Update on the momentum resolution by MCS with the angle method

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- **Improved estimate of ΔP/P**
- **ΔP/P parameterisation as a function of the number of cells and P**

Reference: Opera note OPLAPP 1812-01

How to define the resolution?

Momentum measurement ⇒ determination of ΔP/P

Previous estimate : RMS or σ of gaussian fit

not satisfactory : asymetric with long tails

fitted function = «expected» function

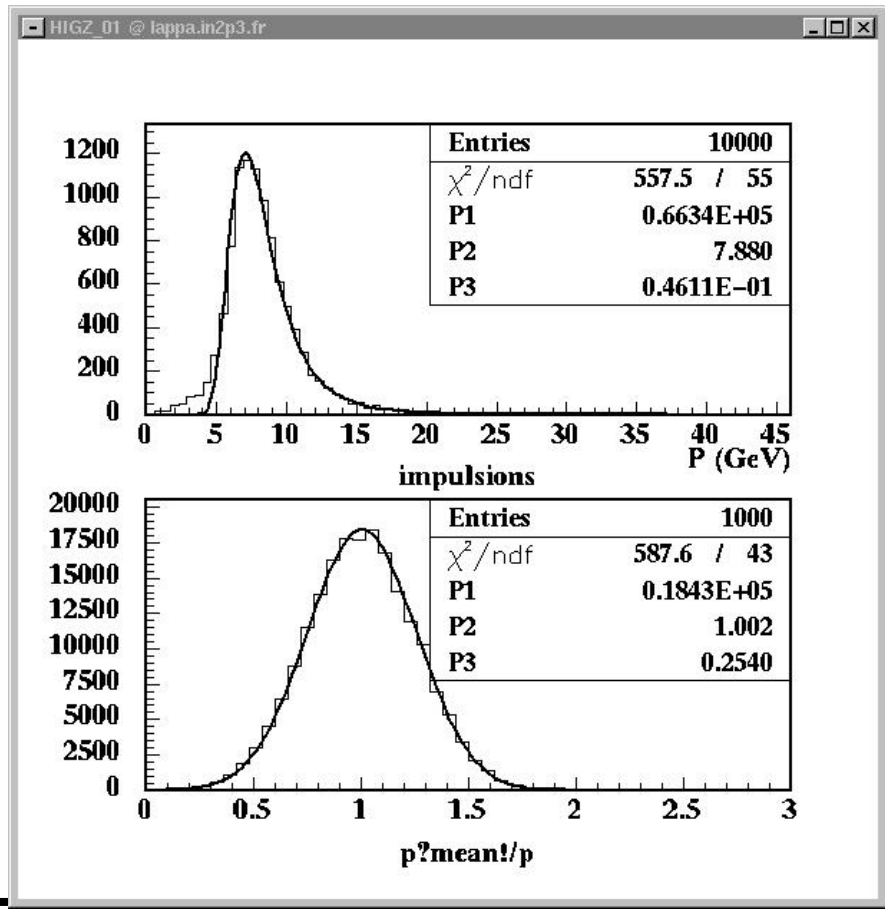
$$f(p) = \frac{1}{p^2}\,\mathrm{par}(1)\exp\left(\frac{-(1/p - 1/\mathrm{par}(2))^2}{\mathrm{par}(3)^2}\right)$$

express f as a function of 1/p ⇒ g(1/p)

g(1/p) is gaussian

- **ΔP/P = Δ(1/P)/(1/P)**

8 GeV muons



Momentum resolution results

muons measured with 56 films (1 brick)

Old estimate was really **underestimating the resolution** : RMS was not a good choice.

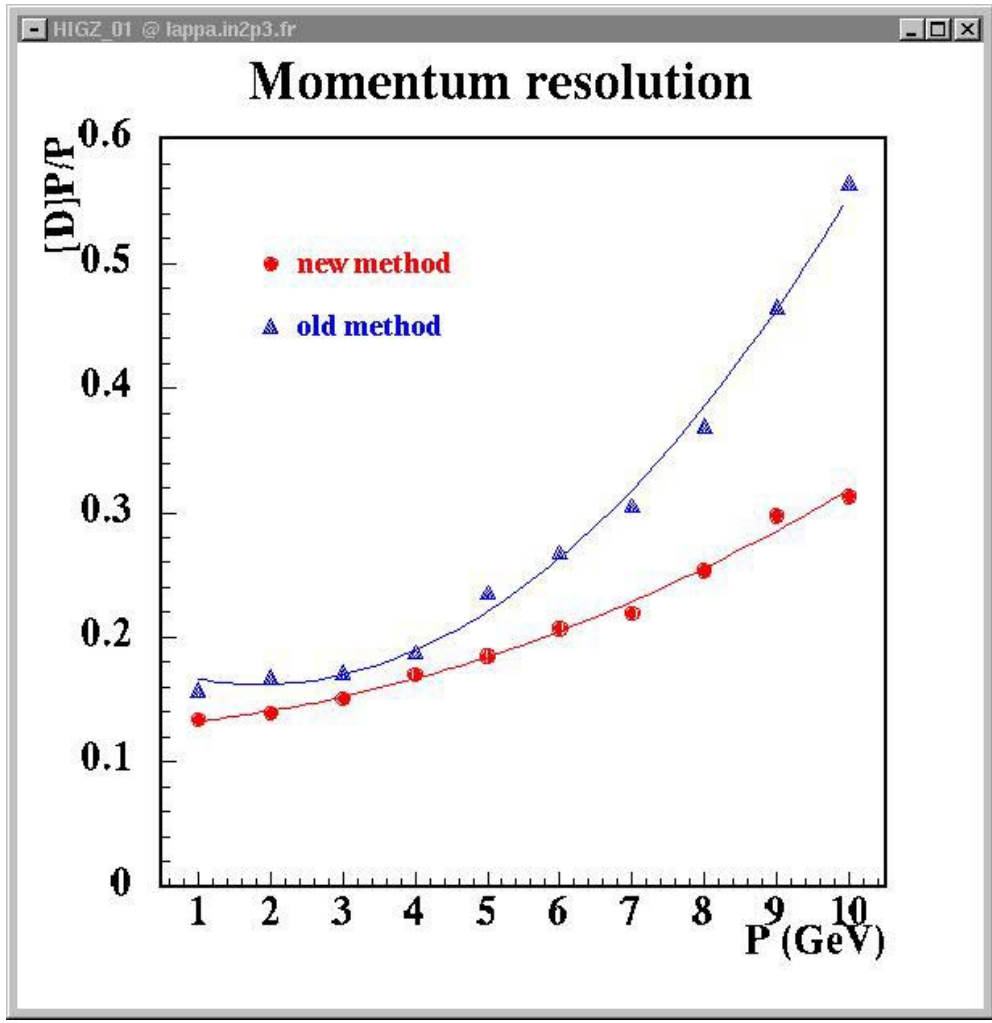
old parameterisation

$\Delta P/P = 0.16 + 1.1\times10^{-2}\ p + 4.8\times10^{-3}\ p^2$

new parameterisation

$\Delta P/P = 0.13 + 4.3\times10^{-3}\ p + 1.6\times10^{-3}\ p^2$

$\Delta P/P < 20\%$ for $p < 7$ GeV



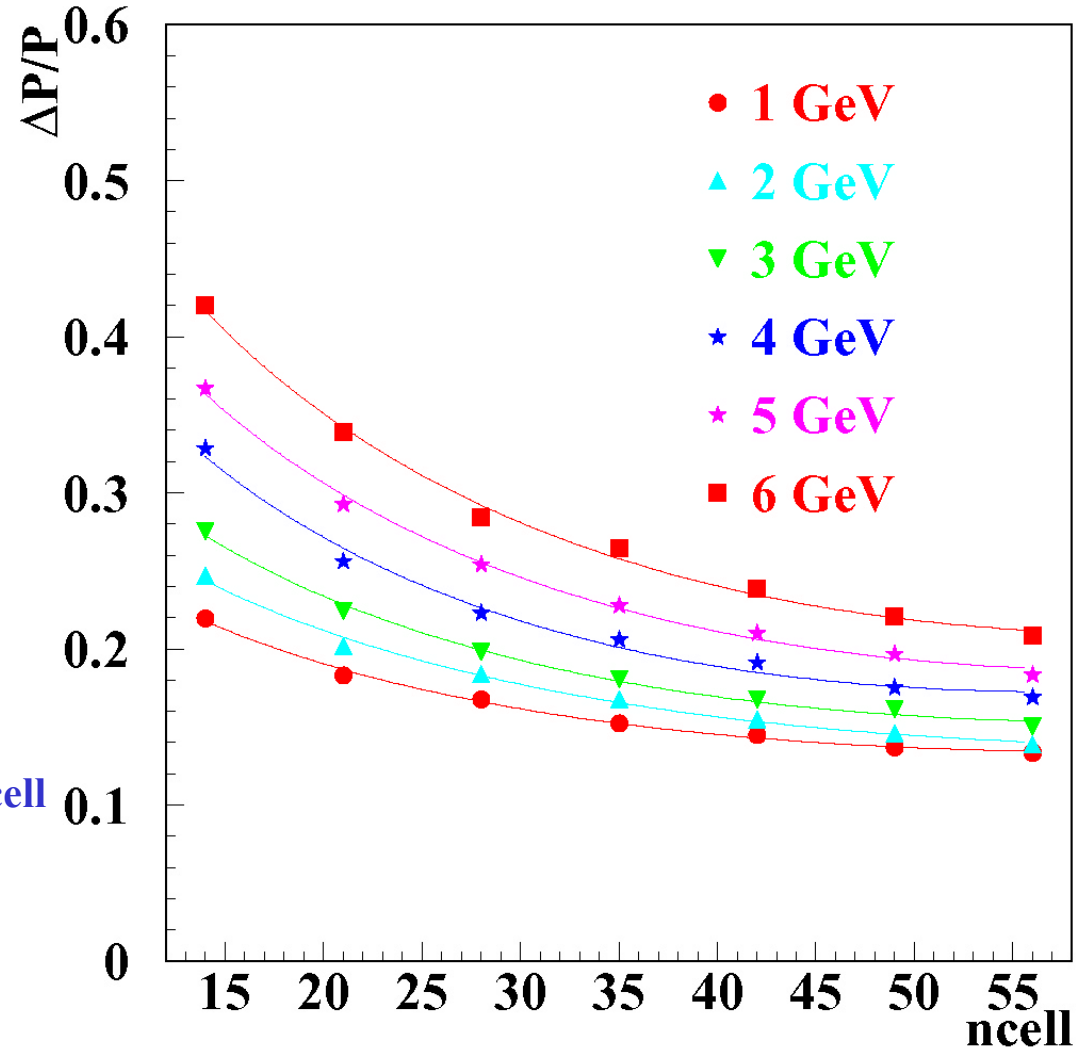
Momentum resolution as a function of the number of cells

$\delta\theta$=2mrad

• Resolution $\Delta P/P$ has been estimated with 14, 21, 28 ,42 and 56 cells for a fixed momentum

for a given p

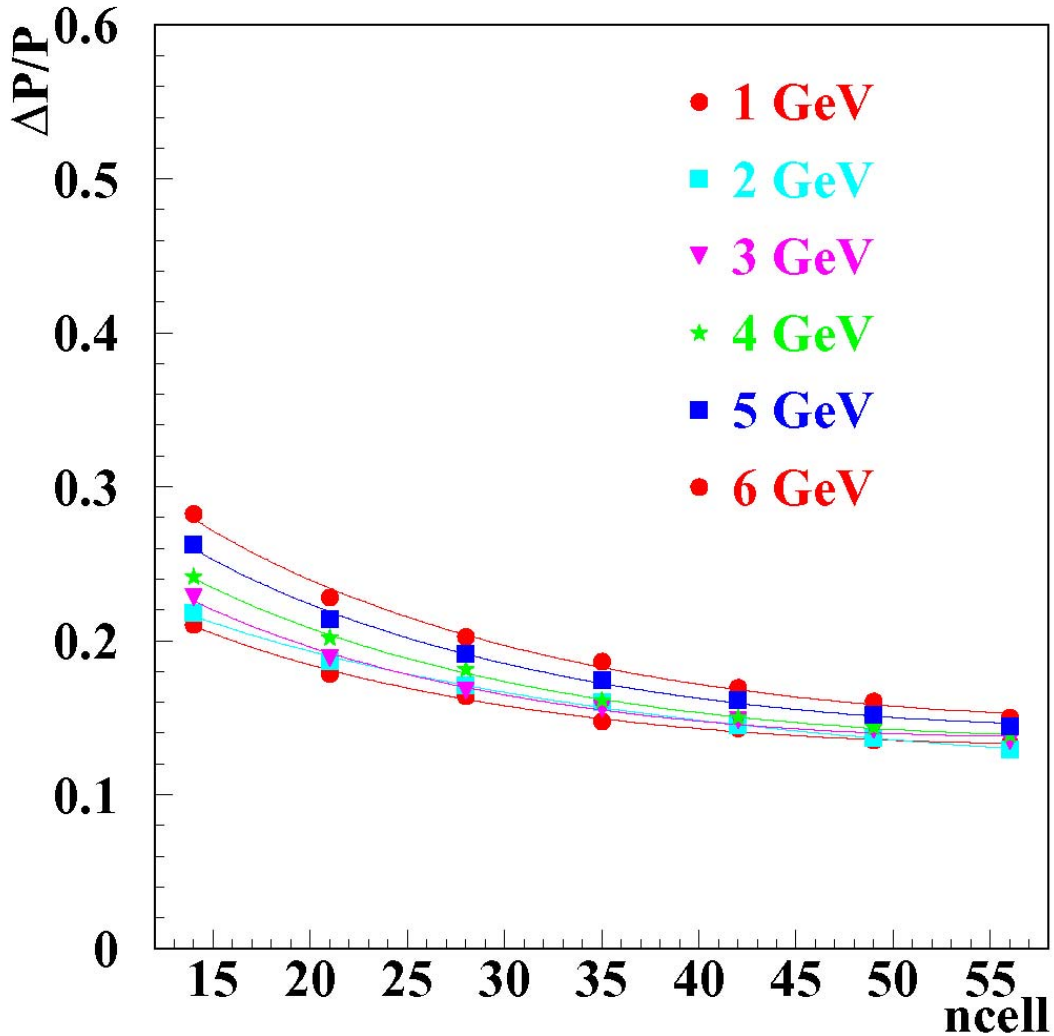
$$\Delta P/P = c + d \times n_{cell}^{0.5} + e \times n_{cell}$$



Momentum resolution as a function of the number of cells

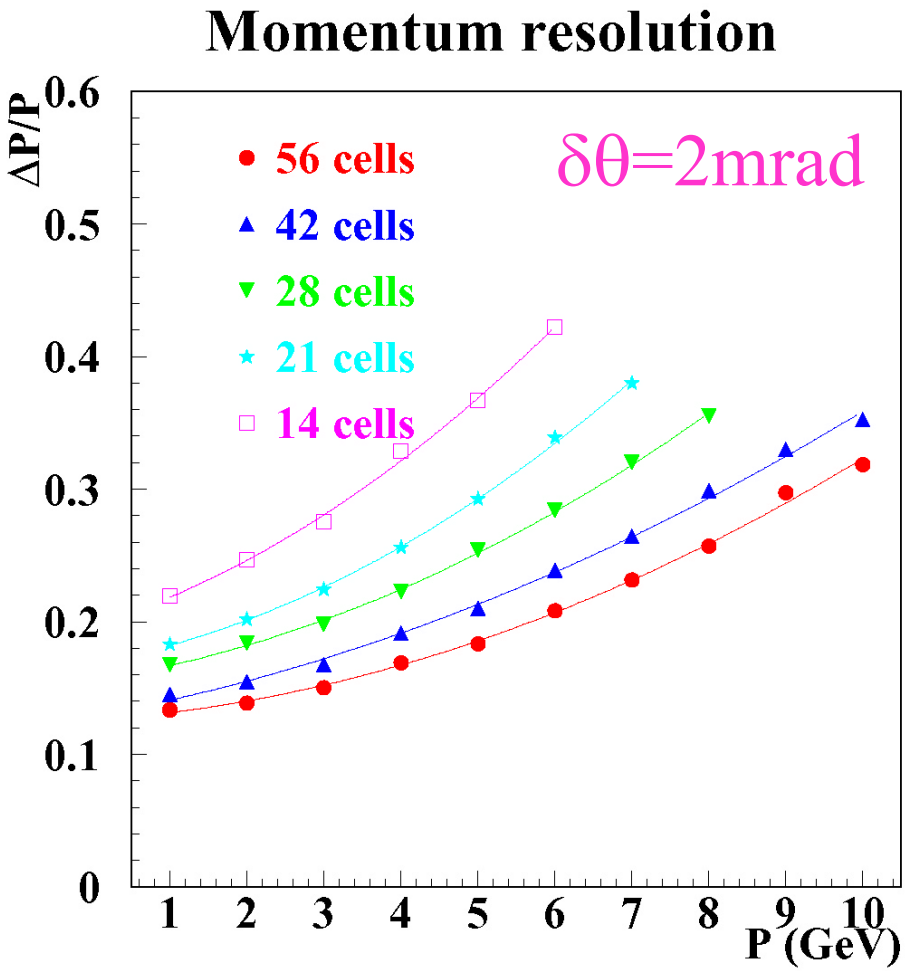
$\delta\theta$=1mrad

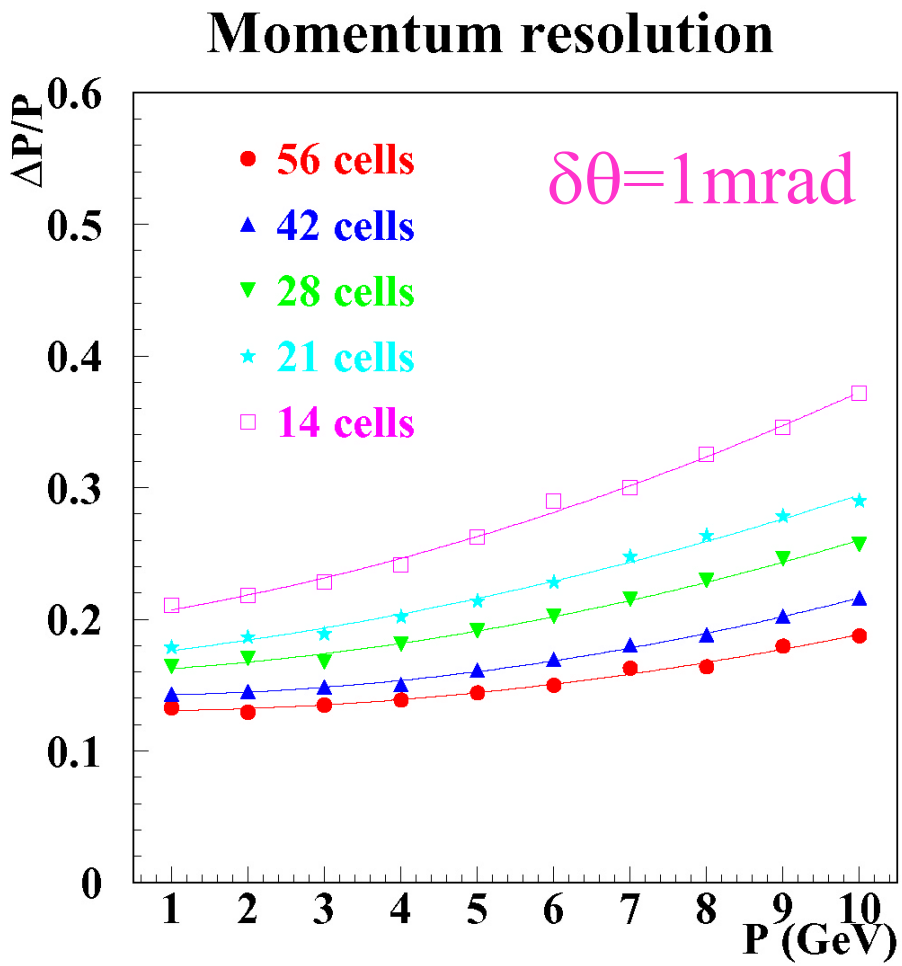
• Resolution $\Delta P/P$ has been estimated with 14, 21, 28 ,42 and 56 cells for a fixed momentum



Results

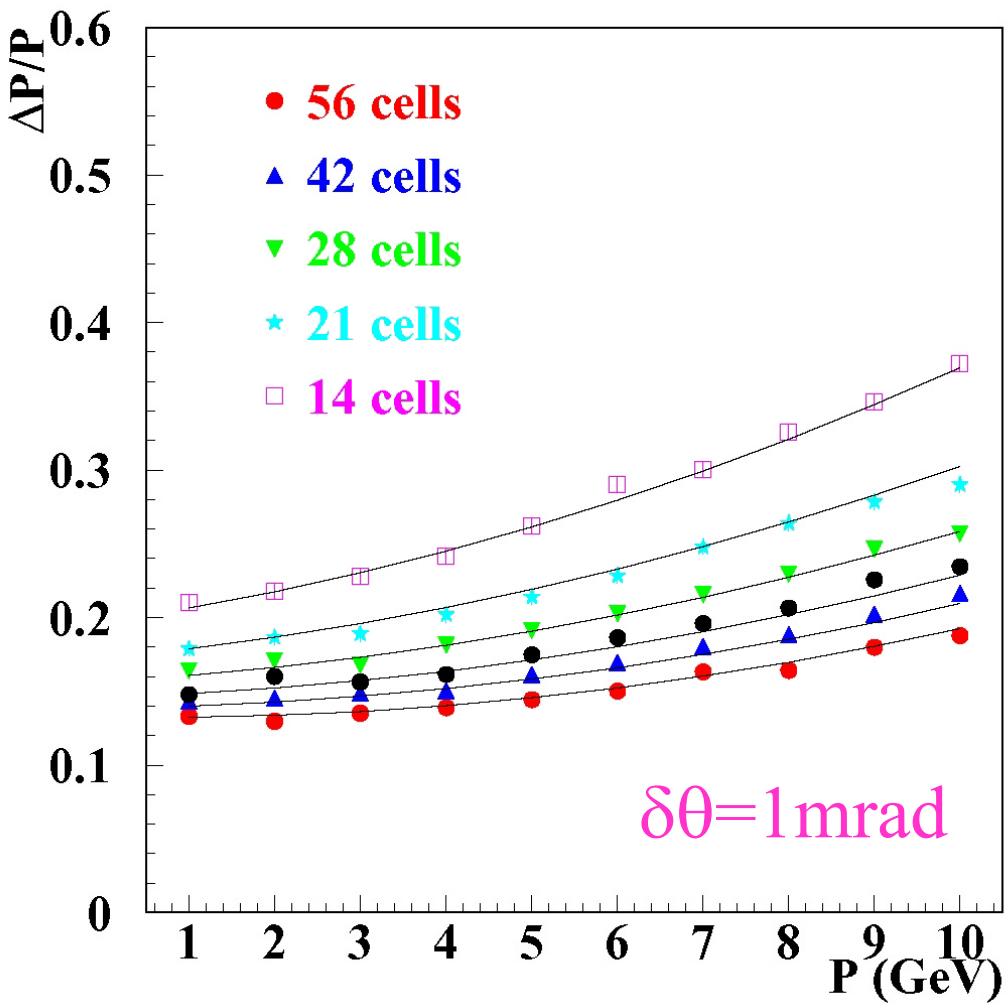
$$\Delta P/P = a + b \times p + c \times p^2$$





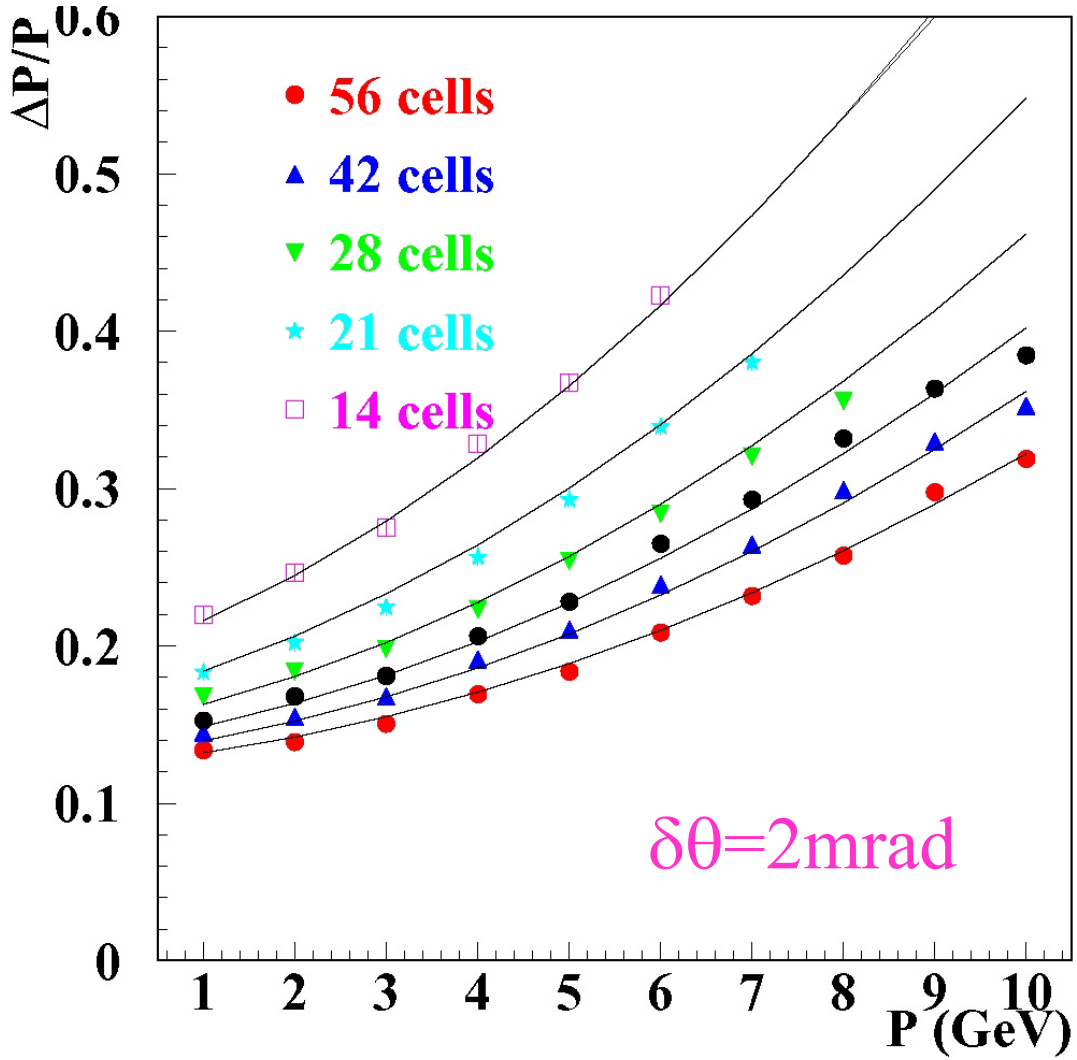
Global parametrisation with n_{cell} and p

$$\Delta P/P = (0.37 + 0.028\times p + 0.0020\times p^2) - (0.062 + 0.0067\times p + 0.00042\times p^2) \times n_{cell}^{0.5} + (0.0040 + 0.00037\times p + 0.000034\times p^2) \times n_{cell}$$



Global parametrisation with n_{cell} and p

$$\Delta P/P = (0.39 + 0.056\times p + 0.0066\times p^2)$$
$$-(0.070 + 0.012\times p + 0.0013\times p^2) \times n_{cell}^{0.5}$$
$$+ (0.0046 + 0.00074\times p + 0.000083\times p^2) \times n_{cell}$$



Conclusion

- **An estimation of the momentum resolution is now possible for each momentum and each number of cells** for 1 and 2 mrad resolution
- **An update of the previous note is being written**