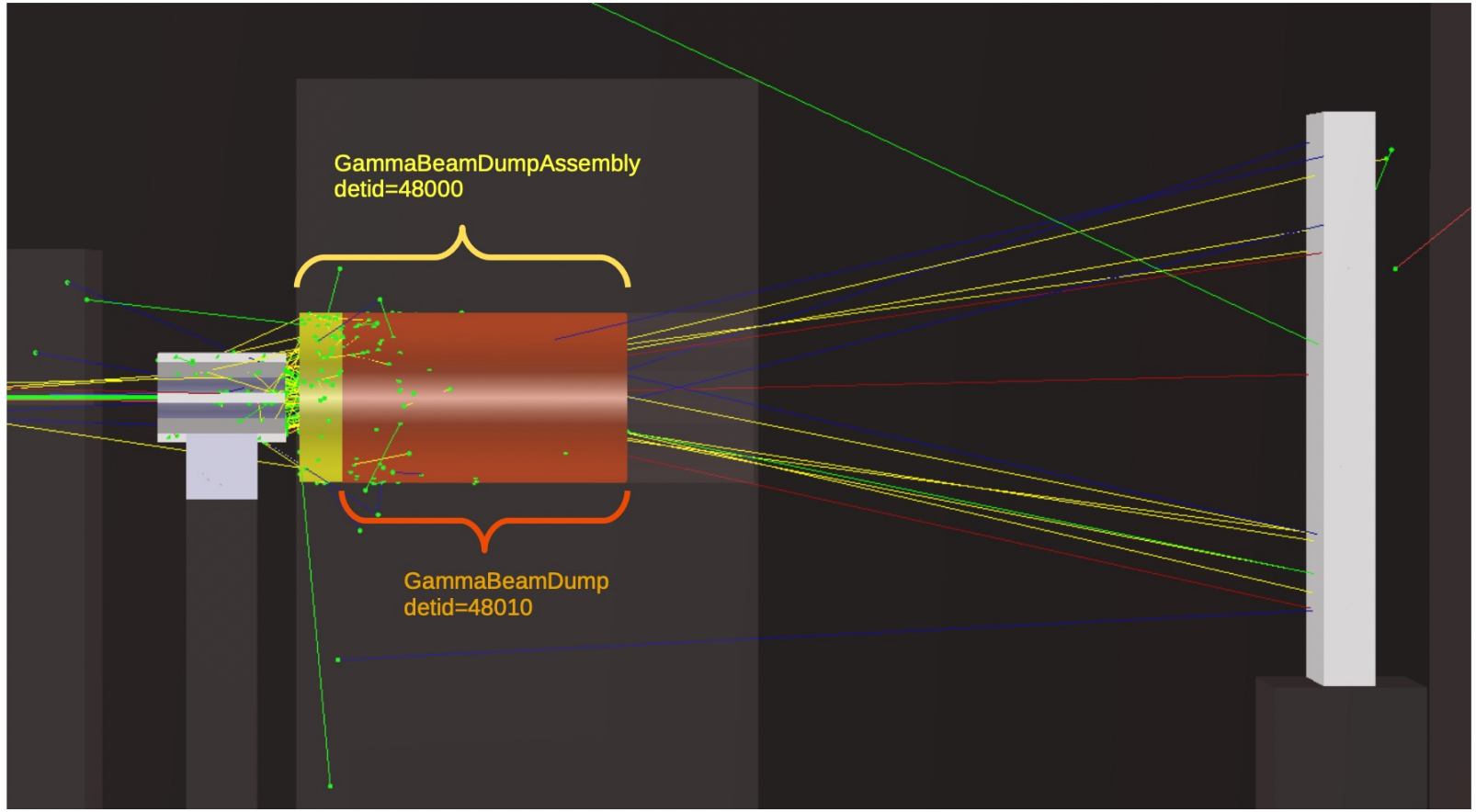
NPOD background simulation studies update

Raquel Quishpe

May 8th , 2023

New NPOD setup including concrete wall

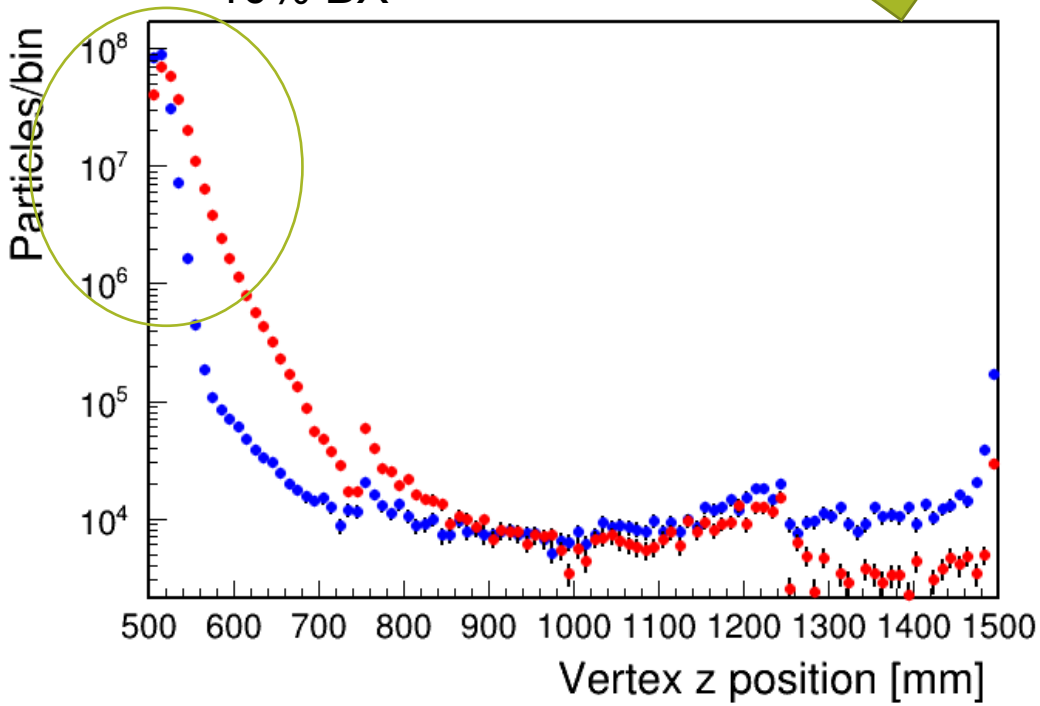


- Added concrete wall wrapping dump
- Air insert removed, and added plug with hole in the front

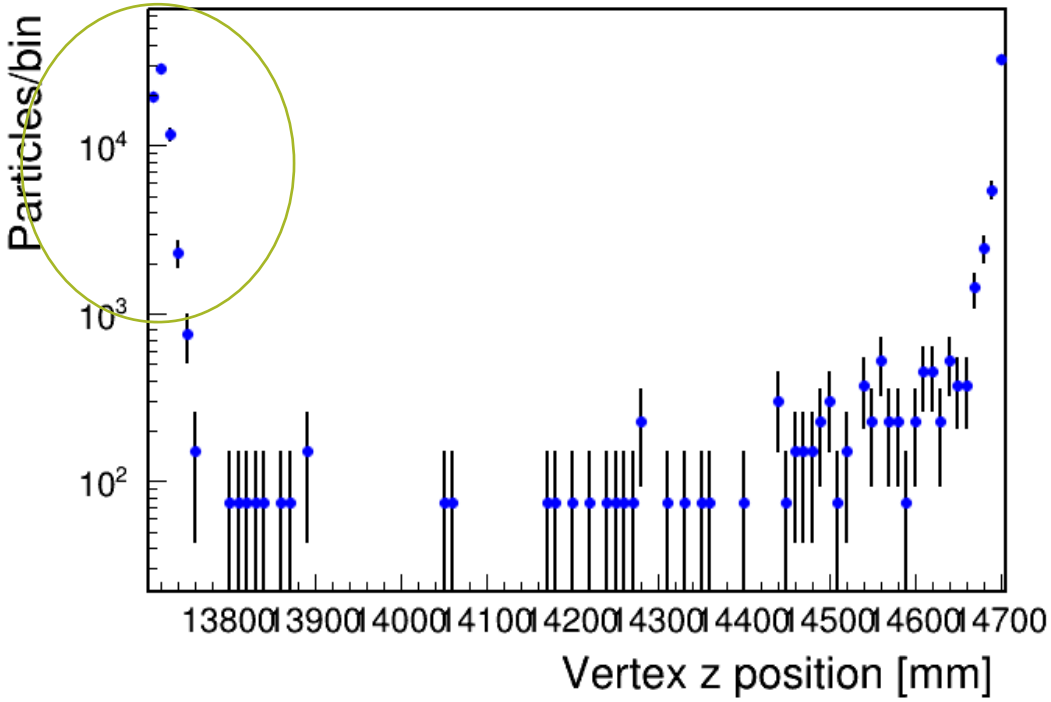
Photons z-vertex distribution

- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**, **Pb**
- 10% BX

old



- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**
- 20% BX



Significant background reduction coming from low-E particles

Photons energy distribution

- Distance dump-BSM= **100cm**
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- Dump material **W**, **Pb**
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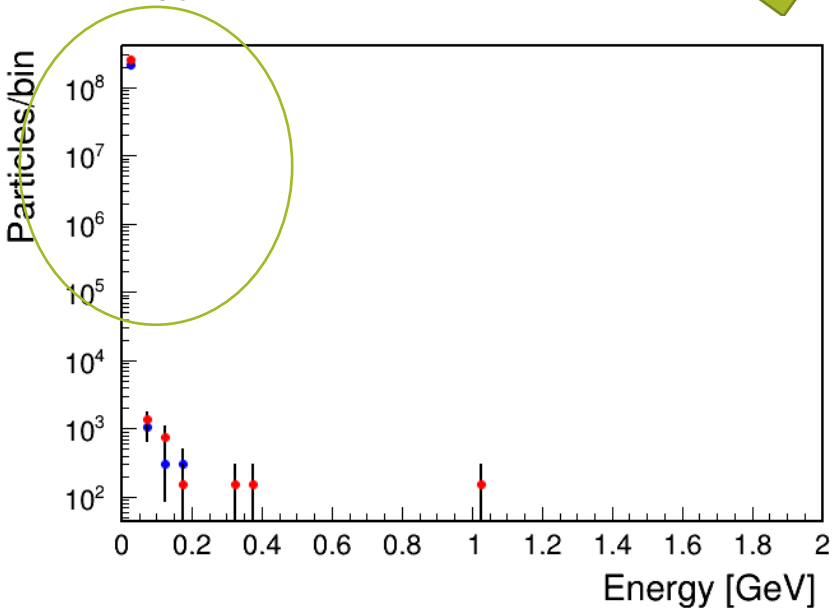

- Distance dump-BSM= **100cm**
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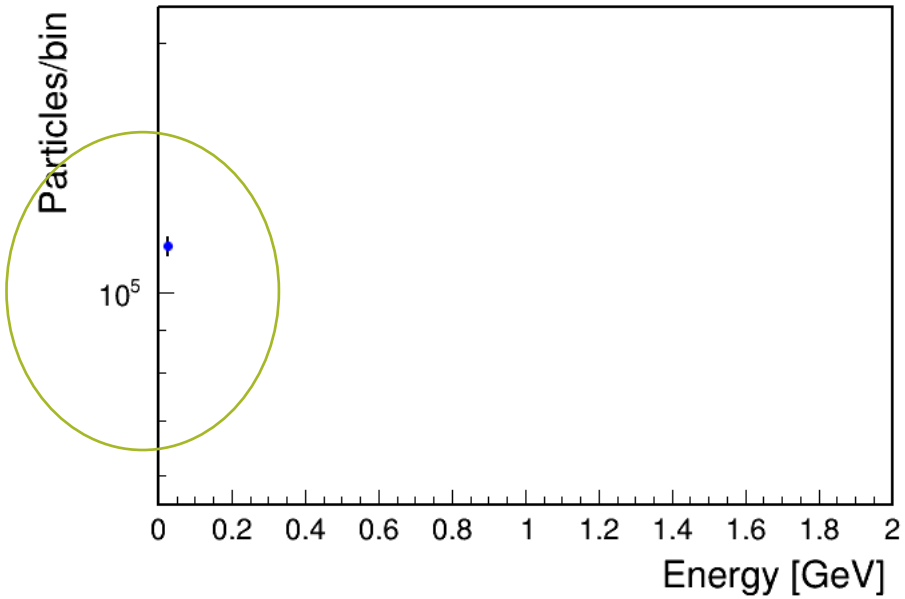
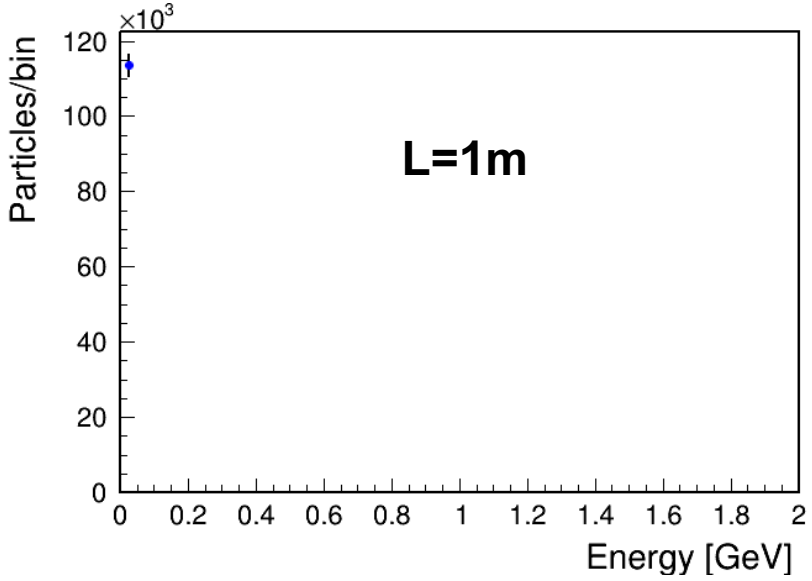
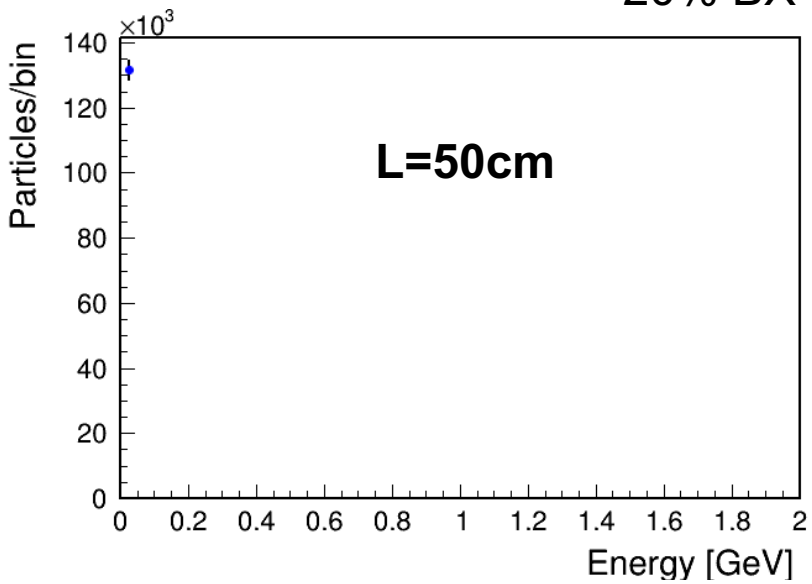
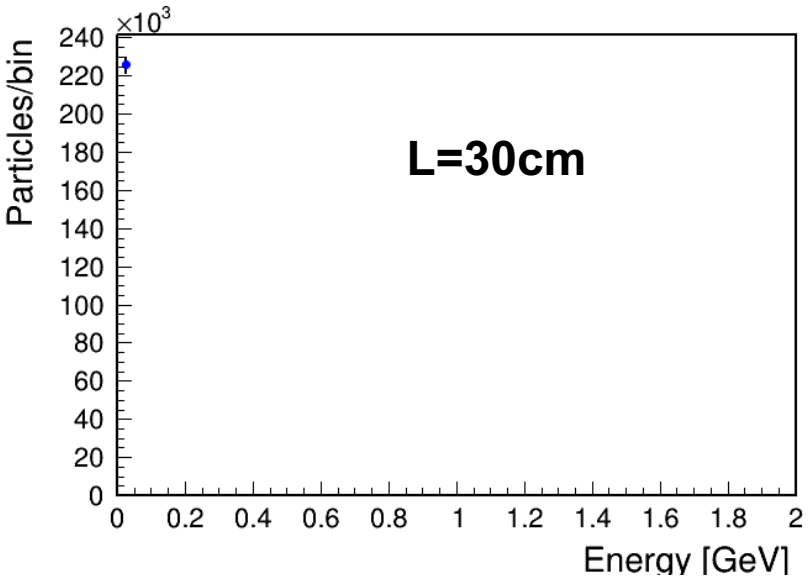


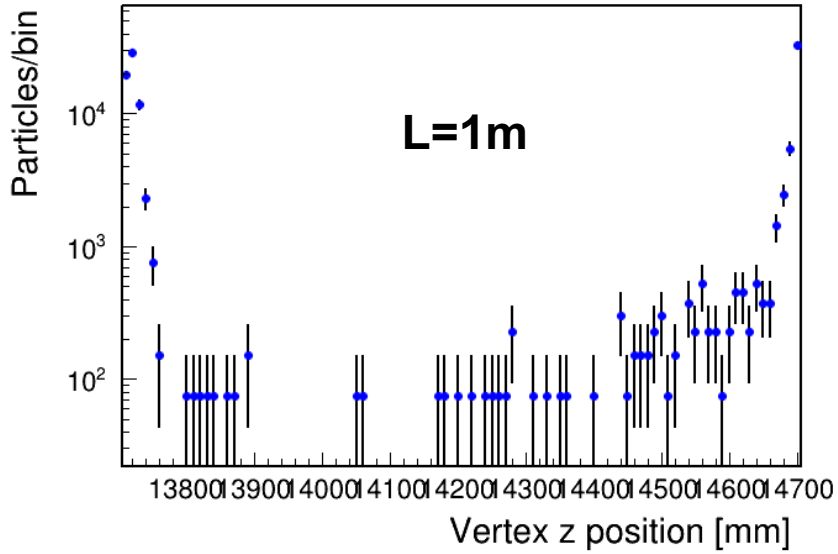
Photons energy and z-vertex

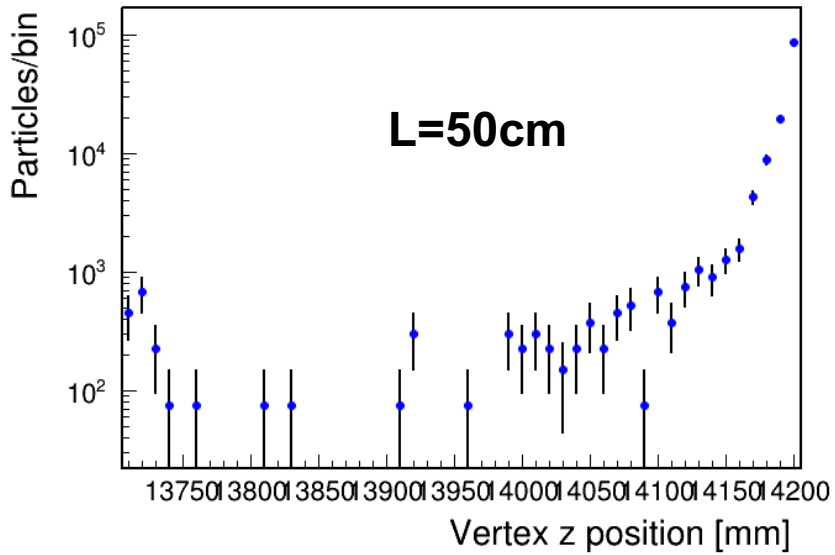
- Distance dump-BSM= **100cm**
- Dump **R= 10cm, W**
- 20% BX

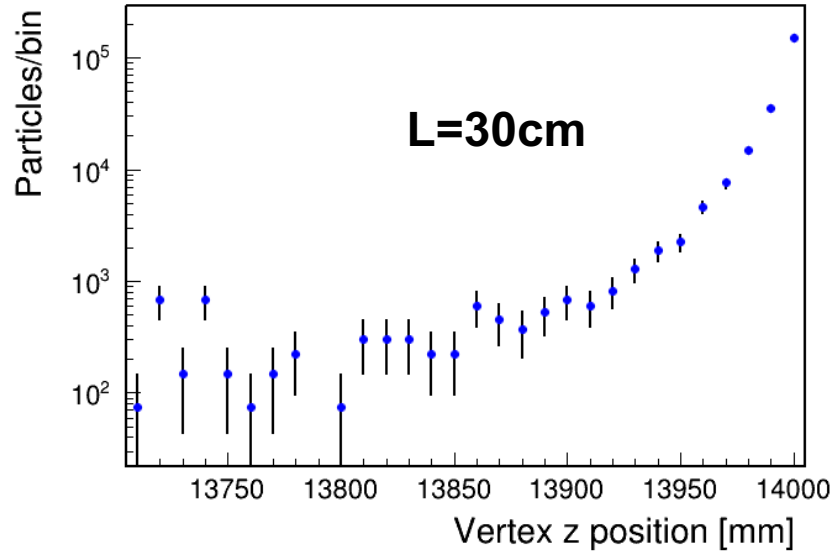








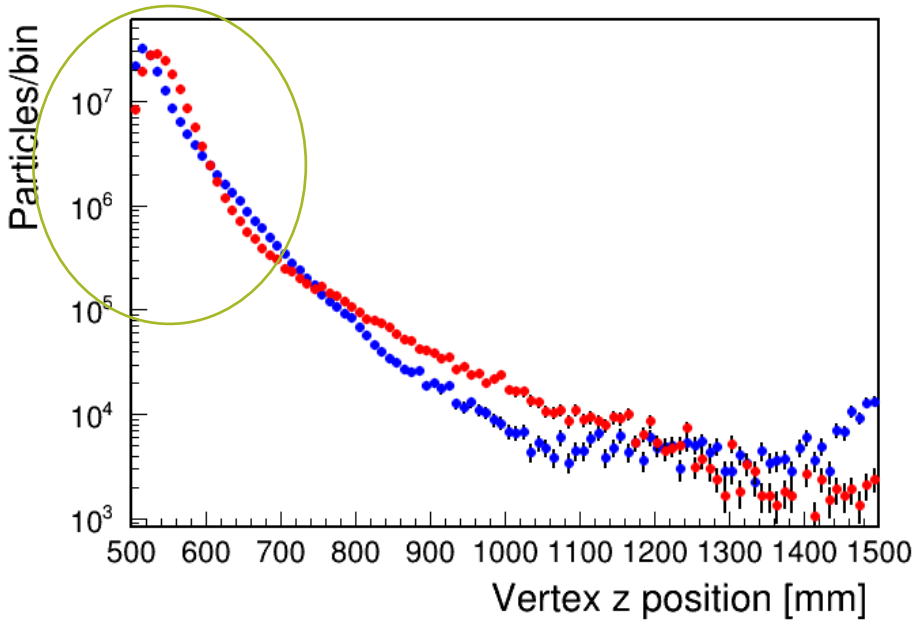




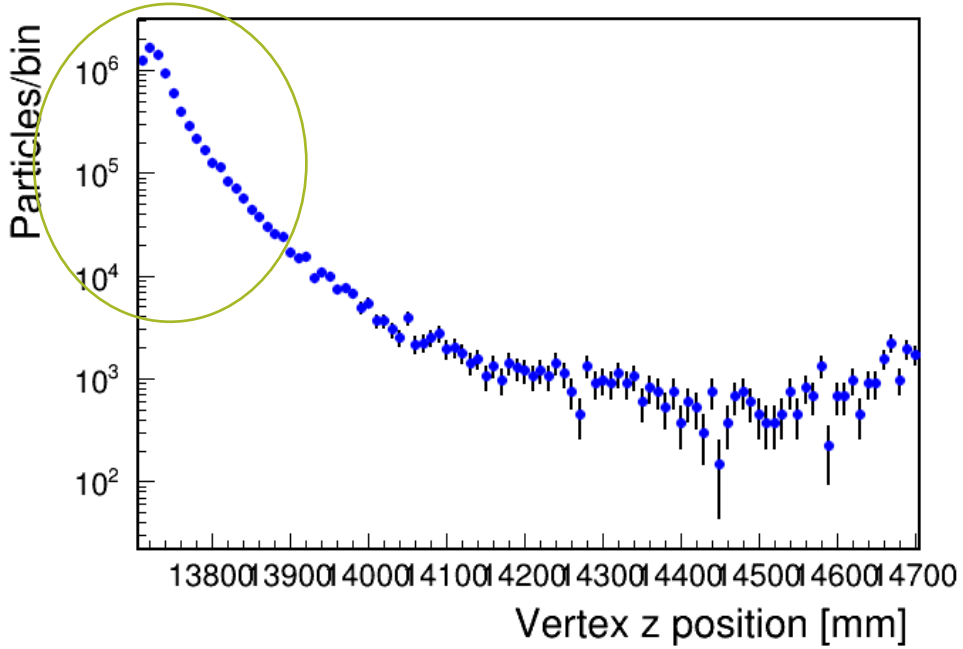
Neutrons z-vertex distribution

- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**, **Pb**
- 10% BX

old



- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**
- 20% BX



Background reduction coming from low-E particles

Neutrons energy distribution

- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**, **Pb**
- 10% BX

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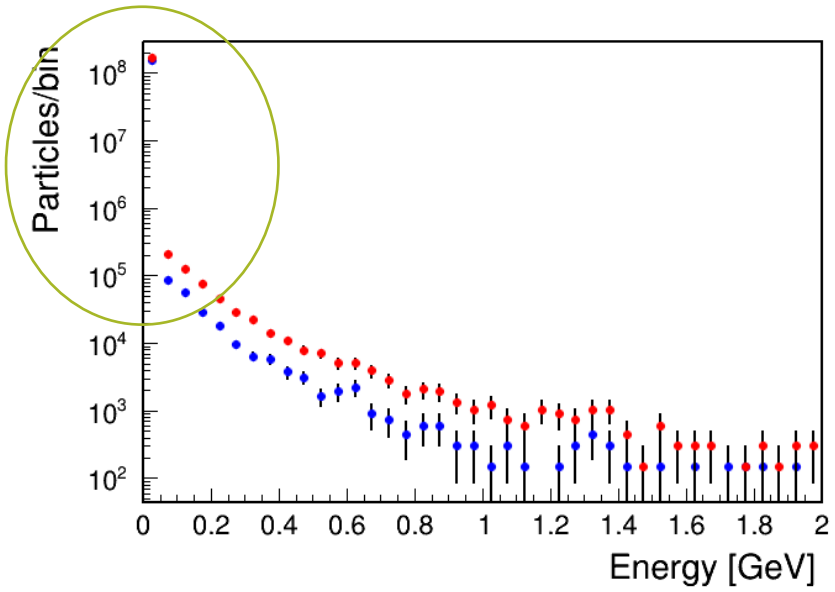
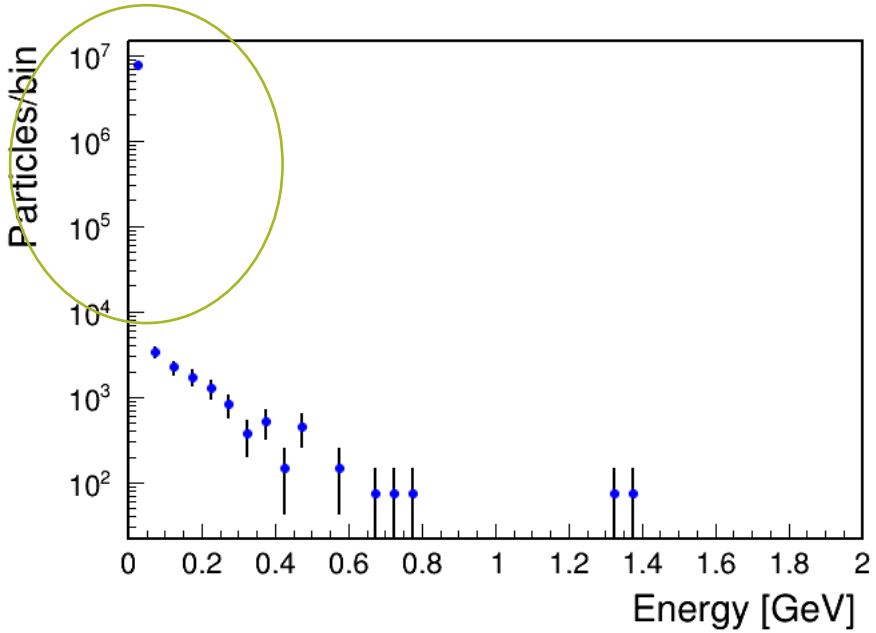
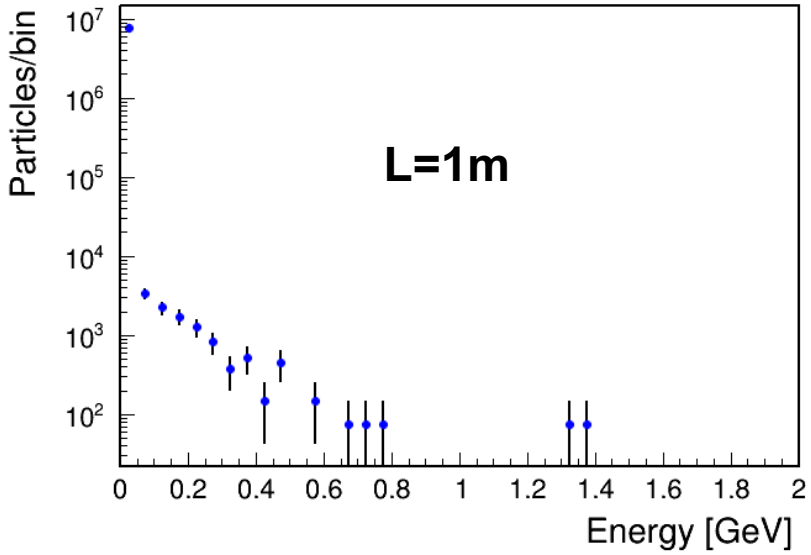


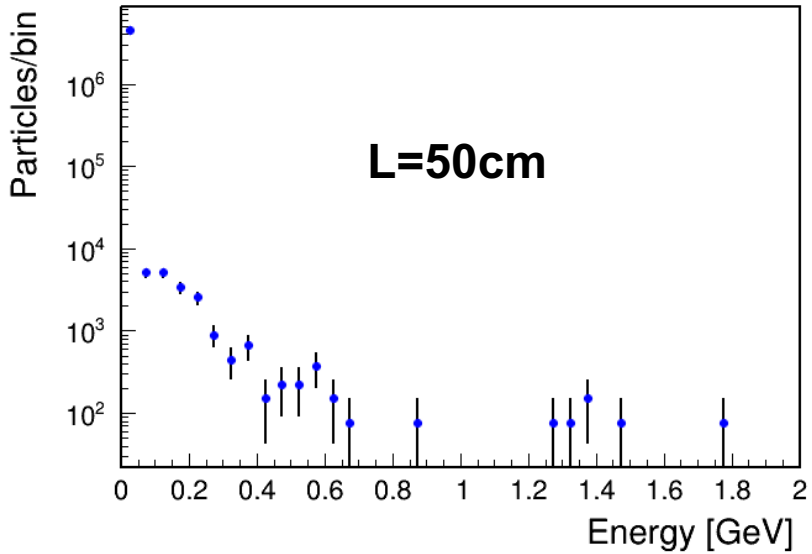
- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**
- 20% BX

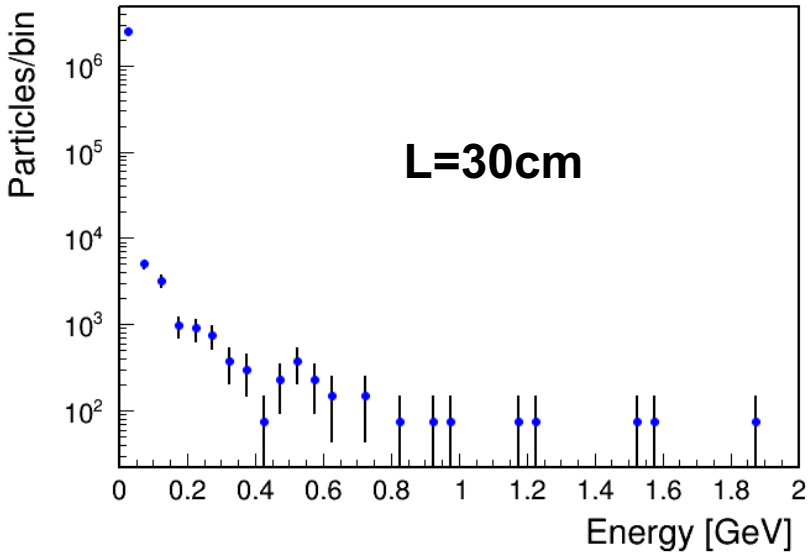


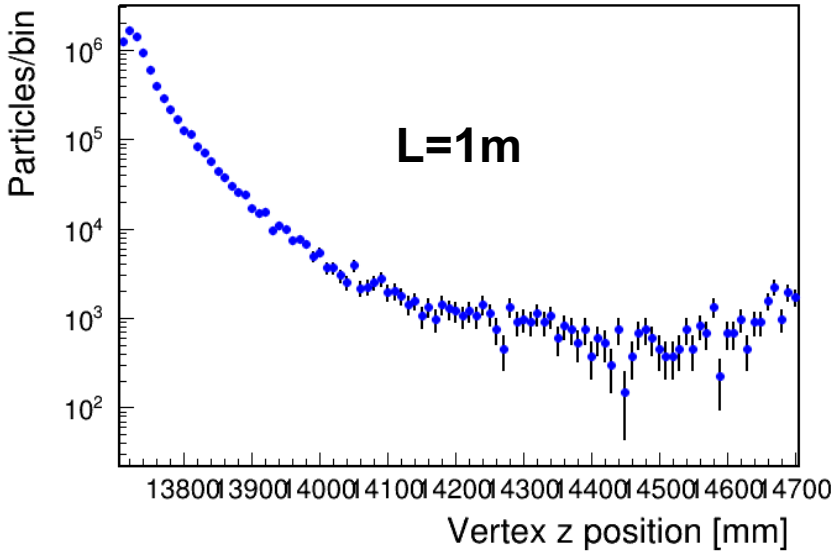
Neutrons energy and z-vertex

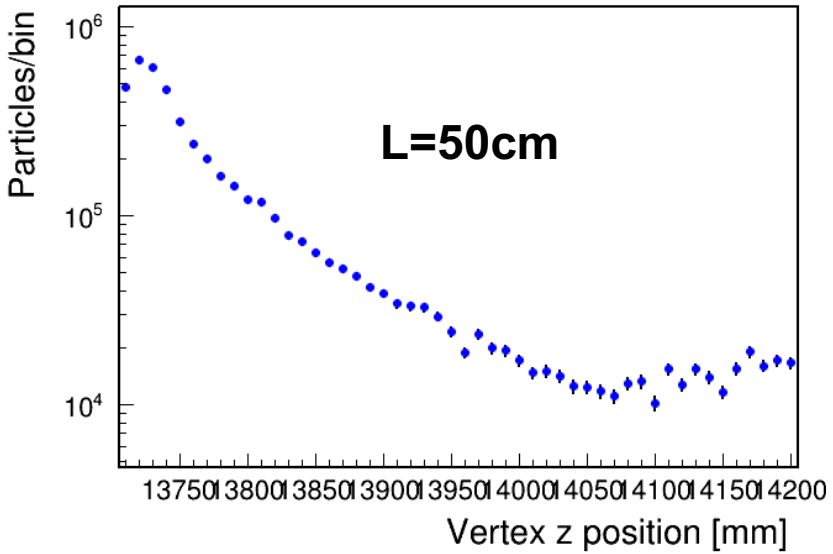
- Distance dump-BSM= **100cm**
- Dump **R= 10cm, W**
- 20% BX

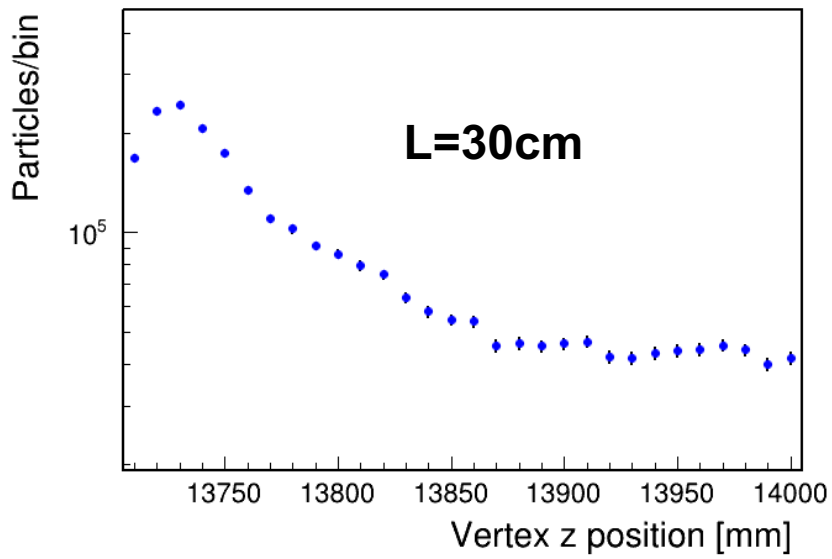








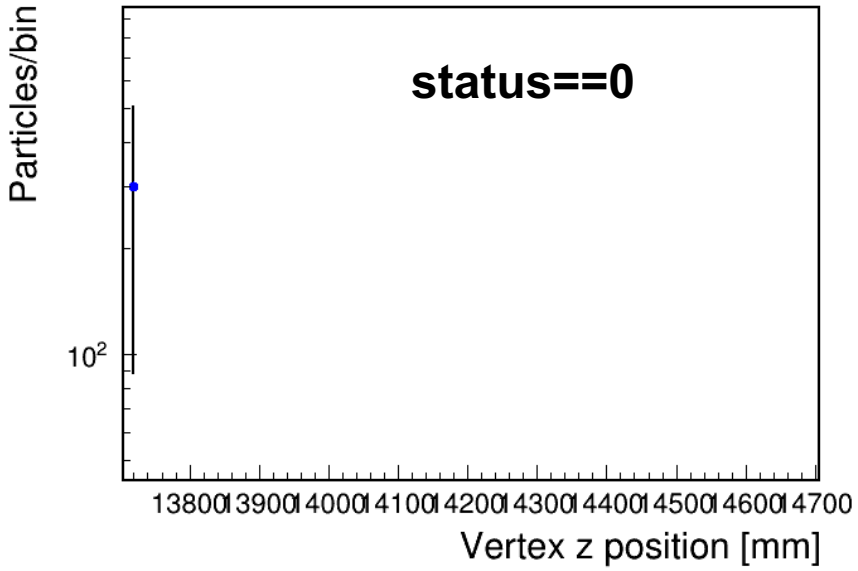


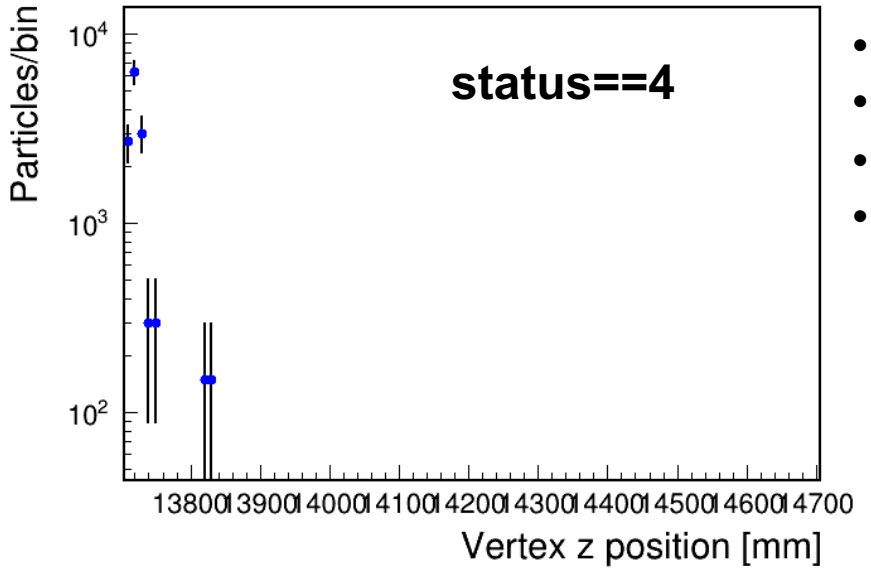


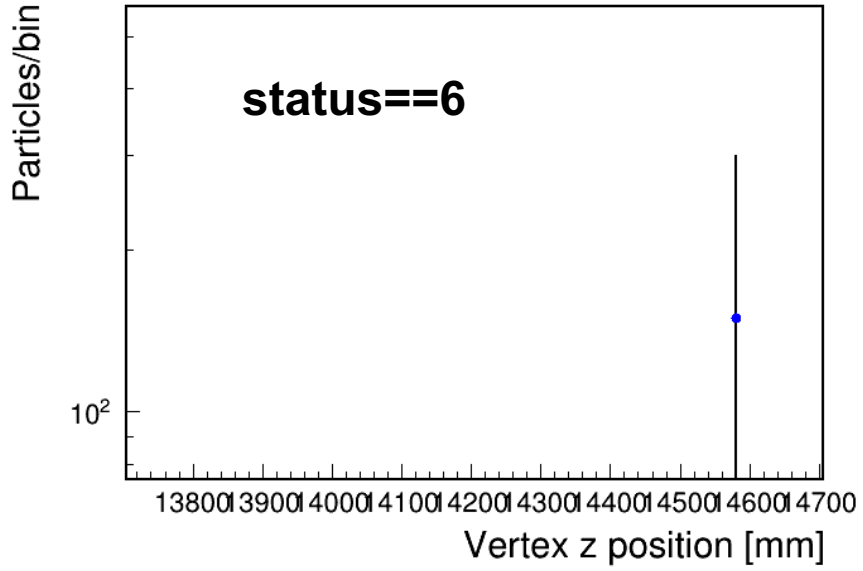
Analysis with flag “status”

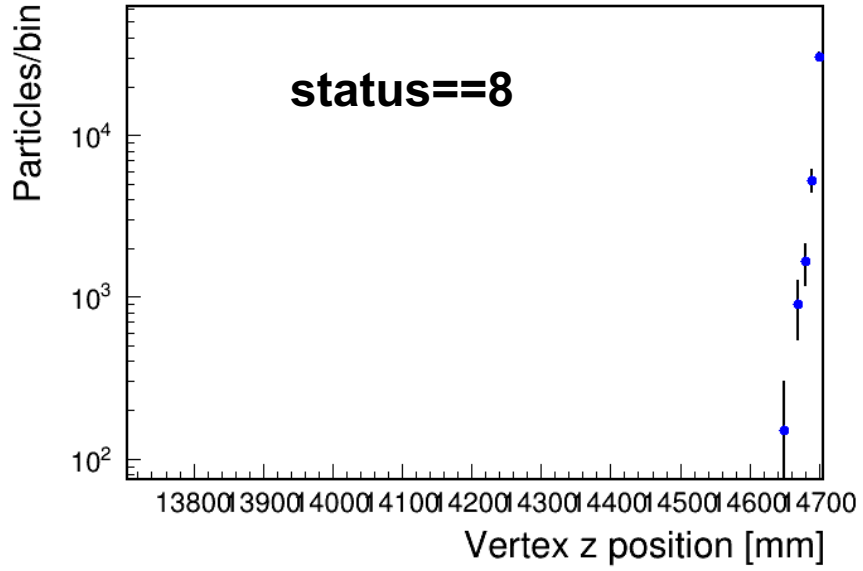
- **status==0** rejects particles which exit the beam dump either from the front or side and it also rejects all secondaries in all generations which were produced by those who escaped
- **status==4** particles escaped from the side
- **status==6** particles produced by "someone" who escaped the beam dump through the front plane and then that particle crossed the beam dump so that it exited through the side
- **status==8** particles whose ancestor escaped the beam dump from the side

Photons z-vertex distribution





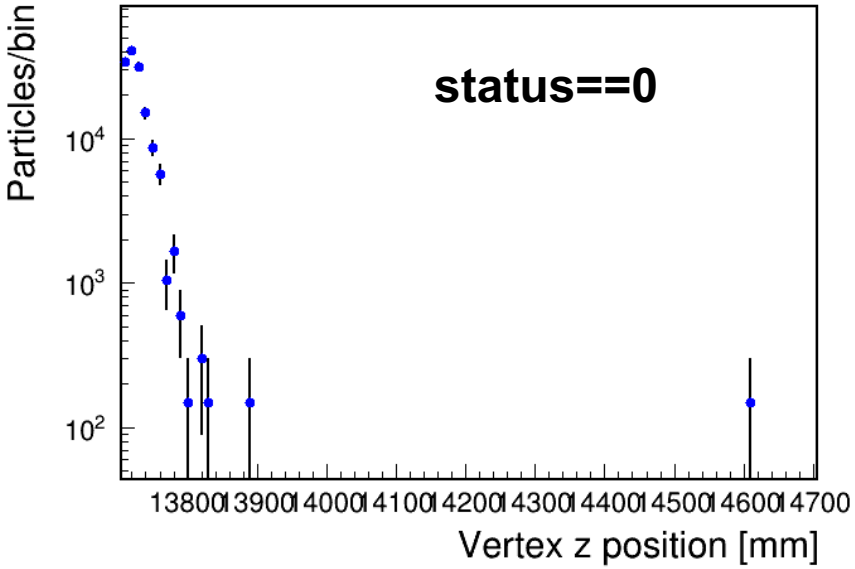


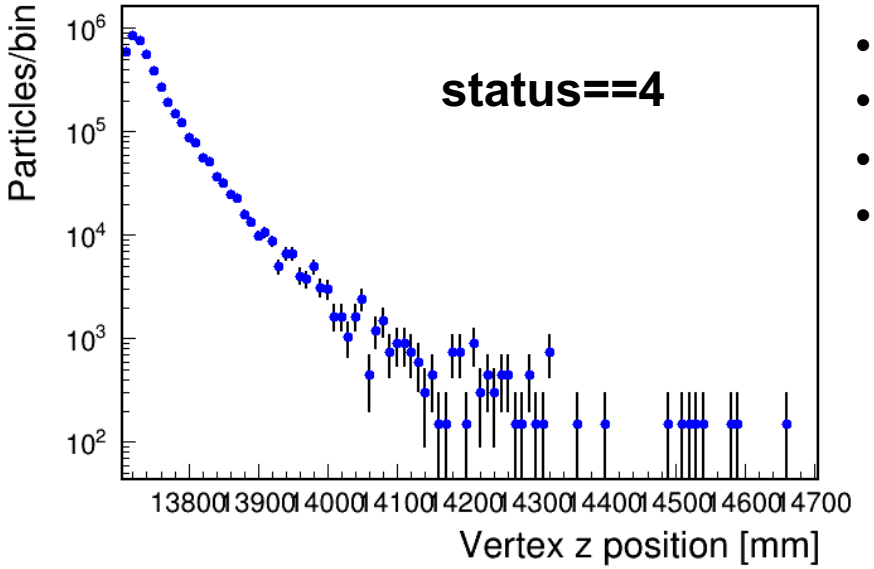


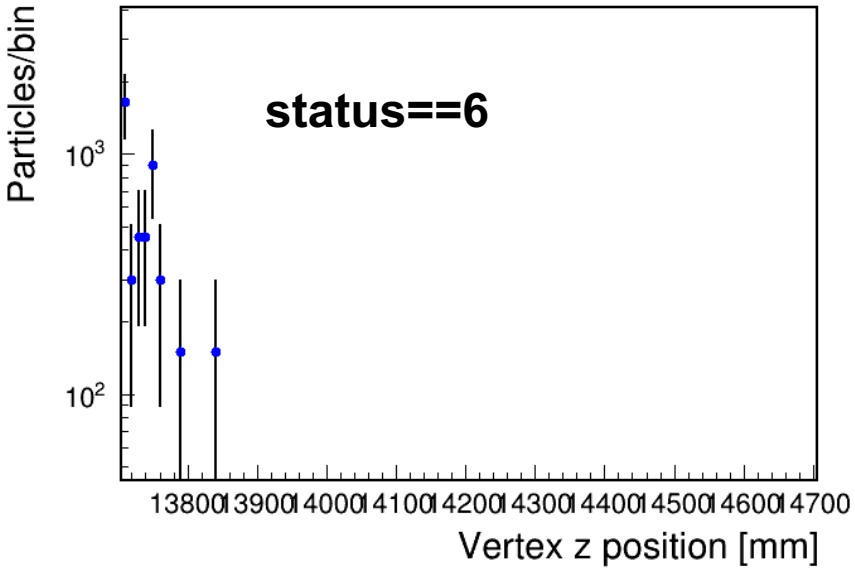
- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**
- 20% BX

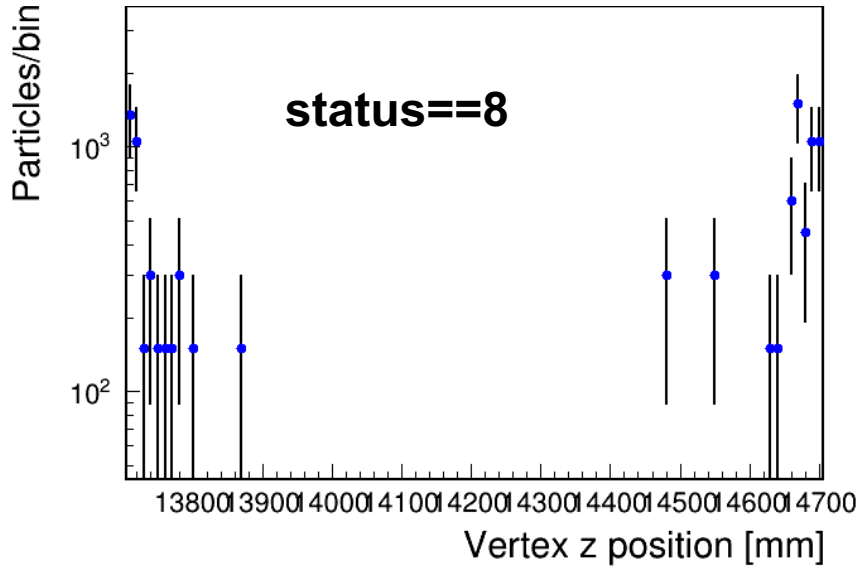
For photons most low-E particles are generated from particles that escaped from the side or whose ancestor did

Neutrons z-vertex distribution









- Distance dump-BSM= **100cm**
- Dump **R= 10cm, L=1m**
- Dump material **W**
- 20% BX

For neutrons most low-E particles are generated from particles that escaped from the side

Outlook

- Significant reduction on low-E particles after adding the concrete wall
- Ongoing study for:
  - dump material: W, Pb
  - dump length: 100, 50, 30 cm
  - dump radius: 10 cm (30 cm from CAD?)
  - distance dump to BSM: 100, 150, 200 cm
- Ongoing analysis for muons

Backup

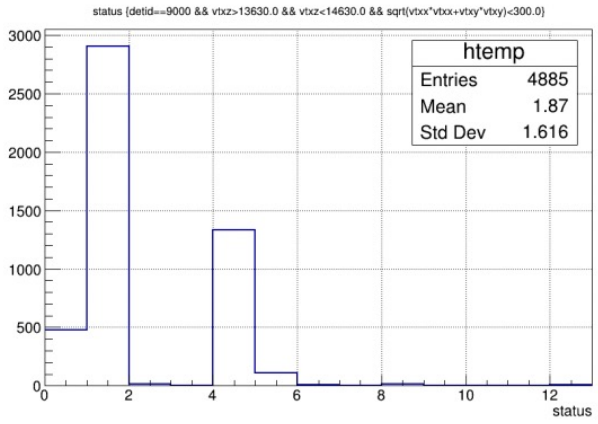
Tagging particles which escape from the the beam dump

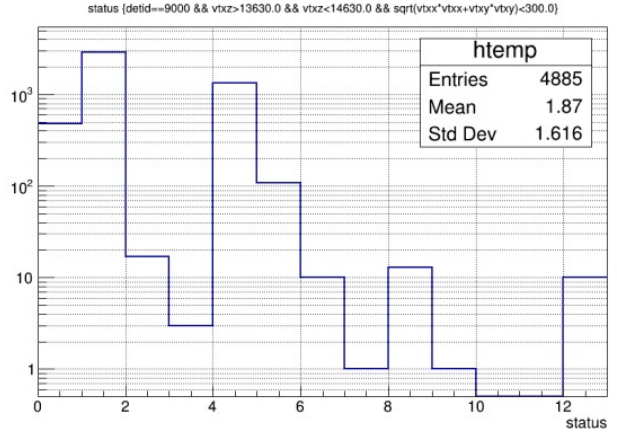
It was easy to implement particle tagging in simulation with modified BSM geometry:

- The status branch was added to the Tracks and HitTracks trees,
- It is 32-bits unsigned integer.

- Bit 0: particle exits the beam dump through the front plane;
- Bit 1: particle's parent (grant parent, any generation in the past) exited the beam dump through the front plane;
- Bit 2: particle exits the beam dump through the side surface;
- Bit 3: particle's parent (grant parent, any generation in the past) exited the beam dump through the side surface.

status branch in short test simulation with PTarmigan Compton photons





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Slide from Sasha