SRC Weekly Meeting
June 12, 2012

Optics for Both Left and Right High Resolution Spectrometers

LHRS & RHRS

and everything else

Navaphon Muangma (Tai)
"SRC Weekly Meeting", June 12, 2011

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Overview

Optics calibration is the calibration of the transport matrix. The transport matrix translates the focal plan information to the target information, i.e.,

(x_fp, y_fp, theta_fp, phi_fp) to

(dp, y_tg, theta_tg,phi_tg)

Where each target variable can be expressed as the series expansion of the focal plan variables.

i.e. $y_{tg} = Y_{jki} * theta^{j} * y^{k} * phi^{l}$

where $Y_{jki} = C_i * x^{i}$

Overview

The optic runs with known target variables are required as follow:

Optimized variable	Required
Vertex	Multiple-foil target. [known separations and locations]
Theta & Phi	Multiple-foil target with Sieve inserted. [know holes separation, Sieve location]
dp	Various dp scan for the same central_p, i.e., +/-4% +/-2% and 0%. For carbon target and Hydrogen target

Left Optic Run-list

Calibration	Run	Target	Beam Energy (GeV)	Central Momentum (GeV)	Central Theta (degree)	Sieve	Comment
Vertex	1237	C-Optics	2.25776	2.05494	16.5026	Out	Known miss-pointing information
Theta & Phi	1238	C-Optics	2.25776	2.05494	16.5026	In	Sieve Location from 2009 survey
Dp	1228, 1229, 1231, 1243, 1241	LH2	2.25776	2.13707, 2.09598, 2.05496, 2.02001, 1.97291	16.5026	Out	Single Elastic strip but strongly dependent on the scattered angle
Dp	1884, 1888, 1892, 1995, 2005	C-Optics	1.1601	1.14002, 1.118, 1.09597, 1.074, 1.05498	17.4997	In	Multiple peaks from Carbon excitation state
Dp	2871, 3,5,6	C-Optics	4.45629	3.60145	20.3008	In	Exact momentum for the production kinematics

Right Optic Run-list

Calibration	Run	Target	Beam Energy (GeV)	Central Momentum (GeV)	Central Theta (degree)	Sieve	Comment
Vertex, Theta & Phi	2017, 2018, 2019	BeO, 4cm Al Dummy, 15 cm Al	?	?	12.5	In	Known miss-pointing information

Outline

- **Vertex**
  - Vertex calibration
  - Target y resolution
  - Solid Target vs. Cryo Target offset
  - Miss pointing Calculation

Outline

- **Theta & Phi**
  - Sieve Location
  - Hole Location

Outline

- Dp
  - Energy lost
  - Exact momentum setting for each point in delta scan

LEFT OPTICS

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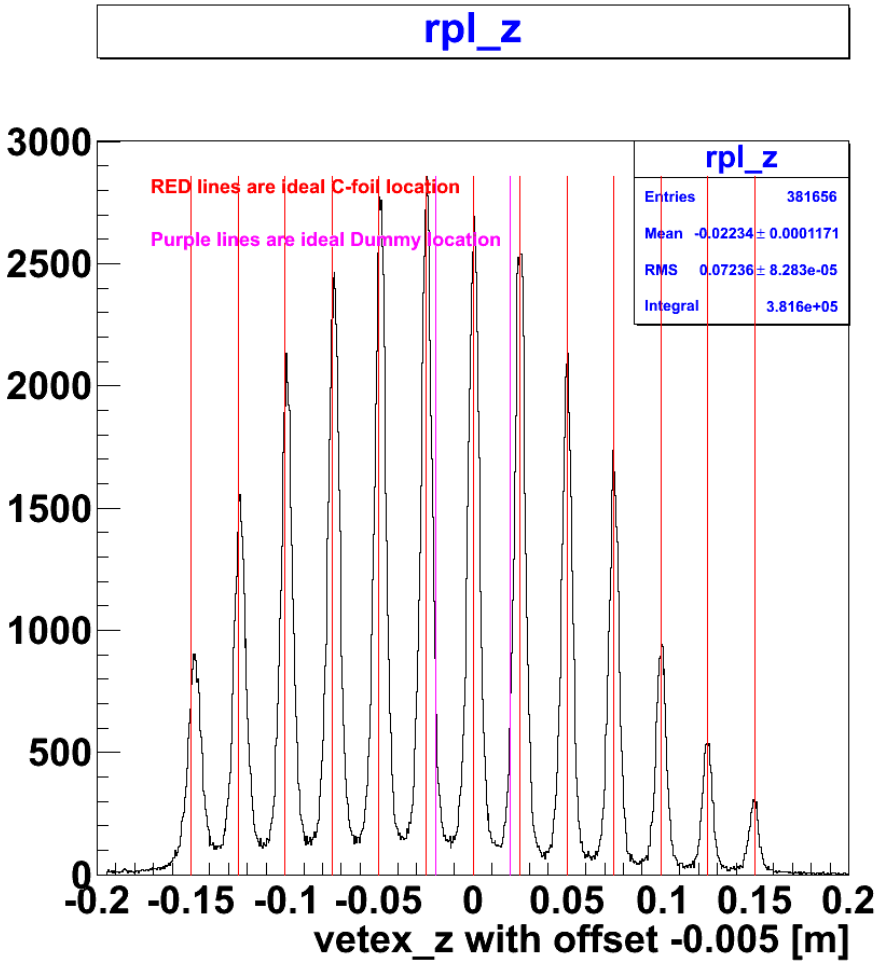
Left Vertex

Offset for the Solid target is -0.005 m (5 mm).

Run 1237

Angle 16.5 degree

With miss-pointing offset imposed.



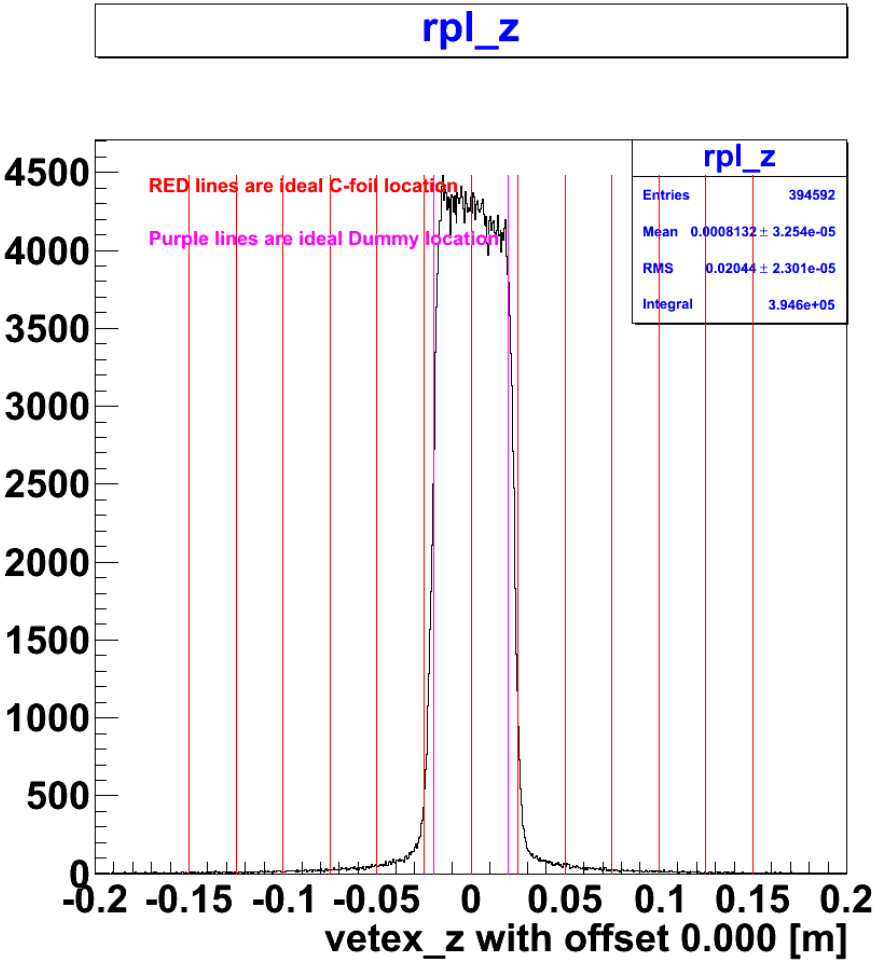
Left Vertex

Cryo Target at the same angle

Run 1231

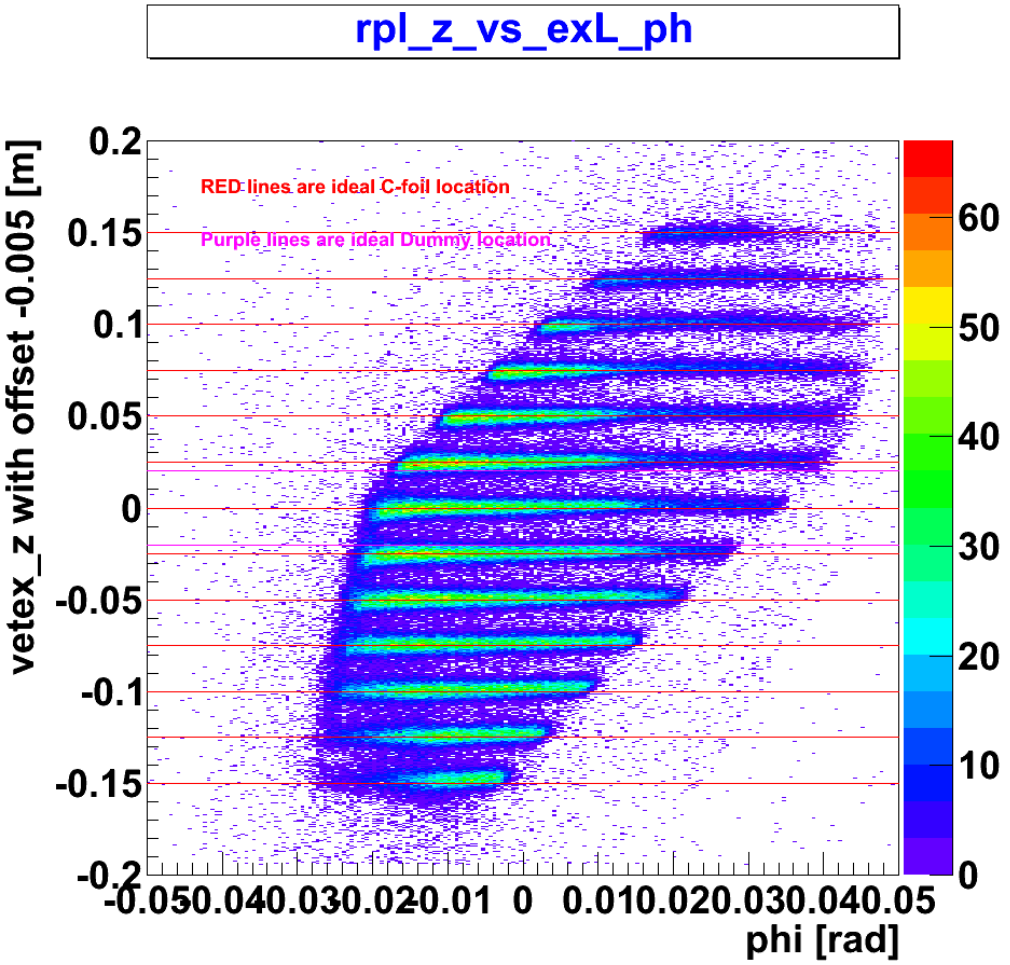
LH2

Angle 16.5 deg



Left Vertex

Vertex vs phi

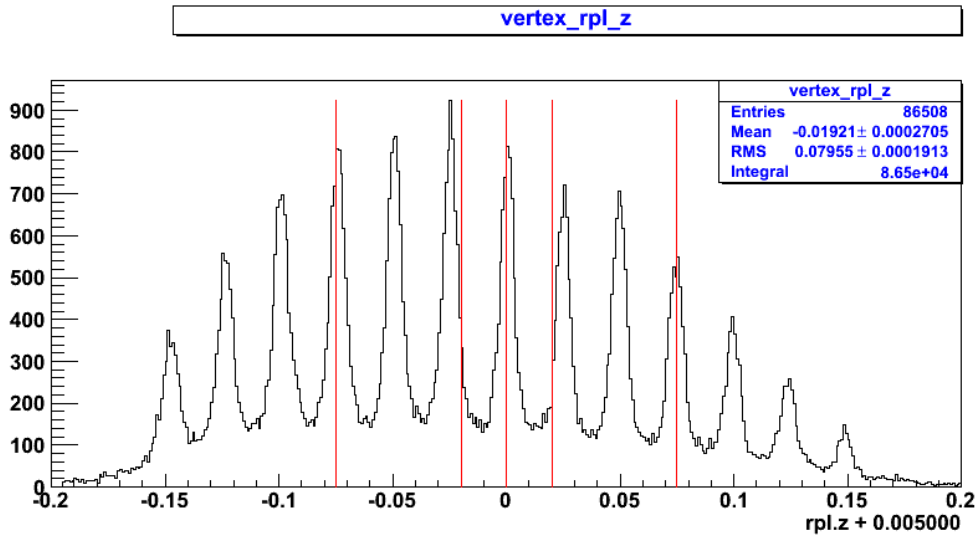


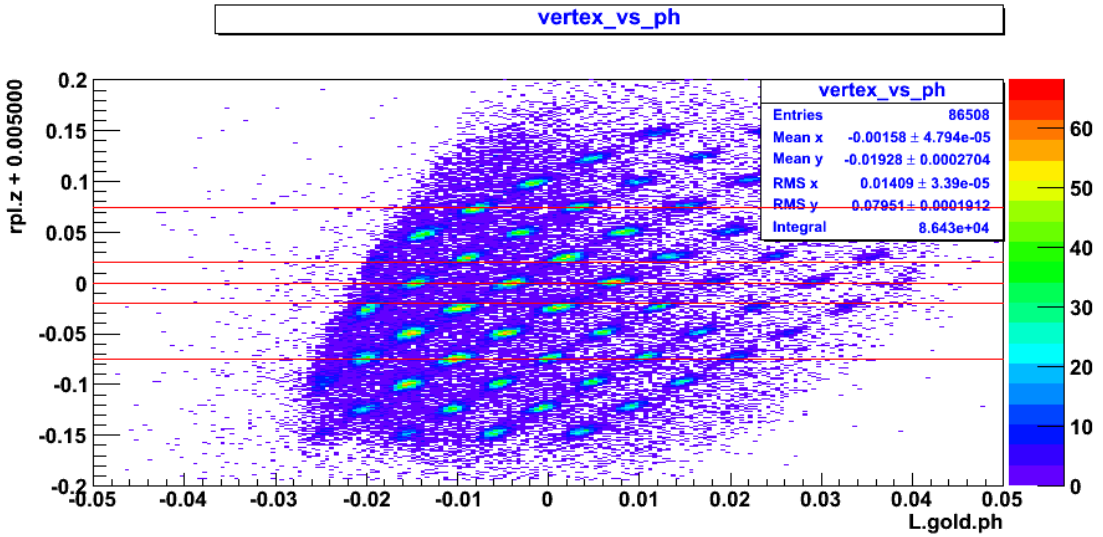
Sieve X Y

Vertex

Run 1238

C12- 13foils



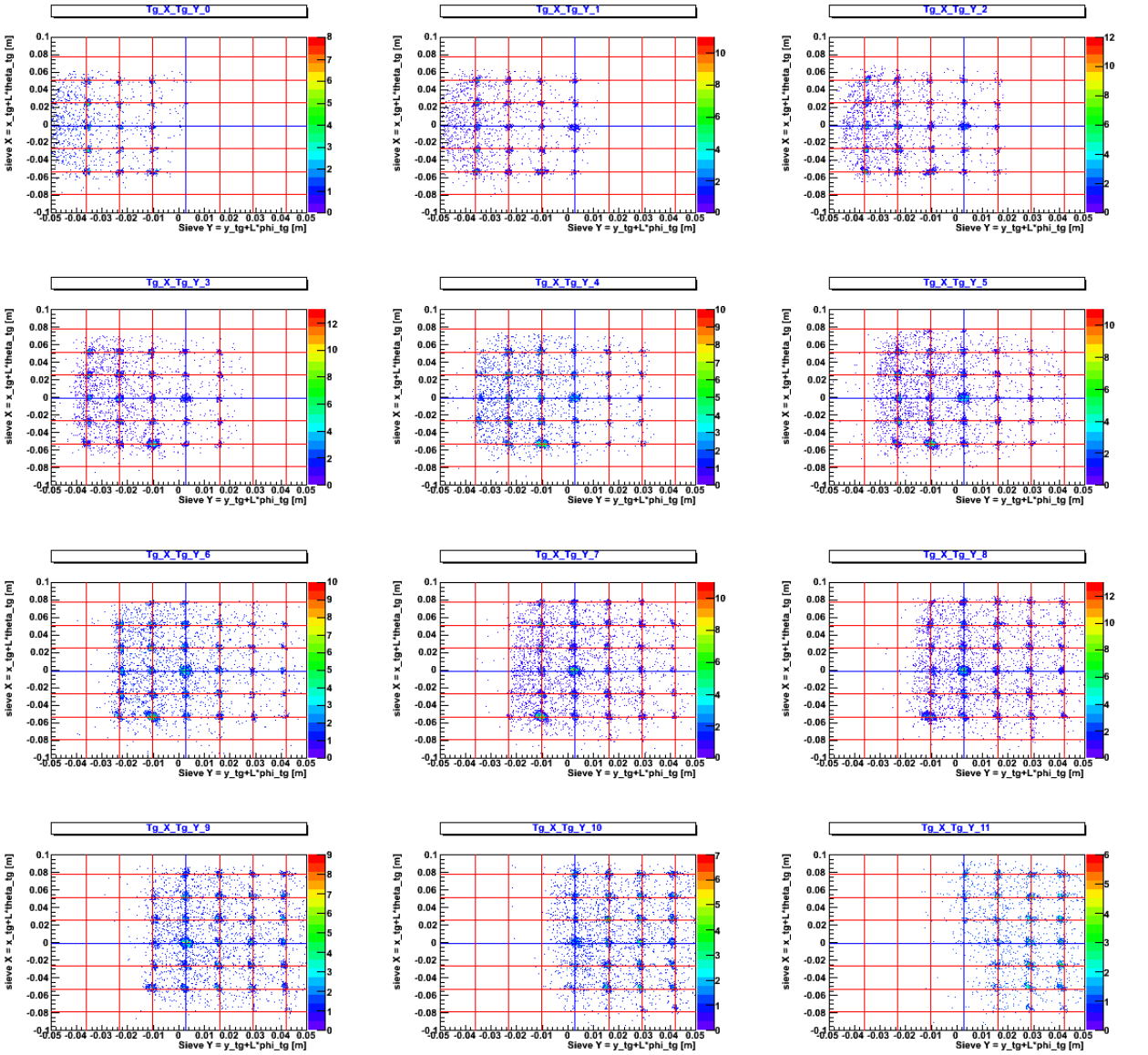


Sieve X Y

Each foil

Run 1238

C12- 13foils

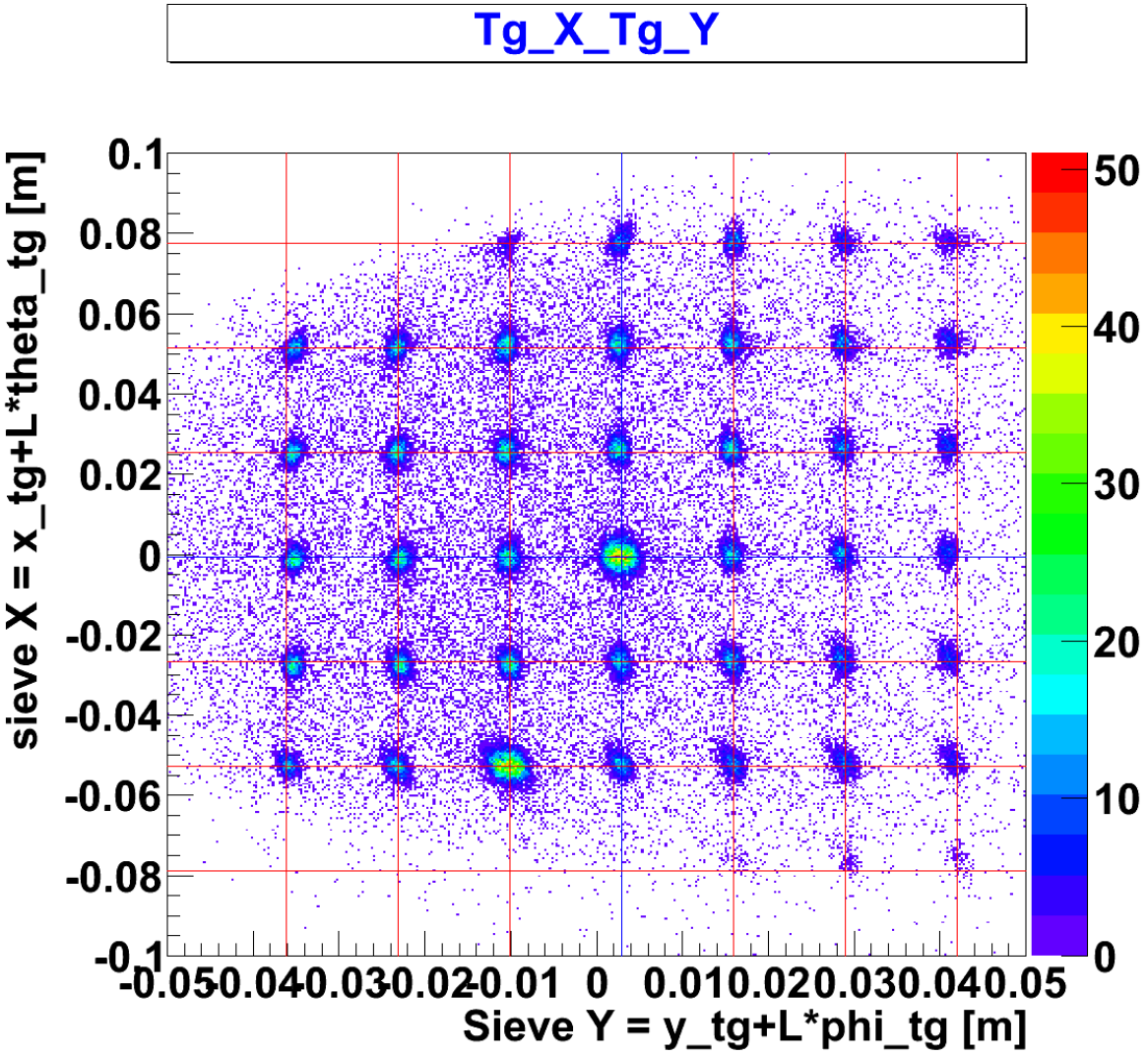


Sieve X Y

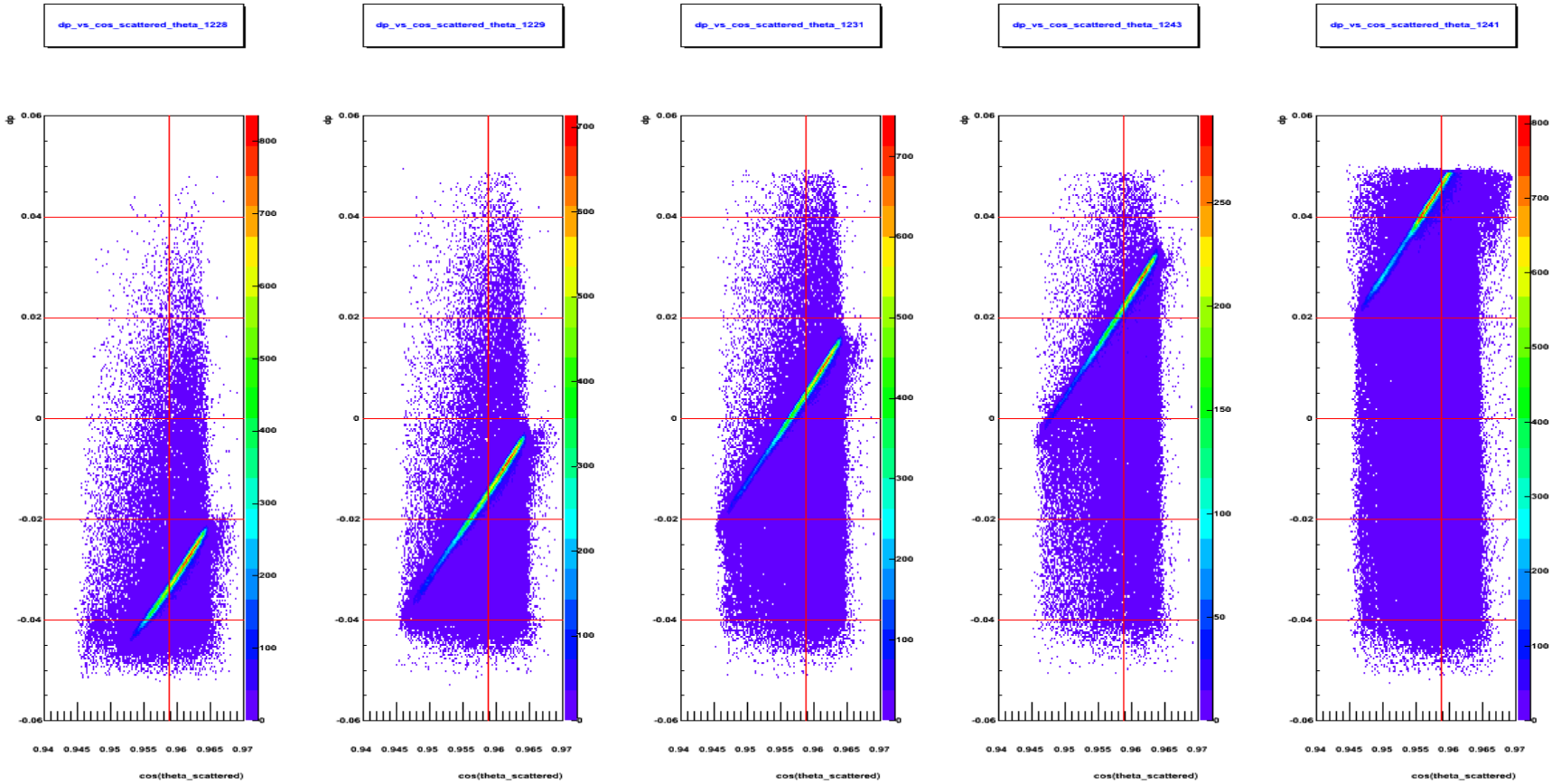
All foils

Run 1238

C12- 13foils



Momentum scan: LH2: dp vs. cos(scattered angle)



Cos(scattered angle) = [cos(theta0) – phi_tg*sin(theta0)]/sqrt(1+theta_tg^2+phi_tg^2)

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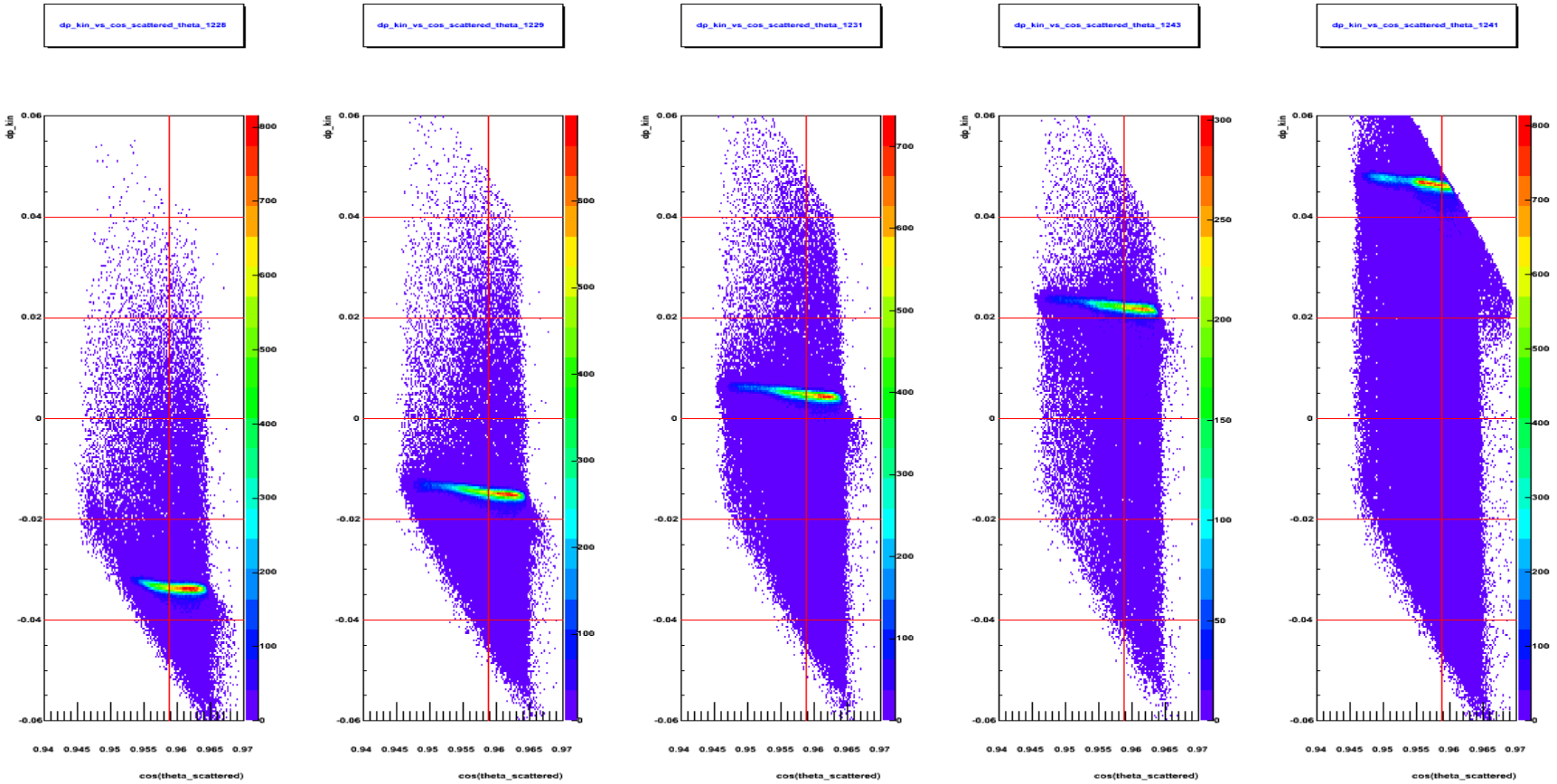
Momentum scan: LH2: dp_kin vs. cos(scattered angle)
Dp_kin = dp – [P(M,theta) – P(M, theta0)]/p0



LH2 at the second pass data at 16.5 deg, dp_kin vs cos(scattered angle)

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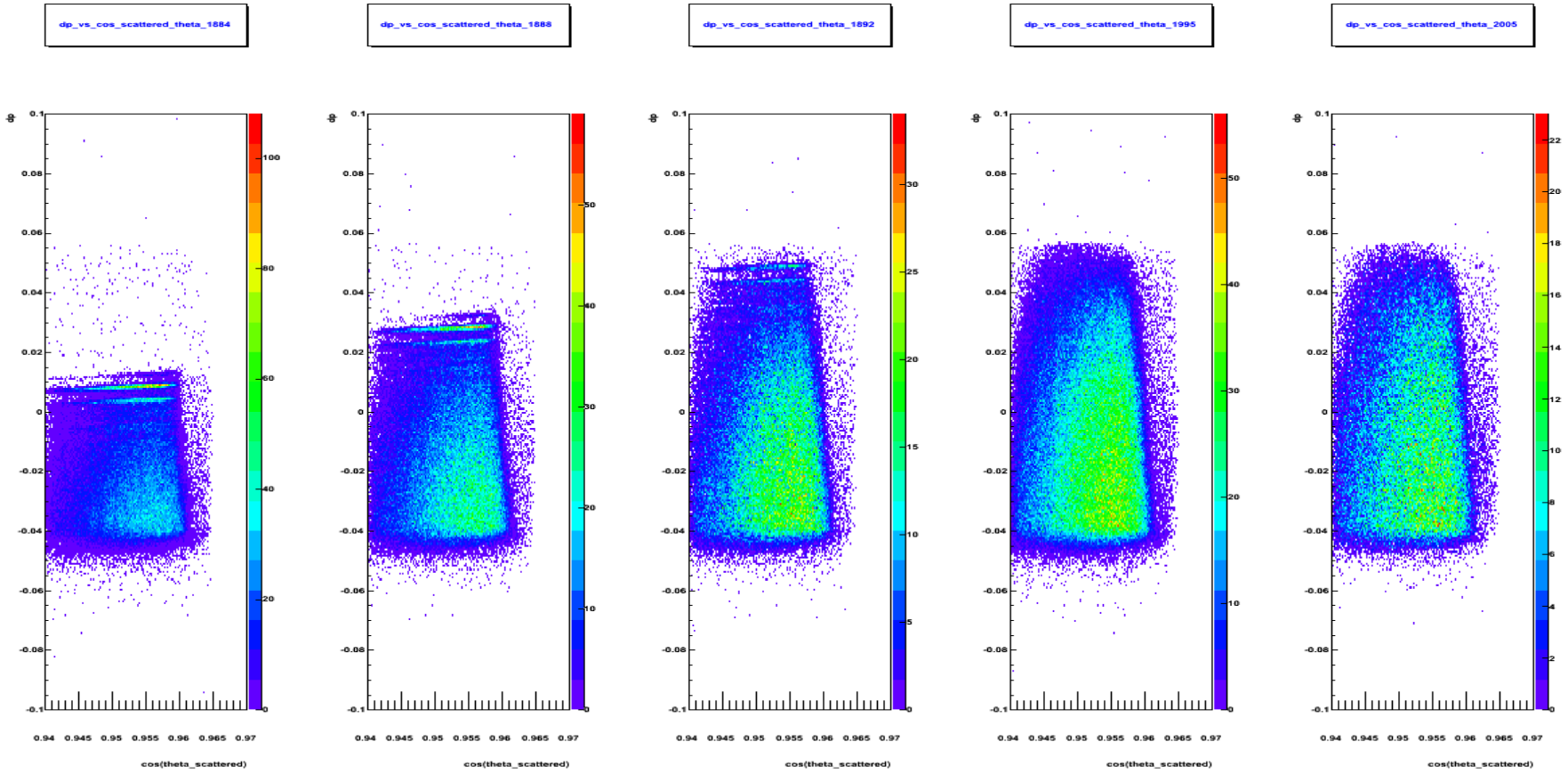
Momentum scan: C12: dp vs. cos(scattered angle)



Less dependent on the scattered angle but not completely independent.

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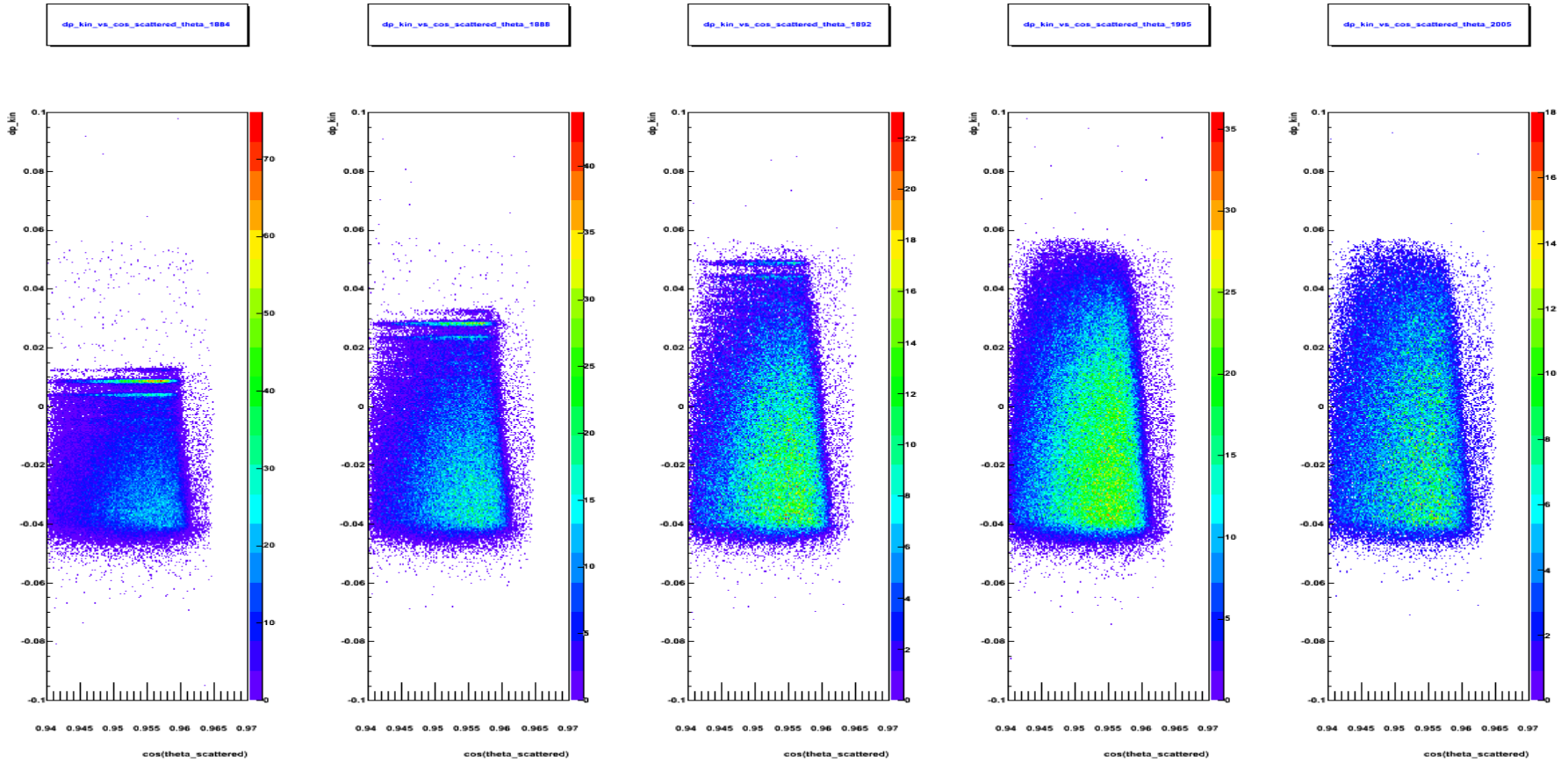
Momentum scan : C12: dp_kin vs. cos(scattered angle)



Problem: only have half of the kinematics cover…. Need to go back and modify the code for LH2

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RIGHT OPTICS

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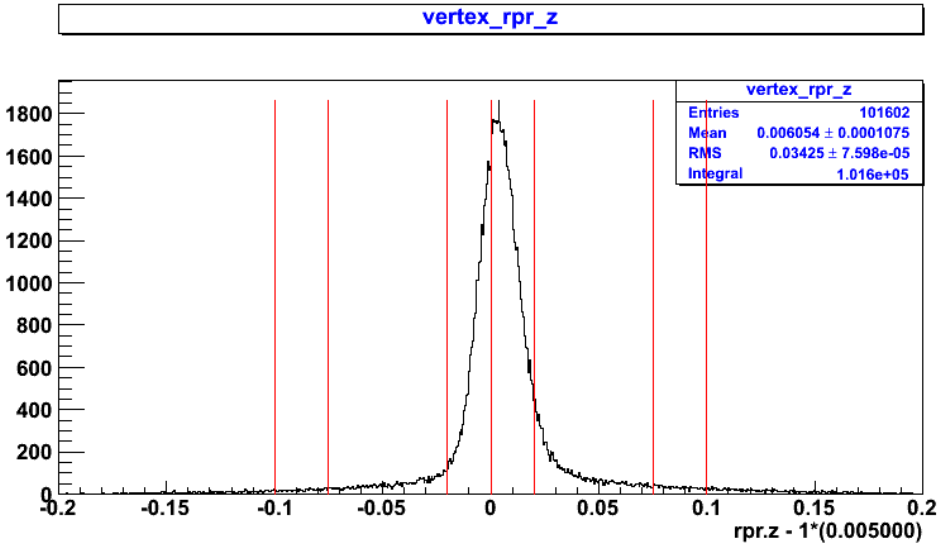
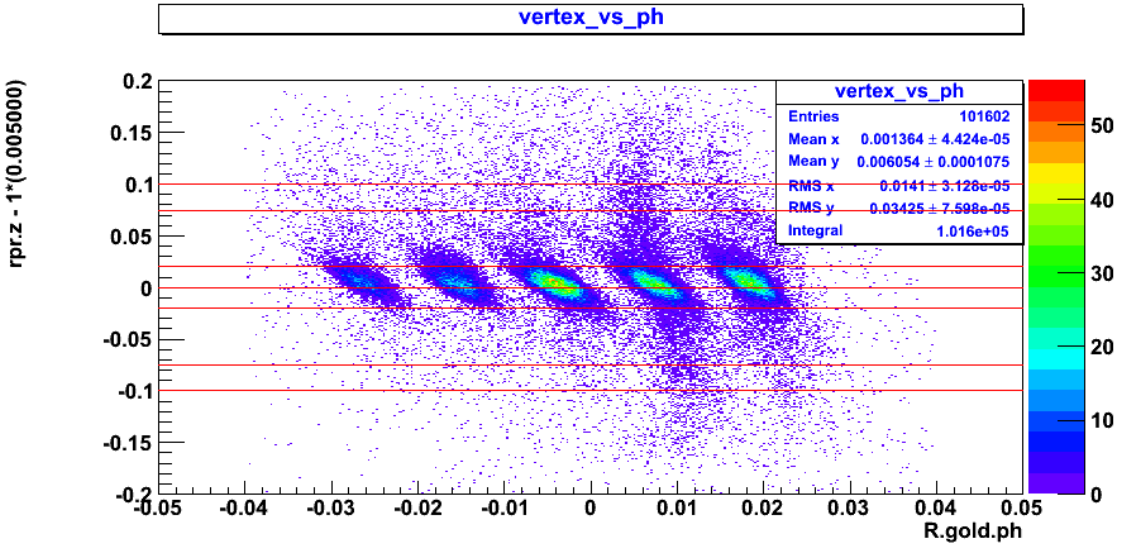
Right Vertex

Miss-pointing survey at 12.5 degree. Try to do the vertex calibration at that angle.

Run 2017





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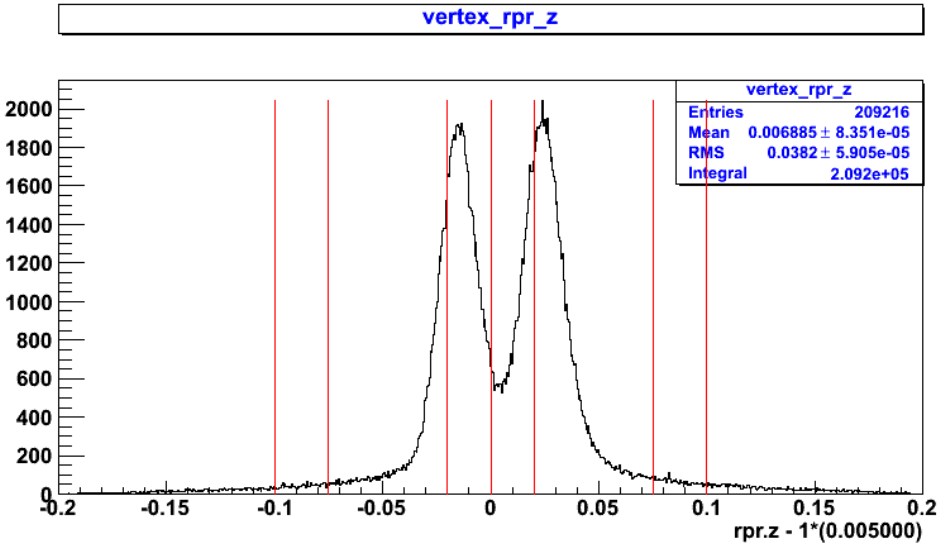
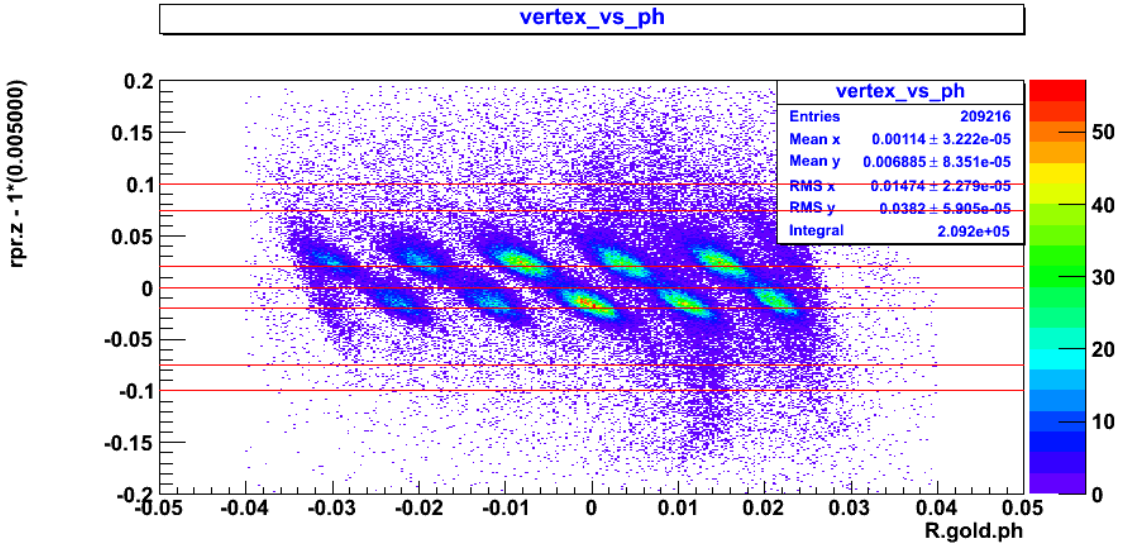
Right Vertex

Combine BeO (previous figure), Dummy 4cm (current), Dummy 15 cm(next)

Run 2018





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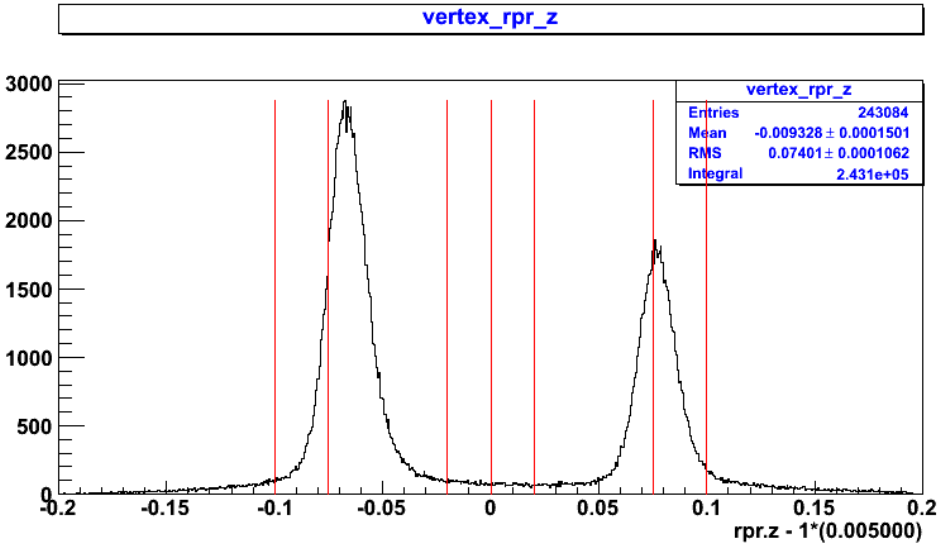
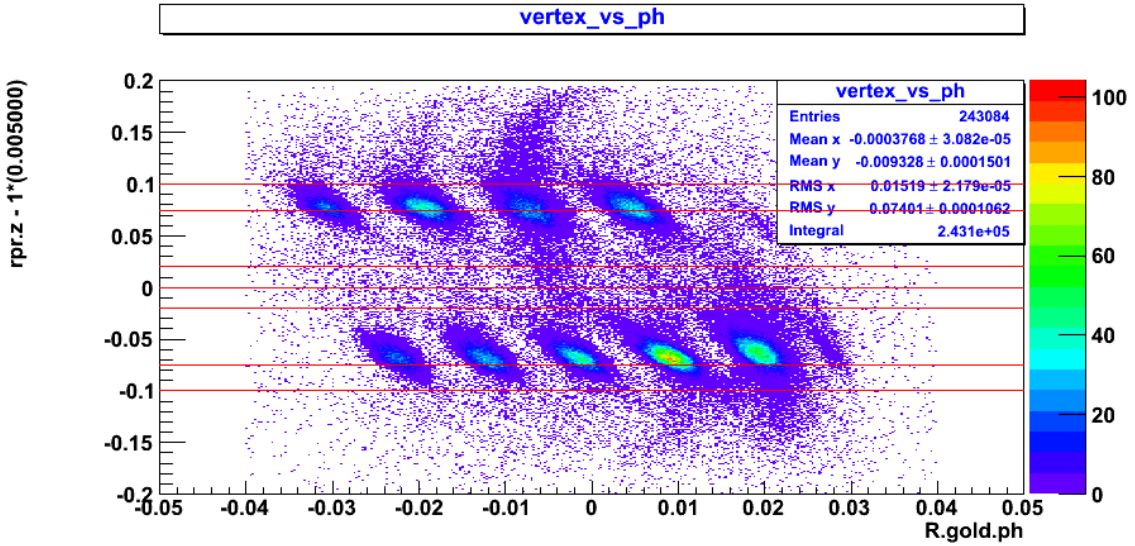
Right Vertex

Dummy 15 cm

Run 2019





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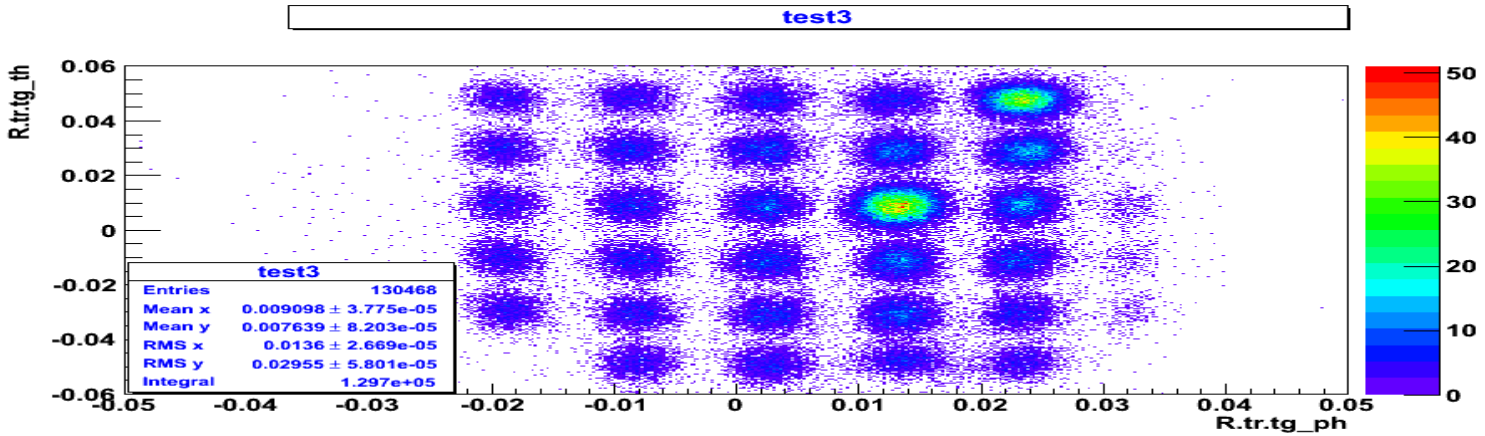
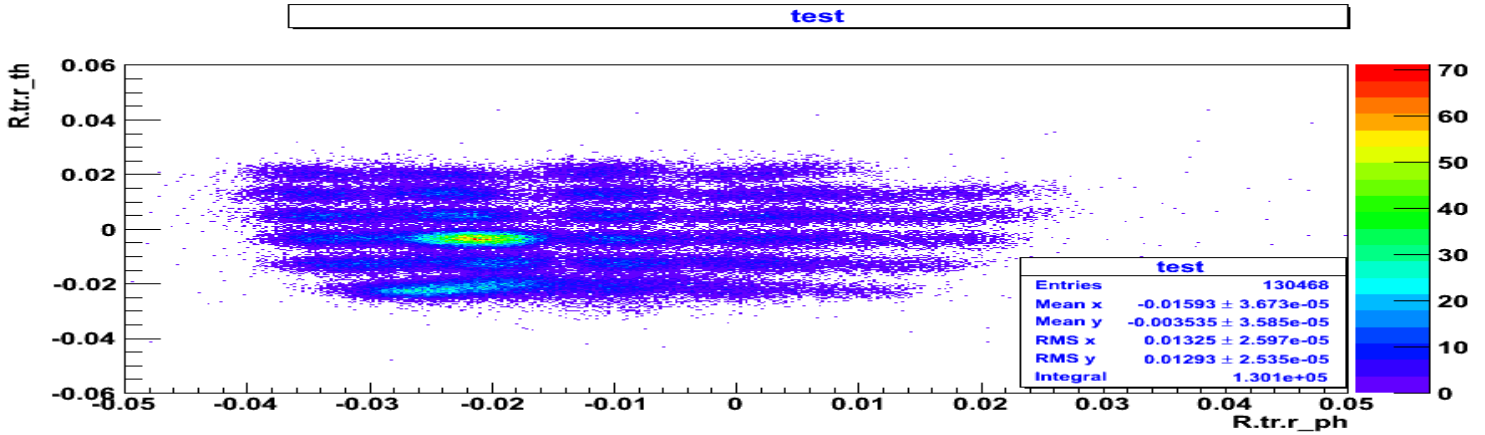
Wrong right optics?





The two large hole appear in the unexpected location.

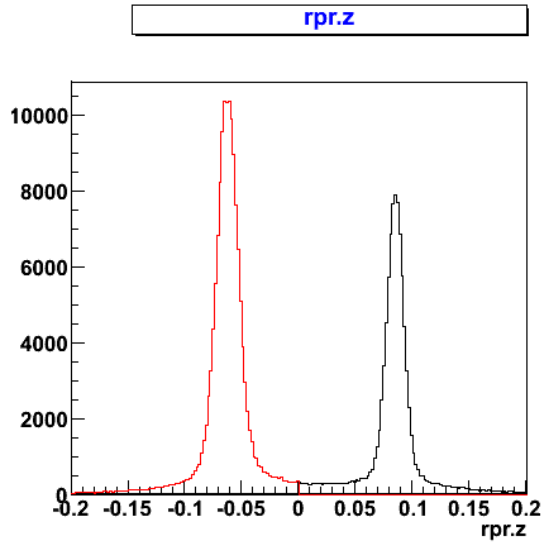
Right Optics?

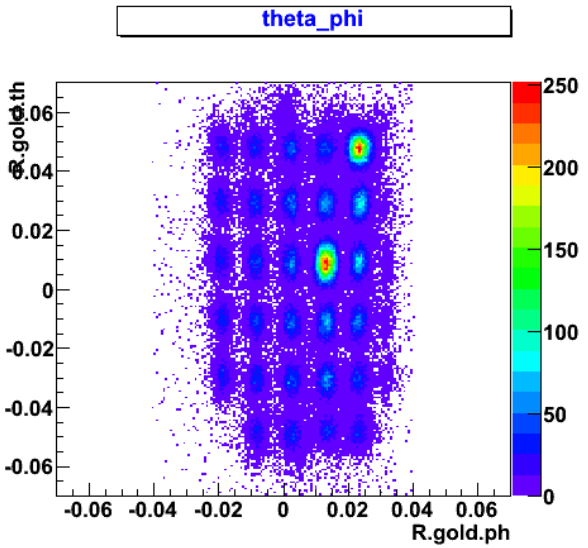
- **Two possible options**
  - Wrong Optics
  - Wrong Sieve inserted.

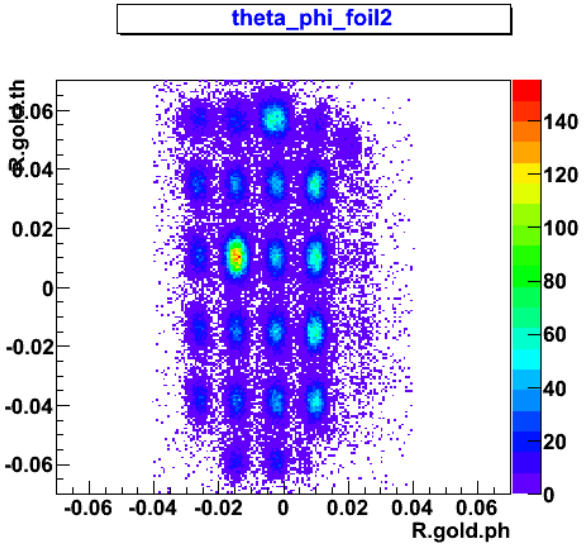
Right Optics?

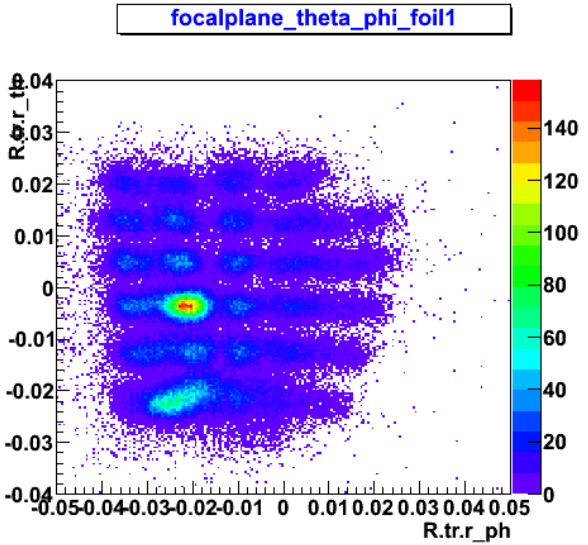
Check with the focal plane variable.

Wrong data base?









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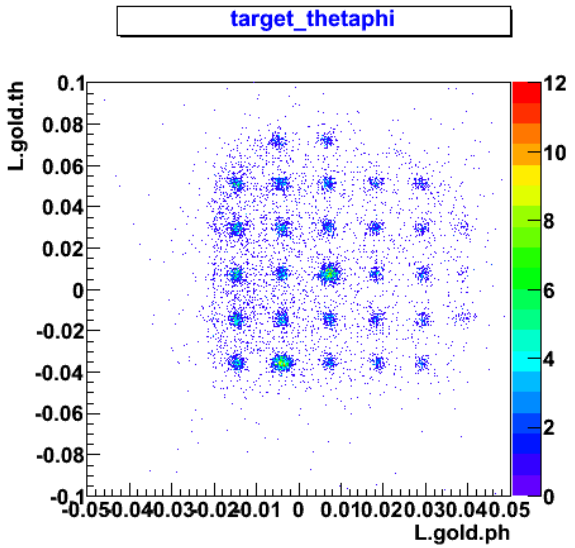
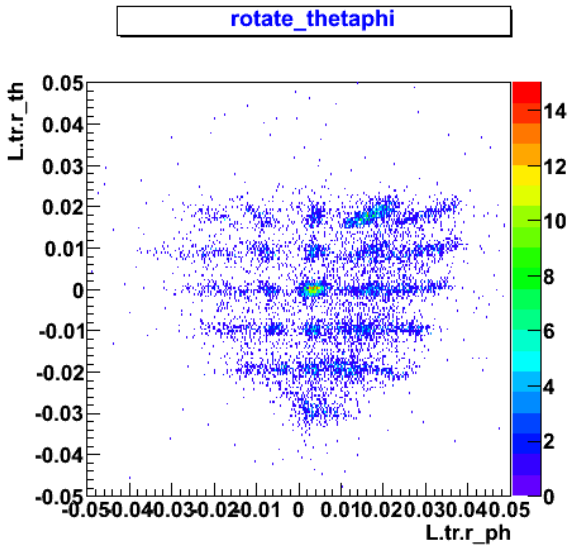
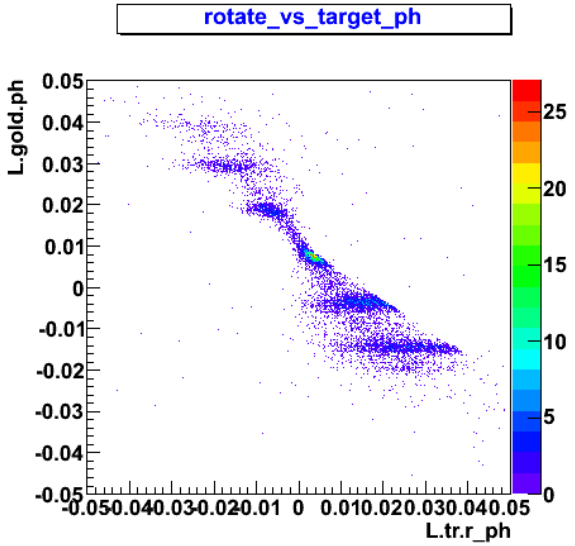
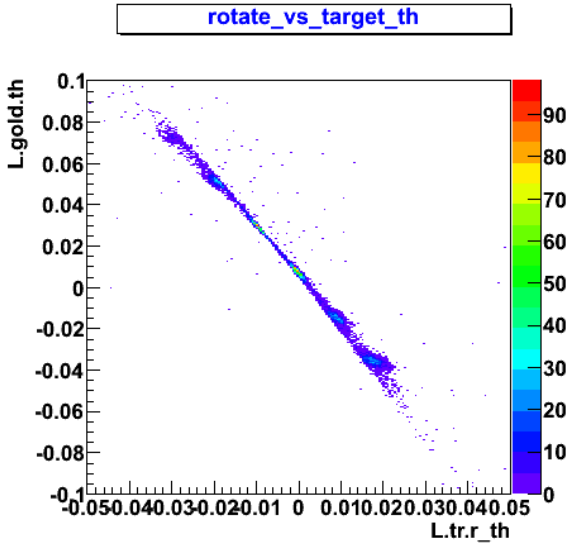
Left theta & phi

Actually the target theta & phi are -45 degree of the focal plane variable









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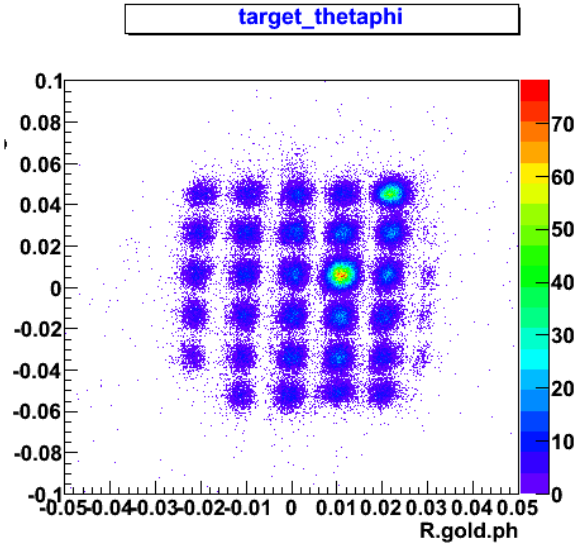
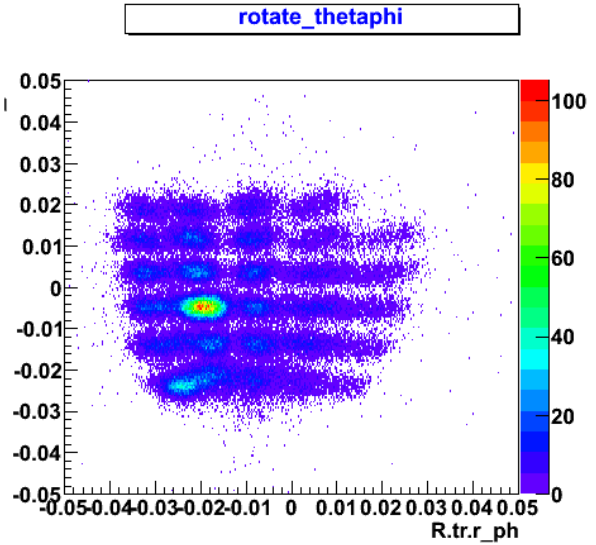
Right Theta & Phi

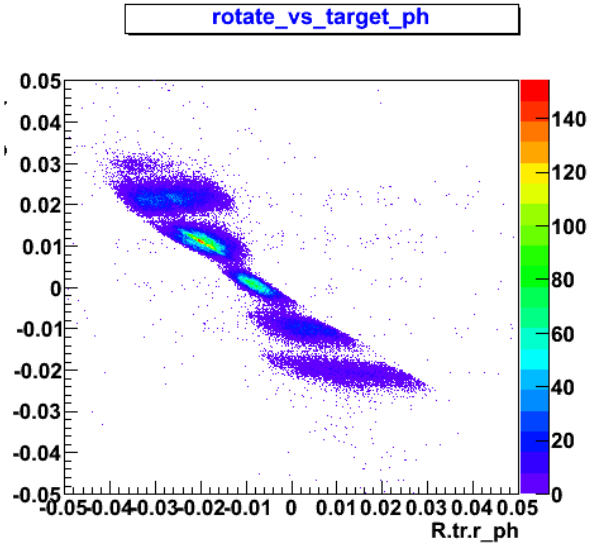
So… we do have the same relation of target to focal plane theta & phi.

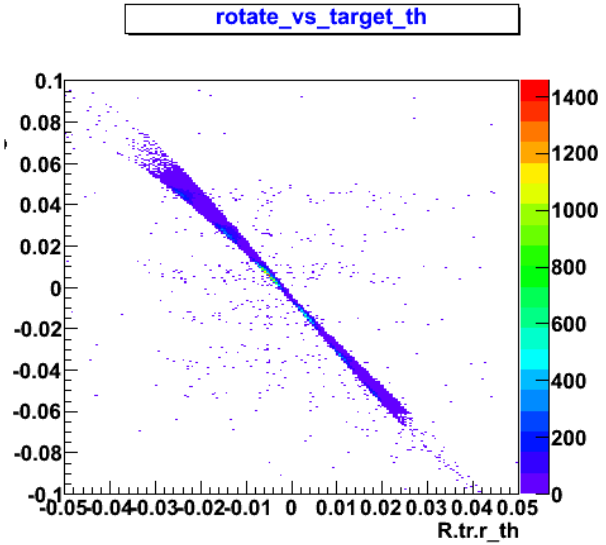
I believe this is good enough to clear the discrepancy.

Someone ~~might~~ put the sieve in wrong.





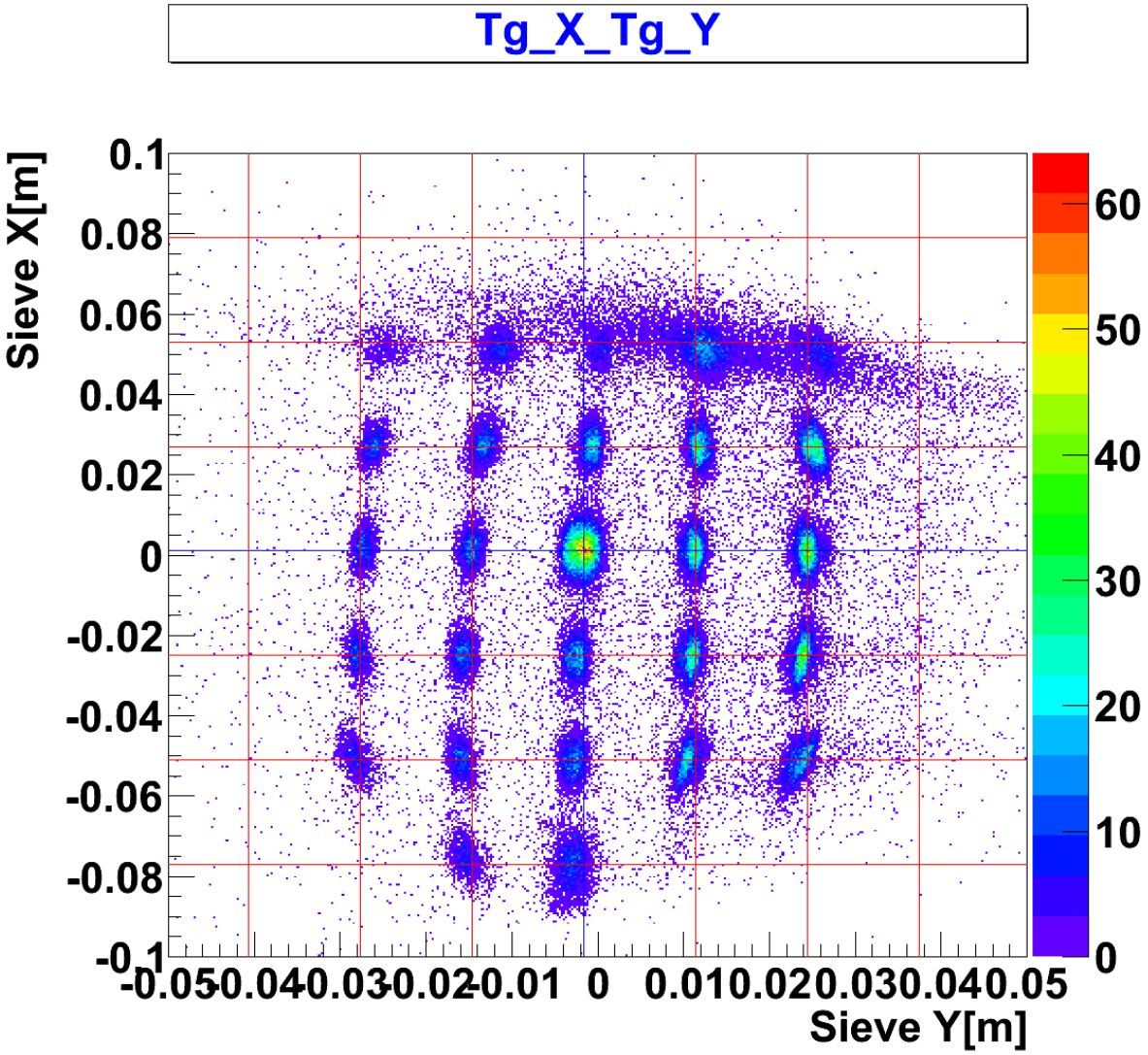




Right
Sieve X Y

Not quite as good as expected

Run 2017 BeO



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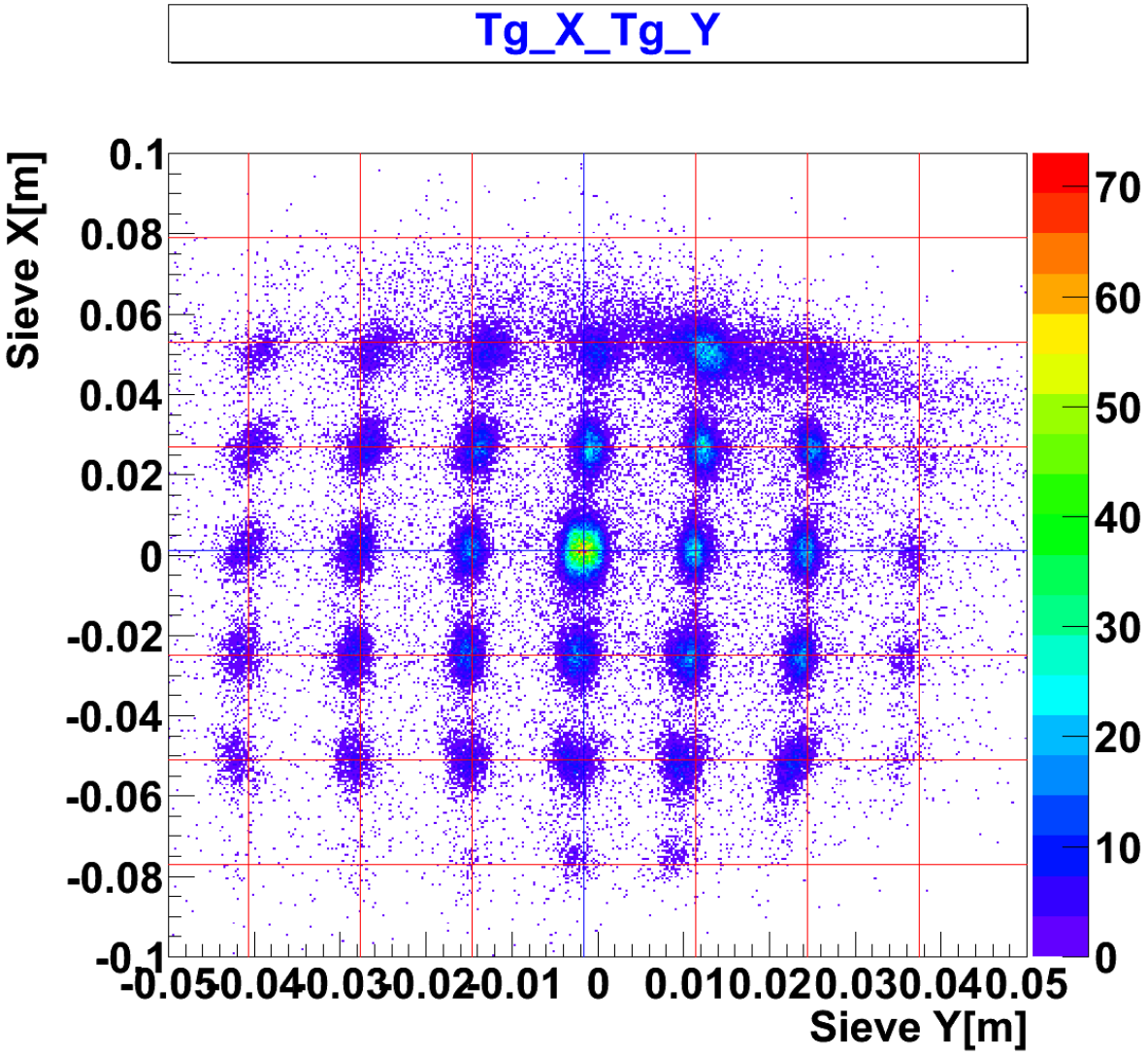
Right
Sieve X Y

Run 2020

C12-optics

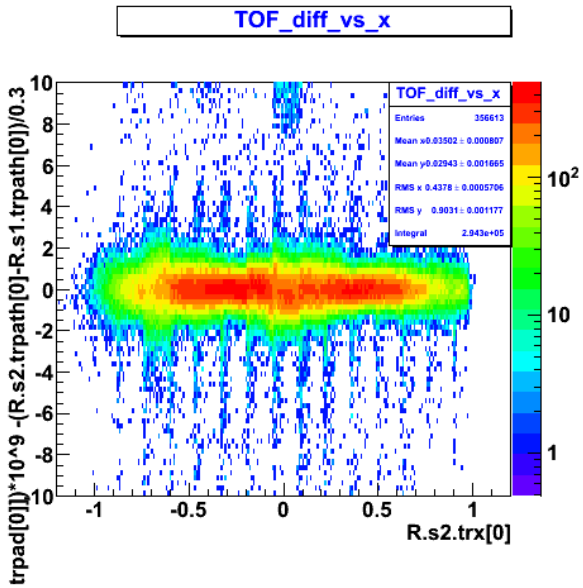
The phi calibration is not good enough… need to go for a new angle.

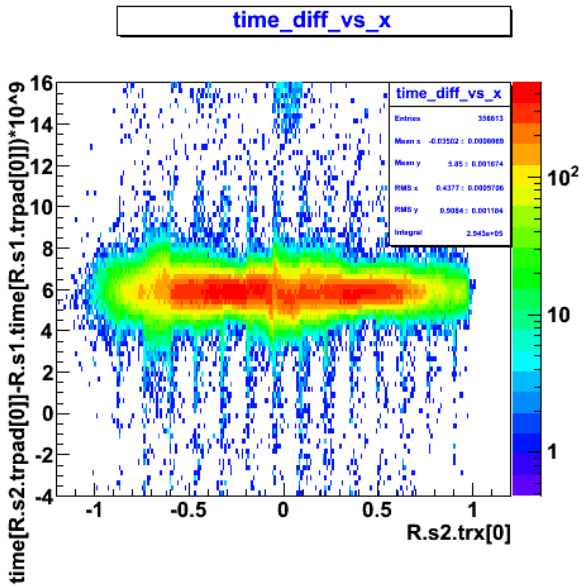


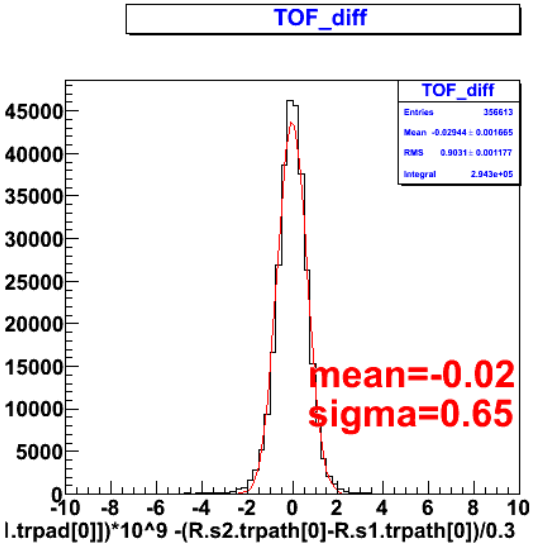
Right Timing

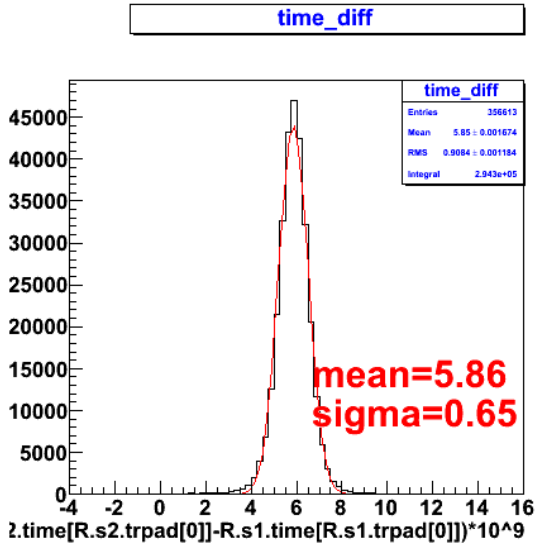
Using the S1 and S2 different.

Using electron run
1380 & 1400









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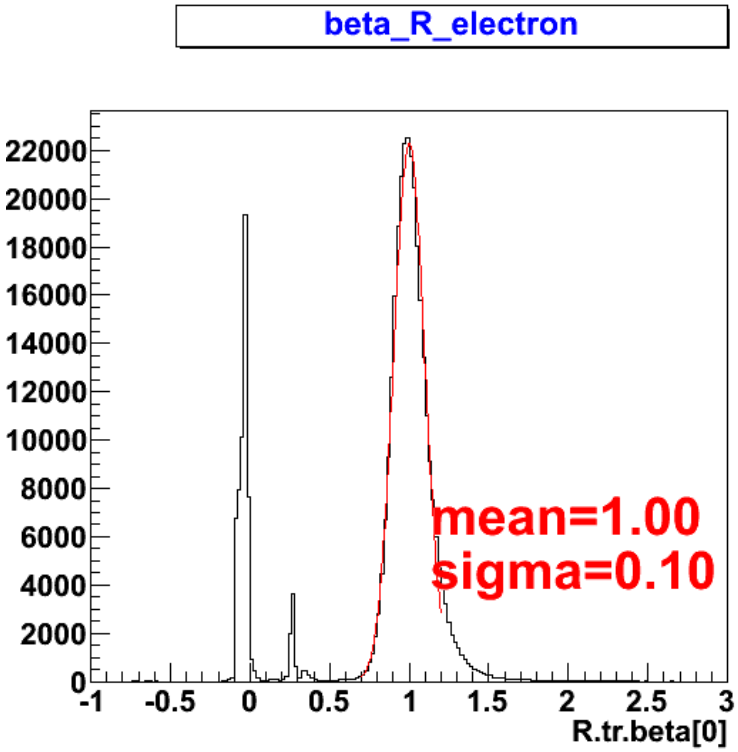
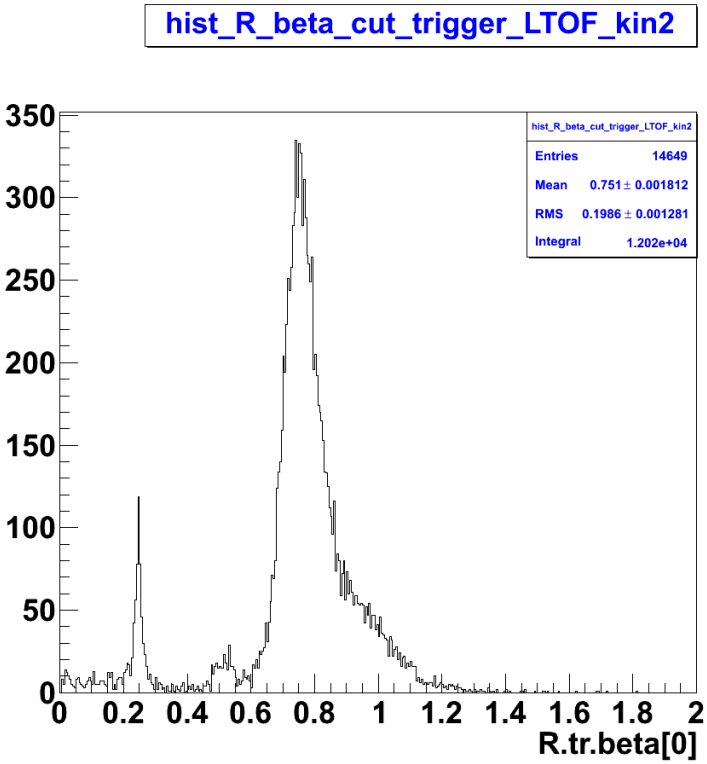
Beta distribution

Electron beta



Production beta



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BIGBITE

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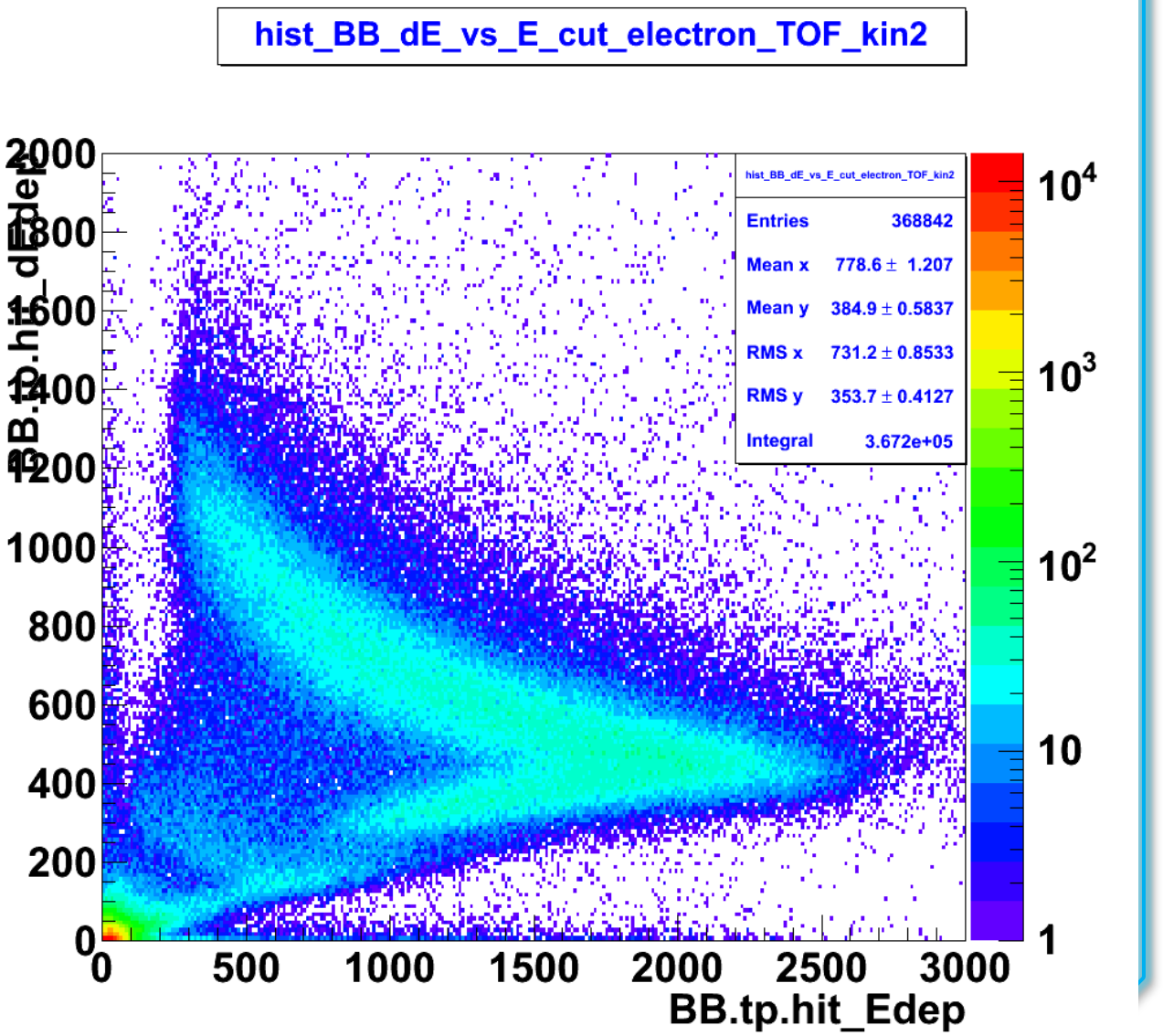
dE vs E

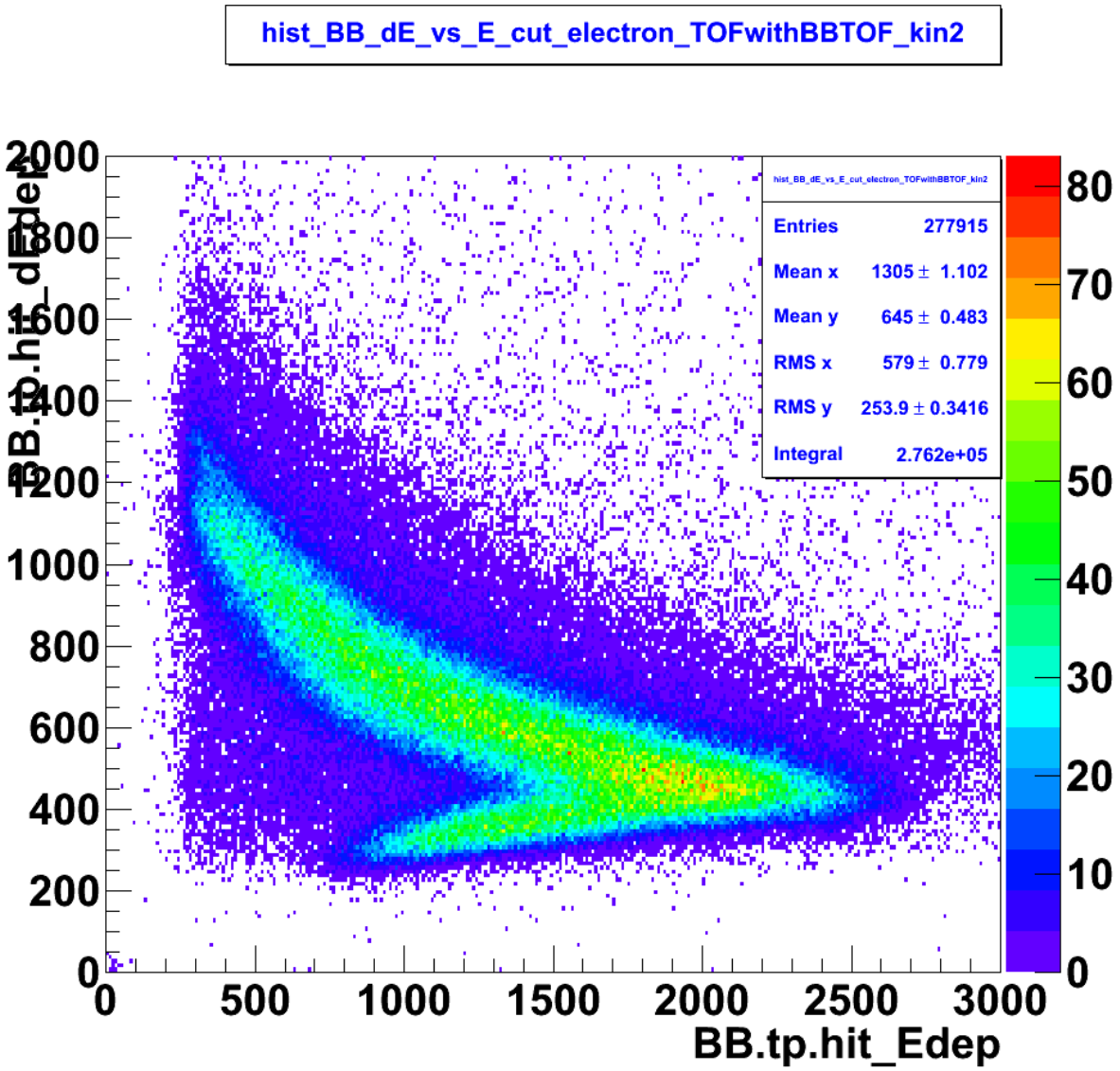
From production data

Within the time window of electron



dE vs E

Demand the coincidence time between electron and bigbite



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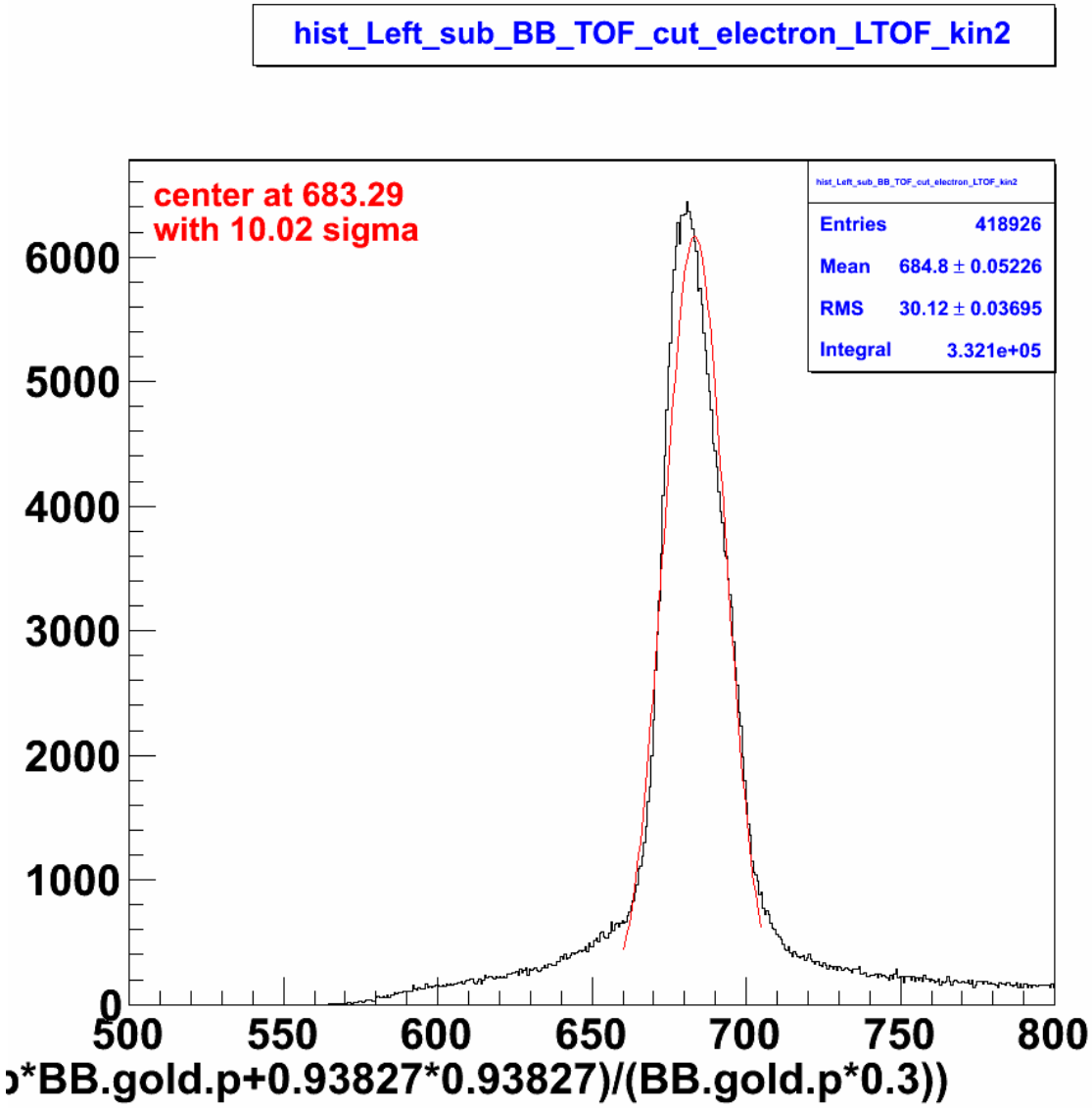
Coincidence time electron & Bigbite

Can be improved with path-length after optics calibration for bigbite.



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More figures …. Let take a loook