Low beam intensity

(MERIT beam spot size – part II)

Goran Skoro

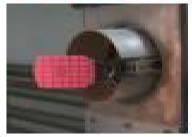
30 June 2008

Goran Skoro

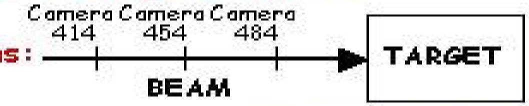
The University Of Sheffield.

Reminder: Idea and Procedure

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



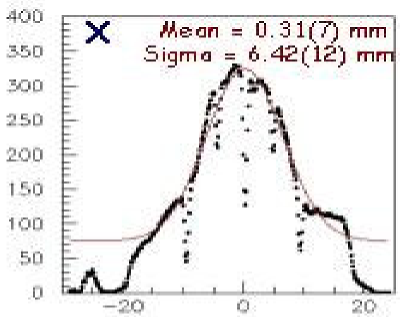
Camera positions:

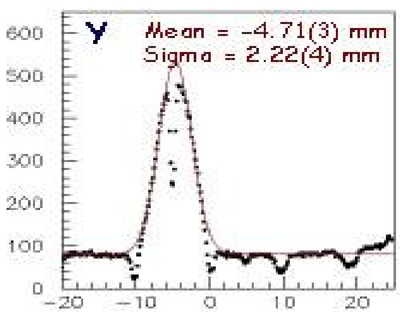


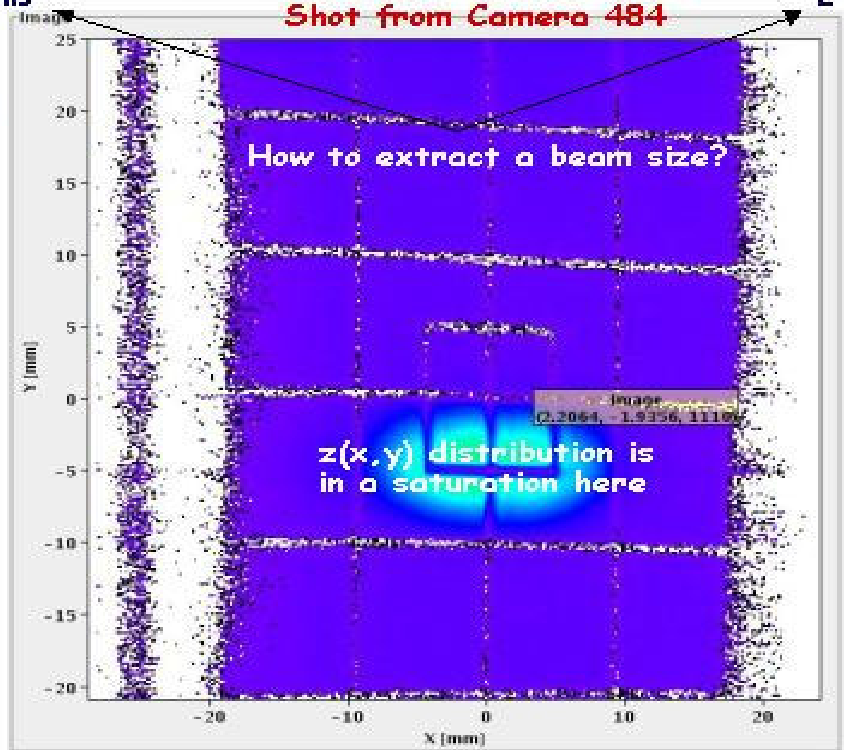
1st approach: To fit projections*

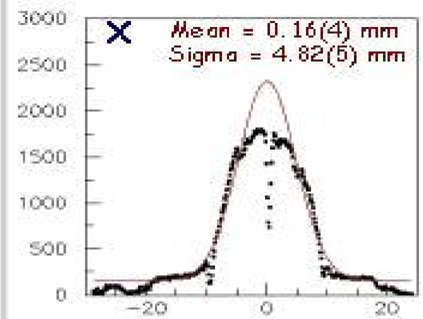
Shot from Camera 484

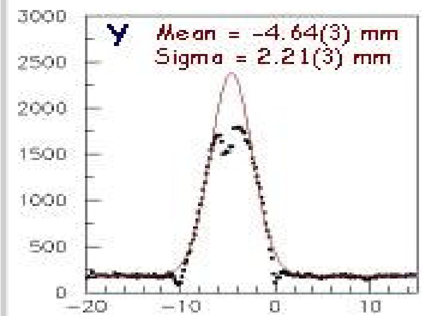
2nd approach: To fit shadows**











* 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.

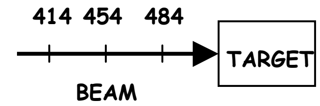
Simple fitting function: Gaussian + 'background'

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)

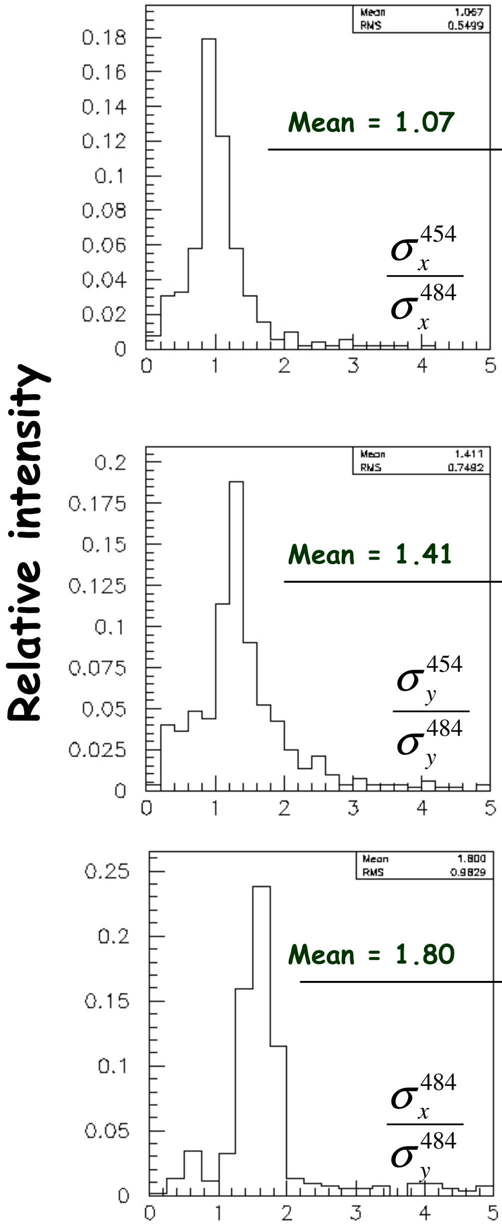
In total: 520 beam pulses* x 3 cameras x 2 projections = 3120 distributions have been fitted

Goran Skoro
The University Of Sheffield

Reminder: Main results (so far)



Distributions of the ratios of the Gaussian sigmas

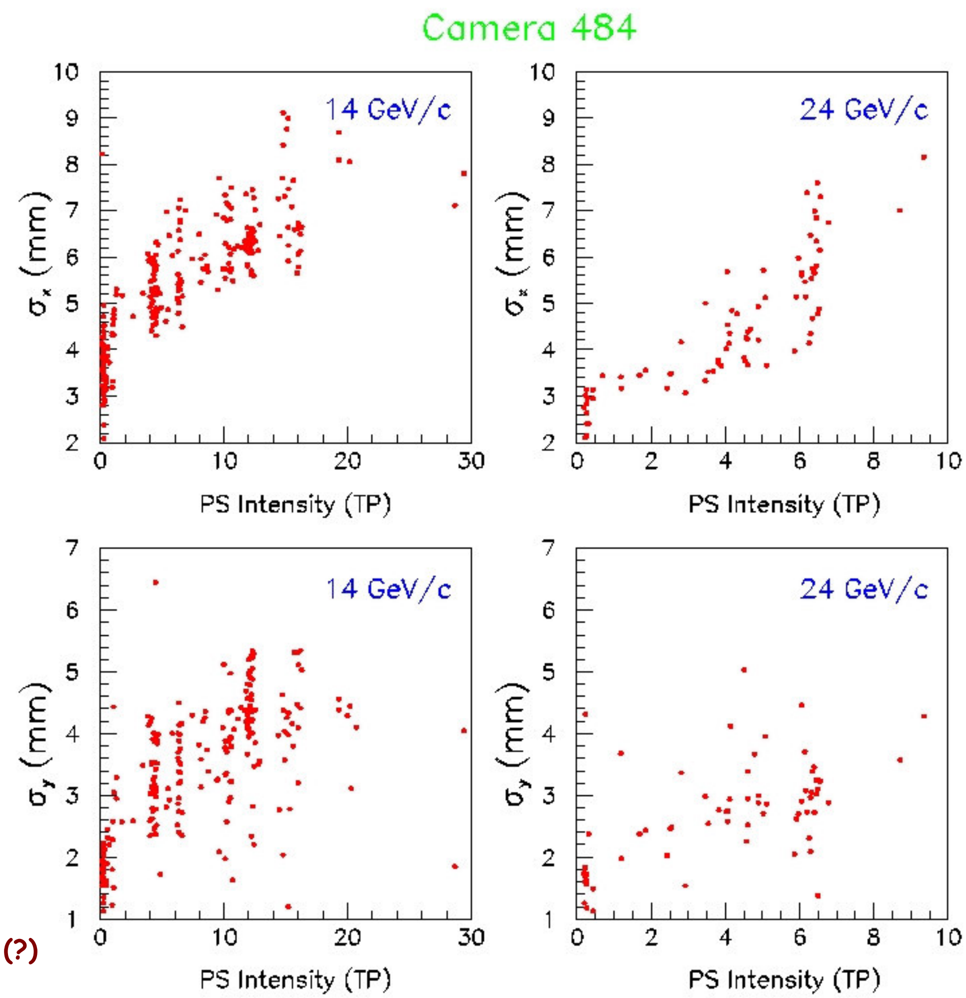


Mean = 1.07 'Beam optics' ~ 1

Mean = 1.41 'Beam optics' ~ 1.33

Mean = 1.80 Expected value = 5 (?)

Beam size vs beam intensity

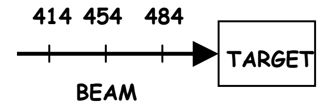


Everything looks reasonable except the x/y widths ratio.

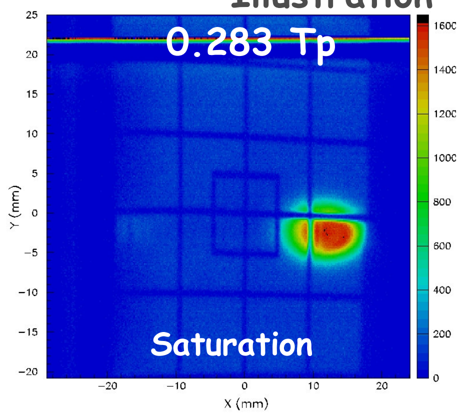
It was proposed to check the low beam intensity shots, hoping that in those cases we will not have saturation. This means that the interpretation will be easier because any possible uncertainty connected with saturation will be eliminated.

Goran Skoro
The University Of Sheffield.

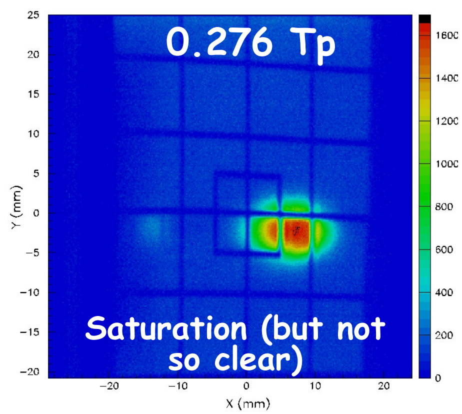
Results: Beam intensity around 1/4 Tp



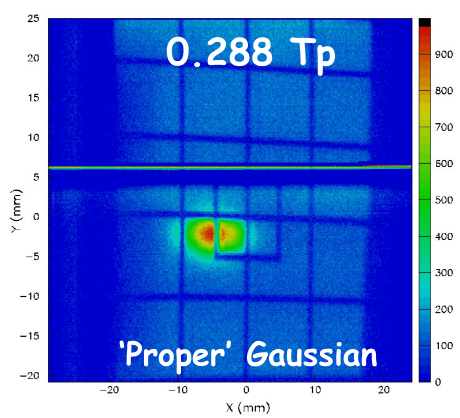
Camera 484
Illustration



(1)

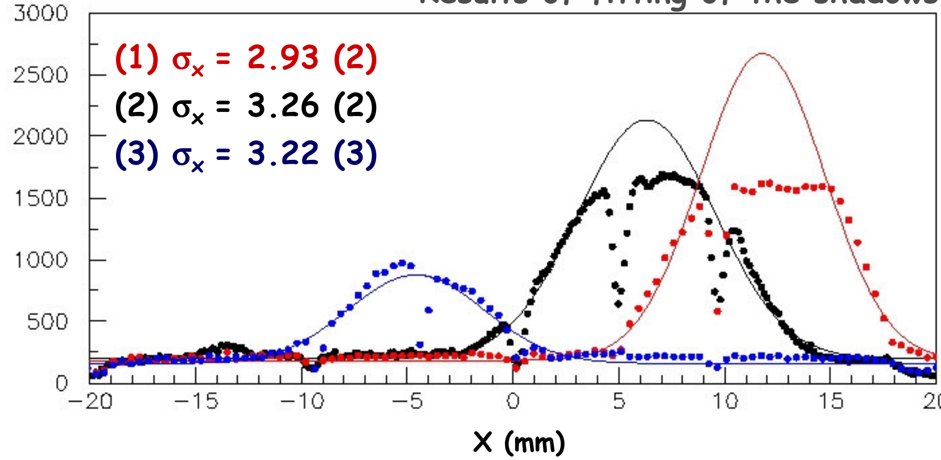


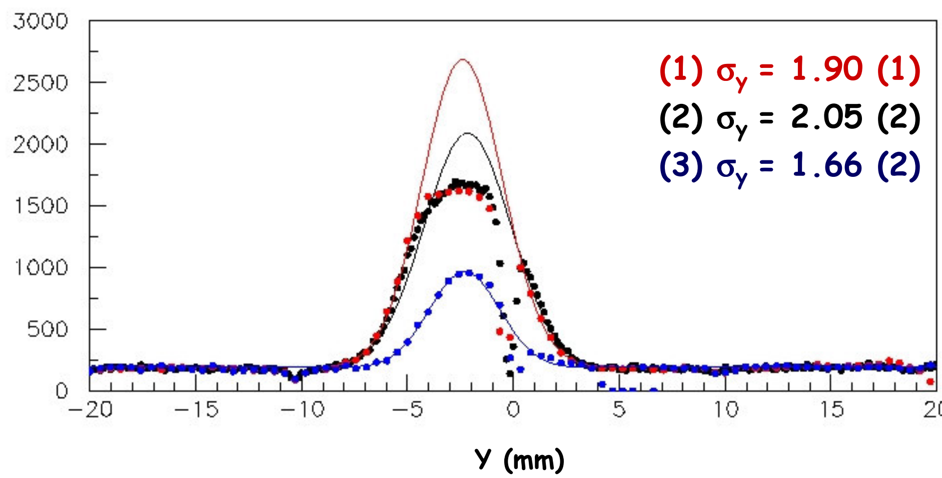
(2)



(3)

Results of fitting of the shadows



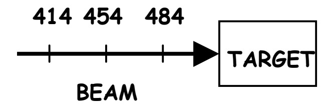


For beam intensity about 1/4 Tp, in around 50% of the cases the situation is similar to (1) and (2). Even when we have a beam shot similar to case (3) the x/y widths ratio is close to 2. The plot above shows the results of the fitting of these 3 distributions.

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.

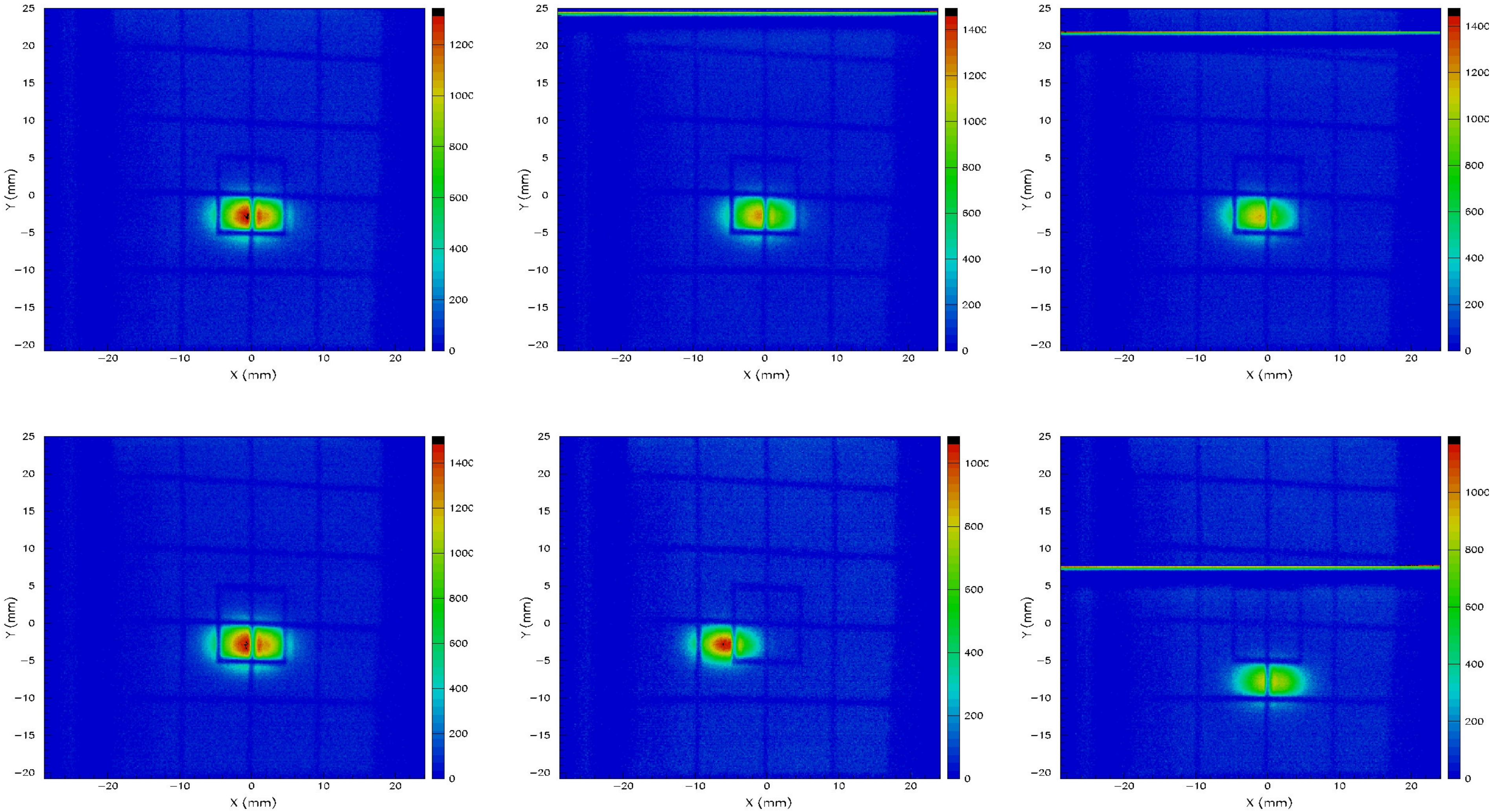
Goran Skoro
The University Of Sheffield.

Results: Beam intensity below 0.2 Tp



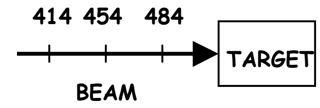
There are a dozen shots (23 Oct 2007) where beam intensity is below 0.2 Tp. The distributions (few examples are shown below) look like fine double-Gaussians for almost all shots. But, again, it can be seen by the naked eye that x/y widths ratio is around 2.

Camera 484



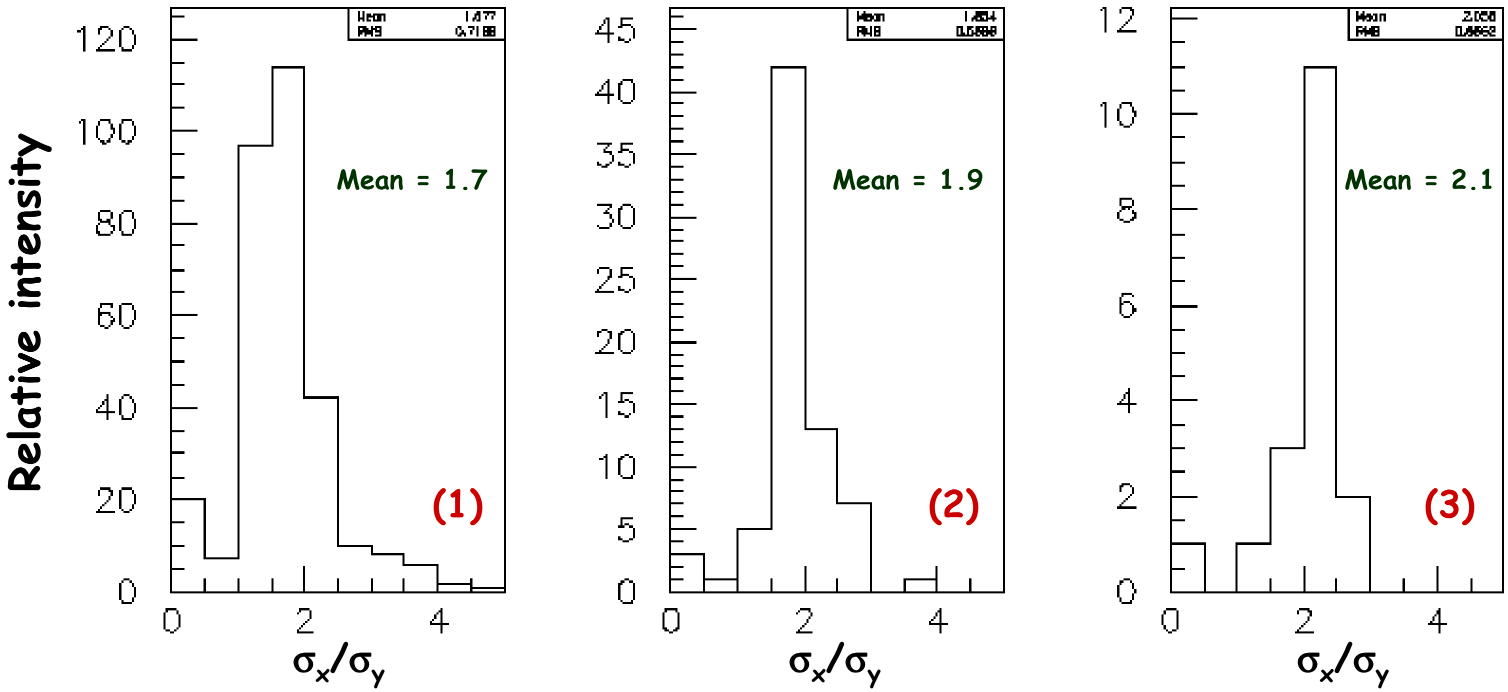
Goran Skoro
The University Of Sheffield.

Results: Summary



Camera 484

Distributions of the ratios of the Gaussian sigmas



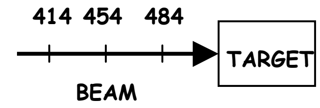
(1) Beam intensity higher than 0.3 Tp

(2) Beam intensity between 0.2 and 0.3 Tp

(3) Beam intensity lower than 0.2 Tp

Goran Skoro
The University Of Sheffield.

Results: Appendix



Beam size vs number of bunches

Camera 484