Migration of reconstruction and analysis software to C++

A proposal based on feedback from the software week

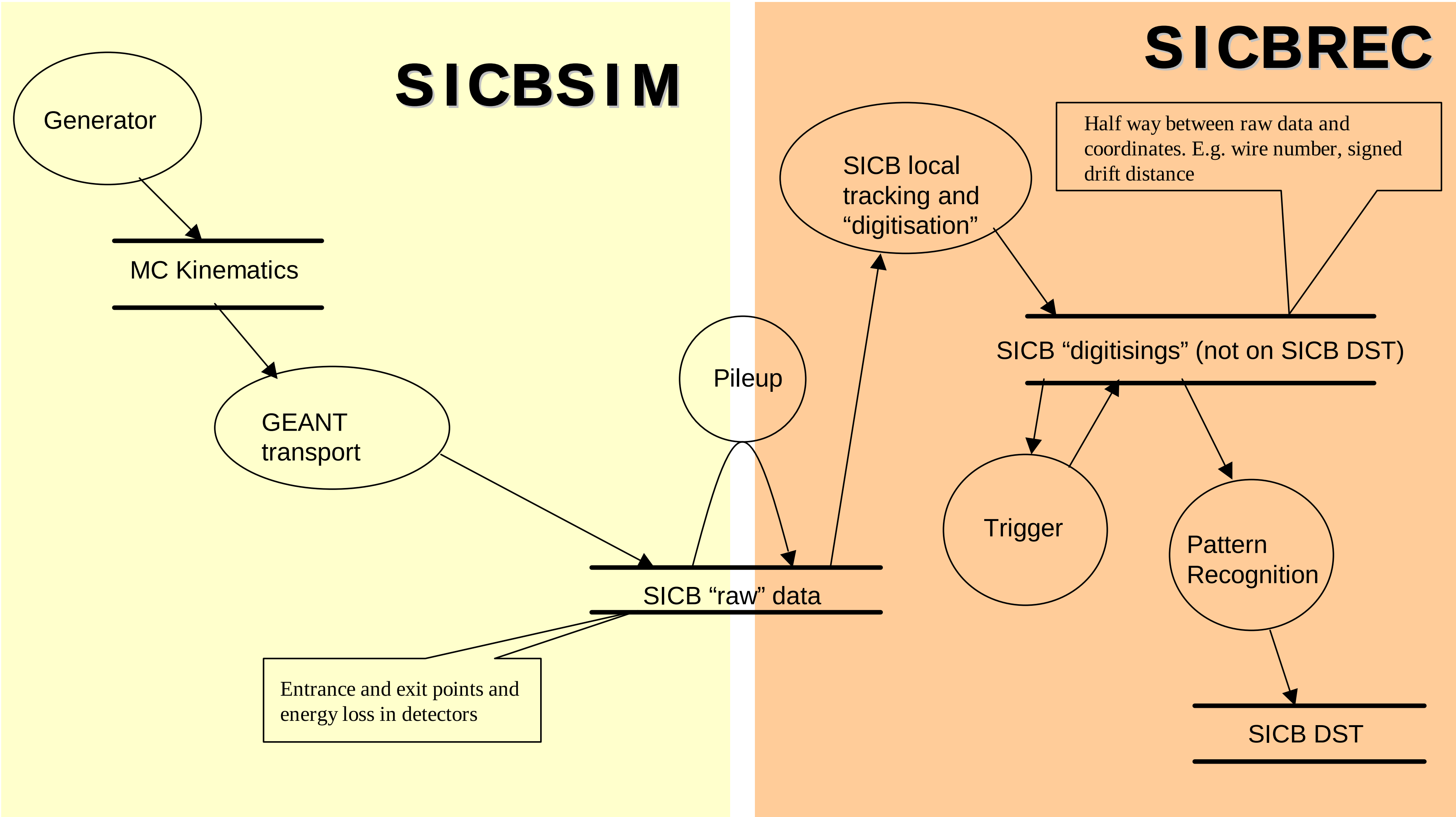
Immediate Goals

- **Physics Goal:**
  - To be able to run new tracking pattern recognition algorithms written in C++ in production with standard FORTRAN algorithms in time to produce useful results for the RICH TDR.
- **Software Goal**
  - To allow software developers to become familiar with GAUDI and to encourage the development of new software algorithms in C++.

Proposed Strategy - Step 1

- **Finish splitting of SICB into:**
  - simulation (SICBMC)
    - Event generation, GEANT tracking
    - outputs kinematics AND raw GEANT hits
      - i.e. Current RAW format, but with xxRW banks from all detectors
  - reconstruction (SICBREC)
    - doesn't need GEANT3 nor its common blocks
    - digitisation, trigger, reconstruction in distinct steps
    - outputs same DST format as now.
- **Benefits:**
  - Clear separation between simulation and reconstruction
  - Modularity of reconstruction
- **Organiser : Florence**

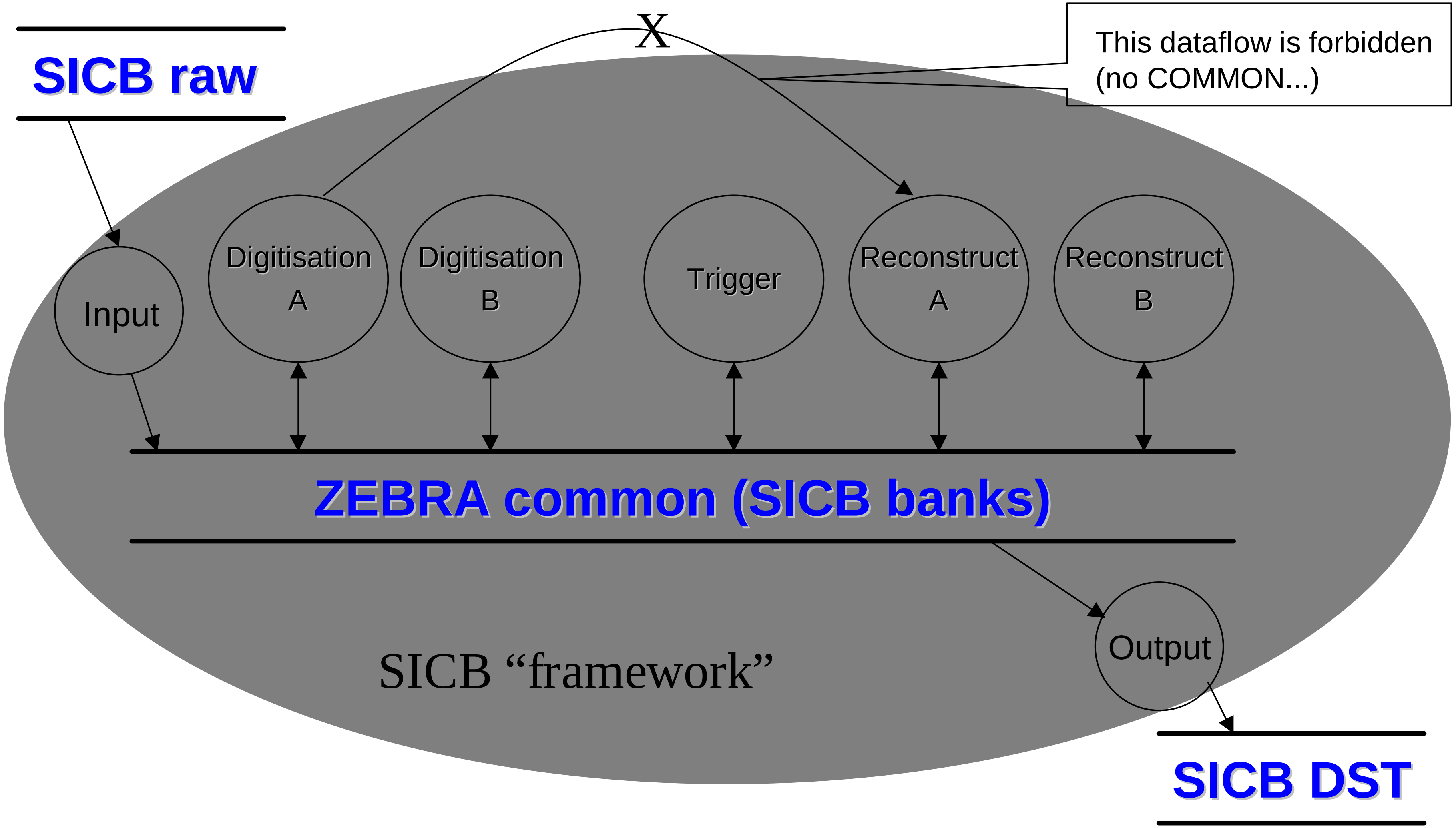
Step 1 overview



Tasks for step 1

- **SICBMC**
  - Remove anything that belongs to digitisation and reconstruction
    - Done
  - Create raw hits for calorimeter
    - To be done by calorimeter experts (~1 week?)
- **SICBREC**
  - Add initialization routines for each step of the processing (digitize, apply trigger, reconstruction)
  - Verify validity of results
    - Both the above are essentially work for the sub-detector experts
    - Time estimate is about two weeks
- **If started now, step 1 could be finished by Xmas**

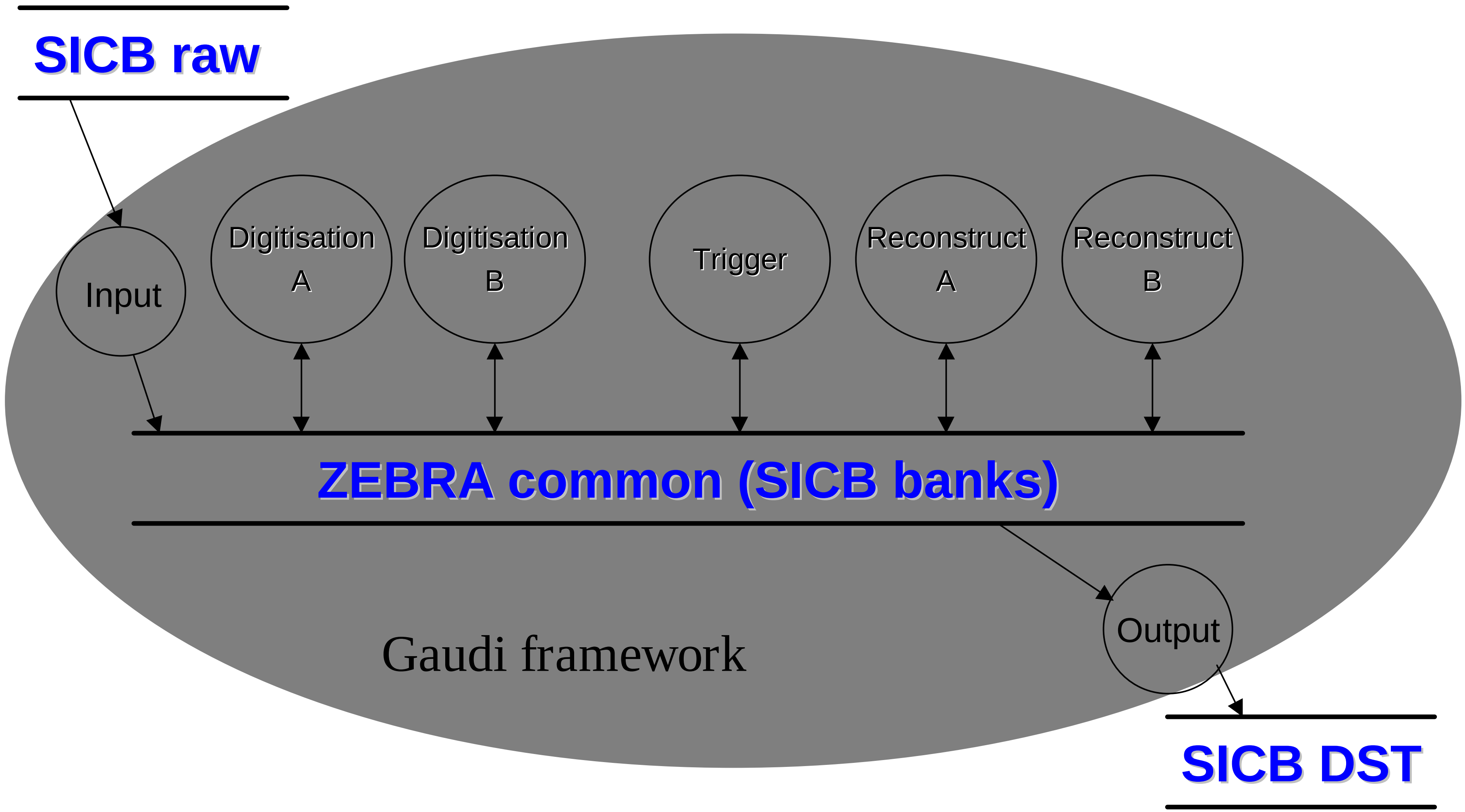
Step 1
SICBREC structure



Proposed Strategy - Step 2

- **For every SICBREC FORTRAN module:**
  - wrap it such that it can be called from C++
  - Integrate with the GAUDI framework
    - Time estimate about 1 month - sub-detectors and Gaudi team
  - Result is a new reconstruction program - BRUNEL
- **Produce a DST (Zebra banks) with this program**
  - check the output is as expected
    - i.e. identical to SICBREC output
    - Must be done by sub-detector experts
- **Drop SICBREC**
  - Could be ready for decision by next LHCb week
- **Benefit:**
  - Single environment for C++ and FORTRAN work
  - Integrated environment for verification of C++ developments
- **Organiser: Marco**

Step 2
BRUNEL structure



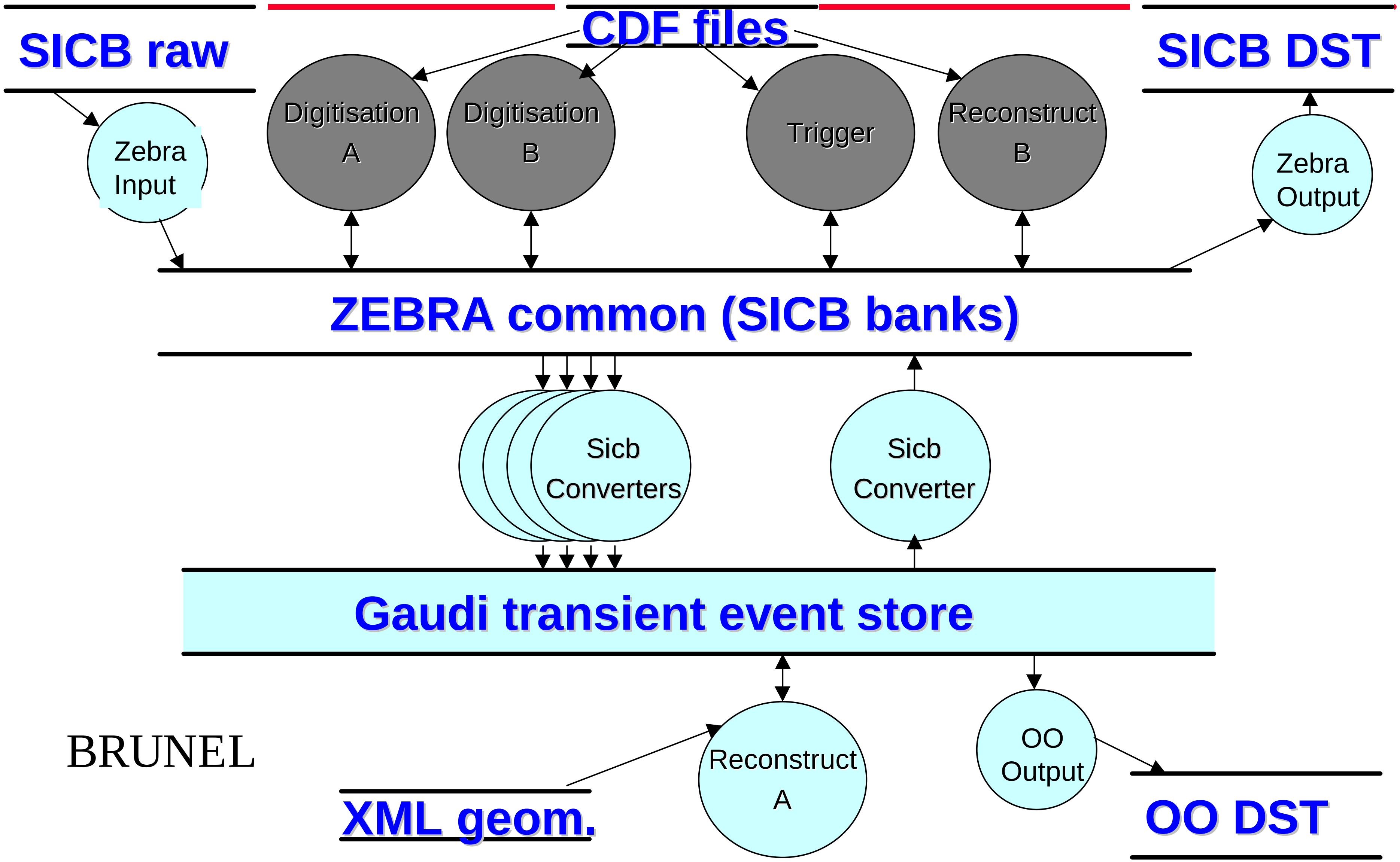
Proposed Strategy - Step 3

- **Start replacing FORTRAN modules with C++ equivalent. Each new piece consists of:**
  - event model
  - detector description
  - algorithm.
- **Provide converters to:**
  - regenerate same SICB output bank that was there before
    - Preserves format of SICB DST
    - DST banks may contain improved data (e.g. Result of tracking pattern recognition
    - Some "added value" of C++ algorithms would NOT be on SICB DST
  - write data out to the supported persistent object manager
    - Contains as complete a reconstructed event as is available in GAUDI event store
    - Including "added value" of C++ algorithms, available only to GAUDI based analyses

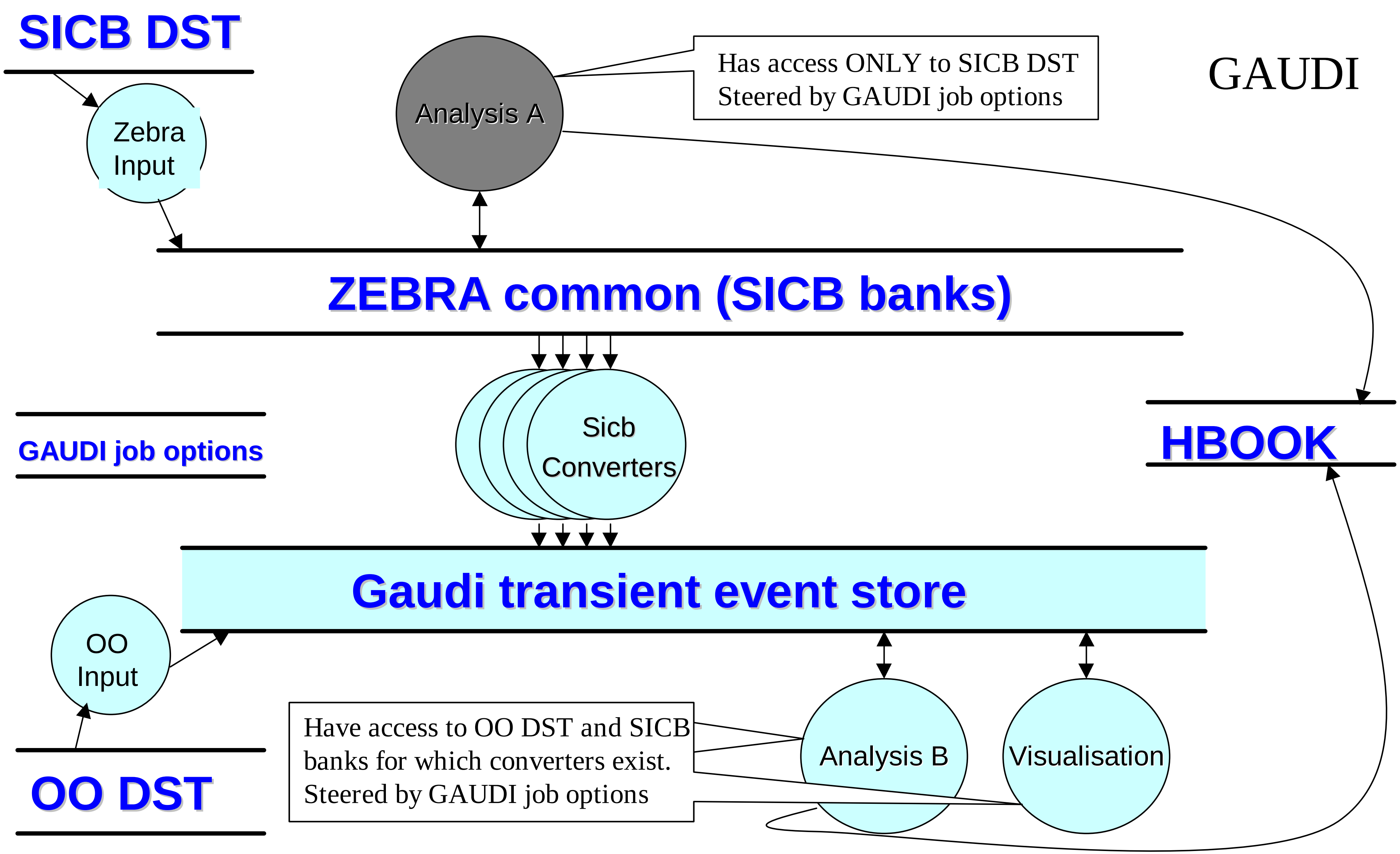
Step 3 - organisation

- **This step implies (for each sub-detector):**
  - Development of event model : help coordinated by Marco
  - Development of detector description : help coordinated by Florence
  - Reviews of evt mod, det desc, algorithms : organised by John.
    - Review panel will include Pere, Marco, Florence, plus SDs
- **Known candidates:**
    - Tracking,
    - Analysis tools,
    - Muon digitisation,
    - Calorimeters,
    - RICH,
    - ...
- **Timescale:**
  - Depends (almost) entirely on sub-detectors

Step 3
BRUNEL structure



Step 3: Analysis structure



Step 3 - benefits

- **A unified development and production environment**
  - As soon as C++ algorithms are proven to do the right thing, they can be brought into production in the official reconstruction program
- **Early exposure of all developers to Gaudi infrastructure**
  - FORTRAN gurus and C++ beginners
- **Increasing functionality of OO 'DST'**
  - As more and more of the event data becomes available in Gaudi, it will become more and more attractive to perform analysis with Gaudi
  - N.B. Contains ALL (and only!) parts of reconstructed event for which data model is defined
- **A smooth transition to a C++ only reconstruction**

Summary

- **Step 1: separate SICBMC and SICBREC**
  - Could be ready by Xmas
- **Step 2: wrap SICBREC algorithms into Gaudi framework**
  - Could be ready by end February
- **Step 3: gradually replace FORTRAN with C++ algorithms**
  - Timescale dictated by sub-detector priorities
  - Development/integration in Gaudi can start now
- **Analysis in Gaudi is possible now**
  - Functionality will increase as subdetectors define their data model
  - Analysis toolkit under development, send requirements to Gloria