Supplemental request from HEP Division at Argonne National Lab.

Introduction and Assumptions

This is the reply to the message from Glen Crawford requesting supplemental requests for the remainder of FY09. Before getting to the request, here is an outline of the assumptions and actions that recently happened and which influence this request.

1. The division has two pending proposals into OHEP:
    a. A proposal to construct layered SC cavities, with Atomic layer deposition, which will allow acceleration gradients on the order of 150MV/m. This proposal was submitted in January 2009, is under review and is part of the SRF program under Bill Weng. I sent email inquiring about this last week. No additional funds are requested, because activity has not been established yet.
    b. A proposal to develop large area, new and cheap photo detectors with a new readout system, enabling these large photo-detectors and very accurate timing. A LOI was submitted in February and a proposal has been submitted as a FWP in the last week to the Detector Technology R&D program under Howard Nicholson. No additional funds are requested , because this activity has not started yet.
2. We anticipate that the AWA activities (Advanced Accelerator R&D, Phil Debenham) will receive a 0.5M increase in base funding and an additional $2M for upgrading the facility. Therefore no supplemental funds are requested for FY09 for this activity.
3. We have received inquiries from collaborations we are in, to fill out forms for additional support. We have filled them out and they are included in the list below, but flagged appropriately. The Collaborations are: MINOS, Nova and Double Chooz, all in neutrino physics. In these case they were NOT prioritized within Argonne, because it is assumed that OHEP will prioritize them nationally. The amounts shown below are the same amounts we requested from those collaborations.

Below are the requests from the division organized according to the Research areas listed on the Web page. The only area where we deviated (because I was confused) is that we split “Advanced technology R&D” into two parts: Detectors and Accelerators. We had a division wide meeting where group leaders and others gave 10 minute presentations about the supplements they requested. They were prioritized afterwards. The first item below is a Table with an overview and prioritization. Below the table is the condensed format you requested organized by research area. Additional information is available.

Prioritized requests from ANL HEP Division for FY09

Rank	Title	Amount (k$)	Recur	Research area
1	*ATLAS Analysis & Support Center*	350+150	One time + recur	Proton
2	*QCD theory collider expertise.*	300/yr	For 2-3 years	Theory
3	*Wireless and fiberless readout*	235	One time	R&D detectors
4	*Postdoc for DHCAL*	100	<3years	R&D detectors
5	*Breakdown in cavities*	200/yr	<3years	R&D accelerator
6	*DUSEL long-baseline neutrino*	50/yr	recur	Proton
7	*Postdoc on PreCam for DES*	100/yr	3 years	Non-accelerator
8	*GEM project*	130	one year	R&D detectors
9	*Massively multi-core framework prototype*	290	one year	Unclear; computing
10	*Computational cosmologist*	175/yr	3 years	Non-accelerator
11	*ROOT I/O on Blue-Gene for HEP.*	320	one year	Unclear; computing
12	*Neutrino expertise in theory group*	$100K/y	recur	Theory
--	*NOvA*	197	one time	Proton
--	*MINOS*	37	one time	Proton
--	*Double Chooz*	70	one time	Non-accelerator

Proton Accelerator Based

Argonne ATLAS Analysis & Support Center(AASC). Rank # 1

(a) A one-time expenditure on infrastructure and software effort at ANL AASC in order to accelerate the push for data-readiness on US ATLAS institutes and build & maintain ATLAS analysis infrastructure that can be used at other institutions (Tier3). Enable LHC physics in US.
(b) $350k + $150K/yr for personnel (1FTE)
(c) No recurring costs(350K) + recurring cost (150K/yr)
(d) This funding, by accelerating the existing plans at ANL AASC, will help close the gap in LHC data readiness at US ATLAS institutes which has become increasingly apparent.
(e) Proton Accelerator-Based Physics

DUSEL long-baseline neutrino. Rank #6

(a) The funding would be used for travel and detector R&D as part of the long-baseline DUSEL collaboration and actively contribute to the long baseline design.
(b) $50,000
(c) Recurring
(d) Several ideas for detector R&D are in the initial stages, but could lead to significant savings in the long run if and when a megaton scale neutrino detector is built at DUSEL.
(e) Proton Accelerator-Based Physics

MINOS (requested through MINOS, amounts identical). Not ranked.

(a) The money would be used for the summer salary of visiting scientist Phil Schreiner, and for a summer student
(b) $37,000
(c) Not recurring
(d) Dr. Schreiner, from Benedictine University, has been visiting ANL, analyzing MINOS data, and is first author of a paper on MINOS results just submitted to Astroparticle Physics. His continued presence is an extremely cost effective way to continue to exploit the multi-million dollar MINOS experiment
(e) Proton

NOvA (requested through NOvA, amounts identica l). Not ranked.

(a) The money would be used for engineering and construction of items involving the block raiser and glue machine that were not in the baselined NOvA project.
(b) $197,000
(c) Not recurring
(d) Devices involving the Adhesive Dispenser Integration, the Block Safety Restraint, the Bock Pivoter Ventilation, and the Block Pivoter Perimeter Access would all decrease risk as construction of the NOvA experiment proceeds.

(e) Proton Accelerator-Based Physics

Non-Accelerator Physics

Double Chooz (requested through Double Chooz, amounts identical). Not ranked.

(a) The money would be used for 20% of a postdoc (Matthew Wetstein) and for travel to meetings and installation for the Double Chooz experiment.
(b) $70,000
(c) not recurring
(d) The Double Chooz experiment will be the next experiment to shed light on the value of theta-13, a crucial parameter to know for the future of U.S. HEP facilities.
(e) Non-accelerator physics

Computational cosmologist. Rank #10

(a) Bring in computational cosmologist to do N-body simulations of the early universe including dark matter and baryons relevant to studies of dark energy with weak lensing measurements, and of the cosmic microwave background polarization. Establish connection between DES and CMB measurements.
(b) 175K
(c) This cost would recur in following years - at least three years.
(d) This is high priority as it relates to the determination of cosmological parameters (such as dark energy) from measurements with the Dark Energy Survey(DES) and South Pole Telescope(CMB).
(e) Non-accelerator physics

Funding for a postdoctoral fellow to assist with PreCam for DES. Rank #7

(a) Add a postdoctoral fellow to assist with the construction, testing, operation, and analysis of data from the PreCam project for the Dark Energy Survey (DES), including the determination of calibration stars for DES photometry.
(b) $100K/year.
(c) Costs would continue for approximately 2-3 years.
(d) This is high priority to minimize observing time with the main DES telescope for photometric calibrations, and enhances ANL expertise with CCDs.
(e) Non-accelerator physics.

Theoretical Physics

QCD theory collider/phenomenology expertise. Rank #2

(a) Bring in new theory staff, with expertise in QCD at hadron colliders. This would be a full time Argonne position. Candidate has been identified. Bring in additional postdoc for new staff (more information in additional exchanges)
(b) $300K/year.

(c) Costs would continue for approximately 2-3 years. Anticipate support from Argonne for this plus some phased retirement, which would reduce the cost in future.
(d) This is to address some of concerns of theory review as well as bringing in needed expertise for upcoming LHC physics and align theory more with LHC experiment
(e) Theoretical physics.

Neutrino expertise in theory group. Rank #12

(a) Hire addditonal theorist with expertise in neutrino physcs (US program concentration). Increase theoretical neutrino physics in Illinois, aligned with US program future and align with Northwestern to increase expertise locally.
(b) $100K (joint position)
(c) Recurring cost. Addition to theory program.
(d) One of the cornerstones of proton accelerator resrecah will be US neutrino program, centered at Fermilab. This increases local expertise and enhances already established expertise at Northwestern.
(e) Theoretical Physics.

Advanced technology R&D: Detectors

Optical Project: wireless and fiberless readout. Rank #3

(a) Development of a Light modulator based DAQ system which can be used without fibers. Together with Center for Nanoscale Materials at Argonne, to use MEMS mirror arrays
(b) The amount requested is 235 K
(c) This is a non-recurring cost to build a demonstration project and do radiation testing for a university. If successful the project would be integrated into some other development project.
(d) This is high priority for overcoming problems in getting data out of future high energy physics detectors, especially “massless” trackers.
(e) Advanced Technology R&D

Postdoc for DHCAL development. Rank #4.

(a) Building of DHCAL test-beam prototype, installation in test-beam, commissioning and data taking and analysis of massive amount of test-beam data. Supplement to current DHCAL funding
(b) Postdoc: $100K
(c) This program will continue in 2010 and 2011
(d) Digital hadron calorimetry and verifying that it will actually work with RPCs is one of the priority items in the Advanced Detector R&D activities.
(e) Advanced Technology R&D

For the GEM project. Rank #8

(a) Developing new ways of using GEM tracking in High-rate, High Multiplicity environments and developing tracking expertise at Argonne.

(b) We are requesting 130K
(c) This development of a new readout plane is non-recurring. GEM development in general is ongoing all over the world.
(d) This is high priority for finding an economical replacement for detectors which cannot handle high rates or high multiplicity with high resolution.
(e) Advanced Technology R&D

Acquisition of CAD Tools for Custom Integrated Circuit Design(no priority for now)Not ranked. For information and for future.

(a) The funding would be used to procure CAD tools for the design of custom integrated circuits, including the strategic hire of an experienced chip designer.
(b) The cost would be as follows:

1 IC designer, annual salary	$250K
3 CAD tools, 1 seat each	$500K (one time)
Training on CAD tools for 2 existing people	$50K (one time)
Procurement of 3 CAD stations	$50K (one time)
Total	$850K

(c) The recurring costs would be:
   1. annual salary of the IC designer : 250K
   2. Maintenance fee of tools, 12%/yr = $60K
(d) The acquisition of these tools is part of our strategic plan to grow a Detector Development Technology Center at Argonne. The capability to design custom integrated circuits is essential in this activity as modern detectors and instrumentation have a high level of integration.
(e) Advanced Technology R&D.

Advanced Technology R&D: Accelerators (Science & Technology)

Simulation of breakdown phenomena in cavities. Rank #5.

(a) We want to do atomistic (molecular dynamics) and mesoscale (based on macroscopic surface thermodynamics) modeling of damage or surface failure mechanisms (including roughening, Ohmic heating and melting, plastic flow, creep, fatigue) during arcing in rf systems to coordinate with PIC code modeling of arc plasmas by Tech-X.
(b) 200k
(c) This cost would recur in FY10 and FY11
(d) Accelerator models need to understand field emission and surface damage since CLIC, ILC and the Muon Collaboration are all limited in some ways by field emission and defects in rf systems. Expertise is available at Argonne, but may leave if not funded.
(e) Advanced technology R&D

The unfunded category:, computing, future computing etc.

Massively multi-core framework prototype. Rank #9

(a) Description: Framework prototype for experimental HEP on increasingly-multi-core platforms. Use Leadership computing facility at Argonne for HEP.
(b) Funding required: $290k for 1 FTE software engineer incl. travel and M&S
(c) Non-recurring: One-year effort concluding mid-FY10 (though if successful, LHC experiments may later wish to invest in moving to such a framework)
(d) Justification: Growth in computing power is coming mainly through increased numbers of cores, without proportional increases in memory; fundamental changes will be needed in HEP codes and the frameworks that support them if HEP is to make effective use of emerging hardware.
(e) "Proton accelerator-based physics", though applicability is wider

ROOT I/O on extreme-scale computing platforms for HEP. Rank #11

(a) ROOT software on extreme-scale computing platforms, beginning with ROOT I/O on BlueGene-class machines
(b) $320k software engineering effort, approximately half to FNAL (ROOT I/O team: Philippe Canal et al), half to ANL (BlueGene effort, and application to ATLAS core software)
(c) Non-recurring: one-year effort concluding mid-FY10
(d) Justification: Experimental HEP (as opposed to, say, lattice QCD) has not managed yet to leverage DOE's sizable investment over many years in extreme-scale computing; this project would provide a foundation, as ROOT permeates experimental HEP computing today.
(e) "Proton accelerator-based physics", though applicability is more general