TPOL GEANT Monte Carlo

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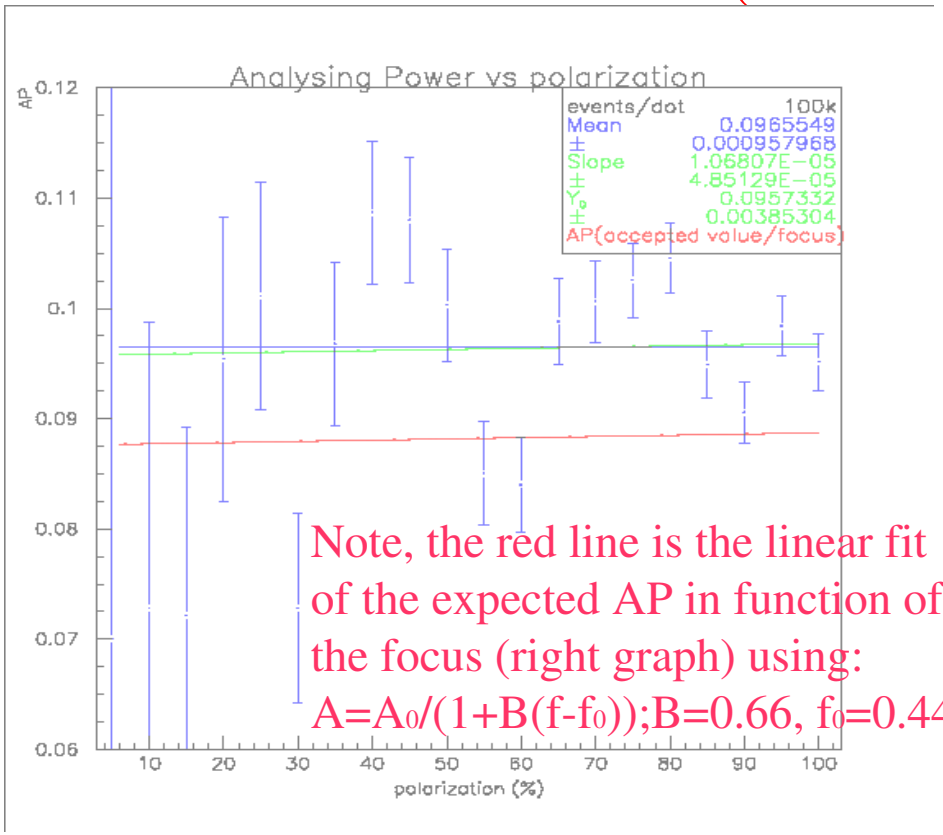
- Go over some potential dependences for the AP and the Focus:
  - Polarization
  - Emittance in x
  - Emittance in y
  - Dilu and Difu parameters
- Effect of the Backsplash:
  - Number of clusters and estimation of the number of backsplashed events
  - Y distribution
  - Difference in the curve Eta-y

Default parameters

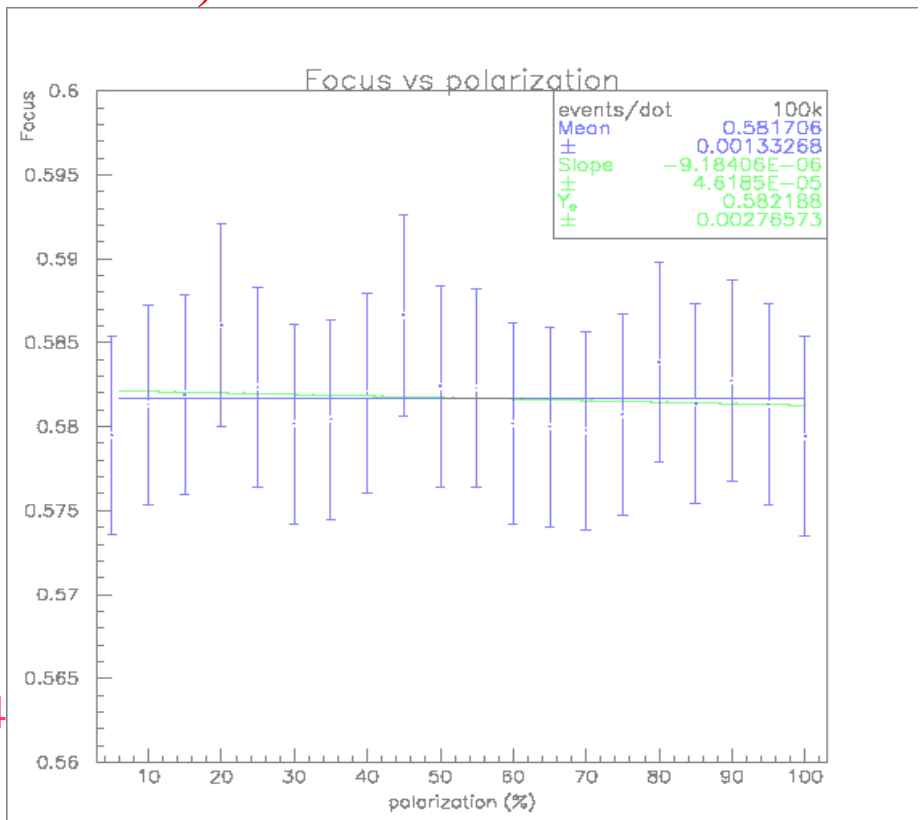
- To Study the dependence of AP and focus, we vary one parameter and keep the other fixed. The default (fixed) parameters are:
  - Polarization = 100%
  - Emx = 54 mm*urad and Emy = 2.4 mm*urad
  - S1(left) = 0.1 and S1(right) = 0.05
  - Dilu = 0.04
  - Difu = 0.6

Polarization dependence

(for 100k events)



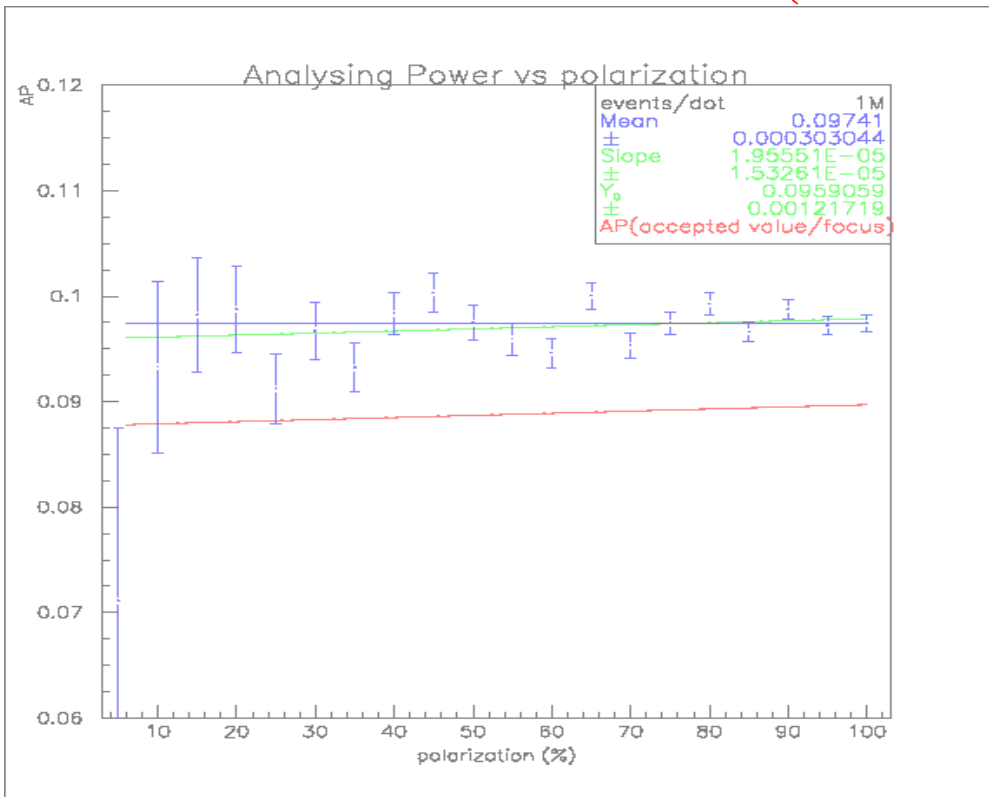
Note, the red line is the linear fit of the expected AP in function of the focus (right graph) using: $A=A_0/(1+B(f-f_0));B=0.66$, $f_0=0.44$

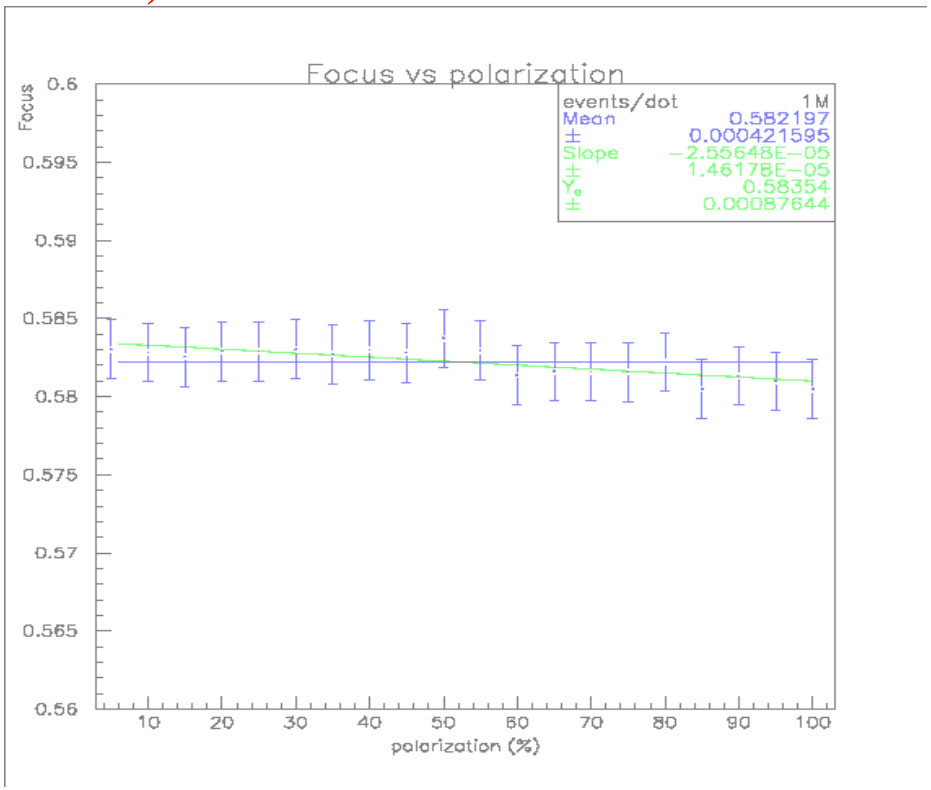


- The error is significant for simulation of 100 000 events.
- The error on AP is reduced as the polarization increase.
- There seems to be no polarization dependence for AP and the Focus (slope=0 is within the error of the slope of AP : (1 +/- 5) X 10E-5)

Polarization dependence

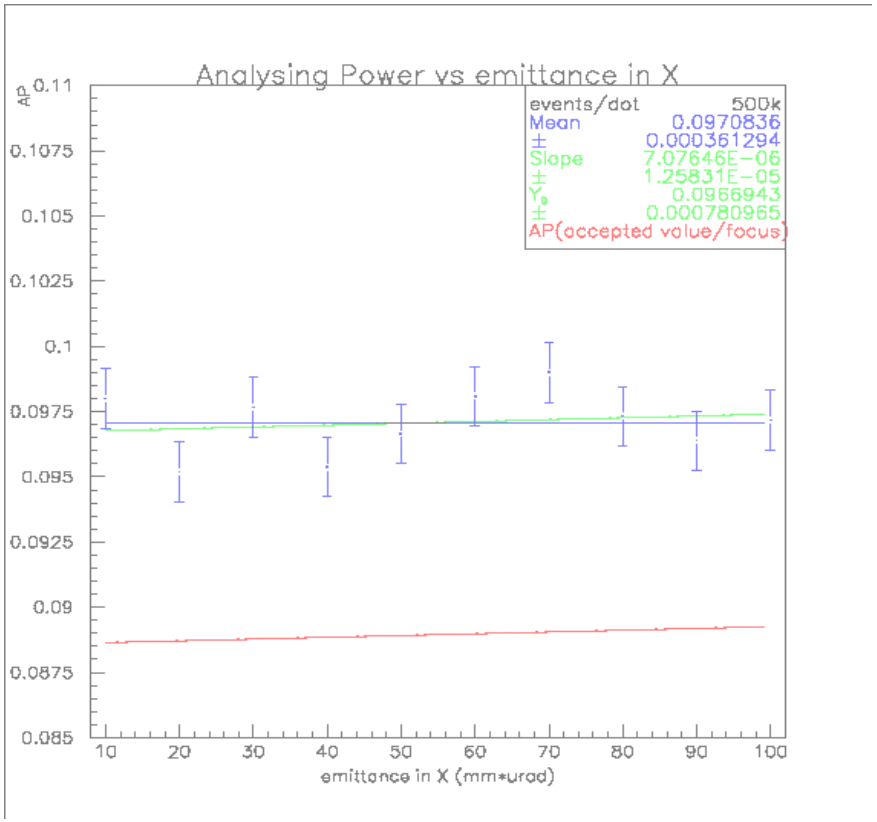
(for 1M events)

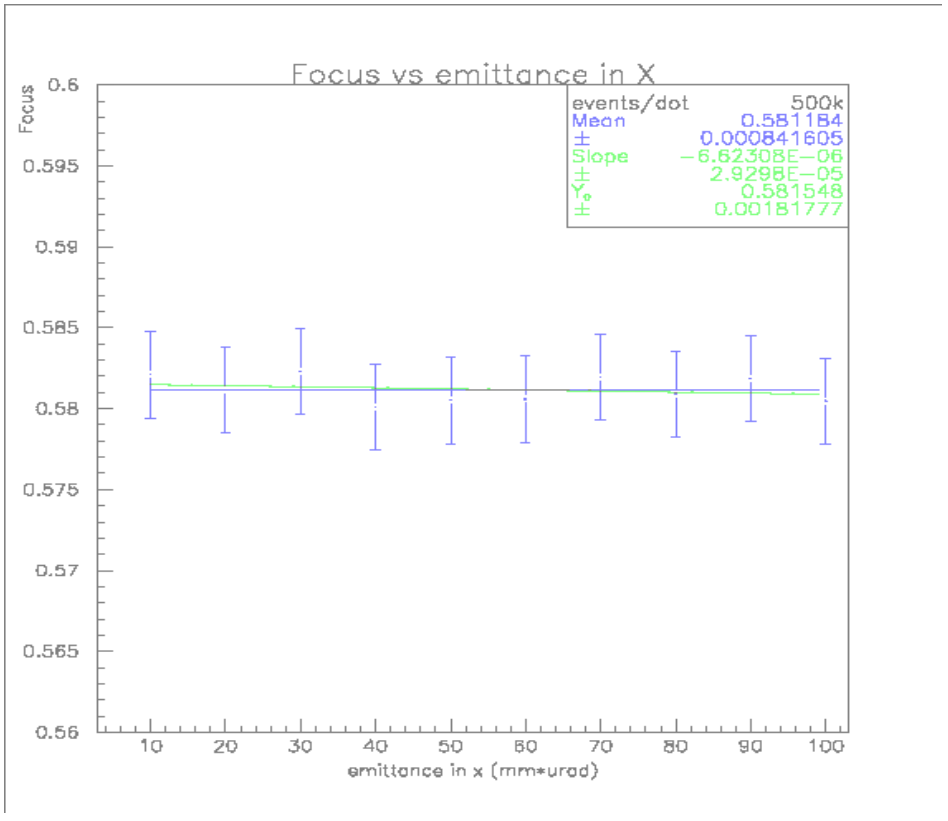




- The error become acceptable for 1 000 000 events simulation.
- Slope = 0 is not within the error of the AP slope: (2.0 +/- 1.5)E-5.
- If there is polarization dependence, it follows from the focus dependence ⇒ the on-line AP correction from focus should remove this source of error.

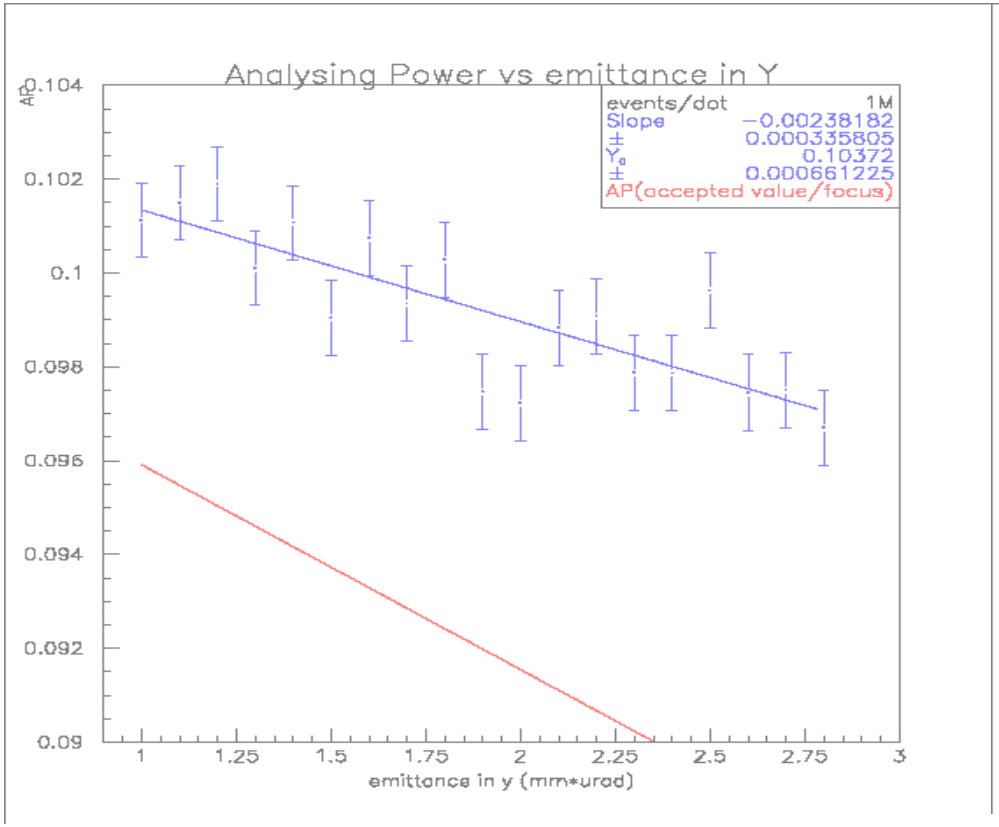
Emittance in x dependence

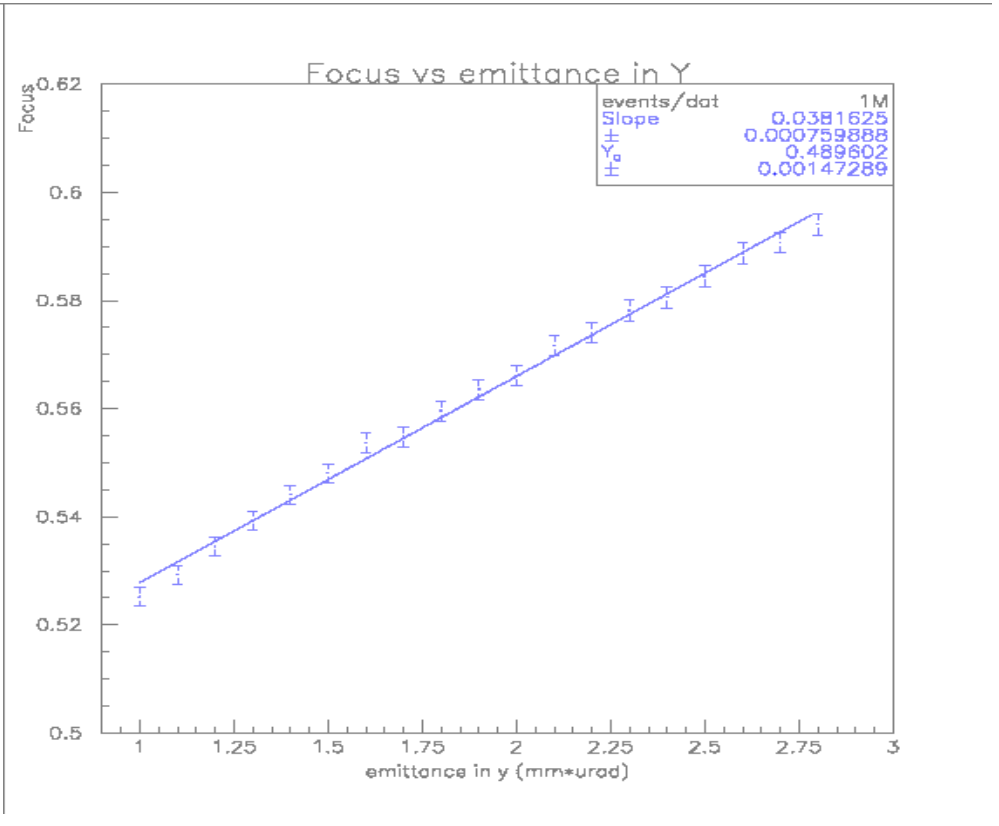




- As expected, AP and the focus have no dependence from the emittance of the beam in x.

Emittance in Y dependence

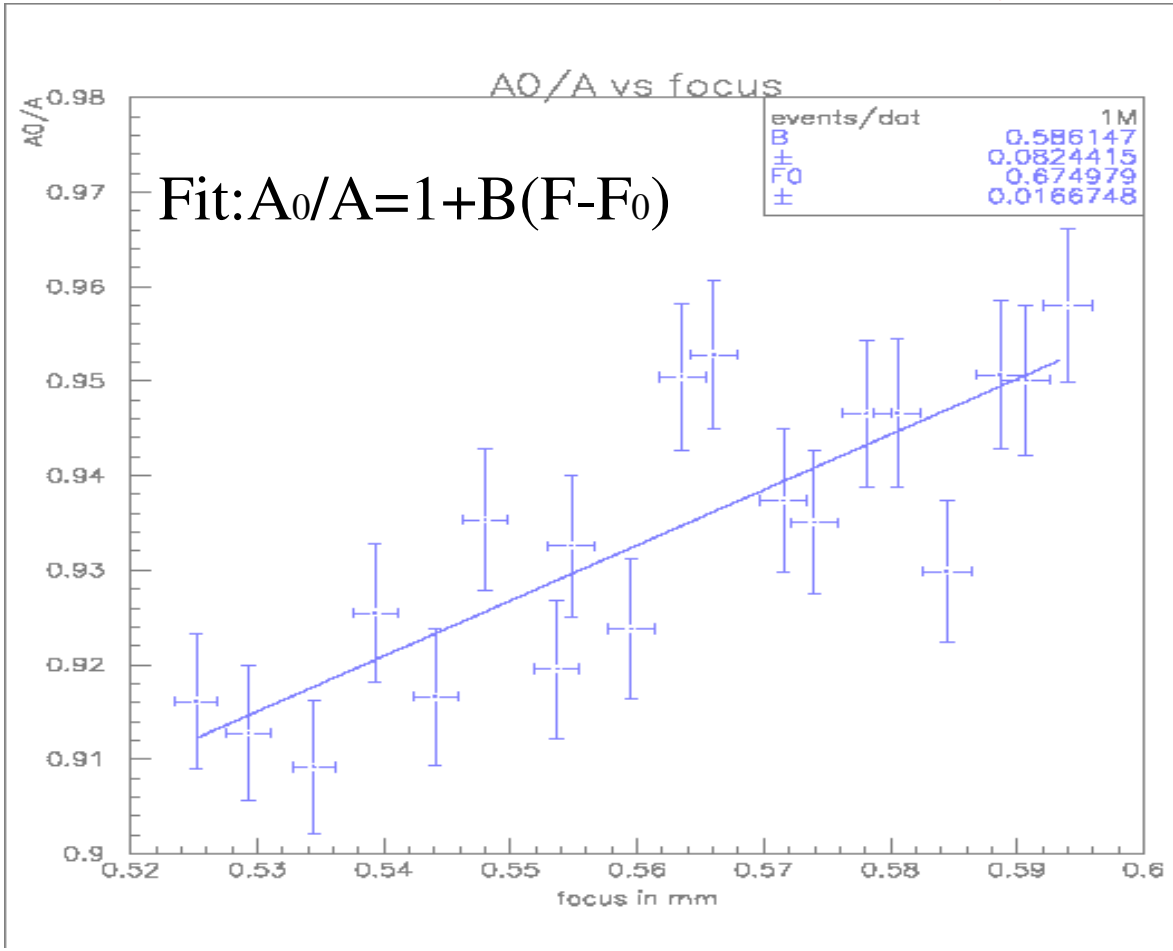




- Emittance in Y has a strong correlation on the focus; thus on AP.
- The slope of AP doesn't agree with the slope of the corrected AP in function of the focus (explanation next slide)

Dependence on focus

(from data of the emittance in y)

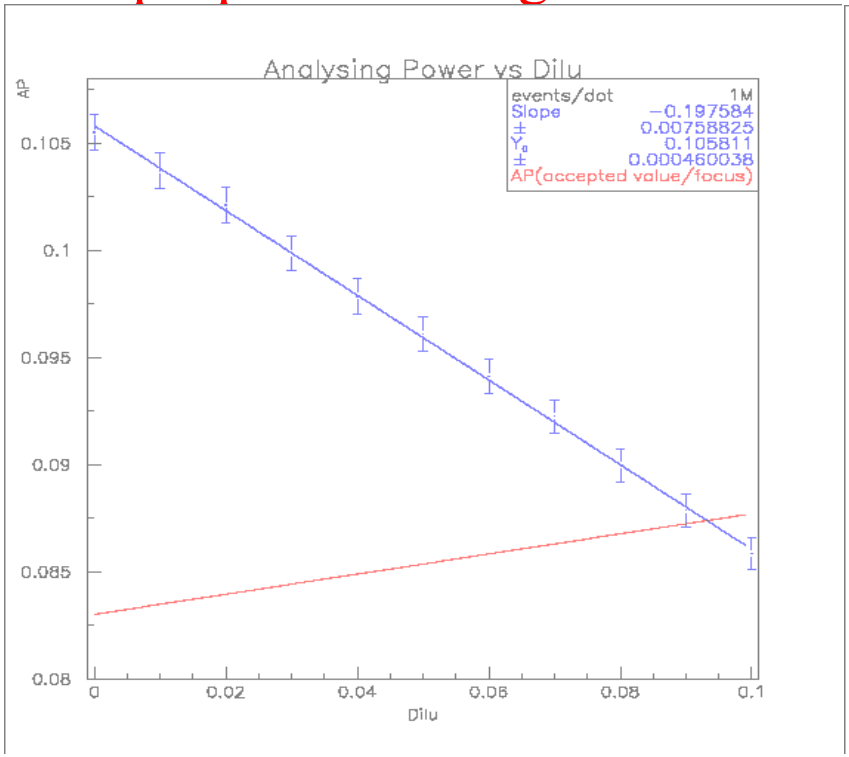


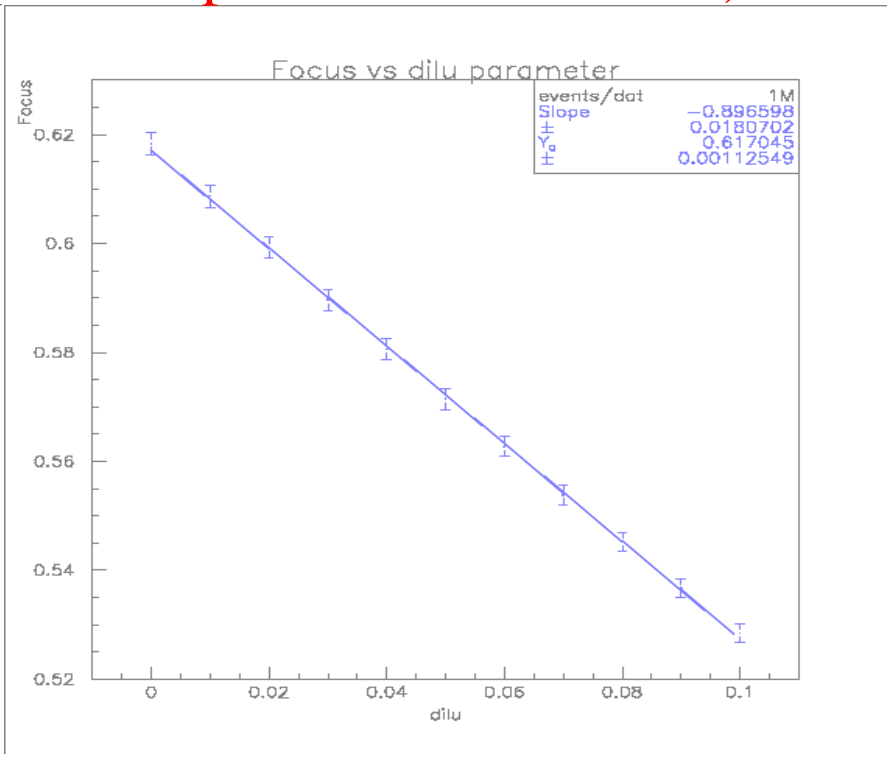
Note: This graph is from the same MC than Yongdok's which explain why F_0 agree so well...

- This graph leads to the following values:
  - B = 0.587 ± 0.082
  - F_0 = 0.675 ± 0.017
- Yongdok's MC got:
  - B = 0.691 ± 0.058
  - F_0 = 0.700 ± 0.009
- Vahagn's MC (accepted value) got:
  - B = 0.664
  - F_0 = 0.444

The B agree within their error, but not the F_0. Need to determine to good "default" parameter to get the "good" F_0.

Dilu parameter dependence (dilu is the proportion of light that cross from up-down calorimeters)

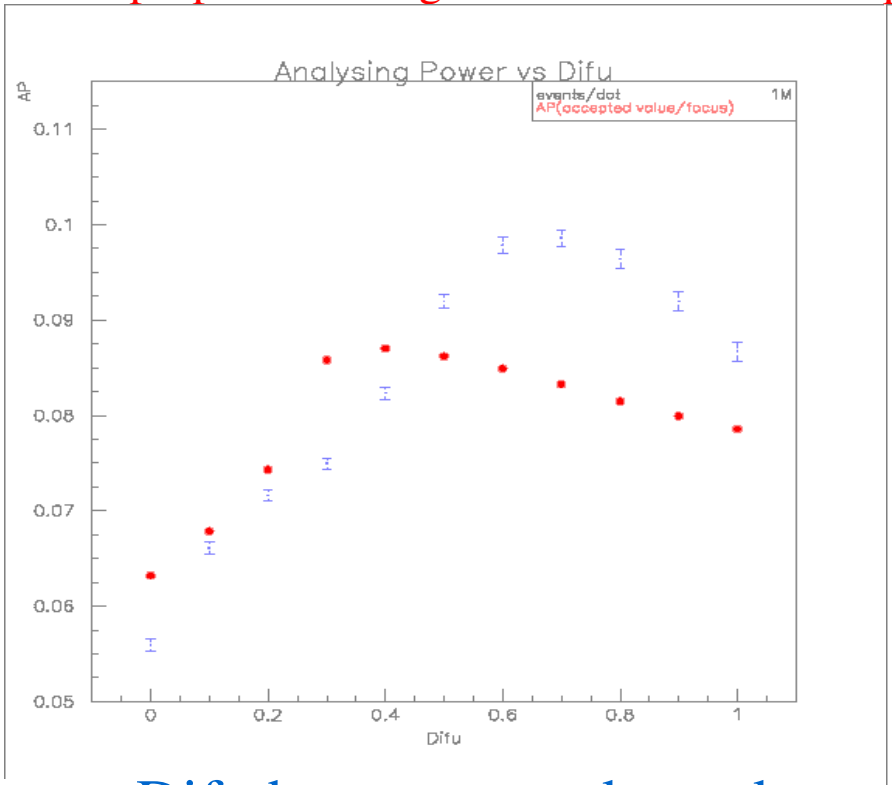


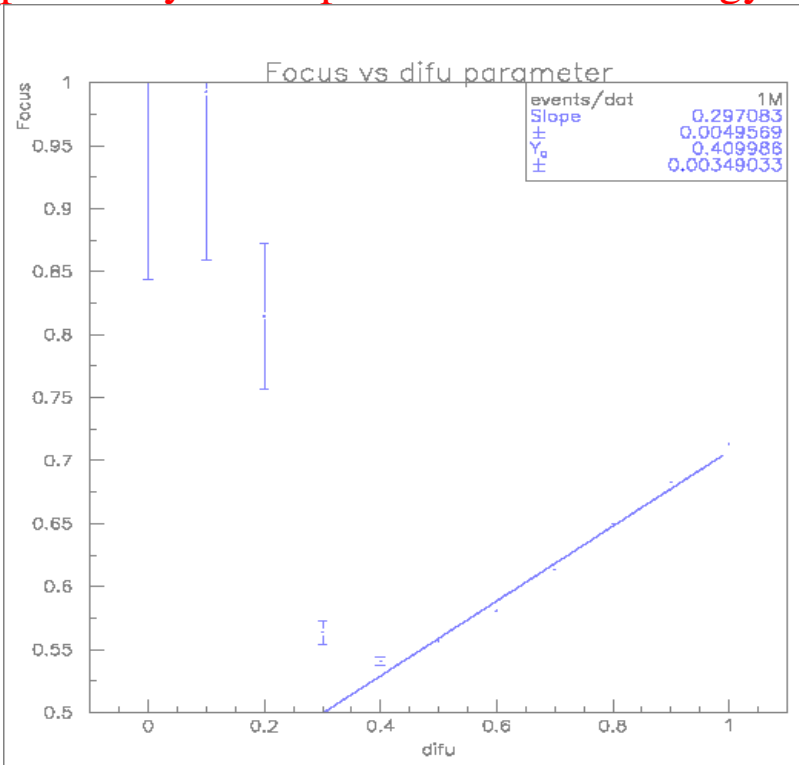


- Dilu parameter has a strong correlation on AP and the focus.
- The AP doesn't follow the expected correlation from the focus. That means that the Dilu parameter influences independently the AP.

Difu parameter dependence

(difu is the proportion of light that is collected independently of the position that the energy is deposited)



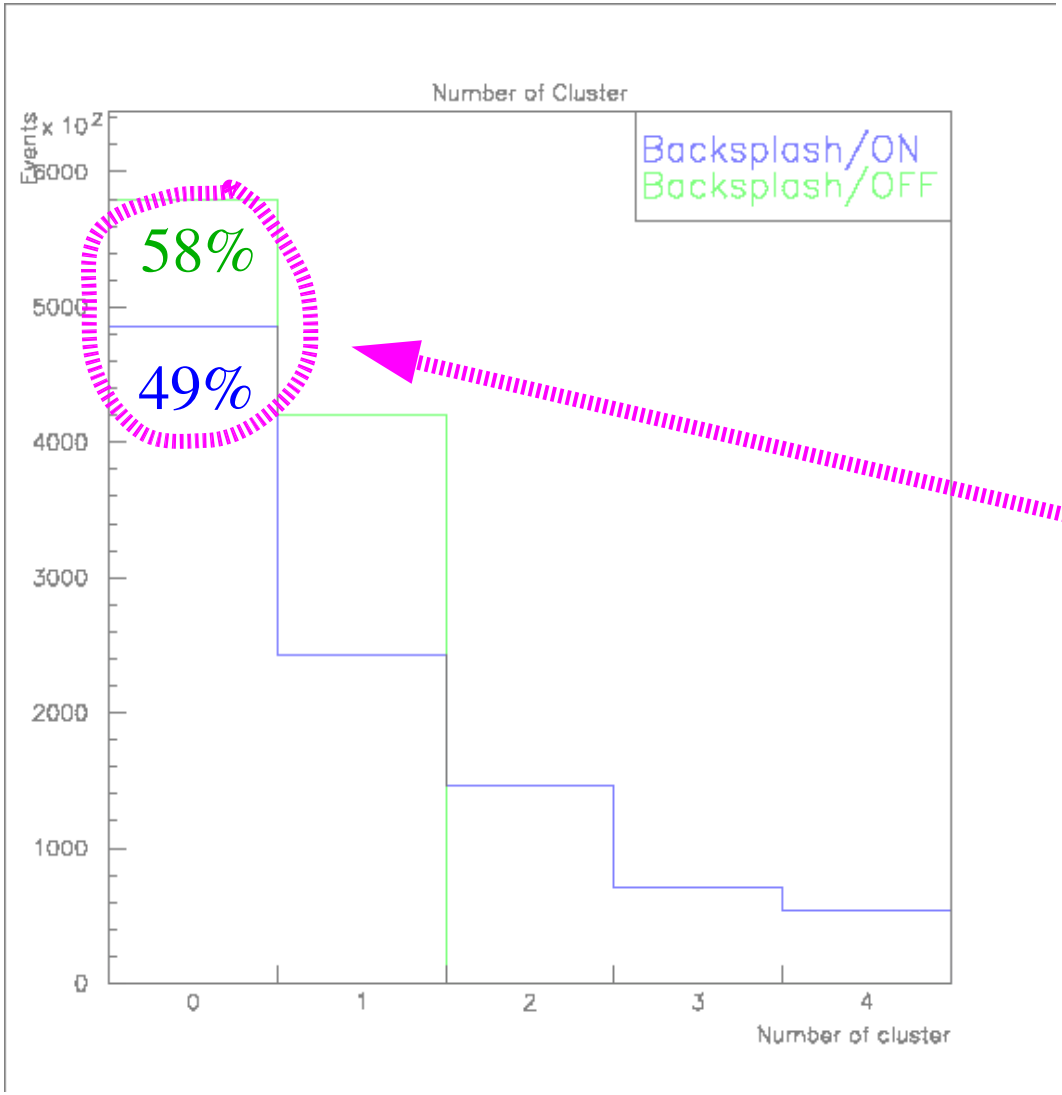


- Difu has a strong dependence on AP and the focus, and this dependence is not linear and not directly related to the focus.
- AP seems to reach a maximum around difu = 0.7. Some investigation should be done to see if this value fit better the real TPOL data than difu = 0.6.

Effect of the Backsplash (BS) on the silicon detector

- In order to analyze this effect, a new TPOL MC simulation has been implemented with Backsplash/Off.
- The Backsplash is removed using the following idea: as soon the position z of the particle(s) cross the end of the silicon detector, the boolean “never_cross” switch from true to false. Once never_cross=false → the energy deposited in the silicon detector is not recorded anymore.
- Backsplash/ON is a “normal” run.

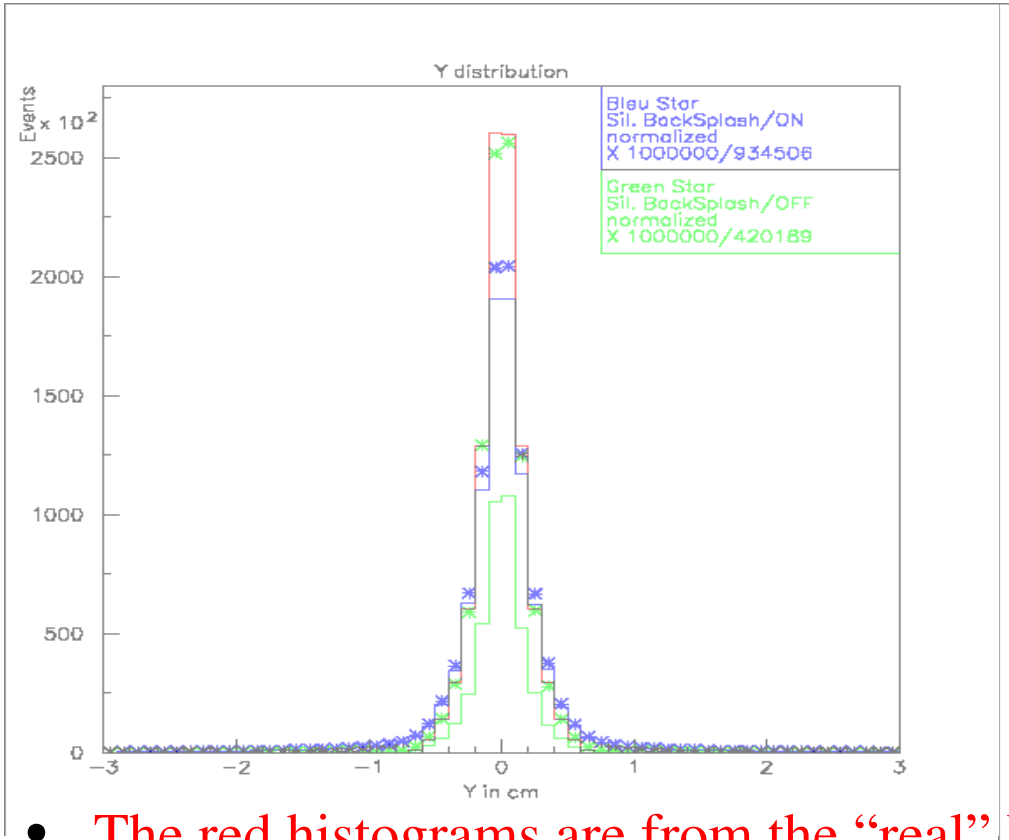
Effect on the # of clusters

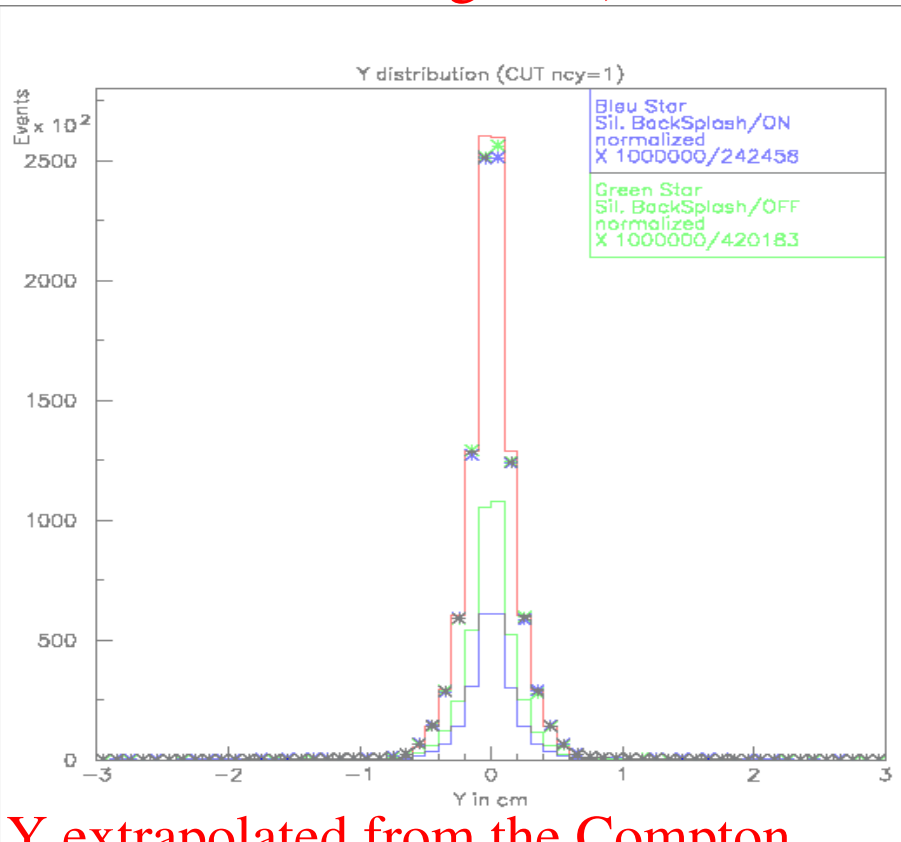


- As expected, there is no more than 1 cluster for BS/OFF.
- 58% of the time there is no cluster for BS/OFF, which mean that the photon did not convert or energy was not sufficient to create a cluster.
- (58-49)/58 = 16%, correspond ~ to the percentage of events with a backsplash significant enough to create at lease one “independent” cluster.
- Will the cut ncy=1 on BS/ON will be enough to remove effect of the BS in the analysis?

The Y distributions

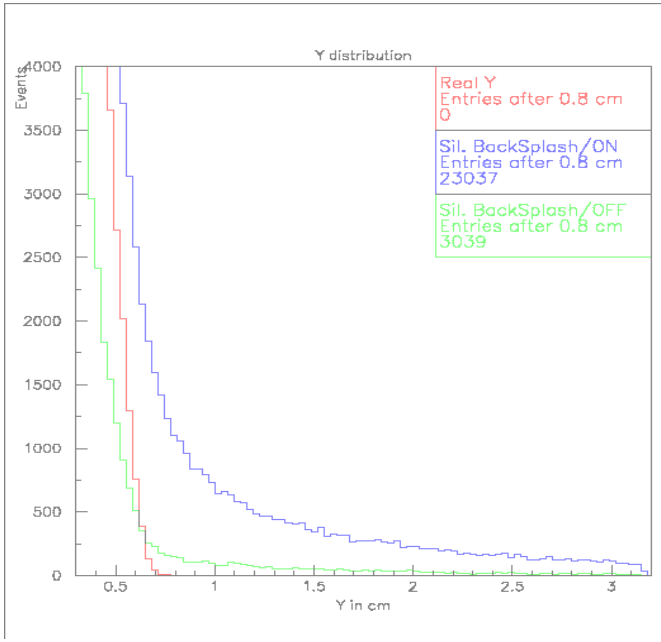
(The stars "*" show the normalized histograms)

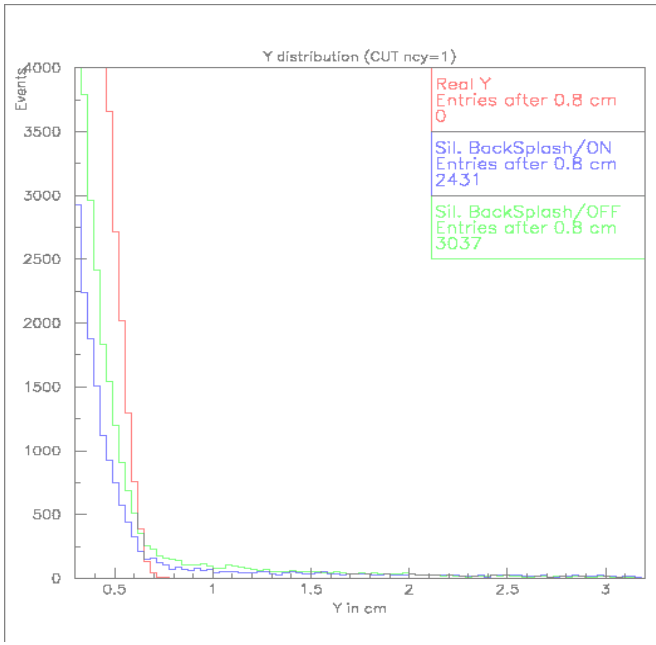




- The red histograms are from the "real" Y extrapolated from the Compton scattering. In other words, the Y we should measured in the MC simulation.
- Y-silicon (BS/off) fits well the "real" Y distribution with and without the cut (ncy=1).
- Y-silicon (BS/on) fits well the "real" Y distribution only with the cut (ncy=1).

Zoom of the end of the Y distributions





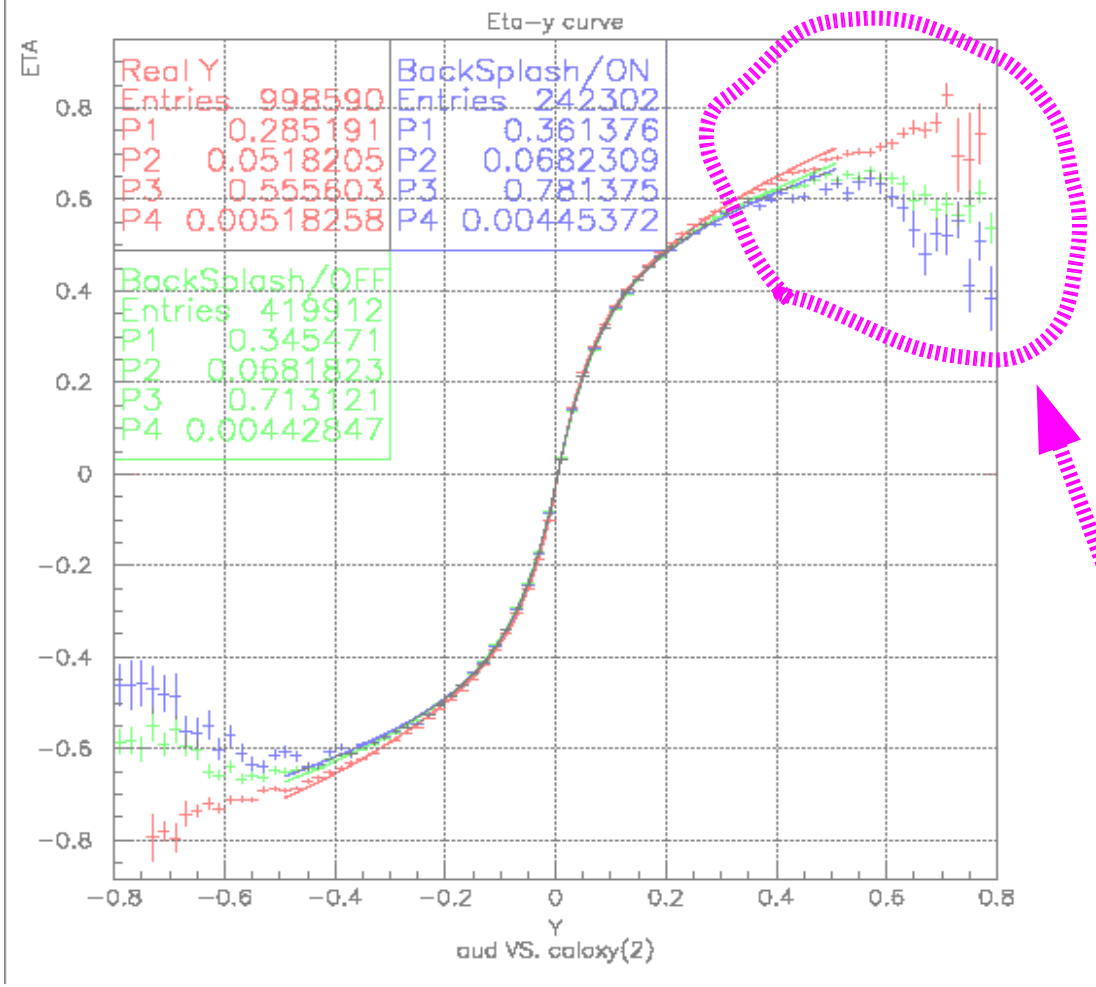
- There is a big disagreement in the end of the Y distributions.
- The cut (ncy=1) make agree BS/ON and BS/OFF , but both don't agree with the “real ” Y distribution: there should be no event detected at more than 0.8 cm.
- Why even BS/OFF record events at more than 0.8 cm? Is it because the way BS/OFF is implemented or there is other “noise” sources?
- If this “noise” is uniform over Y ⇒ represents ~ 1% of the events.

ETA-Y curve

- With cut: ncy=1, E < 16GeV (For Real Y: ncy is free)
- Fitting is done from -0.5 cm to 0.5 cm.

Function Plotted:

eta = abs(y-p(4))/ (y-p(4)) * (1. -p(1) * exp(-abs(y-p(4)) / p(2)) - (1.-p(1)) * exp(-abs(y-p(4)) / p(3)))

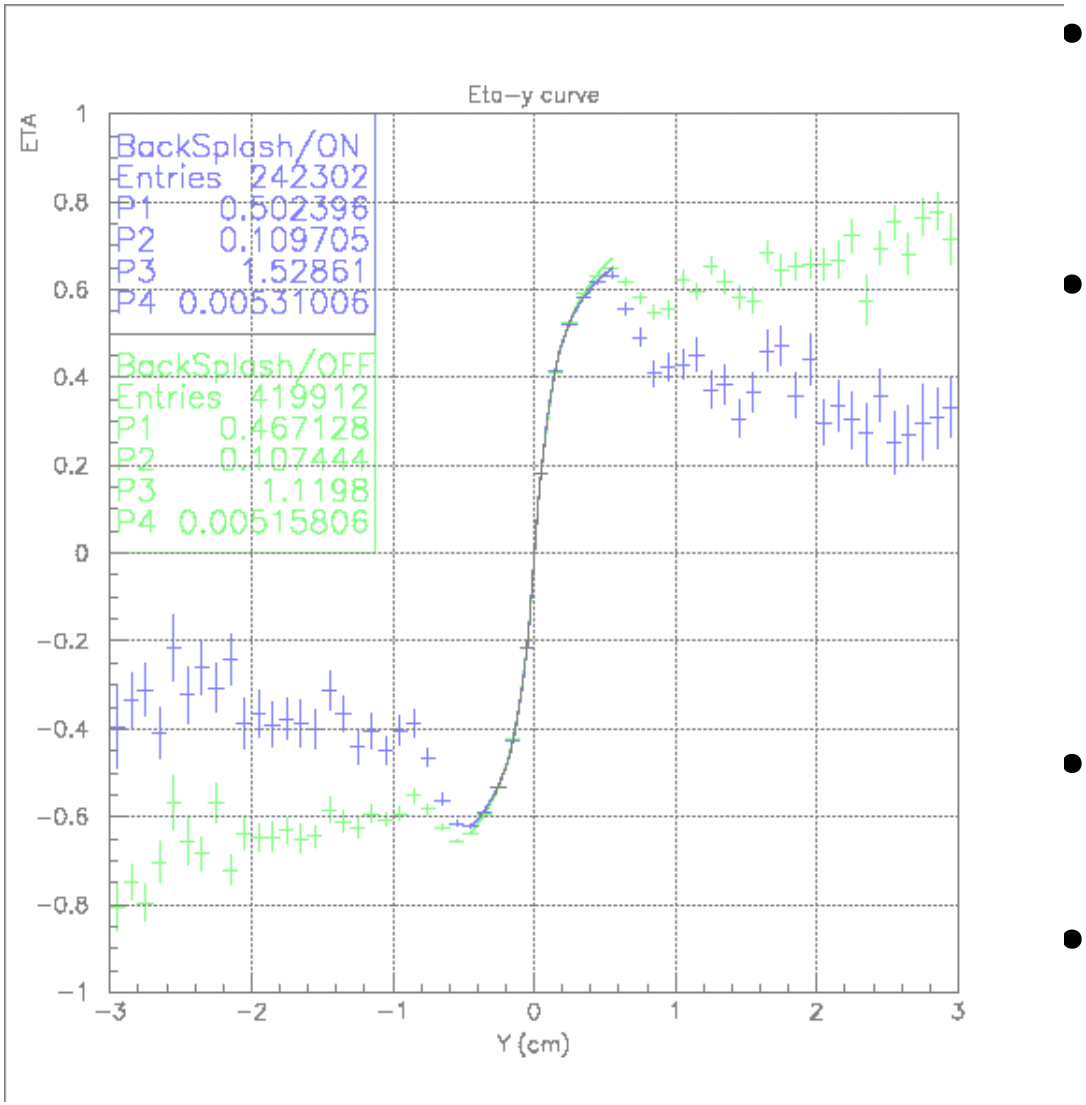


The 3 curves agree very well in the central region.

After ~0.4cm, there is a clear divergence between the silicon data and "real (MC)" data.

The BS/OFF has a better agreement with the "real" η-y curve than BS/ON, but both follow the same divergence... WHY?

ETA-Y curve for large Y



- We can see some obvious noise for Y > 1 cm and it seems to be uniform...
- As we increase Y, our number of statistic decrease and this noise could become significant. Can it explains on its own the divergence with the “real” data after 0.4 cm?
- Is it possible to subtract this noise?
- Why η not the same at large Y for BS/ON and BS/OFF?

The cost of the cut (ncy=1)

The cut ncy=1 seem to remove efficiently the effect of the backsplash, but we pay heavily on the statistic:

% of event collected by the silicon detector	BS/OFF	BS/ON
No cut	42.02%	51.42%
Cut (ncy=1)	41.99%	24.23%

We lose close to 50% of the detectable events using the cut ncy=1

Summary and points to investigate

- The dilu and difu parameters have a strong influence on the AP and the focus. Some investigations should be done to determine more accurately their exact values.
- Most of the effect of the BackSplash can be removed using the cut (ncy=1), but we lose close to 50% of the statistic.
- The “real (MC)” η-y curve doesn't agree with the silicon η-y curve after (|y| > ~0.4 cm). Why?
- Why, even with BS/OFF, the silicon detector in the MC simulation record events at (|y| > 0.8 cm) when there is no “real” event there?