ACTS KF status

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KF/CKF status

- KF Smoothing issue fixed in merged !706
  - Create track state on all passed material surface
  - Create curvilinear parameter on passive material surface
  - Use covariance helper to correct the non semi-positive smoothing covariance
  - Add additional KalmanFitterError type for case where no track state is created

- Work in progress:
  - Implement inverse filtering for smoothing (!725)

- Next to do:
  - Cherry-pick the outlier rejection implementation in !652
  - Implement separate class for track finding (sequential version only) in !710
Truth fitting status

- Adapt to the core and add a few fixes/optimizations in !190
  - Efficiency is redefined as number of tracks with fitted track parameter over number of total truth tracks
  - Add TruthFitTrack struct for truth and fitted result
    • Simplify the retrieving of truth for performance plots (truth is needed for all truth tracks)
  - Fix fatras options for material effects
    • Add process flag in fatras (!37)
    • Notice that including radiation process will make the simulation ‘dead’
- Use DirectNavigator for truth fitting (!192)
  - Store passed surface sequence in additional collection in simulation
  - Need CSV writer/reader for surface sequence
- Next to do:
  - Cherry-pick the outlier/hole emulation tool in !161
  - Implement mis-calibration/alignment emulation tool
  - Make it work for other detectors (eg. ODD)
Tracking efficiency

- Very low efficiency when \( pT > 10 \) GeV due to large particle smearing?
- Fit failing reason: number of processed detector surfaces == 0

```cpp
// compute momentum-dependent resolutions
const auto sigmaD0
    = m_cfg.sigmaD0 + m_cfg.sigmaD0PtA * std::exp(m_cfg.sigmaD0PtB * p);
const auto sigmaZ0
    = m_cfg.sigmaZ0 + m_cfg.sigmaZ0PtA * std::exp(m_cfg.sigmaZ0PtB * p);
const auto sigmaP = m_cfg.sigmaPRel * p;
```

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**Generic Detector**

![Efficiency plot](image)

PT = 10 GeV/c
Track parameter residual

Generic Detector
- $PT = 10$ Gev
- $\eta = 0$
- Include material effects
Track parameter residual

Generic Detector
- PT = 10 Gev
- Eta = 1.2
- Include material effects
Track parameter residual

Generic Detector
- PT = 10 Gev
- Eta = [-4, 4]
- Include material effects
Track parameter pull

Generic Detector

- $PT = 10 \ Gev$
- $\eta = 0$
- Include material effects
Track parameter pull

Generic Detector
- PT = 10 Gev
- Eta = 1.2
- Include material effects
Track parameter pull

Generic Detector

- PT = 10 Gev
- Eta = [-4, 4]
- Include material effects
backup
Track parameter pull
(without covariance correction)

Generic Detector
- PT = 10 Gev
- eta = [-4, 4]
- Include material effects