Study on the impinging angle of the photons on the SiPM

We'll see Plots of the angle the photons make with the nomal of the PM surface

- in function of x,y, coordinates of the impact on the mirror
- the normal changes with the position because the detector it's not a plane

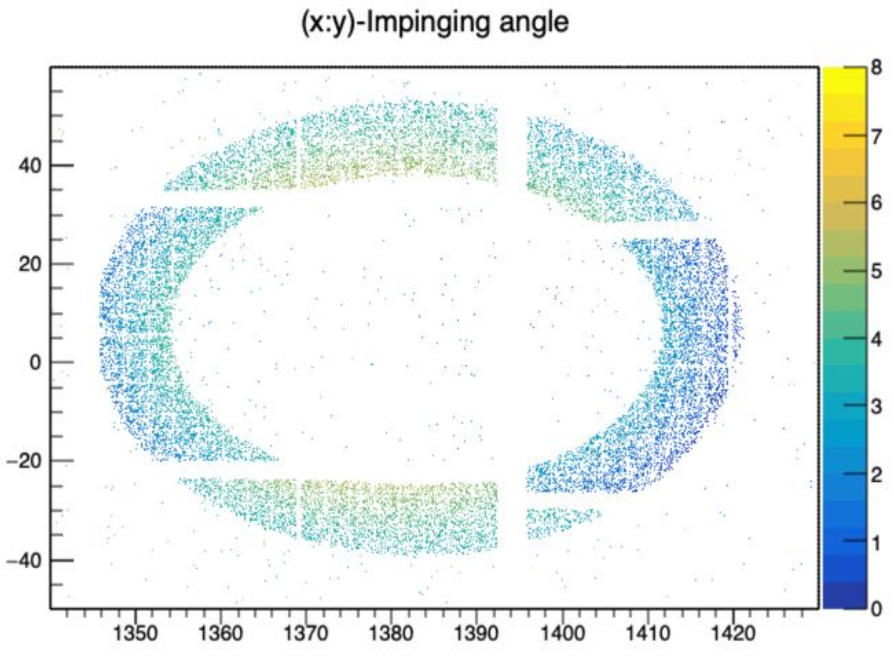
- important because
  - at higher angles the photons can be reflected by the PM without being detected
  - we can tune the detector to minimize this phenomena
- We can also plot the impinging angle with the x and y axis of the PM, just in case

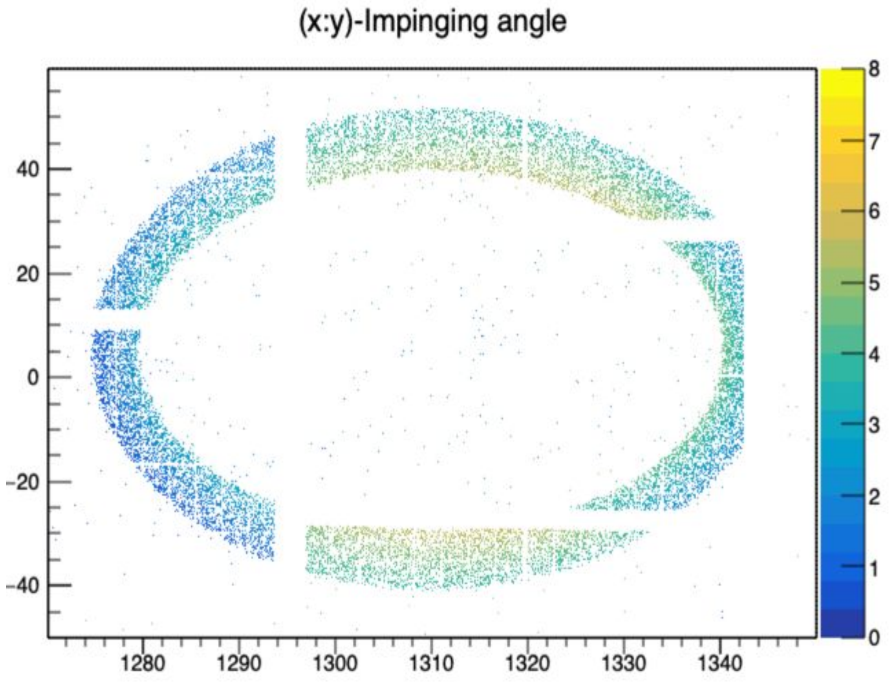
Impinging angle at different η

- Different etas means different angle with the mean axis of the beam
  - The photons will hit the mirror, and the detector in a different region
  - the normal of the detector, the impinging angle, and the spherical aberration will be different
- Pions with 50Gev momentum were launched
- Phi coordinate on the mirror was fixed at Φ=0
- η =1.8,2.0,2.5,3.5
- We are watching the gas ring

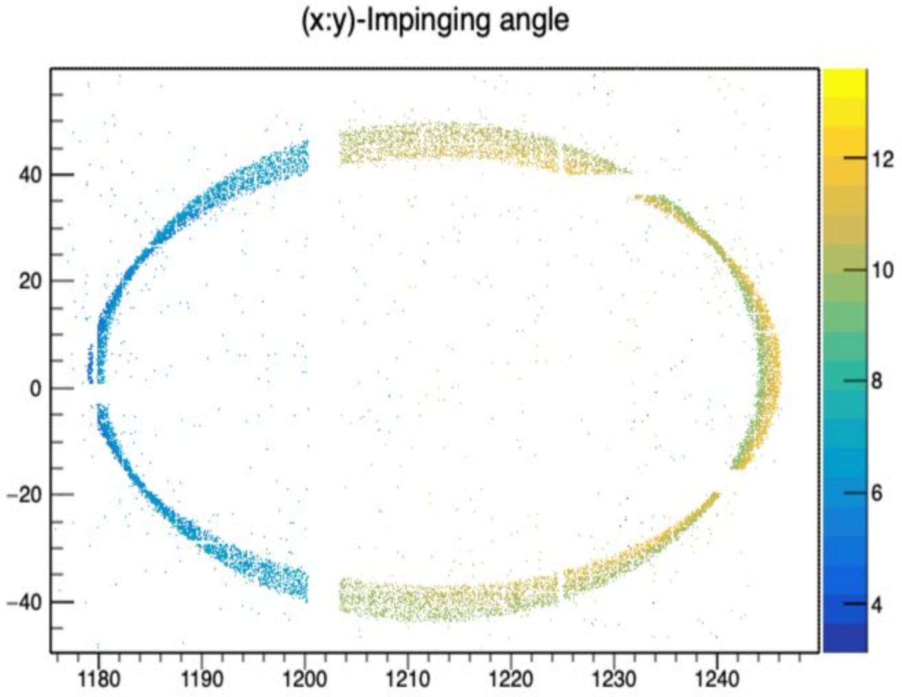
η=1.8, p=50GeV

η=2.0, p=50GeV

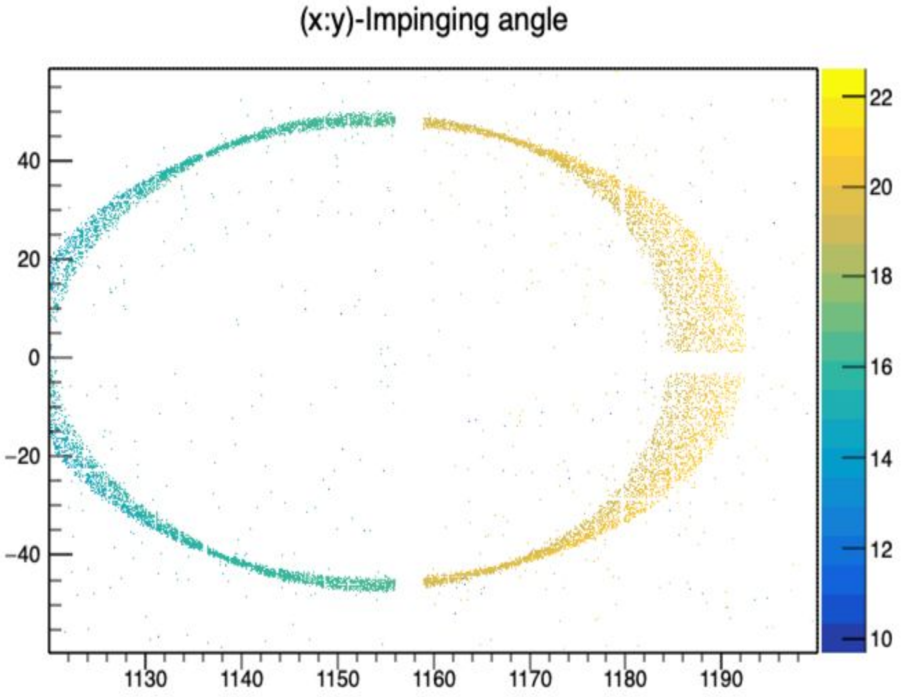




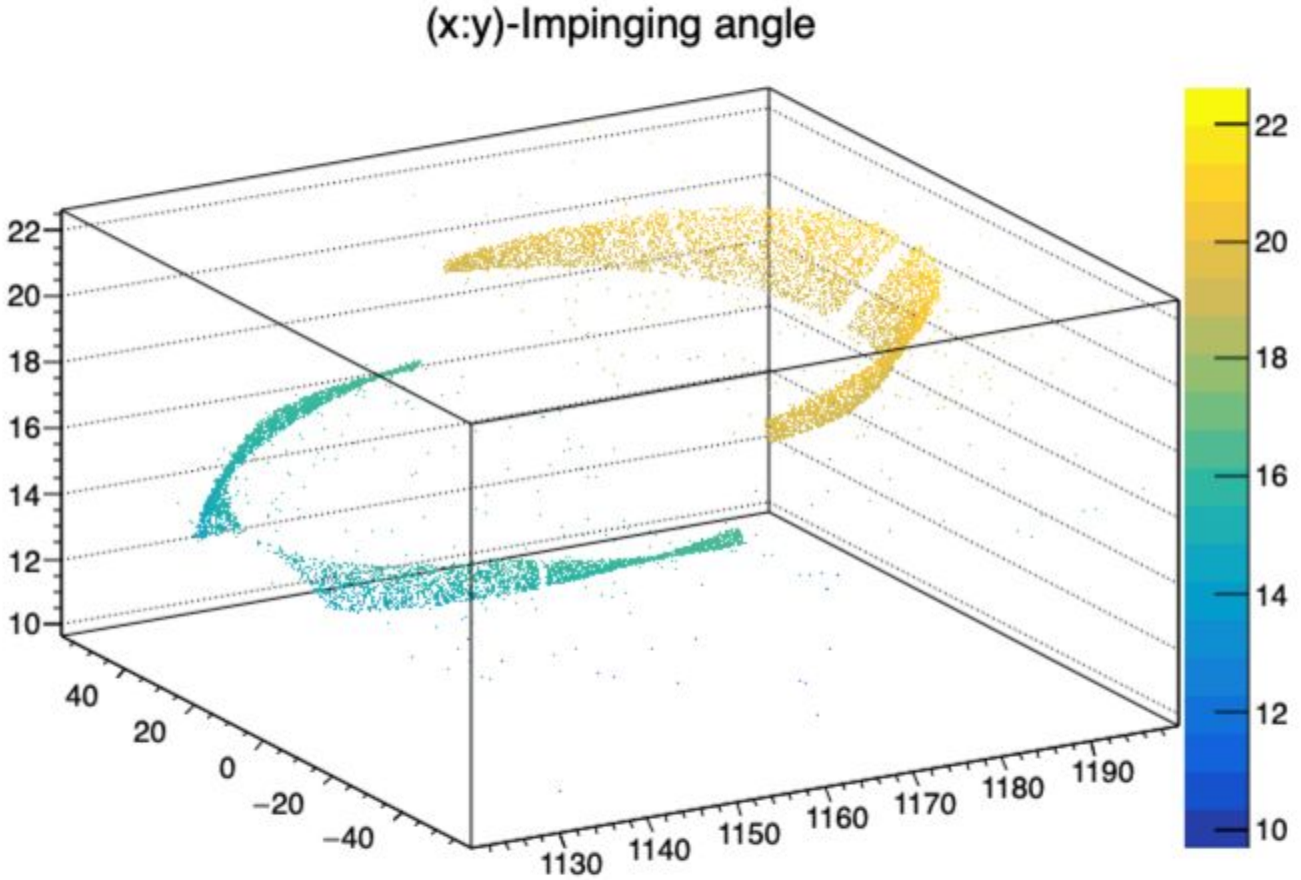
η=2.5, p=50GeV



η=3.5, p=50GeV



η=3.5, p=50GeV, 3Dimensional view

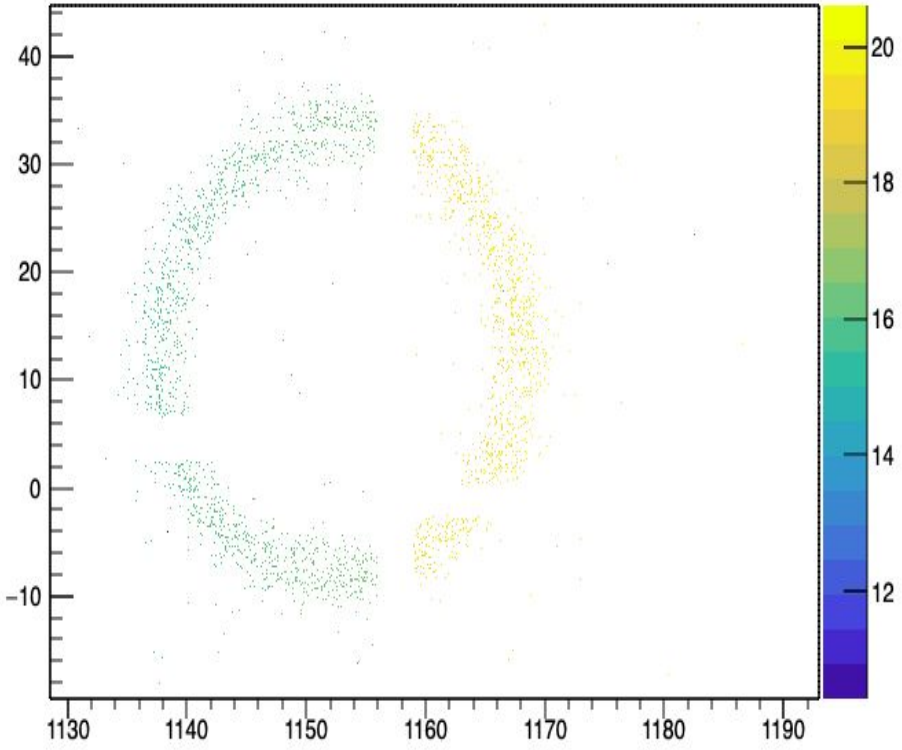


What can we see?

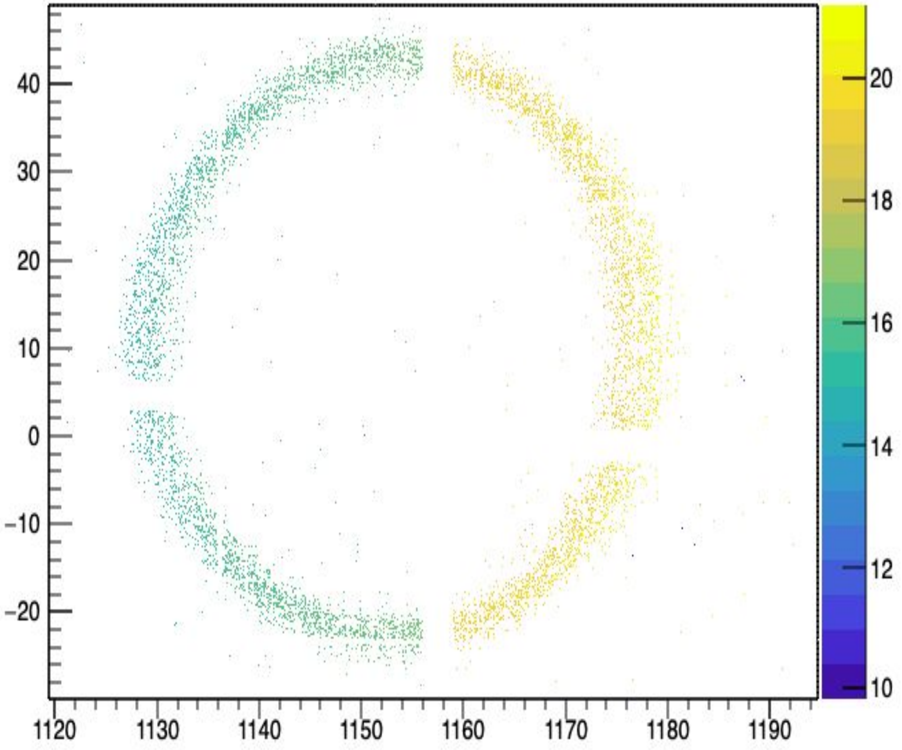
- at lower etas, higher angles, the photons will have a lower impinching angle,
  - the trajectory its almost parallel to the normal
- on different sides the photons will have different angles due to the inclination
  - in our case we fixes phi=0, so the particle is inclined horizontally, up and down are symmetrical
- We can see how the spherical aberration changes with phi (along the ring) , there are regions of the rings thickers and other thinners.
- Keeping the momentum constant, at different η the ring move long the x axis, keeping the y coordinate constant (obvius)

Impinging angle at different momentum

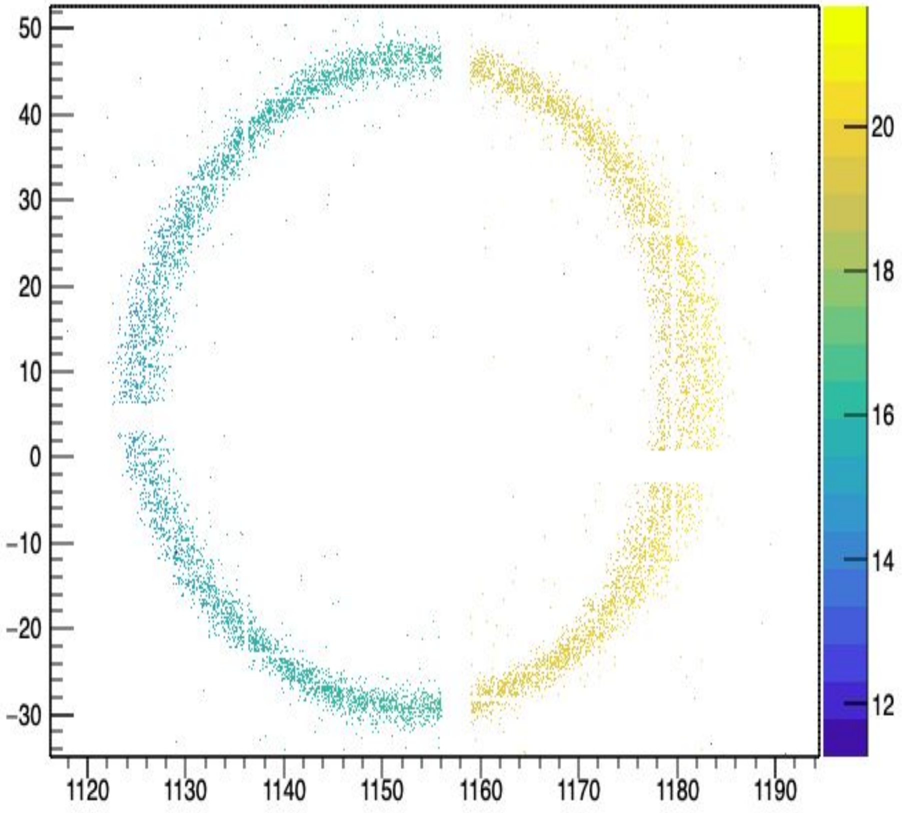
η=3.5, p=4GeV



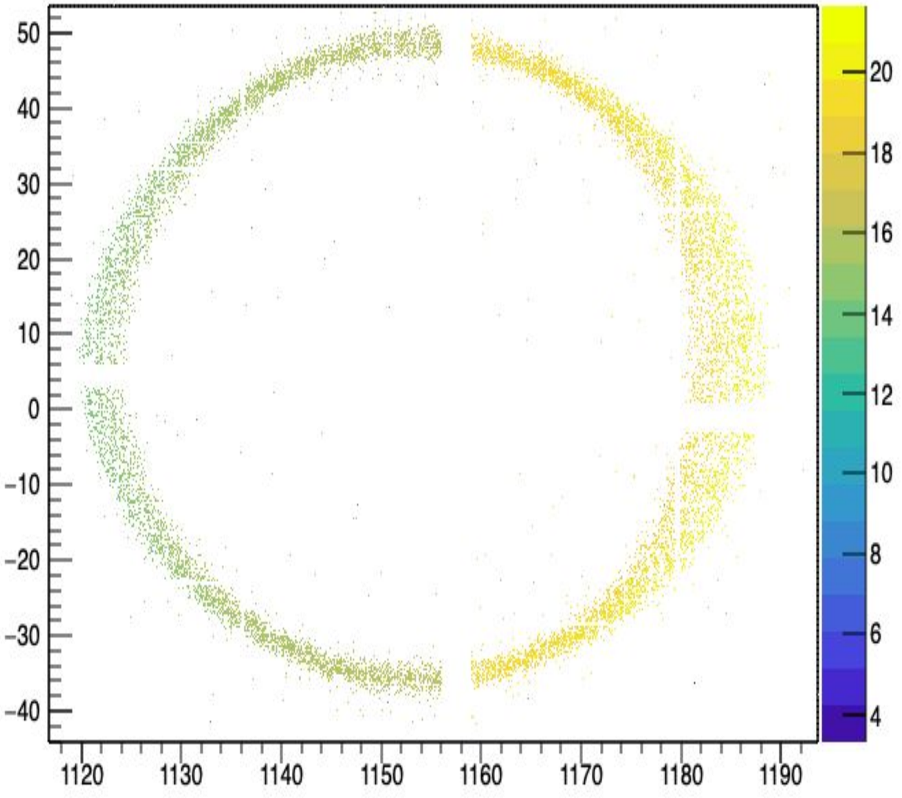
η=3.5, p=5GeV



η=3.5, p=6GeV



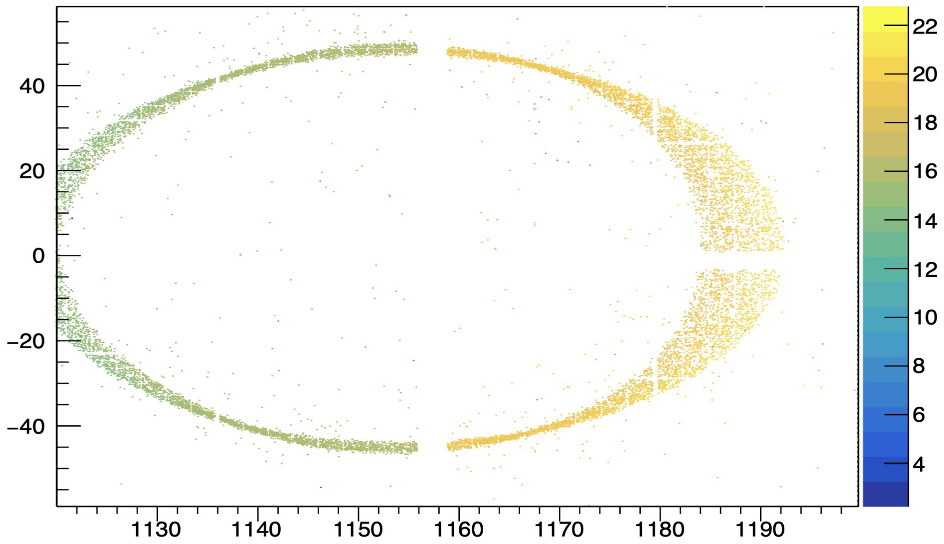
η=3.5, p=8GeV



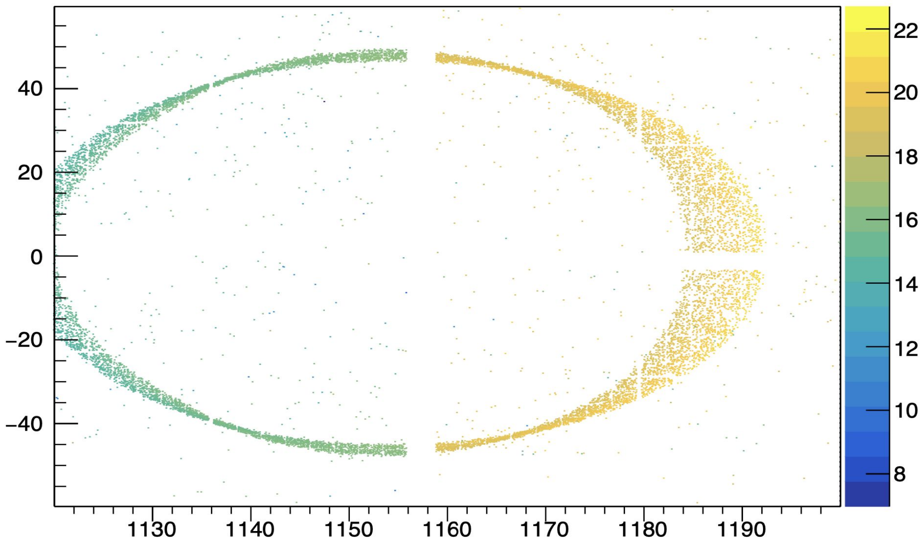
What can we see?

- The angles don't change
- The y position change because of the nenging by the magnetic field becoming less important at higher momentum
- The dimension of the ring increase (until saturation)

η=3.5, p=30GeV



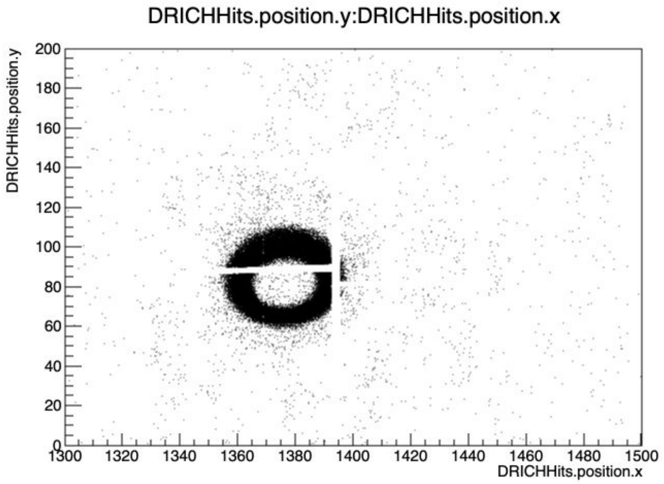
η=3.5, p=60Gev

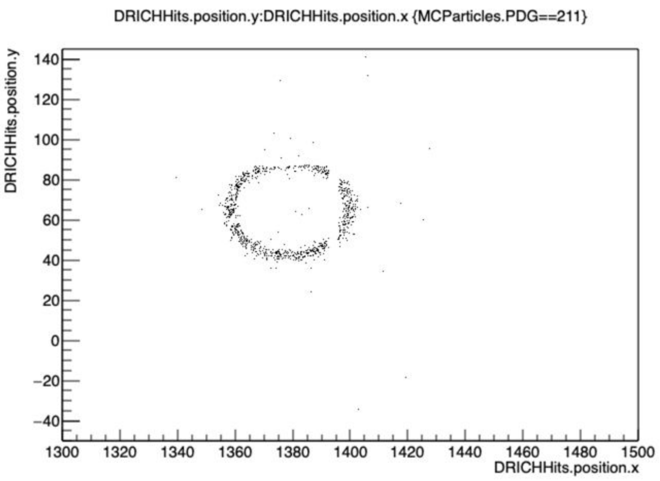


Low momentum

At a lower momentum we can see that a lot of the photons detected are not generated by pions

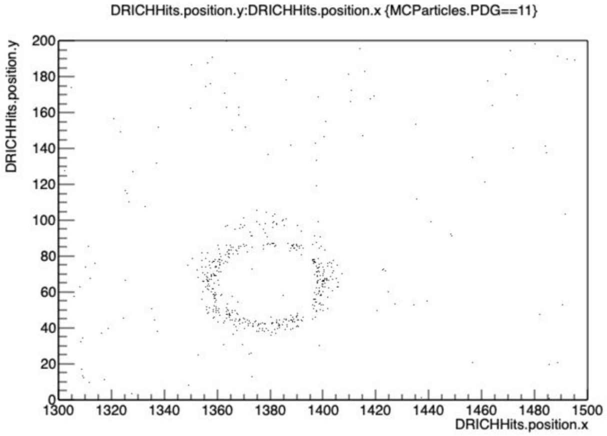
Photons detected at η=1.8, p=5GeV vs only the photons produced by pions





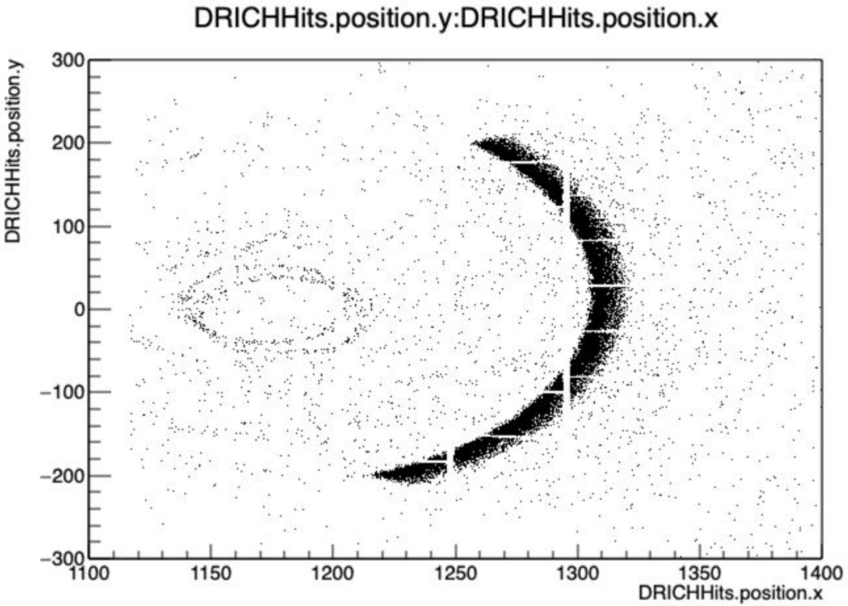
What are they?

Most of them are electrons, we can see it



Even under the threshold, we can see 2 rings,

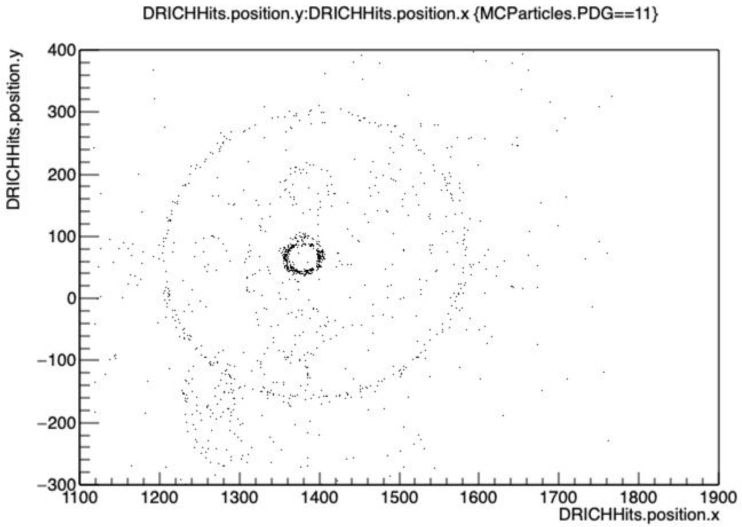
one it’s an electron, the other a positron



η=3.5, p=3GeV

There are no muons

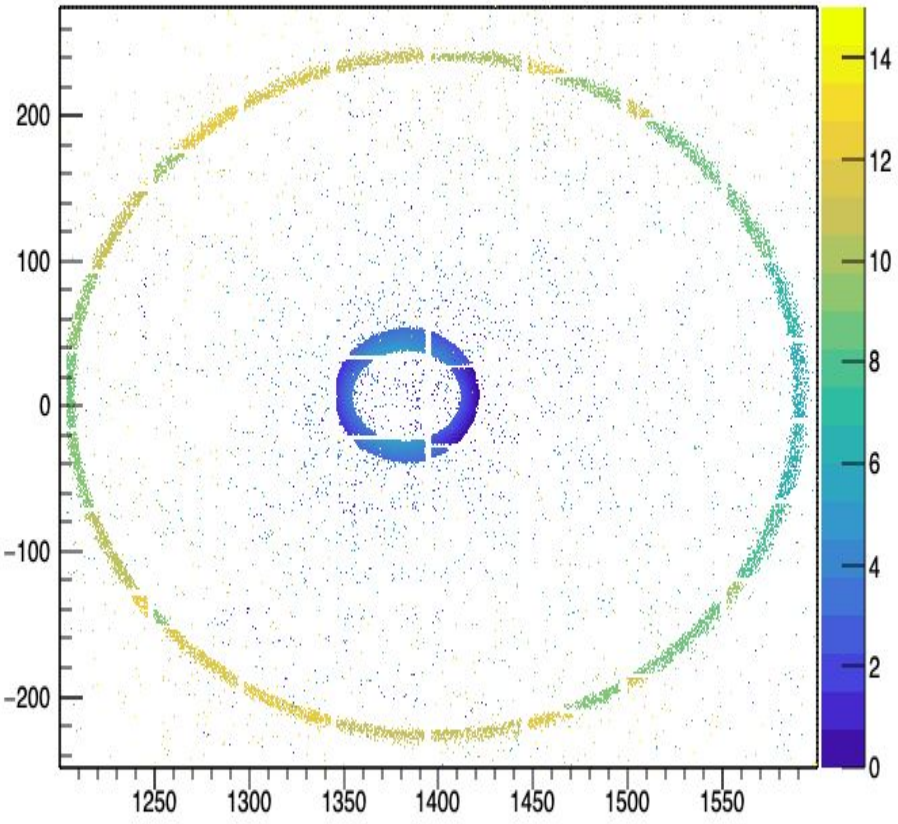
With the aerogel ring



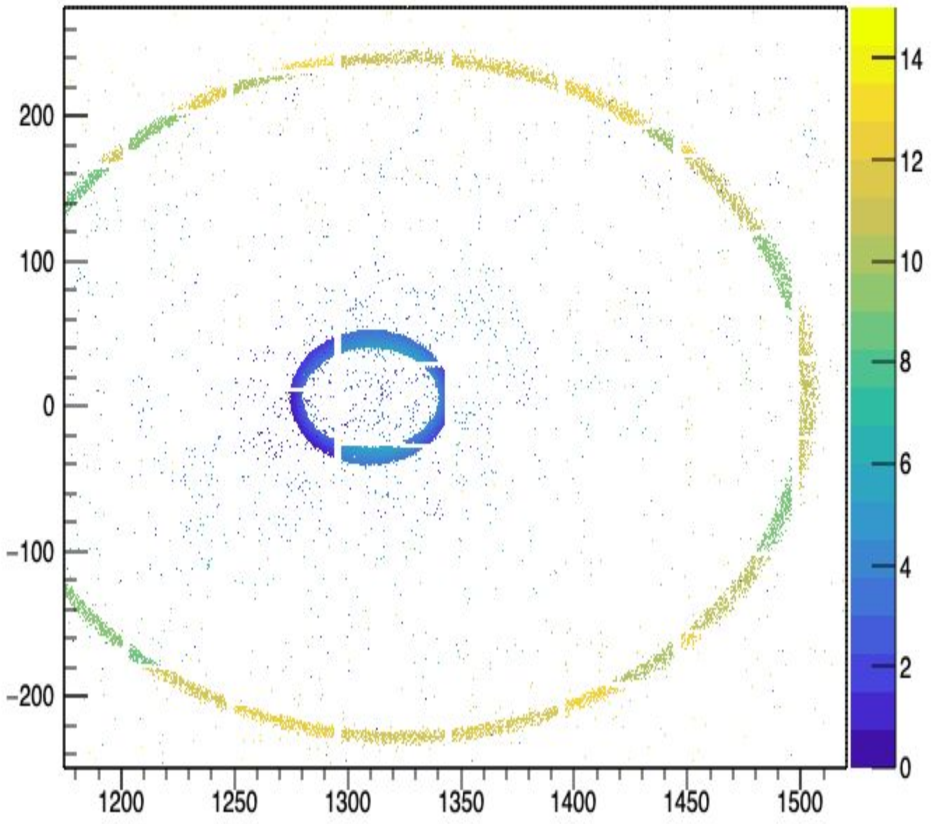
same results, but

- the angles are bigger than gas ones
  - The photons are emitted with a bigger angle
- we have aberration
  - (the angle is higher, but the beam is thinner)
- we can still see an electron ring at lower momentum

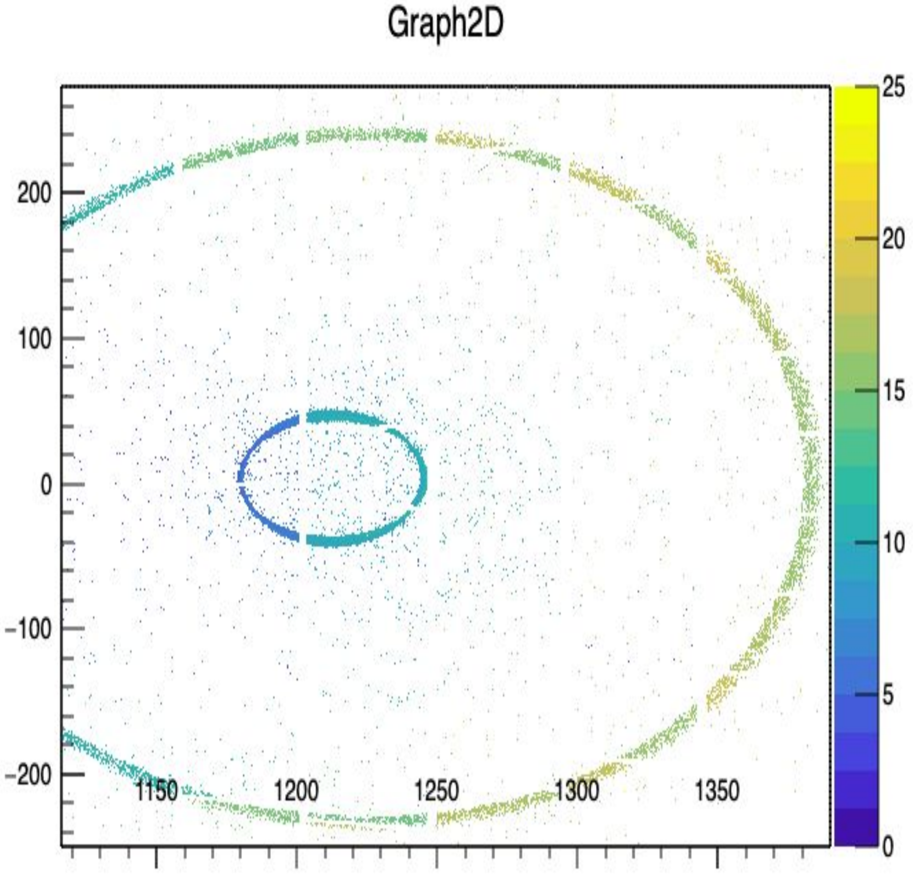
η=1.8, p=50GeV



η=2.0, p=50GeV



η=2.5, p=50GeV



η=3.5, p=50GeV