

Recent Results of the D0 Experiment

Winter 2009

A. Lobodenko

May 26, 2009



Publications

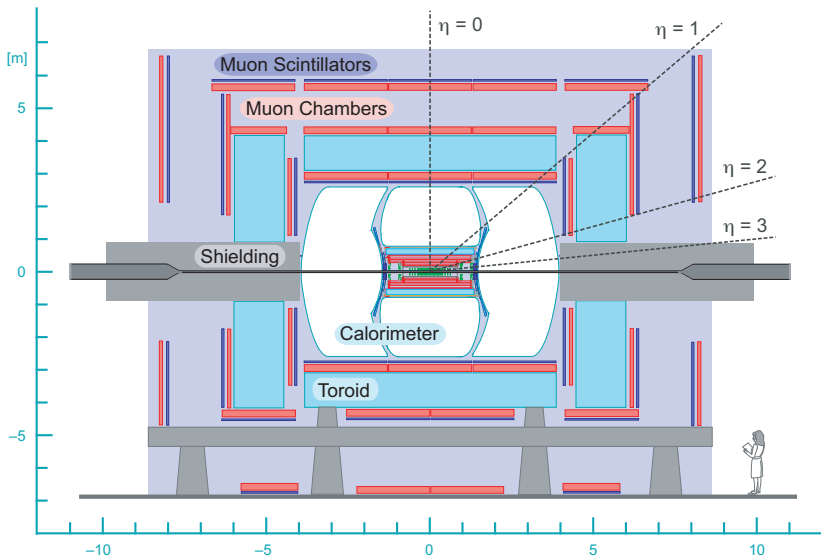
- Bottom 3+2
- Electroweak 3+3
- New Phenomena 3+2
- Higgs 5+10
- QCD 3+1
- Top 5+7

Since fall 2008

Published/Accepted/Submitted 22 Conference Notes 25



Detector



Search for Excess Dimuon Production

Sampling

Muon sample: 2008, $\mathcal{L} = 0.9 \text{ fb}^{-1}$

$p_T > 3 \text{ GeV}/c$; $|\eta| < 1.0$

muons matched to central tracks

$|z_{\mu_1} - z_{\mu_2}|_{pca} < 1.5 \text{ cm}$

$5 < M_{\mu\mu} < 80 \text{ GeV}/c^2$

cosmic muons suppressed ($\Delta\phi$ & tof)

$|z| < 38 \text{ cm}$

Loose sample: $N_{hits}^{SMT} \geq 3$

Tight sample:

2 L0 hits for both muons



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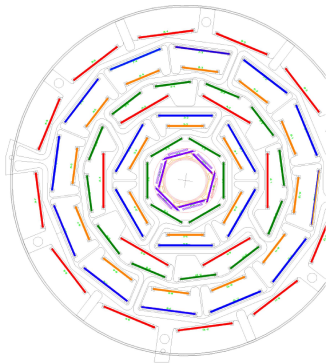
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Muon excess

$$N_{excess} = N_{loose} - N_{tight} / \epsilon_{T/L}; \quad \epsilon_{T/L} \equiv \epsilon_{T/L}(p_T, \phi, Z, \eta)$$

SMT barrel



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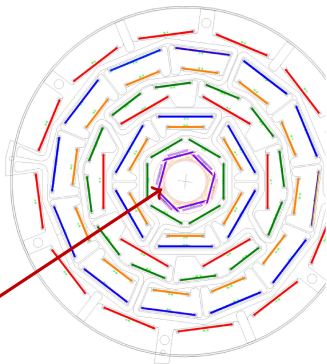
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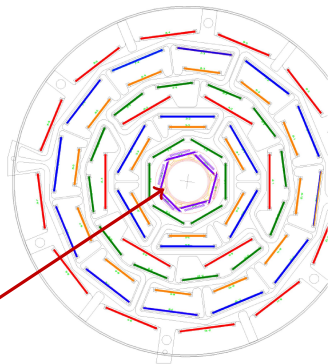
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Muon efficiencies from $J/\psi \rightarrow \mu^+ \mu^-$

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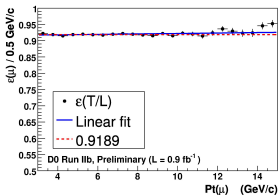
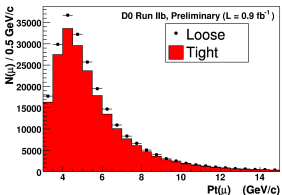
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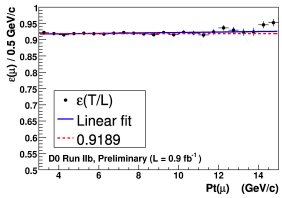
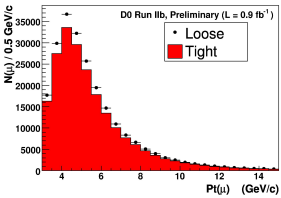
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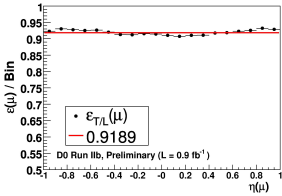
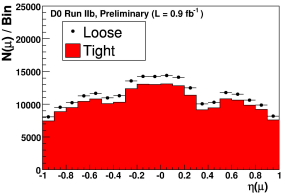
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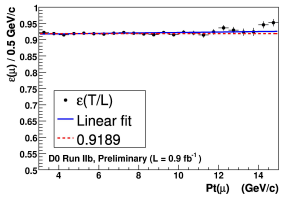
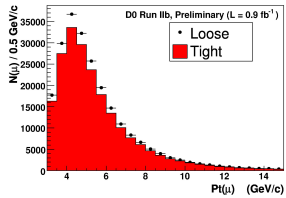
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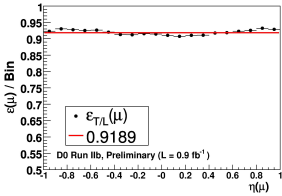
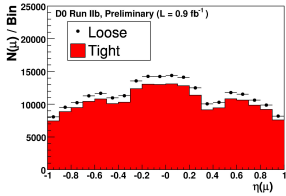
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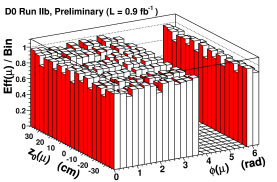
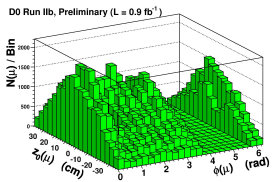
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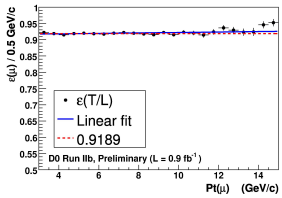
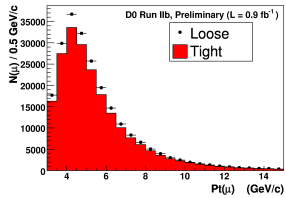
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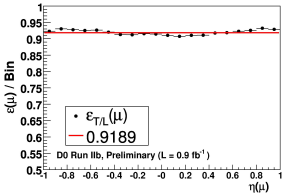
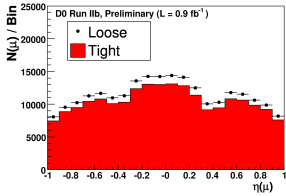
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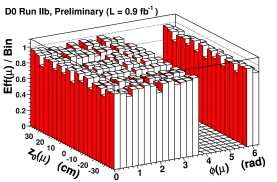
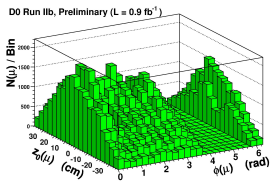
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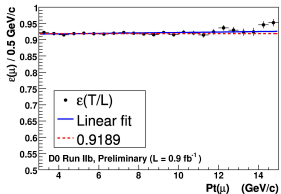
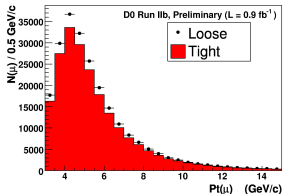
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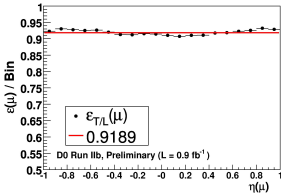
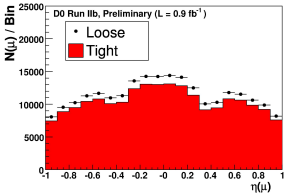
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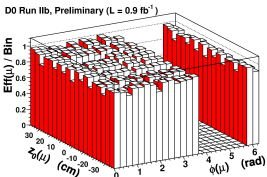
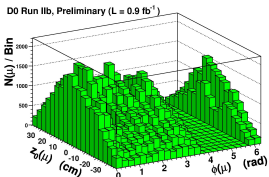
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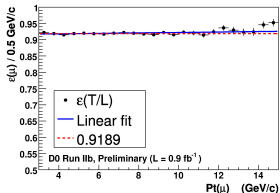
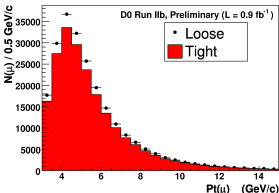
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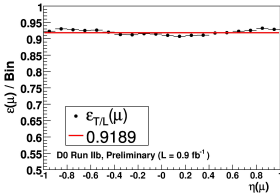
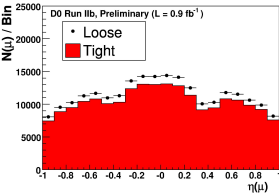
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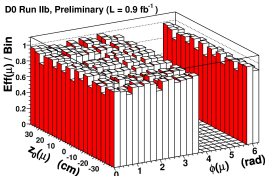
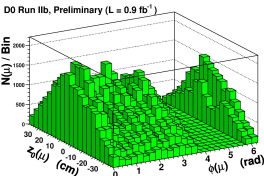
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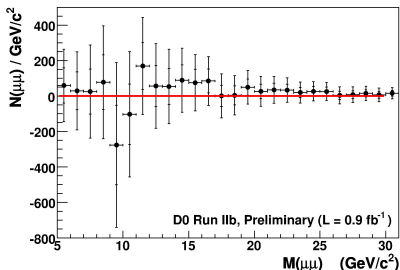
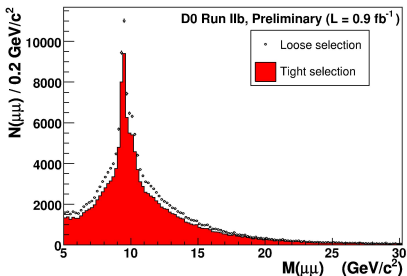


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$N^{\text{obs}}(\text{loose})$	$177\,535 \pm 421$	$134\,097 \pm 437$	$43\,438 \pm 208$
$N^{\text{exp}}(\text{loose})$	$176\,823 \pm 503$	$134\,095 \pm 382$	$42\,728 \pm 121$
$N(\text{excess})$	712 ± 462	2 ± 359	710 ± 138
	± 942	± 705	± 229

Source	$\delta[\%(\text{excess})]$
Rebin ϕ	$\pm 0.14\%$
Rebin z	$\pm 0.18\%$
Rebin η	$\pm 0.01\%$
$\mathcal{F}(p_T^\mu)$ Removed	$\pm 0.48\%$
Total	$\pm 0.53\%$



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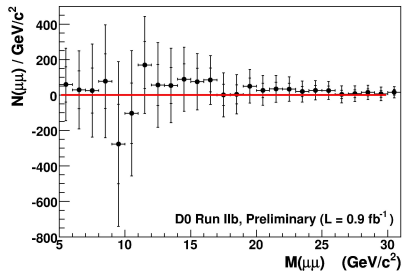
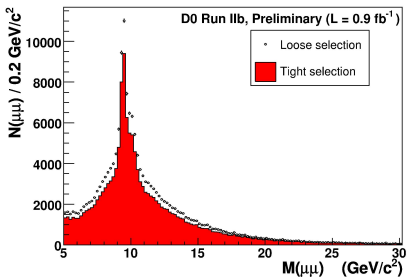


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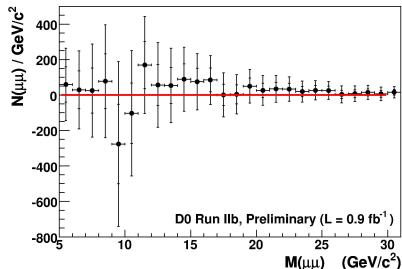
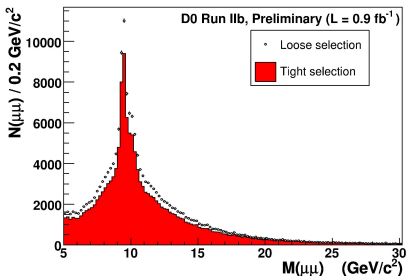


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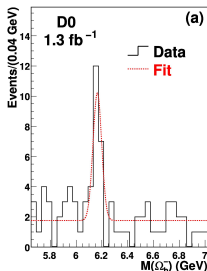
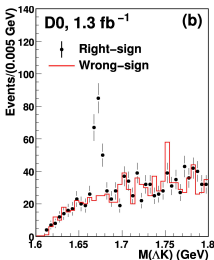
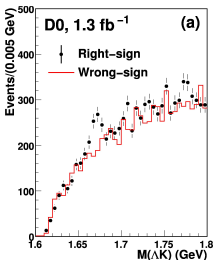
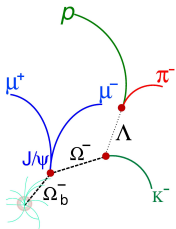


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Observation of Doubly Strange b baryon Ω_b^-

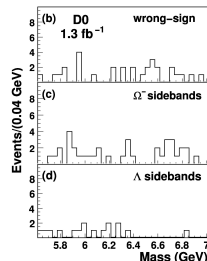


- Since Ξ_b^- observed in 2007, Ω_b^- (bss) is expected to have:
 $J^P = 1/2^+$, $M_{\Omega_b^-} = 5.94 - 6.12 \text{ GeV}$
 $0.55 < \tau(\Omega_b^-)/\tau(B^0) < 1.10$; $\tau(B^0) \approx 1.53 \text{ ps}$
- PYTHIA(Ω_b^-) + EVTGEN(Ω_b^- decays)
- Signal significance $> 5\sigma$

Ω_b^- mass measured

$M_{\Omega_b^-} = 6.165 \pm 0.010 \pm 0.013$

$f(b \rightarrow \Omega_b^-)/f(b \rightarrow \Xi_b^-) \approx 0.07 - 0.14$



Measurement of the W Mass with 1 fb^{-1} Data

Approach

- $W \rightarrow e\nu$; CC: $|\eta_{det}| < 1.05$; $2\% < \frac{\sigma_{EM}}{E} = \sqrt{C_{EM}^2 + \frac{S_{EM}^2}{E}}|_{50\text{GeV}} = 3.6\%$
- $m_T = \sqrt{2p_T^e p_T^\nu (1 - \cos(\phi_e - \phi_\nu))}$; $\vec{p}_T^\nu \equiv \vec{E}_T$; $\vec{p}_T^e = \vec{p}_T^e + \vec{p}_T^\nu = \vec{E}_T$
- Event selection:
 - $W \rightarrow e\nu$
 $p_T^e > 25 \text{ GeV}$; $E_T > 25 \text{ GeV}$; $u_T < 15 \text{ GeV}$; $50 < m_T < 200 \text{ GeV}$; $\sim 5 \cdot 10^5$
 - $Z \rightarrow ee$ $p_T^e > 25 \text{ GeV}$; $u_T < 15 \text{ GeV}$; $70 < m_T < 110 \text{ GeV}$; $\sim 2 \cdot 10^4$
- RESBOS $\implies d^3\sigma/dp_T dy dm (W, Z/\gamma^*)$
- PMCS (fast MC) used to generate templates. Initial parametrizations derived from d0gstar simulation of the detector response to single e , $Z \rightarrow ee$, $W \rightarrow e\nu$.
 Fine tuned on control data sample to fit:
 - trigger efficiency (p_T^e, η_e, z_ν)
 - reconstruction efficiency (p_T^e, η_e, z_ν)
 - energy response and resolution both for electrons and recoil
 $E = R_{EM}(E_0) \otimes \sigma_{EM}(E_0) + \Delta E(\mathcal{L}, u_i)$; $R_{EM}(E_0) = \alpha \times E_0 + \beta$



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- $m_T = \sqrt{2p_T^e p_T^\nu (1 - \cos(\phi_e - \phi_\nu))}$; $\vec{p}_T^e \equiv \vec{E}_T$; $\vec{p}_T^\nu \equiv \vec{E}_T - \vec{E}_T^e$
- Event selection:
 - $W \rightarrow e\nu$
 $p_T^e > 25 \text{ GeV}$; $E_T > 25 \text{ GeV}$; $u_T < 15 \text{ GeV}$; $50 < m_T < 200 \text{ GeV}$; $\sim 5 \cdot 10^5$
 - $Z \rightarrow ee$ $p_T^e > 25 \text{ GeV}$; $u_T < 15 \text{ GeV}$; $70 < m_T < 110 \text{ GeV}$; $\sim 2 \cdot 10^4$
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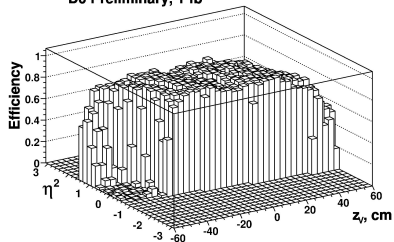
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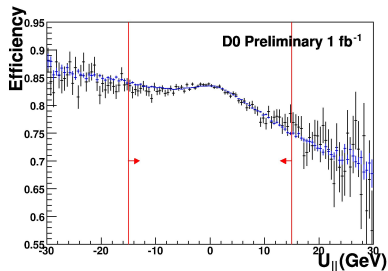
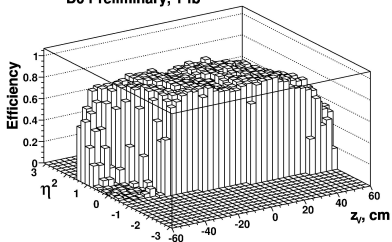
D0 Preliminary, 1 fb^{-1}



Measurement of the W Mass with 1 fb^{-1} Data

Approach

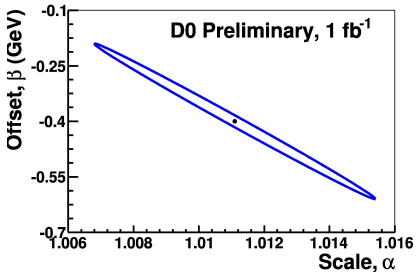
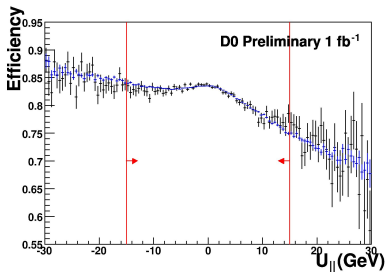
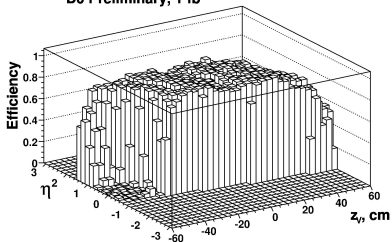
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Measurement of the W Mass with 1 fb^{-1} Data

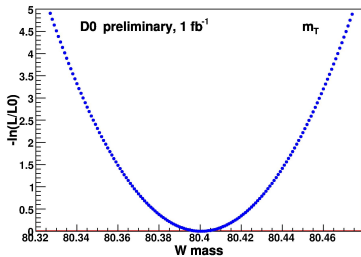
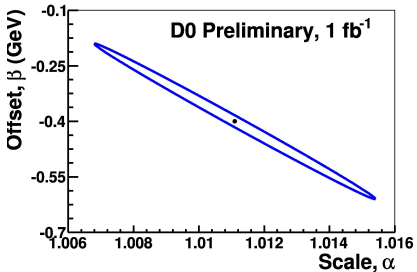
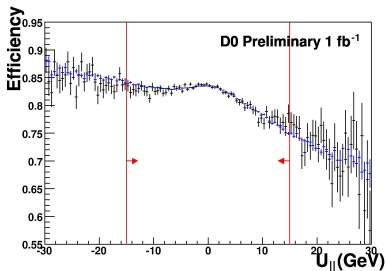
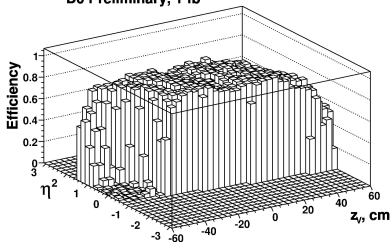
Approach

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Measurement of the W Mass with 1 fb^{-1} Data

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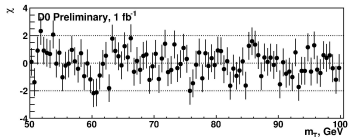
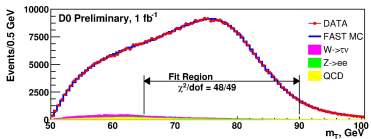
Systematics

Source	$\sigma(m_W)$ MeV m_T	$\sigma(m_W)$ MeV p_T^e	$\sigma(m_W)$ MeV $\#_T$
Experimental			
Electron Energy Scale	34	34	34
Electron Energy Resolution Model	2	2	3
Electron Energy Nonlinearity	4	6	7
W and Z Electron energy loss differences	4	4	4
Recoil Model	6	12	20
Electron Efficiencies	5	6	5
Backgrounds	2	5	4
Experimental Total	35	37	41
W production and decay model			
PDF	9	11	14
QED	7	7	9
Boson p_T	2	5	2
W model Total	12	14	17
Total	37	40	44



Measurement of the W Mass with 1 fb^{-1} Data

Fits



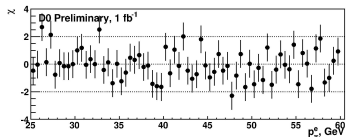
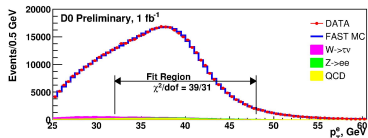
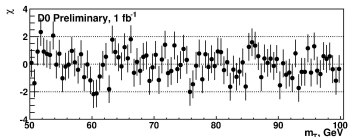
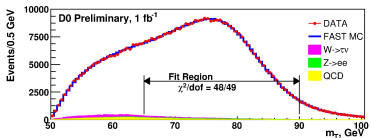
m_W evaluated, GeV

$m_T : 80.401 \pm 0.023 \pm 0.037 \text{ (sys)} \text{ (0.044)}$



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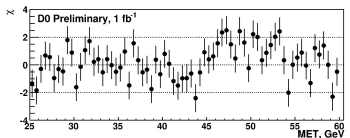
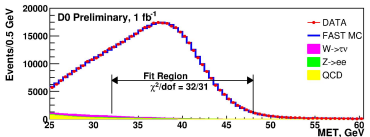
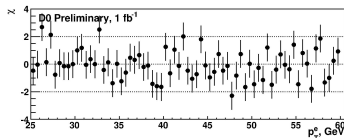
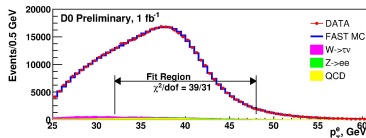
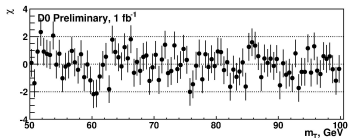
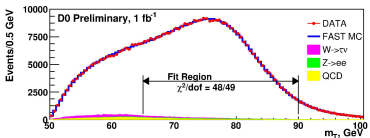
m_W evaluated, GeV

$$m_T : 80.401 \pm 0.023 \pm 0.037 \text{ (sys)} \text{ (0.044)}$$

$$p_T^e : 80.400 \pm 0.027 \pm 0.040 \text{ (sys)} \text{ (0.048)}$$

Measurement of the W Mass with 1 fb^{-1} Data

Fits



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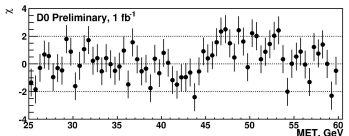
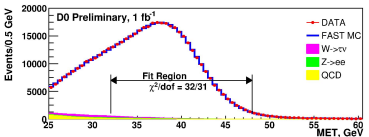
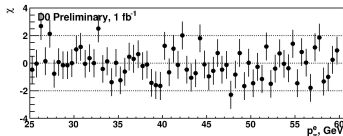
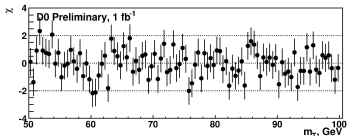
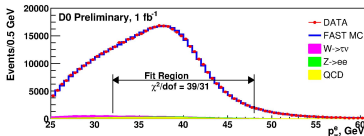
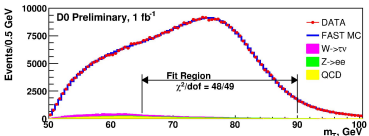
$$E_T : 80.402 \pm 0.023 \pm 0.044 \text{ (sys)} \quad (0.050)$$

Results are not independent!



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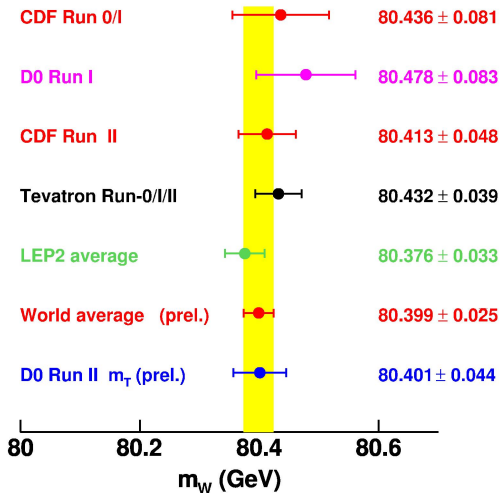
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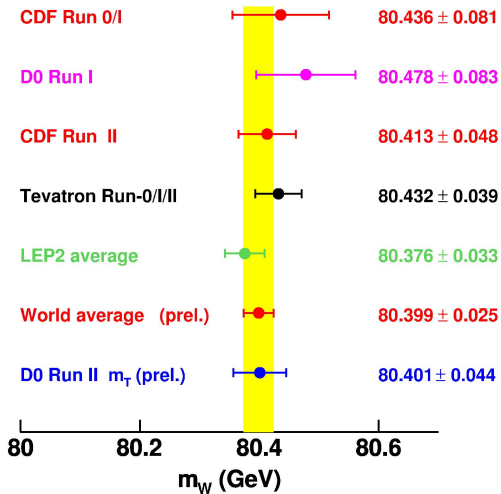
Comparison with the other results



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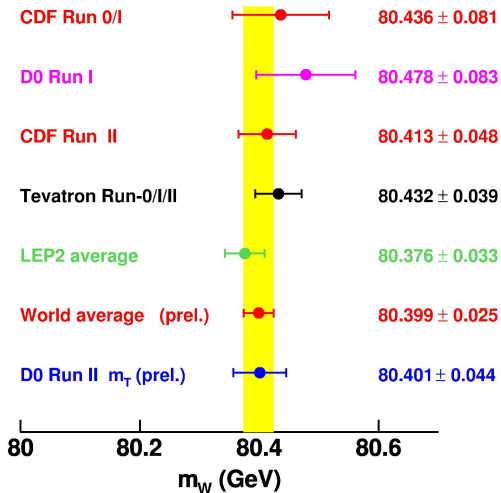
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Constraints on m_H



Measurement of the W Mass with 1 fb^{-1} Data

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Constraints on m_H

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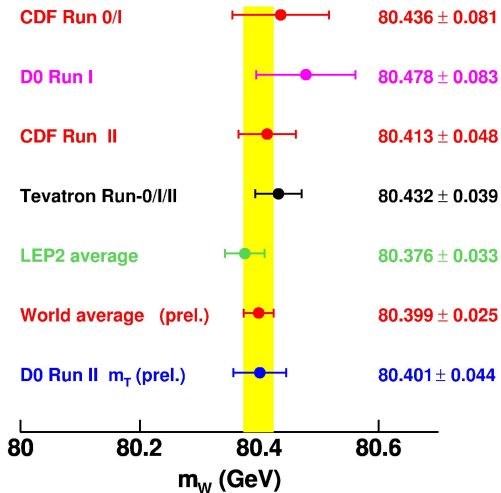
$$m_H = 85_{-28}^{+39} \text{ GeV}$$

$$m_H < 166 \text{ GeV at 95\% CL}$$



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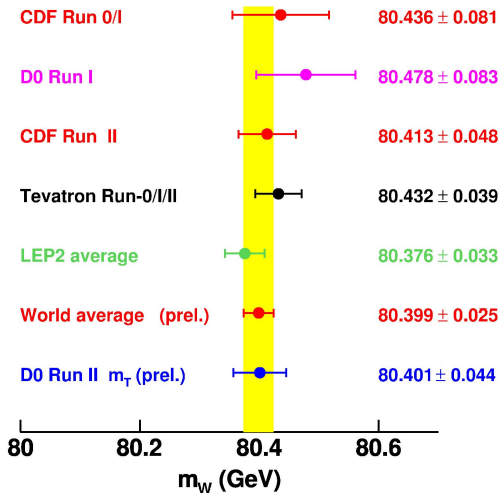
$$m_H = 76_{-24}^{+33} \text{ GeV}$$

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Measurement of the W Mass with 1 fb^{-1} Data

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D0(2009)

?

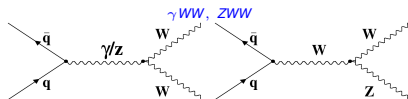


SM Testing

- $Z \rightarrow \tau^+ \tau^- \rightarrow \mu \nu_\mu \nu_\tau + \text{jet}(e \nu_e \nu_\tau)$
 $\sigma \cdot \text{Br}(Z \rightarrow \tau^+ \tau^-) =$
 $240 \pm 8 \pm 12 \pm 15 \text{ pb}$
 $SM: 251.9_{-11.8}^{+5.0} \div 241.6_{-3.2}^{+3.6} \text{ pb}$
- Diboson production & anomalous trilinear gauge couplings
 $p\bar{p} \rightarrow W^+ W^- \rightarrow \ell^+ \nu \ell^- \bar{\nu}$
 $\sigma = 11.5 \pm 2.1 \pm 0.7 \text{ pb}$
 $-0.54 < \Delta k_\gamma < 0.83$
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 $-0.14 < \Delta g_1^Z < 0.30$
 $p\bar{p} \rightarrow WV \rightarrow \ell \nu q \bar{q}$
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 $SM: 39 \pm 4 \text{ pb}$
 $|h_{30}^{\gamma,Z}| < 0.033; |h_{40}^{\gamma,Z}| < 0.0017$

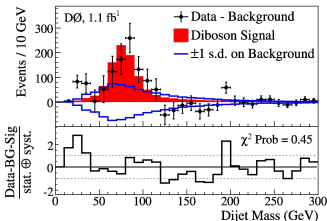
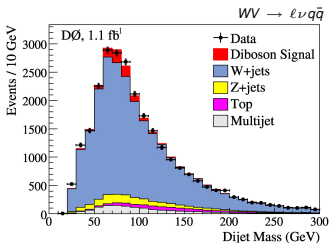
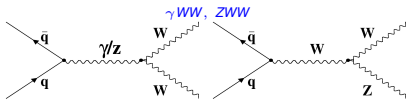
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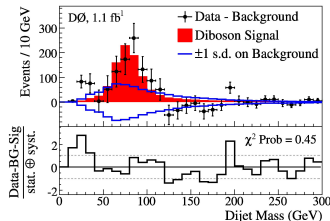
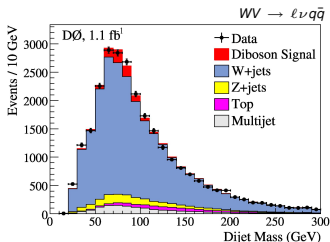
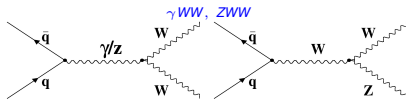
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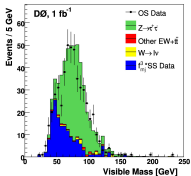
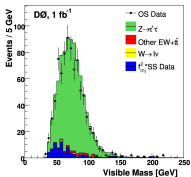
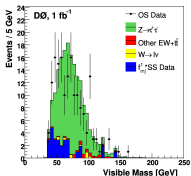
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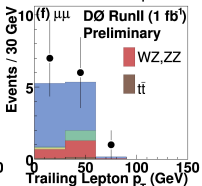
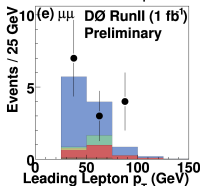
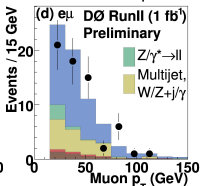
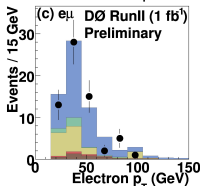
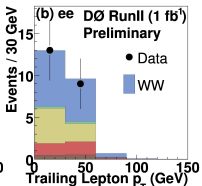
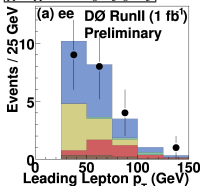


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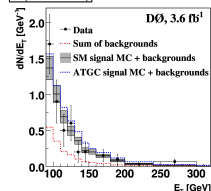
$$Z \rightarrow \tau^+ \tau^-$$



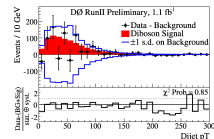
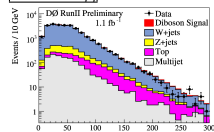
$$W^+ W^- \rightarrow \ell^+ \nu \ell^- \bar{\nu}$$



$$Z\gamma \rightarrow \nu \bar{\nu} \gamma$$



$$WV \rightarrow \ell \nu q \bar{q}$$



Search for Supersymmetric Particles

- Pair produced stable tau sleptons, gaugino-like charginos, higgsino-like charginos

TOF to measure $(1 - \bar{\nu})/\sigma_{\bar{\nu}}$ & M_{inv}^{pair} measurement

- Set most restrictive limits on the cross sections for CMSP
- Stau: $\sigma_{stau}^{max} = 0.31 - 0.04 pb$ for mass range 60-300 GeV
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- Pair produced lightest supersymmetric scalar \tilde{t}_1 quark

$$\tilde{t}_1 \bar{\tilde{t}}_1 \rightarrow b\bar{b}l\ell' \tilde{\nu} \tilde{\nu}; \ell\ell' = e^\pm \mu^\mp, e^+ e^-$$

- Associated production of charginos and neutralinos

$$p\bar{p} \rightarrow \tilde{\chi}_1^\pm \tilde{\chi}_2^0 \rightarrow 3l\tilde{\chi}_1^0 \implies 3l + \cancel{E}_T$$

- R-parity violating sneutrinos in $e\mu$ final state ($R = (-1)^{2j+3B+L}$)

Set limits on $\sigma \cdot Br(\tilde{\nu}_\tau \rightarrow e\mu)$



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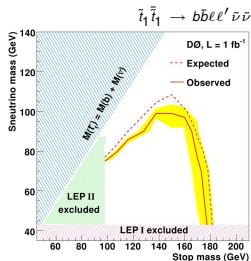
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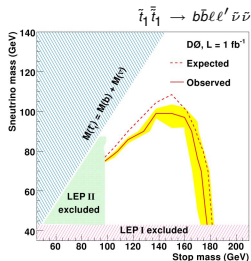
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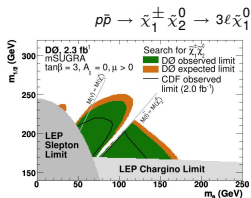
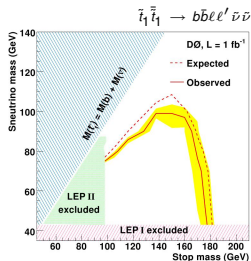
$$\tilde{t}_1 \bar{\tilde{t}}_1 \rightarrow b\bar{b}l\ell' \tilde{\nu} \tilde{\nu}; \ell\ell' = e^\pm \mu^\mp, e^+ e^-$$

- Associated production of charginos and neutralinos

$$p\bar{p} \rightarrow \tilde{\chi}_1^\pm \tilde{\chi}_2^0 \rightarrow 3\ell \tilde{\chi}_1^0 \Rightarrow 3\ell + \cancel{E}_T$$

- R-parity violating sneutrinos in $e\mu$ final state ($R = (-1)^{2j+3B+L}$)

Set limits on $\sigma \cdot Br(\tilde{\nu}_\tau \rightarrow e\mu)$



No SP Found



Search for Supersymmetric Particles

- Pair produced stable tau sleptons, gaugino-like charginos, higgsino-like charginos

TOF to measure $(1 - \bar{\nu})/\sigma_{\bar{\nu}}$ & M_{inv}^{pair} measurement

- Set most restrictive limits on the cross sections for CMSP
- Stau: $\sigma_{stau}^{max} = 0.31 - 0.04 pb$ for mass range 60-300 GeV
- $M > 206 GeV$ for gaugino-like and $M > 171 GeV$ higgsino-like charginos

- Pair produced lightest supersymmetric scalar \tilde{t}_1 quark

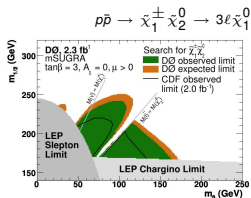
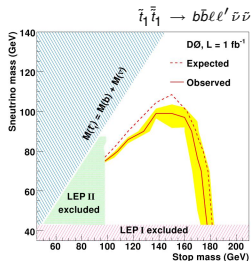
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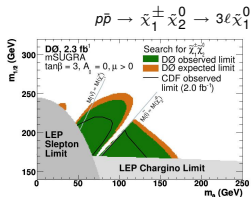
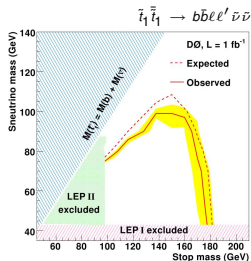
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Search for SM Higgs Boson

SM Higgs boson (N)NLO production cross sections and decay branching fractions

$gg \rightarrow H$; $q\bar{q} \rightarrow W/ZH$; $q\bar{q} \rightarrow VVq'\bar{q}' \rightarrow q'\bar{q}'H$ $H \rightarrow b\bar{b}$; $H \rightarrow W^+W^-$; $H \rightarrow \tau^+\tau^-$; $H \rightarrow \gamma\gamma$

m_H (GeV/ c^2)	$\sigma_{gg \rightarrow H}$ (fb)	σ_{WH} (fb)	σ_{ZH} (fb)	σ_{VBF} (fb)	$B(H \rightarrow b\bar{b})$ (%)	$B(H \rightarrow \tau^+\tau^-)$ (%)	$B(H \rightarrow W^+W^-)$ (%)
100	1861	286.1	166.7	99.5	81.21	7.924	1.009
105	1618	244.6	144.0	93.3	79.57	7.838	2.216
110	1413	209.2	124.3	87.1	77.02	7.656	4.411
115	1240	178.8	107.4	79.07	73.22	7.340	7.974
120	1093	152.9	92.7	71.65	67.89	6.861	13.20
125	967	132.4	81.1	67.37	60.97	6.210	20.18
130	858	114.7	70.9	62.5	52.71	5.408	28.69
135	764	99.3	62.0	57.65	43.62	4.507	38.28
140	682	86.0	54.2	52.59	34.36	3.574	48.33
145	611	75.3	48.0	49.15	25.56	2.676	58.33
150	548	66.0	42.5	45.67	17.57	1.851	68.17
155	492	57.8	37.6	42.19	10.49	1.112	78.23
160	439	50.7	33.3	38.59	4.00	0.426	90.11
165	389	44.4	29.5	36.09	1.265	0.136	96.10
170	349	38.9	26.1	33.58	0.846	0.091	96.53
175	314	34.6	23.3	31.11	0.663	0.072	95.94
180	283	30.7	20.8	28.57	0.541	0.059	93.45
185	255	27.3	18.6	26.81	0.420	0.046	83.79
190	231	24.3	16.6	24.88	0.342	0.038	77.61
195	210	21.7	15.0	23	0.295	0.033	74.95
200	192	19.3	13.5	21.19	0.260	0.029	73.47



Search for SM Higgs Boson

Lists of channels analyzed

DO

Channel	Luminosity (fb ⁻¹)	m_H range (GeV/c ²)	Reference
$WH \rightarrow \ell\nu b\bar{b}$ 2×(ST,DT)	2.7	100-150	[13]
$WH \rightarrow \tau\nu b\bar{b}$ 2×(ST,DT)	0.9	105-145	[14]
$VH \rightarrow \tau\tau b\bar{b}/q\bar{q}\tau\tau$	1.0	105-145	[14]
$ZH \rightarrow \nu\bar{\nu} b\bar{b}$ (DT)	2.1	105-145	[15]
$ZH \rightarrow \ell^+\ell^- b\bar{b}$ 2×(ST,DT)	2.3	105-145	[16]
$WH \rightarrow WW^+W^- \rightarrow \ell^\pm\nu\ell^\pm\nu$	1.1	120-200	[17]
$H \rightarrow W^+W^- \rightarrow \ell^\pm\nu\ell^\mp\nu$	3.0-4.2	115-200	[18]
$H \rightarrow \gamma\gamma$	4.2	100-150	[19]
$t\bar{t}H \rightarrow t\bar{t}b\bar{b}$ 2×(ST,DT,TT)	2.1	105-145	[20]

CDF

Channel	Luminosity (fb ⁻¹)	m_H range (GeV/c ²)	Reference
$WH \rightarrow \ell\nu b\bar{b}$ 2×(TDT,LDT,ST)	2.7	100-150	[7]
$ZH \rightarrow \nu\bar{\nu} b\bar{b}$ (TDT,LDT,ST)	2.1	105-150	[8]
$ZH \rightarrow \ell^+\ell^- b\bar{b}$ 2×(TDT,LDT,ST)	2.7	100-150	[9]
$H \rightarrow W^+W^-$ (low,high s/b)×(0,1 jets)+(2+ jets)	3.6	110-200	[10]
$WH \rightarrow WW^+W^- \rightarrow \ell^\pm\nu\ell^\pm\nu$	3.6	110-200	[10]
$H + X \rightarrow \tau^+\tau^- + 2$ jets	2.0	110-150	[11]
$WH + ZH \rightarrow jjb\bar{b}$	2.0	100-150	[12]

($\ell = e, \mu$)



Search for SM Higgs Boson

D0 list of channels analyzed

Channel	Data Epoch	Luminosity (fb^{-1})	Final Variable	# Sub-Channels	Reference
$WH \rightarrow \ell\nu b\bar{b}$, ST/DT, $W+2$ jet	Run IIa+Run IIb	2.7	NN discriminant	8	[4]
$WH \rightarrow \ell\nu b\bar{b}$, ST/DT, $W+3$ jet	Run IIa+Run IIb	2.7	Dijet Mass	8	[4]
$WH \rightarrow \tau\nu b\bar{b}$	Run IIa	0.9	Dijet Mass	5	[5]
$H+X \rightarrow \tau\tau b\bar{b}/q\bar{q}\tau\tau$	Run IIa	1.0	NN discriminant	1	[5]
$ZH \rightarrow \nu\bar{\nu} b\bar{b}$, DT	Run IIa+Run IIb	2.1	DTree discriminant	2	[6]
$ZH \rightarrow e^+e^- b\bar{b}$, ST/DT	Run IIa	1.1	NN discriminant	2	[7]
$ZH \rightarrow \mu^+\mu^- b\bar{b}$, ST/DT	Run IIa	1.1	DTree discriminant	2	[7]
$ZH \rightarrow e^+e^- b\bar{b}$, ST/DT	Run IIb	3.1	DTree discriminant	6	[8]
$ZH \rightarrow \mu^+\mu^- b\bar{b}$, ST/DT	Run IIb	3.1	DTree discriminant	2	[8]
$ZH \rightarrow \mu^\pm + \text{track } b\bar{b}$, ST/DT	Run IIa+Run IIb	4.2	DTree discriminant	2	[8]
$WH \rightarrow WW^+W^-$	Run IIa	1.1	2-D Likelihood	3	[9]
$WH \rightarrow WW^+W^-$	Run IIb	2.5	1-D Likelihood	3	[10]
$H \rightarrow W^+W^- (\mu^+\mu^-)$	Run IIa+Run IIb	3.0	NN discriminant	1	[11]
$H \rightarrow W^+W^- (e^\pm\mu^\mp)$	Run IIa+Run IIb	4.2	NN discriminant	1	[11]
$H \rightarrow W^+W^- (e^+e^-)$	Run IIa+Run IIb	4.2	NN discriminant	1	[11]
$H \rightarrow \gamma\gamma$	Run IIa+Run IIb	4.2	Di-photon Mass	1	[12]
$t\bar{t}H \rightarrow t\bar{t}b\bar{b}$	Run IIa+Run IIb	2.1	Scaled H_T	12	[13]

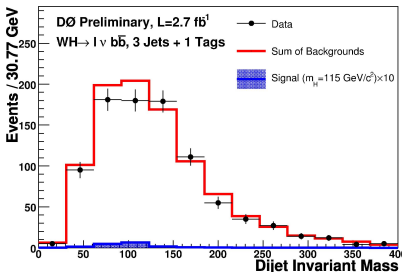
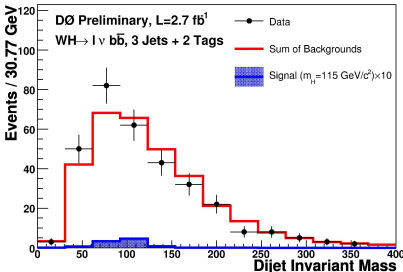
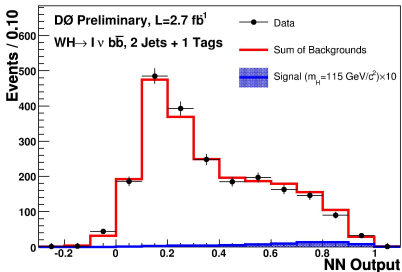
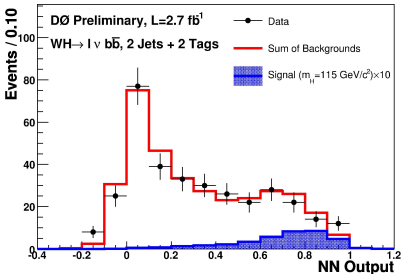
59 final states, 59 analyses combined

($\ell = e, \mu$)



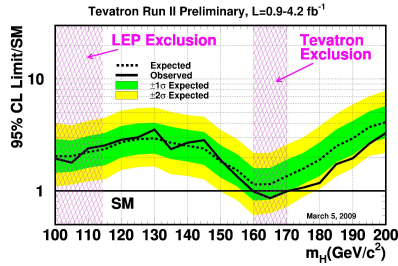
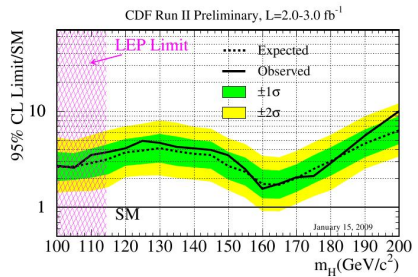
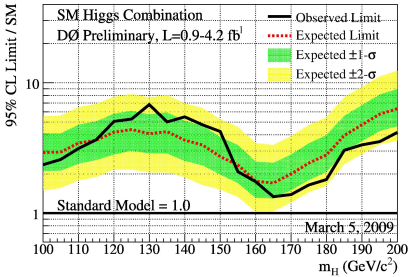
Search for SM Higgs Boson

Example: final variable distributions for $p\bar{p} \rightarrow WH \rightarrow \ell\nu b\bar{b}$ Higgs search analyses



Search for SM Higgs Boson

Results

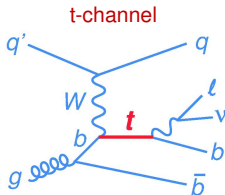
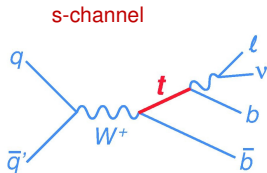


TEVNPH WG



Observation of single top quark production

Approach



Event selection

- ✓ 2-4 jets, $|\eta| < 3.4$,
 $p_T > 25$ (15) GeV
- ✓ 1-2 b-tagged jets,
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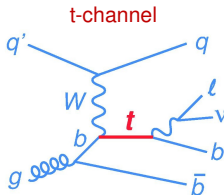
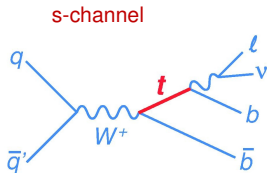
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- SINGLETOP(NLO): t
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- ALPGEN: $t\bar{t}$, $W, Z + jets$
- D0gstar: D0 setup
(reweighting applied)
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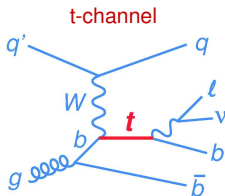
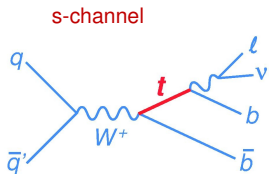
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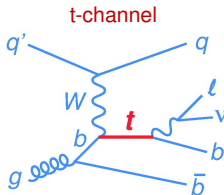
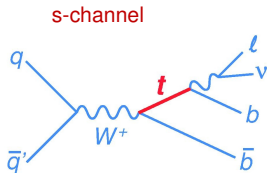
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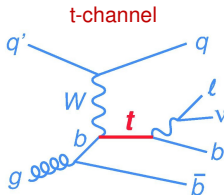
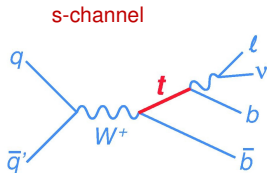
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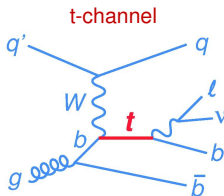
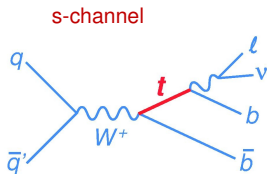
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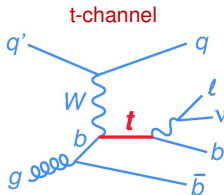
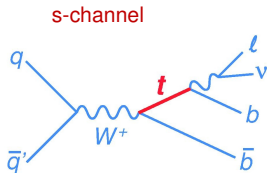
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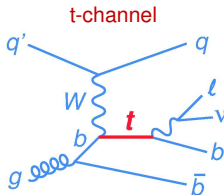
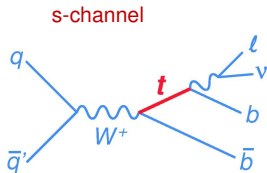
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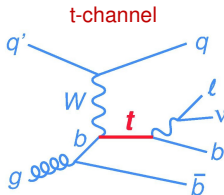
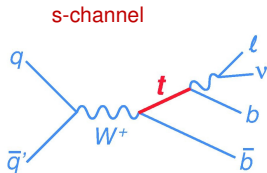
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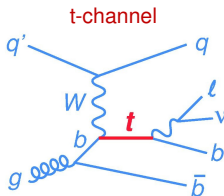
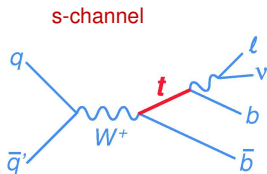
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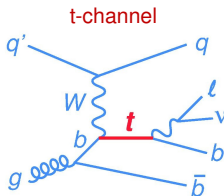
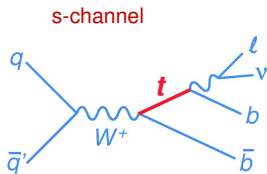
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 $|\eta| < 1.1$ (2)

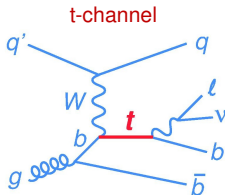
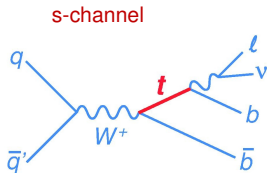
Modeling

- SINGLETOP(NLO): t
- PYTHIA: hadronization
- ALPGEN: $t\bar{t}$, $W, Z + jets$
- D0gstar: D0 setup
(reweighting applied)
- D0reco: sample
- Event selection applied



Observation of single top quark production

Approach



Event selection

- ✓ 2-4 jets, $|\eta| < 3.4$,
 $p_T > 25$ (15) GeV
- ✓ 1-2 b-tagged jets,
 $p_T > 20$ GeV
- ✓ 20 (25) $< E_T < 200$ GeV
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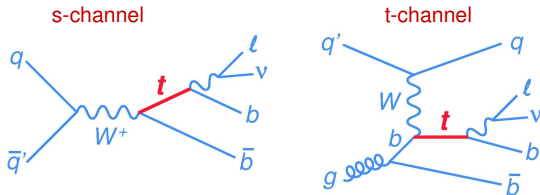
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Observation of single top quark production

Approach



$$\mathcal{L} = 2.3 \text{ fb}^{-1} \quad \sigma_{s+t} = 3.46 \pm 0.18 \text{ pb}, \quad m_t = 170 \text{ GeV}$$

Source	2 jets	3 jets	4 jets
$tb+ tqb$ signal	139 ± 18	63 ± 10	21 ± 5
W +jets	$1,829 \pm 161$	637 ± 61	180 ± 18
Z +jets and dibosons	229 ± 38	85 ± 17	26 ± 7
$t\bar{t}$	222 ± 35	436 ± 66	484 ± 71
Multijets	196 ± 50	73 ± 17	30 ± 6
Total prediction	$2,615 \pm 192$	$1,294 \pm 107$	742 ± 80
Data	2,579	1,216	724

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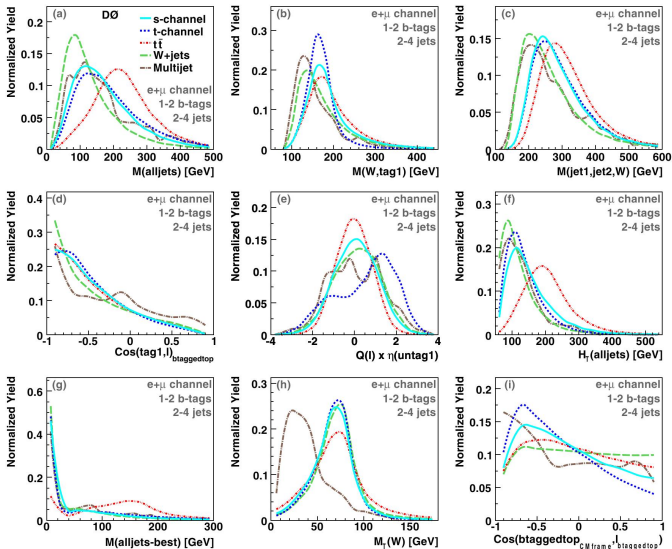


Observation of single top quark production

Shapes & contributions

V.M. ABAZOV *et al.*

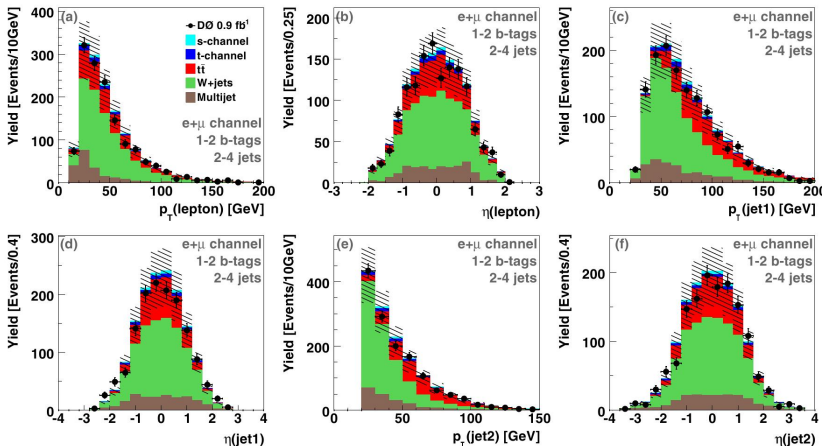
PHYSICAL REVIEW D **78**, 012005 (2008)



Observation of single top quark production

Shapes & contributions

Physical Review D **78**, 012005 (2008)



Observation of single top quark production

Results

Multivariate analyses resulted in:

- BDT: $\sigma_{s+t} = 3.74^{+0.95}_{-0.79} pb$
- BNN: $\sigma_{s+t} = 4.70^{+1.18}_{-0.93} pb$
- ME: $\sigma_{s+t} = 4.30^{+0.99}_{-1.20} pb$

Finally, single top production cross section:

$$\sigma_{s+t} = 3.94 \pm 0.88 pb \text{ with p-value of } 2.5 \cdot 10^{-7} \text{ 5SD}$$

$$\sigma_{exp} = 3.50^{+0.99}_{-0.77} pb, \sigma_{pred} = 3.46 \pm 0.18 pb$$

Since Wtb vertex function $\Gamma_{Wtb}^\mu = -\frac{g}{\sqrt{2}} V_{tb} f_1^L \bar{u}(p_b) \gamma^\mu P_L u(p_t) \implies |V_{tb} f_1^L|^2$

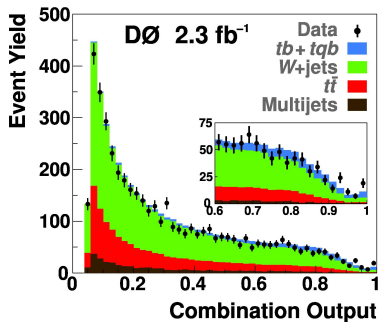
CKM matrix element measured

SM: $|V_{tb}| > 0.78$ at 95% CL. Extensions: $|V_{tb} f_1^L| = 1.07 \pm 0.12$



Observation of single top quark production

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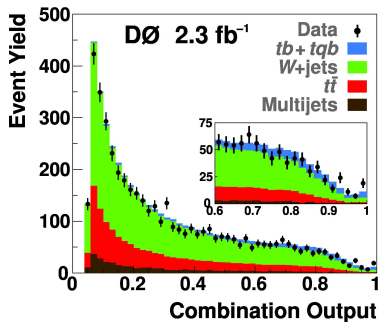
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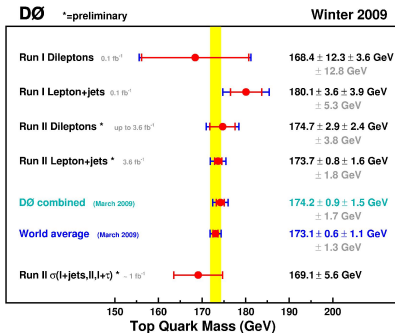
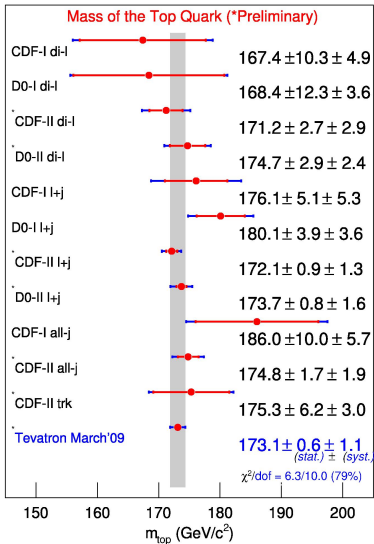
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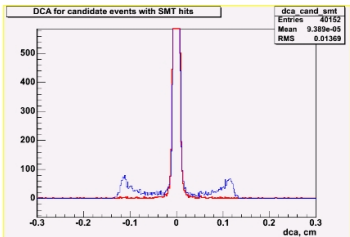
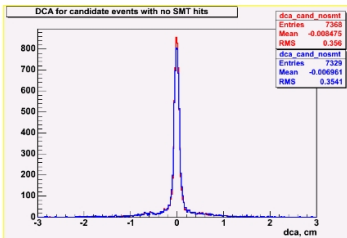
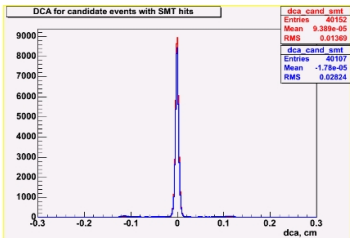
Combination of Top Quark Mass Measurements



Comment on Dimuon Excess



$Z \rightarrow \mu^+ \mu^-$ preliminary results for v13 trigger list data



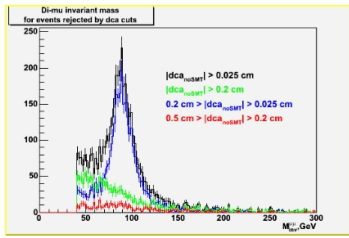
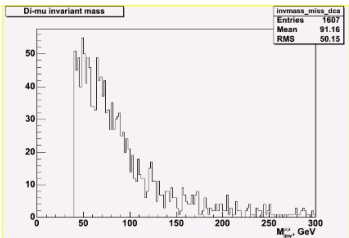
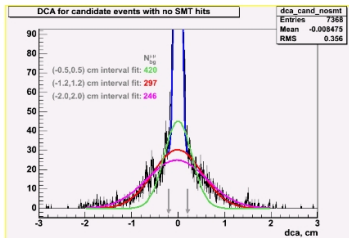
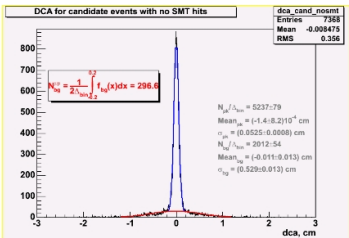
*beamSpot-2.09 file modified
to evaluate beam position
for ~80 runs*



Comment on Dimuon Excess



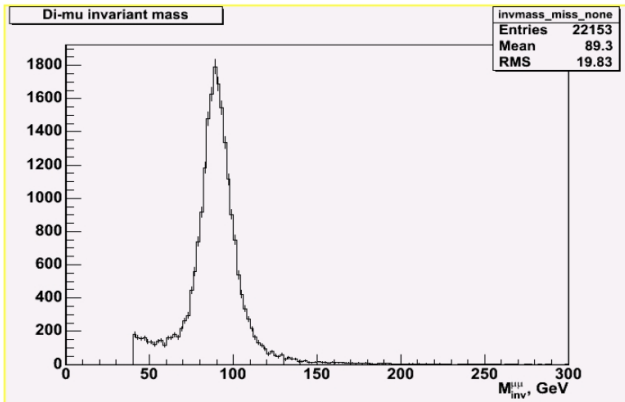
$Z \rightarrow \mu^+ \mu^-$ preliminary results for v13 trigger list data



Comment on Dimuon Excess



$Z \rightarrow \mu^+ \mu^-$ preliminary results for v13 trigger list data



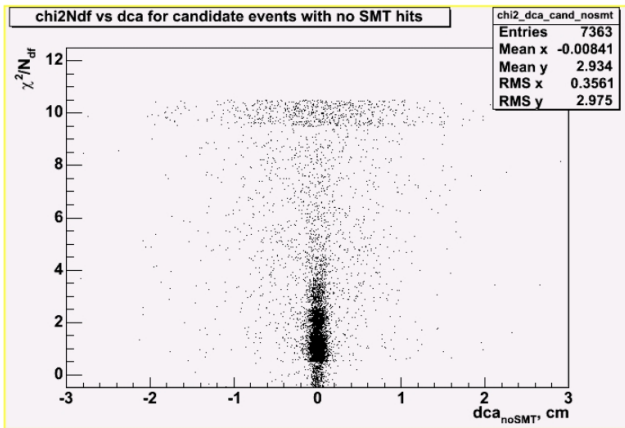
May contain 1-2% of background events with no SMT hits (?)



Comment on Dimuon Excess



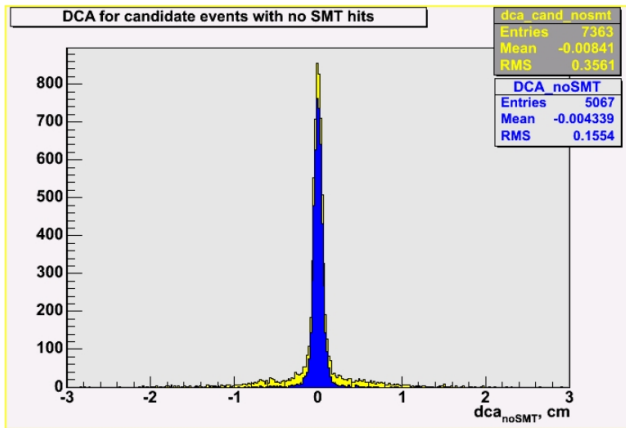
No SMT hits for $Z \rightarrow \mu^+ \mu^-$ v13 trigger list data



Comment on Dimuon Excess



No SMT hits for $Z \rightarrow \mu^+ \mu^-$ v13 trigger list data



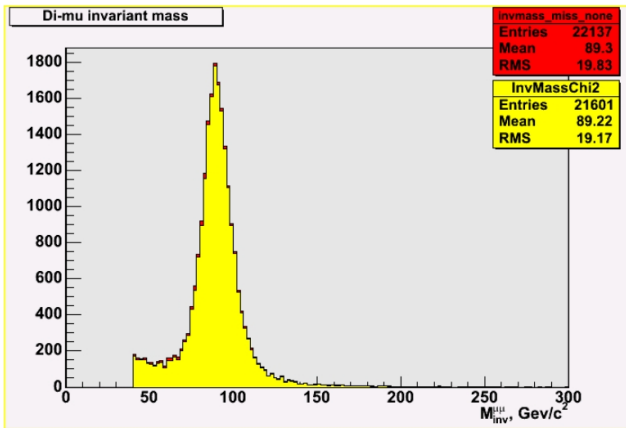
Cut: $x^2/N_{df} < 4$ for both muons



Comment on Dimuon Excess



No SMT hits for $Z \rightarrow \mu^+ \mu^-$ v13 trigger list data



Cuts (for both muons, no SMT hits): $\chi^2/N_{df} < 4$

