ACCEPTANCES FOR MU+ MU- EVENTS

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INTRODUCTION

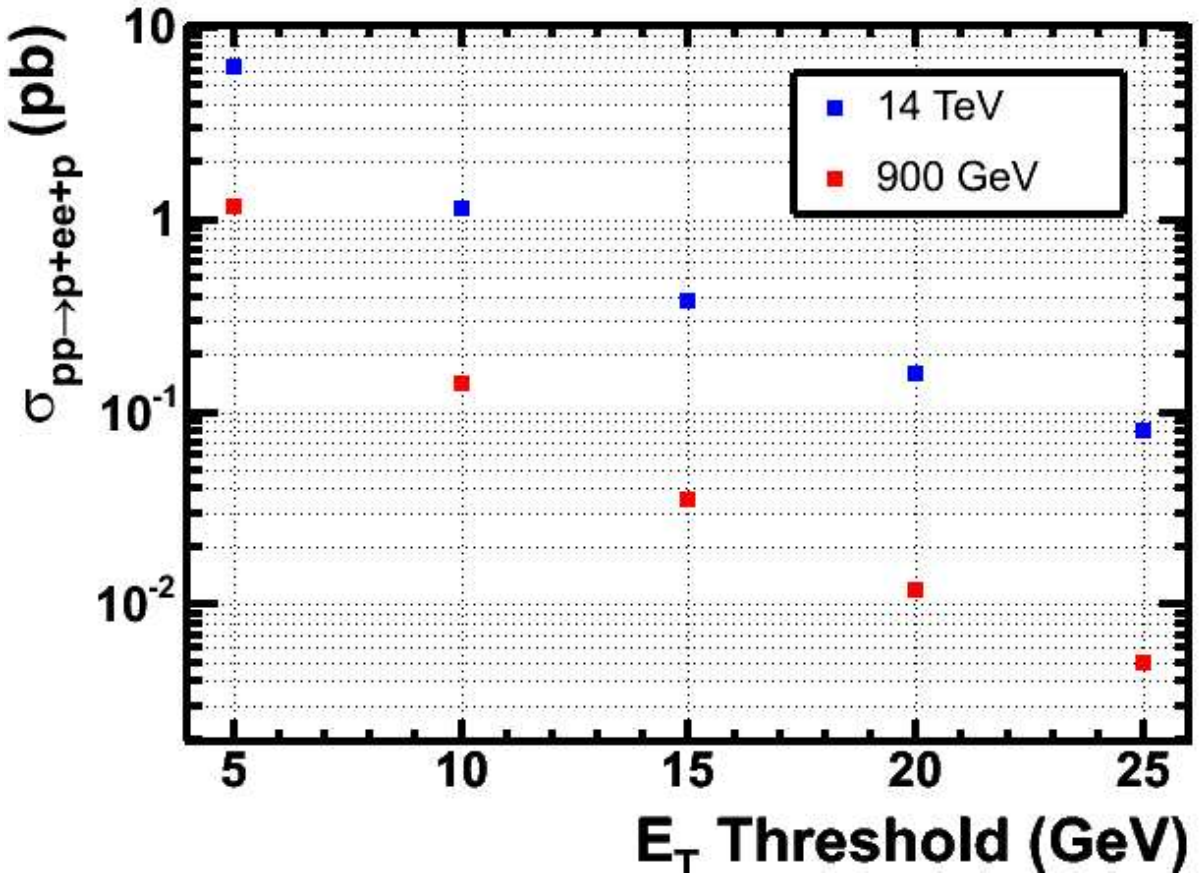
Obtained program **LPAIR** which simulates $\gamma\gamma \to l^+l^-$ from Andrew Hamilton (Alberta) who used it on his CDF analysis.
Thank you, Andrew.

Our proposal is to use the $\mu^+\mu^-$ process as a major part of our FP420 calibration procedure.

Reminder:

- Each proton radiates a photon; these interact to give a muon pair.
- Equivalent photon approximation: the two radiations are independent.
- Most photons continue elastically. We know the interaction point.
- From the $\mu^+\mu^-$ the p_z of each proton can be precisely calculated.
- (However the proton p_T values cannot be separated.)

OVERALL RATES



Comparison (A. Hamilton) between Tevatron and LHC cross sections (pB) using modelled trigger acceptance, as a function of p_T(min) of muons.

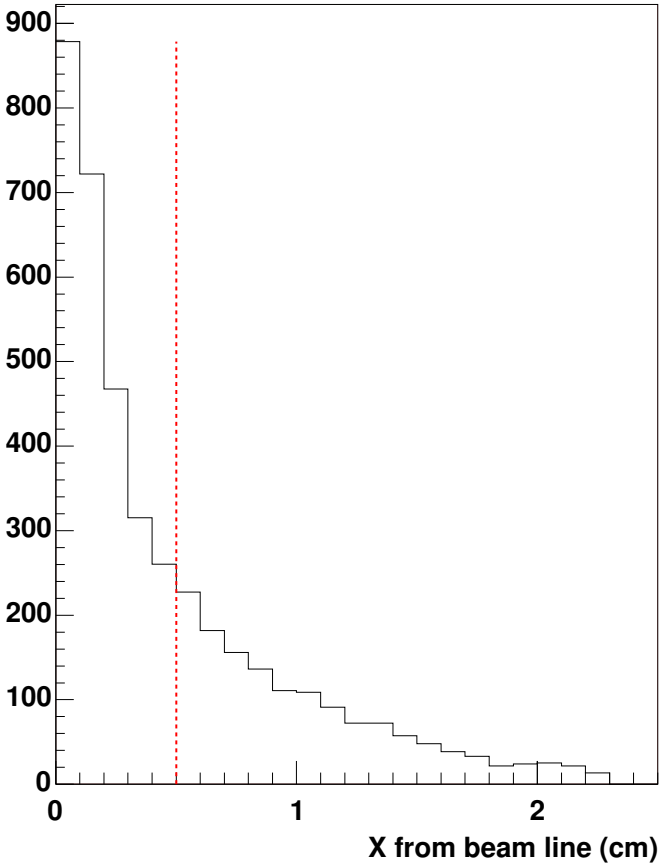
LHC ACCEPTANCES

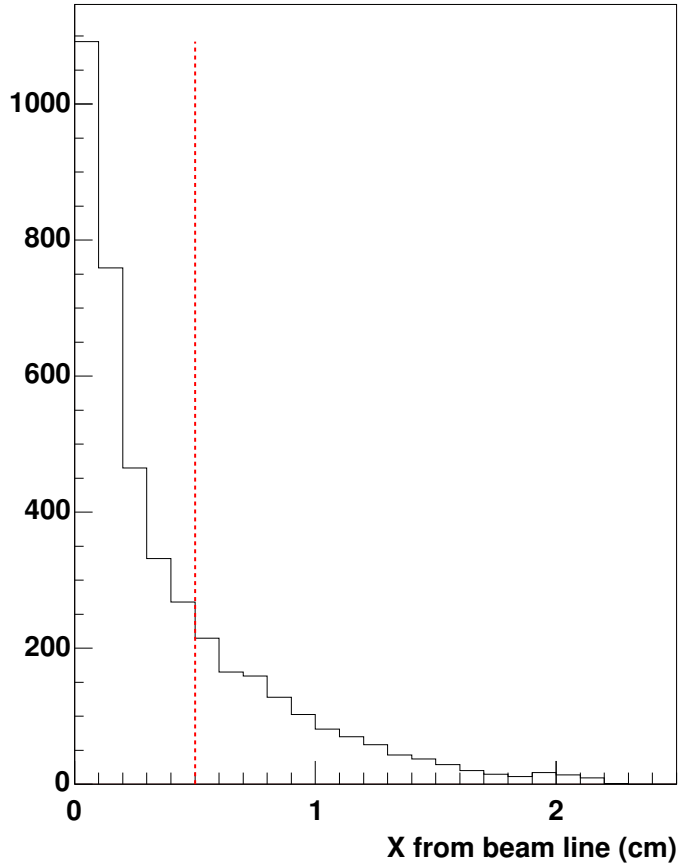
The acceptance rates are now calculated in more detail using ATLAS Level-1 trigger parameters:

- $p_T \geq$ **(currently) 6 GeV, (possibly) 4 GeV**
- $|\eta| < 2.5$

RATES (ATLAS)

$p_T \geq$ 6 GeV. Silicon distance 5mm at 420m.

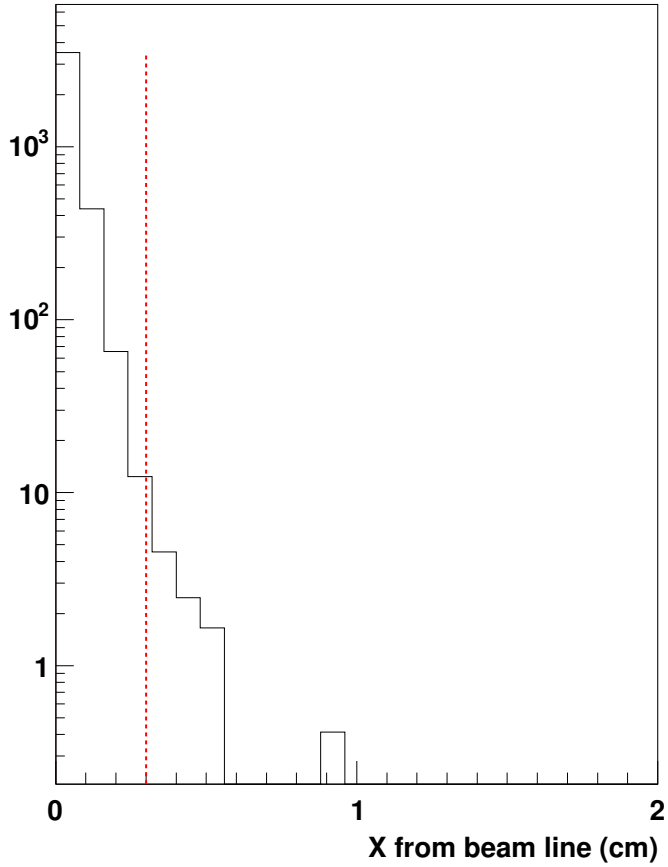


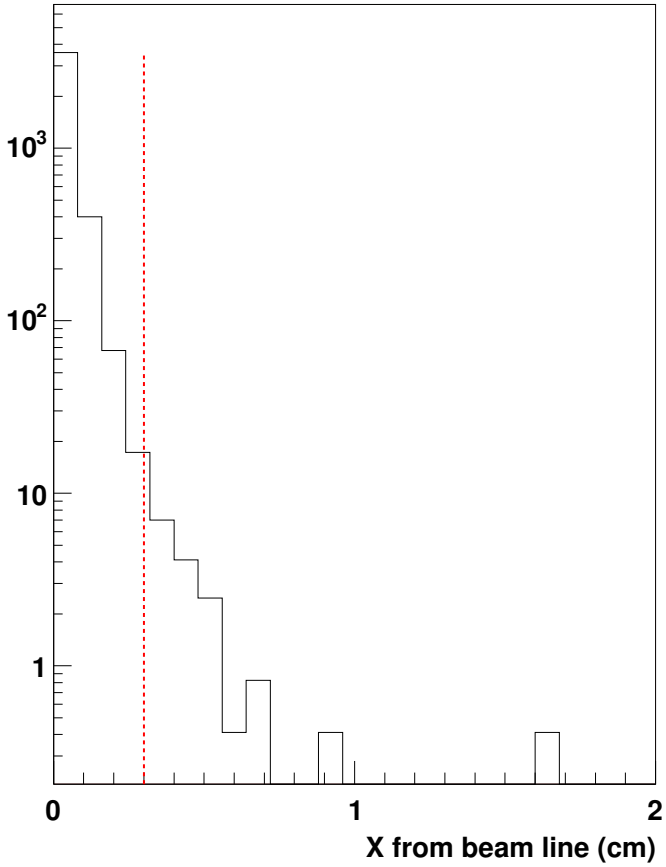


Side +, side −. Rates are single protons per fb $^{-1}$ per bin

RATES (ATLAS)

$p_T \geq$ 6 GeV. Silicon distance 3mm at 220m.

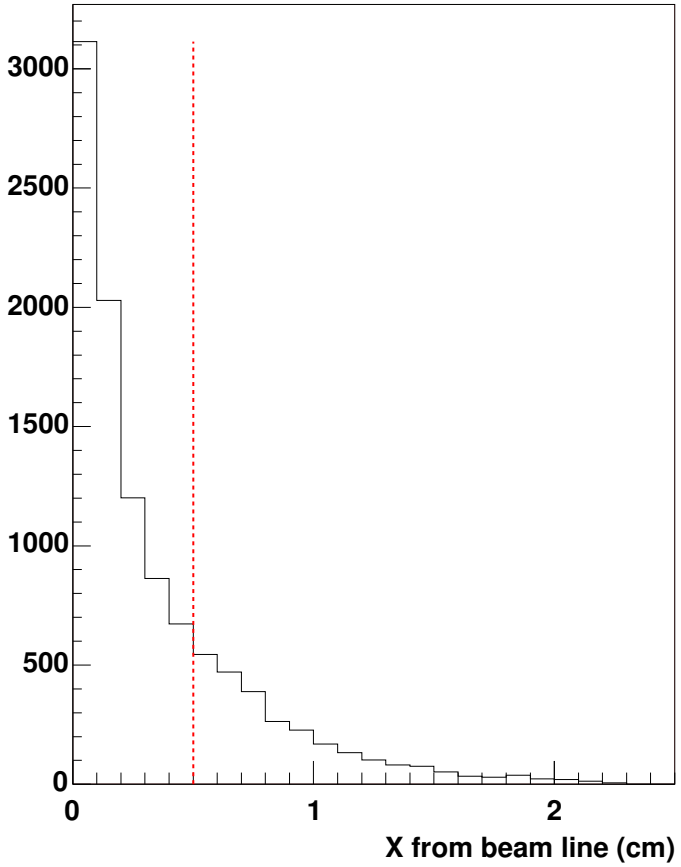


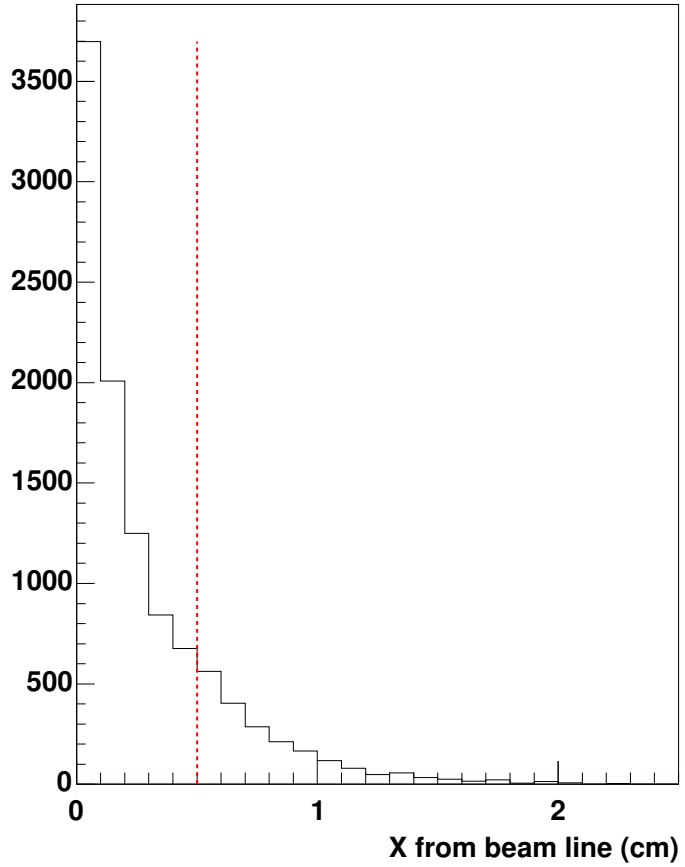


Side +, side −. Rates are single protons per fb $^{-1}$ per bin

RATES (ATLAS)

$p_T \geq$ 4 GeV. Silicon distance 5mm at 420m.

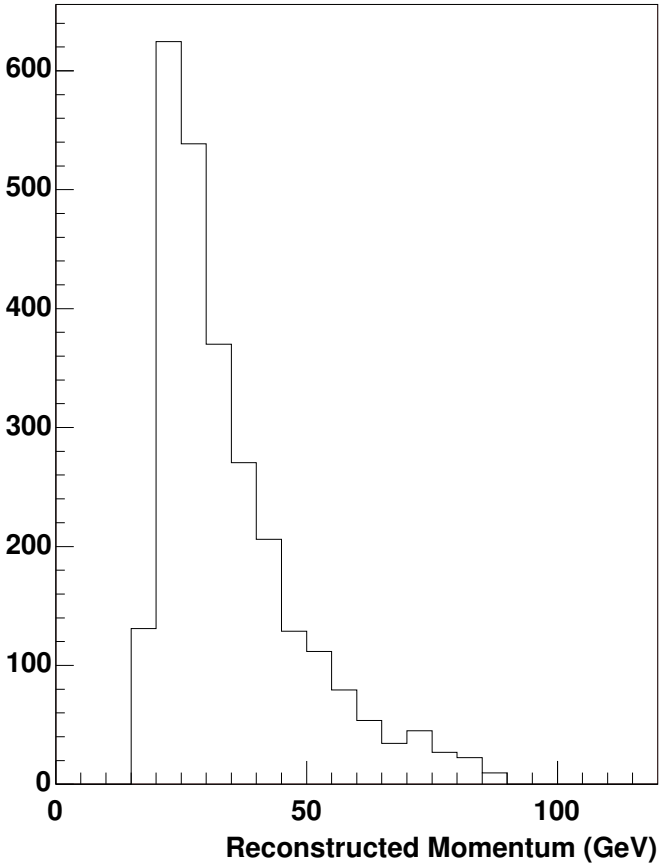


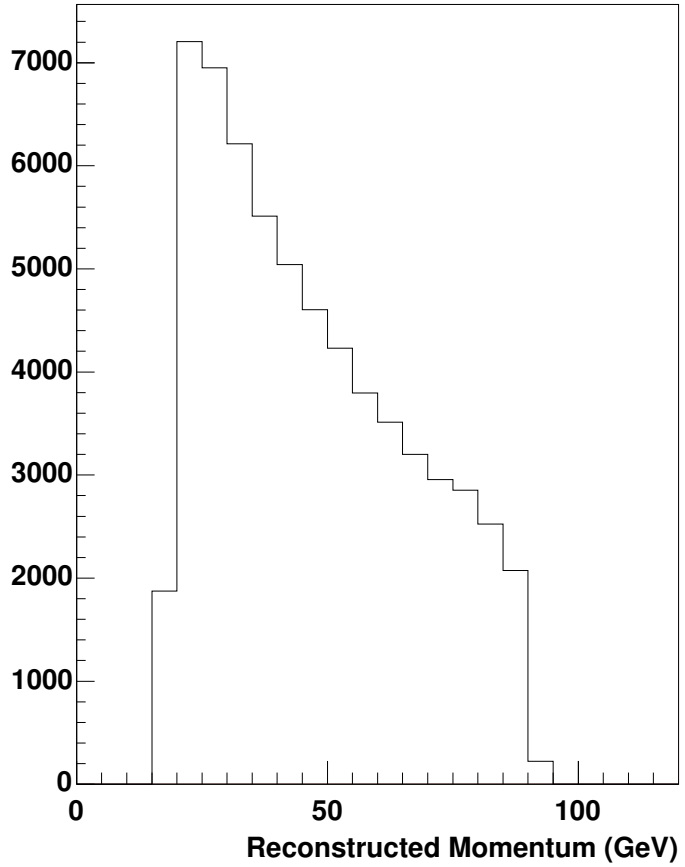


Side +, side −. Rates are single protons per fb $^{-1}$ per bin

MOMENTUM ACCEPTANCE (ATLAS)

$p_T \geq$ 4 GeV. Silicon distance 5mm at 420m.

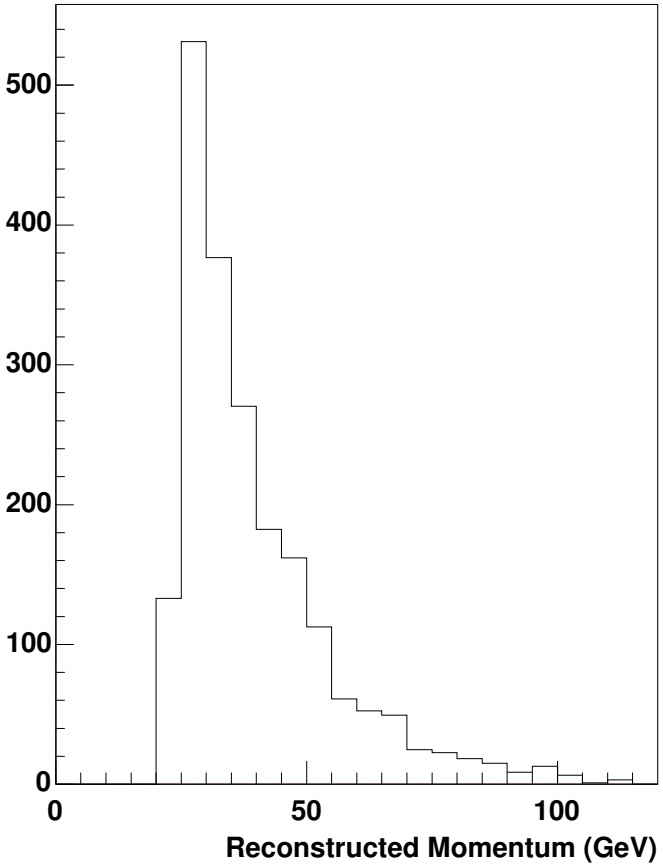


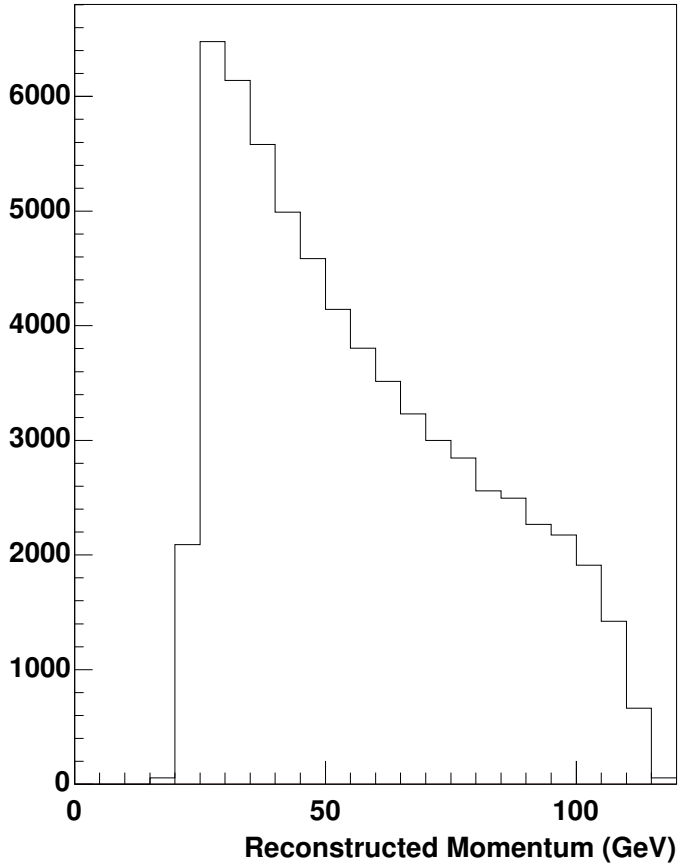


Side+. L: $\mu^+\mu^-$ rates per fb $^{-1}$ per bin. R: 'Typical' physics (unnorm)

MOMENTUM ACCEPTANCE (ATLAS)

$p_T \geq$ 4 GeV. Silicon distance 5mm at 420m.

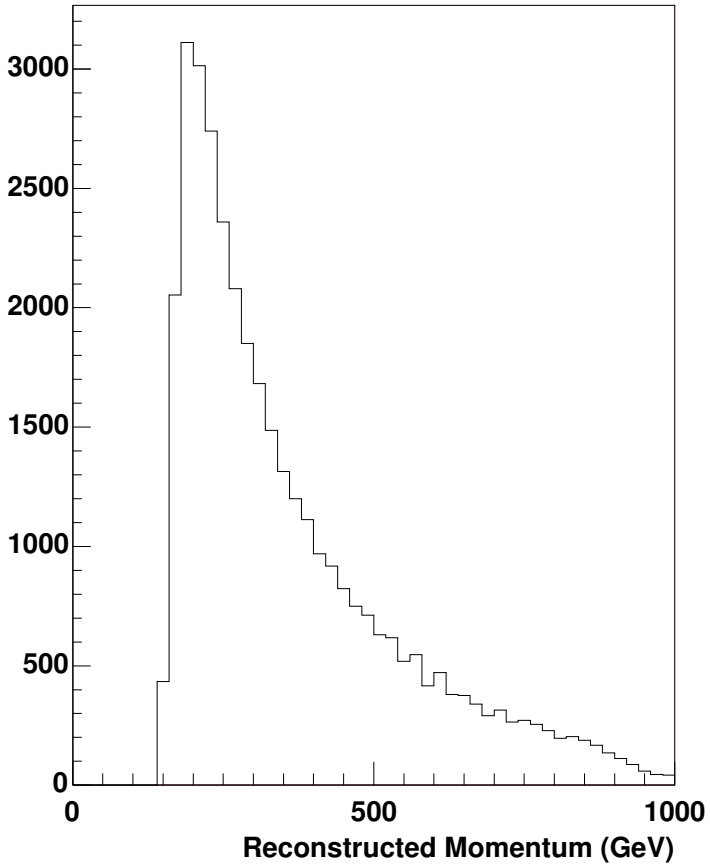


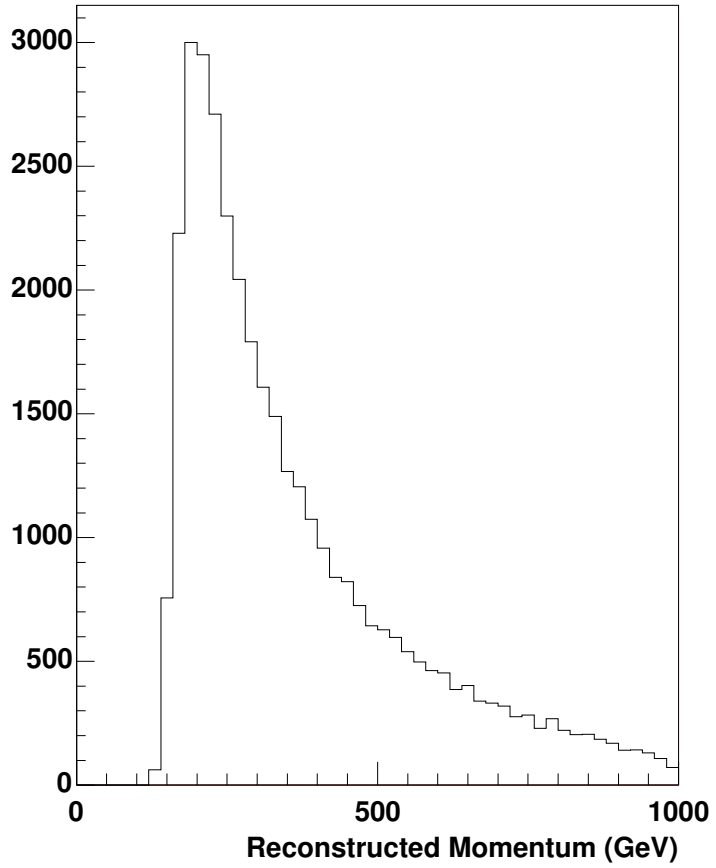


Side −. L: $\mu^+\mu^-$ rates per fb $^{-1}$ per bin. R: 'Typical' physics (unnorm)

MOMENTUM ACCEPTANCE (ATLAS)

$p_T \geq$ 4 GeV, Silicon distance 3mm at 220m.

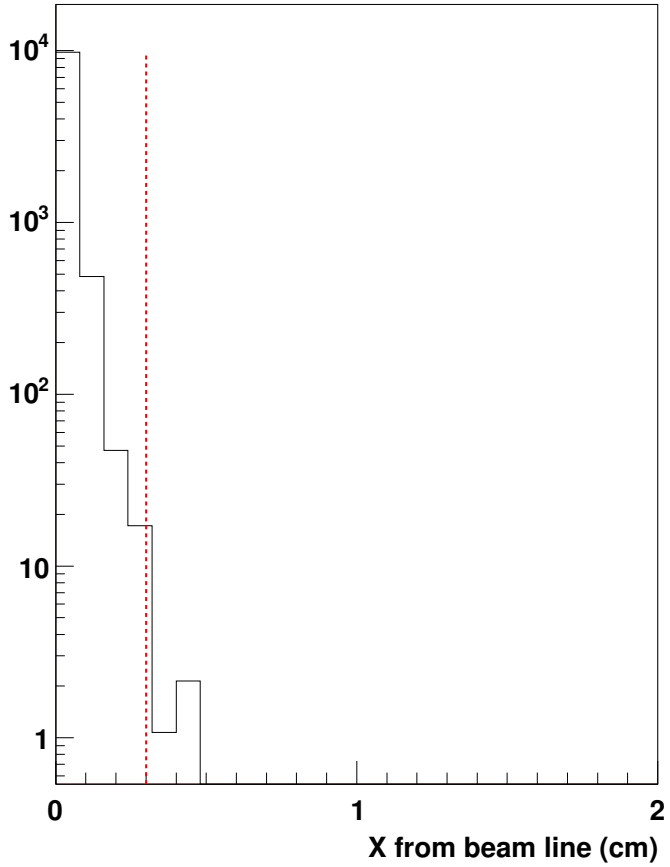


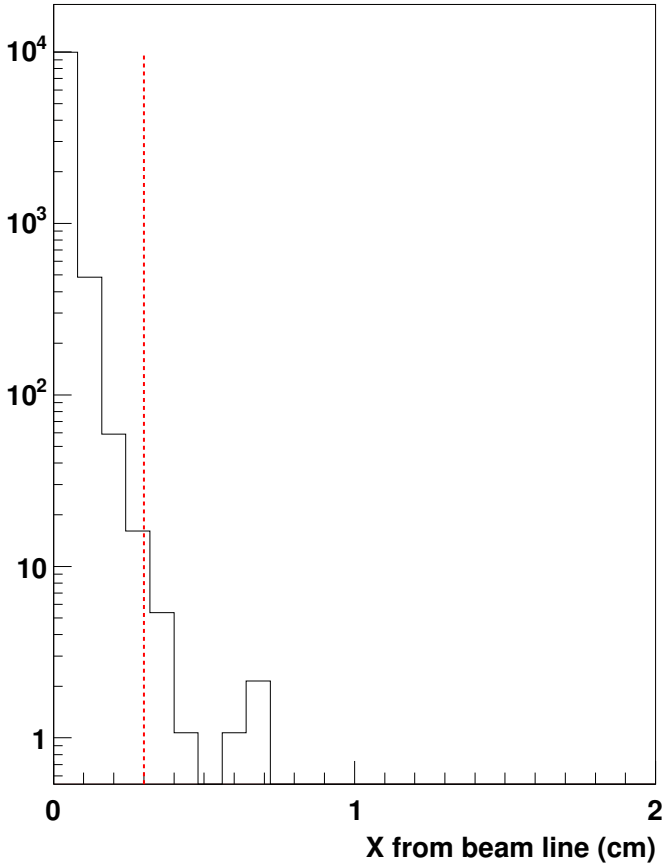


For comparison, a 'typical' 220m physics momentum spectrum.
The upper region is rather uncertain.

220m REGION (ATLAS)

$p_T \geq$ 4 GeV. Silicon distance 3mm at 220m.

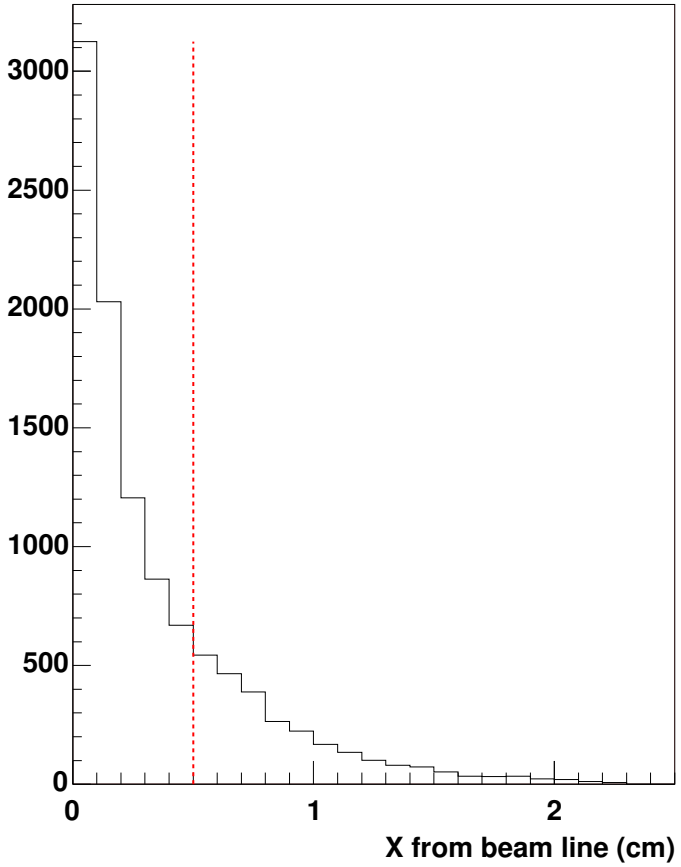


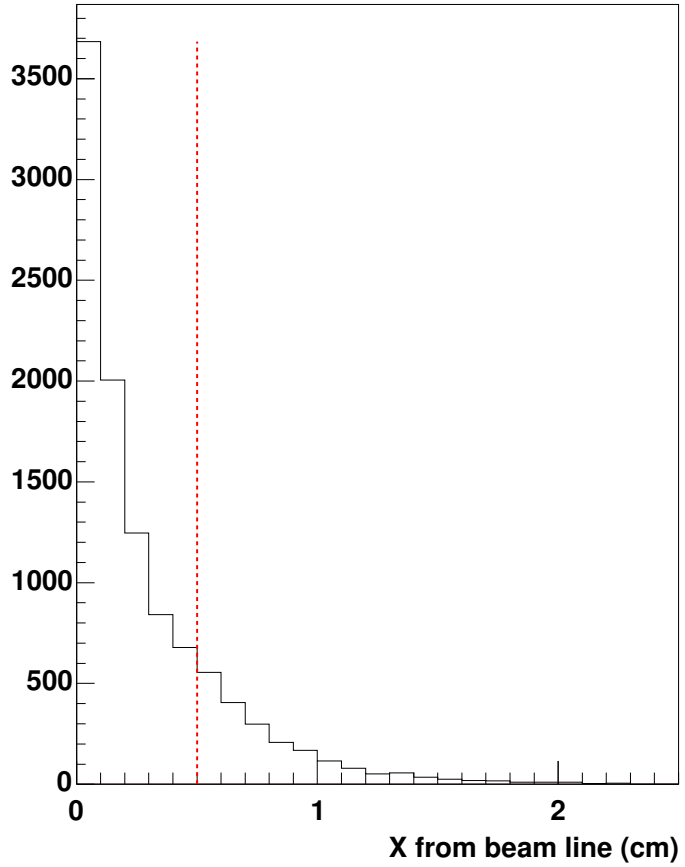


Side +, side −. Still no use!

RESULTS (CMS)

$p_T \geq$ 4 GeV. Silicon distance 5mm at 420m.





Side +, side −. Almost identical to ATLAS

CONCLUSIONS FROM THIS

Perhaps we can do a single calibration with 100-200 events?
If we are lucky (don't count on it) then we will get a clean momentum peak shifted a little from the nominal value, as a function of momentum and position in the silicon.

Then perhaps a 3x3 grid will suffice to calibrate.

Then with a few k events per month we could do this every few days.

But certainly not every few hours, and we have nothing here at all for the 220m regions!

If we are less lucky, for each momentum we will need to calibrate angular effects as well.

ANOTHER POSSIBILITY

As has been discussed before, we can use proton-proton bremsstrahlung as a calibration method.

Need a small aperture photon detector in line with each proton beam after the first bend.

Using Tsai's formula, estimate of rate is about 20M events each end per inverse fb.

E.g. 20 counts per second each end in a photon energy range such as 20-100 GeV or 100-500 GeV.

Photon counter must be fast, and a precision of $5\%/\sqrt{E}$ would be nice. The dimuon method will have better precision however and should still be done as well.