MECO Production Target Design

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Credits

- Numerous people contributed to this effort
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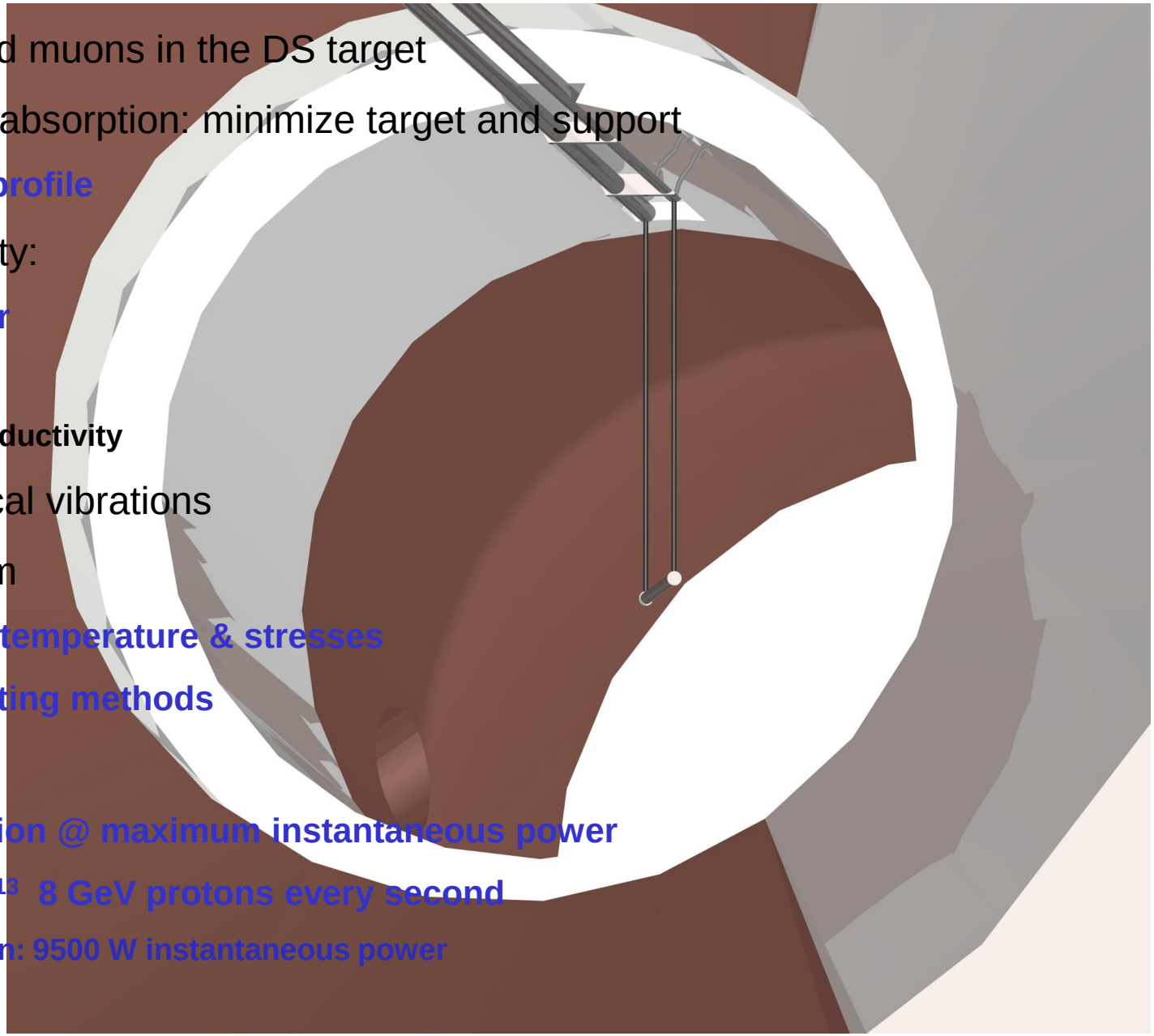
  - R.Rangel, J.Carmona
  - Others

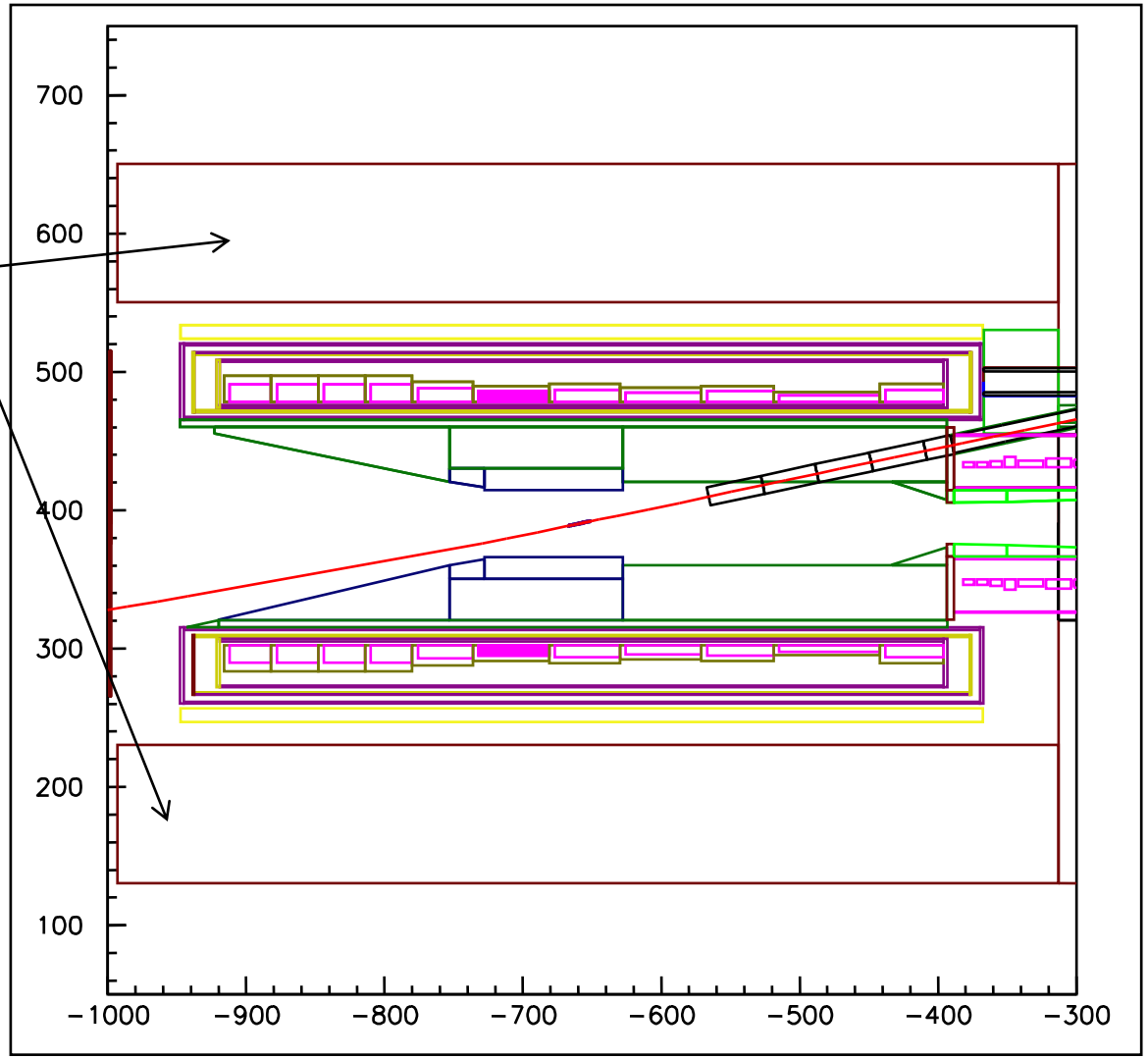
Water-Cooled Production Target

- Goal: Maximize stopped muons in the DS target
- Compact to avoid π^- re-absorption: minimize target and support
  - **Mass & Geometric profile**
- Maximize baryon density:
  - **High atomic number**
  - **High mass density**
    - **High thermal conductivity**
- Insensitive to mechanical vibrations
- Target & cooling system
  - **Minimize operating temperature & stresses**
  - **Stable & safe operating methods**
- Assumed worse case:
  - **Steady state operation @ maximum instantaneous power**
  - **100 kW beam: 4×10^{13} 8 GeV protons every second**
    - **Energy deposition: 9500 W instantaneous power**



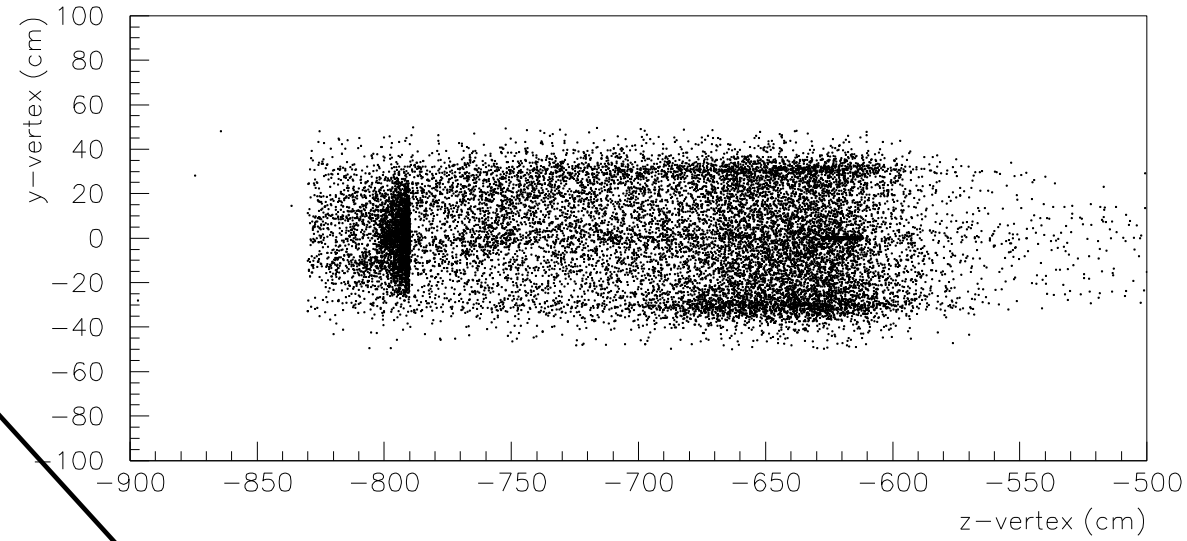
Production Region Cross-section

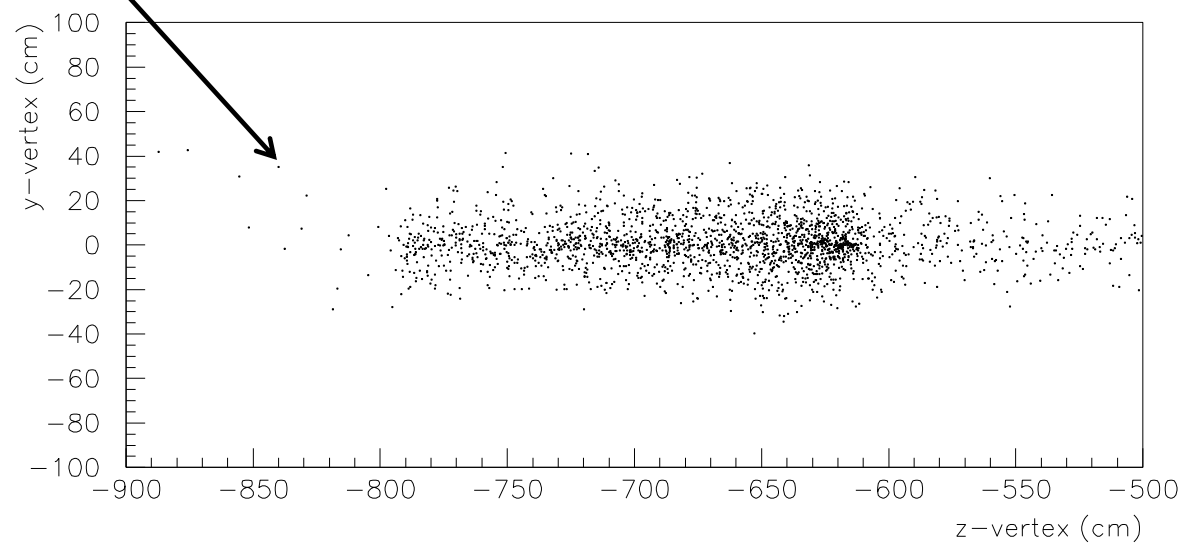
- Proton beam entrance
  - Bend upon
    - entry & exit
- Scale: cm
- Iron return yoke



Pion Production

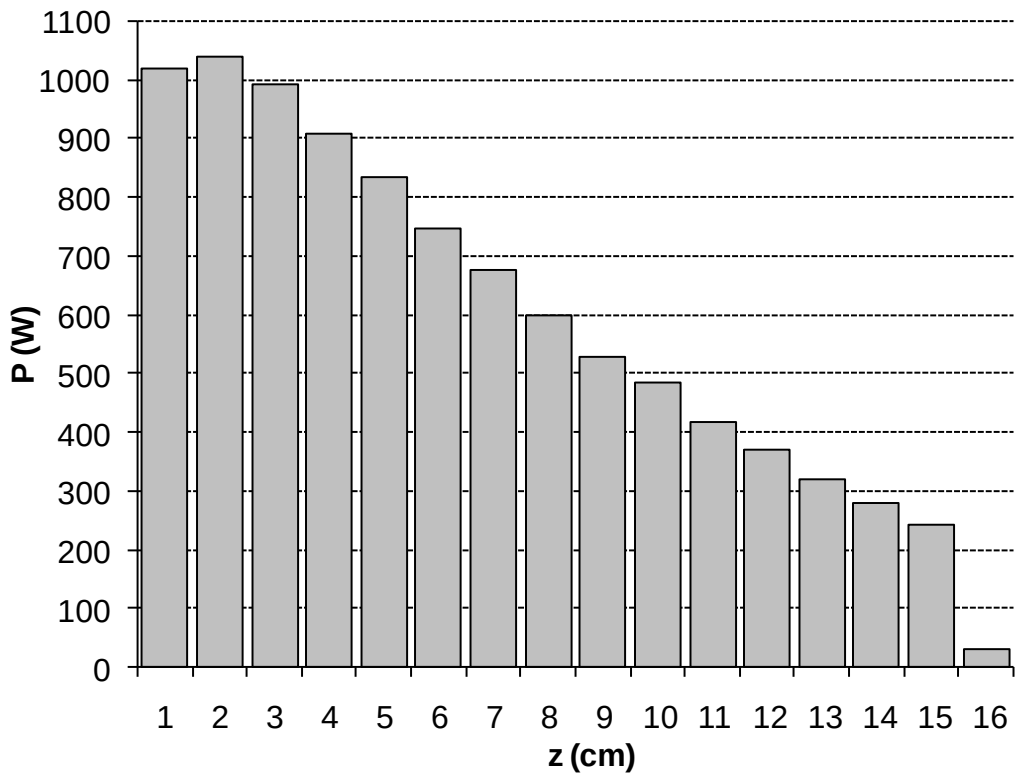
- Most positive muons
  - Generated in walls
- Negative muons
  - Negative pi's
  - Decay in flight
- Scale: cm

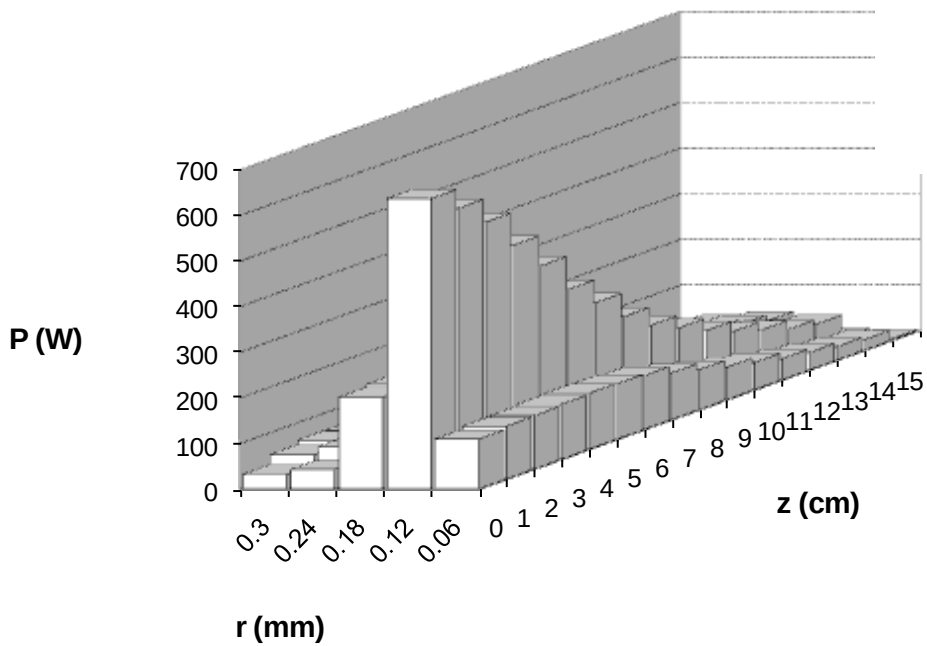




Energy Deposition

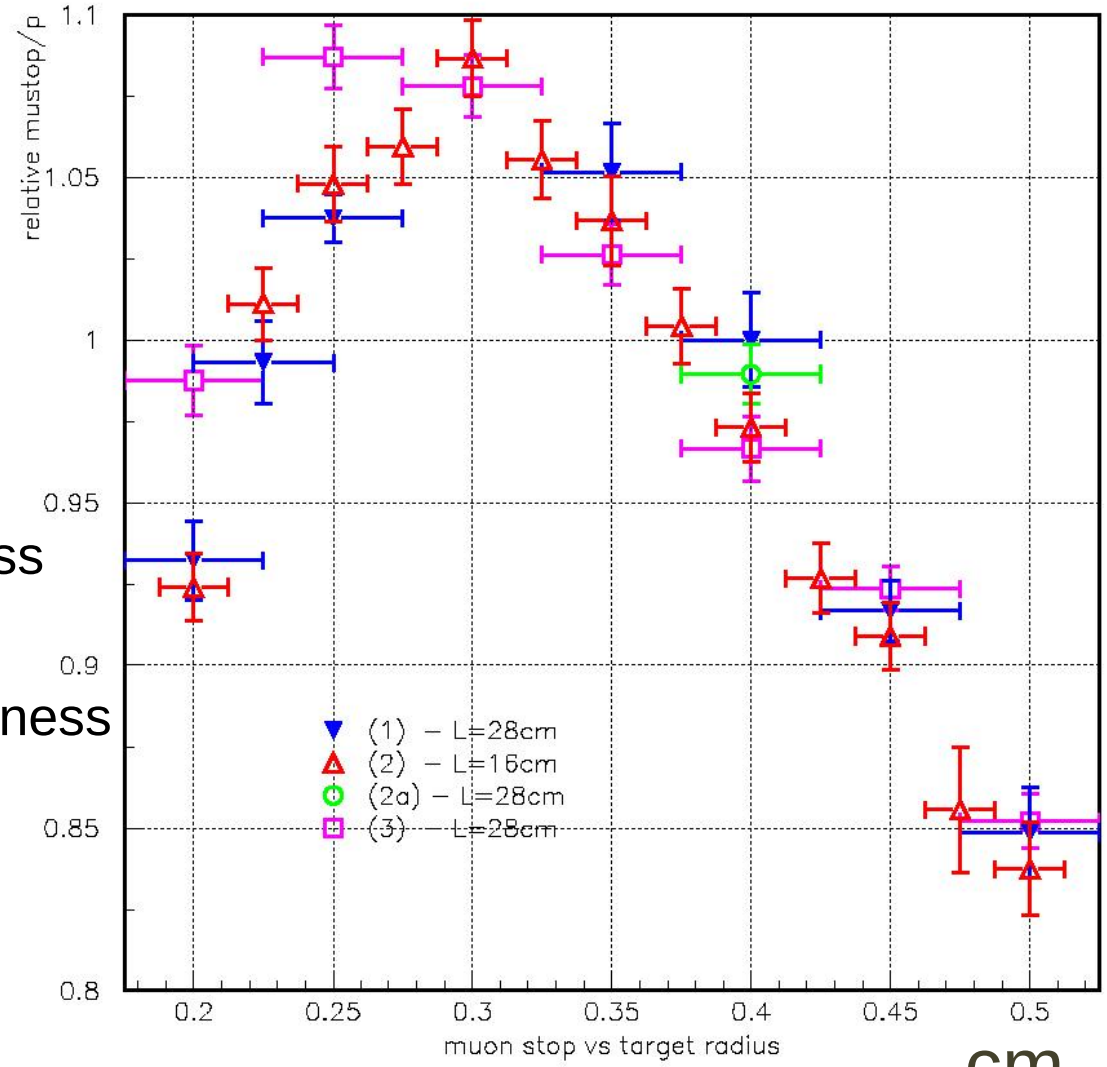
- GEANT3: 7500W
  - R = 3.0 mm
  - L = 16 cm
    - GHEISHA
    - FLUKA
- Scaled up to 9500W





Stopped Muon Yield

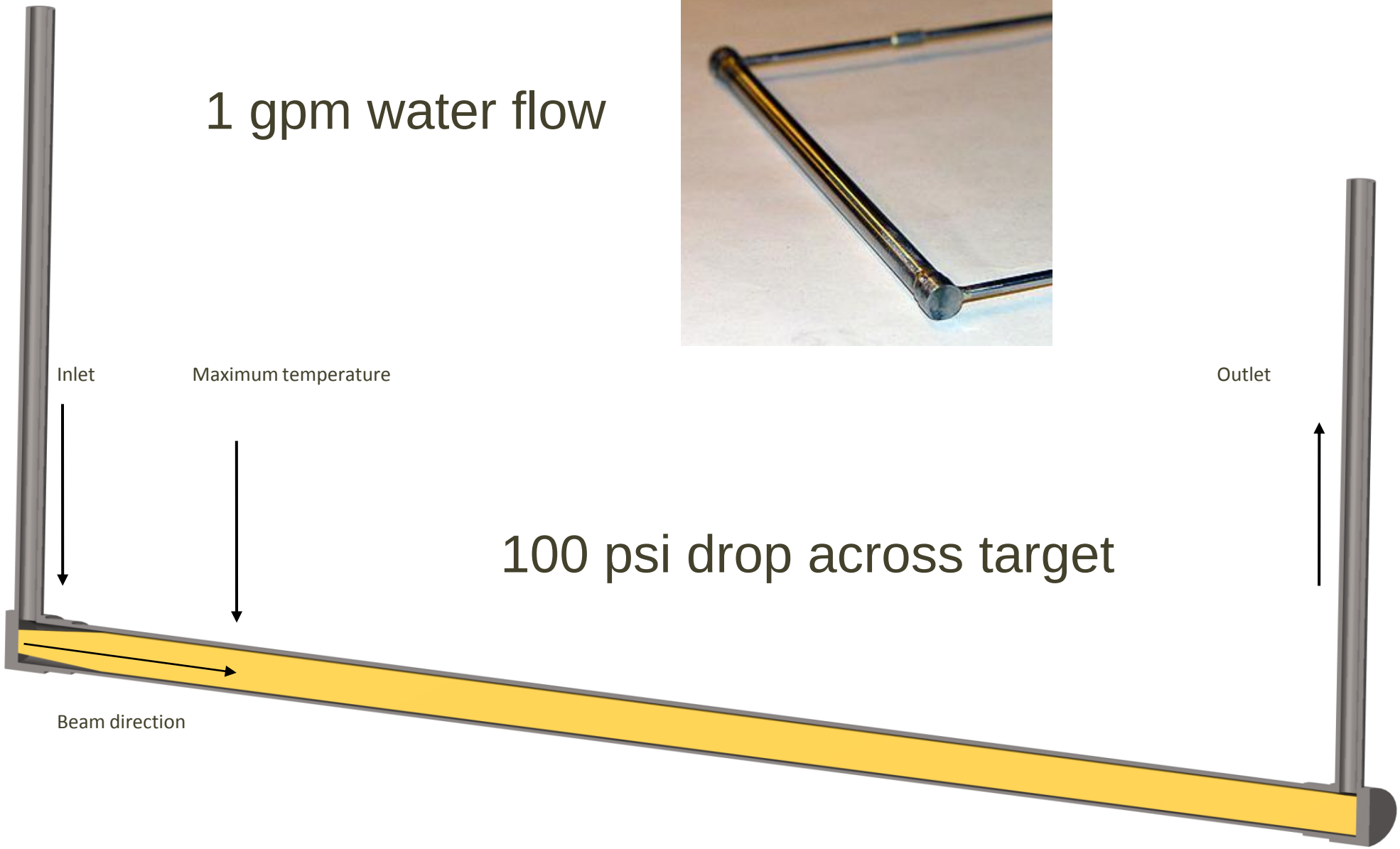
- Sensitivity to target geometry: Radius & Length
- Relative Yield:
  - Water Cooled
  - Radiation Cooled
  - Per primary proton
- Yield also found
  - Insensitive
    - Cylindrical shell thickness
  - Sensitive
    - Vertical water pipe thickness



cm

Target Design & Prototype

1 gpm water flow



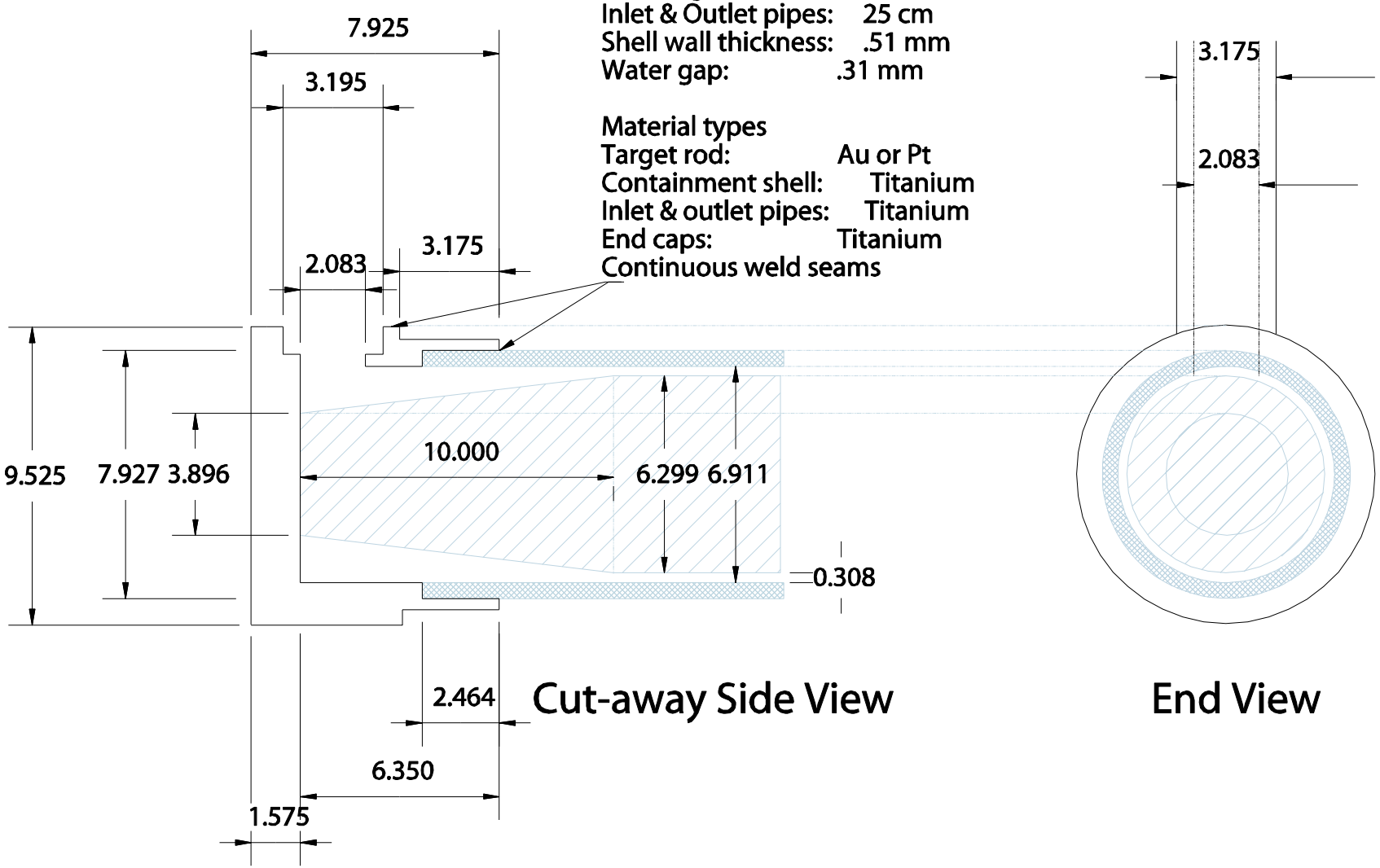
100 psi drop across target

Water Channel Geometry Details

Water Cooled Target Assembly Dimensions: millimeters

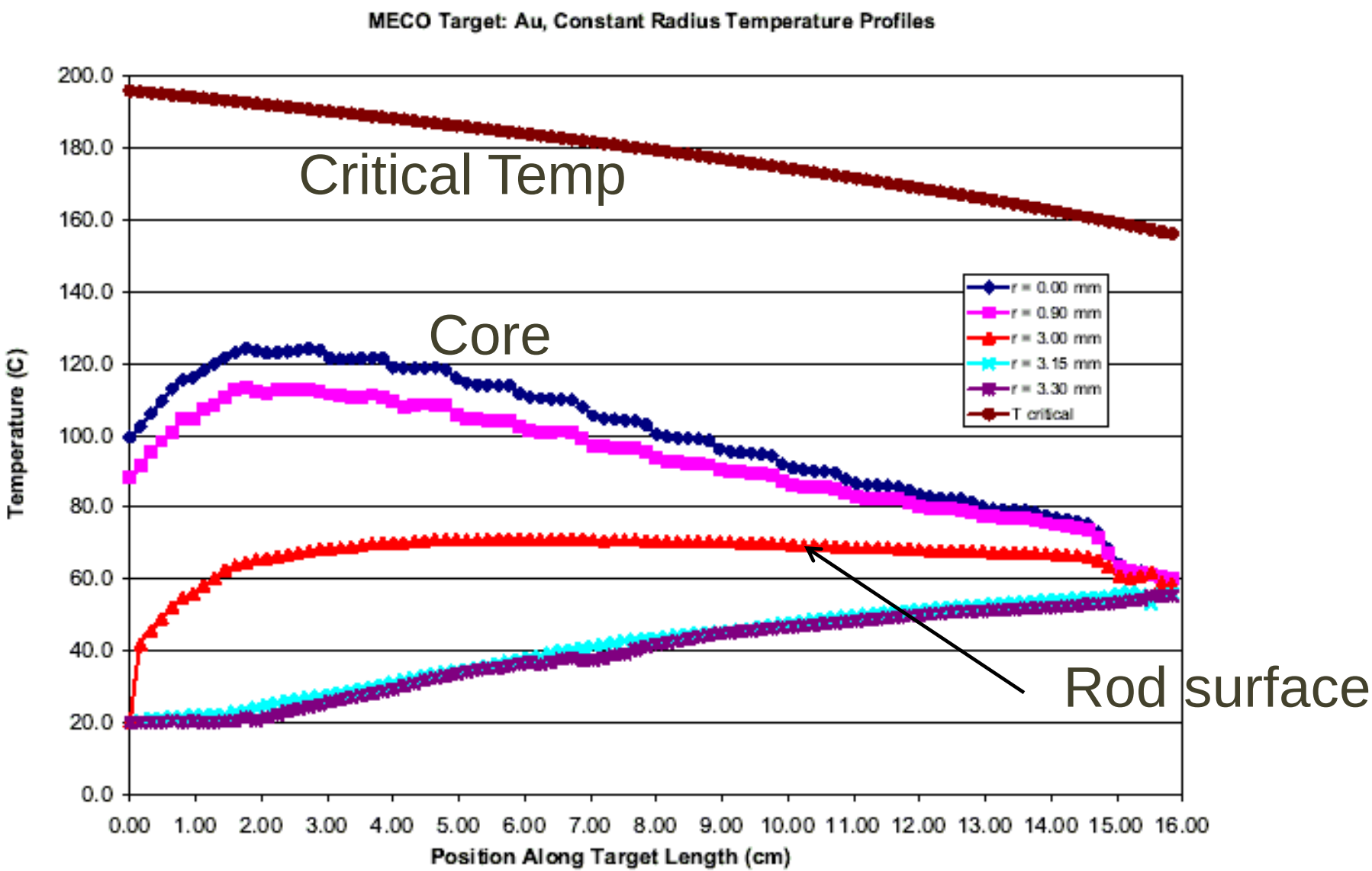
Shell length: 147.3 mm
Rod length: 160 mm
Inlet & Outlet pipes: 25 cm
Shell wall thickness: .51 mm
Water gap: .31 mm

Material types
Target rod: Au or Pt
Containment shell: Titanium
Inlet & outlet pipes: Titanium
End caps: Titanium
Continuous weld seams



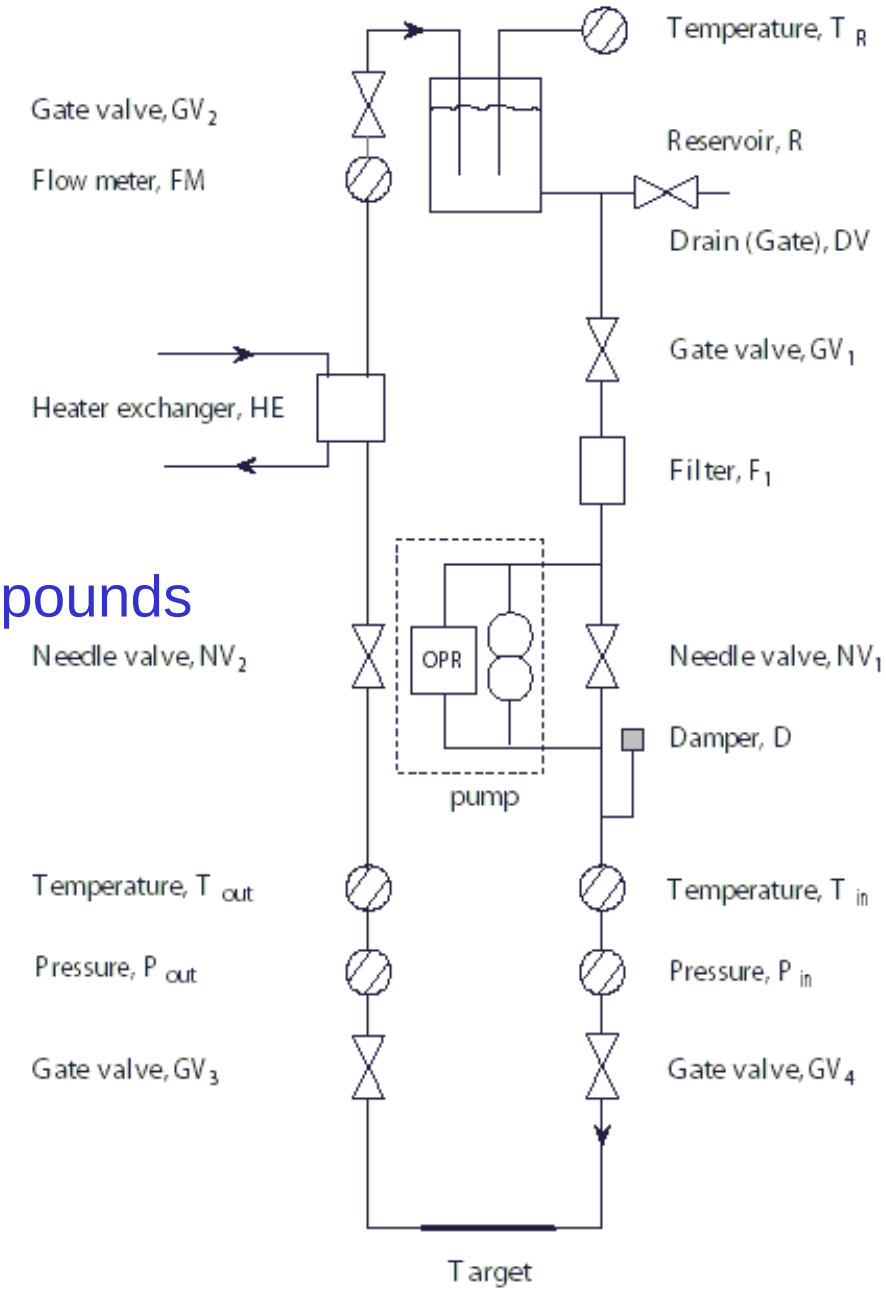
Water Cooling Temperature Profiles

- Au Target radius: 3.0 cm, Length = 16.0 cm



Cooling System Concept

- Primary sensors
  - Water temperature
  - Water pressure
  - Water flow
- Primary coolant loop
  - Tritium contaminated
  - Possible corrosive compounds



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