

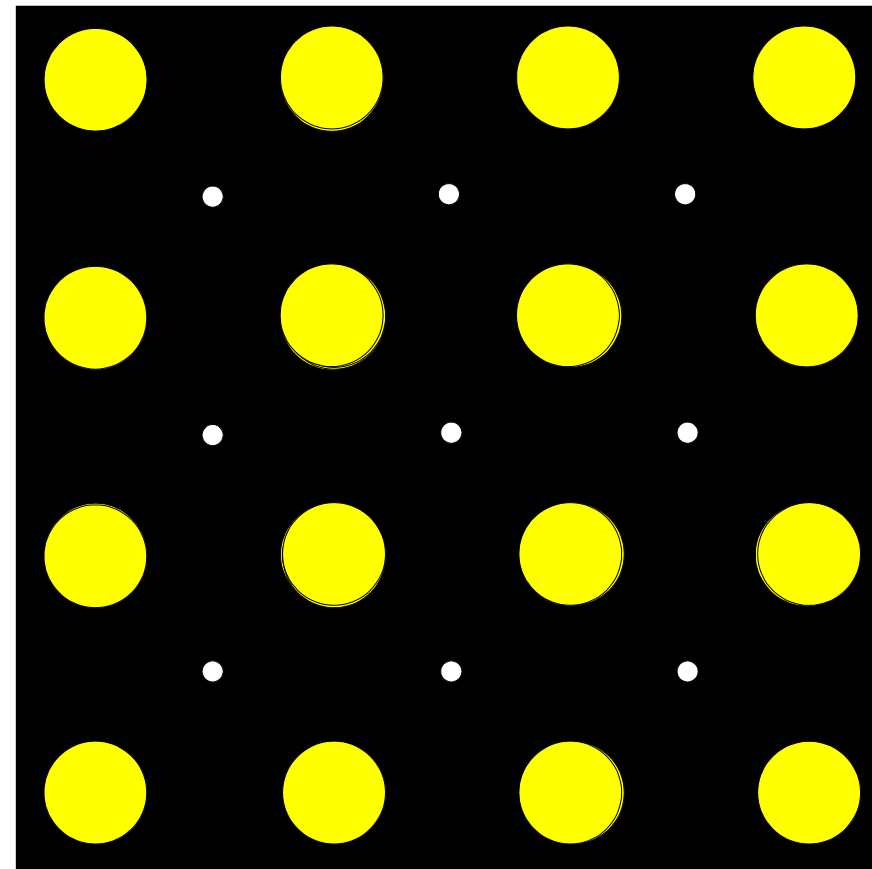
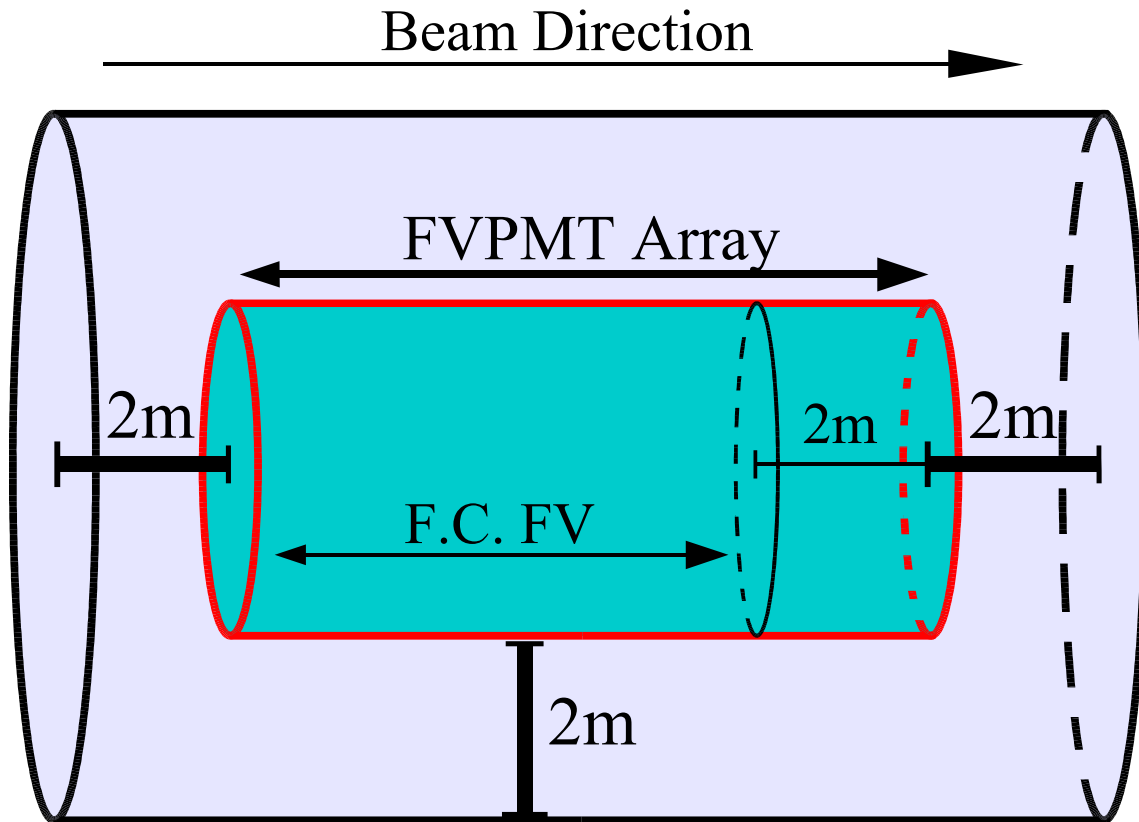
Fiducial Volume PMT Simulation

Mike Litos
Boston University

Oct. 6th, 2005

Small PMTs were placed 2m from the normal PMTs.

The **FVPMTs** were placed such that they lie between the normal PMTs when looking at them head on.



Note: Standard FV is defined with a 4m separation from downstream PMTs--will be studied in future

FVPMT Coverage ~5%

FVPMTs:

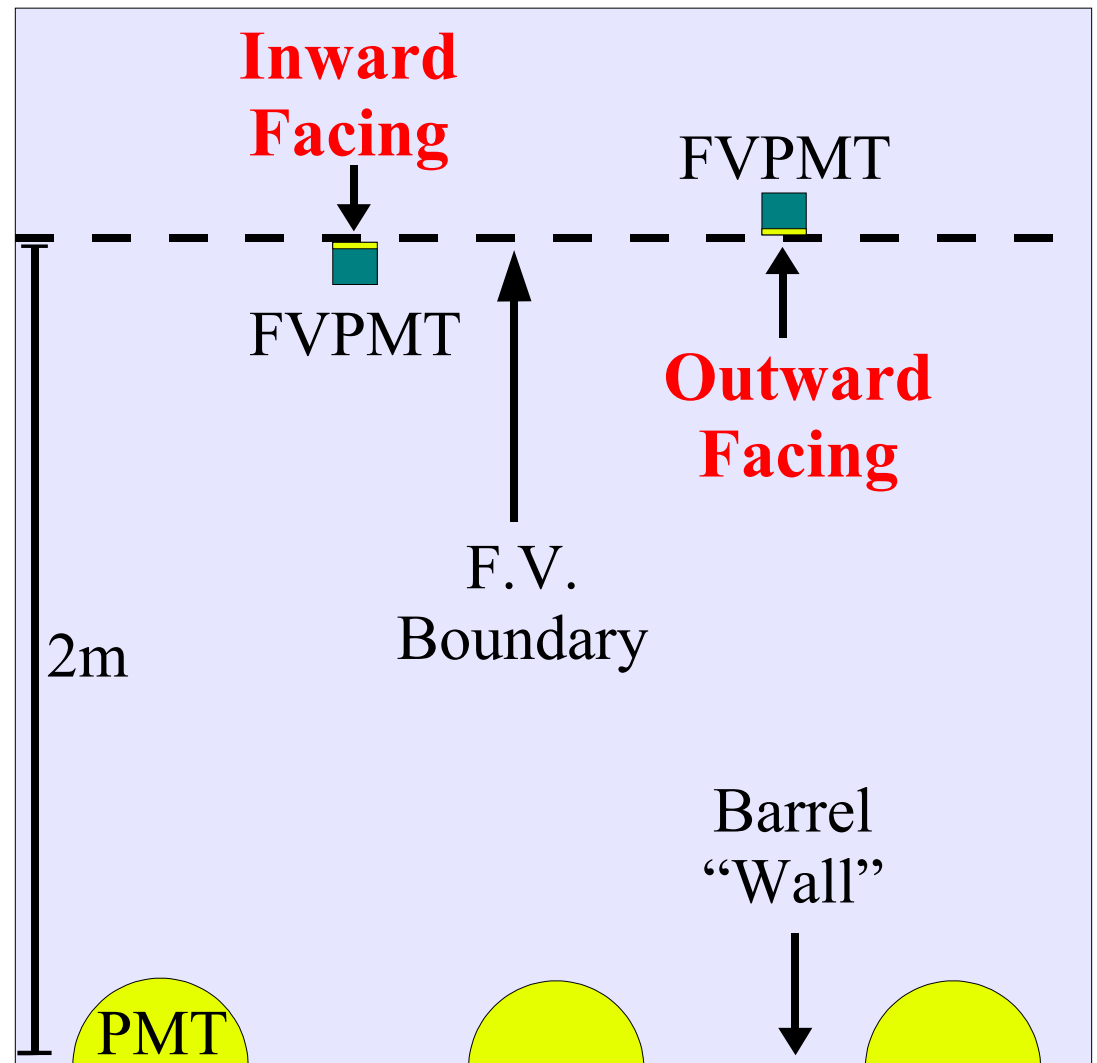
Based on PMTs used in
Mitsuka-san's experiment
in the 1kT tank.*



2" Diameter Face

Two Configurations Considered:

- 1) Inward Facing FVPMTs
- 2) Outward Facing FVPMTs



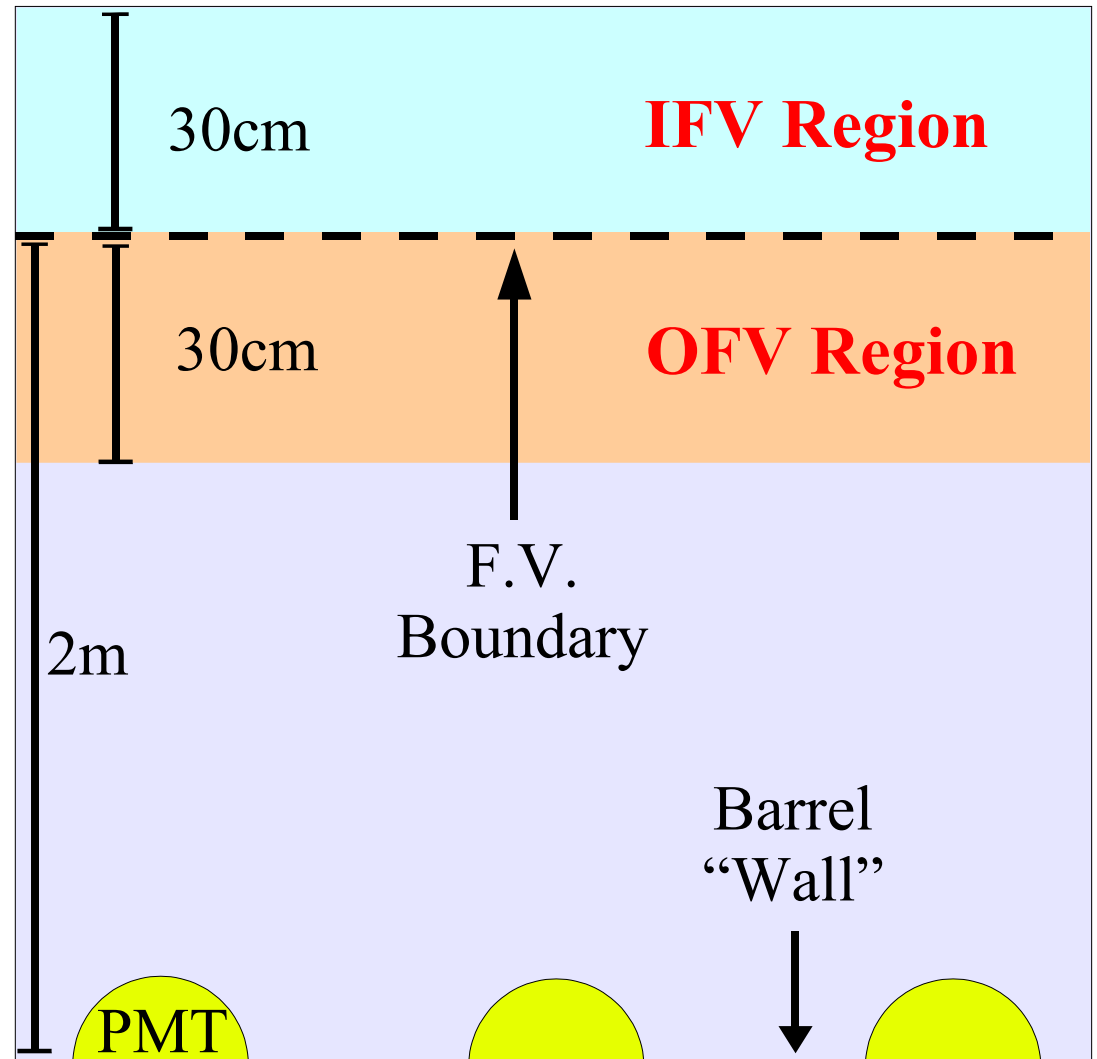
*Warning: Smoking is
hazardous to your health.

Two Event Types Considered:

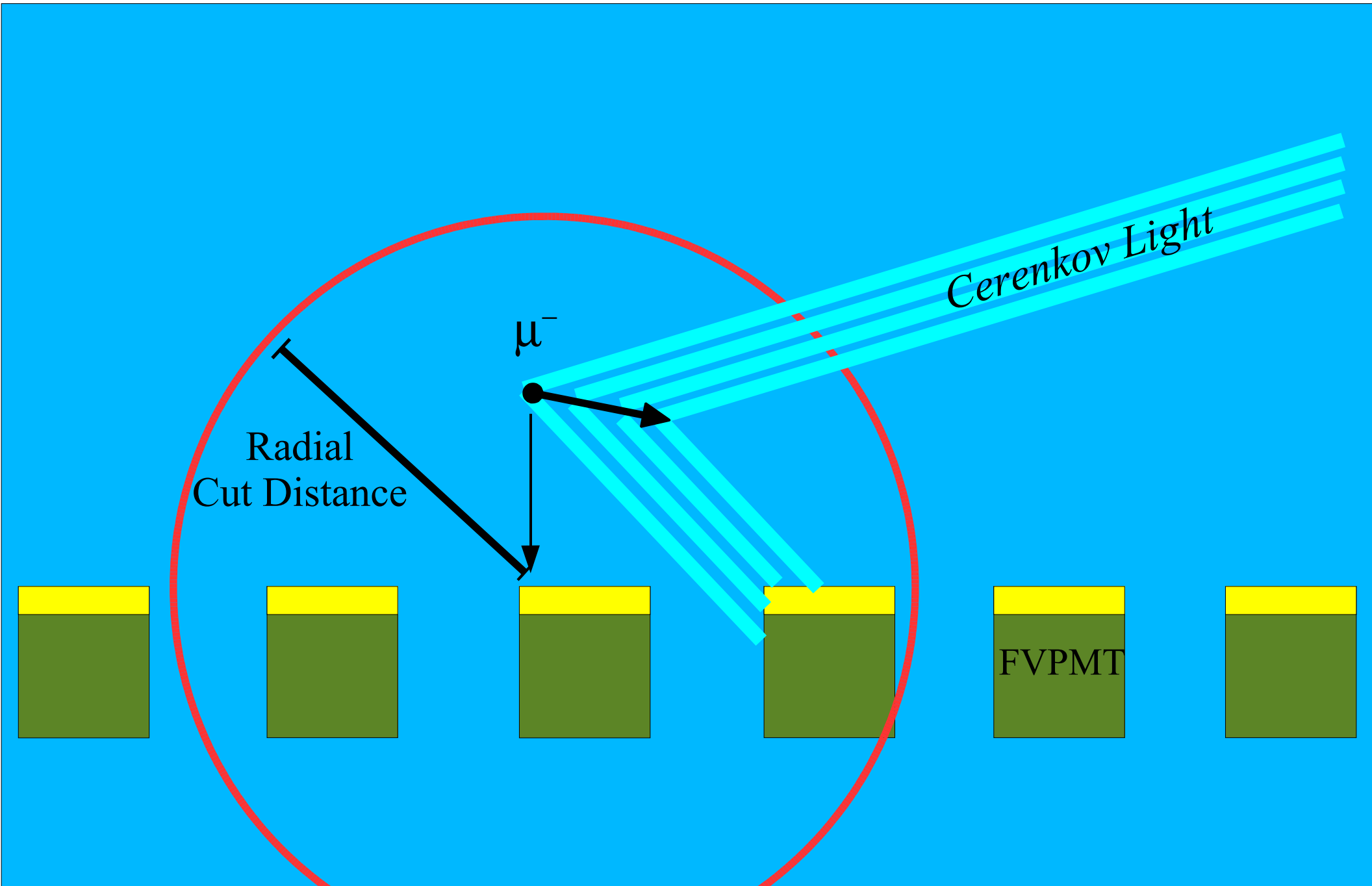
I considered only those events (muon vertices) which occurred within $\pm 30\text{cm}$ distance from the 2m FV Boundary.

I then divided these events into two categories, based on whether they were inside or outside the FV Boundary.

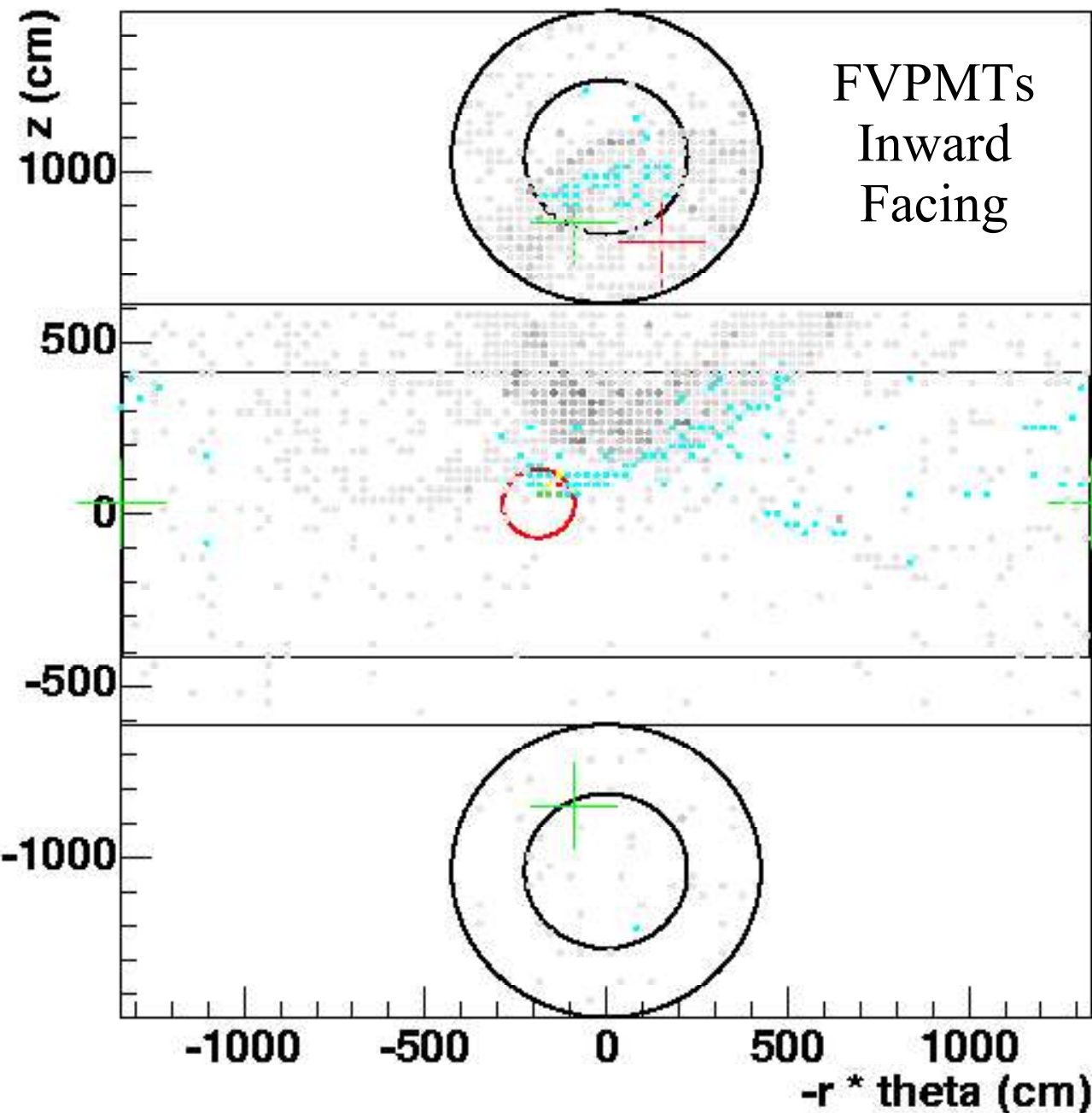
- 1) Just Inside the FV Boundary (**IFV**)
- 2) Just Outside the FV Boundary (**OFV**)



Only the hit FVPMTs which are within the **Radial Cut** are considered.
The **Radial Cut** is made from projected point to FV Boundary.



Example of a “ROOT-Scan” Event



- FVPMTs shown in color.

- Red: most charge
 - Blue: least charge

- Normal PMTs shown in grey tones.

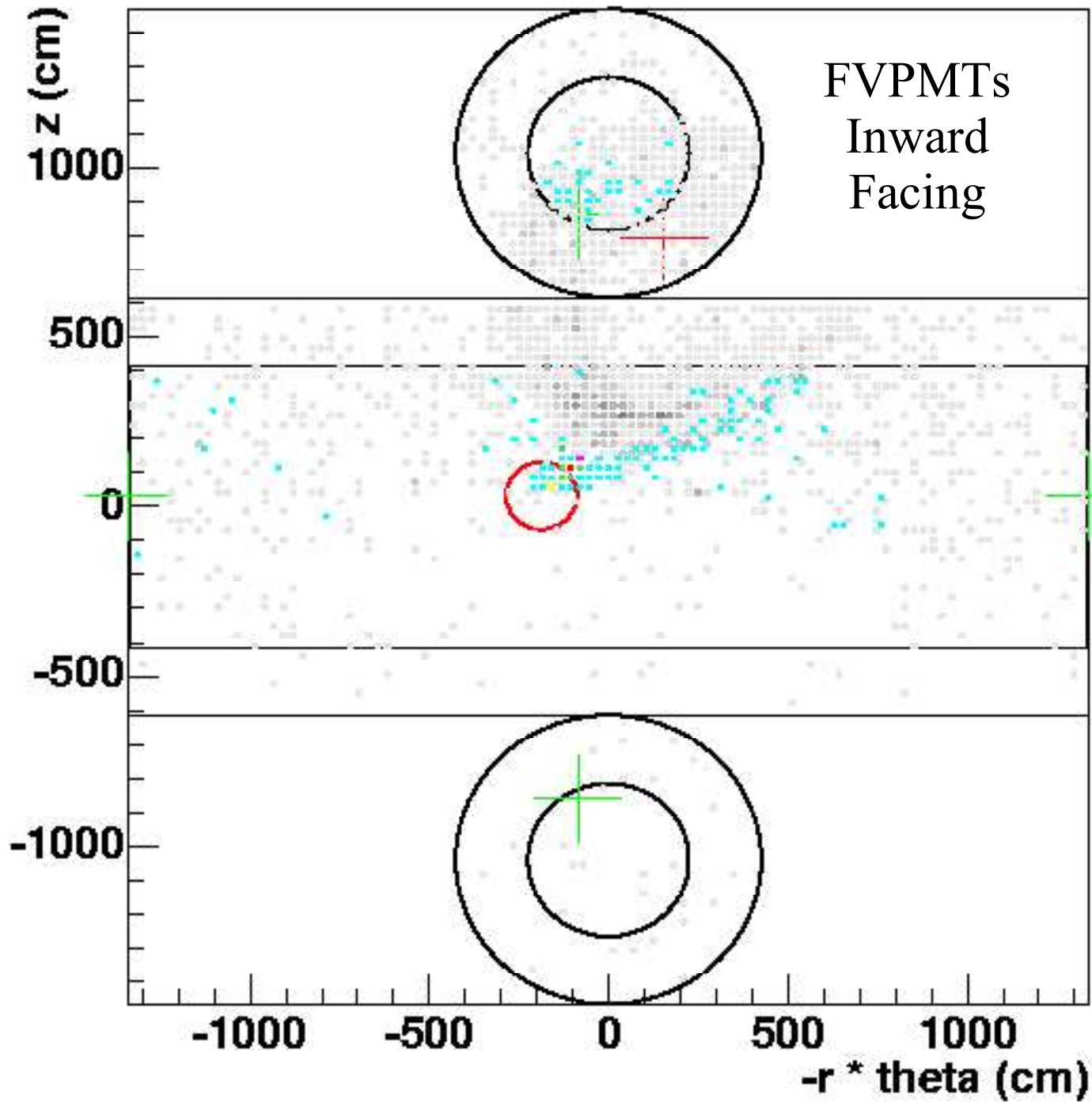
- Dark: most charge
 - Light: least charge

- Green Crosses show vertex point.

- Red Cross shows muon direction projected onto outer “wall”.

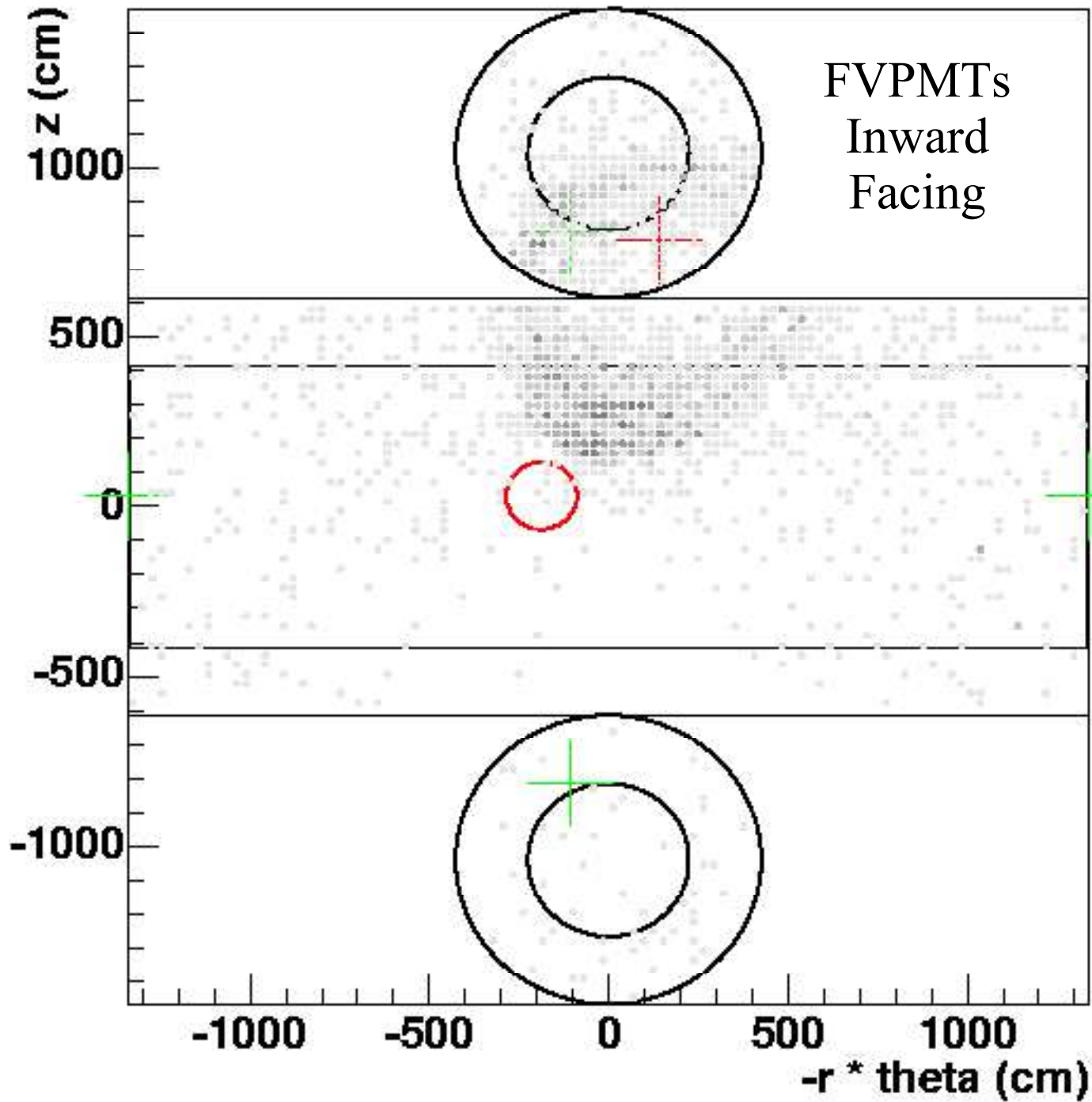
Special thanks to T.J. Corona!

Same: Energy, Direction, z Position



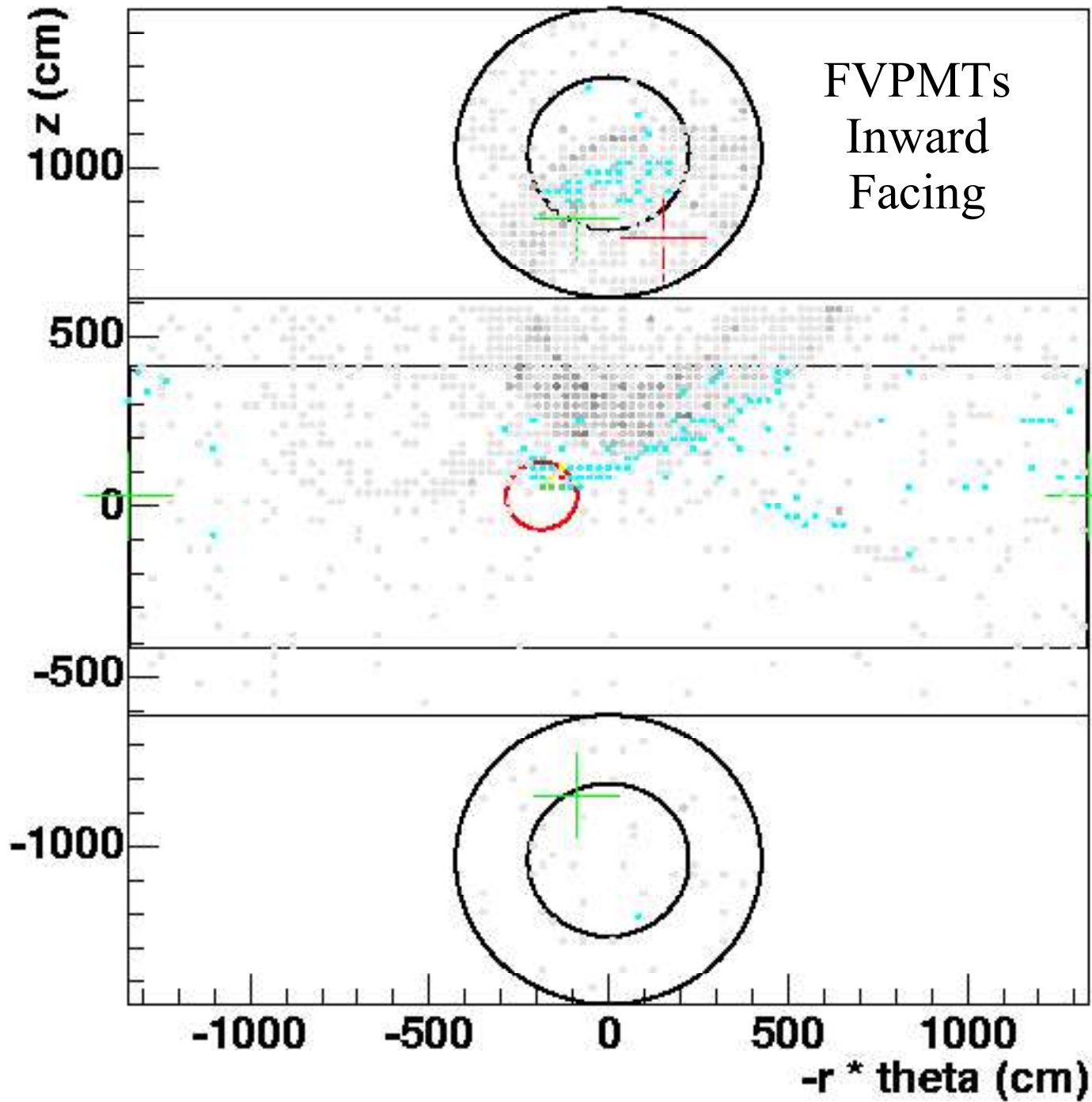
$R = -25\text{cm}$

Same: Energy, Direction, z Position

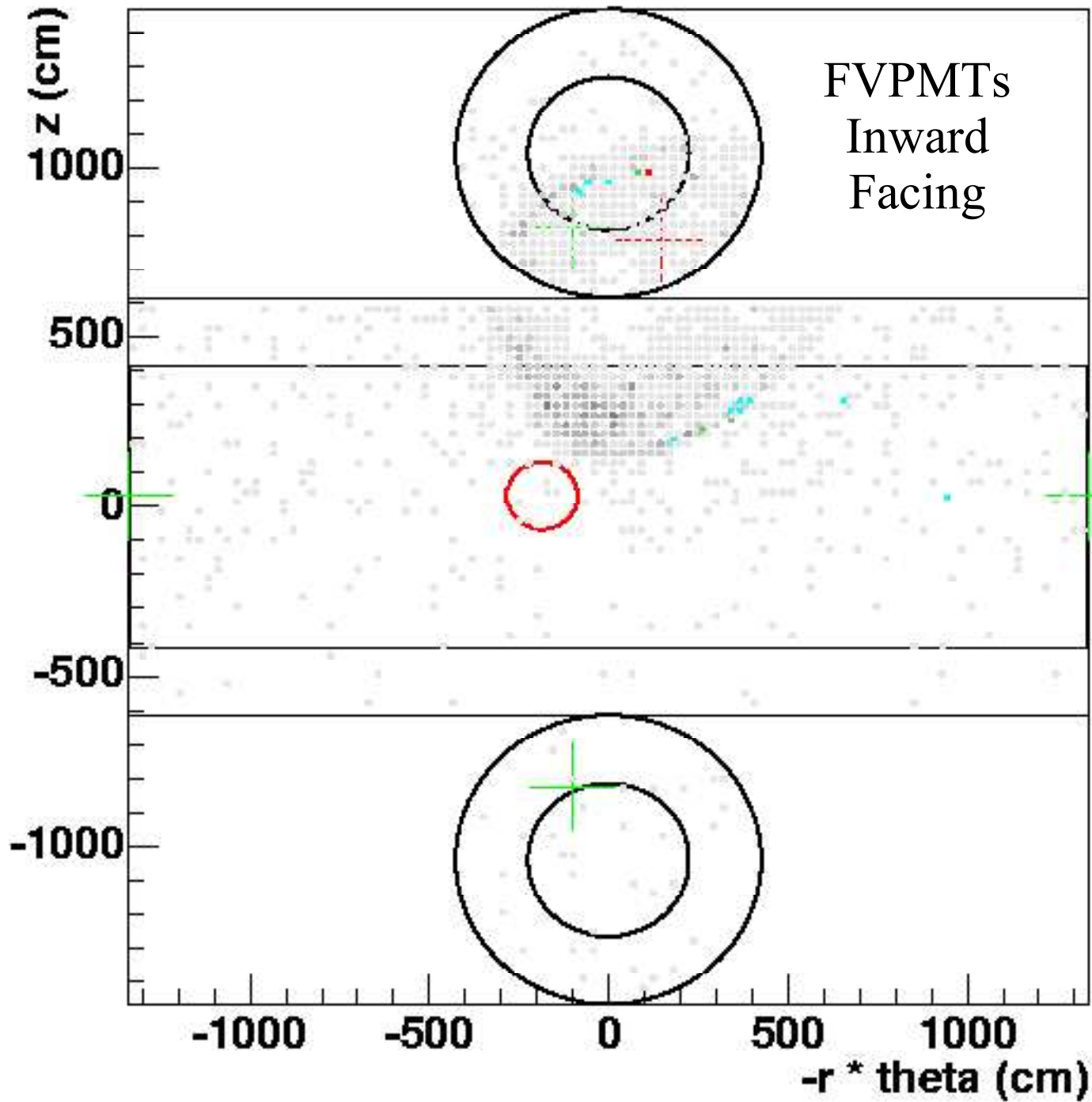


$R = +25\text{cm}$

Same: Energy, Direction, z Position

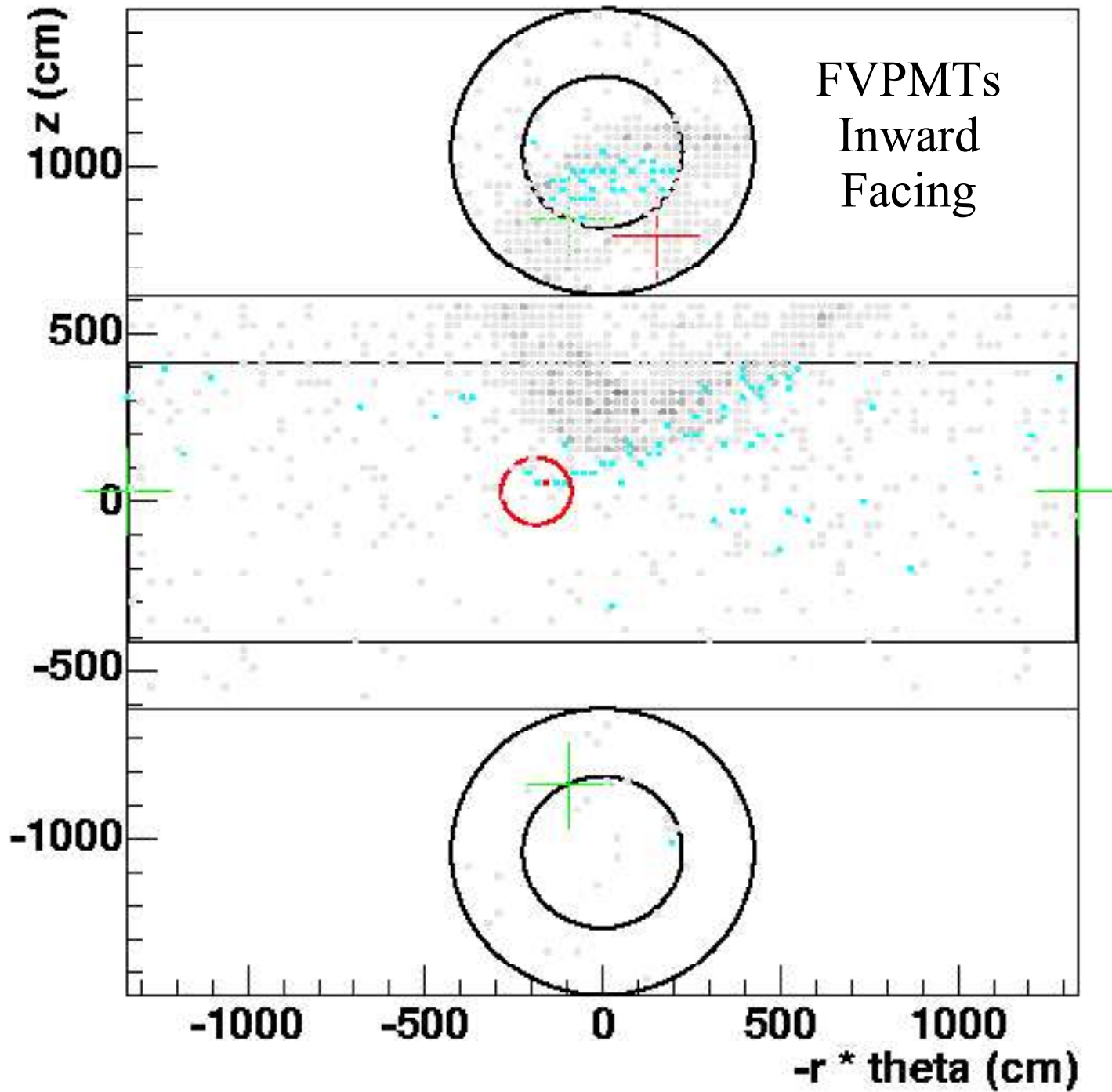


Same: Energy, Direction, z Position

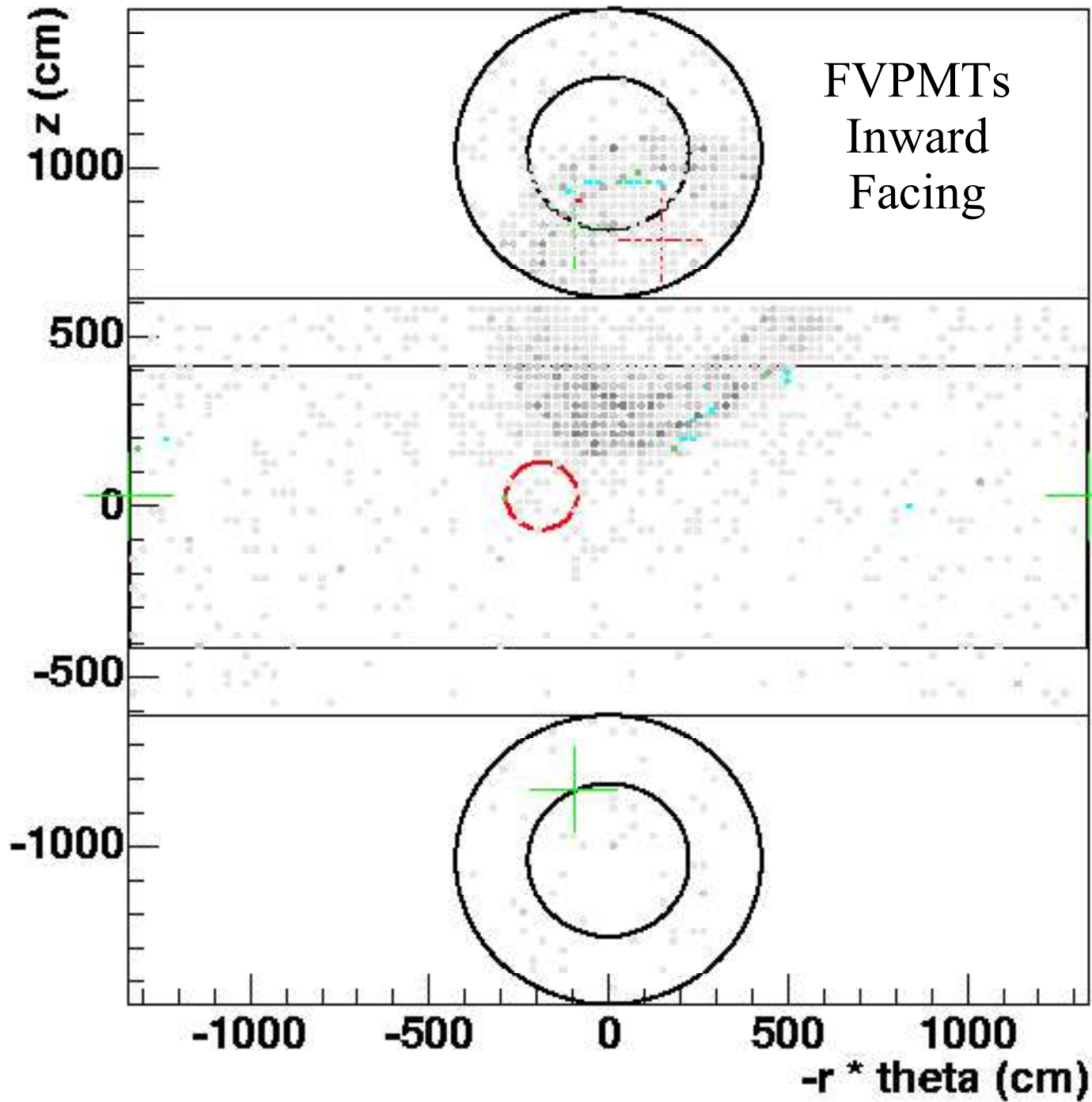


$R = +15\text{cm}$

Same: Energy, Direction, z Position

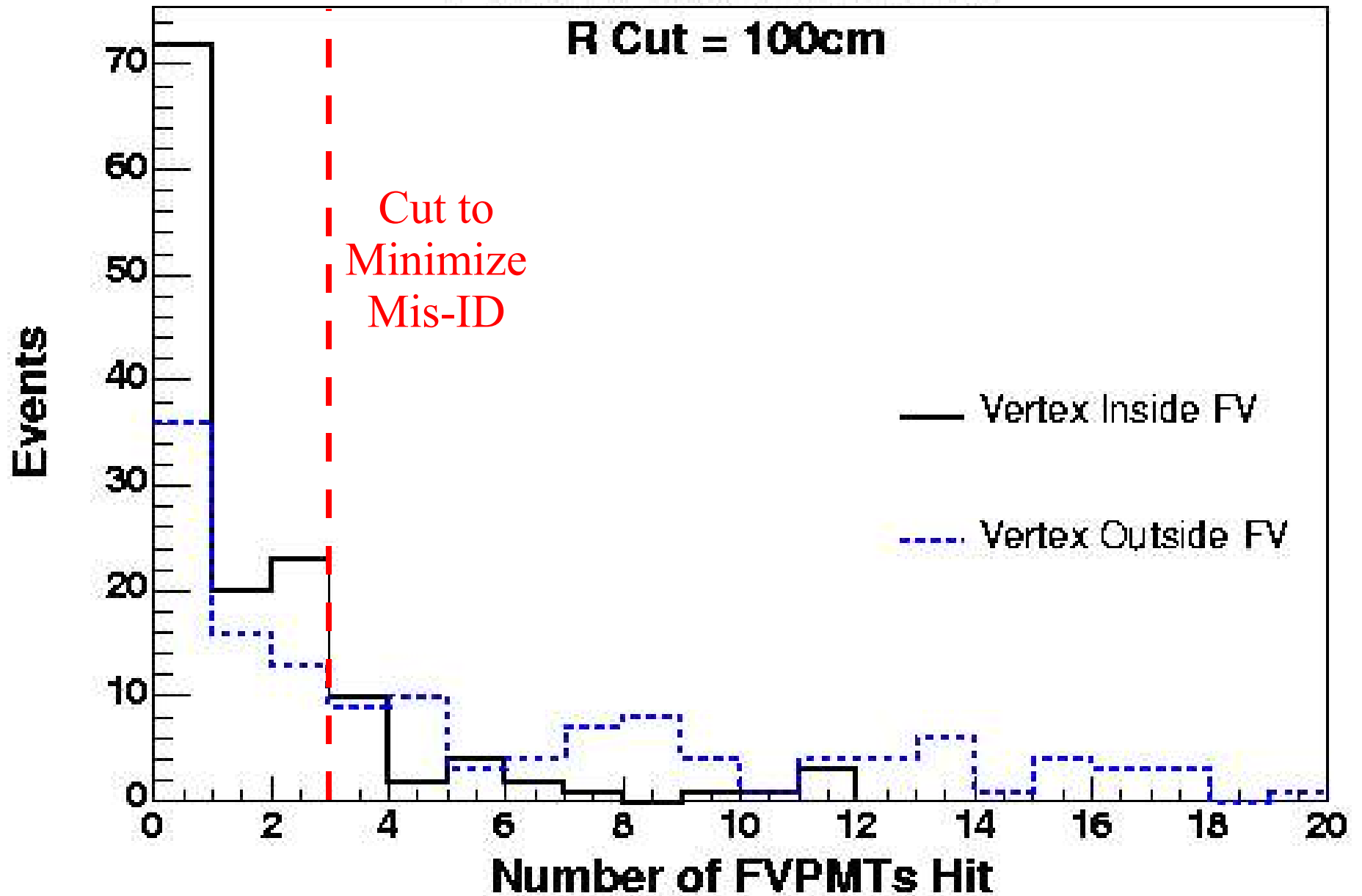


Same: Energy, Direction, z Position



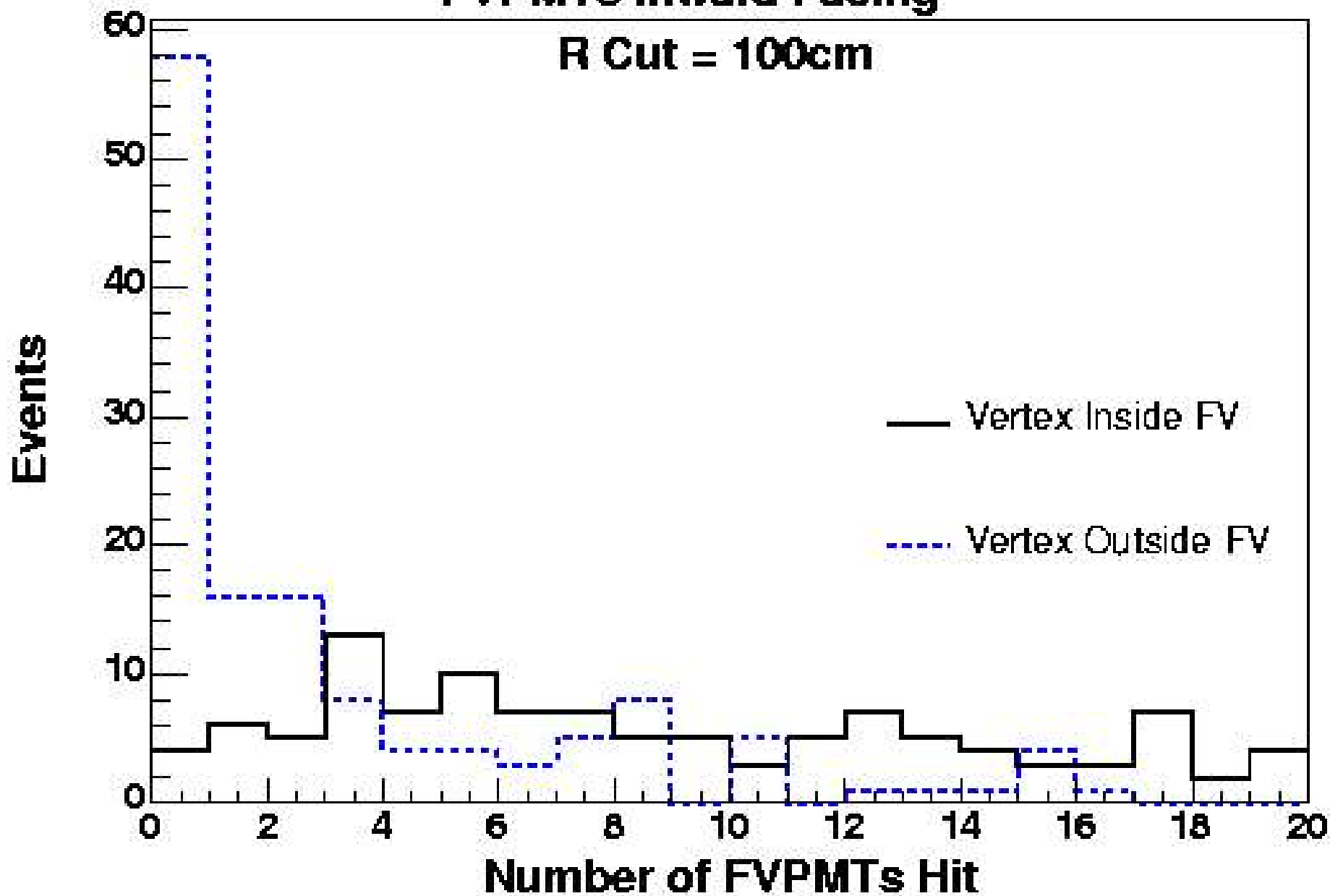
FVPMTs Outward Facing

R Cut = 100cm



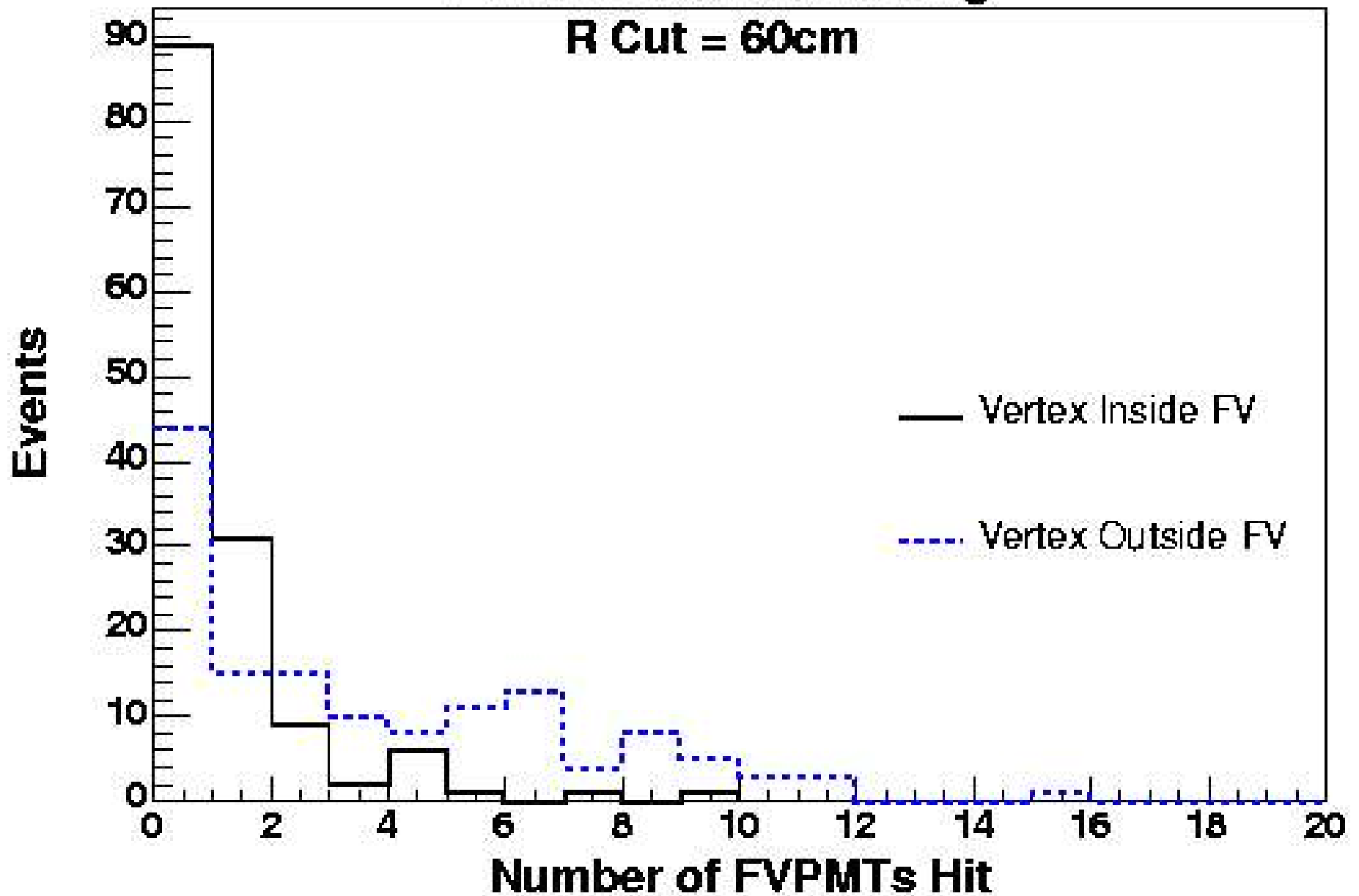
FVPMTs Inward Facing

R Cut = 100cm



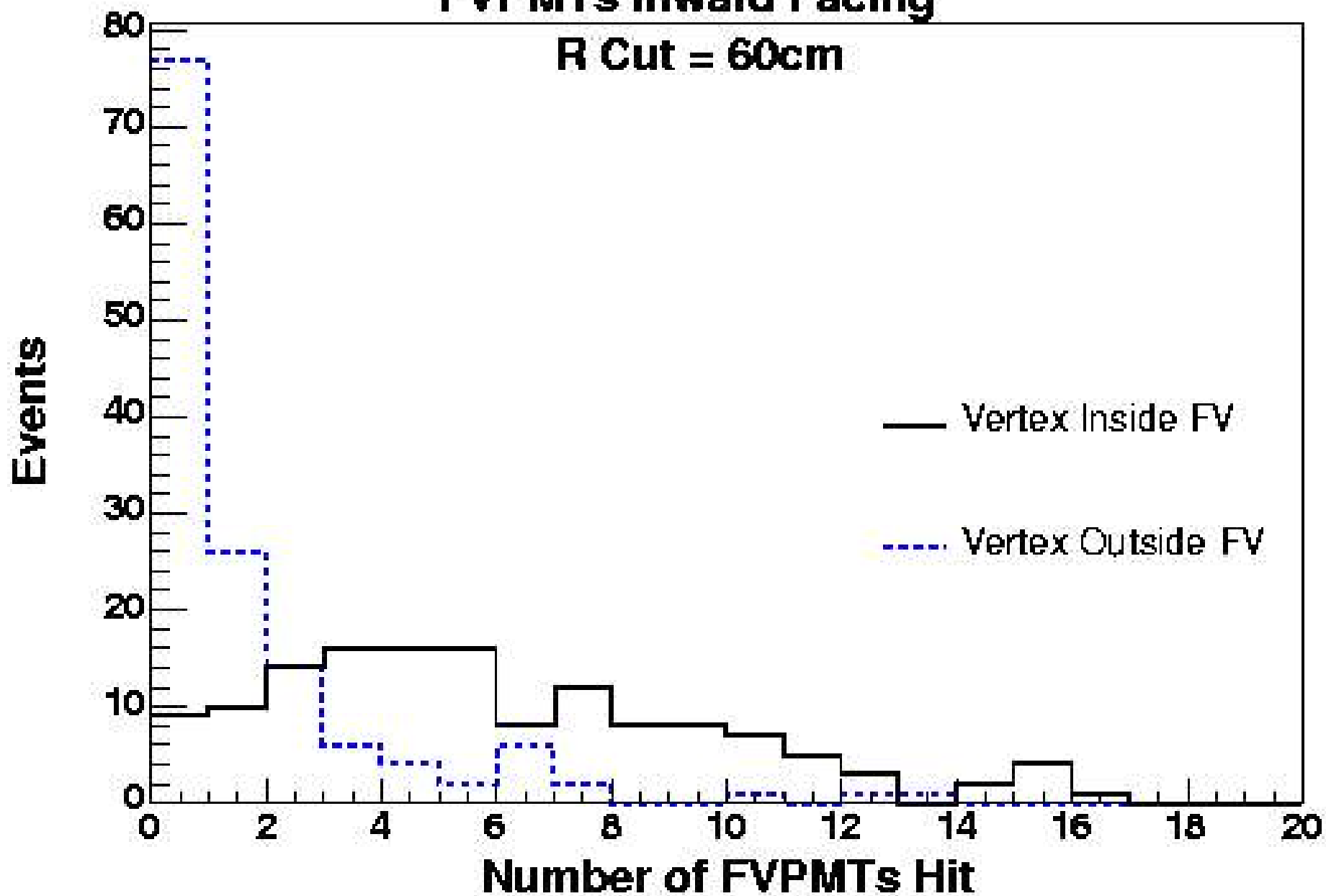
FVPMTs Outward Facing

R Cut = 60cm



FVPMTs Inward Facing

R Cut = 60cm



Wall Projected Sphere

Configuration	R Cut	Lowest Mis ID %	...Occurs at Nhit Cut
Inward Facing	60cm	50	1
Inward Facing	100cm	48	2
Outward Facing	60cm	23	2
Outward Facing	100cm	30	3

Vertex Centered Sphere

Configuration	R Cut	Lowest Mis ID %	...Occurs at Nhit Cut
Inward Facing	60cm	22	3
Inward Facing	100cm	27	3
Outward Facing	60cm	35	2
Outward Facing	100cm	38	4

Conclusion:

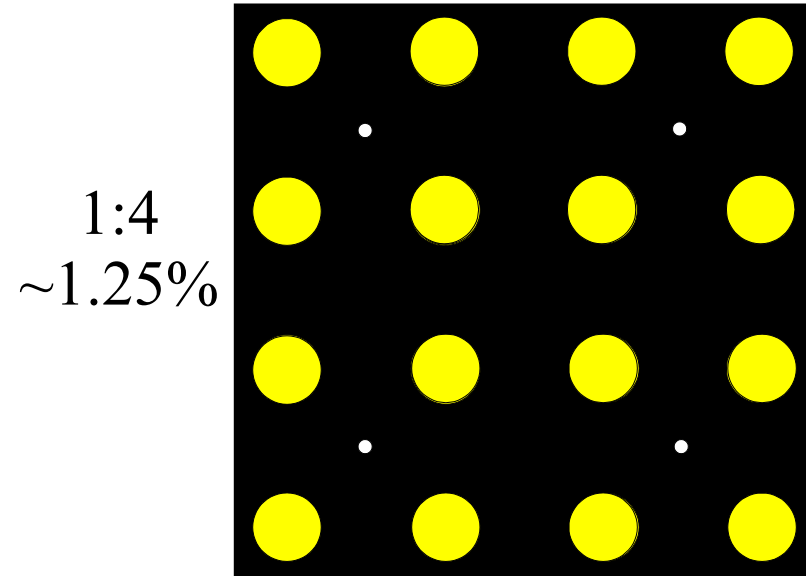
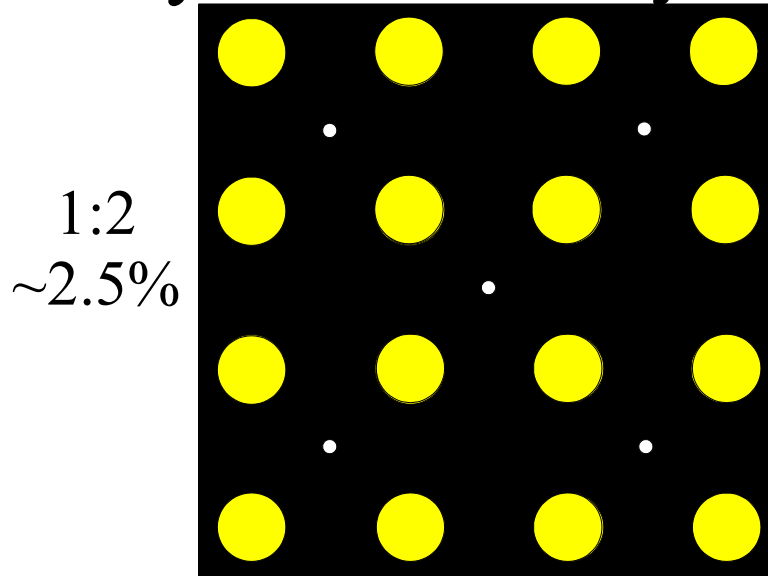
I have constructed a working set of tools for analyzing the effects of the addition of Fiducial Volume PMTs.

The simple first analysis that I have conducted shows that there may indeed be some promise in such an idea, and served as a sanity check for the simulation.

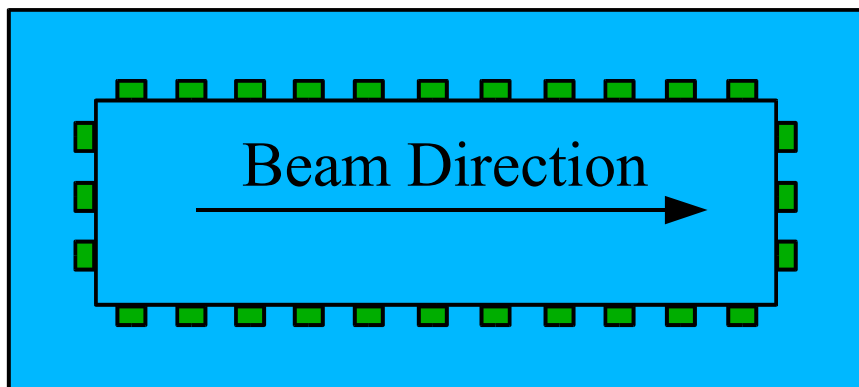
I am now ready to begin a more sophisticated analysis of the cost/benefit of the FVPMTs, replacing MC Truth information with reconstructed data.

Future Plans:

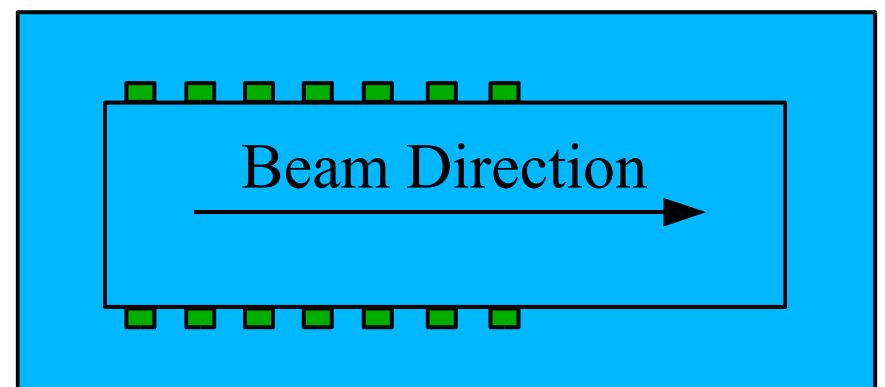
- Study lower density of FVPMTs:



- Study necessary extent of coverage in z:



vs.



- **Most Importantly:** Use reconstructed vertex data.