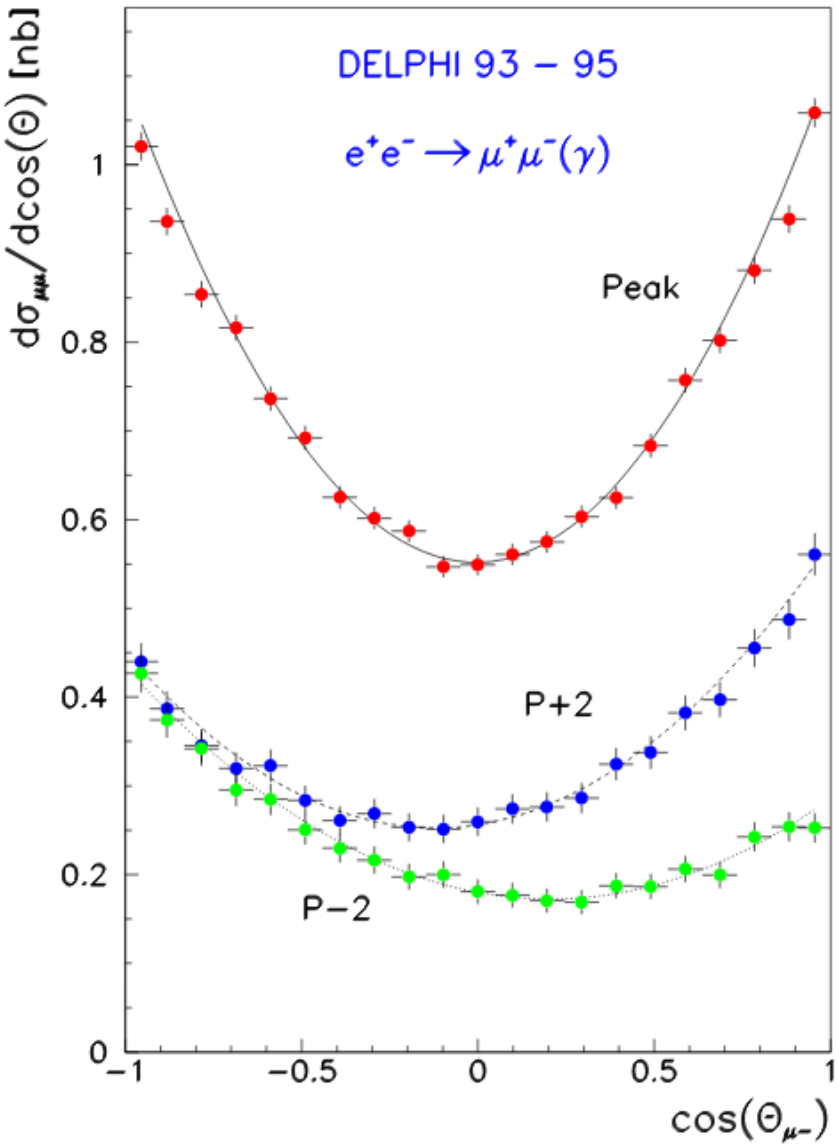
Electroweak measurements
– Questions lecture 1 –

Andrea Knue
Albert-Ludwigs Universität Freiburg

– BND summer school 2019 –

Page 49, left plot: what does P+2 and P-2 mean?



➔ distributions show three main centre-of-mass energies, P stands here for "Peak"

➔ asymmetry is different for on-peak and off-peak

Year	Centre-of-mass energy range [GeV]	Integrated luminosity [pb^{-1}]
1989	88.2 – 94.2	1.7
1990	88.2 – 94.2	8.6
1991	88.5 – 93.7	18.9
1992	91.3	28.6
1993	89.4, 91.2, 93.0	40.0
1994	91.2	64.5
1995	89.4, 91.3, 93.0	39.8

What is the Higgs mass expectation from LEP based on?

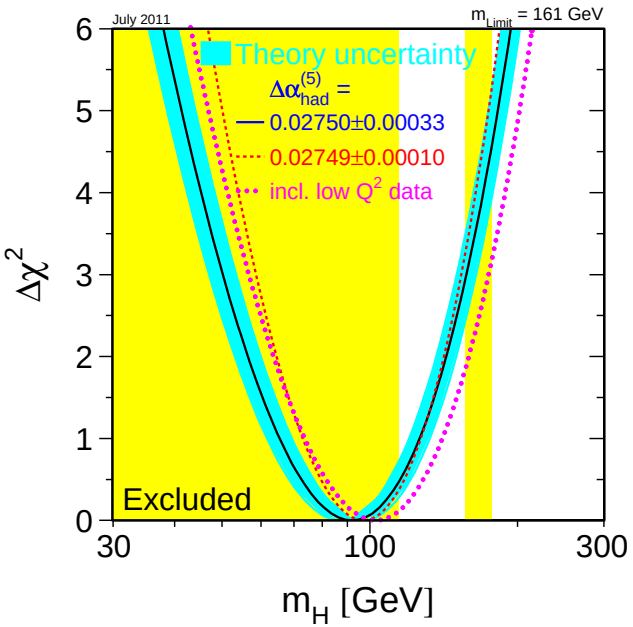
- so: need high precision measurements

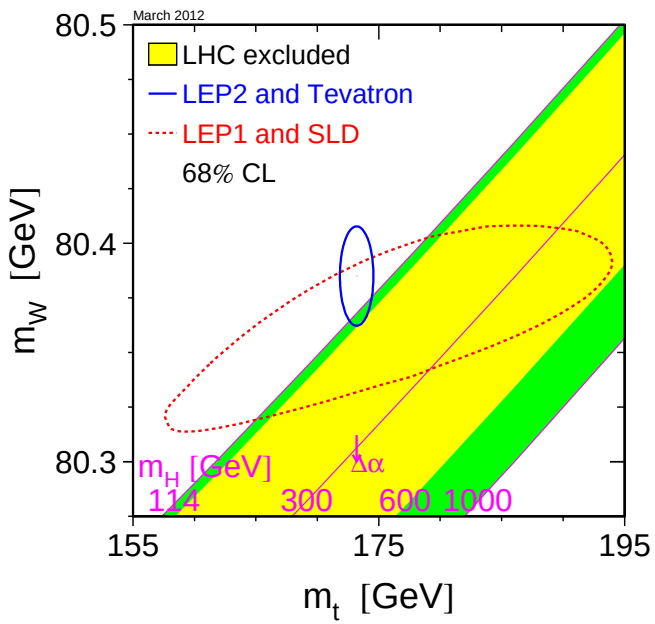
  ↪ 15 observables from LEP-EWWG (m_Z, Γ_Z, ...)

  ↪ + m_Z, Γ_Z, m_{top} and low-energy observables

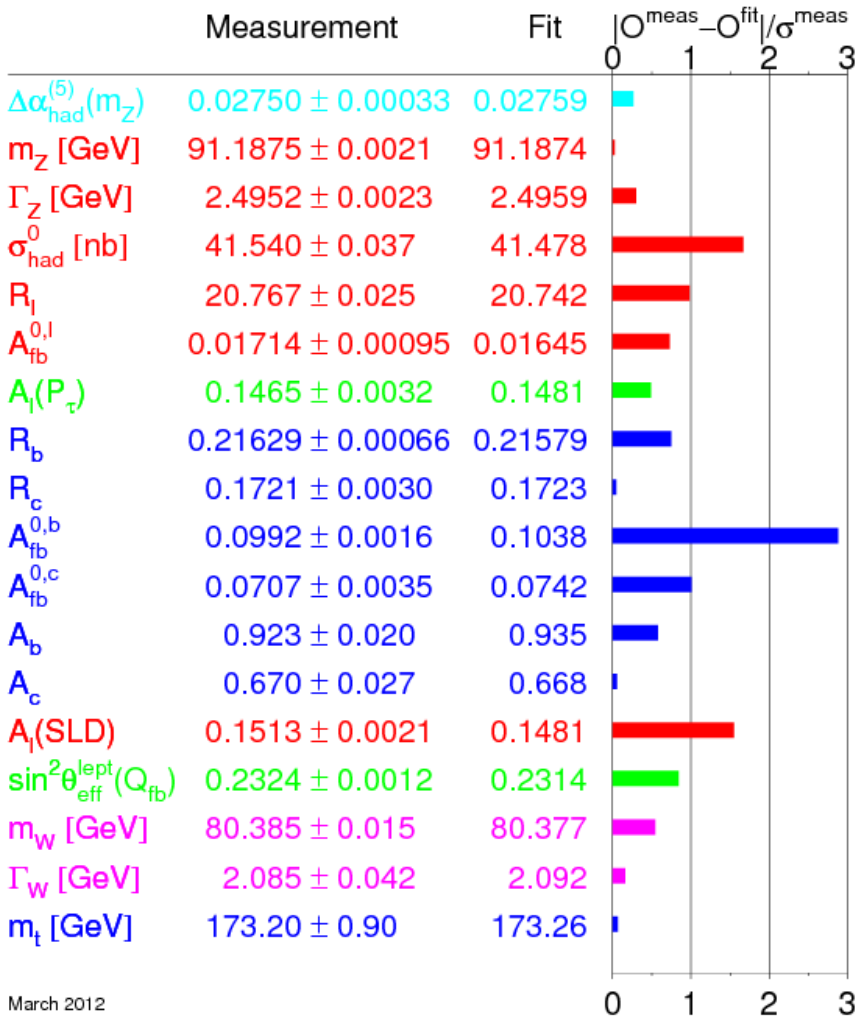
- from indirect searches: Higgs mass most likely around 100 GeV

  ↪ would be still in reach for LEP experiments!





p55: Should not one of the measurements deviate (statistical)?



➔ here: individual measurements of different quantities, different techniques

Did LEP have a trigger? What was the data rate?

➔ yes LEP experiments had triggers, put link in last slide of todays lecture

Snapshot from Talk (Klaus Moenig):

LEP and its experiments

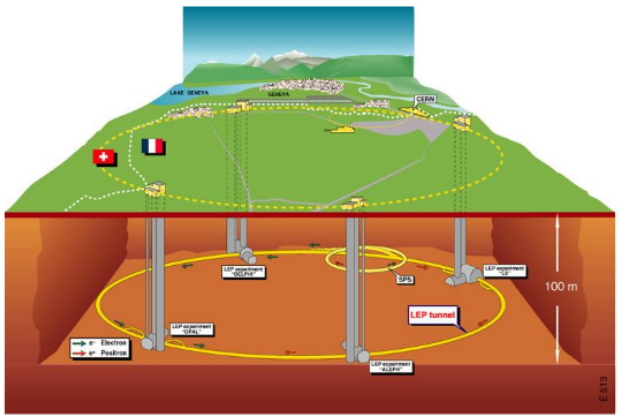
- LEP1 record luminosity
  2.3×10^{31} cm^{-2}s^{-1}

→Z rate at peak < 1 Hz

- LEP2 record luminosity
  10^{32} cm^{-2}s^{-1}

→WW rate ≈ 2 mHz

- Most data delivered with
  4 bunches (bx 44 kHz)



Did LEP have a trigger? What was the data rate?

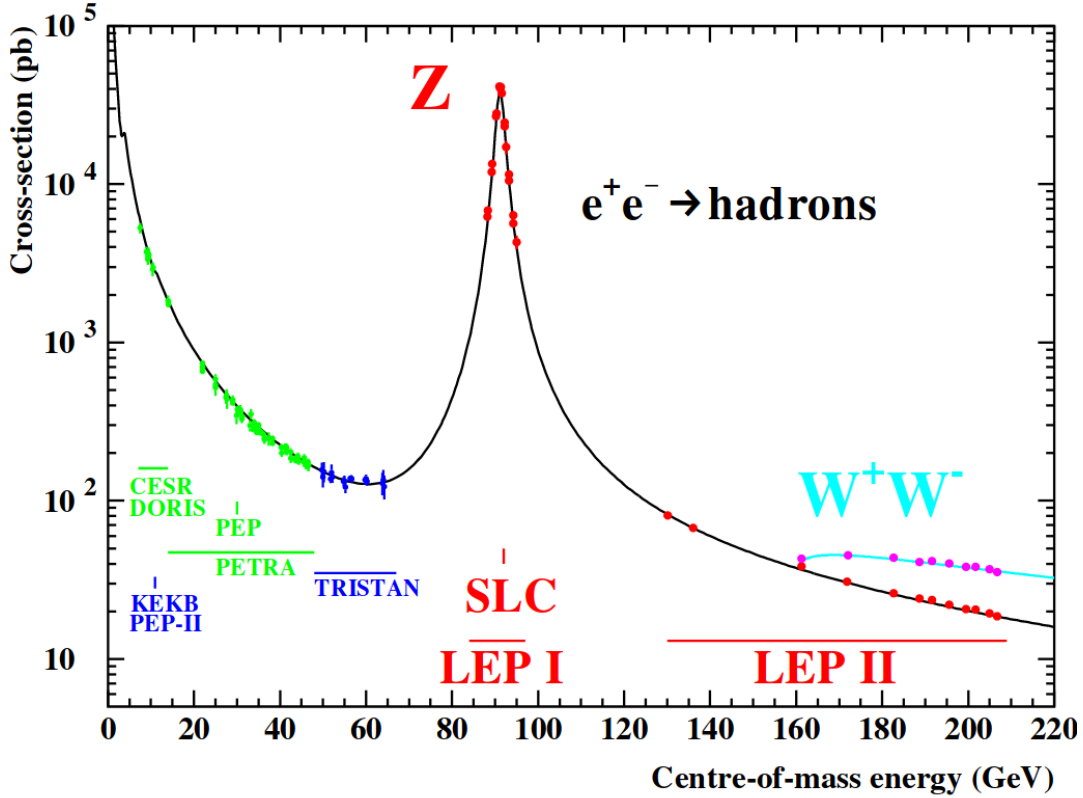
➔ yes LEP experiments had triggers, put link in last slide of todays lecture

Snapshot from Talk (Klaus Moenig):

Example from ALEPH: reality (3)

- Level 1: a powerful (for the eighties) FASTBUS system prepared to provide 500 Hz, mostly due to reject beam-gas interactions, to Level 2
- Level 2 : LEP was so clean that L2 received at most 10 Hz ... so it was not needed ... nevertheless worked for 12 years !!
- Level 3 : used to reject some obvious noise (maximum 30% of L1 triggers) and later on for event tagging, at LEP2 had a role for $\gamma\gamma$ physics

p 39: pink points: what experiment?



➔ that is the *WW* cross-section from the LEP-II combination

Was the vertex detector from SLD made of silicon?

▸ Application of silicon detectors

In HEP, the most advanced application of CCDs has been in the vertex detector of SLAC linear collider detector (SLD), which ultimately had 300 million channels [36]. The slow repetition rate of the SLC collider and the low trigger rate were the ideal condition for the use of CCDs, which require fairly long readout time because the charge has to be shifted across the rows and columns of pixels to the readout. Fig. 7 shows a "typical" picture of a Z decay into three jets, tracked with the SLD CCD detector. For use in next-generation e^+e^- colliders, a faster readout scheme is being developed [37]. An intense area of research and development is the radiation hardness of CCD detectors.

➔ put link in last slide of todays lecture

Was LEP designed with a *pp* upgrade in mind?

▸ Genesis of the Large Hadron Collider

The Large Hadron Collider (LHC) story began in 1976 when the European particle physics community began to discuss building a Large Electron Positron (LEP) collider at CERN. LEP was, of course, eventually built and installed in a 27 km tunnel, which today houses the LHC.

At that time, CERN had two Directors General—Leon van Hove, the Scientific Director, and John Adams, the Technical Director. John thought LEP was the wrong choice for CERN's next major project, but in 1977 conceded that he had lost the argument and wrote a note proposing that the LEP tunnel should be made large enough to accommodate a ring of superconducting magnets to enable the acceleration of protons to at least 3 TeV [1]. This suggestion was widely known by the time of the LEP Summer Study in September 1978.

➔ put link in last slide of todays lecture

How was $\sin\theta$ measured in 1973 without HP computers?

that became commercially available. As had happened for nuclear emulsions a few years earlier, many new groups formed in research centres and universities, where young people were trained. These collaborations produced much of the significant physics. At CERN the use of digital computer and data-handling techniques for experiments began with bubble chambers, and their use in other fields of high-energy experimentation followed later.

CERN-Courier: ▸ Bubble Chamber

Miscellaneous

- Explain blind analysis $\rightarrow$ lecture today
- Can we make a short break in the middle? $\rightarrow$ Yes!
- What is a bavarian mango? $\rightarrow$ no idea
- 42 $\rightarrow$ what is the question?

  $\hookrightarrow$ "Exactly!" said Deep Thought. "So once you know what the question actually is, you'll know what the answer means."

Feedback lecture 1