Momentum Estimate from Multiple Scattering -

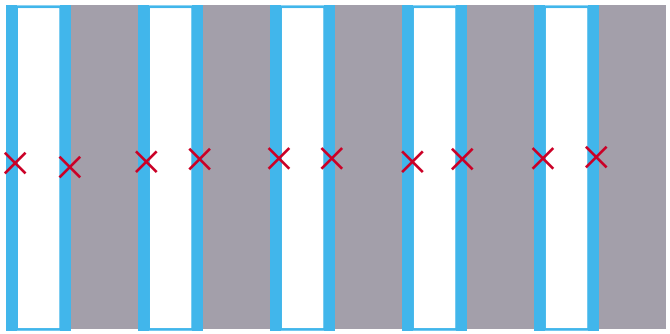
- Second ~independent method to compare to Nagoya
- Use on all found kinks (if data exists) for background study
- Use on candidate events as consistency check

Presentation:

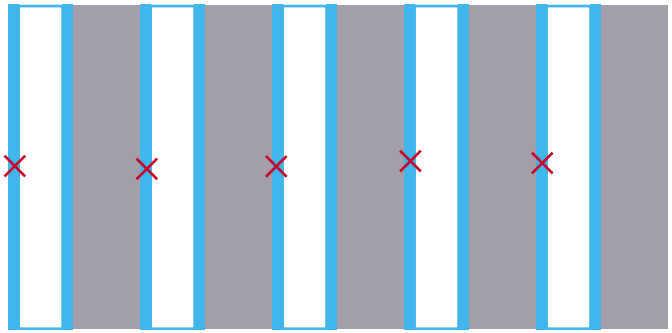
1) Method

2) Calibration

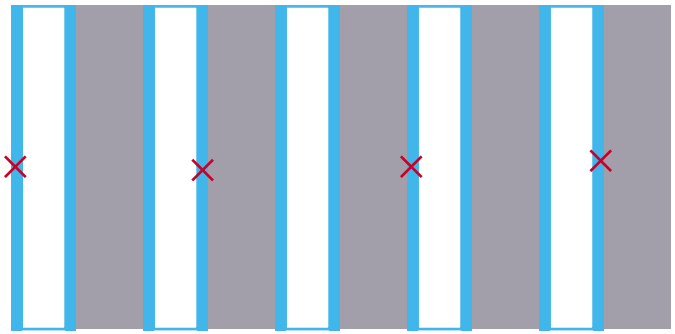
3) Candidate tracks



"skip 0"



"skip 1"



"skip 2"

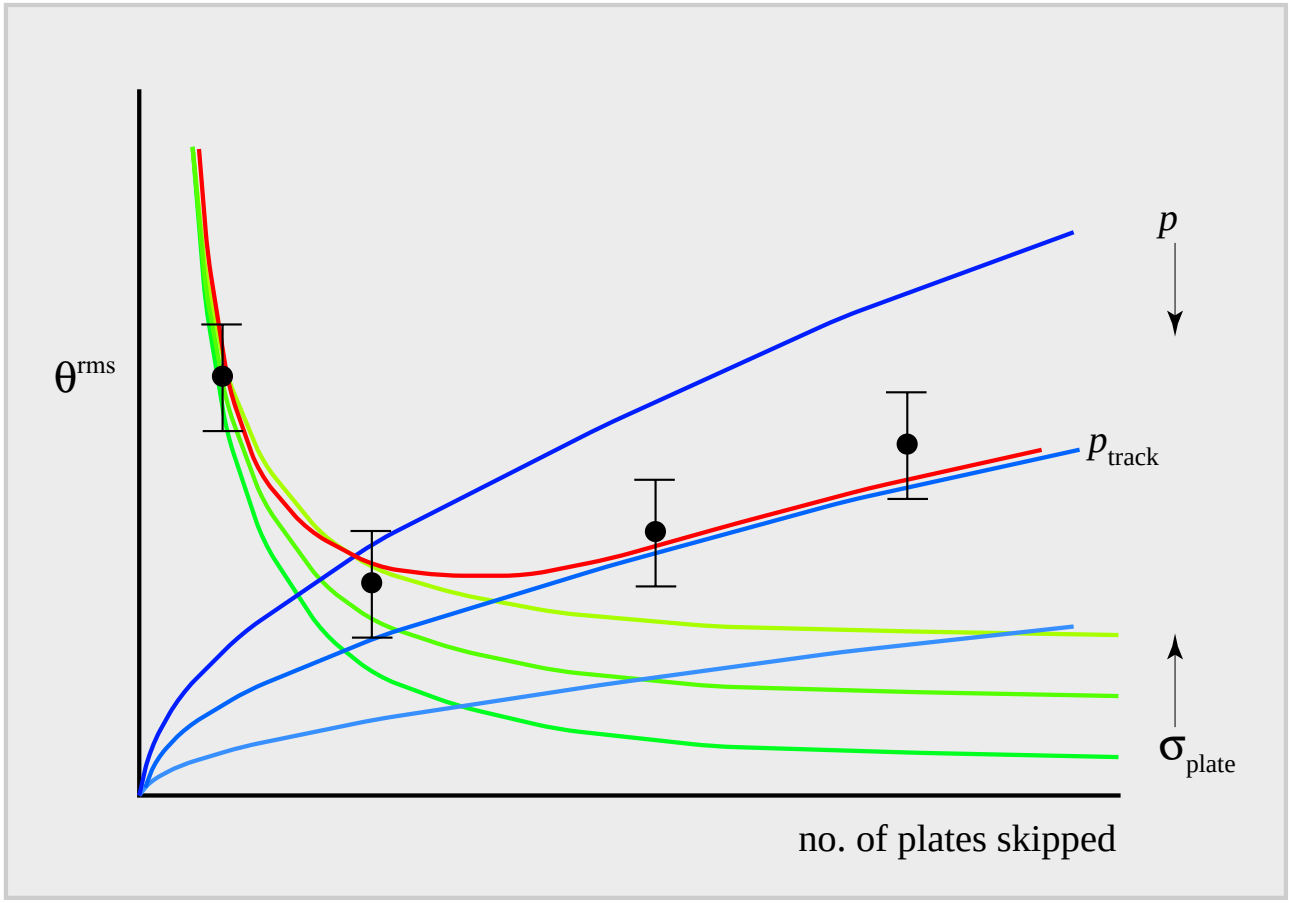
Different sets of data points are used to separate the effects of the finite angular resolution and the deflection due to multiple scattering.

The “skip 0” set yields one value for the rms of the angular difference between points (0,1) and (1,2) ...

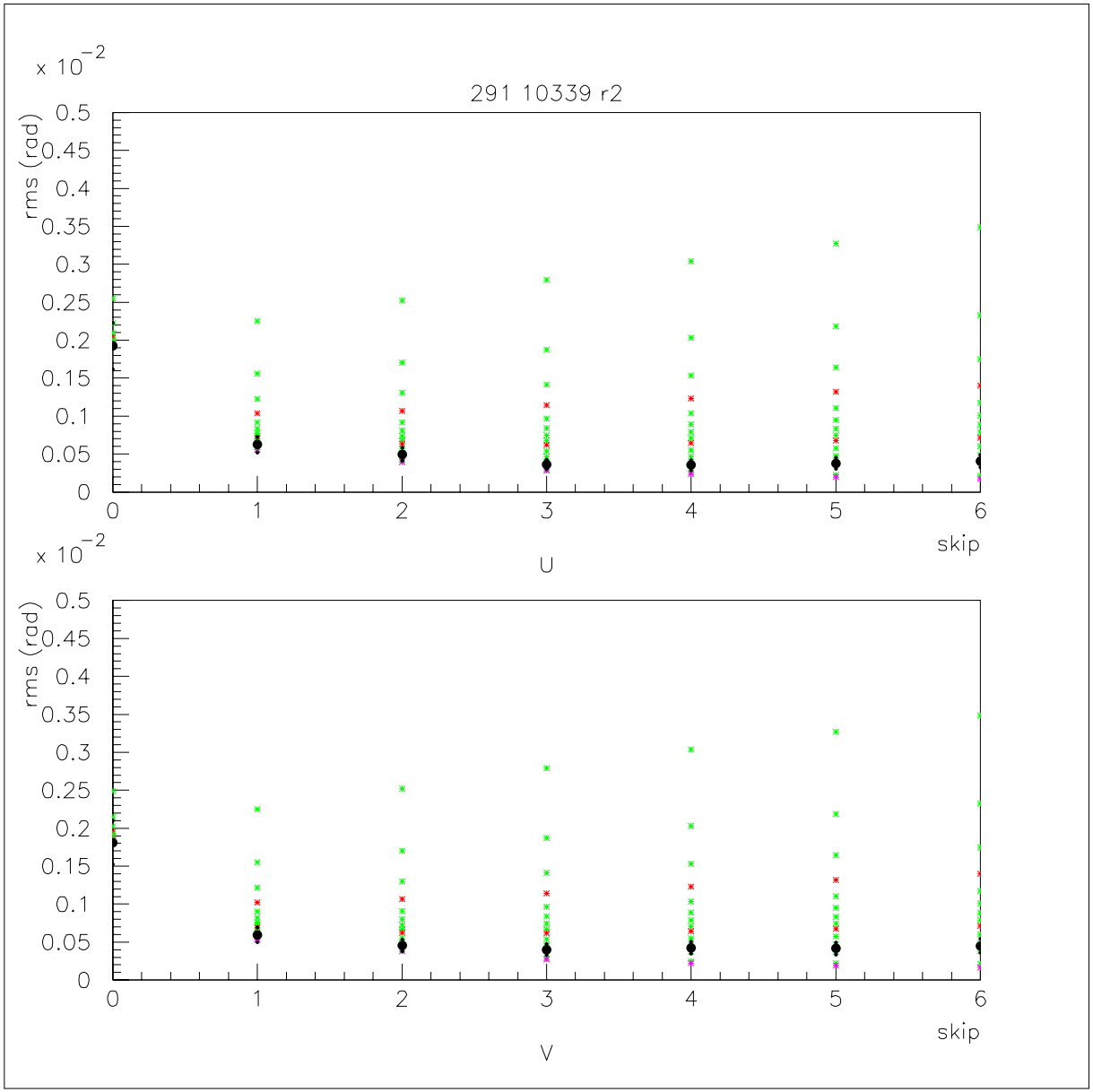
The “skip 1” set gives the rms between points (0,2) and (2,4) ...

The greater the “skip” the better the angular resolution, but lower statistics.

Many systematic effects come into play for the real data.

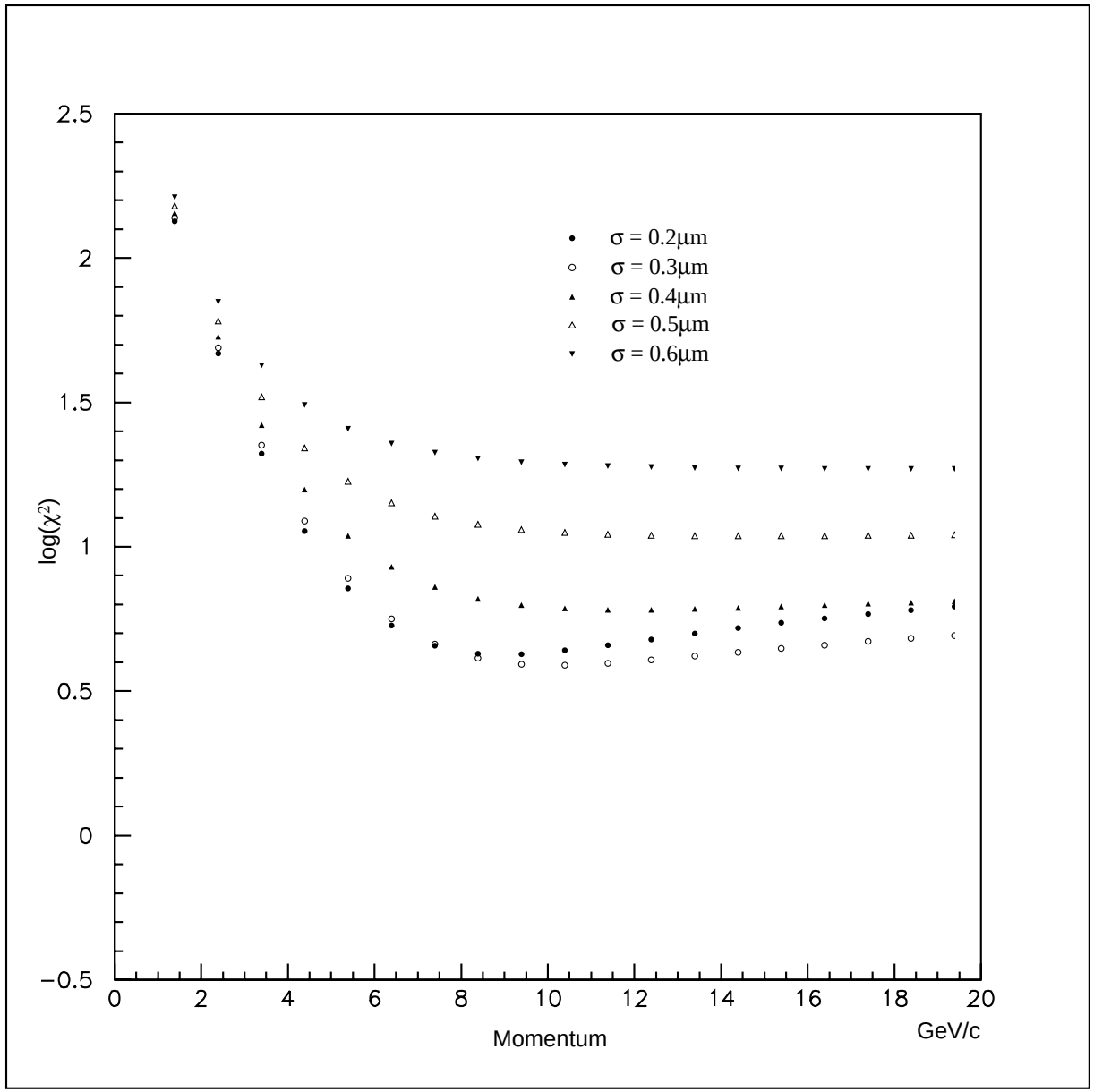


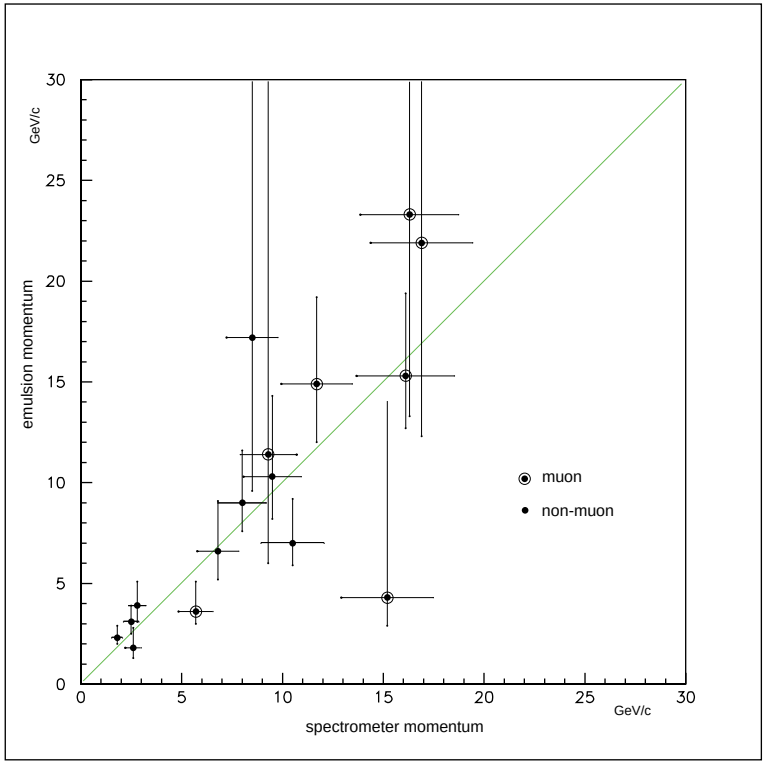
Schematic illustration of the algorithm for estimating track momentum using emulsion data. The rms width of the angular differences is measured as a function of interval between measurements (“skip”). There are two main contributions that add (quadrature) giving the total effect (red curve). The scattering due to finite momentum is shown as blue curves, and the effect of finite angular resolution is shown as green curves. Of course the actual measurements result in a set of points with errors. Both p and σ_{plate} are determined from the fit, for each track.


x 10^-2
291 10339 r2
rms (rad)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5
6
skip
U
x 10^-2
rms (rad)
skip
V

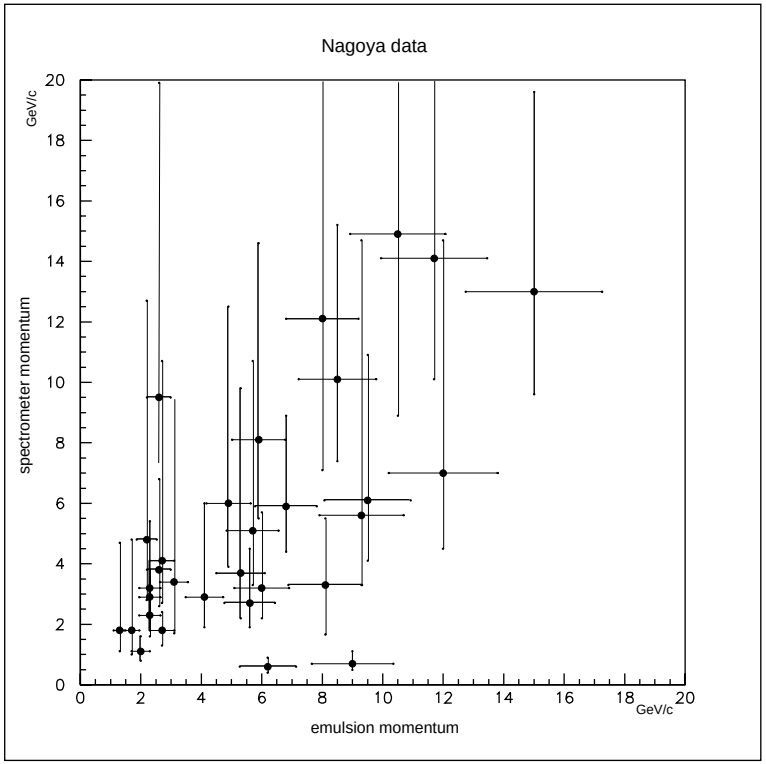
Example of output of fitting procedure:

11 GeV/*c* track *u* view





Comparison of momentum estimates between the emulsion data and spectrometer data for the "Fermilab" method



Comparison of momentum estimates between the emulsion data and spectrometer data for the "Nagoya" method

run	event	track	N_{plates}	p_{MS}(Nagoya)	p_{MS}(Fermi)
3024	30175	092-04391	13	2.9 [2.1 - 4.4]	6.1 [4.5 - 10.4]
3039	01910	171-04275	34	4.6 [3.7 - 6.1]	4.1 [3.4 - 5.2]
3263	25102	391-03610	15	1.9 [1.2 - 3.9]	1.86 [1.50-2.46]
3333	17665	562-07783	10	21.4[15.0-35.8]	10.5 [5.6 - ∞]

Phase 1 tau daughter momentum estimates.

Conclusions:

- The MS method of estimating the momenta of tracks is a very important part of the DONUT analysis

- It is limited by the number of calibration muons that are near the track of interest

- Interactions in downstream ~1cm of module require spectrometer data

- Total tau efficiency is probably 10% lower than estimated earlier