FY18 Run Plan

Brendan Kiburg, Jarek Kaspar [FY18 Run Coordinators]

Operational Readiness Review

02 Oct 2017

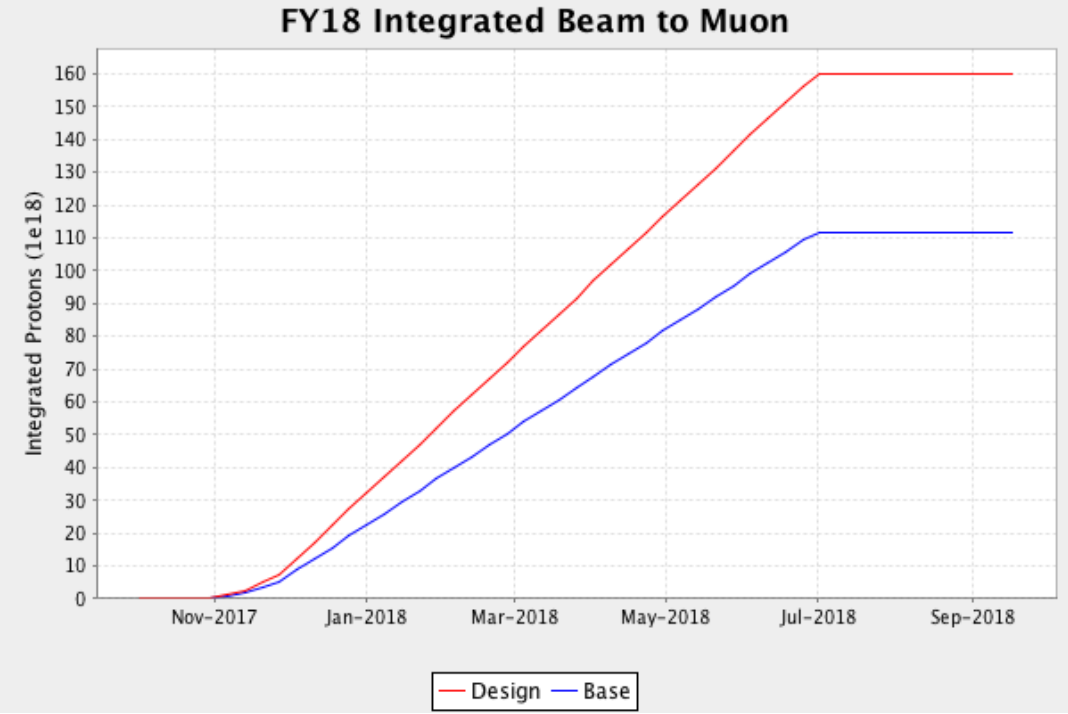
μ g-2

Outline

- Goal Reminder
- Resources
  - Personnel
  - Safety
  - Training
- Run Schedule
  - AD Plan
  - Commissioning Milestones
  - Systematics
  - Steady State Running

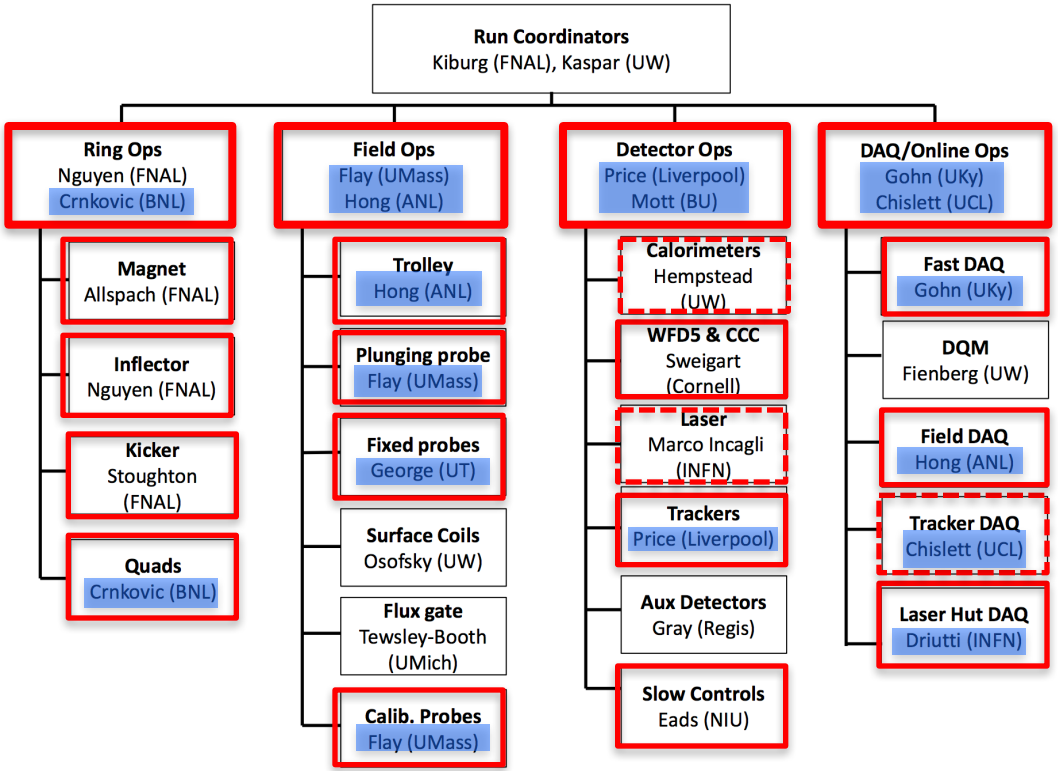
FY18 Run Goals

- FY18 Goal: 3x-5x BNL statistics (Up to ¼ of the planned 4x10^{20} POT)



Total Experiment: ~20-27 months at full operational beam power to reach 4x10^{20} POT

Operations Org Chart

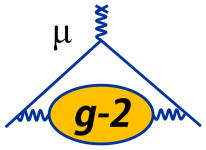


Color code

- Local Personnel
- >50% Local, will have additional on-site experts
- Postdocs

This chart identifies the management structure responsible for maintaining the safe and functional operation of the experimental components, and their ability to produce and store data.

On-Site/Local On-Call Expert List



Ring Ops (Nguyen+Crnkovic)

- Magnet (5):
  - **Allspach**
  - Chappa
  - Sanders
  - Markley
  - Overhage
- Inflector (3)
  - **Badgley**
  - Nguyen
  - Chappa
- Kicker (3)
  - **Stoughton**
  - Schreckenberger
  - Stapleton
- Quads (3)
  - **Crnkovic**
  - Herrod
  - Wu

Field Ops (Flay + Hong)

- Trolley (3)
  - **Hong**
  - Grange
  - Winter
- Plunging Probe (1)
  - **Flay**
- Fixed Probes (2)
  - **George**
  - Hong
- Surface Coils (2)
  - Kiburg
  - Chappa
- Fluxgates (0)
- Calibration Probes (1)
  - **Flay**

Detector Ops (Price+Mott)

- Calorimeter (1)
  - Rotating UW person organized by **Hempstead**
- WFD5+CCC (2)
  - **Sweigart**
  - Labe
- Laser (1)
  - Rotating INFN person organized by **Incagli**
- Trackers (4)
  - **Price**
  - Lukicov
  - Lancaster
  - Mott
- Auxiliary (1)
  - Kaspar
- Slow Controls (1)
  - **Eads**

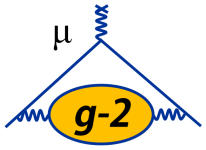
DAQ Ops (Gohn+Chislett)

- Fast DAQ
  - **Gohn**
  - Han
- DQM (0)
- Field DAQ (2)
  - **Hong**
  - Flay
- Tracker DAQ (3)
  - **Chislett**
  - Lancaster
  - Lukicov
- Laser Hut (1)
  - **Driutti**

Org Chart Personnel **Bolded**

Fermilab

On-Site/Local On-Call Expert List



Ring Ops (Nguyen+Crnkovic)	Field Ops (Flay + Hong)	Detector Ops (Price+Mott)	DAQ Ops (Gohn+Chislett)

- Magnet (5)
  - **Allspa**
  - Chapp
  - Sande
  - Markle
  - Overh
- Inflector (3)
  - **Badgl**
  - Nguye
  - Chapp
- Kicker (3)
  - **Stoug**
  - Schre
  - Staple
- Quads (3)
  - **Crnko**
  - Herroc
  - Wu

(2)

AQ (3)
ett
ster
v
(1)

Contact List

Example from June 2017 on Shifter Wiki

Name	System	Email	Cell	Office
Wes Gohn	DAQ	gohn@pa.uky.edu	860-882-9712	630-840-3442
Becky Chislett	DAQ/Tracker	rebecca.chislett.10@ucl.ac.uk	331-401-9838	
Gleb Lukicov	DAQ/Tracker	g.lukicov@ucl.ac.uk	312-838-3507	630-840-6904
Ran Hong	DAQ/Field	rhong@anl.gov	206-607-7689	
Matthias Smith	DAQ/Field	mwsmith2@uw.edu	618-691-8870	
Brendan Kiburg	Field	kiburg@fnal.gov	217-721-3956	630-840-6480
Jarek Kaspar	Calorimeters	kaspar@uw.edu	206-455-3152	
David Sweigart	MicroTCA Electronics	das556@cornell.edu	240-393-0882	630-840-2169
Fang Han	DAQ	fang.han@uky.edu	859-556-1909	
Anna Driutti	Laser system	adriutti@fnal.gov		630-840-8040
Peter Winter	Field	winterp@anl.gov	217-819-8809	

Org Chart Personnel **Bolded**

Fermilab

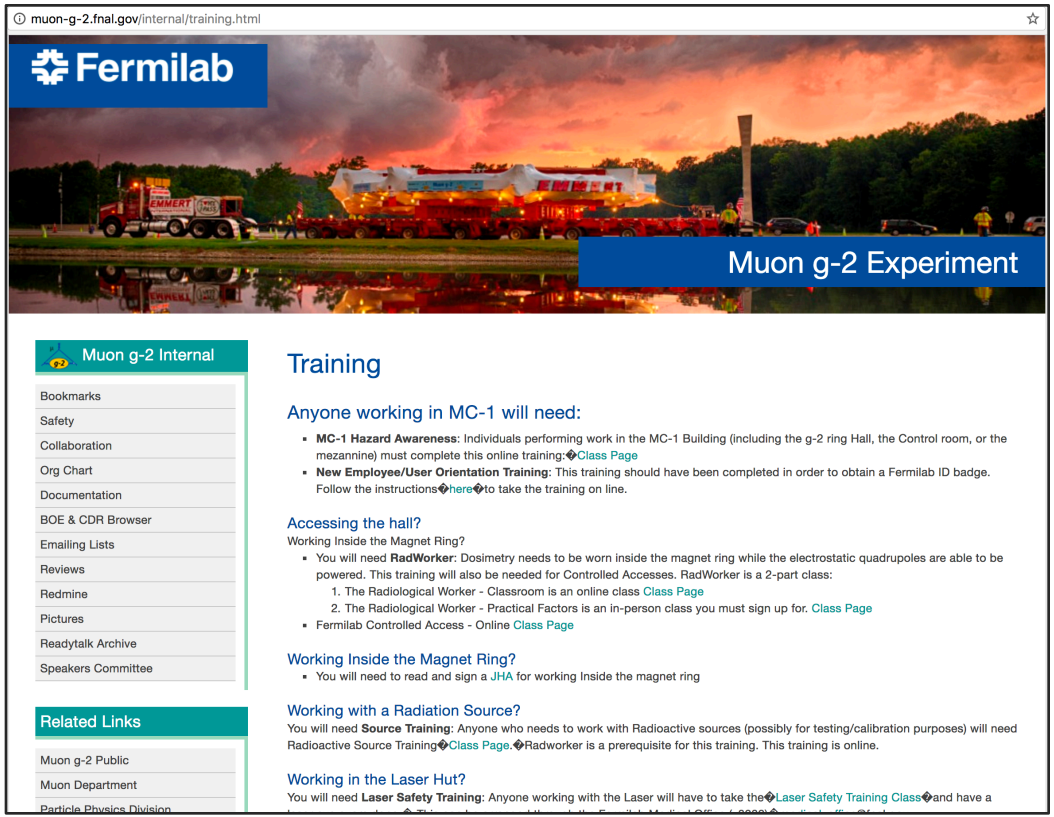
Safety and Training

- Required FNAL training
- Organized on internal website

- Large shifter pool from June run
- Expanding to full collab

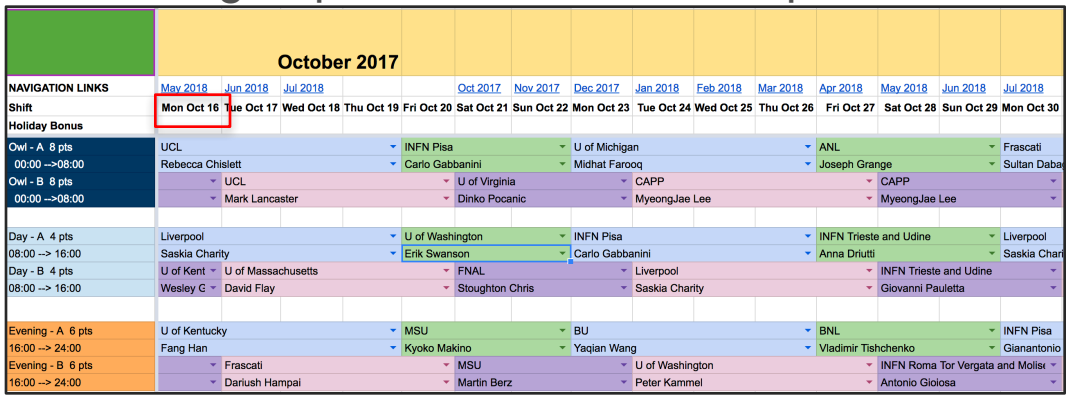
- Bi-monthly review of upcoming shifters training
  - (4 week look-ahead)

- Rad worker training concurrent with November collaboration meeting

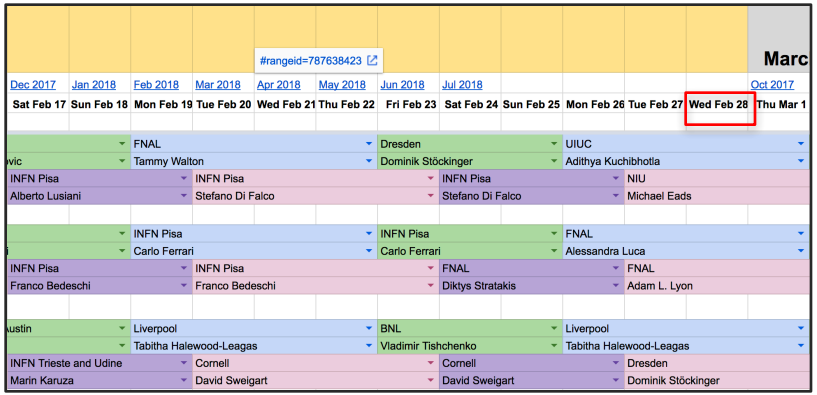


Muon g-2 Shift Personnel

- Active experimenters have a minimum shift requirement (138 people)
- Shifts for Oct 16th 2017 → Feb 28th 2018 have been filled.
- Shift sign-up for Mar -- Jul 2018 opens Jan 8 2018



	October 2017													
NAVIGATION LINKS	May 2018	Jun 2018	Jul 2018			Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018
Shift	Mon Oct 16	Tue Oct 17	Wed Oct 18	Thu Oct 19	Fri Oct 20	Sat Oct 21	Sun Oct 22	Mon Oct 23	Tue Oct 24	Wed Oct 25	Thu Oct 26	Fri Oct 27	Sat Oct 28	Sun Oct 29	Mon Oct 30
Holiday Bonus															
Owl - A 8 pts	UCL				INFN Pisa			U of Michigan				ANL			Frascati
00:00 -->08:00	Rebecca Chislett				Carlo Gabbanini			Midhat Farooq				Joseph Grange			Sultan Daba
Owl - B 8 pts		UCL			U of Virginia			CAPP				CAPP			
00:00 -->08:00		Mark Lancaster			Dinko Pocanic			MyeongJae Lee				MyeongJae Lee			
Day - A 4 pts	Liverpool				U of Washington			INFN Pisa				INFN Trieste and Udine			Liverpool
08:00 --> 16:00	Saskia Charity				Erik Swanson			Carlo Gabbanini				Anna Driutti			Saskia Chari
Day - B 4 pts	U of Kent	U of Massachusetts			FNAL			Liverpool				INFN Trieste and Udine			
08:00 --> 16:00	Wesley C	David Flay			Stoughton Chris			Saskia Charity				Giovanni Pauletta			
Evening - A 6 pts	U of Kentucky				MSU			BU				BNL			INFN Pisa
16:00 --> 24:00	Fang Han				Kyoko Makino			Yaqian Wang				Vladimir Tishchenko			Gianantonio
Evening - B 6 pts		Frascati			MSU			U of Washington				INFN Roma Tor Vergata and Molisu			
16:00 --> 24:00		Dariush Hampai			Martin Berz			Peter Kammel				Antonio Gioiosa			

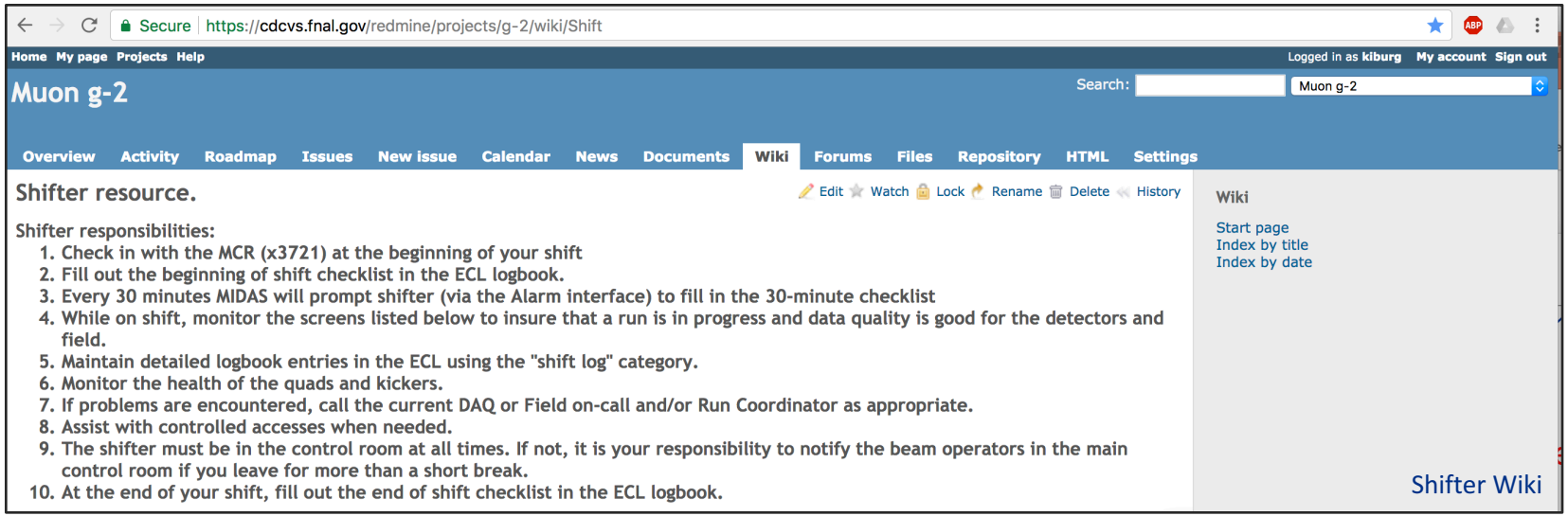


	#rangeid=787638423													Marc
	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018						Oct 2017
	Sat Feb 17	Sun Feb 18	Mon Feb 19	Tue Feb 20	Wed Feb 21	Thu Feb 22	Fri Feb 23	Sat Feb 24	Sun Feb 25	Mon Feb 26	Tue Feb 27	Wed Feb 28	Thu Mar 1	
			FNAL			Dresden		UIUC						
wic			Tammy Walton			Dominik Stöckinger		Adithya Kuchibhotla						
	INFN Pisa		INFN Pisa			INFN Pisa		NIU						
	Alberto Lusiani		Stefano Di Falco			Stefano Di Falco		Michael Eads						
			INFN Pisa			INFN Pisa		FNAL						
			Carlo Ferrari			Carlo Ferrari		Alessandra Luca						
	INFN Pisa		INFN Pisa			FNAL		FNAL						
	Franco Bedeschi		Franco Bedeschi			Diktys Stratakis		Adam L. Lyon						
ustin			Liverpool			BNL		Liverpool						
			Tabitha Halewood-Leagas			Vladimir Tishchenko		Tabitha Halewood-Leagas						
	INFN Trieste and Udine		Cornell			Cornell		Dresden						
	Marin Karuza		David Sweigart			David Sweigart		Dominik Stöckinger						

- Training distributed prior to shifts
- Shadow current shifters day before first shift
- Staggered shifts (A vs B) → Experienced person helps guide first shift

Experiment-specific Training

- Maintain a shifter wiki with responsibilities

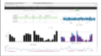
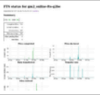


Experiment-specific Training

- Visual examples of systems to monitor
- Will generate periodic snapshots of these pages for shifter comparisons

What to monitor in control room — Shifter Wiki

Each shifter should be monitoring the following items in the control room. Note that some of the links will only work from within the Control Room.

Screen	Location	Access	Example
Run plan	g-2-cr-04	https://muon-g-2.fnal.gov/internal/Operations/index.html	
MIDAS Status for fast DAQ	g-2-cr-04	http://g2be1:8080	
Online DQM for fast DAQ	g-2-cr-02	http://g2be2:3333	
FTS Status	g-2-cr-04	http://g2be2:8787/fts/status	
Electronic Logbook	g-2-cr-04	https://dbweb5.fnal.gov:8443/ECL/gm2	
DAQ Health monitor	g-2-cr-02	http://g2be2:9002/	
Run log	g-2-cr-04	http://g2sc.fnal.gov/page/view/runlog	
Slow Control Trend Plots	g-2-cr-02	http://g2sc.fnal.gov/page/slowplots/MSCB/ring.html/	
MicroTCA Crate Monitor	g-2-cr-02	http://g2sc:7000	

Ring camera	TBD	http://g-2webcam01.fnal.gov/	
MIDAS Status for field DAQ	g-2-cr-03	http://g2field-be:8080	
Online DQM for field	g-2-cr-03	http://g2be2:3333/fpsRing	
Kicker Monitor	g-2-cr-05		
Quad Monitor	g-2-cr-05		
Laser Controls	TBD		
Nearline Monitor	TBD		
Tracker HV Control	g2tracker1	http://g2tracker0:5002	
Tracker SC Monitor	g2tracker0	http://g2tracker0:5000/	
Accelerator Status Display	g-2-cr-04	http://www-bd.fnal.gov/notifyservlet/www?project=&refresh=on&infolinks=bottom	
Beamline Monitor	g-2-cr-04	http://dbweb5.fnal.gov:8080/ifbeam/bmon/gm2mon/Display	
MCR Elog	g-2-cr-02	https://www-bd.fnal.gov/Elog	
FIFE Offline Monitor	TBD	https://fifemon.fnal.gov/	
IBMS Alarm	192.168.30.8	http://192.168.30.8:80	
Event Display	Sharp		

Experiment-specific Training

- Shift checklists integrated with the elog during spring run

Shifter Wiki

Shift checklist

Start of shift
Begin of run
Periodic check
End of shift

Elog Form

Create New Entry

Form: Start of Shift Checklist Use

Category: Shift log (required)

Private: Entry will be visible only to authenticated users

Tags: - add

Textile formatted: Textile help

Email new entry to: add ->

ecl-support@fnal.gov
dervin@fnal.gov (Allen, Dervin)
allspach@fnal.gov (Allspach, Del)
anisyonk@gmail.com (Anisenkov, Alexey)
annala@fnal.gov (Annala, Jerry)

Remove

Entry Subject:

Magnet Current:		Cryo-station screen
Inflector Current:		Cryo-station screen
SRV value:		Storage Ring Vacuum (Quad Station)
Surface coil status:		On/off and what currents (Field Station)
Kicker Strength:		Kicker station
Quad HV:		Quadrupole High Voltage.
T0 on:	☐	DQM/T0
IBMS on:	☐	Inflector Beam Monitoring System. DQM/IBMS
Calorimeters on (/24):		uTCA Monitor
Trackers on (/24):		uTCA Monitor (8 Trackers per station)
DQM Running:	☐	DQM
DAQ Running:	☐	MIDAS
Collimators In:		See https://muon.npl.washington.edu/elog/g2/Vacuum+chambers/ for instructions

Elog Form

Create New Entry

Form: 30-minute Checklist Use

Category: Shift log (required)

Private: Entry will be visible only to authenticated users

Tags: - add

Textile formatted: Textile help

Email new entry to: add ->

ecl-support@fnal.gov
dervin@fnal.gov (Allen, Dervin)
allspach@fnal.gov (Allspach, Del)
anisyonk@gmail.com (Anisenkov, Alexey)
annala@fnal.gov (Annala, Jerry)

Remove

Entry Subject:

Calorimeter FEs and DQM running:	☐	MIDAS/DQM
Tracker FE and DQM running:	☐	MIDAS/DQM: -Check that the StrawTrackerDAQ FE is running, and that there is only one instance of it via "screen -ls" on g2be1 -Check StrawTrackerLVAndSC03 and StrawTrackerHV03 FE are running -Check the TrackerDQM is "connected" and running -DQM/Tracker: check that there are hits in all modules (except a gap in S2_M6_U)
Field FEs and DQM running:	☐	Please check that the FPS DQM FE is alive. If not, restart it from the Programs page in Field MIDAS.
Kicker:	☐	Check the 3 Kicker waveforms on the DRS Oscilloscope display.
Quads:	☐	Check Quad HV
Beam Status:	☐	Acnet Display
Vacuum:	☐	~ 10e-6 torr, stable
Tracker Gas Flow:	☐	Check the gas flow rate at http://g2tracker0:5004 (need to check rate is non zero, might need to wait ~1 min for picture to update)
Trcker HV:	☐	Check that HV is OK : http://g2tracker0:5002 (should have: 0 TRIPS FOUND | 4 CHs FOUND OFF | 64 CHs FOUND ON)

- Forms under development:
  - Shifter bug report
  - Run co feedback

Experiment-specific Training

- Documentation updated during shutdown
- Workshop to review by system experts
- Revision and distribution to collaboration: Oct 9

Shifter Wiki

Manuals

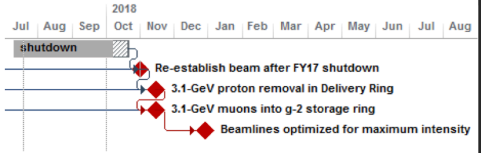
- Shift Training Seminar
- TrackerDAQ: Shift Procedures (also contains some general DAQ procedures)
- Field DAQ User's Guide
- DAQ User's Guide
- WFD5 User's Guide
- THE PROFESSOR'S GUIDE TO RUNNING THE KICKER SYSTEM
- IBMS Manual
- Fiber Harp
- Slow Control documentation
- Lasers documentation

AD-Timeline

Schedule

See M. Convery

- Re-establish beam after shutdown (1-2 weeks depending on whether there are issues with upstream accelerators)
- Commission proton removal (several weeks)
- Commission full repetition rate
- Optimize for maximum intensity
- Detailed run plan (subject to change)
  - week of Oct 23: upstream accelerators turn on
  - week of Oct 30: establish beam to Muon Campus
  - week of Nov 6: DAY/EVE work on Delivery Ring orbits and proton removal, OWL low-rate mixed beam (100:1 protons to muons) to experiment if desired
  - week of Nov 13: DAY/EVE work on Delivery Ring orbits and proton removal, OWL low-rate mixed beam to experiment if desired
  - week of Nov 20: DAY/EVE work on Delivery Ring orbits, proton removal, and increasing rep rate, OWL low-intensity muon beam to experiment if desired
  - week of Nov 27: DAY/EVE work on increasing rep rate, OWL muon beam to experiment
  - Dec: muon beam to experiment while working on rep rate and efficiency
  - Jan: muon beam to experiment



Fermilab

20 10/2/17

- Run planning has two distinct phases
  - Oct-Jan: Re-commission systems & characterize beam
  - Feb-Jul: Steady State

Fermilab

Commissioning Running: Oct Nov Dec Jan

- We have developed a plan in accordance with the accelerator schedule
  - week of Oct 23: upstream accelerators turn on
  - week of Oct 30: establish beam to Muon Campus

- **Oct 16: 24/7 Shift coverage begins**
  - Re-integrate systems → shifters monitor
  - Laser calibration of calos (no beam)
  - Break vacuum
  - Reinstall fiber harps, fixed probe multiplexors

- **Oct 23: Shutdown ends**
  - Laser calibration / DAQ tests
  - Final reinstallation of in-vacuum equipment (trolley/plunging probe
  - Establish full field measurement (calibrated trolley + plunging probe in storage ring)
  - Interlock hall by end of week

- **Oct 30: Commence establishing beam M5 line**
  - Integration of IBMS into the DAQ
  - Establish storage ring vacuum
  - Integration of our beam monitoring tools with the AD beam delivery tools.
  - Investigation and understanding of the injection handoff at the storage ring interface
  - Establish beam to ring

Commissioning Running: Oct Nov Dec Jan

- AD Plan
  - weeks of Nov 6&13: DAY/EVE work on Delivery Ring orbits and proton removal, OWL low-rate mixed beam (100:1 protons to muons) to experiment if desired
  - week of Nov 20 & 27: DAY/EVE work on Delivery Ring orbits, proton removal, and increasing rep rate, OWL low-intensity muon beam to experiment if desired

- **Nov 6 - Nov 28, 2017 [Day/EVE]**:
  - Controlled access as needed
  - Laser calibration prior to beam
  - Periodic trolley runs. Evaluate field stability, Improve uniformity with surface coils.
  - Establish baseline operating conditions for pulsed systems

- **OWL**
  - Establish storage rates vs injection parameters:
    - Quad high voltage, quad scraping voltage
    - Kicker HV, Kicker timing
    - Inflector current
    - M5 line magnet settings w/ storage ring current
  - Measure average B_{radial} with beam and offset via surface coils (center distribution vertically)
  - Install Gate Valves and cryo pumps as available, continue to upgrade SRV pumping systems
    - Scheduled to occur mid November
    - Install opportunistically during the early morning shift prior to daily Delivery Ring work (EVE+OWL shift)

Commissioning Running: Oct Nov Dec Jan

- AD Plan
  - Dec: muon beam to experiment while working on rep rate and efficiency

- **Dec 2017**
  - Repeat regular injection scans
  - Each shift: kicker timing scans as nature of delivered beam evolves
  - Establish beam profile and CBO amplitude via the tracker system
  - Establishing storage sensitivity to beam steering
  - Quantifying beam losses systematically via to the collimator program

- **Continuation**
  - Laser calibration of the calorimeter energy scale interleaved with beam
  - Weekly fiber harps
    - Recalibrate as rate increases
    - Re-characterize the beam
  - Full Analysis chain recommissioning at nominal rate
  - Turn Blinding On

Commissioning Running: Oct Nov Dec Jan

- AD Plan
  - Jan: muon beam to experiment

- **Jan 2018**
  - Cross calibration of beam dynamics parameters utilizing trackers and fiber harps
  - Periodic rescans of key injection parameters to characterize stability
  - Regular (weekly) fiber harp calibrations as the beam delivery rare increases
  - Regular (3x weekly) field measurements
  - Full detector operation

- **Continuation**
  - Full pulsed system operation
  - Establish operating points
    - Demonstrate long-term stability
    - Demonstrate reproducibility
    - Perform week-long stability studies at proposed operating conditions

Steady-State Running: Feb-Jul

- Trolley runs every 2 days. Pseudorandom timing
  - Balance trolley runs -- ability to interpolate field between runs -- with muon statistics
- Periodic systematic measurements. Commissioning already explores parameter space
  - Fiber harp calibrations, *in-situ* measurements of beam profiles vs time
  - CBO Amplitude studies (kicker HV)
  - Run high-n and low-n quad points
  - Muon Losses studies based on algorithm progress
  - Storage Efficiencies
  - Radial Field (vertical offsets)
- Monthly maintenance (targeting planned accelerator maintenance days)
  - Cryo systems
  - Magnet cycles
  - Bookended by trolley runs
- Focus on efficient accumulation of 1e20 POT statistics

Summary

Q3: Is there a well-understood run plan for FY18, consistent with accelerator schedule and performance? Have adequate resources from the laboratory and the collaboration been identified for an efficient and safe running of the experiment and for maintenance of the detector, and is it clear who is responsible for what?

- Resources from the laboratory and the collaboration have been identified for the efficient and safe running of the experiment and for the maintenance of the detectors. The org chart clearly describes the personnel responsible for maintaining each system.

- We have a plan for FY18 that is consistent with the accelerator's commissioning plans.