GSI Aftermath:

a TDAQ account

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Outline

- Runs
- GSI integration experience
  - What worked
  - What needs improvements
    for DAQ-WD and DAQ-VTX integration
- DAQ-WD interface
- DAQ-VTX interface
- Offline event building
- Next steps

Runs

- 14 in total for 504 MB (daq) + 223 MB(vtx)+8726 MB (wd):
- 7 April – no target – first DAQ runs with beams – changing detector conditions…
  - 2197 (BM only), 2199 (BM, VTX), 2200 (BM, VTX),
  - tests: 2202 (BM, WD, VTX), 2203 (BM, WD), 2204 (BM, WD,), 2205 (BM, WD, fragm. Trigger),
  - All good, no target, VTX thresholds low, BM HV nominal: 2210, 2211, 2212 (+2209 no beam, 58k)
- 8 April – BM HV & TOF scans
  - BM HV scans, with target & high VTX threholds: 2239, 2240, 2241
  - TOF scan: 2242

GSI integration experience

- These lists show the TDAQ point of view (not the data content)
- What worked without problems:
  - Beam Monitor (VME boards only; not a single DAQ problem; all information stored; all thresholds stored). But… no HV in DB!
  - Network: everybody was able to have a cable connection.
  - Storage: too few data taken – good runs in less than 50 GB!
  - DAQ and detectors in standalone manner…..

What needs improvements

- Trigger configuration: fixed at GSI; too much workload on the shifter
- WD and VTX starting procedures: needs to be automatic
- Several minor details at the TDAQ level: all meant to reduce shifter workload or to have automatic data, configuration and counters savings
- Online monitoring and warnings

DAQ-WD interface problems - 1

- BCO start, timestamp start

  (used for event synchronization);

  WD starts early;

  TDAQ sends two BCOReset:

  WD uses the first, trigger module uses the second

  (BTW: too few bits in the BCO#)

- Trigger start;
  - WD provides first triggers before the actual run start (between the first and the second BCOReset)
  - Cured with changes in the V2495 firmware

DAQ-WD interface problems - 2

- WD event losses
  - Examples from run 2212 – 116 k events for daq:
    - WD evt 0 not matchable
    - WD evt 1-12350 matched with daq 0-12349
    - From WD evt 12350-41367 one every three WD events is not written out (hw trig # jumps)
    - No more data after WD evt 41367, hw trig 51948 (daq has 64k more events)
  - Same pattern in other runs: ONE unmatchable event at the beginning, ~10k perfect, then 1 over three lost, stop recording at some point

DAQ-WD interface successes

- Except for the begin, all WD triggers are correctly handled by the DAQ (no losses), the busy logic works ok,
- BCO timing difference are OK (all matches within +-1 us)

- Partial conclusion:
  - Once solved for start-of-run problems and event losses (need a SSD), the events can be built online reliably and automatically.

  - Joint work already planned (june?)

DAQ-VTX interface problems - 1

- Integration done only at GSI – not ideal…
- Busy from vertex missing; decided for a fixed busy lenght (about 2-3 us) costing us a DAQ rate of 300 Hz

- BCO not forwarded to VTX
  - - > problems in event building
  - -> Timestamp candidates:
    - framecounter (185 us period)
    - internal clock value (0.5 us period)
- VTX is missing triggers (run dependent)

DAQ-VTX interface problems - 2

- Basically all variables that can be used for event building are NOT reliable:
  - HW triggers restarts after the first 100-200 event (approx 11 s VTX black-out)
  - Sequential events with the same frame counter value have been observed
  - Clearly wrong frame counter values
  - Out of sequence internal clock values and/or frame counters
  - Buggy HW trigger counters (rare)
  - Wrong event-internal clock value association (constantly off by 1 event)

DAQ-VTX interface problems - 3

- Observed VTX freezing:
  - About 11 s long, always after 100-250 events from the start, consistently on all runs and implying an hw trigger reset
  - Can happen also during runs and without hw trigger reset (e.g.: run 2212, VTX evts 39450-39451 matched with 40975 and 41248, 930 ms apart)

DAQ-VTX interface successes

- 7 april runs
  - Long sequences of events that can be matched (DAQ-VTX), starting from event 0
  - Not many VTX fragment losses (<3%).
- 8 april runs (high vtx threshold)
  - Clearly different from 7 april runs.
  - No matching starts from evt #0
  - LOTS of triggers are lost (busy too short?)

    eg run 2240: 20004 daq evts, 10238 vtx evts (50%), 8749 matches from evt 128 to 19954

Almost all VTX triggered events are recorded (wrt WD, events are small)

Offline Event building matches

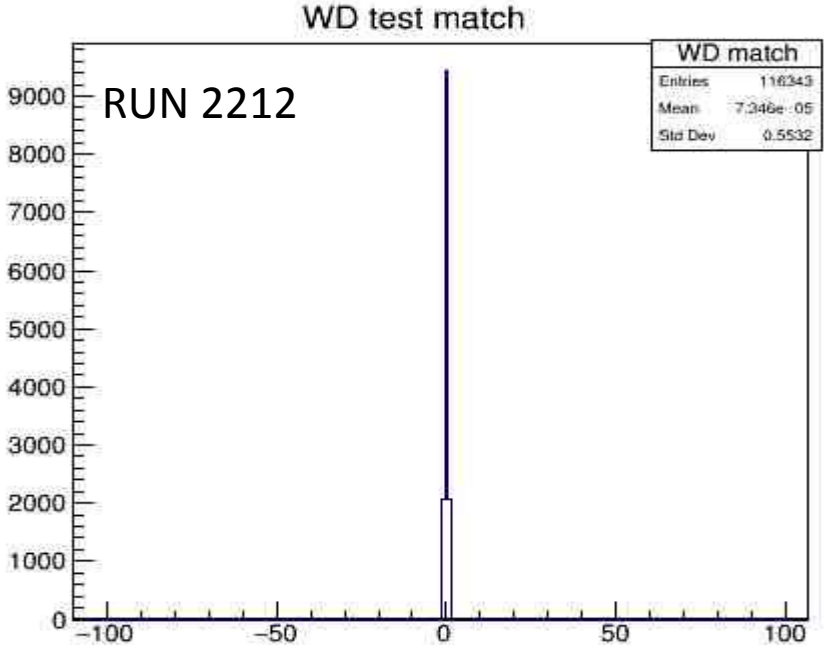
RUN	DAQ EVTs	WD EVTs	VTX Evts	WD matched	VTX Matched	WD&VTX matched
2210	20463	15091	19059	15090	19004	13723
2211	62782	26985	61322	26984	61120	25494
2212	116349	41368	114238	41367	113777	39556
2239	20821	15618	10246	15617	448	342
2240	20004	15370	10238	15369	8749	6560
2241	20041	15235	9777	15234	8348	6174
2242	202729	68078	110721	68077	29458	21572

Note:

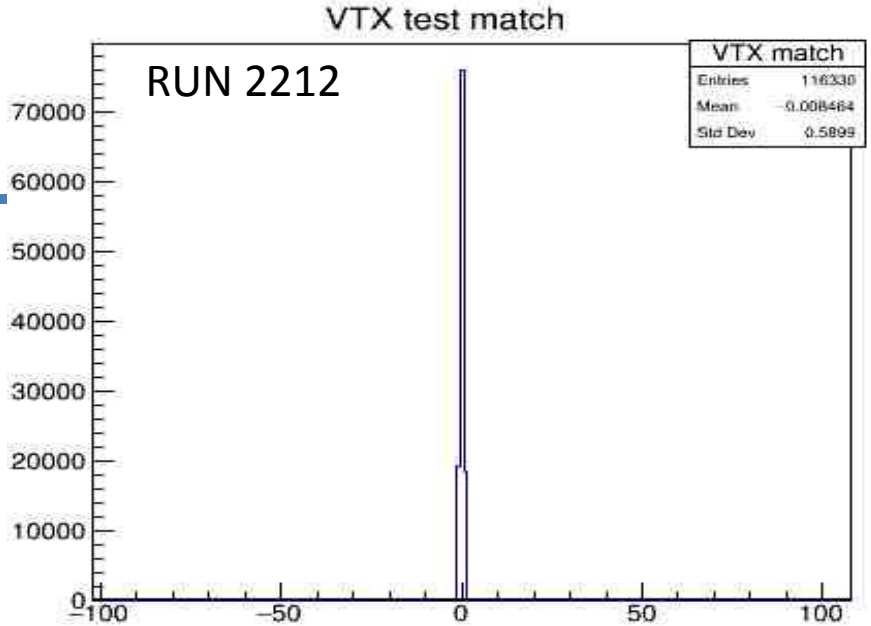
WD – all but first events are matched (in each run)

VTX - **#vtx/#daq ≈ 98% first 3 runs**, #vtx/#daq ≈ 50% last 3 runs,

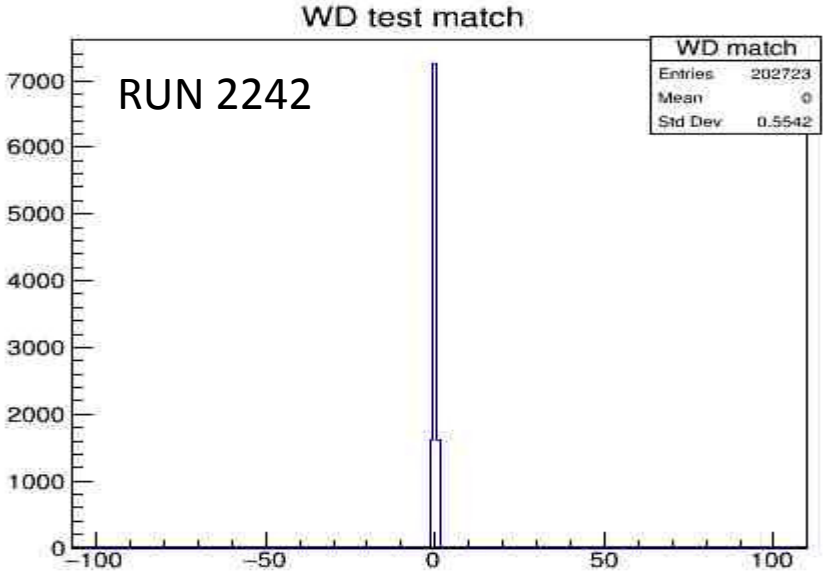
VTX **matches at 99.5% in run 2212**, 85.4% in run 2240, 27% in run 2242



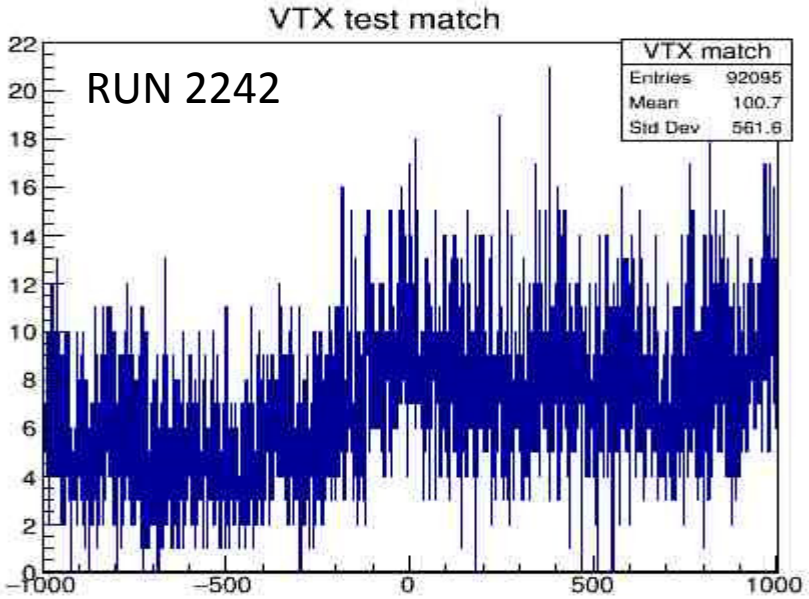
BCO difference: WD-DAQ



BCOlike difference: VTX-DAQ



BCO difference: WD-DAQ



BCOlike difference: VTX-DAQ

Conclusions

- Several problems have been observed at GSI – and can be observed only with real detectors (simulations are not enough) and enough time
- WD seems working in a reproducible manner -> a path to fix all problems has been already drafted
- VTX shows different behaviour in different days/runs. We need to study and understand all the (TDAQ) problems
- For now: we have 7 runs with all detectors in it (3 looks good). It's time to play with **Shoe !** and to see what is inside the data

The end

DAQ-WD matches in run 2212

DAQ				WD				
Evt	HWT	BCO	BCODIFF	EV	HW	BCO	BCODIFF1	BCODIFF2
				0	1	63376	63377	128912
0	0	33393	33394	1	2	**2308**	4294906228	4467
1	1	35768	2375	2	3	4682	2374	2374
2	2	1422810	1387042	3	4	**15468**	10786	10786
3	3	1439408	16598	4	5	32067	16599	16599
4	4	1448413	9005	5	6	41071	9004	9004
5	5	1451440	3027	6	7	44099	3028	3028
6	6	1458024	6584	7	8	50682	6583	6583
7	7	1466418	8394	8	9	59076	8394	8394
8	8	1481037	14619	9	10	**8160**	4294916380	14619
9	9	1486616	5579	10	11	13739	5579	5579
10	10	1491839	5223	11	12	18962	5223	5223