

Positron Production with Compact Photon Source

Pavel Degtiarenko
Radiation Physics Group at RadCon

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Challenges of e^+ Production

- Low energy (under ~ 10 MeV) electron beam
 - ❑ Huge currents needed
 - ❑ High local power deposition
 - ❑ Not optimal efficiency
- High energy electron beam
 - ❑ Problems with neutron radiation damage
 - ❑ Unacceptable material activation
- Compact Photon Source concept
 - ❑ Use high energy electron beam
 - ❑ Absorb almost all beam power immediately
 - ❑ Shield radiation locally

CPS Concept

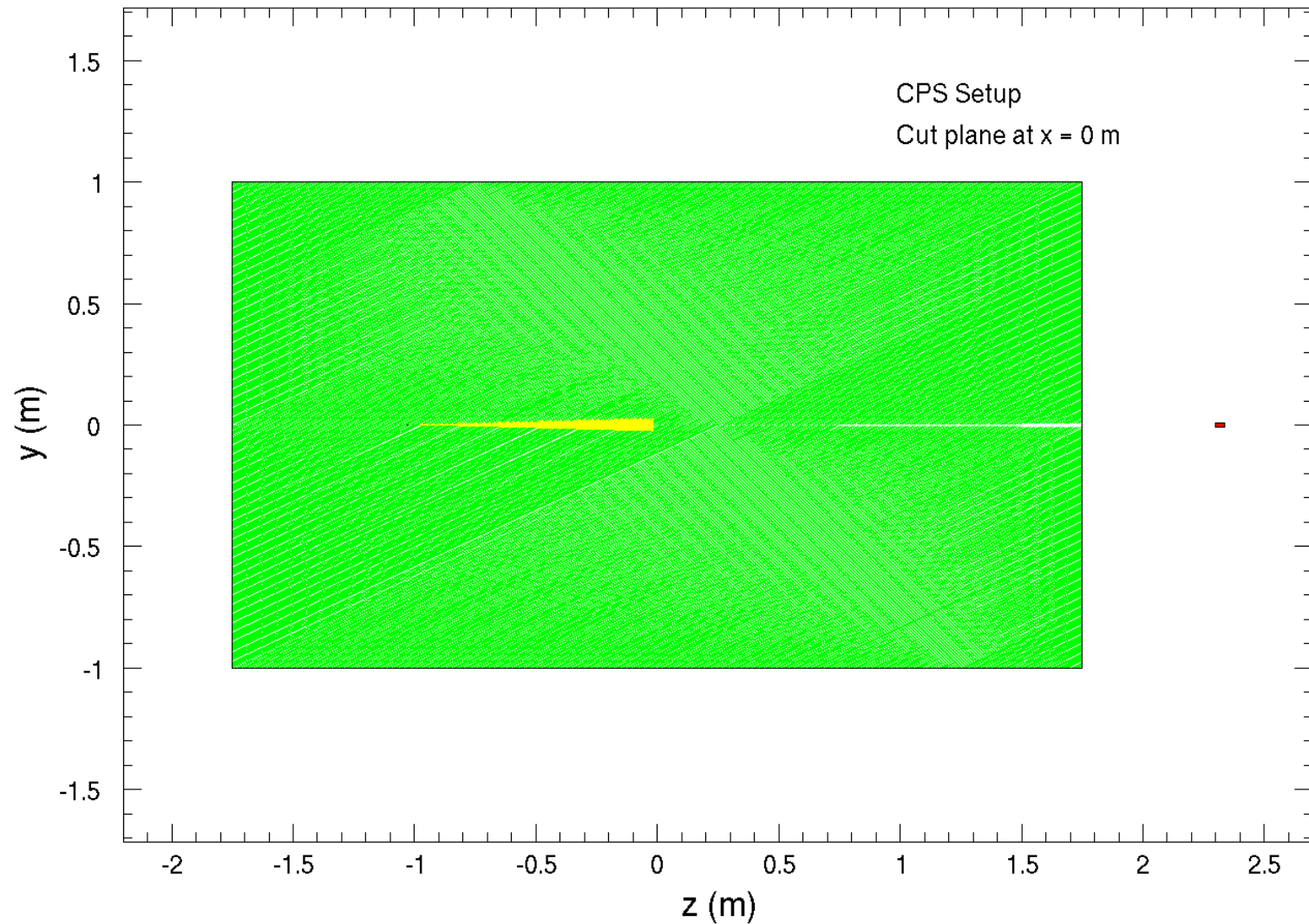
- By B. Wojtsekhowski and P. Degtiarenko
 - ❑ Positron source facility at the FEL
 - ❑ High Intensity photon beams at JLab
 - ❑ Various experimental proposals
 - ❑ Currently approved experiments
- General Scheme
 - ❑ High-Z radiator to produce photon beam
 - ❑ Magnet to direct spent beam to local dump
 - ❑ Exit channel for generated photon beam
 - ❑ All inside of the heavy local shielding

CPS Model

- Parameterized model in GEANT3/DINREG
 - ❑ Cylindrical CPS body (WCu 80%)
 - ❑ Beam slit going through
 - ❑ Radiator placement inside
 - ❑ Magnetic field volume trapezoidal
 - ❑ Expanding slit towards the exit
 - ❑ Ammonia target placement in photon beam
- Scoring volumes around
 - ❑ Side cylinder surface
 - ❑ Upstream and downstream disks

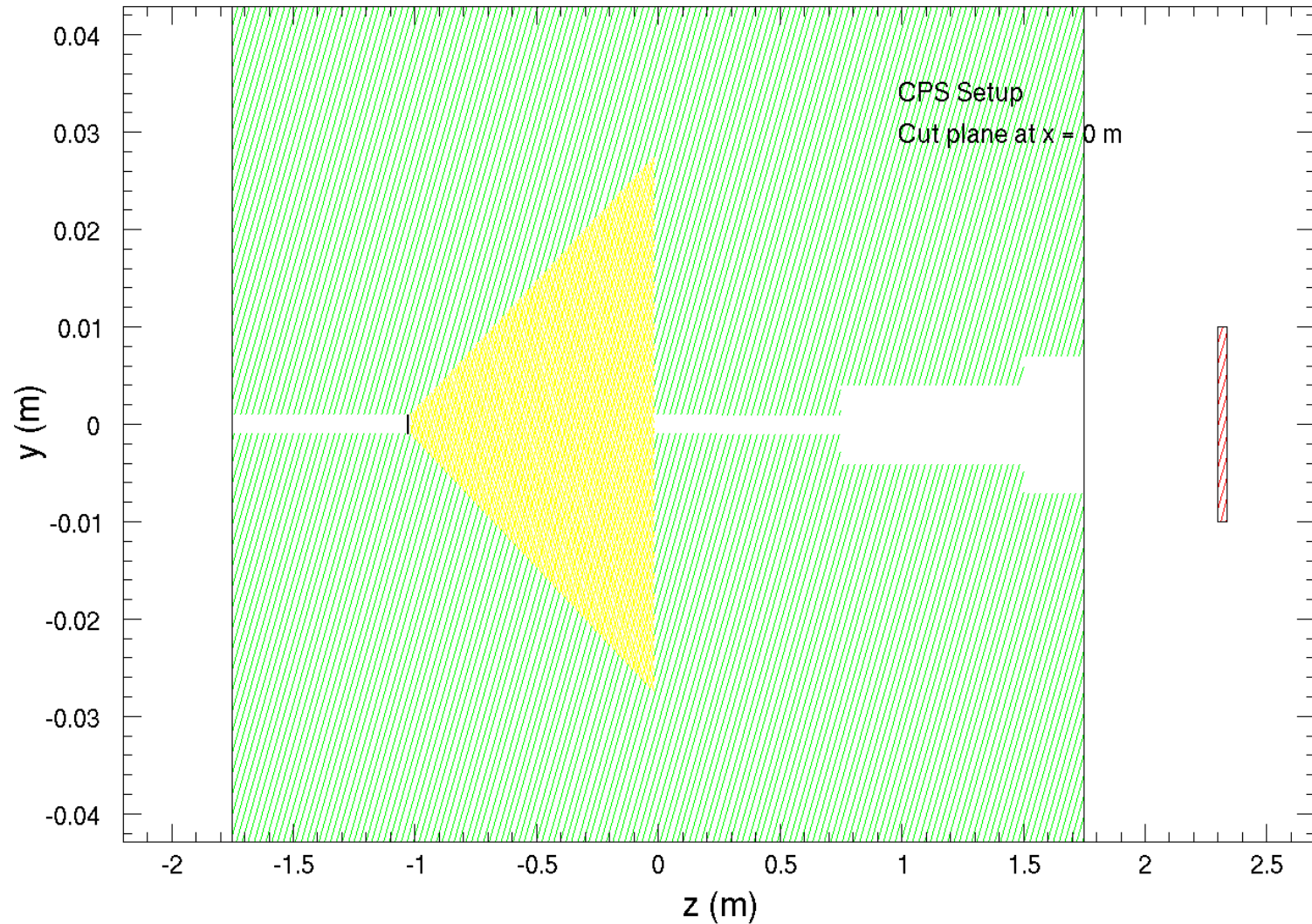
CPS Toy Model

2017/08/25 15.18



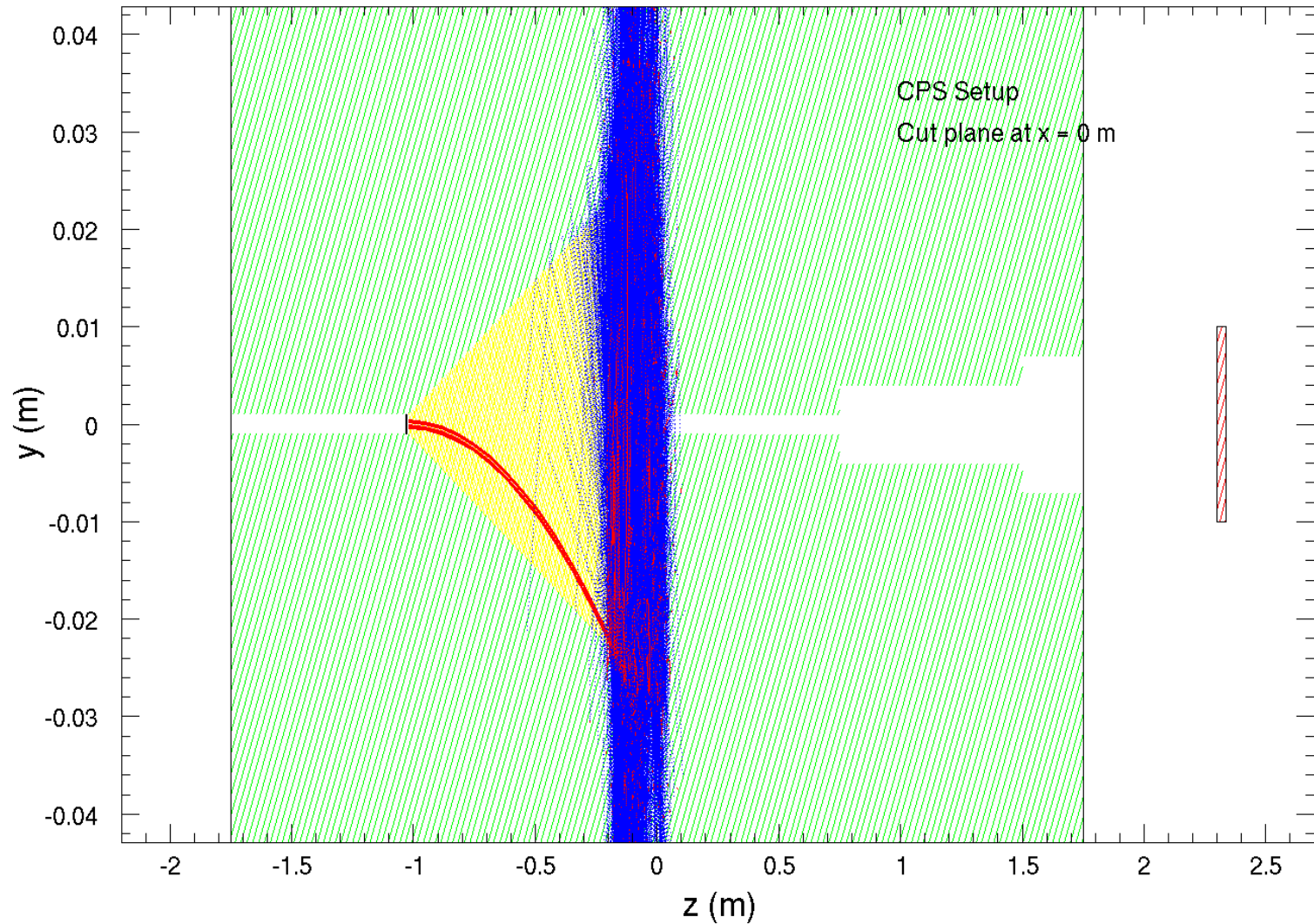
CPS Toy Model Expanded in Y

2017/08/25 15.21



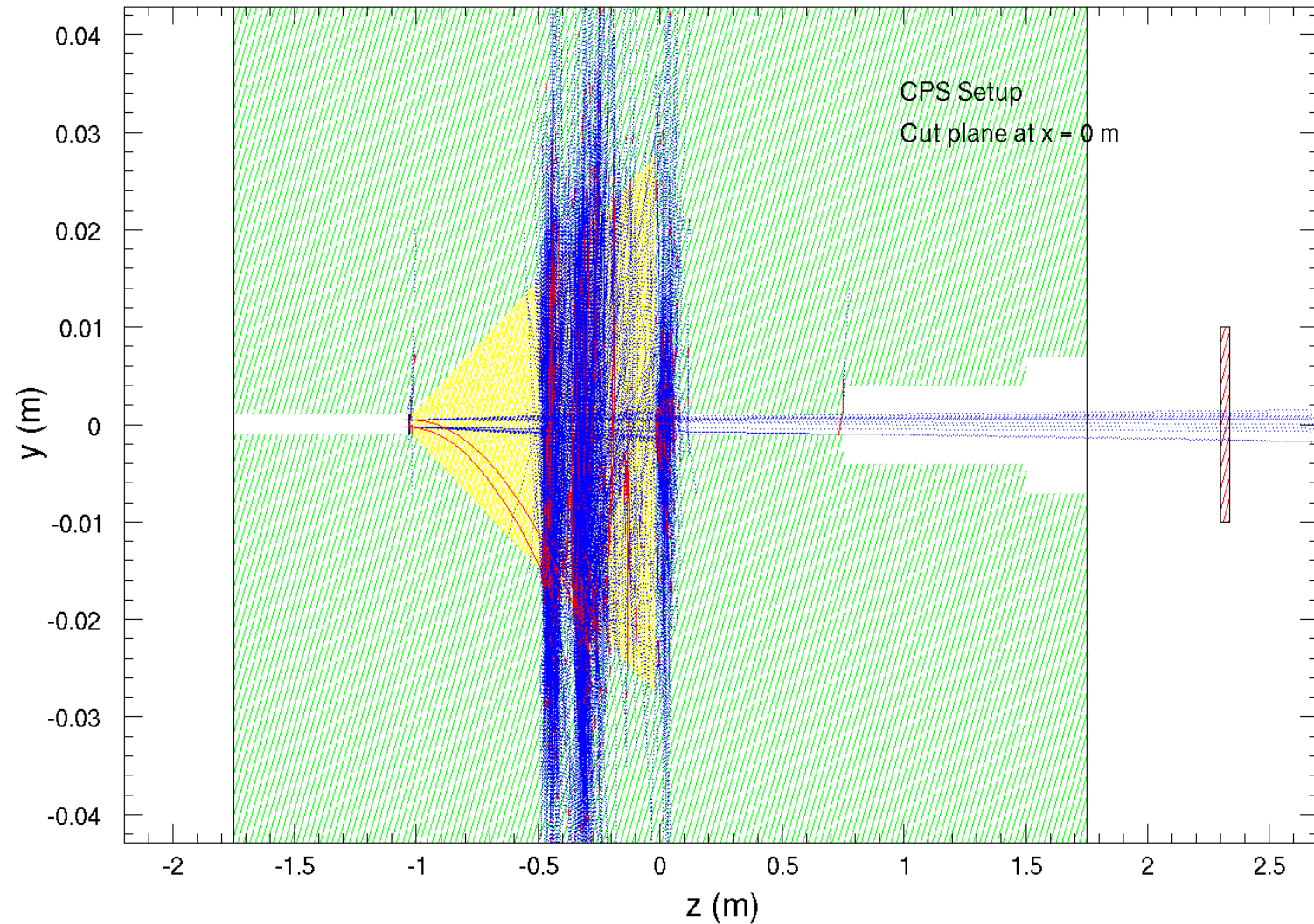
Electrons at 11.5 GeV/c, no Radiator

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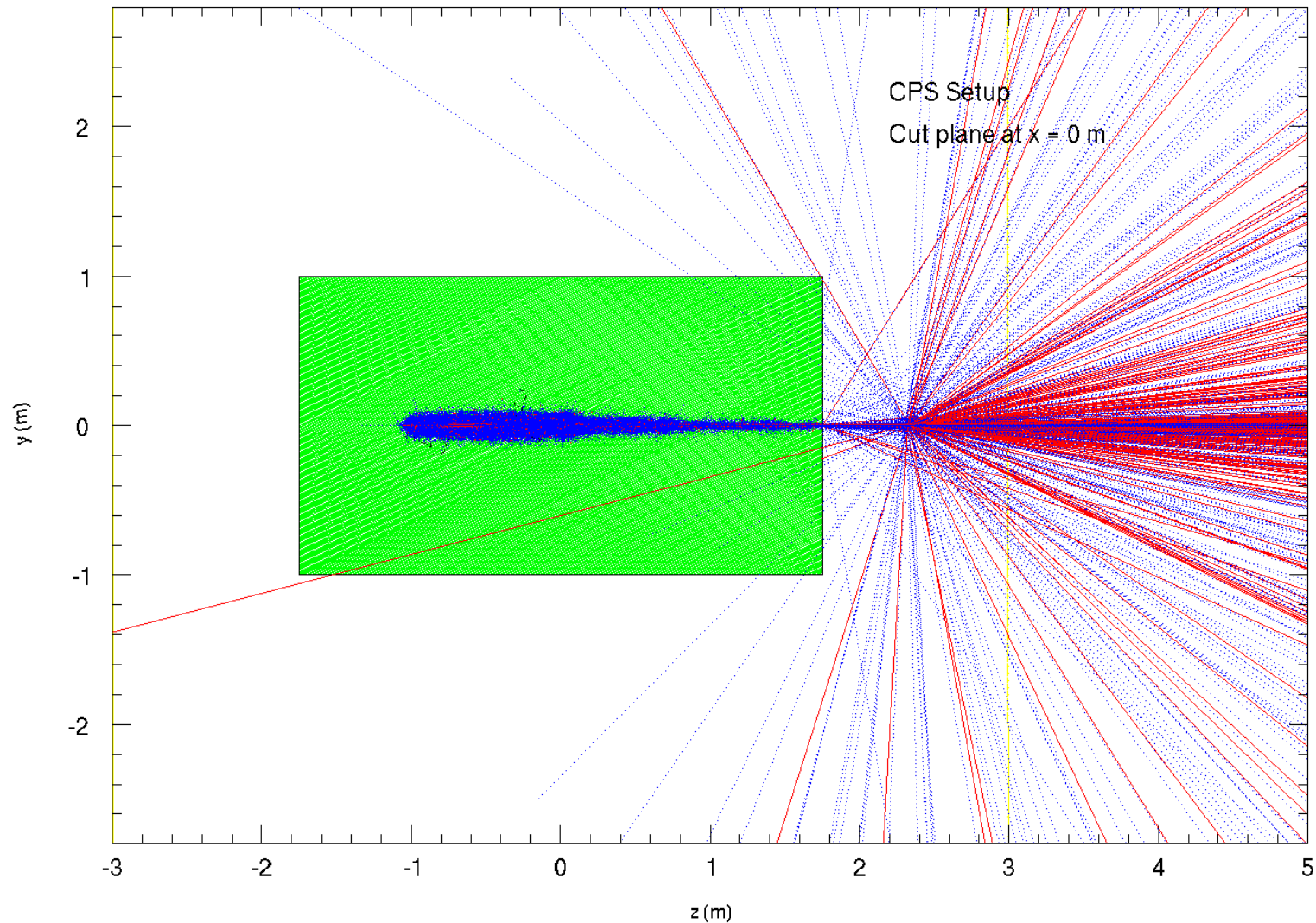
Electrons at 11.5 GeV/c, with Radiator

2017/08/25 15.39



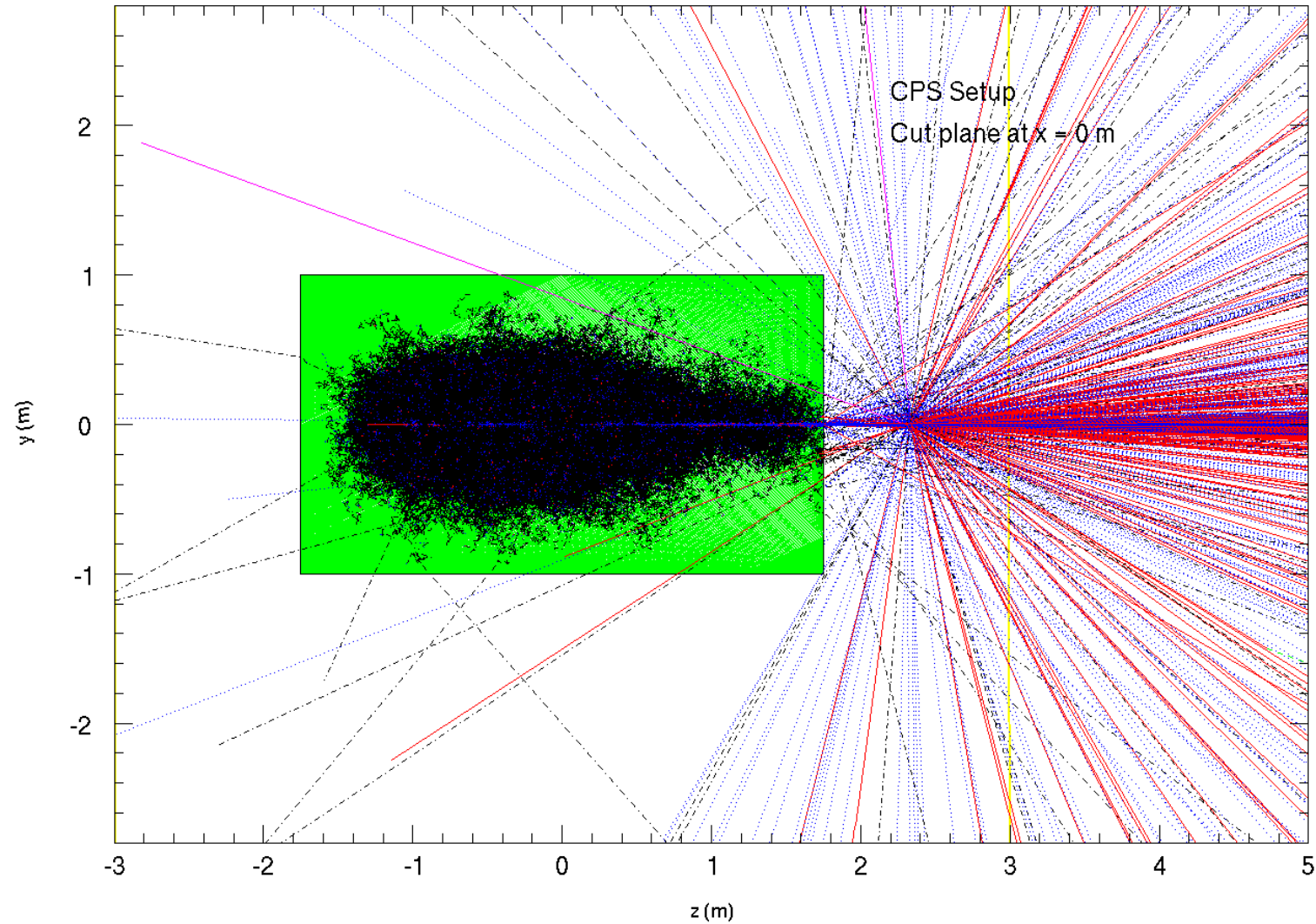
Photon Beam on NH₃ Target, no Neutrons

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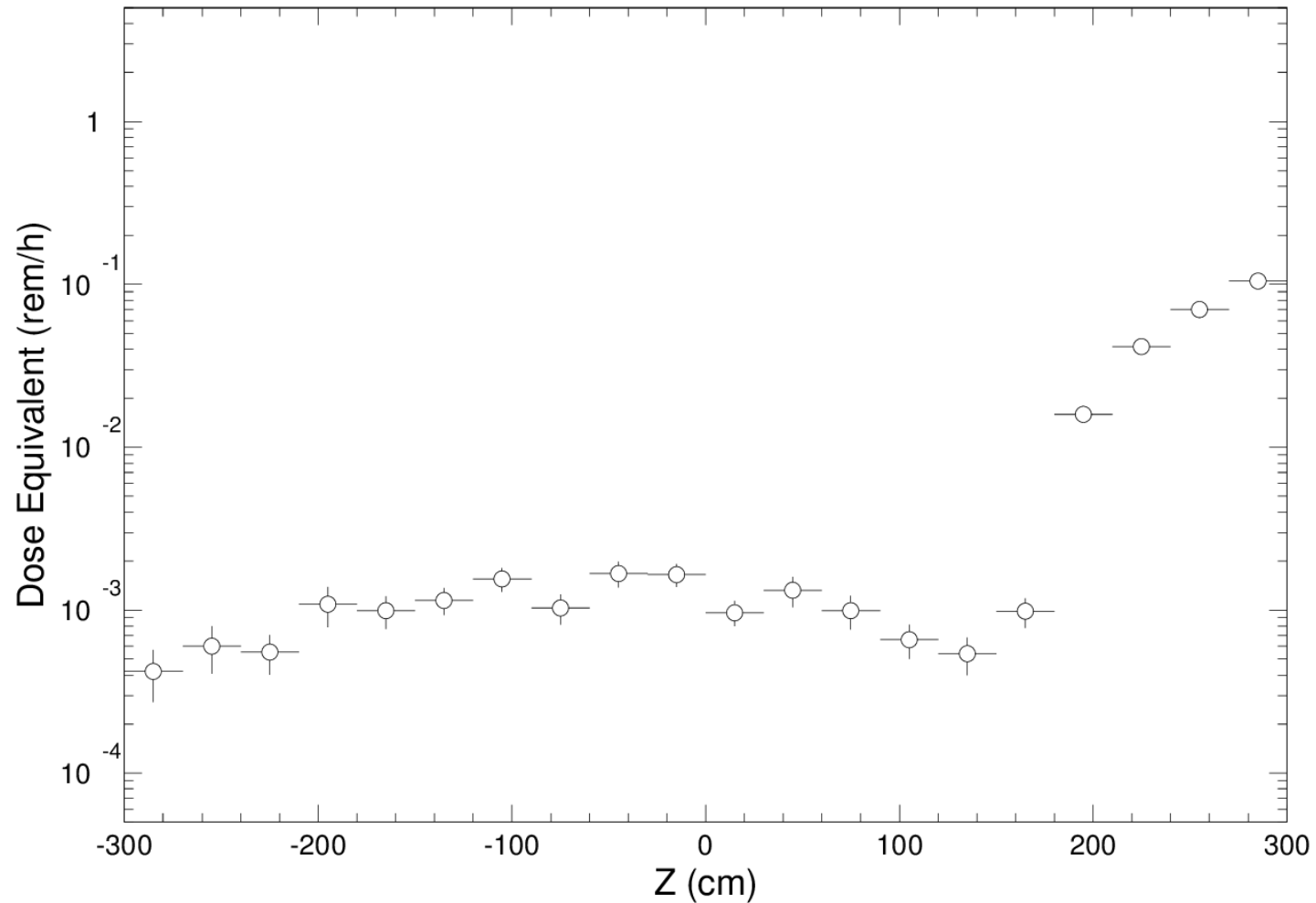


Photon Beam on NH_3 , Neutrons Amplified

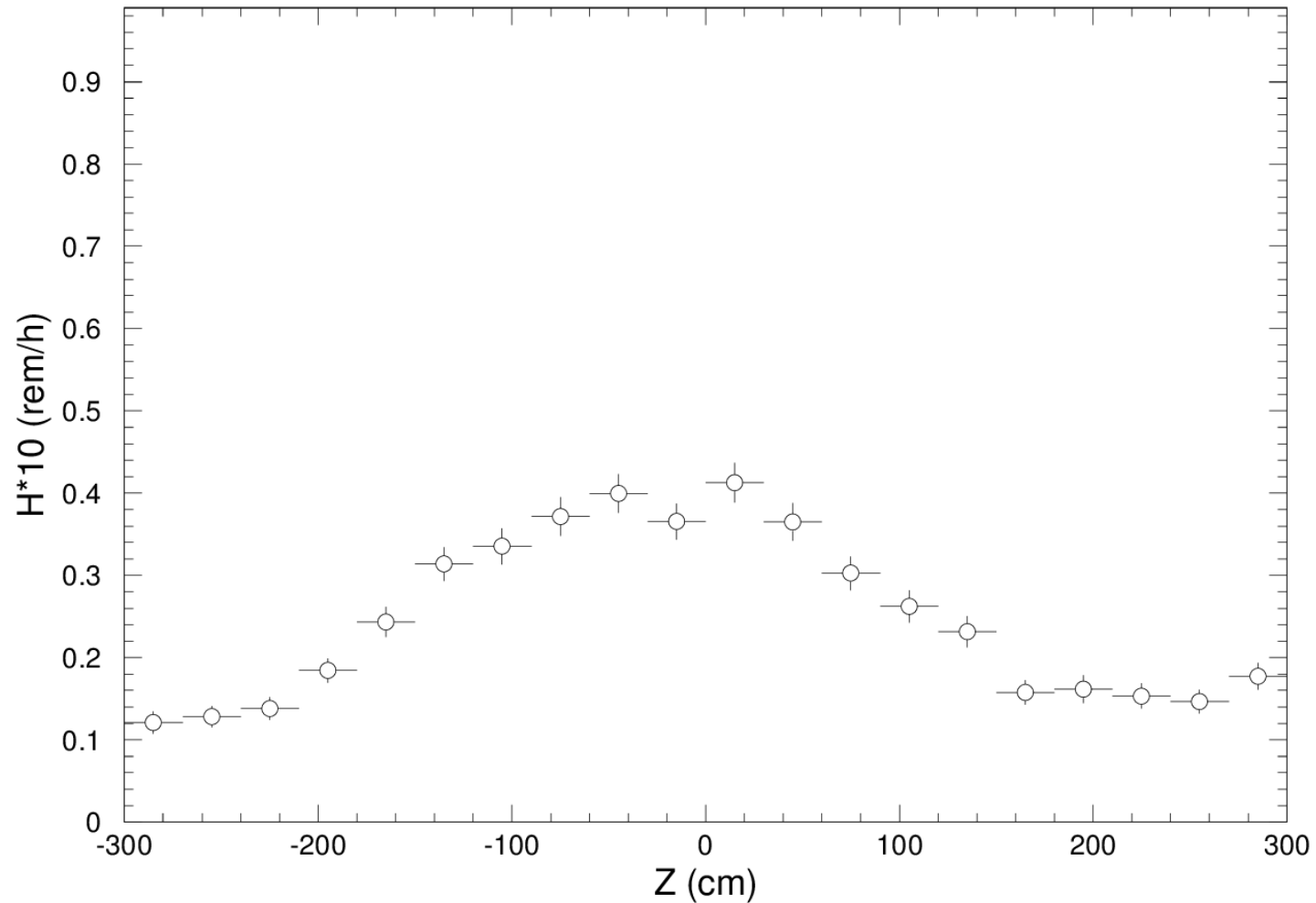
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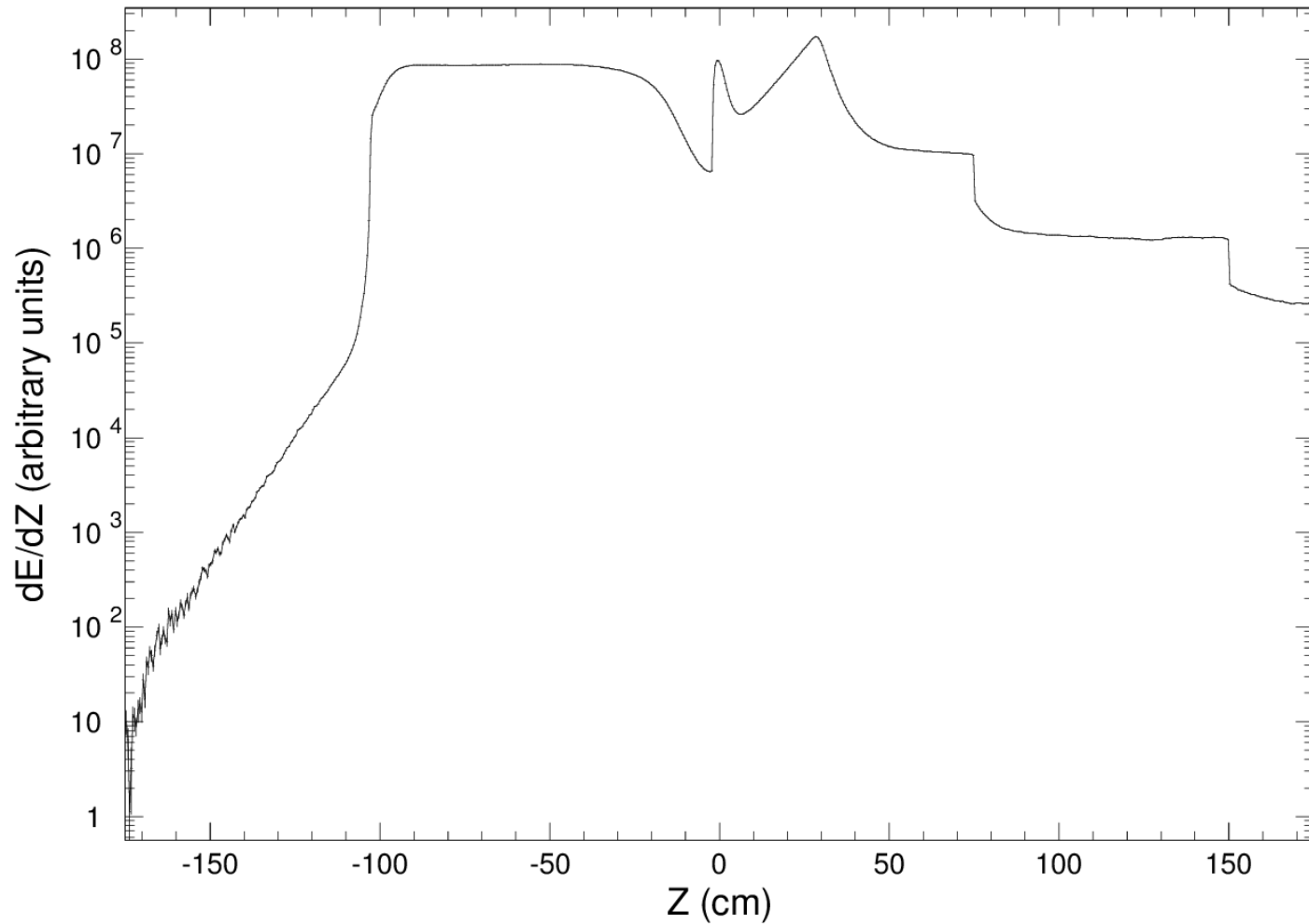
Photon Dose Rate at the Side, no Target



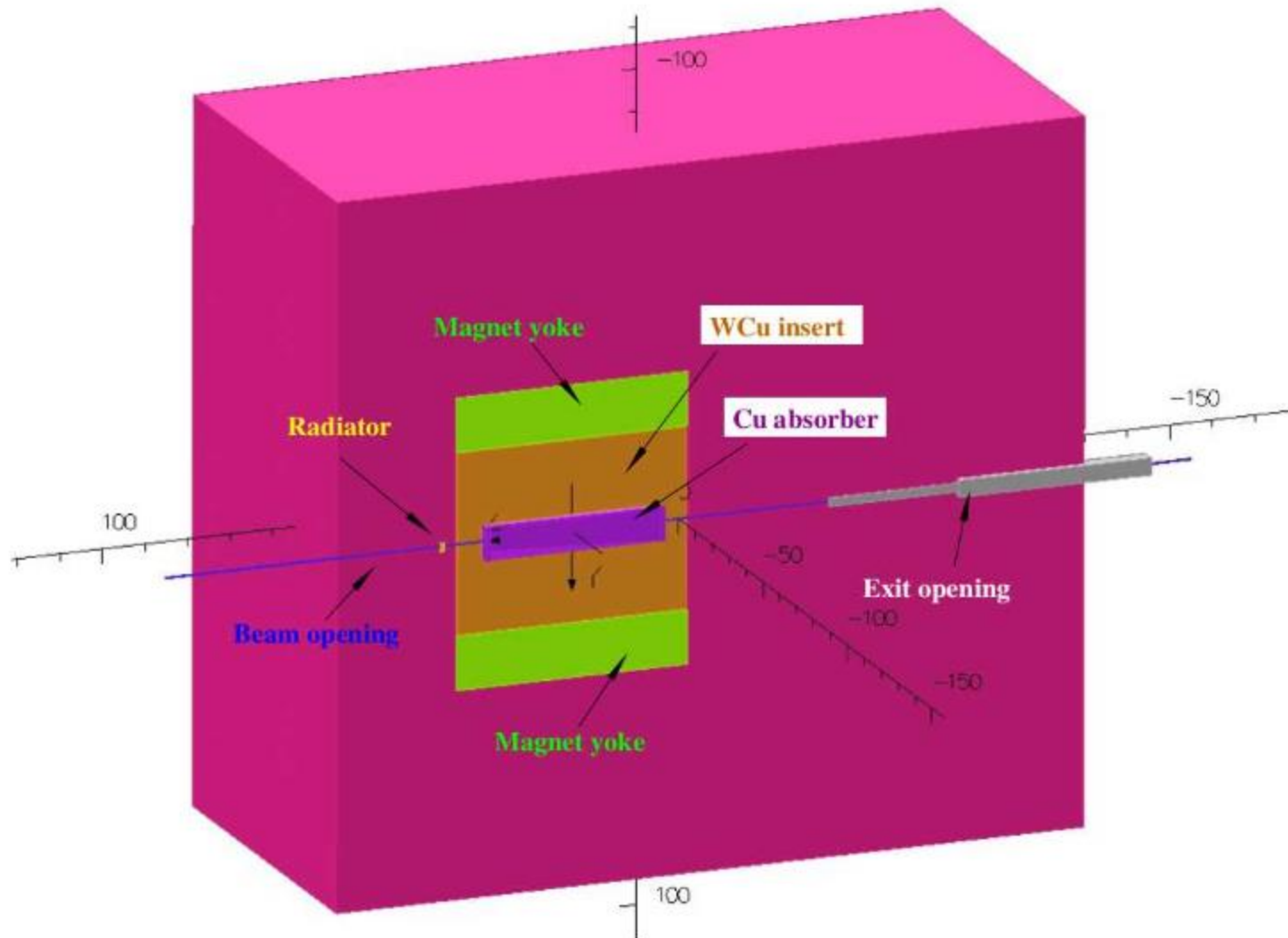
Neutron Dose Rate at the Side, no Target



Power Distribution Density Optimization



Current Design Efforts at JLab



Conclusions

- The CPS design may be used in e^+ production
- Solves the radiation and activation problems
- Need to be optimized to the beam parameters
- Reliability of the internal design is critical

