The LHC Physics Center at Fermilab

1 Introduction

Since 2004, the LHC Physics Center (LPC) at Fermilab (FNAL) has been a center of excellence, providing a home for the US Compact Muon Solenoid (CMS) Collaboration and a wealth of resources for CMS collaborators from around the globe. This document summarizes the history of the LPC and describes the state of the center today, including the programs that it runs.

2 History

In 2004, Daniel Green, US CMS Construction Manager, recommended the creation of two entities to be based at FNAL:

1. A Remote Operations Center (ROC) which would be based at FNAL, but assist in the shifts operation of the CMS experiment at CERN,

2. A center of excellence bringing together university students, postdocs and faculty to work together and with FNAL laboratory scientists on the CMS experiment.

This was the result of a series of discussions between university faculty and FNAL scientists who believed it was critical to the US contribution to have a center where expertise in collider physics could be leveraged so that "the whole could be greater than the sum of the individual parts." At the time, FNAL hosted the only operational hadron collider, the Tevatron, and its two experiments, CDF and DZero, had significant on-site user presence.

After a trip to the DOE and NSF, university faculty and US CMS project management began to make the case for a critical mass of US physicists working on LHC physics at a center based at FNAL, and the proposal was approved and integrated into the operations program. In 2003, a series of workshops were held at FNAL focusing on LHC physics and the CMS experiment. This eventually evolved into an annual series named "CMS 101," focusing on the basics of LHC physics, the CMS detector, and the CMS collaboration. Over the course of the next several years this series morphed into the CMS Data Analysis School (DAS) which will be described later in this document. In addition, a weekly US CMS meeting was inaugurated in April 2004 to centralize the on-going work on CMS. Both of these initiatives inspired the CMS collaboration, leading to the creation of CMS Weekly General Meeting (WGM) and yearly CMS Data Analysis Schools. All these efforts continue to this day and are crucial to the CMS collaboration.

3 LPC Organization and Staff

As specified in the US CMS Constitution [1], the LPC is led by two co-coordinators on staggered two-year terms. One co-coordinator must be university faculty at a US CMS institution while the other must be a FNAL staff scientist. Co-coordinators are selected by a committee appointed by US CMS leadership and are limited to two two-year terms. The final appointment of the LPC co-coordinators is made by the FNAL director. The co-coordinators are advised by a Management Board consisting of several at-large members of the CMS collaboration, including at least one early career member, and several *ex-officio* members, such as the FNAL CMS Center head, the CMS spokesperson, the US CMS Collaboration Board chair, and one of the CMS physics coordinators.

Much of the day-to-day activities at the LPC are facilitated by support scientists based at FNAL. Currently there are three such support scientists, all of whom are PhD research staff from a US CMS institution. They each have a primary area which they support, with cross-availability for the other two areas:

- Physics support: Facilitate LPC users in forming analysis collaborations and networks, leading the organization of training and education events such as CMS DAS, and leading the organization of various event committees to facilitate the scientific program activities at the LPC. Provide users support in doing CMS data analysis.

- Computing support: Support of LPC users in using FNAL and CMS computing resources such as the LPC analysis cluster. Facilitate access and account creation for new LPC users.
- Operations support: Facilitate the scheduling and operation of CMS shifts at the Remote Operations Center (ROC). Serve as the primary ROC manager and contact person for all remote shifts at FNAL.

Each of the regular events listed in Sec. 7 also has an organization committee consisting of LPC users and affiliates.

4 Funding

Funding for the LPC primarily comes from two sources:

- DOE Energy Frontier (EF) research funding. EF research funding is the primary source of support for the LPC Distinguished Researcher (DR) program. In recent years this funding has been entirely a subset of the EF research funding for the FNAL CMS Center. Previously, the LPC also received directly allocated research funding from DOE.
- The US CMS Operations (Ops) Program. Ops program funding is used to support the guest and visitor program, three LPC staff members, teaching buyout and travel of the university LPC co-coordinator, and travel support for visiting speakers.

5 Deliverables

The LPC center offers three primary deliverables:

- Physics Support
- Computing Support
- Operations Support

The physics support comprises various financial support programs to bring users to the LPC, such as the Distinguished Researcher, Graduate Scholar, and Guest & Visitor programs; training and education programs such as the CMS Data Analysis School (DAS), Hands on Advanced Tutorial Sessions (HATS), and graduate courses; Advanced Workshops; and a variety of physics seminars and journal clubs, and various informal coffee and office hours described later in the document. The LPC employs one scientist that focuses on physics support to enable these programs and to help coordinate them. A dedicated community chat (with more than 20 specific channels and more than 500 users), connected with the bi-weekly LPC Physics Analysis Discussion, is used to provide users physics analysis support. Newcomers are regularly onboarded with a dedicated "Welcome to the LPC" chat.

Computing support consists of a managed computing center offering batch CPU, login nodes for interactive work, and significant disk storage for CMS analysis. The LPC employs one scientist leading LPC computing support. This computing support scientist monitors FNAL helpdesk tickets, community chats, and emails to resolve site-specific issues that arise by scientists and students working at the CMS LPC computer analysis facility. Coordination is done with users to assist them in solving their computing problems, such as obtaining accounts, obtaining collaborative group storage space, and learning how to quickly port code from FNAL's batch computing system to the full grid batch system. Documentation for CMS LPC computing at Fermilab is maintained and the computing support scientist leads regular computing discussions (together with LPC users and FNAL computing experts). LPC computing support works with other Fermilab support staff to test new workflows that affect users (such as site access), debug common problems that affect CMS users, and help CMS users navigate site access issues.

At the same time that the LPC was created, FNAL created the Remote Operations Center (ROC). The ROC sits on the first floor of Wilson Hall, and is set up like the control room of a modern particle physics experiment. The difference is that, unlike other control rooms, the experiment it controls not even on the same continent as FNAL. The software that monitors and controls the CMS experiment is run via remote

connection from the ROC. This allows local shifters to take part in the main operations of the CMS experiment from FNAL. In particular, shifts that focus on monitoring the performance of the detector do not need to be in the same room of the CMS main control room. Remote control of the CMS trigger and data acquisition systems is also feasible. The LPC has recently added an Operations Support scientist who ensures that remote shifts at the LPC are performed efficiently, organizes shifter training sessions, and maintains the upkeep of ROC resources such as computing workstations.

All support personnel assist when they are available in ensuring the larger LPC events succeed: such as CMS DAS, HATS, Workshops, and the USCMS PURSUE internship program. Two of the three current support personnel are also hobby photographers and occasionally lend their skills to photograph LPC events.

6 Space

The space of the LPC is primarily the 10th (East half) and 11th (full) floors of Wilson Hall and is shared with the FNAL CMS group. A number of offices and desks are made available to LPC users and affiliates, often delineated by home institute. In addition, LPC members make extensive use of the cross-over open space and video conferencing (Zoom) rooms on the 10th and 11th floors:

- Sunrise (WH11NE)
- Round Table (WH11SE)
- Sunset (WH11SW)
- Pileup (WH11NW)
- West Wing (WH10NW)

The ROC has a dedicated space on the first floor of Wilson Hall.

7 Programs and Activities

The LPC offers several programs and activities for CMS users, these include programs supporting LPC users financially:

- LPC Distinguished Researcher (DR) Award
- LPC Graduate Scholar (GS) Award
- LPC AI Fellowship Award
- LPC Guest and Visitor (G&V) Award

Regular seminars and discussions:

- LPC Topic of the Week
- LPC Physics Forum
- LPC Coffee Hour
- LPC Journal Club
- LPC DR Office Hours
- LPC presents: Colliders Of Tomorrow
- LPC Physics Analysis Discussion
- LPC Computing Discussion

Education and training events:

- CMS Data Analysis School (DAS)
- Hands-On Advanced Tutorial Sessions (HATS)
- LPC Academic Lectures

And Advanced Physics Workshops and topical meetings. Each of these programs and activities is described in the sections below.

7.1 LPC Distinguished Researcher Program

The most prominent program that the LPC offers is the Distinguished Researcher (DR) award. The award is designed to bring university faculty and postdoctoral scientists from all over the world to the LPC, to work together on the CMS experiment. This helps bring a vibrant "whole is greater than the parts" synergy, stimulating existing science and formulating new endeavors in community building partnerships between laboratory scientists and university faculty and postdocs.

The program is divided into two calls: one for senior researchers (faculty), and one for junior researchers (postdocs). The junior program is supported by covering 0.5 FTE of the postdoctoral salary, while the senior program supports a buyout from teaching to afford the faculty more time to focus on research during the LPC DR appointment. Both programs also include travel funding for the year and applicants are highly encouraged to move to the LPC or spend a significant fraction of their time at FNAL.

Each applicant for the program prepares a (few pages long) proposal, highlighting a planned program of research. Typically, for junior applicants, this includes a physics analysis and some technical project involving either FNAL scientists or other university students, postdocs, or faculty based at (or connected to) the LPC. For senior applicants, this typically includes a major organizational role in a CMS research program, possibly with a series of events/workshops or building a standing effort at the LPC on a particular physics or technical topic. Junior applicants are also required to arrange for at least three letters of reference to be sent on their behalf. The applications are evaluated on a competitive basis by the LPC management board. Attempts are made so that the approved distinguished researchers form a broad, coherent vision for compelling physics and technical work across the CMS experiment. Proposals are funded based on their promise to realize the most vibrant LPC program. A list of the distinguished researchers from this and previous years can be found here.

7.2 LPC Graduate Scholar Program

The LPC Graduate Scholar Program supports exceptional PhD students working on the CMS experiment to spend a year at the LPC. Students must be past their second year in graduate school, working full time on CMS but not in their final year of graduate studies. The student prepares a four-page proposal detailing the proposed research which must contain both a physics analysis which they are undertaking as part of their thesis research and a technical project that LPC senior scientists are involved in. Three letters of recommendation are required: one from the student's advisor, one from the proposed LPC mentor who they would be working with closely while at the LPC, and a third letter from a US CMS member from another institution who is familiar with the student's work. The award supports a stipend currently set at $32,000, which allows university faculty to support their students (fully or partially) and is an independent award of recognition for the student. The current and previous graduate scholars can be found here. Typically, two or three LPC graduate scholars are awarded each year.

7.3 LPC AI Fellowships

The newest LPC award is the LPC AI fellowship which seeks postdoctoral researchers and graduate students from across the CMS collaboration with interest in applying machine learning (ML) techniques to challenges in high energy physics. Successful applicants spend at least half of their time conducting research in the area of ML applications developed specifically for CMS. Here is the current list of recent AI fellows. The program was started to take advantage of the growing interest in AI applications and development to collider physics. If funds are available, the LPC envisions enlarging the program in the future.

7.4 Guest and Visitor Program

The Guest and Visitor program is an LPC program that brings university students, postdocs, and faculty to FNAL. The main aim of the program is to facilitate CMS collaborators to spend time at the LPC and collaborate with other LPC residents/applicants on projects that advance, enrich, and impact the interests of the CMS experiment, with a mandatory operations component. The G&V program is open to all CMS members both from U.S. and non-U.S. institutions. In comparison to the other programs, the G&V program typically serves shorter, more focused visits on a specific project: test beam, detector testing or construction, specific targeted software development, or shift work. In a typical year the program supports 20–40 short term visits to FNAL.

7.5 LPC Topic of the Week

The LPC Topic of the Week is a seminar series that extends an invitation to a speaker to come for a seminar and a short stay at the LPC. The visit typically lasts several days to a week, during which the speaker will come to the LPC and give a talk on a particular physics topic of interest. During the visit, speakers engage with LPC residents and visitors and discuss their seminar topic, often generating "hallway conversations" which can lead to new efforts at the LPC. The Topic of the Week committee includes a member from the FNAL theory division to help facilitate interactions with the theory community.

7.6 LPC Physics Forum

The Physics Forum is an interactive informal seminar meant to stimulate discussion. A speaker is invited to give a "chalkboard" talk on a topic of interest. The format is interactive, typically without a polished presentation. The audience is actively encouraged to ask questions and promote a dialogue between the participants. This program does not have travel funds available, so it actively seeks speakers among LPC visitors and residents, or visitors to local universities. A given Physics Forum can be open to the wider FNAL community or restricted to CMS collaborators, the latter offering the unique opportunity for LPC visitors to highlight their activity and engage the rest of the LPC community without needing formal approval from the CMS collaboration. While the program officially started in 2007, a list of topics and speakers over the last 10 years is available on the LPC website.

7.7 LPC Coffee Hour

The LPC Coffee Hour meets monthly. This is an event intended to be a highly interactive talk with no formal slides in most cases. Topics are not constrained to high energy physics. Similarly to Physics Forum, Coffee Hour does not have a travel budget for speakers, so it relies on actively seeking local or visiting speakers who may be traveling to FNAL or nearby universities.

7.8 LPC Journal Club

The LPC Journal Club meets on a bi-weekly basis. Members of the journal club vote for a recently released paper or pre-print, and then read the paper together during a meeting, leading to an in-depth discussion. This inspires an informal, dynamic discussion of recent results, particularly among the students and postdocs at the LPC. This important program encourages students and postdocs to learn the process of reading, evaluating, and critically discussing a variety of physics results. The journal club is a popular component of the LPC.

7.9 LPC DR Office Hours

The LPC Distinguished Researcher Office Hours are weekly, half-hour, casual get-togethers with coffee and snacks. This event is in-person only (except for March 2020–March 2022, when it moved to videoconference), and is run by two distinguished researchers resident at the LPC. Attendees tend to have large and small group conversations about anything from local swimming pools and transportation to physics to computing matters. DR Office Hours is particularly important for newcomers to the LPC as it offers them an informal environment to get to know the community and ask questions about a variety of topics.

7.10 LPC Presents: Colliders of Tomorrow

The LPC Colliders of Tomorrow began in 2023 as a bi-weekly event (alternating with the LPC Physics Forum schedule) to build a community of US scientists interested in the future of collider physics. This meeting combines invited talks and hands-on computing tutorials designed to educate, foster discussion, and develop future collider research and planning.

7.11 LPC Physics Analysis Discussion

The LPC Physics Analysis Discussions are organized by LPC Physics Analysis Support. Leaders of the discussion synthesize the latest CMS subgroup meetings and news about different physics objects (*e.g.* jets, muon, particle tagging), generators, machine learning, trigger, statistics, common analysis tools and similar topics. These summaries capture all news relevant to current CMS data analysis. A broad range of experts is available to answer questions from meeting attendees live and offline on dedicated chat channels. The facilitators of these discussions are typically also lead contacts for other training events and while several are based at the LPC, many are based in the US, at CERN, or at other CMS institutes.

7.12 LPC Computing Discussion

The LPC Computing Discussion is held typically every other week. The LPC Computing Discussion group is designed in the same spirit as the Physics Analysis Discussion group. News, status, and instructions for LPC computing resources are shared in an informal setting. The discussion group encourages everyone at the LPC to share their experience with LPC and CMS computing, and provides a forum for users to discuss computing topics and techniques, ask questions, and get help from experts at the LPC. The local CMS computing facilities at FNAL include both user facilities and those involved in centrally managed production and data analysis. The FNAL person who manages the operation of both facilities attends the computing discussion and provides direct communication with LPC computing support and users in this discussion. Understanding the overlap between issues that arise in user analysis and CMS central Monte Carlo production or data processing have been quite informative to both sides.

7.13 LPC CMS Data Analysis School (DAS)

The CMS Data Analysis School (DAS) hosted at FNAL is an important component of the LPC yearly events. CMS DAS brings approximately 100 students and postdocs to the LPC for a week. During that time, faculty and postdocs give lectures to the school participants on the underlying theoretical framework of the physics at the LHC, the LHC accelerator, the CMS detector, particle identification and reconstruction, and computing, as well as lectures on the CMS physics program. Students also attend a session dedicated to the CMS publication process, in which they learn the full life cycle of a CMS analysis. An important part of the success of the program is a large number of facilitators who are available for detailed one-on-one interactions, and who are available for the entire week to sit and work through the process of setting up an analysis, answering questions, and providing technical help with CMS software.

After the lectures, students engage in two sets of exercises. One set, the so-called "short exercises," are designed to be done in a relatively short amount of time (a few hours), and focuses on specific topics such as the reconstruction and identification of muons, jets, or tracks, or single subjects like statistics or machine learning. The "long exercise" is a multi-day project which focuses on recreating a full CMS analysis. Students are grouped into six to eight teams, each of which is assigned a different CMS analysis topic, and are assisted by a team of facilitators. The students spend the majority of the week working on the analysis, during which they learn about the technical aspects of CMS software and also the underlying physics of their analysis. At the end of the week, they prepare as a group a final talk, and each student presents part of it on the final day.

7.14 Hands-on Advanced Tutorial Sessions (HATS)

Another educational aspect of the LPC is the Hands-on Advanced Tutorial Sessions (HATS) program. The HATS program is a series of dedicated tutorials hosted at the LPC which allows students, postdocs, and faculty to learn in depth about various aspects of CMS. These typically cover a diverse set of topics, from introductory

CMS software to detailed deep dives into particular CMS object identification to advanced tutorials on cutting-edge computing and hardware/firmware technology and techniques. The HATS are typically hosted during the summer, complementing the CMS DAS (which typically is hosted at the beginning of January), and refreshing and updating the training materials used extensively by the whole CMS collaboration. Typically, HATs are taught by faculty and postdocs, but on occasion, they are run by industrial partners who are eager to teach and introduce students and scientists to their commercial products (FPGA and GPU programming are some recent examples). Most HATS, when possible, have long been held as hybrid in-person and videoconference events, with recordings posted for participants to follow along offline.

7.15 LPC Academic Lectures

A number of US CMS faculty associated with the LPC have shared their courses and academic lectures. In most cases, there is the opportunity for graduate students from other insitutes to earn credit at their home institute (in coordination with the academic advisor at their home institute). On some occasions, there have just been a few dedicated lectures. Others have been full one- or two-semester courses, including Computational Physics, Machine Learning/AI, Statistics, Instrumentation for Particle Physics, and Particle Physics. These lectures were prompted by the relative absence of these topics in many of the graduate programs. Lecturers have taught primarily from the LPC or from their home institution. Over the past three years, many of these lectures were recorded, and the recordings and course materials are available on the LPC indico site for other CMS colleagues to review offline.

7.16 Advanced Physics Workshops

A cornerstone of the scientific program activities at the LPC are the advanced physics workshops, organized on selected LHC physics topics aligned with LPC initiatives. These are dedicated workshops, typically organized by the senior distinguished researchers, focusing on particular subjects, inviting experimentalists and theorists from around the world. These can vary from specific physics areas such as multi-boson physics or W mass workshops to more general topics such as machine learning or analyzing open data. Some of these are internal CMS-only events, while others are open to theorists and participants from other experiments. The LPC endeavors to have at least three to five such workshops per year.

8 Diversity, Equity, and Inclusion

Creating and maintaining a diverse, equitable space that is inclusive to all is of paramount importance to US CMS and the LPC. To this end the LPC actively takes into account best practices in the selection of speakers, distinguished researchers, and other LPC leadership positions. In addition, the LPC helps assist in the US CMS PURSUE program which supports women and underrepresented minority undergraduates as research interns during the summer. The program includes a two-week-long, in-person training period at the LPC. A fraction of the students continue their internship at FNAL through the full summer, while others travel to US CMS affiliated universities for the remainder of their internship.

9 Community

The LPC community is made up of CMS faculty, scientists, postdoctoral researchers, and students who come together at a center of excellence at FNAL. The majority of the LPC community comprises US CMS members and FNAL scientists who are based at FNAL. In addition, however, the LPC regularly invites and hosts international collaborators, which at any given time comprise 5–10% of the CMS community at FNAL. Many of the LPC's activities are built around fostering both formal and informal partnerships working on projects, resulting in a critical mass of experts and an exceptional collaborative spirit. For most users, access to physics, computing, and operations support at the LPC rivals the opportunities offered at CERN, thanks to the concentration of expertise, the presence of dedicated resources and personnel, and the effectiveness of the various programs highlighted in this document. The success of the LPC is based on the collaborative spirit of its members, which is exemplified by most of them serving its goals in a pay-it-forward fashion, helping as facilitators in some of the training programs they have benefited from, volunteering in the organization of

events and committee work, and generously sharing their time and expertise. An important foundation of the LPC community is the time spent interacting with each other, genuinely getting to know each other, and sharing ideas across very heterogeneous groups. While the LPC was forced to adapt to a fully remote mode of operation during the pandemic, embracing hybrid events and trying to replicate as much as possible the networking and engagement benefit of in-person interactions, most of the current success of the LPC is rooted in the networking capital accrued over many years of in-person community building.

10 Evolution

In general, the LPC programs and activities have organically grown over time. The original DR program led to the creation of the Graduate Scholar program and the US CMS PURSUE program through community interest and LPC coordinator initiative. An exception to this general trend was the abrupt transition from the early organization of the LPC to the current format. Initially, the LPC was organized according to detector areas, physics object groups, and physics analysis groups in an identical way of the international CMS experiment. However, over time it was found that replicating the same structure in a US setting was not the optimal organization. This structure was eventually dropped in favor of the current model, which is organized according to organic and user-defined group efforts on particular areas of interest to LPC users.

The most difficult time for the LPC in recent years has been the Covid-19 pandemic and the slow restart of activities. For the better part of two years, FNAL was shut to all but essential activities. The cohort of students and scientists who had been at the LPC was initially quite active online, and the LPC continued programs virtually to the extent possible. However, over a period of time as the pandemic wore on, people who were at the LPC on a temporary basis left to go back to their home institutes or moved to new jobs. Over the course of the previous LPC history there had been a continuous ebb and flow of people coming to and from the LPC as they graduated, got other jobs, or returned to their home institutes after extended stays at the LPC. This abrupt and rather dramatic event changed this dynamic, and with FNAL was closed to normal activity, new people did not replace those who left. This led to a dramatic change and rapid shrinking of the LPC community. It has taken dedicated efforts to encourage new people to come to the LPC by providing travel funds, larger than normal cohorts into LPC programs, and asking the CMS community to specifically host activities at the LPC. As of mid-2023, the situation has reversed course, and the LPC is building back its community based at FNAL, but the combination of the pandemic, site access issues, and reduced on-site housing have made this struggle long and difficult, and the LPC is still not back to the pre-pandemic level of activities.

References

[1] USCMS Collaboration. “US CMS Constitution”. In: (2020). URL: https://uscms.org/uscms_at_work/collaboration/constitution.shtml.

A Appendix

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13 February 2004

Mike Witherell, Director
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Dear Professor Witherell:

I am writing to you on behalf of a group of University professors who met on February 12, 2004 at FNAL to discuss how to organize an effort to prepare for data taking and physics analysis with the CMS detector at the LHC while at the same time fulfilling our ongoing commitments to experiments currently running in the US, such as BaBar, CDF, and DØ. We invited Dan Green, Avi Yagil, John Womersley, and Lothar Bauerdick to our meeting, to help us understand whether our interests/needs coincide with the lab's plans for an LHC physics center (LPC). The purpose of this letter is to inform you of our thoughts on this subject, and also of the ways we hope the lab can help us on what we think is an effort which could very well determine the health of our field in the United States, both during the LHC era and afterwards.

We unanimously agreed that the only way in the short term we could both prepare for CMS data taking and continue our vital work on running experiments is to find a way to make it effective for postdocs and students to work on both efforts at the same time, and the only way to do this is to cluster them in a place like the proposed LPC. We were also all hopeful that, if started now, such a center could become our preferred place for clustering even after the start of CMS data taking, so that we travel to CERN only approximately 4 times per year, and travel regularly instead to FNAL to interact with our students and postdocs. Whether this works or not depends crucially on the LPC becoming a power research center well before the LHC data taking starts in 2007.

Most of the current indirect evidence for the scale of new physics hints that the LHC may be able to make a major discovery shortly after turn on. The discovery will go to the collaborations and physicists that are best prepared at the start of data taking. CMS takes this possibility very seriously, and has established the "Physics Reconstruction and Selection" (PRS) groups to make sure the collaboration is prepared. Over the next two years, this preparatory work will take the form of the writing of a "Physics TDR". If US CMS wants to play a leading role in these discoveries, we need to lead in the preparation of this TDR through participation in the PRS groups. We also need to do the kind of activities that are going on now within CMS that will enable us to have an intimate understanding of the detector, especially participating in test beams, but also understanding calibration systems, and the development of robust analysis tools. To be successful, we decided we need the following:

- In the next 6 months: establish a physical place at FNAL in the Hirise with first class computing and video conferencing for a core team of about six researchers working full time on CMS who will collectively develop expertise in all areas of the CMS reconstruction code and prepare to support and help the postdocs who will join them, working part-time on CMS.
- Within the next year: have an additional 10 University postdocs and some number of students working part-time on CMS and part time on a running experiment join the core team. These part-time postdocs and students would need desks in the same physical location as the 6 core researchers.
- In the following years: increase the number of University postdocs shared between CMS and a running experiment to 20 by the end of 2005 and 35 by the end of 2006, and start to have students who will do an LHC thesis working at the center.

- We need to establish milestones to judge our progress, especially over the timescale of the next year, when the success or failure of this project will become clear.
- Over the coming year, meet monthly to make sure we are making the required progress towards our goals that is needed to make the LPC a success.

We unanimously felt we cannot do this alone, and that we would need strong support from FNAL in order to make this a success. We want to take responsibility for the success or failure of this project on the University side. We would like somebody at FNAL to also have the formal responsibility, on the laboratory organization chart, for the success on the lab's behalf. This person would work with us over the next 2 months to establish milestones for the coming year. We would hope, during the first year, when the success or failure of this project will be established, that the lab could match or exceed the Universities in physicist manpower assigned to the project. As the years increase, the fraction of the work force from the Universities would increase. Also, obviously, we need the physical space for desks and desktop computing, a state-of-the art video conferencing system, and the kind of computing infrastructure/data storage system that Lothar is developing. We also need a team of about three scientists in the next six months to help us understand (and improve) the complex low-level code that ensure a physicist's ability to access, calibrate, and analyze the data. By the end of 2006, we would need support commensurate with that being provided to current running experiments. Without support for the LPC, we believe that we will only be able to keep our postdocs/students on CDF/DØ until about 2006. We will be forced to relocate our research groups en mass to LHC causing major disruption and inefficiency at a critical time. This will compromise both the final stages of CDF/D0 analyses and our leadership in extracting physics from early LHC data. We cannot let this happen.

We hope that you would agree that this is an effort that lab should support. We understand that all of the lab personnel who came to our meeting are very enthusiastic about supporting this effort, and are willing to do whatever is in their power to make LPC a success.

Sincerely,

Sarah Eno
Associate Professor of Physics
University of Maryland

For

Darin Acosta, U. Florida
Claudio Campagnari, UCSB
John Conway, Rutgers University
Sridhara Dasu, University of Wisconsin
Regina Demina, University of Rochester
Greg Landsberg, Brown University
Christoph Paus, MIT
Chris Tully, Princeton University