

EW/QCD Karlsruhe: Plans

2006^a

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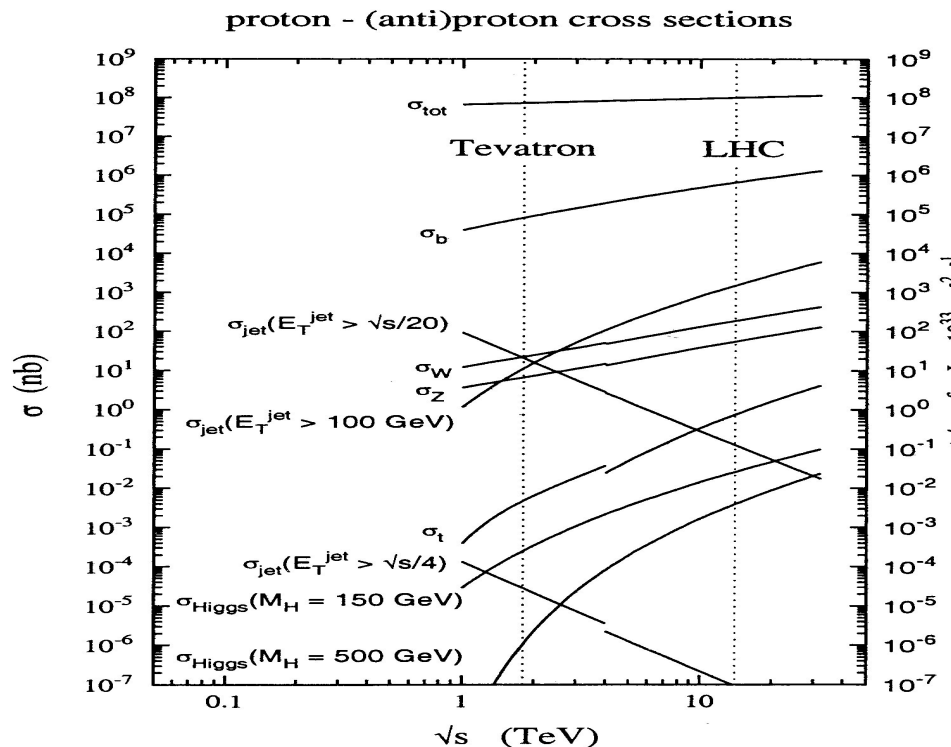
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March 8, 2006

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1 Main tasks and activities

- Understanding of CMS detector with SM physics via W and Z bosons production through their leptonic decays
- How accurate can we measure the Z (W) cross sections or do we have high-precision luminosity monitors from hard scattering processes of the partons inside the protons?



Example: $Z \rightarrow \mu \mu$, $\sigma_{\mu\mu} \simeq 1.865 \text{ nb}$, $\epsilon_{total} \approx 0.5$

Luminosität	L $[cm^{-2} s^{-1}]$	N per day	N per year
very low	$3 \cdot 10^{28}$	≈ 3	≈ 832
low	$2 \cdot 10^{31}$	≈ 1600	$\approx 0.6 \cdot 10^6$
startup	$1 \cdot 10^{33}$	$\approx 0.8 \cdot 10^5$	$\approx 3 \cdot 10^7$

Use for tracker and muon system alignment and calorimeter calibration. Z events are setting the lepton energy and lepton momentum scales.

2 Strategy e.g. for $pp \rightarrow Z/\gamma \rightarrow \mu^+ \mu^-$

$$\sigma \left(pp \rightarrow Z/\gamma \rightarrow \mu^+ \mu^- \right) = \frac{N_{cand} (1 - f_{bb} - f_{cosmics}) (1 - f_{\tau\tau}) (1 - f_{W \rightarrow \mu\nu})}{\epsilon_{total} \int L dt} \quad (1)$$

f_i : Fraction of candidate evts attributed to $b\bar{b}$, cosmic μ , $Z \rightarrow \tau\tau$, and $W \rightarrow \mu\nu$. ϵ_{total} : Eff. of selection cuts and det. acceptance.

Background:

- f_{bb} from data (e.g. # of like sign μ events)
- $f_{cosmics}$ from data (e.g. time info !?)
- $f_{W \rightarrow \mu \nu}$ from data (e.g. # cand. evts with more than one μ)
- $f_{\tau\tau}$ difficult (e.g. from MC) but small !?
- ϵ from data (tracking-, μ identification-, and trigger efficiency...)

$$\epsilon_{total} = \epsilon_{MC}^{eff} \epsilon_{other}$$

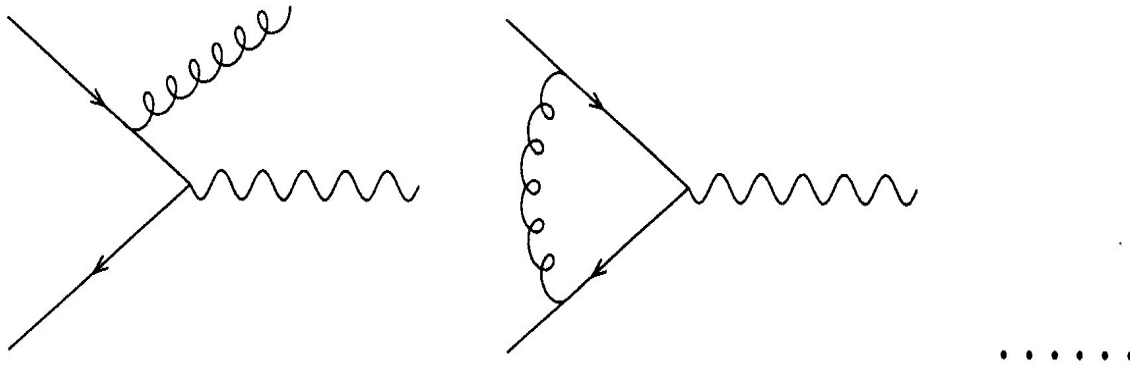
For ϵ_{MC}^{eff} model and PDFs !

Currently using MC@NLO (Frixione, Webber) with full CMS detector simulation.

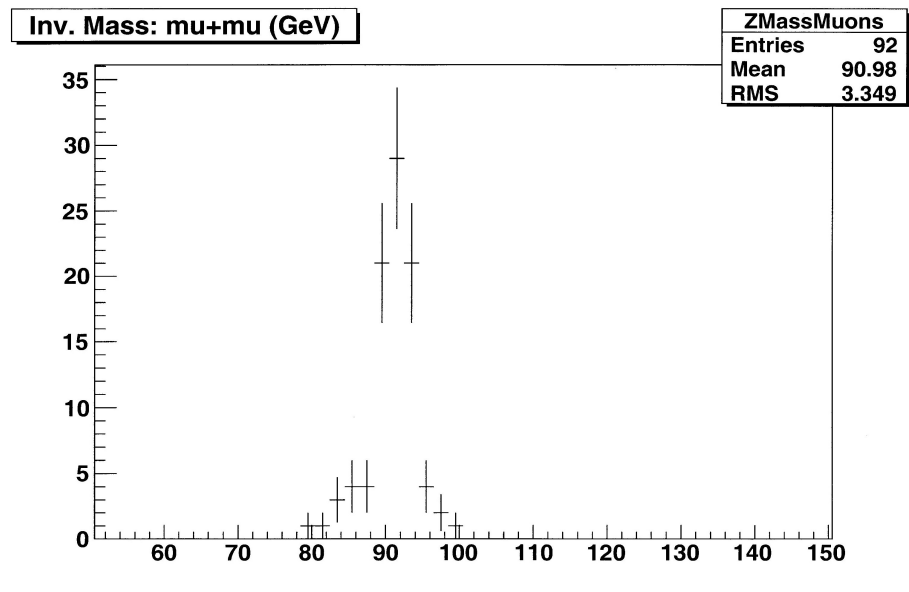
Similar analysis for $\sigma(pp \rightarrow W \rightarrow \mu \mu)$

Other final states e.g. $e^+ e^-$.

MC@NLO computes **all NLO diagrams** before starting the shower



...use **Herwig** for showering...do **full CMS-Detector**



3 Near Future

- Starting point: MC@NLO+Herwig+Full Detector MC
- Next: Study cross sections for W and Z production for different PDFs to get rid of uncertainties. Use W and Z-bosons events simultaneously to determine the luminosity.
- Try to get a second NLO generator or check single amplitudes in MC@NLO
- Currently 1-2 FTE