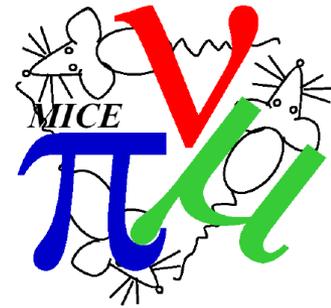


Software and Computing towards Step IV

David Colling

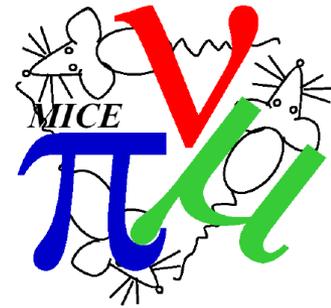
With special thanks to Chris Rogers, Chris Tunnell, Linda Coney and Antony Wilson and the rest of the MICE software and computing team.

Content



- Caveat
- Scope
- Issues and directions
- A little more detail and tentative timelines
- Conclusions

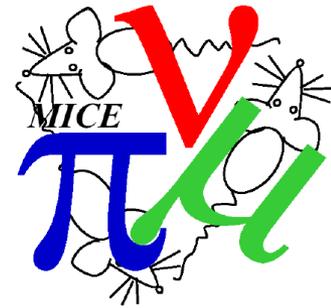
Caveat



We don't yet have a schedule for the computing and software project to reach Stage IV – this is still work in progress and we hope to finalise at the next collaboration meeting.

Any timelines shown are preliminary.

Scope

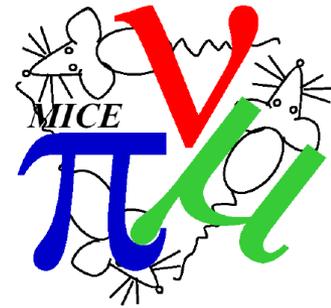


Computing and software covers a wide range of activities from the online, to storage of conditions and meta data, to data security and distribution, to beam line simulation, to detector simulation and finally physics analysis framework.

In a little more detail:

- Control and Monitoring
- Data acquisition
- online reconstruction
- Conditions (and meta data) database
- Data storage and movement
- Beamline and detector simulation
- Physics analysis

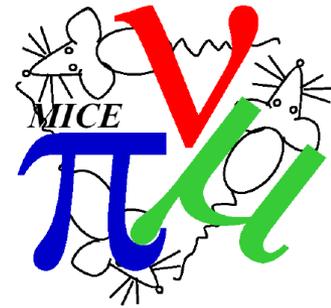
Scope



Our role, in each area, is to build a reliable and infrastructure that is capable of providing what is needed for MICE to be a success. We are a service sector in MICE.

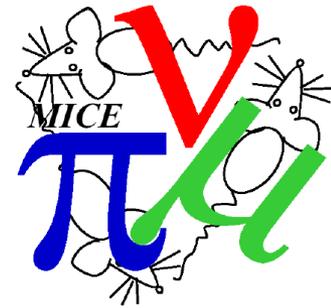
The different activities involve different but overlapping groups of people.

Issues and directions



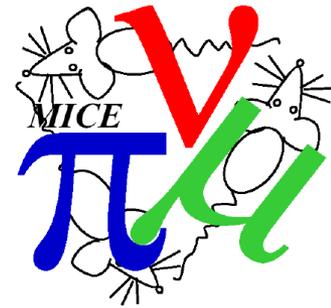
- Effort levels
 - Software is everybody's lowest priority perception that it can be bolted on at the end.
 - Key people leaving the project
- Quality of some of the code
 - Vast amounts of historical code that is useless
 - Errors such as geometries taken from history that are just plain wrong
 - People writing private code that is not shared with the rest of the collaboration and becomes utterly useless when they leave. Somebody then writes it again

Issues and directions



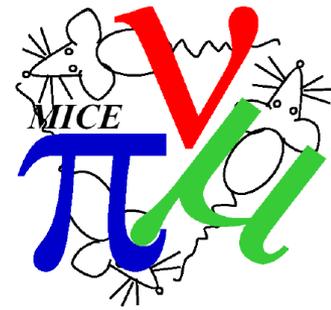
- Restructured the entire management last Autumn
- Decided that the then current set up was unsustainable and so brought in significant changes (to the offline at least)
 - Code must now pass tests
 - (Google) Coding guidelines introduced
 - Finally decided that there was so much rubbish in the existing offline framework (G4MICE) that a new framework (MAUS) was required that only had tested sustainable code. Currently in hand over period
 - More regular release schedule
- All official results must be produced by “official” code and must be reproducible by the rest of the collaboration.

Little more detail



I asked Linda Coney as new leader of the online, Chris Rogers as leader of the offline software and main (only) accelerator developer, Chris Tunnell as main offline detector software developer and main MAUS developer, and Antony Wilson as Config DB developer to make a few slides showing the status and key issues in each area. I also added the odd comment here and there.

I spent quite a while going through these extracting the common ground/issues but then thought that it would be more effective for you to see them as they are. I think that you will spot some common themes.



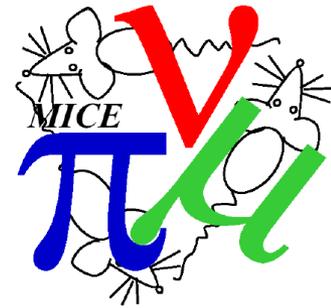
From Linda Coney
(Sorry green background has
disappeared in the cutting
and pasting)

Online Personnel



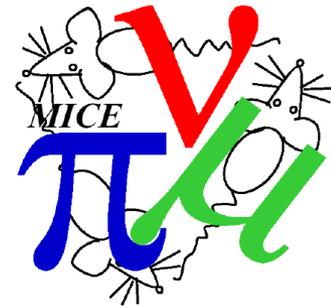
- **Controls & Monitoring** – Pierrick Hanlet (IIT) & James Leaver (Imperial)
 - James Leaver – half of Controls & Monitoring effort - left Jan 1
 - New grad student – Matt Robinson (Sheffield) taking over some of his work? Not sure what exactly
 - IIT undergrad working for summer 2011 on C&M
- **DAQ** – Jean-Sebastien Graulich & Yordan Karadzhov (UGeneve)
 - Jean-Sebastien – DAQ, unpacking, online monitoring code – gone on July 1
- **Online Reco & Monitoring** – Linda Coney (UCR), JS Graulich (UGeneve), Mark Rayner (Oxford), Vassil Verguilov (UGeneve)
 - JS leaving, Mark graduating/unavailable, Vassil graduating/unavailable
- **MLCR & Networking** – Craig Macwaters (RAL) & Mike Courthold (RAL)
 - Craig primary
- **Computing** – Henry Nebrensky (Brunel)
- **Summary** – absolutely need more resources
 - DAQ backup/assistance for Yordan
 - C&M for RF, tracker, absorber integration
 - Online code: fix unpacking & EMR, tracker

Online Monitoring & Reconstruction



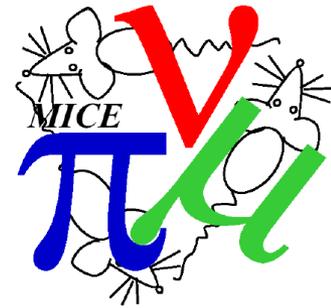
- **Summer 2010 running**
- **Power 'glitch' last fall**
- **Now**
- **Next – EMR running – July 2010**
- **Step IV**

Online Reconstruction



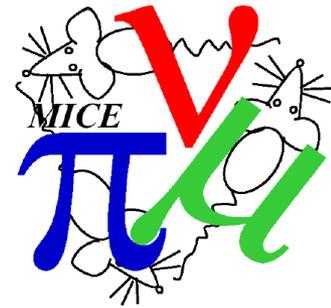
- **Summer 2010 running**
 - TOF 2D profiles for all three detectors
 - Time-of-flight plot for particle ID
 - Phase space and momentum plots
 - Scalar information – # particles at GVA1, TOF0, triggers, normalized with lum monitor
- **After power ‘glitch’**
 - Monitoring – tested but not completely
 - Upgrades to CKOV – not sure if implemented
 - Reconstruction – same – need more testing
- **Do we still maintain functionality from summer 2010 for both? – probably NOT.**
 - Use G4MICE? Or MAUS?
 - Unable to analyze data with MAUS at the moment.
 - But..G4MICE code uses old unpacking method

Online Reconstruction



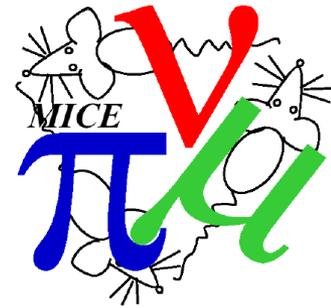
- **Now**
 - Upgrade done to unpacking code
 - Required in order to read out EMR and tracker
 - Absolutely necessary – good thing that it is done/almost done
 - **However:**
 - Causes significant amount of work for both Online & Offline software
 - Does new unpacking code break Online Monitoring & Reco?
 - Yes – definitely for Reconstruction
 - ?Maybe – for Monitoring
 - **Nothing. Power off. Restart and testing begins next week (May 30).**
 - **Beam test June 13/14**
- **Next – EMR running July 2011**

Next: July running



- **EMR Data-taking**
 - Need to fix old code to read new unpacker – otherwise – no plots. Period. (Who available?)
 - EMR group writing “temporary” plot-making code for use with new unpacker code
 - “temporary” needs to become permanent – how accomplish this when Vassil/JS gone?
 - **Very likely no plots in July other than temporary EMR & FNAL BPMs**
- **Step IV**

Step IV

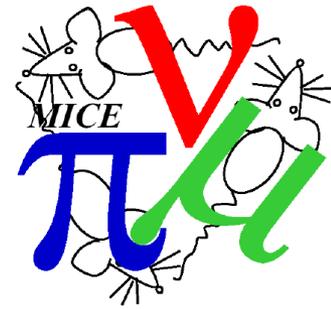


- **Need:**
 - All TOF profiles - (1,2)
 - Time-of-flight & tof phase space - (1,2)
 - CKOVs – π/μ separation (1,2,3,4)
 - EMR plots – (1,2,3,4)
 - tracker plots – (5)
 - Event display – (5)
 - Online global reconstruction – (5)
- 1. **Need fix to use new unpacking**
- 2. **Need to include in MAUS**
- 3. **Need plot requests**
- 4. **Need write code**
- 5. **Have nothing yet**

Online Reco Schedule

System		When	Who?	
New unpacking	No online plots (except EMR) for July – TOF calib broken	August 2011	??	First priority – all others depend on this
TOF	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	✓ Sept 2011 Sept 2011	Yordan? Mark? Possibly Rob. F (UCR), L. Coney	Re-establish Summer 2010 capability
Scalers	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	✓ Sept 2011 Sept 2011	?Vassil,	
CKOV	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	July 2011 ?? ??		CKOV vacant – no input from UMiss
EMR	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	✓ MAUS	Vassil Ruslan?	Ensure “temporary” system evolves into permanent
Tracker	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	July 2011 2 month after Offline Reco	- Depend on Offline Software: Morteza, Edward (Imperial), Chris H. (UCR)	
Event Display	<ul style="list-style-type: none"> ▫Code in MAUS & tested ▫Working in MLCR 	Summer 2012	Matt Robinson (Shef) - Depends on Geometry	Longer term
Global Reconstruction	<ul style="list-style-type: none"> ▫Plot list ▫Code in MAUS & tested ▫Working in MLCR 	Jan 2012 Summer 2012 End 2012	?? - Depends highly on Software Group progress	Depends on completion of previous work to

Config DB Status (Antony Wilson)



Antony Wilson taken over from David Forrest

Server side:

Alarm handler interface

Geometry interface – v1

Control interface

Beam line settings, read only interface

Client side:

Integration of the alarm handler module into the control room code

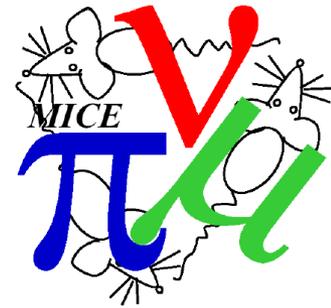
Integration of the control module into the control room code

Python api providing the read only calls to the above interface

Other:

Configure, test and document postgres backup procedure

Config DB Status



TODO

Install the new cdb that is now in the control room

Get redmine database moved

Set up master slave configuration for database machines

Update geometry interface

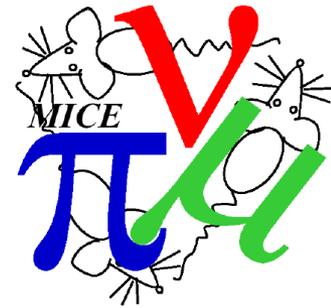
Get control room code updated for new beam line settings, example sql just circulated to Matt R

Sort out the mess that is cabling

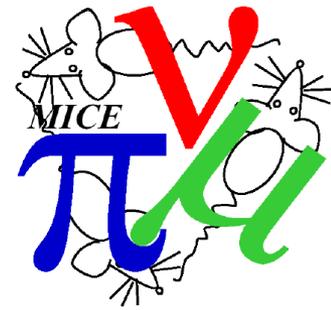
(Add Meta Data DB?)

Overall an appropriate level of effort and a well thought out plan.

Computing infrastructure

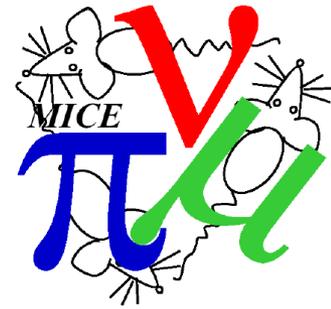


- Had a working (if a little rickety) infrastructure for 2010 data taking:
 - Data mover
 - Meta data database
 - Data secure (stored on two different tapes and simultaneously copied to disk at 2 sites)
- However this set up has decayed and needs resurrecting



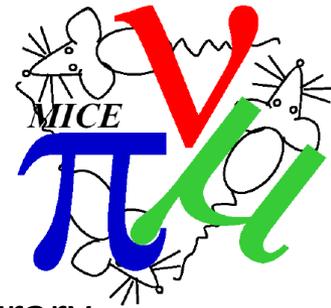
From Chris Rogers

Code Management



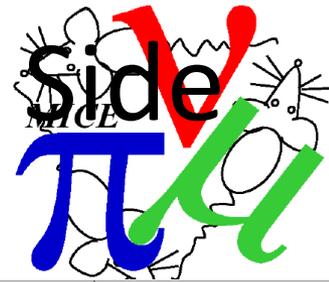
- More robust and usable code infrastructure developing
 - Updated version control system
 - Testing framework
 - Documentation framework
 - Error handling, logging, multiprocessing etc
- People management significant burden
 - Students on MICE often have very light supervision
 - “Secondary or tertiary project” for most lecturers
 - High turnover of post-docs
 - No one developing software full time (or even majority time)
 - “Begging” for contributions to code base

Accelerator Side

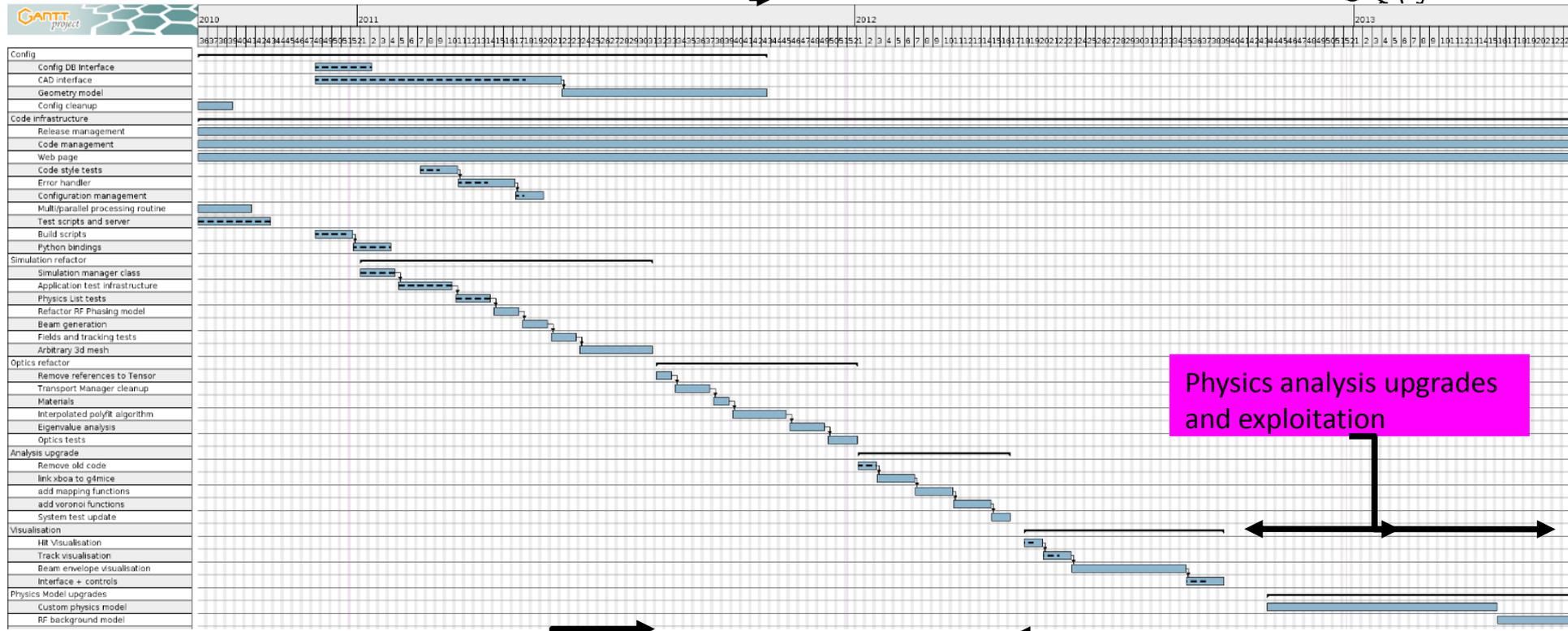


- We need to be able to correctly model the accelerator in arbitrary detail
 - Complicated field set-up (RF, quads, dipoles, solenoids)
 - Frequently changing arrangement of fields and hardware
- We need to be able to analyse physics results in real time and feed back into experiment
 - No good to discover that our RF was mis-phased or magnets misaligned after the experiment
 - Try to prepare as much as possible in advance
 - Will require feedback as experiment progresses
- Accelerator side + code management shares 0.5 FTE senior physicist

Management + Accelerator Side



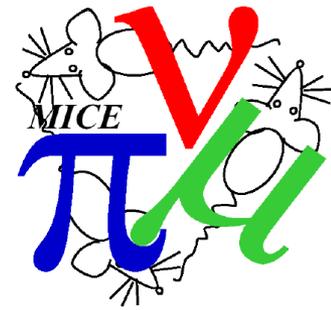
Geoemetry import implemented October 2011



Physics analysis upgrades and exploitation

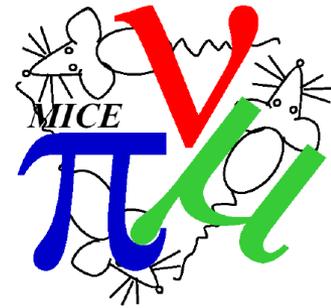
Accelerator simulation tools correct and validated September 2011

Online analysis implemented June 2012 - subject to revision



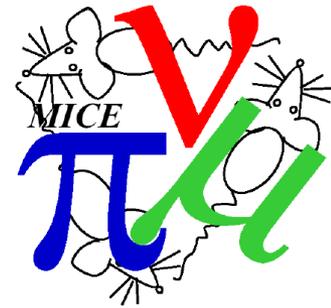
From Chris Tunnell

Needed *Steps* for *Step 4*



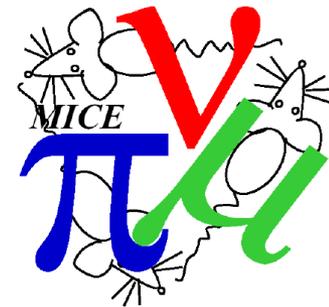
1. Existing in beamline: correct geometry, fields, and materials
2. Basic analysis: get the basic '*bits*' required from the detector (ie. ADC counts, hit location, *good enough* reconstruction, etc.) in a datastructure
3. Analyze data: make sense of the results
 1. Plots in the control room (list still pending)
 2. Basic 'first paper' analysis and start on cuts/corrections (need analysis group input)
 3. Fancy fun stuff that scales as N_{theses}

Distribution of man- power



- What does *good enough* for physics mean?
- That question may not even apply this year
- We need finish basic stuff: 'where was the hit?', 'why isn't this detector in our geometry?', 'which slab is channel 10 on board 8 hooked up to?'
- We don't have enough people to do things poorly (ie. do things twice)

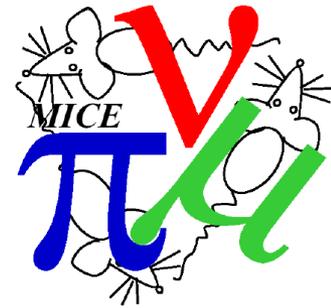
Resource Loaded Schedule



- Later is a resource loaded schedule for detectors only
- Ignores many man-months for new DAQ unpacker after about 6 man-months already
- Ignores many man-months for control room plots that don't crash like last year
- No contingency included

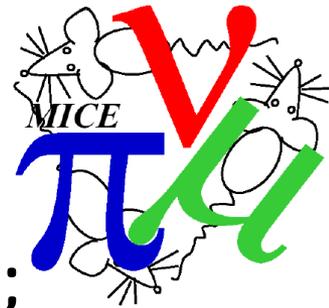
	Geometry	Space-points			Tracks	Man-Time w/o contingency
		MC	Data	Both		
Tracker	80% (needs documentation; 0.5 m)	40% Digitization (1-2m)	2m 40% Cabling in CDB 40% VLPC settings in CDB	60% 2m Clustering (ie. 3 planes)	50% (Kalman 6m-1y, Straight track test 2m, helical track test 2m) Code exists but requires KS tests and much cleanup.	1.5y - 2y
TOF	80% 0.5m (needs documentation)	30% Digitization (1.5m)	50% 3m Cabling/Calib. into CDB. Increase calib. bus factor and converge on calib.	80% 2m Clustering (model deadtime!)	30% 6m. Working prototype. Many hacks: own beamline geometry, own calibrations. No tests.	13m
EMR	70% (MiceModule limitations)	30% Digitization (in progress, 2m)	0% Calibration (2m) 0% Cabling (1m)	20% Clustering (2m)	0% Form PID (2m) 0% Momentum (2m-4m)	11m-13m
KL	20% (not in standard geometry, not checked)	10% No reports from KL group nor usable/testable code. Existing standalone software just for occupancy; unusable for analysis.				3m - 6m?
CKOV	10% (wrong geometry/materials)	0% CKOV nonfunctional; under repaired. Blocks software work. Some routines exist but software very preliminary. Meet CKOVers in month; affects TOF resolution.				6m - 1y

Detector Personnel



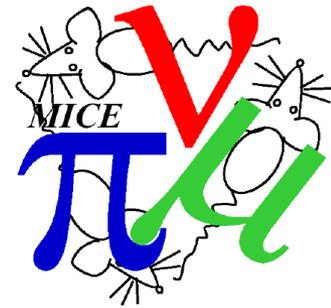
- Detector Coordinator @ 0.5 FTE: MICE core developer at Oxford
- Tracker @ 2 FTE: 2 FTE at Imperial (pre-doc/post-doc). Others coming (3x undergrad, 1x grad) and going (1x grad). Enough man-power if coordinated effectively.
- TOF @ 0.3 FTE: 1 post-doc at UniGe at 0.3 FTE since DAQ expert. 0 FTE on TOF reconstruction.
- EMR @ 0.3 FTE: Focus on EMR production not software. 0.3 FTE student who is graduating thus work possibly 'thesis only'. Two possible new students (Unige/Brunel)
- CKOV @ 0 FTE
- KL @ 0 FTE?: someone possibly exists but trouble contacting

Green Means Publish



- Standalone applications don't cut it; huge overhead for software group
- There are more publishable detectors (ie. ignoring LumiMon, BPM, GVA, etc.) than FTE
- 'mythical man-month': empirical software studies: 'one man can make a baby in nine months but nine men can't make a baby in one month'
- Start now if you want to analyze step 4 data

Conclusions



- Planning for Step IV not complete but underway
- Chronic lack of effort and turnover
 - We need to use the effort we have effectively to produce robust reliable code/infrastructure. We cannot afford to waste effort in private code.
- Prioritising what is needed to be able to get any physics out of MICE.