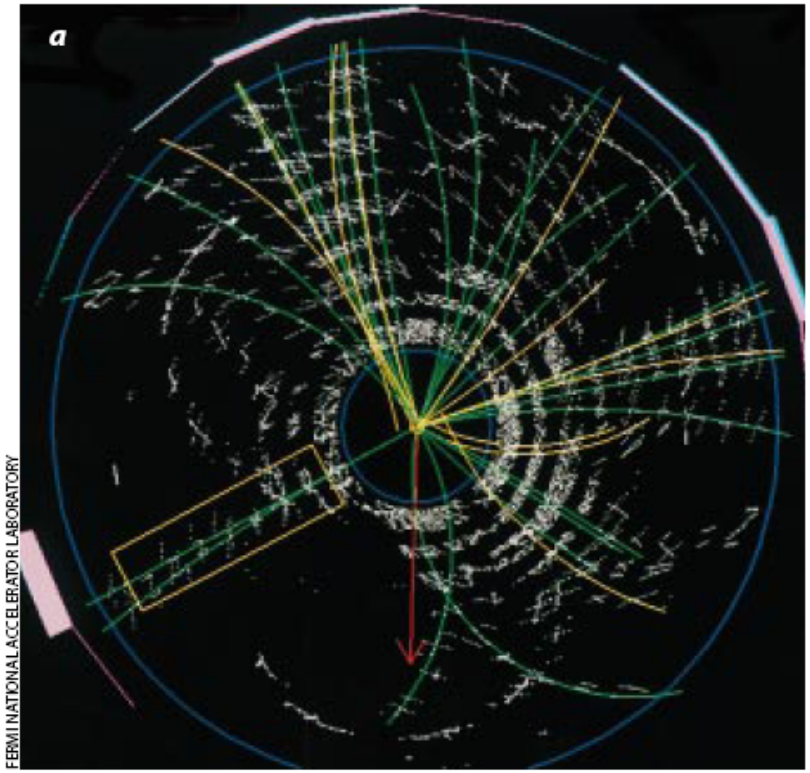
PH3520 / Particle Physics

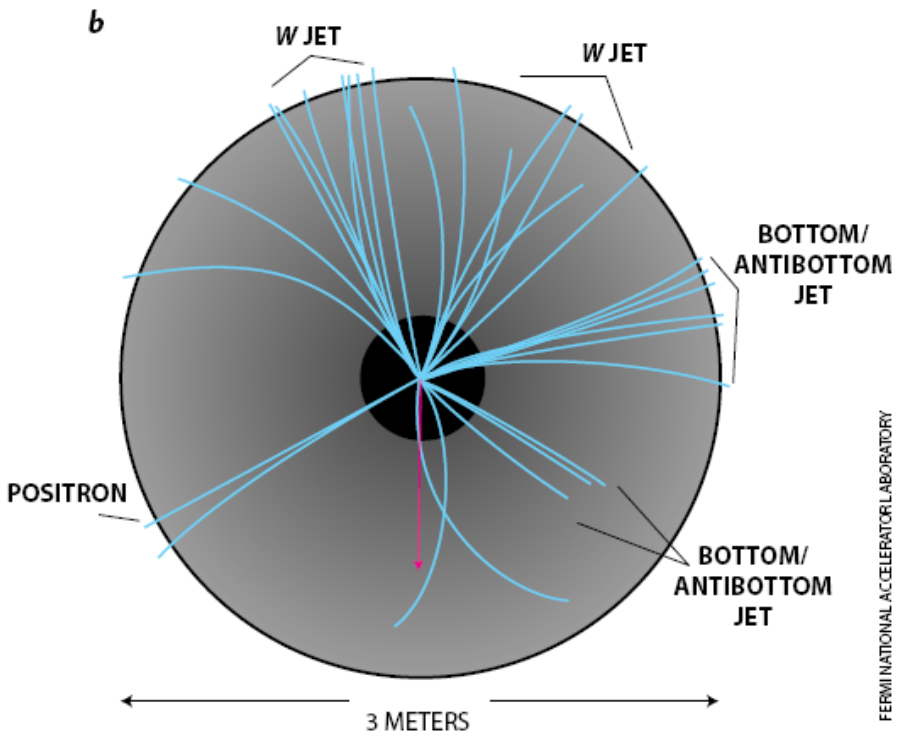
Autumn term 2011 – week 10

Glen Cowan
Stewart Boogert

Discovery of the top quark

Top-antitop candidate event by CDF detector in 1995.





The Discovery of the Top Quark, Scientific American, September 1997, http://www.hep.uiuc.edu/home/tml/SciAmTop.pdf

Charged current event

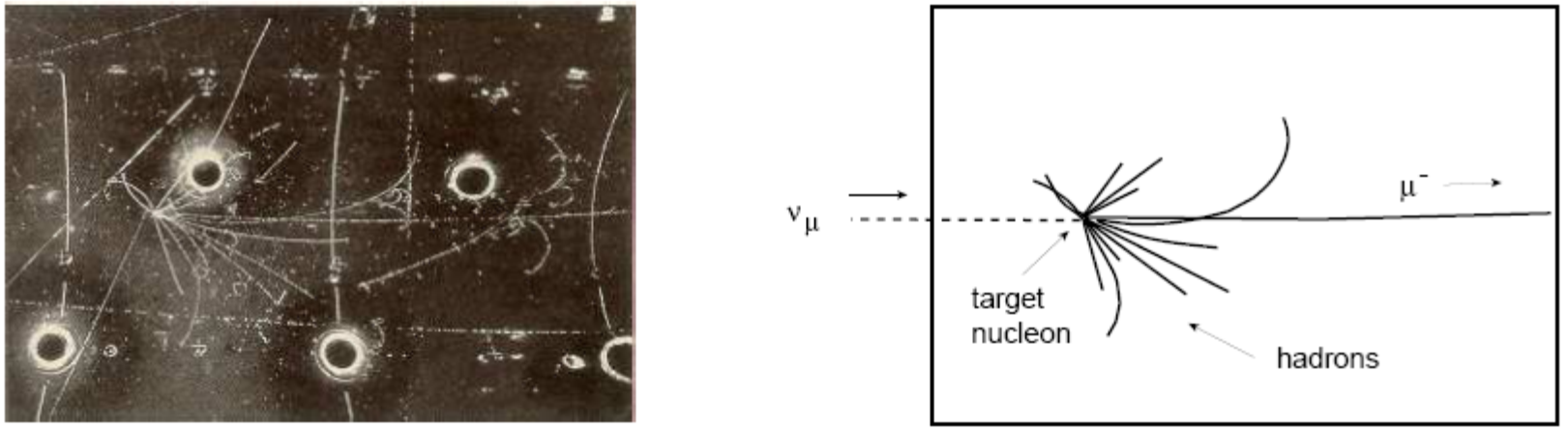


Figure 10.5: Bubble chamber photograph (left) and its interpretation (right) showing the reaction $\nu_\mu \mathrm{N} \to \mu^- +$ hadrons, where N is a nucleon (from D. Perkins in [51], p. 428). The neutrino enters from the left and the muon exits to the right.

Neutral current event

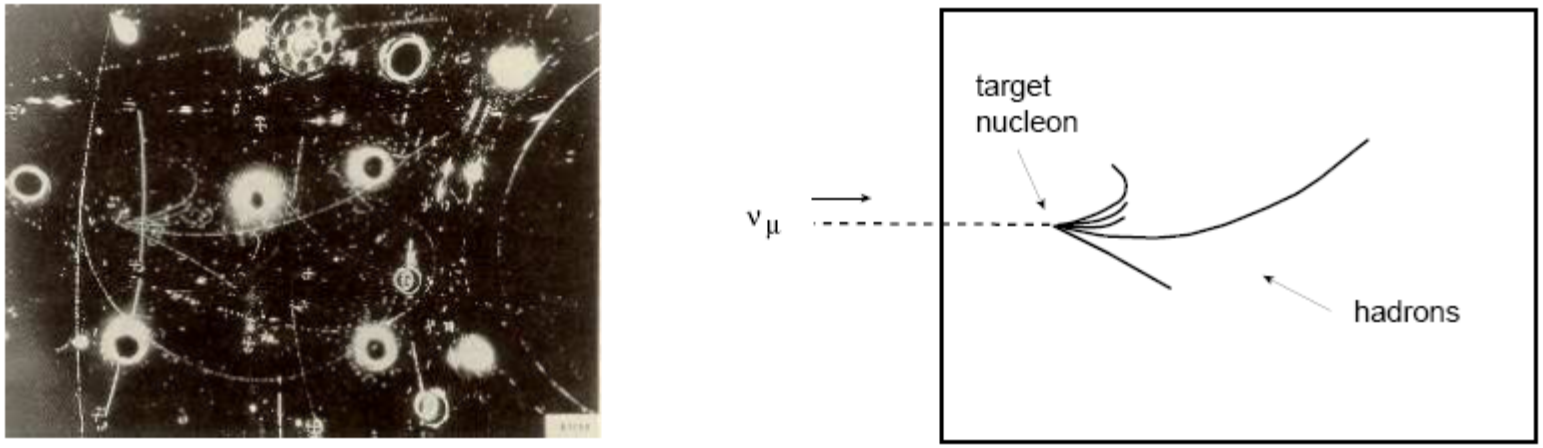
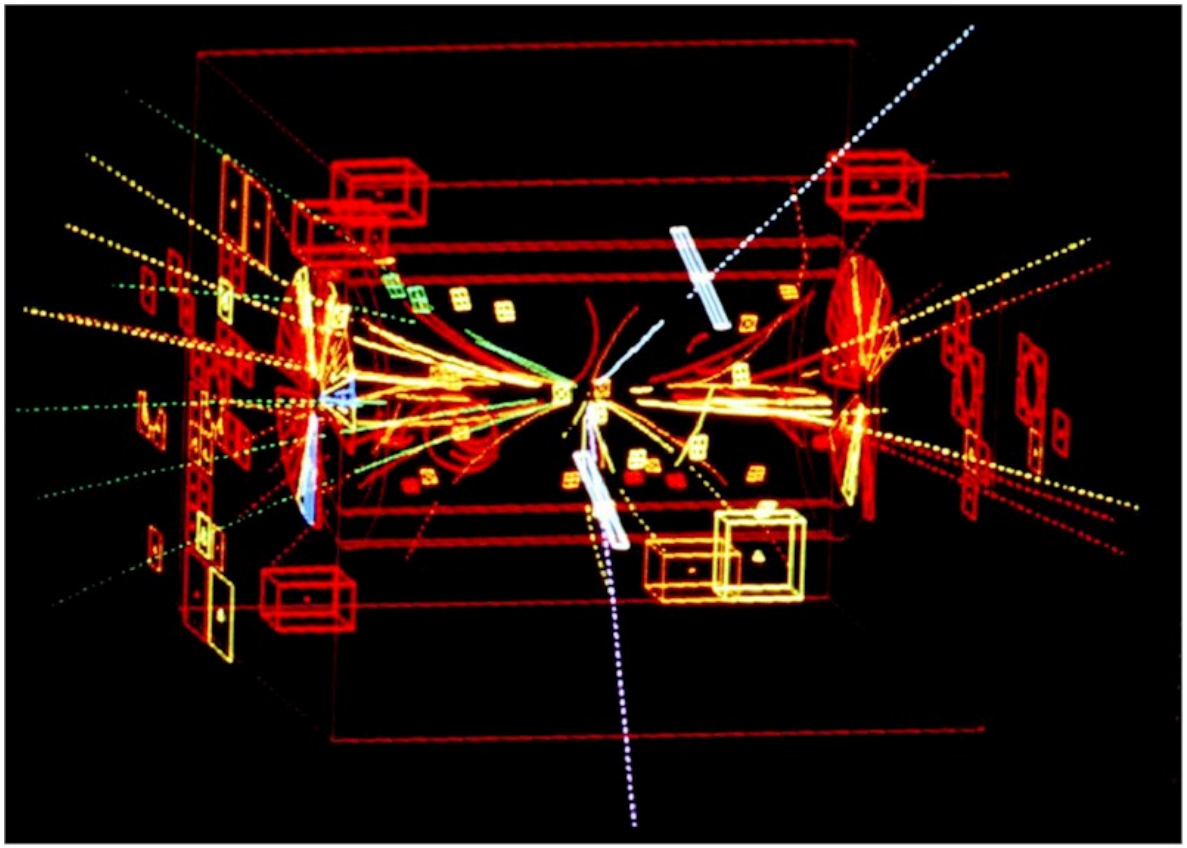


Figure 10.6: Bubble chamber photograph (left) and its interpretation (right) showing the reaction $\nu_\mu N \to \nu_\mu +$ hadrons (from D. Perkins in [51], p. 428). The neutrino enters from the left. All of the final state particles are identified as hadrons.

Discovery of the Z

First $Z \rightarrow e^+e^-$ in the UA1 Detector, 1983



http://www.particlephysics.ac.uk/news/picture-of-the-week/picture-archive/the-first-z-particle.html

Discovery of the Z

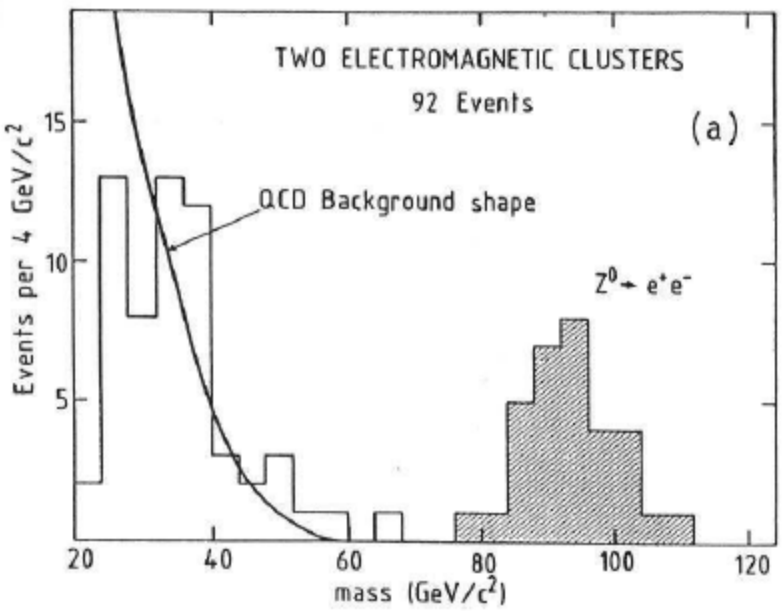
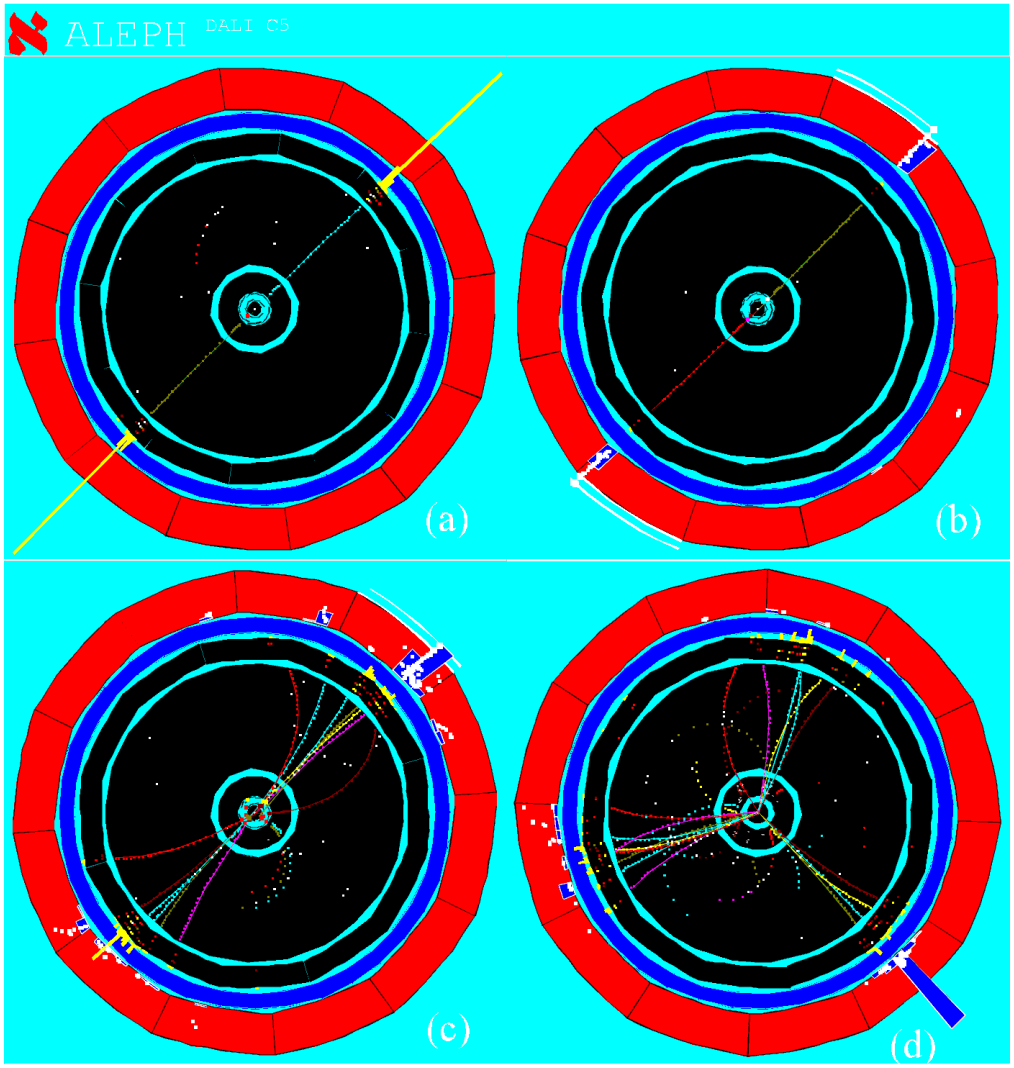


Figure 10.9: The invariant mass distribution of e^+e^- pairs produced in proton–antiproton collisions measured by the UA1 detector, showing evidence for production of the Z boson (from [4]).

e^+e^- collisions at ALEPH (LEP)



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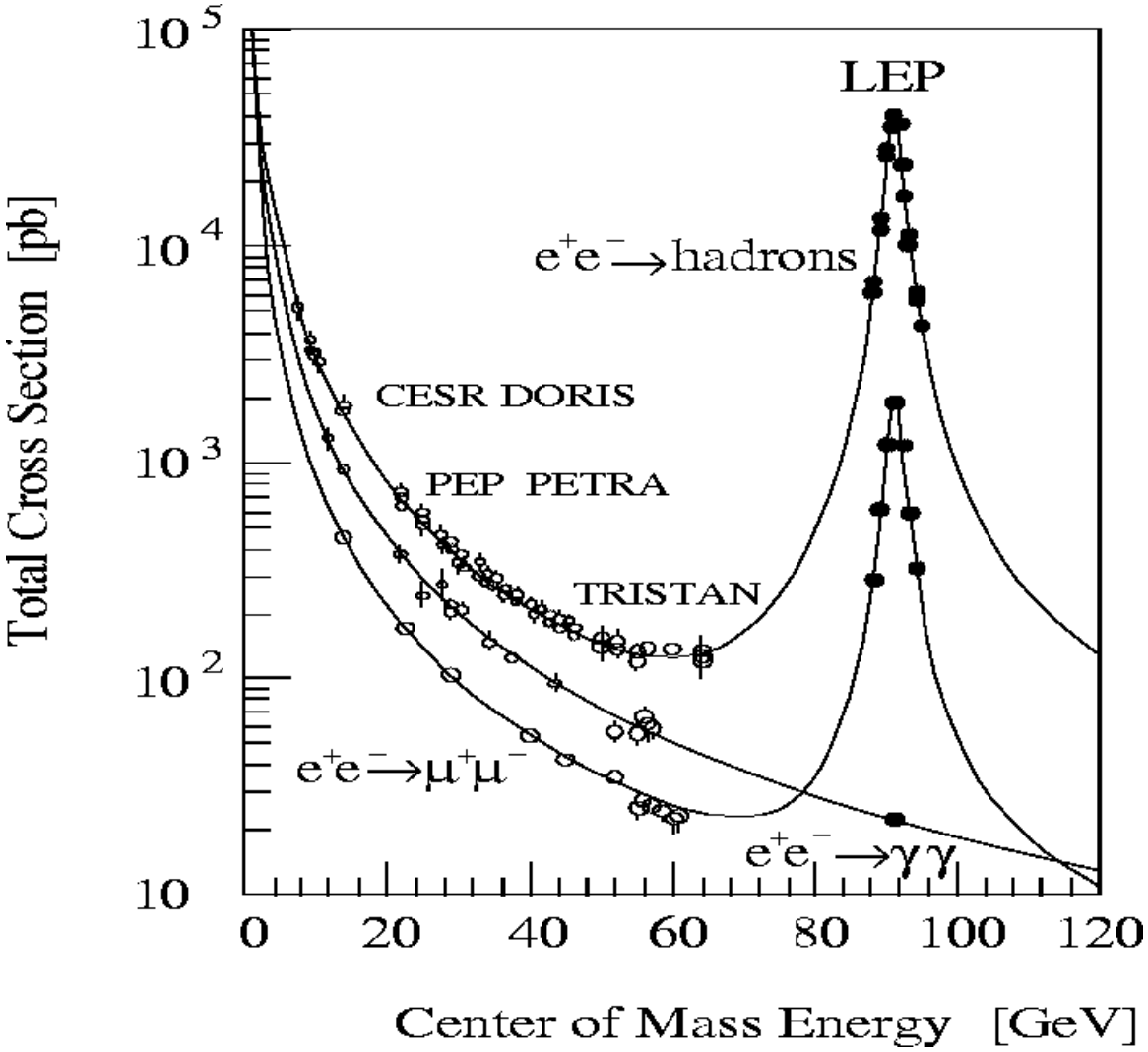
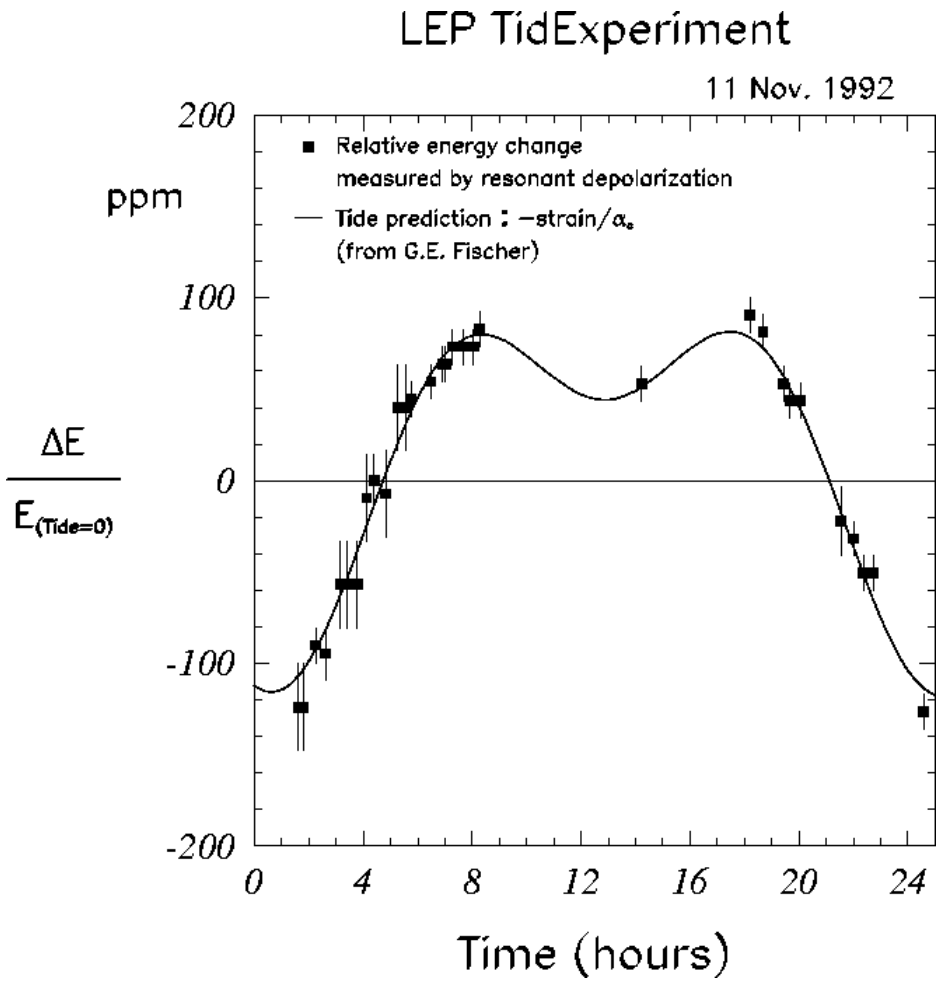
e^+e^- cross sections vs. E_{cm}

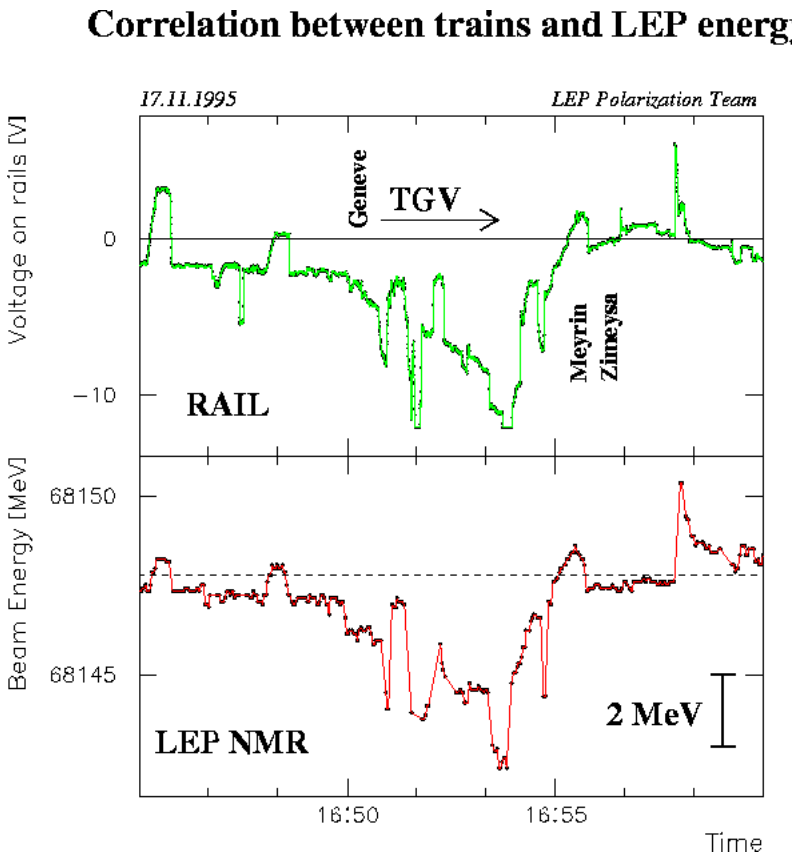


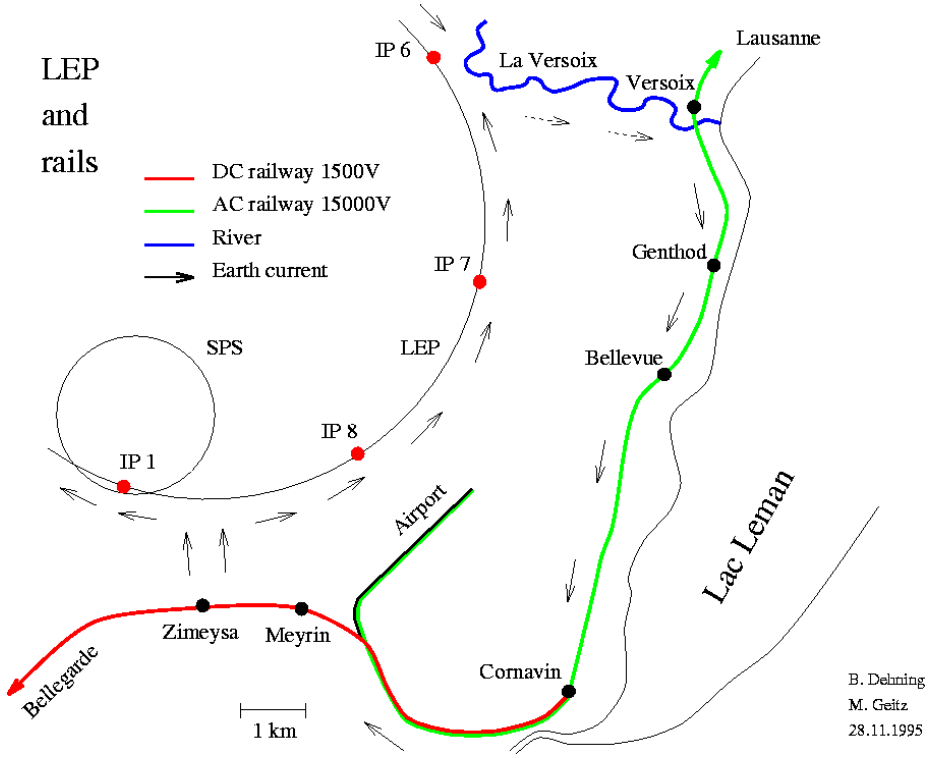
LEP measures the mass of the moon



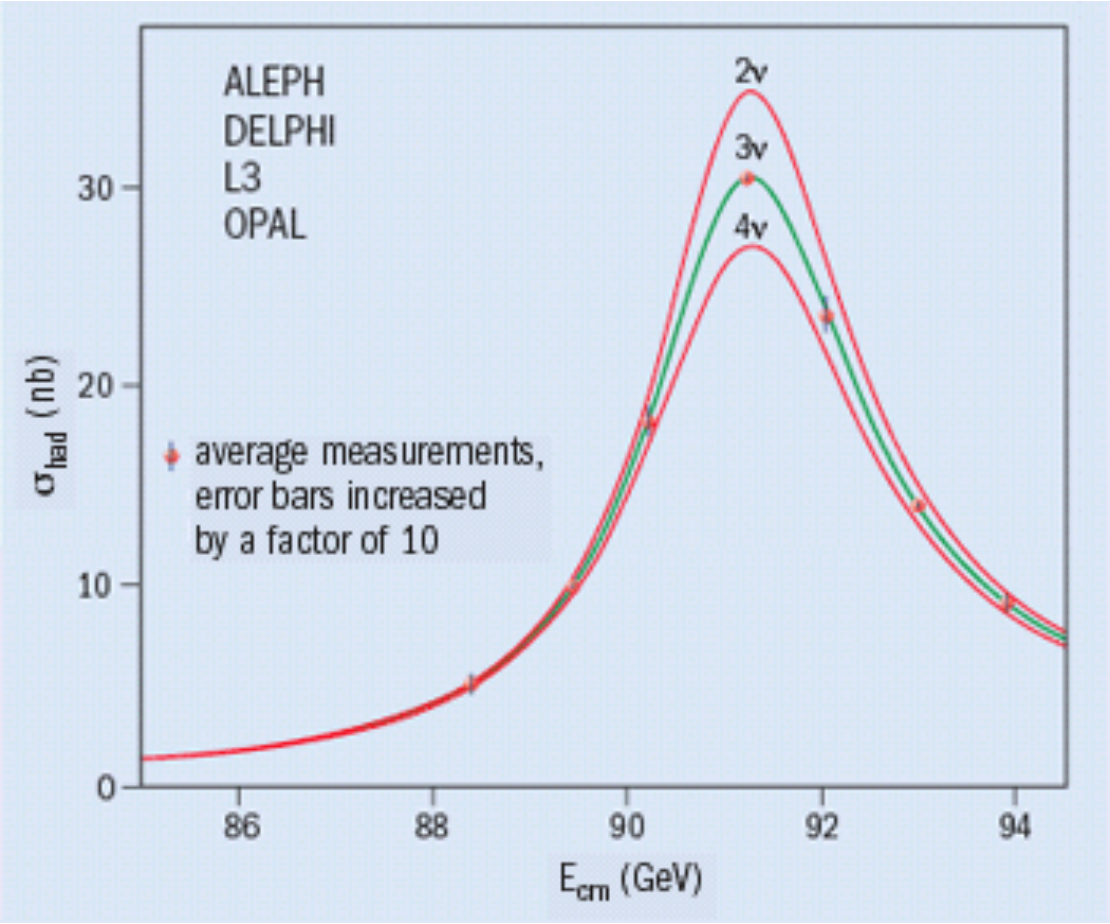
Change of LEP energy during 24h as a result of the tide.

LEP and the TGV





Number of neutrino families



Forward-backward asymmetries

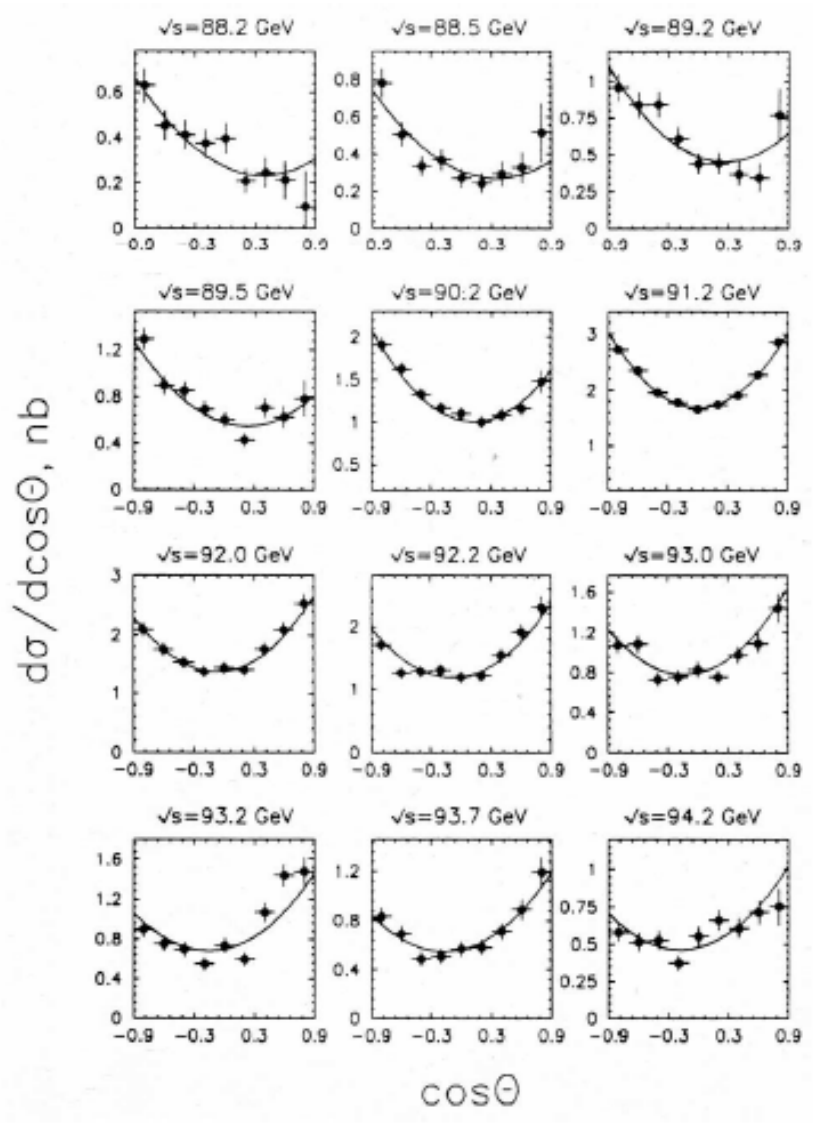
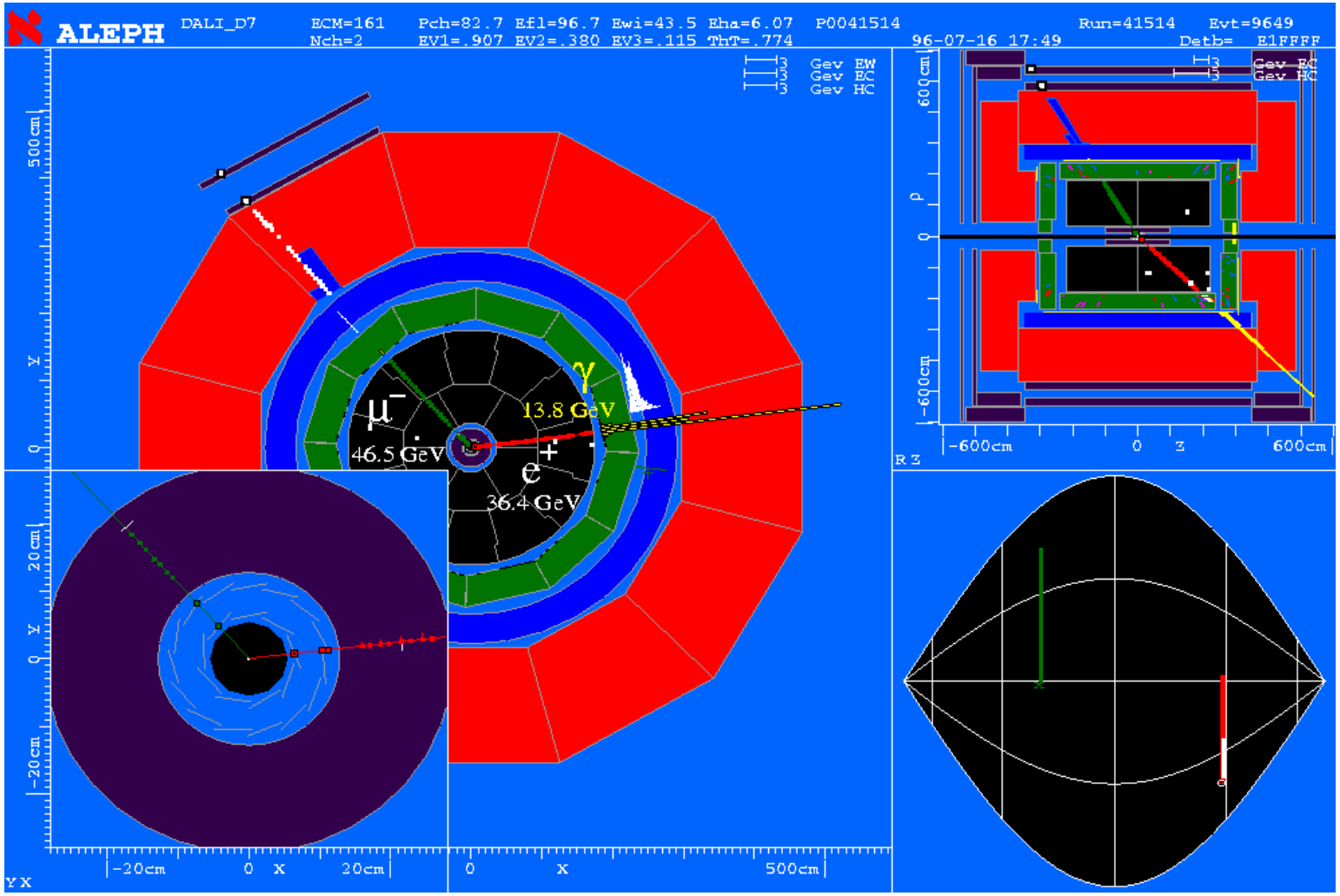
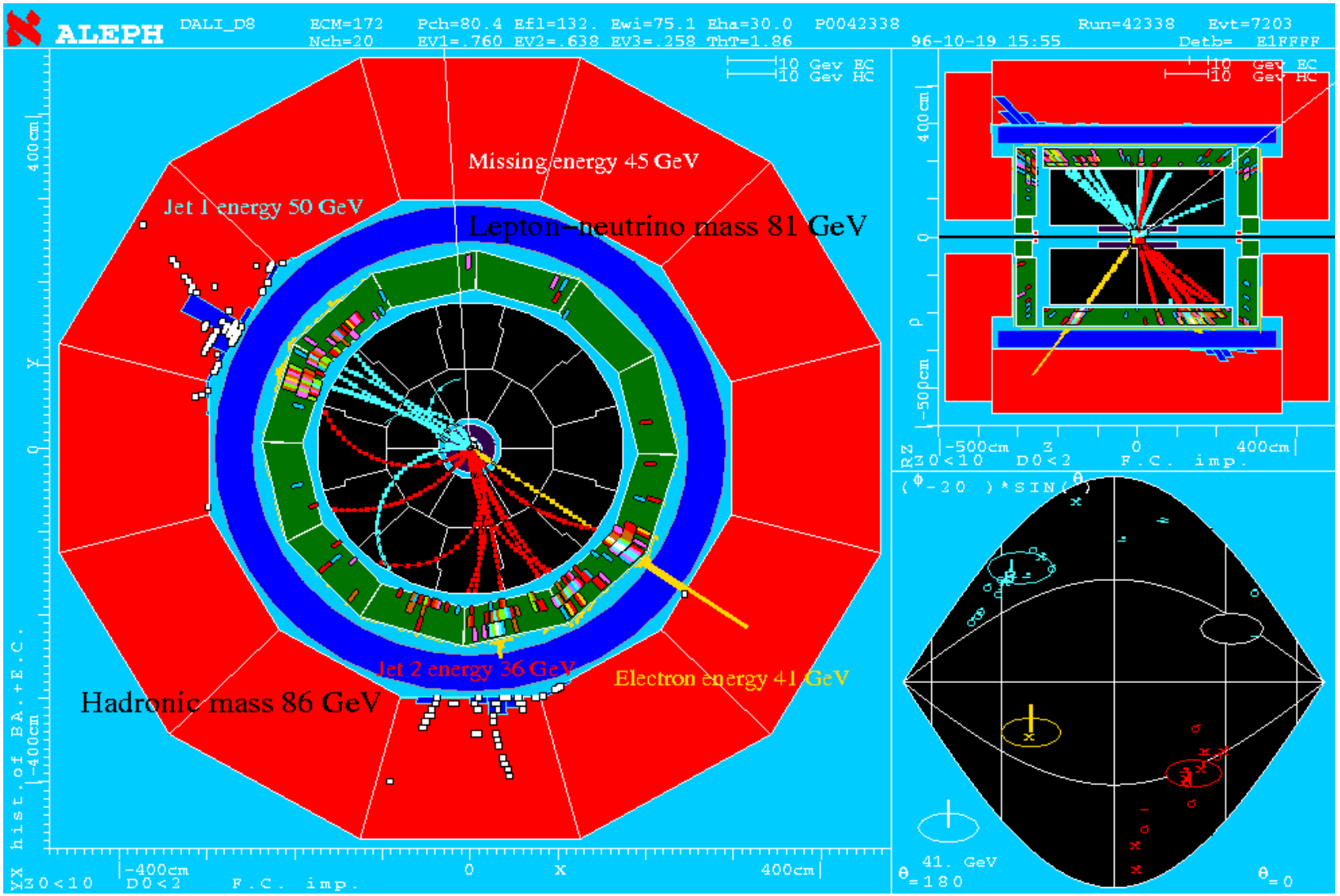


Figure 10.14: Differential cross sections $d\sigma/d\cos\theta$ for $e^+e^- \to l^+l^-$ for all charged leptons combined (from [78]).

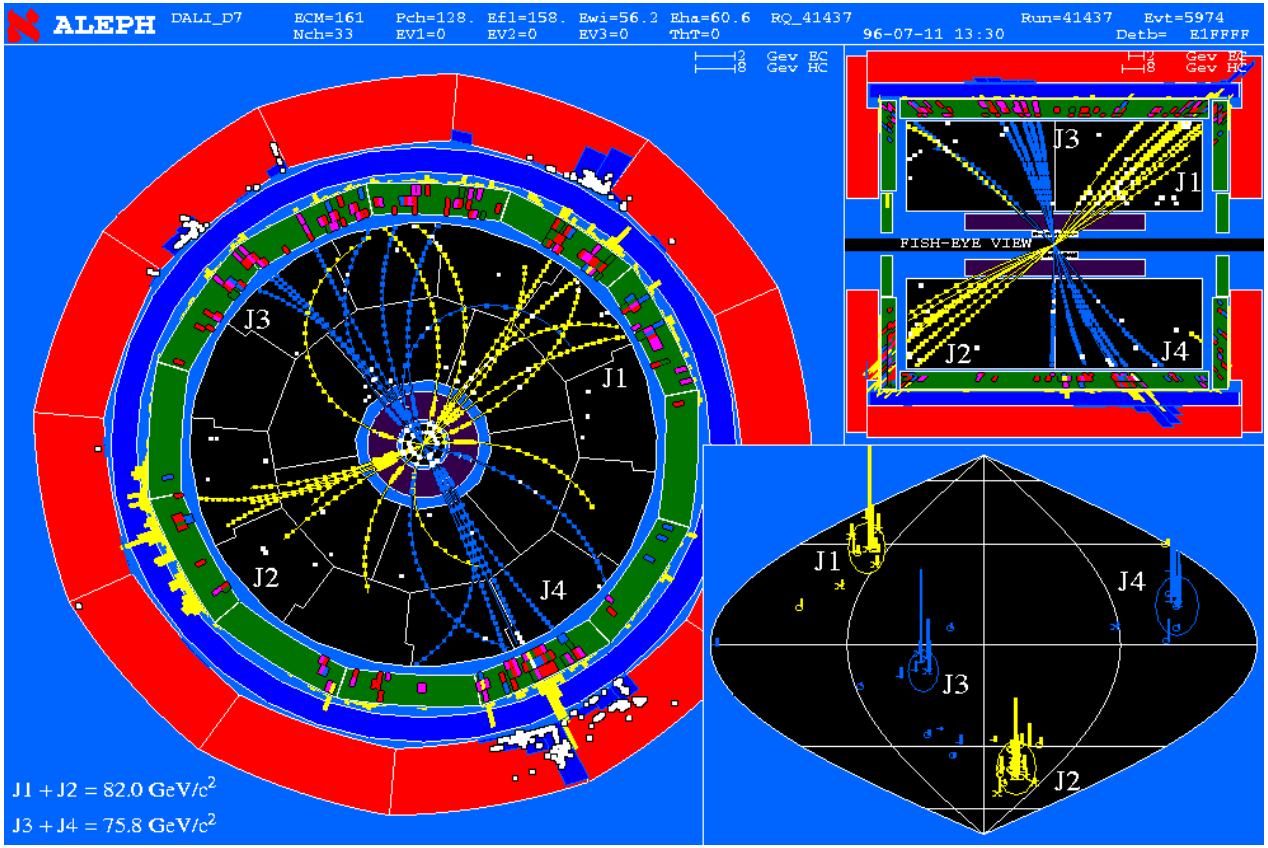
A W^+W^- event at LEP



A W^+W^- event at LEP



A W^+W^- event at LEP



W^+W^- cross section at LEP

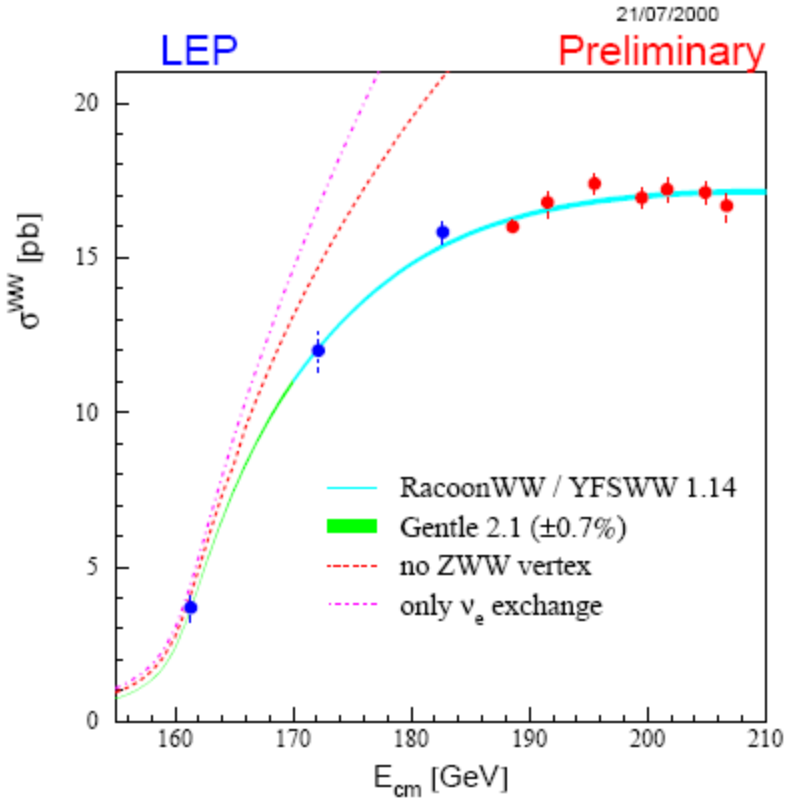


Figure 10.18: The cross section $\sigma(e^+e^- \to W^+W^-)$ measured by the LEP experiments and shown with the Standard Model prediction [80].