An(other) Overlay Processor in Marlin

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Problem

- overlay beam background events to an physics event
  - ↪ for a random position of the 'physics event BX' in BX train
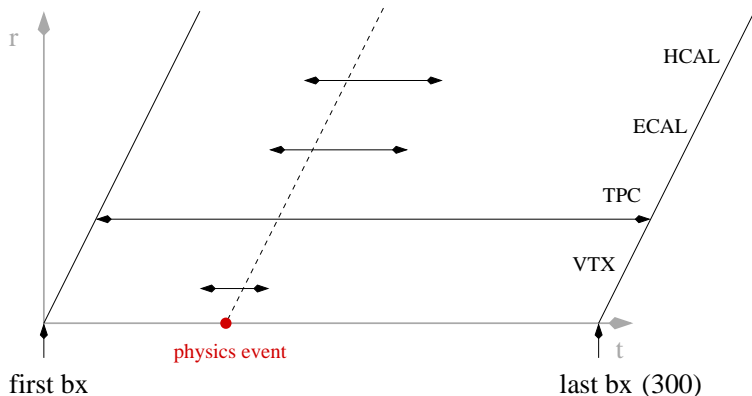 - ↪ respecting the integration times of the sub detectors

Time Handling

- assumptions:
  - ↪ each sub detector has specific integration time Δt_i
  - ↪ each sub detector is read out $t_{\text{train}}/\Delta t_i$ times

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HCAL

ECAL

TPC

VTX

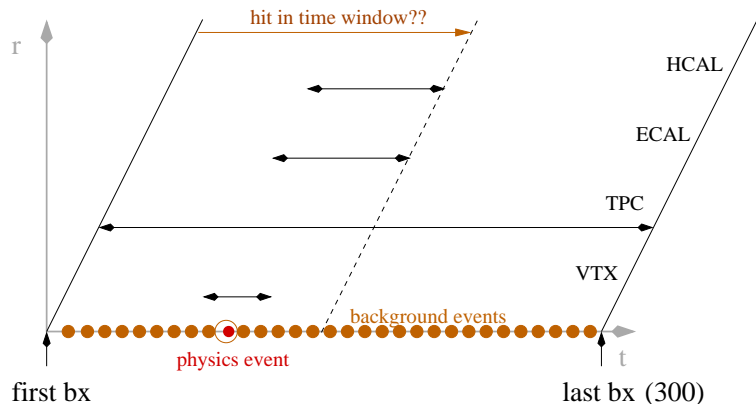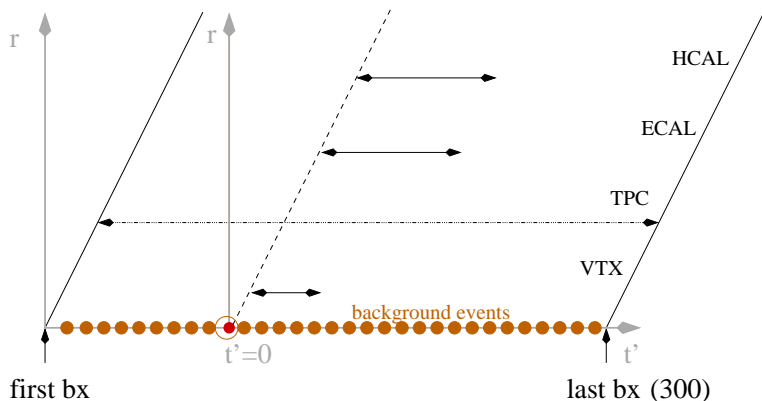physics event

t

first bx

last bx (300)
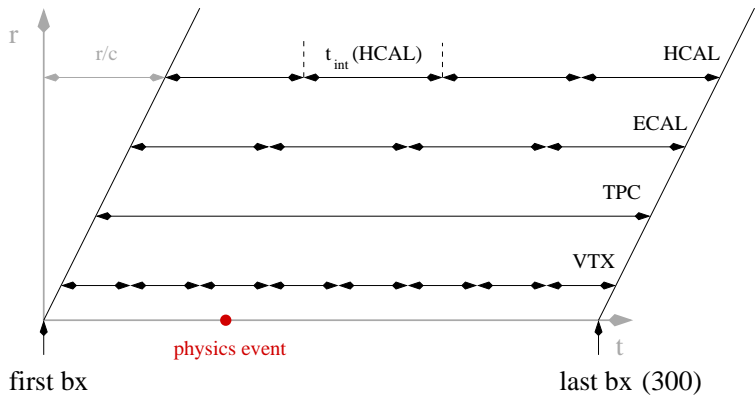
Time Handling

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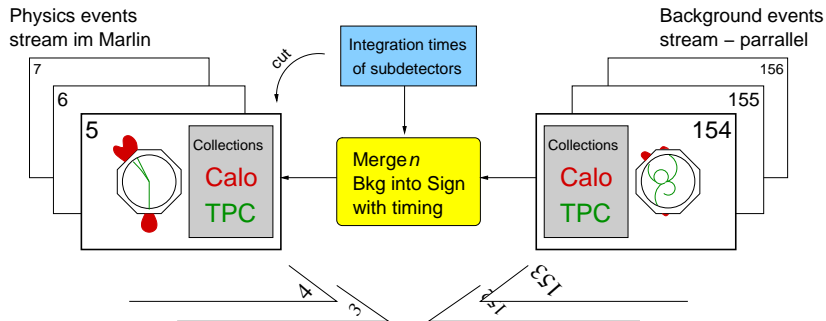
Time Handling

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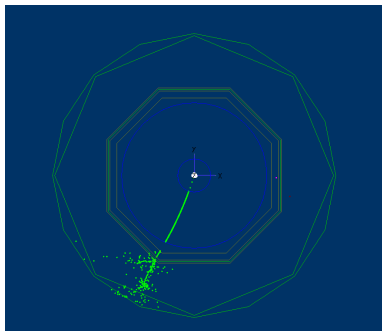- set physics event at $t' = 0$ and overlay 'one integration time'

Overlay Processor

- for each physics event, dice a position in bunch train
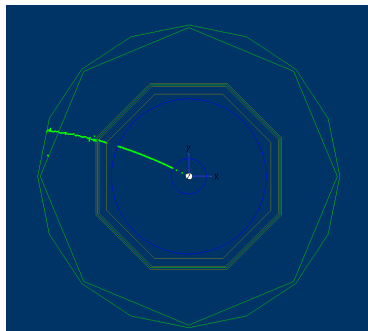- overlay *nBunchtrain* events form the background stream

Example: Signal and background separated

- simulated in Mokka:
  - ↪ one single pion event as signal
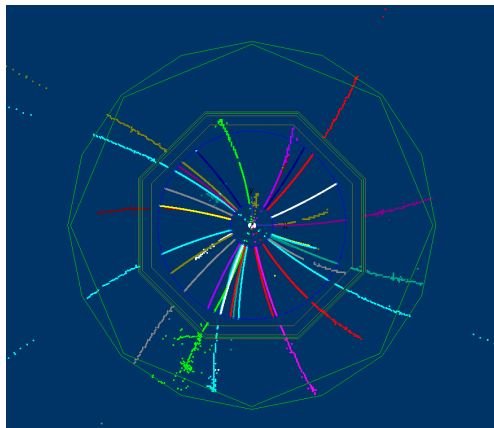 - ↪ many muons events as background

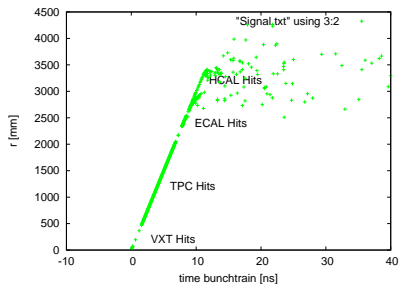signal   background

Example: Signal and background overlayed

- assumed: bunch train with 40 BXs
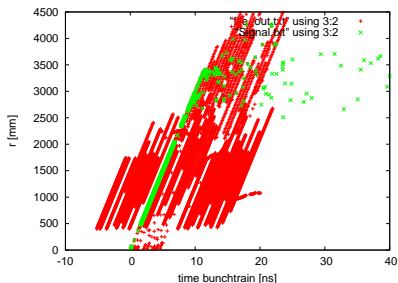- physics event in BX 13

Example: Overlay timing structure

- integration times:
  - $\hookrightarrow$ TPC: full train – VDX: 5 ns – ECAL: 10 ns – HCAL: 10 ns
  - $\hookrightarrow$ timing: physics event per def. set to BX time 0

Example: Overlay timing structure

- integration times:
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  - ↪ timing: physics event per def. set to BX time 0

- physics event was put into the 13th bunch crossing
  - ↪ bunch train starts at $t_{\text{start}} = -13 \times 0.5\,\text{ns} = -6.5\,\text{ns}$

Problem: TPC Hits

- at the moment:
  - $\rightarrow$ total bunch train of TPC hits overlayed – with drift
  - $\hookrightarrow$ probably too pessimistic
- problem:
  - $\rightarrow$ overlayed tracks of later Bxs get $z < 0$
- if time stamping with the TPC is possible
  - $\rightarrow$ overlay 5 events, two before, two after physics event
  - $\rightarrow$ all tracks unshifted in space

Outlook

- Overlay Marlin Processor in the making
  - ↪ overlaying already works in principle
  - ↪ need testing
- comparison between Christian's and Peter's processors to do
- merge with existing software ??