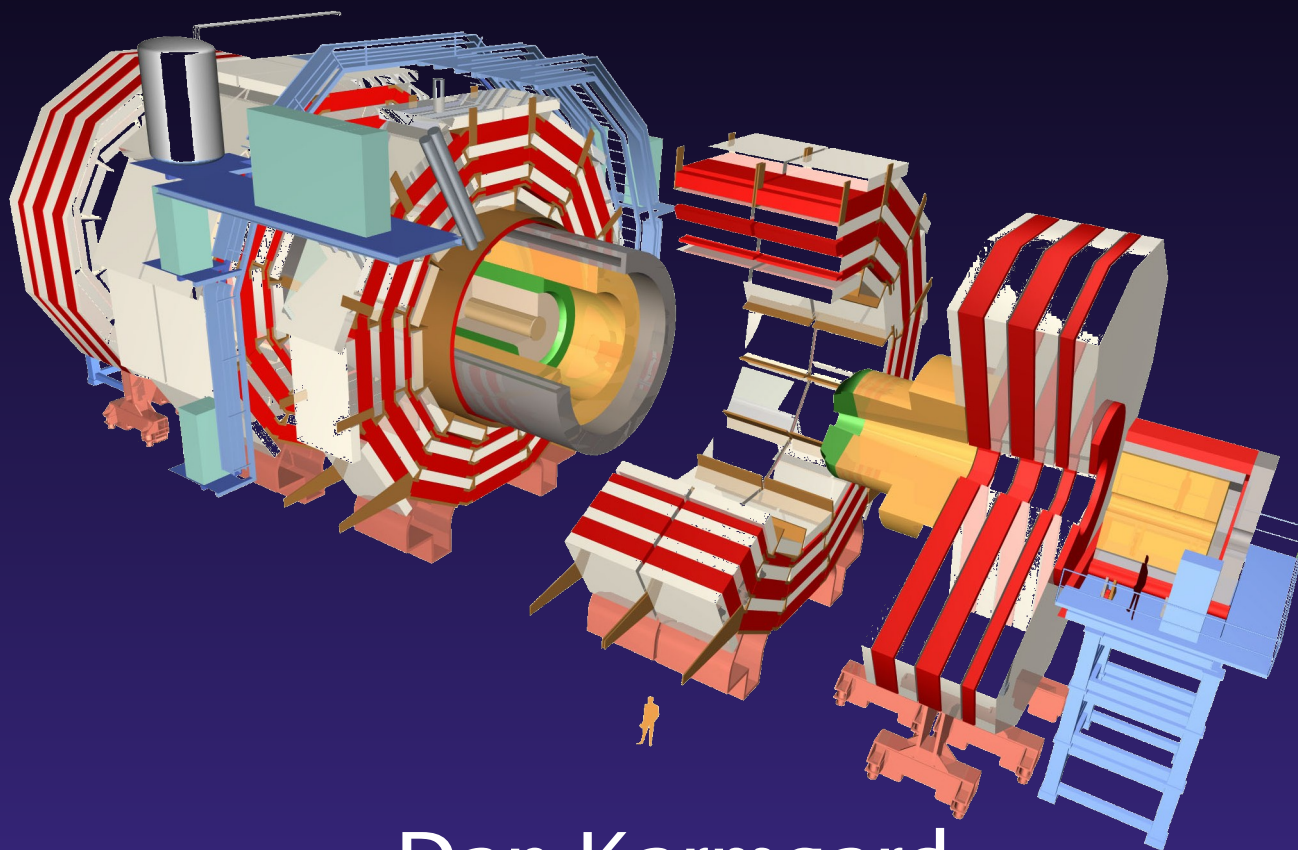




# CMS Education & Outreach



Dan Karmgard  
University of Notre Dame



# 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



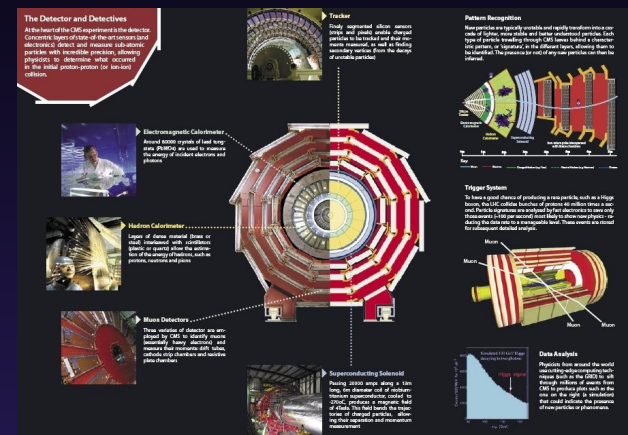




# Ongoing Efforts



- Publications
  - CMS Brochure
    - Worked with CERN PA
    - New brochure is done & published.
  - CERN Playing cards
    - Designed by CMS E&O office
    - for CERN 50<sup>th</sup> 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



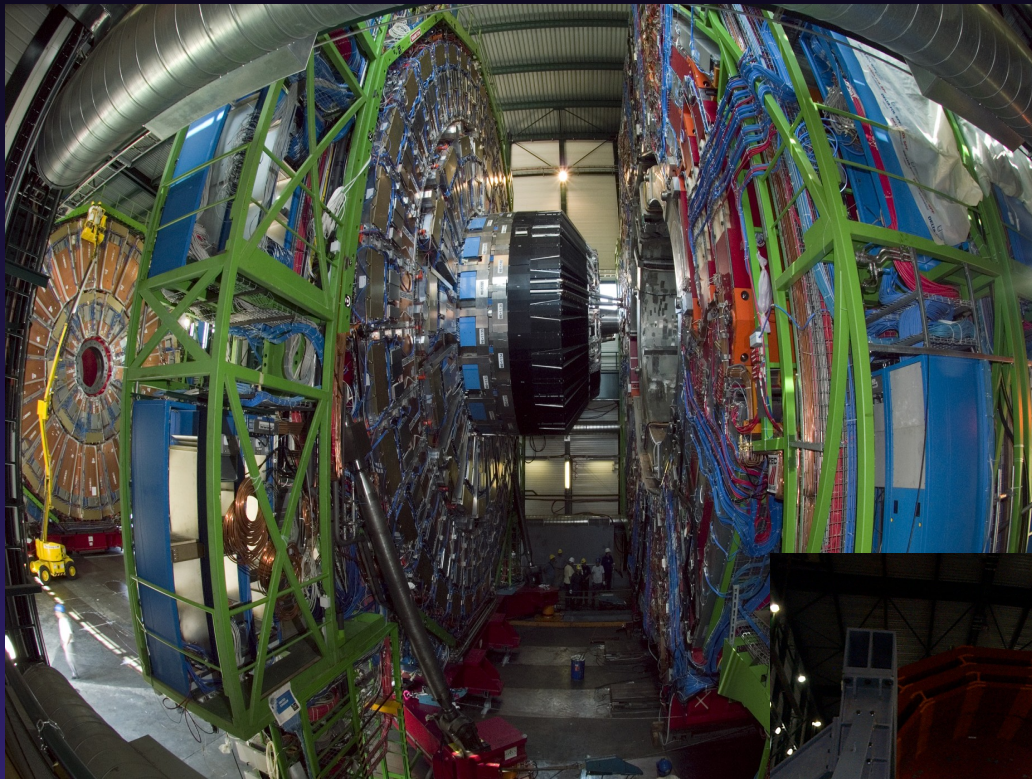
- On line collection of photographs
  - CMS construction
  - Test stands
  - Components
  - People
- Simple idea that can yield big results
  - We stole it fair & square from ATLAS
  - Some of the photos are very impressive
    - Very useful resource for talks, lectures, etc.







# 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



- 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





# eLab



- 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




# CMS eLab Back end



OGRE CMS HCal TB04 Page - Mozilla Firefox

File Edit View Go Bookmarks Tools Help



**OGRE is an Online Graphical ROOT Environment**

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

**CMS HCal Testbeam '04 Data**

Variable	Selection	Color
<input checked="" type="checkbox"/> Total Energy	<input type="radio"/> None <input type="radio"/> > <input type="radio"/> <	Purple
<input type="checkbox"/> Ecal Energy	<input type="radio"/> None <input type="radio"/> > <input type="radio"/> <	None
<input type="checkbox"/> Hcal Energy	<input type="radio"/> None <input type="radio"/> > <input type="radio"/> <	None
<input type="checkbox"/> E vs. H		None
Clustering <input type="text" value="3x3"/>	<input type="checkbox"/> Save Raw Data	<input type="checkbox"/> logx <input checked="" type="checkbox"/> logy

**Graphics Options**

Graphics Size	Output Graphics Type	All Plots on One Histogram
Width <input type="text" value="800"/> Height <input type="text" value="600"/>	<input checked="" type="radio"/> PNG <input type="radio"/> JPG <input type="radio"/> EPS	<input type="checkbox"/> Yes

Data Selection Plot Previous Results Reset Values Close Popups

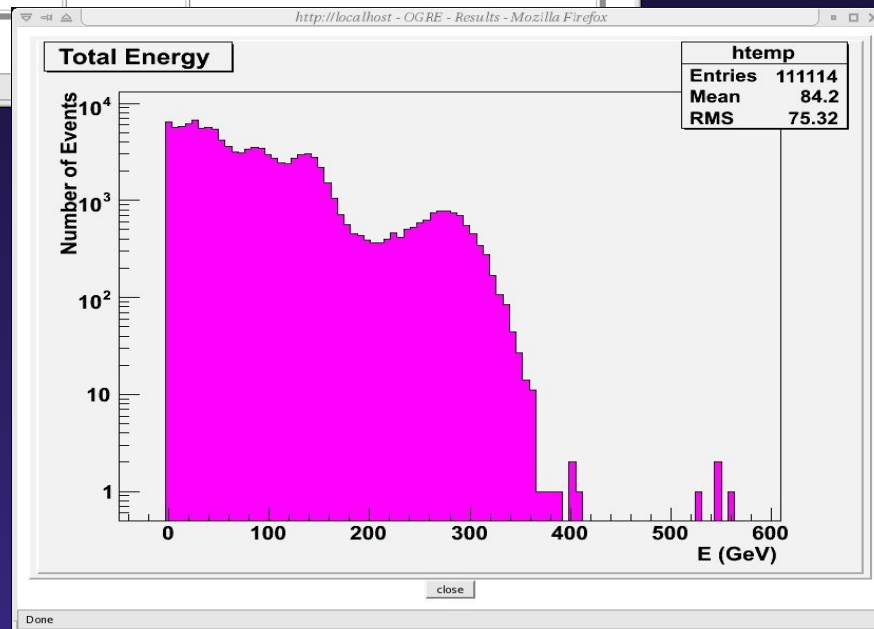
[Bug the OGRE](#)

Done

http://localhost - OGRE Data Selection - Mozilla Firefox

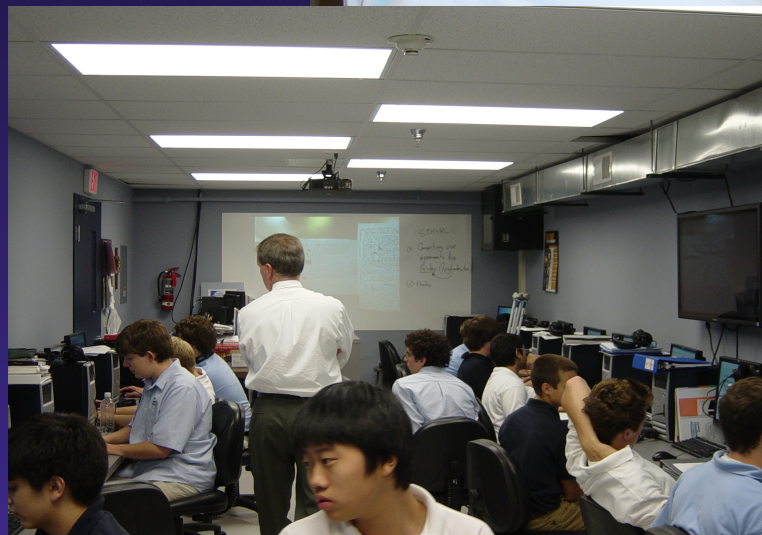
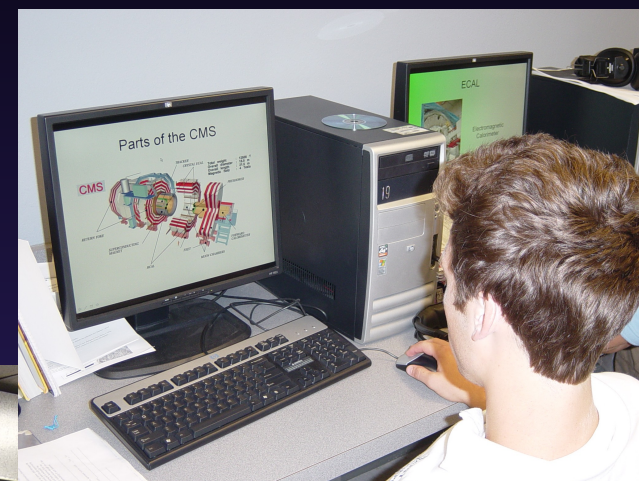
Select all runs of type	Data to Plot	Run Info
<input type="checkbox"/> muons <input checked="" type="checkbox"/> pions <input type="checkbox"/> electron <input type="checkbox"/> Calibration <input type="checkbox"/> All	Run 11525 Run 11526 Run 11527 Run 11528 Run 11529	Run 11505 10000 events of 150 GeV Pi- Run 11506 10000 events of 150 GeV Pi- Run 11507 10000 events of 150 GeV Pi- Run 11508 10000 events of 150 GeV Pi- Run 11509 10000 events of 150 GeV Pi- Run 11510 4391 events of 150 GeV Pi-

Done





# CMS eLab Front end





# I2U2

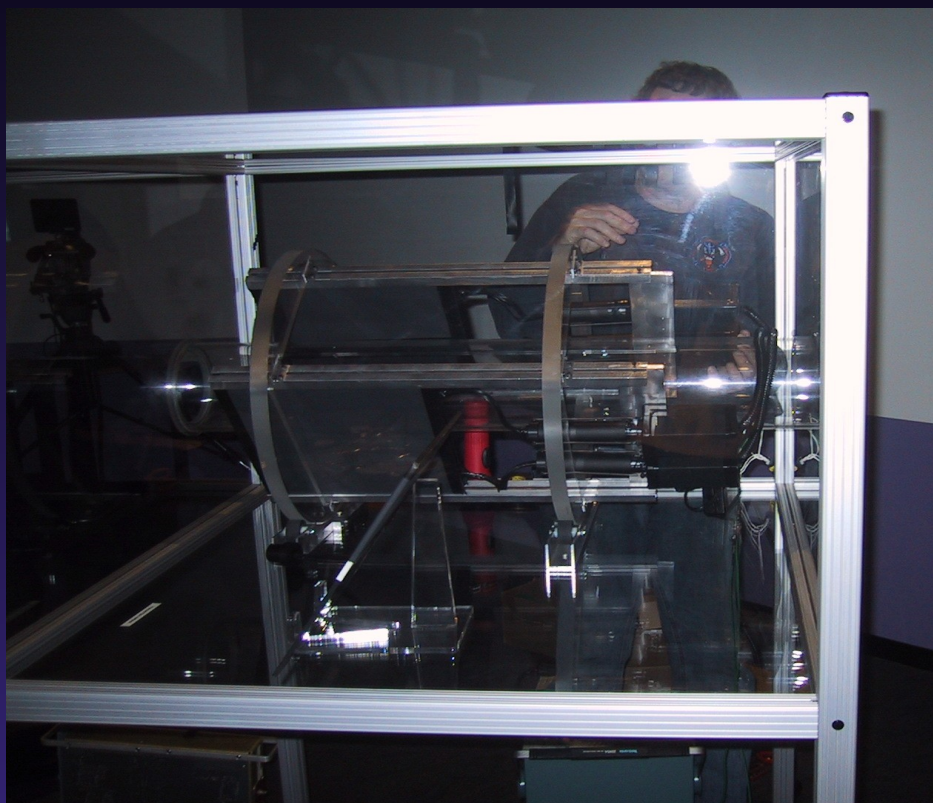


- Offshoot of QuarkNet
  - Mostly informal/semi-formal education
    - Lot of work on the CMS eLab though
  - Especially cosmic ray detectors
    - Demonstrations of detector technology
  - Several detectors in museums
    - Most recent in the Adler Planetarium
  - Several more small demonstration detectors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





# CRIL@Adler







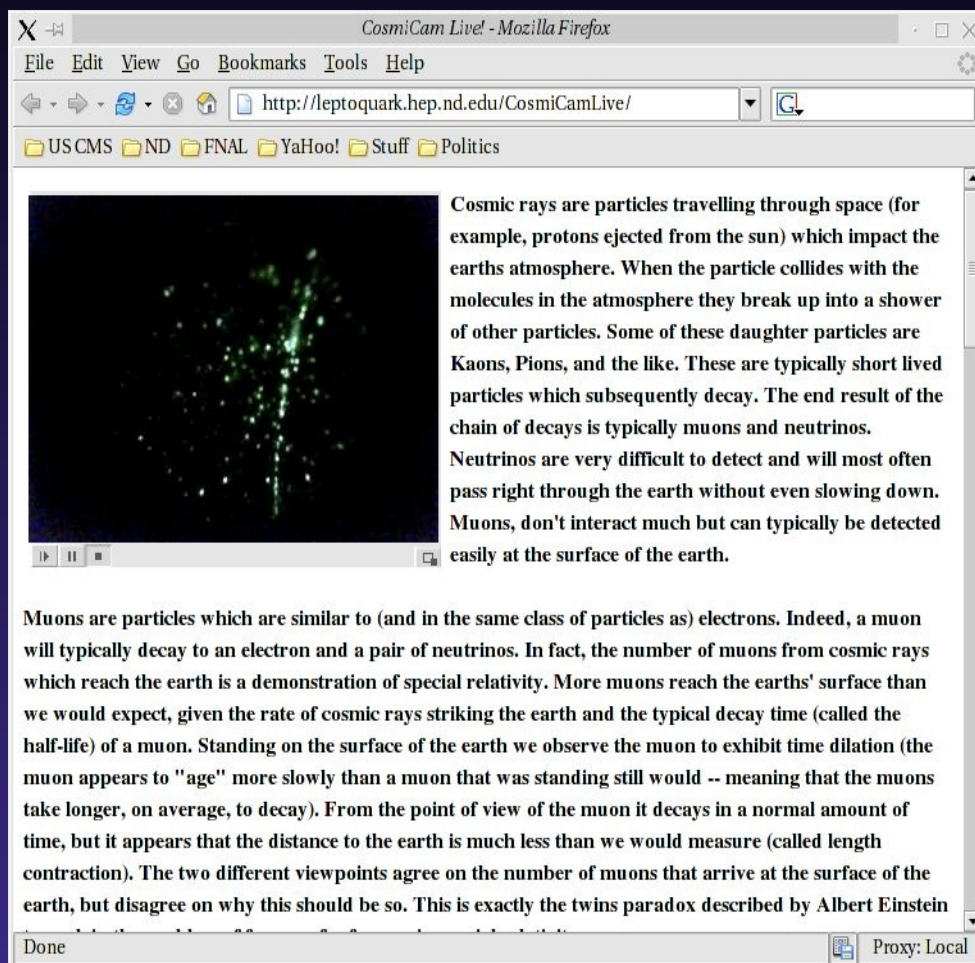
# Further Afield



- 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 the 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