



WBS 3.2 – Data Acquisition

Summary: Cost and Schedule

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June 6, 2002



Outline

- **Schedule**
 - Preseries Schedule
 - DAQ staging scenarios
- **Transition to M&O**
- **Cost estimates**
- **Summary and Conclusions**



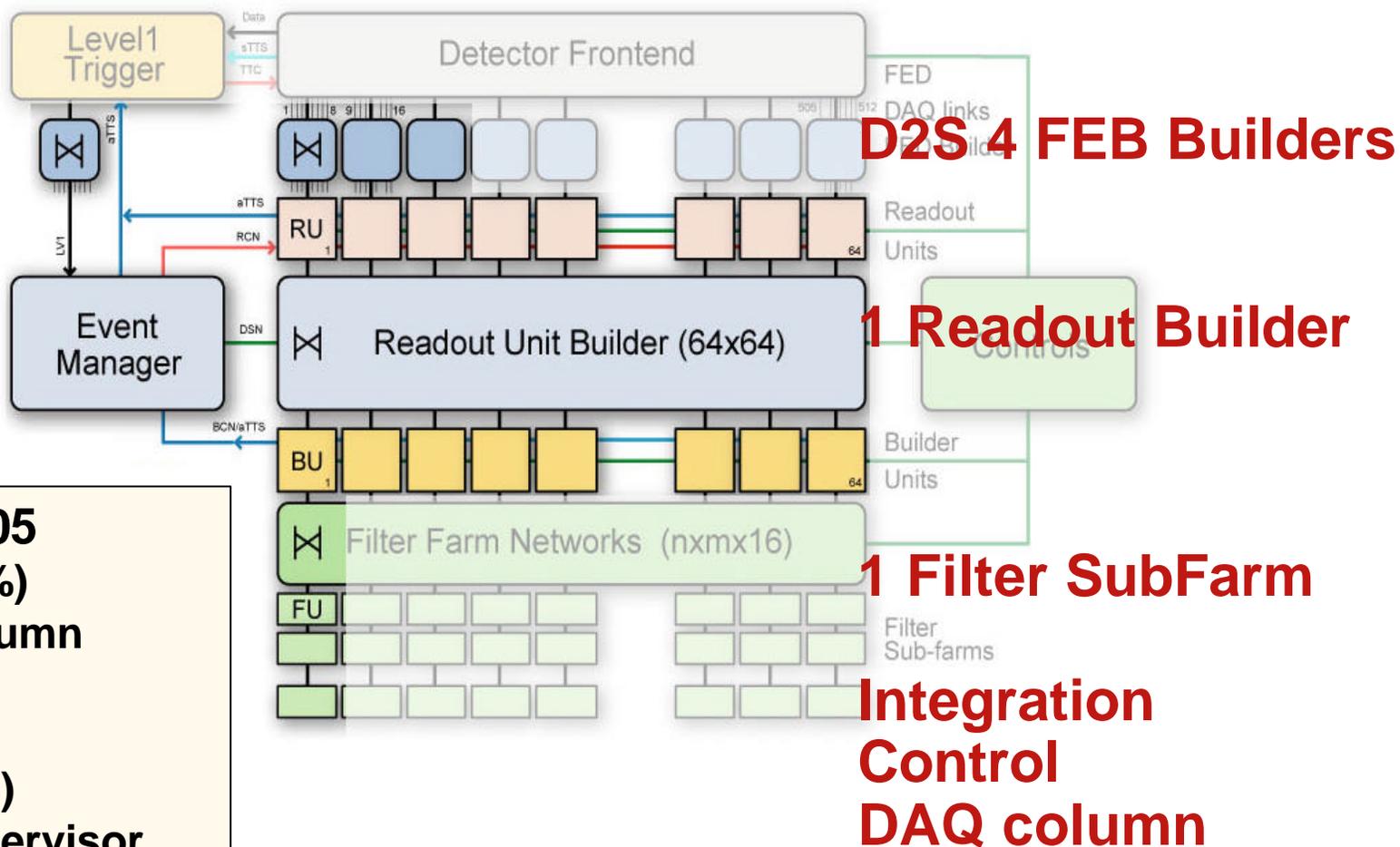
Preseries

Definition of Preseries

Preseries Schedule



Preseries Definition



- 2003-2005**
- D2S (10%)
 - DAQ column (+1FS)
 - Builders (4FB/1RB)
 - DCS supervisor
 - Online software



Milestones*

Prototype DAQ (US Contribution)

D2S Prototype

July, 2004

“Slice Test”

November, 2004 (*)

Readout Builder Prototype

April, 2005

Startup DAQ (US Contribution)

Filter Farm Ready

May, 2006

Readout Builder Ready

August, 2006

Declaration of Victory (US Contribution)

Startup DAQ ready for beam

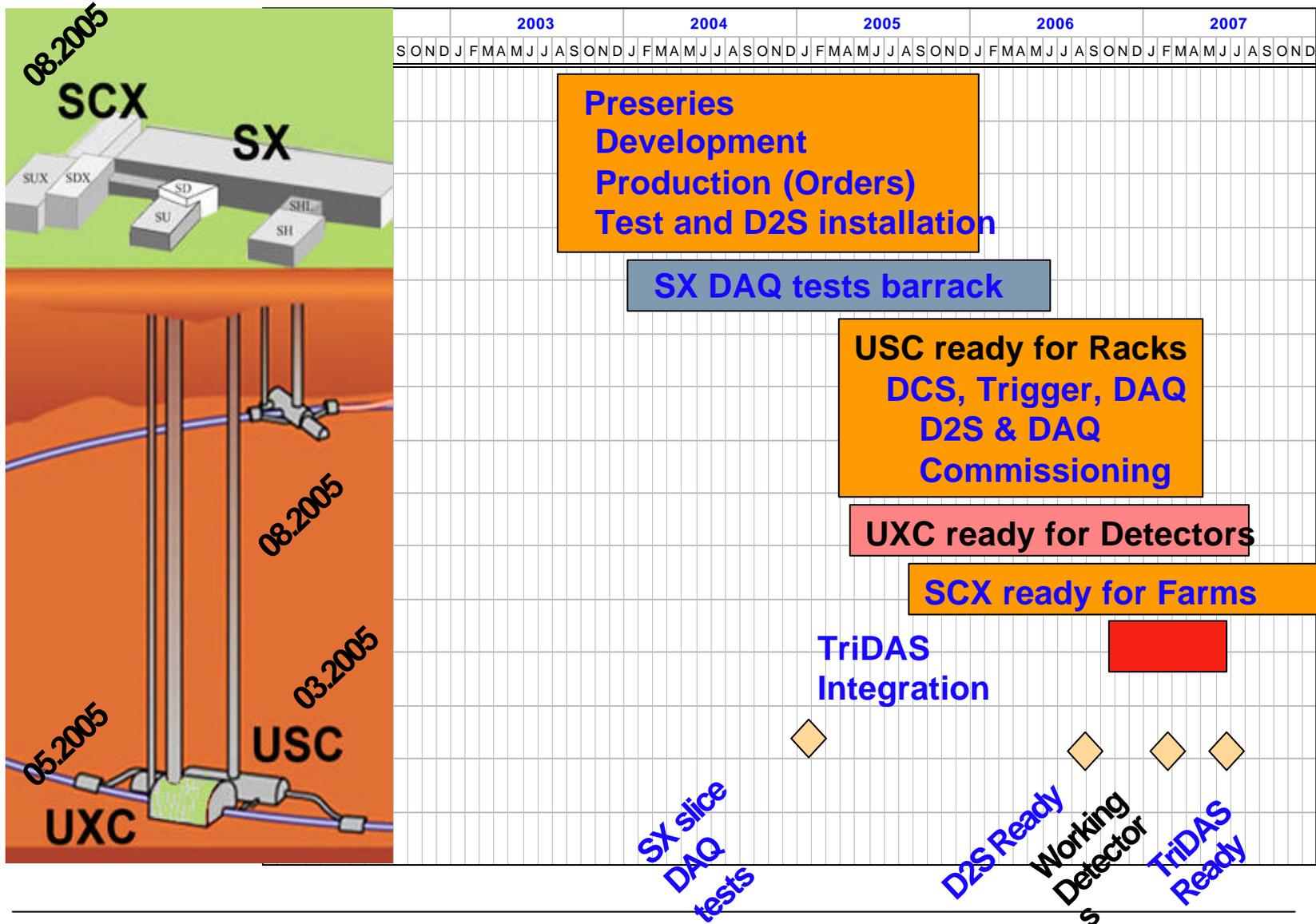
September, 2006

(*) “Slice” Test for US-CMS detectors – DAQ will have full D2S proto + a few RB elements

*(Version 33)

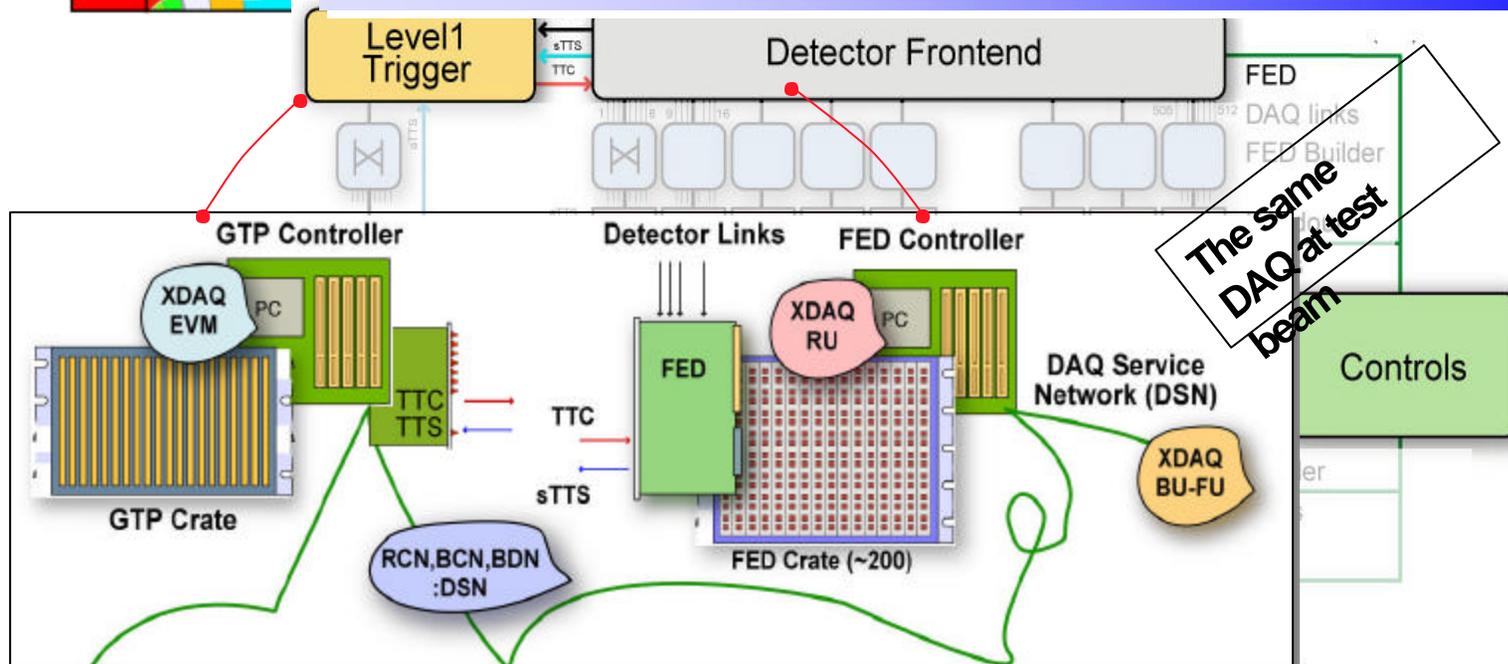


Raw schedule





DAQ v.1: FED local DAQ



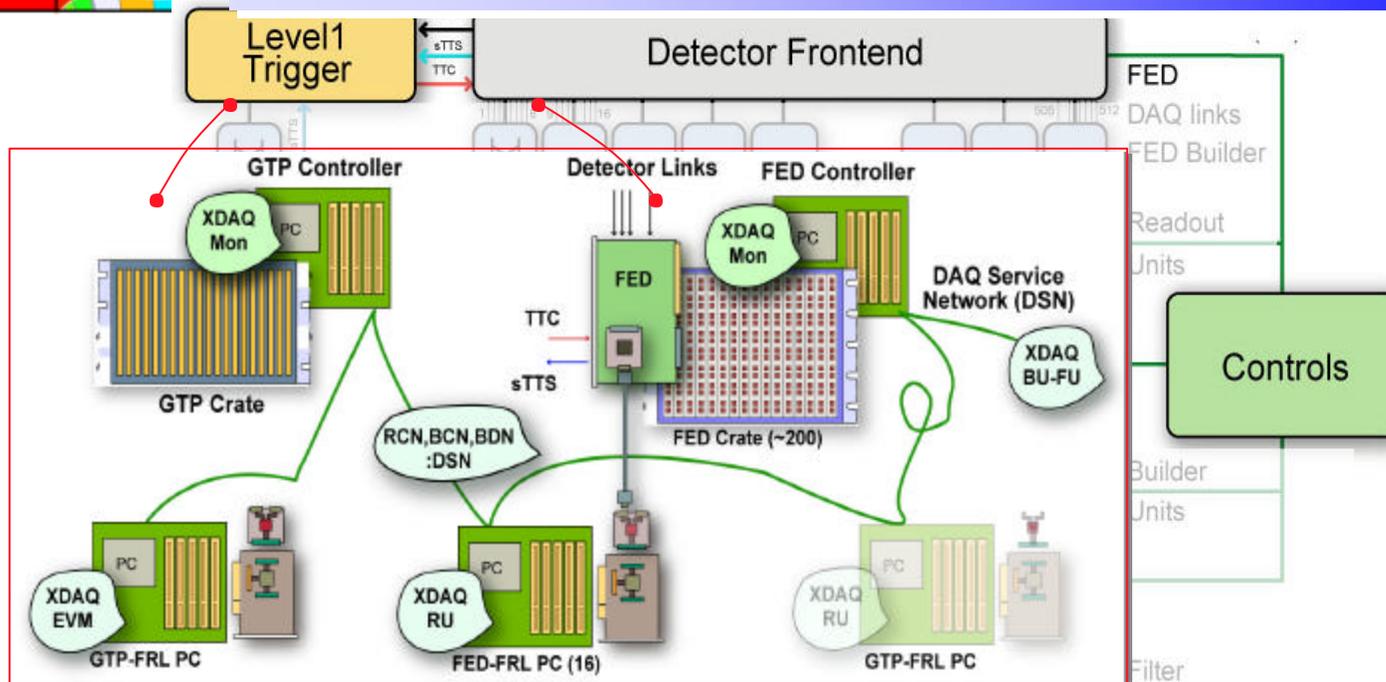
Trigger system
 Detector readout
 Readout Units
 Data to Surface
 RCN, BCN, BDN networks
 Event manager
 Builder/Filter Units
 Performances

GTP, TTC and sTTS

Complete **FED crate systems** (FED-TTC-TTS, Controller CPU+DSN)
 XDAQ **RU-VME-tasks** running in all the **FED controllers**
 None just the **FED-VME bus** of FED crates
 DAQ Service Network (**DSN** eg GEthernet)
 XDAQ **EVM-task** running in the **GTP controller**
 XDAQ **BU-task** running in **any DSN(WAN) CPU**
Few 10 Hz (up to 100s when using GE switches in DSN as EVB)
Only Underground CRs involved (+ DAQ service and control networks)



DAQv.2: FRL local DAQ



Trigger system
 Detector readout
 Readout Units
 Data to Surface
 RCN, BCN, BDN networks
 Event manager
 Builder/Filter Units

Performances

GTP, TTC and sTTS

Complete **FED crate systems** (FED-TTC-TTS, Controller CPU+DSN)

XDAQ PCI-RU-tasks running in the **FRL-PC controllers**

S-Link64 **LVDS-FRL** (no link to surface)

DAQ Service Network (**DSN**)

XDAQ EVM-task running in the **GTP FRL controller**

XDAQ BU-task running in any **DSN(WAN) CPU** using a small (32 ports)

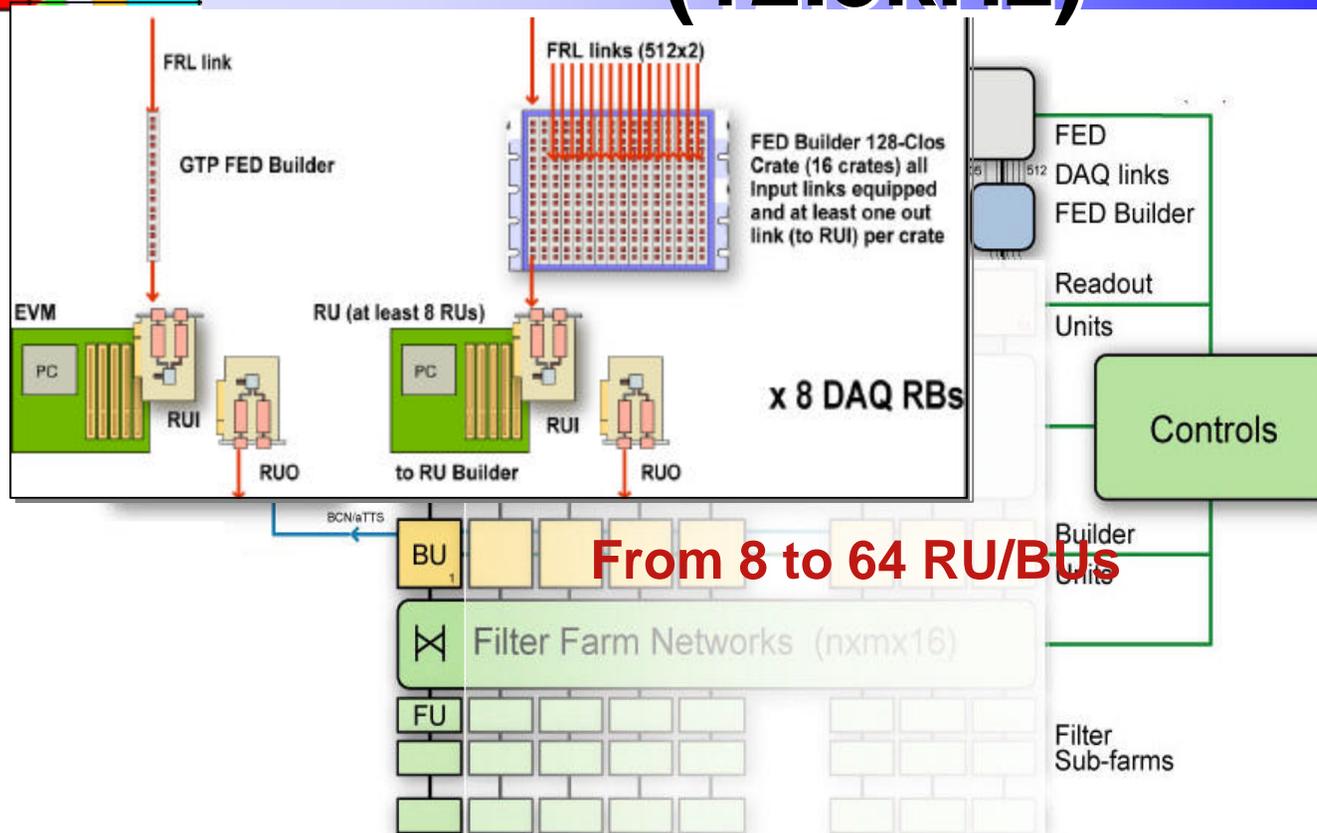
GE switch any way part of FRL-DSN

Few **100-1000 Hz**

Only Underground CRs involved (+ DAQ service and control networks)



DAQv.3: RB scaled DAQ (12.5kHz)



From 8 to 64 RU/BUs

Trigger system 100%
Data to Surface
Readout Units
RCN, BCN, BDN networks
Event manager
Builder/Filter Units
Performances

GTP, TTC and sTTS
Complete with FRLs and all links up to the FED builder input
Minimum 8 RUs (one per 128-Clos FB crate)
Myrinet
Complete system (GTP link included)
Minimum 1 BUs to No output ports in BDN
From few 10 Hz to 12.5 kHz



DAQ commissioning and scaling scenarios

DAQ v.1: FED local DAQs

2002-2004: Laboratory and test beam DAQ applications

2005-20xx: Trigger and Detector readout commissioning and test

DAQ v.2: FRL local DAQs

2006-20xx: Trigger, Detector readout and S-Link64 links commissioning and test

DAQ v.3: RB scaled DAQs

2006-20xx: Trigger, Detector readout, S-Link64 links, FEB Builder, Event Manager, Readout Builder commissioning and test

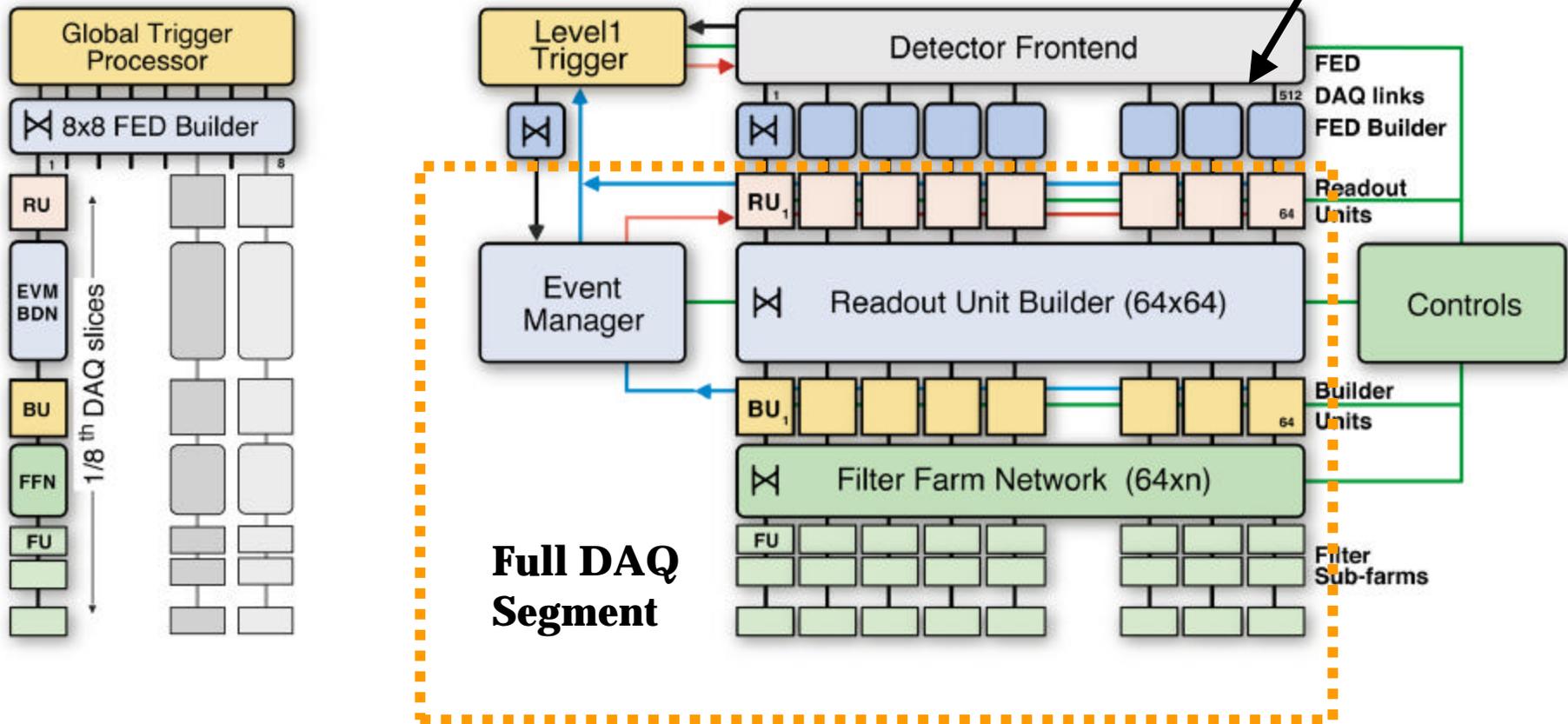
DAQ v.4: RB segmented DAQs

2007-20xx: Full DAQ system commissioning and operation



New US CMS DAQ Project

25% Data2Surface





US CMS DAQ Milestones (v31)

System	Level?	CMS ID	Milestone	v31 Base	Current Start	Variance	'99	'00	'01	'02	'03	'04	'05	'06
			<input type="checkbox"/> Data Acquisition Subsystem (WBS 1.3.2)	NA	May 31 '99	0 days								
DAQ	ML2	D-005	Readout Unit Prototype 2 (Design of)	May 31 '99	May 31 '99	0 days	●							
DAQ	ML2	D-006	Event Builder Prototype 1 Complete	May 31 '99	May 31 '99	0 days	●							
DAQ	ML2	D-007	Readout Unit Prototype 2 Complete	Nov 30 '99	Nov 30 '99	0 days		●						
DAQ	ML2	D-008	Filter Unit Prototype 1 Complete	Nov 30 '99	Nov 30 '99	0 days		●						
DAQ	ML2	D-009	Vertical DAQ Chain Prototype Complete	Nov 30 '99	Nov 30 '99	0 days		●						
DAQ	ML2	D-012	Technologies Choice Preparation: scal 1:N DAQ	May 31 '00	May 31 '00	0 days			●					
DAQ	ML2	D-010	High Level Trigger Prototype 1 Complete	Jul 31 '00	Jul 31 '00	0 days				●				
DAQ	ML2	D-011	Full DAQ Prototype Tests Complete	Nov 30 '00	Nov 30 '00	0 days					●			
DAQ	ML1	D-014	Submit DAQ Technical Design Report (TDR)	Nov 30 '02	Nov 30 '02	0 days						●		
DAQ	ML3	D-1012	EVB Pre-Series and DAQ Slice Ready	Dec 31 '03	Dec 31 '03	0 days							●	
DAQ	ML2*	D-1014	Start of Readout and EVB Commissioning	Jul 31 '04	Jul 31 '04	0 days								●
DAQ	ML2	D-1019	Test Data Injection to DAQ Column, 200Hz per	Jan 31 '05	Jan 31 '05	0 days								●
DAQ	ML2	D-1018	Local DAQ in USC Ready for Use	Feb 28 '05	Feb 28 '05	0 days								●
DAQ	ML1	D-1021	Start Subdetector Trigger/DAQ Integration	Jul 31 '05	Jul 31 '05	0 days								●
DAQ	ML2*	D-1023	DAQ.0: 25% Performance Installed	Jan 31 '06	Jan 31 '06	0 days								●
DAQ	ML1	D-1024	Working CMS Closed, DAQ.0 Ready for Data T	Mar 31 '06	Mar 31 '06	0 days								●





Installation/Commissioning

Definition of deliverables:

- 1. The preseries systems in 2004 for $\frac{1}{4}$ of the D2S and one readout builder. The systems are installed, tested and commissioned at CERN. They will be transported to P5 whenever the latter becomes available.**
 - This is the “startup DAQ” of CMS. Detectors installed at P5 will be read out/installed using this system. The US is delivering a full working prototype of a CMS DAQ segment, from detector to farm.
- 2. Procurement of 1 Readout Builder, 1 Event Filter and $\frac{1}{4}$ of the final D2S systems.**
 - Actual installation of this system in 2005/06, depending on ETA of first beam.



US DAQ Estimate-to-Complete

WBS Number	Description	EDIA	M&S	Base Cost	Cont %	Cont Amount	Total Cost
3.2	Data Acquisition	\$628,148	\$2,067,178	\$2,695,327	51%	\$1,362,339	\$4,057,666
3.2.1	Prototypes: RU	\$40	\$0	\$40	54%	\$22	\$62
3.2.2	Prototypes: FU	\$8	\$0	\$8	54%	\$5	\$13
3.2.3	Prototypes: Event Builder	\$0	\$0	\$0	0%	\$0	\$0
3.2.4	Demonstrator for TDR	\$243,985	\$196,054	\$440,039	58%	\$253,077	\$693,116
3.2.5	Production: Builder Unit	\$0	\$0	\$0	0%	\$0	\$0
3.2.6	Production: Event Builder	\$0	\$0	\$0	0%	\$0	\$0
3.2.7	DAQ Tests/Installation	\$0	\$0	\$0	0%	\$0	\$0
3.2.8	DAQ Prototypes	\$233,705	\$909,761	\$1,143,466	52%	\$592,241	\$1,735,707
3.2.9	Startup-DAQ	\$105,737	\$961,364	\$1,067,101	47%	\$499,125	\$1,566,226
3.2.10	DAQ Tests/Installation	\$44,672	\$0	\$44,672	40%	\$17,869	\$62,541

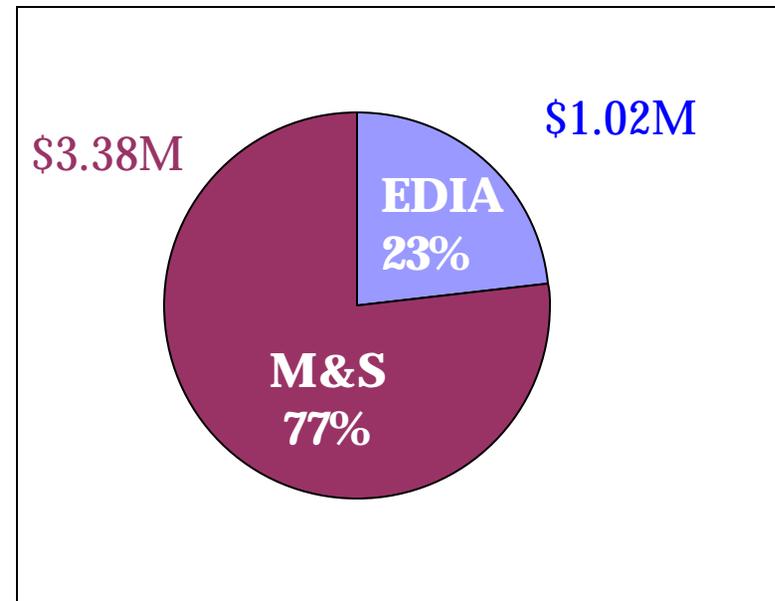
DAQ Cost to complete:

4.4 M\$*

Contingency:

2.24 M\$ (51%)

Note: This project has 1.7M\$ missing. This is a loan which is put in as a descope in the startup DAQ. I will speak to the true costs of the DAQ ignoring this loan.





Maintenance and Operation

Included in US DAQ M&O estimate:

Redundant parts for M&O period (M&S) for US deliverables only

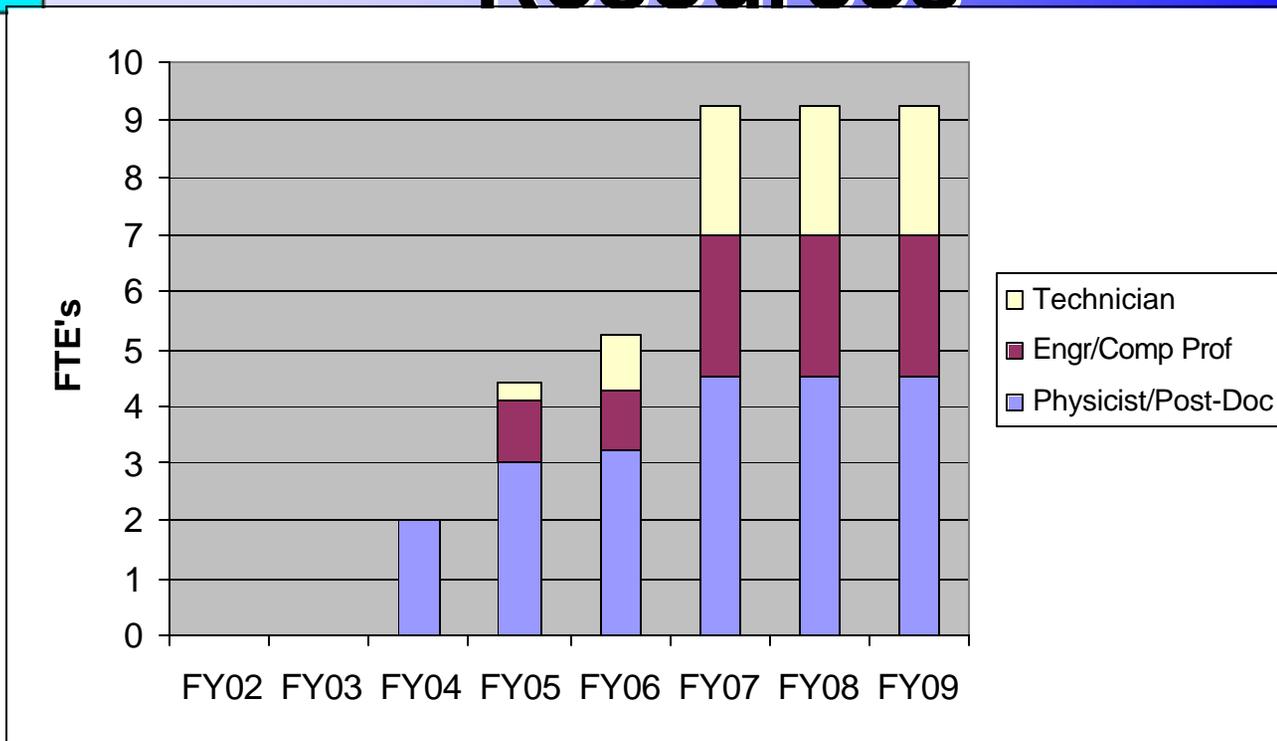
- “non-commercial” items:
 - need total of 25% redundancy
- Commercial items
 - BU/FU/EVM (e.g. specialized I/O PC's)
 - Replace every 5 years
 - Disks/disk servers/ backup systems
 - Replace every 5 years
 - CPU intensive PC's (e.g filtering PC's)
 - Replace every 3 years

**Engineering, System Administration,
Technicians**

Postdocs assumed from base program (0 cost)



Maintenance and Operation: Resources



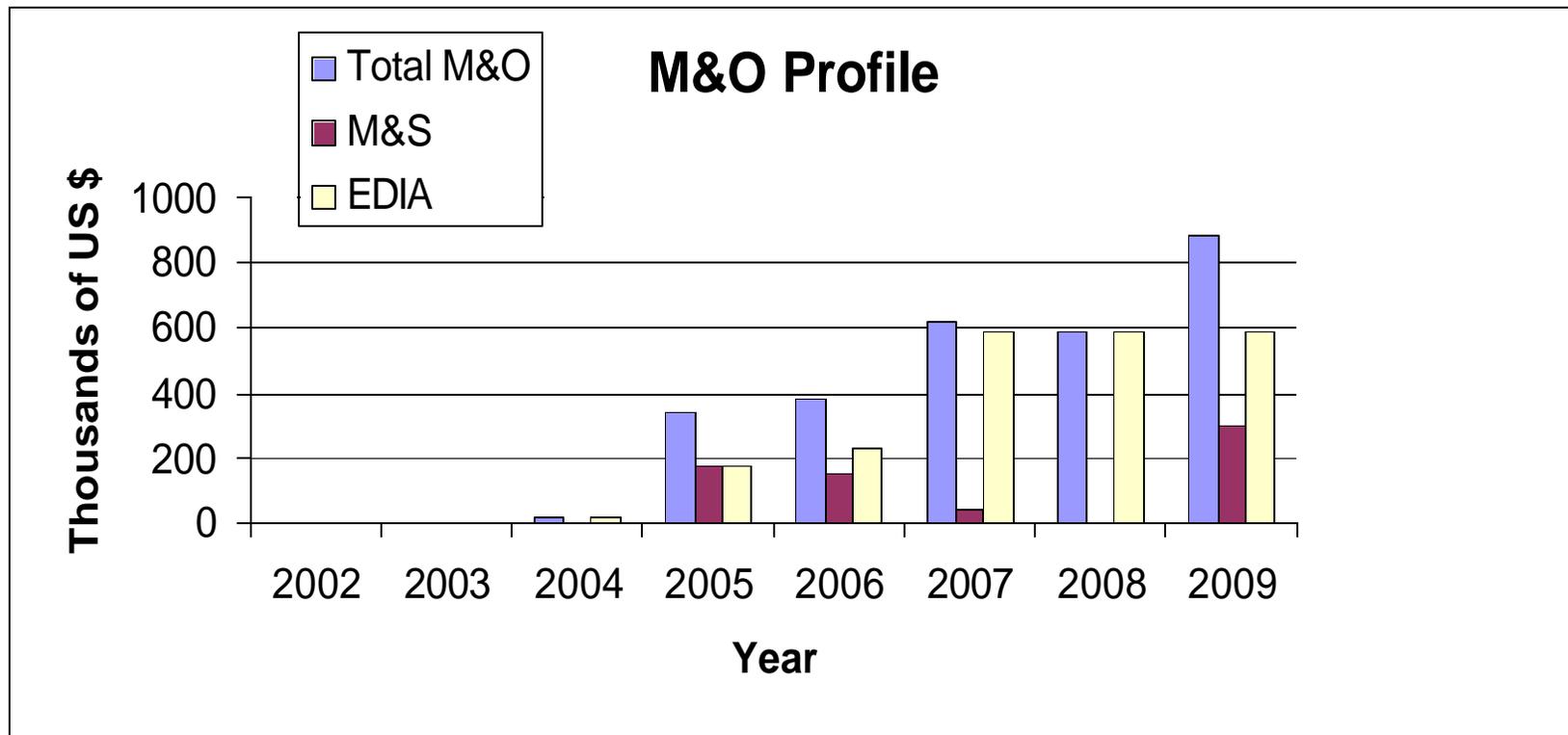
Year	2003	2004	2005	2006	2007	2008	2009
SysAdmin	0	0	1.1	1.15	2.5	2.5	2.5
Technician	0	0	0.3	1.25	2.25	2.25	2.25
Engineer	0	0	0	0	0.5	0.5	0.5
Postdocs		2	3	3.25	4.5	4.5	4.5



M&O Profile (OLD FIX)

US Contribution Only:

- Higher than guidance
- Working on refinements and cuts





DAQ Project Summary

Redefined US-CMS DAQ contribution

- In line with CMS DAQ baseline design
- Built from US-CMS and CMS R&D work.
- Allows US detector projects to commission with official CMS DAQ segment
- Easy scalability (just add segments)
- CMS DAQ cost the same/US-CMS DAQ cost the same
- Profile moved to better match LHC/commissioning schedule

Redefined deliverable:

- A full functioning DAQ in the lab (CERN site)
- Transport to P5
- Commissioning DAQ for detector installation
- Procurement of the final elements of the segment



DAQ M&O Summary

Maintenance and Operation

- Draft project file for M&O period submitted
- M&O starts late for DAQ since DAQ is purchased ALAP
- M&O roughly in line with guidance but needs some refinement
- M&S costs done “bottom up”
- Personnel for operating and trouble shooting system estimated