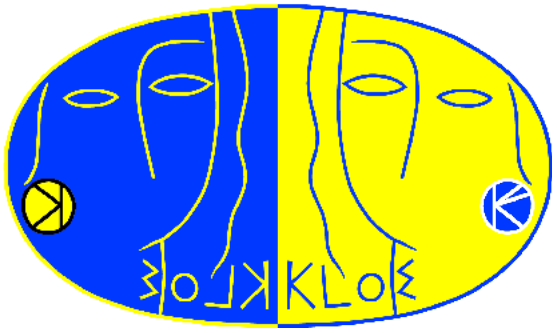


Final results on $e^+e^- \to \omega\pi^0$ cross section

A. De Santis & S. Giovannella

Blessing Meeting

$$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0\pi^0$$

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Dataset

Integrated luminosity *on-peak* 450 pb^{-1}

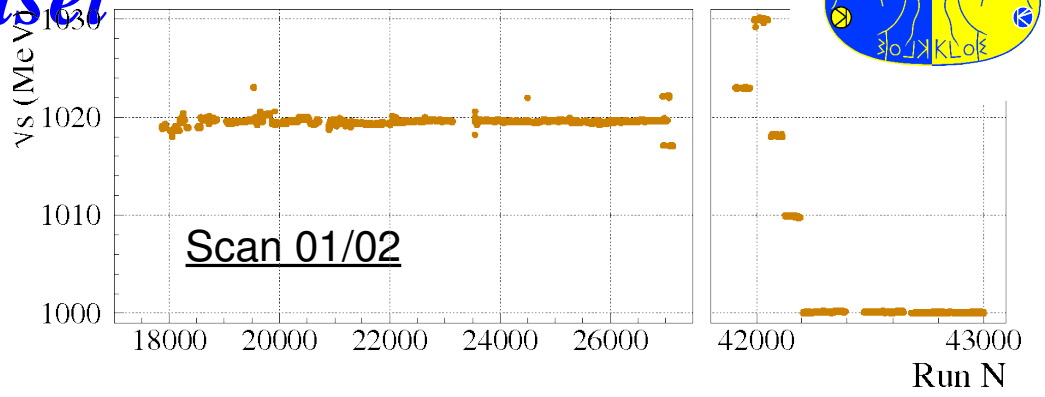
Integrated luminosity *off-peak* 150 pb^{-1}

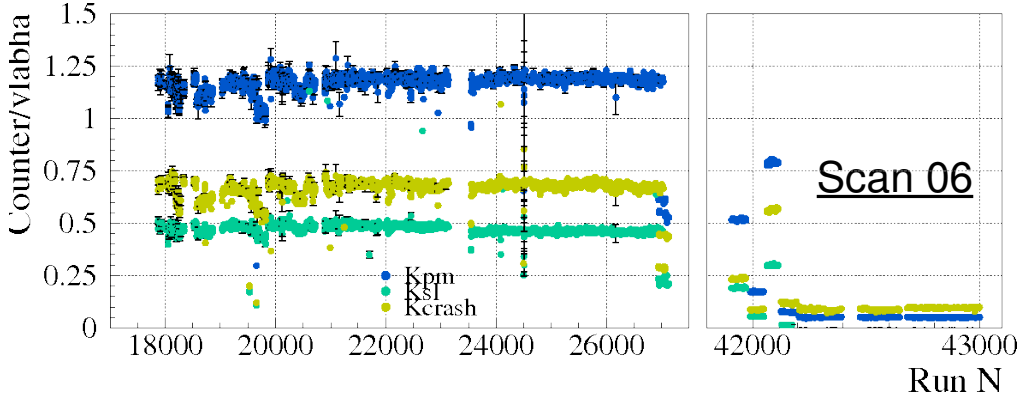
Data:

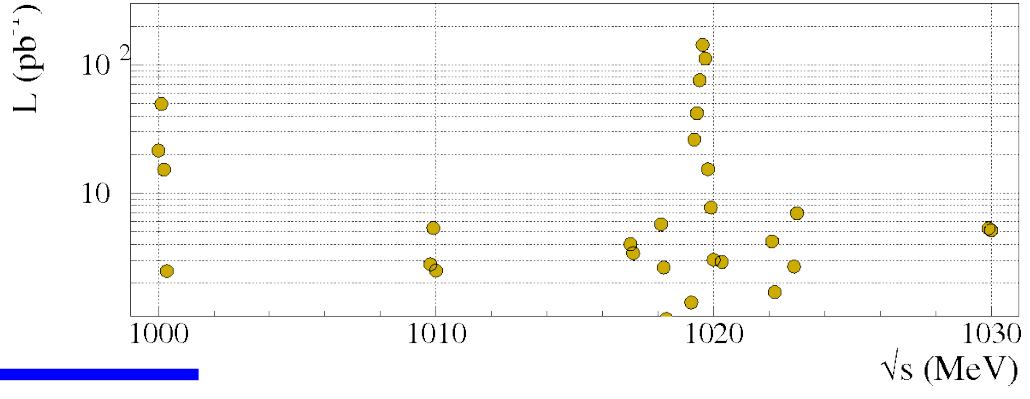
- drc (DBV-13/14) 01/02
- drc (DBV-24/25) 06

MC sample:

- Signal (DBV-26 LSF=5) 01/02(bgg included)
- mrc (DBV-18 all_phys LSF=0.2) 01/02
- mrc (DVB-26 all_phys LSF=1(2)) 06
- mrc (DVB-26 omegapi LSF=5) 06







$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Luminosity

In order to use the correct luminosity for the energy outside the ϕ resonance peak we have used directly vlabha entries.

Energy (MeV)	$\sigma(e^+e^- \to e^+e^-)_{(vla)}$ (nb)
1000	448.40
1010	439.95
1020	431.51
1030	423.06

From babayaga

We have sliced dataset in bins of 100 keV width.

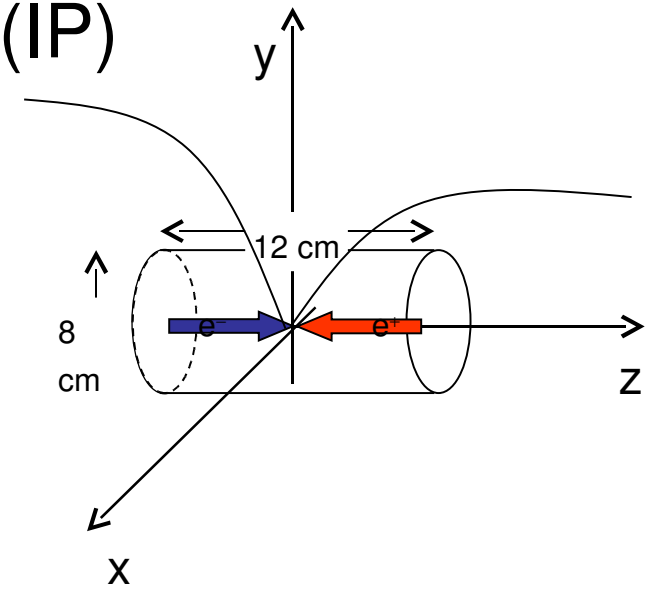
In the region around the ϕ *peak* we have used these bins.

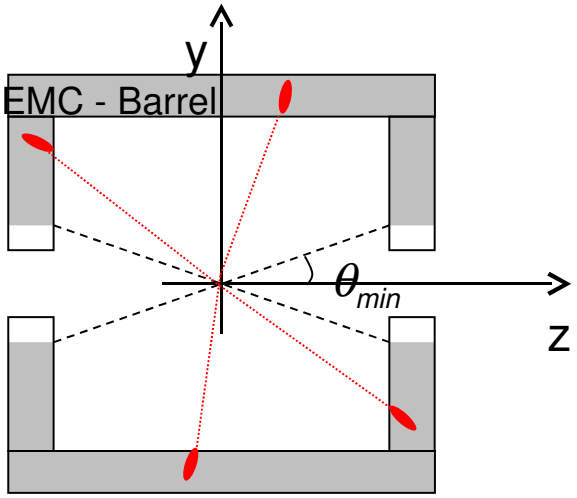
For the *off-peak* data we have packed them using the luminosity weighted energy.

$$E_k = \frac{\sum_j E_{jk} L_{jk}}{\sum_j L_{jk}}$$

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Sample selection

- Only one vertex at Interaction Point (IP)
- Only two tracks connected at vertex
- Four neutral cluster with:
  - E_{clu} grater than 10 *MeV*
  - *ToF* compatible with prompt γ ($Tw = 4\sigma_t$)
  - $22° < \theta < 158°$





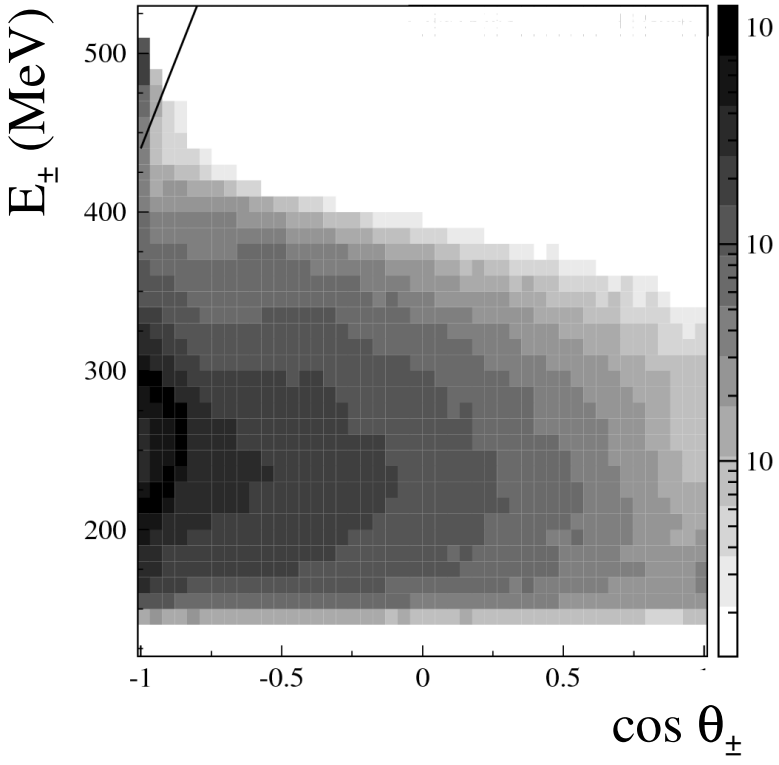
Little change in cut

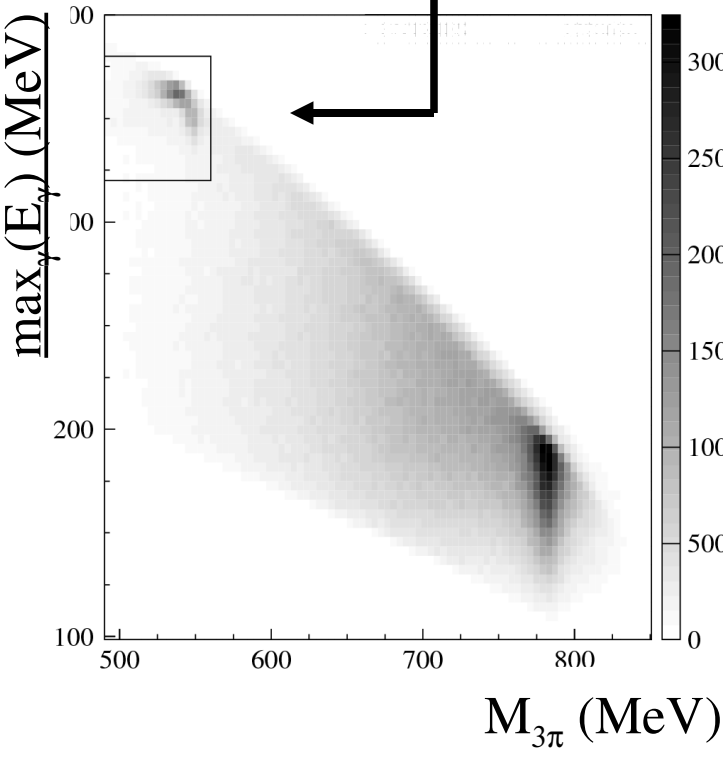
1) Bug found in the selection: asking for a vertex and not for only one vertex

2) Minimum angle 22° (was 21.5)

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Background rejection

- $\Delta m_\pi/m_\pi < 3\sigma$
- bhabha-filter
- η-filter





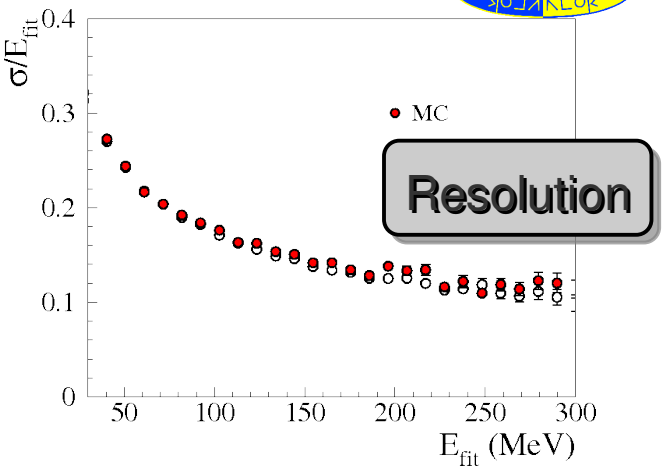
Bhabha-filter is applied on both tracks.

η-filter as been implemented to reject events due to cluster splitting/machine background.

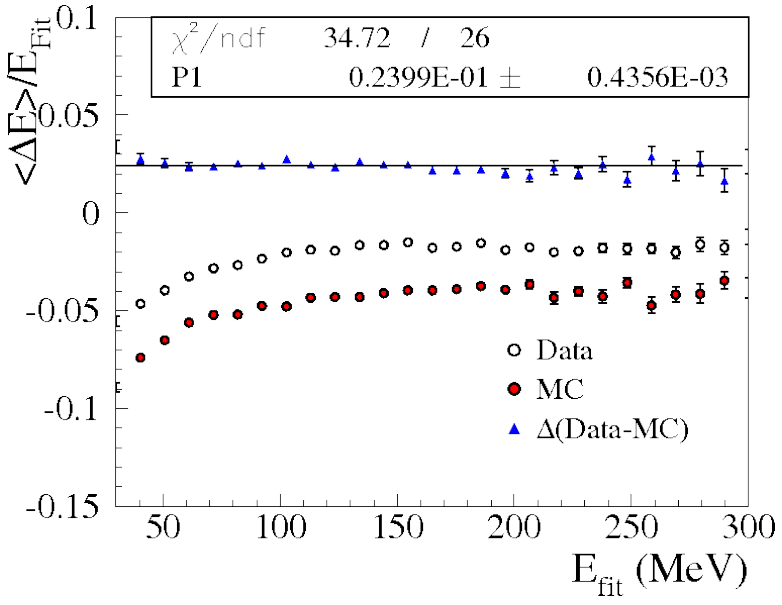
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: MC energy scale

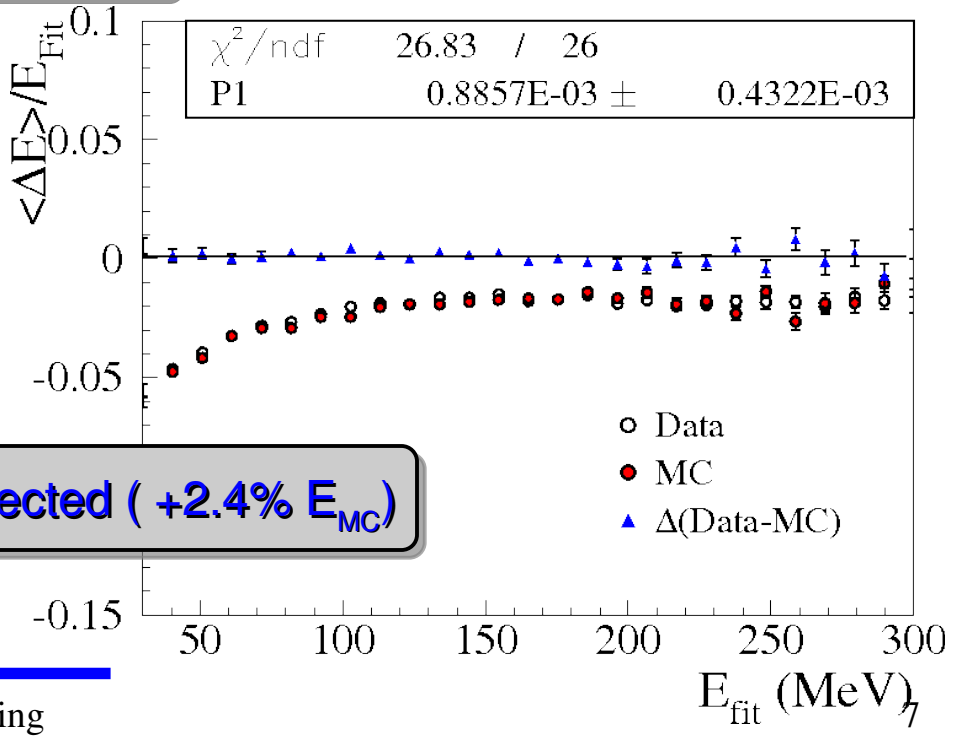
To analyse the MC energy scale for EMC we have fitted the kinematic fit pulls ($E_{rec} - E_{fit}$) with simple gaussian for different value of fitted energy

A difference in the scale calibration of 2.4% has been found



Resolution



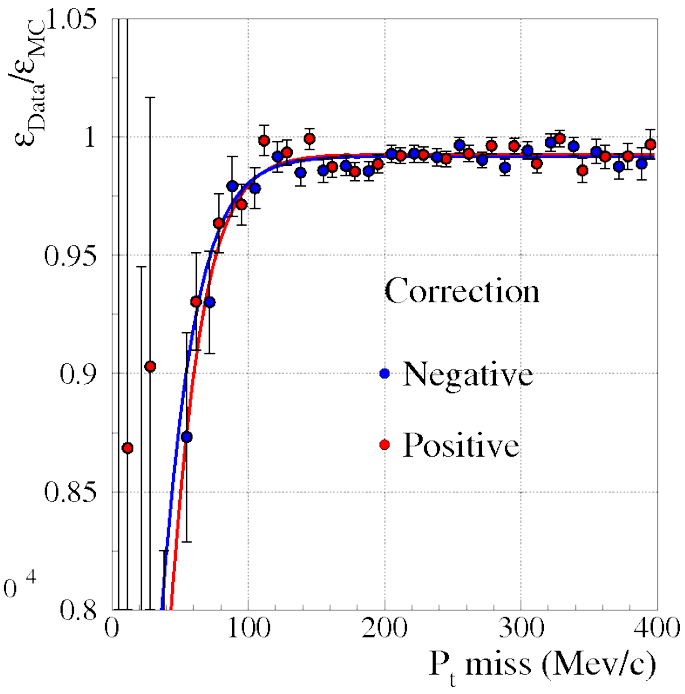


Corrected (+2.4% E_{MC})

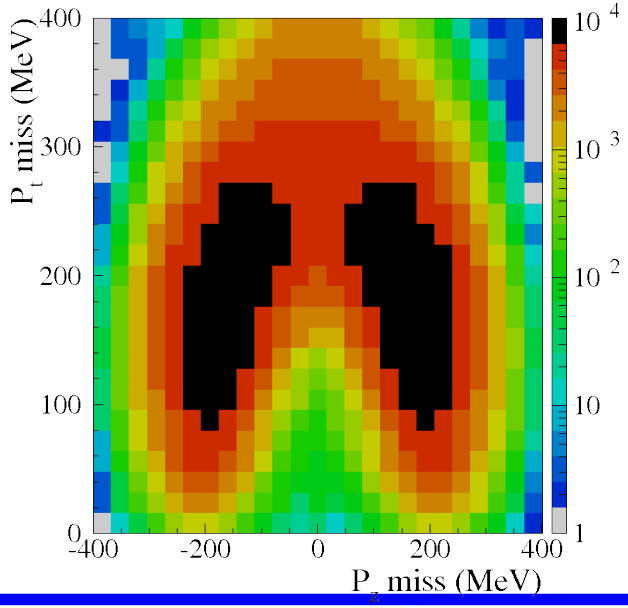
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Data/MC tracking efficiency

Tracking efficiency (KM343) has been determined both for on-peak and off-peak data using UFO stream [DBV-26]

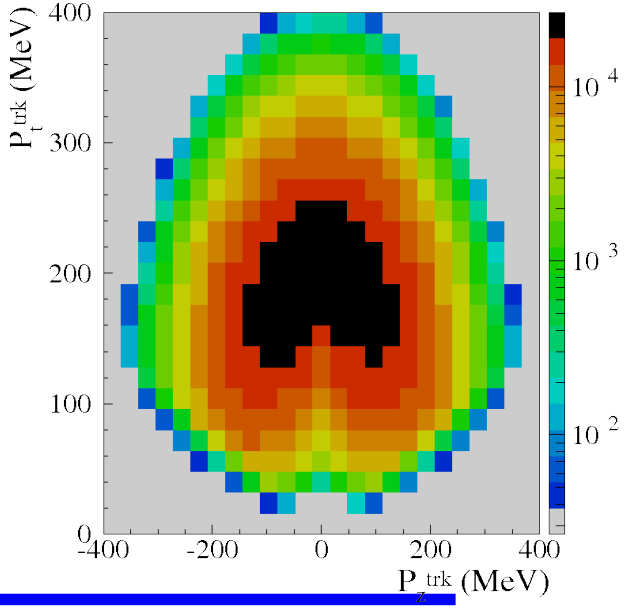
For on-peak the resulting correction is smaller



Control sample



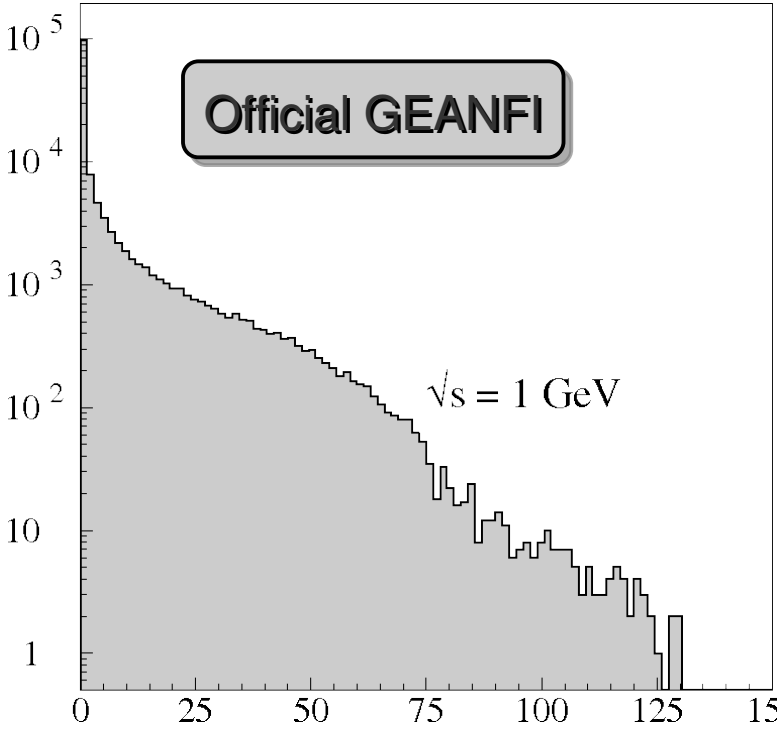
Signal shape

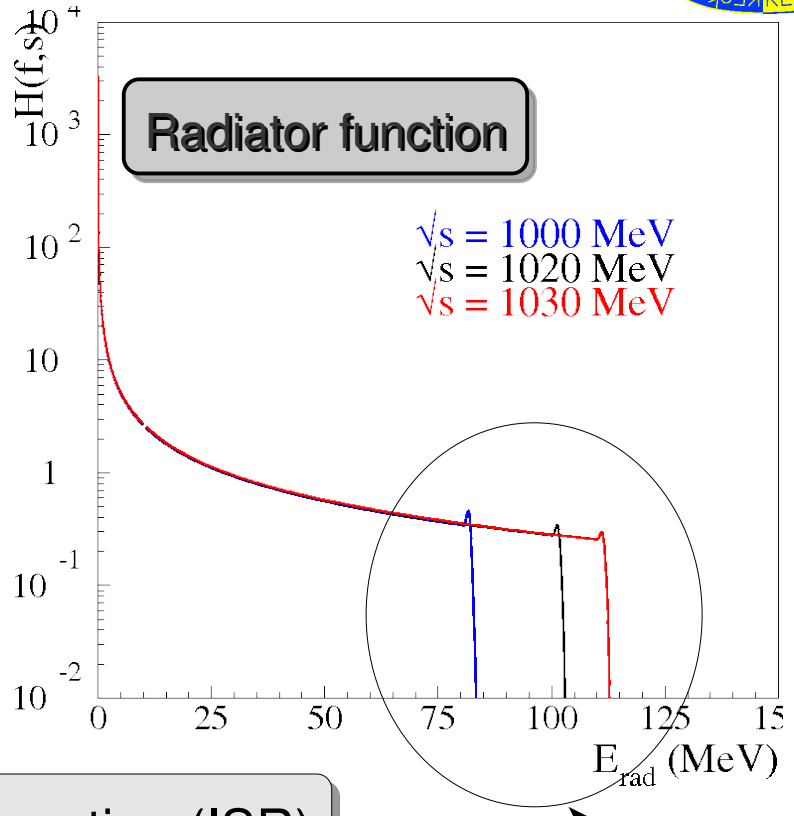


Each slice in Pz of the distribution for Pt-Pz has been fitted with:

$$C_\epsilon = A\left(1 - \frac{1}{1+e^{(X-X_0)/\delta}}\right)$$

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: ISR Tail





In GEANFI (Official release) the radiative correction (ISR) is badly implemented:

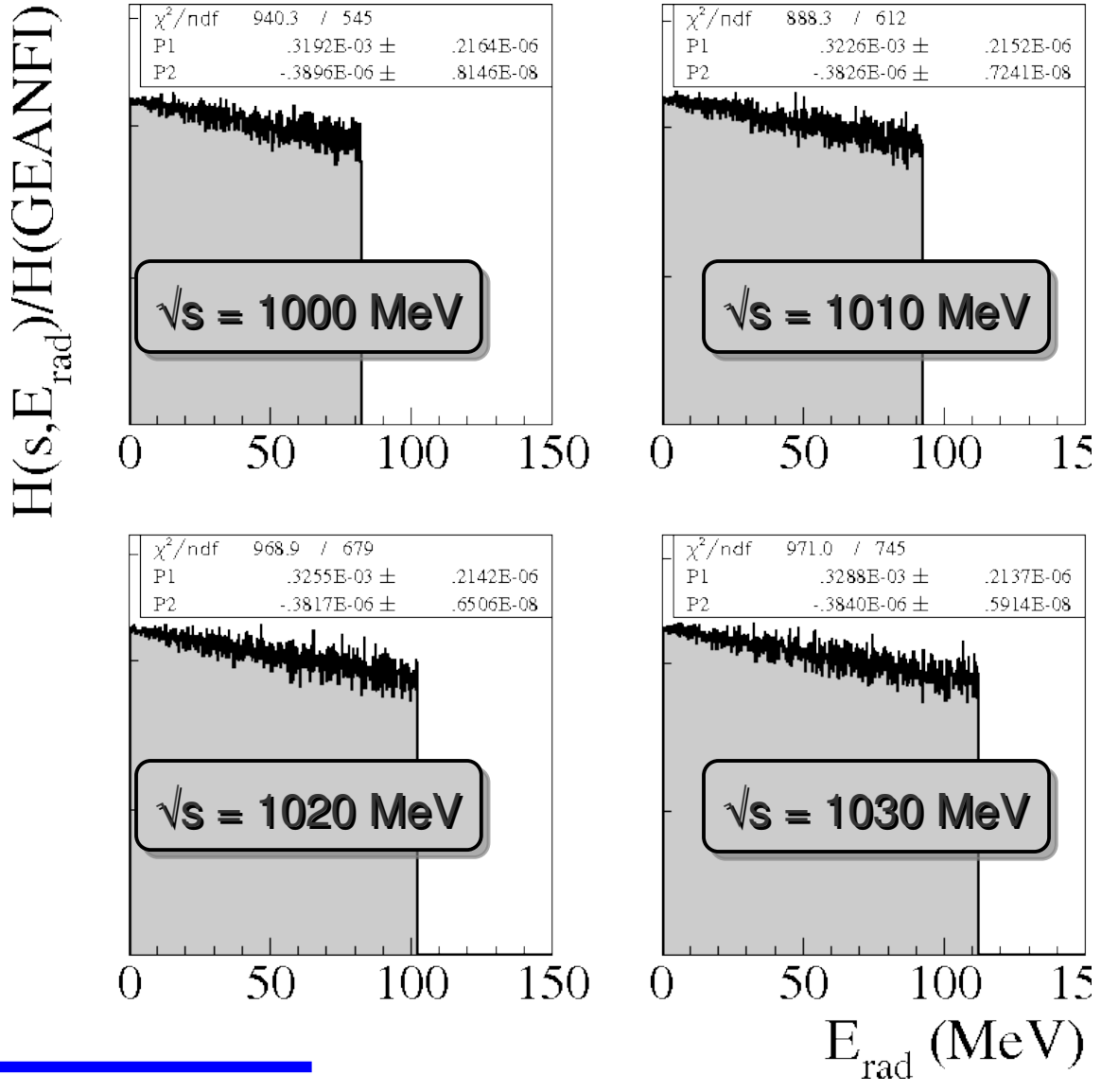
- Maximum radiated energy is fixed (130 MeV)
- Tail not from standard radiator function

Max Radiated energy variation with CoM energy

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: ISR Tail

To correct this effect (~% of the total number of events) we use the ratio of the GEANFI shape and the radiator used in the cross section fit.

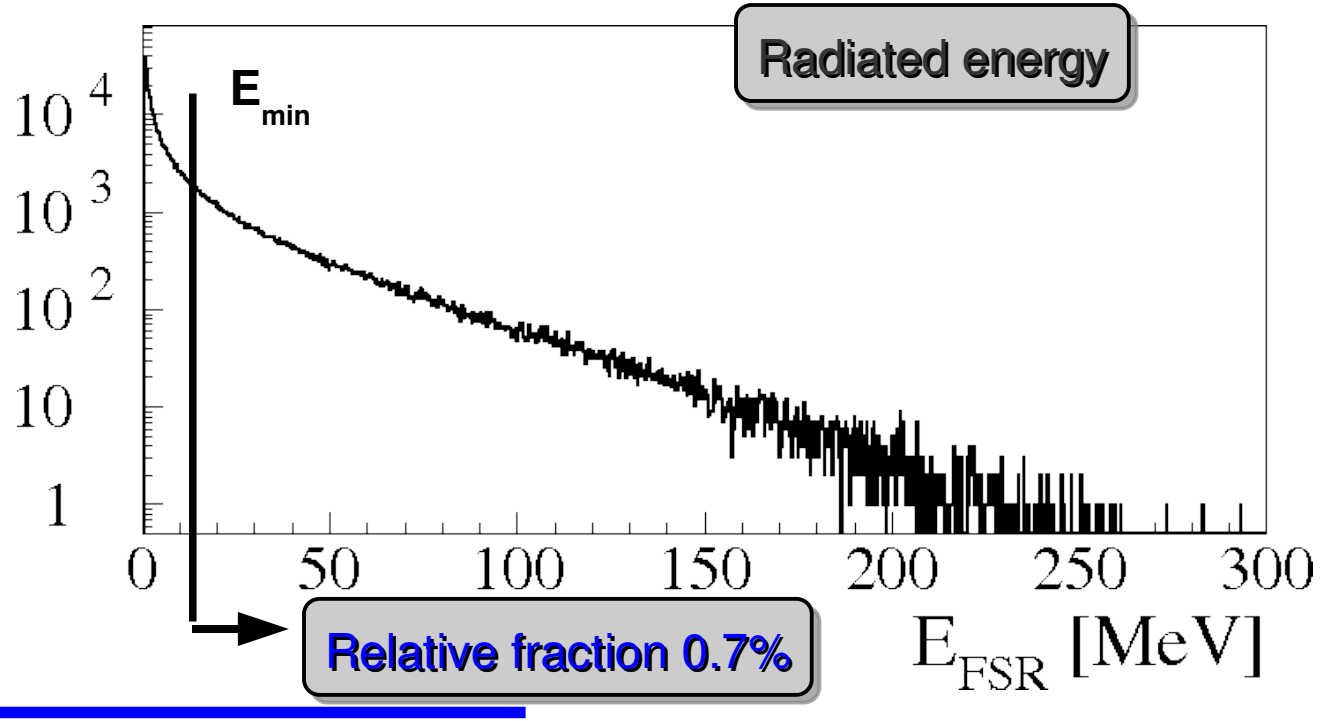
Minimal effect on the global efficiency, small effect on the shape when fitting.



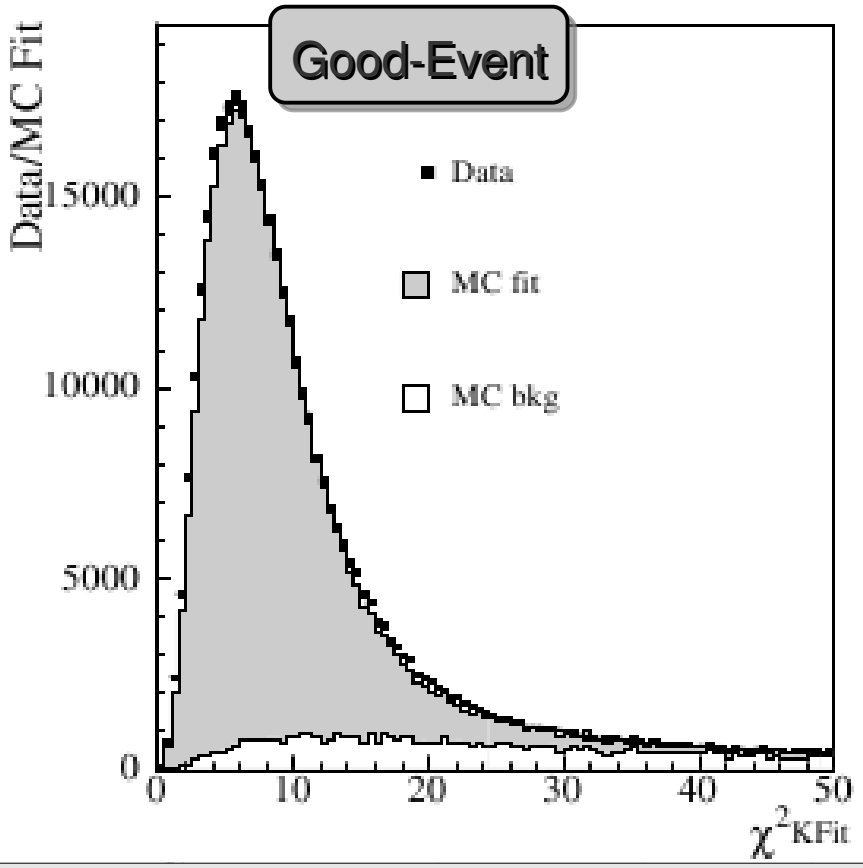
FSR

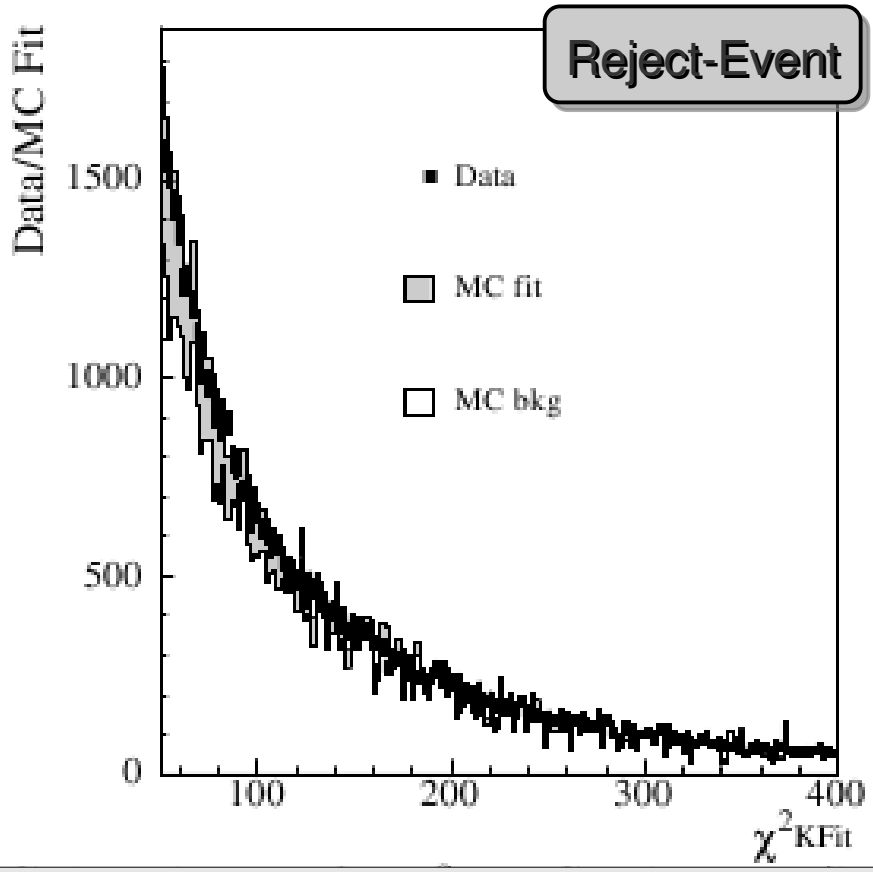
The FSR tail has been obtained with PHOTOS

Variation of the acceptance efficiency assumed as systematics to the absolute normalization
(0.7% of the total events has one photon over threshold)



$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Data-MC comparison

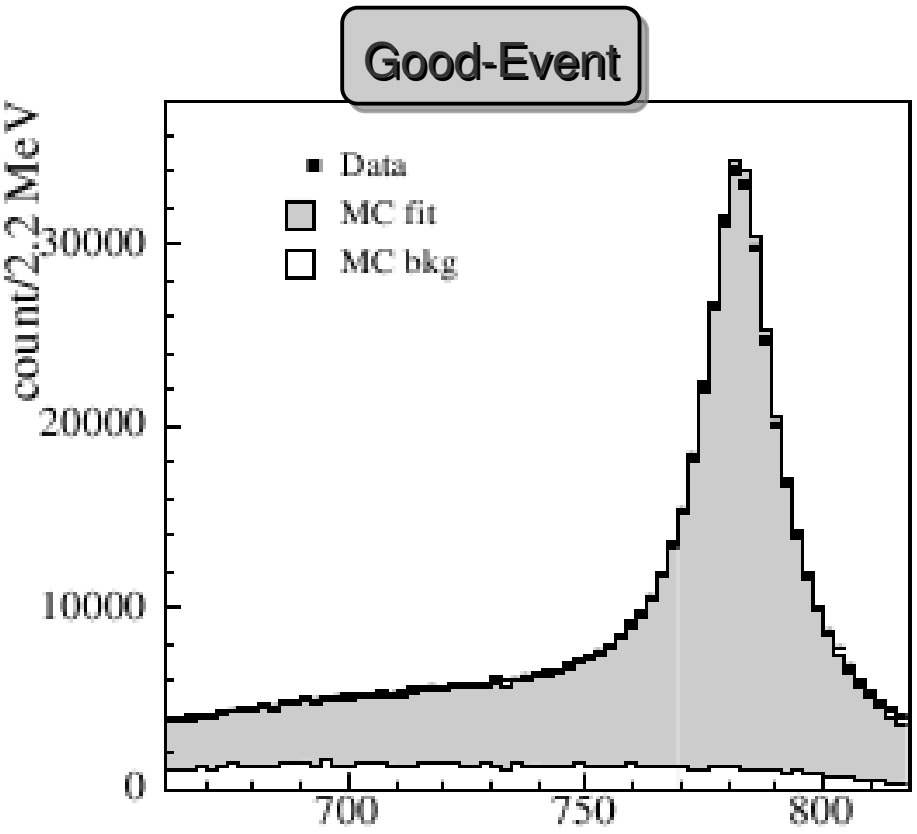


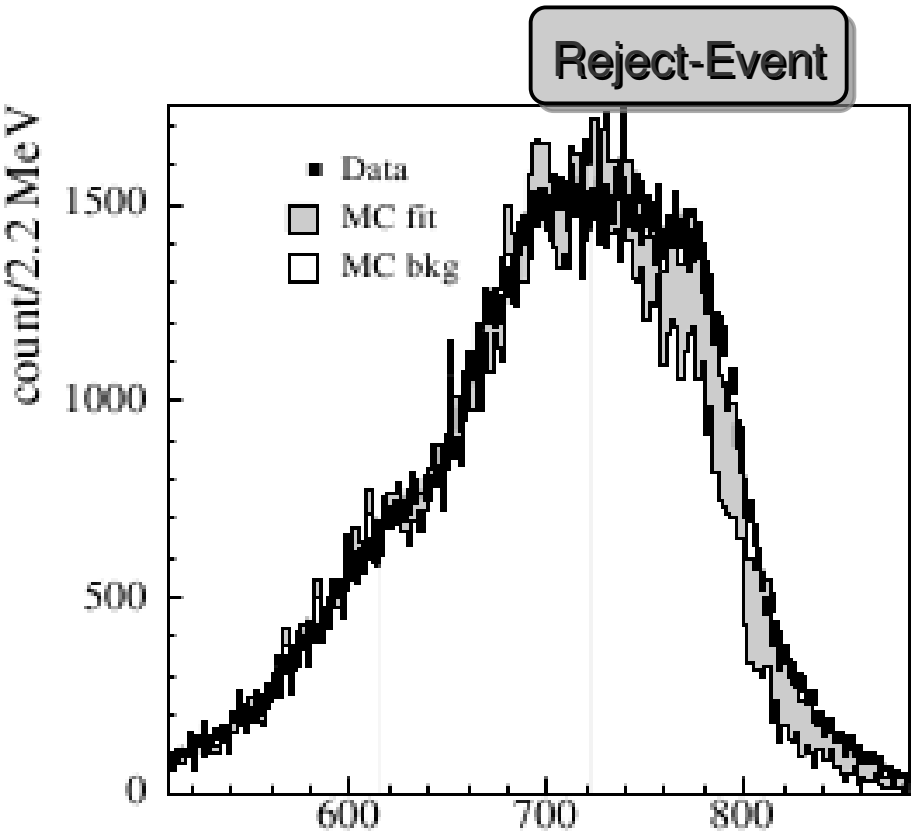


According to χ^2 value data are divided in two categories: Good and Reject event

Both selection are used in the counting fit to normalize Signal and Backgrounds

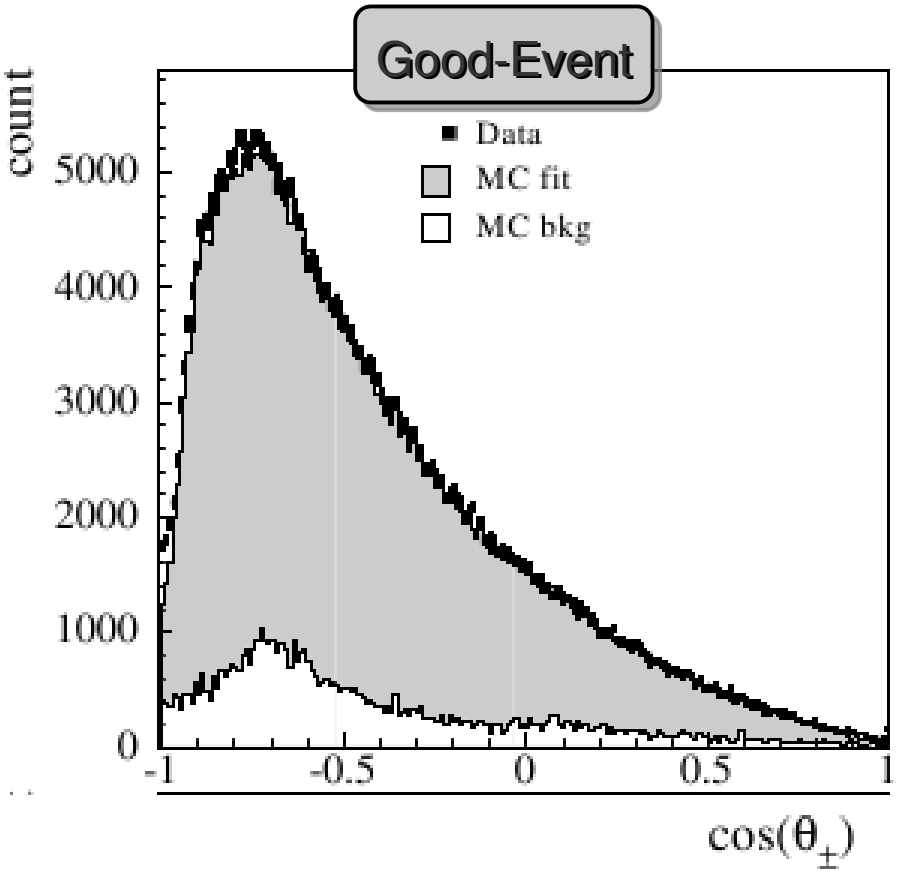
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Data-MC comparison

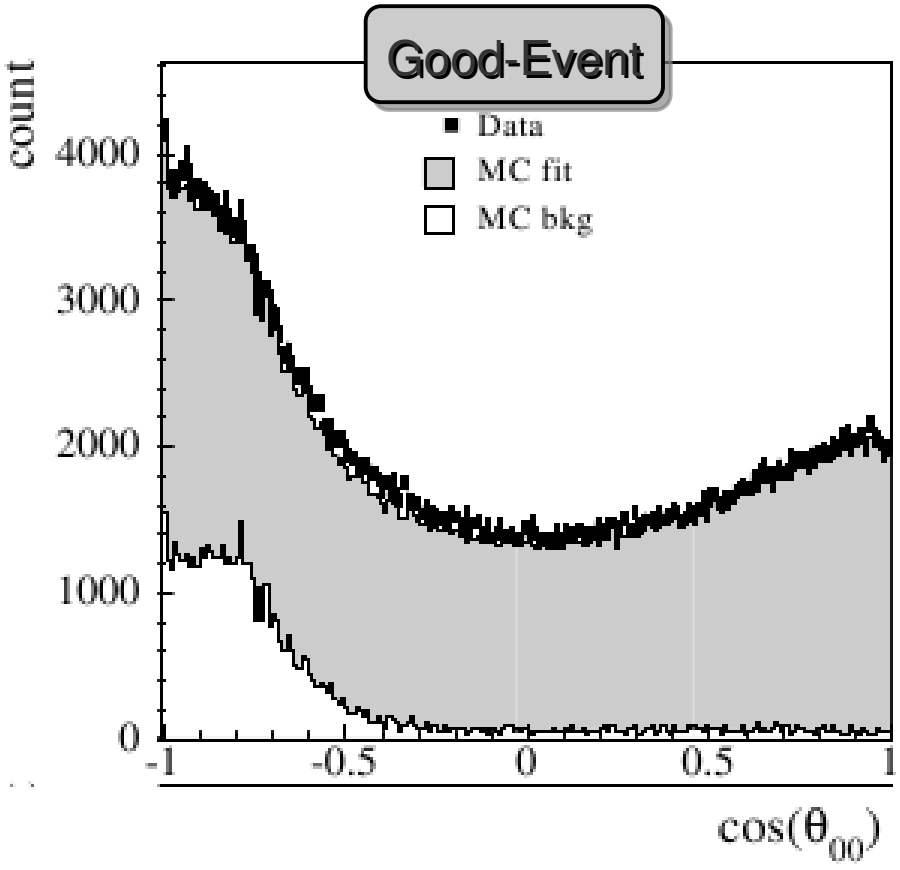




Recoil mass distribution. The standard distribution used in the fit

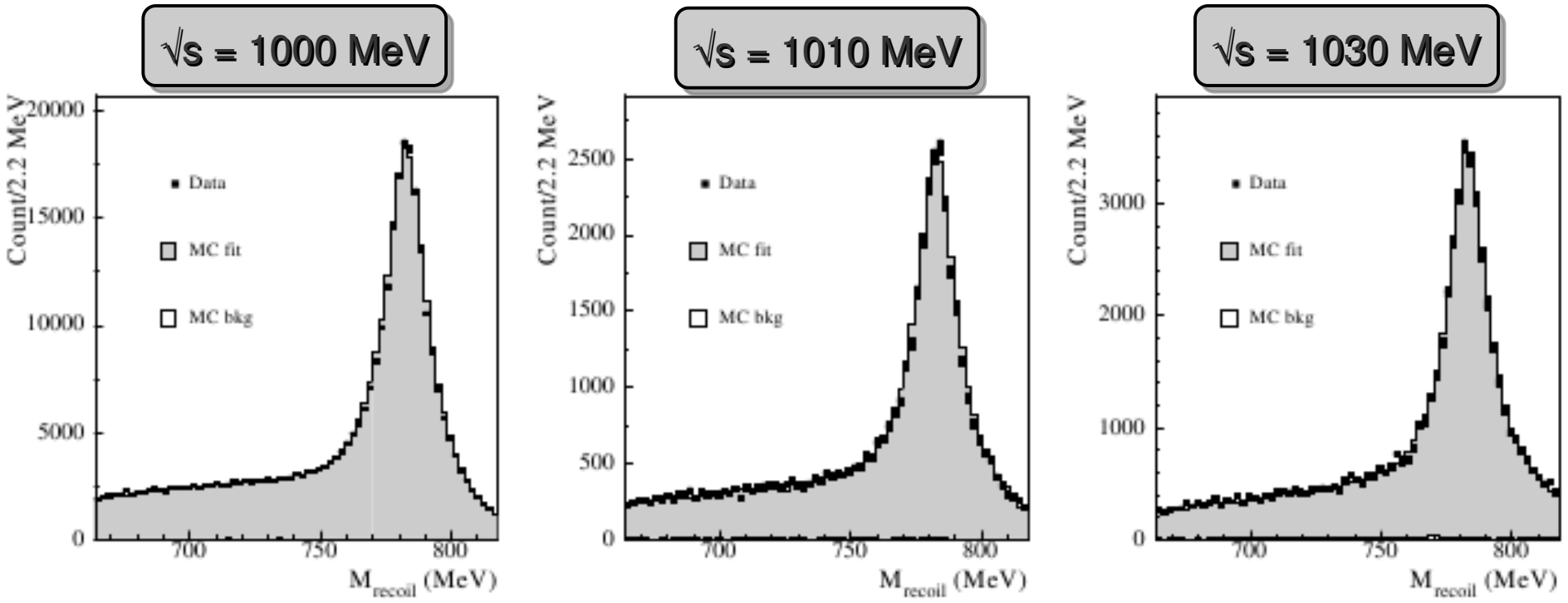
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Data-MC comparison





Angular distributions between the two charged and neutral pions

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Data-MC comparison

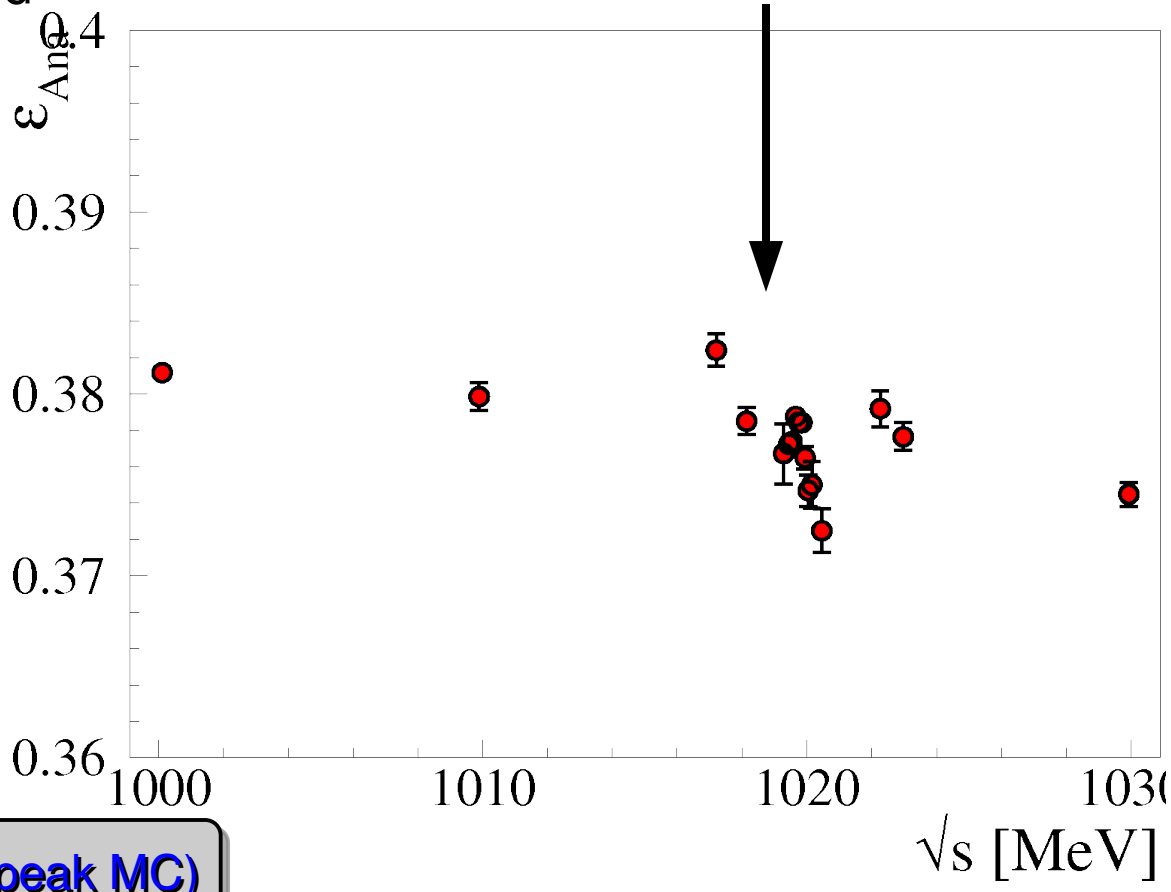


Recoil mass for the off-peak data

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Efficiency

- Tracking and vertexing efficiency correction included
- Clustering efficiency correction curves included
- ISR reshape included
- Machine Background

-0.8% variation w/o MB (cluster + DC hit)



New (for on peak MC)

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Absolute scale systematics

Resolution and reconstruction effect included as systematics to the absolute normalization.

Clustering effect has been studied varying cut on cluster variables (energy, angle and time)

Theoretical uncertainty for Bhabha event generator also included

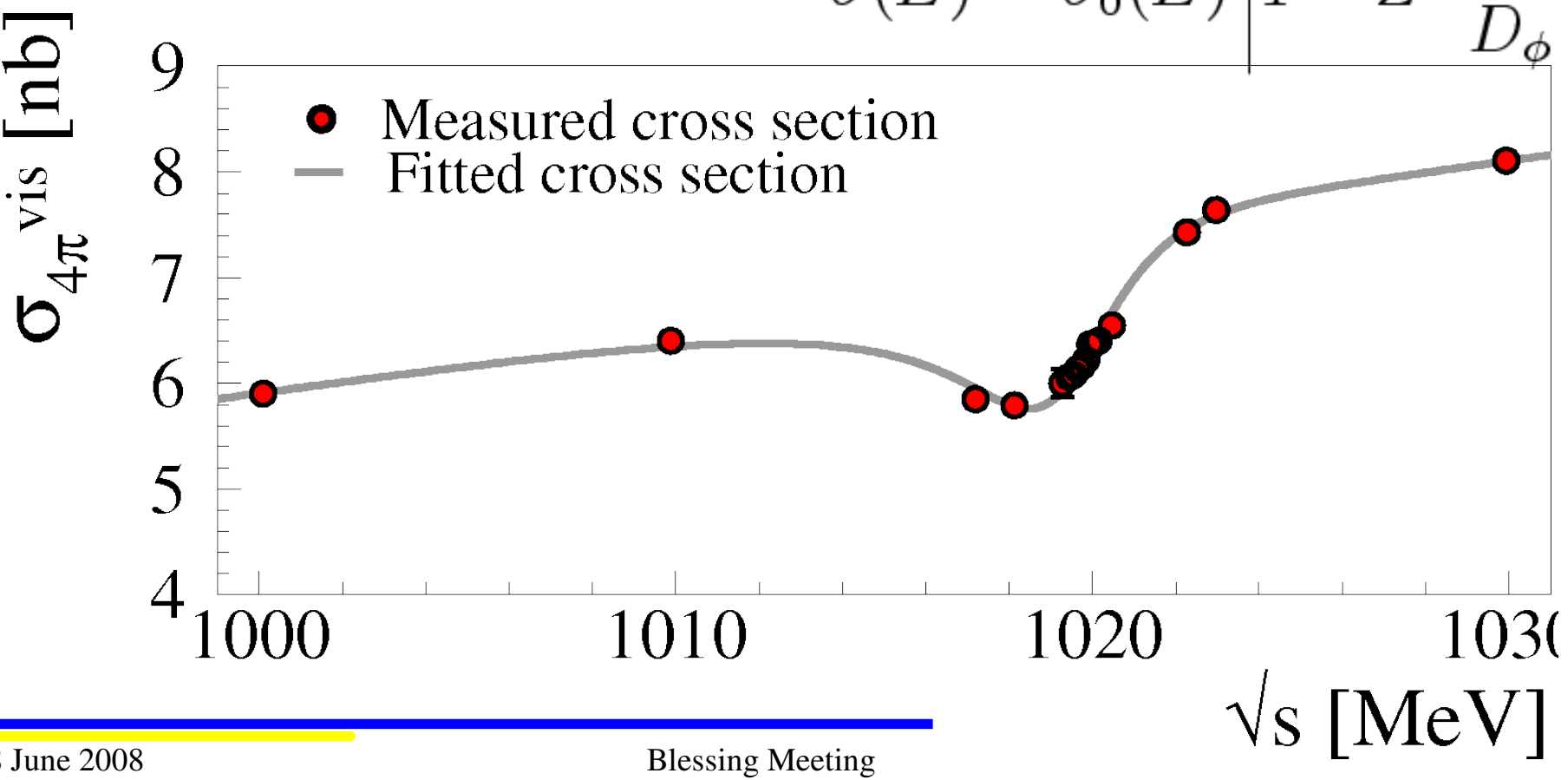
Source	$\delta_\varepsilon/\varepsilon$	
~~Clustering~~	~~0.6 %~~	
Cosmic Veto	0.3 %	
Acceptance	0.3 %	
Analysis cuts	0.3 %	
FSR	0.2 %	PHOTOS
Luminosity	0.5 %	
Total	~~0.96 %~~	0.75 %

$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0(E)$

Efficiency and vlabha luminosity as function of CoM energy included

Radiative correction included and BES included

$$\sigma(E) = \sigma_0(E)\left|1 - Z\frac{m_\phi \Gamma_\phi}{D_\phi}\right|^2$$

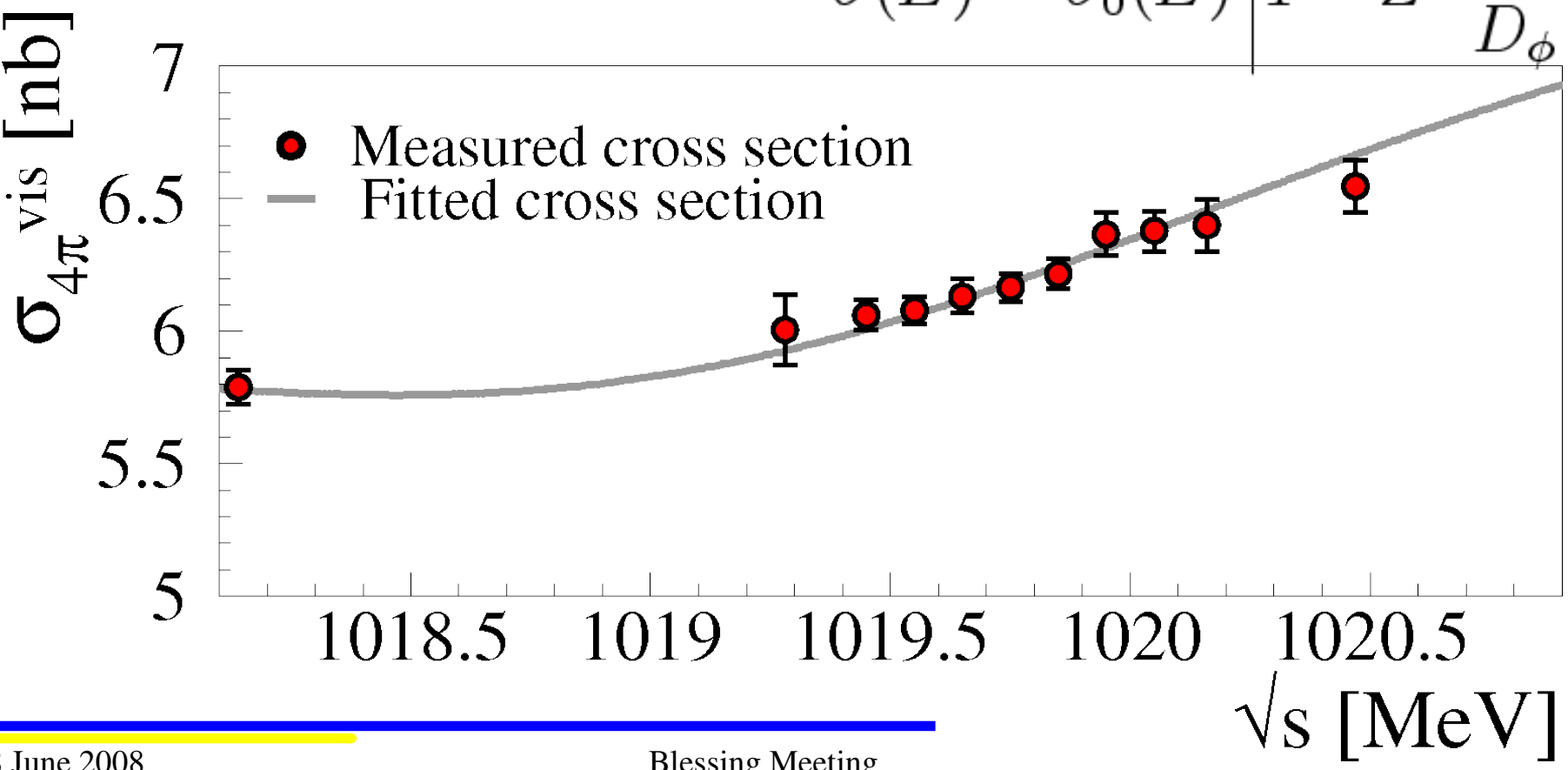


$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0(E)$

Efficiency and vlabha luminosity as function of CoM energy included

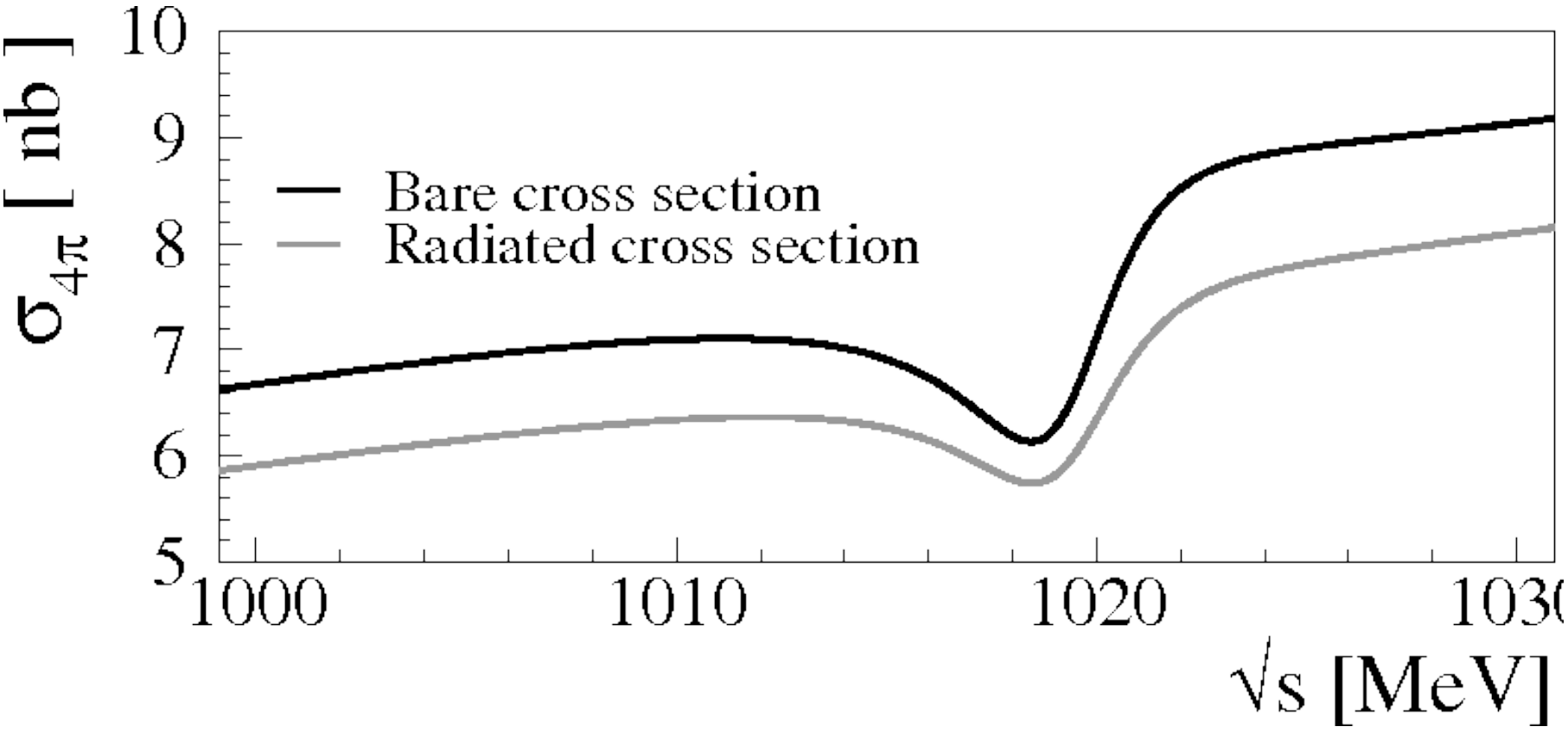
Radiative correction included and BES included

$$\sigma(E) = \sigma_0(E)\left|1 - Z\frac{m_\phi \Gamma_\phi}{D_\phi}\right|^2$$

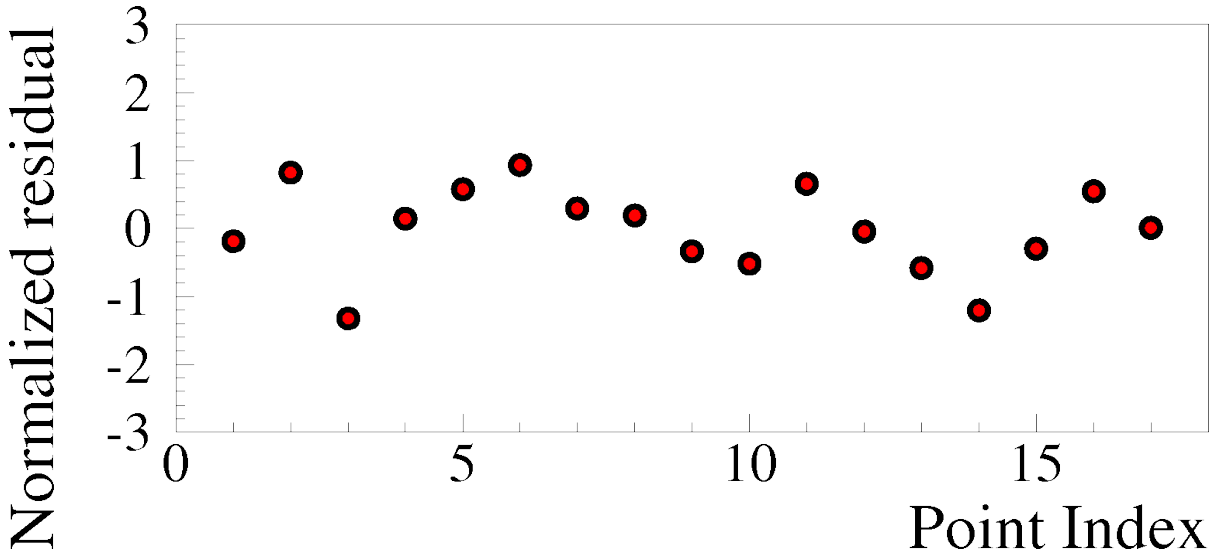


$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0)$

Radiative correction and BES effect



$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0)$



Variation induced by new efficiency (LP07):

σ0 = 8.12(14)

Re(Z) = 0.097(12)

Im(Z) = -0.133(9)

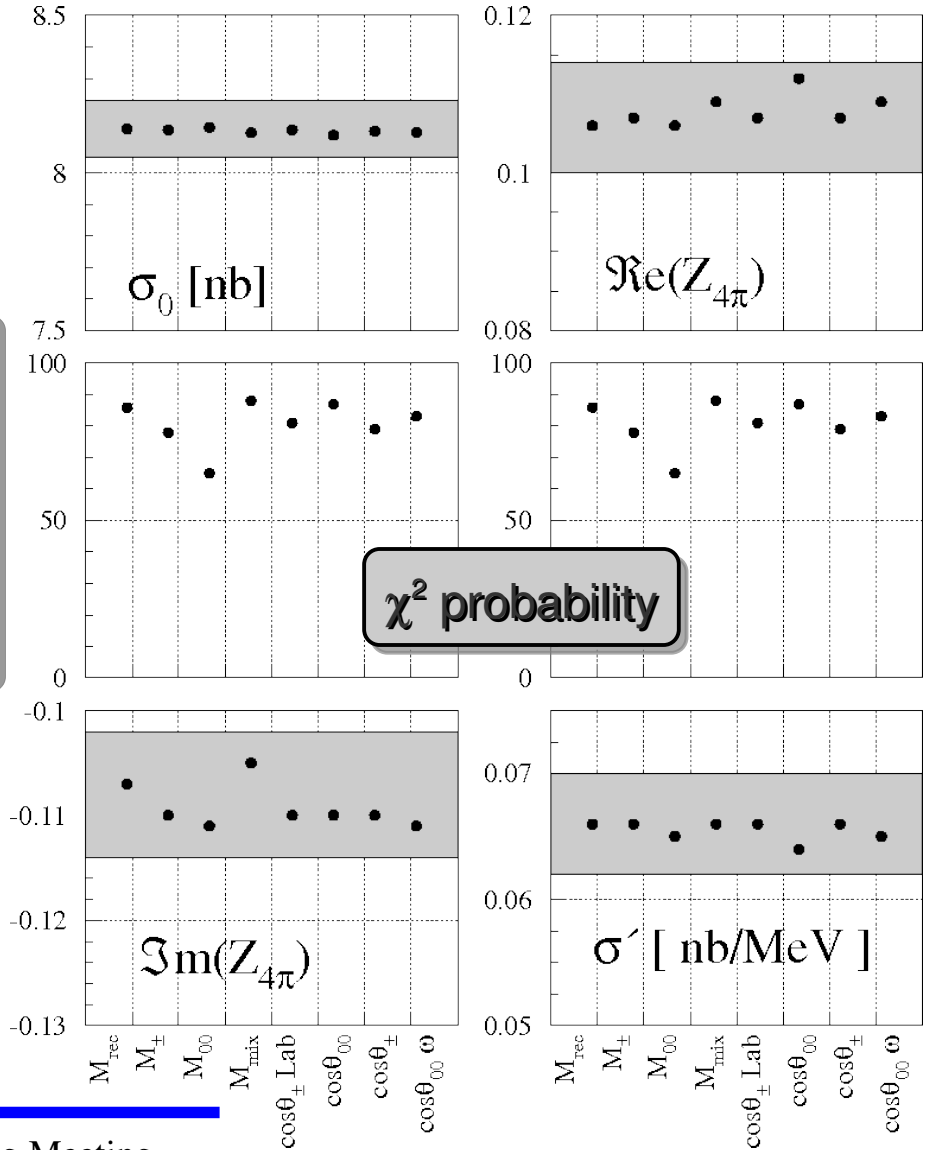
σ' = 0.072(8)

Fit parameters - $P(\chi^2_{fit})$=91%				Correlation matrix			
$\sigma_0^{4\pi}$ (nb)	8.15	±	0.06	-	-36	-81	80
$\Re(Z)$	0.104	±	0.007	-36	-	6	-49
$\Im(Z)$	-0.108	±	0.004	-81	6	-	-46
σ' (nb/MeV)	0.067	±	0.003	80	-49	-46	-

$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

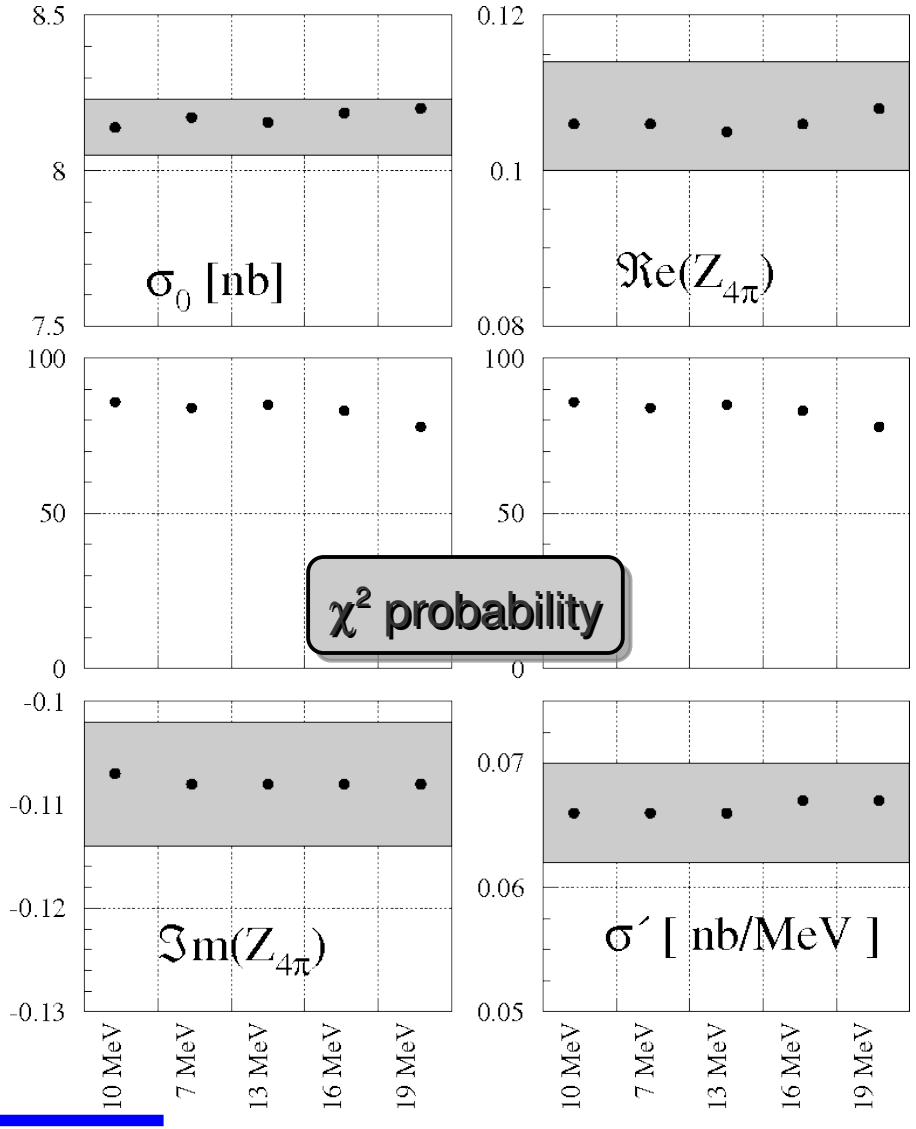
Cross section parameters variation as a function of distribution used in the counting fit.

All the variation refers to different "companion" for the reject -event class



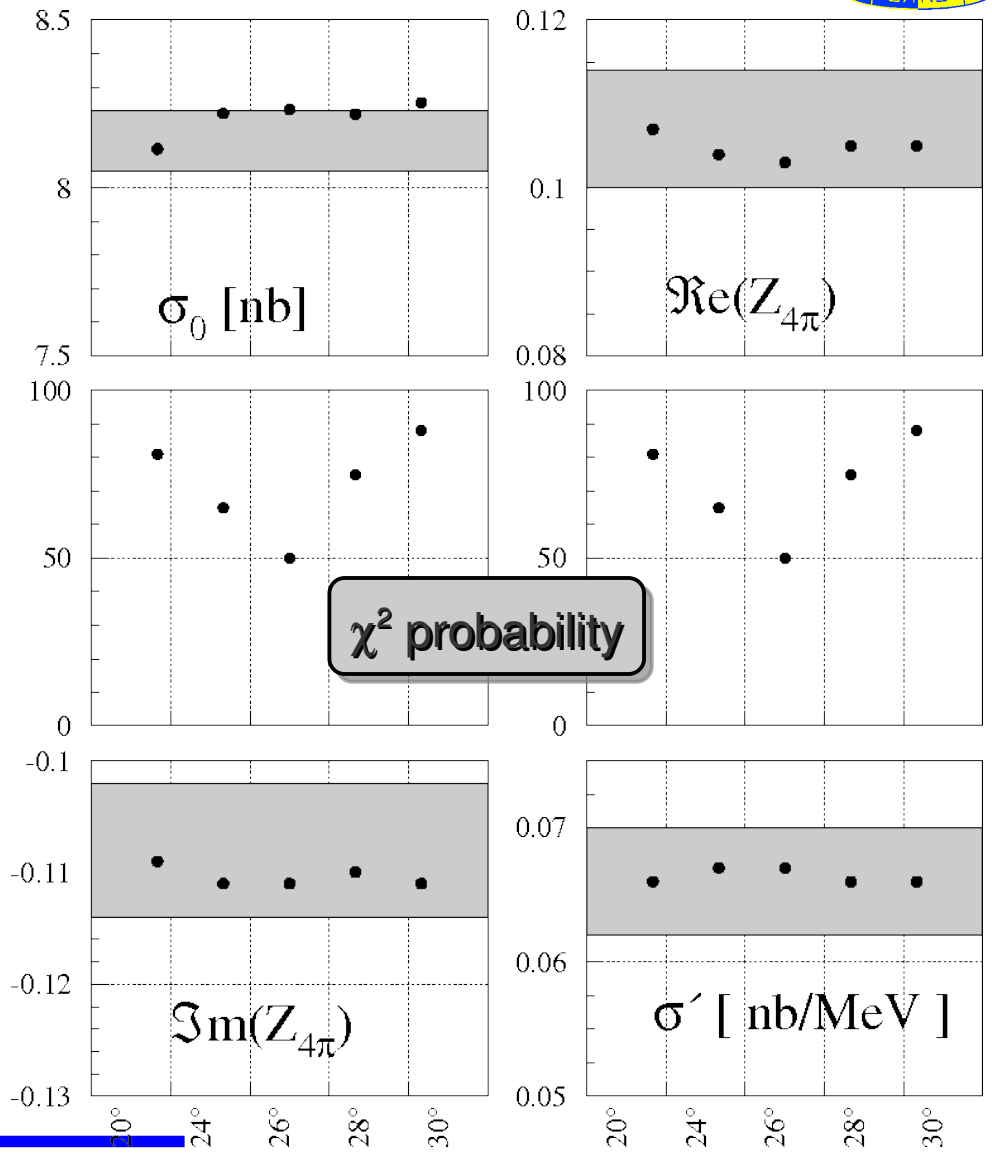
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

Cross section parameters variation as a function of minimum cluster energy.



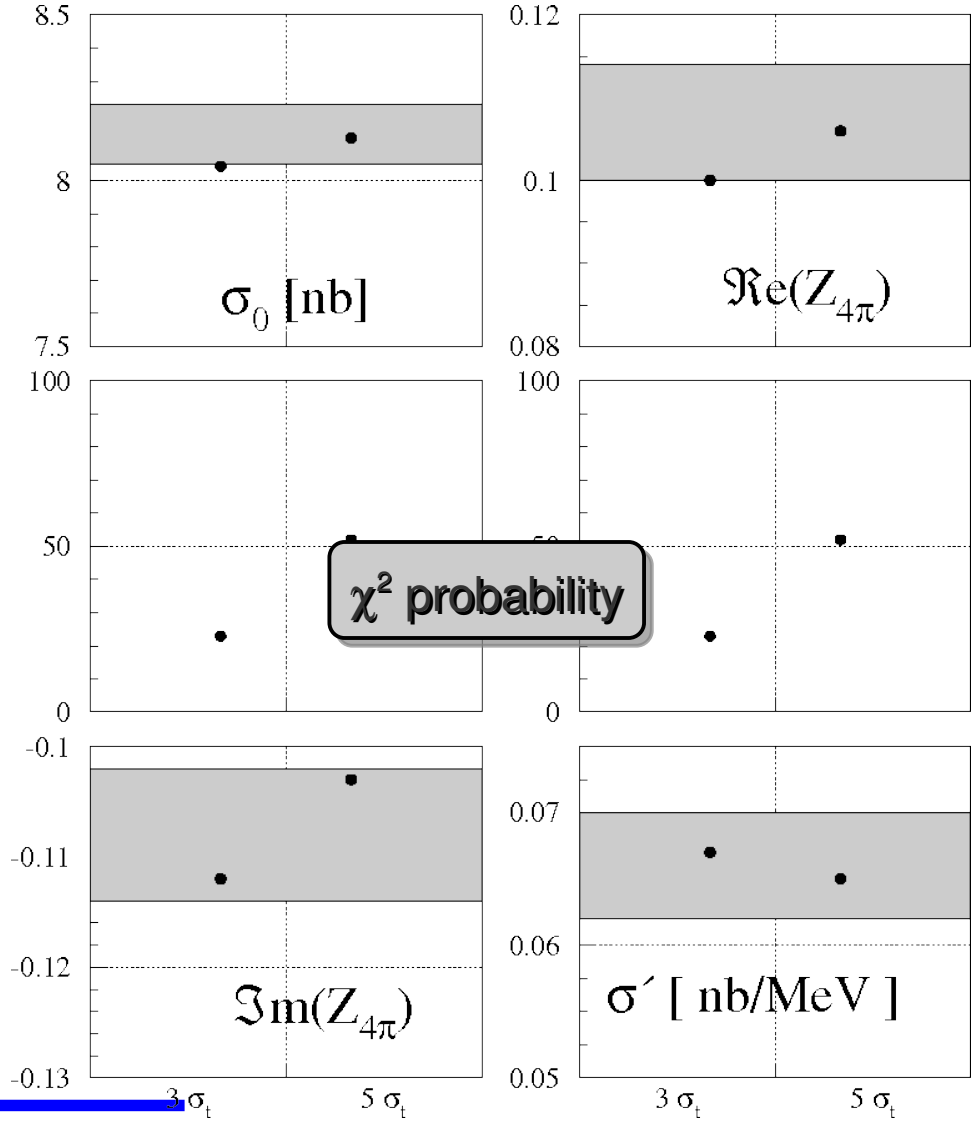
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

Cross section parameters variation as a function of polar angle interval.



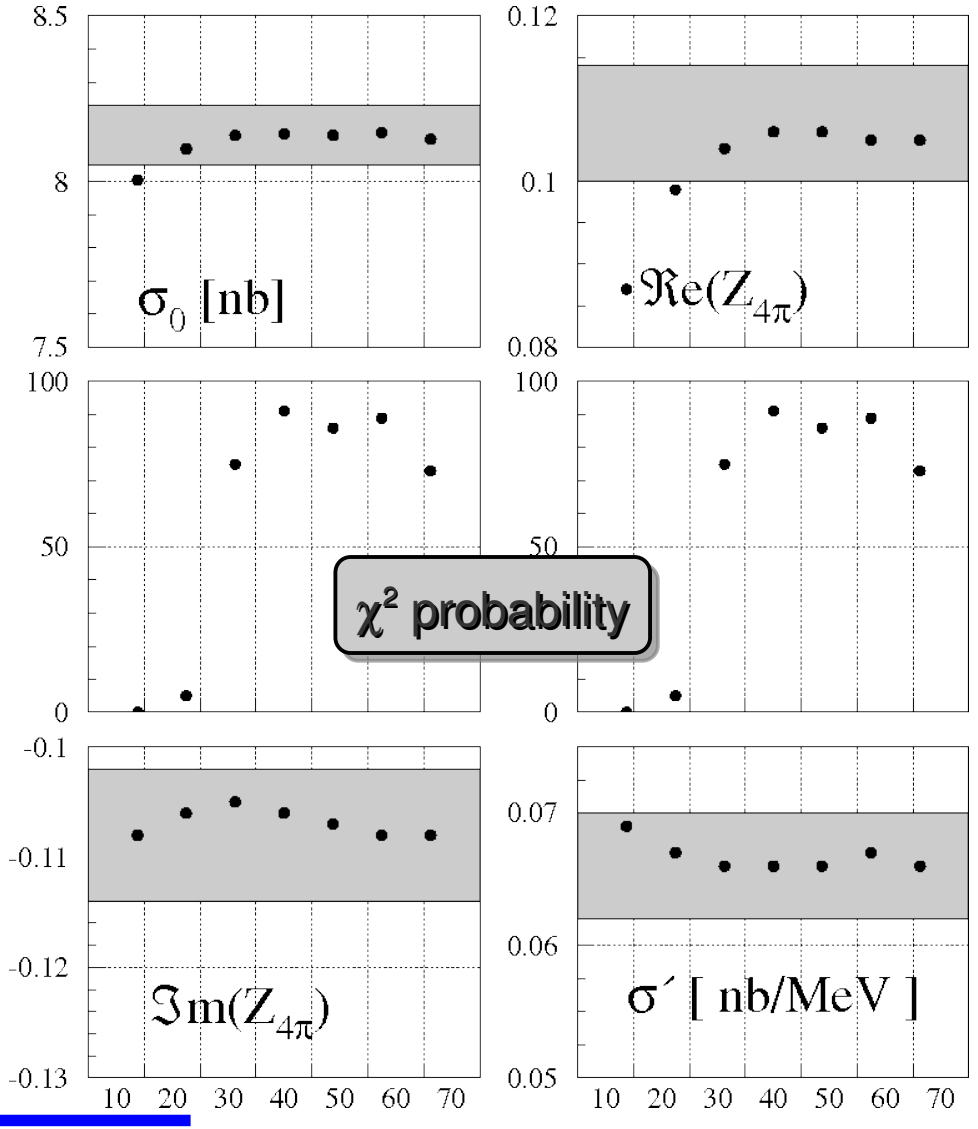
$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

Cross section parameters variation as a function of clusters time window.



$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

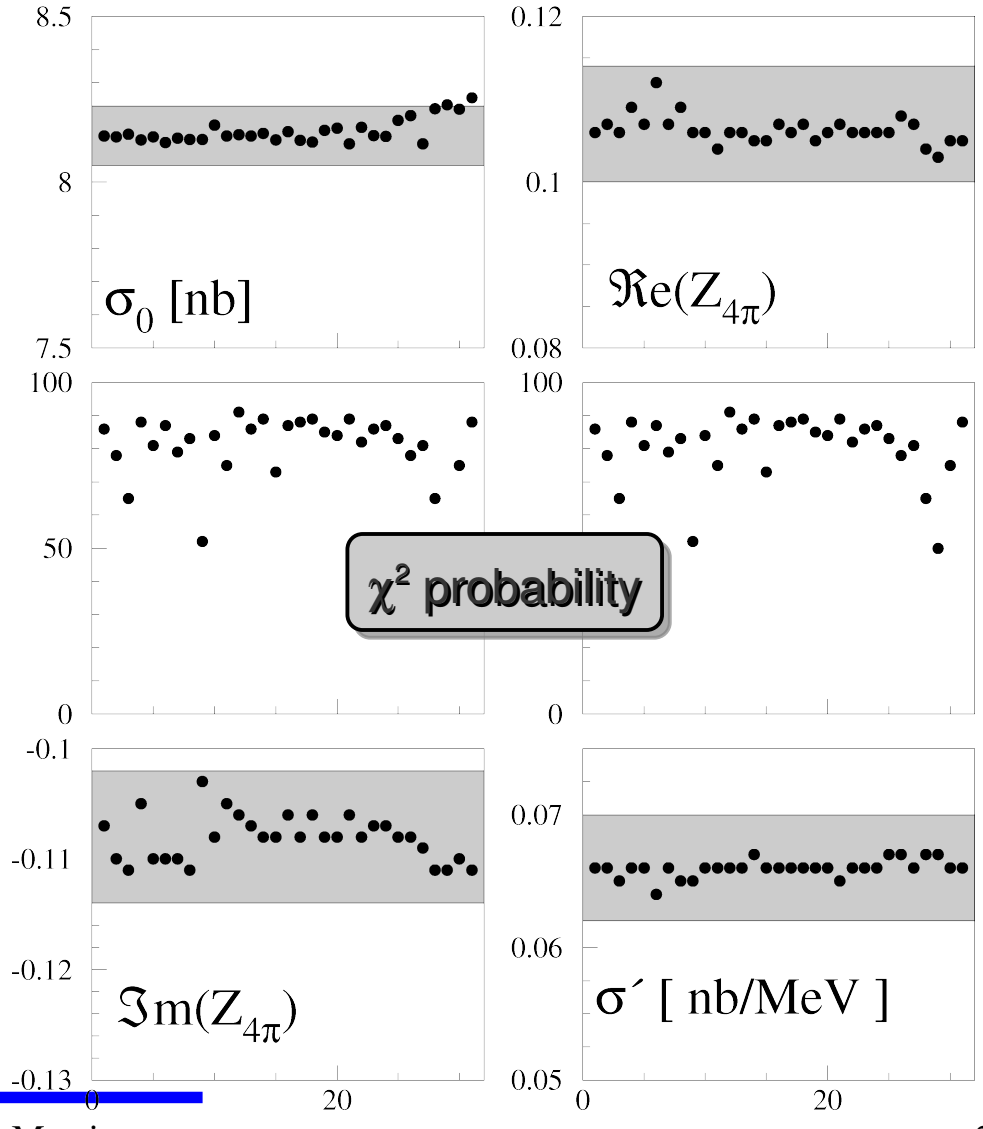
Cross section parameters variation as a function of kinematic fit χ^2 cut.



$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Cross section systematics

Complete set of variation considered
Required minimum probability (10%)
Tracking efficiency and vertexing efficiency corrections variation also included.

Fit parameters					
$\sigma_0^{4\pi}$ (nb)	8.15	$\pm$	0.06	$\pm$	0.05
$\Re(Z)$	0.104	$\pm$	0.007	$\pm$	0.002
$\Im(Z)$	-0.108	$\pm$	0.004	$\pm$	0.003
σ' (nb/MeV)	0.067	$\pm$	0.003	$\pm$	0.001



$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0)(E)$

We tried a different parametrization of non resonant part of the cross section

Linear approximation used

$$\sigma_{nr}^{4\pi}(\sqrt{s}) = \sigma_0^{4\pi} + \sigma'_{4\pi}(\sqrt{s} - M_\phi)$$

Alternative parametrization

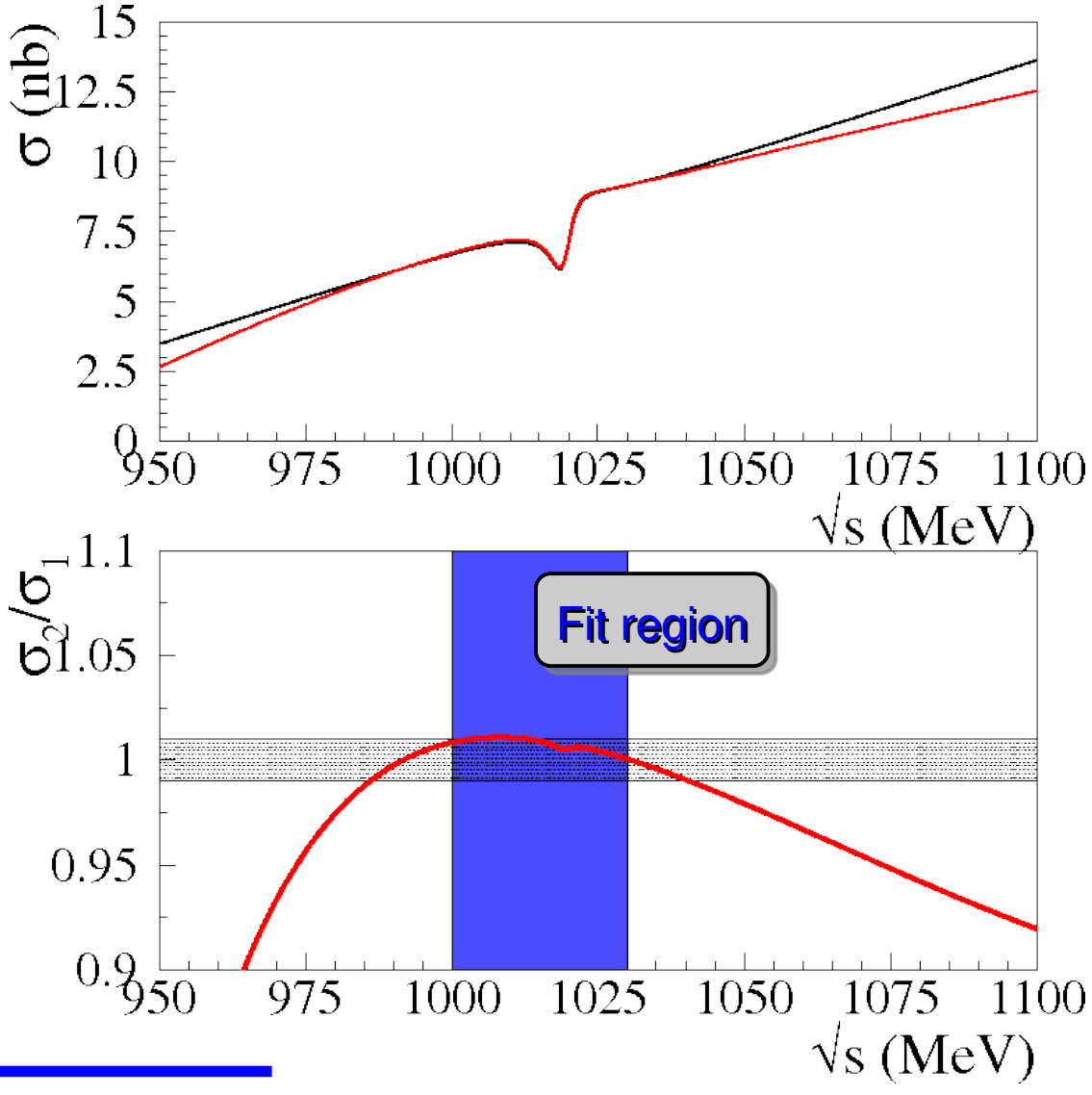
$$\sigma_{nr}^{4\pi}(E) = \frac{4\pi\alpha^2}{E^3}\left(\frac{g_{\rho\omega\pi}}{f_\rho}\right)^2 \left|\frac{m_\rho}{D_\rho} + A\frac{m_{\rho'}}{D_{\rho'}}\right|^2 P_f(E)$$

$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0)$

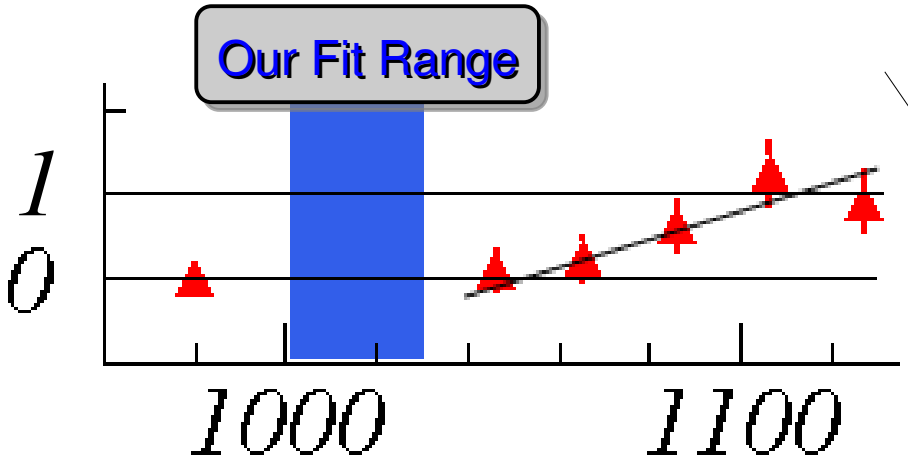
To have comparable parameters we use the ratio of the non resonant part at m_ϕ

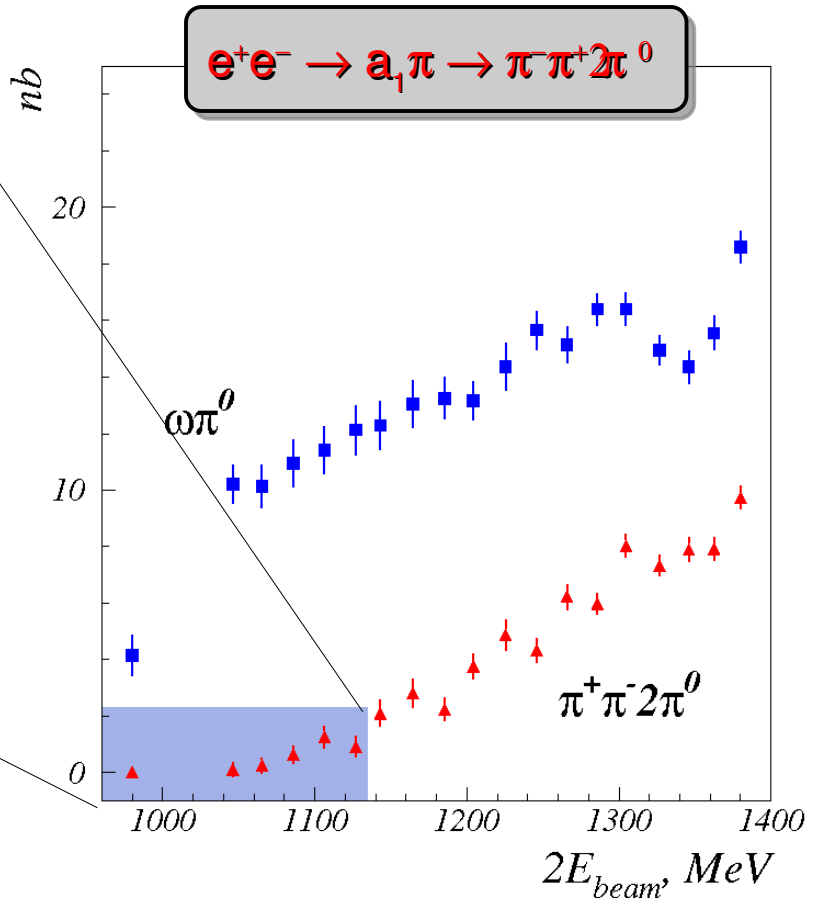
	$\rho\phi$ '	Linear
σ_0	8.20	8.15(8)
$\Re(\mathcal{A})$	0.104	0.104(7)
$\Im(\mathcal{A})$	-0.109	-0.108(7)

The slope cannot be compared



Background from $a_1\pi \to \pi^+\pi^-2\pi^0$ (1)

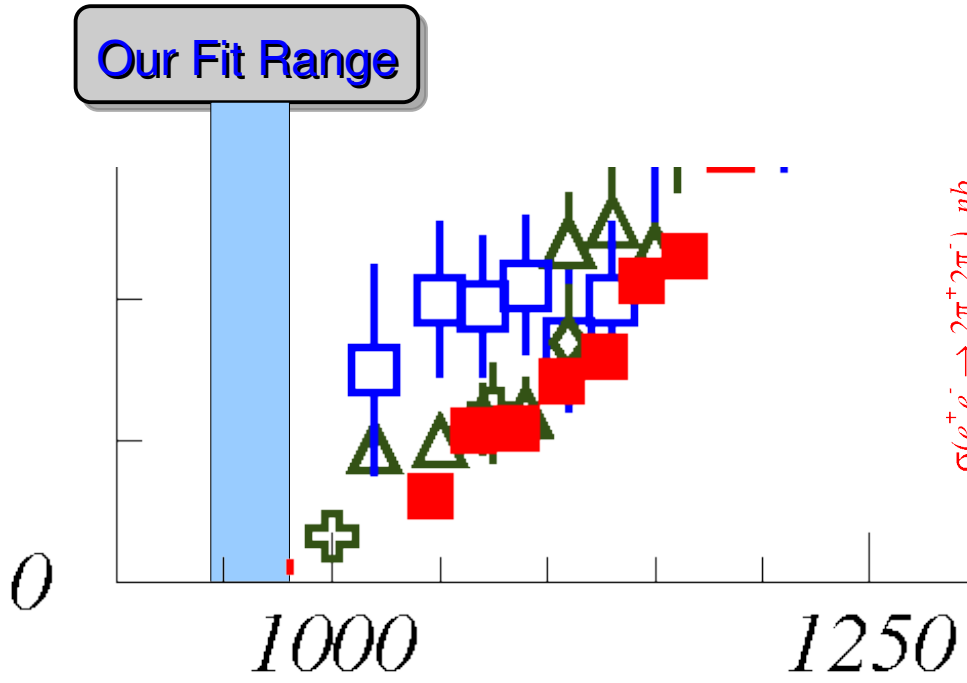


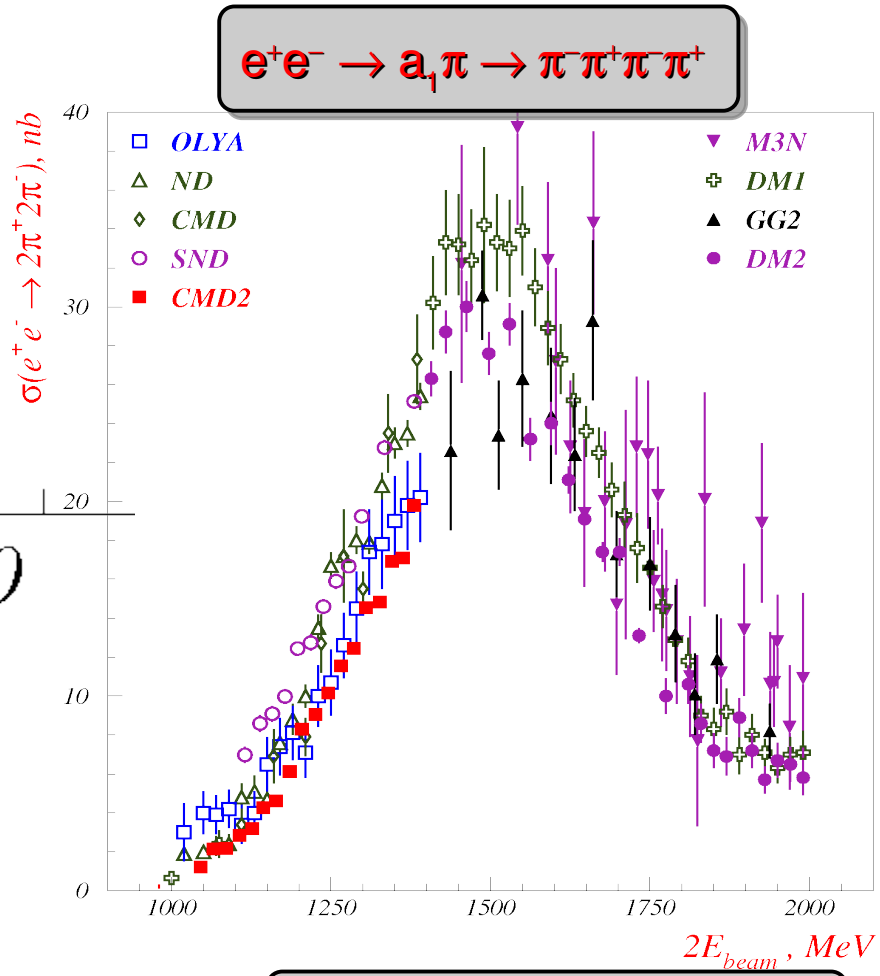


Extrapolating by hand the cross section for $a_1\pi$ in our fit range the amount seems negligible.

CMD-2 [hep-ex/9904024]

Background from $a_1\pi \to \pi^+\pi^- 2\pi^0$ (2)





Following the $a_1\pi$ dominance

$$\frac{\sigma(4\pi)}{\sigma(2\pi 2\pi^0)} \sim 2 \div 3$$

CMD-2 [hep-ex/9904024]

$$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$$

$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$

- Sample selection → 5 clusters
  - neutral (KLOE TCLO km129)
  - in Time Window ($|T_\gamma - R_\gamma/c| < \min(5\sigma_t, 2\ ns)$)
  - $E_\gamma < 7$ MeV
  - $\cos(\theta_\gamma) < 0.92$ (~23°)
  - $E\gamma_1 + E\gamma_2 < 900$ MeV

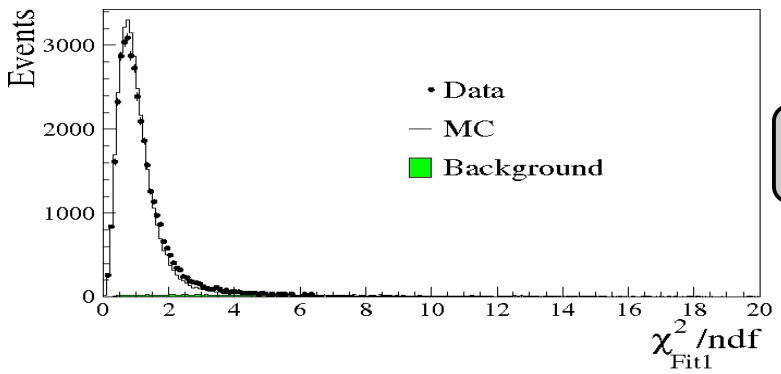
Acceptance (Step1)

- Photons pairing:
  - 1st kinematic fit (ToF and Energy momentum conservation)
  - parametrization of photon energy resolution (MC)
  - photon pairing into π^0 minimizing a χ^2 defined with the previous resolution
- 2nd kinematic fit (ToF, Energy momentum conservation and π^0 masses)

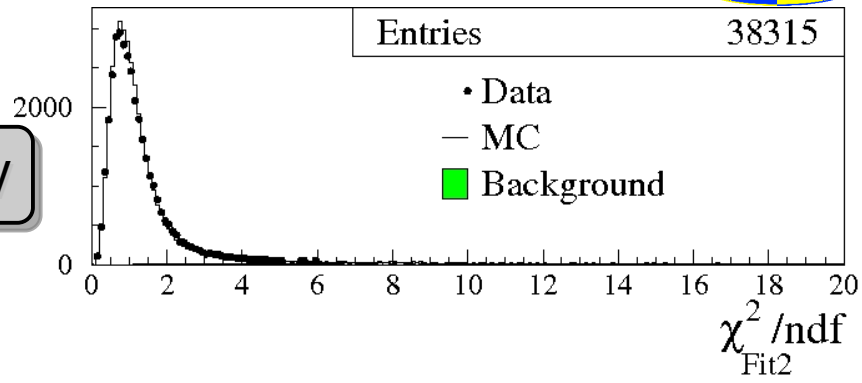
- $\chi^2(2^{nd})/N_{dof} < 5$
- $|\Delta M_{\pi^0}| < 5\sigma_M$

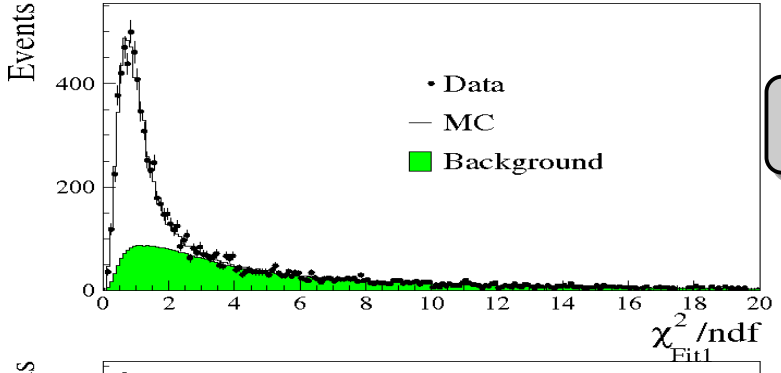
Bkg Rej (Step2)

$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$ Data-MC (Step 1 & 2)

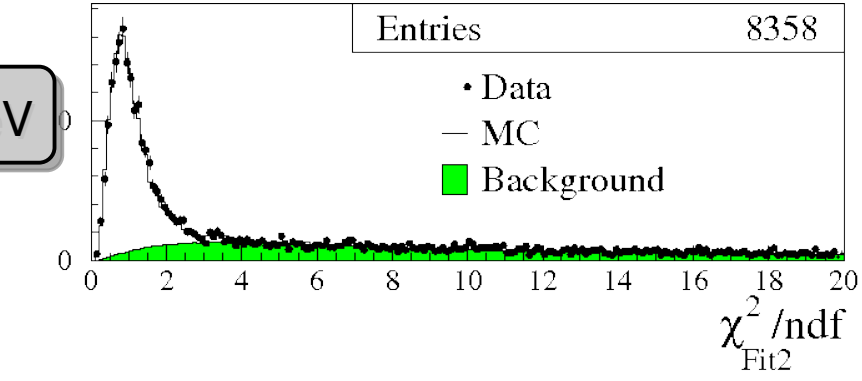


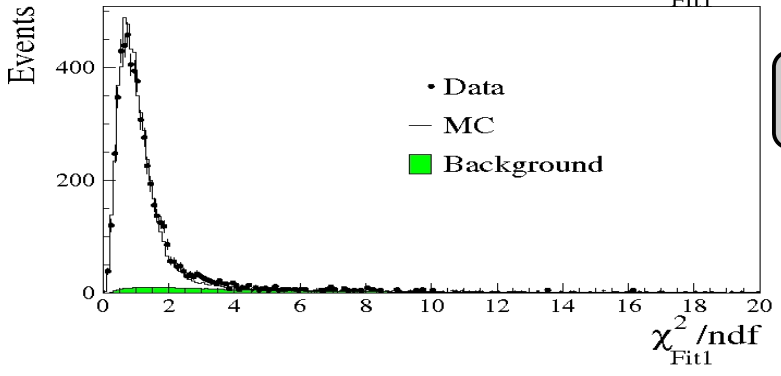
√s = 1000 MeV



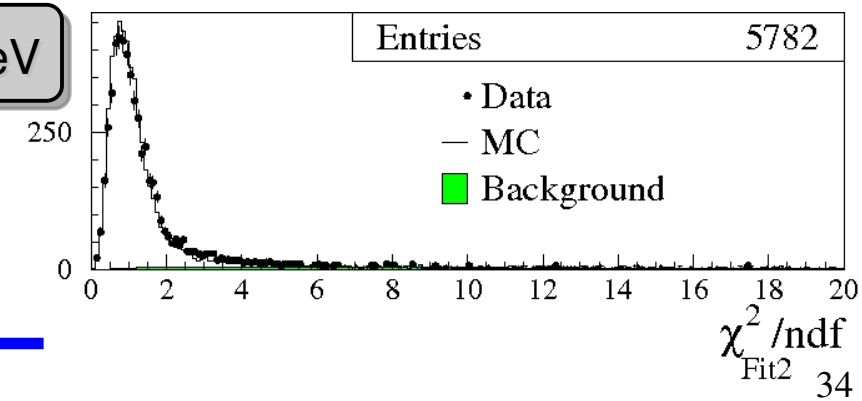


√s = 1018 MeV





√s = 1030 MeV



$\omega\pi^0 \to \pi^0\pi^0\gamma$

$\phi \to S\gamma$ and $\phi \to \omega\pi^0$ are assumed uncorrelated (int ~2% KN212)

Signal identification performed requiring $750 < M_{\pi\gamma} < 830$ MeV

(enlarged with respect to the original analysis $|M_{\pi\gamma} - M_{\omega}| < 3\sigma_M$)

Sig ID (Step3)

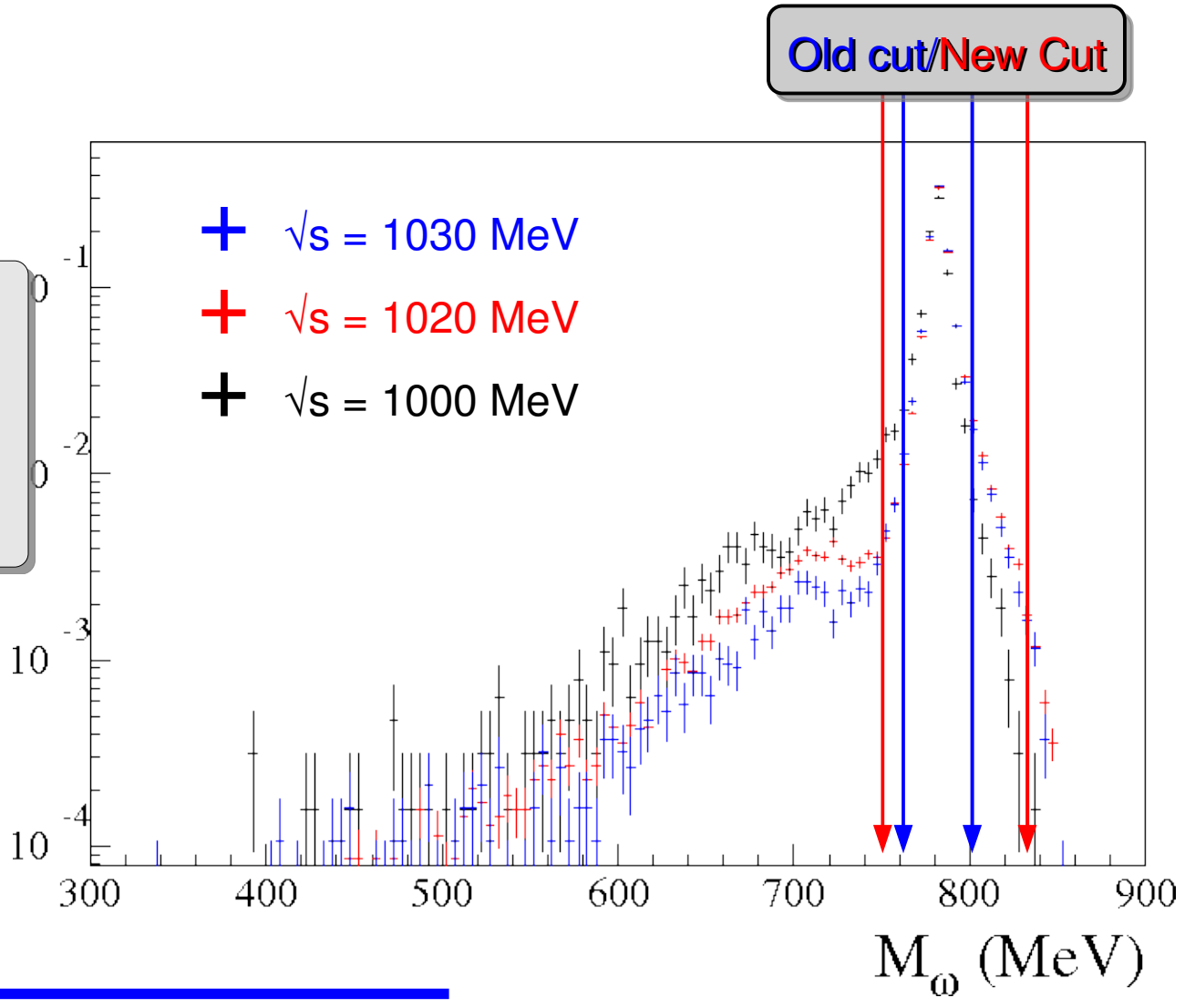
Background contribution estimated from MC distribution normalized with scale factor calculated using the MC/Data luminosity ratio (tested on different background enriched distribution) .

Dominant Background sources

Background	S/B (no cuts)	S/B (selection)	S/B (bkg rej)
$\eta\pi^0\gamma$	8.5	8.8	18.9
$\eta\gamma \to \pi^0\pi^0\pi^0\gamma$	0.1	0.5	3.9
$\eta\gamma \to \gamma\gamma\gamma$	0.1	18.8	32.3

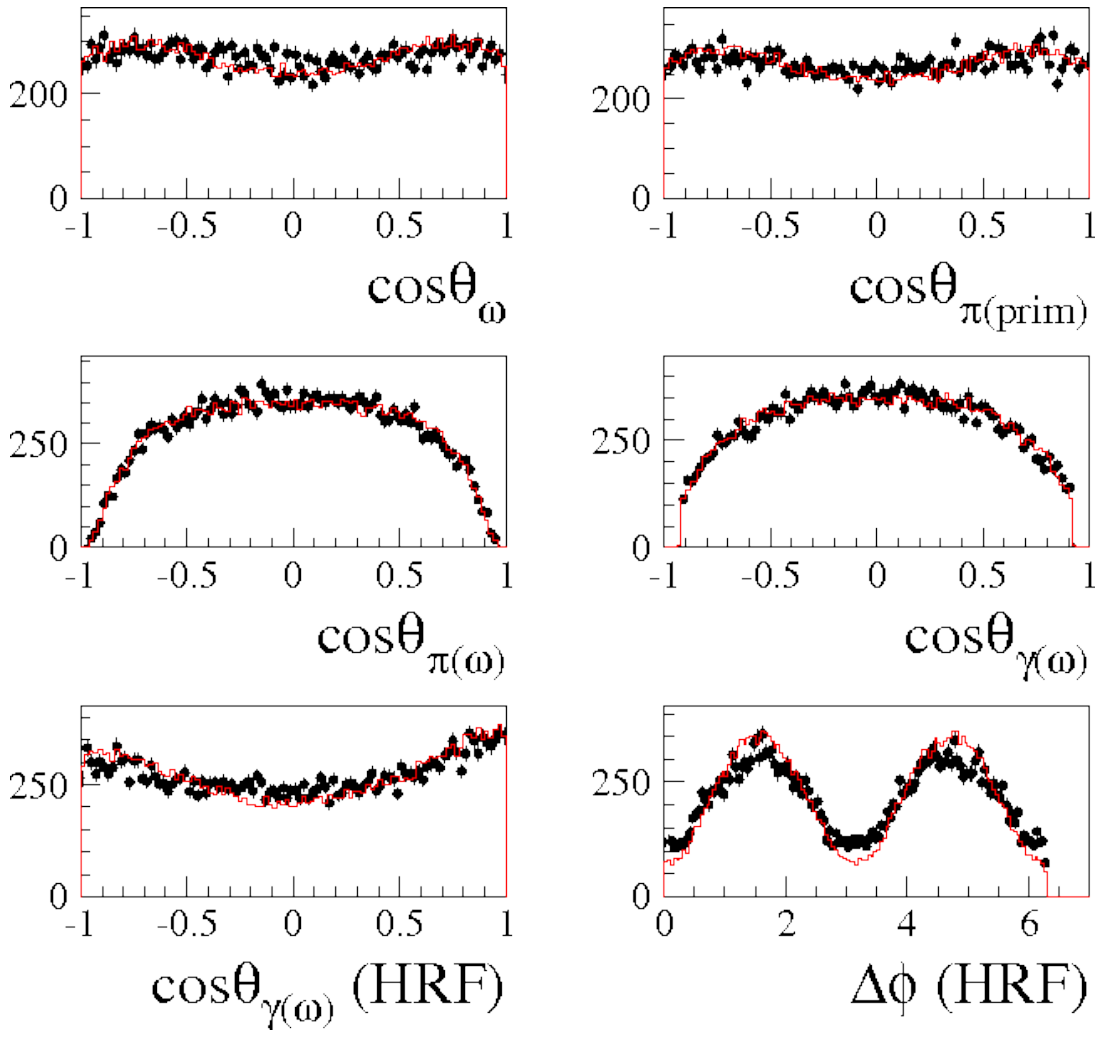
$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$

The ω tail depends on the center of mass energy.



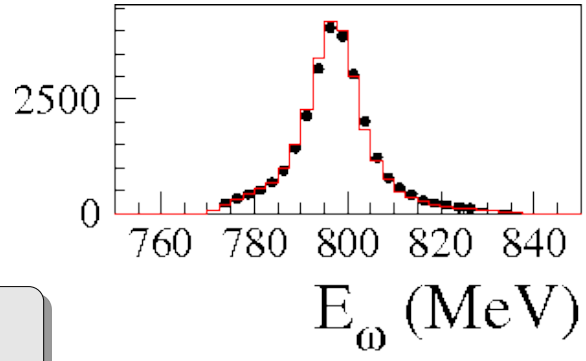
$\omega\pi^0 \to \pi^0\pi^0\gamma$ Data-MC comparison (Step 4)

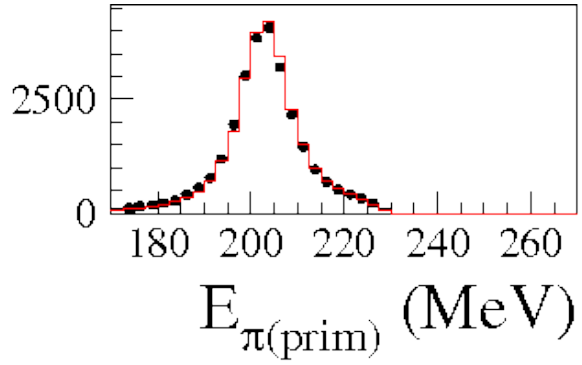
Data-MC comparison after ω identification and residual background subtraction. Angular distributions

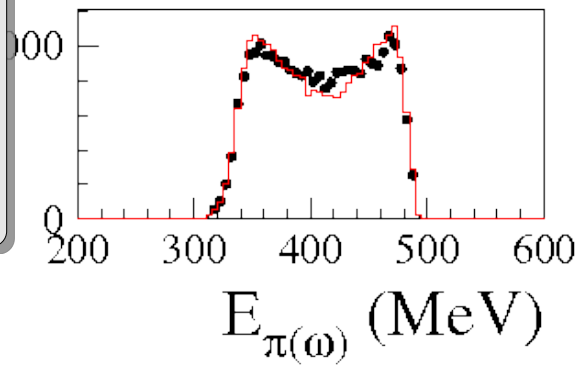


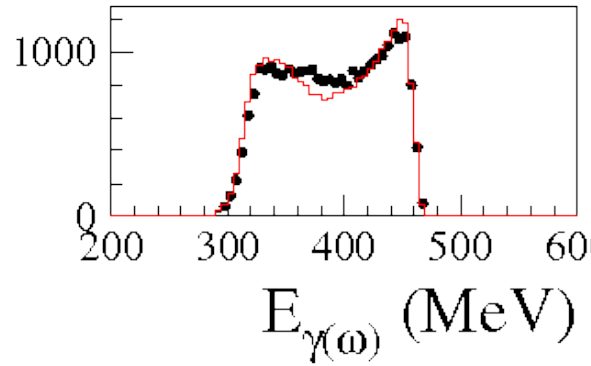
$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$ Data-MC comparison (Step 4)

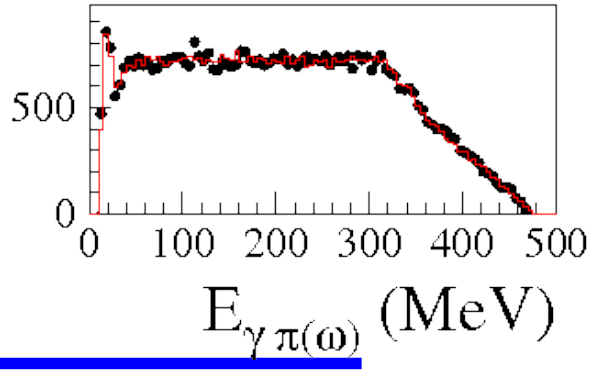
Data-MC comparison after ω identification and residual background subtraction. Energy distributions

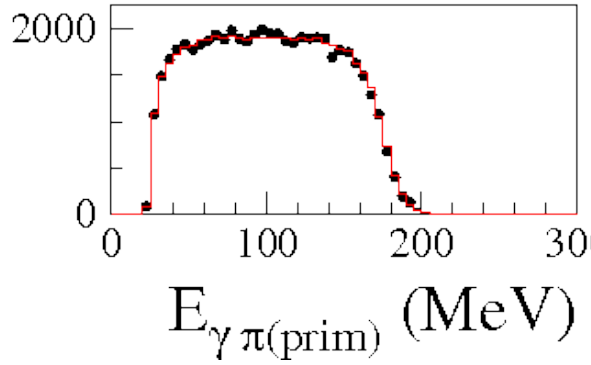






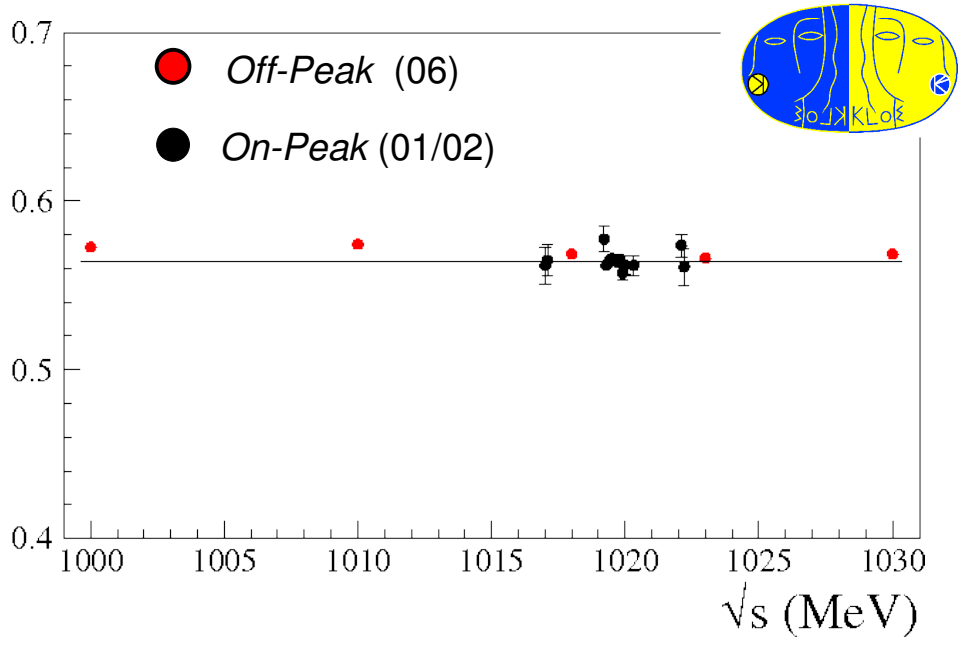




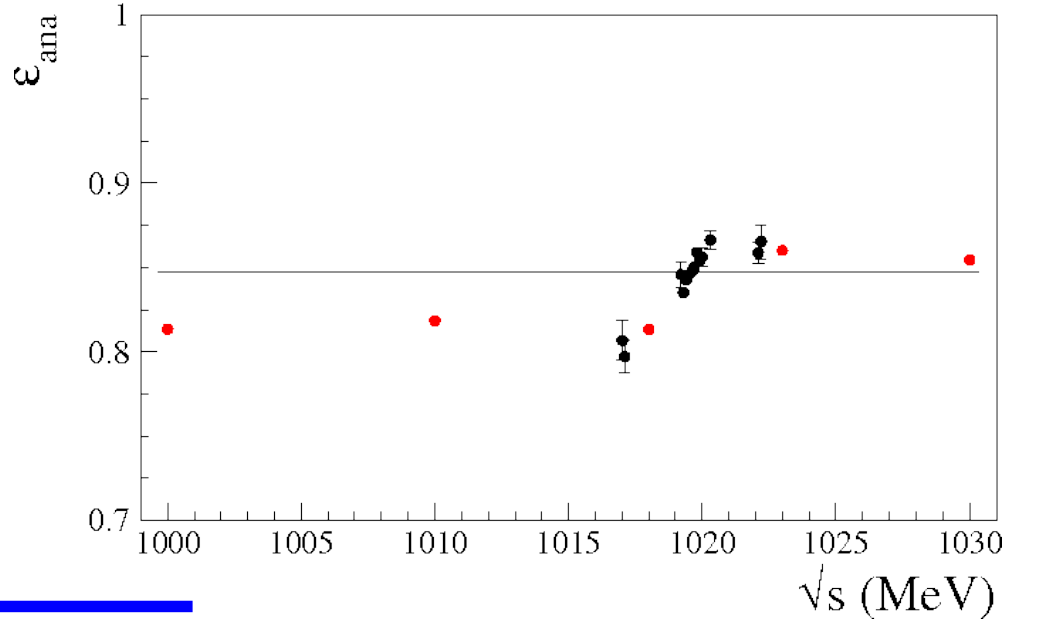


$\omega\pi^0 \rightarrow \pi^0\pi^0\gamma$ Efficiency

Analysis efficiency after the preselection and background rejection (Step1+2)

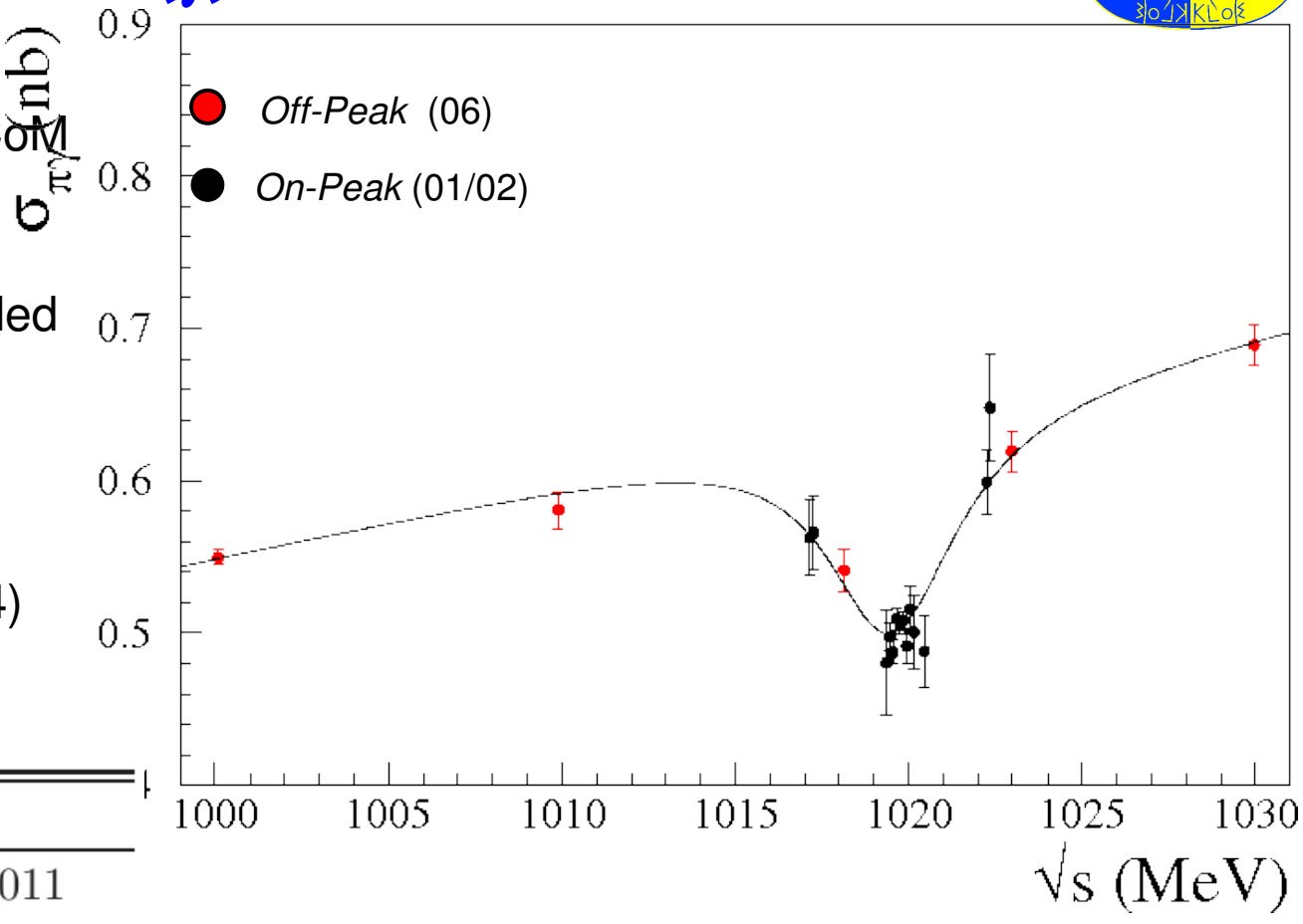


Analysis efficiency after the Mω cut (step 3)



$\sigma(e^+e^- \to \omega\pi^0 \to \pi^0\pi^0\gamma)$

- Efficiency and vlabha luminosity as function of CoM energy
- Radiative correction included
- BES included
- Preselection efficiency correction (1.022 +- 0.004)
- ISR tail correction



Parameter $(e^+e^- \to \pi^0\pi^0\gamma)$	
$\sigma_0^{\pi\pi\gamma}$ (nb)	0.724 ± 0.011
$\Re(Z_{\pi\pi\gamma})$	0.011 ± 0.016
$\Im(Z_{\pi\pi\gamma})$	-0.154 ± 0.004
$\sigma'_{\pi\pi\gamma}$ (nb/MeV)	$0.0053 \pm 0.0.0005$

$$\sigma(E) = \sigma_0(E)\left|1 - Z\frac{m_\phi\Gamma_\phi}{D_\phi}\right|^2$$

$\omega\pi^0 \to \pi^0\pi^0\gamma$ *Systematics*

	σ_0 (nb)	$\Re(Z)$	$\Im(Z)$	σ' (nb/MeV)	χ^2 / Ndof
Default	**0.724(11)**	**0.011(15)**	**-0.154(7)**	**0.0053(5)**	**13.1/15**
χ^2	0.720(11)	0.004(15)	-0.155(7)	0.0054(5)	9.9/15
Mω	0.730(11)	0.005(15)	-0.156(7)	0.0059(5)	8.2/15
Eg	0.727(10)	0.010(15)	-0.155(7)	0.0055(5)	11.0/15
E scale	0.722(10)	0.004(14)	-0.155(7)	0.0054(5)	9.7/15
Bkg	0.724(11)	0.012(14)	-0.157(7)	0.0053(5)	13.9/15
√s scale	0.723(11)	0.022(15)	-0.151(7)	0.0052(5)	12.3/15
ISR tail	0.728(11)	0.010(15)	-0.158(7)	0.0052(5)	12.5/15
Mππ	0.728(10)	0.006(14)	-0.153(7)	0.0053(5)	11.3/15
Interf	0.724(11)	0.019(18)	-0.158(7)	0.0053(6)	13.0/15
All	**±0.003**	**±0.006**	**±0.004**	**±0.0002**	

Combined

ω's BR

Parameter $(e^+e^- \to \pi^+\pi^-\pi^0\pi^0)$	
$\sigma_0^{4\pi}$ (nb)	8.15 ± 0.08
$\Re(Z_{4\pi})$	0.104 ± 0.007
$\Im(Z_{4\pi})$	$-0.108 \pm 0.0.005$
$\sigma'_{4\pi}$ (nb/MeV)	0.067 ± 0.003

Parameter $(e^+e^- \to \pi^0\pi^0\gamma)$	
$\sigma_0^{\pi\pi\gamma}$ (nb)	0.724 ± 0.011
$\Re(Z_{\pi\pi\gamma})$	0.011 ± 0.016
$\Im(Z_{\pi\pi\gamma})$	-0.154 ± 0.004
$\sigma'_{\pi\pi\gamma}$ (nb/MeV)	0.0053 ± 0.0005

$$\frac{\sigma_0(\omega \to \pi^0\gamma)}{\sigma_0(\omega \to \pi^+\pi^-\pi^0)} = 0.0888 \pm 0.0016$$

Phase space correction (1.023)

$$\frac{\Gamma(\omega \to \pi^0\gamma)}{\Gamma(\omega \to \pi^+\pi^-\pi^0)} = 0.0868 \pm 0.0016$$

$$BR(\omega \to \pi^+\pi^-\pi^0) = (90.49 \pm 0.18)\%$$
$$BR(\omega \to \pi^0\gamma) = (\ 7.85 \pm 0.13)\%$$

Unitarity imposed

Δ = 1.66%

ω's BR: combined fit

Parameter $(e^+e^- \to \omega\pi^0)$	
$\sigma_0^{4\pi}$ (nb)	8.12 ± 0.06
$\Re(Z_{4\pi})$	0.108 ± 0.007
$\Im(Z_{4\pi})$	-0.107 ± 0.005
$\sigma'_{4\pi}$ (nb/MeV)	0.064 ± 0.003
$\Re(Z_{\pi\pi\gamma})$	0.006 ± 0.013
$\Im(Z_{\pi\pi\gamma})$	-0.157 ± 0.006
Ratio	0.0902 ± 0.0009
$\sigma_0^{\pi\pi\gamma}$ (nb)	0.732
$\sigma'_{\pi\pi\gamma}$ (nb/MeV)	0.0058

Following referees suggestion we try a simple combined fit

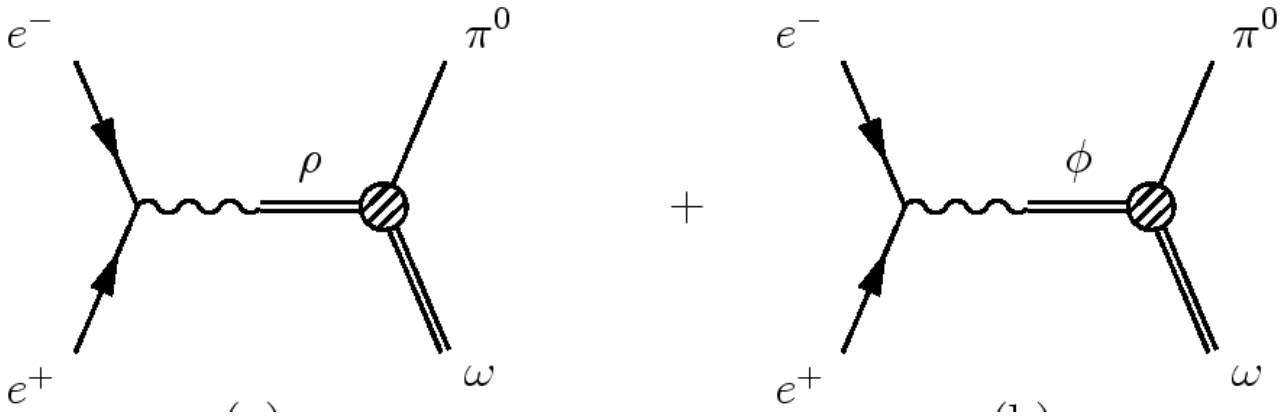
Non resonant cross section assumed proportional

Errors are from fit (no syst)

Good agreement wrt separated fit

$BR(\phi \to \omega\pi^0)$

In the 4π final state only two diagram contribute.
Using our results we extract the amplitude for the $\phi \to \omega\pi^0$ process

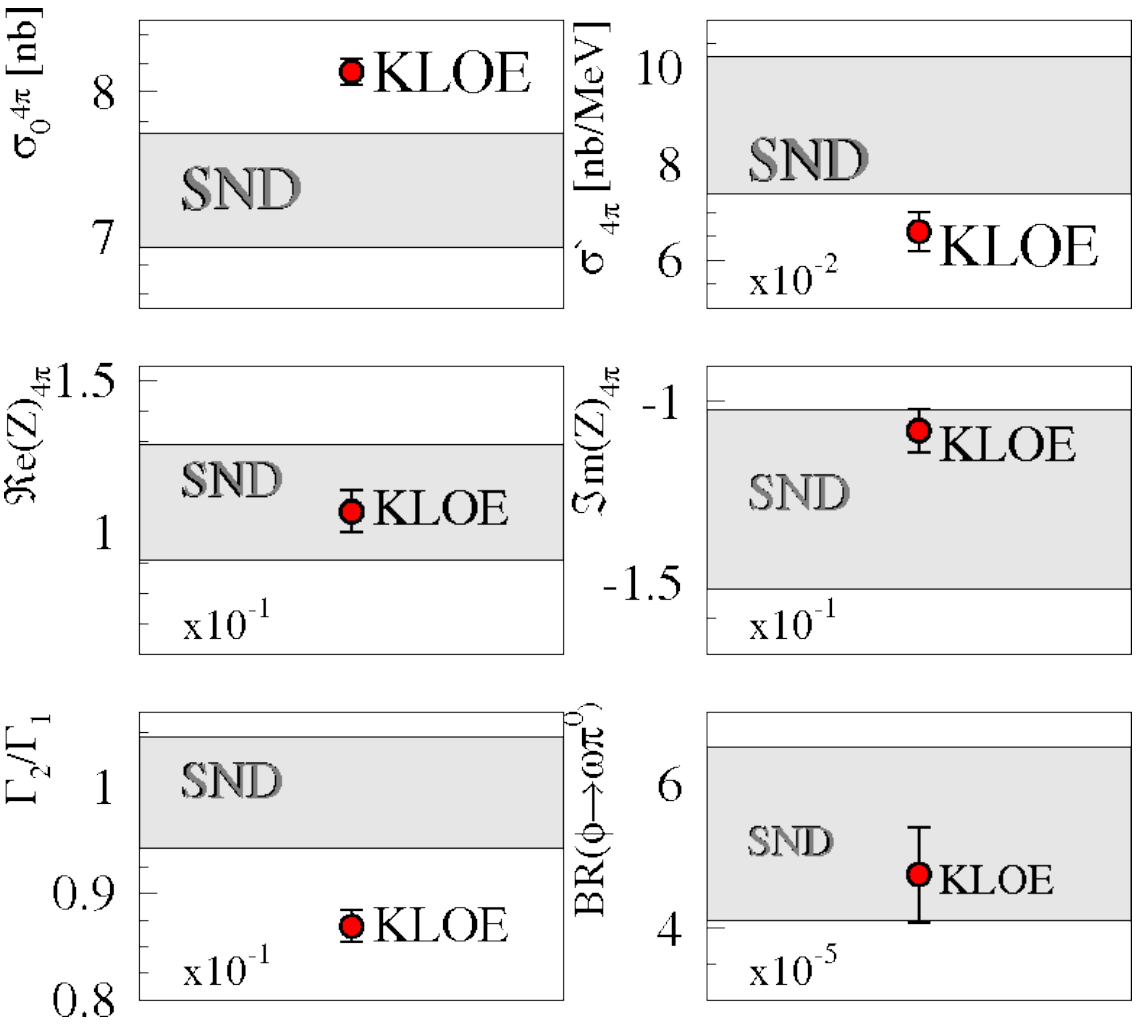


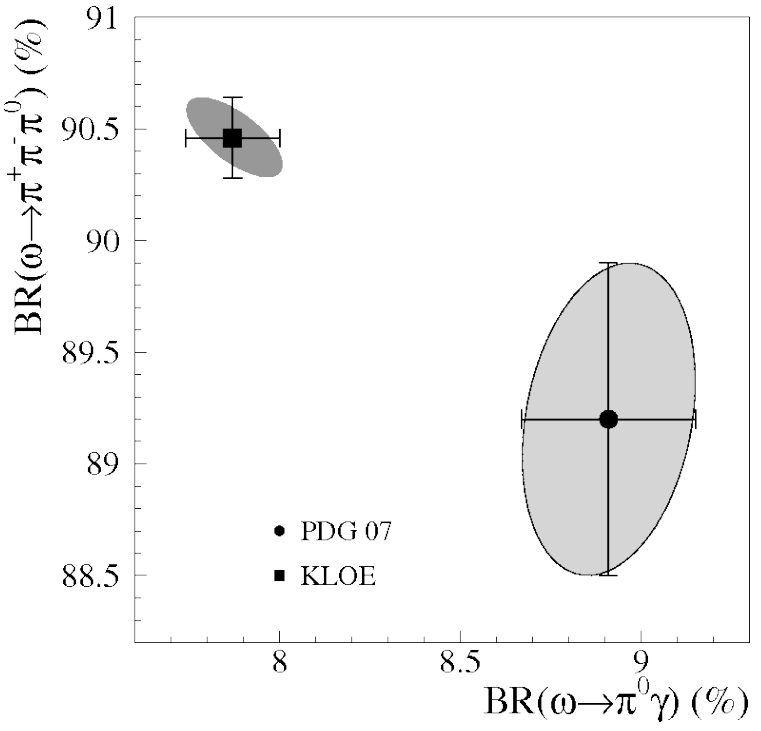
$$BR(\phi \to \omega\pi^0) = \frac{\sigma_0(m_\phi)|Z|^2}{\sigma_\phi}$$

Using KLOE results (correlation included)

$$BR(\phi \to \omega\pi^0) = (4.6 \pm 0.6) \times 10^{-5}$$

Summary





Precision improved by factor 2

Neutral BR changed of ~10%

Before the MEMO's update

Same number of points (19) but different energies.

For a single publication we plan to have same points (17) and same energy

Table of results

$\sqrt{s}$ (MeV)	$N^{4\pi} \pm \delta_N$	$\sigma^{4\pi}_{vis} \pm \delta_\sigma$	$N^{\pi\pi\gamma}$	$\sigma^{\pi\pi\gamma}_{vis}$ (nb)
1000.10	228988 ± 569	5.90 ± 0.06	27110 ± 167	0.550 ± 0.005
1009.89	26807 ± 209	6.40 ± 0.08	2958 ± 56	0.581 ± 0.012
1017.05	16590 ± 182	5.85 ± 0.09	-	-
1017.15	-	-	1020 ± 36	0.563 ± 0.025
1017.25	-	-	884 ± 33	0.566 ± 0.025
1018.09	14963 ± 148	5.82 ± 0.08	-	-
1018.14	-	-	2557 ± 60	0.541 ± 0.014
1018.23	7952 ± 110	5.73 ± 0.10	-	-
1018.81	3083 ± 91	5.50 ± 0.17	-	-
1019.27	4901 ± 99	6.00 ± 0.14	-	-
1019.35	-	-	322 ± 22	0.480 ± 0.034
1019.45	59779 ± 332	6.06 ± 0.07	6058 ± 101	0.497 ± 0.009
1019.55	95901 ± 406	6.08 ± 0.07	9516 ± 130	0.487 ± 0.008
1019.65	175936 ± 1278	6.13 ± 0.08	18349 ± 189	0.509 ± 0.007
1019.75	333601 ± 1261	6.17 ± 0.07	34049 ± 282	0.505 ± 0.006
1019.85	261971 ± 1326	6.22 ± 0.07	26124 ± 234	0.508 ± 0.006
1019.95	36796 ± 371	6.37 ± 0.09	3510 ± 74	0.491 ± 0.011
1020.05	18449 ± 157	6.38 ± 0.09	1843 ± 52	0.516 ± 0.016
1020.16	8414 ± 110	6.40 ± 0.11	702 ± 32	0.501 ± 0.024
1020.47	9864 ± 127	6.55 ± 0.11	667 ± 31	0.488 ± 0.024
1022.27	17383 ± 149	7.43 ± 0.10	1219 ± 38	0.599 ± 0.021
1022.35	-	-	515 ± 25	0.648 ± 0.035
1022.98	30533 ± 201	7.64 ± 0.09	3101 ± 61	0.619 ± 0.013
1029.93	34831 ± 213	8.11 ± 0.10	3896 ± 65	0.689 ± 0.013

After the update

Table of results

WPC:
- 2 point packed in 1
- 1 eliminated

WPN:
- 4 point packed in 2

$\sqrt{s}$ (MeV)	$N^{4\pi} \pm \delta_N$	$\sigma^{4\pi}_{vis} \pm \delta_\sigma$	$N^{\pi\pi\gamma}$	$\sigma^{\pi\pi\gamma}_{vis}$ (nb)
1000.10	228988 ± 569	5.90 ± 0.06	27110 ± 167	0.550 ± 0.005
1009.89	26807 ± 209	6.40 ± 0.08	2958 ± 56	0.581 ± 0.012
1017.20	16590 ± 182	5.85 ± 0.09	2108 ± 46	0.564 ± 0.018
1018.14	22915 ± 185	5.79 ± 0.08	2557 ± 60	0.541 ± 0.014
1019.30	4901 ± 99	6.00 ± 0.14	322 ± 22	0.480 ± 0.034
1019.45	59779 ± 332	6.06 ± 0.07	6058 ± 101	0.497 ± 0.009
1019.55	95901 ± 406	6.08 ± 0.07	9516 ± 130	0.487 ± 0.008
1019.65	175936 ± 1278	6.13 ± 0.08	18349 ± 189	0.509 ± 0.007
1019.75	333601 ± 1261	6.17 ± 0.07	34049 ± 282	0.505 ± 0.006
1019.85	261971 ± 1326	6.22 ± 0.07	26124 ± 234	0.508 ± 0.006
1019.95	36796 ± 371	6.37 ± 0.09	3510 ± 74	0.491 ± 0.011
1020.05	18449 ± 157	6.38 ± 0.09	1843 ± 52	0.516 ± 0.016
1020.16	8414 ± 110	6.40 ± 0.11	702 ± 32	0.501 ± 0.024
1020.47	9864 ± 127	6.55 ± 0.11	667 ± 31	0.488 ± 0.024
1022.28	17383 ± 149	7.43 ± 0.10	1891 ± 43	0.612 ± 0.018
1022.98	30533 ± 201	7.64 ± 0.09	3101 ± 61	0.619 ± 0.013
1029.93	34831 ± 213	8.11 ± 0.10	3896 ± 65	0.689 ± 0.013

Conclusions

- Stable results
- Homogeneous dataset
- Memo ready for upgrade (344 and 345)
- Draft almost complete
- $a_1\pi$ background simulation in progress

SPARE

$\sigma(e^+e^- \to \pi^+\pi^-\pi^0\pi^0)$ OLD-NEW comparison

OLD result (before PONZA):

σ0 = 8.13

Re(Z) = 0.078

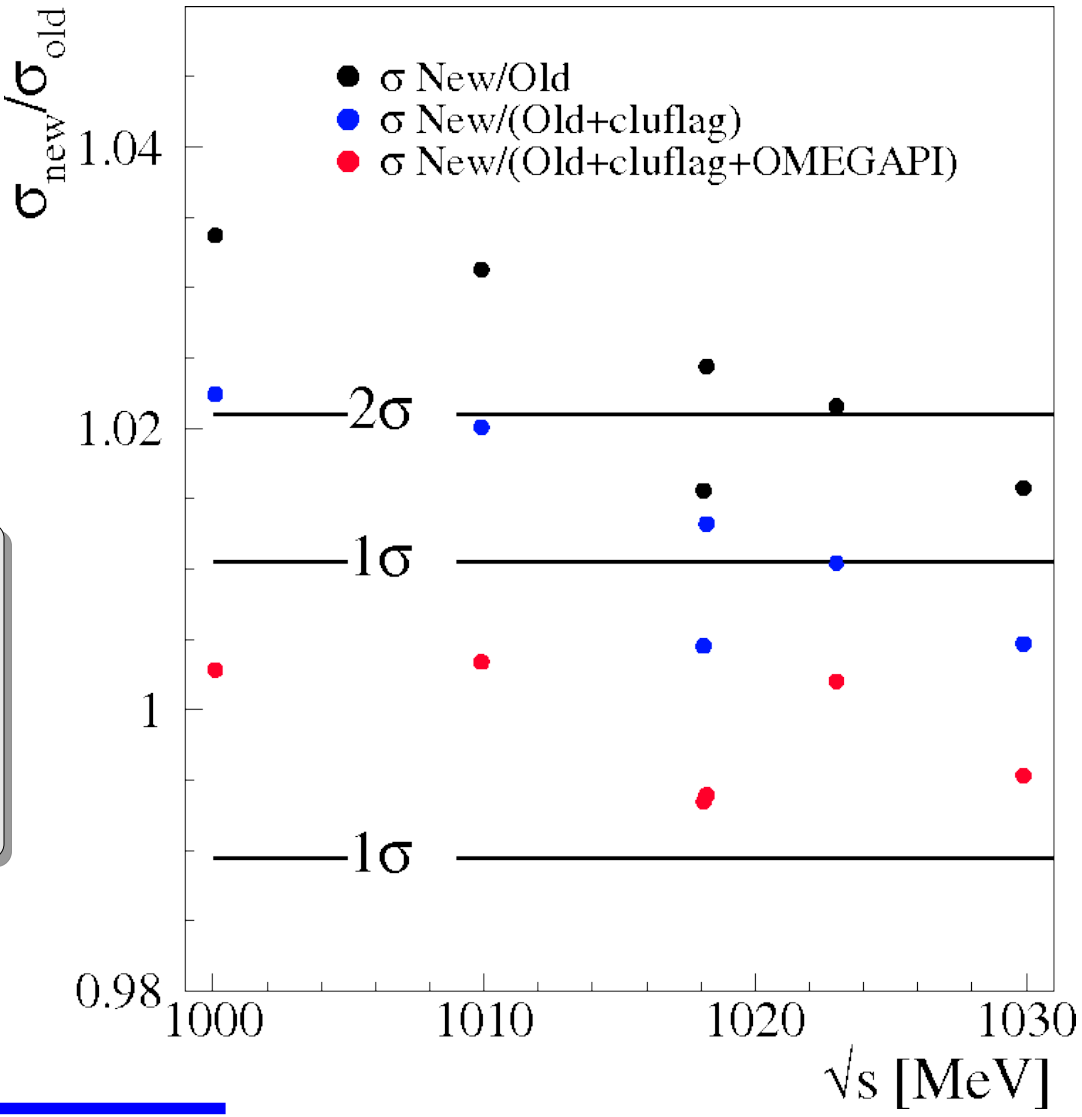
Im(Z) = -0.130

σ' = 0.077

A bug has been found:

requested cluflag≠5 (efficiency curves)

also for data (-1% on counting)

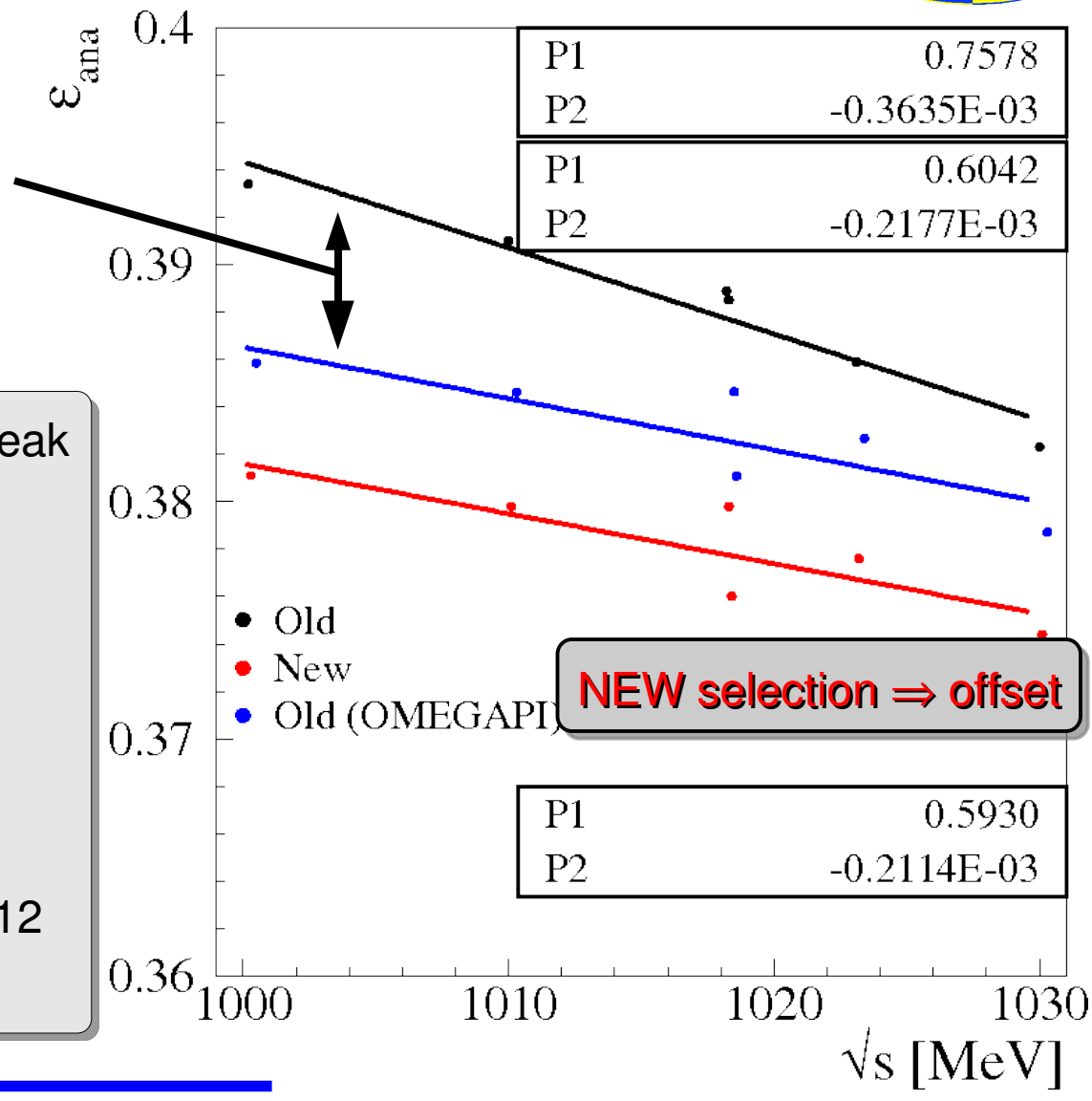


$\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$: Boost effect

Slope correction from boost
OLD selection on OMEGAPI
official production

In the previous version (OLD) the off-peak simulation was done w/o MB insertion.

Important limitation in GEANFI:
when running in user mode (with data card) the crossing angle (ϕ momentum along x) is fixed at 01/02 value.
In the real data the p_x is 16 MeV w.r.t. 12 MeV simulated



$\sigma(e^+e^- \to \pi^+\pi^-\pi^0\pi^0)$ OLD-NEW comparison

OLD result (before PONZA):

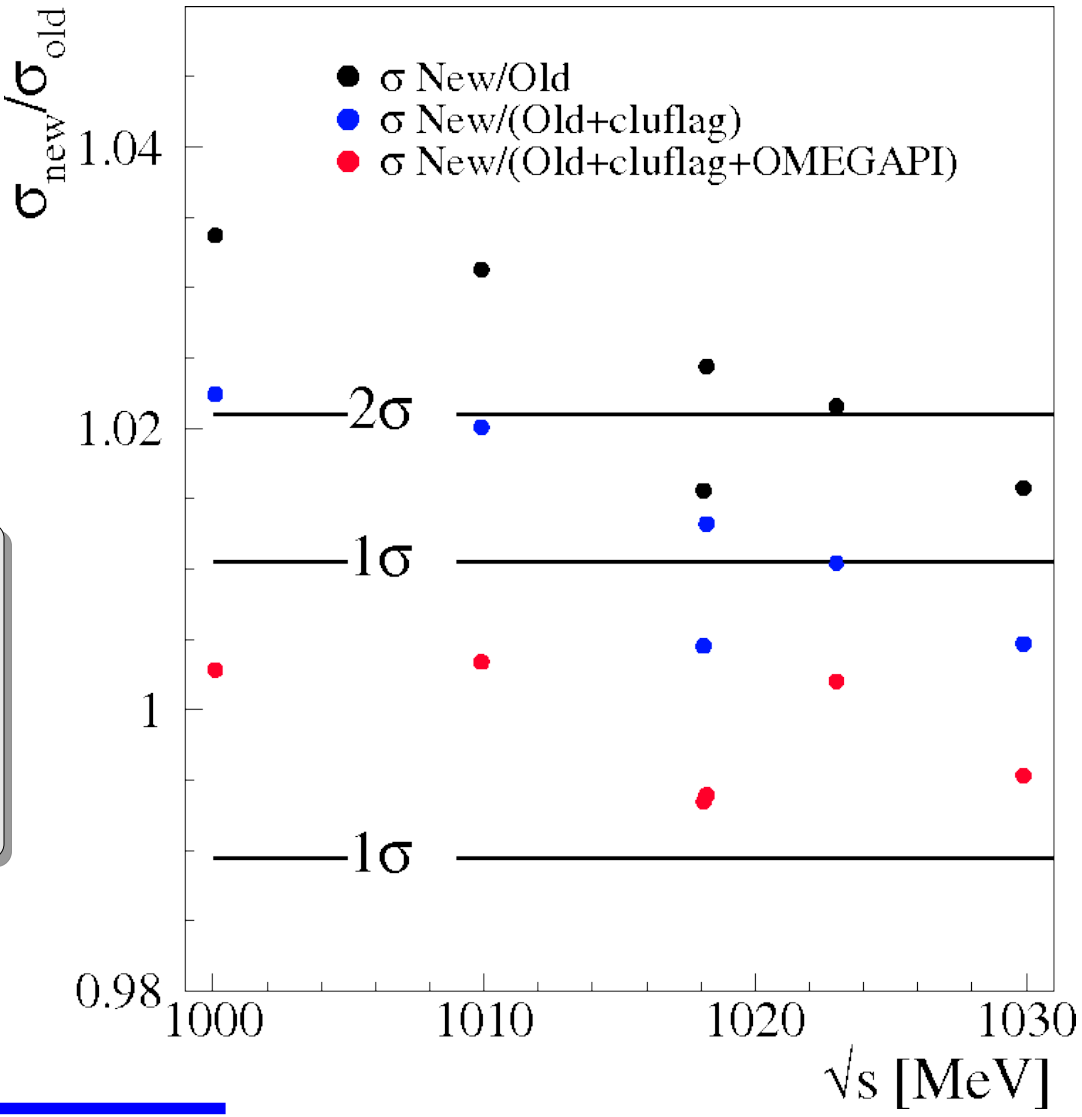
σ0 = 8.13

Re(Z) = 0.078

Im(Z) = -0.130

σ' = 0.077

Repeating OLD selection on OMEGAPI (Offline⇒MBkg+Boost) to get proper efficiency



$\sigma(e^+e^- \to \pi^+\pi^-\pi^0\pi^0)$ OLD-NEW comparison

OLD result (previous MEMO):

$\sigma 0$ = 8.13

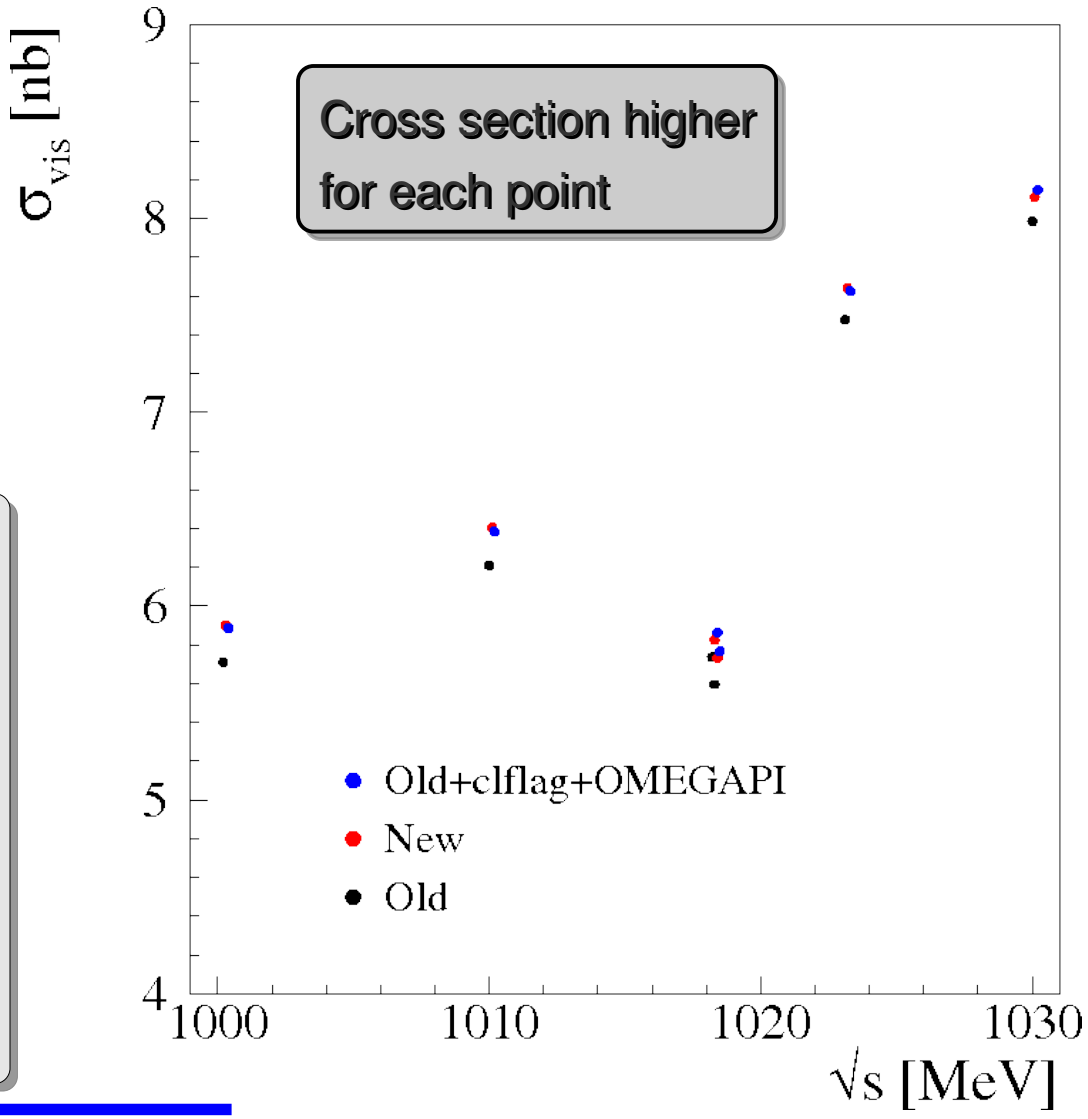
Re(Z) = 0.078

Im(Z) = -0.130

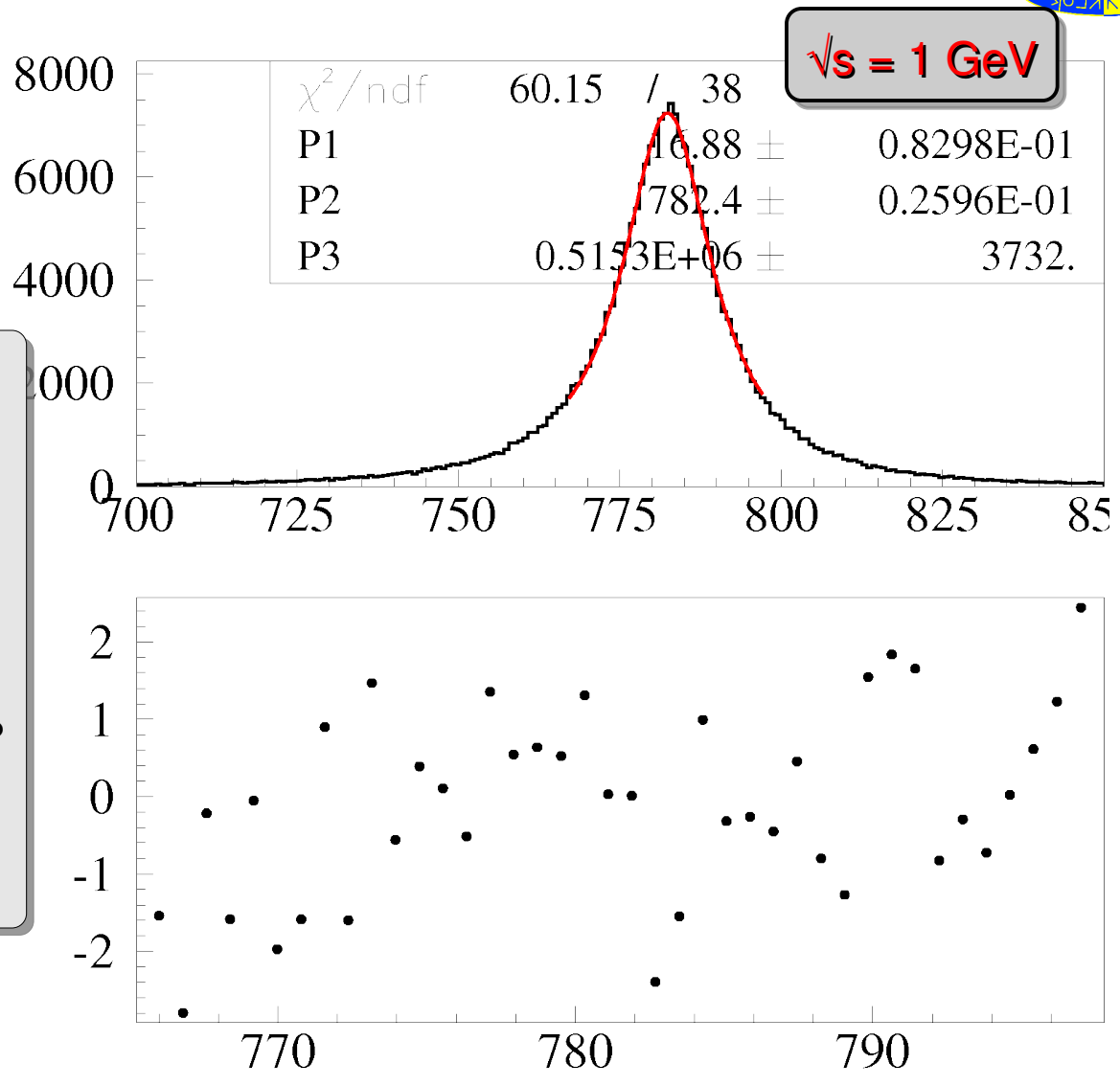
σ' = 0.077

The positive correlation between slope and constant term plays a key role.
with NEW efficiency the slope is lower and then also the constant

Net effect w.r.t. OLD result is negligible for constant term not for other parameters



$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^+\pi\omega$ mass



Fit is done with a simple Breit-Wigner function.

No smearing applied

Background contamination ~1% (from counting fit)

Default

Evidenced 1

Evidenced 1

Description

Long text format