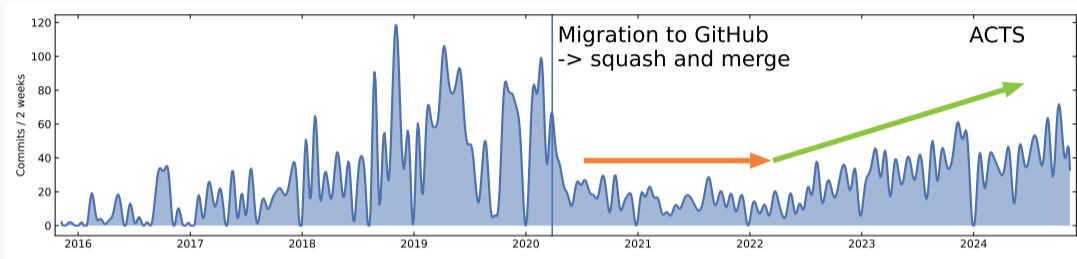# Introduction: What's new

Paul Gessinger
CERN
2024-11-18

State of the project

ACTS

- **27** releases, **994** PRs by **43** contributors
- **63202** jobs (**4%** failed) taking **453520** minutes in total

Code quality

- Started tracking code quality
- **It's improving!**
- Move to C++20, subsequent modernization

Lower is better!

Enabled in June!
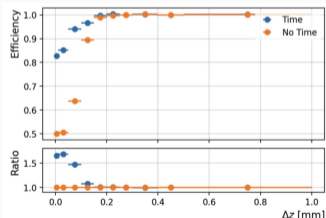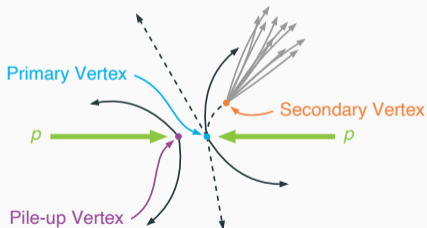
Major developments

Geometry evolution

- **Original geometry model**: layers are first-class concept
  - ▶ Restricts flexibility for other layouts
  - ▶ Adds additional complexity to navigation
- **2nd Generation** experimental geometry model
  - ▶ Drops layers in favor of *layer-volumes*
  - ▶ Validates approach of registering local navigation inside volumes
- **3rd Generation**: combination of both
  - ▶ Layer-volumes with local navigation policies
  - ▶ Rewrote *geometry construction* from the ground up
  - ▶ Extensible, composable and flexible

Geometry	Andreas Salzburger
Chateau de Bossey	09:00 - 09:30

See Andi's talk tomorrow!

Vertexing (incl. time)

- **Major refactoring** in to reduce templating (compile resources)
  - ▶ Unchanged outputs
- Effort launched to *really* **understand how vertexing** behaves with time
  - ▶ Vertex finding now (partially) supports time, support is expanding
- Still missing in our lineup: **secondary vertexing**
- Vertexing is **very low person-power** at the moment: **great opportunity to step up!**
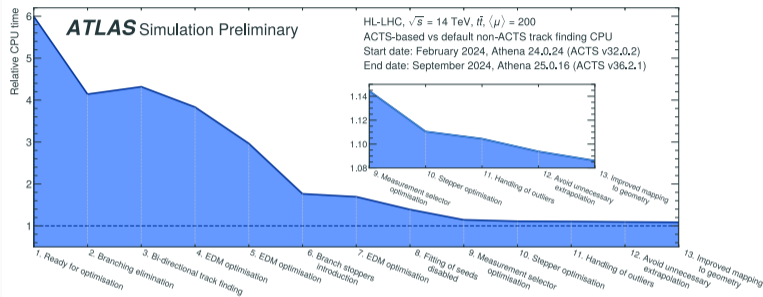

See comprehensive overview by Andreas Stefl tomorrow!

Track finding optimization

[ATL-PHYS-PUB-2024-017], [Carlo's CHEP talk]

- **Year-long** effort to **improve track finding performance** in ATLAS
- CPU performance now **competitive** with *Legacy* tracking
- **Other experiments** should see the benefits as well!
- Many ACTS-side improvements: manual smoothing, improved branch stopping, track selection + more

GNN
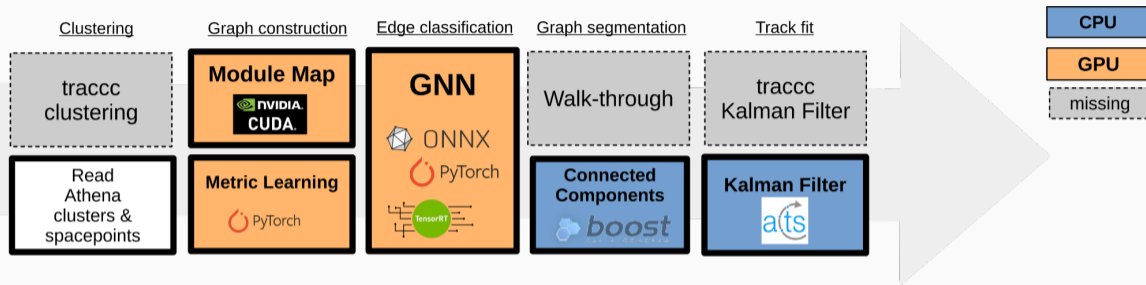
- Steady **progress** on GNN tracking
- Some internal effort in ATLAS that we hope to capture publicly in ACTS
- Combination with ACTS CPU Kalman Fitter, traccc GPU KF foreseen

Other items

- Lots of work on the **Global χ^2 track fitter**
- **Completion** of the **Gen2 experimental geometry** exercise
- **Refactored + improved** Gen1 navigation and propagation
- **Sympy stepper** for numerical integration
- Improved EDM4hep support for inputs and output
- Refactoring with **C++20 concepts**
- **Hough Transform** updated and improved
- Whitepaper on jacobian transport correction and line surface jacobian
- Increased **CI resources at CERN**, moved all hosted infra to CERN resources
- ML seed filtering
- **GeoModel** plugin
- Updated Examples measurement EDM, IO + more

Experiments

Telescopes

Lohengrin NA60+
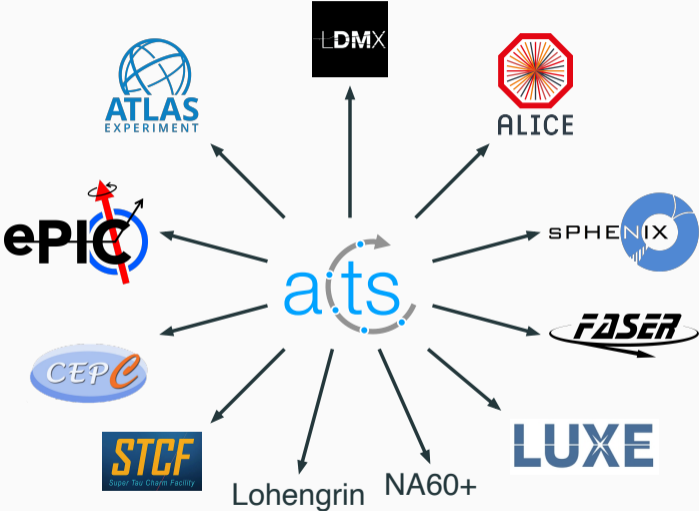
- ACTS used in various **telescope-style** experiments!
- Regular dedicated discussion meetings
- **Geometry handling** in Gen1/2 is still **suboptimal**
- Hope to **improve** this in **Gen3 geometry**

Paper on ACTS for Telescopes in preparation, discussion later **today**:
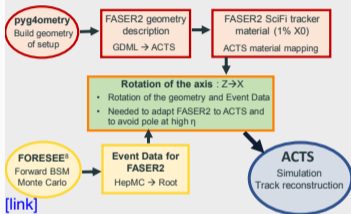
Telescope paper and discussion	Pierfrancesco Butti et al.
Chateau de Bossey	17:05 - 17:25

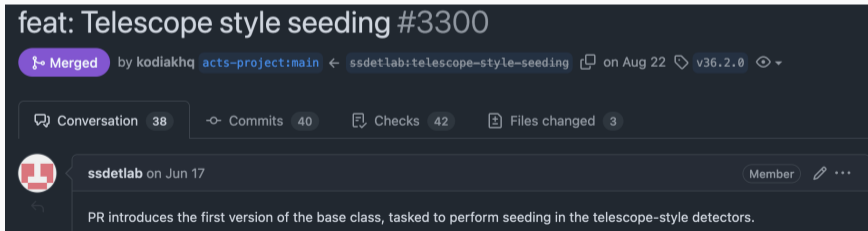Implementation of ACTS for FASER2:

[link]

Early performance of the tracking detector for the FASER experiment

Tomohiro Inada [iD], on behalf of the FASER Collaboration

CERN, CH-1211, Geneva 23, Switzerland   [link]

Contribution

- LUXE really jumped into contributions
- **>20 PRs** in the last 12 months!
  - ▶ Fixes to cuboid tracking geometry construction
  - ▶ Material fixes
  - ▶ Lots of help completing the Gen2 experimental project
  - ▶ Geant4/GDML updates + validation
  - ▶ **Telescope-style** seeding and parameter estimation algorithm

feat: Telescope style seeding #3300

Merged by kodiakhq acts-project:main ← ssdetlab:telescope-style-seeding on Aug 22 v36.2.0

Conversation 38   Commits 40   Checks 42   Files changed 3

ssdetlab on Jun 17   Member

PR introduces the first version of the base class, tasked to perform seeding in the telescope-style detectors.

ODD progress

- Renewed momentum towards **ODD paper**
- First version of **ECal** and **HCal** added, refinement ongoing
- Being used for recent vertexing studies
- Plan to **converge performance** this year
- Finally produce a **decently sized dataset** to **supersede** TrackML
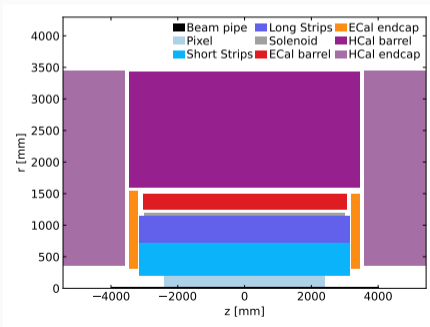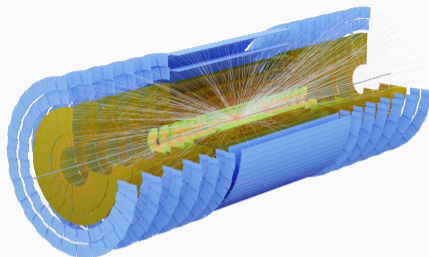
GPU R&D

GPU R&D
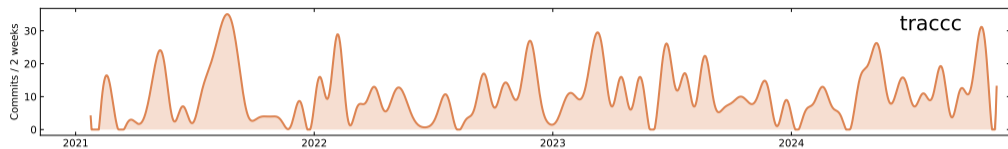
traccc: **232** PRs, **12** contributors
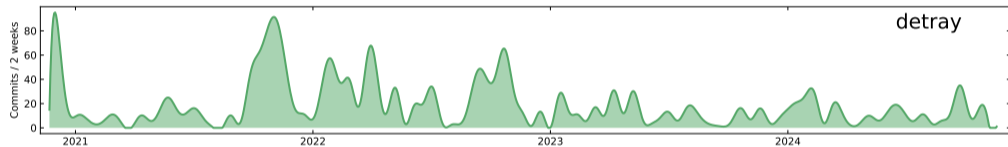
detray: **262** PRs, **10** contributors
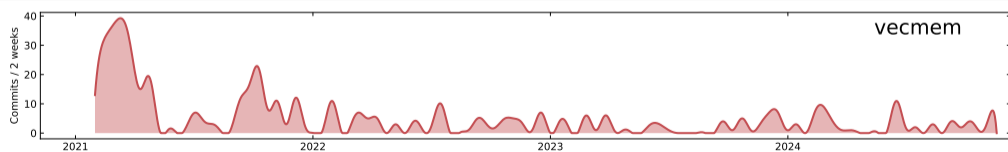
vecmem: **49** PRs, **3** contributors

traccc

- Lot's of **progress** in the **GPU reconstruction**
- **Full chain runs and produces tracks!**
- Integration with ACTS in progress!
- **Optimization work** ongoing to use resources efficiently
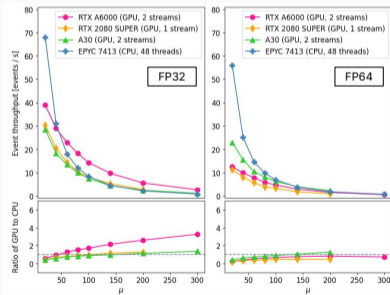
Discussion on publication plans on Wednesday:

traccc and detray: publication plans
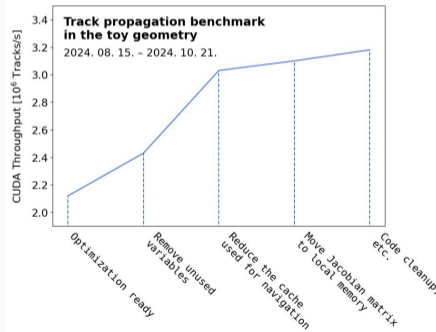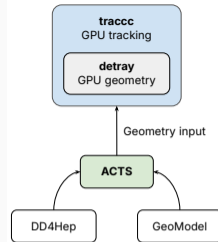
[Beomki's CHEP talk]

This week

Experiment presentations

STCF	Xiaocong Ai
Chateau	

CEPC	Yizhou Zhang
Chateau	

ALICE	Igor Altsybeev et al.
Chateau	

ATLAS - ITk	Luthien Mlynarski
Chateau	

ATLAS - MS	Dimitra Amperiadou
Chateau	

ePIC	Barak Schmookler et al.
Chateau de Bossey	14:20 - 14:40

sPHENIX	Joe Osborn
Chateau	

| FASER	Xiaocong Ai
Chateau	

NA60+	Giacomo Alocco
Chateau	

Lohengrin	Jan-Eric Heinrichs
Chateau	

LDMX	Elizabeth Berzin
Chateau de Bossey	16:45 - 17:00

11 experiment presentations **today!**

Topical presentations

Tuesday:

Geometry — *Andreas Salzburger*
Chateau de Bossey

Propagation and Navigation — *Joana Niermann*
Chateau de Bossey

Seeding — *Rosanne Zara Hasan*
Chateau de Bossey

Track Finding — *Dr Tim Adye*
Chateau de Bossey

Track Fitting — *Alexander J PFLEGER et al.*
Chateau de Bossey

Vertexing — *Andreas Stefl*
Chateau de Bossey — 12:00 - 12:30

Wednesday:

Integration of traccc — *Stephen Nicholas Swatman*
Chateau de Bossey

traccc and detray: publication plans
Chateau de Bossey

Impact of sensor degradation on the time reconstruction of CKF tracking — *Rodrigo Estevam De Paula*
Chateau de Bossey

Cluster formation, calibration, & splitting — *Louis-Guillaume Gagnon*
Chateau de Bossey

Using ACTS with drift chambers and drift/straw tube detectors — *Cheuk Ping Wong et al.*
Chateau de Bossey — 16:00 - 16:20

Hands-on sessions

ACTS Workshop 2024 Hands-on

During this year's workshop, we will have a number of hands-on sessions dedicated to working in groups on a number of topics.

> If you're interested in one or more of these topics, please put your name in the section!

1. detray alignment

Interested parties: Paul, Vakho, Lorenzo

2. Track finding ATLAS

Interested parties: Paul, Dimitra, Benjamin, not-boss-andi, Davide, PF, Lorenzo, Tomohiro, Tobias

3. Job configuration / pipelines

Interested parties: Paul, Benjamin, not-boss-andi

4. Performance monitoring

Interested parties: Paul, Benjamin, not-boss-andi, Davide, PF

5. Measurement selector

Interested parties: Paul, not-boss-andi, Lorenzo

6. Cluster splitting

Interested parties: Paul

7. ActsScalar removal

Interested parties: Paul, not-boss-andi

8. SegmentFitting for Muon Reconstruction

Interested parties: Dimitra, Davide

> If you have any additional topics that you think fit the format, feel free to add it to the end of this document!

Hands-on session

Chateau de Bossey   16:30 - 18:00

Tuesday - Thursday afternoons
CodiMD with topics: please sign up!

–

Also: Performance Mini-Hackathon on Friday

Let's have a great week!