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US LHC Accelerator Research Program
FY2005 Task Sheet

Task Name: Phase II Collimator R&D

Date: 30 June 2004

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

Thomas W. Markiewicz, SLAC (lead)

Nikolai Mokhov, FNAL

Budget (specified for each lab):

SLAC \$300k

FNAL \$ 50k

Subtotal \$350k

FY04 carryover (\$110k)

Total \$240k FY05 funding required

FY05 Milestones

- 1) Jun 04. Phase II collimator meeting, CERN
- 2) Jan 05. Present status report at Chamonix '05
- 3) Apr 05. Phase II collimator review, go/no go decision
- 4) Sep 05. Hire ME, set up lab & test RC0 (existing prototype)

Statement of work for FY05 (include description of year's "deliverable" and, if appropriate one or a few intermediate milestones):

We plan to set up appropriate:

- Accelerator tracking codes (ACCSIM, MARS, or equivalent)
- Hadronic energy absorption codes (FLUKA, MARS or equivalent)
- Material response codes (ANSYS)

so as to arrive at a conceptual design of a Phase II collimator that is based on the rotating collimator [thin (1 cm high Z scatterer, 10cm overall), light, low power (5W, radiatively cooled) 30cm diameter disks] developed and prototyped by SLAC for the NLC, but that

- meets current "Collimation Efficiency" of LHC Phase I graphite collimators
- absorbs sufficiently little energy from beam halo under foreseen normal operating conditions that reasonable water cooling is adequate
- suffers sufficiently small damage in foreseen accident conditions that design will allow on the order of 100 suffered accidents before replacement is required
- has sufficiently low impedance that LHC can reach nominal operating parameters
- meets the required spatial, mechanical, vacuum, radiation constraints of the LHC

Assuming the project goes forward, we plan for 0.25 FTE of a mechanical engineer (FT for last 3 months of FY), who would begin by participating in the technical design of RC1, as well as working with RC0 and setting up a clean work area with adequate power and cooling for testing collimators under heat load.

Clean room attributes

-HVAC

-Vacuum system

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- AC power for DC and Peak heating tests
- Adequate water cooling for DC and pulsed heat testing
- PC/DAQ capability
- Massive flat support
- Crane access
- Capacitec measurement system for mechanical tolerance
- Vacuum and temperature diagnostics
- Hand tools & work bench

Manpower Summary

Postdoc	FNAL	0.50	FTE
Postdoc	SLAC	1.00	FTE
Physicist	SLAC	0.25	FTE
ME	SLAC	0.25	FTE

Milestones:

- Preliminary results presented at an early 2005 LHC workshop
- Phase II collimator review
- Enclosed semi-clean lab

Deliverable

- Written conceptual design

Statement of expected follow-on work in subsequent years (include “ultimate” goal and time scale for this sub-program, as well as plans for specific work and rough budget need for next 2 years):

The ultimate goal of this sub-program is a successful design for low impedance, high efficiency LHC secondary collimators. The design will be validated with a sufficient but small (1-3) number of prototypes and beam tests. The design specifications and the prototypes are the primary deliverables. The time scale is set by the desirability of testing the prototypes with LHC beam in 2008/09. Based on the design study, prototype performance and overall experience with the Phase I collimation system in actual LHC running conditions, CERN will decide whether or not to proceed with the rotating collimator design. If a decision is made to proceed, this sub-project will provide an engineering drawing package to CERN and will support the effort to commission the collimators once they are manufactured and installed by CERN.

Overall Plan:

FY 2004:	Introduction to project
FY 2005:	Phase II CDR and Set Up of collimator lab at SLAC
FY 2006:	Tests of RC0, Design and construction of RC1
FY 2007:	Tests of RC1 (two rounds), design and construction of RC2
FY 2008:	Non-Beam Tests of RC2
FY 2009:	RC2 beam tests & final drawing package for CERN
FY 2010:	Await production & installation by CERN
FY 2011:	Commissioning support

Glossary:

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RC: Rotating Collimator

RC0: Existing NLC prototype

RC1: Prototype with horizontal jaws, made of non-exotic UHV compatible materials

RC2: Beam-test capable prototype with exotic materials

Outyear budget estimates:

FY	Labor	M&S	Shop	Grand Total
2004		11000		11000
2005	265000	89000	7000	361000
2006	471000	124000	153000	748000
2007	462000	204000	321000	987000
2008	603000	50000	95000	748000
2009	621000	65000	32000	718000
2010	245000	26000		271000
2011	381000	81000		462000
Grand Total	3048000	650000	608000	4306000