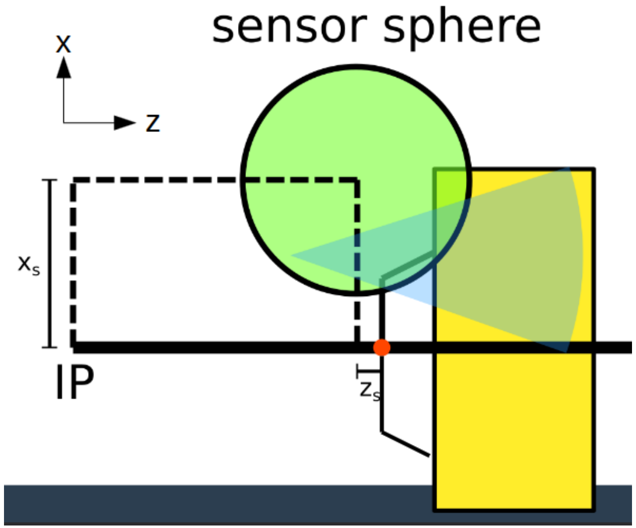
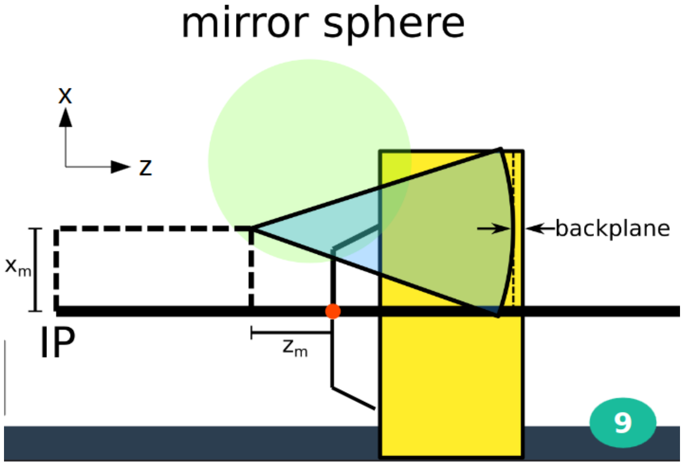
dual mirror tuning

Chandradoy Chatterjee

How a single mirror is defined.

- The parameters of the mirror are dependent on the parameters of sensor.
- Given our sensor sphere has a centre (x_s,0,z_s); we want to focus our image at:
  x_f = x_s+foc_x;
  z_f = z_s+foc_z;
- z_m=(b.z_f)/(2.b-z_f);
  x_m=(b.x_f)/(2.b-z_f);
  b = DRICH_Z_max - backplane





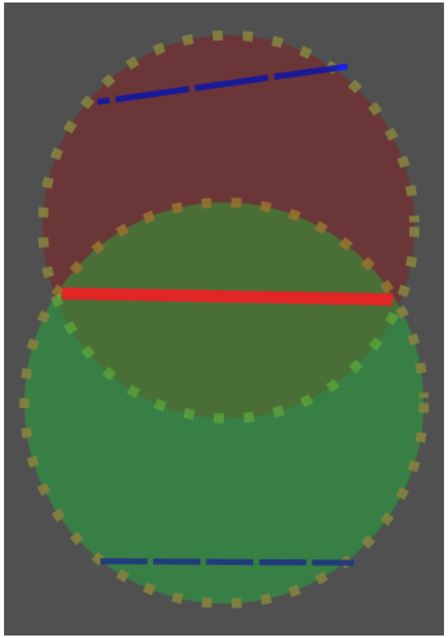
How double mirrors are defined.

1. Each mirror segment is defined with `slightly` different parameters for two different spheres.

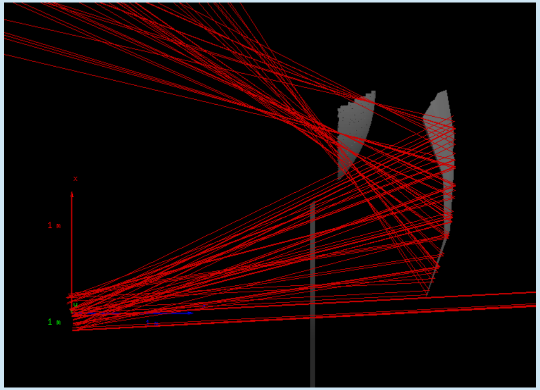
2. Then a bool cut is defines the plane of intersection; essentially this splices (joins) the two mirror segments.

3. The intersections of these two mirrors can have two modes
    a) convergent
    b) divergent

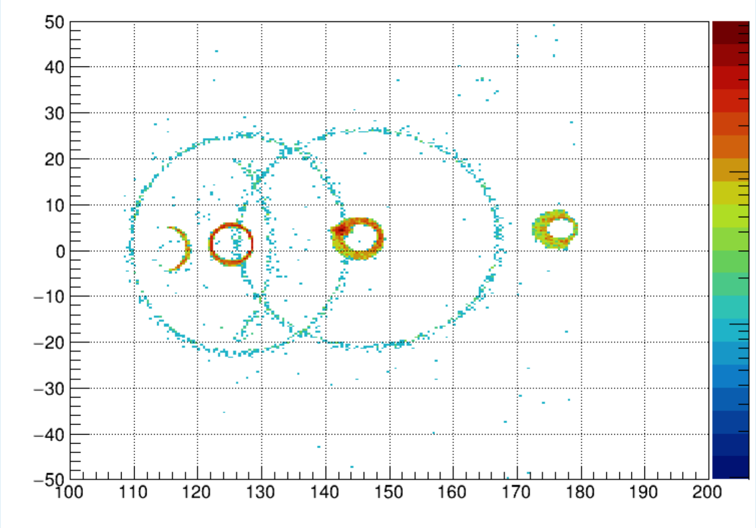
4. The ideal intersection plane is parallel to beam axis. → Two mirrors should have `same` z_centre-→ similar foc_z for a given sensor parametrization.



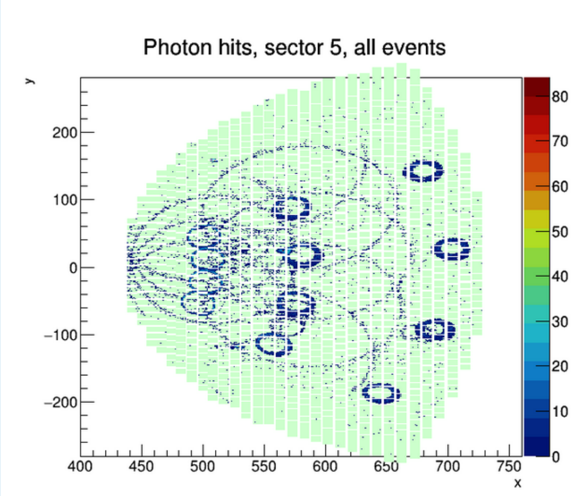
Steps to tune mirror &/ sensors



First a collimated photon beams are shot
to identify parameters where the photons
converge at the sensor envelope.
→ parallel-point



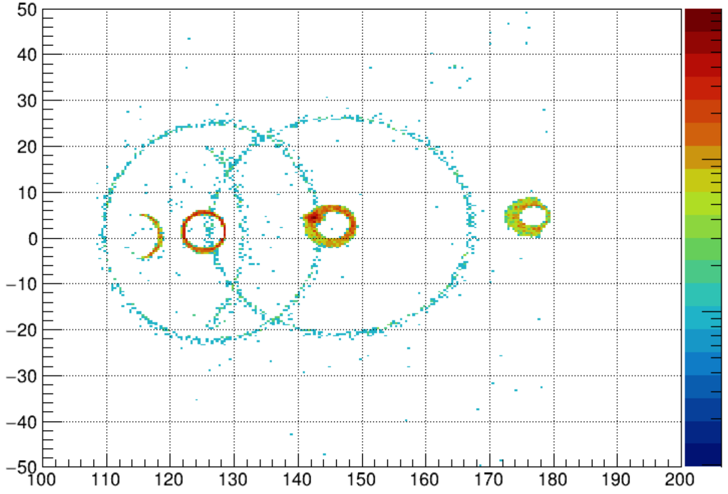
Saturated pions at required eta ranges shot to check ring quality



Azimuthal scan over all sectors...

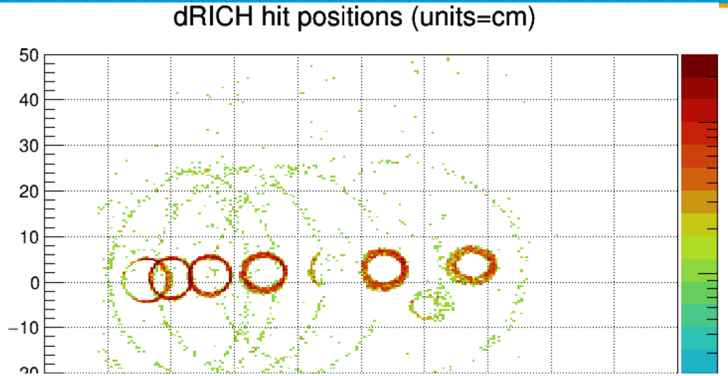
Works reasonably for single mirror configuration!
Final confirmation comes from resolution studies

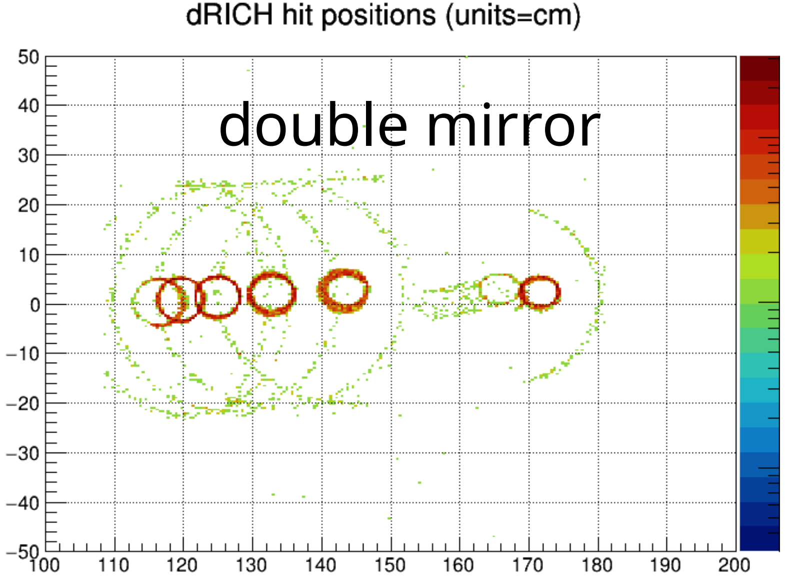
Image from single mirror and double mirror



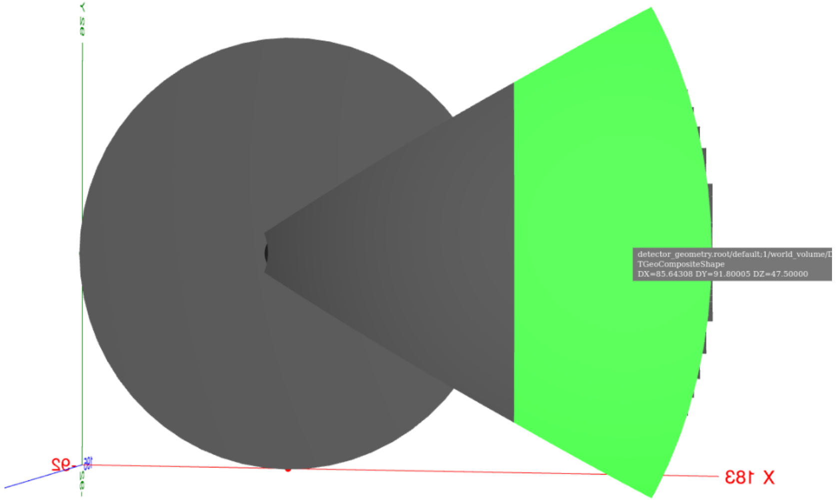
Single mirror

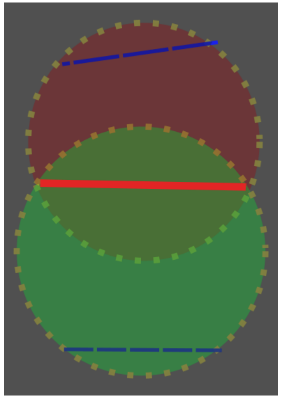
Double mirror imaging can dramatically change on the chopping!

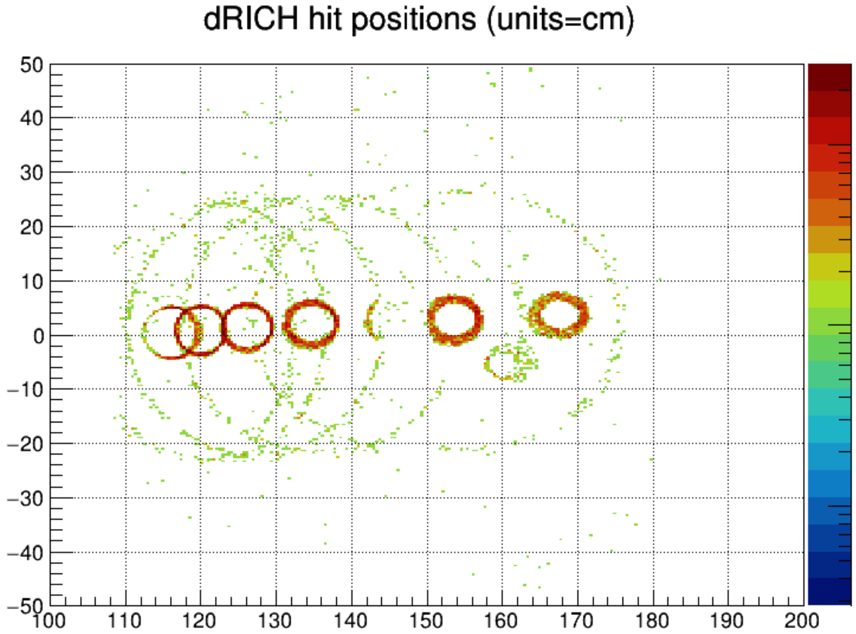




How double mirrors are working.



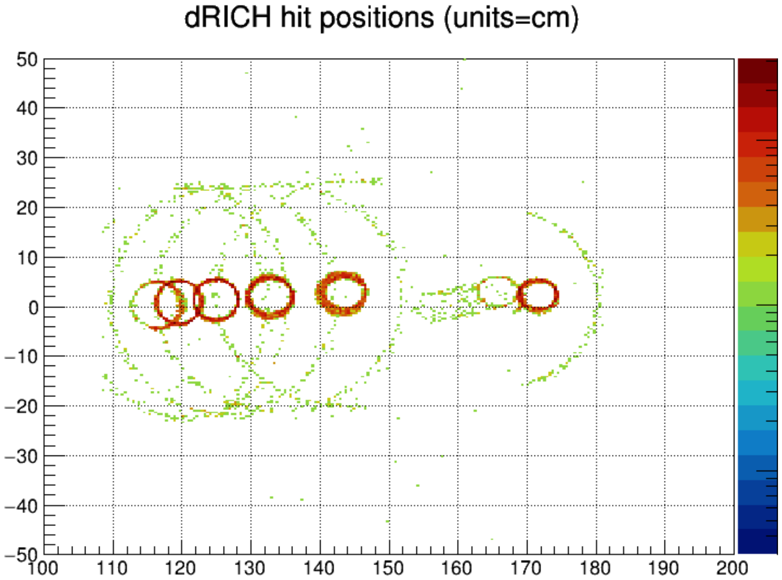


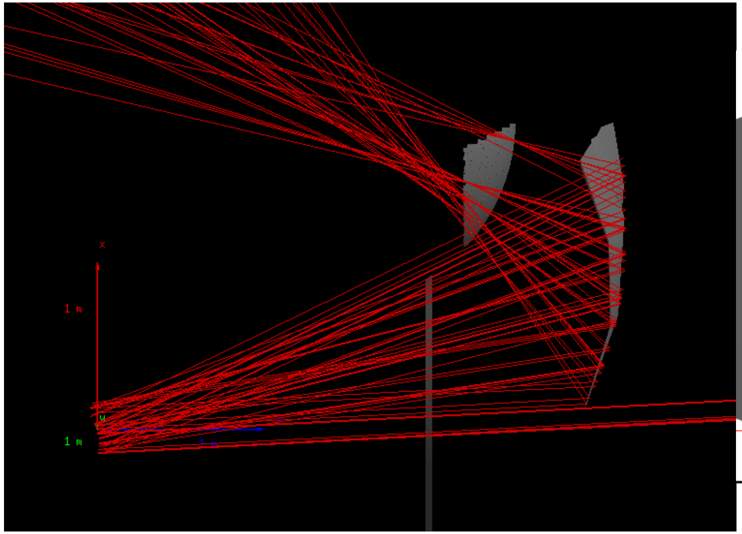


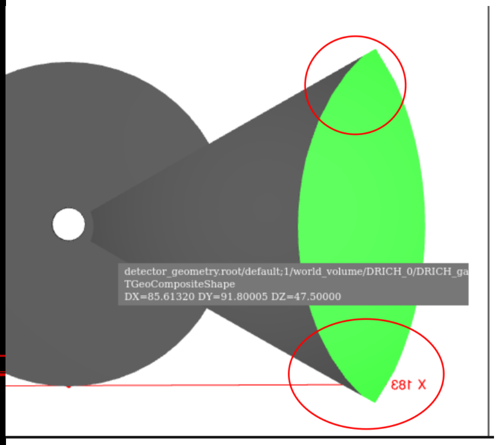
DRICH_mirror_center_x_0_sec0	=	115.059
DRICH_mirror_center_x_1_sec0	=	127.533
DRICH_mirror_center_y_0_sec0	=	0.000
DRICH_mirror_center_y_1_sec0	=	0.000
DRICH_mirror_center_z_0_sec0	=	95.589
DRICH_mirror_center_z_1_sec0	=	99.021
DRICH_mirror_radius_mir0	=	218.311
DRICH_mirror_radius_mir1	=	214.879

DRICH_sensor_size	=	2.580 = 25.8*mm
DRICH_sensor_sph_center_x_sec0	=	183.400 = 183.400000
DRICH_sensor_sph_center_y_sec0	=	0.000 = 0.000000
DRICH_sensor_sph_center_z_sec0	=	138.400 = 138.400000
DRICH_sensor_sph_radius	=	110.000 = 110.000000

How double mirrors are working.



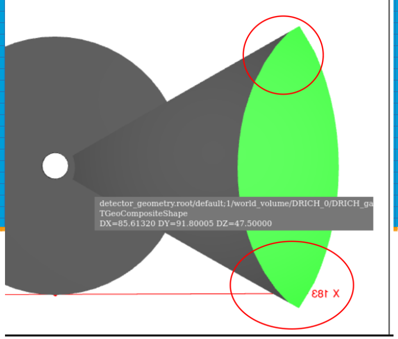




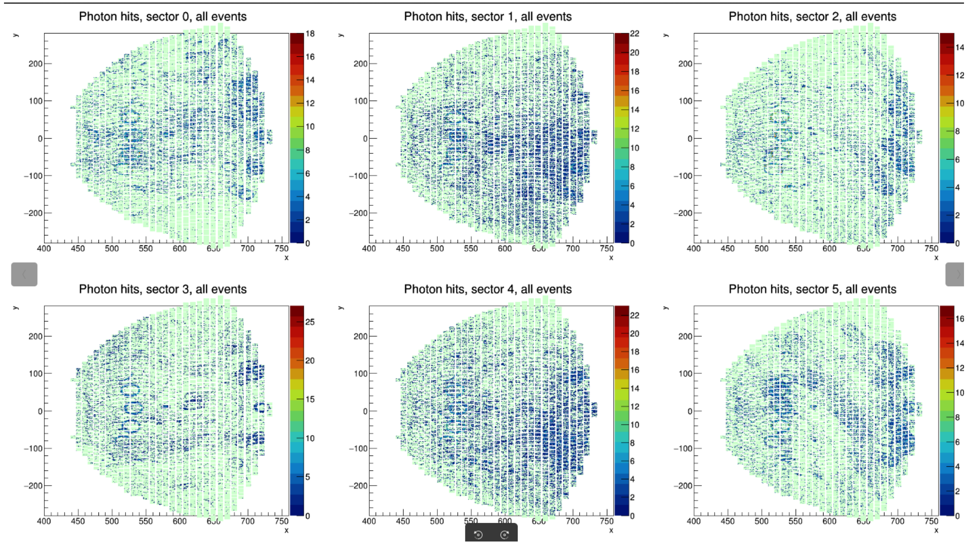
DRICH_mirror_center_x_0_sec0 = 111.697
DRICH_mirror_center_x_1_sec0 = 138.972
DRICH_mirror_center_y_0_sec0 = 0.000
DRICH_mirror_center_y_1_sec0 = 0.000
DRICH_mirror_center_z_0_sec0 = 102.511
DRICH_mirror_center_z_1_sec0 = 161.819
DRICH_mirror_radius_mir0 = 211.389
DRICH_mirror_radius_mir1 = 152.081

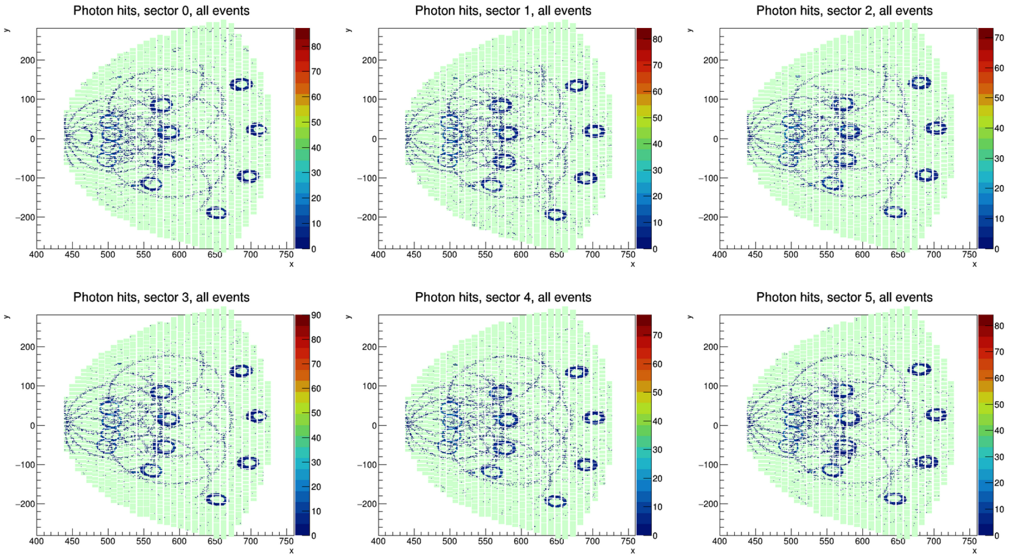
DRICH_sensor_size = 2.580 = 25.8*mm
DRICH_sensor_sph_center_x_sec0 = 183.400 = 183.400000
DRICH_sensor_sph_center_y_sec0 = 0.000 = 0.000000
DRICH_sensor_sph_center_z_sec0 = 138.400 = 138.400000
DRICH_sensor_sph_radius = 110.000 = 110.000000

Noise hits increased?



Depending on the orientations (if wrong) of two mirrors the noise hits is dramatically increasing





Aparantly tuned with particles at fixed polar angle can be disaster in uniform polar angle scan

What we have **understood** and we ***plan*** to do in the next days

- **The tuning of two interescting spheres are very complicated and may require several iterations.**
- **Tuning in uniform particle phi may or may not converge. A polar angle scan is a must (This was not this much critical in the single mirror configuration) → NO MORE 2D TUNING → WE NEED A 3D INTERACTIVE VISUALIZATION!!**
- **The dual mirror kind of works. The full features are not yet understood.**

- ***Our current IRT algorithm is not aware of two mirrors scenarios. No straight forward way to estimate resolution of a dual mirror configuration.***
  - One idea is to upgrade the code. This will take time, (hoping pfRICH IRT will be our main IRT soon)
  - Work around, to run single mirror cofiguration each time with mirror configurations of dual mirrors. Not time saving either.
- ***To try with a `plane` sensor surface? And free the mirror parameters free from sensor-sphere configuration?***
- ***Instead of blind tuning → Analytically compute the mirrrors' parameters first → Plug in to fine tune.***