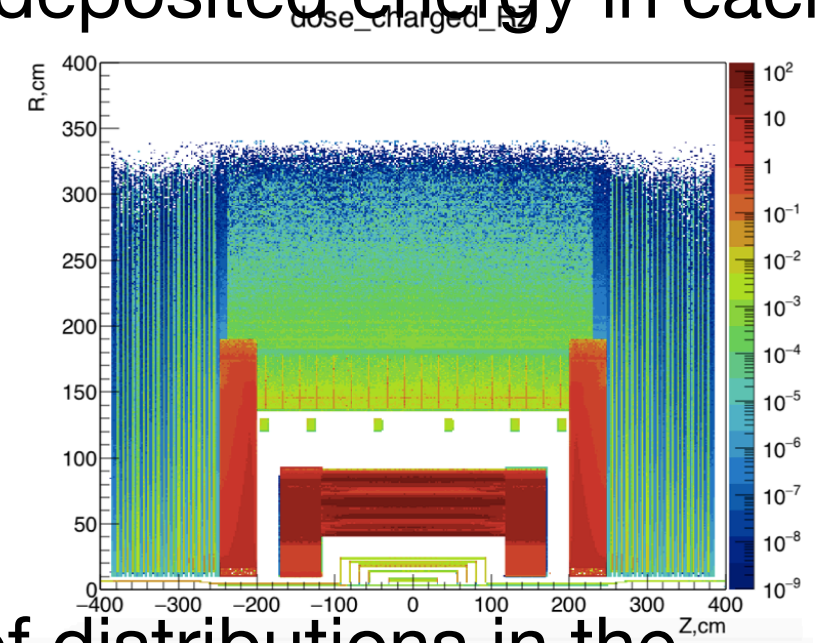


Evaluation of radiative dose at SPD

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SPD Physics & MC meeting
3.03.2021

FairRoot tools

- FairRoot::FairRadMapManager - sum up every deposited energy in each volume in the geometry.
 - Problems with calorimeter?
 - Doesn't compute dose in air.
- FairRoot::FairRadGridManager - plots 3 types of distributions in the given mesh:
 - FLU = Fluence (*particles/cm²/primary*);
 - TID = Total Ionizing Deposit (*GeV/cm³/primary*);
 - SEU = Single Event Upset - basically, the same as FLU, but with a cut on particle momentum $P > 0.02$ GeV/c. No electronic related parameters.



One can estimate the radiative dose using a density map:

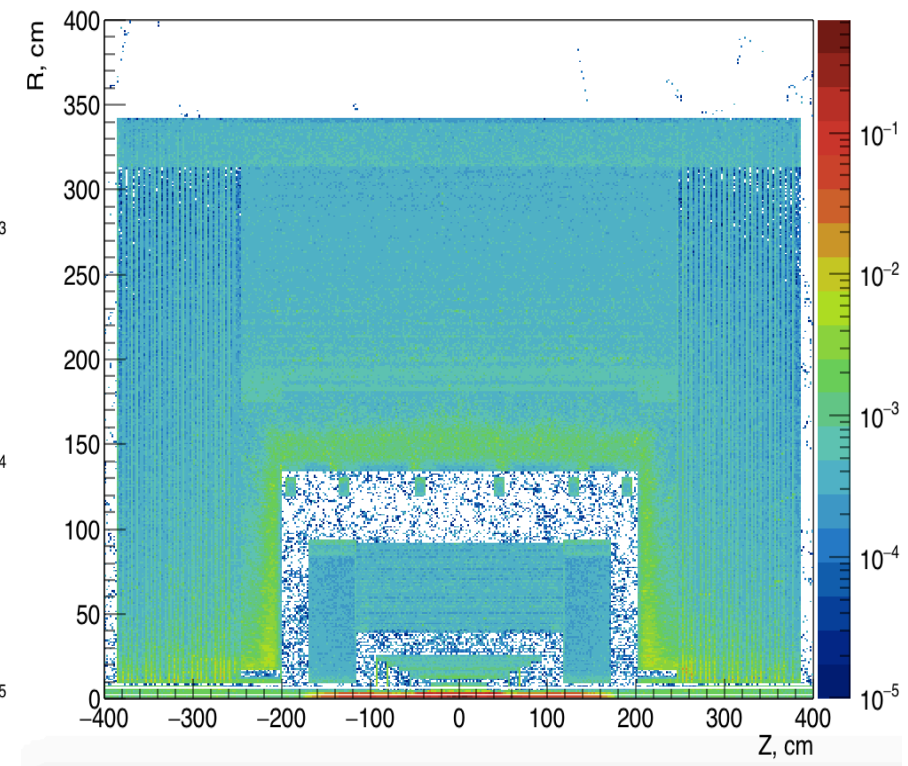
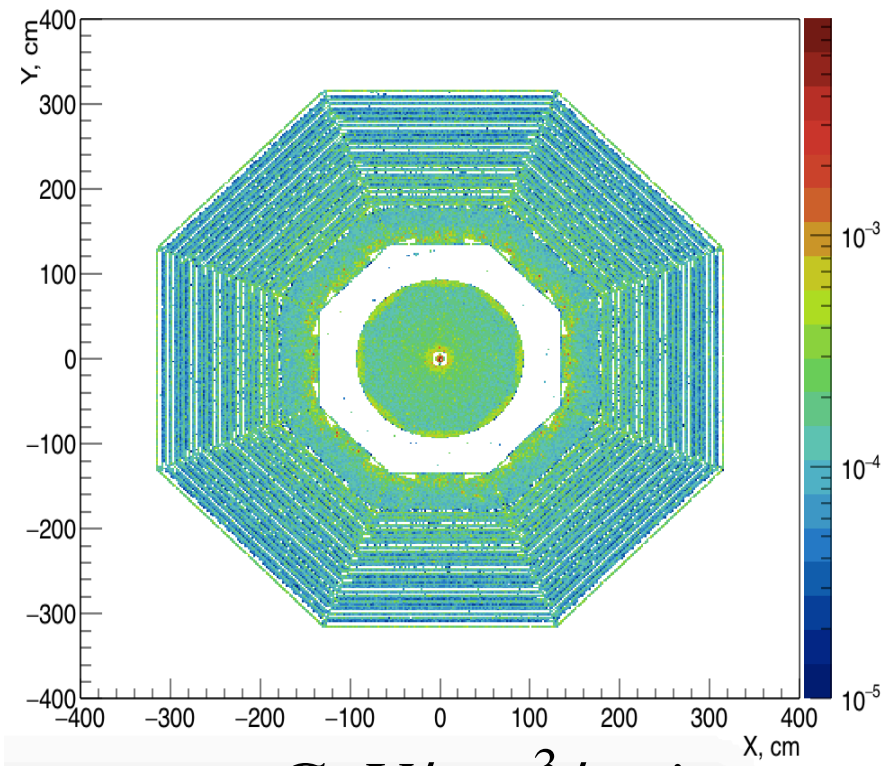
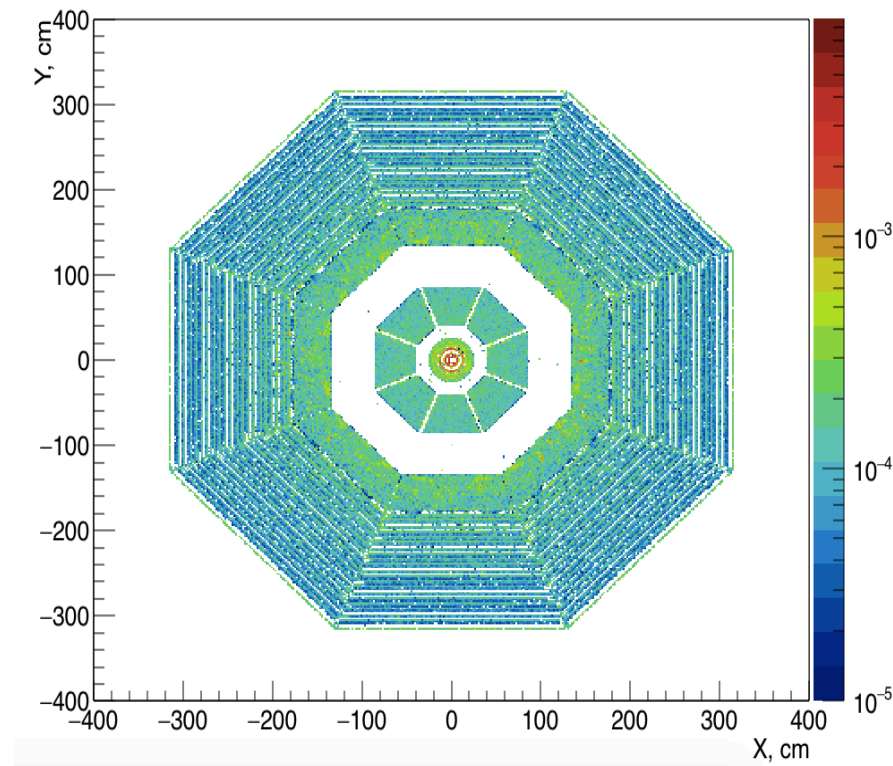
$$Dose\left[\frac{Gr}{year}\right] = 1.6 \cdot 10^{-10} \cdot \overset{\text{GeV} \rightarrow \text{Joule}}{TID}\left[\frac{GeV}{cm^3 \cdot primary}\right] \cdot \frac{10^3}{\rho}\left[\frac{cm^3}{kg}\right] \cdot 4 \cdot \overset{\text{rate}}{10^6}\left[\frac{primary}{sec}\right] \cdot \overset{\text{sec} \rightarrow \text{year}}{10^7}[sec]$$

FLUENCE ($\text{particles}/\text{cm}^2/\text{primary}$)

Z = 0 cm

Z = 170 cm

R vs Z

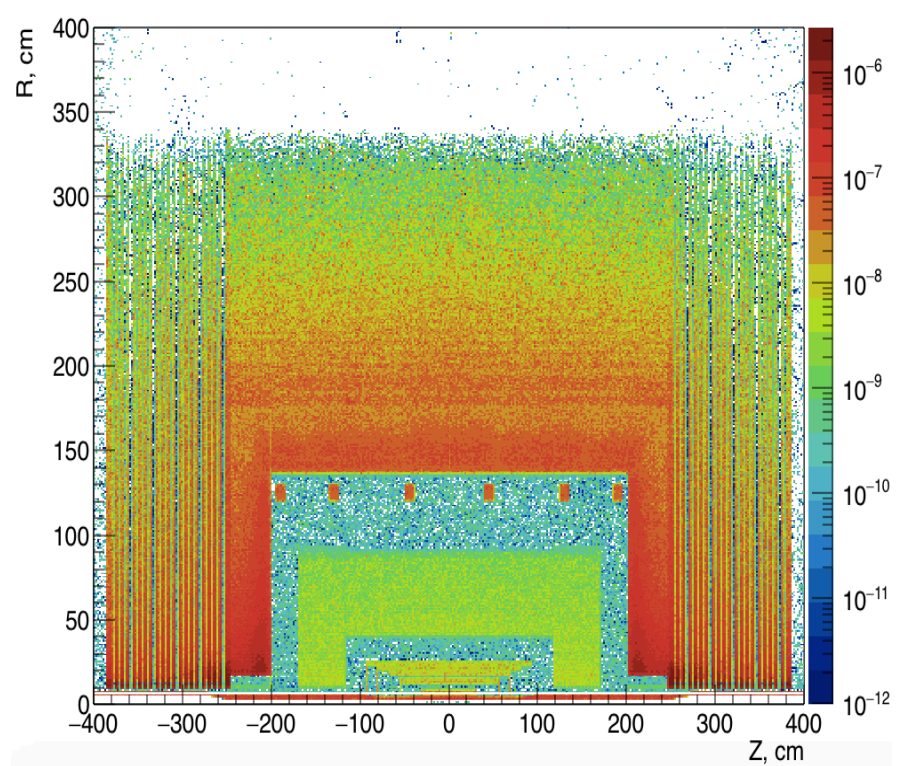
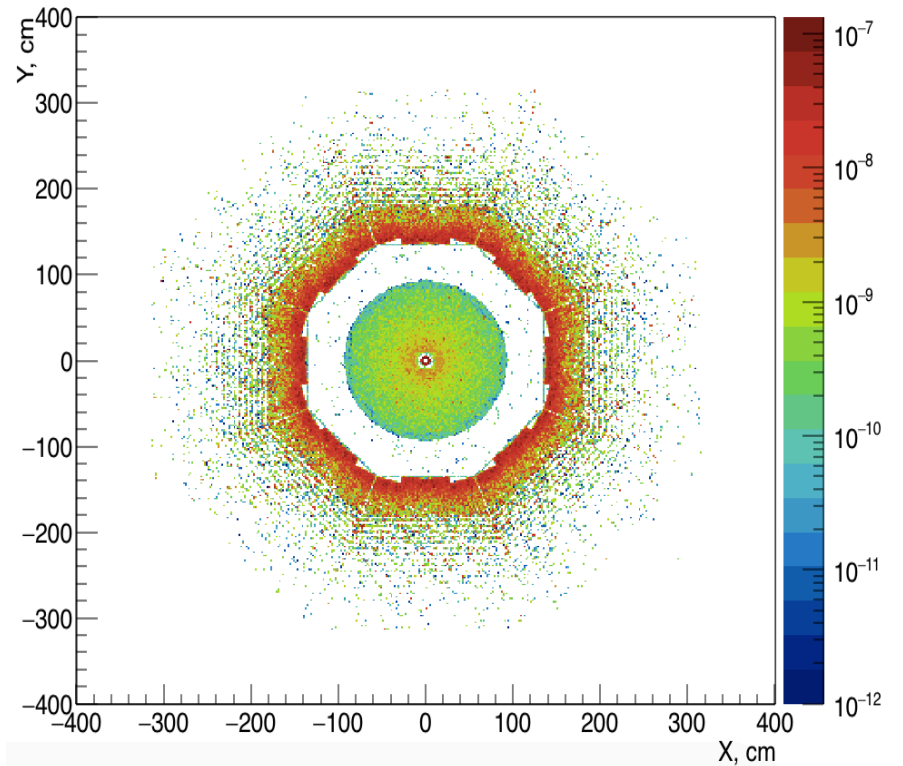
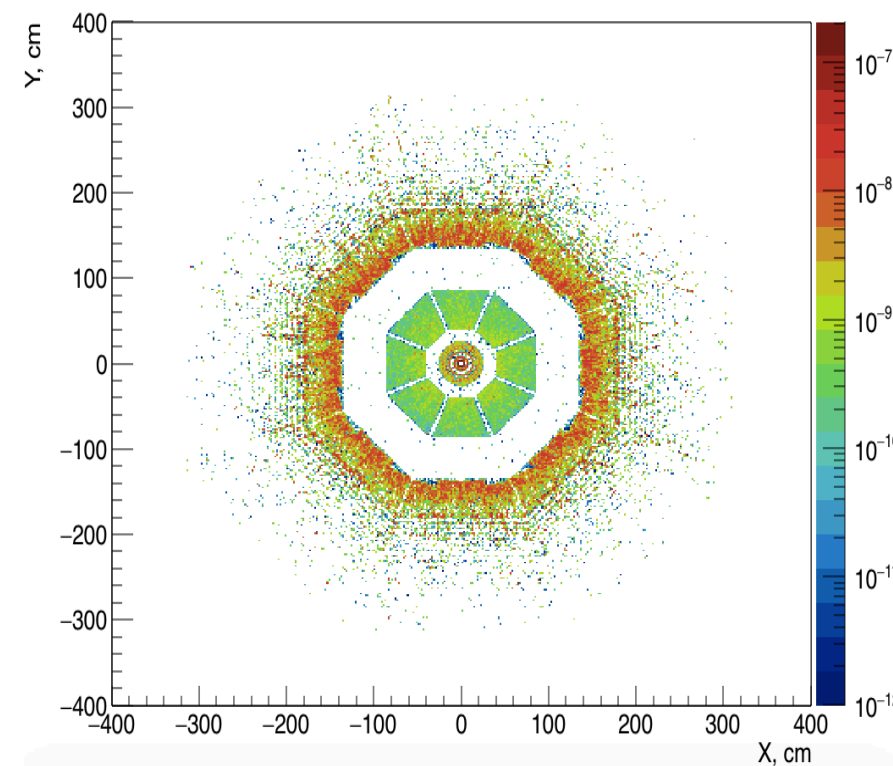


TID ($\text{GeV}/\text{cm}^3/\text{primary}$)

Z = 0 cm

Z = 170 cm

R vs Z



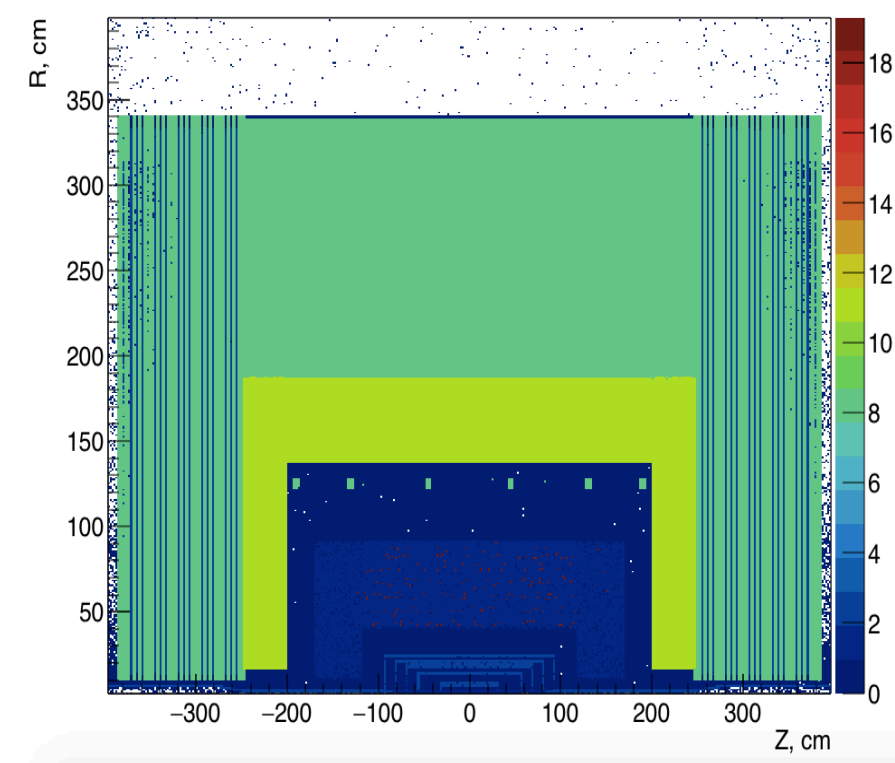
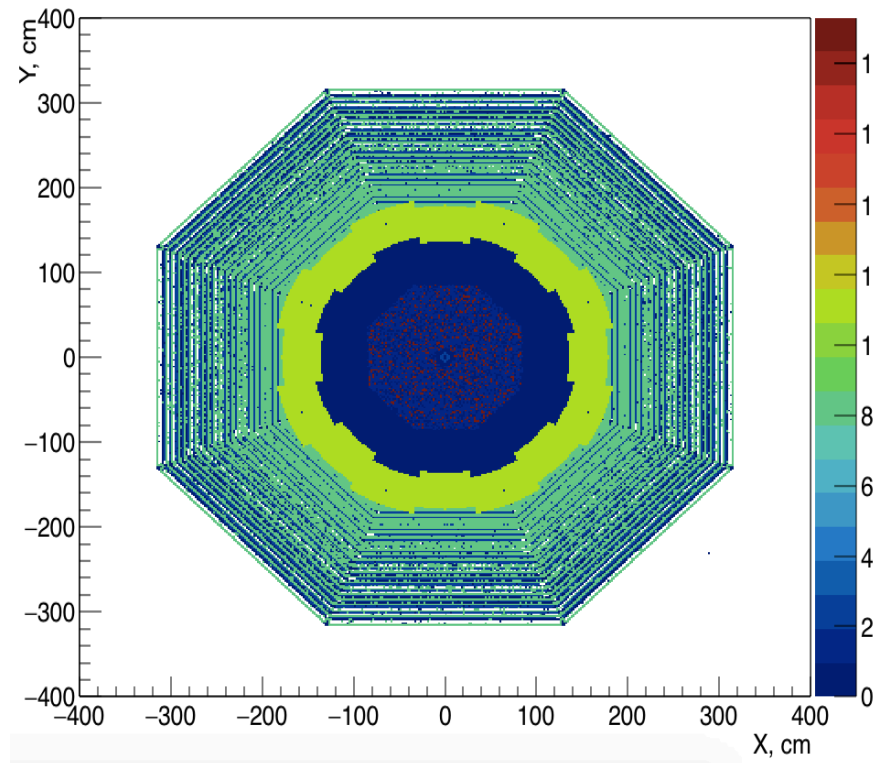
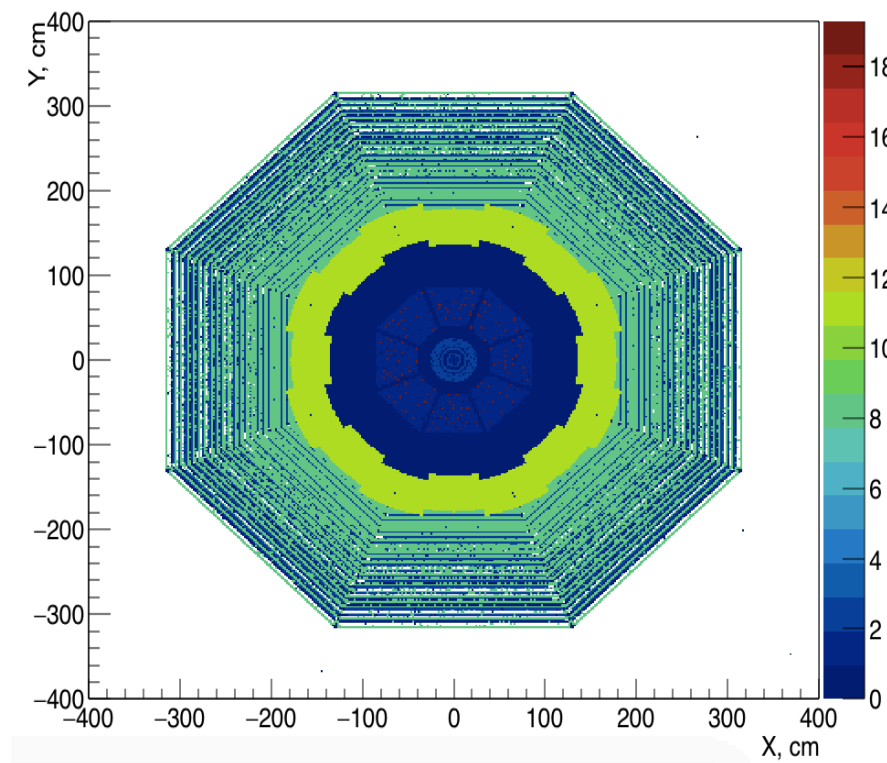
Doze with «contrast» density

DENSITY (g/cm^3)

Z = 0 cm

Z = 170 cm

R vs Z

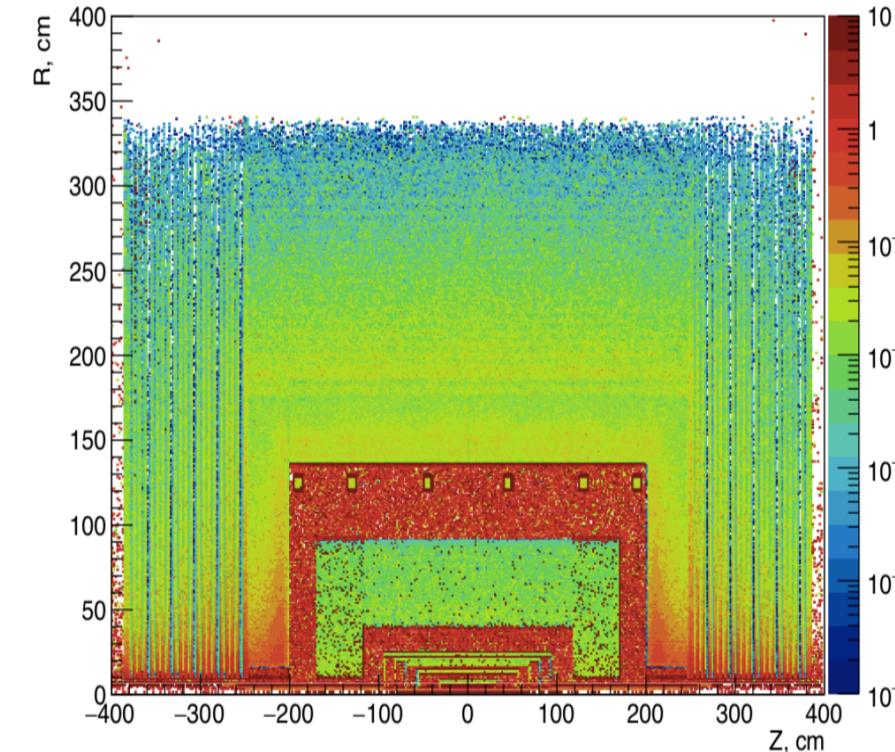
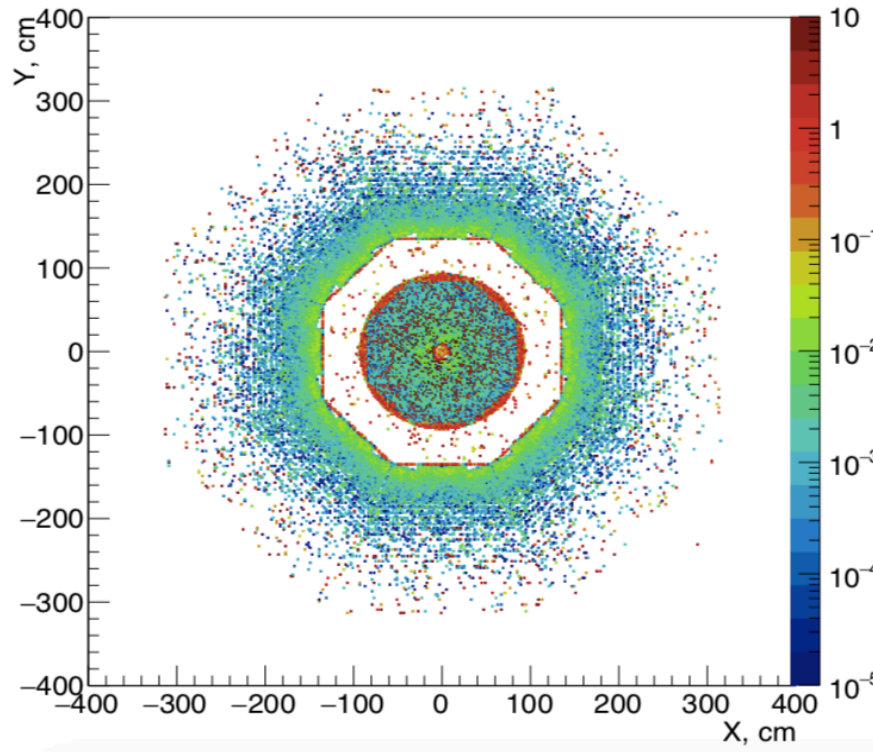
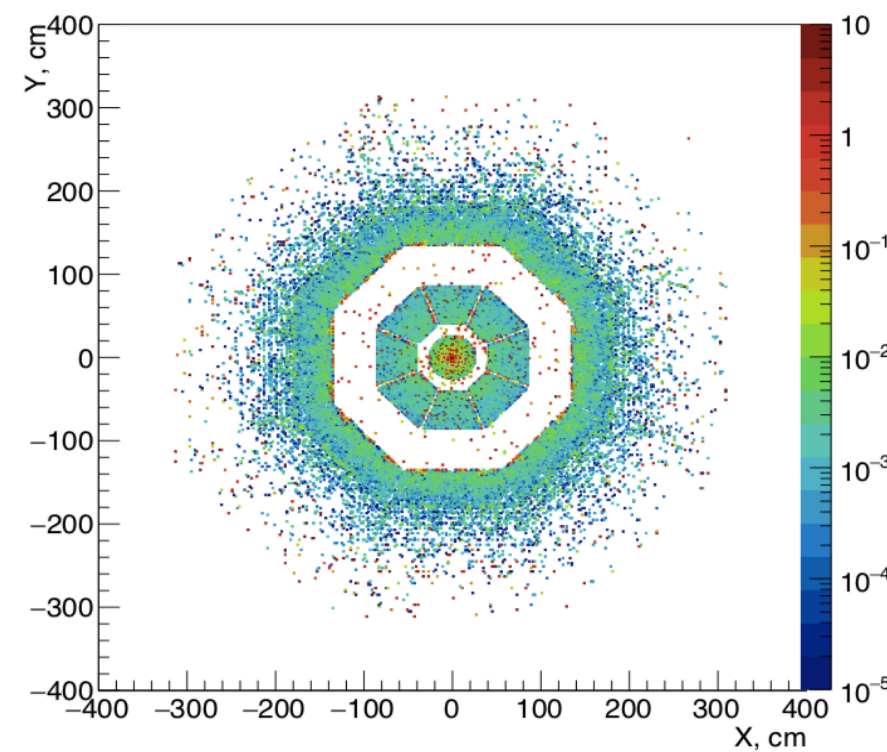


DOZE ($Gr/year$)

Z = 0 cm

Z = 170 cm

R vs Z



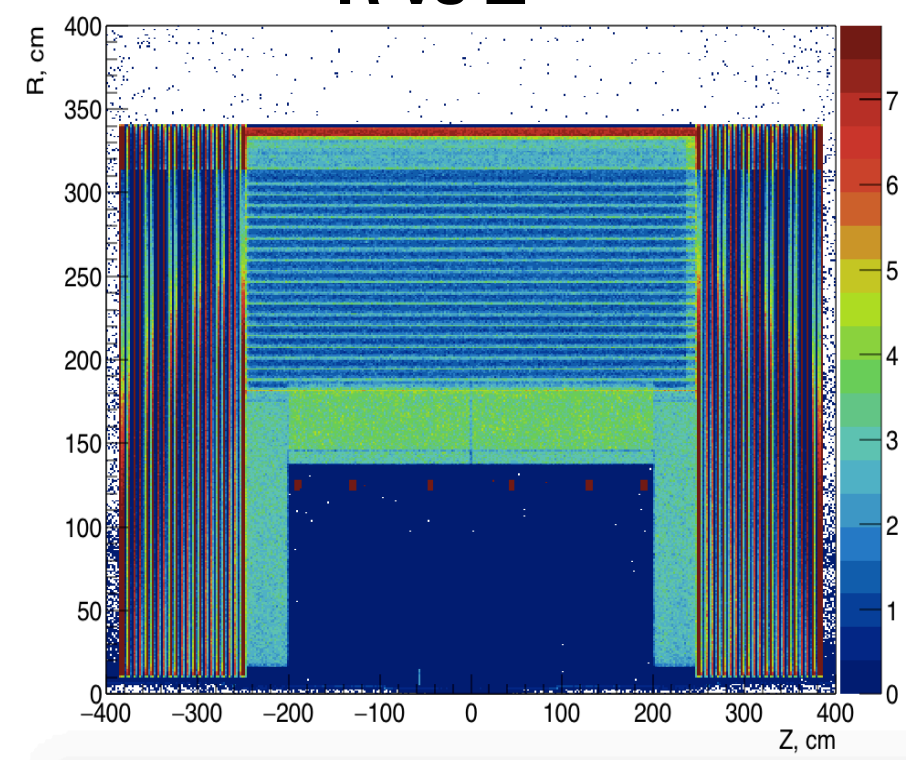
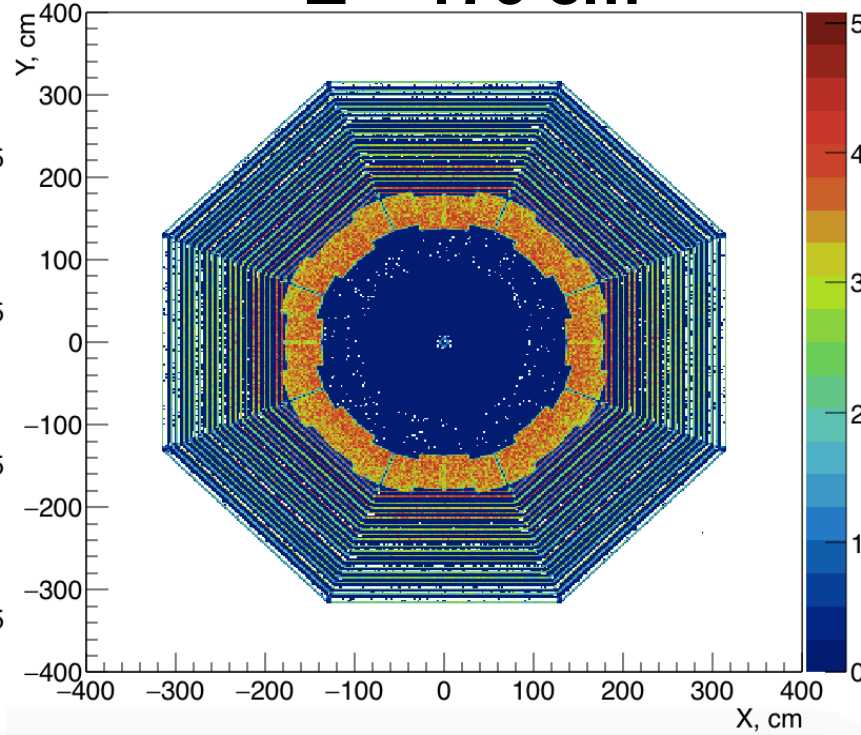
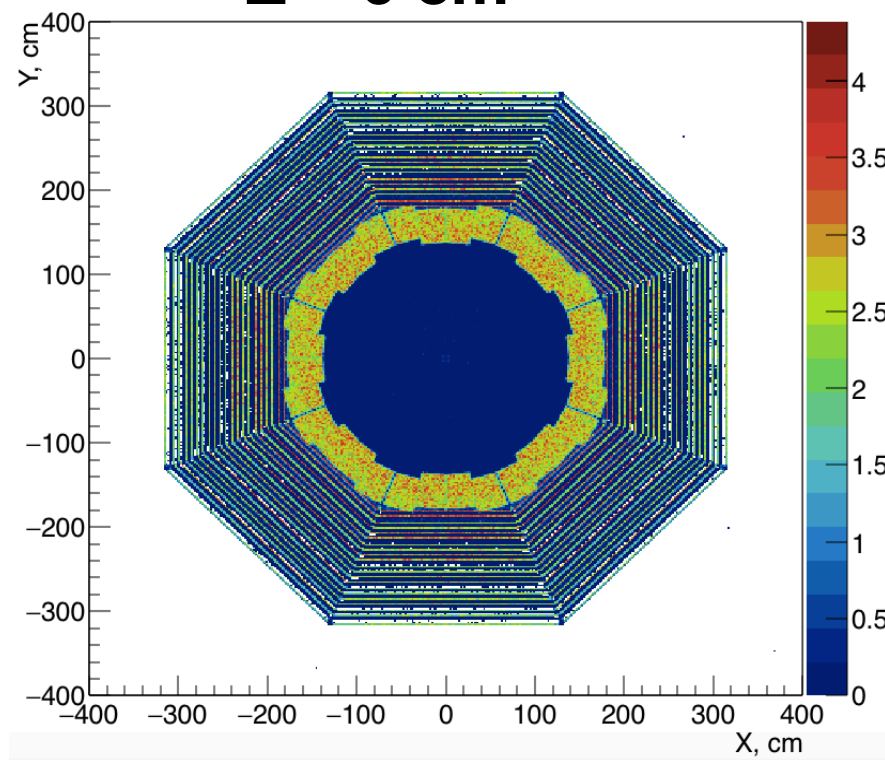
Doze with «effective» density

DENSITY (g/cm^3)

Z = 0 cm

Z = 170 cm

R vs Z

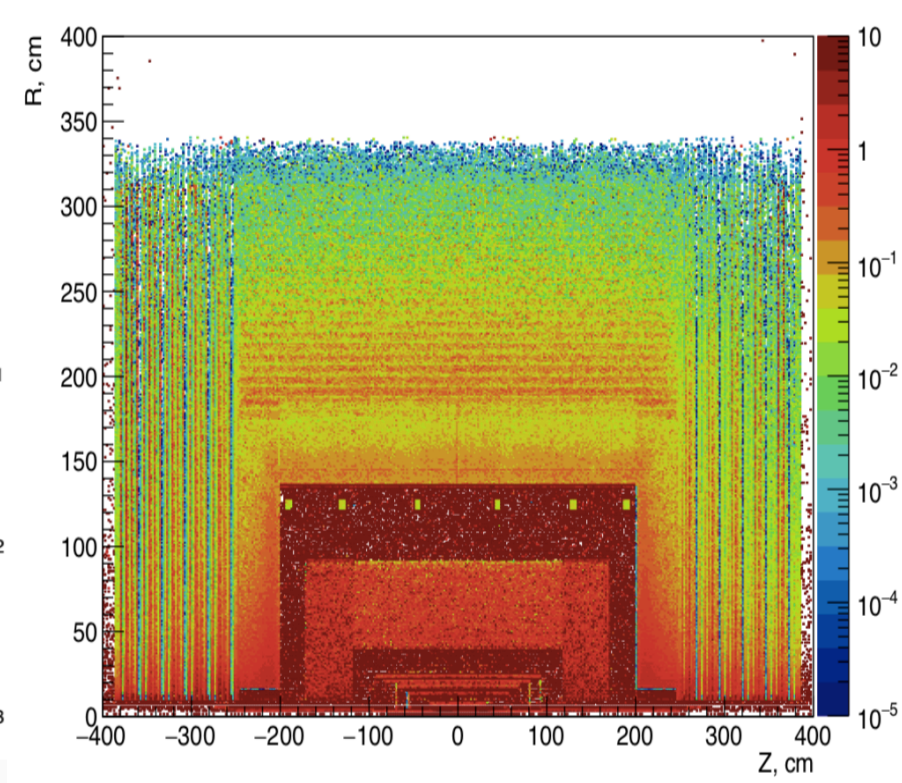
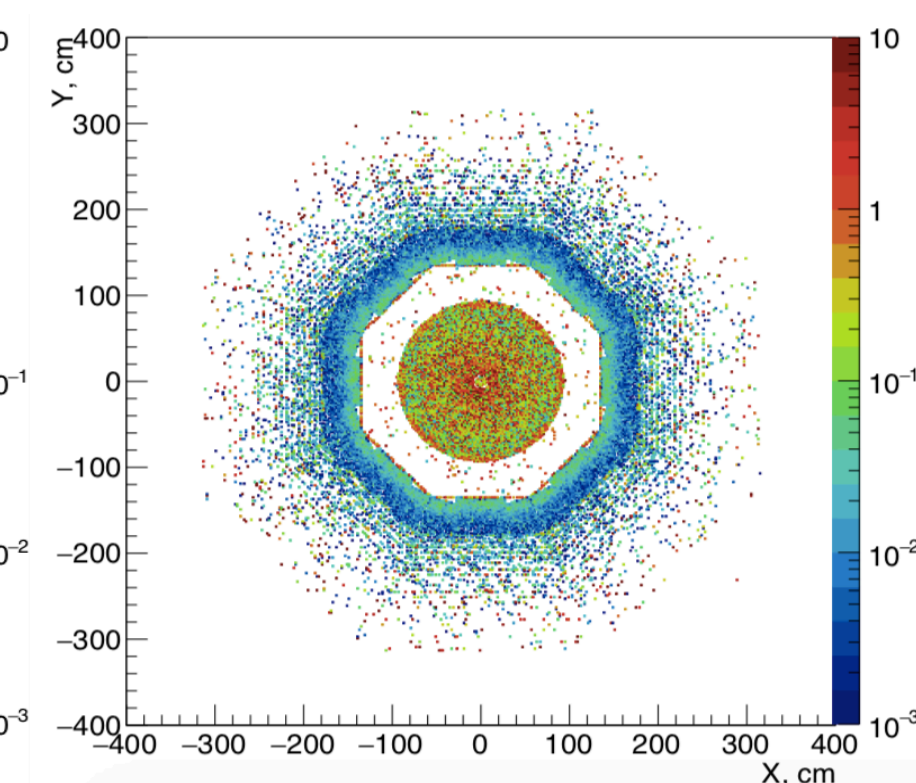
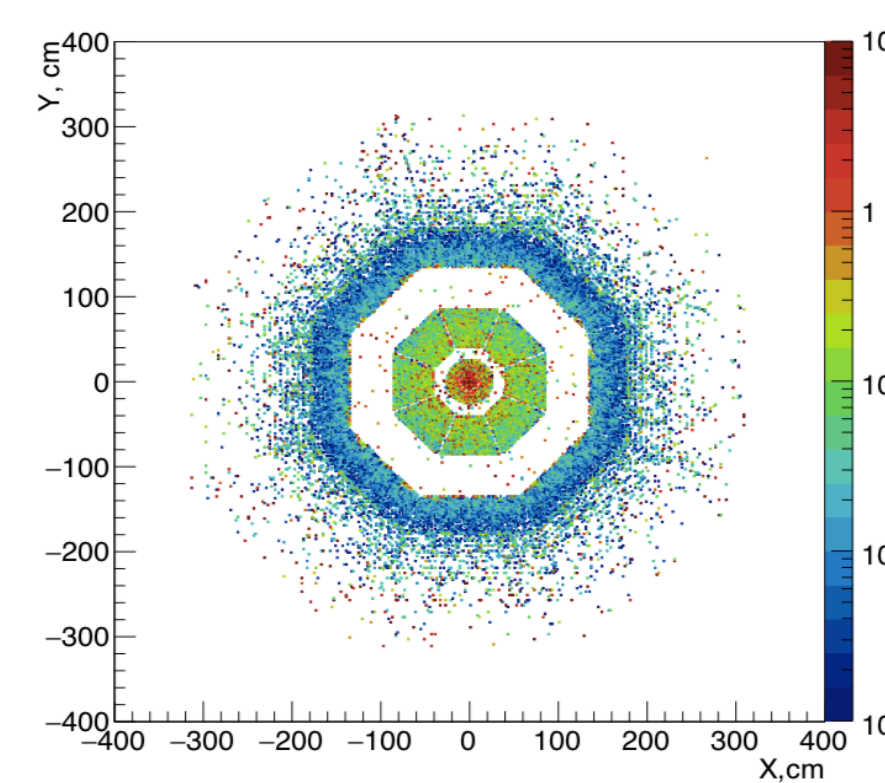


DOZE ($Gr/year$)

Z = 0 cm

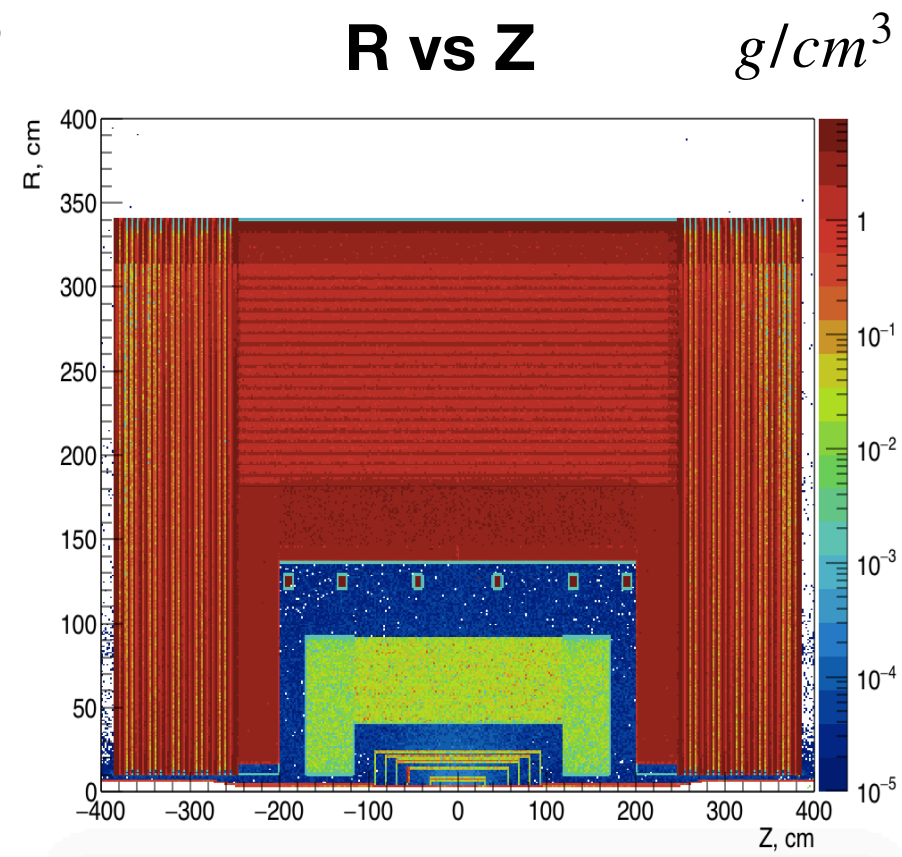
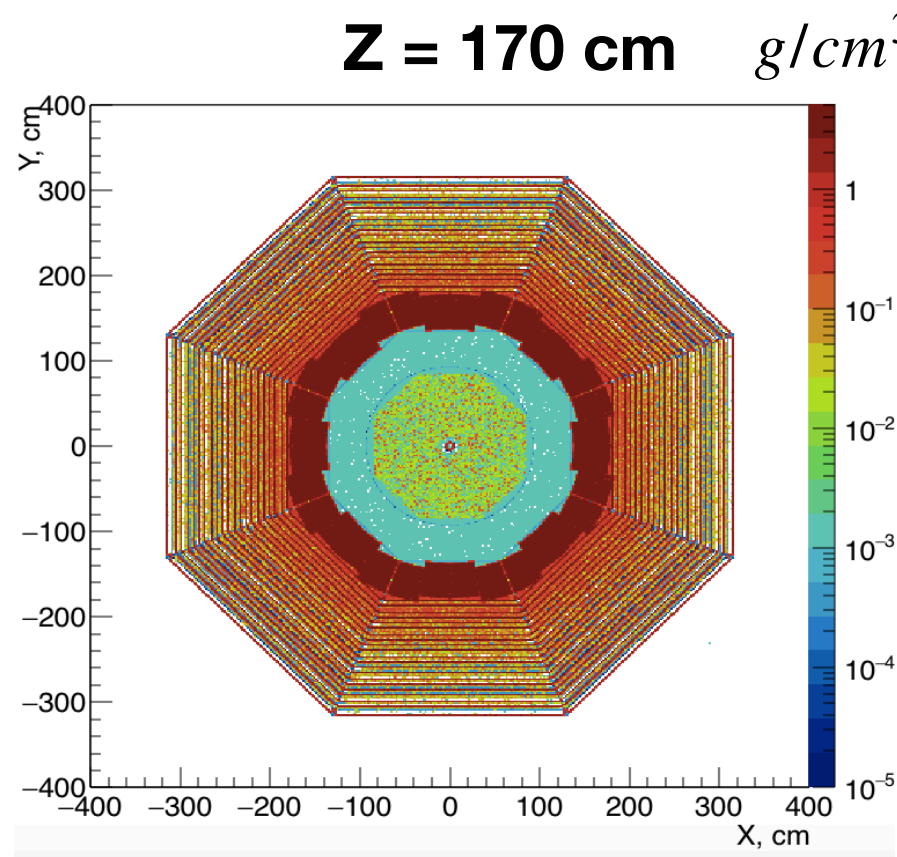
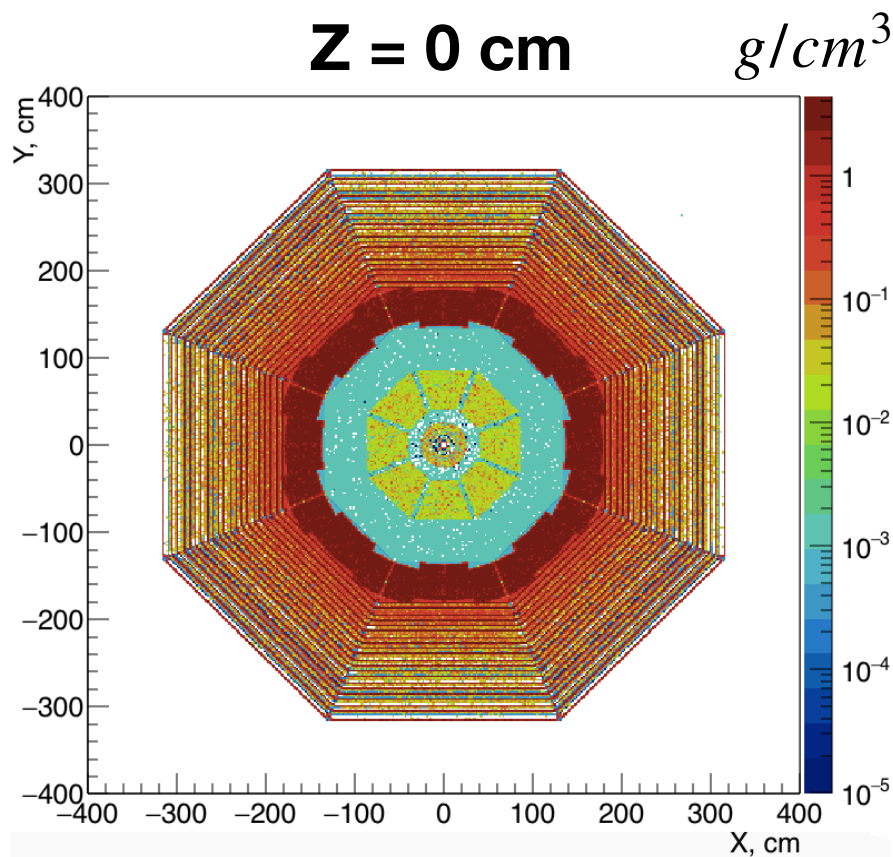
Z = 170 cm

R vs Z



Backup

Effective density with internal structure of SPD detector



Backup: Isotropic muons

$P_\mu = 0.5 \text{ GeV}/c$

Gr/year

$P_\mu = 1.0 \text{ GeV}/c$

Gr/year

