Imperial College
London

MAUS Status

A. Dobbs

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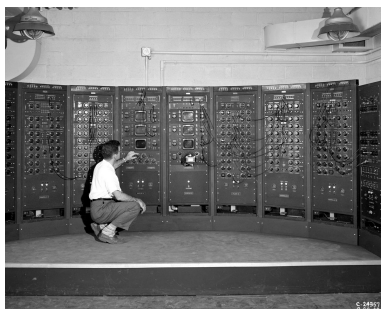
22nd June 2015



Overview

- Current Release
- Detectors
  - CKOV
  - KL
  - EMR
  - TOF
  - Tracker
- Global
- Test Coverage
- Performance
- Step IV

Current Release

- MAUS is currently on version 0.9.5
  - `http://micewww.pp.rl.ac.uk/maus/`
  - `bzr branch lp:maus`
  - See `http://micewww.pp.rl.ac.uk/projects/maus/wiki`
- MAUS 0.9.6 almost ready
  - Unpacker update for latest data (including tracker)
  - Tracker real data updates
  - Build system improvements (speed up, better isolation from system ROOT and Python)
  - Some of the new speed up implementation
  - Various other fixes and improvements
  - `bzr branch lp:maus/merge`

Overview

Ideally what we want from each detector:

- Accurate Geometry and Calibrations in CDB
- Accurate MC simulation
- MC Digitisation
- Real Data Unpacking and Digitisation
- Reconstruction
- Online Recon
- MC Validation Studies
- Coordinate Output in Cartesians
- Data Quality Flag
- Unit and Integration Tests
- Documentation
- Everything in a MAUS Release

CKOV

L. Cremaldi, D. Rajaram

- MC: 50% Complete.
- MC data digitisation: 30% Complete
- Real data digitisation: 95% Complete
- Reconstruction: 100% Complete
- Online Recon: 100% Complete
- Calibration: 75% Complete
- Still a lot of private code not in MAUS

EMR

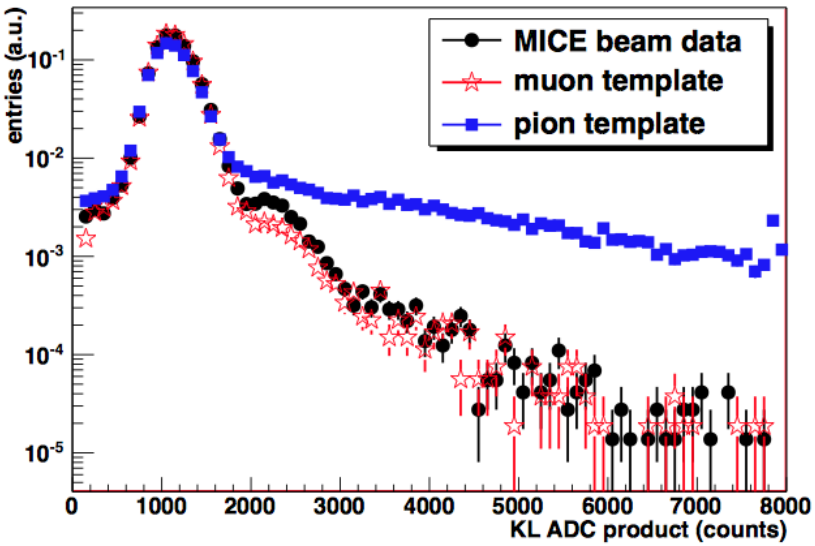
F. Drielsma

- MC: 100% Complete
- MC Digitisation: 100% Complete
- Real Data Digitisation: 100% Complete
- Reconstruction: 100% Complete
  - The charge, range, PID variables and track matching is fully operational
- Calibration - have to wait for user run to finish as trigger would otherwise need to be changed on daily basis
  - Needs to go to CDB
- MC Validation Studies: 0% Complete
- Online Recon: 20% Complete
- See EMR talks

KL

M. Bogomilov, J. Nugent

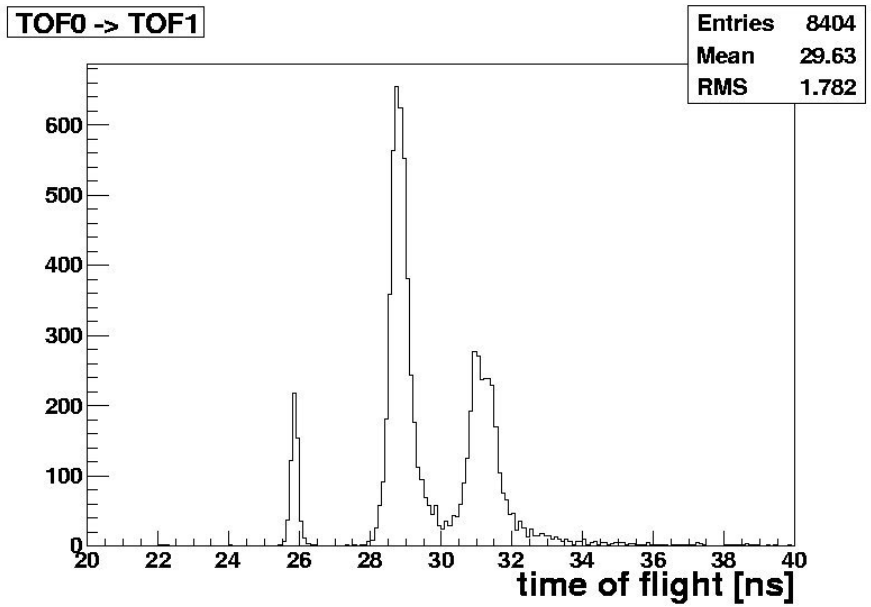
- MC: 100% Complete
- MC Data Digitisation: Virtually Complete
- Real Data Digitisation: 100% Complete
- Reconstruction: 100% Complete
- MC Validation Studies: 100% Complete
- Output now in global coordinates with errors
- Data quality flag added



TOF

D. Rajaram

- MC: 100% Complete
- MC digitisation: 90% Complete
  - MC trigger work ongoing
- Unpacking: 100% Complete
- Real data digitisation: 100% Complete
- Reconstruction: 100% Complete
- Online Recon: 100% Complete



Tracker

P. Kyberd, C. Heidt, C. Hunt, M. A. Uchida, A. Dobbs

MC

- MC: 100% Complete (see C. Heidt talk)
- MC Data Digitisation: 100% Complete
- MC Validation Studies: 80% complete (see C. Hunt talk)

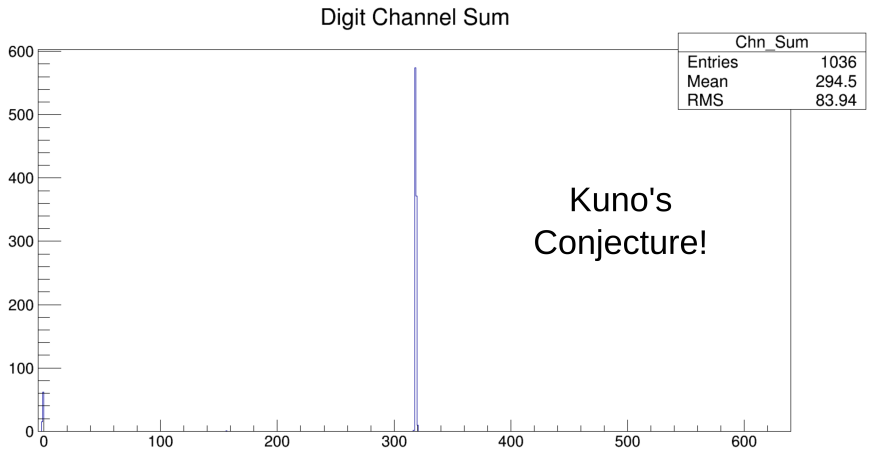
Real Data

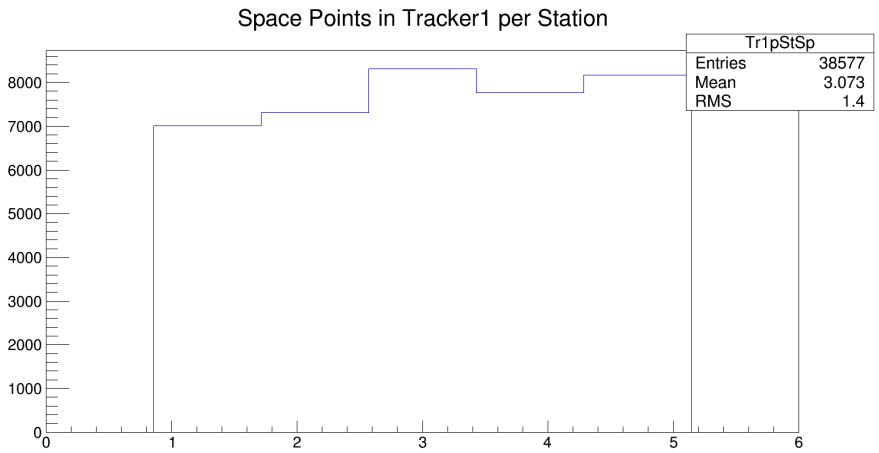
- Real Data Unpacking: **Fixed!** 80% Complete - DAQ issues remain
- Real Data Digitisation: 95% Complete
- Online Recon: 50% Complete

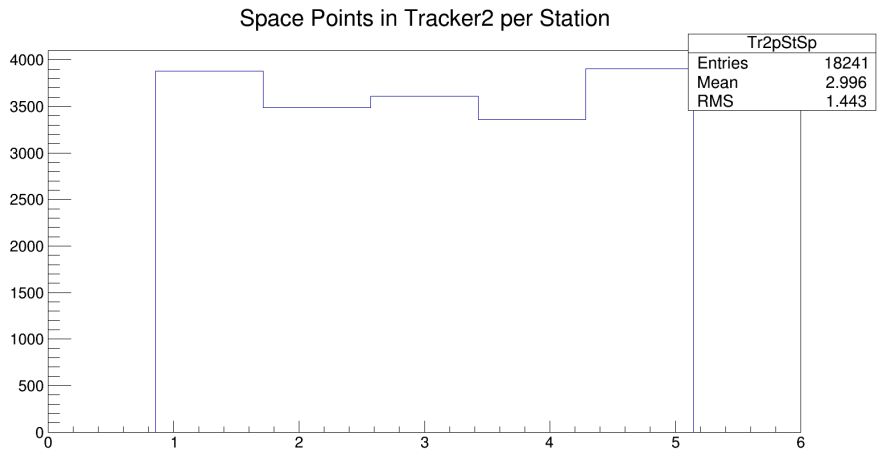
Reconstruction

- 85% Complete
- Almost complete in MC
- Few bugs thrown up by real data
- Final track fit algorithms being refined and tuned (see C. Hunt talk)
- Efficiency may be problem at low p_t

Recent Running Data







Global Status

M. A. Uchida, C. Pidcott, J. Greis

- Track Matching: 50% Complete
- PID: 70% Complete
- Through going tracks: 90% Complete
- Documentation: 30% Complete
- PID framework now includes 5 commissioning (field off) variables, as well as the 6 Step IV variables
- Efficiency and purity studies are ongoing, now being run on (pure muon, 200MeV/c) tracks produced by the RK based track matching
- Track matching includes all detectors (except CKOV)
- Full tracking efficiency calculations done, very promising with mean_energy_loss, some fine-tuning required (waiting for dE/dx in RK4 method and new Kalman for tracker)
- Created no-field through-tracks matched by TOF1/2 dt

Geometry

R. Bayes

Since the last CM:

- GDML parser used in production $\rightarrow$ big speed up
- GDML version of the geometry in the CDB
- CDB interface updated, can now use both cooling channel and beamline tables to reproduce run settings
- Work progressing well on replacing expensive FastRAD software
- However - *no current version of geometry available*. Ryan waiting on Jason for latest survey info.

Test Coverage I

Directory	Line Coverage		
src/common_cpp/API	73.0 %	294 / 403	
src/common_cpp/Converter	74.8 %	83 / 111	
src/common_cpp/Converter/DataConverters	88.8 %	340 / 383	
src/common_cpp/DataStructure	27.8 %	12792 / 46017	
src/common_cpp/DataStructure/Global	95.3 %	548 / 575	
src/common_cpp/DetModel	100.0 %	23 / 23	
src/common_cpp/DetModel/EMR	1.7 %	3 / 181	
src/common_cpp/DetModel/SciFi	62.1 %	64 / 103	
src/common_cpp/FieldTools	93.8 %	316 / 337	
src/common_cpp/Globals	98.0 %	97 / 99	
src/common_cpp/JsonCppProcessors	95.0 %	1171 / 1233	
src/common_cpp/JsonCppProcessors/Common	81.3 %	157 / 193	
src/common_cpp/JsonCppProcessors/Common/ObjectProcessorNS	83.4 %	191 / 229	
src/common_cpp/JsonCppProcessors/Global	92.9 %	78 / 84	

Directory	Line Coverage		
src/common_cpp/JsonCppStreamer	60.3 %	149 / 247	
src/common_cpp/Maths	88.5 %	1735 / 1961	
src/common_cpp/Optics	92.7 %	561 / 605	
src/common_cpp/Plotting/SciFi	44.1 %	520 / 1179	
src/common_cpp/Recon/Bayes	54.5 %	54 / 99	
src/common_cpp/Recon/Global	87.8 %	779 / 887	
src/common_cpp/Recon/Kalman	92.7 %	999 / 1078	
src/common_cpp/Recon/SciFi	83.1 %	1247 / 1501	
src/common_cpp/Simulation	84.0 %	1389 / 1653	
src/common_cpp/Utils	70.4 %	1342 / 1905	
src/input/InputCppDAQData	44.0 %	488 / 1110	
src/input/InputCppDAQOfflineData	85.1 %	40 / 47	
src/map/MapCppEMRMCDigitization	97.9 %	325 / 332	
src/map/MapCppEMRPlaneHits	95.5 %	171 / 179	
src/map/MapCppEMRRecon	97.8 %	570 / 583	
src/map/MapCppExampleMAUSDataInput	100.0 %	17 / 17	

Test Coverage II

Directory	Line Coverage		
		94.5 %	69 / 73
src/map /MapCppGlobalReconImport		**93.6 %**	44 / 47
src/map /MapCppGlobalTrackMatching		**90.9 %**	30 / 33
src/map/MapCppKLCellHits		**93.9 %**	77 / 82
src/map/MapCppKLDigits		**92.6 %**	88 / 95
src/map/MapCppKLMCDigitizer		**82.6 %**	176 / 213
src/map/MapCppSimulation		**96.4 %**	27 / 28
src/map/MapCppTOFDigits		**85.2 %**	132 / 155
src/map/MapCppTOFMCDigitizer		**87.6 %**	227 / 259
src/map/MapCppTOFSlabHits		**94.8 %**	91 / 96
src/map/MapCppTOFSpacePoints		**90.2 %**	147 / 163
src/map/MapCppTrackerDigits		**63.2 %**	12 / 19

Directory	Line Coverage		
src/map /MapCppTrackerMCDigitization		**68.7 %**	92 / 134
src/map/MapCppTrackerMCNoise		**90.5 %**	38 / 42
src/map/MapCppTrackerRecon		**96.2 %**	75 / 78
src/output/OutputCppRoot		**84.2 %**	128 / 152
src/py_cpp		**77.4 %**	452 / 584
src/reduce /ReduceCppGlobalPID		**79.1 %**	87 / 110
src/reduce /ReduceCppGlobalPID/build		**25.8 %**	289 / 1121
src/reduce /ReduceCppPatternRecognition		**69.2 %**	36 / 52
src/reduce /ReduceCppPatternRecognition /build		**24.9 %**	289 / 1160
src/reduce/ReduceCppTofCalib		**39.0 %**	76 / 195
src/reduce/ReduceCppTofCalib /build		**25.9 %**	335 / 1292

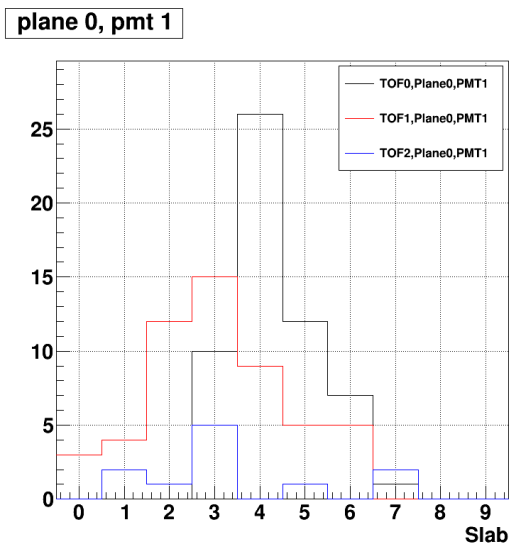
Performance

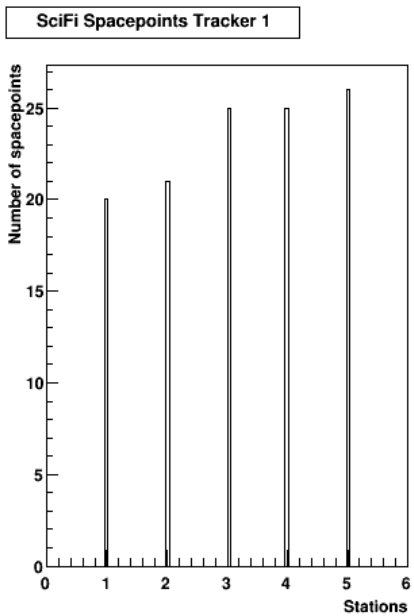
A. Dobbs, C. Rogers, D. Rajaram

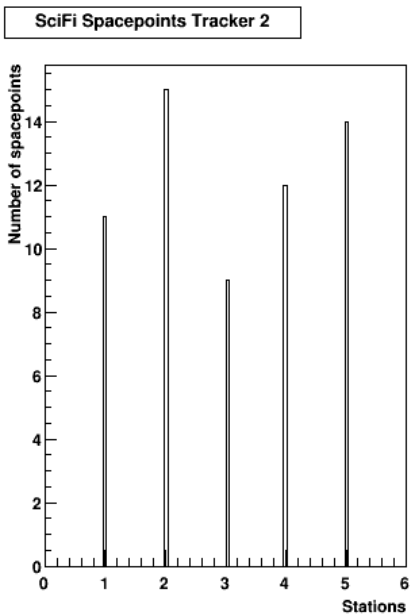
- Progress made on speed up
  - Input now spits out Data* not JSON
  - OutputCppROOT now accepts Data* not JSON
- Still to do:
  - Some maps still take JSON
  - Reducer API needs finishing
- Ryan has already observed a significant speed improvement
- Memory leak hunting still on the ToDo list

Recent Running

- Issues encountered with DAQ and unpacker - lead to lag in getting Onrec and offline batch recon working
- OnRec now working, 0.9.6 will getting fast offline working
- Importance of SOC role
- Speed continues to be an issue but is going in the right direction







Step IV Readiness and MAUS 1.0

- Fix tracker real data reconstruction
- Achieve desired tracker final track performance - 01/04/15 (Milestone)
- Remove memory leaks still present
- Finish remaining detector work (CKOV...)
- Produce detector output in global coordinate frame
- Finish Global PID and track reconstruction - 30/06/15 (Milestone)
- Iron out bugs in Online Reconstruction and get all detector displays in
- Check upstream simulation requirements
- Complete MAUS speed up work and re-profile

Questions

MAUS Schedule

Last updated: *19/06/15* *by* *A. Dobbs*

Category	Task	Sub Task	Person	Modifier	% Done	Start	Time (hrs)	End	Revised	Comments
KL			Bogomilov	1.0	90	1 Apr 14		20 Jun 15		
	MC		Bogomilov	1.0	100	1 Apr 14		Done		First version in
	MC Digitisation		Bogomilov	1.0	100	1 Apr 14		Done		First version in
		Tuning	Bogomilov	1.0	100	1 Apr 14		Done		Tune conversion
		Validation	Nugent	1.0	100	1 Apr 14		Done		Compare with data
	DAQ Digitisation		Bogomilov	1.0	100	1 Apr 14		Done		
	Cell Hits		Bogomilov	1.0	100	1 Apr 14		Done		
	Cal Interface within MAUS		Bogomilov	1.0	100	1 Apr 14		Done		
	Cal Interface to CDB		Rajaram	0.1	100	30 Jun 14		Done		
	Geometry Interface		Bogomilov	1.0	100	1 Apr 14		Done		
	Reducer		Bogomilov	1.0	100	1 Apr 14		Done		
	Cartesian Output		Bogomilov	1.0	0	15 Apr 15		20 Jun 15		
	Measurement Uncertainties		Bogomilov	1.0	0	15 Apr 15		20 Jun 15		
	Data Quality Flag		Bogomilov	1.0	0	15 Apr 15		20 Jun 15		
	Tests		Bogomilov	1.0	70	1 Apr 14		20 Jun 15		Tests for MC, Cal & Geometry
	Documentation		Bogomilov	1.0	0	1 Apr 14		20 Jun 15		
CKOV			Cremaldi	1.0	50	1 Apr 14		No Date		
	MC		Rajaram	1.0	50	1 Apr 14		No Date		
		Detector Geometry	Cremaldi	1.0	100	1 Apr 14		Done		
		Physics Processes	Cremaldi	1.0	25	1 Apr 14		No Date		
		Sensitive Detector	Winters	1.0	25	1 Apr 14		No Date		
		True Hits	Winters	1.0	0	1 Apr 14		No Date		
		Data Structure	Rajaram	1.0	0	1 Apr 14		No Date		
	MC Digitisation		Rajaram	1.0	0	1 Apr 14		No Date		
		Data Structure	Rajaram	1.0	0	1 Apr 14		No Date		
		Collect Light	Winters	1.0	0	1 Apr 14		No Date		
		Light to ADC	Winters	1.0	0	1 Apr 14		No Date		
	DAQ Digitisation		Winters	1.0	95	1 Apr 14		No Date		
		Unpacking	Winters	1.0	100	1 Apr 14		Done		
		Noise	Rajaram	1.0	100	1 Apr 14		Done		
		Charge Integration	Winters	1.0	100	1 Apr 14		Done		
		Peak Finding	Winters	1.0	100	1 Apr 14		Done		
	Calibration		Winters	1.0	75	1 Apr 14		No Date		
		By-run Pedestals	Winters	1.0	75	1 Apr 14		No Date		
		Generate Calibrations	Winters	1.0	75	1 Apr 14		No Date		
		Insert in DB	Winters	1.0	75	1 Apr 14		No Date		
		Read from DB	Winters	1.0	75	1 Apr 14		No Date		
	Geometry Interface		Rajaram	0.1	0	1 Apr 14		No Date		
	Reducer		Winters	1.0	90	1 Apr 14		No Date		

	Data Quality Flag		Rajaram	0.1	0	15 Apr 15		No Date		
	Tests		Rajaram	0.1	50	1 Apr 14		No Date		
		Recon	Rajaram	0.1	75	1 Apr 14		No Date		
		MC	Rajaram	0.1	0	1 Apr 14		No Date		
		Reducer	Rajaram	0.1	50	1 Apr 14		No Date		
		Integration	Rajaram	0.1	0	1 Apr 14		No Date		
	Documentation		Rajaram	0.1	0	1 Apr 14		No Date		
Tracker			Kyberd	1.0	90	1 Apr 14		No Date		
	MC		Heidt	1.0	100	1 Apr 14		Done		
	MC Digitisation		Heidt	1.0	90	1 Apr 14		Done		
		ADC Smearing	Heidt	1.0	0	1 Apr 14		Done		
		Noise	Heidt	1.0	100	1 Apr 14		Done		
	DAQ Digitisation		Kyberd	1.0	50	1 Sep 14		No Date		Fix bug post release 0.7.3
	DAQ Unpacking		Kyberd	1.0	80	1 Apr 14		No Date		Fix bug post release 0.7.3
	Cluster Reconstruction		Santos	1.0	100	1 Apr 14		Done		
	Spacepoint Reconstruction		Santos	1.0	100	1 Apr 14		Done		
	Pattern Recognition		Kyberd	1.0	90	1 Apr 14		1 Jun 15		
		Efficiency	Hunt	1.0	50	1 Sep 14		No Date		Spacepoint level efficiency
		Optimisation	Kyberd	1.0	75	1 Apr 14		1 Jun 15		Especially for low pt, noise
	Kalman		Hunt	1.0	90	1 Apr 14		15 Jun 15		
		Optimisation	Hunt	1.0	90	1 Apr 14		15 Jun 15		
	Calibration Interface		Kyberd	1.0	0	1 Apr 14		No Date		
	Geometry		Heidt	1.0	100	1 Apr 14		Done		
		Data held	Heidt	1.0	100	1 Apr 14		Done		
		Interface	Heidt	1.0	100	1 Apr 14		Done		
	Code profiling		Hunt	1.0	20	1 Nov 14		No Date		
	Truth Matching		Hunt	1.0	100	1 Apr 14		Done		
	Efficiency Studies		Hunt	1.0	20	1 Apr 14		No Date		
	Reducer		Uchida	1.0	75	1 Apr 14		30 Jun 15		
	Cartesian Output		Santos	1.0	100	1 Apr 14		Done		
	Measurement Uncertainties		Hunt	1.0	50	15 Apr 15		15 Jun 15		
	Data Quality Flag		Kyberd	1.0	0	15 Apr 15		15 Jun 15		
	Tests		Kyberd	1.0	90	1 Apr 14		30 Jun 15		
		Unit tests	Kyberd	1.0	100	1 Apr 14		Done		
		Integration tests	Hunt	1.0	80	1 Apr 14		30 Jun 15		
	Documentation		Kyberd	1.0	75	1 Apr 14		No Date		
TOF			Rajaram	0.1	90	1 Apr 14		No Date		
	Fine grained position		Rajaram	0.1	0	7 Dec 14		No Date		
	MC		Rajaram	0.1	100	1 Apr 14		Done		
	MC Digitisation		Rajaram	0.1	90	1 Apr 14		No Date		
		Optimisation	Rajaram	0.1	25	5 Jul 14		No Date		Better trigger pixel finding
		Truth atching	Rajaram	0.1	50	1 Jul 14		No Date		
		Restructure trigger	Rajaram	0.1	80	26 Nov 14		No Date		

	DAQ Digitisation		Rajaram	0.1	100	1 Apr 14		Done		
	Slab Hits		Rajaram	0.1	100	1 Apr 14		Done		
		Optimisation	Rajaram	0.1	100	21 Jun 14		Done		
			Rajaram	0.1	100	1 Apr 14		Done		
	Calibration Interface		Rajaram	0.1	100	1 Apr 14		Done		
		Get calibrations by run	Rajaram	0.1	100	30 Jun 14		Done		
	Cartesian Output		Rajaram	0.1	100	15 Apr 15		Done		
	Measurement Error		Rajaram	0.1	0	15 Apr 15		No Date		
	Data Quality Flag		Rajaram	0.1	0	15 Apr 15		No Date		
	Documentation		Rajaram	0.1	80	1 Apr 14		No Date		Digitisation documentation
EMR			Drielsma	1.0	80	1 Apr 14		3 Aug 15		
	Particle ID		Drielsma	1.0	100	1 Apr 14		Done		
	Reconstruction		Drielsma	1.0	100	1 Apr 14		Done		
		Hit reconstruction	Drielsma	1.0	100	1 Apr 14		Done		
		Track reconstruction	Drielsma	1.0	100	1 Apr 14		Done		
		Range measurement	Drielsma	1.0	100	1 Apr 14		Done		
		Decay products matching	Drielsma	1.0	100	1 Apr 14		Done		
		Energy measurement	Drielsma	1.0	100	1 Apr 14		Done		
	Calibration		Drielsma	1.0	0	1 Apr 14		16 May 15	15 Aug 15	
		Take data w cosmics	Drielsma	1.0	0	1 Apr 14		8 May 15	7 Aug 15	
		Calibrate + validate	Drielsma	1.0	0	1 Apr 14		16 May 15	15 Aug 15	
	MC		Drielsma	1.0	100	1 Apr 14		Done		
		Physics Process	Drielsma	1.0	100	1 Apr 14		Done		
		Sensitive Detector	Drielsma	1.0	100	1 Apr 14		Done		
		Data structure	Drielsma	1.0	100	1 Apr 14		Done		
	MC Dig		Drielsma	1.0	100	1 Apr 14		Done		
		ADC simulation	Drielsma	1.0	100	1 Apr 14		Done		
		Data structure	Drielsma	1.0	100	1 Apr 14		Done		
	DAQ Dig		Drielsma	1.0	100	1 Apr 14		Done		
	Calibration Interface		Drielsma	1.0	100	1 Apr 14		Done		
	Geometry Interface		Drielsma	1.0	100	1 Apr 14		Done		
	Truth Matching		Drielsma	1.0	0	1 Apr 14		19 Jul 15		
	Reducer		Drielsma	1.0	60	1 Apr 14		18 Jun 15	30 Jun 15	
	Cartesian Output		Drielsma	1.0	100	15 Apr 15		Done		
	Measurement Error		Drielsma	1.0	100	15 Apr 15		Done		
	Data Quality Flag		Drielsma	1.0	0	15 Apr 15		30 Jun 15		
	Test		Drielsma	1.0	100	1 Apr 14		Done		
	Doc		Drielsma	1.0	0	1 Apr 14		3 Aug 15	31 Aug 15	
Global			Uchida	1.0	65	24 Feb 15		19 Jul 15		
	Inputs		Pidcott	1.0	80	24 Feb 15		1 Apr 15	5 Jun 15	Dep on global coords & EMR
		Tracker	Pidcott	1.0	100	24 Feb 15		Done		Dep on EMR recon update
		TOF	Pidcott	1.0	95	24 Feb 15		10 Apr 15	5 Jun 15	
		KL	Pidcott	1.0	95	24 Feb 15		26 Feb 15	5 Jun 15	

		CKOV	Pidcott	1.0	100	24 Feb 15		Done	
		EMR	Pidcott	1.0	95	24 Feb 15		30 Apr 15	5 Jun 15
	Runge-Kutta no dE/dx		Greis	1.0	75	24 Feb 15		12 Jun 15	
		US	Greis	1.0	100	24 Feb 15		Done	
		DS	Greis	1.0	100	24 Feb 15		Done	
	Through-going tracks		Greis	1.0	80	24 Feb 15		20 Apr 15	13 Jun 15
		Create MC w/o field	Greis	1.0	90	24 Feb 15		10 Apr 15	12 Jun 15
		Create tracks TOF1-2	Greis	1.0	90	24 Feb 15		10 Apr 15	12 Jun 15
		Select trks based on TOF	Greis	1.0	90	24 Feb 15		Done	
		Select fiducial volume	Greis/Pidcott	1.0	0	24 Feb 15		20 Apr 15	13 Jun 15
	Add dE/dx to Runge-Kutta		Uchida	1.0	0	24 Feb 15		1 Apr 15	29 May 15
	Track matching		Greis	1.0	50	24 Feb 15		10 May 15	15 Jun 15
		US inc dE/dx	Greis	1.0	50	24 Feb 15		10 Apr 15	12 Jun 15
		Multiple tracks per spill	Greis	1.0	10	24 Feb 15		30 Apr 15	30 Jun 15
		Comp Kalman and RK	Greis/Hunt	1.0	0	24 Feb 15		10 May 15	15 Jul 15
		Efficiency	Greis	1.0	80	24 Feb 15		20 Apr 15	7 Jul 15
		Add EMR	Greis	1.0	100	24 Feb 15		Done	
	PID		Pidcott	1.0	70	24 Feb 15		5 May 15	12 Jun 15
		DS tracks	Pidcott	1.0	100	24 Feb 15		Done	
		US tracks	Pidcott	1.0	100	24 Feb 15		Done	
		Improve PID vars	Pidcott	1.0	100	24 Feb 15		Done	
		No field PID	Pidcott	1.0	100	24 Feb 15		Done	
		Add EMR	Pidcott	1.0	100	24 Feb 15		Done	
		pt	Pidcott	1.0	30	24 Feb 15		27 Apr 15	12 Jun 15
		efficiency	Pidcott	1.0	30	24 Feb 15		27 Apr 15	12 Jun 15
	Test programs		Uchida	1.0	30	24 Feb 15		25 May 15	7 Jul 15
		Importing inputs	Pidcott	1.0	50	24 Feb 15		1 May 15	15 Jul 15
		PID	Pidcott	1.0	25	24 Feb 15		25 May 15	15 Jul 15
		Tracks	Greis	1.0	0	24 Feb 15		25 May 15	7 Jul 15
	Documentation		Uchida	1.0	30	24 Feb 15		1 Jun 15	
		PID doc in MUG	Pidcott	1.0	50	24 Feb 15		6 Apr 15	15 Jul 15
		MAUS Paper	Uchida	1.0	20	24 Feb 15		Done	
		Doxygen	Uchida	1.0	20	24 Feb 15		1 Jun 15	
	Improvements from Eff & pt		Uchida	1.0	0	24 Feb 15		1 Jun 15	19 Jul 15
		Track matching	Greis	1.0	0	24 Feb 15		1 Jun 15	15 Jun 15
		PID	Pidcott	1.0	0	24 Feb 15		1 Jun 15	19 Jul 15
Geometry	CAD Import		Bayes	1.0	100	1 Apr 14		Done	
		STEP I (Oct 2012 run)	Tarrant	1.0	100	1 Apr 14		Done	
		STEP IV (Ideal)	Tarrant	1.0	100	1 Apr 14		Done	
		DEMO (Ideal)	Tarrant	1.0	0	1 Apr 14		No Date	
	Detectors		Bayes	1.0	100	1 Apr 14		Done	
		Integration	Bayes	1.0	100	1 Apr 14		Done	
		TOF	Rajaram	1.0	100	1 Apr 14		Done	

		Chrenkov	Cremaldi	1.0	100	1 Apr 14		Done		
		Absorbers	Snopok	1.0	100	1 Apr 14		Done		
		Tracker	Heidt	1.0	100	1 Apr 14		Done		
		EMR	Asfandiyarov	1.0	100	1 Apr 14		Done		
		KL	Bogomilov	1.0	100	1 Apr 14		Done		
		Diffuser	Bayes	1.0	100	1 Apr 14		Done		
			Blackmore	1.0	100	1 Apr 14		Done		
		Speed improvement	Bayes	1.0	100	1 Apr 14		Done		
		Survey integration	Bayes	1.0	100	1 Apr 14		Done		
	Validation		Ricciardi	1.0	100	1 Apr 14		Done		
	Documentation		Bayes	1.0	20	1 Apr 14		1 May 15	1 Jun 15	
MC			Rajaram	0.1		12 May 15	104			
	Restructure TOF Digits		Rajaram	0.1	60	12 May 15	48	20 May 15		
	TOF Digits Data Structure		Rajaram	0.1	0	3 Jun 15	16	9 Jun 15		
	Trigger Data Structure		Rajaram	0.1	0	10 Jun 15	24	20 Jun 15		
	Tests		Rajaram	0.1	0	30 Jun 15	16	6 Jul 15		
API	Globals		Rajaram	0.1	100	1 Apr 14		Done		
	Input		Rajaram	0.1	100	1 Apr 14		Done		
	Map		Rajaram	0.1	100	1 Apr 14		Done		
	Data Structure		Rogers	1.0	100	1 Apr 14		Done		#1376
	Processors		Rajaram	0.1	100	1 Apr 14		Done		
	Output		Rogers	1.0	50	29 Apr 15		1 Jun 15		
	Reducer		Rogers	1.0	50	29 Apr 15		1 Jun 15		
	Framework		Rajaram	0.1	100	1 Apr 14		Done		
	Exception Handling		Rajaram	0.1	90	1 Apr 14		3 Jun 15		
	Logging		Rajaram	0.1	100	1 Apr 14		Done		
	Multithreading		Dobbs	0.5	15	20 Mar 15		1 Jun 15		
	Speed Up		Dobbs	0.5	0	29 Apr 15		1 Jun 15		
		Data mangle in Reducers to use new API	Rogers	1.0	0	29 Apr 15		1 Jun 15		
		Data mangle in Outputters to use new API	Rogers	1.0	90	29 Apr 15		1 Jun 15		
		Refactor CKOV map to cpp using Data*	Rajaram	0.1	50	29 Apr 15		1 Jun 15		
		Refactor KL maps to use Data*	Rajaram	0.1	100	29 Apr 15		Done		
		Refactor TOF maps to use Data*	Rajaram	0.1	100	29 Apr 15		Done		
		Refactor MapPyRecon	Dobbs	0.5	0	29 Apr 15		1 Jun 15		
		Refactor InputCppDAQData to use Data*	Dobbs	0.5	80	29 Apr 15		Done		
		Refactor single_thread.py to remove JSON	Dobbs	0.5	90	29 Apr 15		1 Jun 15		In framework/
		Refactor multithread.py to remove JSON	Rajaram	0.1	0	29 Apr 15		1 Jun 15		In framework/
		Refactor utilities.py to remove JSON	Dobbs	0.5	90	29 Apr 15		1 Jun 15		In framework/
		Refactor MapPyBeamMaker	Rogers	1.0	0	29 Apr 15		1 Jun 15		
	Test		Rajaram	0.1	100	1 Apr 14		Done		
	Doc		Rajaram	0.1	100	1 Apr 14		Done		