

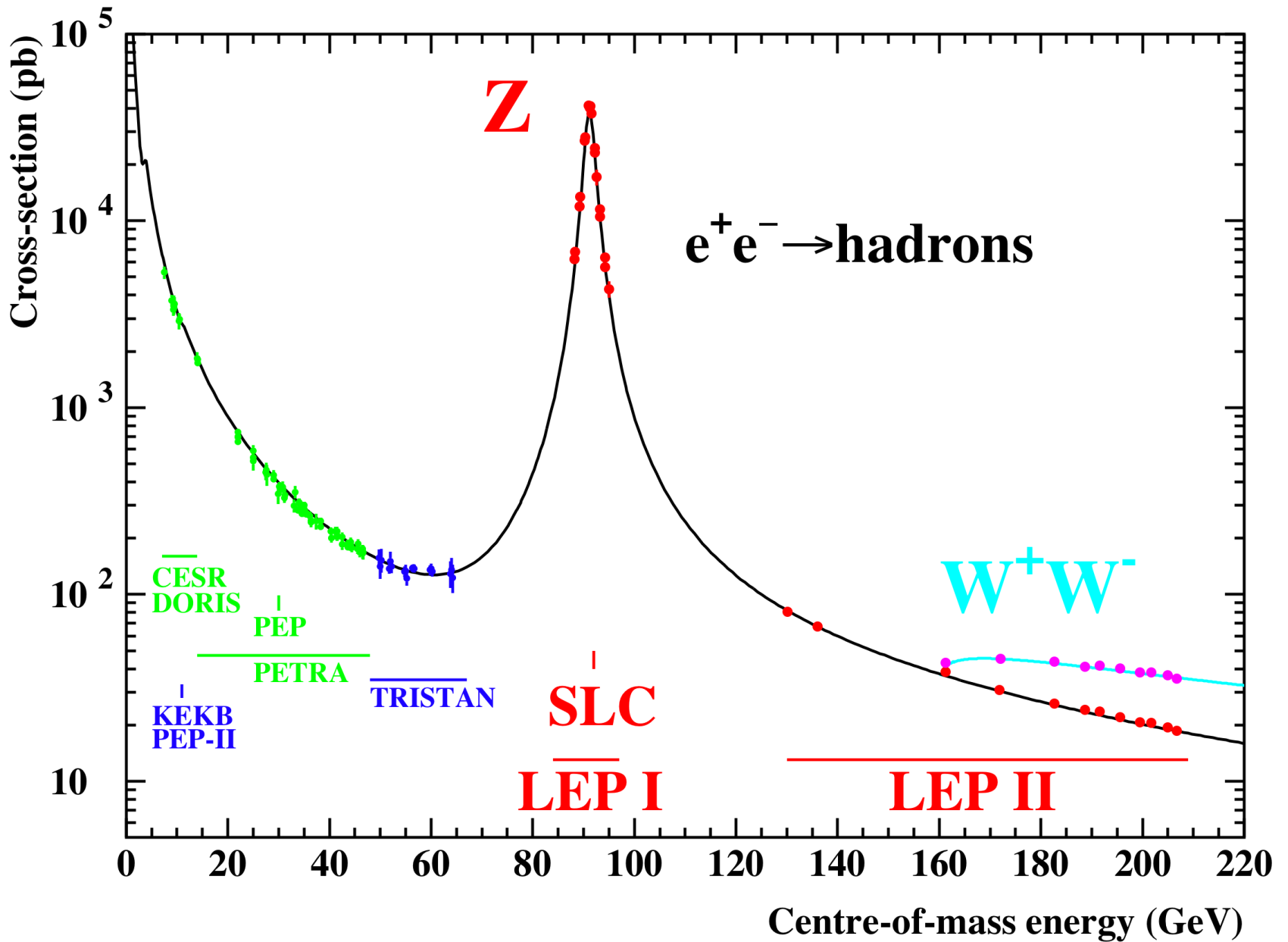


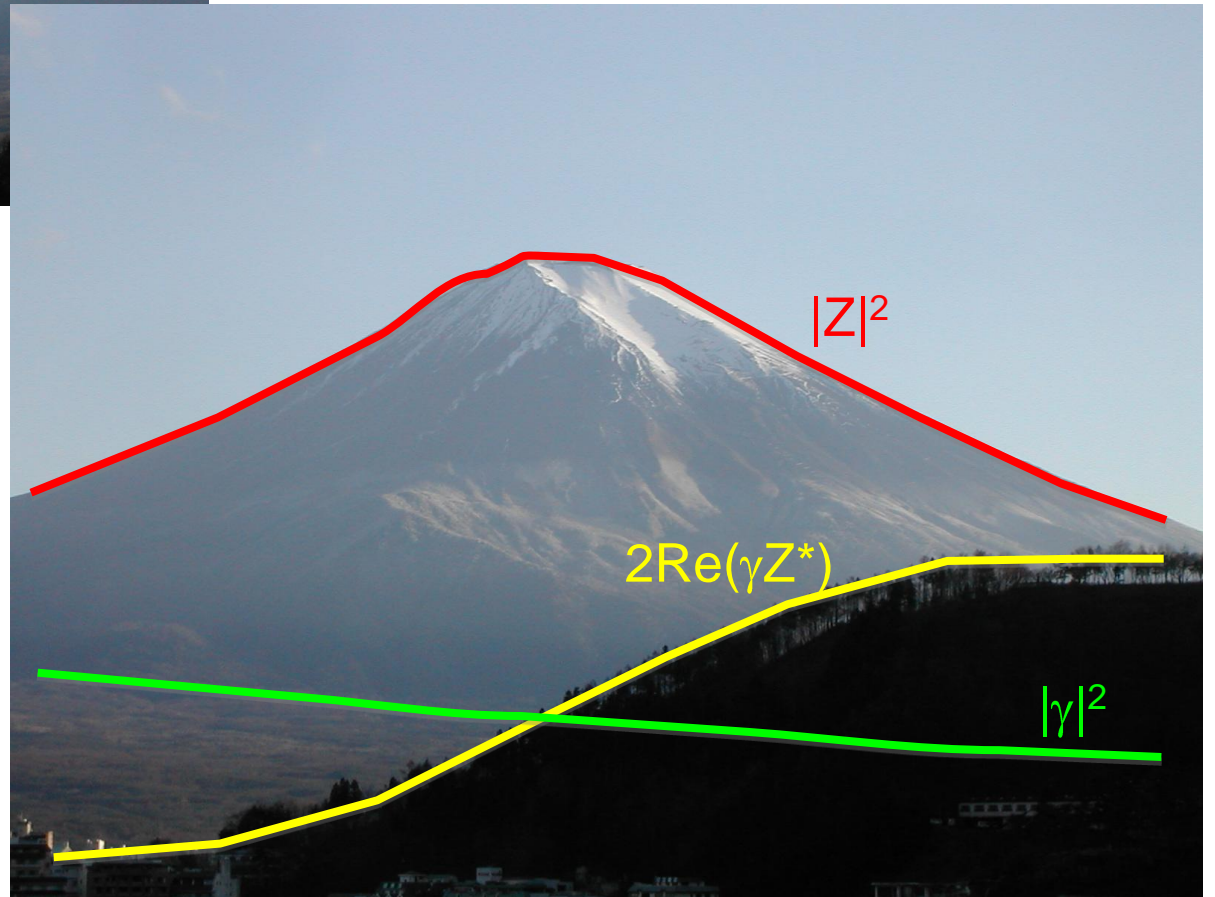
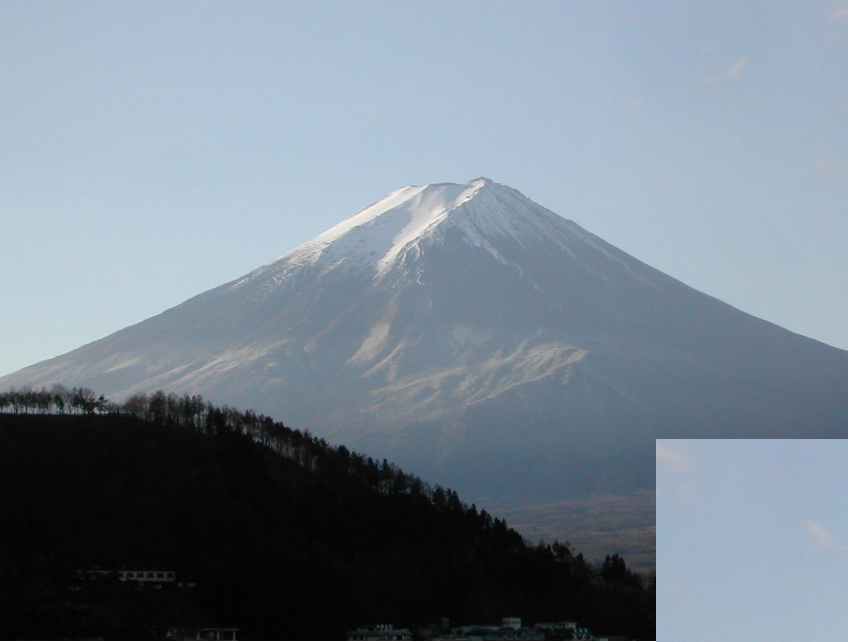
Zedometry

OPAL plenary

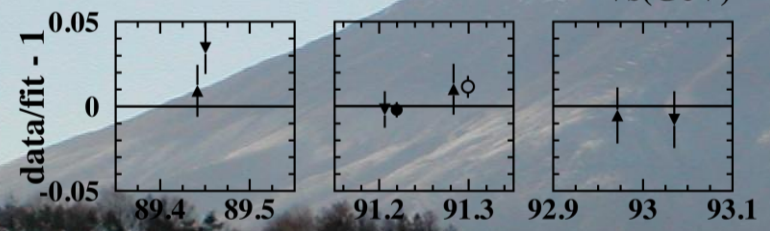
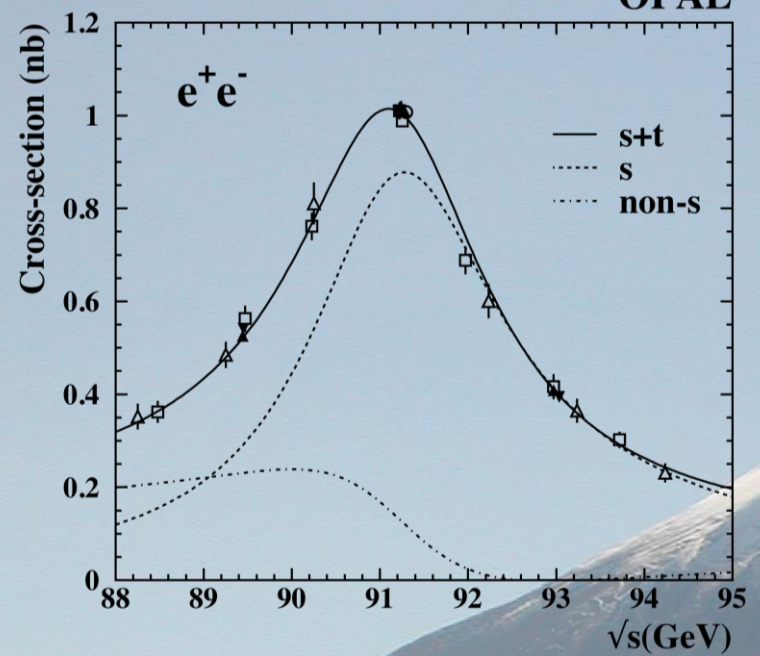
21.10.2010

T.Kawamoto





OPAL

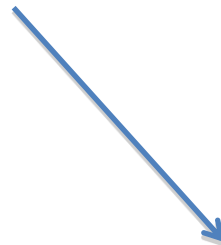


“Zedometry”

was the (working) title of an OPAL paper describing the ~ final words on the OPAL determination of the basic Z parameters based on the measurements of the Z lineshape and lepton A_{FB}

If I understand the history correctly, the name was coined by Chris Hawkes when he volunteered and started writing the initial draft of the paper.

Inspired from :



LEP SUMMER STUDY
Organized under the Joint Sponsorship of
ECFA and CERN

Les Houches and CERN
10 to 22 September 1978

e^+e^- PHYSICS AT LEP ENERGIES

Zedology	J. Ellis*
Weak Interactions Beyond the Z Pole(s)	M.K. Gaillard**
Testing Strong Interaction Theories	J. Ellis*

“Zedometry” is the last of the series :

PR001 Measurement of the Z^0 Mass and Width with the OPAL Detector at LEP.

The OPAL Collaboration, M.Z. Akrawy et al. *Phys. Lett. B231* (1989) 530-538

PR002 Measurement of the Decay of the Z^0 into Lepton Pairs.

The OPAL Collaboration, M.Z. Akrawy et al. *Phys. Lett. B235* (1990) 379-388

PR009 A Combined Analysis of the Hadronic and Leptonic Decays of the Z^0 .

The OPAL Collaboration, M.Z. Akrawy et al. *Phys. Lett. B240* (1990) 497-512

PR016 Analysis of Z^0 Couplings to Charged Leptons.

The OPAL Collaboration, M.Z. Akrawy et al. *Phys. Lett. B247* (1990) 458-472

PR035 Measurement of the Z^0 Line Shape Parameters and the Electroweak Couplings of Charged Leptons.

The OPAL Collaboration, G. Alexander et al. *Zeit. fur Physik C52* (1991) 175-207

89+90

PR071 Precision Measurements of the Neutral Current from Hadron and Lepton Production at LEP.

The OPAL Collaboration, P. Acton et al. *Zeit. fur Physik C58* (1993) 219-237

+91

PR089 Improved Measurements of the Neutral Current from Hadron and Lepton Production at LEP.

The OPAL Collaboration, R. Akers et al. *Zeit. fur Physik C61* (1994) 19 – 34

89+90+91+92

1989 data

Actually, two OPAL papers for the final analyses of the 93+94+95 data

PR289 Precision Luminosity for Z^0 Lineshape Measurements with a Silicon-Tungsten Calorimeter.

The OPAL Collaboration, G. Abbiendi et al. *Eur. Phys. J. C14* (2000) 373-425

PR328 Precise Determination of the Z Resonance Parameters at LEP : Zedometry.

The OPAL Collaboration, G. Abbiendi et al. *Eur. Phys. J. C19* (2001) 587-651

+ LEP energy calibration

IP069 Calibration of centre-of-mass energies at LEP1 for precise measurements of Z properties.

R. Assmann et al. *European Physical Journal C6* (1999) 187-223

+ Theory efforts for precision calculation :

ZFITTER, TOPAZ0, ALIBABA, KORALZ, KK2F, BHWIDE, BHLUMI,

+ Combination by EWWG (with many physics and technical discussions)

PR426 Precision Electroweak Measurements and Constraints on the Standard Model.

The ALEPH, DELPHI, L3, OPAL, SLD Collaborations, the LEP Electroweak Working Group, the SLD Electroweak and Heavy Flavour Groups, *Phys. Rept. 427* (2006) 257-454



Line Shape and Asymmetry Analyses

Editorial boards

Lineshape : Aldo Michelini, Dorothee Schaile, Pippa Wells, Terry Wyatt, Roger Barlow, Michael Kobel, Kirsten Sachs, Peter Watkins, Dean Karlen

Luminosity : Marco Dallavalle, Mike Hildreth, Tatsuo Kawamoto and Pippa Wells

[The luminosity paper](#) (CERN-EP/99-136) is published: Eur. Phys. J. C14 (2000) 373-425

[The lineshape paper](#) (CERN-EP-2000-148) is published: Eur. Phys. J. C19 (2001) 587-651

[LS+Afb 93/94/95 results.](#)

Documentation

- Electroweak [papers and notes](#).
- Fermion pair analysis [technical notes](#), and [technical notes drafts](#).
- [Conference reports](#) on the subject of line shapes asymmetries etc.
- Lepton Pair Analysis Packages: [LL and LA](#).
- [Mailing list](#)
- [Some plots](#)

Electroweak programs

- [zfitter5_0](#).
- [zfitter5_10](#).
- [zfitter5_12](#).
- [topaz040i](#).
- [topaz043 \(new version\)](#).

Meeting

Nice, the lineshape web page still exists.



LS+Afb 93/94/95 results

Paper draft

- Zedometry [paper](#) has finished (29.11.2000).

[Dick Kellogg's useful Web page](#)

Fit

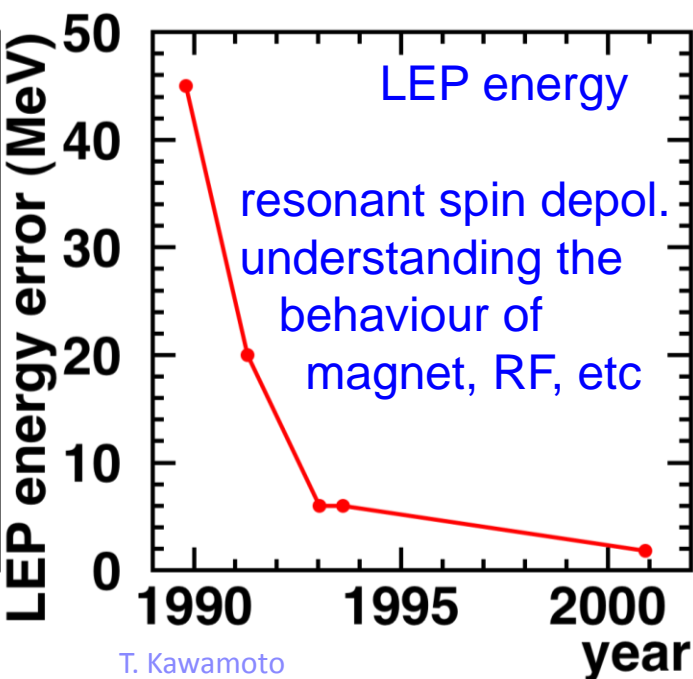
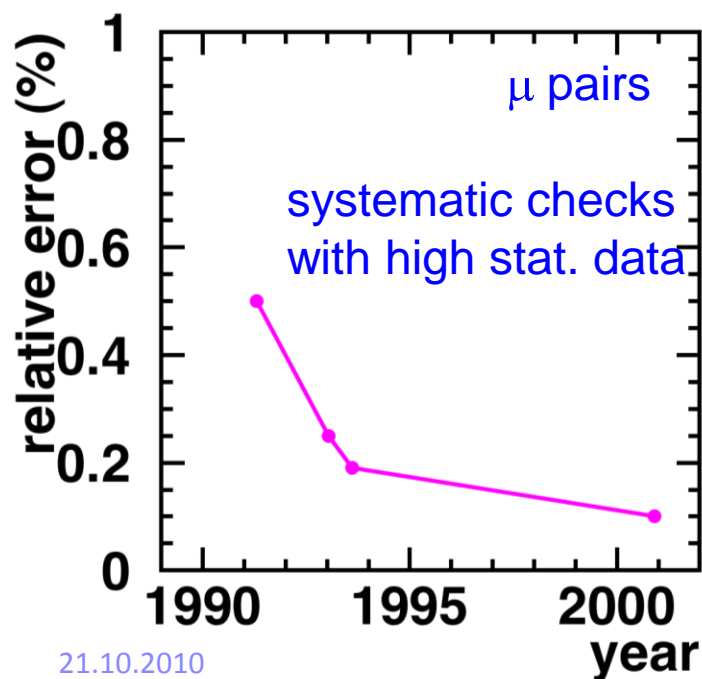
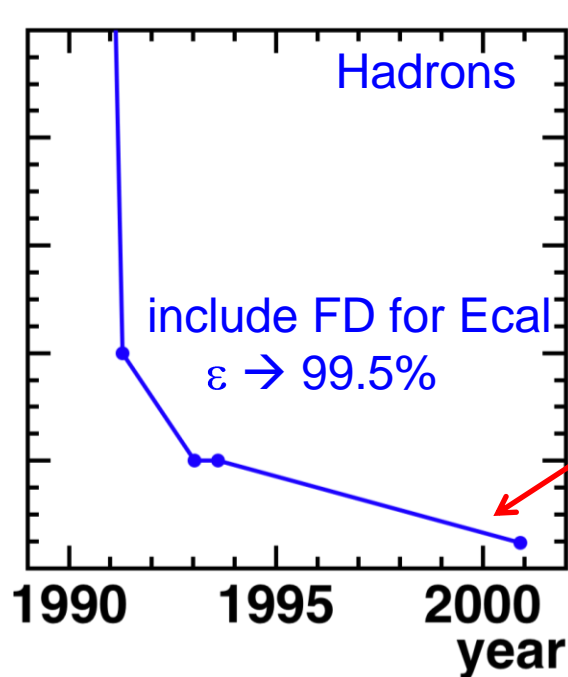
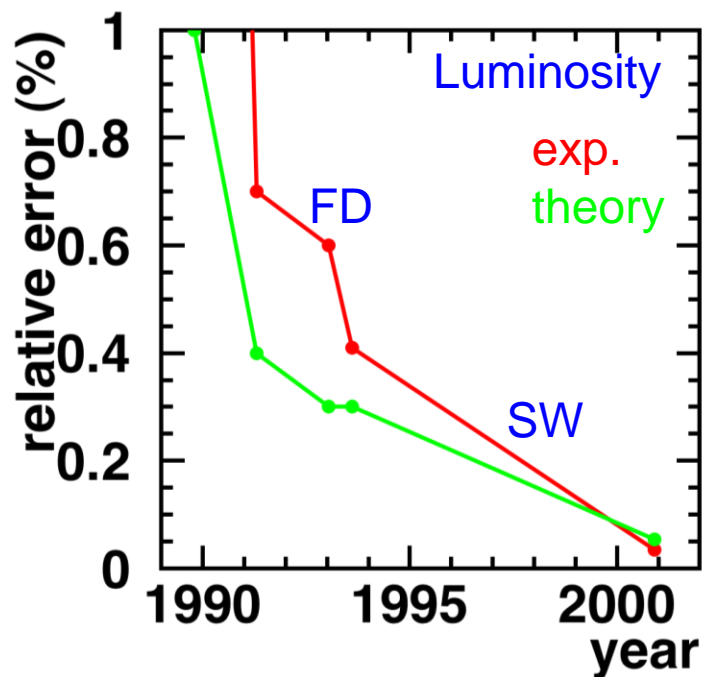
- [Collection of emails about FD float discussion](#)
- [Pete Clarke's document on Fitting \(PS file\)](#)
- [Link to Pete Clarke's fit results](#)
- [Fit input data used for the Moriond 97 result](#)
- [Anti-correlation of systematic error between lepton species \(PS file\)](#)
- [Lepton inter-species anti correlation.](#)
- [Lepton error matrix \(version 18.12.1997\) *Read me // input data // matrix \(readable format\) // matrix \(format for Peter\) //*](#)
- [MH correlation between \(90-92\) and \(93-95\).](#)
- [LEP energy related issues.](#)
- [Koralz kinematical cuts. // Lepton MC parameters.](#)
- [93-95 KORALZ mu/tau s' cut correction.](#)
- [Correction to KORALZ mu/tau efficiency due to I/F interference. // Write up \(ps file\)](#)
- [List of fit input files.](#)
- [ALIBABA table for t-ch corr..](#)
- [TOPAZ0 table ls+tl// TOPAZ0 table ls//](#)
- [Bhabha taskforce workpage.](#)
- [Some theory documents](#)

Also the Zedometry analysis page.

It took so long since the previous publication of 1992 data in 1994.

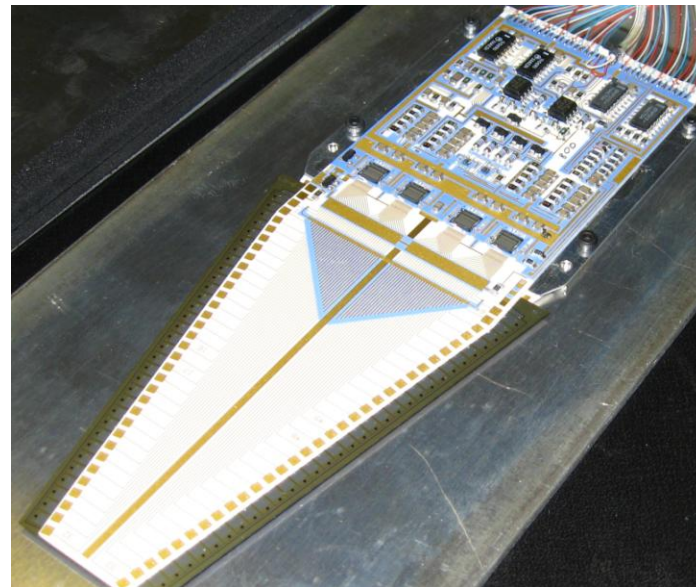
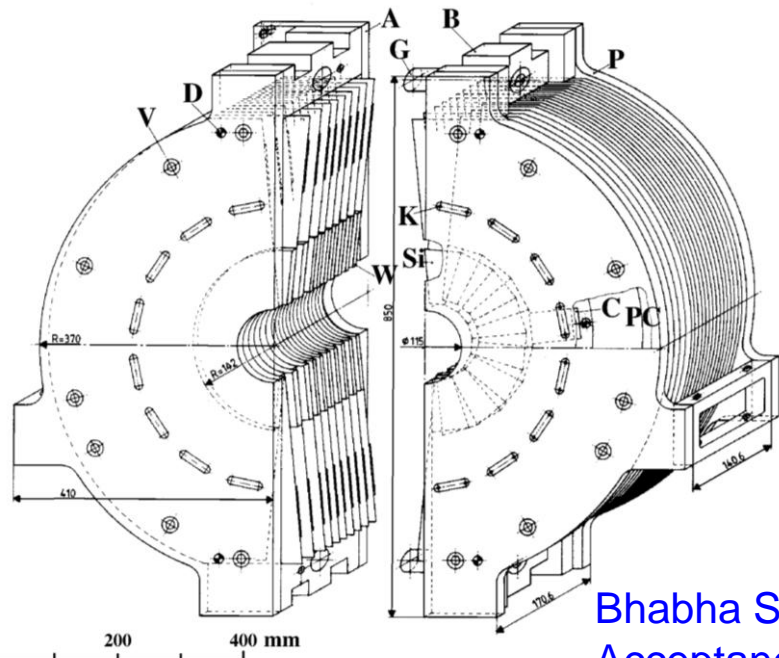
Well,

- we were aiming ultimate measurements
- progress also in theory precision
- had to wait for the LEP energy calibration anyway
- other collaborations were also slow ...
- lack of man power ...
- busy for LEP2 things ...
- ...
- public reading was 20 hours or so long ...
- ...

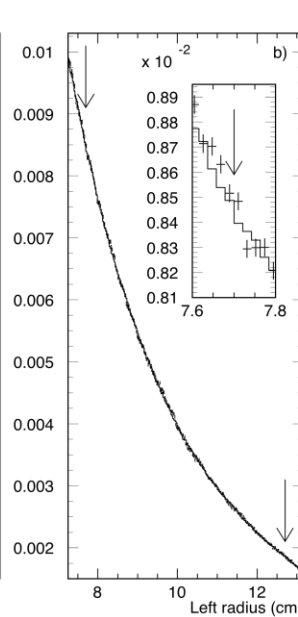
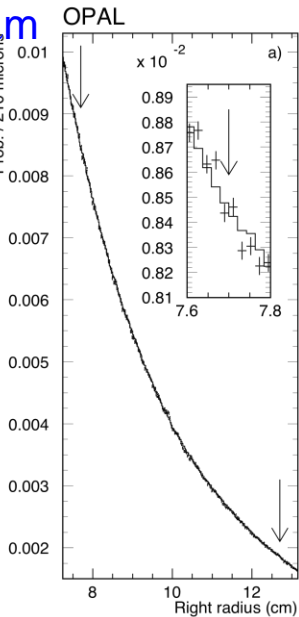
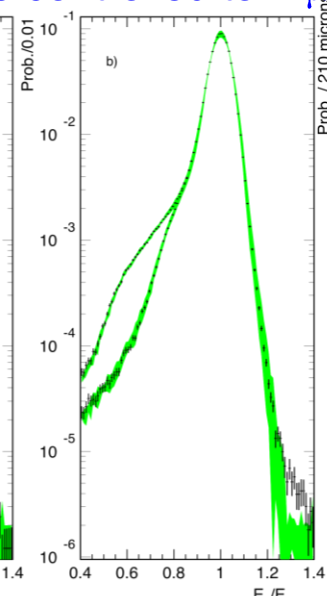
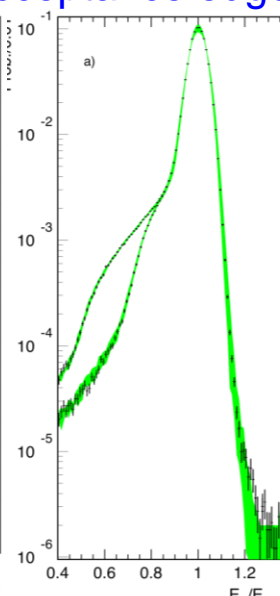
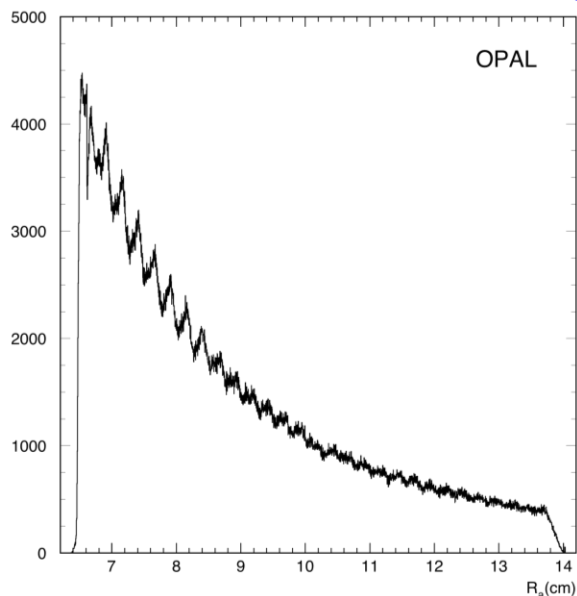


Systematic uncertainties

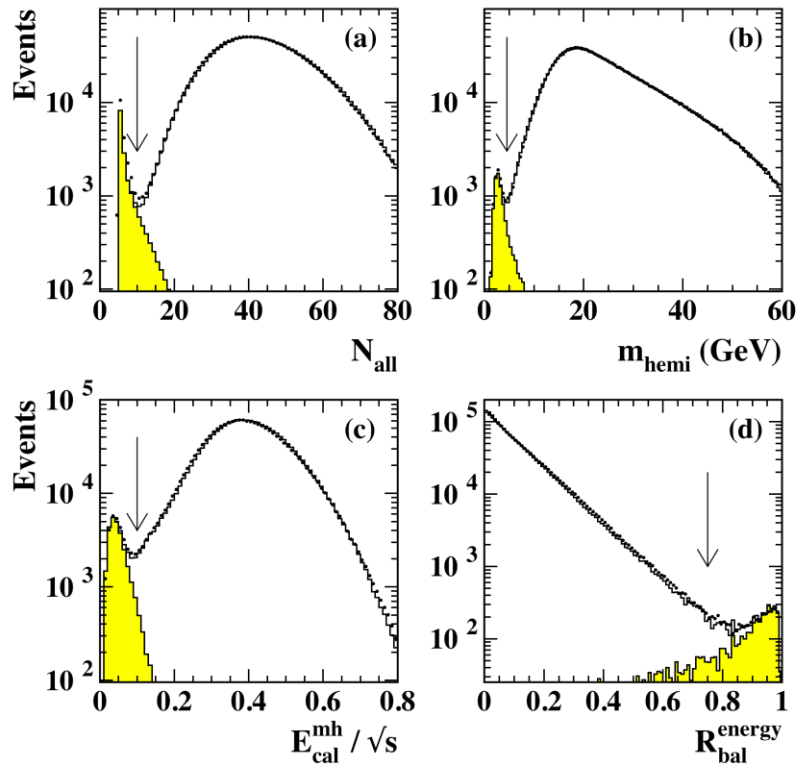
Precision luminosity determination with SiW luminometer



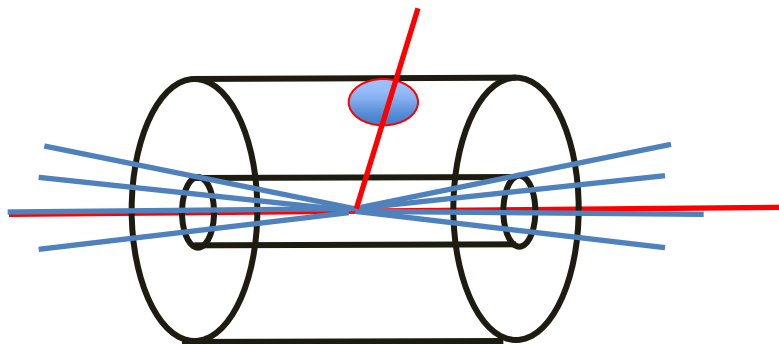
Bhabha SW cross-section = 79 nb
 Acceptance edge controlled to 7 μm



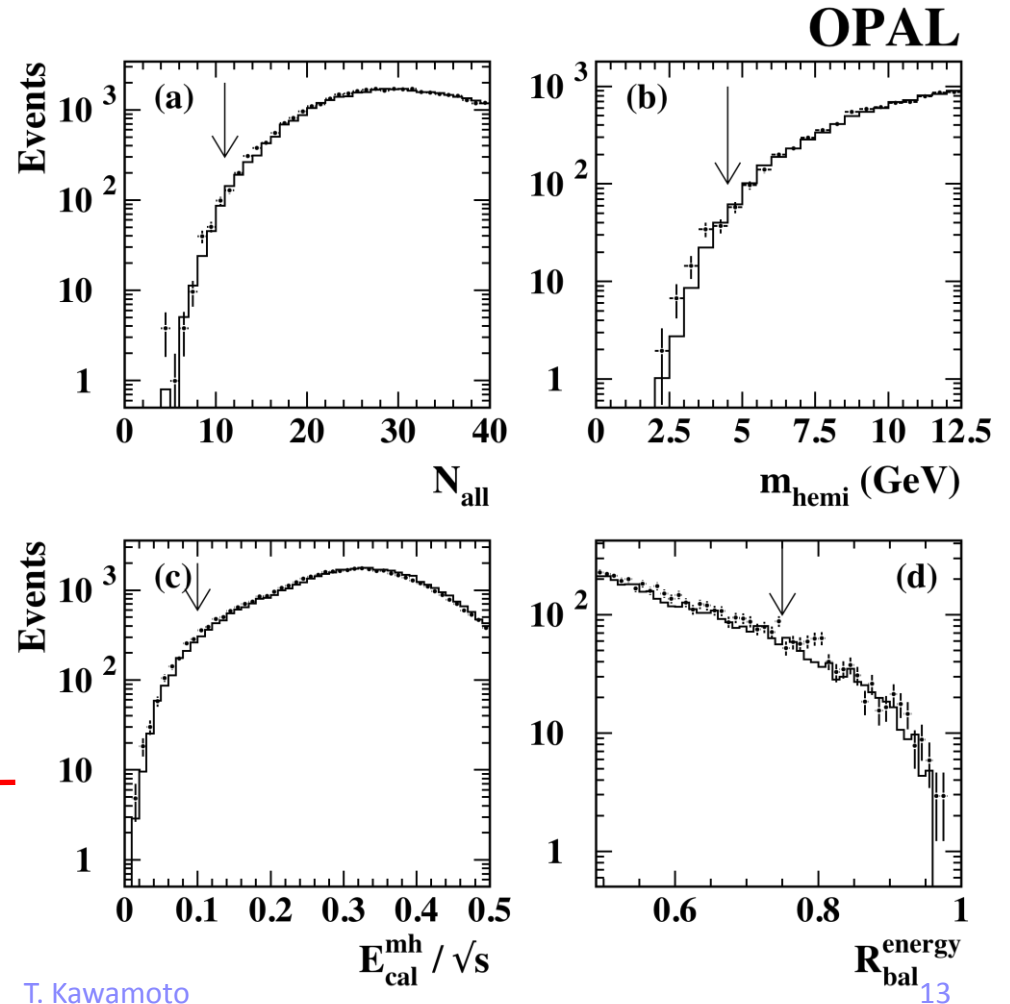
Hadronic event selection OPAL



Comparison of data and MC



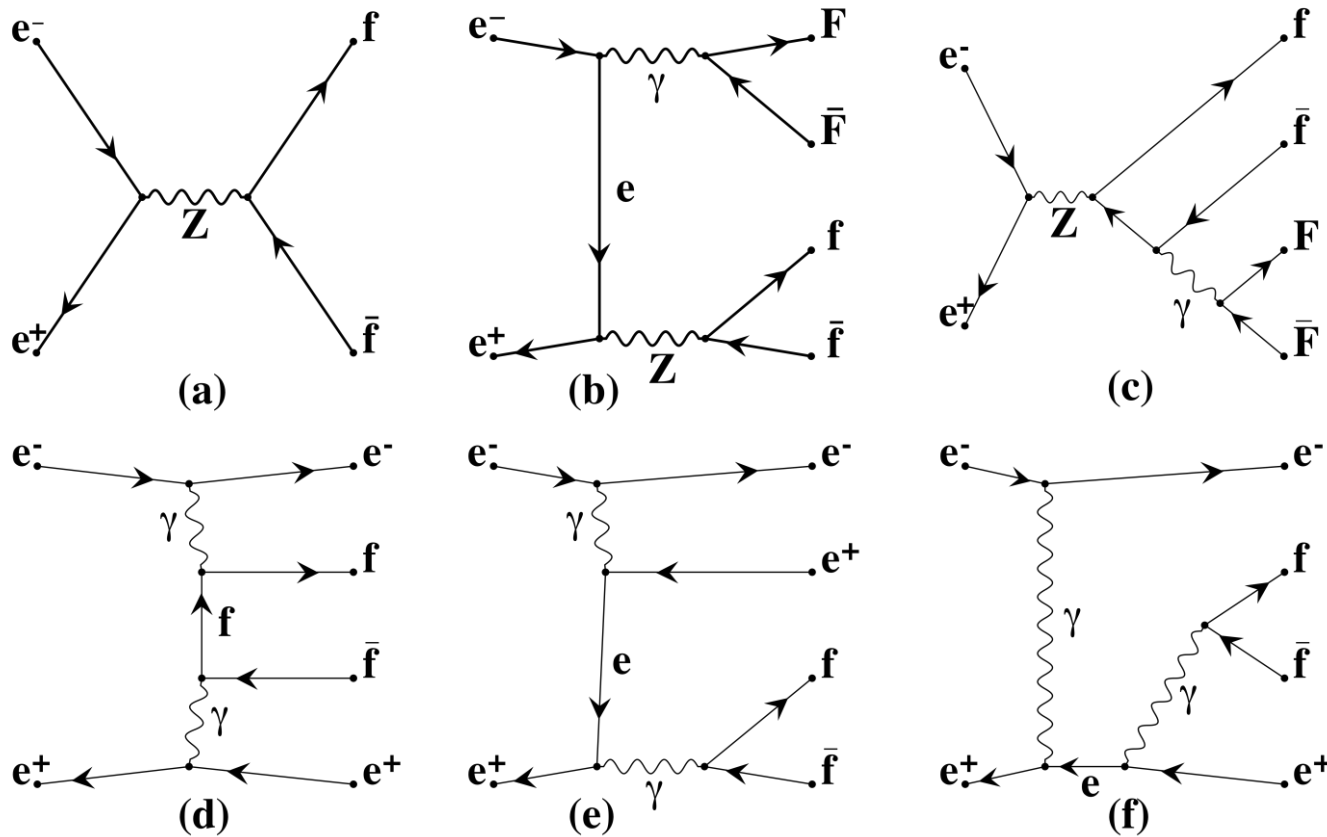
Emulation of acceptance hole (beam pipe) in barrel \rightarrow detailed calibration of MC using data
 \rightarrow eliminating the hadronisation uncertainty



LEP2 analyses helped

Learned to worry about and how to manage in data and theory such effects like

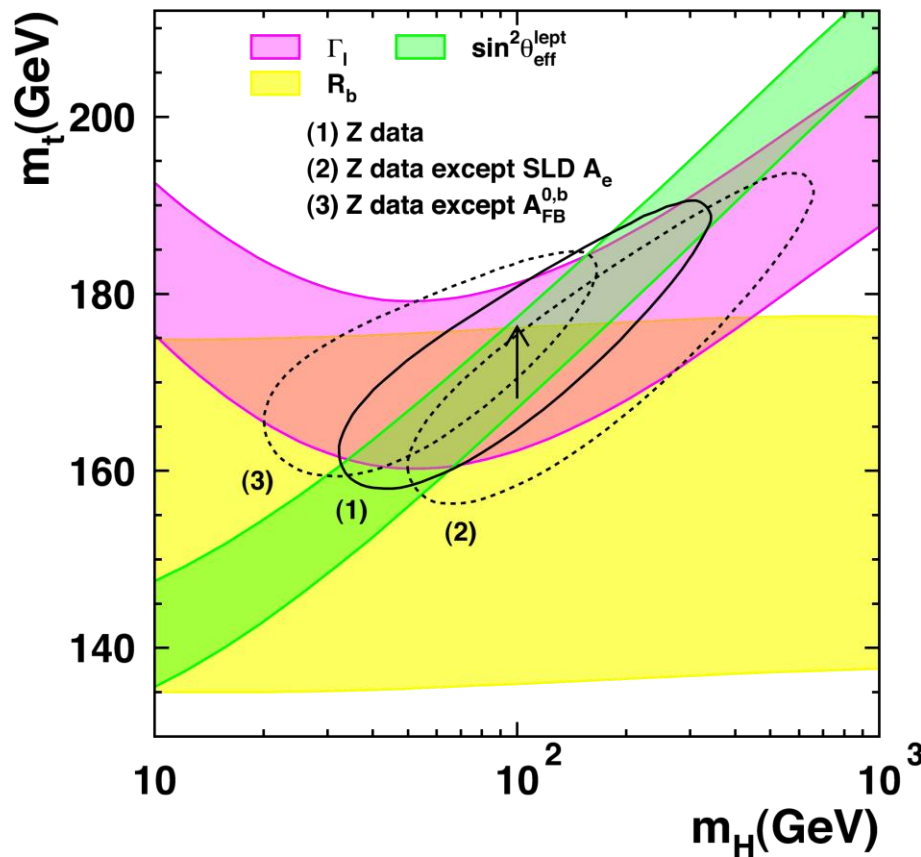
I/F interference, s' cut, 4 fermion final states,



Effects are relatively small on Z pole, but they are all evaluated and taken into account

Also, worrying about $LS+A_{FB}$ and EW interpretation, considered various things, for example --

Why m_t from the SM fit is so stable and does not depend much on the assumed m_H ?

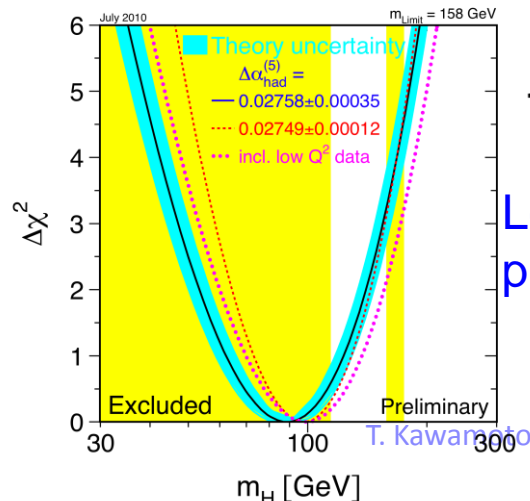
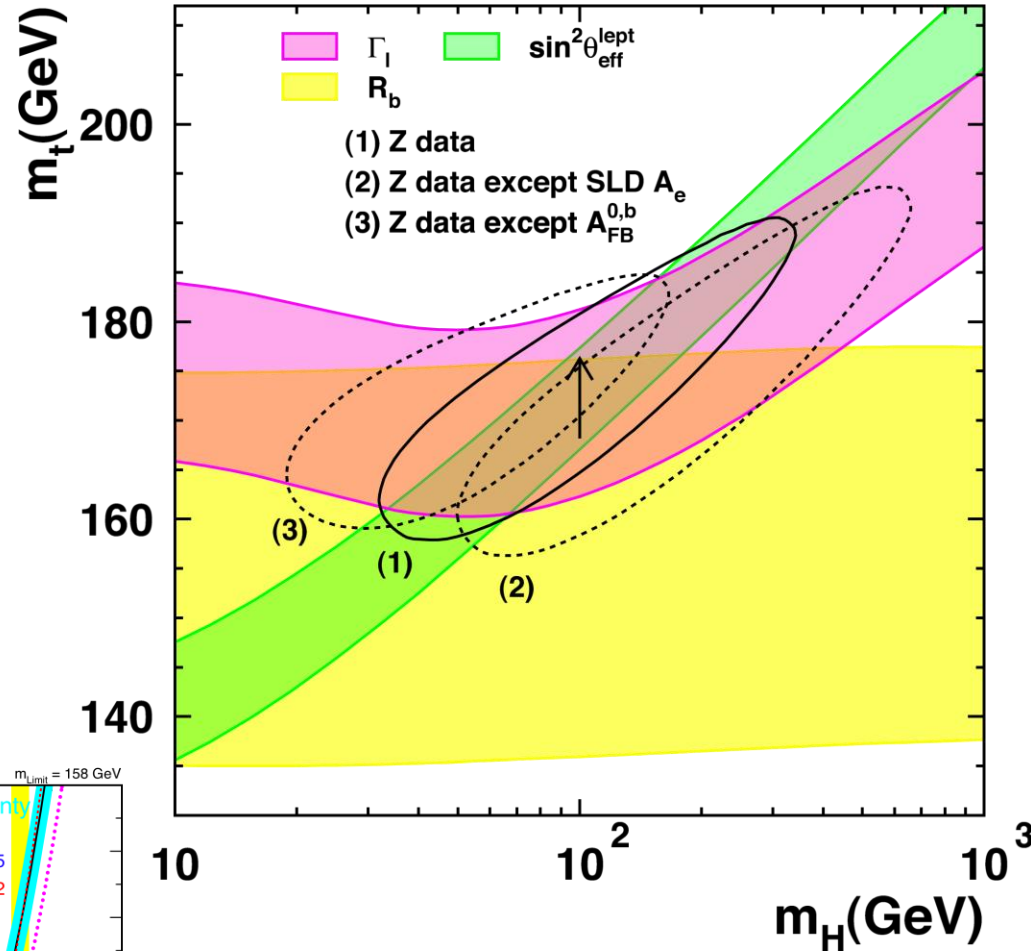
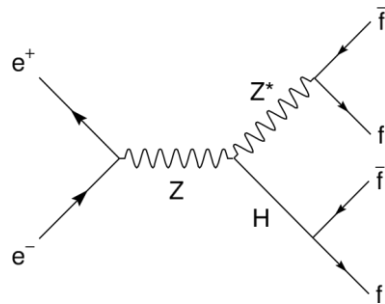
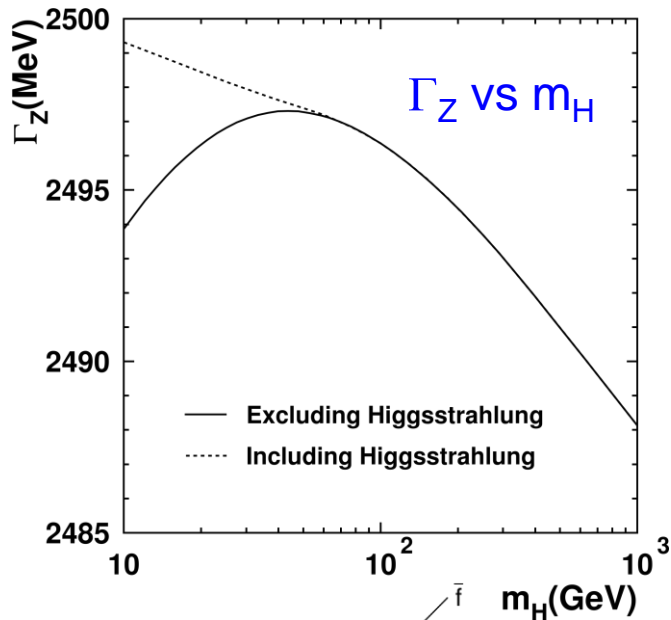


So produced a plot like this to see.

OK, I see, ...
but why the constraint from Γ_f is banana shape ?

Ah, the standard SM calculation (Zfitter) does not include Higgs-strahlung

If Higgs-strahlung is included, the previous plot would look like:



Low m_H region of this plot should, to be precise, be modified.

Difference is small

No Higgs below ~ 60 GeV anyway ...

T. Kawamoto and R.G.Kellogg
Phys.Rev.D69:113008,2004

21.10.2010

T. Kawamoto

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