Task 12.2 - Turnkey Software

AIDAinnova WP12 Meeting

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HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

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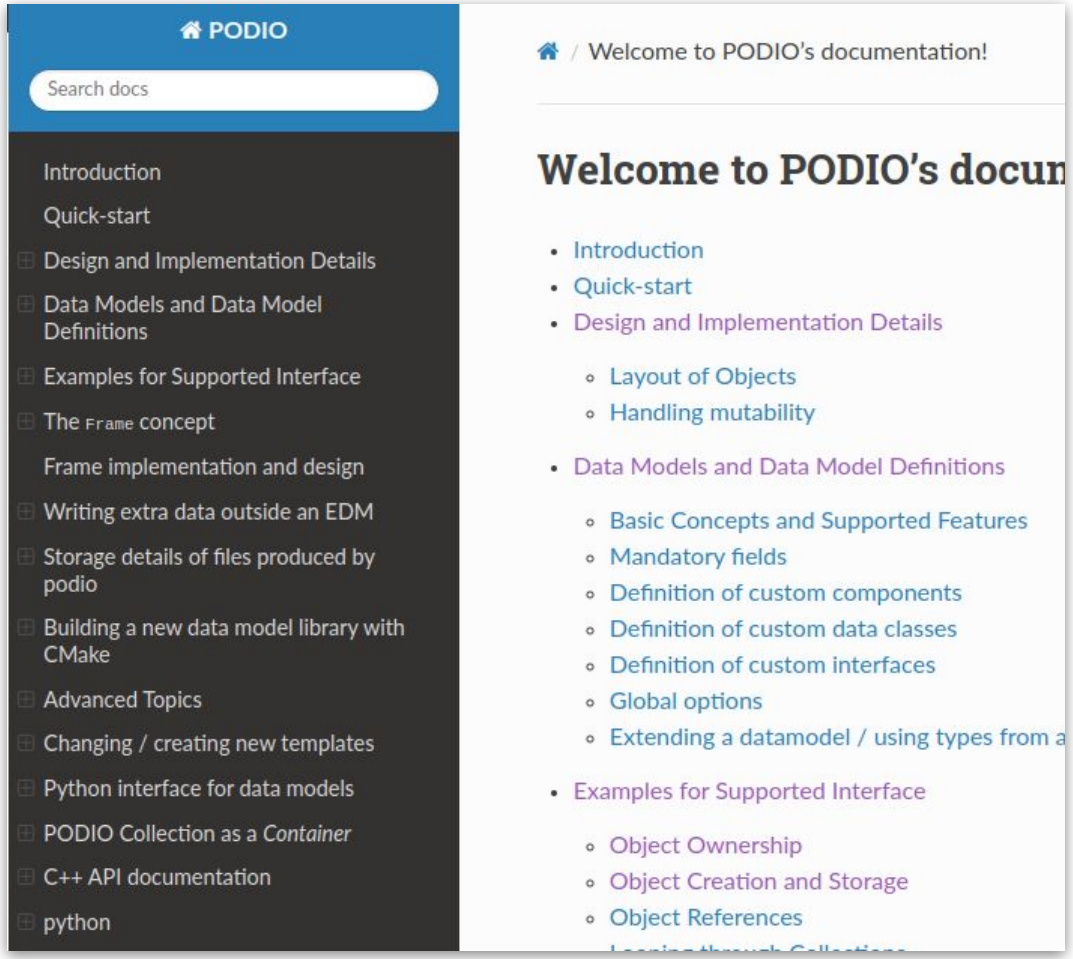
Developments in podio

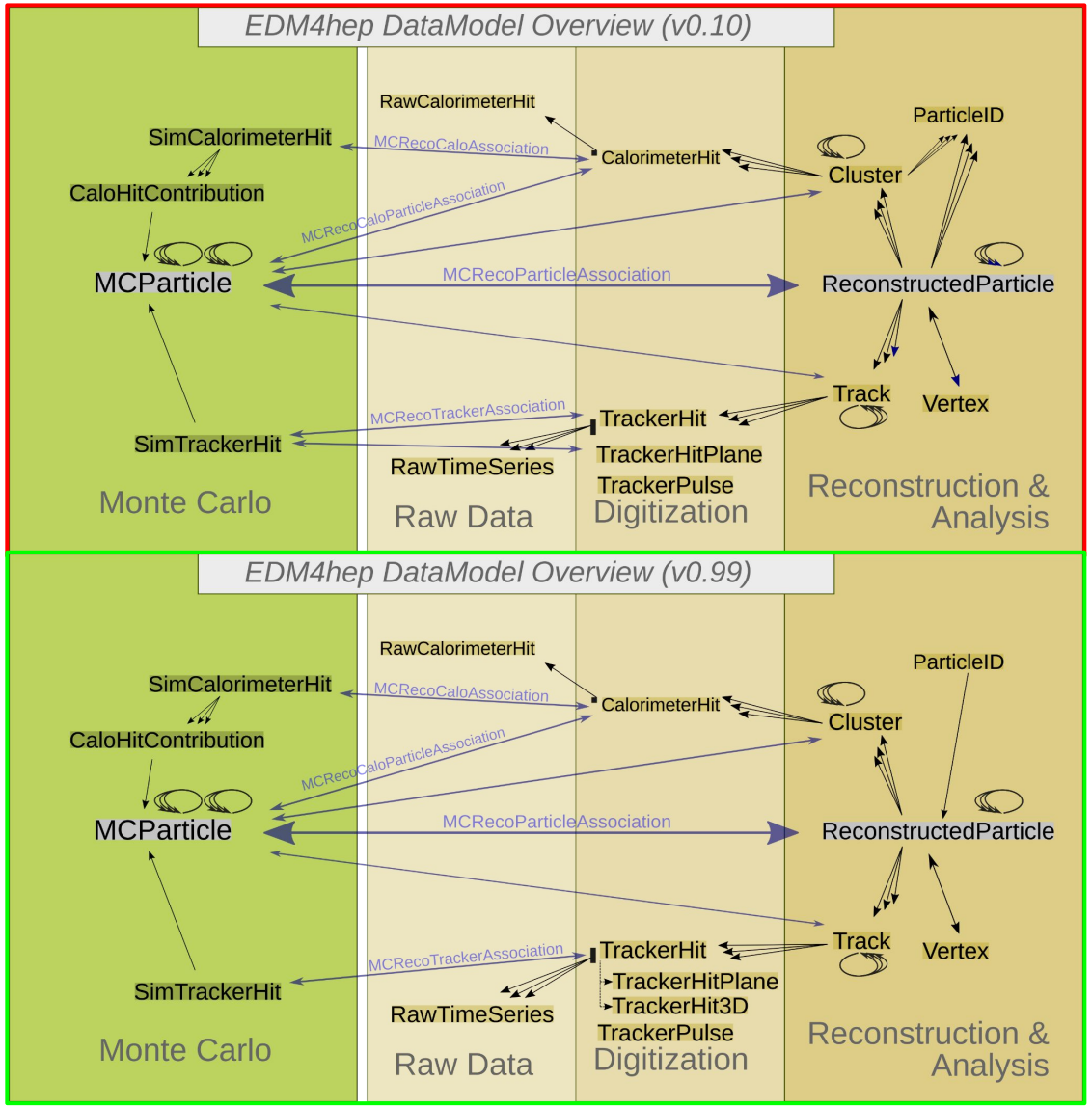
- **Version 1.0** (and 1.0.1) (see here for a more detailed list)
- Lots of documentation updates
  - Deployed to key4hep.web.cern.ch/podio
  - Compatibility between collection and *STL container* (#598)
- Few (small-ish) bug fixes
  - Schema evolution detects more impossible evolutions (#622)
  - Fix relations in cloned objects (#583)
- `Reader` and `Writer` "interface" (#522)
- Some API "fixes" (i.e. breaking changes)
  - `Frame::getParameter` returns `std::optional` (#580)
  - `clone` can now skip relations (#609)
  - Homogenize storage of parameters for TTree & RNTuple(#625)
- On the list for v1.1 (or beyond)
  - `RDataSource` for podio (#593)
  - Still a list of open issues and ideas :)



Developments in EDM4hep

Things that were done

- Many developments towards v1.0 - **almost done**
  - Quite a few breaking changes
  - Introducing conceptual differences wrt LCIO
  - Check EDM4hep v1.0 project for more details
  - Changes in edm4hep.yaml are trivial, but usually several repositories affected downstream
- New datatypes for generator info (#310)
- Reverse the direction of the ParticleID relation (#268)
  - Including utilities for resolving relations again
- Dedicated covariance matrix components (#287)
- Remove some of the drift chamber study types (#333)
  - Needs a bit more design work to be better integrated into the overall structure
- Remove TrackerHitPlane - SimTrackerHit assoc. (#331)
- Change probability to ndf in Vertex (#324)



Developments in EDM4hep

Things that are still ongoing

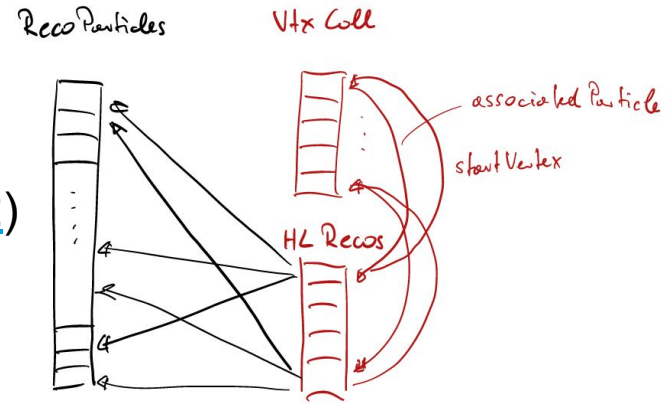
- Make `primary -> type` bitfield in Vertex (#329)
  - Consistent with what we do in other types
- Remove radiusOfInnerMostHit from Track (#326)
  - Part of an overall goal to not mix analysis and reconstruction level quantities too much
- Remove the dQ/dx information from Track (#311)
  - Not really usable in multithreaded context
- Refine Vertex - ReconstructedParticle relations (#332)
  - Should become a bit more intuitive to use
- Plan to tackle them this / next week
- Make pre-release tag before summer break
- Some documentation still to do
- v1.0 after summer (before CHEP)

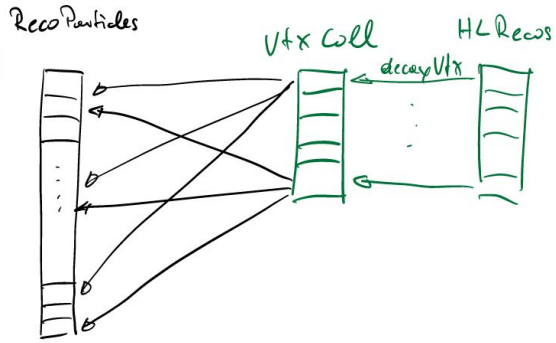
Vertex:

```
-     OneToOneRelations:
-       - edm4hep::ReconstructedParticle associatedParticle //
+     OneToManyRelations:
+       - edm4hep::ReconstructedParticle particles // particles
```

ReconstructedParticle:

```
      OneToOneRelations:
-       - edm4hep::Vertex          startVertex    // start vertex
+       - edm4hep::Vertex          decayVertex    // decay vertex
      OneToManyRelations:
```





Developments in k4FWCore

- Improved errors from k4run (#178)
- Make `MetaDataHandle::get` throw on missing values (#195)
- Support for multithreading (#173, #201)
  - Introduce dedicated `IOSvc` & `Reader` / `Writer` algorithms (to replace `Podio[In|Out]put`)
  - Custom implementations of `Consumer`, `Producer`, `Transformer` (of Gaudi) to integrate with podio
  - Support for variable number of input collections
- Tested for mixing & matching of “legacy” algorithms and functional ones
  - Including wrapped Marlin processors
- Required features coming from porting DDMarlinPandora processors to Gaudi

#201 (wip)

```
struct ExampleFunctionalConsumerRuntimeCollections final
    : k4FWCore::Consumer<void(const std::vector<const edm4hep::MCParticleCollection*>& input)> {
  // The pair in KeyValue can be changed from python and it corresponds
  // to the name of the output collection
  ExampleFunctionalConsumerRuntimeCollections(const std::string& name, ISvcLocator* svcLoc)
      : Consumer(name, svcLoc, KeyValues("InputCollection", {"DefaultValue"})) {}

  // This is the function that will be called to produce the data
  void operator()(const std::vector<const edm4hep::MCParticleCollection*>& input) const override {
    if (input.size() != 3) {
      throw std::runtime_error("Wrong size of the input vector, expected 3, got " + std::to_string(input.size()));
    }
    for (int i = 0; i < 3; i++) {
      if (inputLocations(0)[i] != "MCParticles" + std::to_string(i)) {
        throw std::runtime_error("Wrong name of the input collection, expected MCParticles" + std::to_string(i) +
                                 ", got " + std::string(inputLocations(0)[i]));
      }
    }
```

```
consumer = ExampleFunctionalConsumerRuntimeCollections(
    "Consumer",
    # InputCollection="MCParticles0,MCParticles1,MCParticles2",
    InputCollection=["MCParticles0", "MCParticles1", "MCParticles2"],
    Offset=0,
)
```

Key4hep stack news

- DDFastShowerML part of they key4hep stack (nightlies)
  - Result of hackathon at annual meeting
- New MarlinMLFlavorTagging package (nightlies)
  - Developed at DESY
  - First prototype of a somewhat generic inference interface
  - Can serve as example and basis for similar things in Gaudi(?)
- New k4Reco package (nightlies)
  - Home for generic reco algorithms (digitizer atm)
- New k4DetPerformance package (not yet part of stack)
  - Home for generic performance study script (currently tracking only)
  - Started from G. Sadowski's studies
- New k4GeneratorsConfig package (not yet part of stack)
  - Automatic generation of input files for generators from one source
  - Part of ECFA study
  - Uncovered several generator (build) issues already