

HPS Simulation

Beam Line: Beam Positions Constant Field Map.

Beam Positions for the constant field beam line.

Beam positions in the pair spectrometer magnet were determined with GEMC, using virtual detectors at various locations along the beam.

1. I first needed to fix the table: hps_beamline to reduce the length of the ps_field volume. This stuck out into the detector. (Done on Improv)
2. For this simulation, the ps_field volume has the constant field. NOT THE MAP.
3. Fix up and add FLUX detectors in the monitor table to "measure" the beam position.
4. Run 10000 electrons through and analyze.



Beam Line Modification

To allow for flux detectors and the like the hps_beamline table needed modifying:

```
mysql> delete from hps_beamline where name like "%_field";  
Query OK, 3 rows affected (0.00 sec)
```

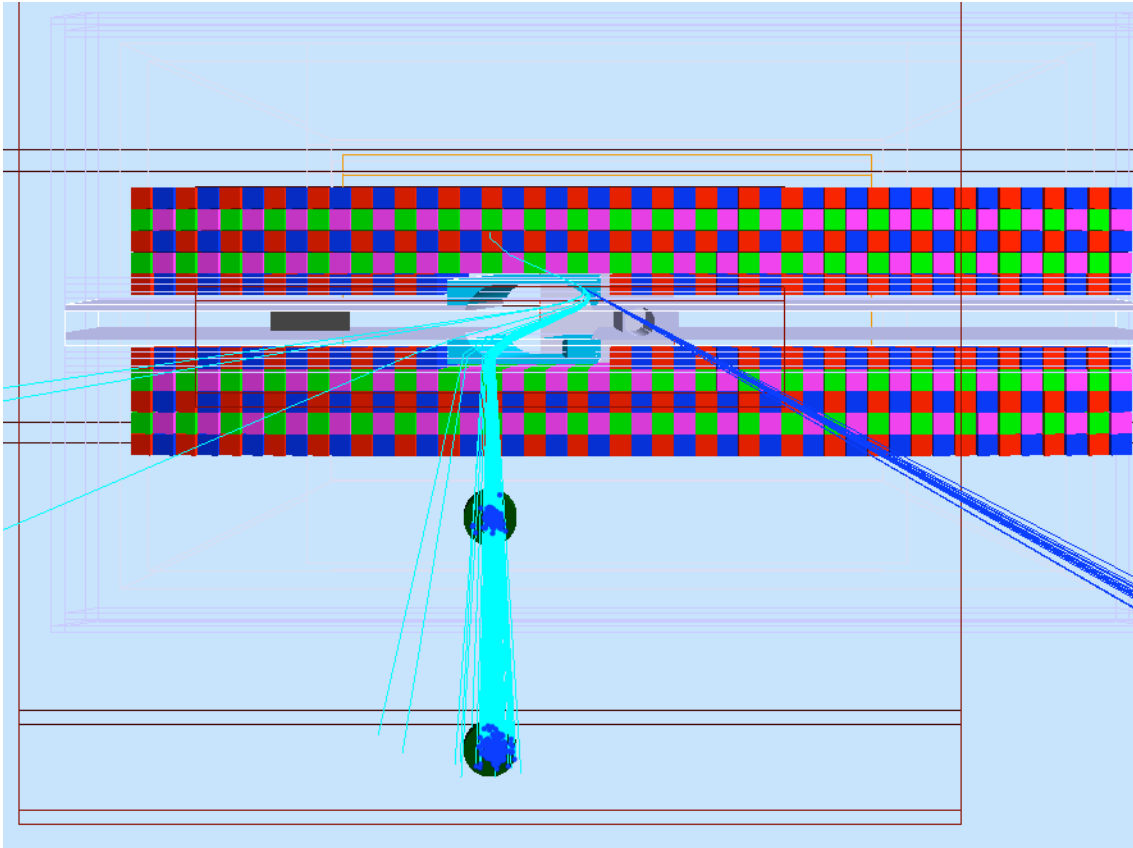
```
mysql> insert into hps_beamline select * from hps_beamline_fast where name like "%_field";  
Query OK, 3 rows affected (0.00 sec)  
Records: 3 Duplicates: 0 Warnings: 0
```

This gives the ps_field box the same dimensions as in the hps_beamline_fast table, allowing for FLUX detectors to function. This also make the field a constant field.

The picture shows that the beamline still hits the bull's eye.

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[Beam Alignment June 4 2011.png](#)

Monitor Table

```
mysql> select * from monitor;
```

| name | mother | description | pos | rot | col | type | dimensions | material | magfield | ncopy | pMany |
|-------|----------------|-------------------------------|-----------------------|-------------------|----------|------|-----------------------------|----------|----------|-------|-------|
| exist | visible | style | sensitivity | hitType | identity | rmin | rmax | time | | | |
| A6 | SiContainer | Beam Monitor at target | 0*mm 0*mm 0*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A7 | SiContainer | Beam Monitor at target | 0*mm 0*mm 200*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A8 | SiContainer | Beam Monitor at target | 0*mm 0*mm 400*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A5 | SiContainer | Beam Monitor at target | 0*mm 0*mm -200*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A4 | SiContainer | Beam Monitor at target | 0*mm 0*mm -300*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A3 | SiContainer | Beam Monitor at target | 0*mm 0*mm -400*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| B1 | ps_field | Beam Monitor at target | 0*mm 0*mm -0.11*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A2 | ps_field | Beam Monitor at target | 0*mm 0*mm -10*cm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| A1 | ps_ecal_mother | Beam Monitor at target | 0*mm 0*mm -314.2*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 100*mm 20*mm 0.1*mm | Vacuum | no | 1 | 1 |
| B3 | ps_ecal_mother | Beam Monitor in front of ECAL | 0*mm 0*mm 1319.002*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 384.175*mm 228.6*mm 0.01*mm | Vacuum | no | 1 | 1 |
| B4 | IC_vacuum2 | Beam Monitor behind ECAL | 0*mm 0*mm -134.99*mm | 0*deg 0*deg 0*deg | ffff00 | Box | 400*mm 12*mm 0.1*mm | Vacuum | no | 1 | 1 |

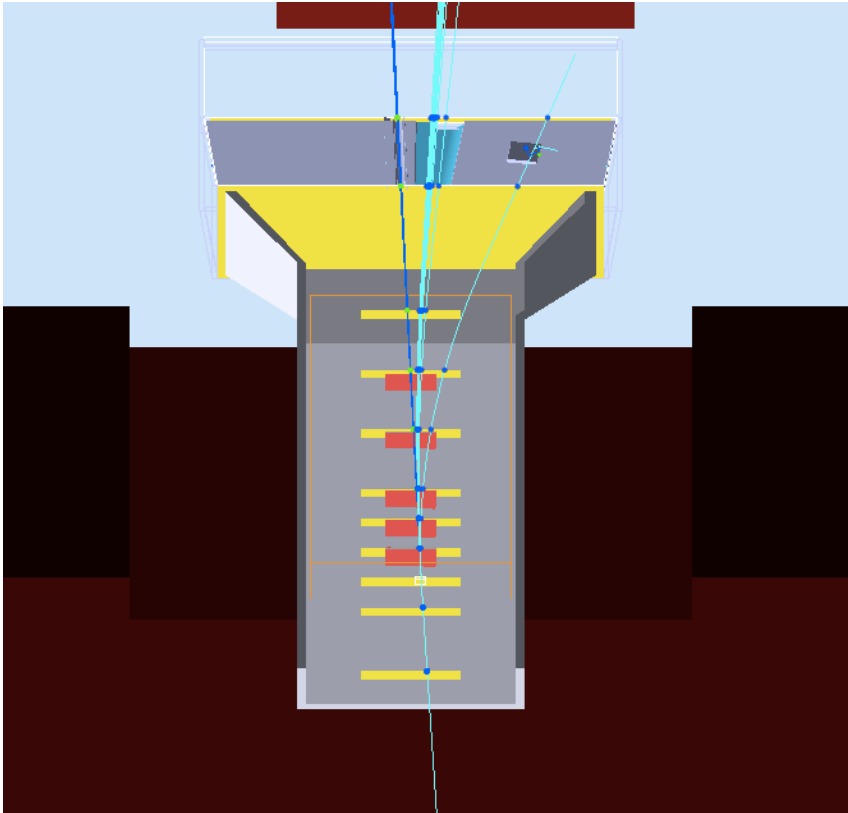
11 rows in set (0.00 sec)

Location of beam monitor detectors

Each of the yellow rectangles represents a beam monitor detector. The blue dots are hits by an electron (blue green lines) the green dots by a photon (blue lines)

HPS Simulation

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Beam Positions.

Results for Electron Beam

| Name | Z Pos | X Pos | Local Z pos | Local X pos |
|----------------------|-----------|----------|-------------|-------------|
| A1 - 110 | -314.2 mm | 55.71 mm | | -32.78 mm |
| A2 - 111 | -100 mm | 64.14 mm | | -24.34 mm |
| B1 - Target (+2 mm) | 2 mm | 67.67 | | -20.82 mm |
| A3 - 112 Silicon 1 | +100 mm | 70.4 mm | -400 mm | -18.1 mm |
| A4 - 113 Silicon 2 | +200 mm | 72.49 mm | -300 mm | -16. mm |
| A5 - 114 Silicon 3 | +300 mm | 73.91 mm | -200 mm | -14.85 mm |
| A6 - 115 Silicon 4 | +500 mm | 74.71 mm | 0 mm | -13.79 mm |
| A7 - 116 Silicon 5 | +700 mm | 72.77 mm | +200 mm | -15.72 mm |
| A8 - 117 Magnet Exit | +900.1 mm | 68.12 mm | +400 mm | -20.38 mm |
| B3 - 12 Ecal Entry | 1319 mm | 52.28 mm | | -36.24 mm |
| B4 - 13 Ecal Middle | 1549 mm | 43.25 mm | -135 mm | -45.27 mm |

Results for Photon Beam

| Name | Z Pos | X Pos | Local Z pos | Local X pos |
|--------------------|-----------|----------|-------------|-------------|
| A1 - 110 | -314.2 mm | - | | |
| A2 - 111 | -100 mm | - | | |
| B1 - 10 Target | 0 mm | - | | |
| A3 - 112 Silicon 1 | +100 mm | 70.73 mm | -400 mm | -17.75 mm |
| A4 - 113 Silicon 2 | +200 mm | 73.86 mm | -300 mm | -14.63 mm |
| A5 - 114 Silicon 3 | +300 mm | 76.98 mm | -200 mm | -11.5 mm |

HPS Simulation

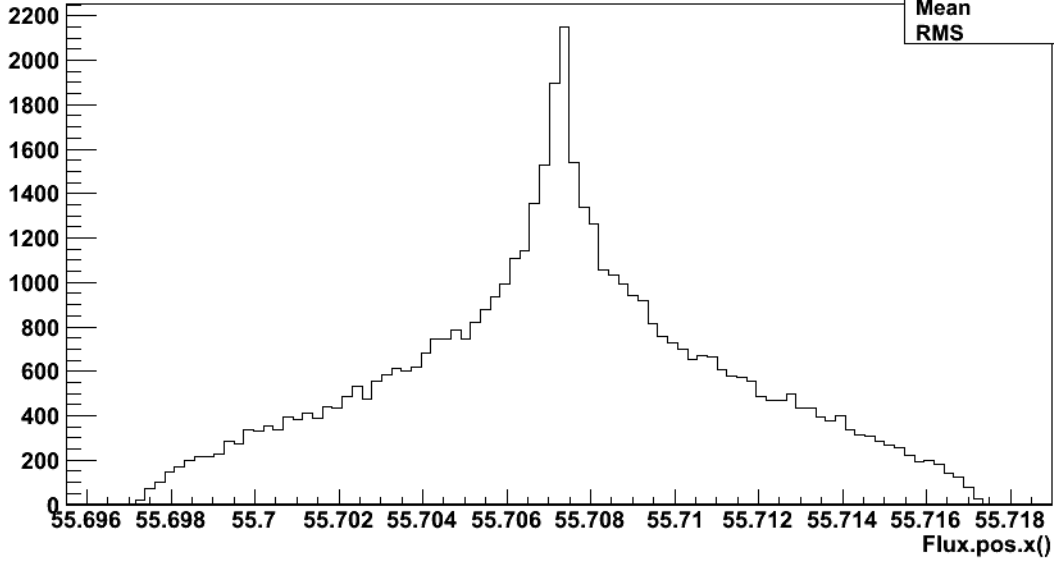
Beam Line: Beam Positions Constant Field Map.

| | | | | |
|----------------------|-----------|----------|---------|----------|
| A6 - 115 Silicon 4 | +500 mm | 83.23 mm | 0 mm | -5.26 mm |
| A7 - 116 Silicon 5 | +700 mm | 89.48 mm | +200 mm | 0.99 mm |
| A8 - 117 Magnet exit | +900.1 mm | 95.73 mm | +400 mm | 7.24 mm |
| B3 - 12 Ecal Entry | 1319 mm | 108.8 mm | | 20.33 mm |
| B4 - 13 Ecal Middle | 1549 mm | 116. mm | -135 mm | 27.52 mm |



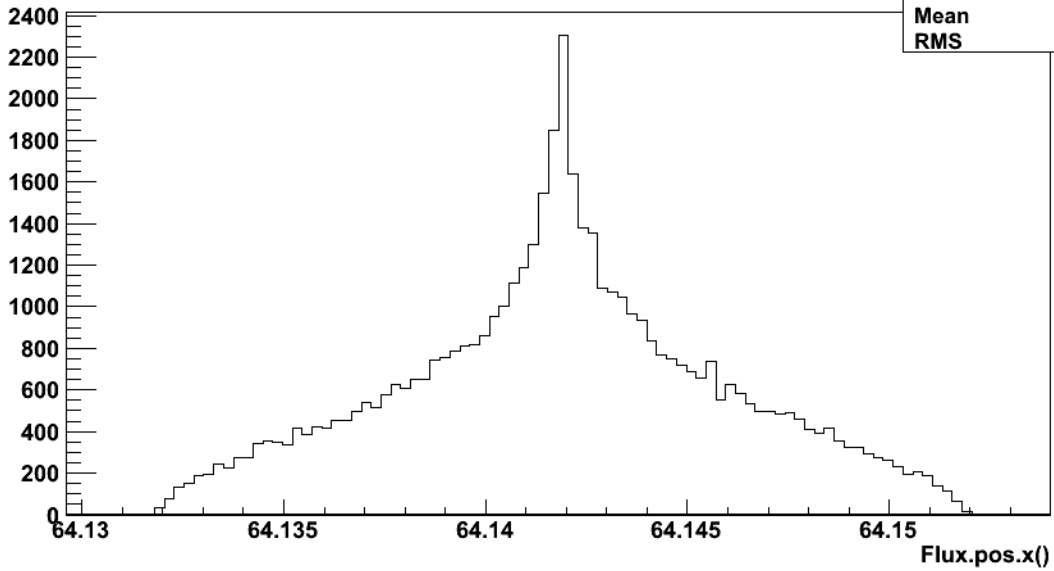
Flux.pos.x() {Flux.id==110}

| htemp | |
|---------|---------|
| Entries | 50000 |
| Mean | 55.71 |
| RMS | 0.00408 |



Flux.pos.x() {Flux.id==111 && Flux.pos.x(>60. && Flux.pos.x(<70.)}

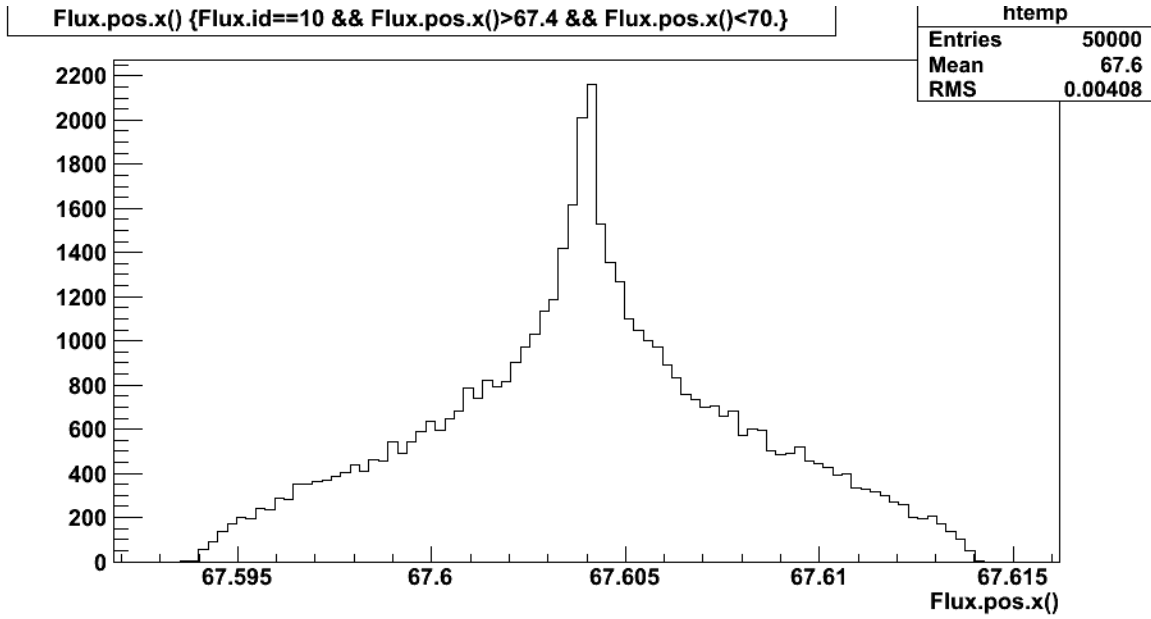
| htemp | |
|---------|---------|
| Entries | 50000 |
| Mean | 64.14 |
| RMS | 0.00408 |



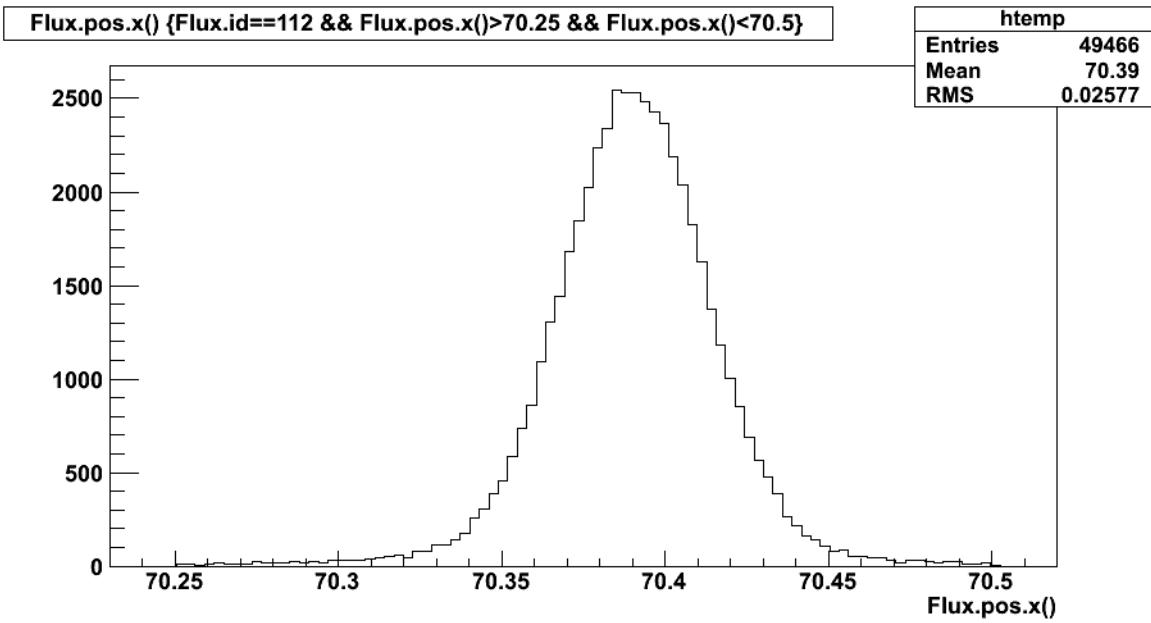
TARGET: _____

HPS Simulation

Beam Line: Beam Positions Constant Field Map.



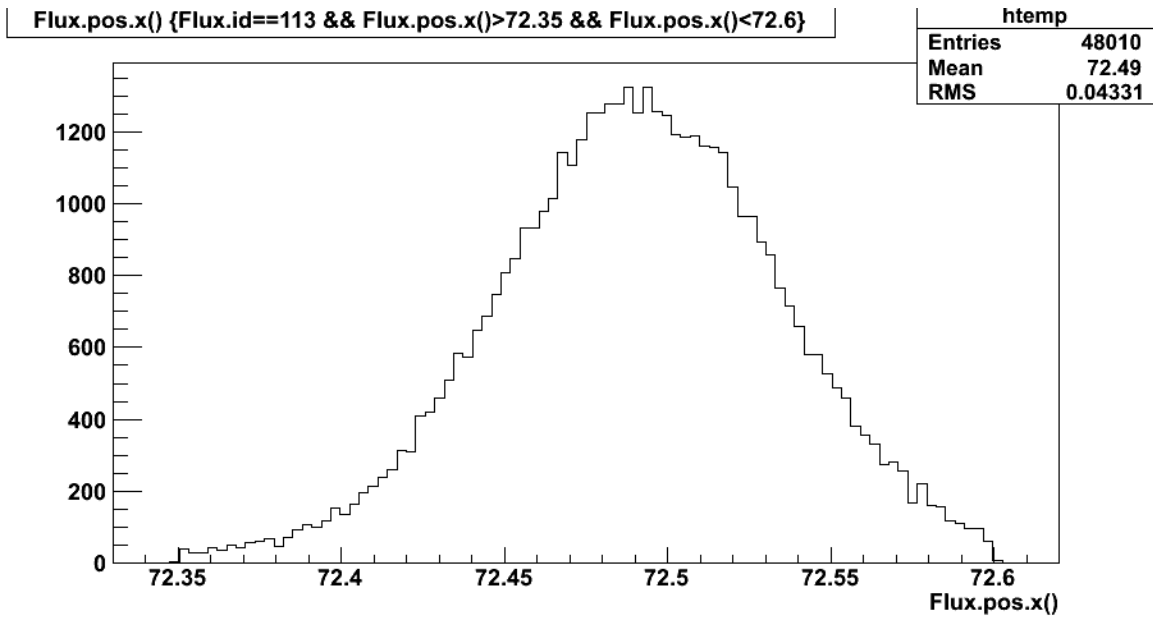
Silicon 1:



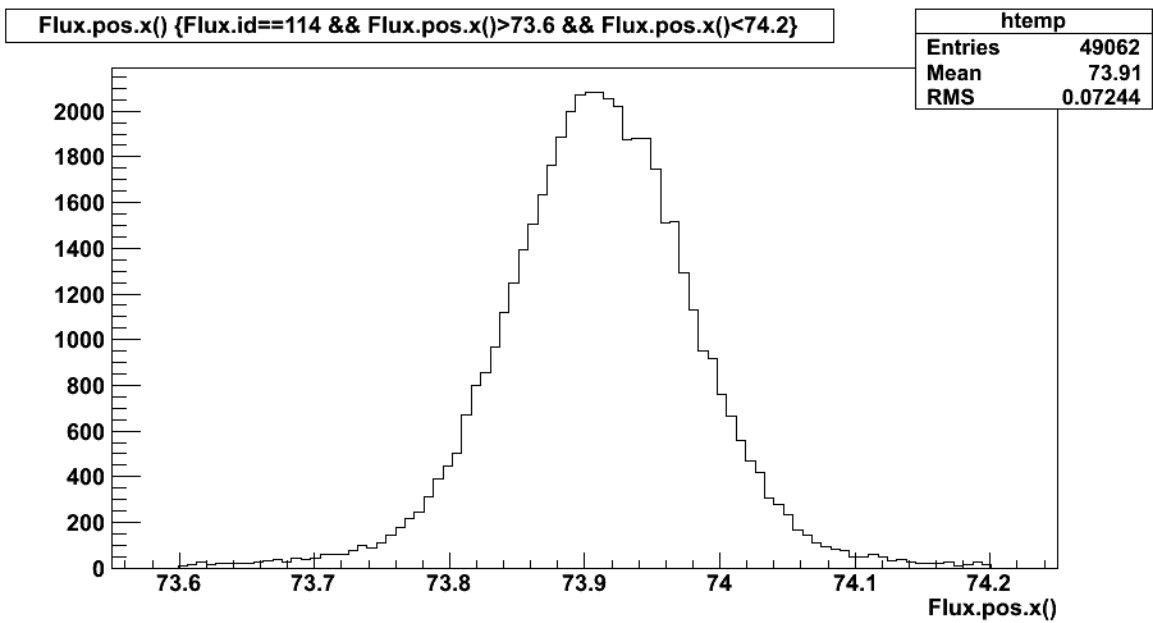
Silicon 2

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Beam Line: Beam Positions Constant Field Map.



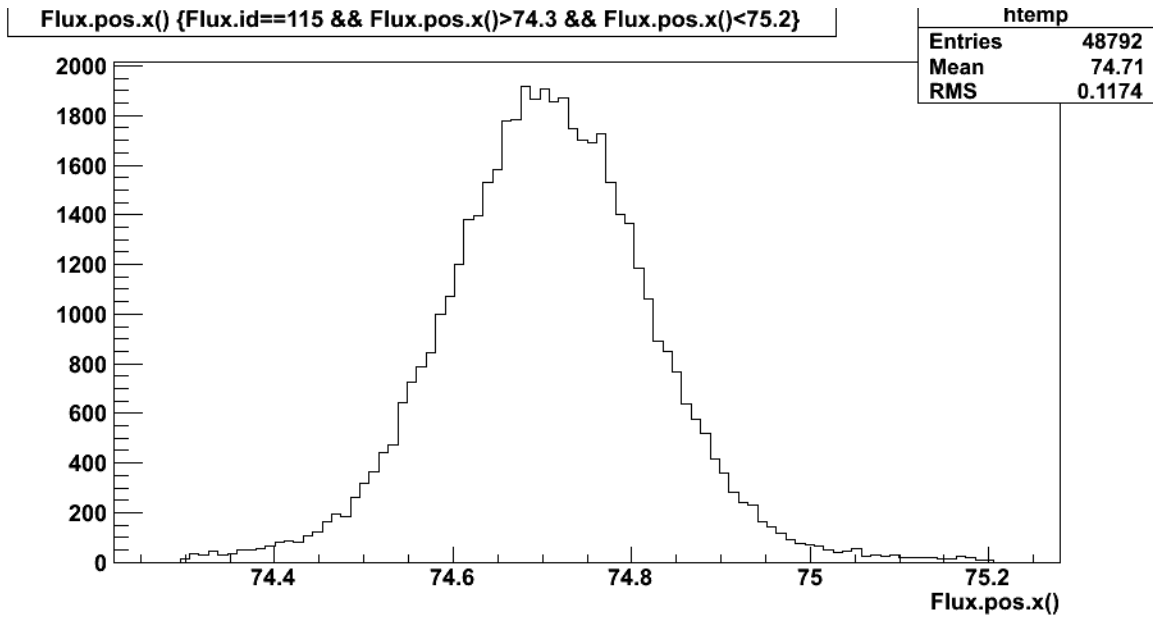
Silicon 3



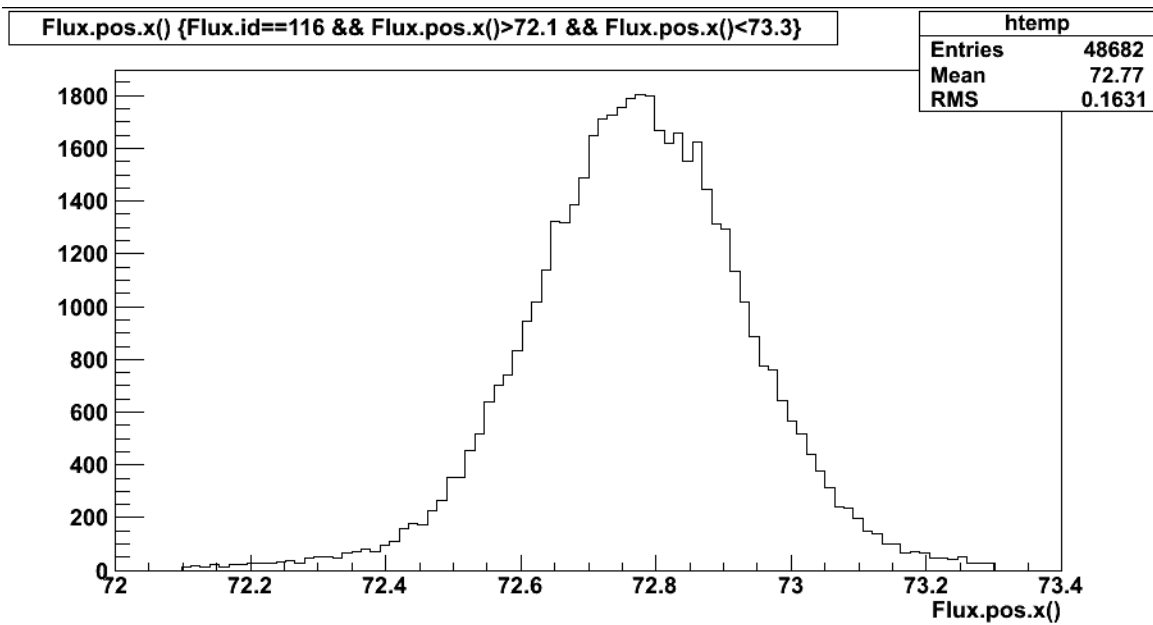
Silicon 4

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Beam Line: Beam Positions Constant Field Map.



Silicon 5

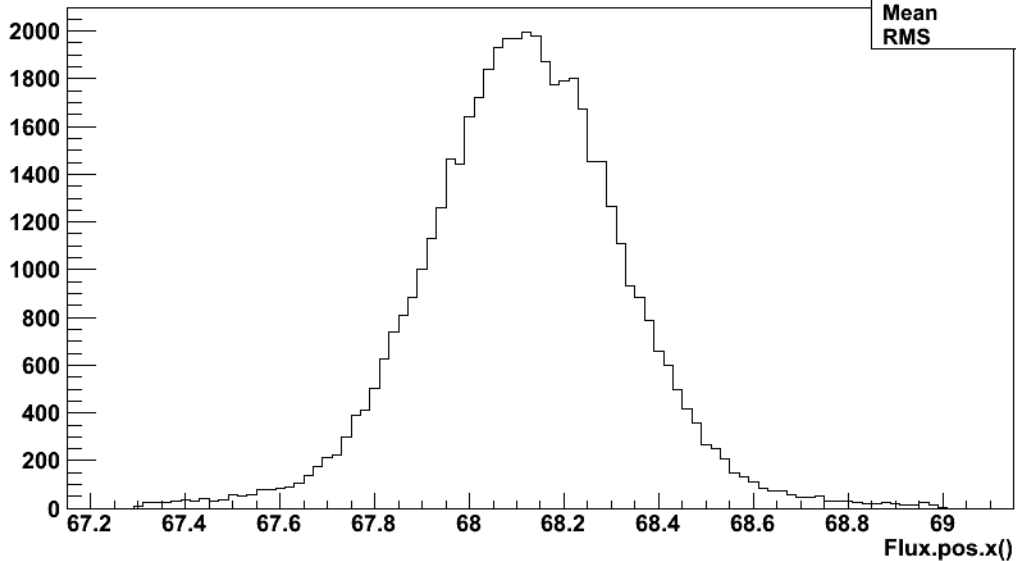


Magnet Exit

HPS Simulation

Beam Line: Beam Positions Constant Field Map.

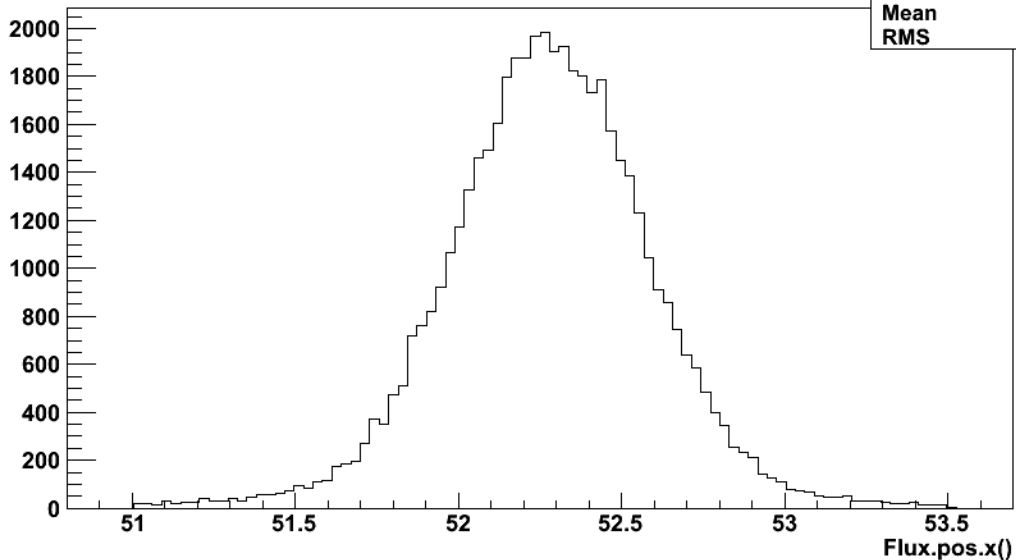
Flux.pos.x() {Flux.id==117 && Flux.pos.x(>67.3 && Flux.pos.x(<69.)}



| ntemp | |
|---------|--------|
| Entries | 48807 |
| Mean | 68.12 |
| RMS | 0.2139 |

Ecal Entry

Flux.pos.x() {Flux.id==12 && Flux.pos.x(>51 && Flux.pos.x(<53.5)}



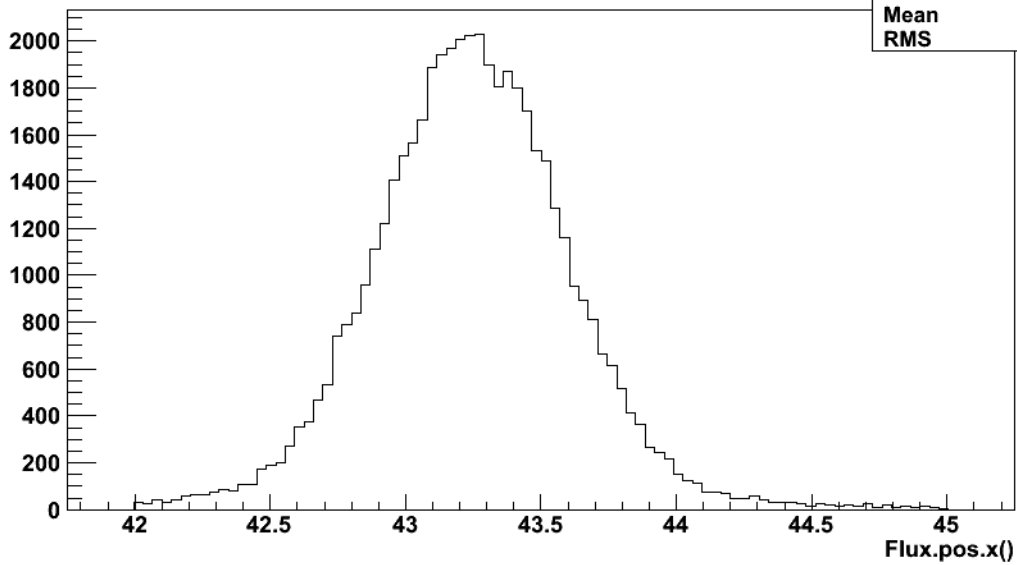
| htemp | |
|---------|--------|
| Entries | 48767 |
| Mean | 52.28 |
| RMS | 0.3141 |

Ecal Exit

HPS Simulation

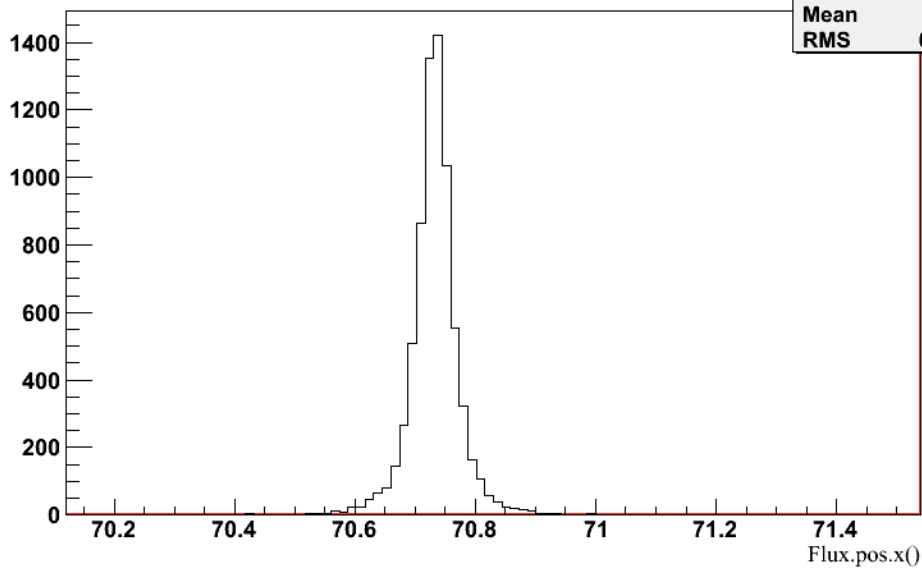
Beam Line: Beam Positions Constant Field Map.

Flux.pos.x() {Flux.id==13 && Flux.pos.x(>42 && Flux.pos.x(<45.)}



Photons at Silicon 1

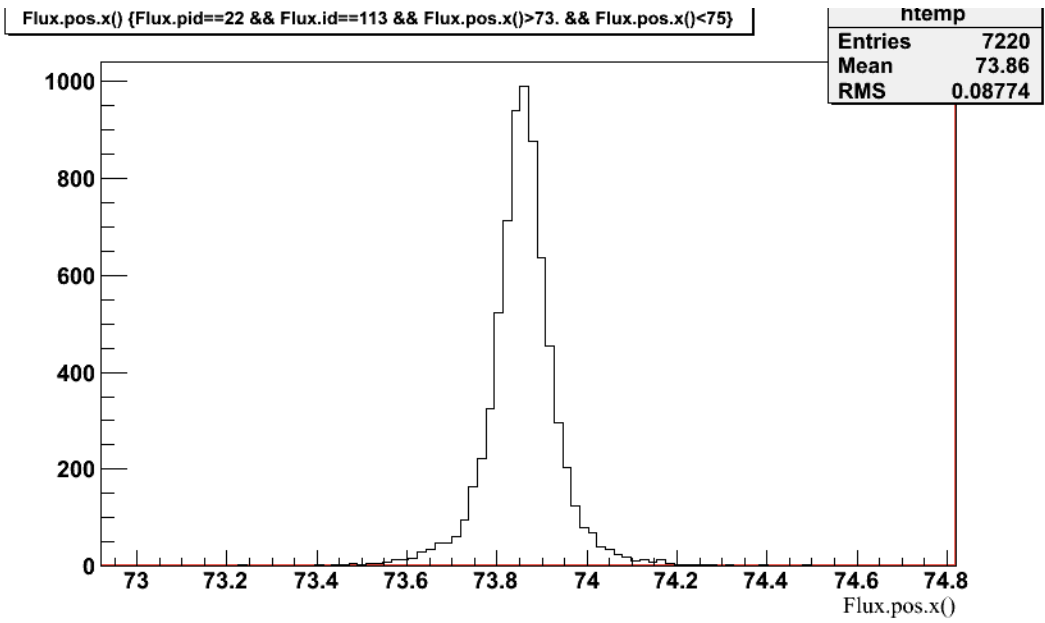
Flux.pos.x() {Flux.pid==22 && Flux.id==112 && Flux.pos.x(>70. && Flux.pos.x(<78)}



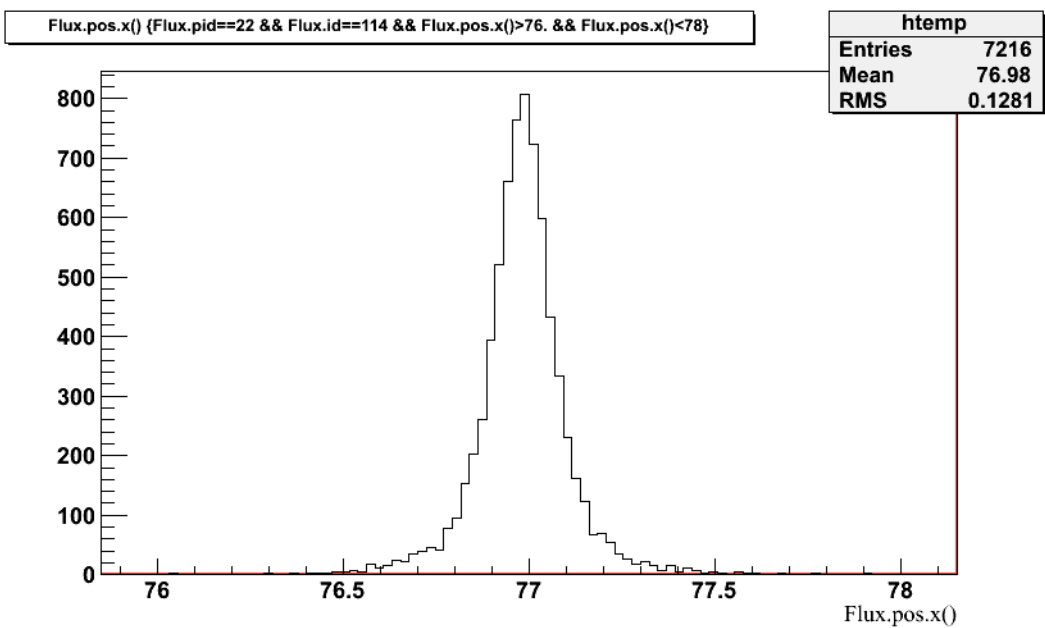
Photons at Silicon 2

HPS Simulation

Beam Line: Beam Positions Constant Field Map.



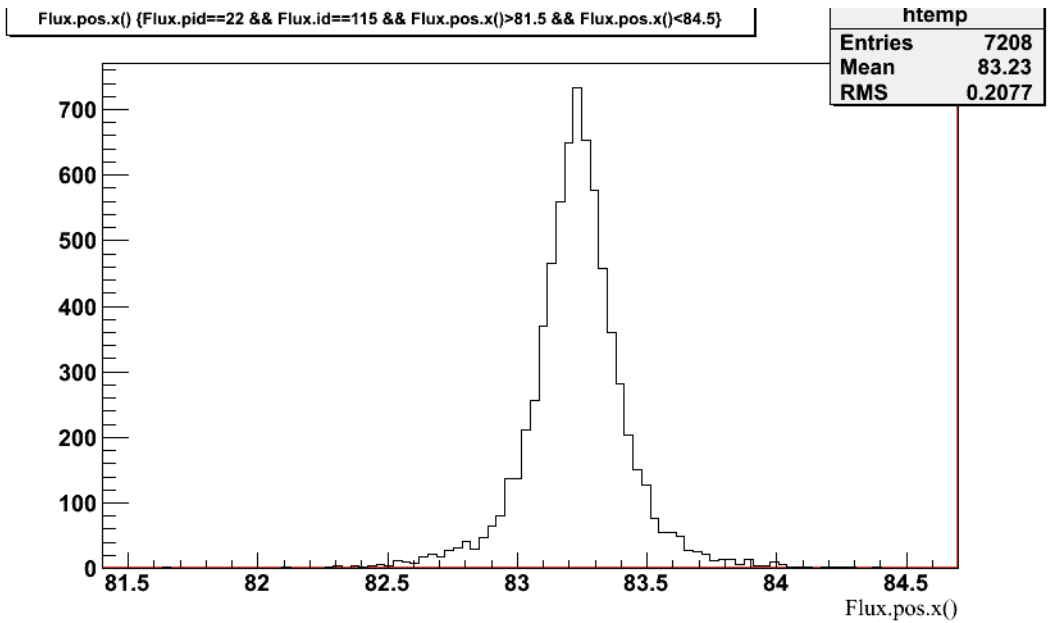
Photons at Silicon 3



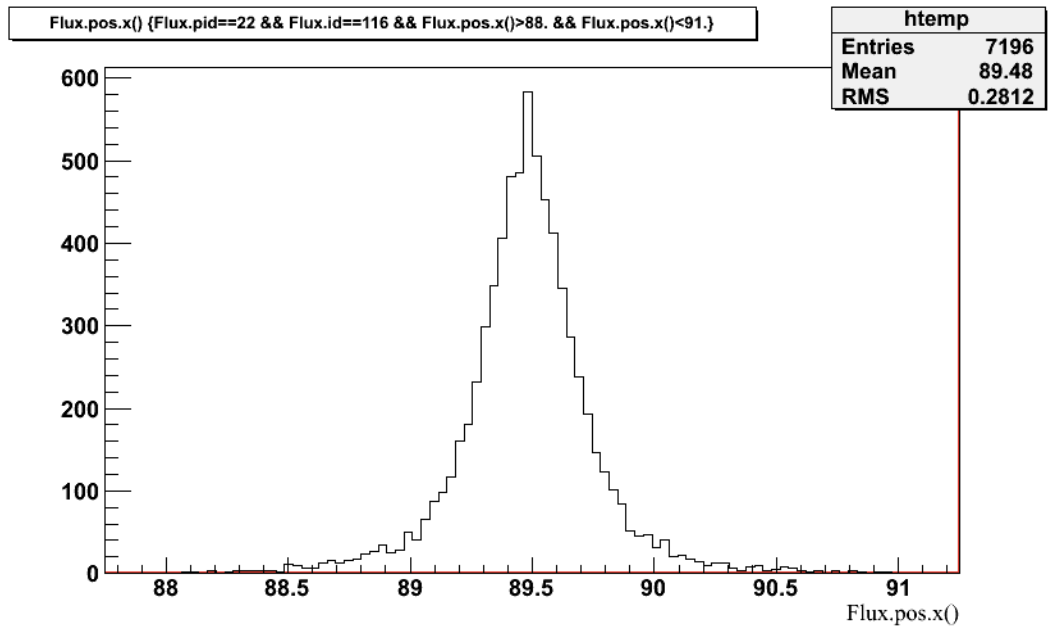
Photons at Silicon 4

HPS Simulation

Beam Line: Beam Positions Constant Field Map.



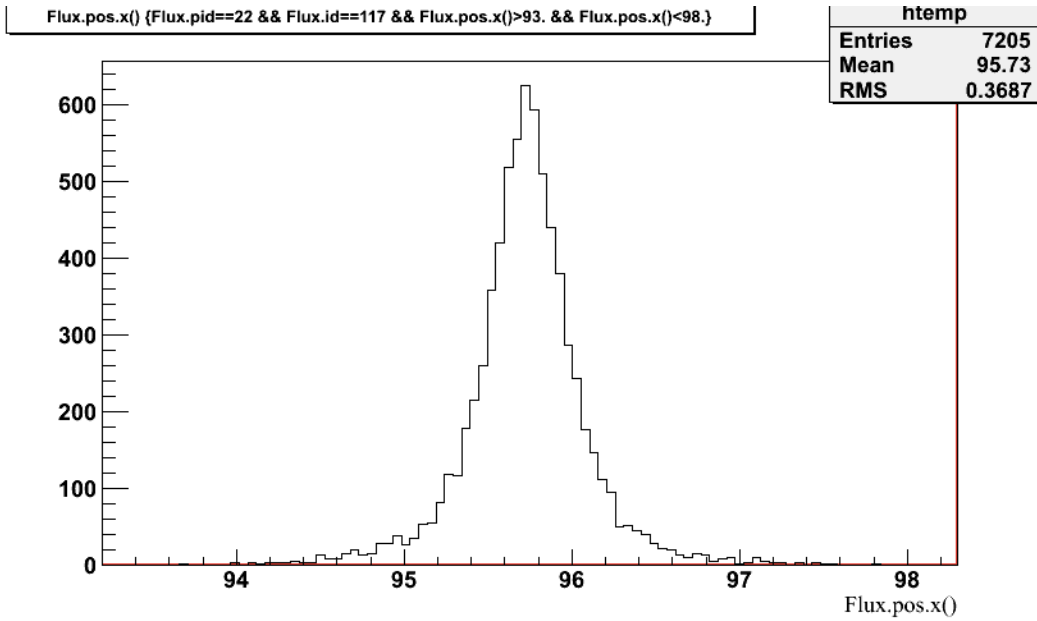
Photons at Silicon 5



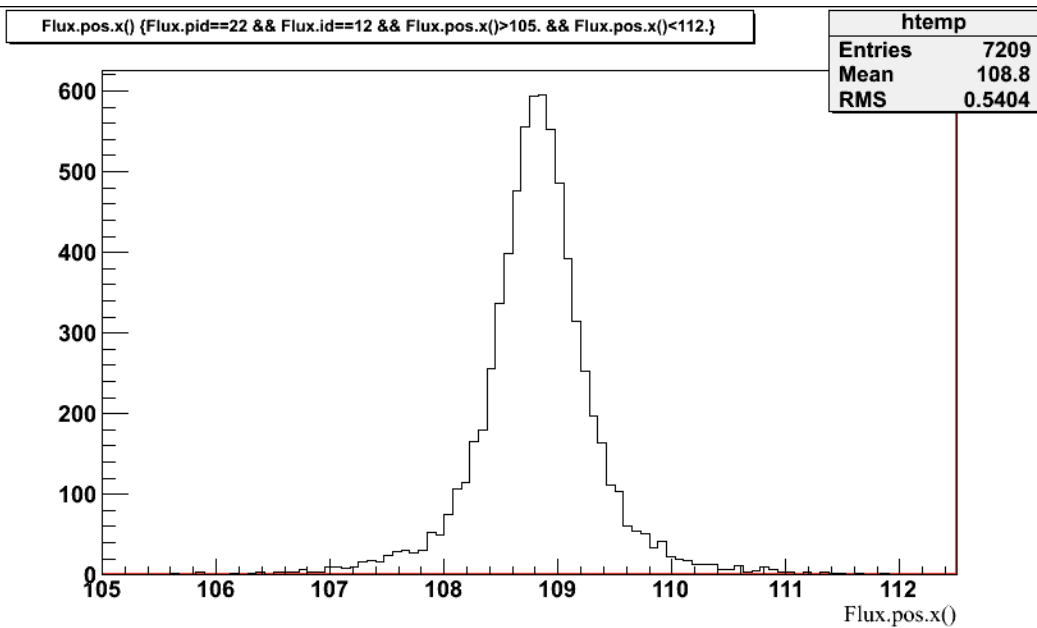
Photons at Magnet Exit

HPS Simulation

Beam Line: Beam Positions Constant Field Map.



Photons at Ecal Entrance



Photons at Ecal middle



HPS Simulation

Beam Line: Beam Positions Constant Field Map.

Flux.pos.x() {Flux.pid==22 && Flux.id==13 && Flux.pos.x(>112. && Flux.pos.x(<120.)

| htemp | |
|---------|--------|
| Entries | 7206 |
| Mean | 116 |
| RMS | 0.6366 |

