

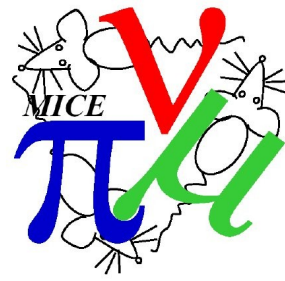


Some Thoughts Regarding Tracker Analysis: A Brain Dump

Melissa Uchida

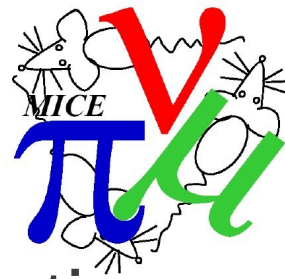
25/11/13

Considerations



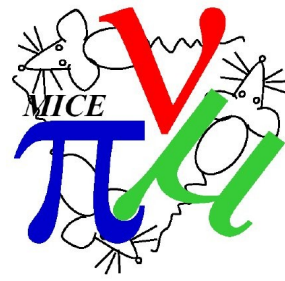
- 1.Measurement Capabilities.
- 2.Backgrounds.
- 3.Misalignments of elements is one of the largest sources of systematic errors. Minimise!
- 4.Misalignment between the two Trackers.
- 5.Magnetic field homogeneity.
- 6.Differences in efficiency/errors etc. between the two trackers?
- 7.Reconstruction efficiency.
- 8.Saturated channels on an ADC (counts >255) occurring in a tracker cluster means that cluster is not used for light yield.
- 9.Online Plots.
10. Attenuation length in fibres.

Measurement Capabilities



- 1) Detectors should measure (PID in collaboration with TOFs and Cherenkov):
 - a) muons
 - b) residual undecayed pions (inc TOFS and Cherenkov)
 - c) decay electrons (in order to restrict emittance measurement to that of the beam).

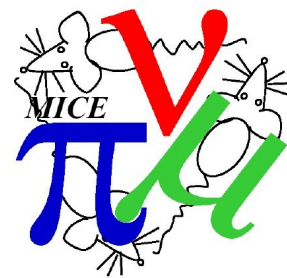
2. Backgrounds



a) RF dark current (minimised by 3 fibre plane system)

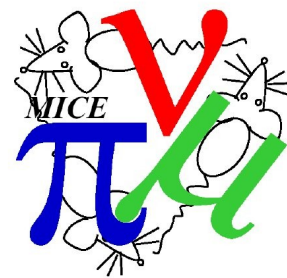
- X rays
- electrons

b) Decay electrons



3. Misalignments

- a) Rotational offsets between tracker stations
- b) Non-parallel tracker stations (pitch)
- c) X-Y offsets in trackers stations (I believe this has already been fully accounted for by E. Santos??)
- d) Misalignment between the two Trackers (see later slides)
 - Check in early stage of Step IV without absorbers and RF.
 - Mechanical/installation solution?
 - Calibration method?
 - Global tracking (tracker 1 and 2s position relative to x)



4. Magnetic Field Homogeneity

Inside solenoids

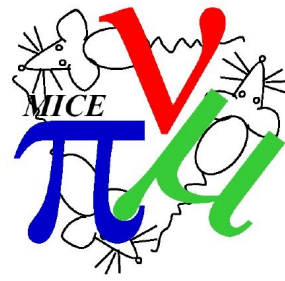
- a) 4T with max 10^{-5} T variation over 0.1m^3 along trackers.
- b) Positions of sensors monitoring magnetic fields must be known to $\sim 100\ \mu\text{m}$ (from proposal).

Work being Carried out by V. Blackmore.

Inside trackers

- c) Missing hall probes inside trackers...

5. Differences in efficiency/errors etc. between the two trackers?



a) Particle Response

b) Light yield

- Variation in light transmission between fibres <10%.

c) How alike is their detection, interpretation, electronics readout, noise...?

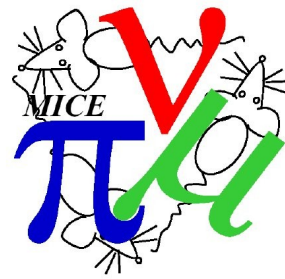
d) Can we use cosmic data for this?

- Concrete blocks?..
- Can we take again?

e) Any differences should be determined:

- their impact assessed
- documented and accounted for.

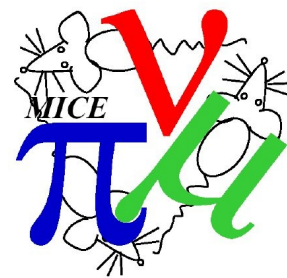
6.Reconstruction efficiency



- a) Currently 99.5% efficient (losing 5/1000 events)?
- b) Why?
- c) Can we/How to improve?

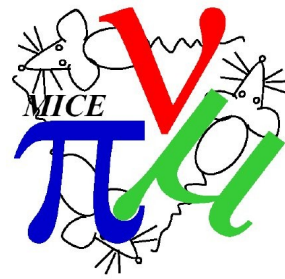
Pretty sure that this is already in hand by AD and ES but we should keep it in mind.

7. Saturated channels on an ADC (counts >255) occurring in a tracker cluster means that cluster is not used for light yield.



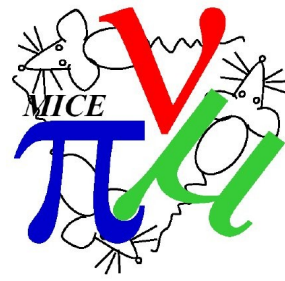
- a) How often does this occur?
- b) Problems?

8. Online Plots



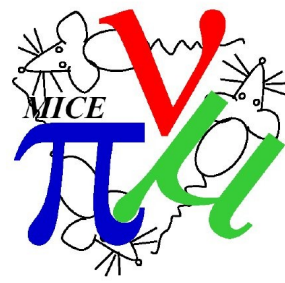
- a) Dead channels, in some form easy to read?
- b) Channel-by-channel high gain RMS plot?
- c) Saturated ADC channels flagged?
- d) Number of digits per fibre plane (ribbon) and station?
- e) Number of clusters per fibre plane (ribbon) and station?
- f) Cluster maps with ADC threshold above a certain value?
- g) Number of spacepoints every XX secs/spill? (may not be possible online)
- h) High gain vs low gain plots - to be plotted in a format that is useful (maybe show deviations from expected behaviour, with large deviations highlighted)?
- i) High gain ADC counts vs channel ID?
- j) Some sort of simple event display?

9. Attenuation Length in Fibres.



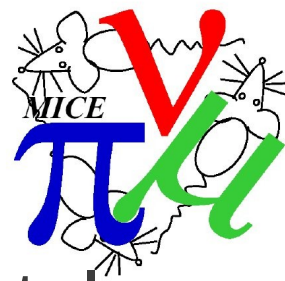
- a) Has this been considered.
- b) Included in SW?

3d. Misalignments between Trackers

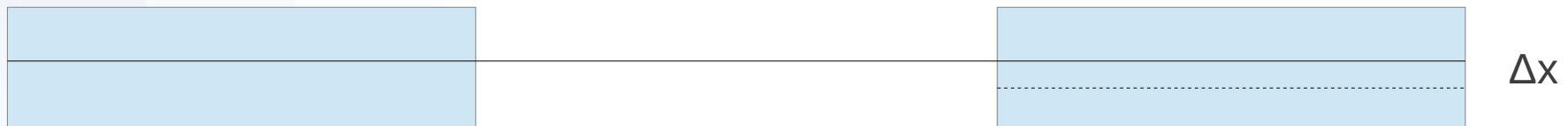


- We need to come up with a strategy of how we will do this.
- There is more than one way to skin a cat (and align trackers).
- There may be engineering constraints to consider beyond our ideas so a broad approach is best.

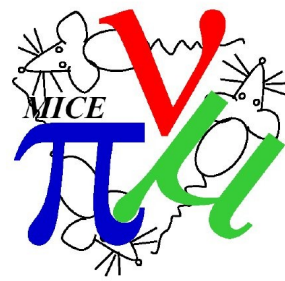
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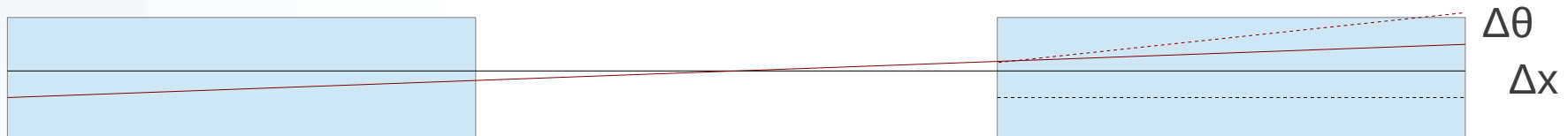
- Measure physically using surveying tools e.g. total stations (clever theodolites) +/- 1.5mm, 5-10 arc-seconds.
- First compare alignment with nothing between trackers
Then install absorber windows and compare
Finally use beam itself
Magnetic field off at first then later an alignment study with field can be done (inc ΔB).



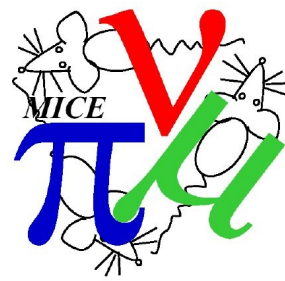
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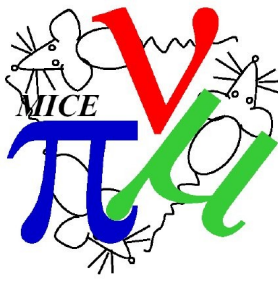
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3d. Misalignments between Trackers



- Use an infrared laser (any light source with wavelength $>450\text{nm}$).
 - Cover ends of trackers with blocking filters (only allowing light $>450\text{nm}$ through).
 - Shine laser from upstream tracker 1 in various locations and measure offsets in tracker 2.
 - Also point laser at angles to get $\Delta\theta$ offset.
- Using horizontal cosmic muons
 - Low stats but no need to shield detectors
 - With magnetic field off
 - Selecting high momentum muons
- Can also use beam of course but could be useful to start earlier than that ~ 3 month window (Step IV_0)?



Conclusions

- Hopefully this has created some useful discussion.
- Keep an eye on this list.
- Add to it and improve it.