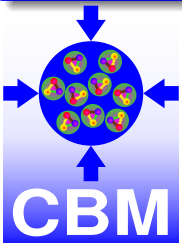
CBM online: updates in the code base



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Outline

- Goals
- Header inclusion
- Library management
- New reco-data classes and containers in online/offline

Goals

- **Purpose:** development of clean, transparent and efficient timeslice/event reconstruction algorithm
- **Goal**: replacement of "legacy" algorithms and data-classes with the new ones from `cbm::algo`
- **Goal**: only one instance of each data unpacking/reconstruction algorithm in CbmRoot
- **The algo code-base organization and full integration to the CbmRoot is to be carried out**

Case 2: Headers included with partial path

- Mostly in `algo` folder/libraries
- Flat install of headers not enforced there, mainly due to usage of namespaces

Cause:

- `algo` headers not consistently installed with full original path
  - Sometime flat directly in install folder
  - Sometime with partial path (e.g. "`<install>/include/yaml`" for a file from "`<source>/algo/base/utils/yaml`")
- Partial path used in include macro but not matching install path:
  - `#include "<subfolder>/header.h"`

⇒ Complex fix for single instance of problem: Need expert intervention

⇒ Long term need consistent convention, even if "it leads to long includes" or "it leads to long filenames"

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[1] See presentation by Pierre-Alain

Header inclusion

- The solution with “long includes” was selected for headers in `Algo/AlgoOffline`

```
/// Example: algo/ca/TrackingSetup.h
#include "algo/base/SubChain.h"
#include "algo/detectors/sts/TrackingInterface.h"
#include "algo/detectors/tof/TrackingInterface.h"
#include "algo/detectors/trd/TrackingInterface.h"

/// Example: reco/steer/CbmSourceDigiTimeslice.h
#include "algo/base/DigiData.h"
#include "algo/global/RecoResultsInputArchive.h"
#include <FairSource.h>
```

- Headers are installed in nested directories starting from `algo`:

```
install(DIRECTORY base DESTINATION include/algo PATTERN "*.h")
install(DIRECTORY ca
        DESTINATION include/algo
        FILES_MATCHING
        PATTERN "ca/core" EXCLUDE  # NOTE: installed from another library
        PATTERN "*.h")
```

- Merge request !2084

Library management

- Issues:
  - two versions of libraries: XXX and XXXOffline: handling of different loggers and NO_ROOT derictive
  - `Algo/AlgoOffline` contains useful features, which are generic and should not be a part of it
  - the features are reused in many places, which brings unnecessary dependency on `Algo/AlgoOffline`

- Migration of the features to separate libraries: `CbmUtility` and `CbmContainers/OnlineContainers`

- `CbmUtility` (merge request !2086):
  - extension to the C++ STL and BOOST: utilities to work with templates, enumerations, generic algorithms
  - no detector/analysis specific classes, no ROOT dependencies
  - namespace `cbm::util`
  - first class `cbm::util::EnumDict`
  - other related classes will be moved soon (**review of classes is needed**)

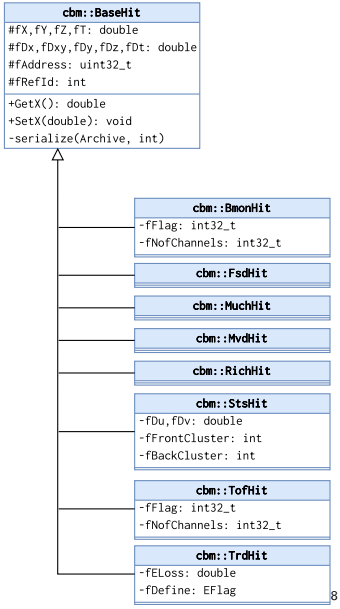
- `CbmContainers/OnlineContainers` (merge request !2085)
  - extension to the C++ STL and BOOST: different containers
  - no detector/analysis specific classes, no ROOT dependencies
  - namespace `cbm`
  - first classes: `cbm::PODVector`, `cbm::PartitionedVector`, `cbm::PartitionedSpan`
  - other related classes will be moved soon

New reconstructed data structures

- Purpose: online-friendly uniform data structures for reconstruction algorithms
- Self-contained representation of reconstructed event/timeslice
- Remastered Hit and Track classes
- Merge request !1983 [WIP]

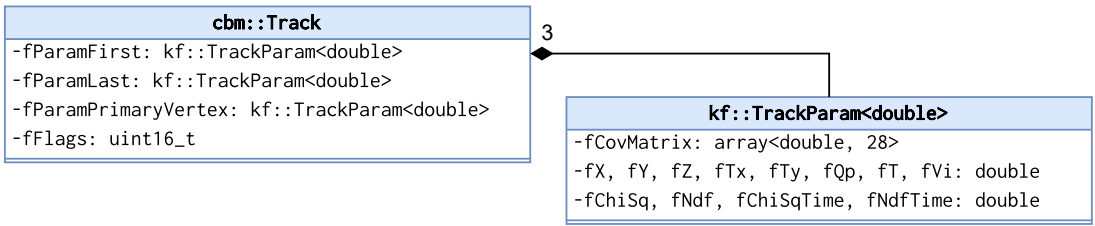
New reconstructed data structures: hit classes

- Base class – a pixel hit (x, y, z, t)
- No custom detector layout classes allowed, only CBM 32-bit address
- Derived classes add extra fields, **but do not override getters of base class**
- Derived classes are accessible via `template<ECbmModuleId> cbm::Hit_t`:
  - e.g.: `cbm::Hit_t<ECbmModuleId::kSts>`, `cbm::Hit_t<ECbmModuleId::kTof>`
  - easily accessible in template functions with the `ECbmModuleId` template parameter

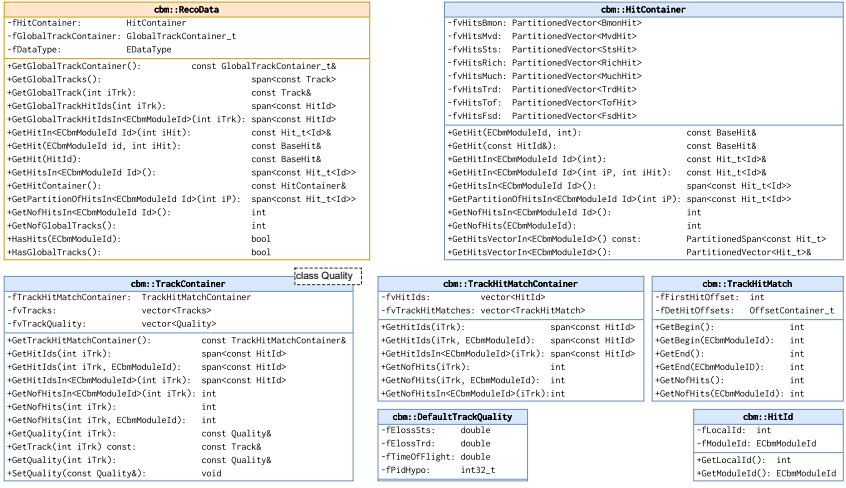


Track class

- Track parameters in three points: first hit, last hit and primary vertex
- Track parameter class – from `KfCore`, naturally used by CA Tracking
- No information on individual hits (only flags)

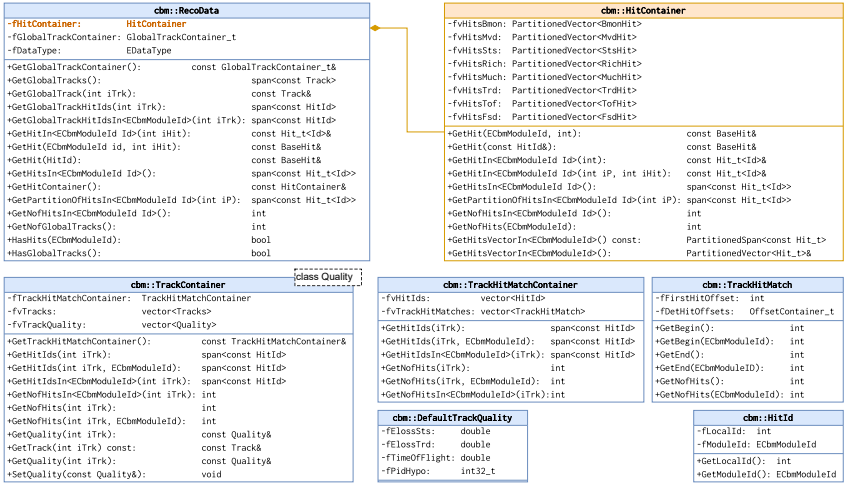


New reconstructed data structures: RecoData class



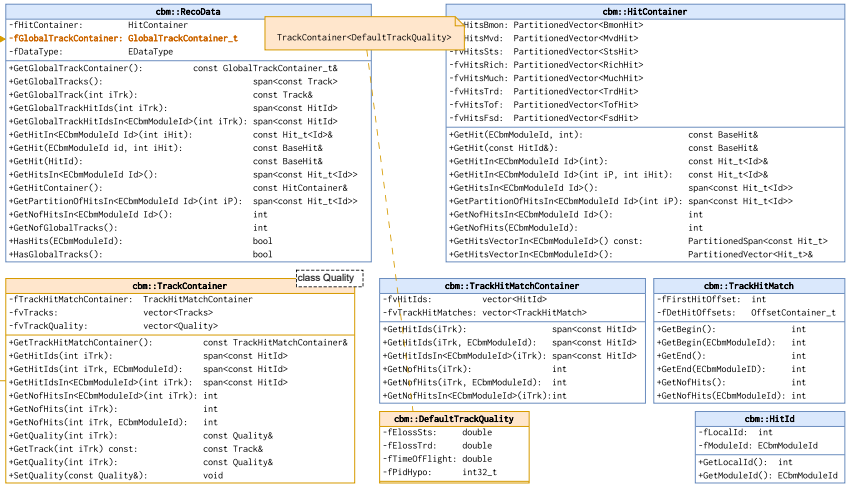
- Self-contained output format for timeslice/event reconstruction in CBM
- Contains tracks, hits, matching information, PID

New reconstructed data structures: HitContainer class



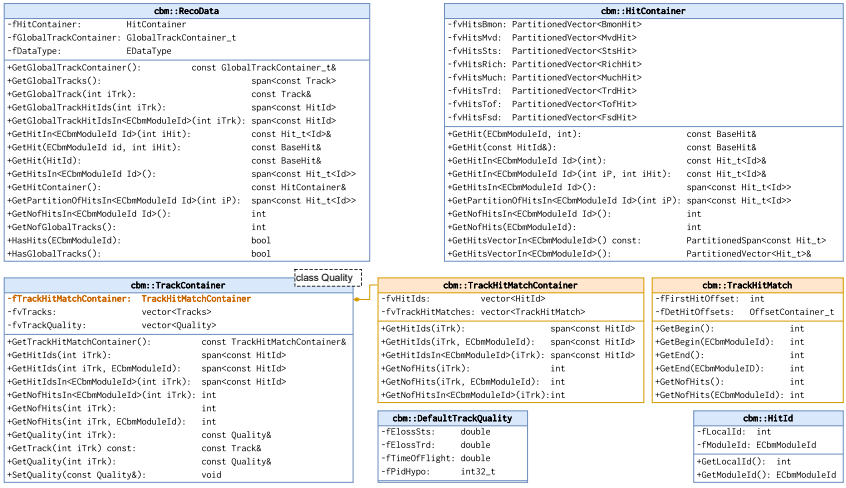
- Vectors of hits in different detectors
- Uniform access with run-time and compile-time detector ID selection

New reconstructed data structures: TrackContainer class



- Vectors of tracks, track quality (PID information), and track-hit matching

New reconstructed data structures: TrackHitMatchContainer class



- A flat vector of IDs of hits attached to tracks and vector of track-hit matches
- Track-hit match: a light-weight object, contains an index of first hit for a track in IDs vector and hit number offsets from different detector subsystems

Summary

- The new data classes are delivered, integrated to the online and being tested
- Next step – implementation of common reconstruction class (digi-timeslice/digi-event in online binary/offline task)