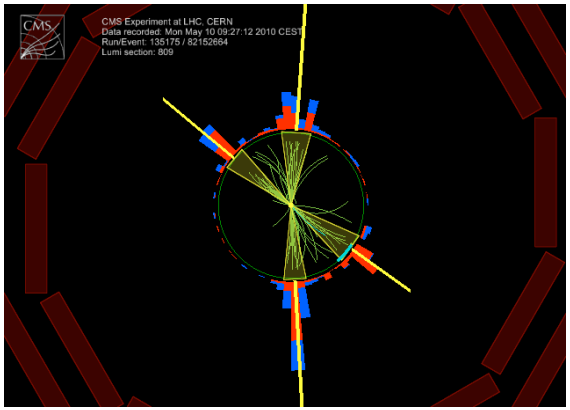
Exotica Hotline

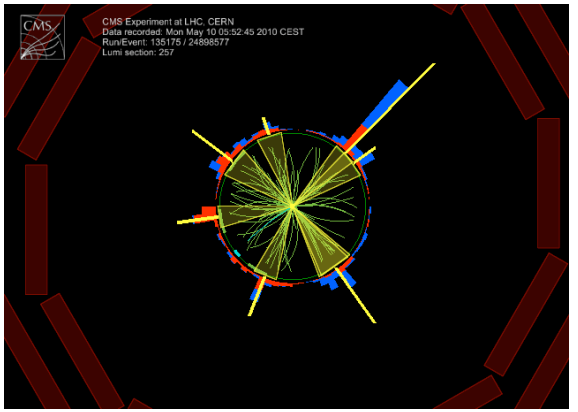


Tulika Bose

Boston University

(On behalf of the Exotica Group)

Physics Plenary (May 19th, 2010)



Exotica "Hotline"

- Use the Express Stream as a "hotline" for events with new physics signatures:
  - events with a large "sum H_T" or five or more jets above a certain threshold
  - events with large missing E_T/H_T
  - events with high track multiplicities
  - events with high transverse momentum objects (electrons, muons, photons) above a certain threshold
  - anomalously high activity in certain detectors
  - etc.
- Aim for a max. of ~100 interesting events per day
- Hotline to provide first glimpse of "unusual" activity and enable prompt action
- Also helps provide fast feedback to DPGs and POGs

The Hotline workflow

Step 1:

- The existing Express stream (ES) serves our purpose well i.e. no need to define a separate stream
  - avoids imposing additional resources at HLT/online
- The current list of ES trigger bits (unprescaled single/double object triggers) work well
- In the future, for higher luminosity scenarios, ES bits will be proposed (as needed) by putting higher thresholds on existing triggers and/or looking for higher multiplicity events
  - will include appropriate rate and timing studies
    - Total Express stream rate should be under ~40 Hz
    - Tight CPU budget at HLT
      - ES bits should not add to total HLT rate or cpu time

The Hotline workflow

Step 2:

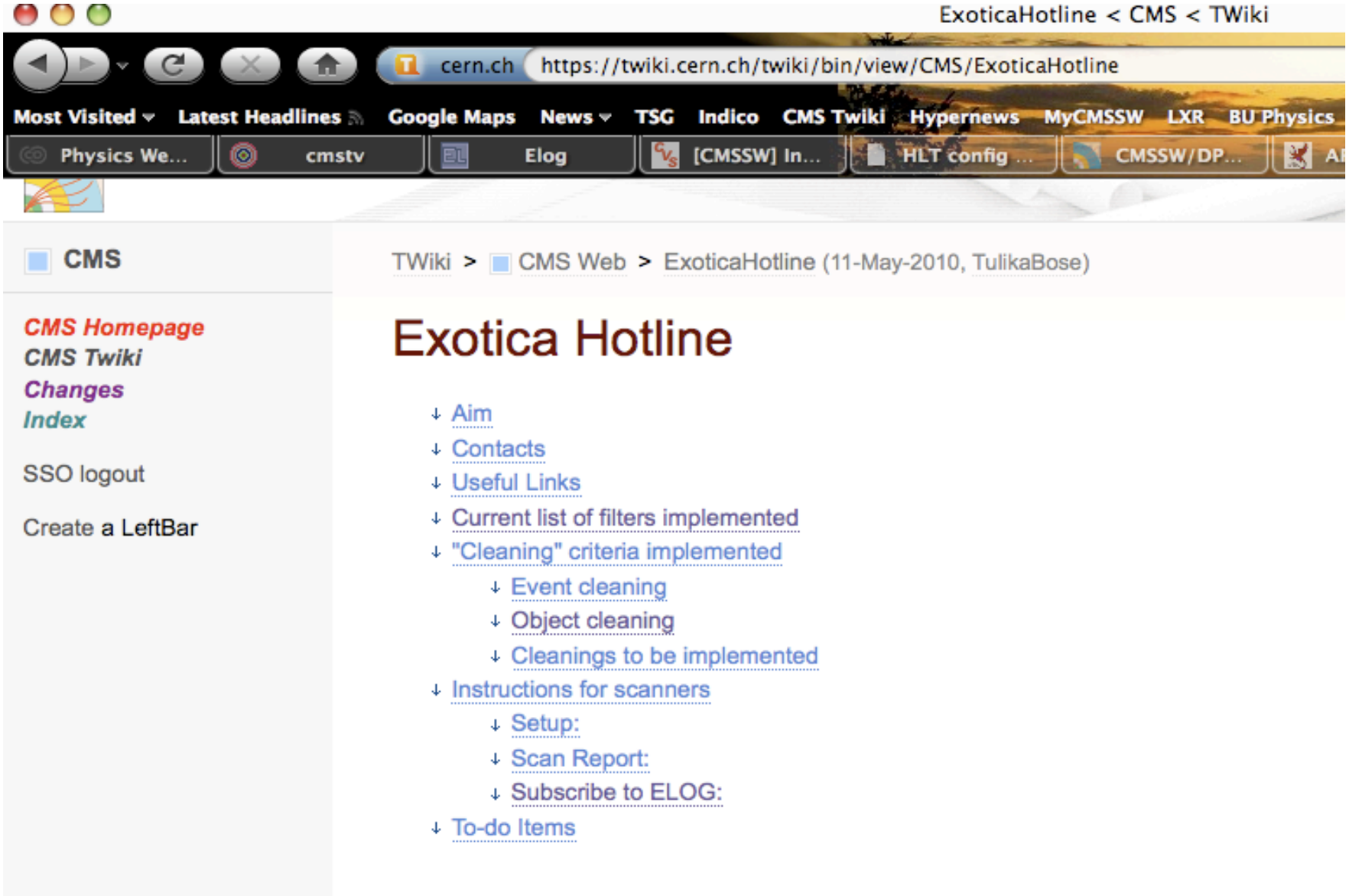
- Automatic machinery set up on CAF for running "skim" jobs daily starting from the reconstructed express stream data
  - 1 root file produced per day
  - lists of interesting run #/ event #/ lumi section and the filters that fired produced as well
    - to include detailed information regarding object (p_T, η, ϕ, isolation,…)

- Uses flexible code that can be modified/updated whenever needed
  - Not tied to specific releases
  - Resides in UserCode/ExoticaHotLine/

- Uses reconstructed quantities and trigger bits for optimal filtering
  - RECO information particularly useful for the cases cpu consumption may be prohibitive @ HLT
    - e.g. look for events with > 4000 tracks

Hotline Twiki

https://twiki.cern.ch/twiki/bin/view/CMS/ExoticaHotline



Hotline Filters

- Jets:
  - > 1 jet with p_T > 200 GeV
  - > 5 jets with p_T > 40 GeV
- MET/HT:
  - MET > 250 GeV
  - HT > 300 GeV
- Electrons/Muons:
  - > 1 electron (muon) with p_T > 100 GeV
  - > 2 electrons (muons) with p_T > 15 GeV
- Photons:
  - > 1 photon with p_T > 100 GeV
  - > 3 photons with p_T > 20 GeV
- Misc:
  - > 3500 tracks
  - > 1 track with p_T > 50 GeV and dE/dX > 5.6 MeV/cm

Cleaning criteria

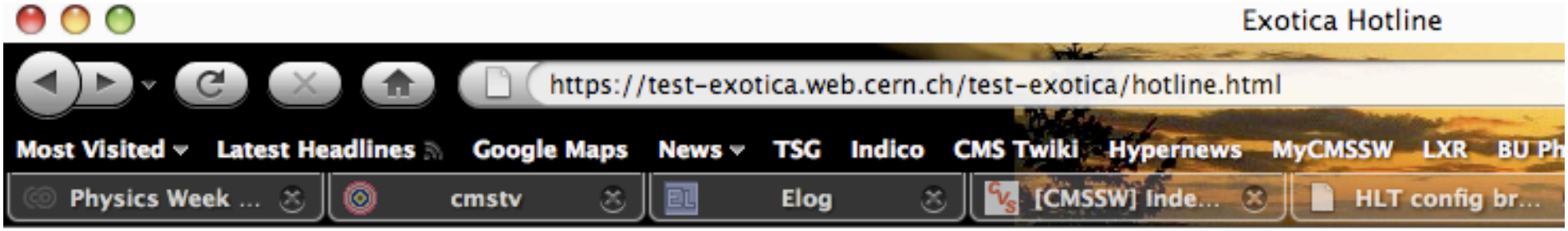
- Good primary vertex
- Physics Declared info from L1
- Reject scraping events
- Reject ECAL spikes (HLT bit, swiss cross)
- Reject HBHE HPD noise (HF noise filter being incorporated)
- Loose set of criteria suggested by Exotica Jet/Electron/Muon/Photon groups (JetID, H/E, isolation, etc.)
  - in consultation with DPGs and POGs

Detailed list at https://twiki.cern.ch/twiki/bin/view/CMS/ExoticaHotline

Filter selection and cleaning criteria being updated/optimized for higher luminosities

Hotline webpage

https://test-exotica.web.cern.ch/test-exotica/hotline.html



CMS Exotica Hotline

Here are some old event displays:

Here are some old root files:

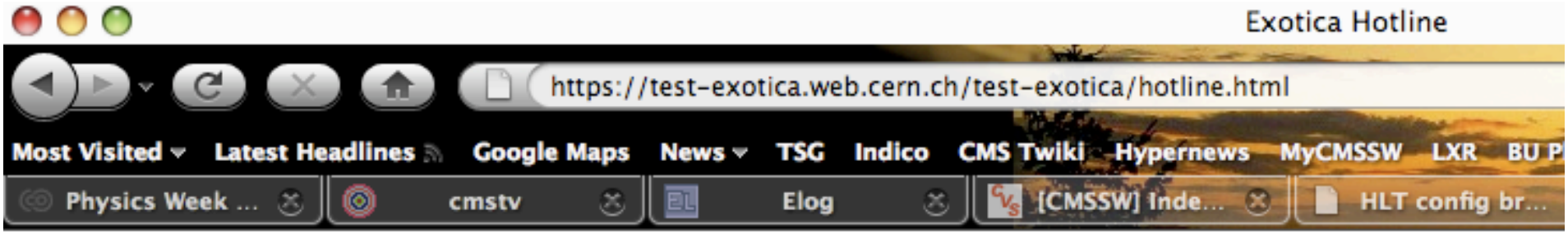
Newer data will appear in directories each day. Choose the date you wish to scan below:

Date: 2010_05_15

submit

Hotline webpage

https://test-exotica.web.cern.ch/test-exotica/hotline.html



CMS Exotica Hotline

Here are the auto event displays (not working yet):

Here are this date's root files:

2010_05_15.root

hotLineSummaryPlot.root

Here are this date's summary files:

ListOfEventsPerFilter.stat

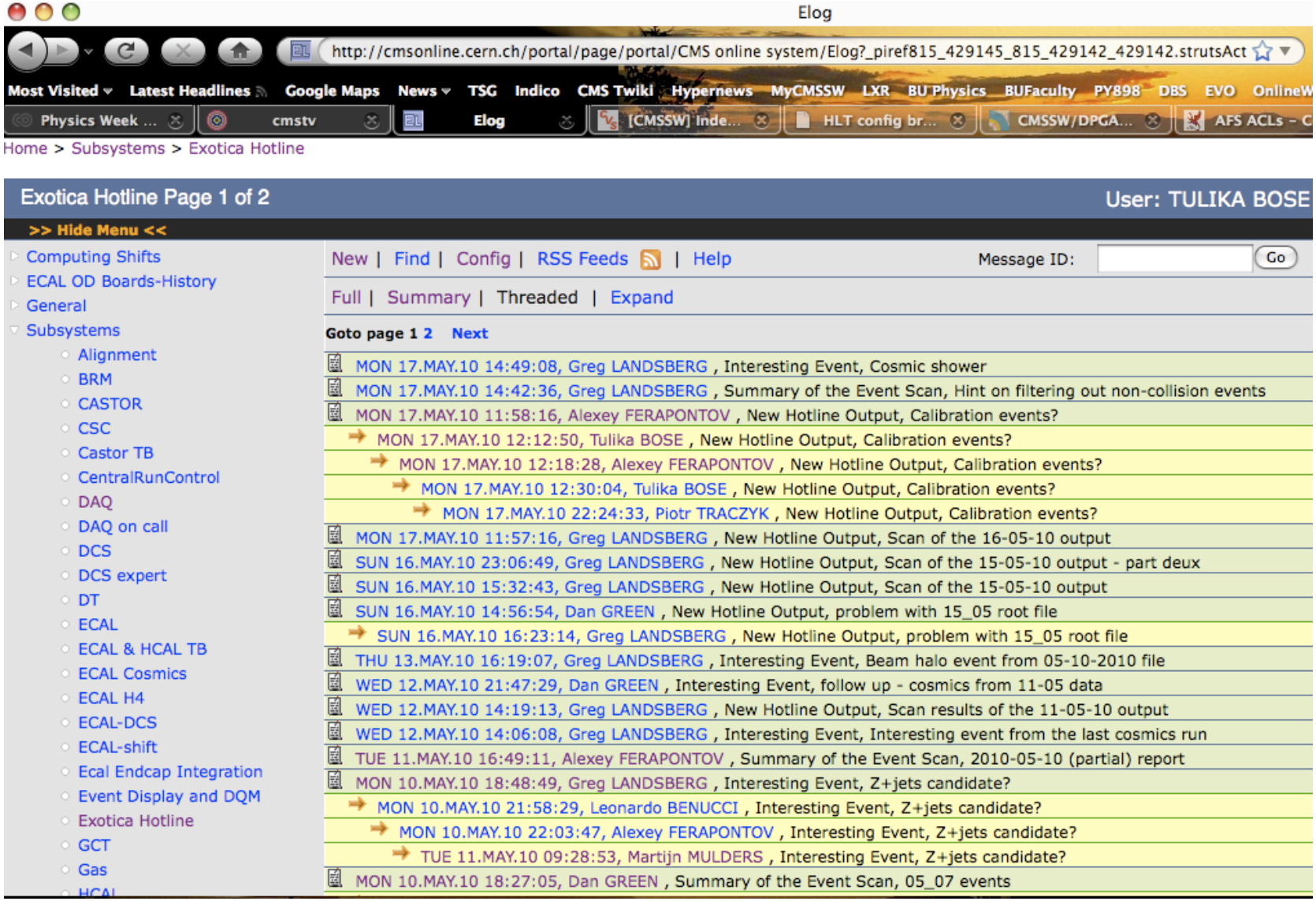
ListOfFiltersPerEvent.stat

Hotline summary

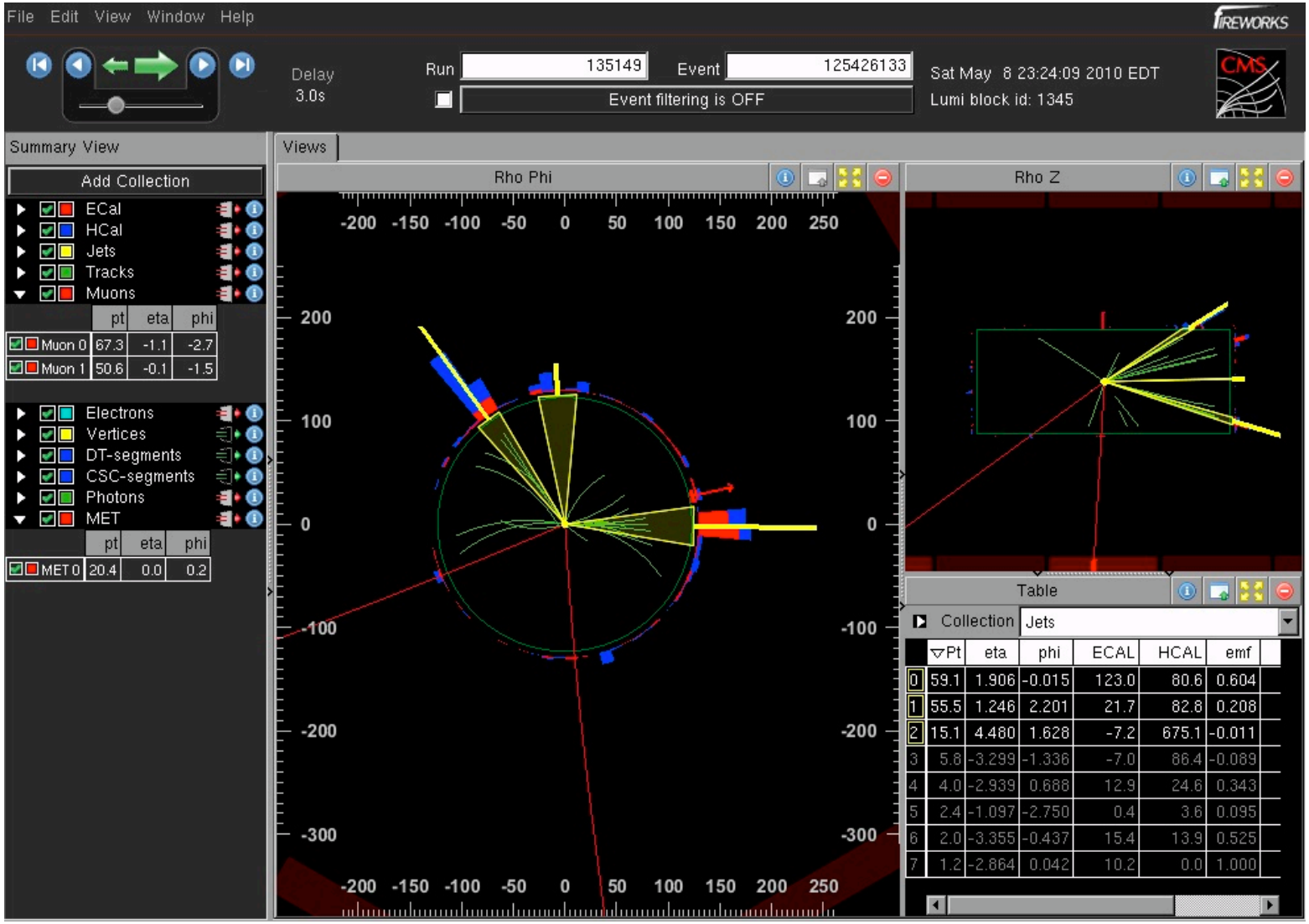
```
------------------------------
Event:
    Run    number  = 135521
    Event number  = 20894946
    Lumi   section = 196
 List of Filters fired by this event:
filterHighHt
filterHighMet
filterHighPtJet


------------------------------
Event:
    Run    number  = 135521
    Event number  = 38258053
    Lumi   section = 280
 List of Filters fired by this event:
filterMultiMuon


------------------------------
Event:
    Run    number  = 135521
    Event number  = 42422711
    Lumi   section = 300
 List of Filters fired by this event:
filterMultiMuon


------------------------------
```

Hotline ELOG

Enthusiastic team of scanners examine the root files and enter comments

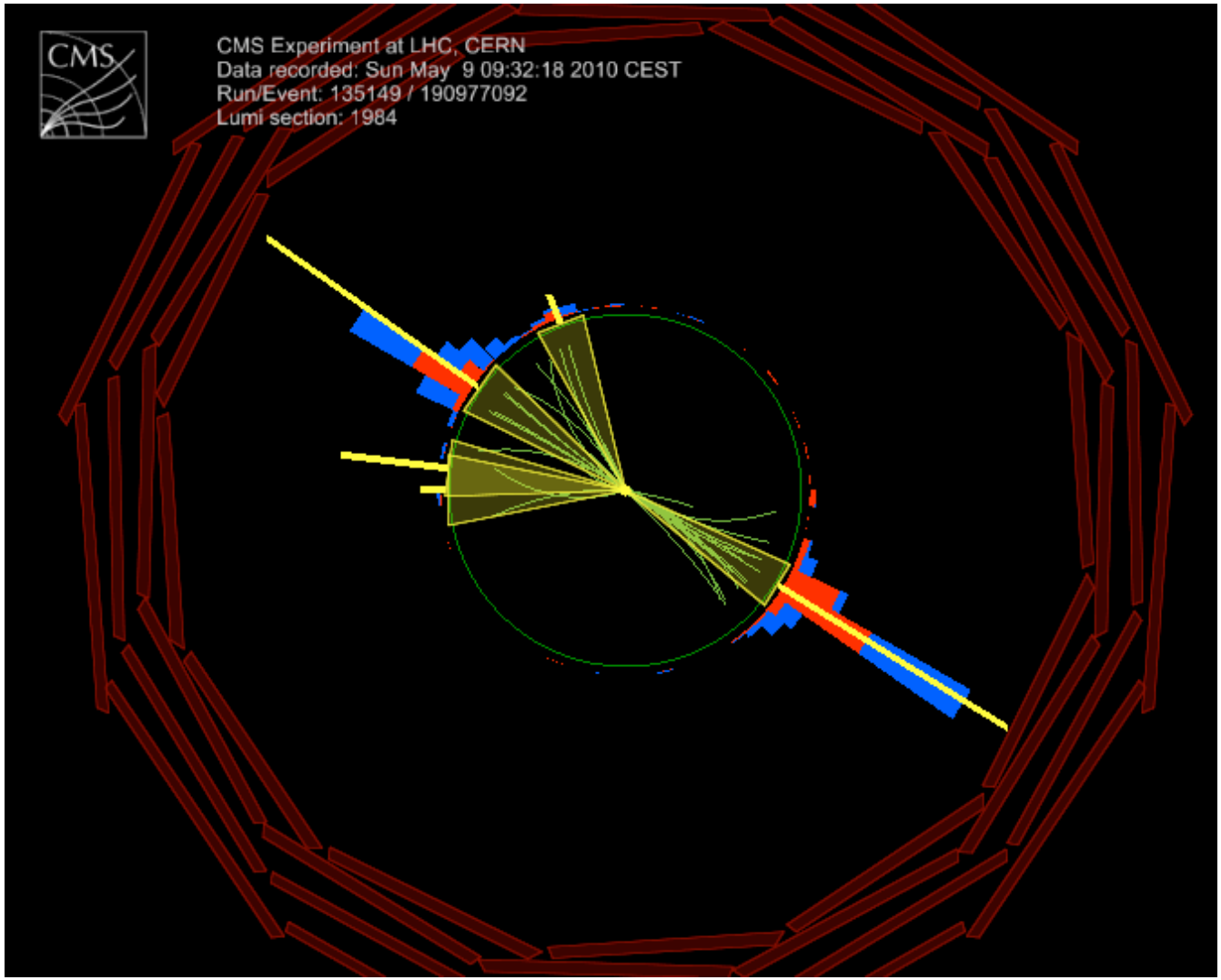


“Discoveries”



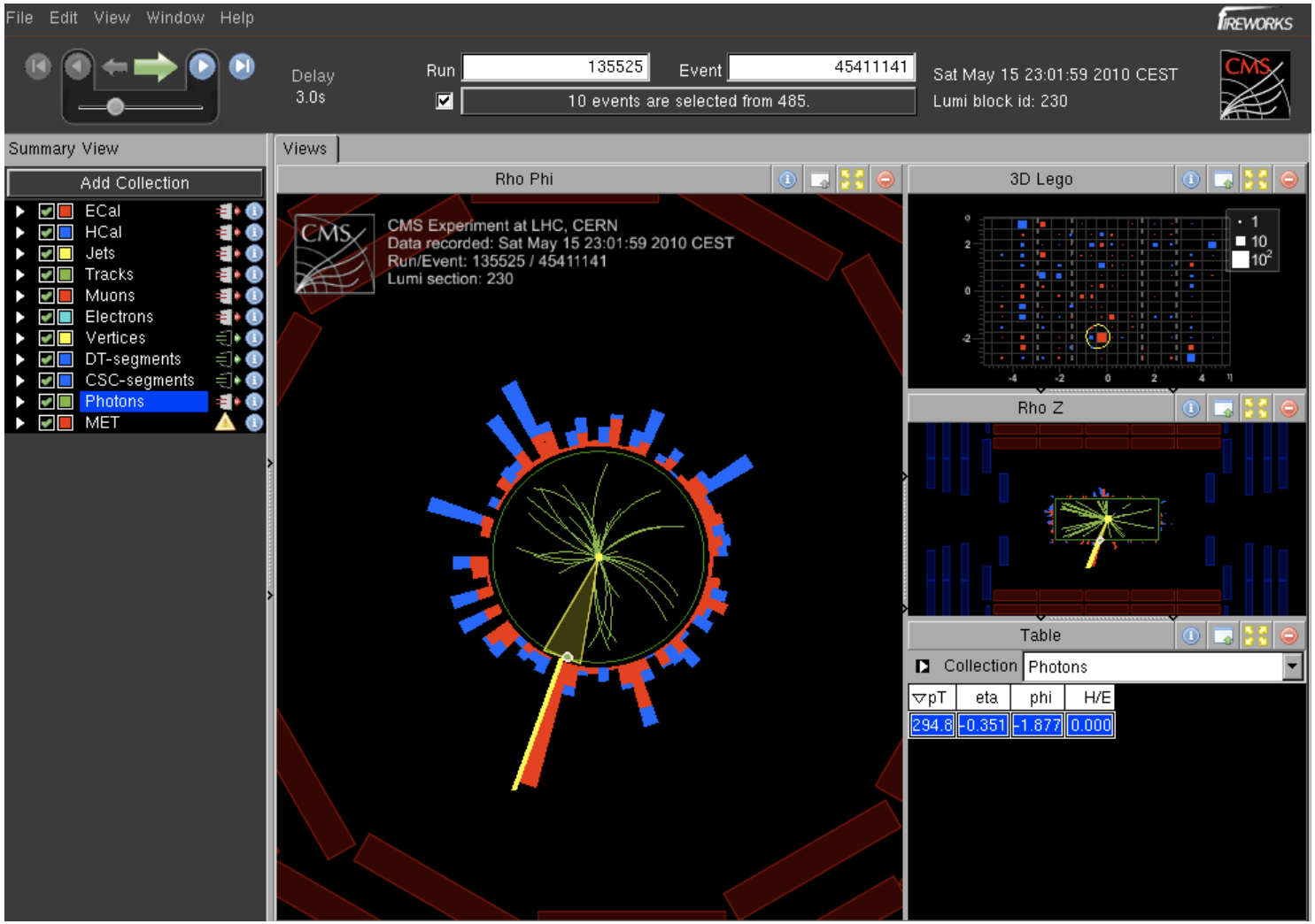
Z + jets event (found around the same time as Muon POG/EWK PAG)

Interesting events…



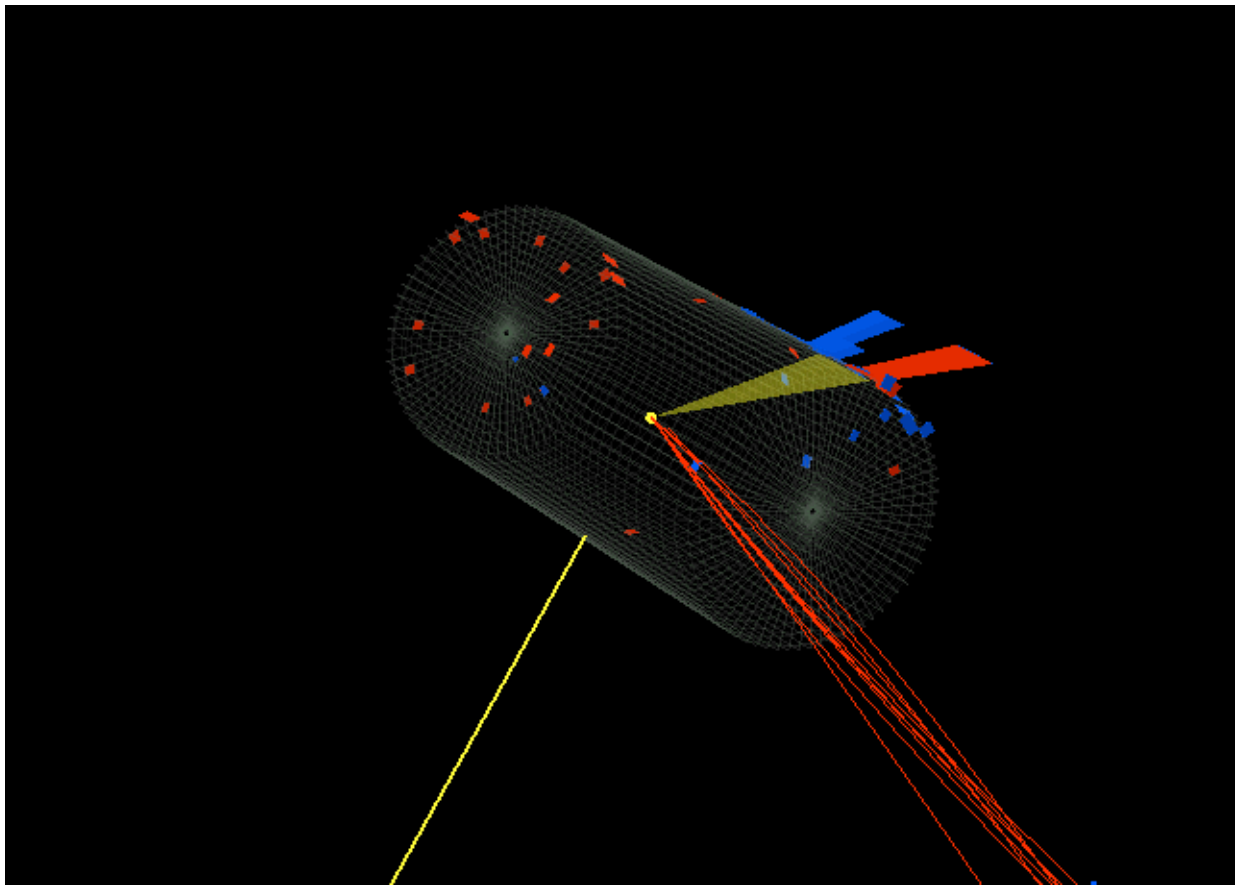
Very energetic multijet event with ~500 GeV HT

Interesting events…



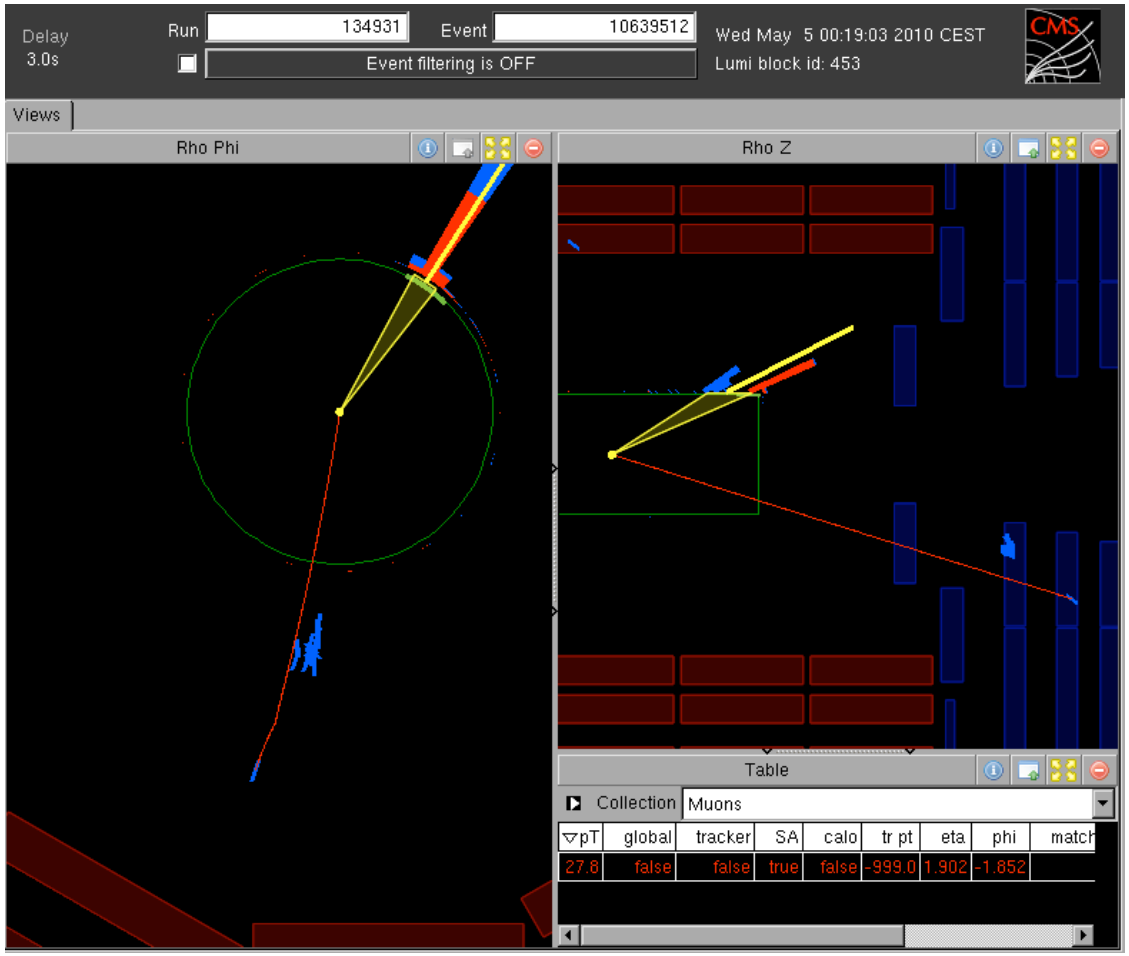
High p_T (~300 GeV) photon event

Odd muons



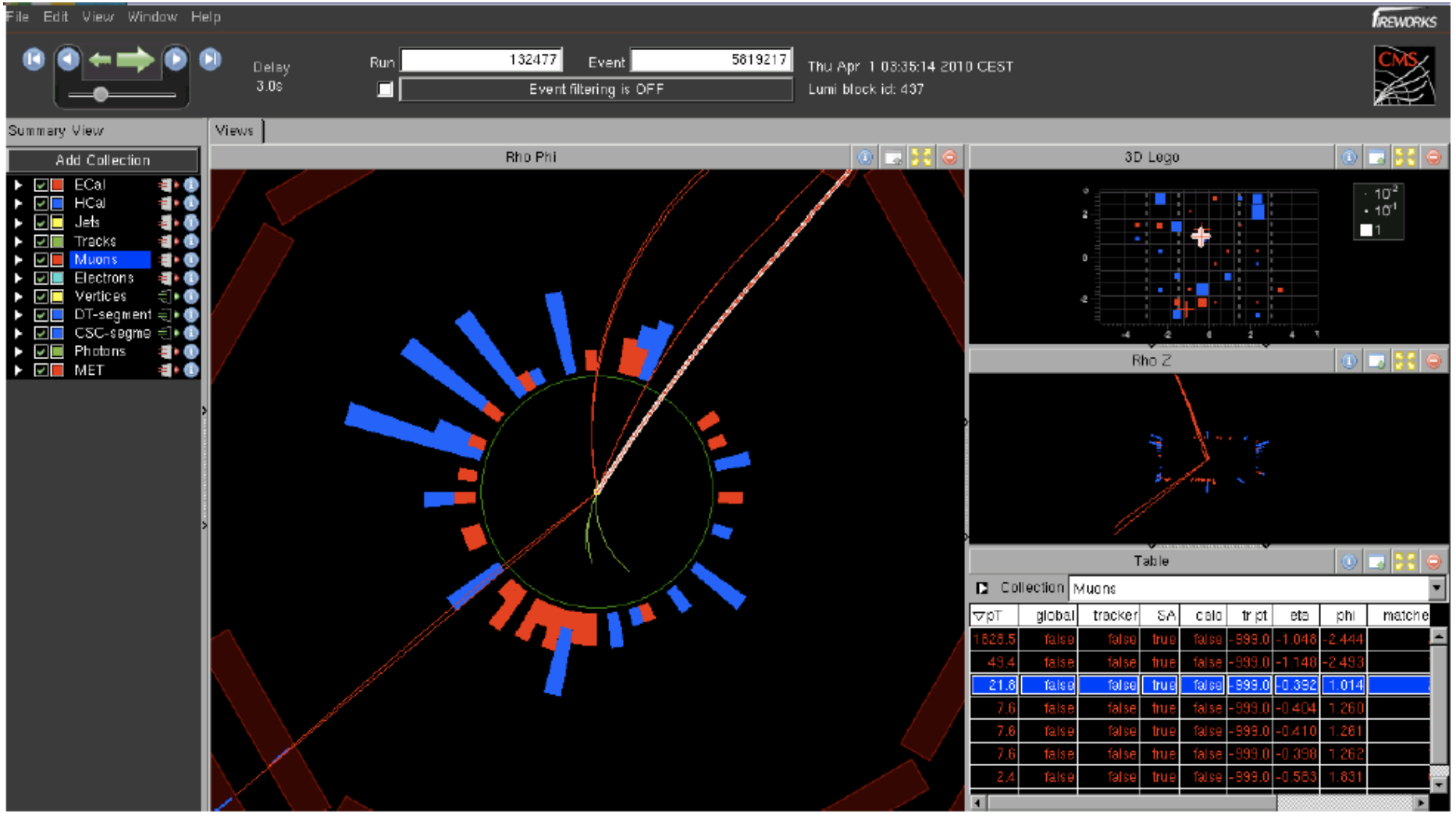
A cosmic muon showers in the CSC producing 19 segments that result in 9 STA muons
Reported to the Muon POG

Odd muons



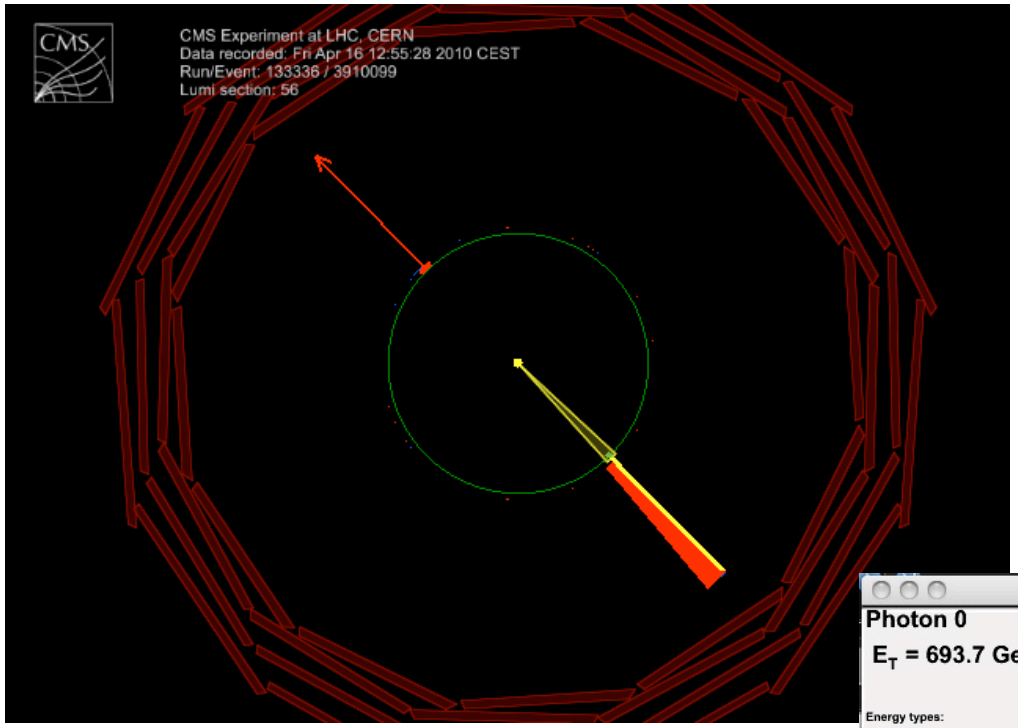
Only one standalone track remains after using an improved version of the muon trajectory cleaner (fix courtesy Daniele Trocino)

Odd muons

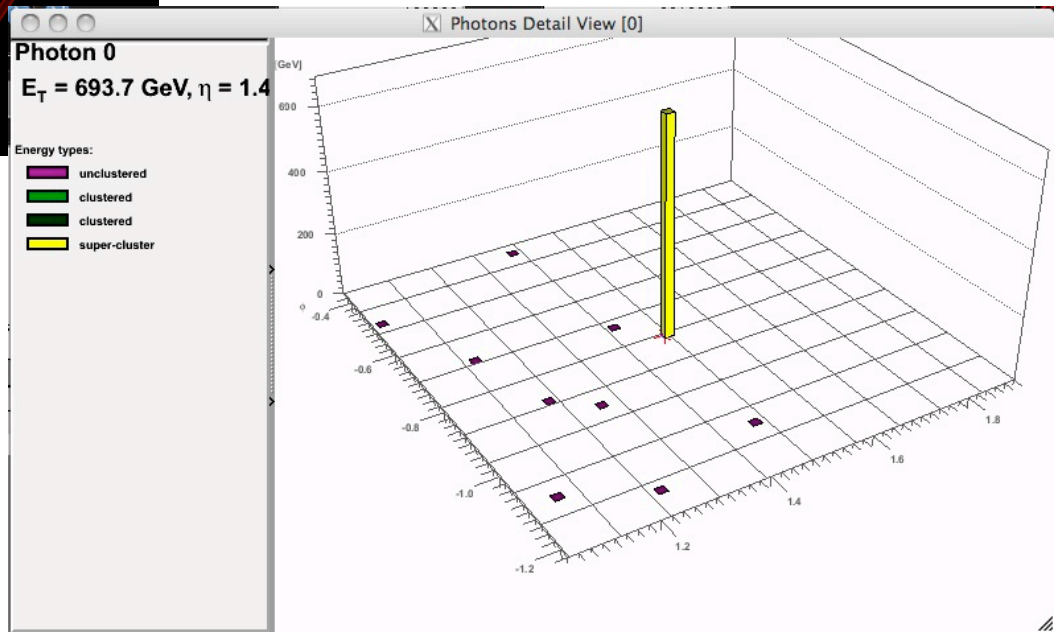


7 standalone muons!! 1.8 TeV muon – out of time cosmic in coincidence with minimum bias events….? Reported to the Muon POG – under investigation.

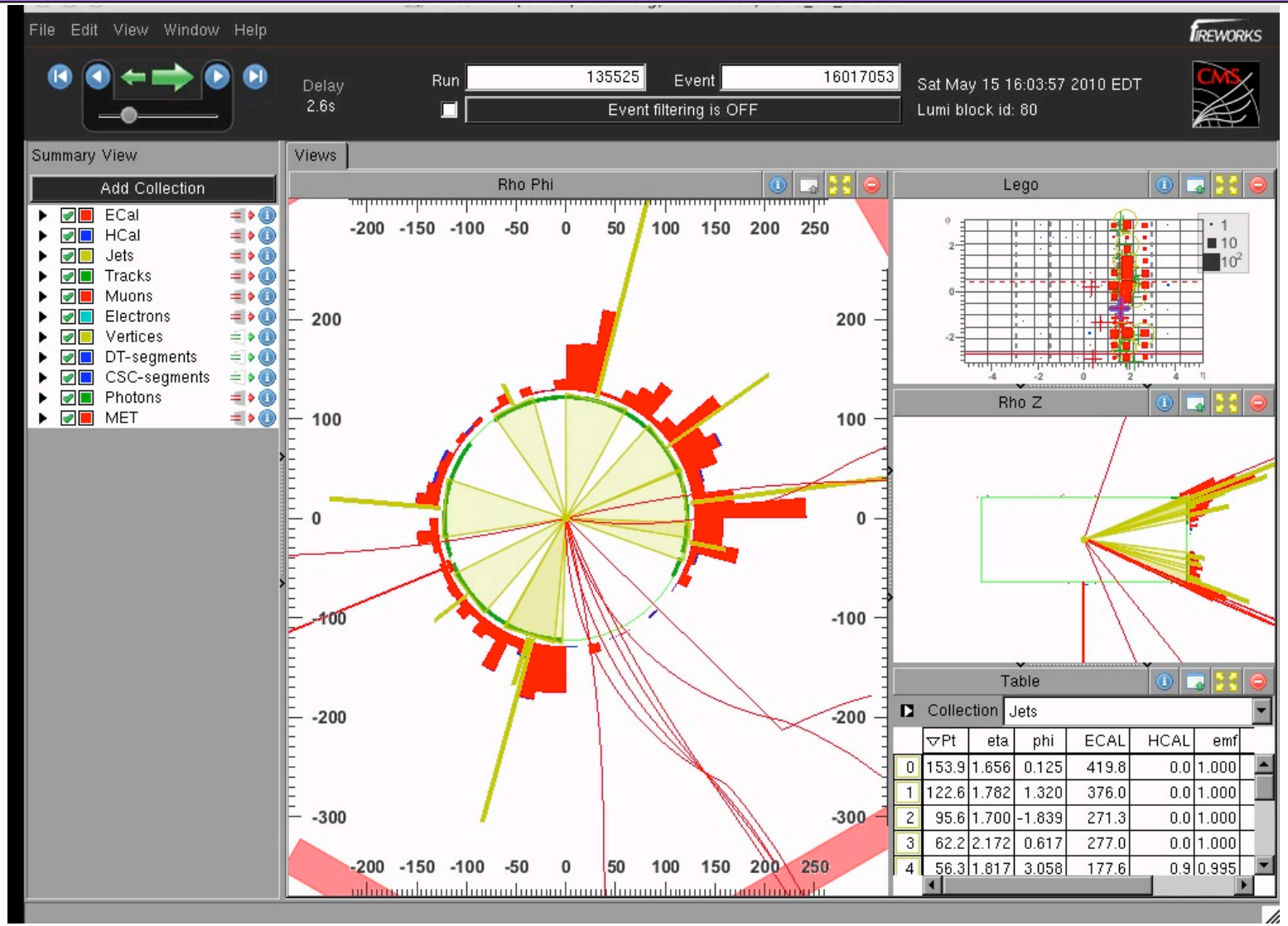
EB/EE boundary spike



Reported to ECAL DPG

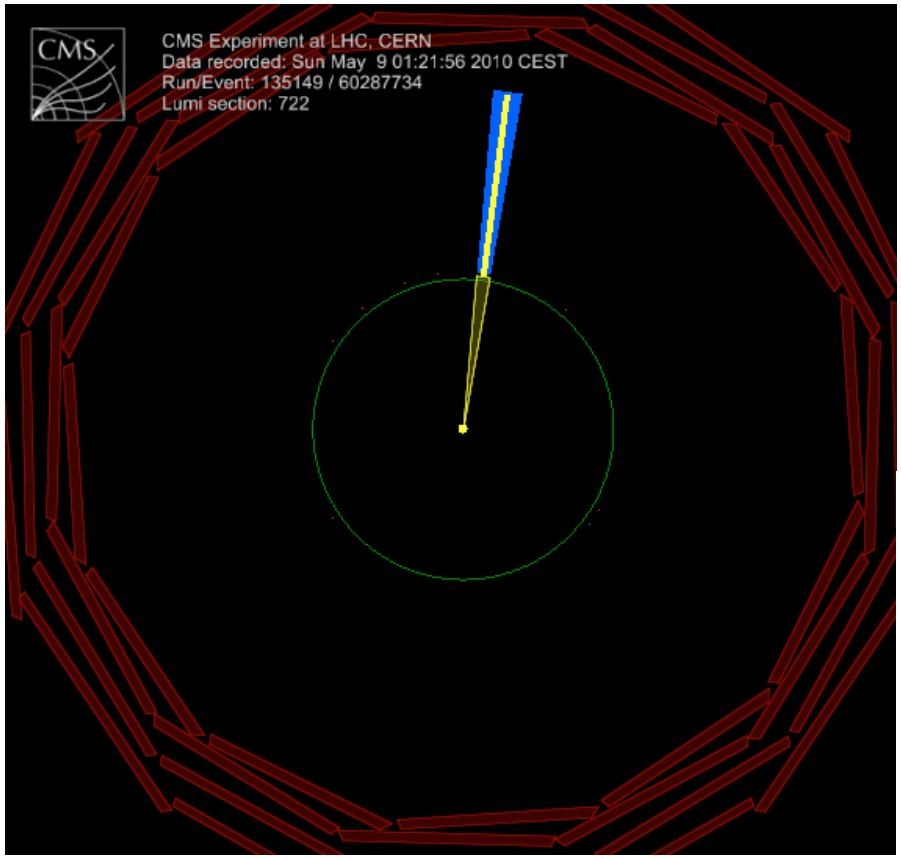


Coherent EE noise

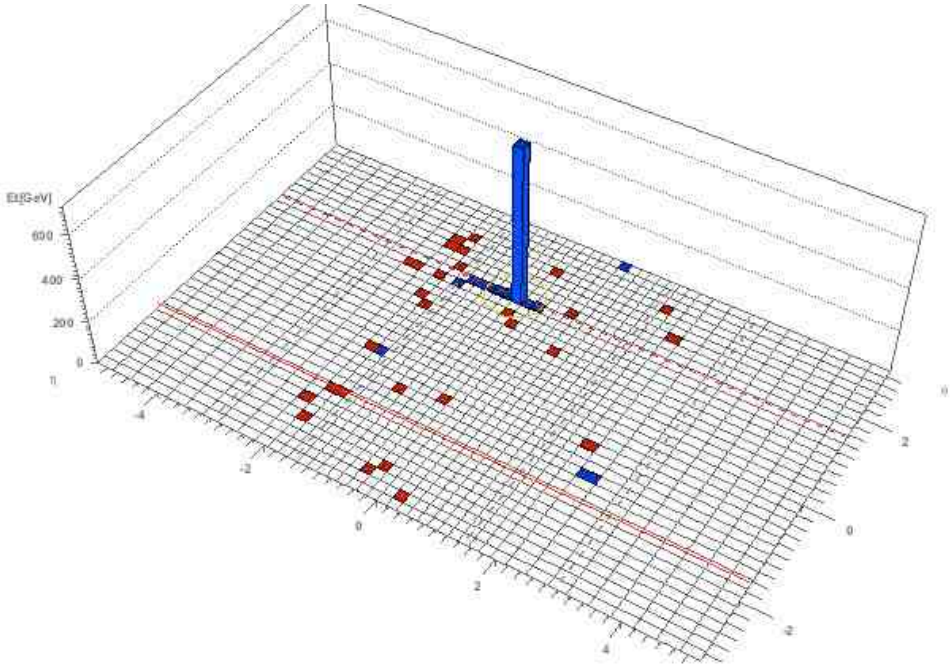


Coherent EE noise event

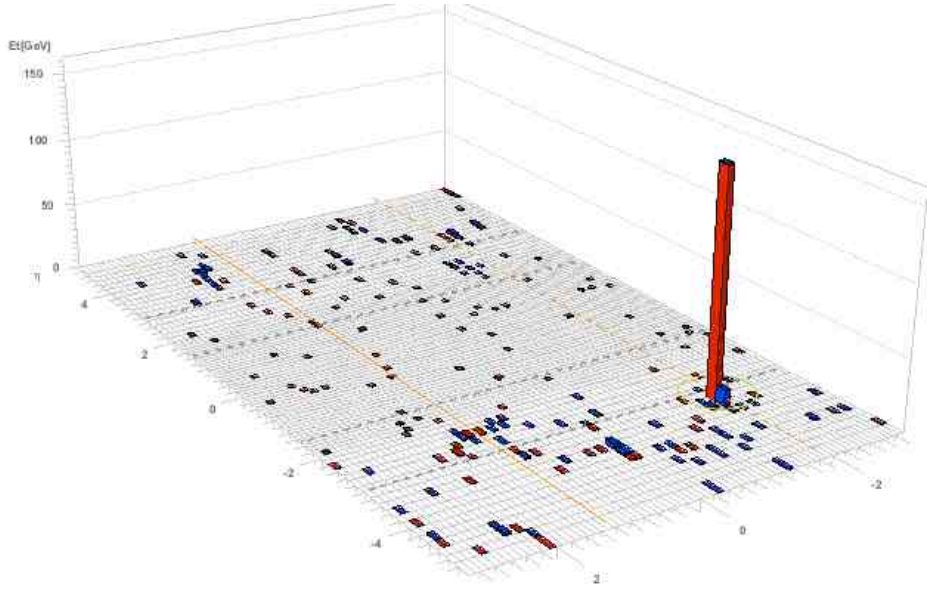
HB/HE HPD noise

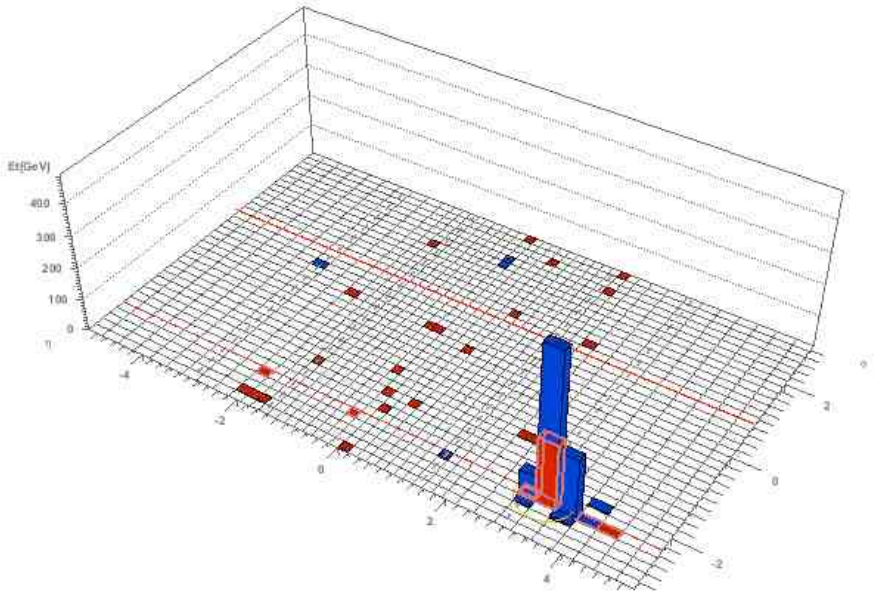


Reported to HCAL DPG – testing fix



HF noise





HF PMT noise event

Summary

- The Exotica Hotline is in place and working very well
- It has already identified interesting physics events and odd detector/ instrumental effects
- Developers and scanners are maintaining close contact with the DPGs and POGs and are providing feedback and implementing DPG/POG recommended changes, cleaning criteria
- Work on streamlining parts of the workflow and producing event displays in addition to the root files is ongoing
- Selection criteria are being optimized (and scaled based on increasing luminosity)

Outlook

- Comments/feedback/suggestions ?
- Please contact any of the primary hotline developers:
  - Tulika Bose, Massimiliano Chiorboli, Maurizio Pierini, Ellie Twedt
  - Exotica conveners (Greg and Chris)
  - Or send e-mail to cms-exotica-hotline@cern.ch
- Please volunteer to join the team of scanners
  - Dan Green, Greg Landsberg, Leo Benucci, Joel Goldstein, Alexey Ferapontov, Philippe Mine…
  - Only requirement: laptop/desktop that can run Fireworks
  - … and the next discovery may be yours !!