Synchronizing event fragments for GSI 2021 and CNAO 2022 campaigns

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18/01/2023

Event building phase during DAQ

Each detector provides a data fragment containing (if possible):

- Progressive event number (software number)
- Time stamp with microsecond accuracy
- Progressive trigger number (hardware number)

Event building is a strict sequential procedure:

- Data fragments are assumed to arrive in a time sorted ordering
- FIFO logic for fragment association in events
- No or limited checks are done on the fragment themselves

What can go wrong:

- A detector can miss a trigger
- A detector can see a spurius trigger
- A detector can receive a wrong time information
- (Time stamp reset or time stamp clock)

Offline we can check….
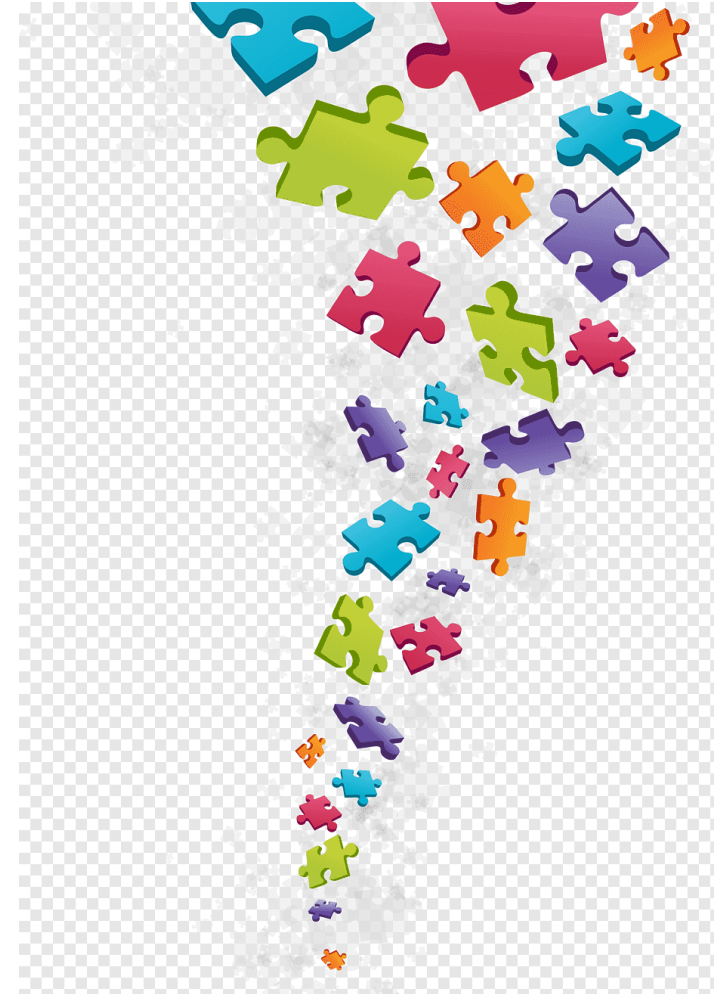
Synchronizer code

A specific code has been written to:

- Check the internal consistency of an event

- ensure:
    - that the event is complete (no missing trigger)
    - that basic information is present
    - that all the time stamps are equal (or within a given tolerance)

In case of misalignments:

- Events are rebuilt looking at the time-stamp only

- RAW data files can be written with complete and time-aligned fragments

- Uncomplete events are discarded

GSI2021 and CNAO2022 campaigns

- What went wrong? Ask Murphy and his famous law!

- VTX: «occasional» missing a trigger. Probability $10^{-5} – 10^{-3}$ per event depending on rate
- VTX @ GSI2021: a buffer overflow has been observed rarely ($10^{-4} – 10^{-2}$). It might give more background in single events

- WD: «occasional» missing data: event and trigger counters skip this event
  - Frequently this happens at the first event (e.g. 4306, 4308, 4309….)

- WD: Two runs with heavily compromised data (4285, 4325)

- MSD: in one run the TimeStamp has been reset in the middle of the run (4258)

- In few others MSD experienced a missing trigger (e.g. 4249)

GSI2021 and CNAO2022 campaigns

- The full statistics has been processed

- New RAW files with coherent data have been produced and are available at the Tier 3 farm

- Curently running SHOE to test the quality of the new data
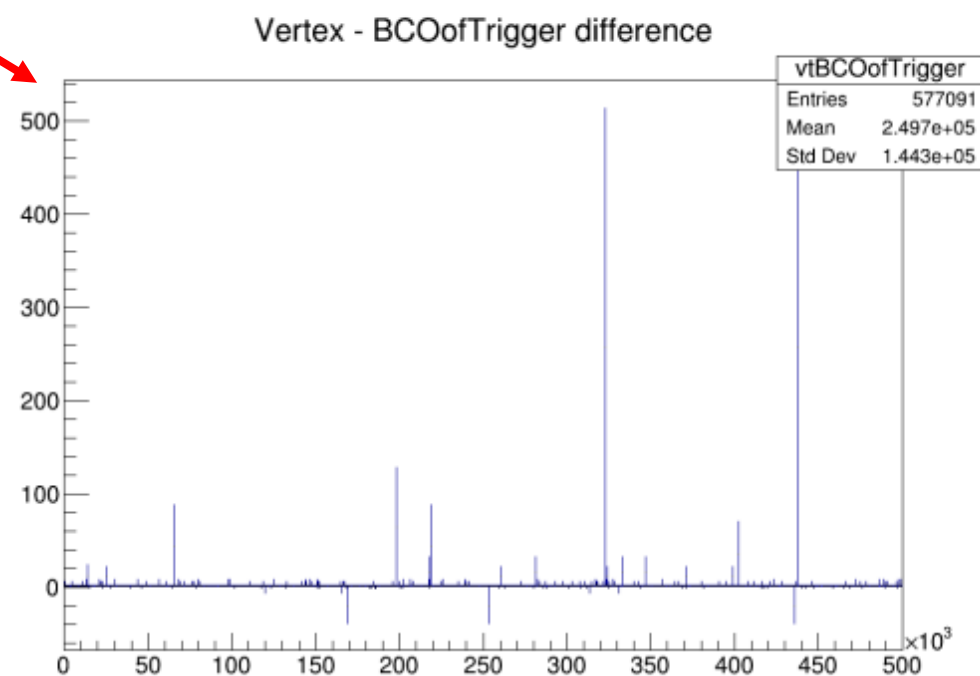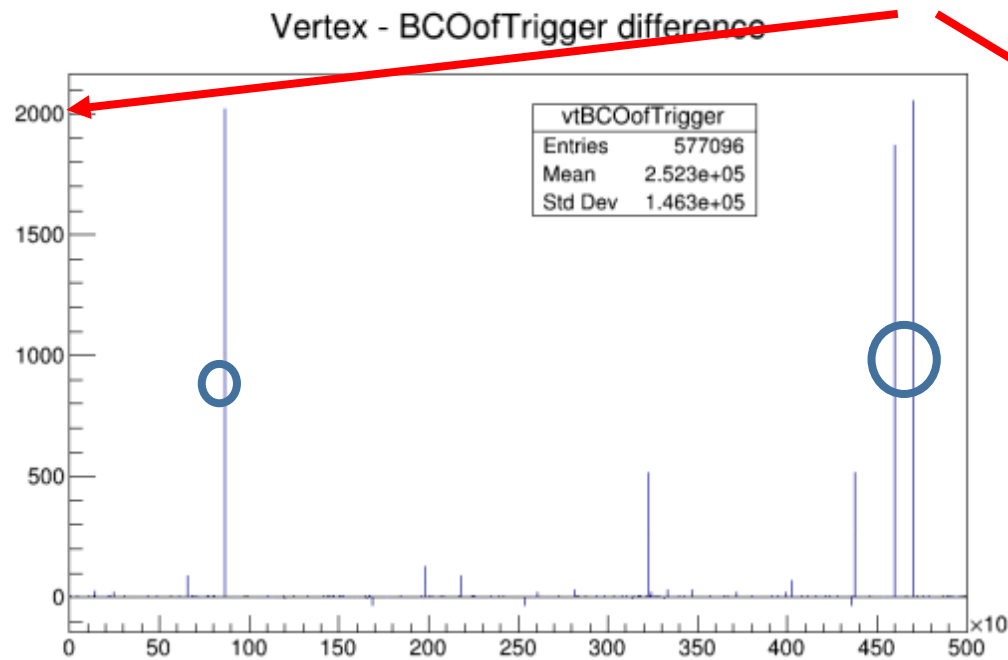 - → see G. Ubaldi slides in the following

VTX – BCO of Trigger difference

Unsynched Dataset vs Synched Dataset

RUN 4306: MB; 5 events lost

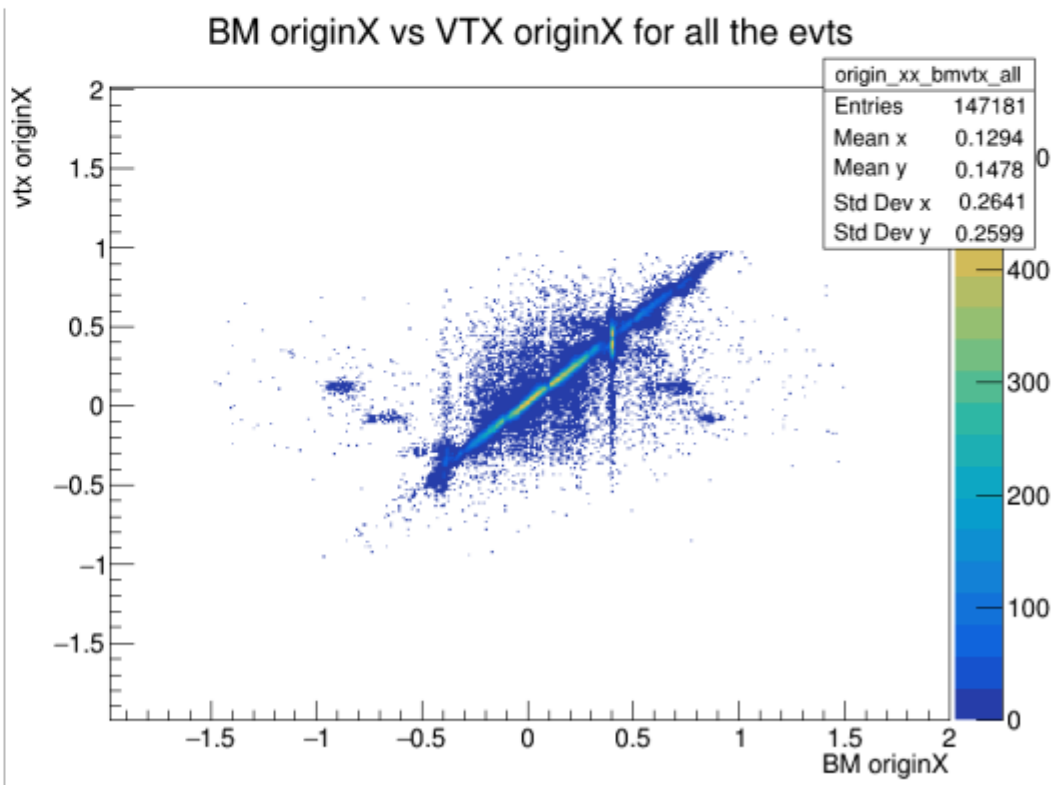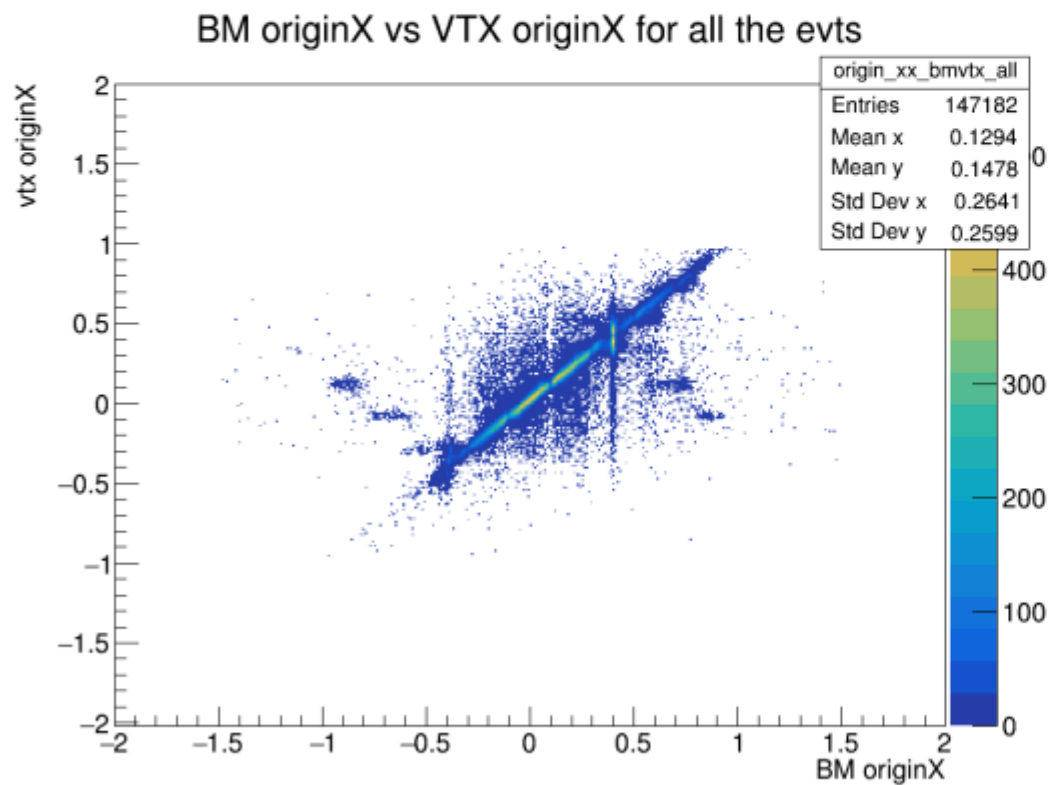
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BM vs VTX origin X - correlation

Unsynched Dataset   vs   Synched Dataset
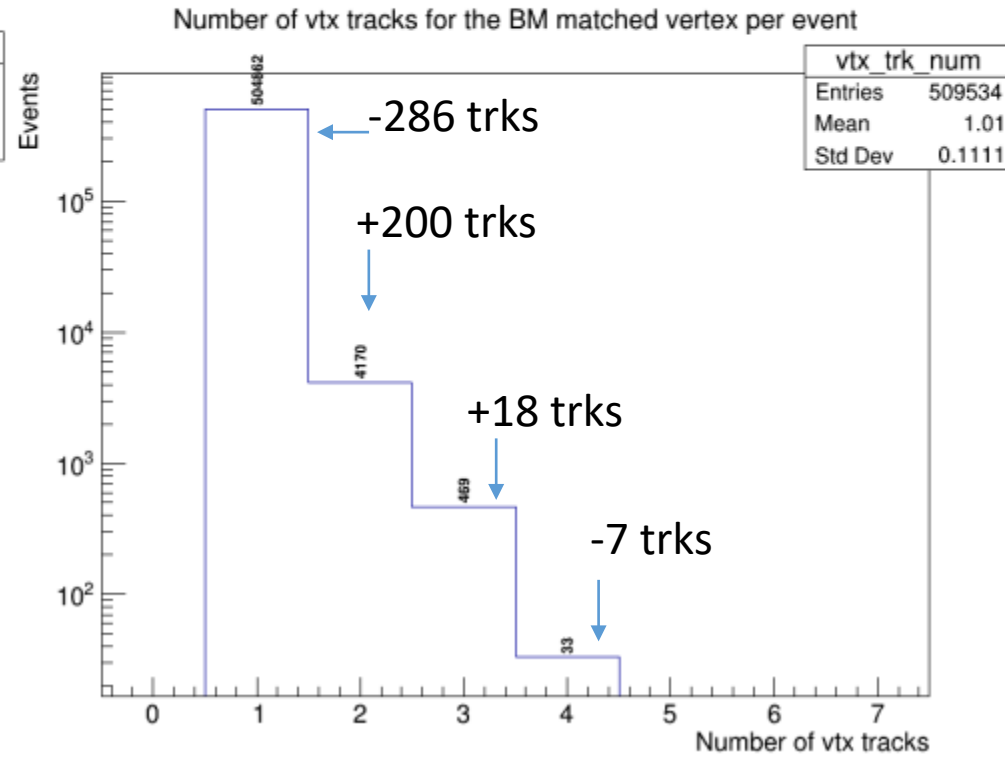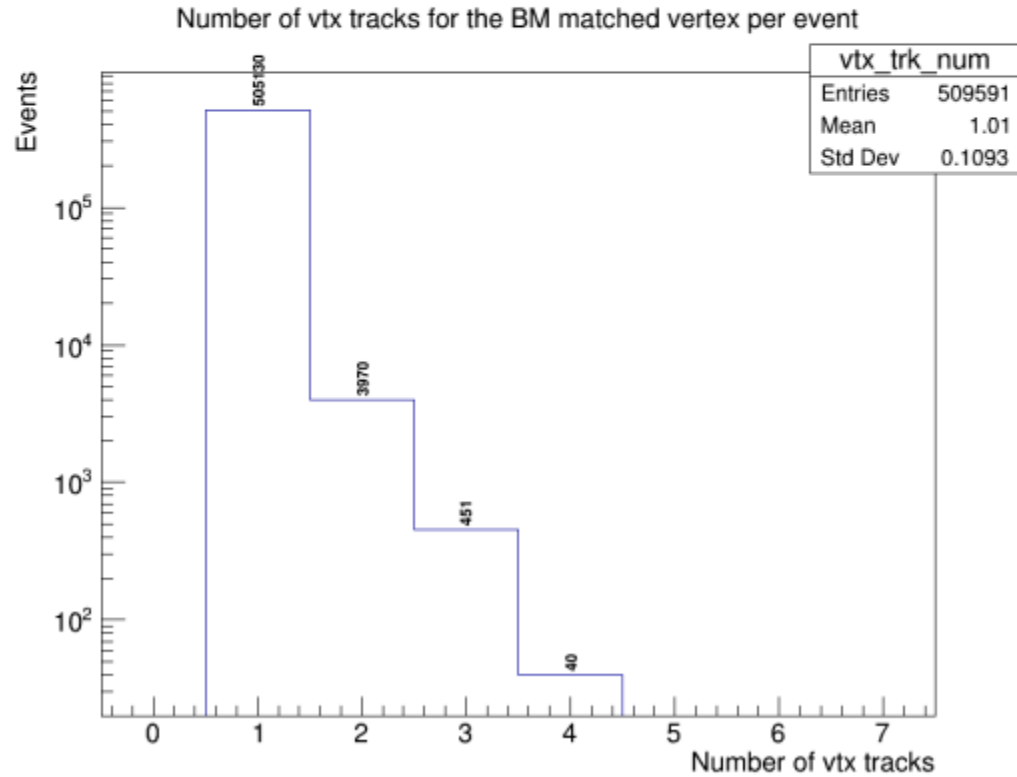
No SHOE retuning

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N° of VT tracklets matched with BM per event

Unsynched Dataset **vs** Synched Dataset