NPOD background simulation studies update

Raquel Quishpe

February 20th, 2023

NPOD background studies – general cuts

- Beam dump: Tungsten, 1m
- No air insert
- pdg==22 ; pdg==2112
- detid==9000
- sqrt(x*x+y*y)<1000.0
- abs(z-*$BSMCalo_z*)<0.1 (front side of the detector)
- vtxz>13630.0 && vtxz< *$BSMCalo_z*
- Factor 10 from MC already included in normalization

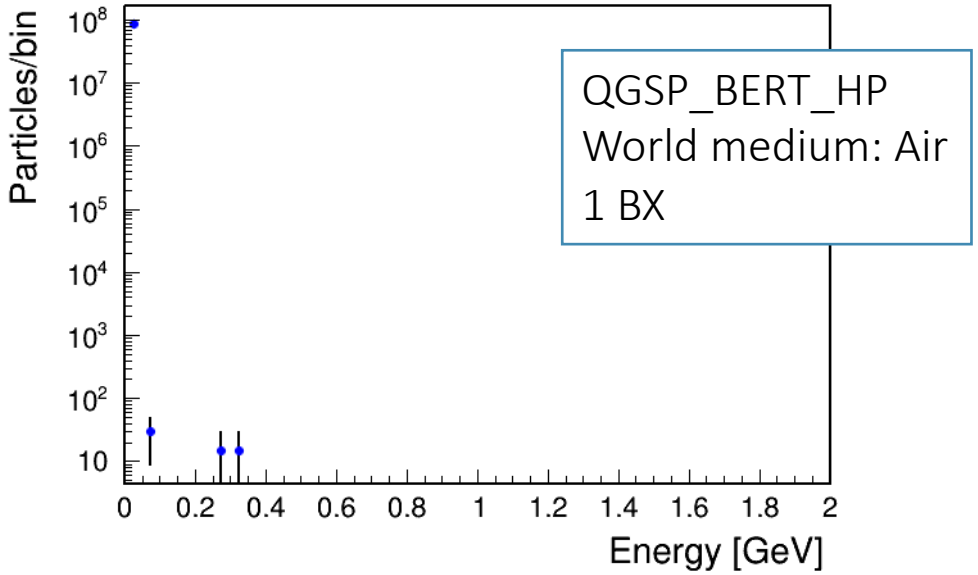
Comparison of new g4 simulations with NPOD paper

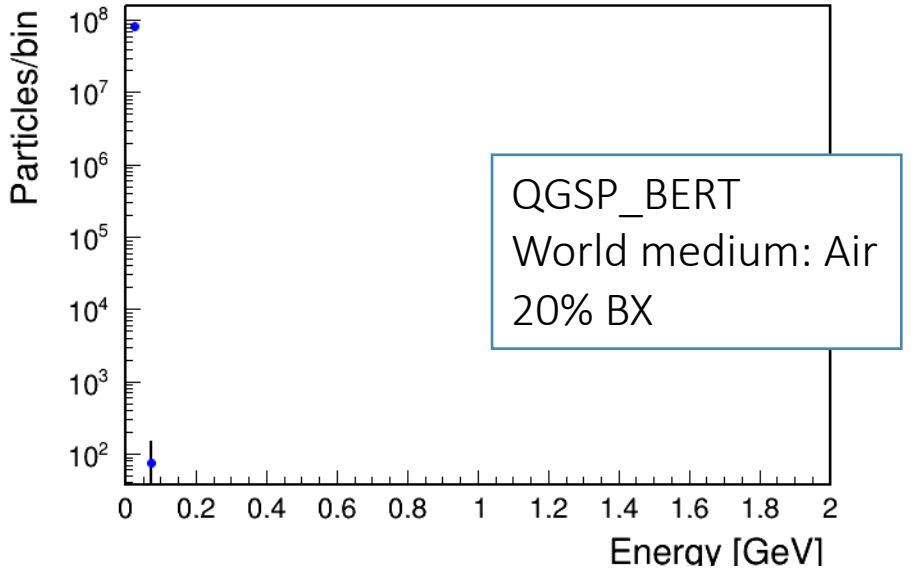
Previous results here

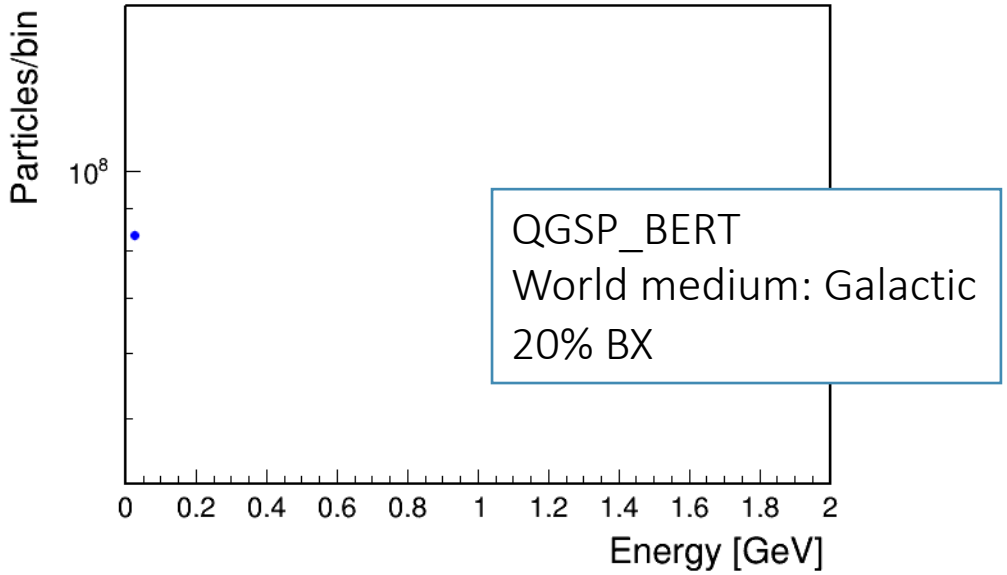
Photons energy spectra

Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

```
sqrt(vtxx*vtxx+vtxy*vtxy)<300.0
```





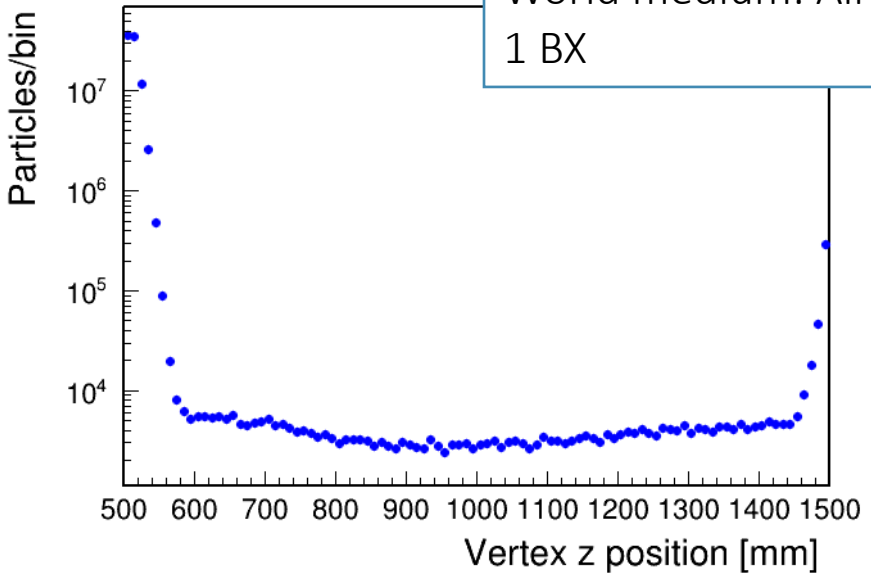


Photons z-vertex distribution

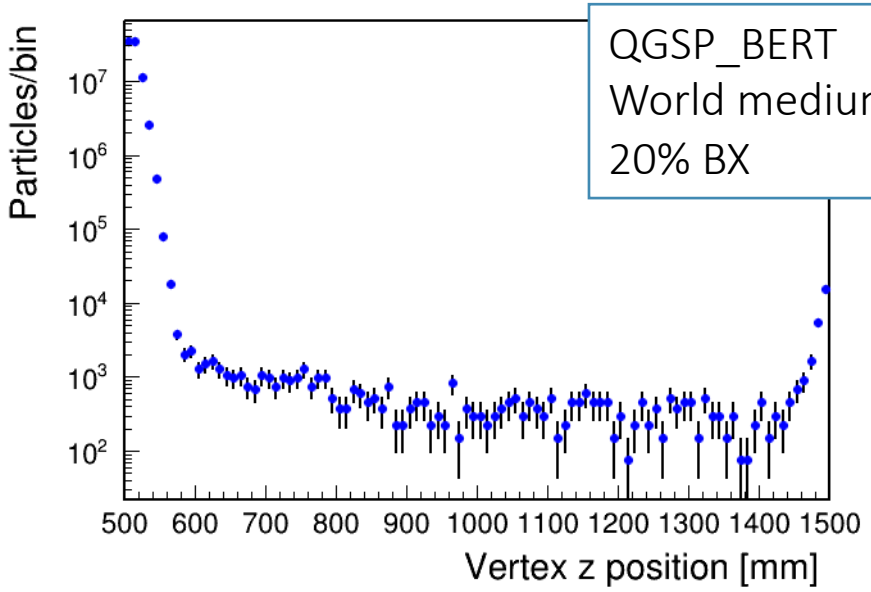
Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

```
sqrt(vtxx*vtxx+vtxy*vtxy)<300.0
```

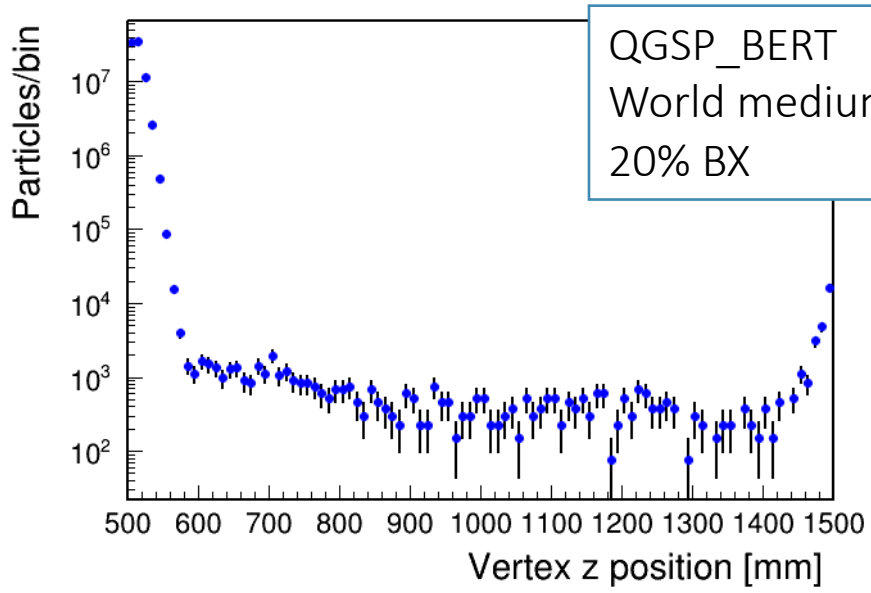
QGSP_BERT_HP
World medium: Air
1 BX



QGSP_BERT
World medium: Air
20% BX



QGSP_BERT
World medium: Galactic
20% BX

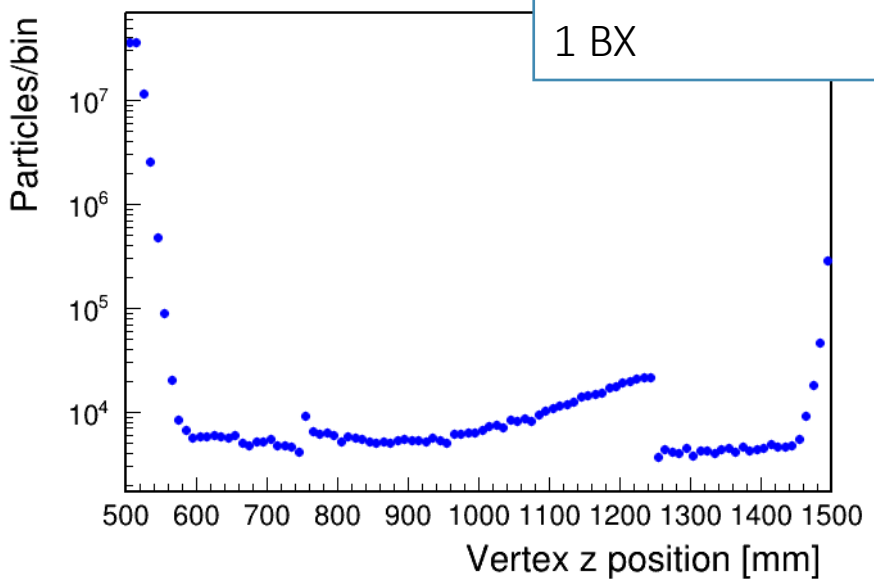


Photons z-vertex distribution

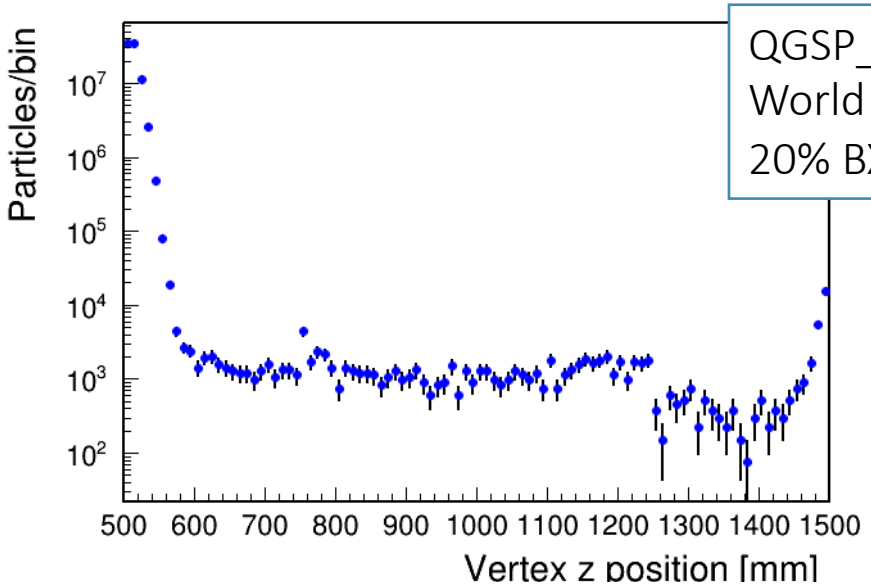
Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

```
sqrt(vtxx*vtxx+vtxy*vtxy)<1000.0
```

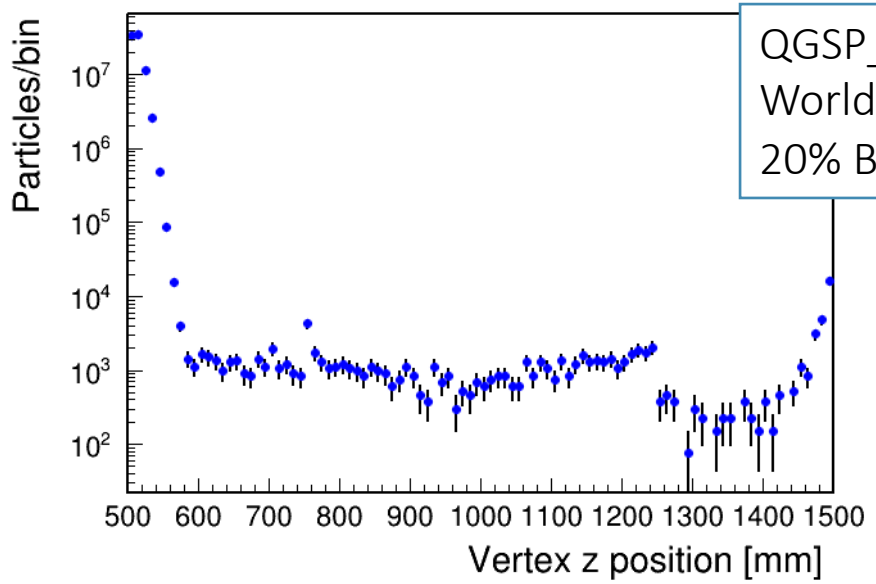
QGSP_BERT_HP
World medium: Air
1 BX



QGSP_BERT
World medium: Air
20% BX



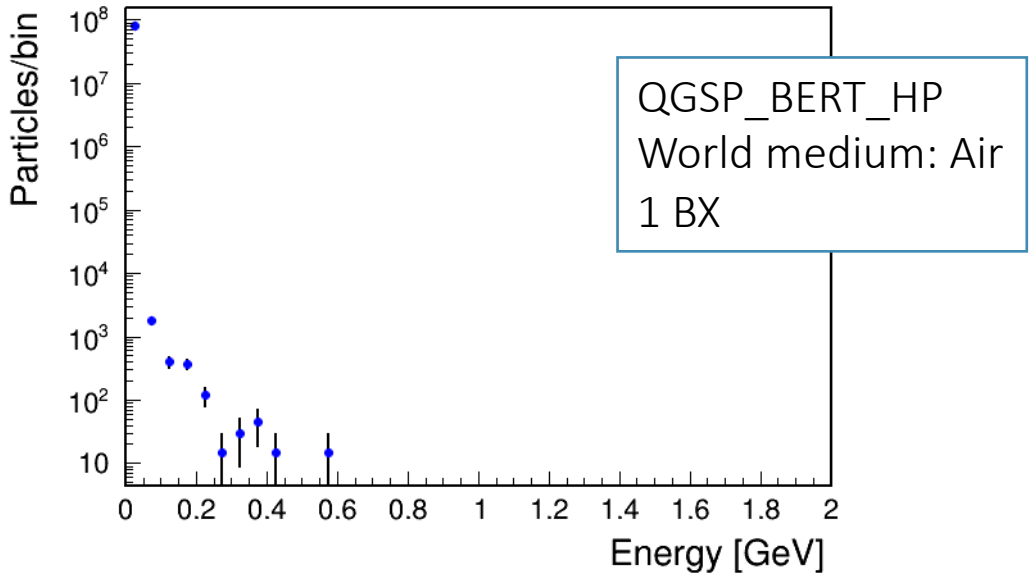
QGSP_BERT
World medium: Galactic
20% BX

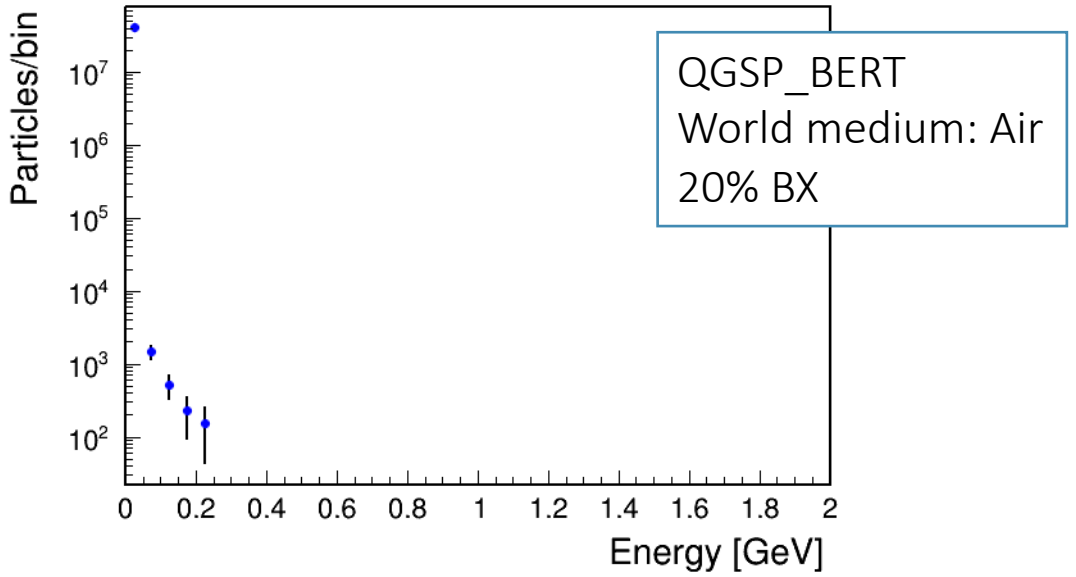


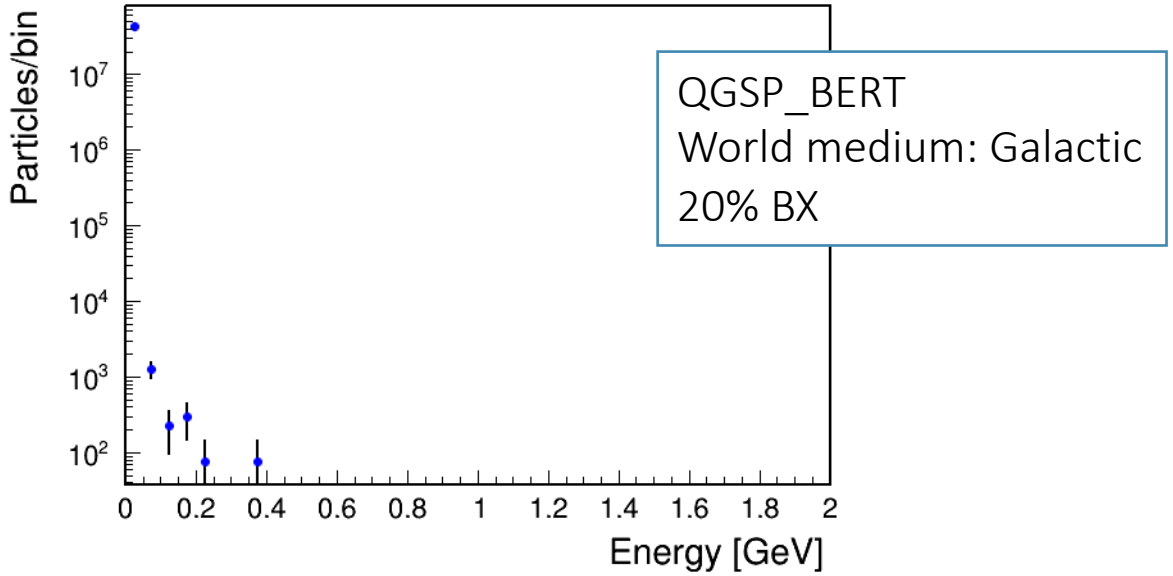
Neutrons energy spectra

Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

```
sqrt(vtxx*vtxx+vtxy*vtxy)<300.0
```



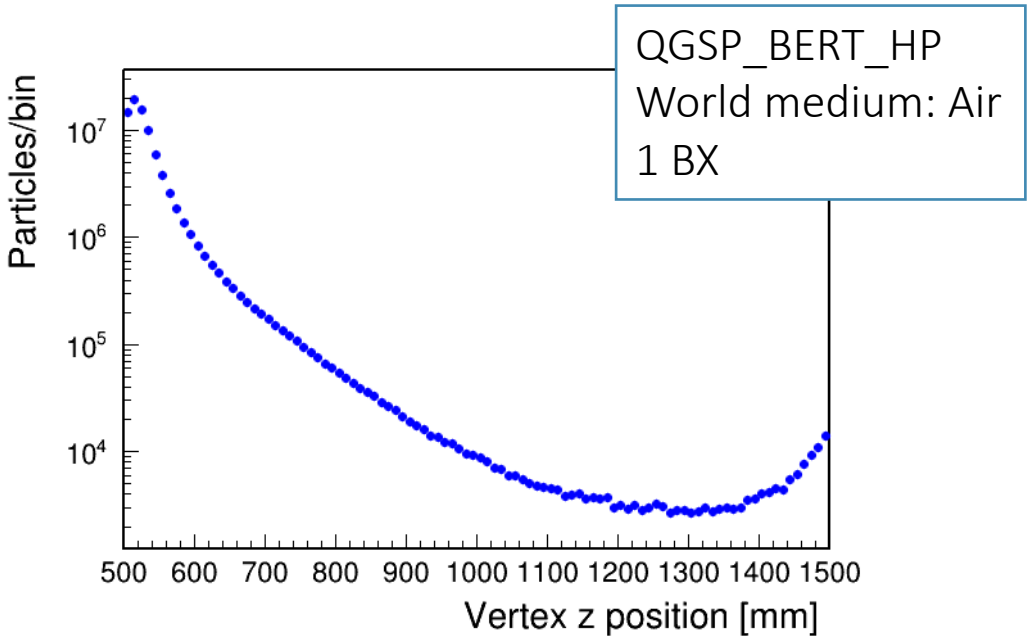


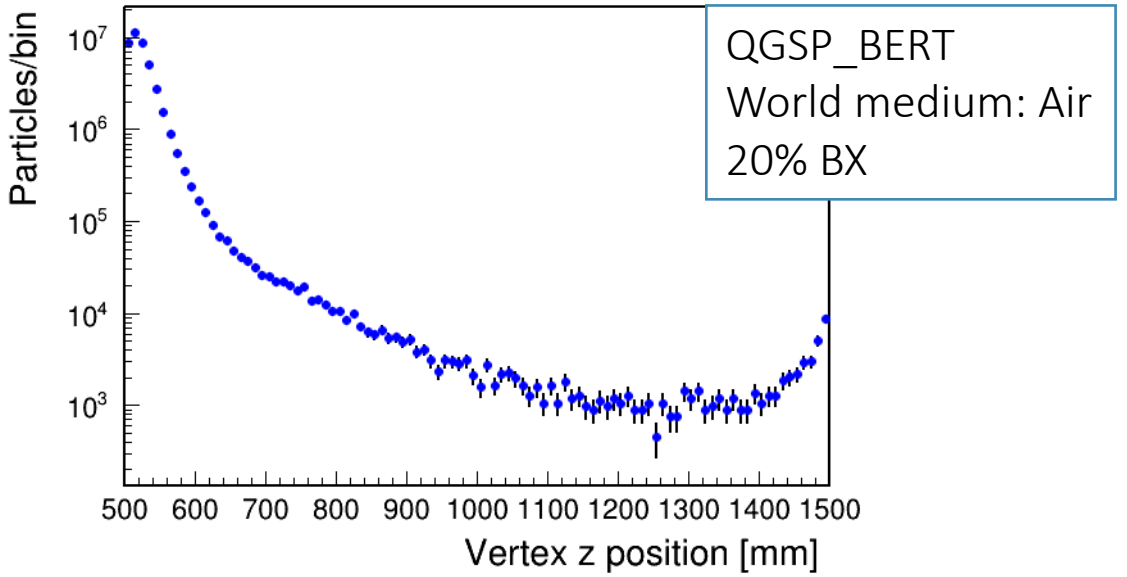


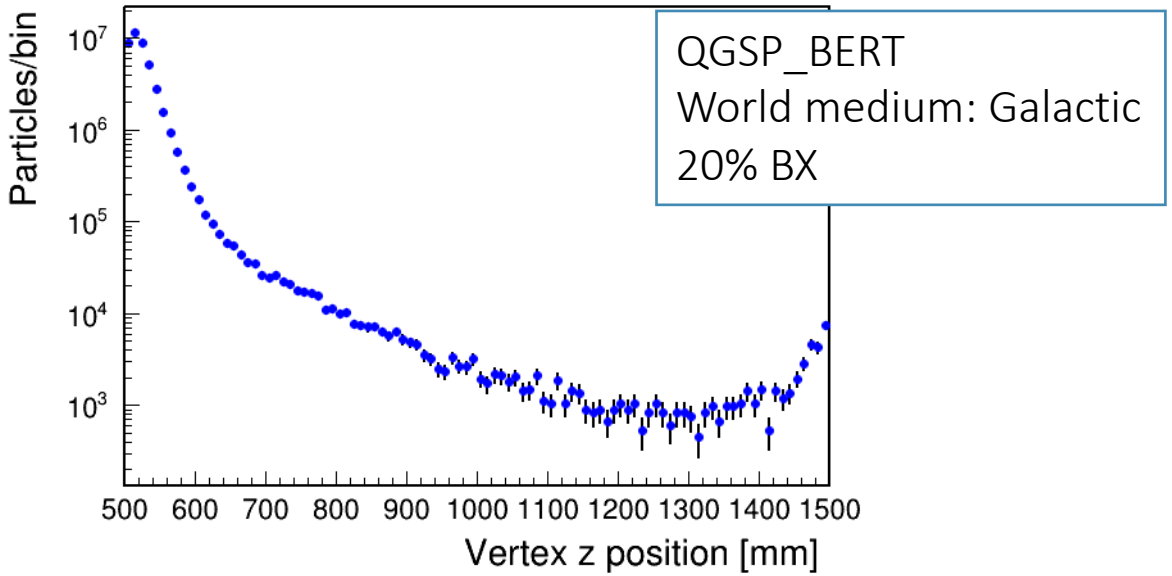
Neutrons z-vertex distribution

Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

```
sqrt(vtxx*vtxx+vtxy*vtxy)<300.0
```



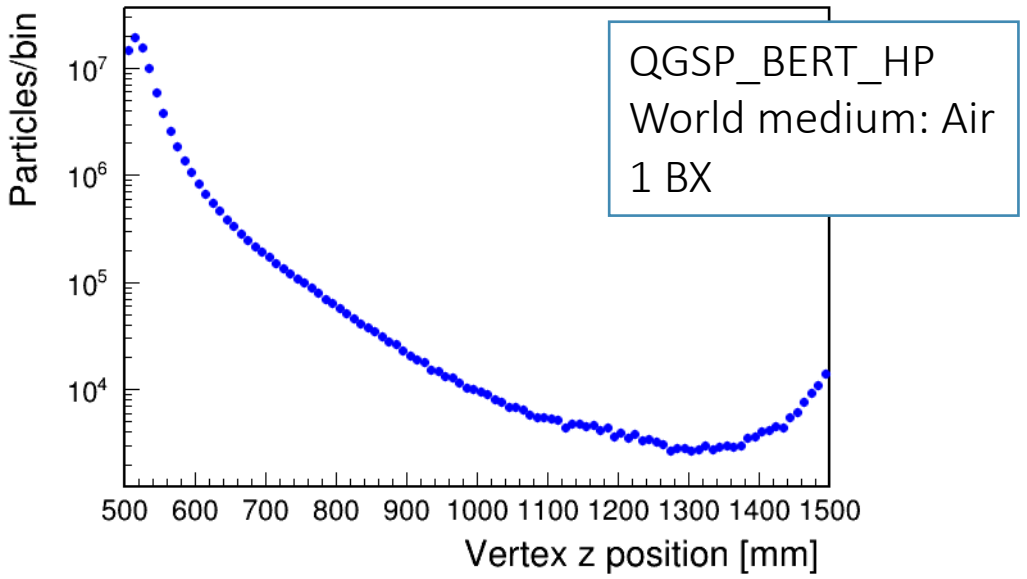




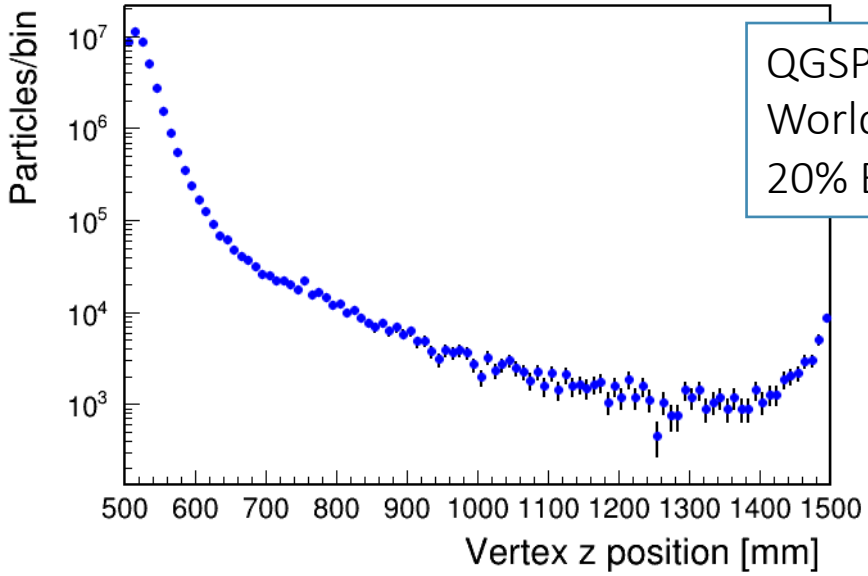
Neutrons z-vertex distribution

Distance dump to BSMCalo = 2.5m
Dump radius = 30cm

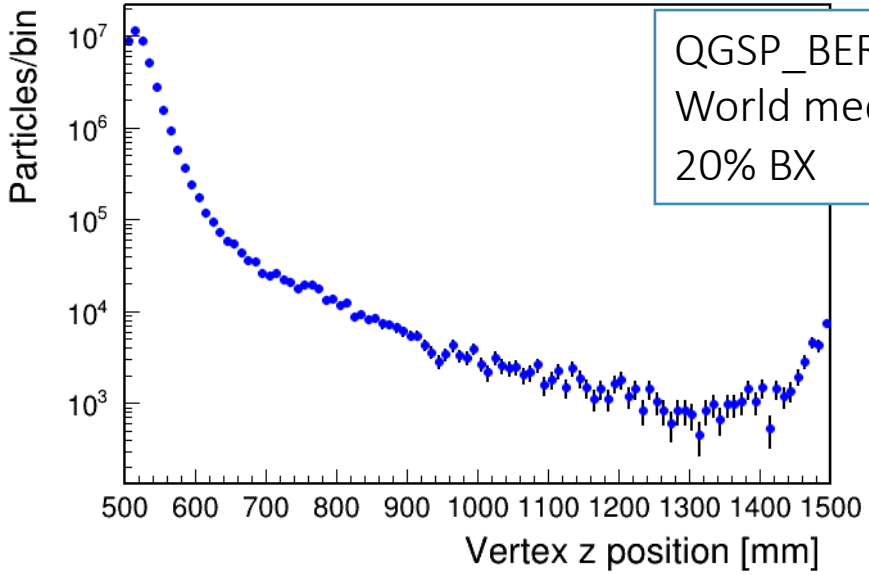
```
sqrt(vtxx*vtxx+vtxy*vtxy)<1000.0
```



QGSP_BERT_HP
World medium: Air
1 BX



QGSP_BERT
World medium: Air
20% BX

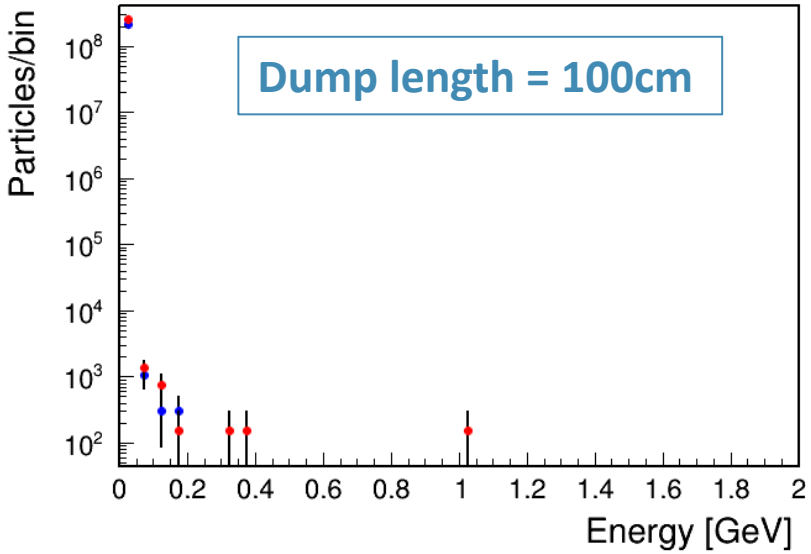


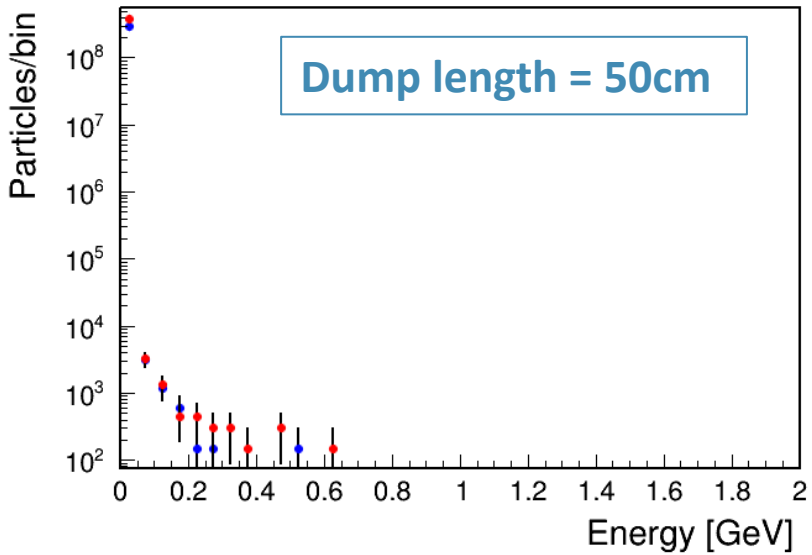
QGSP_BERT
World medium: Galactic
20% BX

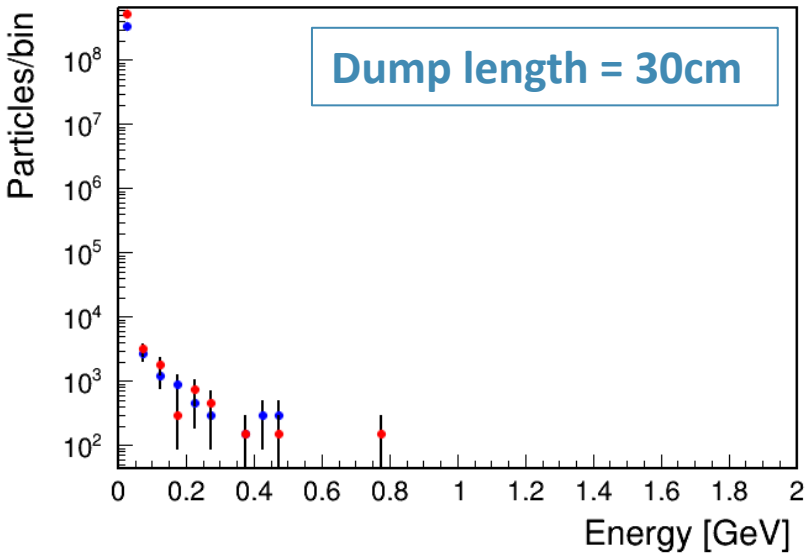
Comparison of different dump materials and length

Photons energy spectra

- Distance from dump to detector = **100cm**
- Dump radius = **10cm**
- Dump material **W**, **Pb**
- 10% BX

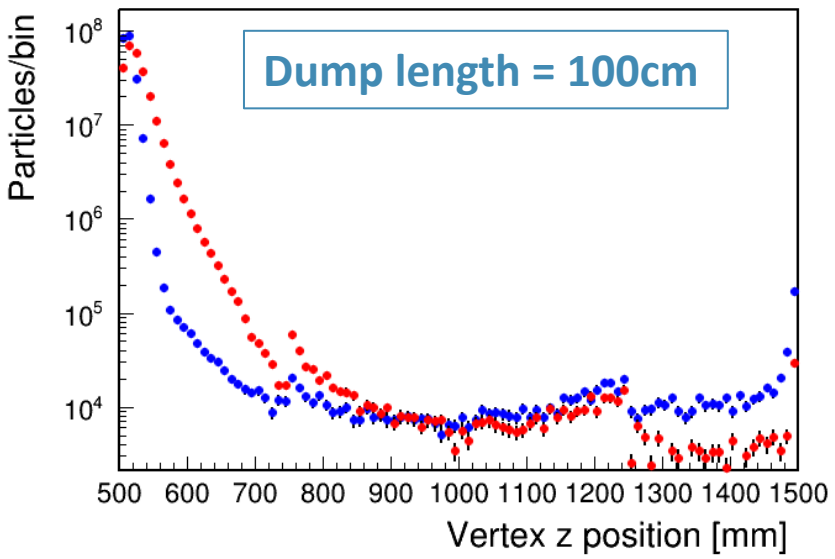


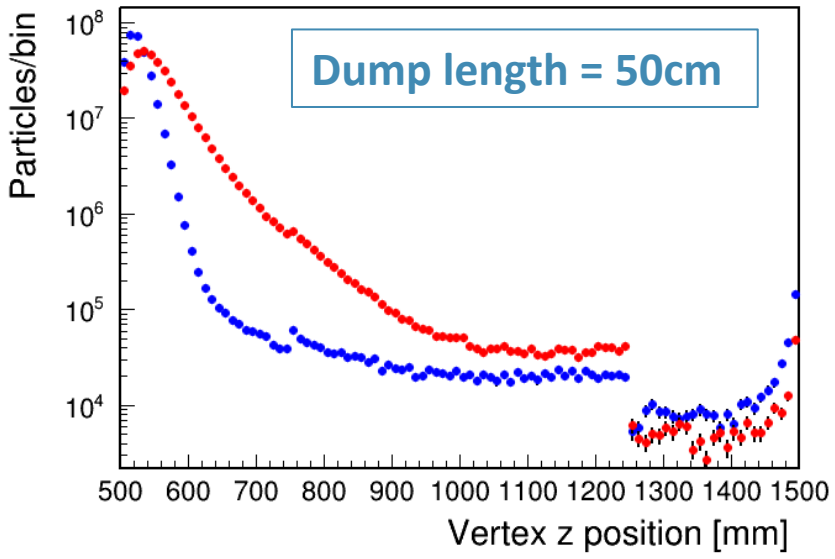


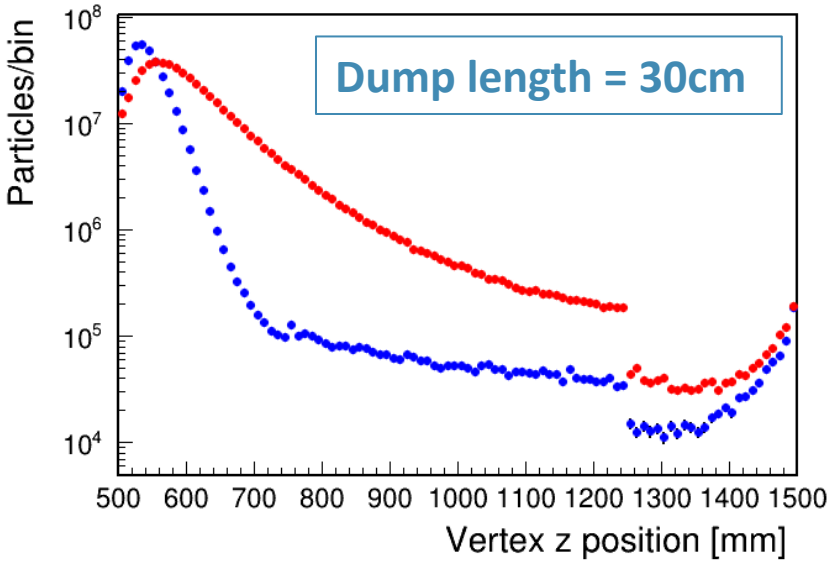


Photons z-vertez distribution

- Distance from dump to detector = 100cm
- Dump radius = 10cm
- Dump material **W**, **Pb**
- 10% BX

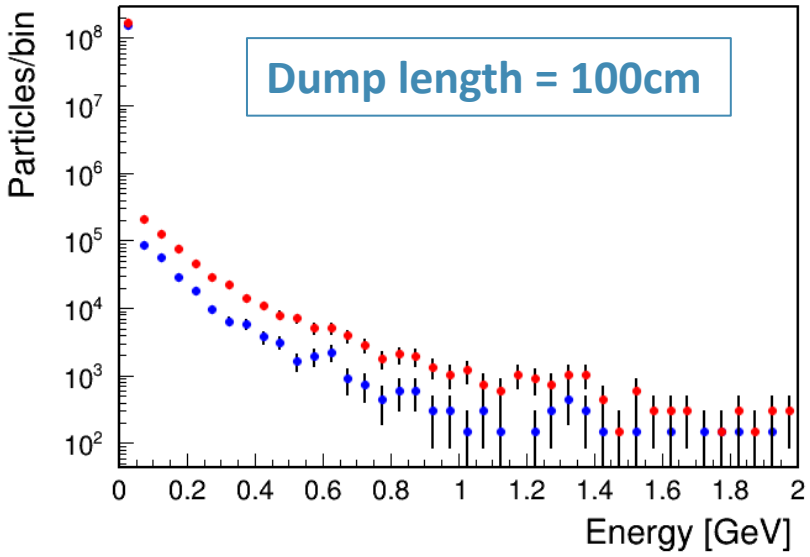


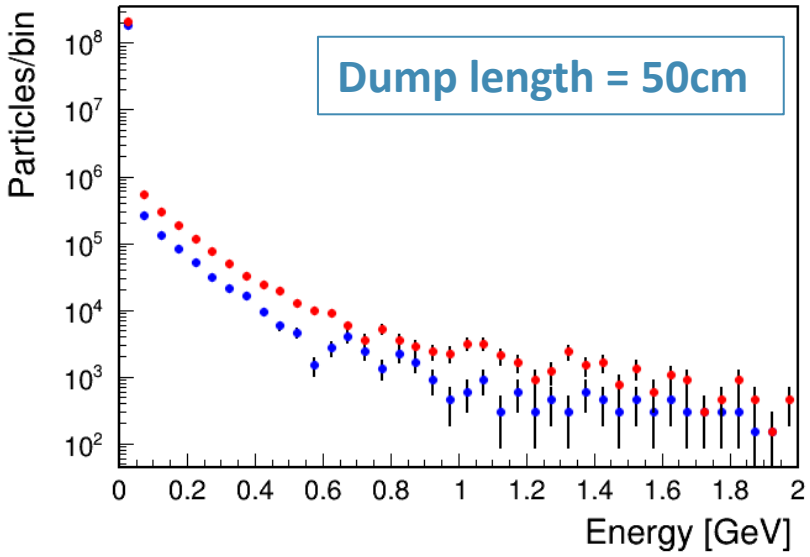


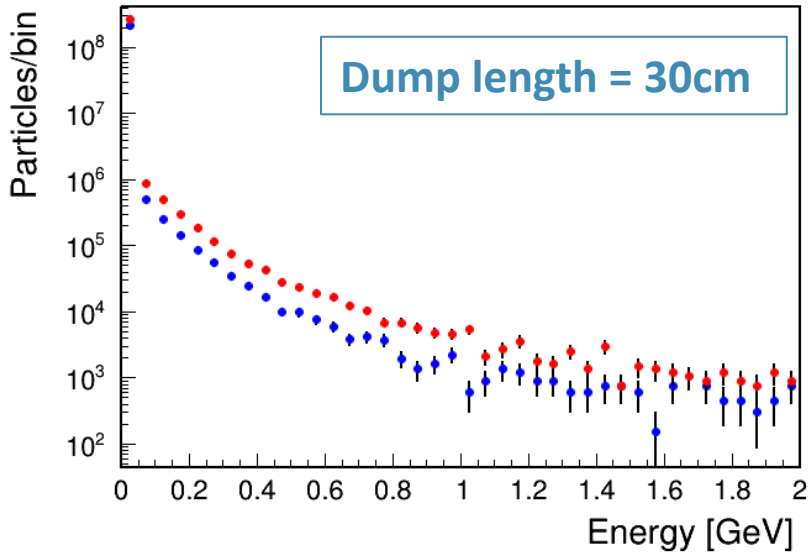


Neutrons energy spectra

- Distance from dump to detector = 100cm
- Dump radius = 10cm
- Dump material **W**, **Pb**
- 10% BX

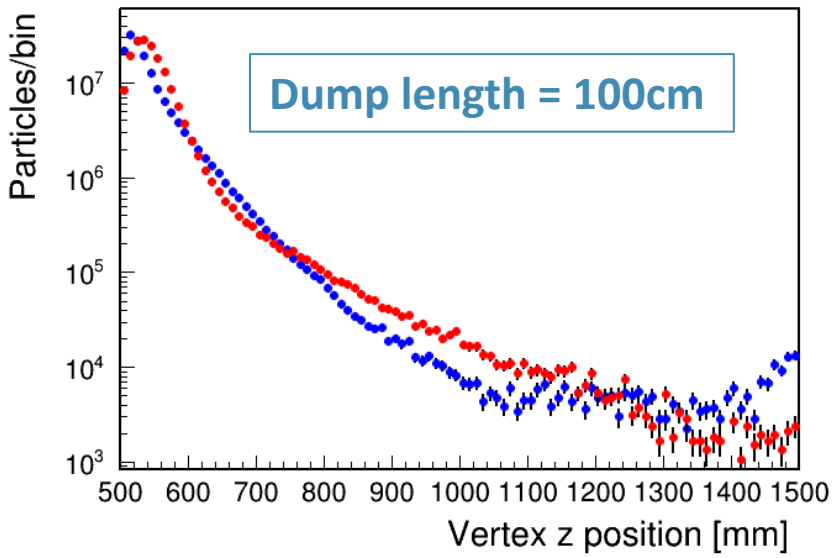


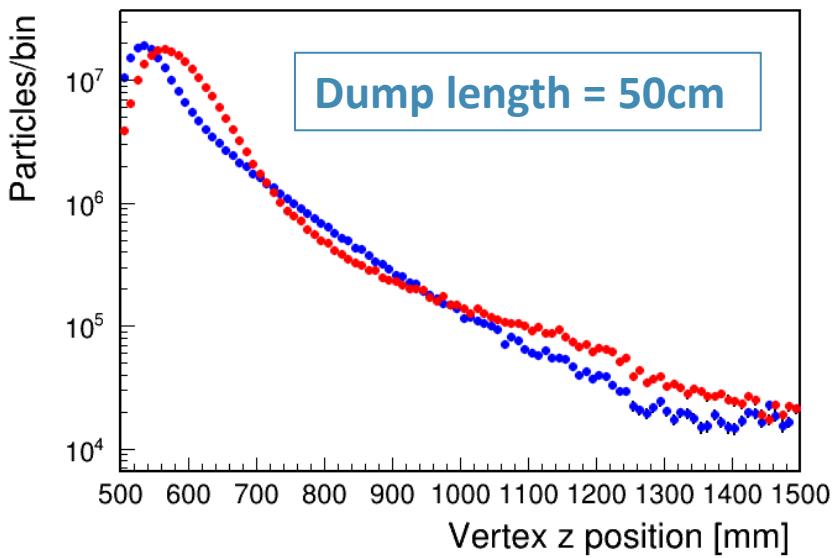


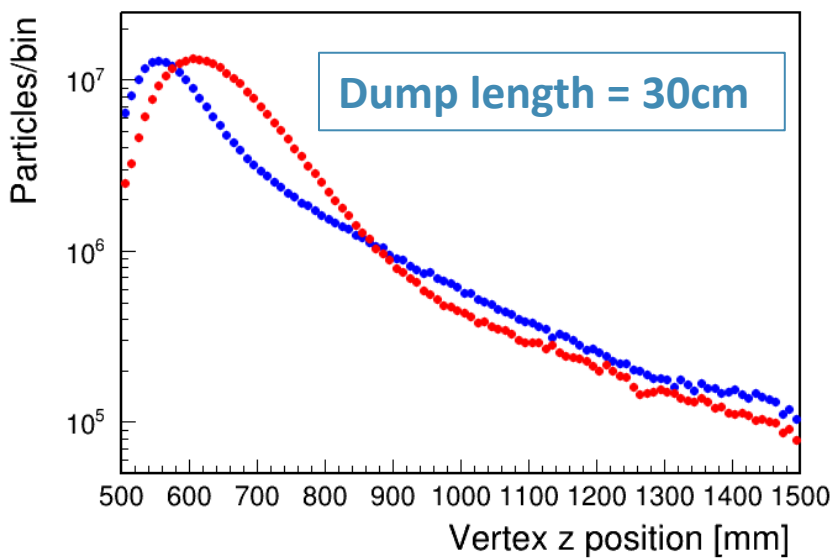


Neutrons z-vertex distribution

- Distance from dump to detector = 100cm
- Dump radius = 10cm
- Dump material **W**, **Pb**
- 10% BX







Comments

- No significant difference noticed among the different configurations:
  - Physics list: QGSP_BERT_HP; world medium: air
  - Physics list: QGSP_BERT; world medium: air
  - Physics list: QGSP_BERT; world medium: galactic

- Is there a difference between the primary photons energy spectra we obtain vs. the one in the NPOD paper?
  - New simulations use input from ptarmigan-v0.11
  - Primary photons distribution comparison ongoing

- ToDo: distance to the detector 150cm and 200cm