



Update on USCMS Education and Outreach

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E&O Coordinators

- Dan Karmgard (Notre Dame)
 - USCMS Outreach Coordinator
- Don Lincoln (Fermilab) & Randy Ruchti (Notre Dame)
 - LPC Outreach
- Dave Barney (CERN)
 - CMS Outreach Coordinator





Program Elements

- Education (formal and informal)

- QuarkNet
 - 26 Centers
 - Research Experiences for High School Teachers and Students
 - CMS Trigger stream
- USCMS Fellows
- I2U2
 - eLabs
 - iLabs
- Masterclasses
- Books

- Outreach

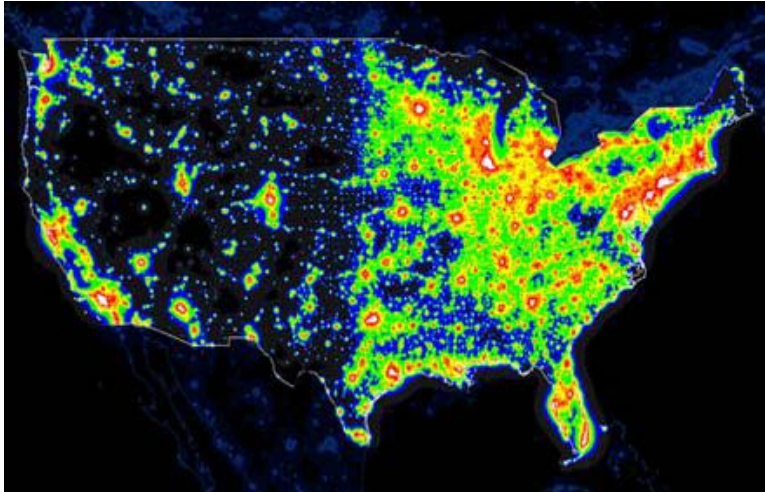
- CMS Outreach (including CMS Centre)
- LPC Outreach (including important events)
- LHC Awareness (including LHC Video Animation)

- Support





QuarkNet Centers and CMS



BU/Northeastern
SUNY Buffalo
UC Riverside
Fermilab/Chicago
Florida
Florida Inst of Tech
Florida International
Florida State
Illinois at Chicago
Iowa
Johns Hopkins
Kansas
Kansas State

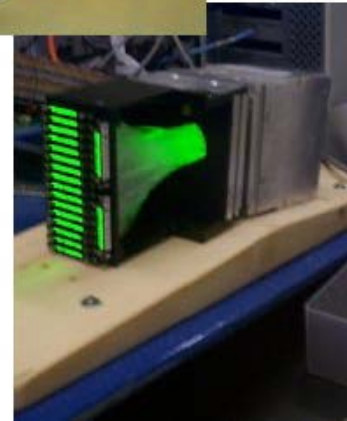
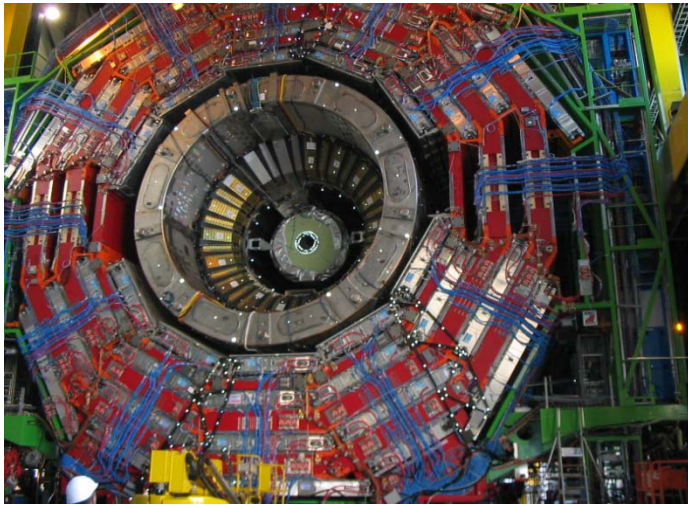
Maryland
Minnesota
Mississippi
Notre Dame
Puerto Rico
Purdue
Rice
Rochester
Rutgers
Texas Tech
Vanderbilt
Wayne State
Wisconsin





Student Research

- Optical decoding for the HCAL Barrel, Outer Barrel and Endcap
- 550 Fiberoptic decoder units.





USCMS Fellows

- A follow-on to QuarkNet
- Research with an USCMS Group
 - For QuarkNet teachers
 - Up to 8 weeks
 - Location can be at CERN or elsewhere
- Examples
 - Florida State, Iowa, Mississippi, Notre Dame, Texas Tech, Wayne State...

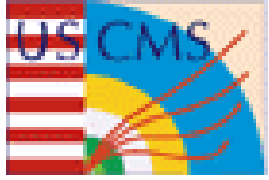




QuarkNet Trigger Stream

- A very small fraction of the CMS Trigger Bandwidth will be reserved for QuarkNet
 - Teachers and students can select the processes
 - Starting is likely dilepton events
- Data will be processed into an acceptable form for student use
 - Four vectors for a start
 - Ancillary information available based upon interest
 - Preliminary analyses using OGRE





Interactions in Understanding the Universe (I2U2)

- A program combining domain science, computing including grid, and education: <http://www.i2u2.org>
- Current effort includes (e-labs)
 - QuarkNet/Cosmic
 - LIGO
 - CMS
- Data in the hands of students in the classroom
- Data analysis in informal situations (i-labs)





CMS e-lab

- Online Graphical Root Environment (OGRE)
 - Developed by Dan Karmgard with collaboration from QuarkNet Teachers and Students
 - Students can carry out analyses using the web interface.
 - Data from Test Beams, Monte Carlo Simulation and (ultimately) Collision Data will be available for student study
 - This effort is intended (ultimately) to be compatible with QuarkNet e-Lab structure
 - <http://leptoquark.hep.nd.edu/~ogre/>





CMS electronic Laboratory

Logged in as group: cmsguest [Logout](#) [My Logbook](#)

CMS
Test Beam Collaboration
Investigation

Home Library Data Posters Site Index Assessment

Join a national collaboration of high school students to study CMS test beam data.

How small is small? [Logout](#)
If you are not cmsguest, [Logout](#)

How small is so small that we can get no smaller?
Why do objects have mass?

cmsguest [Logout](#) [My Logbook](#)

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Show Depth Lateral Size Beam Purity Resolution View Data View Plots

OGRE is an Online Graphical ROOT Environment

Visit the [ROOT](#) Homepage. (Creates a new window.)

CMS HCal Testbeam '04 Data

Variable	Selection	Color
<input type="checkbox"/> Total Energy (1x1)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Ecal Energy (1x1)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Hcal Energy (1x1)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Total Energy (3x3)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Ecal Energy (3x3)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Hcal Energy (3x3)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Total Energy (5x5)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Ecal Energy (5x5)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> Hcal Energy (5x5)	<input type="checkbox"/> None <input type="checkbox"/> > <input type="checkbox"/> <	None
<input type="checkbox"/> E vs H (1x1)	c1x1.ee:c1x1.eh	None
<input type="checkbox"/> E vs H (3x3)	c3x3.ee:c3x3.eh	None

Logg

CMS
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Show Depth Lateral Size Beam Purity Resolution View Data View Plots

What can you learn? Choose a study.

Analysis

- [Shower Depth](#) - Determine shower length in the detector.
- [Lateral Shower Size](#) - Determine shower width in the detector.
- [Beam Purity](#) - Determine beam composition.
- [Detector Resolution](#) - Determine the precision of the energy measurements.
- [ROOT Tutorial](#) - Learn how to use ROOT (the underpinnings of OGRE) to analyze any aspect of the data directly

Management

- VIEW**
- [Data Files](#) - Done using OGRE.
- [Plots](#) - Look at what you and other groups have found!
- [Posters](#) - View and create posters of your plots.
- DELETE**
- [Plots](#) - Delete plots your group owns.
- [Posters](#) - Delete posters your group has made.

Grids - These Investigations are brought to you by grid computing

Grab File Edit Capture Window Help

Cosmics Resources

http://www12.i2u2.org/8080/lab/cms/library.jsp

Global Warming Inter... Online Christian Rad... Login Change email address of account Unable to handle request

Cosmics Resources [Logout](#) [My Logbook](#)

Logged in as group: cmsguest

CMS
Test Beam Collaboration
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The Basics Study Guide Resources Big Picture FAQ Site Help

Use the library as you work.

Library

[The Basics](#) - Review research skills you need for this project.

[Study Guide: \(graphical version\) \(text version\)](#) - Measure your progress as you work using milestones.

[Resources](#) - Explore Tutorials, Online Resources, Animations and Contacts. The tutorials should help you use this website. The contacts will allow you to contact other student research groups. The animations demonstrate your hardware and what happens when you are uploading data and using grid techniques. The Online Resources will broaden your understanding of cosmic rays and research.

[Big Picture](#) - Read an overview of this project and view a sample poster.

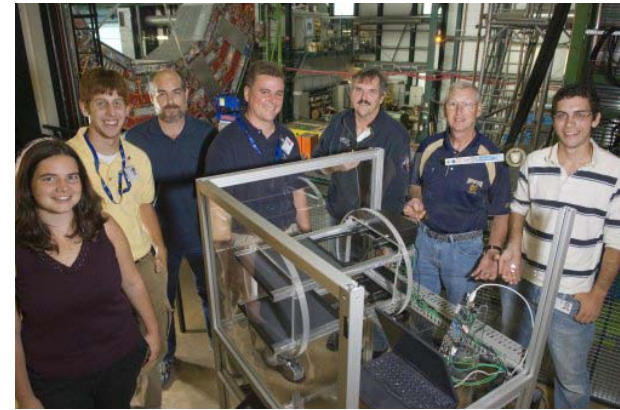
[CMS Overview](#) - Educational Outreach of the Compact Muon Solenoid Collaboration.

[CMS Test Beam Overview](#) - Explanation and description of Compact Muon Solenoid Collaboration's Test Beam.





Cosmic Ray i-Lab (CRiL)



1. Located at CERN SX5
2. Adler Planetarium
3. On Web – remotely controllable

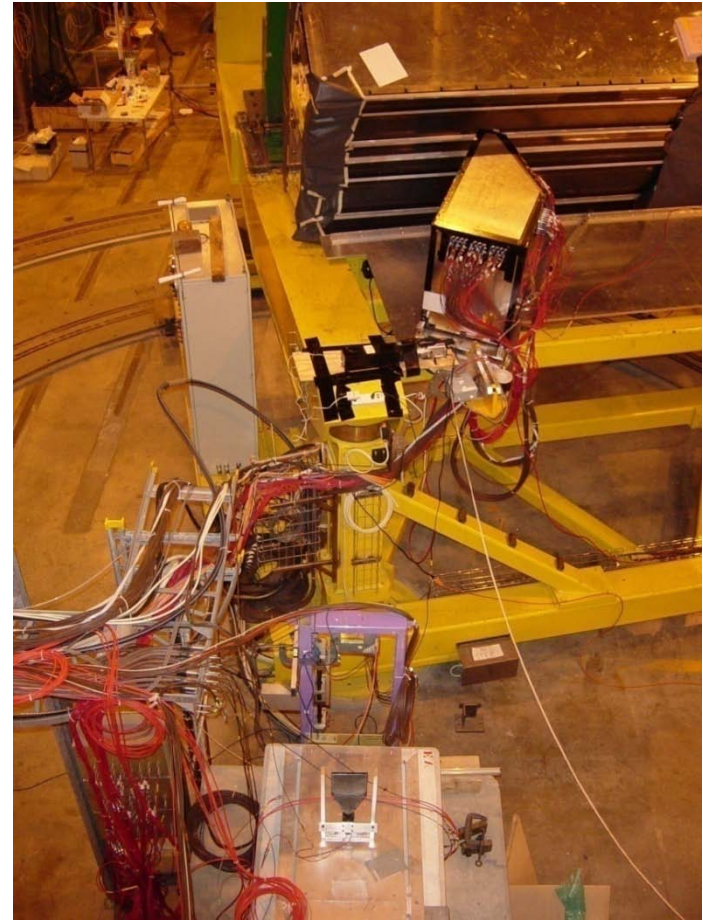




Compact Particle Detectors

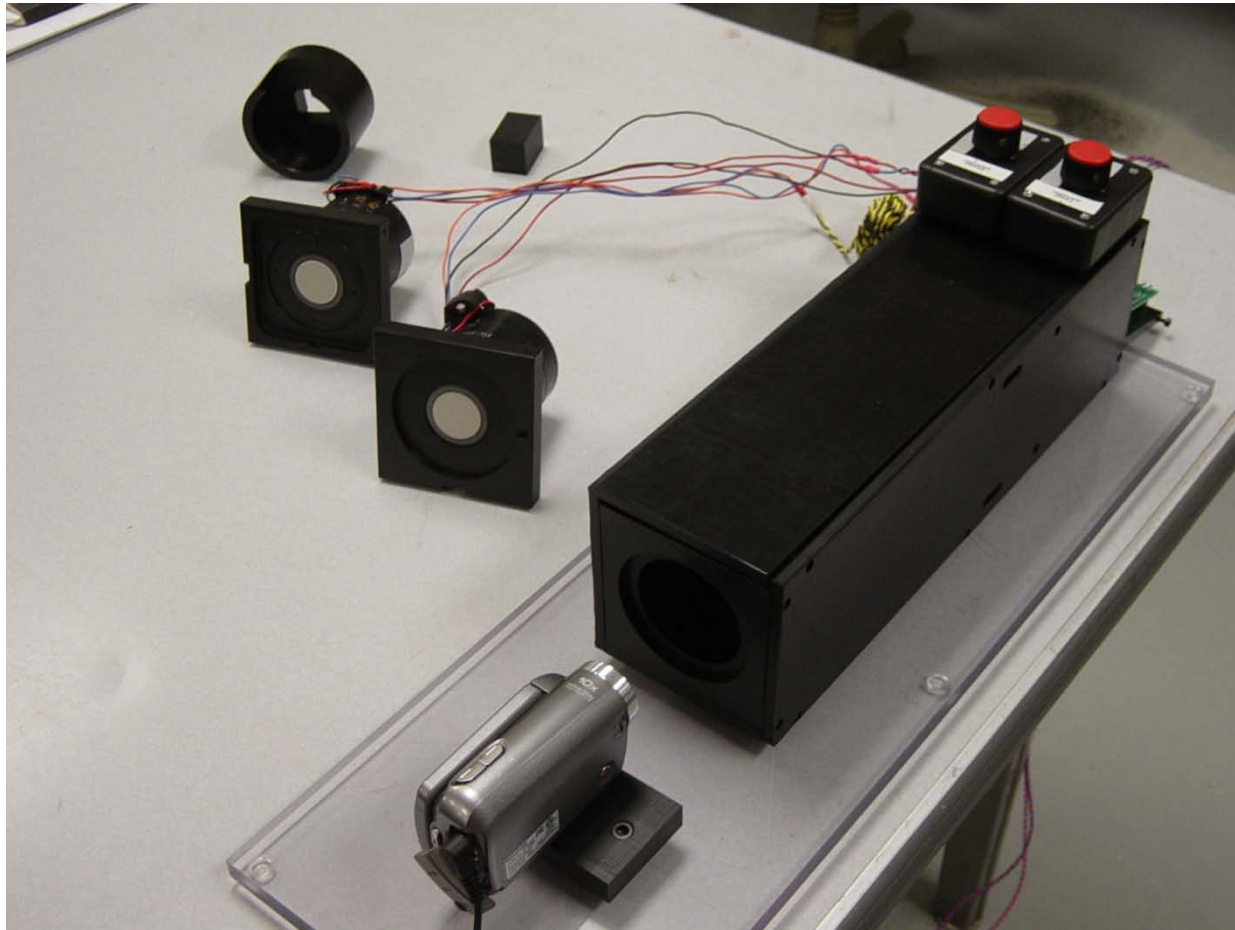


Assembly ↑ CERN Beam →



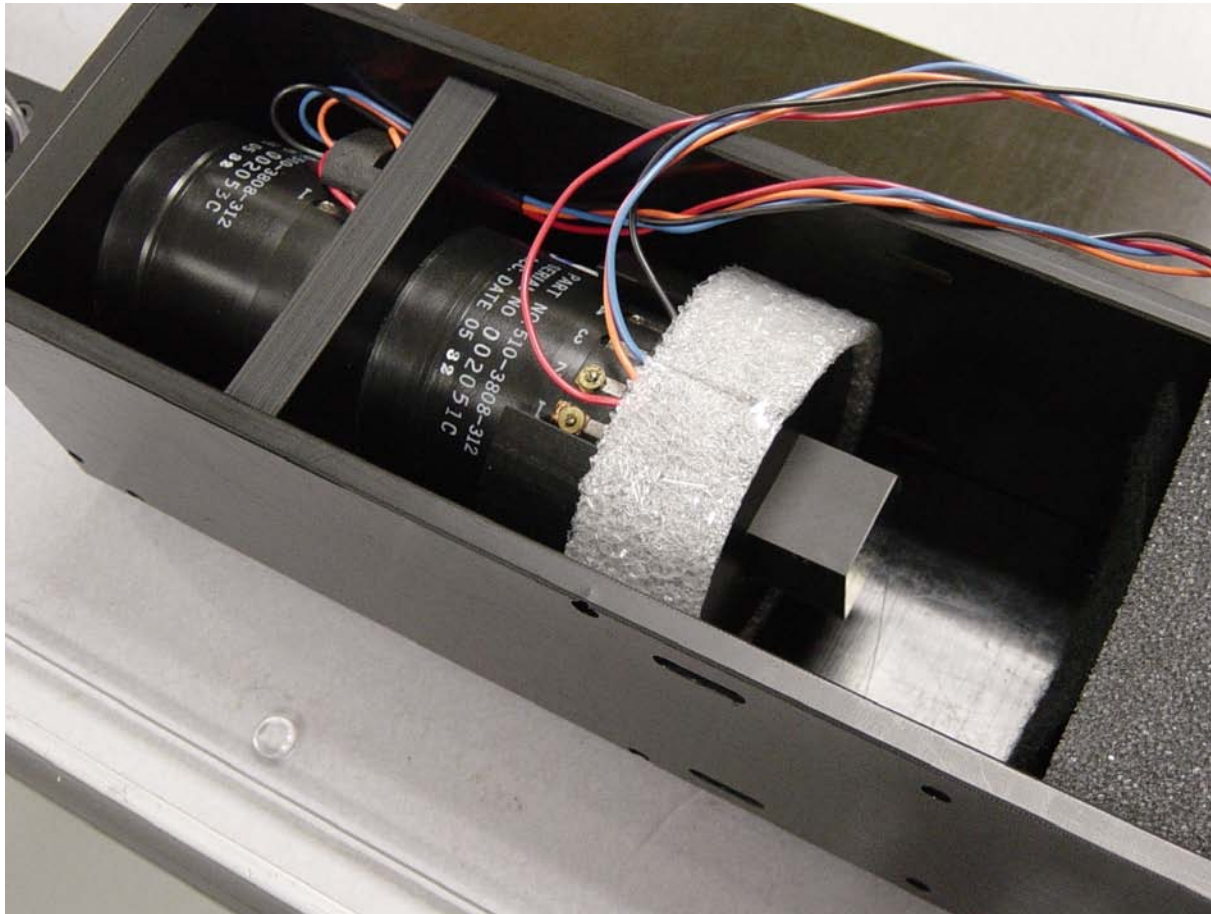


Compact tracking detector



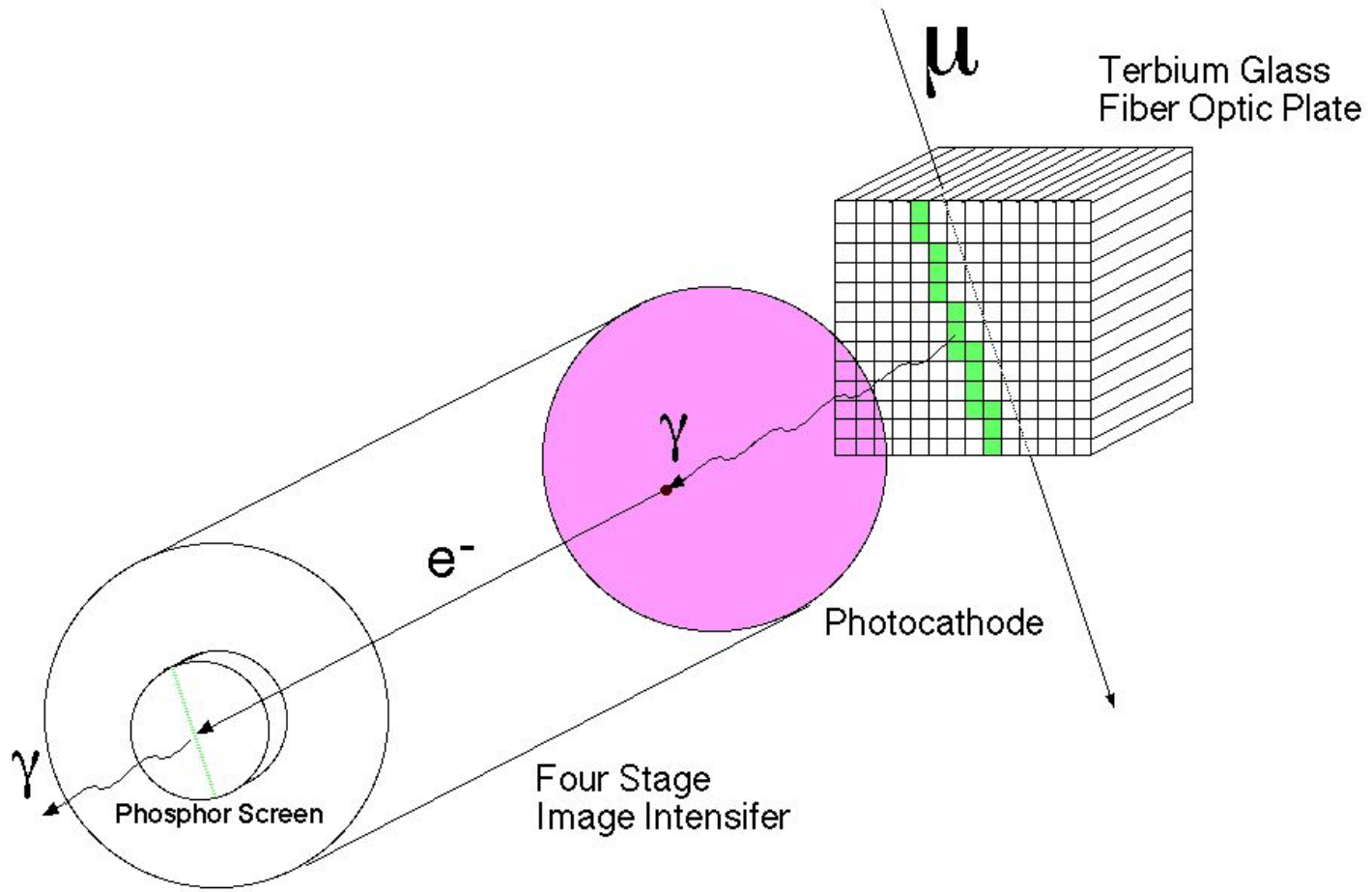


Assembled Structure



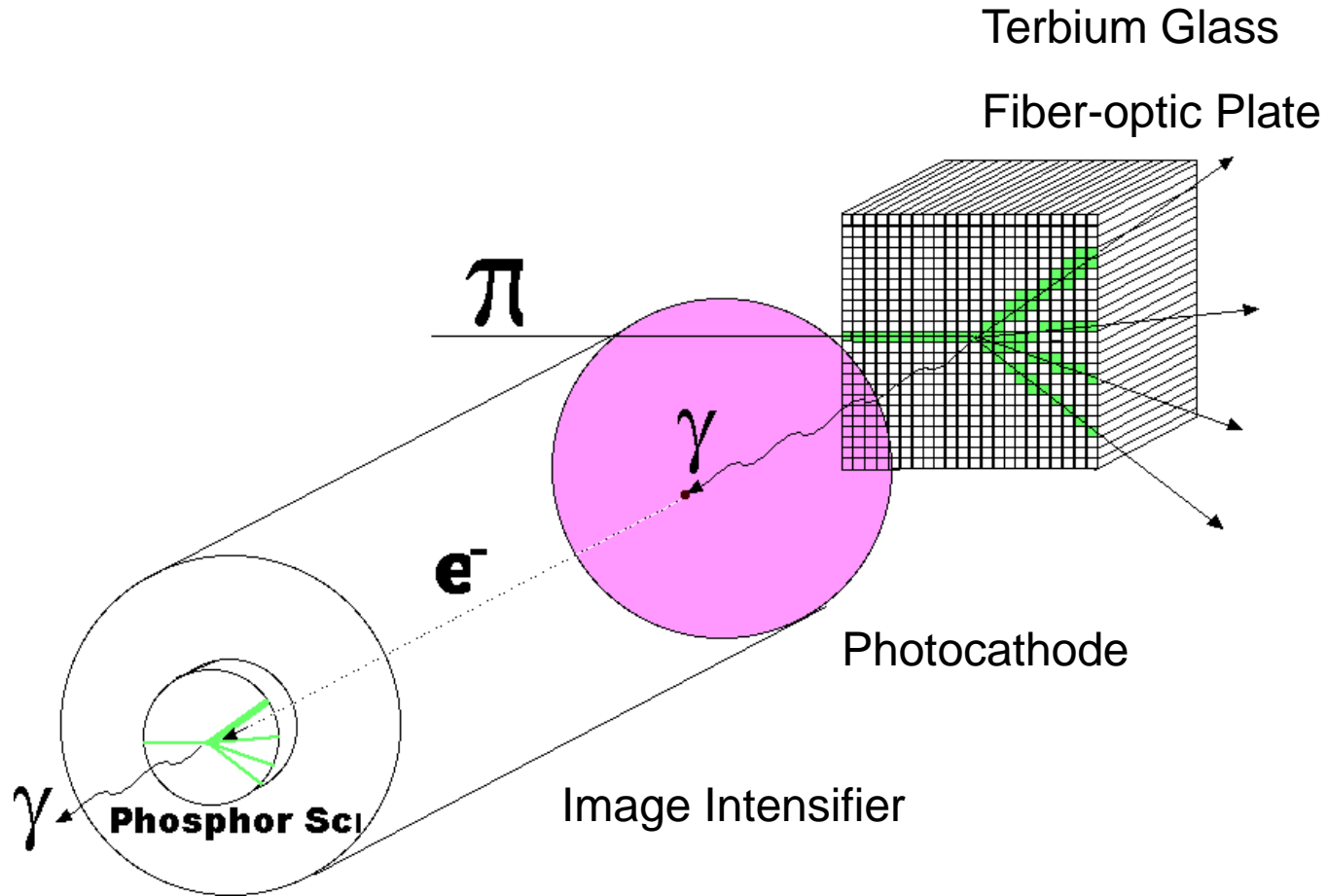


Schematic of the Apparatus





Schematic of use in a particle beam





LPC Outreach

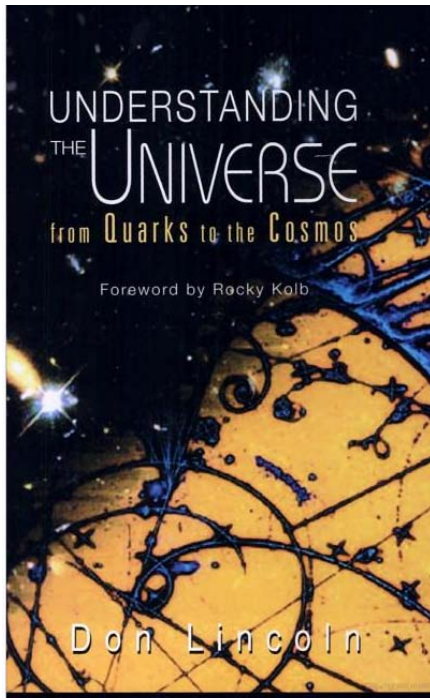
- LHC Awareness
 - CERN Open Days
 - 9000 waveshifter fibers prepared for distribution to CMS visitors at SX5
- LHC Startup
 - Pajama Party
- Angels and Demons
 - In collaboration with CERN and ATLAS, encouraged public lecture and Café Scientifique
- Informal Education Displays
 - USLUO Meeting
 - Annual Users Meeting
- Book authorship





Books

- Don Lincoln



The LHC Revealed **Unlocking the Mysteries of the Universe**
Stand back. I'm about to do *SCIENCE*.

**THE QUANTUM FRONTIER:
THE LARGE HADRON COLLIDER**

The Large Hadron Collider is a new "atom smasher" designed to recreate the conditions of the universe just scant fractions of a second after the Big Bang.


In his new book, *The Quantum Frontier*, author Don Lincoln explains the Large Hadron Collider (LHC) and the physics it is intended to explore. The book is broken into five chapters:

1. The Standard Model of particle physics, which details our current understanding of the universe
2. Some of the mysteries the LHC was built to study
3. How accelerators work and some of the trivia of the LHC (how big, how fast, how many, etc.)
4. How particle detectors work and some of the details of the many detectors at the LHC (CMS, ATLAS, Alice, LHCb, to name a few.)
5. The future of particle physics, LHC upgrades, follow-on accelerators and how the LHC links with cosmology mysteries.

When you've read this book, you'll understand the excitement engendered by the turn-on of this fascinating scientific marvel.

[Contact the publisher](#)

[Home](#) | [About the Author](#) | [Other Books](#) | [Related Links](#) | [Ways to Buy](#) | [Reviews](#) | [Ask a Question](#)



The Quantum Frontier: The Large Hadron Collider is a new book that explains what the LHC is and why it's interesting.





CMS Outreach

- US CMS had a significant presence at open days



Estimates from CERN are that 70,000 people attended the open days.



USCMS Collaborators demonstrate CMS technology with the CRiL detector in SX5





Open Days

- We continued our collaboration with the LHC Awareness project and the student journalist project during open days



Student & teachers attended open days and reported on what they found with film, interviews with scientists and blogs





In the works...

- Continuing engagement with teachers and students
- In collaboration with USATLAS, an animated video on LHC Discovery Physics
- CMS Data Stream for QuarkNet and analysis tools (e-Lab)
- Fabrication of additional interactive displays
- Development of lecture materials
- CMS Discovery Centre adjacent to the CMS Control Room at CERN/Meyrin

