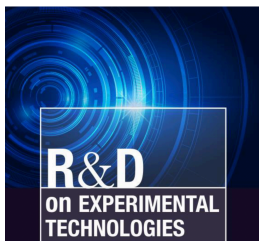# Key4hep status from CERN

AIDA Innova Annual Meeting

**Swathi Sasikumar Kollassery**

Key4hep Validation: Simulation and Reconstruction

- Validation of the algorithms, either newly developed or ported from other places is very important

- Regular check of simulation and reconstruction chain performed with the latest key4hep nightlies by J M Carceller

- Plots of the relevant quantities are made and compared to the reference samples

- Plots are deployed to WebEOS

- https://key4hep-validation.web.cern.ch/

- Work in progress, no documentation yet
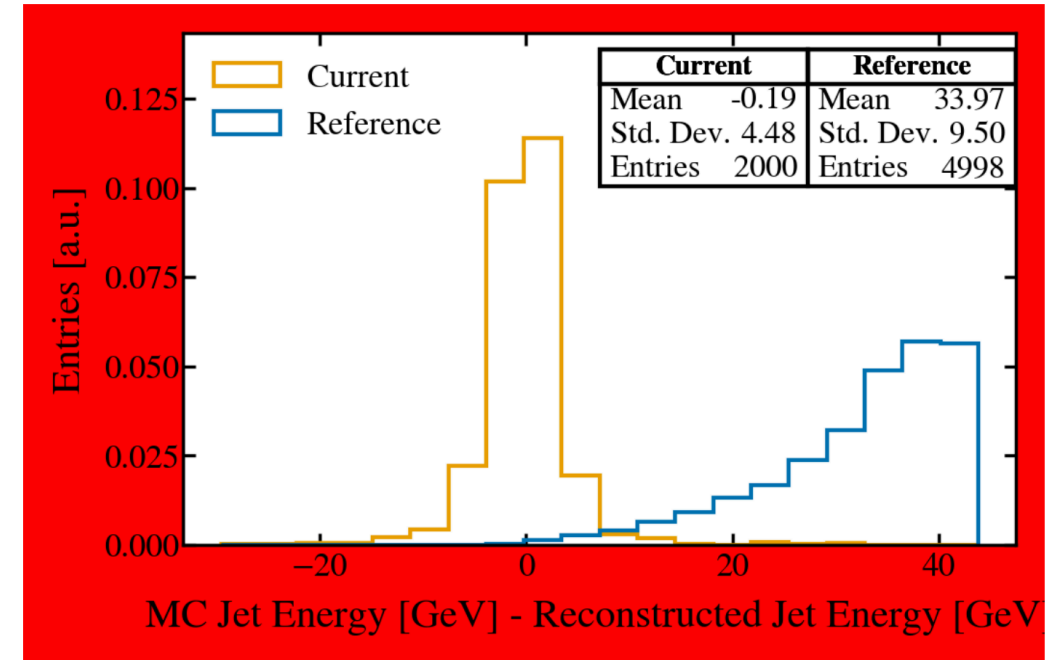
ACTS in Key4hep

- L. Reichenbach is working on integrating ACTS (A common tracking software) into the Key4hep framework

- Goal: Create all 'true' tracks

- Take all the reconstructed hits of a `MCParticle` and fit them with the ACTS Kalman filter

- Checks on all the relevant parts made

- Status: first track fits achieved!

- Missing: conversion from ACTS to EDM4hep tracks

- ACTS integration into Key4hep is progressing: https://github.com/Zehvogel/k4ActsTracking
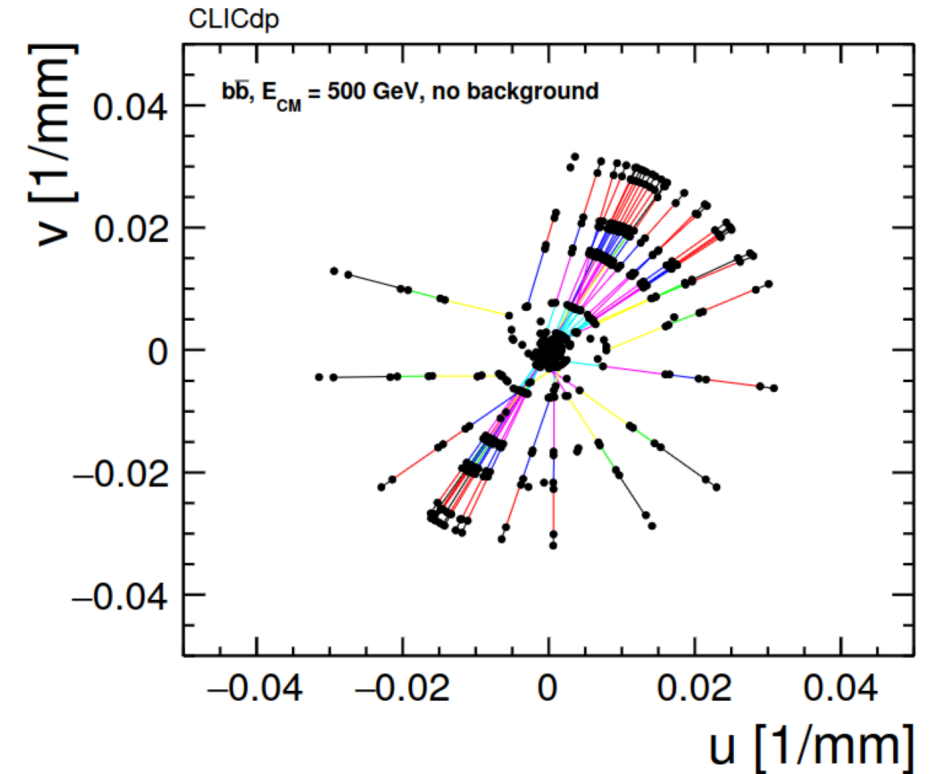
Pandora PFA in Key4hep framework

- S. Sasikumar working on integrating Pandora PFA (particle flow algorithm) into the Key4hep framework

- Pandora PFAs application has primarily been confined to high-granularity CALICE calorimeters

- To use it across the detector models it was tested on the Nobel Liquid Argon Calorimeter for FCC

- The study showed that Pandora particle flow objects (PandoraPFO's) from LAr calorimeter could be observed
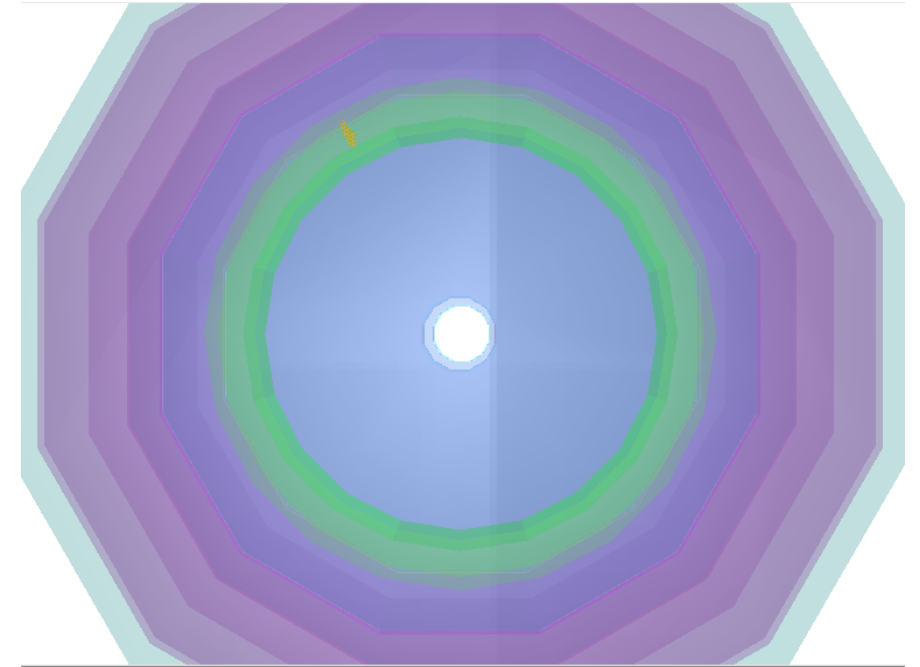
Energy of Pandora PFO

- The sum of the energies of the digitised sim calorimeter hits peaks nicely at 10 GeV as expected

- The energy of the pandora PFO obtained seen in the second figure mostly peaked at 9 GeV and has a tail

- The correction factor for photon energies needs to be adapted to the LAr calorimeter from CLD

Energy sum of digitised sim calorimeter hits

Pandora PFO Energy
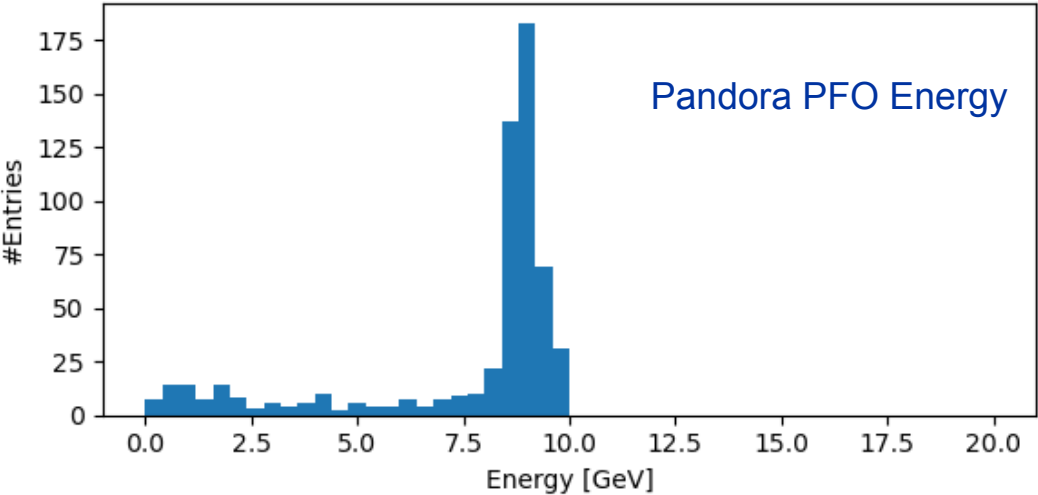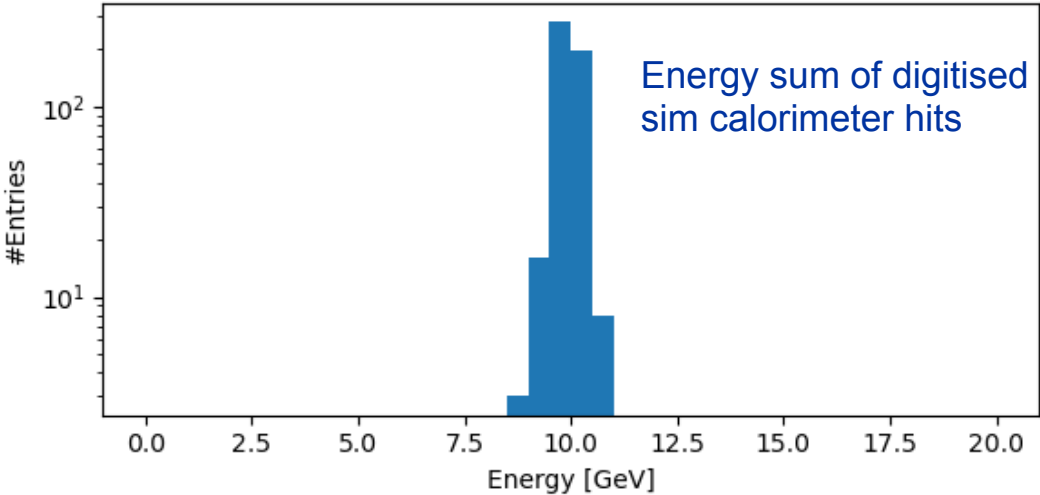
Probability to find two photon clusters

- To apply the correction factor - study how well the photon clusters can be separated

- The cell size of ALLEGRO- LAr is 2 x 2 cm²

- The Molière radius for LAr calorimeter is 4cm which is much bigger than the CALICE calorimeters

- The photons need to be at least 5-6 cms apart for a high probability to be separately clustered

- Work in progress
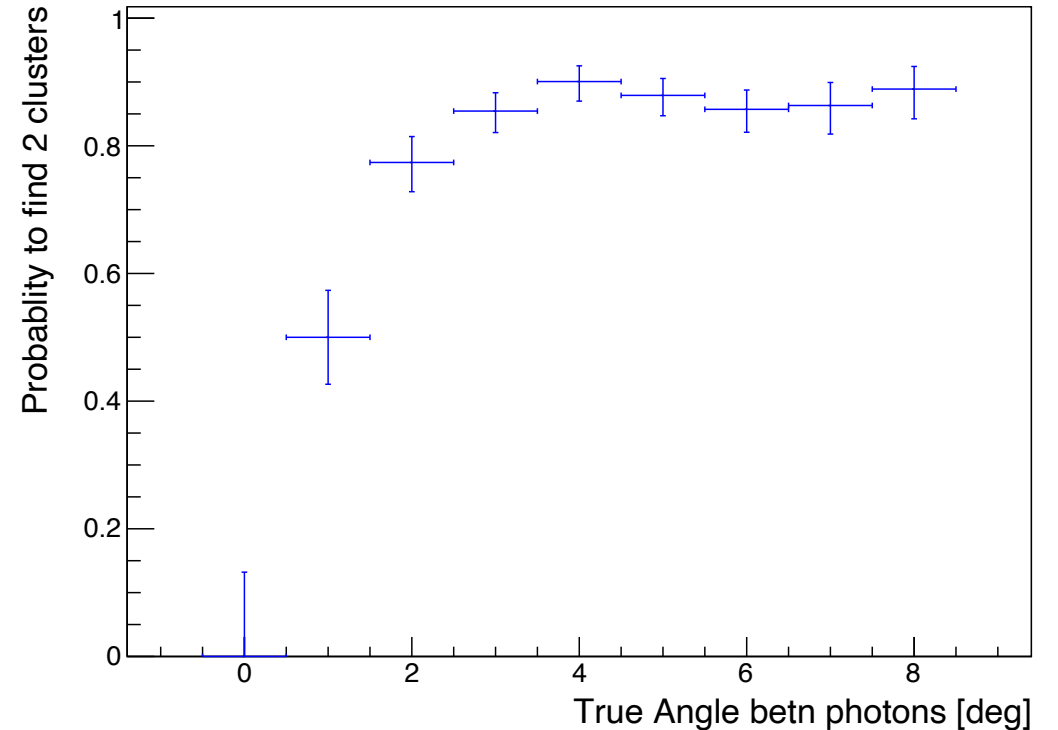
The Key4hep Stack

- Software provided in *stacks* deployed on cvmfs

- More than 500 packages built with Spack

- Releases in `/cvmfs/sw.hsf.org` with tagged versions of the packages

- Nightly builds in `/cvmfs/sw-nightlies.hsf.org` with the latest version of the Key4hep packages and other packages

- Easy setup with cvmfs:

```
source /cvmfs/sw.hsf.org/key4hep/releases/setup.sh           # Latest release
source /cvmfs/sw-nightlies.hsf.org/key4hep/releases/setup.sh  # Latest nightly
```

- Questions, problems, complaints and anything else related to the packages happens mostly https://github.com/key4hep/key4hep-spack

The Key4hep stack and CI

- Both the latest release (and future) and the nightly builds now support CentOS 7, AlmaLinux 9 and Ubuntu 22.04 (previously it was only CentOS 7)

- Warning: CentOS 7 is soon approaching its end by June after which building for it will stop at some point

- Nightly builds are now compiled using C++20 standard, meaning that one could start using C++20 features

- Several improvements implemented due to user requests: keep giving us your feedback

Summary

- Lots of progress in Key4hep in different areas

- Integration of novel and existing methods to Key4hep framework

- Progress on integration of ACTS into Key4hep framework

- Pandora PFOs could be observed for LAr Calorimeter study

- More to come, expect more integrations and native algorithms in Key4hep framework, bug fixes and quality of life improvements