Management, Cost & Schedule, Controls, ES&H, manpower

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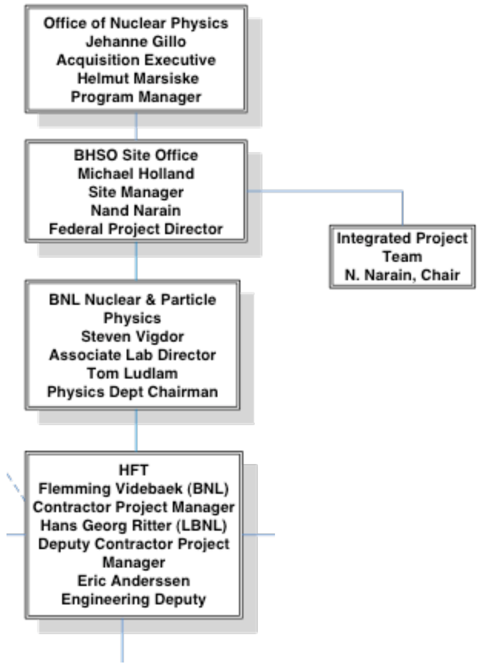
Overview

- **Organization**
  - Sub-system responsibilities
- **Communication and Reporting**
  - DOE/BNL
  - Project wide
- **Cost & Schedule**
  - Cost & Schedule
  - Contingency
  - Budget control
  - Change Control
- **ES&H/Safety**
- **Risk Assessment**
- **Manpower, Collaboration**
- **Summary**

Organization - DOE

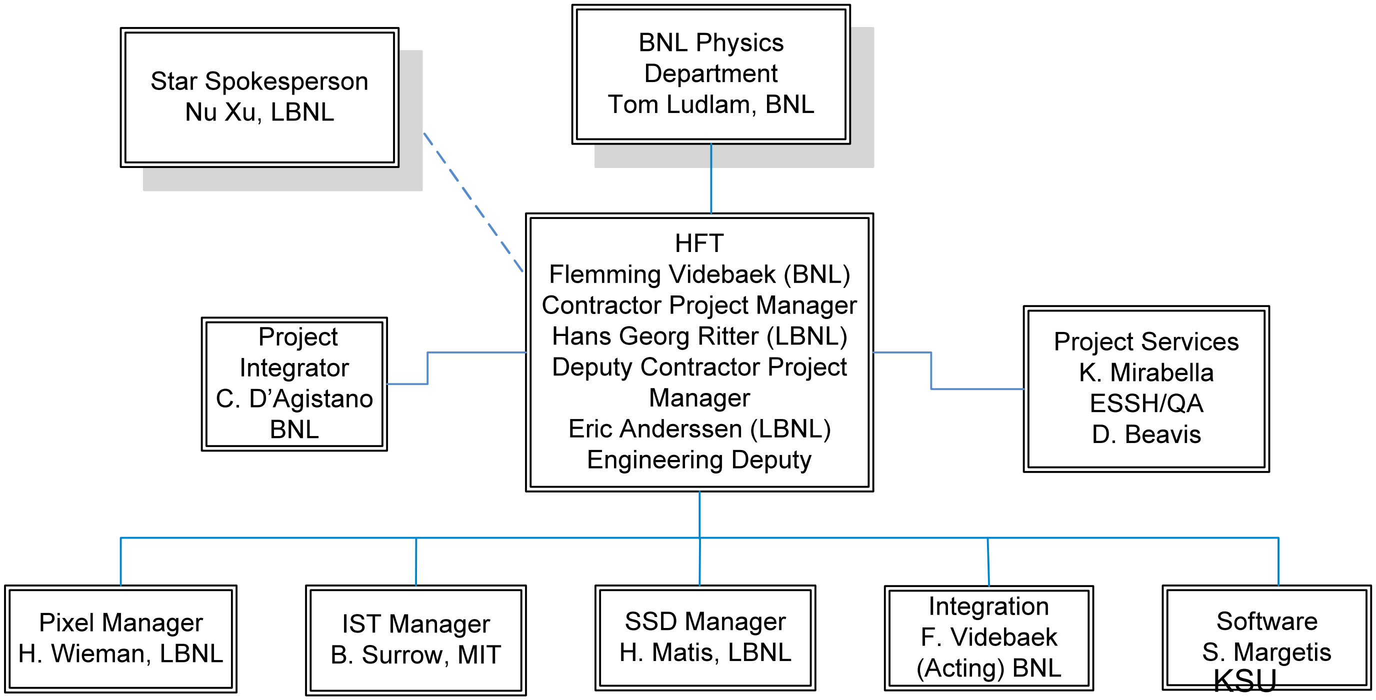


Integrated project Team

DOE Federal Project Director (Chair)	Nand Narain
DOE Site Contracting Officer	Evelyn Landini
DOE Program Manager for HFT	Helmut Marsiske
DOE Science Program Manager	Gulshan Rai
BNL Contractor Project Manager for HFT	Flemming Videbaek
LBNL Deputy Project Manager	Hans Georg Ritter
BNL ESSH Lead	Ed Lessard
Physics Assistant Chair for Administration	Robert Ernst
BHSO Facility Representative	Patrick Sullivan

Project team has been meeting weekly with the DOE Federal Project Director.

Organization – Project level



- BNL, as the prime contractor, is responsible for the design, procurement, fabrication, assembly and integration of the HFT components.

- Responsibility for sub-systems are delegated to several institutions and groups as shown here.

Project Organization

- Sub-systems
  - Further delegation of tasks and responsibilities
- ES&H
  - Safety Coordinator Dana Beavis
- Q&A board
  - C. d'Agostino (TBC), R.A.Scheetz, E.Anderssen, TBD (STAR/BNL)
- Technical Committee
  - CPM, DPM, sub-system managers, other sub-system experts.

Reporting & Communication

- High Level
  - Project Assessment and Reporting System (PARS) will be updated on a monthly basis by the Federal Project Director (Nand Narain, BNL site office)
  - Contractor Project Manager will report to FPD on a monthly basis.
  - The CPM will provide quarterly reports with the sub-system managers and BNL management to the DOE office via phone conferences
  - Annual progress reviews with outside experts will be conducted by DOE.

Reporting & Communication

- **Weekly**
  - Technical committee (Management issues, progress reports)
  - Hardware group meeting (PXL, IST, SSD)
  - Integration team (sometimes bi-weekly)
    - Members from HFT, FGT projects and STAR operations group.
  - Software group
  - SSD sub-system (bi-weekly) includes engineering participation from Subatech, Nantes.
- **Bi-monthly project meetings**
- **Monthly**
  - progress report to Collaboration
- **As often as needed -** Management team will conduct design reviews and technical progress reviews on a regular basis
- **Regular telecons -** LBNL-IPHC, yearly face-to face meetings

Work Breakdown Structure

- The WBS matches the sub-systems. Funding will be tracked within institutions for the different phases of project and the WBS structure at lower level.
- The Draft preliminary WBS dictionary is developed to level 5 for internal project purposes and level 4 for project documentation under change control.

WBS	Title
1.1	Project Management
1.2	Pixel Detector
1.3	Intermediate Silicon Tracker (IST)
1.4	Silicon Strip Detector (SSD)
1.5	Global support structure and integration
1..6	Software

Preliminary Cost Estimate

- Cost by WBS estimated by the subsystem experts as a bottoms-up analysis for labor, material and contributed labor.
- Developed high level schedule from engineering judgment, quotes, and sensor development timeline.
- Currently refining schedule and cost into one resource loaded schedule using MS Project software.
- A technically driven schedule is constrained by the proposed DOE funding

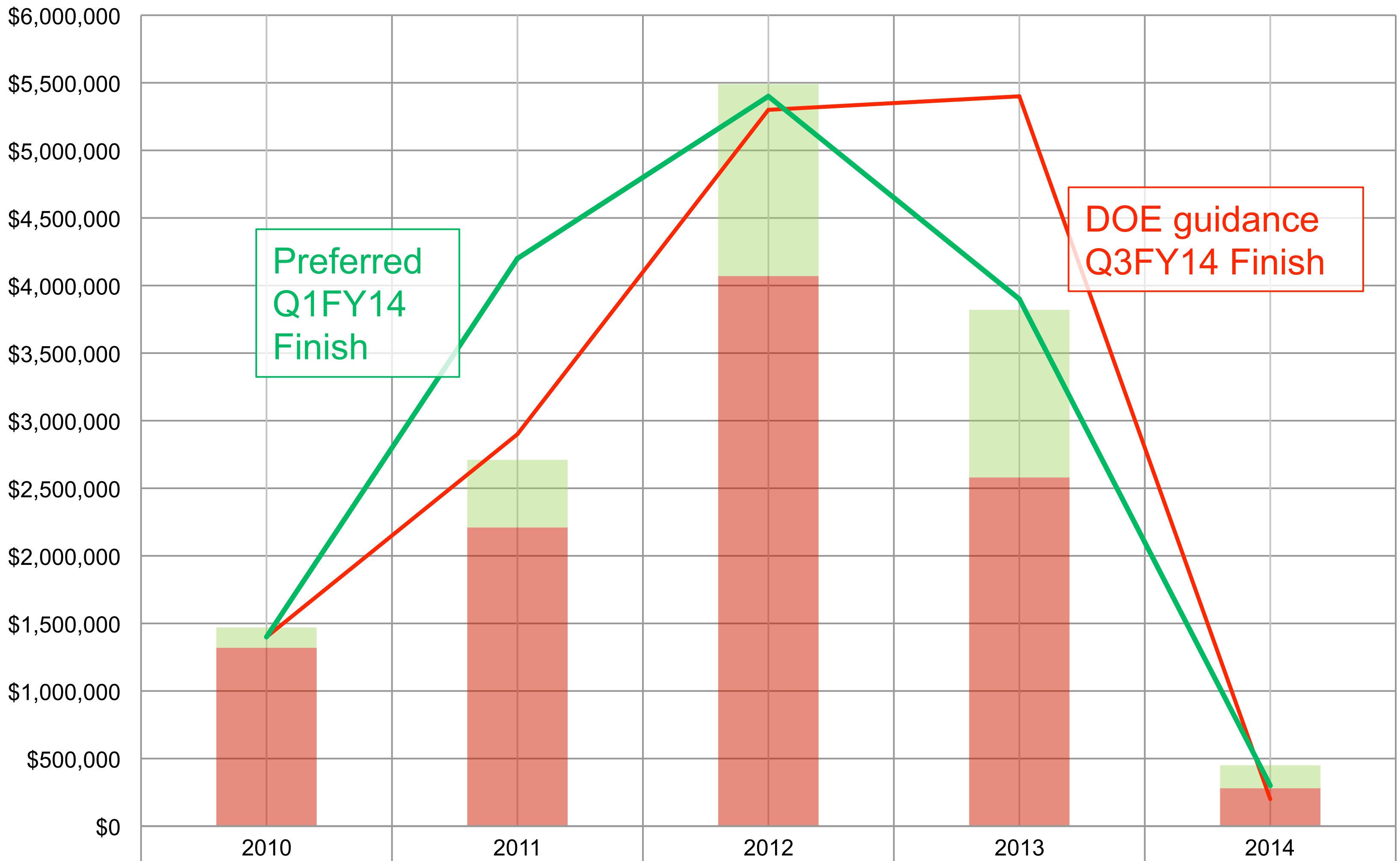
Cost & Profile

WBS	Title	Cost	Contingency %	Contingency $	Low range	High Range
1.1	Project Management	1002	9%	90	1047	1124
1.2	Pixel	4780	32%	1540	5550	6859
1.3	Intermediate Silicon Tracker (IST)	2650	36%	960	3130	3946
1.4	Silicon Strip Detector (SSD)	660	44%	290	805	1052
1.5	Integration	1380	43%	600	1680	2190
	subtotal	10472	33%	3480	12212	15170
	Contributed Labor	2345		0	2345	2345
	Total Project Cost	12817		3480	14557	17515

Cost break down by WBS : cost - AY$ (excluding contingency)

		FY10	FY11	FY12	FY13	FY14	total
1.1	Management	230	250	220	230	70	1000
1.2	PXL	610	820	1530	1680	140	4780
1.3	IST	160	530	1290	640	30	2650
1.4	SSD	120	110	220	210	0	660
1.5	Integration	200	500	510	130	40	1380

Proposed Funding and Planned Spending



	2010	2011	2012	2013	2014
Contingency					
Base					
DOE Suggested Profile	$1,400,000	$2,900,000	$5,300,000	$5,400,000	$200,000
Requested Profile	$1,400,000	$4,200,000	$5,400,000	$3,900,000	$300,000

Funding Advance allows for earlier finish

Major Procurements

PXL

- Si Masks and test wafers (final sensor 1st prototype) : $155k
- Si Masks and test wafers (final sensor 2nd prototype) : $155k
- sensor production (48 wafers) : $270k
- Kapton / Al production cables : $240k

IST

- Silicon Pad Sensors: $518k
- APV Readout Modules: $120k
- Kapton hybrids/cables: $208k
- Carbon Fiber ladders: $140k

Contingency

- At this pre CD-1 phase contingency percentages vary from a low 15% for well-understood / well defined tasks to 50% for tasks with high associated risks. The percentages were based on the judgment of the subsystem experts and were applied at the appropriate WBS level.

- After the Project is base-lined at CD-2 the FPD will manage the contingency funds according to the DOE Order 413.3A procedure and as detailed in the Preliminary Execution Plan (Baseline Change Control section and Change Control table)

Non DOE contributions

- The sensor development is taking place at the Institut Pluridisciplinaire Hubert Curien (IPHC) in Strasbourg, France. The LBNL group is working in close collaboration with Marc Winter and his group. The sensor development path for the PXL detector sensors is tailored to follow the development path of the technology as it was set by the IPHC group. This work and collaboration will be covered by an MOU that is expected to be signed by early 2010.

- The electronics upgrade of the SSD is the responsibility of the STAR BNL group in collaboration with electric engineers from the SUBATECH group that will provide engineering for layout and initial testing of the new boards. This work and collaborations will be covered by an MOU that is expected to be signed by January 2010. (~ 0.5 FTE over 2 years)

Cost Control

- BNL uses an approved Project Management System to integrate the project management elements required to effectively plan, organize, and control projects.
- Physics and C-AD personnel have project experience integrating cost and schedule data between other national laboratories and university collaborators.
- The HFT Project will utilize project procedures and systems that have been used successfully on EBIS, US ATLAS and Daya Bay.

Change Control

- Changes to the technical, cost and schedule baselines will be controlled using the thresholds.
- Procedures are defined in PEP

Change Level	**Cost**	**Schedule** (Table 6.2)	**Technical Scope** (Table 4-1)
DOE-SAE	> 25% cumulative increase to TPC	6 or more months increase (cumulative) to project completion date	Any change affecting conformance to mission need requirement
DOE-SC-26 Program (Level 1)	Any increase in the TPC or cumulative allocation of more than $500k contingency	3-month or more delay of a Level 0 or 1 milestone date	Any change in CD-4 deliverable that affects mission need requirement
DOE-BHSO Federal Project Director (Level 2)	A cumulative increase of more than $250k in WBS Level 2 or cumulative allocation of more than $250k contingency	> 1-month delay of a Level 0 or 1 milestone date or > 3-month delay of a Level 2 milestone date	Any deviation from technical deliverables that does not affect expected performance specifications
HFT Contractor Project Manager (Level 3)	Any increase of >$50k in the WBS Level 2	> 1-month delay of a Level 2 milestone date or any change greater than 3 months to a level 3 milestone	Any significant change in the System Requirements document.

Related Activities

- Activities that are related to, but not part of this project, are:
  - **Beryllium vacuum beam-pipe** fabrication. The specification for this is carried out by BNL and STAR to ensure it meets the needs for both the accelerator and the experiment in regard to all detector systems, not solely the HFT detector. Beam-pipes have because of these multiple aspects always been the funding responsibility of BNL/RHIC, while design is carried out by the STAR experiment jointly with Collider Accelerator Department.
  - **The Forward Gem Tracker (FGT)** is an independent upgrade project to STAR funded by NP/RHIC capital equipment (< 2M$) that also resides inside the STAR TPC detector. This requires tight integration between the HFT and FGT to ensure that both detector systems can operate within the envelope of STAR. The integration is ensured by weekly integration meetings between the two projects and by overall STAR integration meetings.

STAR Collaboration

- The project is an upgrade to the STAR detector, and the collaboration as such has a vital interest and commitment.
- Institutions below have committed resources to the HFT project.

Brookhaven National Laboratory
Czech Technical University, Prague, Czech Republic
University of California, Los Angeles
Kent State University, Kent
Nuclear Physics Institute ,Prague, Czech Republic
Institut Pluridisciplinaire Hubert Curien, Strasbourg, France
Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge
Lawrence Berkeley National Laboratory, Berkeley
Purdue University, West Lafayette
SUBATECH – Ecole des Mines, Nantes, France
University of Texas, Austin

MOU's

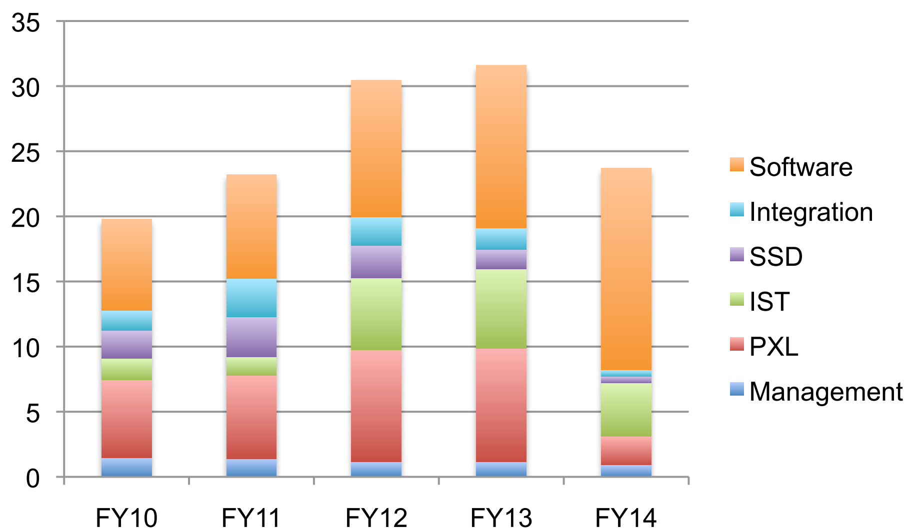
- The participating Institutions activity in the HFT MIE project will be governed by Memoranda of Understanding (MOU) that will be completed and signed before CD2.

- Preliminary discussions on content of these have been conducted with the institutions with major hardware involvement.

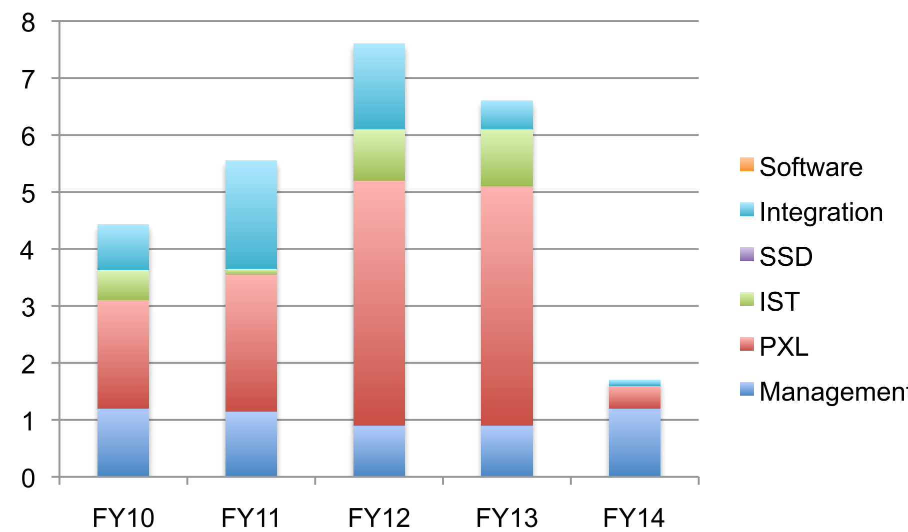
Manpower Summary

- Breakdown of man-power per subsystem vs. fiscal year. Total and FTE costed to project.

All FTE per sub-system



FTE costed to project



ES&H

- The ES&H issues for this project are minor.

- BNL Standards Based Management System (SBMS) provides the basis to identify standards for all equipment, control works, and mitigate hazards.

- The C-AD Experimental Safety Review Committee (ESRC) reviews the equipment and work procedures using the ESRC procedures and the SBMS.

ES&H cont.

- ESRC has experts to review hazards
  - Fire, Gas, HV, electrical,…
  - STAR has two members on the committee
  - HFT has a Safety Coordinator to expedite materials on safety to the ESRC.
- Preliminary Hazard Assessment Document
  - Subsystem managers completed the Hazards assessment tool
  - PHAD sent to C-AD for input/review
  - Design questionnaire completed and sent to C-AD for review
- Security vulnerabilities (SVAR) were reviewed.
  - The project has been found to fall within the standard envelope of the laboratory requirements.

Risk Assessment

- Risk management follows the standard procedures for DOE funded projects and the specifics are given in the HFT Risk Management plan.
- It involves an integrated approach from project management identifying the risk, and providing mitigation on a frequent basis.
- A preliminary Risk list has been developed by the sub-system managers. Assessment of risk is an on-going activity and reviewed regularly.

Risk Assessment Matrices

Consequence Risk Area	**Low**	**Moderate**	**High**
Cost:	≤ \$100K	≤\$250K	>\$250K
Schedule:	Delays Level 2 milestone or Project critical path by < 1 month	Delays Level 2 milestone or Project critical path by <4 months	Delays Level 2 milestone or Project critical path by >4 months
Technical:	Negligible, if any, degradation.	Significant technical/scope degradation.	Baseline scope or performance requirements will not be achieved.

	Impact		
Probability	**Low**	**Moderate**	**High**
High (p > 75%)	Low	Moderate	High
Moderate (25% p < 75%)	Low	Moderate	High
Low (p < 25%)	Low	Low	Moderate

Risk Assessment

- APS Sensor depending on Strasbourg pace of development
  - Push for early prototype, involved in testing and design with IPHC
- Kinematic mount, low mass ladder, alignment challenging, cooling
  - Solve problem in the R+D and prototype phase
- SSD is essential, readout
  - SSD prototype readout will be done early in collaboration with Subatech.
- Integration
  - Most risk are in schedule area and can be mitigated by early procurements.
- Mitigation was discussed in sub-system talks
- Preliminary risk assessment list completed

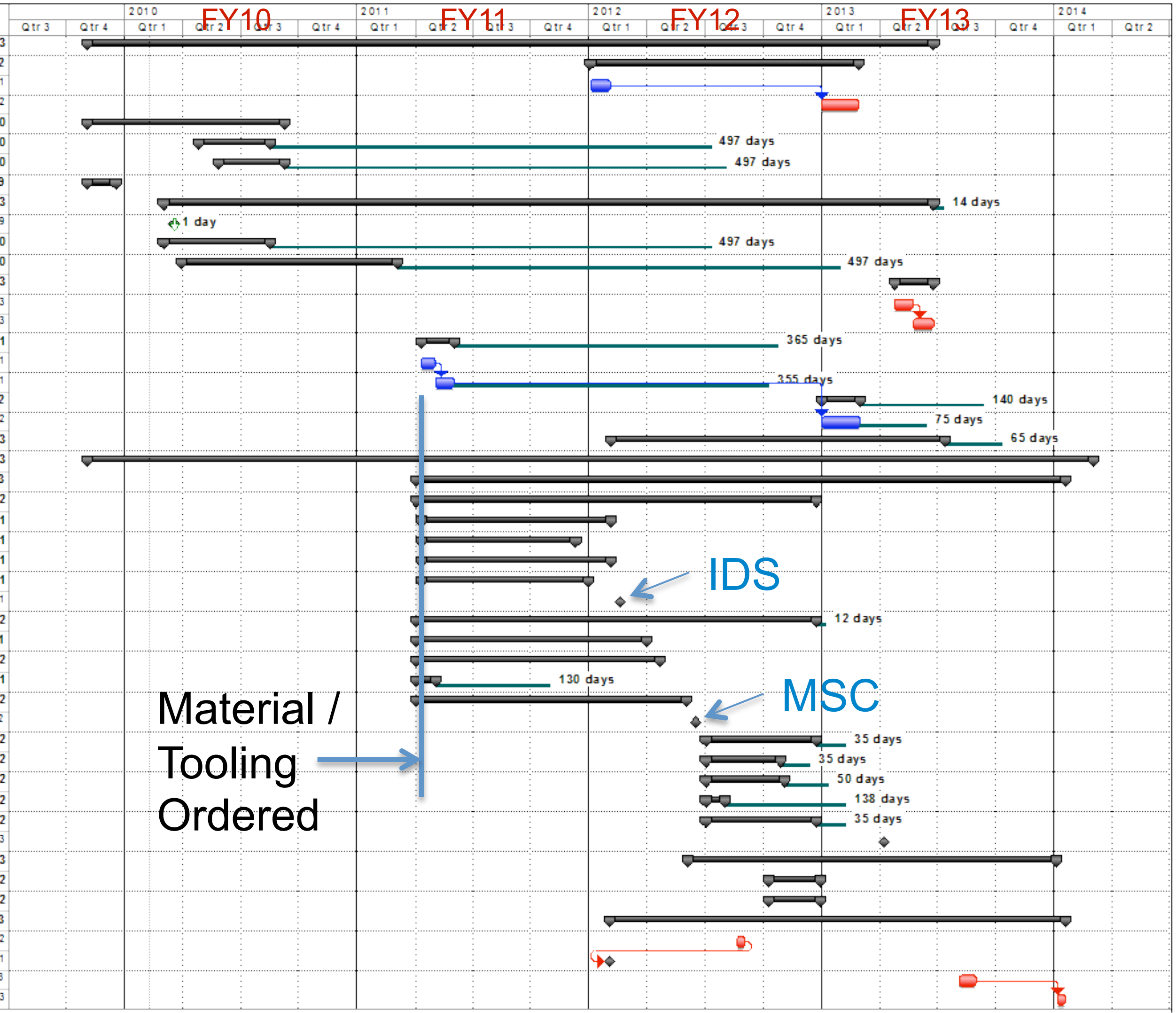
Summary

- Management team is in place.
- Cost, schedules and constraints are being further and better developed and defined.
- The ES&H issues for this project are minor.
- MOUs with all institutions will be in place before CD2.
- Project team ready to move forward with engineering and design for base-lining.
- Ready for CD-2/3 review in Q3 FY10

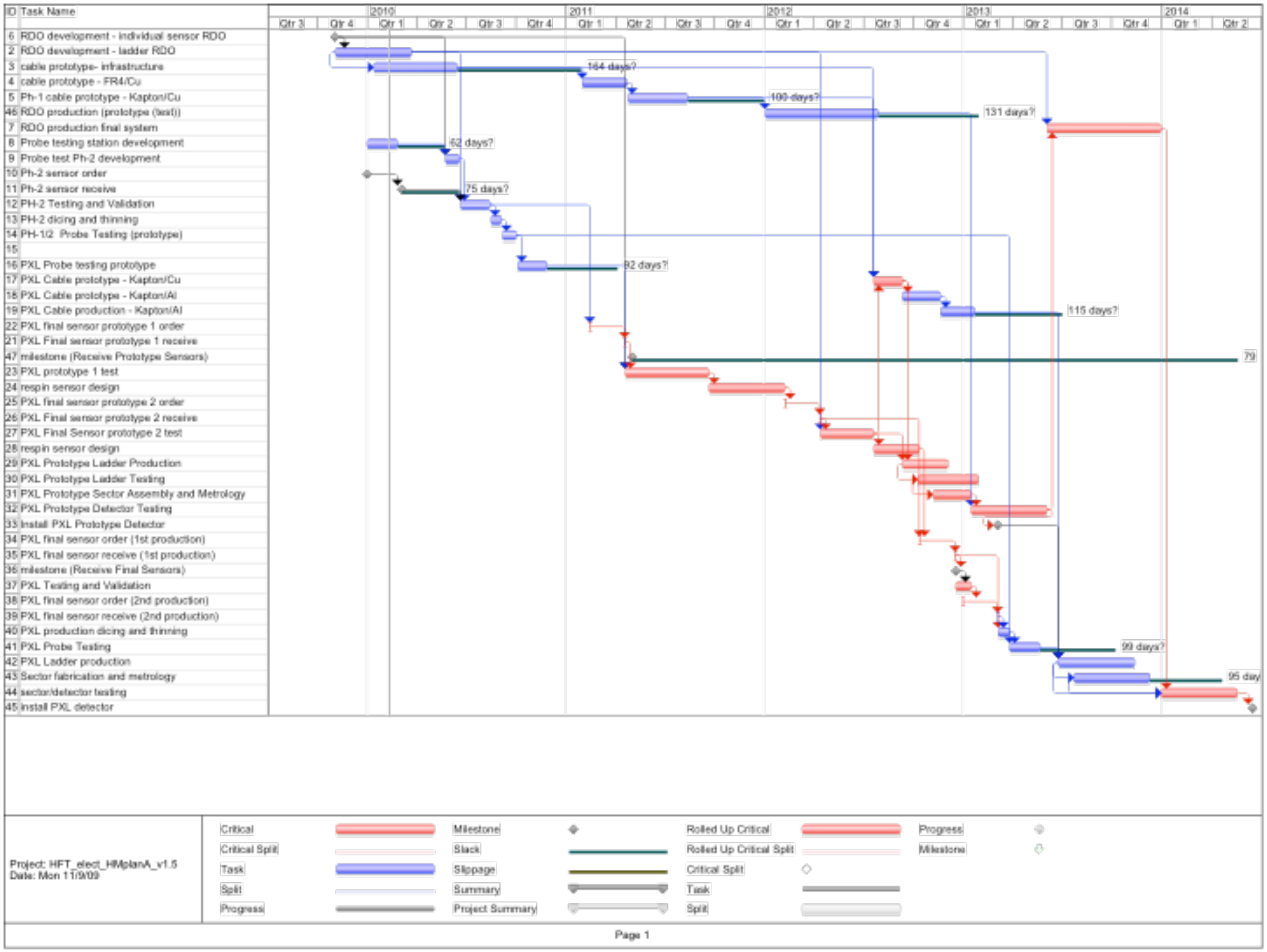
Backup Slides

Integration

ID	Task Name	Finish
1	Pixel Mechanics	Mon 3/25/13
2	Module Support (Sector)	Tue 11/27/12
3	Sector Mechanical Prototypes (EngRun)	Thu 11/3/11
4	Production Sectors (Batch 1)	Tue 11/27/12
5	D-Tube and Kinematic Mounts	Wed 6/9/10
6	Prototype D-Tube	Mon 5/17/10
9	Prototype Kinematic Mounts	Wed 6/9/10
12	Production D-Tube and Kinematic Mounts	Wed 9/16/09
15	Insertion Mechanism and Internal Service Supports	Mon 3/25/13
16	Thermal Prototype Complete	Fri 12/18/09
17	Insertion Test Bed	Mon 5/17/10
24	Prototype Insertion Mechanism	Fri 12/3/10
31	Production Insertion Mechanism	Mon 3/25/13
32	Production Insertion Mechanism Final	Thu 2/21/13
33	Production Insertion Mechanism Spare	Mon 3/25/13
34	Prototype Patch Panel Bulkhead	Wed 3/2/11
35	Design	Mon 1/31/11
36	Fabricate/Assemble	Wed 3/2/11
37	Production Patch Panel Bulkhead	Fri 11/30/12
38	Detector 1	Fri 11/30/12
39	Detector Assembly	Fri 4/12/13
50	Pixel Electronics	Mon 12/2/13
93	Integration and Global Supports	Fri 10/18/13
94	Mechanics	Fri 9/21/12
95	Inner Detector Support (IDS)	Fri 11/4/11
96	East Support Cylinder (ESC)	Fri 9/9/11
100	Outer Support Cylinder (OSC)	Fri 11/4/11
104	E-Field Shroud (EFS)	Fri 9/30/11
107	IDS Shipped to BNL	Fri 11/18/11
108	Middle Support Cylinder (MSC)	Fri 9/21/12
109	Pixel Insertion Tube	Fri 12/30/11
113	Bulkhead Extension	Fri 1/20/12
117	Transition Plate	Tue 2/1/11
120	Pixel Support Tube	Fri 3/2/12
124	MSC Shipped to BNL	Fri 3/16/12
125	MSC COPY	Fri 9/21/12
126	Pixel Insertion Tube	Fri 7/27/12
130	Bulkhead Extension	Fri 8/3/12
134	Transition Plate	Tue 5/1/12
137	Pixel Support Tube	Fri 9/21/12
141	IST Integration START	Mon 1/7/13
142	Assembly	Fri 10/4/13
148	Integration Infrastructure	Fri 9/28/12
149	Hall Modifications and Safety	Fri 9/28/12
151	Installation	Fri 10/18/13
152	Install Run 12 (effort)	Fri 6/1/12
153	Install Run 12 Milestone	Tue 11/1/11
154	Remove Run 13	Fri 5/31/13
155	Install Run 14	Fri 10/18/13

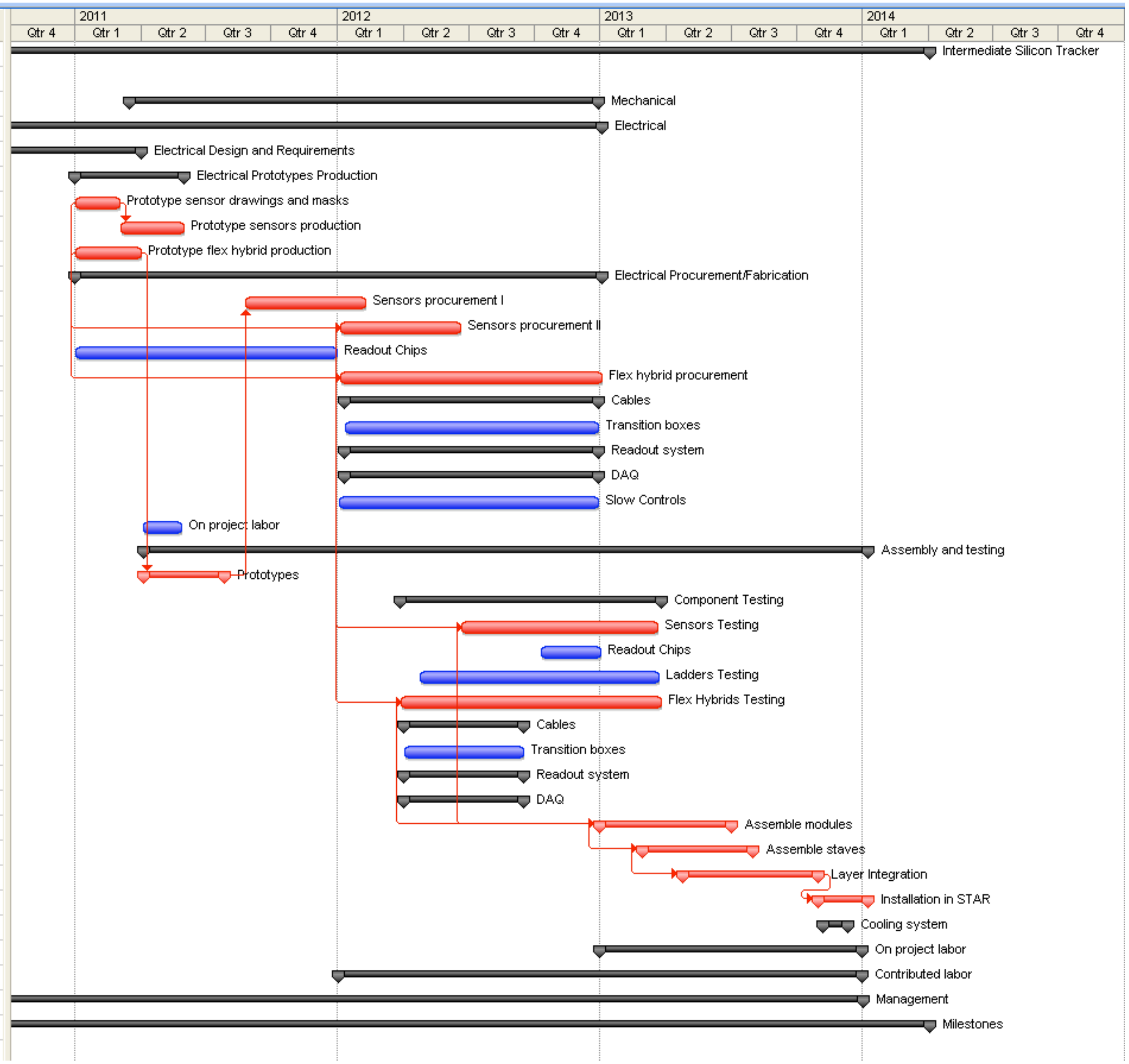


PXL sensors schedule overview



IST

WBS	Task Name
1	**Intermediate Silicon Tracker**
1.1	**R&D**
1.2	**Mechanical**
1.3	**Electrical**
1.3.1	**Electrical Design and Requirements**
1.3.2	**Electrical Prototypes Production**
1.3.2.1	Prototype sensor drawings and masks
1.3.2.2	Prototype sensors production
1.3.2.3	Prototype flex hybrid production
1.3.3	**Electrical Procurement/Fabrication**
1.3.3.1	Sensors procurement I
1.3.3.2	Sensors procurement II
1.3.3.3	Readout Chips
1.3.3.4	Flex hybrid procurement
1.3.3.5	**Cables**
1.3.3.6	Transition boxes
1.3.3.7	**Readout system**
1.3.3.8	**DAQ**
1.3.3.9	Slow Controls
1.3.3.10	On project labor
1.4	**Assembly and testing**
1.4.1	**Prototypes**
1.4.2	**Component Testing**
1.4.2.1	Sensors Testing
1.4.2.2	Readout Chips
1.4.2.3	Ladders Testing
1.4.2.4	Flex Hybrids Testing
1.4.2.5	**Cables**
1.4.2.6	Transition boxes
1.4.2.7	**Readout system**
1.4.2.8	**DAQ**
1.4.3	**Assemble modules**
1.4.4	**Assemble staves**
1.4.5	**Layer Integration**
1.4.6	**Installation in STAR**
1.4.7	**Cooling system**
1.4.8	On project labor
1.4.9	Contributed labor
1.5	**Management**
1.6	**Milestones**



SSD milestones

date	milestone
Q3 FY10	Review of board layout for ladder board and RDO Start board (prototype) fabrication for both
Q2 FY11	Finish testing ladder board @BNL (digital event processing only). Finish testing RDO @BNL. Integrated testing @ Subatech for both boards
Q3 FY11	Develop slow controls and DAQ software
Q4 FY11	Produce full complement of boards
Q4 FY12	Move Full System to STAR for test
Q3 FY13	Install completed SSD in STAR

Re-direct Labor

Contributed Labor	FY10	FY11	FY12	FY13	FY14	
LBL	266	273	279	285	73	
						1176
MIT-LNS	0	37	116	232	0	
						385
BNL-SSD	140	192	245	168	40	
						785
Project Total	406	502	640	685	113	**2346**

Risk List

WBS	Name	Description	Type of Risk	Impact	Probability	Severity
1.2.1.1		Air cooling could be insufficient	technical	high	high	high
1.2.1.1		cooling could impart vibration	technical	high	high	high
1.2.1.1		Sector/ladder structure is a new thinner approach with stability risks resulting from gravity, humidity and temperature changes	technical	high	high	high
1.2		Schedule risk that pixel spacial maps are not integrated into STAR software before detector is installed into STAR. These maps will be required to understand the PXL performance at startup and allow physics goals to be achieved.	schedule	high	moderate	high
1.2		The STAR environment at small radius may be different than expected in terms of radiation levels, wake field RF noise or other unexpected issues that could compromise detector performance	technical	high	moderate	high
1.2.2.2	PXL Sensor -	Multiple iterations to meet spec - delay	Cost/Schedule	high	moderate	high
1.2.2.2	PXL Sensor -	not meet spec	technical	high	moderate	high
1.2.2.3	Ladder Cable -	Al conductor fabrication	technical	high	moderate	high
1.2.2.6	PXL Sensor Ladder Production -	Al based RDO cable fabrication	technical	high	moderate	high
1.2		Schedule risk if diagnostic software and full integration of readout software with the STAR DAQ and trigger system is not fully functional at time of installation	schedule, technical	high	low	moderate
1.2.2.2	PXL Sensor -	Fluctuation in $/Euro	Cost	moderate	moderate	moderate
1.2.2.2	PXL Sensor -	particle density too high	technical	high	moderate	moderate
1.2.2.3	Ladder Cable -	Cable meet spec	technical	moderate	moderate	moderate
1.4.1.2.1	SSD Production ladder card	SSD Production ladder card				moderate
1.4.1.2.1	SSD Production ladder card	parts unavailable	cost/schedule	moderate	moderate	moderate
1.4.1.2.2	SSD production RDO card	parts unavailable	cost/schedule	moderate	moderate	moderate
1.4.1.2.4	DAQ components	DDL components become unavailable	cost/schedule	high	low	moderate
1.5.1.1	Inner Detector Support (IDS)	Delay in Funding availability	Schedule	Moderate	Moderate	Moderate
1.5.1.1	Inner Detector Support (IDS)	E-Field Shroud Failure	All	Moderate	Low	Moderate
1.5.1.3	Beam Pipe Mechanics	Bake-Out equipment develops insufficient Beam Pipe temp.	Technical	Moderate	Moderate	Moderate
1.5.4.3	Hall Modifications and Safety	Safety Measures for Semi-Permanent installations	Cost	Moderate	Moderate	Moderate
1.5.1.3	Beam Pipe Mechanics	Beam Pipe not on Time	Technical/Cost	Moderate/Low	Moderate	Moderate/Low

Basic Approach

- **Summary level schedule will define time spans for WBS Level 2 Schedules**
- **Create detailed schedules for each Level 2 WBS using MS Project**
  - **Include sufficient detail to define the work that needs to be done**
  - **Provide predecessor/successor relationships as needed**
  - **Use connector milestones to relate to the summary schedule or other interfaces**
- **Resource load each schedule based on the cost estimate using FY 10 dollars**
  - **Resource tasks by fiscal year can be used to spread labor and low value material**
  - **Labor and Material should be fully burdened**
  - **Labor and low level material can be prorated over the task duration**
  - **High value items should be at the start of procurement to ensure that funding is available; Cost can be spread after the PO is placed and funding is defined**
- **The BNL Financial system will be used to collect costs**