

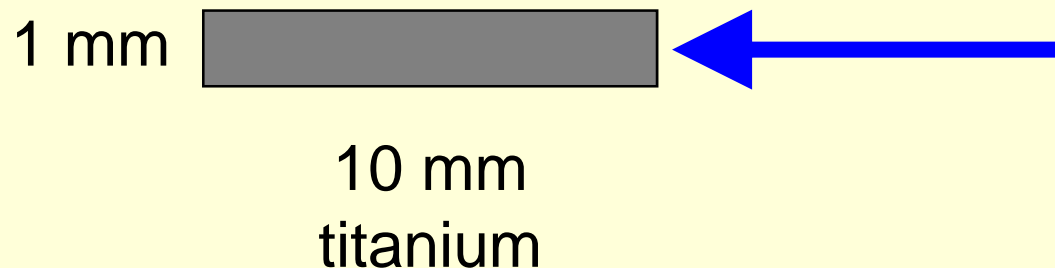
Beam and Target Issues

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5th May 2004

Tom Roberts' presentation to collaboration meeting (30th March):

“1.4E12 protons on target” to deliver
300 – 500 good muons to MICE

i.e. 1.4×10^{12} traverses of target



PDG values for titanium:

$$dE/dx)_{\min} = 1.476 \text{ MeV (g cm}^{-2}\text{)}^{-1}$$

$$\text{density} = 4.54 \text{ g cm}^{-3}$$

$$T = 800 \text{ MeV} \Rightarrow p = 1.46 \text{ GeV}/c$$

$$\beta\gamma = 1.56$$

$$dE/dx \sim 1.25 \times dE/dx)_{\min}$$

Hence E_{loss} per transit $\sim 8.4 \text{ MeV}$

(TR simulation $\Rightarrow 5.4 - 5.9 \text{ MeV}$)

Energy loss per machine cycle

$$\sim 1.4 \times 10^{12} \times 8.4 \text{ MeV} = 1.9 \text{ J}$$

i.e. 1.9 kW in 1 ms!

Effect on Target?

Heat loss by radiation only (2 cm² area,
30% emissivity?)

$$1 \text{ Hz} \Rightarrow 1.9 \text{ W} \Rightarrow T = 860 \text{ K}$$

$$10 \text{ Hz} \Rightarrow 19 \text{ W} \Rightarrow T = 1500 \text{ K}$$

$$50 \text{ Hz} \Rightarrow 95 \text{ W} \Rightarrow T = 2300 \text{ K}$$

Conduction? Thin, low-mass shaft.

Poor thermal path through suspension.

Curie temperature of magnet?

Effect on ISIS?

$$\text{PDG} \Rightarrow \lambda_1 = 124.9 \text{ g cm}^{-2} \equiv 27.5 \text{ cm}$$

$$p = 1.6 \text{ GeV}/c \Rightarrow \sigma \sim 0.7 \sigma_0$$

\Rightarrow 2.5% probability of inelastic interaction in
10 mm thickness

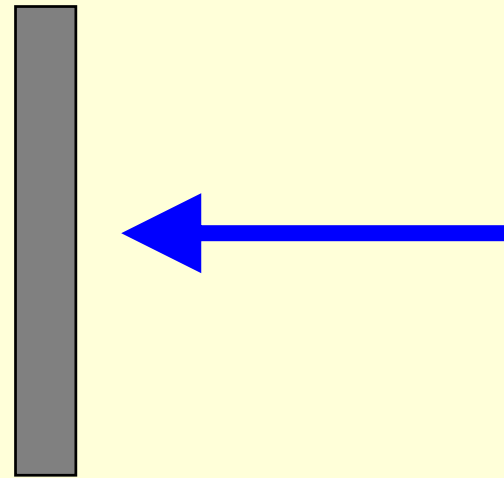
i.e. 3.6×10^{10} inelastic interaction/pulse

Beam losses acceptable?

Induced radiation a problem?

Other points raised by Tom Roberts:

- Momentum loss per traverse $\sim 6.4\text{-}7.0 \text{ MeV}/c$
 - Will *all* be lost from beam?
- Rotate target 90° ?



No effect on heating or hadronic interactions.

Mom. Loss $\div 10$, Mult. scat. $\div 3$

Is transverse slot in beam pipe acceptable?