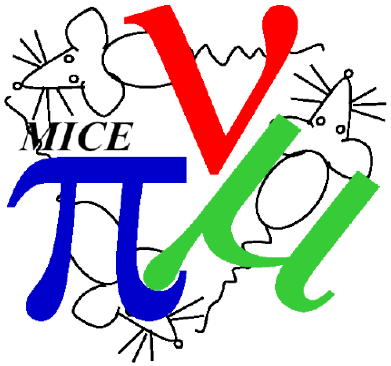
MICE Computing – Status



Chris Rogers,
ASTeC,
Rutherford Appleton Laboratory

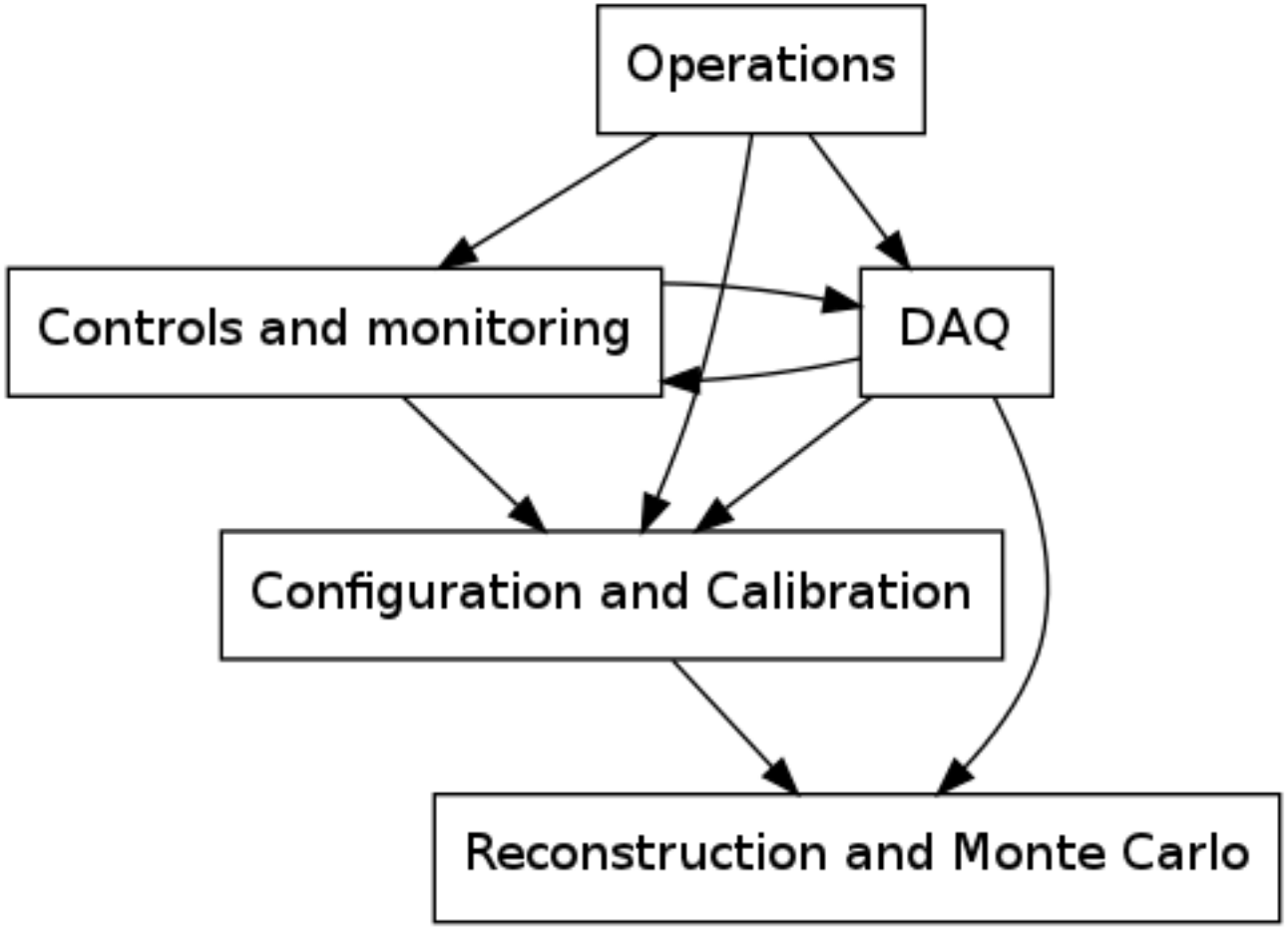
Project Goal

- Aim of the computing project
  - Provide reconstructed data for physics analysis
  - Provide experimental monitoring and controls
- End product
  - A set of GUIs in the control room to control the experiment
  - A set of reconstructed data for analysis users

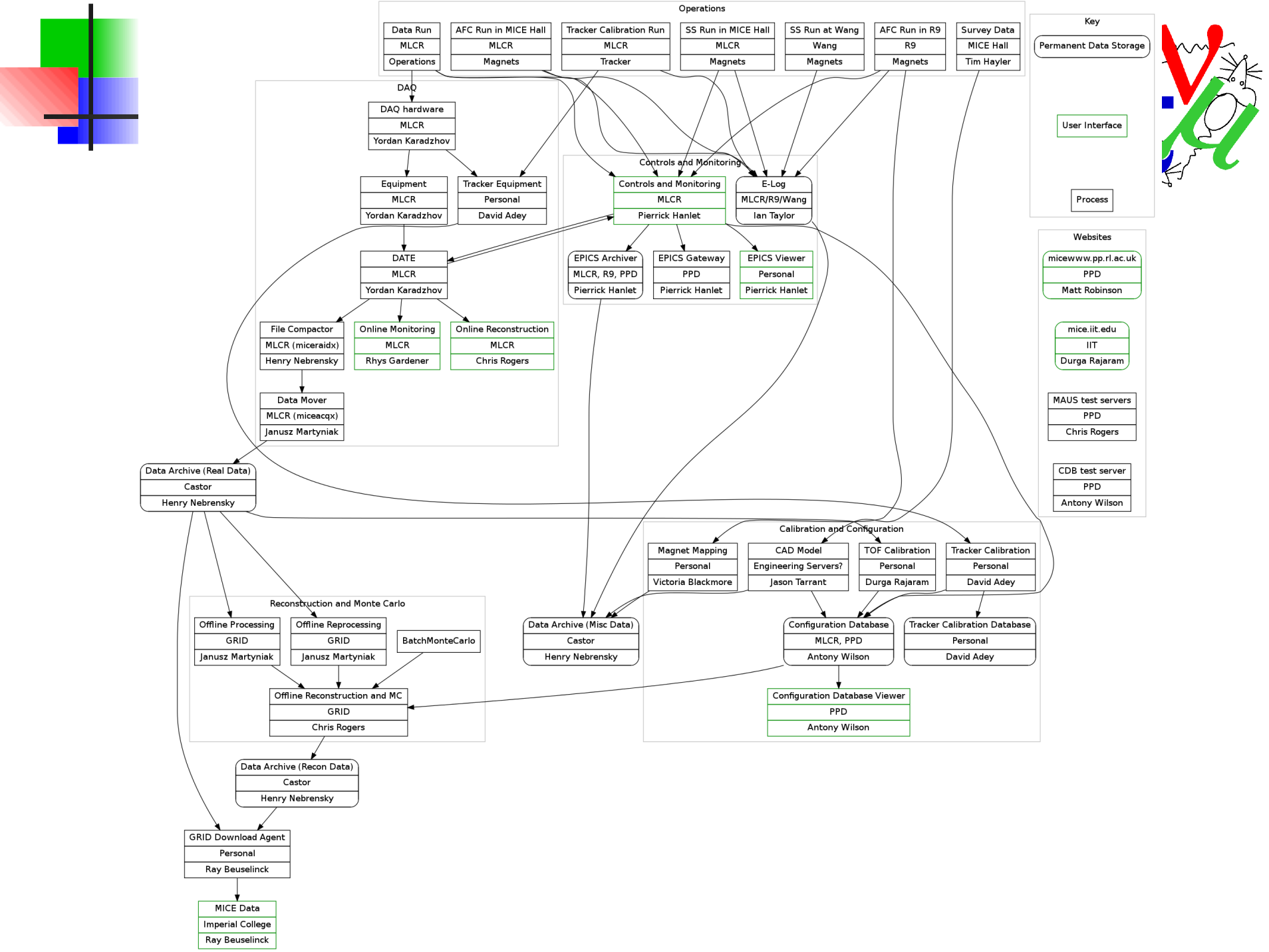
Methodology

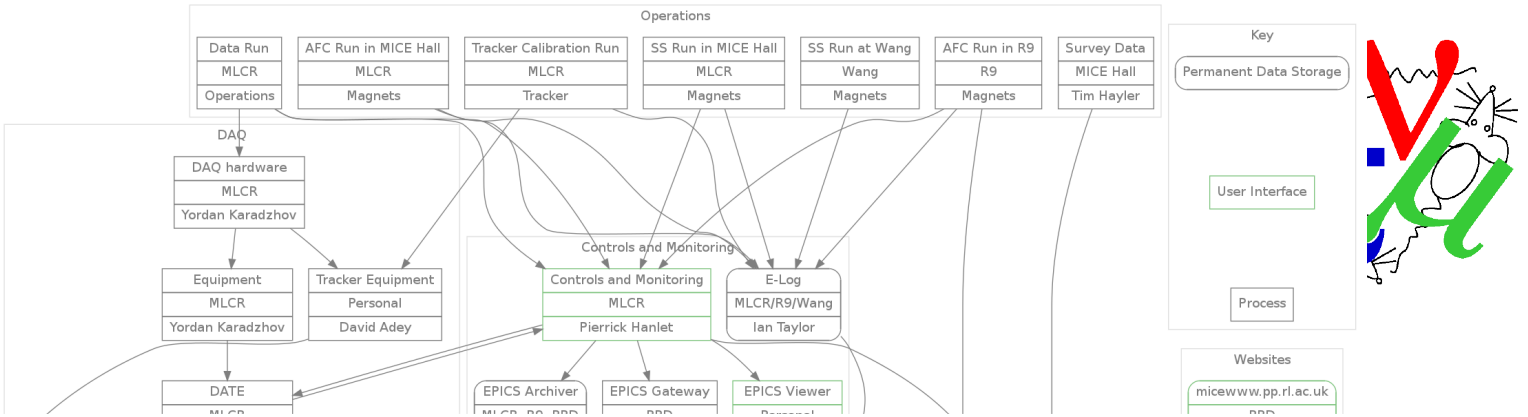
- Key methodology
  - Reproducible
  - Reliable
  - Correct
- This means
  - Audit trail
    - Which code was used? Which calibration? etc
  - Testing
    - Once it works it should not break
  - Written procedures and documentation
    - How did they do that?
  - Frequent reviews
    - We share the risk and responsibility to get it right
- **Not rocket science**
  - It should be done carefully and well

How

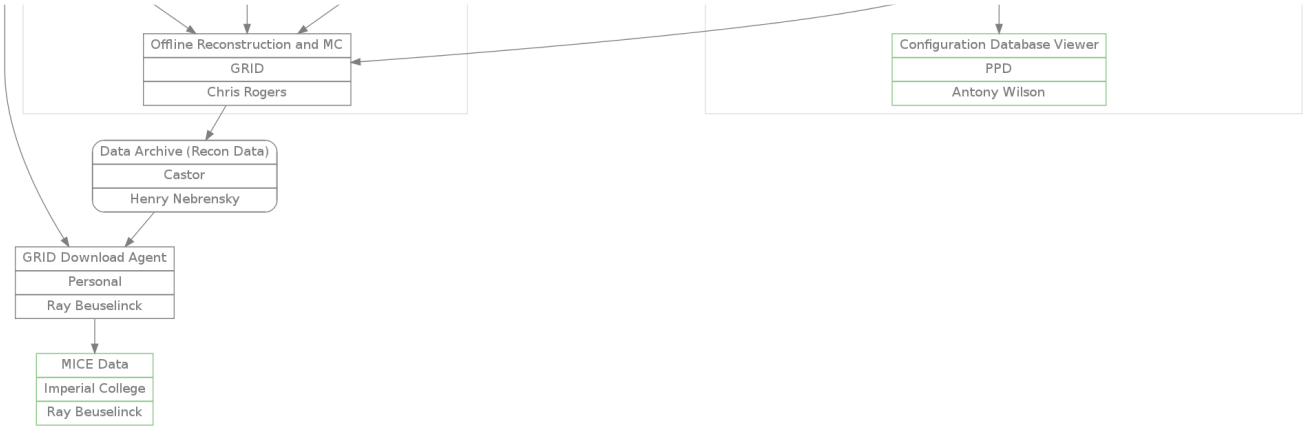


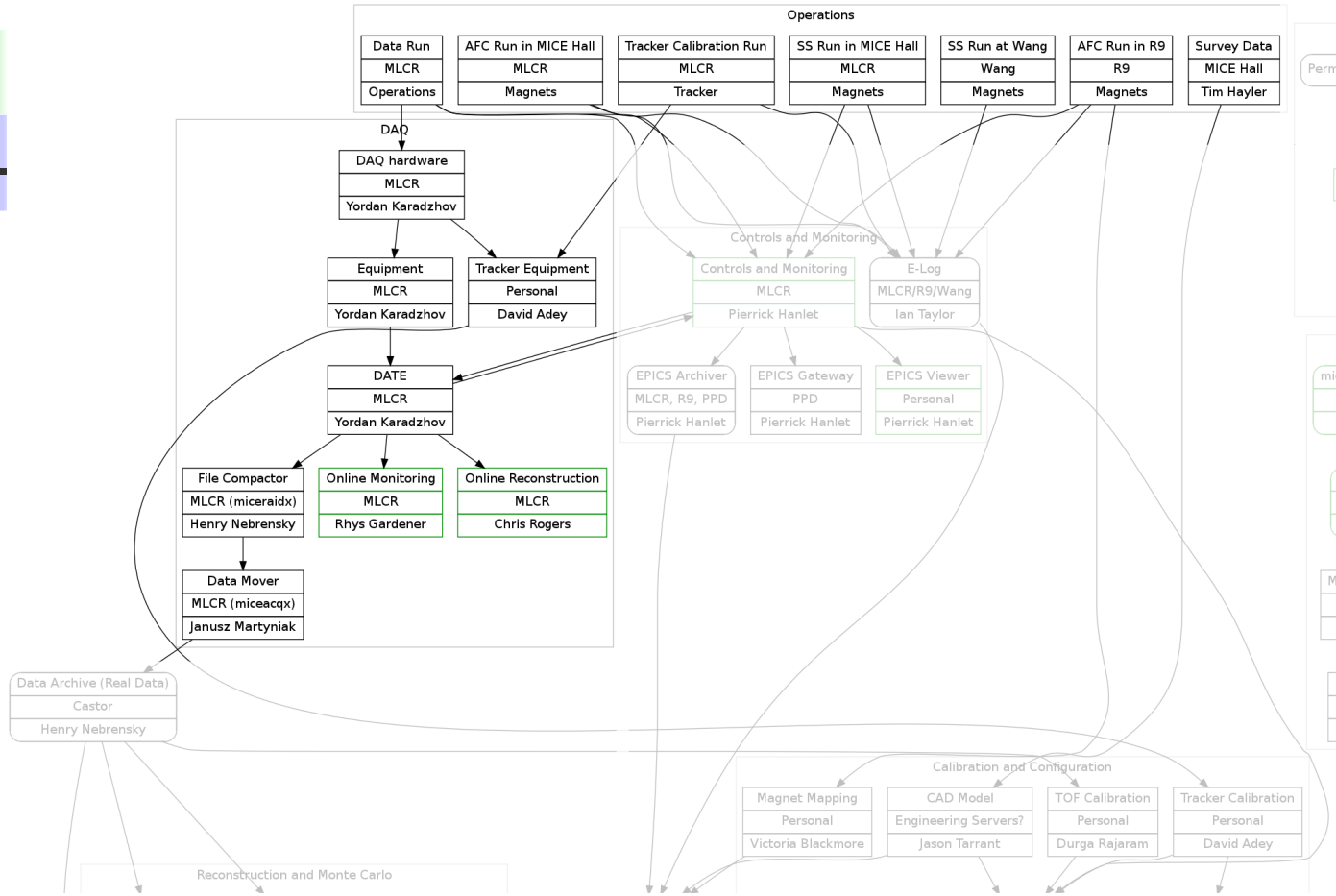
- Details on next slide
  - Caveat work in progress


Operations
Data Run
MLCR
Operations
AFC Run in MICE Hall
MLCR
Magnets
Tracker Calibration Run
MLCR
Tracker
SS Run in MICE Hall
MLCR
Magnets
SS Run at Wang
Wang
Magnets
AFC Run in R9
R9
Magnets
Survey Data
MICE Hall
Tim Hayler
Key
Permanent Data Storage
User Interface
Process
DAQ
DAQ hardware
MLCR
Yordan Karadzhov
Equipment
MLCR
Yordan Karadzhov
Tracker Equipment
Personal
David Adey
DATE
MLCR
Yordan Karadzhov
File Compactor
MLCR (miceraidx)
Henry Nebrensky
Online Monitoring
MLCR
Rhys Gardener
Online Reconstruction
MLCR
Chris Rogers
Data Mover
MLCR (miceacqx)
Janusz Martyniak
Controls and Monitoring
Controls and Monitoring
MLCR
Pierrick Hanlet
E-Log
MLCR/R9/Wang
Ian Taylor
EPICS Archiver
MLCR, R9, PPD
Pierrick Hanlet
EPICS Gateway
PPD
Pierrick Hanlet
EPICS Viewer
Personal
Pierrick Hanlet
Websites
micewww.pp.rl.ac.uk
PPD
Matt Robinson
mice.iit.edu
IIT
Durga Rajaram
MAUS test servers
PPD
Chris Rogers
CDB test server
PPD
Antony Wilson
Data Archive (Real Data)
Castor
Henry Nebrensky
Calibration and Configuration
Magnet Mapping
Personal
Victoria Blackmore
CAD Model
Engineering Servers?
Jason Tarrant
TOF Calibration
Personal
Durga Rajaram
Tracker Calibration
Personal
David Adey
Reconstruction and Monte Carlo
Offline Processing
GRID
Janusz Martyniak
Offline Reprocessing
GRID
Janusz Martyniak
BatchMonteCarlo
Offline Reconstruction and MC
GRID
Chris Rogers
Data Archive (Misc Data)
Castor
Henry Nebrensky
Configuration Database
MLCR, PPD
Antony Wilson
Tracker Calibration Database
Personal
David Adey
Configuration Database Viewer
PPD
Antony Wilson
Data Archive (Recon Data)
Castor
Henry Nebrensky
GRID Download Agent
Personal
Ray Beuselinck
MICE Data
Imperial College
Ray Beuselinck

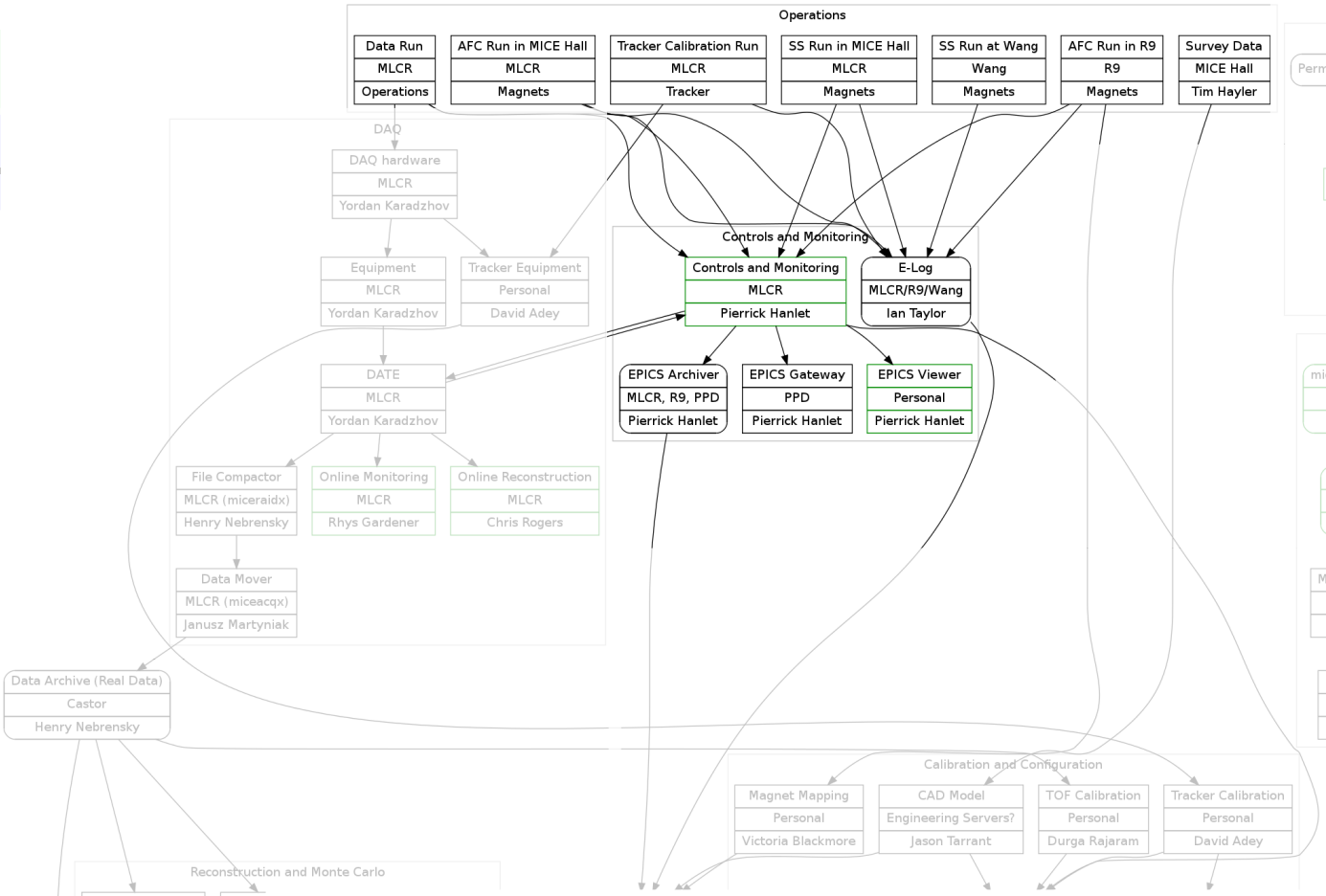


- Caveat
  - I will use lines of code to indicate project complexity
    - Generated by cloc version 1.52
  - Inexperienced developers tend to produce more lines of code for the same functionality
  - Effort is highly correlated with lines of code
  - Functionality is less well correlated with lines of code
- I will count source files and header files excluding tests



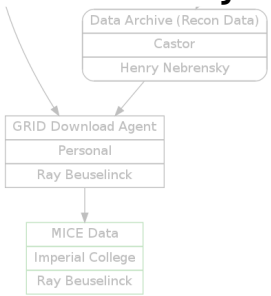


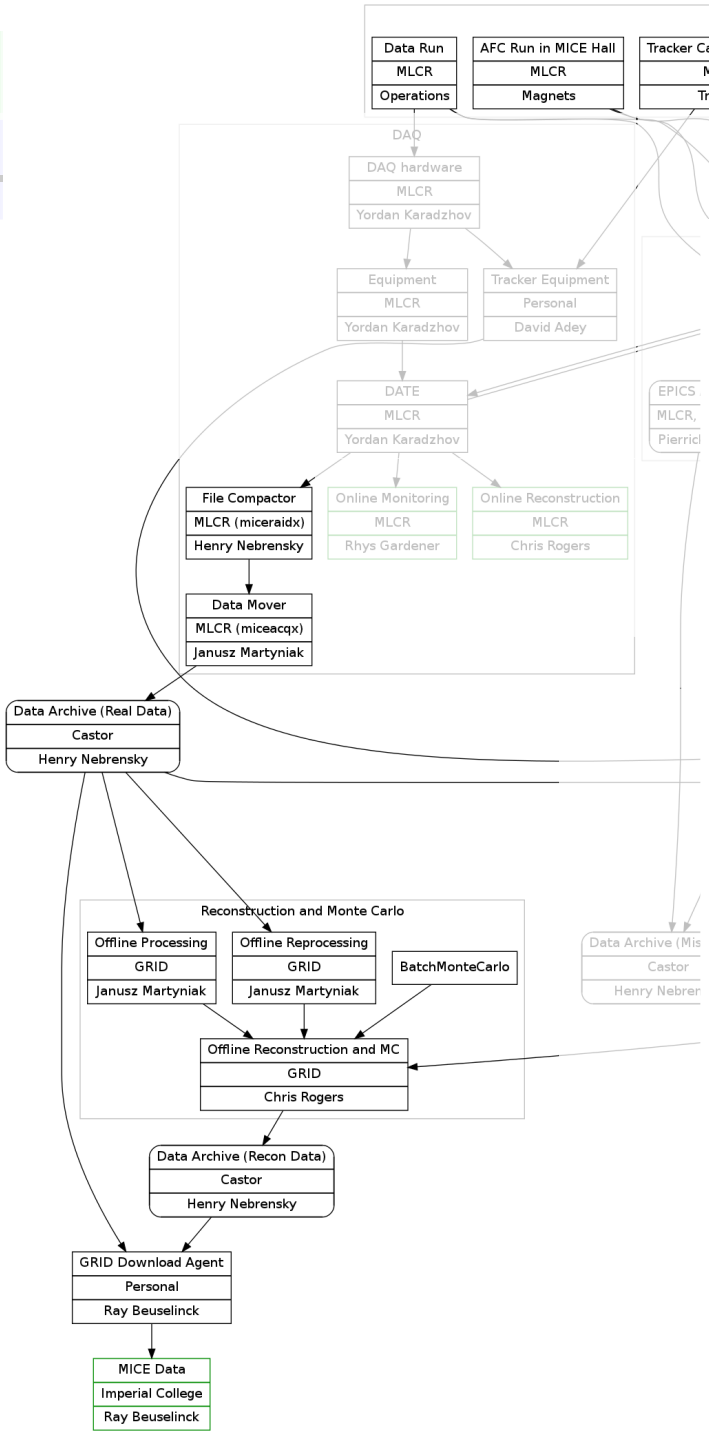
- DAQ
  - Extract data from the detectors and convert to MAUS
  - Provide monitoring information to C+M
  - ~4 racks of electronics
  - 8 servers
  - ~ 15k lines C++



- Controls and Monitoring (C+M)
  - Control MICE equipment
  - Monitor MICE equipment
  - Provide feedback to off-site experts
  - ? lines code
  - 10 servers + few VME crates

- Calibration and Configuration misc codes
  - Generate configuration and calibration information for reconstruction and Monte Carlo
  - ? lines of code
  - Calibration and Configuration is “owned” by relevant group
    - e.g. magnets “own” field mapping activity
- Configuration Database
  - Provide time-stamped configuration and calibration information for reconstruction
  - 2000 lines python (client side)
  - ~8000 lines java (server side)





- GRID
  - Data curation
  - Batch processing for Monte Carlo and reconstruction
  - ~ 1k lines of python
  - ~ 1k lines of bash
  - 3 servers
- MAUS Monte Carlo and Reconstruction
  - Convert from electronics signals to particle type, position, momenta
  - Model cooling channel
  - ~ 50k lines C++
  - ~ 10k lines python
  - 3 online servers + 2 test servers

Potential Problems

- Problems can (in order of severity)
  - Delay analysis
  - Interrupt operations
  - Require new data taking
  - Cause risk to personnel or equipment
- Go through each set of problems, most severe first

Risk to personnel or equipment

- Risk to personnel or equipment
  - Controls software
    - Mitigated by physical interlocks
    - Mitigate by testing software thoroughly
  - PPS
    - Is not part of computing project
  - In principle, malicious physical access to MLCR
    - MLCR should be locked out of hours
    - Keypad entry? (Rack room 2)
  - In principle, malicious access to MICENet
    - Access to MICENet from outside MLCR should be through mousehole only

Problems leading to bad data 1

- Data loss
  - Believe our data is secure once it gets to CASTOR or Configuration Database
  - Before it gets there, it has to go through “DAQ”, “Controls and Monitoring” or “Calibration and Configuration” processing
- DAQ infrastructure has two checks that data is good
  - DAQ monitoring
  - Online Reconstruction
- Controls and Monitoring checks
  - Alarm handler
  - Online analysis would help here
    - Using configuration database as start

Problems leading to bad data 2

- Calibration and configuration
  - If a calibration or configuration turns out to be incorrect AND we don't store raw data then this can cause problems
  - If we store raw data, we can usually redo the required analysis and generate a correct calibration
  - Calibration and configuration raw data must be stored
    - TOF calibration data OK
    - Tracker calibration raw data?
    - Field map raw data?
    - Survey raw data?

Problems causing interruption to operations

- Hardware or software bug in Configuration DB, DAQ or C+M
  - Need relevant experts available during operations
  - We now have two system experts for DAQ and C+M
    - Would be expedient to have a rota
  - We only have < one CDB expert
- Comment
  - Need to work on reliability and robustness in both DAQ and C+M
  - DAQ has been non-functional for ~ 2 months
  - Elements of C+M have been non-functional for ~ 6 months

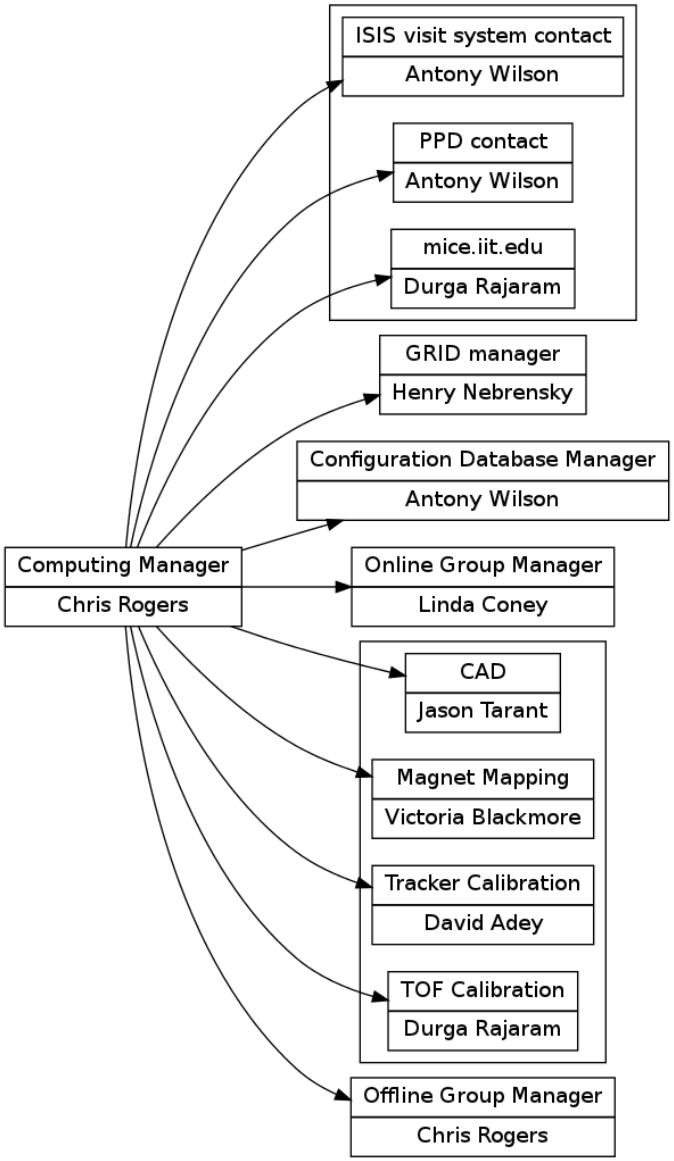
Problems delaying analysis

- Bug in calibration or configuration
- Bug in reconstruction routines
- These issues are likely to come up – but the impact can be reduced by ensuring a proper audit trail
  - Which calibration was used?
  - Which calibration code produced it? What version of that code?
  - What version of reconstruction code was used?
  - What were the control variables used?
  - Etc

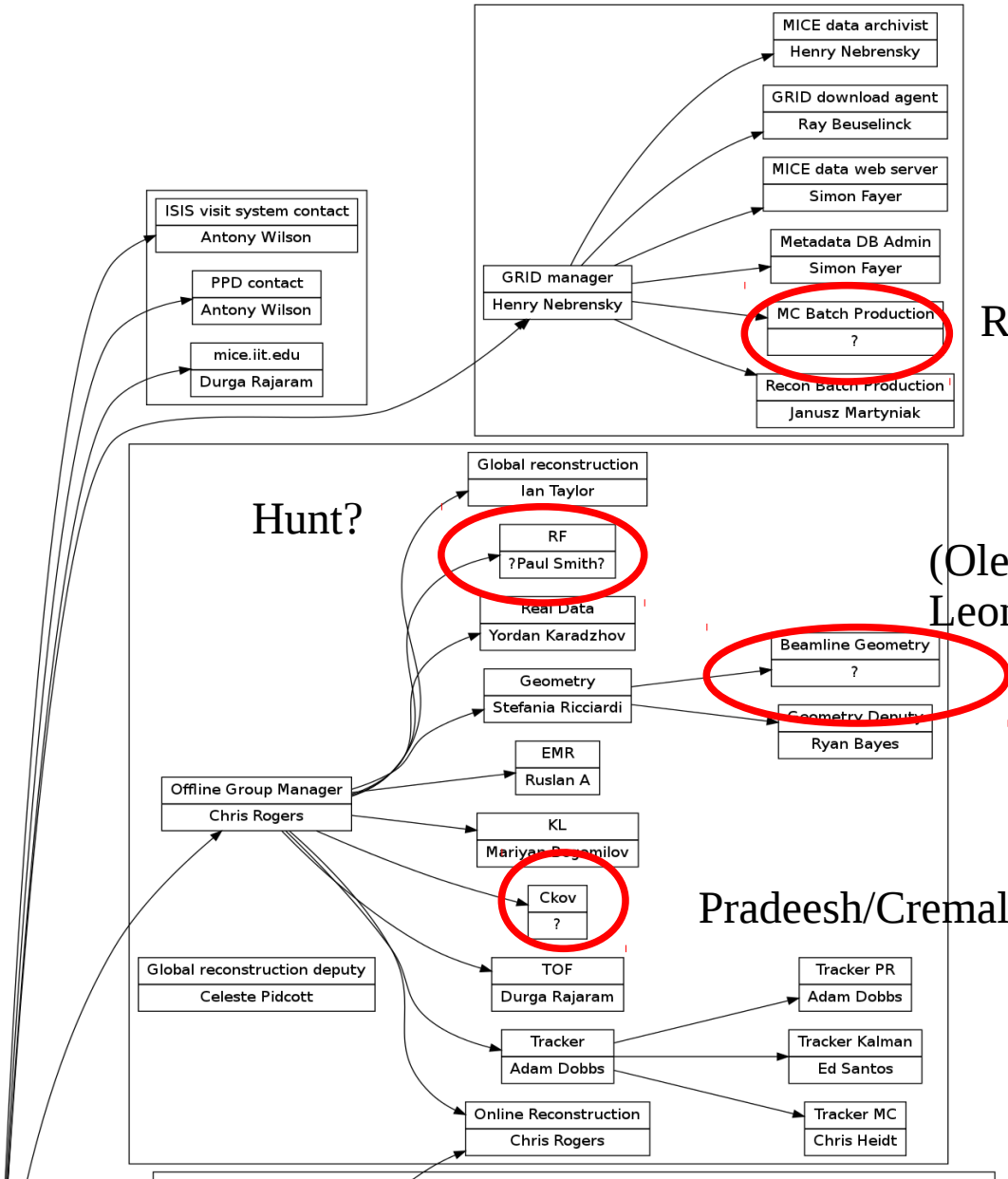
Problems delaying analysis

- Propose:
  - Production environment and development/testing environment should be separated
  - All production code should have a version number
  - All production code should have release notes
  - All code should be stored on launchpad
  - All output data sets should be traceable to version number, control variables and input data sets
  - Should be a written procedure for creating any production data
    - e.g. written procedure for generating a calibration

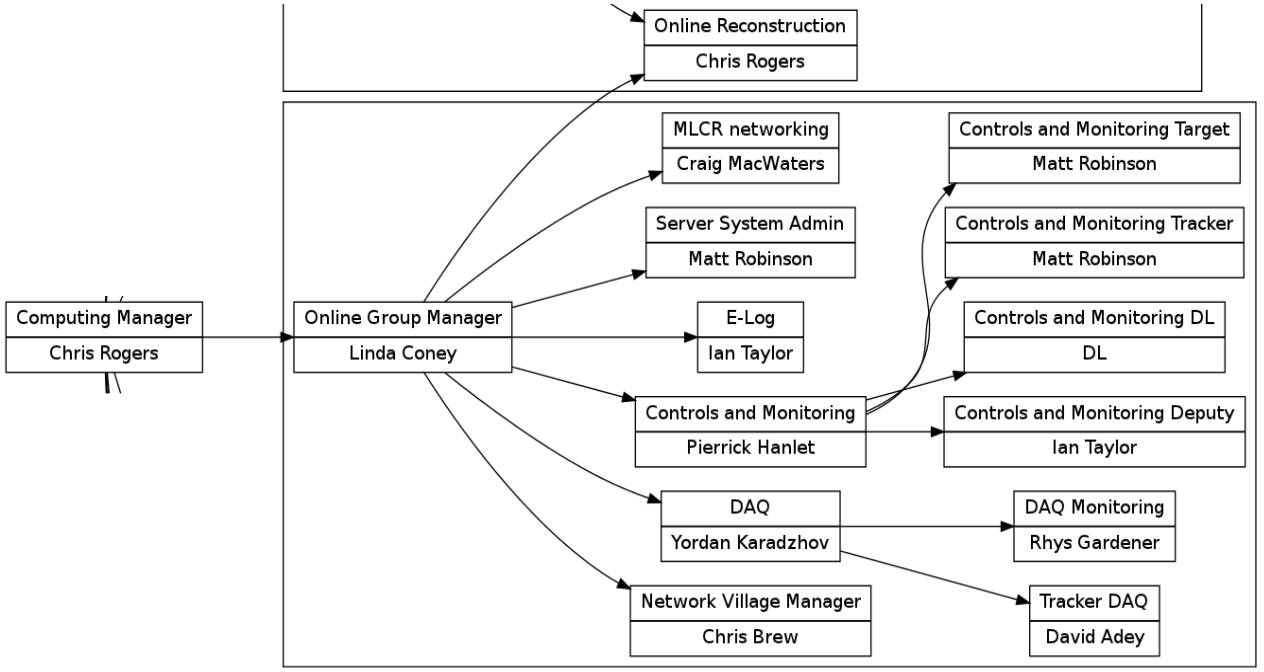
Organisation structure



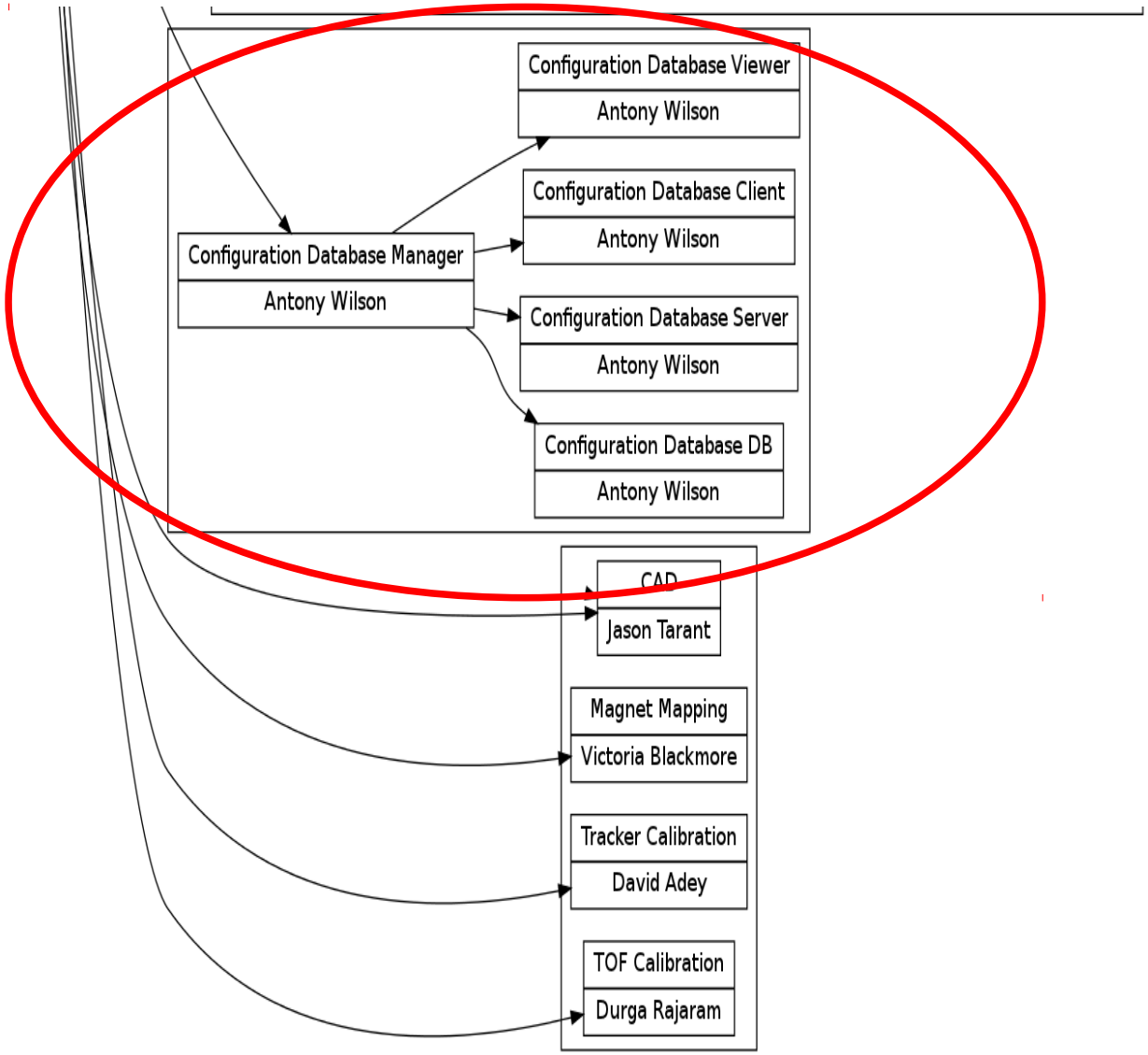
Organisation structure (2)



Organisation structure (2)



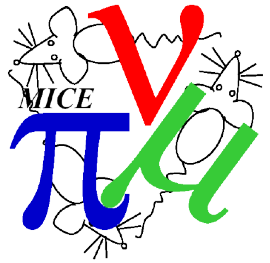
Organisation structure (3)



CDB Expert

- Antony Wilson has left MICE collaboration
  - Responsible for configuration database
  - We have a robust and reliable configuration database
  - He will finish any work in progress and support his replacement
  - I have a person to take on the role from 1st August
  - Needs a second expert to provide backup/support

Conclusions



- The bones of the computing project are in place
- The architecture looks reasonably sound
- Development is, and will be, ongoing with operations
- We have to focus on improving robustness of our development process
  - Need to keep systems operational
- We may, initially, need to slow down development
  - We have to take the hit of providing a robust system sometime
- **This is not rocket science**
  - It should be done carefully and well