

Radiation Levels in the Dispersion Suppressors of IR3

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4th RADWG-RADMON Radiation workshop

Recent Study of Radiation in DS3

(adjacent to the momentum cleaning section)

The study was done for the IR3 setup **“V6.2+”** :

- Layout and optics version 6.2
- Collimator jaw material - double density graphite (does not exist unfortunately) as a step to the new collimation system
- Iron shielding around and downstream of the collimators

Simulation details and results in :

I.Baishev, J.B. Jeanneret and I.A.Kurochkin

“Irradiation of electronic components in the dispersion suppressors of LHC IR3” - LHC Project Note 331, Dec.2003

Recent Study... - Main Features

Codes to simulate ...

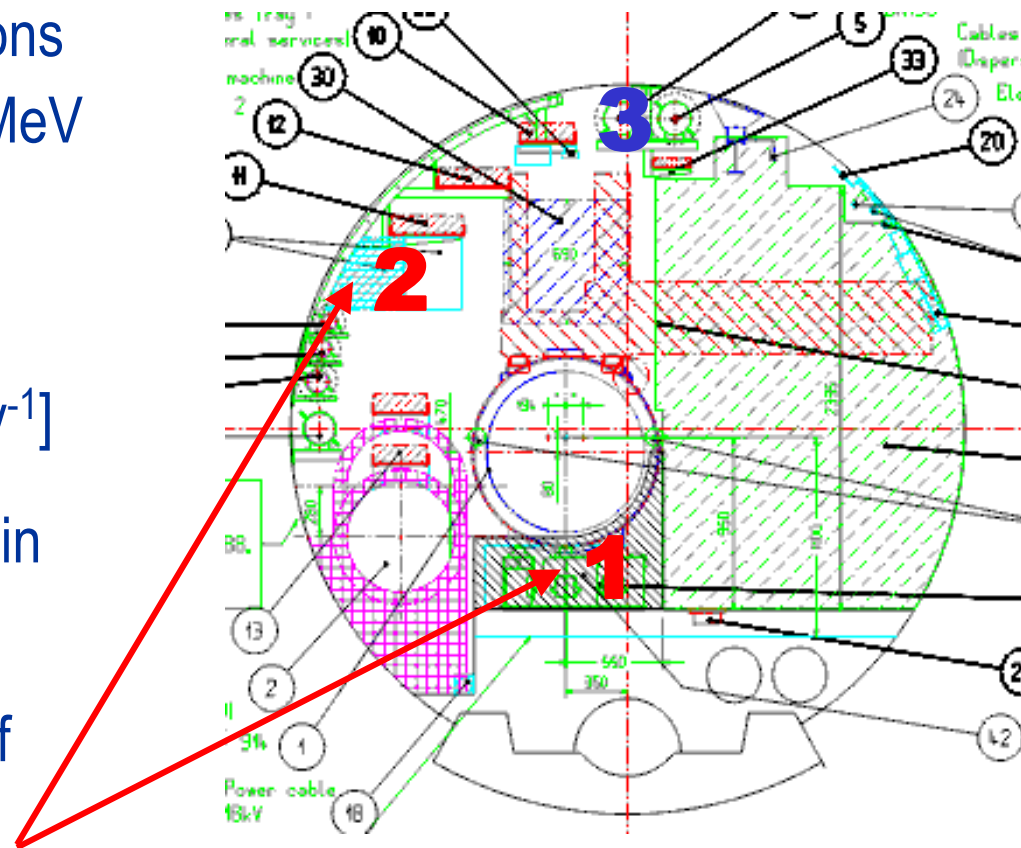
- **K2** - cleaning process
- **STRUCT** - proton losses along the DS
- **MARS** - nuclear and electromagnetic cascades in the elements of LSS and DS, low-energy neutron production and transport

Basic parameters

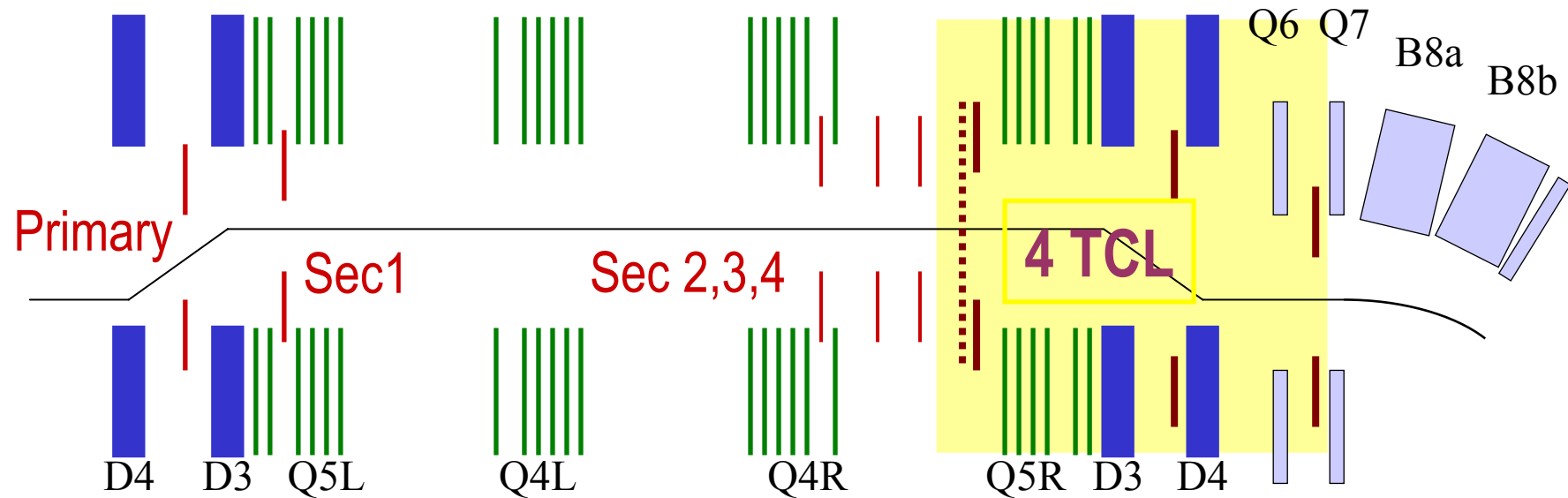
- Collision energy (7 TeV)
- 10^{16} protons per year lost in the momentum collimators of each ring
- 1.6×10^{10} protons per meter per year lost in the DS due to beam-gas inelastic interactions in each ring

Recent Study ... - the Goal

- **FH** - fluence of all hadrons with energy exceeding 20 MeV [$\text{cm}^{-2} \times \text{y}^{-1}$]
 - **FN1** – “1 MeV neutron equivalent” fluence [$\text{cm}^{-2} \times \text{y}^{-1}$]
 - **D** – total absorbed dose in silicon [Gy/y]
- along DS3 at the location of electronics



Even More Recent Changes in IR3

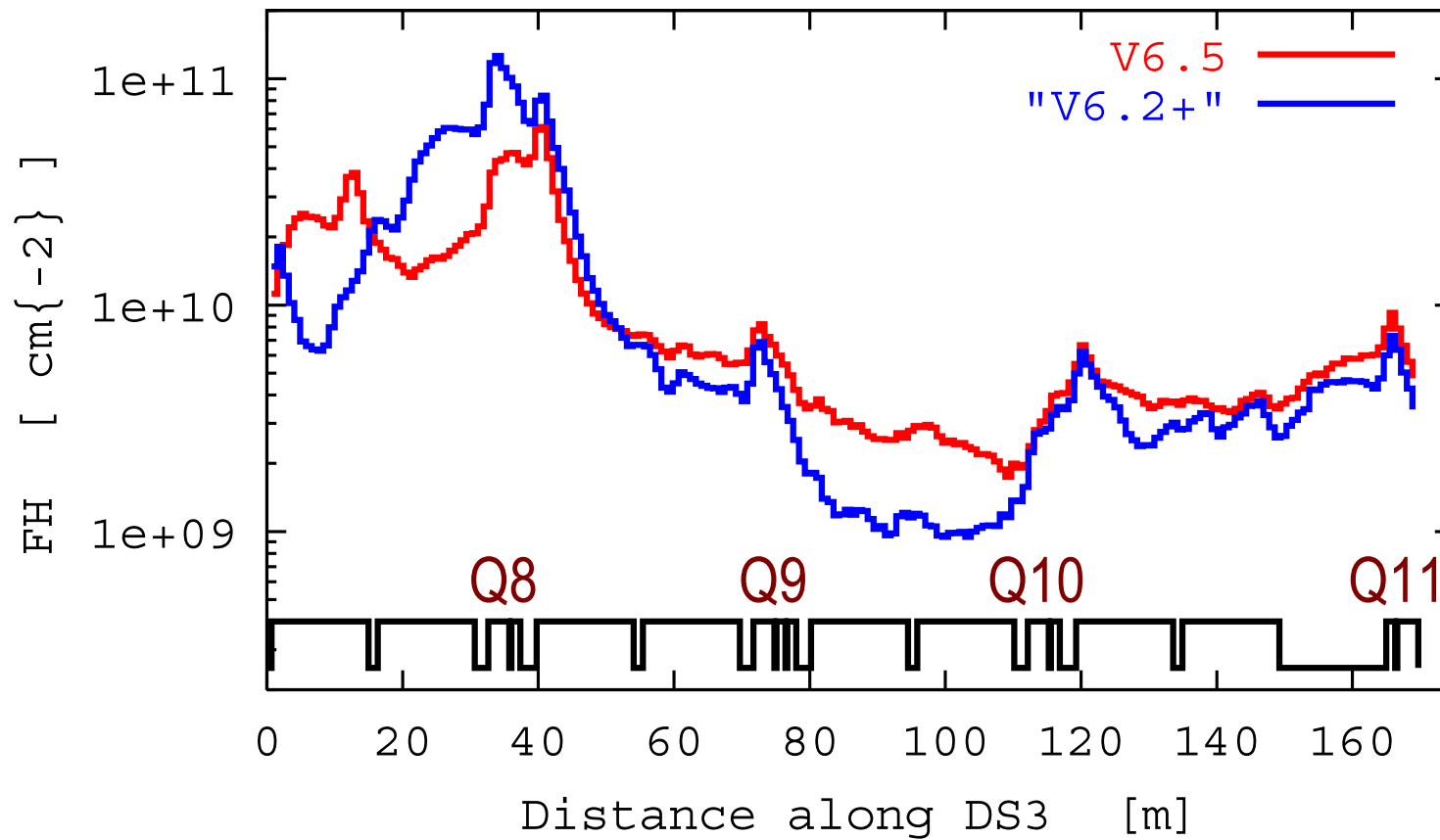


New layout and optics version 6.5
New collimator locations
Additional active absorbers (TCL type)
No shielding in IR3



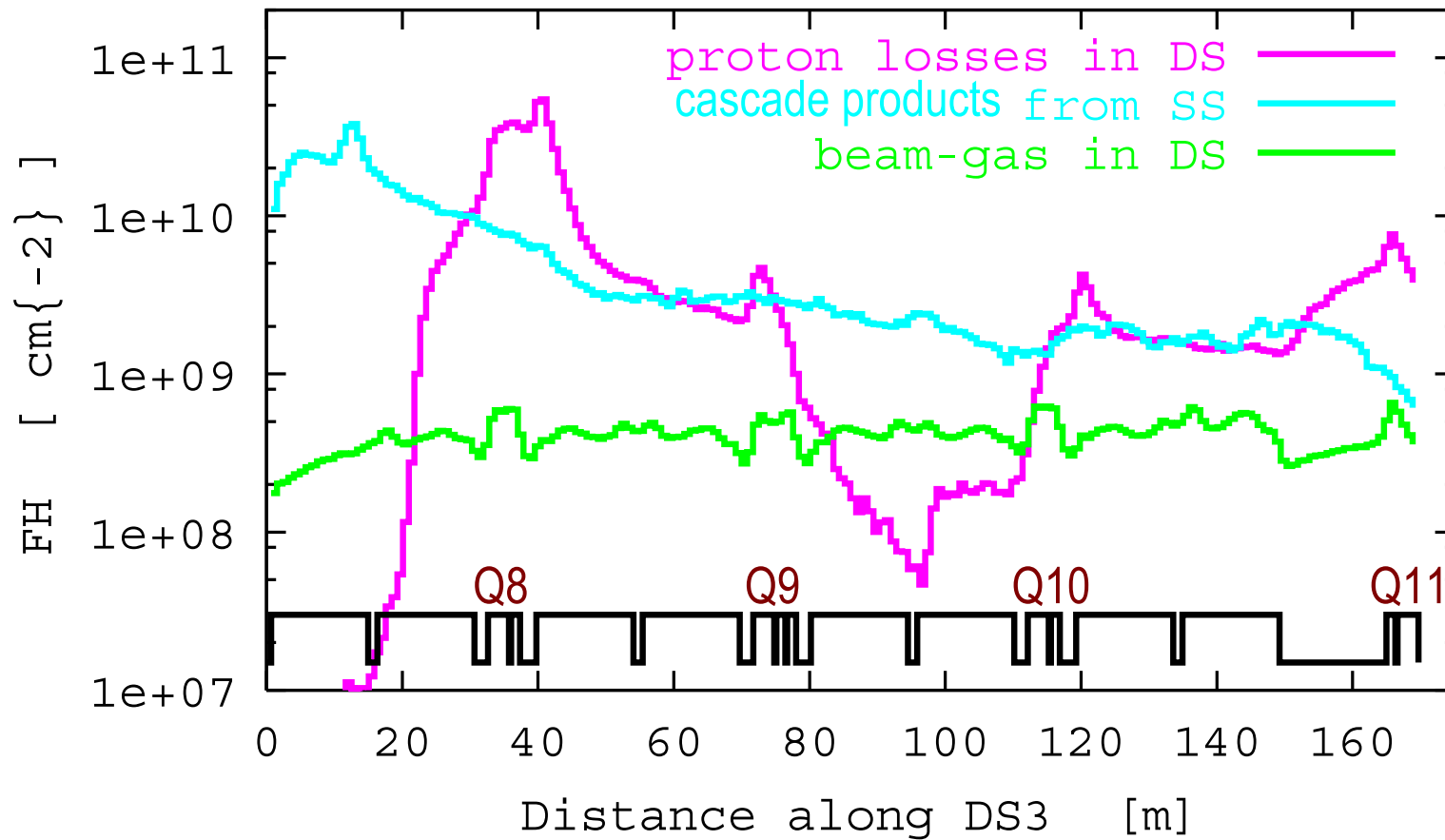
**Revisit
radiation
levels in
DS3**

Hadron Fluence at location 1

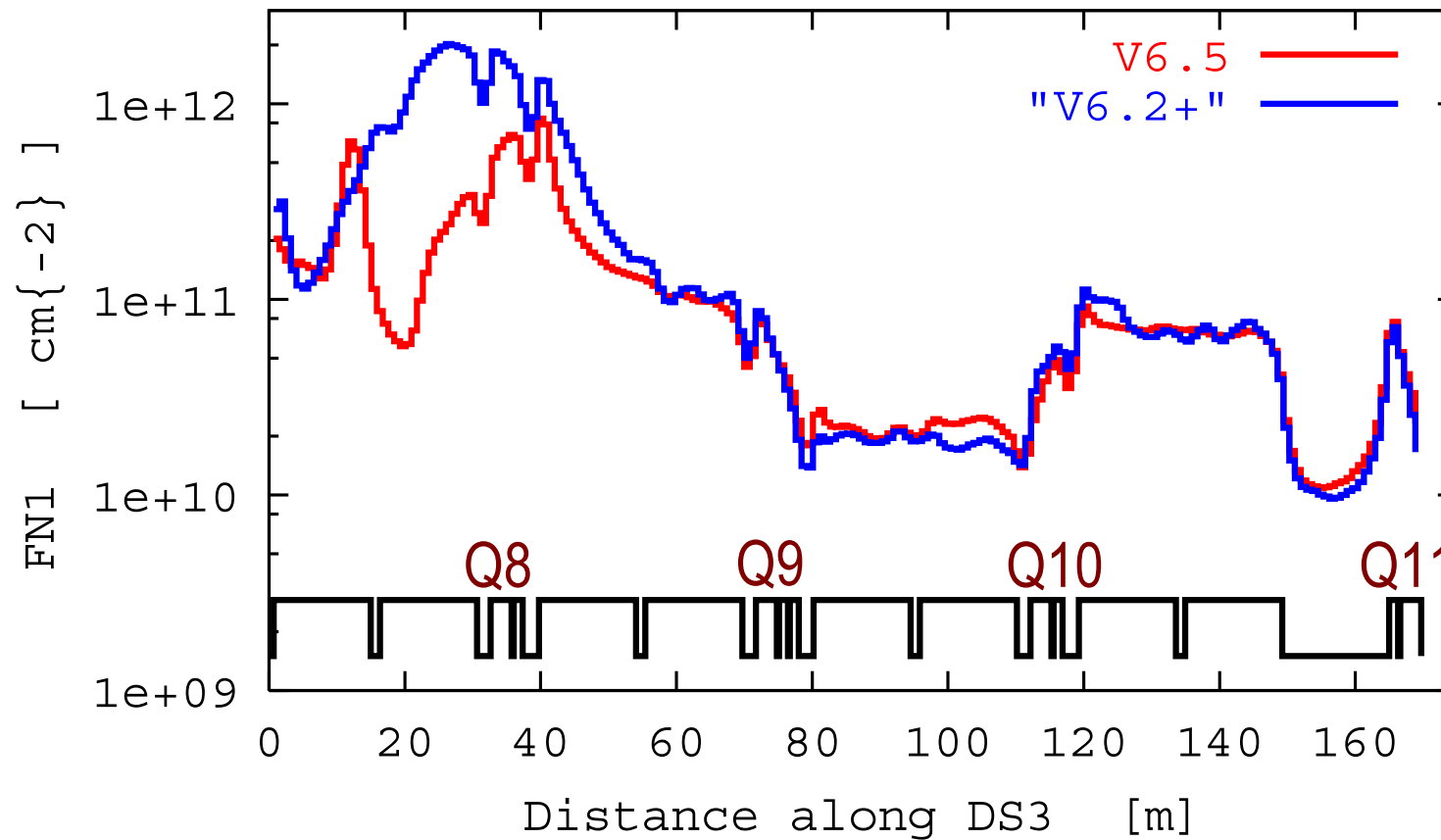


Contribution of the Sources

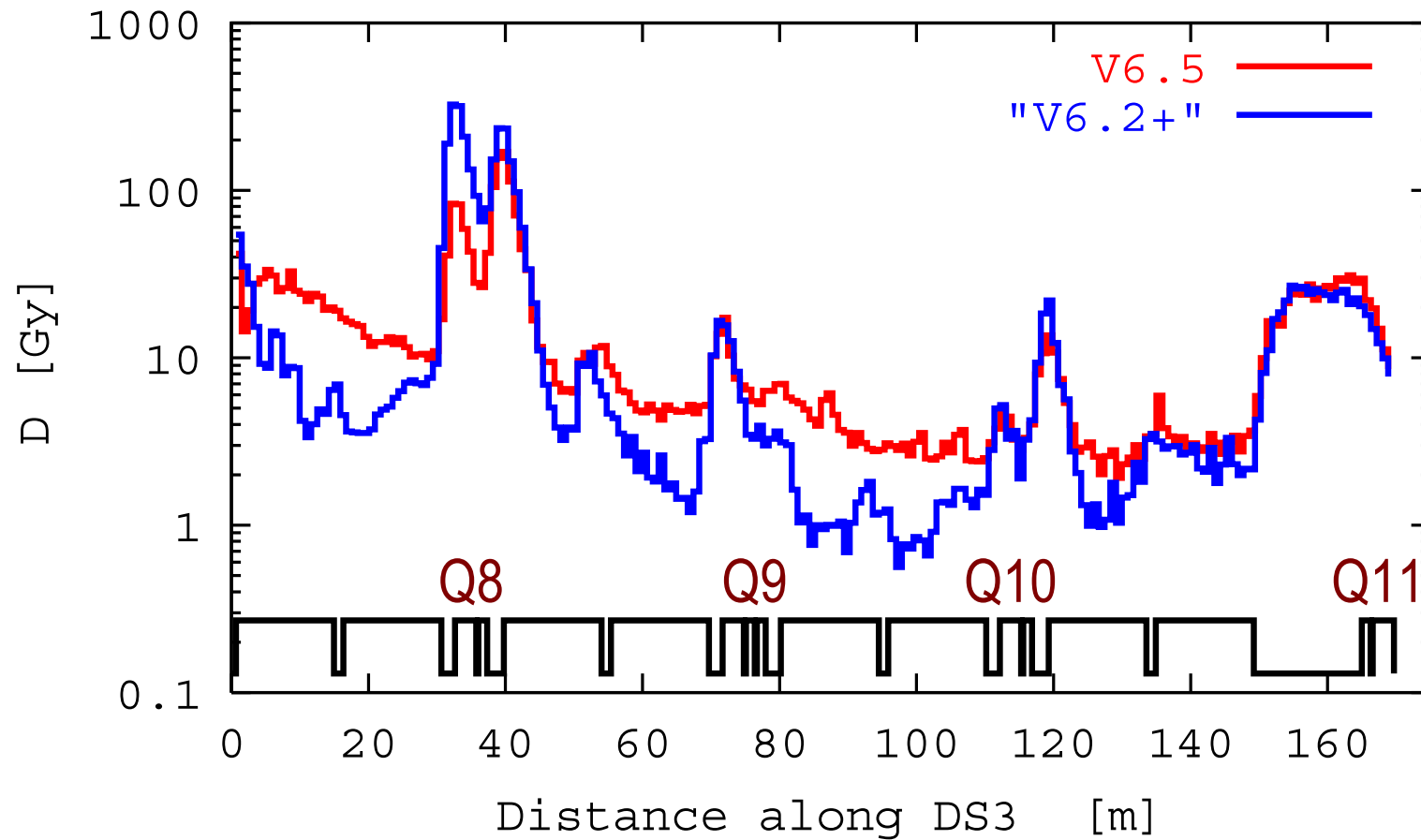
(Hadron Fluence at location 1 for V6.5)



“1 MeV Neutron” Fluence at location 1



Absorbed Dose at location 1



Summary

- DS3 is not the most comfortable place for electronics :

$$\mathbf{FH} > 10^9 \text{ cm}^{-2}/\text{y}$$

$$\mathbf{D} > 1 \text{ Gy/y}$$

- First 50 m of DS3 are the least comfortable :

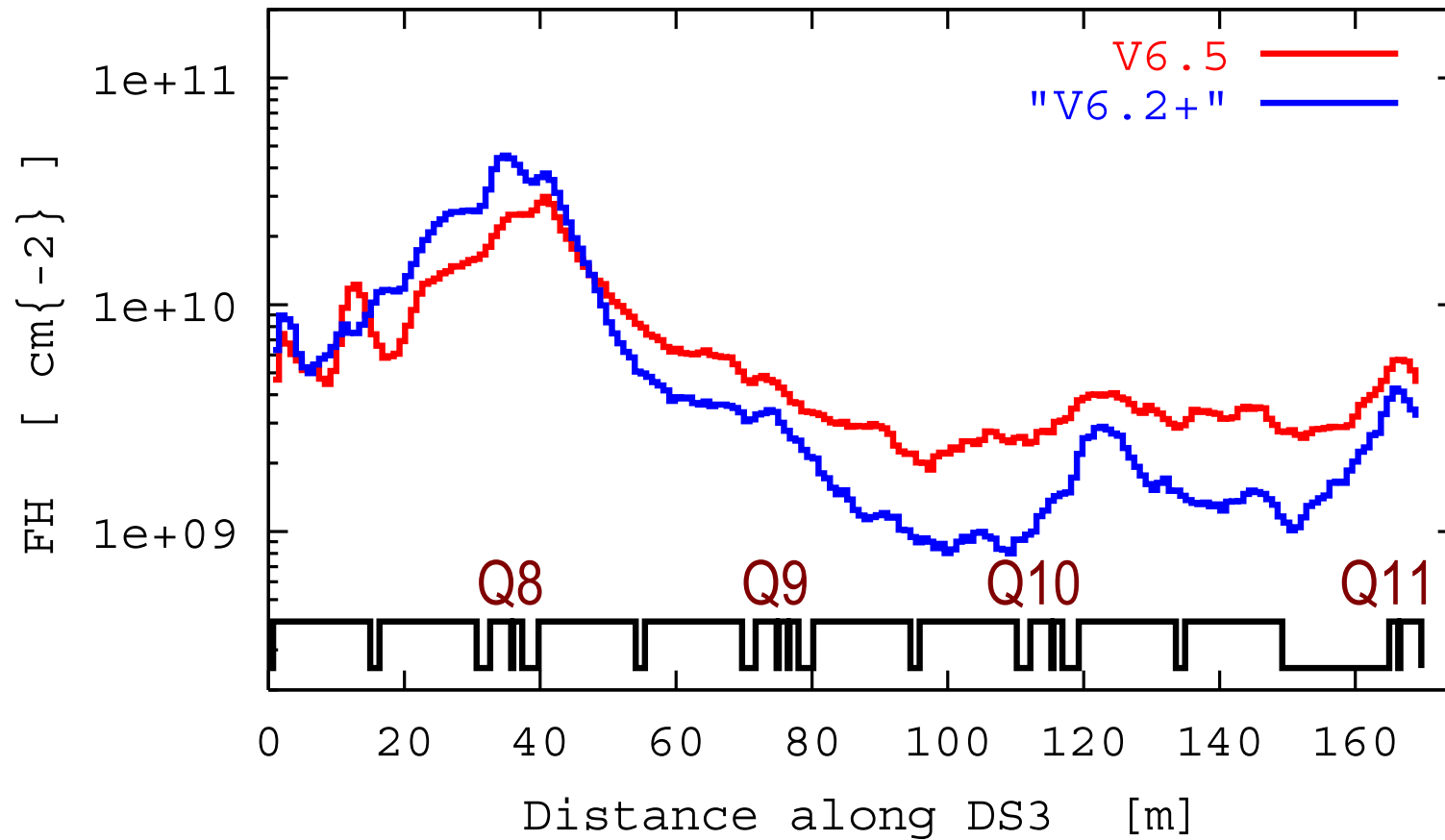
$$\mathbf{FH} = (1 \text{ to } 6) \times 10^{10} \text{ cm}^{-2}/\text{y}$$

$$\mathbf{D} = 10 \text{ to } 200 \text{ Gy/y}$$

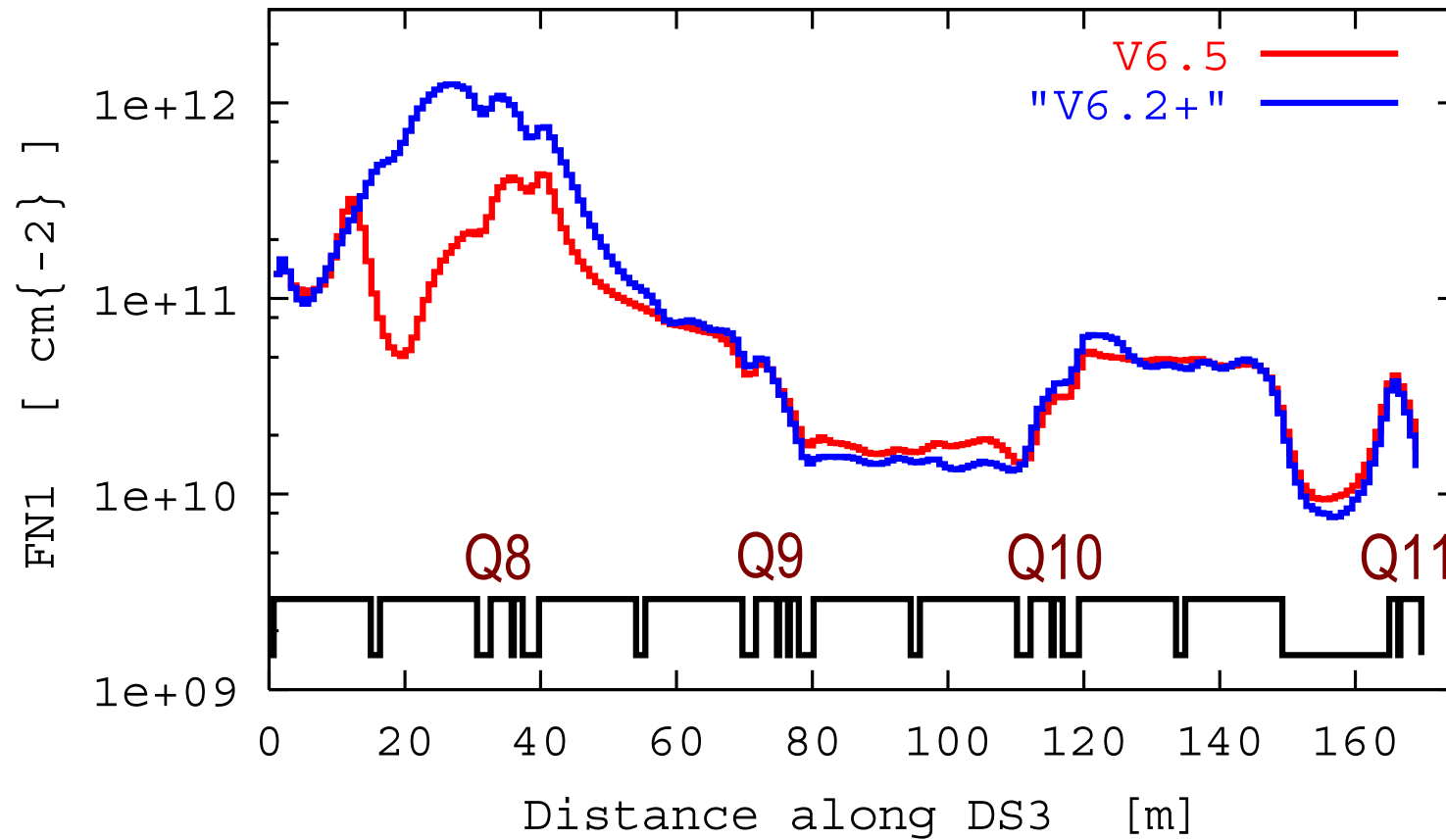
Additional Slides for “home reading”

- Fluences and doses at the locations 2 and 3
- “Reduced shielding” in IR3

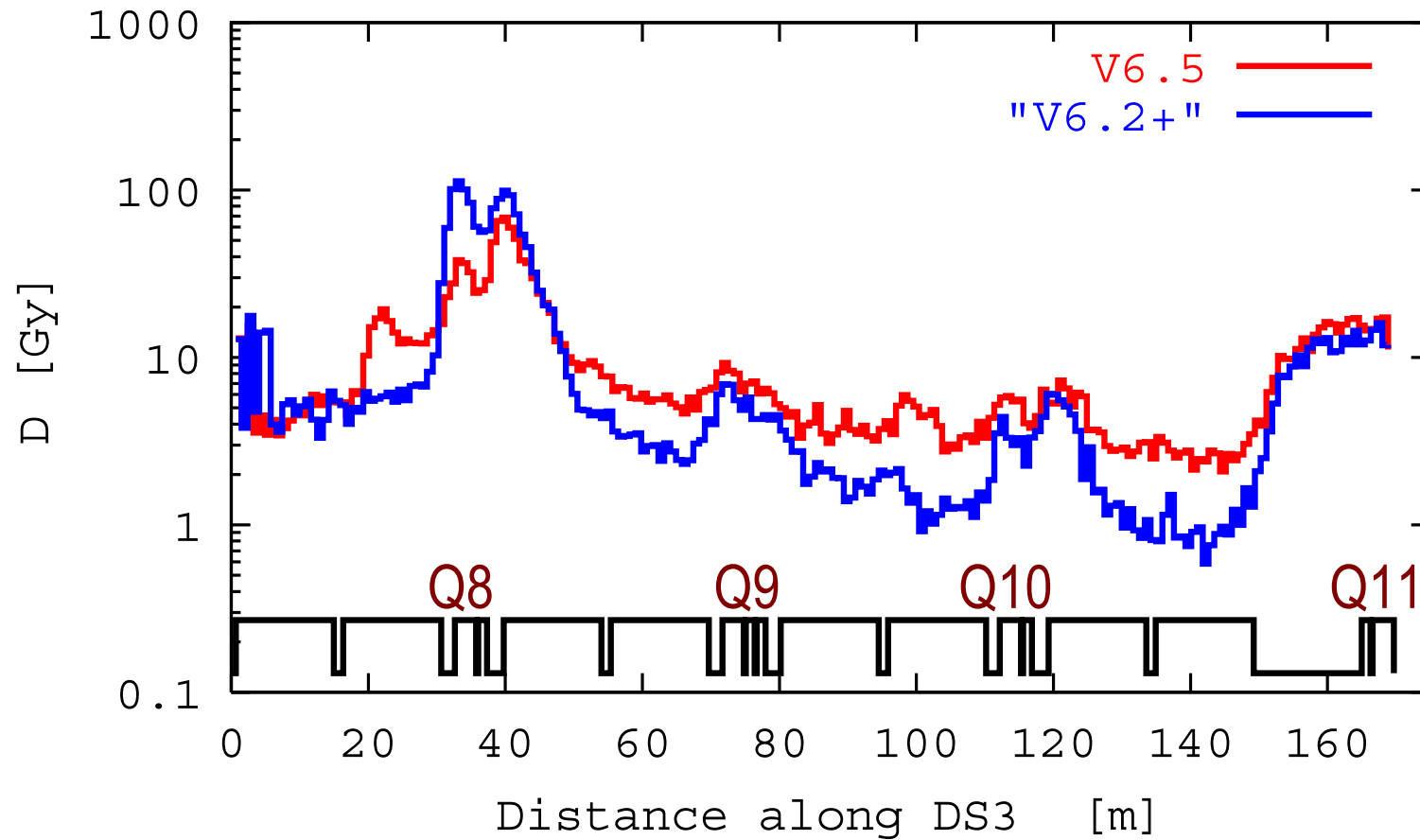
Hadron Fluence at location 2



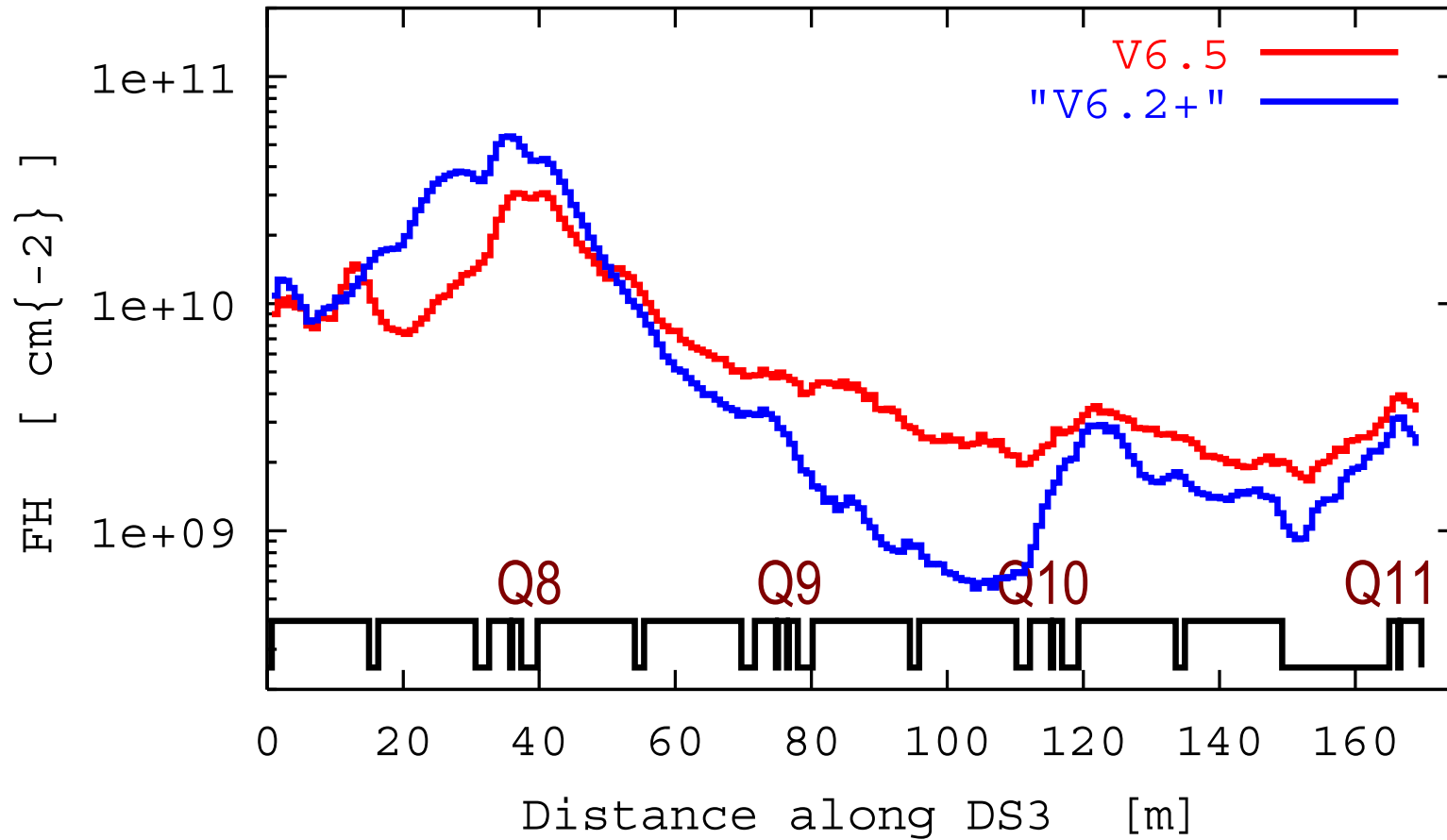
“1 MeV Neutron” Fluence at location 2



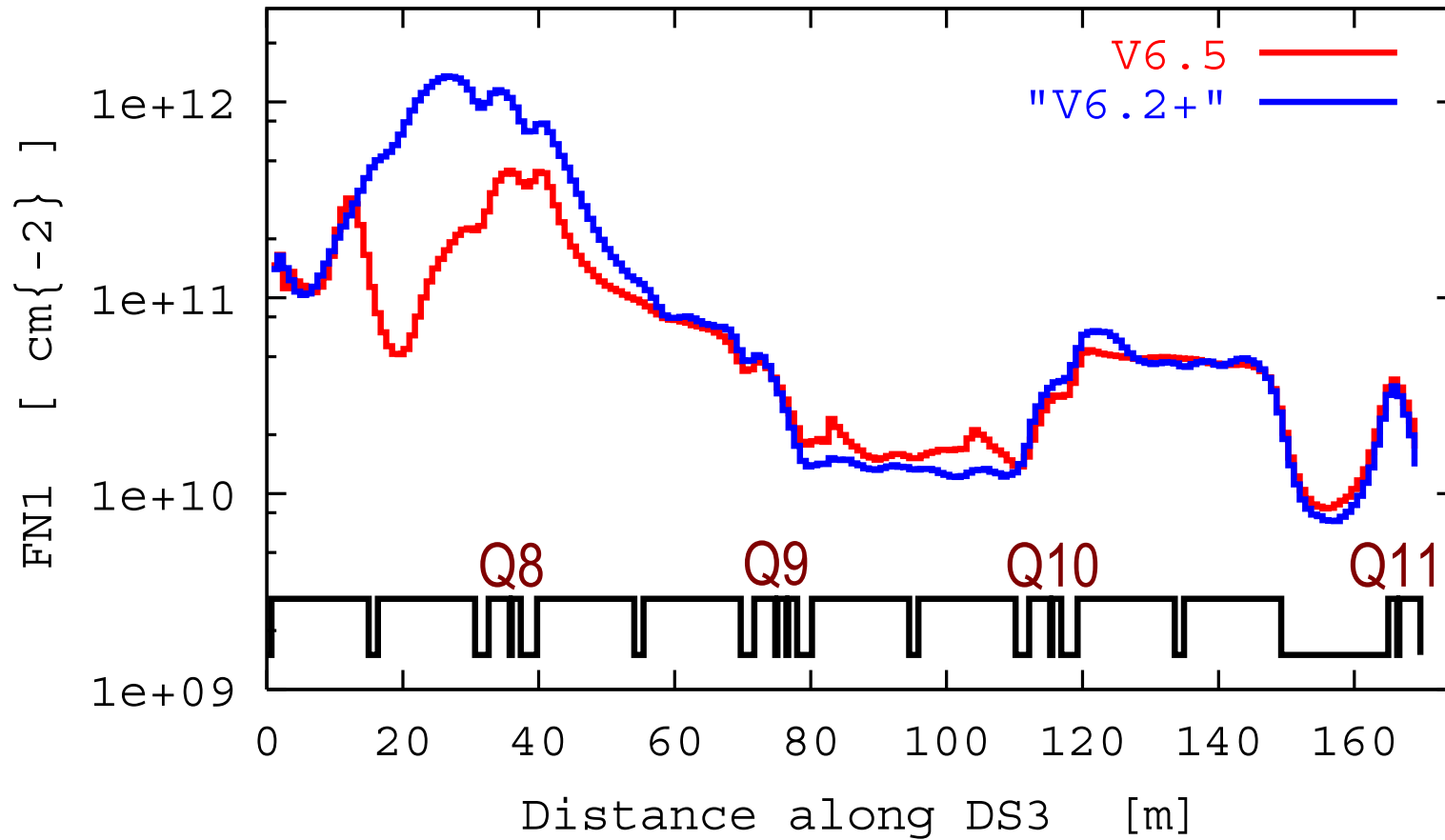
Absorbed Dose at location 2



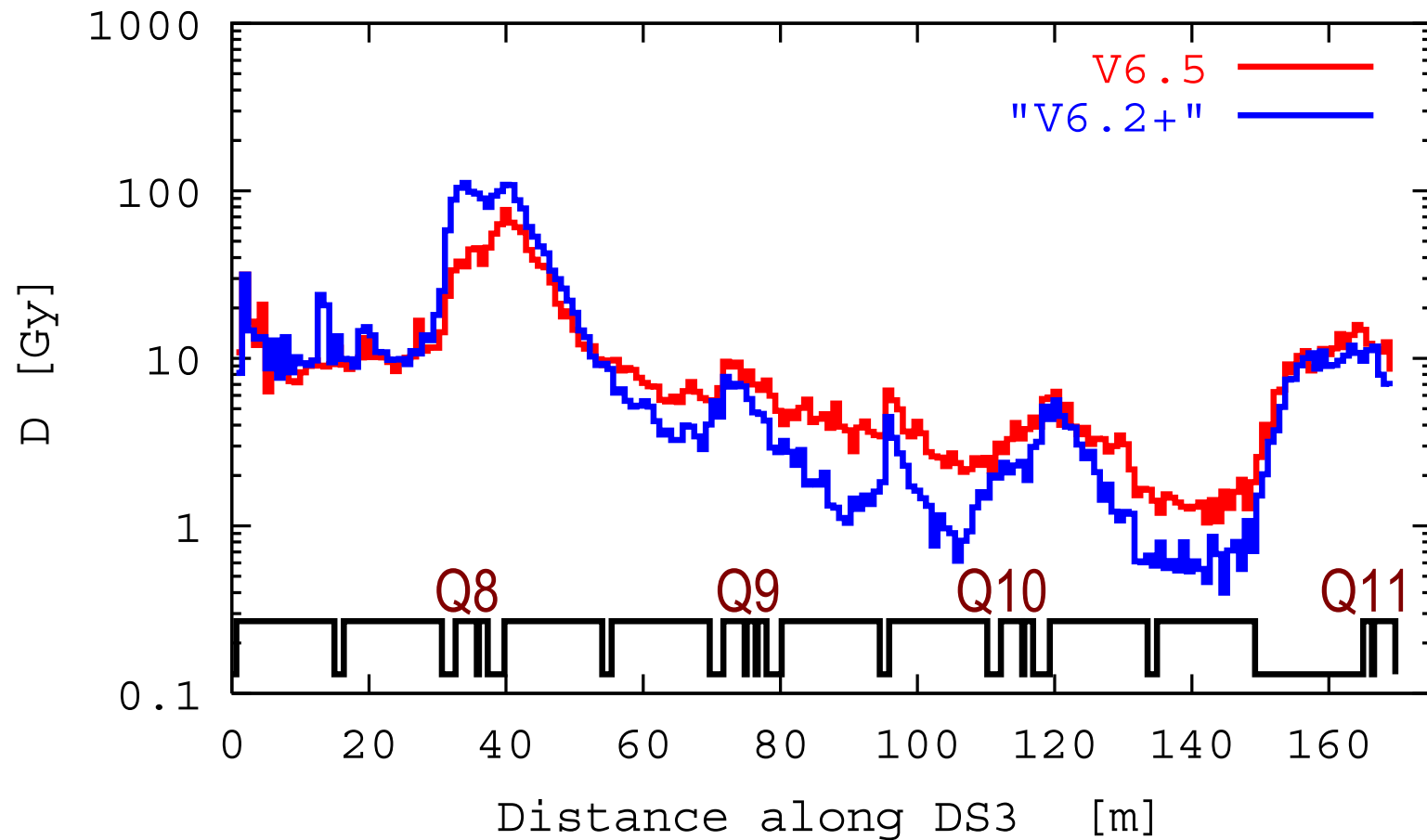
Hadron Fluence at location 3



“1 MeV Neutron” Fluence at location 3



Absorbed Dose at location 3



Shielding in IR3 V6.2+ (obsolete ?)

↓ - points to shield

◇ - collimator locations

