

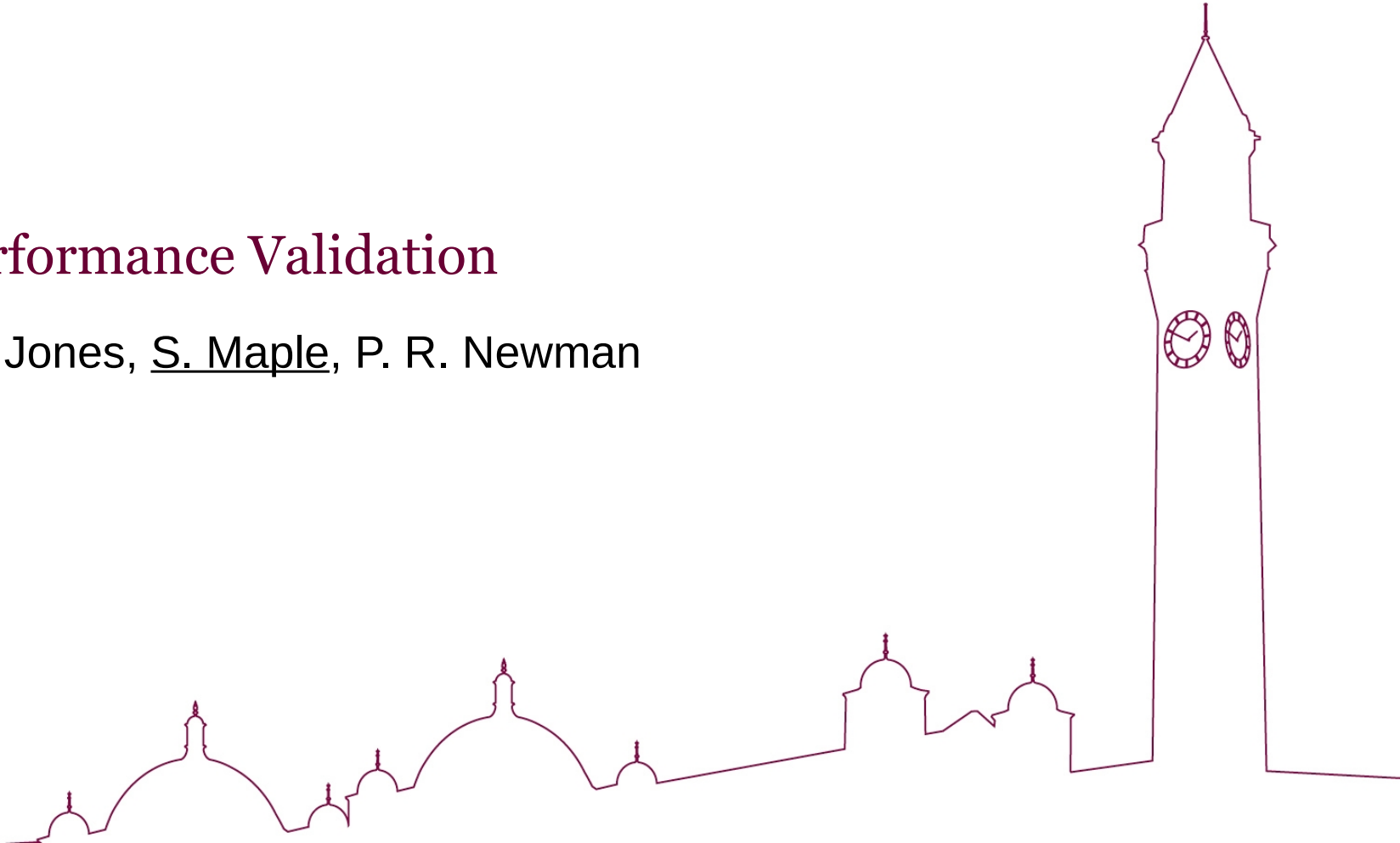


UNIVERSITY OF
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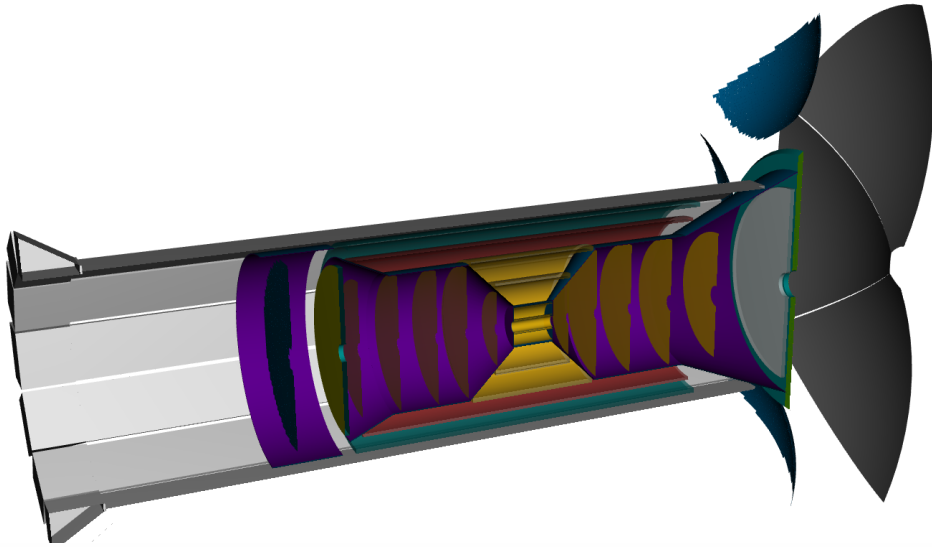
Craterlake Performance Validation

L. Gonella, P. G. Jones, S. Maple, P. R. Newman

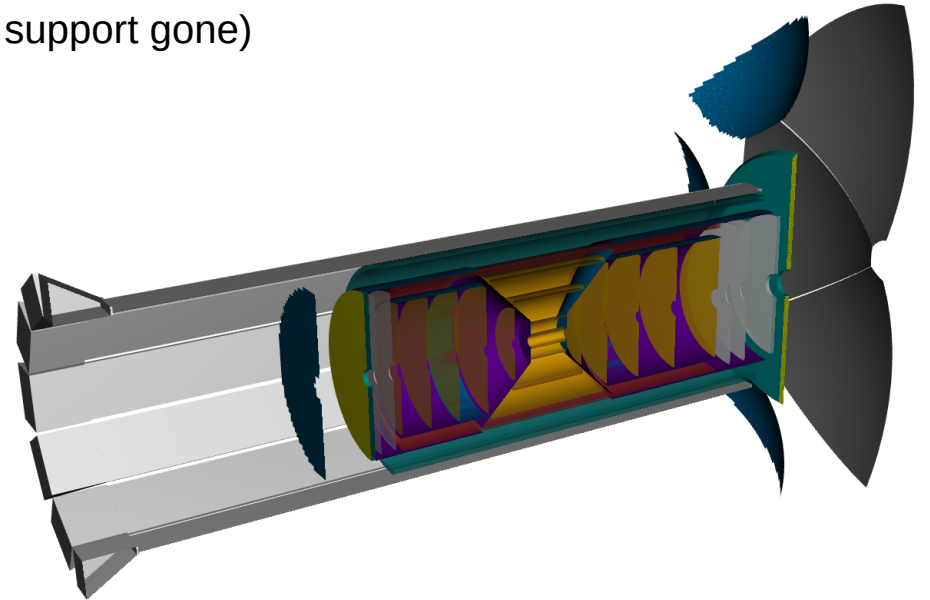


Brycecanyon vs Craterlake

- What might change the performance?
 - Si Negative lever arm reduced: disk ED4 moved from -115cm → -105cm (disk ED3 also moved)
 - Additional MPGD layers in endcaps
 - Some services changes → less material in barrel (L2 support gone)



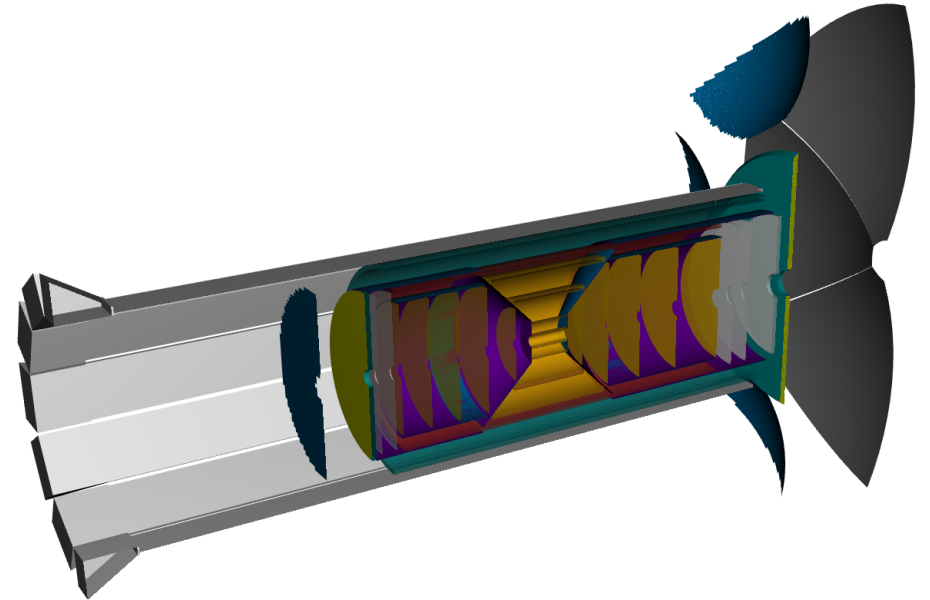
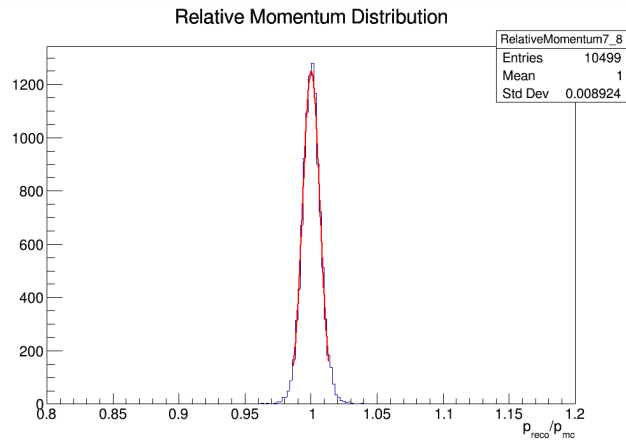
Brycecanyon



Craterlake

Simulation Procedure

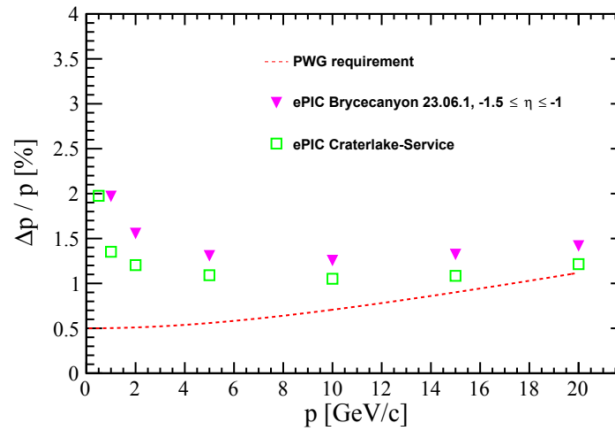
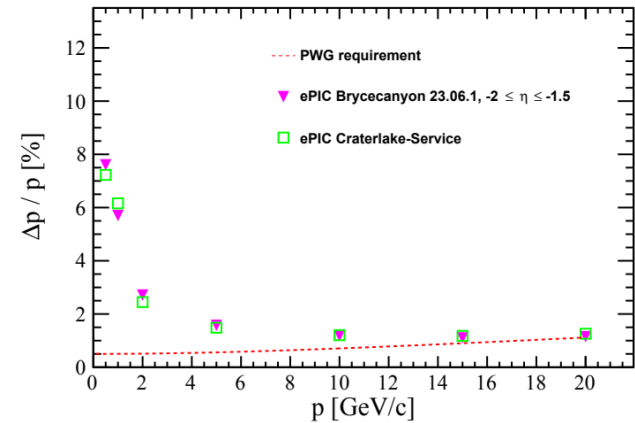
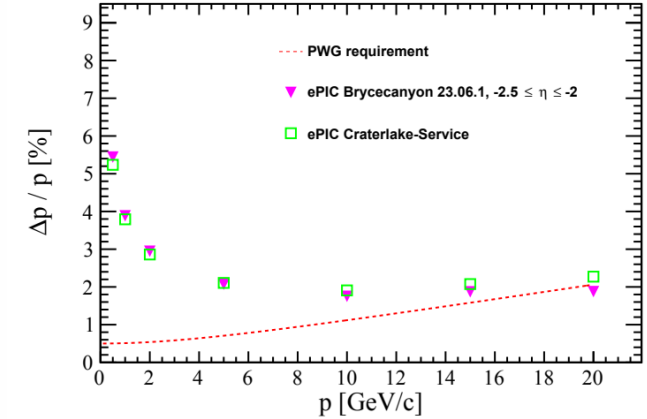
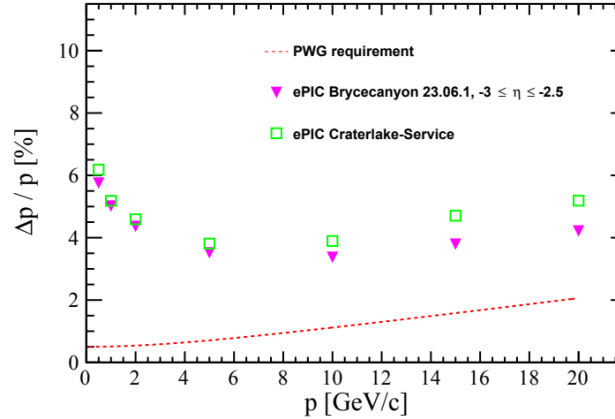
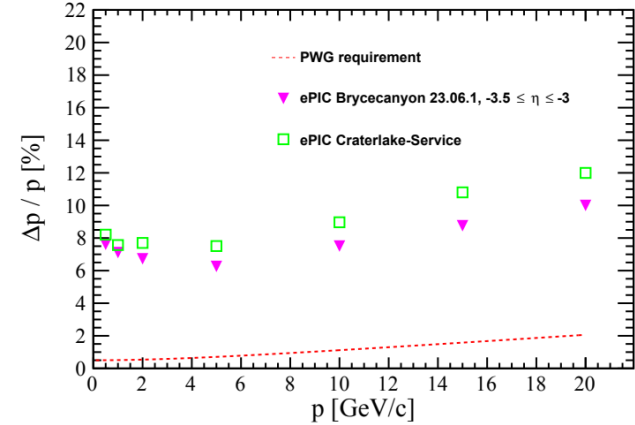
- Generate pions with fixed energies, flat in η
 - $0.5 < p < 20$ GeV
 - $-4 < \eta < 4$
- Pass through desired ePIC geometry with npsim
- Reconstruct pion tracks with EICrecon



- Reconstructed events binned in η and p , fitted in 2σ range around peak and resolution extracted



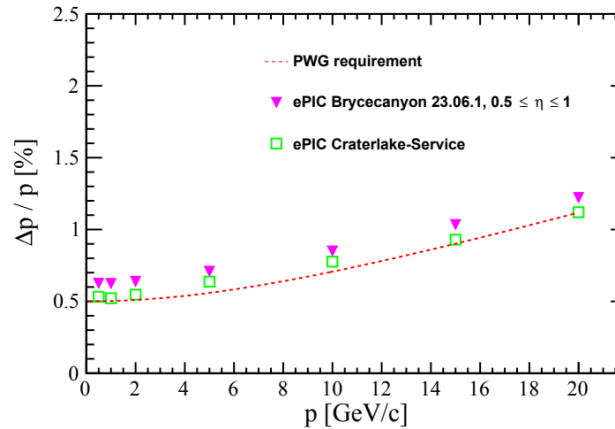
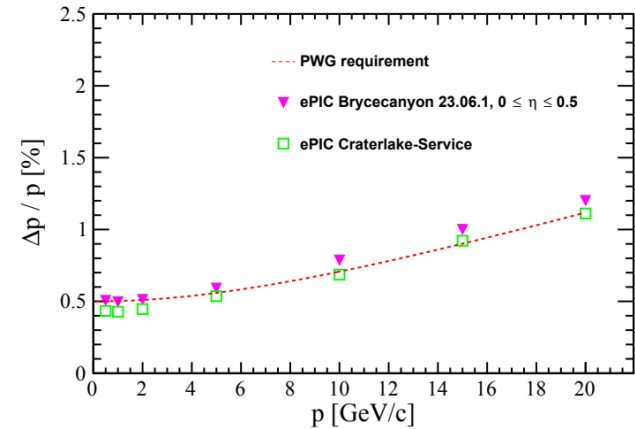
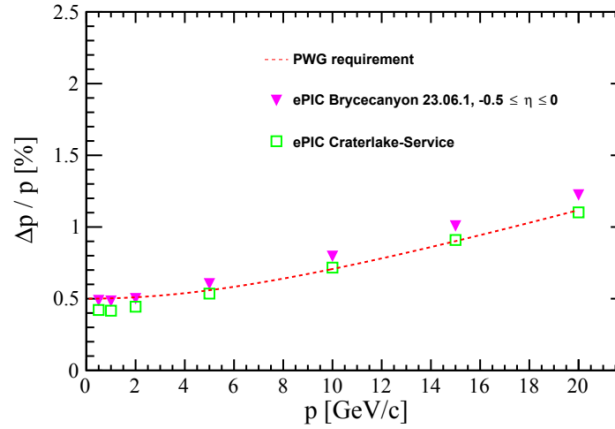
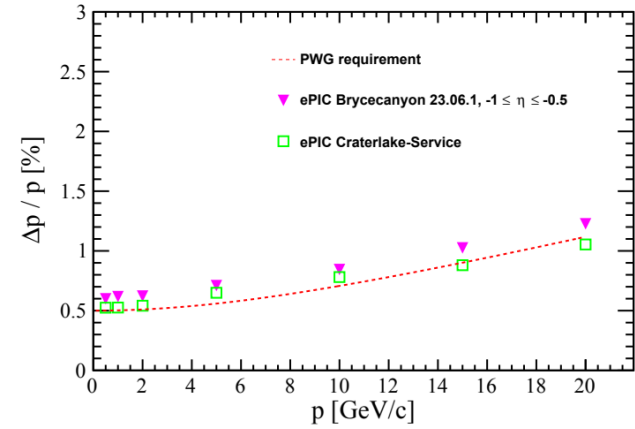
Relative Momentum Resolution Backward (pions)



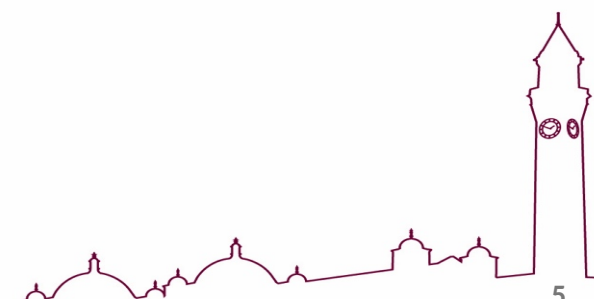
- Craterlake loses $\sim 1\%$ for $-3.5 < \eta < -2.5$ compared to Brycecanyon \rightarrow shorter lever arm of high granularity Si
- $-2.5 < \eta < -1.5$ performance is similar
- $-1.5 < \eta < -1$ craterlake improves by $\sim 0.2\%$ \rightarrow service material differences?



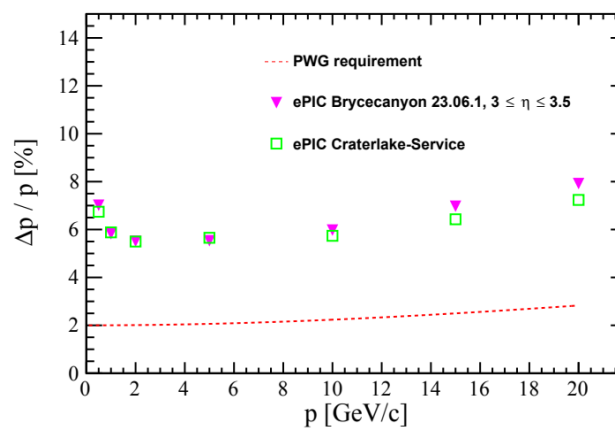
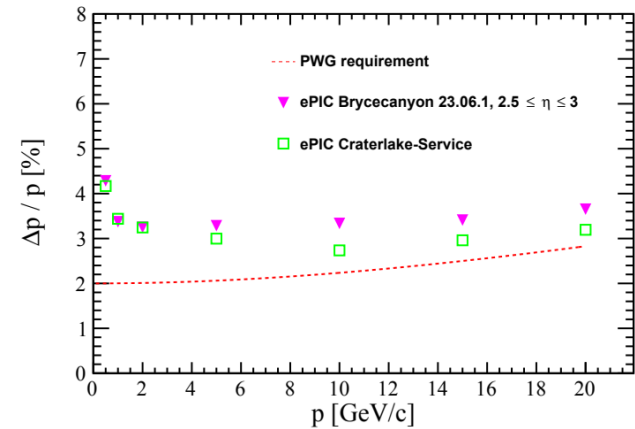
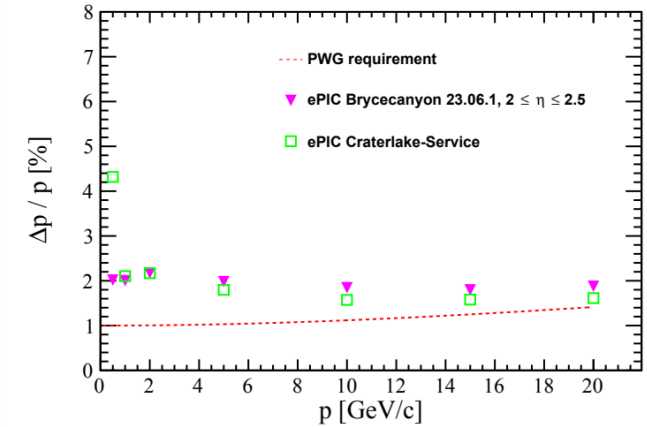
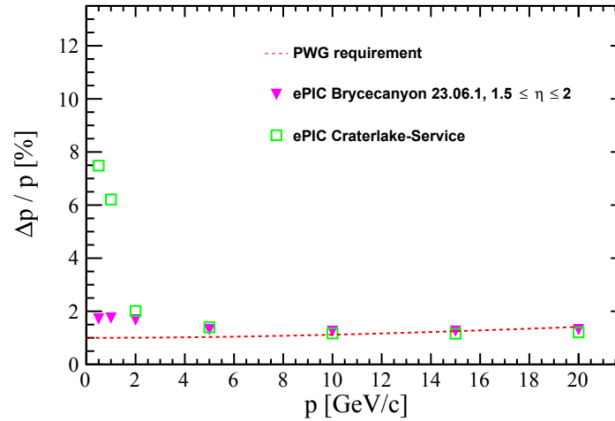
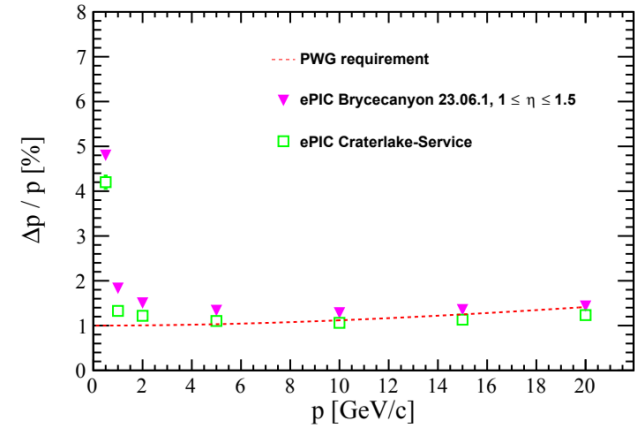
Relative Momentum Resolution Central (pions)



- Craterlake improves dp/p by $\sim 0.1\%$ in central region
→ removal of L2 support material



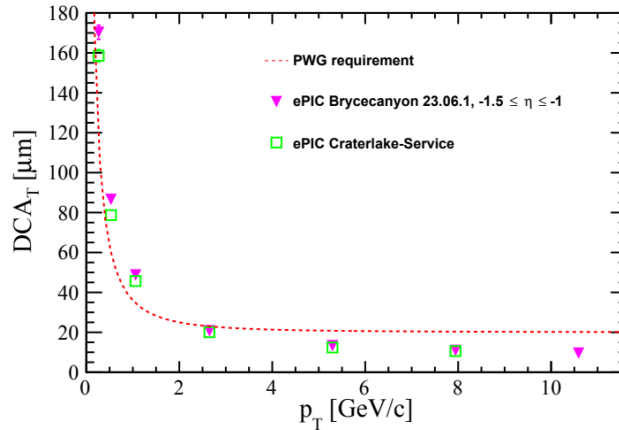
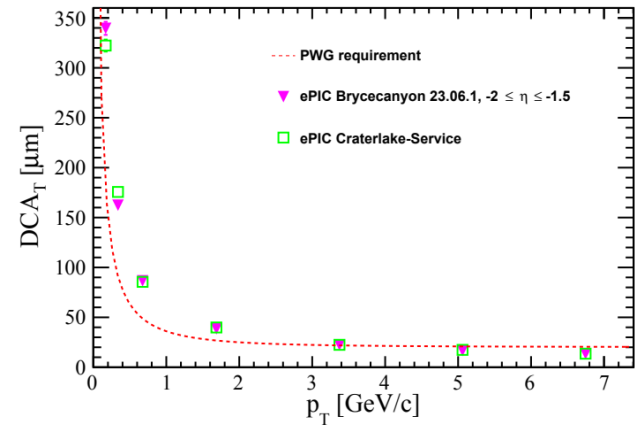
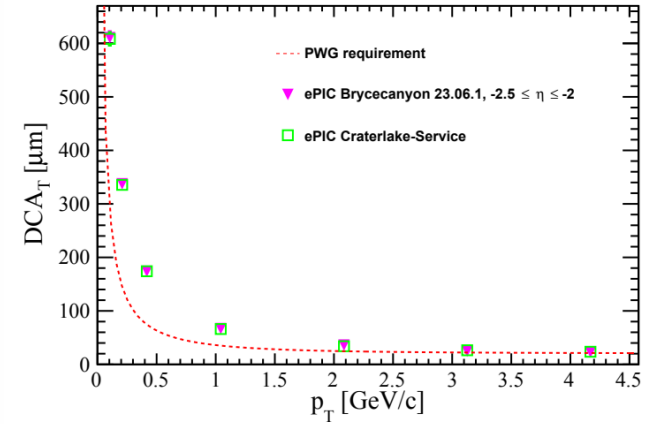
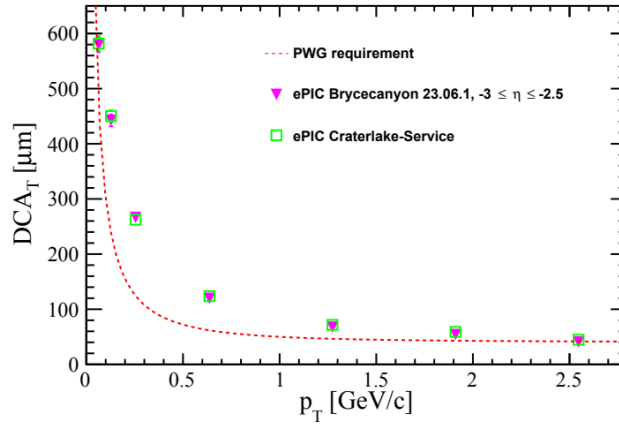
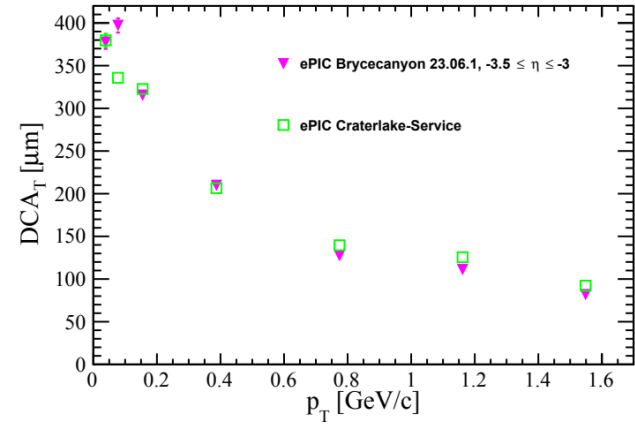
Relative Momentum Resolution Forward (pions)



- $1 < \eta < 1.5$ craterlake improves by $\sim 0.2\%$ → service material differences?
- Sharp rise at low p for $1.5 < \eta < 2.5$ → dp distribution shows strange features here that require further investigation
- Craterlake is improvement for $2.5 < \eta < 3.5$ → same Si lever arm but extra MPGD hits?

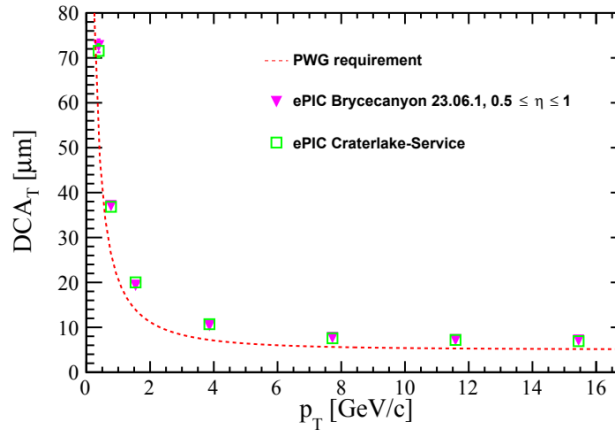
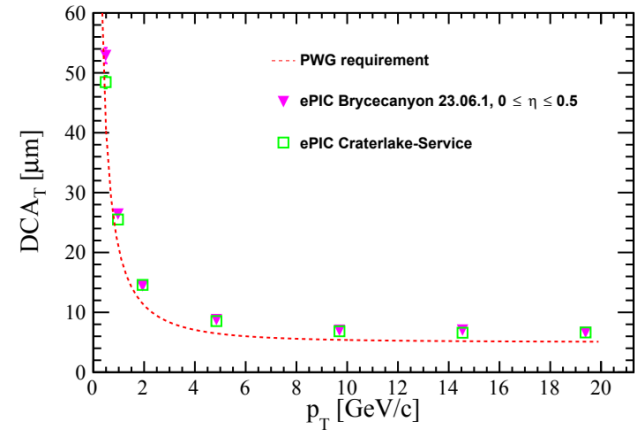
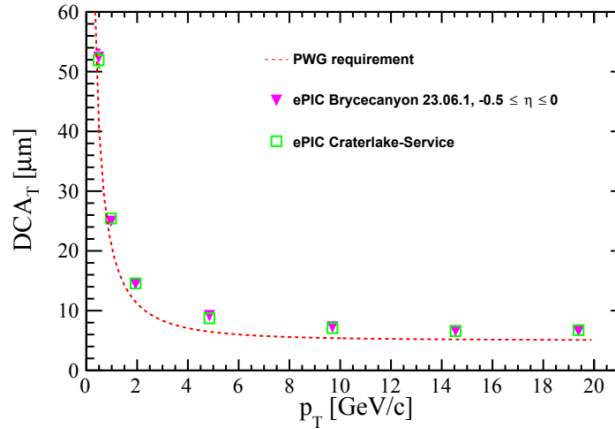
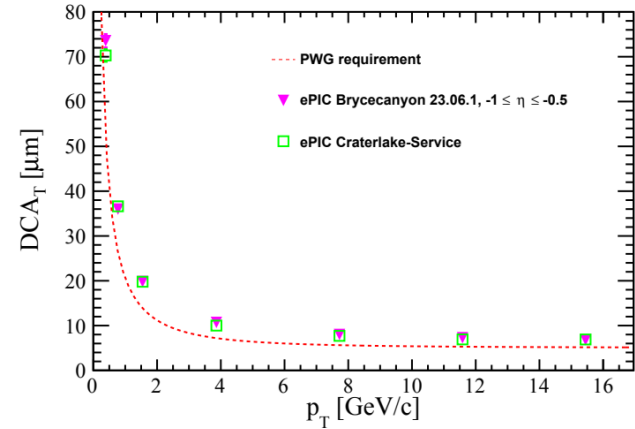


Transverse Pointing Resolution Backward (pions)



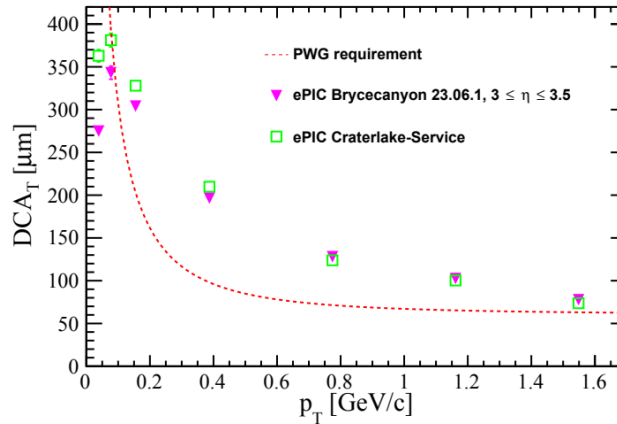
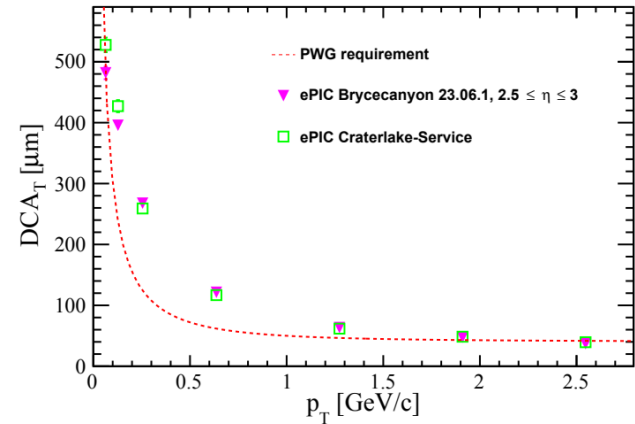
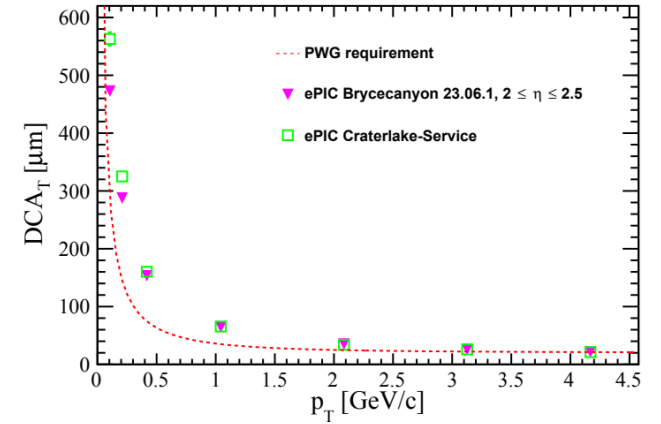
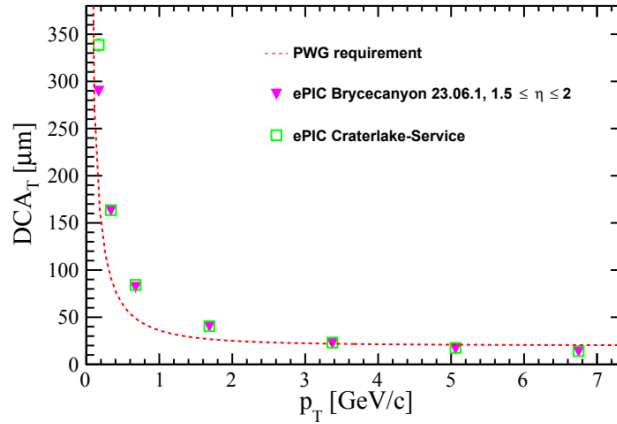
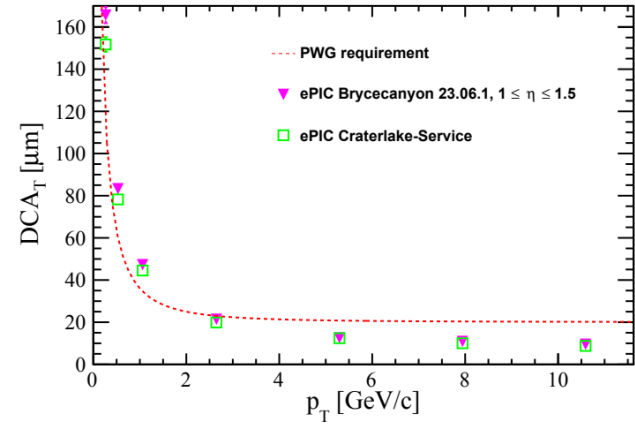
- DCA resolution dominated by first hits \rightarrow any changes in this η range are further from the interaction point

Transverse Pointing Resolution Central (pions)



- DCA resolution dominated by first hits → no changes to barrel until after L2 → performance unchanged

Transverse Pointing Resolution Forward (pions)



- DCA resolution dominated by first hits \rightarrow any changes in this η range are further from the interaction point

Realistic Seeding + CKF

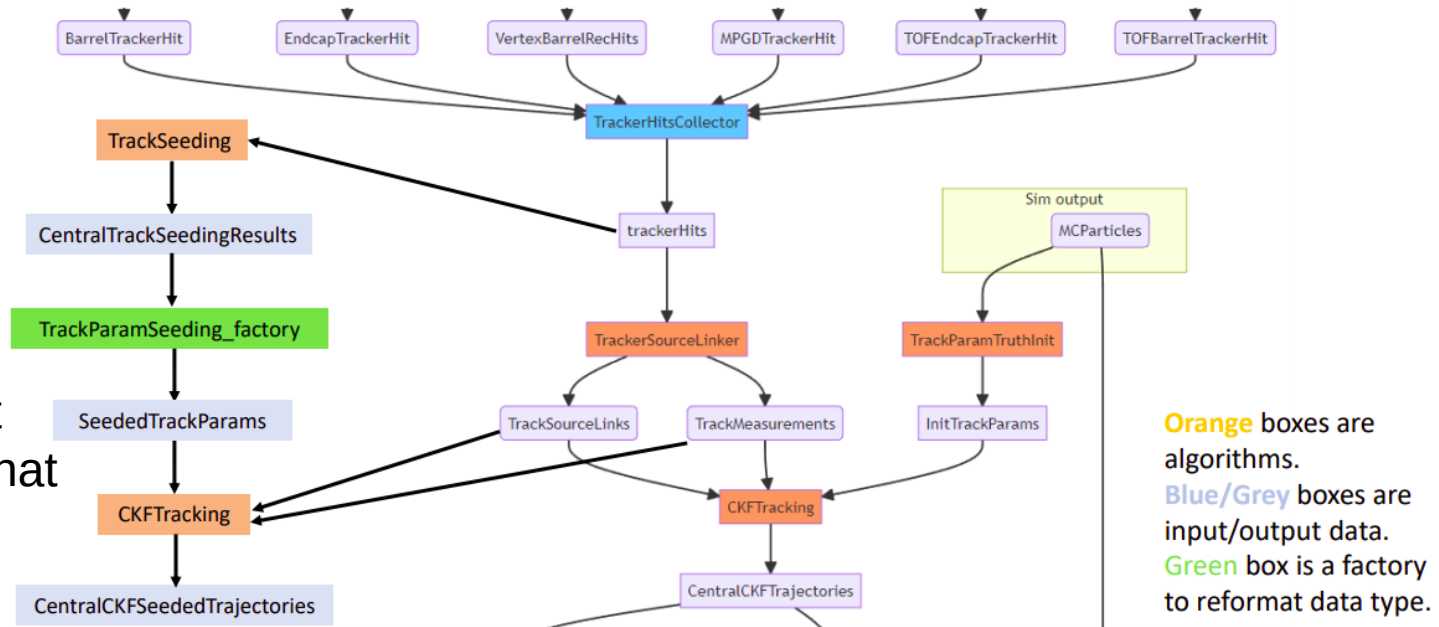
- Simulations performed with same procedure as before
- Using Barak's track-QA branch of EICrecon <https://github.com/eic/EICrecon/tree/track-qa-barak>

- Realistic seeds are output from seeder → passed to CKF
- Note: A single particle may produce multiple seeds depending on how many layers are hit (not the case for truth seeding)

From here: when I say “Best Seed” I mean the the seed that gives the p_{reco} closest to p_{true} .

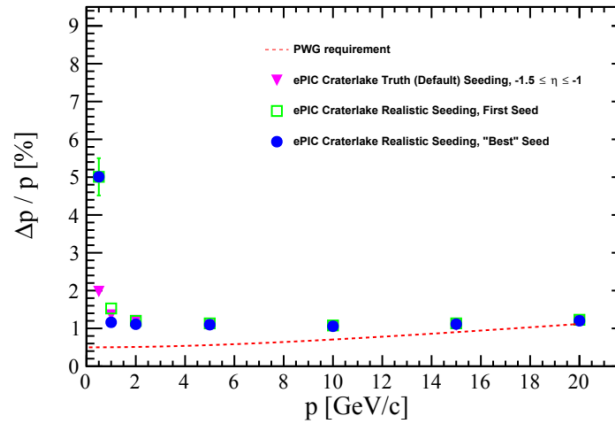
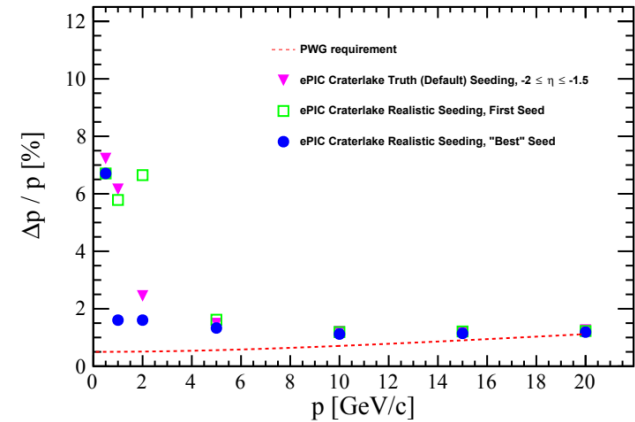
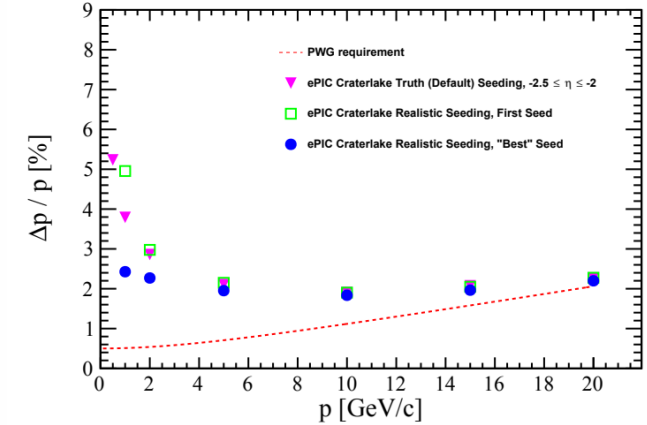
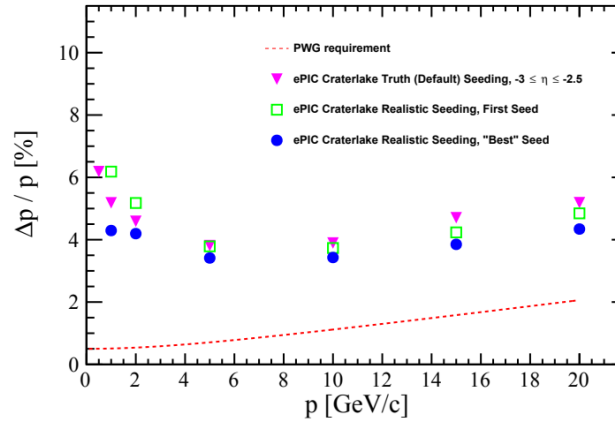
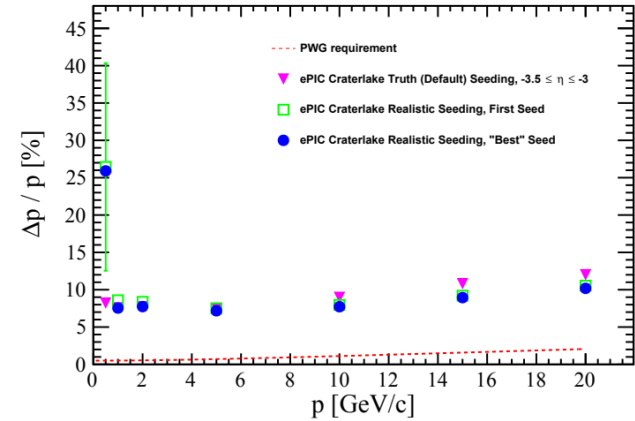
First seed refers to the first seed in the list of seeds

Update to use real seed for tracking



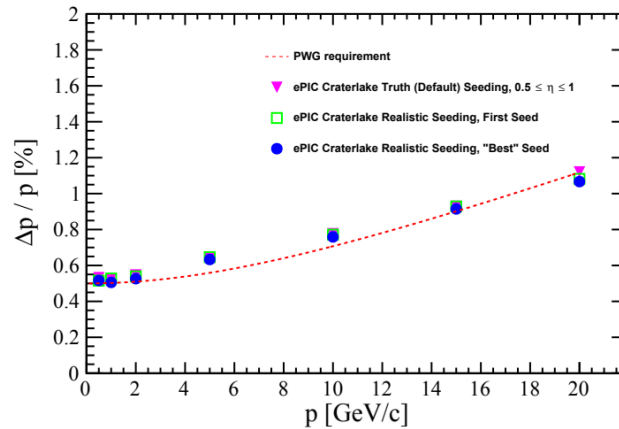
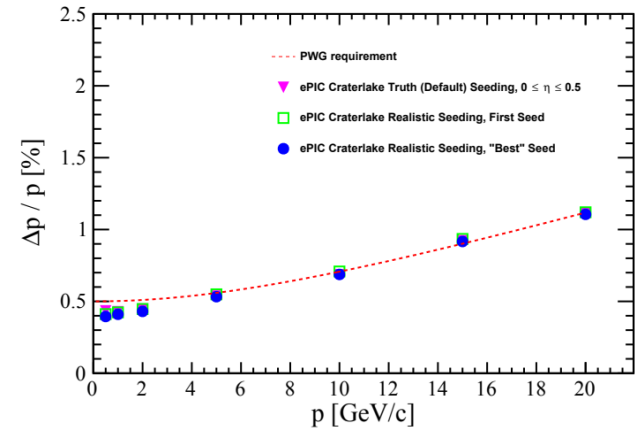
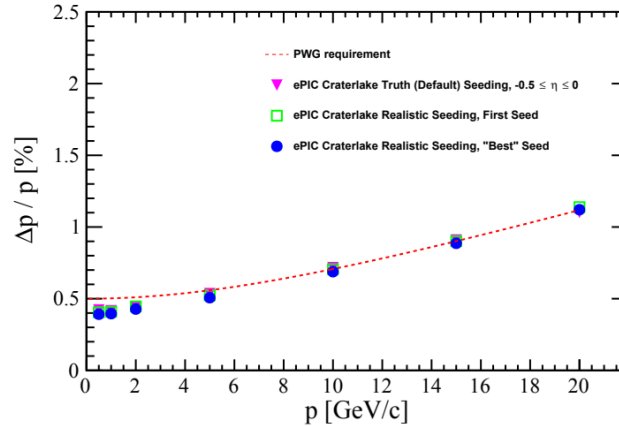
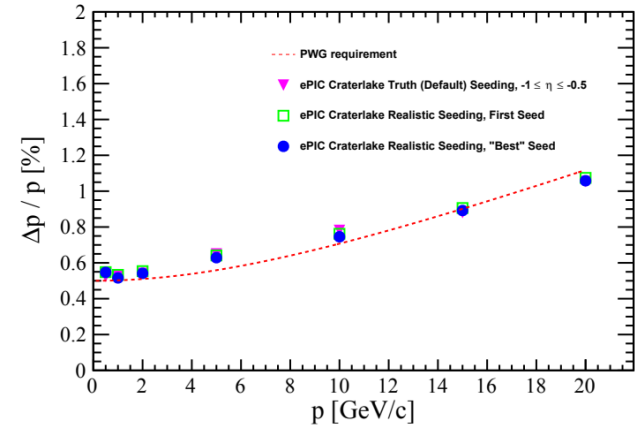
See <https://indico.bnl.gov/event/19357/>

Relative Momentum Resolution Backward (Realistic vs Truth seed)

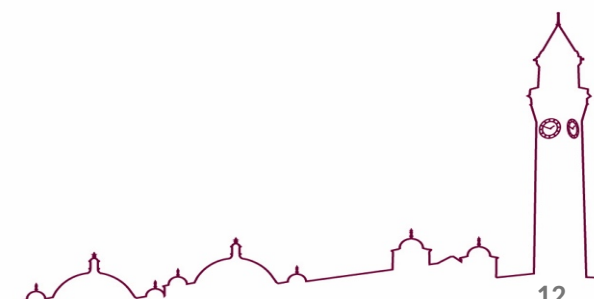


- Realistic Best/First and Truth seeding match fairly well
- “Best seed” typically outperforms truth seed and realistic “first” seed

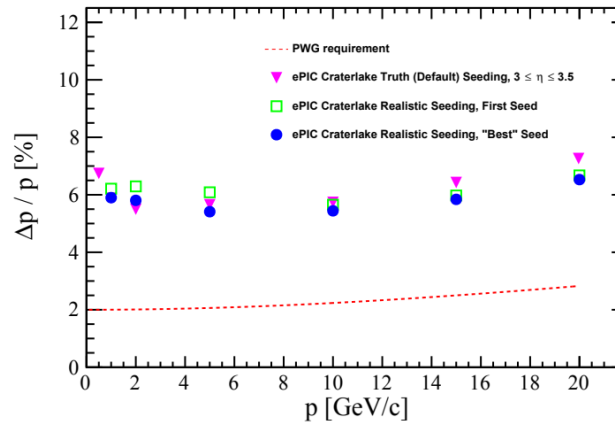
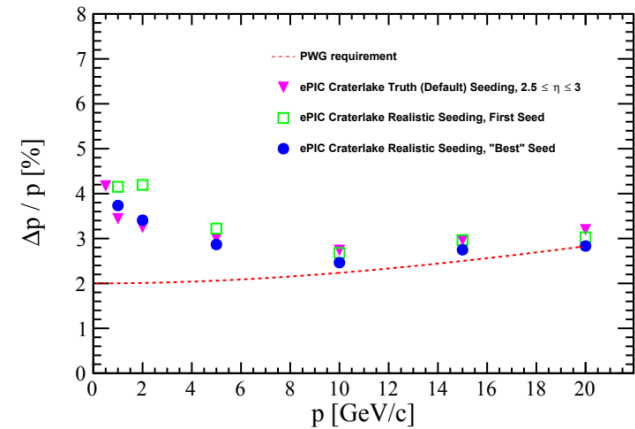
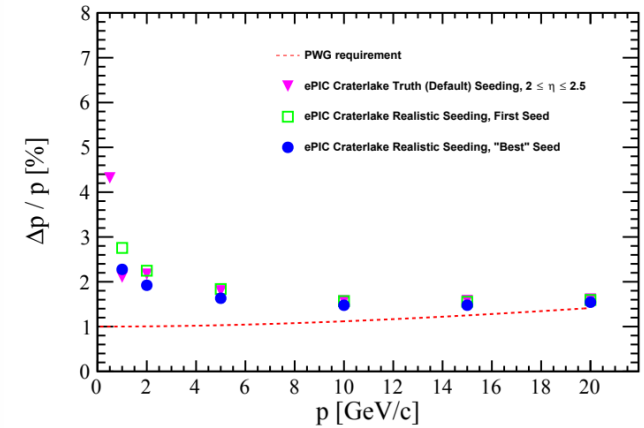
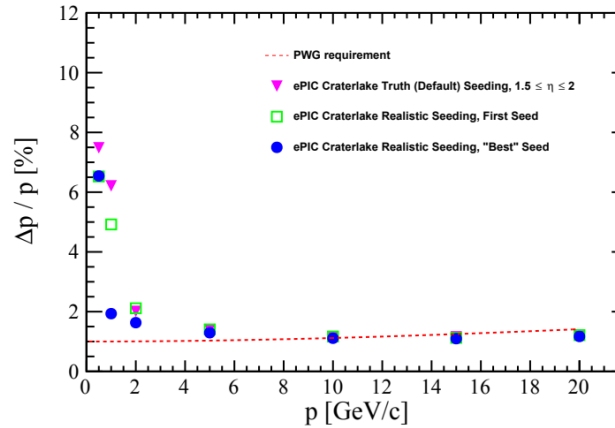
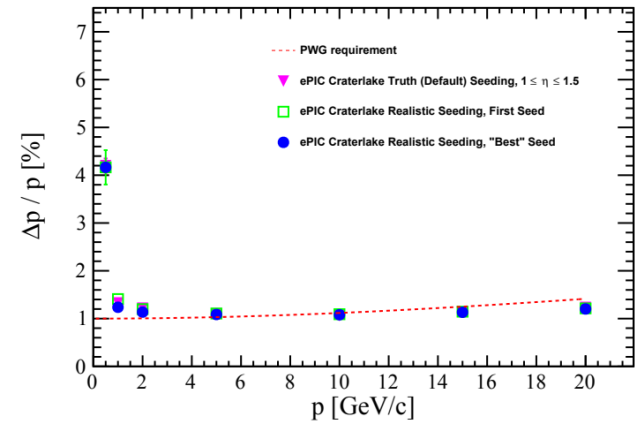
Relative Momentum Resolution Central (Realistic vs Truth seed)



- Excellent agreement between truth seeding and realistic seeding for the central region!



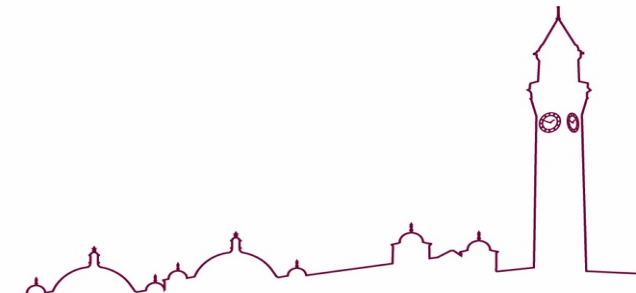
Relative Momentum Resolution Forward (Realistic vs Truth seed)



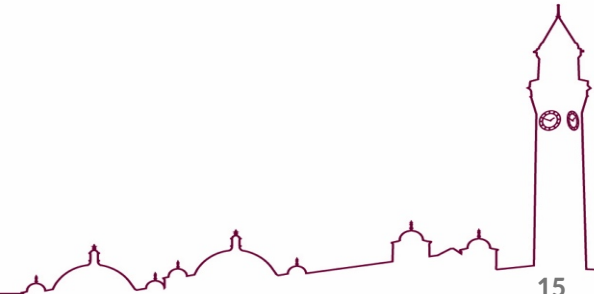
■ Similar story as for backward: seeds all produce similar results, realistic "best seed" typically gives the best momentum resolution, but generally all are close

Summary

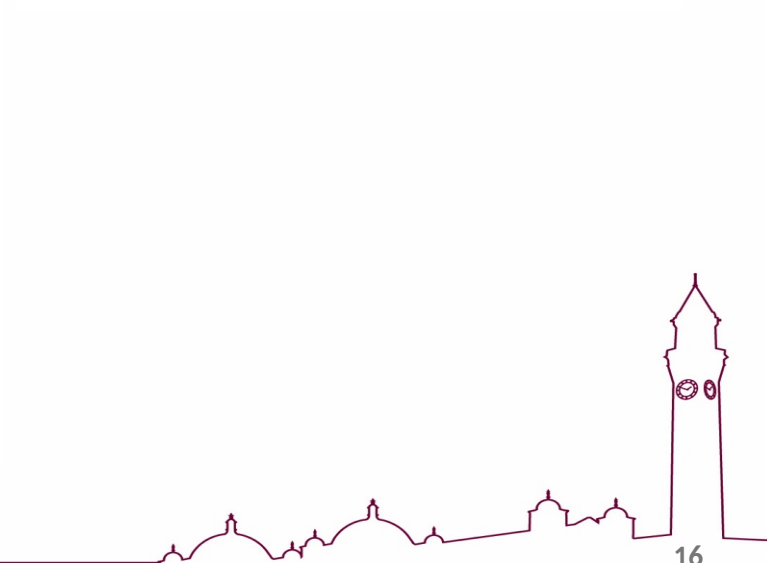
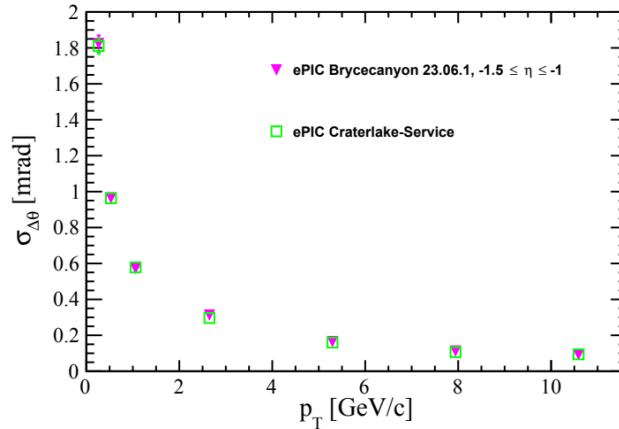
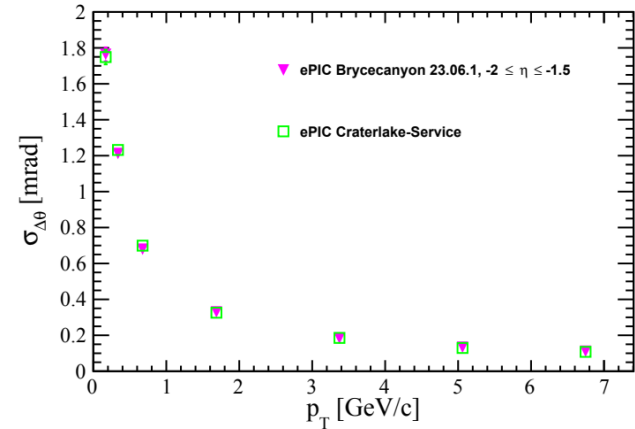
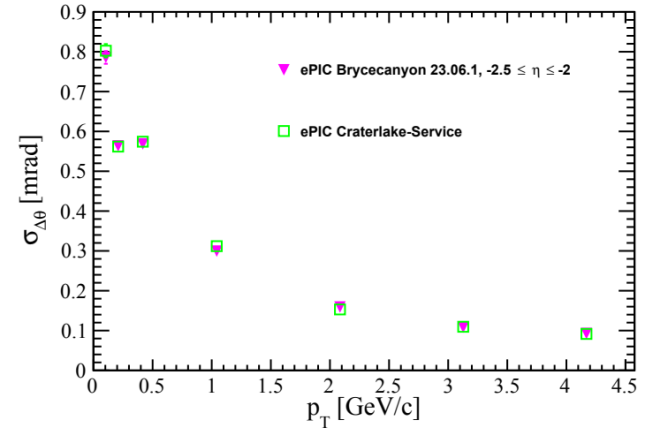
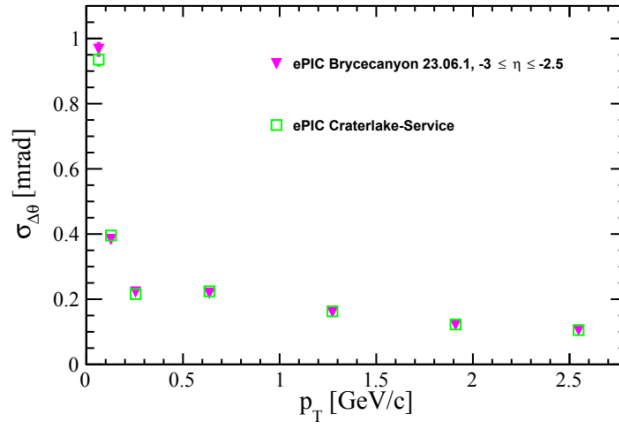
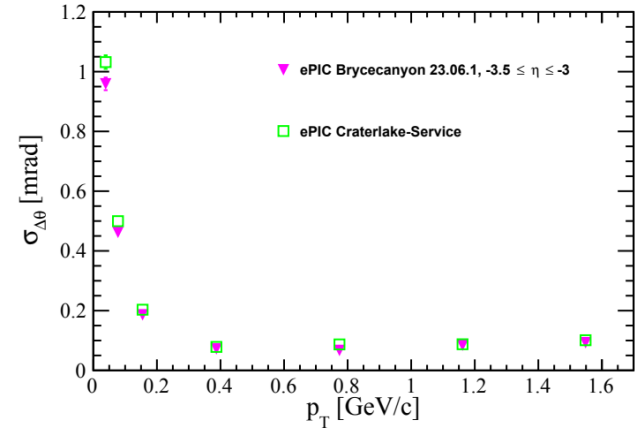
- Craterlake geometry now available
 - Momentum and Vertex resolutions benchmarked and compared to Brycecanyon → performance differences make sense
- Momentum resolution from using the EICrecon default (truth seeding) and seeds from orthogonal seeder compared
 - Performance from realistic seeding is consistent with truth seeding → realistic seeding looks to be working well!



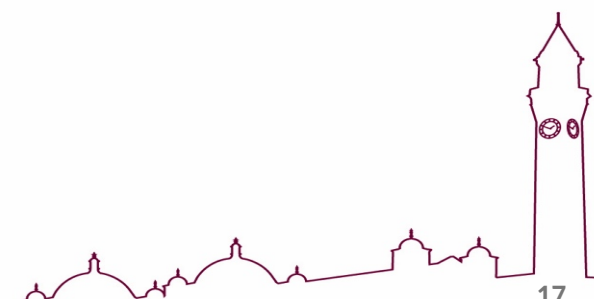
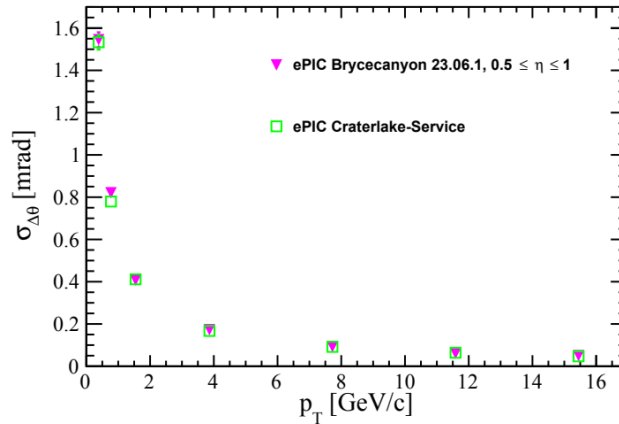
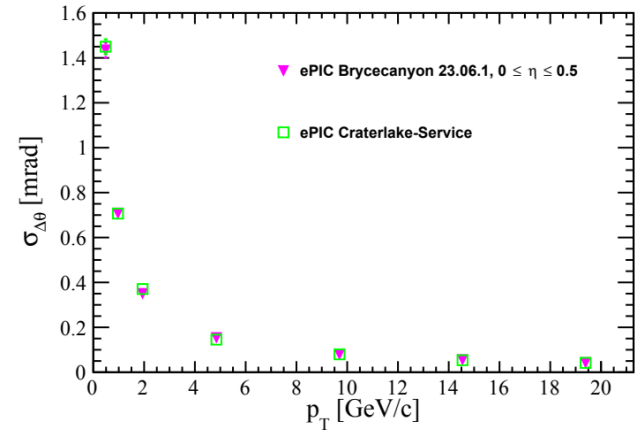
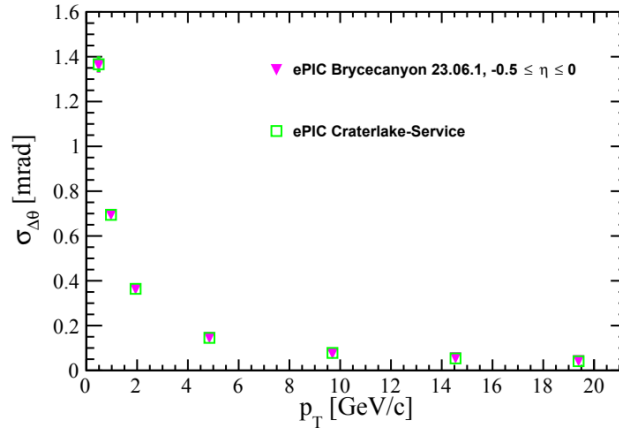
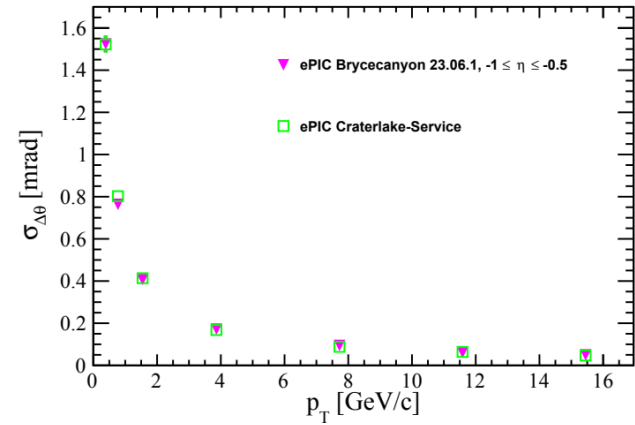
Backup



Polar Angle Resolution Backward (pions)



Polar Angle Resolution Central (pions)



Polar Angle Resolution Forward (pions)

