



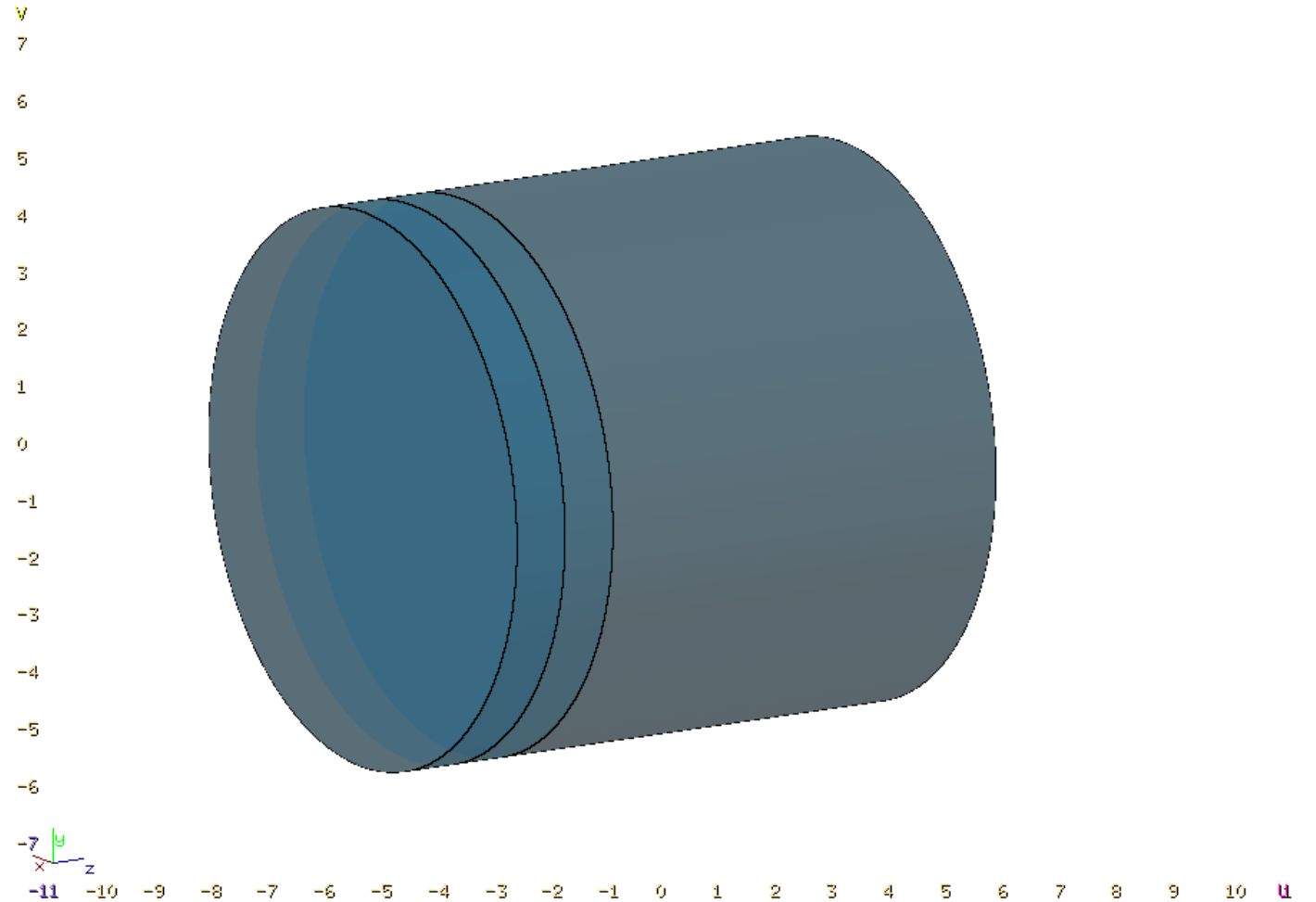
## Exercise : Scoring

Aim of the exercise:

- Learn how to use **USRBIN** scoring cards
- Learn how to look at simulation results
- Plot the Bragg peak
- See that bin size matters
- Scoring by region vs scoring by grid

# The input file

- Cylindrical water target split in 3 parts
- 100 MeV proton beam



# Implement these scorings and run

## 1. Plot the Bragg peak

- Add a **USRBIN** covering the target to score ENERGY with a 0.1-cm R-bin, 1  $\Phi$ -bin, 0.1-cm z-bins
- Think what you need to plot: 1D Projection or 1D Max?

## 2. Compare previous scoring to one with different bin sizes

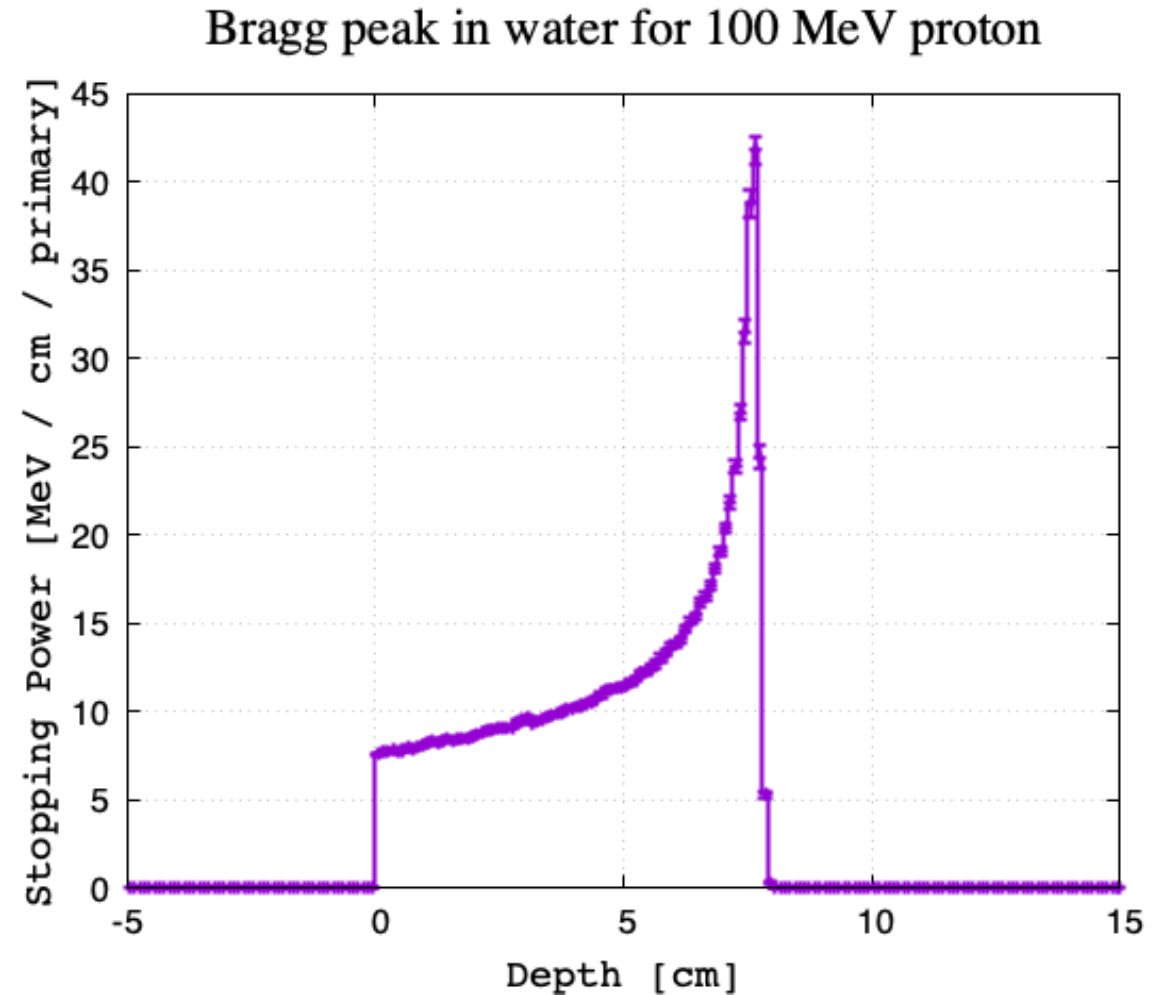
- Add a **USRBIN** covering the target to score ENERGY with a 0.2-cm R-bin, 1  $\Phi$ -bin, 0.1-cm z-bins

## 3. Compare results of **USRBIN** by regions and by grid

- Add a **USRBIN** to score ENERGY by region
  - Add a **USRBIN** covering the target to score ENERGY with a 1 R-bin, 1  $\Phi$ -bin, 10 z-bins (1-cm)
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- Run 5 cycles, 1000 primaries each, process the data files
  - Try running with different number of primary/cycles, and look at statistics

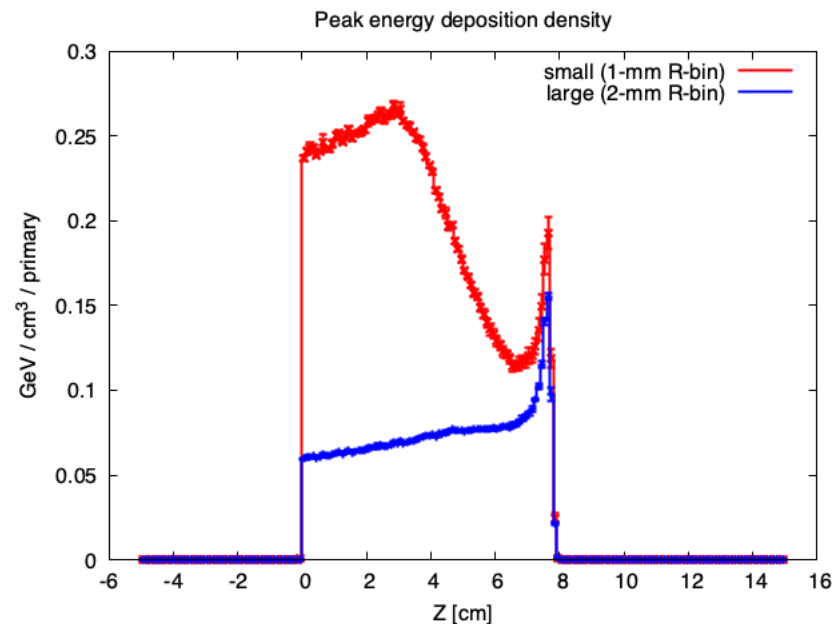
# Result – 1 : Plot the Bragg peak

- Plot the **USRBIN** results
  - 1-D projection: Z
  - Multiply by the transverse scoring area to get stopping power (notice that the grid covers a suitably large transverse area)



# Result – 2 : Compare USRBIN with different bin sizes

- Plot the **USRBIN** results with different bin sizes
  - 1-D Max: Z
  - Compare the two plot using USR-1D plot in Flair
- Note that
  - 2mm binning gives smaller max value → be careful to bin size, without exaggerations. Depends on beam, geometry, thresholds (see lecture on ionization and transport)
  - 1mm binning has worse statistical errors (use histerror): excess in smallness means no convergence, and might be meaningless



# Result – 3 : Compare scoring by regions and by grid

- The first two bins of the grid scoring correspond to the regions TARGS1 and TARGS2, respectively
- Do you see why the values are different?
  - The scaling factor is 78.5398 ...

