PET Simulation

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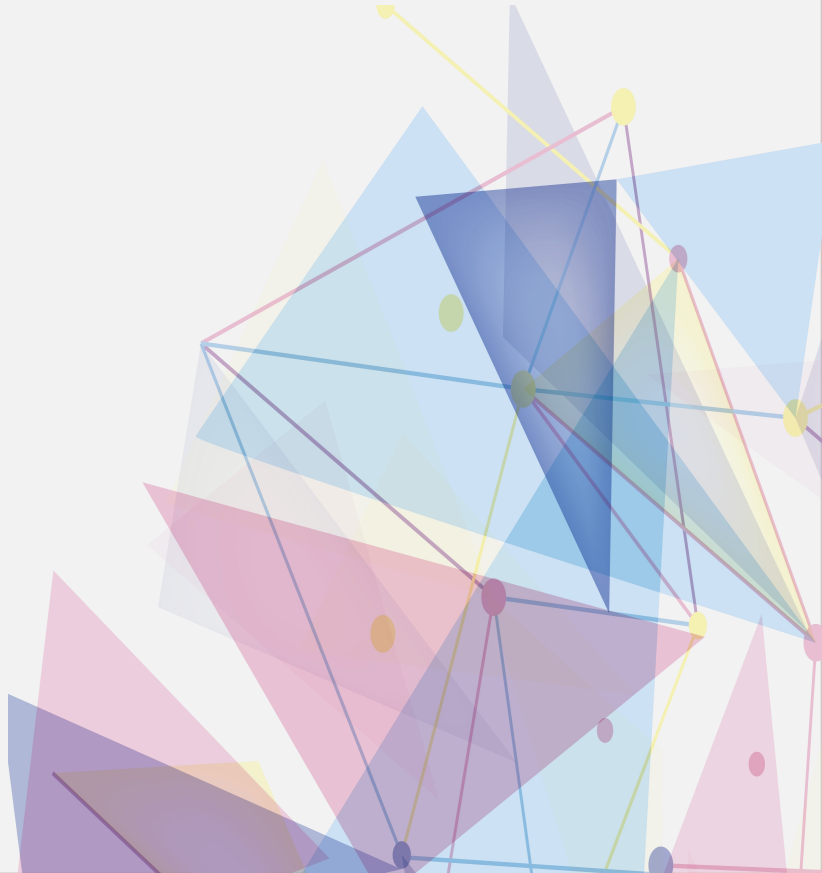
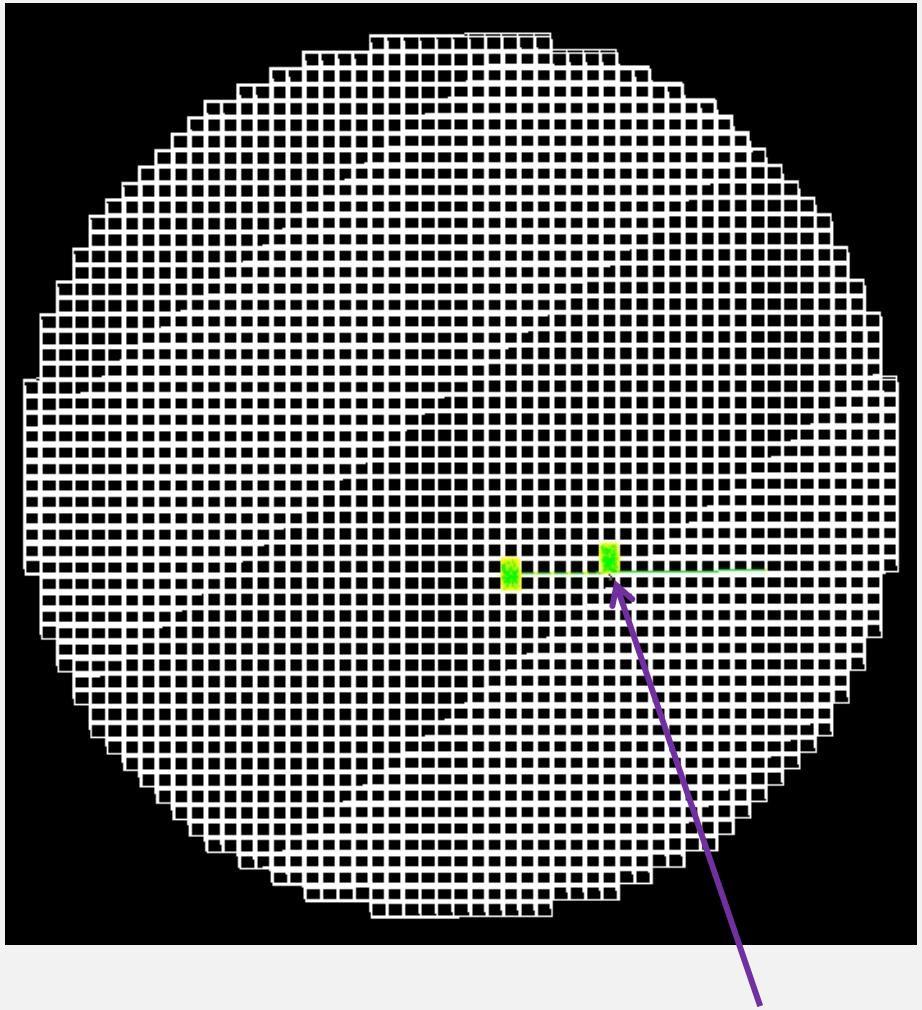
CONTENTS

PATR 01
Progress



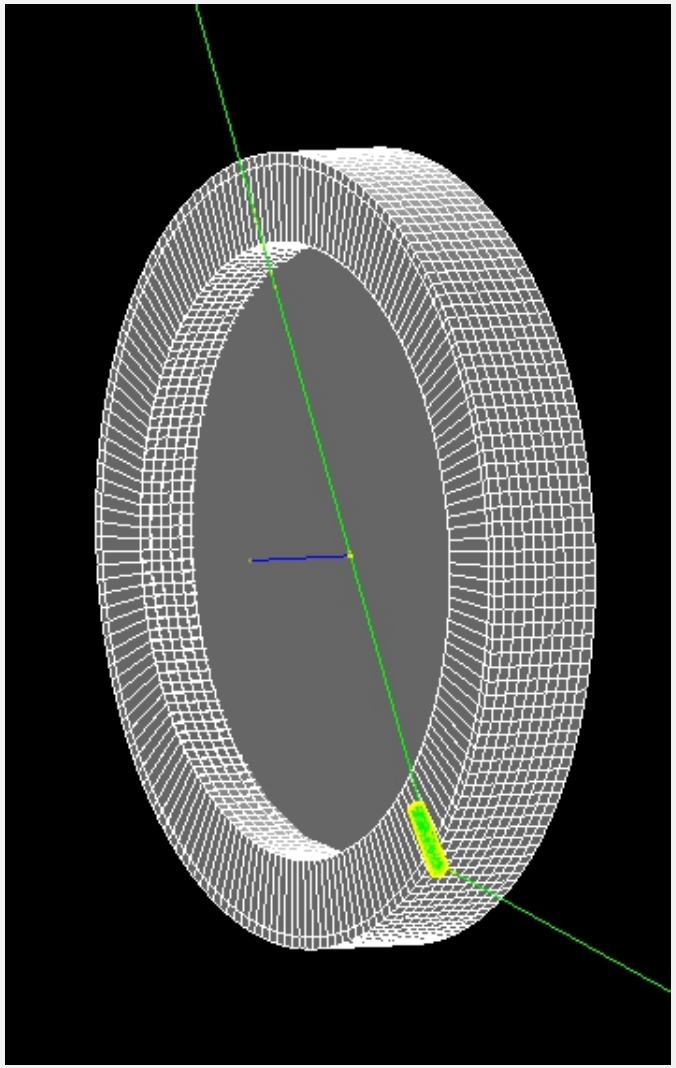
First structure of Positron detector



Parameter	
Reflectivity	0.7
Refractive index (LYSO)	1.82
Refractive index (Mylar)	1.65
Radius of beam pipe	80 mm
Length of LYSO crystal	20 mm
Width of LYSO crystal	3 mm

The gammas produced from the annihilation can transported to other module so that the position can not be reconstructed properly. The first structure can not meet our requirement.

Second structure of Positron detector

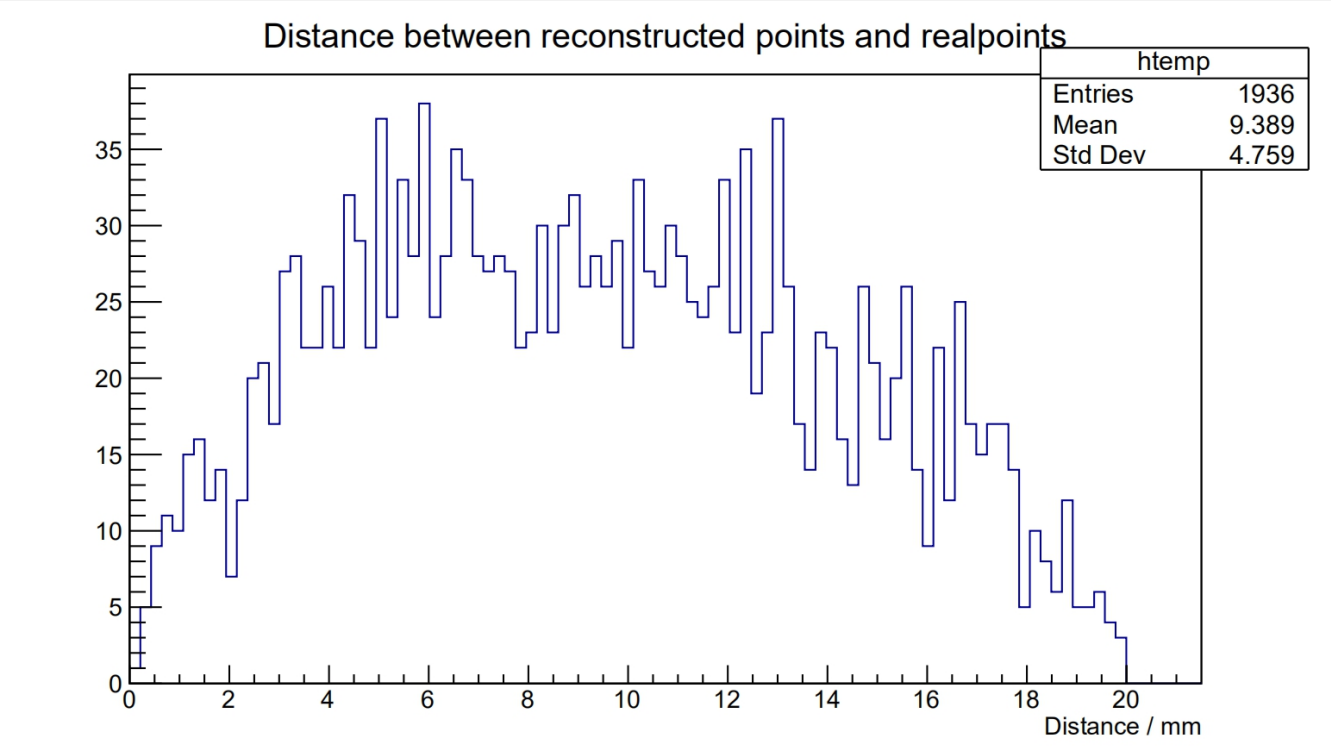


Parameter	
Reflectivity	0.9
Refractive index (LYSO)	1.82
Refractive index (Mylar)	1.65
Radius of beam pipe	80 mm
Length of LYSO crystal	20 mm
Width of LYSO crystal in Z axis	3 mm
Thickness of target	0.1 mm
Thickness of reflective film	0.1 mm
Number of layers in Z axis	170
Number of layers in Phi axis	170

Limited by the rendering speed of my PC, only 10 layers in Z-axis are shwon here. The gammas produced in annihilation may not be all detected like the case shown in the picture.

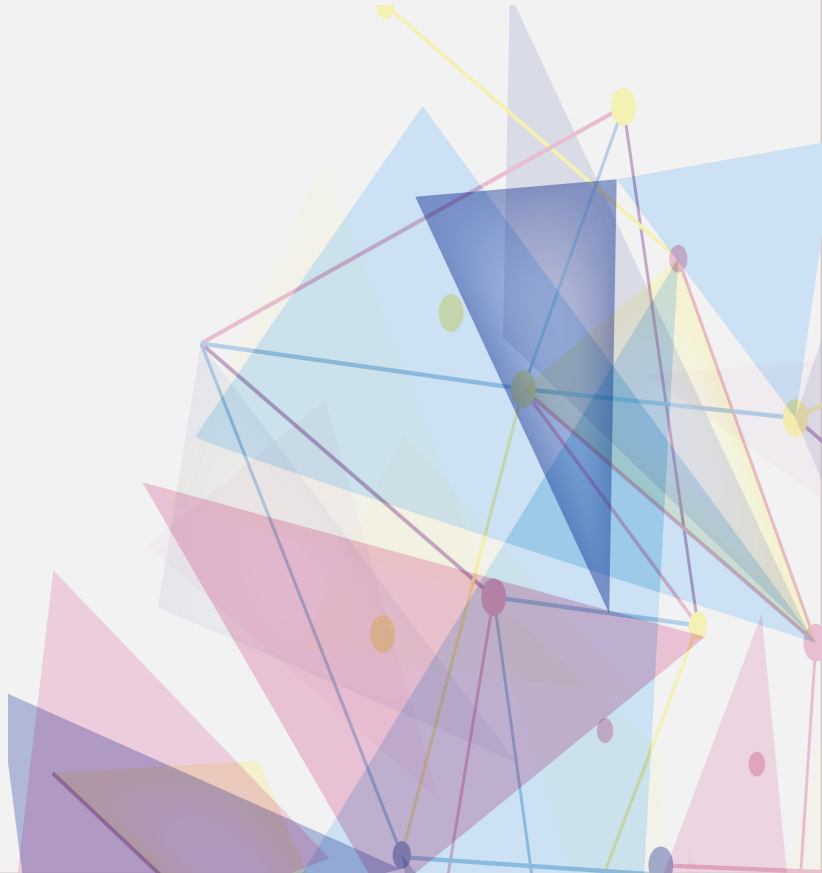
A simple trail to reconstruct signals

- If the number of photons hitting one pixel of SiPM is above 50, this SiPM pixel are treated to be triggered.
- If the number of SiPM triggered is not 2 in one event, then this event will not be reconstructed.
- The center of an activated LYSO crystal is used as the position of incident gamma.
- The intersection of the line between two signal positions and the target plane is the reconstructed position of incident positron.



As we can see, the preliminary results of reconstruction are not so good as our expectation. Of cource, I will check my reconstruction algorithm later, but it is possible that the PET method is not a good choice for the detection of a single positron since the PET used in medical science uses plenty of positrons to reconstrut the position.

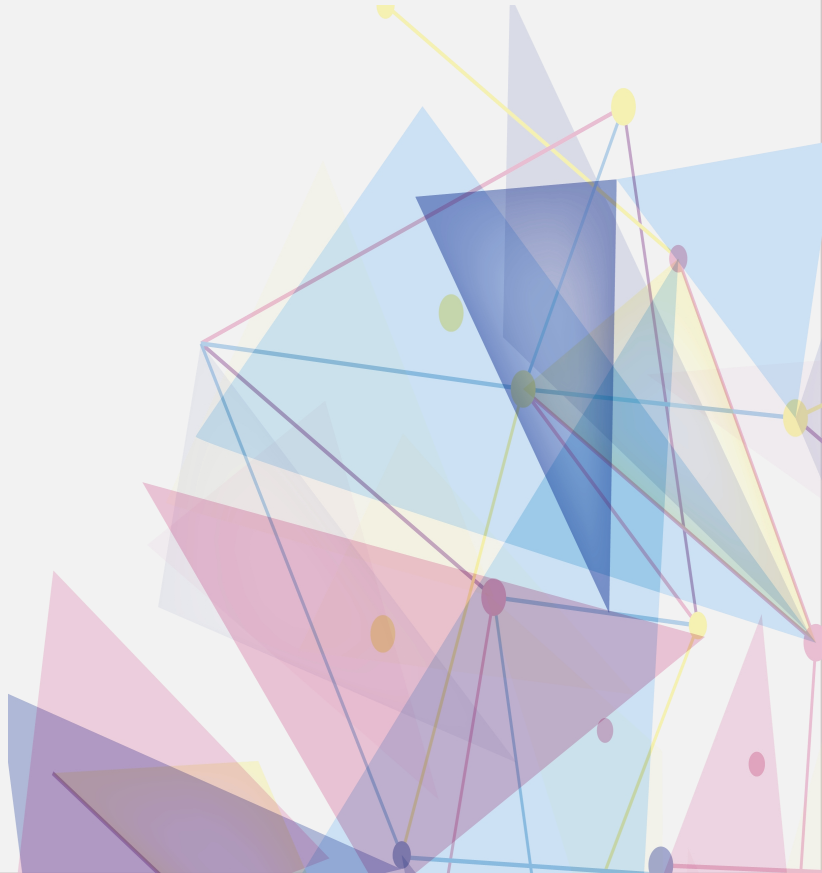
PATR 02
Conclusions



Conclusions

- The two possible structures of positron detector inhirited from PET method seem to be not suitable for our experiment, as precision of reconstructed position is not meet our requirement.
- I will check my reconstrution algorithm later.
- Maybe other type of position detector shold be considered as well. The MCP used in former experiment in PSI can reach a position resolution of several micrometers. I’m wondering whether the spatial resolution can be improved significantly with the help of novel detector technology.

PATR 03
Next work



Next work

- I will consult teachers who are experience in the field of spatial detector and investigate some more papers to find another practical method for the detection of positron.
- As the failure of my first trial, the progress of positron detector is delayed a lot, so sorry for this.

THANK YOU

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