ACTS

status – CKF – Belle II

2 April 2020
ErUM-Data Meeting

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Part 1

news

ACTS workshop — DESY, 25-29 May 2020

- cancelled ☹

- remote meeting on 25 May

- new workshop for **2021**

- updates on https://indico.desy.de/event/25025 𝒫

news
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Updates from Area D — Cost- and energy-efficient use of computing resources

- Aachen + Frankfurt + Bonn

- cellular automaton, Kalman filter, ... → **ACTS**

- regular meetings, exchange with core ACTS devlopers @ CERN
    - https://indico.belle2.org/event/1653 ⧉

Bonn

- – new PhD student **Tobias Böckh**

- – starts in May

- – focussing on general ACTS development + FASER

Frankfurt / Aachen

- – PhD student positions also filled

Part 2
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ACTS — introduction

– *A Common Tracking Software*

  – ATLAS, Belle II, FASER, sPHENIX, …

– components:

  – **acts-core**: geometry, EDM, **propagator**, tracking algorithms, …

  – **acts-framework**: parallel event processing, testing

  – **acts-fatras**: track simulation

P. Gessinger

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Collaboration with LBNL — CKF

– IRIS-HEP Fellowship → LBNL Berkeley, CA

– collaboration with Heather **Gray** and Xiaocong **Ai**

→ deep insight into ACTS, testing+validation of CKF

– `FW::FindingAlgorithm` interface core ↔ FW

– `FW::CKFPerformanceWriter` .root tree: efficiency, fake rate...

– `FW::RecCKFTracks` example sequence for CKF reconstruction

$$\text{efficiency} = \frac{N_{\text{truth matched, reco}}}{N_{\text{truth}}} \qquad \text{fake rate} = \frac{N_{\text{reco, matched}}}{N_{\text{reco}}}$$

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CKF fitting efficiency — TrackML detector, ATLAS B field

Part 3
Belle II

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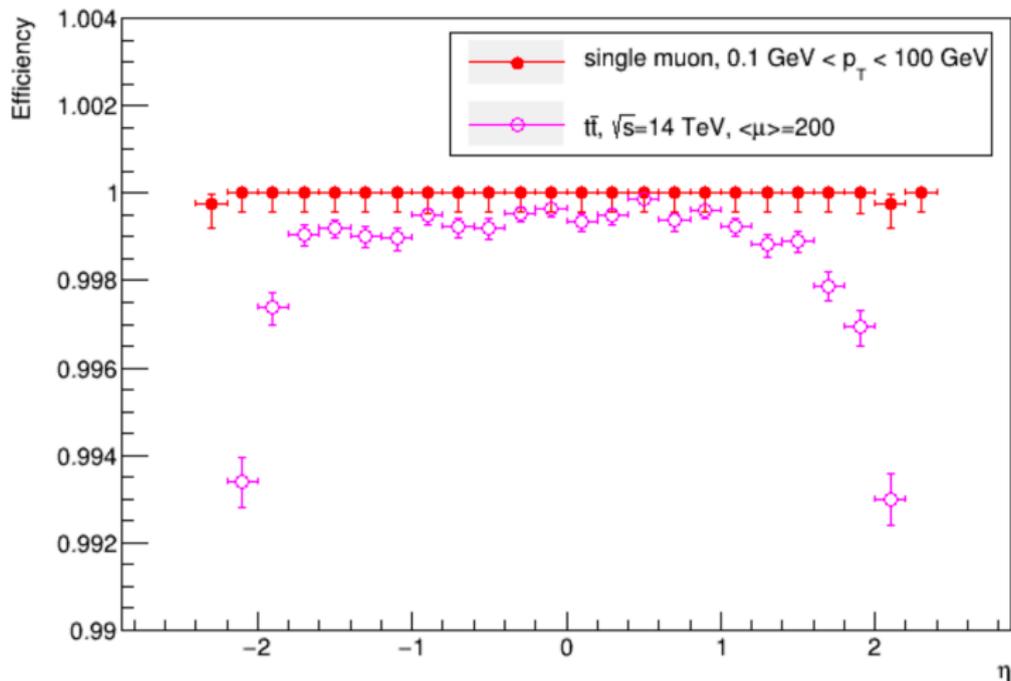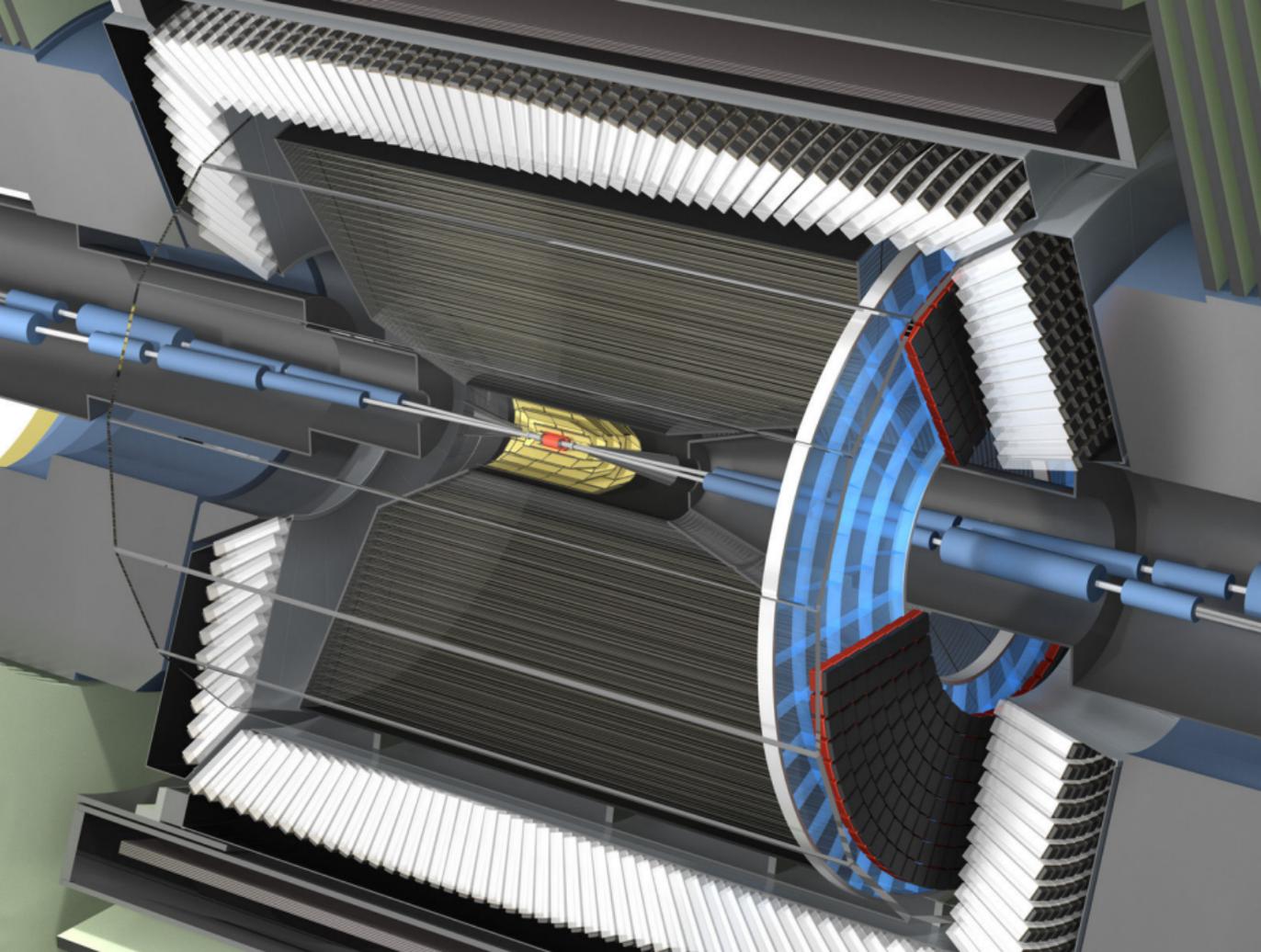
Belle 2 geometry in ACTS — PXD + SVD

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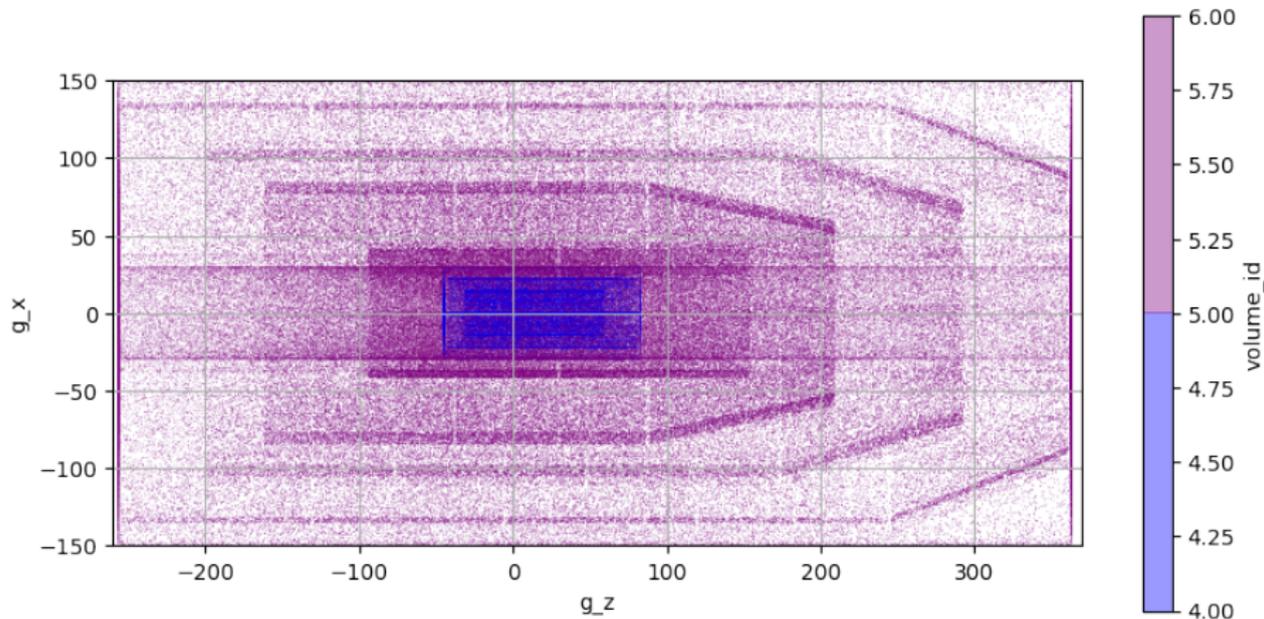
ACTS ↔ basf2 — conceptional differences

- GenFit deeply integrated into basf2
    - → challenging integration of ACTS
- differences in extrapolation/propagation
    - different base objects (plane vs. surface + volume + bounds)
    - ACTS: fast extrapolation to next surface
    - different material handling
- → cf. slides Nils Braun (ErUM 2019) $\mathcal{C}$

Part 4

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summary

- CKF usable, more testing needed (other detectors, …)

- rudimentary support for Belle II geometry in ACTS

open questions

- ☉ SVD: conical shapes ($\rightarrow$!779 $\mathcal{O}$)

- ☉ CDC ($\rightarrow$ sPHENIX)

- ☉ integration ACTS $\leftrightarrow$ basf2/GenFit

backup

FW::TrackFindingAlgorithm — Examples/Reconstruction/RecCKFTracks.cpp

```cpp
#include "ACTFW/Framework/Sequencer.hpp"
#include "ACTFW/TrackFinding/TrackFindingAlgorithm.hpp"

Sequencer sequencer(Options::readSequencerConfig(...));

TrackFindingAlgorithm::Config findCfg;
findCfg.inputSourceLinks = hitSmearingCfg.outputSourceLinks;
findCfg.inputInitialTrackParameters
    = particleSmearingCfg.outputTrackParameters;
findCfg.outputTrajectories = "trajectories";
findCfg.find = TrackFindingAlgorithm::makeTrackFinderFunction(
    trackingGeometry, magneticField, logLevel);

sequencer.addAlgorithm(
    std::make_shared<TrackFindingAlgorithm>(findCfg, logLevel));
```

FW::CKFPerformanceWriter — Io/Performance/CKFPerformanceWriter.cpp

```cpp
for (const CKFTrack& traj : trajectories) {
  for (const size_t& tip : tips) { // entry index
    std::vector<ParticleHitCount> particleHitCount
        = traj.identifyMajorityParticle(tip);

    bool  is_matched = false;
    if (particleHitCount.front().hitCount * 1. / nMeasurements
       > m_cfg.match_majority_thresh) { // 80%
      is_matched = true;
    }

    m_fakeRatePlotTool.fill(m_fakeRatePlotCache, *truth_part, !is_matched);
```

acronyms

ACTS   **A** **C**ommon **T**racking **S**oftware 🔗
FASER   **F**orw**A**rd **S**earch **E**xpe**R**iment, at LHC
basf2   **B**elle **II** **a**nalysis **s**oftware **f**ramework 🔗
GenFit   track reconstruction framework, used in basf2 🔗
CKF   **C**ombinatorial **K**alman **F**ilter