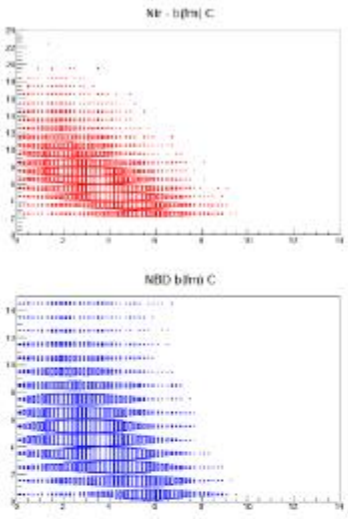
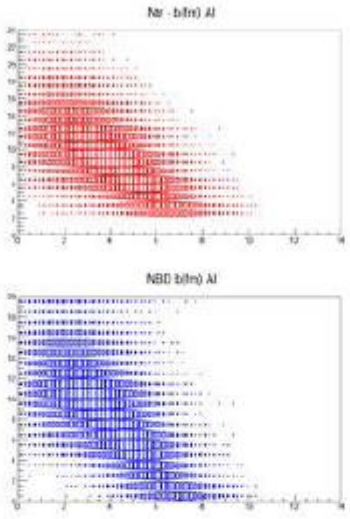
Definition of centrality classes in Ar+A data

Ar+C



Ar+Al

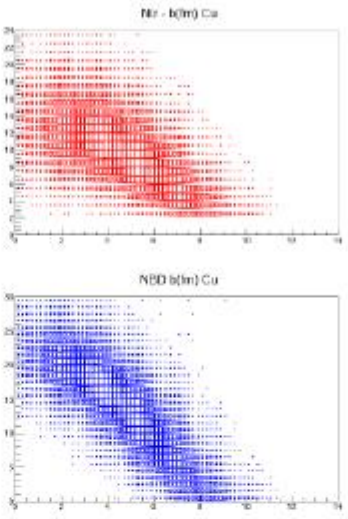


Ntr

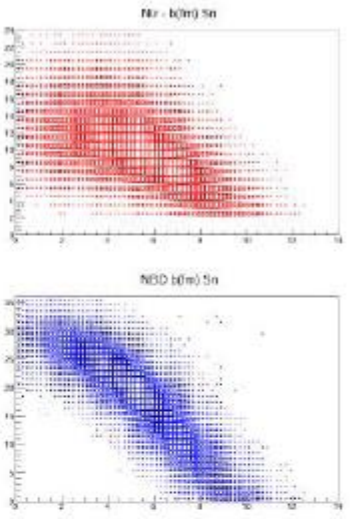
NBD

B, fm

Ar+Cu

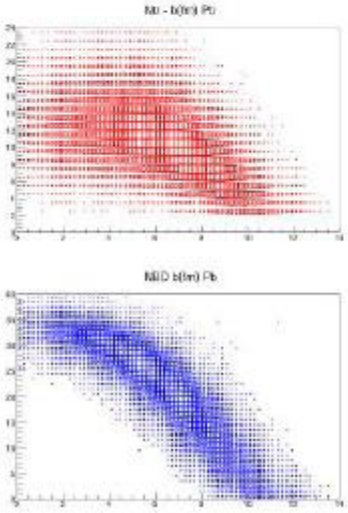


Ar+Sn



B, fm

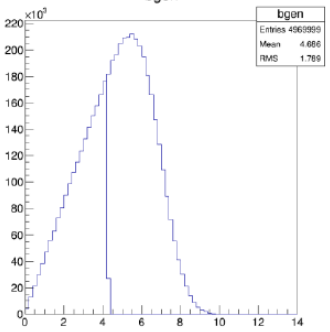
Ar+Pb



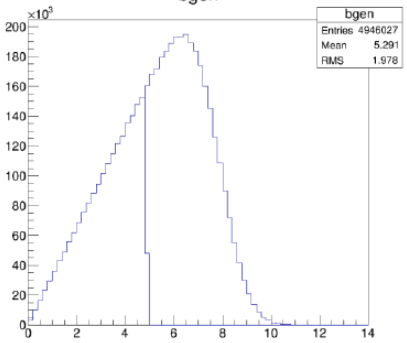
DCM-SMM simulation for Ar+C, Al, Cu, Sn, Pb:
Correlation plots between the collision impact parameter b and
-number of tracks Ntr,
-number of hits NBD in the BD detector

Impact parameter distributions for Ar+A collisions

Ar+C

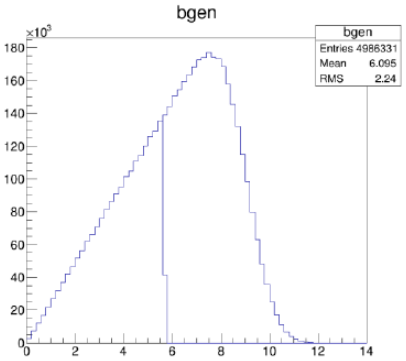


Ar+Al

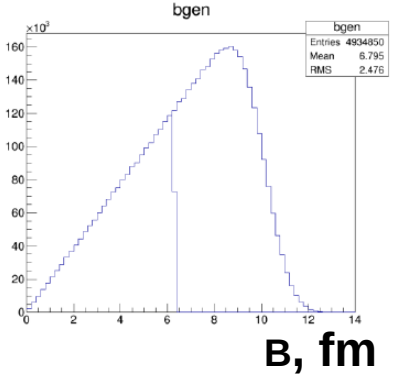


B, fm

Ar + Cu

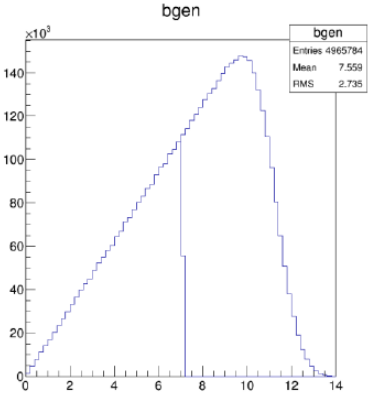


Ar + Sn



B, fm

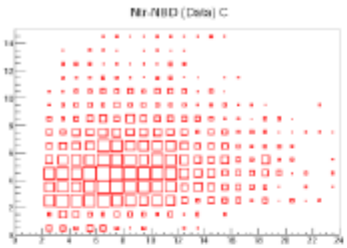
Ar + Pb

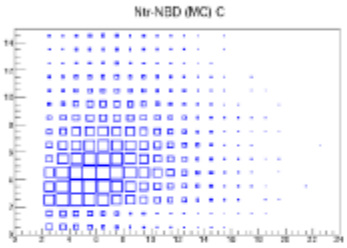


Distribution of the impact parameter b of Ar+C, Al, Cu, Sn, Pb collisions. Lines show the boundary of collisions with centrality 0-40% and 40-100%.

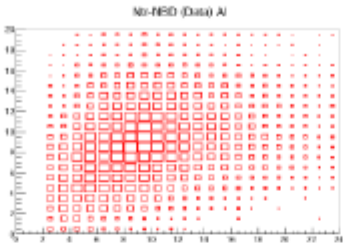
Correlation between Ntr tracks and NBD hits

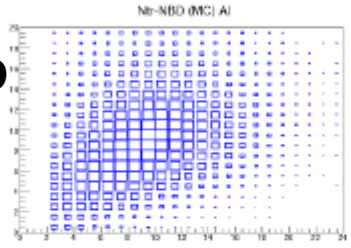
Ar+C





Ar+Al





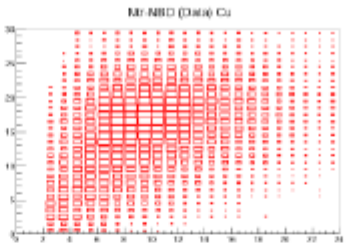
Data

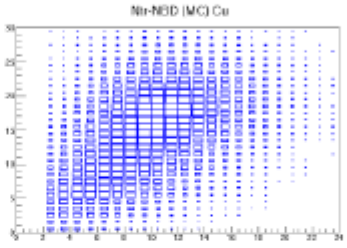
NBD

Sim

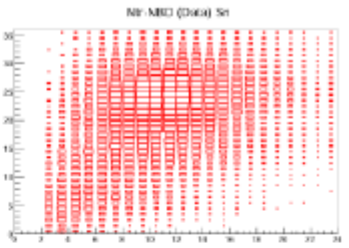
Ntr

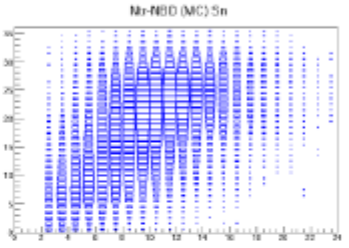
Ar+Cu





Ar+Sn

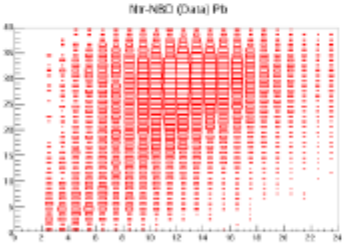


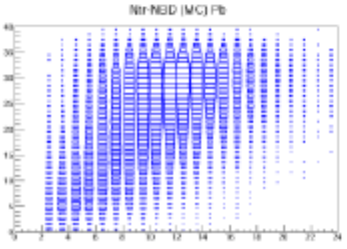


NBD

Ntr

Ar+Pb





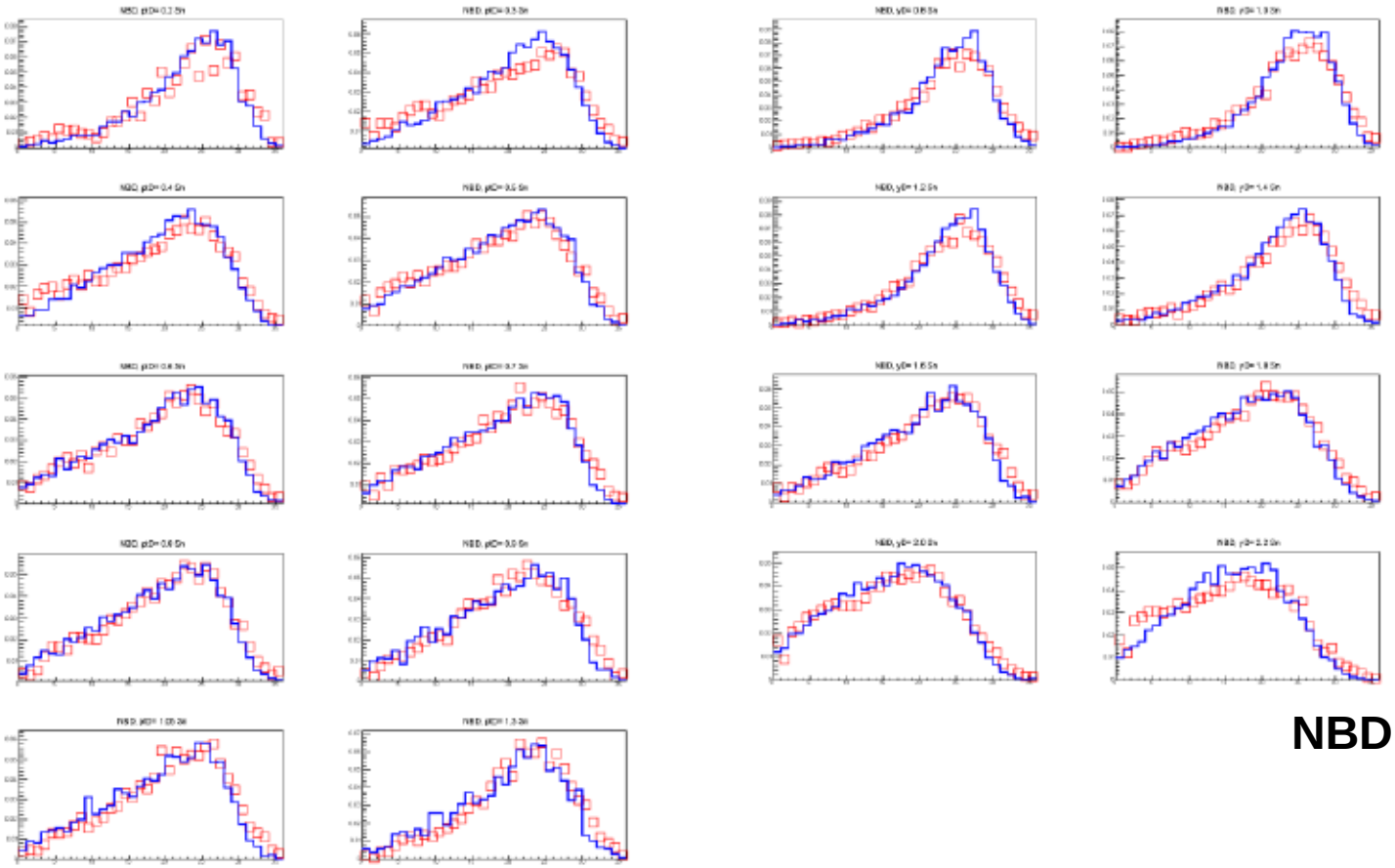
2-dimensional distribution:
- number of hits NBD vs number of tracks Ntr
Upper red plots : Data
Lower blue plots: DCM-SMM simulation for Ar+C,Al, Cu, Sn, Pb

Deuterons: PDF of NBD hits in p_T and y bins

pT bins

y bins

PDF



NBD

NBD

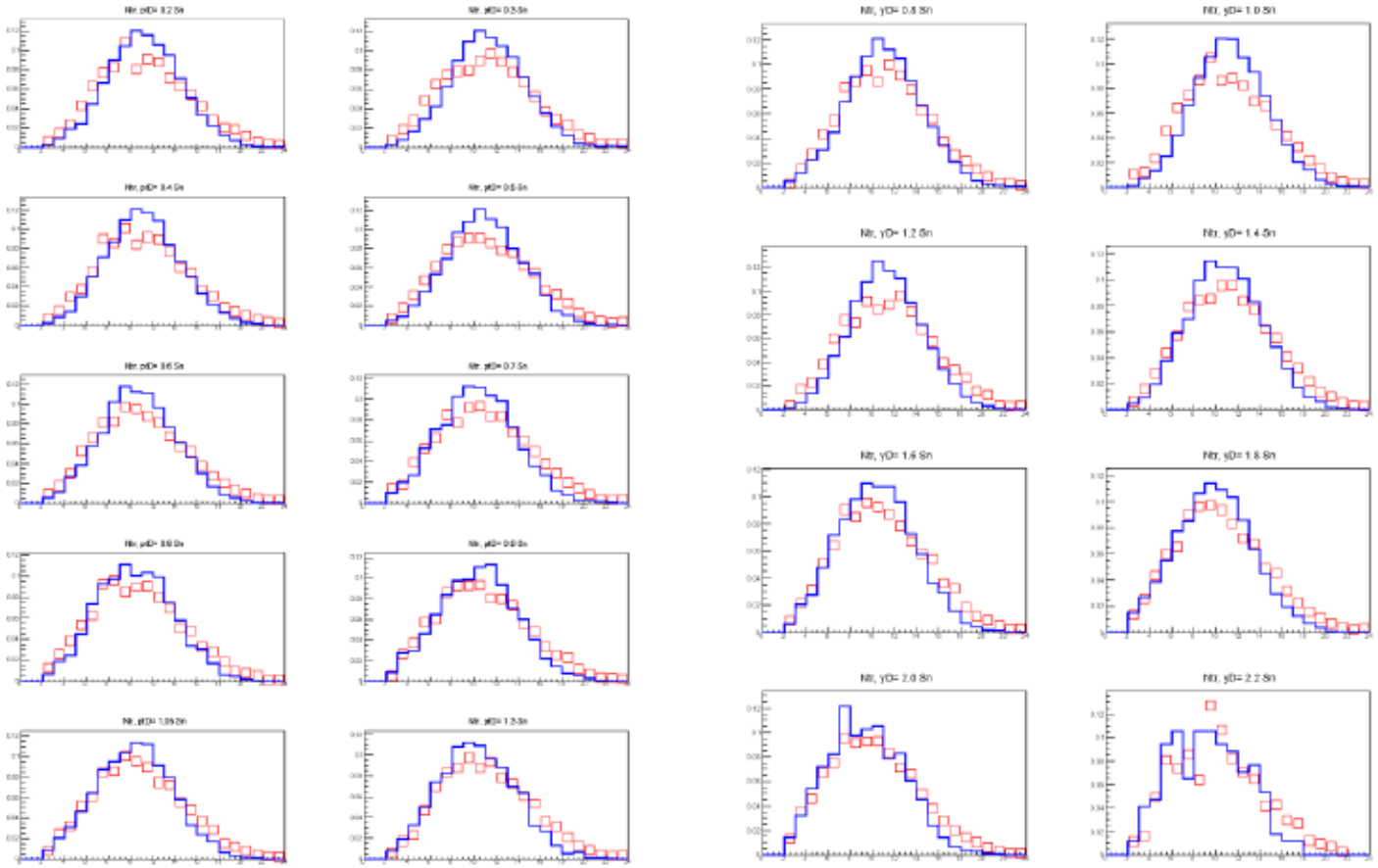
Ar+Sn: PDF distribution of the number of hits in the BD detector NBD in events with identified deuterons (ToF-700) Blue histogram - DCM-SMM simulation, open red symbols – data.

Deuterons: PDF of Ntr tracks in p_T and y bins

pT bins

y bins

PDF



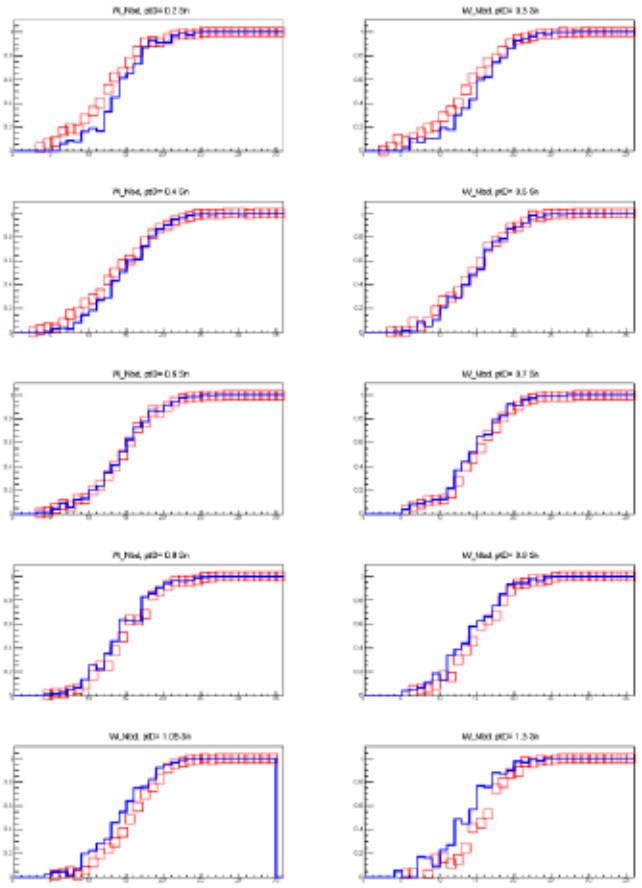
Ntr

Ntr

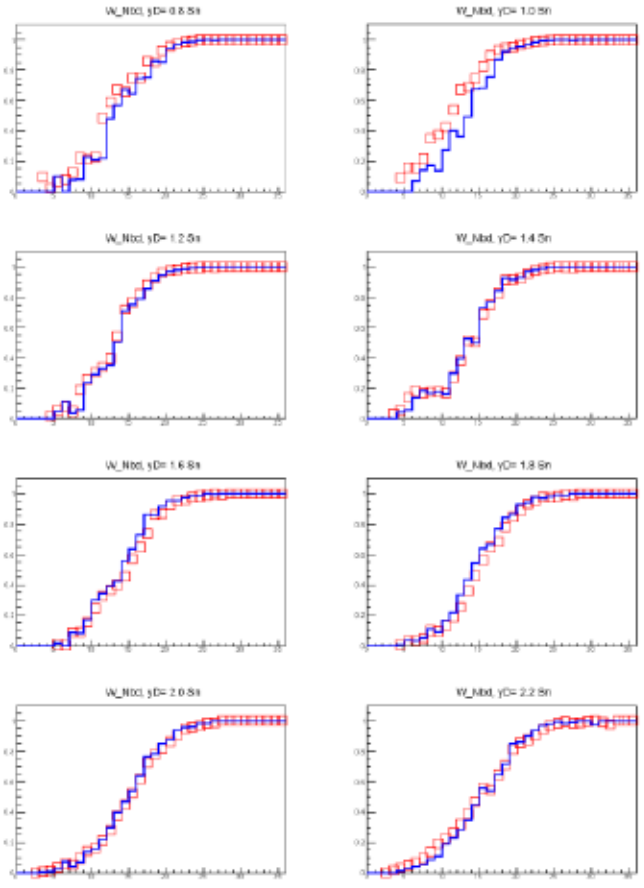
Ar+Sn: PDF distribution of the number of tracks Ntr in the vertex in events with identified deuterons (ToF-400). Blue histogram - DCM-SMM simulation, open red symbols – data.

Deuterons: fraction of 0-40% events vs NBD

pT bins



y bins



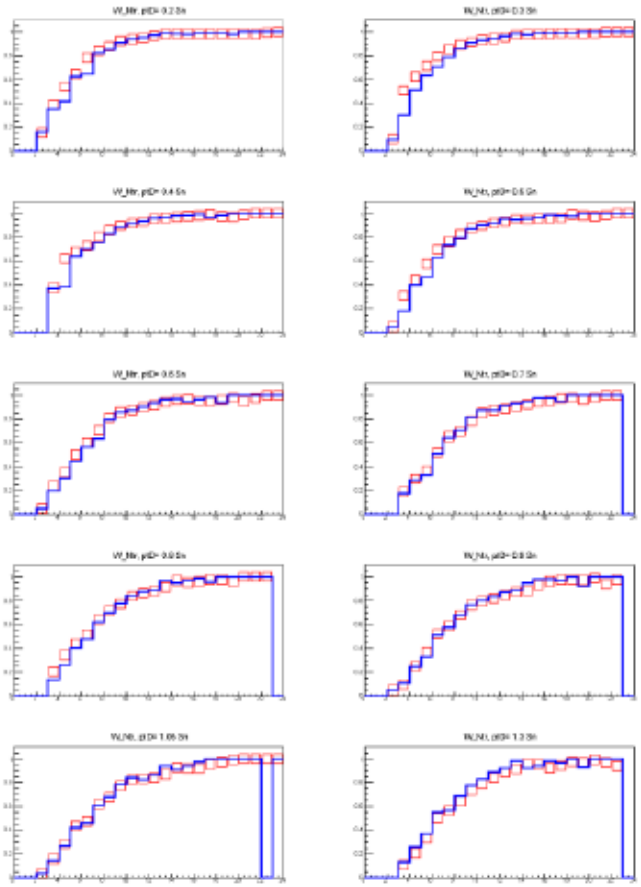
NBD

NBD

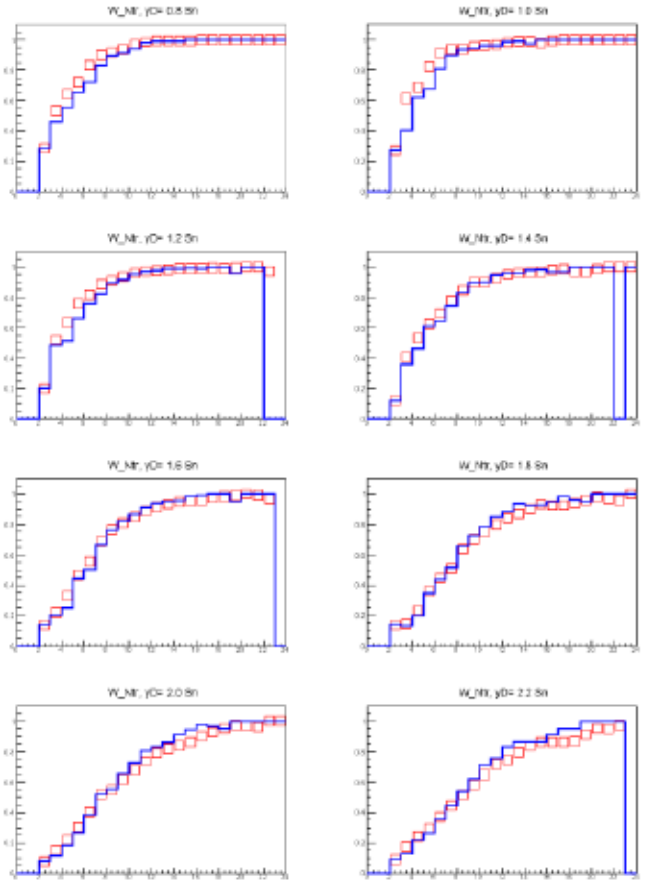
Ar+Sn: Fraction of events with identified deuterons of centrality class 0-40% as a function of the NBD hits. Blue histogram - DCM-SMM simulation, open red symbols – data.

Deuterons: fraction of 0-40% events vs Ntr

pT bins



y bins



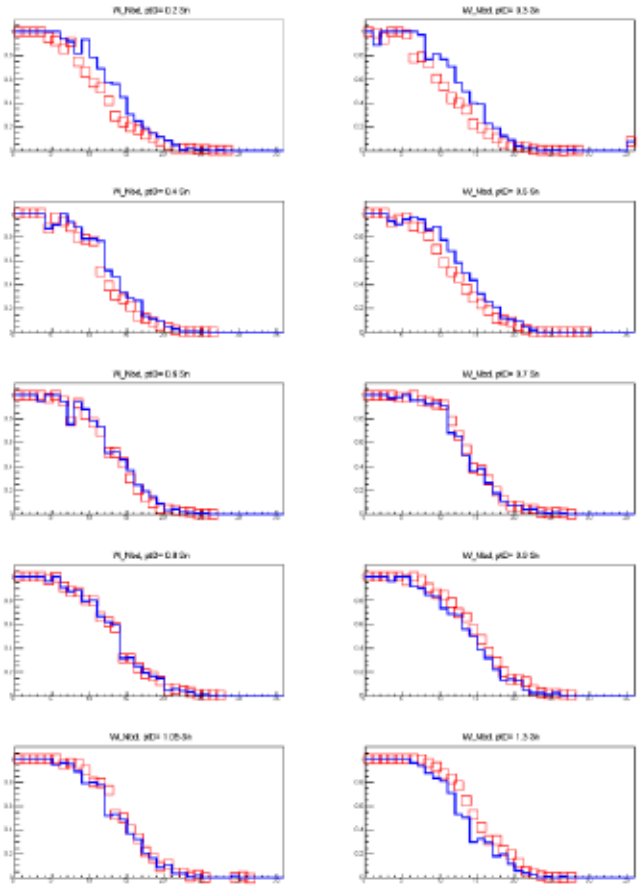
Ntr

Ntr

Ar+Sn: Fraction of events with identified deuterons of centrality class 0-40% as a function of the Ntr tracks. Blue histogram - DCM-SMM simulation, open red symbols – data.

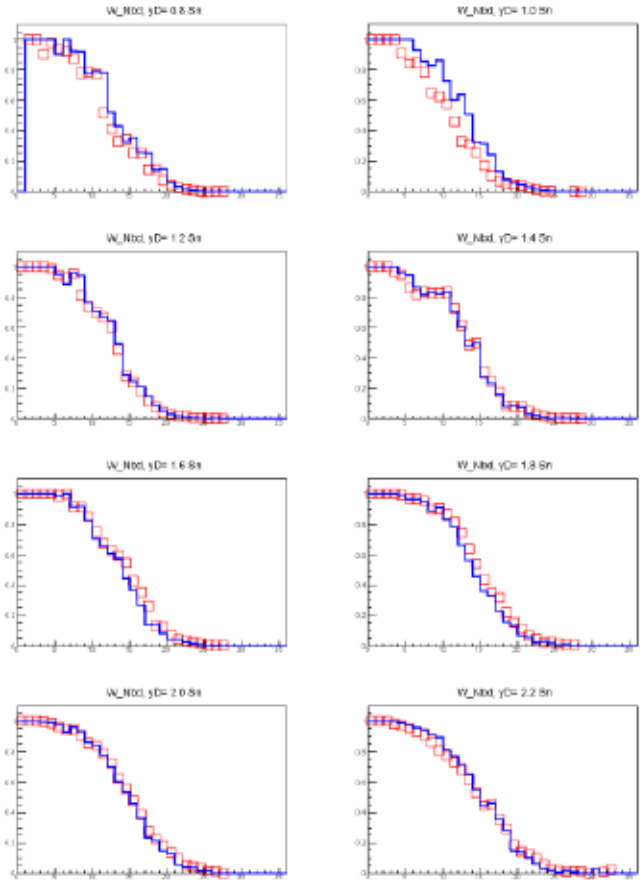
Deuterons: fraction of 40-100% events vs NBD

pT bins



NBD

y bins

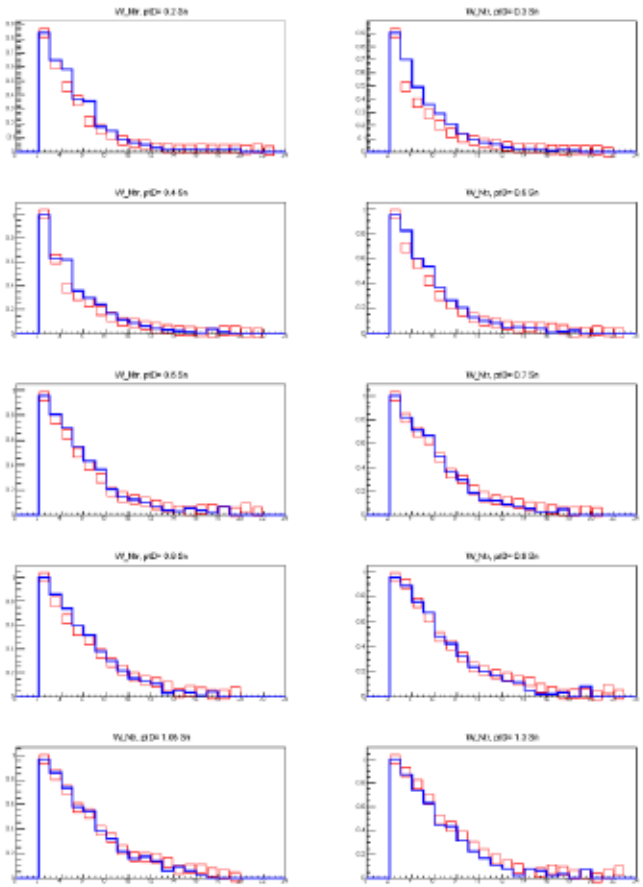


NBD

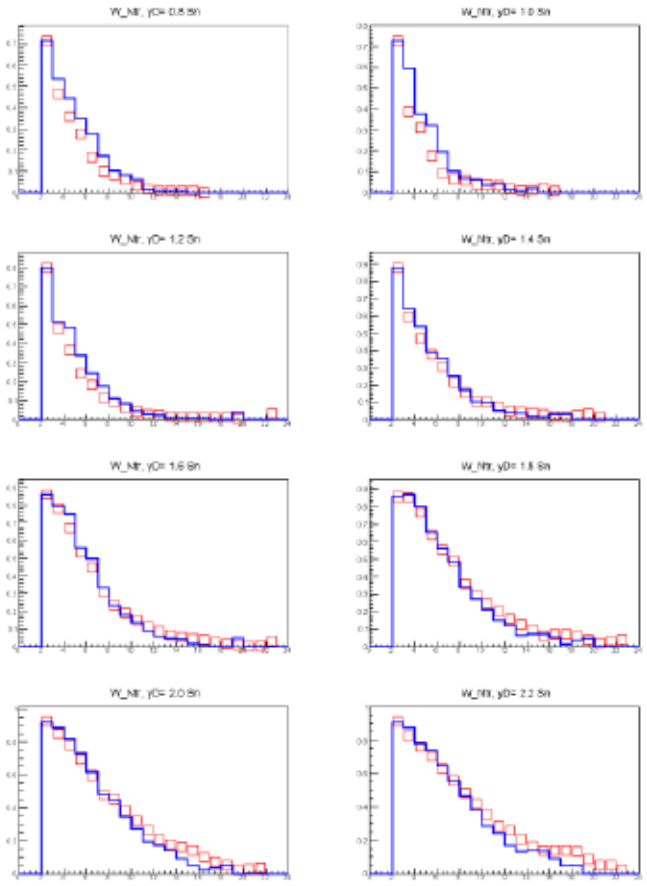
Ar+Sn: Fraction of events with identified deuterons of centrality class 40-100% as a function of the NBD hits. Blue histogram - DCM-SMM simulation, open red symbols – data.

Deuterons: fraction of 40-100% events vs Ntr

pT bins



y bins

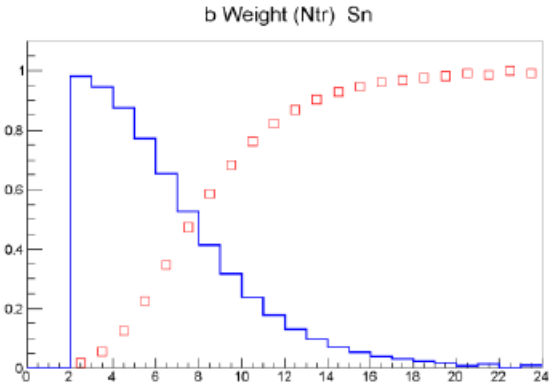


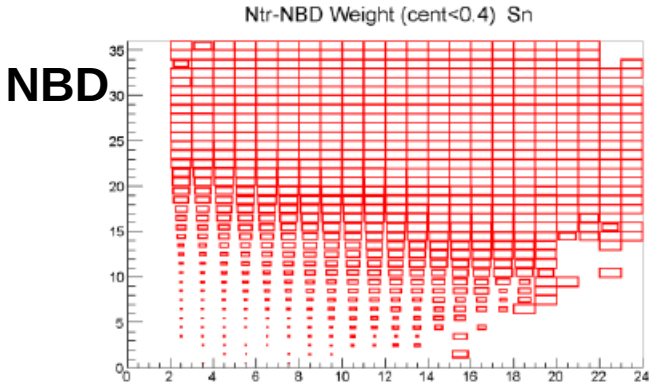
Ntr

Ntr

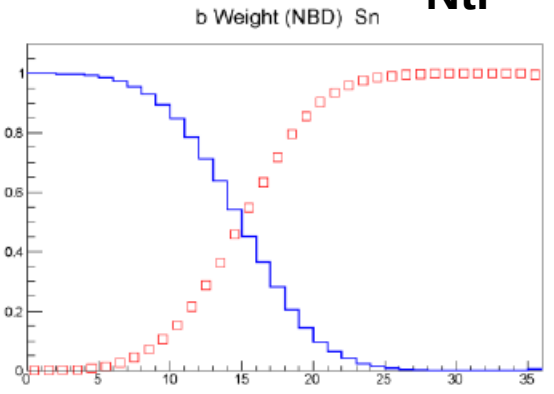
Ar+Sn: Fraction of events with identified deuterons of centrality class 40-100% as a function of the Ntr tracks. Blue histogram - DCM-SMM simulation, open red symbols – data.

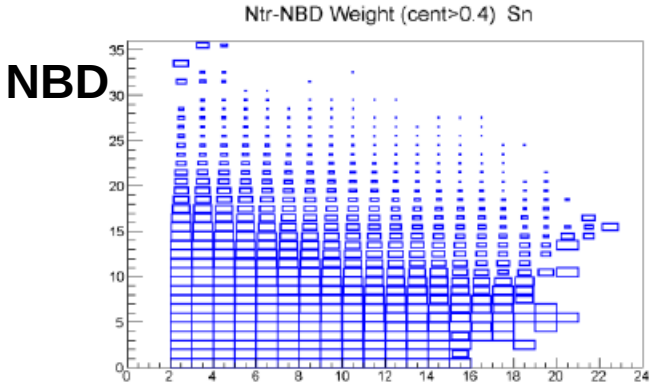
Fractions of 0-40% and 40-100% events vs Ntr, NBD, Ntr&NBD





Ntr





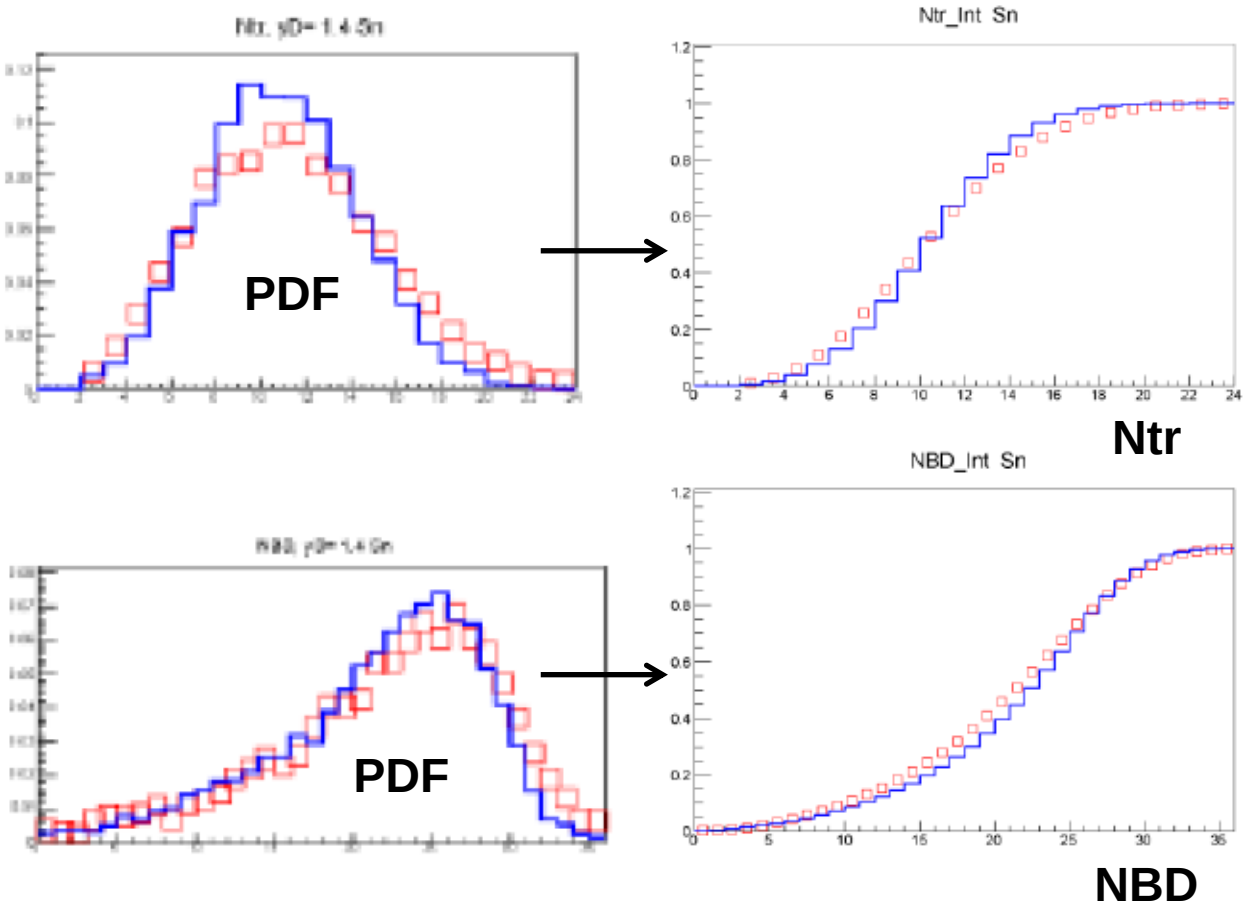
NBD Ntr

Left: Fraction of events with centrality 0-40% (red open symbols) and 40-100% (blue histogram) as a function of the number of tracks Ntr (upper plot) and number of hits NBD (lower plot).

Right: 2-dimensional distribution of the fraction of events with centrality 0-40% (upper red histogram) and 40-100% (lower blue histogram) as a function of Ntr tracks and NBD hits.

Cumulative distributions for Ntr and NBD

$$\Sigma(\mathrm{Ntr} \le i) / \Sigma(\mathrm{Ntr\ all}) \ , \ \Sigma(\mathrm{NBD} \le i) / \Sigma(\mathrm{NBD\ all})$$



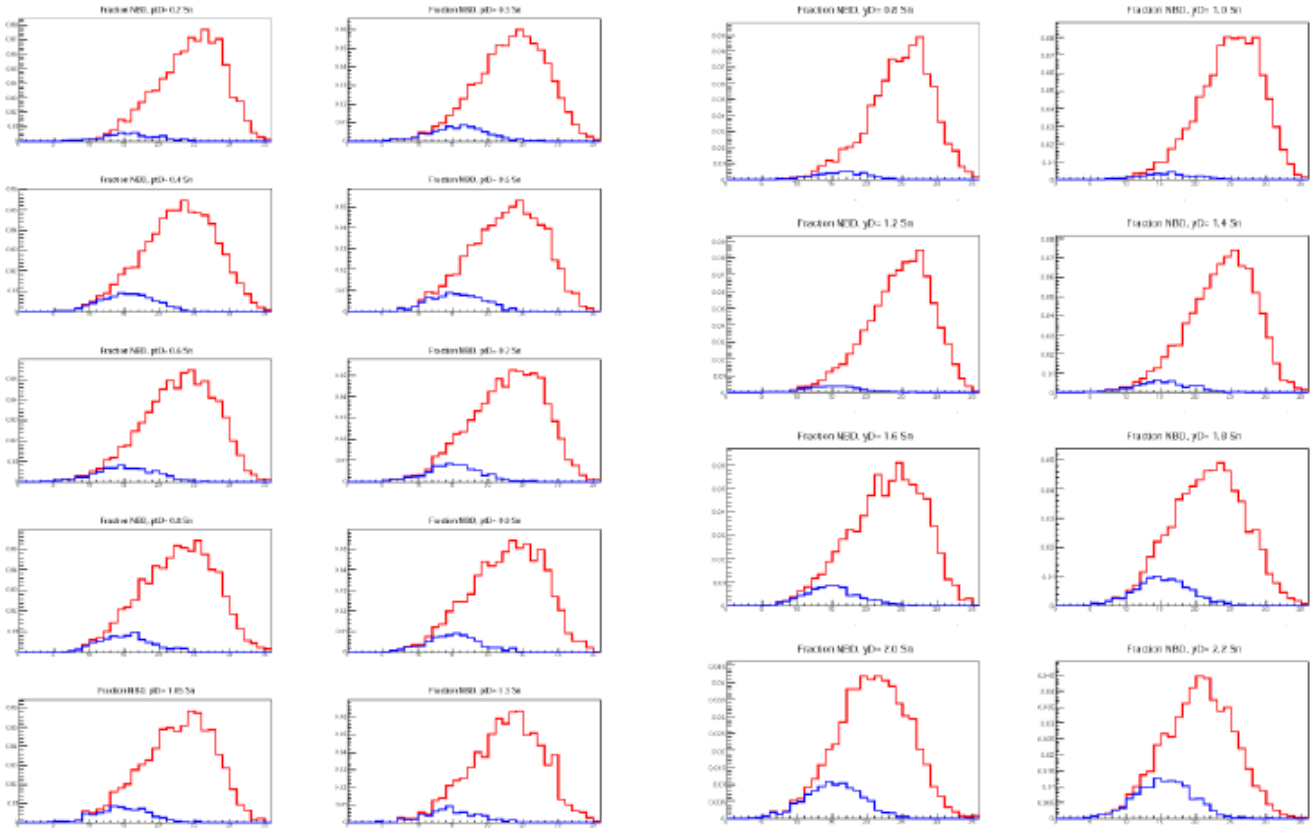
Ar+Sn: Cumulative distributions for Ntr and NBD in events with identified deuterons. Blue histogram – DCM-SMM simulation, red symbols – data.

NBD fraction of migrated events from 40-100% to 0-40%

pT bins

y bins

PDF



NBD

NBD

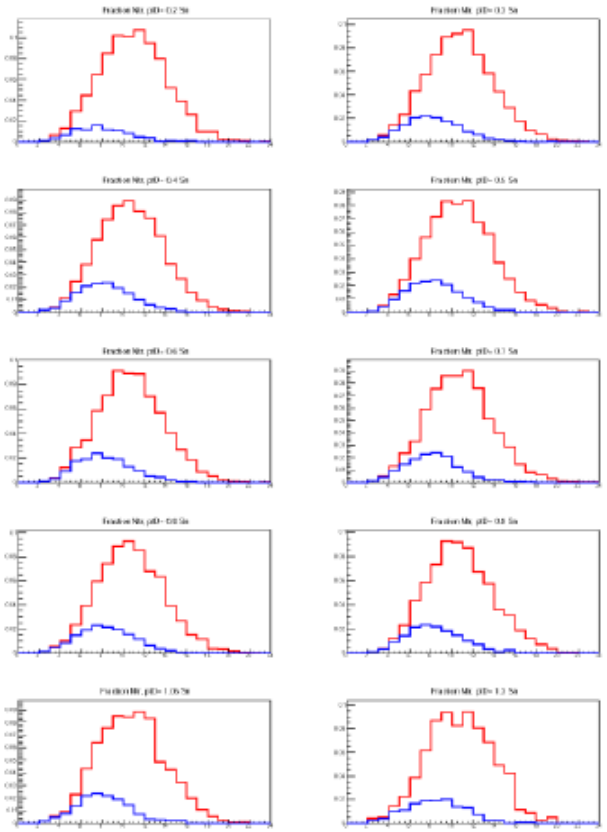
Ar+Sn: PDF distribution of NBD hits in events with identified deuterons (ToF-700). Red histograms – simulated events from centrality class 0-40%, blue histograms – simulated events from centrality class 40-100%, but migrated to centrality class 0-40%.

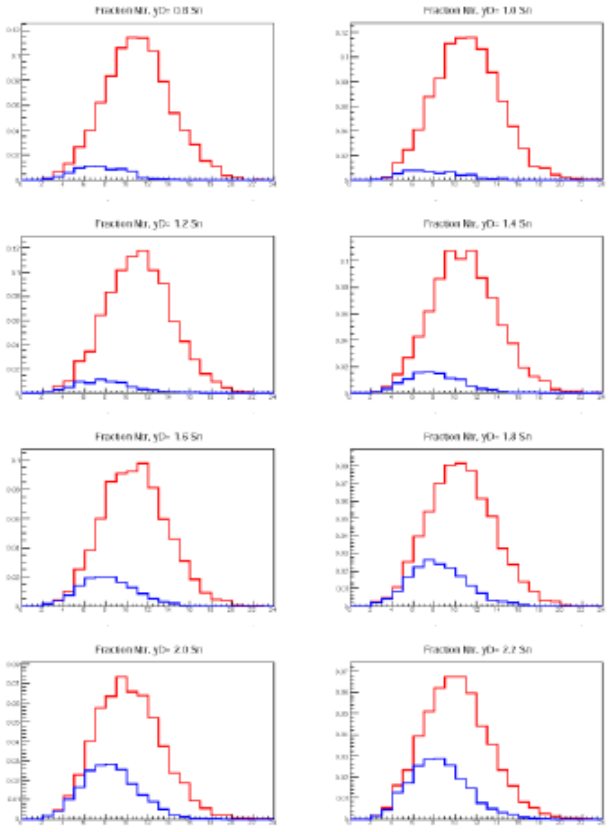
Ntr fraction of migrated events from 40-100% to 0-40%

pT bins

y bins

PDF





Ntr

Ntr

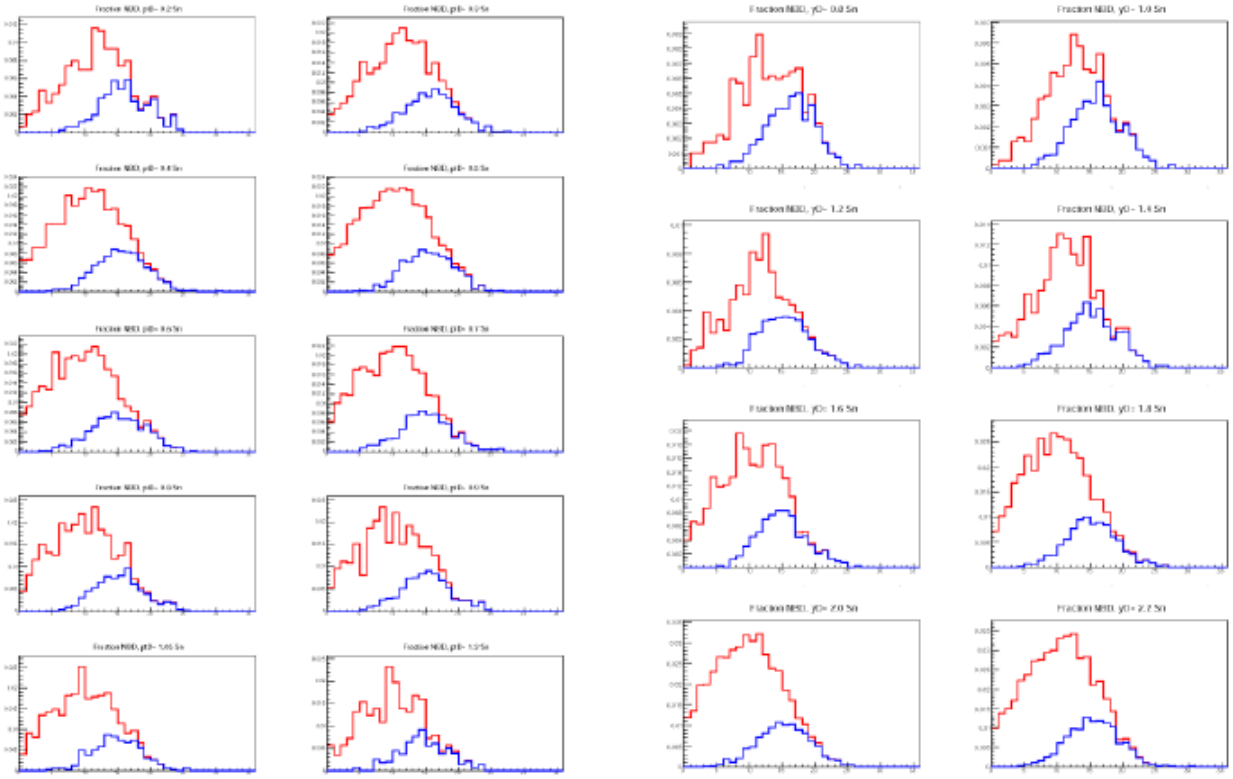
Ar+Sn: PDF distribution of Ntr tracks in events with identified deuterons (ToF-700). Red histograms – simulated events from centrality class 0-40%, blue histograms – simulated events from centrality class 40-100%, but migrated to centrality class 0-40%.

NBD fraction of migrated events from 0-40% to 40-100%

pT bins

y bins

PDF



NBD

NBD

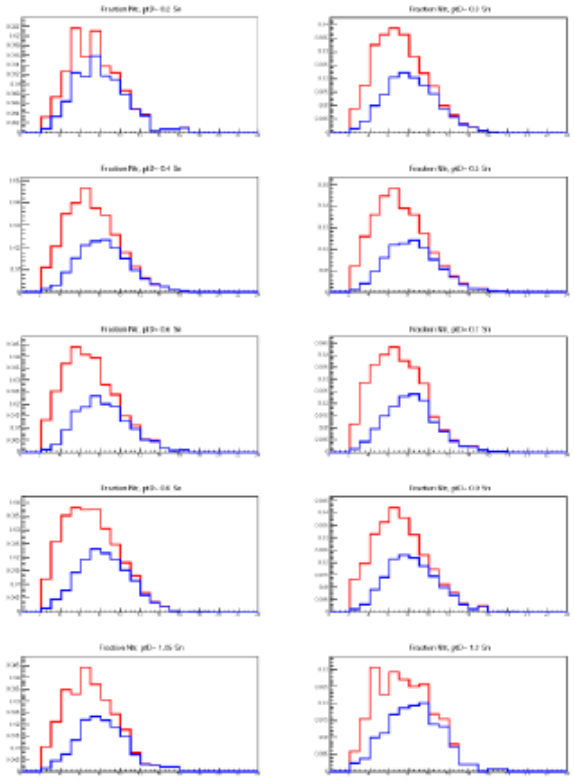
Ar+Sn: PDF distribution of NBD hits in events with identified deuterons (ToF-700). Red histograms – simulated events from centrality class 40-100%, blue histograms – simulated events from centrality class 0-40%, but migrated to centrality class 40-100%.

Ntr fraction of migrated events from 0-40% to 40-100%

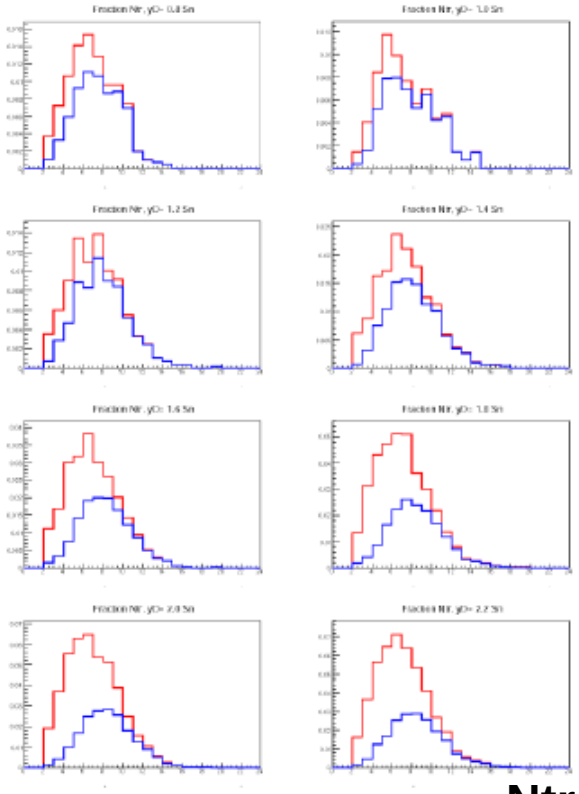
pT bins

y bins

PDF



Ntr

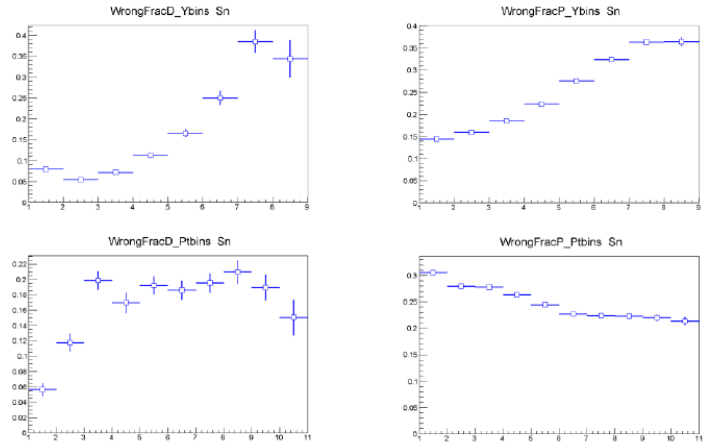


Ntr

Ar+Sn: PDF distribution of Ntr tracks in events with identified deuterons (ToF-700). Red histograms – simulated events from centrality class 40-100%, blue histograms – simulated events from centrality class 0-40%, but migrated to centrality class 40-100%.

Ntr fraction of migrated events between 40-100% and 0-40%

deuterons ToF-700 protons



y bins

pT bins

40-100% → 0-40%

Fraction D ~ 0.17

Fraction P ~ 0.25

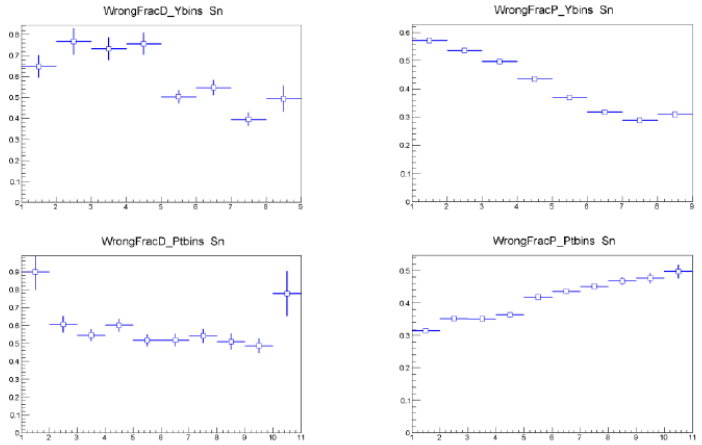
Ar+Sn: Fraction of events migrated from centrality class 40-100% defined from Ntr tracks to centrality class 0-40% for bins in y (upper plots) and bins p_T (lower plots). Left plots - for events with deuterons detected in ToF-700, right plots – for events with protons detected in ToF-700.

0-40% → 40-100%

Fraction D ~ 0.60

Fraction P ~ 0.41

deuterons ToF-700 protons



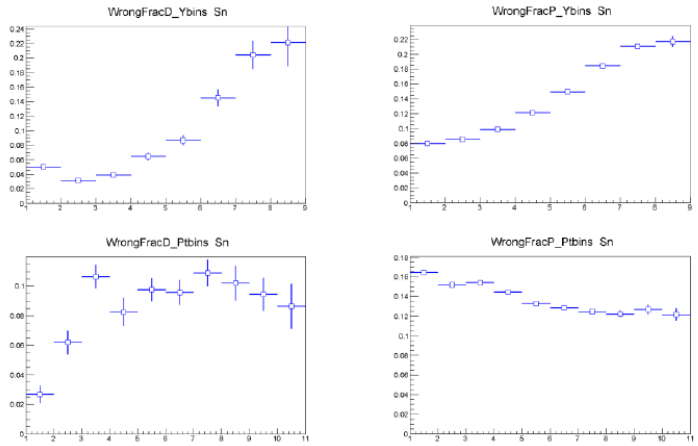
y bins

pT bins

Ar+Sn: Fraction of events migrated from centrality class 0-40% defined from Ntr tracks to centrality class 40-100% for bins in y (upper plots) and bins p_T (lower plots). Left plots - for events with deuterons detected in ToF-700, right plots – for events with protons detected in ToF-700.

NBD fraction of migrated events between 40-100% and 0-40%

deuterons ToF-700 protons



y bins

pT bins

40-100% → 0-40%

Fraction D ~ 0.10

Fraction P ~ 0.14

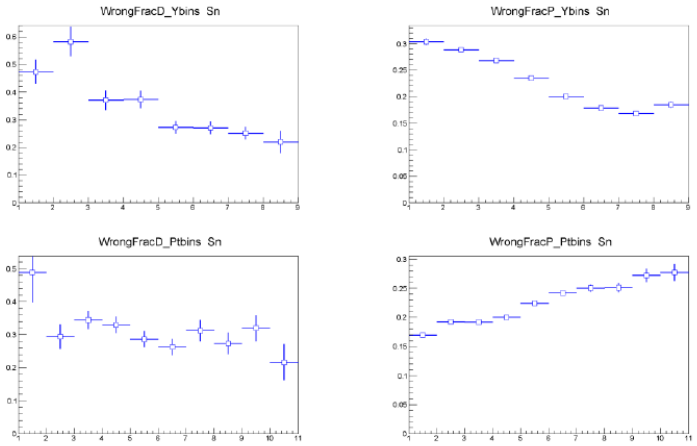
Ar+Sn: Fraction of events migrated from centrality class 40-100% defined from NBD to centrality class 0-40% for bins in y (upper plo and bins p_T (lower plots). Left plots - for events with deuterons detec in ToF-700, right plots – for events with protons detected in ToF-700

0-40% → 40-100%

Fraction D ~ 0.33

Fraction P ~ 0.23

deuterons ToF-700 protons



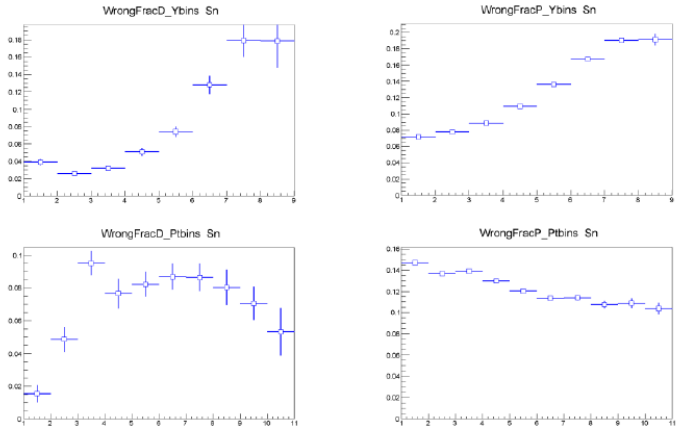
y bins

pT bins

Ar+Sn: Fraction of events migrated from the centrality class 0-40% defined by NBD to centrality class 40-100% for bins in y (upper plots) and bins p_T (lower plots). Left plots - for events with deuterons detected in ToF-700, right plots – for events with protons detected in ToF-700.

2-dim Ntr & NBD fraction of migrated events between 40-100% and 0-40%

deuterons ToF-700 protons



y bins

pT bins

40-100% → 0-40%

Fraction D ~ 0.08

Fraction P ~ 0.12

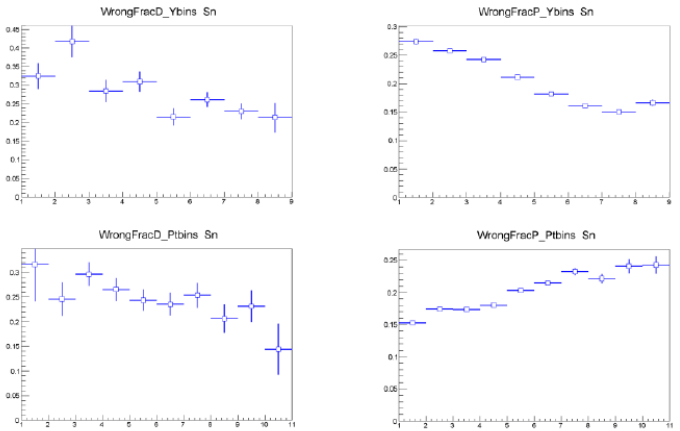
Ar+Sn: Fraction of events migrated from centrality class 40-100% to centrality class 0-40% difined from 2-dim Ntr & NBD distribution for bins in y (upper plots) and bins p_T (lower plots). Left plots - for events with deuterons detected in ToF-700, right plots – for events with protc detected in ToF-700.

0-40% → 40-100%

Fraction D ~ 0.26

Fraction P ~ 0.20

deuterons ToF-700 protons



y bins

pT bins

Ar+Sn: Fraction of events migrated from centrality class 0-40% to centrality class 40-100% defined from 2-dim Ntr & NBD distribution for bins in y (upper plots) and bins p_T (lower plots). Left plots - for events with deuterons detected in ToF-700, right plots – for events with protons detected in ToF-700.

Definition of centrality classes

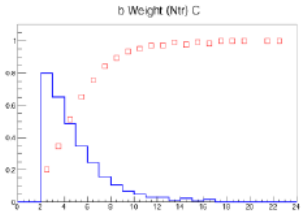
Average fraction of migrated events between centrality classes in Ar+ Sn interactions

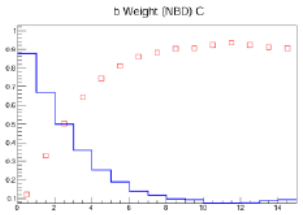
Centrality Class Event selection	40-100% →0-40% deuterons / protons	0-40% →40-100% deuterons / protons
Ntr selection	0,17 / 0.25	0.60 / 0.41
NBD selection	0.10 / 0.14	0.33 / 0.23
Ntr & NBD selection	0.08 / 0.12	0.26 / 0.20

Definition of the centrality class from the 2-dim Ntr & NBD distribution gives somewhat better separation of the centrality classes compared to the NBD distribution. The usage of the Ntr distribution gives large migration between the centrality classes compared to the NBD distribution. Based on these results, the Ntr & NBD distributions are used to define the centrality classes 0-40% and 40-100% in the analysis of the Ar+A data.

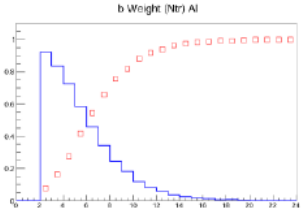
Fractions of 0-40% and 40-100% events vs Ntr, NBD

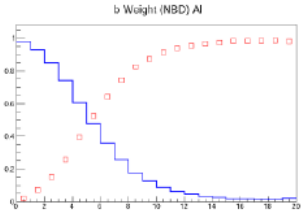
Ar + C



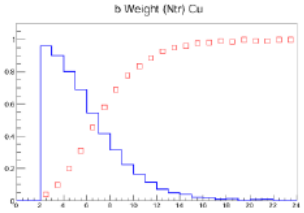


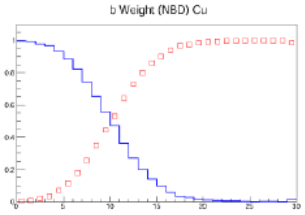
Ar+Al





Ar+Cu

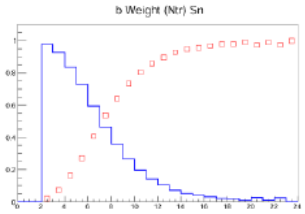


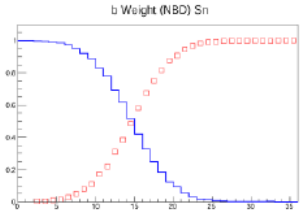


Ntr

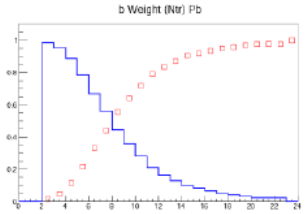
NBD

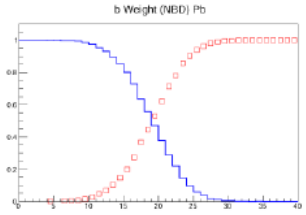
Al+Sn





Al+Pb





Ntr

NBD

Fraction of events with centrality 40-100% (blue histograms) and 0-40% (red open symbols) as a function of Ntr tracks (upper plots), as a function of NBD hits (lower plots). DCM-SMM simulations for Ar + C, Al, Cu, Sn, Pb.