Recent DØ Results

Andrew Askew

Disclaimer

- Please note that the results herein contained are merely those I have SELECTED.
- There are many, many results. Please see: http://www-d0.fnal.gov/Run2Physics/ICHEP08/S08D0Results.html
  - Please forgive me, I cannot possibly cover them all, even at only 1 slide/result.

Disclaimer

ICHEP Abstract	Analysis	Luminosity	More Information
511	**Measurement of the lifetime of the Bc meson in the semileptonic decay channel**	1.3 fb^{-1}	Web page
512	**Measurement of the Bc meson mass in the exclusive decay Bc->JpsiPi**	1.3 fb^{-1}	Web page
514	**Measurement of the polarization of the Upsilon(1S) and Upsilon(2S) states in pp(bar) collisions at sqrt(s)=1.96 TeV**	1.3 fb^{-1}	Web page
515	**Study of direct CP violation in B+ to J/psi K+-(pi+-) decays**	2.8 fb^{-1}	Web page
516	**D0 Bs0 oscillation combination for Summer 2007**	2.4 fb^{-1}	Web page
519	**Measurement of the Bs mixing parameters from the flavor-tagged decay Bs->JpsiPhi**	2.8 fb^{-1}	Web page
521	**Search for CP violation in semileptonic B_s decays**	2.8 fb^{-1}	Web page
	Measurement of Br(B0s->Ds(*)Ds(*)) and the lifetime difference in B0s system	2.8 fb^{-1}	Web page

Electroweak Physics

ICHEP Abstract	Analysis	Luminosity	More Information
445	**Measurement of the forward-backward charge asymmetry and the effective weak mixing angle in Z to ee events at D0**	0.75 fb^{-1}	Web page
446	**Measurement of the electron charge asymmetry in ppbar->W+X->e+nu+X events at D0**	0.75 fb^{-1}	Web page
447	**Measurement of the muon charge asymmetry from W boson decays**	0.30 fb^{-1}	Web page
448	**Measurement of the W boson width in the W->e+nu final state at sqrt(s)=1.96 TeV**	0.18 fb^{-1}	Web page
449/450	**Measurement of the shape of the boson transverse momentum distribution in Z to ee at D0**	0.75 fb^{-1}	Web page
451	**Measurement of sigma(ppbar->Z)*BR(Z->ee) at sqrt(s)=1.96 TeV**	0.18 fb^{-1}	Web page
453	**First study of the radiation-amplitude zero in Wgamma production and limits on anomalous WWgamma couplings**	0.75 fb^{-1}	Web page
454	**A measurement of WW+WZ production in lepton plus jets final states at D0**	xx fb^{-1}	
455	**ZZ->llnunu production in pp(bar) collisions at sqrt(s)=1.96 TeV**	2.2 fb^{-1}	Web page
456	**Measurement of sigma(ppbar->Z)*BR(Z->tautau) at sqrt(s)=1.96 TeV**	1.0 fb^{-1}	Web page

Disclaimer

ICHEP Abstract	Analysis	Luminosity	More Information
457	Measurement of the W boson mass in the W->e+nu final state at sqrt(s)=1.96 TeV		
601	WW production cross section measurement and limits on anomalous trilinear gauge couplings	0.23 fb^{-1}	Web pa
602	Z+gamma production and limits on anomalous ZZgamma and Zgammagamma couplings in ppbar collisions	1.0 fb^{-1}	Web pa
603	Measurement of pp(bar)->ZZ->4l production cross section using Run IIb data	1.7 fb^{-1}	Web pa
604	Measurement of differential Z/gamma^*+jet+X cross sections in ppbar collisions	x.x fb^{-1}	
605	Measurement of the ratio of the ppbar->W+c-jet cross section to the inclusive ppbar->W+jets cross section	1.0 fb^{-1}	Web pa
607	Measurement of the ratio of inclusive cross sections sigma(ppbar->Z+b-jet)/sigma(ppbar->Z+jets) in ppbar collisions		
608	Search for W bosons produced via vector boson fusion in ppbar collisions at sqrt(s)=1.96 TeV		
625	Measurement of the W boson helicity in top quark decays at D0	1.0 fb^{-1}	Web pa
695	Probing anomalous Wtb couplings with 1 fb^-1 of D0 data	0.9 fb^{-1}	Web pa
	A measurement at D0 with Z->ll (l=e,mu) events in a 2 fb^{-1} dataset of the BNLY parameter g_2 using a_T	2 fb^{-1}	Web pa
	Search for a scalar or vector particle decaying into Zgamma in pp(bar) collisions at sqrt(s)=1.96 TeV	1.0 fb^{-1}	Web pa

Electro

IC

New Phenomena

ICHEP Abstract	Analysis	Luminosity	More Informa
493	Search for the Associated Production of Charginos and Neutralinos in Final States with Three Leptons	1.1 fb^{-1}	Web pa
494	Search for pair production of the supersymmetric partner of the top quark in the e+mu+b+b+MET decay channel at D0	1.1 fb^{-1}	Web pa
495	Search for Supersymmetry with Gauge-Mediated Breaking in Diphoton Events at DØ	1.1 fb^{-1}	Web pa
496	Search for Squarks in Events with Jets, Hadronically Decaying Taus and MET	1.0 fb^{-1}	Web pa
498	Search for large extra dimensions via single photon plus missing energy final states at sqrt(s)=1.96 TeV	2.7 fb^{-1}	Web pa
499	Search for large extra spatial dimensions in the dielectron and diphoton channels in pp(bar) collisions at sqrt(s)=1.96 TeV	1.05 fb^{-1}	Pape
501	Search for charged massive stable particles with the D0 detector	1.1 fb^{-1}	Pape
504	Search for pair production of second generation leptoquarks	1.0 fb^{-1}	Pape

Disclaimer

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457	Measurement of the W boson mass in the W->e+nu final state at sqrt(s)=1.96 TeV		
601	WW production cross section measurement and limits on anomalous trilinear gauge couplings	0.23 fb^{-1}	Web pa

505	Search for long-lived particles decaying into electron or photon pairs with the D0 detector	1.0 fb^{-1}
	Search for scalar leptoquarks and T-odd quarks in the acoplanar jet topology using 2.5 fb-1 of ppbar collison data at sqrt(s)=1.96 TeV	2.5 fb^{-1}
	Search for first-generation leptoquarks in the dielectron channel with the D0 detector in pp(bar) collisions at sqrt(s)=1.96 TeV	1.0 fb^{-1}

Electro

IC

New Ph

Higgs Physics

ICHEP Abstract	Analysis	Luminosity
480	Search for WH Production using a Neural Network Approach	1.7 fb^{-1}
481	Search for the standard model Higgs boson in the HZ->bbnunu channel in 2.1 fb-1 of pp(bar) collisions at sqrt(s)=1.96 TeV	2.1 fb^{-1}
482	Search for ZH(->l+l-bb(bar)) in pp(bar) collisions at sqrt(s)=1.96 TeV	2.3 fb^{-1}
484	Search for the Higgs boson in H->WW(*)->ll'vv (l,l'=e,mu) decays with 3 fb^{-1} at D0 in Run II	3 fb^{-1}
485	Search for the Higgs boson in WH->WWW^(*)->ll'+X decays in ppbar collisions at sqrt(s)=1.96 TeV	1.0 fb^{-1}
486	Search for the standard model Higgs boson in diphoton final states at D0	2.7 fb^{-1}
488	Search for neutral Higgs bosons in in multi-b-jet events in pp(bar) collisions at sqrt(s)=1.96 TeV	2.6 fb^{-1}
489	Search for MSSM Higgs boson production in the decay h->tau tau with the D0 detector at sqrt(s)=1.96 TeV	2.2 fb^{-1}
492	Search for pair production of doubly-charged Higgs bosons in the H^{++}H^{--}->4mu final state in ppbar collisions at sqrt(s)=1.96 TeV	1.1 fb^{-1}
682	A search for charged Higgs bosons in tt(bar) events	1 fb^{-1}
686	Search for the standard model Higgs boson in the tt(bar)H->tt(bar)bb(bar) channel	2.1 fb^{-1}
692	Search for a heavy charged Higgs boson reconstructed in the t+b final state at D0	0.9 fb^{-1}
	Search for the standard model Higgs boson in the WH to tau nu bb channel in 0.94 fb-1 of ppbar collisions at sqrt(s)=1.96 TeV	0.94 fb^{-1}
	A search for neutral Higgs bosons at high tan(beta) in the mode phi+b->tau_mu+tau_had+b in Run IIb data	1.2 fb^{-1}

Disclaimer

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505	Search for long-lived particles decaying into electron or photon pairs with the D0 detector	1.0 fb^{-1}	

Higgs

Electro

New Ph

QCD Results

ICHEP Abstract	Analysis	Lumin
506	Measurement of the inclusive jet cross-section in ppbar collisions at sqrt(s)=1.96 TeV	0.7
507	First measurement of dijet angular distributions in the TeV regime and searches for quark compositeness and extra dimensions	0.7
509	Measurement of the differential cross section for the production of an isolated photon with associated jet in ppbar collisions at sqrt(s)=1.96 TeV	1 f
	Measurement of the triple differential photon plus heavy-flavor jet cross section in pp(bar) collisions at sqrt(s)=1.96 TeV in D0	1 f

Top Physics

ICHEP Abstract	Analysis	Lumino
610	Measurement of the top quark mass in the electron-muon channel using the matrix element method at D0	2.8 fb
610	Measurement of the top quark mass in dilepton channels using the neutrino weighting method at D0	2.8 fb
612	Measurement of the top quark mass in the lepton+jets channel at D0	1.0 fb
613	Measurement of the top quark mass in the all-hadronic channel at D0	
614	Measurement of the ttbar cross section in the dilepton channel at D0	1.0 fb
615	Measurement of the ttbar production cross section at D0 using hadronic tau events	2.1 fb
616	Measurement of the ttbar production cross section in the lepton+jets channel at D0	1.0 fb
618	Measurement of the ttbar production cross section in the all-hadronic channel at D0	0.4 fb
619	Measurement of differential distributions of top quarks	
623	Simultaneous measurement of the ratio B(t->Wb)/B(t->Wq) and the top quark pair production cross section with D0	0.9 fb

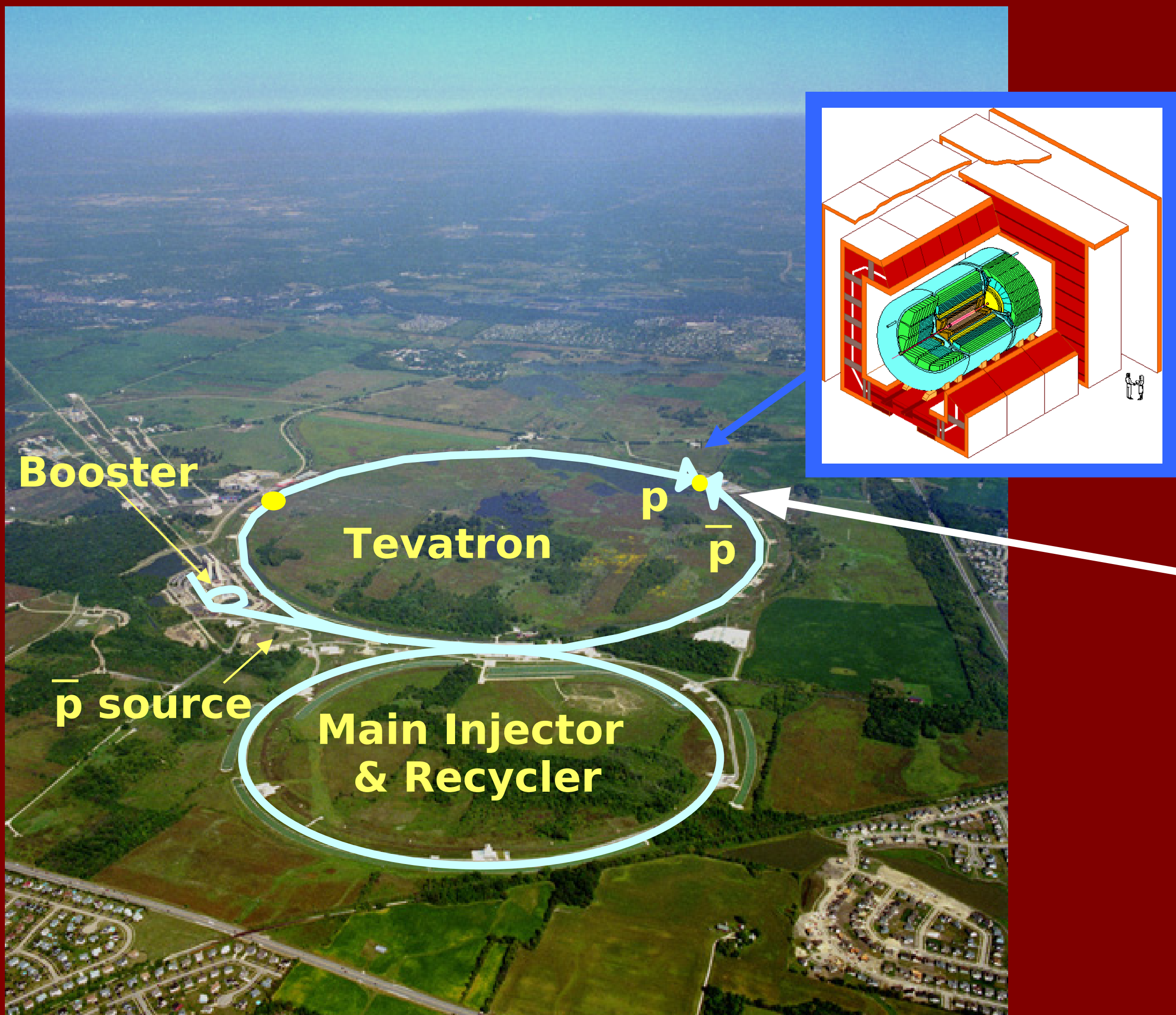
Setting the Stage…

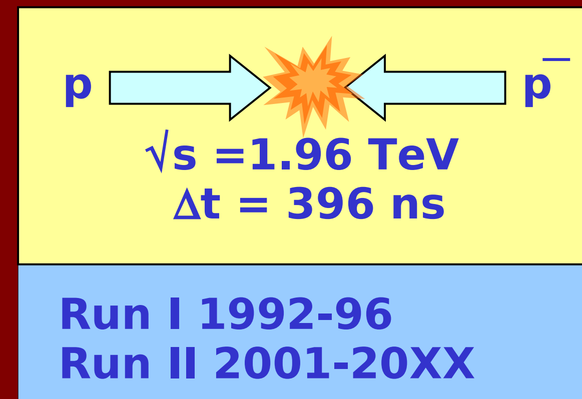
p → ← $\bar{p}$

$\sqrt{s}$ =1.96 TeV
Δt = 396 ns

Run I 1992-96
Run II 2001-20XX

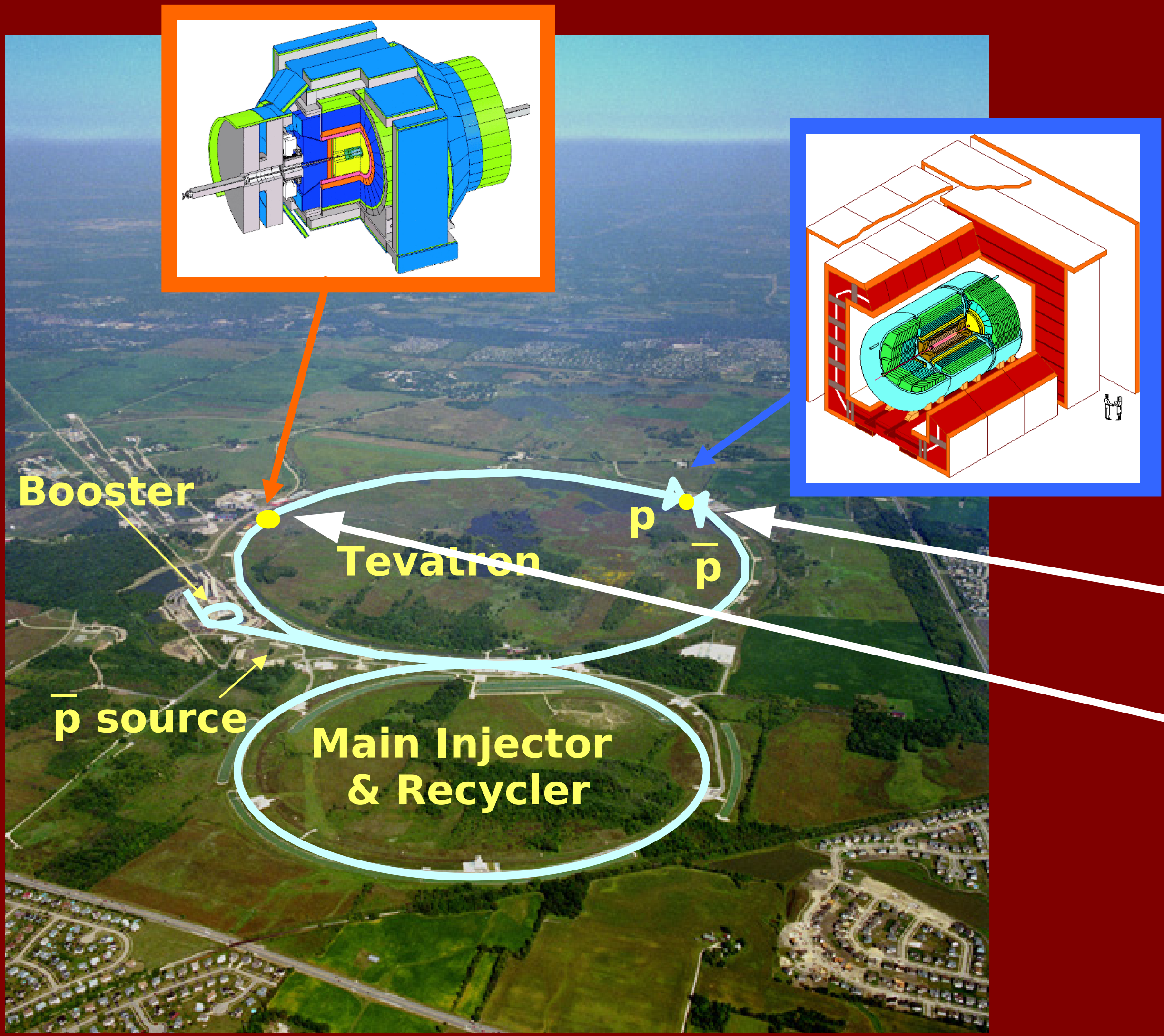
Setting the Stage…

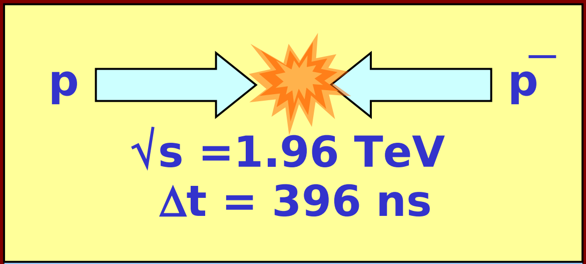




- You are here.

Setting the Stage...

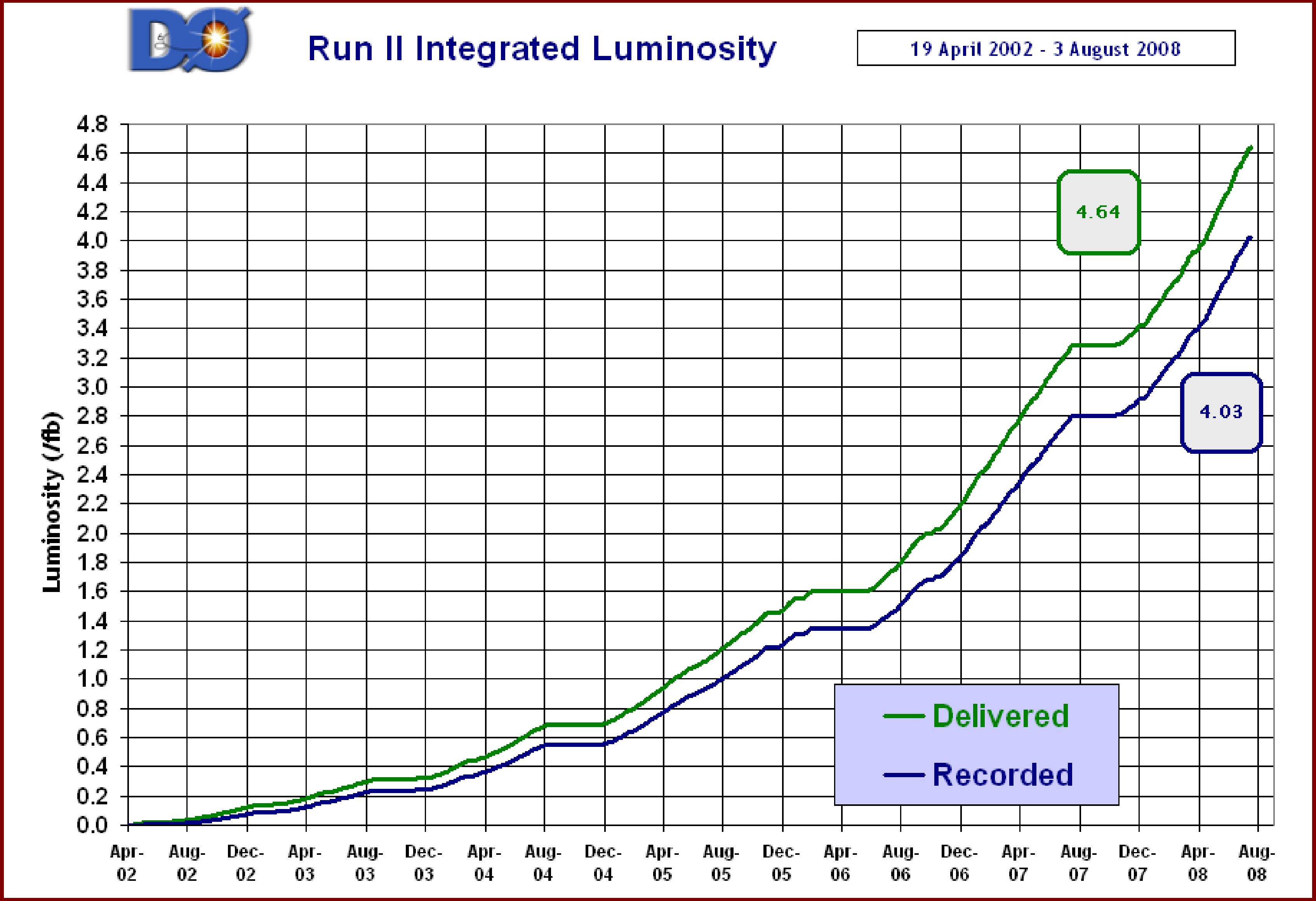




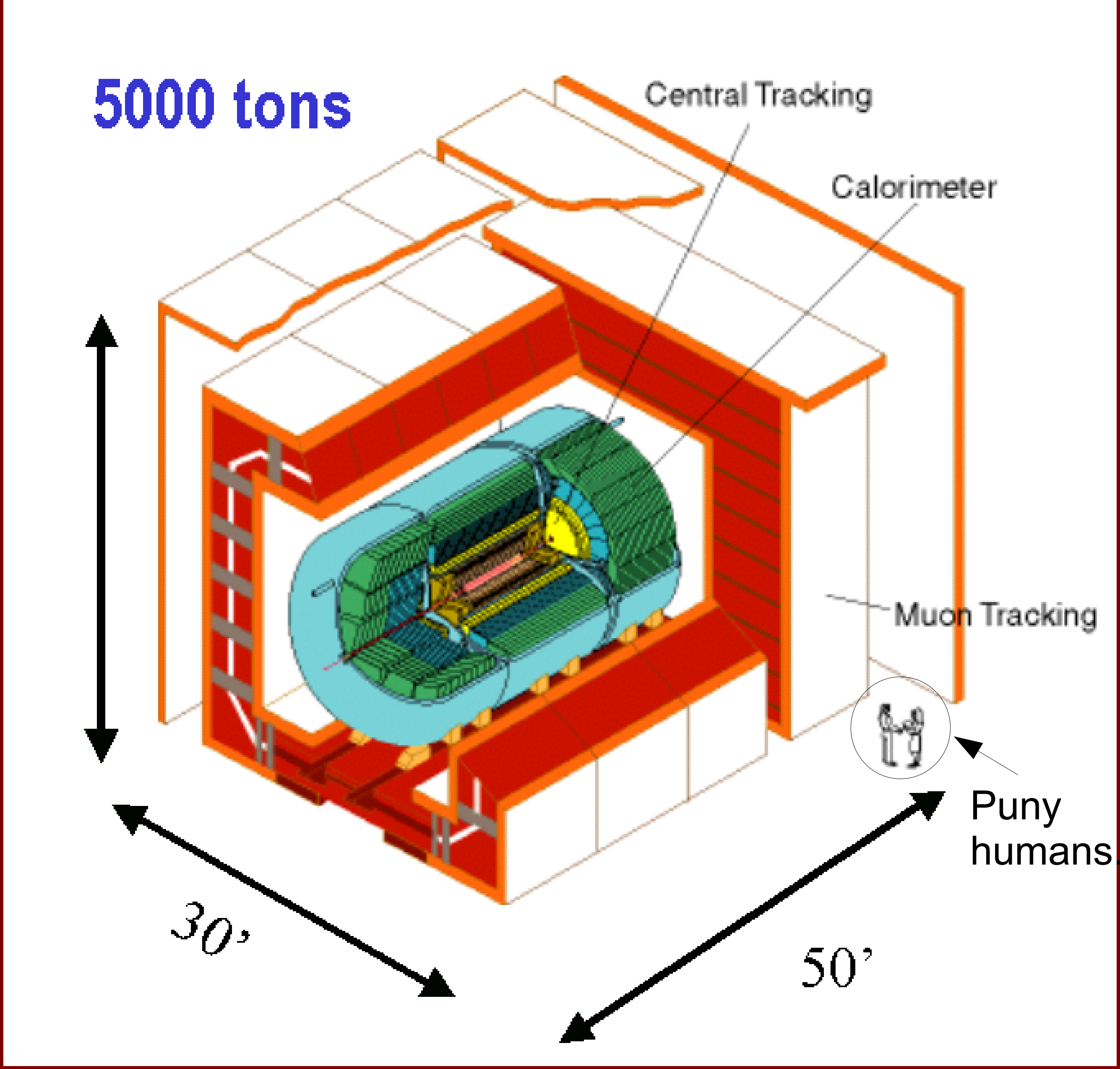
Run I 1992-96
Run II 2001-20XX

- You are here.
- You've just heard from our sister experiment over there.

One must always mention…



Results presented here span 0.7-3.0 fb^{-1}

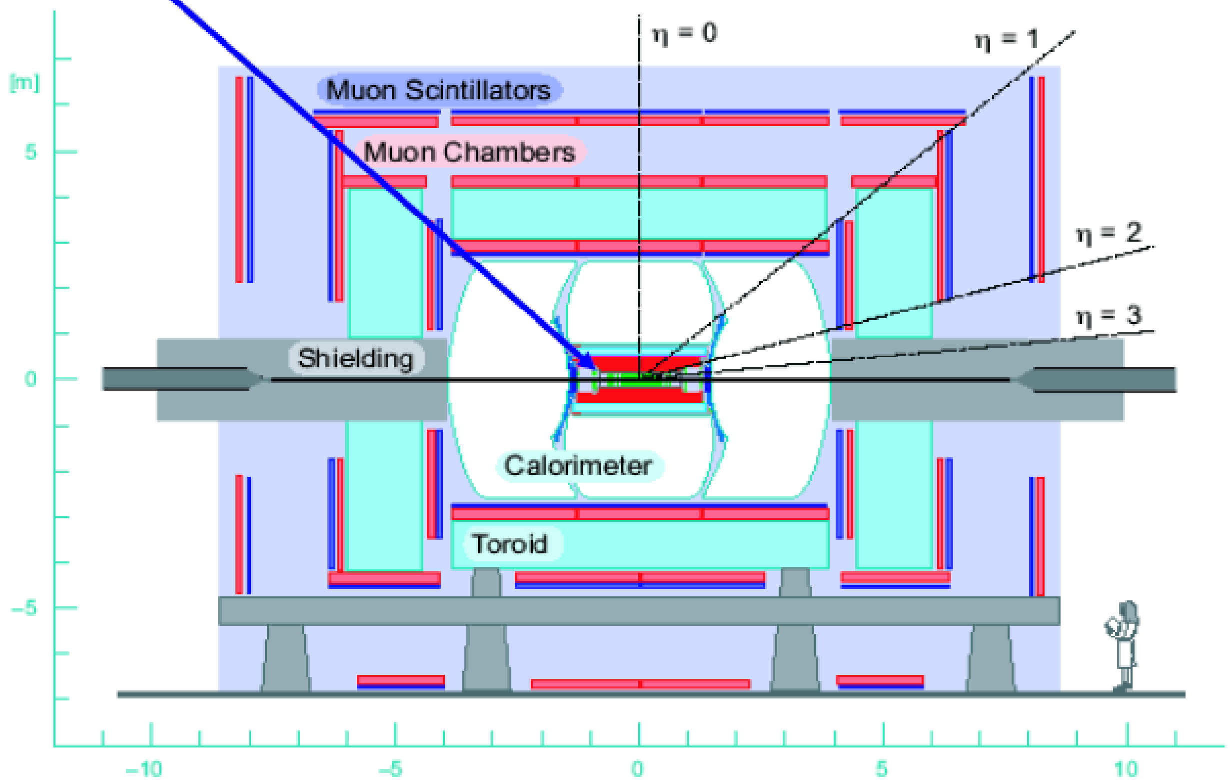

5000 tons
Central Tracking
Calorimeter
Muon Tracking
Puny
humans.
30'
50'

Lightning Overview:

Silicon Microstrip Tracker (SMT)

Central Fiber Tracker (CFT)

2 T magnetic field



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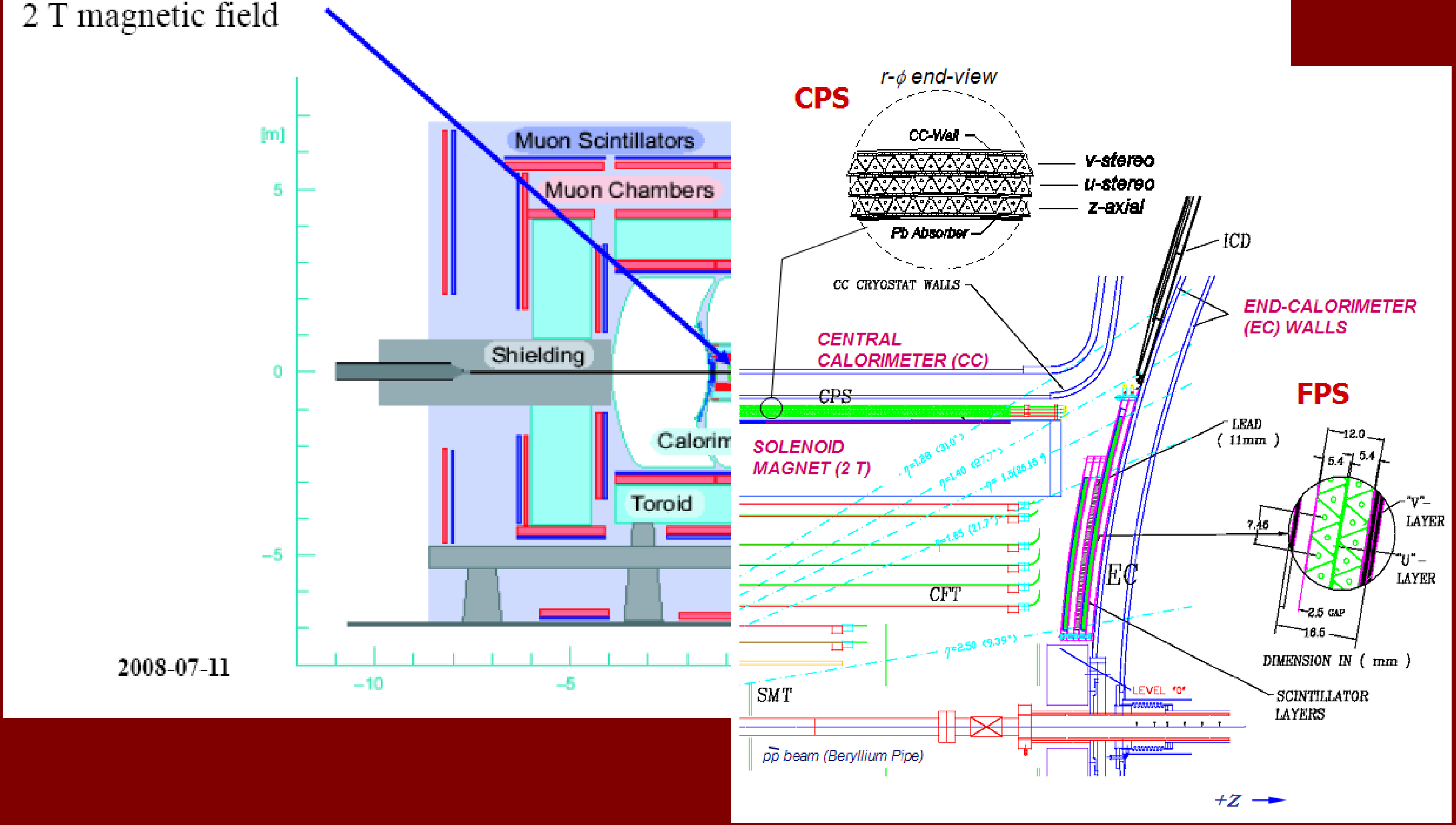
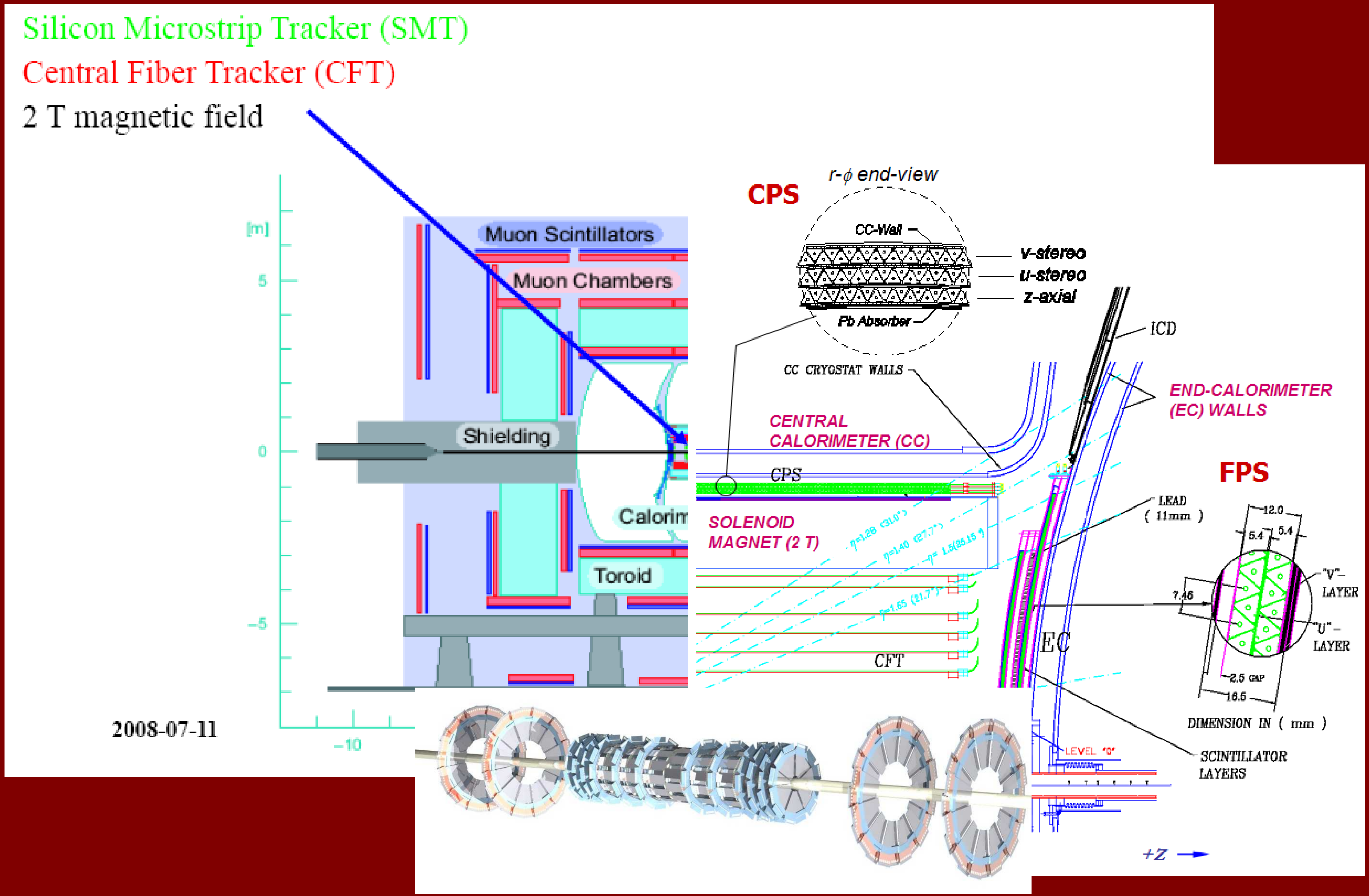


Lightning Overview:



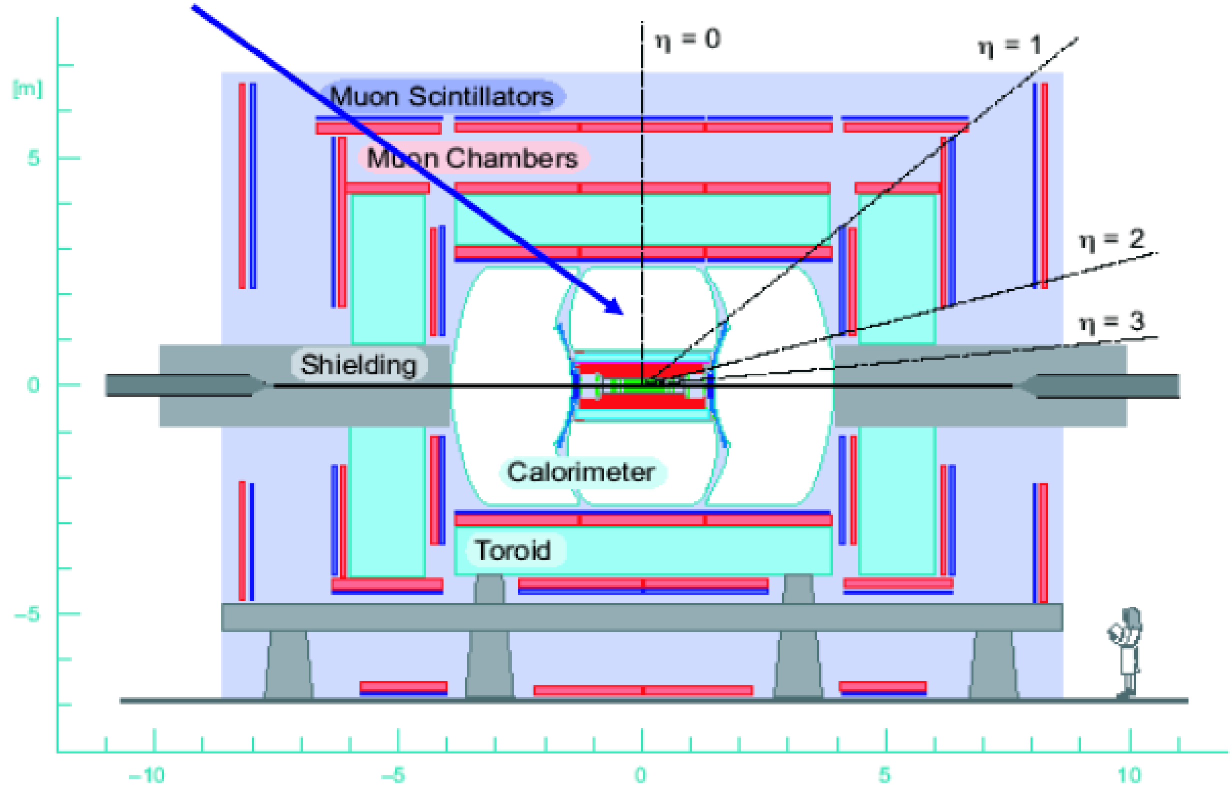
Lightning Overview:

Liquid-argon sampling calorimeters

Central (CC) and Endcap (EC)

Coverage: $|\eta| < 4.2$

Important for MET measurement



2008-07-11

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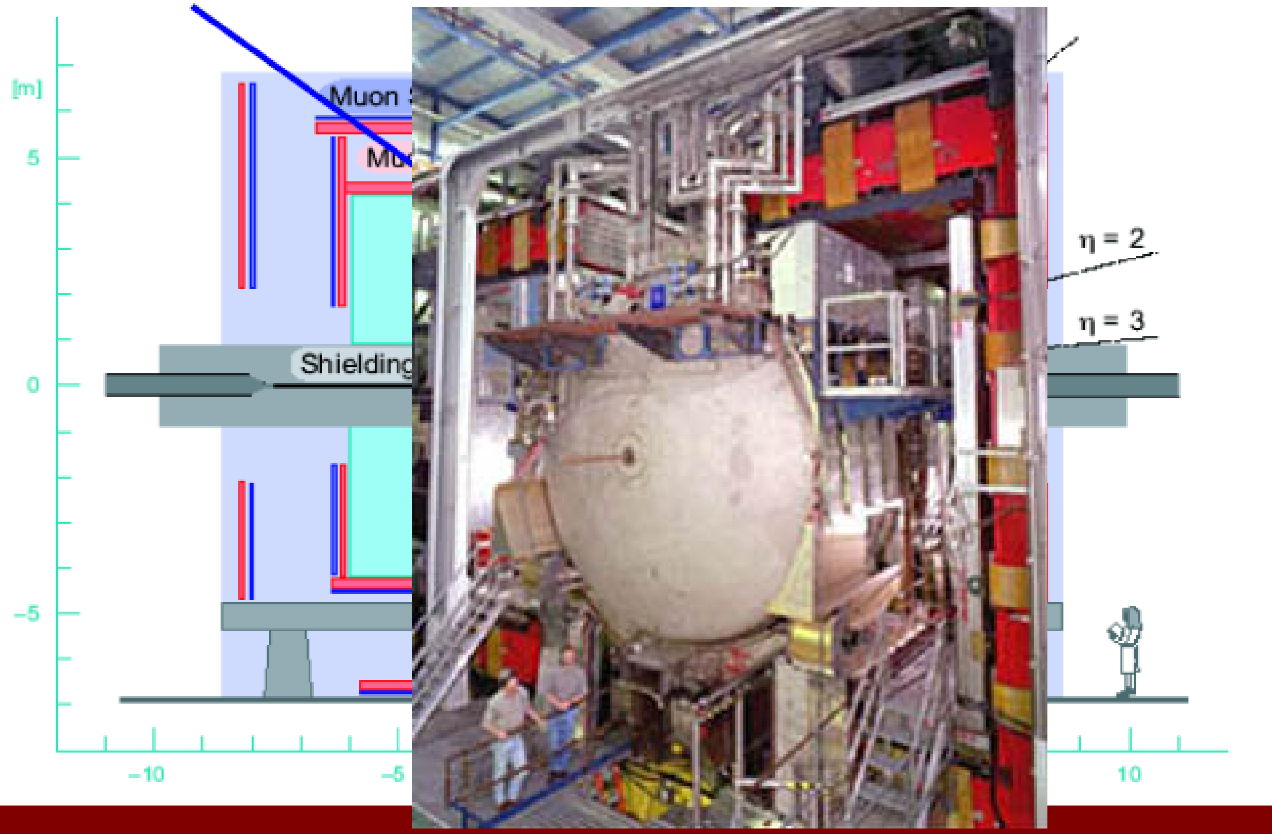

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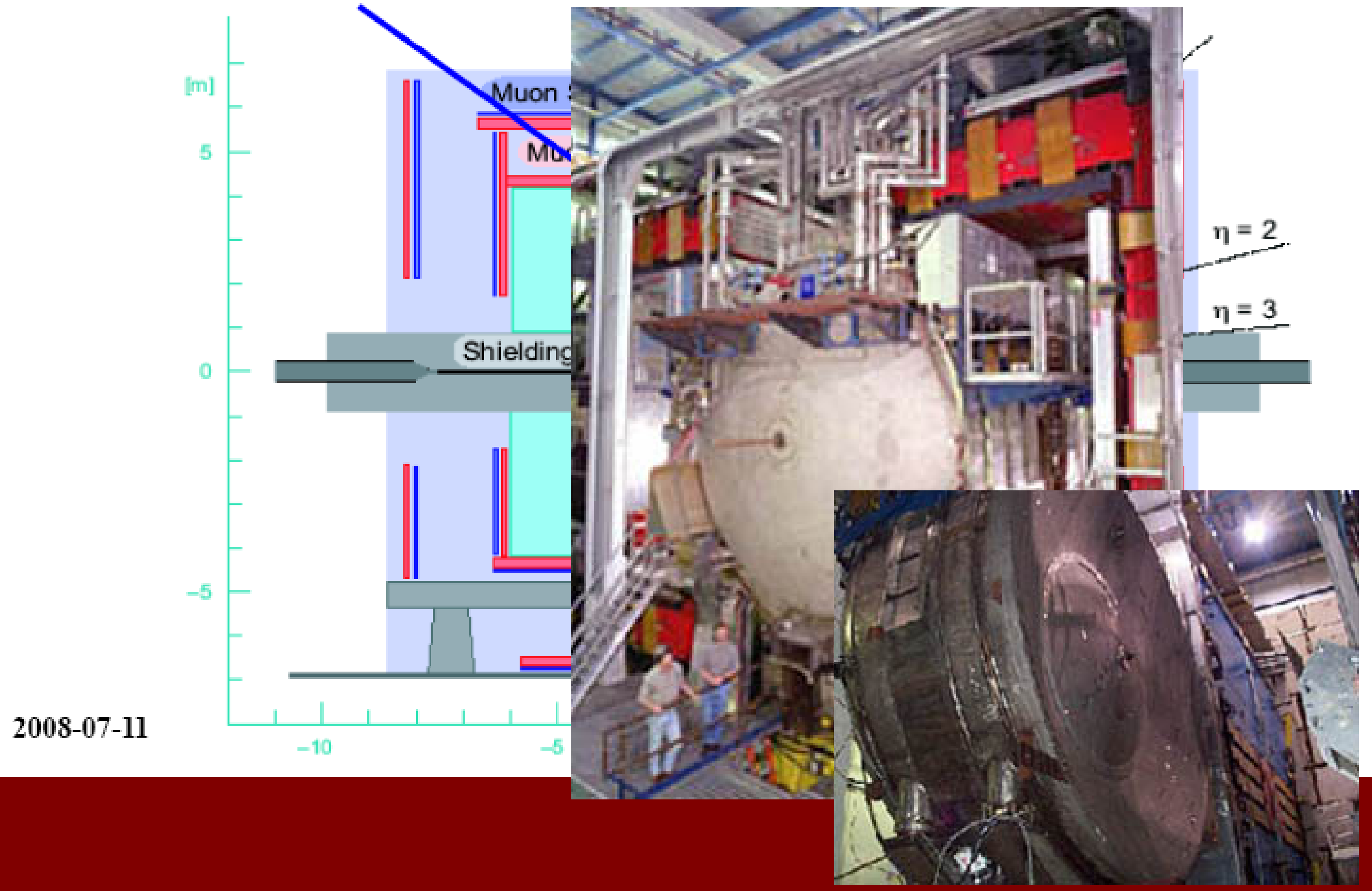
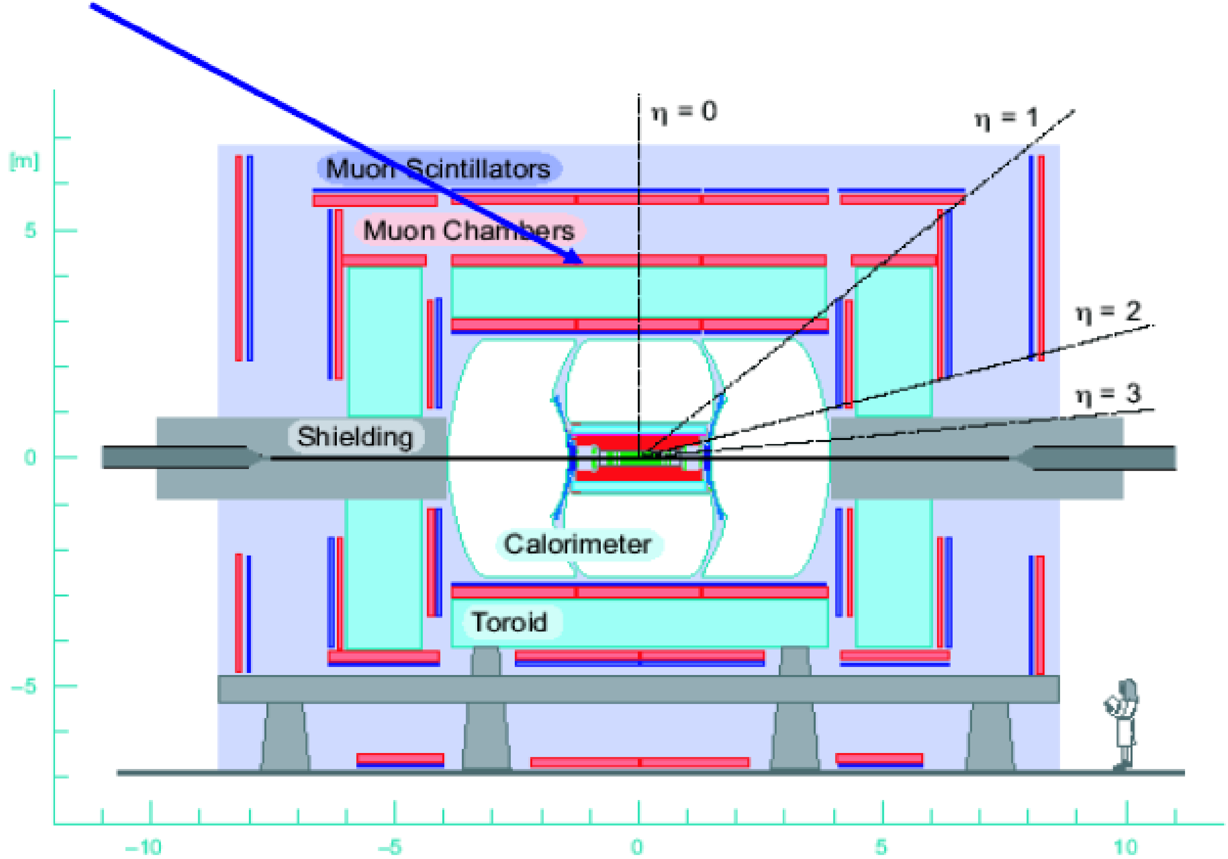


Lightning Overview:

Muon system

Drift chambers and scintillator counters

1.8 T toroids



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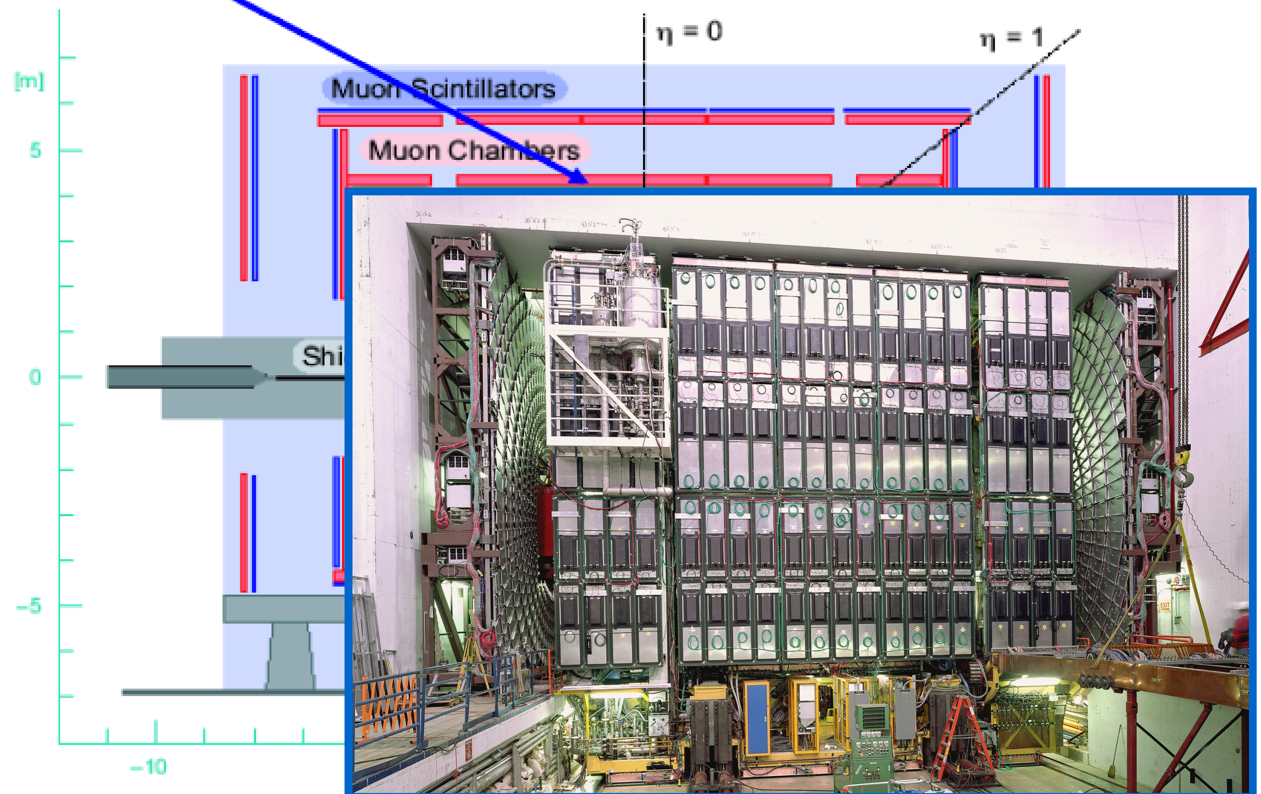

2008-07-11

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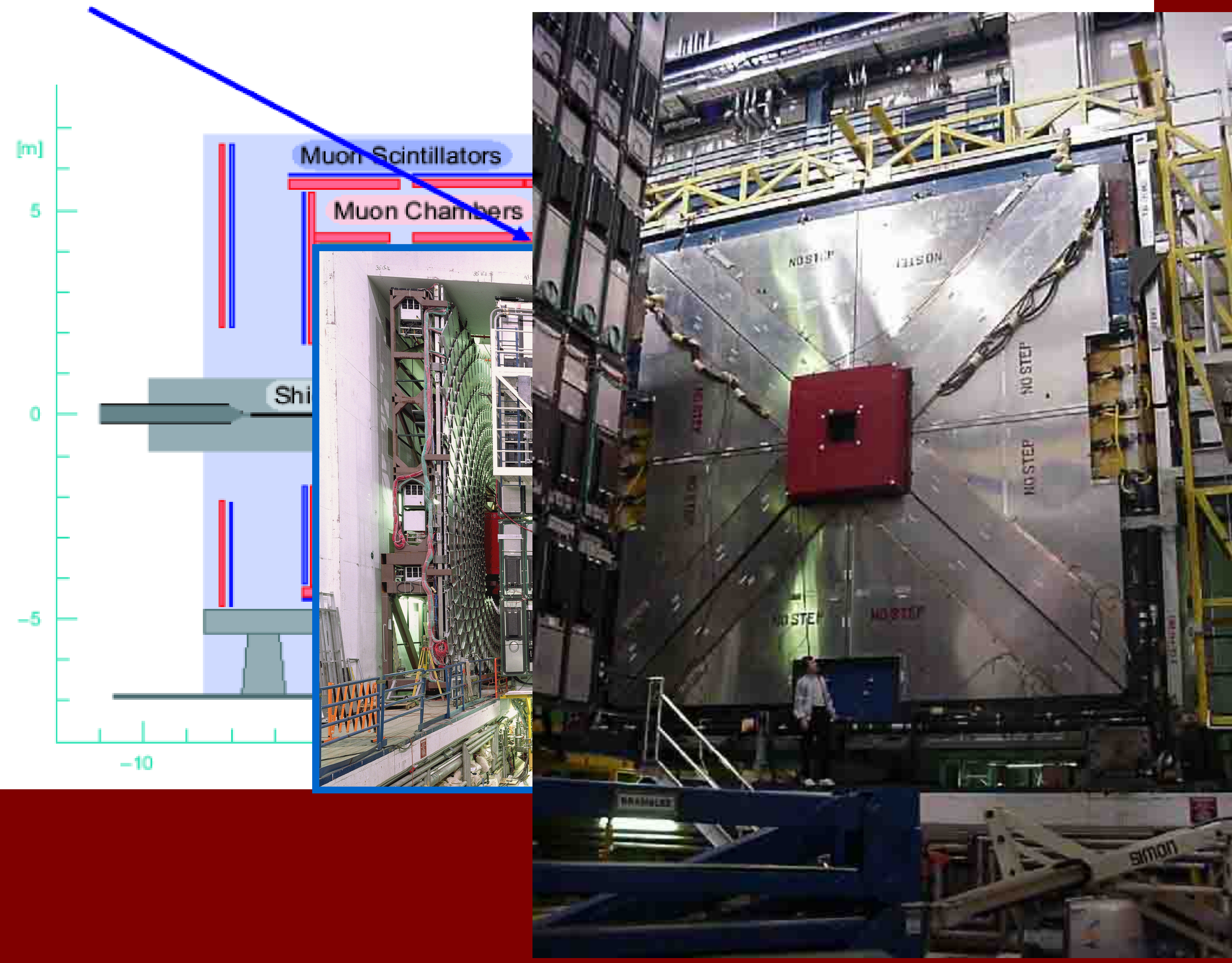
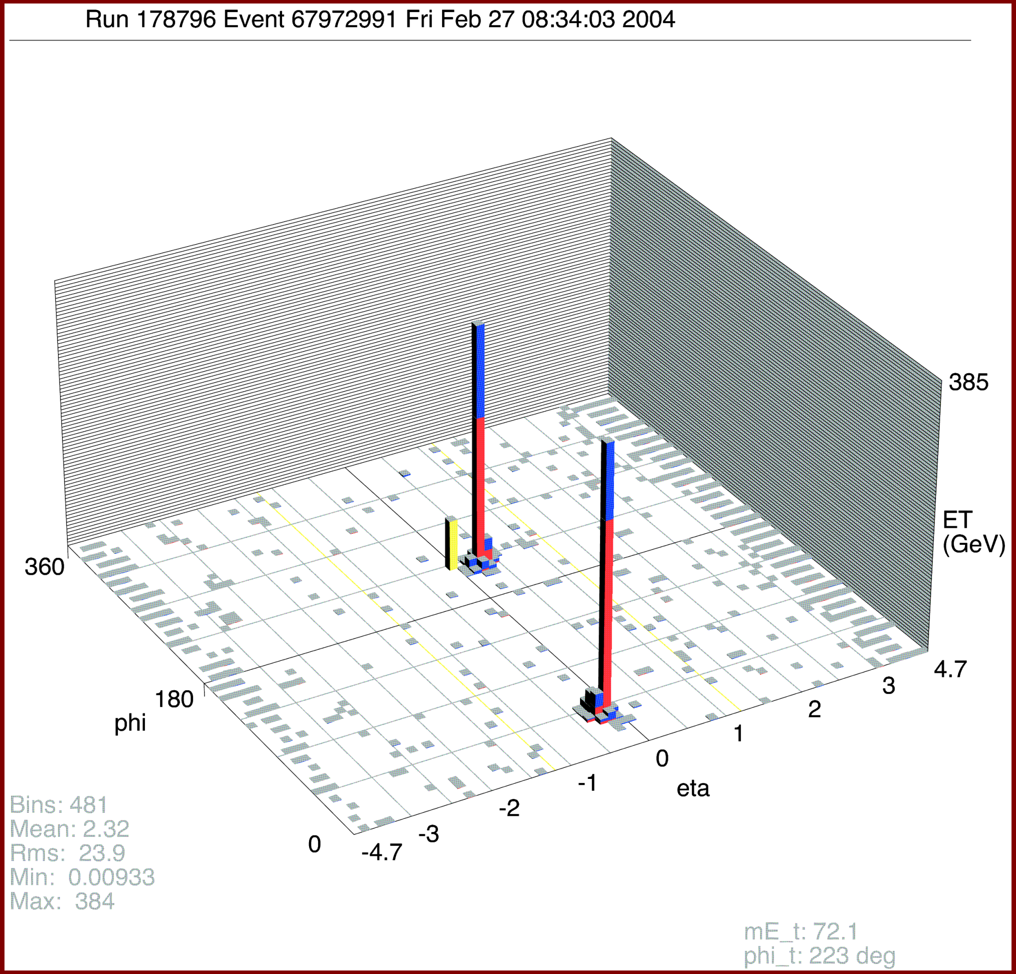


2008-07-11

Physics With Jets:

- Both the most obvious, and one of the most difficult things to do at a hadron collider:
  - Most common objects in collisions, and probe the highest energies. But…
  - Significant systematics due to energy scale, resolution.



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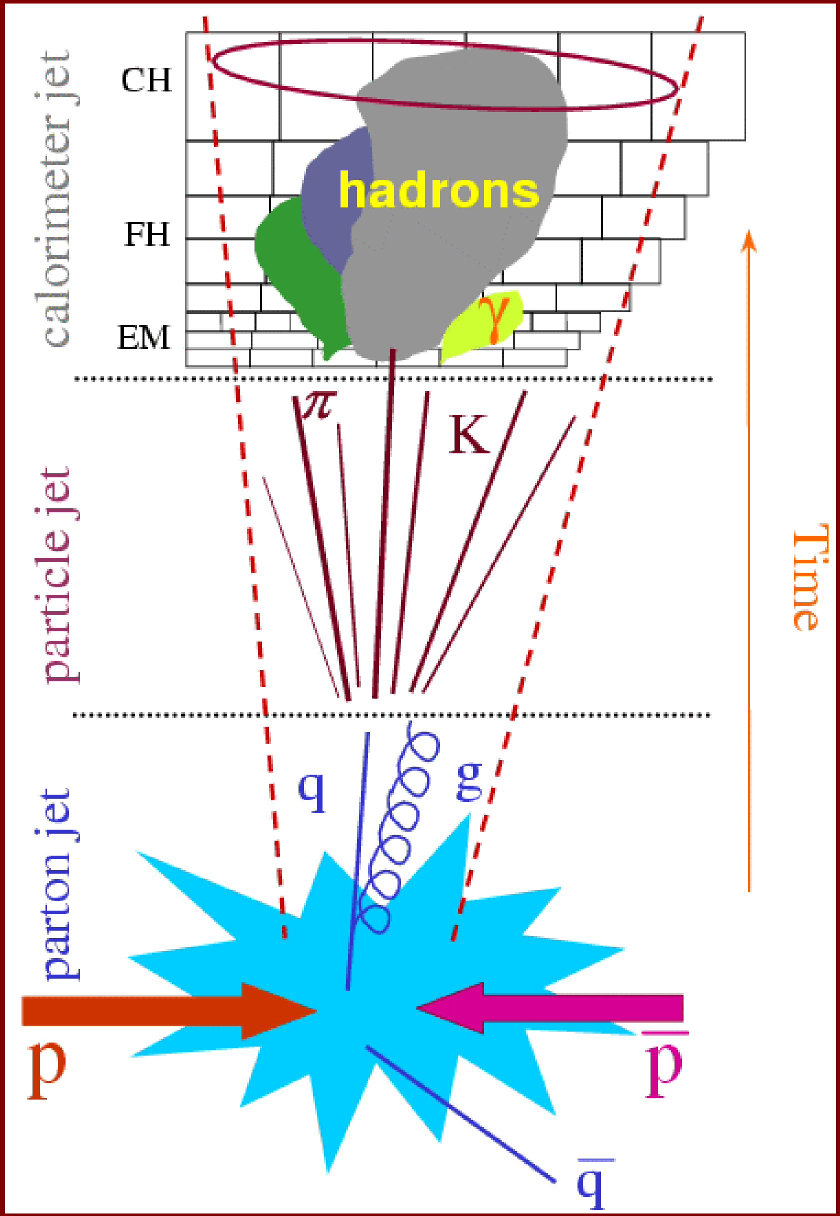
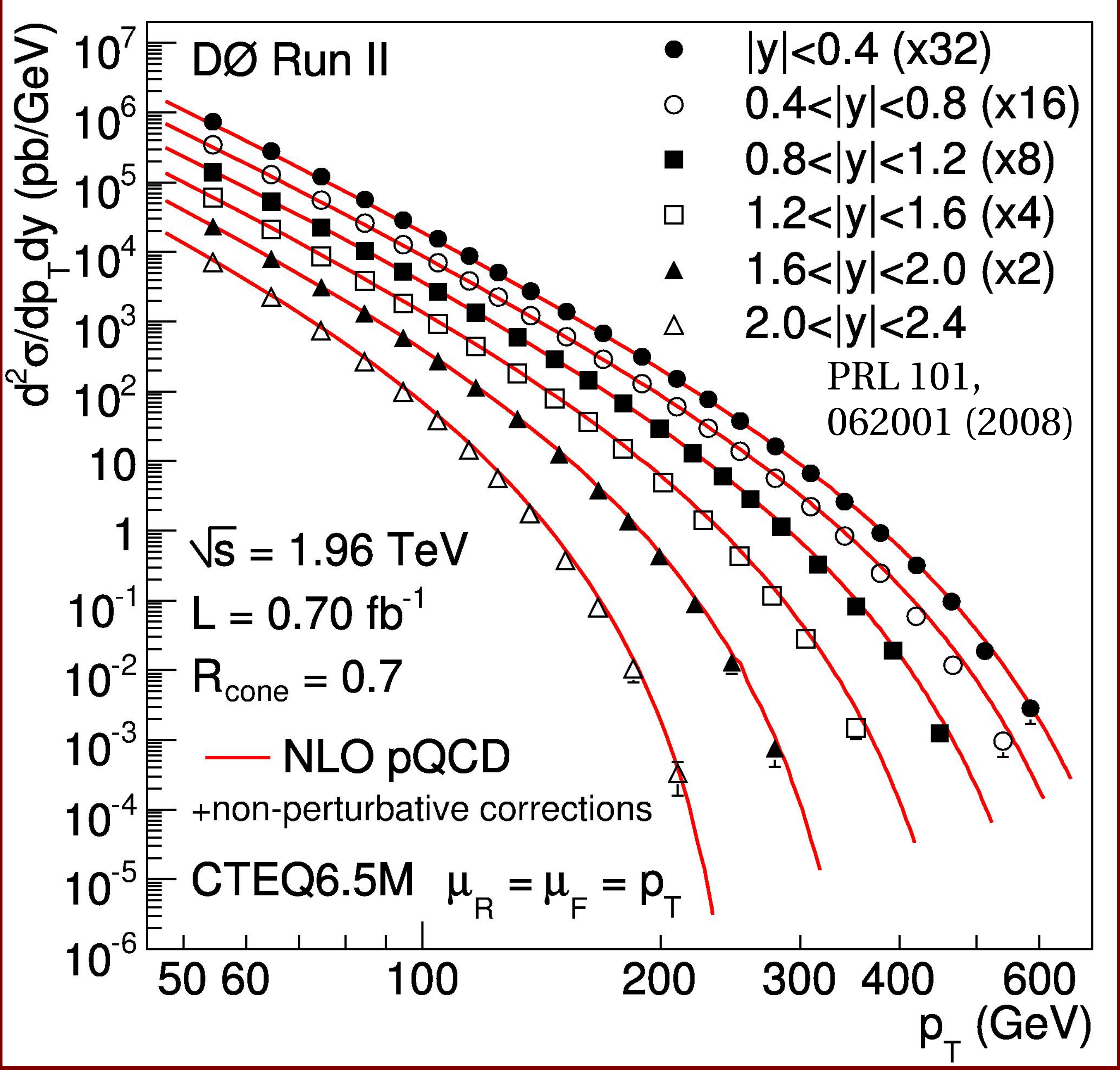
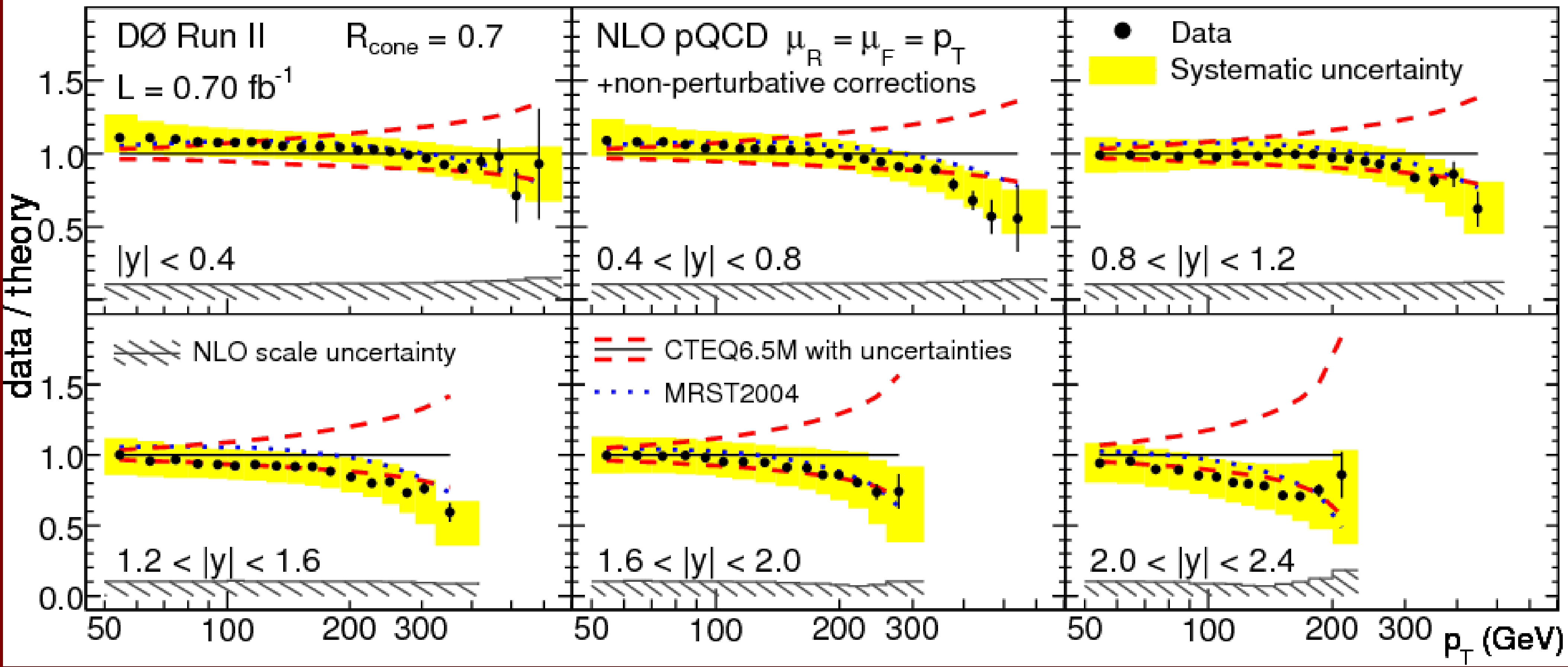


Jet Cross section

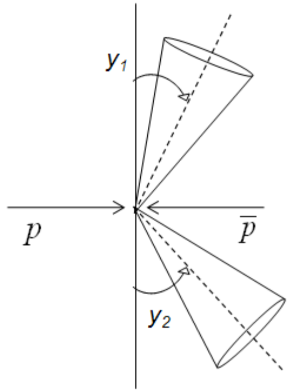
- Cross section in both jet p_T and rapidity.
- Good agreement with NLO prediction.
- Largest dataset with smallest uncertainties to date!



Jet Cross section

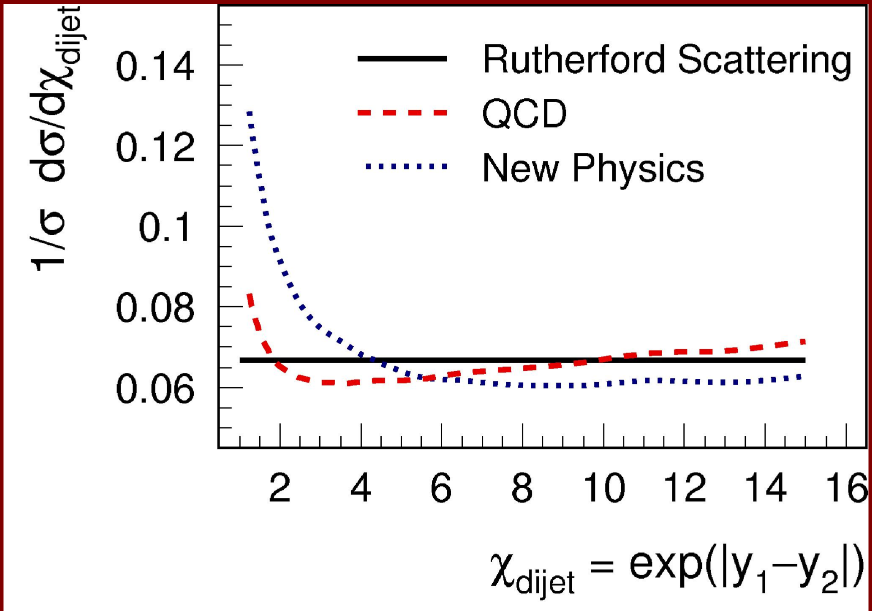


Dijet Angular Distributions:



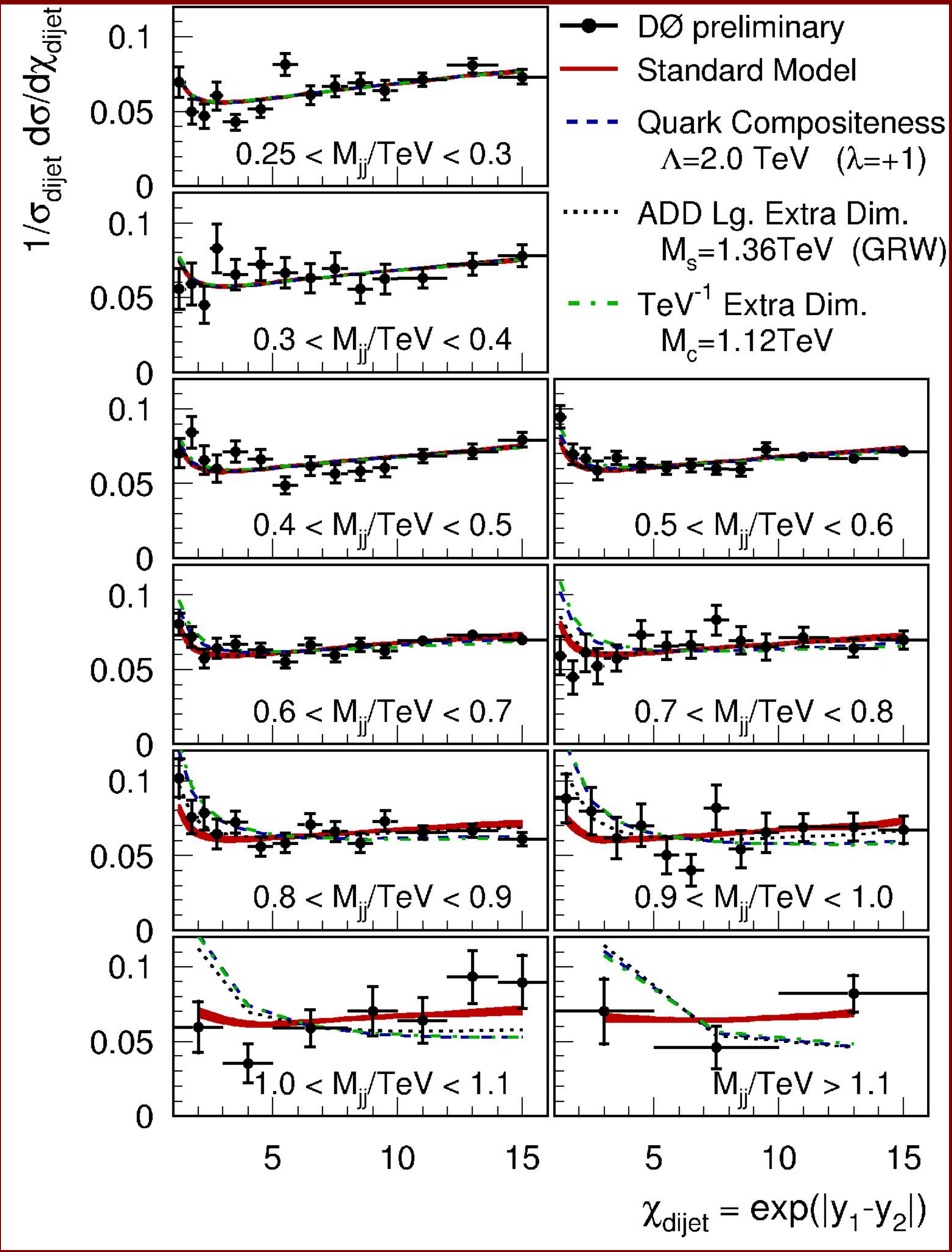
$$\chi_{dijet} = \exp(|y_1 - y_2|) \approx \frac{1+\cos\theta^*}{1-\cos\theta^*}$$

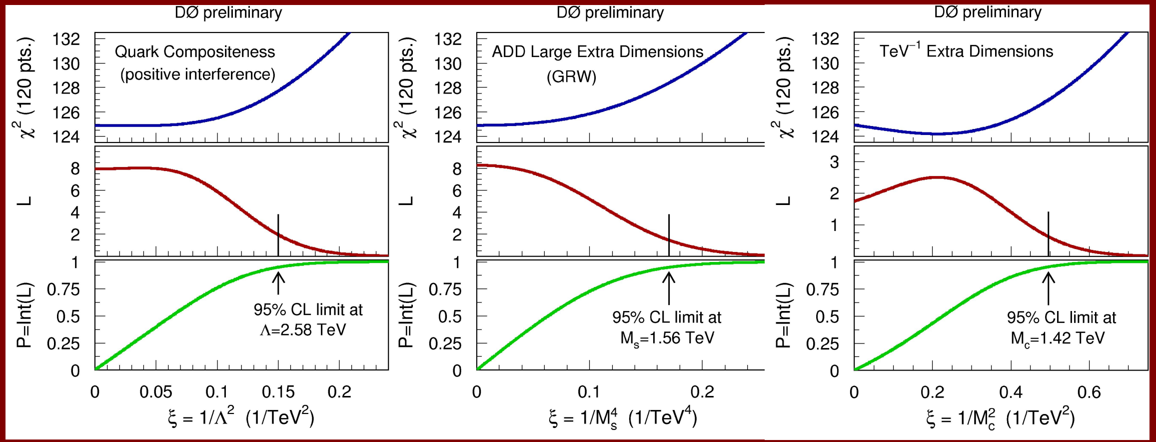
y_i = jet rapidity



- A clever choice of variables can reduce systematics while keeping sensitivity.
- Shape of jet χ distribution can indicate presence of new physics (ADD, LED, quark compositeness), and is less sensitive to jet energy.

χ Limits on new physics:



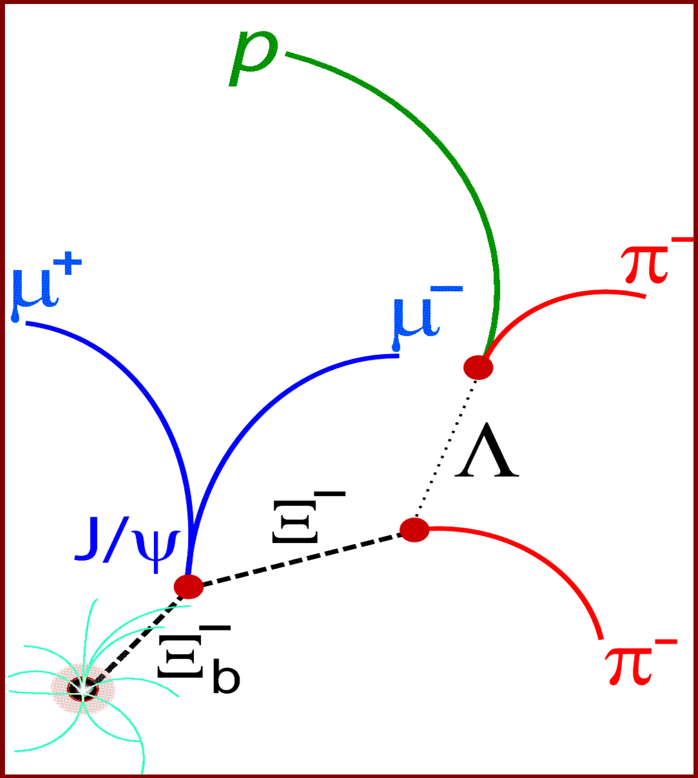


- Best limit to date on quark compositeness, and one of the strongest yet on both ADD and TeV^{-1} scale extra dimensions.

Physics with Bs

- As something of a special case, hadrons containing b-quarks are produced copiously in collisions.
- In order to study the decays of these hadrons, typically one starts at the end of the decay chain and works back.
- Use kinematics of these decays to tell us about the interaction.

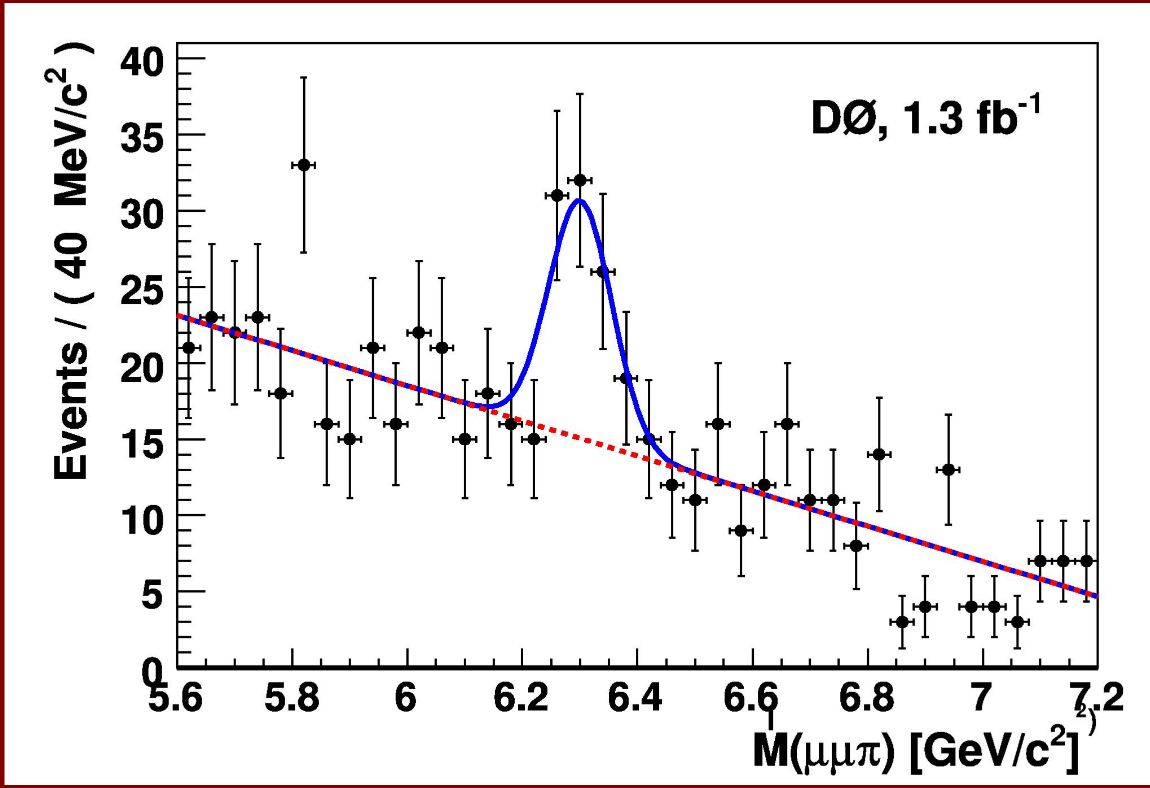
An example: the Ξ_b^-



Incidentally, the Ξ_b^- baryon was first observed by DØ, see: PRL 99, 052001 (2007).

B_c Mass:

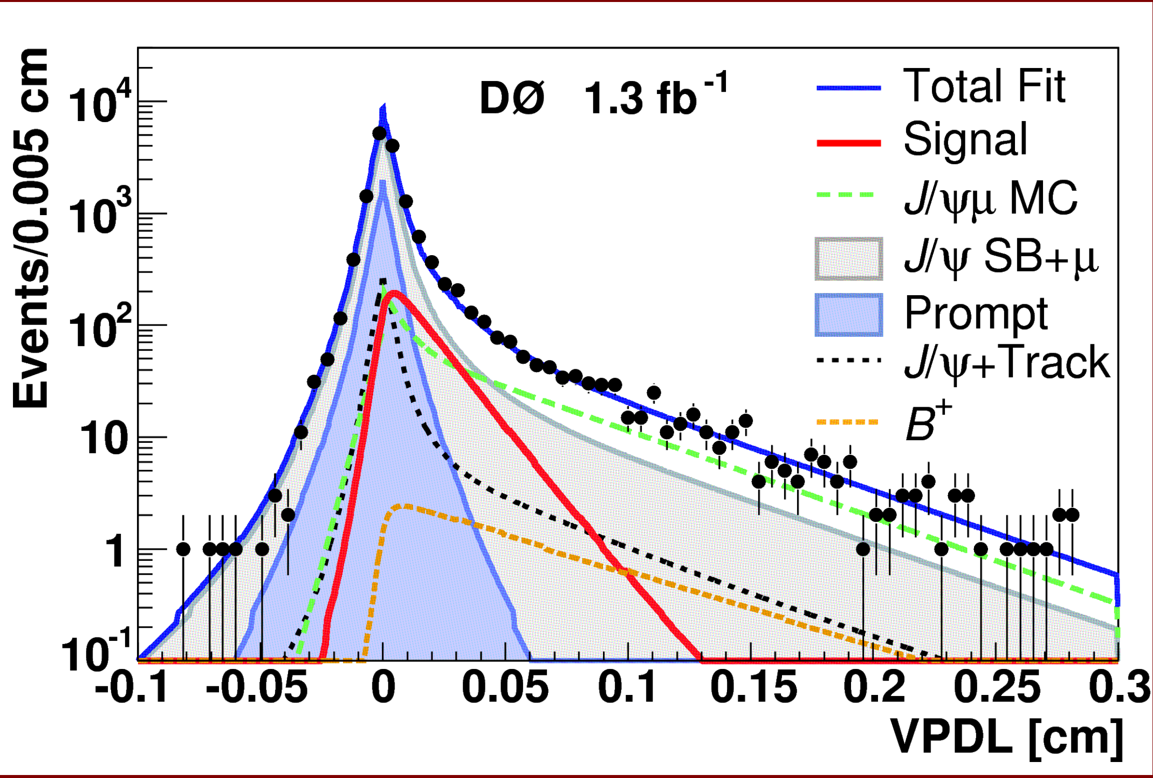
- Use exclusive decay of $B_c \to J/\psi + \pi$. Reconstruct $J/\psi \to \mu\mu$, require additional track.
- Use isolation, kinematics and vertex quantities to isolate signal.
- Perform unbinned maximum likelihood fit.



$M_{B_c} = 6300 \pm 14\ (\text{stat}) \pm 5\ (\text{sys})\ \text{MeV}/c^2$.

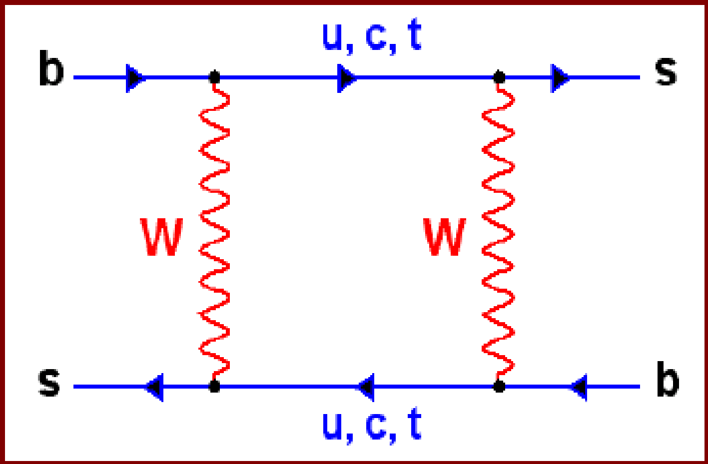
B_c Lifetime:

- Select $B_c^{\pm}$->$J/\psi\mu^{\pm}$ +X.
  - Less interested in the decay products here, interest is distance between primary vertex and decay vertex.
  - Model backgrounds, and use invariant mass and visible proper decay length (VPDL) to fit for the lifetime.



$$\tau(B^{\pm}_c) = 0.448^{+0.038}_{-0.036}\ (\text{stat}) \pm 0.032\ (\text{sys})\ \text{ps}$$

B_s Mixing Parameters:



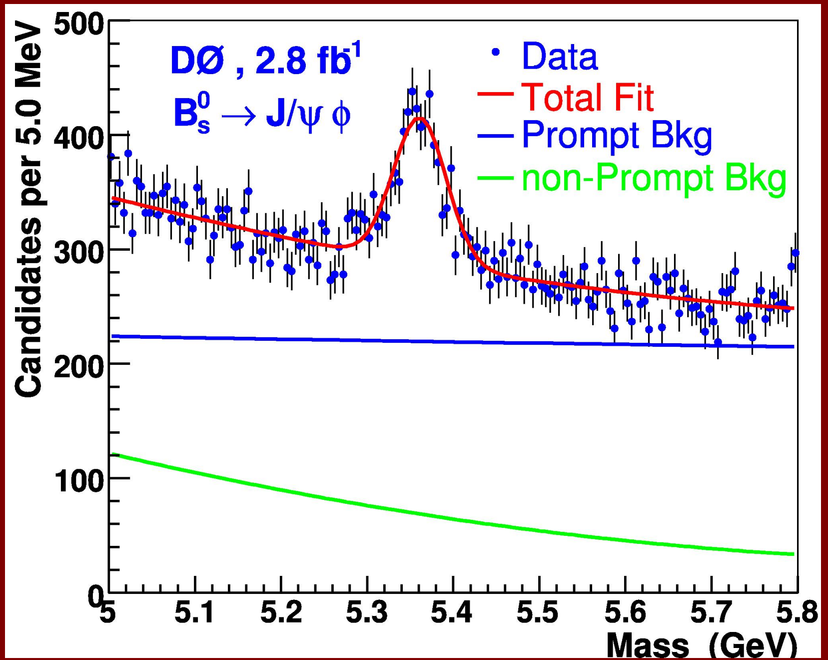
$$i\frac{d}{dt}\begin{pmatrix} |B_s^0\rangle \\ |\bar{B}_s^0\rangle \end{pmatrix} = \begin{pmatrix} M - i\frac{\Gamma}{2} & M_{12} - i\frac{\Gamma_{12}}{2} \\ M_{12}^* - i\frac{\Gamma_{12}^*}{2} & M - i\frac{\Gamma}{2} \end{pmatrix} \begin{pmatrix} |B_s^0\rangle \\ |\bar{B}_s^0\rangle \end{pmatrix}$$

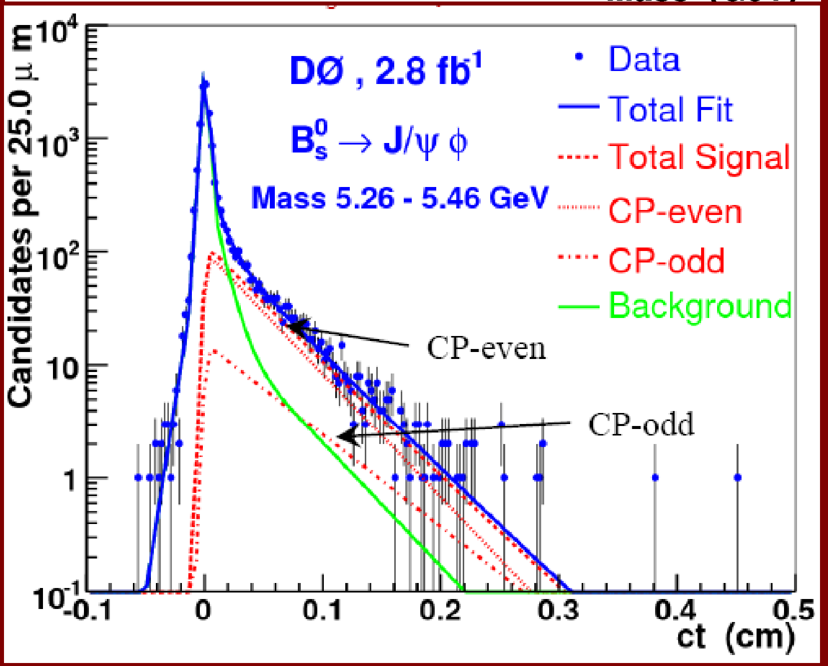
- Fast facts about B_s^0:
  - Oscillates between eigenstates of different mass and width.
  - These mass eigenstates should be mostly CP-eigenstates

$$\phi_s^{SM} = -2\beta_s = -2\arg\left(-\frac{V_{ts}V_{tb}^*}{V_{cs}V_{cb}^*}\right) \approx 0.04$$

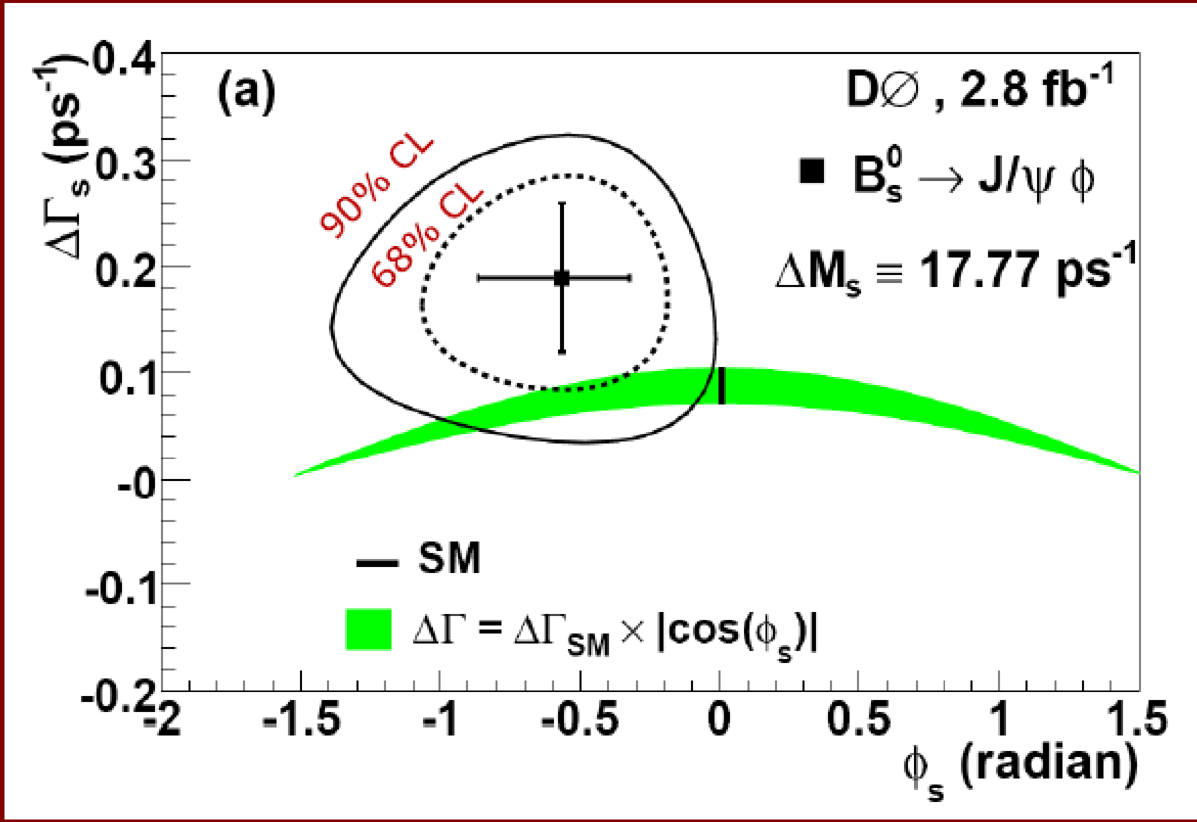
Extracting the parameters:

- Reconstruct decay chain $B_s^0 \to J/\psi\ \phi$.
- Tag initial flavor (event charge, opposite side, same side…)
- Perform simultaneous, unbinned fit to the mass, the decay length and the three decay angles.





$\Delta\Gamma$ vs. ϕ_s:

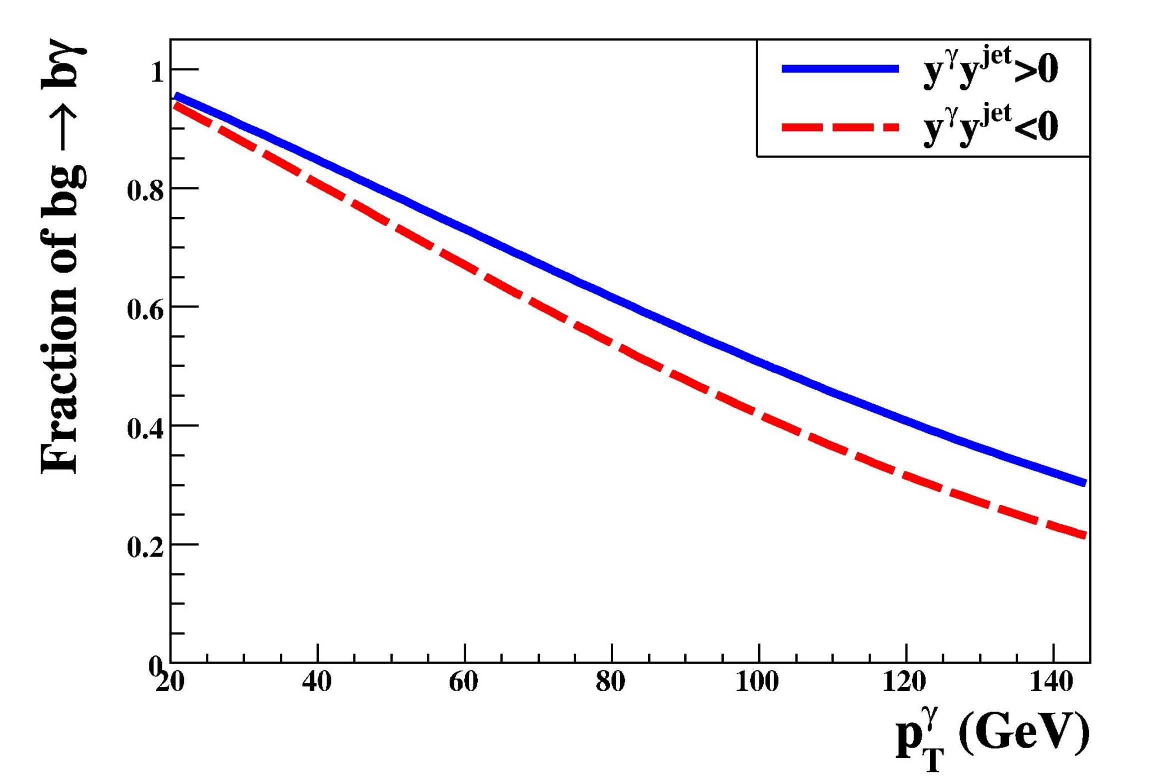


- Final extracted values (numerous different fits performed in order to ensure stability):
  - $\Delta\Gamma = 0.19 \pm 0.07(\text{stat})^{+0.02}_{-0.01}(\text{syst})\ \text{ps}^{-1}$
  - $\phi_s = -0.57^{+0.24}_{-0.30}(\text{stat})^{+0.07}_{-0.02}(\text{syst})$

Physics With Bosons:

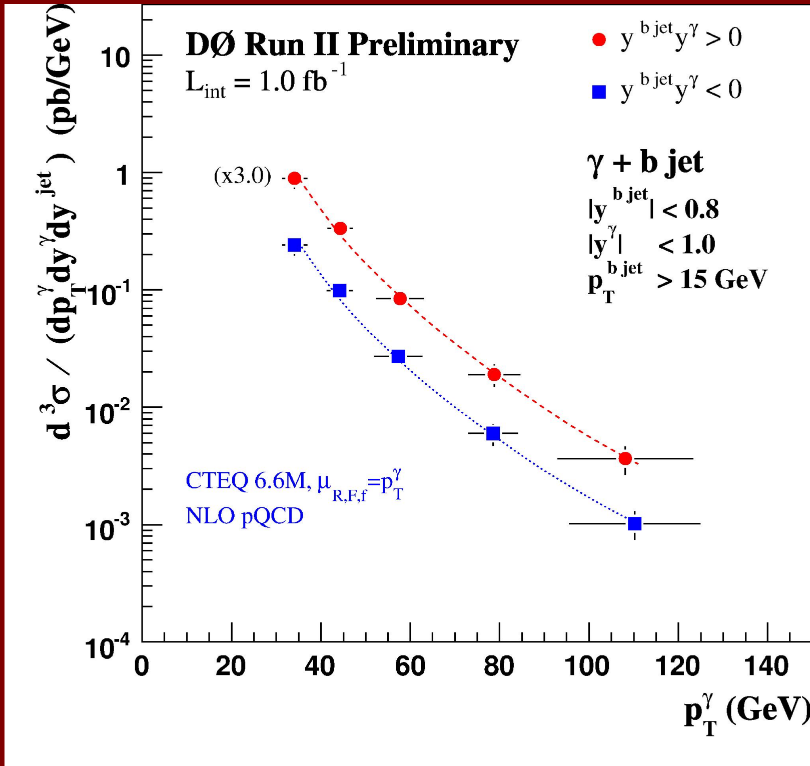
- Smaller cross sections than for jets, but VERY different systematics:
  - At some level almost everything at a hadron collider is QCD.
  - Now replace one side of the diagram with a boson.
  - One can use gauge bosons (γ, W, Z) to probe QCD (low energy resummation, parton distribution functions) with very precisely measured objects!

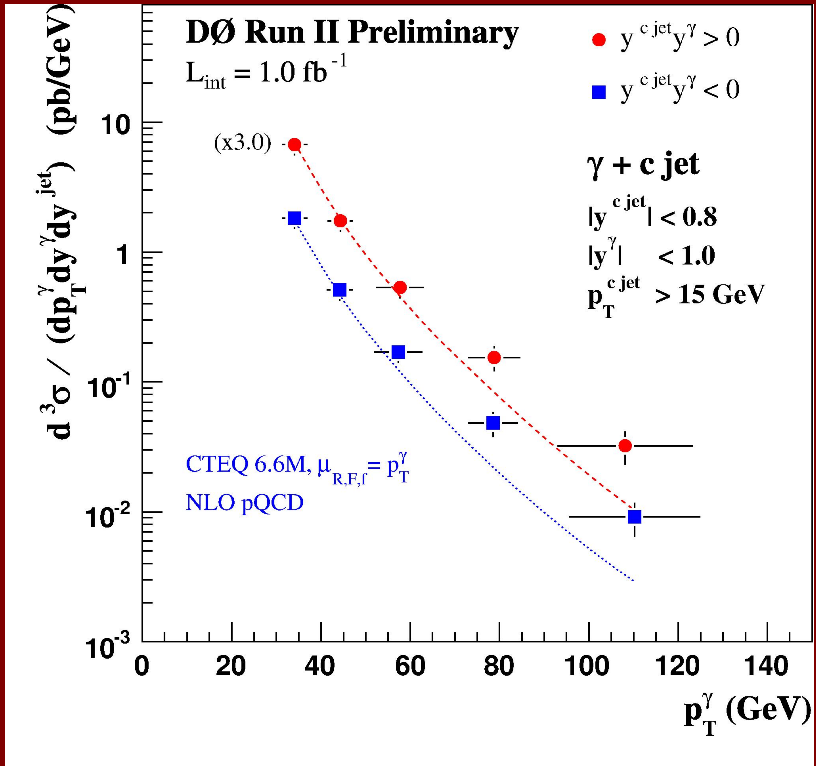
γ+b/c



- Important for probing both the flavor content of the proton, and gluon splitting.
- Key point is to differentiate b/c jets from light quarks.
- Photon provides a great experimental signature!

γ+b/c

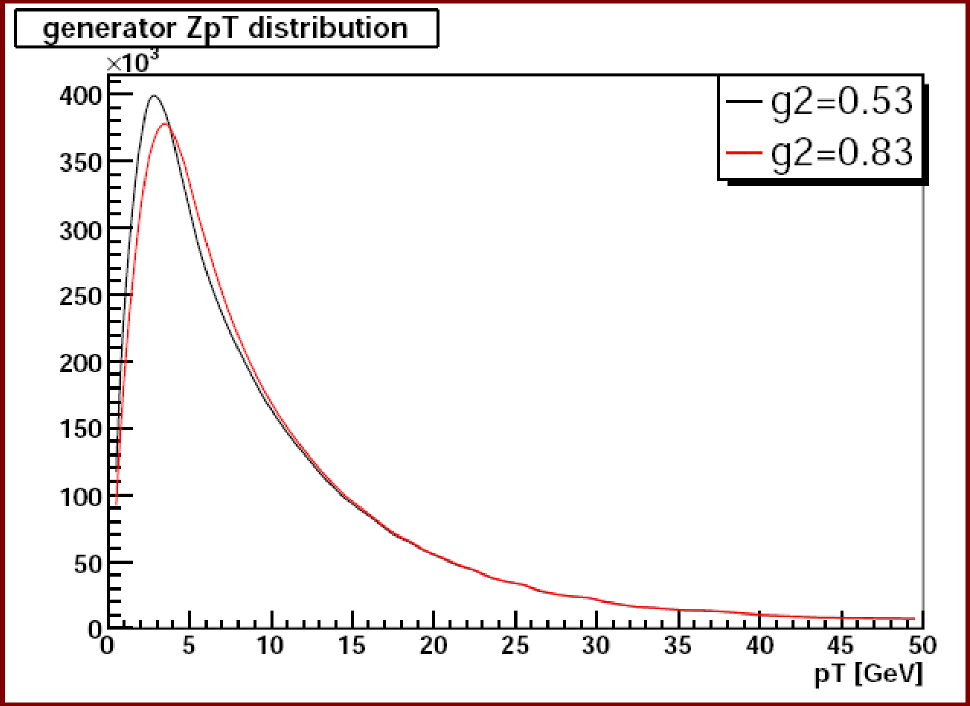




- Triple differential cross section: measured as a function of E_T^{γ}, y^{γ} and y^{j}.
- Good agreement for b, considerable difference for c. Currently under study.

a_T and g_2

$$S_{NP}(b, Q^2) = [g_1 + g_2 \ln(\frac{Q}{2Q_0}) + g_1 g_3 \ln(100 x_i x_j)] b^2$$



- Low p_T boson production (both Z and W) are the realm of resummation.
  - g_2 parameter must be measured from data.

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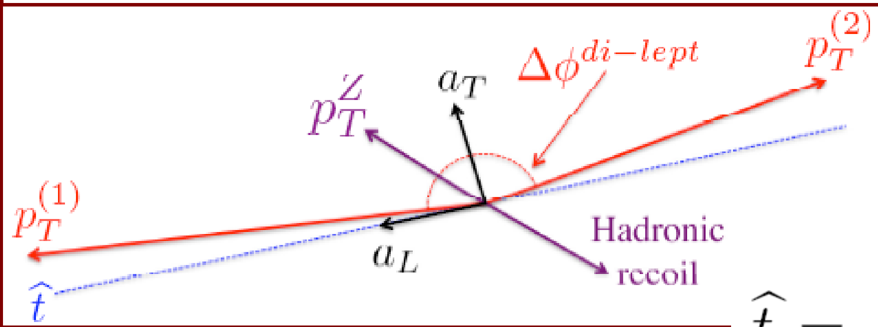
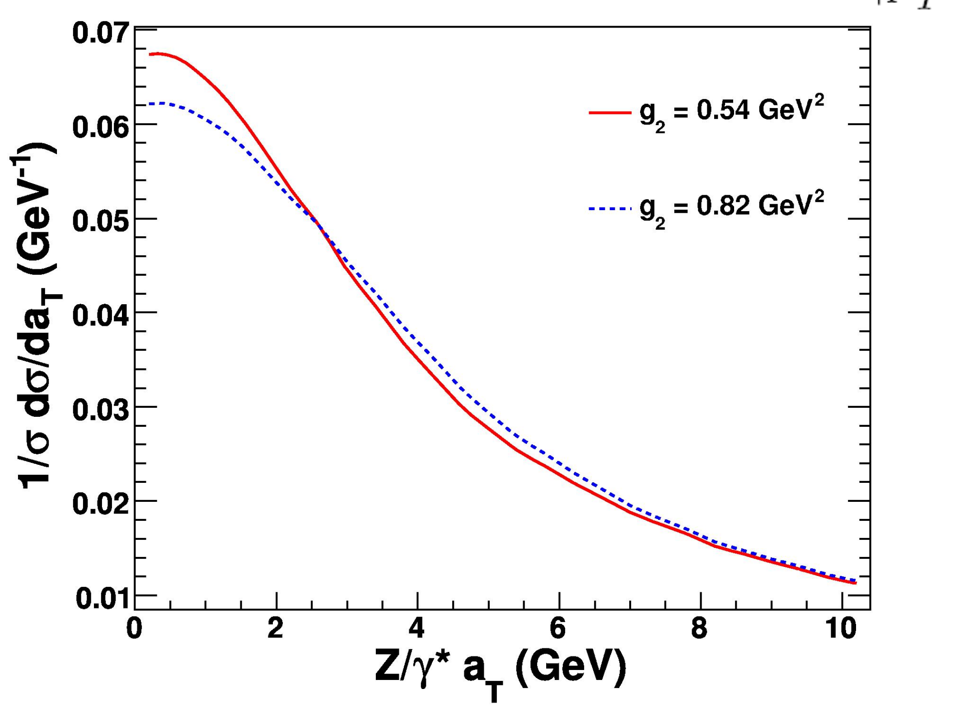
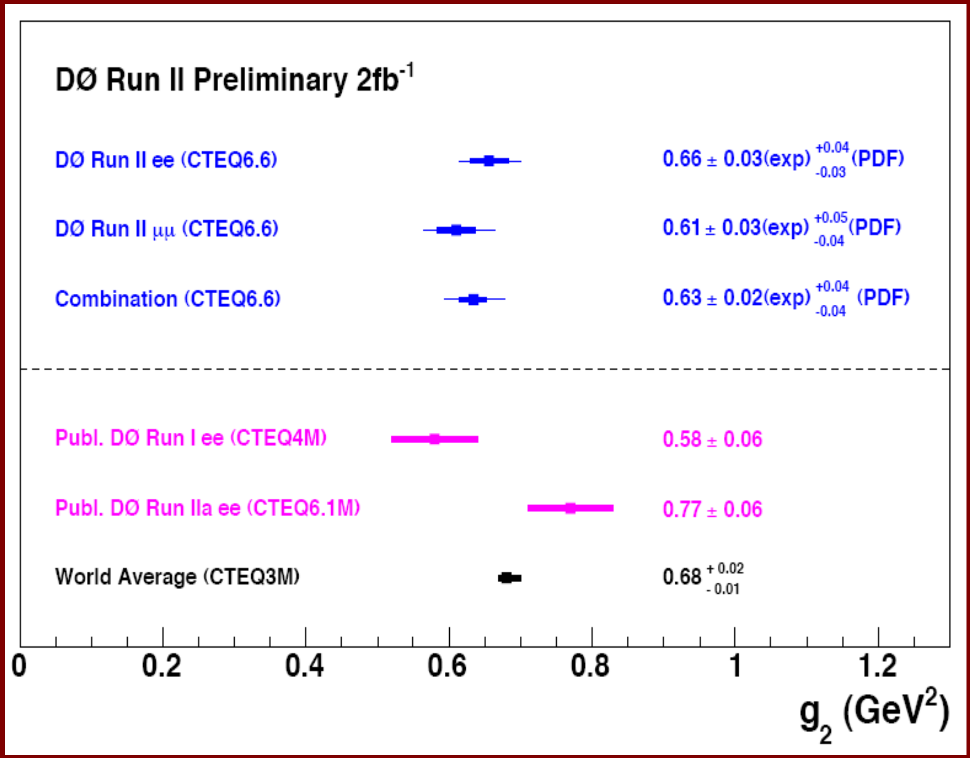


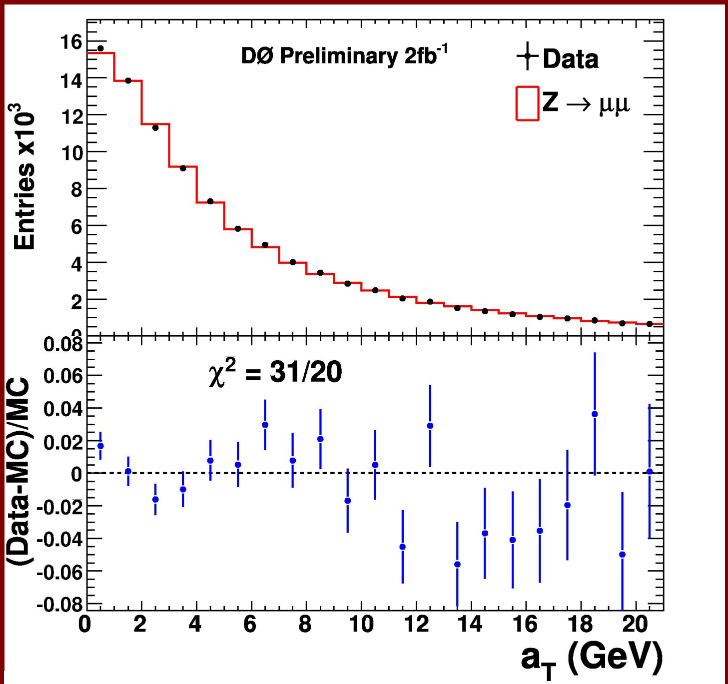
$$\hat{t} = \frac{\vec{p}_T^{\,(1)} - \vec{p}_T^{\,(2)}}{|\vec{p}_T^{\,(1)} - \vec{p}_T^{\,(2)}|}$$

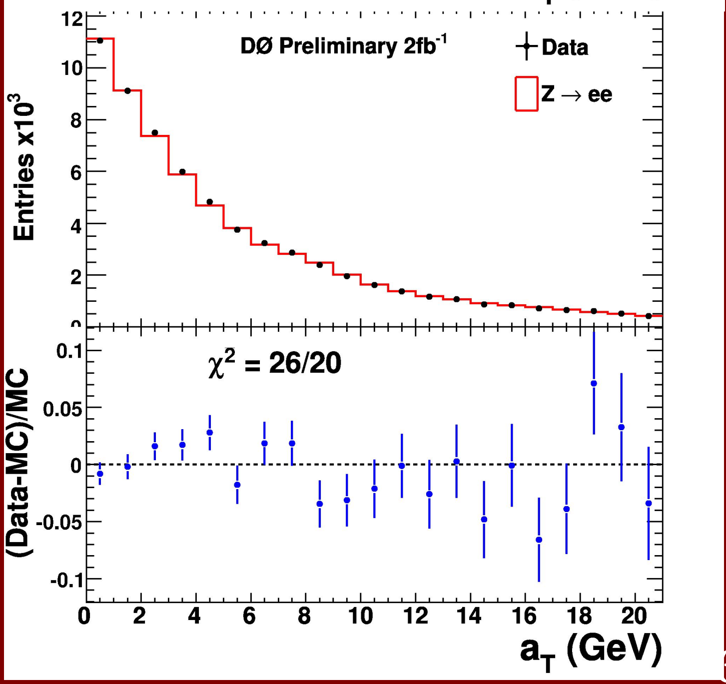


- Low p_T boson production (both Z and W) are the realm of resummation.
  - g_2 parameter must be measured from data.
- Another clever choice of variables allows us to minimize the effect of experimental resolution.

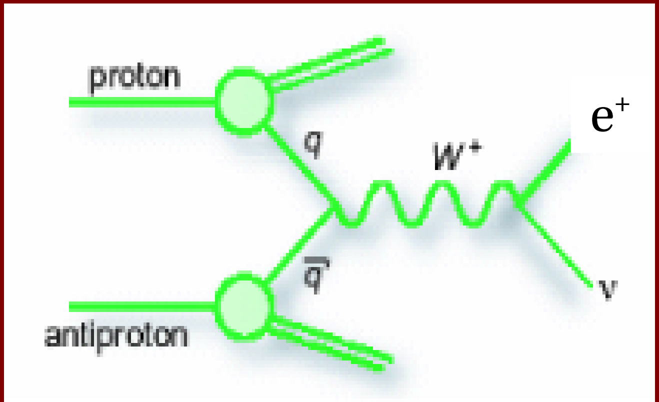


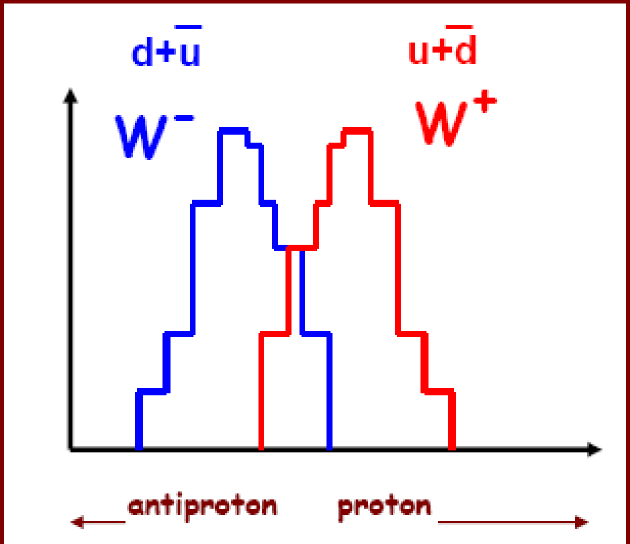
- Resolution effects reduced greatly by choice of variables (μ and e combination).
- Good agreement with world average!





W Charge Asymmetry:

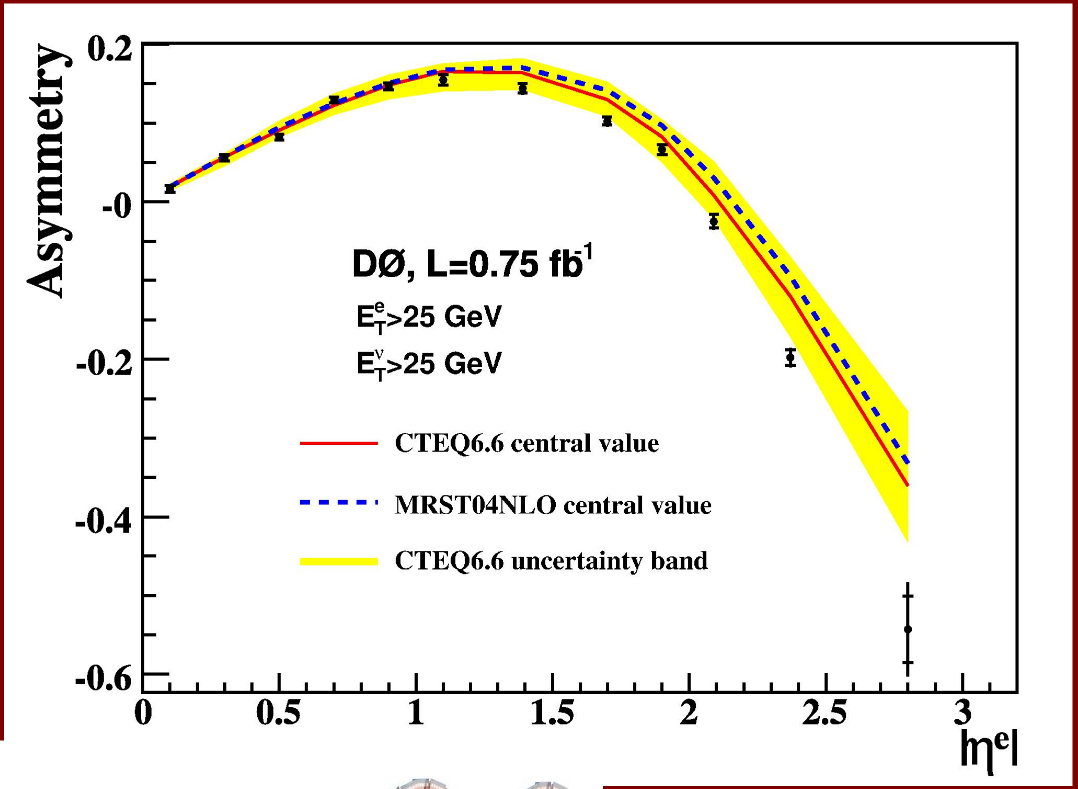


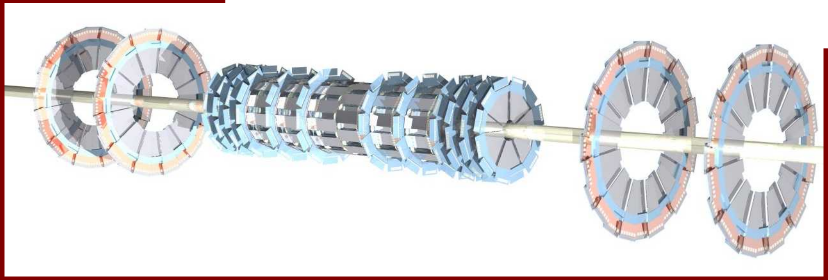


- Typically u-quarks carry more of the proton momentum than d-quarks, and thus W^+ will tend to go in the positive rapidity direction.
- Lepton rapidity is correlated to the W rapidity, and thus a very clean probe into these momentum distributions.

W Charge Asymmetry

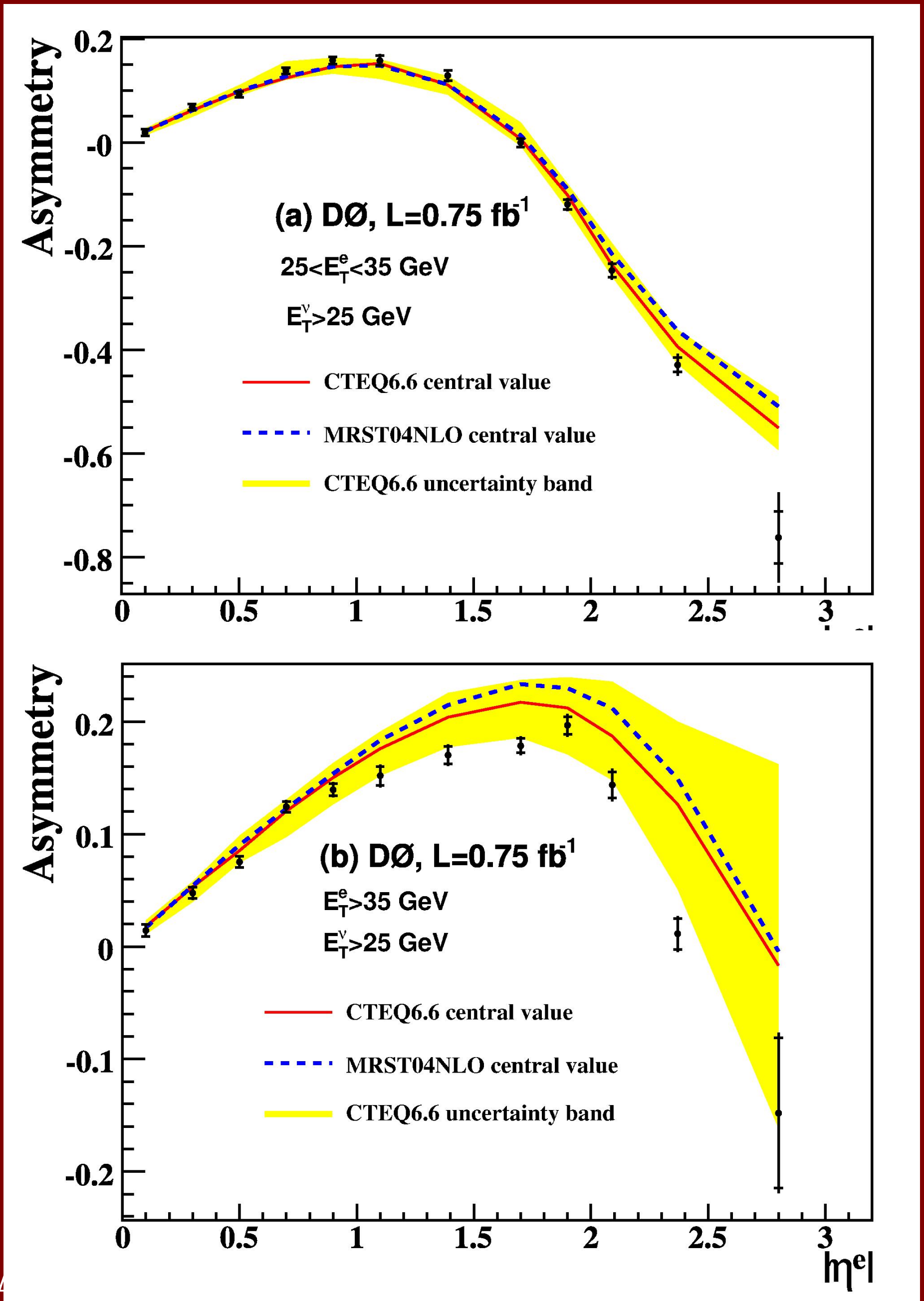
- Completely different systematics to other measurements sensitive to PDFs.
- Very large range of rapidity covered, thanks to silicon design.
- That's not all however...





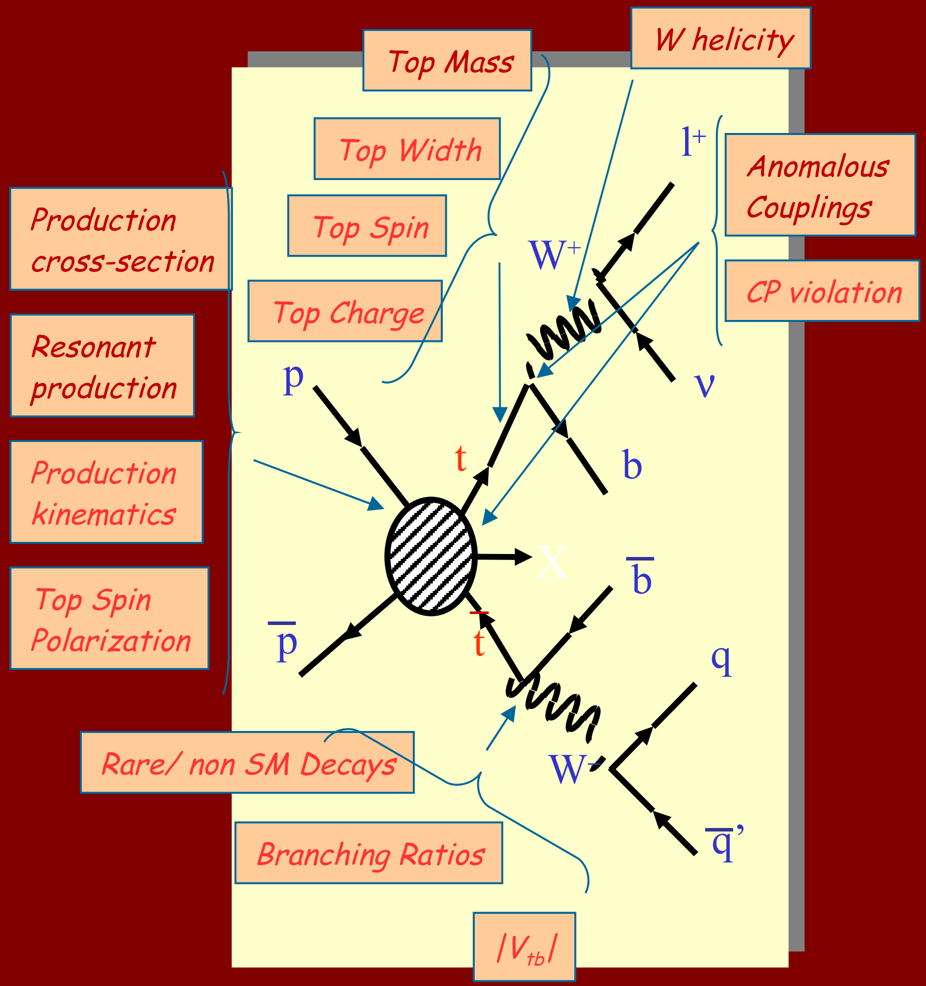
W Charge Asymmetry

- Completely different systematics to other measurements sensitive to PDFs.
- By selecting different slices of lepton p_T, we select different x and Q^2 of the initial W.



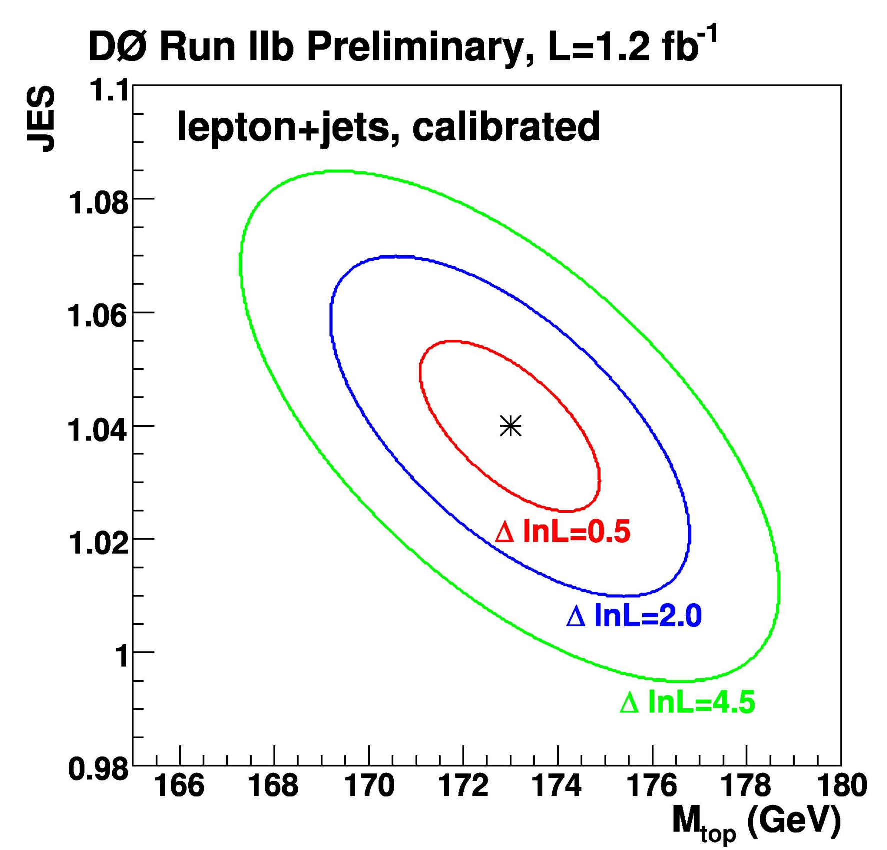
Top Quarks

- Analyses contain both vector bosons AND jets.
- Discovered in Run I, now sufficient statistics not only to do precision measurements of mass and cross section, but also probe new physics.
- Most massive of quarks, implies a special connection to EWSB.



Top Mass:

- Top mass important input to electroweak global analyses.
- But…challenging!
  - Jet energy scale
  - Signal modeling
  - Combinatorics.
- Requires sophisticated techniques to minimize statistical and systematic uncertainties.



Lepton+jets (2.1 fb^{-1}):

$$m_{top} = 172.2 \pm 1.0\,(\text{stat}) \pm 1.4\,(\text{syst})\ \text{GeV}$$

e+μ (2.8 fb^{-1}):

$$m_{top} = 172.9 \pm 3.6\,(\text{stat}) \pm 2.3\,(\text{syst})\ \text{GeV}$$

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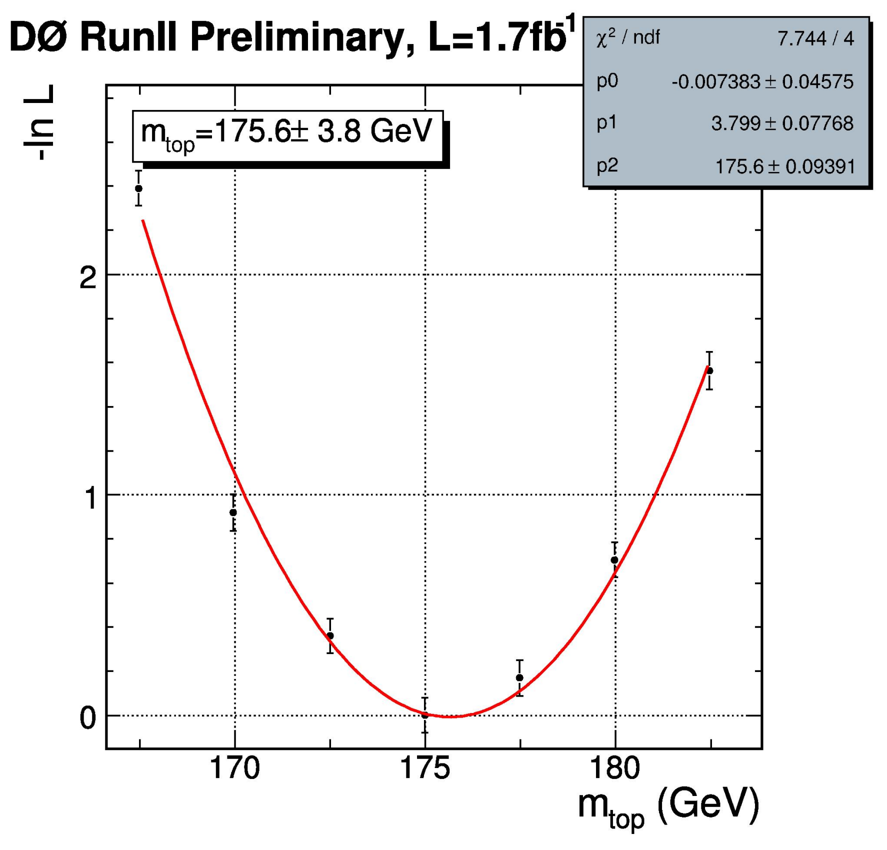

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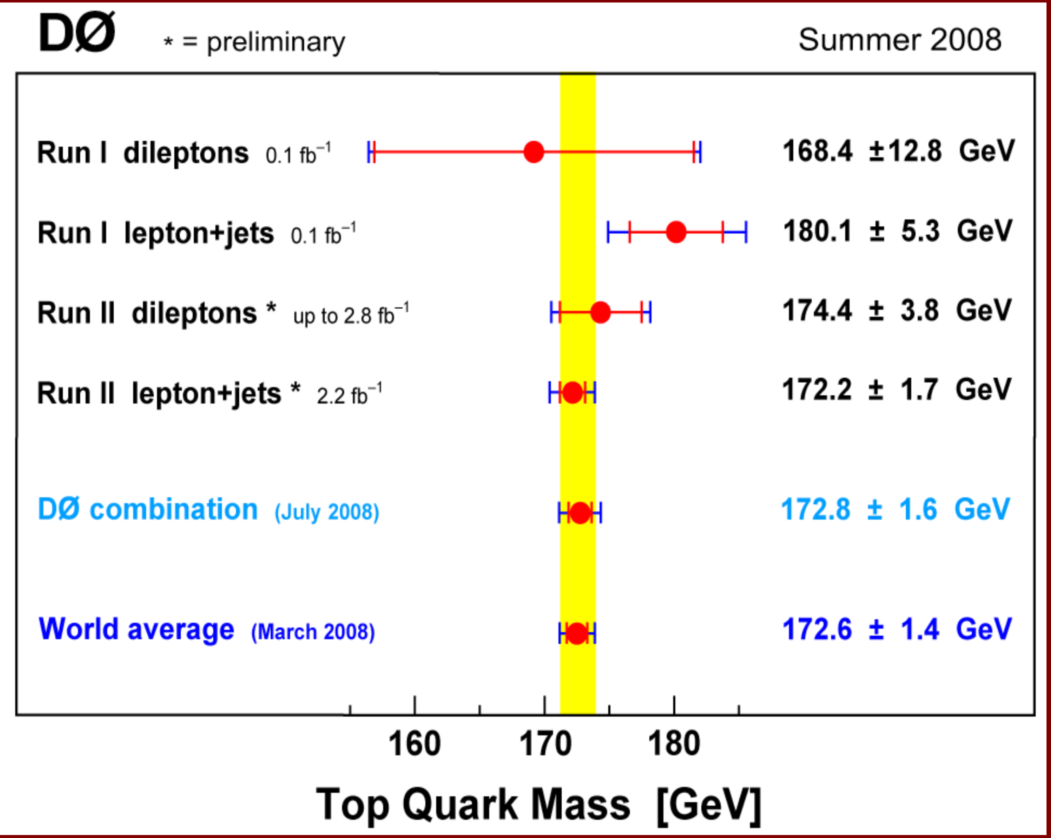

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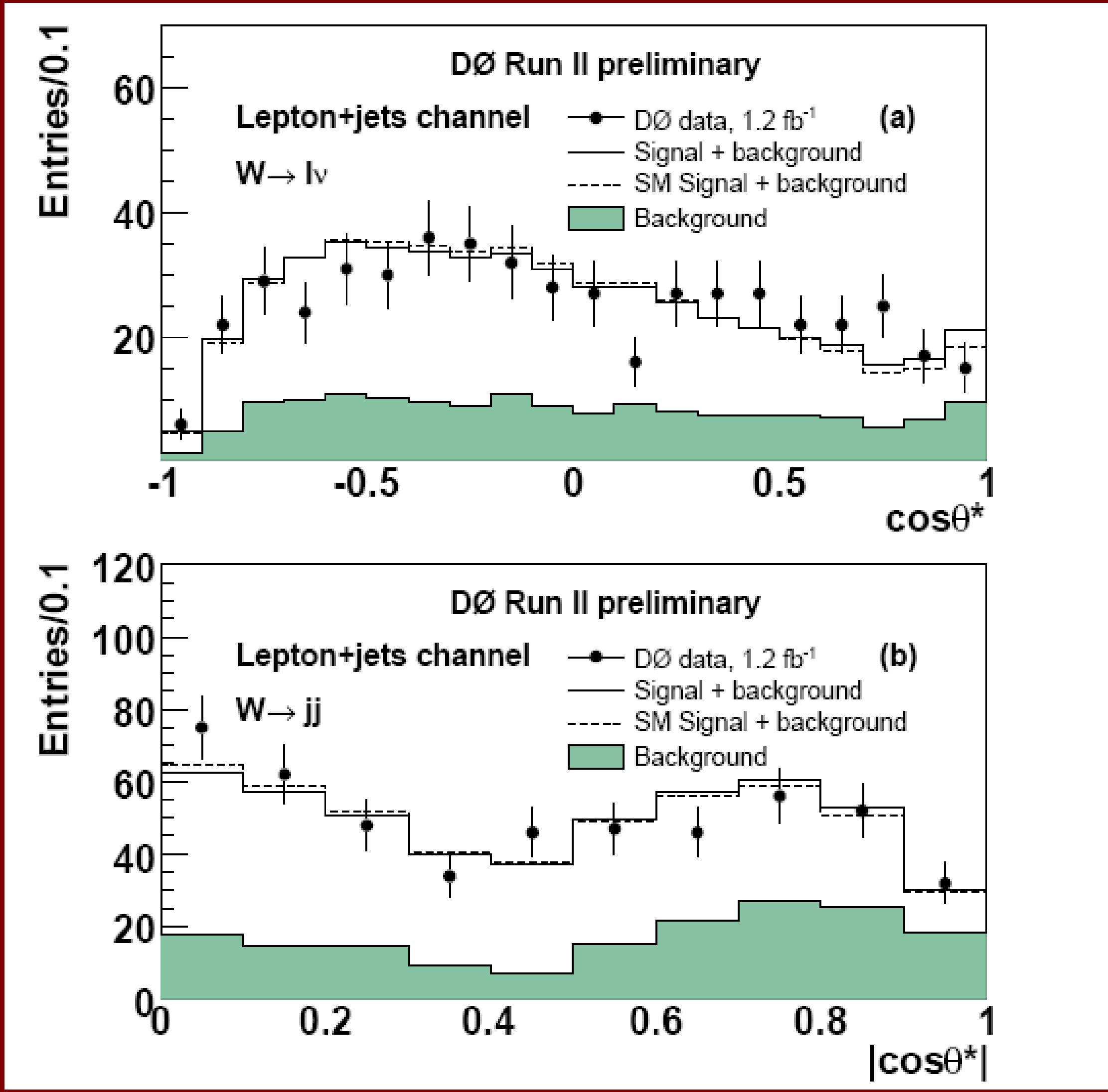
W helicity:

- Since coupling ~1, one can directly study t->Wb.
- Reconstruct t-quark kinematics, calculate angle (θ^*) between top direction and W decay product.



$$\omega(c) \propto 2(1-c^2)f_0 + (1-c)^2 f_- + (1+c)^2 f_+$$

$$c = \cos\theta^*$$

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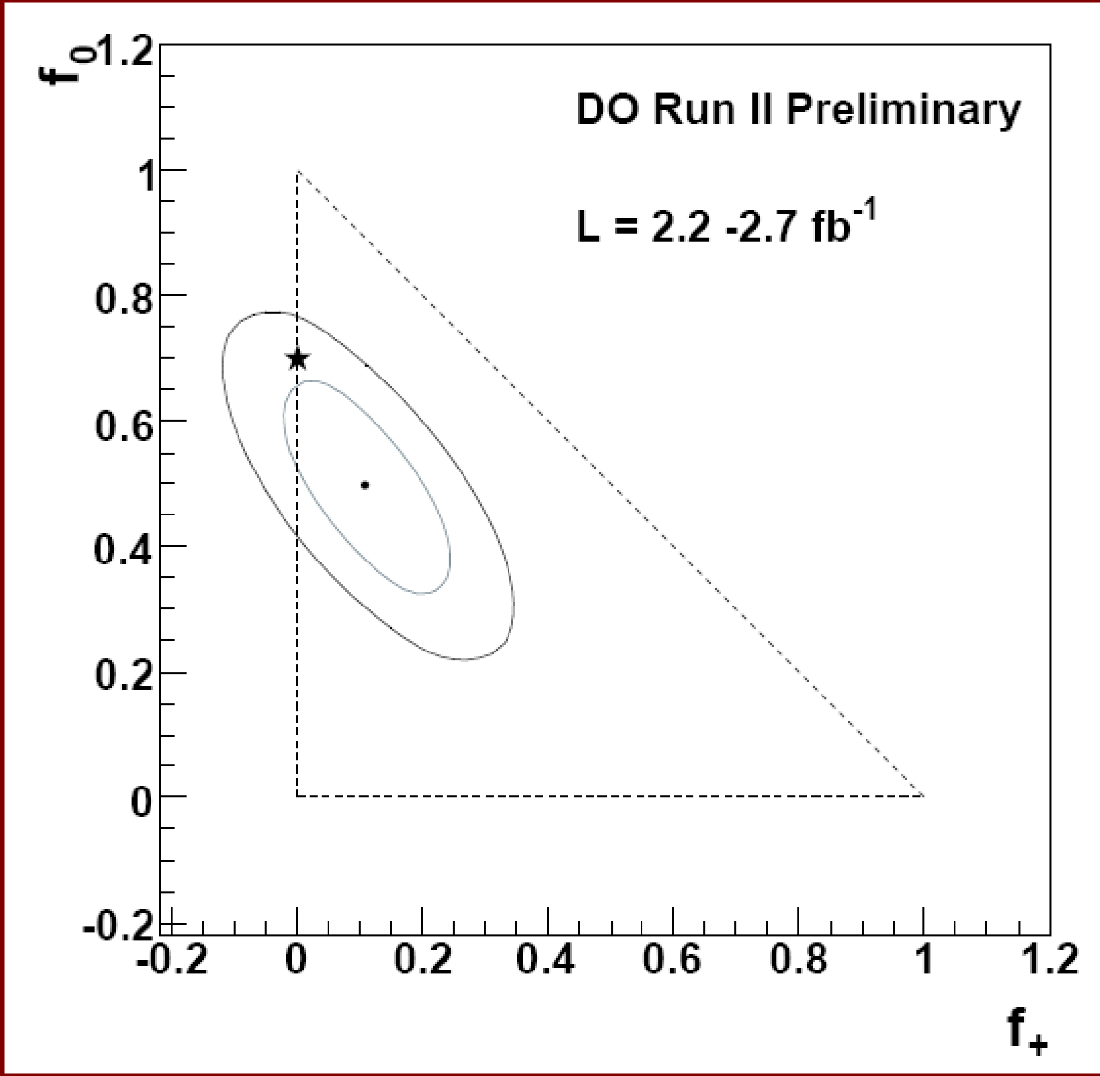
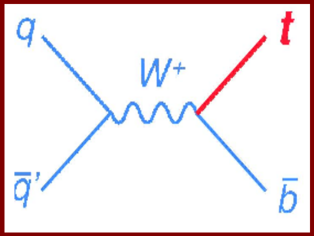
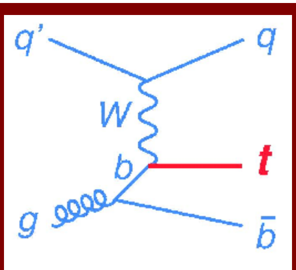


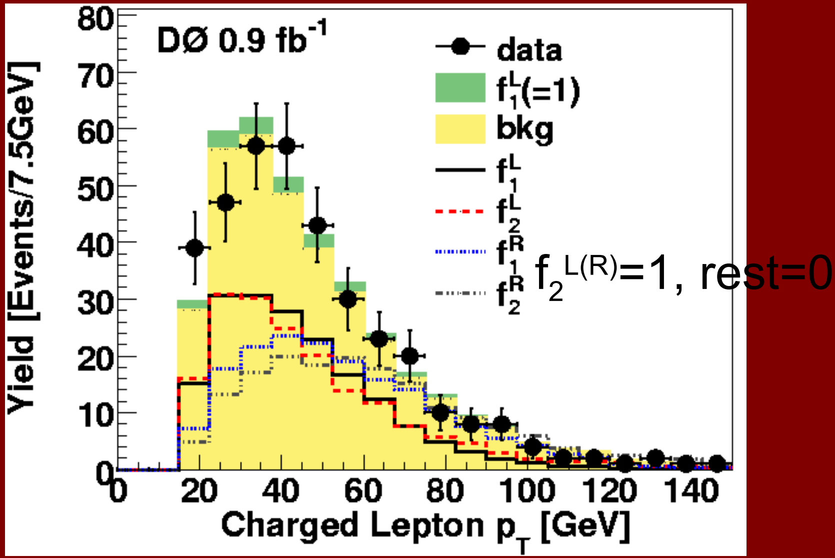
Single Top

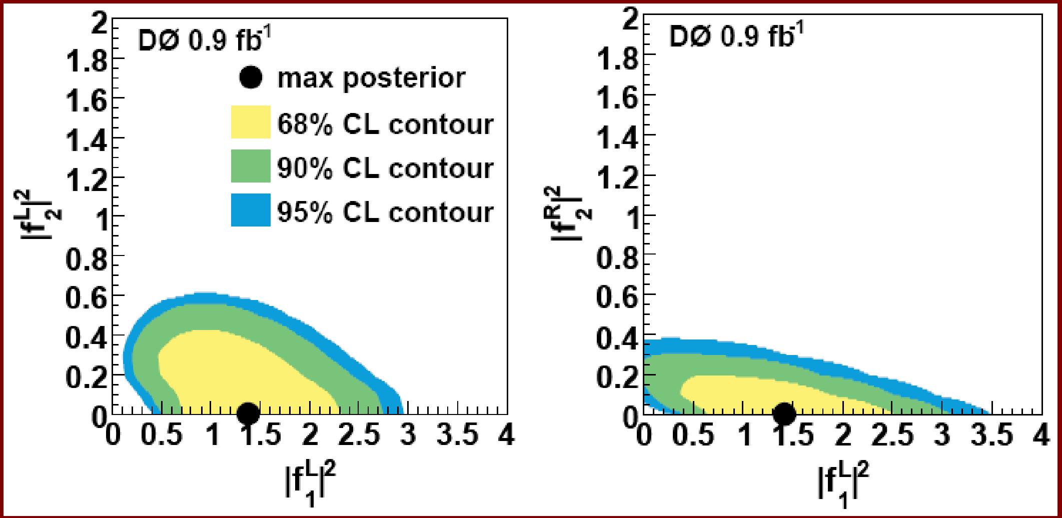
- Top coupling to W interesting, and Single top directly sensitive to Wtb interaction, both in rate and kinematics.

$$\mathcal{L} = \frac{g}{\sqrt{2}} W_\mu^- \bar{b} \gamma^\mu \left(f_1^L P_L + f_1^R P_R \right) t - \frac{g}{\sqrt{2} M_W} \partial_\nu W_\mu^- \bar{b} \sigma^{\mu\nu} \left(f_2^L P_L + f_2^R P_R \right) t + h.c.$$





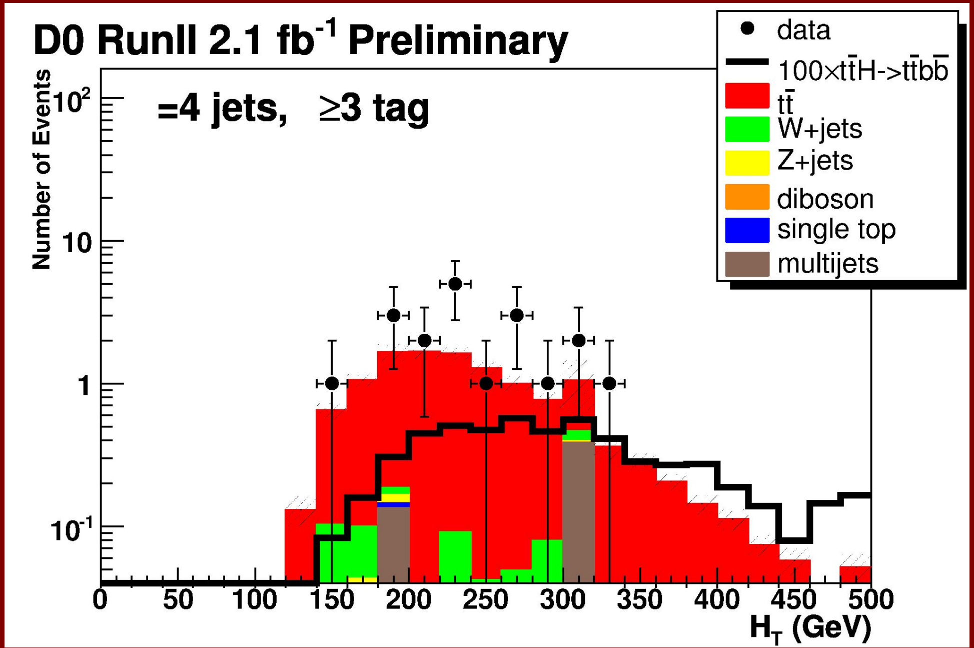


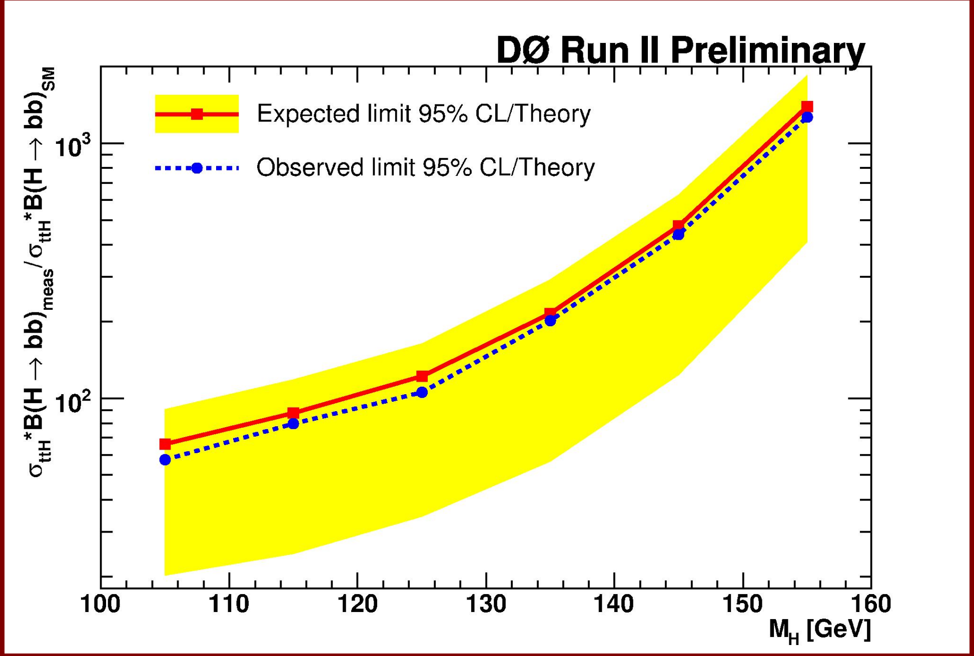


First direct constraints on *tbW* tensor couplings! Same data sample as first single top evidence.

Top + Higgs?

- An important channel for LHC, aids only in combination at Tevatron.
- Higgs +tt->ttbb
- Enhanced in some models (2HDM for instance).



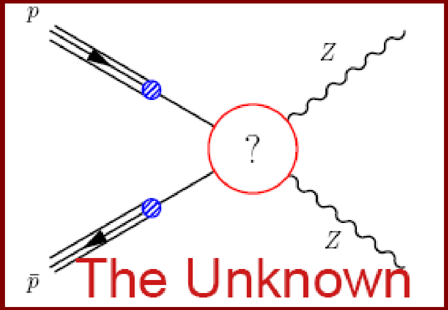


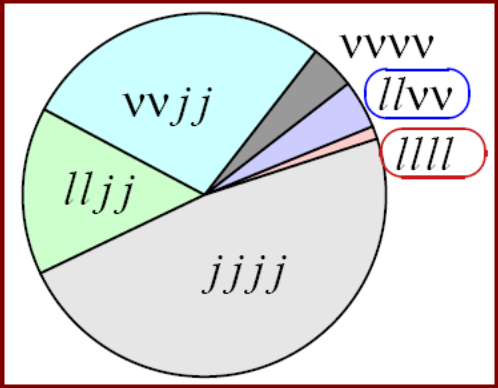
Searching for New Physics:

- Not simply doing the experiments to more precisely measure the Standard Model, we want it to BREAK!
- Searches for exotic states can give indications for new physical processes that aren't given within our current models.

ZZ

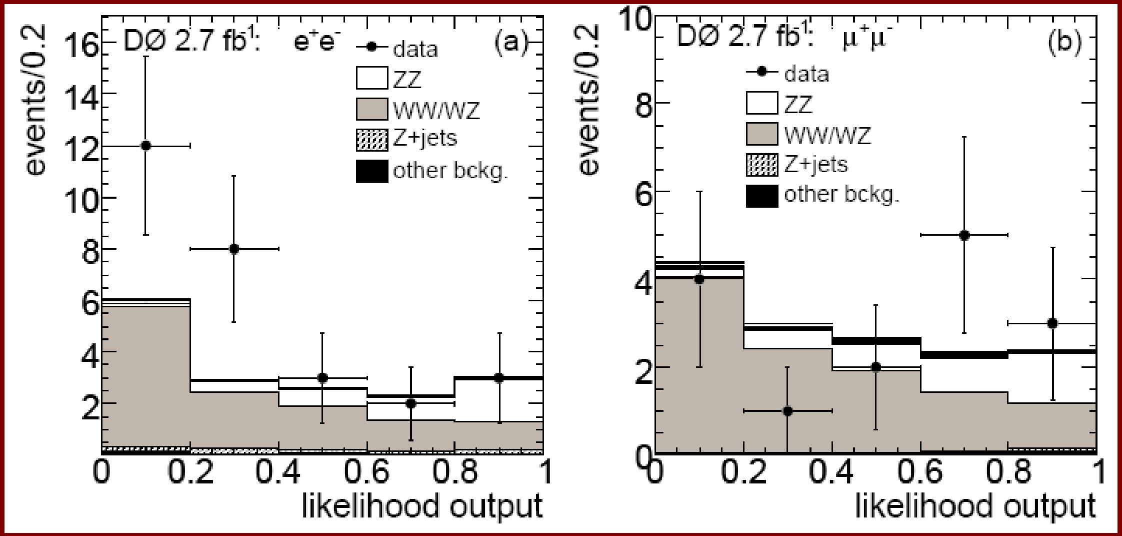
- Reality check for searches, smallest SM diboson cross section 1.6 +/- 0.1 pb.
- ZZ->llll: Smallest branching fraction (0.4%) but smallest backgrounds.
- ZZ->llνν: Large branching fraction (2.6%) but more substantial backgrounds.





ZZ->llνν

- Minimize mismeasurement probability on missing E_T.
- Combine remaining information into a likelihood against WW.



$$\sigma(ZZ) = 1.9 \pm 1.0(stat) \pm 0.4(syst)\ \text{pb}$$

	Expected	Observed
P-value:	1.92×10^{-2}	1.00×10^{-2}
Significance:	2.1σ	2.3σ

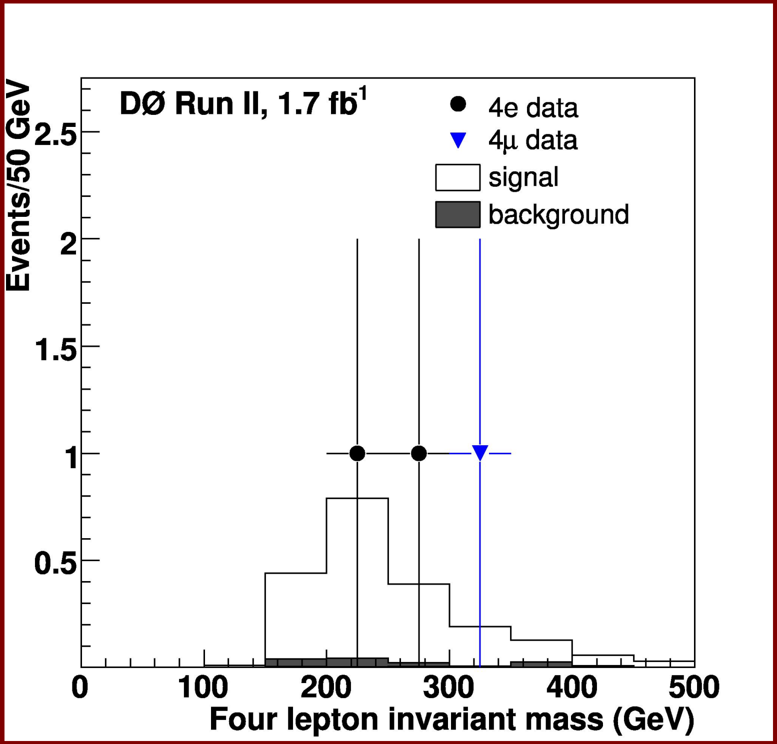
ZZ->llll

Subchannel	$4e_{2C}$	$4e_{3C}$	$4e_{4C}$	4μ	$2\mu 2e_{0C}$	$2\mu 2e_{1C}$	$2\mu 2e_{2C}$
Luminosity (fb^{-1})	1.75 ± 0.11	1.75 ± 0.11	1.75 ± 0.11	1.68 ± 0.10	1.68 ± 0.10	1.68 ± 0.10	1.68 ± 0.10
Signal	0.084 ± 0.008	0.173 ± 0.015	0.140 ± 0.012	0.534 ± 0.043	$0.058^{+0.007}_{-0.006}$	0.352 ± 0.040	$0.553^{+0.045}_{-0.044}$
$Z(\gamma)$+jets	$0.030^{+0.009}_{-0.008}$	$0.018^{+0.008}_{-0.007}$	$0.002^{+0.002}_{-0.001}$	0.0003 ± 0.0001	$0.03^{+0.02}_{-0.01}$	0.05 ± 0.01	$0.008^{+0.004}_{-0.003}$
$t\bar{t}$	–	–	–	–	$0.0012^{+0.0016}_{-0.0009}$	0.005 ± 0.002	$0.0007^{+0.0009}_{-0.0005}$
Observed events	0	0	2	1	0	0	0

- Channels divided up by topology:
  - Some are more pure, thus more significant

$$\sigma(ZZ) = 1.75^{+1.27}_{-0.86}(stat) \pm 0.13(syst)\ \text{pb}$$

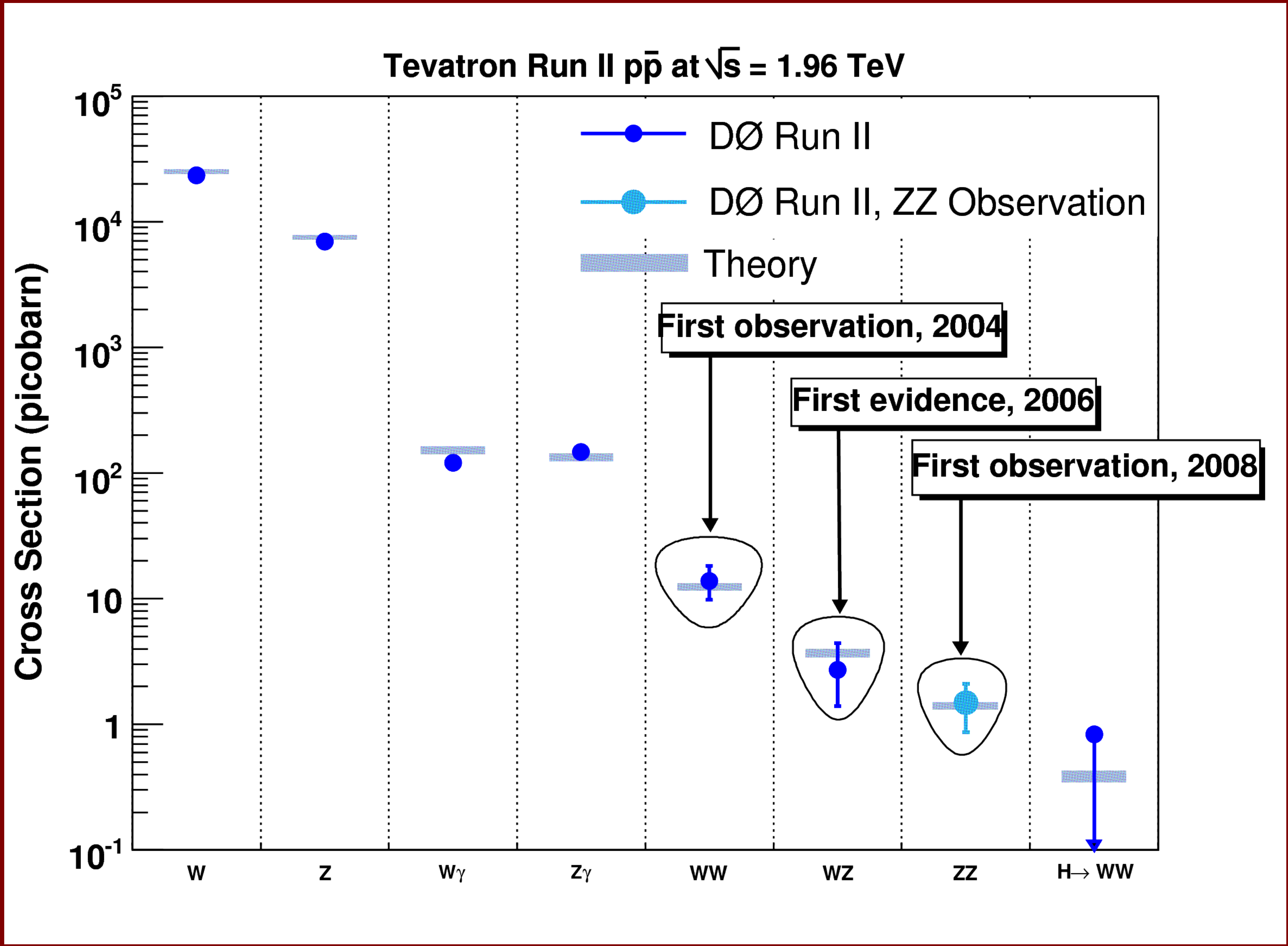
	Expected	Observed
P-value:	1.32×10^{-4}	2.94×10^{-8}
Significance:	3.65σ	5.42σ



ZZ->llll

- Last in the series of SM dibosons.

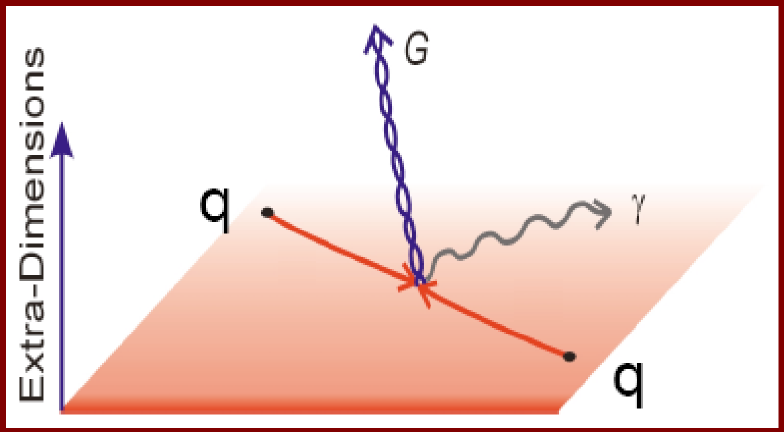
5.7σ significance! First observation of ZZ production at hadron collider.

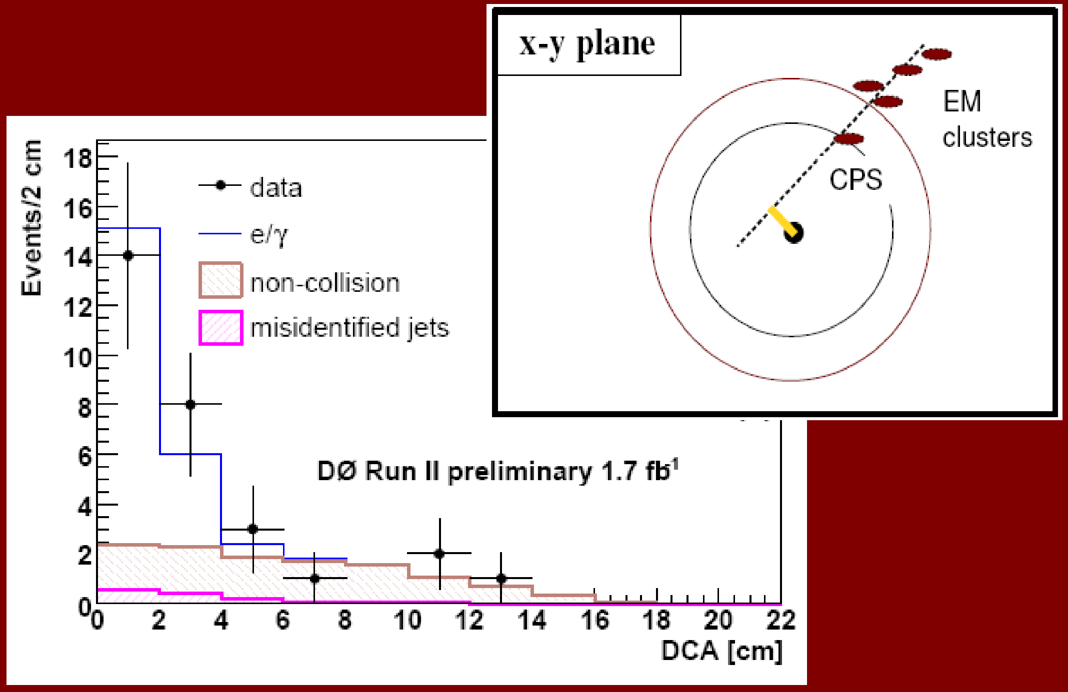


$$\sigma(ZZ) = 1.60 \pm 0.63\ (\text{stat.})^{+0.16}_{-0.17}\ (\text{syst.})\ \text{pb}$$

Mono-photon:

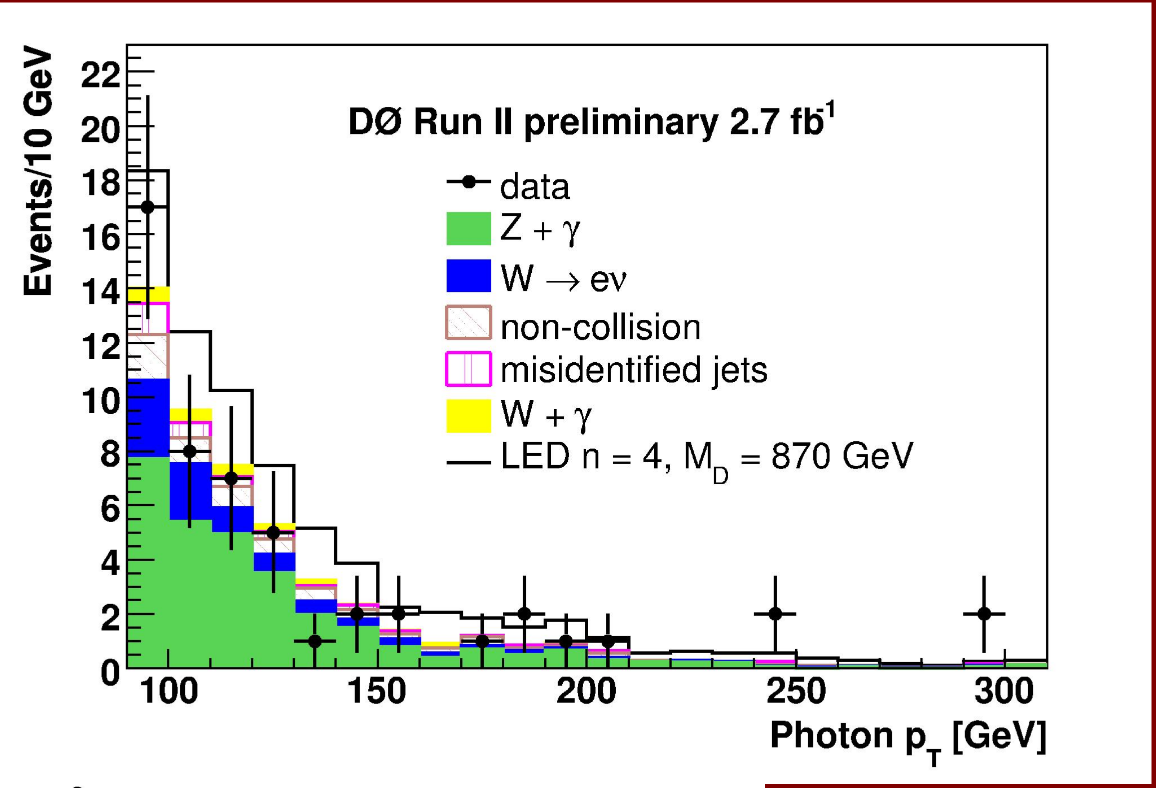
- G+γ, graviton escapes leaving only a single photon and missing transverse energy.
- Irreducible physics background from Zγ–>ννγ.
- Instrumental backgrounds from W->eν, Wγ, beam halo, cosmics.

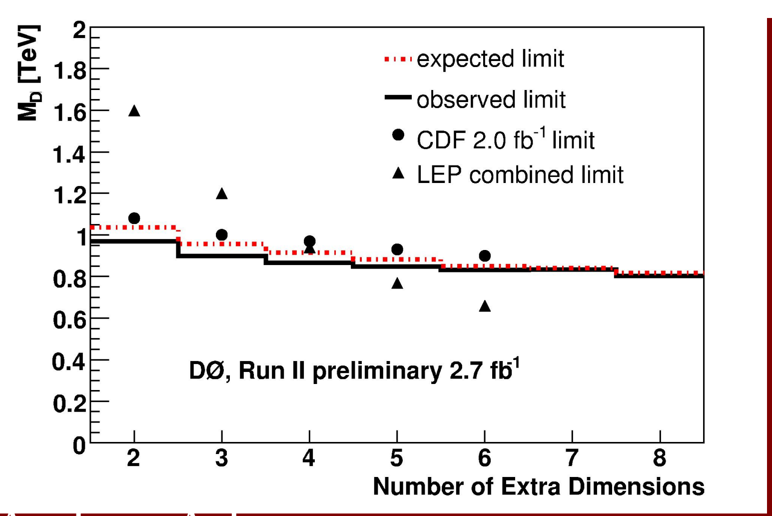




Mono-photon:

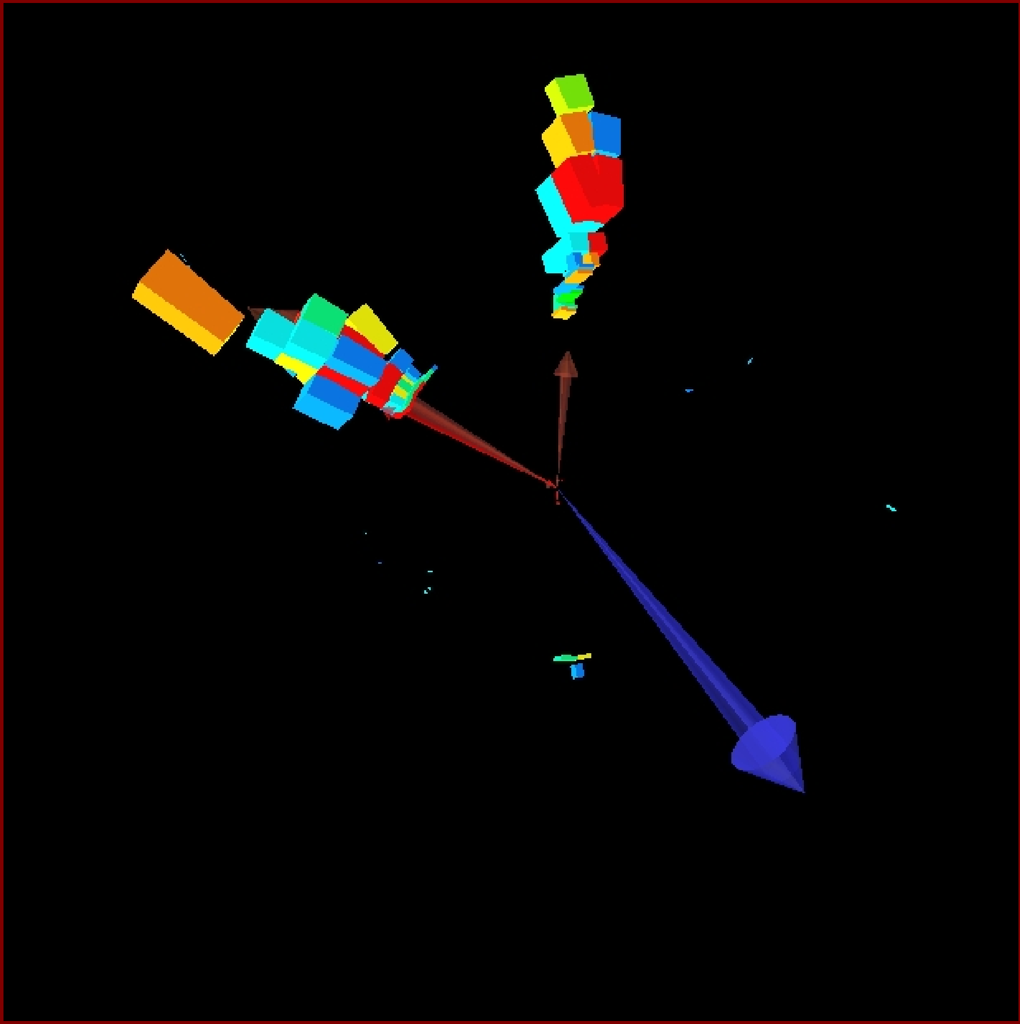
- Exploit EM calorimetry and longitudinal segmentation to control backgrounds.
- Improve upon LEP limits for n_D>4!



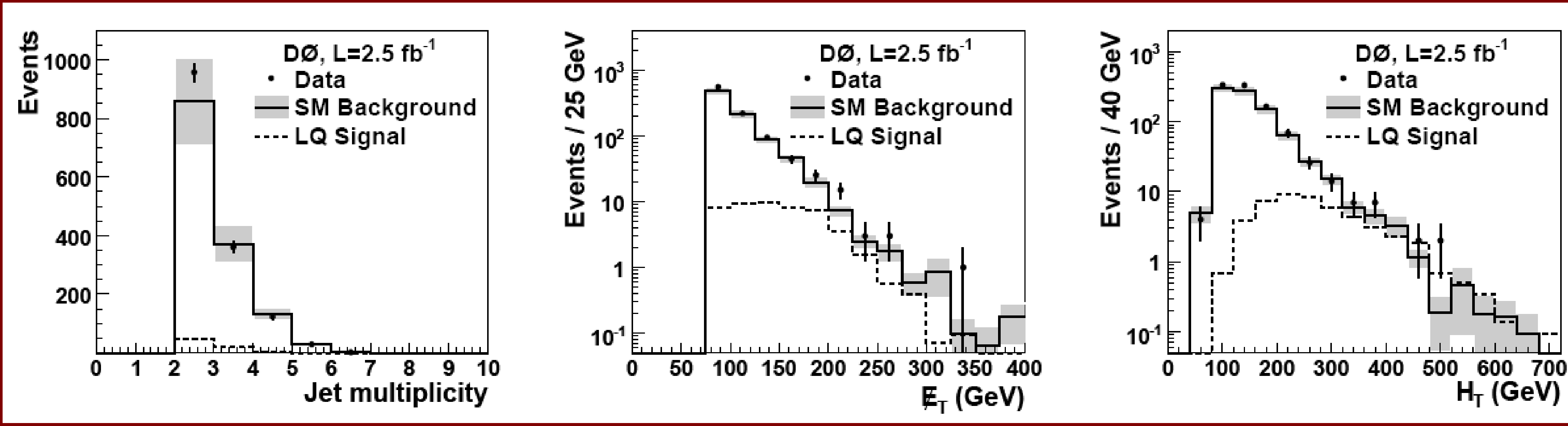


Acoplanar Jets:

- Two jets, unbalanced by additional activity.
- Can be a signal of pair produced leptoquarks decaying to qνqν.
- Alternatively, could be sign of a stable particle which leaves no trace in the detector.



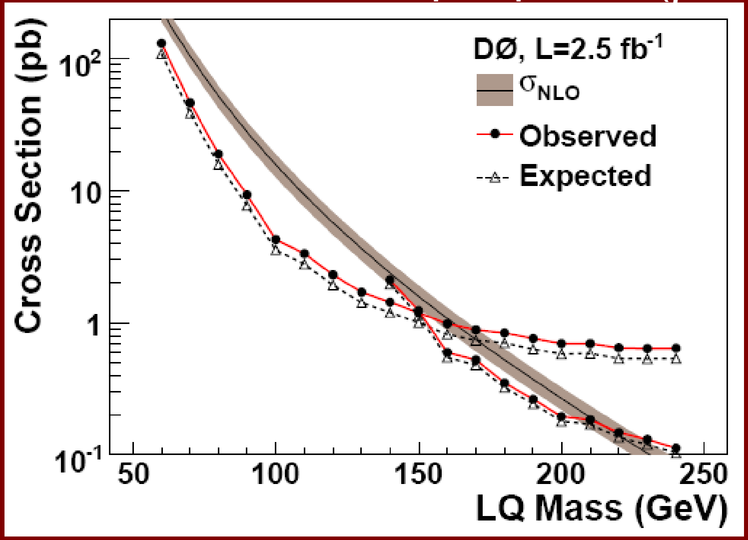
Acoplanar Jets:



- Nothing outside of standard model expectations observed.
- Limits improved over previous single generation leptoquark by ~70 GeV.

$$LQ\overline{LQ} \rightarrow \nu q \overline{\nu q}$$

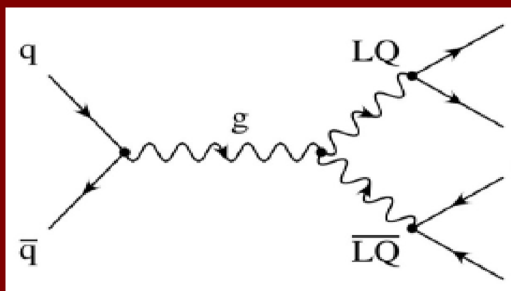
1st Generation Leptoquarks (β=0)



Most restrictive direct limits!

Leptoquarks (3^{rd} gen):

- Predicted by a variety of New Physics models (GUTs, Compositeness, etc).
- Couple directly to a quark and a lepton:

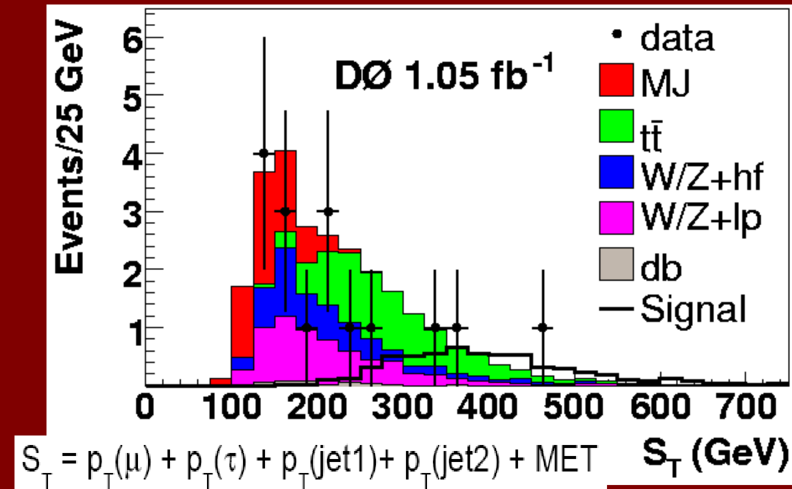


l,ν
q β ~ B(LQ→l+q)
l̄, ν̄
q̄

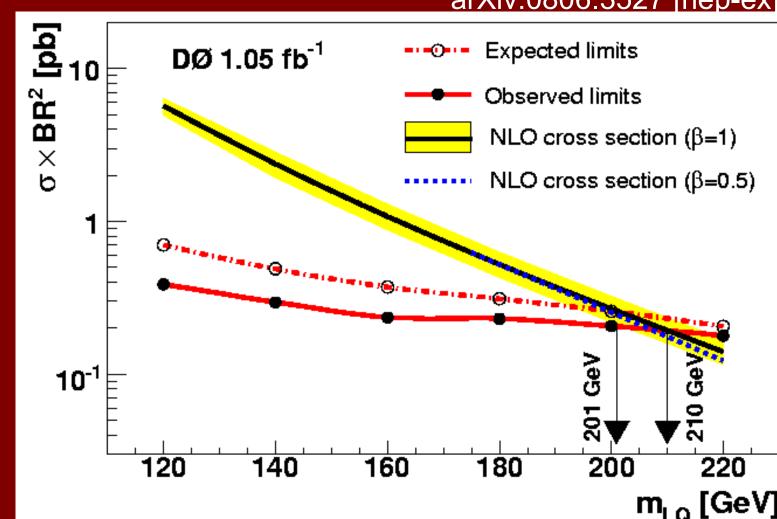
- Consider 3^{rd} gen scalar LQ with charge 2/3 or 4/3: LQ→τ+b

$$LQ_3 \overline{LQ}_3 \rightarrow \tau^- b \tau^+ \bar{b}$$
$$\tau_1 \rightarrow \mu \bar{\nu} \nu, \tau_2 \rightarrow \nu + hadrons$$

- 1 isolated μ, p_T>15 GeV
- 1 τ candidate, p_T>15-20 GeV
- 2 jet, p_T>25(20) GeV; 1 and 2 b-tags



arXiv:0806.3527 [hep-ex]



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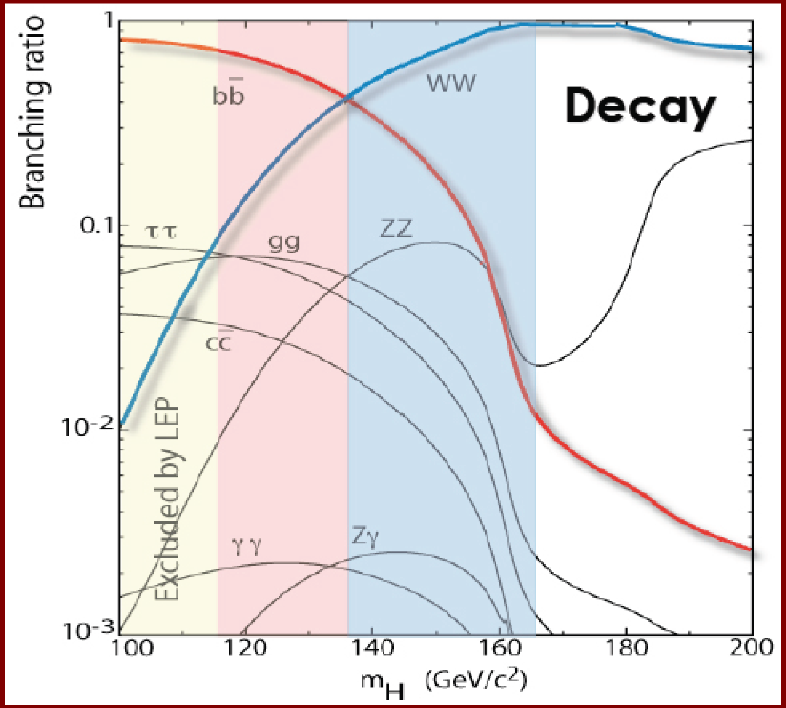
Most restrictive limits in this decay channel!

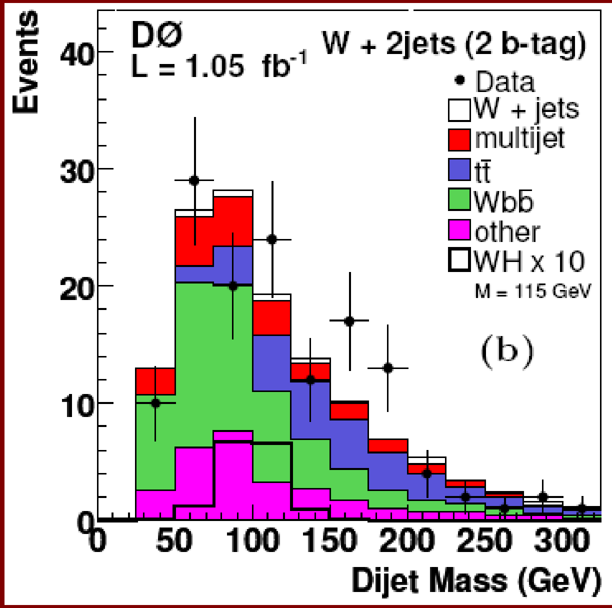
Higgs Searches

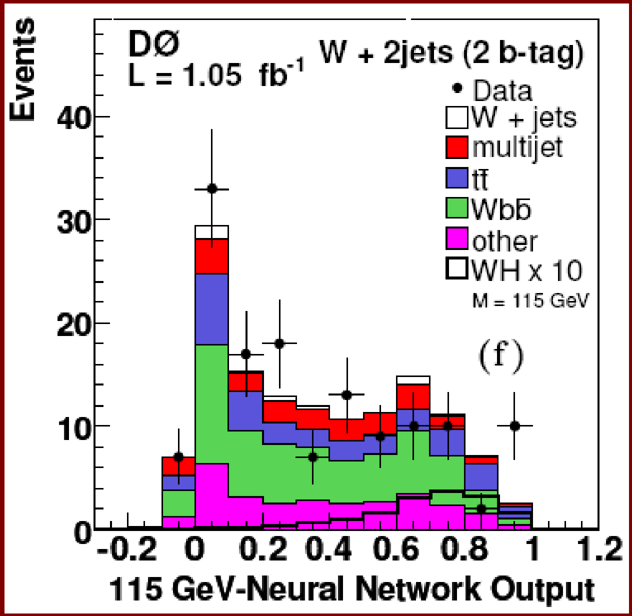
- At Tevatron, must cover a large range of different channels (especially at low mass). Leave no stone unturned!
- Associated Higgs production (ZH, WH) at low mass, coupled with H->WW at high mass.



WH->lνbb

- Large backgrounds, very small signals. Combine 8 independent channels:
  - e+jets, μ+jets
  - 2 or 3 jets
  - 1 or 2 b-tags
- Use dijet mass and kinematics in multivariate discriminants to improve sensitivity.





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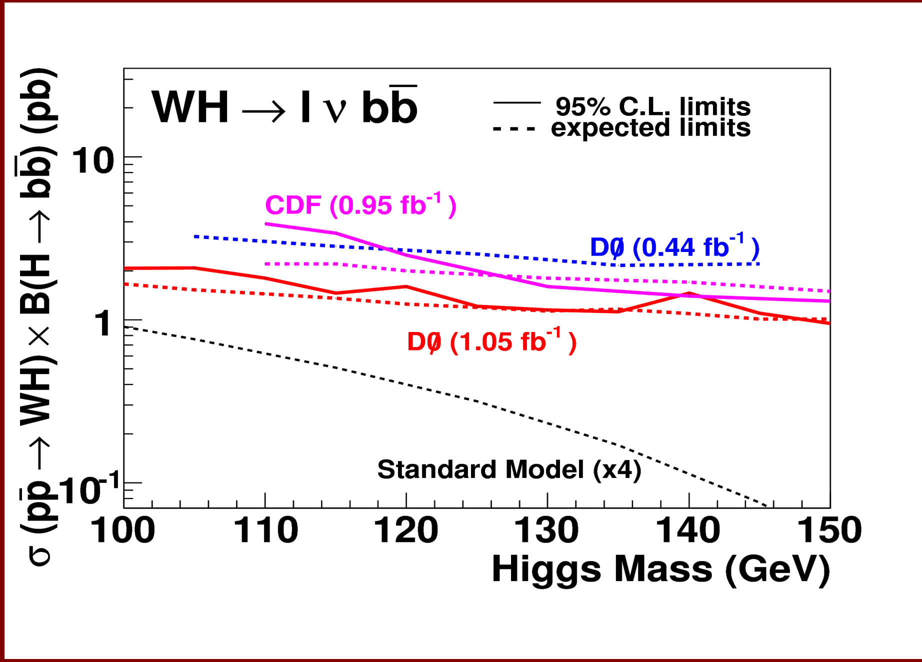
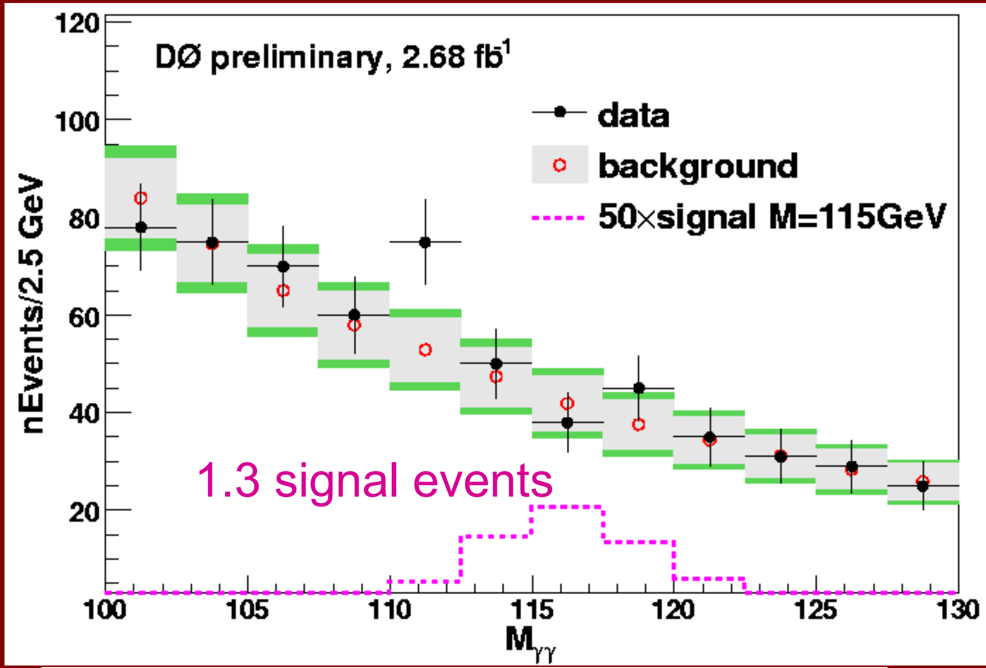
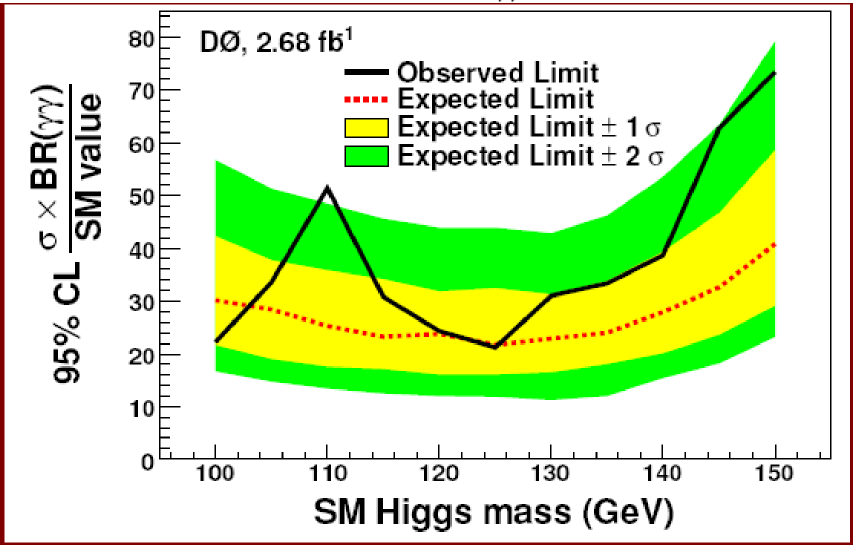


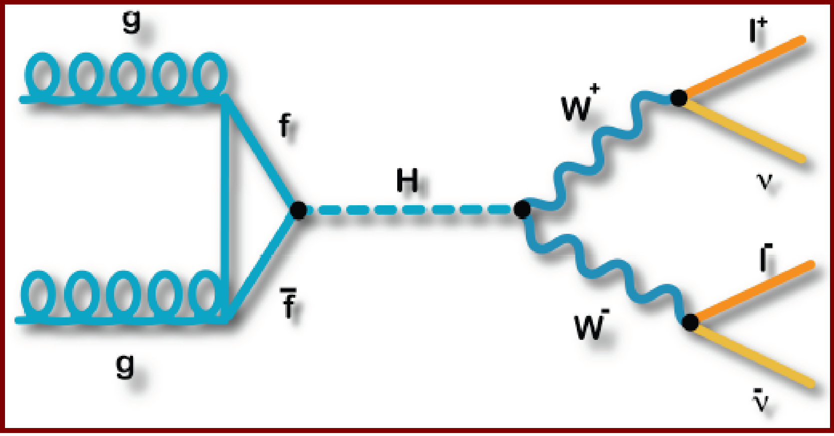
H->γγ Search

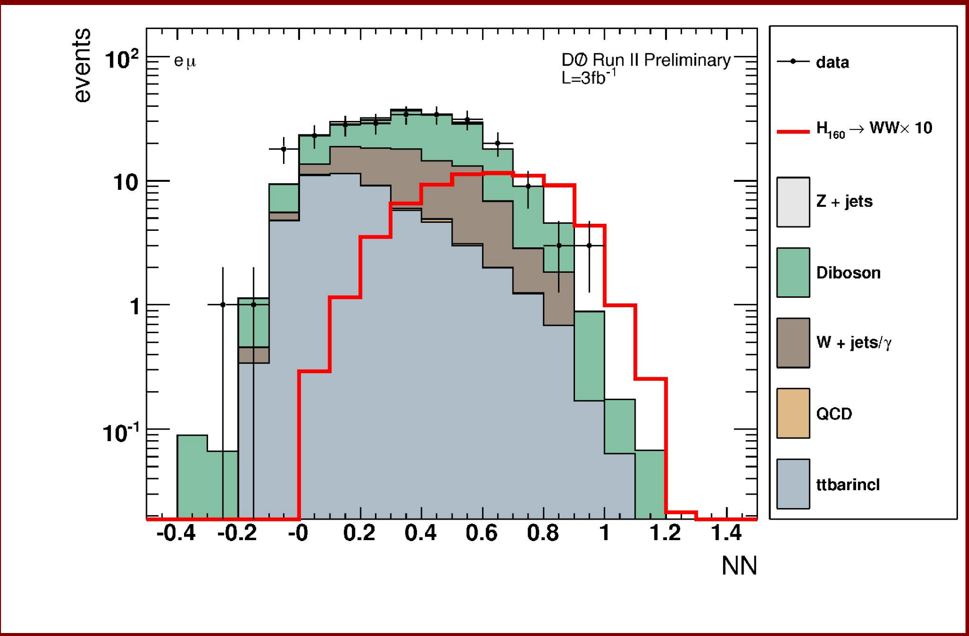
- Just a quick note, this analysis is difficult no matter WHERE you do it.
  - dijet
  - γ+jet
  - continuum γ+γ
- Inclusion does help with low mass Higgs limits, but expected signal small.





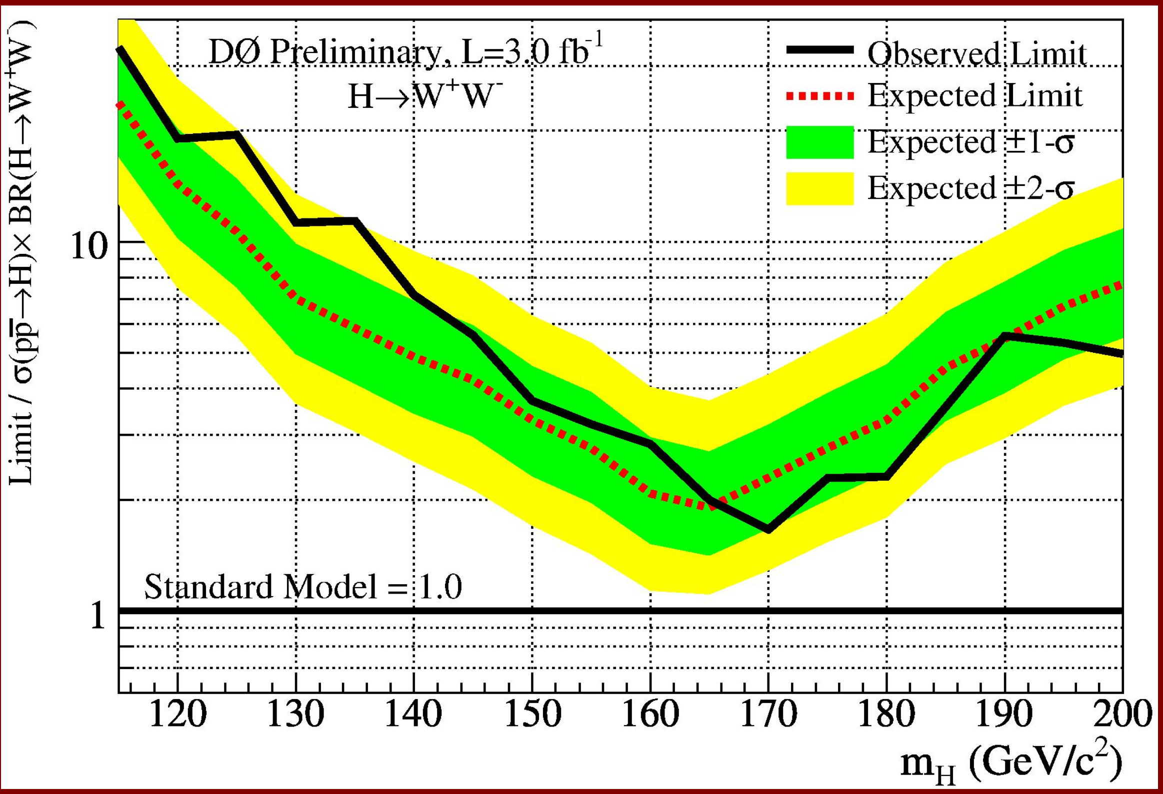
H->WW





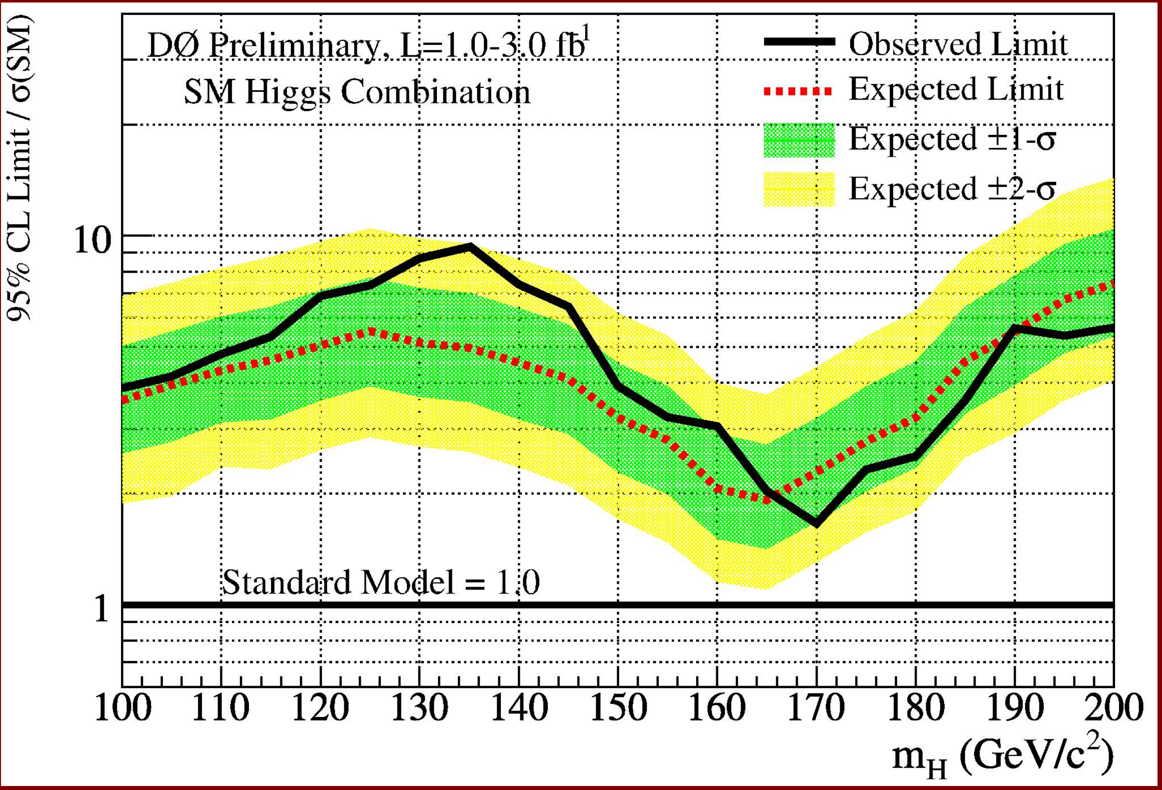
- The money channel, best chance for excluding (discovering) SM Higgs.
- Large (but not irreducible) background from SM WW production (at high mass, W+j at low mass).
- Dominates sensitivity ~160 GeV.

H->WW Limits:



- Limits from just the fully analyzed 3 fb^{-1} of luminosity from DØ.
- Good agreement with expected limits.

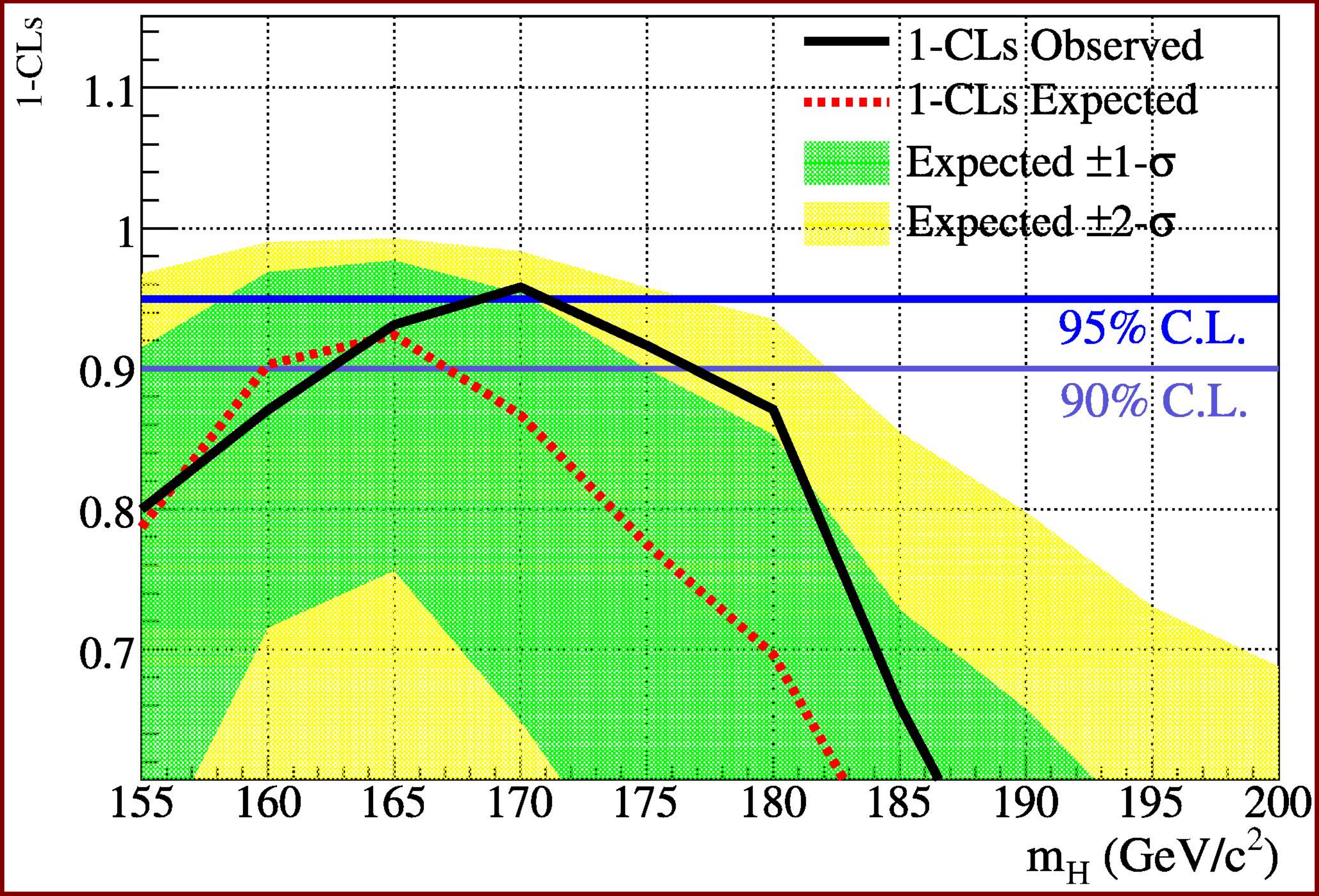
Combined D0 SM Higgs Limits:



- DØ experiment combined Higgs mass limits, making use of all the individual channels, using different amounts of luminosity.

Tevatron Higgs Limits:

- My CDF colleague in all likelihood showed this, but it bears a re-viewing.



Conclusions:

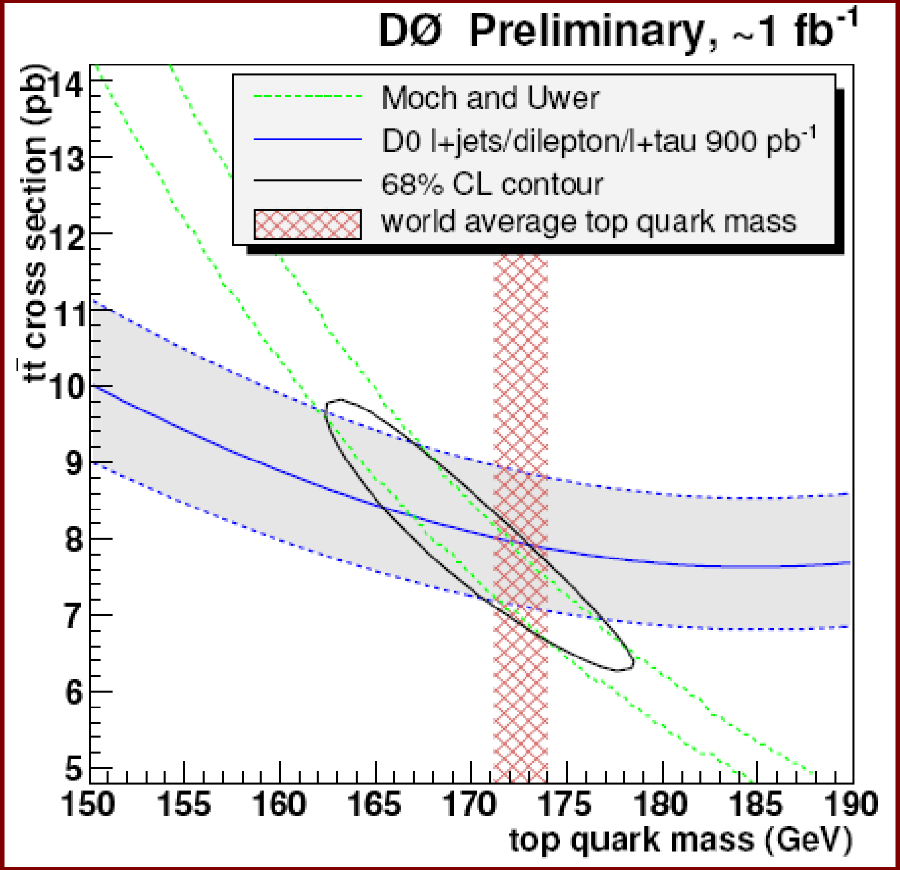
- I have merely scratched the surface here of all the most RECENT analyses.
- Please, have a look at the full list if your interest is piqued.
- On the road to Higgs!

Backups:

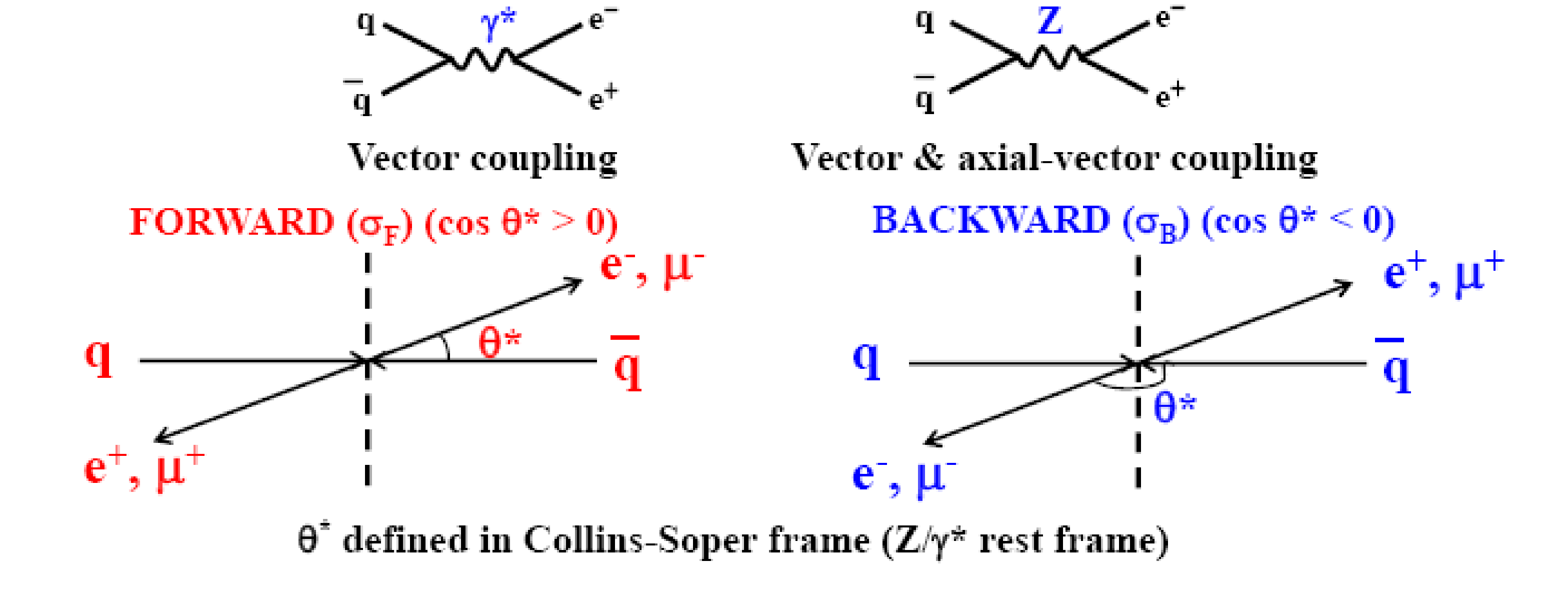
for your entertainment

Top Mass and Cross section:

- Measurement of cross section and mass together, less dependent on assumptions, and in good agreement with theory.

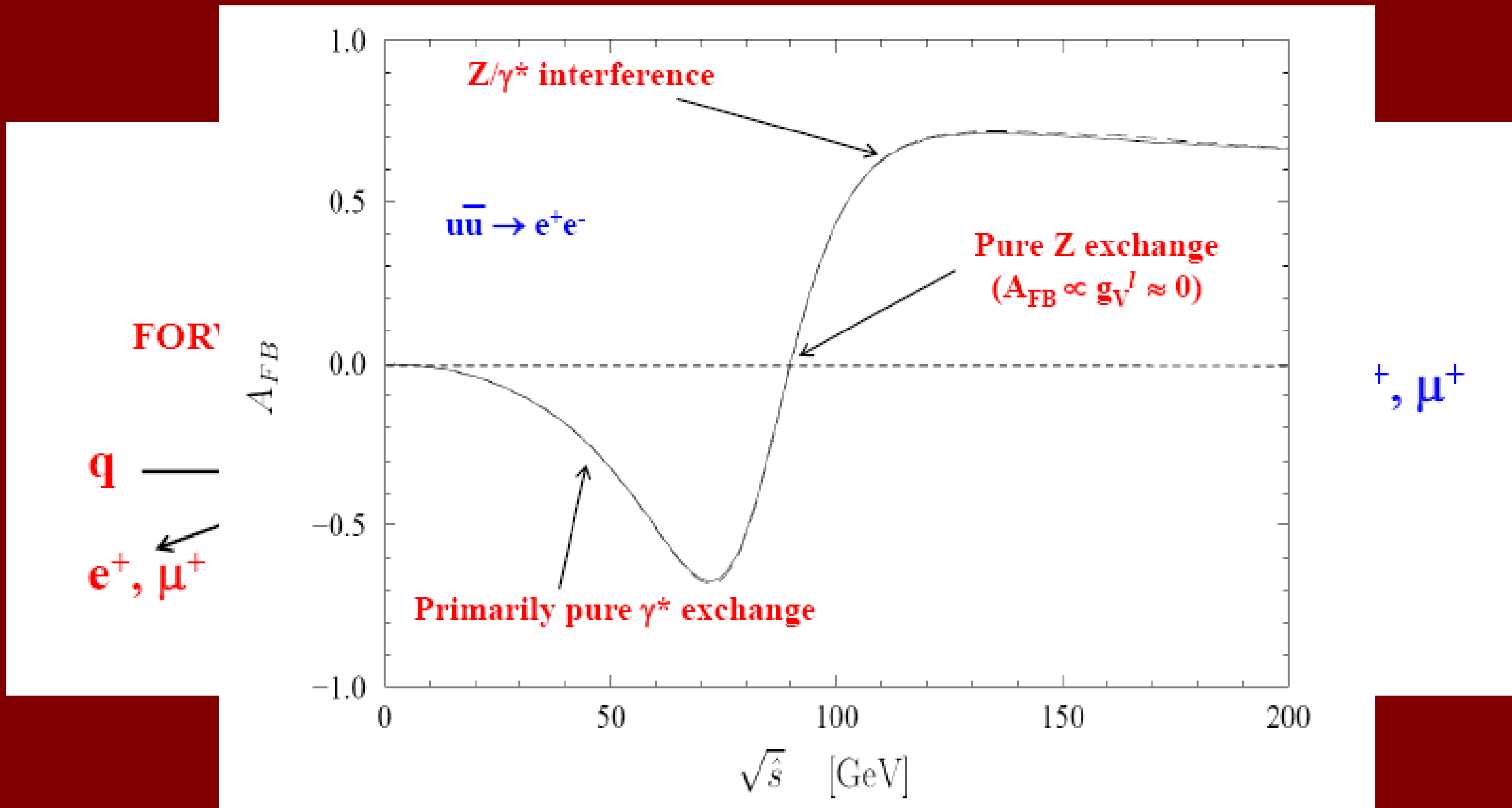


A_{FB}



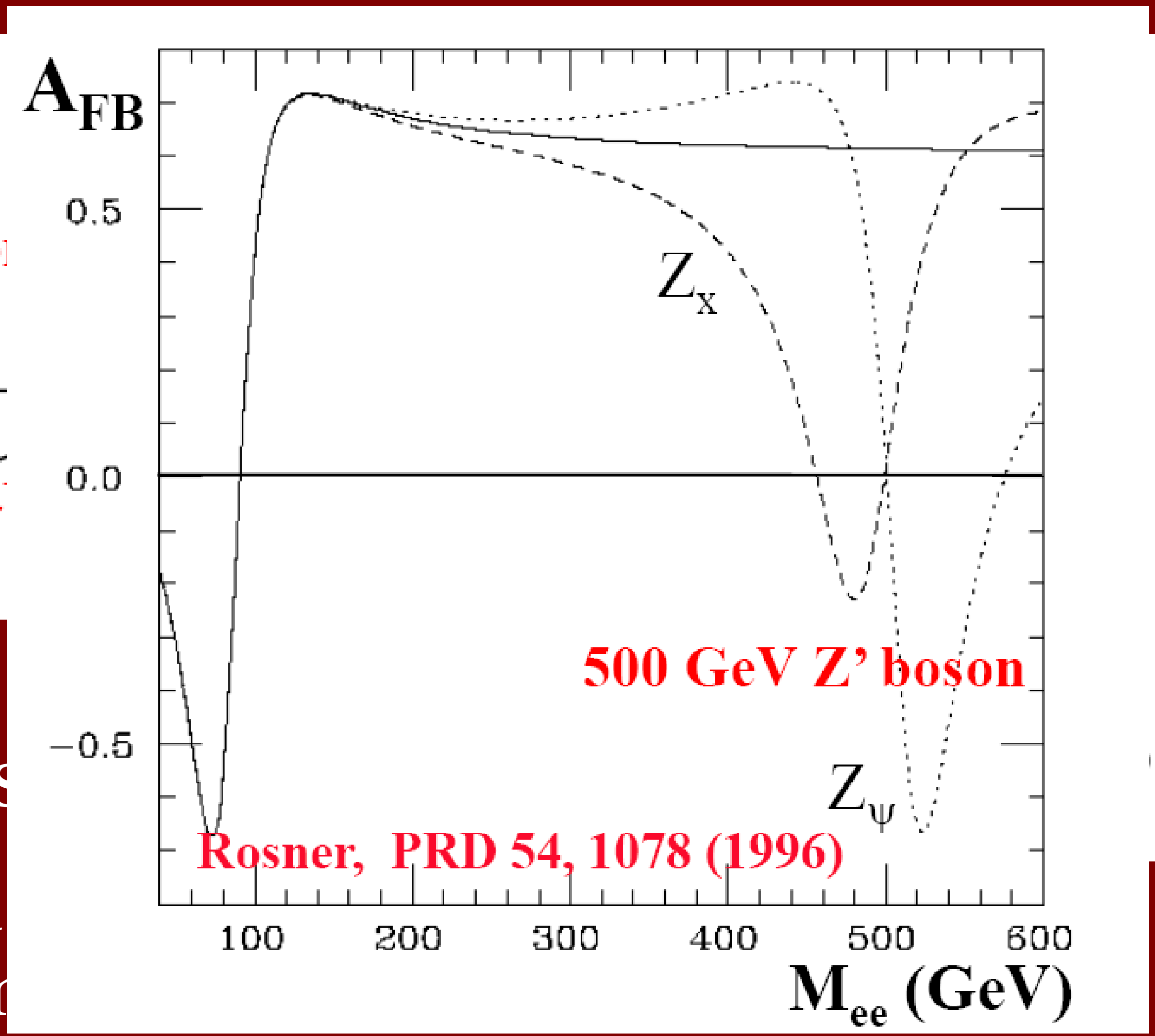
- Shows interference effects:

A_{FB}



- Shows interference effects:
  - As a function of invariant mass, shows transition from pure γ* to Z/γ* interference.

A_{FB}



FO

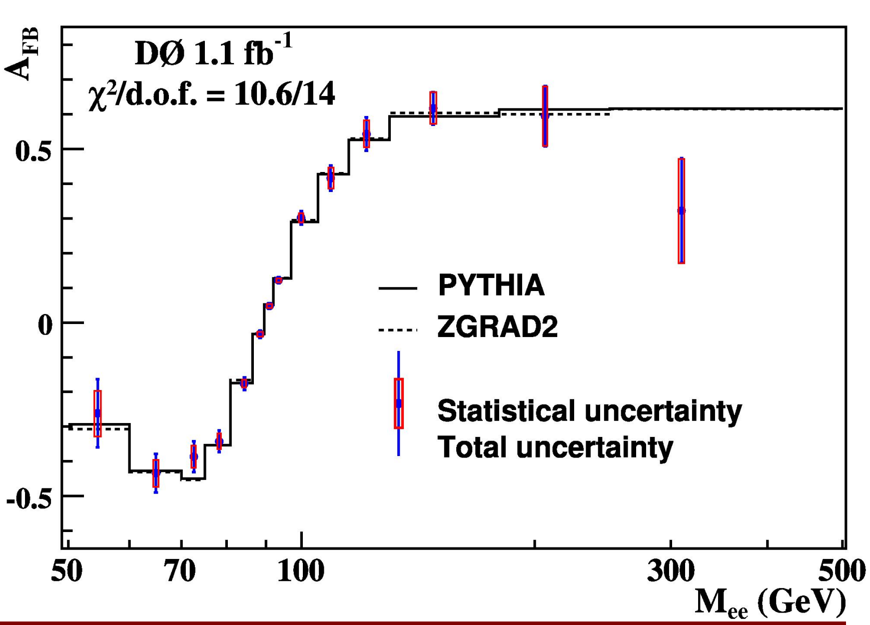
q —

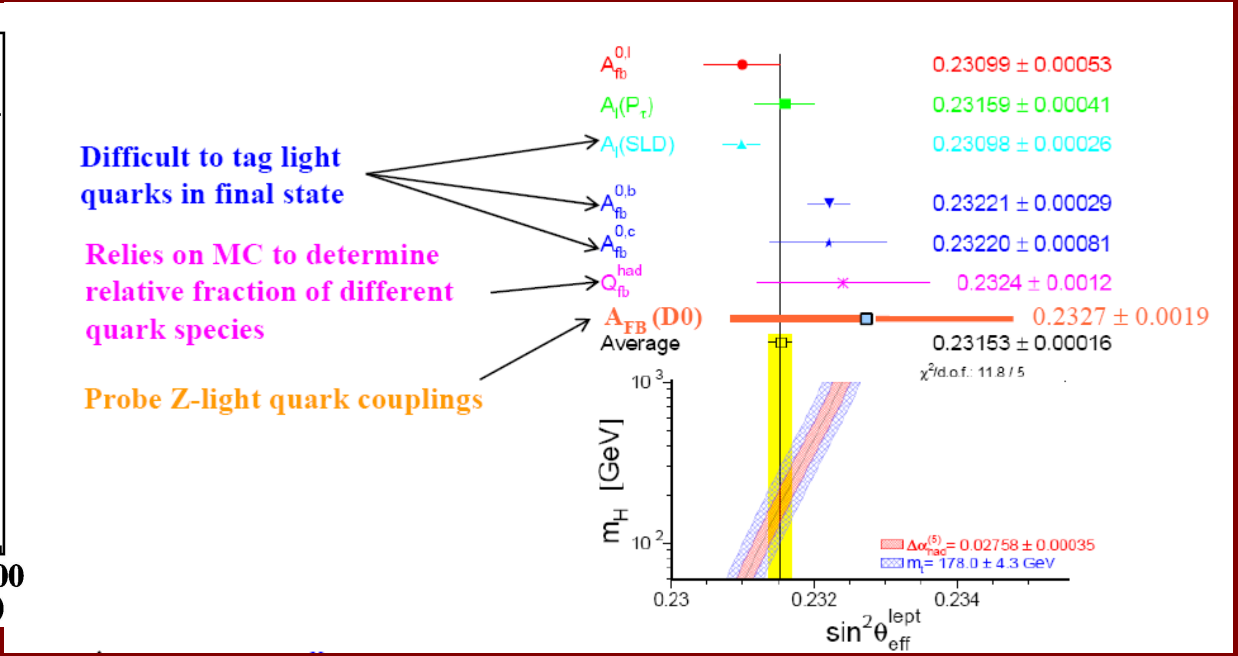
e⁺, μ

⁺, μ⁺

- Shows
  - As a ... transition from
  - If interference from additional Z', would also manifest.

A_{FB}





- AFB measured to be consistent with the Standard Model.
- $\sin\theta_W$ extracted (effectively value at Z-pole).