Status and Plans

- **Operations**
  - Collection of data
  - Detector status
  - Processing: local & remote
- **Algorithms**
- **Upgrades**

Institutions:

84 Total

35 US, 49 non-US

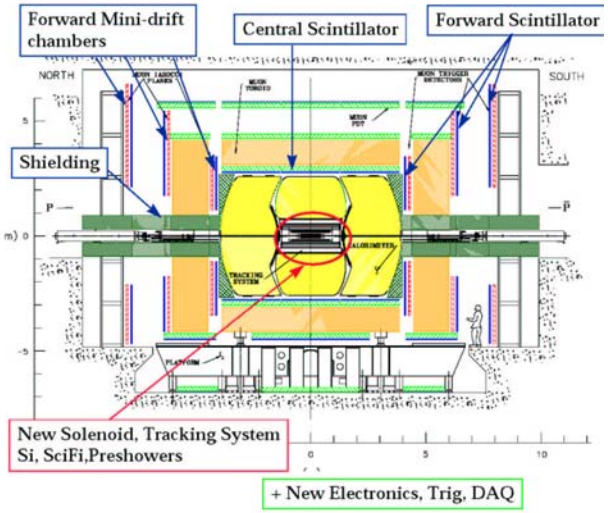
Collaborators

~ 675 Total

~ 50% from non-US institutions

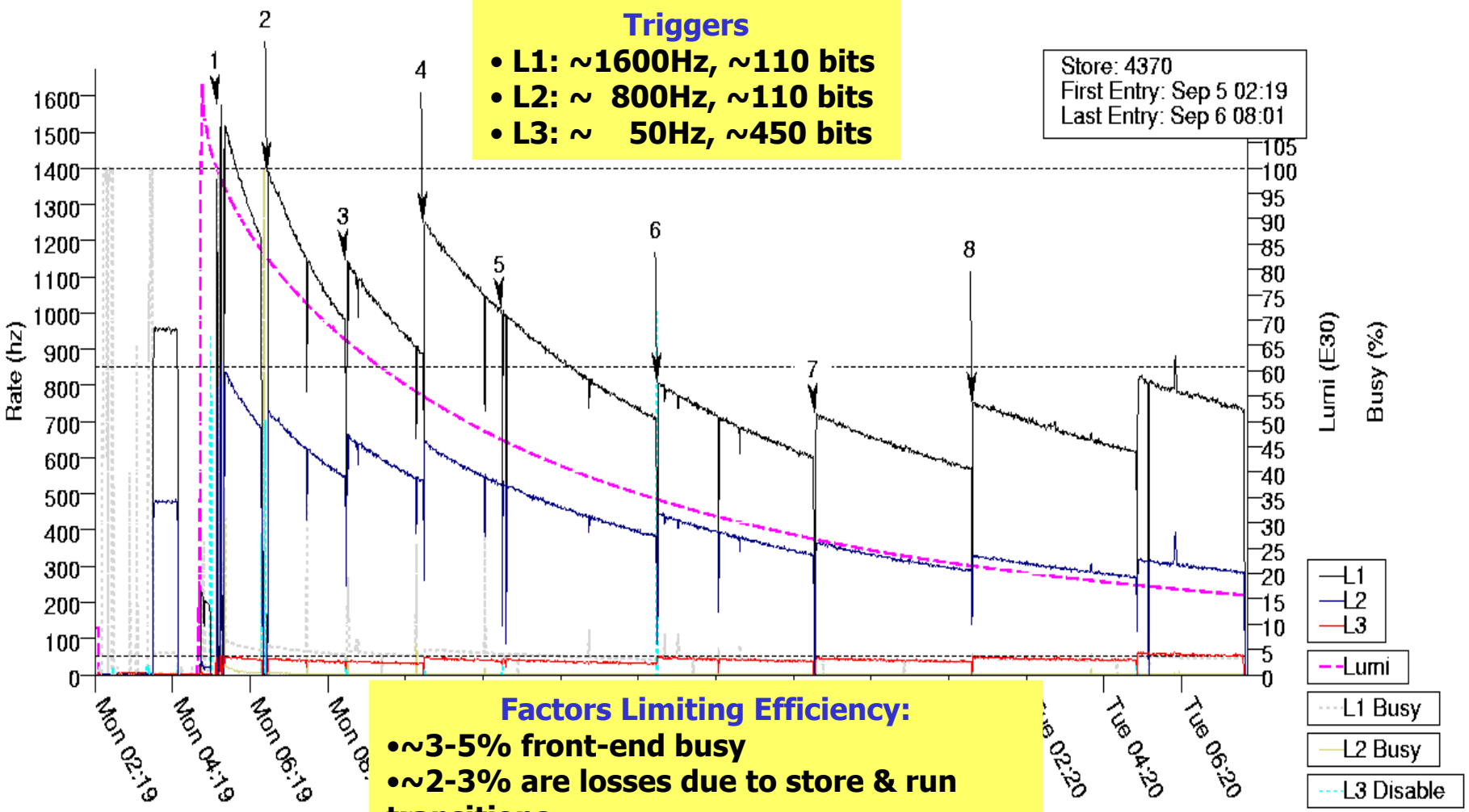
~ 100 post-docs

~ 140 graduate students



A "100E30" Store

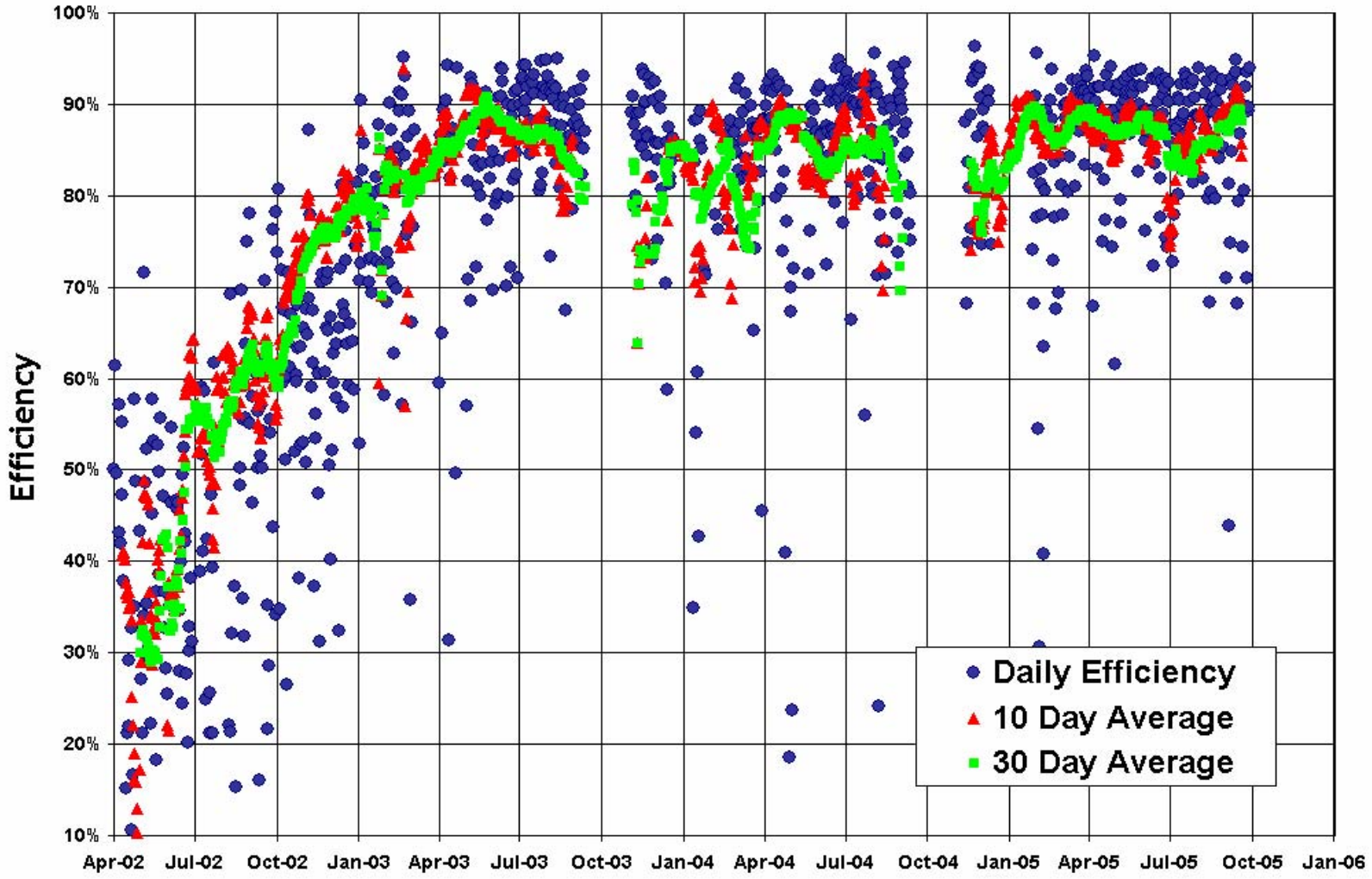
Triggers
- **L1: ~1600Hz, ~110 bits**
- **L2: ~ 800Hz, ~110 bits**
- **L3: ~ 50Hz, ~450 bits**

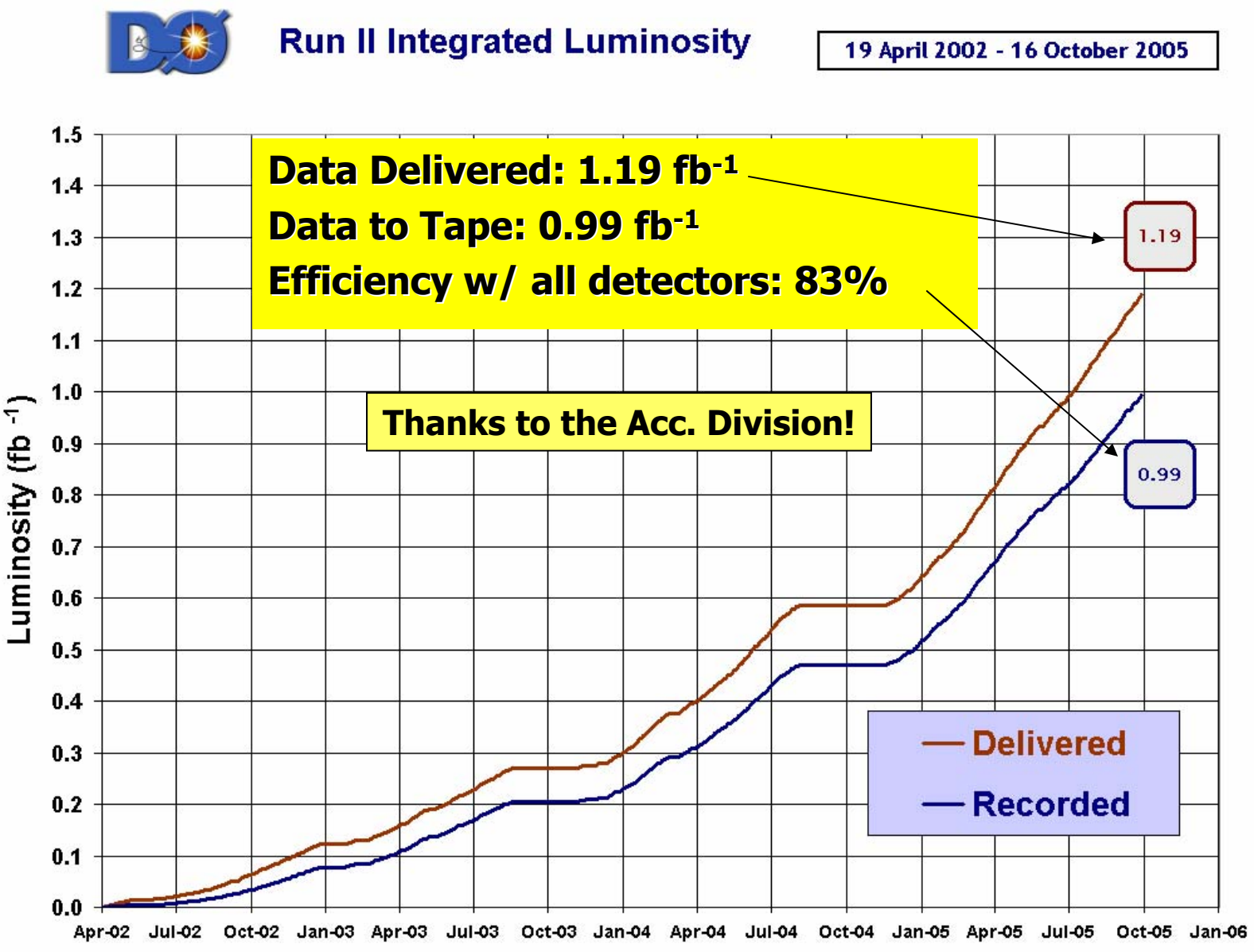


Factors Limiting Efficiency:
- **~3-5% front-end busy**
- **~2-3% are losses due to store & run transitions**
- **~5% "incidentals"**

Daily Data Taking Efficiency

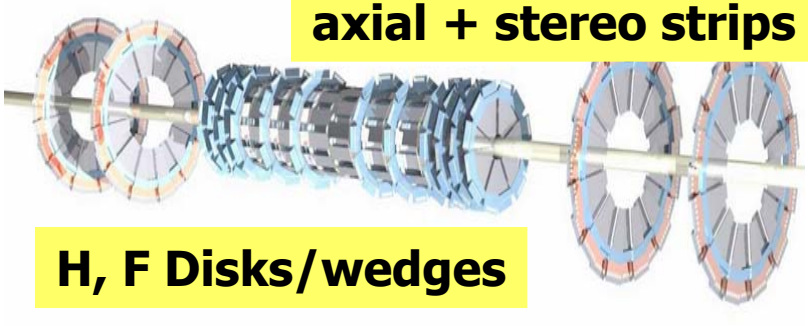
19 April 2002 - 16 October 2005




Run II Integrated Luminosity
19 April 2002 - 16 October 2005
Data Delivered: 1.19 fb-1
Data to Tape: 0.99 fb-1
Efficiency w/ all detectors: 83%
Thanks to the Acc. Division!
1.19
0.99
Delivered
Recorded
Luminosity (fb -1)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Apr-02
Jul-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06

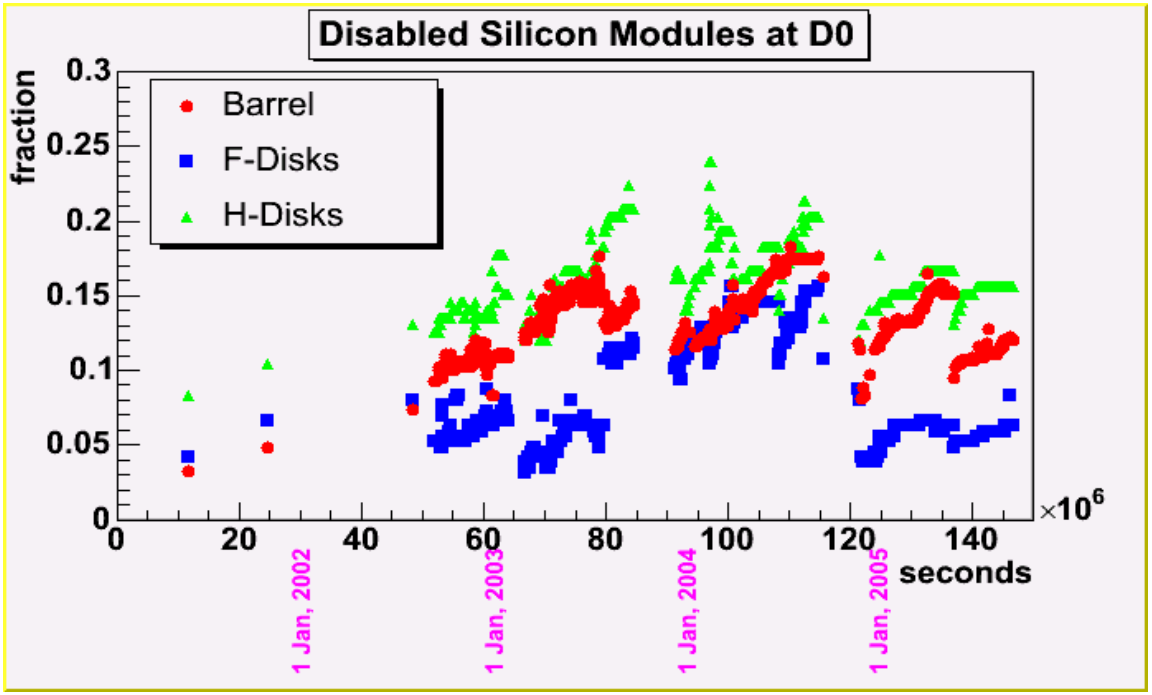
Silicon Microstrip Detector

4 barrel layers
axial + stereo strips



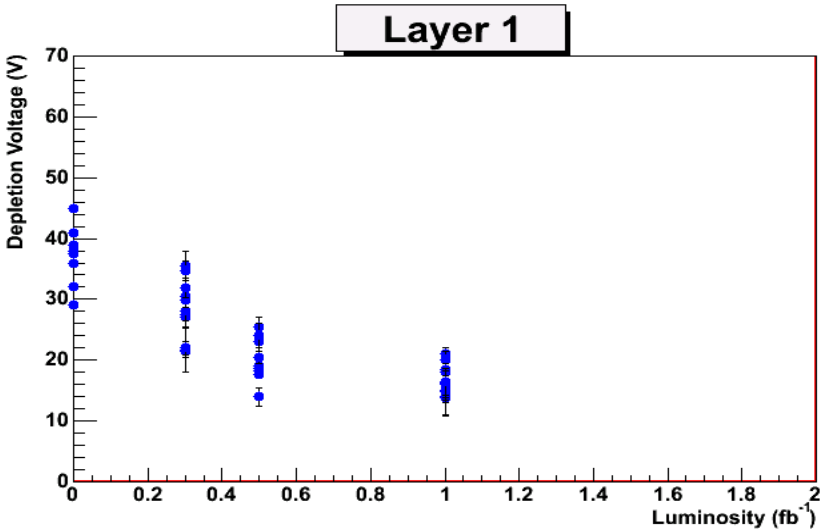
H, F Disks/wedges

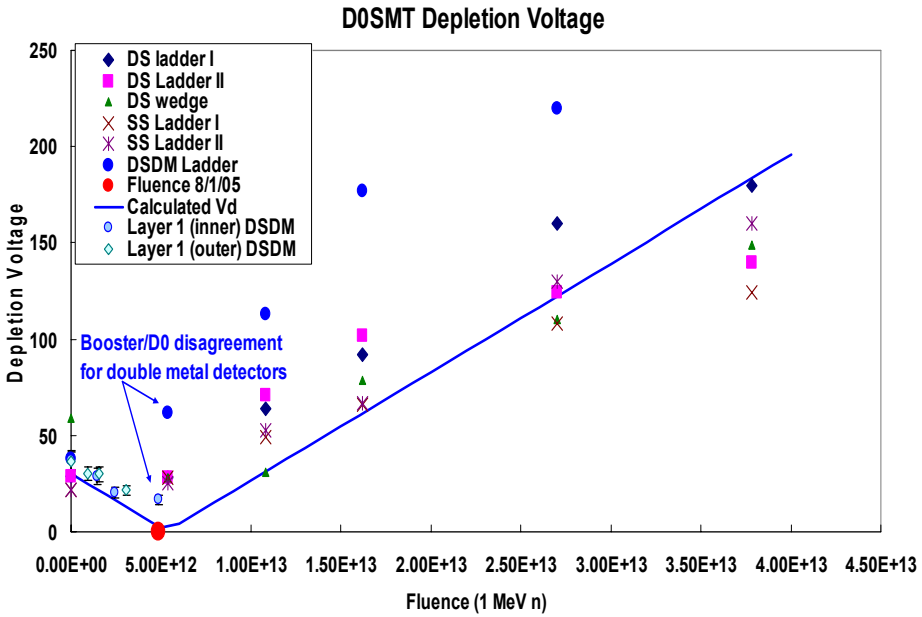
- **793k Channels**
- **S/Noise: > 10 all devices**
- **Cluster Efficiency: > 97%**
- **No fiducial loss**



Radiation Hardness

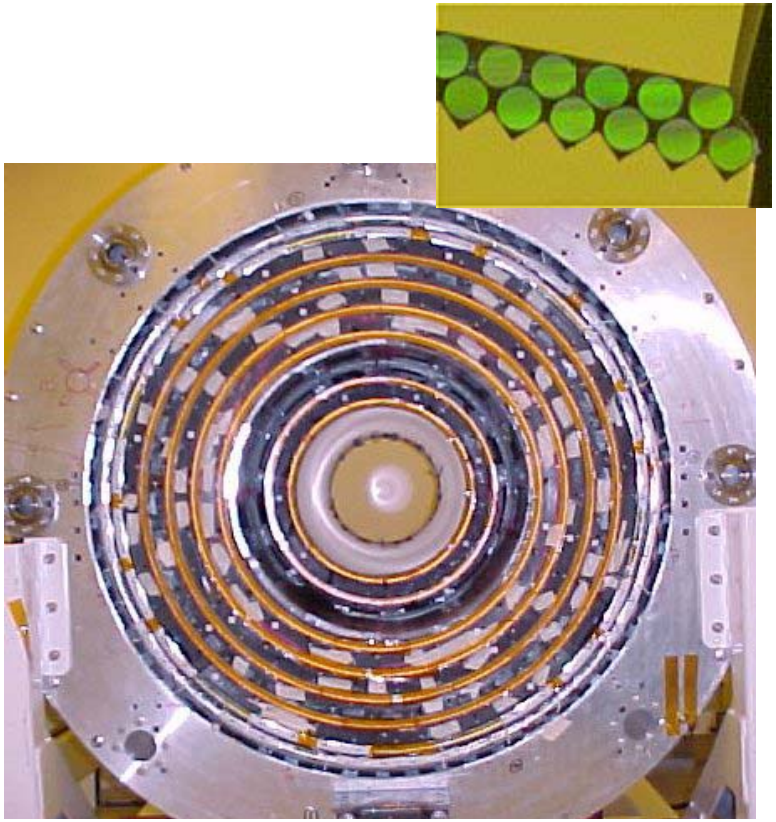
- **Studied**
  - In the booster
  - In situ with HV Scans of noise and efficiency
- **Depletion voltages**
  - Evolving as expected
  - For inner layer $V_{depletion} \sim V_{max} = 150V$ at 5—7 fb^{-1}





Central Fiber Tracker & Preshowers

- Eight axial & eight stereo layers
- VLPC readout at 8K
- Performing well
  - good light yield
  - layer $\varepsilon > 98\%$
- After November 2003 shutdown ~ 1% of VLPC channels not functional
  - was 0.1% before November
  - a one-time event
  - water contamination in cryostat?
- Last shutdown warmed up 1 (of 2) cryostats
  - pumped out 0.5l H_20
  - Upon cool down same loss rate BUT different channels
- Does not seriously degrade performance, but requires vigilance.

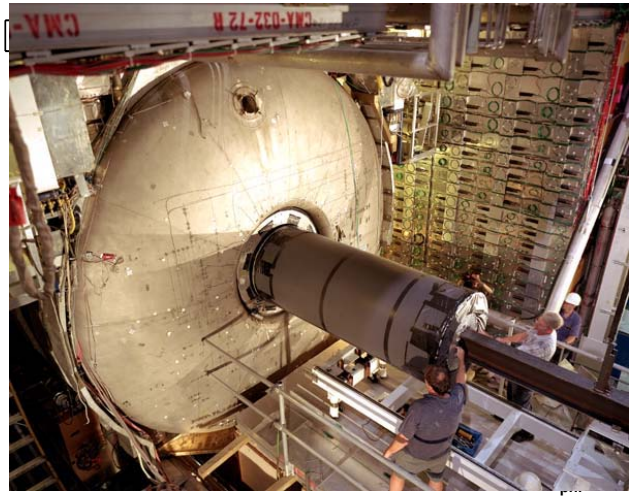


Solenoid

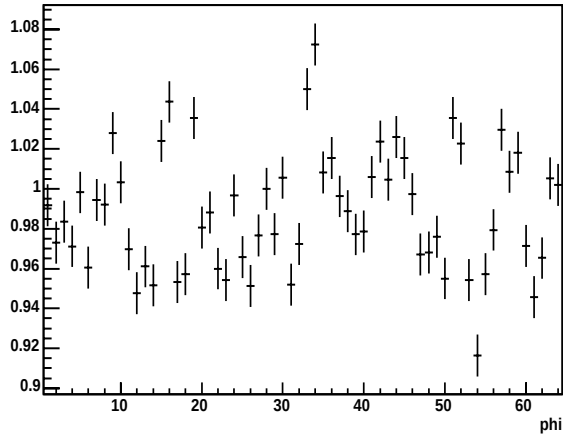
- Coming out of FY04 shutdown, while attempting to ramp to full current, the solenoid quenched.
- Clues :
  - An additional ~8W heat load was seen on the cooling system during operation
  - The south end of support cylinder shows an elevated temperature when powered
  - An excess in resistance is seen in the inner coil layer
  - Careful detailed review of history of temperature rise of south coil support when powered indicates that the degradation is strongly correlated with coil thermal cycles above 90K
- Diagnoses: Suspect degradation of inner layer conductor joint at south end of solenoid coil.
- Prescription:
  - Minimize future thermal disturbances
  - Limit power cycles
  - Upgraded cryogenics plant to provide additional operating margin
- Carefully monitored coil resistance and support temperature since beginning of FY05 run & show no further signs of degradation.
- Have run stably at 4550A (rather than 4750A)

Calorimeter

- Liquid argon calorimeter with uranium absorber
  - Operating Smoothly
  - 99.9% of 55,000 channels operational
- Aggressive program to reduce noise was productive, certain types of noise down 4 orders of magnitude.
- Completed an in situ cell-by-cell calibration of EM and Had calorimeters
- Z pole resolution improves from 3.35 GeV to 2.93 GeV



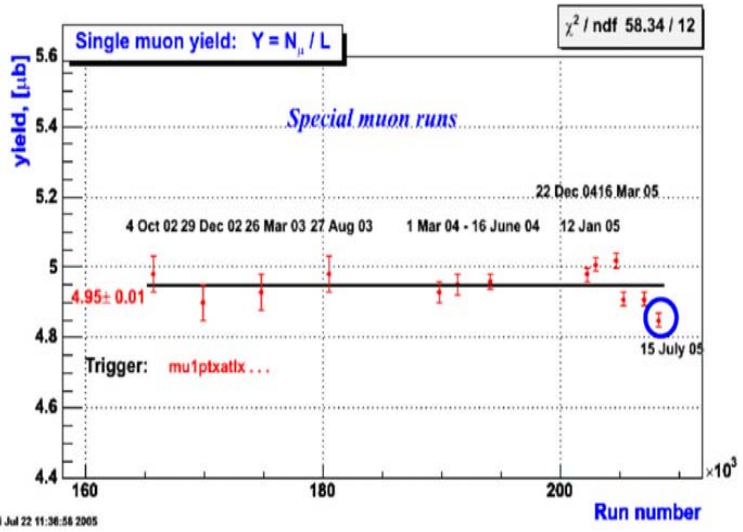
layer 3 Calibration Constants

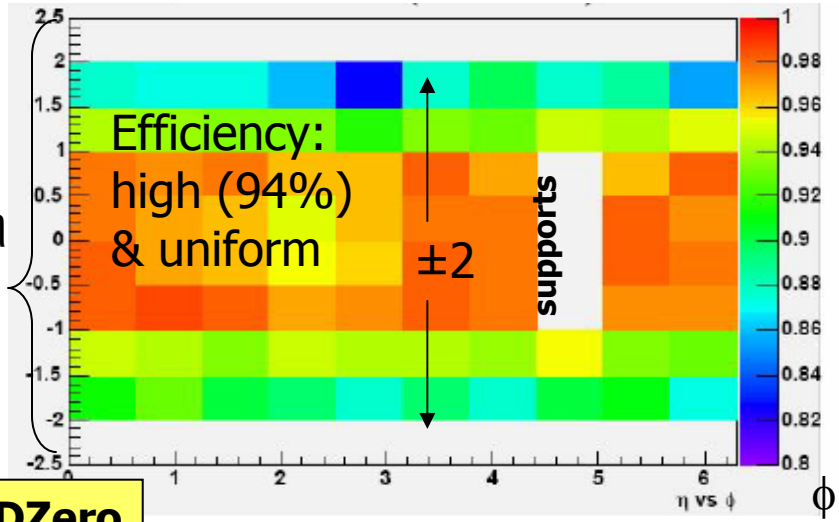


Correction factors at η=0.5

Muon Systems

- **Three layers tracking & triggering**
- **Central**
  - **PDTs: 98.6% of 8k tubes active**
  - **Scintillator: 99.8% of 630 counters active**
- **Forward**
  - **Scintillator:**
    - **99.9% of 4608 counters active**
    - **Expect around 10% degredation (mainly in phototube) at 15 fb^{-1}**
  - **MDTs:**
    - **99.7% of 50k wires active**
    - **one plane disabled due to broken wire.**
- **Stable to 1%**
- **Highly Efficient**





Strength of DZero

Publications

(http://www-d0.fnal.gov/www_buffer/pub/Run2_publications.html)

2004

1) *Search for Doubly-charged Higgs Boson Pair Production in the Decay to mu+mu+mu-mu- in pbarp Collisions at sqrt(s)=1.96 TeV*
2) *Observation and Properties of the X(3872) Decaying to J/psi pi+pi- in pbarp Collisions at sqrt(s)=1.96 TeV*

2005

1) *Search for Supersymmetry with Gauge-Mediated Breaking in Diphoton Events at DZero*
3) *Measurement of Dijet Azimuthal Decorrelations at Central Rapidities in pbarp Collisions at sqrt(s)=1.96 TeV*
4) *Measurement of the B_s^0 Lifetime in the Exclusive Decay Channel B_s^0->J/psi phi*
5) *A Search for the Flavor-Changing Neutral Current Decay B_s^0->mu+ mu- in pbarp Collisions at sqrt(s)=1.96 TeV*
6) *Measurement of the Ratio of B+ and B0 Meson Lifetimes*
7) *Measurement of the Lambda-B Lifetime in the Decay Lambda-B -> J/psi Lambda With the D0 Detector*
8) *A Search for Wbb and WH Production in pbarp Collisions at sqrt(s)=1.96 TeV*
9) *Measurement of the WW Production Cross Section in pbarp Collisions at sqrt(s)=1.96 TeV*
10) *A Measurement of the Ratio of Inclusive Cross Sections pbarp->Zb/pbarp->Zj at sqrt(s)=1.96 TeV*
11) *A search for anomalous heavy-flavor quark production in association with W bosons*
12) *First measurement of sigma(ppbar->Z)xBr(Z->tau tau) at sqrt(s)=1.96 TeV*
13) *Search for first-generation scalar leptoquarks in ppbar collisions at sqrt(s)=1.96 TeV*
14) *Study of Zgamma events and limits on anomalous ZZgamma and Zgammagamma couplings in pbarp collisions at sqrt(s)=1.96 TeV*
15) *Measurement of inclusive differential cross sections for Upsilon(1S) production in ppbar collisions at sqrt(s)=1.96 TeV*
16) *Measurement of the p-barp -> Wgamma +X Cross section and Limits on Anomalous WWgamma Couplings at sqrt(s)=1.96 TeV*
17) *Search for Randall-Sundrum Gravitons in Dilepton and Diphoton Final States*
18) *Search for right-handed W bosons in top quark decay*

Accepted or Submitted

20) *Production of WZ Events in p-barp Collisions at sqrt(s)=1.96 TeV and Limits on Anomalous WWZ Couplings*
21) *Search for neutral supersymmetric Higgs bosons in multijet events at sqrt(s)=1.96 TeV*
22) *Search for supersymmetry via associated production of charginos and neutralinos in final states with three leptons*
23) *Search for single top quark production in pbarp collisions at sqrt(s)=1.96 TeV*
24) *Measurement of the lifetime difference in the Bs system*
25) *Measurement of semileptonic branching fractions of B mesons to narrow D** states*
26) *Search for large extra spatial dimensions in dimuon production at DZero*

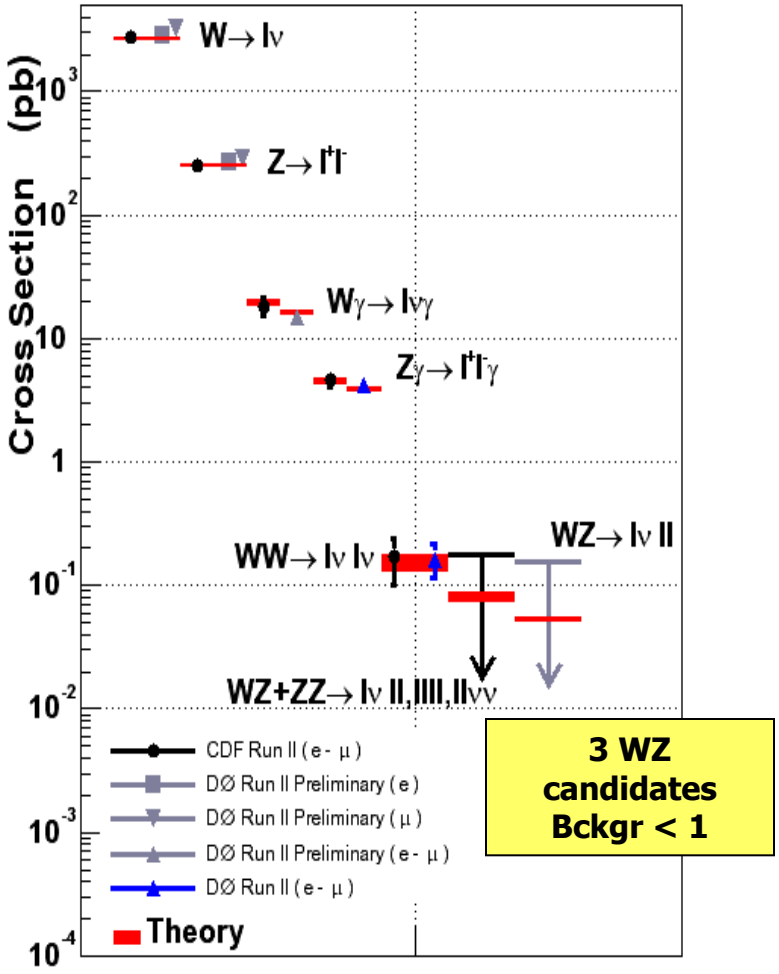
27) *Measurement of the ttbar cross section in pbarp collisions at sqrt(s)=1.96 TeV using kinematic characteristics of lepton plus jets events*
28) *Measurement of the ttbar cross section in pbarp collisions at sqrt(s)=1.96 TeV using lepton plus jets events with lifetime b-tagging*
29) *Measurement of the ttbar production cross section in pbarp collisions at sqrt(s)=1.96 TeV in dilepton final states*
30) *Search for the Higgs Boson in H->WW(*) Decays in ppbar Collisions at sqrt(S)=1.96 TeV*
31) *The Upgraded D0 Detector*

Thirty(+1) Run II Papers

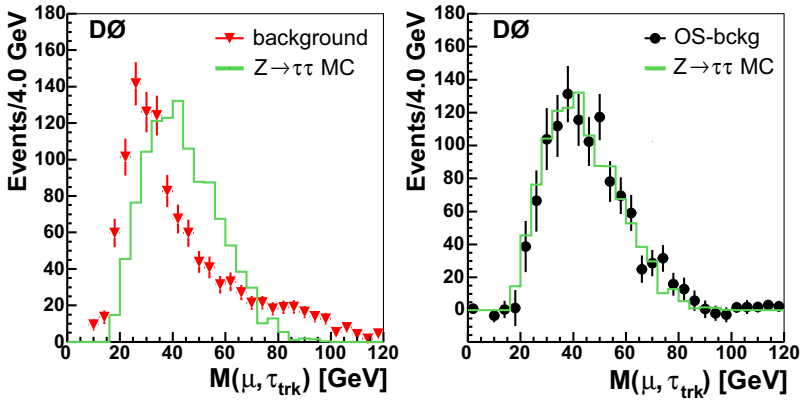
Luminosity: ~0.3-0.4fb^{-1} as much as 0.6fb^{-1}
Group: B-8/EW&QCD-6/NewP-6/Higgs-5/Top-5
Twenty-six in Draft or Review
Conference Results: 61 Approved

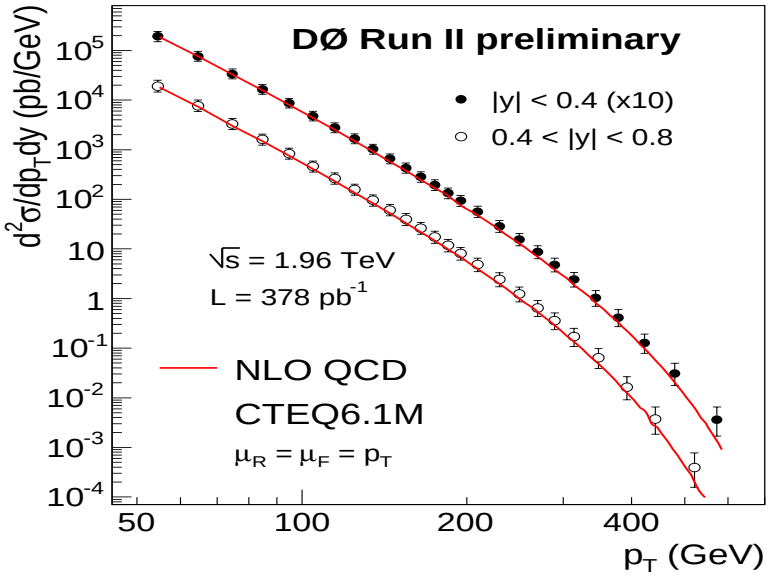
EW & QCD

Z→ ττ: σ = 237+/- 27 pb

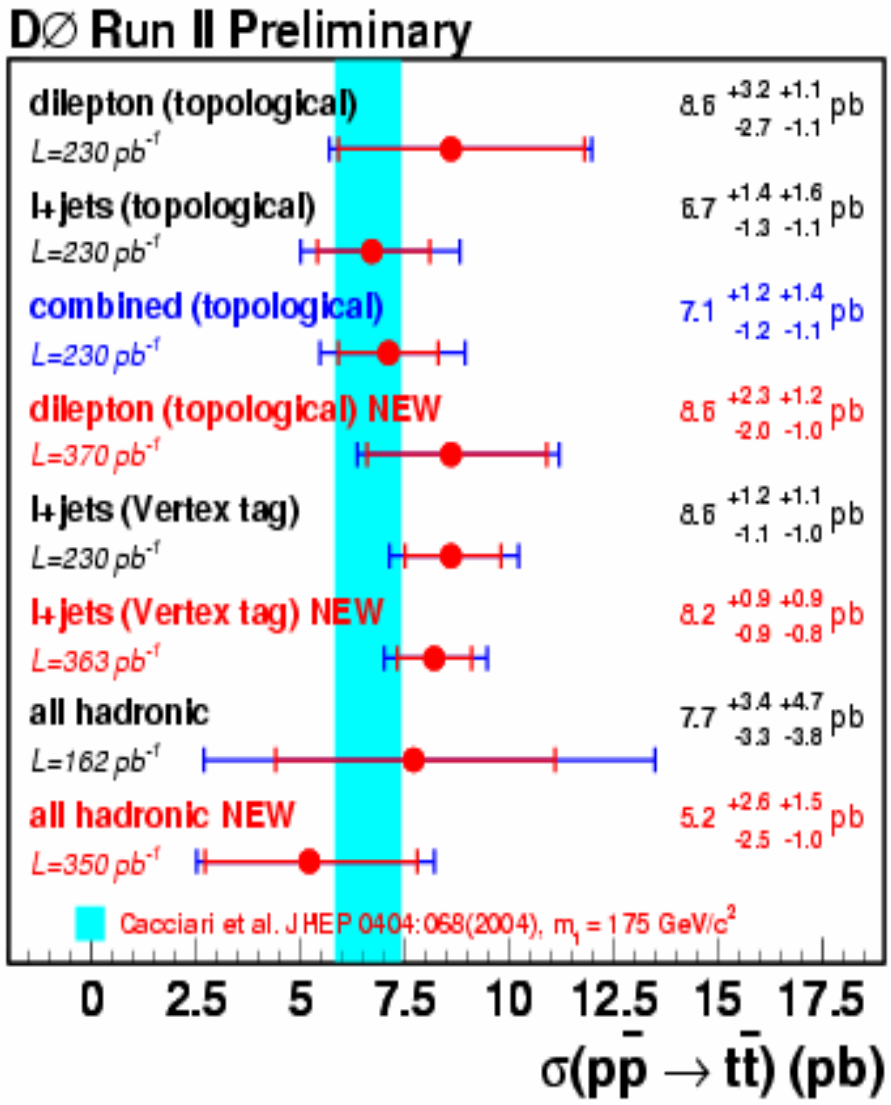


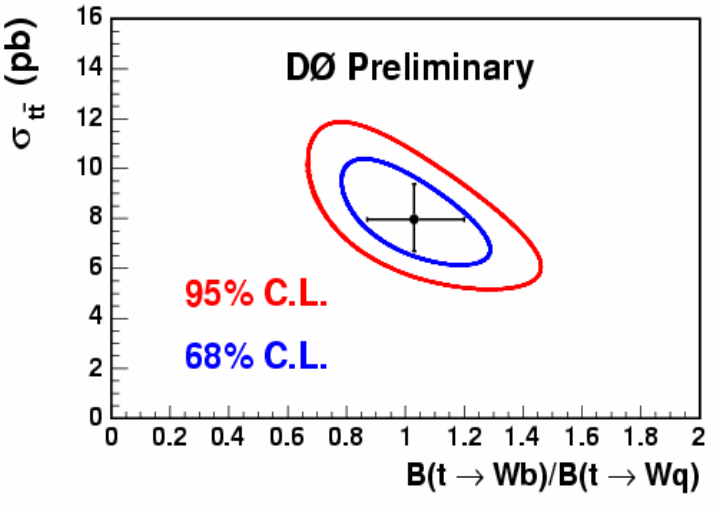
3 WZ candidates Bckgr < 1

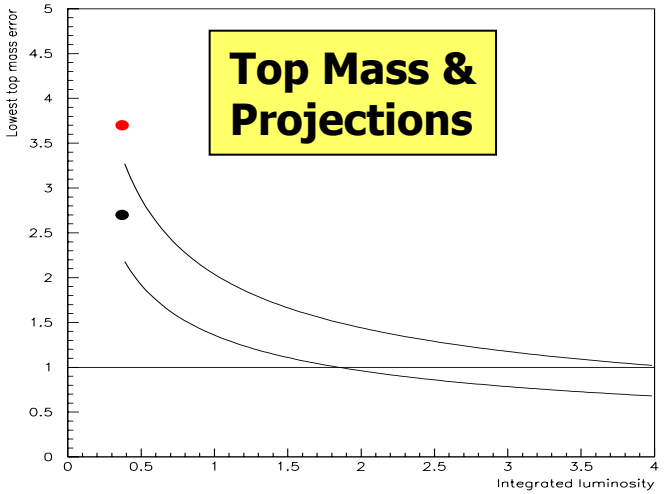




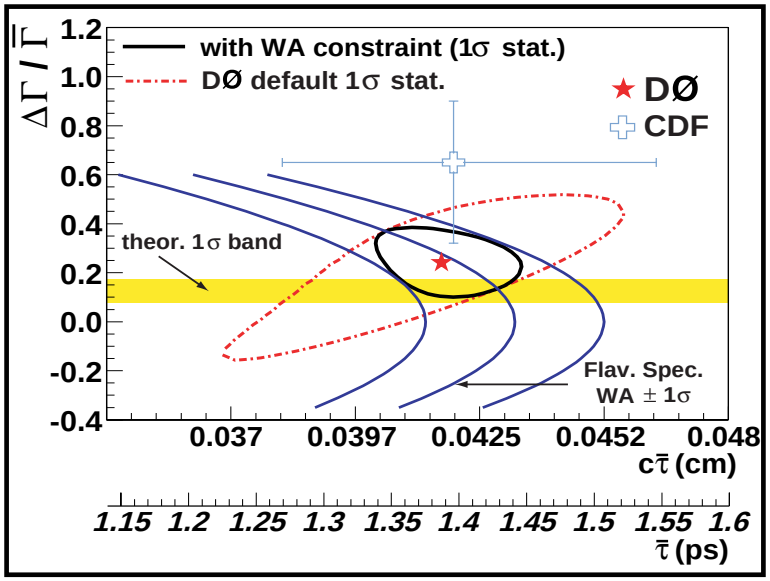
Top

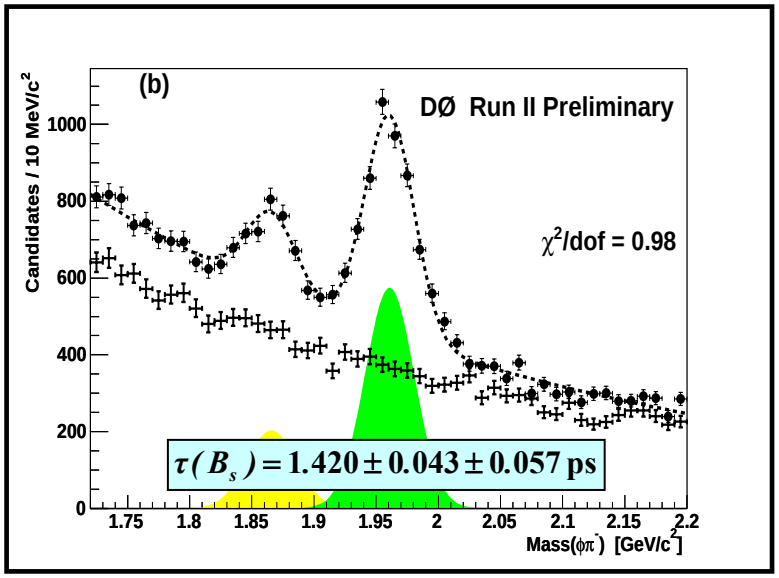

DØ Run II Preliminary
dilepton (topological)
L=230 pb-1
8.6 +3.2 +1.1 -2.7 -1.1 pb
l+jets (topological)
L=230 pb-1
6.7 +1.4 +1.6 -1.3 -1.1 pb
combined (topological)
L=230 pb-1
7.1 +1.2 +1.4 -1.2 -1.1 pb
dilepton (topological) NEW
L=370 pb-1
8.6 +2.3 +1.2 -2.0 -1.0 pb
l+jets (Vertex tag)
L=230 pb-1
8.6 +1.2 +1.1 -1.1 -1.0 pb
l+jets (Vertex tag) NEW
L=363 pb-1
8.2 +0.9 +0.9 -0.9 -0.8 pb
all hadronic
L=162 pb-1
7.7 +3.4 +4.7 -3.3 -3.8 pb
all hadronic NEW
L=350 pb-1
5.2 +2.6 +1.5 -2.5 -1.0 pb
Cacciari et al. JHEP 0404:068(2004), mt = 175 GeV/c2
0 2.5 5 7.5 10 12.5 15 17.5
σ(pp̄ → tt̄) (pb)

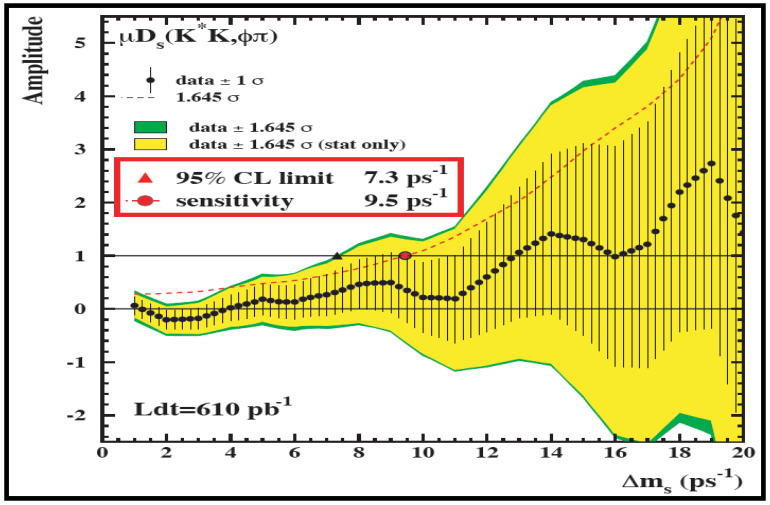

DØ Preliminary
95% C.L.
68% C.L.
σtt̄ (pb)
B(t → Wb)/B(t → Wq)

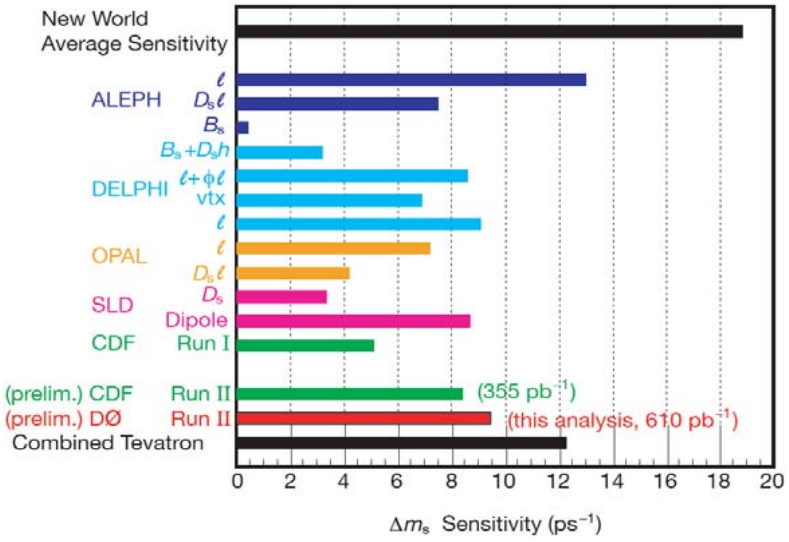

Top Mass & Projections
Lowest top mass error
Integrated luminosity

B Physics


with WA constraint (1σ stat.)
DØ default 1σ stat.
DØ
CDF
theor. 1σ band
Flav. Spec.
WA ± 1σ
ΔΓ / Γ̄
cτ̄ (cm)
τ̄ (ps)

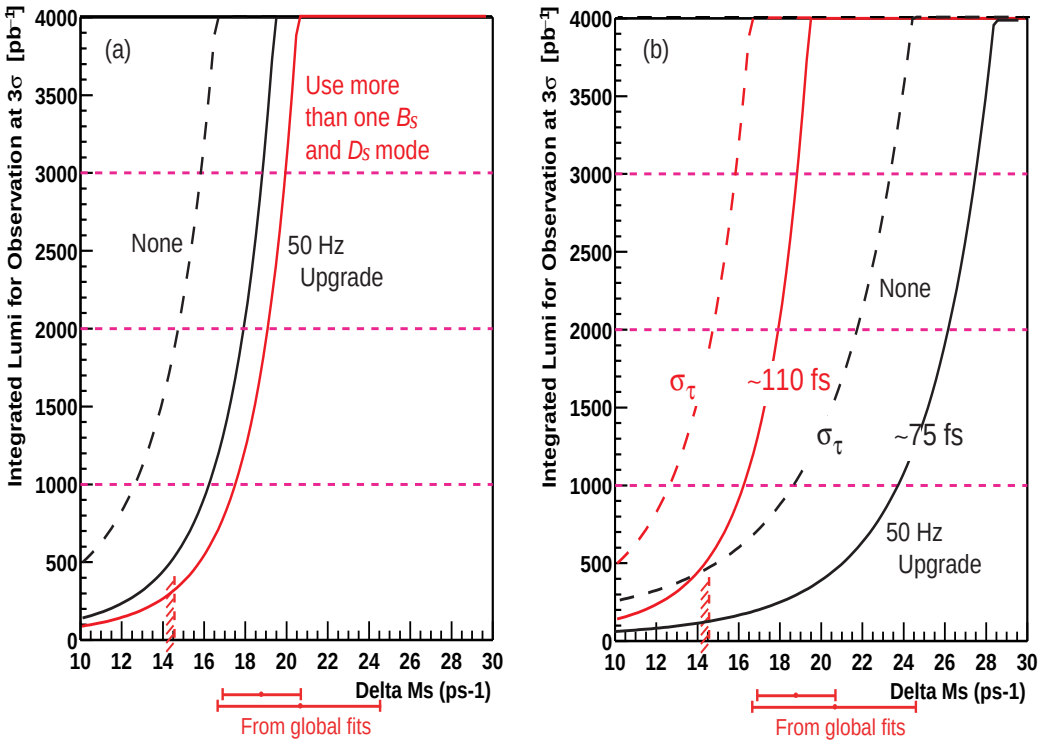

(b)
DØ Run II Preliminary
χ²/dof = 0.98
τ(B_s) = 1.420 ± 0.043 ± 0.057 ps
Candidates / 10 MeV/c²
Mass(φπ⁻) [GeV/c²]


μD_s(K*K,φπ)
data ± 1 σ
1.645 σ
data ± 1.645 σ
data ± 1.645 σ (stat only)
95% CL limit 7.3 ps⁻¹
sensitivity 9.5 ps⁻¹
Ldt=610 pb⁻¹
Amplitude
Δm_s (ps⁻¹)

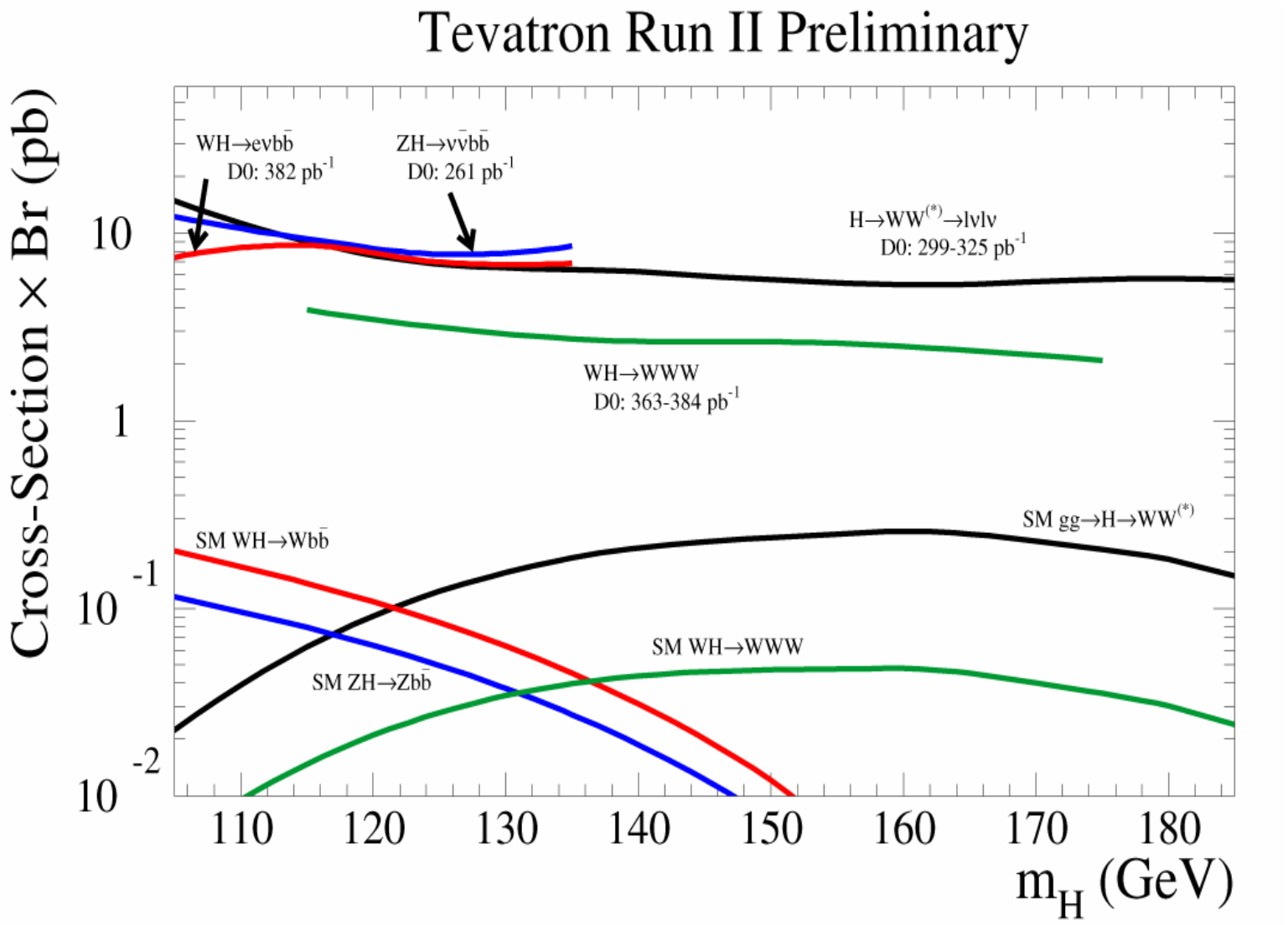

New World
Average Sensitivity
ALEPH
DELPHI
OPAL
SLD
CDF
(prelim.) CDF Run II (355 pb⁻¹)
(prelim.) DØ Run II (this analysis, 610 pb⁻¹)
Combined Tevatron
Δm_s Sensitivity (ps⁻¹)

Improving Bs Mixing Reach

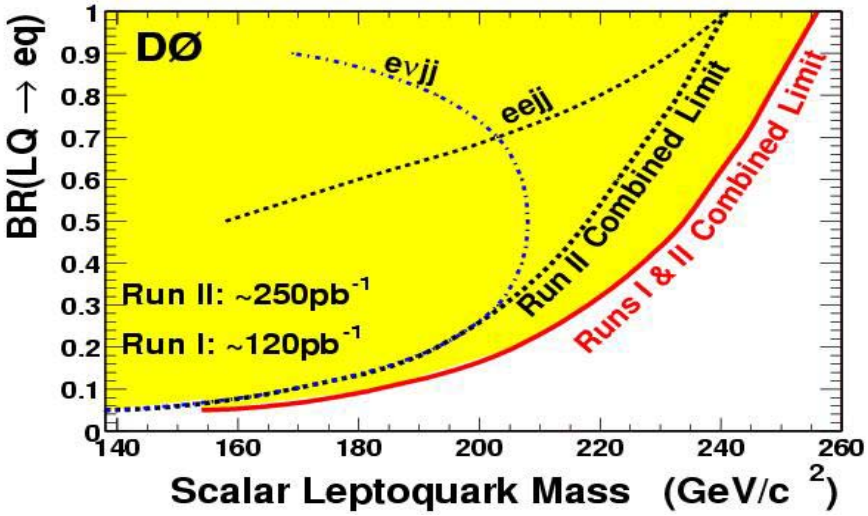
- Have submitted a proposal to improve Bs mixing reach.
- Measurement is statistically limited.
- L3 bandwidth
- 50 Hz store average limited by computing budget
- Have submitted a proposal to DOE for additional offsite reconstruction CPU
  - Located at IndianaU and UofOklahoma
  - 50% match by the institutions

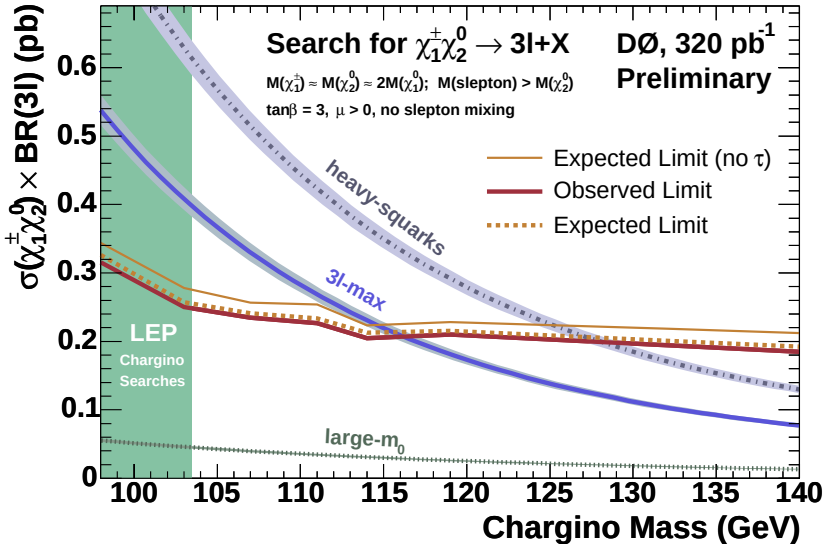


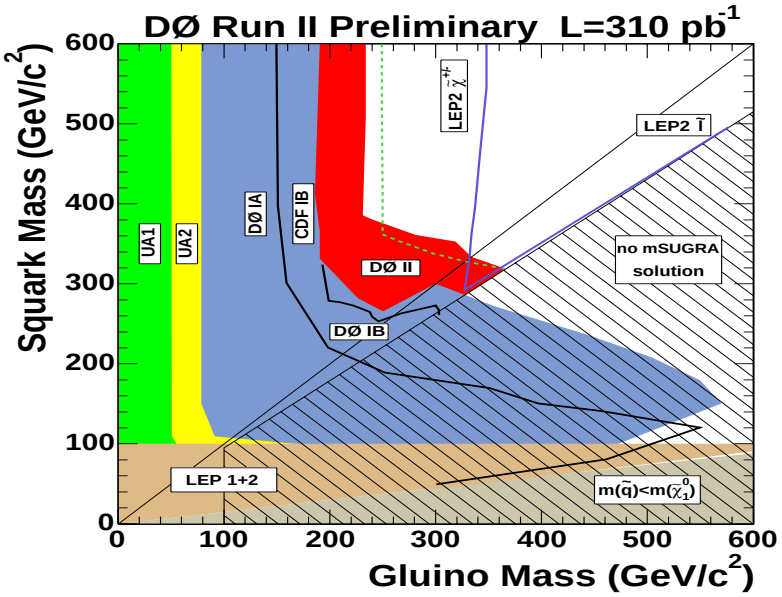
Higgs Searches

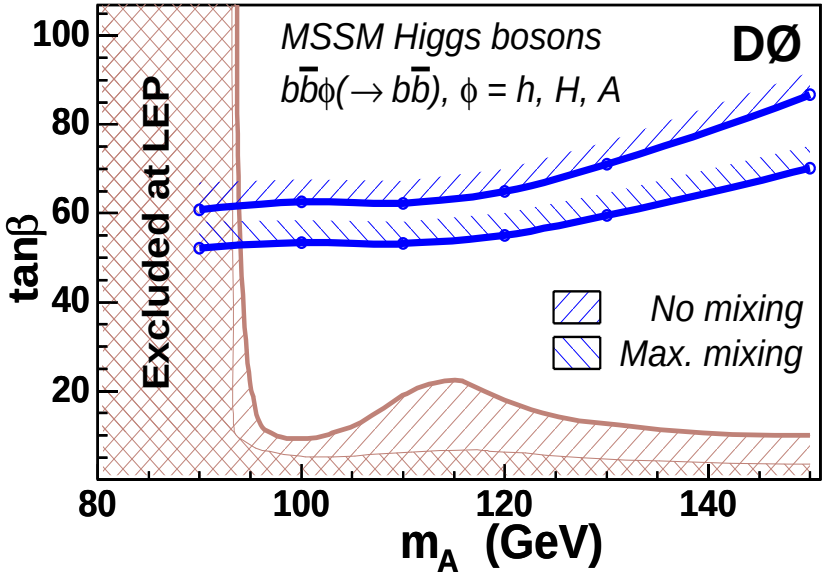


New Phenomena









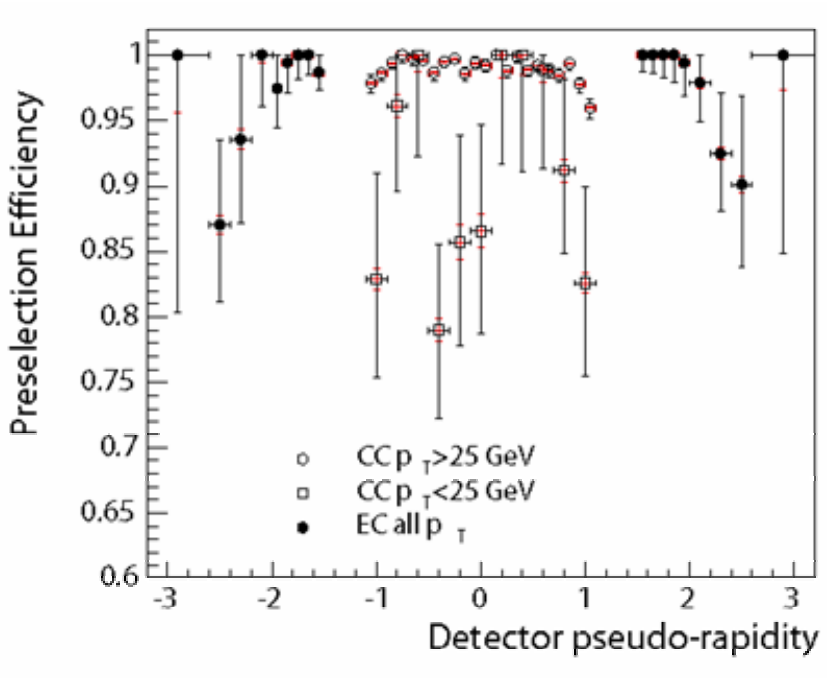
Experimental and Analysis Plan

- Each December upper management proposes a set of major goals for the experiment. The CY05 goals focused on
  - Completion of the upgrades
  - Preparation of the full Run IIa data set for CY06 presentation and publication
  - Increased automation/efficiency for long term data preparation and analysis
- Highlights of late CY05 goals:
  - July:
    - Reprocessing well underway.
    - Implementation of Common Analysis Format
  - August/September:
    - Complete upgrade elements.
  - October:
    - Preliminary version new jet calibration.
  - November:
    - Processing and Reprocessing of entire 1fb^{-1} data set complete with improved calibration/tracking
    - Automated certification of all object definitions.

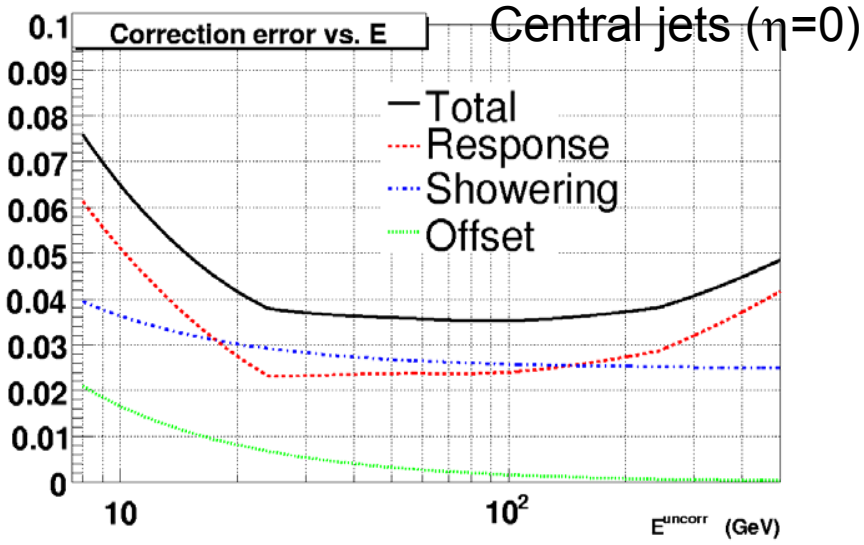
Key to future efficiencies

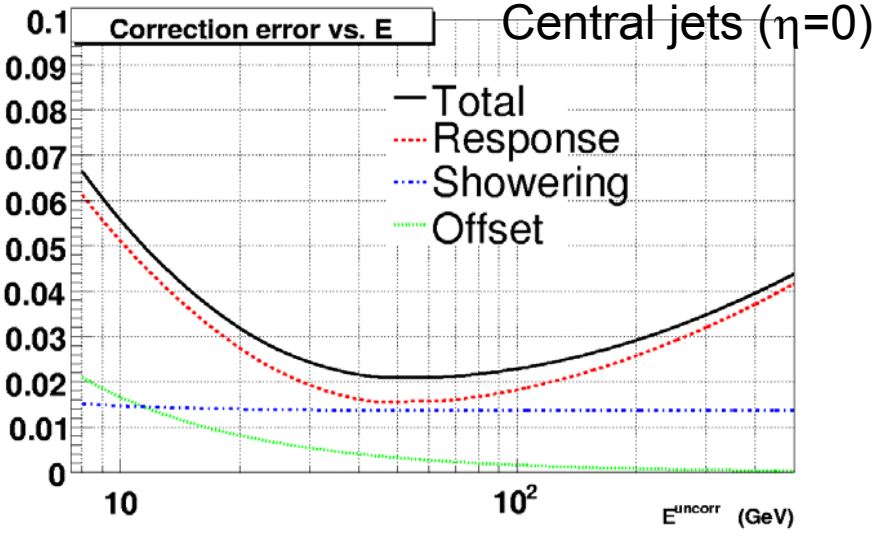
Improving Electron Acceptance

- For searches, extending electron acceptance beyond central region.
- Backgrounds ~1% in CC expected to be similar in EC.
- Working to achieve lower trigger thresholds with calorimeter trigger upgrade and understand track matching in the forward regions.



Jet Energy Calibration and Improvements

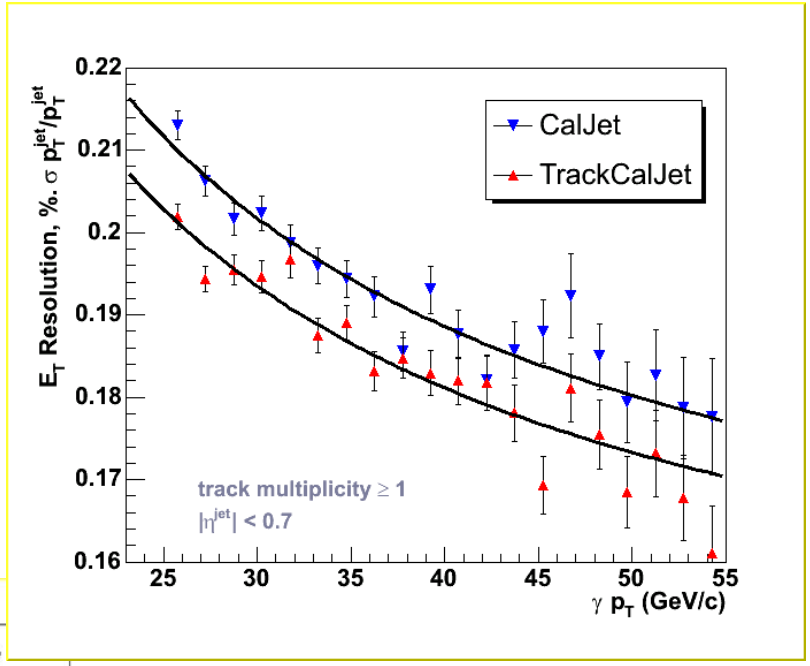


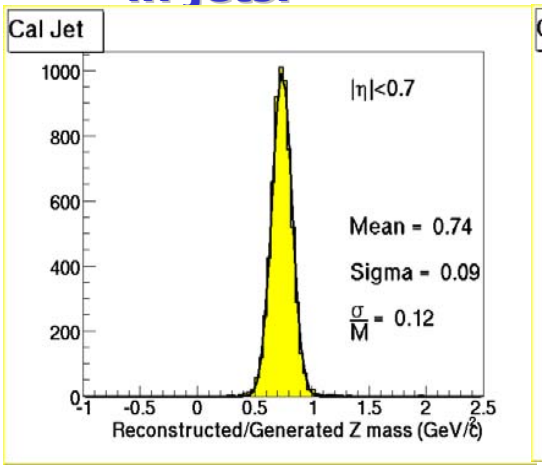


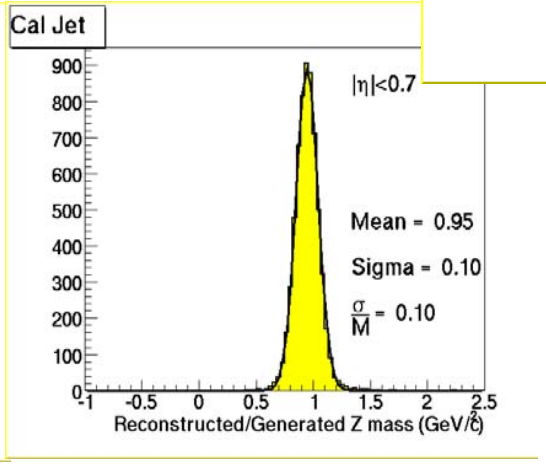
- **Negligible statistical uncertainties**
- **Factor of two improvement in systematic uncertainties in jet response related to photon purity and background estimation**
- **With completion of MC study out-of-cone energy loss uncertainty reduced from 2% to 0.5%**
- **Further improvements not shown here:**
  - **Jet response bias measurement at low E**
  - **Jet response extrapolation using Monte Carlo at high E**
- **Some Beneficiaries**
  - **Top mass in lepton+jets, cross sections**
  - **Single top**
  - **Any Search w/ jets**
  - **Inclusive jets…**

Jet Resolution & Improvements

- TrackCal Jet, an "add-on"
- Improve calorimeter jet resolution using tracks for hadron response.
- Track momentum measurements set an accurate scale for hadron response.
- Takes into account the non-linear response of individual particles in jets.



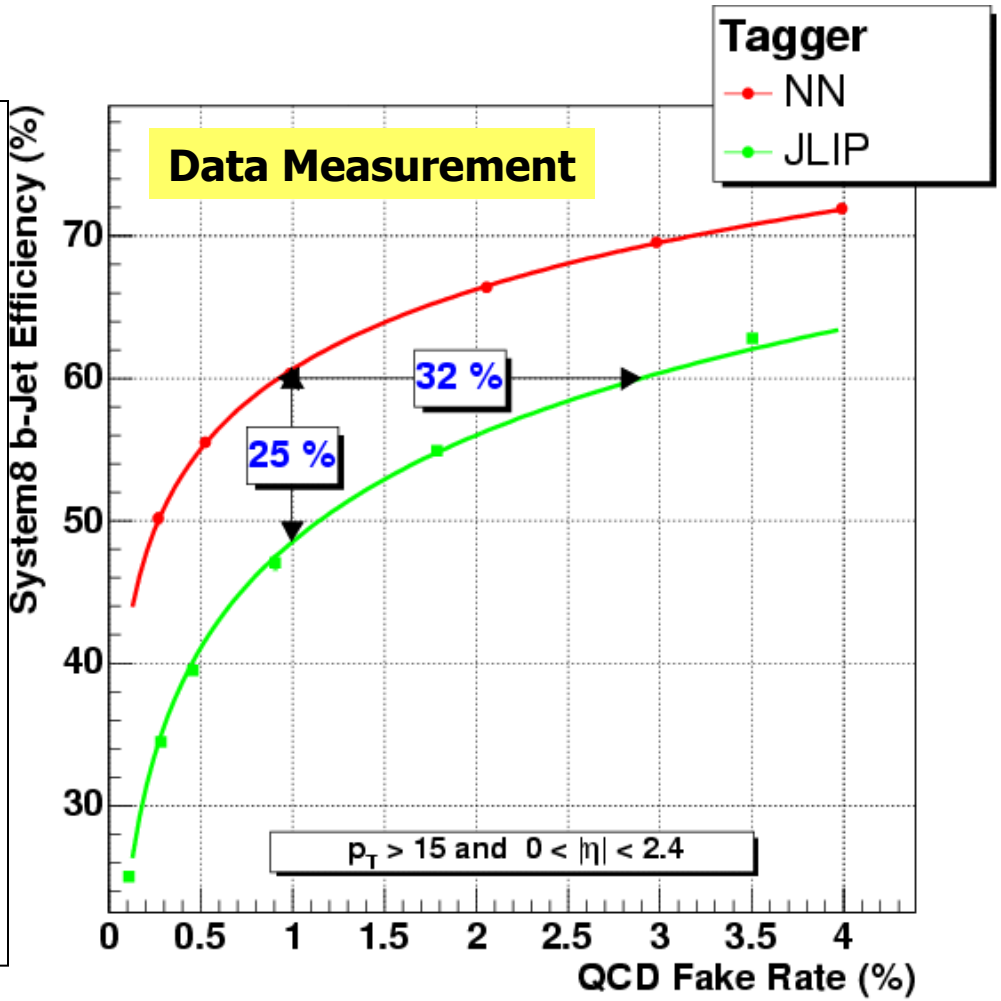




* 10% improvement in jet resolution.
* 20% improvement in MC Z resolution

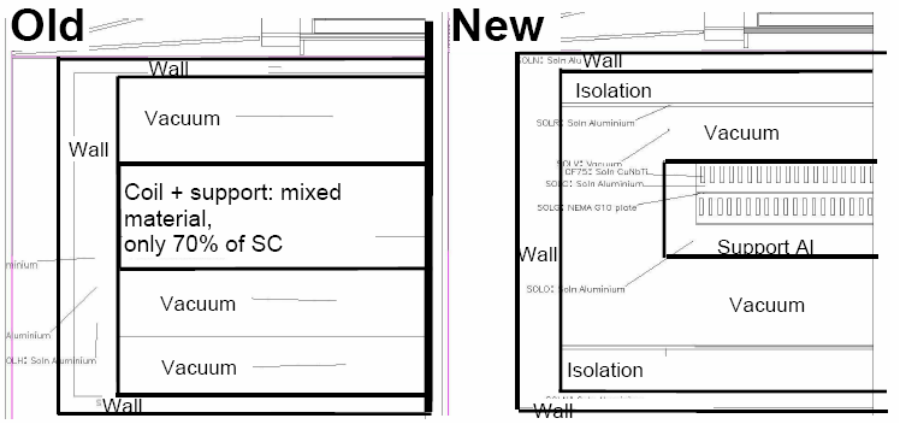
B-ID & Improvements

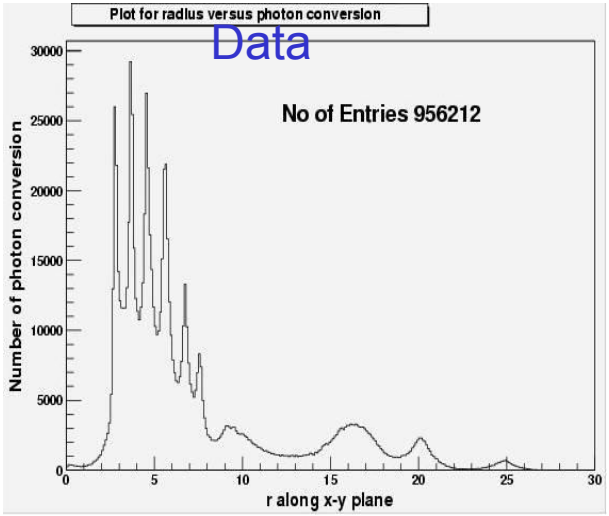
- Based on NN
- Seven inputs from
  - Secondary vertex tagger
  - Jet impact parameter tagger
- Significant improvement
  - 25% at fixed fake
  - X3 less fakes at fixed efficiency

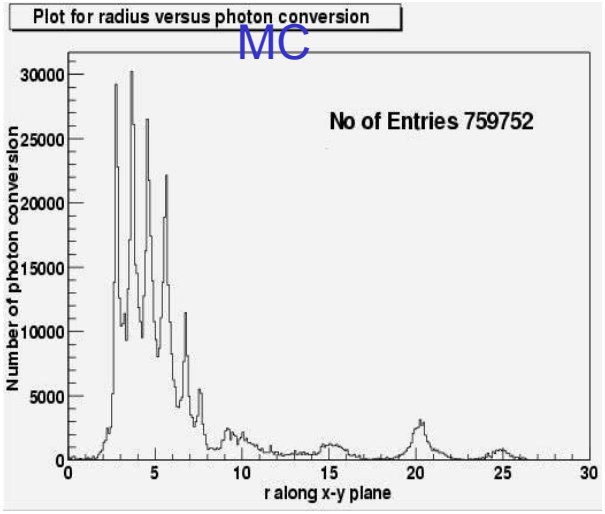


Simulation and Improvements

- **Improving description of material**
  - **Calorimeter, Cryostat, Solenoid**
  - **SMT volume, verified with photon conversions**

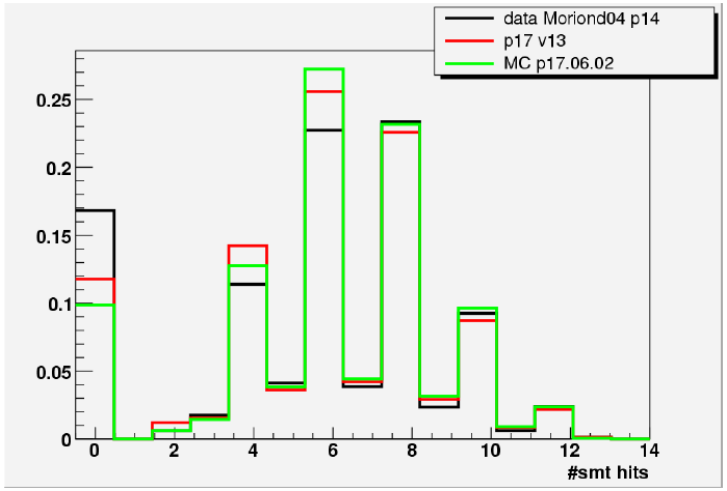


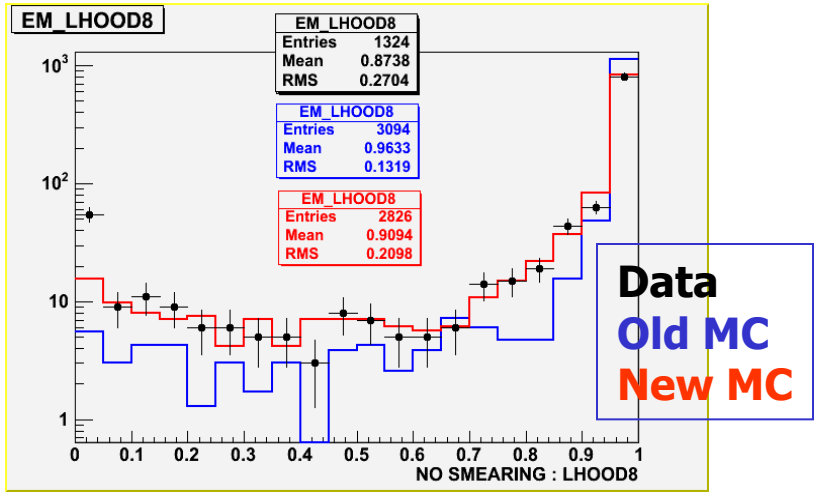


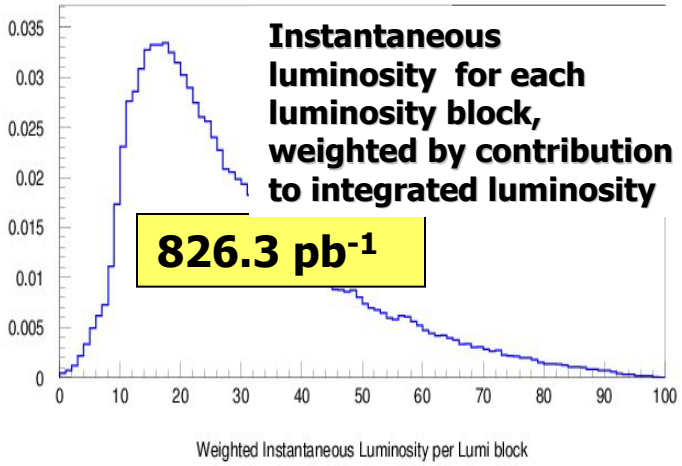


Simulation and Improvements

- **Simulation of dead channels in SMT & CFT**
- **Overlay of zerobias events on top of MC hard scatter**
  - **simulate detector occupancy, noise…**
  - **one zerobias event per MC event**
  - **Taken randomly from Run II luminosity profile:**







Conclusions

- The DØ detector is working well at ~90% efficiency
- Publishing at a healthy rate (up to 600 pb^{-1})
- Algorithms and simulation reaching maturity and improved sensitivity.
- The collaboration is enthusiastic about the nearly 1.0 fb^{-1} data to tape and the prospects for more.