

# DAQ Status of COMPASS and AMBER Experiments

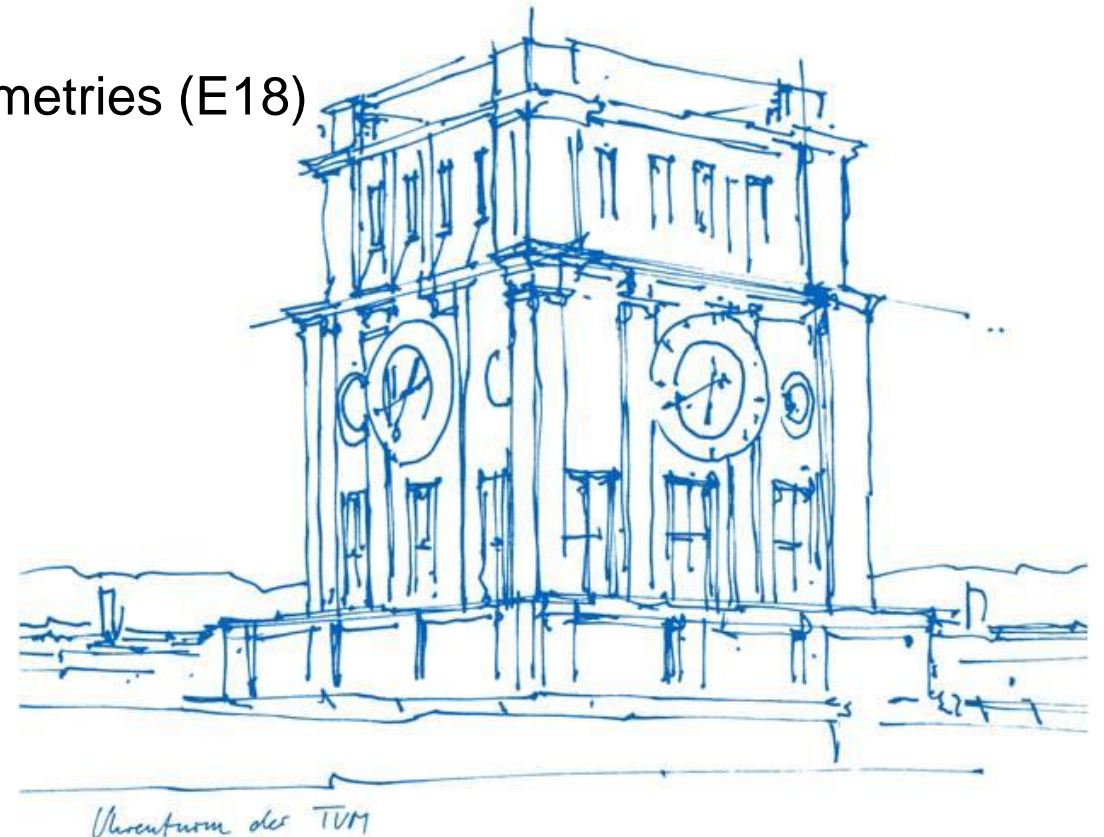
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TUM Department of Physics

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Online Meeting, 08-th February 2022



# COMPASS DAQ Status

- DAQ modifications after 2021 run
  - DAQ structure was switched to AMBER pilot run
  - Some fiber connections were reallocated
  - BMS CATCHs attached to NA64 DAQ, will be moved back after NA64 run
- MWPC PA05 equipped with iFTDC FE cards for tests and commissioning
  - First collected data showed high detector noise, operated at 10fC threshold
  - No observation of time crosstalk down to 0.5 us dead time
  - Plan to make full commissioning for 2022 run together with Torino group
  - Installation of missing infrastructure by Torino group: JTAG chain + Raspberry Pi
- New GEM detectors will be installed together with new FE electronics (Bernhard's talk)

# COMPASS DAQ Status

- After AMBER pilot run most of fiber connections were restored, except BMS
- DAQ computers and DAQ Event builder are UP and running
- All VME crates will be switched ON in end of February
- DAQ will be ready for detector commissioning in March
- Standalone DAQ is ready for DC05 tests in clean room

# AMBER DAQ

# AMBER DAQ DB

- Data Base On Demand(DBOD), official service provided by CERN
  - Two CERN critical systems started to use this service
  - Fully virtualized environment
  - CERN guaranties continuity, high availability
  - Maintenance : daily backups, automatic failover, replication, updates, monitoring
  - Service free of charge
  - Will be affected by network problems
  
- DAQ and HLT were successfully tested with DBOD
- Data production with CORAL was also successfully tested
  
- We propose to use this service for AMBER

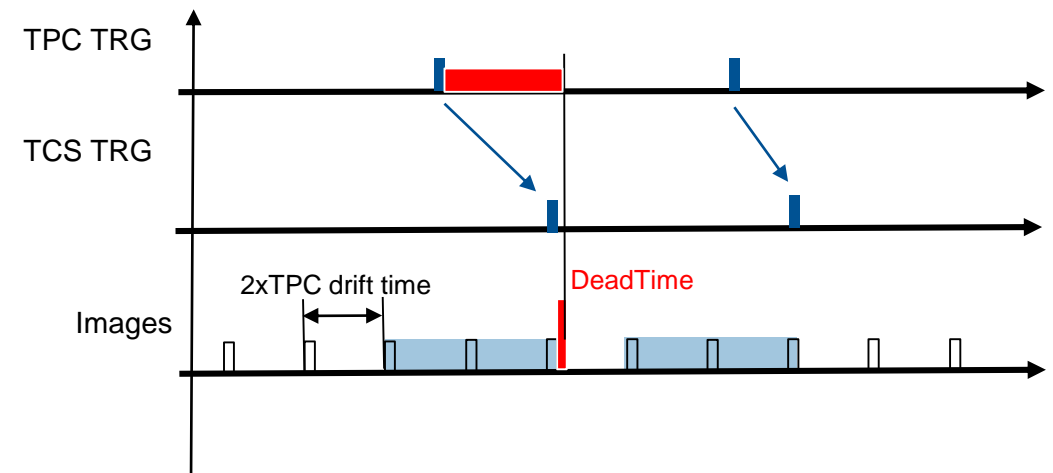
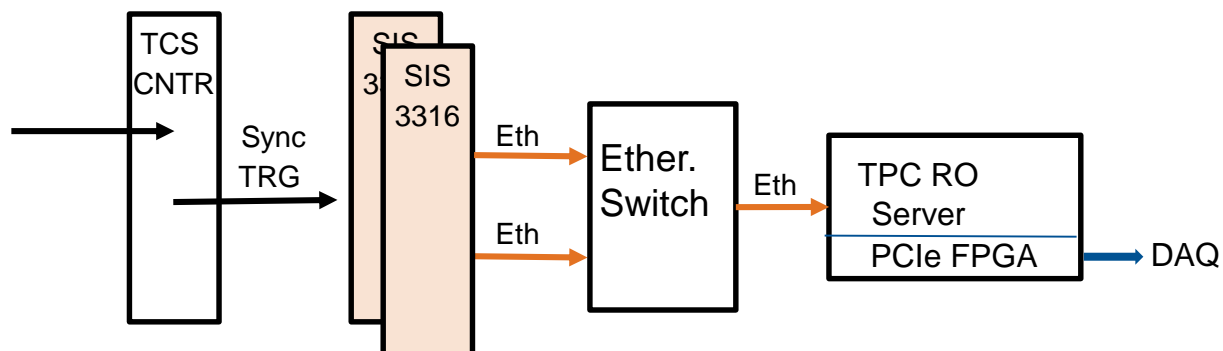
# Integration of TPC Readout in FriDAQ

- TPC is read out by SIS3316 ADC module, 16 channels 14 bits up to 250 MHz
- Trigger driven read out
- Built-in Digital Trigger logic :  $(\text{SUM of 16 channels})/\text{Threshold} \Rightarrow \text{OR of all ADC modules} \Rightarrow \text{Recoil proton trigger}$

## Outcome of meeting with GSI colleagues

Proposal for TPC read out integration in AMBER DAQ

- Oversampling with 77.78 MHz (2xTCS clock), averaging 4 samples will make effectively 19.44 MHz sampling rate
- Use TPC trigger for data reduction



# Current DAQ Activities

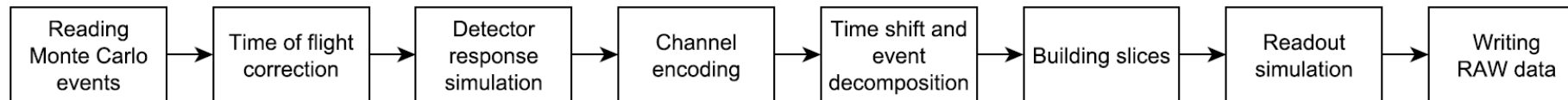
## Setting up DAQ components hardware at CERN

- TCS controller firmware was upgraded to Free running mode and installed at CERN
- 3 Spill buffers and event building are up
- DAQ Hardware tests are going on
- Next steps
  - Combined test of DAQ software with TCS controller + EB switch + Spill Buffers
  - Add iFTDC MUX and iFTDCs

Goal : make operational FriDAQ with iFTDCs by end of March

# HLT Developments

Further development of test environment for HLT:



- Full implementation of SciFi detectors with iFTDC readout to emulate HLT functionality
- T0 calculation
- Evaluate HLT functionality in case of TPC trigger
  - It was not foreseen to trigger on detector with such time uncertainty



# DAQ Man Power

Antonin Kveton has left COMPASS/AMBER, January was his last month in COMPASS.

- Thanks to Antonin for his contribution, it was very important and very valuable ! Great work!
- Prague group is looking for a new student

Martin Zemko's 3 year contract will come to the end in 7 month.

- I have asked Giovanna Lehmann to extend it till end of this year.
- Important to keep Martin for longer time at least for full commissioning of AMBER DAQ

Martin's position at CERN was agreed by Gerhard with EP group for support of COMPASS runs

We shall negotiate with EP group to provide this position for new students as support and development of AMBER DAQ

Stefan Huber will leave TUM in July

**We will face severe problem with AMBER DAQ manpower**

# BACKUP Slides

# Complications of COMPASS and AMBER DAQ Interleaved Operation

Anticipated order : switch off COMPASS DAQ and move detectors to AMBER DAQ

Although AMBER computing and DAQ FPGA module are independent from COMPASS DAQ and both DAQ can be operated in parallel there are complications to operate them in parallel or interleaved

- Computing and shared software
  - Support of computing infrastructure and two software versions requires additional manpower
  - Short term support can be discussed but long term support is excluded
- Shared detectors

## Common used detectors for PRM and pbar

### COMPASS SciFis:

- 6 Stations (FI01/05/55/06/07/08) → **Total: 1804 channels**
- Current read-out: F1 TDC with single / double resolution ( $\approx 128/64$  ps)
- New read-out: ifTDC with 150 ps resolution

### MWPCs:

- 4 Stations with three view each (768 channel) → **Total: 9216 channel**
- Current read-out: F1 TDC in latch mode
- New read-out: ifTDC with 1 ns resolution

### GEMs

- 6 G1 GEM stations will be replaced against streaming readout capable G4 GEM stations. → **Total: 18432 Channel**
- Current read-out: APV
- New read-out: VMM

# DAQ Computing

## DAQ computing for PRM run

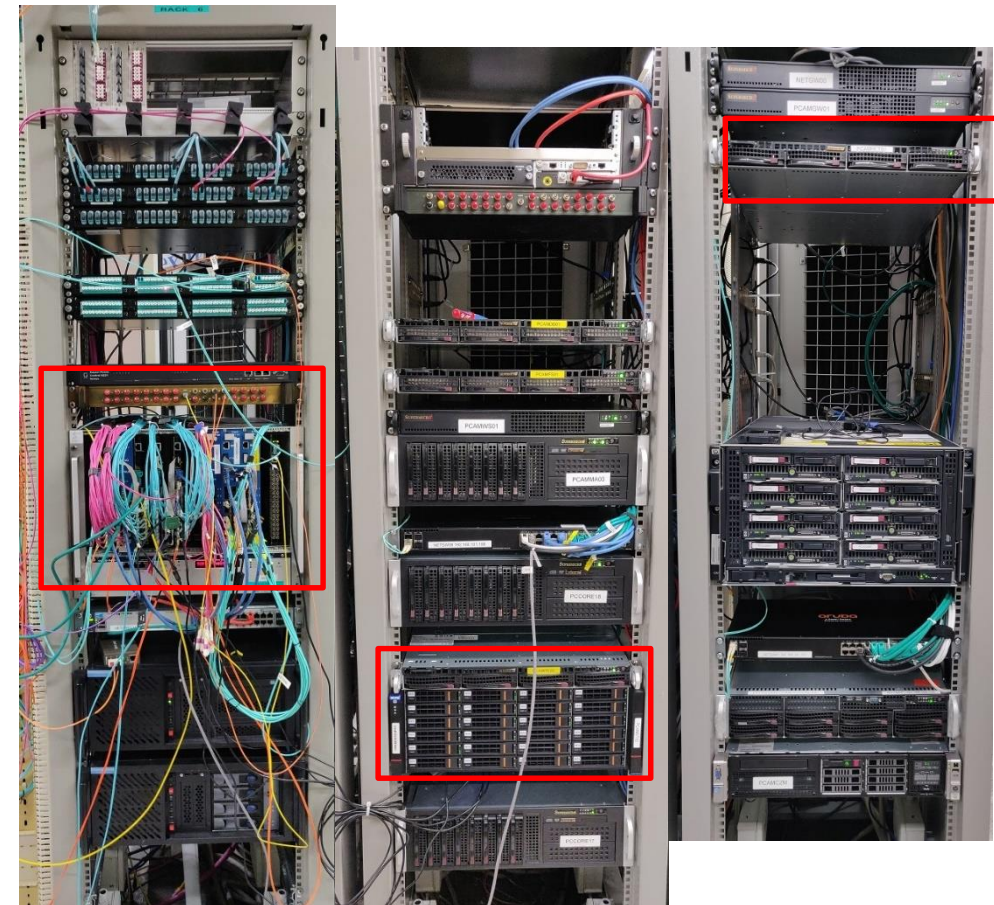
- 4 Read Out Engines + 4 Disk Storage Servers
- 8 HLT nodes

## Mini AMBER DAQ

- 2 x COMPASS type Read out Engines with new PCIe cards
- 1 x AMBER type Read out Engine with New Data storage
- File Server, DB Server
- 1 HLT nodes + 2 HLT nodes shall be delivered (Prague)
- 48 port Ethernet switch will be purchased
- 3 more RC computers for DAQ room will be purchased (Prague)

## Missing computing for PRM run

- 3 Read out engines
- 5 HLT nodes



# DAQ Hardware

## Mini DAQ setup

- Old and new TCS controller
- DAQ Event builder
- 2 iFTDC DHMUX for Hodoscopes and SciFi
- 3 iFTDC DHMUXes for MWPC
- 15 DHMUXes for other detectors
- 2 x UltrascalePlus FPGA cards – for future developments: high performance event builder, trigger logic

## Front-end electronics

- 12 x iFTDCs for Hodoscope + 3 x iFTDC for SciFi
- 15 x DAQ DHMUX cards available
- 2 x UltrascalePlus FPGA cards

Still migration to ATCA standard to be done otherwise we have sufficient FPGA cards for PRM run !!!

# To Do List

- Finalize the data format (error words, detector specific data words)
- Mapping file format and content (detector specific formats)
- Logbook modifications (slices, calibrations, bookies, etc.)
- Decoding library (convert slice to events, interface to CORAL, COOOL)
- Calibration database (values, requirements, options)
- Calibration extractor (stand-alone software)
- Backup of the /online folder – preferably to TSM (paid CERN service)
- Monitoring of servers (Zabbix server required)
- Run control commands (start-of-the-run command, TCS communciation)
- Start-of-the-run scripts

# DAQ Preparation for 2022

- Decouple software from ACTAR / GEM DAQ - done
- If desirable, after AMBER run control software is finished, it could be backported to COMPASS.  
Motivation: we do not know for how long we are going to be using the COMPASS SW before the changeover to AMBER SW. Switching before the run would maximize the benefit from new SW and allow us to test it. Of course, it is a big change.