

DAQ for AMBER Experiment

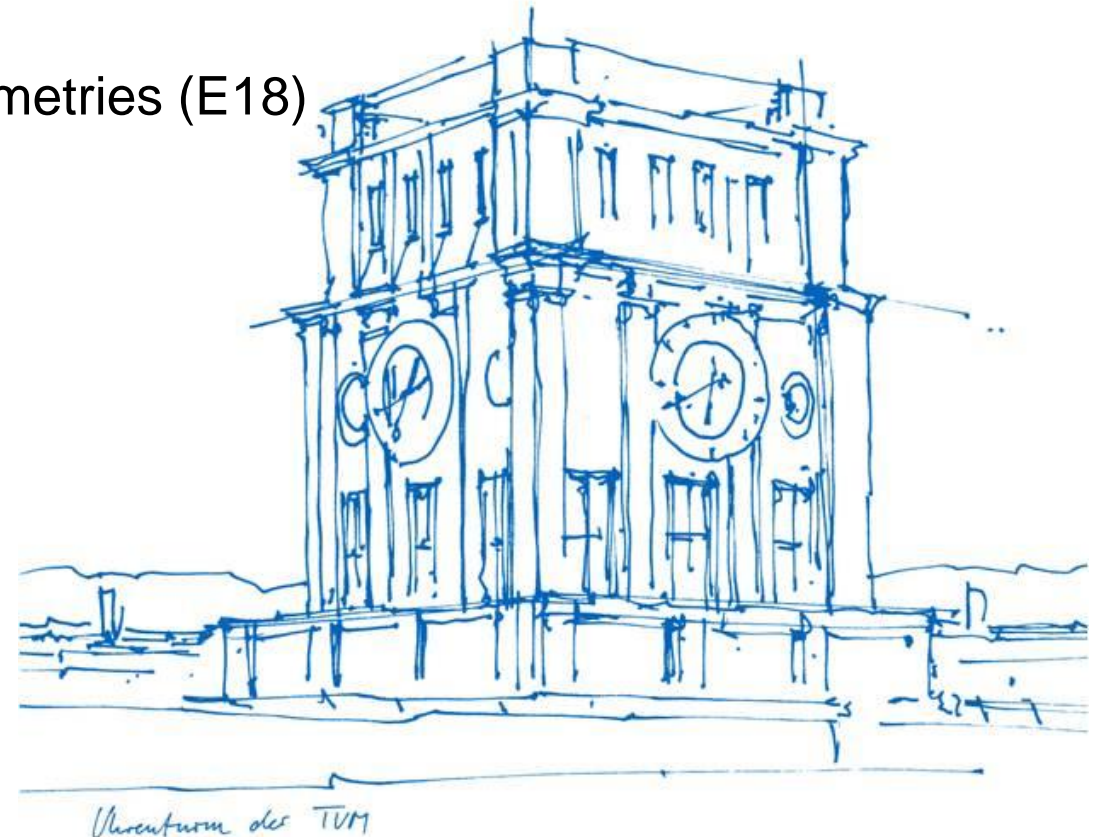
Igor Konorov on behalf of DAQ group

Institute for Hadronic Structure and Fundamental Symmetries (E18)

TUM Department of Physics

Technical University of Munich

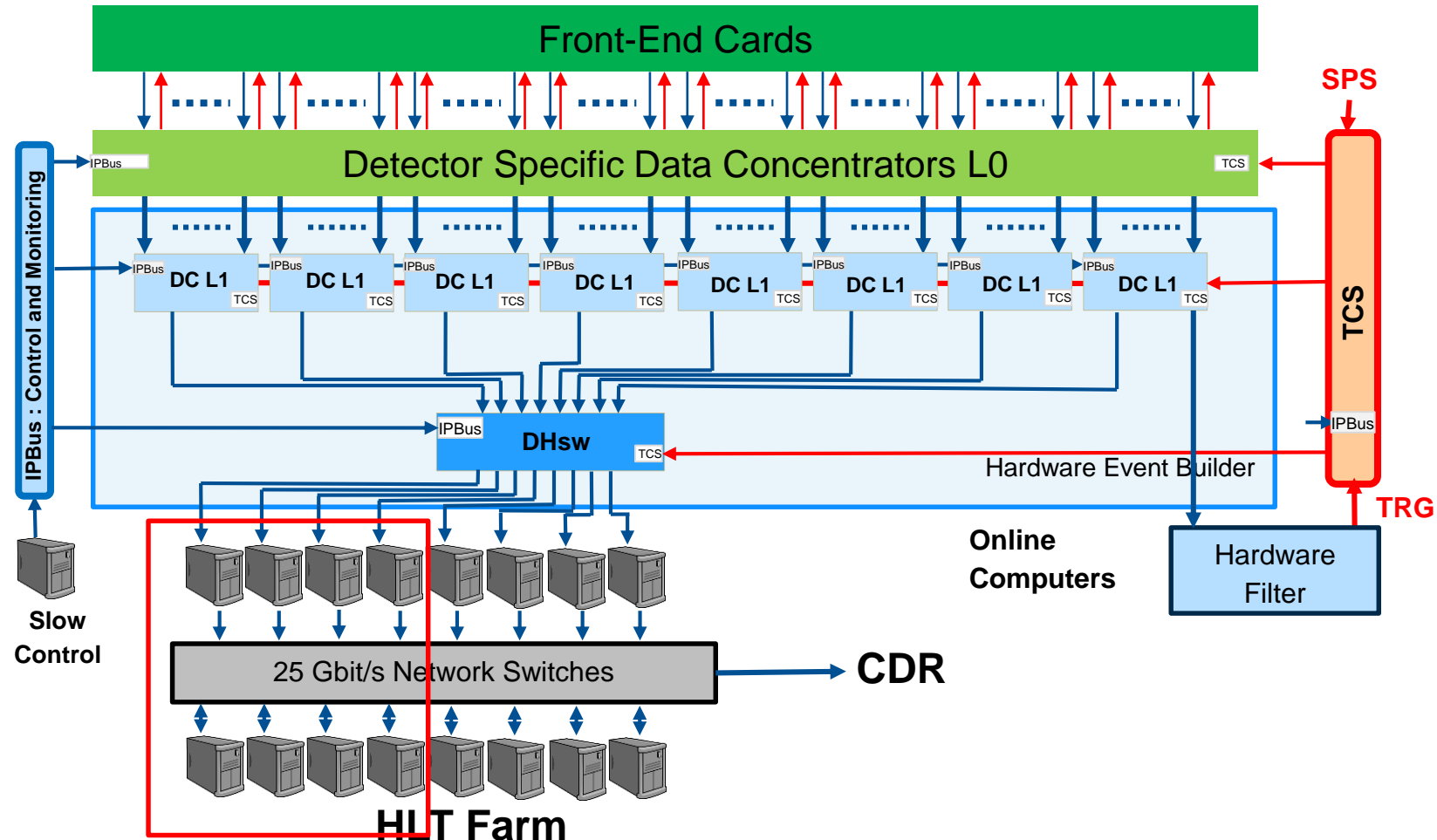
AMBER Technical Board, 19-th April 2022



PRM Setup

Detectors	#Planes	#Channels	FEE	#FEs	#L0 MUX	Channel Noise, Hz	Data rate Total / L0 MUX GB/s	Data rate after TPC TRG GB/s
BMS 1-6	6	512	iFTDC	16	2	10	0.07 / 0.04	0.002
HODO	5	528	iFTDC	18	2	200	0.2 / 0.1	0.005
SciFi Tracker	16	3072/1536	Special iFTDC	16	2	10 000	0.4 / 0.2	0.01
SciFi	44	3148	iFTDC	99	12	100	2.0 / 0.2	0.04
Pixel Silicon	12	113 M	ALPIDE+FMUX	36	4	0	0.32 / 0.08	0.01
GEM	24	36864	VMM/TIGER	?	6-12	1000	1.0 / 0.16	0.03
MWPC	15	11520	iFTDC	180	15	100	1.5 / 0.1	0.04
ECAL	1	256	Upgraded MSADC	16	2	?	?	?
TPC	4	192	SIS3316	12	1	-	0.18 / 0.18	0.18
TOTAL					46-52		5.2	0.32

COMPASS++/AMBER DAQ Architecture



DAQ FPGA Cards for PRM Run

Expected data rate : 6 GB/s within spill or maximum 2 GB/s sustained.

Needed and available DAQ FPGA Cards:

- 8 x L1 MUX
- 1 x TS Builder
- 4 x Spill Buffer PCIe cards
- Migration to ATCA
 - 2x + 6x ATCA shelves available
 - 4 x ATCA carrier cards to be produced

=> 8 kEuro

Development of new MUX card for DAQ

- V6 FPGA are old, although still can be purchased
- K7 Ultrascale based on XCKU3P FPGA
 - 16 x 12 Gbps ports, 16GB DDR4 Memory
 - Few modules will be developed and produced for upgrade of DAQ MUX

=> N x 380 Euro

DAQ FPGA Cards for PRM Run

DAQ Computing:

- 4 x PCAMRE
 - 1 x AMBER type + 4 AMBER type servers => 10 kEuro
 - Alternative 2 x COMPASS type available, more COMPASS type can be taken from COMPASS DAQ later

- 1 x disk storage + 1 being ordered + 3 disk storages are needed => 5+15 kEuro

- 3 x HLT notes available + few more (?) to be purchased => N x 2.5 kEuro

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Components Availability for MUX and iFTDCs

- ❑ L0 MUX : 46-52 Cards needed , V6 version, components availability
 - PCB production and assembly => 500 Euro x 50 = 25 kEuro
 - V6 FPGA => 380 Euro x 50 = 20 kEuro, 2 weeks delivery
 - Other components => 300 Euro x 50 = 15-20 kEuro
 - Flash XCF128XFT64C, last order 07.2022, not available, consider to program FPGAs remotely at power up
 - Jitter cleaner Si5338, no delivery time, to be investigated
 - TCS clock recovery ADN2814, available
 - DC/DC converters => some available, some delivery 35 weeks

- ❑ iFTDC : 320 cards needed
 - PCB production and assembly => 150 Euro x 320 = 48 kEuro
 - Artix XC7A50T FPGA => 100 Euro x 320 = 32 kEuro , delivery date 4.01.2024 (Digikey), 60 weeks (Mouser, AVNET)
 - Other components => 150 Euro x 320 = 48 kEuro
 - Flash S25FL256, available
 - DC/DC, 35 weeks delivery time

Module's Production Strategy

- Many components have long delivery time
- High volatility of IC market affects delivery time and price
- Proposed strategy :
 - Define priority for module production : number of modules to be produced and amount of money available. I would suggest to start with L0 MUX.
 - Order most critical components like FPGAs, DCDC converters
 - Order all others components and schedule PCB production and assembly

Summary of DAQ Investments

□ Computing

- Optional 4 x PCAMRE - 10 kEuro
- 4 x Disk storage - 20 kEuro
- HLT nodes - N x 2.5 kEuro

□ DAQ Hardware

- 4 x ATCA carrier cards - 8 k Euro

□ Detector cards

- 50 x L0 MUX
 - PCB and assembly - 25 kEuro
 - V6 FPGA - 20 kEuro
 - Other components - 20 kEuro
- 320 x IFTDC cards
 - PCB and assembly - 48 kEuro
 - ARTIC FPGA - 32 kEuro
 - Other components - 48 kEuro

Thank you