The Muon Ionisation Cooling Experiment - RAL

Beamline Simulation with G4Beamline for September Run

September 2009

m.apollonio@imperial.ac.uk

Introduction **and CAVEAT**

This is an "in-progress" document meant to inform about what we expect to "see" in our beamline during the 5/6 September run. We will fill the missing parts as long as we proceed with measurements and our understanding of the line.

1 Beamline Elements

The MICE beamline comprises 11 conventional magnets and 1 superconducting solenoid. A visualization of the beamline can be found on Fig. 1.

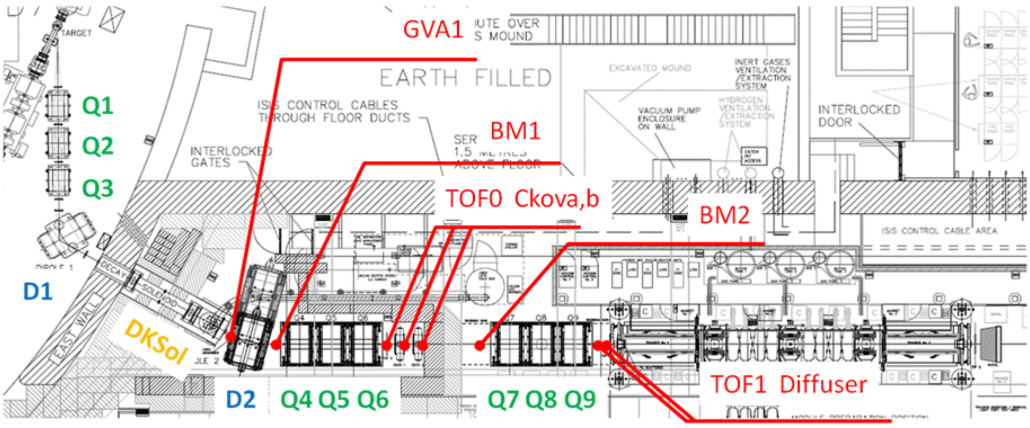

Figure 1 view of the MICE Beam Line as of September 2009.

1.1 G4Beamline

This is the code used to reproduce the beamline. We use a beam model developed by Tom Roberts to describe the production of secondaries out of the target. Its reliability, above all in terms of absolute rates, has to be assessed in particular after the installation of the new target station.

1.2 5/6 September Optics

This is the optics we used to select a PION beamline. The last triplet of quadrupoles is OFF and we are not using the DK Solenoid.

```
RUN  5/6 September 2009
MICE - Beamline Optics - optimised for ***PION*** Transport
Ptgt=336.85   / PD1=333.39 / PD2=330.92 MeV/c
DKsol and Q7-8-9 NOT in use

Q1           71.62  A
Q2           130.97 A
Q3           80.16  A
D1           256.16 A
DKsol               ------
D2           123.96 A
Q4           220.38 A
Q5           295.54 A
Q6           196.06 A
Q7           ------ A
Q8           ------ A
Q9           ------ A
```

A G4Beamline Simulation has been run on the same optics and results are summarized in the following figures. The initial sample has a momentum distribution centred around 336.85 MeV/c. D1 hase been tuned to select a momentum of 333 MeV/c. Fig. 2 represents the look of the beam at GVA1-US. In particular one can appreciate the selection of 333 MeV/c pions. At this stage the ratio protons/pions=493/219=2.25. The ratio muon/pion=18/219=0.08.

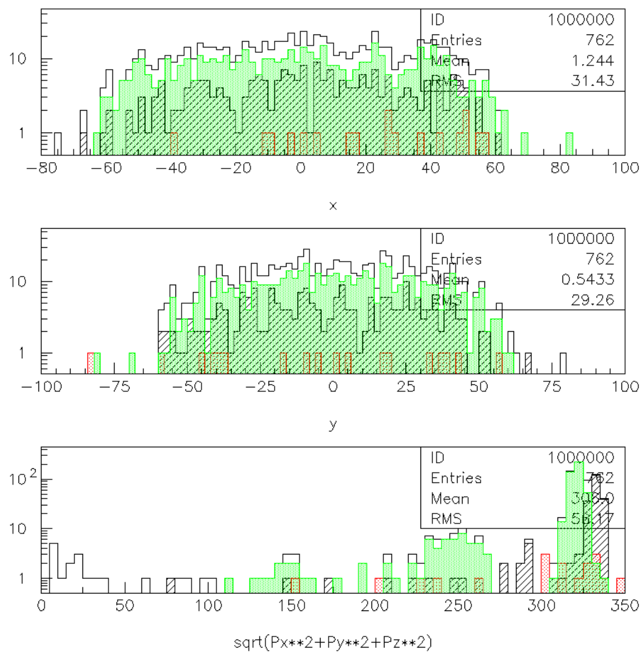

Figure 2 G4Beamline distribution at the US face of GVA1 for an initial sample of secondaries from the target point. Black line: all particles. Green shade: protons. Black hatched: pions. Red shade: muons. Top: x distribution (mm), Centre: y (mm), Bottom: total momentum (MeV/c).

Fig. 3 shows the same variables at TOF0US. We notice how pions are now as twice as protons and their x-position is highly biased to positive x values due to the higher bending power (protons have a lower momentum when crossing D1 due to higher energy losses) . The ratio protons/pions is now 64/140=0.46. The ratio muon/pion=38/140=0.27.

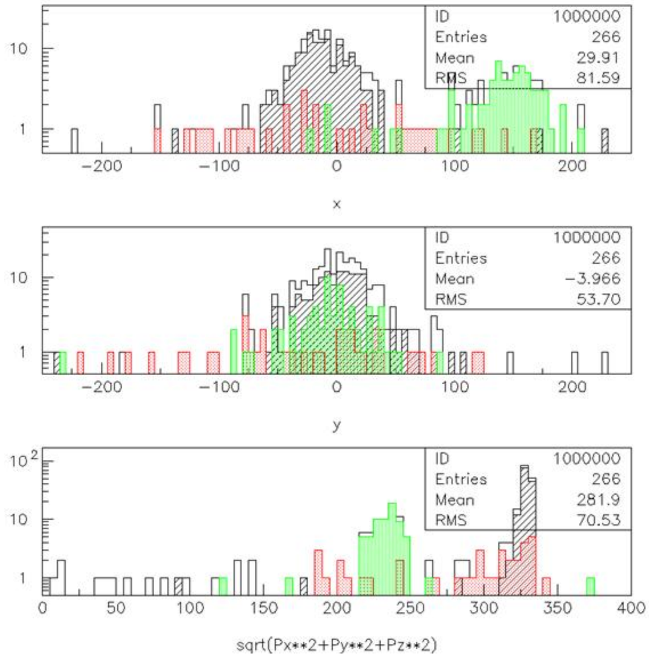

Figure 3 G4Beamline distribution at the US face of TOF0 for an initial sample of secondaries from the target point. Black line: all particles. Green shade: protons. Black hatched: pions. Red shade: muons. Top: x (mm), Centre: y (mm), Bottom: total momentum (MeV/c).