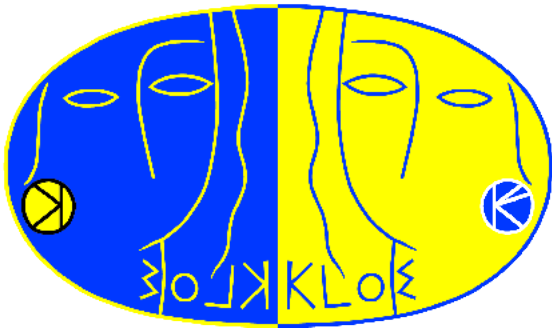


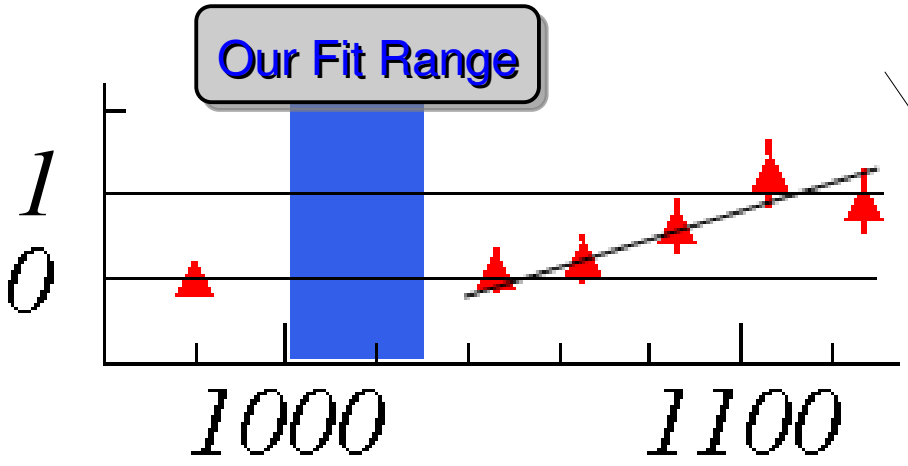
Final results on $e^+e^- \to \omega\pi^0$ cross section

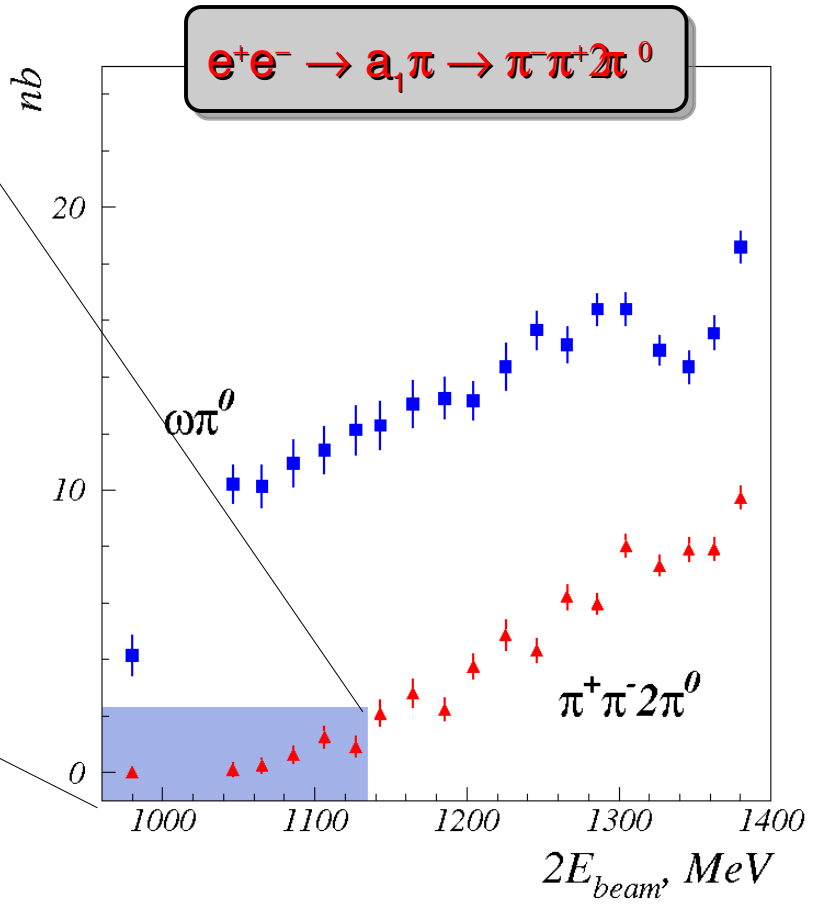
A. De Santis & S. Giovannella

Addendum to the Blessing

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

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

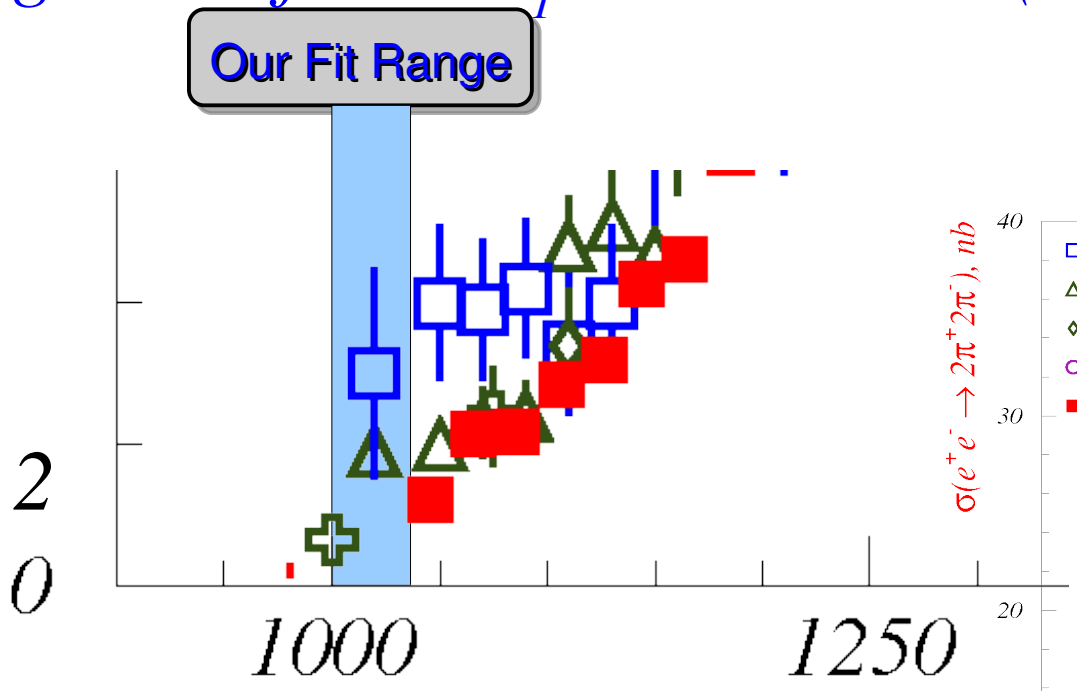


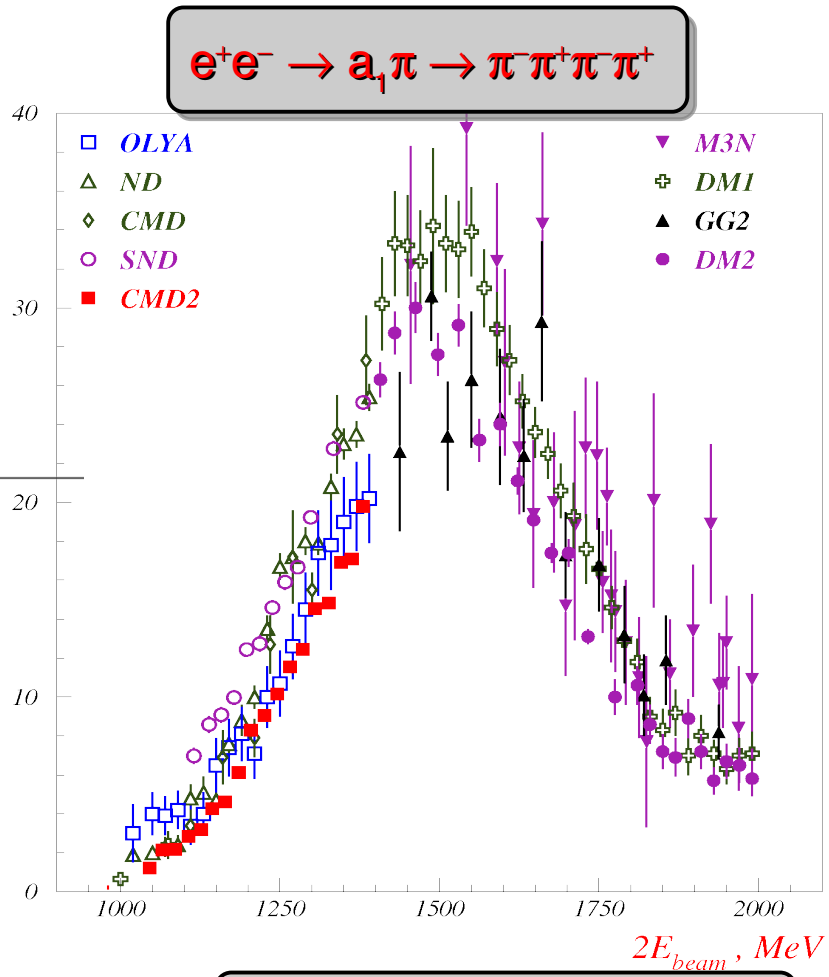


Extrapolating by hand the cross section for $a_1\pi$ in our fit range the amount seems negligible.

CMD-2 [hep-ex/9904024]

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





Following the $a_1\pi$ dominance

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

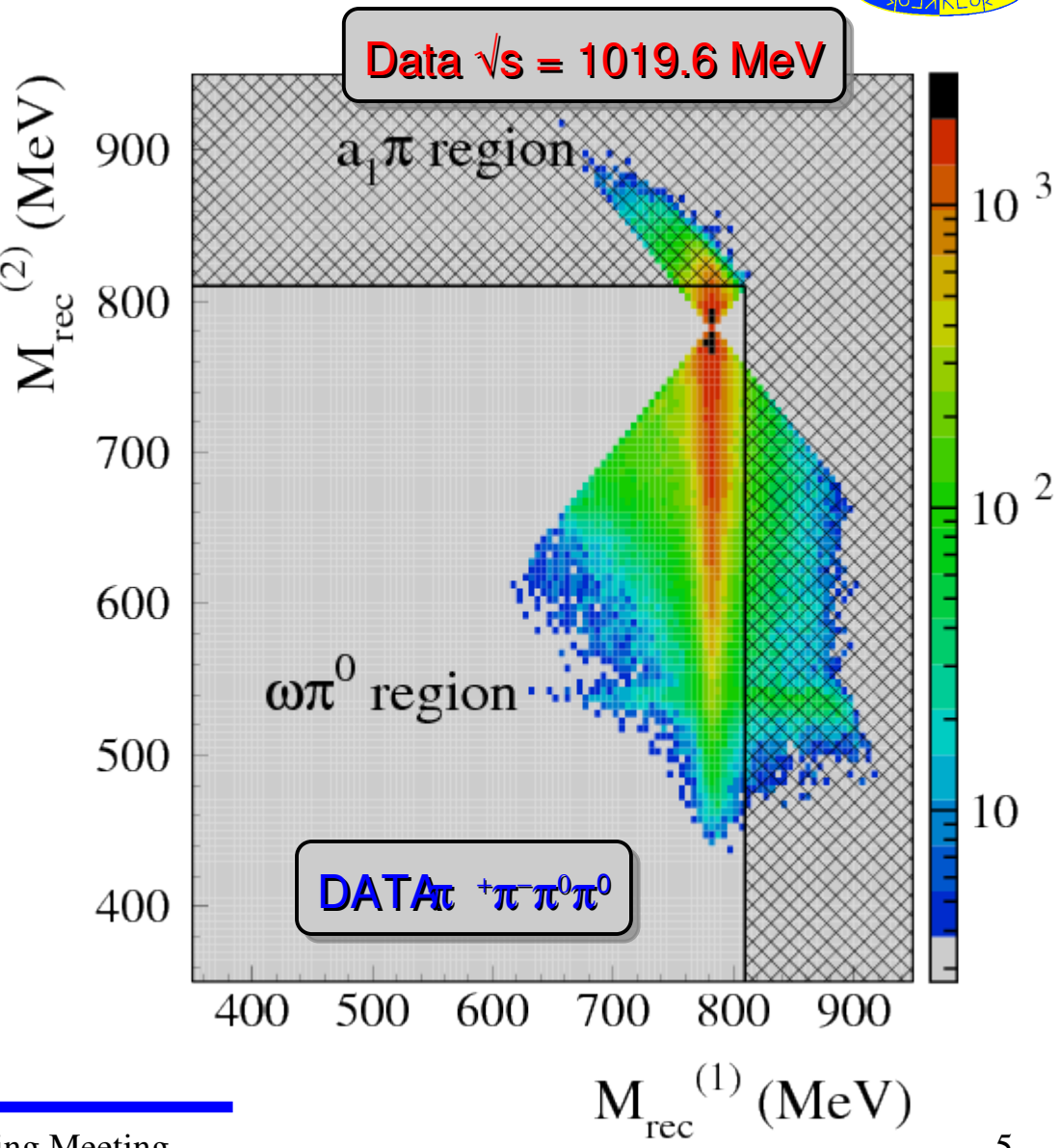
CMD-2 [hep-ex/9904024]

Sidebands for $a_1\pi \to \pi^+\pi^-2\pi^0$

To select a subsample enriched of $a_1\pi$ candidate we choose in the the plane $M_{recoil}(2)$ vs $M_{recoil}(1)$ events in witch at least one of the reconstructed recoiling masses is greater than 810 MeV ($a_1\pi$ region).

$N_{evt}(a_1\pi$ region) ~ 6÷12 % (off/on peak)

Notes:
The value of M_{recoil} are ordered according to the absolute distance from M_ω

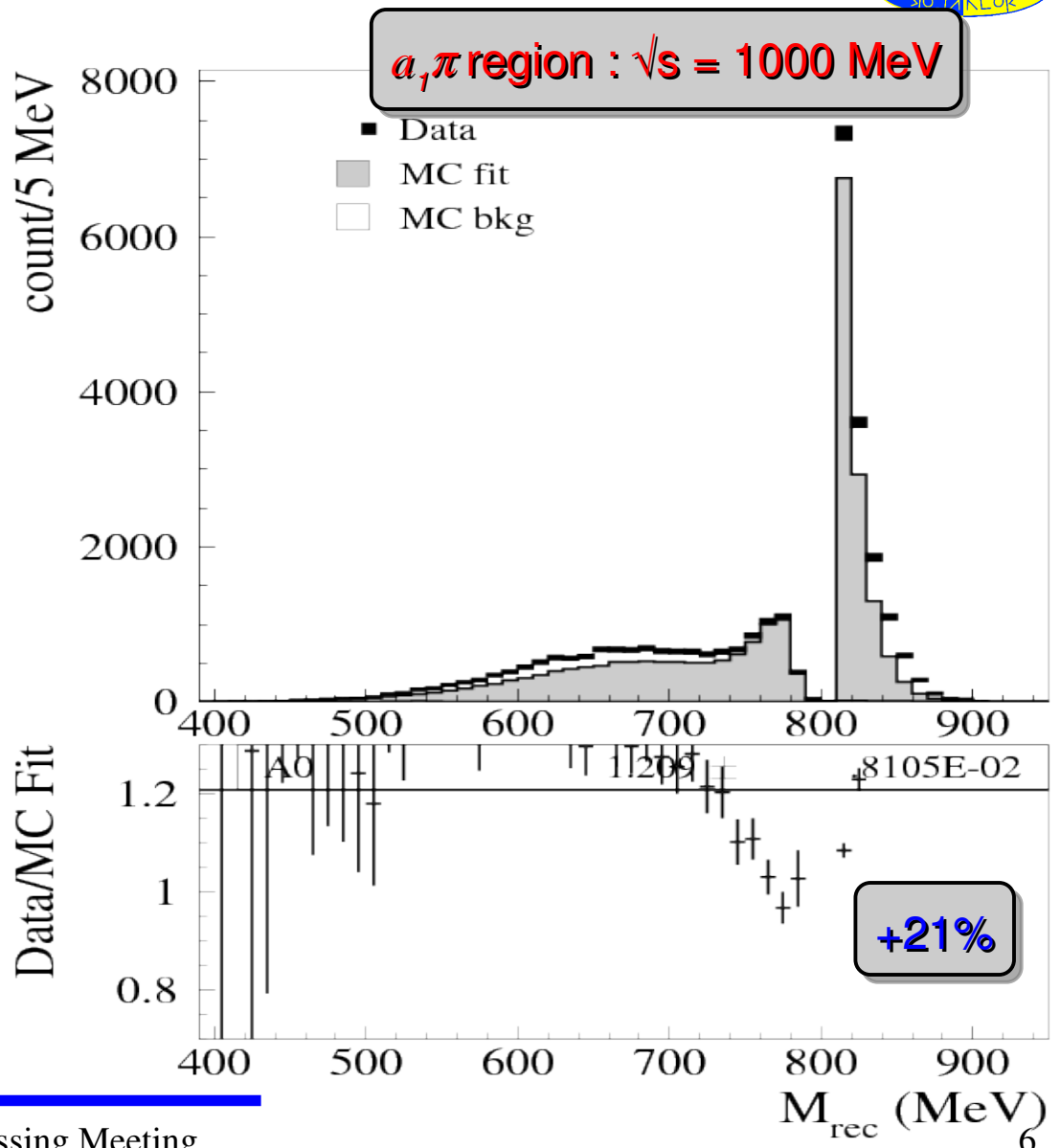


Data-MC comparison in Sideband: OLD

Comparing Data and MC sample selected in "$a_1\pi$ region" using the scale factor for signal and ϕ backgrounds determined with the standard fit (w/o $a_1\pi$ contribution) we observe large disagreement.

The ratio between Data and MC-fit is not flat. This implies that the lacking background has some structure that will help in the fit.

Notes:
M_{rec} is the combinatorial distribution of the two values of M_{recoil}



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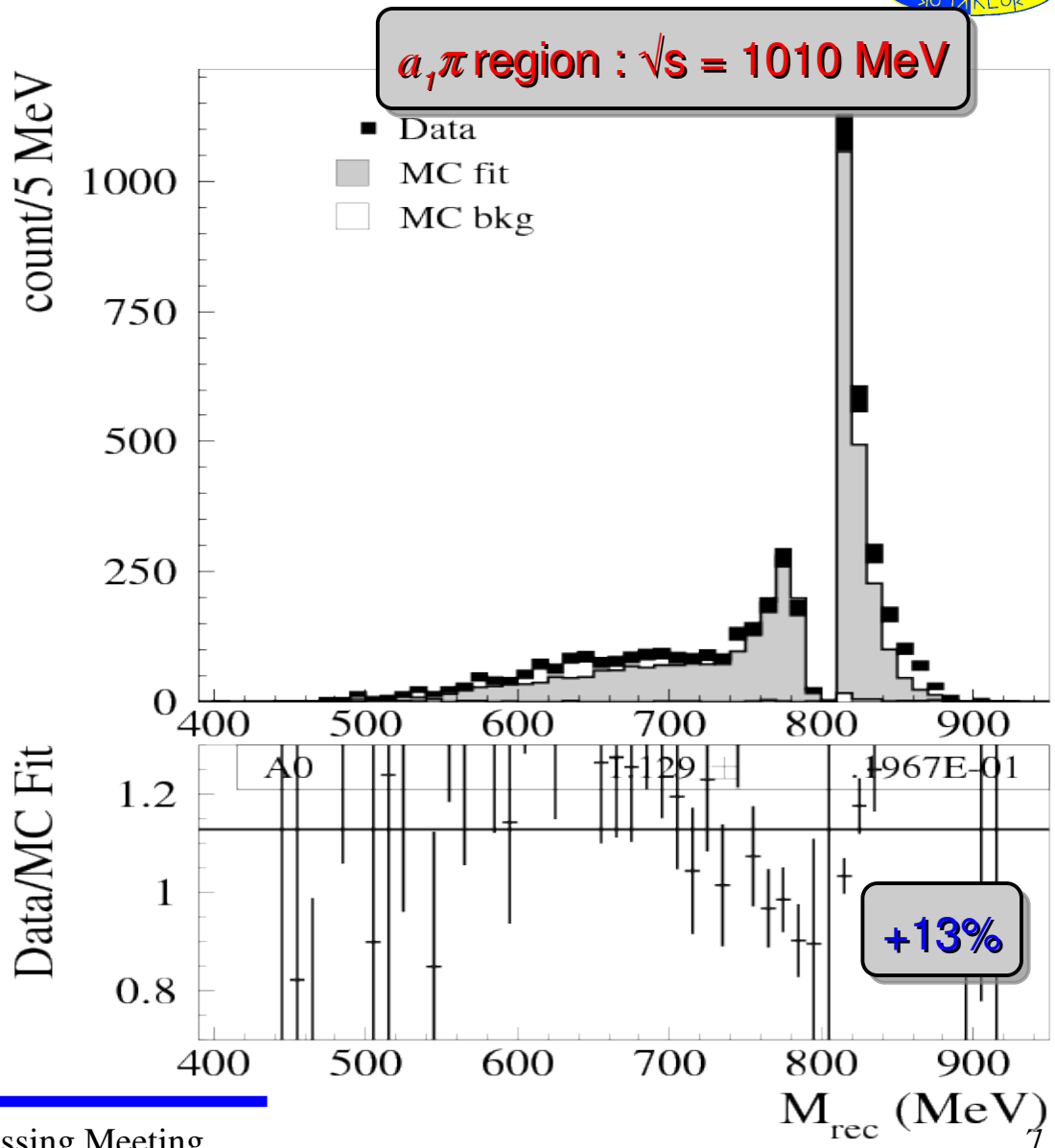

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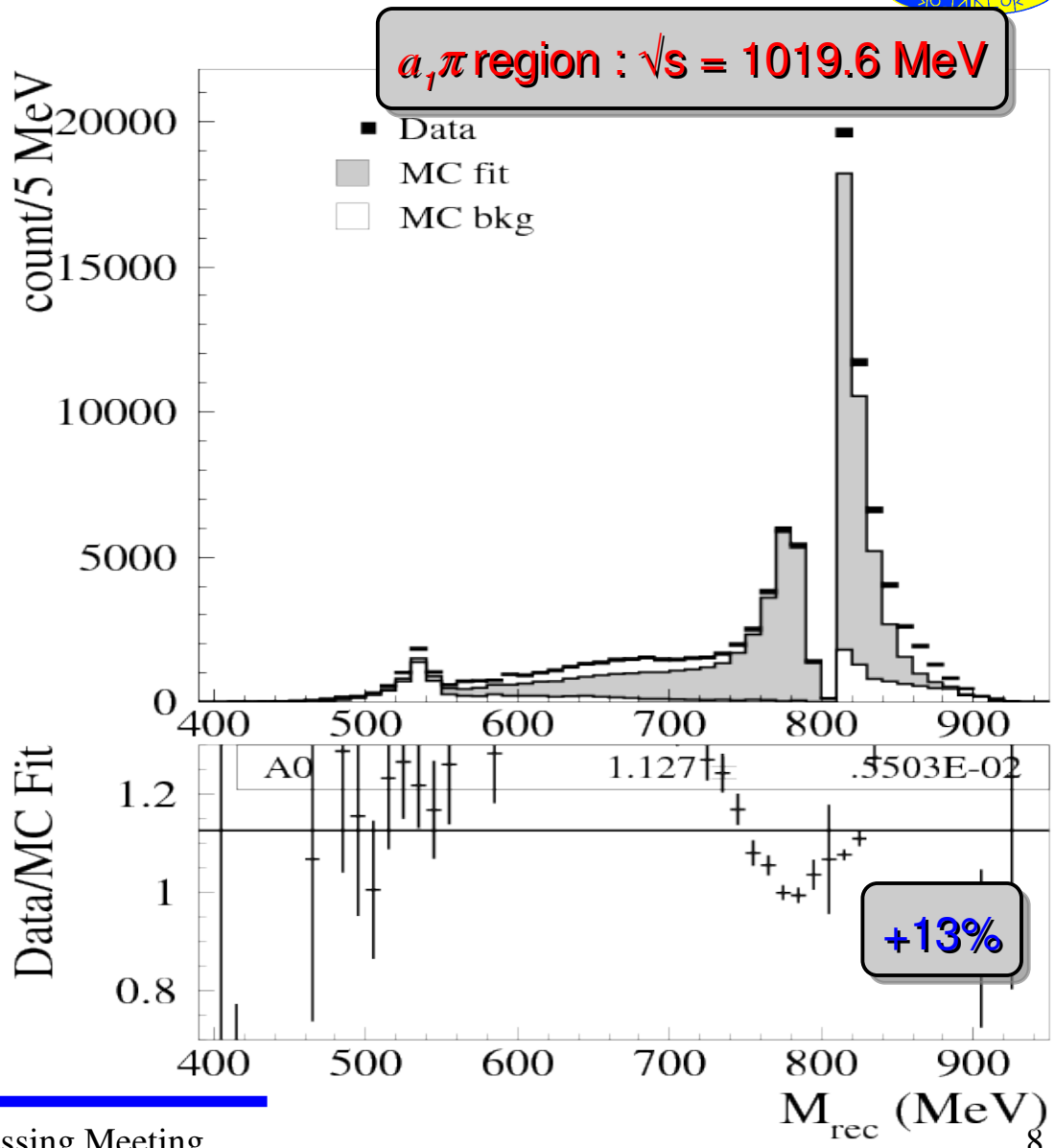

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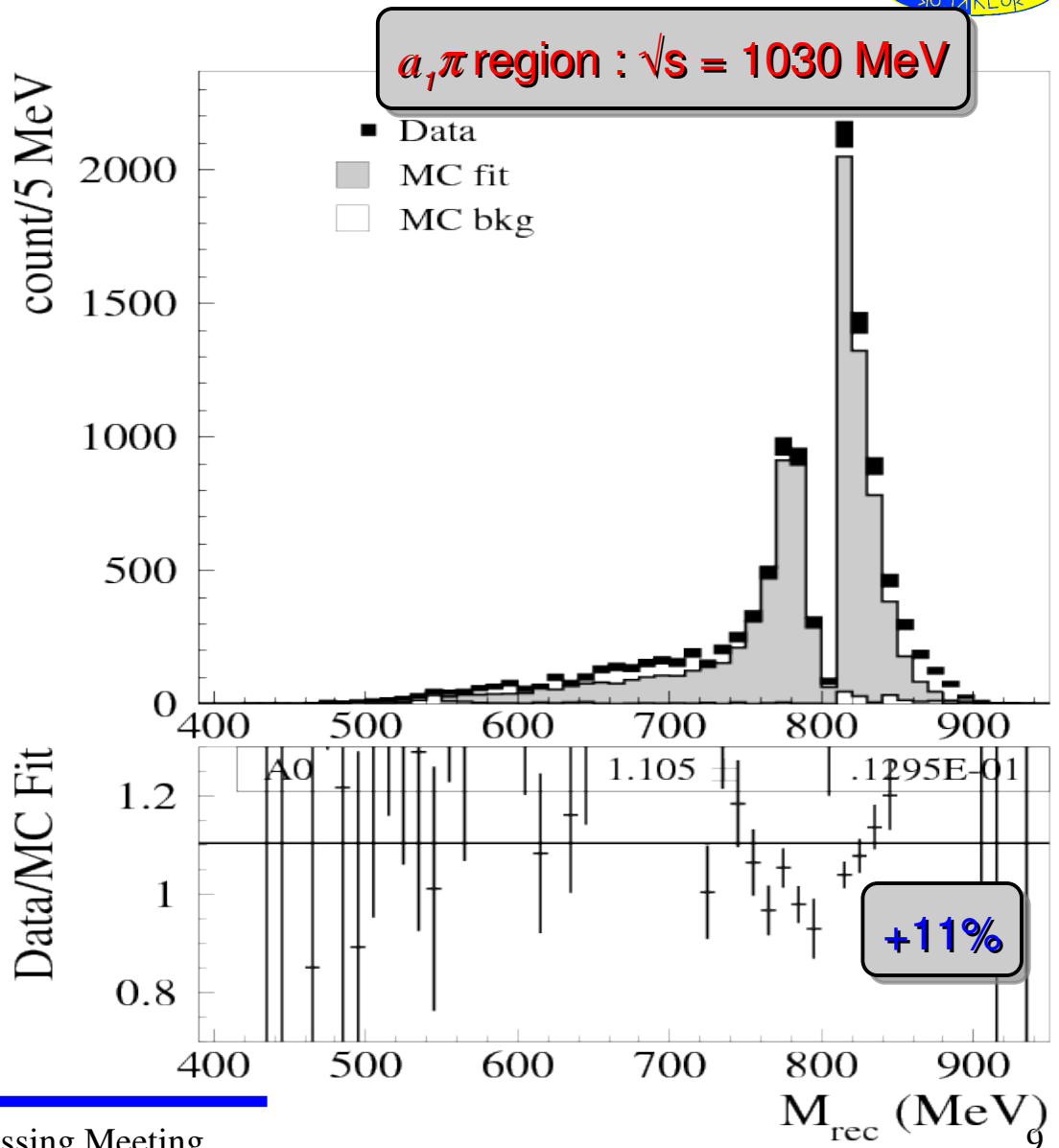
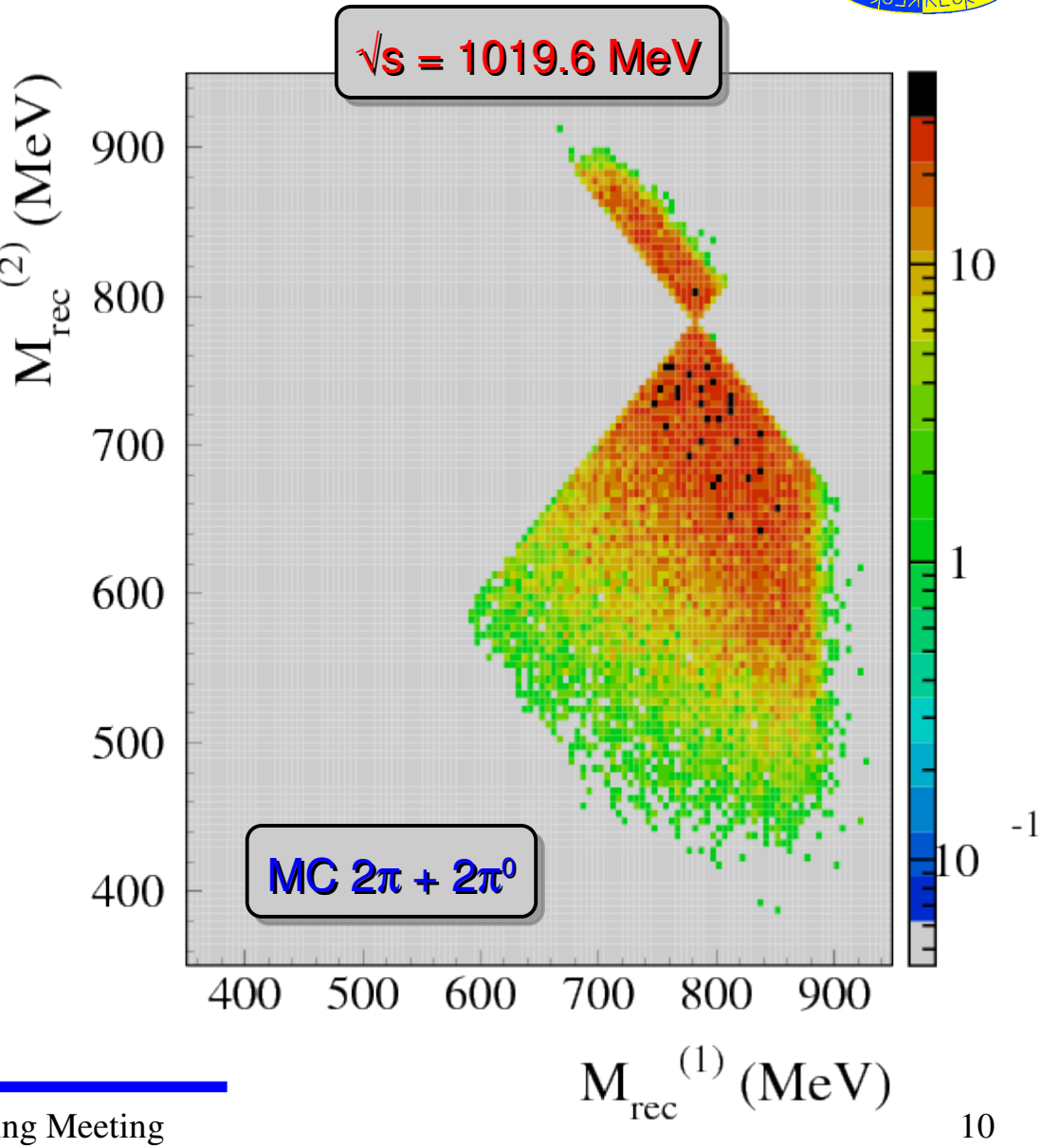


MC simulation for $a_1\pi \to \pi^+\pi^-2\pi^0$ (2)

To evaluate the contribution of $a_1\pi$ we have produced a dedicated MC for all runs used in the analysis (01/02 and 06) including also the run condition simulation via background insertion.

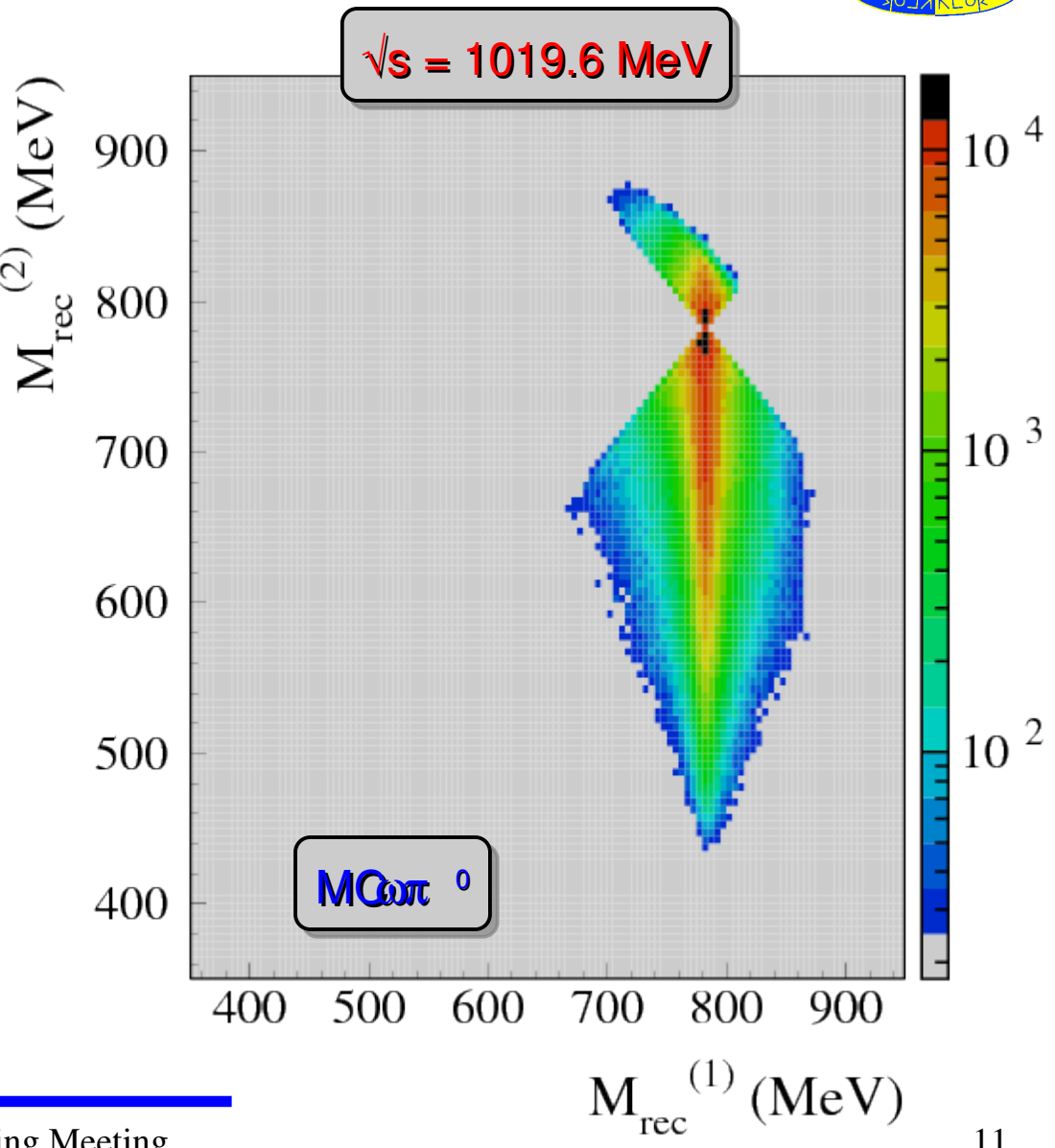
We have modified the 4π routine in GEANFI to have 2π $2\pi^0$ final state.



Signal distribution

Same distribution for the MC signal.

The vertical band in the distribution depends on the ordering.

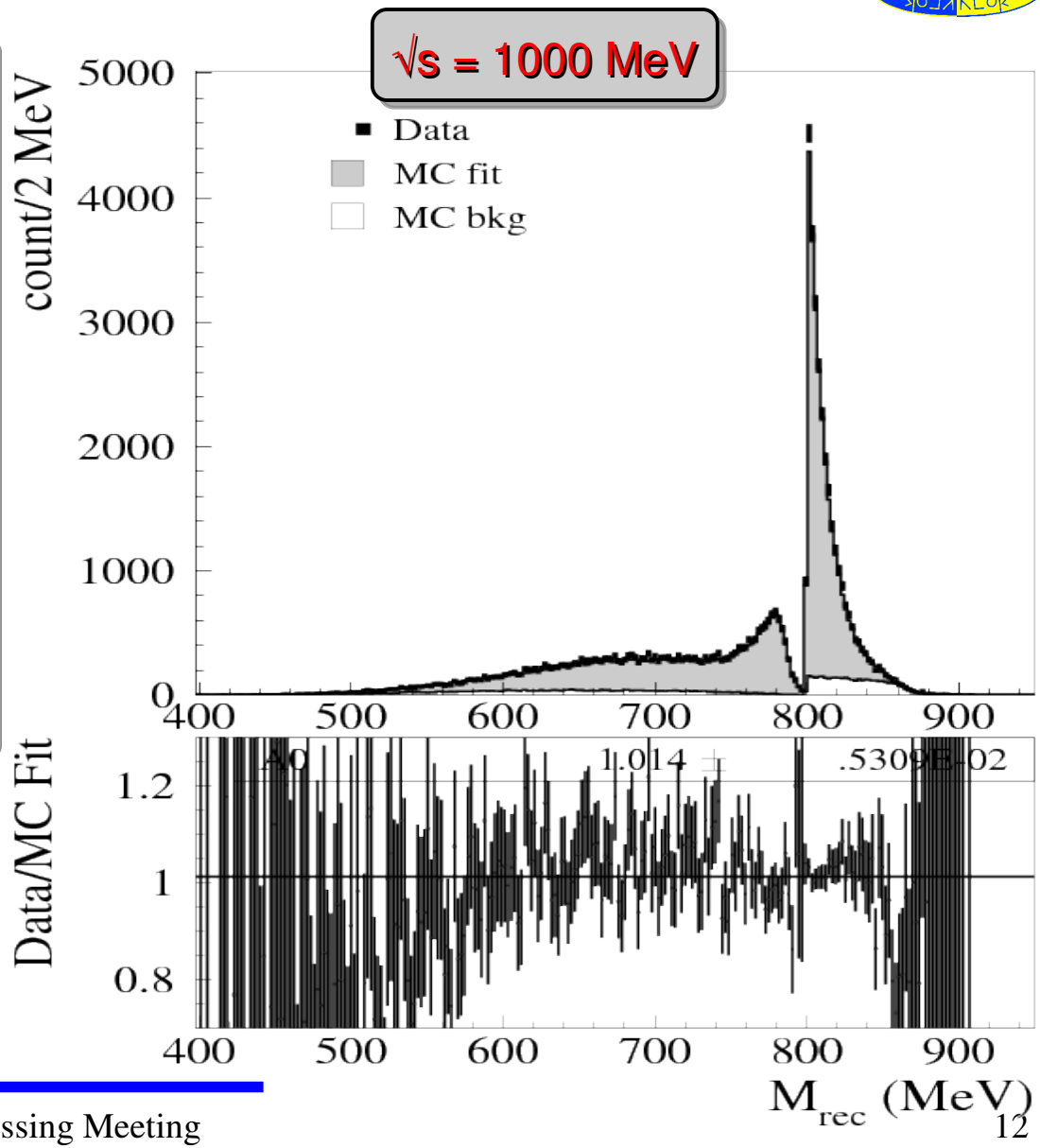


Data-MC comparison in Sideband: NEW

In the fit we have included a third free MC component: $a_1\pi$

Now the Data are fitted with:
- MC signal
- MC ϕ background
- MC $a_1\pi$ background

Comparison between Data and MC in the "$a_1\pi$ region" greatly improves.



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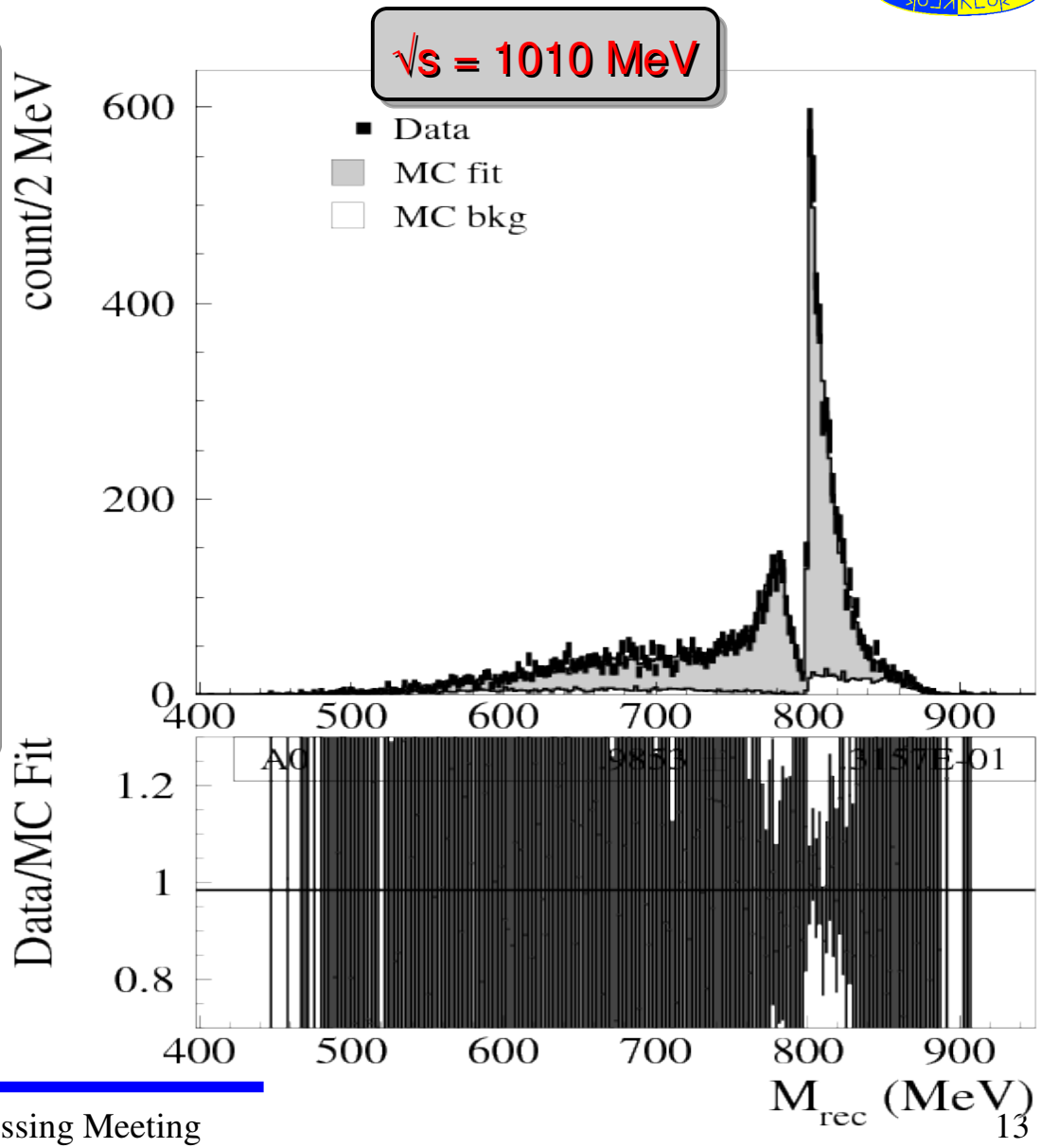

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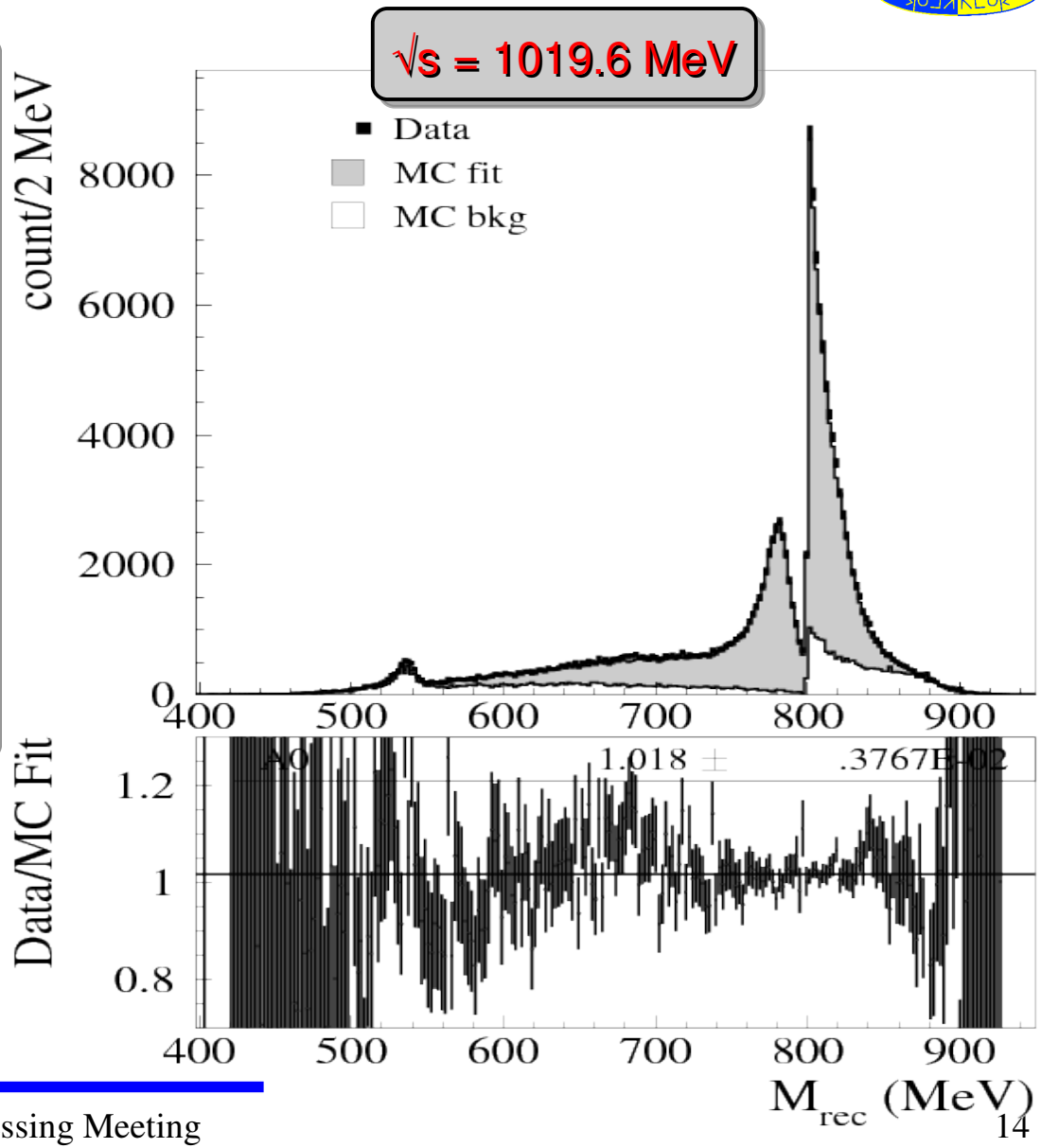

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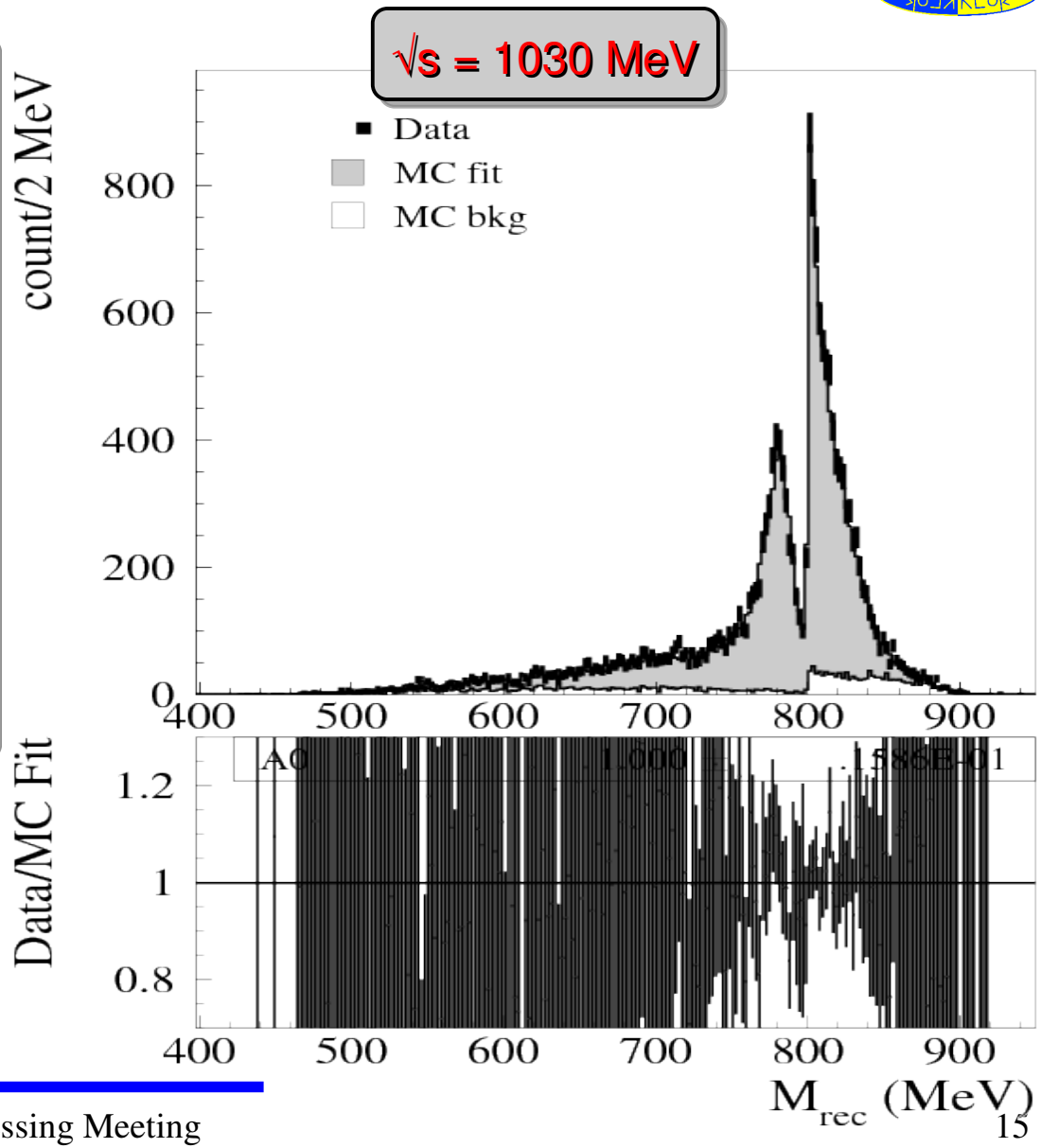
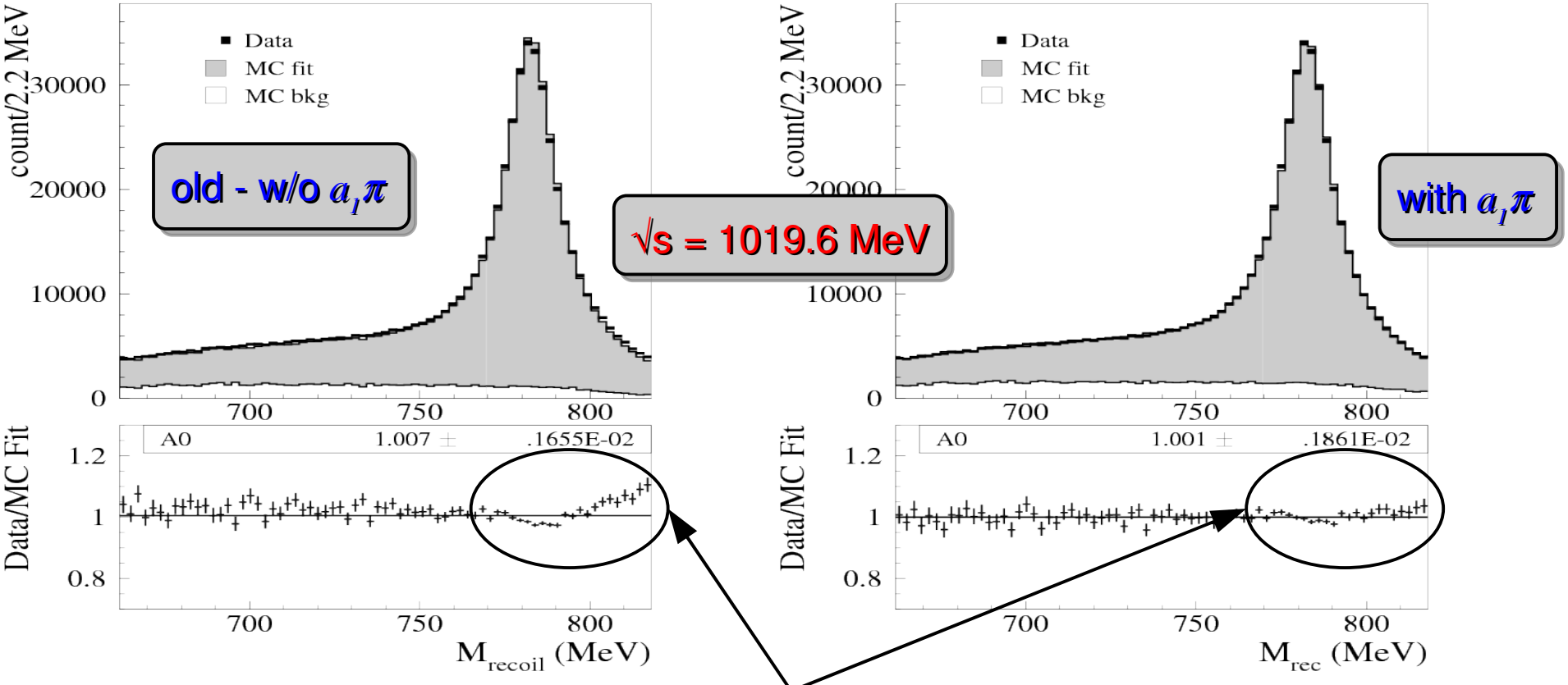


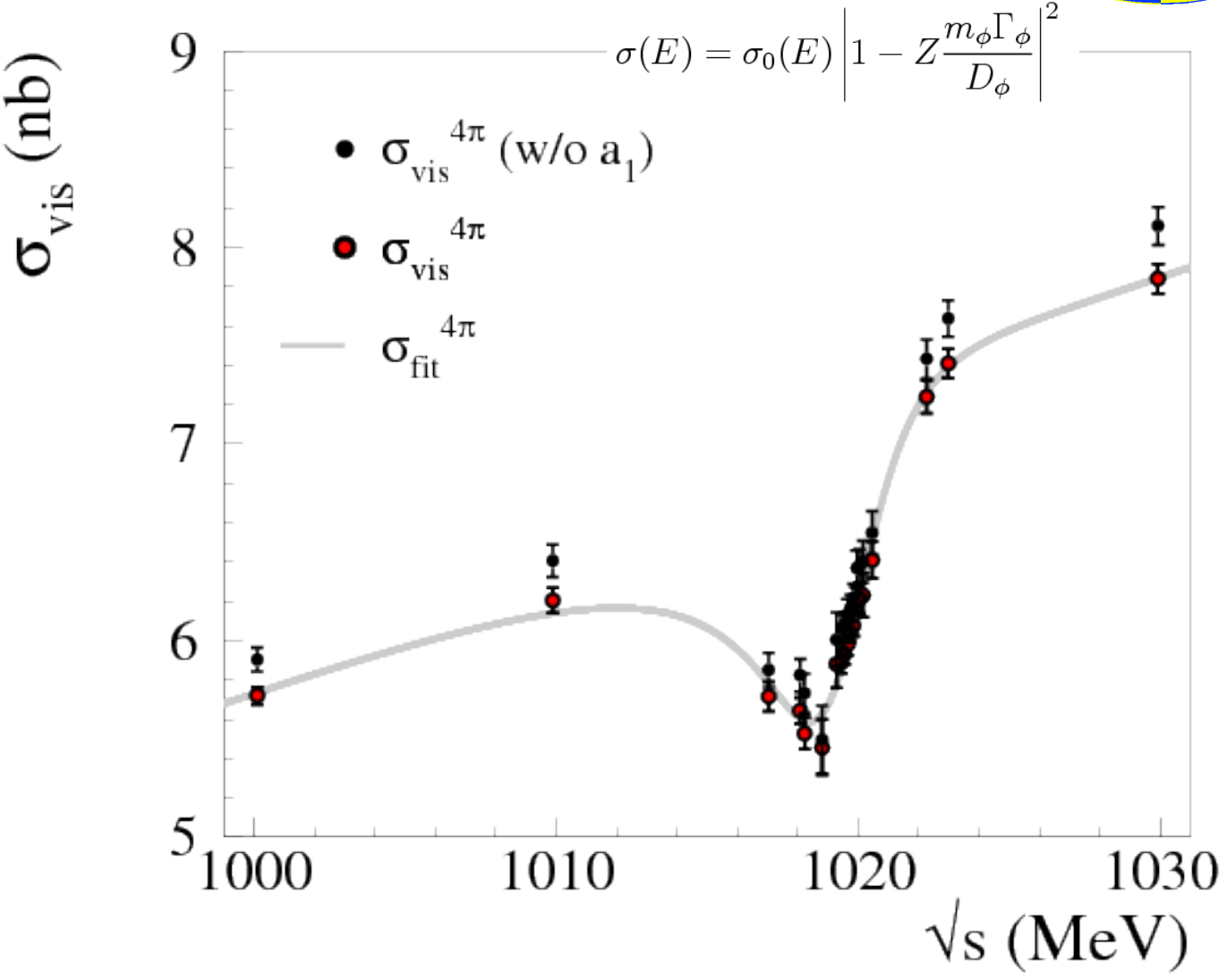
Data-MC comparison: NEW vs OLD



The Inclusion of the MC distribution for $a_1\pi$ background improves also the agreement between Data and MC for the recoil mass distribution in the whole region.

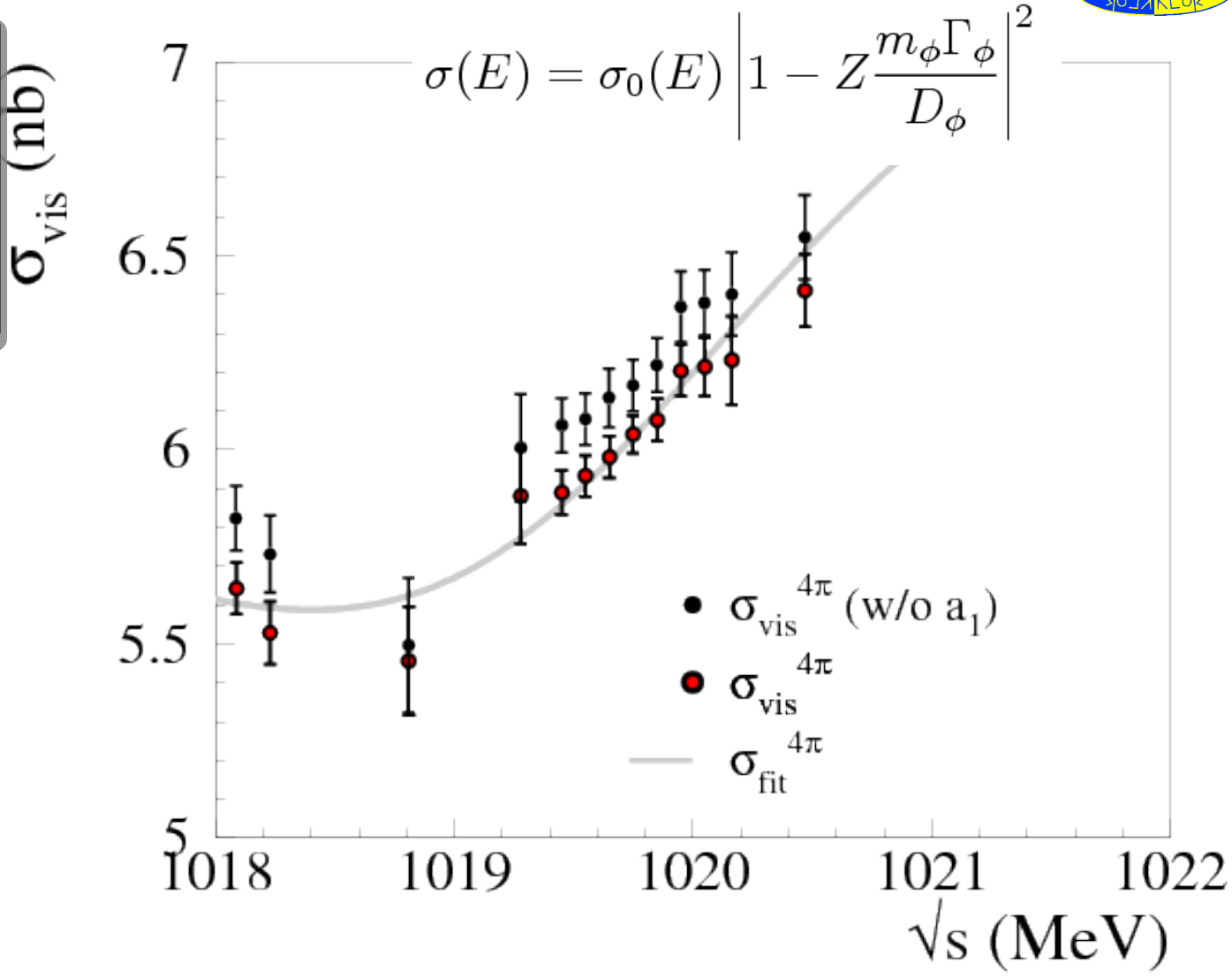
$\sigma(e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0(\gamma))$

The cross section variation is almost flat.



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

The cross section variation is almost flat along √s



$e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$

Cross section parameters variation

The variation of the constant term (σ_0) is due to a reduction in the signal counting (a fraction of the a1p events was assigned to $\omega\pi^0$ selection in the previous results). The variation of the other parameters follows from the correlation matrix.

	with $a_1\pi$	***w/o $a_1\pi$***	***Δ (new -old)/old***
σ_0	7.89 ± 0.06	8.15 ± 0.06	-3.3 %
$\Re(Z)$	0.109 ± 0.006	0.104 ± 0.007	+4.8 %
$\Im(Z)$	-0.103 ± 0.004	-0.108 ± 0.004	+4.6 %
σ'	0.063 ± 0.003	0.067 ± 0.003	-5.6 %

correlation matrix

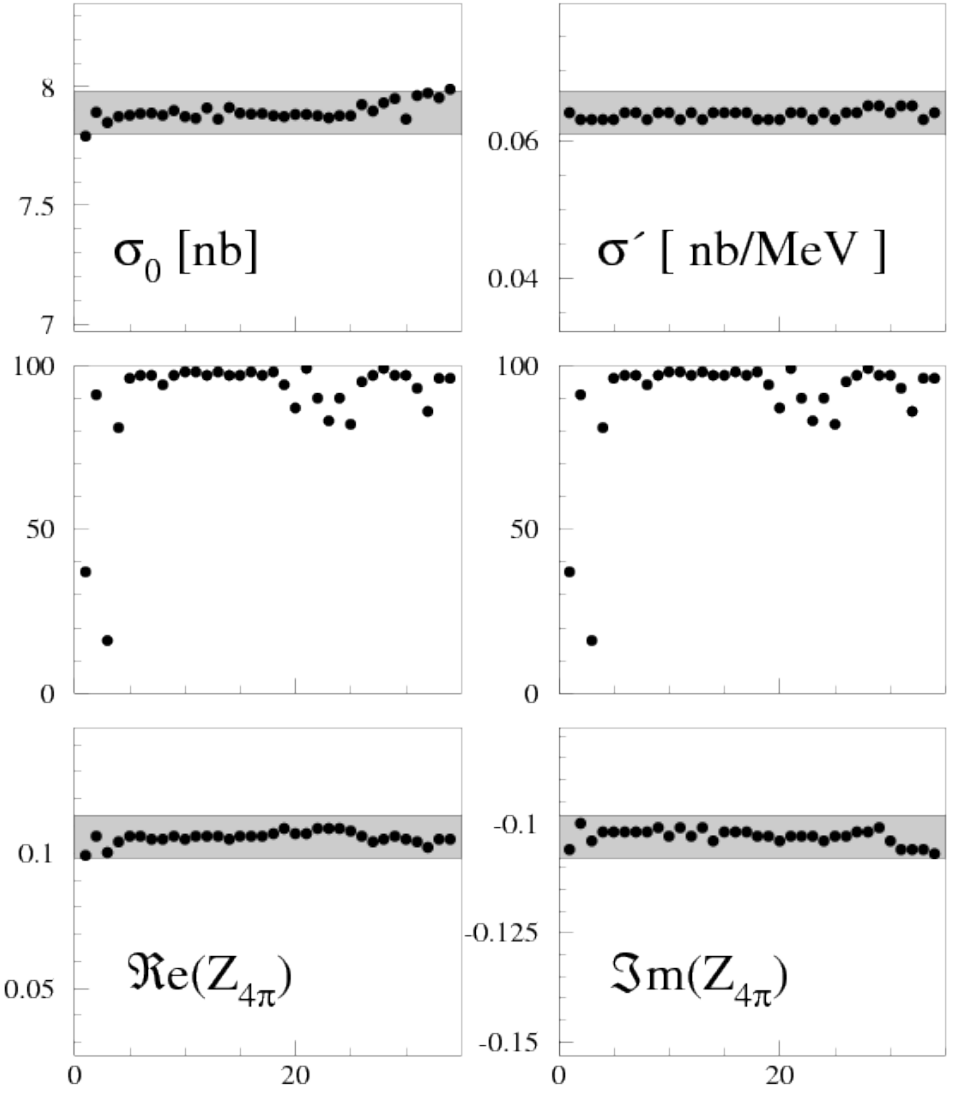
$\rho(\%)$	$\Re(Z)$	$\Im(Z)$	σ'
σ_0	-34	-81	79
$\Re(Z)$		6	-46
$\Im(Z)$			-45

Systematics of $e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$

Full variation considered has been recalculated.

Variations includes:

- Minimum clusters energy (7-19 MeV)
- Minimum clusters angle (20-30 degrees)
- Time window definition
- χ^2 cut used in the class definition
- TRK/VTX efficiency curves



Systematics of $e^+e^- \to \omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0$

According to what decided in the blessing meeting we have recalculated systematics by summing in quadrature the r.m.s. obtained for each set of variations considered:

$$\delta_X = rms(X)_{fit\ distro} \oplus rms(X)_{E\ clu} \oplus rms(X)_{\theta\ clu} \oplus rms(X)_{\sigma_t\ clu} \oplus rms(X)_{\chi^2_{KFit}\ cut} \oplus rms(X)_{\epsilon trk}$$

$$X \equiv \{\sigma_0, \Re(Z), \Im(Z), \sigma'\}$$

Same treatment also for $\omega\pi^0 \to \pi^0\pi^0\gamma$ systematics. No change in that case

Contributors

	σ_0	Re(Z)	Im(Z)	σ'
distro	0.005	0.0011	0.0006	0.0005
Eclu	0.023	0.0008	0.0006	0.0004
θ clu	0.046	0.0013	0.0017	0.0007
σ(t)clu	0.047	0.0033	0.0025	0.0005
χ_2	0.013	0.0020	0.0007	0.0005
$\varepsilon_{trk/vtx}$	0.017	0.0004	0.0010	0.0004

Final results

σ_0	7.89	±	0.06	±	0.07
$\Re(Z)$	0.109	±	0.006	±	0.004
$\Im(Z)$	0.103	±	0.004	±	0.003
σ'	0.063	±	0.003	±	0.001

Combined

w's BR with NEW cross section parameters

The ω's BR has been reevaluated using the new input

$$BR(\omega \to \pi^- \pi^+ \pi^0) = 90.24 \pm 0.19\,\%$$
$$BR(\omega \to \pi^0 \pi^0 \gamma) = 8.09 \pm 0.14\,\%$$

Also the ϕ's BR has been reevaluated using the new input:

$$BR(\phi \to \omega \pi^0) = (4.4 \pm 0.6) \times 10^{-5}$$