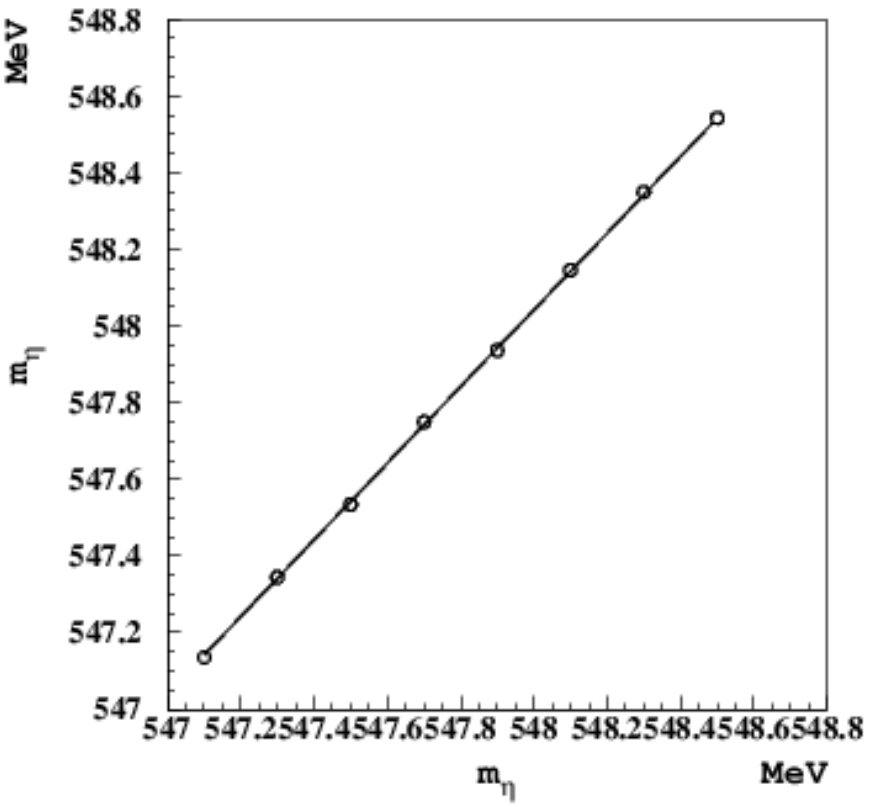
Status of the η mass measurement

Biagio Di Micco

Global correction to the mass value



To check possible corrections.

$M_{fit} = M_{input} + (41 \pm 3)$ keV/c^2

$\chi^2/\text{n.d.f} = 0.32$

50pb^{-1} for each point

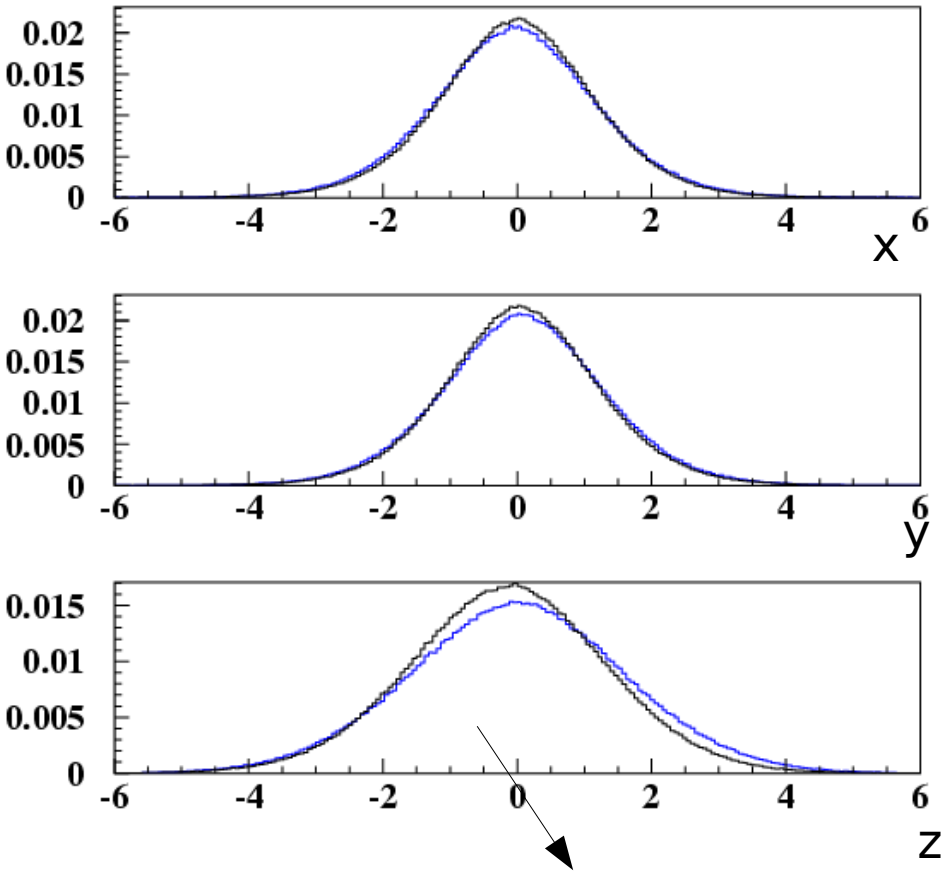
linearity is perfect.
A correction for the
constant term is needed.

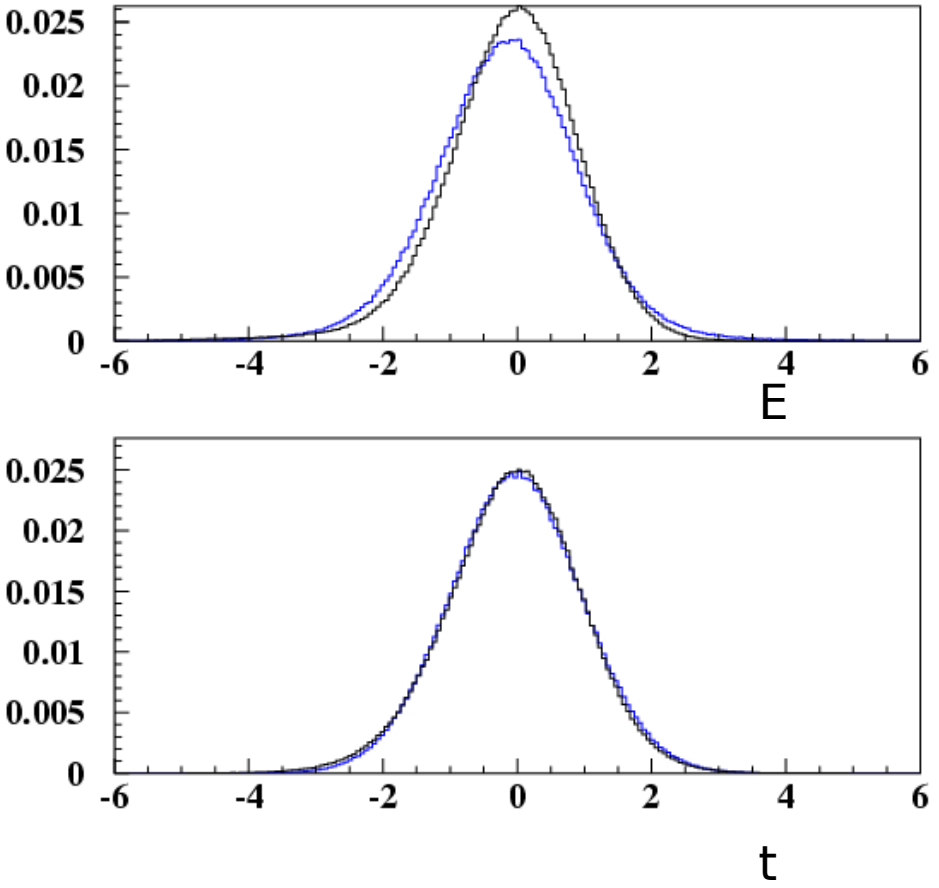
Check of the pulls to validate MC

DATA

GEANFI personal production

pulls

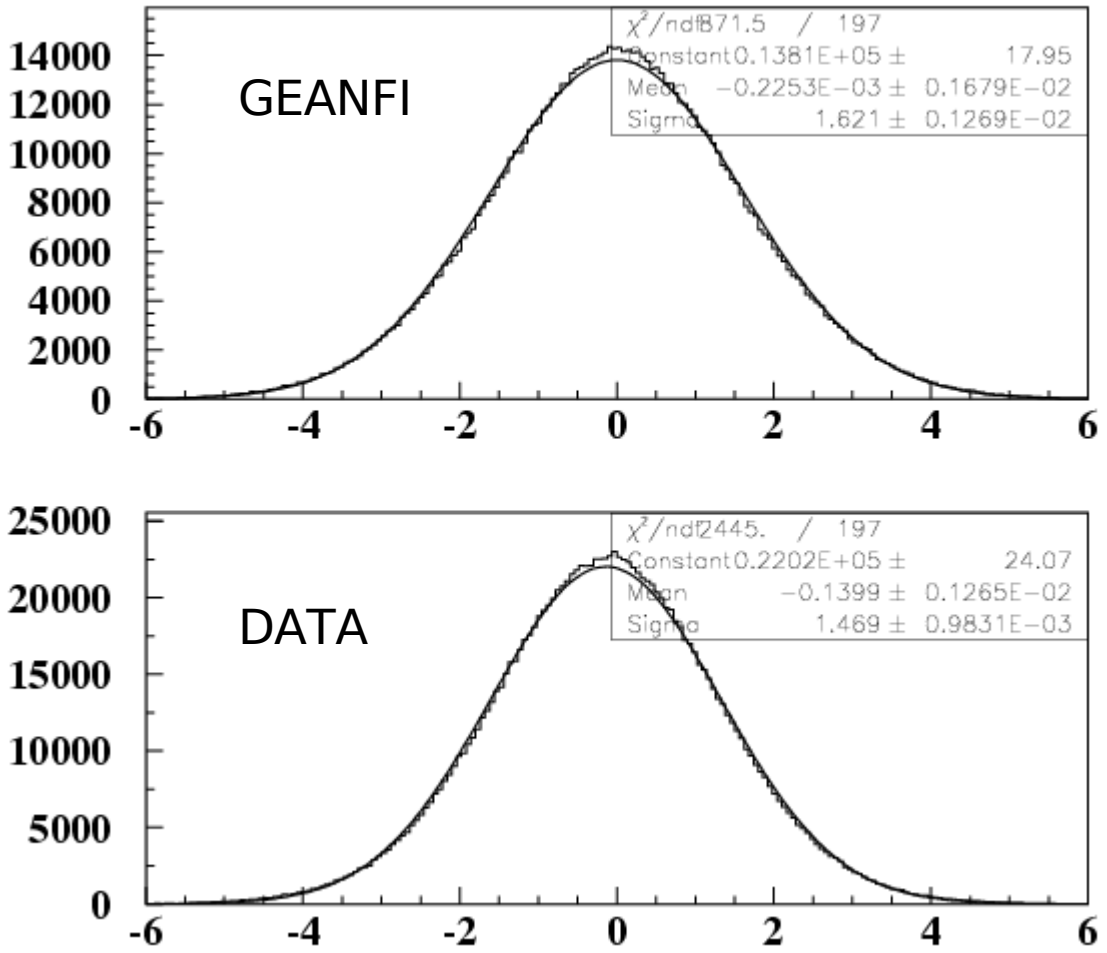




Larger deviation for z

Check of the pulls to validate MC

Pulls Z fit



response

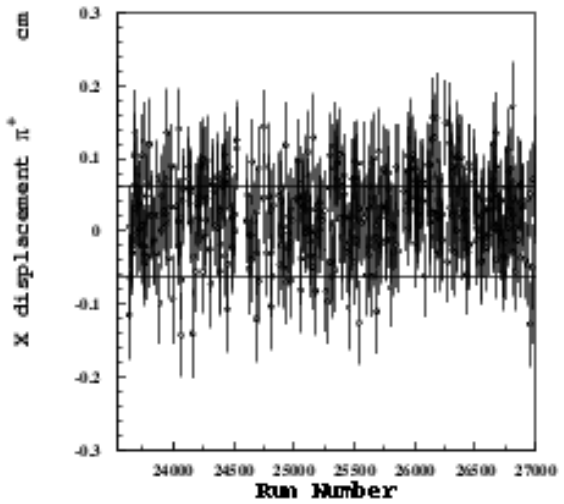
1) The DATA are not centered;

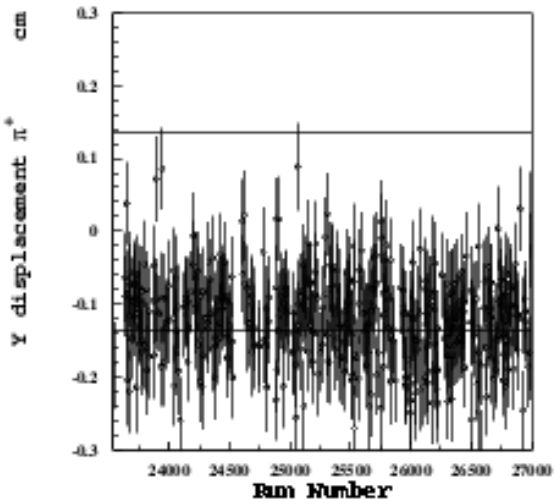
2) The MC is broader

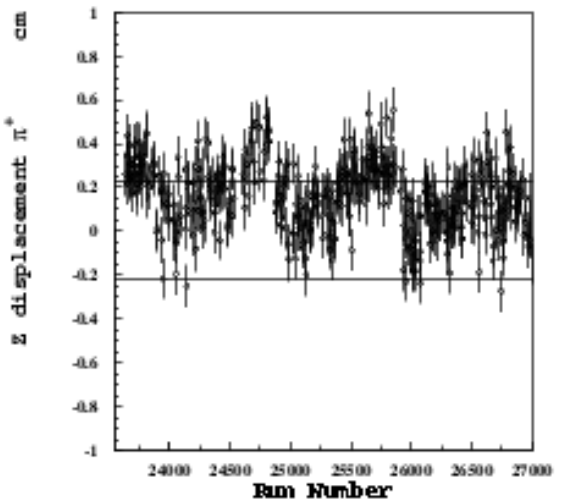
It can be an effect of the displacement already seen with $\pi\pi\gamma$ c.s

x y z

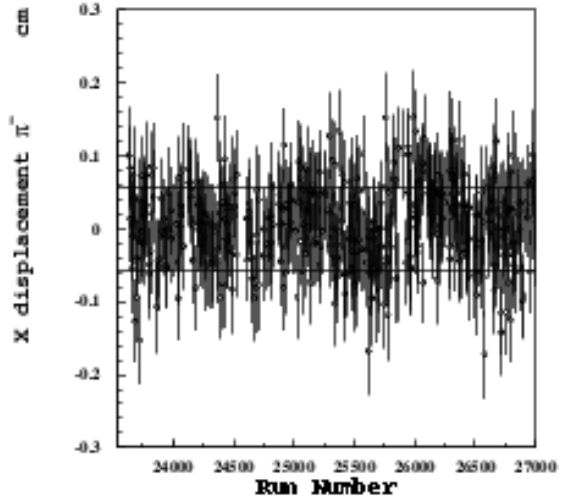
π^+

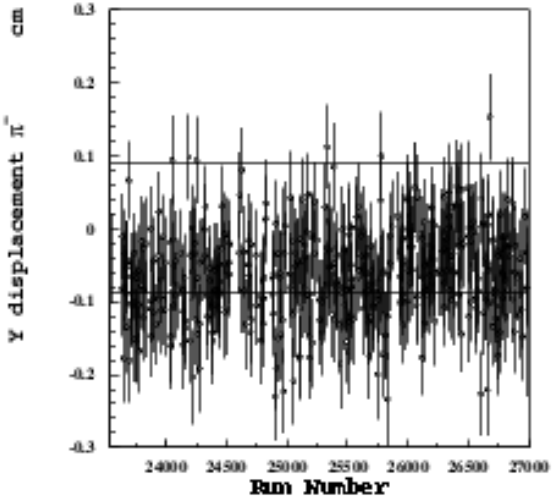


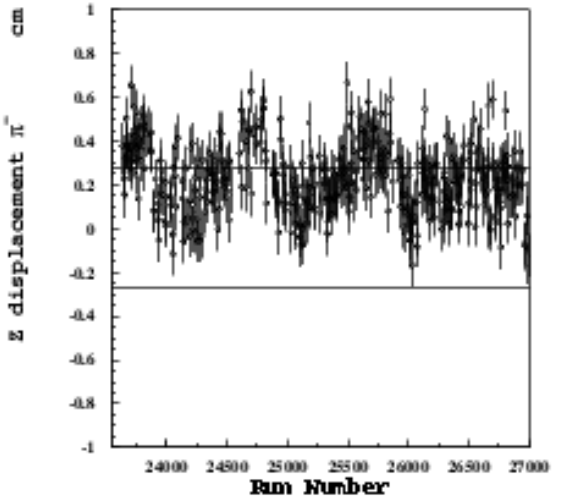




π^-

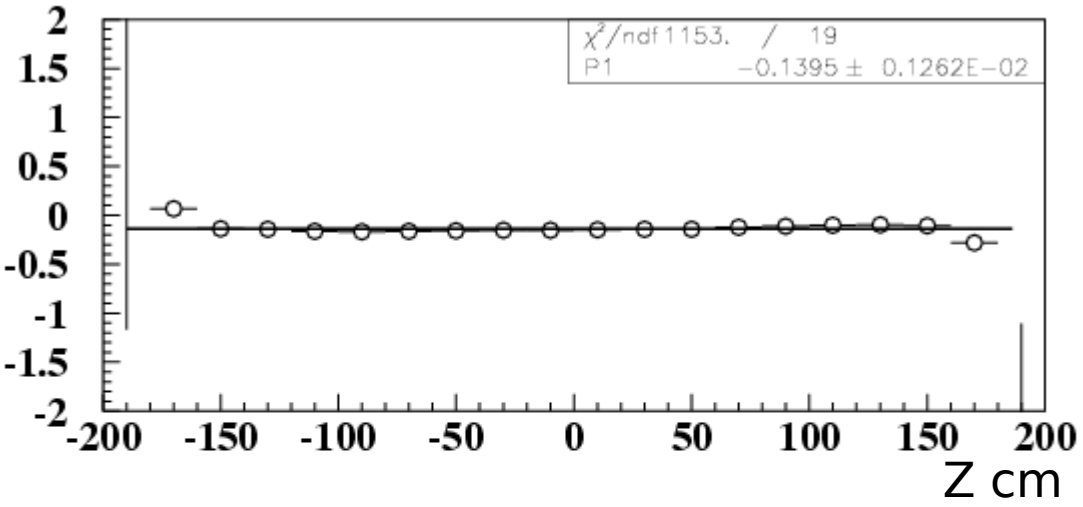




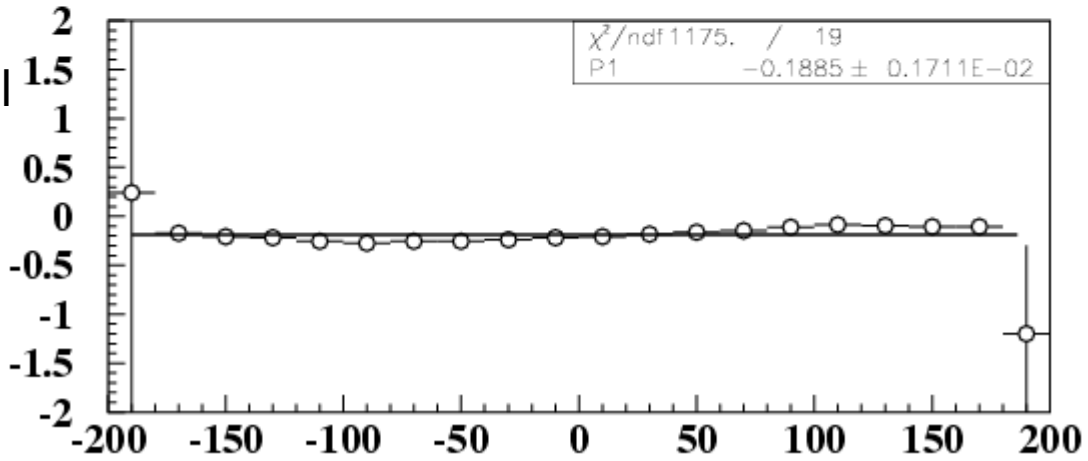


DATA correction

pull



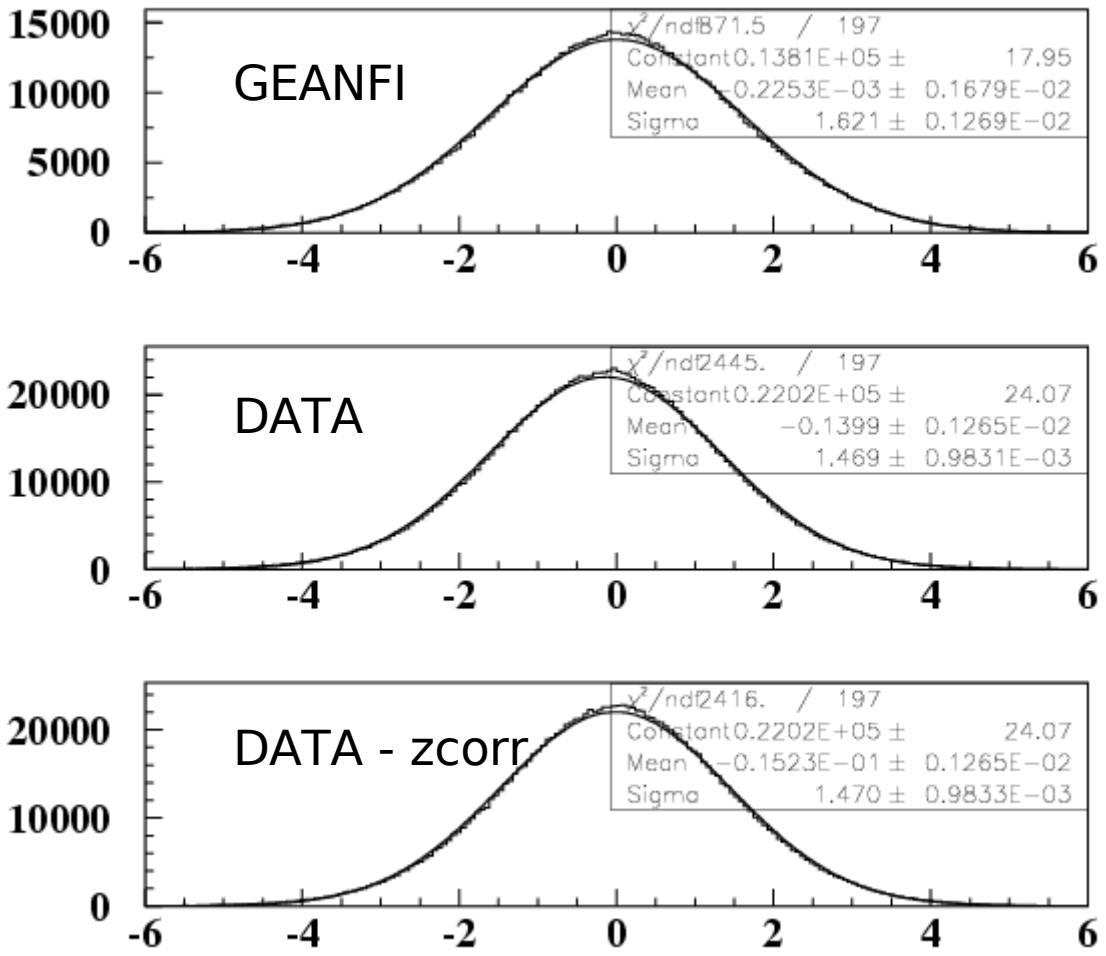
residual



$$\text{Pull} = (Z - Z_{fit})/\text{sqrt}(\sigma_z^2 - \sigma_{zfit}^2)$$

$$\text{Res} = (Z - Z_{fit})$$

Residuals Z cm



Correction applied to the cluster position in data

$Z_{clu\text{-}corr} = Z_{clu} + 0.19$ cm

Value of the eta-mass (not corrected)

	m (MeV)	σ(MeV)
	547.81317 ± 0.008	2.14
Z corr.	547.81311 ± 0.008	2.14

The new distribution is centered as expected
no improvement in σ

MC DUMMY

In order to reproduce all the residuals distributions we use a

We smear the conversion point time, positions and energy in order to reproduce the resolution functions of the detector.

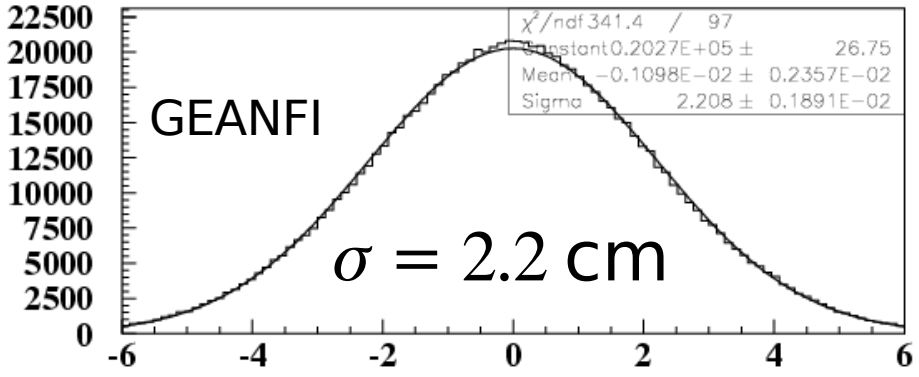
$$\frac{\sigma E}{E} = \frac{0.057}{\sqrt{E\,GeV}} \qquad \sigma_t = \sqrt{\frac{(54\,ps)^2}{E(GeV)} + (140\,ps)^2} \qquad \sigma_z = \frac{0.9\,cm}{\sqrt{E(GeV)}}$$

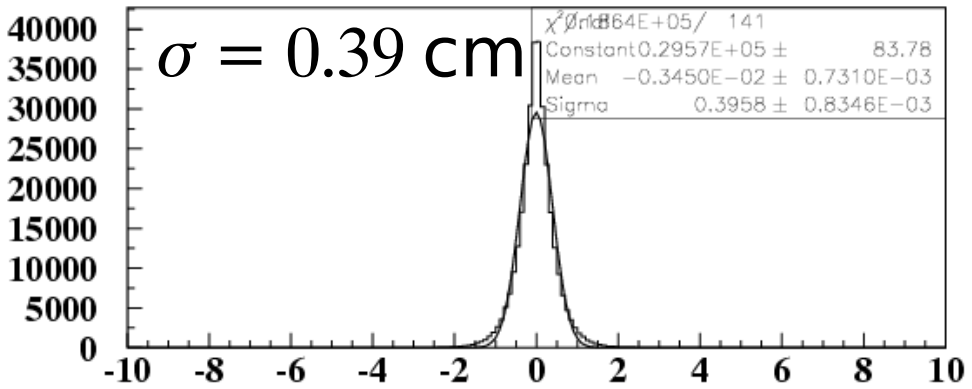
$$\sigma_x = \sigma_y = 3.4\,\frac{cm}{\sqrt{12}}$$

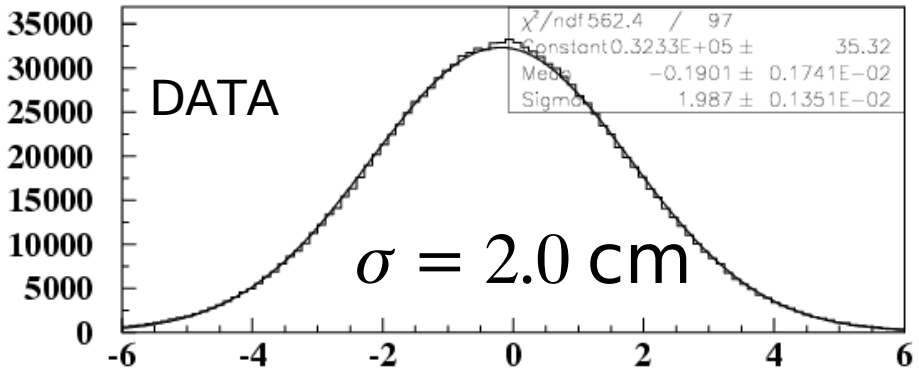
Several attempt to apply different resolution functions to the photon **z** position without success (then check done on the luminouse region)

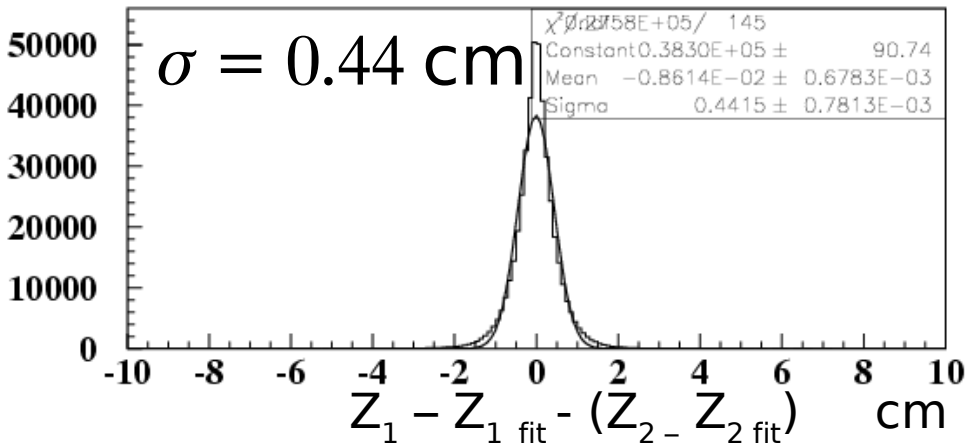
In the kinematic fit enter the Z_{clu}-Z_{vtx}, the mean vertex position is considered but one should use the real vertex position of each event (unknown). So the extension of the luminouse region affects the cluster position residuals.

The residuals are dominated by the vertex indetermination



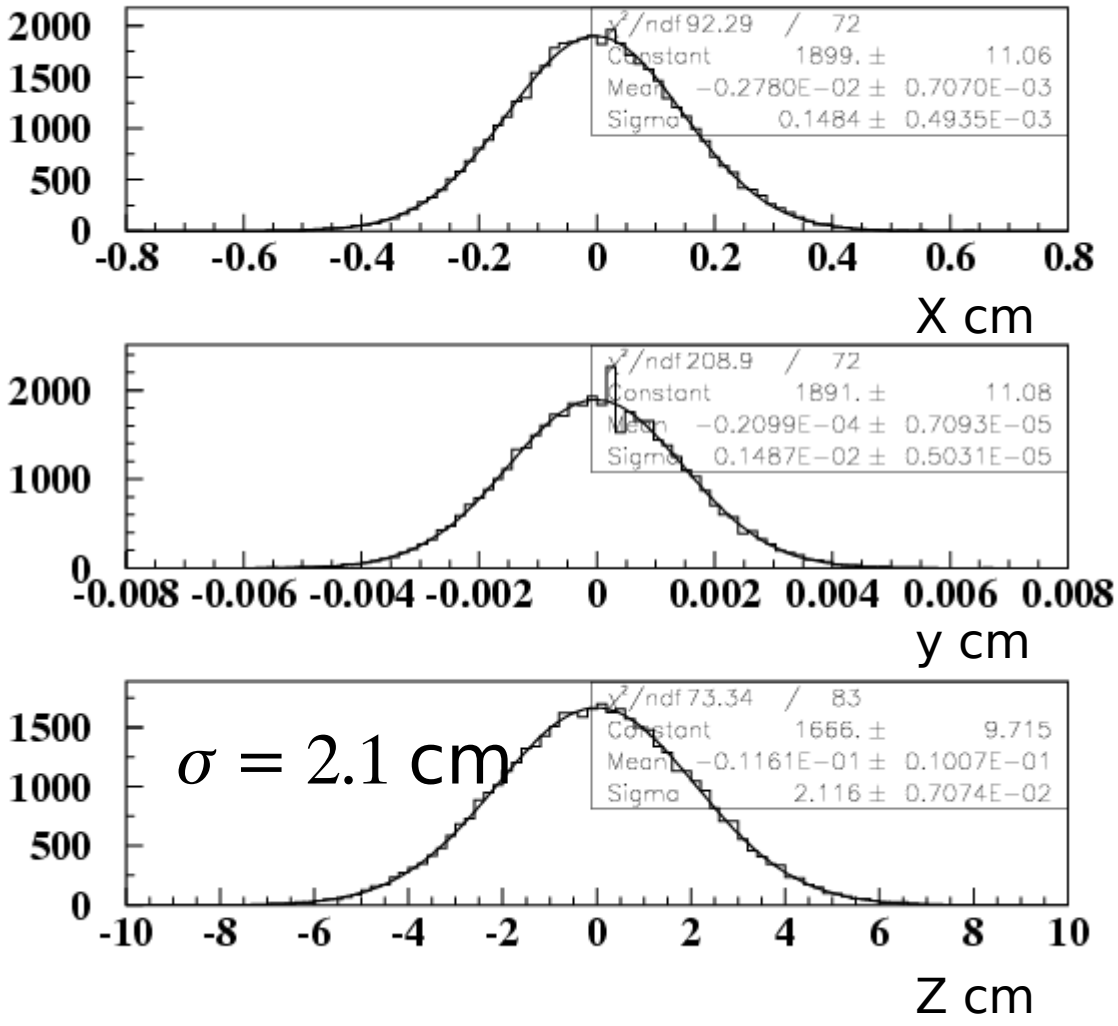






Simulated luminouse region

Primary vertex distribution



Solution:

subtract the vertex position from the cluster position (only z)

add a gaussian distributed zvtx with $\sigma = 1.96$ cm

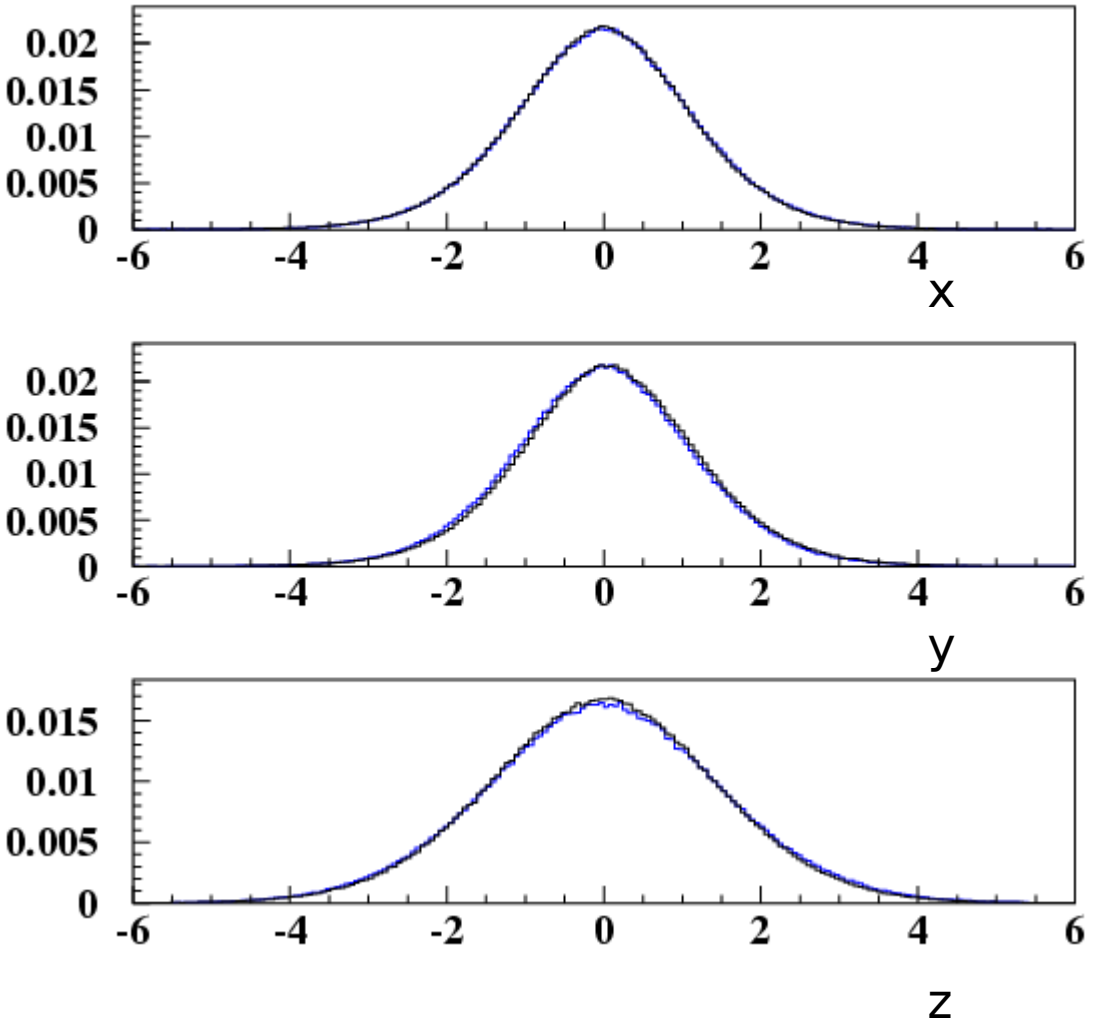
apply Z resolution in the dummy MC given by 0.91 cm /sqrt(E GeV)

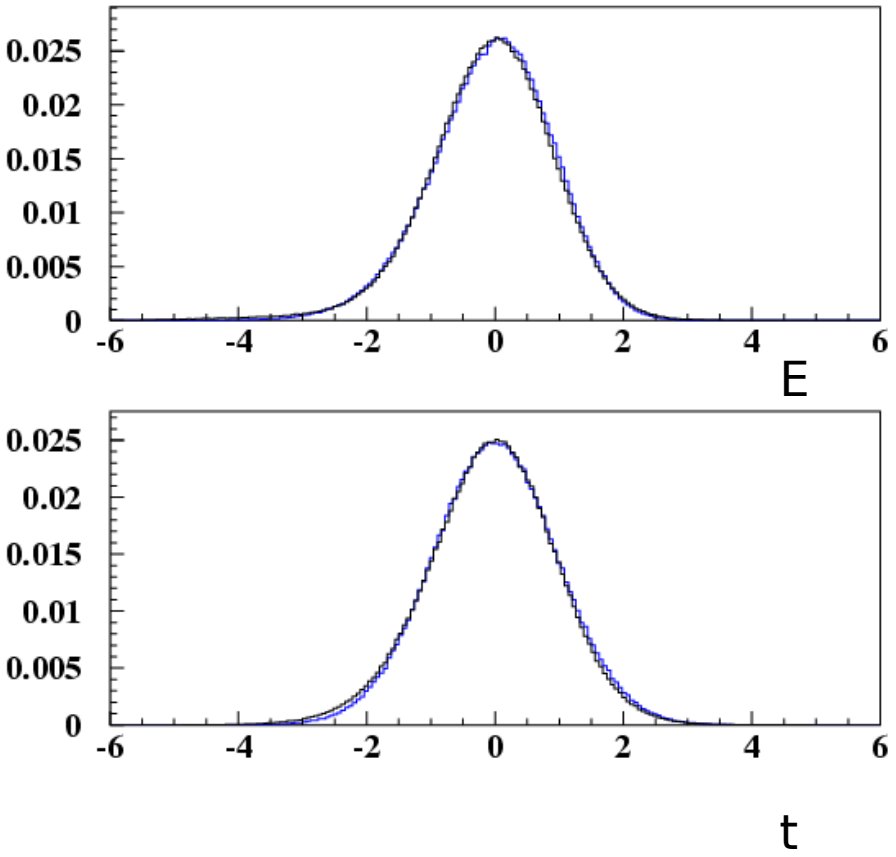
Again residuals

DATA

DUMMY MC

pulls





The DUMMY MC nicely reproduce the DATA residuals

Is the mass sensitive to these corrections?

	m (MeV)	σ(MeV)
GEANFI	547.938 ± 0.011	2.32
DUMMY	547.947 ± 0.011	2.28

The answer is no

(the small difference in σ can even reduce the difference due to the Dalitz cut)

What do the DUMMY and GEANFI have in common?

The total momentum is used as the ϕ momentum;

The ϕ momentum for each event can be evaluated as the sum of the momenta of photons in the KINE bank, taking only those coming from the ϕ

if we set in the KF event by event the total momentum as the ϕ momentum, we are blind to the whole production + ISR process.

	m (MeV)	σ(MeV)	
DUMMY	547.947 ± 0.011	2.28	Large variation is seen ~ 100 keV
DUMMY (ptot = pϕ)	547.831 ± 0.011	2.23	

Moreover: if we select photons coming from the η using KINE informations - no cut - we have:

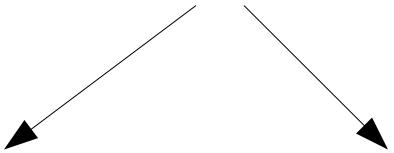
	m (MeV)
DUMMY	547.931 ± 0.007
DUMMY (ptot = pϕ)	547.889 ± 0.007

I am reproducing the ISR off case to check for errors...,

Conclusions

- Rechecking of ISR off
- Rechecking of beam energy spread off

Deviation confirmed



yes

reweighting ISR according several models to give systematics

no

Looking for other effects that can produce the difference between the ϕ momentum and the beam momentum