MICE Collaboration

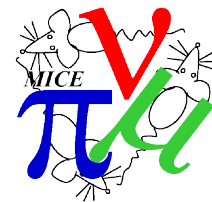# MC Batch Production Status

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MICE CM 52, 12th of October 2018.

Outline

- Introduction

- MICE on the grid organisation

- About MICE MC productions

- Information about finished MC productions

- Information on RECO processing

- Resources available for MC production

- Conclusions

Introduction

- The MC production on the grid includes G4BeamLine simulation, MAUS Cooling channel simulation. Now, real data reconstruction using MAUS is also done on the grid.

- MAUS G4 Cooling channel simulations, using already made G4BL libraries, started in March 2016.

- As of March 2017, the G4BeamLine production was restarted on the grid.

- As of February 2018 RECO is done using the Grid, too.

MICE on the grid organisation
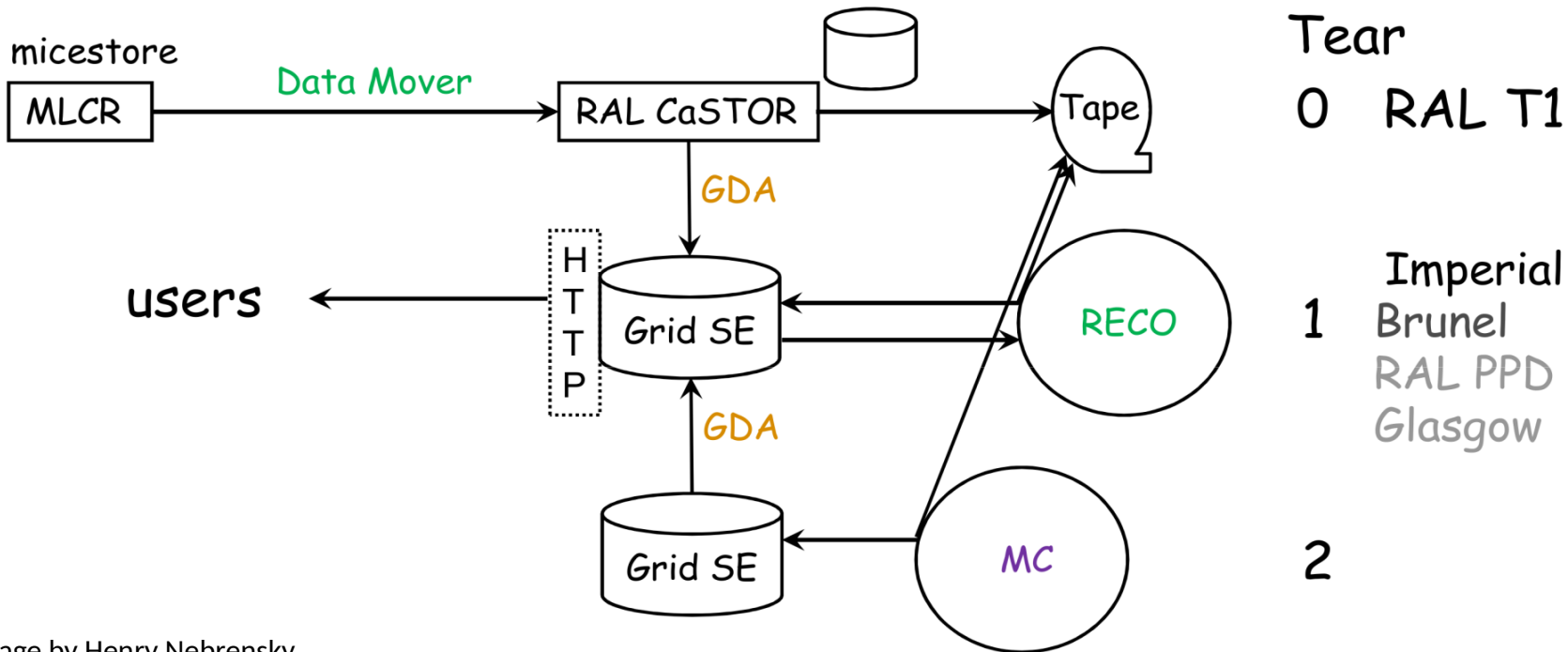
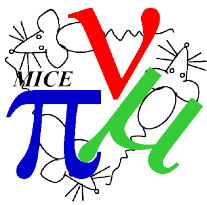*MICE MC production on the grid block schema*
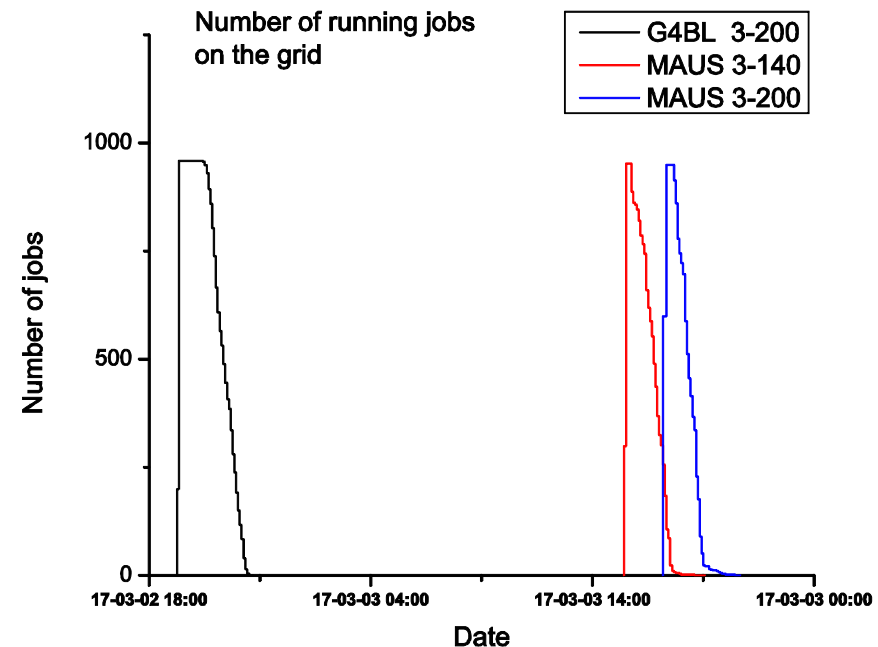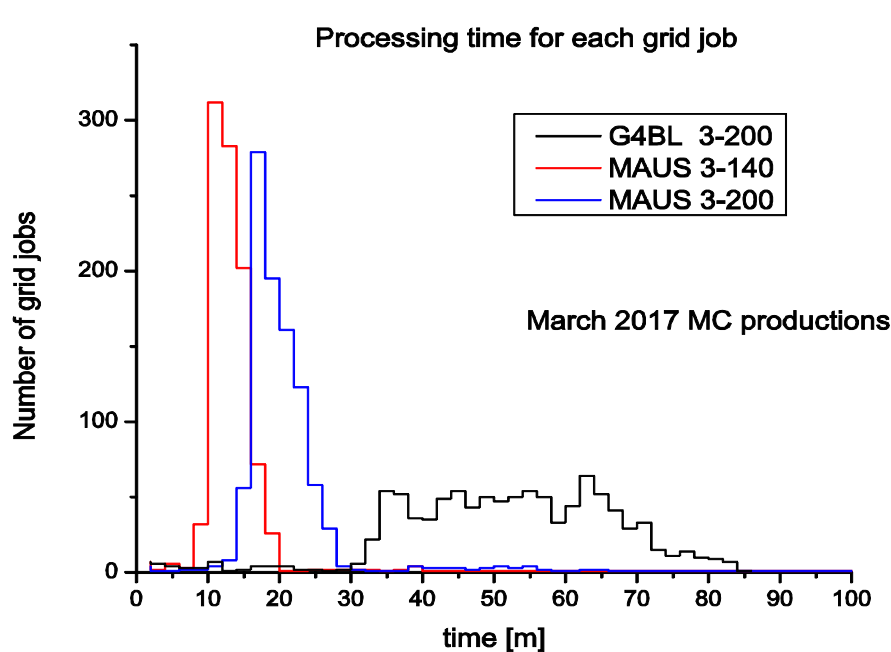

Image by Henry Nebrensky

- MICE on the grid has CERN like organisation into Tears.
- MC production is running on sites supporting MICE VO, but not RAL T1.
- MAUS or G4BL output (or replica) copied to Imperial College SE for http access.
- RECO runs on RAL PPD only, and outputs are copied to IC SE for http access.
- Copy of aggregated output files and RECO files are backuped on RAL T1 tape.
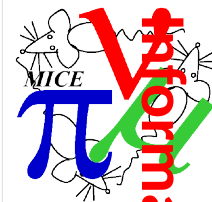
About MICE MC production

- MCproduction is regularly discussed at *Grid and Data Mover meetings*, as part of *Software and Computing Infrastructure project*. Talks are also given on *MICE CMs*.
- The MC production on the grid starts with the request on the request page.
- *http://micewww.pp.rl.ac.uk/projects/analysis/wiki/MCProductionRequests*
- The production manager (me) should be informed about the request.
- Then I insert the entry about the MC production into the CDB, and submit the grid jobs. *(needs a valid grid certificate and to be included into MICE VOMS)*
- The MCproduction is using the MAUS software installed on CVMFS on the grid.
- Necessary information for MC simulation are http/srm **list of G4Beamline chunks**, **MAUS SW Version**, and **a simulation datacard** details.
- Information about done MC productions and output links are placed at the MCproduction page, linked from MICE Software home page.
- *http://micewww.pp.rl.ac.uk/projects/analysis/wiki/MCProduction*
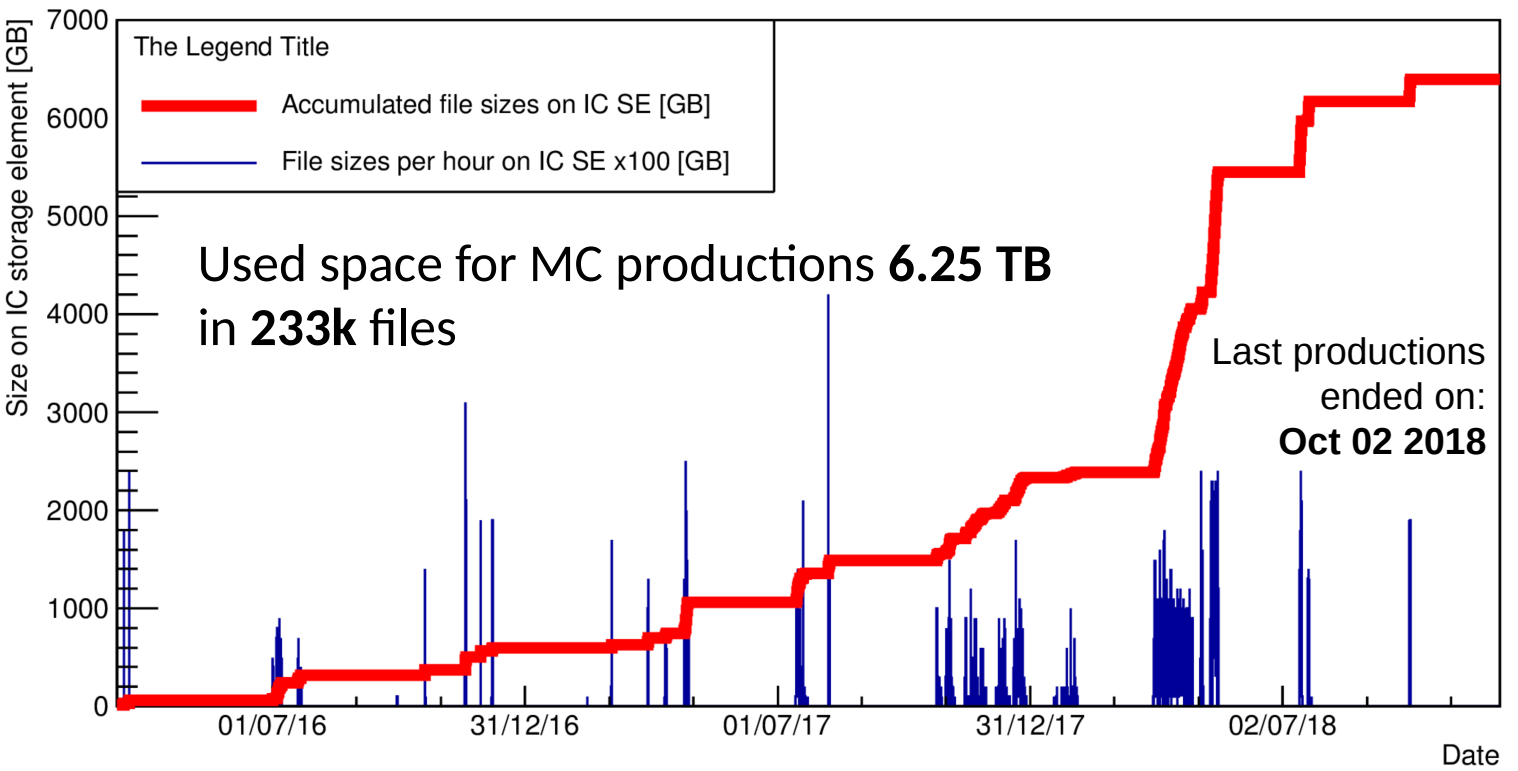
Information about finished MCproductions (1/2)

- There were **148 productions** till now.
- Used space for MC productions **6.25 TB** in **233k** files.
- MAUS simulations are significantly faster than G4BL, but there is no problem with proccessing time.

Processing time for each grid job

March 2017 MC productions

Number of running jobs on the grid

MCproduction data stored on IC Storage Element

Used space for MC productions **6.25 TB** in **233k** files

Last productions ended on: **Oct 02 2018**

The Legend Title
- ▬▬ Accumulated file sizes on IC SE [GB]
- │ File sizes per hour on IC SE x100 [GB]

Report on MC productions for MCserials: 90-92, 96-98, 102-107

Disk space IC: G4BL 384 GB, MAUS 2949 GB,
   **Total 3.26 TB.**

Number of files. 95953 files MAUS, average 1/3 h per job.
     48000 files G4BL, average 3/4 h per job.

CPU usage – **68.000 wall clock hours**,
on average running on 110 cores = 26 days of running (took more).

30 days of MCproductions – using Dirac (~82k jobs):

Site	No of done jobs	%
VAC.UKI-SCOTGRID-GLASGOW.uk	**23480**	**28**
LCG.UKI-LT2-QMUL.uk	15272	18
LCG.UKI-LT2-IC-HEP.uk	10944	13
LCG.UKI-NORTHGRID-SHEF-HEP.uk	6962	8
LCG.UKI-LT2-RHUL.uk	6903	8
LCG.UKI-SOUTHGRID-OX-HEP.uk	6455	7
LCG.UKI-SOUTHGRID-RALPP.uk	5500	6
LCG.UKI-NORTHGRID-LIV-HEP.uk	2919	3
VAC.UKI-NORTHGRID-MAN-HEP.uk	2230	2
VAC.UKI-SOUTHGRID-BHAM-HEP.uk	1068	1

RECO running

- First few test with running the experimental data reconstruction on the grid in February 2018.

- From end of February to end of March about 550 runs processed.

- After that were fighting for a MICE fair-share of a 2.8% other-VOs allocation on RAL PPD cluster

- Chris Brew set up better MICE allocation
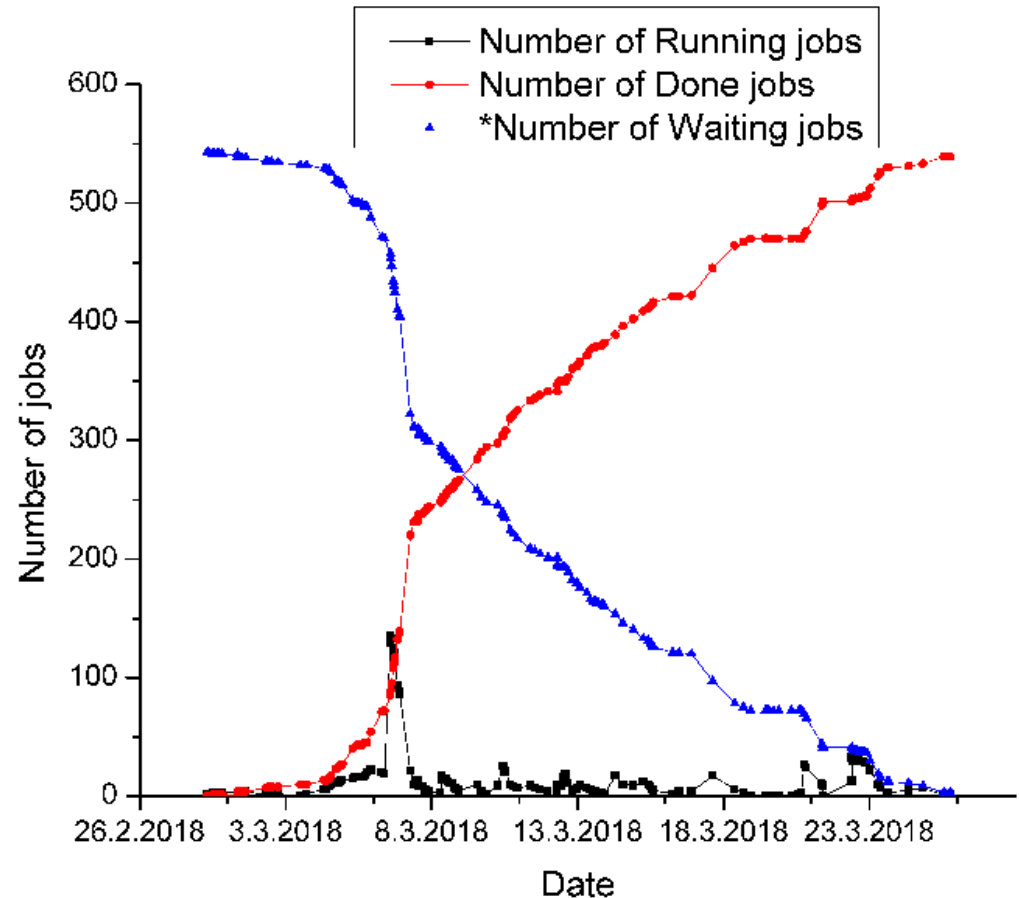
RECO fails after using all RAL PPD allocated disk space, need to request more when this happens. **This is a bottleneck for RECO running**
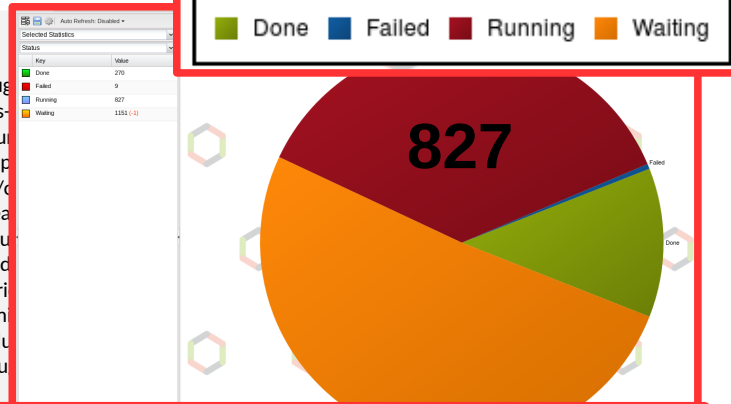
Resources available for MCproduction

Status of available slots for grid jobs for MICE VO

# CPU	Free	Total Jobs	Running	Waiting	ComputingElement
22216	537	22450	21679	771	arc-ce01.gridpp.rl.ac.uk:2811/nordug...
1472	285	157	144	13	ce-01.roma3.infn.it:8443/cream-pbs-...
2325	0	3260	137	3123	ce04.esc.qmul.ac.uk:8443/cream-slu...
2568	202	0	0	0	ce3.ppgrid1.rhul.ac.uk:8443/cream-p...
5104	0	4228	2848	1380	ceprod05.grid.hep.ph.ic.ac.uk:8443/c...
2177	106	0	0	0	cream2.ppgrid1.rhul.ac.uk:8443/crea...
2336	0	2333	2256	77	dc2-grid-22.brunel.ac.uk:2811/nordu...
1706	735	1325	971	354	hepgrid5.ph.liv.ac.uk:2811/nordugrid...
2628	0	2453	2450	3	heplnx206.pp.rl.ac.uk:2811/nordugri...
1096	163	0	0	0	lcgce2.shef.ac.uk:8443/cream-pbs-m...
5032	0	4189	2976	1213	svr019.gla.scotgrid.ac.uk:2811/nordu...
3240	432	3314	2808	506	t2arc01.physics.ox.ac.uk:2811/nordu...

Auto Refresh: Disabled ▾
Selected Statistics
Status

Key	Value
Done	270
Failed	9
Running	827
Waiting	1151 (-1)

Done	Failed	Running	Waiting

827

MICE VO View *8.10.2018*

29k CPUs, w/o RAL T1. Average ~110 jobs at once, max ~1k5

Available storage space for MICE VO

Avail [TB]	Used [TB]	Site
148.56	808.995	dc2-grid-64.brunel.ac.uk
87.9249	67.6821	gfe02.grid.hep.ph.ic.ac.uk
0.224303	5.99612	hepgrid11.ph.liv.ac.uk
88.3741	51.2903	heplnx204.pp.rl.ac.uk
149.925	64.9334	se01.dur.scotgrid.ac.uk
17.2383	3.24125	se2.ppgrid1.rhul.ac.uk
29.1937	51.2787	srm-mice.gridpp.rl.ac.uk
12.804	16.1085	srm-mice.gridpp.rl.ac.uk
128.408	28.2728	svr018.gla.scotgrid.ac.uk

Avail	690.45 TB
Used	1195.37 TB

At RAL (srm-mice only):
Disk Used: 62.81 % (6.98 TB)
Disk total: 10.84 TB
Tape used: 57.31 TB

Imperial SE (http access)
Available 87.92 TB
Used 67.68 TB

Last production ended on:
Tue Oct 02 12:46:45 BST 2018

MCproduction
Usage 6.25 TB

MICE CM 52, 12th of October 2018.

Conclusions

➔ Available CPU processing power and disk/tape storage capacity is not a bottleneck for running much more MC productions.

➔ My availability is not an issue.

➔ Running jobs on the grid using DIRAC workload manager made job submission even more faster and easier. Especially the Bulk job submission [now submitting 100 jobs in one job file].

➔ RECO. Running successfully. Processing has a RAL PPD disk space as a bottleneck.

➔ All aggregated MCproduction and RECO files are backuped on RAL T1 tapes.

Selected Statistics :: Site (Wed May 16 2018 12:47:26 GMT+0200 (CEST))

Legend:
- VAC.UKI-SCOTGRID-GLASGOW.uk
- LCG.UKI-LT2-QMUL.uk
- LCG.UKI-LT2-IC-HEP.uk
- LCG.UKI-NORTHGRID-SHEF-HEP.uk
- LCG.UKI-LT2-RHUL.uk

Labels:
- LCG.UKI-LT2-QMUL.uk
- VAC.UKI-SCOTGRID-GLASGOW.uk
- LCG.UKI-LT2-IC-HEP.uk
- NORTHGRID-SHEF-HEP.uk
- LCG.UKI-LT2-RHUL.uk
- LCG.UKI-SOUTHGRID-OX-HEP.uk
- LCG.UKI-SOUTHGRID-RALPP.uk
- LCG.UKI-NORTHGRID-LIV-HEP.uk
- VAC.UKI-NORTHGRID-MAN-HEP.uk
- VAC.UKI-SOUTHGRID-BHAM-HEP.uk
- VAC.UKI-SCOTGRID-GL
- ANY

THANK YOU!

Divide and conquer Monte Carlo

- The full MICE experiment simulation is **pieced out** in manageable components for speed and versatility.
    - Target hadroproduction simulation
    - MICE beam line simulation
    - MICE experiment simulation

- MICE runs with many beam line and experimental configurations and needs a wide range of simulations.
    - Tunable currents in the dipoles, quads, solenoids
    - Choice of proton absorber thickness
    - Variable absorber material, diffuser thickness
    - Adjustable geometry during commissioning (detectors move)

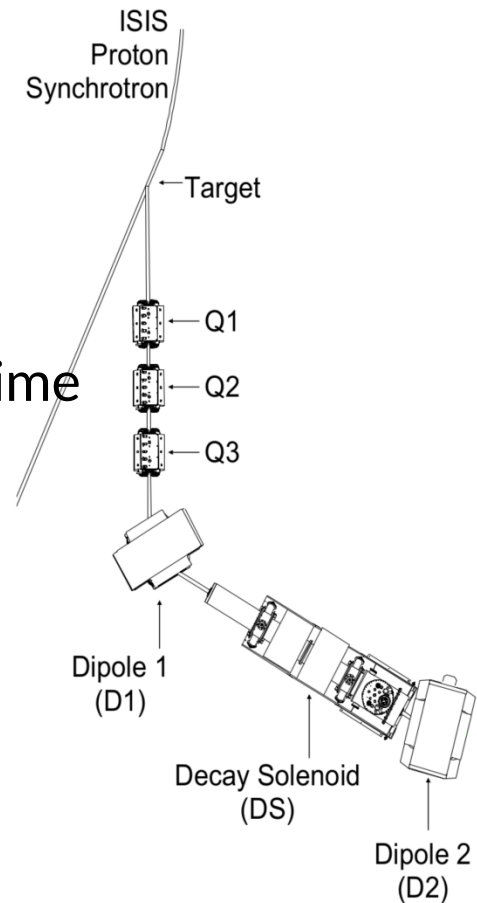- Requires a robust infrastructure to handle many MC production jobs

Target hadroproduction and G4BeamLine

Target hadroproduction

All secondary particle species are sampled from a
parent distribution originally produced by tracking
1.97×10^9 POT using G4Beamline:
- Geant4 physics based simulation.
- Would be very inefficient to simulate from target each time

G4BeamLine simulation steps:
1. Sample p+, π+, π -, e+, e-, γ
   from secondary parent distribution
2. Match though the quads Q1-3 fields
3. Most pions decay in flight in the decay solenoid
between the two bending magnets. Propagation
through the fields and scattering handled by G4Beamline, particles that hit
the magnets bores are killed
4. Store a file with a list of particles and their parameters 1m downstream
of D2.

ISIS
Proton
Synchrotron

←Target

←Q1

←Q2

←Q3

Dipole 1
(D1)

Decay Solenoid
(DS)

Dipole 2
(D2)

MICE Analysis User Software

Downstream of D2, the MICE Analysis User Software (MAUS) takes over
- Uses the G4BL "chunks" as an input beam
- Geant4 based simulation
- Handles complex detector geometries and field interpolation
- Robust connection with the reconstruction software to ensure consistency between truth and digitized MC