

ACTS Tracking Software Status

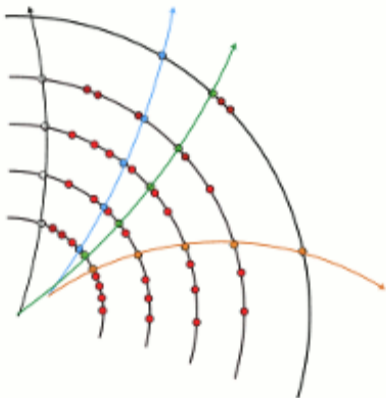
Moritz Kiehn (msmk@cern.ch)
for the ACTS developers

Université de Genève

2016-10-19 FCC-hh detector meeting

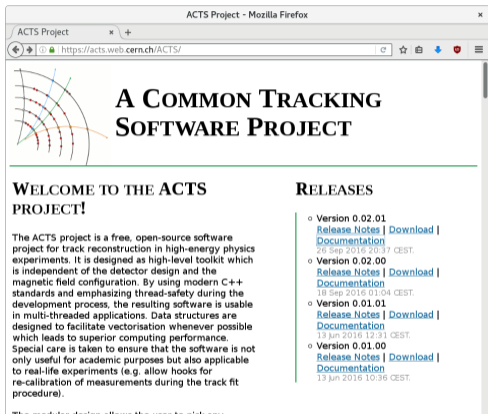


**UNIVERSITÉ
DE GENÈVE**



- Experiment independent tracking tools
- Derived from current ATLAS reconstruction
- Standalone
- Minimal dependencies





WELCOME TO THE ACTS PROJECT!

The ACTS project is a free, open-source software project for track reconstruction in high-energy physics experiments. It is designed as high-level toolkit which is independent of the detector design and the magnetic field configuration. By using modern C++ standards and emphasizing thread-safety during the development process, the resulting software is usable in multi-threaded applications. Data structures are designed to facilitate vectorisation whenever possible which leads to superior computing performance. Special care is taken to ensure that the software is not only useful for academic purposes but also applicable to real-life experiments (e.g. allow hooks for re-calibration of measurements during the track fit procedure).

RELEASES

- Version 0.02.01
[Release Notes](#) | [Download](#) | [Documentation](#)
29 Sep 2016 20:37 CEST.
- Version 0.02.00
[Release Notes](#) | [Download](#) | [Documentation](#)
19 Sep 2016 01:04 CEST.
- Version 0.01.01
[Release Notes](#) | [Download](#) | [Documentation](#)
13 Jun 2016 12:31 CEST.
- Version 0.01.00
[Release Notes](#) | [Download](#) | [Documentation](#)
13 Jun 2016 10:36 CEST.

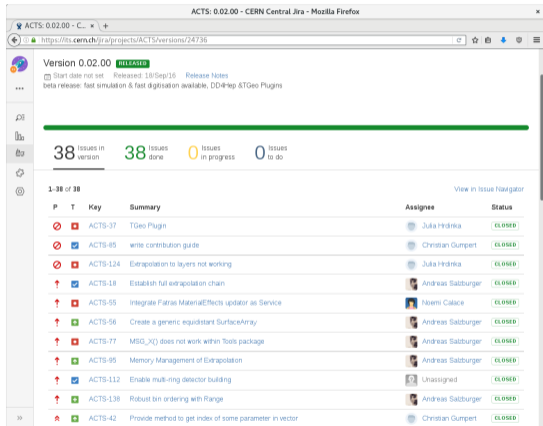
What's new?

- Website
- Issue Tracker
- Continuous Integration
- Unit tests
- Mailinglists
acts-developers, acts-users

<https://acts.web.cern.ch/>

<https://gitlab.cern.ch/acts/a-common-tracking-sw>





Version 0.02.00 **RELEASED**

Start date not set Released: 18/Sep/16 [Release Notes](#)
beta release: fast simulation & fast digitisation available, DD4hep & TGeo Plugins

38 Issues in version 38 Issues done 0 Issues in progress 0 Issues to do

1-38 of 38 View in Issue Navigator

P	T	Key	Summary	Assignee	Status
🚫	📄	ACTS-37	TGeo Plugin	Jula Hrdnika	CLOSED
📄	✅	ACTS-85	write contribution guide	Christian Gumpert	CLOSED
🚫	📄	ACTS-124	Extrapolation to layers not working	Jula Hrdnika	CLOSED
⬆️	✅	ACTS-18	Establish full extrapolation chain	Andreas Salzburger	CLOSED
⬆️	📄	ACTS-55	Integrate Fatras MaterialEffects updatior as Service	Nómi Calace	CLOSED
⬆️	📄	ACTS-56	Create a generic equidistant SurfaceArray	Andreas Salzburger	CLOSED
⬆️	📄	ACTS-77	MSG_X() does not work within Tools package	Andreas Salzburger	CLOSED
⬆️	📄	ACTS-95	Memory Management of Extrapolation	Andreas Salzburger	CLOSED
⬆️	✅	ACTS-112	Enable multi-ring detector building	Unassigned	CLOSED
⬆️	📄	ACTS-138	Robust bin ordering with Range	Andreas Salzburger	CLOSED
⬆️	📄	ACTS-42	Provide method to get index of some parameter in vector	Christian Gumpert	CLOSED

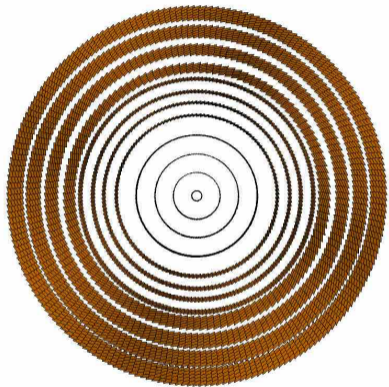
Latest release 0.02.01

- Updated DD4Hep, TGeo Plugins
- Updated extrapolation
- Bugfixes

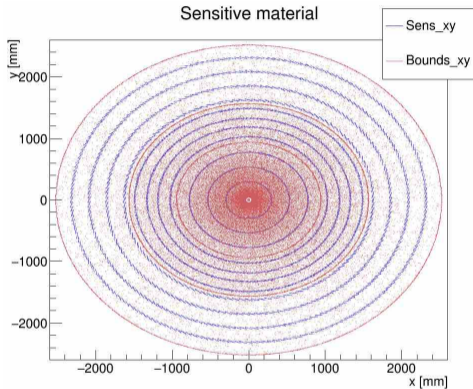
Upcoming 0.03.00

- Generic example detector
- Digitization
- Seeding
- Propagator



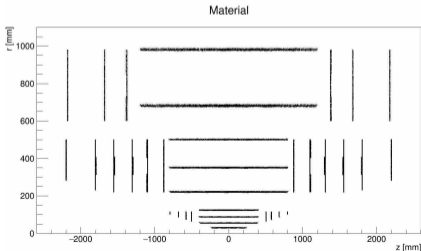
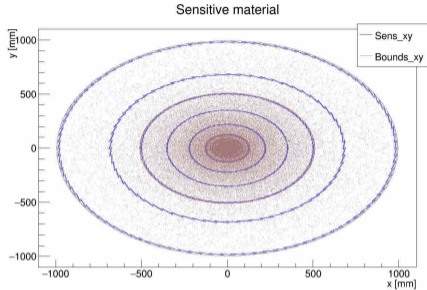


DD4Hep detector model



Fast navigation & extrapolation

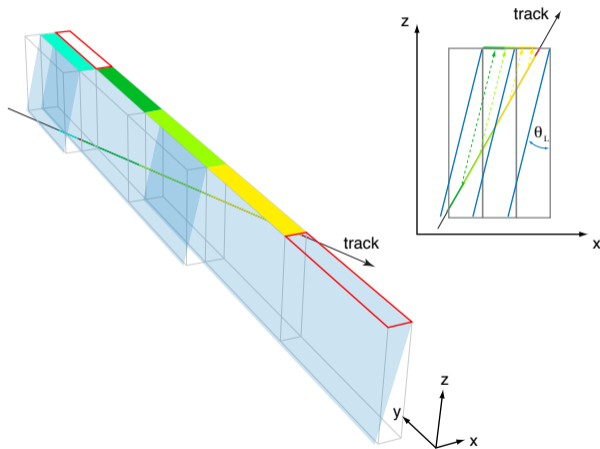




Geometric Components

- Pixels
- Short/long strips
- Barrels
- Discs

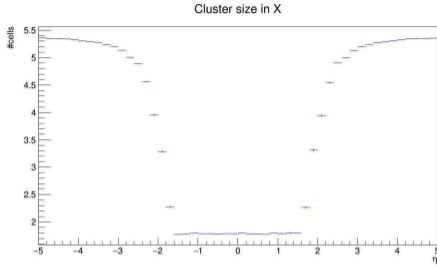
- Debugged extrapolation
- Validation



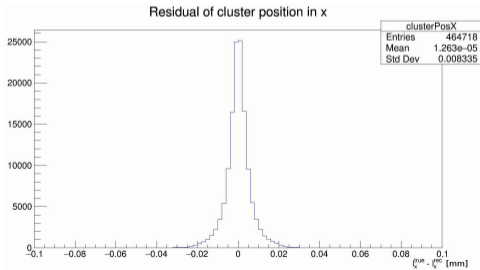
Features

- Purely geometric
- Variable segmentation
- Includes Lorentz-angle





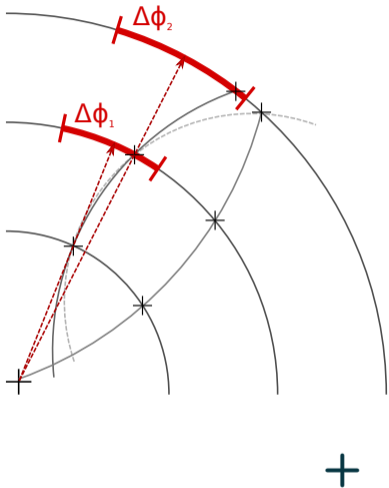
Preliminary results
Clustering in ϕ -direction



Features

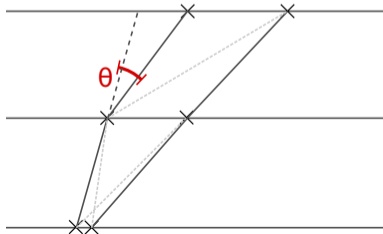
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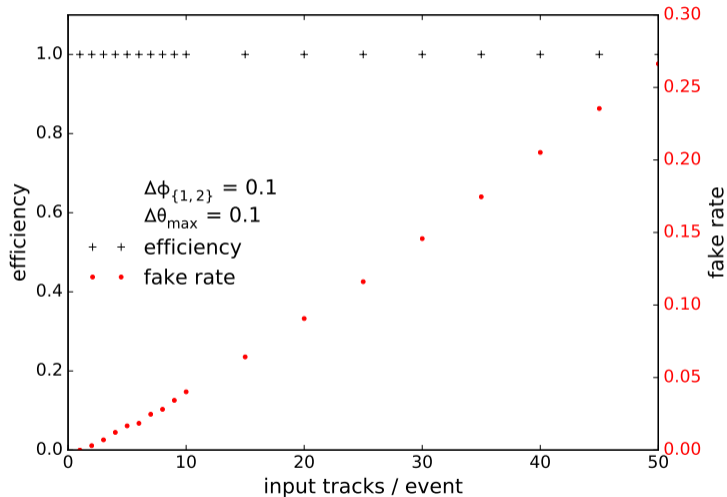




Helix Seed Finder

- Circle + line
- Combinatorial seed finder:
Search window $\Delta\phi_{\{1,2\}}$
Cut $\Delta\theta_{\max}$



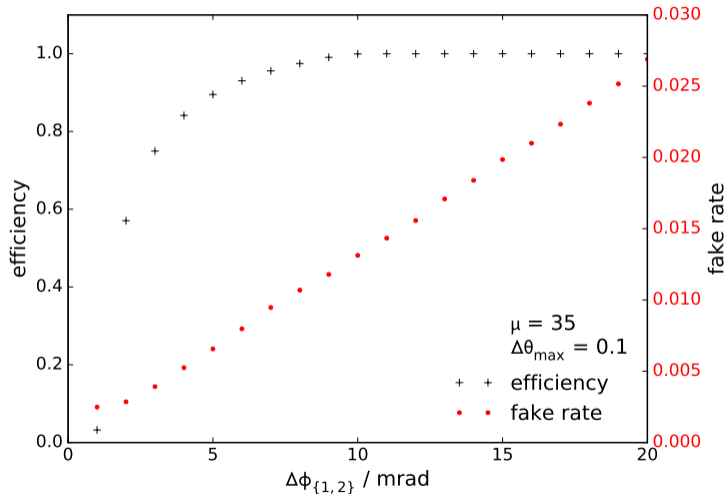


Input:

- Flat track parameters
- $p_{\perp} = 1\text{--}100\text{ GeV}$
- Truth hits from ACTS extrapolation

Efficiency vs number of tracks





Input:

- Flat track parameters
- $p_{\perp} = 1\text{--}100 \text{ GeV}$
- Truth hits from ACTS extrapolation

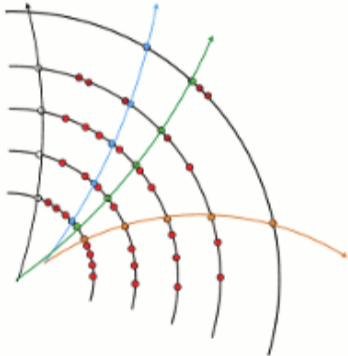
Efficiency vs ϕ window



Setup

- 4-cores/8-threads Xeon CPU
- ExtrapolationTest with generic detector (test framework)
- Using OpenMP
- Without I/O

threads	time / ns	speedup
1	47	
2	24	2.0
4	12	3.9
8	9	5.2



Status

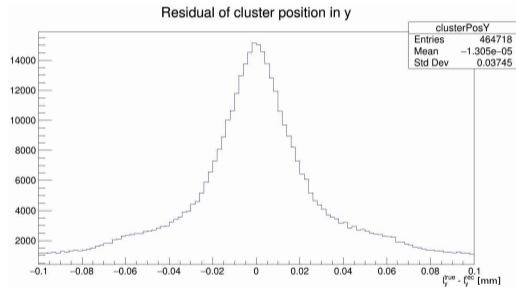
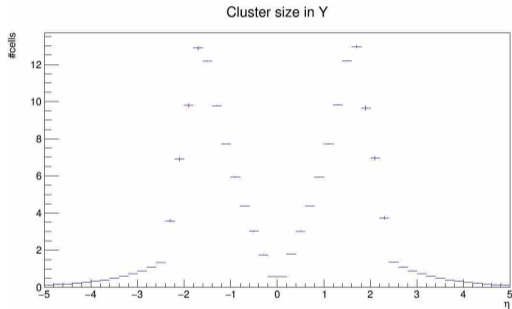
- Geometry, e.g. from DD4Hep
- Propagation
- Basic seeding
- Parallel-ready codebase

Outlook

- Full pipeline: from fast simulation to reconstructed tracks
- FCC demonstrator



Backup

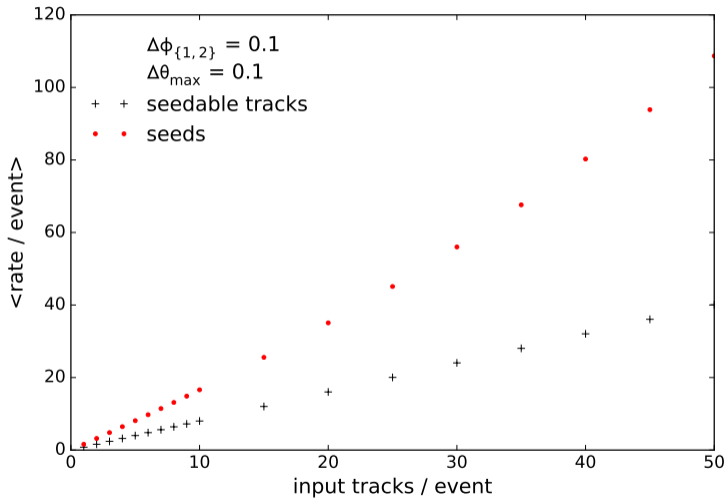


Preliminary Results



Helix Seeding — Rates

A2



Helix Seeding — Efficiency vs θ Window

A3

