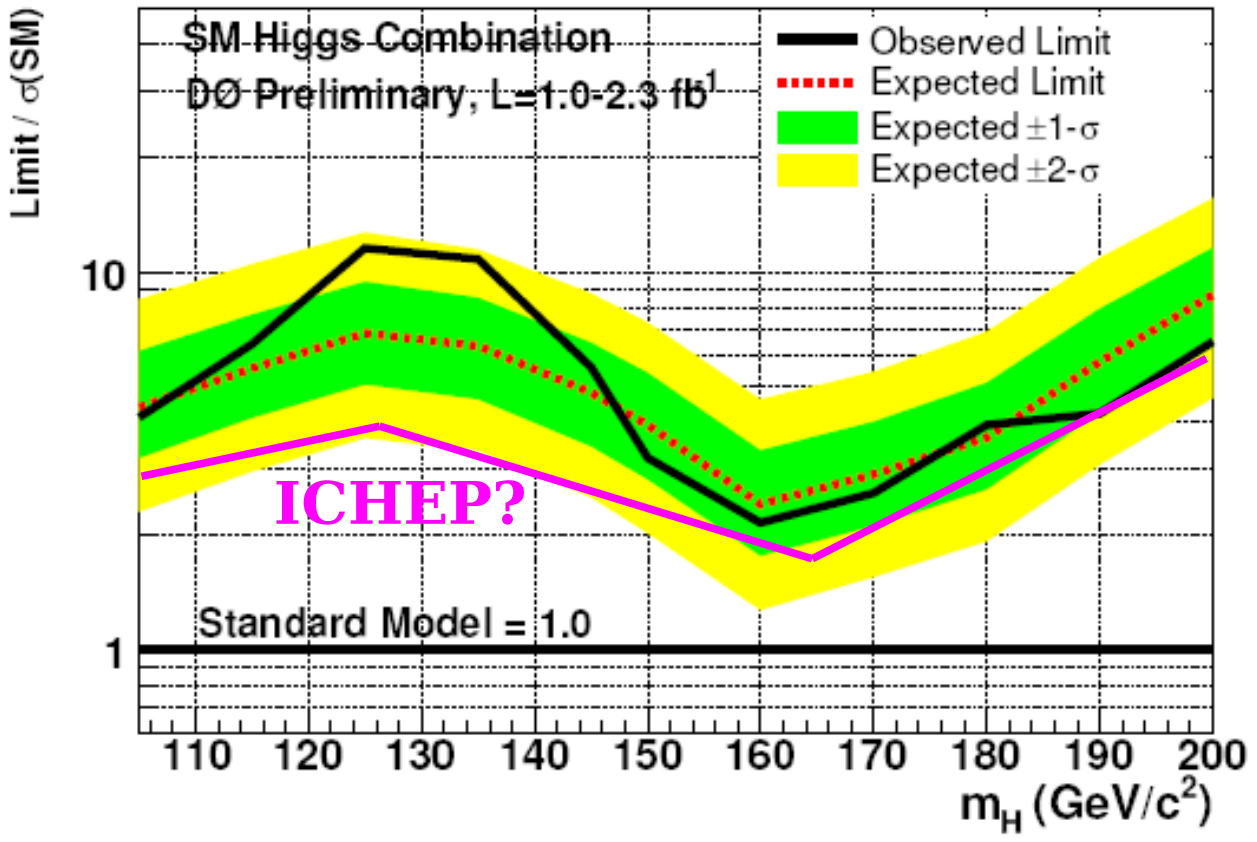
Higgs Plans for ICHEP

Gave status at conveners meeting last Friday



A lot of work is going into making this plot a reality!

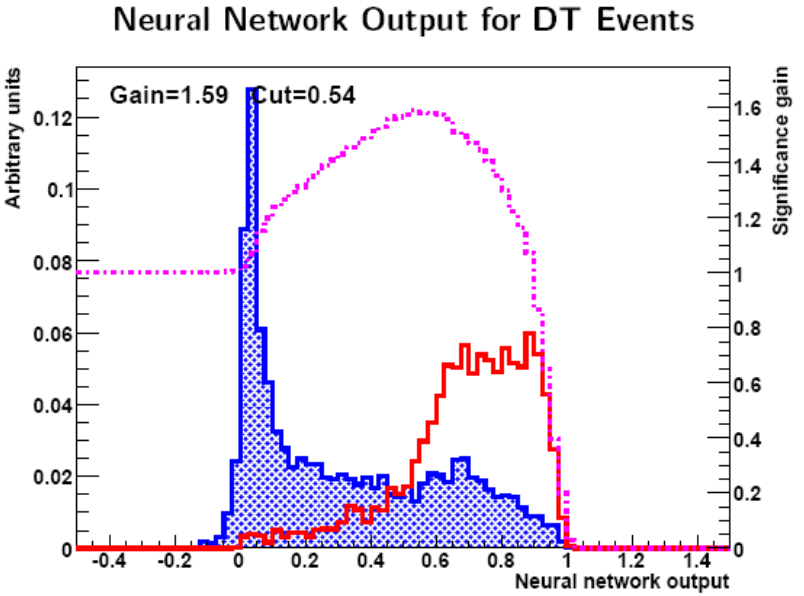
WH -> l nu b b

Unified NN and ME event selections!

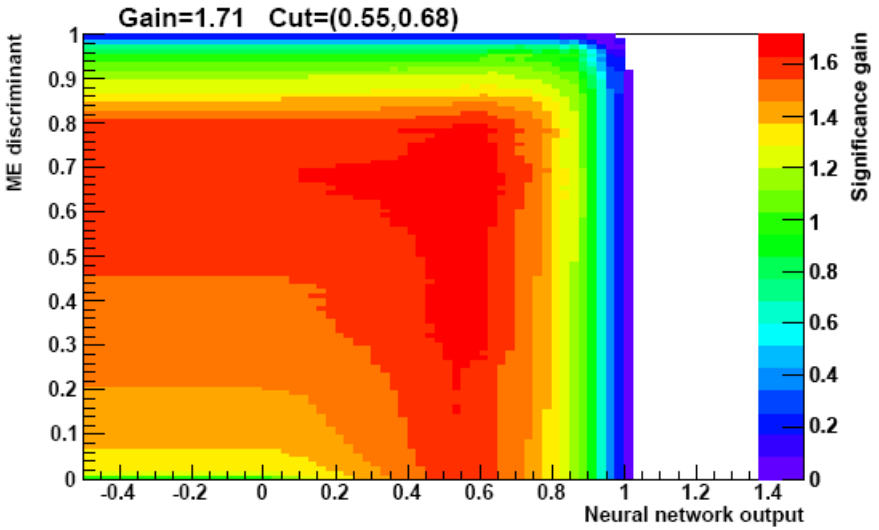
Can compare NN and ME discriminants

Combination is better than either alone!

Will now train NN with ME as input...

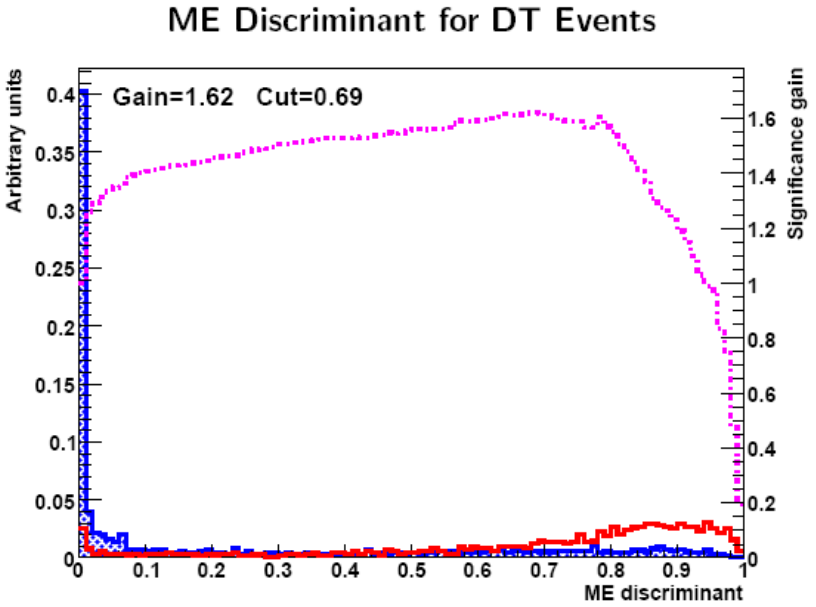


⇒ If cutting, gain in significance: 1.59



⇒ If cutting, gain in significance: 1.71

⇒Better than ME or NNet on its own



⇒ If cutting, gain in significance: 1.62

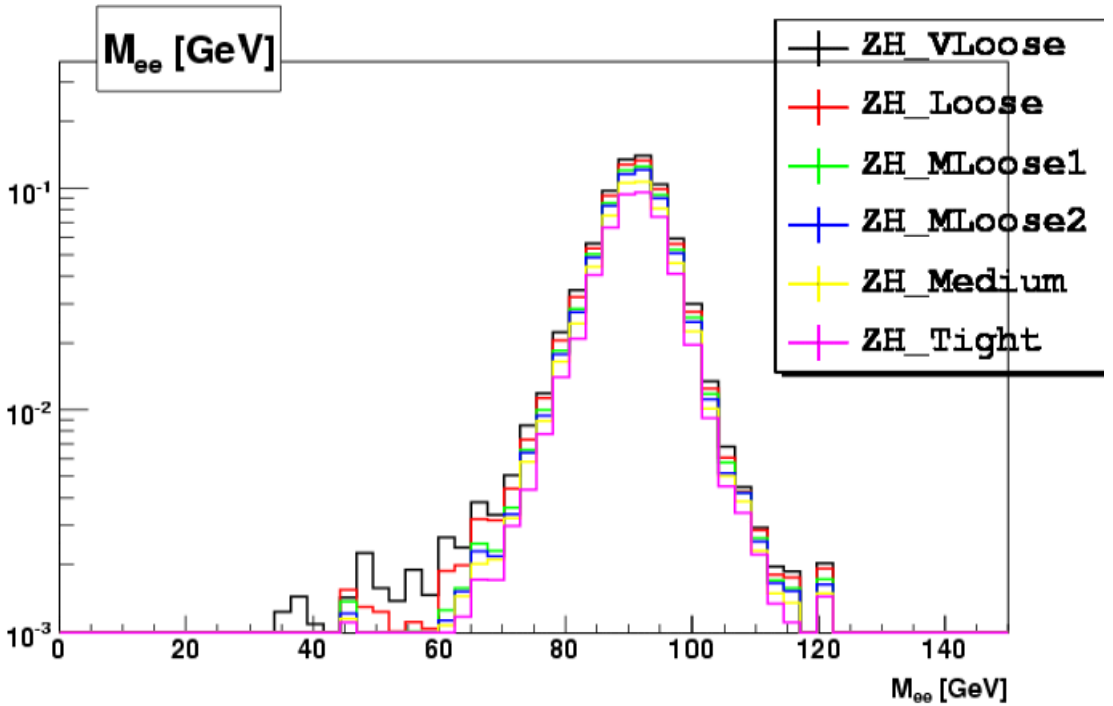
ZH-> l l b b

p17+p20 (2.3/fb) NN preliminary for HCP

p17+p20 (3/fb) with NN+ME, publication for summer - ICHEP?

- Mu+track
- Mass resolution improvements
- New p20 EM-id

σ(ZH_VLoose) : 0.1449
σ(ZH_Loose) : 0.1341
σ(ZH_MLoose1) : 0.1246
σ(ZH_MLoose2) : 0.1195
σ(ZH_Medium) : 0.1050
σ(ZH_Tight) : 0.0931

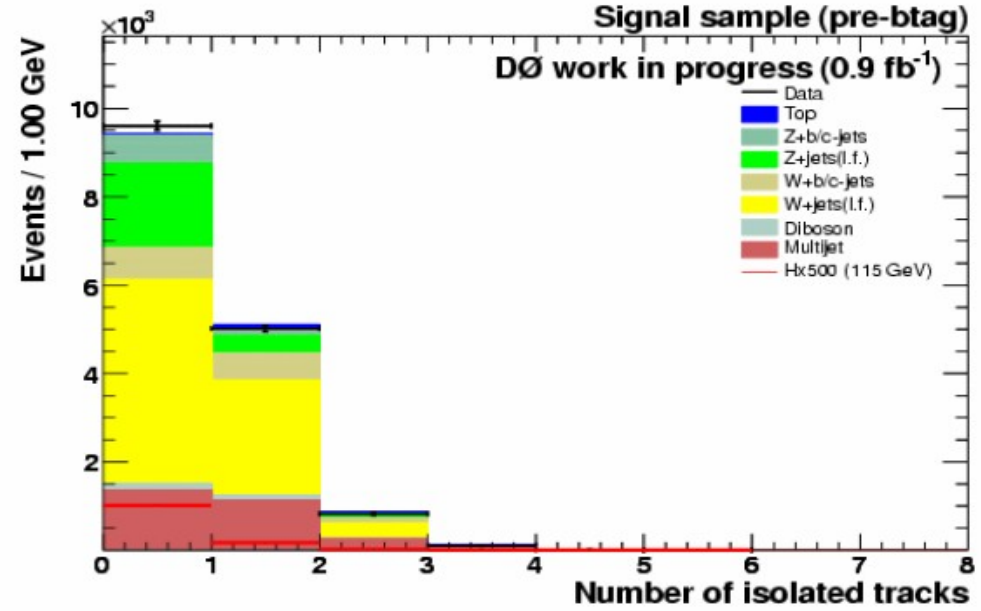


ZH -> nu nu b b

p17 PRL in EB review

Full p17+p20 (3/fb) dataset, publication quality for summer

- Better QCD understanding / looser cuts
- Single-tag channel
- Muon JES / Mass resolution
- Separate ZH / WH using isolated tracks

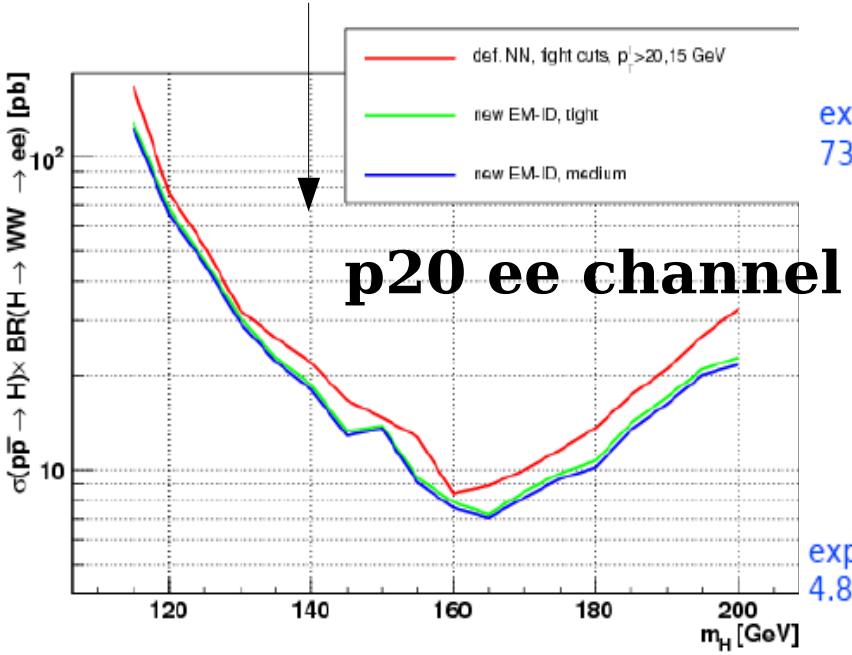


H->WW-> l nu l nu

<u>The Big One – we may be sensitive to some Higgs masses!</u> (w/ CDF)

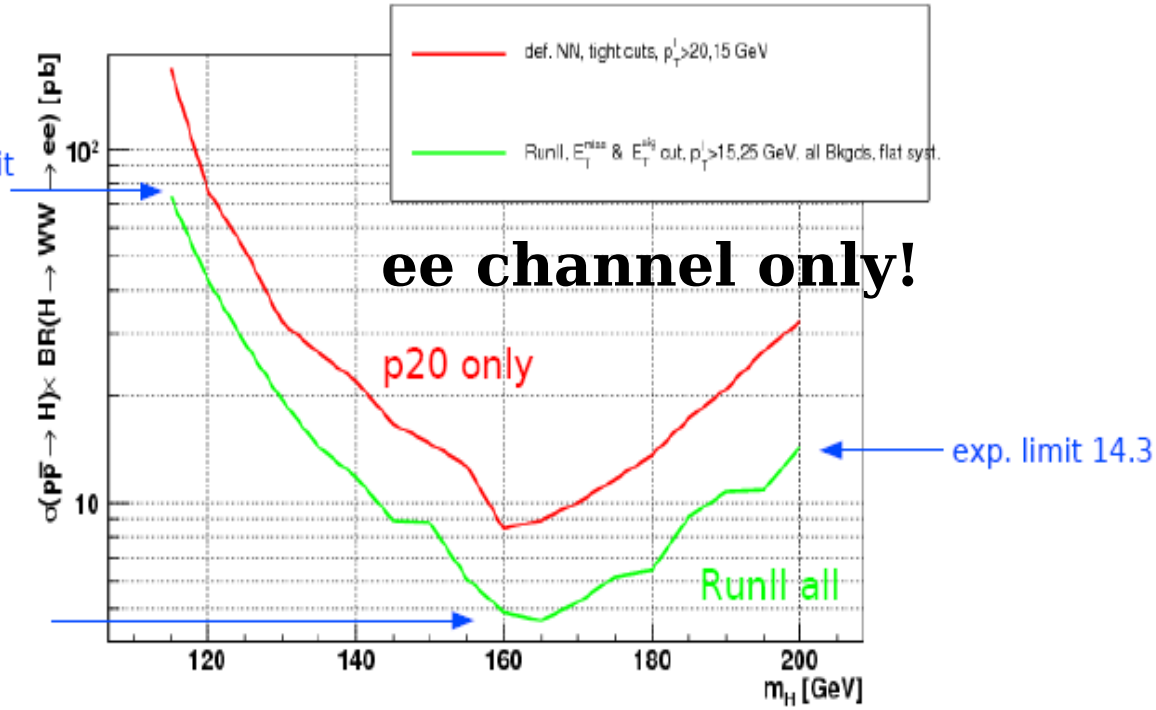
p17+p20 NN+ME full dataset (3/fb)

- Greatly improved NN (based on mumu Moriond work)
- Looser cuts
- W+j/gamma ME
- Systematics (MC@NLO/Sherpa, better W+jets understanding, ...)
  - shape systematics for everything)
  - D0/CDF h->WW systematics meetings (May 19th ?)
- Include W/Z+H-> VVV -> l+l- jj (and VBF), optimize 2j bin (Mjj, ...)
- New p20 EM-id



exp. limit 4.8/4.6 !

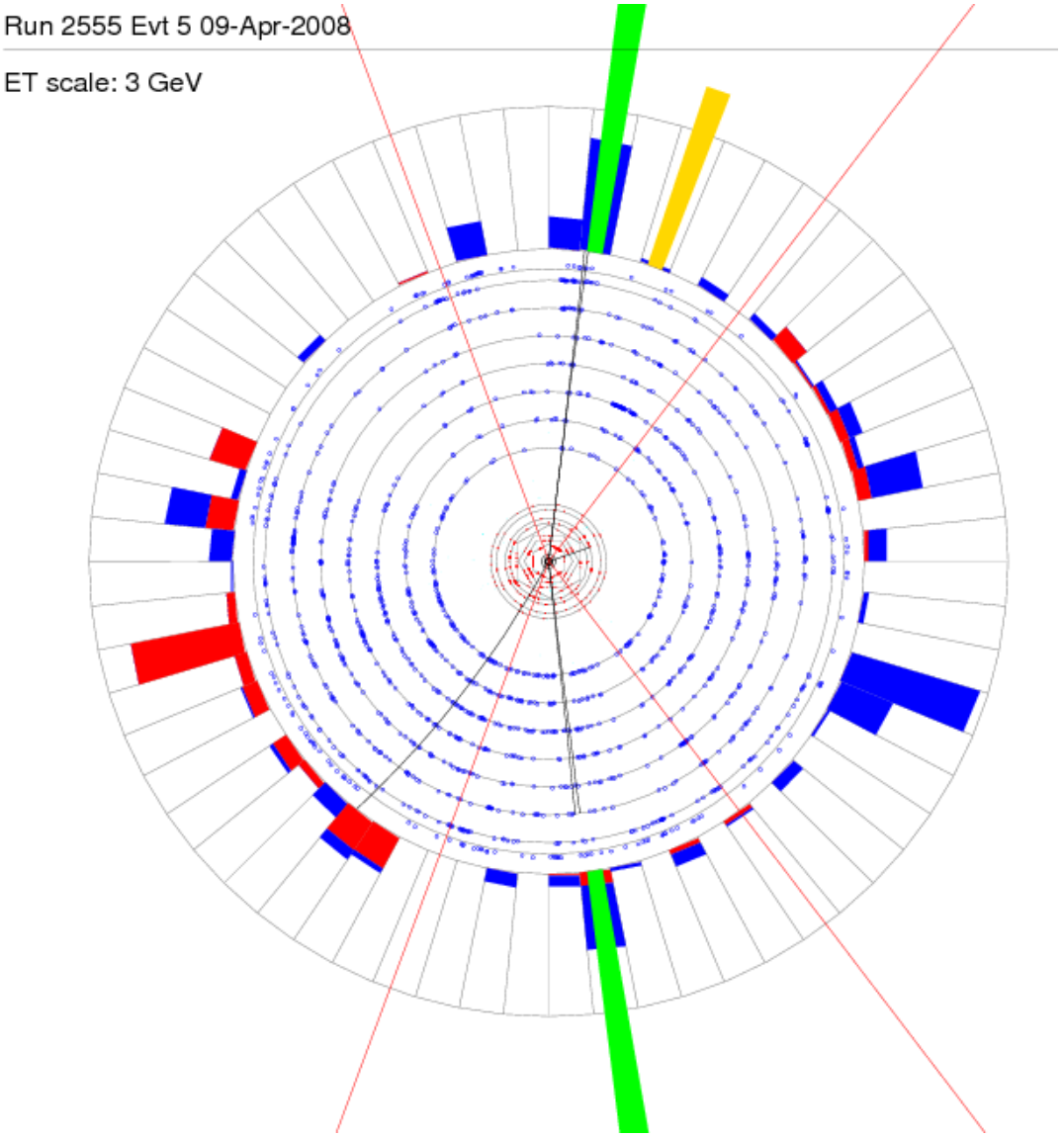
exp. Limit 73.4

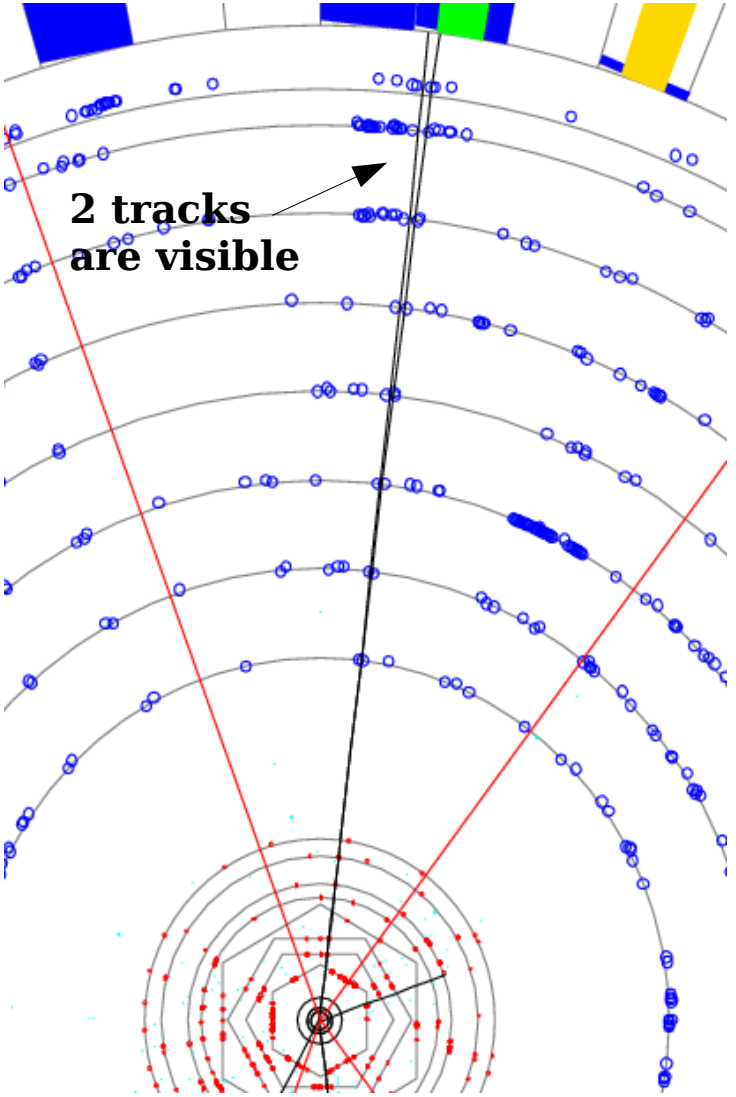


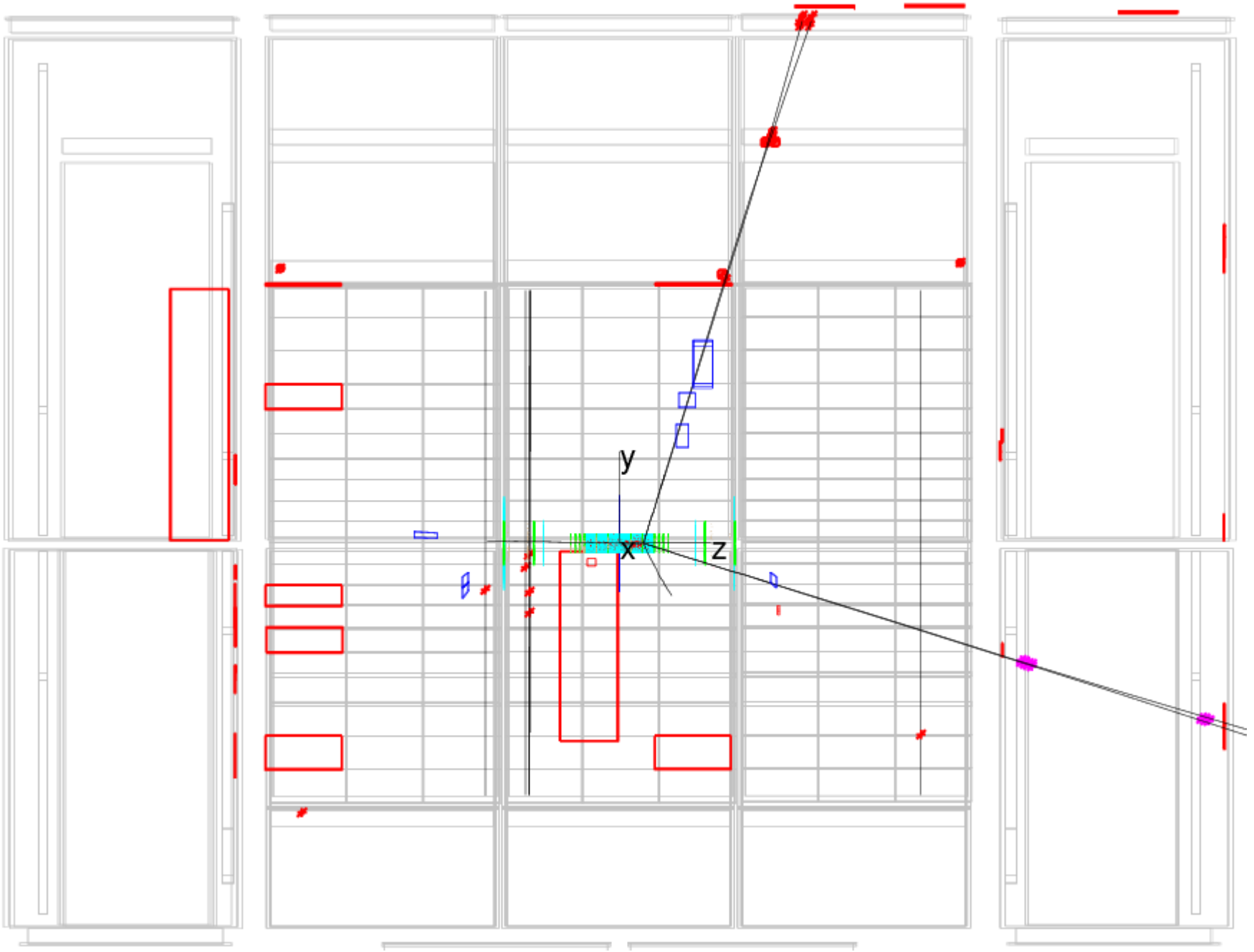
exp. limit 14.3

h->aa->4mu

If M_a is just above $2M_\mu$ the muons will be extremely collinear !!!






y
x
z

h->aa->4mu

A very distinct signature

Would have been overlooked because:
- often only one muon is reconstructed per collinear muon pair
- muon fails standard track isolation

Analysis must look for muons with a collinear partner track
(and still good calorimeter isolation)

Two pairs in the same event would be a smoking gun

Some theorists have thought about it:
http://arxiv.org/abs/hep-ph/0611270v3

No experimental search that I know of

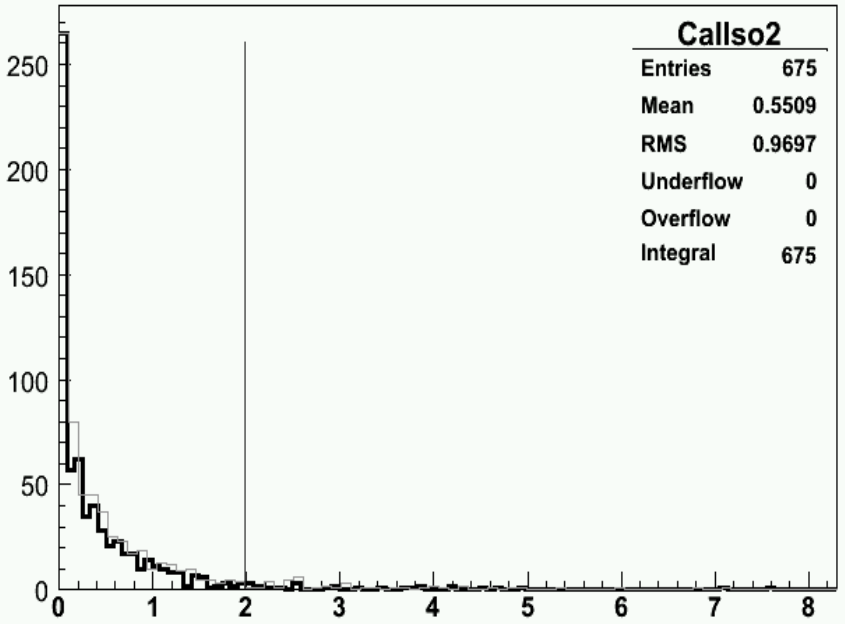
h->aa->4mu Selections

Start with 1210 MC events (m_h=100 GeV)

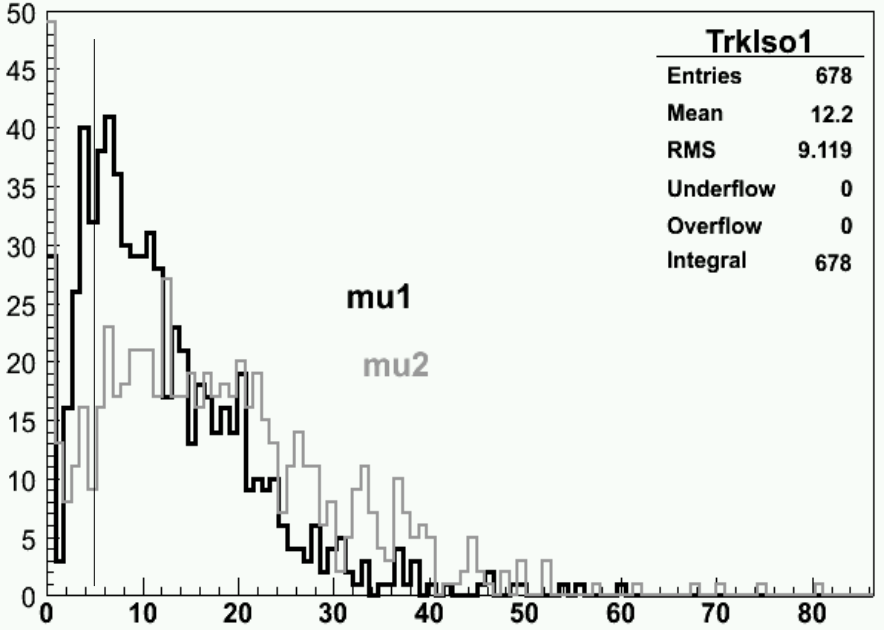
680 have 2 muons, pT>10 GeV, $M_{\mu\mu}$ >10 GeV

(no opposite-sign requirement!)

Cal Isoation < 2 GeV



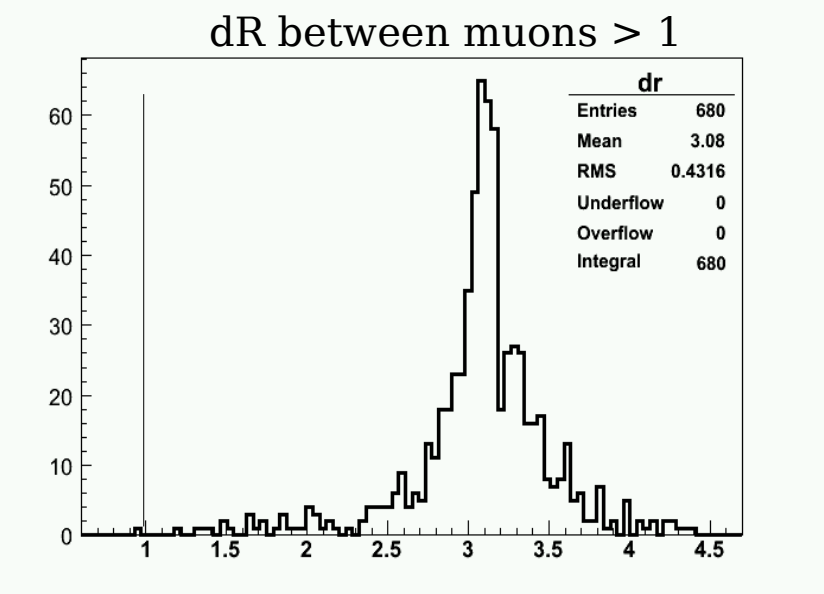
Track Isolation > 5 GeV

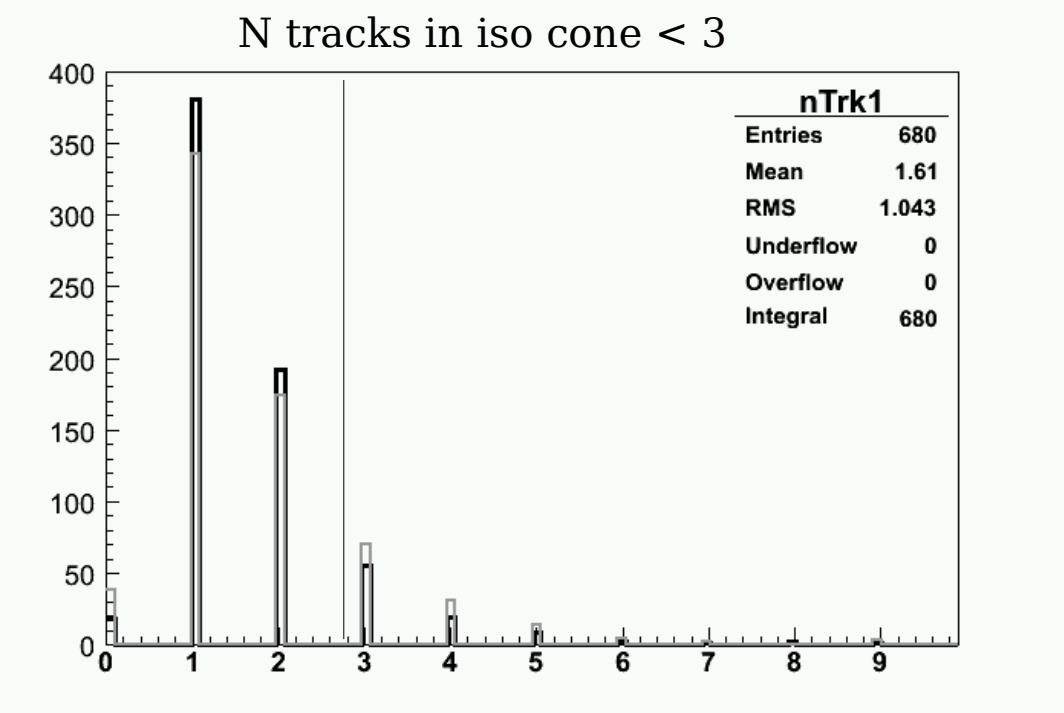


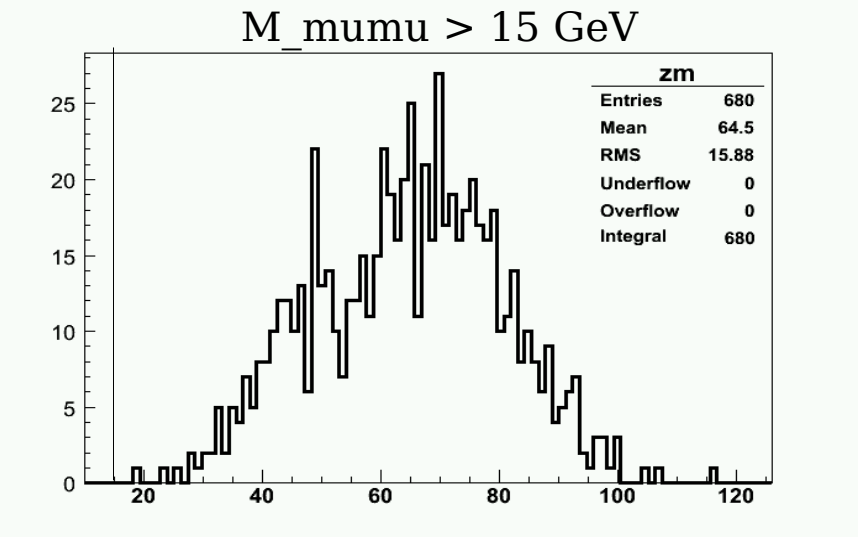
h->aa->4mu Selections

298/1210 events pass all selections
25% acceptance

sigma(h)=0.5-2pb (120-80 GeV)
~125-500 events expected in 1/fb







Let's look at the data!

h->aa->4mu in Data

p17 2MuHighPt skim, 1.1/fb

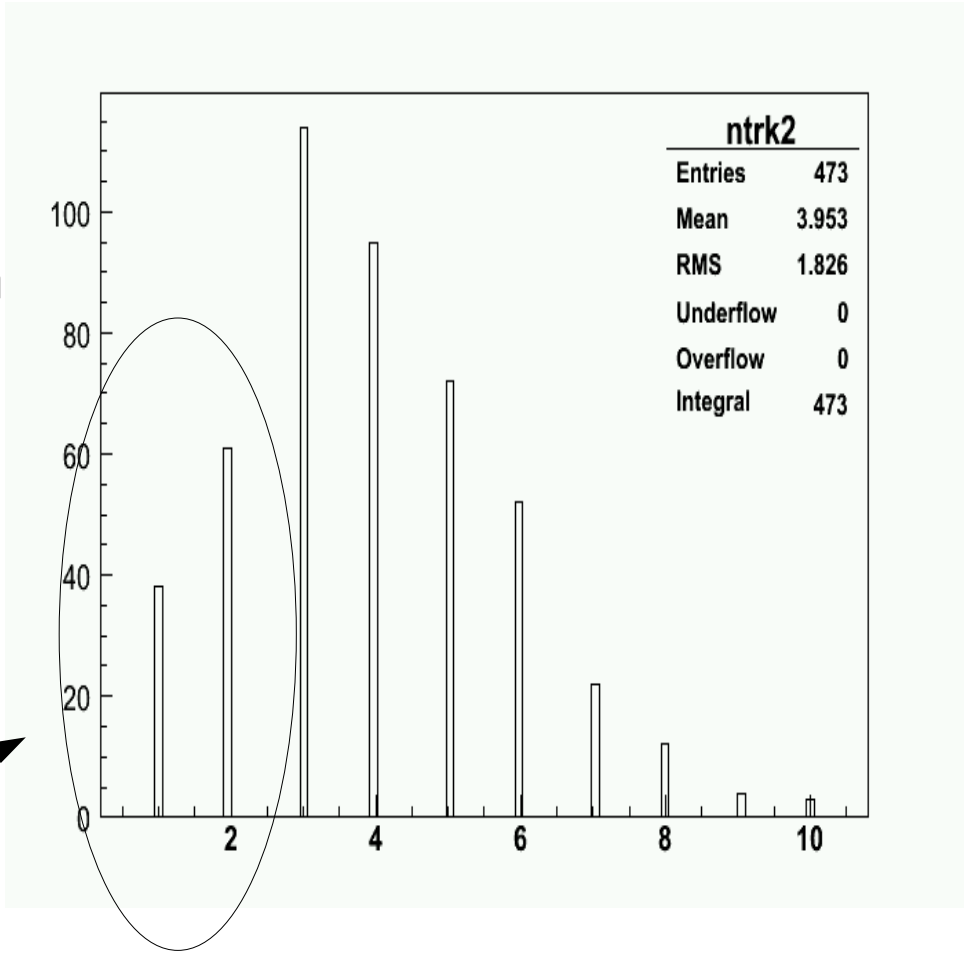
6 events pass all selections!

But 0 with just 1 (extra) track in each cone (10% acceptance for that)

Look at QCD sample: reverse cal isolation cut on one side

~20-25% of muon jets with cal iso < 2 and track iso > 5 have <3 tracks

(~10% have just one track)



h->aa->4mu QCD

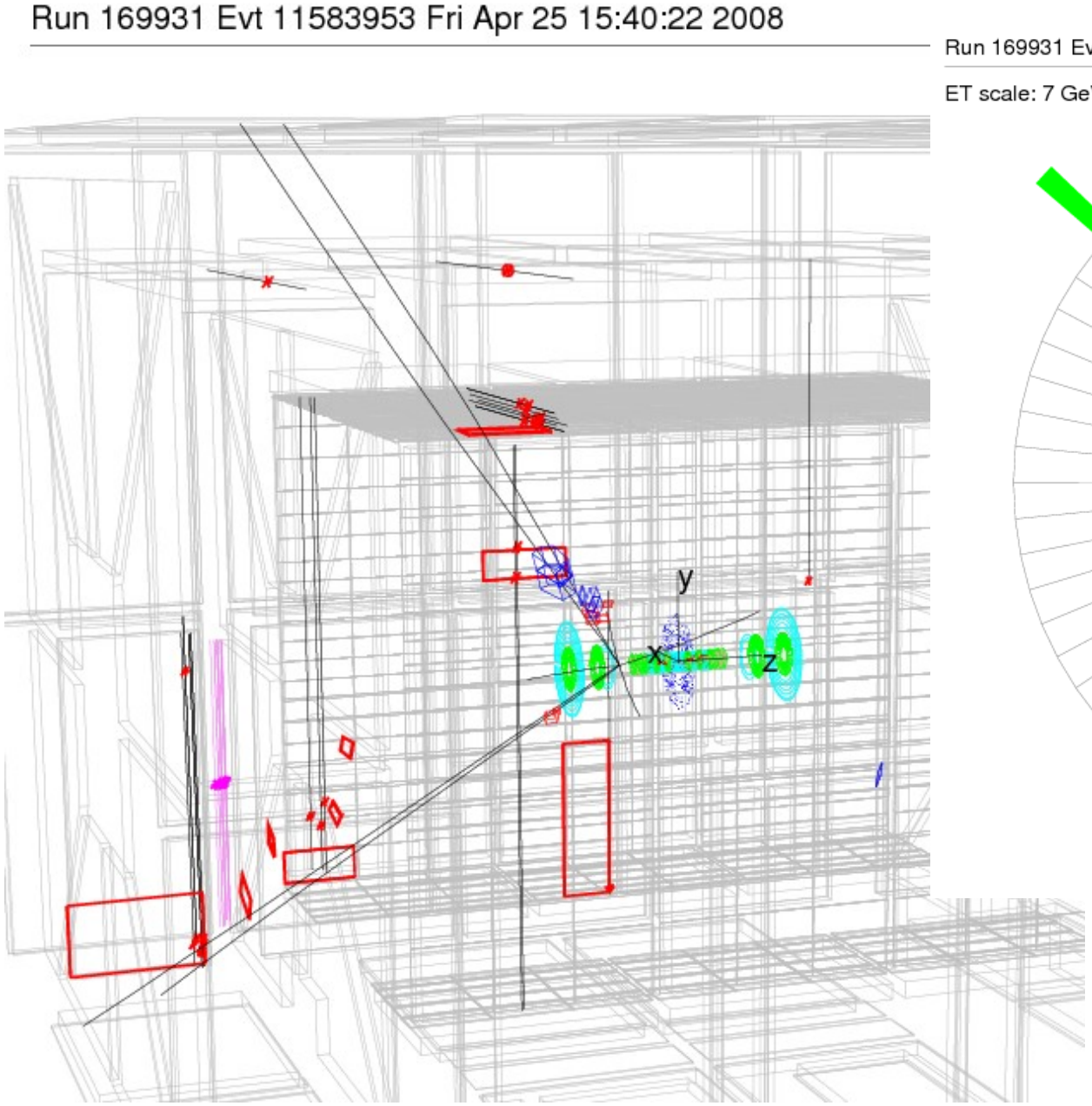
92 events pass all cuts except the Ntrk requirements

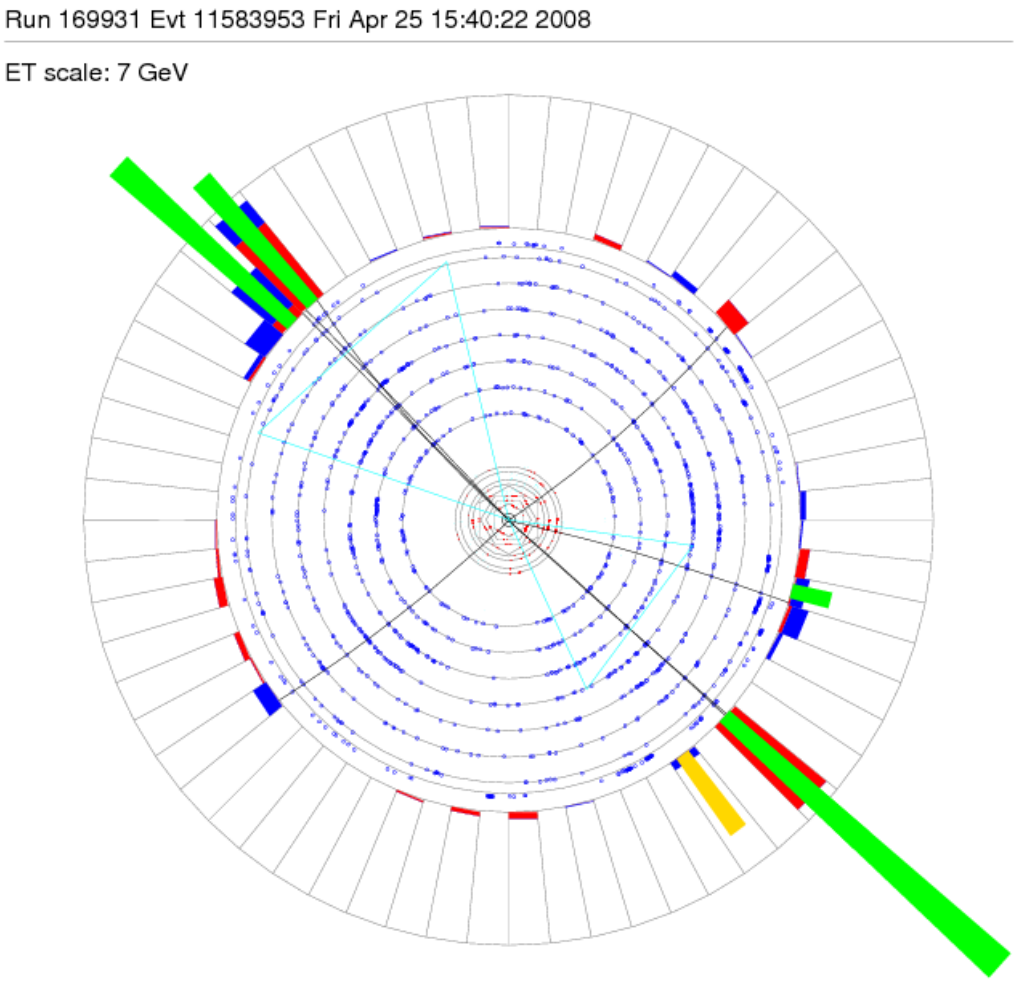
Expect 92*.25=23 events with leading side with <3 tracks,
observe 28

Expect 23*.20=4.6 events with both sides with <3 tracks,
observe 6

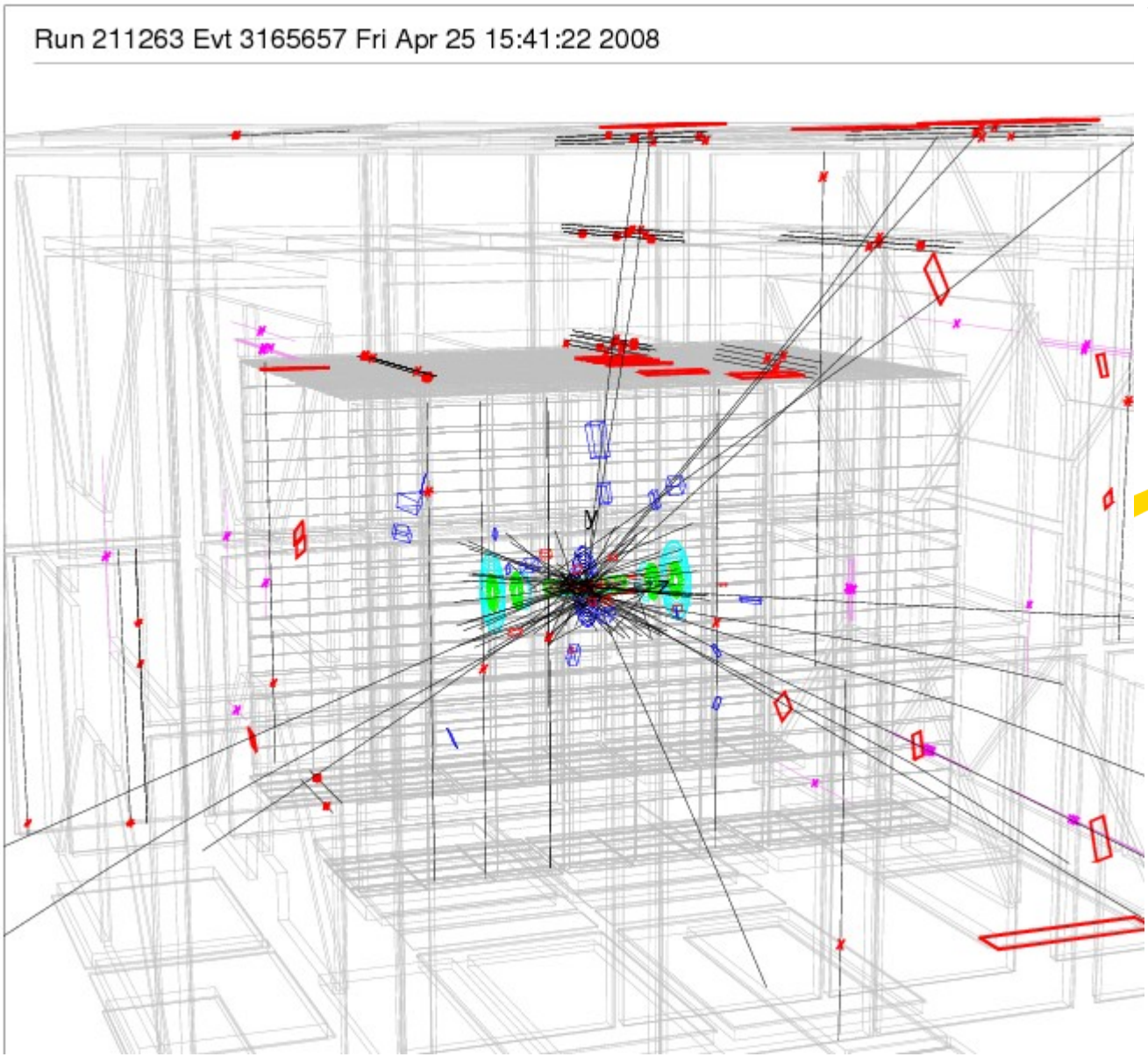
Expect 92*.1*.1=0.9 events with both sides with 1 (extra) track,
observe 0

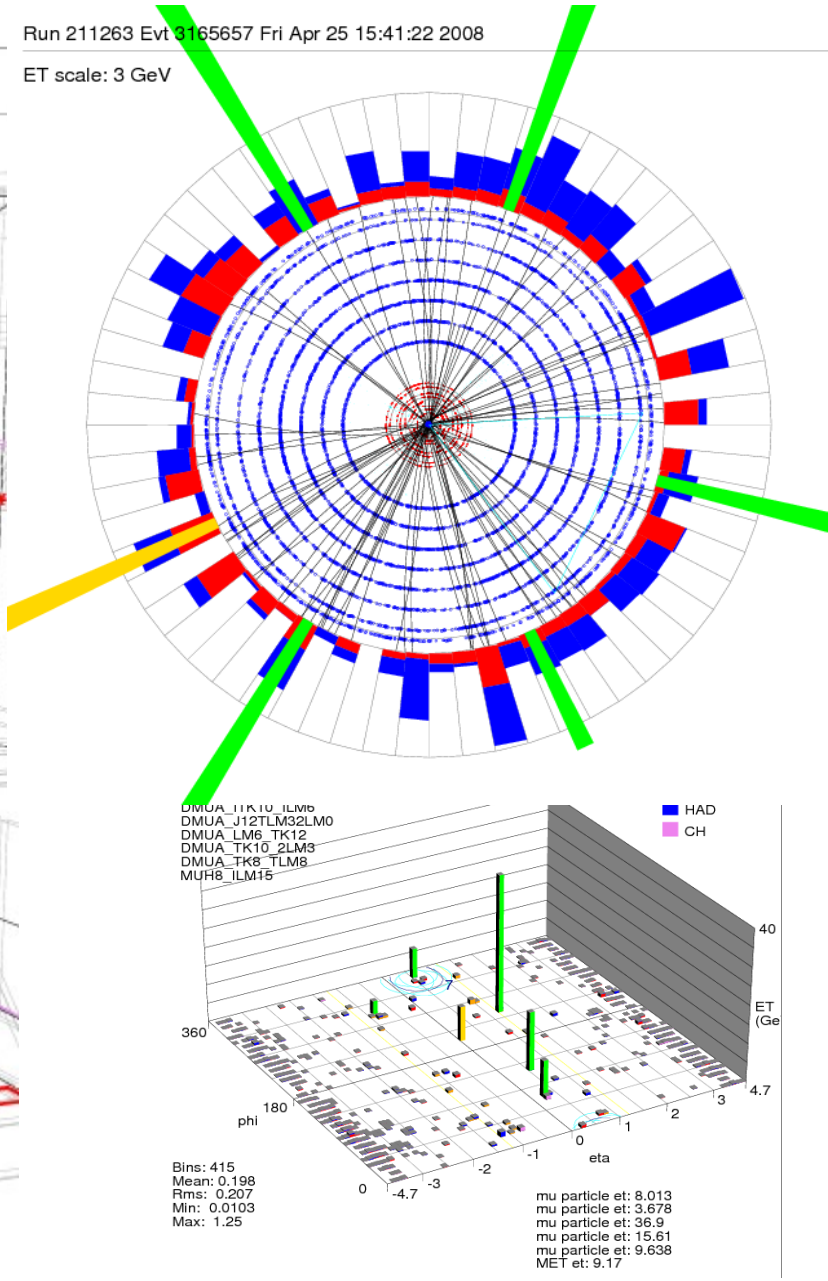
Event Display 1



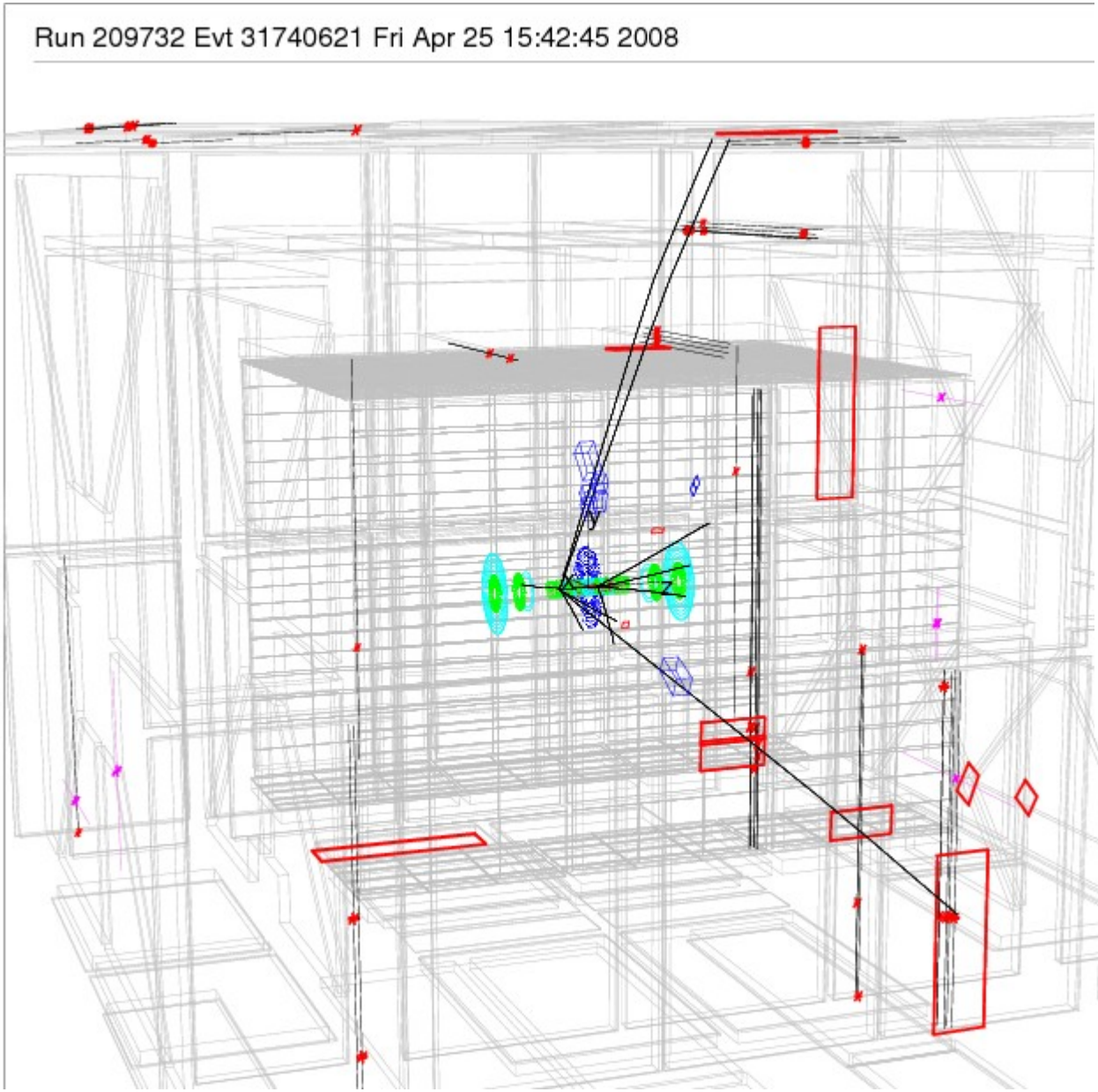


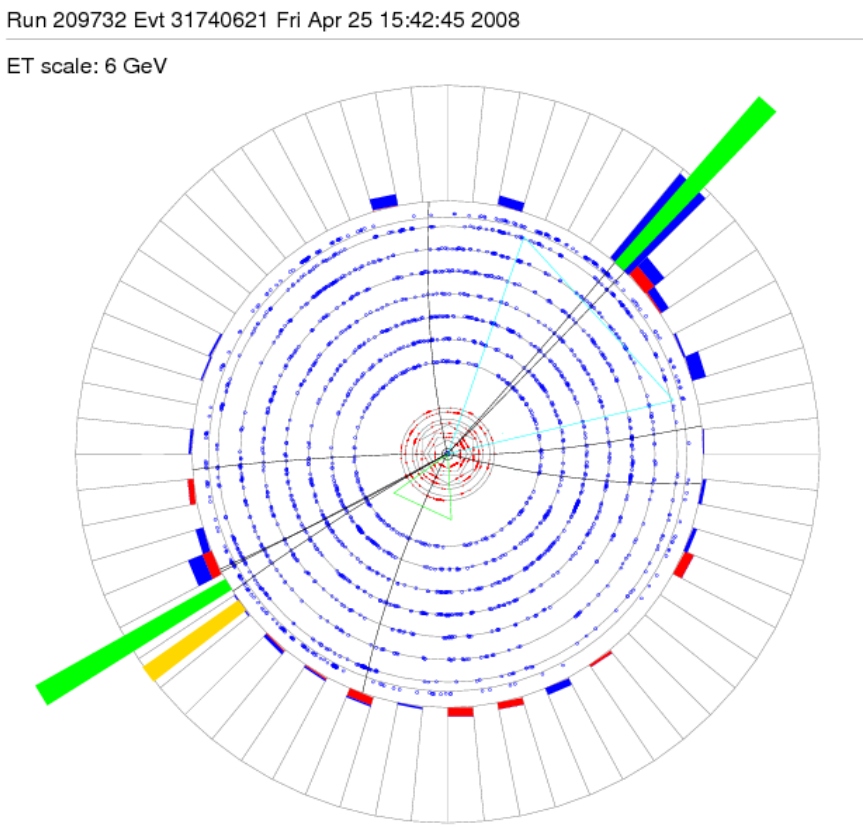
Event Display 2



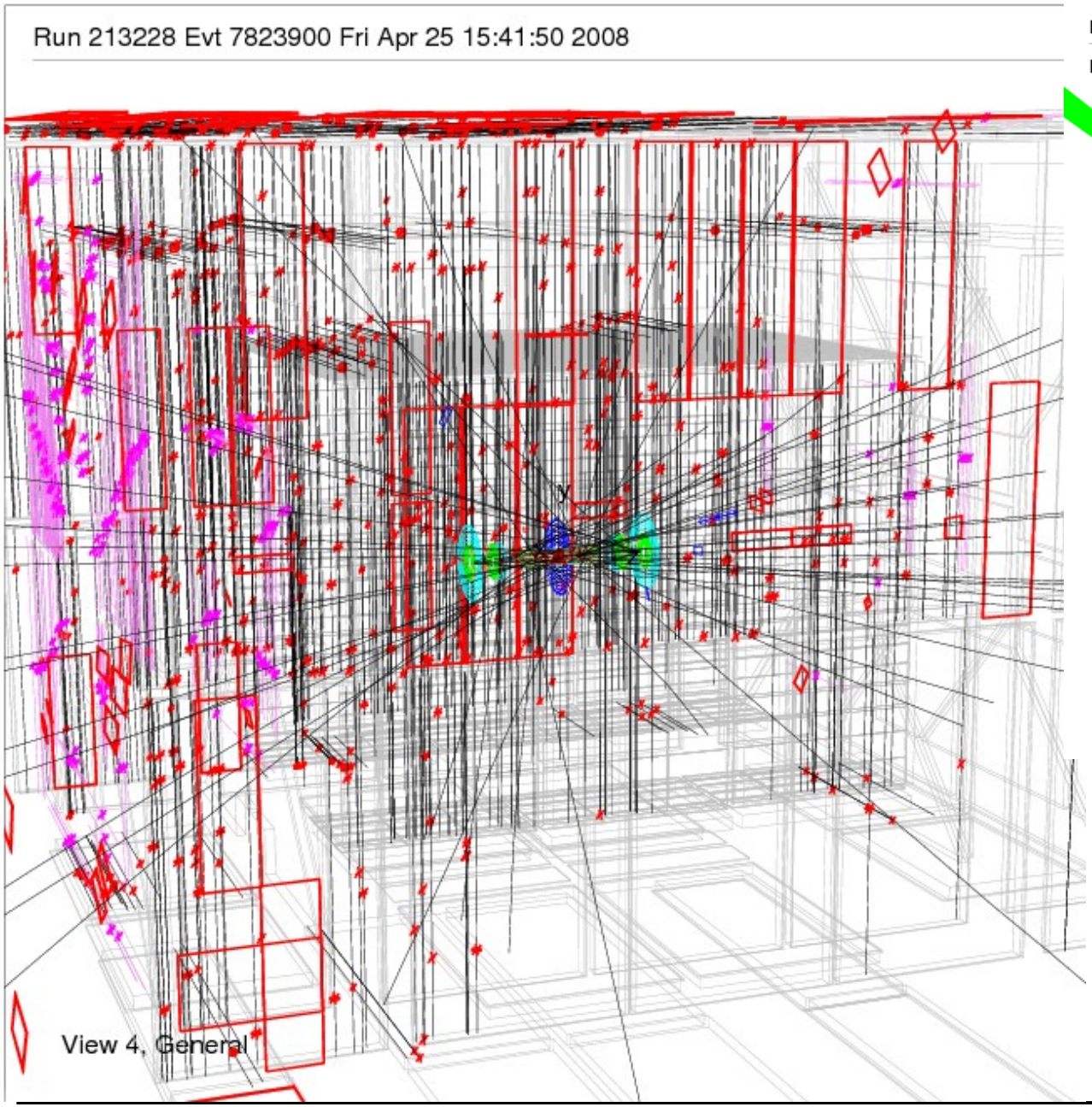


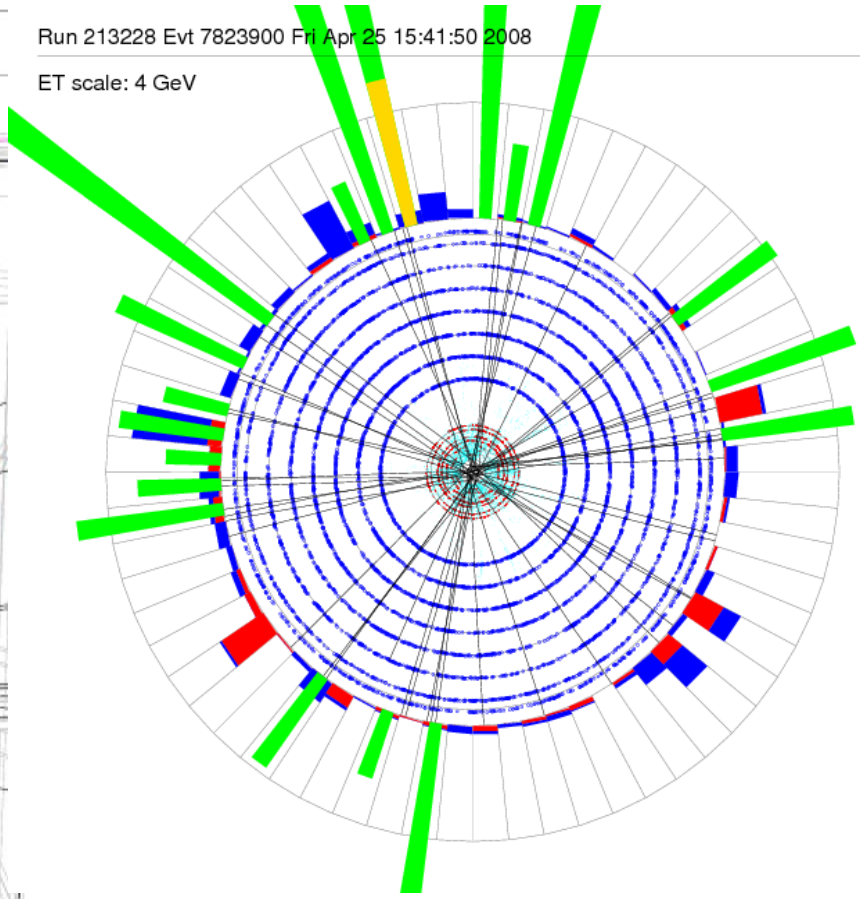
Event Display 3



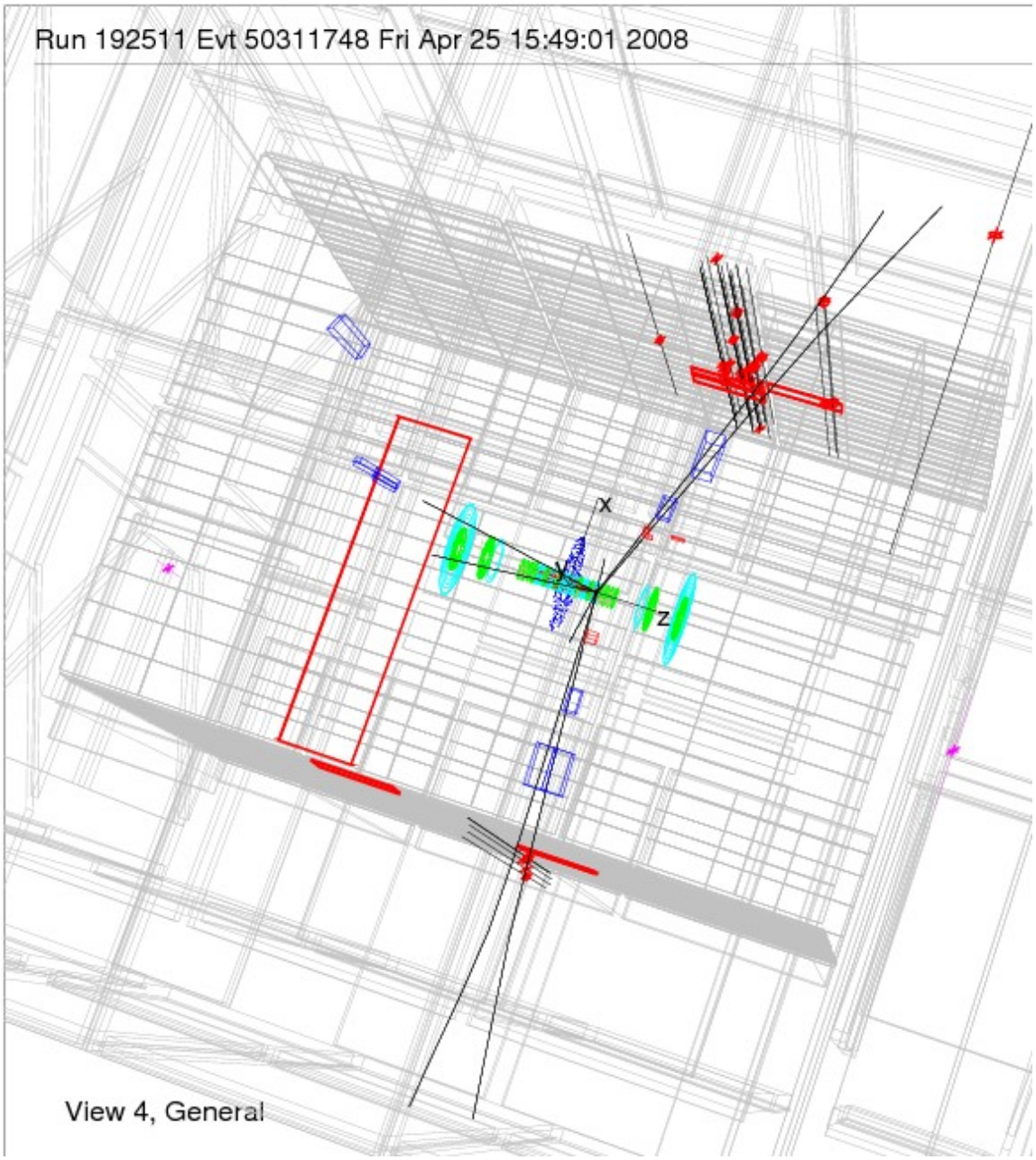


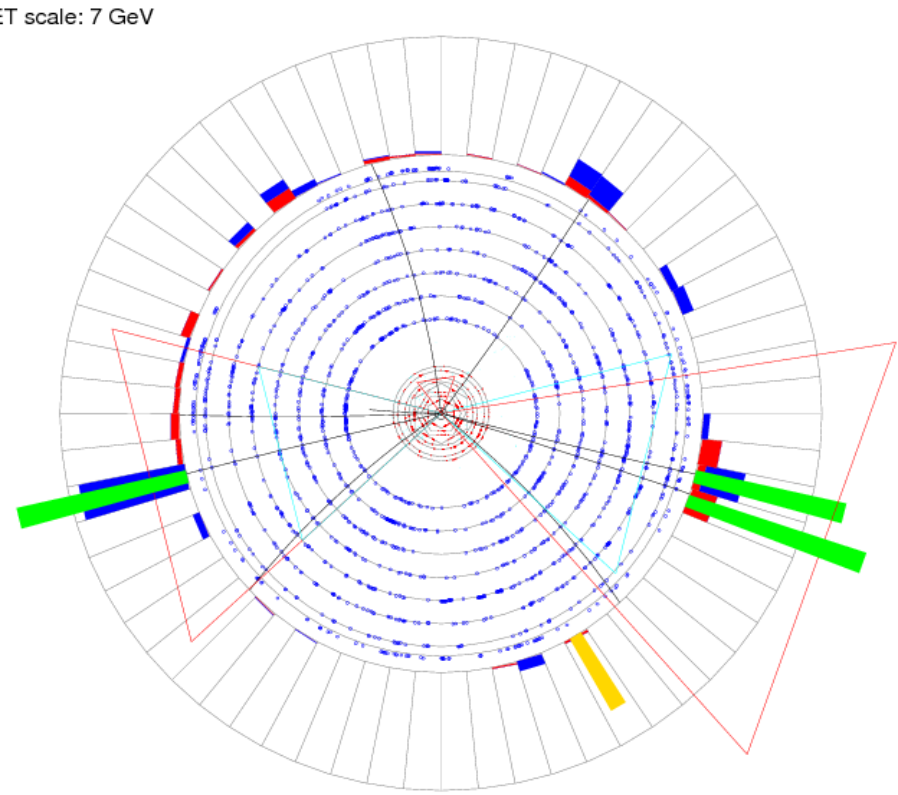
Event Display 4



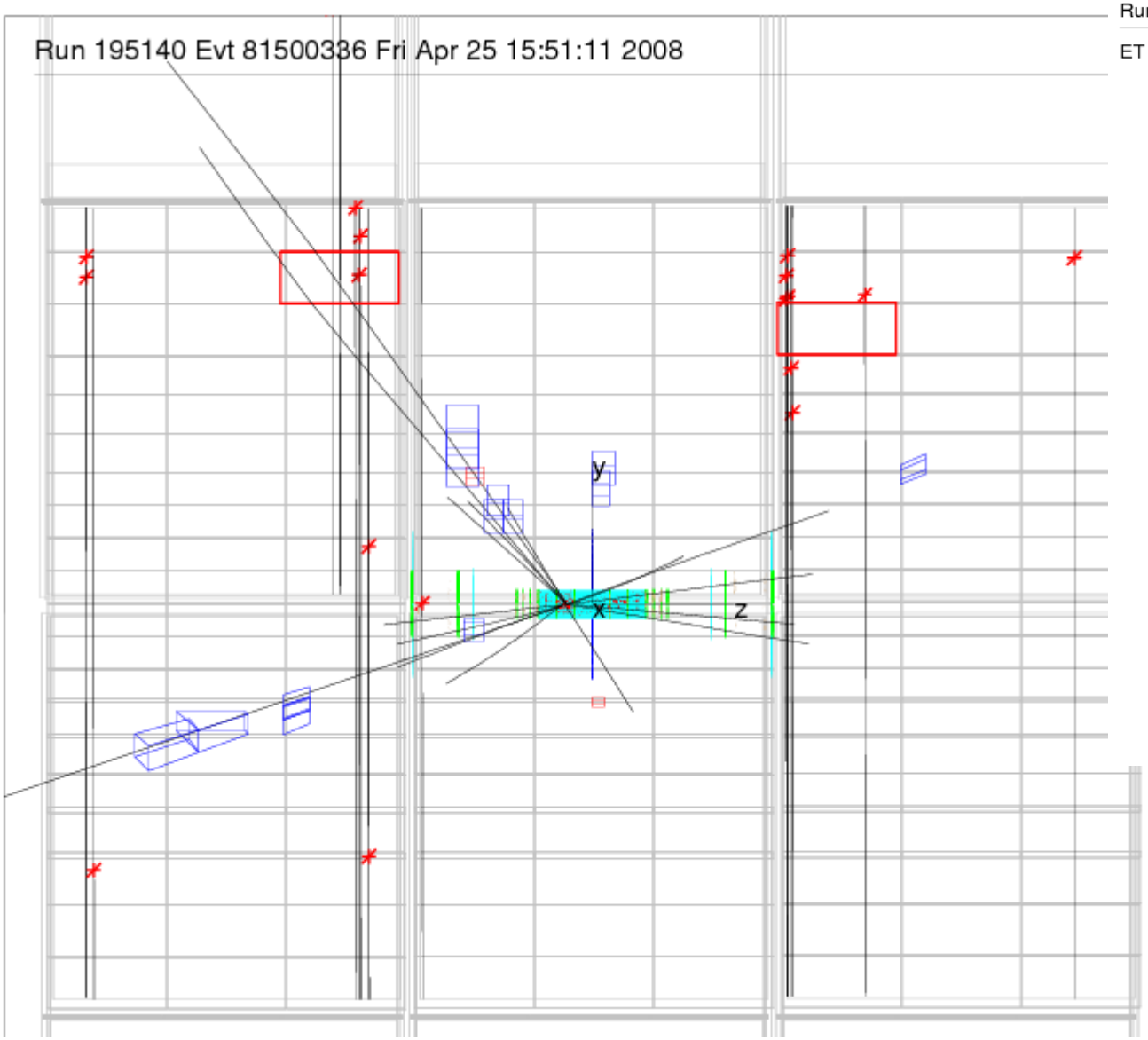


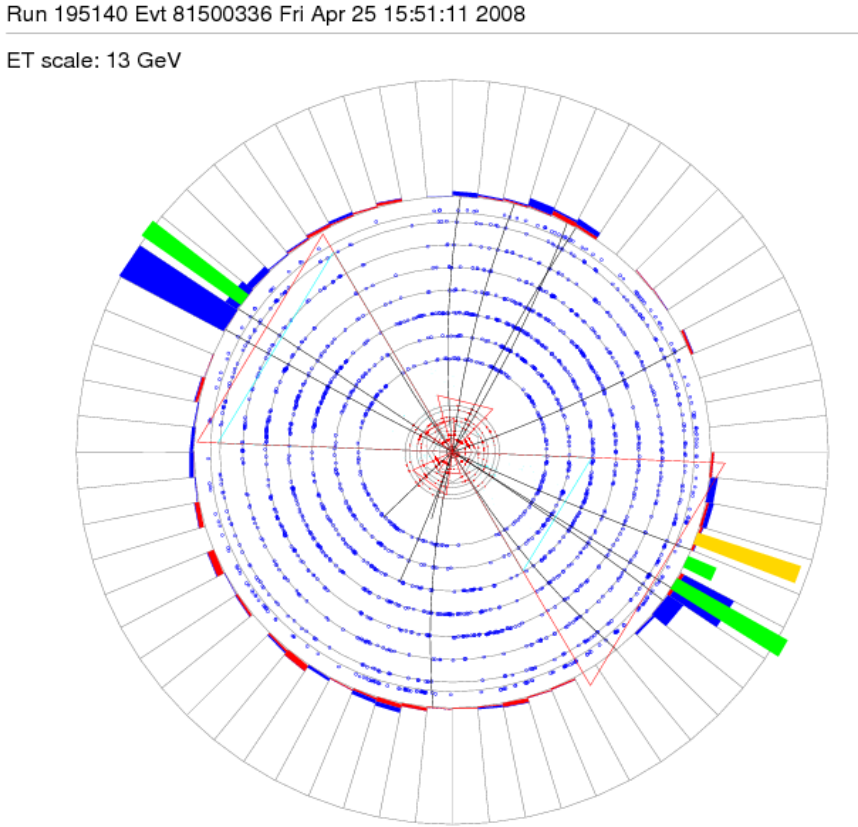
Event Display 5





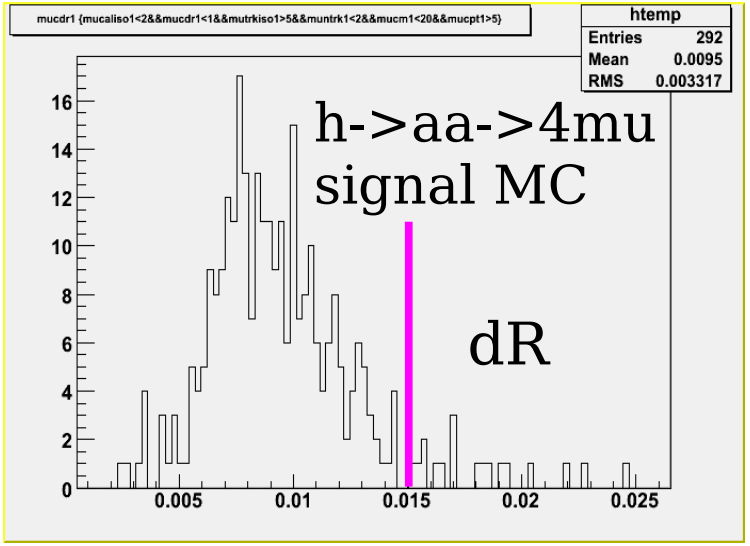
Event Display 6

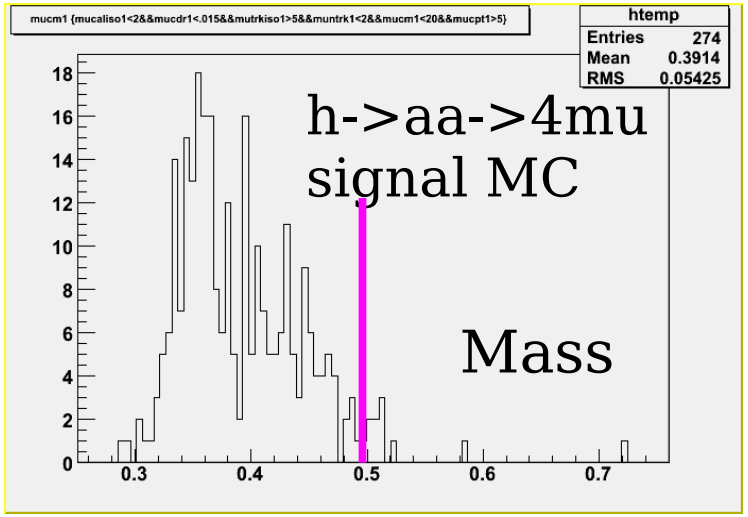




Additional Selections

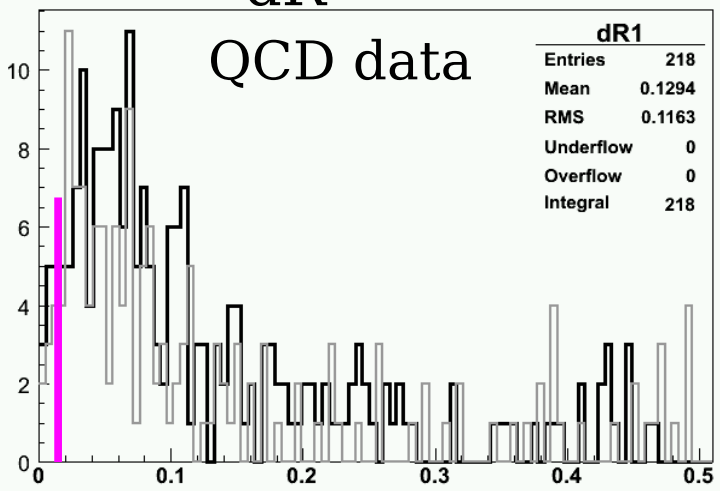
Can also look at the mass and dR of (mu, nearby high-pt track)



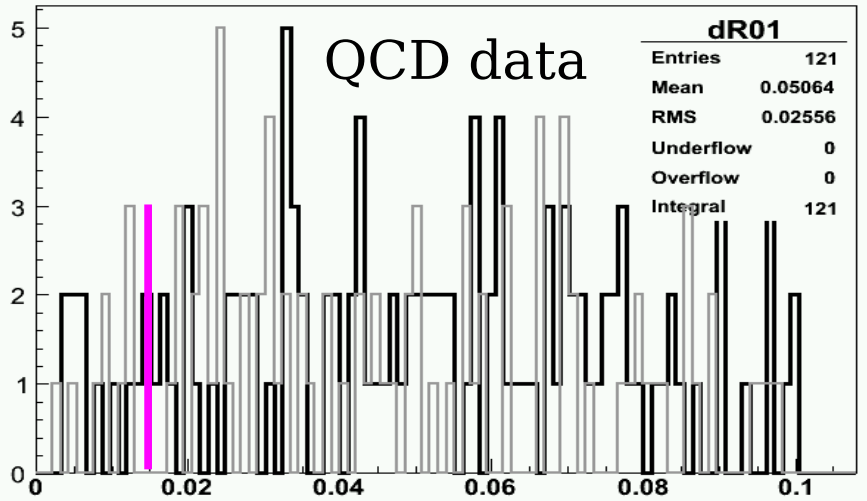


Additional Selections

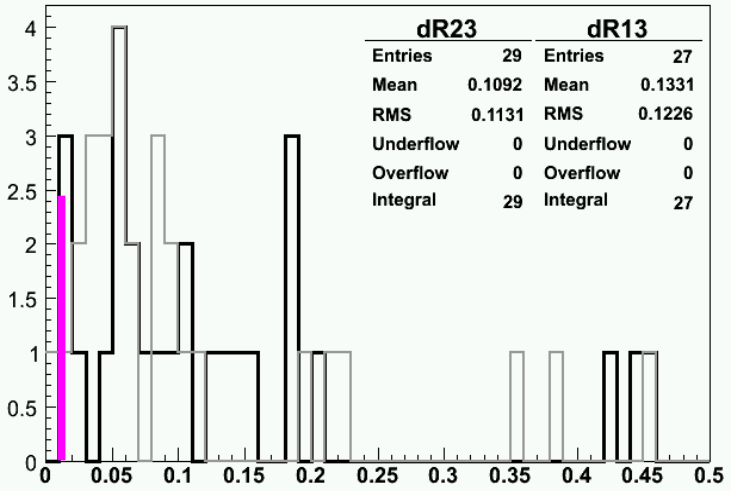
dR

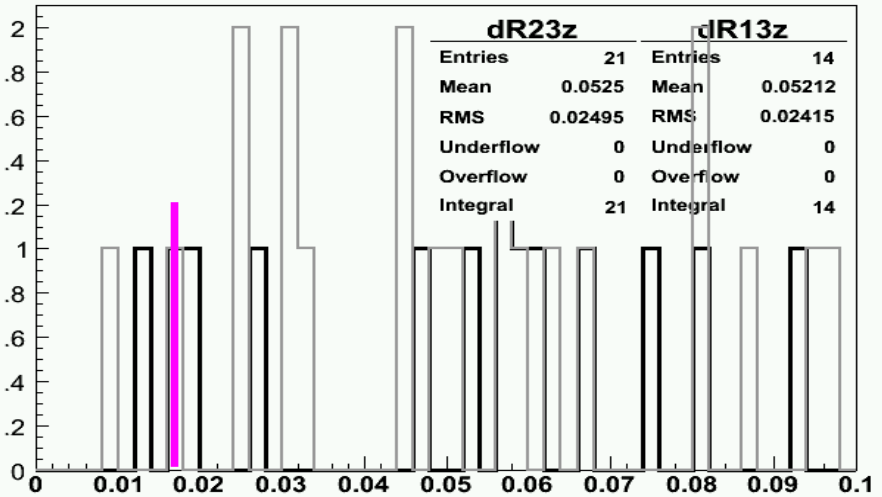


dR - ZOOM



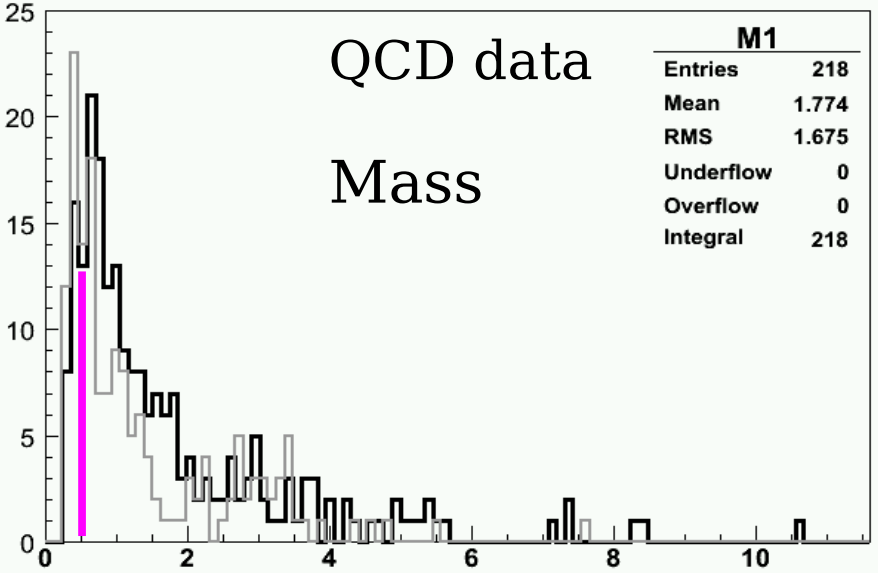
ntrk on other side <30



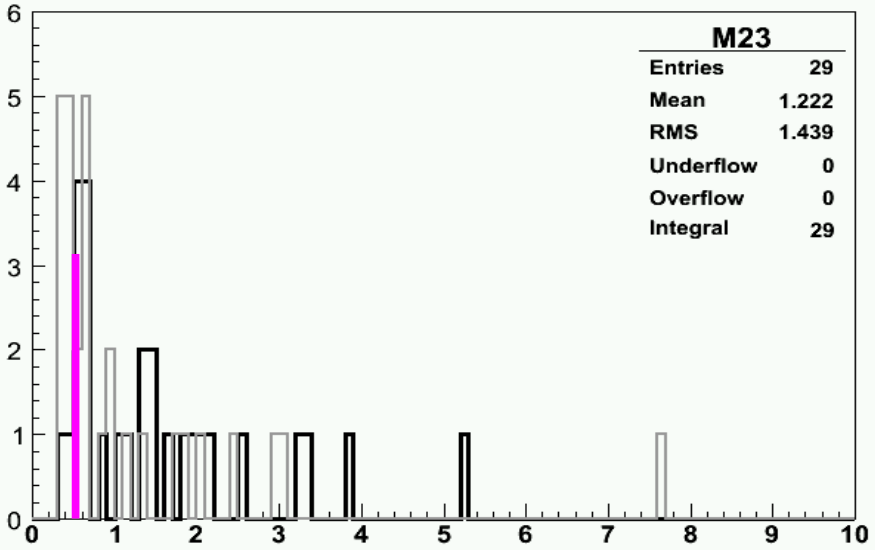


ntrk on other side <3

Additional Selections



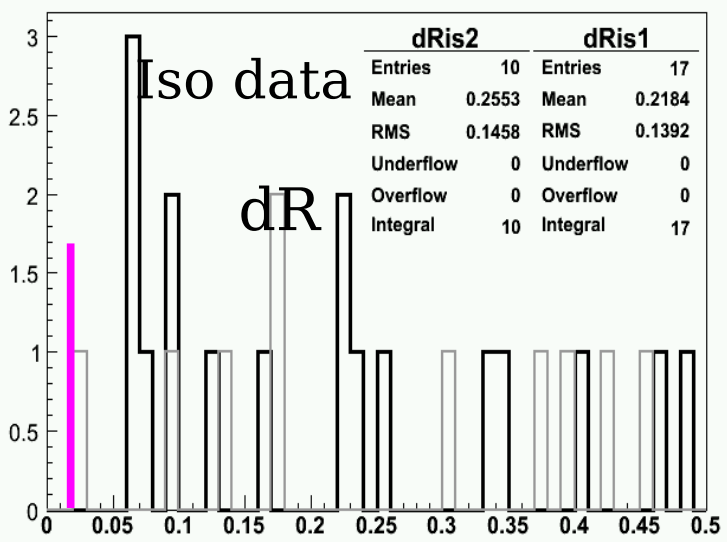
ntrk on other side <30

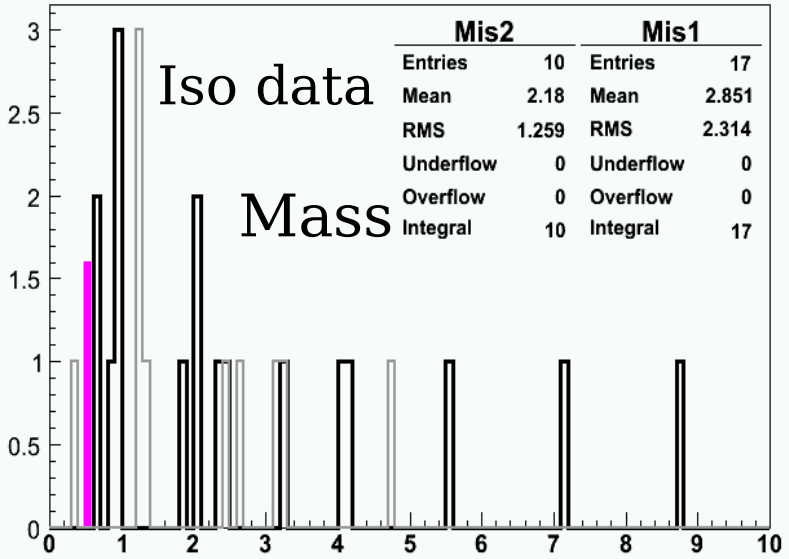


ntrk on other side <3

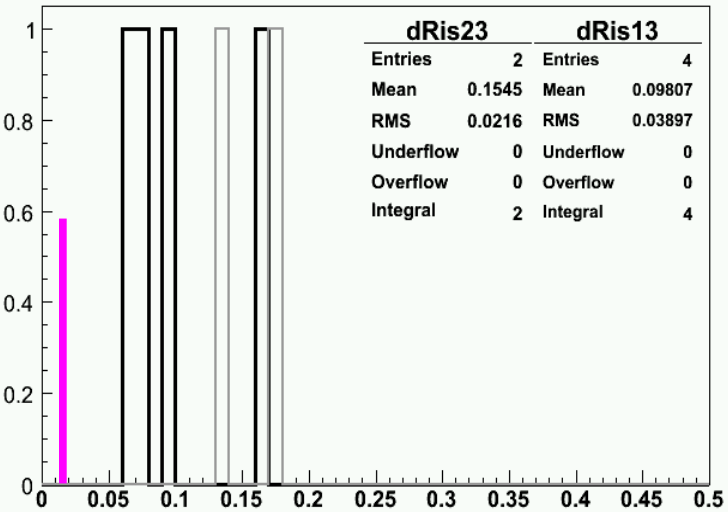
Additional Selections

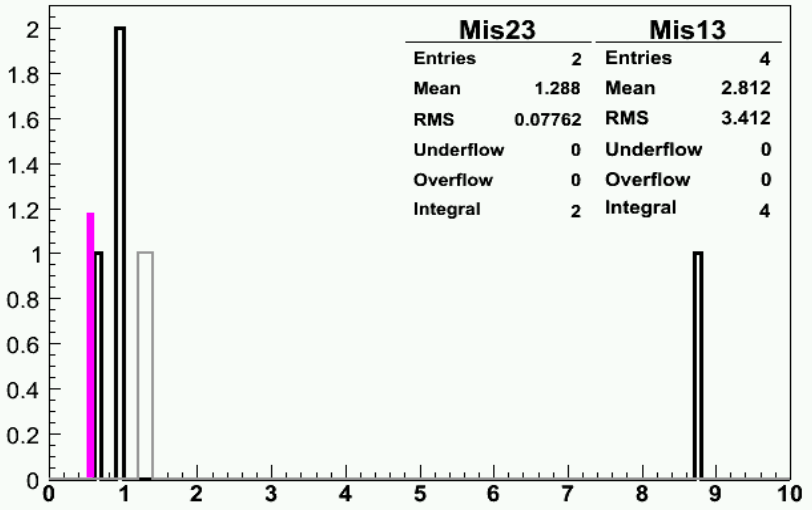
Now require cal iso <2 in the data again on the other side





ntrk on other side <30





ntrk on other side <3