Results from CDF and D0 on:

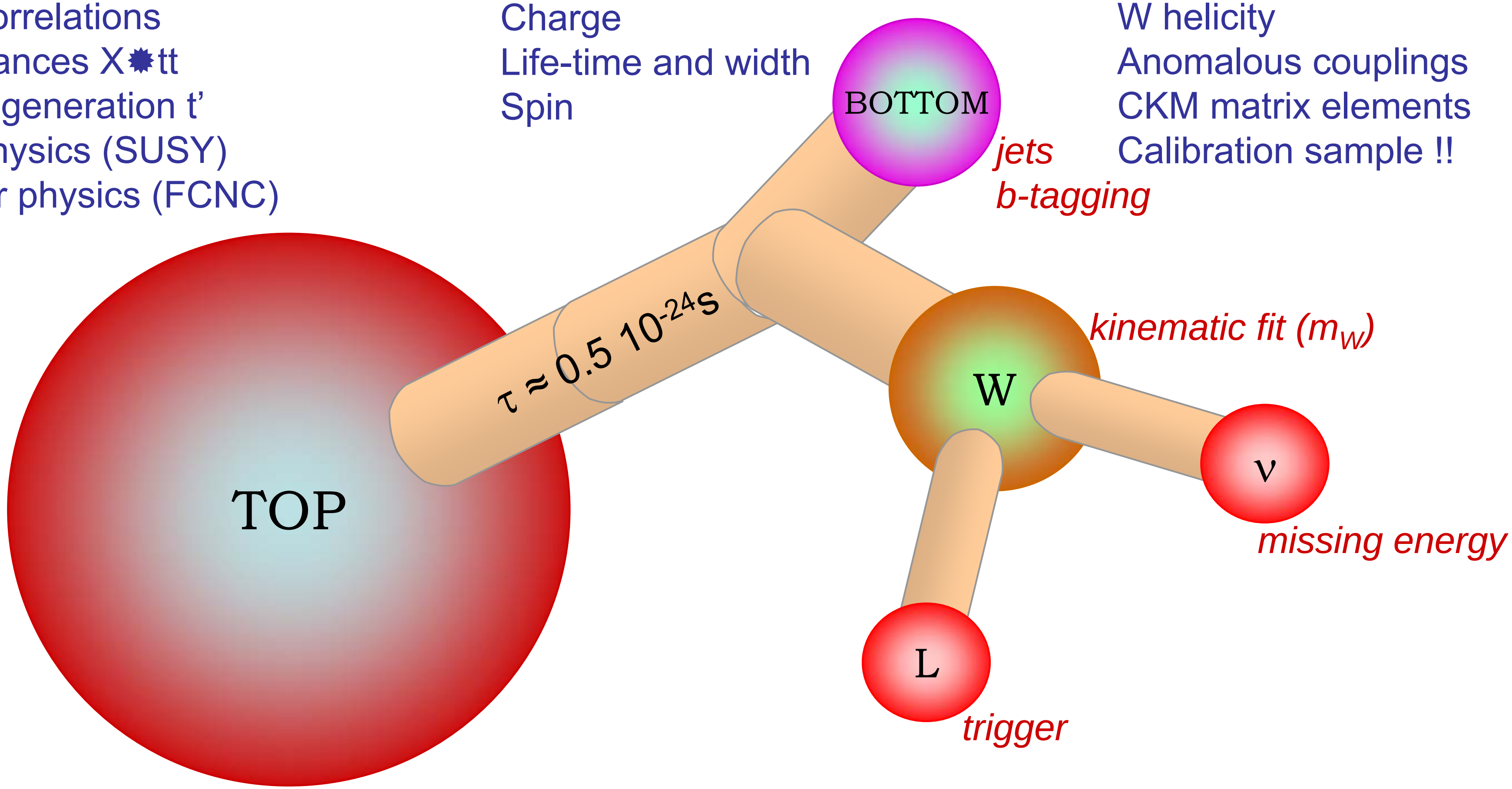
1. **Pair Production of Top Quarks**
   - Cross Section
   - Search for Resonances
   - Forward-Backward Asymmetry
2. **Single Top Production**
   - Search for SM EWK Production
   - Search for Anomalous Processes
3. **Decay Physics**
   - W Helicity
4. **Top Properties**
   - Mass
   - Charge
   - Lifetime
5. **Outlook**

Top Subjects

PRODUCTION
Cross section
Spin-correlations
Resonances X✸tt
Fourth generation t'
New physics (SUSY)
Flavour physics (FCNC)

PROPERTIES
Mass (matter vs. anti-matter)
Charge
Life-time and width
Spin

DECAY
Charged Higgs
W helicity
Anomalous couplings
CKM matrix elements
Calibration sample !!

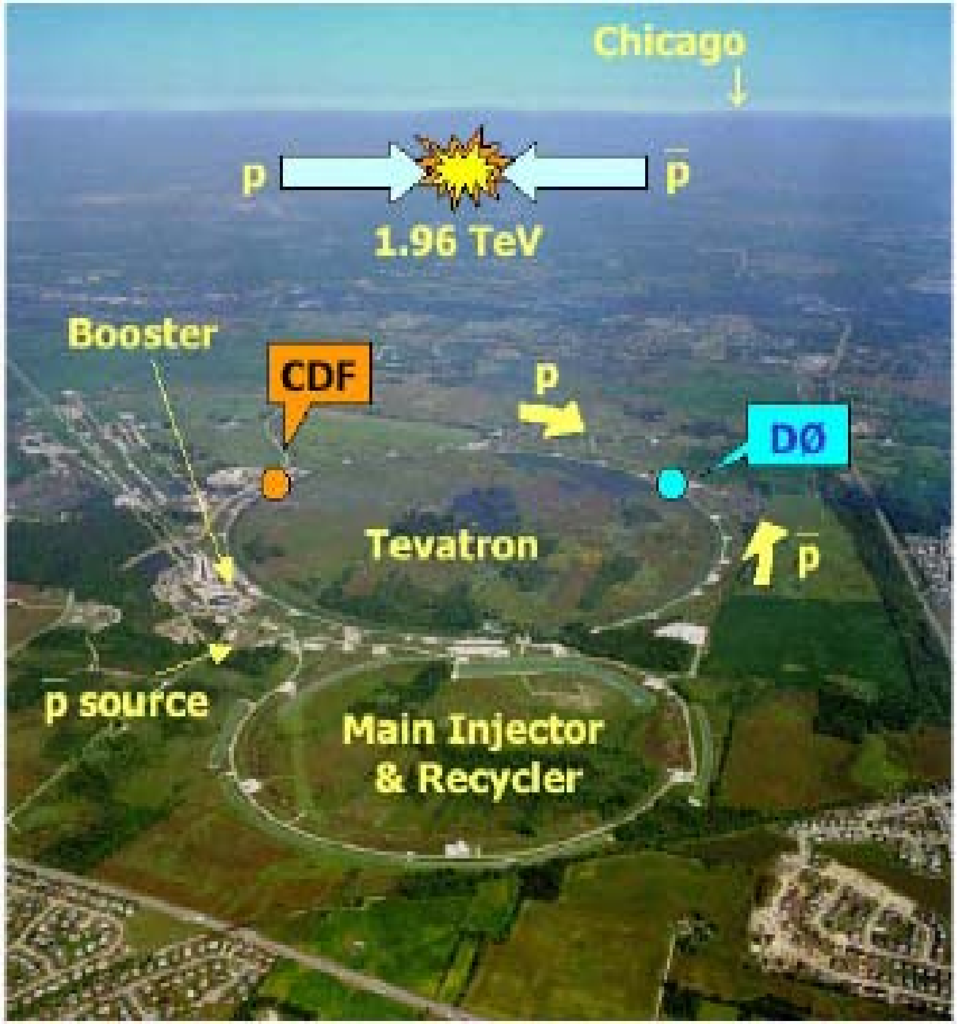


J. D'Hondt (VUB)

- Currently the world's only top quark "factory"

- Run I (1992-1996)
  $\sqrt{s}$ = 1.8 TeV
  Integrated Luminosity ~110 pb^{-1}
  top discovery!

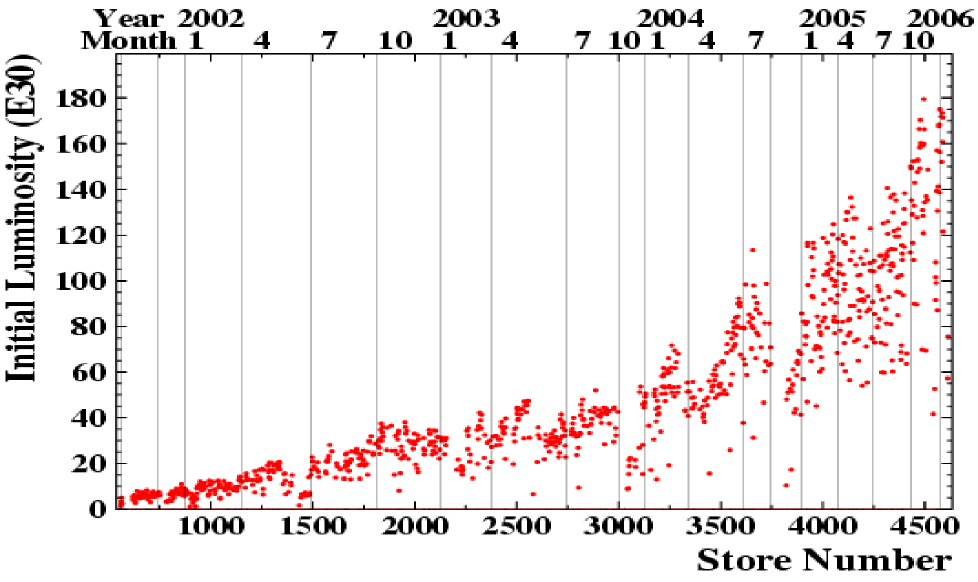
- Run II (2001-present)
  $\sqrt{s}$ = 1.96 TeV
  30% higher $t\bar{t}$ cross section
  Integrated Luminosity todate 1.6 fb^{-1}
  Aim for 4-8 fb^{-1} by 2009

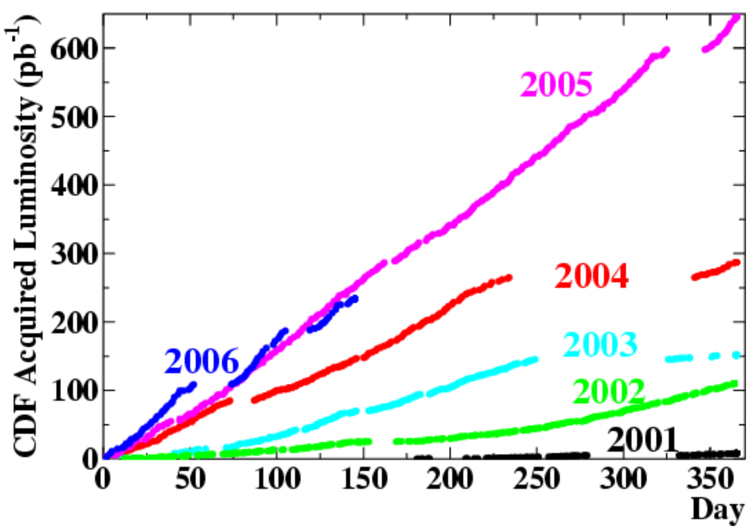


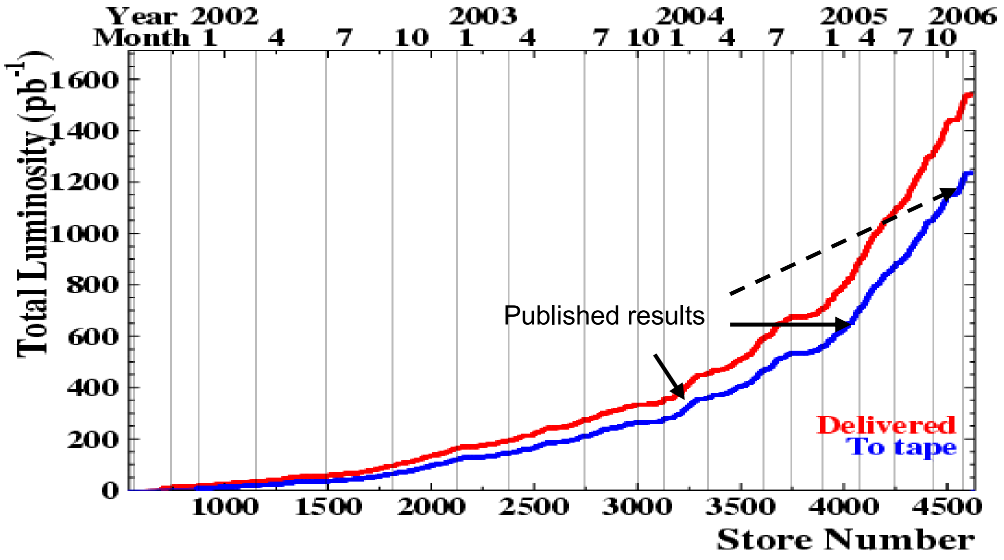
Luminosity in Run II

Luminosities:

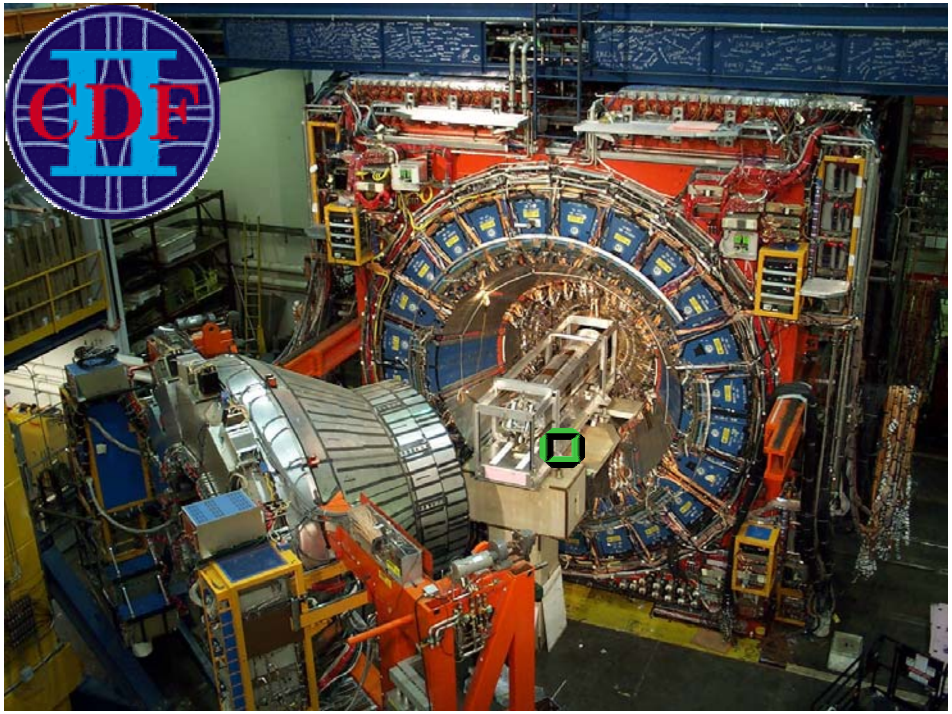
- Record so far:
  1.8×10^{32} cm^{-2}s^{-1}
  Expect 2.5×10^{32} cm^{-2}s^{-1} this year
- On tape ~1.2 fb^{-1}
- New results with ~320 pb^{-1} to ~750 pb^{-1} (*7 of Run I)
- Preliminary results 1 fb^{-1} shortly







CDF and D0 in Run II



- New silicon tracker, new drift chamber, TOF
- Upgraded calorimeter and muon system
- Upgraded DAQ/trigger
- Displaced track trigger

- New silicon and fibre tracker
- New ~2 T solenoid
- Upgraded muon system
- Upgraded (track) trigger/DAQ
- Roman pots

Resolutions:

EM: σ_E/E = 13.5 - 15% / sqrt(E)

HAD: σ_E/E = 50 – 80 % / sqrt(E)

CDF Collaboration

Canada
McGill Univ.
Univ. of Toronto

USA
Argonne National Laboratory,IL
Brandeis Univ.,MS
Univ. of Chicago,IL
Davis UC,CA
Duke Univ.,NC
FNAL,IL
Univ. of Florida,FL
Harvard Univ.,MA
Univ. of Illinois,IL
The Johns Hopkins Univ.,MD
LBNL,CA
MIT,MA
Michigan State Univ.,MI
Univ. of Michigan,MI
Univ. of New Mexico,NM
The Ohio State Univ.,OH
Univ. of Pennsylvania,PA
Univ. of Pittsburgh,PA
Purdue Univ.,IN
Univ. of Rochester,NY
Rockefeller Univ.,NY
Rutgers Univ.,NJ
Texas A&M Univ.,TX
Texas Tech Univ.,TX
Tufts Univ.,MA
UCLA,CA
Univ. of Wisconsin,WI
Yale Univ.,CT

China
Academia Sinica,
Taiwan

Korea
KHCL

Russia
JINR, Dubna
ITEP, Moscow

Germany
Univ. Karlsruhe

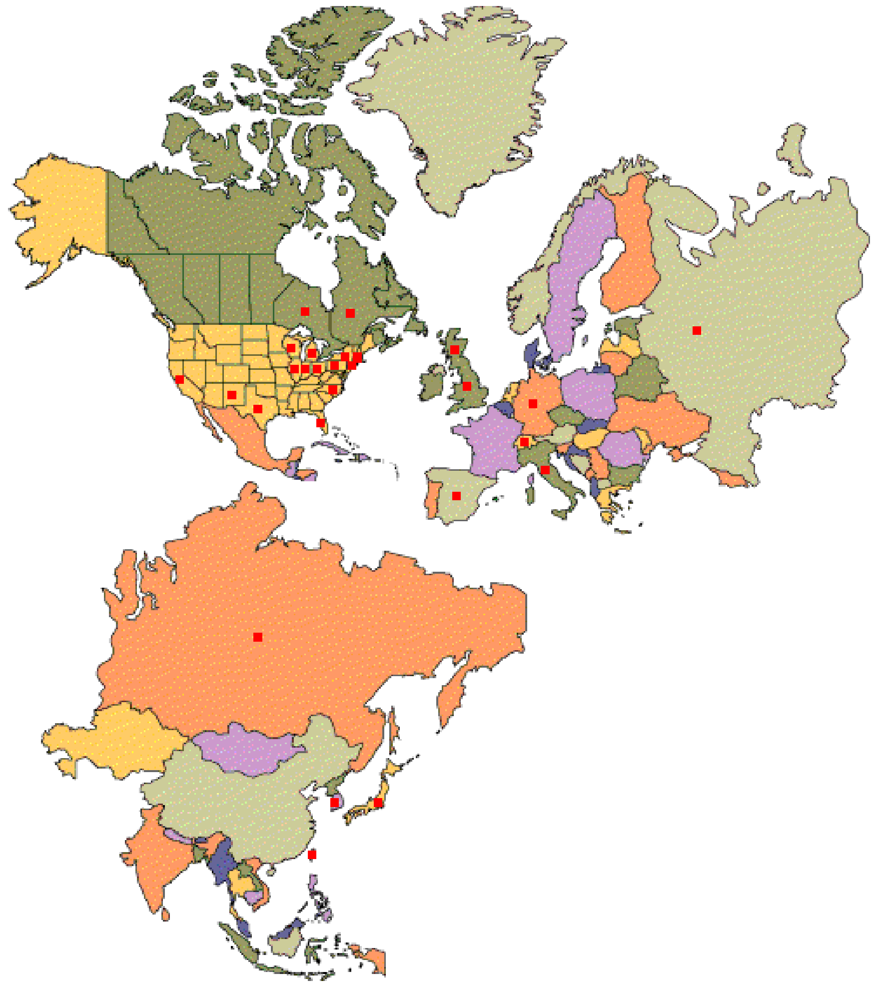
Switzerland
Univ. of Geneva

UK
Glasgow Univ.
Univ. of Liverpool
Univ. of Oxford
Univ. College London

Italy
Univ. of Bologna,INFN
Frascati, INFN
Univ. di Padova,INFN
Pisa, INFN
Univ. di Roma I,INFN
INFN-Trieste
Univ. di Udine

Spain
Univ. of Cantabria

Japan
Hiroshima Univ.
KEK
Osaka City Univ.
Univ. of Tsukuba
Waseda Univ., Tokyo

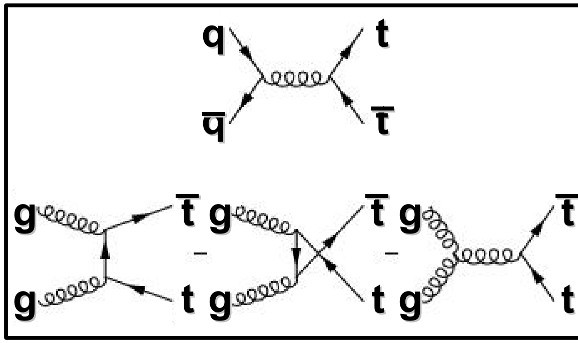


730 Physicists, 22 from Germany

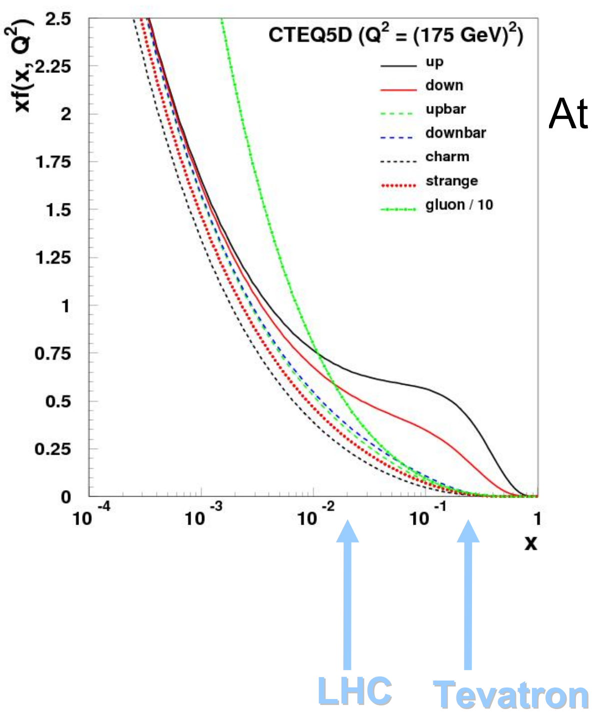
DØ Collaboration

670 Physicists, 47 from Germany

1. PAIR PRODUCTION OF TOP QUARKS



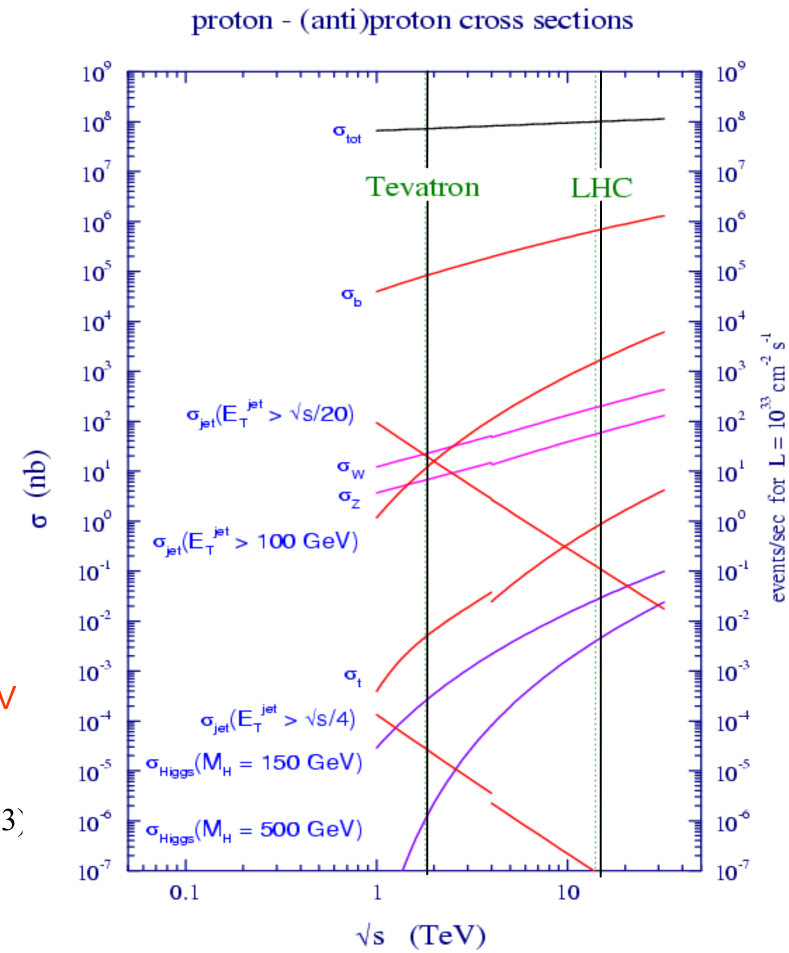
TEV	LHC
~85%	~15%
~15%	~85%



At the Tevatron, within SM:

$\sigma_{tt} = 6.7 \pm^{0.7}_{0.9}$ pb @ m_{top} = 175 GeV

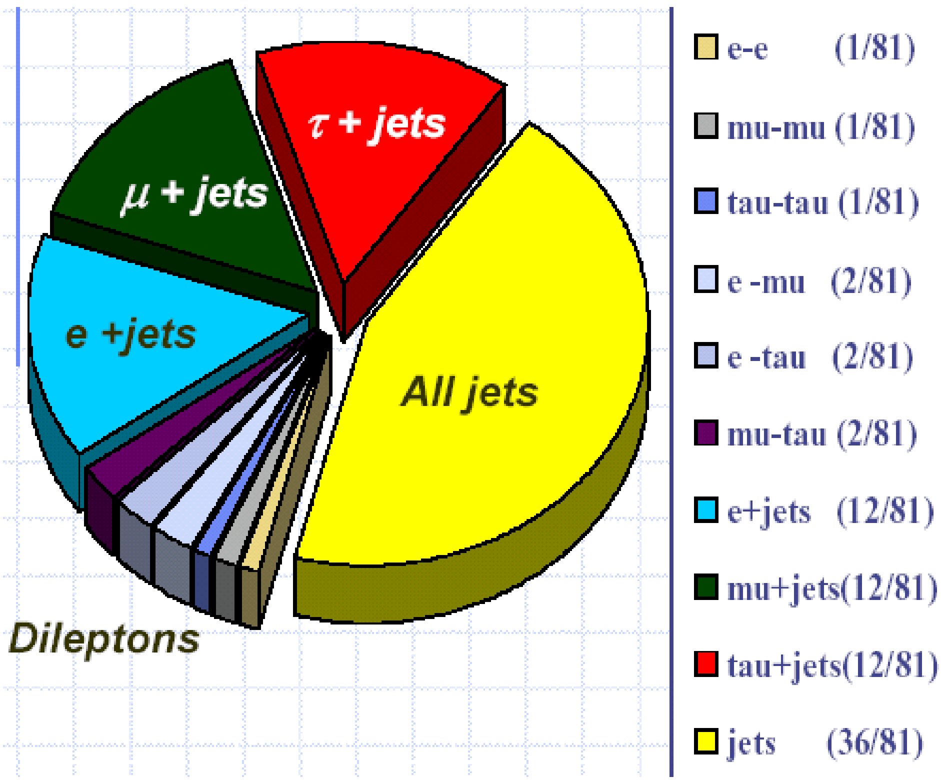
Cacciari et al. JHEP 0404:068(2004)
Kidonakis,Vogt PRD 68 114014(2003)

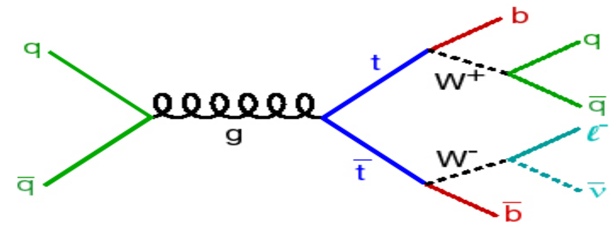


One top pair every 10^{10} inelastic collisions

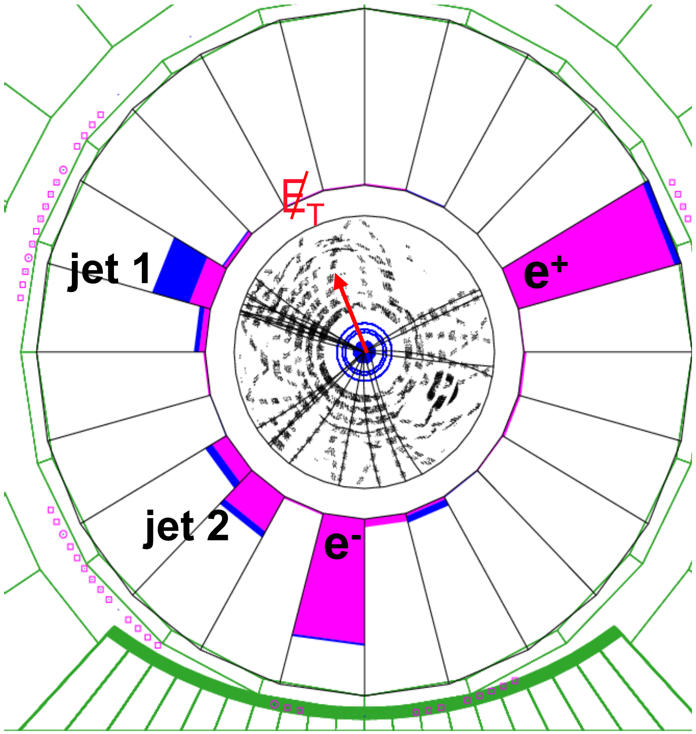
So far (0.93 fb^{-1}):
Produced ~6000 top pairs
Fully reconstructed ~233 top quark pairs

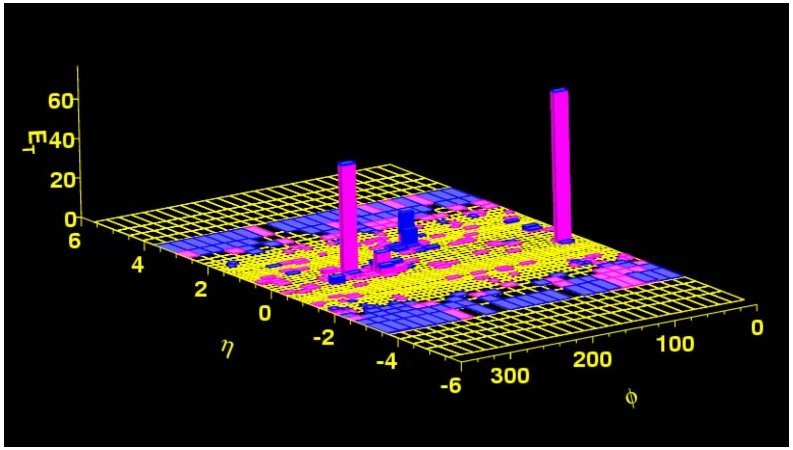
Top Quark Decay Modes





- **$t \rightarrow Wb$**
  Events classified by W decay
  - "Lepton [e,μ] + jets" (30%)
    $tt \rightarrow bl\nu bqq'$
  - "Dilepton [e,μ]" (5%)
    $tt \rightarrow bl\nu bl\nu$
  - "All jets" (44%)
    $tt \rightarrow bqq'bqq'$
  - **"Tau + X" (21%)**





Finding the top:

Signal:

- Triggering on lepton
- High missing transverse energy ($\not{E}_T$)
- High E_T jets, central and spherical
- Two b-jets (displaced vertex)

Background:

- W+jets:
  dominant in leptonic modes
  fakes the second lepton
- Drell-Yan(dileptons): no $\not{E}_T$
- QCD: huge in all jet mode

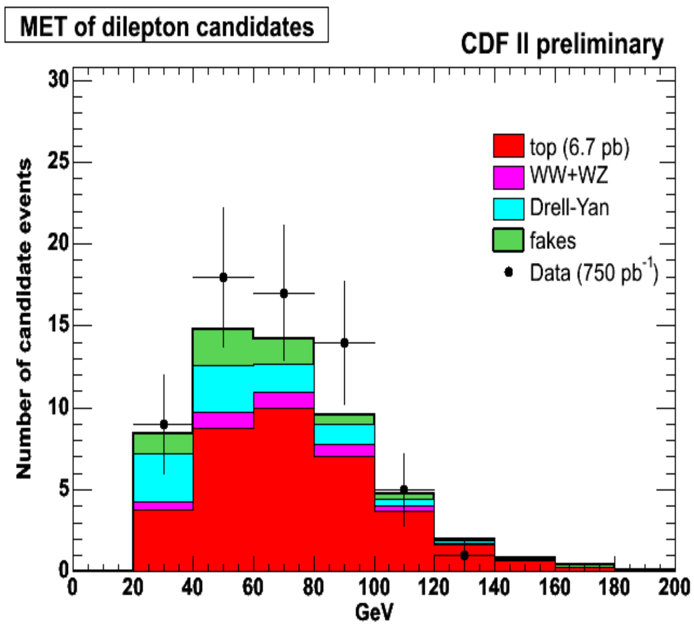
Determination of the cross section

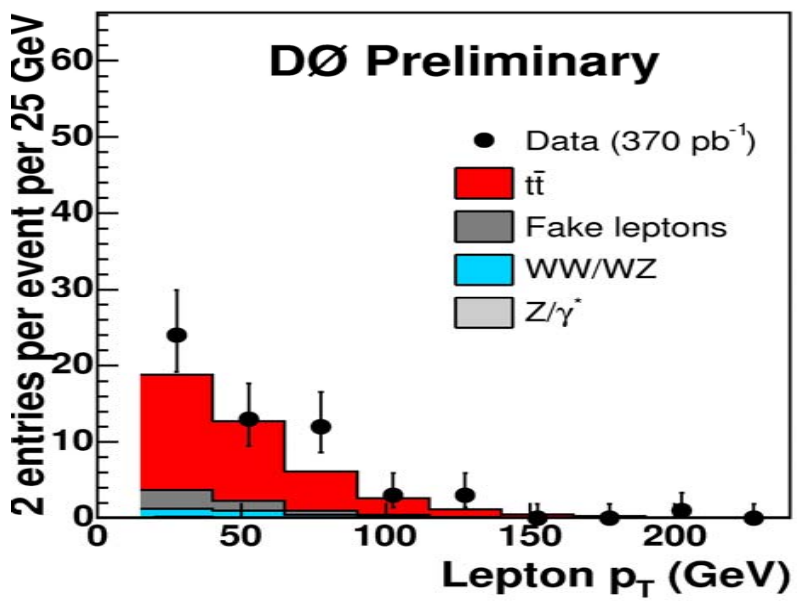
$$\sigma_{t\bar{t}} = \frac{N_{obs} - N_{bgd}}{\varepsilon_{t\bar{t}} \cdot \int L dt}$$

Cross Section in the Dilepton channel

	obs	expected
ee	12	14.3 ± 2.2
μμ	24	16.1 ± 2.4
eμ	28	25.0 ± 1.5

	obs	expected
ee	5	4.5 ± 0.5
μμ	2	3.8 ± 0.5
eμ	21	15.8 ± 2.8

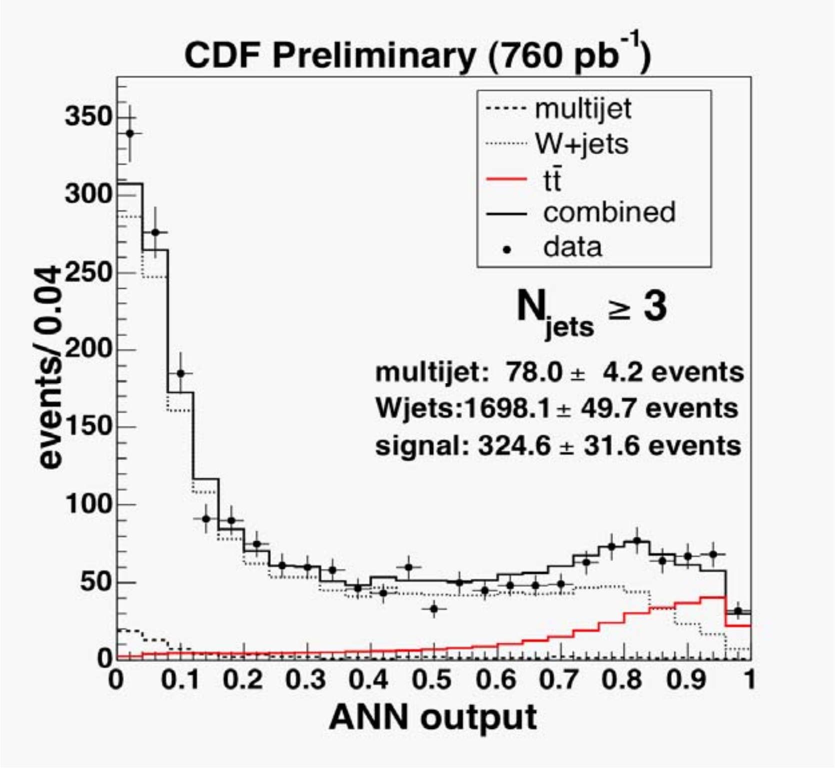


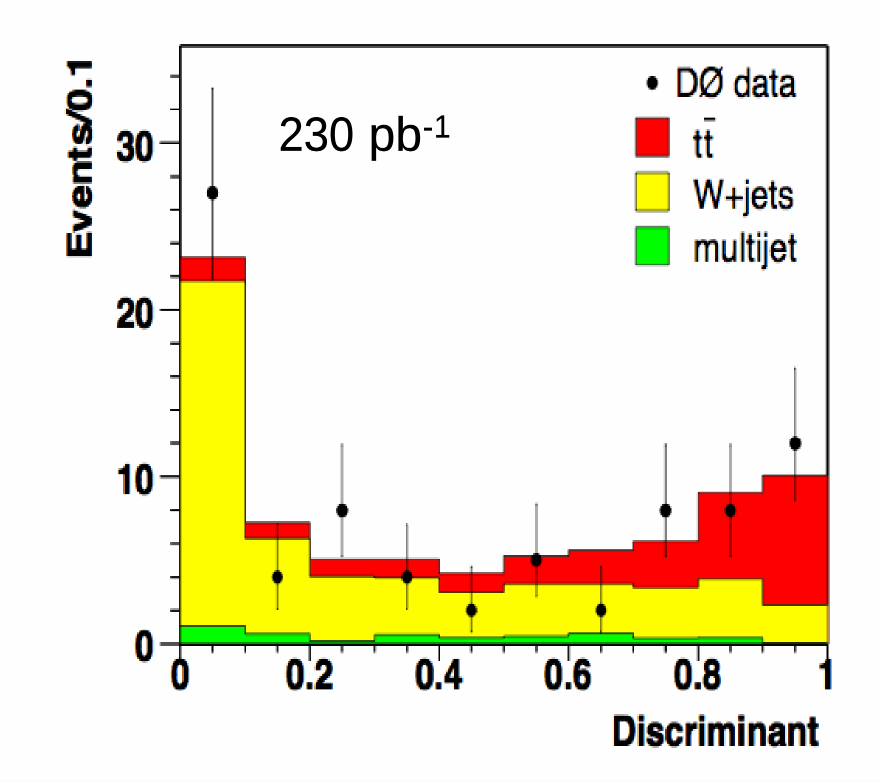


σ (tt) = 8.3 ± 1.5 (stat) ± 1.0 (syst) ± 0.5 (lumi) pb

σ (tt) = 8.6 ± 2.3 (stat) ± 1.1 (syst) ± 0.6 (lumi) pb

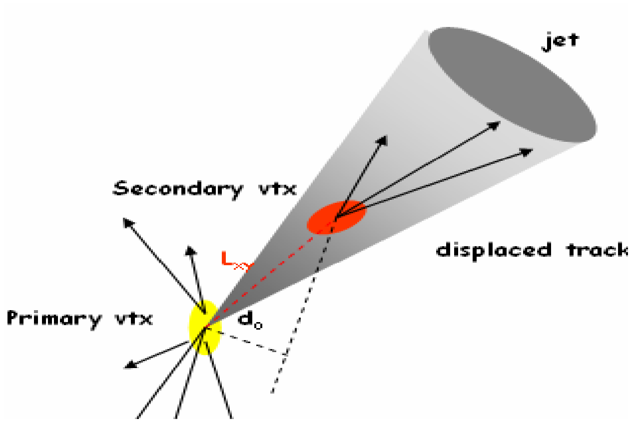
- Topological/kinematical analyses:
  Neural Network (CDF) / Likelihood Discriminant(D0)





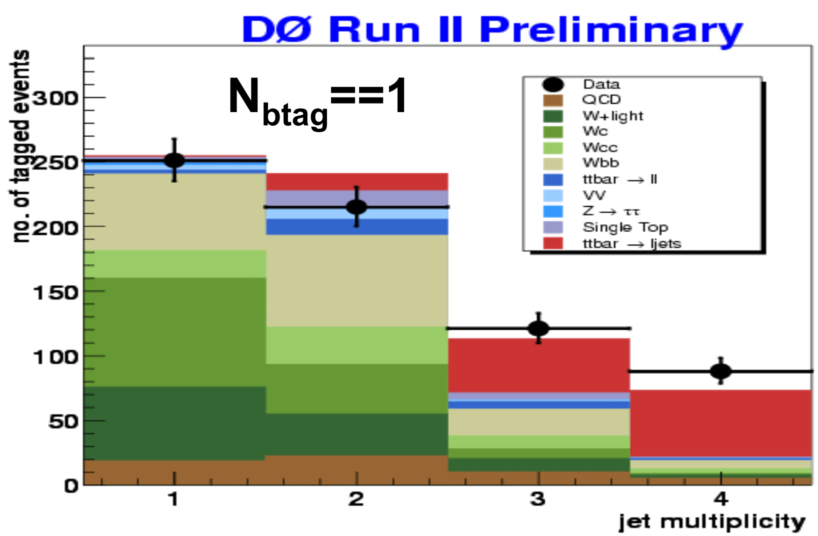
σ (tt) = 6.0 ± 0.6 (stat) ± 0.9 (syst) pb

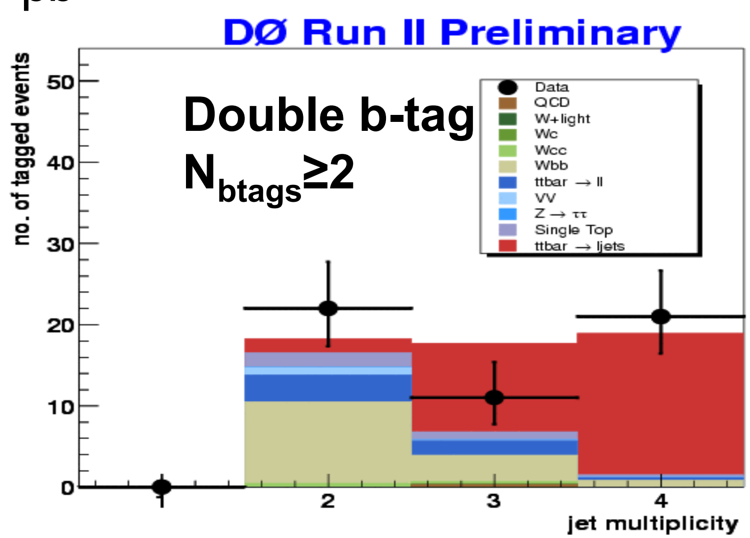
σ (tt) = 6.7 ± 1.4 (stat) ± 1.4 (syst) pb



- B-jets are tagged by finding displaced vertex within a jet
- B-quark lifetime $c\tau \sim 450\ \mu m$
- Strong background reduction

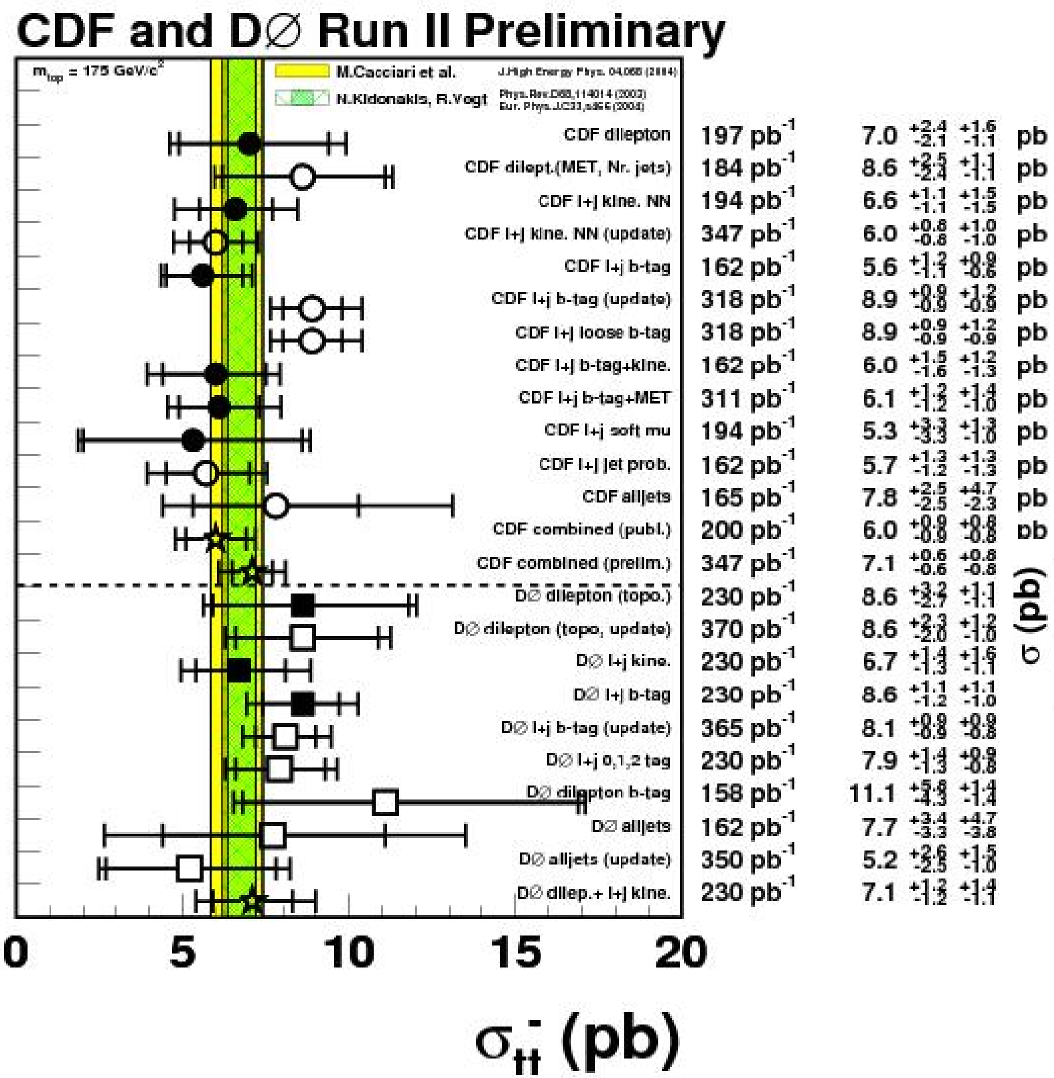
370 pb^{-1}

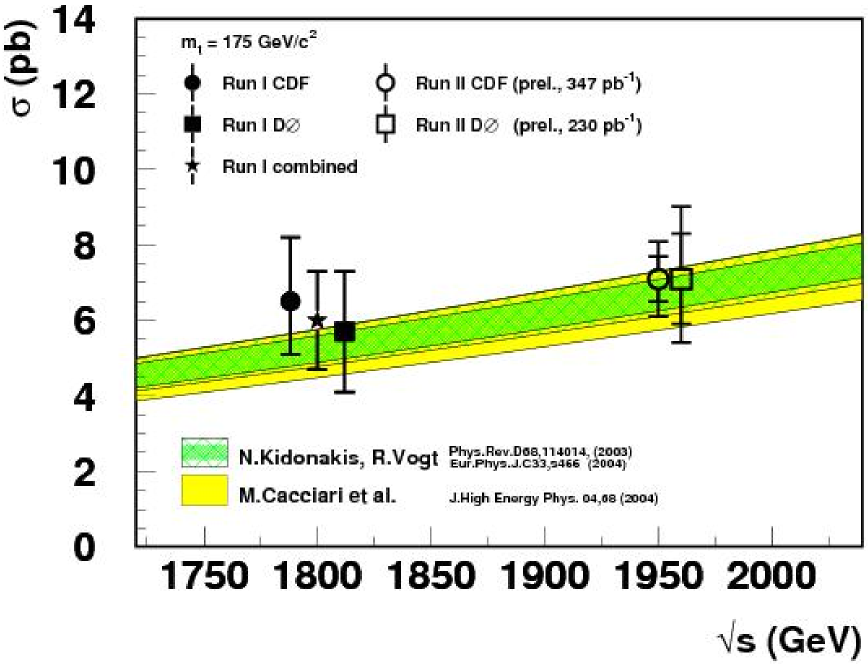




$$\sigma(t\bar{t}) = 8.1 \pm 0.9(\text{stat}) \pm^{0.9}_{0.8} (\text{syst}) \pm 0.5(\text{lumi})\,\text{pb}$$

Cross Section Summaries





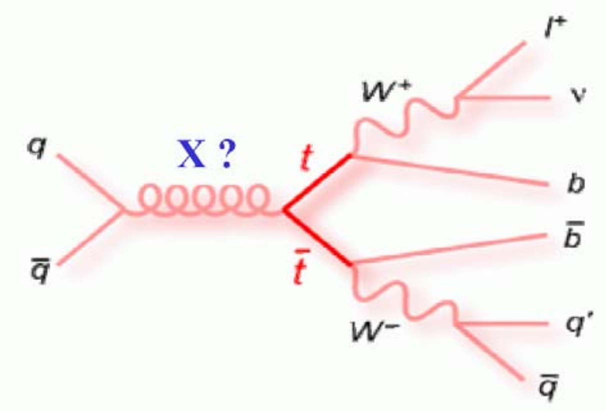
1.2 Search for $t\bar{t}$ Resonances

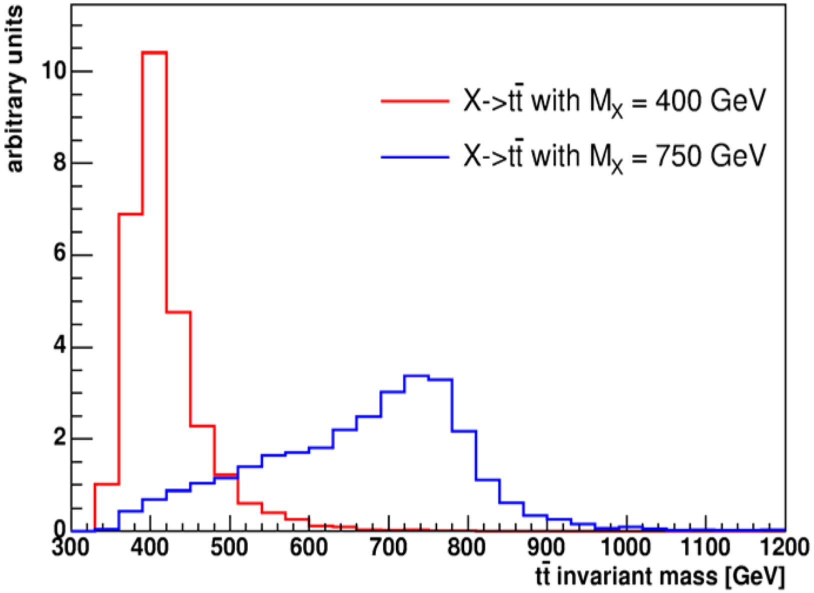
Topcolor-Assisted Technicolor
Hill, Phys Lett. B345, 483 (1995);
Hill and Parke Phys. Rev. D49, 4454 (1994):

- Introducing a new strong interaction
- Predicts new massive bosons "topgluons" and a topcolor Z'

Assume resonance mass M_X in the range [350-1000] GeV

Assume resonance width $\Gamma_X=0.012 \cdot M_X$



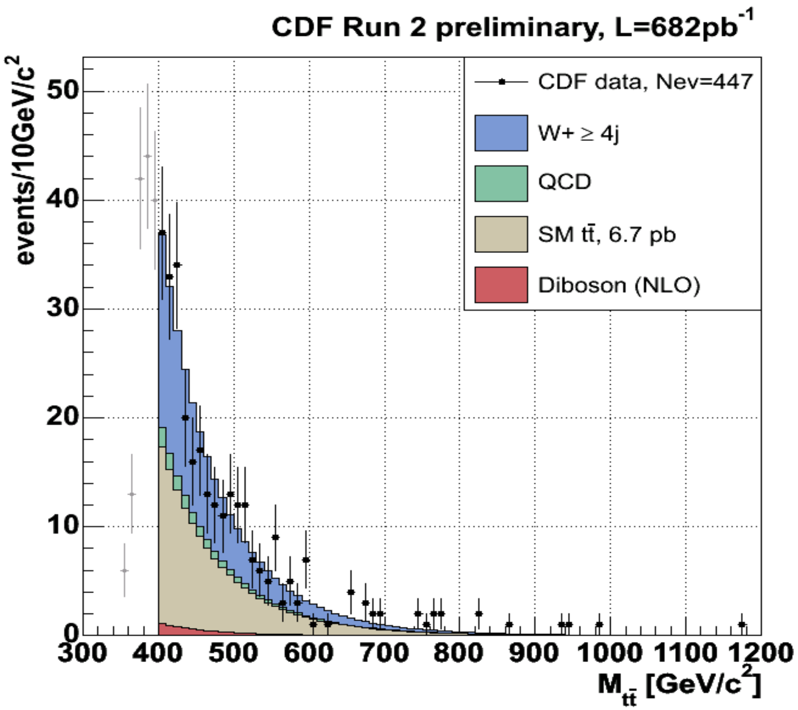


Consequences:

- cross-section higher than SM expectation
- resonances in the $t\bar{t}$ mass distribution

CDF:

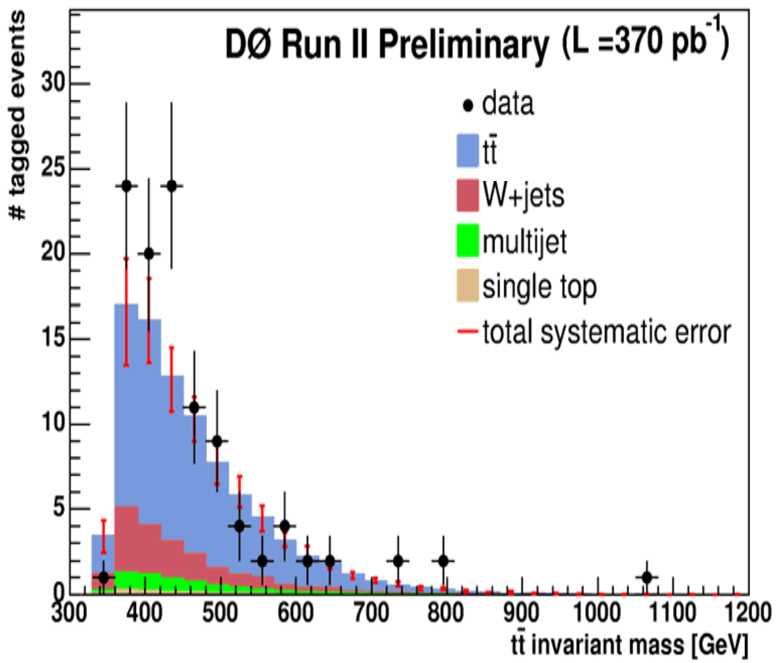
lepton+jets selection, no b-tagging requirements



M_X>725 GeV @95% C.L.

DØ:

lepton+jets selection, at least one b-tagged jet (secondary vertex tag)

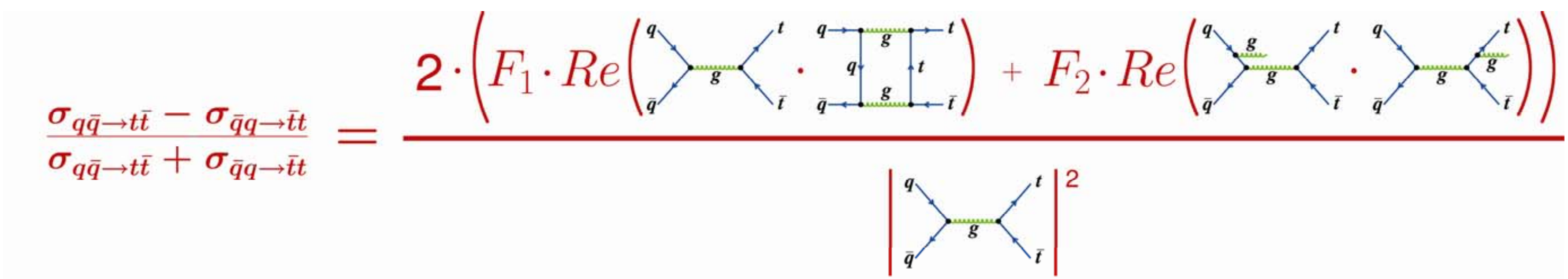


M_X>680 GeV @95% C.L.

Top pair production well described by QCD

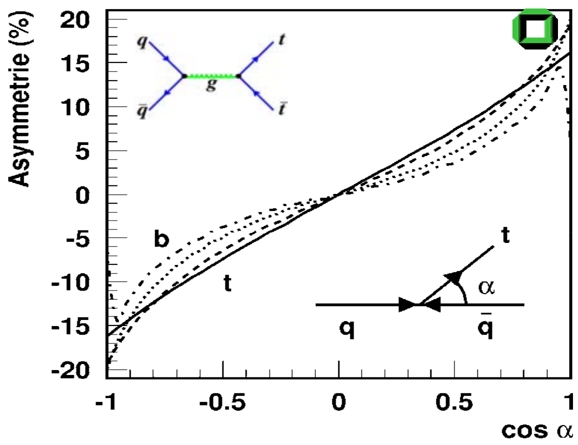
- NLO QCD: expect an asymmetry:
  Interference of Gluonradiation in the initial and final state
  Interference of box diagrams with leading order graphs

- Total asymmetry: 6-8%



J. Kühn et al.

Effect can be measured
only at the Tevatron!



- $N_{\bar{t}}(\cos\alpha) \neq N_t(\cos\alpha)$

- Conservation of C-Parity

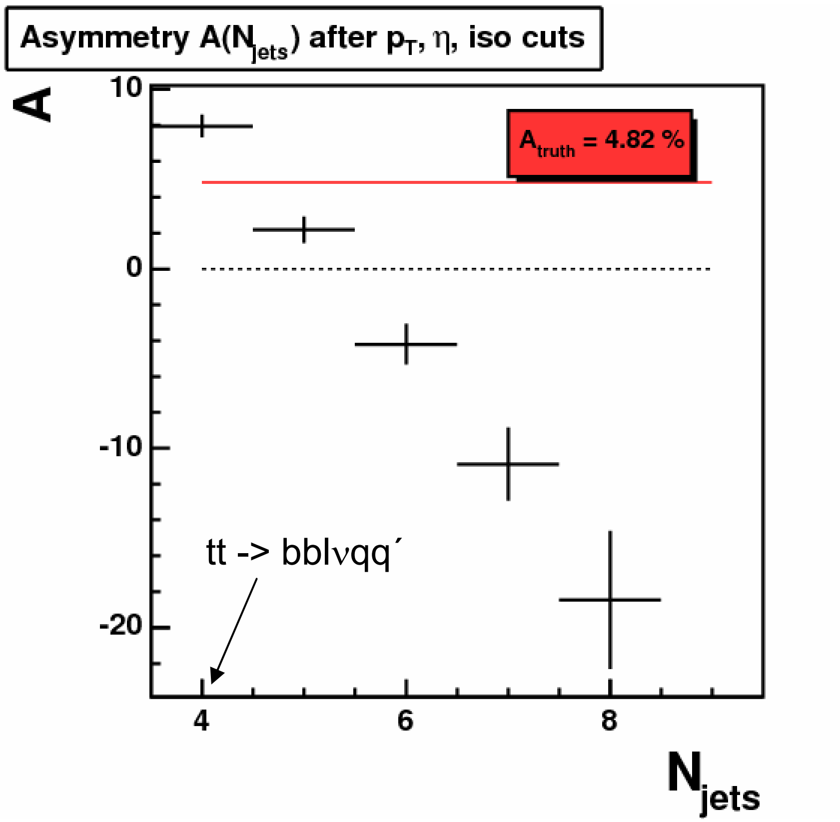
$\Rightarrow N_{\bar{t}}(\cos\alpha) = N_t(-\cos\alpha)$

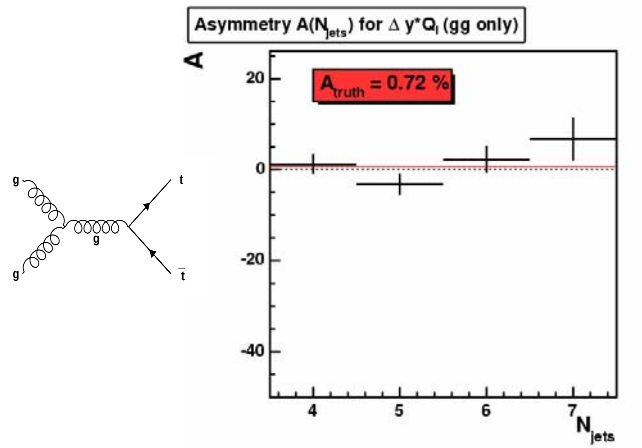
- Determination of $\cos\alpha$ difficult

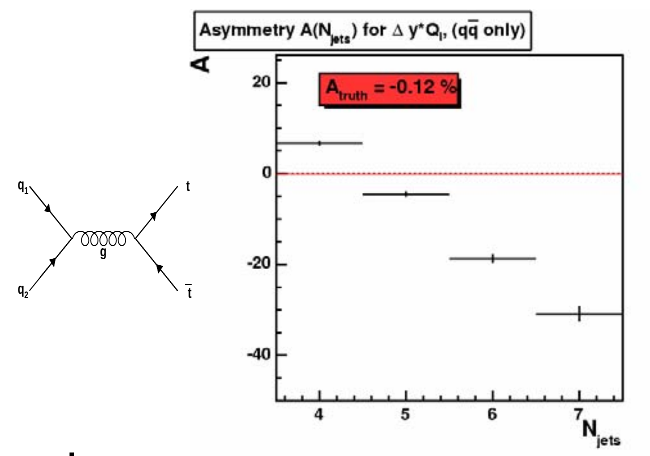
$\Rightarrow$ Use difference of rapidity of Top-Quarks Δy

So far we see no significant effect

A Puzzle: Dependence of Asymmetry on N_{jets} in M/C

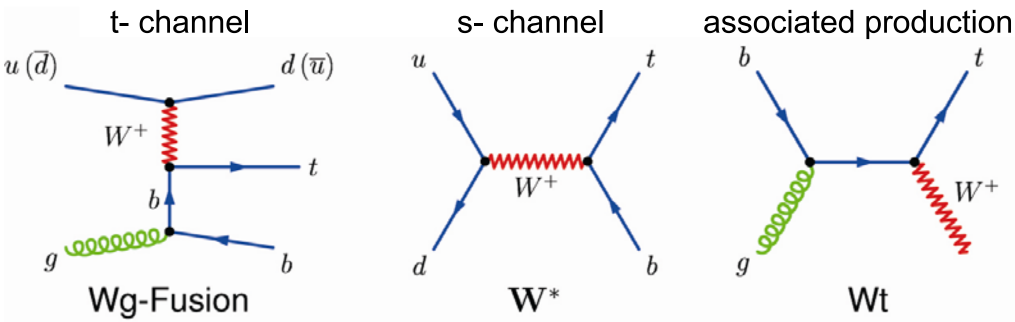






MC@NLO simulation of $t\bar{t}$ in the lepton-jet channel

2. SINGLE TOP PRODUCTION



Theoretical cross sections at √s = 1.98 TeV

1.98 ± 0.08 pb 0.88 ± 0.05 pb 0.1 ± 0.02 pb

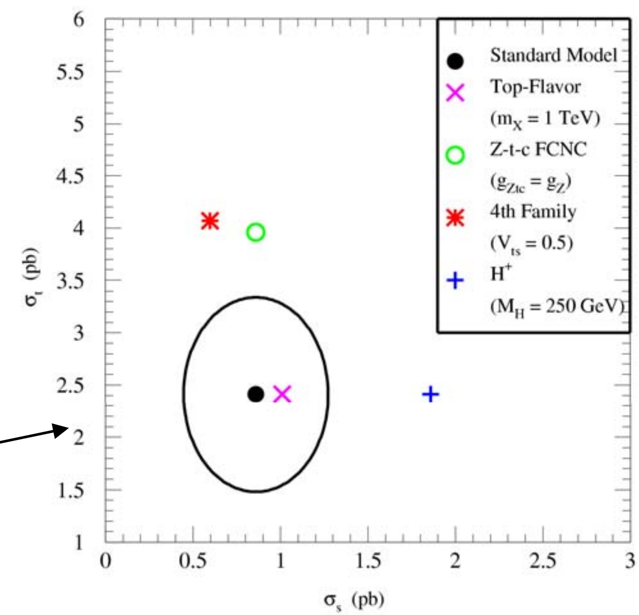
B.W. Harris *et. al.* Phys. Rev. D 66, 054024 (2002)

Observation of single top allows direct access to V_{tb}

- cross section $\propto V_{tb}^2$
- study top-polarization and EWK top interaction

Test of non-SM phenomena

- 4^{th} generation
- FCNC couplings like $t \to Z/\gamma\ c$
- heavy W' boson
- anomalous Wtb couplings

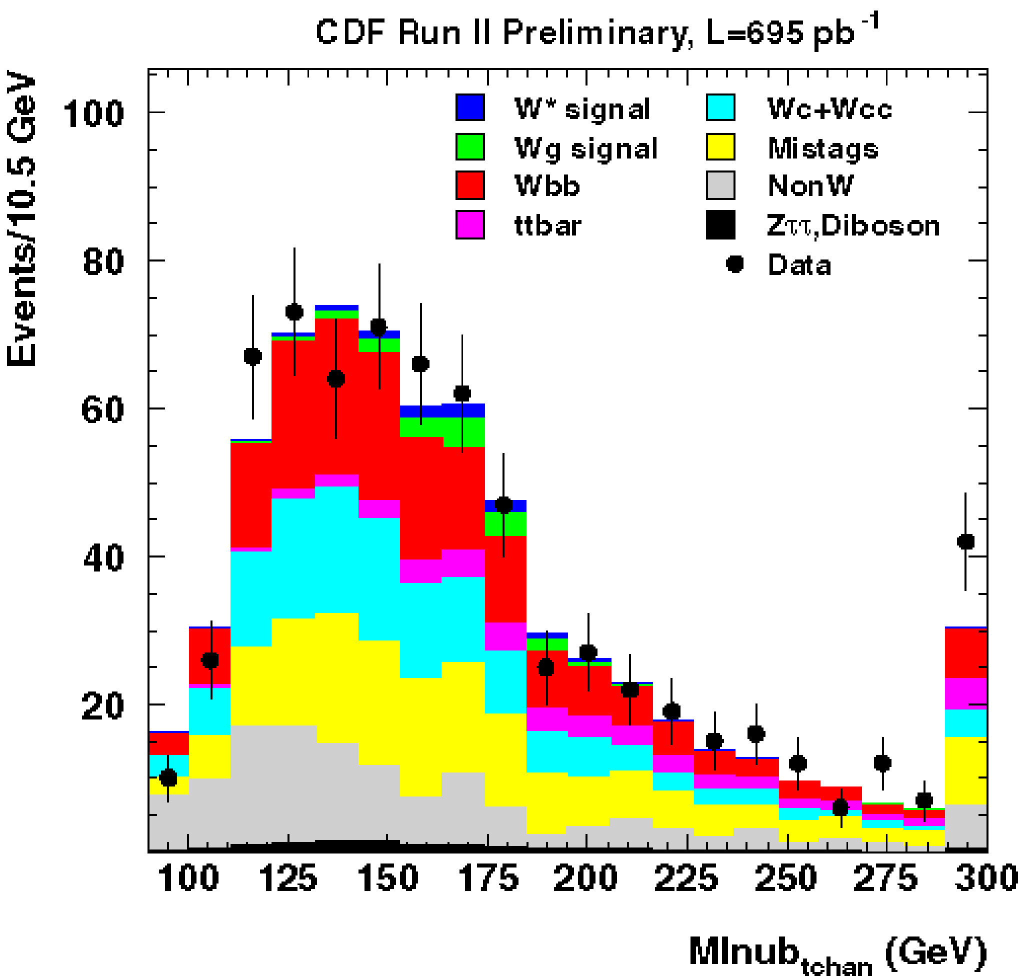


Y. Tait, PRD63, 014018(2001)

Potentially useful for Higgs searches

- single top has same final state as Higgs+W (associated) production

Challenge: Background



- Main background:
  - W+Jet events
  - Bottom-Antibottom events
  - Top-Antitop events
  - Diboson production
- After standard selection: signal to background ratio
  S/B = 1/20
- Observed number of events: 689

Improved b-Jet-Identification

Fit of W + 2Jet events with secondary vertex

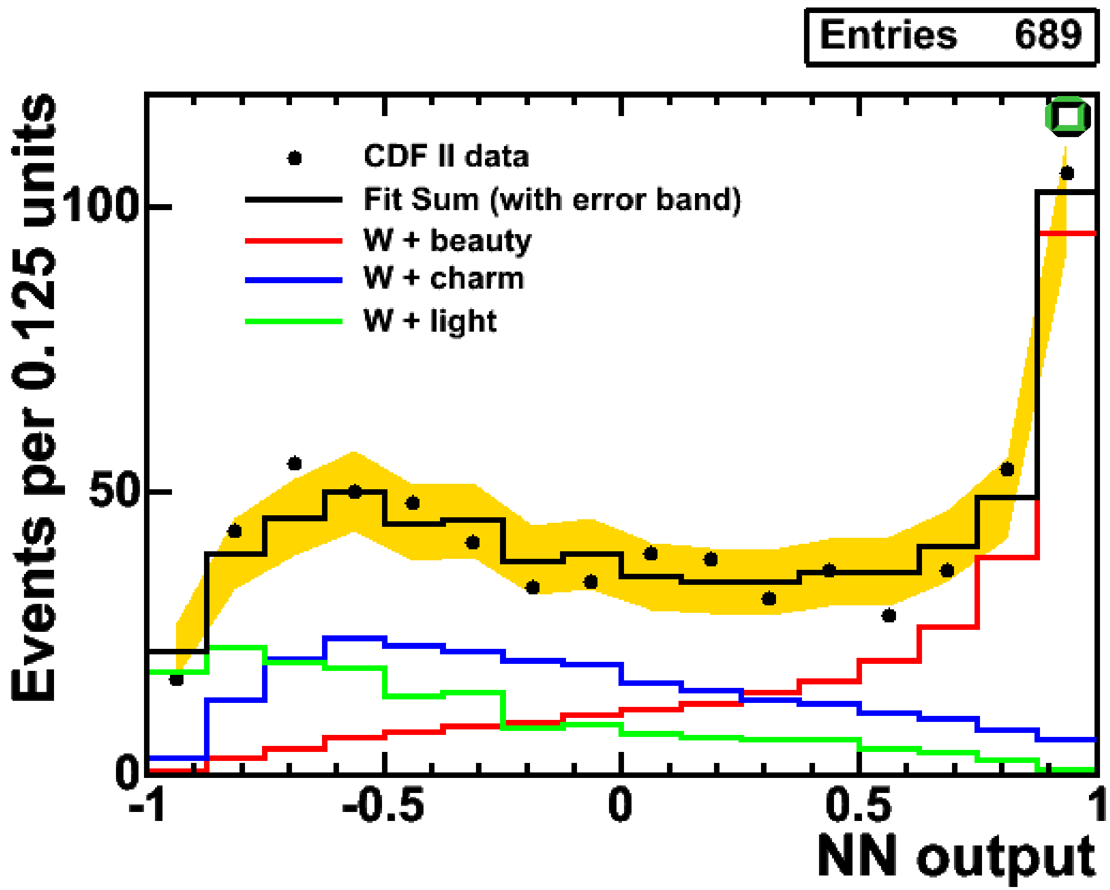
50% of all background from W+charm or W+light parton with mistags

Improvement:
Combination of 25 Jet or track variables to a discriminant e.g. mass of particles from vertex, decay length, track multiplicity

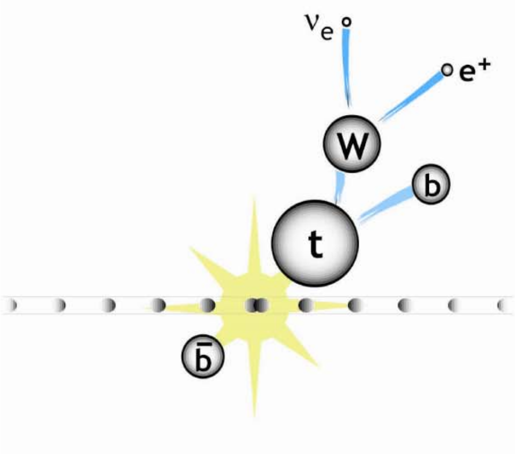
This allows for an in situ measurement of heavy flavor composition of background

First NN b Tagger at a hadron collider

NN algorithm developed by M. Feindt

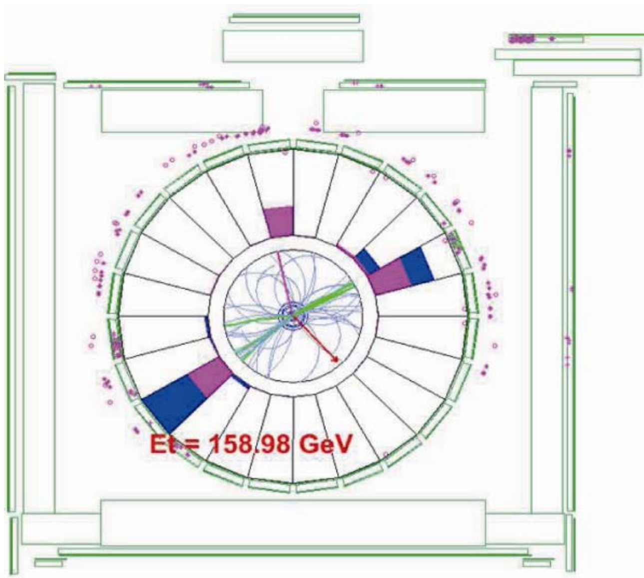


2.1 Search for SM Single Top Production



Selektionsschnitte

- isoliertes, zentrales e od. μ
  $P_T > 20$ GeV/c
- $\not{E}_T > 20$ GeV
- Veto: Z^0, Zwei-Lepton-Ereignisse
- 2 Jets:
  $E_T > 15$ GeV und $|\eta| < 2.8$
- ≥ 1 identifizierter b-Jet
- $140\ \mathrm{GeV}/c^2 \leq M_{\ell\nu b} \leq 210\ \mathrm{GeV}/c^2$



Run: 153389 · Event: 361345
- CEM Electron E_T=50.9 GeV, η=0.24
- MET=25.7 GeV, Phi=5.6
- Jet1 E_T=173.8 GeV, η=0.45
- Jet2 E_T=149.8 GeV, η=-0.13

Simulation: MadEvent

S. TOP CANDIDATE

Systematics and Event Selection Efficiencies

CDF II 695 pb^{-1} Preliminary

Source	t-channel	s-channel
JES	1.8%	1.2%
ISR	1%	2%
FSR	5%	1%
PDF	2.5%	2.2%
MC	2%	1%
ϵ_{evt}	10.3%	8%

Event selection efficiency(*)

s-channel 1.87 ± 0.15%

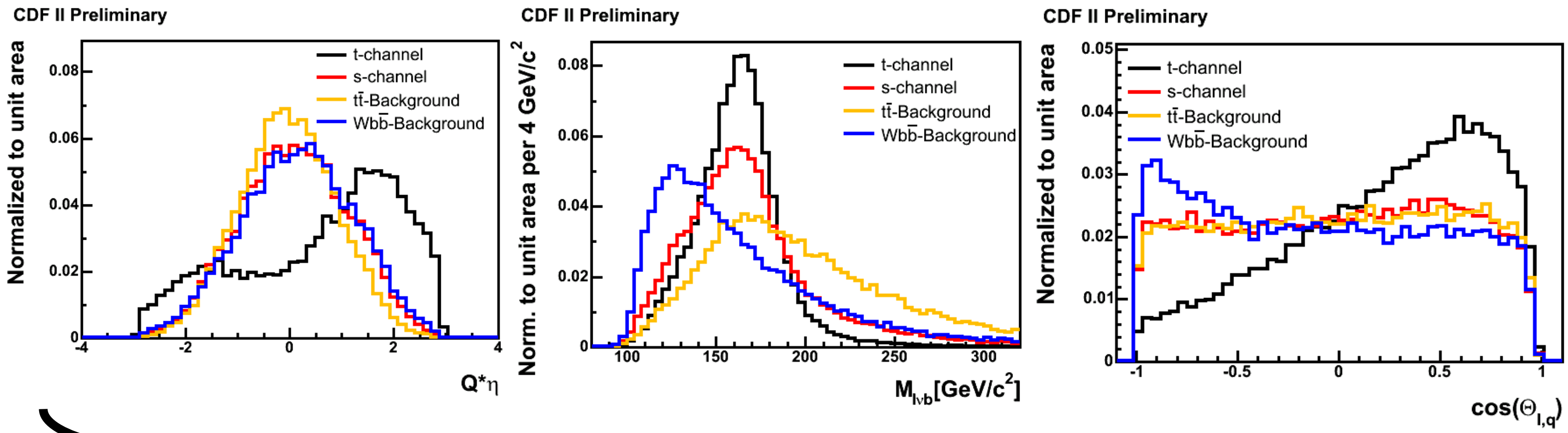
t-channel 1.21 ± 0.17%

(∗) Including W→leptons BR

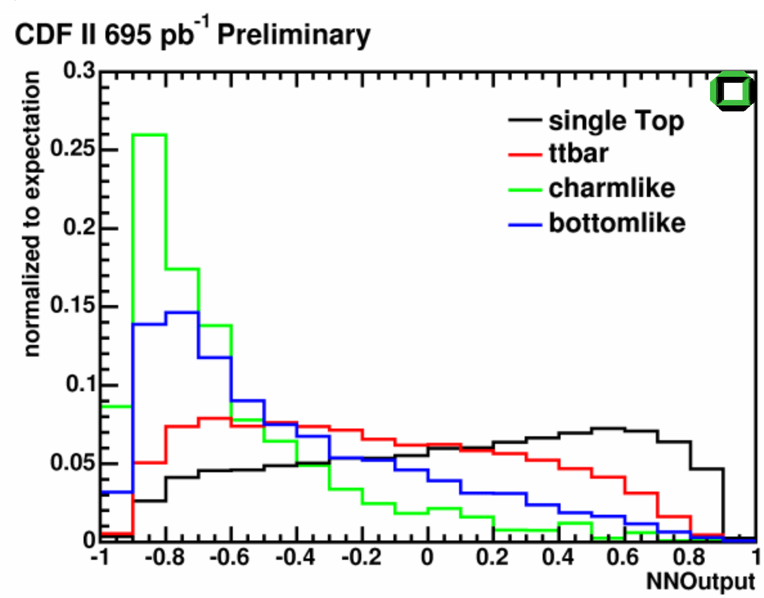
CDF II 695.5 pb^{-1} Preliminary

	W + 2 jets
Pretag W	13934 ± 550
Non-W	119.5 ± 40.4
Mistags	164.3 ± 29.6
$Wb\bar{b}$	170.7 ± 49.2
$Wc\bar{c}$	64.5 ± 17.3
Wc	69.4 ± 15.3
$t\bar{t}$	40.3 ± 3.5
WW	3.8 ± 0.4
WZ	6.1 ± 0.6
ZZ	0.2 ± 0.0
$Z->\mu\mu$	4.4 ± 0.5
$Z->\tau\tau$	2.6 ± 0.3
Total Background	645.9 ± 96.1
Single Top	28.2 ± 2.6
Total Prediction	674.1 ± 96.1
Observation	689

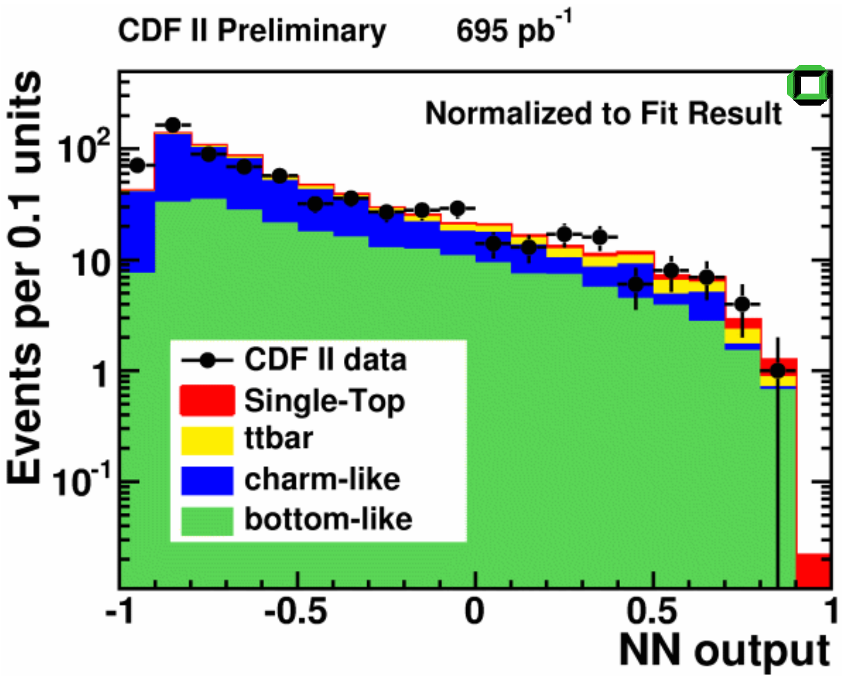
Neural Net for Single Top Search

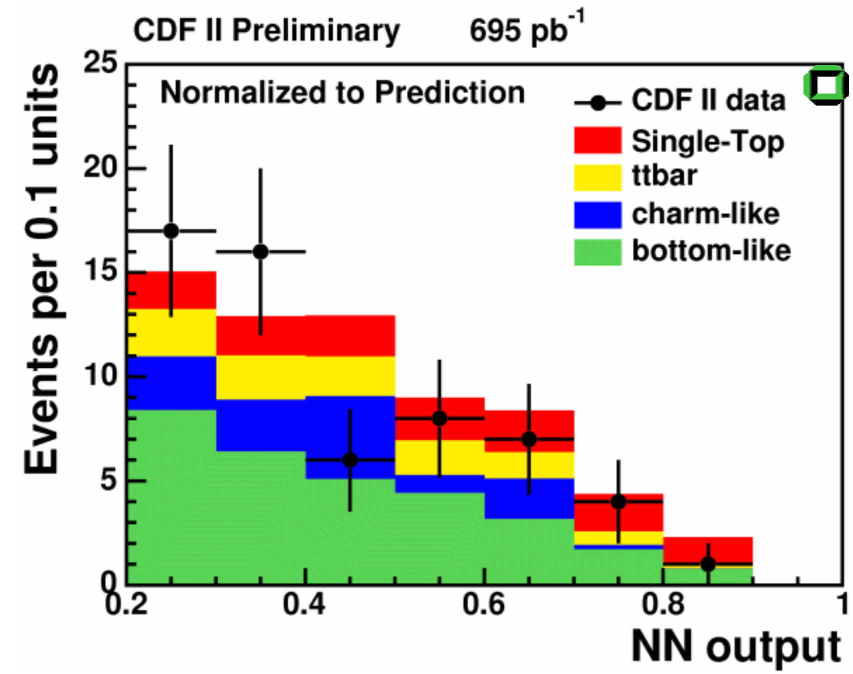


14 Variables, e.g. $Q \cdot \eta$, reconstructed top mass, top quark polarisation, Jet E_T and η, NN b Tagger-Output, W boson η



Fit of signal and background templates to CDF II data





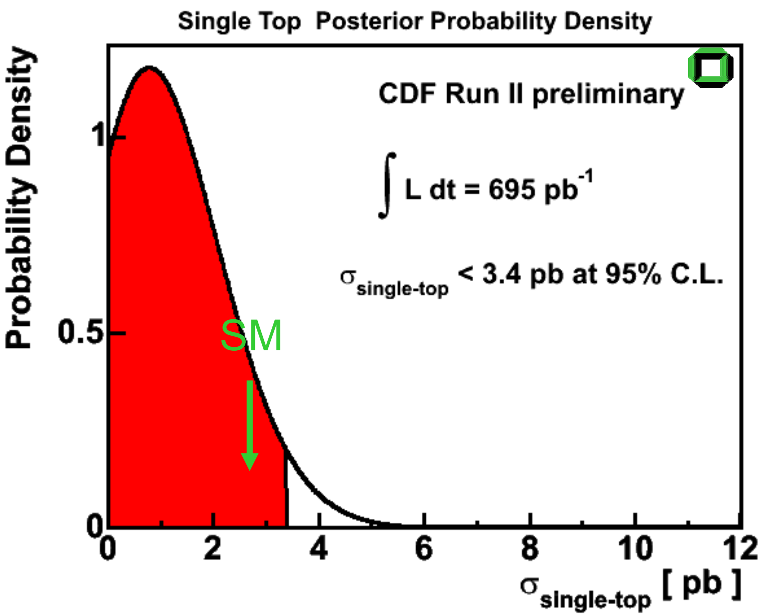
$\sigma_{Fit} = 0.8\ ^{+1.3}_{-0.8}$ (stat.) $^{+0.2}_{-0.3}$ (syst.) pb

$\sigma_{SM} = 2.9 \pm 0.4$ pb

Indication of a deficit ?

Limits

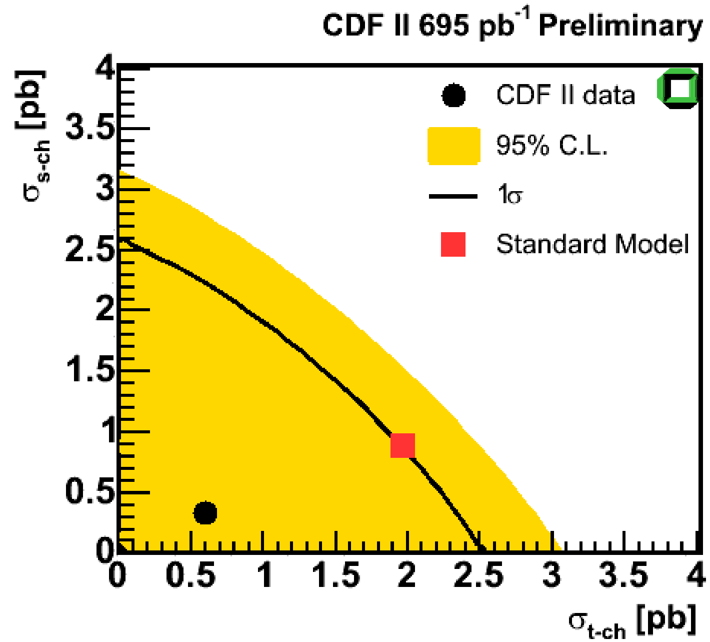
Calculation of 95% upper limits with Bayesian statistics



σ (Single-Top) < 3.4 pb

σ_{SM} (Single-Top) = 2.9 ± 0.4 pb

Separation of t- und s-channel with 2D-Likelihood

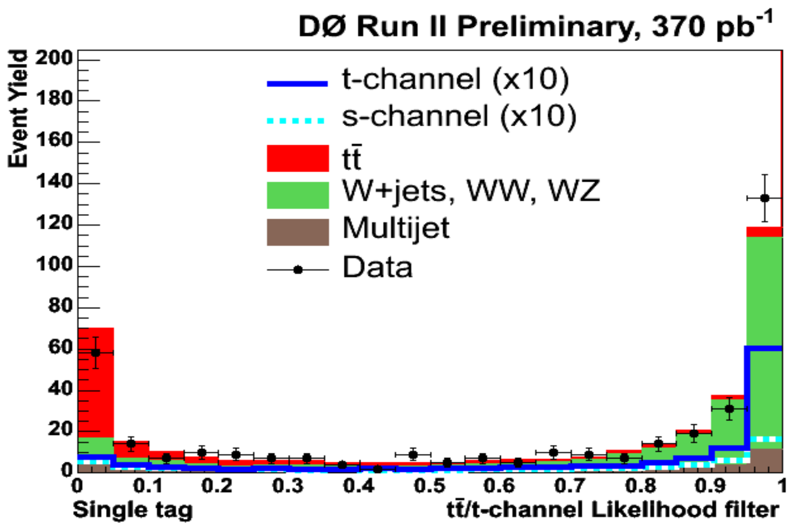


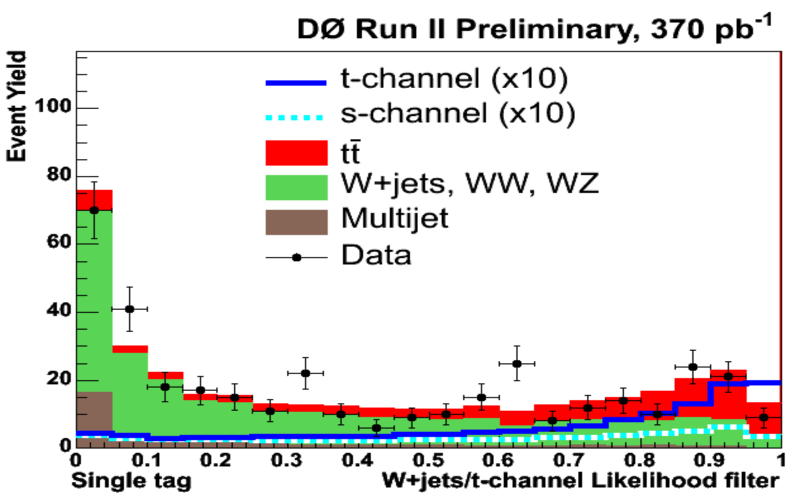
σ (t-channel) < 3.1 pb

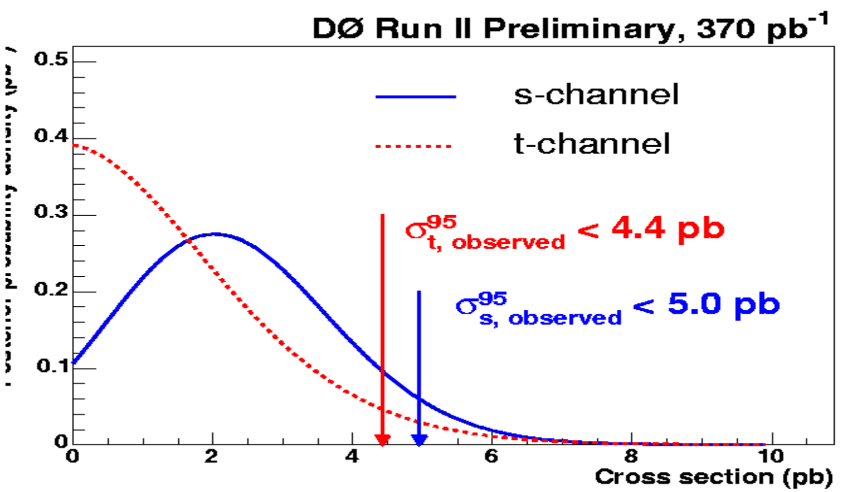
σ (s-channel) < 3.2 pb

Next steps: further background studies, search at 1 fb^{-1}

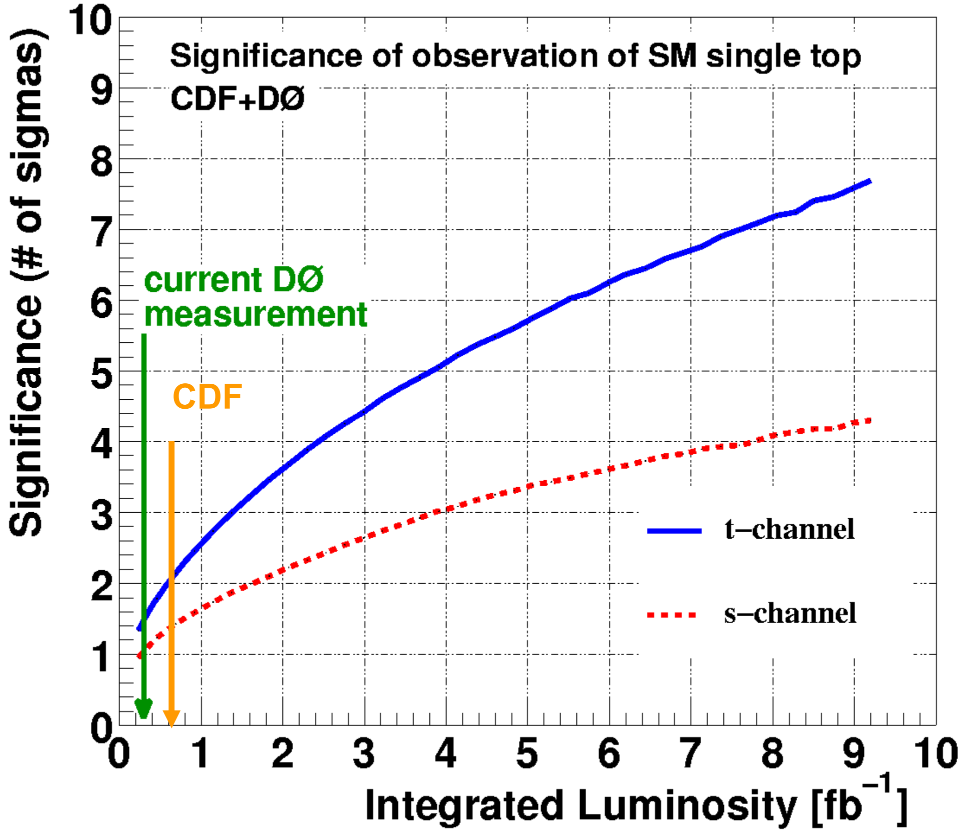
Single Top Search in D0







Projections

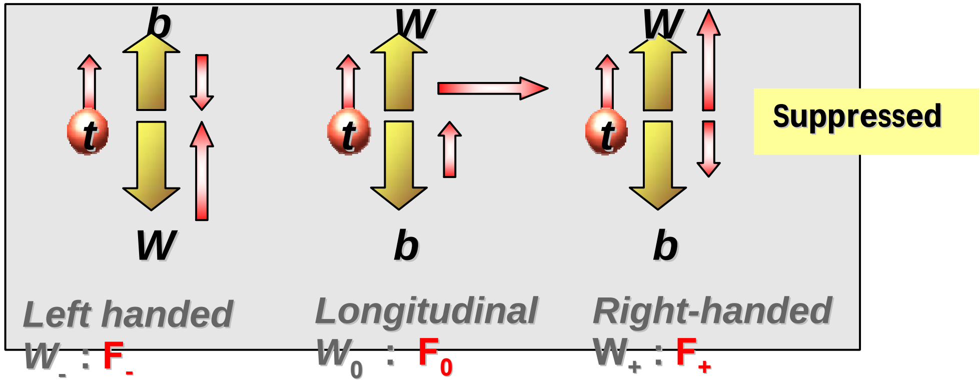


- Assume no further improvement in analysis technique, methods, and resolution:

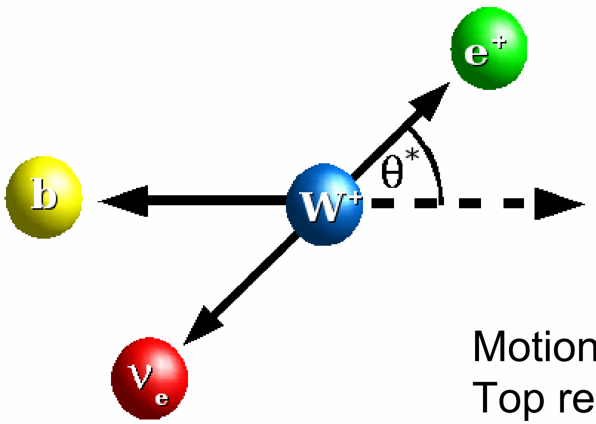
  it will take 1.5 fb^{-1} of data for each experiment to prove single top production

- Both experiments have more than 1 fb^{-1} on tape!

Three possible helicities:



$$F_0 = \frac{m_t^2}{2M_W^2 + m_t^2}$$



Motion of W in Top rest system

Distribution of Angle θ* between charged lepton in W system and W-Boson in Top-Quark system:

$$\frac{dN_{h_W=-1}}{d(\cos\theta^*)} \sim \frac{3}{8}(1-\cos\theta^*)^2$$

$$\frac{dN_{h_W=0}}{d(\cos\theta^*)} \sim \frac{3}{4}(1-\cos^2\theta^*)$$

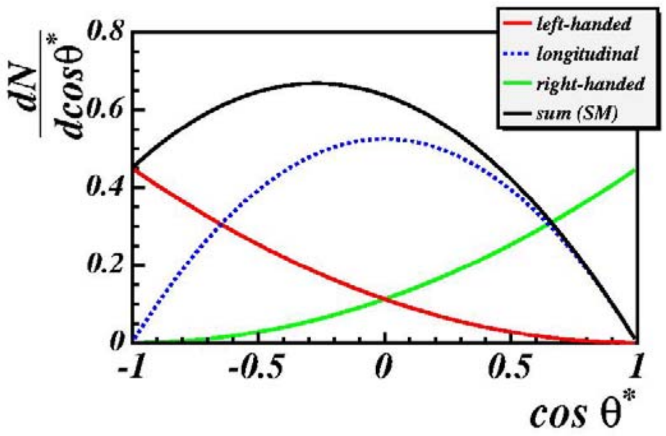
$$\frac{dN_{h_W=+1}}{d(\cos\theta^*)} \sim \frac{3}{8}(1+\cos\theta^*)^2$$

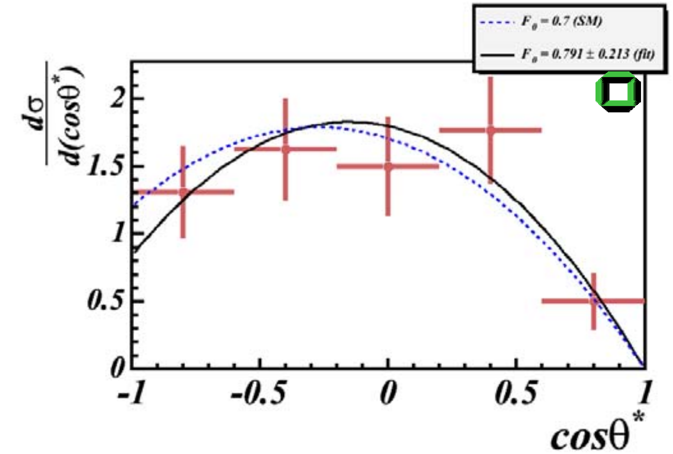
SM:

$F_- = 0.30$

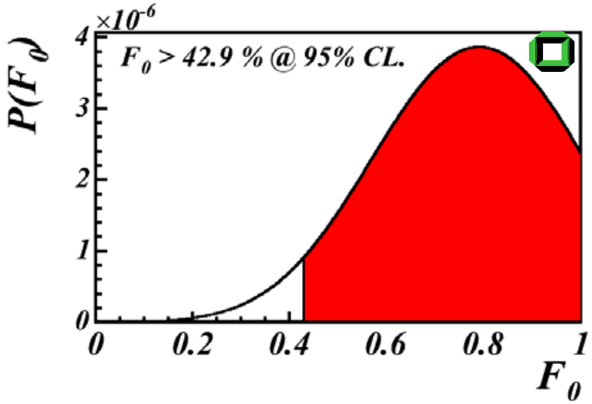
$F_0 = 0.70$

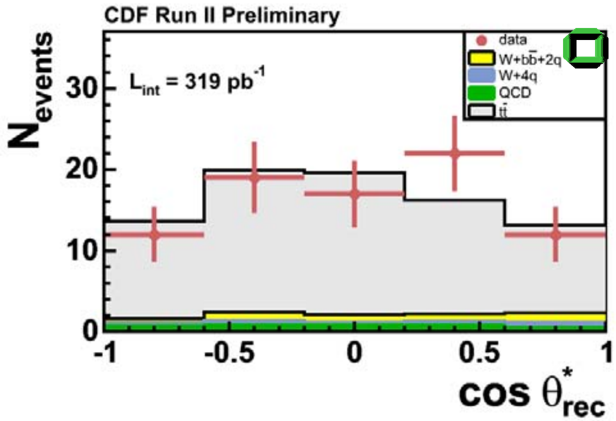
$F_+ = 0.0004$





Raw data: 85 $t\bar{t}$ lepton + jets candidates in 319 pb^{-1}





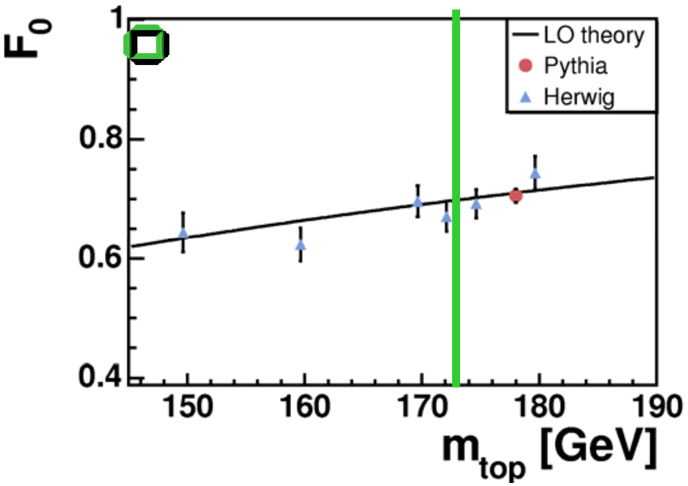
F_0 = 85+15-22 +- 6 (stat) %
F_0 > 43% @ 95% C.L.
F_+ = 5+11-5 +- 3 (stat) %
F_+ < 26% @ 95% C.L.

Next steps: analysis with 1 fb^{-1}

Expected precision ca. 15%

(At LHC 1%)

Worth looking at: mass dependence of F_0



4. TOP QUARK PROPERTIES

4.1 Mass of the Top Quark

dilepton

- Neutrino weighting ($\eta \rightarrow \varphi$) ⇨ 1-dim. fit
- Phi-weighting ($\varphi \rightarrow \eta$) ⇨ 1-dim. fit
- P_z(tt) method ⇨ 1-dim. fit
- ME weighting ⇨ 1-dim. fit
- ME method ⇨ 1-dim. fit

l+jets

- Template method in m_{top} after kinematic fit, topological or b-tag, with internal or external JES constraint ⇨ 1- or 2-dim. fit

  Matrix Element/Dynamical Likelihood Method, topological or b-tag, with internal or external JES constraint, complex analysis ⇨ 1- or 2-dim. fit

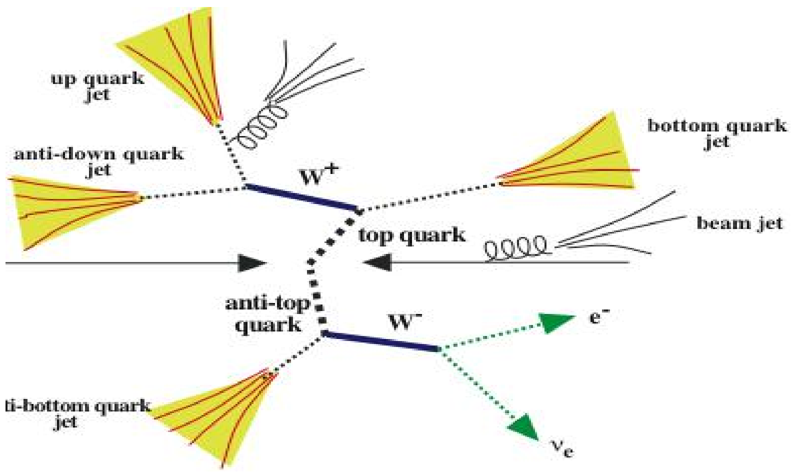
  Ideogram method (W-mass @ LEP), compare signal and background mass spectrum, chi^2 weighting (kine fit), with internal/external JES constraint ⇨ 1- or 2-dim. fit
- Decay Length Method, compare transv. Decay length spectrum with expecation from $c\tau(B) \cdot \beta(m_{top})\gamma(m_{top})$ ⇨ 1-dim. fit

alljets

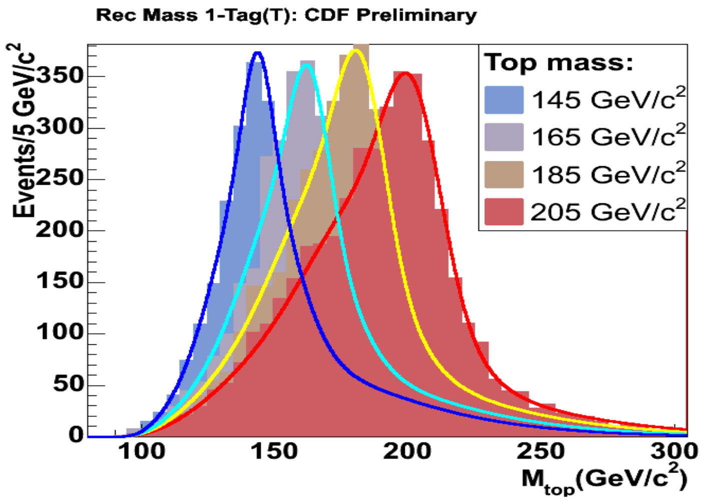
- Kinematic fit, only from Run-I ⇨ 1-dim. fit

A. Quadt, Bonn

CDF Lepton+jets Analysis

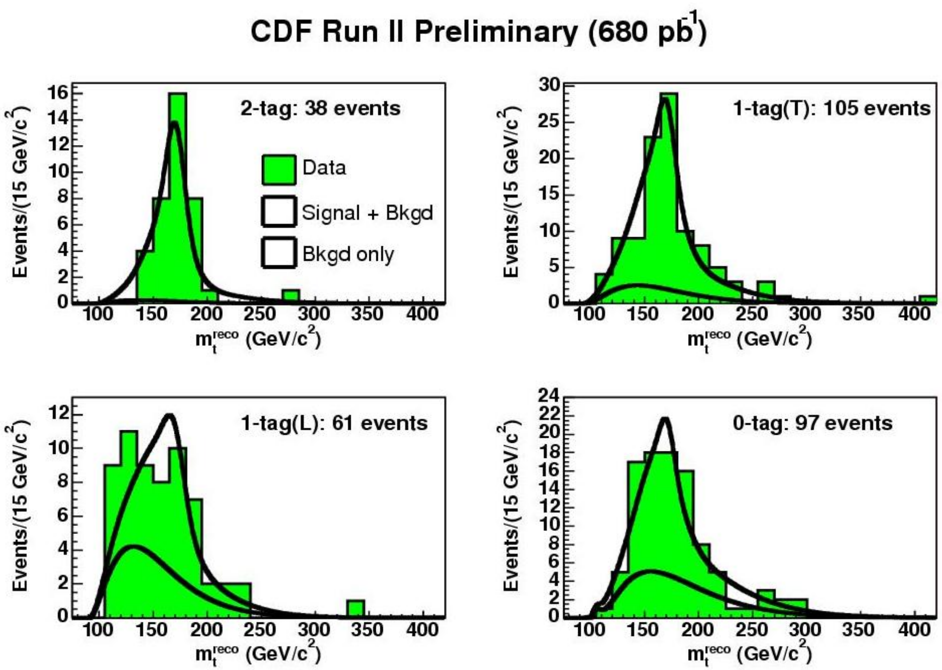


- Constrain m(jj) = m_W , m(ℓυ) = m_W and m(ℓυb) = m(jjb)
  - 24 possibilities for 0 b-tags
  - 12 possibilities for 1 b-tag
  - 4 possibilities for 2 b-tags
- Select configuration with best χ^2 fit -> obtain M_{reco}



- 2005 New: Jet Energy Calibration in situ
- Simultaneous fit to invariant mass of W->jj
- Global factor used to correct energies of jet
- Reduces systematic uncertainty

Fit four data samples (0-tag, 1-tag(Loose), t-tag(Tight), 2-tag with SecVtx tagger) in m_{top} and ΔJES, i.e. 2-dim fit :



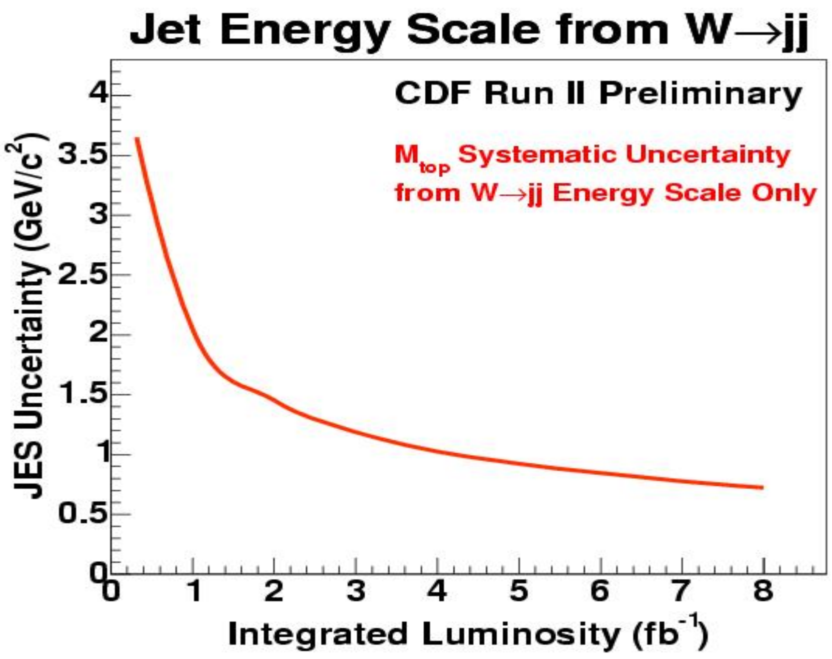
Systematic Source	ΔM_{top}
b-jet energy scale	0.6
Residual JES	0.7
Background JES	0.4
ISR	0.5
FSR	0.2
Parton Distribution Functions	0.3
Generators	0.2
Background Shape	0.5
b-tagging	0.1
Monte Carlo statistics	0.3
TOTAL	1.3

$$m_{top} = 173.4 \pm 1.7 (stat) \pm 1.8 (JES) \pm 1.3 (syst.) GeV/c^2$$

$$m_{top} = 173.4 \pm 2.8 GeV/c^2$$

Future Projection

Systematic Source	Uncertainty (GeV/c^2)
Radiation	0.7
Model	0.7
b-jet	0.6
Method	0.6
PDF	0.3
Total	1.3
Jet Energy	2.5



- Expect significant reduction in JES uncertainty with more data
- Turning JES systematic into a statistical uncertainty

Decay Length Technique

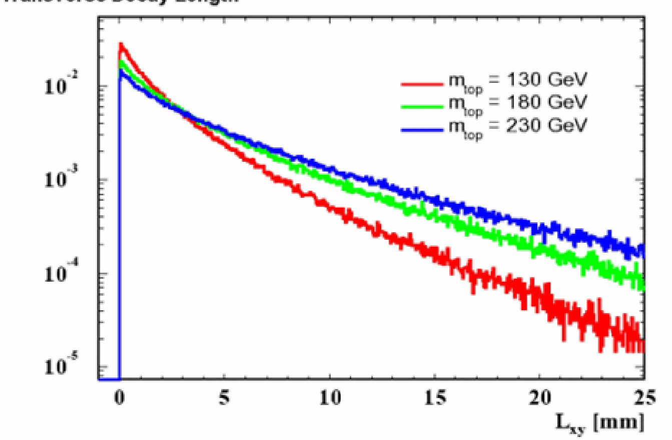
method by C. Hill *et al.* at PRD 71, 054029

- Top quarks at Tevatron produced nearly at rest
  ⇨boost of the b-quark a function of m_{top}

$$\gamma_b = \frac{m_t^2 + m_b^2 - m_W^2}{2 m_t m_b} \approx 0.4 \frac{m_t}{m_b}$$

- Measure transverse decay length of B-hadrons from top decay ⇨infer on top quark mass

Transverse Decay Length

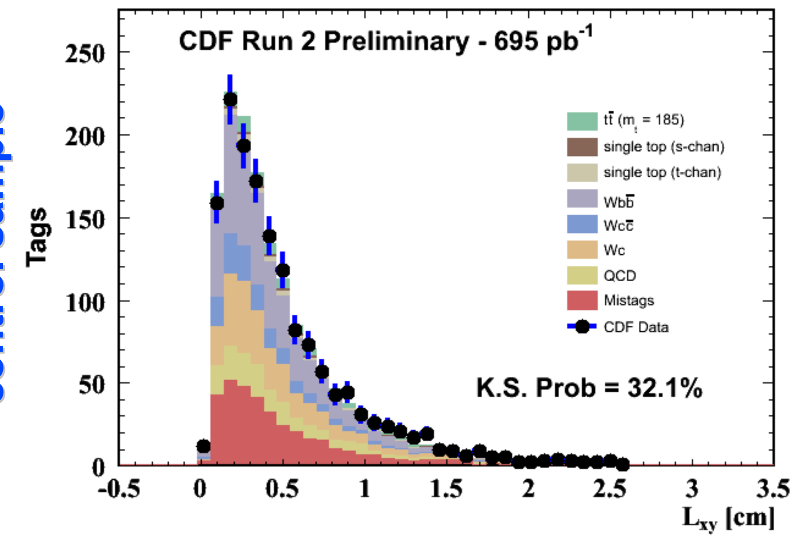


- Select l + ≥ 3 jets events with ≥ 1 SecVtx tag in 695 pb^{-1} ⇨ 456 pos. SecVtx tags in 375 events

$$m_{top} = 183.9\,^{+15.7}_{-13.9}\,(stat.) \pm 5.6\,(syst.)\,GeV/c^2$$
$$\Delta m_{top}(JES) = 0.3\,GeV/c^2$$

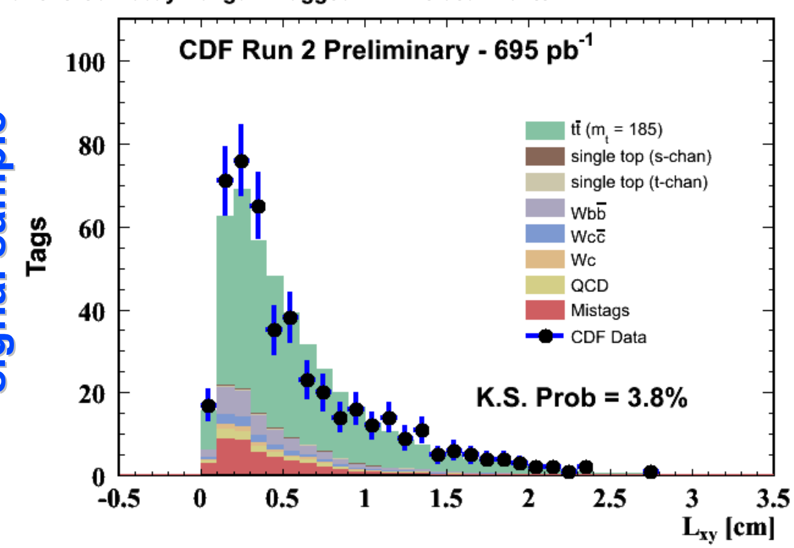
control sample

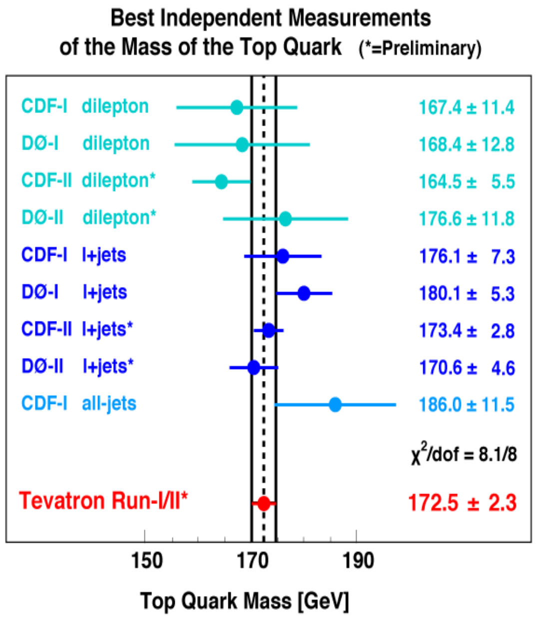
Transverse Decay Length - Tagged W + ≤ 2 jet Events

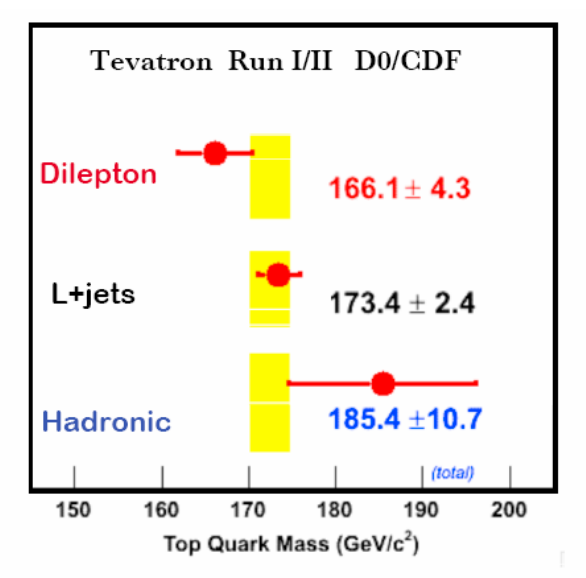


signal sample

Transverse Decay Length - Tagged W + ≥ 3 Jet Events



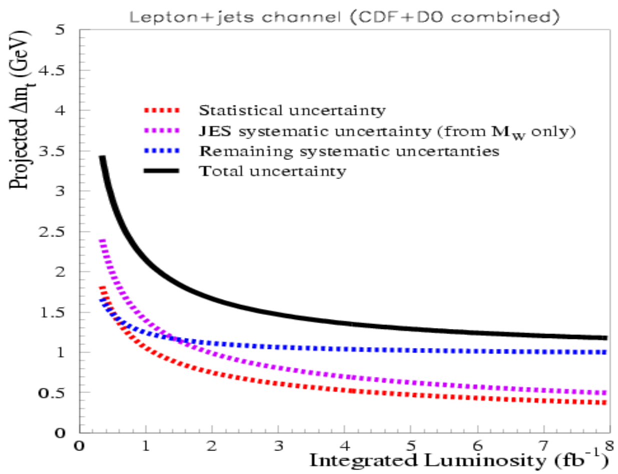




World Average:

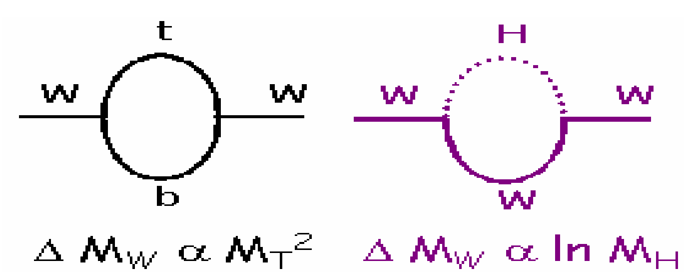
m_t=172.5 ± 1.3 (stat) ± 1.9 (syst) GeV

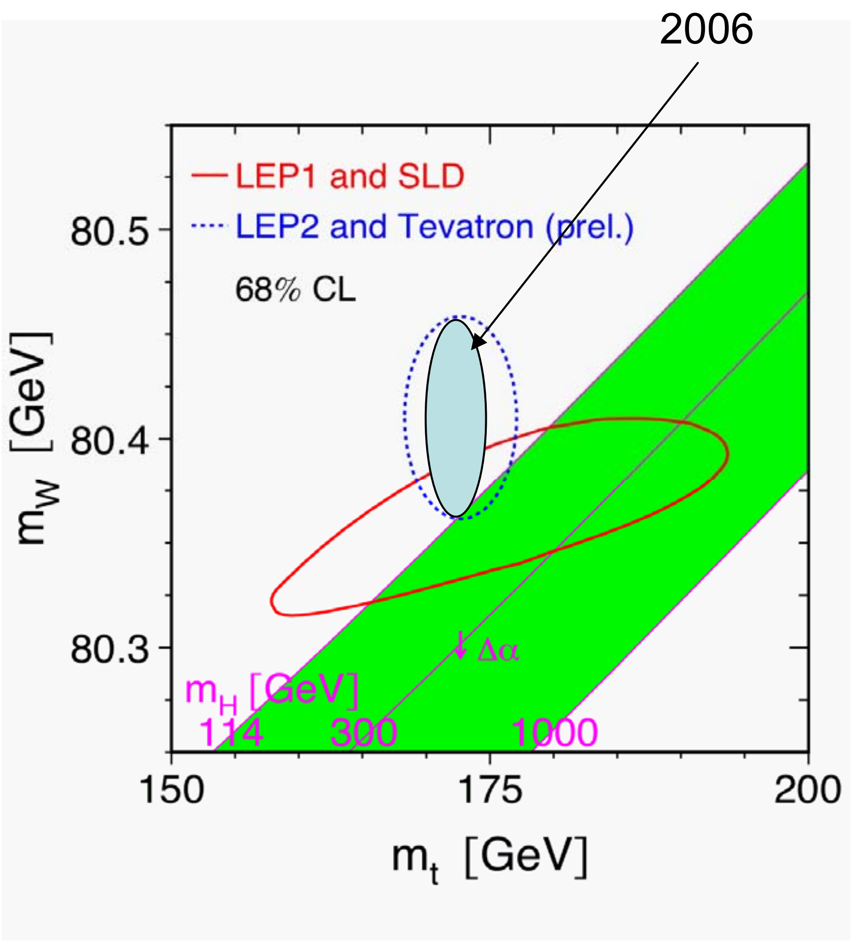
- Systematics limited!
- Precision Measurement: Δm_t~1.3%
- In the 4-8fb^{-1} future, we expect ...
  - ... ~1.5 GeV total error
  - ... dilepton to become systematics limited
  - ... all-hadronic measurements to contribute significantly



Masses of Top, W Boson and the Higgs

- Radiative corrections relate top quark mass, W boson mass
- Within SM, they allow to place a constraint to the mass of the Higgs

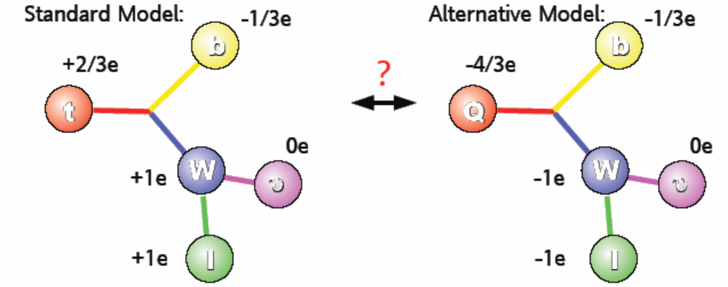




Did we find the Standard Model Top ?

W.-F. Chang et al.,Phys. Rev. D 59, 091503 (1999), (hep-ph/9810531):
exotic doublet of quarks $(Q1, Q4)_R$ with charges (-1/3,-4/3) and M ~ 175 GeV

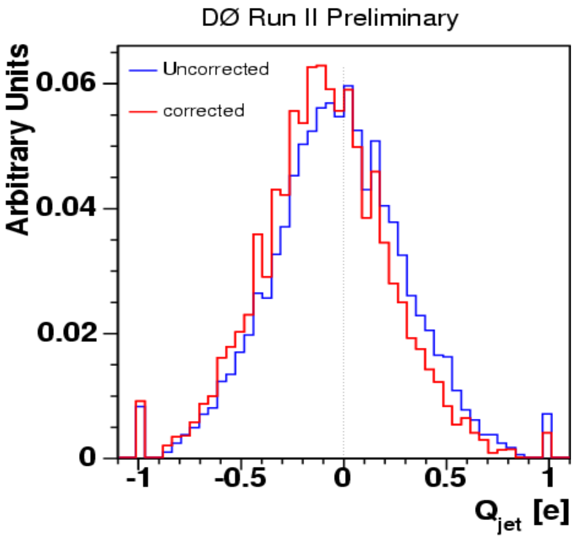
q = -4/3 is consistent with EW data (E. Ma et al. , hep-ph/9909537)



Search by D0:

Lepton+jets, double b-tag events
Determine:

- charge of W (lepton)
- pairing between W and b (χ^2 fit)
- flavor of b-jet

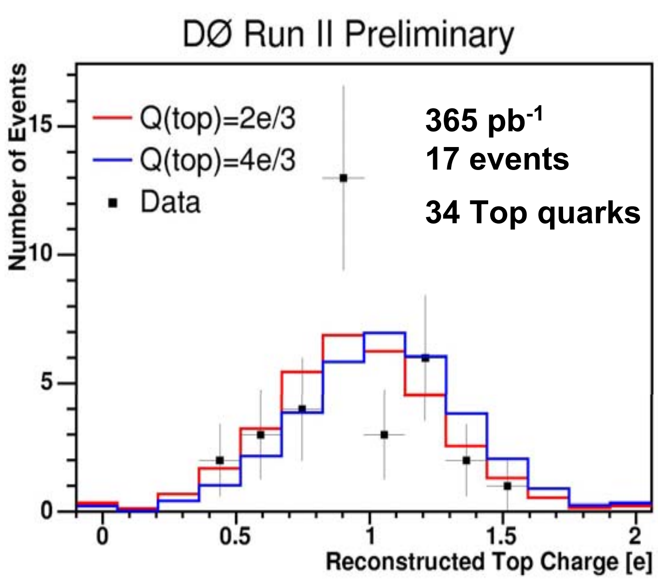


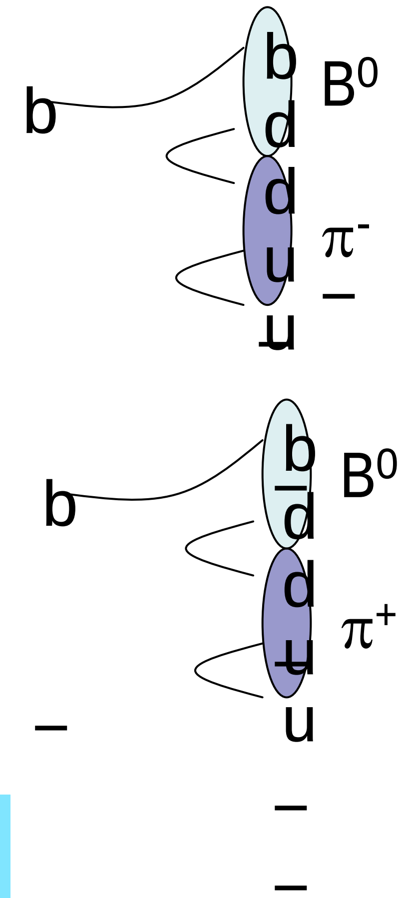
Calibration with a b-jet sample

- 17 candidate events with two tagged b-jets, lepton, missing E_T, ≥ 4 jets.
- two entries per event for top and anti-top.
- discriminate b and bbar with jet charge algorithm,

$$q_{jet} = \frac{\Sigma_i q_i \, p_{Ti}^{0.6}}{\Sigma_i \, p_{Ti}^{0.6}}$$, pT > 0.5 GeV & $\Delta R < 0.5$.

- calibrate Monte Carlo with data using two jet heavy flavor sample with opposite jet tagged with μ charge.





$Q_{top,1} = | \; q_l + q_{,b(l)} \; |$
$Q_{top,2} = | -q_l + q_{,b(j)} \; |$

Excluded Q=4/3 with 94%CL

4.3 Top Lifetime

- Within the SM: τ_{top} ~5 10^{-25} s ($c\tau$ = 3 10^{-10} μm)
- Use d_0-lepton impact parameter with respect to beamline
- Determine detector resolution from $Z^0/\gamma \to e^+e^-/\mu^+\mu^-$

$$\tau_{top} \propto \left(\frac{M_W}{M_{top}}\right)^3$$

$$\tau_{top} \approx 4.7 \cdot 10^{-25}\ \mathrm{s}$$

Data:

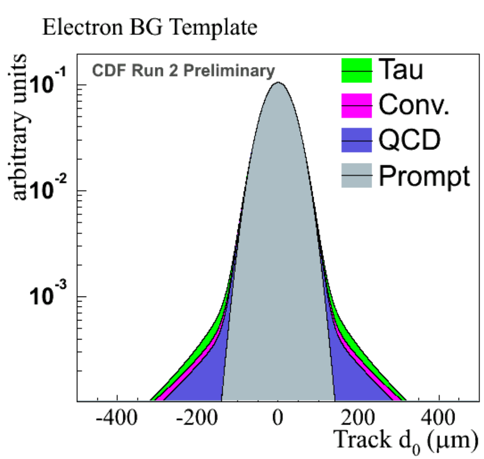
lepton + ≥ 3 jets with ≥1 b-tag in 318 pb-1

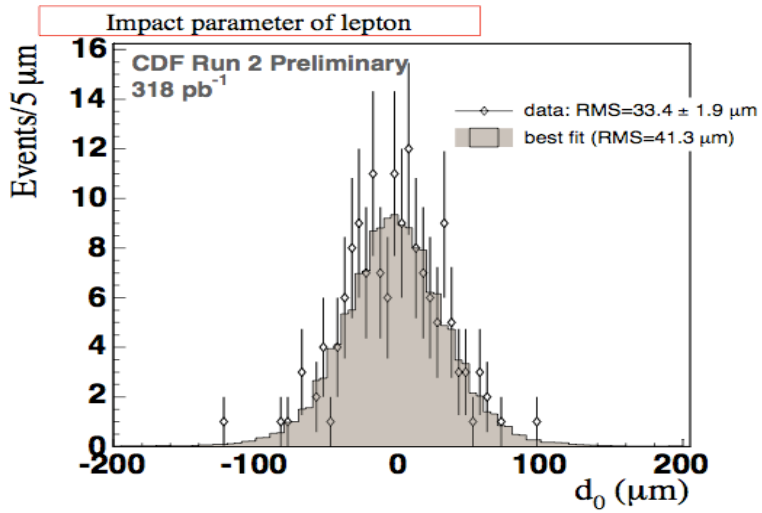
⇨97 e+jets candidates

⇨60 μ+jets candidates

measure impact parameter d_0 for lepton tracks

use max. likelihood fit with templates of variing lifetime (incl. track resolution)





$c\tau$ < 52.5 μm with 95% CL

5. OUTLOOK : TOP AT THE LHC

The LHC will be the Top factory !

in 10 fb^{-1}:

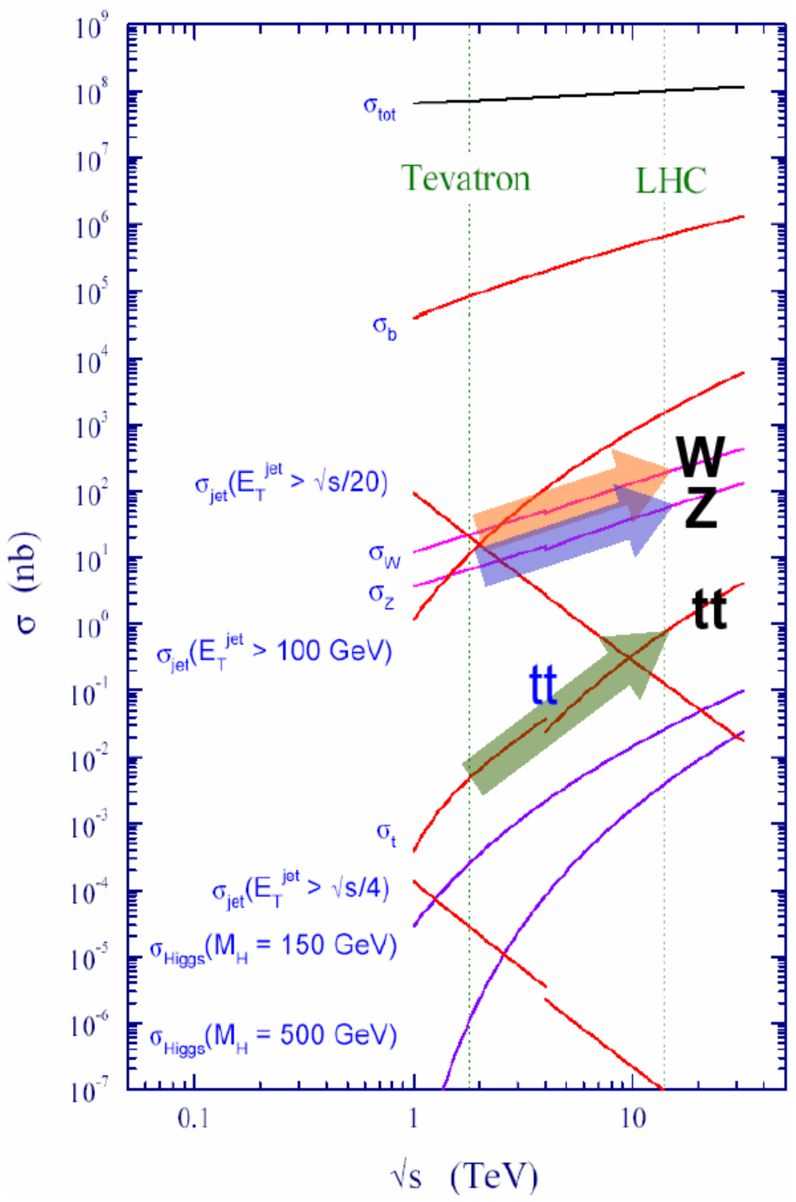
$8 \cdot 10^6$ top-pairs (1 Hz)

$2 \cdot 10^6$ single top events

Precision measurements:
Mass, Couplings,
Spin correlations

Means of calibration:
Lepton ID, b- Jet Identification,
Jet-Energy scale

Main Background for many searches

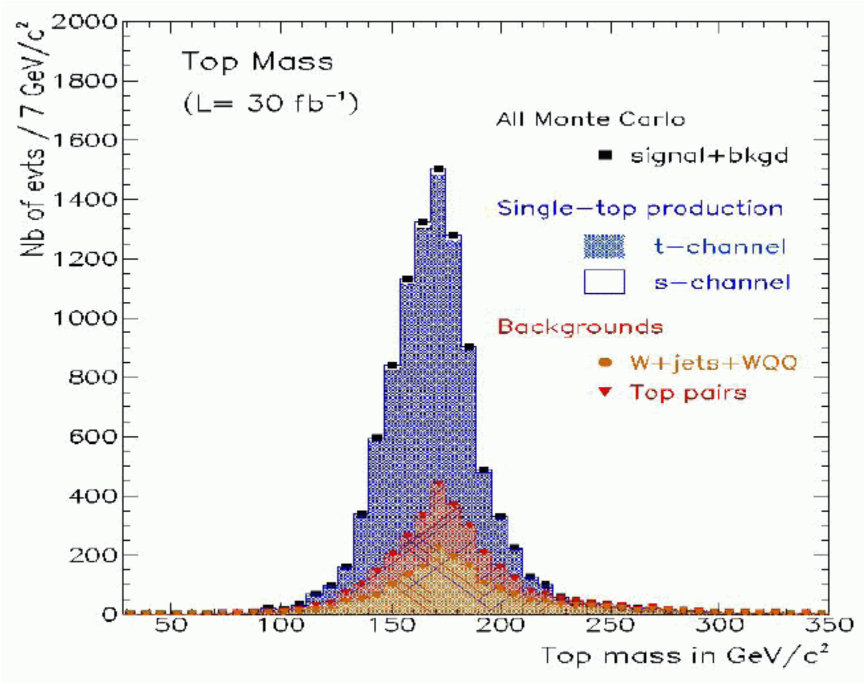


5.1 Single Top Quark Production at the LHC

Tevatron:

- First observation
- Precision of $|V_{tb}|$ O(10%)

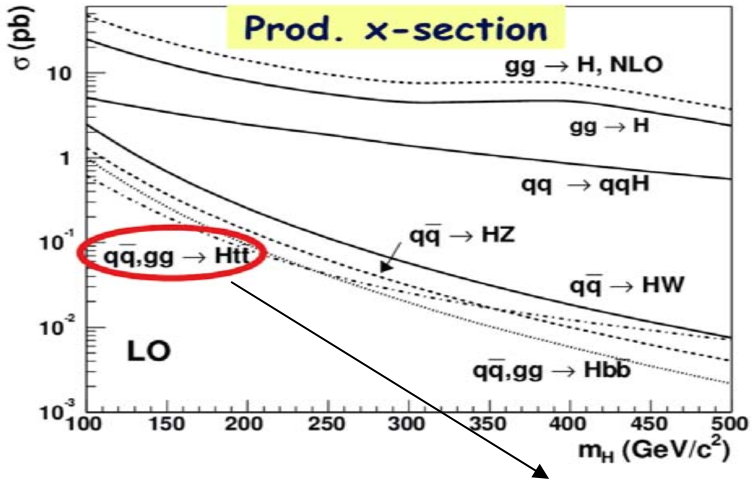
Single Top study by ATLAS



LHC:

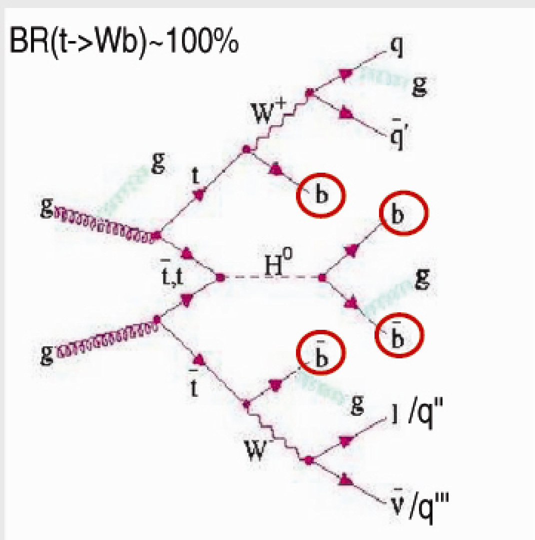
- Cross Section x 100
- W+Jets background smaller
- Larger acceptance for leptons, jets in detectors
- Already with 1 fb^{-1} precision of $|V_{tb}|$ O(2%); limited by systematics

5.2 Sensitivity for $t\bar{t}H$ with CMS



σ = 0.664 pb (NLO, m_H =120 GeV)

40×10^3 with 60fb^{-1} integrated luminosity



Very challenging topology:

- **4 b jets** from top and Higgs decays
- Depending on W decays:

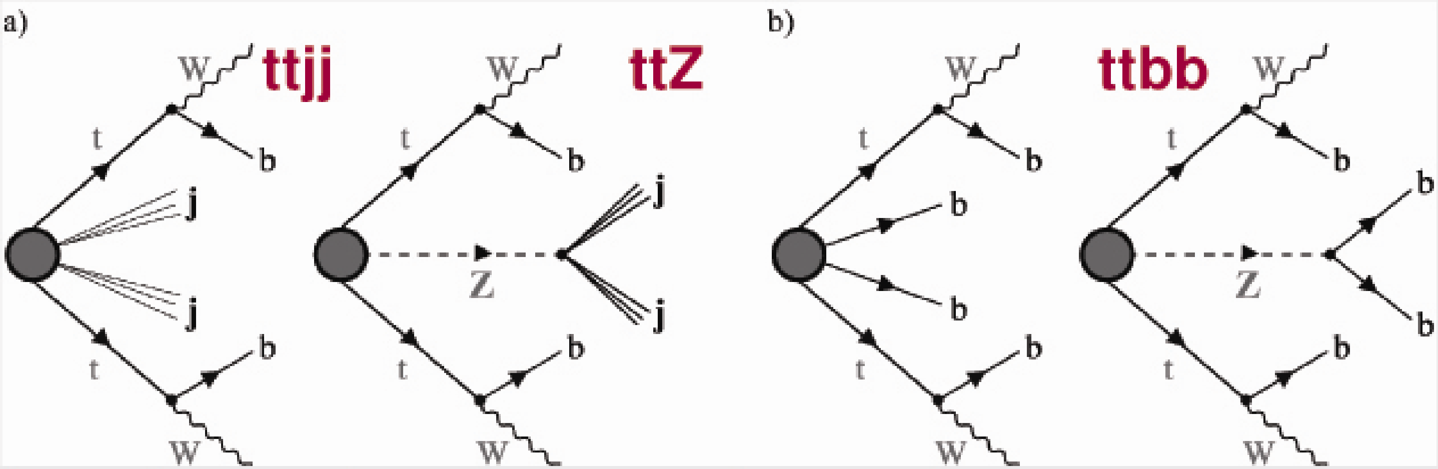
➔ **Semi-leptonic channels (~28%):**
2 light jets +Isolated lepton (e/μ) + Missing Energy

➔ **Di-lepton channel (~6% including $\tau \to e/\mu\nu\nu$):**
2 isolated leptons (e/μ) + Missing Energy

➔ **Fully-Hadronic channel (~49%):**
4 light jets + 4 b jets (very difficult!!)

- additional jets from gluon radiations

ttH, H->bb: Backgrounds



σ	507 pb	0.65 pb	3.28 pb	(leading order)
Exp. Ev. @60fb-1				
	30×10^6	40×10^3	20×10^3	
Simu. Ev.	1.4×10^6	123×10^3	450×10^3	

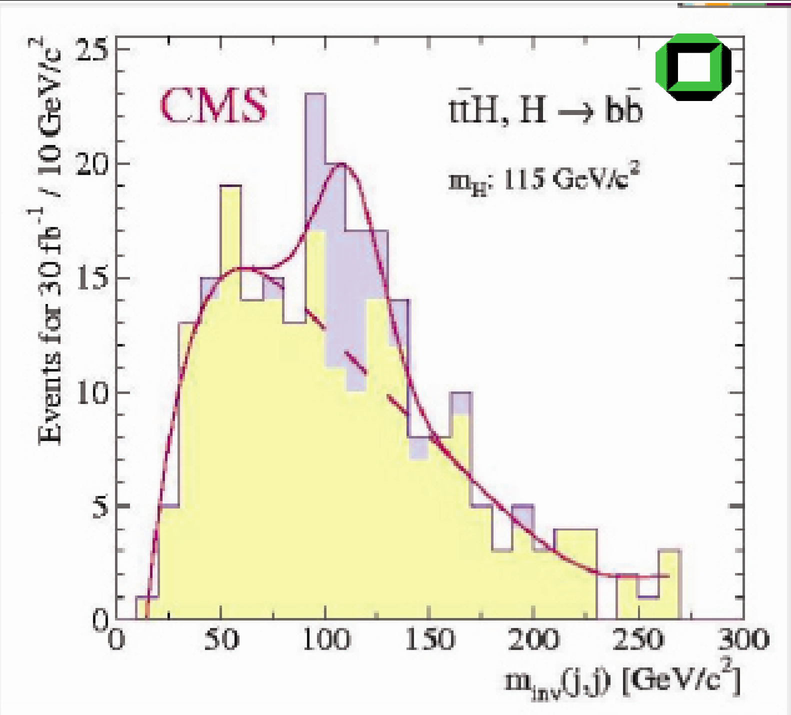
- **ttbb** irreducible background => almost same topology as the signal
- **ttjj** turned out to be the most dangerous background:
  - cross-section $O(10^4)$ higher than signal cross-section and c-mistagging rate.

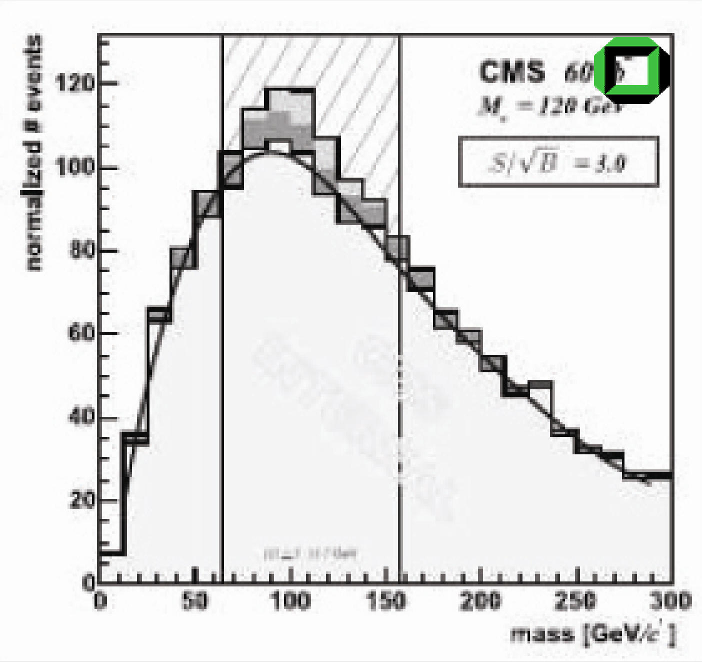
CMS Note 2001/054

Fast Simulation and very optimistic b-tag

S/sqrt(B)~3 @ 30 fb-1 and

mH = 115 GeV in the mass window





CMS Internal Note 2004/048

Fully Simulation and optimistic Btag in ttjj events

S/sqrt(B)~3 @ 60fb-1

and mH=120 GeV in the mass window

Next steps: Background simulations (Comphep/Pythia ->ALPGEN)

Jet-, Lepton-, MET- Reconstruction

Only method to determine Y_t !

CONCLUSIONS

So far, CDF, D0 have "seen" O(100) fully reconstructed $t\bar{t}$ pairs

- Strong production measured to O(10%) – now looking for higher order QCD effects
- Electroweak production not yet found: still need patience!
- Decay SM; V-A O(20%)
- Properties SM – will reach limit in mass accuracy at < 1%
- The Top Quark opens the door to Physics at new scales; however: no evidence for non-standard effects so far
- LHC will be giant step forward; ultimate precision by ILC

Acknowledgements:
Help, advise and transparencies from DO / Arnulf Quadt
CDF / Wolfgang Wagner and the Karlsruhe Top group

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