Using Timing Info in Track Reconstruction

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ePIC

Timing Info in Track Finding/Fitting with ACTS

acts/**Core**/**src**/**TrackFinding**/**MeasurementSelector.cpp**
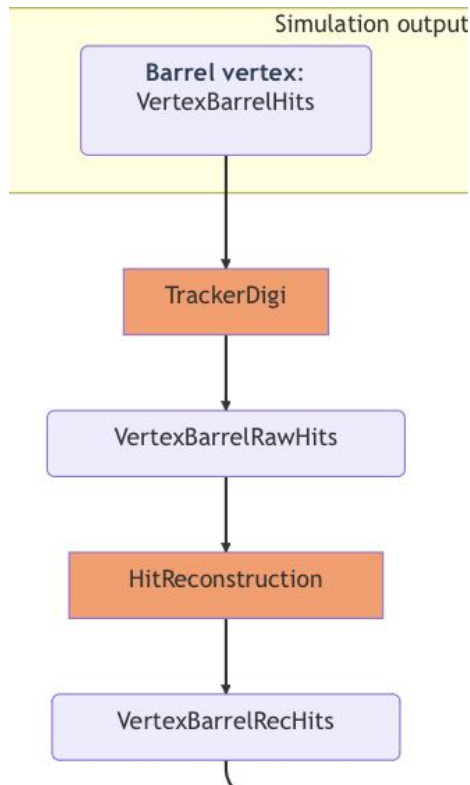
```
// Get the residuals
ParametersVector res;
res = calibrated − H * predicted;

// Get the chi2
return (res.transpose() *
        ((calibratedCovariance + H * predictedCovariance * H.transpose()))
            .inverse() *
        res)
    .eval()(0, 0);
```

Use all members in the parameter
for chi2 calculation

To do: verify chi2 calculation after including timing info

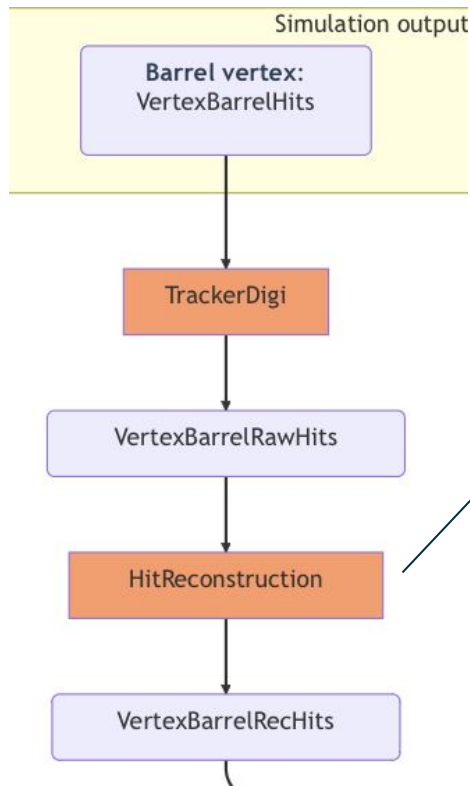# Timing Info in Reconstruction Chain

VertexBarrelHits.time

```
cell_hit_map[sim_hit->getCellID()] = {
        (std::int32_t) std::llround(sim_hit->getEDep() * 1e6),
        hit_time_stamp}; // ns->ps
```

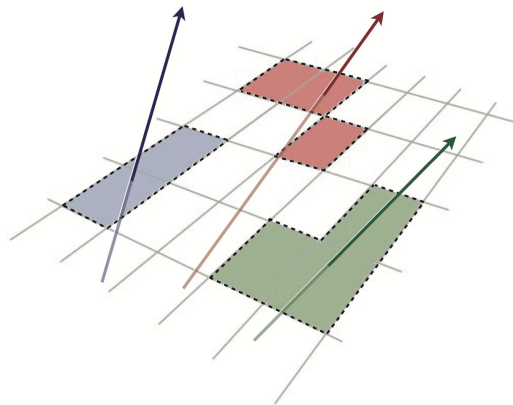Smeared hit time

```
for (auto item : cell_hit_map) {
    rawhits.push_back(new edm4eic::RawTrackerHit(
            item.first,
            item.second.charge,
            item.second.time_stamp));
}
```

Timing Info in Reconstruction Chain

Task 1 (optional): include timing check in clusterization

See Luis's talk:
https://indico.bnl.gov/event/18821/contributions/74559/attachments/46537/78759/2023-03-16_EIC_ACTS-Cluster.pdf
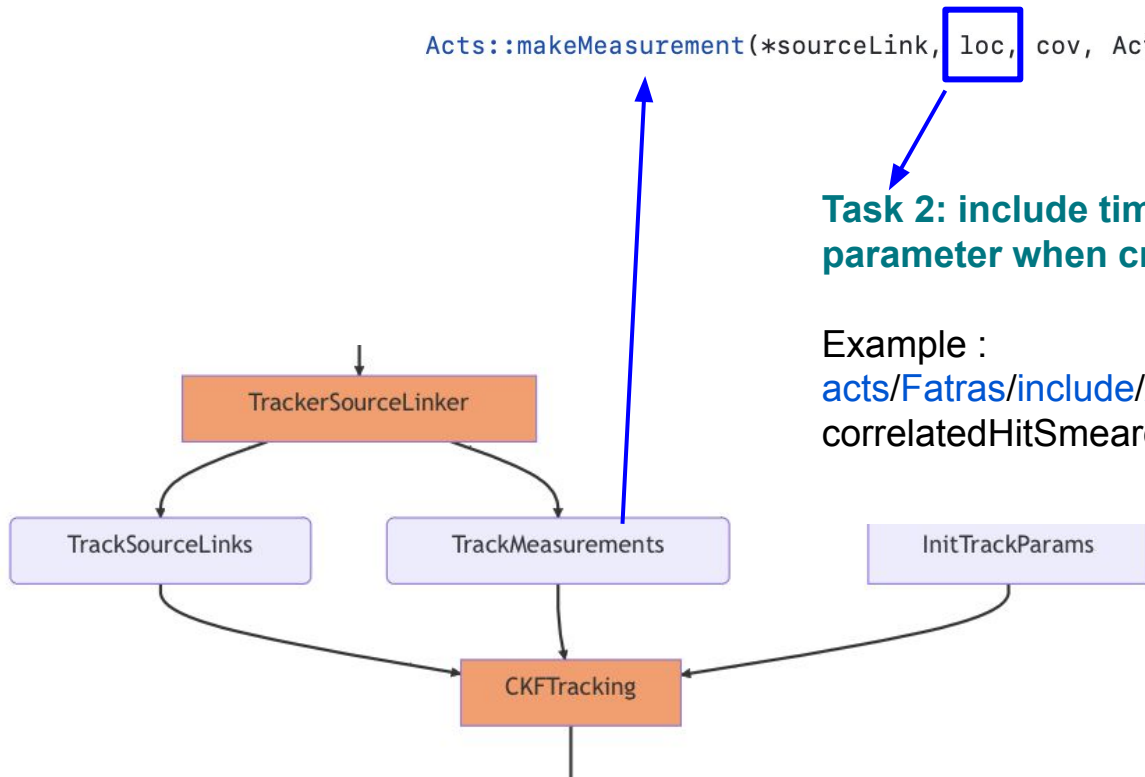
Timing Info in Reconstruction Chain

```
Acts::makeMeasurement(*sourceLink, loc, cov, Acts::eBoundLoc0, Acts::eBoundLoc1);
```

Task 2: include timing info in this parameter when creating measurements

Example :
acts/Fatras/include/ActsFatras/Digitization/UncorrelatedHitSmearer.hpp

Timing Info in Reconstruction Chain

Task 3 (optional):
Add a time tag to seeder