ACTS for ALICE Upgrade

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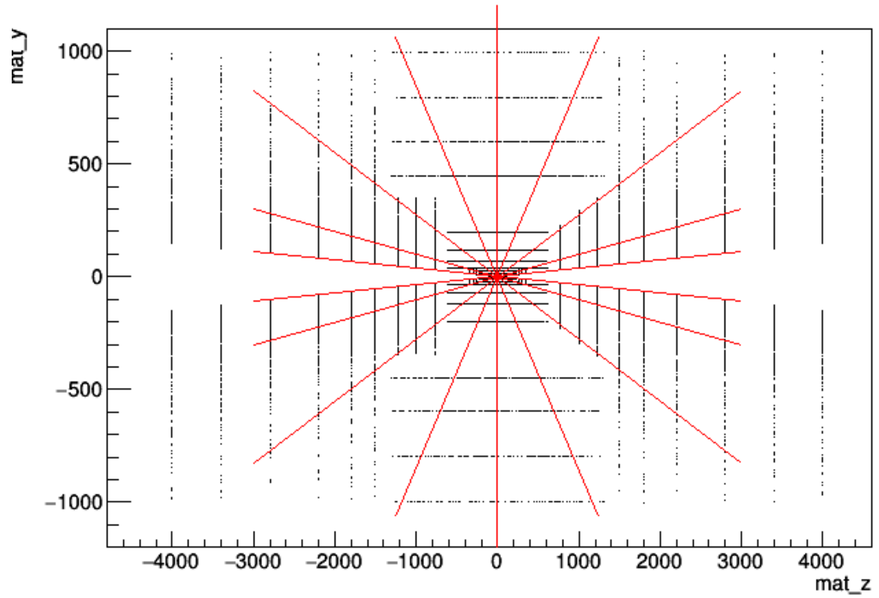
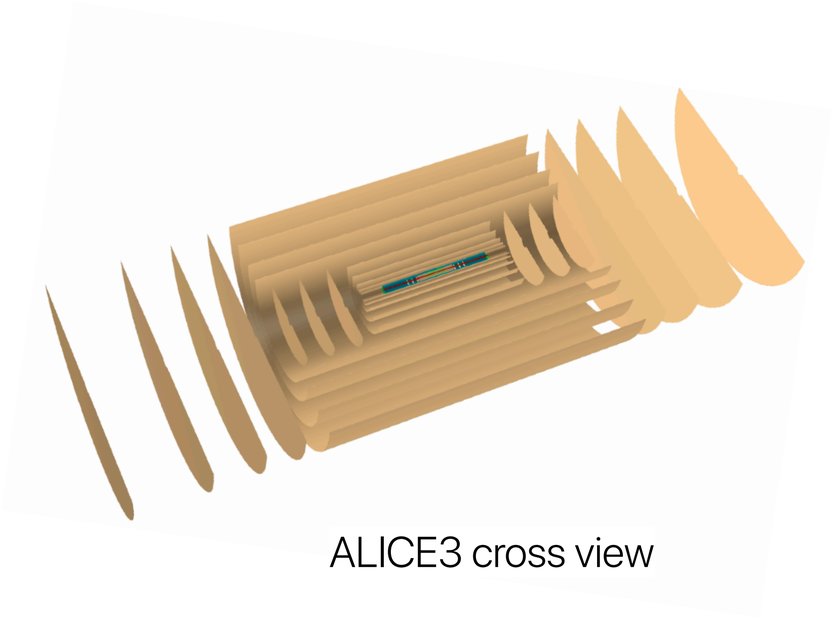
ACTS developers workshop 26.09.22

ALICE3



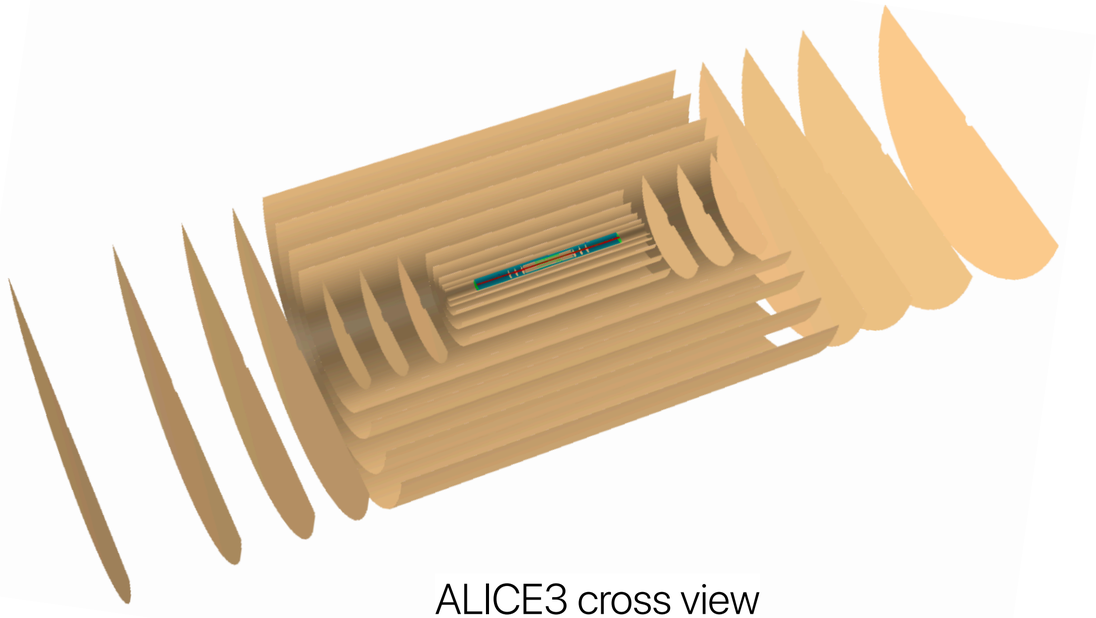
Hit map view of the ALICE3 layout



ALICE3 cross view

- ALICE3: Run5 and beyond Letter of Intent
- Tracker: low mass silicon pixel
- Pseudorapidity coverage: -4:4
- LOI submitted, detailed performance studies for the TDR upcoming
- ALICE Run3 reconstruction software: O^2
  - Limitations for full reconstruction at forward η
  - ACTS
- ACTS presented to the ALICE Upgrade collaboration, positive response
- Integration in O^2

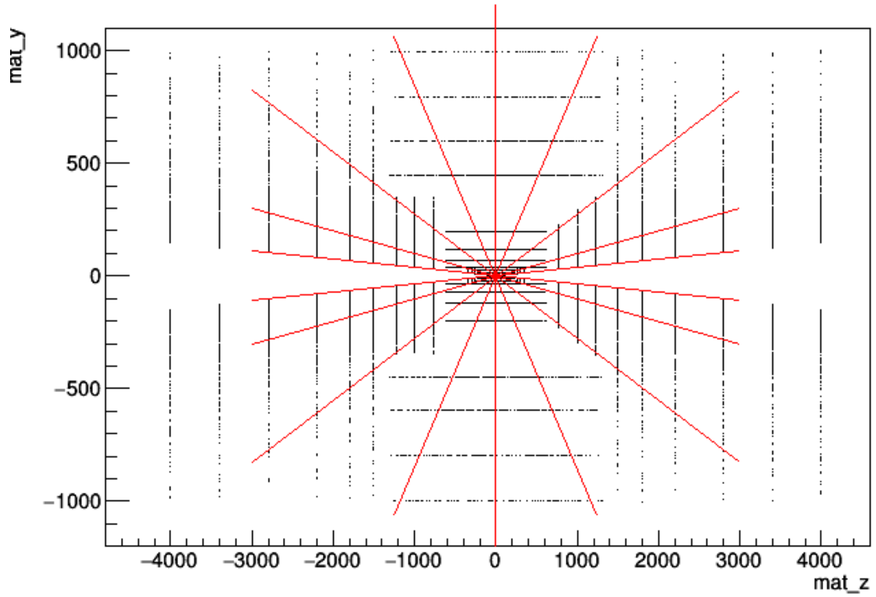
Using ACTS use for ALICE3



ALICE3 cross view

- Layout optimization studies
- Performance studies for the TDR
  - Full simulation and reconstruction
  - Various field configuration
- Input for ALICE fast simulation
  - Lookup tables for DelphesO2
- Integration in the ALICE reconstruction framework

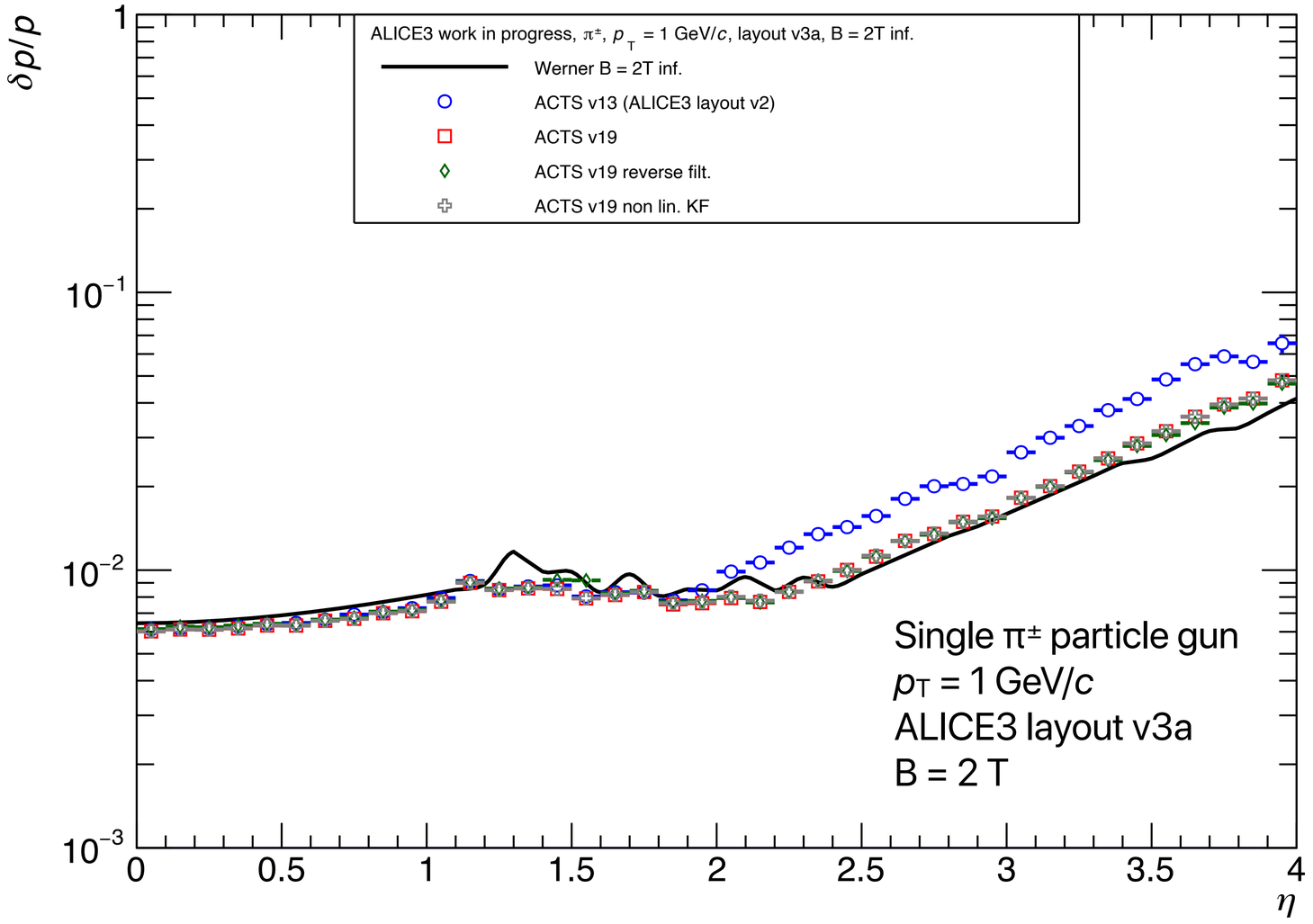
Configuration for the studies



Hit map view of the ALICE3 layout

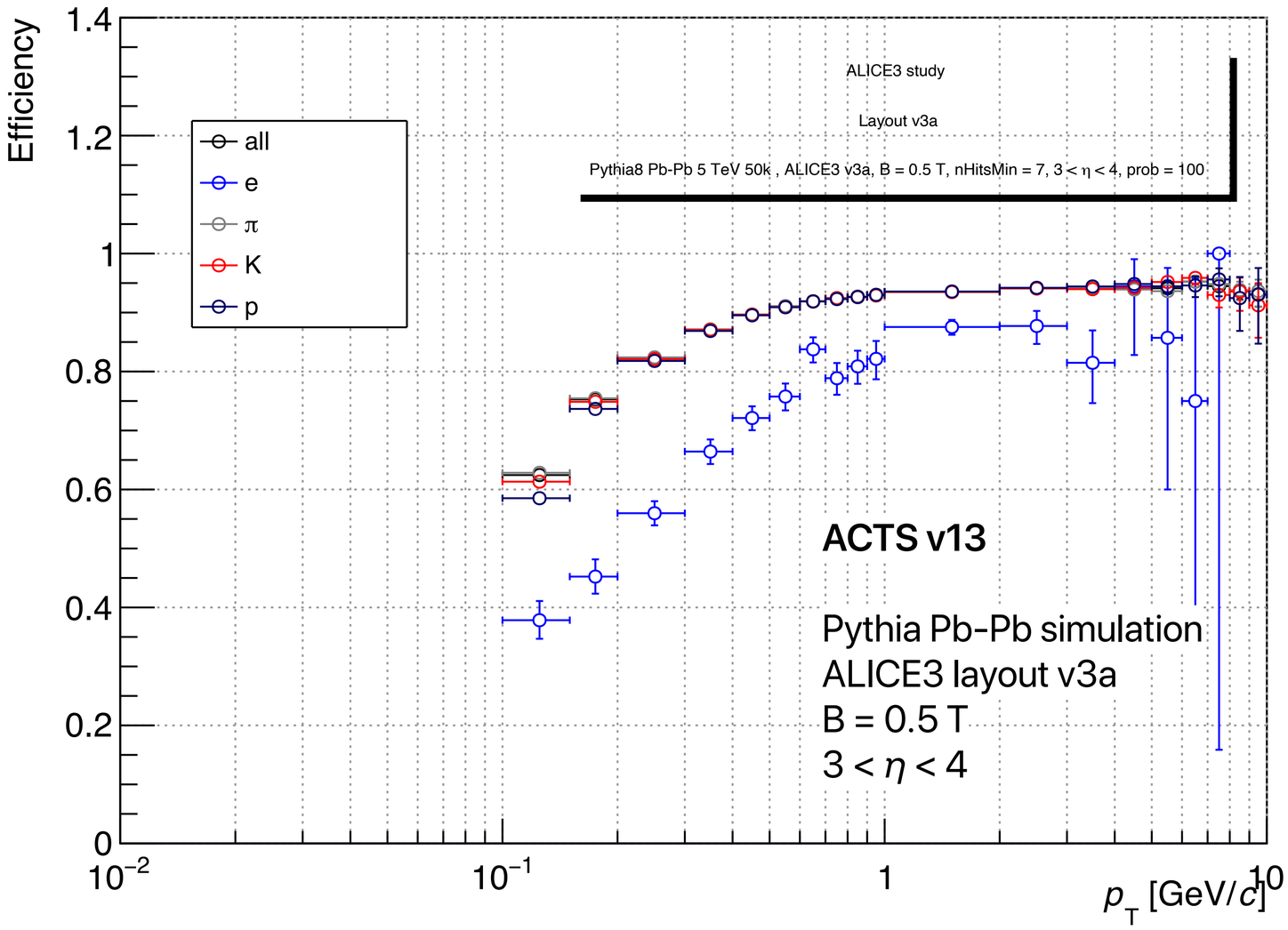
- Studies performed using ACTS v13 and ACTS v19
- TGeo based example executables
- Particle generation: Particle gun, Pythia
- Propagation: Fatras
- Track fitting: TruthTracking, CKF
- Vertex finder: not yet used

Momentum resolution using TruthTracking



- TruthTracking, single pions
- Smearing of MC truth momentum using Gluckstern formula based calculation + scaling
- Comparison with the Gluckstern based calculation
- Smearing of the other parameters: default
- Some pulls are problematic

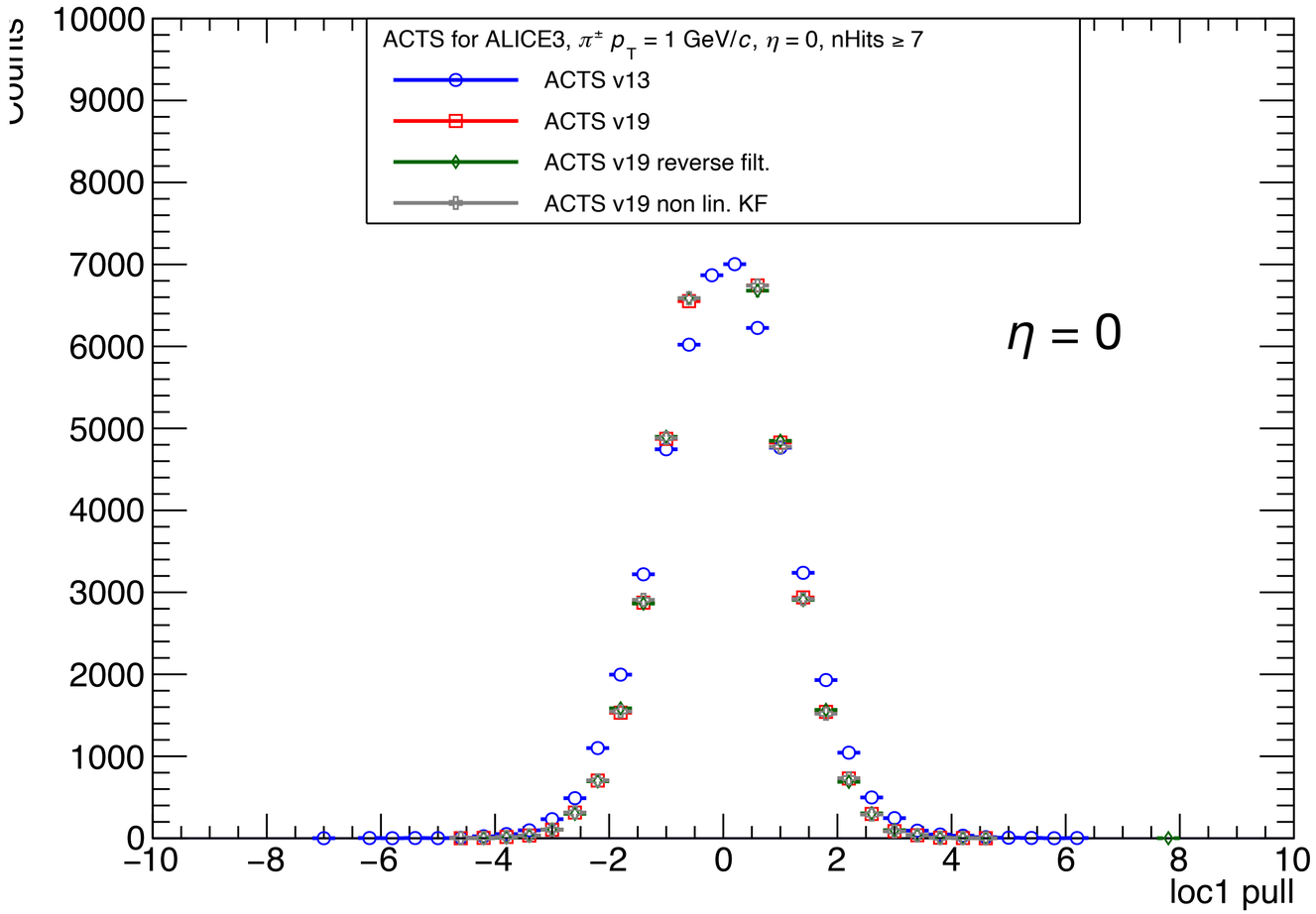
Tracking efficiency with CKF



- CKF efficiency
- Primary particle selection applied
- Min number of hits = measurements = 7, association 100%
- Min p_T = 100 MeV/c
- High number of duplicates: ambiguity resolver needed

Issues/things to be understood

Pulls in TruthTracking



- LOC1 pull
- Pulls for various filtering/smoothing options
- Problems at high pseudorapidities
- Pulls for the reverse filtering based smoothing: best performance
- Default smoothing, reverse filtering, non linear KF

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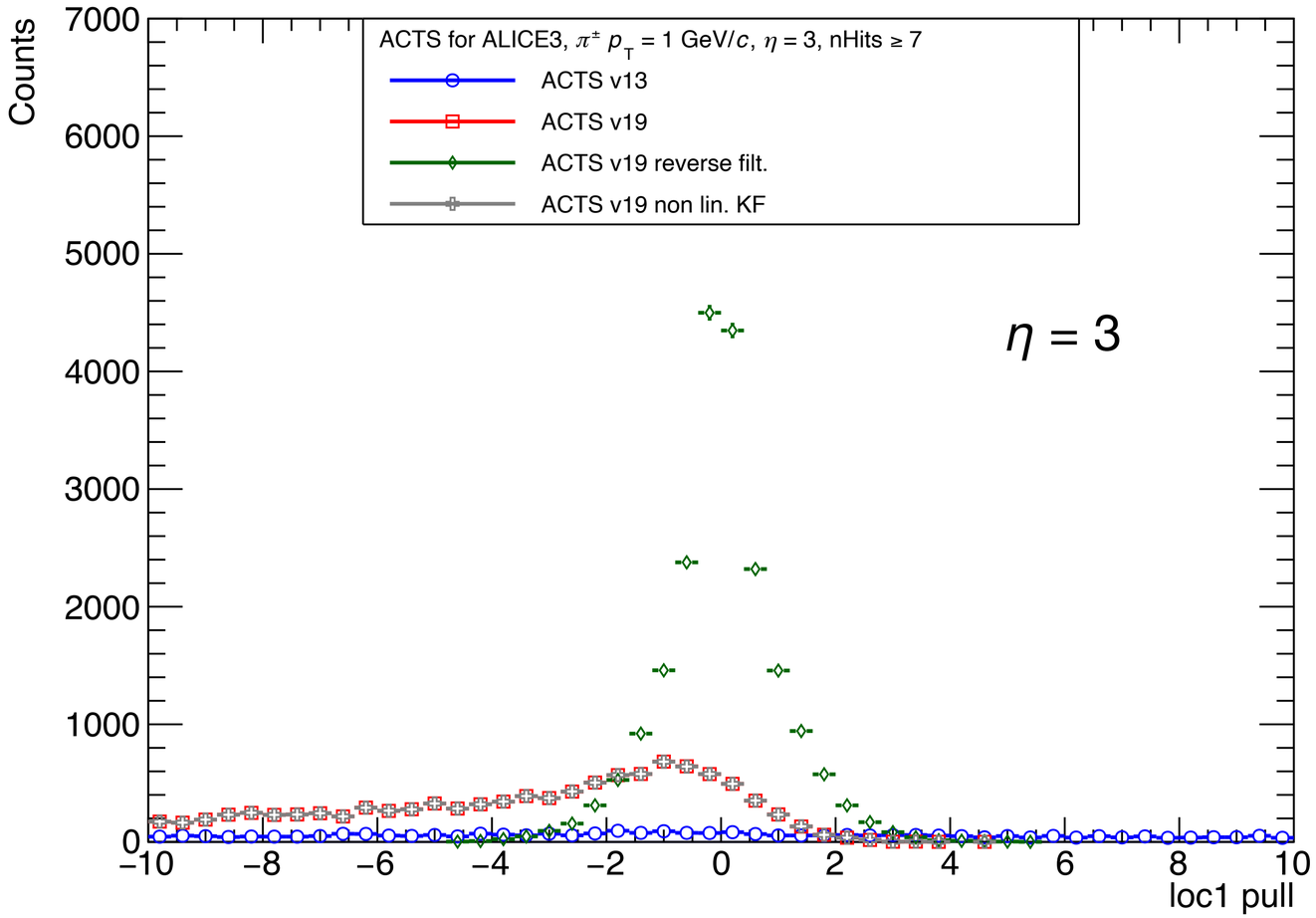

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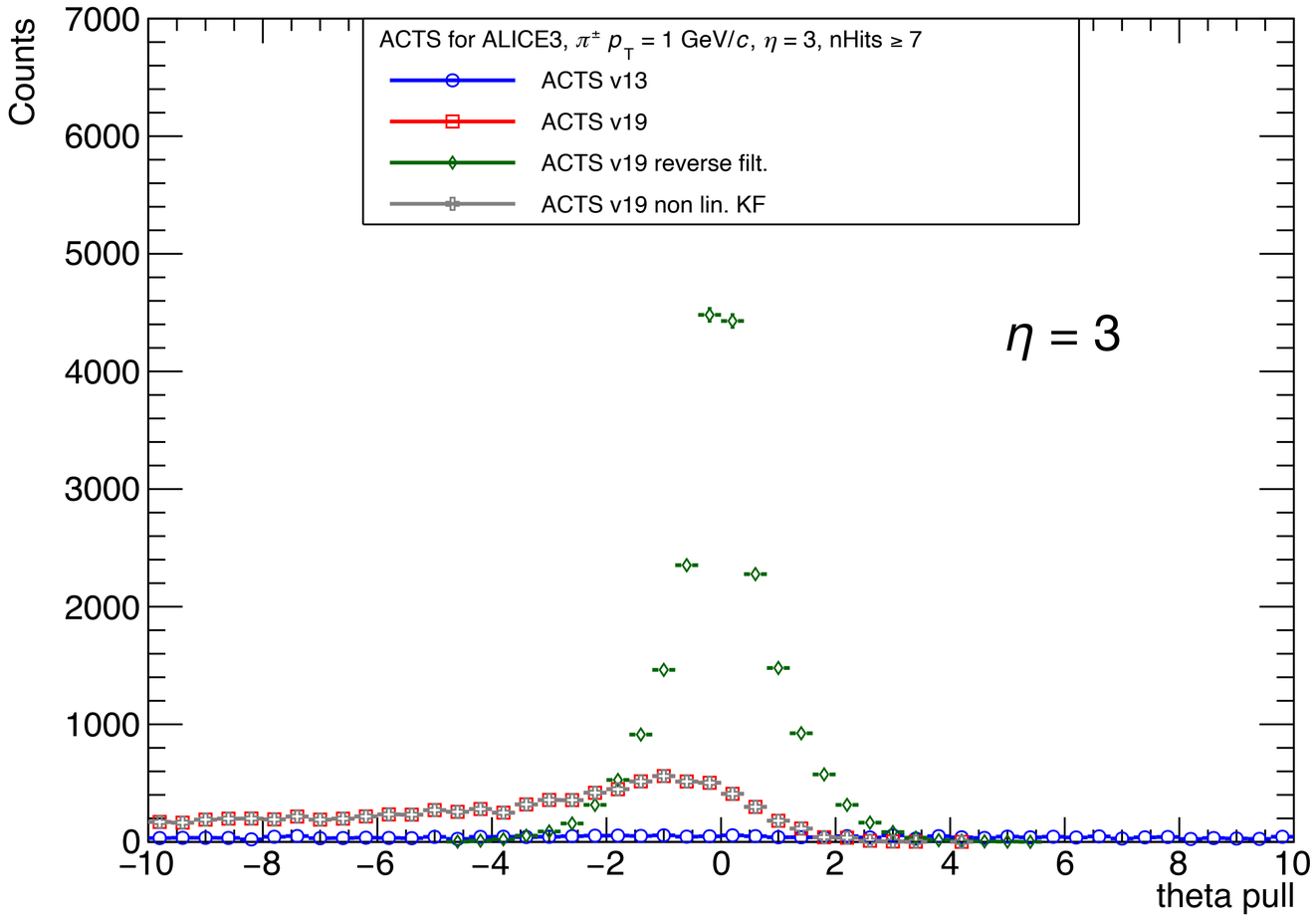

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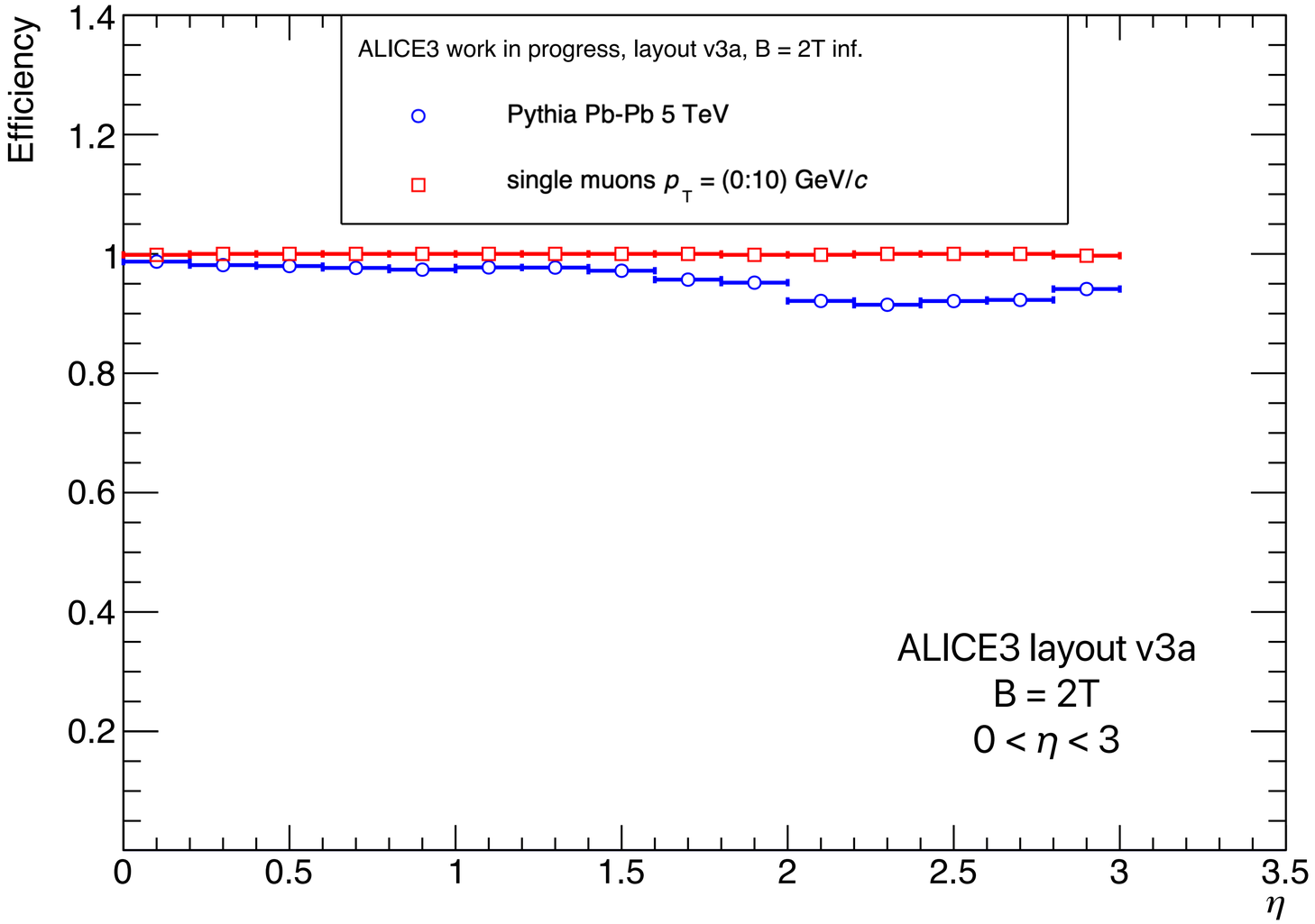
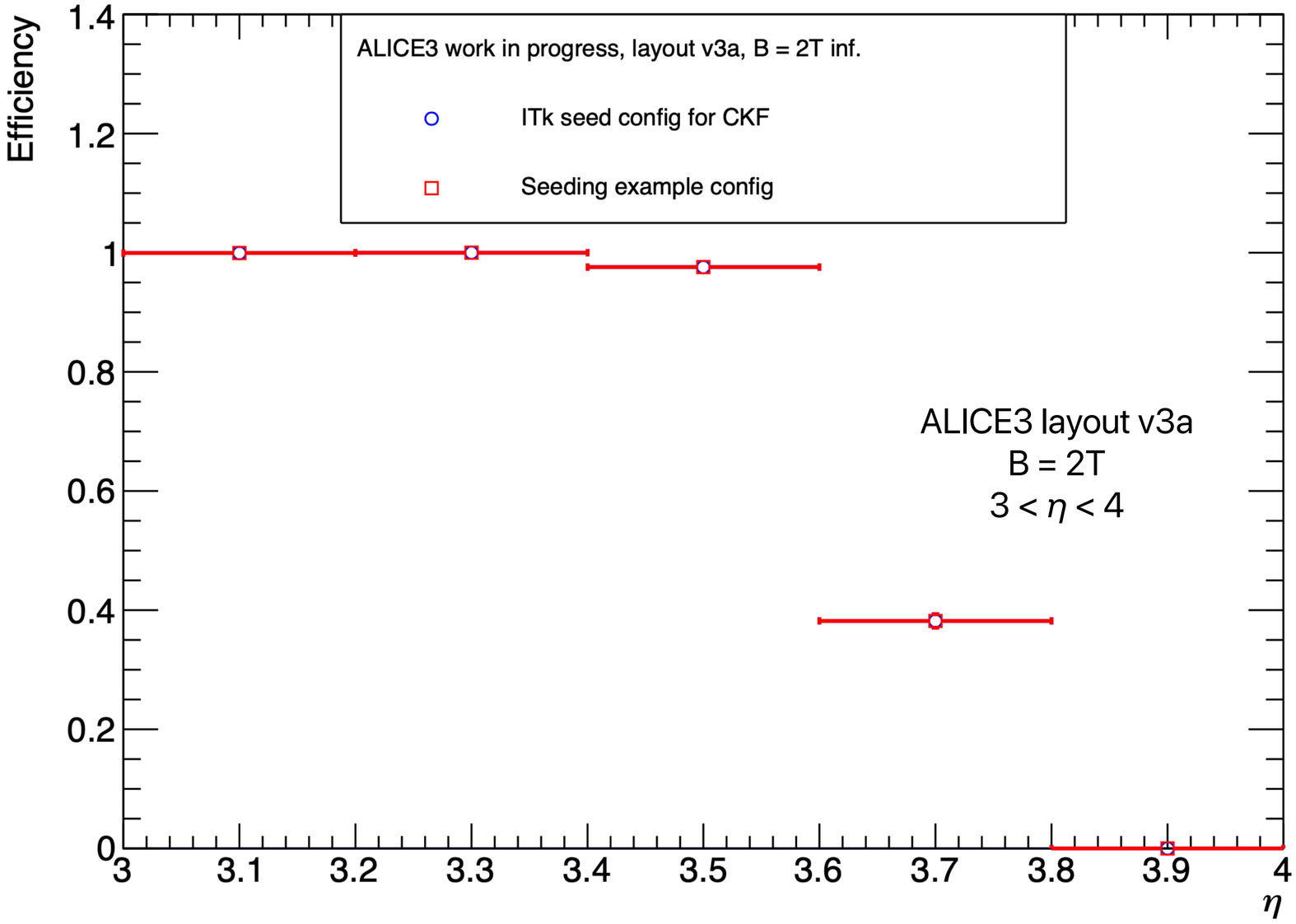
CKF issues



- Running CKF for Pb-Pb events very problematic
- Excessive memory consumption
  - Killed process

CKF issues



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  - Killed process
- Efficiency drop at $\eta > 3.5$

Requests

Requests for ALICE

- Seed parameter configuration documentation
- Optimisation of the seeding parameters using ML
- Layout optimization: easy way to disable layers, set single layer efficiency
- Performance plots including pull distributions for the ODD and ITk in full pseudorapidity ranges
- Post-processing ambiguity resolver (remove duplicate tracks) for Combinatorial Kalman Filter
- Support for full Geant4 simulation for TGeo/GDML based geometry
- Option to sample the number of particles per event within a given range in particle gun

Summary

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Thank you for your attention!