High Mass Drell-Yan Study
– Status and Plan —

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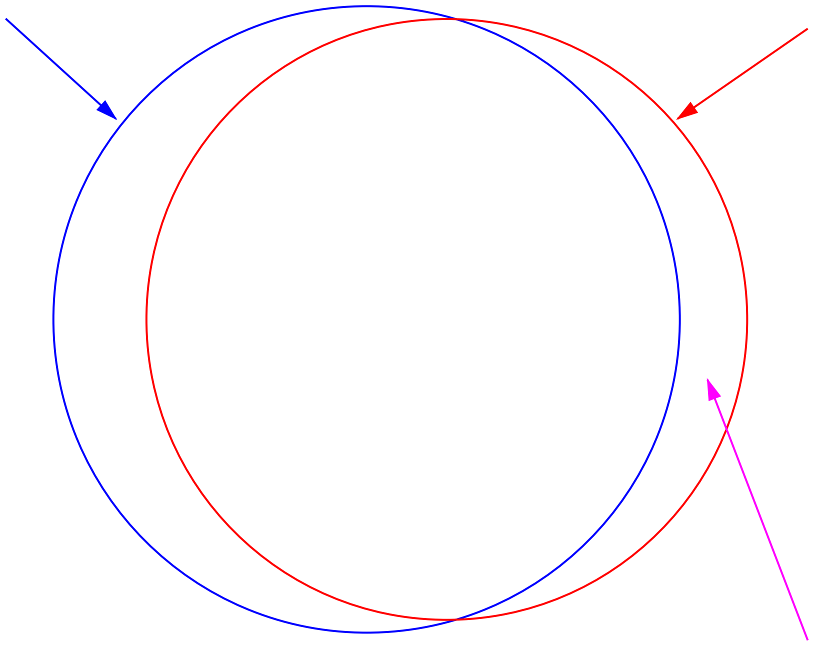
"First Look at Run II Dielectron Data" (CDF 5779)
"First Look at Run II Dimuon Data" (CDF 5807)

Dielectron and Dimuon invariant mass PR plots were blessed in early spring, 2002.

Characteristics of Very High Pt Leptons

For EWK/Top physics study
Typical Pt range: 20 - 100 GeV

For high mass DY
Exotic physics searches
Typical Pt range: 100 - 400 GeV



Nature of Super High pt leptons (+photons) which is unique where we need to pay special attention

$\longrightarrow$ Plot

- **Much of the work on high pt leptons are common to both EWK/TOP and higher mass DY studies, and we are working with ETF and muon groups. (see other talks following this talk)**
- **In this talk, we concentrate on the issues unique to very high pt leptons.**

passage of muon through matter (PDG)

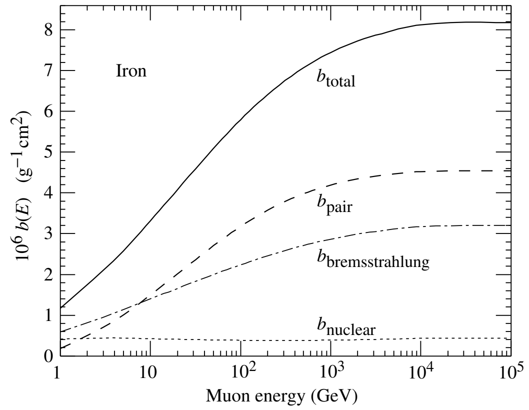


Figure 23.16: Contributions to the fractional energy loss by muons in iron due to e^+e^- pair production, bremsstrahlung, and photonuclear interactions, as obtained from Lohmann *et al.* [62].

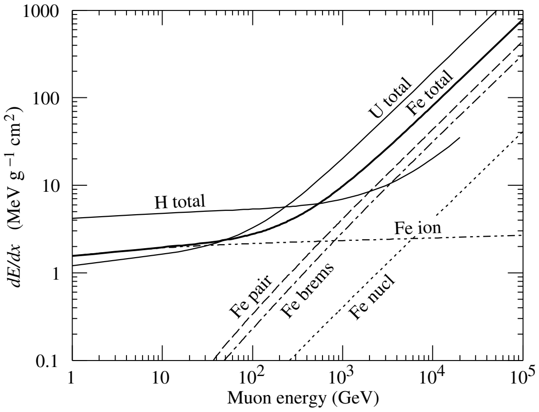


Figure 23.17: The average energy loss of a muon in hydrogen, iron, and uranium as a function of muon energy. Contributions to dE/dx in iron from ionization and the processes shown in Fig. 23.16 are also shown.

Muons with pt above 100 Gev loose more energy than what we use to (muons from Z and W's)

$\rightarrow$ We need to be carefull with mini I cut, for example.

Had/em Cut (electron)

Typically, Had/em $<$ 0.125 cut is used for
a) L2 high pt electron triggers, and also
b) to make it into EMObject (electron candidates) in L3 and offline reconstruction.

Is that a problem? $\rightarrow$ Plot

Answer: Yes
L2 ele trigger efficiency drops down significantly for Et above 150 GeV. (20% at Et=450 GeV)

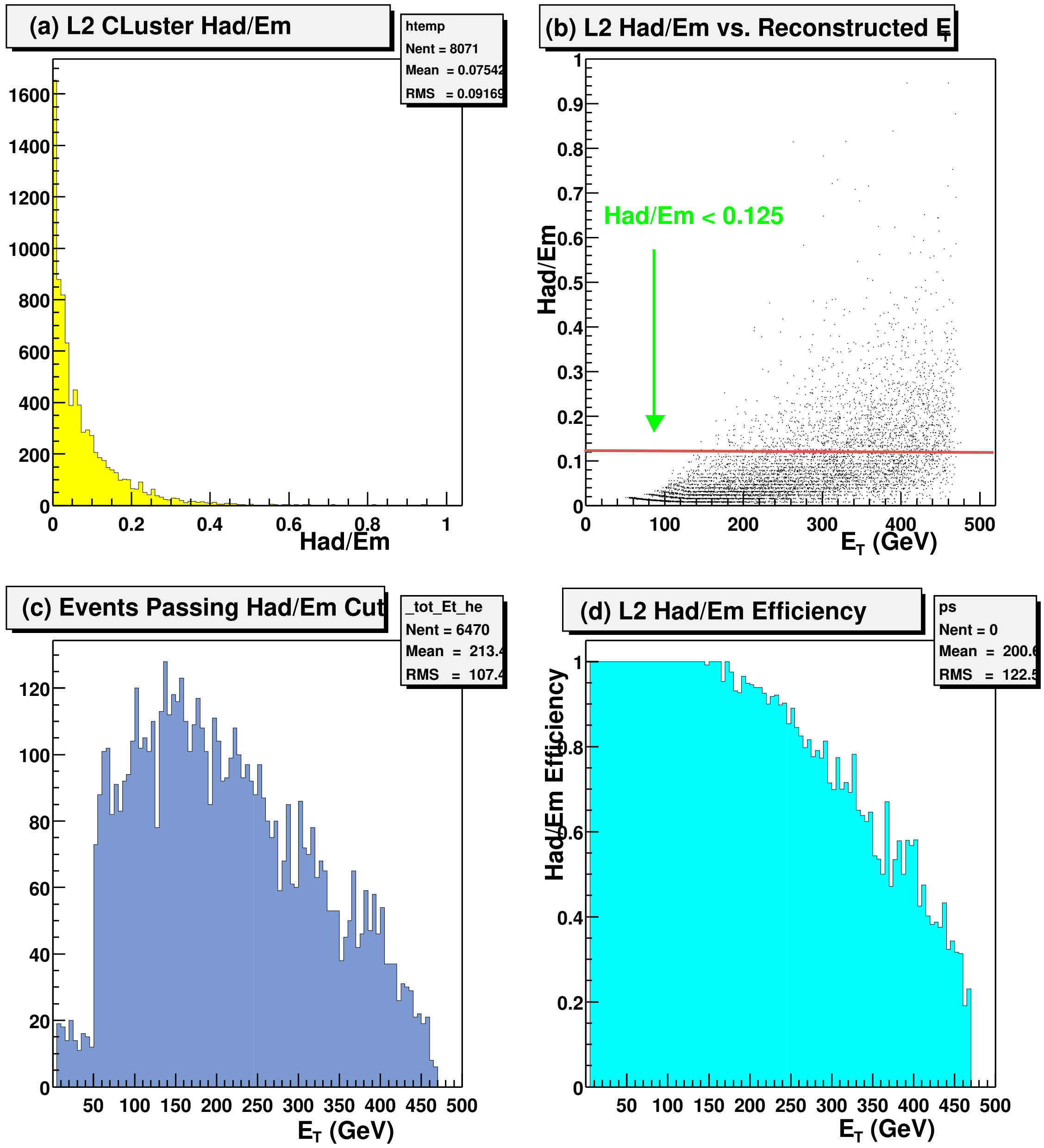
Solution: Proposed/implemented ELE70 Trigger
(CDF4718 and CDF5602 for details)

ELE70 Trigger Path

Level 1	L1_JET10 Single tower $E_T > 10$ GeV
Level 2	L2_JET90 Jet cluster $E_T > 90$ GeV
Level 3	L3_ELECTRON70_CENTRAL EM $E_T > 70$ GeV $P_T > 15$ GeV had/em $< 0.2 + 0.001 \times E$ ($E < 100$ GeV)

Level2 Electron Trigger Simulation

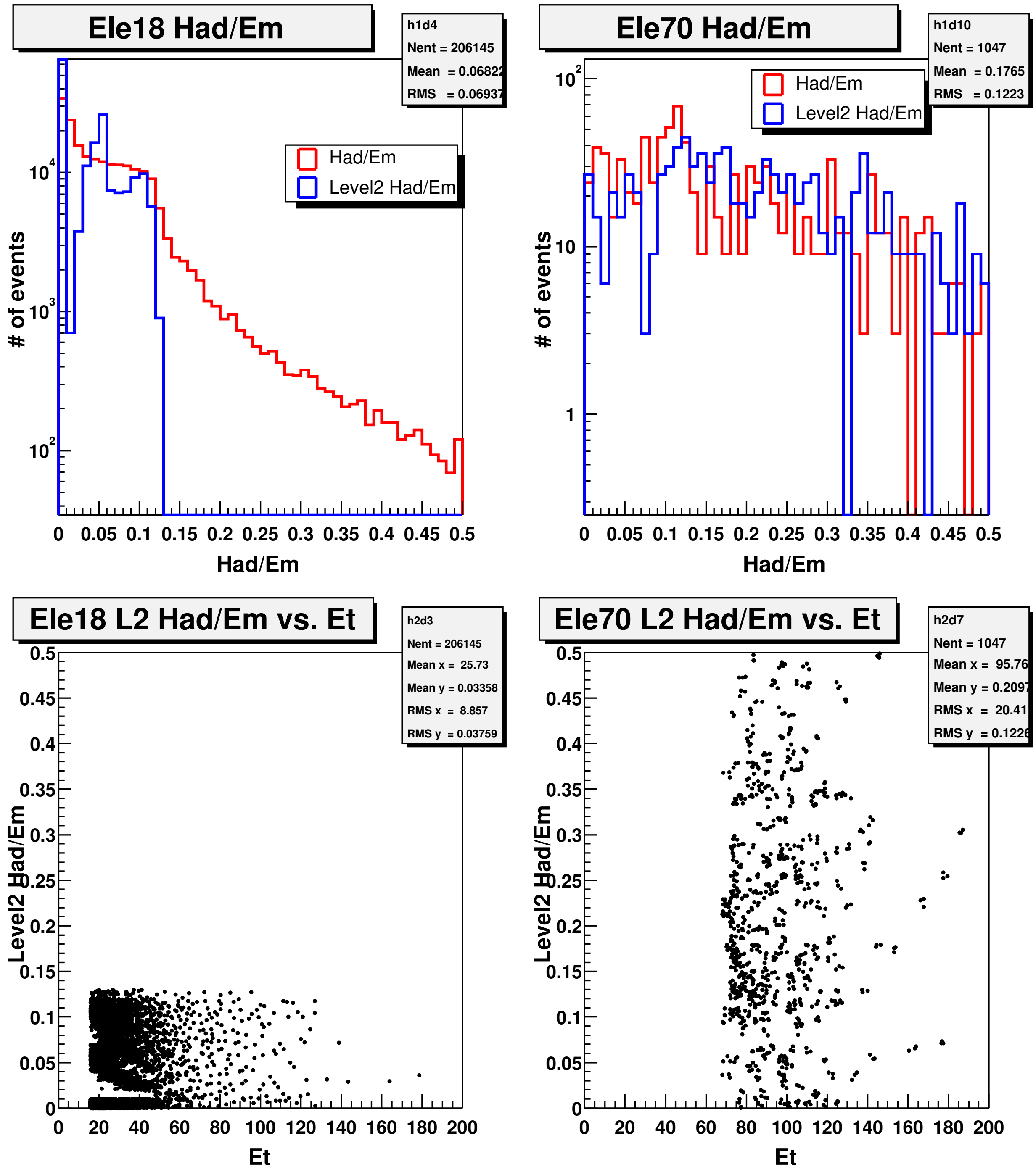
Electrons are generated flat in Pt: 50 -450 Gev



(a) Level 2 trigger Had/Em distribution, (b) Level 2 Had/Em vs. reconstructed electron E_T, (c) reconstructed electron E_T of events passing the cut Had/Em < 0.125 and (d) Level 2 Had/Em efficiency as a function of electron E_T.

ELE70 Trigger Validation (in progress)

Rate is not a problem: L3 trigger xsection: 0.65nb, 0.2% of StreamB data (from run 145005).



Comparison of Had/Em for Ele18 and Ele70 triggers. Events plotted contain one and only one EmObject.

What have we done about this in Run I?

We used L3 Jet100 Trigger to make our own data sample, combined with Inclusive electron triggered events in order not to loose efficiency at high mass.

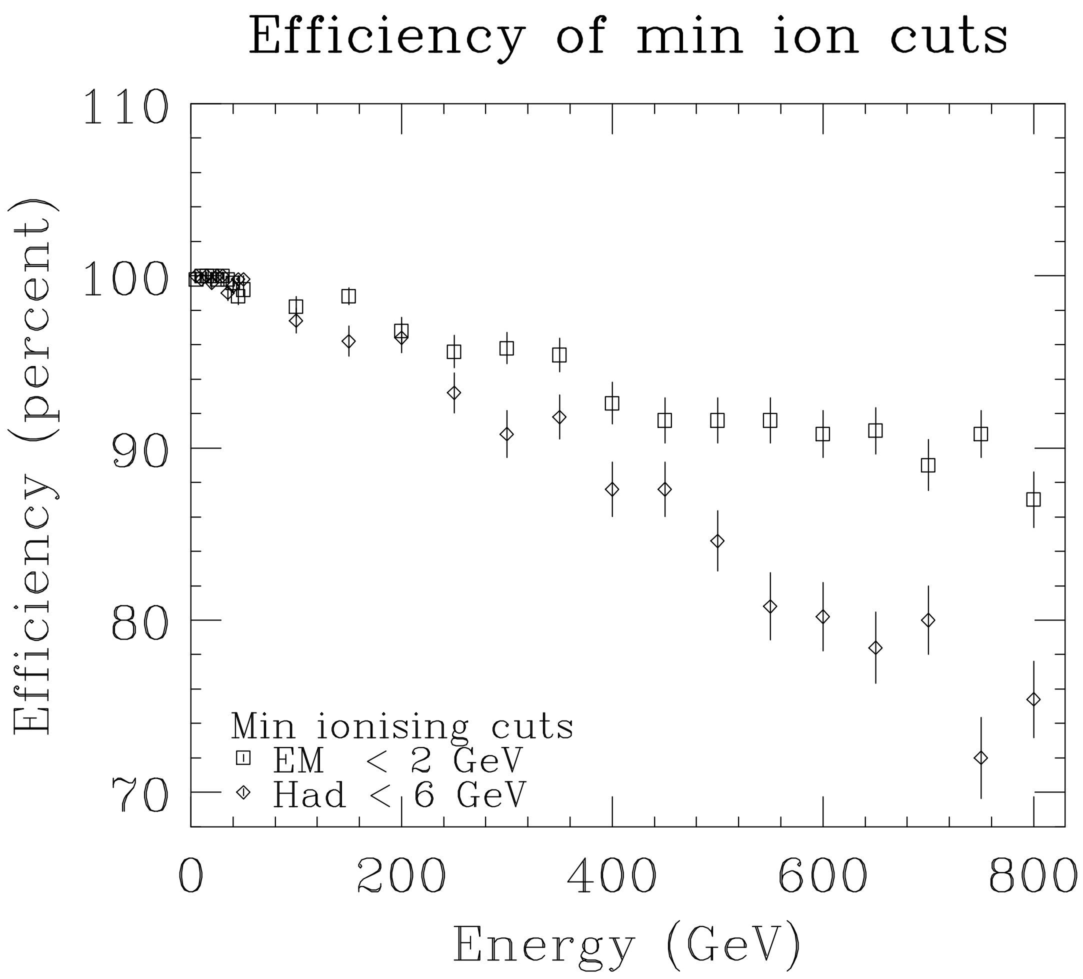
In Run II?

Effort is made to ensure ELE70 triggered data will end up as a part of the 'high pt inclusive electron' data set.

Similarly, we are working with muon group to ensure the 'high pt inclusive muon' data be made to include very high pt muons efficiently. (i.e., we do not want to repeat the same problem we had in Run I: we found in the later stage that mini-I cuts for muons were too tight, and we had to go though very large data sample (run I stream B) to pick up a few missed events.)

$\longrightarrow$ Plot

Muon Mini-I Cut Efficiency



MC study, From M.Pillai thesis

Current Status

- Eagerly waiting for 4.5.2 processed inclusive electron and muon data sets.
- Studying efficiencies of triggers, and other quantities. $\longrightarrow$ Plot
- Getting ready to produce MC events with 4.5.2. (DY, other background events, signal events). Small amounts of various MC samples were made before as an exercise.

Physics with High Mass Dilepton

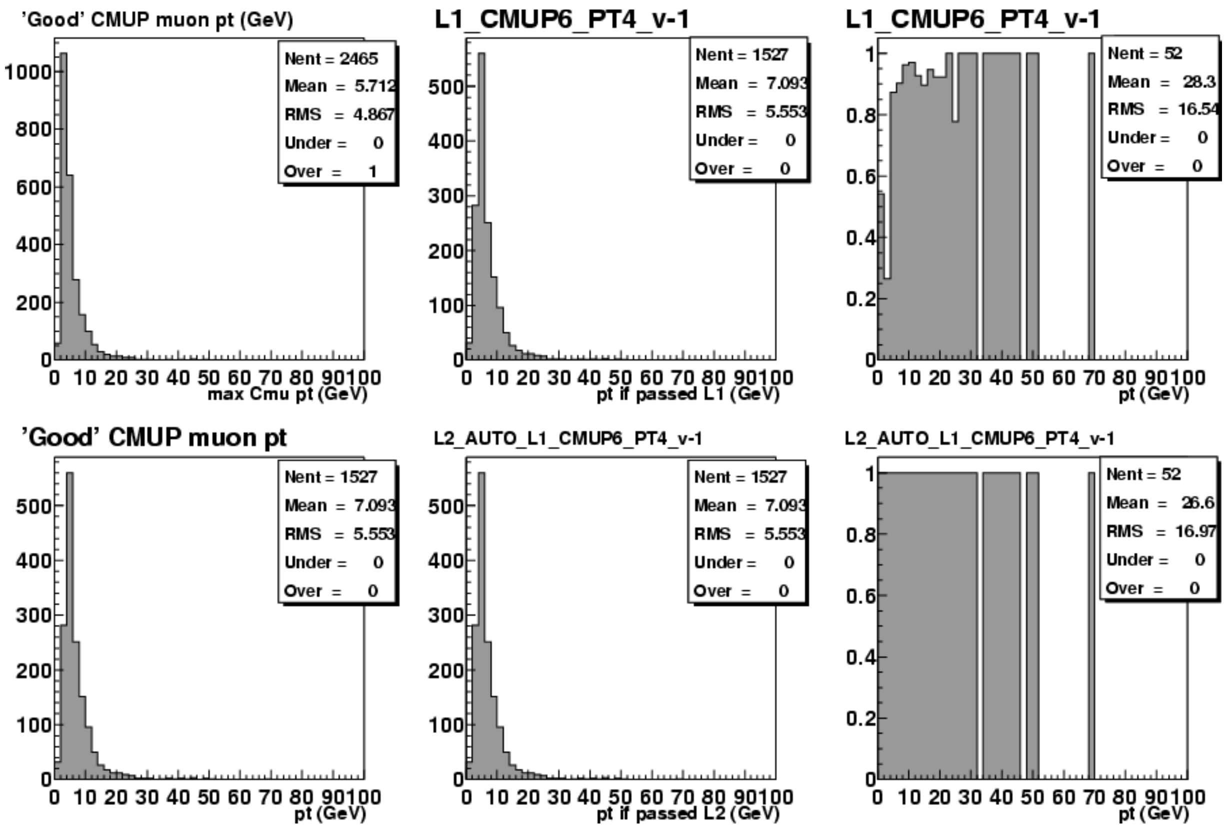
- Z'
- Quark Lepton Compositeness
- Extra Dimensions
- Techinicolor
- ....

Invariant mass distribution is the main spectrum we normally look at, but also the asymmetry distribution maybe interesting.

$\longrightarrow$ Plot

Muon Trigger Efficiency Study

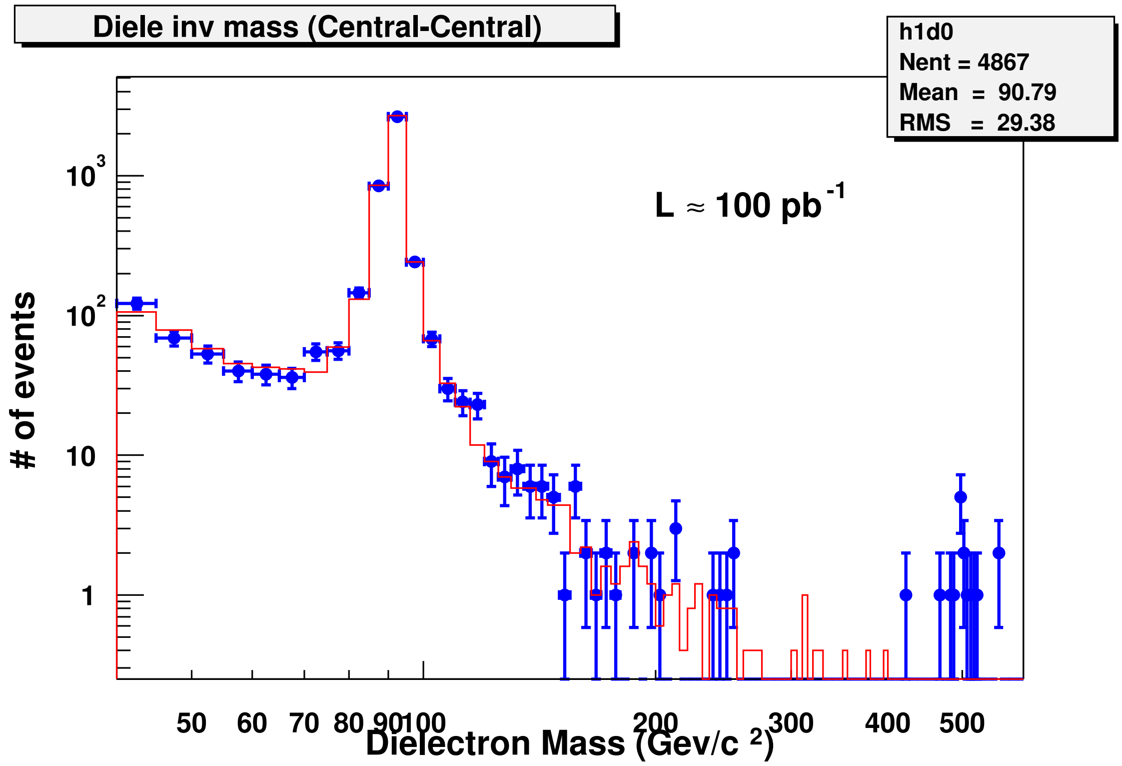
work in progress

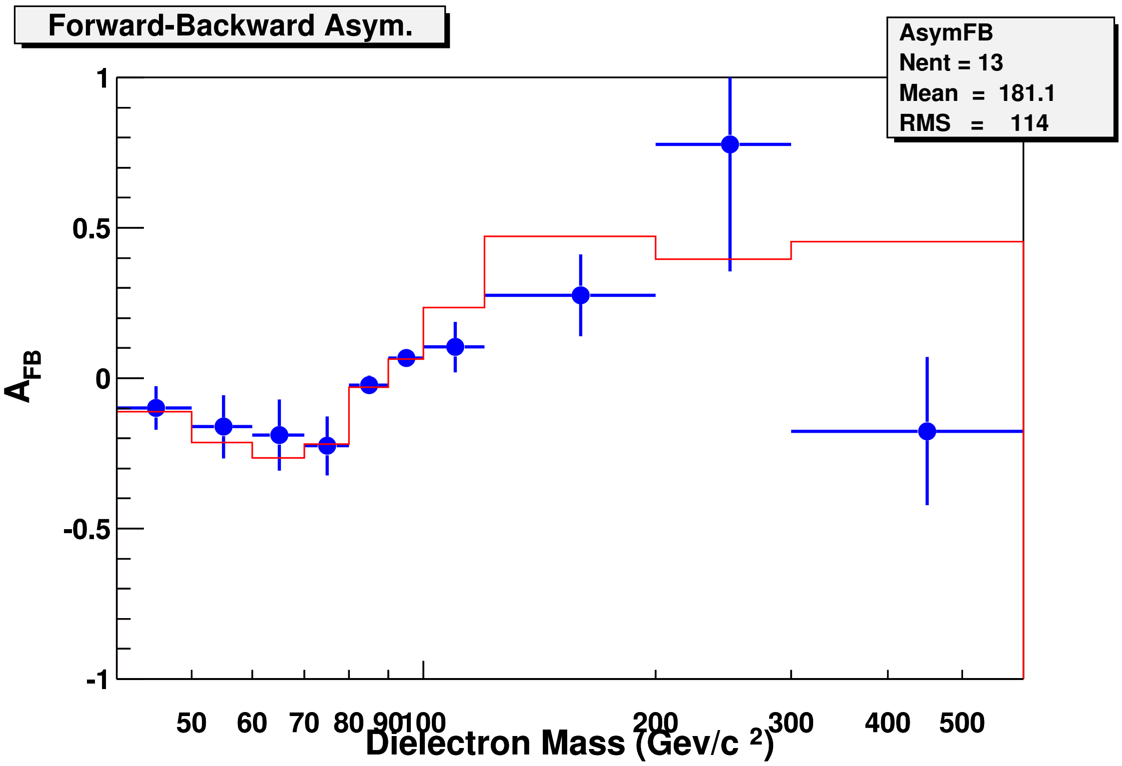


Steps:

- start with inc. electron data sample
- select events with one and only one 'good muons' in offline
- compare to muon trigger simulation result (Eric)
- compare to actual trigger bit set or not
- verify that trigger simulation is working
- use multiple muon events as well, using simulation

Inv. Mass and FB asymmetry Distributions





MC data. Blue is with 500 GeV Z' (SM couplings assumed)

Plan

- analyse data as soon as 4.5.2 reprocessed data become available.
- plan to have preliminary results to show for the summer conferences.