Software Summary

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IIT, MICE CM 36
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Outline

- MAUS overview (Rogers)
- Geometry (Bayes)
- Tracker (Dobbs)
- TOF (Rajaram)
- Global (Lane)

MAUS Overview (Rogers)

Responsibility/Block Diagram

Project management **Rogers**			
Build system **~~Rogers~~ Rajaram**	QA + Release **~~Rogers~~ Rajaram**	Documentation **~~Rogers~~ Rajaram**	
Geometry + fields **Ricciardi/Bayes**	Geant4 Simulation **Rogers/Bayes/Middleton**	Data flow/API/Online **Rogers/~~Richards~~**	
TOF **Rajaram**	Tracker **Dobbs/Santos et al**	Ckov **Cremaldi/Pradeesh?/ ~~Kafka~~**	KL **Bogomilov**
Data Unpacking **Karadzhov**	EMR **Karadzhov/Ruslan**	RF **TBD**	
Detector Integration **Taylor/Lane**	Accelerator physics analysis **Rogers/Lane**		

MAUS Online & Offline (Rogers)

Online

- Since CM 35
  - Implemented reasonable deployment procedure
  - Added integration tests – check that we can reconstruct a run
  - Can't test against cosmics because of DAQ issues

Offline

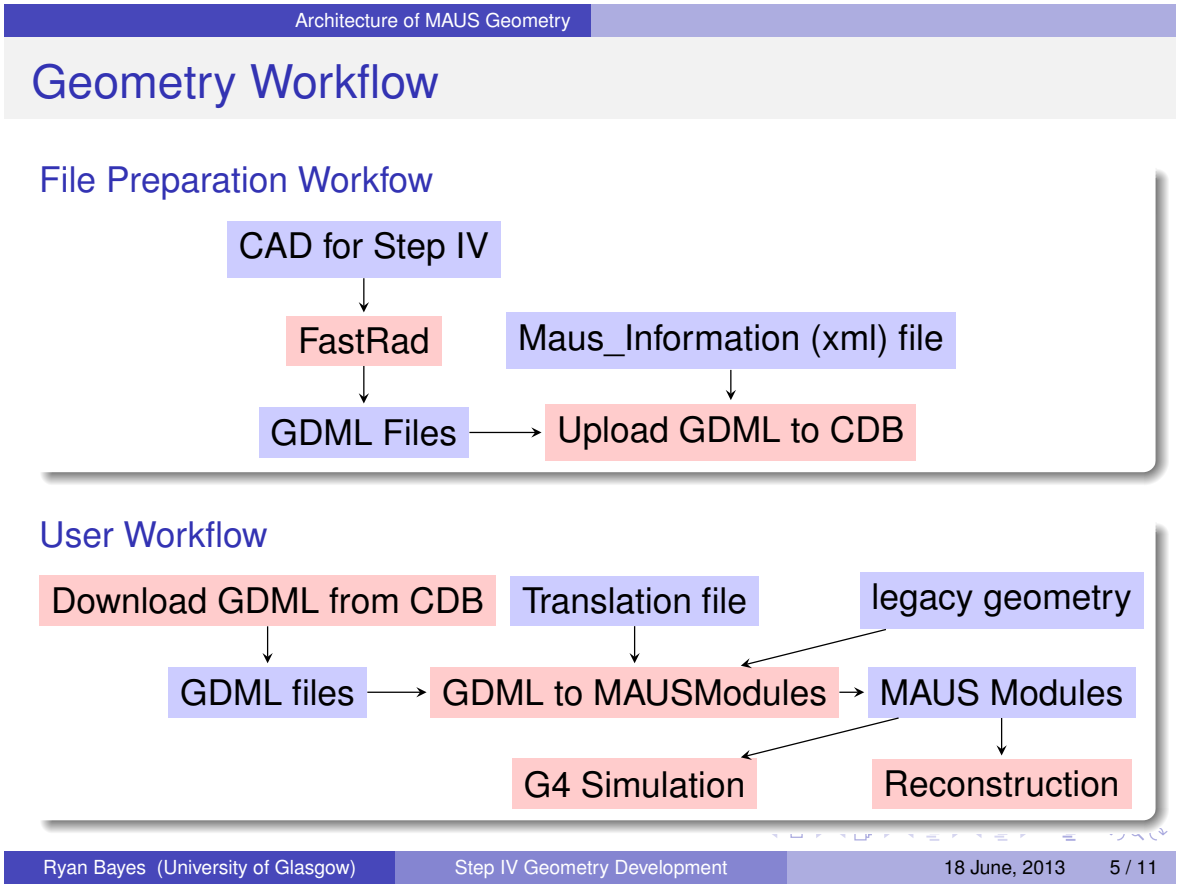
- Successful batch reconstruction run against a limited dataset
  - Some failures (MAUS bugs + batch script bugs)
  - Aim to make a full reconstruction run, validate reconstructed output
- Monte Carlo batch job blocked by Geometry, SciFi, Ckov MC

MAUS Test Coverage (Rogers)

ReducePyTOFPlot	3%	Durga Rajaram
MapPyTOFPlot	12%	Durga Rajaram
framework.merge_output	27%	~~Alex Richards~~
framework.input_transform	34%	~~Alex Richards~~
MapPyScalersDump	45%	~~?~~
docstore.MongoDBDocumentStore	55%	~~Alex Richards~~
ReducePyCkovPlot	61%	?Gene Kafka?
docstore.DocumentStore	68%	~~Alex Richards~~
Calibration.get_tof_cabling	73%	Durga Rajaram
framework.utilities	77%	Chris Rogers

src/common_cpp/API	51%	~~Alex Richards~~
src/common_cpp/DetModel/SciFi	53%	Chris Heidt
src/common_cpp/JsonCppStreamer	59%	~~Alex Richards~~
src/input/InputCppDAQData	63%	Yordan Karadzhov
src/common_cpp/Utils	67%	Durga Rajaram
src/input/InputCppDAQOfflineData	67%	Yordan Karadzhov

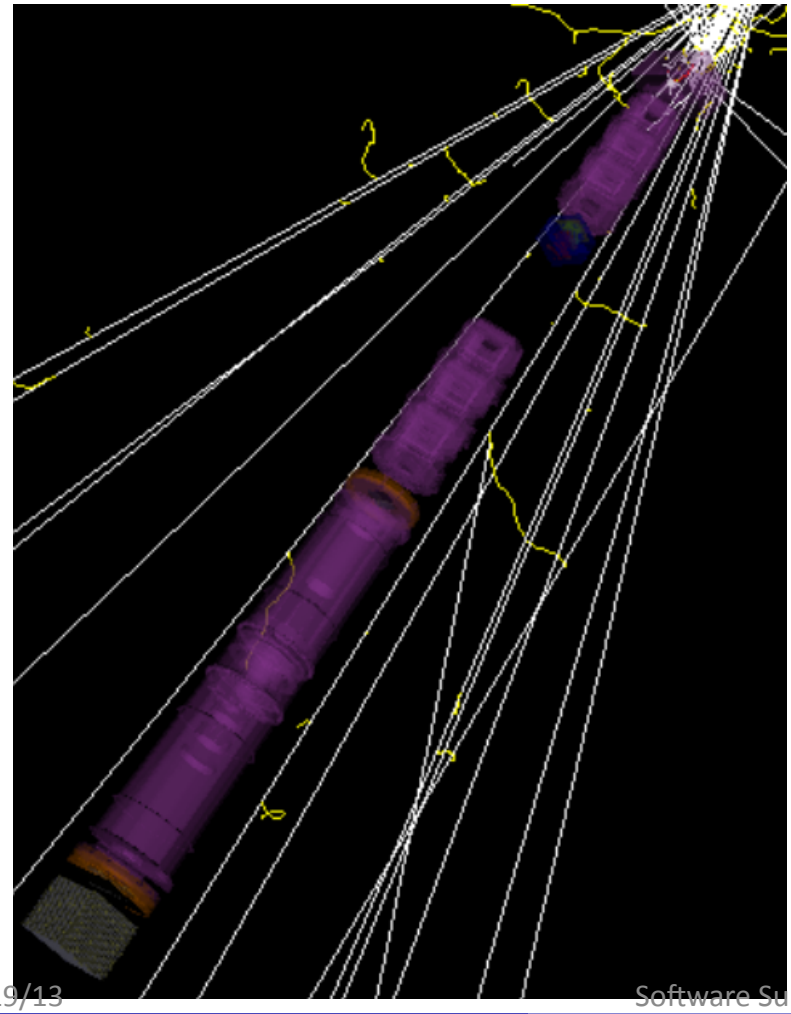
Geometry (Bayes)



- Need to match MAUS geometry to surveys instead of feeding in by hand
- Geometry is written to DB
- Jason Tarrant -- CAD model & GDML
- Stefania Ricciardi -- Geometry validation
- Pavel Snopok -- Absorber model development
- Victoria Blackmore – B-fields
- Chris Heidt – tracker geometry in GDML.
- Ryan Bayes -- Assuming software development and handling of new models & Implementation of tracker geometry in GDML.

Geometry (Bayes)

Simulations in MAUS

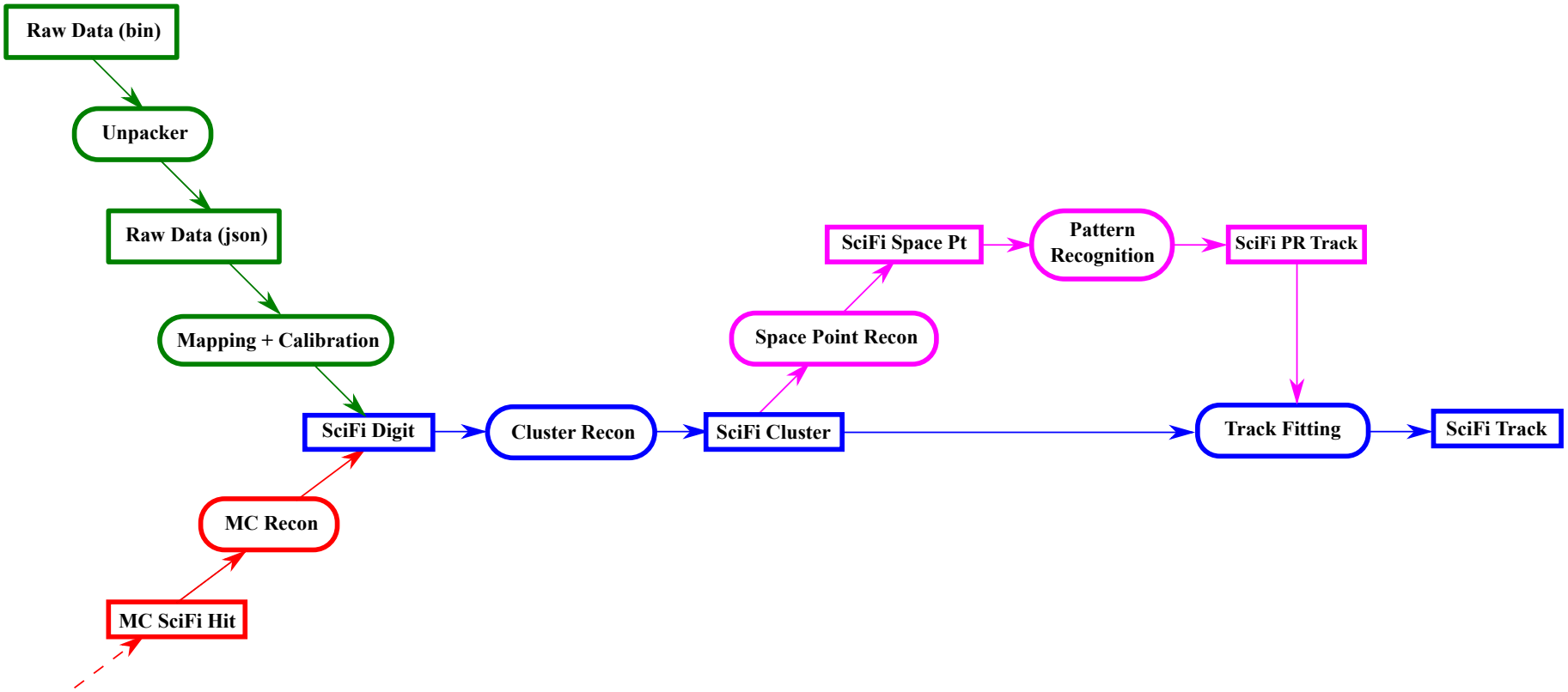


- Translation of GDML works in correct coordinate system.
- Geometry includes placeholders for all detectors except Tracker
- Needs diffuser and absorber placeholders.
- Legacy geometry used for specific detectors
  - TOFs
  - Cherenkovs
  - KL
  - EMR

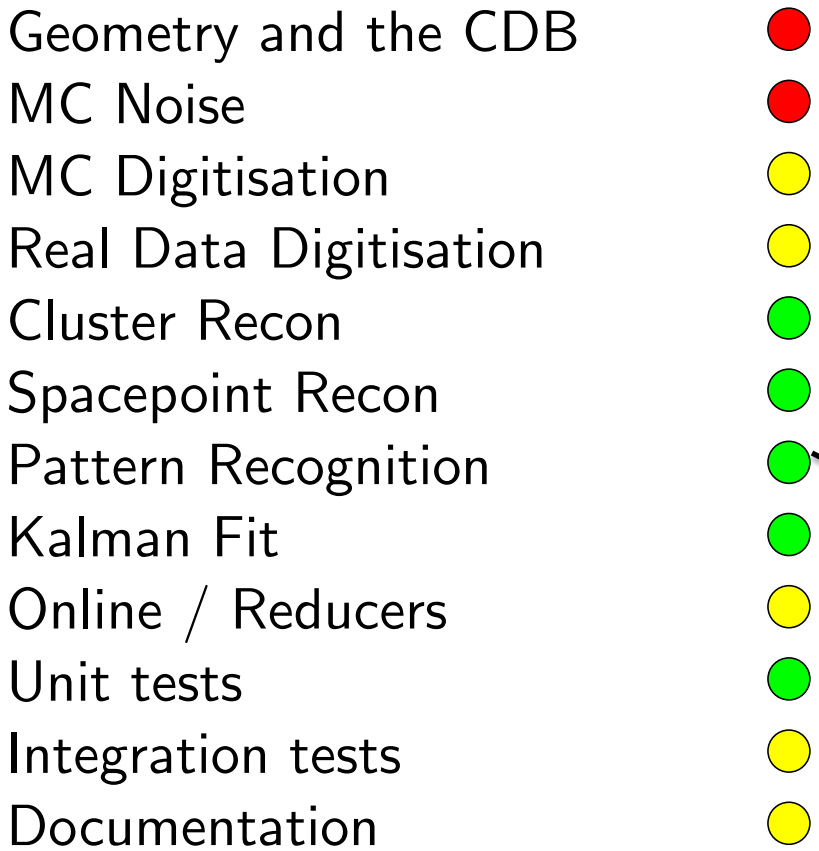
Geometry (Bayes)

- Much progress has been made since last collaboration meeting
  - Viable beam-line geometry from CAD.
- Solved a few technical issues against running the simulation.
- Made the new geometry put the legacy detectors in correct places.
- Still some work to do.
  - Complete CDB controlled tracker geometry
- Vet and place magnetic fields.
- Optimization and testing of implementation.

Tracker Recon (Dobbs)



Tracker Recon (Dobbs)



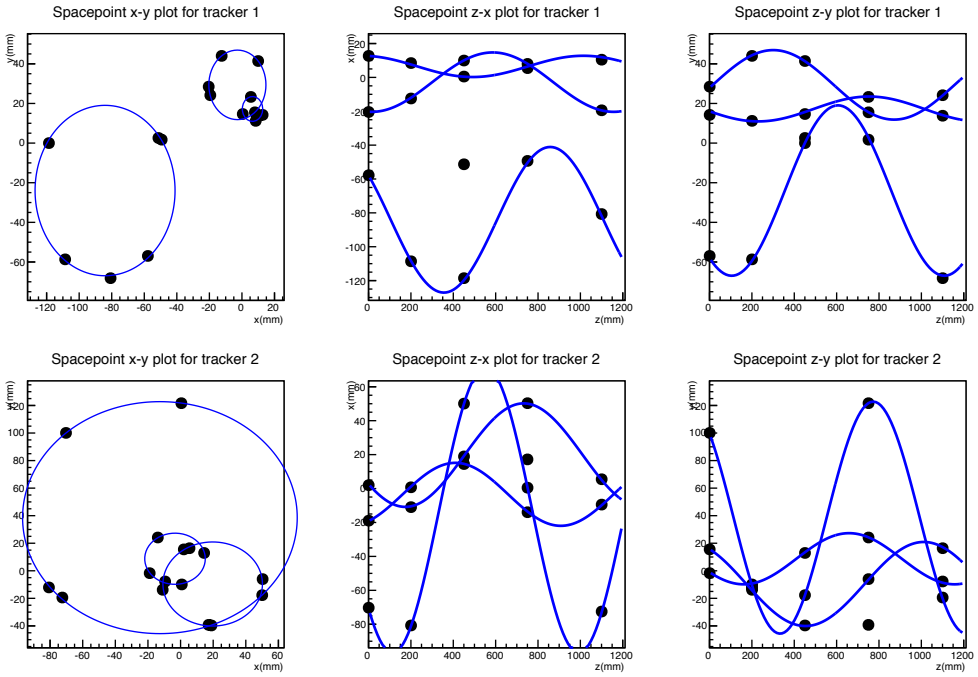
- Currently using legacy files
- Need to validate geometry in CDB, convert XML to GDML to MiceModules

- PR: now using all spacepoints in fit, finds 99.5% MC tracks
- Code needs cleanup and (another) review
- Kalman reviewed, issued being worked on

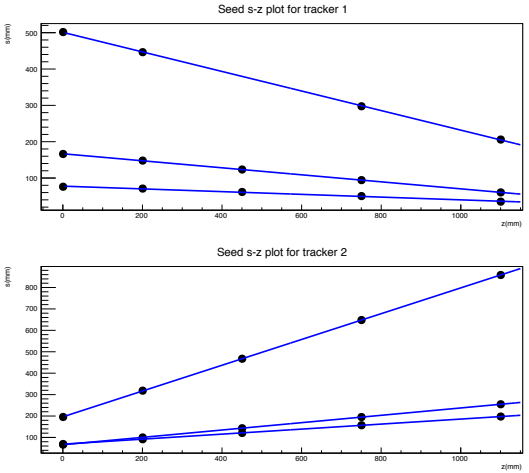
Tracker Kalman (Dobbs)

Data Viewer

XYZ View



SZ View



All found spacepoints look good here, but one spacepoint has been missed in T1

Tracker Online (Dobbs)

Info Box

Tracker	1	2
Spill num	1	1
Events	3	3
Digits	51	53
Clusters	48	47
Spacepoints	16	16
Str Tracks	0	0
Helical Tracks	3	3
Total Spoints	16	16
Total Str Tracks	0	0
Total Helical Tracks	3	3

The infobox displays data for the current spill

Question

What data / plots would people like to see, both online and offline?

Tracker Goals (Dobbs)

- *Sort out CDB / geometry issues*
- Pattern Recognition spacepoint efficiency study
- Test with full trigger MC and realistic noise
- Improve online / offline analysis tools
- *Merge Kalman & updated pattern recognition into trunk*
- Optimise performance
- *Data challenge*
- Produce a paper for CHEP
- Produce a technical journal paper
- *Code in working form in a MAUS release for Step IV*

TOF (Rajaram)

- Useful review of calibration + MC + reconstruction software last Thursday
- Reconstruction and MC code stable
  - Room for improvements in MC: trigger formation, pulse shape, noise
- Calibration:
  - code is stand-alone, not documented, not integrated with MAUS, not tied to survey
    - Need a documented `calibrate_tof` that can be run in the CLR
  - Slabs/pixels on the periphery have poor statistics and hence several of them are uncalibrated
    - improve coverage next calibration run
  - Re-run calibration with correct geometry & TDC conversion
  - Add Rayner's calibration and integrate with MAUS so that we have one (correct) TOF calibration

Global Recon (Lane)

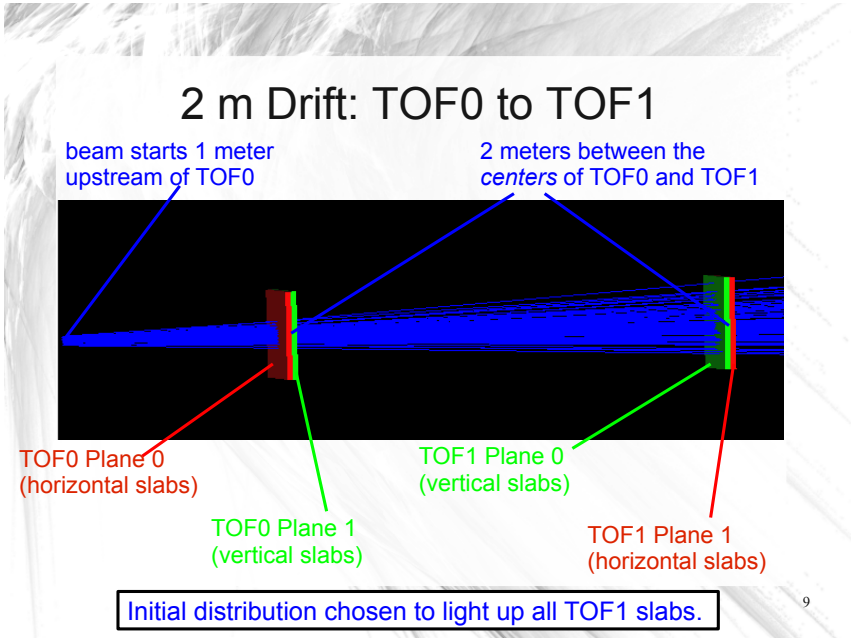
Earlier:

- Had tested with moderate success on MC truth and smeared MC inputs
- MC truth was a check on the fitting algorithm, Smeared MC simulated detector resolutions
- Drift and single quad configurations
- Verified the linear order transfer maps using COSY INFINITY transfer matrices
- Developed software framework for plugging in different optics models and fitting algorithms: Polynomial Approx., Runge-Kutta, χ^2 minimization, Kalman Filter
- Created flexible, simple to use data structure capable of storing complicated triggers and event topologies if needed.

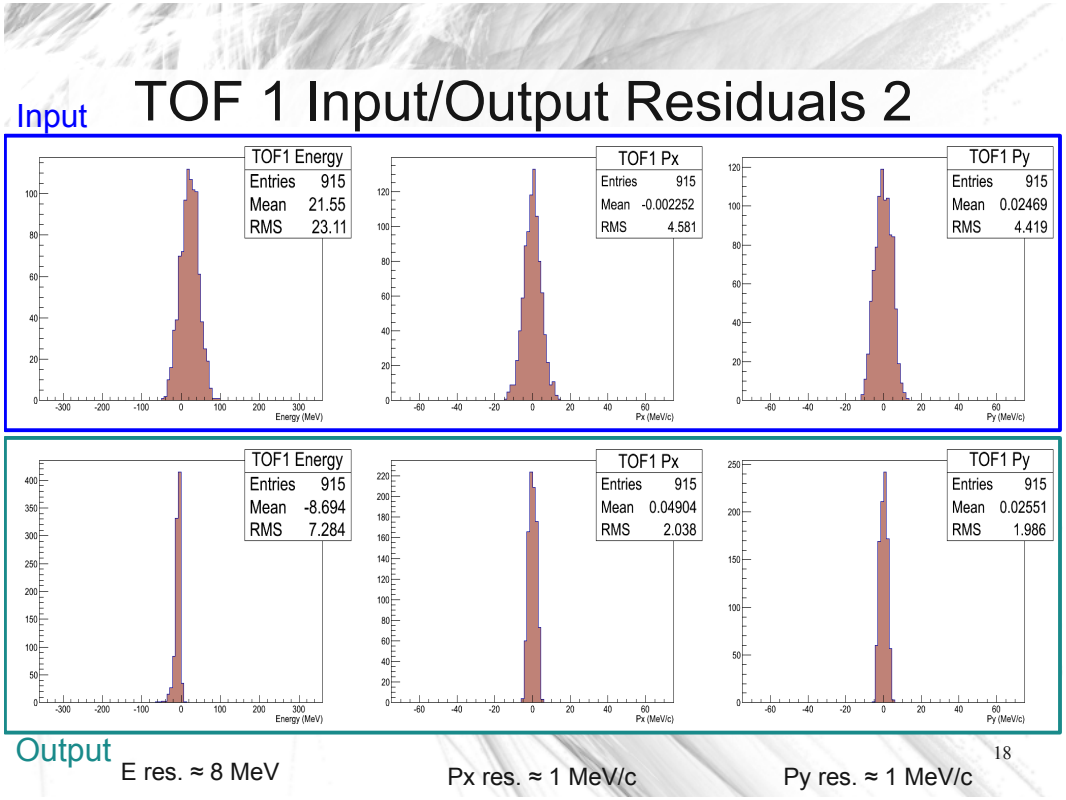
Global Recon (Lane)

Now

- Using reconstructed detector data
- Space-points instead of smeared MC for track fitting inputs
- Using the new global recon data structure
- Verified track fitting inputs using a drift configuration of TOF0 and TOF1
- Improved/fixed track fitting algorithm



Global Recon (Lane)



- TOF inputs verified:
  - Time residual RMS within resolution,
  - x/y residual RMS are close to transverse spacial resolution of TOF0/TOF1 slabs
- Drift track fitting working
- Next:
  - add detectors (TOF2, tracker..) & magnets
  - Use realistic geometry & SciFi tracks

Summary

- Tracker reconstruction advancing
  - ✓ Space-point finding, pattern recognition, Kalman, online reconstruction
  - – Issue with geometry/CDB interfacing needs to be resolved soon
- Much progress & much ongoing work on geometry
  - ✓ Viable beamline geometry from CAD
  - – Fix tracker geometry, add B-fields
  - – Validation, Optimization & tests
- TOF reco/MC is OK, but calibration needs to be re-run
  - – Procedure to be documented and easy for a shifter to run (July goal)
- Global reconstruction now producing fits and residuals
  - – for Step IV need to have it working with at least TOF+Tracker
- Ckov: at risk
- EMR: being developed within MAUS (preview this Fall)
- Software coming along, but much needs to be done to be ready for Step IV
  - – Need: tracker in trunk, calibrations in DB, *geometry implementation*
  - – Data challenge: simulation/data → reconstruct → analyze → validate