

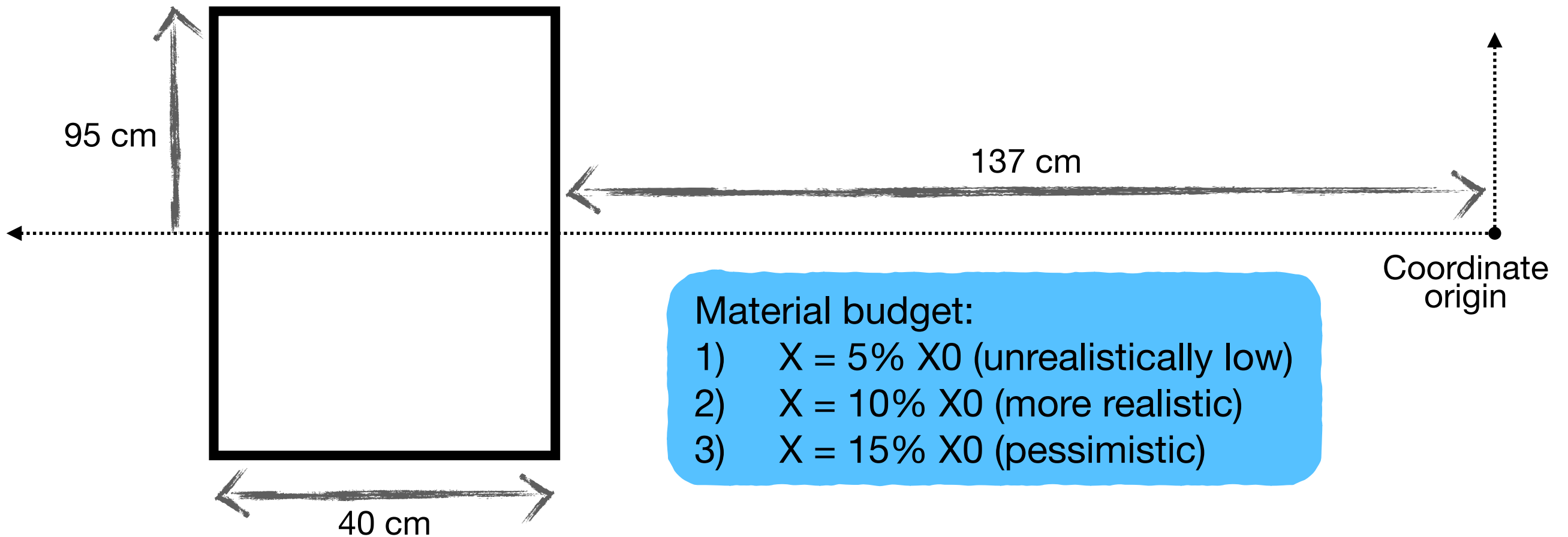
Location of backward tracking plane relative to mRICH



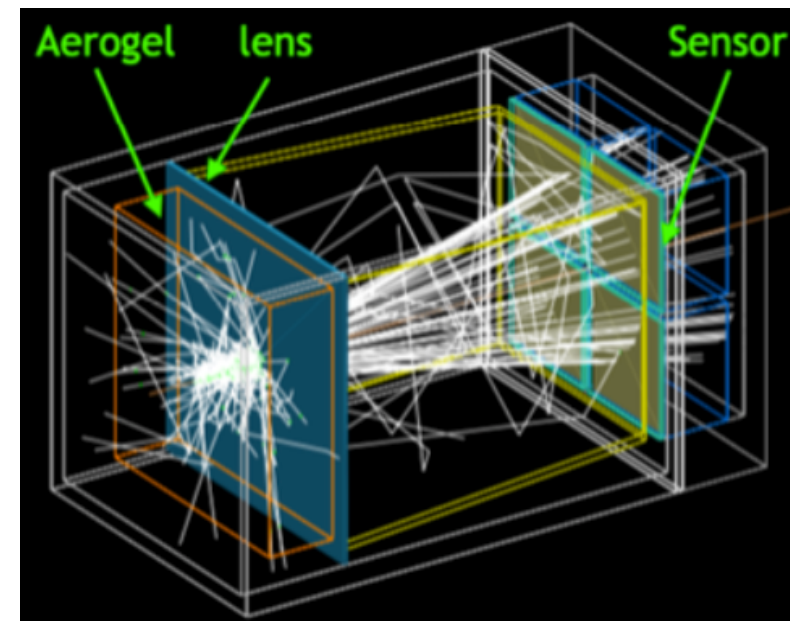
Rey Cruz-Torres
ATHENA Tracking Meeting
09/14/2021

mRICH Parametrization

Information from private communication with S. Joosten (09/08/2021)

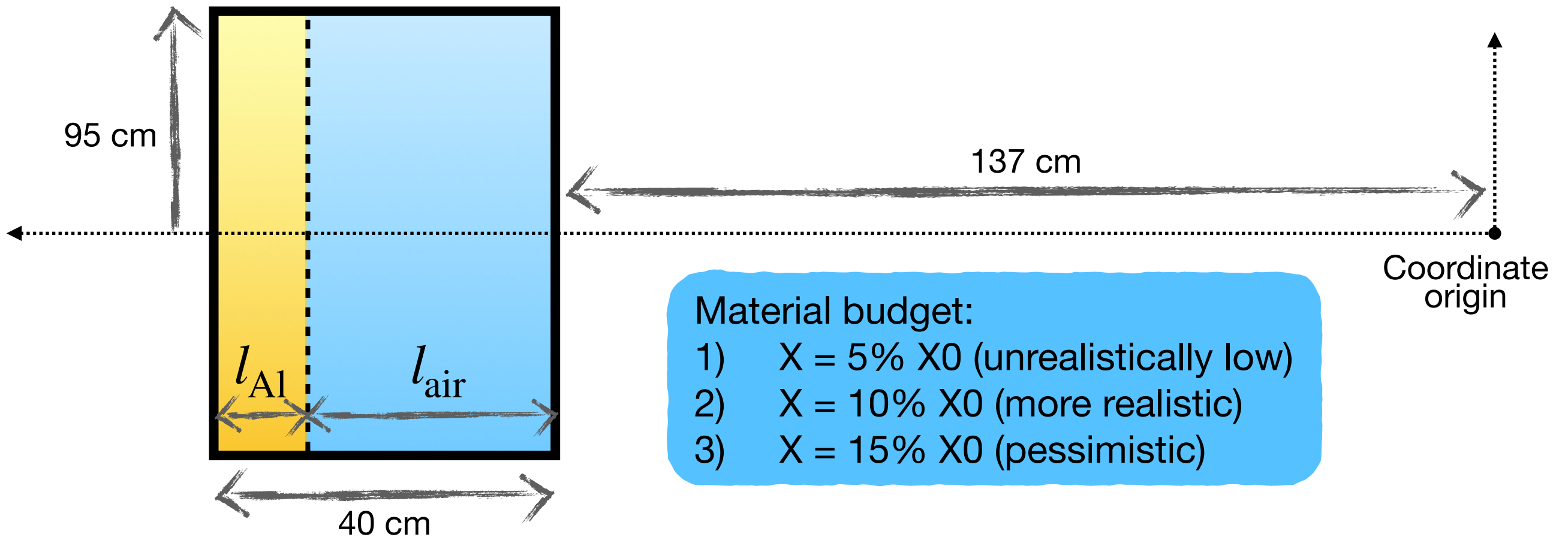


Parametrize as air with support in the back adding up to the right material budget



mRICH Parametrization

Information from private communication with S. Joosten (09/08/2021)



$$l_{\text{Al}} + l_{\text{air}} = 40 \text{ cm}$$

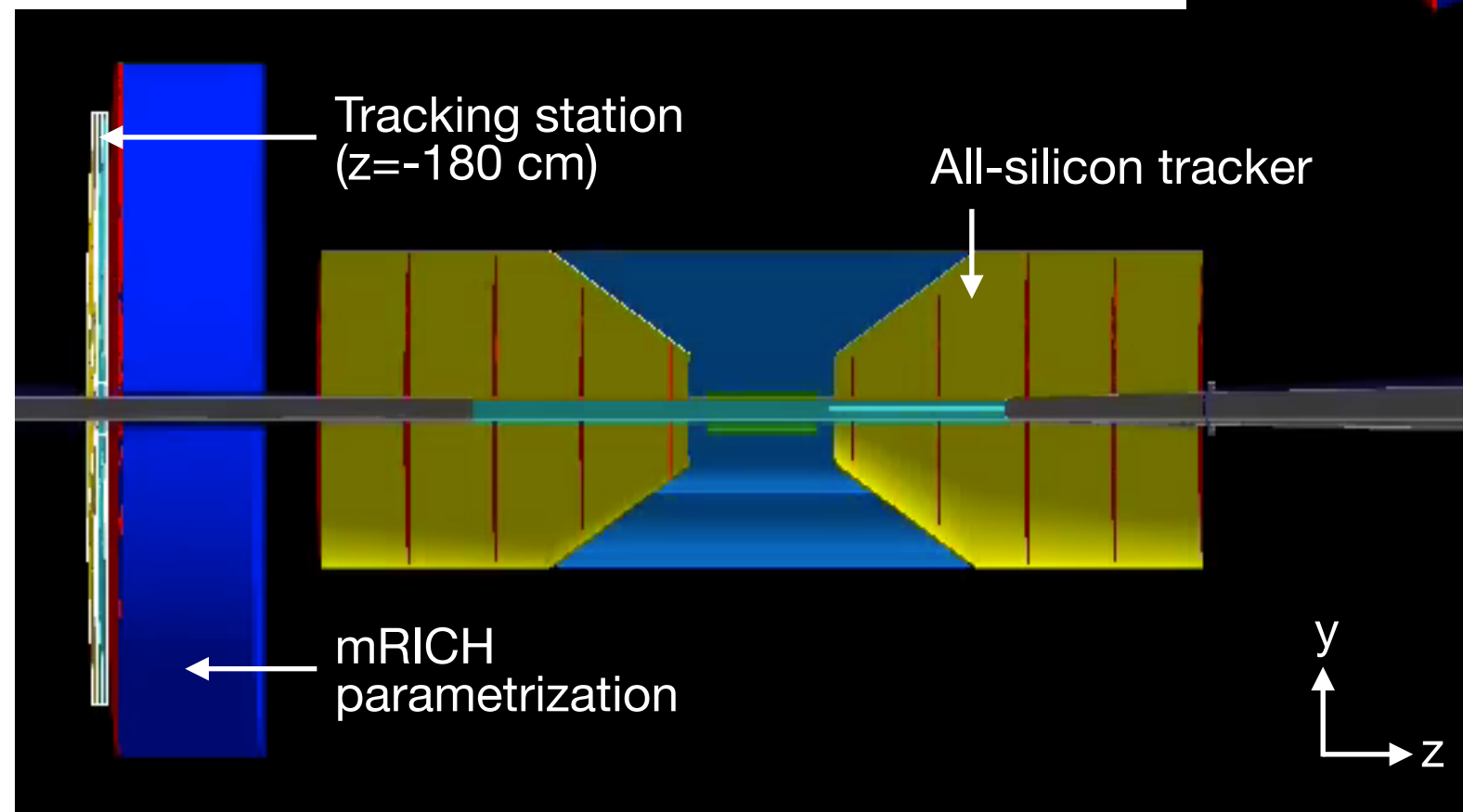
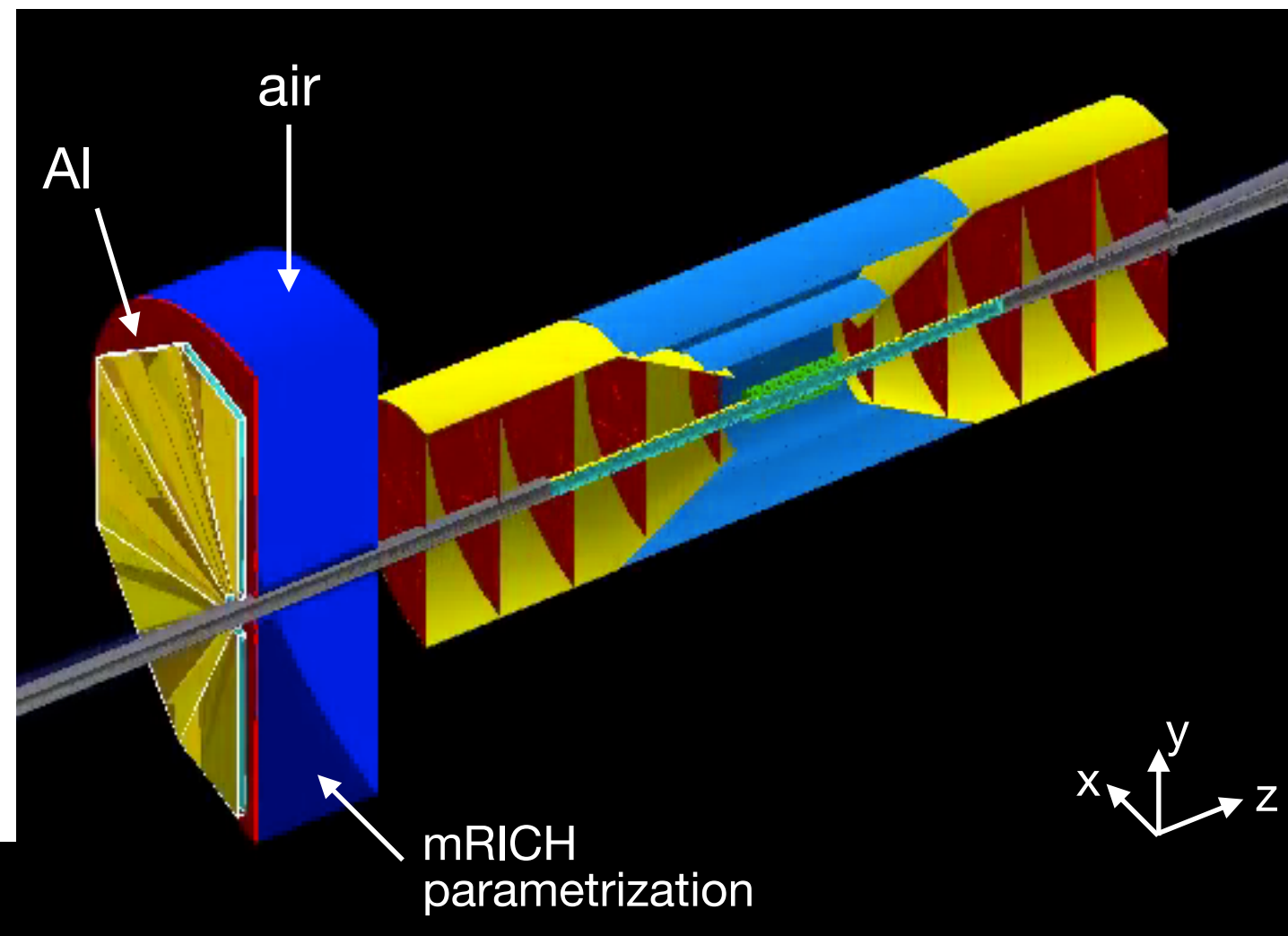
$$\frac{l_{\text{Al}}}{X_0^{\text{Al}}} + \frac{l_{\text{air}}}{X_0^{\text{air}}} = \frac{X}{100}$$

$$X_0^{\text{Al}} = 8.897 \text{ cm}$$

$$X_0^{\text{air}} = 3.039 \times 10^4 \text{ cm}$$

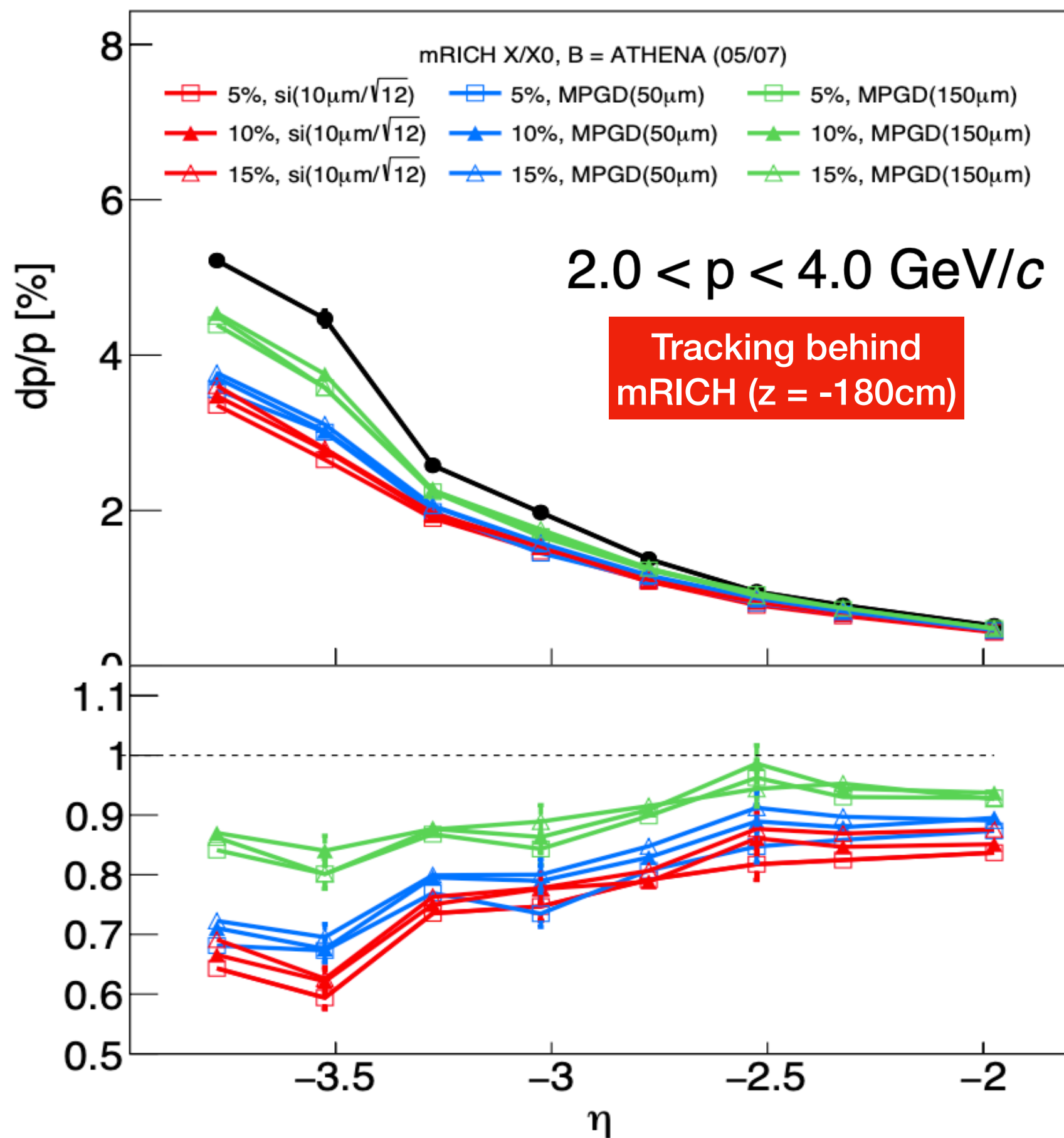
mRICH Parametrization

X [% X0]	l_{air} [cm]	l_{Al} [cm]
5	39.567	0.433
10	39.122	0.878
15	38.677	1.323



**Measured the mockup
mRICH material budget
with a geantino scan**

Performance vs. pseudorapidity



All-Si tracker only

All-Si tracker + si disk

All-Si tracker +
MPGD ($\sigma = 50 \mu\text{m}$)

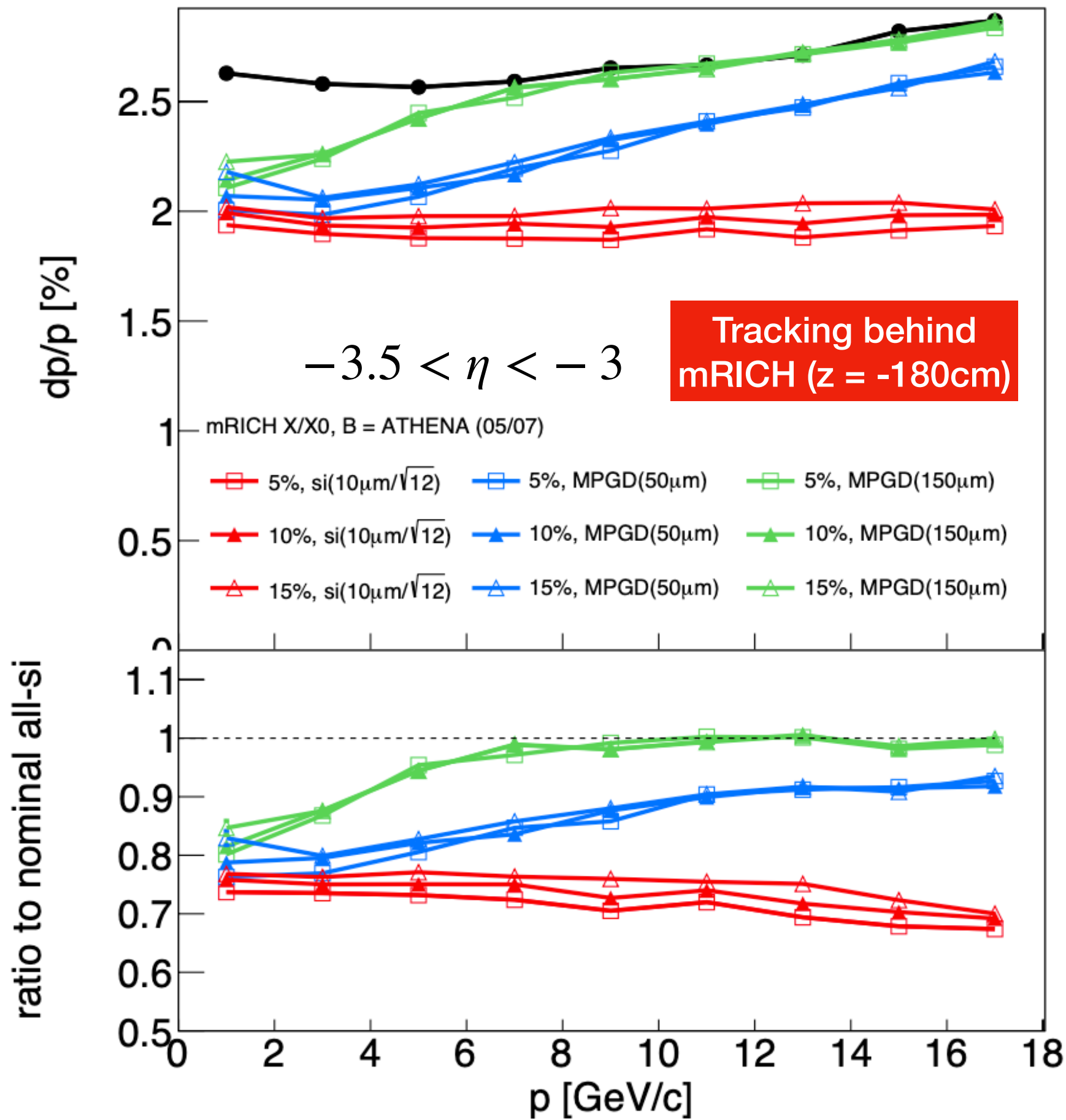
All-Si tracker +
MPGD ($\sigma = 150 \mu\text{m}$)

mRICH X = 5% X0

mRICH X = 10% X0

mRICH X = 15% X0

Performance vs. momentum



All-Si tracker only

All-Si tracker + si disk

All-Si tracker +
MPGD ($\sigma = 50\mu\text{m}$)

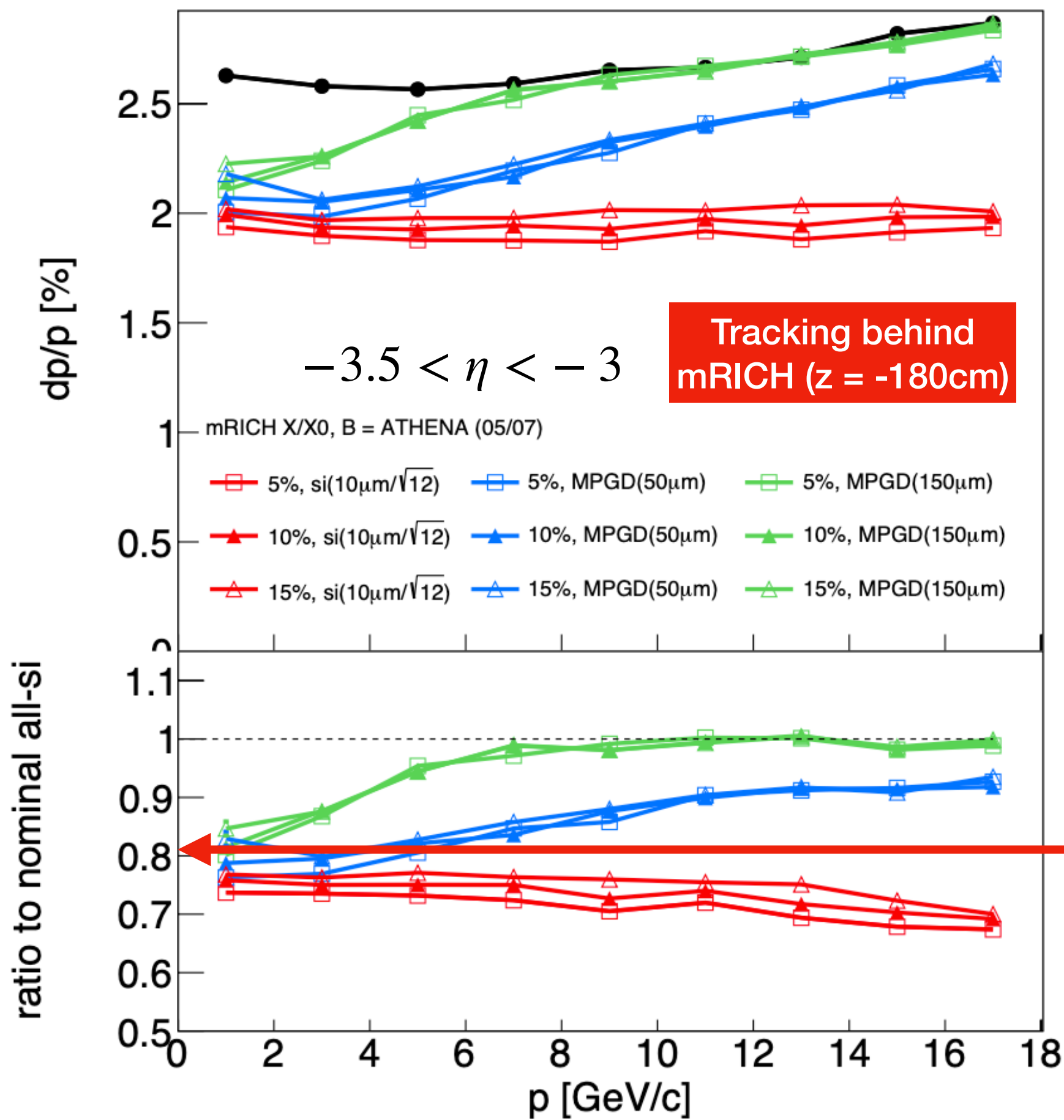
All-Si tracker +
MPGD ($\sigma = 150\mu\text{m}$)

mRICH X = 5% X0

mRICH X = 10% X0

mRICH X = 15% X0

Summary



All-Si tracker only

All-Si tracker + si disk

All-Si tracker +
MPGD ($\sigma = 50 \mu\text{m}$)

All-Si tracker +
MPGD ($\sigma = 150 \mu\text{m}$)

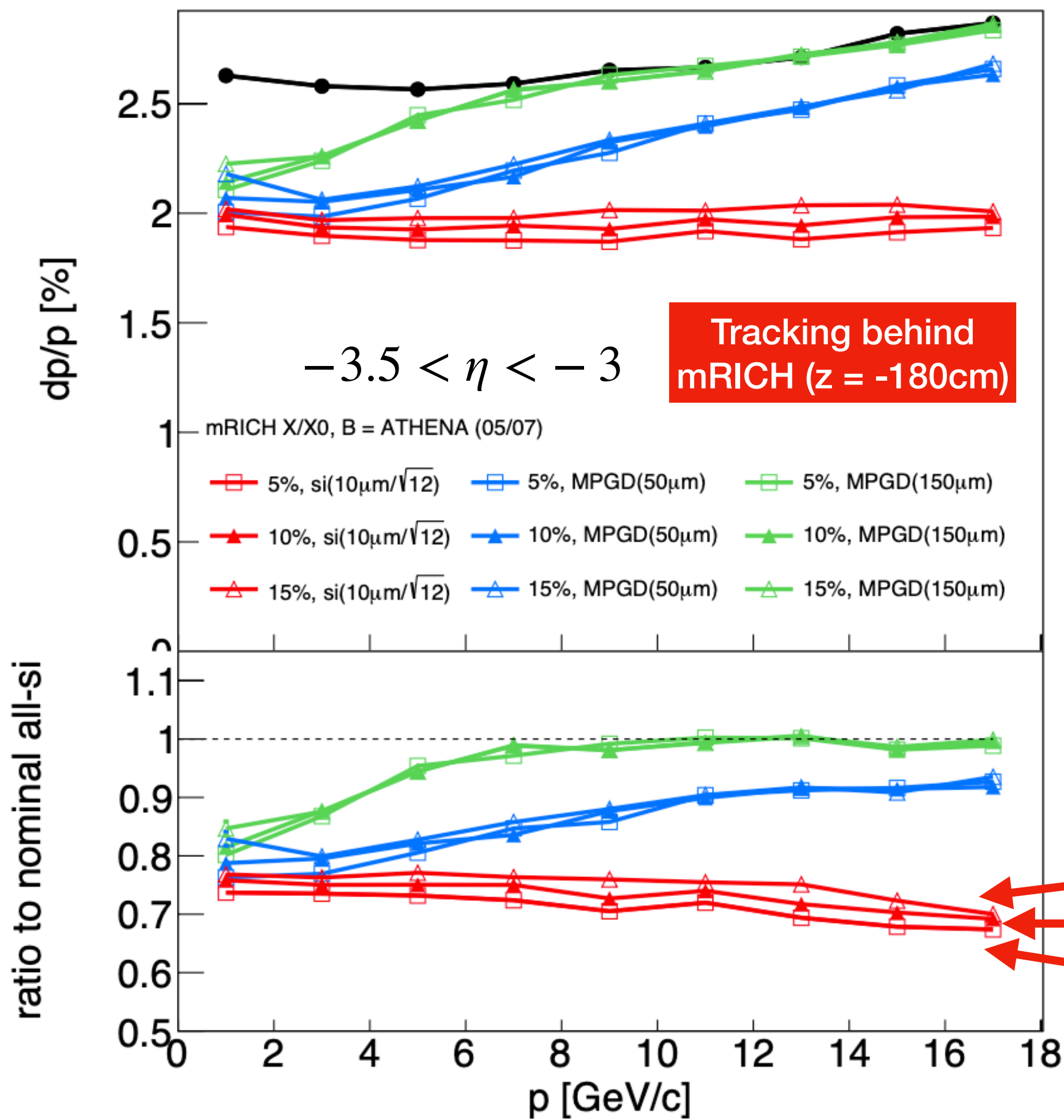
$m\text{RICH } X = 5\% X_0$

$m\text{RICH } X = 10\% X_0$

$m\text{RICH } X = 15\% X_0$

At high η and low p both
GEMs and silicon disks
enhance the
momentum-resolution
performance up to
 $\approx 20\%$

Summary



All-Si tracker only

All-Si tracker + si disk

All-Si tracker +
MPGD ($\sigma = 50\mu\text{m}$)

All-Si tracker +
MPGD ($\sigma = 150\mu\text{m}$)

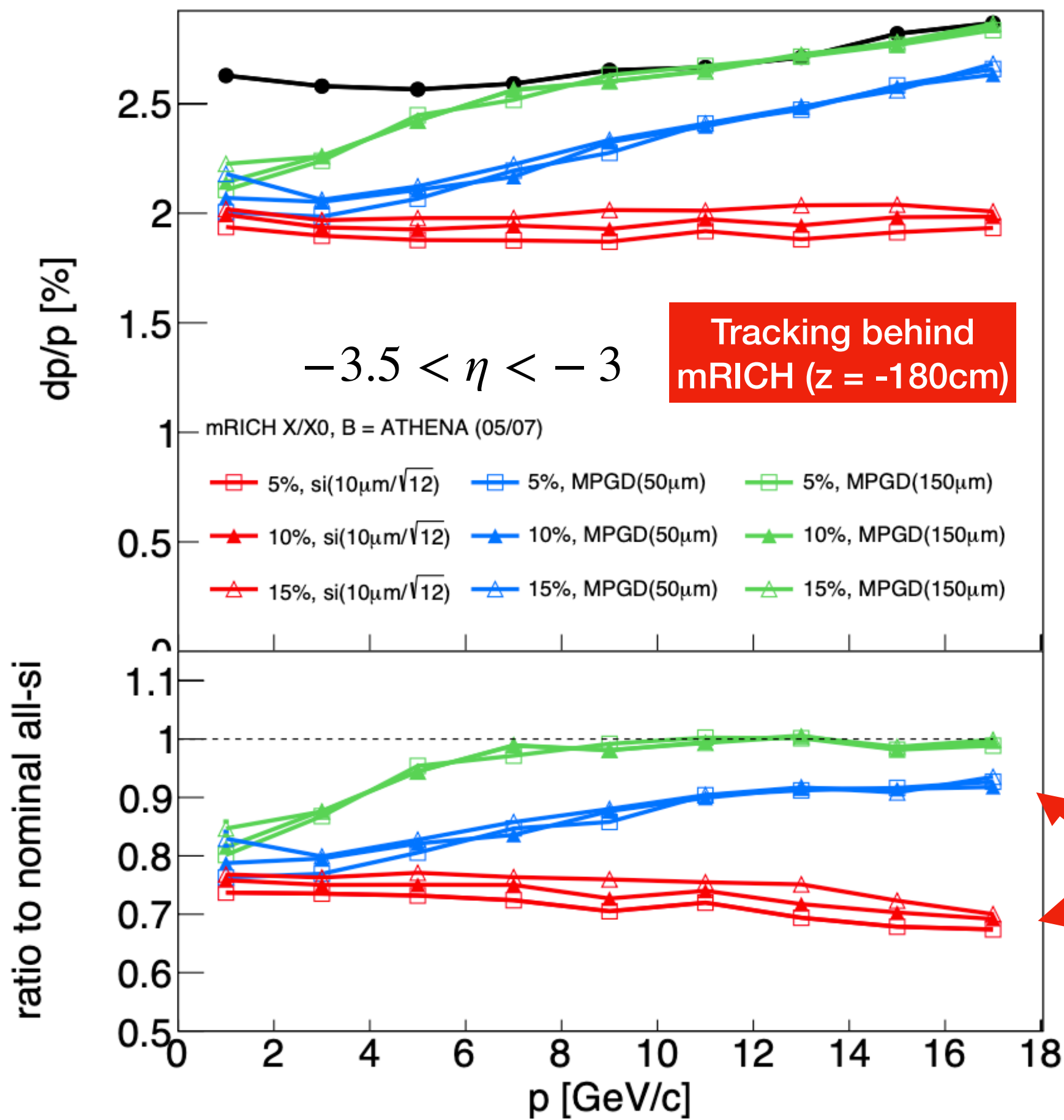
mRICH X = 5% X0

mRICH X = 10% X0

mRICH X = 15% X0

The performance does not change significantly for the different mRICH material budgets (even in the pessimistic case)

Summary



All-Si tracker only

All-Si tracker + si disk

All-Si tracker +
MPGD ($\sigma = 50\mu\text{m}$)

All-Si tracker +
MPGD ($\sigma = 150\mu\text{m}$)

mRICH X = 5% X0

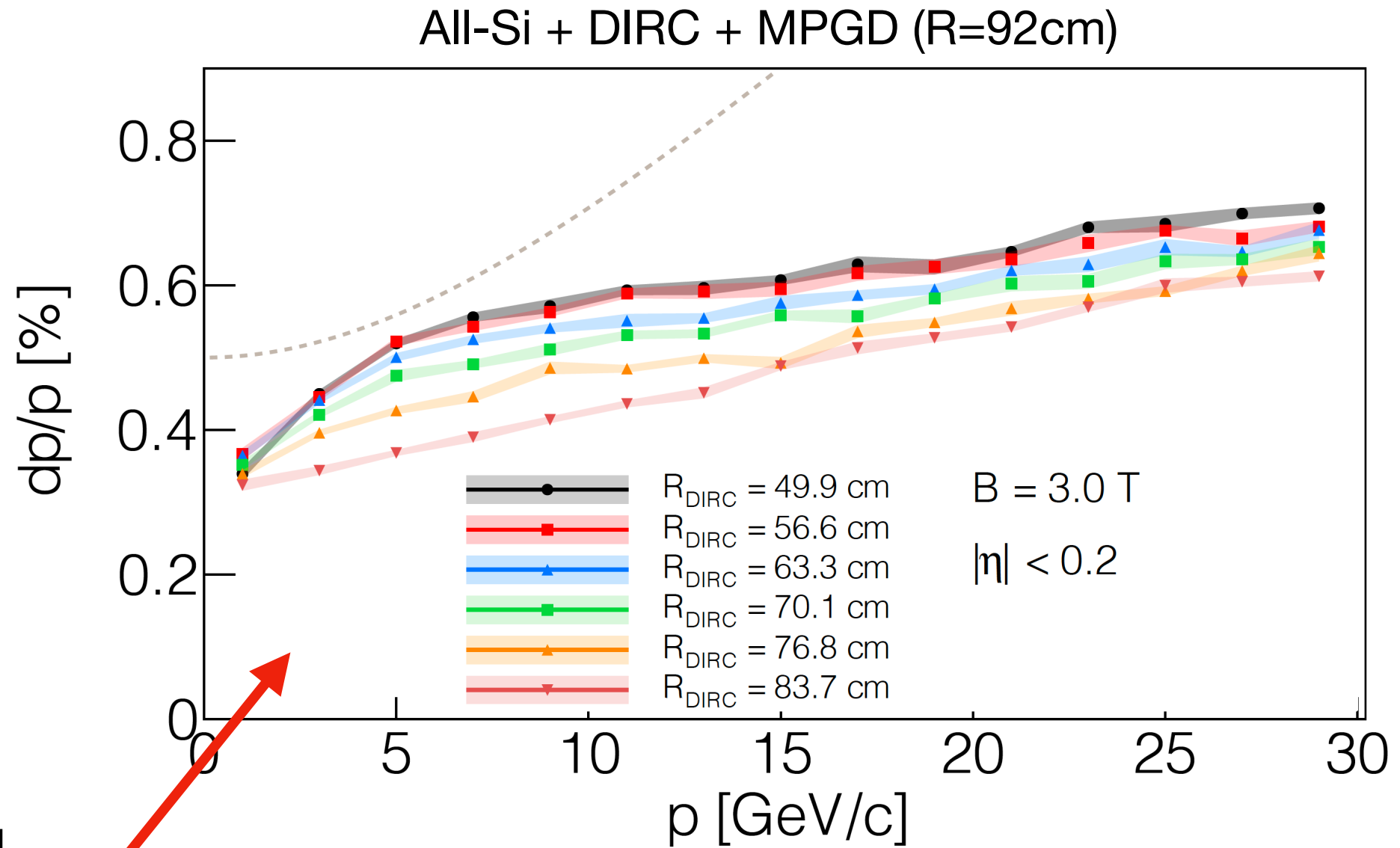
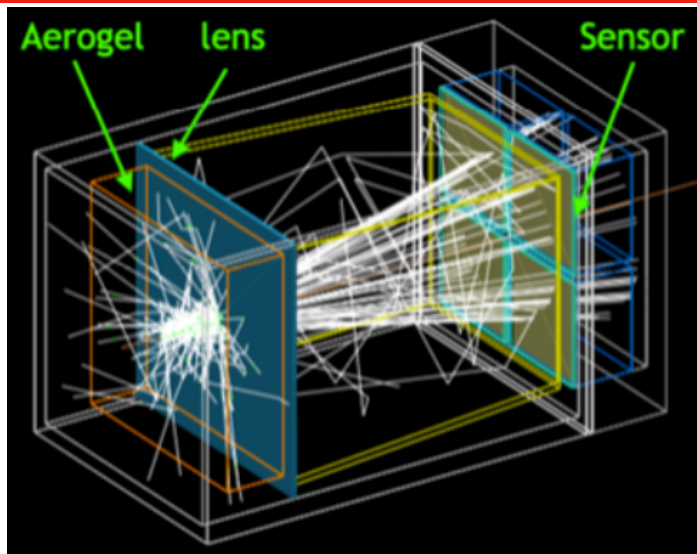
mRICH X = 10% X0

mRICH X = 15% X0

With a silicon disk or a
 $\sigma = 50\mu\text{m}$ GEM, the
performance is better
than with the nominal
all-silicon tracker in the
entire range (at higher η)

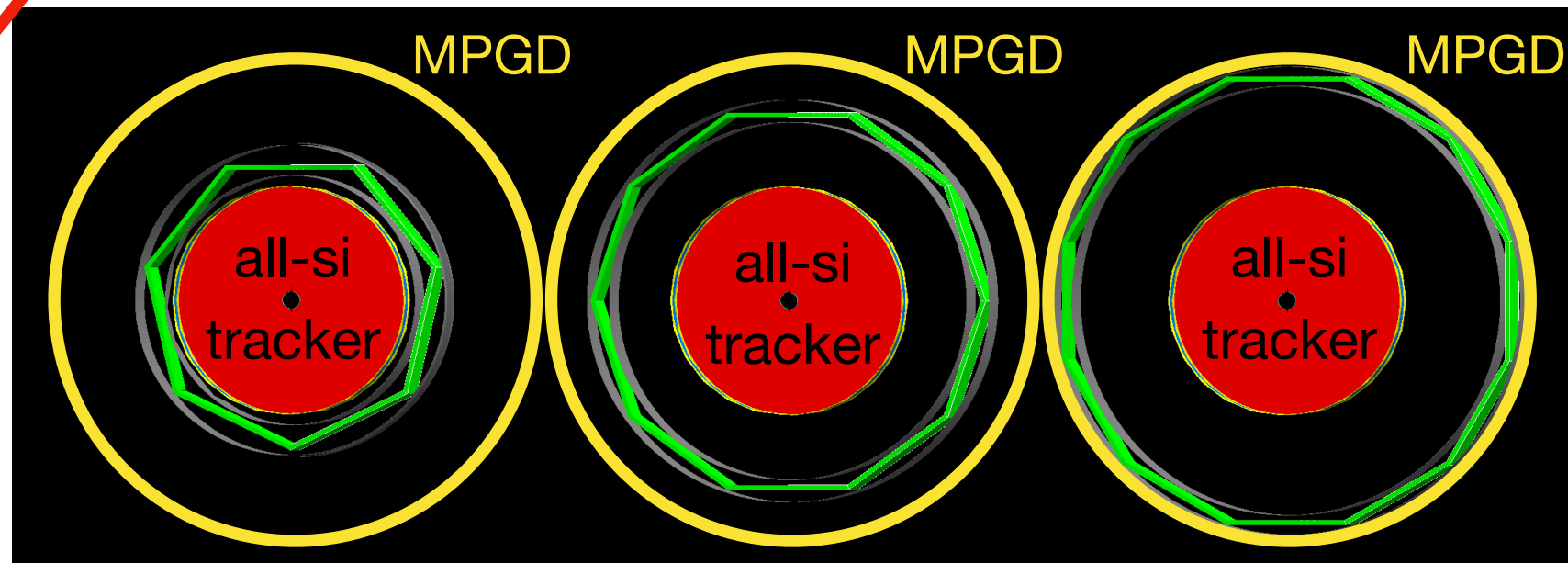
Caveat!

In these simulations the mRICH was modeled with all the material concentrated towards the back (higher $|z|$)

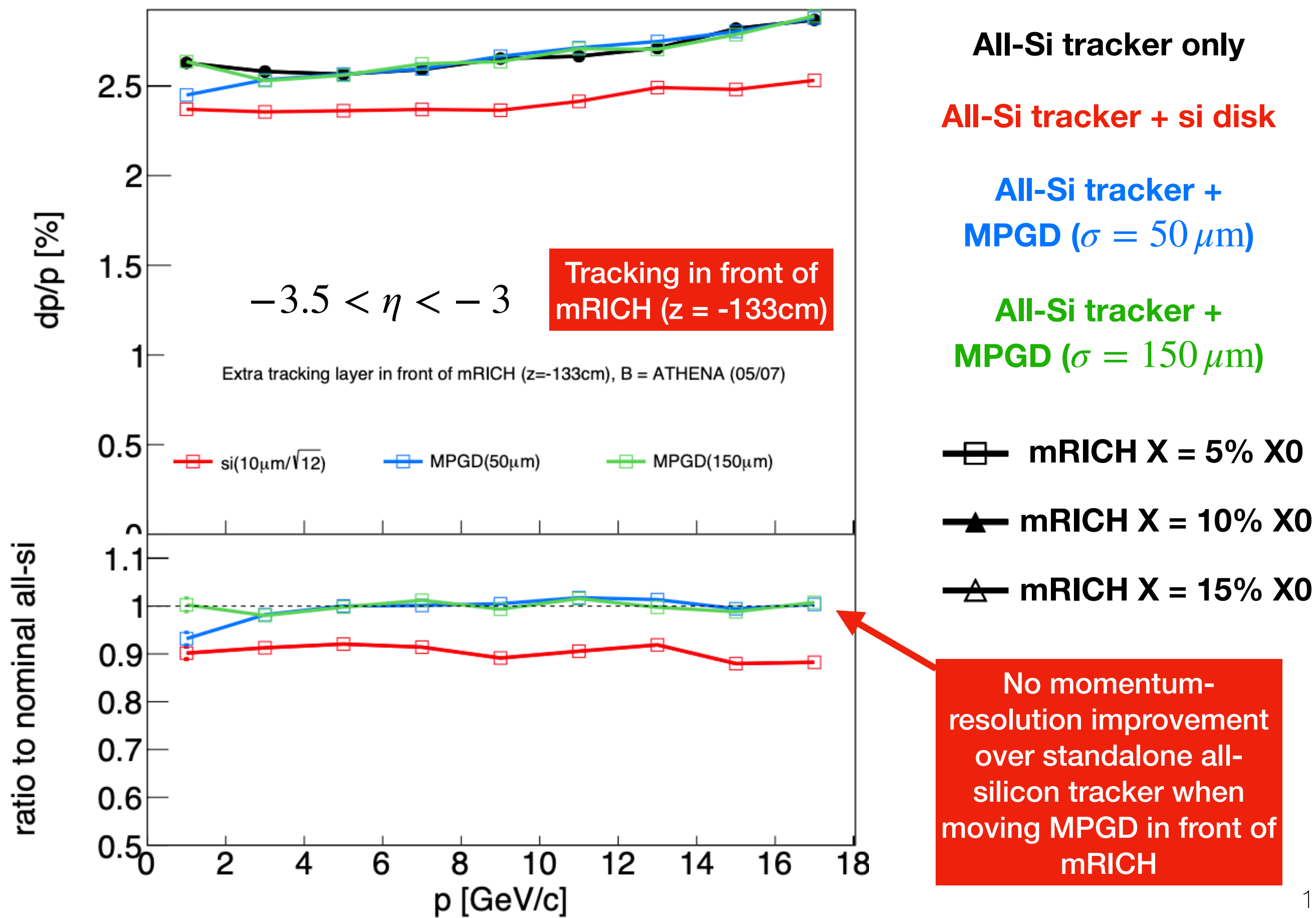


This study should be repeated with a more realistic mRICH geometry and placement

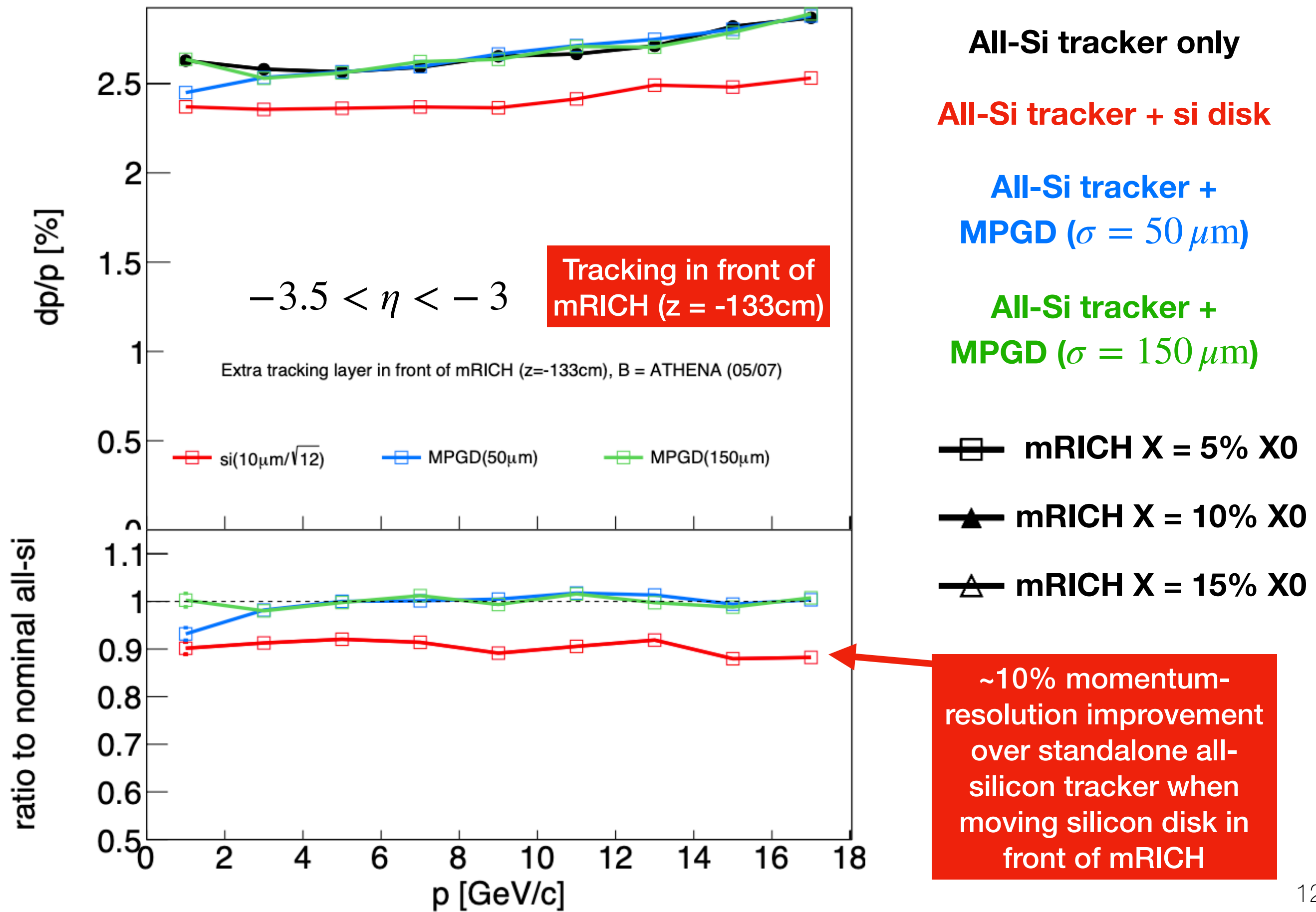
The distance between scattering centers and tracking layers affects the momentum resolution.



Tracking (MPGD or Si disk) in front of mRICH



Tracking (MPGD or Si disk) in front of mRICH



Thanks