Characteristics of SM events
Multiple interactions
Dijet cross sections

Event Characteristics at 200 TeV
Is about 0.3 pb

For a pT cut of 10 TeV, the LO dijet cross section

\[ E_{\text{min}} (\text{GeV}) \]

\[ \gamma S = 200 \text{ TeV} \]

Dijet Cross Section vs pT Cut
For $L \approx 10^{3.4} \text{ cm}^2 \text{s}^{-1}$ and 25ns bunch spacing,

\[ \text{Bunch spacing (ns)} \]

\[ \text{Number of Multiple Interactions} \]

\[ L = 10^{3.4} \text{ cm}^2 \text{s}^{-1} \]

\[ L = 10^{3.3} \text{ cm}^2 \text{s}^{-1} \]

\[ \sigma_{101} = 100 \text{ mb} \]
Estimation based on zero underlying event number per unit eta unit phi for 25 MI events. At $\eta = 3$, the energy flow is about 200 GeV.

Energy Distributions of MI Events
Magnetic field may modify the distribution

Average Energy in a \( R = 0.5 \) Cone
Jet ET threshold has to be way above this.

Average ET in a R=0.5 Cone
W events

Leptonic Kinematic Distributions (1)
Leptron Kinematic Distributions (II)
top quark pair events

Lepton Kinematic Distributions (III)
top quark pair events
b-jet Kinematic Distributions
Leptons and jets from $t\bar{t}$bar events are central.
Their $p_T$s are generally less than 500 GeV.
Leptons from W/Z are essentially flat in $\eta$ and $\phi$.

This deposit energy in a jet cone, jet $E_T$ cut has to be way above.
Multiple interactions deposit a large amount of $E_T$.
Dijet cross section is large even for large $p_T$ cut.

Summary
Working Group E4C Summary: Detectors for VLHC

Snowmass 2001

Conveners: M. Albrow, D. Denisov

• Group charge
• List of talks
• Brief overview of presented results
• Interface with accelerator
• Radiation doses
• Tracking, calorimetry, muon detection
• R&D on detectors for VLHC
• Summary
Summary

- E4C group concentrated on discussions of detectors for VLHC Stage I (40TeV, $10^{34}$) and Stage II (175TeV, $2.10^{34}$)
- Accelerator parameters presented in 2001 VLHC design study are suitable for detectors. Reduction in bunch spacing time below 18ns, if handled by detectors and electronics, will provide reduction in number of interactions per crossing
- Radiation dose in central rapidity region is function of luminosity, “not” beam energy. Forward region doses increase rapidly with energy
- Detectors for stage I VLHC could be built based on existing (~LHC) technology. For Stage II detectors major issues are:
  - Momentum resolution of tracker and muon system
  - Radiation doses in the forward region
  - Events pileup
- Major areas of VLHC detectors and electronics R&D: radiation hardness, precision timing, tracker/muon momentum resolution, cost
- In addition to two general purpose detectors specialized detectors should be considered
- Cost of general purpose Stage I VLHC detector based on LHC/SSC extrapolation is ~$0.7B, unless cost reduction ways are established
- While R&D is needed in order to reduce cost and improve experiments capabilities detectors for VLHC are feasible