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US LHC Accelerator Research Program
Task Sheet

Task Name: Hardware Commissioning

Date: 4 June 2004

Responsible Person(s) (overall lead, lead at other labs):

Mike Lamm, FNAL (lead), Peter Wanderer, BNL, Joseph Rasson, LBNL

Budget :

FY04 (actual) Total \$100k

BNL \$33k
FNAL \$44k
LBNL \$33k

FY05 (proposed) Total \$390k

BNL \$ 75k
FNAL \$211k
LBNL \$ 104k

FY06* (proposed) Total \$710k

BNL \$ 82k
FNAL \$506k
LBNL \$ 122k

*Breakdown of budget among labs for FY06 will be reviewed again in early FY05. See below.

Notes on Budget:

The schedule and level of effort for LARP Hardware commissioning is very closely tied to the CERN installation and commissioning schedule, which is clearly beyond our control. This schedule is now going through significant changes to account for delays in the QRL installation and DFB production, while still maintaining a FY07 startup. While the integrated commissioning effort can be estimated, it is very difficult to project our required participation/year in detail. The effort in FY05 and FY06 is based on the best available information as well as our funding constraints.

We are also "planning for success". It is hoped that the installation and commissioning will go smoothly. However, some of these components such as the DFBX will be cold tested for the first time in the tunnel. While all cold mass will have been quench tested,

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over half of the cryostated elements will be placed into service for the first time in the tunnel. There will be no prior string test of the IR's.

Finally, for FY06, the working assumption is that FNAL will supply two FTE's at CERN. The division of effort among the labs will be reviewed in early FY05 as the schedule and commissioning requirements become solidified. As labor rates vary among the labs, this could have an impact on the required budget (it could increase) to support two FTE's at CERN.

Statement of work for current FY (include description of year's "deliverable" and, if appropriate one or a few intermediate milestones):

Budget covers 0.5 FTE (.15 @BNL , .2 @FNAL, .15@LBNL) + \$8K for travel. There are two primary tasks for the Hardware commissioning in FY04.

1) Develop in conjunction with CERN a hardware commissioning plan for the FY05 and beyond. (expected effort ~.2 FTE over the three labs)

2) Provide effort at CERN towards the commissioning of USLHC deliverables. This will consist of trips to CERN (several trips of 1-2 week duration) weighted towards the end of FY04. Depending on the delivery schedule, activities would include:

Fit up of TAS/TAN, and Inner Triplet including D1, DFBX and Q1-Q3.

Review of CERN procedures using US supplied interconnect kits for US deliverable commissioning

Actual installation of US deliverables

(expected effort ~.3 FTE over the three labs)

Status of effort:

1) Plan: In conjunction with CERN Hardware Commissioning Group as well as the CERN/MEL engineer in charge of installation, we have presented a plan for the LARP participation in Hardware Installation and Commissioning. The plan was first presented last October in the hardware commissioning working group meeting on 2003-11-19 (see CERN EDMS Id 414942) as well as at subsequent LARP collaboration meeting in February 2004.

2) Commissioning deliverables: The fitup for the TAS/TAN is still scheduled for FY04. Review of CERN procedures using US supplied interconnects will likely occur in late FY04 in preparation for the Surface fitup in FY05. There is no plan for actual installation of US deliverable this fiscal year.

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Statement of expected work

The ultimate goal of the hardware commissioning is to assist CERN in the effective and timely commissioning of USLHC hardware deliverables. This is accomplished by providing effort by way of short duration visits to CERN from the three participating laboratories as well as providing a small continued presence at CERN during the installation and commission. Most of the installation will take place in FY05-FY06. There is planned sector commissioning test in FY06 followed by full commissioning through FY07.

In FY05 the following activities are planned:

1) Surface fitup of inner triplet (D1/DFBX/Q3/Q2/Q1)

Present schedule calls for a complete set of US deliverable sent to CERN by the fall of 2004. The elements will be set in their proper longitudinal positions in CERN Bldg. 180 for a surface fitup. Elements will be placed on tunnel stands. There will be a dry fit up of interconnect piping with room temperature ohmic electrical connections made (no soldering) for continuity. DFBX cabling trays will be installed by CERN ELQA group. There is a possibility for a SSW measurement of the triplet. Effort across the three labs is estimated to be ~5 man months.

2) Installation

The latest unofficial schedule calls for the installation of three IR's installed in FY05. TAS/TAN in IR1 will likely be installed. Effort across the three labs is budgeted to be ~6.5 man months. This budget was based on a previous schedule with 2 IR's for FY05 and is truly "planning for success", hoping that most of the installation issues will be resolved during the surface fitups. However, some steps such as alignment, welding and bus soldering will be performed for the first time in the tunnel.

3) Commissioning

At the end of FY05, commission efforts are expected to begin. Tasks include final room temperature room temperature tests, vacuum tests, final alignment and initial cool down. A .25 FTE is estimated for this program including the moving details for the first resident LARP person on hardware commissioning.

4) Oversight

A 0.2 FTE is reserved for planning for overseeing effort and planning for future years. We can expect that even in FY05 there will likely be changing to the commissioning schedule for FY06 as the projects goes into full swing.

In FY06 the following activities are planned:

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1) Installation and Commissioning

If the latest unofficial schedule holds, then FY06 will be far be the most important year for installation and hardware commissioning. Most of the hardware installation for the IR's to be completed in FY06. The working assumption is that the effort/IR will decrease as the installation becomes routine. The vast majority of the effort will be dedicated to commissioning. Effort includes final alignment, final room temperature checkout, cooldown, cold electrical checkout, and powering and protection tests. A sector test is still proposed for FY06. Two resident LARP personnel will work at CERN, with effort reserved for short term visits from "experts" for a total effort of 2.6 FTE's.

A major cost uncertainty continues to be the cost of living for a resident person. The cost depends greatly on the \$\$\$/CHF conversion. CMS will send US personnel to CERN in FY05. There is good communication between the LARP and US CMS planning office on this program.

2) Oversight

A 0.25 FTE is reserved for planning for overseeing effort and planning for future years. This is appropriate as we can expect that there will be small but constant adjustments to schedules.