

LQCD Computing Review



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LQCD Computing Project



- **Scope:** The Office of Science has initiated an investment project titled “SC Lattice Quantum Chromodynamics (LQCD) Computing” to create a seamless multi-site computing system necessary for sustained computational capabilities to perform the calculations essential to support Lattice QCD scientists. The goal of the project is to deploy a system delivering a total (average) computing capacity of 17.4 teraflop/s by the end of FY 09. This figure includes the 4.2 teraflop/s expected from the US QCDOC computer.
- **Drivers:** Need for computing capacity by LQCD scientists, and available funding

Lattice QCD Computing

- An OMB300 IT Investment initial proposal for FY06 was submitted on May 18, 2004. The revised submission for FY07 is with the DOE now.
- Proposed Project initiation date – 10/1/05; end date – 9/30/2009
- Proposed funding from HEP and NP to FNAL, BNL, & JLab
- Proposed level of funding: \$2.5M for FY06 thru FY 08, and \$1.7M for FY 09.
- Before the approval of RFPs for procurement at each site, a rigorous specification review will be held to evaluate the merit of the proposed systems against alternatives.
- WBS items for specifications will not be considered complete before the closeout of specification reviews.

FNAL Level 1 Milestones

Name	Finish Date
Release 1.8 new Tflops to operation	9/14/2006
Deliver 0.85 Tflops-yr at FNAL FY06	9/30/2006
Release 2.2 new Tflops to operation	4/1/2007
Deliver 4.0 Tflops-yr at FNAL FY07	9/30/2007
Release 3.6 new Tflops to operation	4/1/2008
Deliver 6.2 Tflops-yr at FNAL FY08	9/30/2008
Release 2.9 new Tflops to operation	4/1/2009
Deliver 8.6 Tflops-yr at FNAL FY09	/30/2009

JLab Level 1 Milestones

Name	Finish Date
Release 0.45 new Tflop/s to operation	4/1/2006
Deliver 1.15 Tflops-yr at JLabFY06	9/30/2006
Release 0.6 new Tflop/s to operation	4/1/2007
Deliver 1.3 Tflops-yr at JLab FY07	9/29/2007
Release 0.9 new Tflop/s to operation	4/1/2008
Deliver 1.6 Tflops-yr at JLab FY08	9/30/2008
Release 0.7 new Tflop/s to operation	4/1/2009
Deliver 2.2 Tflops-yr at JLab FY09	9/30/2009

BNL Level 1 Milestones

Name	Finish Date
Deliver 4.2 Tflops-yr at BNL FY06	9/30/2006
Deliver 4.2 Tflops-yr at BNL FY07	9/30/2007
Deliver 4.2 Tflops-yr at BNL FY08	9/30/2008
Deliver 4.2 Tflops-yr at BNL FY09	/30/2009

LQCD Phases and details

- Project phases in OMB300
 - Planning – project management
 - Acquisition – all hardware purchases
 - Operations – FTE for installation/operations
- Project management documents in progress:
 - Project Execution Plan (Preliminary)
 - Work Breakdown Structure
 - Detailed Budget Estimate
- This system is based on the R&D work done with SCIDAC funding

Fund Management

- Throughout its duration, the project is jointly funded by DOE-HEP and DOE-NP
 - Funds will go to Laboratories directly
 - An agreement between DOE-HEP and DOE-NP will be established to track the awards
- Allocation to laboratories:
 - FNAL – only HEP
 - JLab – only NP
 - BNL – distributed funds: HEP and NP
- Laboratories will contribute to the project in kind (base)
- SCIDAC efforts and funds are excluded from the project.

Project Management Strategies

- Distributed WBS, but integrated cost/performance accounting (more later)
- Financial/operational risks and mitigation strategy
 - Cost and release schedules of commodity HW: Built to optimized cost using competitive bidding, experienced buyers, rigorous vendor evaluation
 - Schedule of FNAL facility upgrade: Early start on upgrade process (already begun)
- Change management of cost and schedule: change control board, memoranda of understanding, budget authorization process, annual statement of work, WBS status reporting
- Baseline management of WBS and budget authority processes will be created

Project Management Strategies (contd)

- Change management of controlled documents including review documents will be maintained in the project office
- Cyber security: Laboratories are responsible for implementing cyber security procedures. Site managers will provide annual assessment reports to the project office
- ESH compliance: Laboratories will obtain necessary permits and assure compliance. Site managers will provide reports to the project office.
- Quality assurance: peer reviews, self-assessments, deployment of operational metrics, quality control of procured hardware

Project Control

- Project WBS control: Once baselined, primary controlled elements of the project are schedule and cost as defined in the WBS.
 - Site managers are responsible for reporting monthly status of the project WBS to APM.
 - Financial officers from laboratories are responsible for reporting monthly actual project cost at each site in a predefined format
 - APM is responsible for conducting monthly status reviews, preparation of the comprehensive status reports
 - PM leads quarterly overall cost, schedule and technical performance reviews and reports the results to the Federal Project Manager.
- Working with the project office, each Laboratory will establish unique accounting charge codes associated operating and equipment funds.

Project Control (cntd.)

- Controlled items:
 - Technical deliverables defined in milestones
 - Schedule defined by Level 1 and Level 2 milestones
 - Cost specified in the WBS at the cost accounting level
- Change management of controlled items using change control threshold table (later) and Change Control Request (CCR) process
- Reviews:
 - Critical system specifications associated with RFPs will undergo technical team reviews
 - Design reviews and performance testing of the completed systems will be used to ensure that each system meets the system specifications
 - All CCRs to be reviewed by LQCD Scientific Program Committee for potential impact to the scientific program

Change Threshold Table

Level	Cost	Schedule	Technical Scope/Performance
DOE Federal Project Director (Level 1)		6 or more months increase (cumulative) in a Level 1 milestone date	Changes to scope that affect mission need and requirements
LQCD Change Control Board (Level 2)	Change of > \$100K in labor/equipment balance or movement of > \$25K between laboratories	3-month or more delay of a Level 1 milestone date	> 10% decrease from baseline of either the targeted computing capability increment (Tflop/s) or integrated delivery (Tflop/s-yrs) in a single project year.
LQCD Contractor Project Manager (Level 3)	Any increase of > \$25K in equipment purchase price	> 1-month delay of a Level 2 milestone date	ny deviation from technical deliverables that negatively affects expected performance specifications by more than 3%

Risk Identification

Area of Risk	Probability of Occurrence	Description
Schedule	Low	Vendors may take longer than anticipated to bring new cpu's, memory systems, and/or interconnect systems to market.
Performance	Low	Vendors may take longer than anticipated to bring new cpu's, memory systems, and/or interconnect systems to market, or the performance of these components does not meet predictions.
Performance	Low	Low utilization of the computing systems due to inadequate user support or due to unreliable components.
Cost	Low	Although cost projections for current budget year appear to be reasonably reliable, projections for subsequent years become progressively uncertain.
Cost	Low	Unexpected increases in life costs arise after systems are acquired.
Performance	Low	Systems are held too long and become ineffective, increasing cost and using facility space.
Dependencies	Low	Host institutions will not provide space, network connectivity, and mass storage.
Surety	Low	Natural disaster and/or major electrical failure
Performance	Low	A major system simply fails to work.
Performance	Medium	Changes in funding, due to alteration in administration policy, or legislative directives.
Data	Low	Loss of stored data.

Risk Management

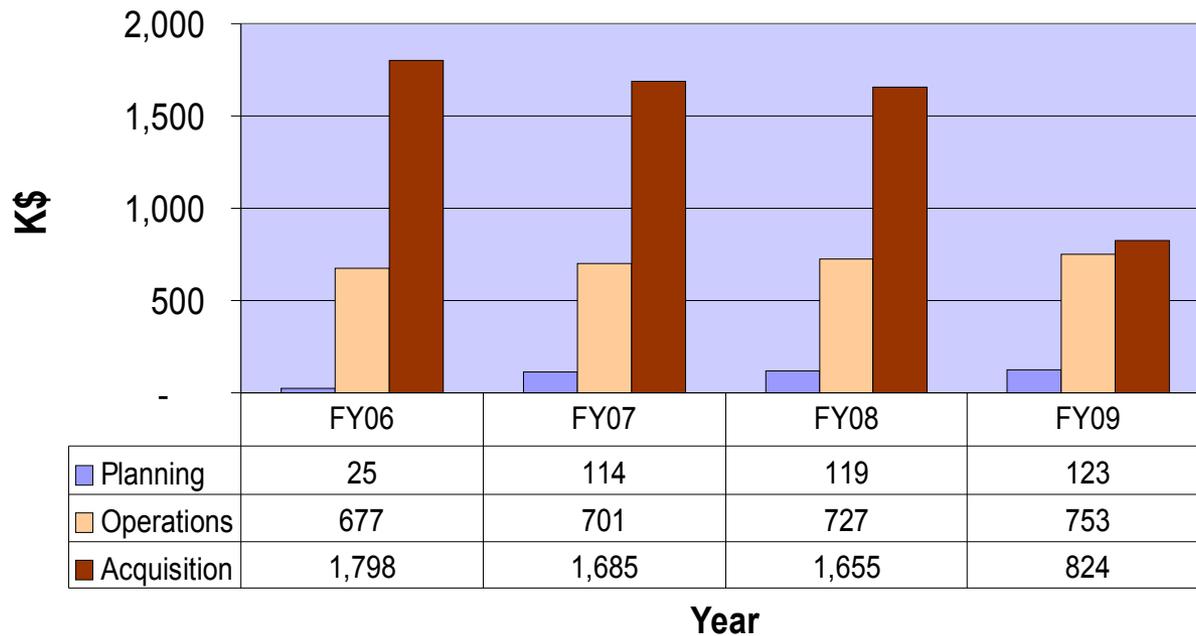
- Procurement risk assessment will be an integral part of each specification review
- Benchmark data will be collected for prototypes and delivered systems using LQCD specific formulations. The data will be analyzed and used to make decisions during the next procurement cycle
- If the outcome of risk assessment results in significant changes, they will be managed using CCR process described above. Risk management process will be integrated with the CCR process
- If the risk is minimal and does not exceed the threshold designed for CCB, risk assessments and their outcomes will be consolidated and reported to DOE as a part of quarterly reports.

LQCD Cost and Schedule



Budget Allocation

LQCD Budget



Highlights of WBS

- Structure of the MS Project WBS
 - The master WBS is composed of three subprojects for three laboratories.
 - Controlled master file will be managed at Fermilab
 - Once the implementation of the WBS is understood by all parties, the master WBS and its components will be baselined
 - Each laboratory will status the WBS file on a monthly basis and provide updated project file on a monthly basis
- Performance Based Management System (PBMS):
 - Project WBS from each site will be integrated with the WelcomCobra available at Fermilab
 - Each site will provide monthly reports on actual cost

LQCD Master WBS

Iniqui ID	WBS	Task Name	Start	Finish	Schedule											
					2005		2006		2007		2008		2009		2010	
					H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
0	0	LQCD Computing	10/3/05	10/3/09	[Gantt bar from 10/3/05 to 10/3/09]											
940	1	LQCD_FHIAL.mpp	10/3/05	10/3/09	[Gantt bar from 10/3/05 to 10/3/09]											
0185	1.01	Fermilab	10/3/05	10/3/09	[Gantt bar from 10/3/05 to 10/3/09]											
0186	1.01.01	LQCD FHIAL site deployment	10/3/05	9/21/09	[Gantt bar from 10/3/05 to 9/21/09]											
0187	1.01.01.01	FY06 FHIAL - Procure and deploy system	10/3/05	9/21/06	[Gantt bar from 10/3/05 to 9/21/06]											
0243	1.01.01.02	FY07 FHIAL - Procure and deploy system	10/3/06	9/21/07	[Gantt bar from 10/3/06 to 9/21/07]											
0456	1.01.01.03	FY08 FHIAL - Procure and deploy system	10/3/07	9/19/08	[Gantt bar from 10/3/07 to 9/19/08]											
0490	1.01.01.04	FY09 FHIAL - Procure and deploy system	10/3/08	9/21/09	[Gantt bar from 10/3/08 to 9/21/09]											
0265	1.01.02	LQCD FHIAL site operation	10/3/05	10/3/09	[Gantt bar from 10/3/05 to 10/3/09]											
0256	1.01.03	LQCD equipment purchases	5/5/06	9/16/09	[Gantt bar from 5/5/06 to 9/16/09]											
0263	1.01.04	LQCD project management	10/3/05	9/30/09	10/3/05	[Gantt bar from 10/3/05 to 9/30/09, highlighted in blue]										
939	2	LQCD_JLab.mpp	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
7365	2.01	JLAB	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
7345	2.01.01	LQCD JLAB site deployment	10/3/05	9/28/09	[Gantt bar from 10/3/05 to 9/28/09]											
7442	2.01.01.1	FY06 JLAB - Procure and deploy system	10/3/05	9/29/06	[Gantt bar from 10/3/05 to 9/29/06]											
7443	2.01.01.2	FY07 JLAB - Procure and deploy system	10/3/06	9/28/07	[Gantt bar from 10/3/06 to 9/28/07]											
7446	2.01.01.3	FY08 JLAB - Procure and deploy system	10/3/07	9/29/08	[Gantt bar from 10/3/07 to 9/29/08]											
7449	2.01.01.4	FY08 JLAB - Procure and deploy system	10/3/08	9/28/09	[Gantt bar from 10/3/08 to 9/28/09]											
7424	2.01.02	LQCD JLAB site operation	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
7425	2.01.03	LQCD JLAB equipment purchases	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
941	3	LQCD-BHL.mpp	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
3061	3.01	BHL	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
3111	3.01.01	LQCD BHL site operation	10/3/05	9/30/09	[Gantt bar from 10/3/05 to 9/30/09]											
3112	3.01.02	LQCD BHL equipment purchases	10/3/05	9/29/09	[Gantt bar from 10/3/05 to 9/29/09]											

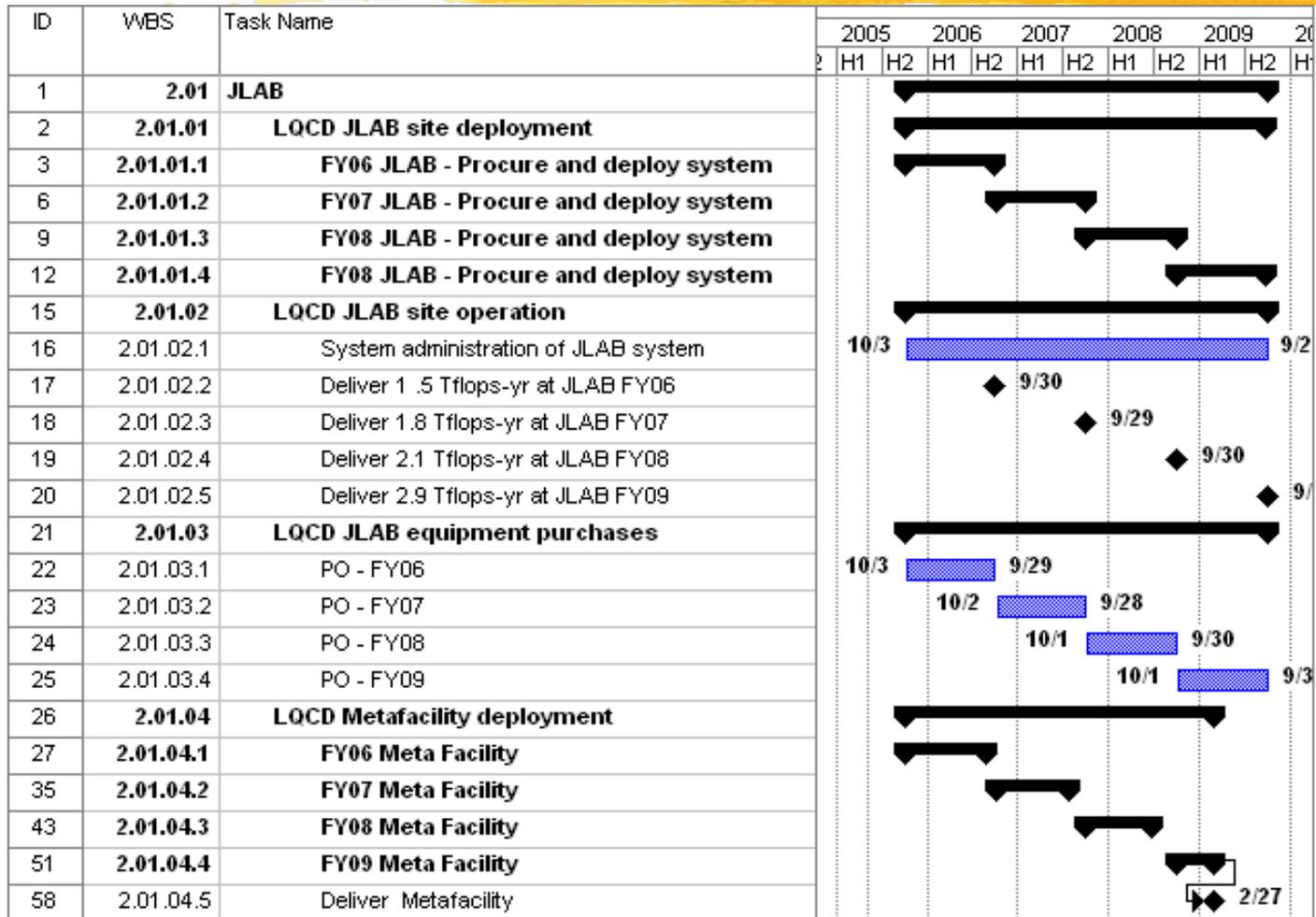
LQCD-FNAL WBS

req. ID	WBS	Task Name	2005		2006		2007		2008		2009	
			H2	H1	H2	H1	H2	H1	H2	H1	H1	
57	1.01	Fermilab										
58	1.01.01	LQCD FNAL site deployment										
59	1.01.01.01	FY06 - Procure and deploy 1.8 Tflops system										
115	1.01.01.02	FY07 - Procure and deploy 2.2 Tflops system										
328	1.01.01.03	FY08 - Procure and deploy 3.6 Tflops system										
362	1.01.01.04	FY09 - Procure and deploy 2.9 Tflops system										
137	1.01.02	LQCD FNAL site operation										
154	1.01.02.01	System administration of LQCD FNAL system										
149	1.01.02.02	Deliver 1.0 Tflops-yr at FNAL FY06										
152	1.01.02.03	Deliver 3.9 Tflops-yr at FNAL FY07										
151	1.01.02.04	Deliver 5.7 Tflops-yr at FNAL FY08										
150	1.01.02.05	Deliver 8.1 Tflops-yr at FNAL FY09										
128	1.01.03	LQCD Equipment Purchases										
138	1.01.03.1	PO - FY06										
145	1.01.03.2	PO - FY07										
146	1.01.03.3	PO - FY08										
147	1.01.03.4	PO - FY09										
135	1.01.04	LQCD project management										

LQCD-BNL WBS

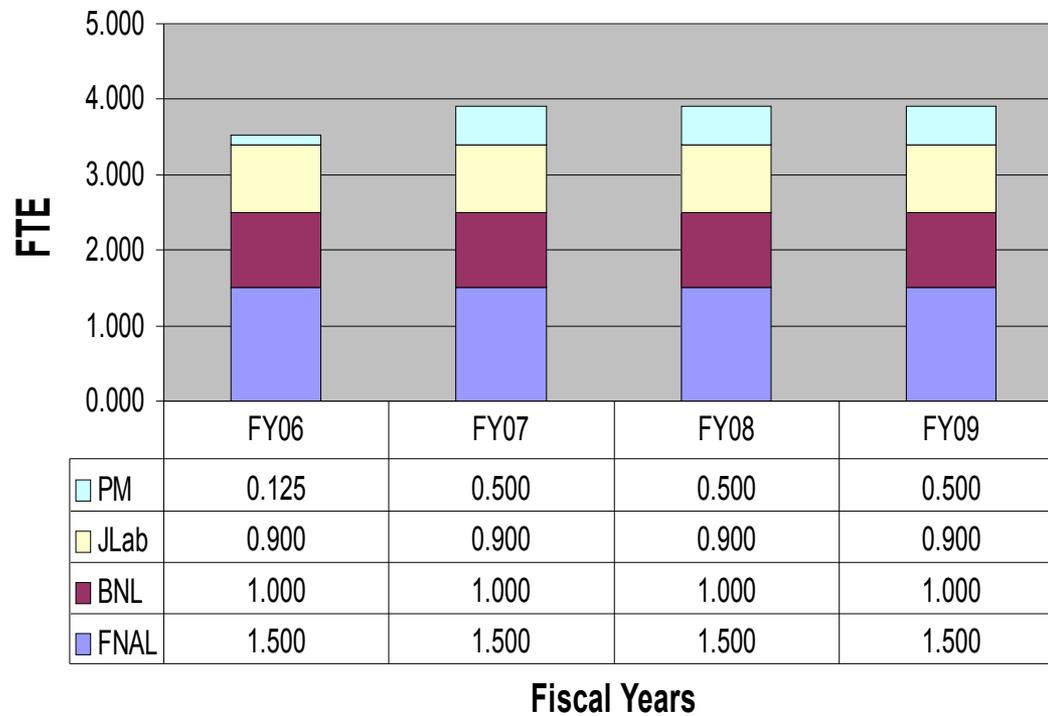
Task ID	WBS	Task Name	2005		2006		2007		2008		2009	
			H2	H1	H2	H1	H2	H1	H2	H1		
21	3.01	BNL										
71	3.01.01	LQCD BNL site operation										
80	3.01.01.1	System administration of LQCD BNL system										
79	3.01.01.2	Deliver 5.0 Tflops-yr at BNL FY06										
78	3.01.01.3	Deliver 5.0 Tflops-yr at BNL FY07										
77	3.01.01.4	Deliver 5.0 Tflops-yr at BNL FY08										
81	3.01.01.5	Deliver 5.0 Tflops-yr at BNL FY09										
72	3.01.02	LQCD Equipment Purchases										
73	3.01.02.01	PO - FY06										
74	3.01.02.02	PO - FY07										
75	3.01.02.03	PO - FY08										
76	3.01.02.04	PO - FY09										

LQCD-JLAB WBS



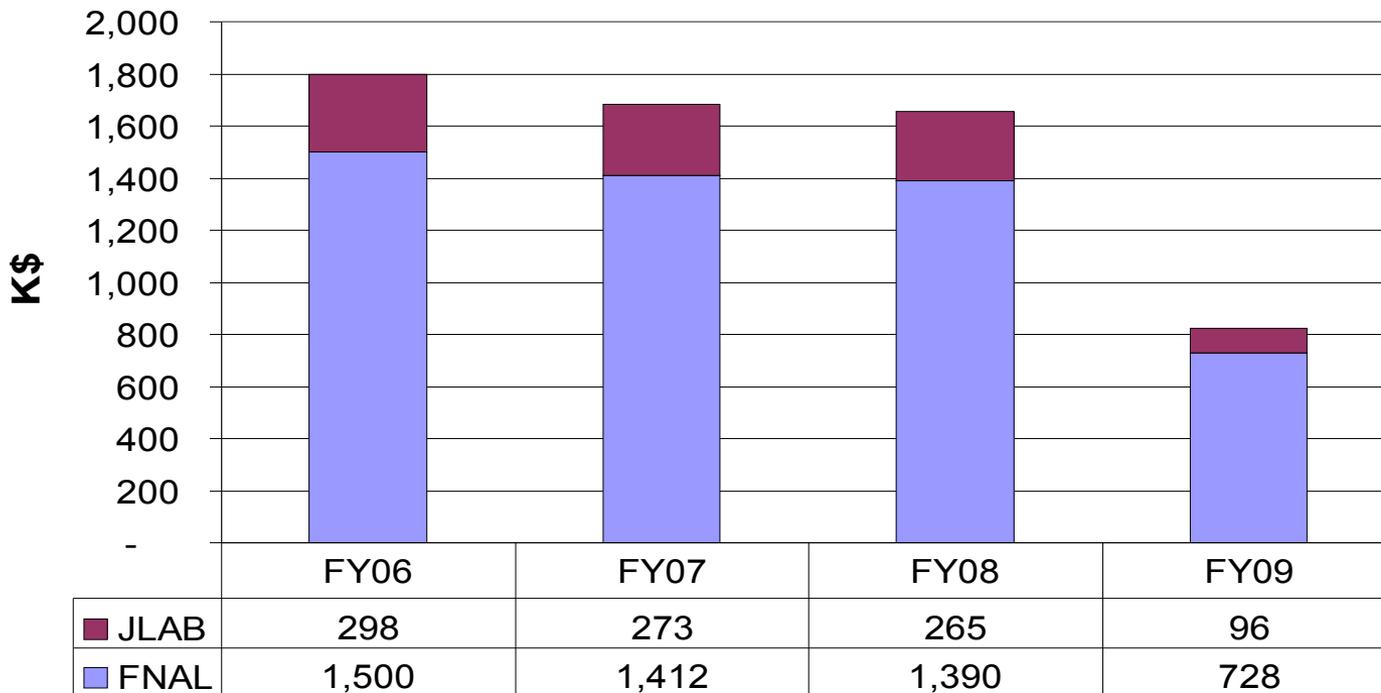
FTE Profile

Funded FTE Profile (Years)



LQCD Fixed Costs

Equipment Purchases





Questions?