

CMS Top Physics at DESY

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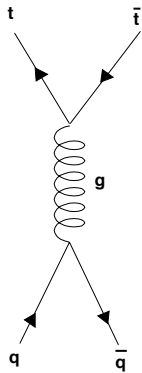
DESY Hamburg

Low luminosity phase with

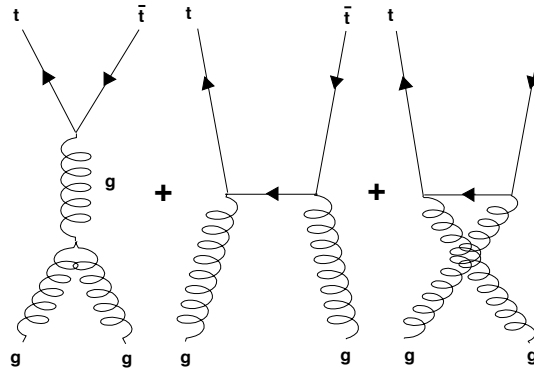
$$10^{33} \frac{s}{cm^2} = 1 \frac{s}{nb}$$



200 W-bosons
50 Z-bosons
1 tt-pair **per second!**

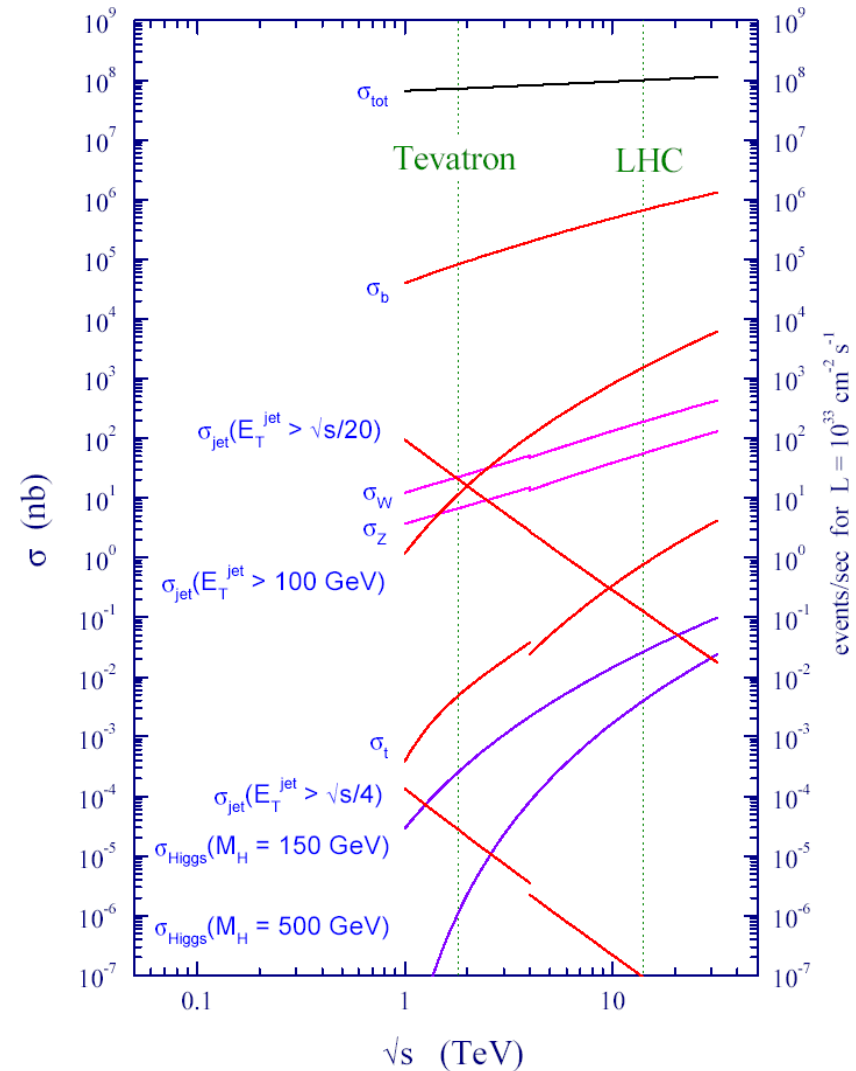


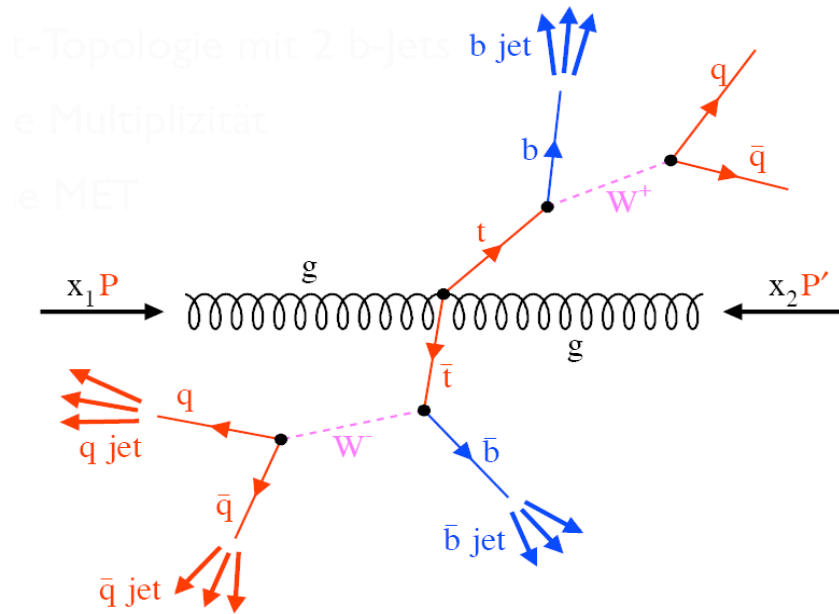
13 %
quark annihilation



87 % gluon fusion

proton - (anti)proton cross sections



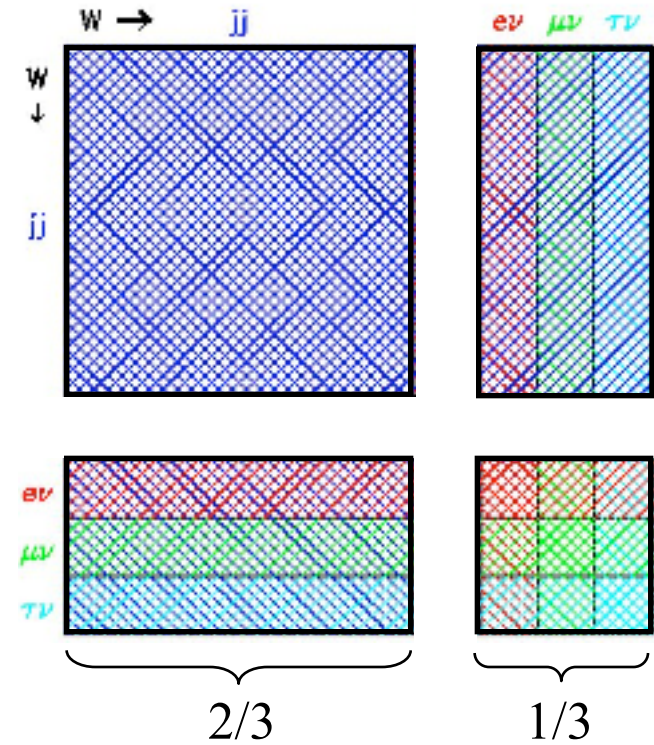


$$\text{BR}(t\bar{t} \rightarrow bW^+ \bar{b}W^-) \sim 100\%$$

$$\text{BR}(W^+W^- \rightarrow l\bar{\nu}l\nu) \sim 11\%$$

$$\text{BR}(W^+W^- \rightarrow q\bar{q}q\bar{q}) \sim 45\%$$

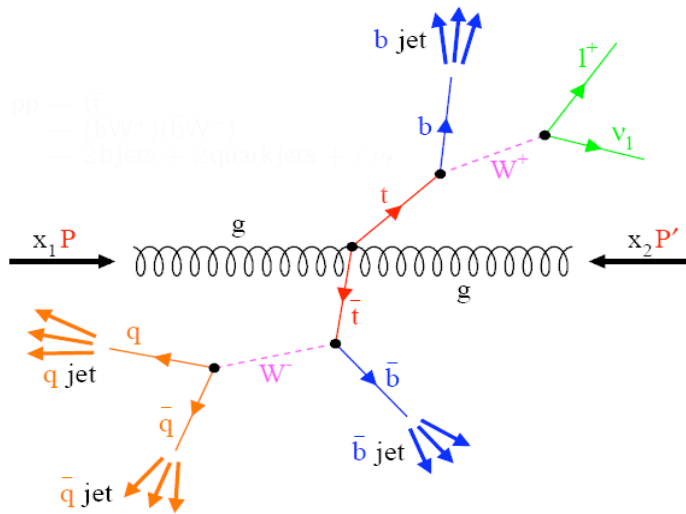
$$\text{BR}(W^+W^- \rightarrow q\bar{q}l\nu) \sim 44\%$$



Event Selection for

$$t\bar{t} \rightarrow b\bar{b}q\bar{q}l\nu$$

(Christoph Rosemann)



- 44 % decay in the semileptonic channel
- one charged lepton
- two b-jets
- two non-b jets

**combination of
“easy” tag and high statistics**



- Good channel for measuring cross section

$$\sigma(t\bar{t})$$

- Differential cross sections could be possible as well

$$\frac{d\sigma}{dp_t} \quad \frac{d\sigma}{d\eta} \quad \frac{d\sigma}{dm_{t\bar{t}}}$$

- Allows SM checks
- Do our pdfs work?

$$\sqrt{s_{pp}} = 14 \text{ TeV}$$

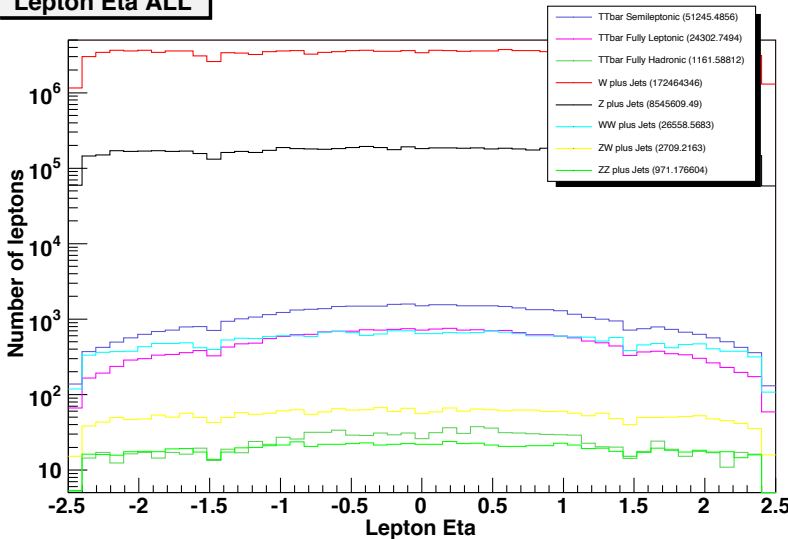
$$x = 0.005$$

$$Q^2 = 350^2 \text{ GeV}^2$$

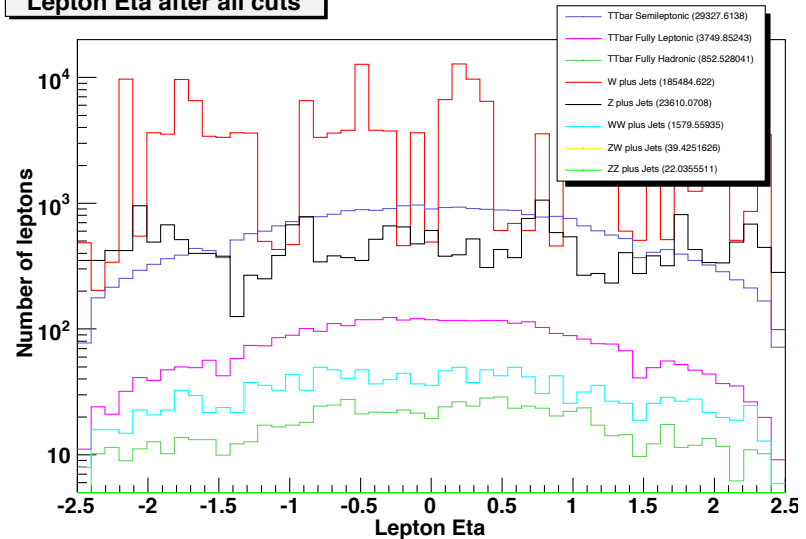
Cross sections need very clean studies of systematic effects!

**For instance:
how affect the selection criteria
the phase space?**

Lepton Eta ALL



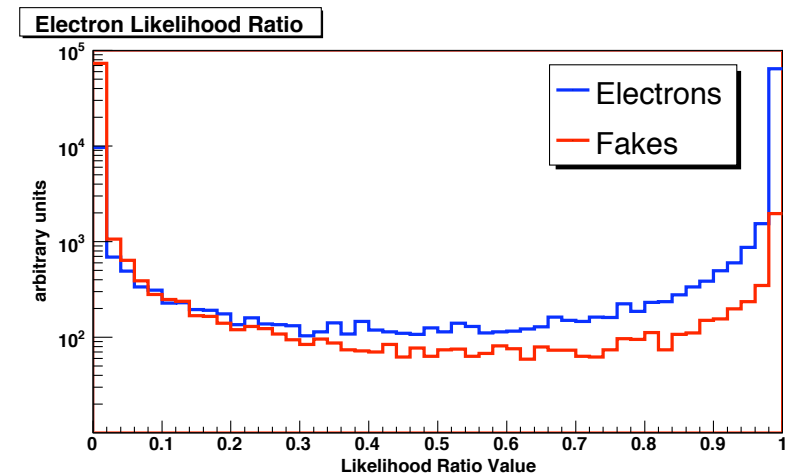
Lepton Eta after all cuts



$$S/N = \frac{1}{6000} \rightarrow S/N = \frac{1}{7}$$

Electron Identification

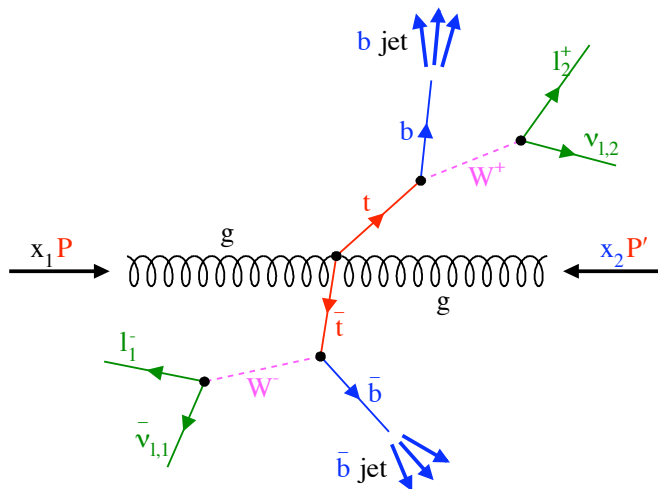
- ID plays an important role for counting measurements
- Working on likelihood for electron ID
- Already a good performance
- **Will go into official e/gamma reconstruction**



Spin-Spin Correlation in

$$t\bar{t} \rightarrow b\bar{b}l\bar{\nu}l\nu$$

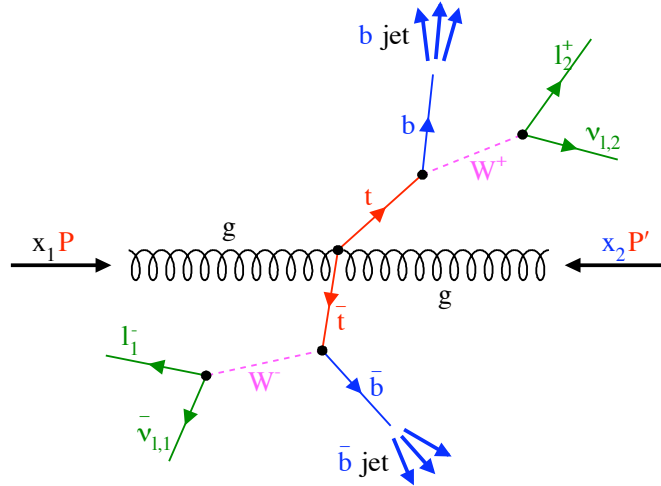
(Benedikt Hegner)



- short decay length (about 1 fm)
- decays before hadronisation/ spin flip
- spin measurement possible (top is the only “bare” quark!)
- spin state strongly correlated to production mechanism
- dileptonic channel has strongest “signal”

$$\frac{1}{N} \frac{dN}{d \cos \theta_{\pm}} = \frac{1}{2} (1 + \kappa_f \cos \theta_{\pm}) .$$

f	ℓ^+, \bar{d}, \bar{s}	ν_{ℓ}, u, c	b	W	low energy q, \bar{q}
κ_f	1	-0.31	-0.41	0.41	0.51



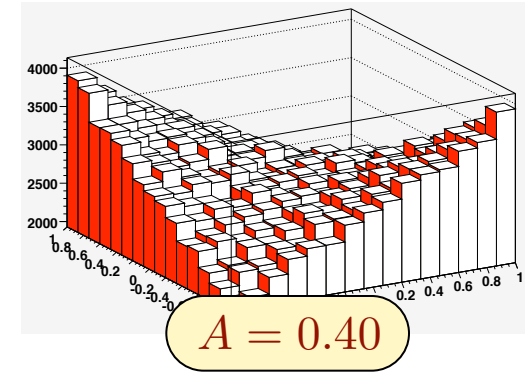
Asymmetry Factor

$$\mathcal{A} = \frac{N(t_L \bar{t}_L + t_R \bar{t}_R) - N(t_L \bar{t}_R + t_R \bar{t}_L)}{N(t_L \bar{t}_L + t_R \bar{t}_R) + N(t_L \bar{t}_R + t_R \bar{t}_L)}$$

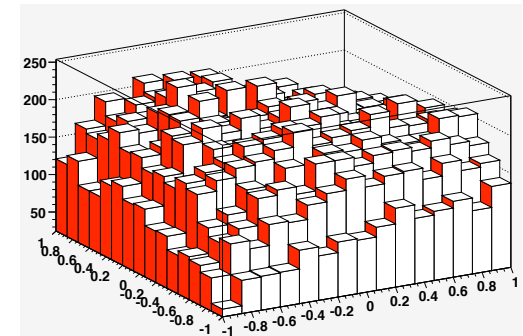
Angular Distribution

$$\frac{1}{N} \frac{d^2 N}{d \cos \theta_{\ell^+}^* d \cos \theta_{\ell^-}^*} = \frac{1}{4} (1 - \mathcal{A} \cos \theta_{\ell^+}^* \cos \theta_{\ell^-}^*)$$

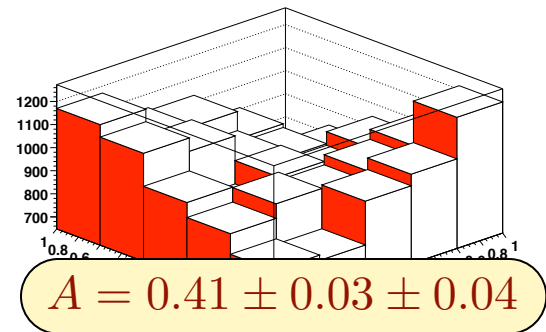
TopReX information



after simulation and reconstruction



after correction for acceptance and migration



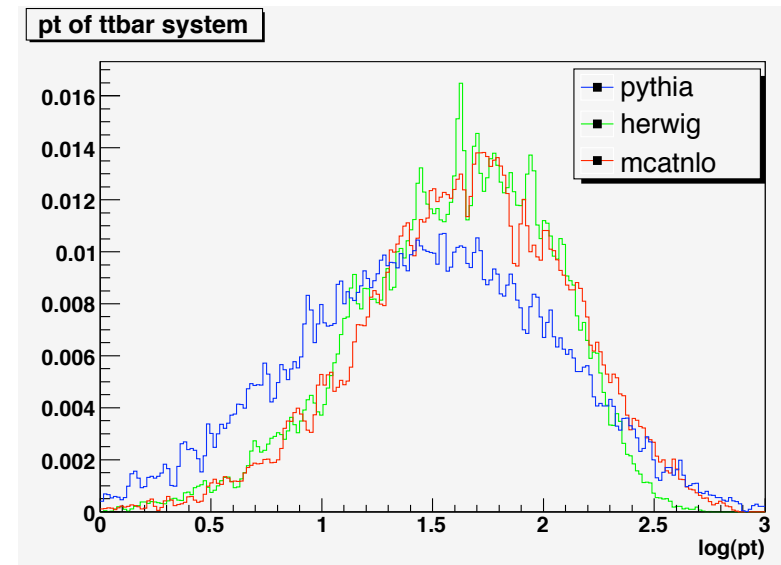
NLO Studies for Channel

$$t\bar{t} \rightarrow b\bar{b}q\bar{q}l\nu$$

(Alexander Floßdorf)

(N)LO Studies of Top-Pair Physics

- MC@NLO, Herwig, Pythia
- ALPGEN coming soon
- Currently production of data samples
- First comparison studies performed
- Cross section
490pb (Pythia) vs. 842 pb (MC@NLO)



Generator Studies for Channel

$$t\bar{t} \rightarrow b\bar{b}q\bar{q}l\nu$$

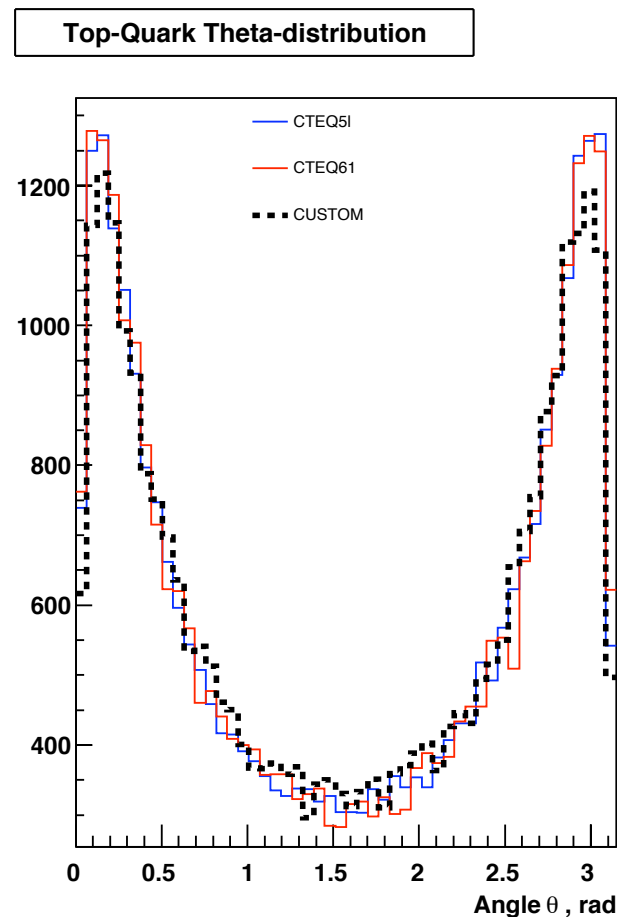
(Markus Marienfeld)

Generator Studies of Top-Pair Physics

- Influence of different Pythia parameters
- e.g. Hadronization parameters

Possible long term goals

- Comparison of different pdfs with input from HERA
- Cascade (Hannes Jung)
- Full simulation





Thanks for your attention!