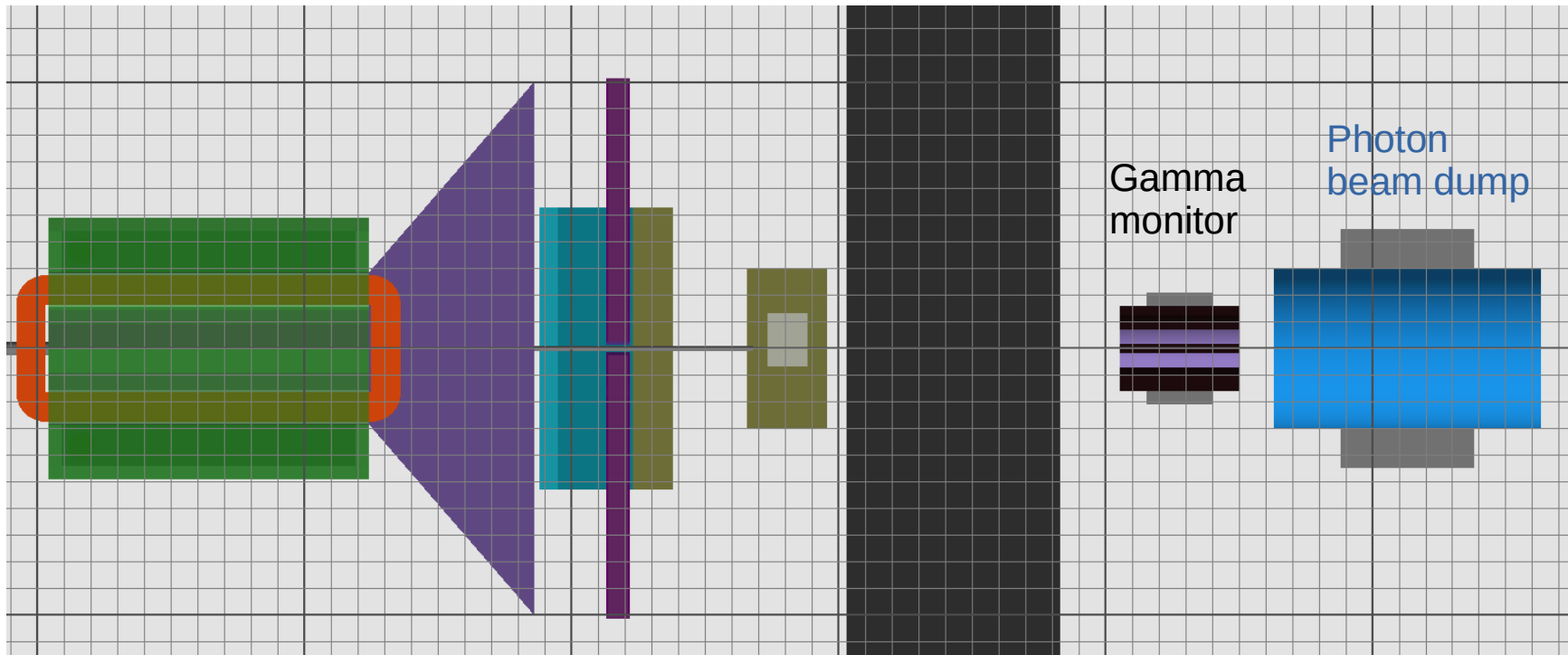# Possible alternative implementation of LUXE gamma monitor
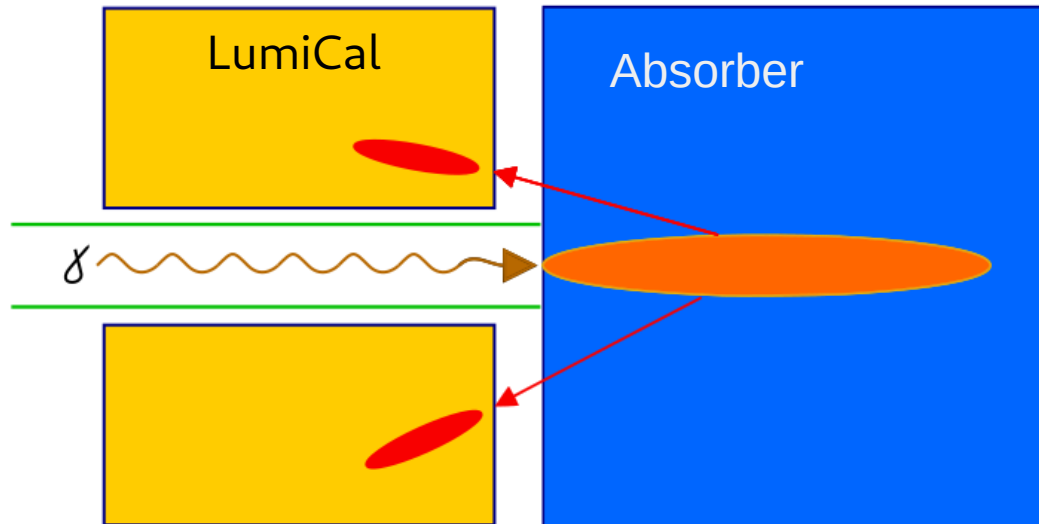
Oleksandr Borysov

Get extra space for BSM setup

- Gamma monitor takes 0.6 m of space in z direction;

- This is substantial distance for BSM setup;

- Consider alternative implementation could give extra space and preserve the possibility to monitor the photon flux.
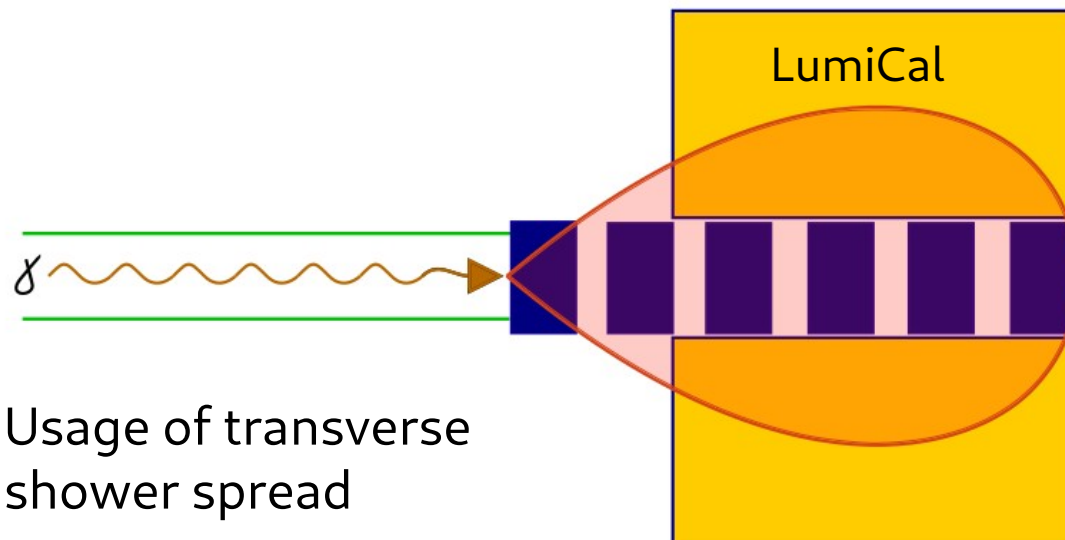

Gamma monitor

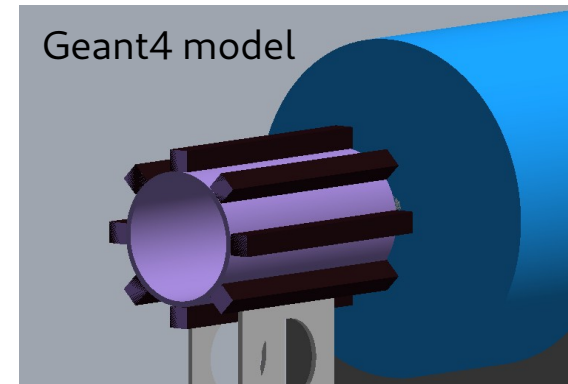Photon beam dump

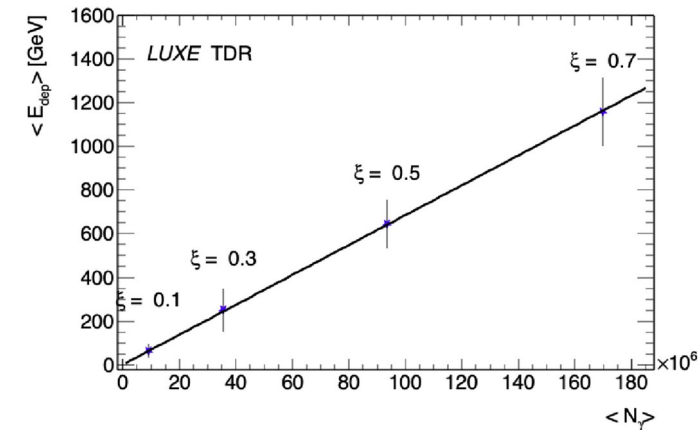# Possible techniques for gamma detector

Usage of back scattering from absorber

Usage of transverse shower spread

Geant4 model

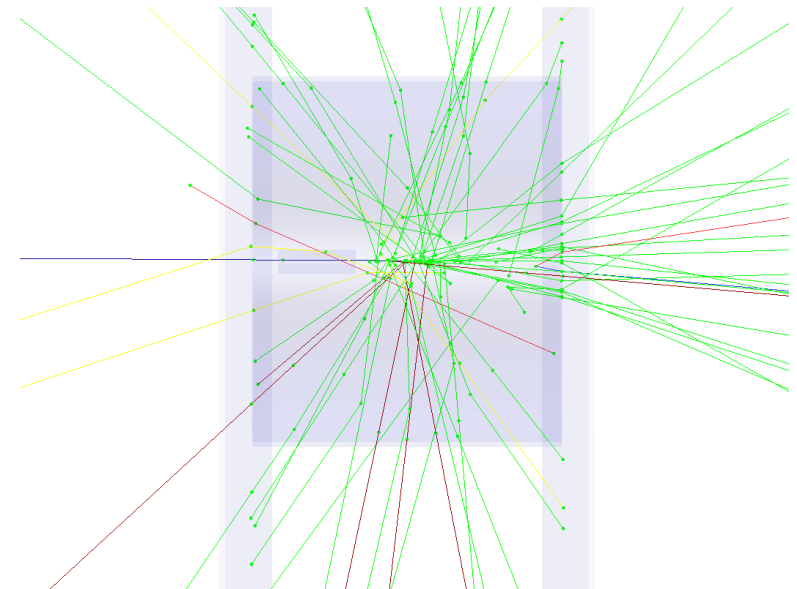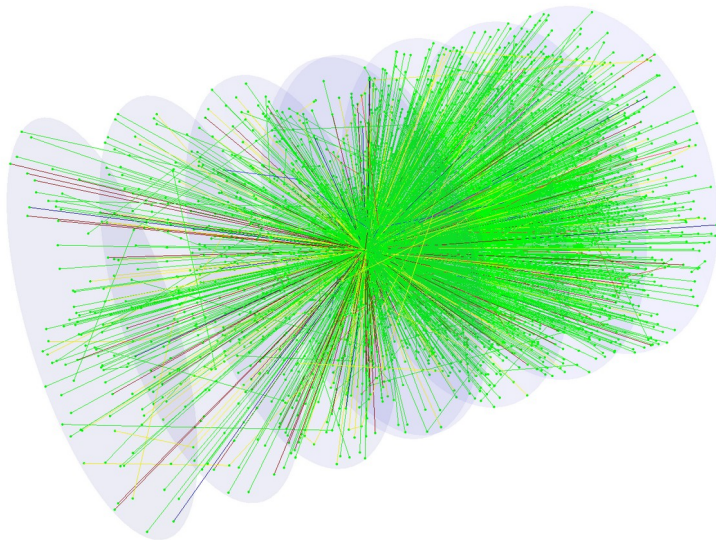

Detector response obtained in Geant4 simulations

- Another possible implementation;
- It has not been studied. 3

Check particles flow in radial and backward directions from the photon beam dump

17.6M photons of 16.5 GeV were simulated

- The radial flow density is calculated at R = 300 mm.
- Backward flow recorded 50 mm from the dump and cut at R = 150 mm.
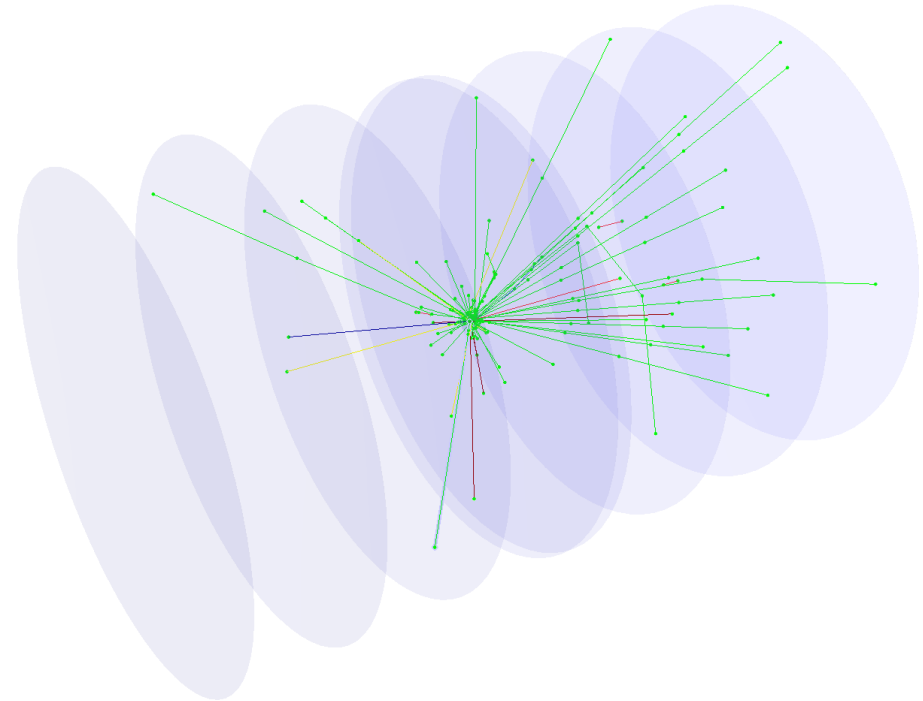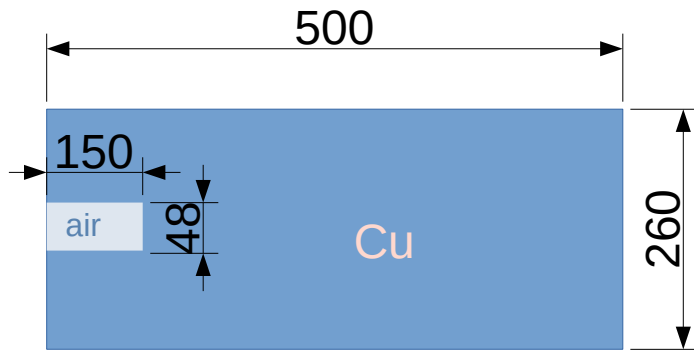
Spectra of photons moving in different directions from the dump

Radial	
Entries	2.531635e+08
Backward w/ cut	
Entries	5322729
Backward	
Entries	1.17857e+08

cut at R = 150 mm

Radial

Backward w/ cut

Backward

$\frac{dN}{dSdlog_{10}(E)}$, $(mm^{-2} \ log_{10}(GeV))^{-1}$

$log_{10}(E)$ $(log_{10}(GeV))$
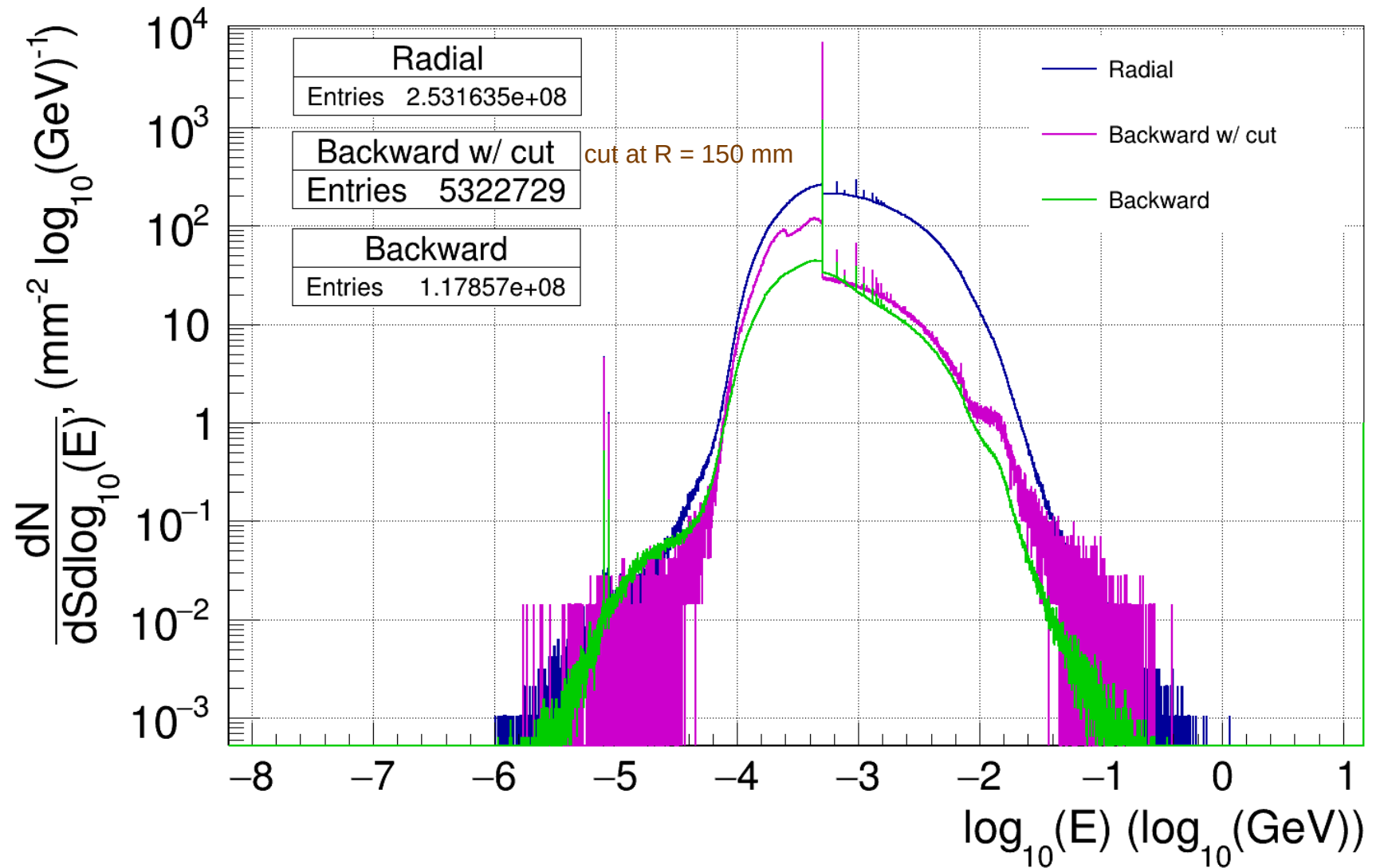
Spectra of electrons moving in different direction from the dump

Radial	
Entries	2020771

Backward w/ cut	
Entries	40449

Backward	
Entries	2147854

Radial

Backward w/ cut

Backward

$\frac{dN}{dSdlog_{10}(E)}$, $(mm^{-2}log_{10}(GeV))^{-1}$

$log_{10}(E)$ $(log_{10}(GeV))$
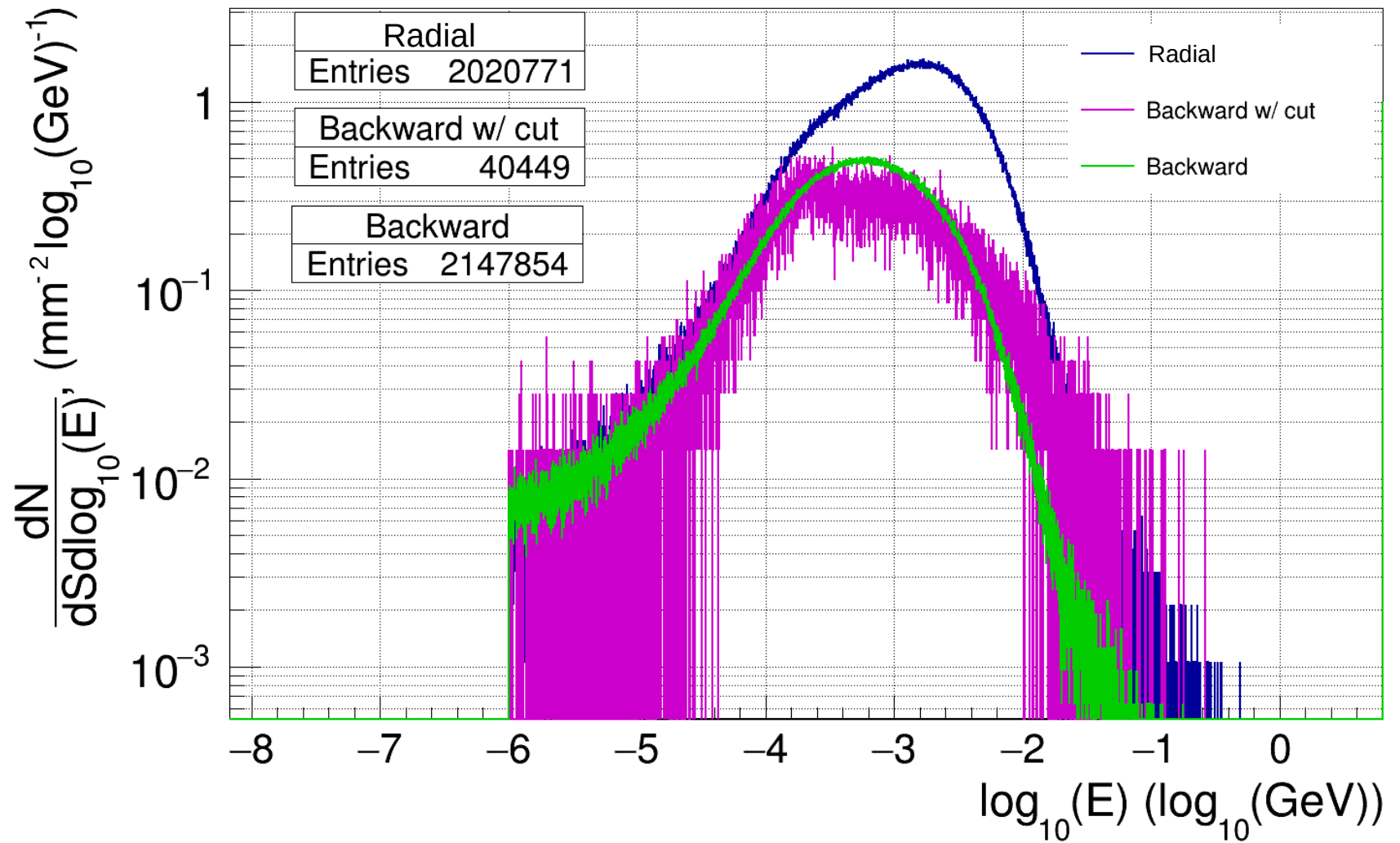
Spectra of positros moving in different direction from the dump

Spectra of neutrons moving in different direction from the dump

Radial
Entries 2.531635e+08

Backward w/ cut
Entries 5322729

Backward
Entries 1.17857e+08

Radial

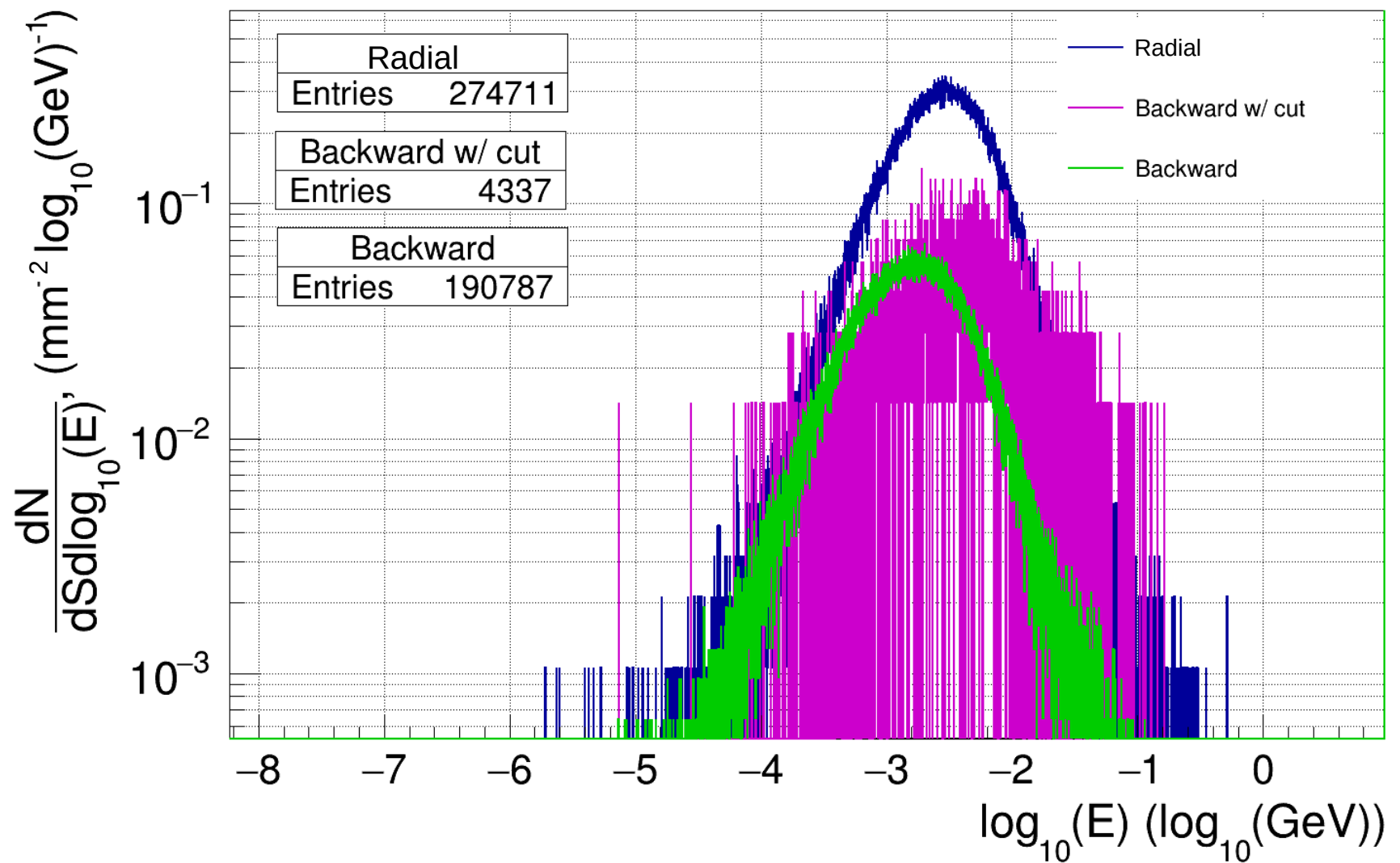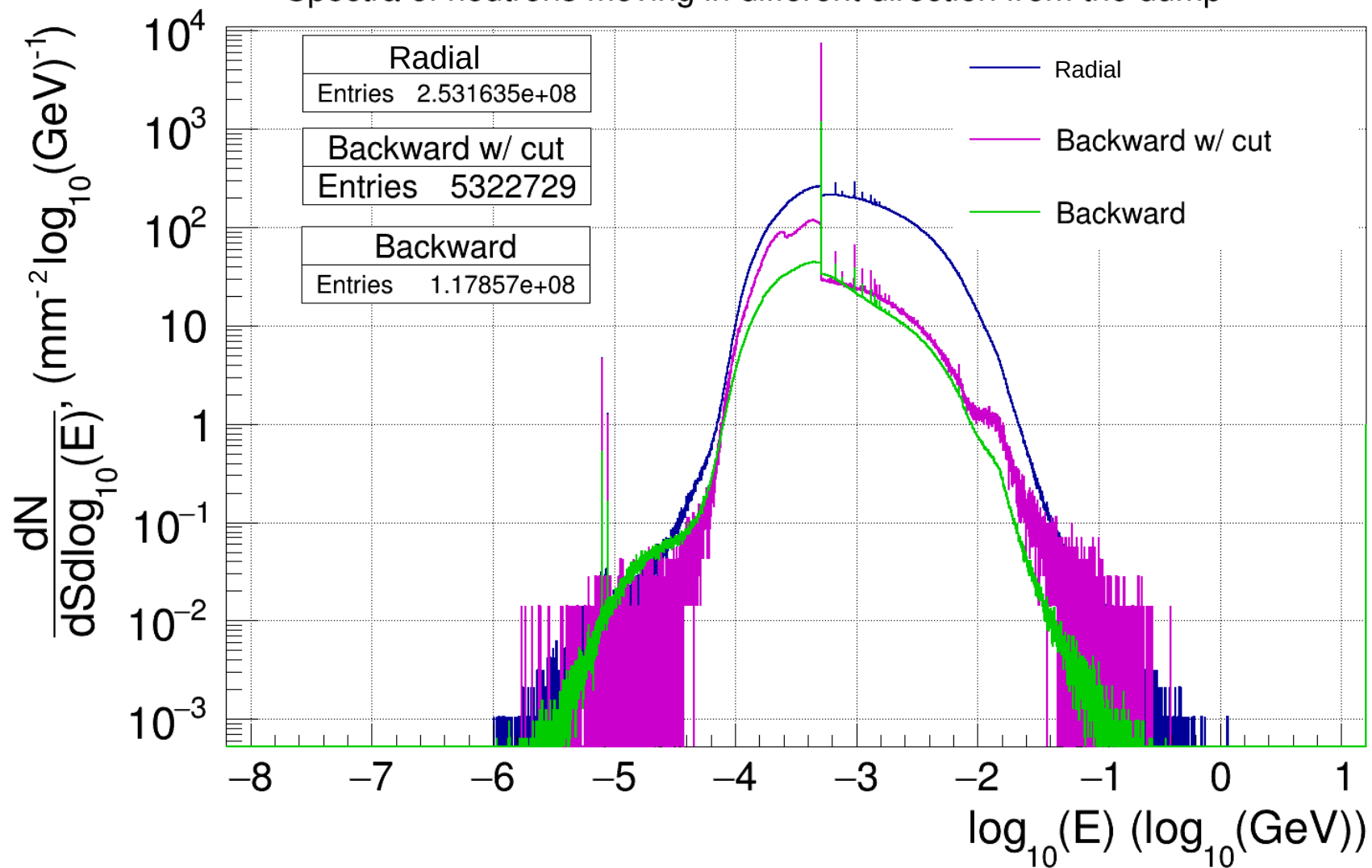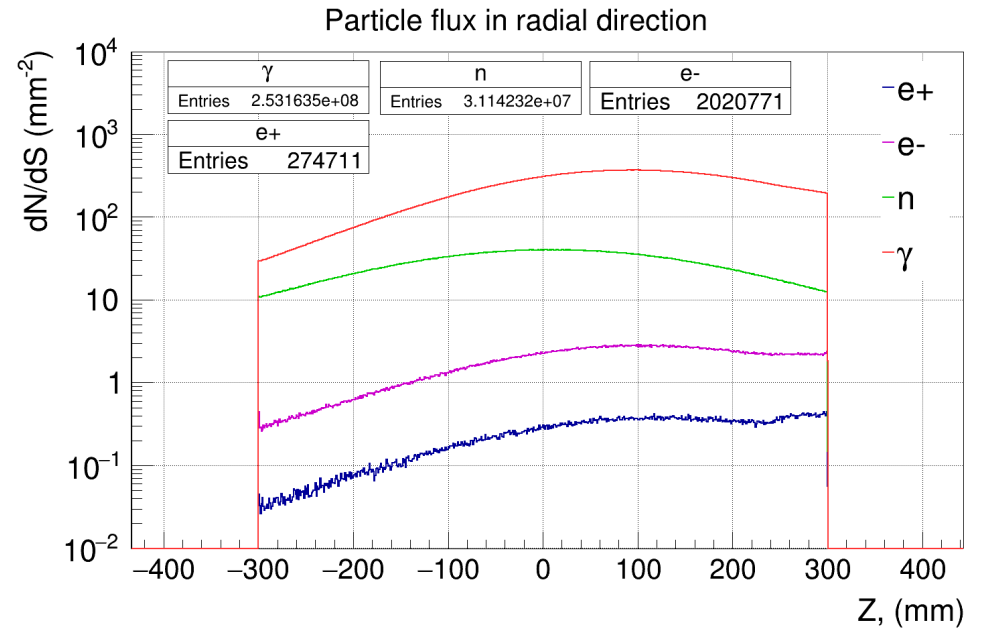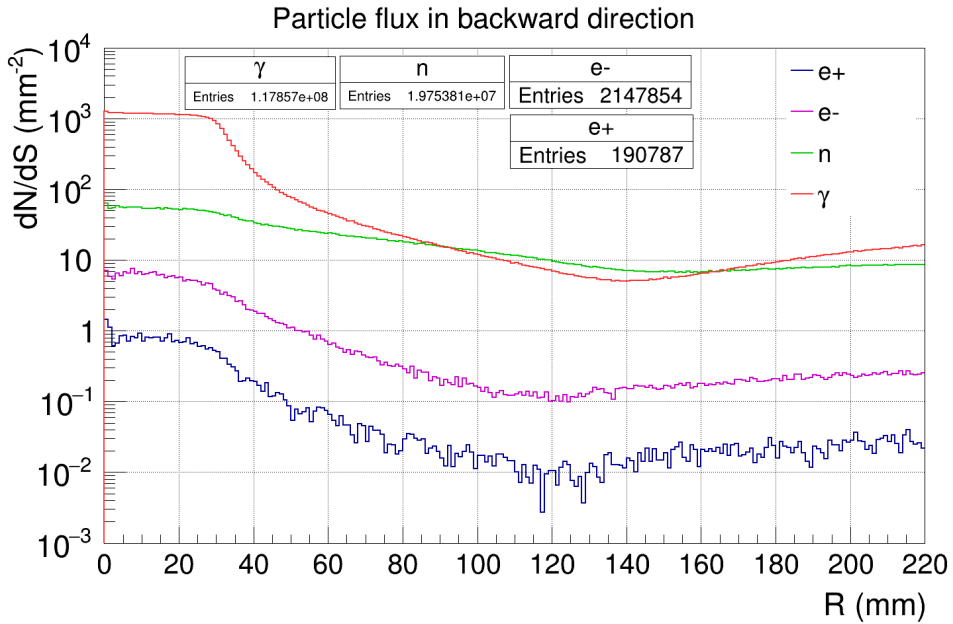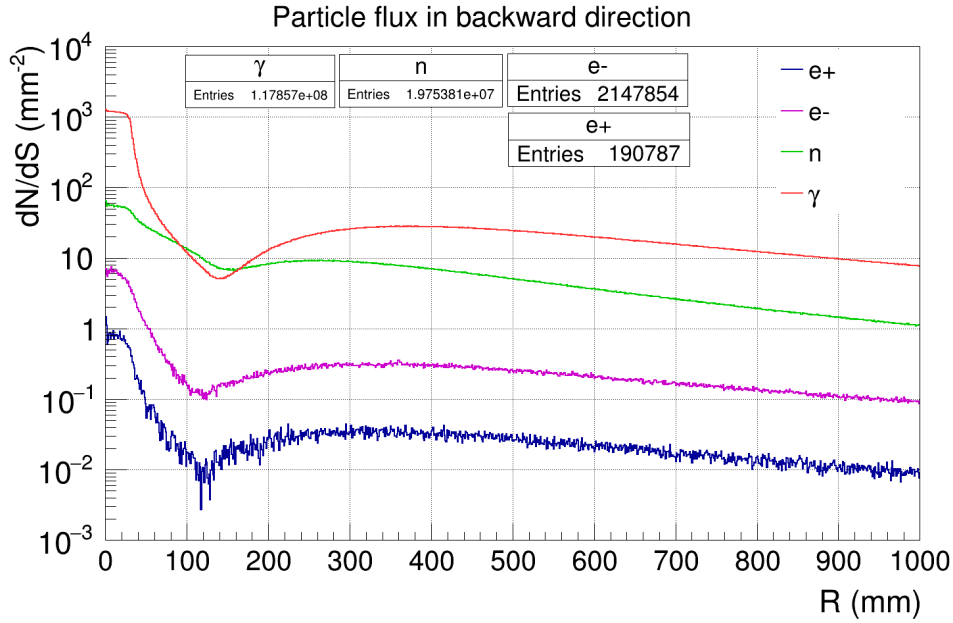Backward w/ cut

Backward

$\dfrac{dN}{dSdlog_{10}(E)}$, $(mm^{-2}log_{10}(GeV))^{-1}$

$log_{10}(E)$ $(log_{10}(GeV))$

Particle flux in backward direction

	γ	n	e-
	Entries 1.17857e+08	Entries 1.975381e+07	Entries 2147854
			e+
			Entries 190787

Legend: e+ (blue), e- (magenta), n (green), γ (red)

Axes: dN/dS (mm^{-2}) vs R (mm)

Particle flux in backward direction

	γ	n	e-
	Entries 1.17857e+08	Entries 1.975381e+07	Entries 2147854
			e+
			Entries 190787

Legend: e+ (blue), e- (magenta), n (green), γ (red)

Axes: dN/dS (mm^{-2}) vs R (mm)

Particle flux in radial direction

	γ	n	e-
	Entries 2.531635e+08	Entries 3.114232e+07	Entries 2020771
	e+		
	Entries 274711		

Legend: e+ (blue), e- (magenta), n (green), γ (red)

Axes: dN/dS (mm^{-2}) vs Z, (mm)

Energy flow in backward direction

	γ		n		e-	
	Entries	1.17857e+08	Entries	1.975381e+07	Entries	2147854

e+	
Entries	190787

— e+
— e-
— n
— γ

dE/dS (GeV/mm²)

R (mm)

Energy flow in backward direction

	γ		n		e-	
	Entries	1.17857e+08	Entries	1.975381e+07	Entries	2147854

e+	
Entries	190787

— e+
— e-
— n
— γ

dE/dS (GeV/mm²)

R (mm)

Energy flow in radial direction

	γ		n	
	Entries	2.531635e+08	Entries	3.114232e+07
	e-		e+	
	Entries	2020771	Entries	274711

— e+
— e-
— n
— γ

dE/dS (GeV/mm²)

Z, (mm)
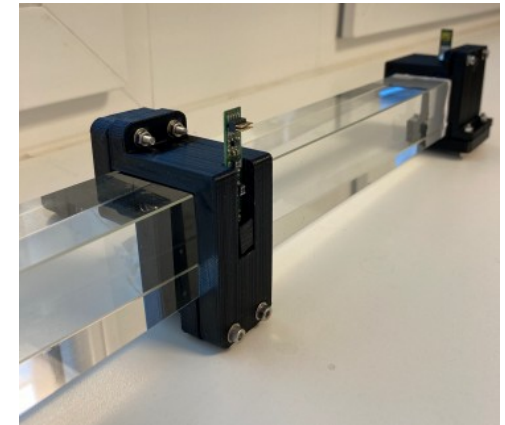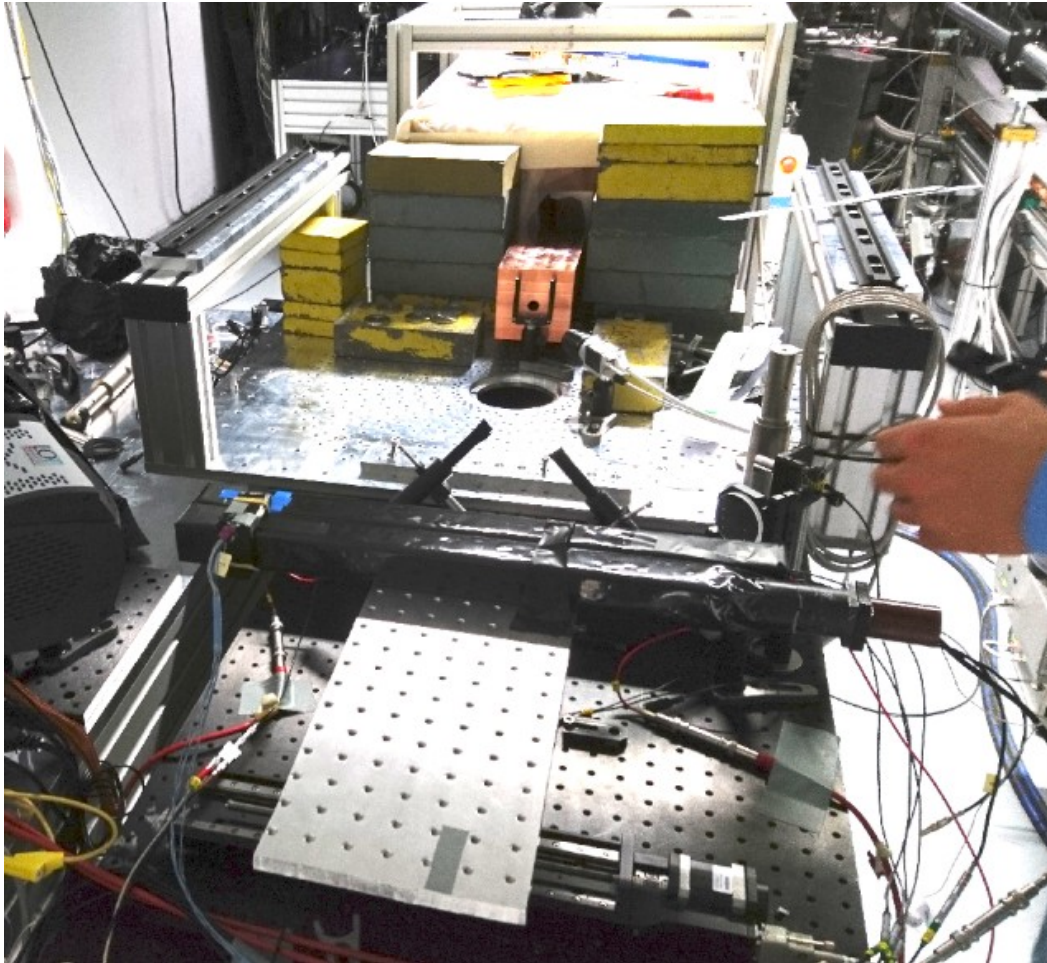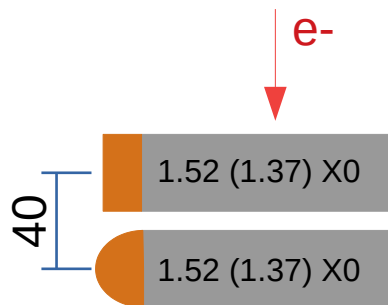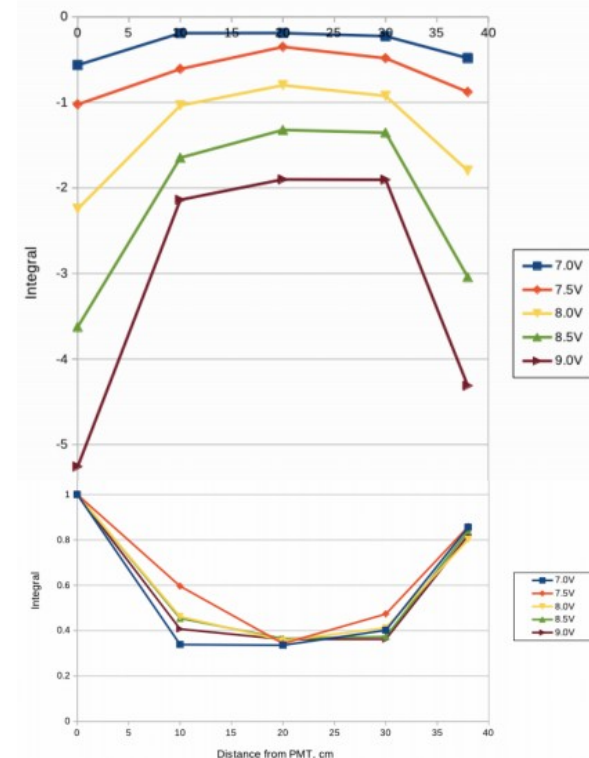
Lead glass bars perpendicular to the beam

Lead Glass,
(refraction index is 1.65, angle 37º or 53º grad with respect to surface.)

Lab measurements

e-

40

1.52 (1.37) X0

1.52 (1.37) X0

- UV LED tests showed signal dependence as a function of LED position, within ~60%

- Beam test demonstrated good sensitivity with perpendicular beam.

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Summary

- The spectra of the photons and electrons are similar in backward and radial direction, they are main particles which generate the signal in the detector.

- The number of particles and energy they carry together in this particular simulation is different by an order of magnitude.

- But with bigger radius of the beam dump it can be tuned as needed for the detector to work.

- Probably combining the detector with the beam dump increases the complexity, but it does not look impossible and with some extra study might work well.