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MERIT beam parameters

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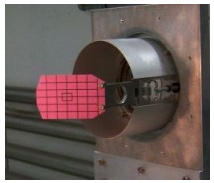
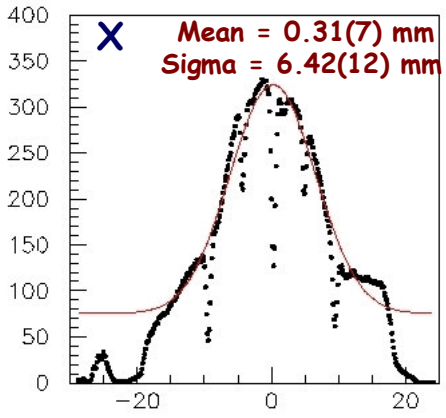
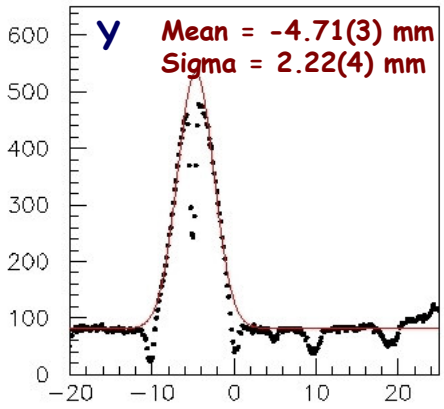
We have 3 beam 'cameras' -> 3 images for every beam pulse



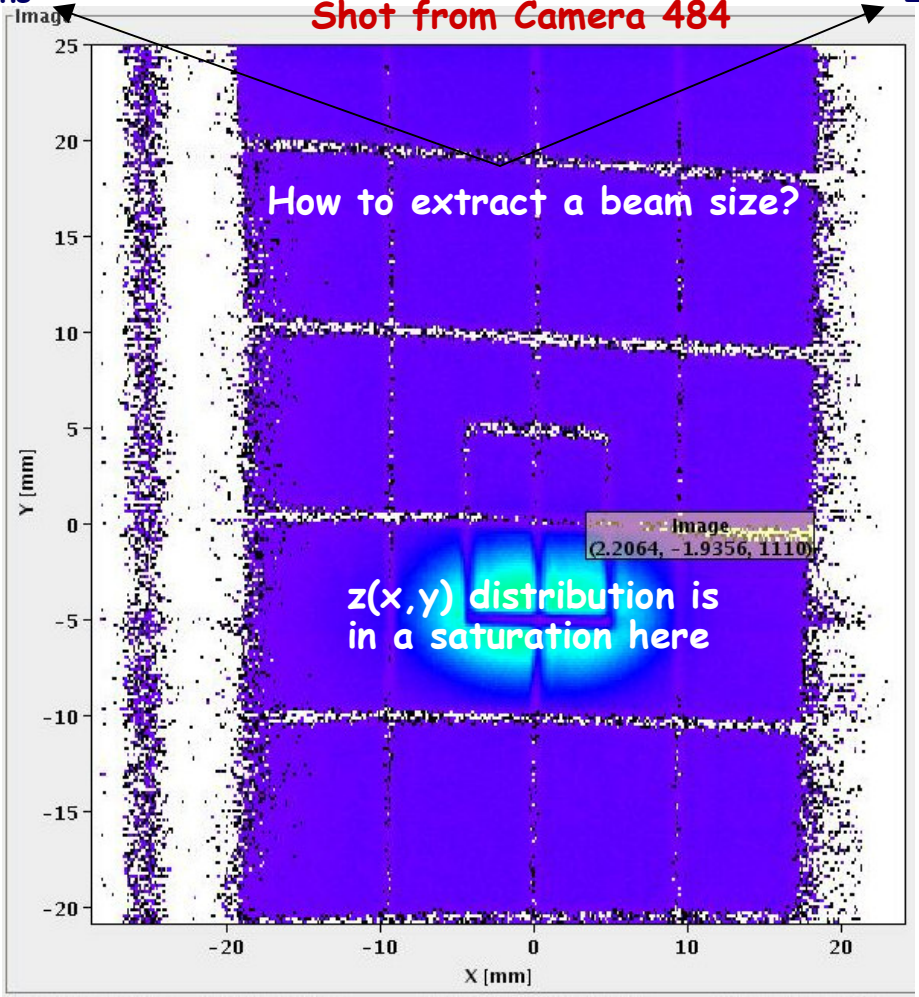
Camera positions: Camera 414, Camera 454, Camera 484 → BEAM → TARGET

1st approach: To fit projections*

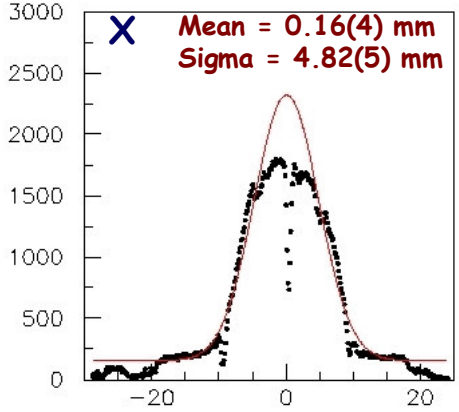


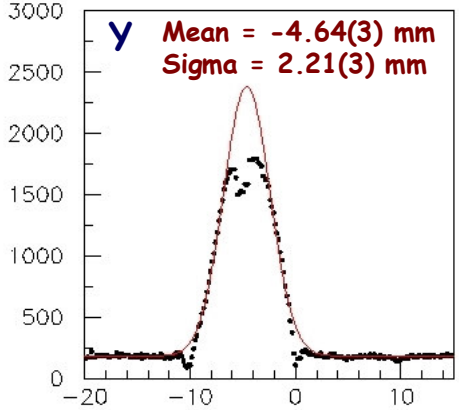


Shot from Camera 484



2nd approach: To fit shadows**





* Projection for X is $P(x) = \frac{1}{n_y}\sum_{i=1}^{n_y} z(x, y_i)$, similarly for Y.

** Shadow for X is $S(x) = \max[z(x, y_i)], (i = 1, n_y)$, similarly for Y.

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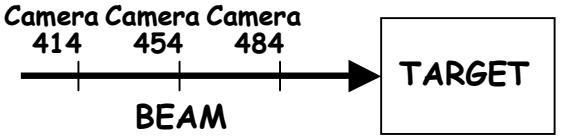
Fitting: Procedure



Simple fitting function: Gaussian + 'background'

Fitting algorithm (how to avoid gaps; how to choose initial value of the 'background' term, etc…) was based on the analysis of the 15-20 randomly selected images (after this, completely 'blind' analysis -> no parameters tuning)

In total: 520 beam pulses* x 3 cameras x 2 projections = 3120 distributions have been fitted

Result: Table – ntuple (part of it shown below)

		Camera 414				Camera 454			Camera 484
Date (ddmmyyyy)	Time (hhmmss)	X_{mean} (mm)	$Sigma_x$ (mm)	Y_{mean} (mm)	$Sigma_y$ (mm)	X_{mean} (mm)	$Sigma_x$ (mm)	Y_{mean} (mm)	
11112007	115919	9.164	6.153	6.468	5.999	-1.205	6.541	-10.317	.....
11112007	122348	9.204	6.081	5.331	5.723	-1.234	6.671	-10.043	.....
11112007	123724	9.851	5.720	5.490	4.750	-0.695	5.703	-10.521	.....
11112007	124959	10.288	5.508	5.880	3.615	0.270	4.599	-10.108	.....
11112007	125201	7.971	6.342	6.038	3.678	3.236	3.448	-10.015	.....
11112007	125545	12.105	4.446	5.808	3.516	-1.036	5.781	-10.194	.....
11112007	125829	13.043	3.803	5.821	3.545	-1.424	5.613	-10.246	.....
11112007	130436	8.399	6.587	6.164	3.939	1.542	4.026	-10.022	.....
11112007	130618	11.813	4.675	5.870	3.730	-1.200	5.505	-10.205	.....
11112007	131023	13.622	3.459	5.709	3.493	-2.083	5.311	-10.238	.....
11112007	131549	14.397	2.934	5.613	3.350	-3.255	5.101	-10.263	.....

This will be used to reconstruct the Run number and to attach this table to the 'global' table with experimental results.

This will be used to recognize a shot with the 'suspicious' fitting result and to fit it 'manually'.

* Period: 23 Oct 2007 – 11 Nov 2007

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Results: Shadows

Distributions of the Gaussian means

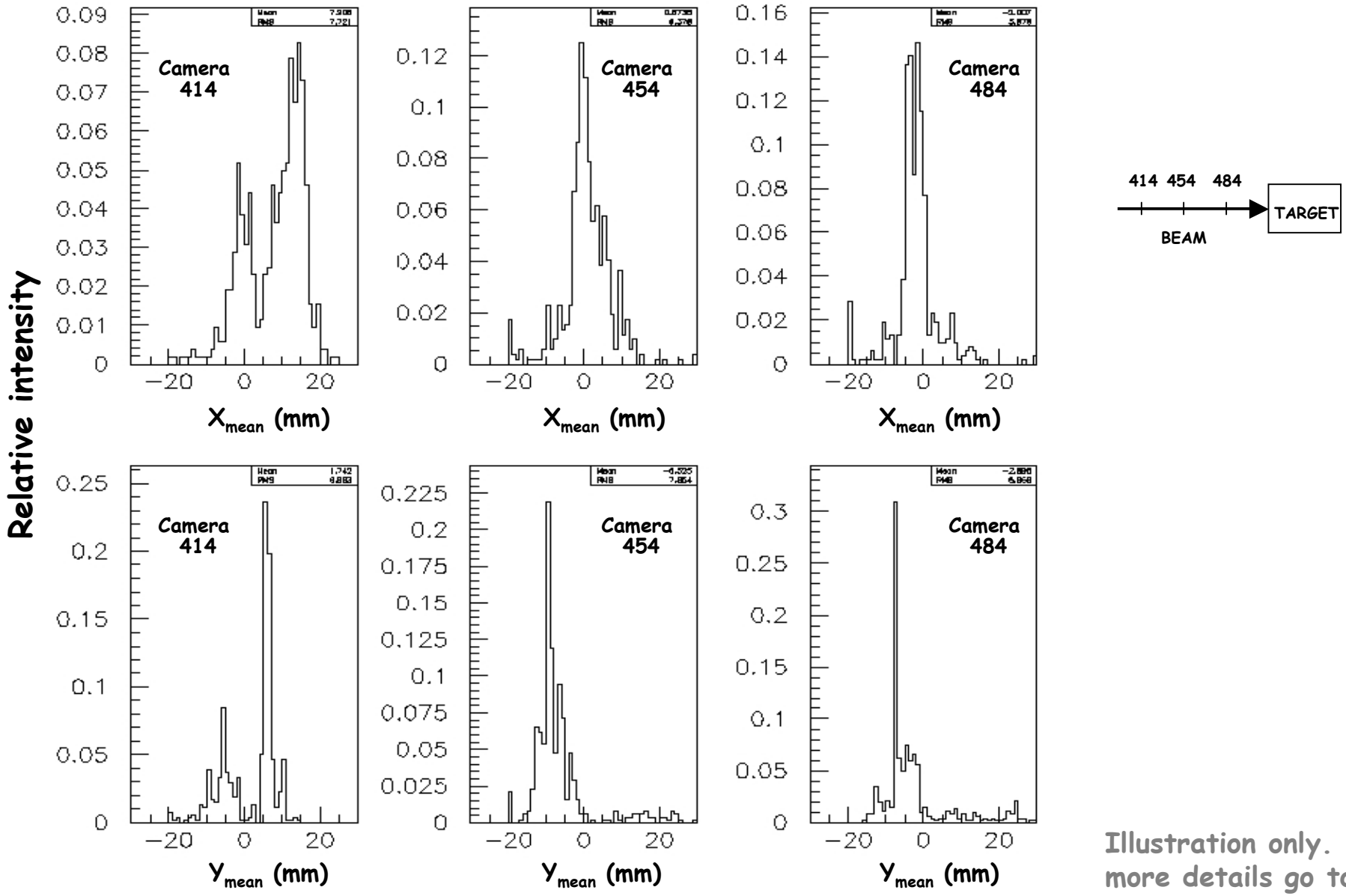

Illustration only. For more details go to:

http://hepunx.rl.ac.uk/uknf/wp3/shocksims/mermar/

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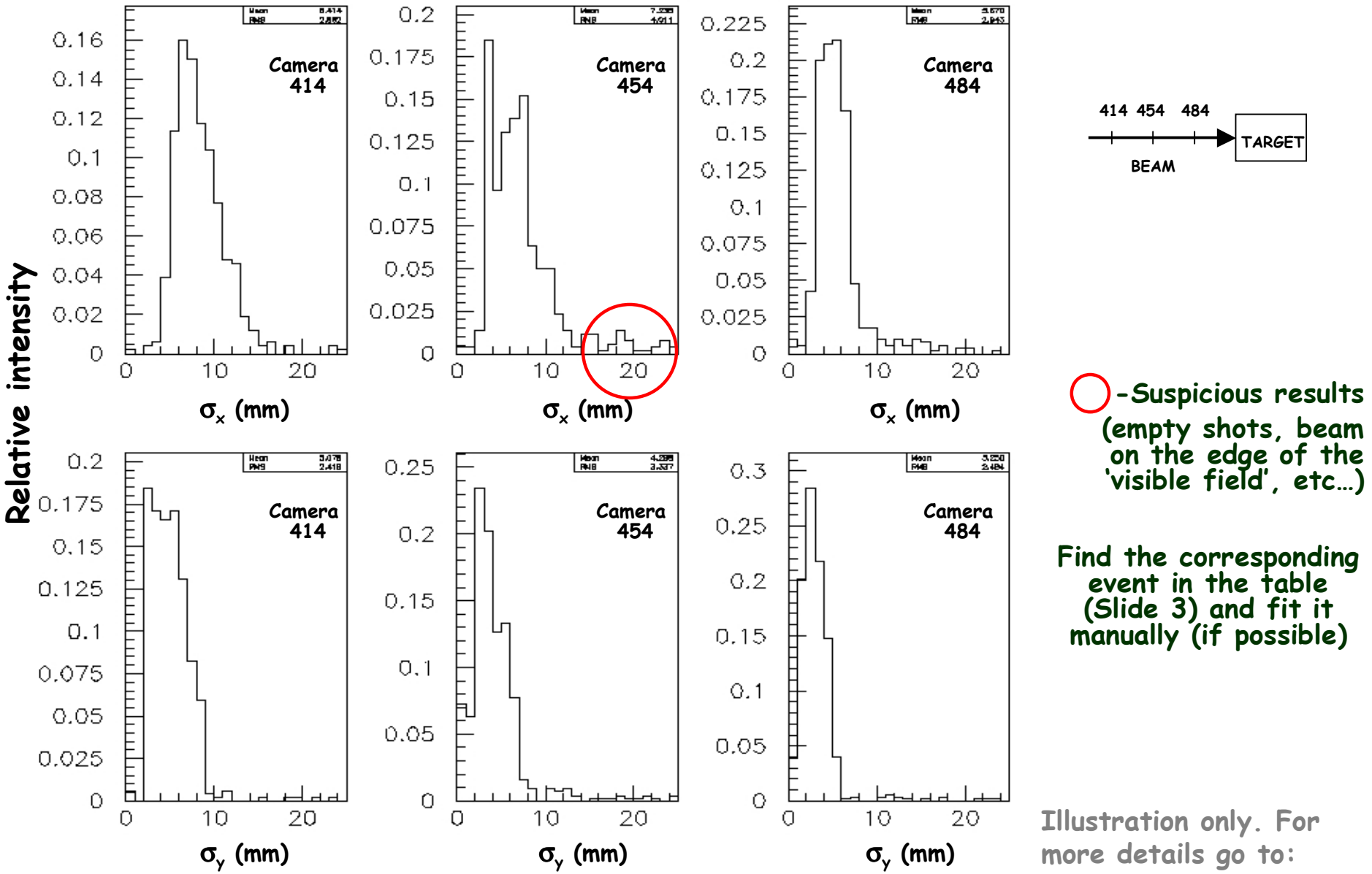
Results: Projections

Distributions of the Gaussian sigmas



○ -Suspicious results (empty shots, beam on the edge of the 'visible field', etc…)

Find the corresponding event in the table (Slide 3) and fit it manually (if possible)

Illustration only. For more details go to:

http://hepunx.rl.ac.uk/uknf/wp3/shocksims/mermar/

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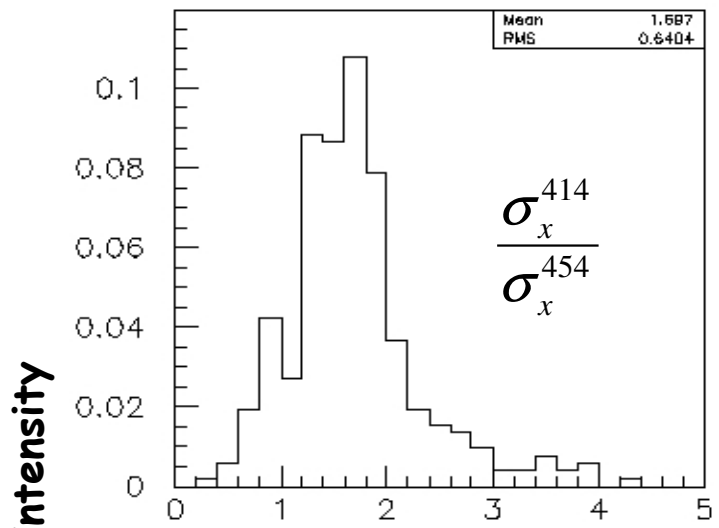
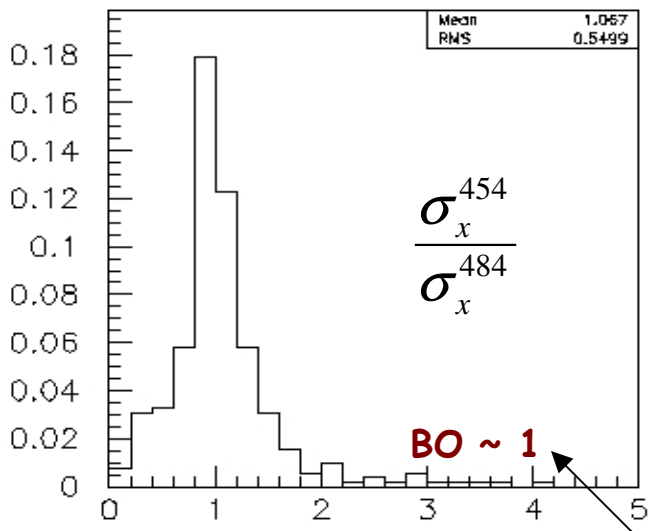
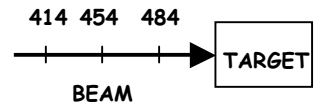
Results: Shadows

Distributions of the ratios of the Gaussian sigmas

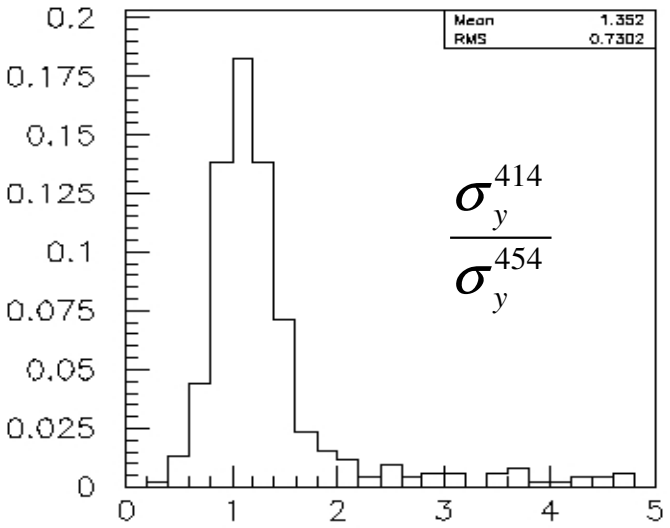
$\left(\sigma_x^i / \sigma_x^j\right), \left(\sigma_y^i / \sigma_y^j\right)$

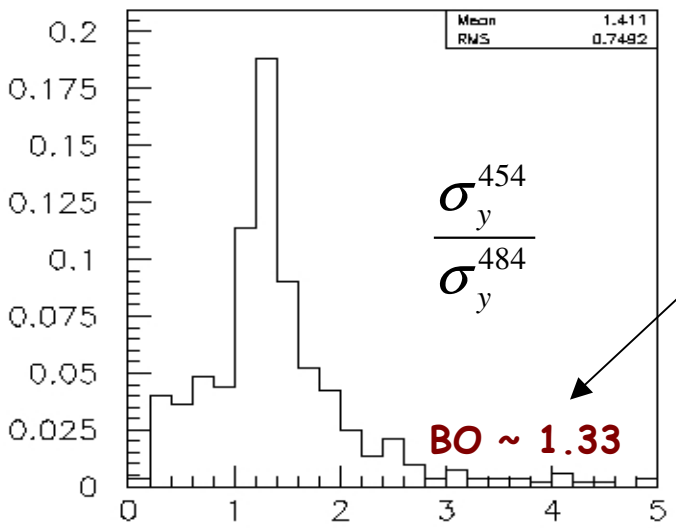






Relative intensity





Nice agreement with 'Beam Optics' values

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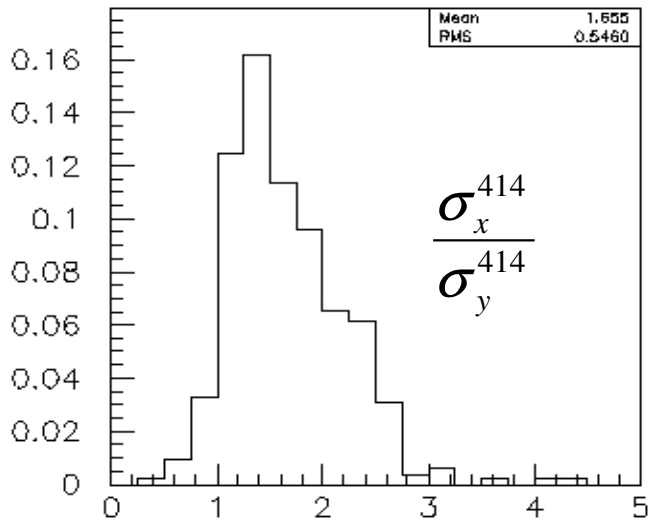
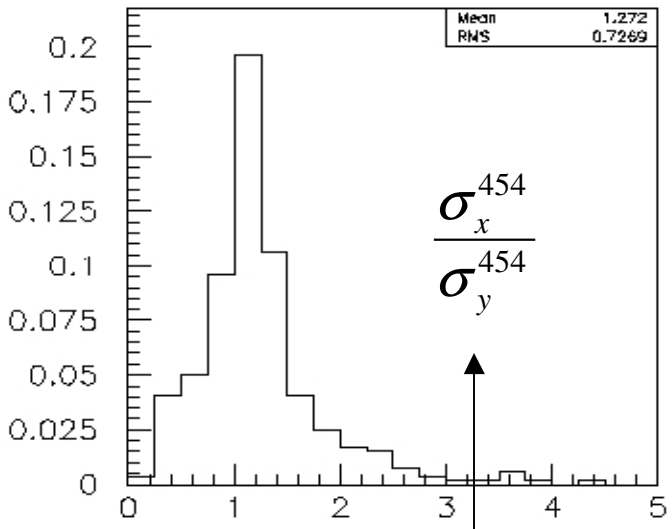
Results: Shadows

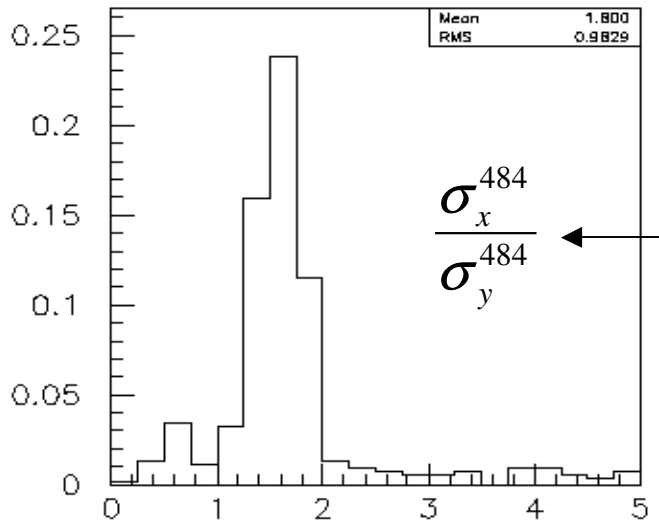
Distributions of the ratios of the Gaussian sigmas

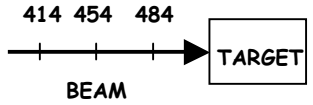
$\left(\sigma_x^i / \sigma_y^i \right)$

Relative intensity









'Beam Optics' value = 1.3

'Beam Optics' value = 1.7

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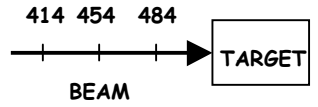
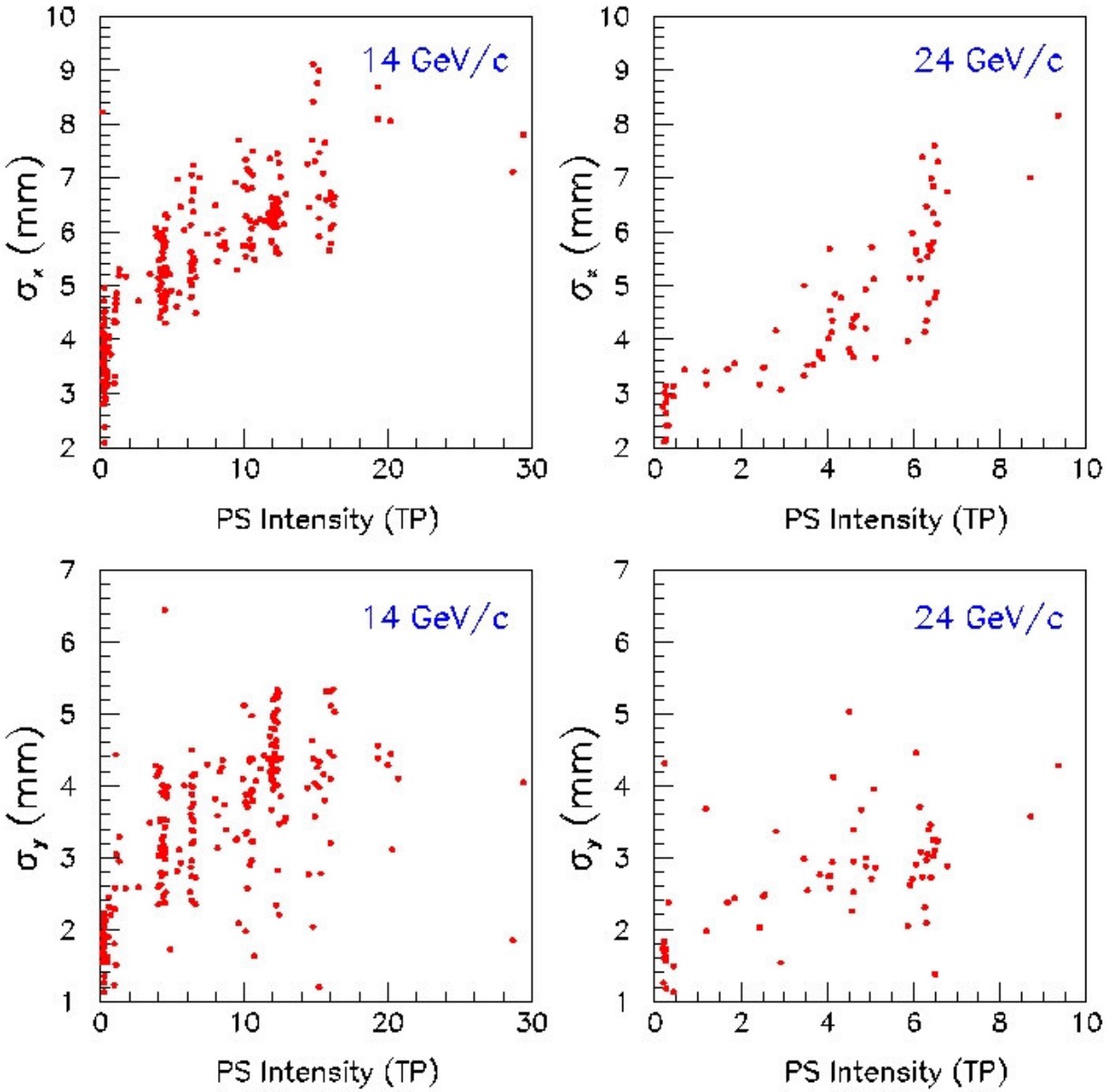
Beam size vs beam intensity



Camera 484



The beam-spot datafile (see Slide 3) has been attached to the 'global' MERIT datafile

This is a first result about beam size dependence on beam intensity (and momentum)

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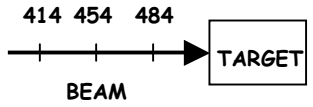
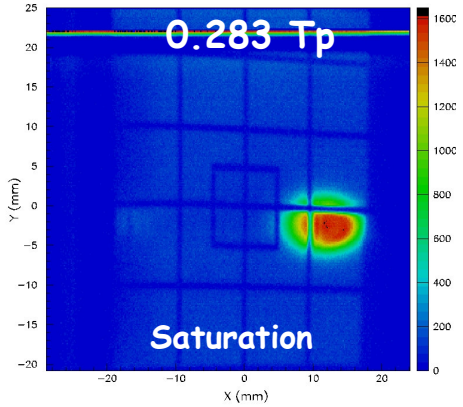
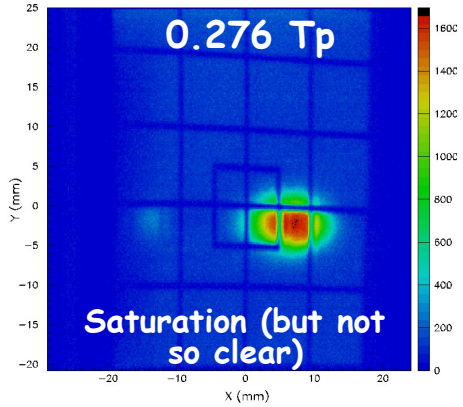
Illustration



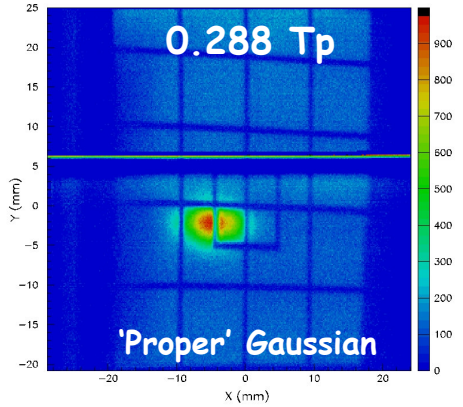
Camera 484



(1)

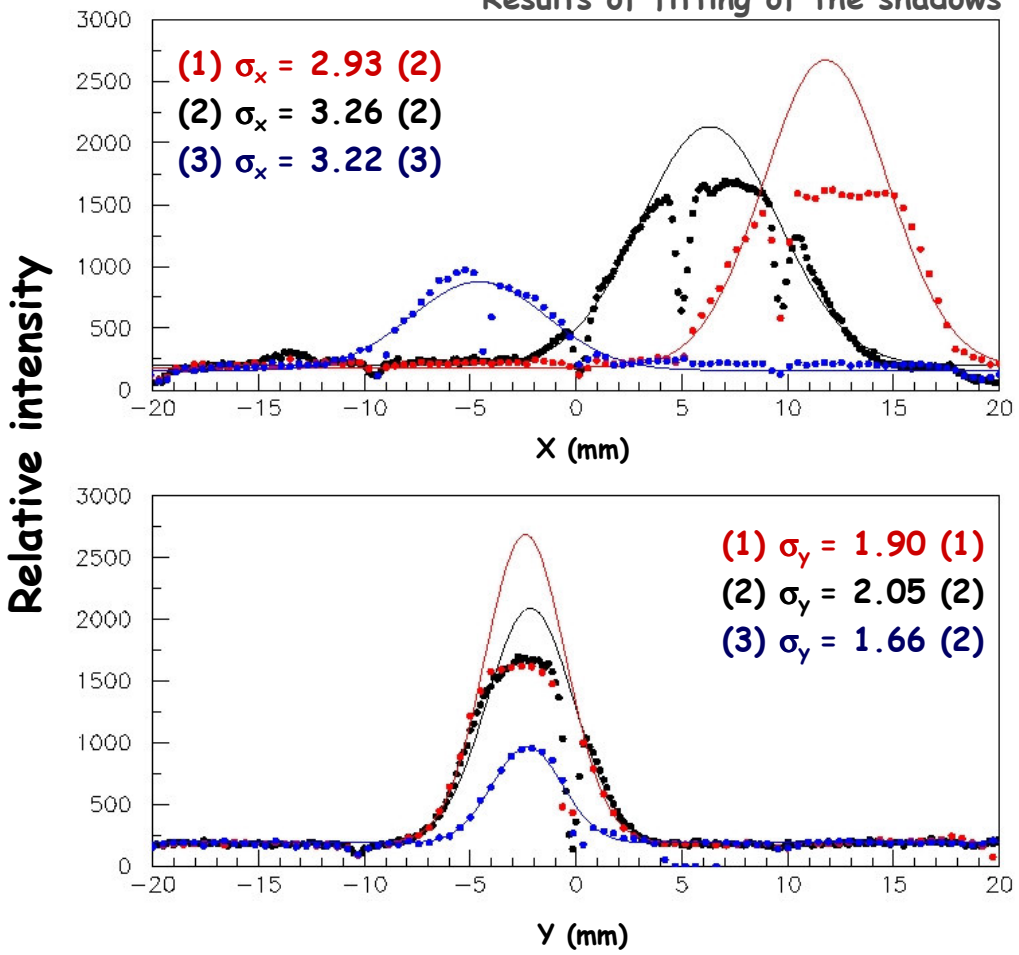


(2)



(3)

Results of fitting of the shadows



For low beam intensity shots, in around 50% of the cases the situation is similar to (1) and (2). Even when we have a beam shot similar to case (3) the x/y widths ratio is close to 2. The plot above shows the results of the fitting of these 3 distributions.

The interesting fact is that in the case (3) we have the highest value of the beam intensity and the camera response does not reflect this.

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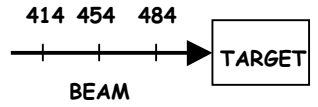
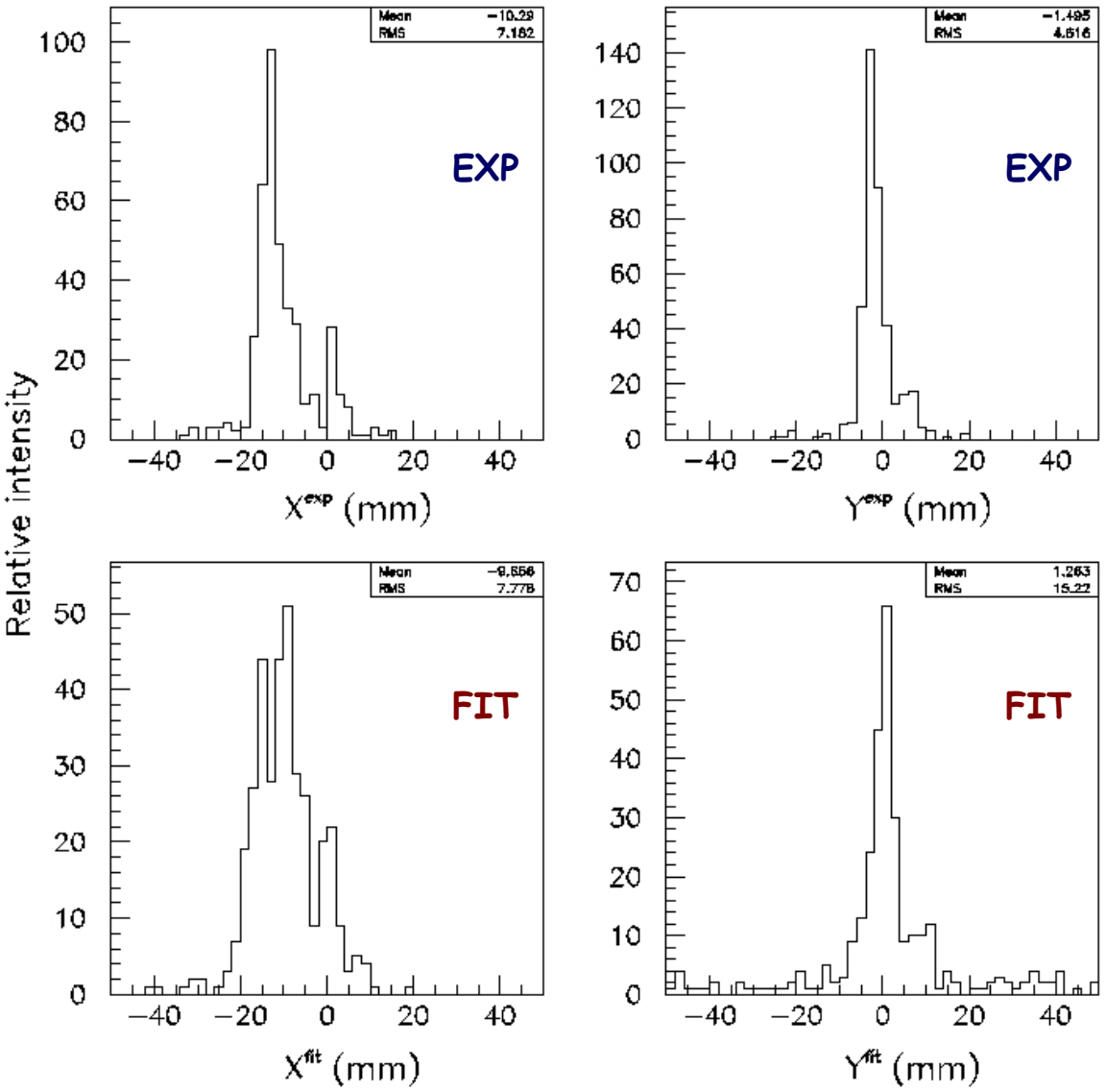
Beam position on target





EXP

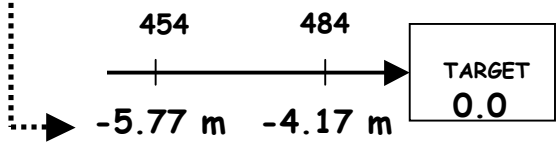
Taken online (estimated by the eye from the screen data)

FIT

Calculated by using:

1) the fitted beam positions for Camera454 and Camera484 (see Slide 4, for example);

2) the Camera454, Camera484 and target positions*



* From 'Beam Spot Information' talk, I. Efthymiopoulos, VRVS Meeting, November 30, 2007

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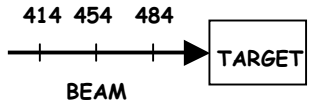
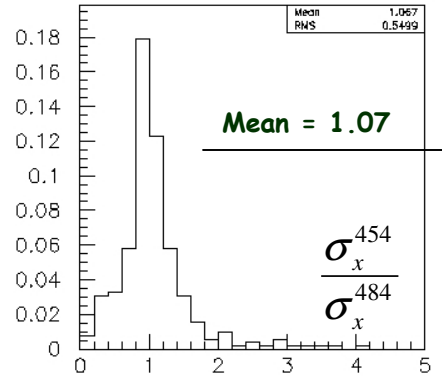
Conclusions (Main results so far)

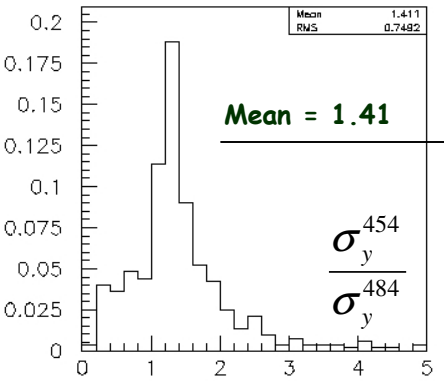


Distributions of the ratios of the Gaussian sigmas

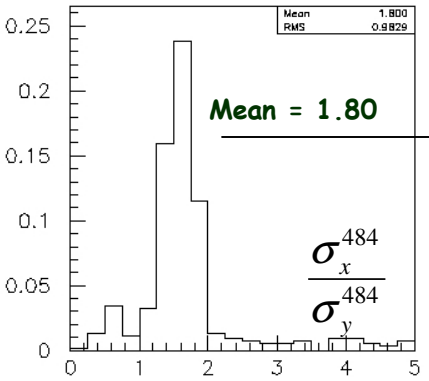
Relative intensity



Mean = 1.07 'Beam optics' ~ 1

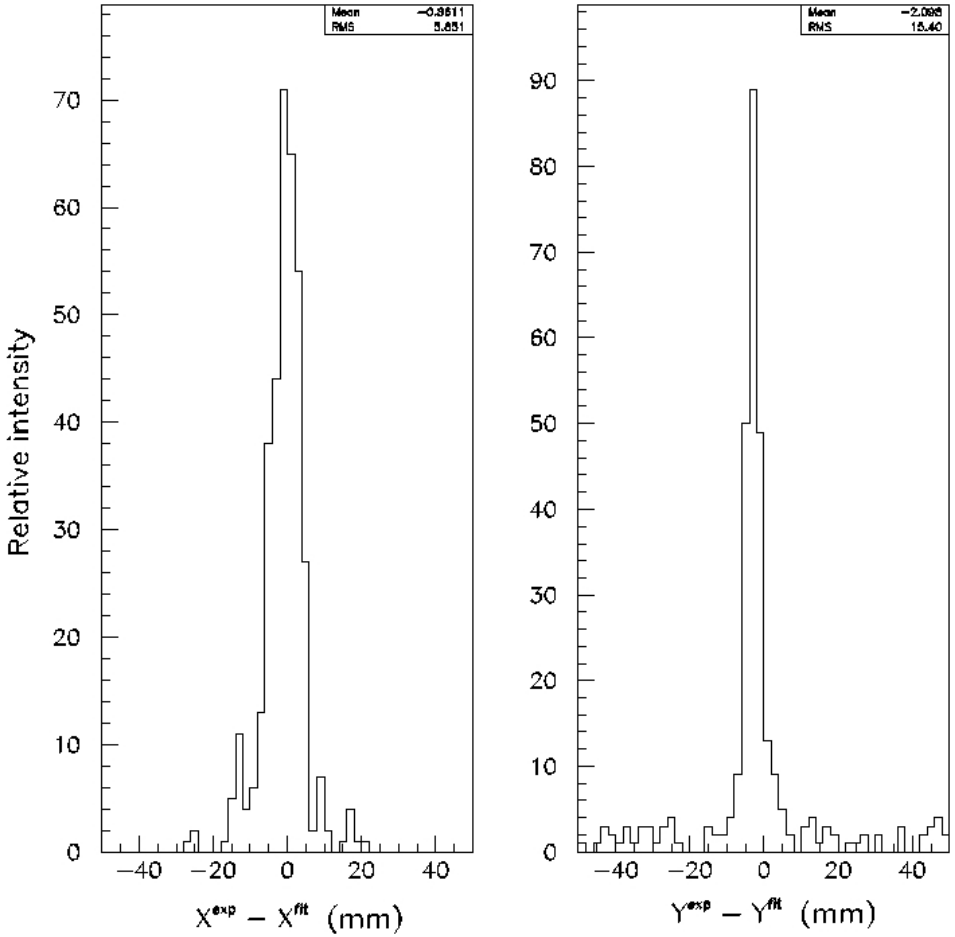


Mean = 1.41 'Beam optics' ~ 1.33



Mean = 1.80 'Beam optics' = 1.7

Beam position on target



MERIT beam parameters have been obtained (on the basis of the beam monitors data) for each shot during the run; Two approaches: Cross-checked; So far, everything looks as expected; Next; compare with beam optics calculations shot-by-shot.