A Summary of Changes Made for Digitized MC Trigger

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Introduction

Particulars of Changes in Code

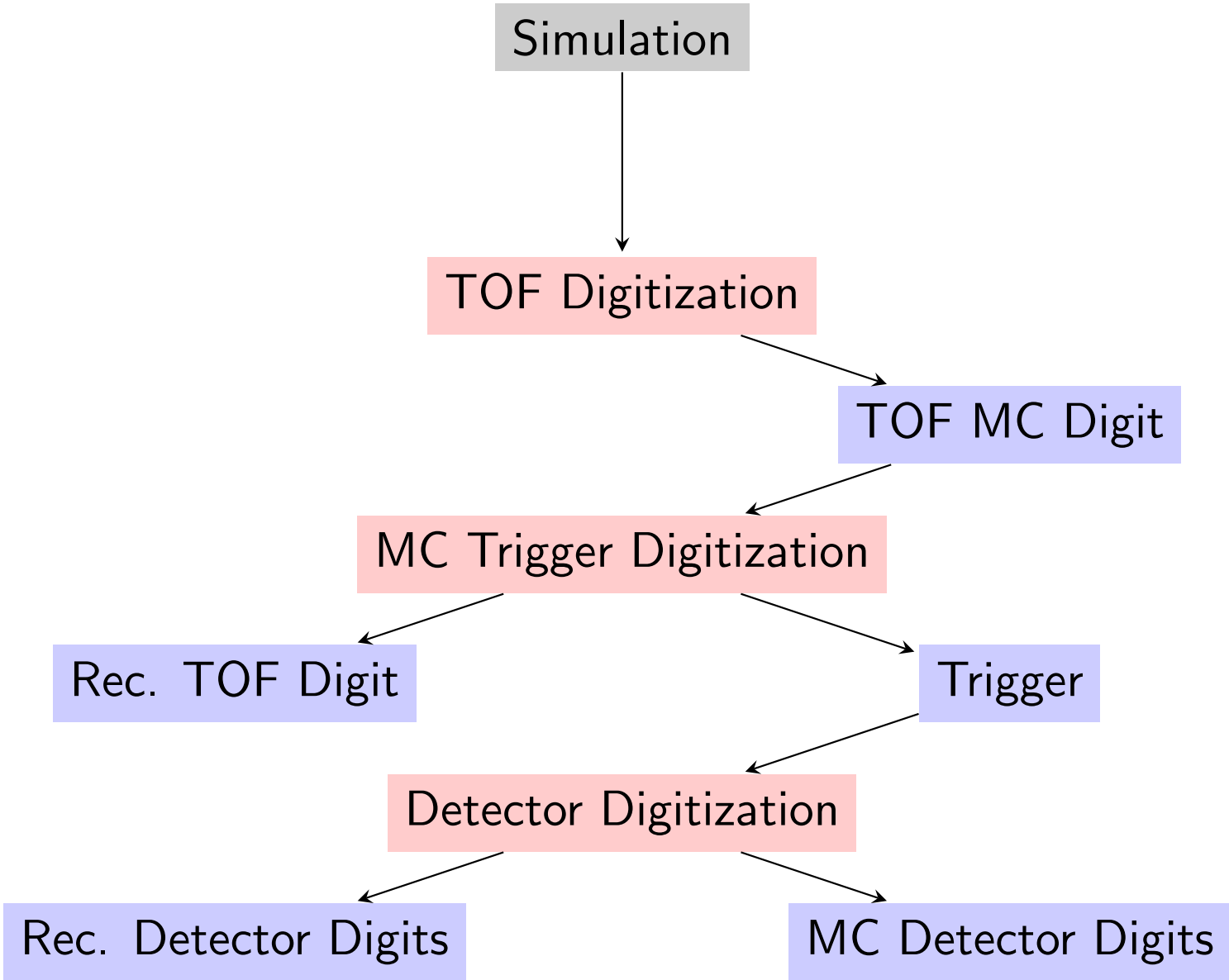
Pseudo Code for MCTrigger Digitizaton

Conclusions

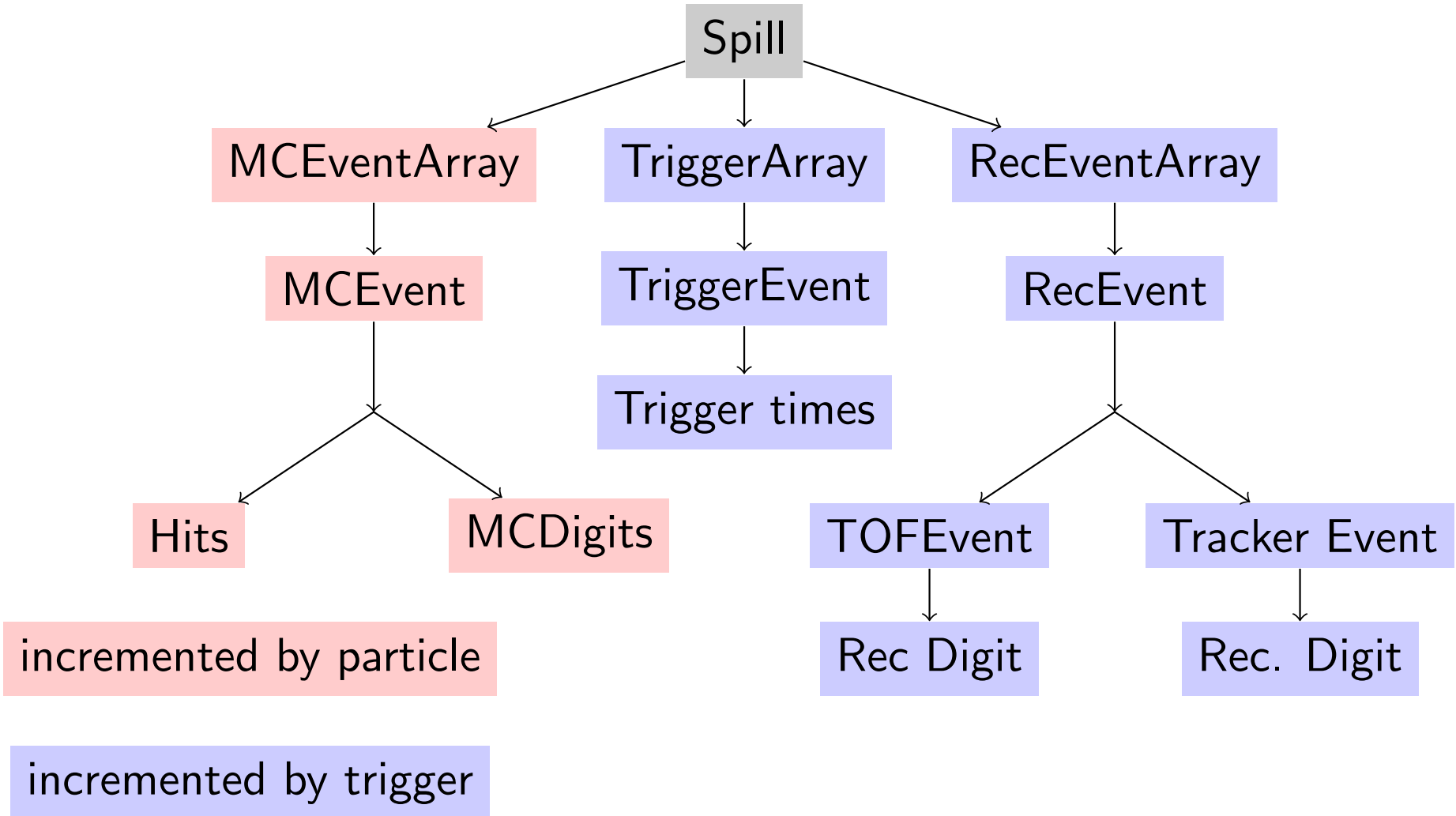
Requirements of Digitized MC Trigger

- Introduce configurable simulated trigger into simulation
  - Read a combination of TOFs into algorithm as a string
  - Trigger string to be recorded in CDB
- Possibility for multi-particle pileup
- Include effects due to instrumentation and electronics
  - Define a trigger window
  - Following dead time for event
  - Information to be stored in CDB
- Require an agnostic output

Proposed Code Structure



Altered MAUS Data Structure



New and Altered Files in MAUS Data Structure

MC events data structure

- Added a TOF Digits object to data structure

MC Trigger data structure

- Completely new
- Meant to coordinate the particle incremented (MC) and trigger incremented (recon) branches of data structure
- Contains lists of MC particle indices and event timing offsets for each event trigger

Pseudo-Code for MapMCTriggerDigi::Process

- Read in Json document

Loop over all particles in spill

- if only single particles are considered
  - if there is a Single Particle Trigger
    - Correct times in digits based on trigger time
    - increment particle by one
- otherwise if pileup is included
  - if there is a Trigger with Pileup
    - Correct times in digits based on the trigger time for affected events
    - increment particles by number in trigger.
    - increment number of triggers by one.

Single Particle Trigger

Check for potential triggers

- is "TOF*n*" in the trigger config?
- if so, are there tof_digits associated with "TOF*n*"?
- if not, there is no trigger. Proceed to next particle.
- if so, use the latest TOF to set trigger time (?).

Determine Trigger Time

- Loop over all TOF digits associated with latest trigger TOF.
  - Find the minimum digitized "leading_time".
- Minimum time is designated as the trigger time
- trigger time pushed to "pileup offset" (even though there is no pileup).
- particle pushed to "particles in Event" (which always has a size=1).

Pileup Trigger

Check for potential triggers

- as in Single Particle case
- particle pushed to “particles in Event”.

Find the trigger time

- Also the same as in single particle case
- Correct the primary time of particle by the trigger time.
- corrected trigger time pushed to “pileup offset”

Look for subsequent events in trigger window

- loop over subsequent particles in spill
  - If corrected time of particle is less than trigger window add the particle to event
    - particle pushed to "particles in Event"
    - corrected time pushed to "pileup offset"
  - If corrected time falls into trailing time move to next particle
  - If corrected time outside window + trailing time event ends.

Correct Digit Times

Loop over all particles in event

- increment the "pileup offset" time with particles in event
- loop over all TOF detectors
  - Loop over all hits in TOF
    - make a copy of the TOF digit
    - correct the TOF digit leading using the trigger time
  - Copy corrected TOF digits into reconstructed event
- Store particle IDs associated with event in "mctrigger_event"
- Store "pileup offset" times in "mctrigger_event"

Status of Code

- Code has been written.
- Code under version control — on launchpad under "~ryan-bayes/maus/devel".
- Compilation of all affected files are successful.
- Still need to interface with CDB and Configure.