ALICE Software Week
TRD status

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On behalf of the TRD working group.

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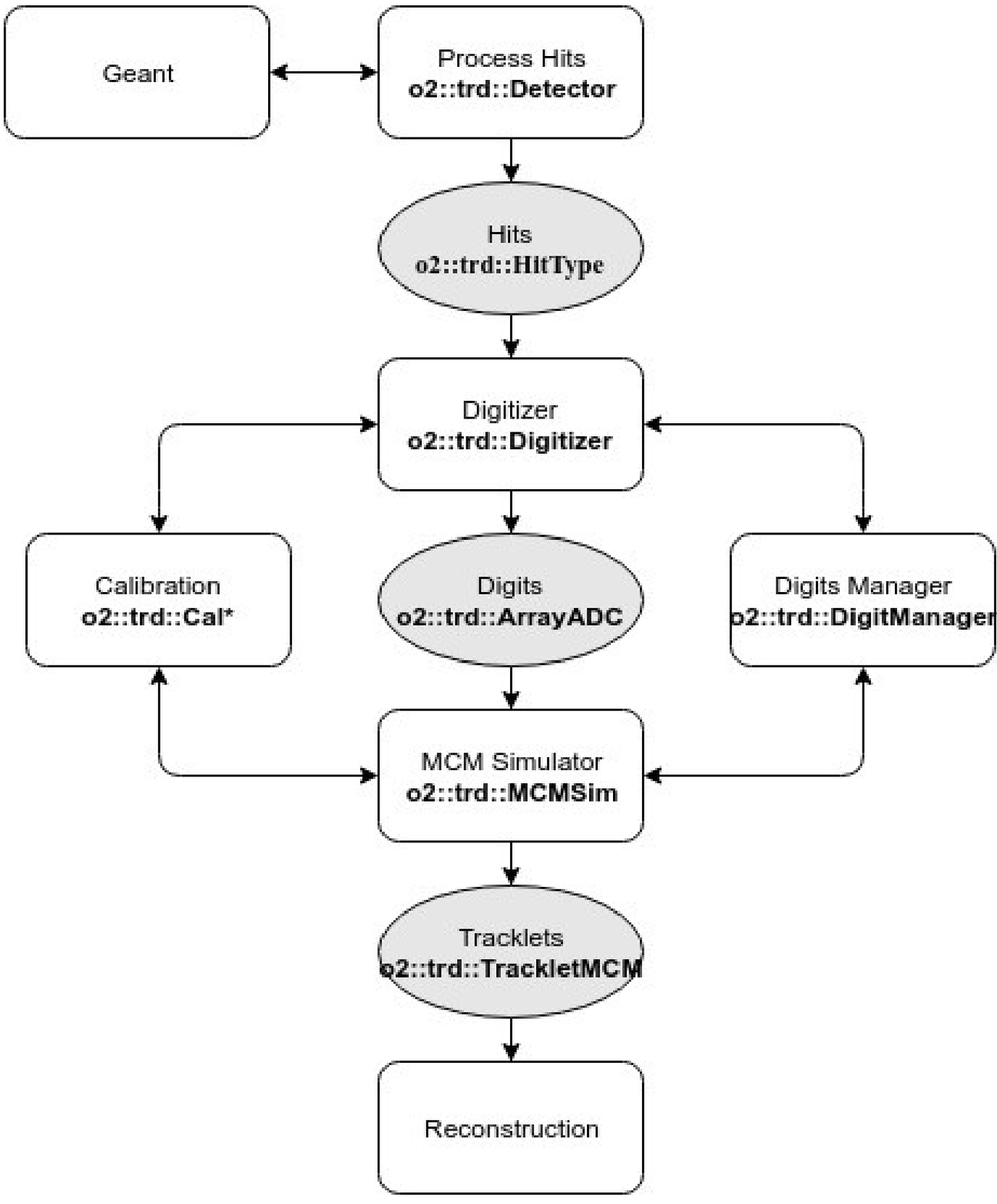
SPES BONA

General outline

- TRD simulation is progressing in several aspects, mostly divided in two:
  - Hits & Digitization
  - Calibration & MCM simulation
- General progress and relevant people visible on JIRA (https://alice.its.cern.ch/jira/browse/O2-449)



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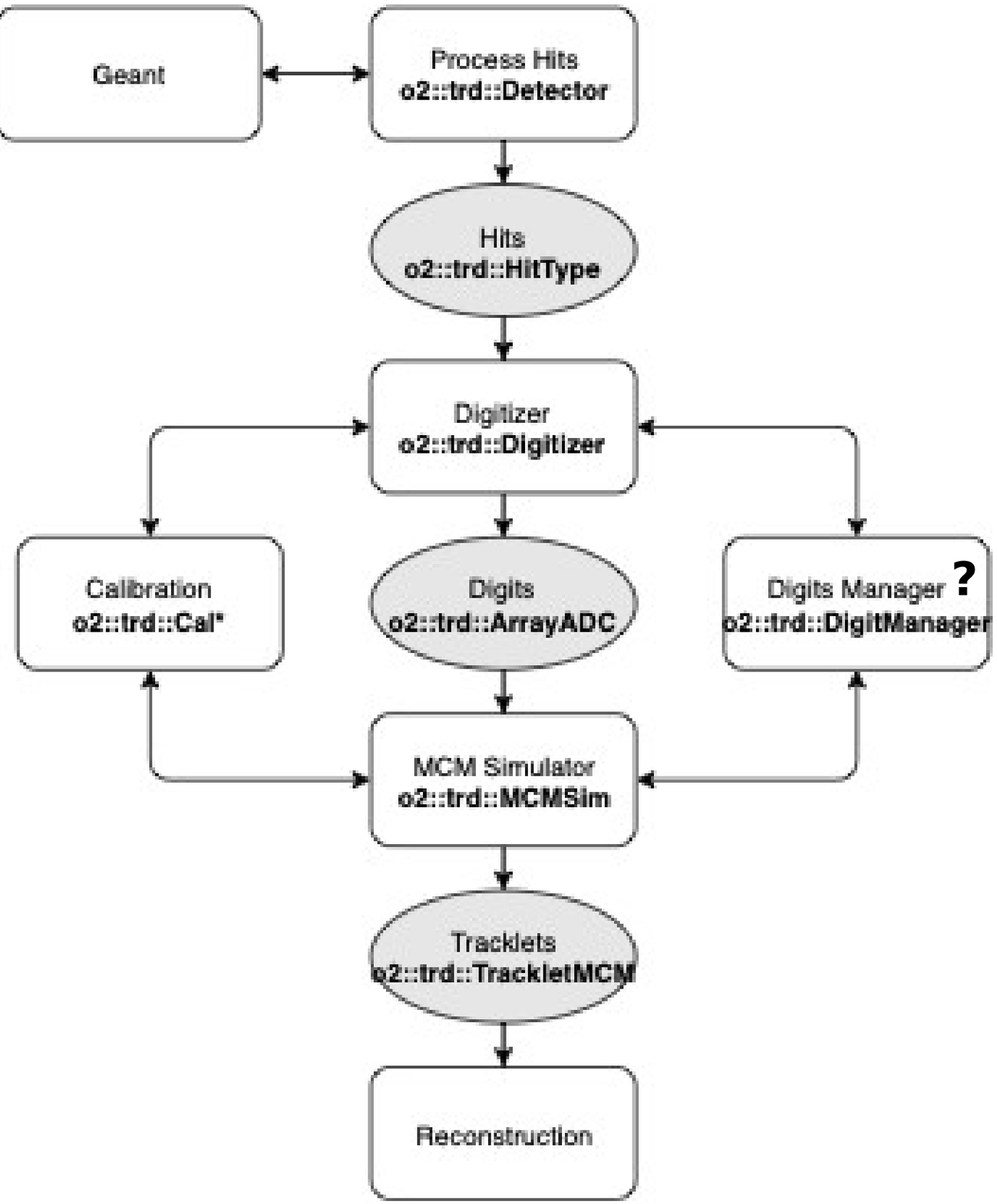


Hits

- Hit generation was based on the work done in AliRoot, primarily:
  - https://github.com/alisw/AliRoot/blob/master/TRD/TRDsim/AliTRDv1.cxx
- Porting of hits creation at the level of AliRoot was completed in pull requests #1643 and #1782 with the addition of hits from transition radiation photons.
- Transition radiation (TR) is not implemented from Geant4 simulation. It is parametrized following the same algorithms used in AliRoot.
  - https://github.com/alisw/AliRoot/blob/master/TRD/TRDsim/AliTRDsimTR.cxx
- Improved TR simulation using new features available in Geant4 will be discussed in O2-454. This will be implemented as soon as possible.
- The current plans is to keep both TR simulation frameworks (parametrized and Geant4).
- Some improvements are expected on the design of the hit type.

Digitization

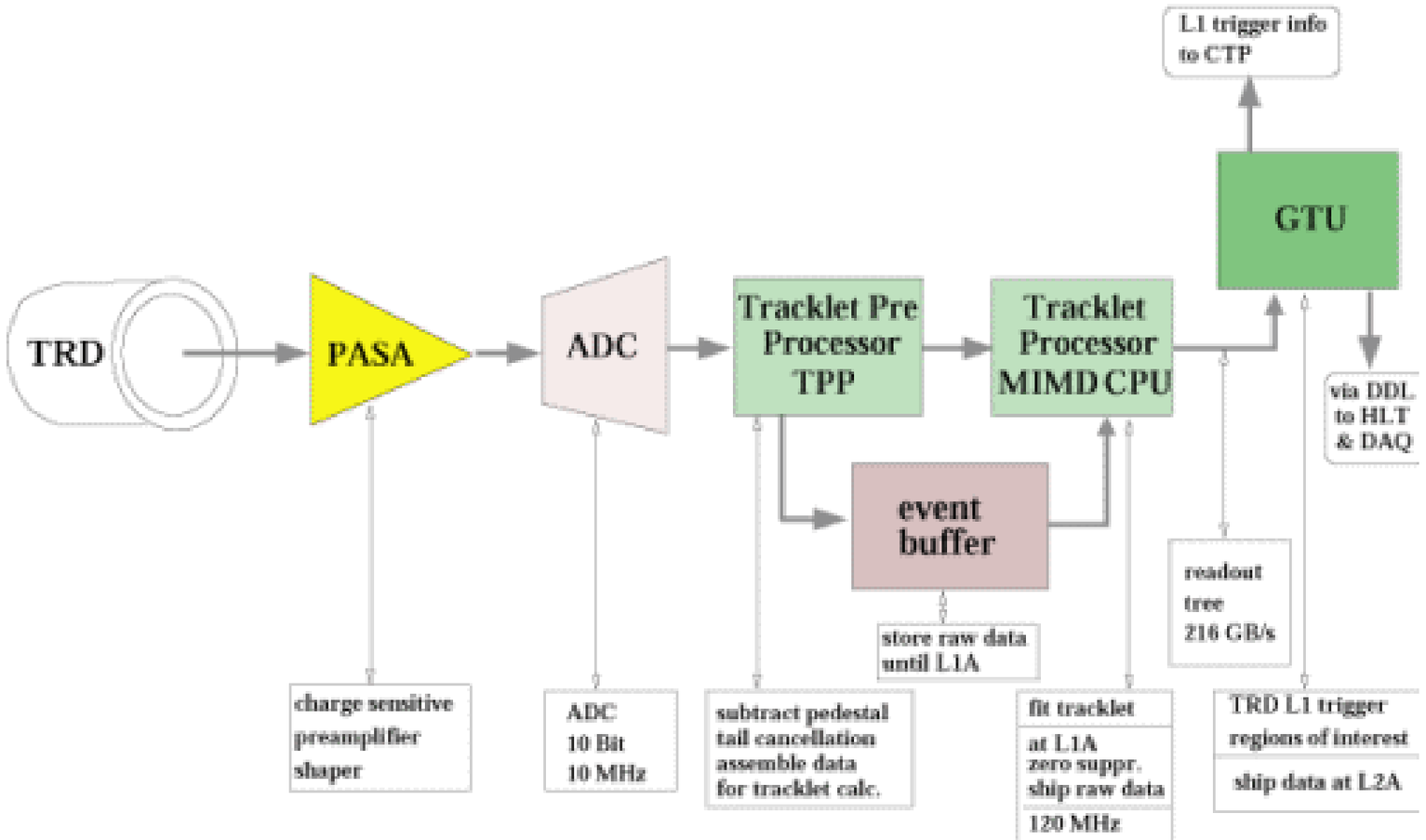
- Digitization algorithms are based also on work done in AliRoot:
  - https://github.com/alisw/AliRoot/blob/master/TRD/TRDsim/AliTRDdigitizer.cxx
- This part does not follow AliRoot very closely, as done with the hit generation.
- Main classes:
  - Digitizer
  - SignalADC, ArrayADC, DigitsManager
  - Several calibration classes (in cross-talk with MCM simulation).
- Digitizer algorithms are almost the same as in AliRoot with changes in places were modernization is allowed for improved efficiency and reliability.
- Digit type (SignalADC and ArrayADC) will have new features which being implemented now to follow the O^2 data flow design and recommendations.
- The digits manager will probably end-up being deprecated.

Underlying TRD storage structure

- TRD depends on an underlying storage structure which has now been ported from the original code, and tested for O^2.
  - https://github.com/AliceO2Group/AliceO2/blob/dev/Detectors/TRD/base/src/TRDArrayADC.cxx
- There are some options for performance improvements for memory usage and speed that will be investigated later, when performance characteristics and usage is more clearly understood.
- We have written some optimizations but decisions on which to apply will be tested when we properly understand the usage characteristics.
- This data structure stores all the 30 time points for all channels in a chamber.
  - Stored as a singular linear array. Although it has 3 dimensions of information.
  - This is then used extensively for most TRD code at each step of reconstruction and simulation.

Multi-chip module simulation

- The Multi-Chip Module (MCM) consists of 18 channels of Pre-Amplifier Shaper, output buffers, a mixed analog/digital ASIC containing 18 channels of ADCs, Tracklet PreProcessor and Event Buffers and then 4 CPUs to process 4 tracklets in parallel for all channels.



Multi-chip module simulation

- The Multi-chip module (MCM) needs to be simulated for TRD simulations, as TRD raw format is tracklets produced by the MCM.
- The MCM simulator has been ported and is being tested, it is critical that it gives the same results as before.
  - https://github.com/bazinski/AliceO2/blob/trd_hits/Detectors/TRD/base/src/MCMSim.cxx
- Pending successful tests upcoming.
- The FairMQ Device is now about 80% complete for MCM to go into the DPL. This will happen before the end of this month.

Calibration

- Most of the calibration classes have been ported across.
  - https://github.com/AliceO2Group/AliceO2/pull/1596
- Currently, numbers are defaulted in the constructor pending finalization of the CCDB.
- The caching of calibration information has been rejected and calibration classes will talk directly to CCDB.

Summary

- TRD developments ongoing in all different simulation steps
- Hits & digitization needs finalization.
  - Hits had been tested with reasonable results.
  - Digitizer needs work.
- MCM & calibration:
  - Ongoing, needs to finish FairMQ device finished to go into the DPL

Sub-Tasks

1.	Finish porting of hits from AliRoot to O2	95%	IN PROGRESS	Jorge Lopez
2.	Improved description of transition radiator physics	10%	OPEN	Jorge Lopez
3.	Implement TRD digitization in O2	70%	IN PROGRESS	Jorge Lopez
4.	Port MCM simulator to O2	80%	IN PROGRESS	Sean Murray
5.	re-implement AliTRDarrayADC in O2	80%	IN PROGRESS	Sean Murray

People involved

- Johanna Stachel, Jorge López (Heidelberg)
- Thomas Dietel, Sean Murray (Cape Town)
- Sandro Wenzel, Ruben Shahoyan (CERN)