

# DØ Run 2 Online Computing

DOE Review  
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Fermilab

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# Scope of Presentation

- **Online Computing** includes:
  - Elements of the Data Acquisition system hardware from the Level 3 Trigger system thru to Tape
  - DAQ control and monitoring software
  - Downloading to detector elements
  - Detector control and monitoring software
- **This presentation discusses:**
  - The scope of the ‘upgrade’
  - Hardware architecture (WBS 1.5.1)
    - Costs, schedule, and management
  - Software architecture
  - Principal milestones
  - Software management structure
  - Full task list and schedule



# Online System Upgrade

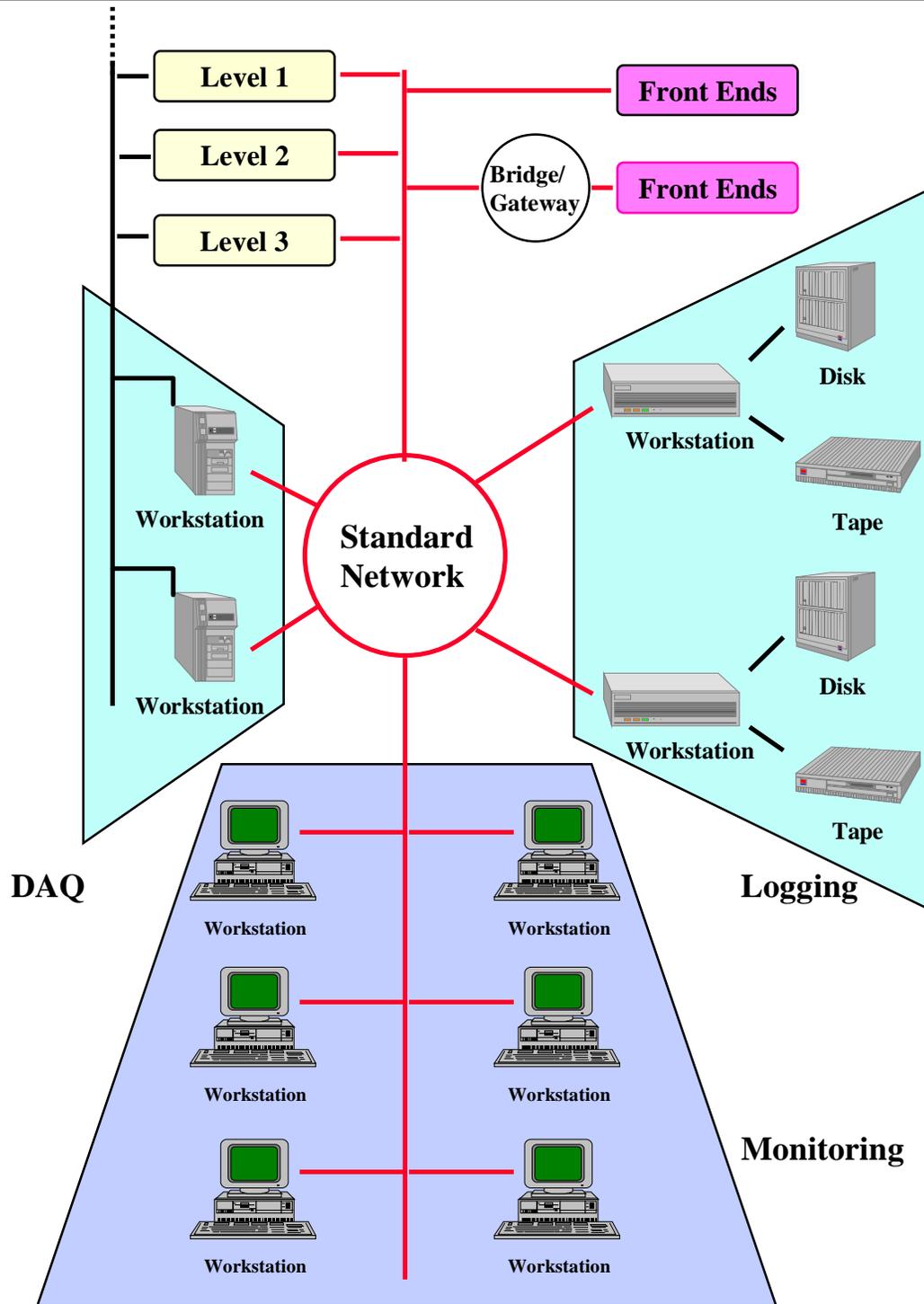
Upgrade from Run 1 to Run 2 :

- **changing:**

	from:	to:
– Bandwidth	2 MB/sec	5 MB/sec
– Architecture	VAX/VMS	UNIX
	VAX/ELN	WinNT
– Software	FORTRAN	C++
	PASCAL	C
- **not changing:**
  - **Philosophy:** Online system built from commodity components
  - **Personnel:** retain principals in
    - Trigger system
    - Configuration and Run control
    - Control and monitoring
  - **Reliability!**
    - Run 1 less than 1% downtime attributable to Online system



# Hardware Architecture



# Hardware Acquisition

WBS 1.5.1		ONLINE COMPUTING									
Revision: 1 (Fuess)		September 30, 1994									
WBS 1.5.1	ITEM ONLINE COMPUTING	MATERIALS & SERVICES (M&S)							CONTINGENCY		
		Unit #	Unit Cost	M&S TOTAL	FY97	FY98	FY99	%	Cost	TOTAL Cost	
1.5.1.1	<i>Workstations</i>			260000	55000	55000	150000	17.69	46,000	306000	
1.5.1.1.1	DAQ Workstations (CPU,mem,netwk,IO,	ea	4	35000	140000	35000	35000	70000	20	28,000	168000
1.5.1.1.2	Monitoring Workstations	ea	6	20000	120000	20000	20000	80000	15	18,000	138000
1.5.1.2	<i>Network (switch,bridge,router)</i>	lot	1	80000	80000	0	80000	0	25	20,000	100000
1.5.1.3	<i>Disk/tape Peripherals</i>			90000	15000	15000	60000	25	22,500	112500	
1.5.1.3.1	Disk	Gb	60	500	30000	5000	5000	20000	15	4,500	34500
1.5.1.3.2	Tape	ea	12	5000	60000	10000	10000	40000	30	18,000	78000
1.5.1.4	<i>Printers/Monitors/Xterms/PCs</i>	lot	1	75000	75000	10000	15000	50000	5	3,750	78750
1.5.1.5	<i>Software</i>	lot	1	100000	100000	10000	40000	50000	25	25,000	125000
TOTAL ONLINE COMPUTING				605,000	90,000	205,000	310,000	19.38	117,250	722,250	

## Schedule:

- System plan by Oct. '96
- Purchases in FY97, FY98, FY99

## Management:

- S.Fuess (FNAL)
- D.Schamberger (Stony Brook)



# Hardware Examples

- **Workstations**

- \$35K DAQ workstation  
eg DEC AlphaServer 2100 5/250
- \$20K Monitoring workstation  
eg DEC AlphaServer 2000 4/233

- **Network**

- \$80K  
eg DEC FDDI GigaSwitch, FDDI concentrators

- **Peripherals**

- \$30K disk  
eg SCSI disk at \$0.20/MB plus  
RAID disk at \$1.00/MB
- \$60K tape  
eg 12 Quantum DLT drives at  
\$5K each



# Hardware Examples

- **Screens**

- \$5K printer
- \$40K 10 PCs @ \$4K
- \$30K 15 21" monitors @ \$2K

- **Software**

- \$100K

various needs:

- Database
- Compilers
- Clustering software
- RAID software

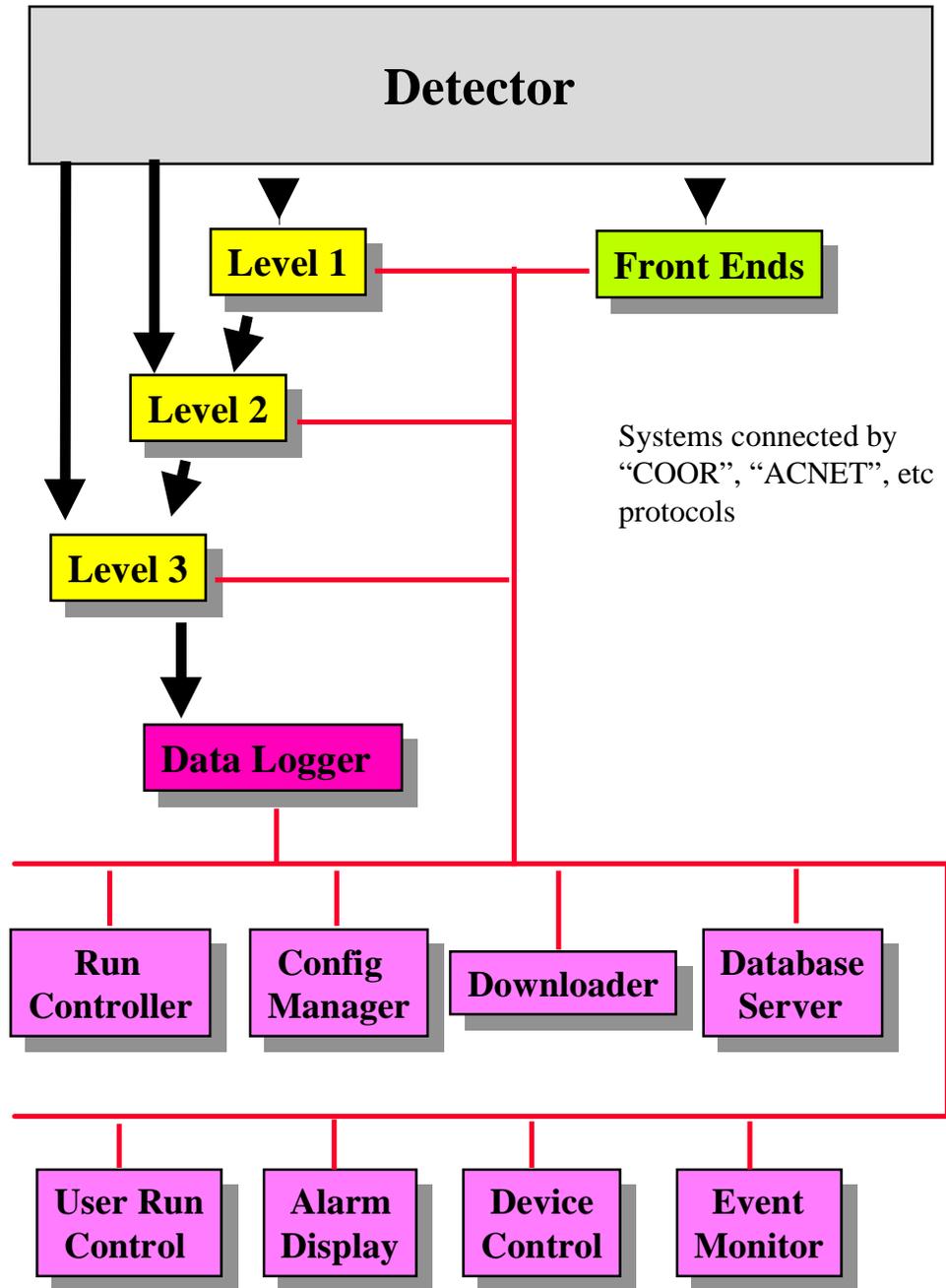


# Contingencies

<b>Item</b>	<b>%</b>	<b>Amount</b>	<b>Explanation</b>
DAQ workstation	20%	\$28K	1 additional
Monit. workstation	15%	\$18K	1 additional
Network	25%	\$20K	not yet designed
Disk	15%	\$4.5K	unforeseen needs
Tape	30%	\$18K	media undetermined
Monitors...	5%	\$4K	unforeseen needs
Software	25%	\$25K	not yet designed



# Software Architecture



# Milestones

## Oct 1996 *Basic tools available*

- Architecture determined
- Task-to-task communication ready
- Database API determined
- Control path API determined

## Oct 1997 *Communication paths*

- Host to Level 1/2/3 communication
- Host control tasks
- Control path operational
- Alarm system

## Apr 1998 *Data path operational*

- Detector data into host via DAQ path

## Jan 1999 *Coordinated operation*

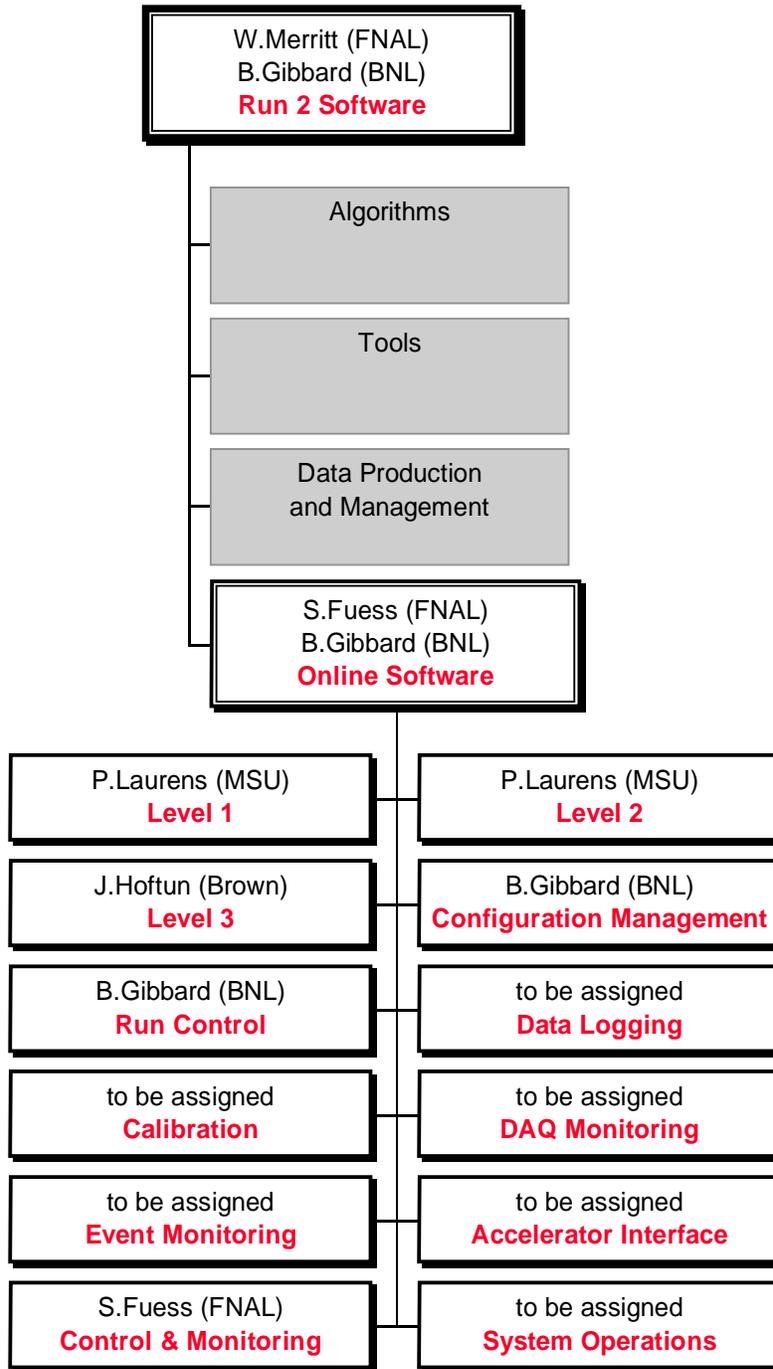
- Configuration and Run control ready

## Jul 1999 *Online system ready*

- Filter code loaded
- User interfaces ready



# Organization Chart



# Tasks and Schedules

ID	Task Name	Duration	Start	Finish	Predecessors	Constraint	Resources
1	<b>Online Computing System</b>	169w	1-Jan-96	1-Apr-99		Must Finish On	
2	<b>Management</b>	169w	1-Jan-96	1-Apr-99		Must Finish On	
3	<i>Management</i>						
4	Management	169w	1-Jan-96	1-Apr-99		Must Finish On	PhysF[.5],PhysU[.5]
5							
6	<b>Online tools</b>	39w	1-Jan-96	1-Oct-96		Must Finish On	
7	<i>General tools</i>						
8	Hardware architecture plan	13w	1-Apr-96	1-Jul-96		As Soon As Possible	PhysF[.125],PhysU[.125]
9	Interprocess communication package	13w	1-Apr-96	1-Jul-96	8	As Soon As Possible	PhysU[.125]
10	Client/Server package	26w	1-Apr-96	1-Oct-96	9	Must Finish On	PhysF[.25]
11	Database decision	39w	1-Jan-96	1-Oct-96	8	Must Finish On	PhysF[.125],PhysU[.125]
12	<i>Level 1</i>						
13	Level 1 framework	39w	1-Jan-96	1-Oct-96	8	As Soon As Possible	CProfU[.25]
14	<i>Level 2</i>						
15	Level 2 framework	39w	1-Jan-96	1-Oct-96	8	As Soon As Possible	CProfU[.25]
16	<i>Level 3</i>						
17	Level 3 framework	39w	1-Jan-96	1-Jul-96	8	As Soon As Possible	PhysU[.25]
18	<i>Control and monitoring</i>						
19	Front end framework	39w	1-Jan-96	1-Oct-96	8	As Soon As Possible	CProfF[1]
20	Prototype control path communication	39w	1-Jan-96	1-Oct-96	11,19	As Soon As Possible	CProfF[.25]
21	VME-based DAQ	39w	1-Jan-96	1-Oct-96	19,20	As Soon As Possible	PhysU[.25]
22	Detector-specific tasks	39w	1-Jan-96	1-Oct-96	19	As Soon As Possible	PhysU[.25]
23							
24	<b>Communication paths</b>	52w	1-Oct-96	1-Oct-97	6	Must Finish On	
25	<i>General tools</i>						
26	Database tools	52w	1-Oct-96	1-Oct-97		As Soon As Possible	CProfF[.5]
27	Debugging and maintenance	26w	1-Oct-96	1-Oct-97		As Soon As Possible	PhysF[.25],CProfF[.5],PhysU[.25]
28	<i>Level 1</i>						
29	L1 operation by host control	13w	1-Oct-96	1-Jan-97	10	Must Finish On	CProfU[1]
30	<i>Level 2</i>						
31	L1 and L2 operation by host control	39w	1-Jan-97	1-Oct-97	10	Must Finish On	CProfU[1]
32	<i>Level 3</i>						
33	L3 configuration management	52w	1-Oct-96	1-Oct-97	10	As Soon As Possible	PhysU[.5]
34	<i>Calibration</i>						
35	Front end calibration tasks	52w	1-Oct-96	1-Oct-97	19	As Soon As Possible	PhysU[.25]
36	<i>Control and monitoring</i>						
37	Control path communication	52w	1-Oct-96	1-Oct-97	20	As Soon As Possible	CProfF[.5],PhysF[.5]
38	Alarm system	52w	1-Oct-96	1-Oct-97	10,37	As Soon As Possible	CProfF[.25],PhysF[.25]
39	Front end with 1394 support	52w	1-Oct-96	1-Oct-97	19	As Soon As Possible	CProfF[.25]
40	Front end with 1553 support	52w	1-Oct-96	1-Oct-97	19	As Soon As Possible	CProfF[.25]
41							
42	<b>Data path and monitoring</b>	91w	1-Jul-96	1-Apr-98	24	Must Finish On	
43	<i>General tools</i>						
44	Debugging and maintenance	26w	1-Oct-97	1-Apr-98		As Soon As Possible	PhysF[.25],CProfF[.5],PhysU[.25]
45	<i>Level 1</i>						
46	Auto-rate, serving, logging features	13w	1-Oct-97	1-Jan-98	29	As Soon As Possible	CProfU[.5]
47	<i>Level 2</i>						
48	Auto-rate, serving, logging features	13w	1-Oct-97	1-Jan-98	31	As Soon As Possible	CProfU[.5]
49	Data path operational	26w	1-Oct-97	1-Apr-98	29,31	As Soon As Possible	PhysU[.5]
50	<i>Level 3</i>						
51	Data path operational	78w	1-Jul-96	1-Jan-98	29,31,35,49	As Soon As Possible	PhysU[.5]
52	Monitoring tasks operational	39w	1-Jul-97	1-Apr-98	33	As Soon As Possible	PhysU[.25]
53	<i>Configuration management</i>						
54	Configuration framework	78w	1-Jul-96	1-Jan-98		As Soon As Possible	PhysU[.5]
55	Configuration downloading operational	52w	1-Jan-97	1-Jan-98	10,37,54	As Soon As Possible	PhysF[.25]
56	User configuration control	52w	1-Jan-97	1-Jan-98	10,54,55	As Soon As Possible	PhysU[.25]
57	<i>Run control</i>						
58	Run state management framework	78w	1-Jul-96	1-Jan-98	11	As Soon As Possible	PhysU[.25]
59	User run control	52w	1-Jan-97	1-Jan-98	10,51,58	As Soon As Possible	PhysU[.125]
60	<i>Data Logging</i>						
61	Host data path operational	78w	1-Jan-97	1-Apr-98	51	As Soon As Possible	PhysU[.5]
62	Data spooling operational	52w	1-Apr-97	1-Apr-98	61	As Soon As Possible	PhysU[.125]
63	<i>Calibration</i>						
64	Calibration databases operational	65w	1-Jan-97	1-Apr-98	11	As Soon As Possible	PhysU[.125]
65	<i>Event monitoring</i>						
66	Event data pool operational	13w	1-Jan-98	1-Apr-98		As Soon As Possible	PhysU[.25]
67	<i>Control and monitoring</i>						
68	Host control process	52w	1-Jan-97	1-Jan-98	37	As Soon As Possible	PhysU[.5]
69	High voltage control process	52w	1-Jan-97	1-Jan-98	37	As Soon As Possible	PhysU[1]
70	Clock control process	26w	1-Jul-97	1-Jan-98	37	As Soon As Possible	CProfF[.25]
71	Liquid Argon monitoring	26w	1-Jul-97	1-Jan-98	37	As Soon As Possible	PhysU[.25]
72	Specialized muon system controls	26w	1-Jul-97	1-Jan-98	37	As Soon As Possible	PhysU[.25]
73	Specialized tracking system controls	26w	1-Jul-97	1-Jan-98	37	As Soon As Possible	PhysU[.25]
74	Specialized calorimeter controls	26w	1-Jul-97	1-Jan-98	37	As Soon As Possible	PhysU[.25]
75	<i>System Operations</i>						
76	System performance monitors	13w	1-Jan-98	1-Apr-98		As Soon As Possible	PhysU[.125]

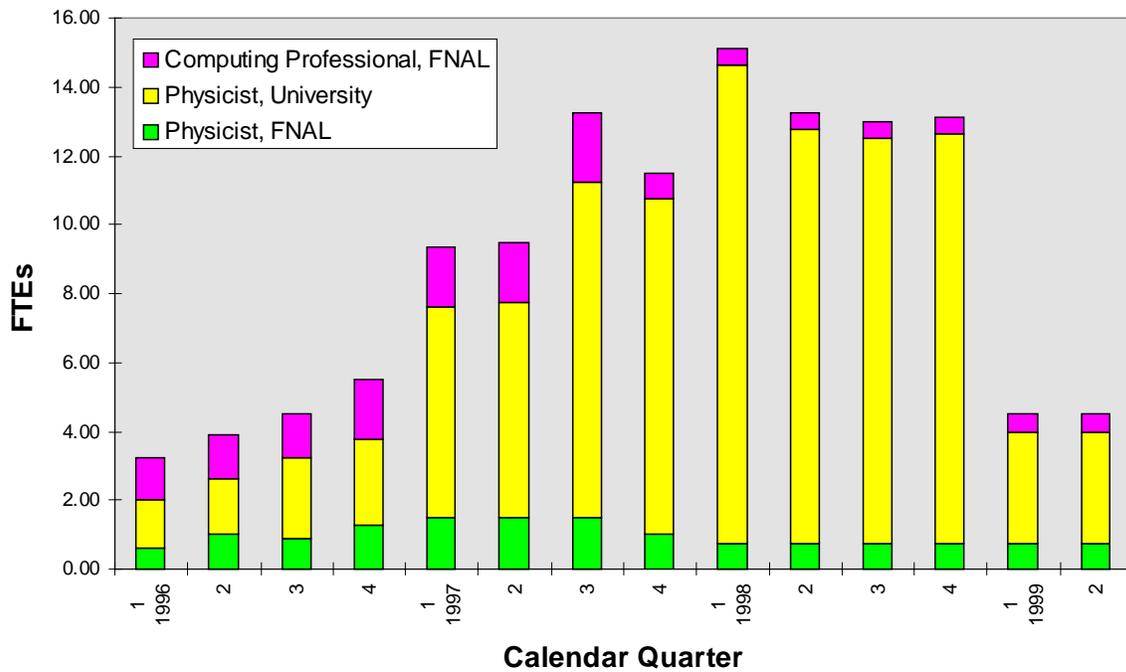


# Tasks and Schedules

ID	Task Name	Duration	Start	Finish	Predecessors	Constraint	Resources
78	<b>Coordinated operation</b>	<b>104w</b>	<b>1-Jan-97</b>	<b>1-Jan-99</b>	<b>42</b>	Must Finish On	
79	<i>General tools</i>						
80	User interface tools	52w	1-Jan-97	1-Jul-98		As Soon As Possible	PhysU[.125]
81	Debugging and maintenance	39w	1-Apr-98	1-Jan-99		As Soon As Possible	PhysF[.25],CProfF[.5],PhysU[.25]
82	<i>Level 1</i>						
83	Level 1 and Level 2 coordinated operation	52w	1-Jan-98	1-Jan-99	31	Must Finish On	CProfU[.5]
84	<i>Level 2</i>						
85	Level 2 and Level 1 coordinated operation	52w	1-Jan-98	1-Jan-99	31	Must Finish On	CProfU[.5]
86	Level 2 muon pre-processor	52w	1-Jan-98	1-Jan-99	85	As Soon As Possible	PhysU[.5]
87	Level 2 calorimeter pre-processor	52w	1-Jan-98	1-Jan-99	85	As Soon As Possible	PhysU[.5]
88	Level 2 tracking pre-processor	52w	1-Jan-98	1-Jan-99	85	As Soon As Possible	PhysU[.5]
89	Level 2 global processor	52w	1-Jan-98	1-Jan-99	85	As Soon As Possible	PhysU[.5]
90	<i>Configuration management</i>						
91	Configuration recording	52w	1-Jul-97	1-Jul-98	56	As Soon As Possible	PhysU[.125]
92	<i>Run control</i>						
93	Run information recording	78w	1-Jul-97	1-Jan-99	59	As Soon As Possible	PhysU[.125]
94	<i>Data Logging</i>						
95	Data information recording	52w	1-Jan-98	1-Jan-99	62	As Soon As Possible	PhysU[.125]
96	<i>Calibration</i>						
97	Level 2, Level 3, Host routines	78w	1-Jan-97	1-Jul-98	56,59,64	As Soon As Possible	PhysU[1]
98	<i>DAQ monitoring</i>						
99	Global monitoring process	52w	1-Jan-98	1-Jan-99	10,46,48,52	As Soon As Possible	PhysU[.5]
100	<i>Event monitoring</i>						
101	Event monitoring processes	52w	1-Jan-98	1-Jan-99	66	As Soon As Possible	PhysU[4]
102	<i>Accelerator interface</i>						
103	Communication procedures	52w	1-Jan-98	1-Jan-99	10	As Soon As Possible	PhysU[.25]
104	Data monitoring and recording	52w	1-Jan-98	1-Jan-99	11,103	As Soon As Possible	PhysU[.25]
105	<i>Control and monitoring</i>						
106	Data logging	52w	1-Jan-98	1-Jan-99	62	As Soon As Possible	PhysU[.25]
107	<i>System Operations</i>						
108	Electronic log	26w	1-Jul-98	1-Jan-99		As Soon As Possible	PhysU[.25]
109	DAQ process monitor	13w	1-Oct-98	1-Jan-99		As Soon As Possible	PhysU[.125]
110	Store monitor and logging	26w	1-Jul-98	1-Jan-99	11	As Soon As Possible	PhysU[.25]
111							
112	<b>Data taking</b>	<b>91w</b>	<b>1-Jul-97</b>	<b>1-Apr-99</b>	<b>78</b>	Must Finish On	
113	<i>General tools</i>						
114	Debugging and maintenance	39w	1-Jan-99	1-Apr-99		As Soon As Possible	PhysF[.25],CProfF[.5],PhysU[.25]
115	<i>Level 2</i>						
116	Level 2 filter code operation	65w	1-Jan-98	1-Apr-99	85	As Soon As Possible	PhysU[.5]
117	<i>Level 3</i>						
118	Level 3 filter code operation	91w	1-Jul-97	1-Apr-99	51	As Soon As Possible	PhysU[2]
119							
120							
121							

# Human Resources

## Online Software Resource Requirements



# Online Computing: Summary

- **Hardware** upgrade
  - Commodity components purchased as late as possible
  - modest system requirements
  - most details to be determined
  
- **Software** upgrade
  - move to industry / FNAL standards
  - retain philosophy and expertise from Run 1
  - part of overall DØ Run 2 Computing plan

