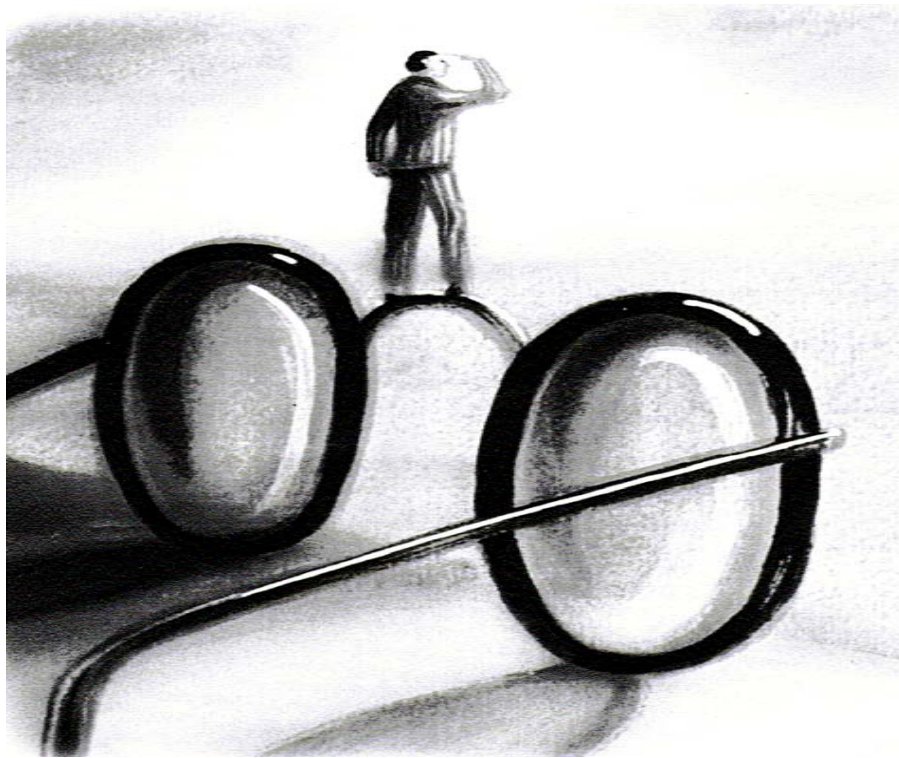


ZooFinder at CDF



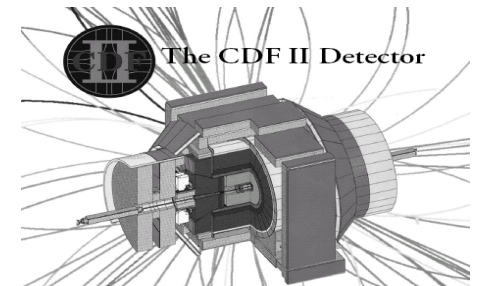
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Run II of the Fermilab Tevatron

- Proton anti-proton collisions at center of mass energy = 2 TeV
- Two detectors: CDF and D-Zero took data from 1992-1996 (Run I)
 - Discovery the top quark!
 - Other interesting/unusual hints!
- Run II of the Fermilab Tevatron is currently taking data again
 - A more sophisticated detector (CDF II)

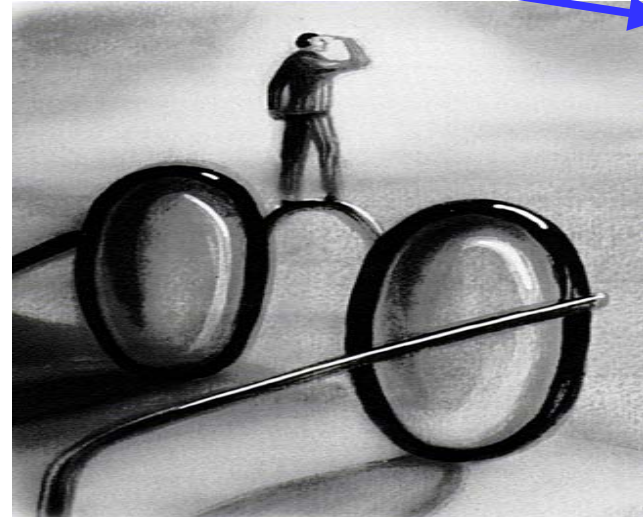


Need extensive monitoring for CDF II

- **Detector problems during data taking need to be addressed.**
I.e., is anything broken?
- **If unusual (bad) things in the detector are happening, we need to know about them immediately.**
- **Real-time monitoring of the detector for potential problems is crucial to any possible future discovery at the Tevatron.**

A new monitoring system at CDF

- **ZooFinder** : Searches for “unusual” events (anomalous animals!). Finds, categorizes, then puts them into a “Zoo” to be studied.
- Identifies and classifies individual events as “unusual” by looking at the objects in the event.
- ZooFinder runs via a daemon program.
- Looks for “unusual” signature in high energy events.



object:
Electron
muon
tau
photon
MeT
etc.

Why monitor “unusual” events?

- An unusual event could imply detector malfunction(s).

e.g. Event with 6 muons at 1 Tev each.

=> Discovery of non-conservation of energy?

=> Likely a “broken” muon chamber... we need to monitor for such events.

- **ZooFinder** may also find unusual events in the absence of detector problems. (anomalous animals!)

=> Hint of new physics?

=> Supersymmetry?

- Want this type of information ASAP!

Categorizing Unusual Events

- Unusual event during Run I:
 - Famous $e e \gamma \gamma$ + Missing Energy candidate
(10^{-6} background predicted, unexpected!)
- A systematic approach towards unusual event types, e.g. : Events with high energy/mass.
 - $N_{\text{objects}} = 2$; $e e, \mu \mu, \tau \tau, e \tau, e \gamma$ pairs, etc.
 - $N_{\text{objects}} = 3$; $e e e, \mu \mu \mu, e \mu \tau$, etc.
 - $N_{\text{objects}} = 4$; $e \mu \gamma \tau$, etc.
 - $N_{\text{objects}} = \dots$

Detained Information on the Unusual

When an unusual event is found, quickly send email to experts and post it to a web page which provides easy access to the “Zoo” events

- Run Number and Event Number(s)
- Event Type : “eμγ”
- Event Kinematics
- Event Display: “snapshots” → easy, quick inspection of unusual events by eye

ZooFinder Web Page

The screenshot shows a Netscape browser window displaying the ZooFinder web page. The browser's address bar shows the URL: `http://www-cdf.fnal.gov/internal/people/links/SungwonLee/zoo/`. The page title is "CDF II ObjectMon Zoo Event Finder".

The main content of the page includes a magnifying glass icon and the following text:

CDF II ObjectMon Zoo Event Finder

- **More general description:** [Click Here!!](#)
- "Event Display" pictures (COT/Lego views) are now available.
- For Best results set up Netscape to automatically view ps files with Ghostview (or gv).
- We skip the URL update if ZooFinder fails to find an interesting event.
- For **comments and suggestions**, please e-mail: Sungwon + Matt

Below the text is a table of search results:

AC++	Event	Data	
Mass/Met	Dump	Display	Taking @
8/92.54)	root	COT, LEGO	0805
8/106.94)			
5/133.07)			
3/4/15.36)			
1/18.58)			
4/16.37)			
6/19.61)			
8/15.66)			
4/116.96)			
1/16.86)			
1/4/16.29)			
8.1/19.74)			
2.0/20.63)	root	COT, LEGO	0803
8.6/37.95)			
6/20.86)			
5.6/18.61)			
7/24.61)			
1/16.36)			
3/15.97)			
1/27.05)	root	COT, LEGO	0803
2.6/22.71)	root	COT, LEGO	0803
8/23.56)			
2.9/26.20)			
5.0/26.20)			
2.6/26.20)			
1/22.50)	root	COT, LEGO	0802

Overlaid on the browser window are two windows from the "/cd/home/slee/149386" directory:

- A 3D plot window showing a grid with axes labeled ϕ (0 to 300) and η (-4 to 4). A red vertical bar and a blue vertical bar are visible. The plot title is "Event : 878256 Run : 1-9382 EventType : DATA | Uprase: 3.5..0.12..H..1520.2..23 Presc: 8".
- A circular detector diagram window showing a cross-section of a detector with a central blue dot and a red text label "Et = 75.60 GeV". The plot title is "Event : 878256 Run : 1-9382 EventType : DATA | Uprase: 3.5..0.12..H..1520.2..23 Presc: 8".

At the bottom, a terminal window shows the following commands:

```
een6.xwd mscreen6.jpg
SLEE@TAMU:~> xv mscreen6.jpg
SLEE@TAMU:~> cp mscreen6.ps /home/slee/ana/objmon/talk/
SLEE@TAMU:~> xwd -root -out mscreen7.xwd
```

The system tray at the bottom right shows the time as 16:38 on 2002-08-06.

Summary

- I. **ZooFinder** is a monitoring system for the CDF detector at the Fermilab Tevatron which works to identify unusual events in real time.
- II. It provides a **powerful tool** which helps insure **robust detector operation**, which is imperative for an experiment at the **high energy frontier**.
- III. **Early warning** system of **new physics...**