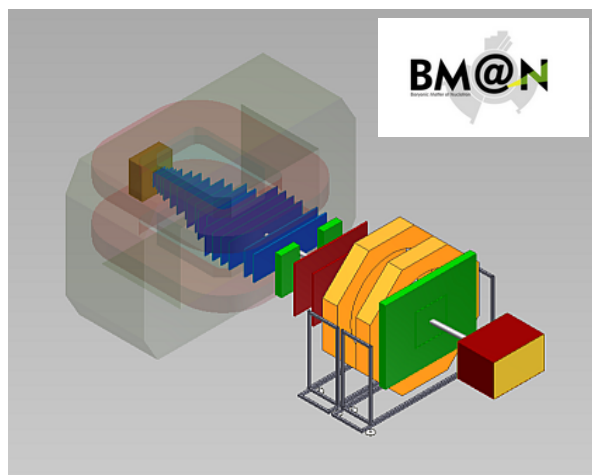


# Centrality with ZDC in carbon-nucleus data

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

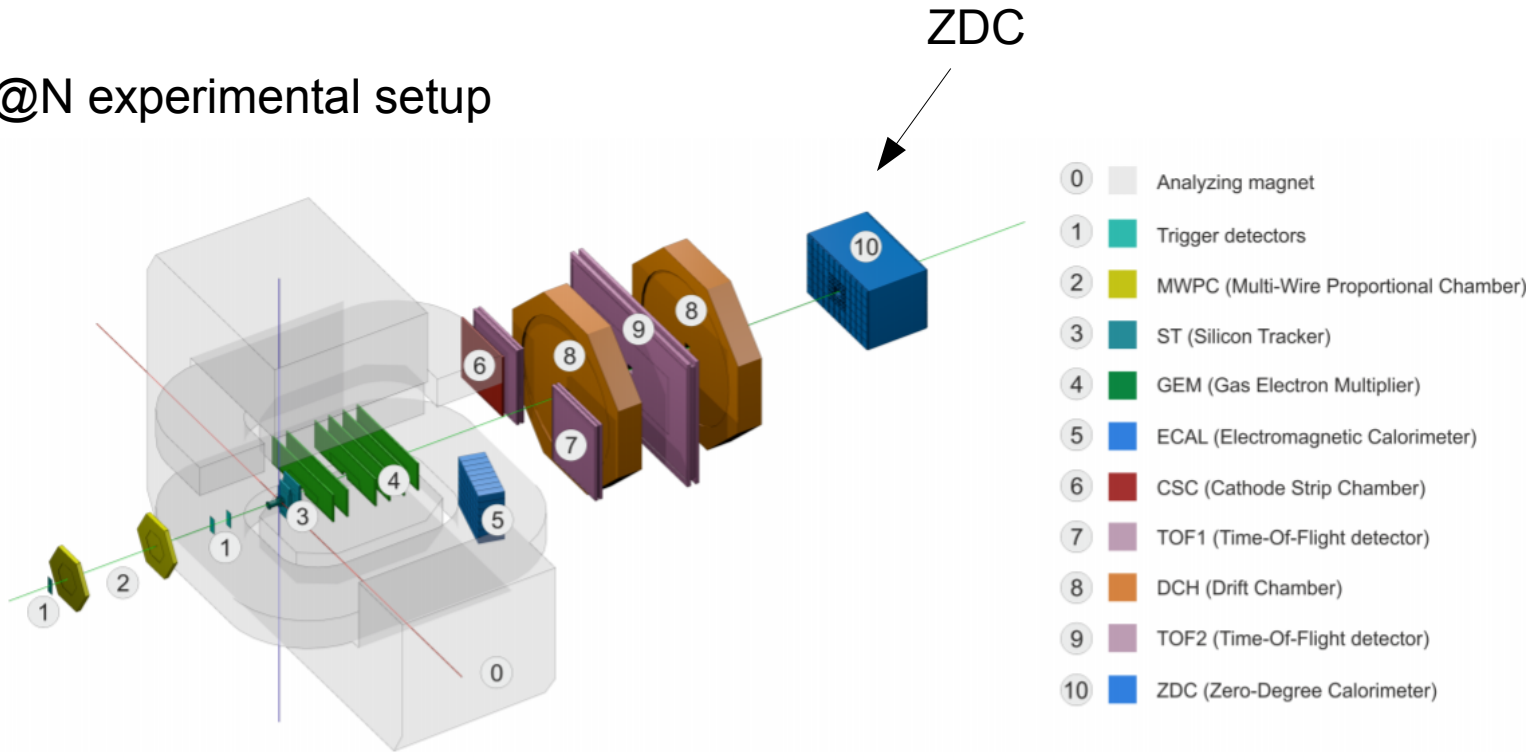
The 4<sup>th</sup> collaboration meeting of the MPD and BM@N experiments at the NICA Facility  
VBLHEP, JINR, Dubna, 14 – 15 October 2019

# Centrality with ZDC in carbon-nucleus data

## Outline:

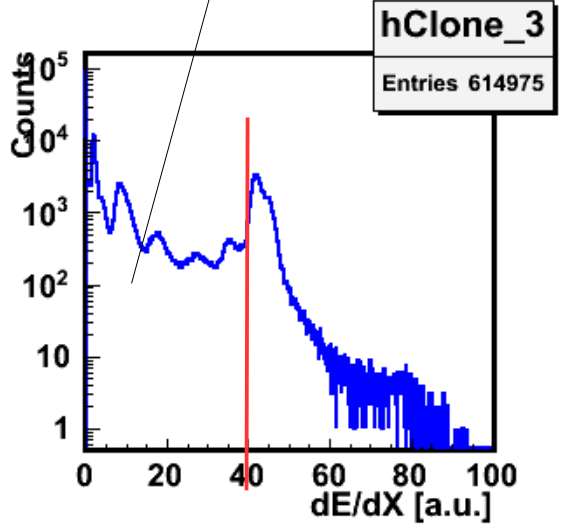
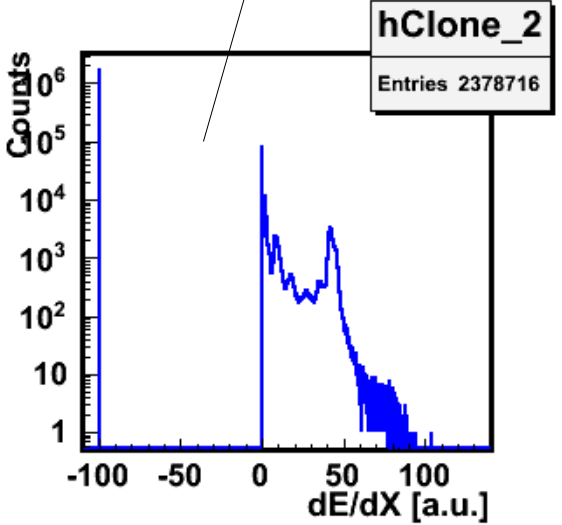
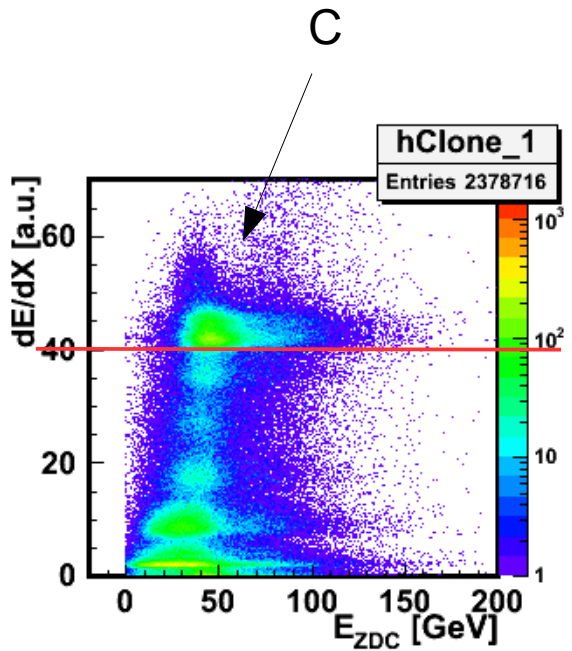
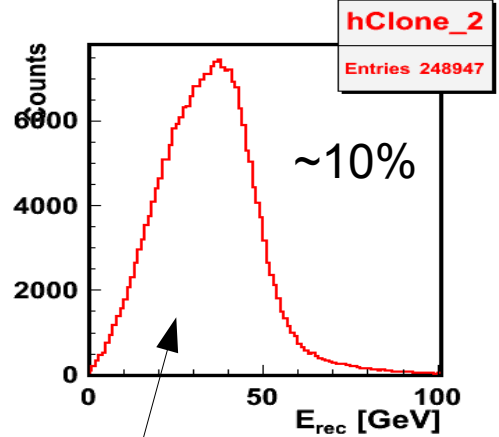
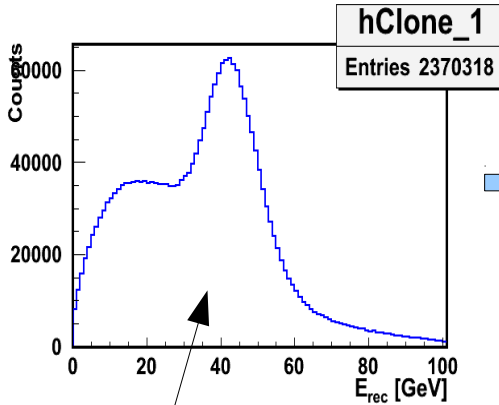
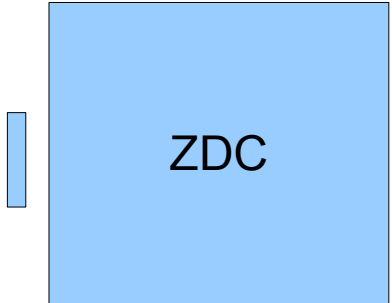
- ZDC energy reconstruction in C+C runs
- centrality of ion-ion collision and comparing of data and MC for C+C
- centrality estimation with asymmetry of energy in ZDC

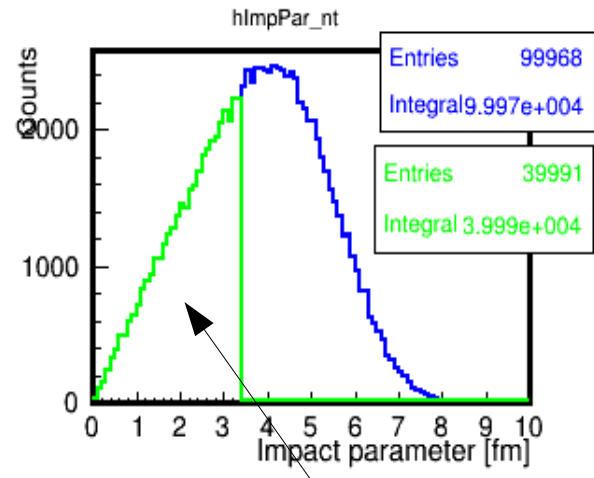
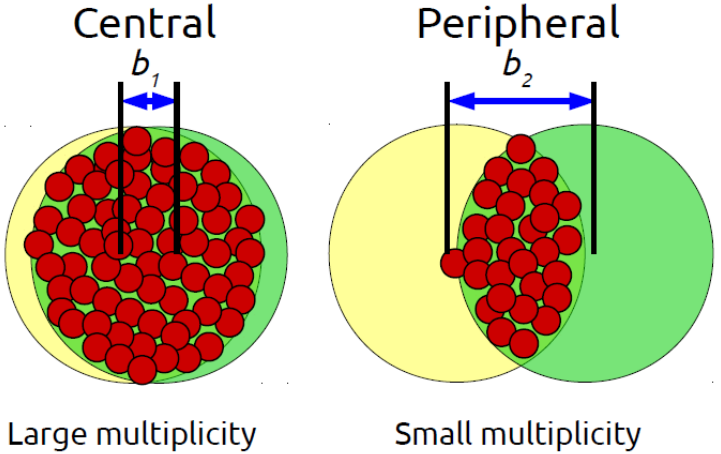
### BM@N experimental setup



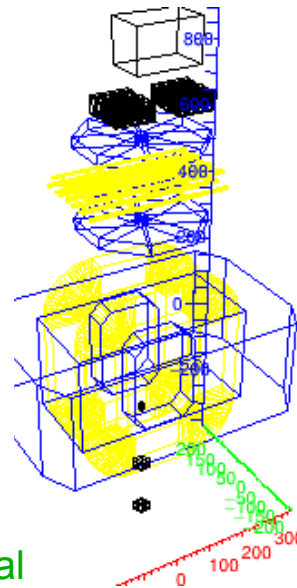
Carbon peak rejection with dE/dx counter before ZDC

dE/dx counter

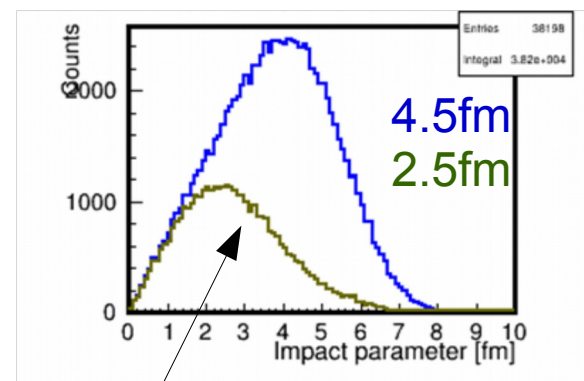
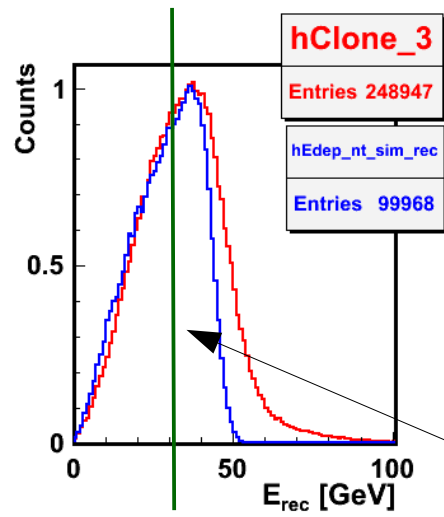
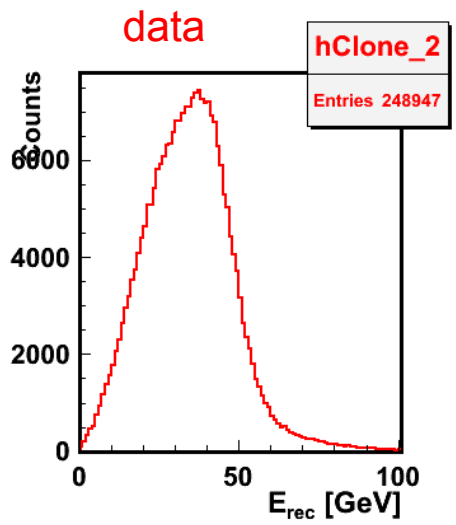
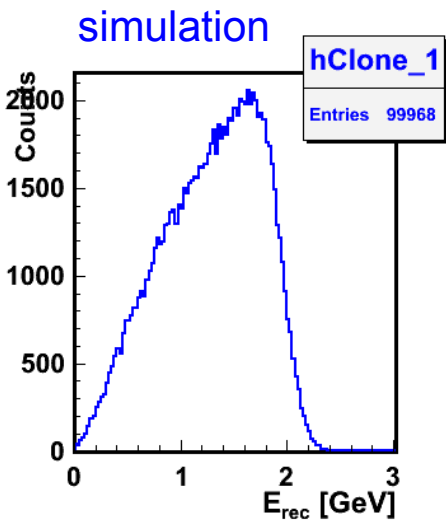




40% of most central events ("b-centrality")

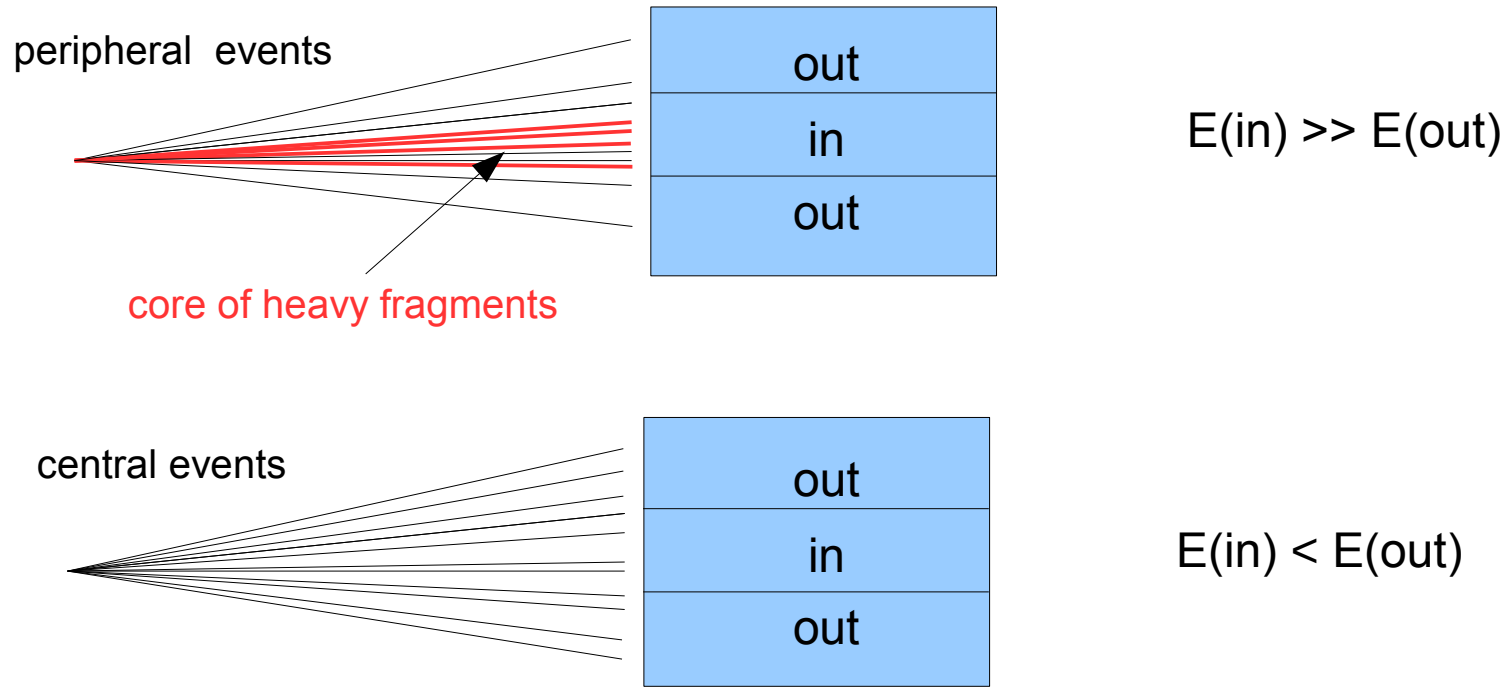


- C+C MC:
- DCM-QGSM
  - GEANT4
  - full BM@N geometry
  - real magnetic field



40% of most central events with cut on ZDC energy

Centrality determination with energy asymmetry



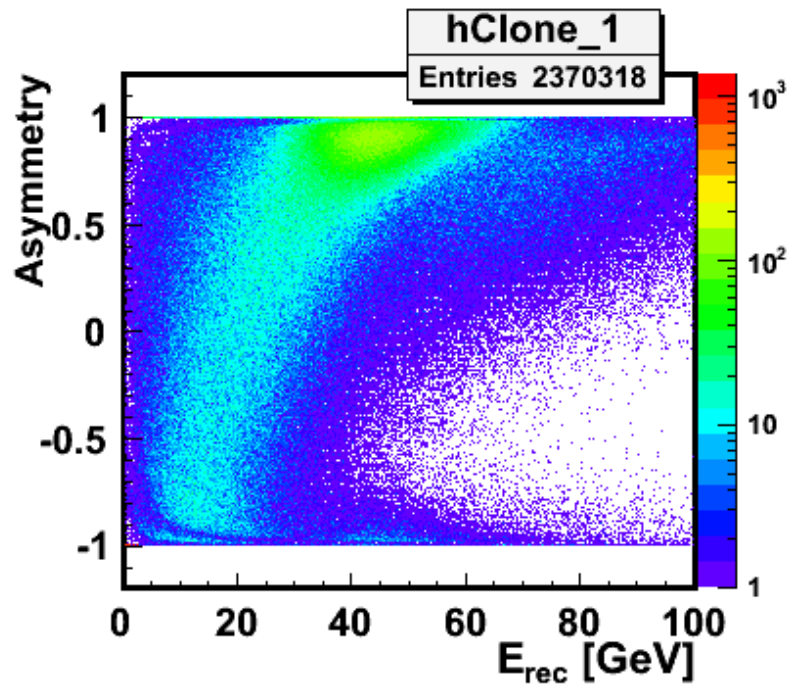
Centrality with ZDC in carbon-nucleus data

Centrality determination with energy asymmetry

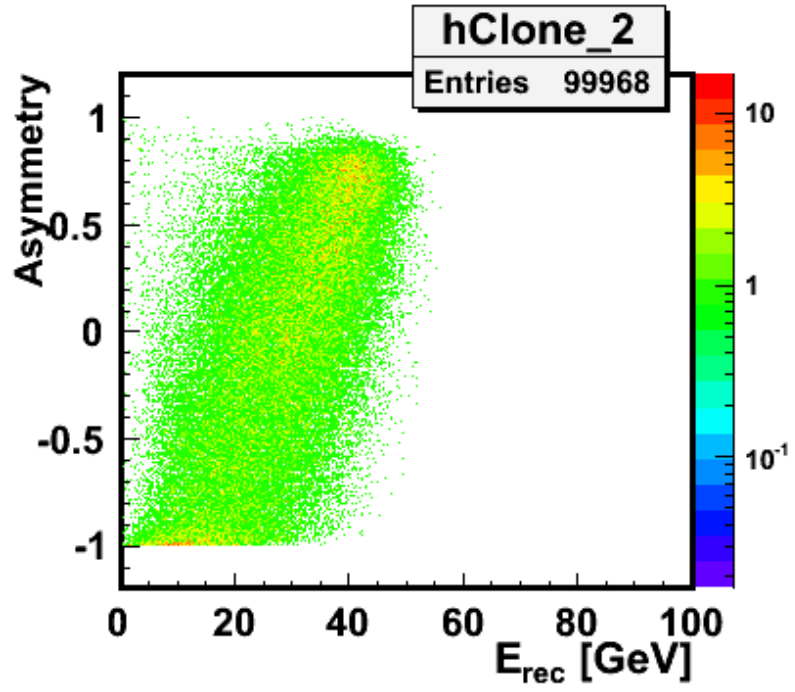
$$\text{Energy asymmetry} = (E_{\text{blue}} - E_{\text{red}}) / (E_{\text{blue}} + E_{\text{red}})$$

68	61	54	47	40	36	32	28	21	14	7
67	60	53	46	39	35	31	27	20	13	6
66	59	52	45	104	98	92	86	80	74	26
				103	97	91	85	79	73	19
65	58	51	44	102	96	90	84	78	72	18
				101	95	89	83	77	71	11
64	57	50	43	100	94	88	82	76	70	10
				99	93	87	81	75	69	3
63	56	49	42	38	34	30	23	16	9	2
62	55	48	41	37	33	29	22	15	8	1

experimental data



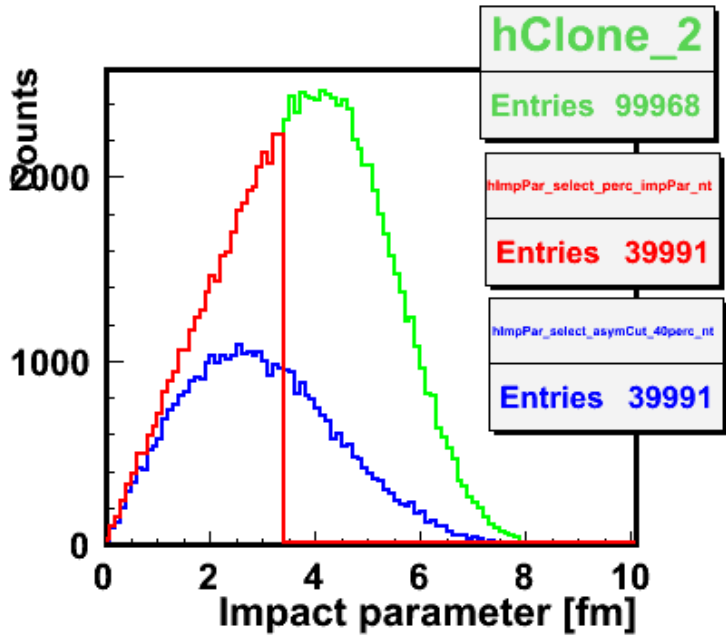
MC



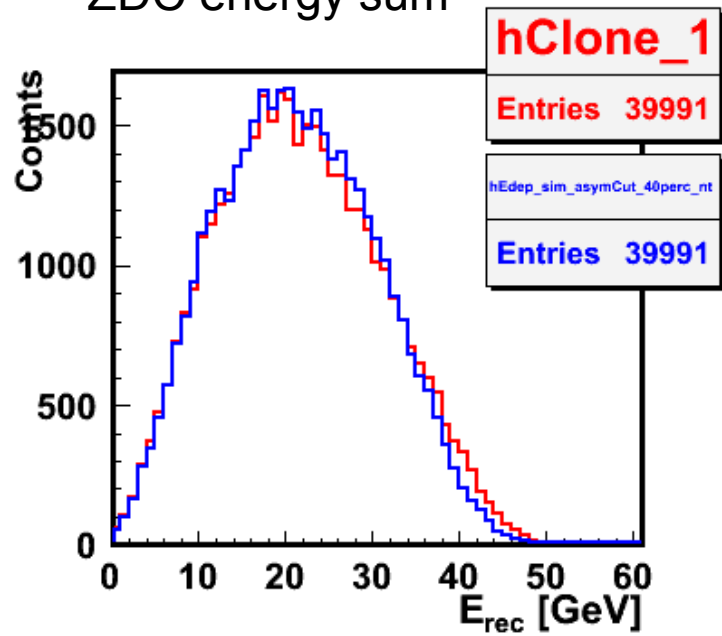
All events

Events with cut on impact parameter ( $\leq 3.4$  fm, 40% centrality)

Events with cut on asymmetry to have 40% statistics with least asymmetry (asymmetry  $< -0.108$ )



ZDC energy sum

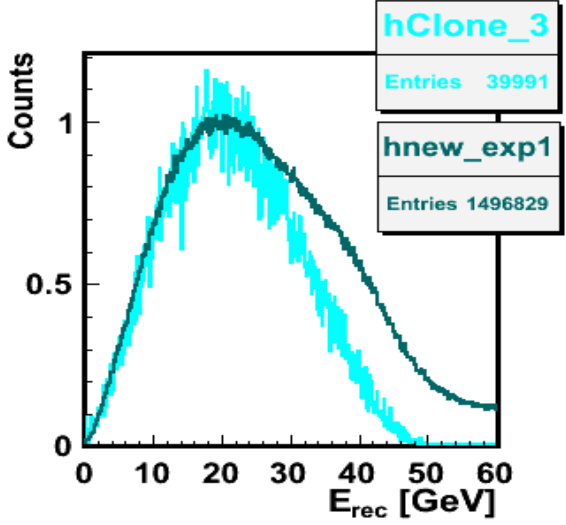


Good agreement of data and MC!

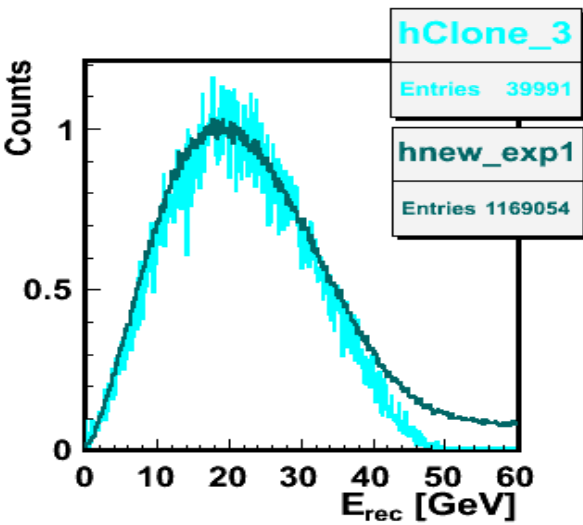
Simulations - 40% most central events (selected with impact parameter)

Experiment – events with asymmetry cut

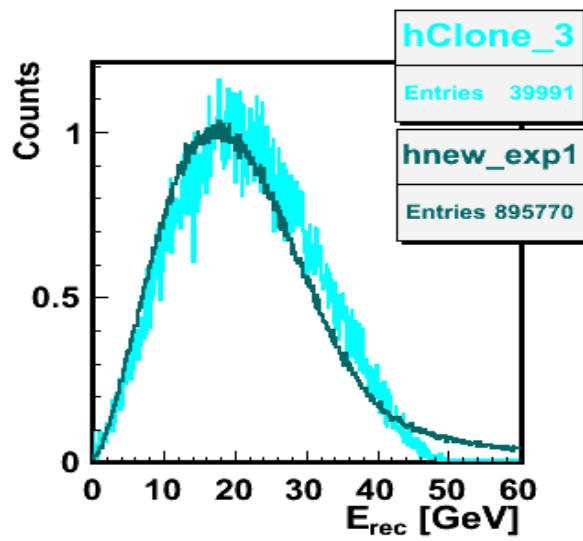
-1 < asymmetry < 0.75



-1 < asymmetry < 0.6



-1 < asymmetry < 0.4

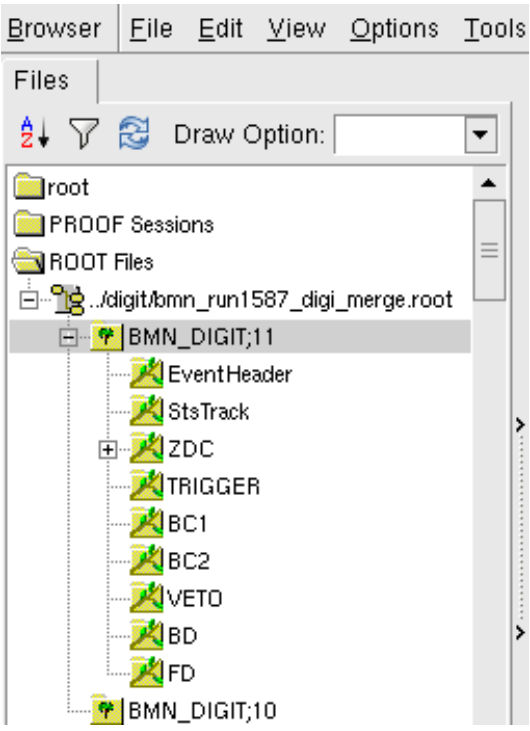




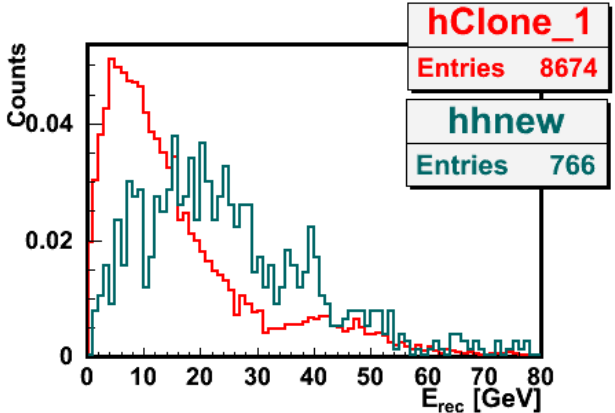
# Centrality with ZDC in carbon-nucleus data

## Merging files with ZDC and tracks:

- bmnroot digi files from official data reconstruction
- stsTracks reconstructed by Gleb Pokatashkin
- merging event by event with eventID from EventHeader
- events with lambda reconstructed have been marked



## experimental data with lambda selection



All events + lambda selection

All events + dE/dx selection (“true MB”) + lambda selection

Real reconstruction of MC tracks with lambda selection is needed!

..to be done soon..

### Conclusions:

- preliminary centrality determination is done for C+C @ 4A GeV
- comparing data to MC simulations → done for selected minimum biased events
- energy asymmetry approach has been developed for centrality estimation

### Outlook:

- comparison with full MC reconstructed events (lambda selected)
- centrality selection for data in C+C, C+Al, C+Cu (all run6 reactions with C)

Thank you for your attention!