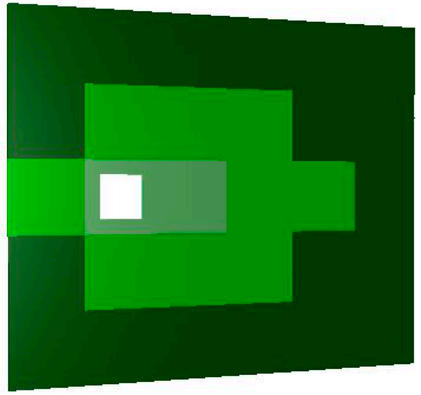
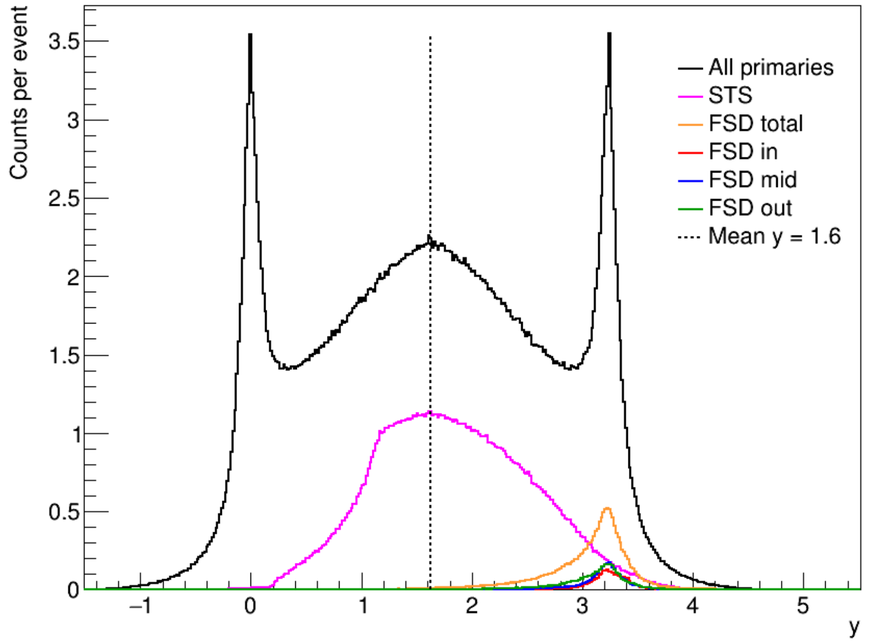
Centrality estimation with FSD

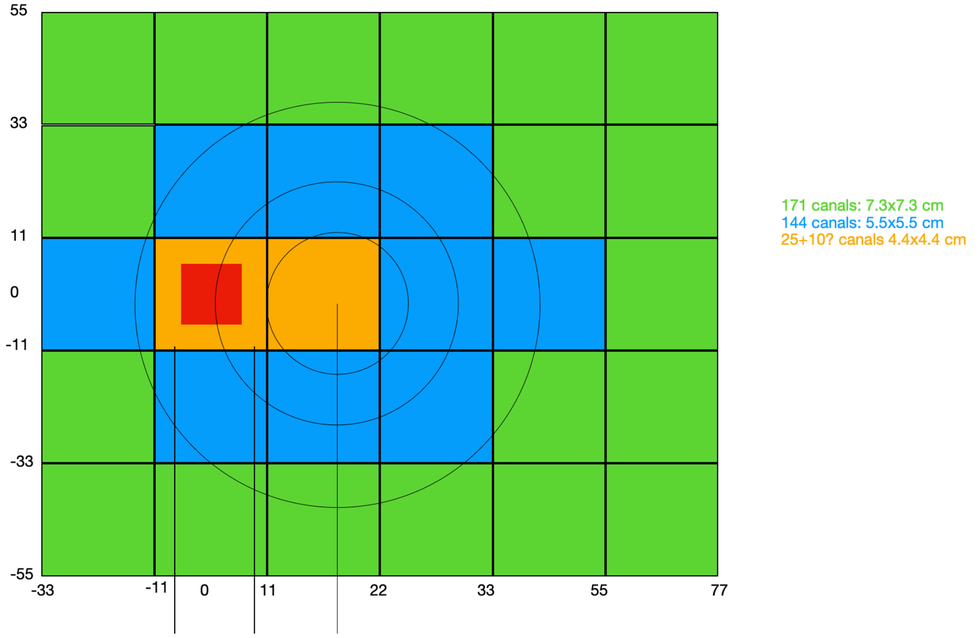
Radim Dvořák

Simulation setup

- DCM-QGSM-SMM
- 11AGeV Au+Au collisions
- Area of interest
  - x=40 cm, r=40 cm (large circle)
- Hole in FSD diameter 14 cm
- Focus of this presentation: reproduce plots from PSD TDR

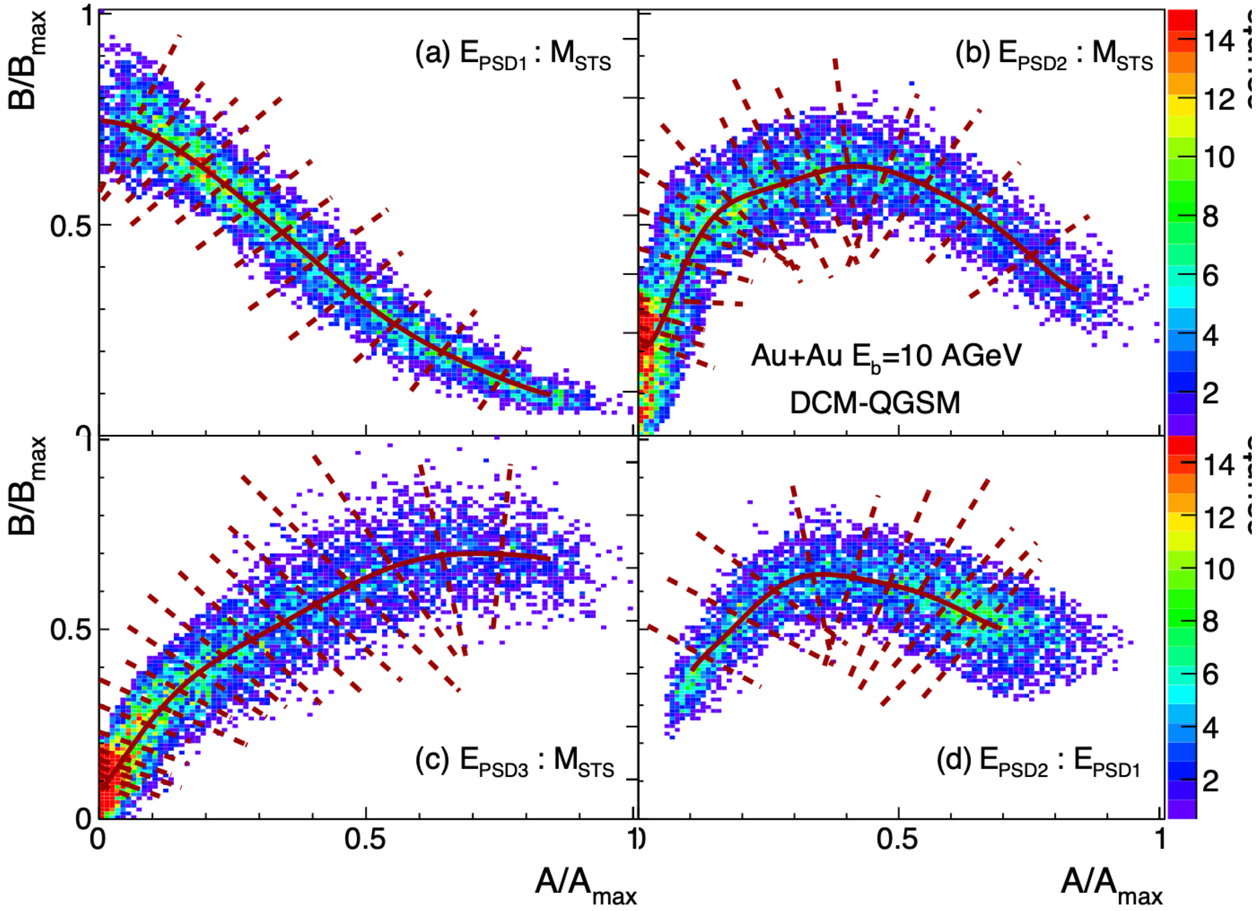


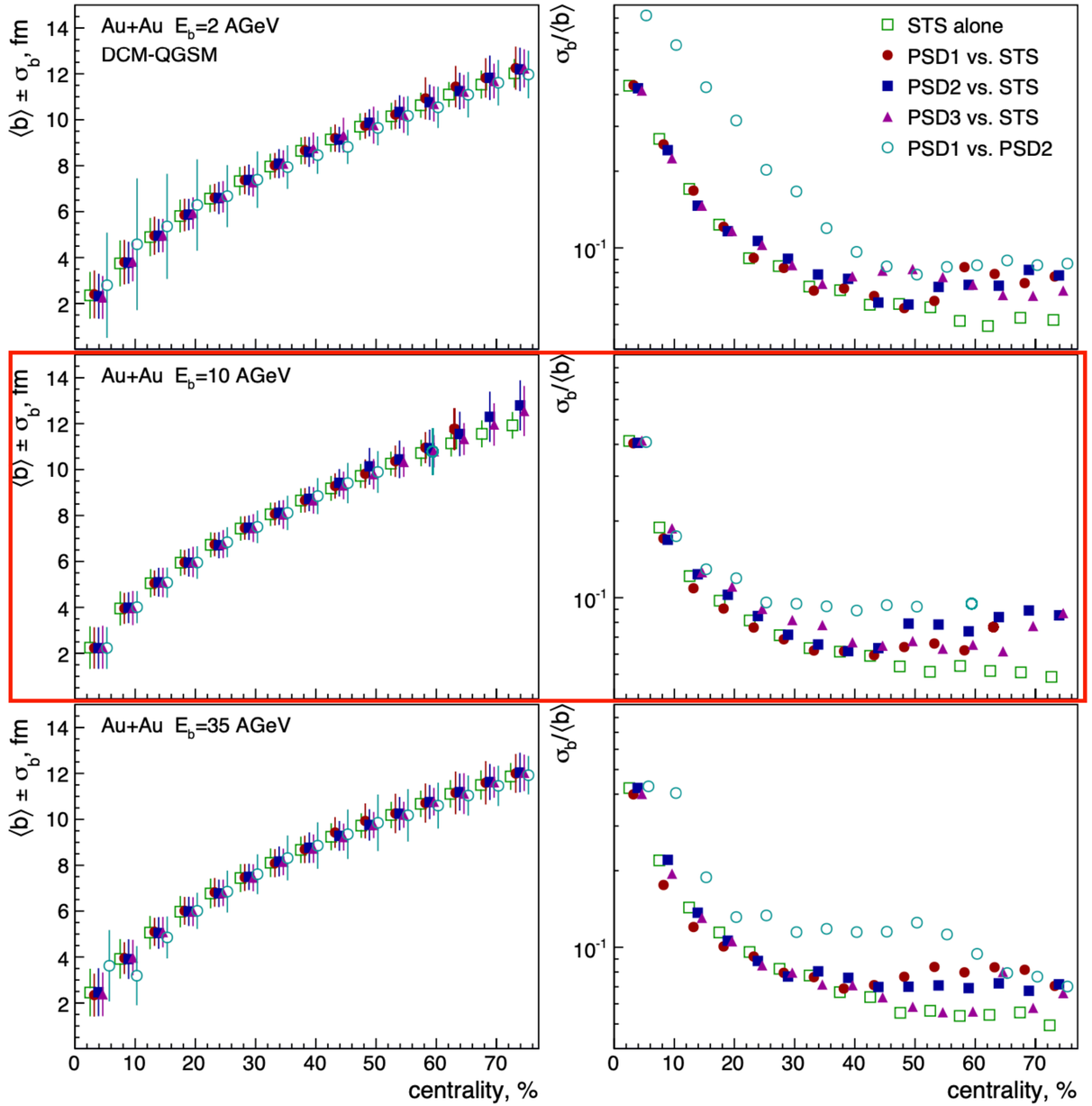




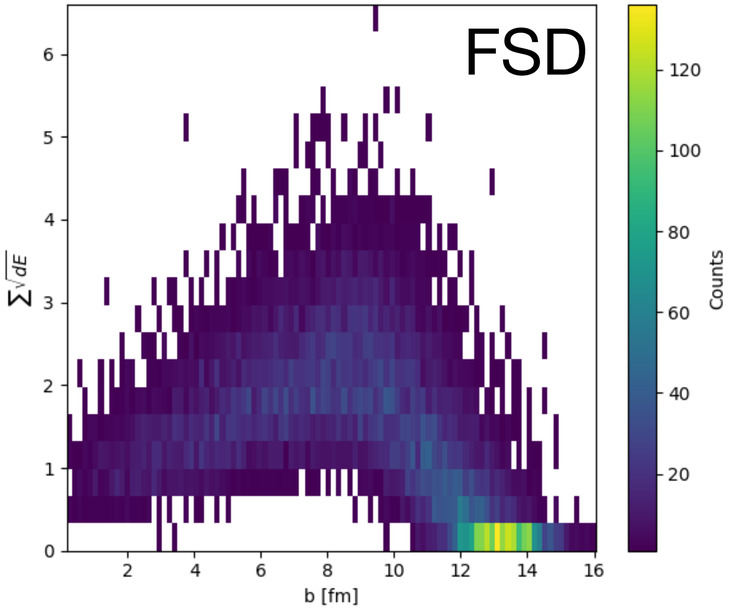
PSD performance

- Small hole: diameter 6 cm - unrealistic





FSD performance



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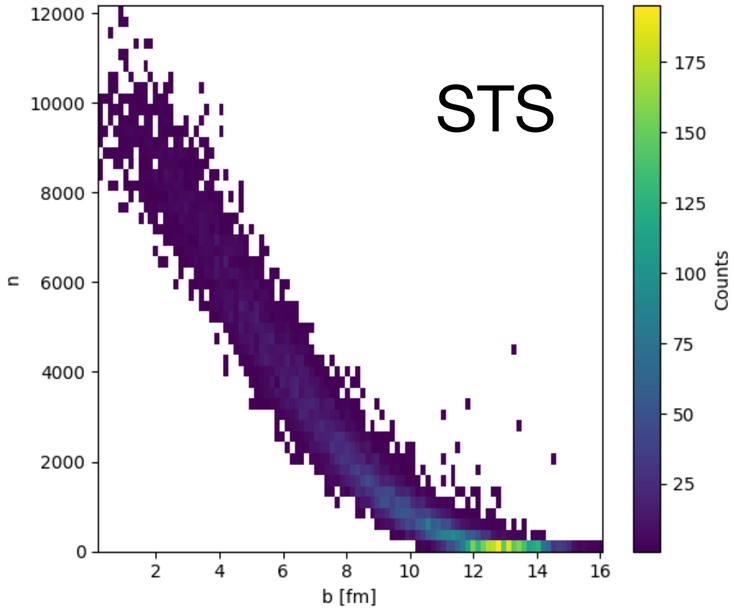

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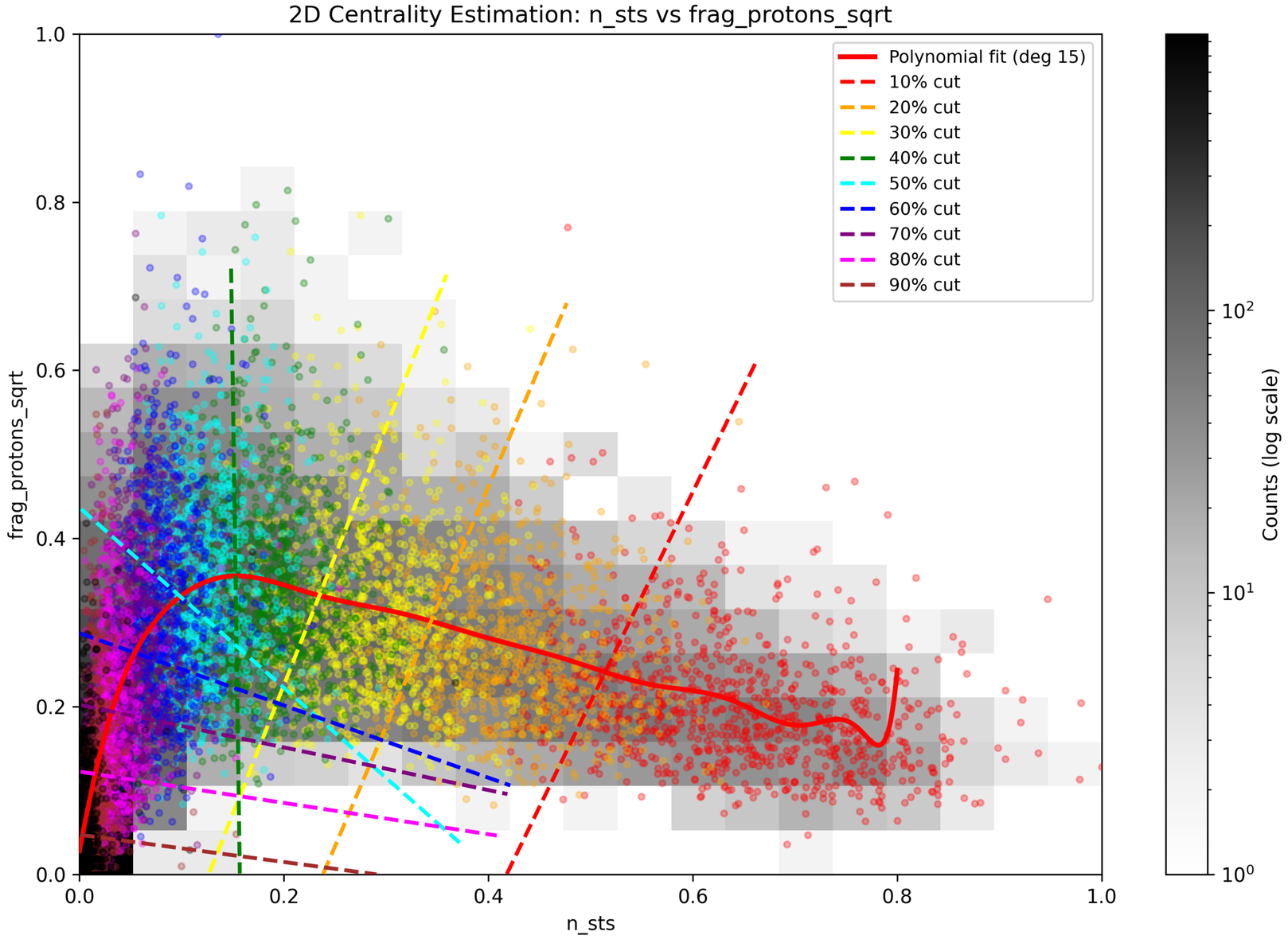
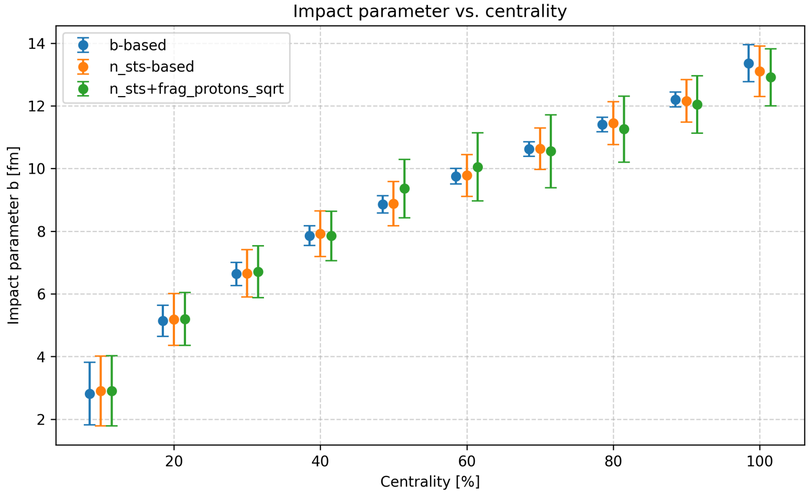
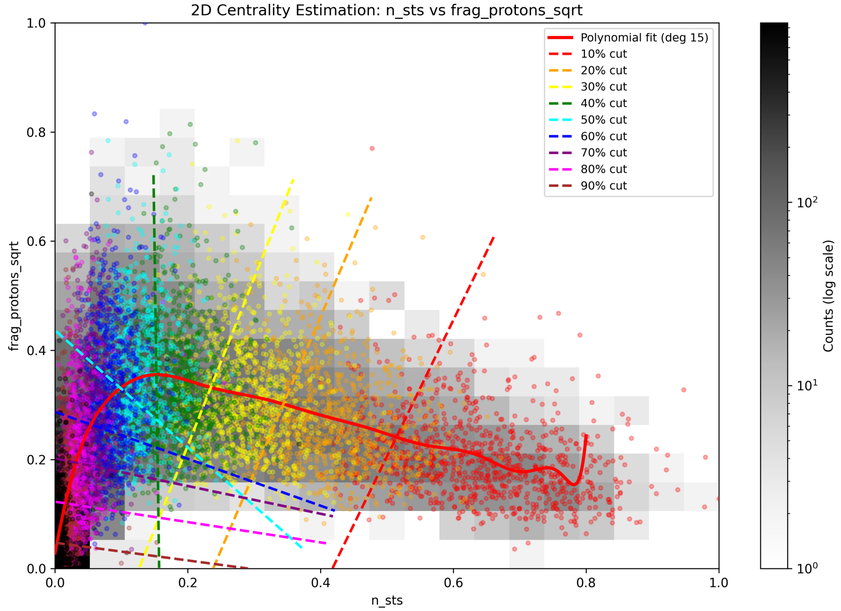
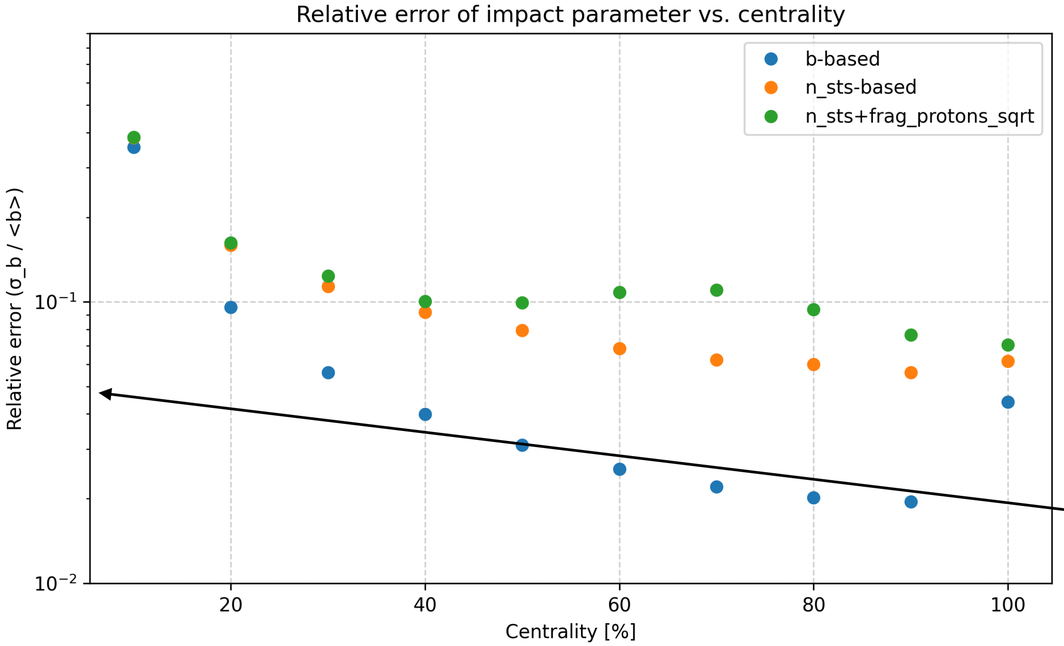


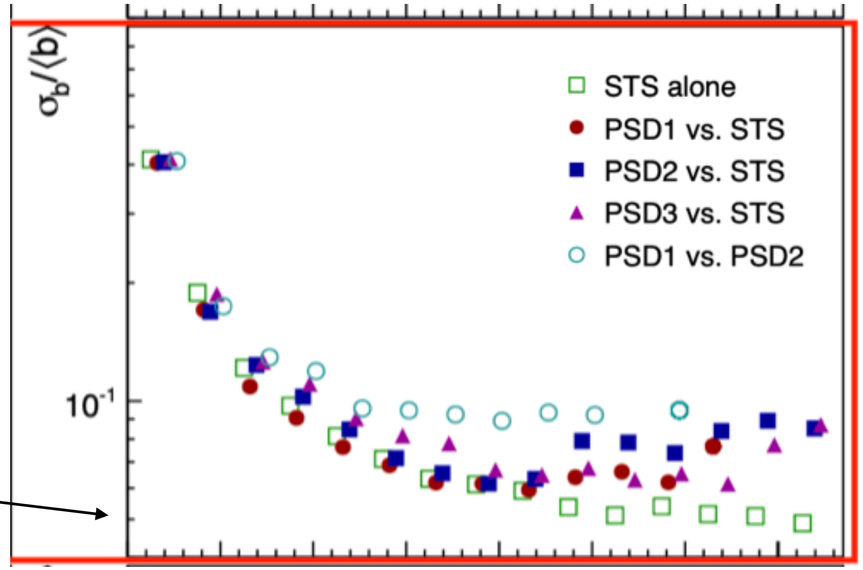
FSD performance

- Similar results to PSD



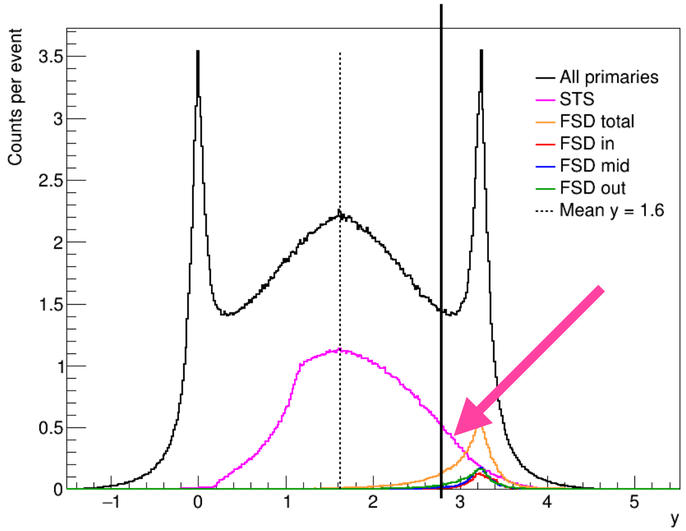




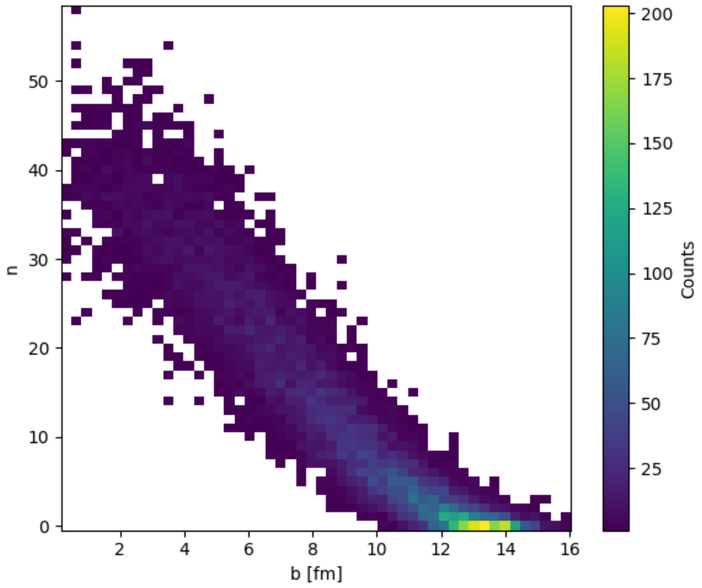


Forward STS region

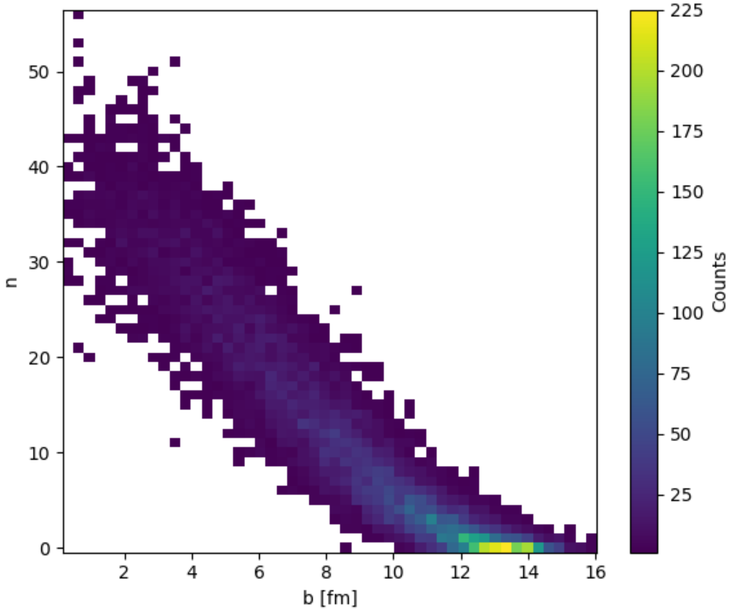
- STS has some coverage for spectators y>2.8



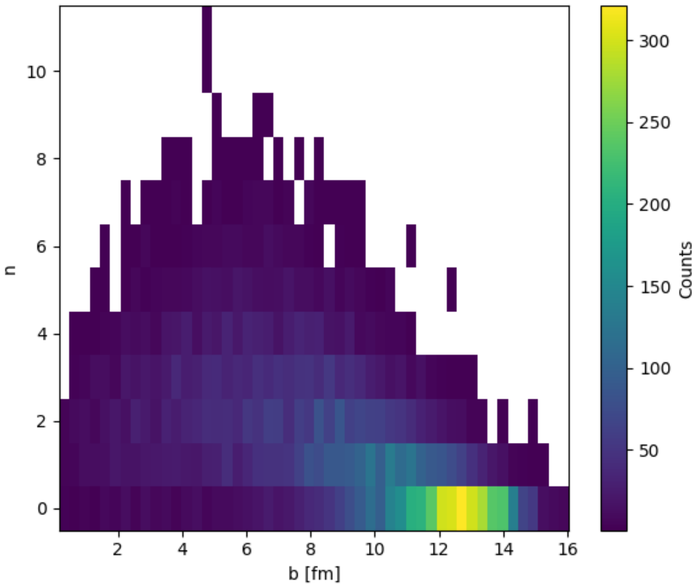
MC primary tracks with hit in STS, y>2.8



MC primary tracks with hit in STS, y>2.8, pions

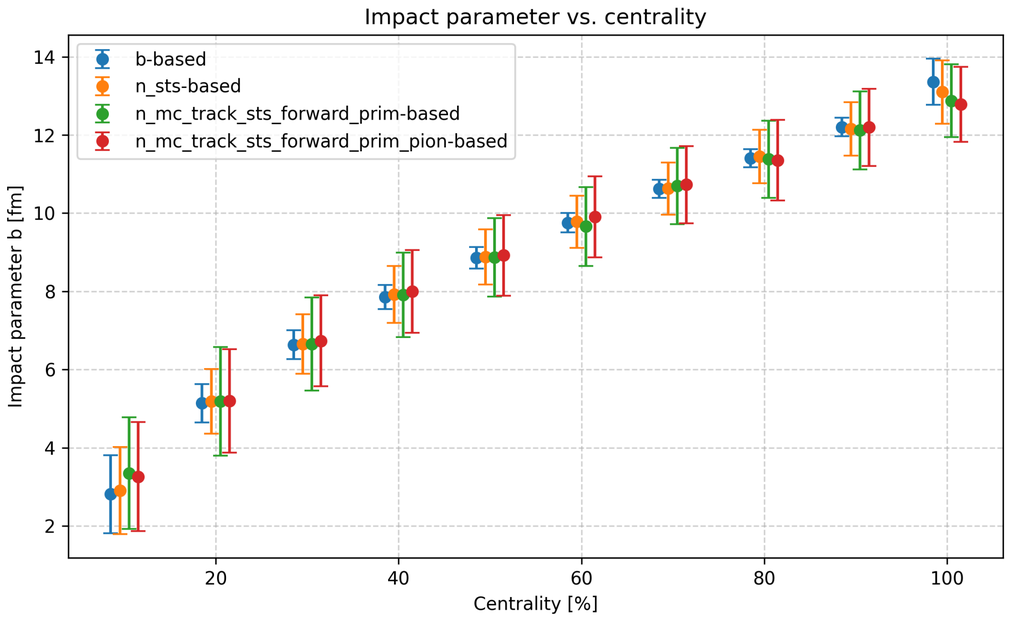


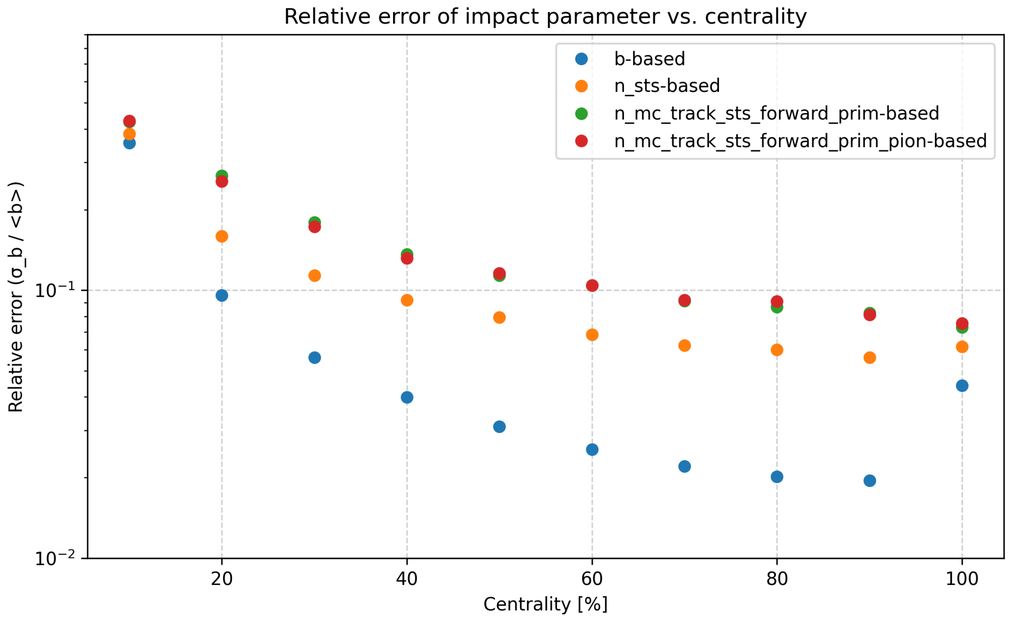
MC primary tracks with hit in STS, y>2.8, protons



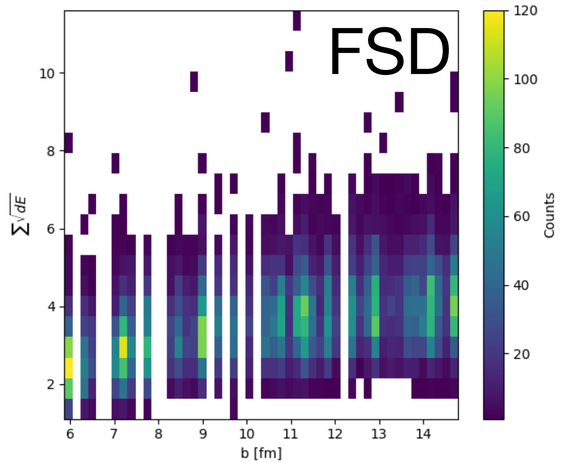
Forward STS region

- Forward STS region has only slightly worse results than full STS
- Forward pions as a good centrality estimator???





Model comparison - PHQMD small clusters



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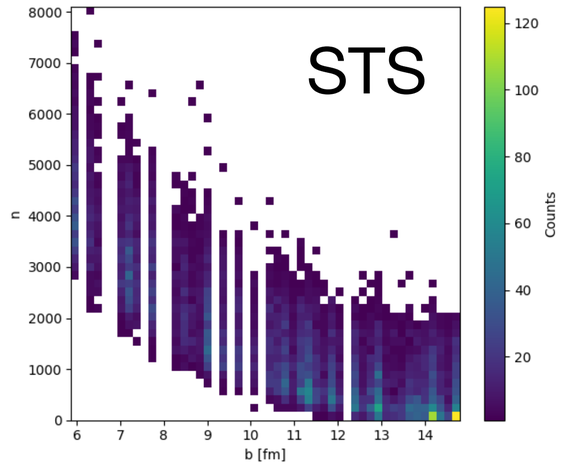

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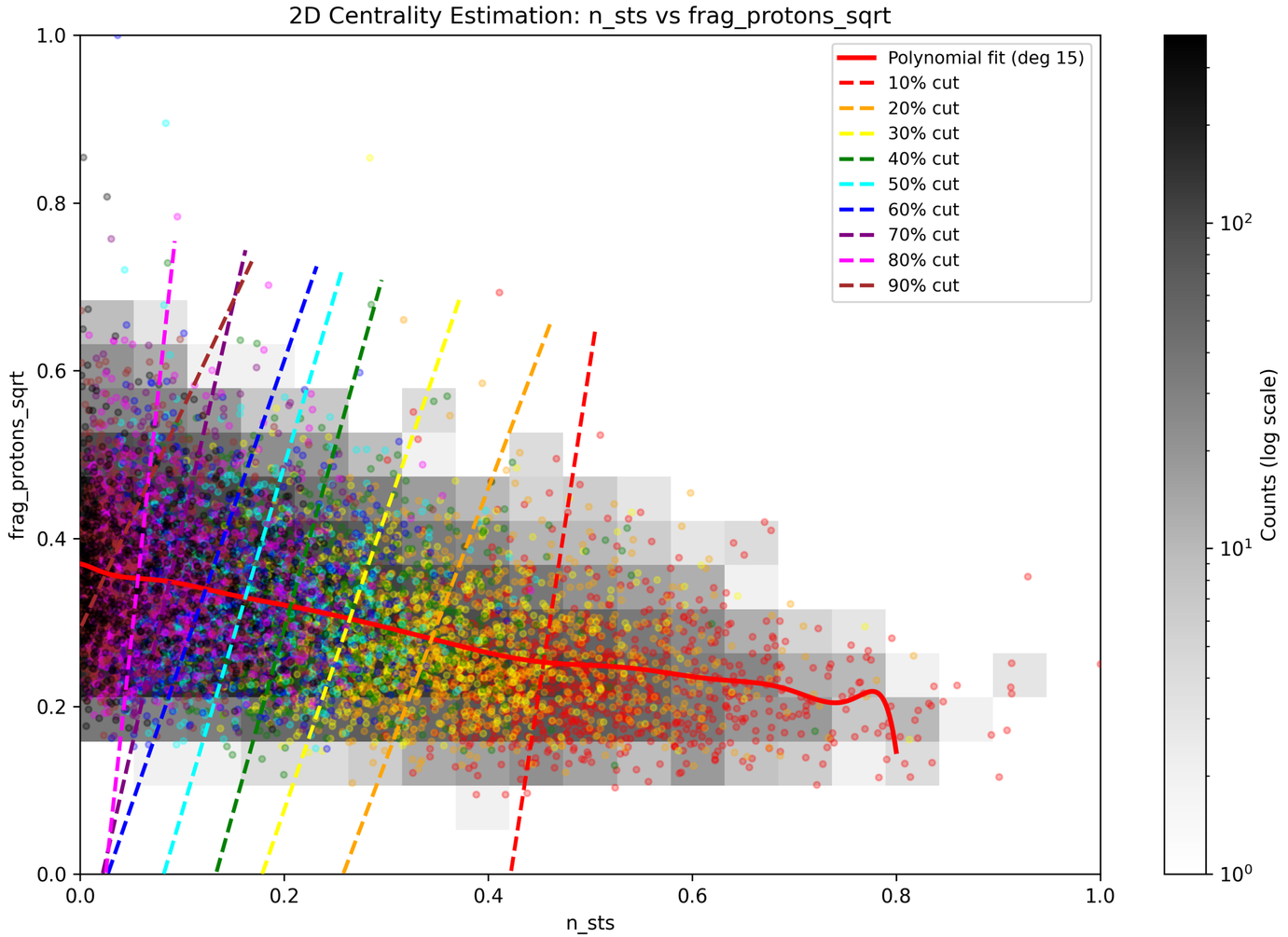
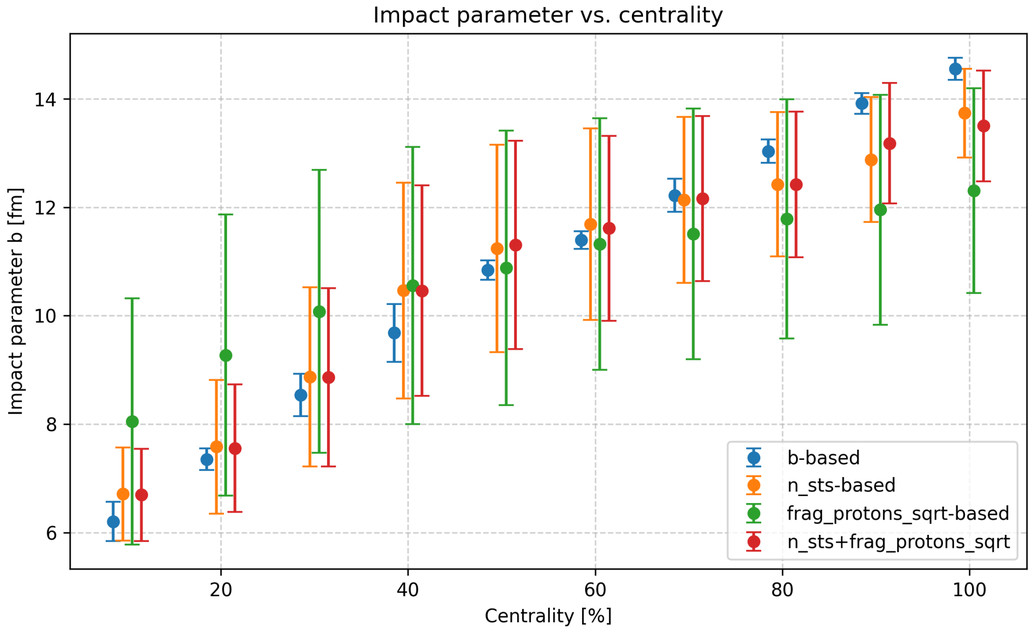
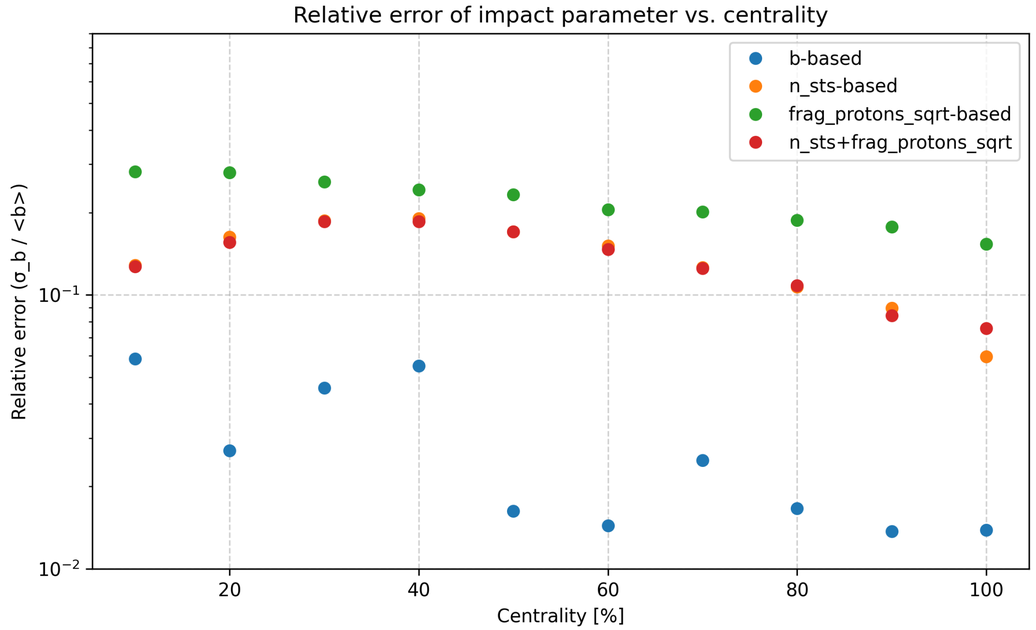


Different behavior to DCM!

Model comparison - PHQMD small clusters

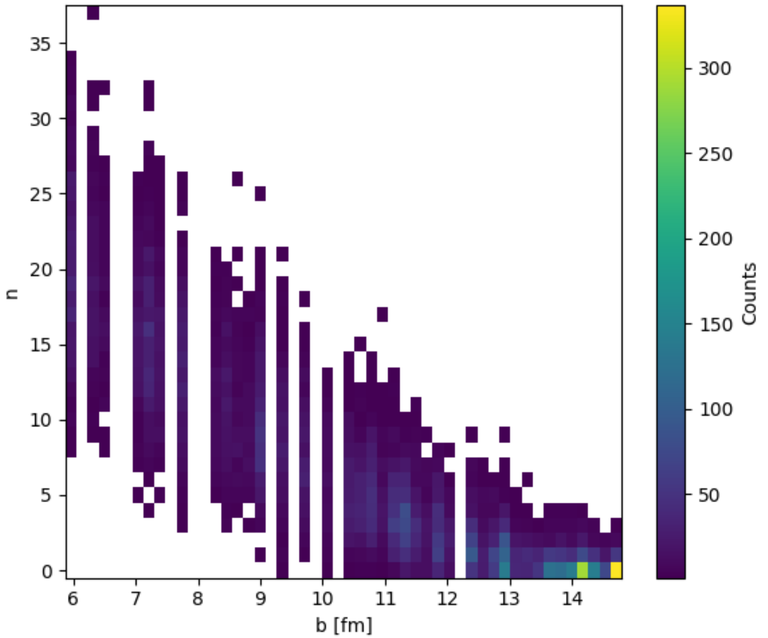
- With PHQMD we can estimate centrality only using FSD
- Combination STS+FSD same as STS alone



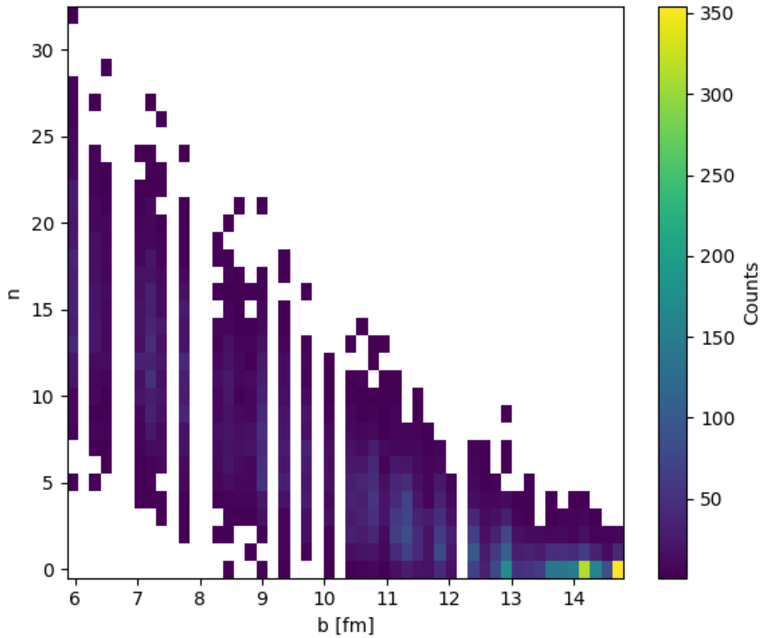


Model comparison - PHQMD small clusters

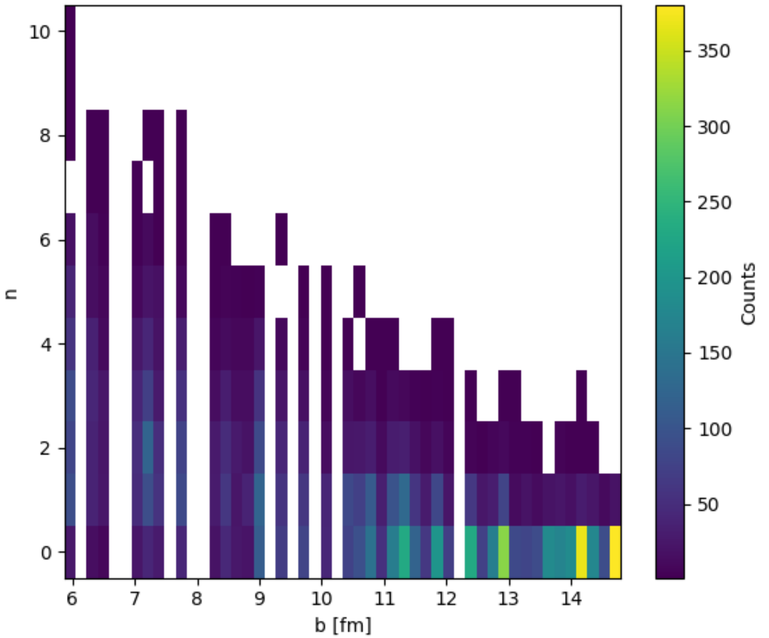
MC primary tracks with hit in STS, y>2.8



MC primary tracks with hit in STS, y>2.8, pions

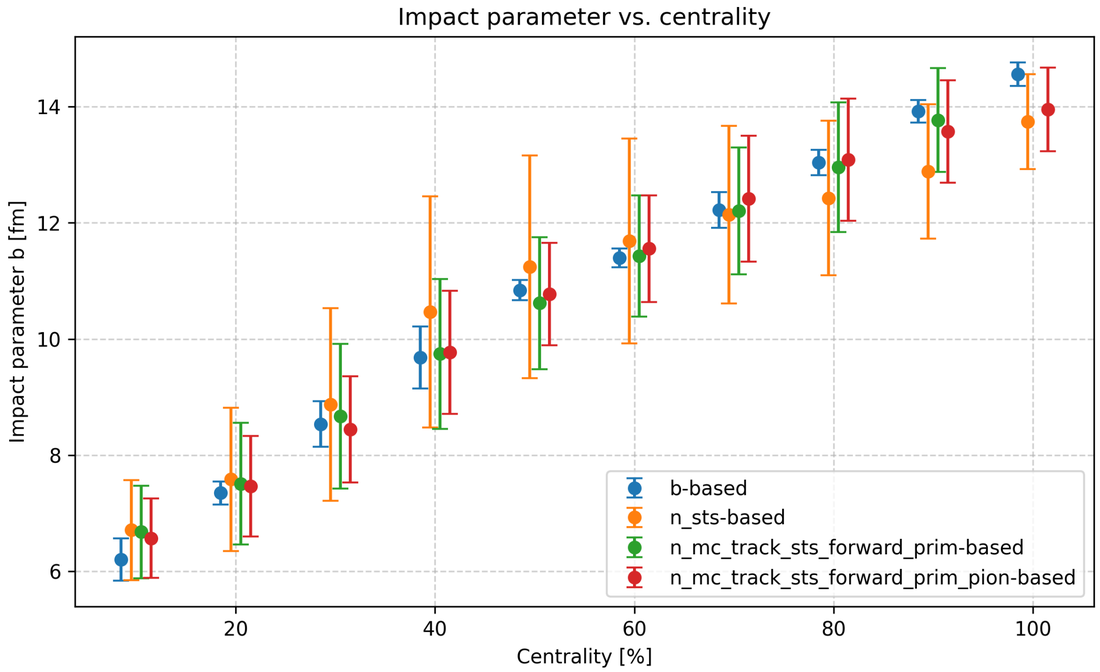


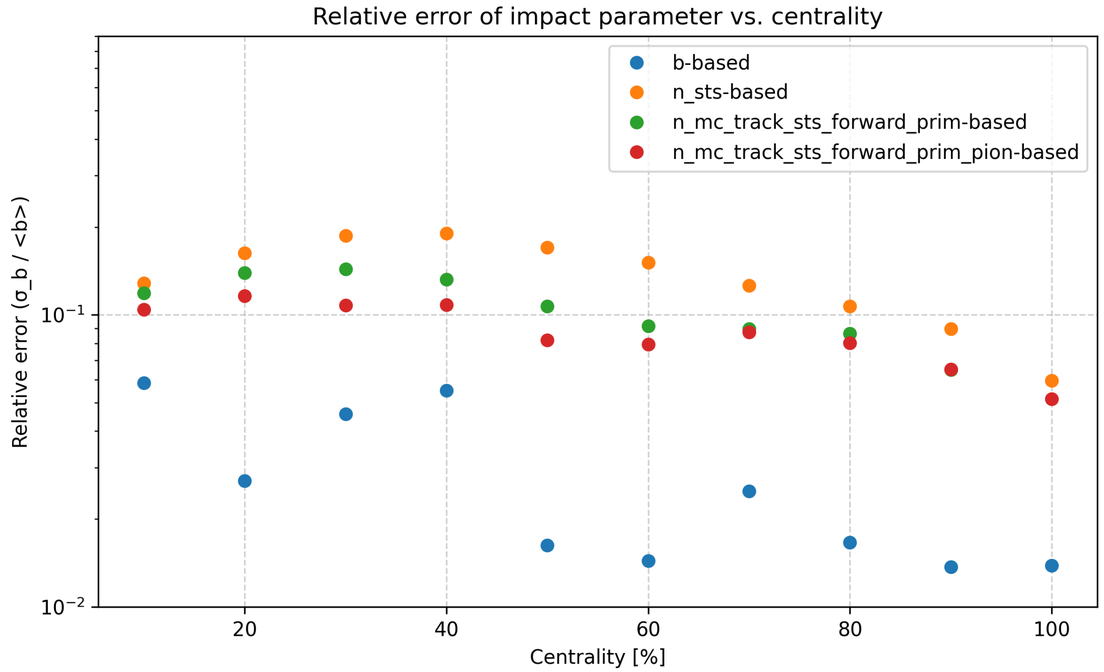
MC primary tracks with hit in STS, y>2.8, protons



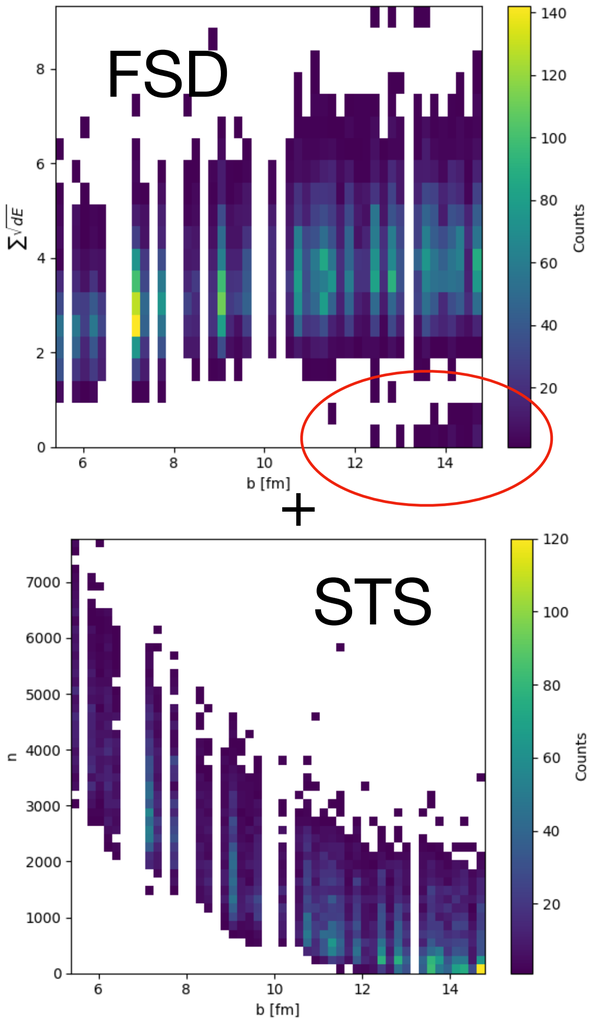
Model comparison - PHQMD small clusters

- Forward pions are the best estimator for centrality for this model





Model comparison - PHQMD all clusters



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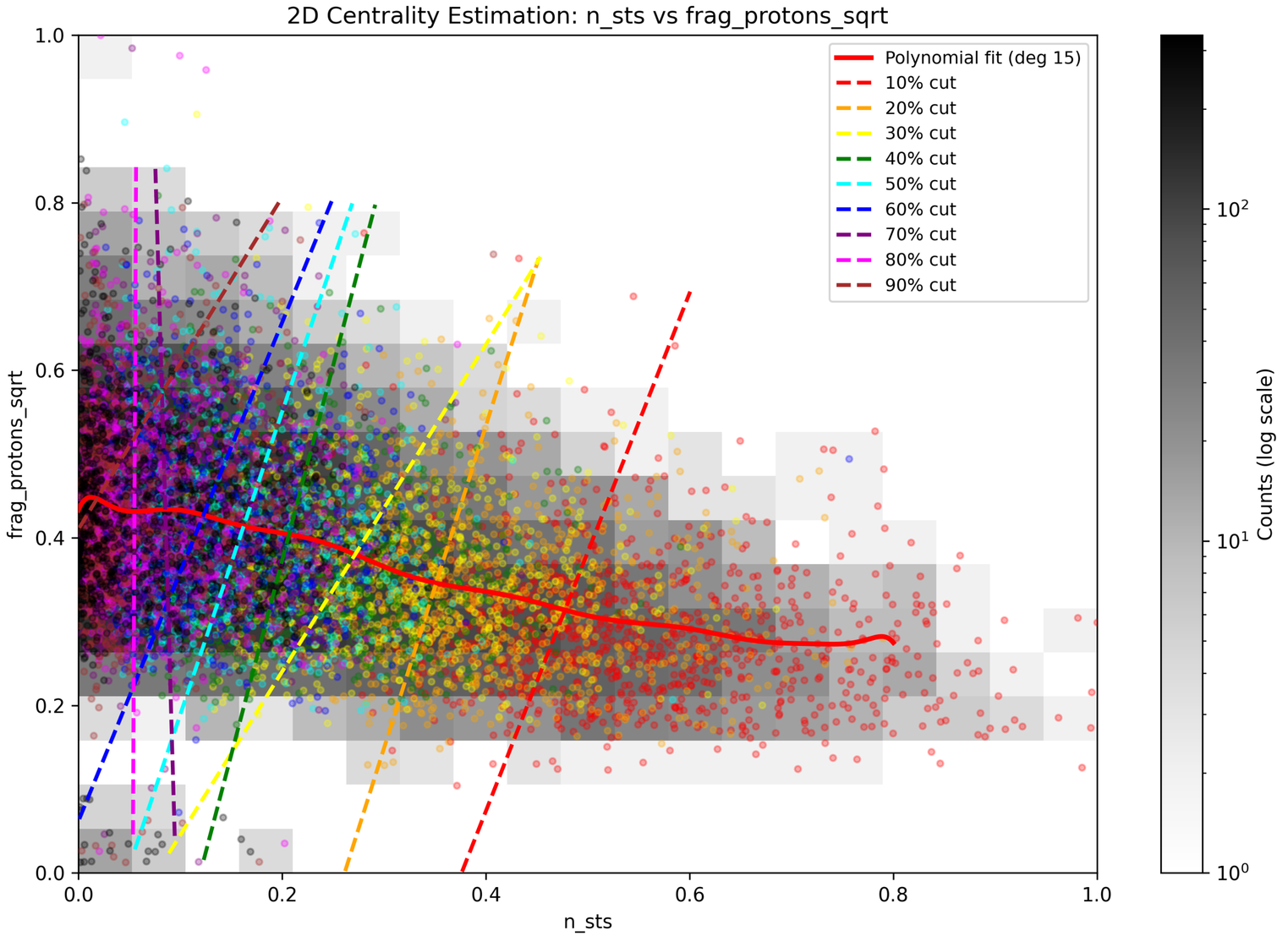
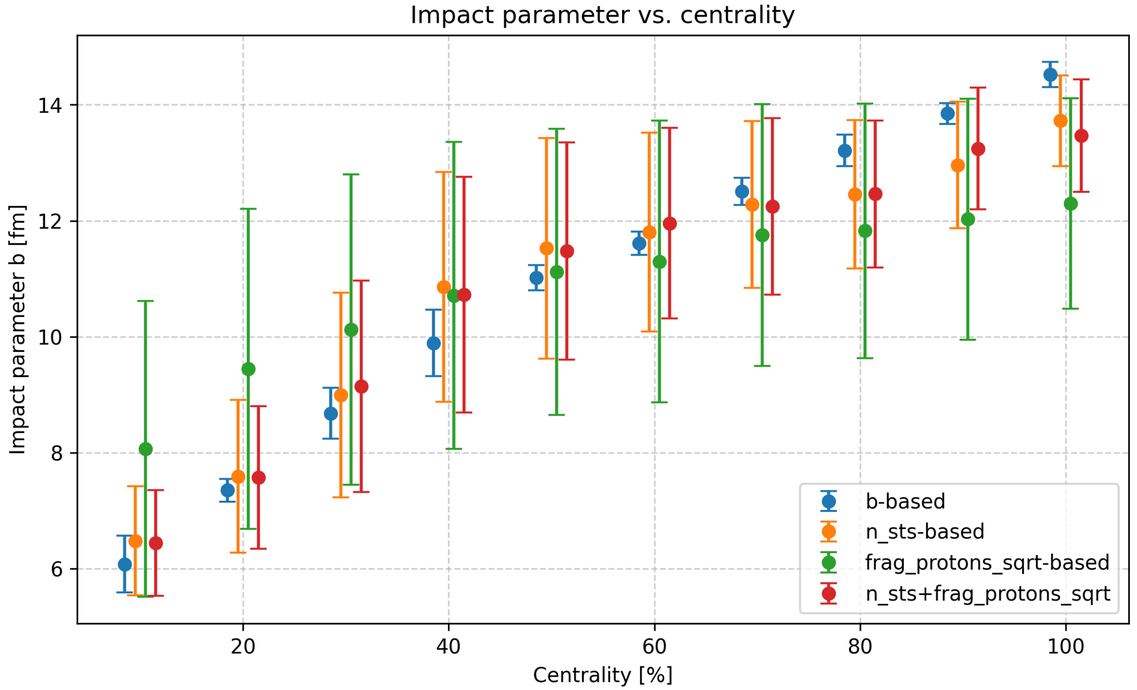
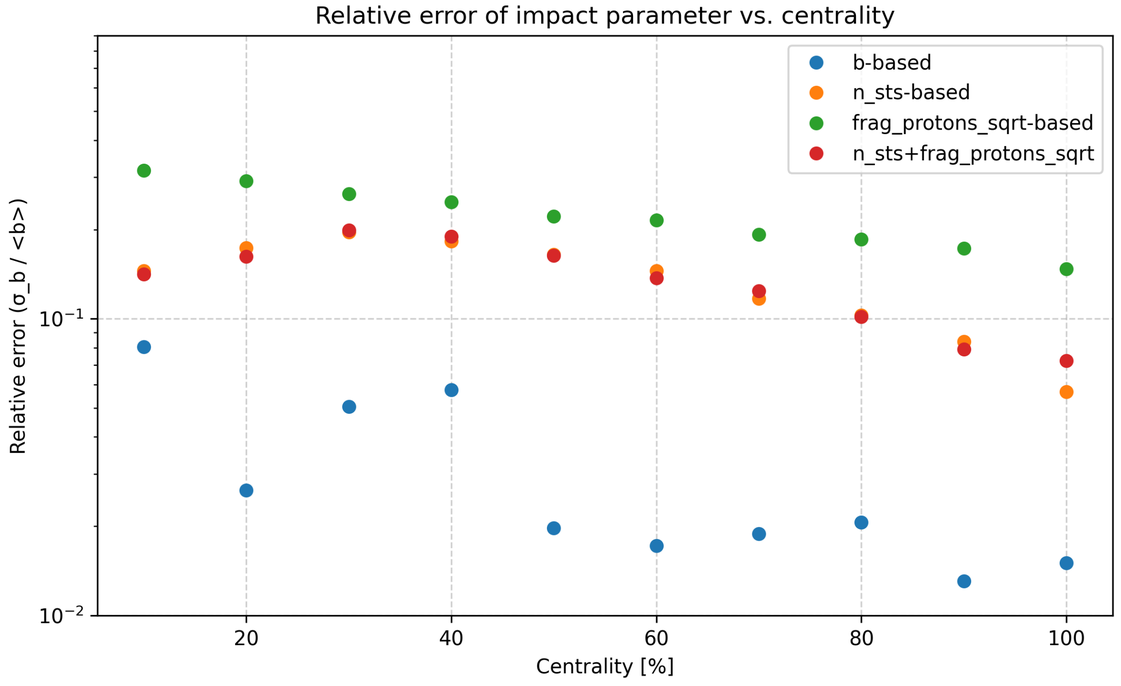


Model comparison - PHQMD all clusters

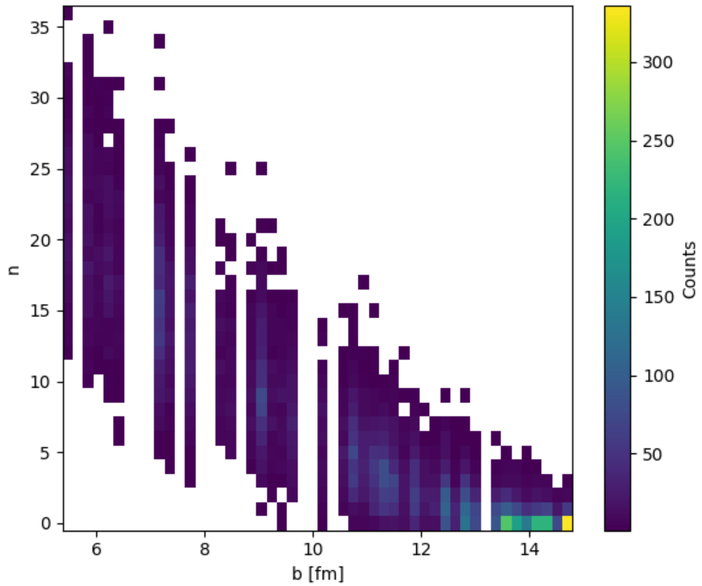
- Identical results to small clusters



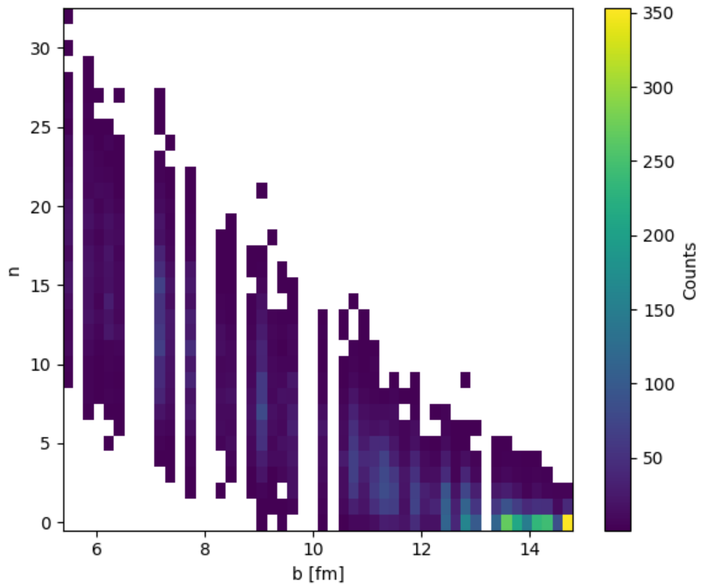


Model comparison - PHQMD all clusters

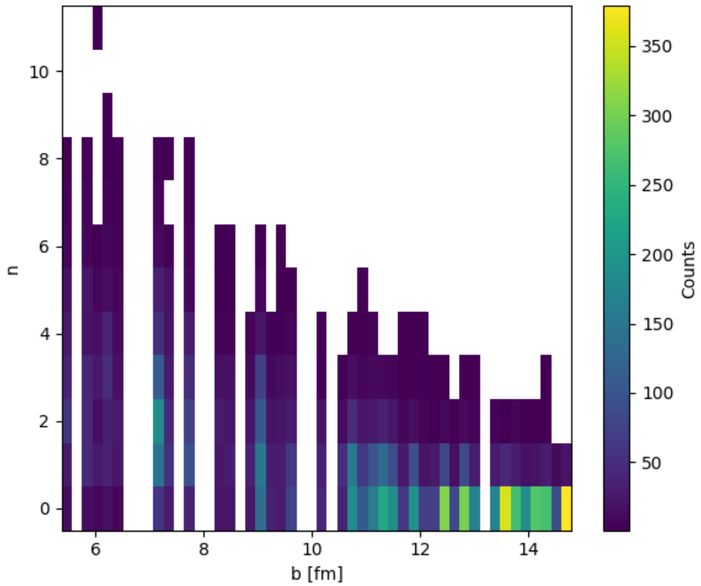
MC primary tracks with hit in STS, y>2.8



MC primary tracks with hit in STS, y>2.8, pions

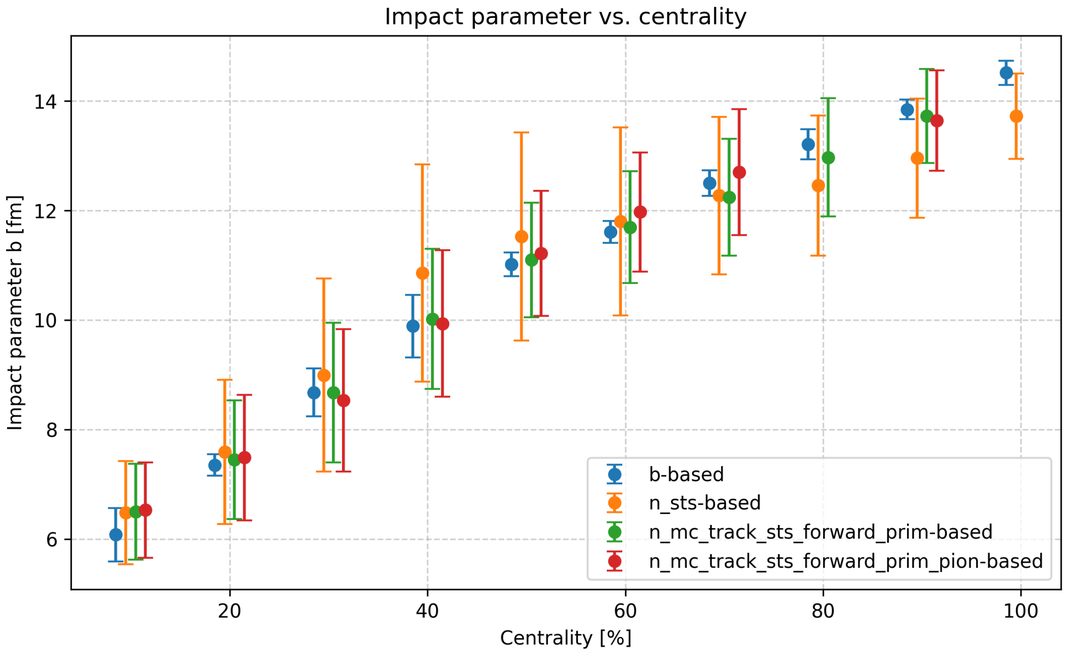


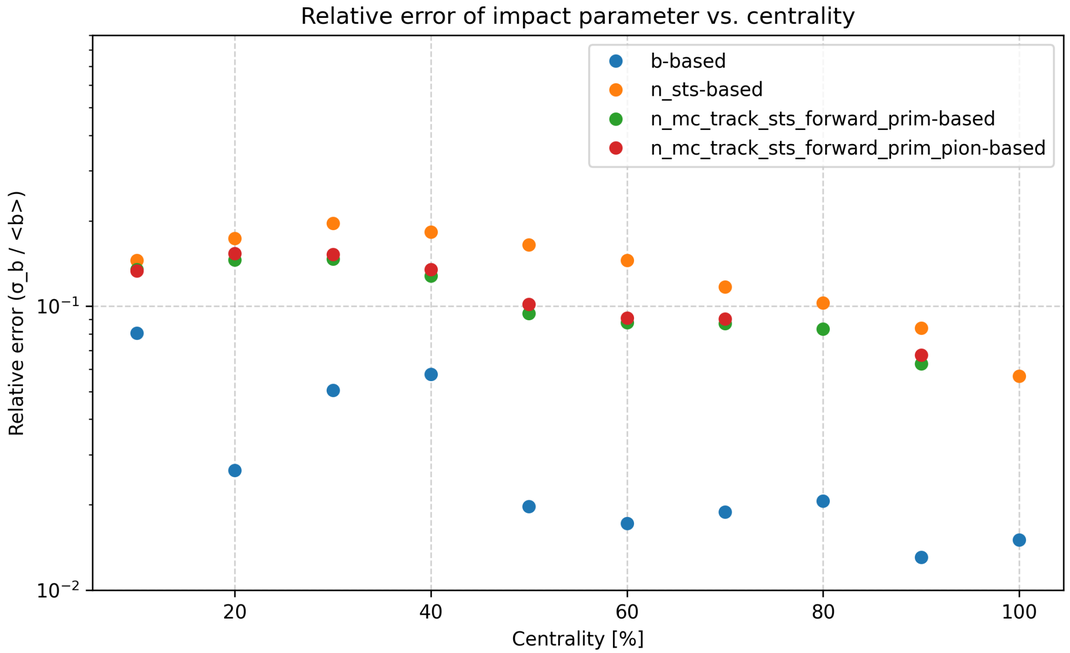
MC primary tracks with hit in STS, y>2.8, protons



Model comparison - PHQMD all clusters

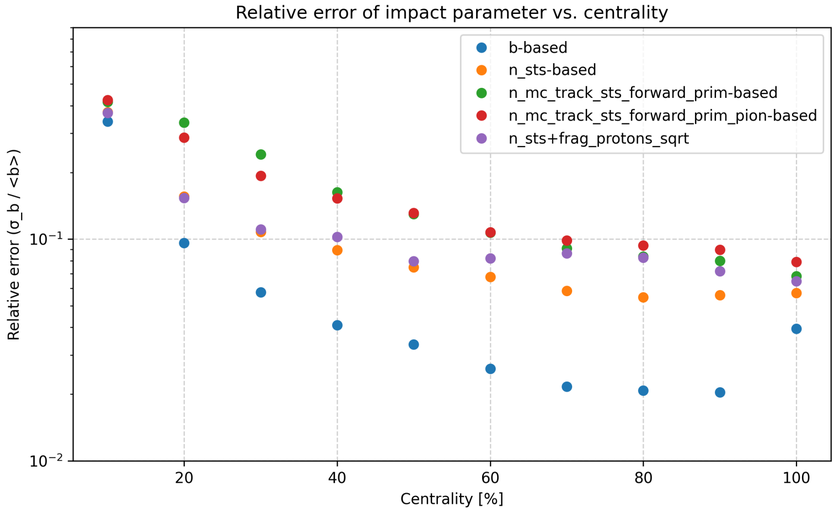
- Forward pions are agin the best estimator

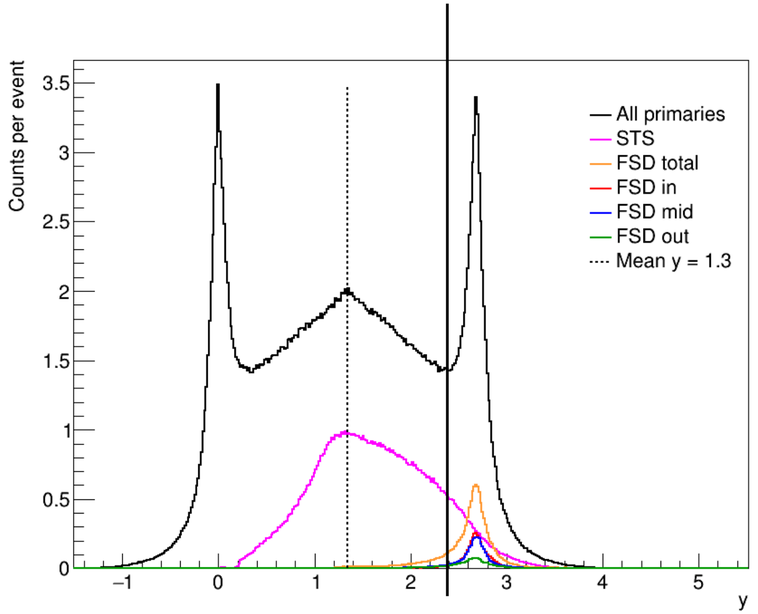


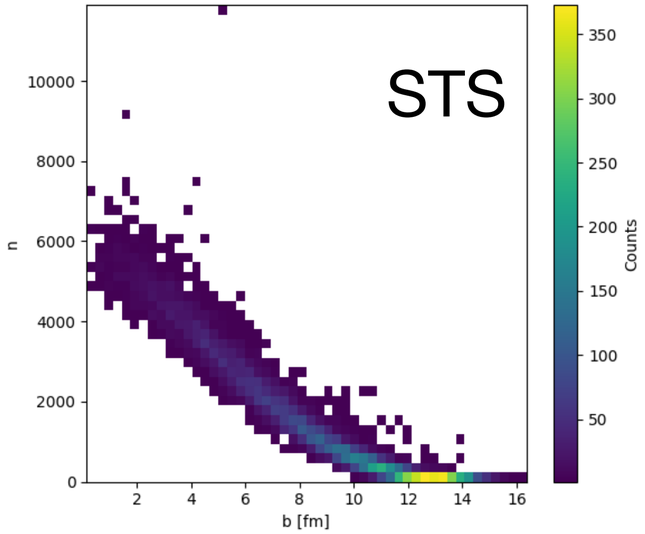


6AGeV

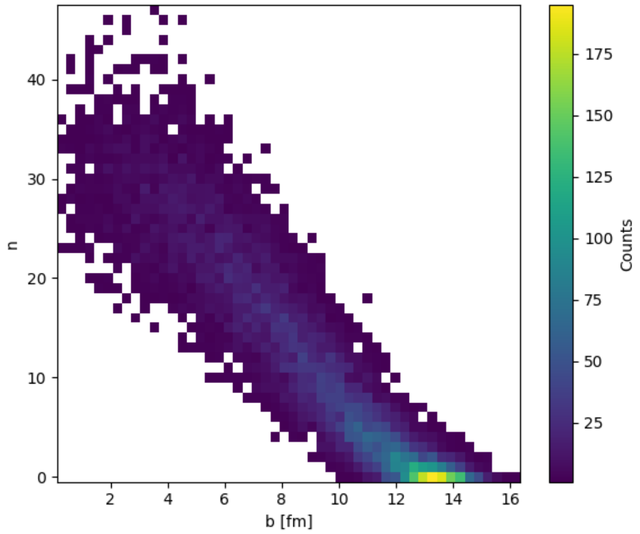
DCM-QGSM-SMM



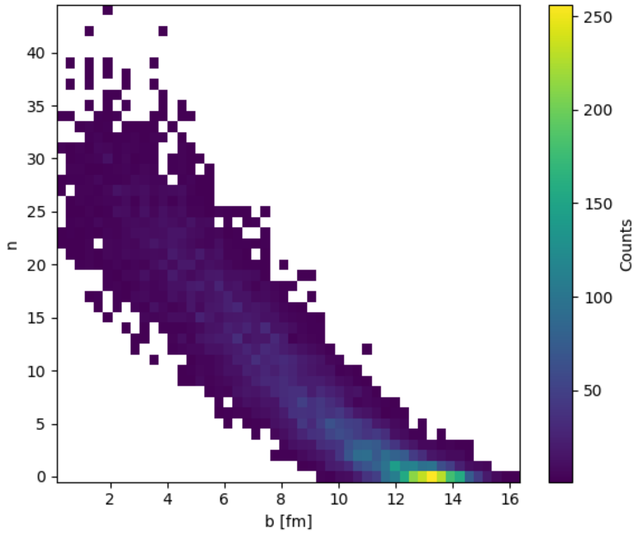




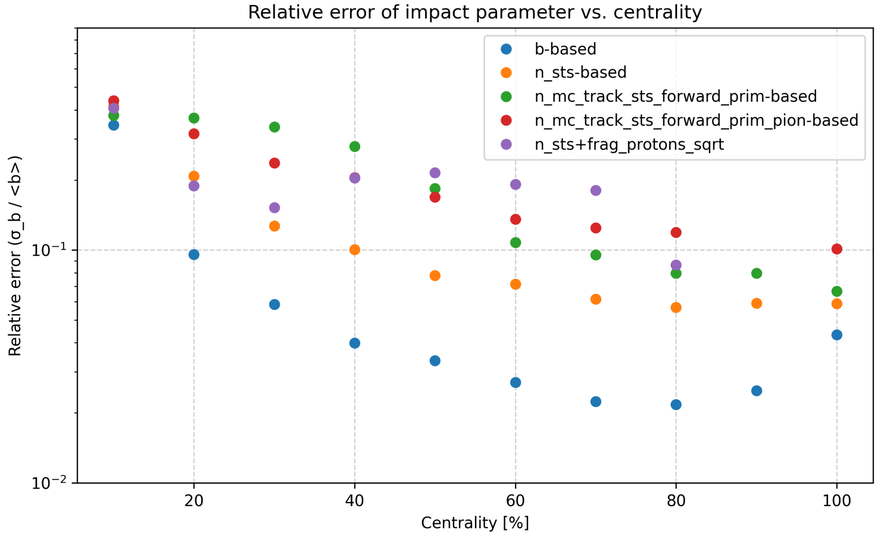
MC primary tracks with hit in STS, y>2.4

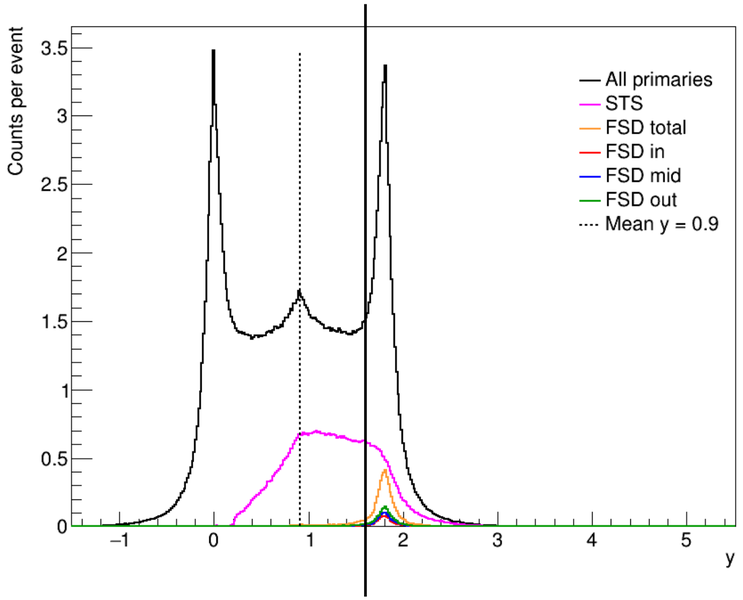


MC primary tracks with hit in STS, y>2.4, pions

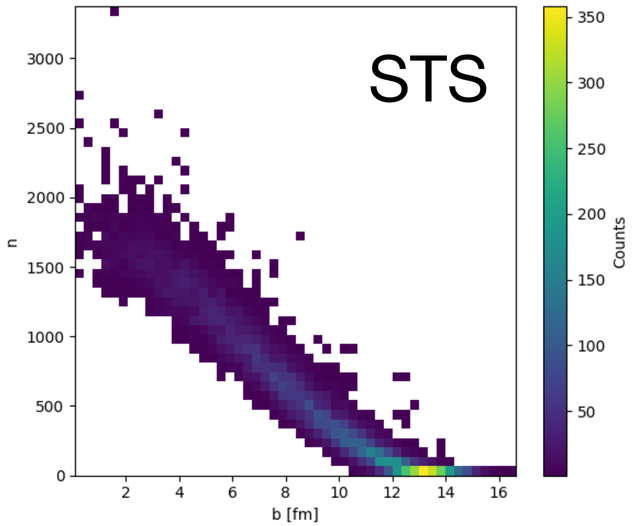


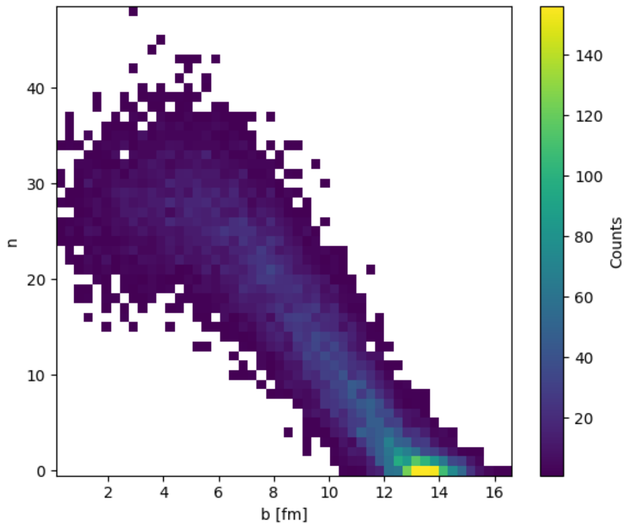
2AGeV
DCM-QGSM-SMM



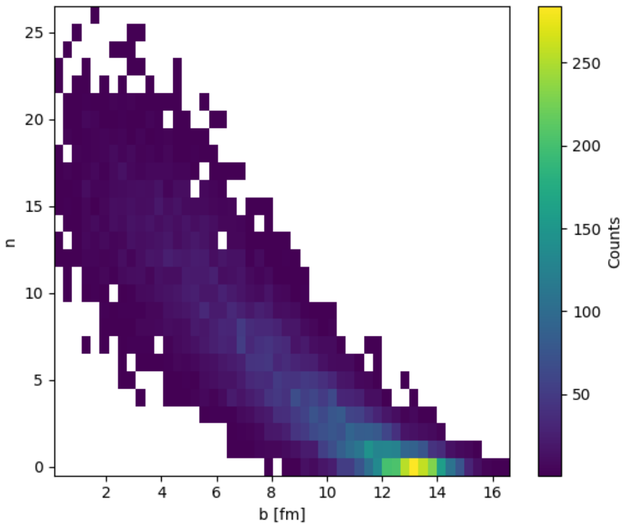


MC primary tracks with hit in STS, y>1.6





MC primary tracks with hit in STS, y>1.6, pions

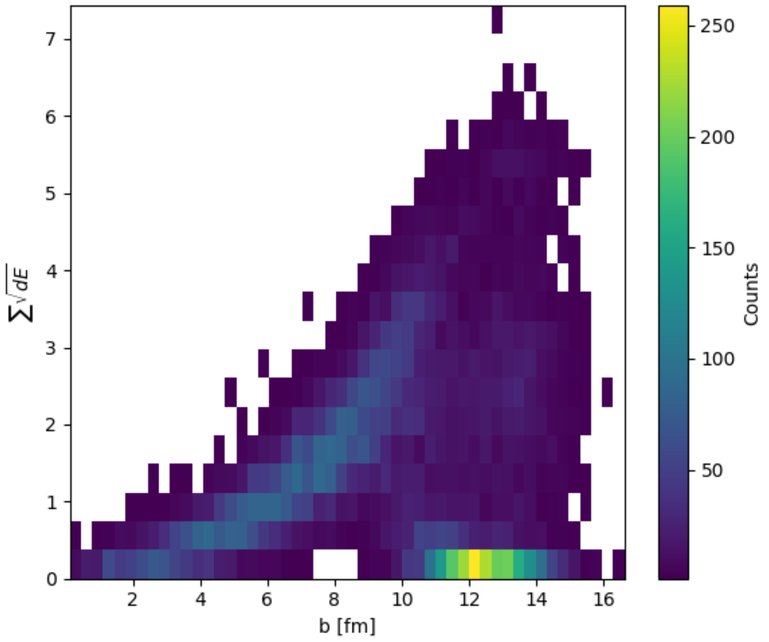


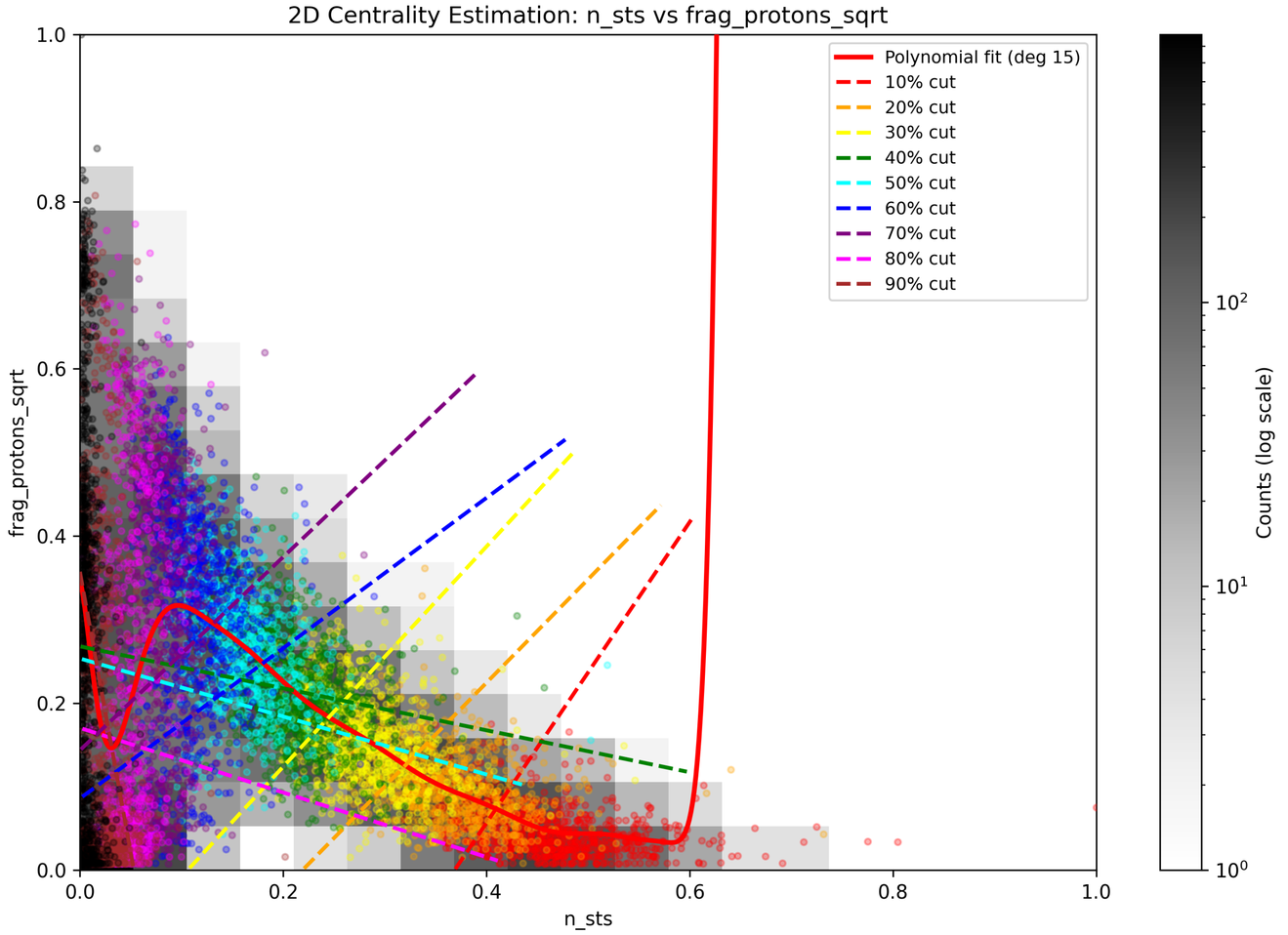
Conclusion

- FSD has similar performance as PSD - no improvement of centrality measurement of STS using 2D method
- Forward pions are good estimator of centrality - model and energy independent - todo: the estimator are primary MC tracks with STS hit and y>2.8 not reconstructed STS tracks
- In PHQMD FSD can reconstruct centrality alone
- FSD can reconstruct centrality using ML - see my previous presentation

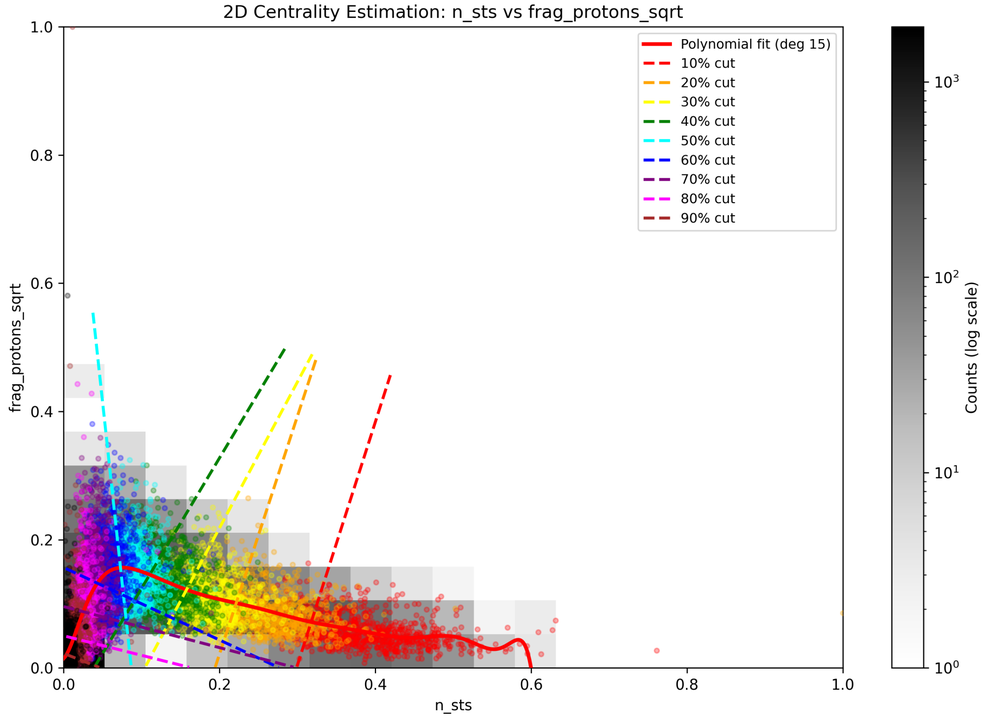
Backup

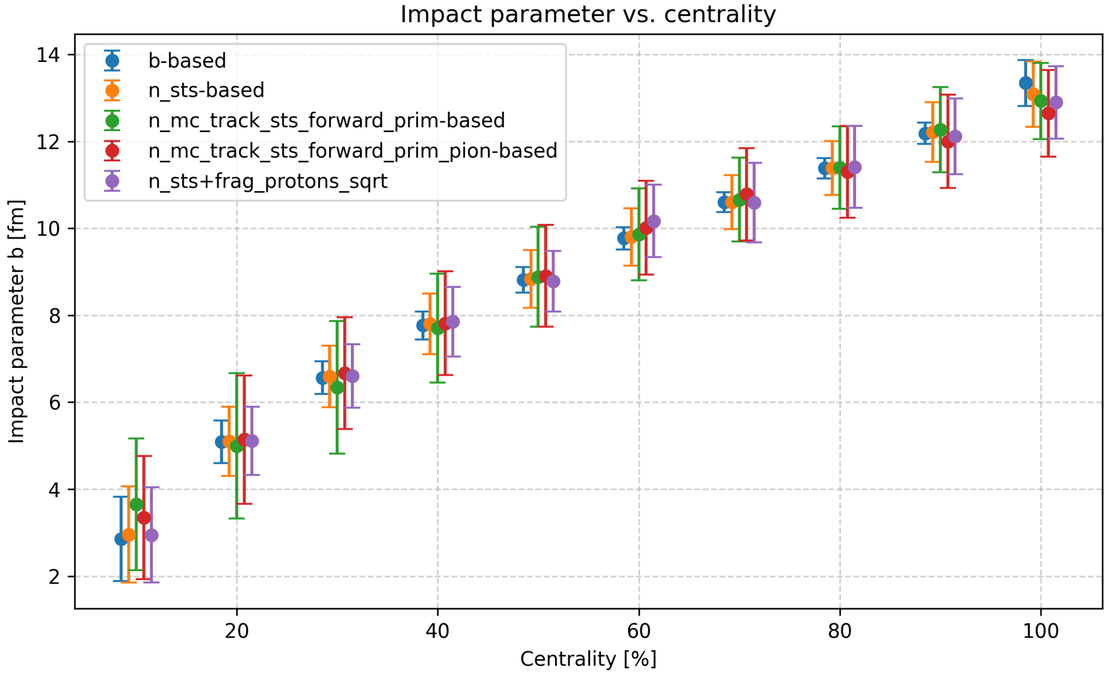
2AGeV


$\sum\sqrt{dE}$
b [fm]
Counts


2D Centrality Estimation: n_sts vs frag_protons_sqrt
Polynomial fit (deg 15)
10% cut
20% cut
30% cut
40% cut
50% cut
60% cut
70% cut
80% cut
90% cut
frag_protons_sqrt
n_sts
Counts (log scale)

6AGeV


2D Centrality Estimation: n_sts vs frag_protons_sqrt
Polynomial fit (deg 15)
10% cut
20% cut
30% cut
40% cut
50% cut
60% cut
70% cut
80% cut
90% cut
frag_protons_sqrt
n_sts
Counts (log scale)


Impact parameter vs. centrality
b-based
n_sts-based
n_mc_track_sts_forward_prim-based
n_mc_track_sts_forward_prim_pion-based
n_sts+frag_protons_sqrt
Impact parameter b [fm]
Centrality [%]