

Introduction to BESIII DAQ

CGEM Workshop

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Outline

Requirement for BESIII DAQ

- Functional
- Performance

System design of BESIII DAQ

- Hardware
- Software

Preliminary Thoughts on CGEM DAQ

Functional Requirements

Data readout from electronics modules

Event building

Online event filtering

Event recording

Run control

Monitoring (event, histogram display ...)

Message reporting

Information sharing

...

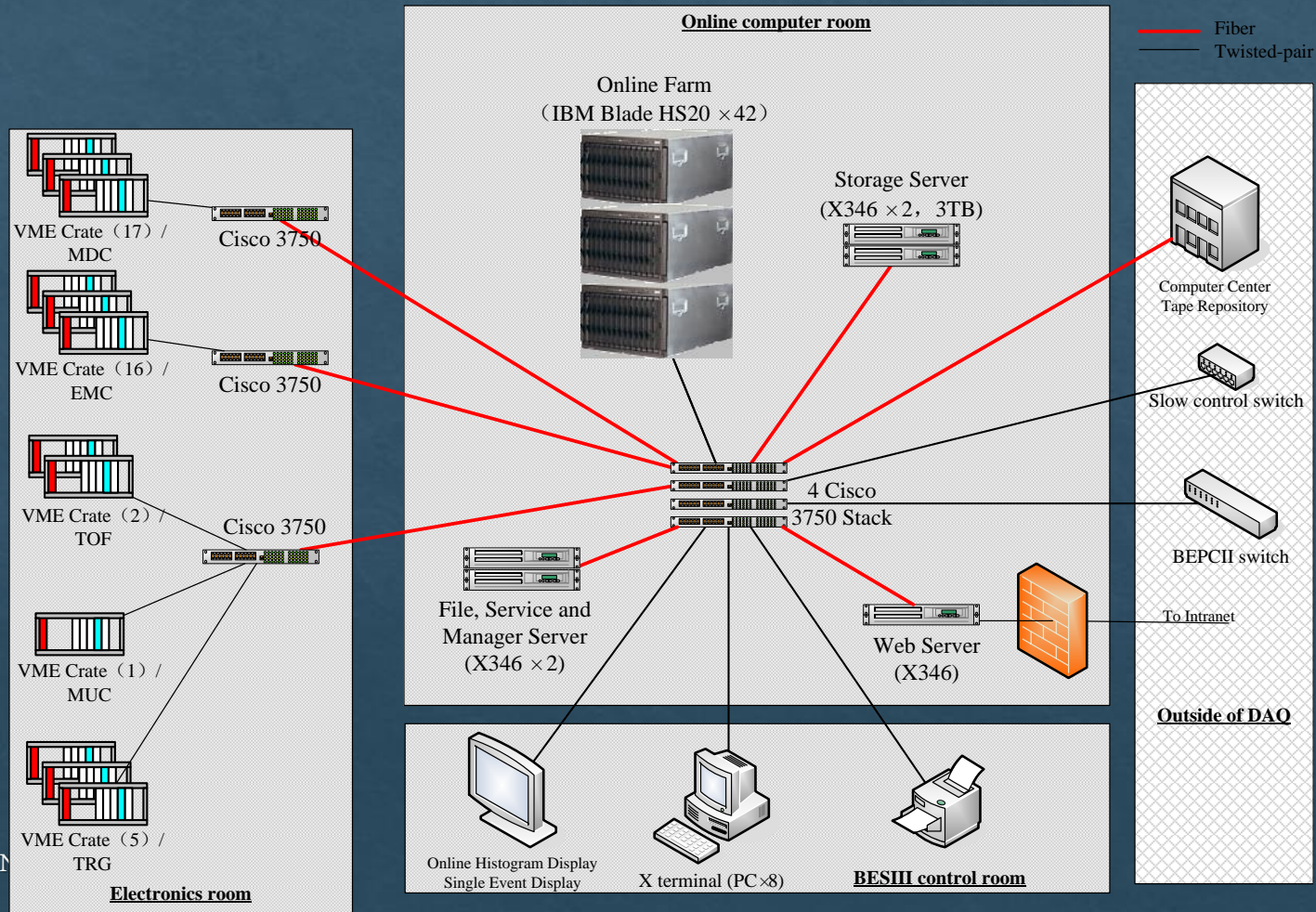
Performance Requirement

- ◆ Electronic Channels to be Readout: 40000
- ◆ Maximum Level-1 Trigger Rate: 4kHz
- ◆ Event Size: 12kBytes
- ◆ Data throughput after L1: 48MBytes/sec

Sub-Detector	Channels
MDC	9096+9096
EMC	9864
TOF	448+448
Muon	10000
Trigger	400
Total	~ 40000

Performance requirement for BESIII DAQ:
Continuously data taking at 4kHz & 12kB, dead-time <5%

DAQ Hardware Deployment

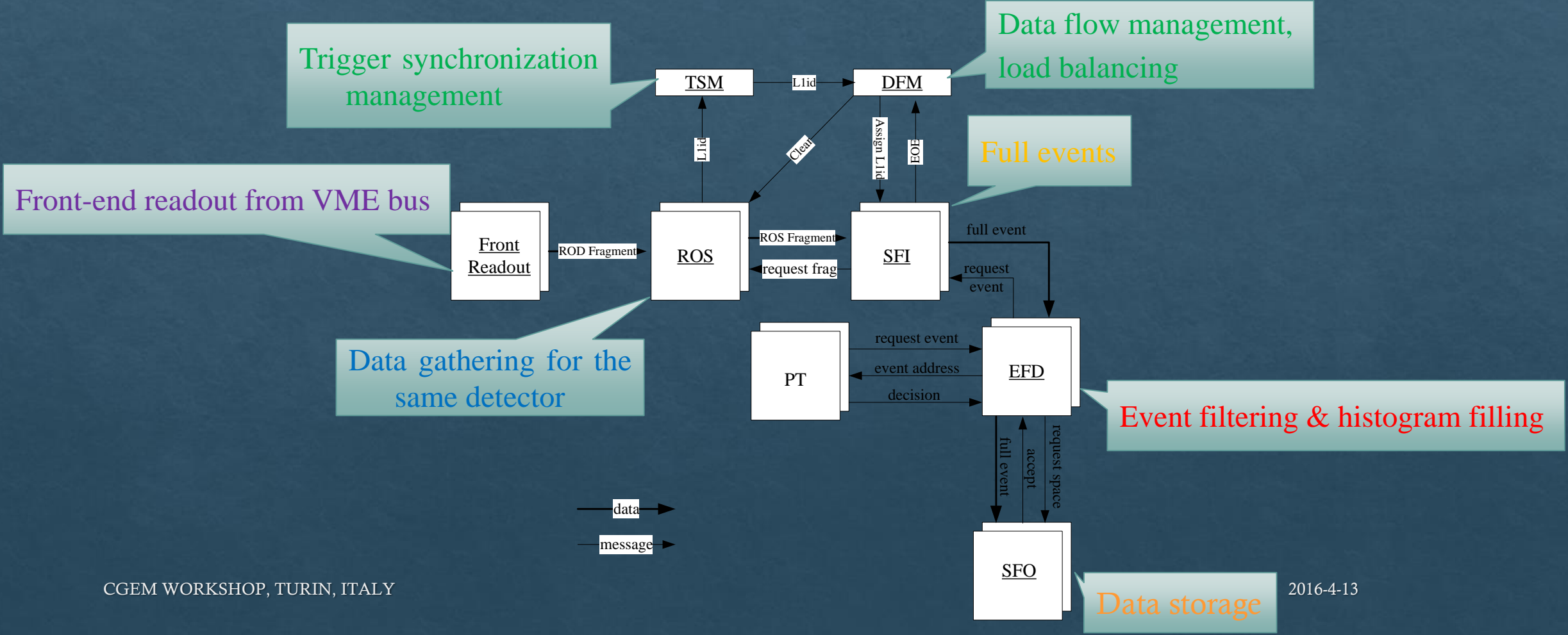


Software Framework

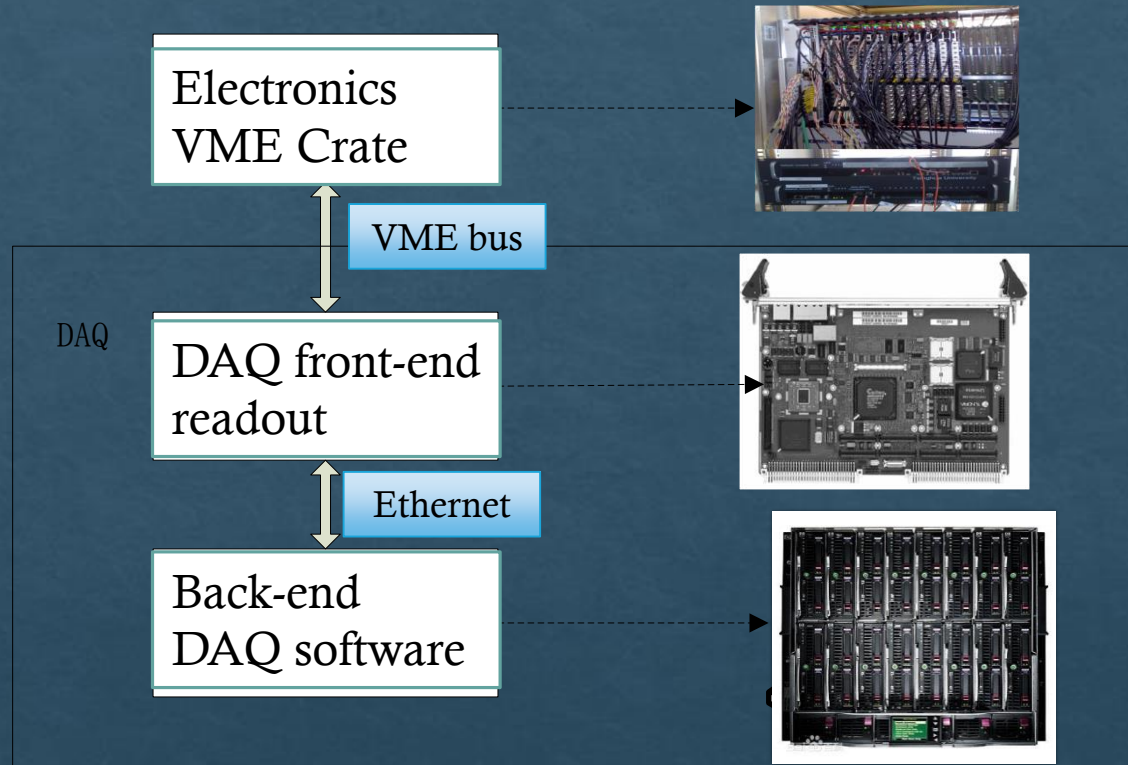
- ◆ Use ATLAS TDAQ software as the basic framework of BESIII DAQ
- ◆ Software can be divided into two parts:
 - ◆ Online software
 - ◆ Configuration/Control/Monitoring
 - ◆ Dataflow software
 - ◆ Data processing



Dataflow Overview



Front-end Dataflow

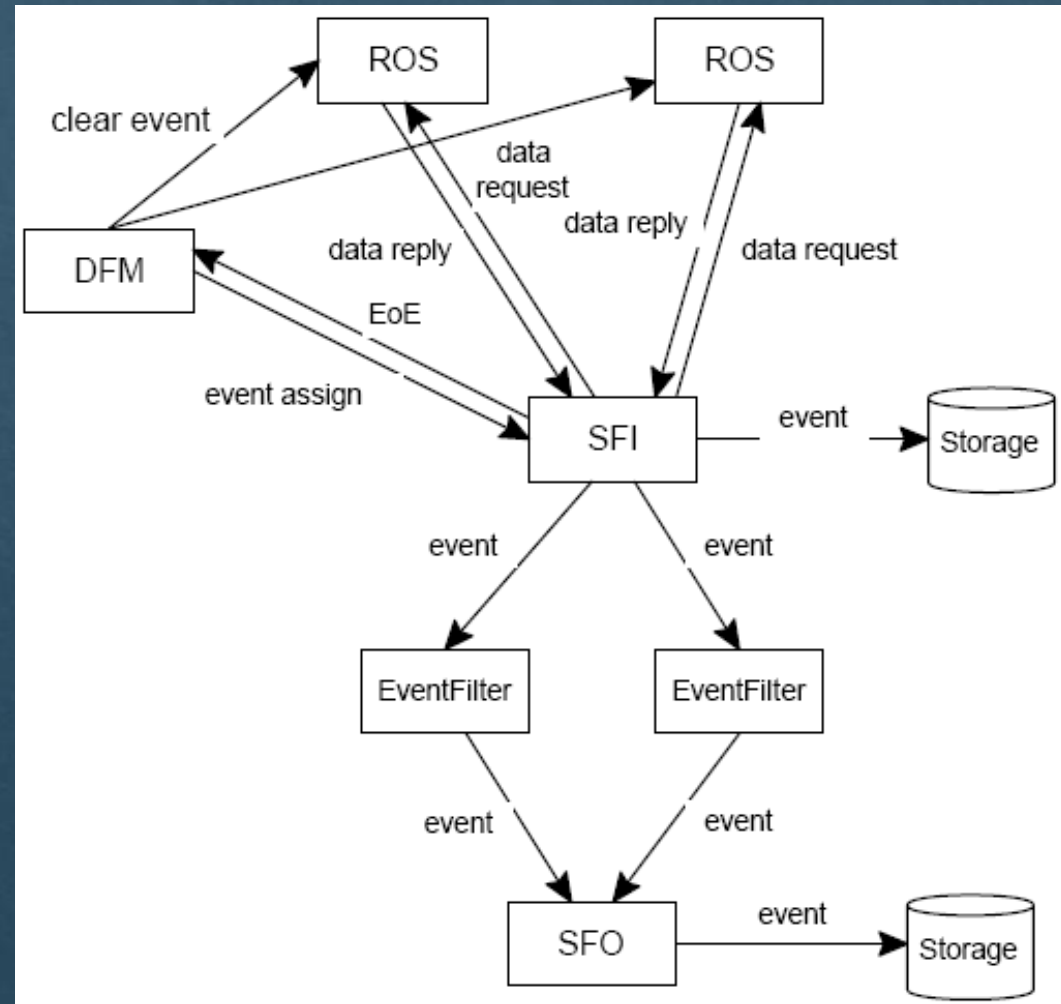


- DAQ front-end readout
- VME based system
- VME controller – MVME5100
- VME readout & Ethernet output
- Readout data fragment of each VME crate

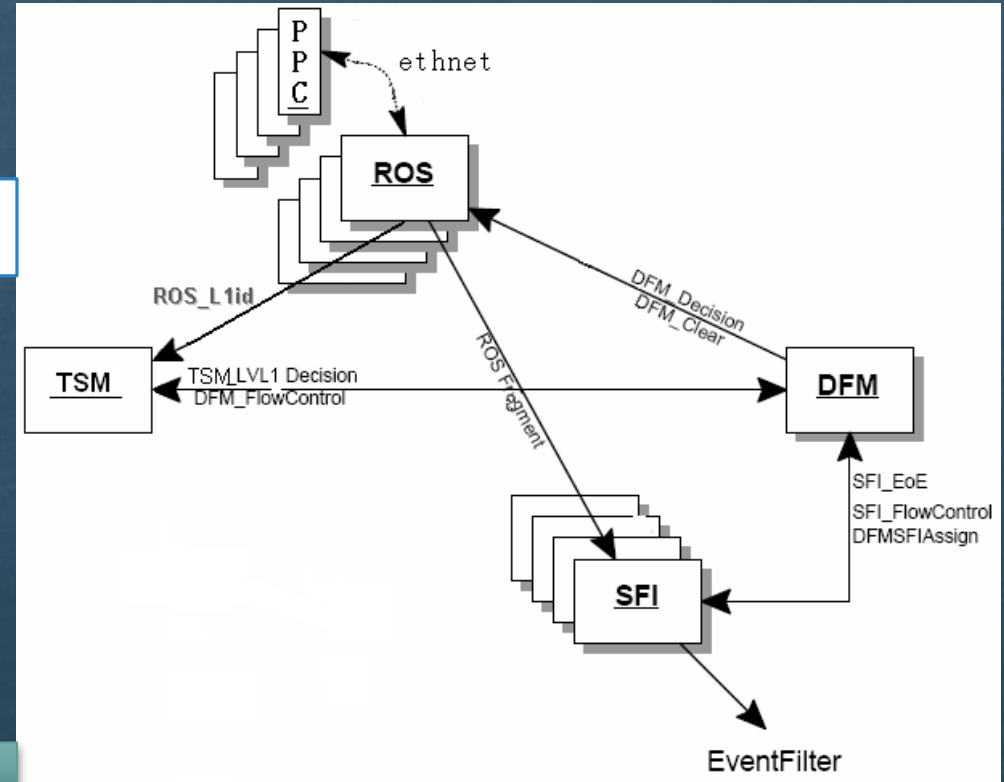
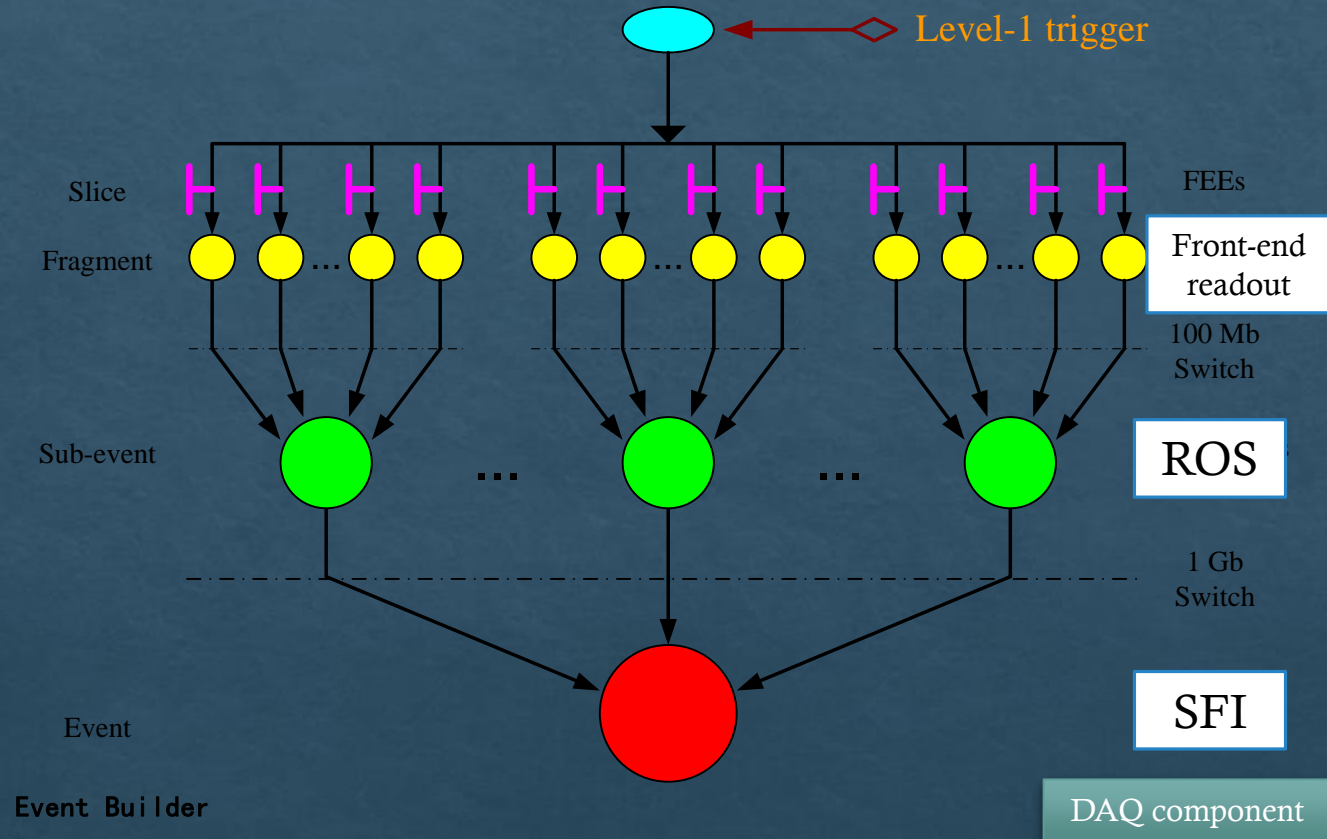
Back-end Data Flow Diagram

◆ Most functions of dataflow executed here:

- ◆ Event Data Formatting
- ◆ Event Building
- ◆ Online Event Filtering
- ◆ Histogram Filling
- ◆ Event Storage



Three Levels of Event Building

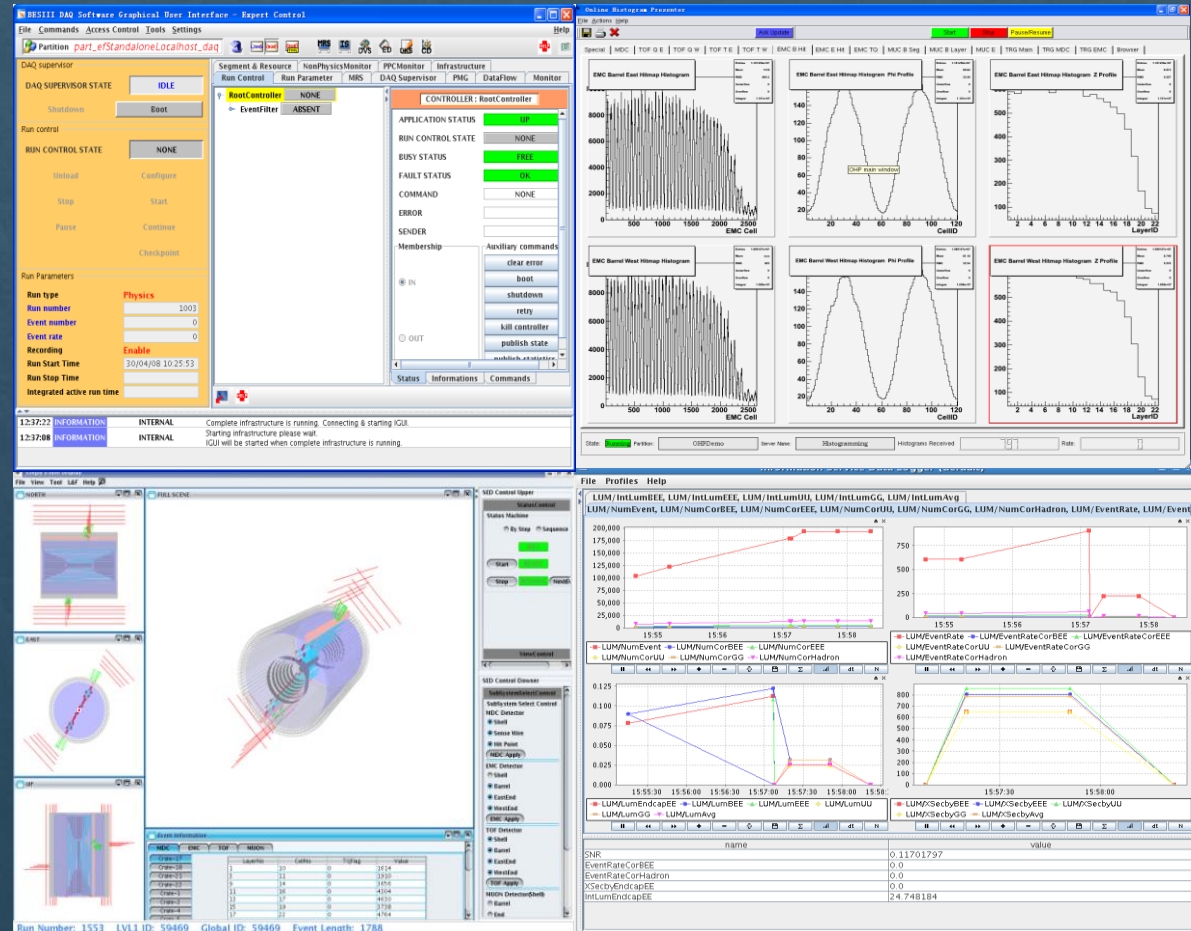


Online Software

Administrator of software

- ◆ Controller of state machine
- ◆ Database configuration
- ◆ Processes management
- ◆ Information services
- ◆ Message reporting
- ◆ Real-time monitoring

CGEM WORKSHOP, TURIN, ITALY



Preliminary Thoughts on CGEM DAQ

- ◇ CGEM will be considered as a new detector in BESIII DAQ
- ◇ This new system can be binding to current DAQ
 - ◇ Share the same controller
 - ◇ Synchronized with current system
- ◇ CGEM data will be merged with other current data streams in SFI (last step of event building)

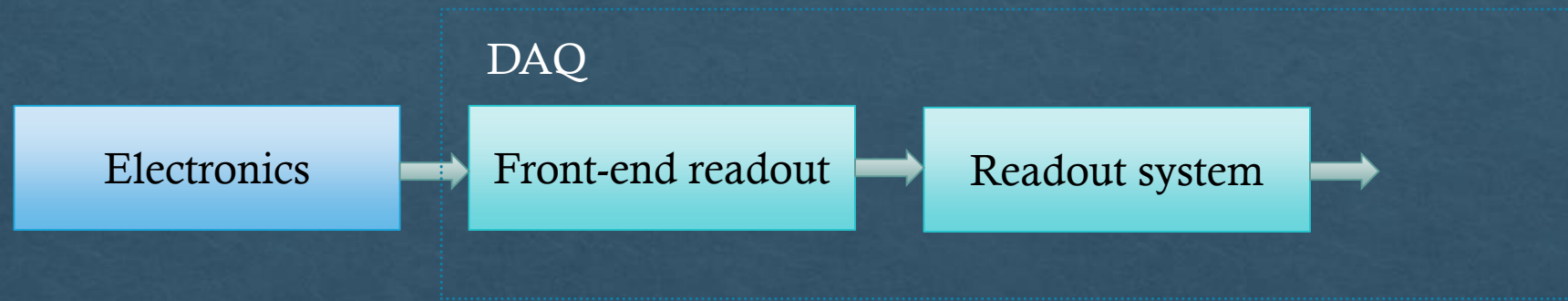
Hardware:

- provide switch and more servers to support the new system running

Software:

- No major changes, follow the existing scheme
- most of the DAQ functions have been provided
- Adding functions to this new detector according to the system requirement
 - Configuration & Data readout & Histogram & ...

New Front-end Readout for CGEM



Front-end readout	Interface	Hardware platform	OS
current	VME	PowerPC controller	VxWorks
For CGEM	Ethernet	Blade server	Linux

CGEM Data Bandwidth Estimation

- ◇ Total amount of the on-detector electronics channels is ~ 10000 (CDR)
- ◇ BESIII trigger rate is designed to the maximum 4kHz
- ◇ Suppose each single channel event contains 32bits data, for the extreme case, when 100% channels on fire
- ◇ Maximum data throughput could reach 1.3Gbps ($10000 * 4000 * 32$).

Performance Considerations

- ◇ Test been done in current DAQ framework
- ◇ Data transfer capability
 - ◇ ROS/EFD/SFI running on Blade server
 - ◇ Gigabit Ethernet IO: >900Mbps
 - ◇ 10Gigabit Ethernet IO: >9Gbps
- ◇ Data storage capability
 - ◇ SFO running on Storage server
 - ◇ Data storage capability : >500MB/s
- ◇ Data IO performance can meets the bandwidth requirement for the CGEM system

Summary

- ◇ Brief introduction to current BESIII DAQ system
- ◇ Current framework can be used for CGEM DAQ
- ◇ Developed new front-end readout DAQ for CGEM
- ◇ Performance test in hardware services gave very good results

Thanks!