Measurement of $\Gamma(\phi \to e^+e^-)$ from 2002 scan bhabha events

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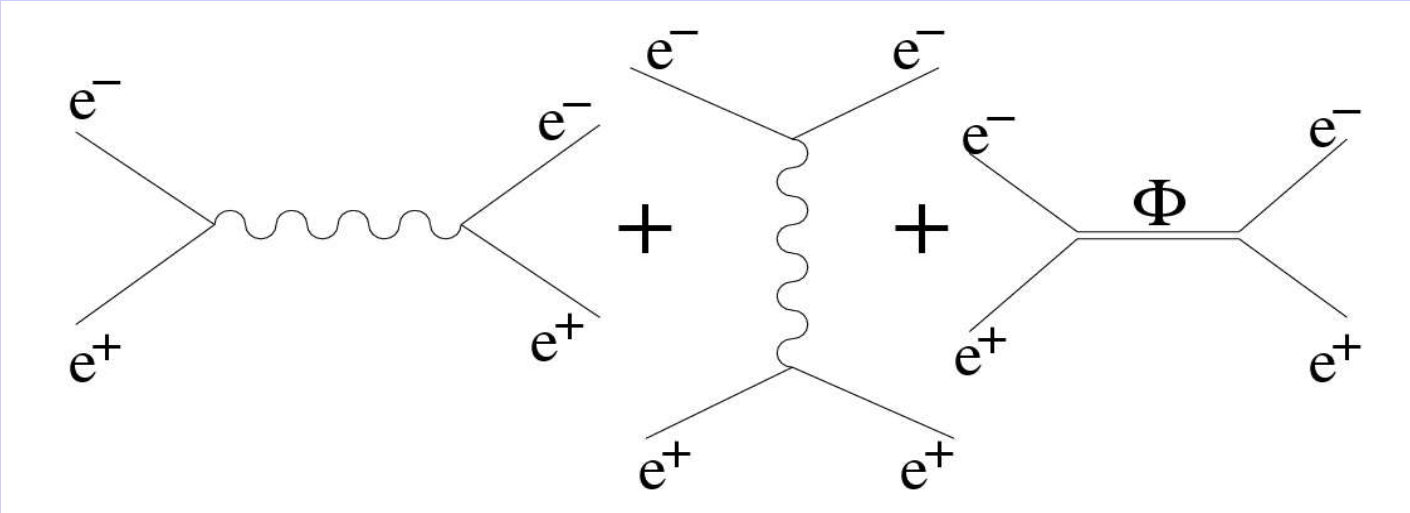
Bhabha cross section

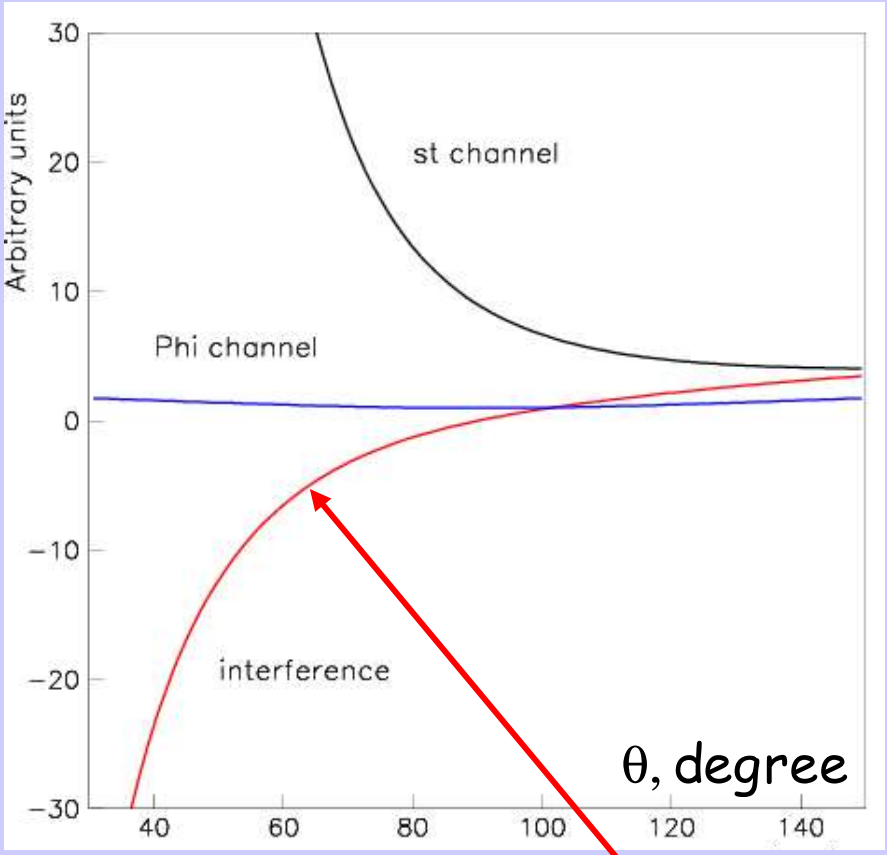


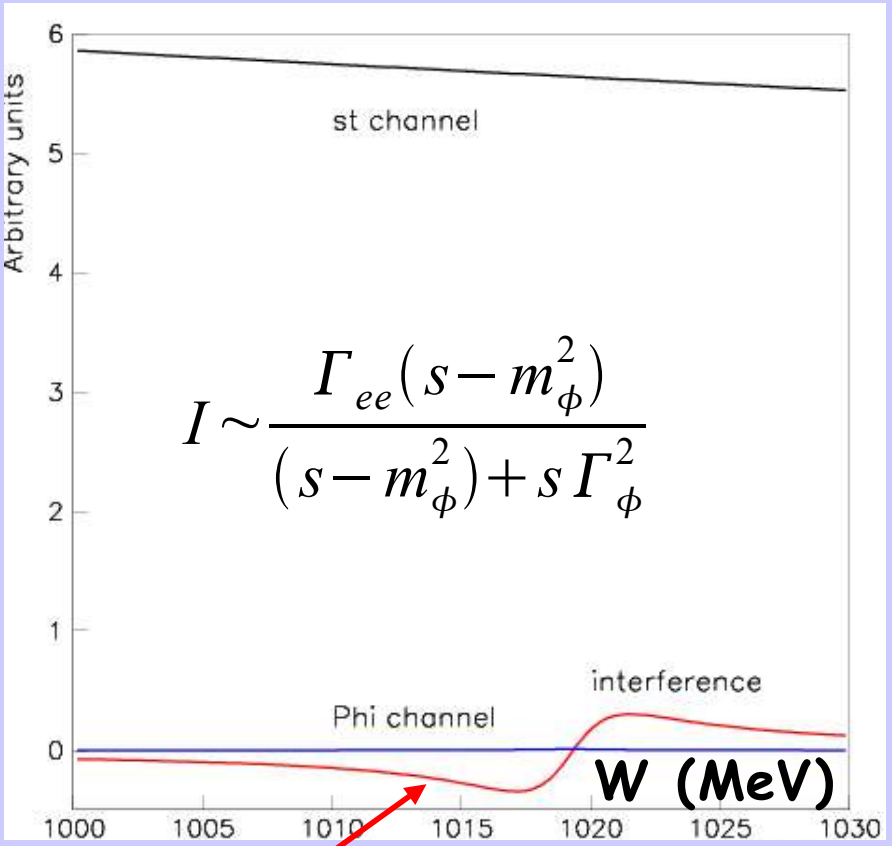
$$A = A_{st} + A_{\Phi}$$

$$\sigma = \sigma_{st} + \sigma_{\Phi} + I$$

angular dependence

energy dependence



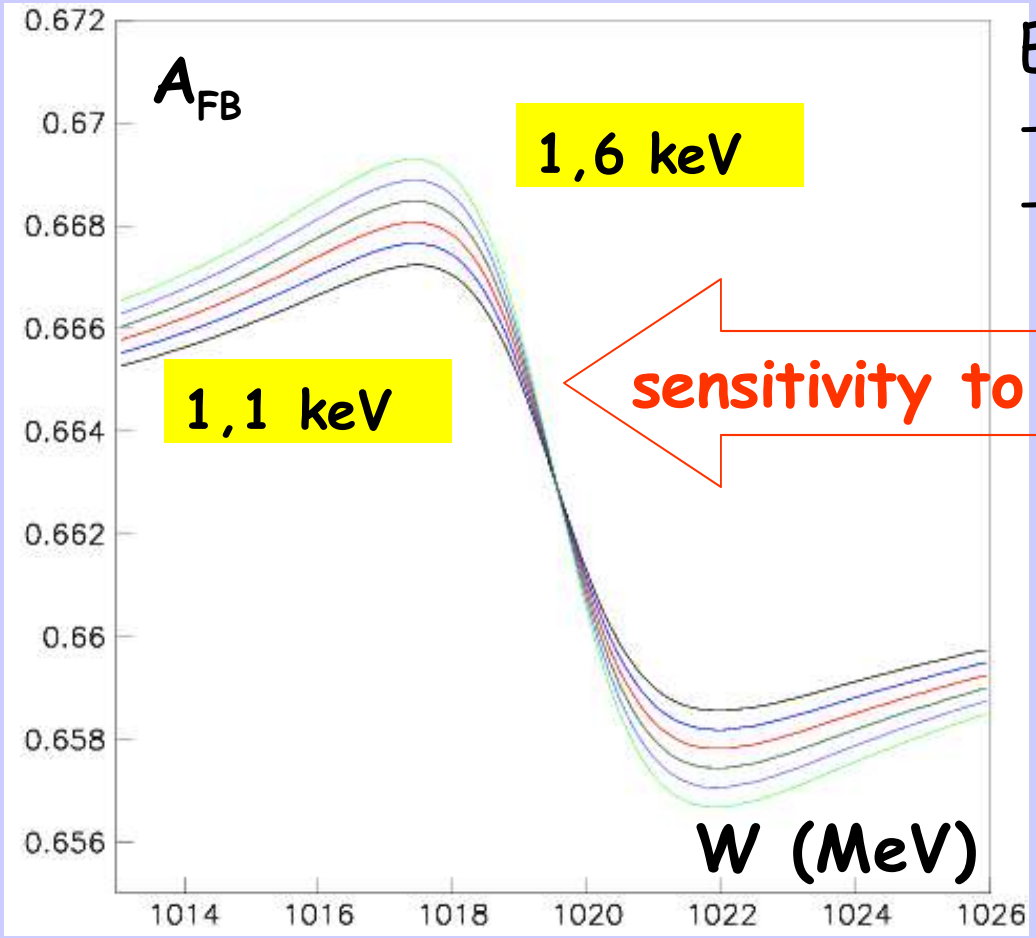


interference

Forward backward asymmetry A_{FB}

Enhanced sensitivity to Γ_{ee} respect to σ_{ee}

$$A_{FB} = \frac{\sigma_F - \sigma_B}{\sigma_F + \sigma_B}$$



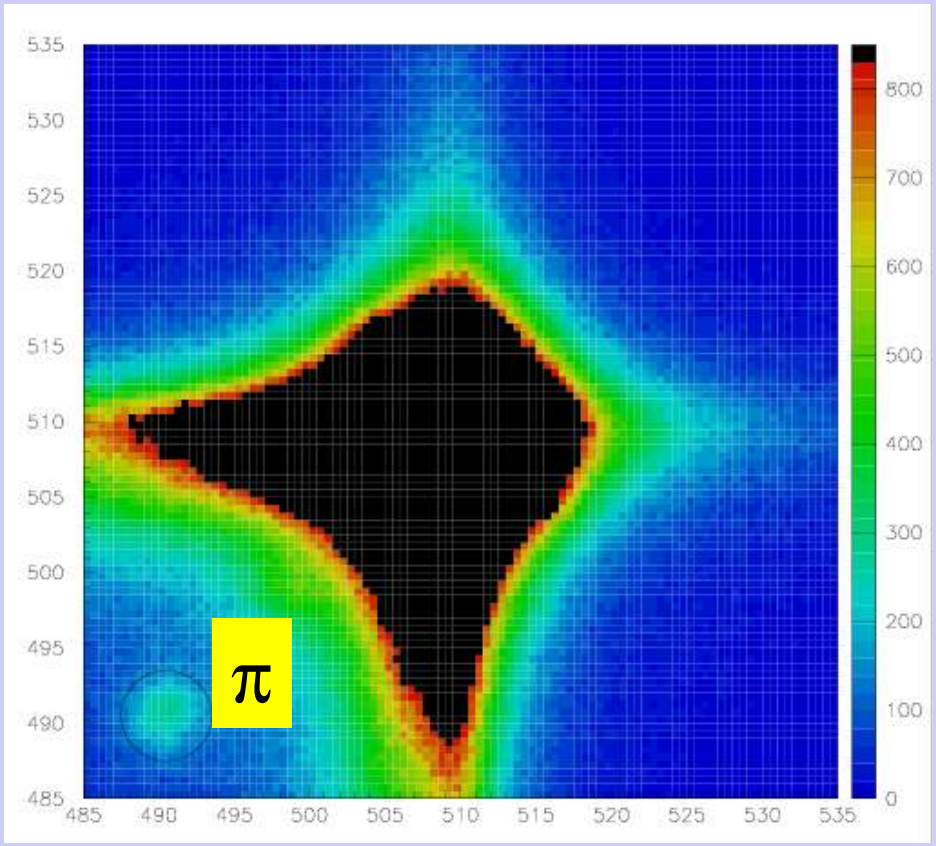
Experimental advantages:
- Luminosity not needed
- Partial cancellations (eff, bkg, syst.)

Γ_{ee} depends on abs asymmetry difference

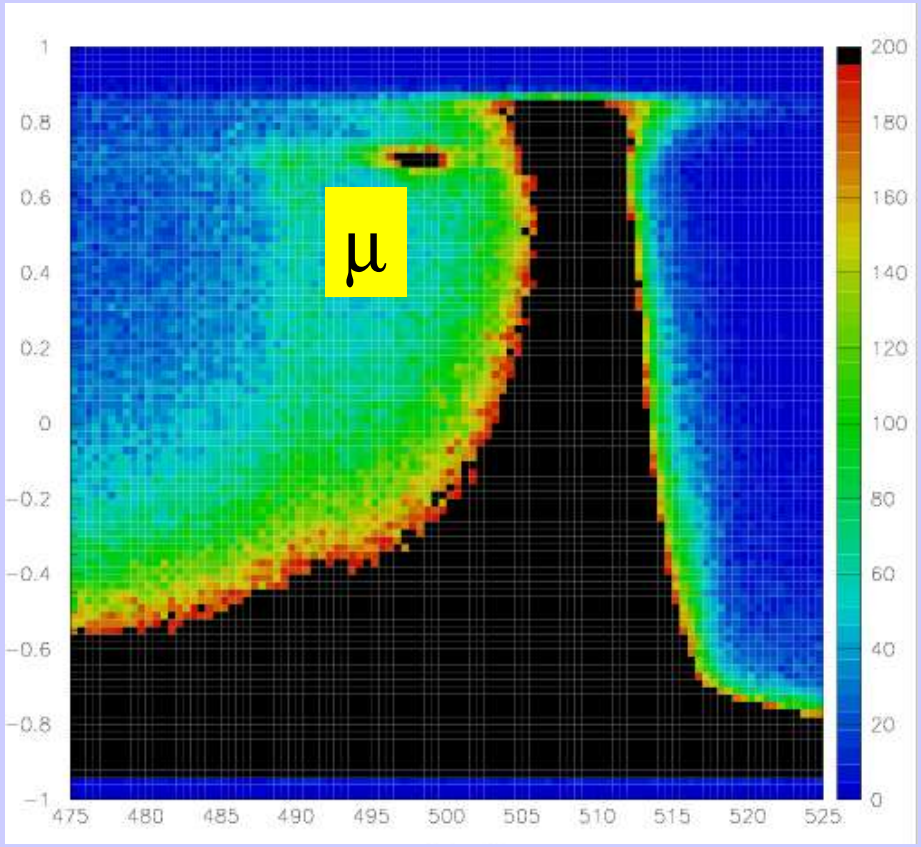
Bhabha data sample

- 3 energy points (~7 pb^{-1} each) of 2002 scan

- Pion's and muon's contamination (~$2 \cdot 10^{-3}$) have been removed from stream Bhabha



p_1 vs p_2

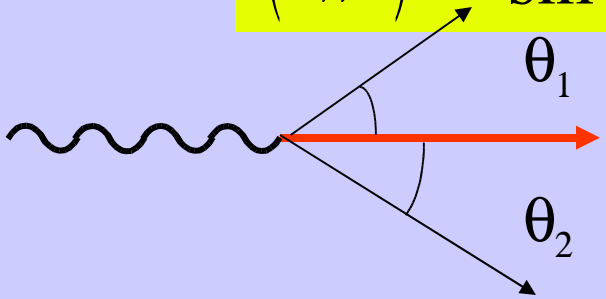


p_1 vs $\cos\theta_1$

W'/W reconstruction

Boost back in ϕ rest frame,assuming a single beam collinear ISR photon and collinear FSR

$$\left(\frac{w'}{w}\right)^2 = \frac{\sin(\theta_1)+\sin(\theta_2)-\left|\sin(\theta_1+\theta_2)\right|}{\sin(\theta_1)+\sin(\theta_2)+\left|\sin(\theta_1+\theta_2)\right|}$$

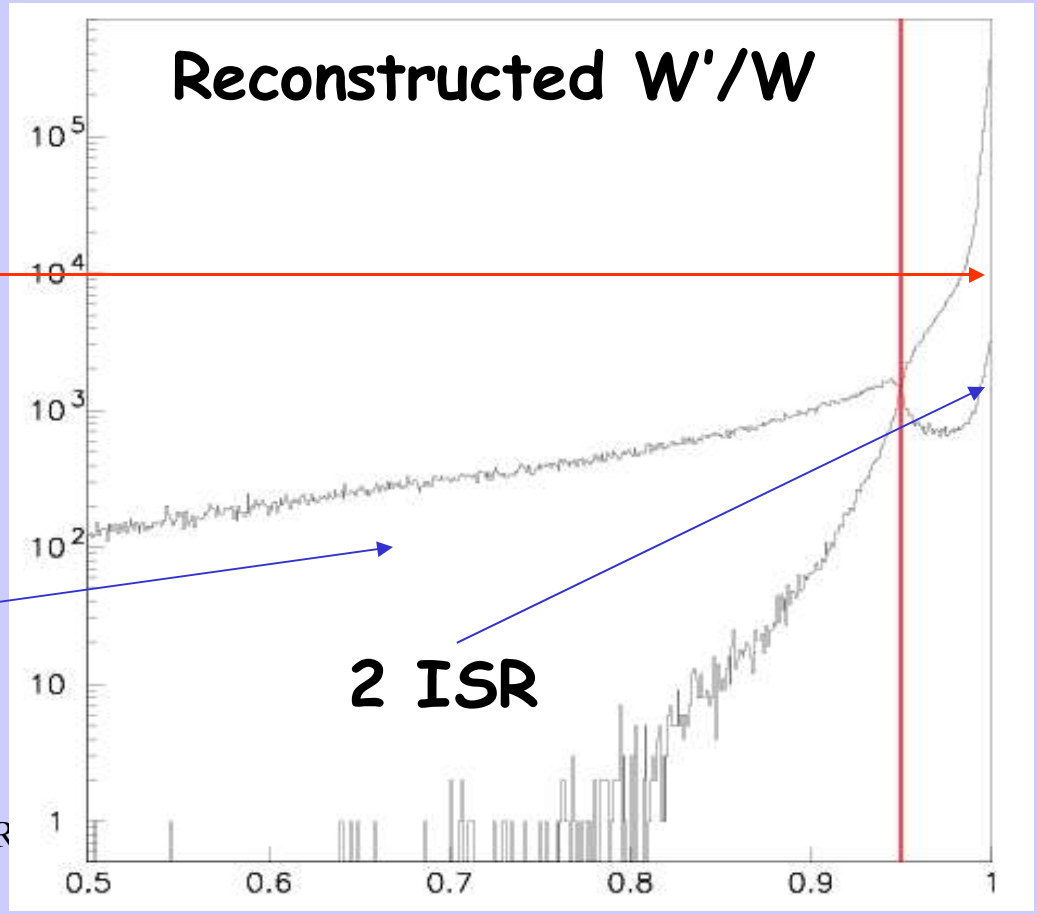


- Signal:

True W'/W>0.95
Efficiency ~ 98%

- Background:

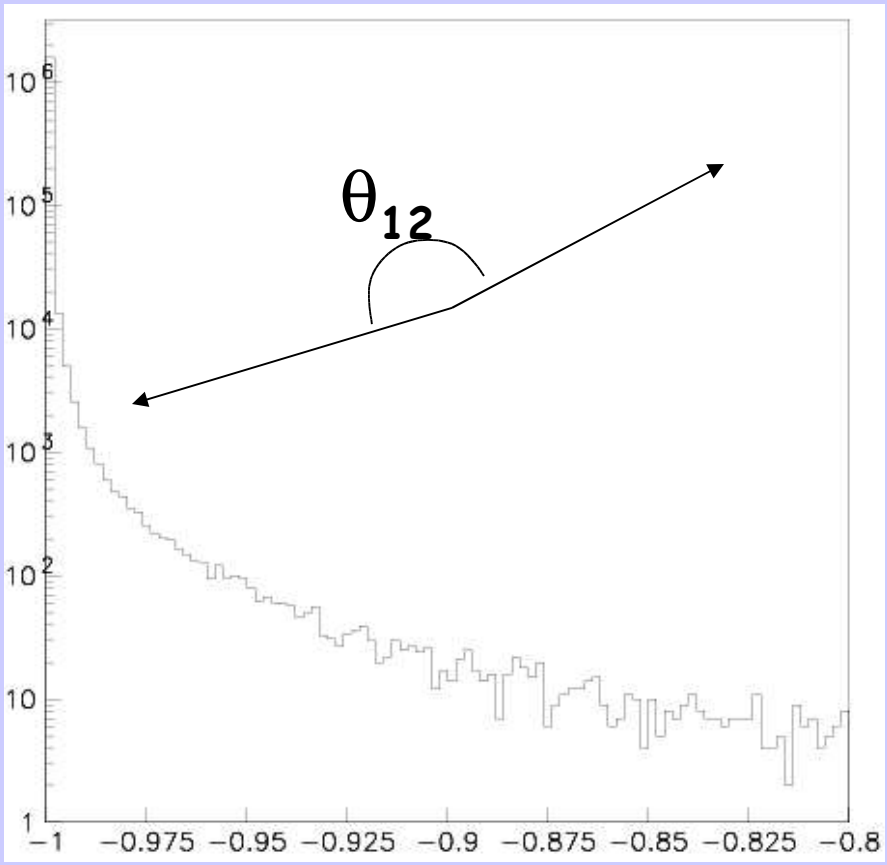
True W'/W<0.95
Contam. ~ 2 %



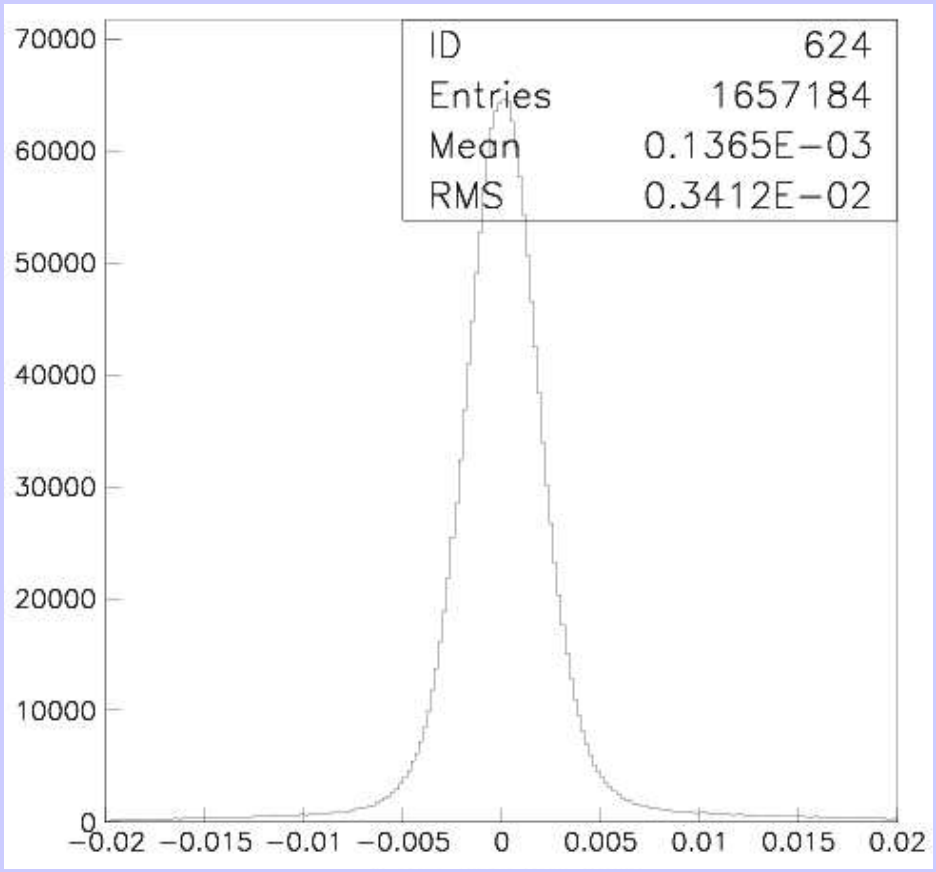
θ reconstruction

Boost back in born rest frame

Analysis cuts: (i) M_{miss}<150 MeV ; (ii) $\cos\Theta_{12}$<-0.997



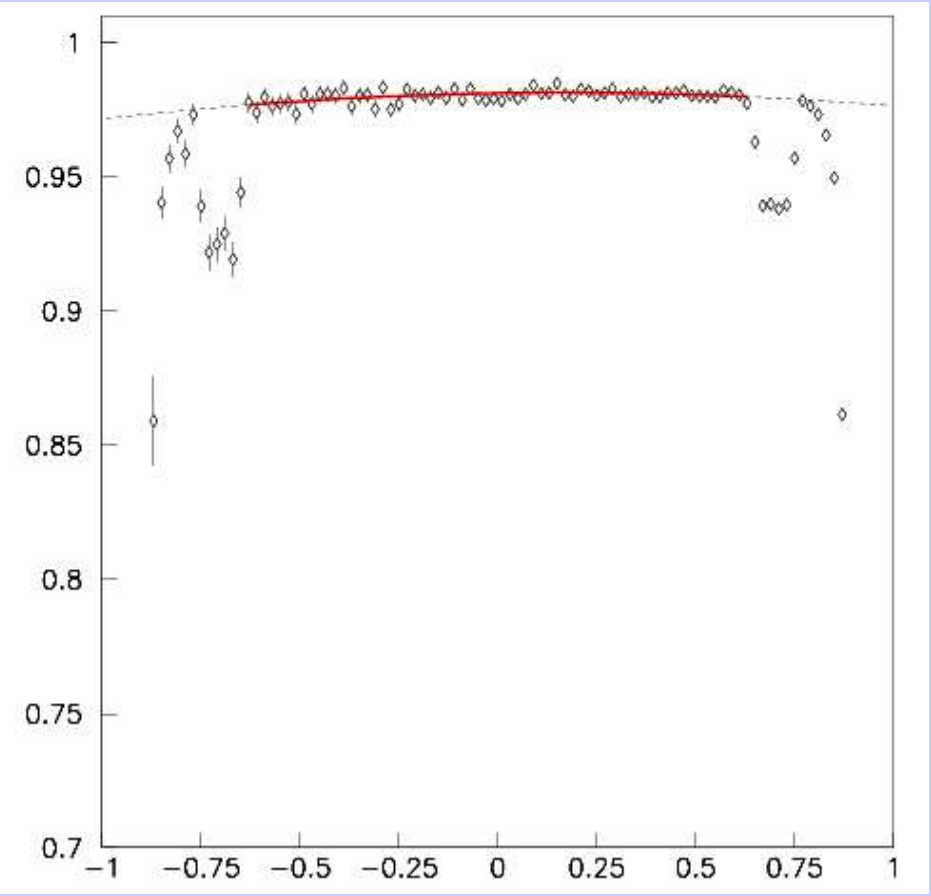
$\cos(\theta_{12})$



angular resolution

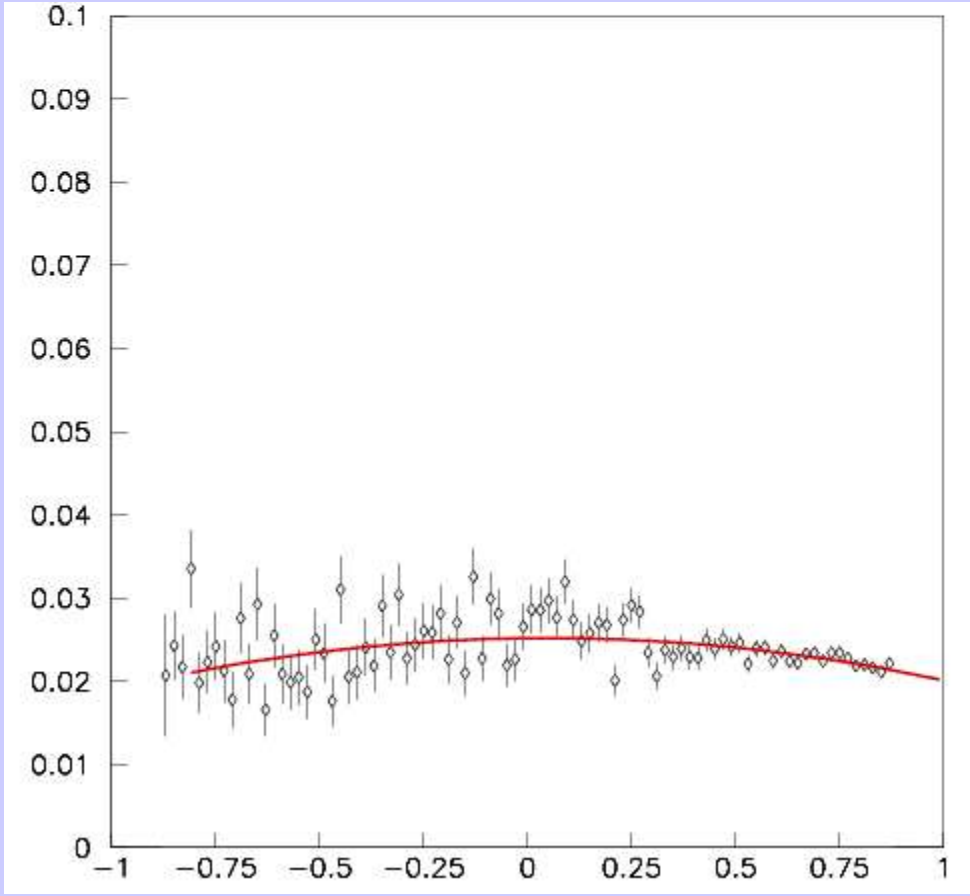
Efficiency and background vs cosθ

Efficiency



Cos(θ)

background



Cos(θ)

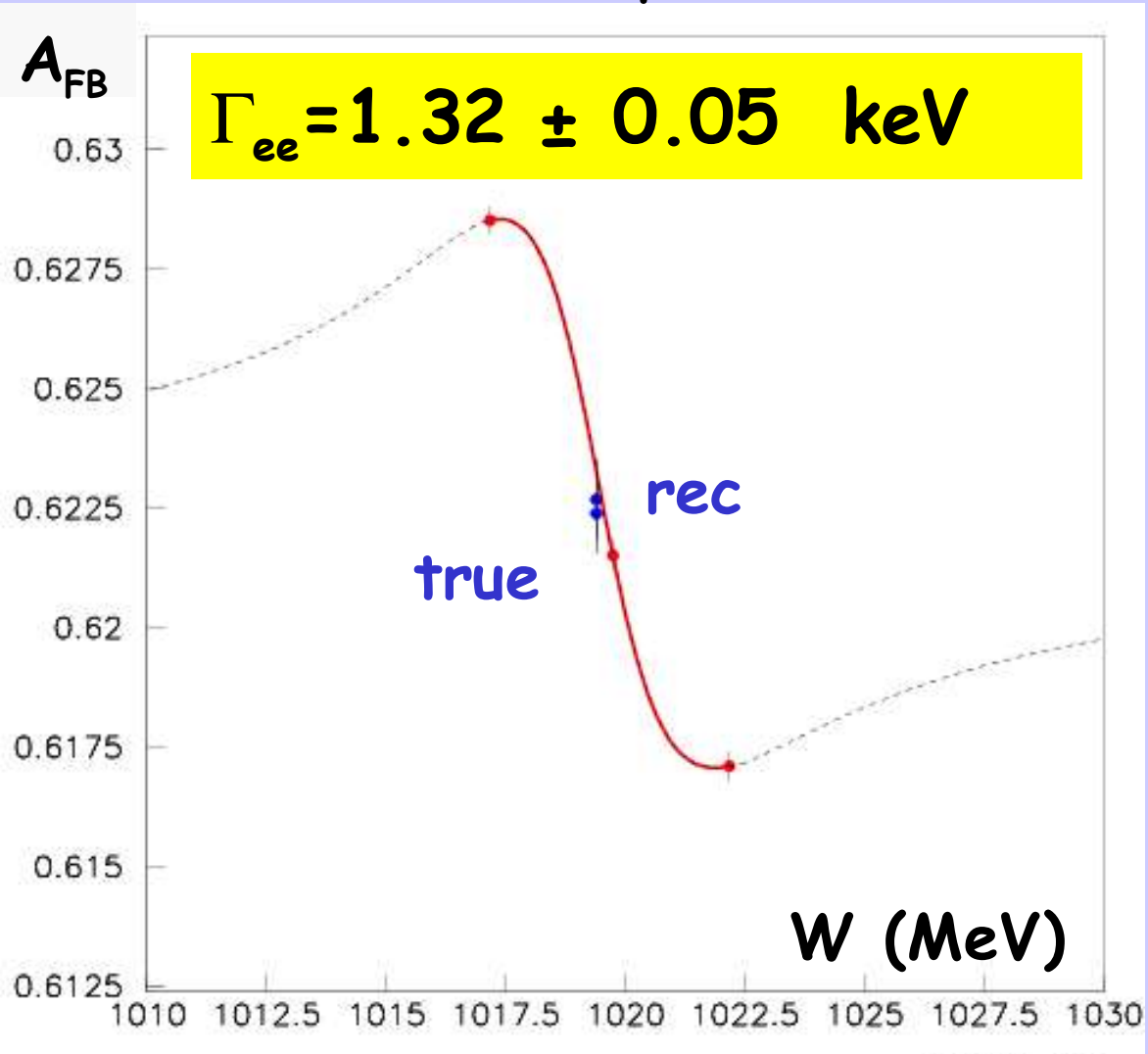
Fit result

Fit function : born + rad + bes (d.p.)

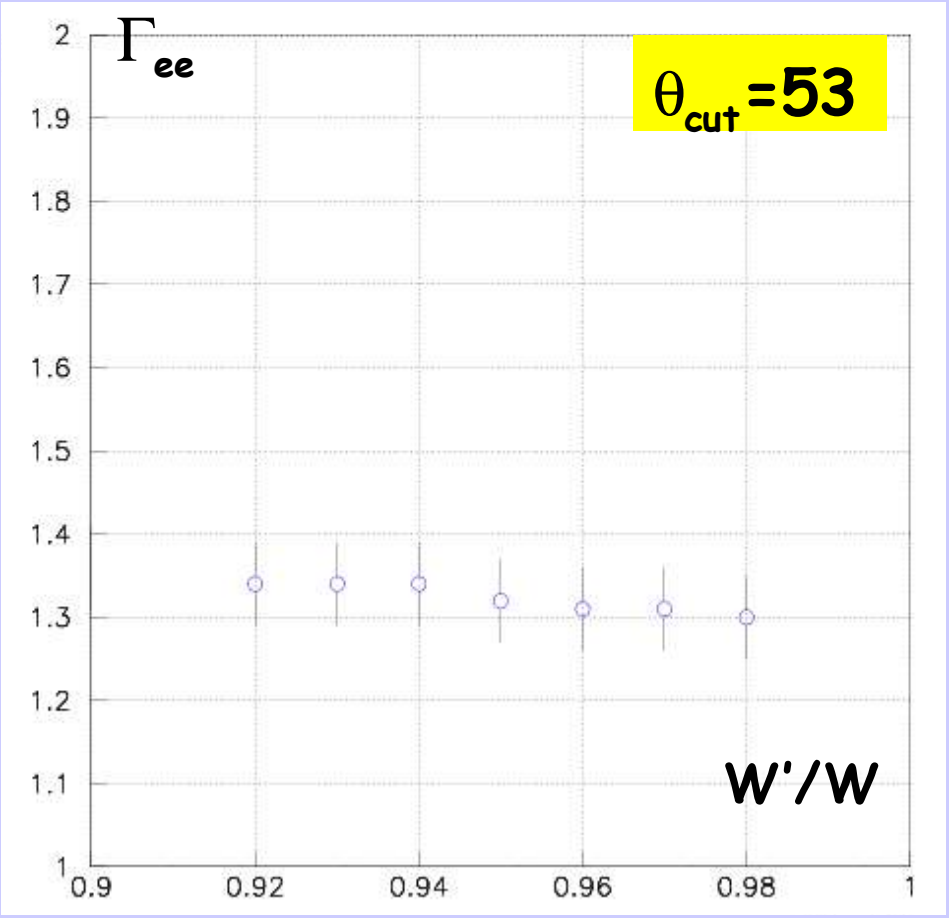
Red - Data sample : scan 2002, 3 energy points, 7 pb^{-1} each

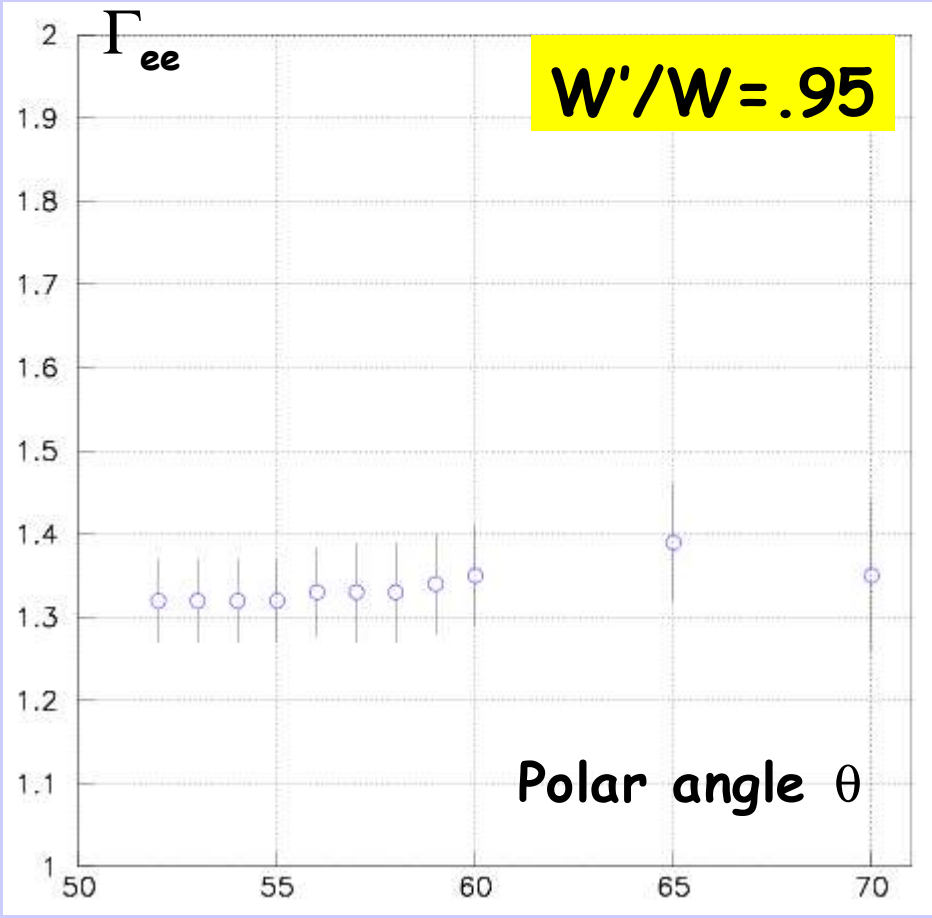
Blue - Monte Carlo : Geanfi (no interfer, Babayaga generator)

- W'/W>0.95
- Angular acceptance: $53^{o} < \theta < 127^{o}$



Stability


Γ_{ee}
θ_{cut}=53
W'/W
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.92
0.94
0.96
0.98
1


Γ_{ee}
W'/W=.95
Polar angle θ
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
50
55
60
65
70

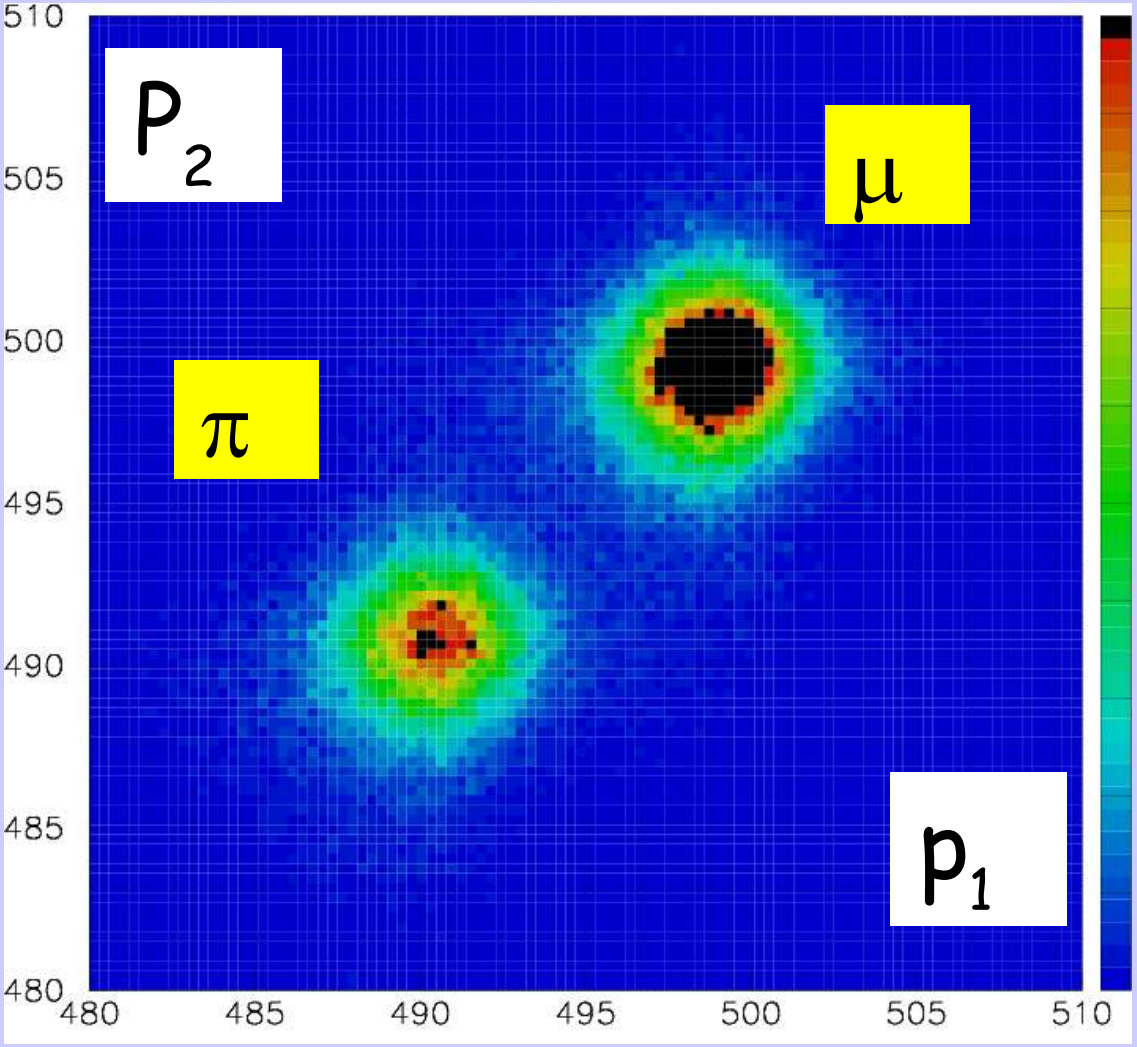
Systematics

- 3 mrad bias in θ_{rec} ~ 10^{-2} keV
- Γ_{tot} uncertainty ~ 10^{-2} keV
- eff uncertainty ~ 10^{-3} keV
- bkg uncertainty ~ 10^{-3} keV
- ω exhange contribution ~ 10^{-3} keV
- radiative cut ~ $1.7 \cdot 10^{-2}$ keV

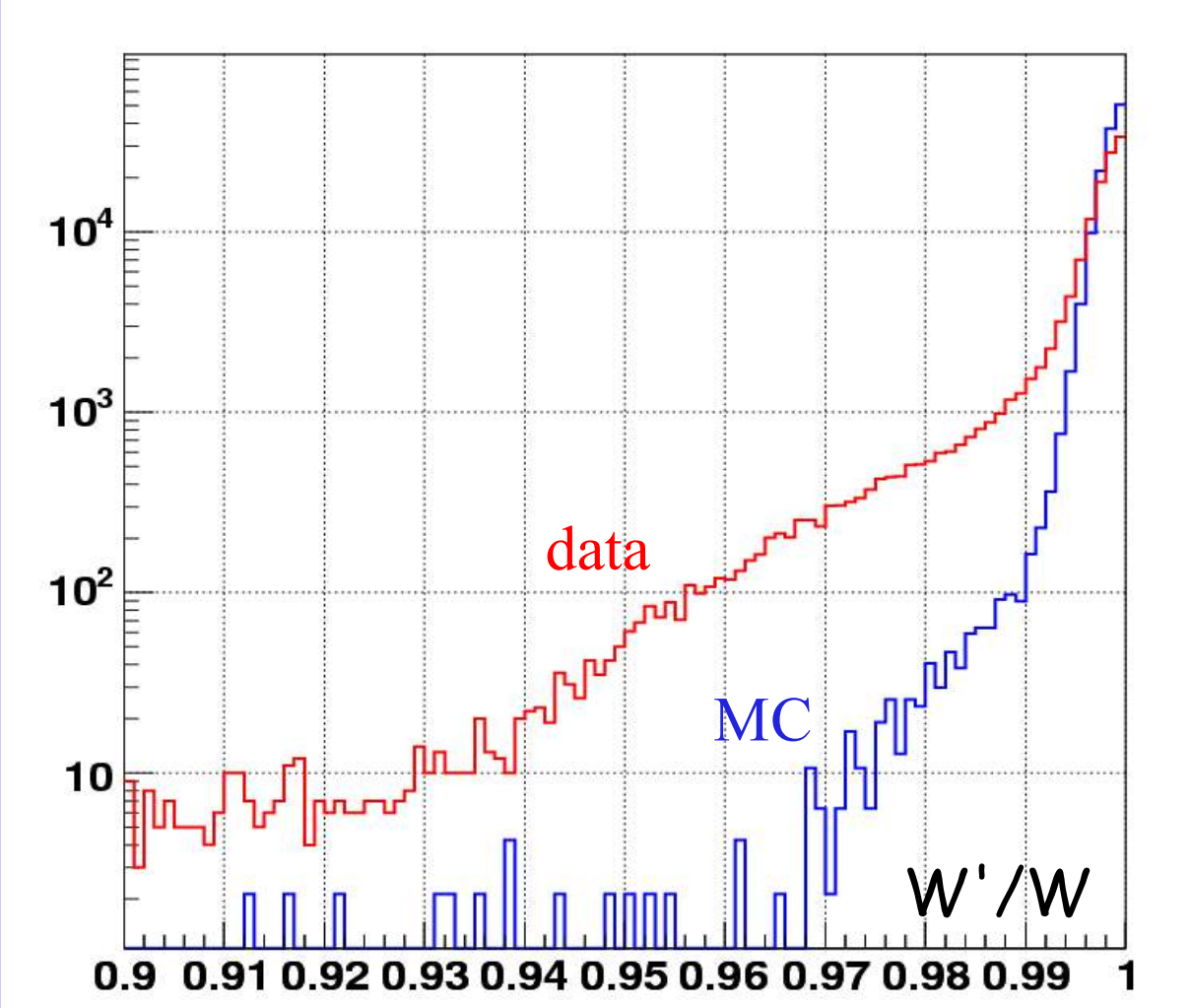
KLOE	$1.32 \pm 0.05 \pm 0.02$
CMD-2 (1999)	$1.32 \pm 0.02 \pm 0.04$ (indirect)
CMD-2 (2003 reanalysis)	$\rightarrow$ 1.36

Leptonic width from $\sigma(ee \to \mu\mu)$

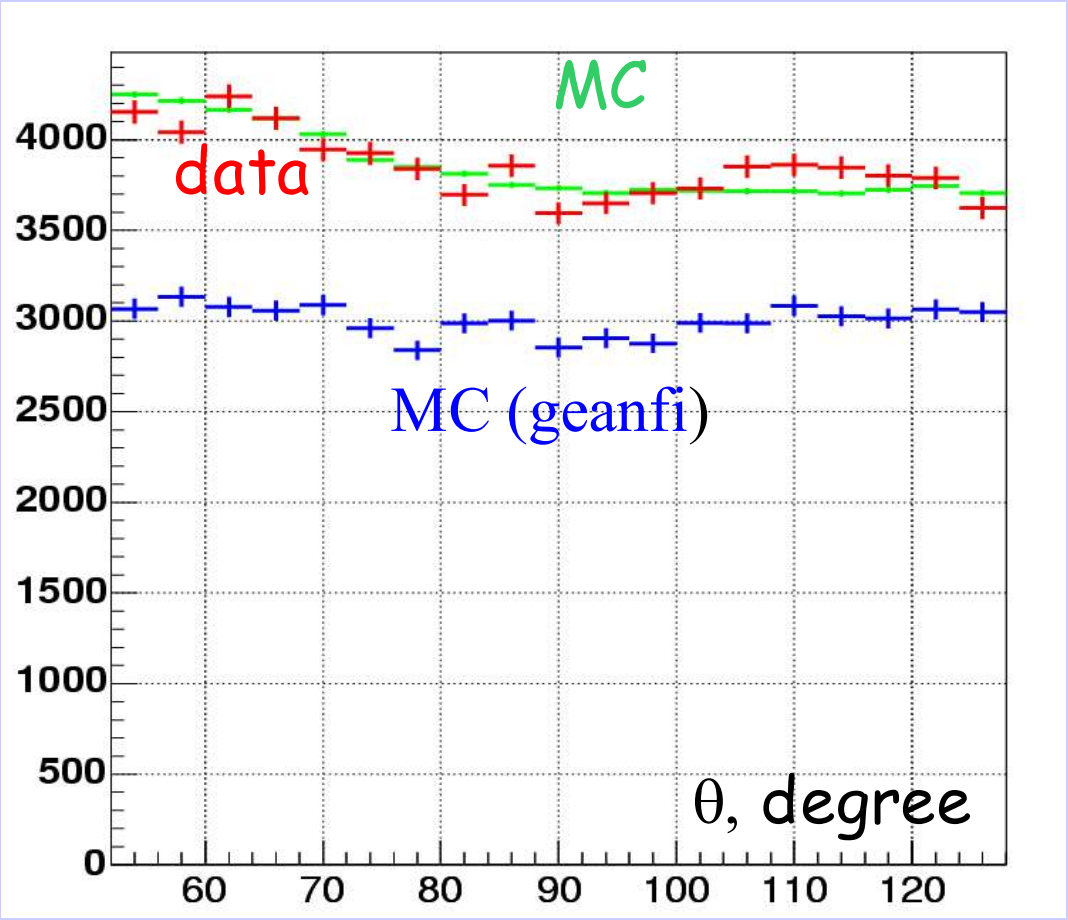
- Selection from CLB stream seems to be promising
- Filfo seems to work correctly



- We need a reliable MC (efficiency computation)



- We have tested a MC in which radiative corrections in the 1st order are taken into account exactly and leading logarithmic contributions are computed in all orders using the structure-function method (A.B.Arbuzov et al., hep-ph/9702262)



- As a preliminary check we have compared cross section from data (CLB 2002-scan) with this MC

- Data and Mc selection : $W'/W > 0.95$, $\theta_{cut}=50^{o}$
- Analisys cut on data : $p_1+p_2 > 990$ MeV

σ (ee->$\mu\mu$), nb			
	1017 MeV	1019.5 MeV	1022 MeV
MC	31.6±0.1	36.5±0.1	38.7±0.1
Data *	29.8±0.3	33.2±0.4	37.2±0.2

(*) No efficiency correction

Conclusion

- Bhabha analysys is complete
- $\mu\mu$ channel :

  1) we need a reliable MC

  2) further improvements on theoretical cross section