

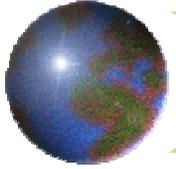
# LHC/Tevatron Tracking Workshop

# Welcome

**Dan Green**

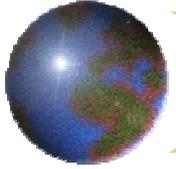
**US CMS Program Manager**

**Fermilab**



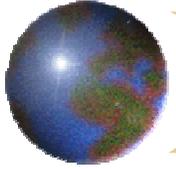
## Workshops – LHC/TEV

- ✚ **We are creating a LHC Physics Center (LPC) at Fermilab.**
- ✚ **Joint workshops, sponsored by the LPC, of CDF, D0, and CMS are held to explore synergy and commonality (lessons learned).**
- ✚ **This is the third – Jet/Met, Muon, Tracking, and then a Theory Workshop – TeV4LHC.**



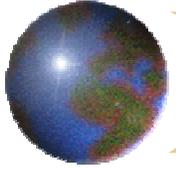
# Tracking is Crucial

- ✚ A raw CMS event has tracks, ECAL and HCAL deposits and muon tracks.
- ✚ The tracks cluster in primary vertices and b tag secondary vertices.
- ✚ The ECAL and HCAL cluster into  $e$ ,  $\gamma$ ,  $\pi^0$  and charged pions. These clusters can then be calibrated correctly –  $e/\pi \sim 1.5$  at low momentum.
- ✚ Swim tracks to calorimetry
- ✚ Match tracks to clusters. Replace matched energies with track momentum



## Tracking - II

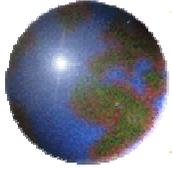
- ✦ Match muon tracks with Si tracker. Global fit to muon? Improved momentum?
- ✦ Find the vertex associated with the trigger.
- ✦ Remove all tracks and associated clusters (charged pion pileup) due to other vertices from the event. Reduce pileup “noise”? Improve  $E_T$  resolution?
- ✦ Start event processing.



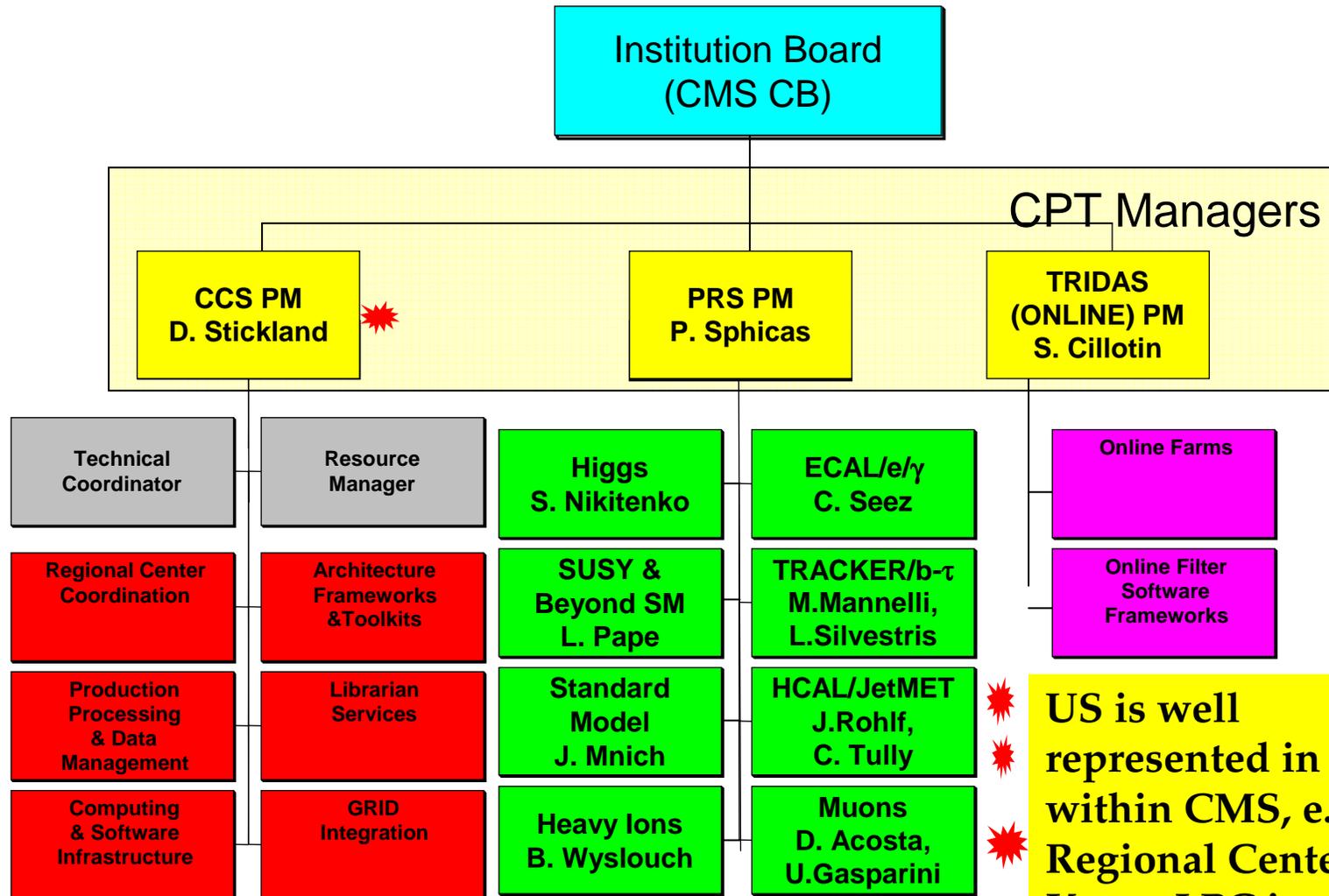
**LPC**

# **The LPC Physics Center**

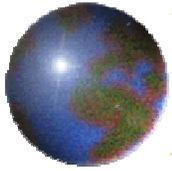
**Not  
Sarah Eno**



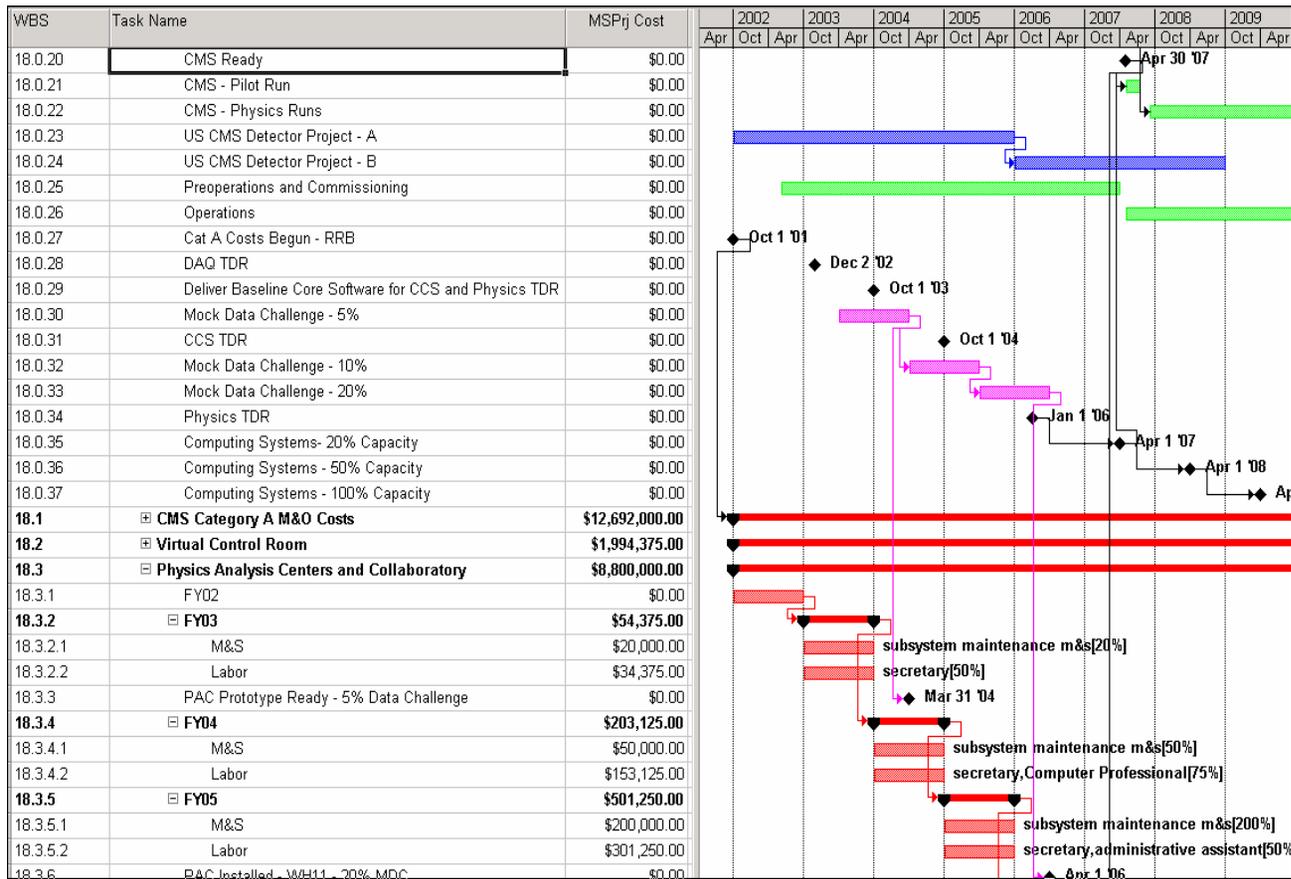
# Software/Computing: CPT



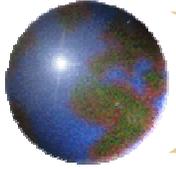
US is well represented in CPT within CMS, e.g. Regional Centers. Keeps LPC in synch with CMS CPT



# LPC – Connection to SWC

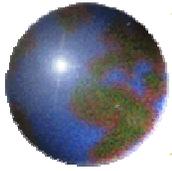


**The LPC is part of the M&O baseline. The LPC schedule is tied to the CMS SWC schedule (V34), e.g. Data Challenges.**



# LPC - Points of Contact

- ✦ **Heidi Schellman - LHC Workshops**
- ✦ **K. Maeshima - WH11 layout and funding. We want a bottoms up User defined layout.**
- ✦ **L. Bauerdick - Tier 1 and SWC interfaces (Ian Fisk – UAF)**
- ✦ **S. Eno + A. Yagil - Think through initial tasks and assemble the core group.**



# LPC Web Page

## LPC



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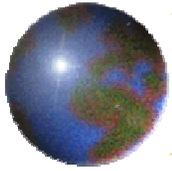
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## The LHC Physics Center at FNAL

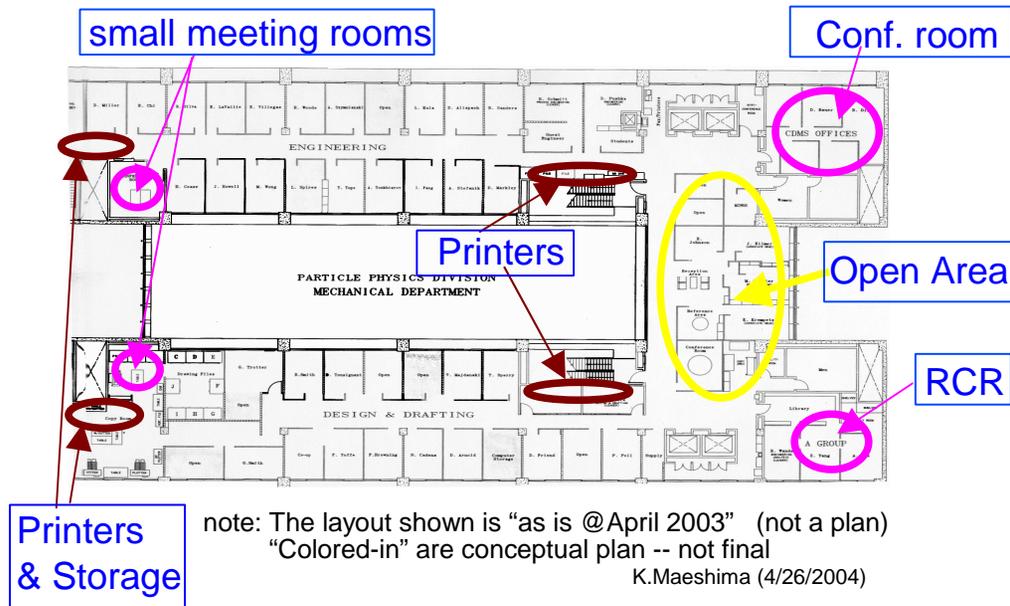
The LHC Physics Center (LPC) at FNAL was established in April 2004 by Mike Witherall and Dan Green for the following purposes:

- a "brick and mortar" location for CMS physicists to find experts on all aspects of data analysis, particle ID, software, and event processing within the US, working during hours convenient for U.S.-based physicists
- a center of physics excellence within the US for LHC physics
- a place for workshops/conferences/gatherings on LHC physics
- a place for the training of graduate and postgraduate scientists from URA Universities.
- a "remote control room" that CMS physicists can use to participate in data taking and quality control for the CMS experiment in the U.S.
- a tool to help provide a graceful transition between the Tevatron and LHC experiments for those physicists participating in both, maximizing the manpower available to each during the transition time.

The center is run by [Avi Yagil](#) (FNAL) and [Sarah Eno](#) (UMD) and is located on the 11th floor of the FNAL hi-rise. The level-2 manager is [Kaori Maeshima](#). The members of our advisory board can be found [at this link](#). Our milestones can be found [at this link](#). The LPC makes use of the proximity of the [FNAL "Tier-1" computing center](#) and the Tevatron experiments. To learn more about our center, choose one of the following options.

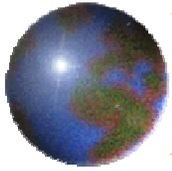


# LPC Physical Location-11<sup>th</sup> floor



(Kaori Maeshima)

- high speed internet access
- transient area on cross over
- lockers for transients
- 1 large and 2 small meeting rooms
- secretary support, printers, etc
- Italian espresso machine
- remote control room
- offices for permanent workers



# Schedule - 11<sup>th</sup> floor

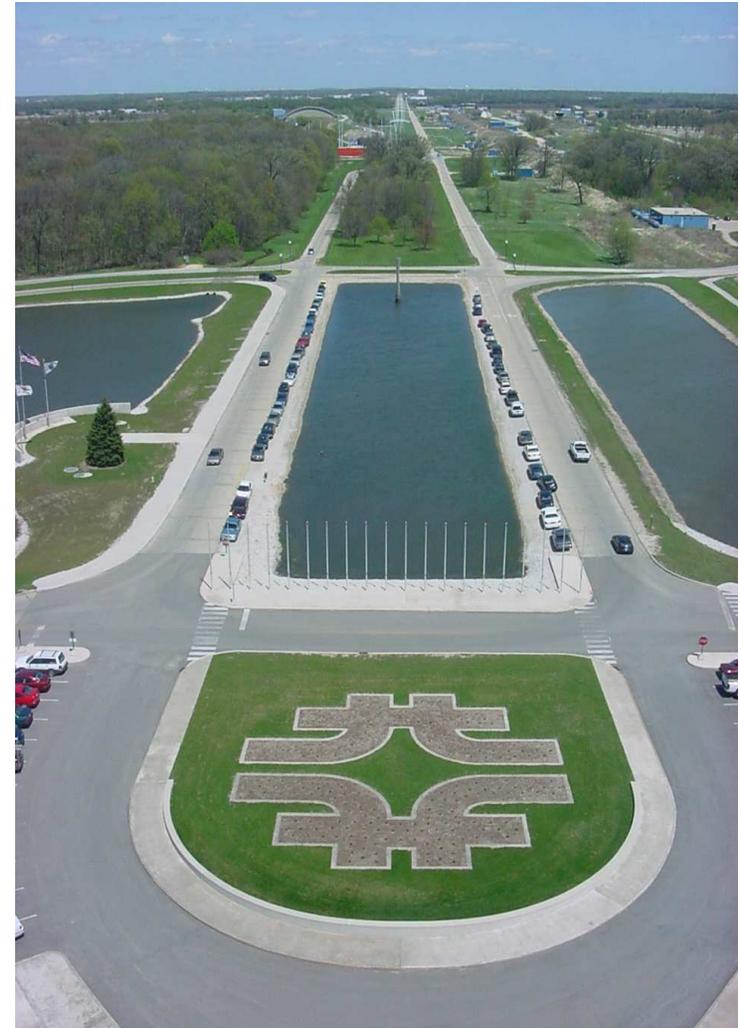
Transients get the best view!!

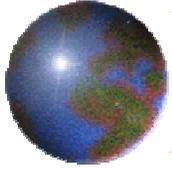
Major infrastructure work will be done this summer. Ready for occupation this fall.

(Kaori Maeshima)



LPC Tracking Workshop, Aug. 3-4, 2004





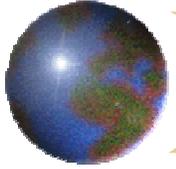
## RCR Prototype – TB2004 , Data Shifts



at 11<sup>th</sup> fl X-over May 26, 2004

- 3 pc's are setup
- cmsrcr01 (window)
  - for communication
  - via video setup via esnet
    - at hcal testbeam (CERN)
    - at emu testbeam (CERN)
    - at 11<sup>th</sup> floor (FNAL)
- cmsrcr02,03 (linux)
  - for analysis

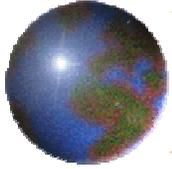
- two web-cams are setup at the hcal (done) and muon (just arrived) test beams
- e-log deployed



# LPC Concept (S. Eno)

An attempt to reproduce the benefits of being at the lab in our time zone, on our side of the Atlantic.

- a **critical mass** (clustering) of young people who are actively working on software (reconstruction, particle identification, physics analysis)
- one stop shopping for your analysis questions
- analysis tools such as large meeting rooms, video conferencing, large scale computing, “water cooler”
- remote control room for active participation in the running and quality control of the experiment



# LPC Status

- ✦ Establish an Advisory Board (the customers)

- ✦ Darin Acosta (Florida)
- ✦ Claudio Campagneri (UCSB)
- ✦ John Conway (Rutgers)
- ✦ Sridhara Dasu (Wisconsin)
- ✦ Regina Demina (Rochester)
- ✦ Greg Landsberg (Brown)
- ✦ Christoph Paus (MIT)
- ✦ Chris Tully (Princeton)
- ✦ Max Chertok (Davis)
- ✦ Cecilia Gerber (UIC)

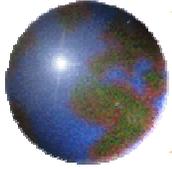
**Also are**

**PRS heads –  
alignment to  
PRS**

- ✦ Starting algorithm study groups.

- ✦ Goal: understand what is available, learn to use it, evaluate performance.

- ✦ Weekly meeting of people looking at code of: tracking, electron, muon. Will be expanded as rapidly as possible.



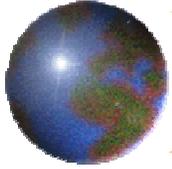
# Local Experts

Want to develop strong **local** expertise in all areas of reconstruction, particle ID

- calorimetry/jets/met
- muon
- e/gamma
- tracking
- framework code/tools

Working within PRS groups, but clustered physically at FNAL, doing coordinated work

**Maintain good communication with the PRS groups and the CPT PM, P. Sphicas**



# Web Page – LPC Working Groups

## LPC Working Groups

One of the main goals of the LPC is to have a place in the U.S. where CMS Physicists can find experts in all areas of CMS software and reconstruction. Our current working groups and their conveners are:

[Agenda Server for LPC Meetings](#)

[LPC Offline Coordinators](#): Liz Sexton-Kennedy and Hans Wenzel

[Tracking](#): Kevin Burkett and Sasha Khanov

[Electron/Photon](#): Yuri Gershtein and Heidi Schellman

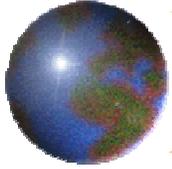
[Muon](#): Eric James and ???

[Jet/Met](#): Rob Harris and Marek Zielinski

[Trigger](#): Sridhara Dasu and Stephan Lammel

[Simulation](#): Daniel Elvira and Boaz Klima

**The goal is to assemble a team of experts available in US time zones to all US CMS physicists, regardless of physical location**



# LPC Workshops

## LPC Workshops

### CMS 101

Are you on the CMS mast head, but have not really been involved up until now? Want to learn some basics to help you get started on moving towards active participation in CMS? Maybe CMS 101 is the course for you! We will present what you need to know. We plan to offer this course approximately every 3 months.

[Sept 13](#)

### Tevatron/LHC

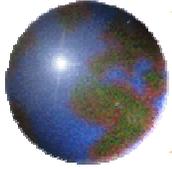
A series of Tevatron/LHC workshops have been organized by Heidi Schellman to increase dialogue between these two groups.

[Aug 3,4 2004 Tracking Workshop](#)

[April 14,15 2004 Muon Workshop](#)

[Jan 28,29 2004 Jet/Met Workshop](#)

**The FNAL theory group is organizing a workshop and then a following extended study of the “TeV4LHC” physics possibilities.**



# LPC Summary

- ✦ **Planning for US CMS Physics Centers has been a long process.**
- ✦ **At all points a dialogue within the Collaboration has been maintained.**
- ✦ **The RCR and LPC are part of the baseline planning.**
- ✦ **One size does not fit all. US CMS physicists will do analysis at CERN, FNAL, selected T2, and at their home institutions.**
- ✦ **The possible physics analysis supported by the RP at selected T2 has been delayed pending a proof of principle at the T1 located prototype LPC.**
- ✦ **Clearly, physics research in US CMS has the SWC supported Tier 1 and Tier 2 as possible points of nucleation.**
- ✦ **The aim is to have a “critical mass” of US physicists doing LHC physics at each viable location.**
- ✦ **The next step is to establish the LPC local experts and make a success of the prototype LPC at Fermilab.**