Various Efforts

• Education
  – Formal (classroom)
    • Curriculum development
    • Lesson plans using particle physics as examples
  – Informal
    • Museum displays, Web sites, etc.

• Outreach
  – Public awareness
  – Lot of overlap with informal education
CMS E & O

• CMS has a general E & O effort
  – Led by Dave Barney
  – Works closely with CERN PA office

• The US collaboration has it's own E&O effort
  – Integrated into the larger effort concentrates on the US

• CMS has made a significant commitment to E&O
  – Overall collaboration & US collaboration
  – The experiment as a whole is committed to E&O
Ongoing Efforts

• US CMS Fellowships
  - Provide stipends for 6 teachers
    • Work on CMS projects
    • At CERN or at a local university
  - Last summer
    • 2 fellows went to CERN to work
      - Integration & assembly
      - Test beams
    • 2 fellows working on R&D
    • 2 did other CMS related work
Ongoing Efforts

- Publications
  - CMS Brochure
    - Worked with CERN PA
    - New brochure is done & published.
  - CERN Playing cards
    - Designed by CMS E&O office
    - for CERN 50th anniversary
    - Incredibly popular
    - All distributed
    - Another production run necessary
Ongoing Efforts

- Pamphlets & Articles
  - Produced several small pamphlets
    - Popular handouts for tour groups
  - CMS Times
    - On line magazine for the collaboration
    - Articles on construction of CMS components
      - Highlighting student involvement
        - new article featuring interviews with students
        - Especially high school students who've now gone on to study physics at university
    - Combine these into an article for the CERN Courier
  - Good base for articles in local papers
    - Develop this for an article in a national science magazine?
In Progress

• Master Classes
  - CERN initiative -- CMS & ATLAS E&O
  - Use LEP data & MC to develop a one day lesson plan schools all over Europe to analyze data.
    • Students join a video conference with CERN to discuss their results with scientists & other students.
      - Get the flavor of what a working scientists life is like
  - One US school joined last spring
    • Time difference makes this difficult
    • Working on expanding the idea in the US
CMS Photo Album

- On line collection of photographs
  - CMS construction
  - Test stands
  - Components
  - People

- Simple idea that can yield big results
  - We stole it fair & square from ATLAS
  - Some of the photos are very impressive
    - Very useful resource for talks, lectures, etc.
CMS Detector

- Photo of CMS
  - From CMS web cam
  - Assembled detector
  - Endcap moving into the central barrel

Contrast with CMS '01
Upcoming

• Multimedia Blitz
  – LHC turn on is a major scientific event
    • Trying to answer deep questions about the universe
    • A lot of people are fascinated by the topics we address
      – Gives us a singular opportunity to publicize our field
      – In the popular press (magazines, newspapers, TV, web casts)
      – Among people who wouldn't otherwise know what we do
  – CMS & ATLAS are impressive detectors
    • They look imposing
      – The scale and design catch peoples attention
      – Perfect opportunity to talk about what drove the design
Partnerships

- CMS is only one part of CERN & the LHC
  - We have to be part of the larger effort at the lab
  - Work closely with ATLAS & CERN PA office
  - We're all in this together
  - Together we can do a better job
    - Catching peoples interest & attention
    - Showing the richness of particle physics
    - Demonstrating the immense effort required to get one of these large experiments up & running
  - Ultimately outreach is our common responsibility
Partnerships

• CMS is an integral part of QuarkNet
  – Involvement is natural and ongoing
• QuarkNet is devoted (mostly) to formal Ed.
  – Target audience is high school science teachers
    • Reach students well before they pick a major in college.
  – Curricular development
    • How do we get HEP into the classroom?
    • Little room in the curriculum for new subjects
    • Integrate HEP into the existing lessons
Partnerships

- Focused on LHC startup
  - Much of the informal education effort of QuarkNet over the years has been R&D for ATLAS and CMS
  - Numerous detector components have been constructed by QuarkNet teachers
  - Can't overstate the impact
    - involving teachers in current research
      - Anecdotal evidence
      - Learning communities of teachers for mutual support
      - Increased viability of teachers in their schools
      - Attention grabber for students in the classrooms
eLabs

• QuarkNet initiative
  – One of the few active GRID applications
  – CMS eLab aims to allow students to analyze data
  – CMS is committed to provide a “trigger stream”
    • Low bandwidth data filter
    • Students will define data selection
      – Can argue for & against and get the real scientific experience
  – How we manage this is still a work in progress
  – Not a trivial exercise
Lot of work has been done on the back end
- Data interface & analysis tools are well developed
  - Web front end & a ROOT back end
  - XML data description
    - Aim is to make it easy for us to make data available
  - Project is reasonably stable
    - Though we have to make it GRID aware
- eLab wraps the back end to lead students through an analysis project
  - Makes previous analyses available as well
OGRE is an Online Graphical ROOT Environment

Visit the Root Homepage. (Creates a new window.)

CMS HCal Testbeam '04 Data

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Clusterings

Save Raw Data

Graphics Options

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Total Energy

Number of Events

htemp

Entries 111114
Mean 84.2
RMS 75.32

0 100 200 300 400 500 600
E (GeV)
CMS eLab Front end
I2U2

• Offshoot of QuarkNet
  - Mostly informal/semi-formal education
    • Lot of work on the CMS eLab though
  - Especially cosmic ray detectors
    • Demonstrations of detector technology
  - Several detectors in museums
    • Most recent in the Adler Planetarium
  - Several more small demonstration detectors
    • Visitors gallery at SX5 & FermiLab
CRIL@Adler
Further Afield

- **CosmiCam**
  - On-line streaming video of a cosmic ray detector
  - Anyone can see muon detection using scintillator
  - Would like to see a network of these on-line
    - All the video streams as thumbnails
    - Anyone can see what's happening in real time worldwide

- **Virtual Seminar Webcast**
  - Public lectures from scientists on LHC/ATLAS/CMS
  - Simple video stream & chat for questions
CosmiCam Website

Cosmic ray detector on-line. Simple streaming video of a visible cosmic ray detector (from R. Ruchti) with an explanation of what they viewer is looking at.
Further Afield

- Any interested person could join in
- Streaming video opens up a world of possibilities
  - Magazine & newspaper articles
    - We have a lot of talented authors
    - We should use their talents
    - People are interested in what we're doing
      - We just have to present it in a way they can connect to
- LHC in Discover Magazine?
  - LHC, ATLAS, & CMS sections.
Further Afield

- Untapped Market
  - Outreach to seniors
  - Lots of senior citizens around
  - Interested in science & technology
  - Can we develop something for them?
    - A set of public lectures we can use in our local areas
    - Articles in AARP
  - Engaging seniors in our work is a win-win for both
    - Seniors vote. A lot.
    - Getting them engaged & interested is also good for them
Conclusions

- First collisions are coming soon
  - We have to be ready to capitalize on this unique opportunity
  - People are interested but we have to engage them
  - It's our responsibility to get the word out

- CMS is committed to E&O
  - There's a lot of effort going into this
  - We can make a greater impact if we each do a little bit in our own local area