

Proton detection threshold and efficiency

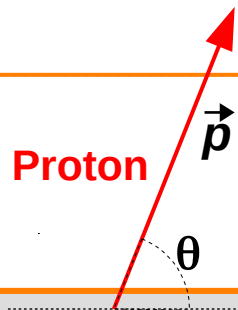
Proton generated flat in $0.05 < p \text{ (GeV/c)} < 2.0$, $-1 < \cos\theta < 1$, along all target length

Checked which reached the most inner TPC gas layer.

NB: what I call “efficiency” in these slides is a misuse of language: it just represent the probability for the proton to reach the most inner gas layer of the mTPC.

mTPC most up-to-date geometry (Marco)

mTPC inner wall: $2 \mu\text{m kapton}$



Between target and mTPC: ^4He gas, 0.1 atm

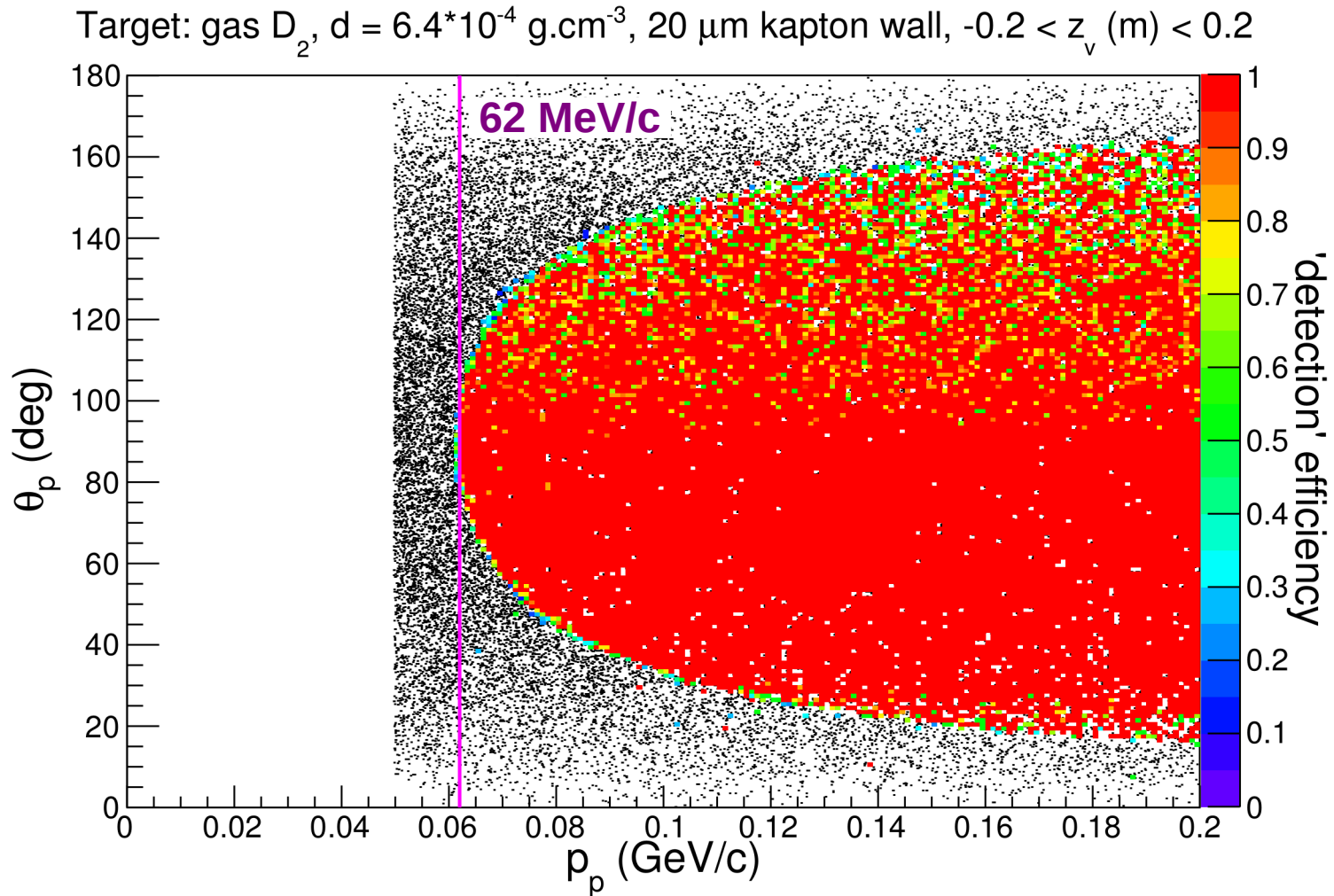
Target wall: $20 \mu\text{m kapton}$

Target: D_2 gas, $6.4 \cdot 10^{-4} \text{ g.cm}^{-3}$

mTPC gas: ^4He , 0.1 atm

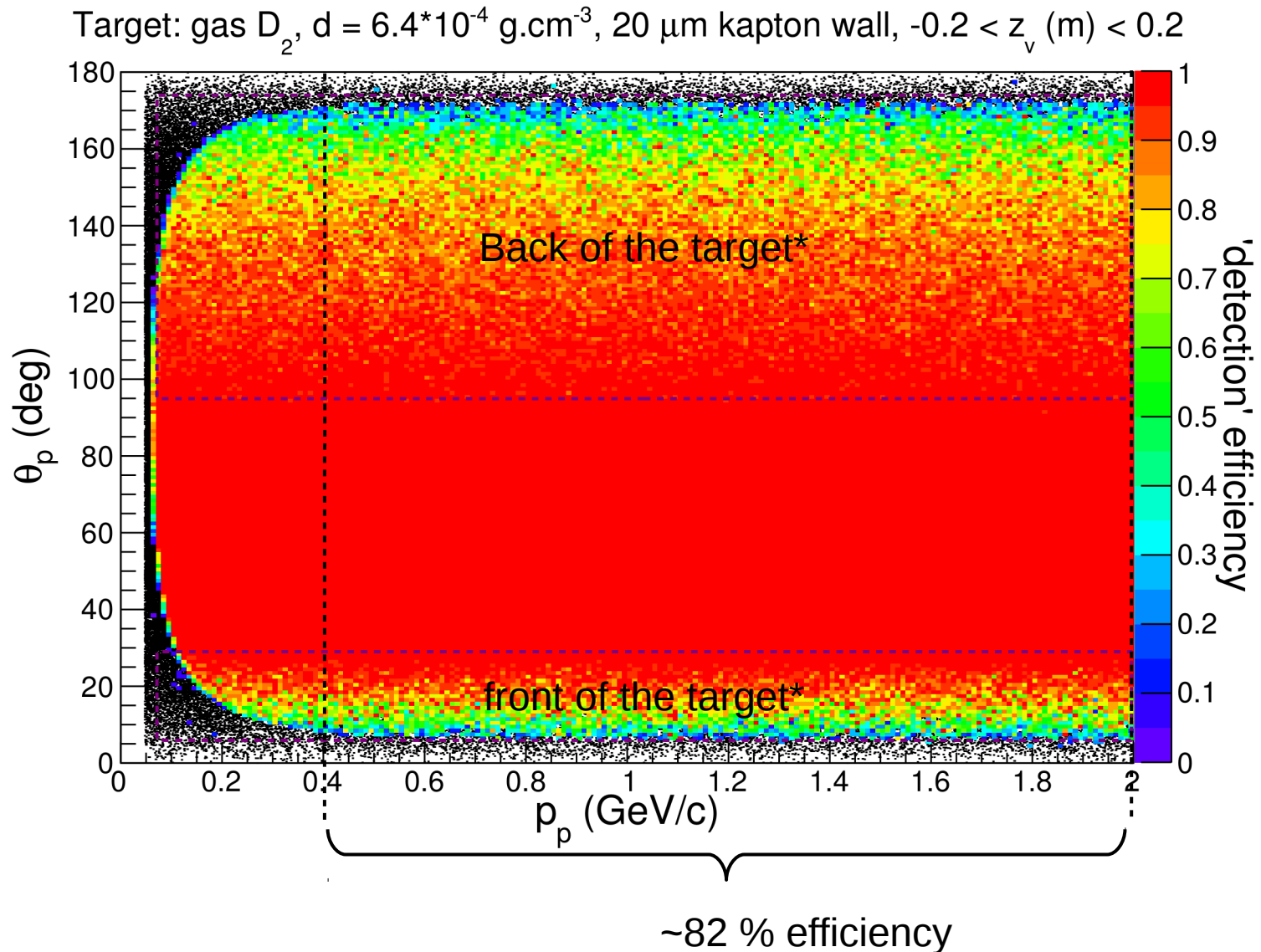
(for practical reasons, I have made the most inner layer denser (1atm))

“Efficiency” : angle Vs momentum : Zoom at low momentum



Proton threshold: 62 MeV/c
(with 20 μm kapton target wall and
Target gas: D_2 , $6.4 \cdot 10^{-4} \text{ g.cm}^{-3}$)

“Efficiency” : angle Vs momentum over a wider momentum range

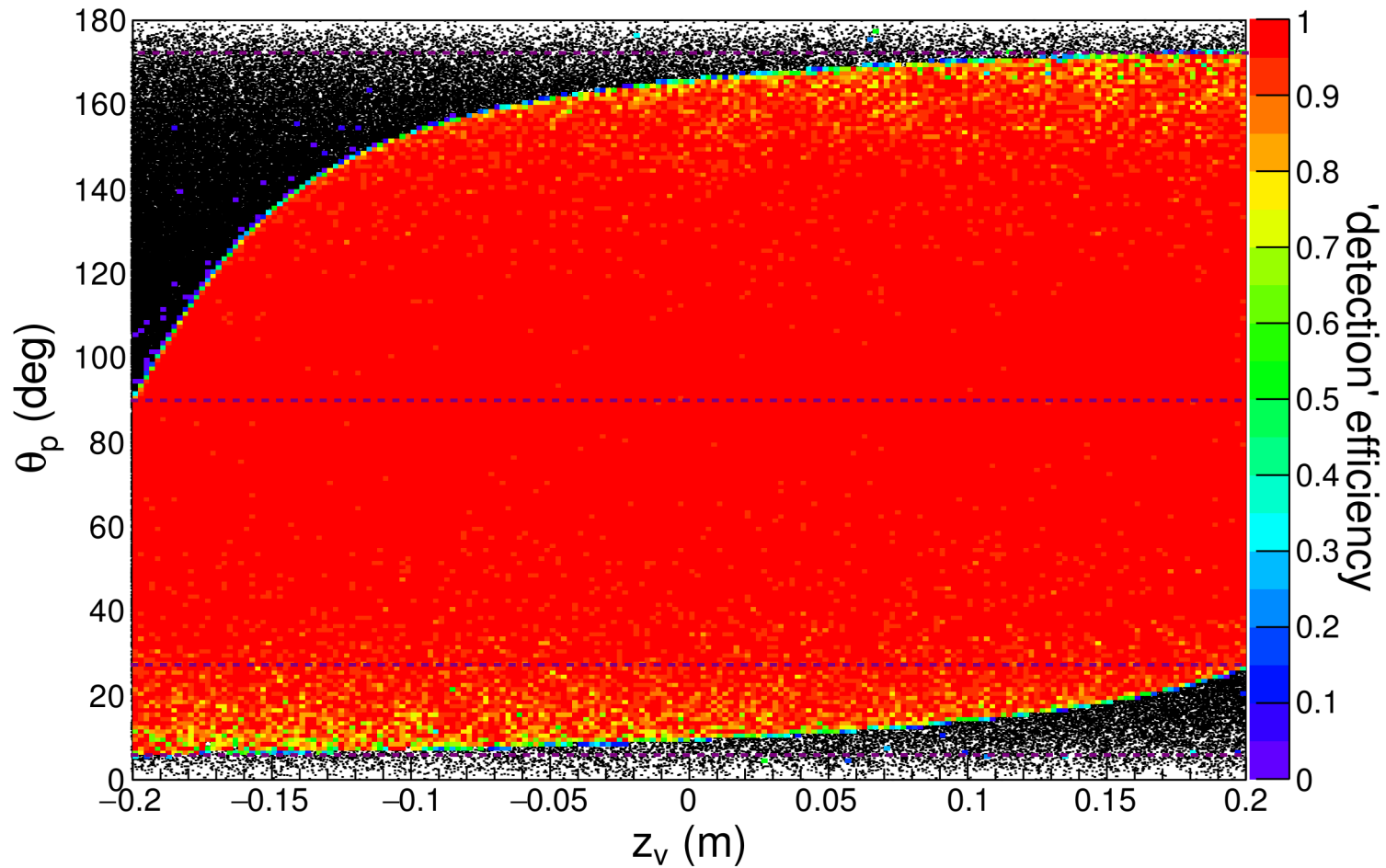


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(*): see next slide

“Efficiency” : angle Vs vertex position

Target: gas D_2 , $d = 6.4 \cdot 10^{-4} \text{ g.cm}^{-3}$, 20 μm kapton wall



Backup : Luminosity and target density

$$\frac{dL}{dt} = \frac{I_{beam}}{e} \times L_{tgt} \times \frac{d_{tgt} \times N_A}{m_D}$$

Knowing:

$$dL/dt \sim 3.0 \cdot 10^{36} \text{ cm}^{-2} \text{ s}^{-1};$$

$$L_{tgt} = 40 \text{ cm};$$

$$I_{beam} = 60 \text{ } \mu\text{A};$$

$$\Rightarrow d_{tgt} \sim 6.4 \text{ g cm}^{-3}.$$

Deuterium gas: $1.68 \cdot 10^{-4} \text{ g cm}^{-3}$ @ $T_0 = 293 \text{ K}$, $P_0 = 1 \text{ atm}$.

To bring it to $6.4 \cdot 10^{-4} \text{ g cm}^{-3}$:

$$d_{tgt}(T, P) = d_{tgt}(T_0 = 293 \text{ K}, P_0 = 1 \text{ atm}) \times \frac{T_0}{T} \times \frac{P}{P_0}$$

$T = 77 \text{ K}$, $P = P_0$ or

$T = T_0$, $P = 3.8 \text{ atm}$ (not as much to hold as e.g BONUS).