Studies for the BeBe using PHSD

MexNICA collaboration winter meeting

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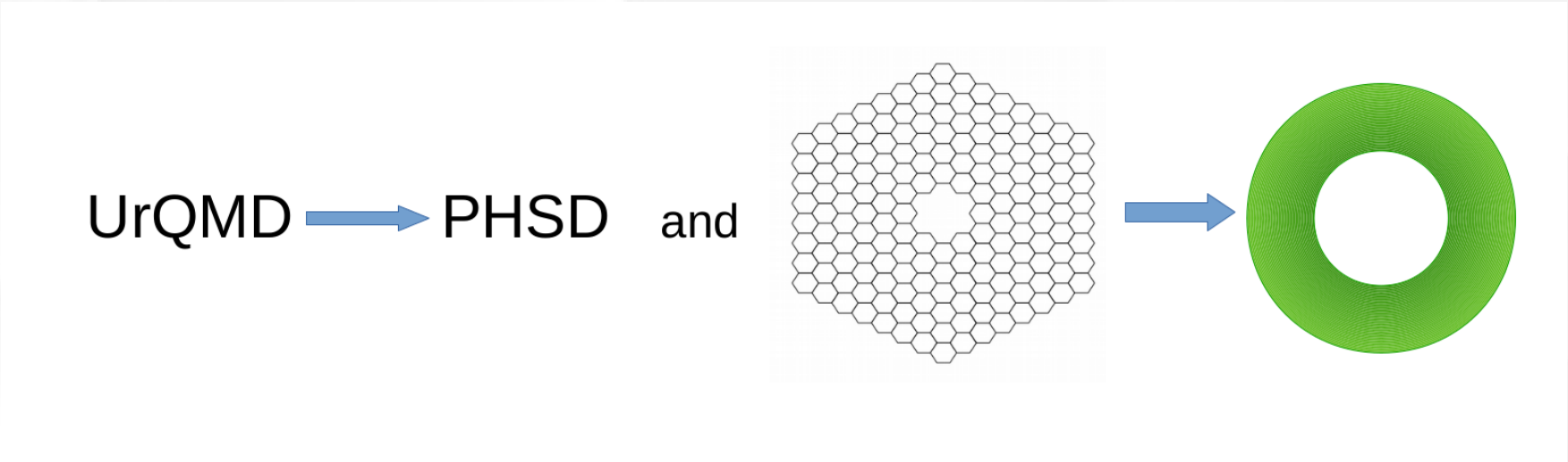
Motivations

- Simulations carried out with UrQMD showed a number of particles hitting the innermost ring of the BeBe above the minimum to act as a level 0 trigger.
- Since these studies were reported as a best case scenario, the optimization of the geometry and other event generators are needed to test the efficiency of the BeBe detector.
- These results were made with the UrQMD transport approach and the hex geometry for the BeBe.
- The work done here is focused on the Pie geometry for the BeBe and the PHSD generator.



Principal aspects of PHSD

- The Parton-Hadron-String Dynamics is a dynamical transport approach for strongly interacting systems.
- It simulates the dynamics and transition of both parton and hadron phases.
- The theoretical description of the parton is given by the Dynamical-Quasiparticle Model, which reproduces Lattice QCD results.
- The hadronization phase is written in the Hadron-String-Dynamics part of the code, which is mainly described by Lund string model.

Principal aspects of PHSD

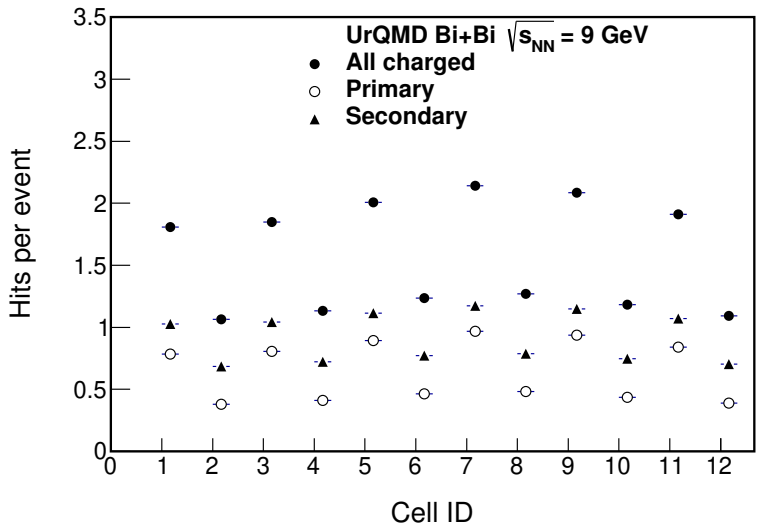
Example of an input file of PHSD (Au+Au @ 200 GeV with centrality 30% - 40%)

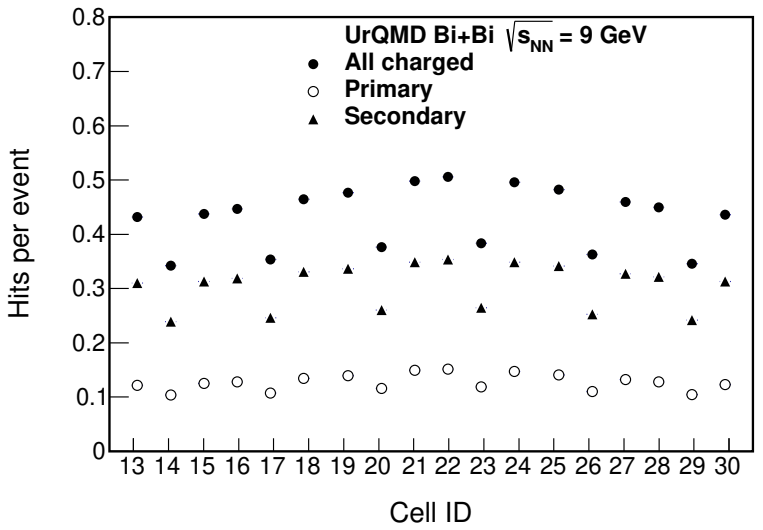
197,	MASSTA:	target mass
79,	MSTAPR:	protons in target
197,	MASSPR:	projectile mass
79,	MSPRPR:	protons in projectile
21300.,	ELAB:	lab energy per nucleon
8.7,	BMIN:	minimal impact parameter in fm
8.7,	BMAX:	maximal impact parameter in fm
1.,	DBIMP:	impact parameter step in fm
30,	NUM:	optimized number of parallel ensembles
1,	ISUBS:	number of subsequent runs
4567,	ISEED:	initial random seed [integer]
1,	IGLUE:	=1 with partons, =0 w/o partons (HSD)
150.,	FINALT:	final time of calculation in fm/c
10,	ILOW:	output level (default=10)
0,	IDILEPT:	=0 no dileptons; =1 electron pair; =2 muon pair
0,	ICQ:	=0 free,=1 drop. mass,=2 broad.,=3 drop.+broad.
0,	IHARD:	=1 hard collisions + direct charm/beauty, =0 no
0,	IBweight_MC:	=0 constant step in B =DBIMP; =1 B by MC
1,	IUSER:	=1 for general users; = 0 for PHSD team

The setting IGLUE will be a key feature in this work, setting it equal to 1 (**glue1**) includes the partonic phase, whereas setting in to 0 (**glue0**) excludes the partonic phase and therefore the QGP formation.

Previous Results

Results coming from the conceptual design report (CDR) show the number of hits per event per cell in the rings of the Hex configuration for MB Bi+Bi events @9 GeV:

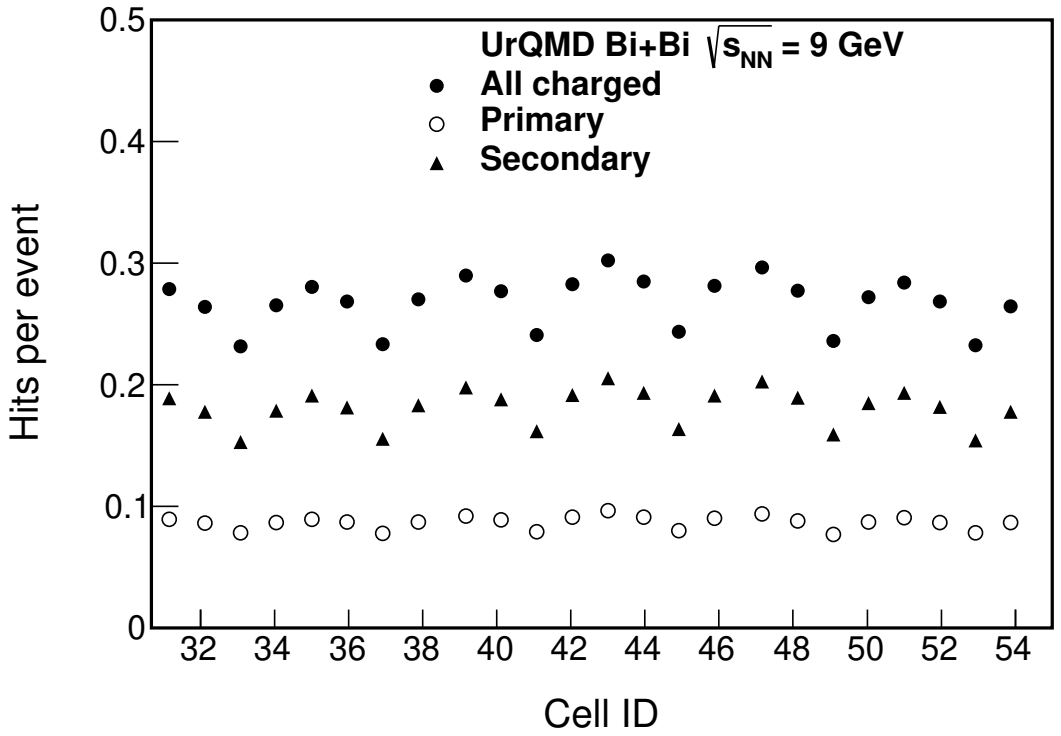




- Charged: hits lay around 1 and 1.5 in the worst case, while for the best case lay above 2.
- Primary: below and above .5
- Secondary: around .5 and 1

- Charged: above and below .4, around .5 in the best case
- Primary: around .1
- Secondary: around .3 and above .2, above .3 in the best case

Previous results



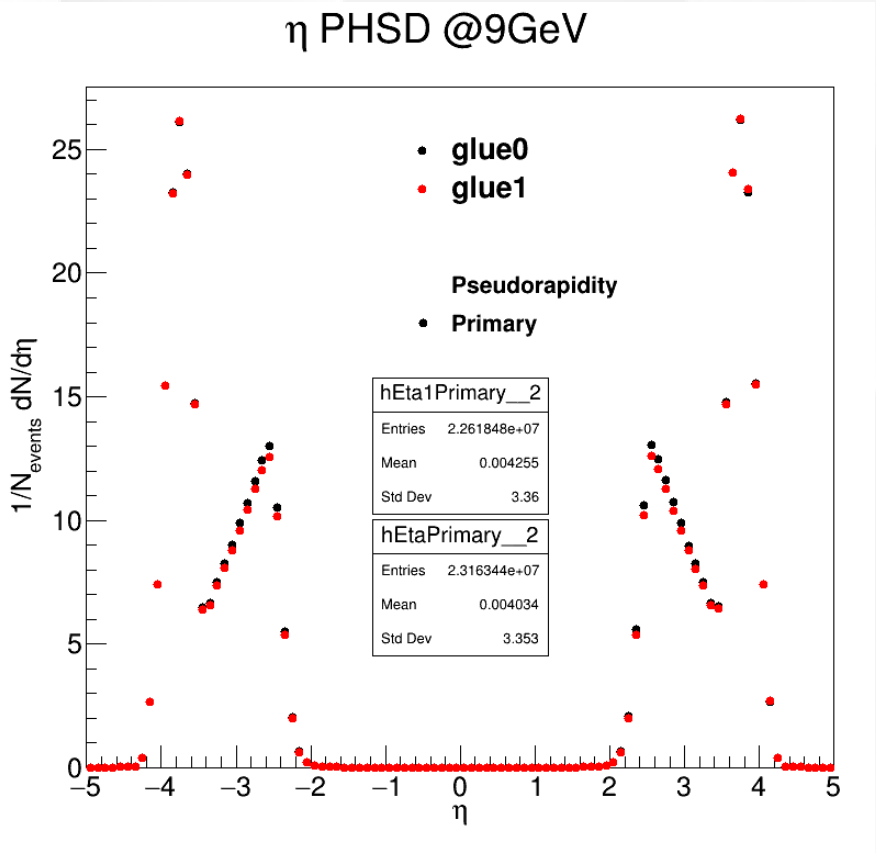
- Charged: Oscillates insider the range of 0.3 and 0.2, it hardly surpasses .3
- Primary: Below.1
- Secondary: Slightly above 0.2 in the best case

Pseudorapidity and transverse momentum distributions

The following results came from a sample of 500 000 Au+Au events at $\sqrt{s_{NN}} = 9$ GeV and $\sqrt{s_{NN}} = 11$ GeV with both settings glue1 and glue0. This was made with the purpose of checking the implications of turning off the partonic phase and visualize the basic distributions such as P_T and η.

500 000 events of Au+Au $\sqrt{s_{NN}} = 9$ GeV

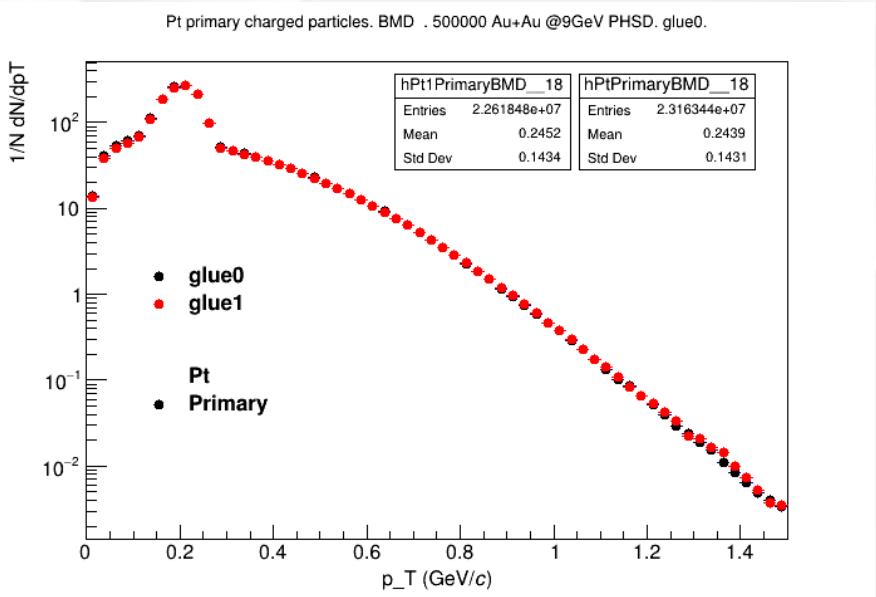
Pseudorapidity distributions



- BeBe pay, PHSD @9 GeV
- Primary particles that hit the BeBe
- glue0 (black dots)
- glue1 (red dots)
- Overall glue0 seems to surpass glue1 slightly
- The difference can only be perceived at pseudorapidity ranges between ± 4 and ± 2.

500 000 events of Au+Au $\sqrt{s_{NN}} = 9$ GeV

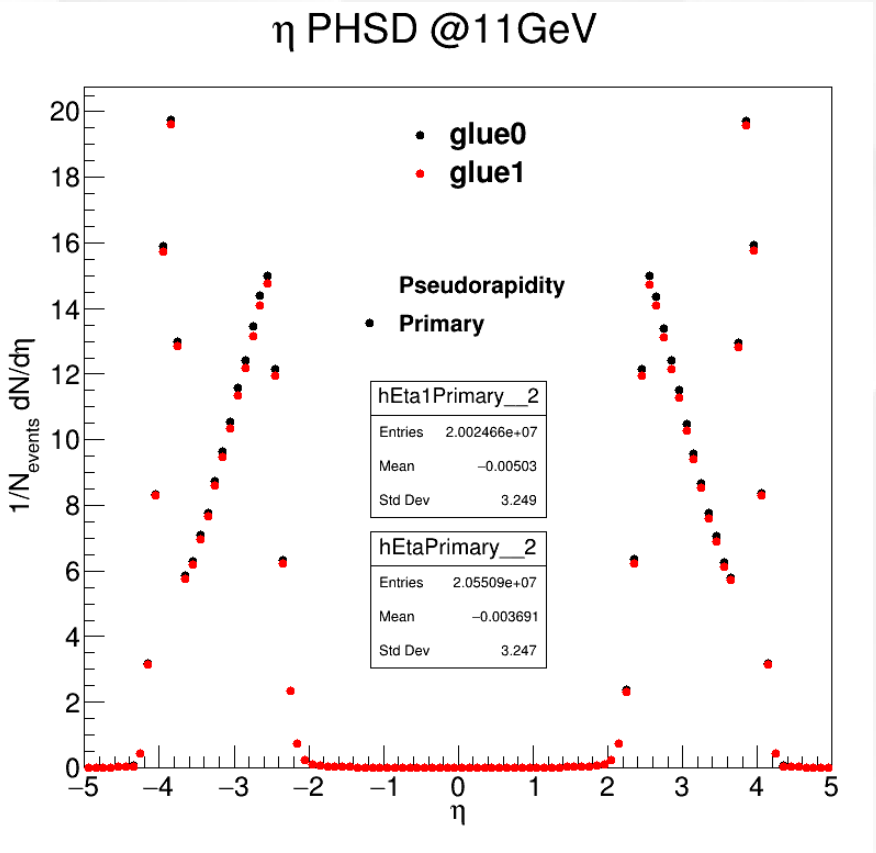
Transverse momentum distributions



- Same configuration as before
- On this distribution a difference is almost not perceptible
- Lumpiness for great values of P_T

500 000 events of Au+Au $\sqrt{s_{NN}} = 11$ GeV

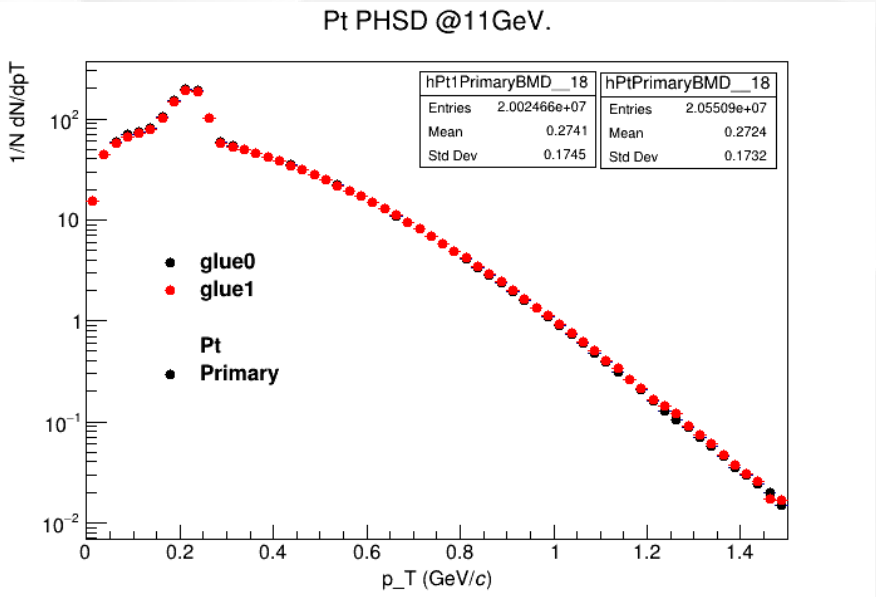
Pseudorapidity distributions



- BeBe pay, PHSD @11 GeV
- Primary particles that hit the BeBe
- glue0 (black dots)
- glue1 (red dots)
- Overall glue0 seems to surpass glue1 slightly
- The difference can only be perceived at pseudorapidity ranges around ± 4 and ± 2.
- There's a decrease in the entries coming from the beam directions.

500 000 events of Au+Au $\sqrt{s_{NN}} = 11$ GeV

Transverse momentum distributions

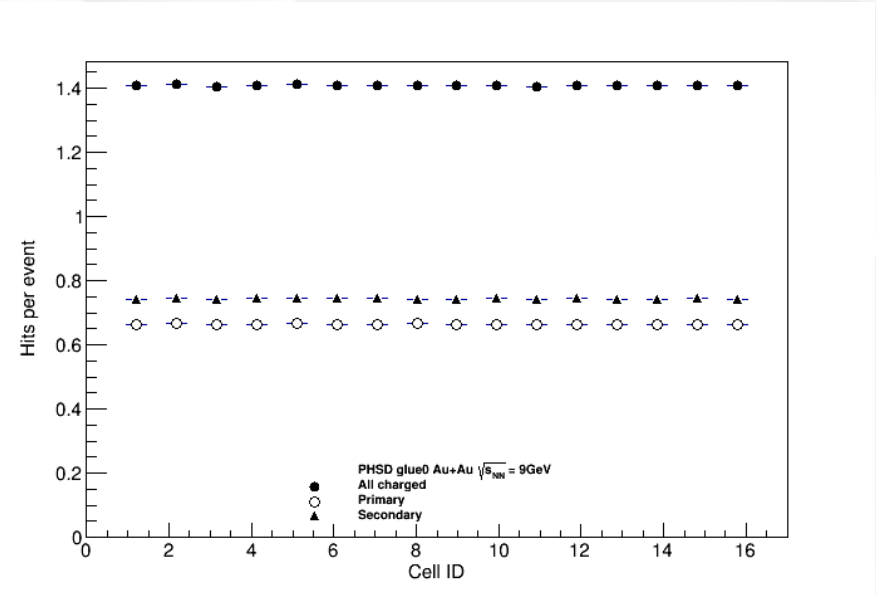


- Same configuration as before
- Again the difference is almost not perceptible in this distributions
- But the lumpiness for great values of P_T is reduced as well

First ring of BeBe Pay at $\sqrt{s_{NN}} = 9$ GeV

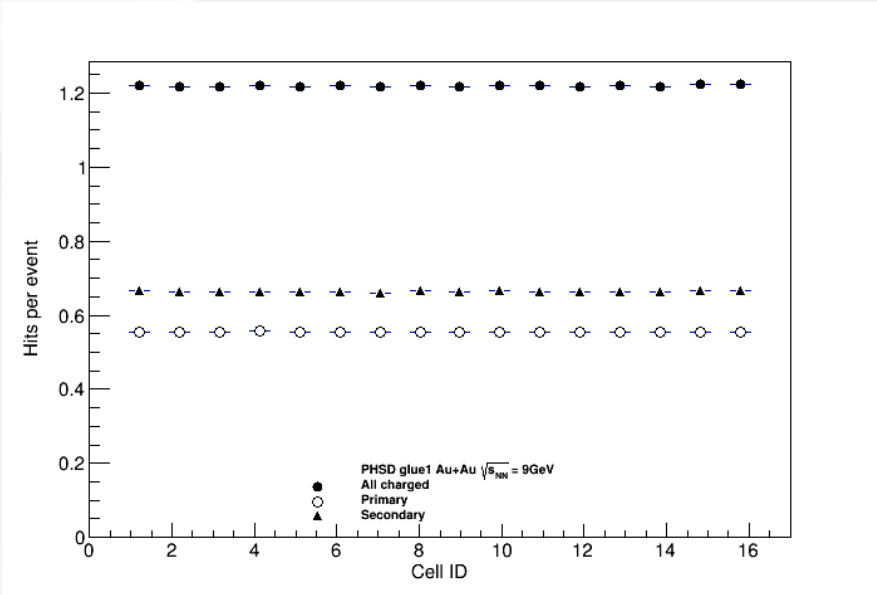
To go further in this analysis, over the following sections, I'm showing the results coming from the distributions of hits per event using PHSD and the Pay geometry

glue0



All: around 1.4
Primary: around 0.65
Secondary: around 0.75

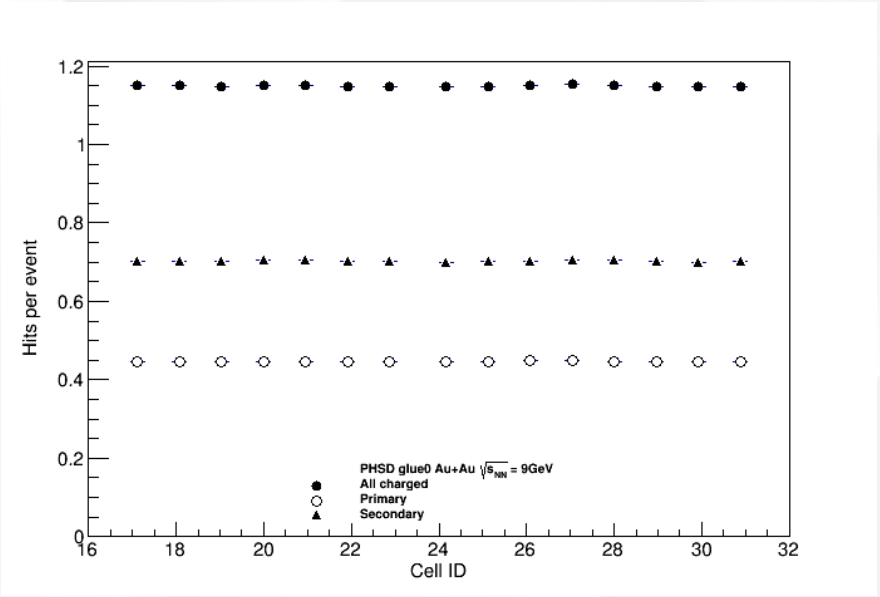
glue1



All: around 1.2
Primary: around 0.55
Secondary: around 0.65

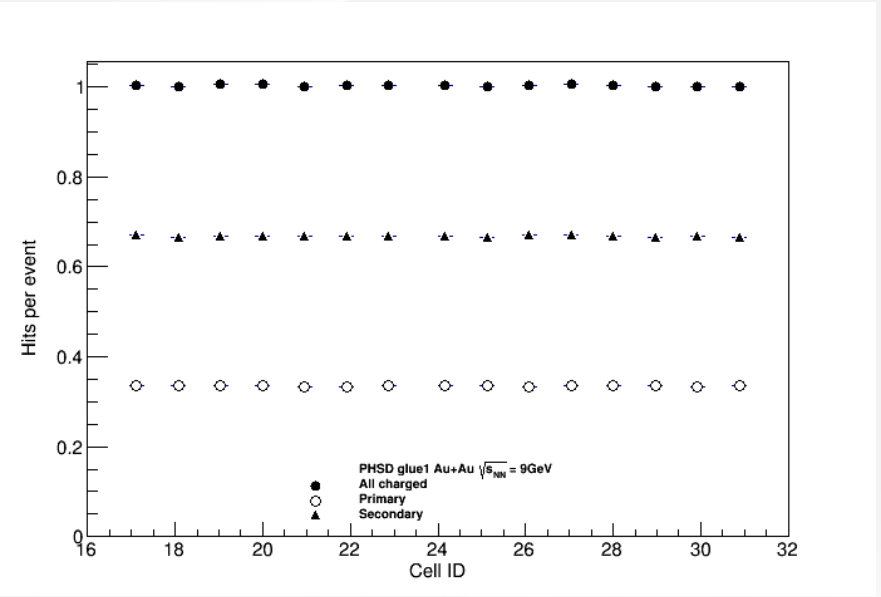
Second ring of BeBe Pay at $\sqrt{s_{NN}} = 9$ GeV

glue0



All: around 1.2
Primary: around 0.45
Secondary: around 0.7

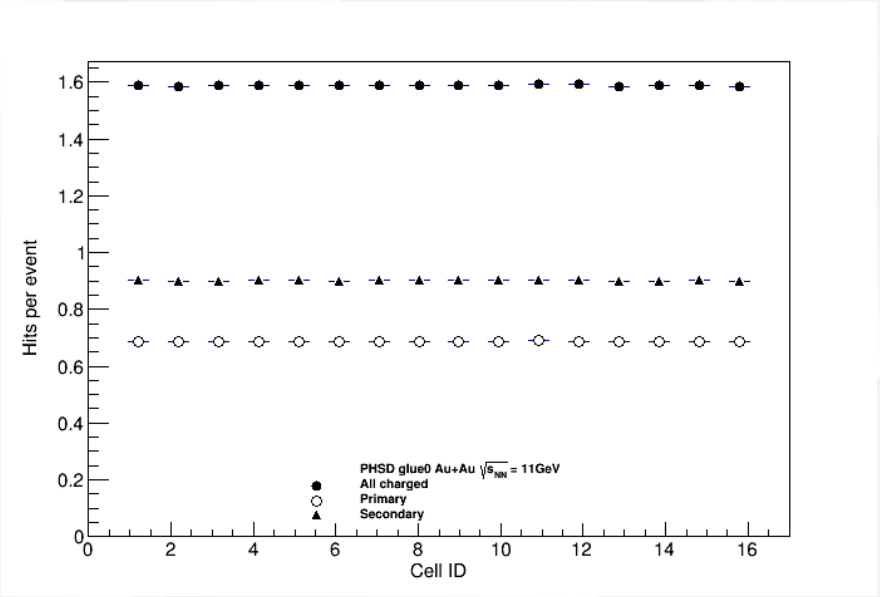
glue1



All: around 1
Primary: around 0.35
Secondary: around 0.65

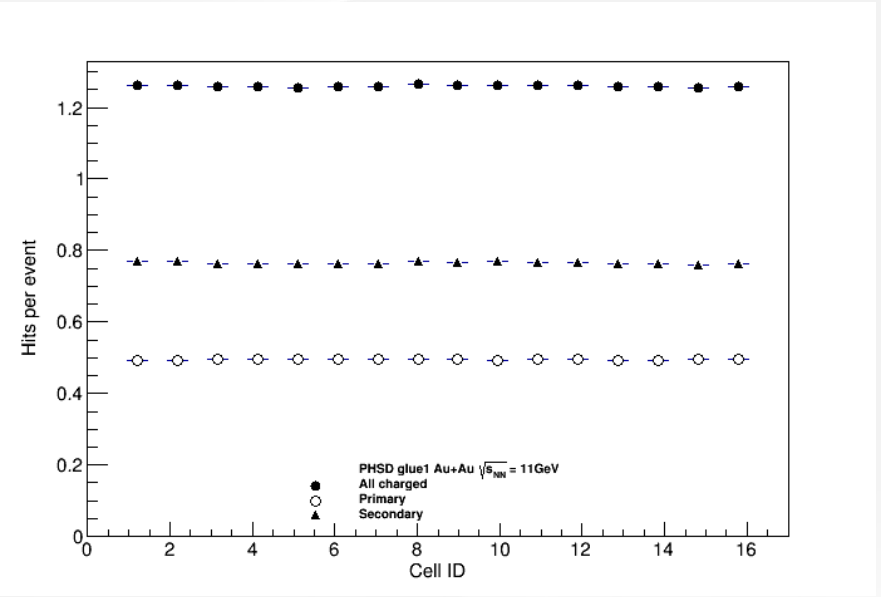
First ring of BeBe Pay at $\sqrt{s_{NN}} = 11$ GeV

glue0



All: around 1.6
Primary: around 0.7
Secondary: around 0.9

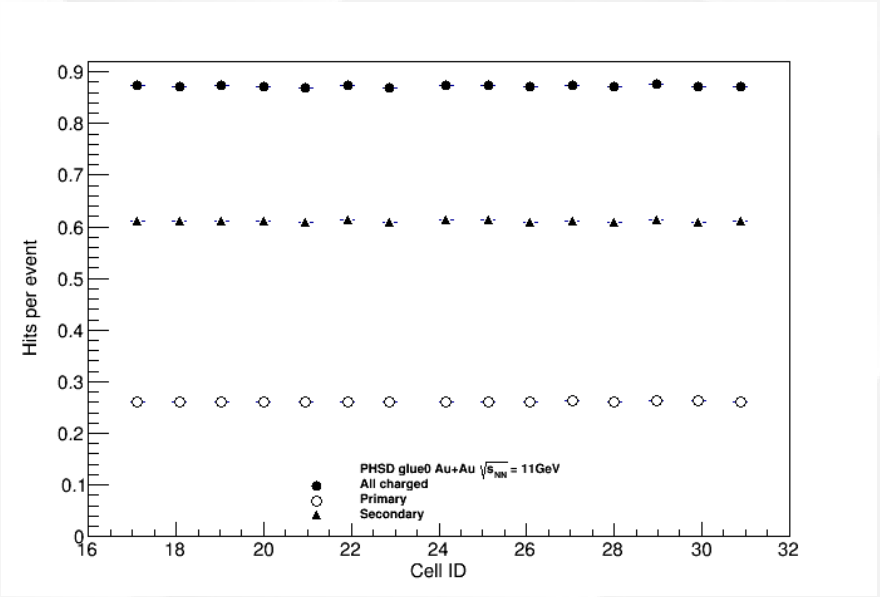
glue1



All: around 1.25
Primary: around 0.5
Secondary: below 0.8

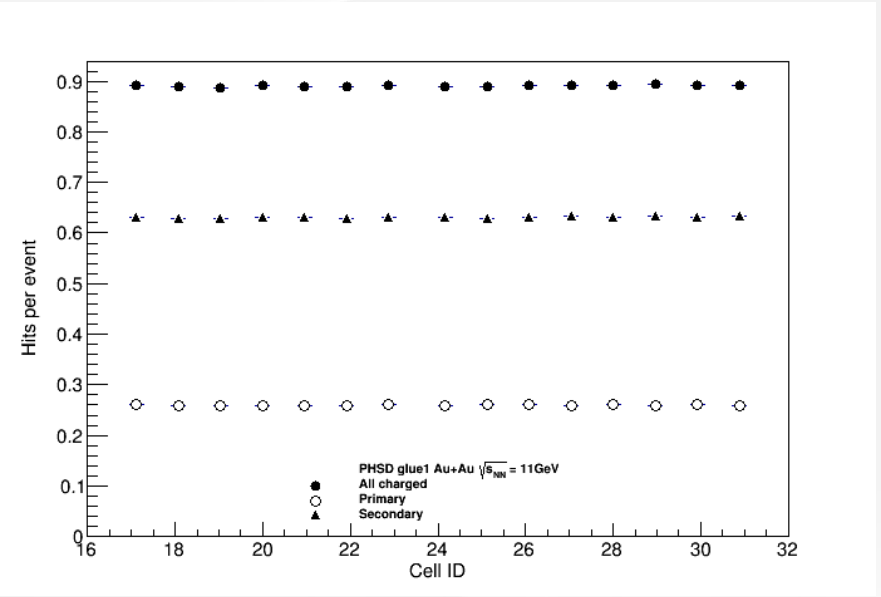
Second ring of BeBe Pay at $\sqrt{s_{NN}} = 11$ GeV

glue0



All: around 0.88
Primary: around 0.26
Secondary: above 0.6

glue1



All: around 0.9
Primary: around 0.26
Secondary: around 0.62

Synthesized tables for the three innermost rings

$\sqrt{s_{NN}} = 9$ GeV

Ring	Gen. Setting	All	1ary	2ary
1	glue0	~ 1.4	~ 0.65	~ 0.75
	glue1	~ 1.2	~ 0.55	~ 0.65
2	glue0	~ 1.2	~ 0.45	~ 0.7
	glue1	~ 1	~ 0.35	> 0.65
3	glue0	> 0.7	> 0.25	> 0.45
	glue1	< 0.75	< 0.3	~ 0.45

$\sqrt{s_{NN}} = 11$ GeV

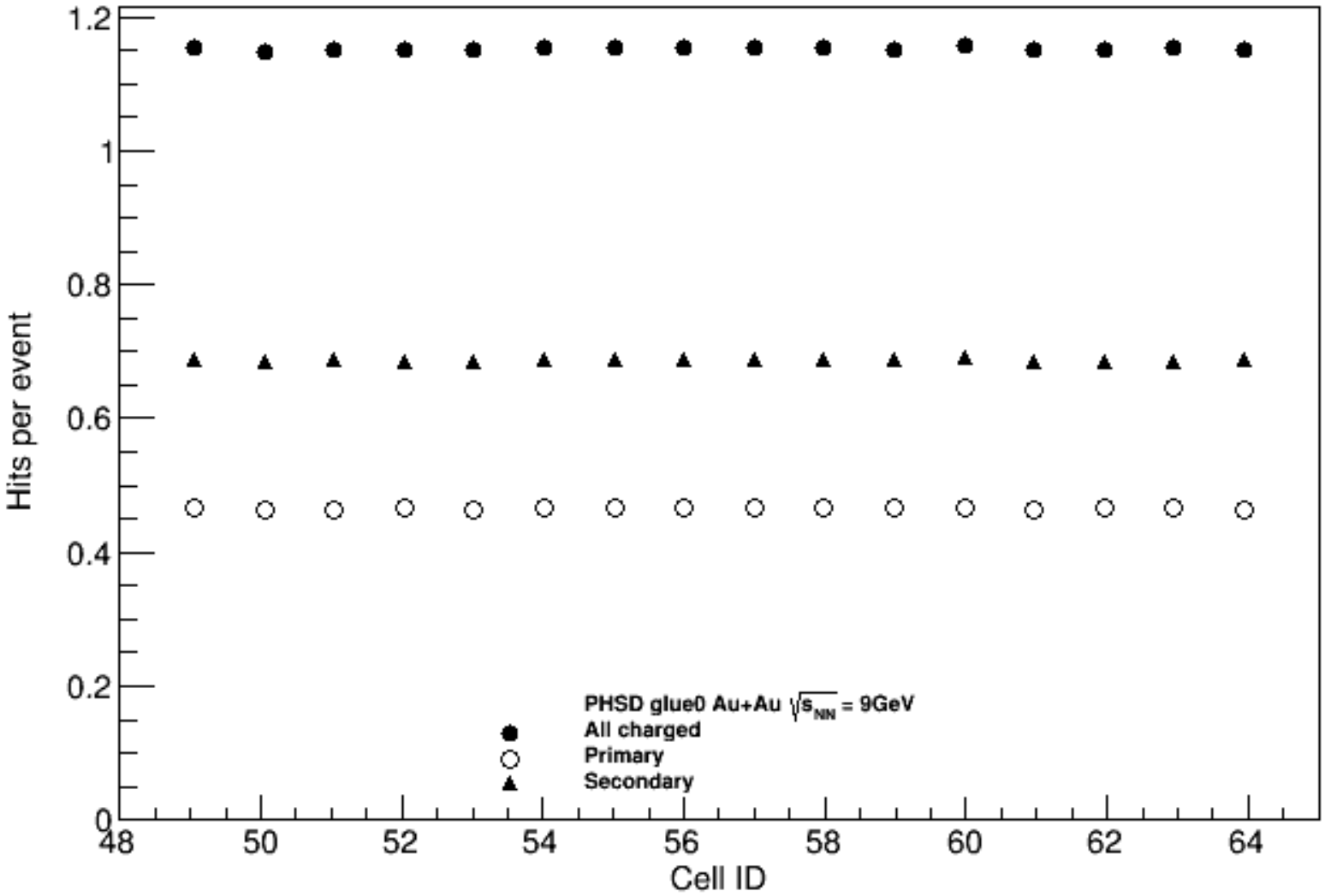
Ring	Gen. Setting	All	1ary	2ary
1	glue0	~ 1.6	~ 0.7	~ 0.9
	glue1	~ 1.25	~ 0.5	< 0.8
2	glue0	~ 0.88	~ 0.26	> 0.6
	glue1	~ 0.9	~ 0.26	~ 0.62
3	glue0	~ 0.82	> 0.3	~ 0.5
	glue1	> 0.82	~ 0.3	~ 0.5

Conclusions and further work

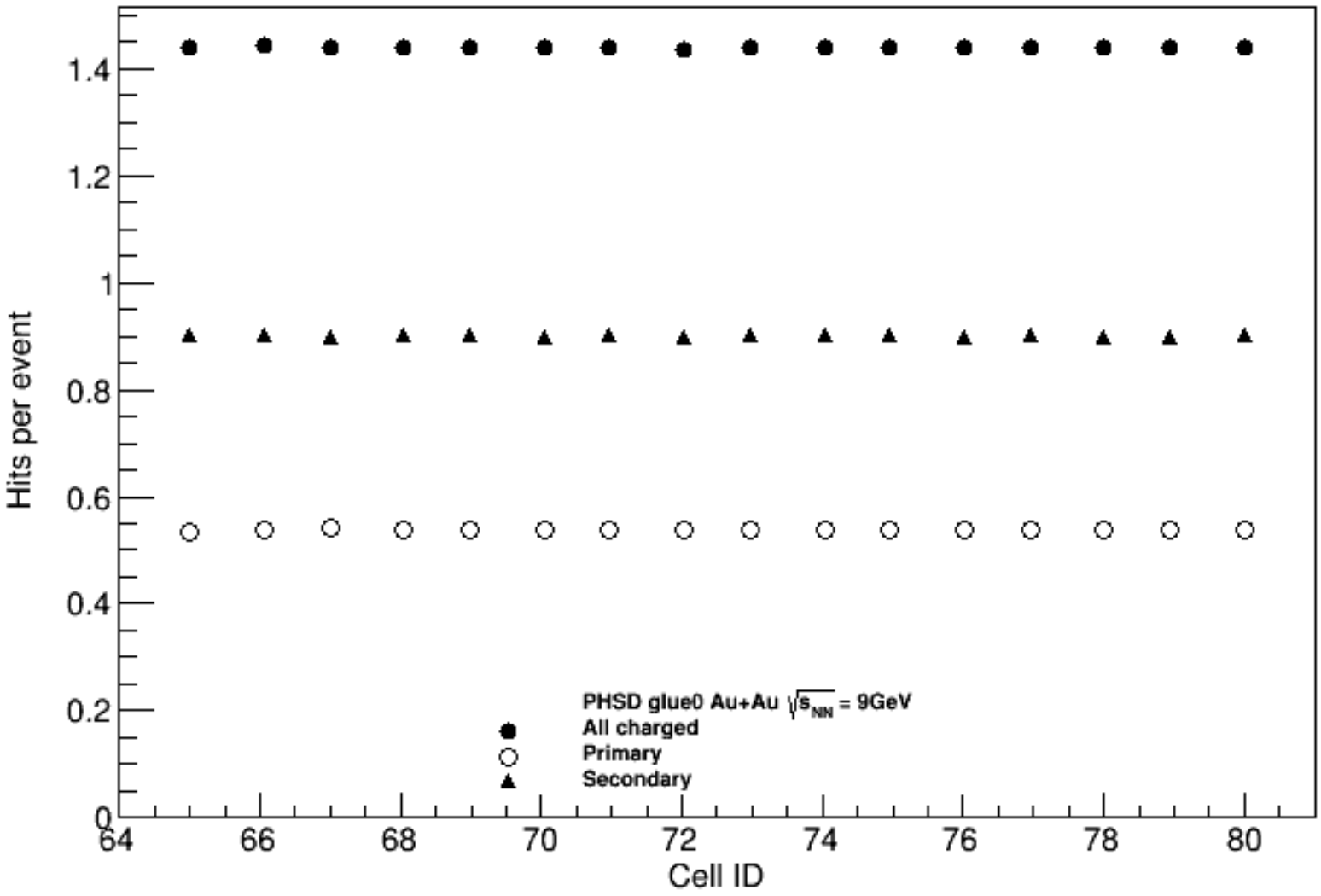
- Although for the first ring of the BeBe, the UrQMD/Hex configuration showed similar values for the mean hits in contrast with the PHSD/Pay config, the values of the latter config. showed higher number of hits for the second and third rings for both glue0 and glue1 settings.
- Also the difference between glue0 and glue0 is more evident @ 11GeV
- Between glue0 and glue1, the difference in hits came mostly form the inner rings of the BeBe.
- The lumpiness for high values of P_T can be better studied including the outermost rings of the BeBe or the miniBeBe
- To have a better comparison between PHSD and UrQMD, events of Bi+Bi @9GeV

Thanks!

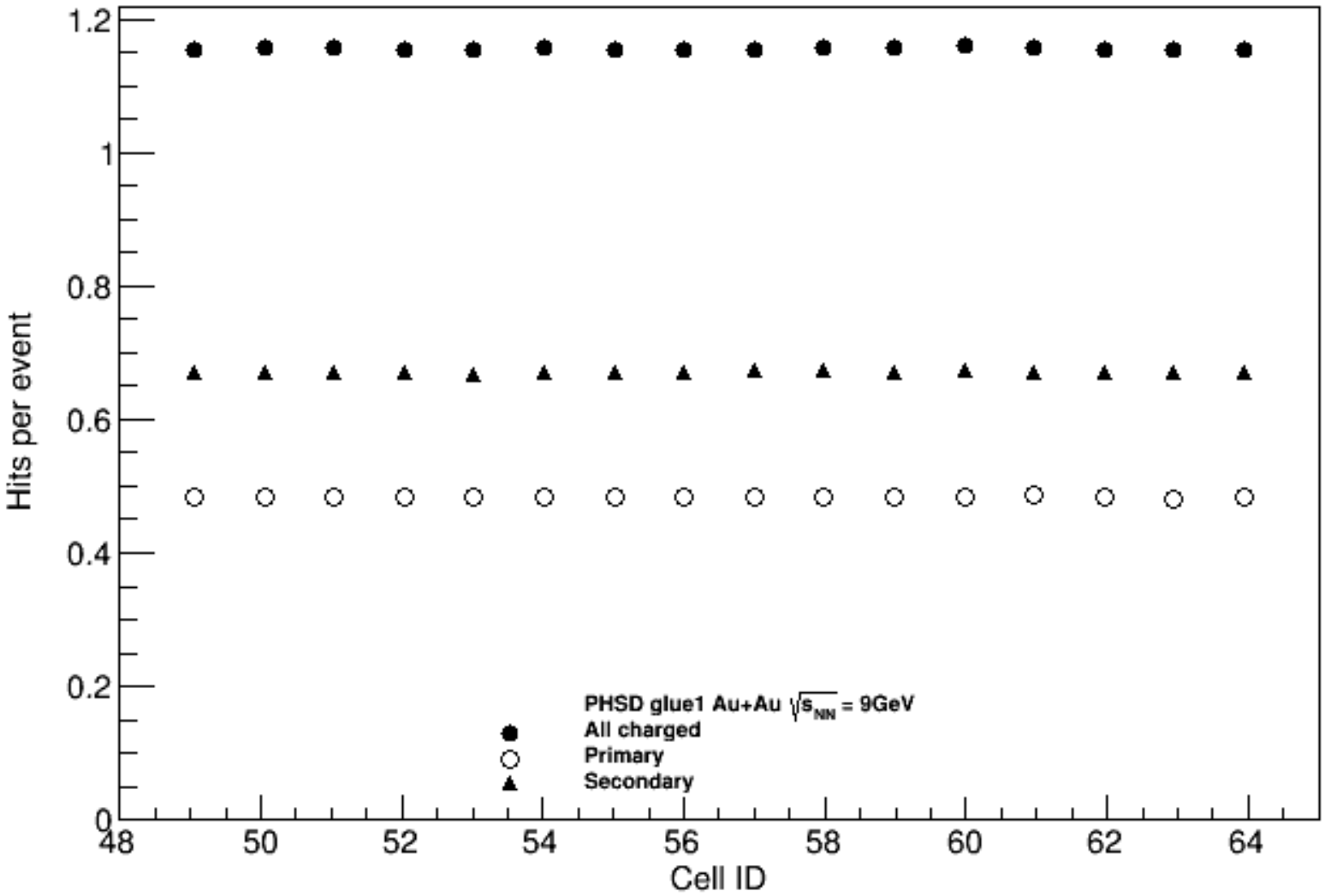
Backup 9GeV glue0, ring 4



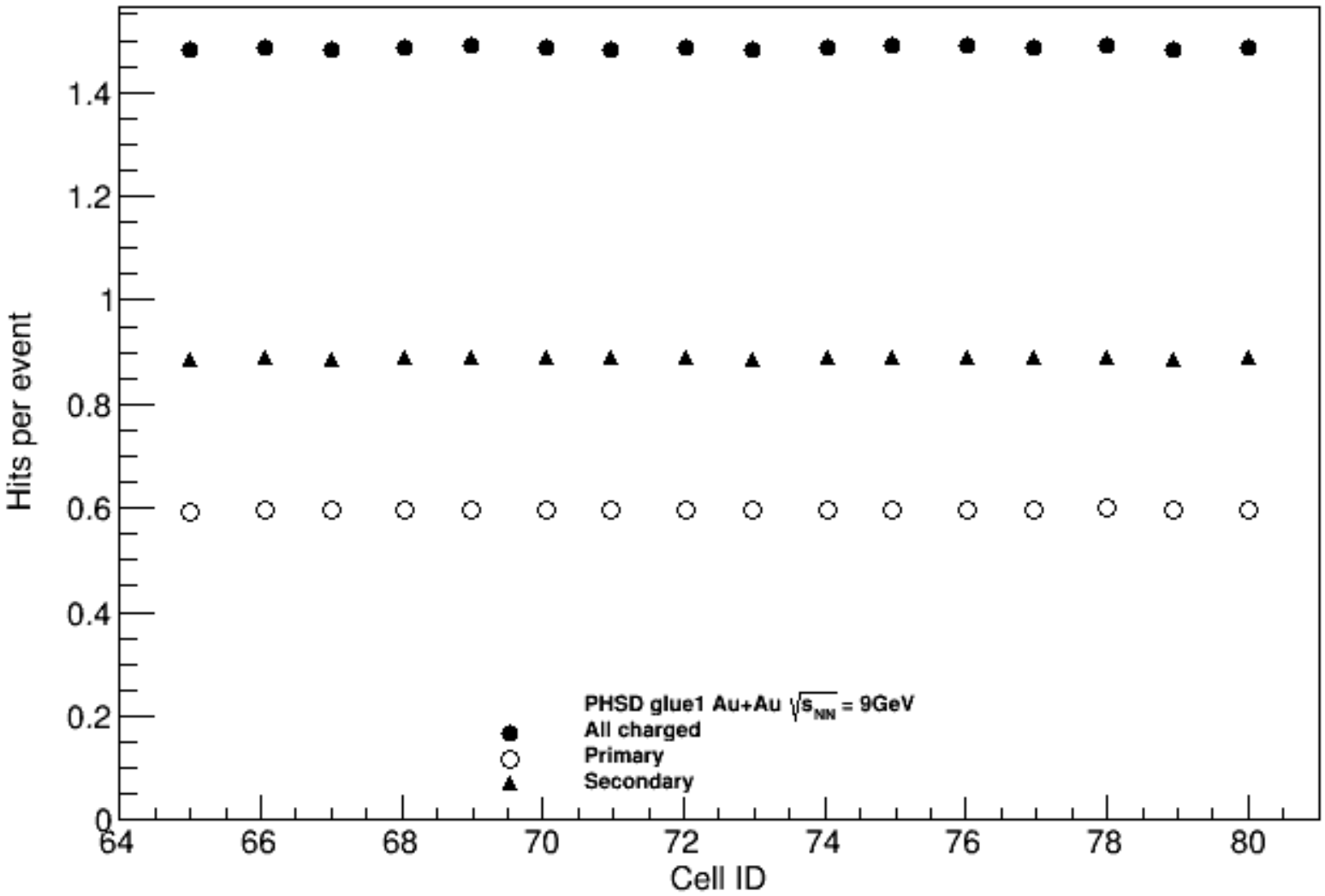
Backup 9GeV glue0, ring 5



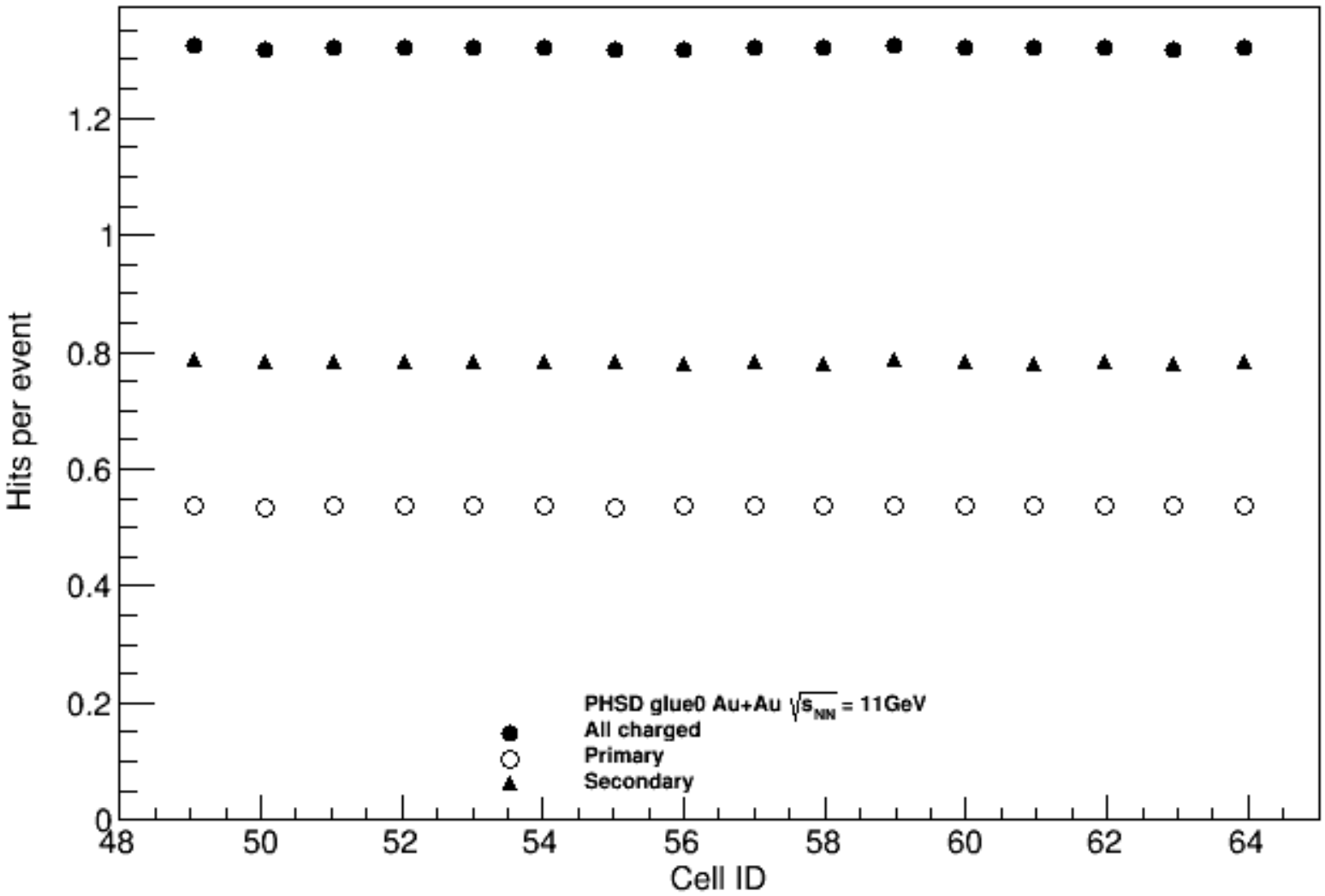
Backup 9GeV glue1, ring 4



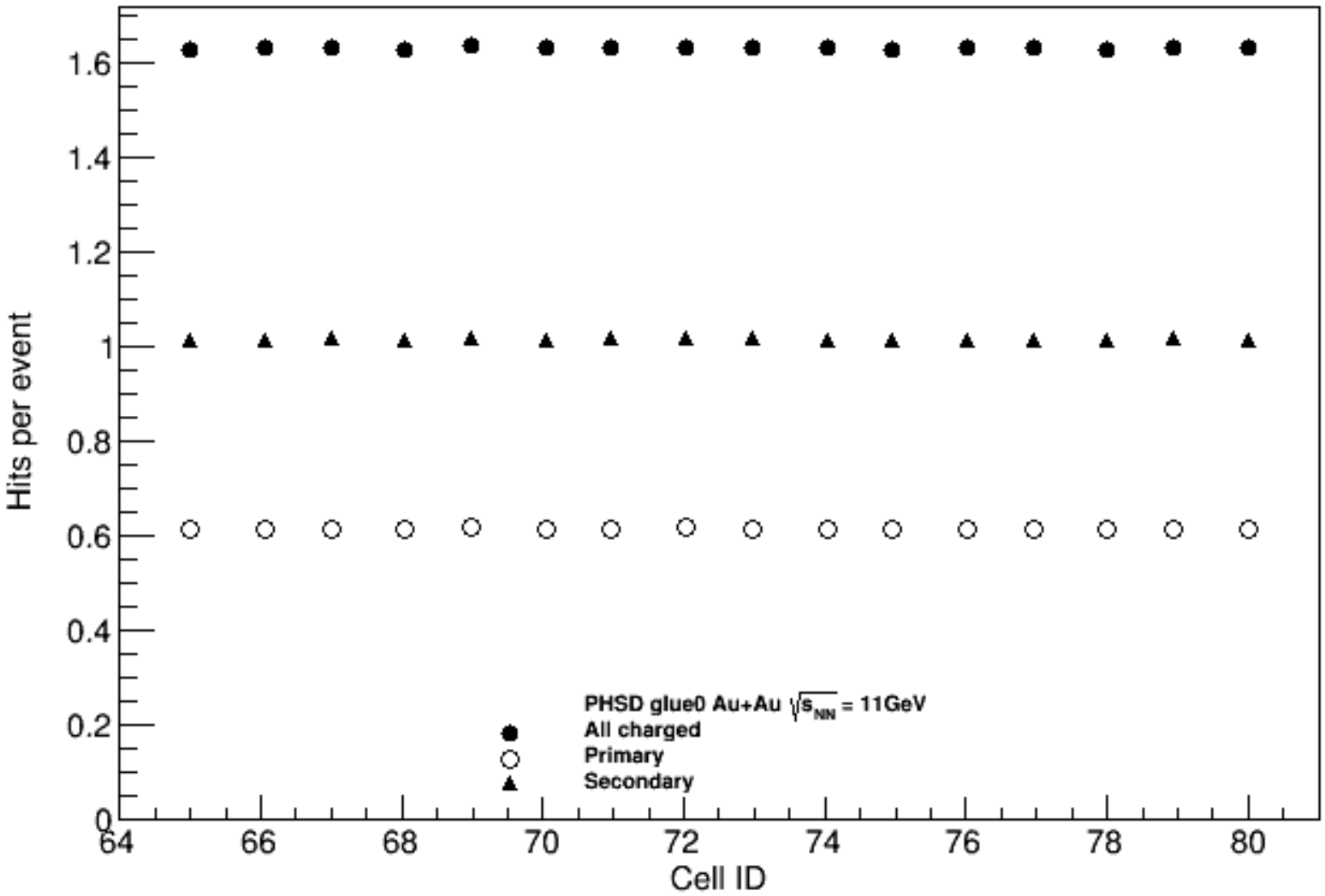
Backup 9GeV glue1, ring 5



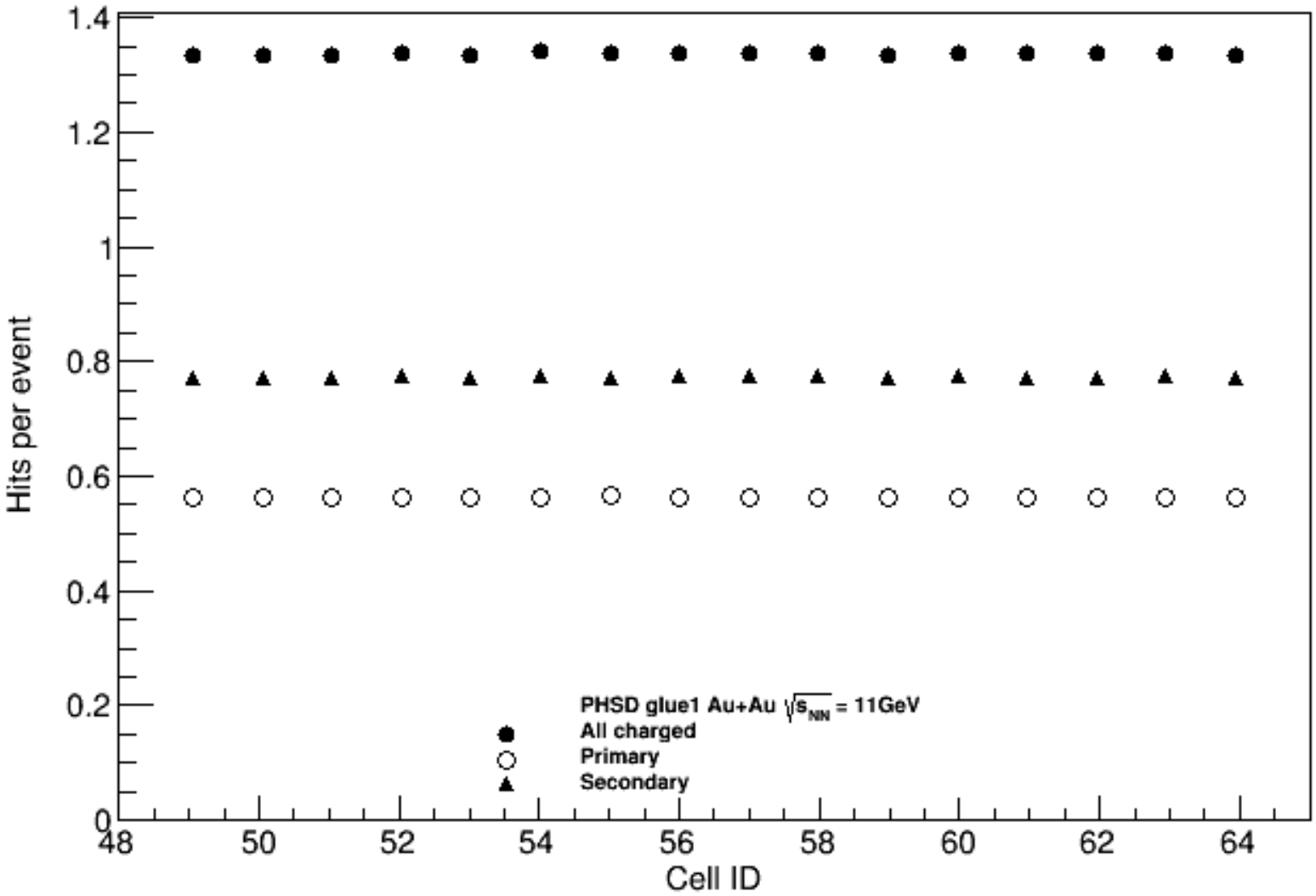
Backup 11GeV glue0, ring 4



Backup 11GeV glue0, ring 5



Backup 11GeV glue1, ring 4



Backup 11GeV glue1, ring 5