Cost and Schedule Methodology

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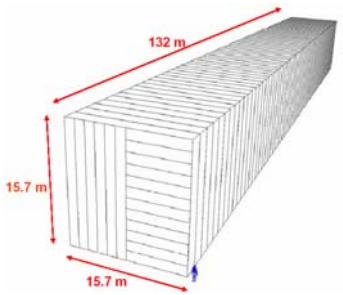
Fermilab

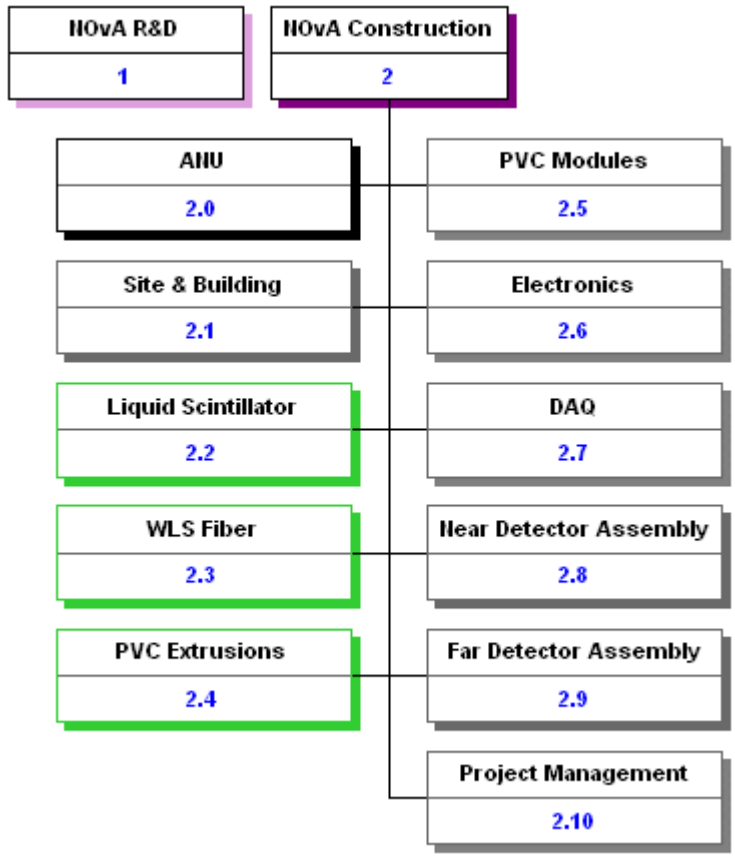
Director's CD-2/3a Review of NOνA

June 4-6, 2007

Introduction

- **Deltek Open Plan™** is the software tool we are using to develop the project schedule and cost estimate.
  - Schedules being developed by Level 2/3 managers and Project Office.
  - R&D (WBS 1) and Construction (WBS 2)

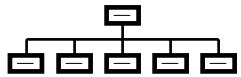




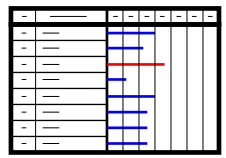
Deltek

Schedule Features

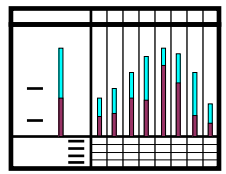
- WBS is represented by the scheduled activities



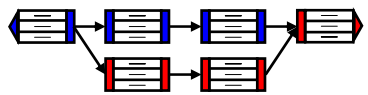
- Multiple ways to view project information
  (i.e. filters, sorts, sub-sections, networks, bar charts, resource histograms…)



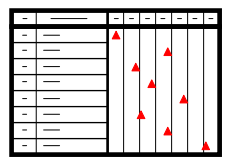
- Activities are resource-loaded (labor and equipment)
- Milestones included
- Baselining feature will be utilized



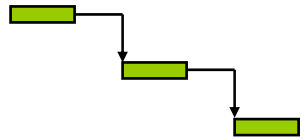
- Progress tracking will be utilized (i.e. % complete)
- Critical path determination
- Available slack/float



- Resource-leveling
- Exporting data
- Add-in capability for customization



Required Activity Information



- Activity ID, Description, Type, Duration
- Dependencies (predecessors, successors, lags, target dates)
- Resource assignments (FNAL and other participating labs & universities; labor and M&S)
- Contingency estimates on labor and M&S
- Funding source (DOE R&D, Cooperative agreement, DOE equipment [MIE], etc.)
- Responsible institution
- WBS definition, M&S and Labor Basis of Estimate (BOE) (in activity notes fields)
- Performance Measurement Technique, Cost Account, and Work Package (for COBRA use, EV calculations, accounting)

Activity Spreadsheet – Schedule Info Example

WBS #
Activity ID

Activity Type
SubProject, Milestone, ASAP

Duration & Dates

Predecessor
2.9.4.1.50.2[FS]

WBS	Activity Desc.	Activity Type	Duration	Early Start	Early Finish	Predecessors
2	**Construction Project**	Subproject	1715d	01Dec06	30Sep13	
2.9	**Far Detector Assembly**	Subproject	1335d	01Oct07	28Jan13	
2.9.4	**Block Assembly and Installation**	Subproject	771d	04Jan10	28Jan13	
2.9.4.3	**Block Assembly and Alignment**	Subproject	590d	27Apr10	28Aug12	
2.9.4.3.1	Review and approve far detector plane assembly procedures	ASAP	5d	**27Apr10**	**03May10**	**2.9.4.1.50.2[FS]**
2.9.4.3.2	Far detector plane assembly begins	Start Milestone	0	**10Jun10**	**10Jun10**	**2.9.4.3.1[FS]; 2.9.4.2.2.2[SS+5d]; 2.9.4.1.6[FS]; 2.9.4.2.4.2[FS]; 2.9.4.1.3[FS]; 2.9.4.1.4[FS]; 2.9.4.1.40.6[FS]; 2.9.4.1.50.5[FS]; 2.9.4.2.1.2[FS]; 2.9.4.1.2[FS]**
2.9.4.3.3	Assemble and mount block 1	ASAP	25d	**10Jun10**	**15Jul10**	**2.9.4.3.2[SS]**
2.9.4.3.4	Assemble and mount block 2	ASAP	25d	**16Jul10**	**19Aug10**	**2.9.4.3.3[FS]**
2.9.4.3.5	Assemble and mount block 3	ASAP	25d	**20Aug10**	**24Sep10**	**2.9.4.3.4[FS]**
2.9.4.3.6	Assemble and mount block 4	ASAP	13d	**27Sep10**	**13Oct10**	**2.9.4.3.5[FS]**
2.9.4.3.7	Assemble and mount block 5	ASAP	13d	**14Oct10**	**01Nov10**	**2.9.4.3.6[FS]**
2.9.4.3.8	Super-block 1 assembled	Finish Milestone	0	**01Nov10**	**01Nov10**	**2.9.4.3.7[FS]**

Milestone
Start, Finish

FS – Finish-to-Start
SS – Start-to-Start
FF – Finish-to-Finish
SF – Start-to-Finish

Activity Spreadsheet–Cost Info Example

M&S $ | Labor $ | Total $

Activity ID	Activity Description	Activity Type	Early Dates	Funding Source	BAC Material	BAC Labor	BAC Total
2	**Construction Project**	Subproject	01Dec06 30Sep13		$149,035,941	$41,109,118	$190,145,059
2.9	**Far Detector Assembly**	Subproject	01Oct07 28Jan13		$7,577,588	$4,877,823	$12,455,411
2.9.4	**Block Assembly and Installation**	Subproject	04Jan10 28Jan13		$4,159,823	$4,308,735	$8,468,559
2.9.4.3	**Block Assembly and Alignment**	Subproject	27Apr10 28Aug12		$174,506	$2,211,485	$2,385,990
2.9.4.3.1	Review and approve far detector plane assembly procedures	ASAP	27Apr10 03May10	DE	$0	$7,396	$7,396
2.9.4.3.2	Far detector plane assembly begins	Start Milestone	10Jun10 10Jun10		$0	$0	$0
2.9.4.3.3	Assemble and mount block 1	ASAP	10Jun10 15Jul10	DE	$3,000	$82,782	$85,782
2.9.4.3.4	Assemble and mount block 2	ASAP	16Jul10 19Aug10	DE	$3,000	$82,782	$85,782
2.9.4.3.5	Assemble and mount block 3	ASAP	20Aug10 24Sep10	DE	$3,000	$82,782	$85,782
2.9.4.3.6	Assemble and mount block 4	ASAP	27Sep10 13Oct10	DE	$3,000	$76,014	$79,014
2.9.4.3.7	Assemble and mount block 5	ASAP	14Oct10 01Nov10	DE	$3,000	$76,014	$79,014
2.9.4.3.8	Super-block 1 assembled	Finish Milestone	01Nov10 01Nov10		$0	$0	$0
2.9.4.3.9	Assemble and mount block 6	ASAP	02Nov10 18Nov10	DE	$3,000	$66,626	$69,626
2.9.4.3.10	Assemble and mount block 7	ASAP	19Nov10 09Dec10	DE	$3,000	$66,626	$69,626
2.9.4.3.11	Assemble and mount block 8	ASAP	10Dec10 30Dec10	DE	$3,000	$54,718	$57,718
2.9.4.3.12	Assemble and mount block 9	ASAP	03Jan11 20Jan11	DE	$3,000	$54,718	$57,718
2.9.4.3.13	Assemble and mount block 10	ASAP	21Jan11 08Feb11	DE	$3,000	$54,718	$57,718
2.9.4.3.14	Super-block 2 assembled	Finish Milestone	08Feb11 08Feb11		$0	$0	$0

Budget-at-Completion (BAC)
FY07 dollars (burdened, no contingency)

Activity Spreadsheet–Cont Info Example

M & S Cont | Labor Cont | Total Cont | Total BAC+Cont

Activity ID	Activity Description	M&S Cont. ($)	M&S Cont. (%)	Labor Cont. ($)	Labor Cont. (%)	Total Cont. ($)	Total Cont. (%)	BAC + Cont. ($)
2	**Construction Project**	**$43,446,882**	**29%**	**$15,530,430**	**38%**	**$58,977,312**	**31%**	**$249,122,371**
2.9	**Far Detector Assembly**	**$4,633,963**	**61%**	**$4,877,823**	**100%**	**$9,511,786**	**76%**	**$21,967,197**
2.9.4	**Block Assembly and Installation**	**$2,706,802**	**65%**	**$4,308,735**	**100%**	**$7,015,537**	**83%**	**$15,484,096**
2.9.4.3	**Block Assembly and Alignment**	**$144,253**	**83%**	**$2,211,485**	**100%**	**$2,355,737**	**99%**	**$4,741,727**
2.9.4.3.1	Review and approve far detector plane assembly procedures	$0	0%	$7,396	100%	**$7,396**	**100%**	**$14,792**
2.9.4.3.2	Far detector plane assembly begins	$0	0%	$0	0%	**$0**	**0%**	**$0**
2.9.4.3.3	Assemble and mount block 1	$3,000	100%	$82,782	100%	**$85,782**	**100%**	**$171,564**
2.9.4.3.4	Assemble and mount block 2	$3,000	100%	$82,782	100%	**$85,782**	**100%**	**$171,564**
2.9.4.3.5	Assemble and mount block 3	$3,000	100%	$82,782	100%	**$85,782**	**100%**	**$171,564**
2.9.4.3.6	Assemble and mount block 4	$3,000	100%	$76,014	100%	**$79,014**	**100%**	**$158,027**
2.9.4.3.7	Assemble and mount block 5	$3,000	100%	$76,014	100%	**$79,014**	**100%**	**$158,027**
2.9.4.3.8	Super-block 1 assembled	$0	0%	$0	0%	**$0**	**0%**	**$0**
2.9.4.3.9	Assemble and mount block 6	$3,000	100%	$66,626	100%	**$69,626**	**100%**	**$139,251**
2.9.4.3.10	Assemble and mount block 7	$3,000	100%	$66,626	100%	**$69,626**	**100%**	**$139,251**
2.9.4.3.11	Assemble and mount block 8	$3,000	100%	$54,718	100%	**$57,718**	**100%**	**$115,435**
2.9.4.3.12	Assemble and mount block 9	$3,000	100%	$54,718	100%	**$57,718**	**100%**	**$115,435**
2.9.4.3.13	Assemble and mount block 10	$3,000	100%	$54,718	100%	**$57,718**	**100%**	**$115,435**
2.9.4.3.14	Super-block 2 assembled	$0	0%	$0	0%	**$0**	**0%**	**$0**

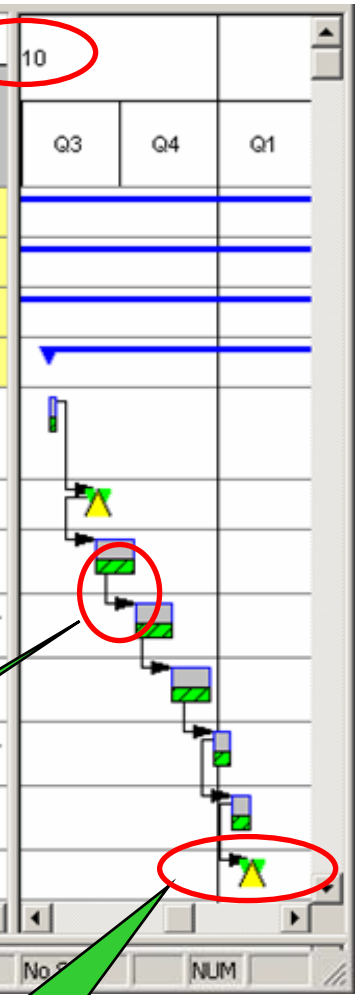
Contingency ($ and %)
FY07 dollars (burdened)

Bar (Gantt) Chart - Example

Resource Assignments
M.UMNTC.PD.MANDSEXEMPT,3000 (FY07 $)
L.UMNTC.FD.TECH.LDR,400 (hrs)

Fiscal Yr

WBS	Activity Desc.	ResInfo
2	Construction Project	
2.9	Far Detector Assembly	
2.9.4	Block Assembly and Installation	
2.9.4.3	Block Assembly and Alignment	
2.9.4.3.1	Review and approve far detector plane assembly procedures	L.UMNTC.PD.MNG.IM,20.00,;L.UMNTC.PD.SCI.PHY,20.00,;L.ANL.PD2.ENG.ME,20.00,;L.FNAL.PPD.ENG.ME,20.00,;L.ANL.PD2.SCI.PHY,20.00,;L.UMNTC.PD.TECH.LDR,20.00,;L.FNAL.PPD.SCI.PHY,20.00,
2.9.4.3.2	Far detector plane assembly begins	
2.9.4.3.3	Assemble and mount block 1	L.UMNTC.FD.TECH.EO,400.00,;M.UMNTC.FD.MANDSXMPT,3000.00,;L.UMNTC.FD.TECH.MT_W,2200.00,;L.UMNTC.FD.TECH.LDR,400.00,
2.9.4.3.4	Assemble and mount block 2	L.UMNTC.FD.TECH.LDR,400.00,;M.UMNTC.FD.MANDSXMPT,3000.00,;L.UMNTC.FD.TECH.EO,400.00,;L.UMNTC.FD.TECH.MT_W,2200.00,
2.9.4.3.5	Assemble and mount block 3	L.UMNTC.FD.TECH.EO,400.00,;M.UMNTC.FD.MANDSXMPT,3000.00,;L.UMNTC.FD.TECH.MT_W,2200.00,;L.UMNTC.FD.TECH.LDR,400.00
2.9.4.3.6	Assemble and mount block 4	L.UMNTC.FD.TECH.LDR,416.00,;M.UMNTC.FD.MANDSXMPT,3000.00,;L.UMNTC.FD.TECH.EO,416.00,;L.UMNTC.FD.TECH.MT_W,1872.00,
2.9.4.3.7	Assemble and mount block 5	L.UMNTC.FD.TECH.MT_W,1872.00,;M.UMNTC.FD.MANDSXMPT,3000.00,;L.UMNTC.FD.TECH.LDR,416.00,;L.UMNTC.FD.TECH.EO,416.00,
2.9.4.3.8	Super-block 1 assembled	

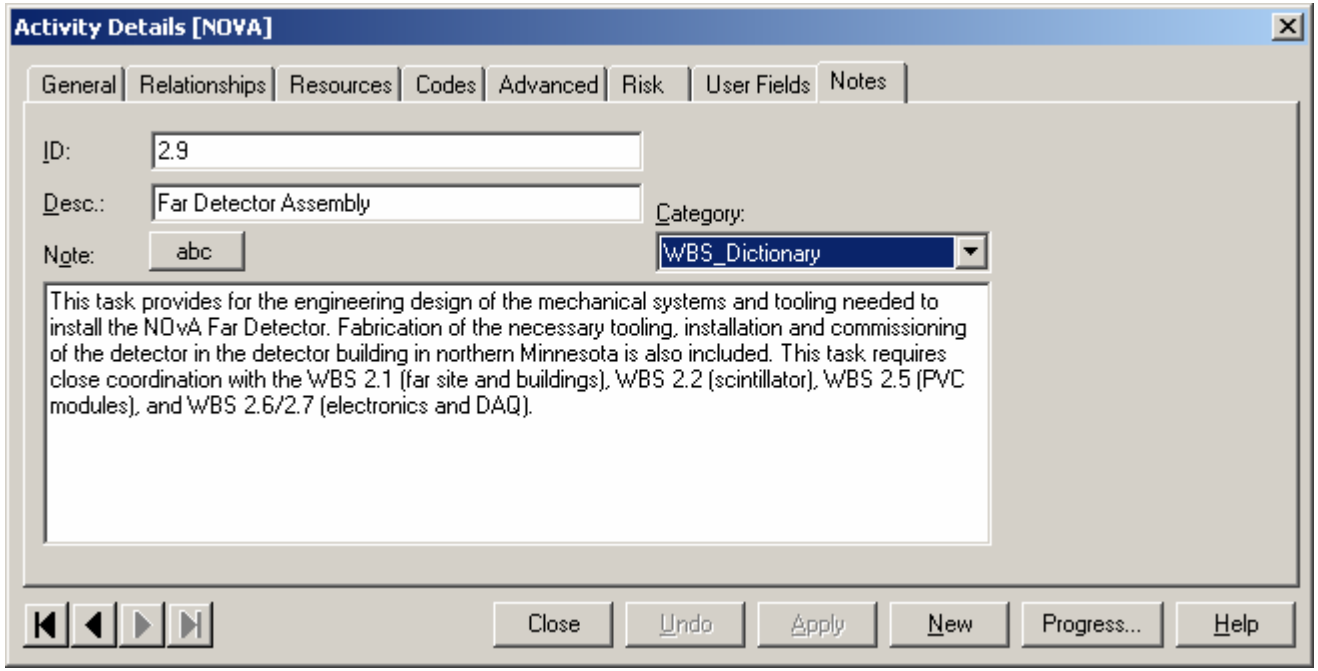


For Help, press F1 | WBS_PARENT | NUM

Linked Activities

Milestone

Activity Notes - Example



Includes-

- **WBS Definition**
- **Ground Rules & Assumptions**
- **M&S BOE**
- **Labor BOE**

Resource Information

- Hierarchical set of labor resources
  (e.g. L.FNAL.PPD.ENG.EE)
  - Labor rates provided by PPD Office and collaborators.
    - » FNAL rates include Fringe, Vacation, and Other Paid Time Off (VAC/OPTO), and ~30% indirect.
    - » University rates include fringe and overhead applied at each institution.
- Hierarchical set of material resources
  (e.g. M.FNAL.PPD.MANDS)
  - MANDS material resource costs include various burdening, depending on the nature of the procurements
    - » 16% Nominal
    - » 1.5% Pass-through (to university, > $100k)
    - » 0% Exempt (single procurements, only on amount > $500k)
- Standard calendar includes Fermilab holidays
- Conversion from work hours to FTEs assume 1,768 hours per year per FTE (85% availability factor)

Resource Sheet-Example

ID

Description

Burdened Rate
(FY07$ per hr)

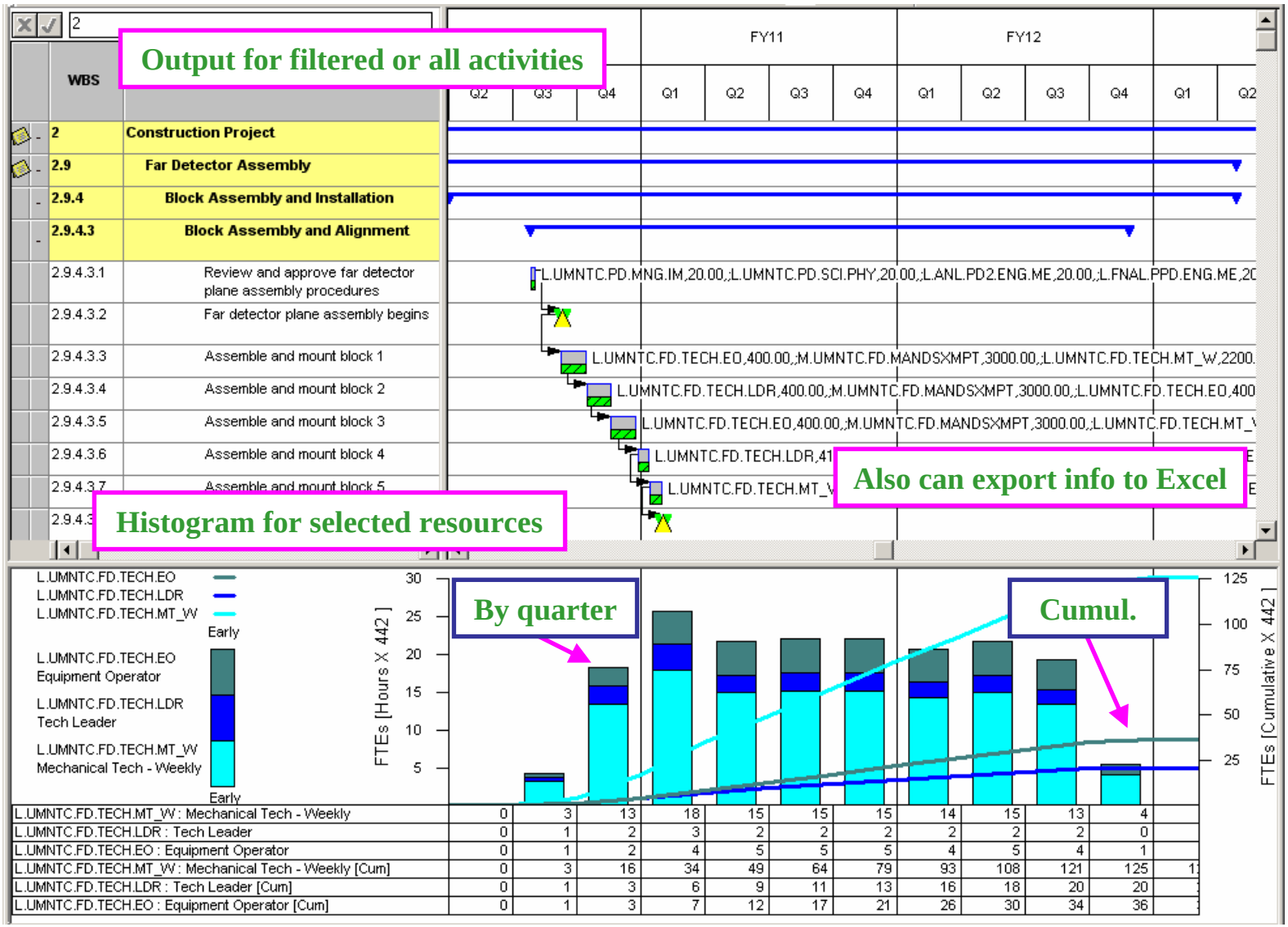
Category
Material,Labor

NOVA Resource Spreadsheet [NOVA_RBS (Read Only)] Resource Data Table

M

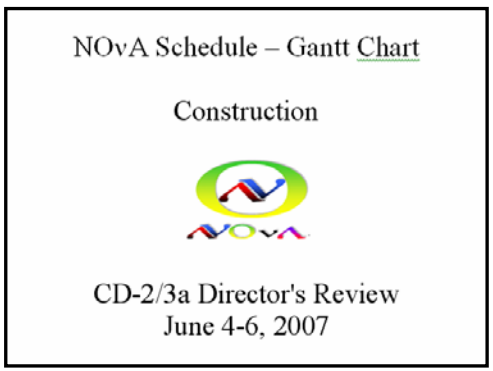
Resource ID	Res. Desc.	Res. Unit Cost	Res. Units	Res. Type	Res. Category
L	Labor	0.00	hr	Resource Pool	Labor
L.FNAL	Fermilab	0.00	hr	Resource Pool	Labor
L.FNAL.PPD	Particle Physics Division	0.00	hr	Resource Pool	Labor
L.FNAL.PPD.ENG	Engineers	0.00	hr	Resource Pool	Labor
L.FNAL.PPD.ENG.AE	ASIC Engineer	106.24	hr	Normal	Labor
L.FNAL.PPD.ENG.COOP	Co-Op Student	25.28	hr	Normal	Labor
L.FNAL.PPD.ENG.DES	Designer	69.06	hr	Normal	Labor
L.FNAL.PPD.ENG.DRFT	Drafter	69.06	hr	Normal	Labor
L.FNAL.PPD.ENG.EE	Electrical Engineer	106.24	hr	Normal	Labor
L.FNAL.PPD.ENG.EE_SR	Electrical Engineer - Senior	106.24	hr	Normal	Labor
L.FNAL.PPD.ENG.EP	Engineering Physicist	102.06	hr	Normal	Labor
L.FNAL.PPD.ENG.GE	Guest Engineer	110.44	hr	Normal	Labor
L.FNAL.PPD.ENG.ME	Mechanical Engineer	110.44	hr	Normal	Labor
L.FNAL.PPD.ENG.ME_SR	Mechanical Engineer - Senior	110.44	hr	Normal	Labor
M	Material	0.00	$	Resource Pool	Material
M.FNAL	Fermilab	1.00	$	Resource Pool	Material
M.FNAL.PPD	Particle Physics Division	1.00	$	Resource Pool	Material
M.FNAL.PPD.MANDS	Materials and Services	1.16	$	Normal	Material
M.FNAL.PPD.MANDSXMPT	Materials & Services - Exempt	1.00	$	Normal	Material

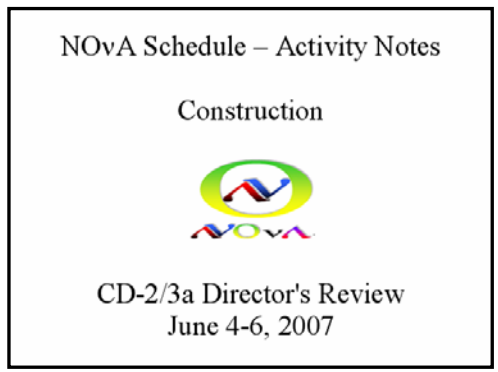
Resource Profiles - Time-phased Info



Information Provided to Committee

- Gantt chart of complete schedule (R&D and Construction)
  - dates, durations, milestones, predecessors, and resource assignments
- Budget and contingency spreadsheet (R&D and Construction)
  - Summary rollup at WBS level 2
  - Complete schedule
  - Burdened, FY07 $$
- Spreadsheet with activity notes (R&D and Construction)
  - WBS definitions, ground rules & assumptions, M&S and labor BOE





6 books in the set (3 construction and 3 R&D)

Summary

- We have a good tool for understanding our project baseline cost and schedule and determining project needs. (personnel, costs, etc.)
- We have a good tool for tracking/recording activity progress. (% completes)
- We have a good tool for tracking schedule slippages, determining critical path(s), available float, etc. via Open Plan.
- We have a good tool for tracking cost and schedule performance via Earned Value Analysis with COBRA, which integrates with Open Plan.