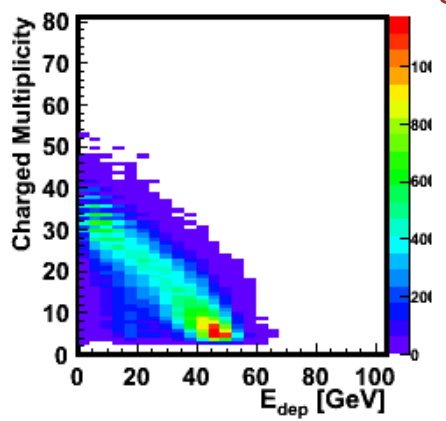
Reconstructed energy in ZDC vs nb of StsTracks



Simulations:



Charged particles multiplicity from generator
vs energy in ZDC



ZDC analysis in carbon run6

Run1587 (C @4 AGeV + Cu)

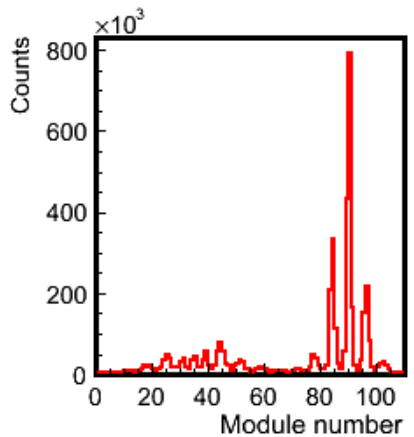
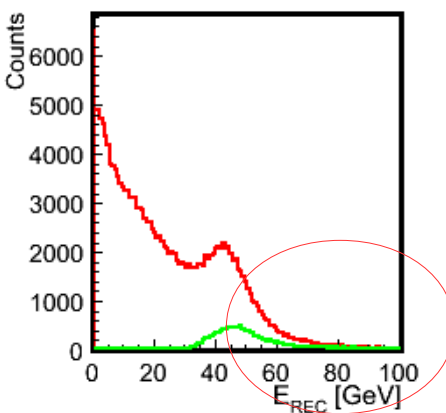
ZDC data analysis
run6, C@4AGeV

Trigger: beam trigger + $BD \geq 3$

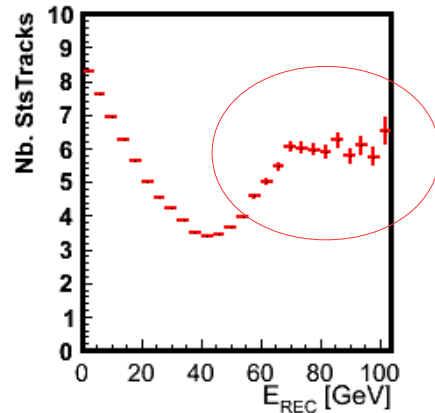
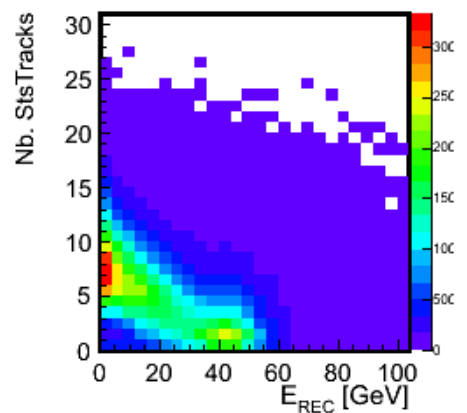
Reconstructed energy
in ZDC

Modules distribution

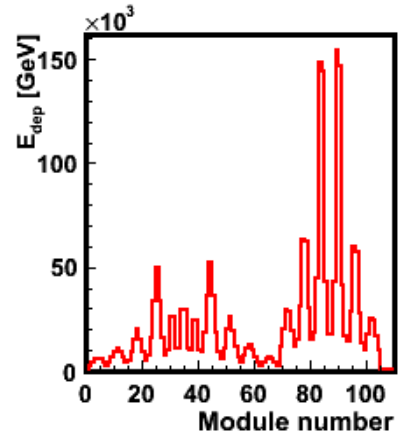
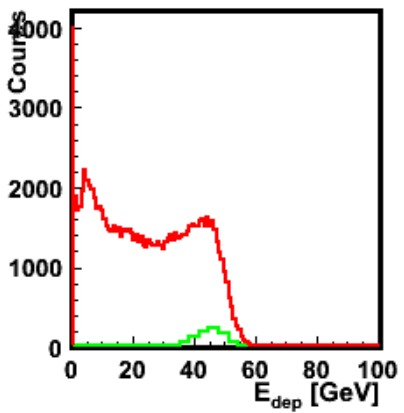
Experiment:



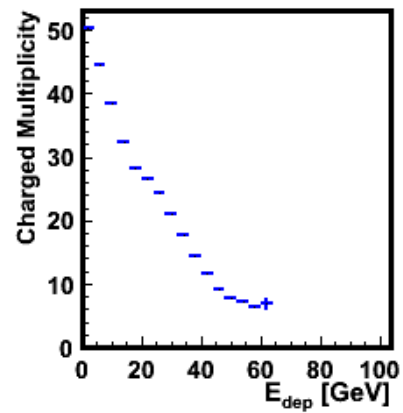
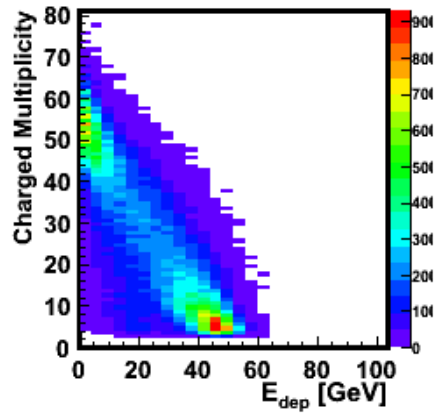
Reconstructed energy in ZDC vs nb of StsTracks



Simulations:



Charged particles multiplicity from generator
vs energy in ZDC

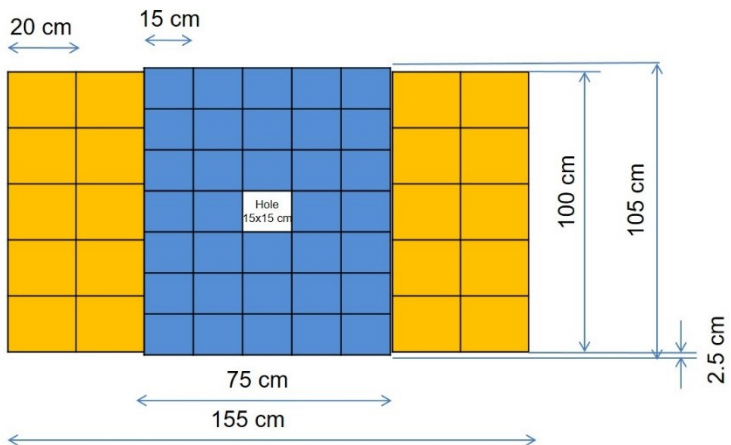


Preparation of the new FHCAL installation

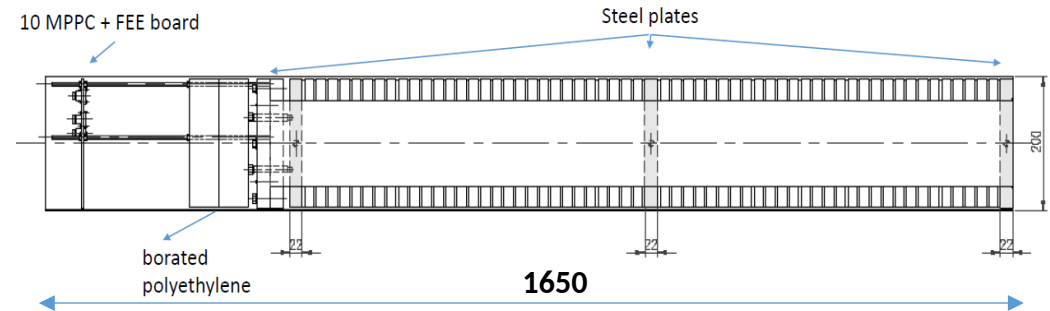
Future FHCAL proposed

Au+Au high rate beam in future:

- high radiation doses in ZDC central modules with heavy ion beams → degradation of ZDC performance
hole in the calorimeter center is needed
- hadron shower leakage in ZDC (small modules in the ZDC center, WLS plates for the light collection)

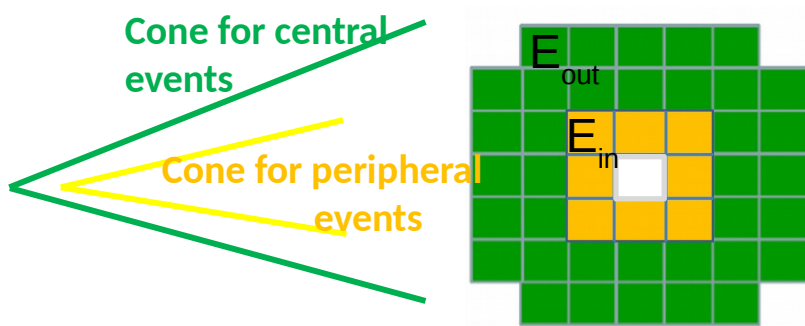


20 PSD CBM modules (20 cm x 20 cm)
34 FHCAL MPD modules (15 cm x 15 cm)



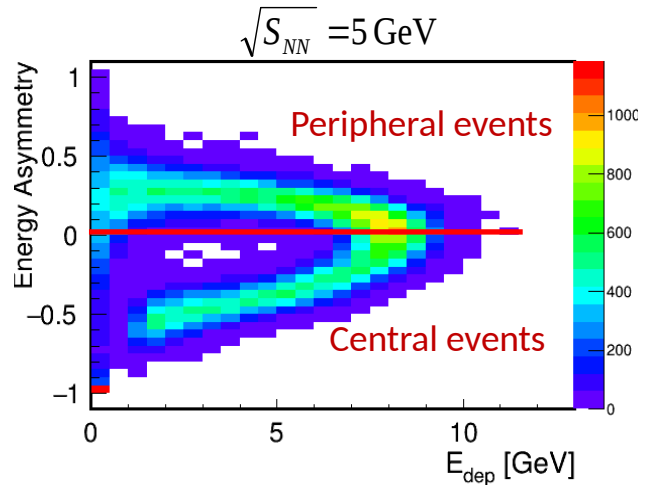
PSD CBM module - 60 Pb (16mm)/scint(4mm) layers
 Light readout - with 10 MPPCs from 10 longitudinal sections

FHCAL MPD module - 42 Pb (16mm)/scint(4mm) layers
 Light readout - with 7 MPPCs from 7 longitudinal sections.

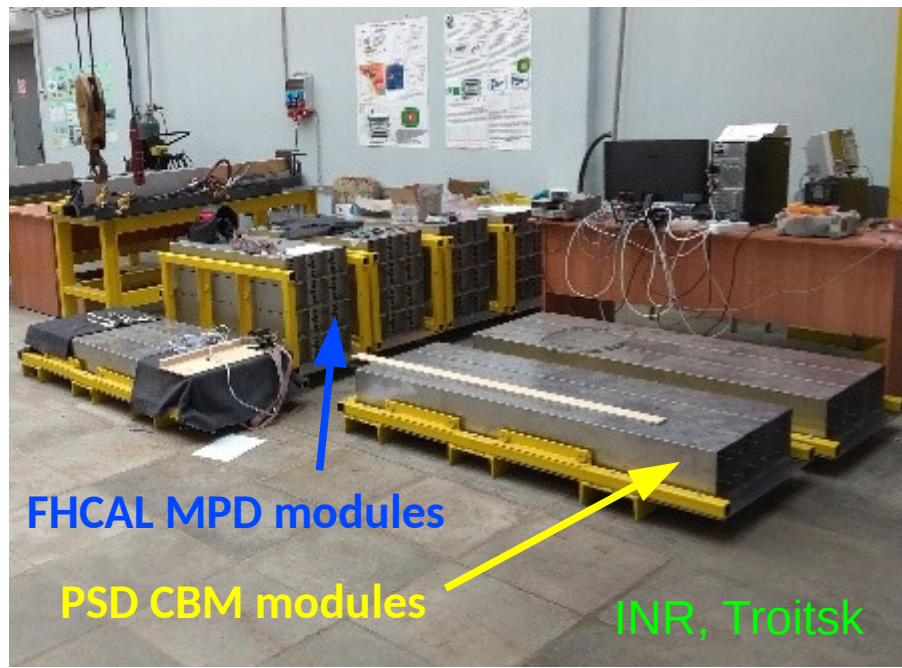


Energy asymmetry:

$$A_E = \frac{E_{in} - E_{out}}{E_{in} + E_{out}}$$



Preparation of the new FHCAL installation



Support structure for new FHCAL is ready



All FHCAL modules have been delivered at BM@N

Assembly of new FHCAL - end of May

Conclusions:

- ZDC raw converter is updated in bmnroot
- first attempt of event selection for centrality has been done for C+C, C+Al, C+Cu (run6)
- comparing to MC simulations → improvement of event selection in data in progress..
- preparation for upgrade of ZDC to new FHCAL is going, installation planned to end of May 2019

Outlook:

- improvement of ZDC raw to digi converter for better event selection
- installation of new FHCAL at BM@N

Thank you for your attention!