

Reality check on ND tracking options from fundamentals
Or why it is you need to make sure the multiple scattering is “on” in the
simulations

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$$\left(\frac{\delta p}{p}\right)^2 = \left(\frac{\sigma_s p}{0.3BL^2} \sqrt{\frac{720}{N+4}}\right)^2 + \left(0.045 \frac{1}{B\sqrt{LX_o}}\right)^2$$

From:
Gluckstern NIM 24 (1963) 381
Michael Moll, presentation at CERN on tracking on 15 May 2011

Single point measurement resolution (m)

Track length in m

Track momentum in GeV/c

$$\left(\frac{\delta p}{p}\right)^2 = \left(\frac{\sigma_s p}{0.3BL^2 \sqrt{N+4}}\right)^2 + \left(0.045 \frac{1}{B\sqrt{LX_o}}\right)^2$$

B field strength in T

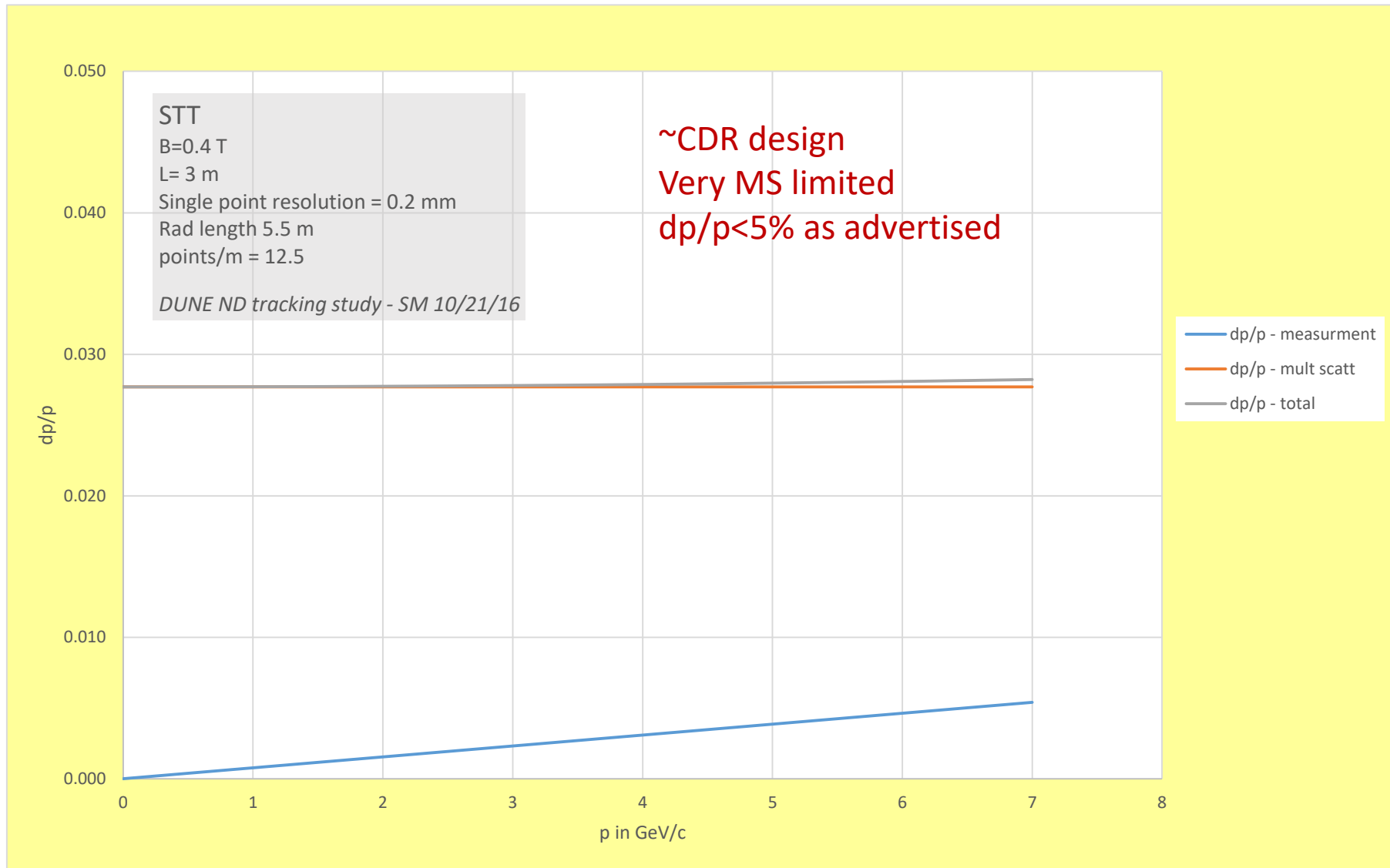
Measurement term

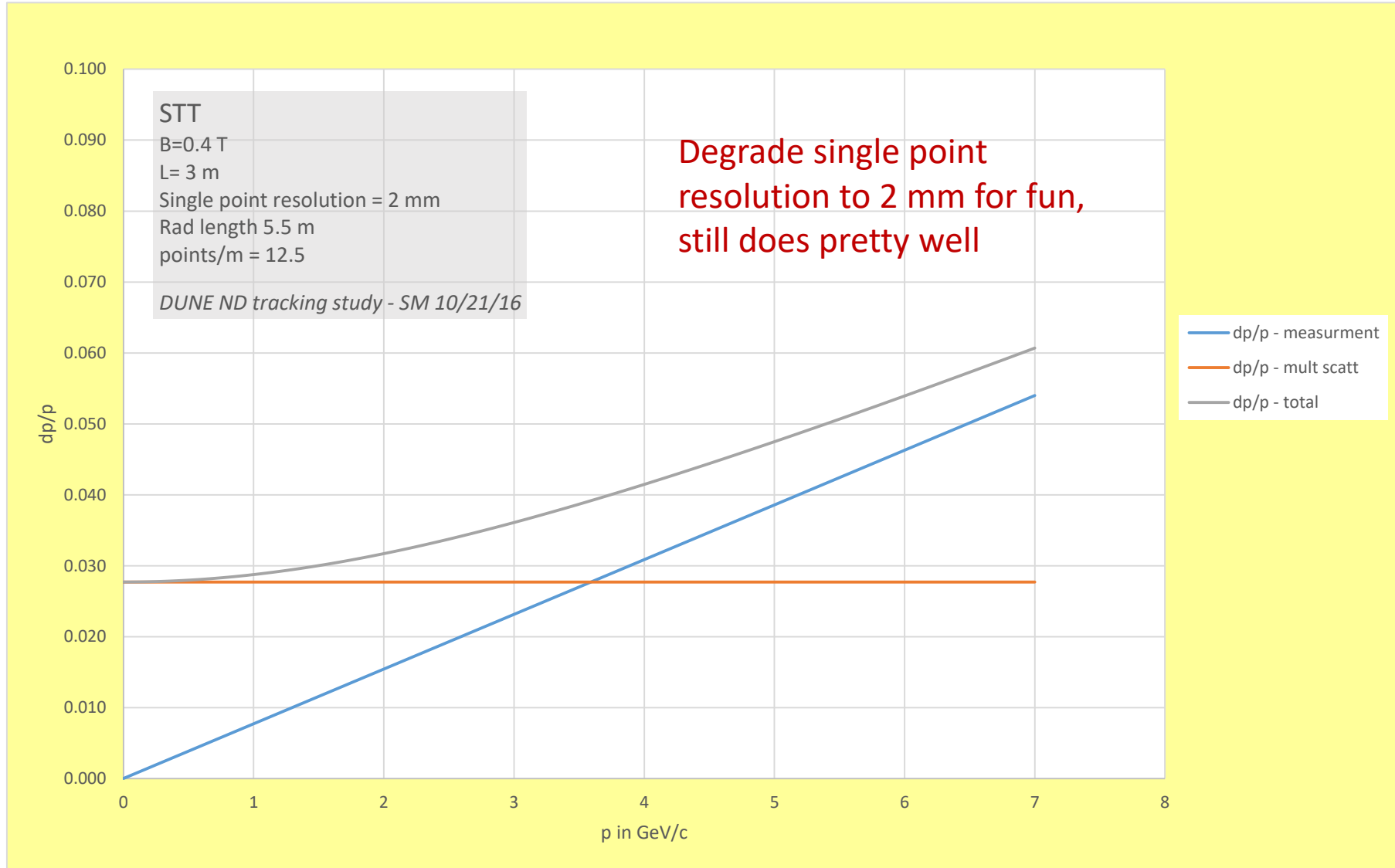
Multiple scattering term

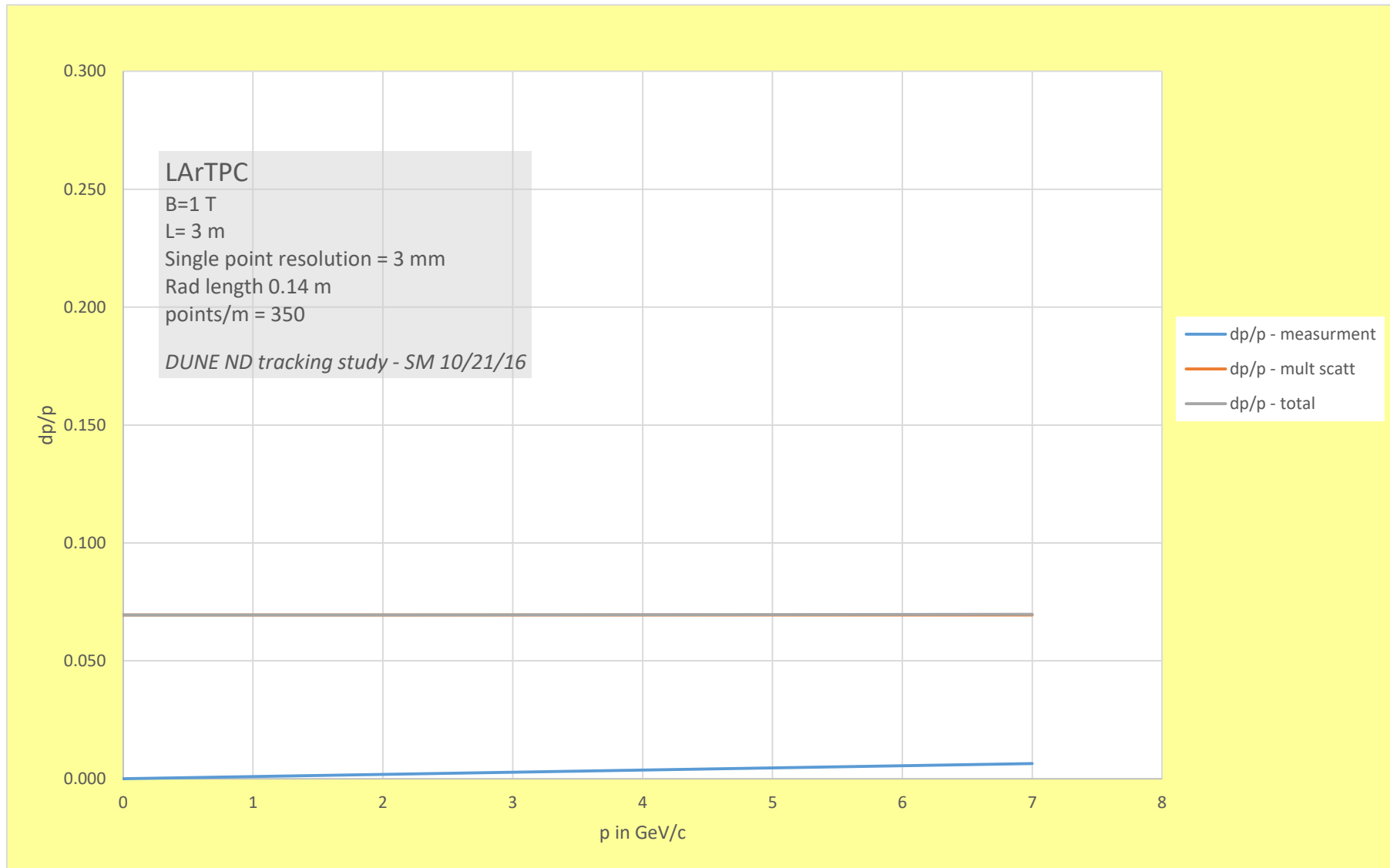
Number of measurement points

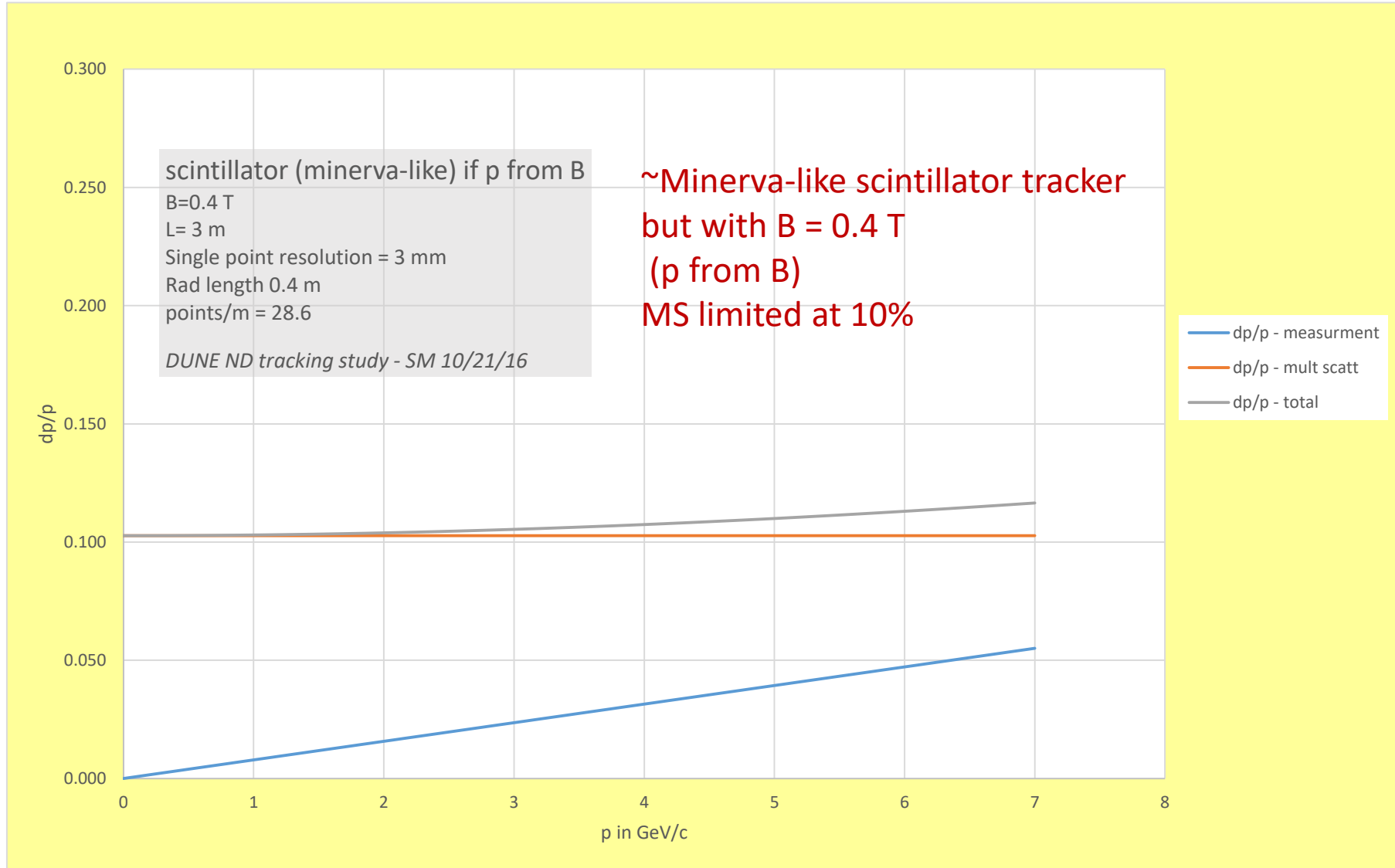
Radiation length of medium (m)

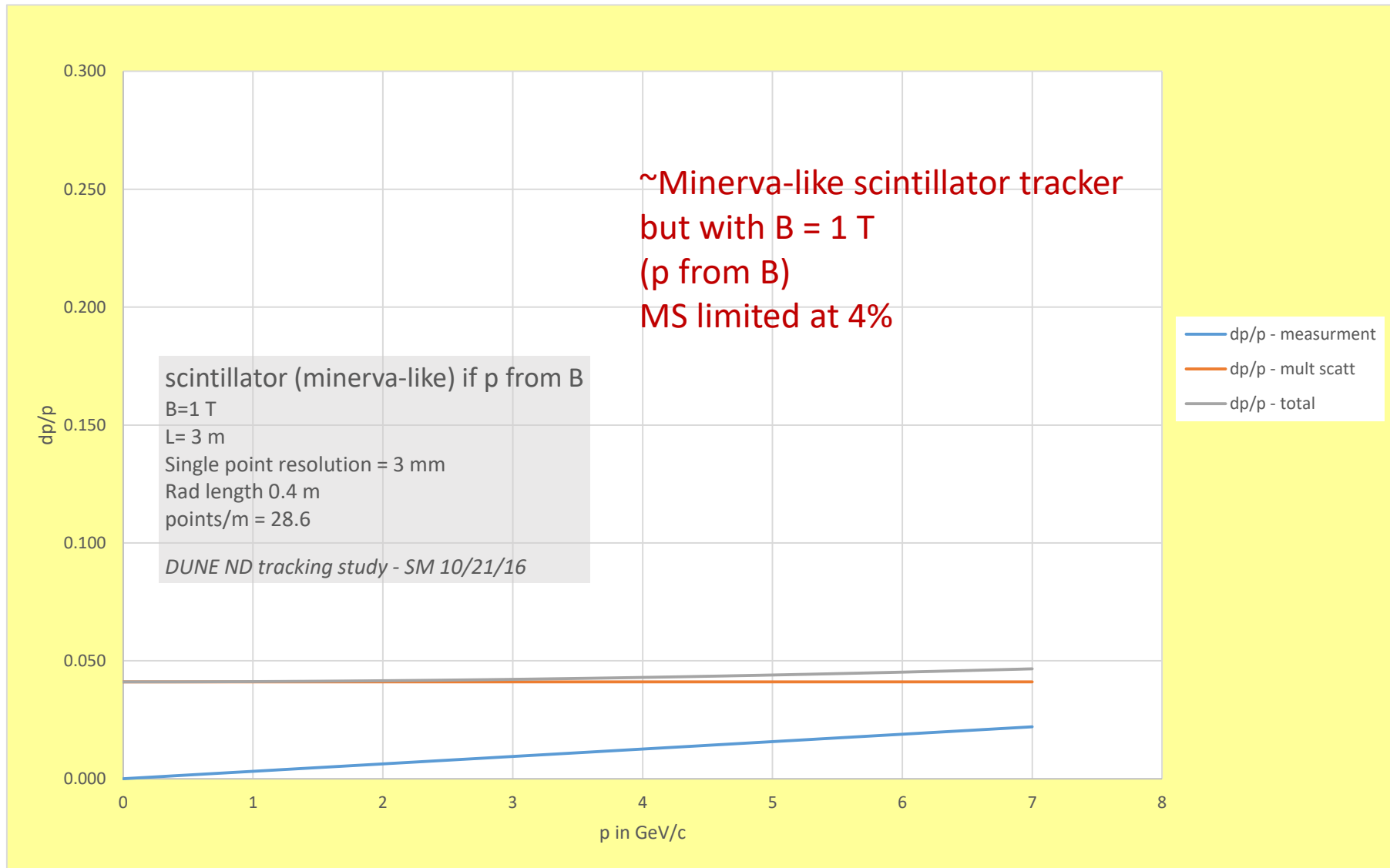
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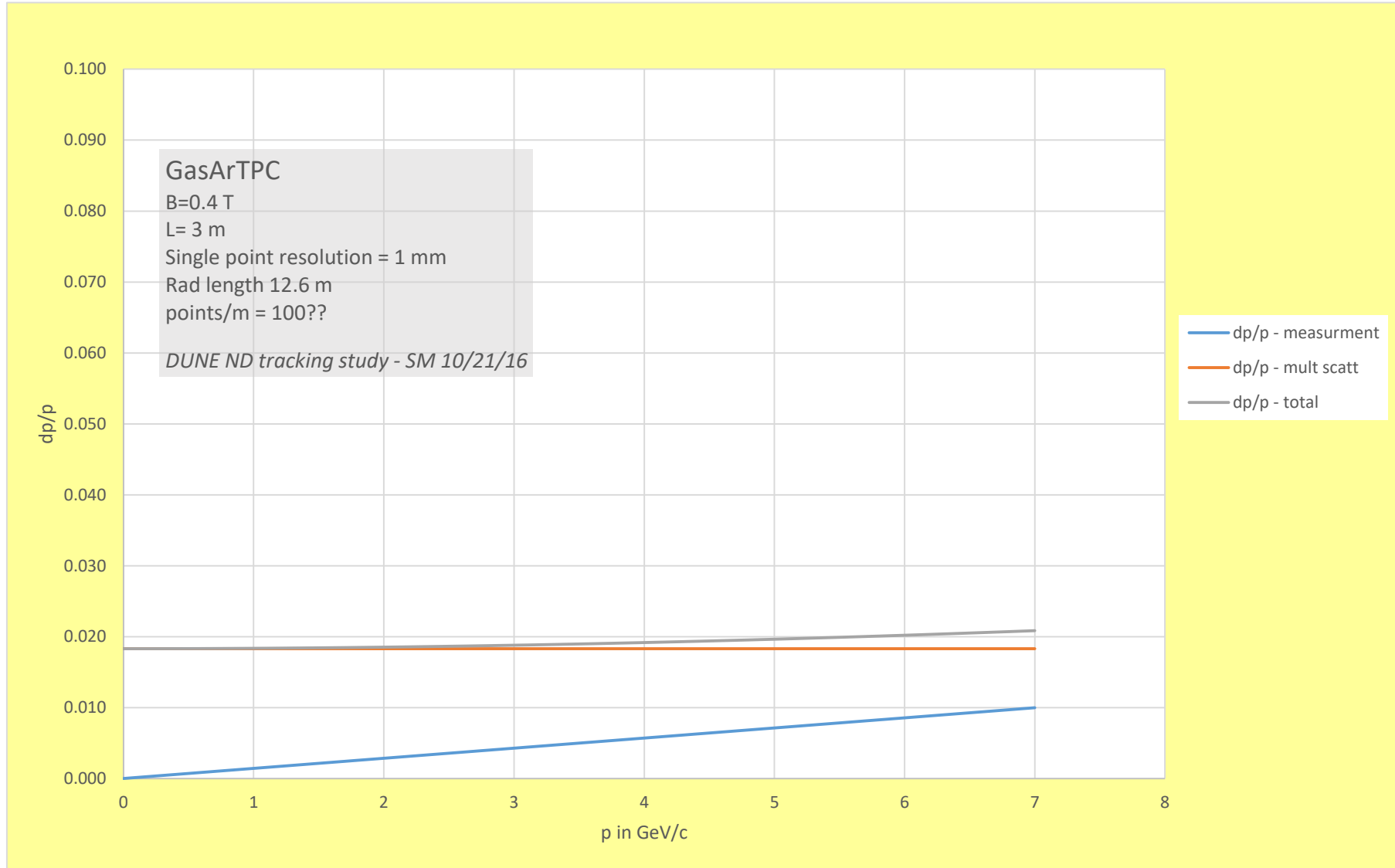






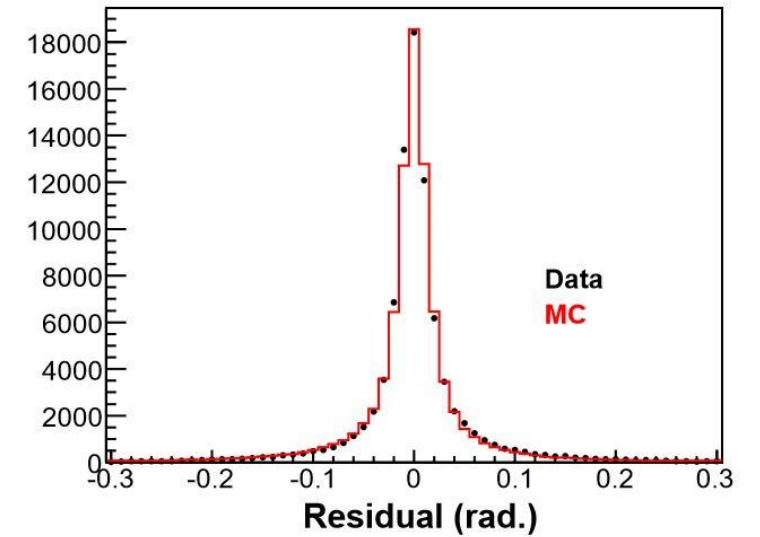






$$\mathcal{G}_{rms} \Big|_{multiscatt} = \frac{0.015}{p} \sqrt{\frac{t}{X_o}}$$

Option	~thickness	Xo	θrms @ 1 GeV/c
Minerva-like	7 cm (3 hits)	40 cm	6.3 mrad
LArTPC	1 cm?	14 cm	4 mrad
STT	16 cm (3 hits)	5.5 m	2.5 mrad
GasArTPC	1 cm?	12.6 m	0.04 mrad



MINERvA angular resolution from rock muon study (from detector NIM)