Tracking software status going into January workfest

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sPHENIX Workfest
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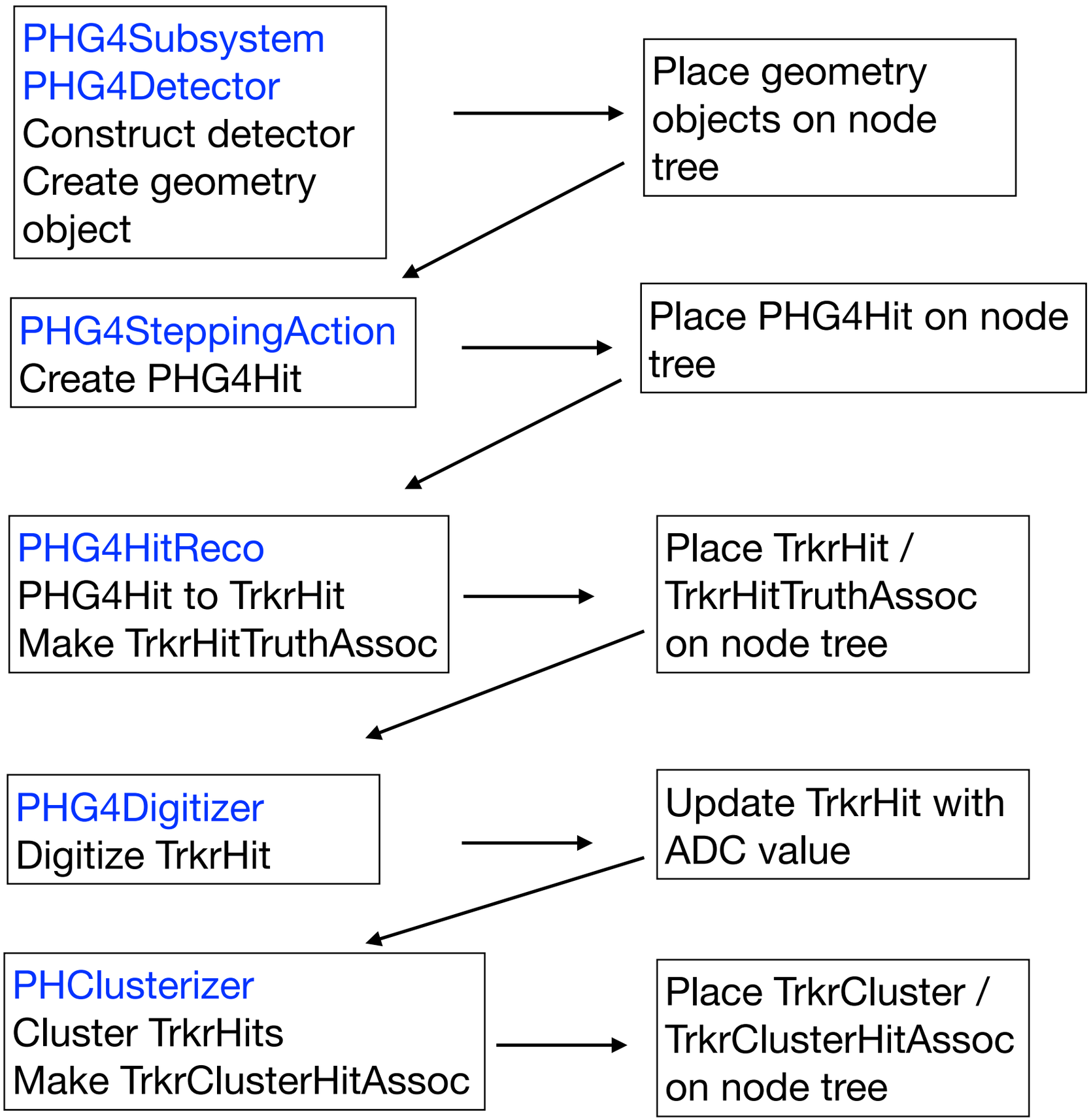
Tracking Software Work in 2019

Focus in 2019 was on reorganizing and modularizing the tracking simulations and reconstruction code, and implementing new storage containers.

- All sims code moved to subsystem specific areas in g4simulations.
- All reco code moved to subsystem specific areas in offline/packages.
- Offline code modularized, and now inherits from base classes
  - To facilitate adding alternative methods.
- New tracking storage objects implemented
  - Reduced memory use by a factor of two.
- Event vertexing code using MVTX hits added
  - Previously used smeared truth vertex.
- Ability to track to multiple vertices in a single collision was added
  - Can do for truth vertexing or MVTX vertexing.
- Implemented multiple vertices in Rave final vertexing - but needs tuning
- Ongoing study of outer detector parameters for SC distortion corrections

Simulations and clustering flow (each detector)



Tracking Flow

PHInitZVertexing
Initial vertex finding using silicon clusters

Add vertices to SvtxVertexMap

OR

PHTruthVertexing
Initial vertex from truth information

PHHoughSeeding
- Loop over vertices
- Find all track seeds
- Add vertex ID to each track seed.

Add seeds to SvtxTrackMap

PHGenFitTrkProp
Associate all clusters with each track seed using vertex location.

Update SvtxTrackMap

PHGenFitTrkFitter
Final track fit using Genfit

Update SvtxTrackMap

PHGenFitTrkFitter
RAVE vertex fitting with "avr" method

Replace SvtxVertexMap

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All of these reco modules will be replaced eventually

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Final track fit using Genfit

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RAVE vertex fitting with “avr” method

Replace SvtxVertexMap

Known Issues

Tracking efficiency is lower by ~ 5% in low multiplicity events, worse in high occupancy events.

Existing Hough track seeding is very slow.

Genfit final track fitting fails mysteriously for a few percent of tracks.

TPC clustering is primitive, needs upgrade to better handle cluster overlaps.

Multi-vertexing needs tuning to limit spurious vertices - both initial and final.
Also will need to consider cuts for analysis - not all vertices will be real.

TPC space charge distortions are not properly implemented in tracking.

Moving forward

- Implement TPC space charge distortions.
  - Ongoing: Ross Corlis heading up this effort.
- Do we need a new outer detector?
  - Ongoing: Hugo Pereira is making a study of what performance parameters would be needed.

Replace Hough track seeding.

  - Christof working on new version. Wait for ACTS package instead?

- Replace tracking with ACTS.
  - Seems to be the (only) way for us to go
  - Includes replacement for final vertexing as part of package.
- Replace TPC clusterizer with more powerful one. Not the main priority yet.
- Track down loss of tracking efficiency after the container upgrade and modularization (which included new hit and storage objects, a new TPC clusterizer, and which was coincident with a new version of Genfit).
  - Before the January workfest, if possible
- Tune our initial vertexing code. Maybe it gets replaced, but it works!

Tracking Software - meeting priorities

Learn from experts while we have them here!

Tracking package **interface for ACTS**

- ACTS is really the only package we see as suitable at present
- Will need an interface from/to current vertexing, clustering

Track seeding

- Recent implementation by Christof
- Needs tuning

TPC distortion simulations - Ross

- Comparison of sPHENIX model with ALICE model to validate

Outer detector studies

- Try to define performance parameters by the end of the workfest.

Tracking QA - Jin would be able to help a volunteer set it up

Calibration and infrastructure - outline a plan in workfest

- Start to think through how to do it.
- Involves geometry and data storage containers.
- When we rotate or translate a detector, all points have to rotate or translate with it.
- Discuss with David Rohr how this is done in ALICE