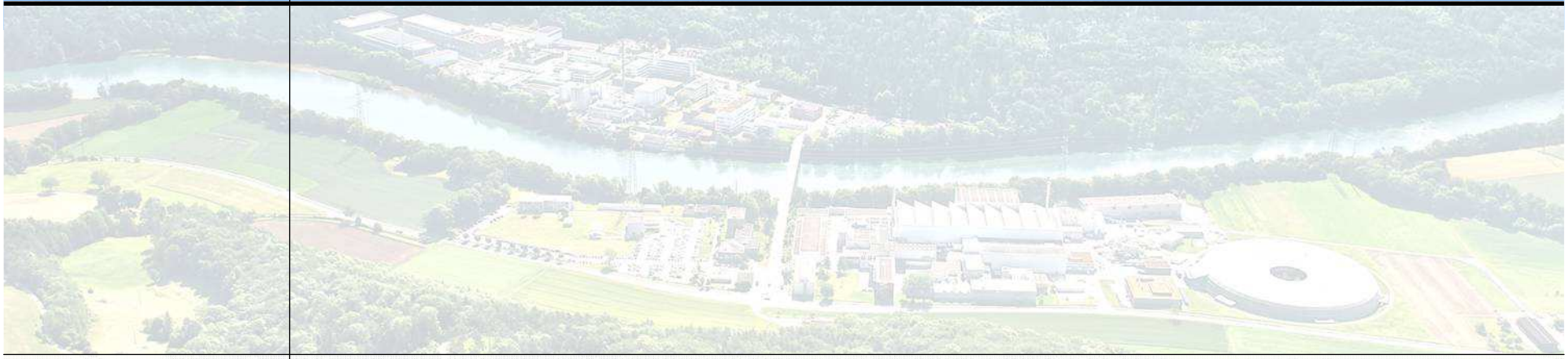
PAUL SCHERRER INSTITUT

PSI



Wir schaffen Wissen – heute für morgen

Paul Scherrer Institut

Rafael Abela

Working Group: DAQ and DM

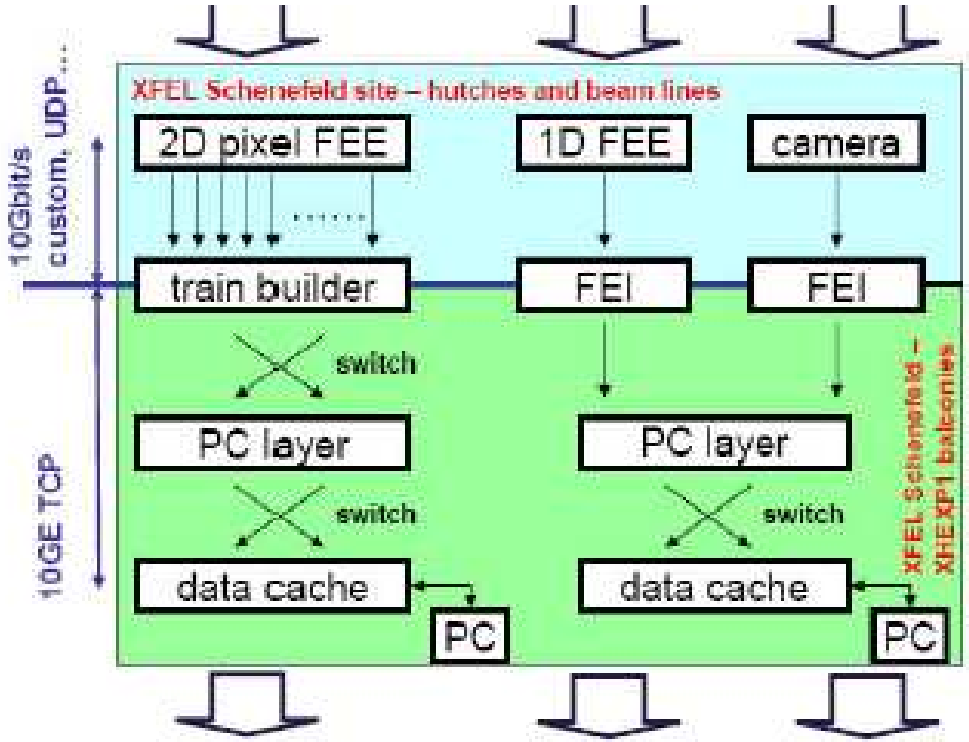
General Comments Data Rate

Readout rate : driven by bunch structure 100Hz 400 Hz

Readout data volume : driven by detector type:

	RATE	DATA/PULSE	BANDWIDTH
Optics	100Hz	1kB	100kB/s
Diagnostic	100Hz	100kB	10MB/s
Detectors	100Hz	10MB	1GB/s

European XFEL: General Architecture



Front End Electronics

Data Processing (rejection)

On the fly processing and monitoring

Archiving

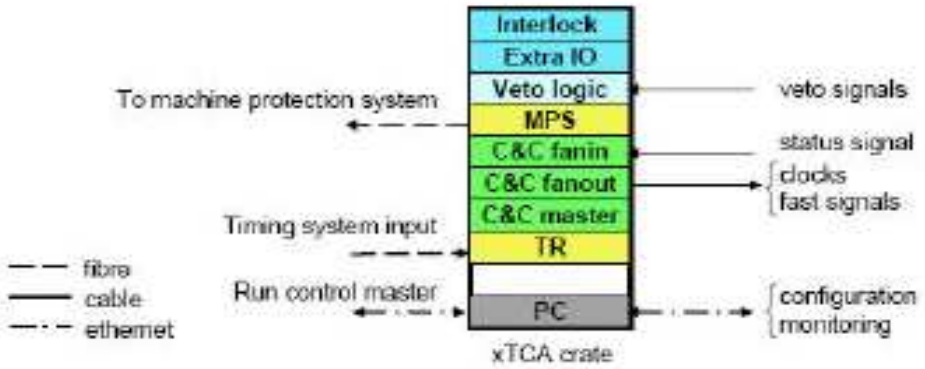
DAQ 10 GE readout link

- Dual link FMC mezzanine development led by DESY-FEA
  - collaborating with STFC and Uni. Heidelberg
- Use as standard transport link technology = 10Gbit/s fibre
  - no grounding issues
  - IEEE standard fixed (PHY and optical chips available)
  - FPGAs (e.g. Xilinx Vertex 5) can drive rate
- Measured data transfer (of 10Gbit/s max) and error rates:
  - Custom (Aurora) or UDP FPGA-to-FPGA
    - → wire-speed without losses
  - UDP FPGA-to-PC
    - → 78% without losses
  - Bit transmission Error Rate ~10**-15
    - → = 1 frame/10hrs
- Status
  - First batch of pre-final FMC in production

Test setup: ML510 Vertex 5 evaluation Board + XPB personality board

DAQ Clock & Control – control FEI

- Common sequencing and control developed by UCL
- Functionality:
  - distributes fast signals
    - clocks (100MHz control, 5MHz bunch..
    - EuXFEL timing events (start & stop train…)
    - VETO events (reject bunch number…)
  - Network messages (configuration…)
- Status:
  - finishing spec (clocks, protocols, VETOs…)
  - Phase 1 = working prototype (end 2010)
  - Contract signed



Front End Interfaces:

- Interface to standard timing system
- Interface to machine protection system
- Identification by bunch number

- Control commands via LAN
- System Monitoring via LAN

Common specifications for all instruments

European XFEL : Data Volume

- Estimations of data volume per beam line and year
  - numbers in table are for compressed / not compressed data
  - SASE3 is assumed to be similar to SASE1

Beam line	Data volume per year per beam line [PB]		
	2014	2015	2016+
SASE1 (SPB+MID)	0.6/10	1.3 / 20	2.8 / 39
SASE2 (FDE+HED)	-	1.9 / 1.9	3.8 / 3.8
SASE3 (SQS+SCS)	0.6/10	1.3 / 20	2.8 / 39
Total	1.2 / 20	4.5 / 31.9	8.8 / 81.8

Estimate March 2009,
See DAQ and DM computing TDR

Conclusion = Design generic DAQ and DM systems assuming 10PB/year data volume with the possibility to scale it in the range of 5 to 100PB/year

General comments :Data storage

Store and provide access to data and metadata
Specifications for data format
File transfer, data export services

Storage policy: How, Where, how long
Capacity at PSI
Coherent Authentication, Authorization Accounting
European approach

Data transfer to home institution
Data Analysis : Virtual center?

Software : Common DAQ package
Dataformat compatible with SLS and SINQ?

CONCLUSIONS

Data rate, data volume: There is no bottle neck. Challenging
Space for server room and cooling capacity!

Algorithm for lossless compression are needed

Specification of the Front End Interface
On-the-fly Data Processing
Parallel processing

Detector read-out architecture + IT Infrastructure

Experience from SLS Beamlines (TOMCAT, cSAXS) and the new detector developments at PSI (Eiger) are an important test for SwissFEL

DAQ Software:
Matlab, IDL… evaluate other alternatives
Experience from LCLS, FLASH, European XFEL

MANPOWER!