Second Look at ACTS in Marlin

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MCC Meeting

Why ACTS for MCC?

ACTS GitHub

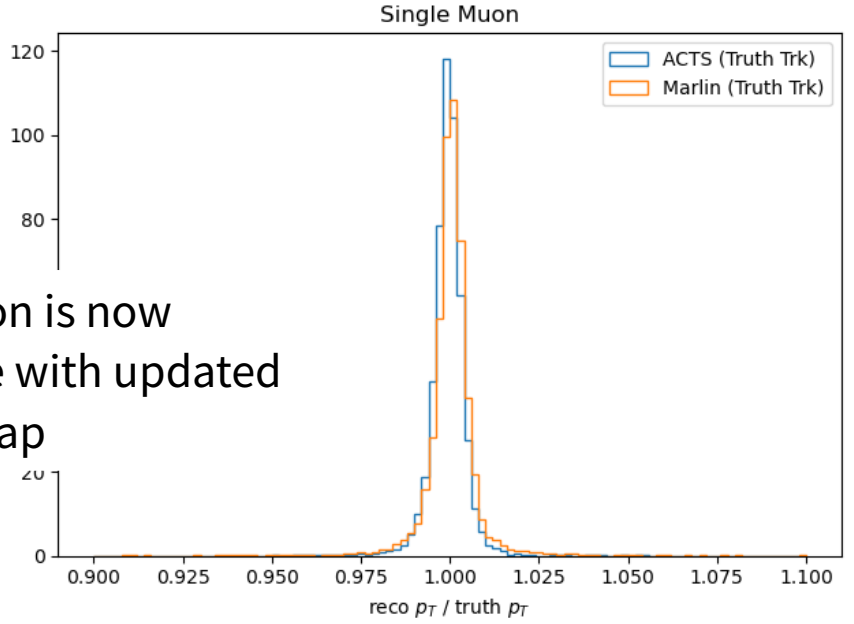
ACTS is a generic library for track fitting at collider experiments.

- **Dedicated team working on advancing tracking algorithms**
  - Tracking is hard!
- **Allows us explore alternate algorithms**
  - Triplet-based seeding optimized for high multiplicity environments
- **Code optimization come for free**
  - Also explores modern computing architectures (ie: CUDA)

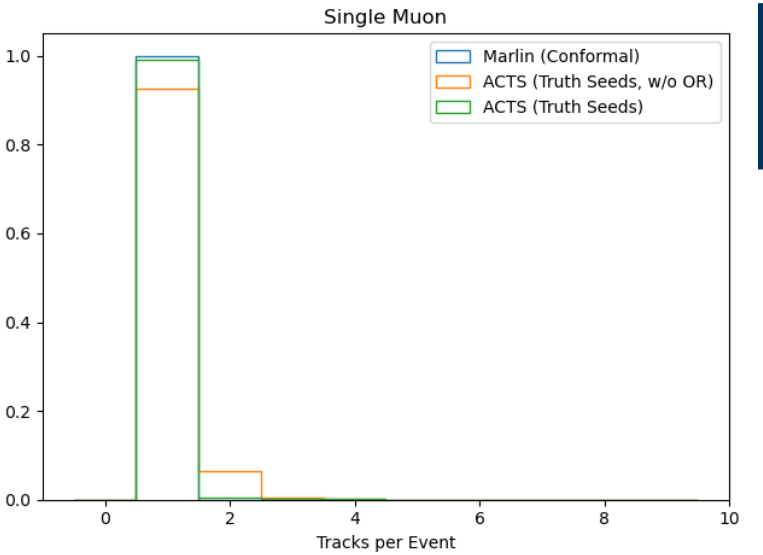
Updates Since Last Talk

- **Updated ACTS from 4.0 to 6.0**
  - Needed for implementation of seeding algorithm
  - Required updating boost to 1.73 (custom container)
  - Required remaking material map
- **Geometry is now unmodified MuColl_v1**
- **Implemented reconstruction using CKF**
- **First look at BIB**

p_T resolution is now compatible with updated material map



Truth CKF Tracking



Seeding (the truth part)

- Use MC particle kinematics

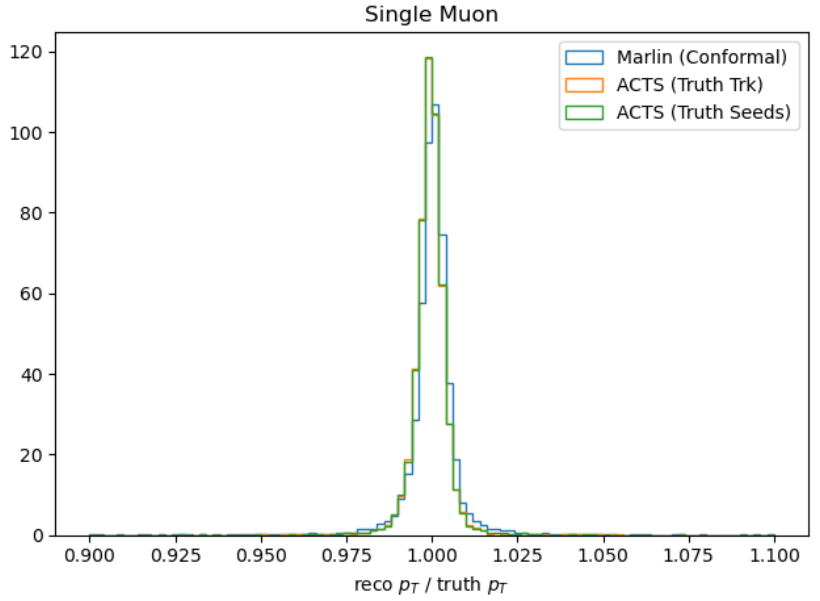
Track Fit

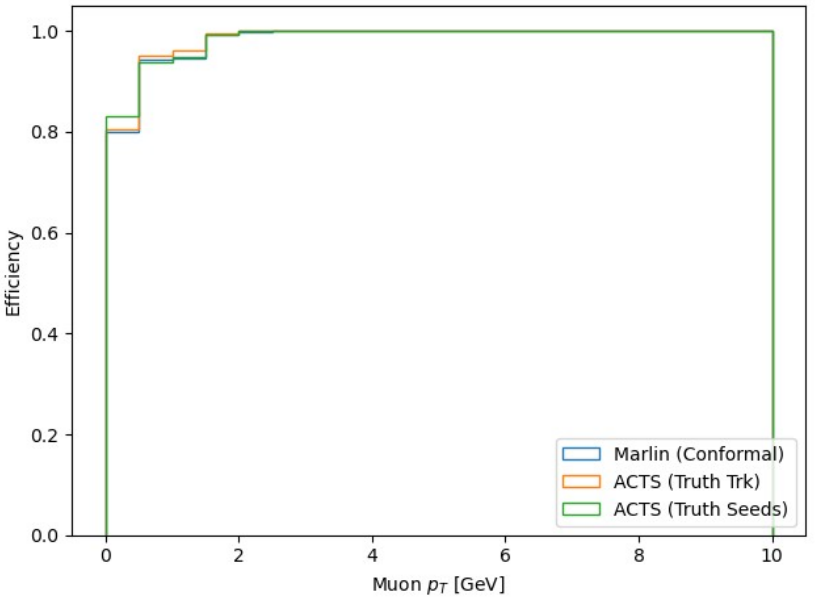
- Combinatorial Kalman Filter in ACTS

Fit Library	Execution Time
ACTS	0.5 ms / evt
Conformal	120 ms / evt

Overlap Removal

- Group by tracks sharing 50% of the hits, pick one with most (or highest χ^2)

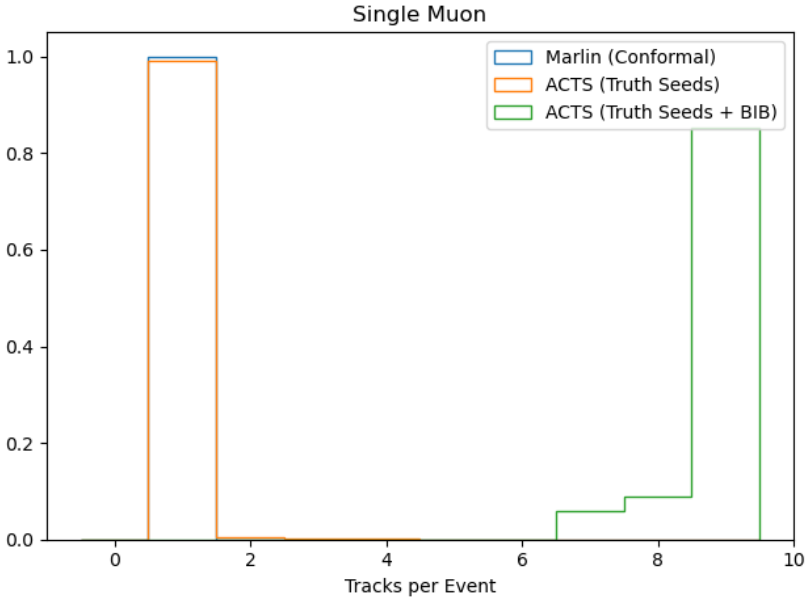


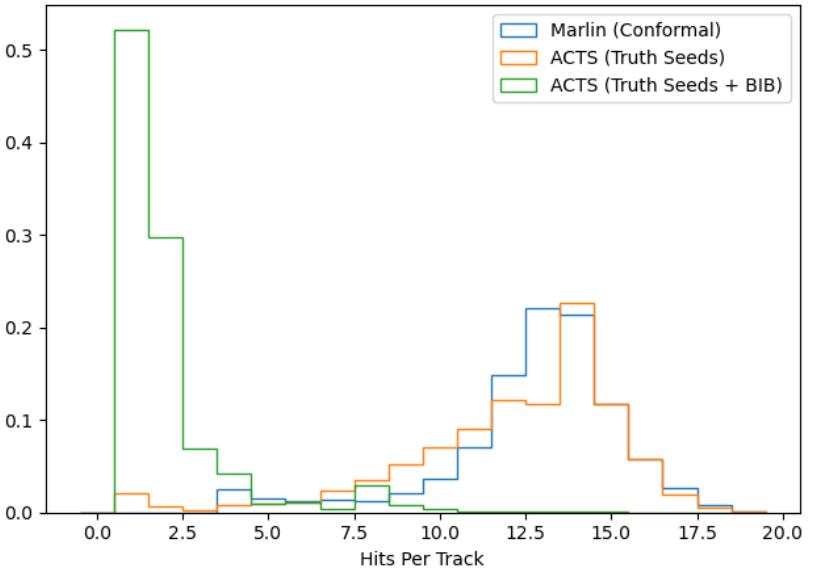


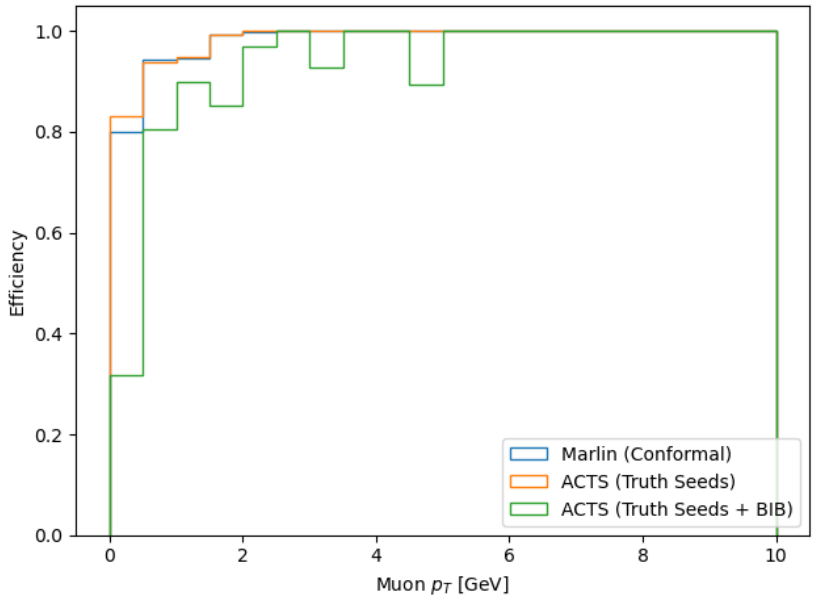
Truth CKF + Full BIB

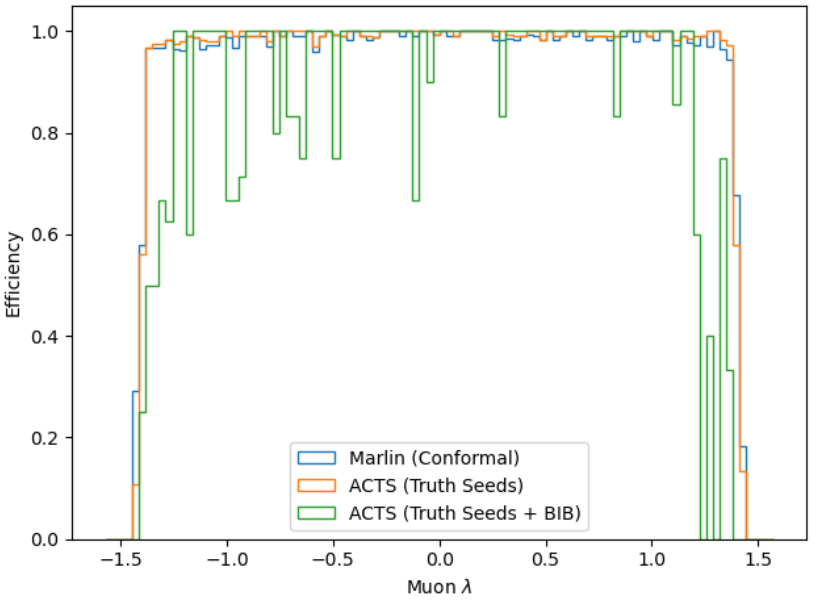
* Conformal is run without BIB

Fit Library	Execution Time
ACTS	5 s / evt
Conformal*	*lol*





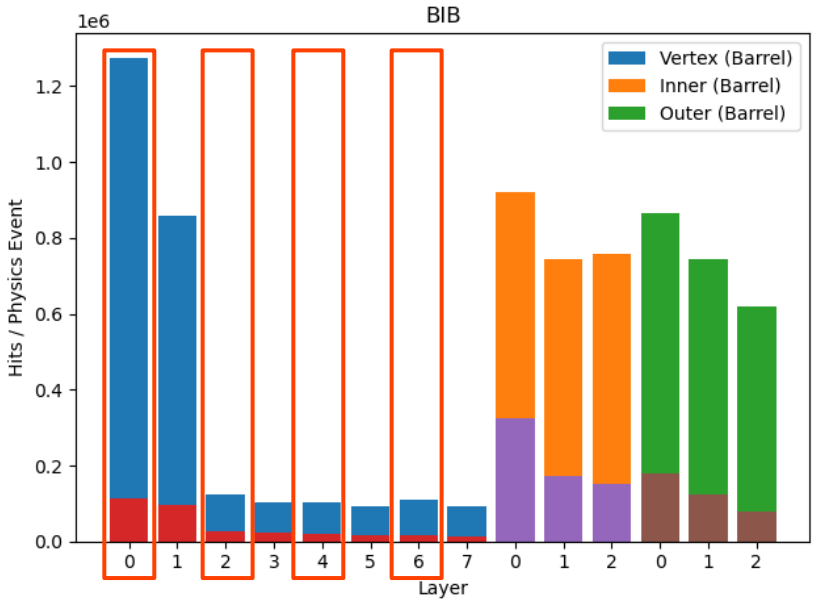




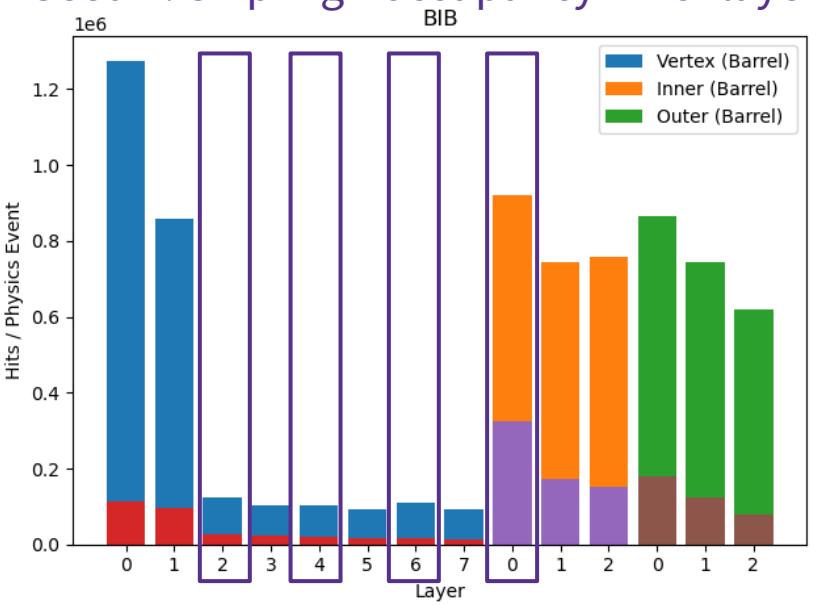
ACTS + BIB is currently low stats

Seeding Layers

Seed 0: Vertex detector

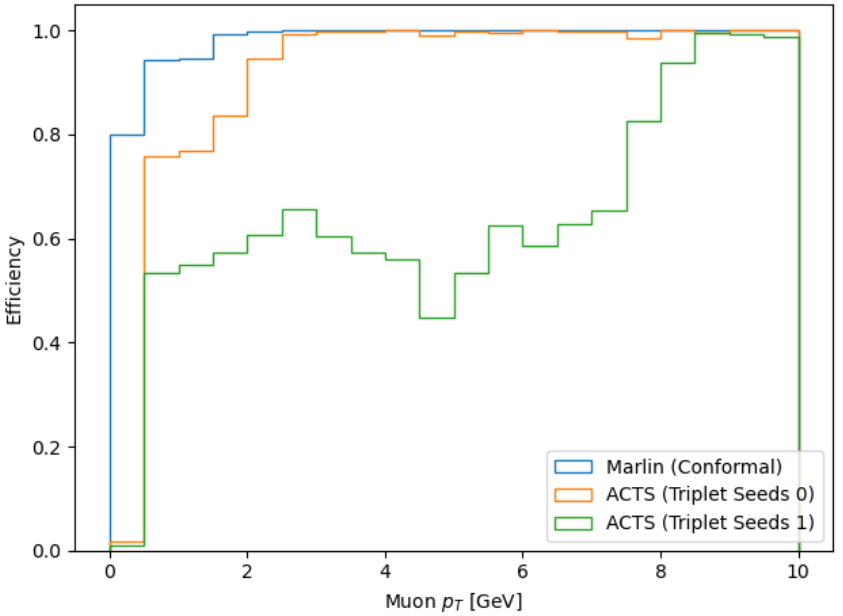


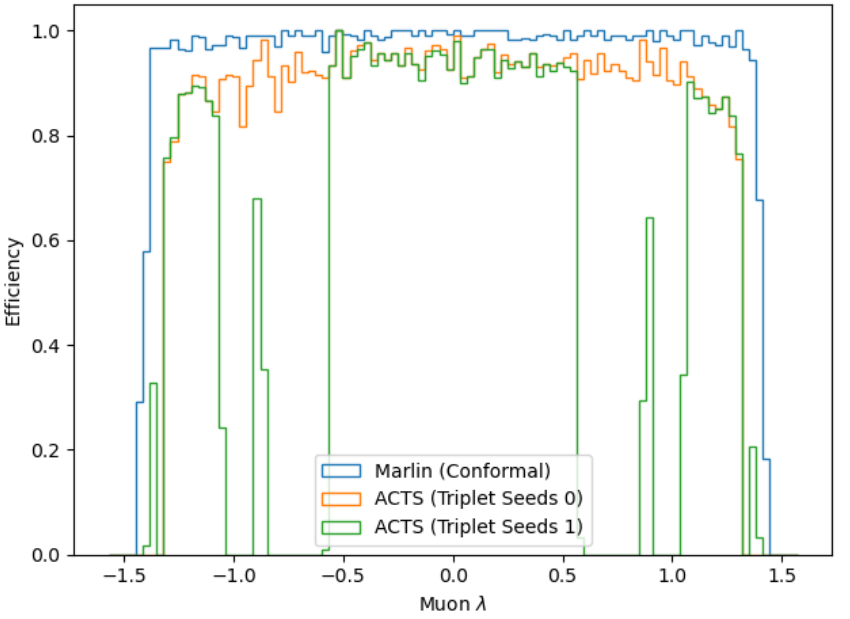
Seed 1: Skip high occupancy inner layer

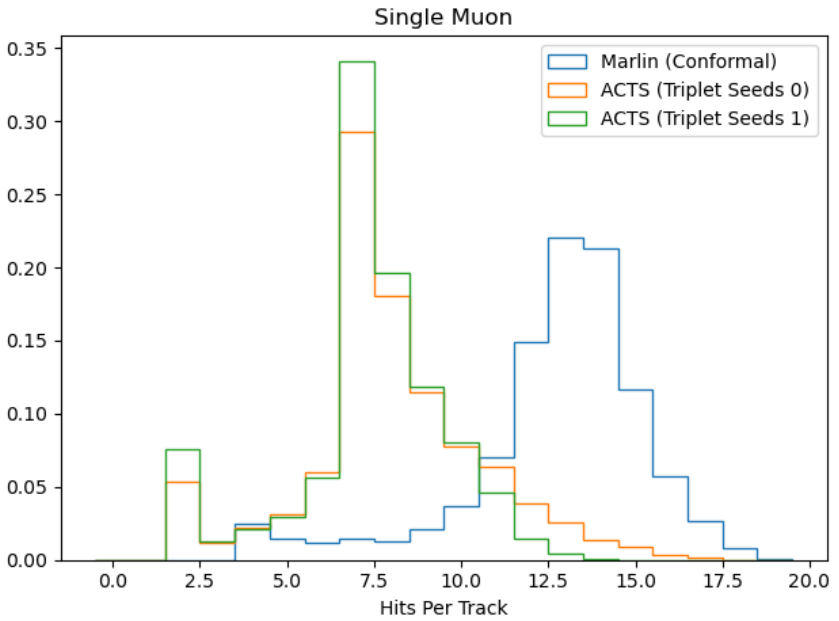


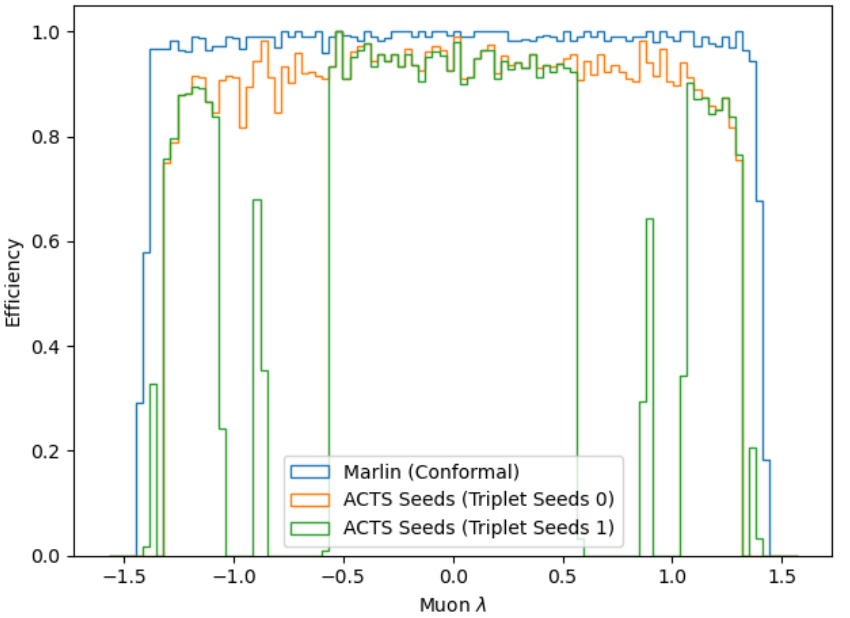
- **Using only inner part of the Vertex doubles**
  - Prevents redundant “too close together” combinations
- **Similar idea for Vertex detector**
- **Future: Reduce hits with doublets in a double layer?**

Tracking Output









Limit is from finding seeds. Many settings...

Next Steps

- **Continue optimizing the seed finding settings**
- **Study hit residuals to understand quality of fit**
- **Run seeded CKF with full BIB**
  - ~600k seeds per events, currently runs out of memory