Update on $h \rightarrow \gamma\gamma + X$ channel

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- **Efficiency**
- **Mass Peak Width**
- **Acceptance**
- **Cross-Sections**

02/28/2003 Higgs Group Meeting

$h \rightarrow \gamma\gamma$ Efficiencies

1. CCCC+CCEC :

$$\text{Efficiency} = \frac{N(CCCC) \times \varepsilon_{EM}(CC)^2 + N(CCEC) \times \varepsilon_{EM}(CC) \times \varepsilon_{EM}(EC)}{N(CCCC) + N(CCEC)}$$

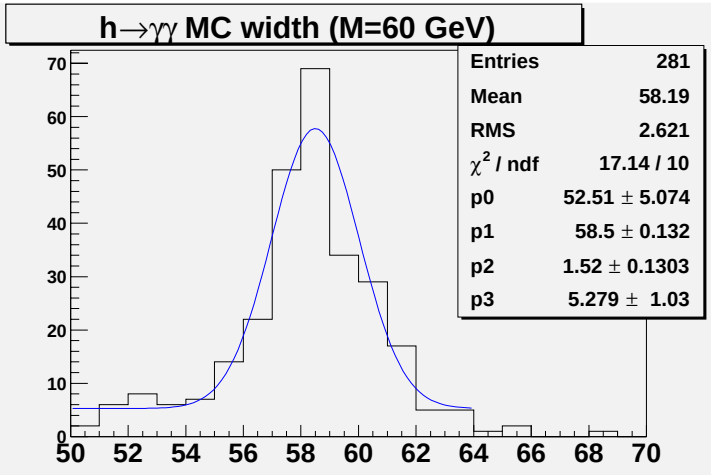
2. In case of CCCC : Efficiency = $\varepsilon_{EM}(CC)$ ^2

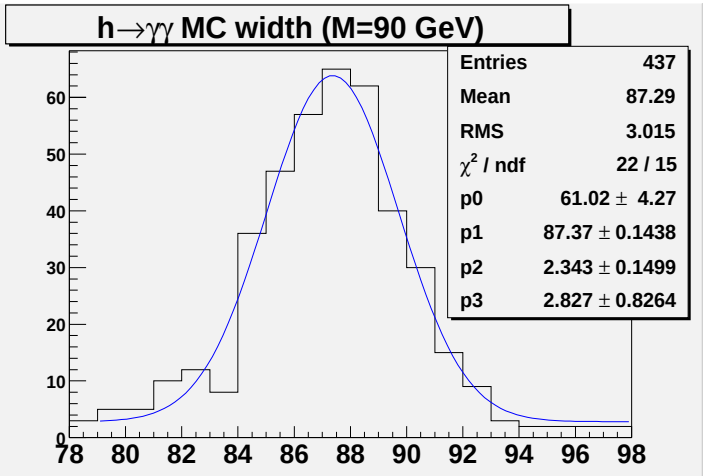
where $\varepsilon_{EM}(CC/EC)$ is measured in $Z \rightarrow ee$ data

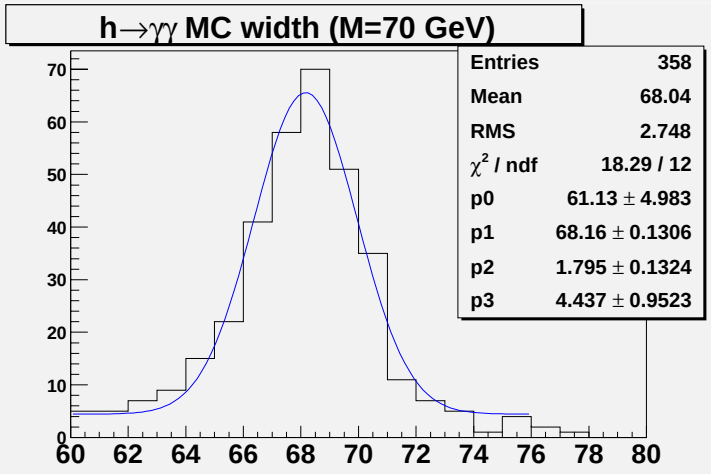
CCCC+CCEC

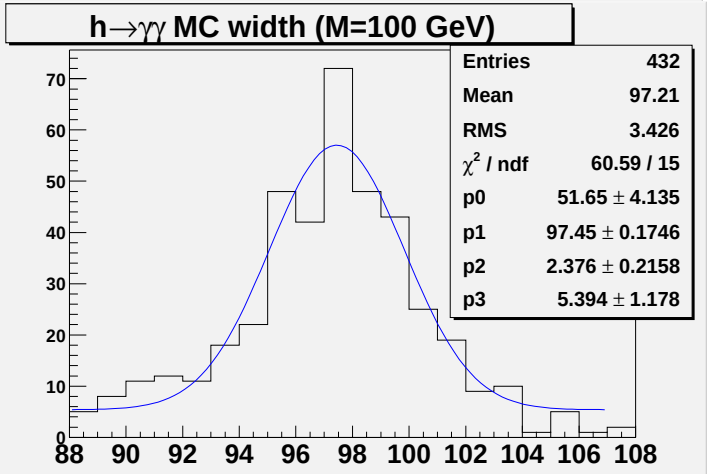
M	Efficiency	Error
60	0.6194	0.0617
70	0.6222	0.0609
80	0.6279	0.0594
90	0.63	0.0651
100	0.6343	0.0578
120	0.6344	0.0578
CCCC	0.6084	0.6084

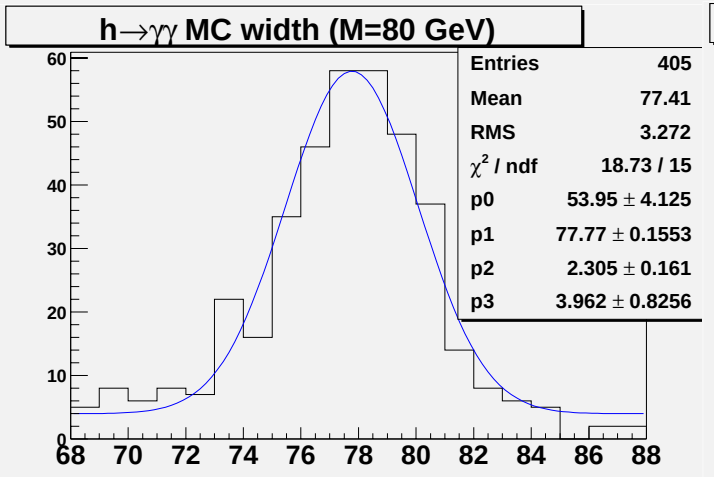
Reconstr.
$h \to \gamma\gamma$
Width
CCCC

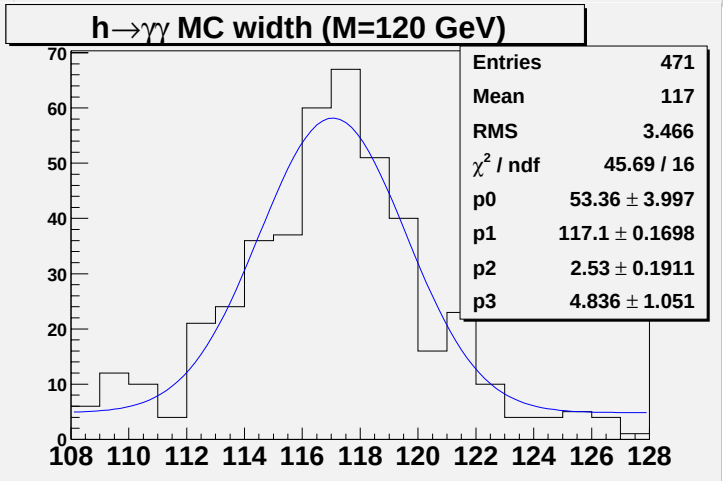




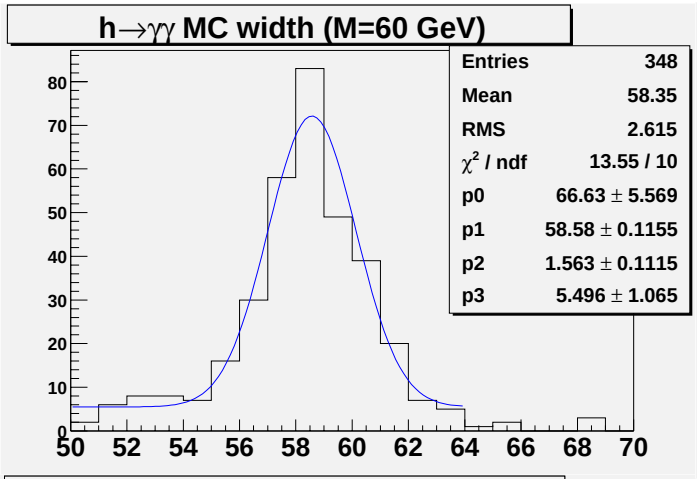


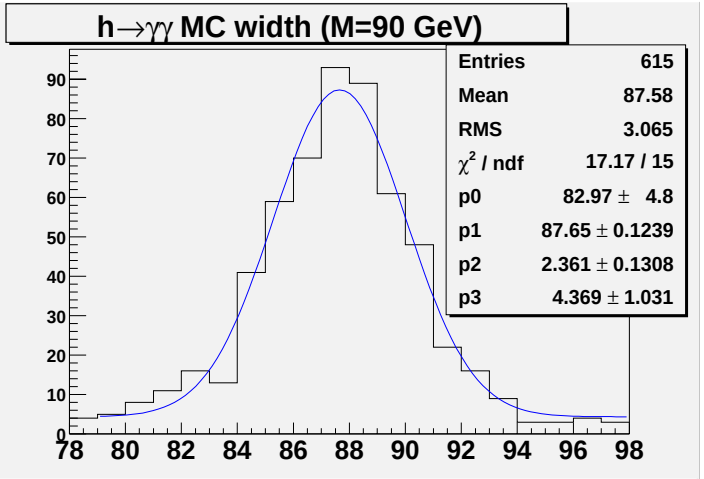


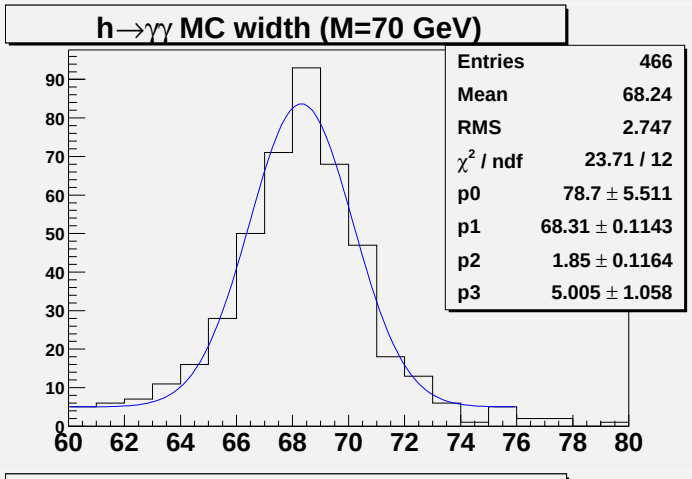


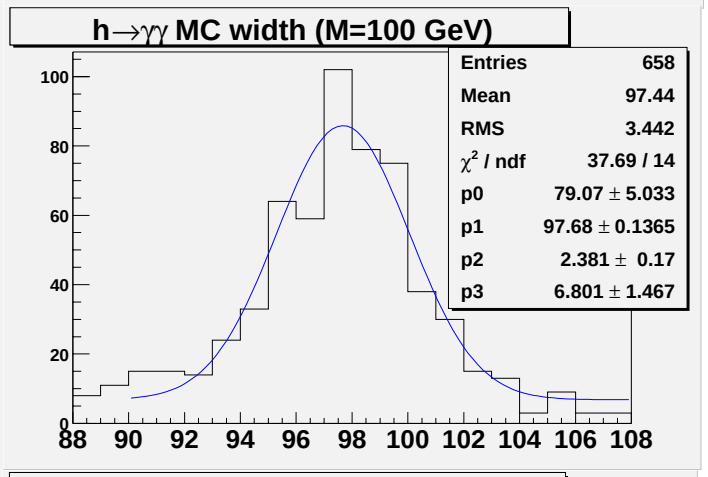


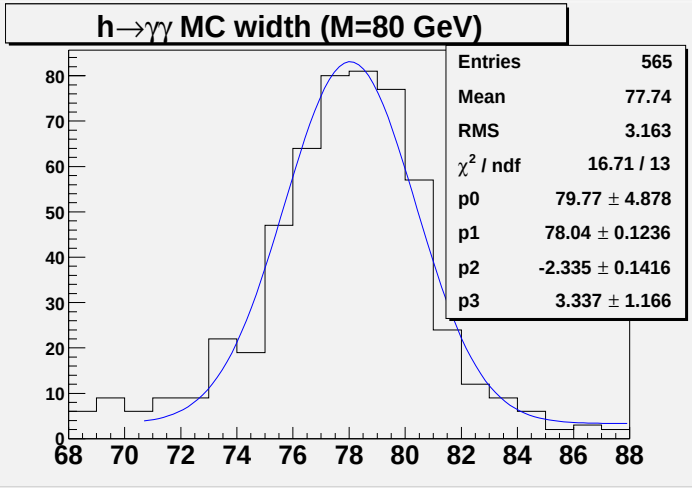
Reconstr. h→γγ Width CCCC+ CCEC

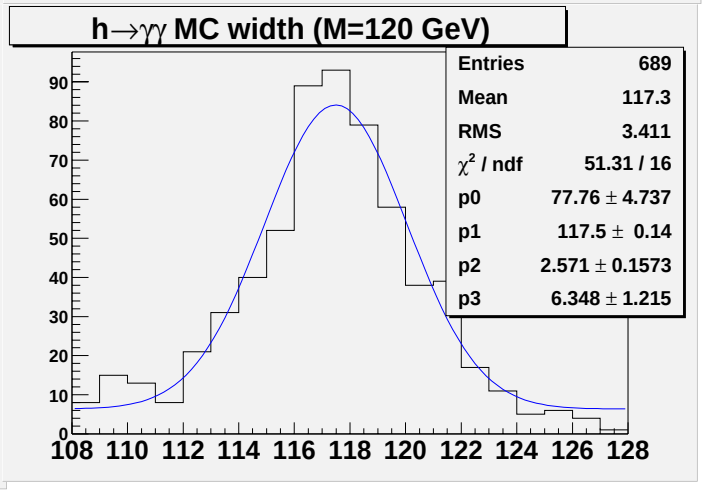




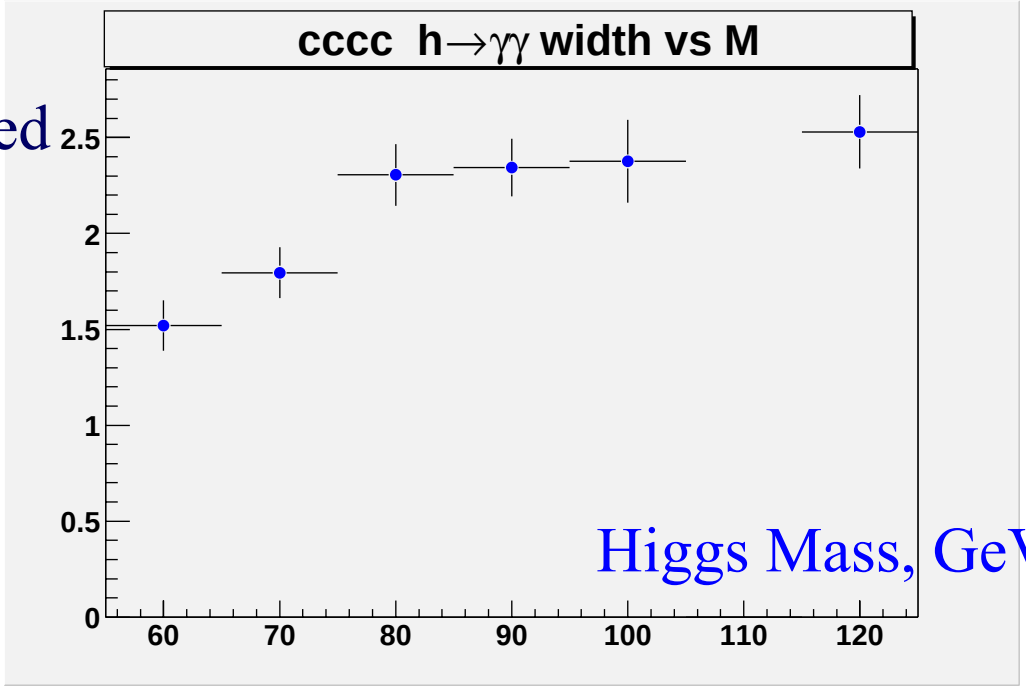




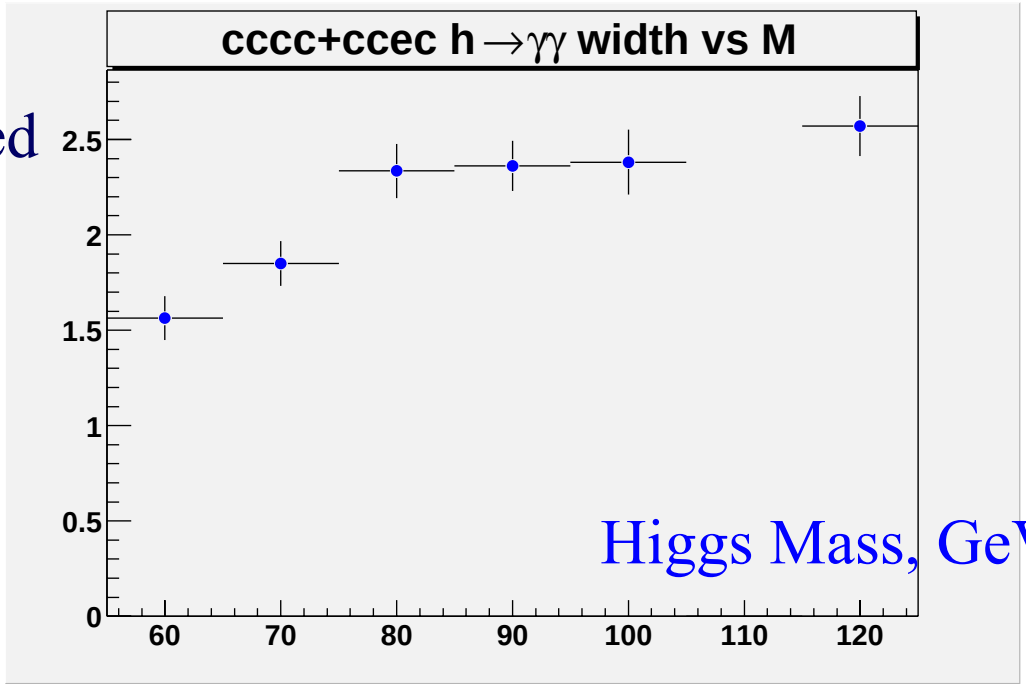




$h \rightarrow \gamma\gamma$ MC
Reconstructed
Mass Peak
Width, GeV



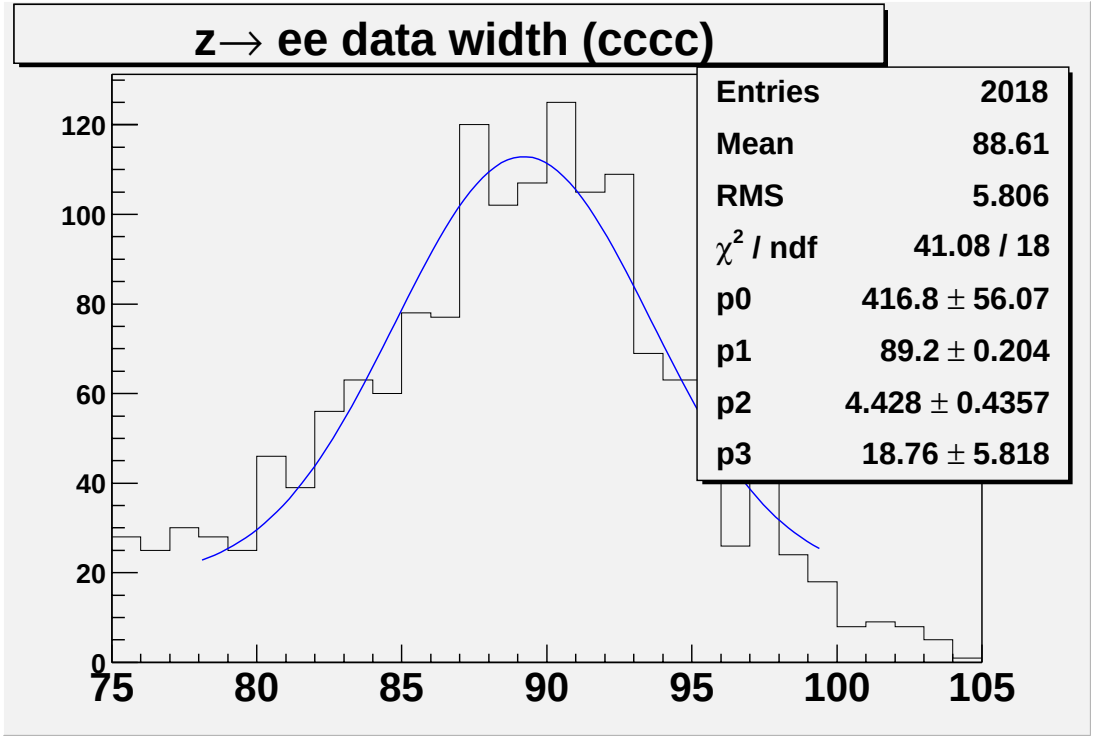
$h \rightarrow \gamma\gamma$ MC
Reconstructed
Mass Peak
Width, GeV

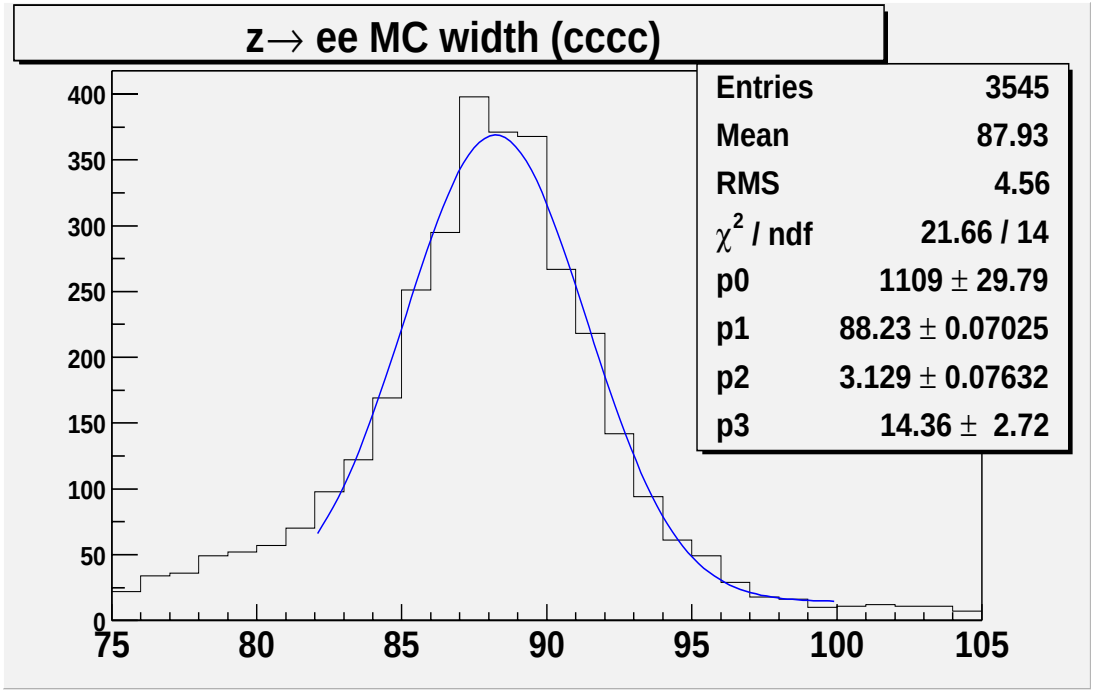


CCCC

$$k(mc \rightarrow data) = \frac{\sigma(Z \rightarrow ee\ data)}{\sigma(Z \rightarrow ee\ mc)}$$

$$= 1.415 \pm 0.143$$

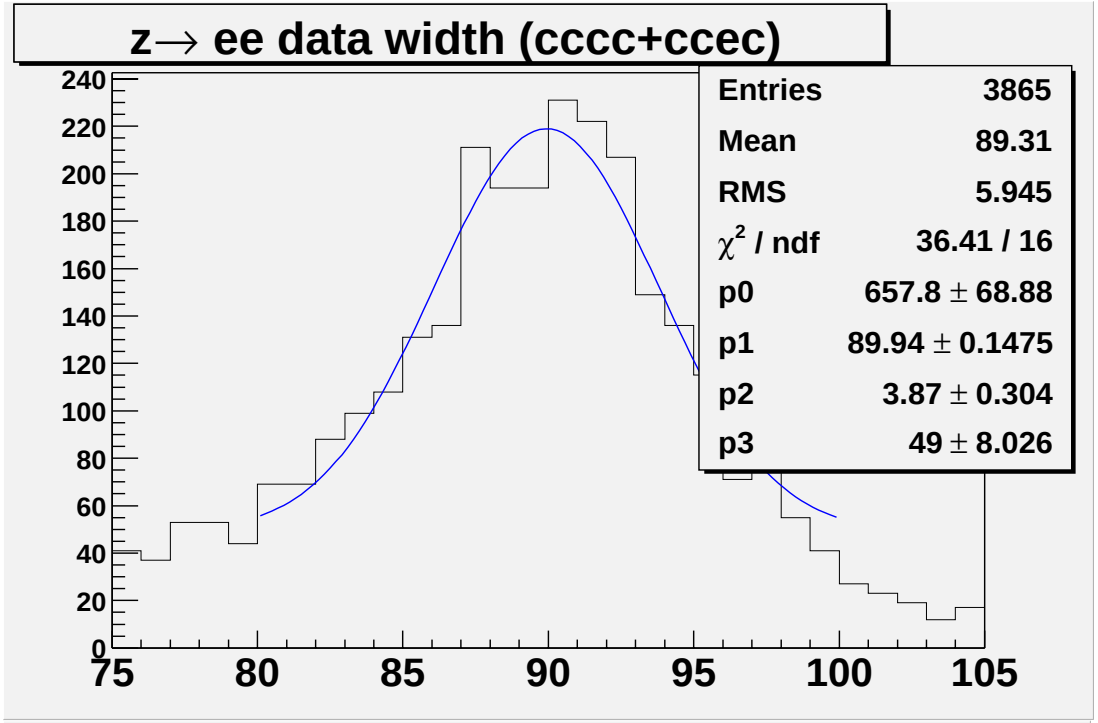


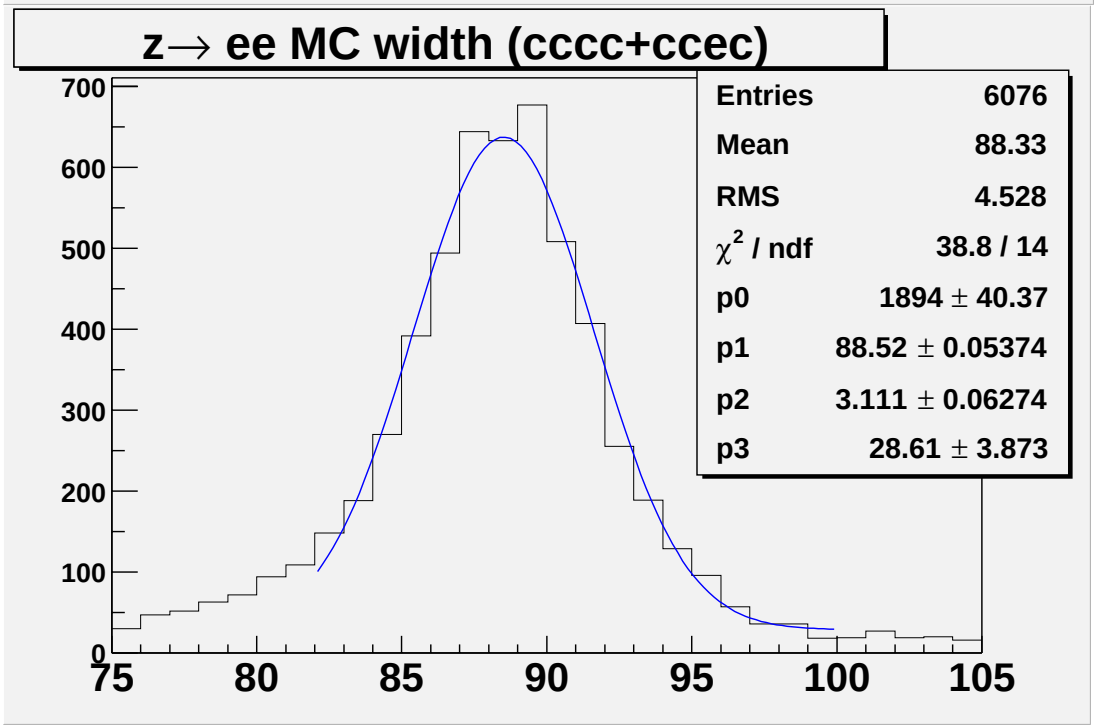


CCCC+CCEC

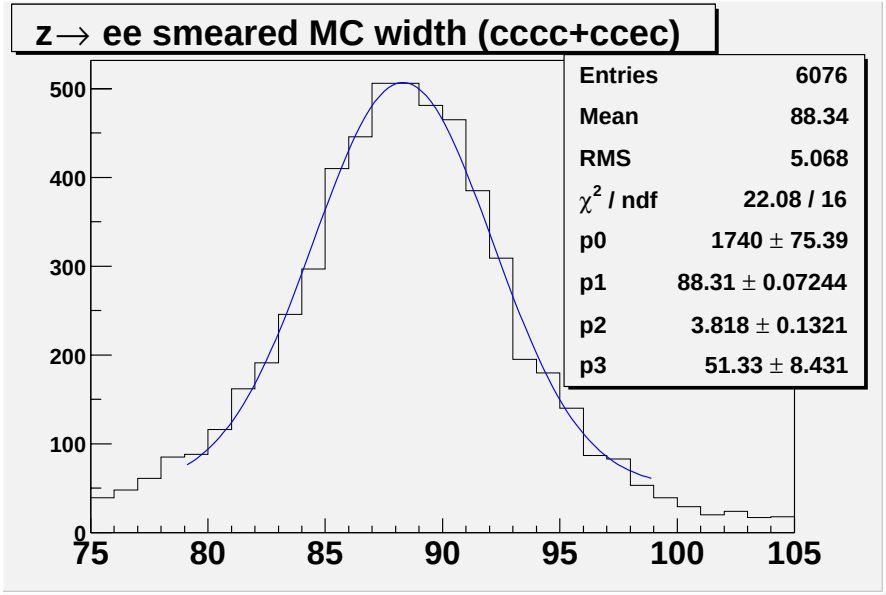
$$k(mc \rightarrow data) = \frac{\sigma(Z \rightarrow ee\ data)}{\sigma(Z \rightarrow ee\ mc)}$$

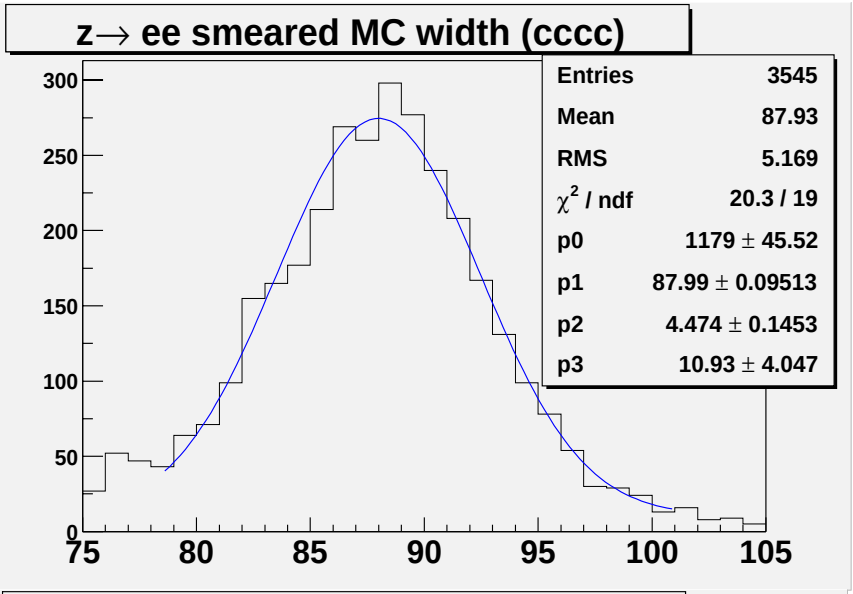
$$= 1.244 \pm 0.101$$

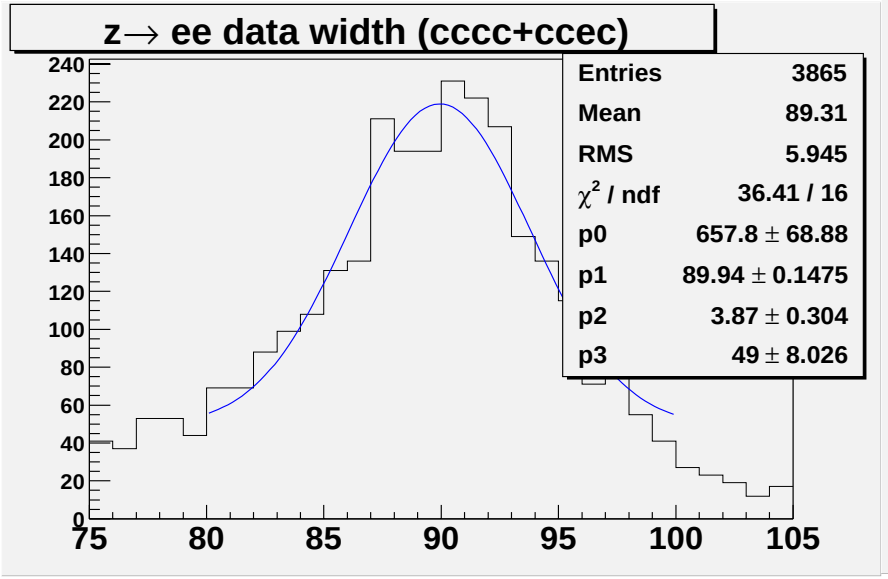


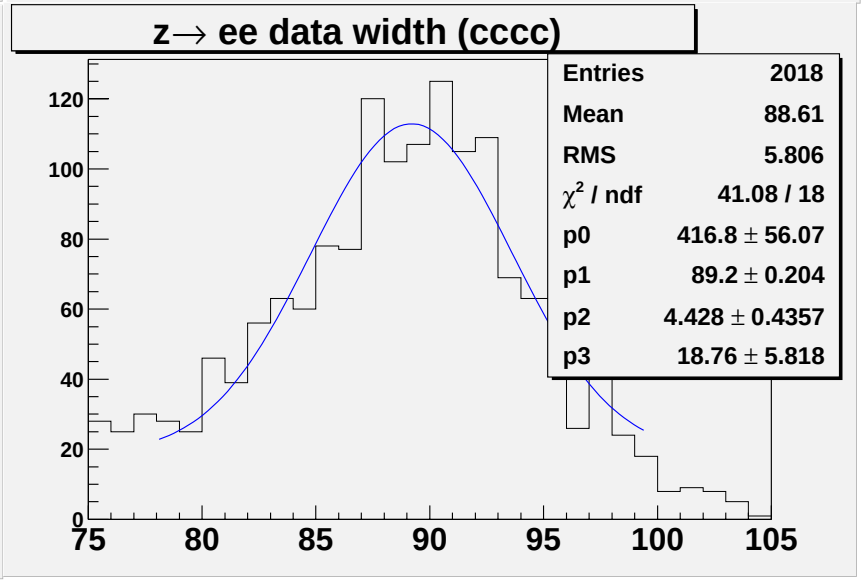


Trying Additional Energy Smearing on Reconstructed Z → ee MC. Still to work on









Acceptance

- **Acceptance =**

  η-fiducial+PT acceptance $\times$ mass window acceptance

- **η-fiducial+PT acceptance is calculated using generator level information**
- **Mass window acceptance is calculated using reconstructed MC information.**

Acceptance

	M	Mass Window Acceptance	Eta+PT Acceptance
CCCC+ CCEC	60	0.7047± 0.0259	0.1912
	70	0.7346 ± 0.0370	0.3089
	80	0.7386 ± 0.0297	0.3867
	90	0.7277 ± 0.0444	0.4380
	100	0.6878 ± 0.0367	0.4984
	120	0.6580 ± 0.0405	0.5303
CCCC	60	0.6946 ± 0.0419	0.1695
	70	0.7384 ± 0.0466	0.2532
	80	0.7115 ± 0.0495	0.2963
	90	0.7401 ± 0.0520	0.3258
	100	0.6930 ± 0.0468	0.3478
	120	0.6767 ± 0.0460	0.3690

…And

- count $\gamma\gamma$ events and estimate background in a window around each mass point
- For each mass calculate 95% CL upper limit on $h \rightarrow \gamma\gamma$ cross-section (Br=1)
  try using :
  - Web based Calculator by John Hobbs (Poisson Statistics),
  - Recent ROOT based code from Greg Landsberg (Poisson and Gaussian available)
  - Recent code from John with Gaussian approximation (still under testing)

  and compare results
- Calculate corresponding cross-sections using NLO HIGLU, VV2H, V2HV programs by M. Spira and Avto's help.

M	N bkgd cccc+ccec	N	NLO σ, pb	95% CL upper limit on cross-section, pb John Poisson	John Gaussian	Greg Gaussian	Greg Poisson
60	65.6±18.3	76	6.99	11.59	15.44	11.74	11.99
70	107.9 ± 25.7	117	4.63		12.19	8.98	9.12
80	155.2 ± 28.6	163	3.22		10.38	7.70	7.80
90	243.1 ± 44.3	253	2.33		14.47	10.34	10.43
100	103.8 ±17.6	104	1.73		4.99	3.81	3.90
120	44.0 ± 9.2	44	1.02	2.18	2.57	2.08	2.18
	cccc						
60	49.4 ± 16.2	57	6.99	12.03	15.87	11.82	12.11
70	64.7 ±19.5	80	4.63	10.10	13.07	9.91	10.10
80	83.6 ± 19.8	88	3.22	7.74	10.28	7.54	7.70
90	117.2 ± 30.2	133	2.33		14.71	10.76	10.90
100	43.0 ±10.3	42	1.73	3.47	4.38	3.34	3.48
120	11.9 ± 3.8	9	1.02	1.23		1.06	1.24