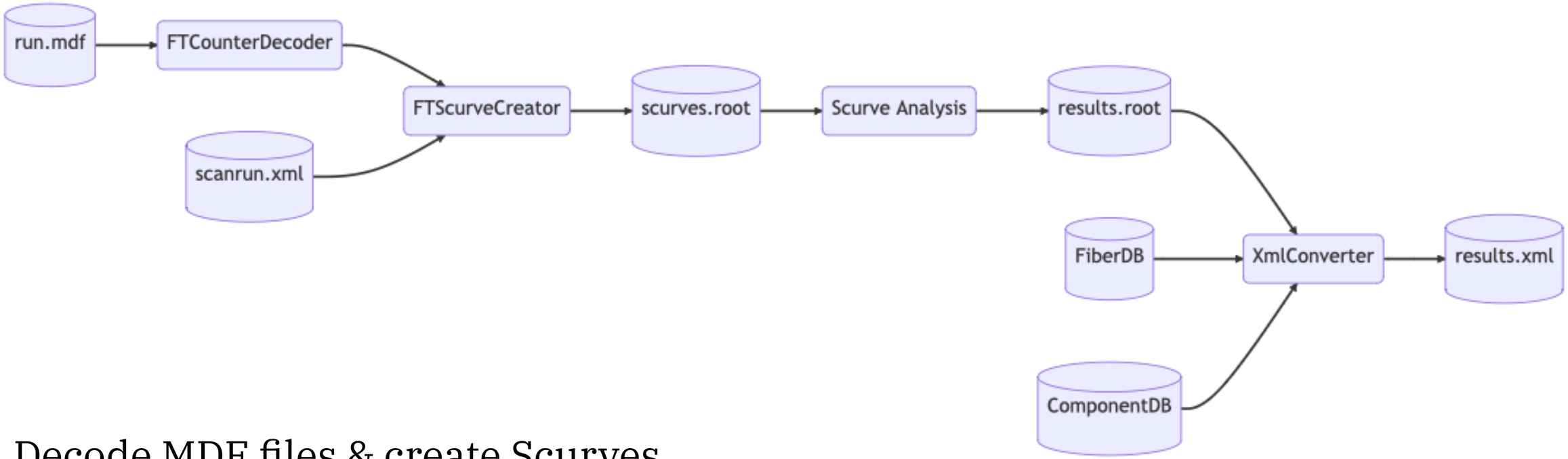
Threshold Scan Software

SciFi simulation and reconstruction 03.04.23

Lukas Witola
Physikalisches Institut
Universität Heidelberg

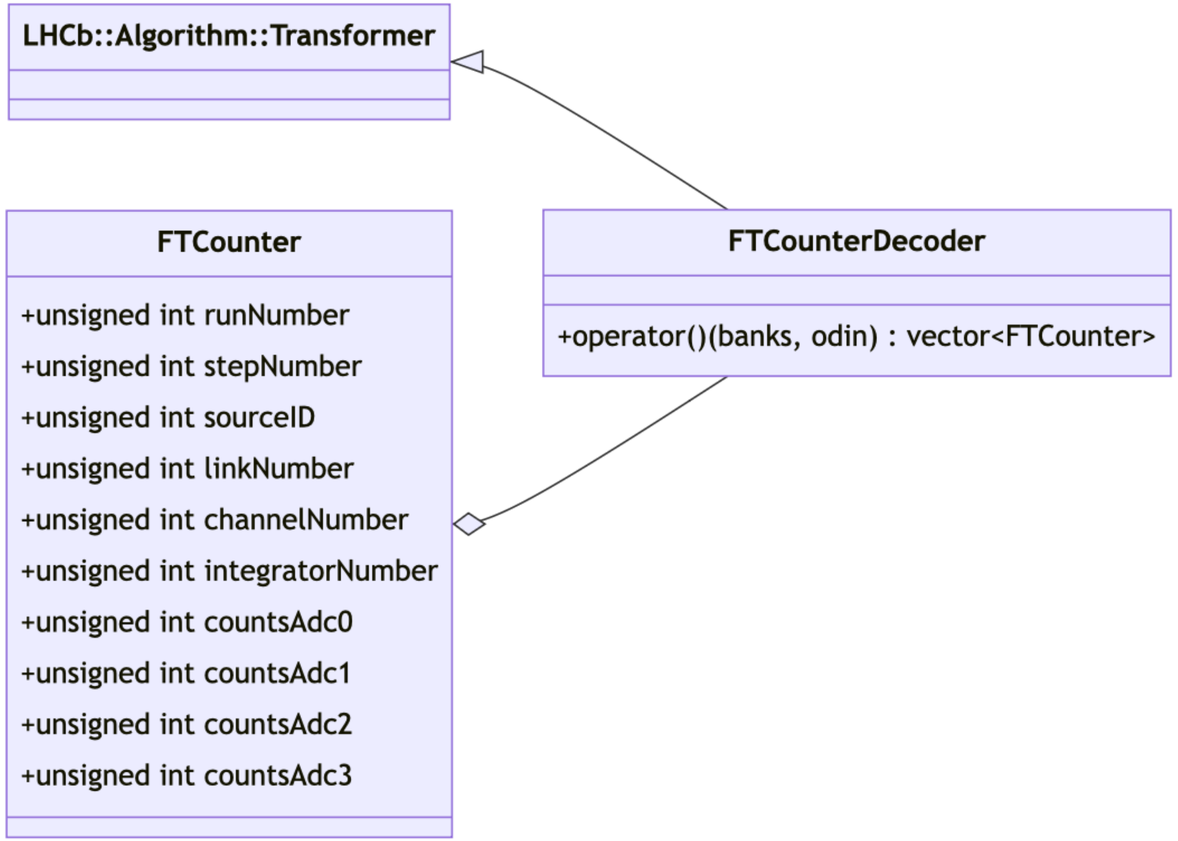
FSP LHCb
Erforschung von
Universum und Materie

Analysis Workflow



1. Decode MDF files & create Scurves
2. Analyse Scurves & save results
3. Convert results to XML format

FTCounterDecoder



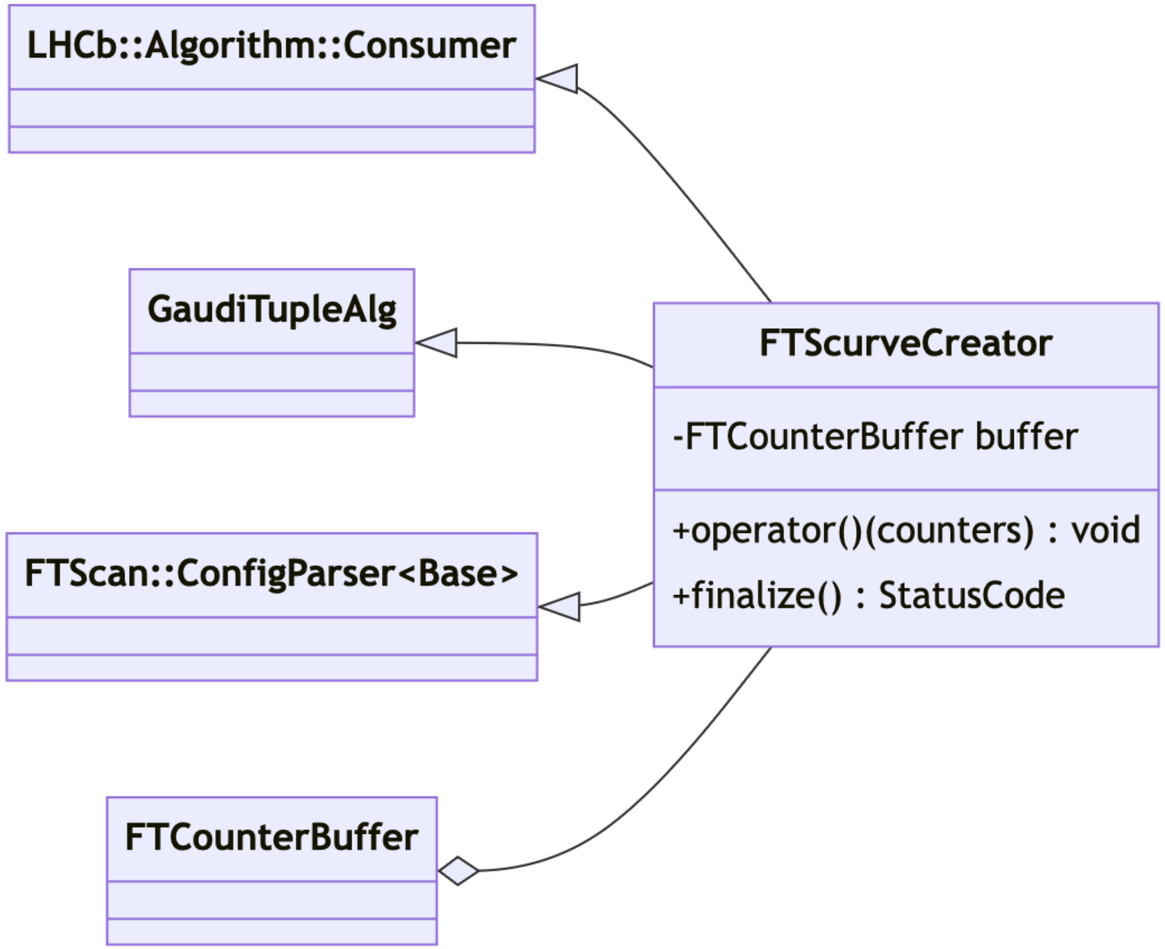
FTCounterDecoder

- Simple algorithm that decodes the *FTCalibration* raw banks into *FTCounter* objects

FTCounter

- Class to store the counter values from the *FTCalibration* raw banks per channel
- Additionally the *ODIN* information *runNumber* and *stepNumber* are stored

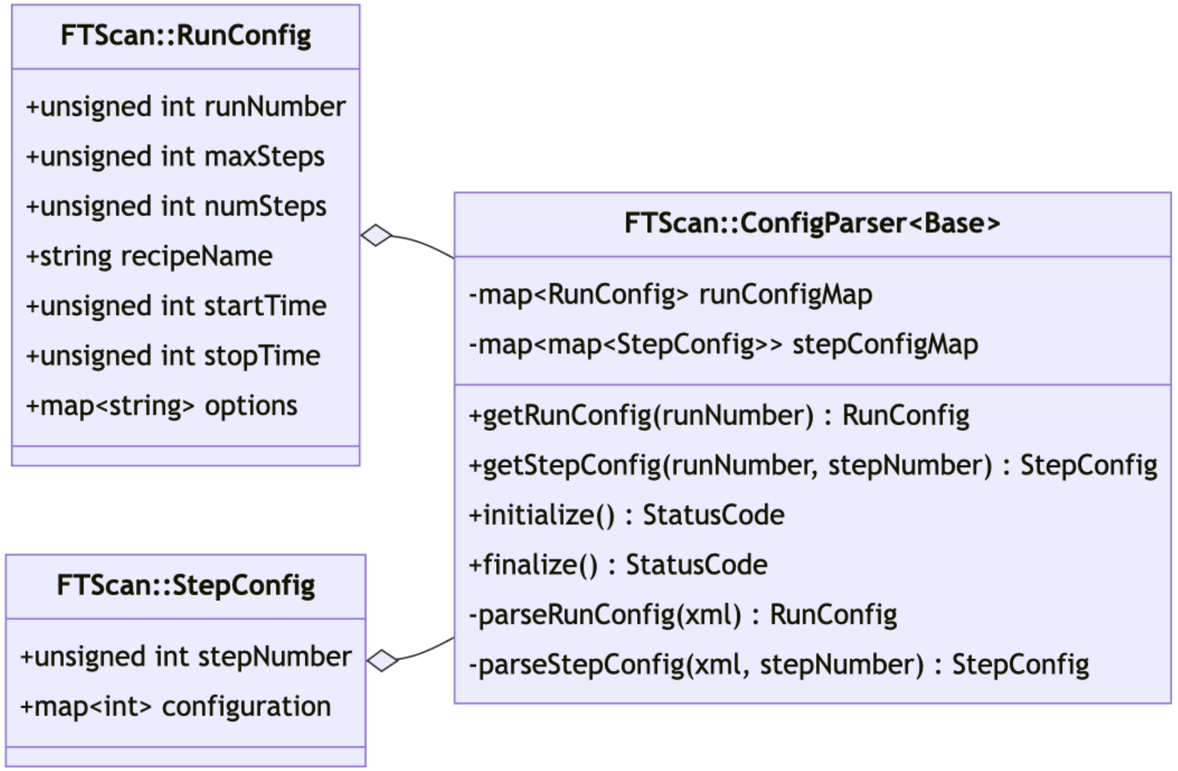
FTScurveCreator



FTScurveCreator

- Algorithm to convert *FTCounters* to Scurves
- Need *FTCounters* from all steps to construct Scurves but can't keep them all in memory
- Write to temporary buffer on disk
  - *Buffer* class design not finalised
- At the end read *FTCounters* from buffer and *StepConfig* from scanrun.xml to construct Scurves

FTScan ConfigParser



FTScan::ConfigParser

- Mixin class to provide access to the information stored in scanrun.xml files
- This information can be used to correctly construct Scurves
- How to interpret the values in *StepConfig::configuration*, is left to the caller

Scurve Analysis

- **LIS/PED Threshold Scan**
  - Fit Scurves to extract calibration constants
- **Charge Threshold Scan**
  - Study integrator & comparator differences
  - Verify integrator trimming
- **LIS Delay Scan**
  - Fit Scurves to extract gain and find optimal delay

- A program already exists to fit the Scurves
- Additional algorithms can be implemented relatively easily e.g to fit charge Scurves

XMLConverter

- Convert scan results to their XML representation
  - XML format documented in SciFiOnlineScansRuns TWiki page
- Usage: `XMLConverter OUTPUT INPUT… –scan_type=<SCANTYPE>`
- Depending on the *scan_type* the actual conversion is handed over to a dedicated *ScanConverter* class
  - Need to interact with SciFi ComponentsDB and LHCb FiberDB
- The *XMLDocument* class initialises the common XML structure and allows to add entries in the form of *XMLEntry* objects

```
<Entry>
    <Table>table_name</Table>
    <ProdDBId>production_id</ProdDBId>
    <ScanResults>
        <key attribute="attribute">value</key>
    </ScanResults>
</Entry>
```

```
<Entry>
    <Table>table_name</Table>
    <ProdDBId>production_id</ProdDBId>
    <ScanResults>
        <GBTData>
            <GBT_N>gbt</GBT_N>
            <key attribute="attribute">value</key>
        </GBTData>
    </ScanResults>
</Entry>
```

```
<Entry>
    <Table>table_name</Table>
    <ProdDBId>production_id</ProdDBId>
    <ScanResults>
        <ChData>
            <CH>ch</CH>
            <LOCALTH>vth</LOCALTH>
            <key attribute="attribute">value</key>
        </ChData>
    </ScanResults>
</Entry>
```

Databases

OnlineDBs

- Three databases (ComponentDB, CalibrationDB, GeographicDB)
- Only ComponentDB is relevant for us
  - Geographical table (Detector location—> ComponentIDs)
  - Component tables (ComponentID —> ProductionID)
- Read-only login credentials
- GitLab

FiberDB

- Python package already exists but is missing som functions
- Convoluted way of accessing the DB
  - Create SQL database —> Convert to CSV —> Read CSV to pandas.DataFrame
- Implemented new interface to access the database (GitLab)
  - Same interface as OnlineDBs
  - Create the SQL database and interact directly with it
  - Breaks compatibility with *lhcb-scifi-timingscans*

Status

Component	Status	Developer
FTCounterDecoder	Current implementation has poor code quality (GitLab). New implementation using modern C++ (GitLab), needs to be verified against current version.	Lukas, Ya
FTScan::ConfigParser	Done (GitLab)	Lukas
FTScurveCreator	Current implementation can only handle LIS_TH_SCAN, does not use scanrun.xml files, and has poor code quality (GitLab) New algorithm in work to address current shortcomings (GitLab)	Lukas, Ya
LIS/PED Threshold Scan Analysis	Currently in private GitLab repository. Plan to migrate to public repo and add documentation so other people can use and develop it.	Lukas
Charge Threshold Scan Analysis	Not started	
LIS Delay Scan Analysis	Not started	
FibreDB Python Package	Update of interface in progress (GitLab)	Lex, Lukas
OnlineDB Python Package	Done (GitLab)	Lukas
XMLWriter	Implemented XML structure and first converter class	Lukas