The Start of Tevatron and DØ in Run 2

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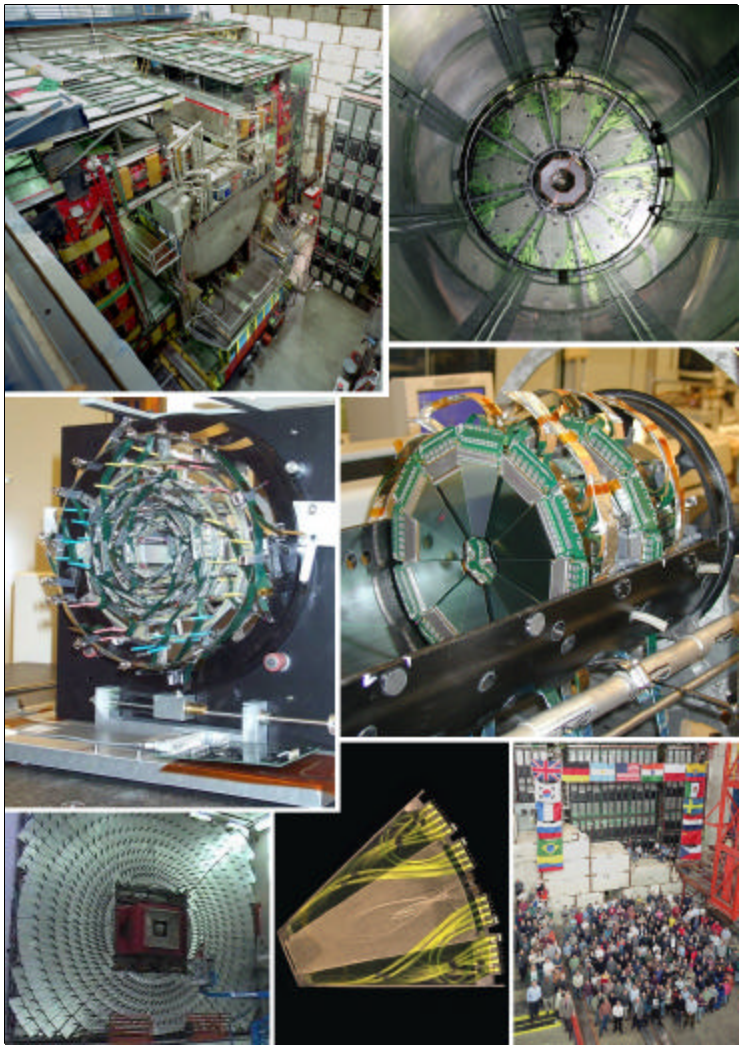
On behalf of the DØ collaboration

- Run 2 : introduction
- Tevatron
  - Status
  - Luminosity
- DØ detector
  - Status
  - Performance
- First physics results



Run 2

Tevatron upgrade:

- **Increased energy**
  - **Ös = 1.96 TeV (Run 1: 1.8 TeV)**
- **Increased luminosity**
  - **Run 2a: L ~ $1x10^{32}$ $cm^{-2}s^{-1}$, ?Ldt ~ 2 fb^{-1}**
  - **Run 2b: L ~ $5x10^{32}$ $cm^{-2}s^{-1}$, ?Ldt ~ 15 fb^{-1}**

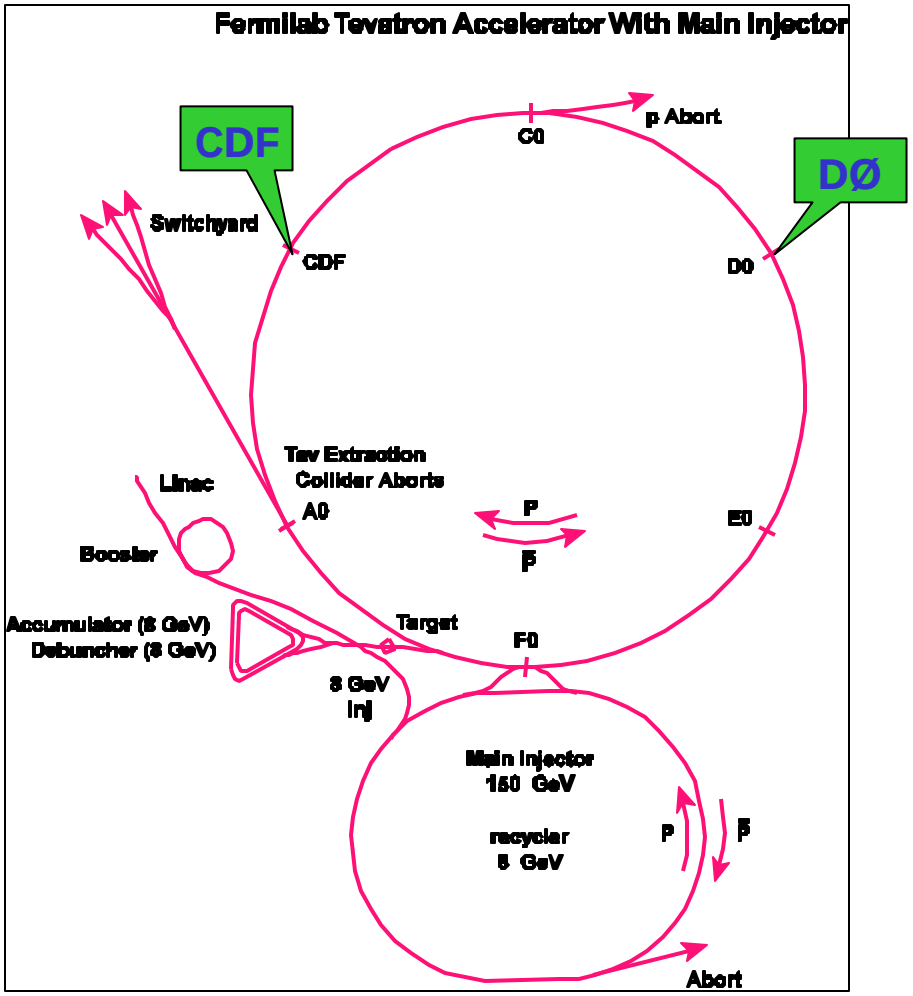
Detector upgrade:

- **Necessary adaptation to luminosity upgrade (electronics, trigger, DAQ)**
- **New tracking system + 2T solenoid**
- **Add preshower to existing calorimetry**
- **New muon system**

Run 2 physics

- Standard Model
  - Top quark properties
  - W/Z properties
  - B physics
  - QCD
- Higgs
- Physics beyond the Standard Model
  - Supersymmetry
  - Technicolor
  - Extra dimensions
  - ...

Tevatron


Fermilab Tevatron Accelerator With Main Injector
CDF
DØ
C0
p Abort
Switchyard
CDF
D0
Tev Extraction
Collider Aborts
Linac
A0
E0
Booster
Accumulator (8 GeV)
Debuncher (8 GeV)
Target
F0
8 GeV
Inj
Main Injector
150 GeV
recycler
8 GeV
Abort

Tevatron upgrade

Protons

- Main injector replaces main ring

Antiprotons

- Target upgrades, Li lens
- debuncher and accumulator stochastic cooling systems
- Run 2b -> use Recycler: antiproton intensity improvement

Tevatron

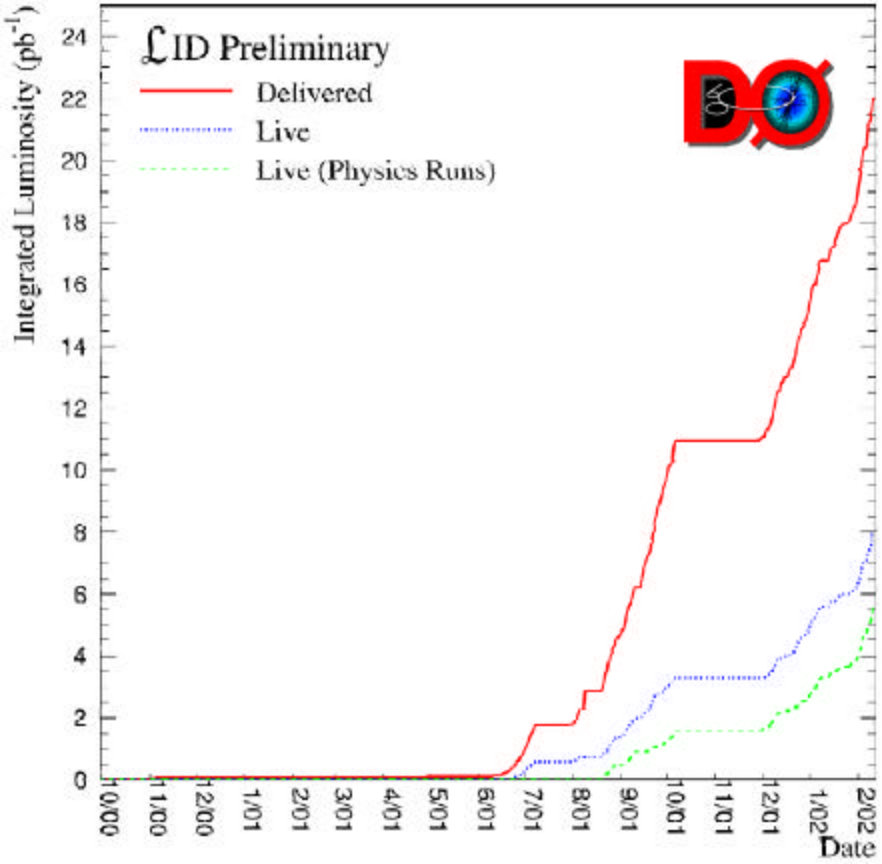
- Energy increase
- Beam intensity increase / emmittance decrease

Tevatron parameters

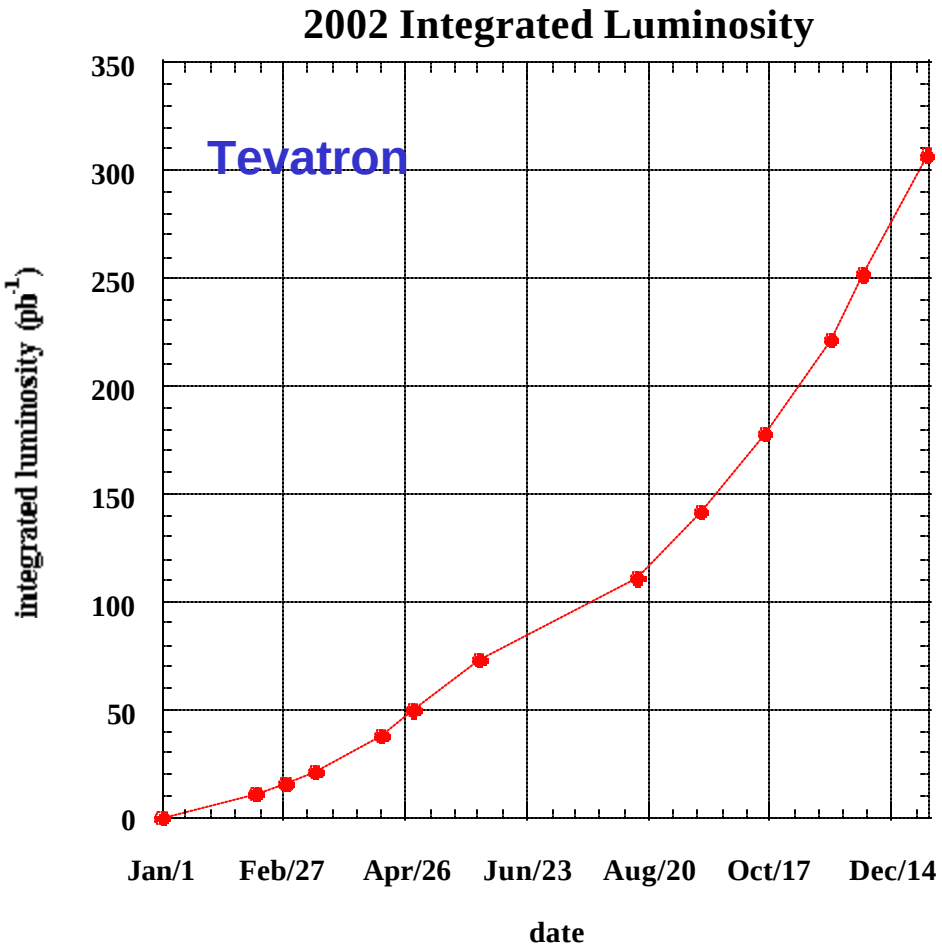
	Run 1b	Run 2a	Run 2b	
p/bunch	2.3	2.7	2.7	10^{11}
pbar/bunch	5.5	3.0	10	10^{10}
bunches	6x6	36x36	140x103	
bunch length	60	37	37	cm
bunch spacing	~3500	396	132	ns
interactions/xing	2.5	2.3	4.8	
crossing angle	0	0	136	mrad
p/p emittance	23p/13p	20p/15p	20p/15p	mm mrad
Ös	1.8	1.96	1.96	TeV
typical L	0.16	8.6	52	$10^{31}cm^{-2}s^{-1}$
?Ldt	3.2	17.3	105	pb^{-1}/week

Luminosity

Luminosity to date



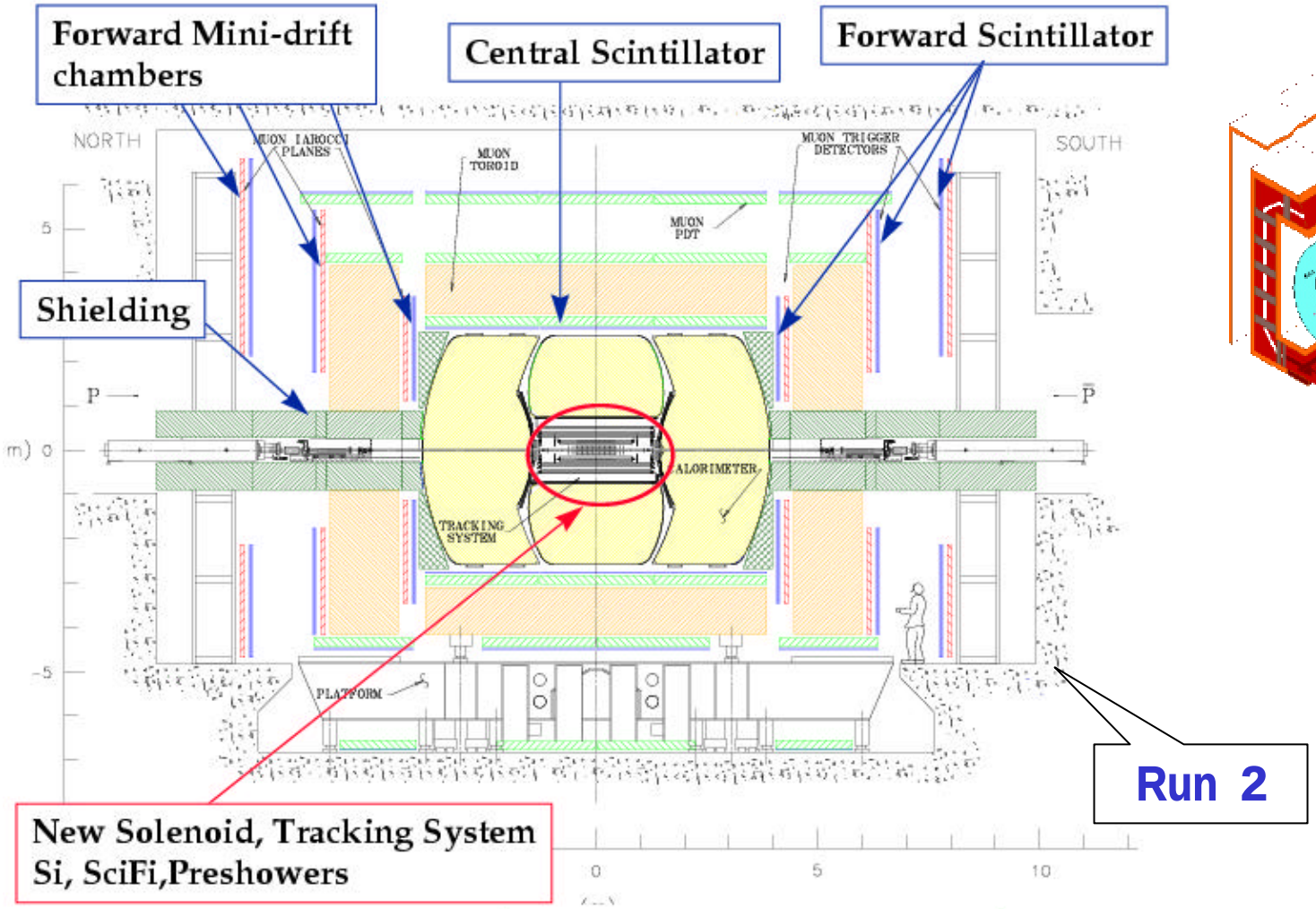
Forseen luminosity for 2002

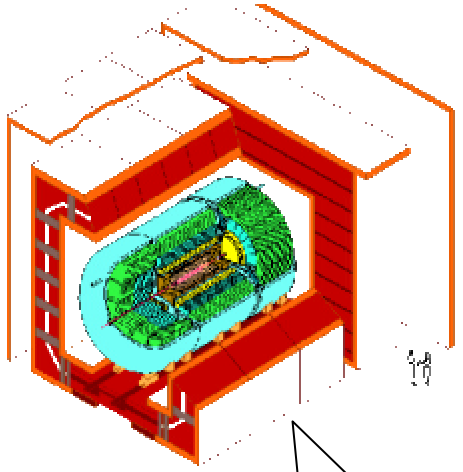


The DØ Collaboration

- 18 countries
- 81 institutions or universities
- 500-600 physicists

DØ Upgrade





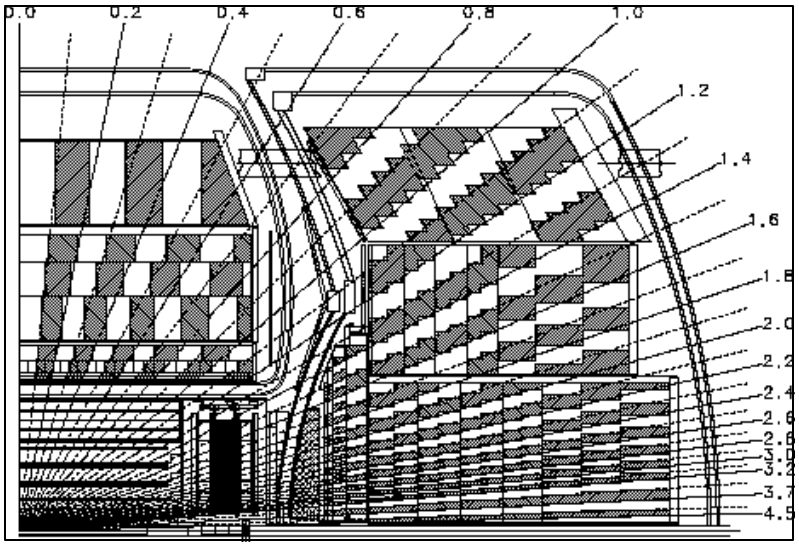
Run 1

Run 2

DØ detector

DØ detector in the Collision Hall, January 2001

Calorimeters



Detector

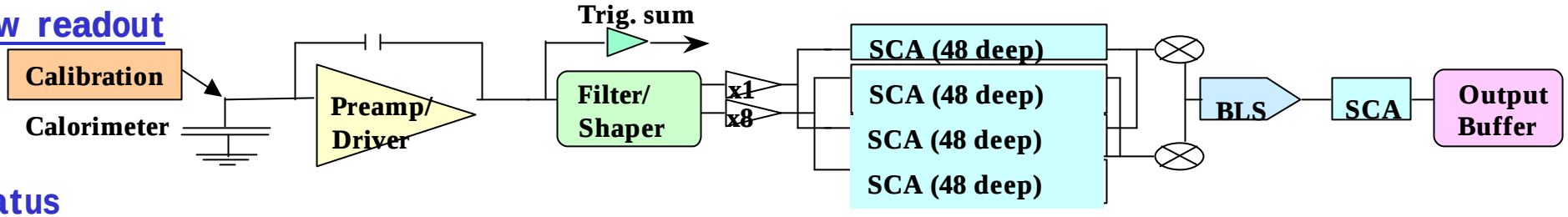
Liquid argon sampling and Uranium absorber (Cu or Steel for coarse hadronic)

- |?| < 1 (central)
- 1.2 < |?| < 4.2 (forward)

Readout segmented into h, f for charge detection

- Transverse segmentation ??x? f = 0.1x0.1
- At shower max. : ?? x ? f = 0.05 x 0.05
- 55 000 channels

New readout



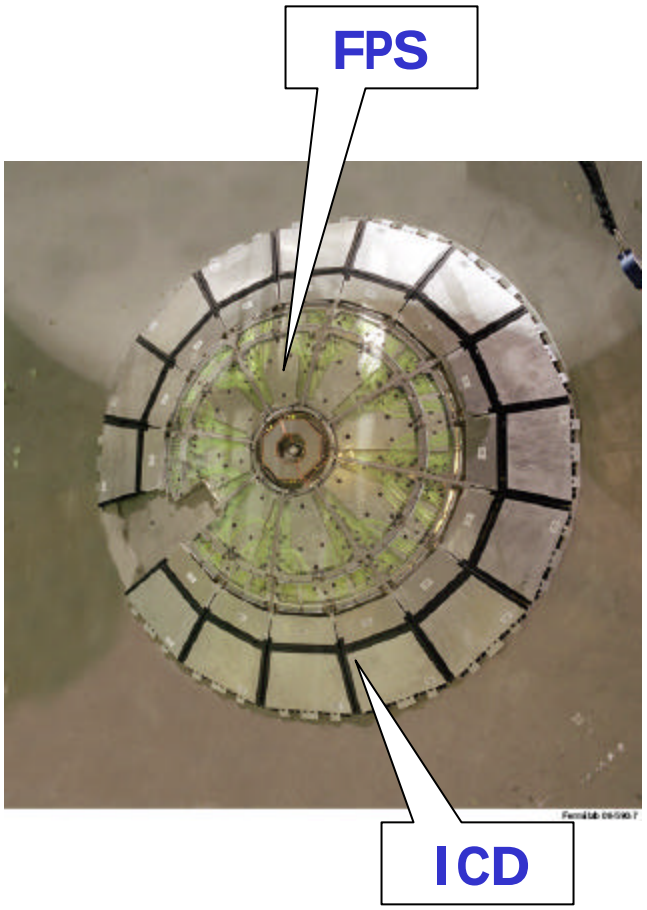
Status

- Fully operational (~0.1% bad channel), calibrated: gain and non linearity corrected

Performances

- e: s(E)/E = 23%/ÖE ⊕ 20%/E ⊕ 0.004
- Compensating e/p ~ 1

Preshowers and ICD



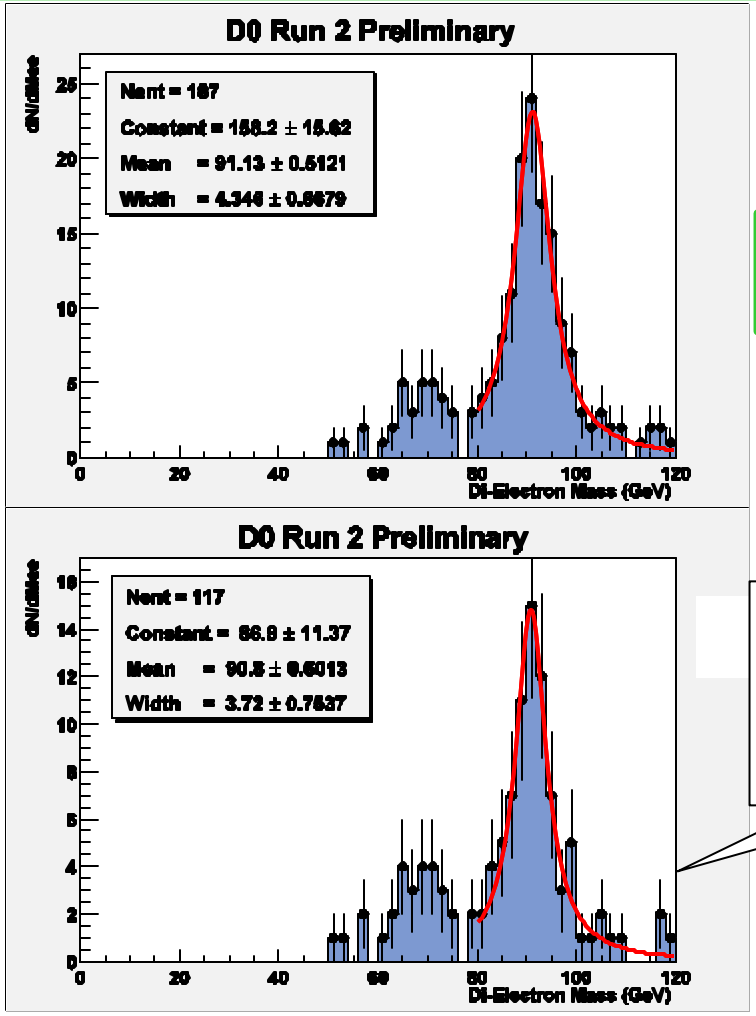
Preshowers

- Central mounted on solenoid (|h| < 1.2)
- Forward on calorimeter endcaps (1.4 <|h|<2.5)
- Extruded triangular scintillator strips with embedded fibers and Pb absorber (3 or 4 layers)
- Allow to trigger on low-p_T EM showers and reduce overall electron trigger rate by x3-5
- Central preshower: 80% axial readout
- Forward preshower not readout for the moment

ICD (Inter Cryostat Detector)

- scintillator tiles
- Improve coverage for the region 1.1<|h|<1.4
- Improves jet E_T and ME_T

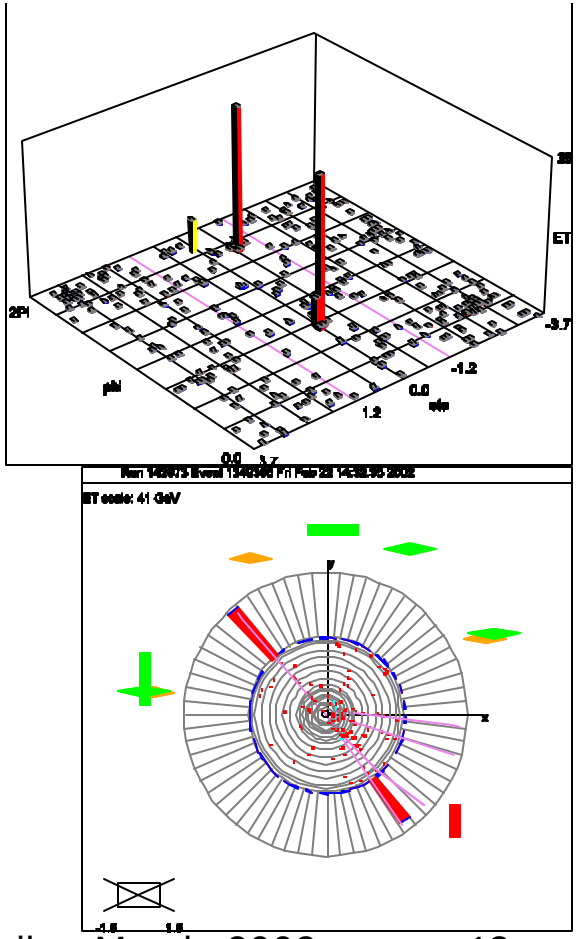
On the way to W/Z/top physics



Z ® e^+e^-

Central Calorimeter, only

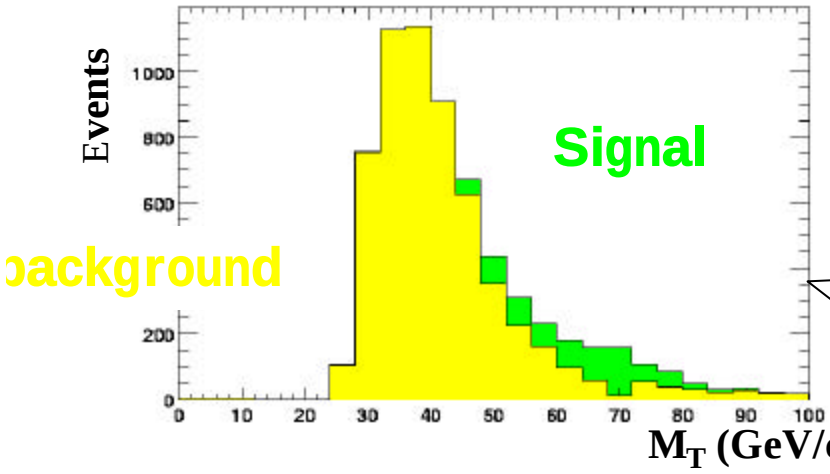
Mee=93.2 GeV
Each e have calorimeter energy and Global track



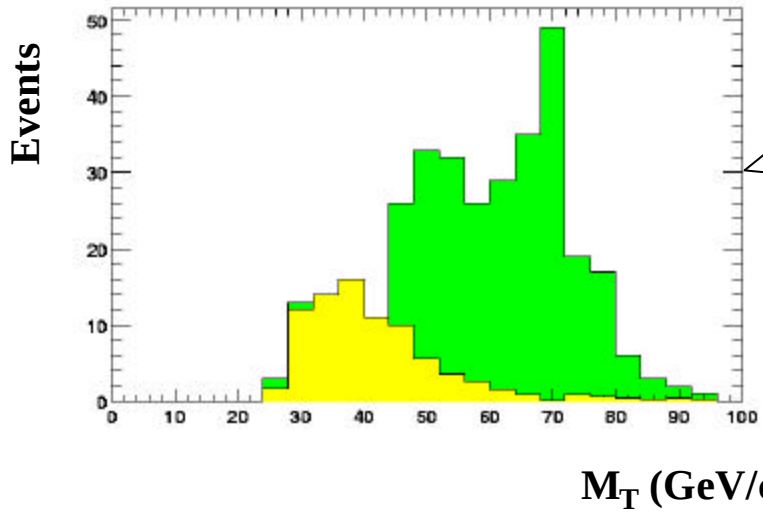
Di-EM mass spectrum after energy corrections.

On the way to W/top physics

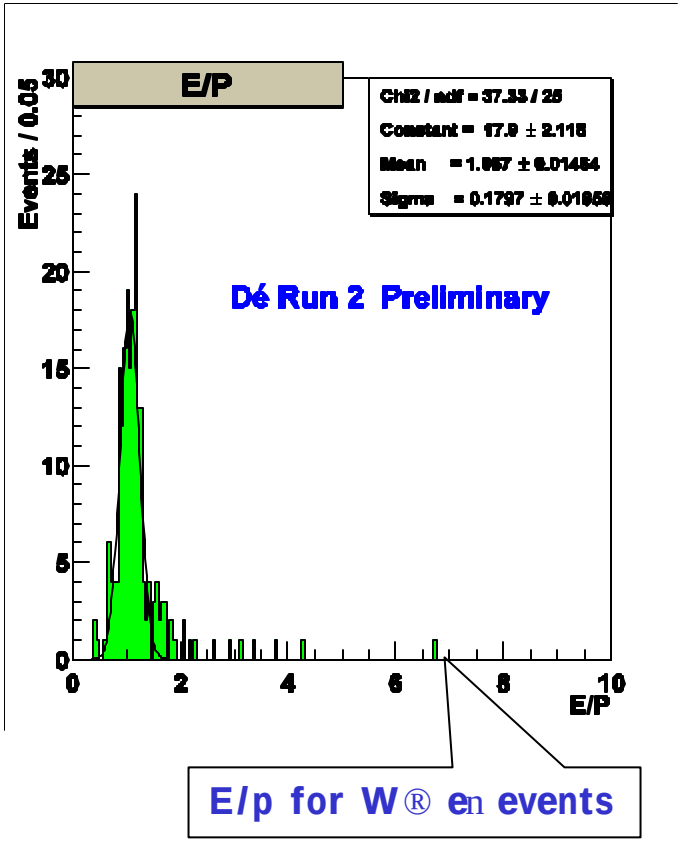
W® en



Without matching of track and calo cluster
Purity ~ 35 %
(~650 signal events)



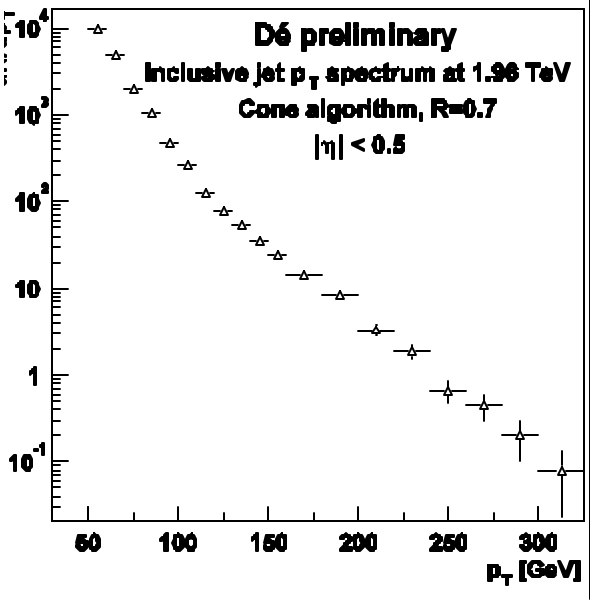
With matching of track and calo cluster
Purity ~ 95 %
(~200 signal events)



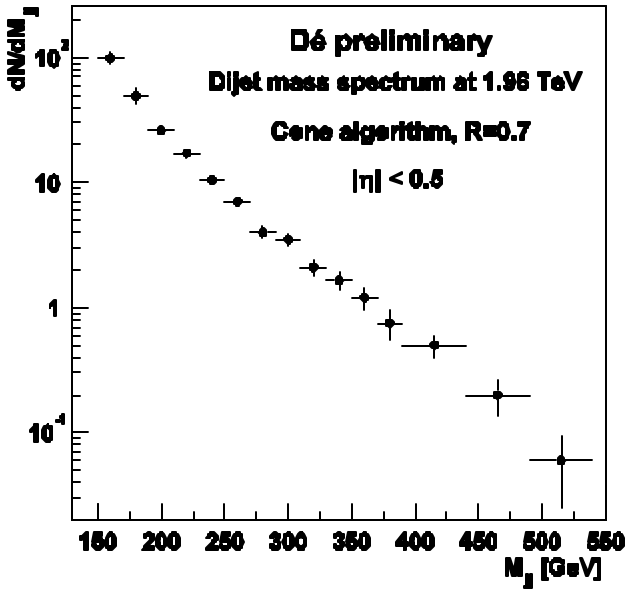
E/p for W® en events

On the way to QCD physics

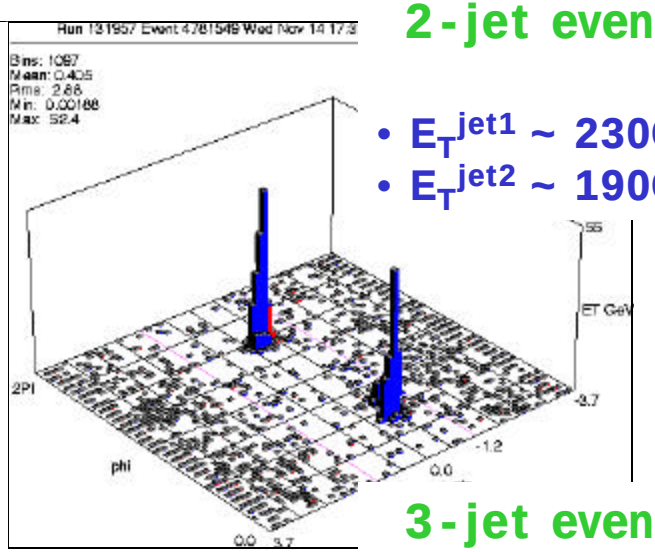
Single Jet P_T



Dijet Invariant Mass

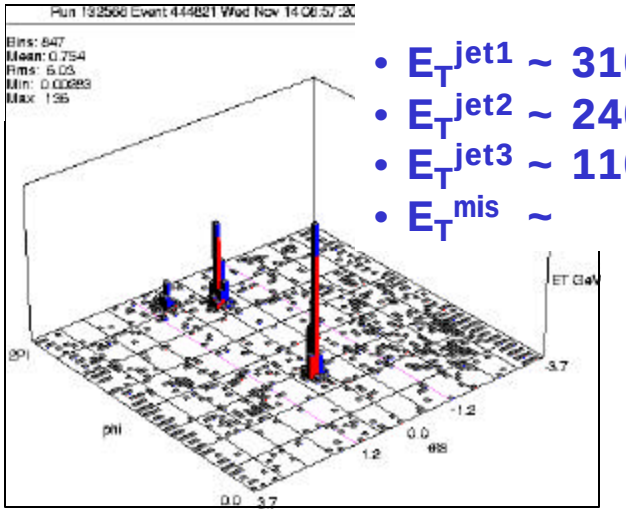


2-jet event



- E_T^{jet1} ~ 230GeV
- E_T^{jet2} ~ 190GeV

3-jet event



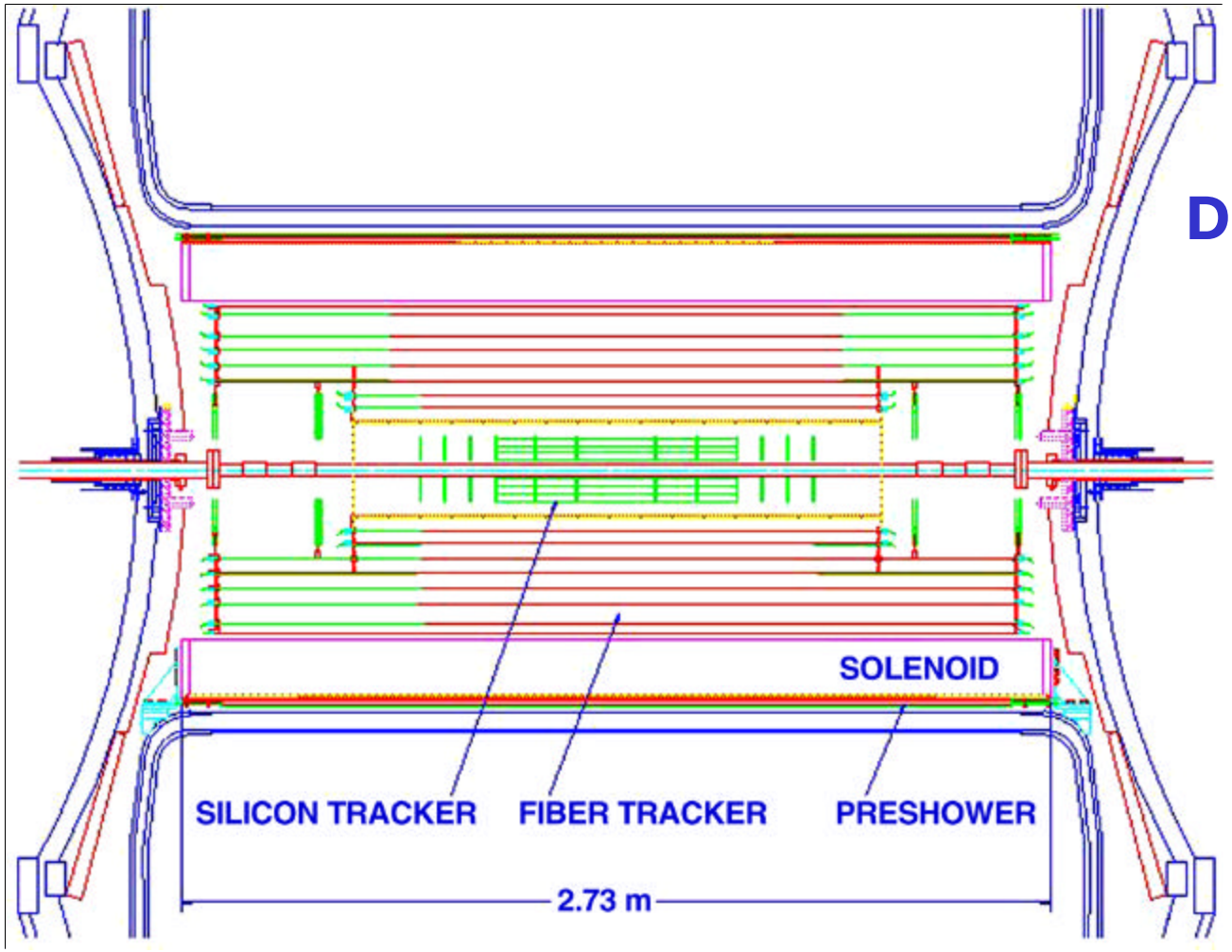
- E_T^{jet1} ~ 310 GeV
- E_T^{jet2} ~ 240 GeV
- E_T^{jet3} ~ 110 GeV
- E_T^{mis} ~ 8 GeV

Plots obtained with < 1 pb^{-1} (not normalized with L).

No trigger efficiency correction applied.

Preliminary energy corrections.

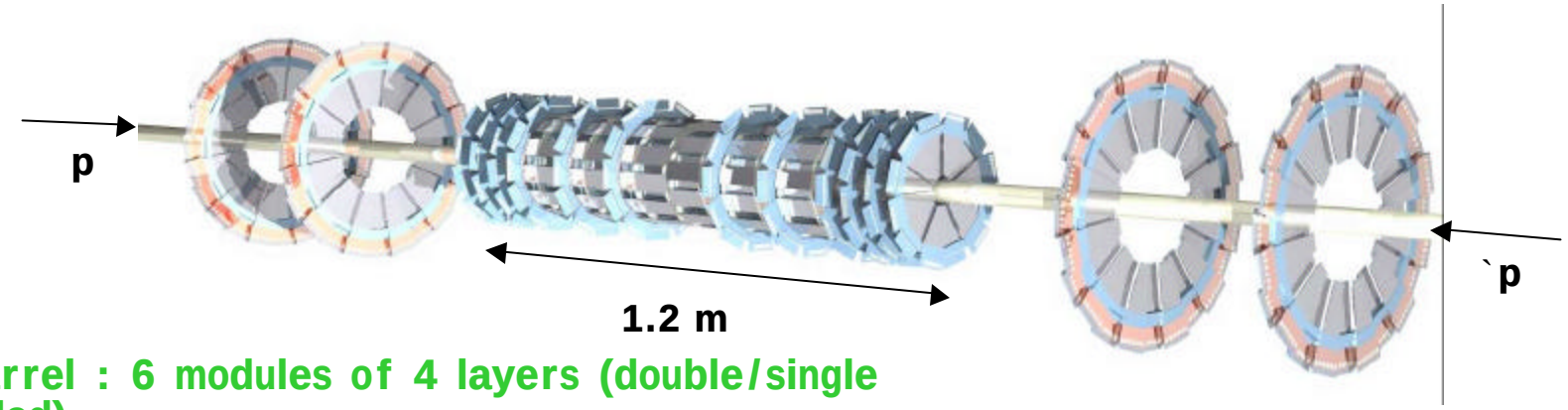
Tracking



DØ tracking upgrade:

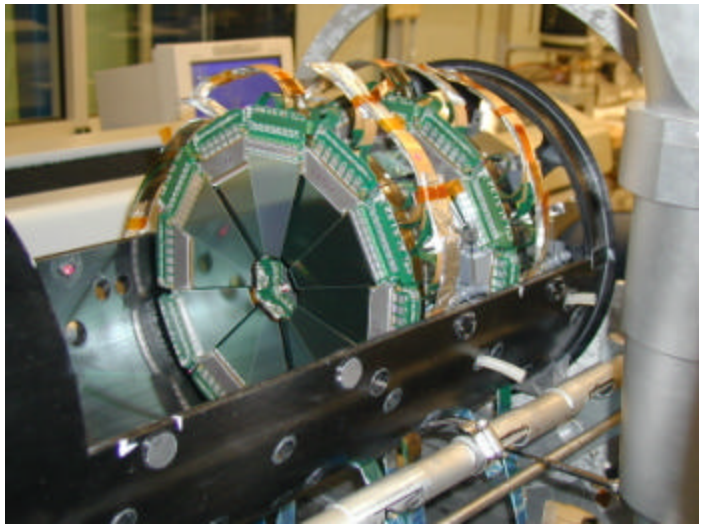
- Solenoid: 2 T
- CFT = Central Fiber Tracker
- SMT = Silicon Microstrip Tracker

Silicon Microstrip Tracker



Detector:

- Barrel : 6 modules of 4 layers (double/single sided)
- 12 central disks (double sided)
- 4 forward disks (single sided)
- 793 000 channels of electronics
- |?| = 3, 2.5 cm < r < 9.5 cm
- rad hard -> 1 Mrad



Status

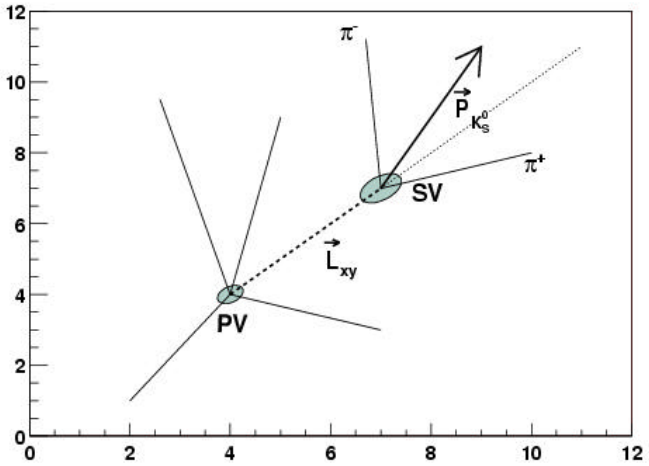
- Fully operational

Performance

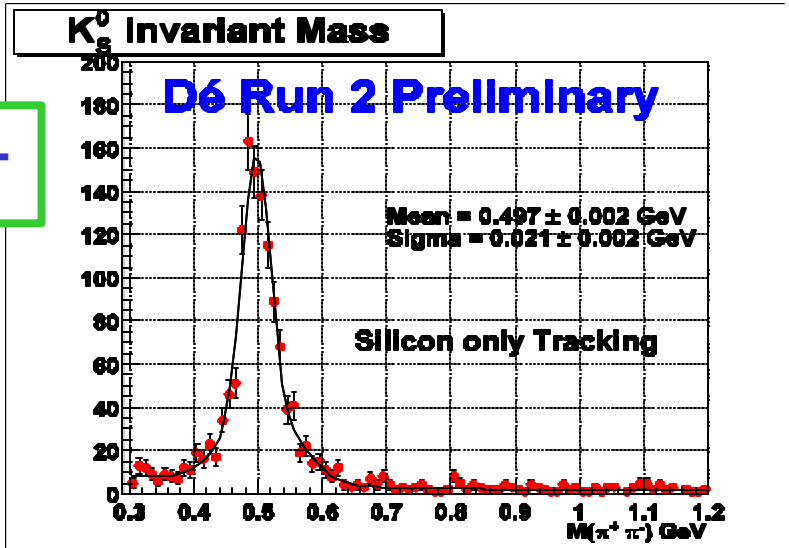
- Point resolution to 10mm
  s^{vertex}= 40 mm (r-f) ; 100 mm (r-z)
- secondary vertex measurement -> b jets

On the way to B physics …

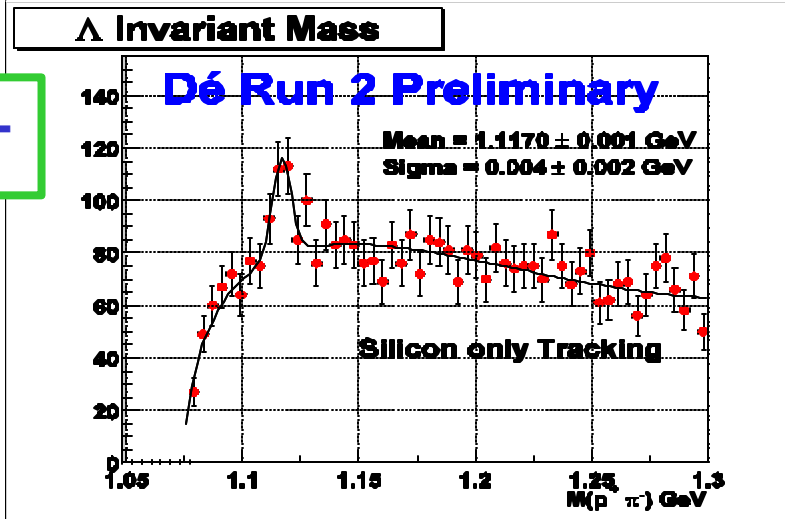
Displaced vertices



Ks ® p⁺p⁻



? ® p⁺p⁻



Method:

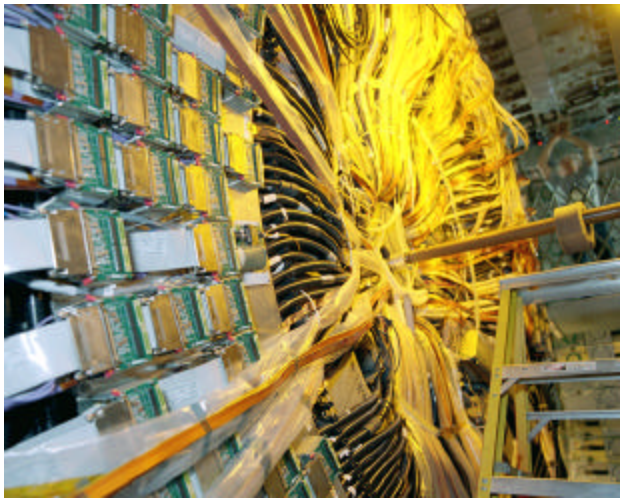
- Select primary vertices
- Find all 2 tracks combinations
- Select Ks secondary vertices

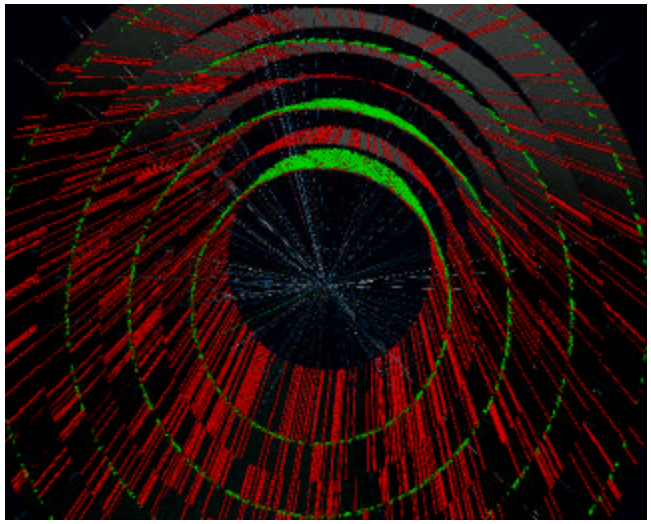
(SMT only tracking)

Central Fiber Tracker

Detector

- |?| = 1.7, 20 = r = 50cm
- Eight layers ribbon doublets (axial, stereo 2º), 2.6m active length
- 74 000 830 mm fibers with Visible Light Photon Counters (VLPC) readout (6-13 K)
- Rad hard (10 years @ 10^{32})





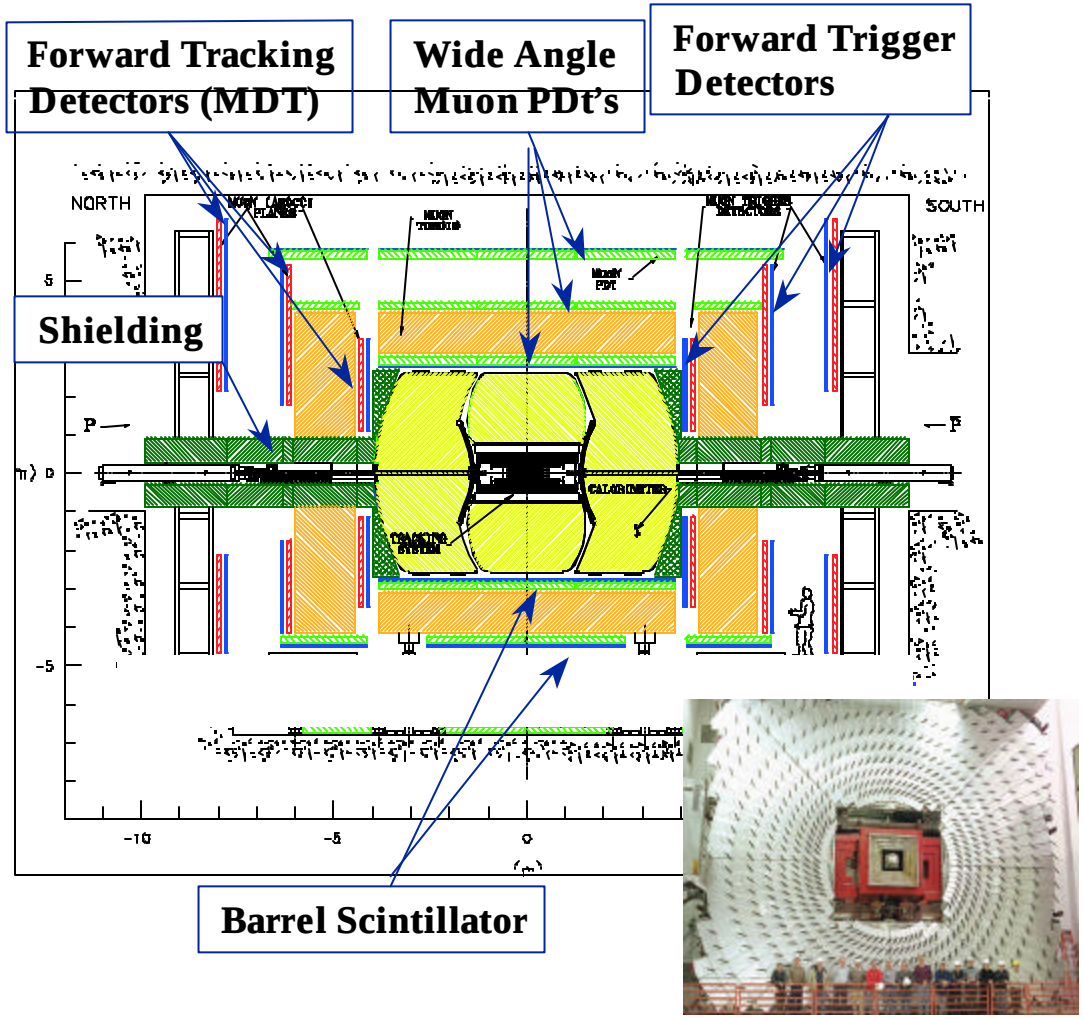
Status

- 100% axial readout installed,
- 50 % for stereo

Performance

- z information from small angle stereo
- fast r-f information for L1 trigger
- Position resolution ~ 100 µm

Muon detector



Detectors

Wide Angle Muon Proportional Drift Tubes (PDT)

- use existing PDT's for |h| < 1 and faster gas (Ar-CF4-CH4)
- add bottom layer to complete coverage

Forward Tracking Chambers

- Plastic mini-drift tubes provide hit info in 1< h < 2 (3 layers)

Barrel Scintillators

- time info and match m tracks to fiber tracker

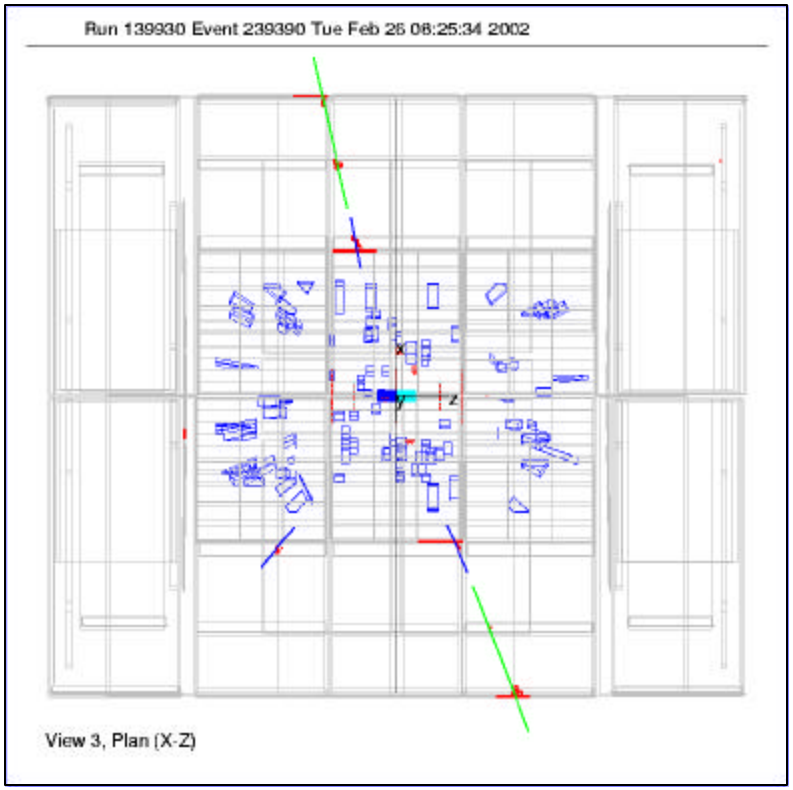
Forward Trigger Detectors

- Scintillator pixel counters (3 layers)

Status: fully operational

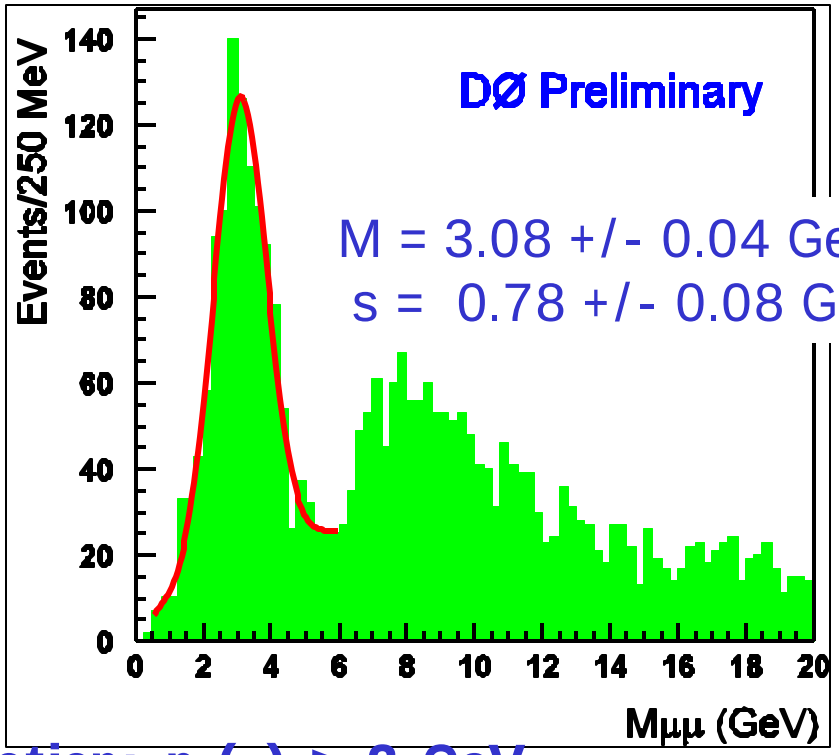
On the way to B physics

Z → $\mu^+\mu^-$



Invariant Mass = 103GeV

J/ψ → $\mu^+\mu^-$



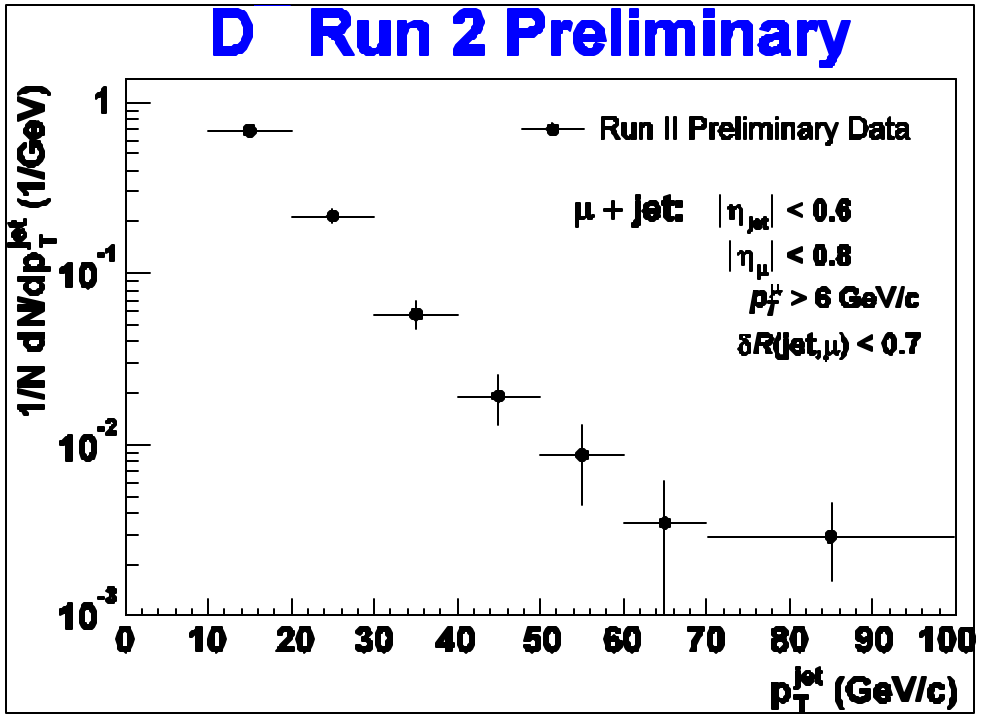
Selection: $p_T(\mu) > 3$ GeV

N(J/ψ) = 865 +/- 10% (bgd uncertainty)

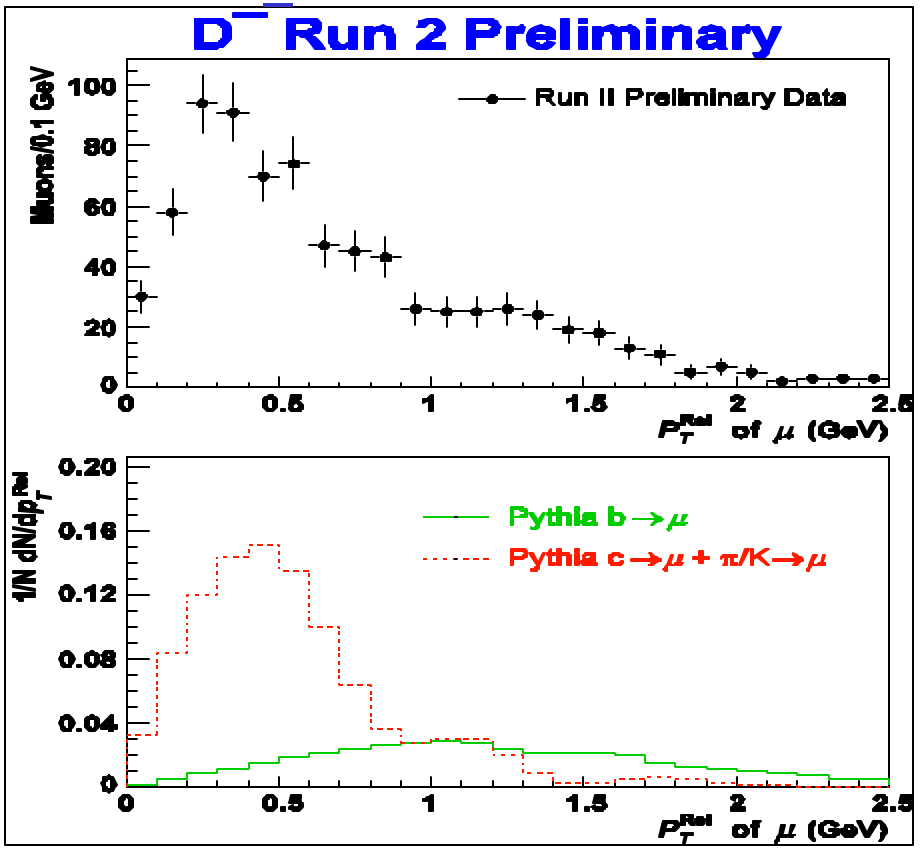
On the way to B physics

m in jets

Cross Section

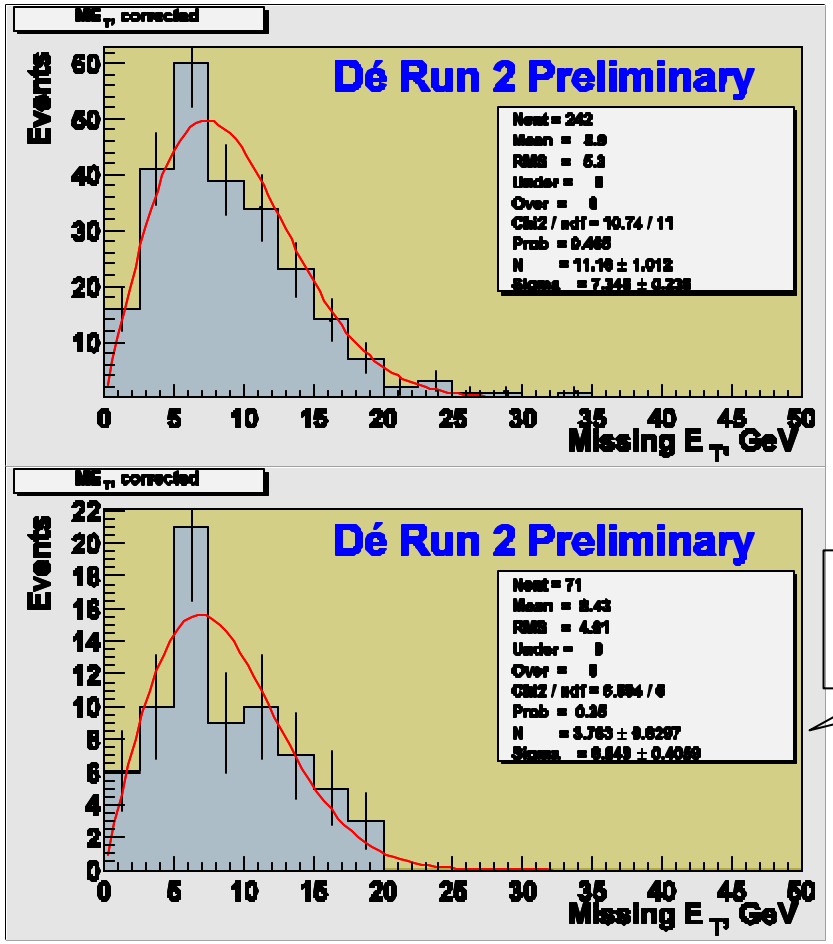


P_T rel distribution

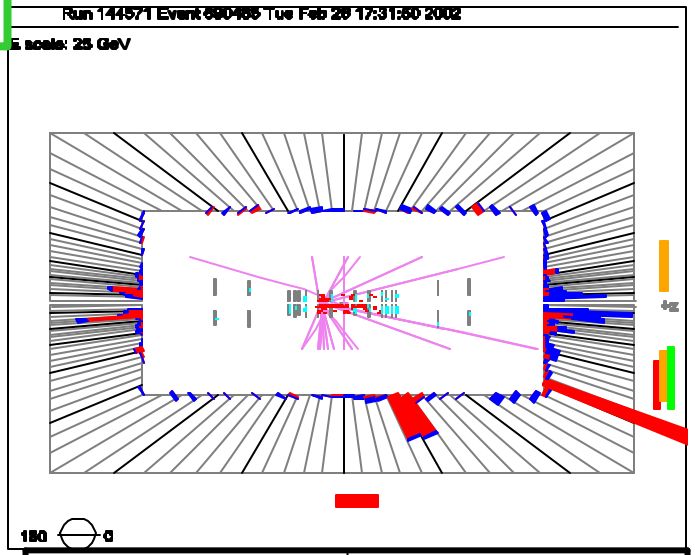


On the way to new phenomena physics

diEM+ME_T Channel



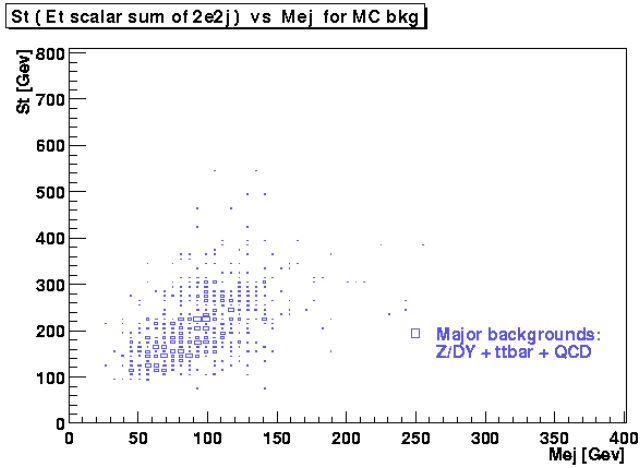
With 1 track matching



EM1	EM2
E_T = 27.4 GeV h = 0.52 j = 3.78 Loose match with a low-p_T track	E_T = 26.0 GeV h = 1.54 j = 5.86 No track match
ME_T = 34.3 GeV; M(diEM) = 53 GeV	

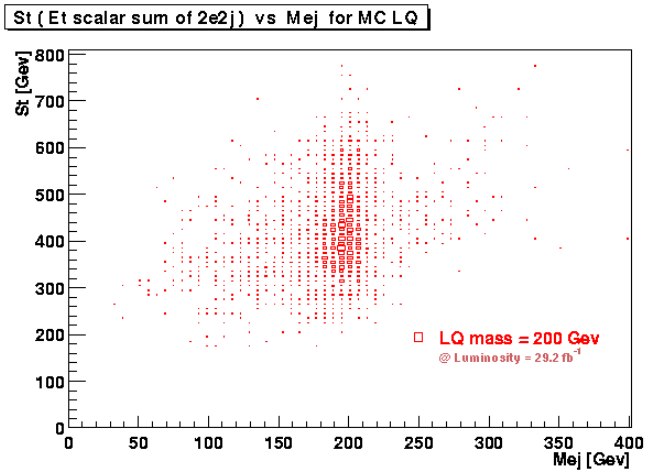
On the way to new phenomena physics

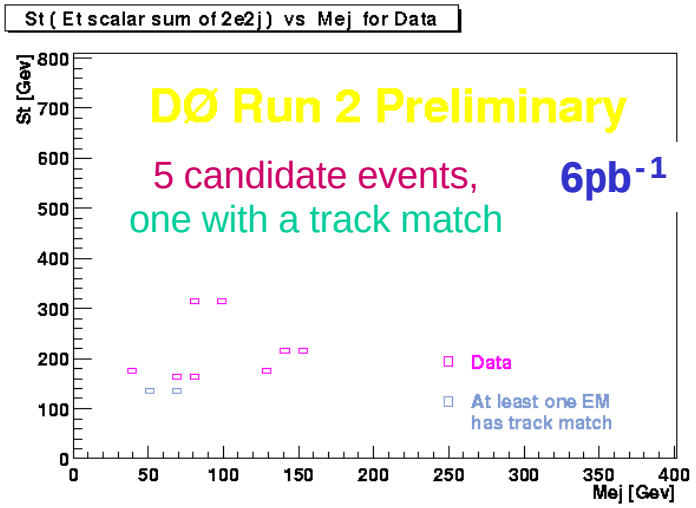
First generation LQ
(2 electrons + 2 jets)

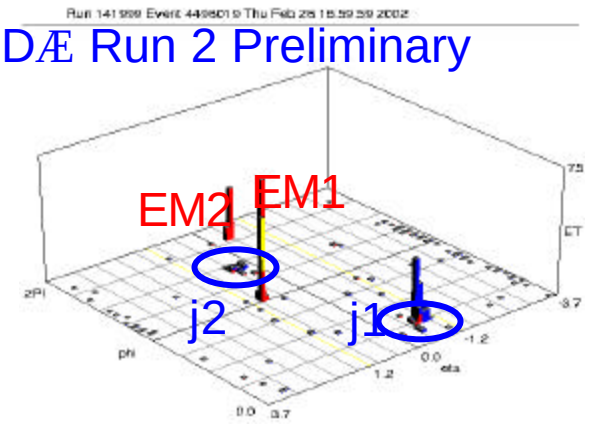


Kinematic cuts: 2 EM objects with E_T > 25 GeV and more than 2 jets with E_T > 20 GeV
S_T = scalar sum of transverse energies of electrons and jets to separate signal and background

Most energetic event has S_T = 315 GeV

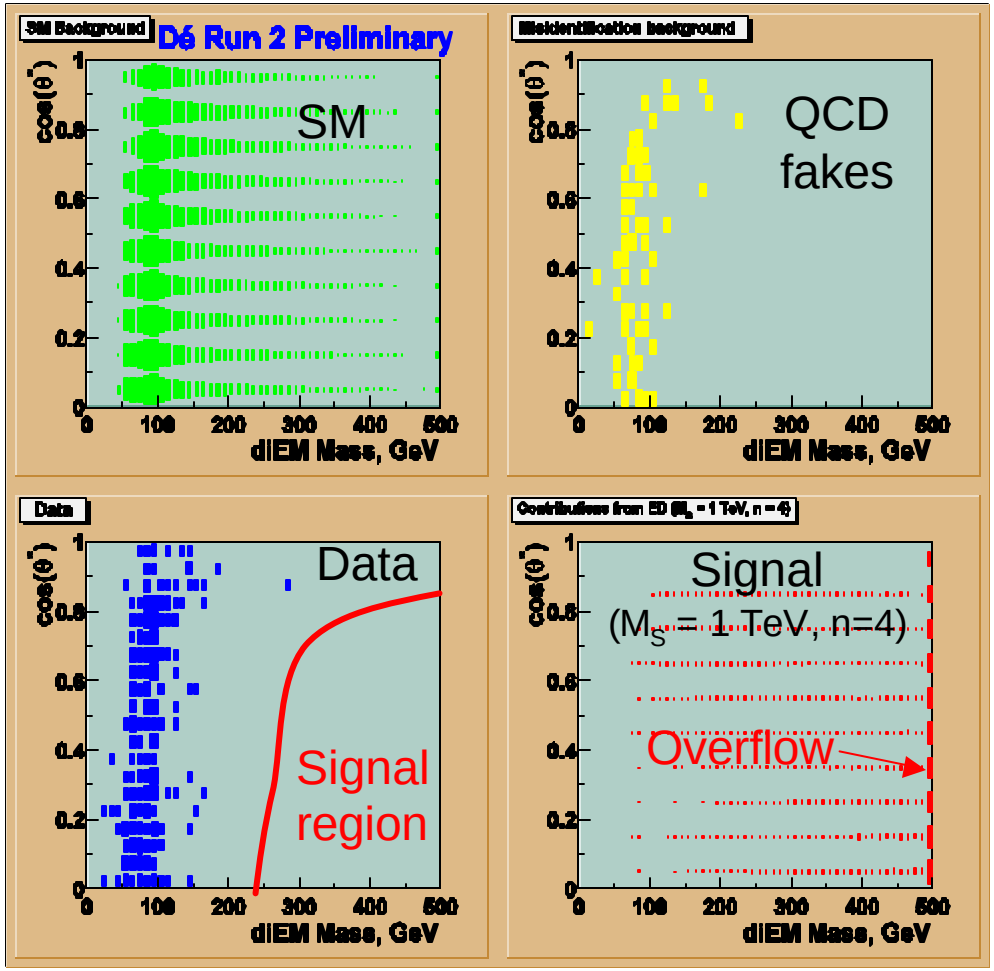






On the way to new phenomena physics

Search for Extra Dimensions



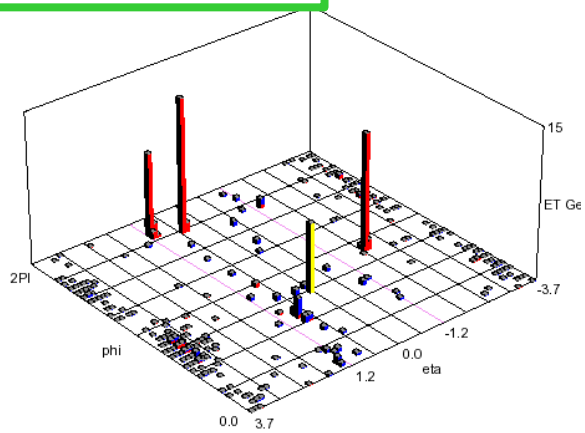
Search for extra spatial dimensions via virtual graviton effects.
Variables: center of mass scattering angle and diEM mass (gg and ee).
Kinematic cuts: E_T(EM) > 25 GeV

Background dominated by Drell-Yan and direct photon production

On the way to new phenomena physics

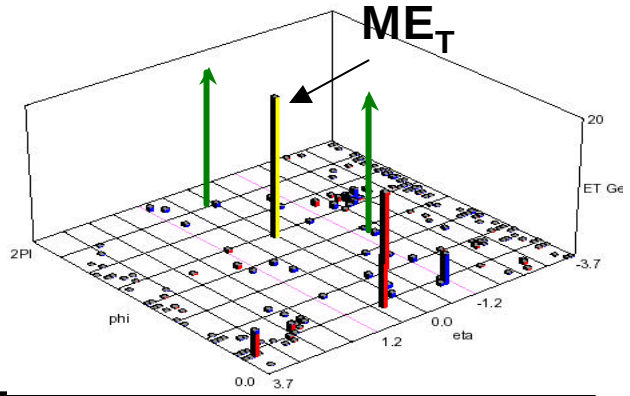
RpV ? coupling Trilepton search

eee canditate event



e1	e2	e3
p_T(cal) = 17.9 p_T(CFT) = 0.52 h = 0.43 φ = 5.42 charge = +1	p_T (cal) = 13.9 p_T (SMT) = 10.9 h = -1.94 j = 2.8 charge = +1	p_T (cal) = 13.2 p_T (CFT) = 15.1 h = 1.06 j = 5.72 charge = -1
m_{e1e2} = 55.7	m_{e1e3} = 10.8	m_{e2e3} = 63.5
m_{e1e2e3} = 85.2 GeV/c^2		ME_T =10.9 GeV

eμμ candidate event



e	m1	m2
p_T(cal) = 19.2 h = 0.40 j = 0.63	p_T = 28.2 h = -0.10 j = 6.20 charge = -1	p_T = 9.82 h = -1.48 j = 2.88 charge = 1
	m_{mm} = 41.5 GeV/c^2	
ME_T =31.8 GeV		

Outlook

Tevatron:

- Run 2 started in March 2001
- 20 pb^{-1} delivered today, 300 pb^{-1} expected at the end of the year.

DØ Detectors:

- Roll in: January 2001
- Commissioning and calibration
- Ready to do physics !

Physics Results:

- First Z, W, Ks, J/? … already there
- First results are really promising
- DØ is looking forward seeing soon: more top, W, Z, QCD and B physics, and why not Susy or Higgs events ?!?!