Trigger studies with D* sample

S.Burdin, A.Nomerotski Trigger Workshop 10/31/2003

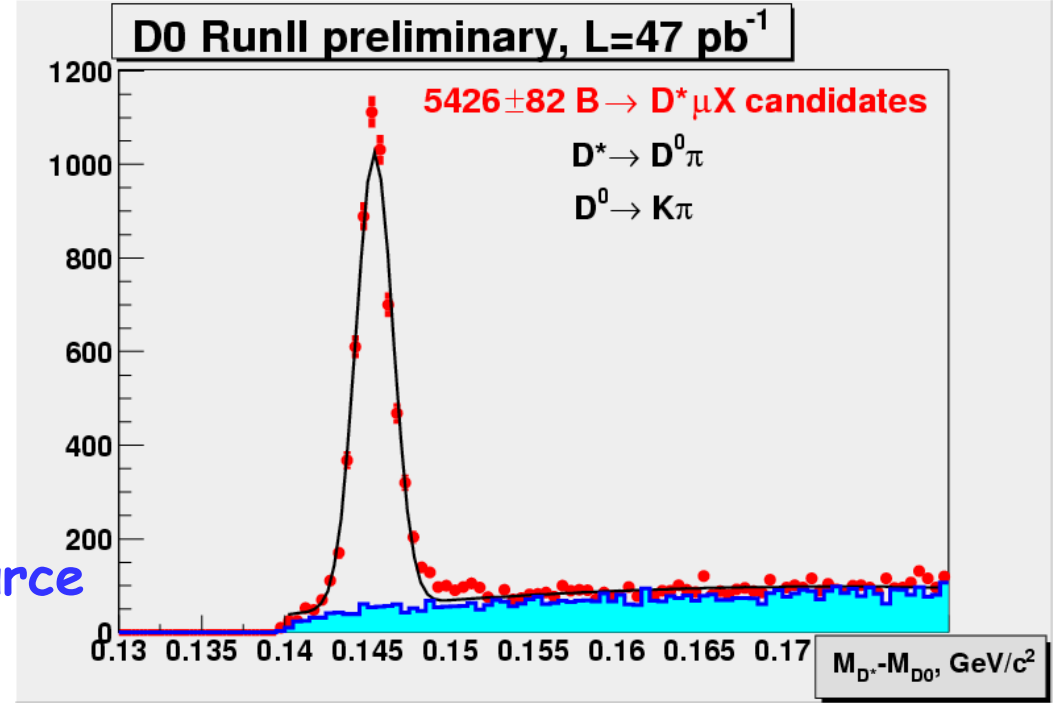
DO has a broad B physics program which includes

- Precision SM measurements
  - Lifetime measurements
  - Bd oscillation measurements
  - CP effects in B mesons
  - **Bs oscillation measurements (currently accessible only at Tevatron)**
- Rare and exotic B decays
- Searches for new B states (Bc, b baryons/hyperons)
- Cross section measurements

- DO has comparable or better yields for leptonic modes of B wrt CDF – we are competitive
- Many analyses (including Bs oscillations) will be statistically limited even for a few fb^-1 scale luminosity

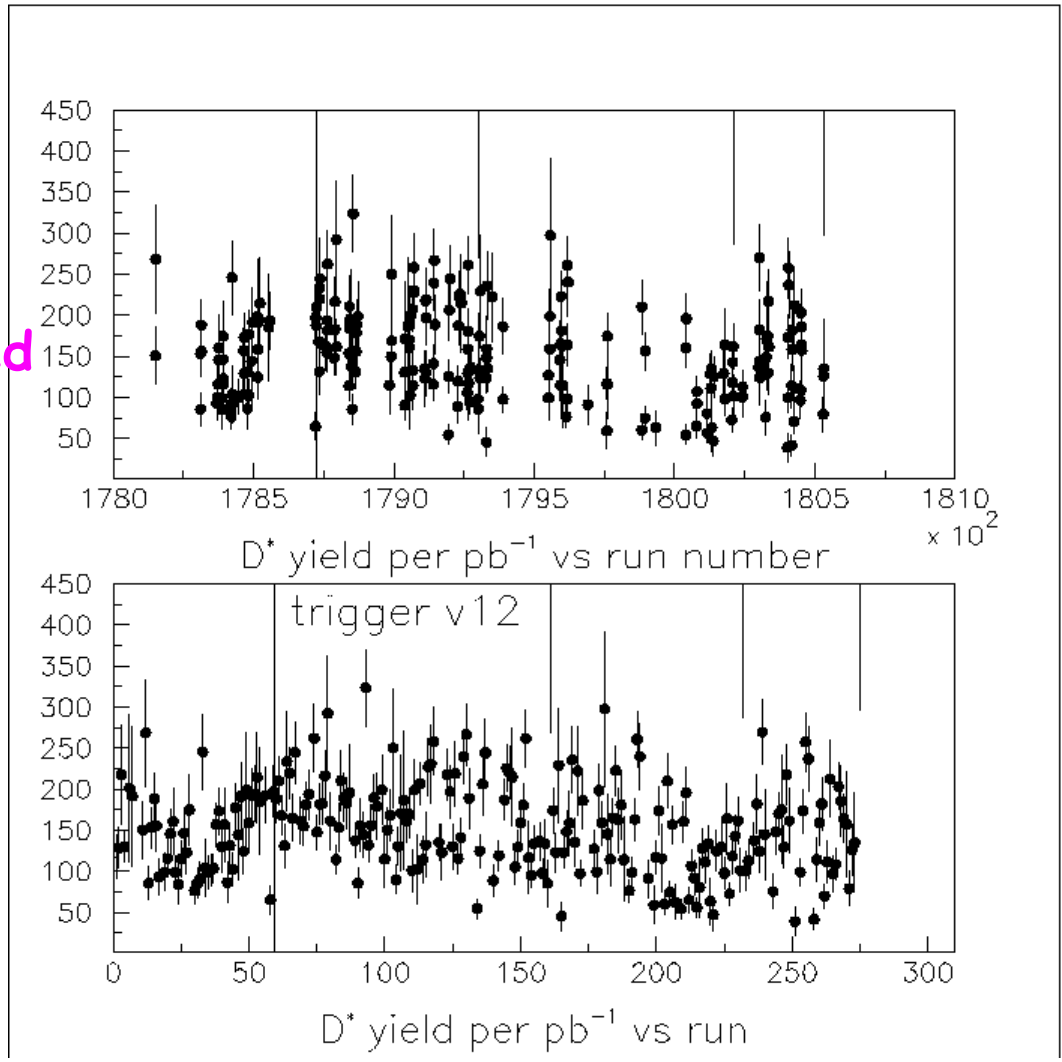
D* sample

- Used clean sample of D* to look
  - Yield
  - Time dependence
  - Luminosity dependence
  - Other basic distributions
  - Triggers
- D* has typical kinematics – results can be propagated to other channels
- D* sample itself will be a source of interesting physics
  - Neutral B lifetime
  - B_d oscillations
  - Testing grounds for B_s mixing analyses



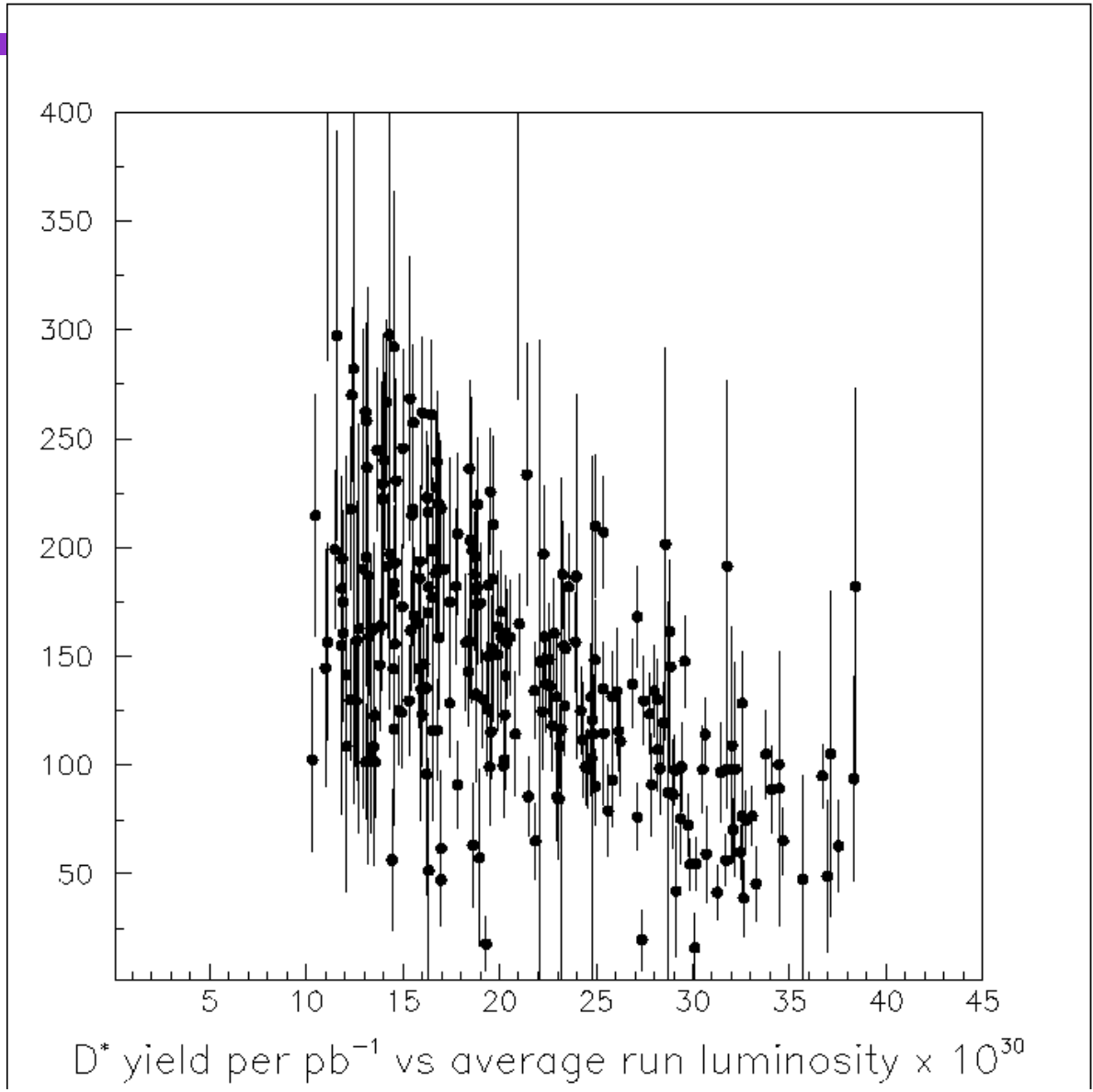
Time dependence

- Number of D*/pb-1 vs time
  - Corresponds to ~ last summer
  - No abnormalities observed
  - Spread explained by luminosity, next slide



Luminosity dependence

- **Prescales at work : D* yield falls with increasing luminosity**
- **This is NOT due to efficiency (see next slide)**
- **The most interesting measurements (like Bs mixing) will be statistically limited – yield is as important for us as for other groups**



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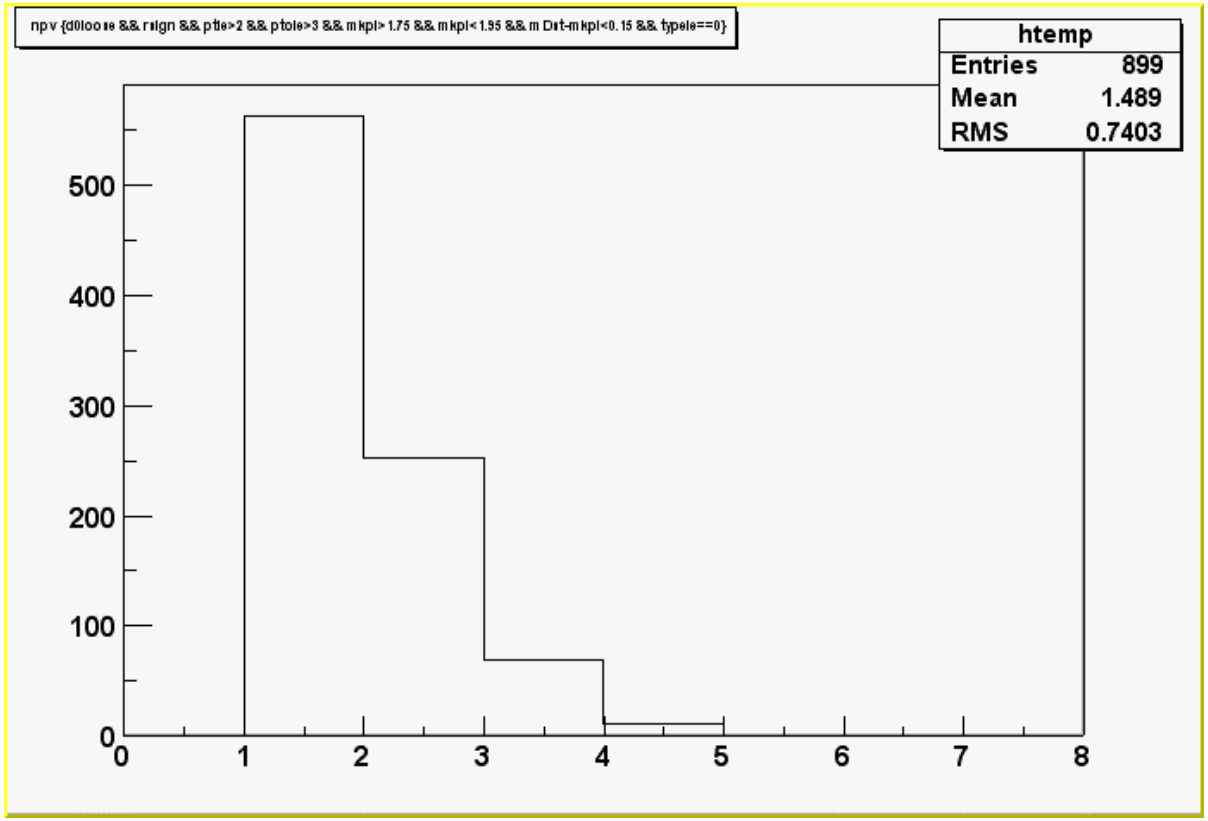
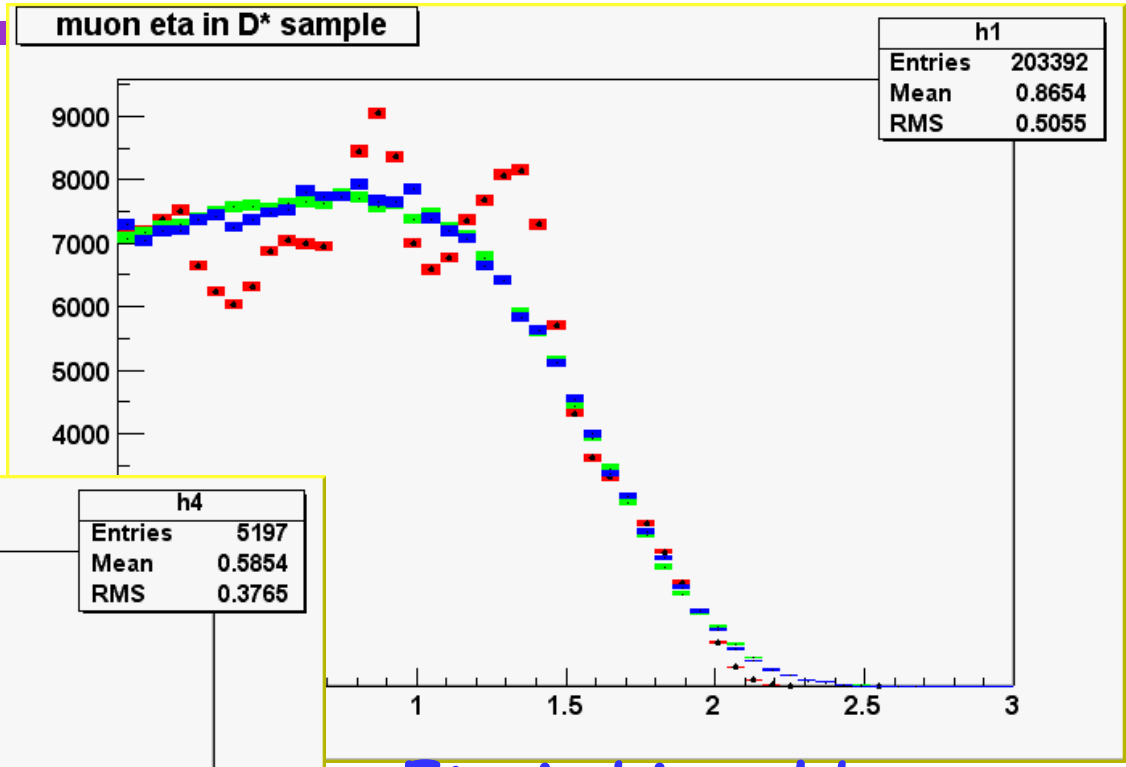
Luminosity dependence

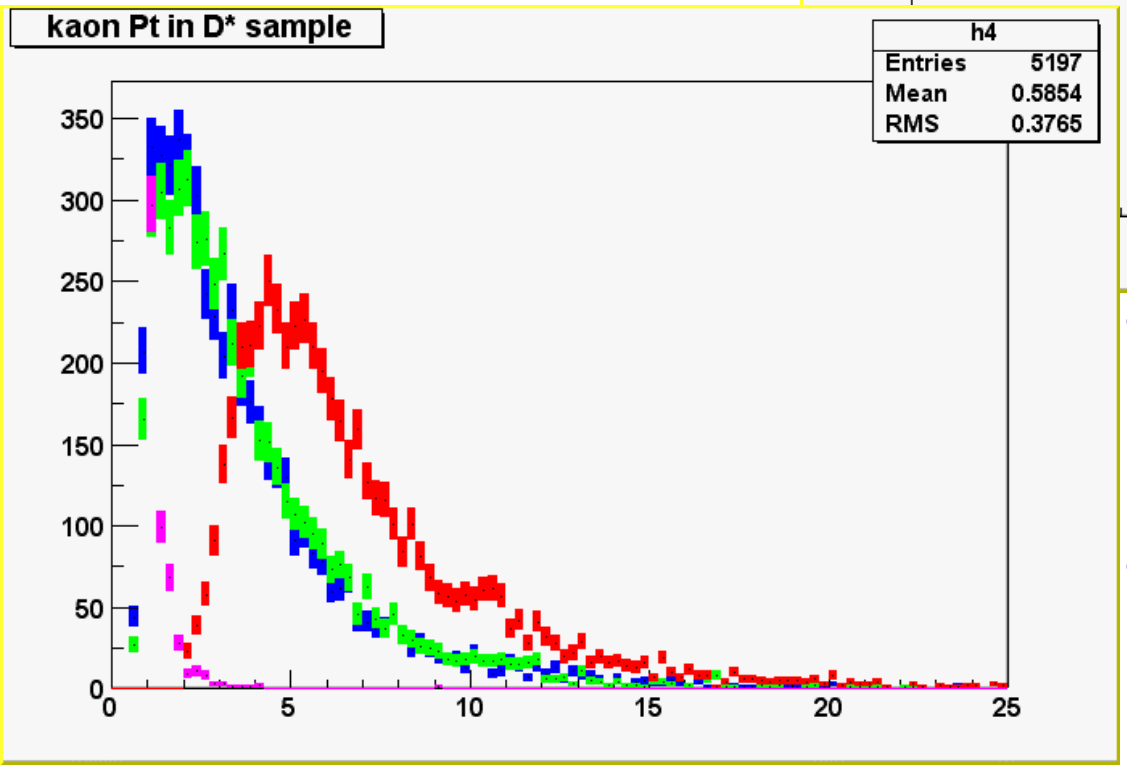
- D* vs # of primary vertices in event
  - Consistent with luminosity =>
  - Reconstruction efficiency is high and depends weakly on # PV



Eta and Pt distributions

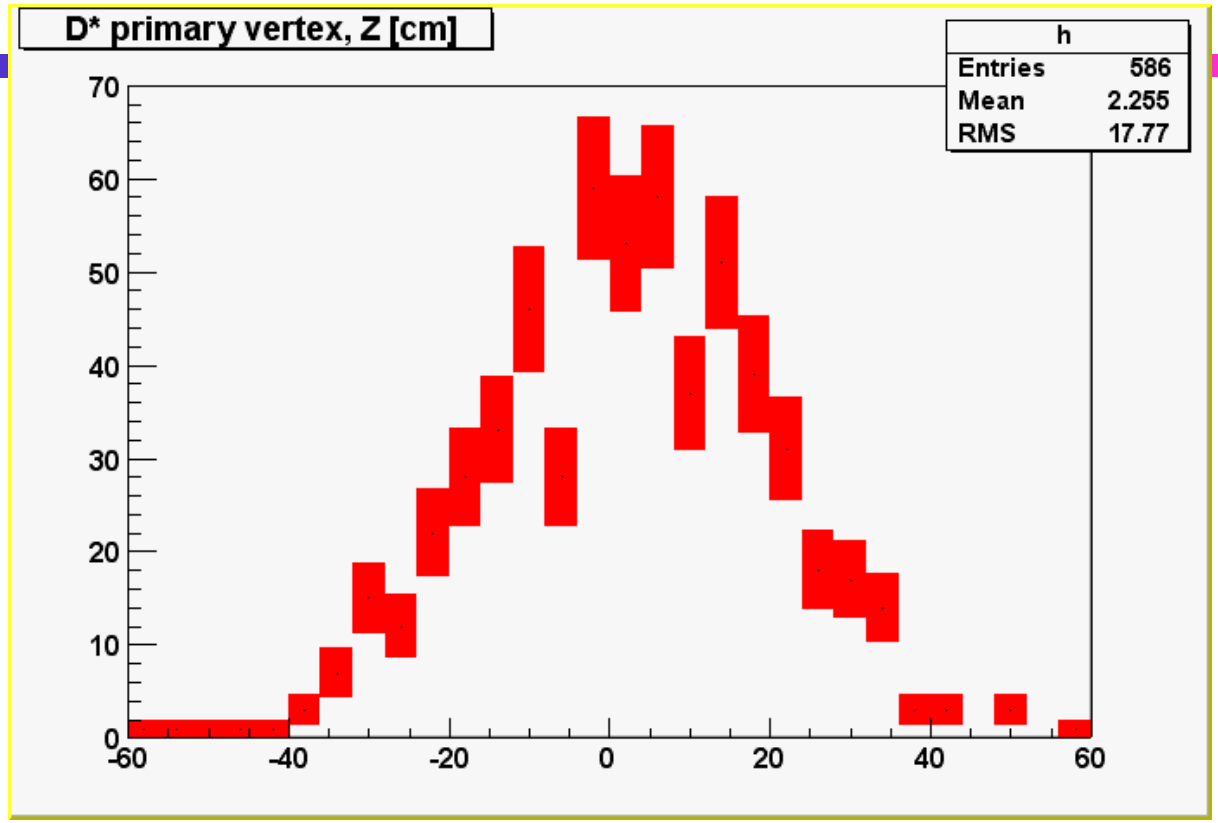
- D* sample
  - Muon
  - Kaon
  - Pion
  - Soft pion





- Eta is biased by
  - L1/2/3 muon triggers
  - CFT at L3/offline
- Pt is biased by
  - Muon triggers
  - Lifetime offline cuts

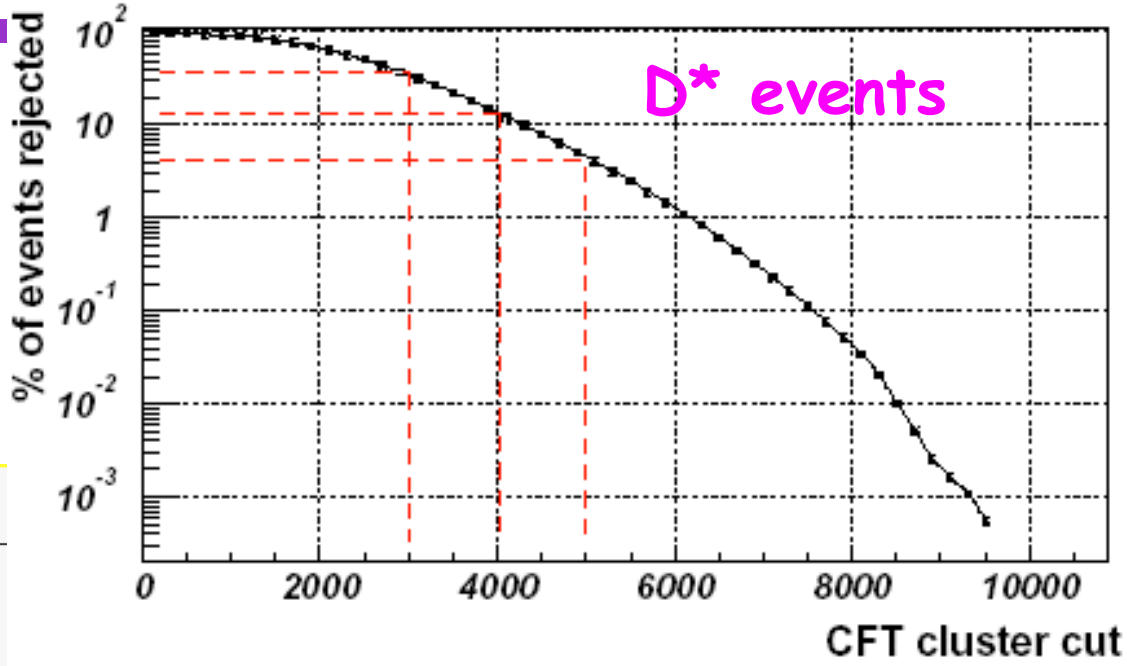
PV Z distribution

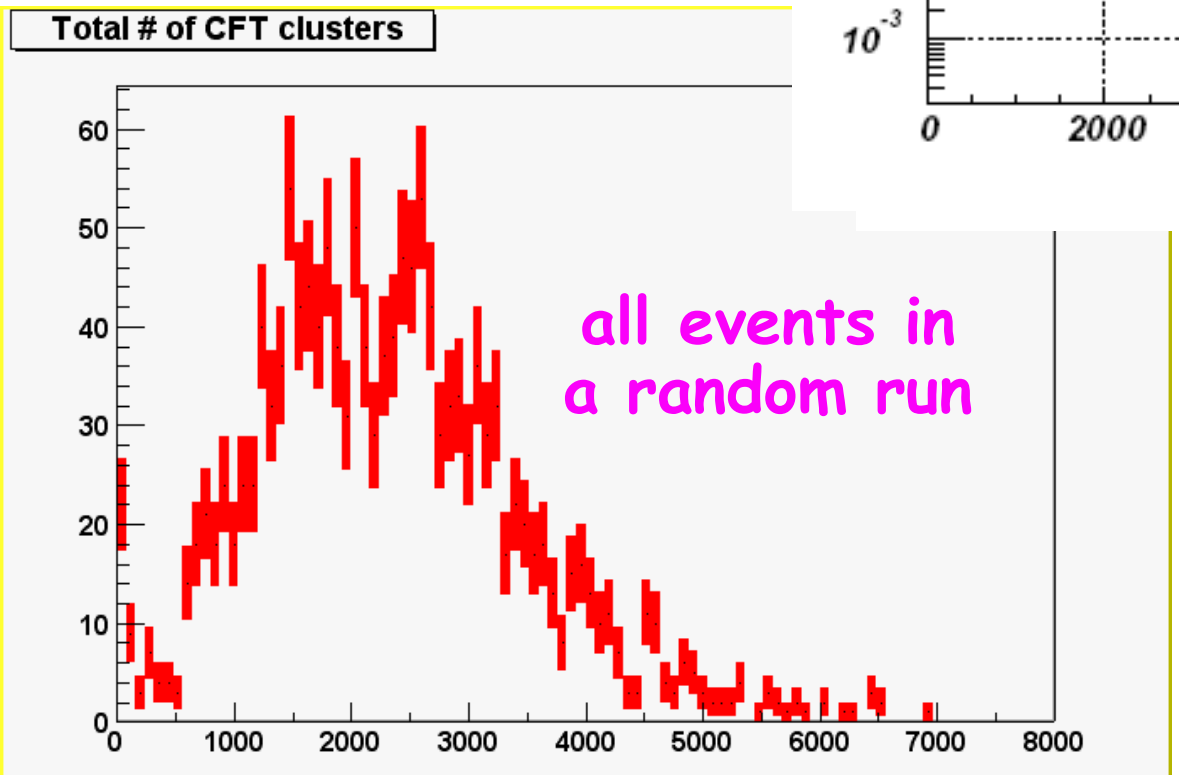


- SMT fiducial volume cut
- Cut at |z|< 35 cm has 95% efficiency for D*
  - Confirmed by other signal samples (B, Bs, /\b)

Cut on total # of CFT clusters?

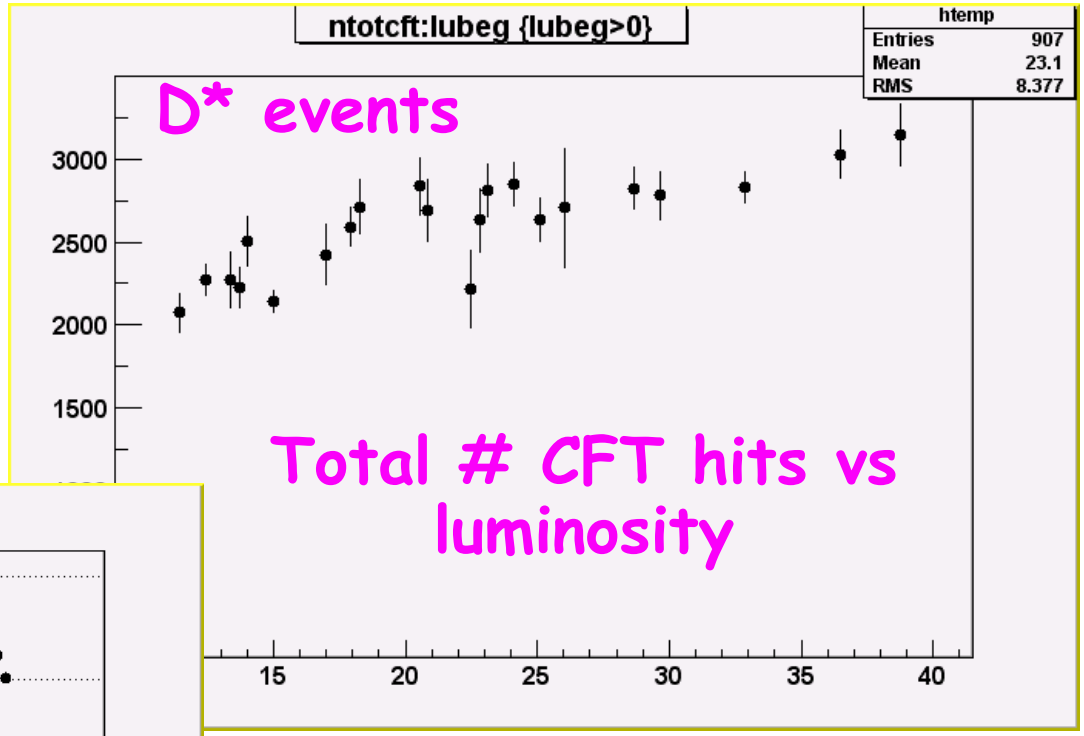
- Cut at 5000 has 98% efficiency for D* events
- Does not cut off much in data but (next slide)

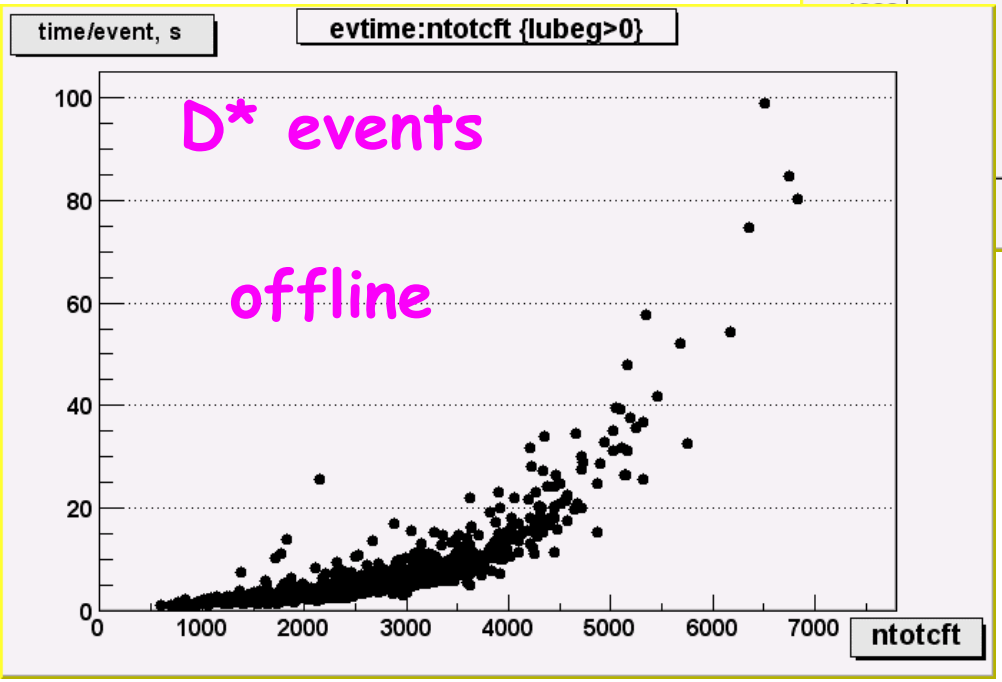




Cut on total # of CFT clusters?

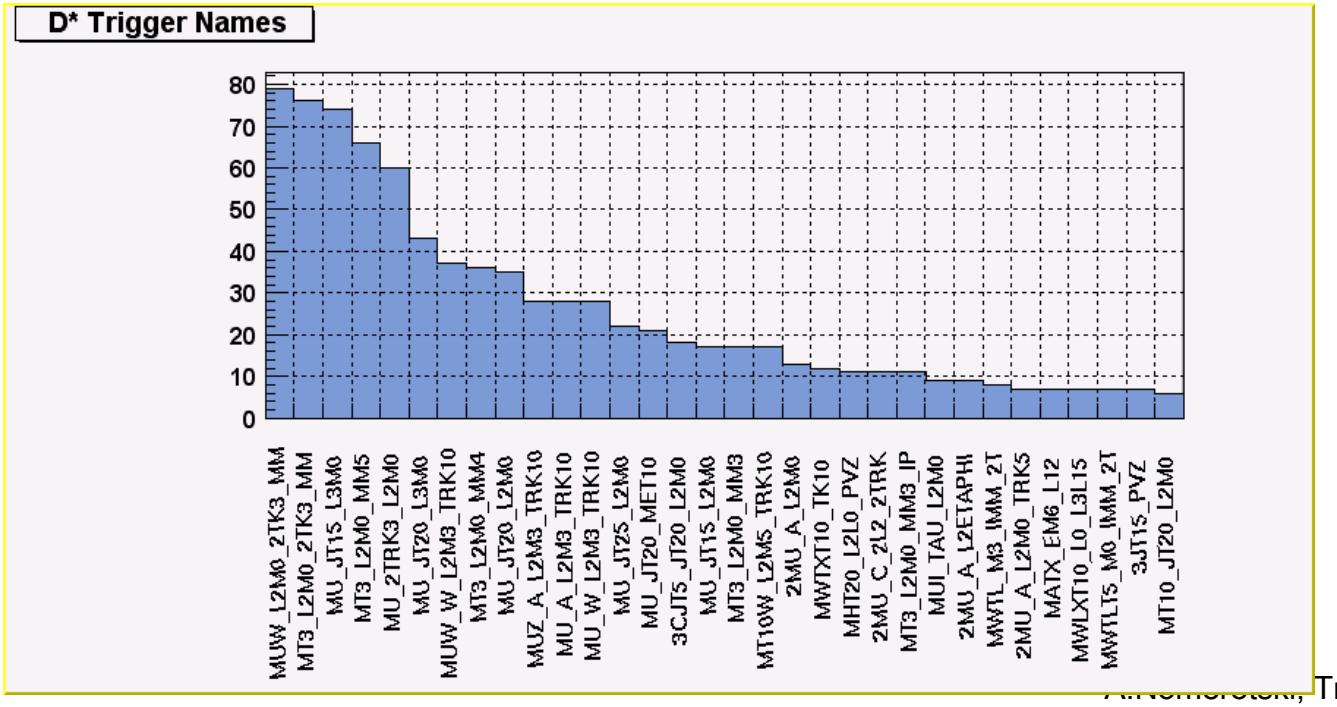
- Will help if there are CPU time issues at Level3 for large # of CFT clusters





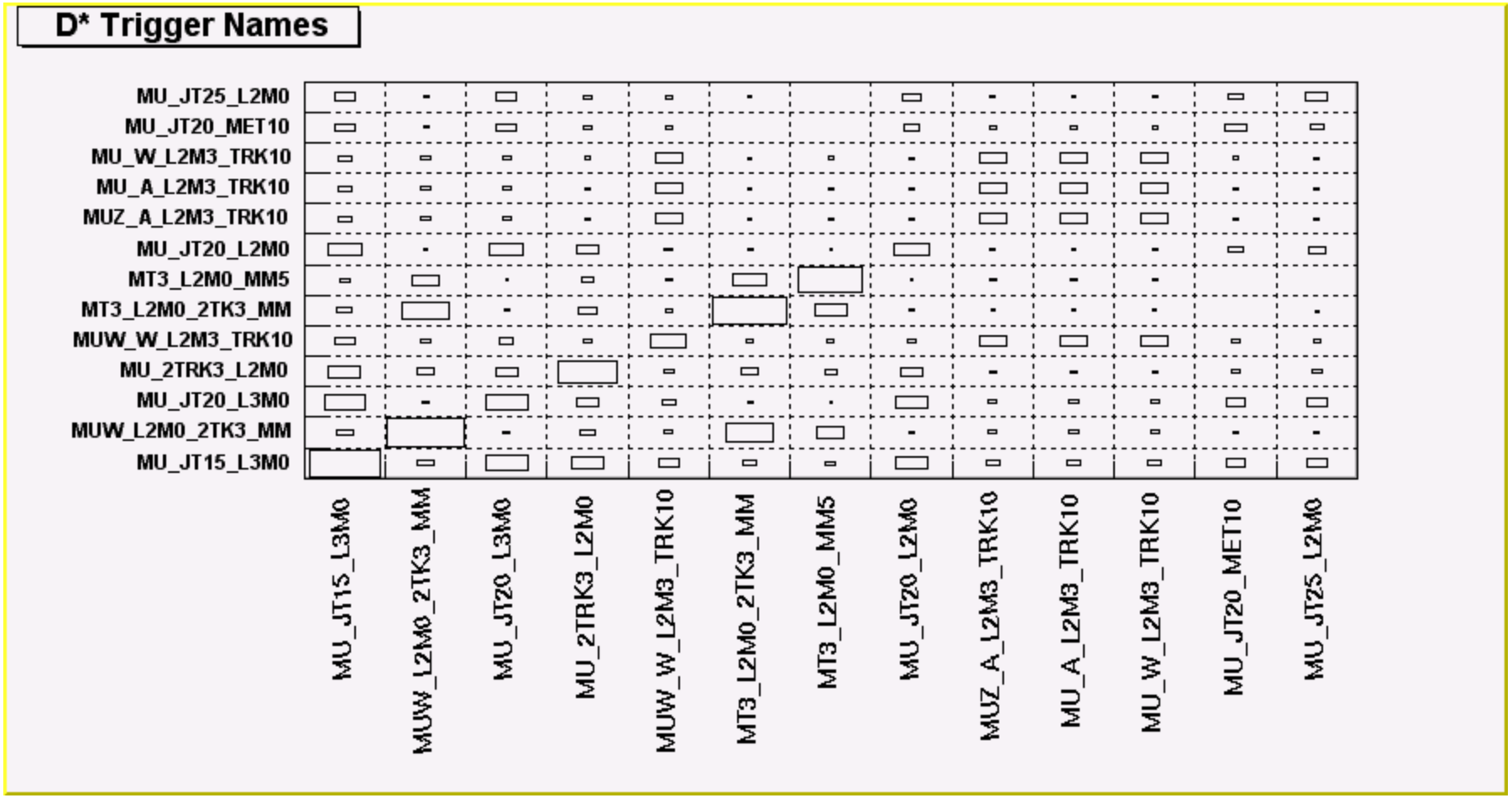
D* triggers in v12

- Find D* in variety of muon triggers
- CTT triggers are ones of the best
  - Note that MT3_L2M0_MM4(3) are prescaled (very prescaled)
- Note that this is averaged over many runs



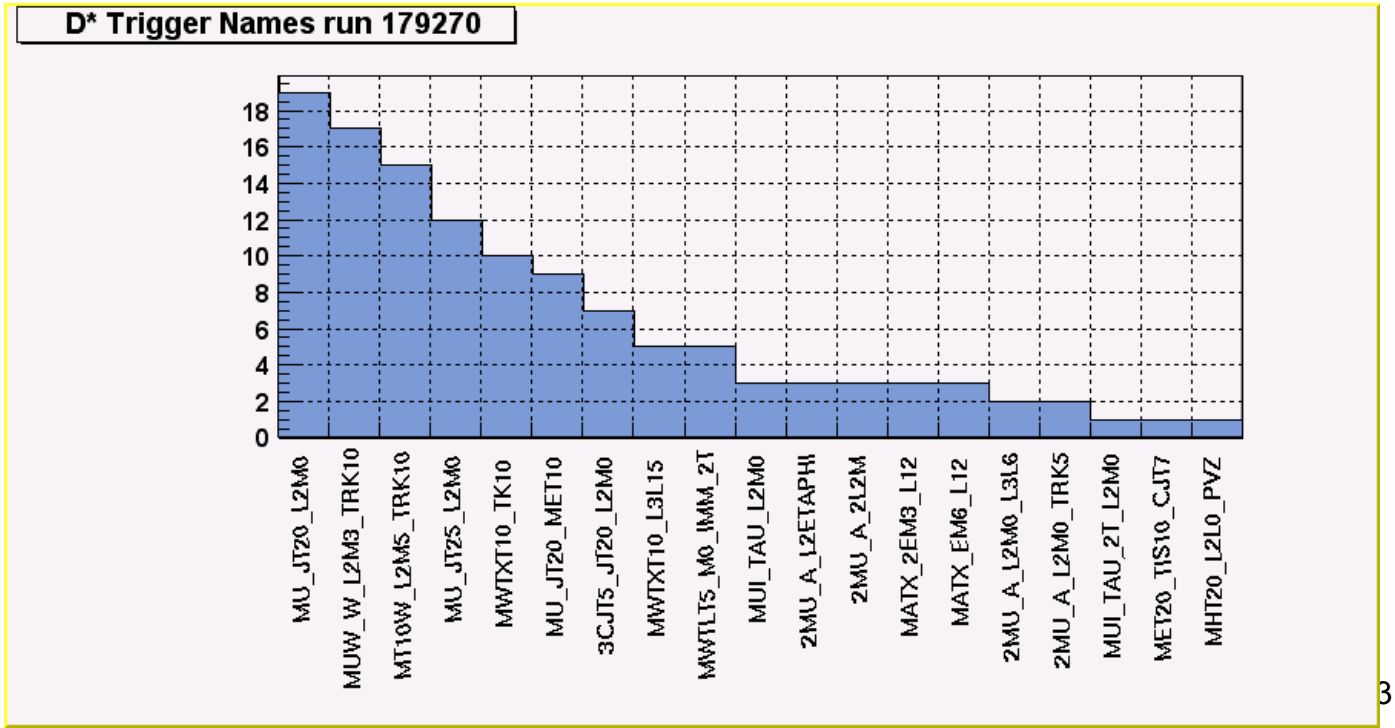
Correlation of D* triggers

- Matrix of correlations for 13 best triggers



What triggers D* at high lumi?

- Run 179270 (initial lumi 44 10E30)
- Found 90 D*/pb^-1 in this run
  - Average ~ 75 D*/pb^-1 for luminosity > 30 10E30
    - compared to ~200 at low luminosity => loose 65% of signal!
  - Most of signal comes from muon+jet and muon+stiff track triggers



Summary on D*

- Clean D* sample is handy to study B-triggers

- A variety of muon triggers contribute to the signal
- At high lumi D* yield is strangled by prescales
  - Loose factor of ~3 in D* yield, the same factor can be propagated to most of other semileptonics channels

Bs mixing is statistically limited – we need those B's!

- L3 Z fiducial and # of CFT clusters cuts will be efficient to signal