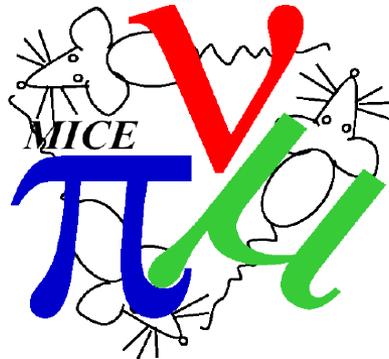


# Physics Group Plans

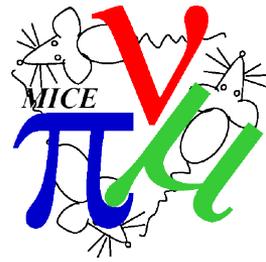
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Chris Rogers,  
ASTeC,  
Rutherford Appleton Laboratory

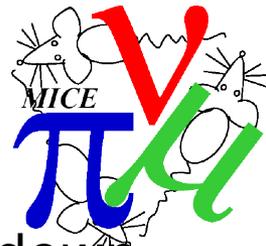


# Physics Group Aims

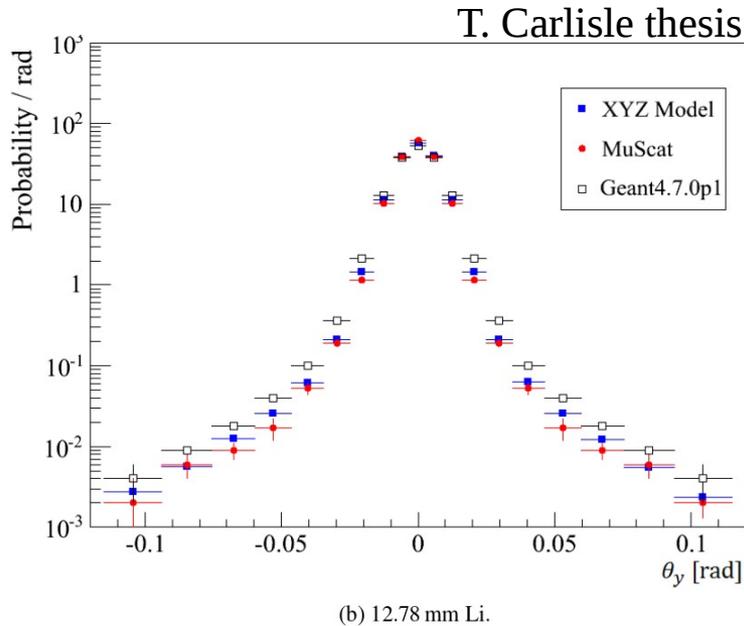
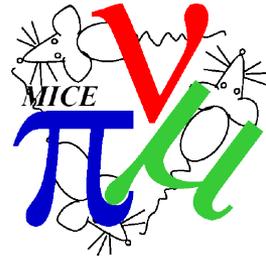


- Victoria Blackmore has done a great job of coordinating the physics group for the past 4 years
  - Now I have the task of negotiating Step IV analysis!
- The physics group is responsible for
  - Writing MICE collaboration papers
  - Controlling changes to MICE that can affect physics results
  - Specifying settings needed to support the papers
- Physics group is responsible for the physics output of MICE
  - Present a structure to achieve this aim
  - List of upcoming tasks (focus on Step IV)

# Substructure



- The physics that we want to publish on can be broken down into a few main areas
  - Material Physics
    - what are the effects of materials in MICE?
  - Magnetics
    - what is the magnetic lattice and how does it effect the beam?
  - Diagnostics
    - What are the measurement capabilities of the detector system?
  - Cooling/Integration
- There are a couple of ancillary things
  - Support tools
    - Any supporting analysis tools that we need (probably software)
  - Future steps
    - We need to look after specification of next step of MICE
  - Step 1
    - We need to clear back log of Step 1 papers



## Specific needs

- Understand the material budget in the cooling channel, especially the region between the trackers
  - Validate with measurement
- Understand and develop as necessary, models for energy loss and scattering through materials in the cooling channel
  - MCS model in Tim Carlisle thesis
  - Energy loss model?

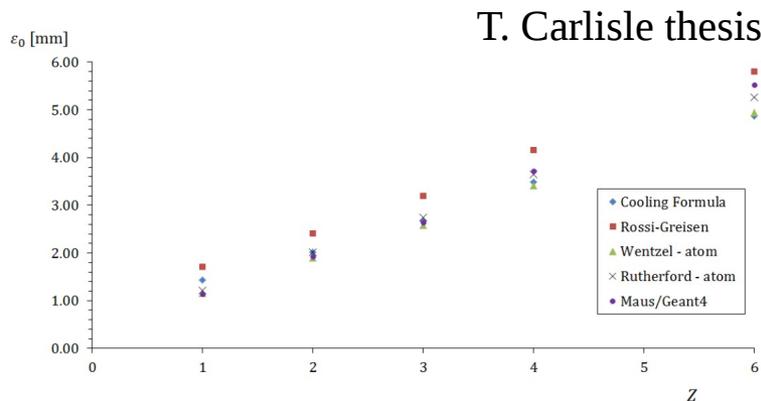
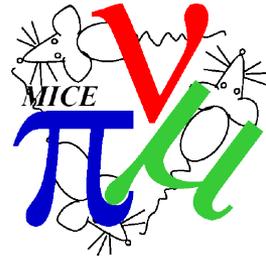
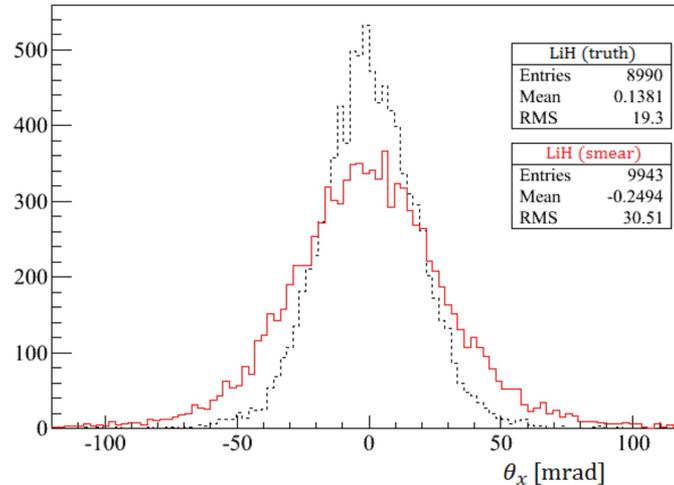


Figure 5.8: Equilibrium emittance predicted by formulae and obtained in MAUS

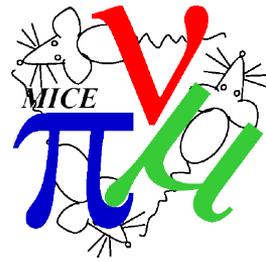


T. Carlisle thesis



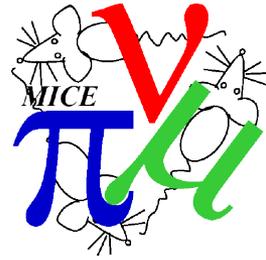
- More Needs:
  - Develop measurement of energy loss and scattering techniques
    - Brief intro in Tim Carlisle thesis
    - Perhaps measurement on scale of MuScat is possible
    - But needs significant “unfolding” of detector resolution
    - What systematics?
- A team of 3-4 people is needed to do a good job
  - We have very few people here (<1)

# Magnetics



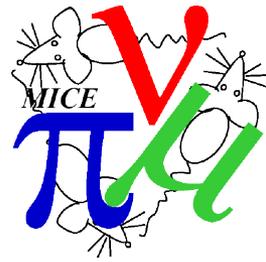
- Specific needs
  - Understand the MICE beam optics, both linear and non-linear
    - Do we have the full set of linear beam optics and currents?
    - What about non-linear stuff? Can we measure it?
  - Develop and analyse a procedure for measuring the MICE magnetic lattice properties
    - Through field mapping and alignment
    - Using beam data
  - Understand systematics introduced by magnetic alignment procedure and support other measurements as required
- A team of 3-4 people is needed to do a good job
  - We have core team here
  - But cannot continue to be distracted by Step V
- Beamline integration physicist should have a strong role in this work

# Diagnostics



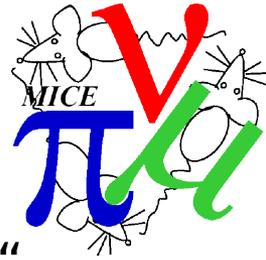
- Specific needs
  - Understand MICE diagnostic resolutions (e.g. on  $x$ ,  $p_x$ ,  $p_{id}$ , etc)
  - Understand how resolutions affect the MICE measurements
- A team of 3-4 people is needed to do a good job
  - We have core team here if we can draw from detector people
- MAUS coordinator should have a strong role in this group

# Support

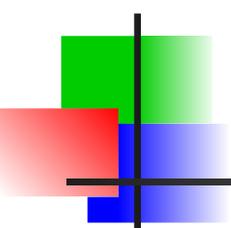


- Need to provide tools to support other areas
  - Online analysis tool
    - Event display to display beam properties theoretical vs measured in the MLCR
  - Offline analysis tool
    - Emittance calculation, beam selection, general purpose routines (e.g. peak finding) where required
  - Interface to GRID stuff
    - Coordinate batch production
- Some stuff may prefer to go within C+S/W remit...

# Future Steps

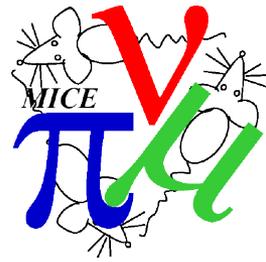


- Need to continue “Demonstration of Ionisation Cooling”
  - Baseline design (200 MeV/c, at some beta)
  - Baseline alignment and tolerances
  - Not-baseline design specifications (off-momentum, off-beta optics)
  - Responding to change requests from the engineers
  - Determining run conditions
- Physics group must focus on Step IV
- Any funding bids for extensions could be supported here...



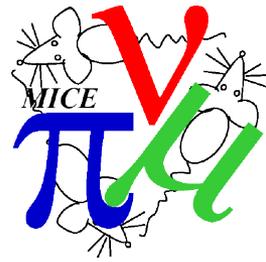
# Step 1

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- A few papers still on the go
  - EMR Paper
  - PID/KL paper
  - Maybe quad alignment paper
  - Maybe polarisation paper
- Physics group must focus on Step IV
  - Must have fast turnaround on at least first couple of papers

# Priorities



## 1. Magnet mapping

- Axis calculation due in December for magnet install

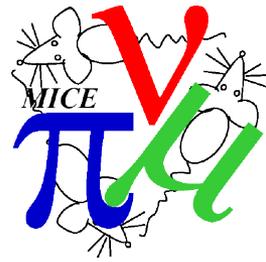
## 2. Description of MICE Step IV paper

- Requirement by funding agencies to publish quickly
- Workshop 26<sup>th</sup> November at RAL
- Aim is to make a job list
- [http://micewww.pp.rl.ac.uk/projects/analysis/wiki/FF\\_2014-11-26](http://micewww.pp.rl.ac.uk/projects/analysis/wiki/FF_2014-11-26)
- 26<sup>th</sup> November, at RAL

## 3. First observation of emittance reduction paper

- Requirement by funding agencies to publish quickly
- Plan for a workshop in January
- (I will also be MOM)

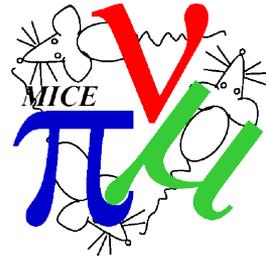
# Job List



3. Other papers also need significant advanced planning

- **We can only install each absorber setting once**
- No room to fix mistakes/retake data
- Having a detailed understanding of each paper is best way to spot potential problems early
  - Physics understanding for gross concepts
  - MC for details
  - Fast turnaround on analysis
  - Likely to result in improvements to the proposed data taking programme

# Summary



- How do we measure diagnostics performance?
  - PID
  - Phase space resolutions
- How can we exploit the nice experimental set up to best understand magnet effects
- How do we do MCS, energy loss measurements?
  - What magnet settings are really the best?
  - **Need more people here**
- What do we really want to show in our cooling papers?
  - Is the physics grid really the best thing?
  - What are our errors like? How do we control them?
- What is the schedule required by engineers for “Demonstration of Ionisation Cooling”?
  - Can we meet it and get Step IV on the rails?
- We have a lot of work to be ready for data taking