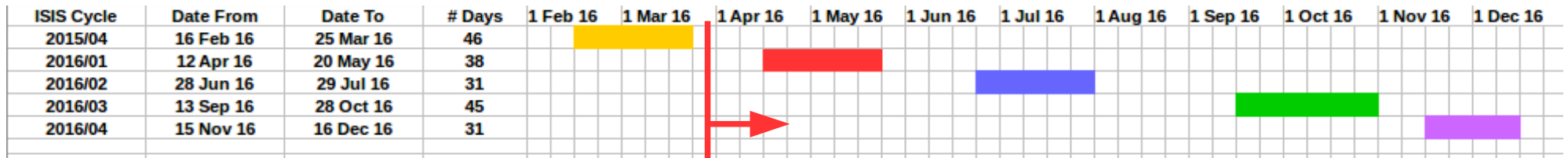


# MICE Run Plan

- ▶ 2016 ISIS User Cycle Schedule
- ▶ Step IV Run Framework

# 2016 ISIS Run Schedule



| ISIS Cycle | Date from              | Date To                | Length (days) |
|------------|------------------------|------------------------|---------------|
| 2015/04    | 16 <sup>th</sup> Feb   | 25 <sup>th</sup> March | 46            |
| 2016/01    | 12 <sup>th</sup> April | 20 <sup>th</sup> May   | 38            |
| 2016/02    | 28 <sup>th</sup> June  | 29 <sup>th</sup> July  | 31            |
| 2016/03    | 15 <sup>th</sup> Sep   | 28 <sup>th</sup> Oct   | 45            |
| 2016/04    | 15 <sup>th</sup> Nov   | 16 <sup>th</sup> Dec   | 31            |

What happens to most of my run plans



# April/May

**Cycle 2016/01 (Apr 2016 – May 2016)** : Expected to be largely focussed on QP/QD, spectrometer and SSD realignment work. Some data-taking to bolster zero-absorber data set in April if we can run (depending on chilled water workplan) and if we get shift sign-up

| Feb-16                             |       | Apr-16  |                                  |   |       | May-16   |       |                     |       | Jun-16                           |                       |       |
|------------------------------------|-------|---|----------------------------------|---|-------|--|-------|---------------------|-------|----------------------------------|-----------------------|-------|
| Wk                                 | week2 | week1   | week2                            | week3   | week4 | week1  | week2 | week3               | week4 | week1                            | week2                 | week3 |
| ISIS Cycle                         |       |   |                                  |   |       | ISIS cycle 2016/01   |       |                     |       |                                  |                       |       |
| MOM                                |       | Duty Co-ordinator   |                                  | MOM (TBC)/DC.   |       | MOM(TBC) / DC?   |       |                     |       |                                  |                       |       |
| Hall priority - MOM or DC Absorber |       | Magnet re-alignment/ QP&QD priority                                     |                                  |   |       | QP/QD  |       |                     |       |                                  |                       |       |
|                                    |       | LiH to safe storage?  |                                  | Weekend running Fri-Mon 15-18, 22-25 29-2 contingency |       | Data-taking suspended QD/QP priority/ PRY closed currents in magnets |       |                     |       | Magnet string training/operation |                       |       |
| Power supplies                     |       | QP/QD installation  |                                  |   |       | QD/QP install contingency  |       | QD/QP commissioning |       |                                  |                       |       |
| Engineering                        |       | bellows removal   | Bellows Re-drill off site + step |   |       | Bellows - align magnets- drill to template.                          |       |                     |       |                                  | Bellows - contingency |       |
| Engineering2                       |       |   | Bellows template fab.            |   |       |  |       |                     |       |                                  |                       |       |
| Engineering3                       |       | Procure - offset bellows? Requires multiple quotes. 6 weeks to deliver. |                                  |   |       |  |       |                     |       |                                  |                       |       |
| Focus Coil                         |       | Focus coil preparation to run   |                                  |   |       |  |       |                     |       |                                  |                       |       |
| Hydrogen                           |       |   |                                  |   |       |  |       |                     |       |                                  |                       |       |
| Clock!                             |       |   |                                  |   |       |  |       |                     |       |                                  |                       |       |

(latest online near-term work plan from Colin)

# Data Rate Assumptions

- ▶ Based on rates observed in running from this user cycle with
  - ▶ ISIS @ 700 MeV
  - ▶ 1.5 V/ms beamloss
  - ▶ Decay solenoid on
  - ▶ 30% contingency (for whatever reason)
  - ▶ 66% duty factor (16 / 24 hour running)
- ▶ Not using Jan/Paolo's pionic beam at the moment. Rate estimate could increase by a factor of two or more.

# Measurement Time Estimate

Require (from John Nugent's study):  
to be a *good muon*

(Selection efficiency (11%) roughly the same  
to that assumed in cooling study)

- ▶ 1 Track
- ▶ TOF 0/1/2 space points
- ▶ > 8 tracker space points
- ▶  $27 \text{ ns} < |\text{TOF}| < 30 \text{ ns}$

- ▶ Scattering measurements require on the order of  $1 \times 10^5$  muons per absorber per momentum point with and without SS fields
- ▶ Data rate from previous user cycle is about  $0.7 \text{ good muons / s}$
- ▶ Total run time for scattering measurements would be :  $1.3 \text{ days}$
- ▶ Include 30% contingency and 66% duty factor :  $3 \text{ days}$

# Step IV Measurement Program

- ▶ A physics plan for STEP IV has been defined by the physics group

For each of three absorbers : empty, liquid hydrogen, lithium hydride and flip mode

| Measurement |                | # Momentum settings | # Emittance Settings | # Muons / setting | Time (days) |
|-------------|----------------|---------------------|----------------------|-------------------|-------------|
| 1.          | Scattering     | 3                   | 1                    | 100k              | 9           |
| 2.          | Emittance scan | 1                   | 3                    | 100k              | 9           |
| 3.          | Grid scan      | 3                   | 3                    | 50k               | 12          |

# 2016 Data-taking

April - May : 2016/01 (38 days) :

QP/QD installation/commissioning  
SSD Realignment  
Focus coil preparation



# 2016 Data-taking

June - July : 2016/02 (32 days) :

Configuration : SSU + FC + SSD

M2D off

Empty (FCU) absorber

Magnet & channel commissioning (need to define this more precisely)

Scattering/Energy loss baseline measurements for LiH scattering data

| Run Types     | Absorber | Time (days - 16 hour running) |
|---------------|----------|-------------------------------|
| Setup         | None     | 1                             |
| Beamline Comm | None     | 15                            |
|               |          |                               |
| Comm/Phys     | None     | 21                            |
|               |          | 37/32                         |

# 2016 Data-taking

September / October : 2016/03 (45 days) :

Configuration : SSU + FC + SSD

+ M2D ???

LH2 absorber

Liquid hydrogen absorber measurements

Should we power M2 in this user cycle?

| Run Type        | Absorber | Time (days - 16 hour running) |
|-----------------|----------|-------------------------------|
| Setup           | LH2      | 1                             |
| Physics w/o M2D | LH2      | 9                             |
| Switch M2D On?  |          |                               |
| Physics         | LH2      | 21                            |
|                 | Vacuum   | 21                            |
|                 |          | 52/45                         |

# 2016 Data-taking

November/December : 2016/04 (31 days) :

Configuration : SSU + FC + SSD

+ M2D ???

LiH absorber

Lithium hydride absorber measurements

| Run Type        | Absorber | Time (days - 16 hour running) |
|-----------------|----------|-------------------------------|
| Setup           | LiH      | 1                             |
| Physics w/o M2D | LiH      | 9                             |
| Switch M2D on?  |          |                               |
| Physics         | LiH      | 21                            |
|                 |          | 31/31                         |

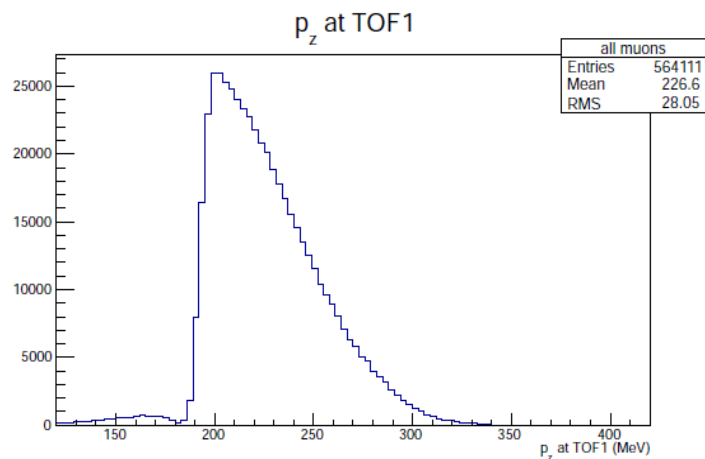
Finish Step IV data-taking

# Summary

- ▶ Only a framework based on schedule as it is currently known.
- ▶ Can do scattering measurements over the next few user cycles.
- ▶ Optics group's studies show that cooling measurements are tricky without M2D.
- ▶ Do we energise M2D ? If so : when?
- ▶ The run plan necessarily must be flexible – we approach this on a user cycle by user cycle basis but plan each cycle well in advance.

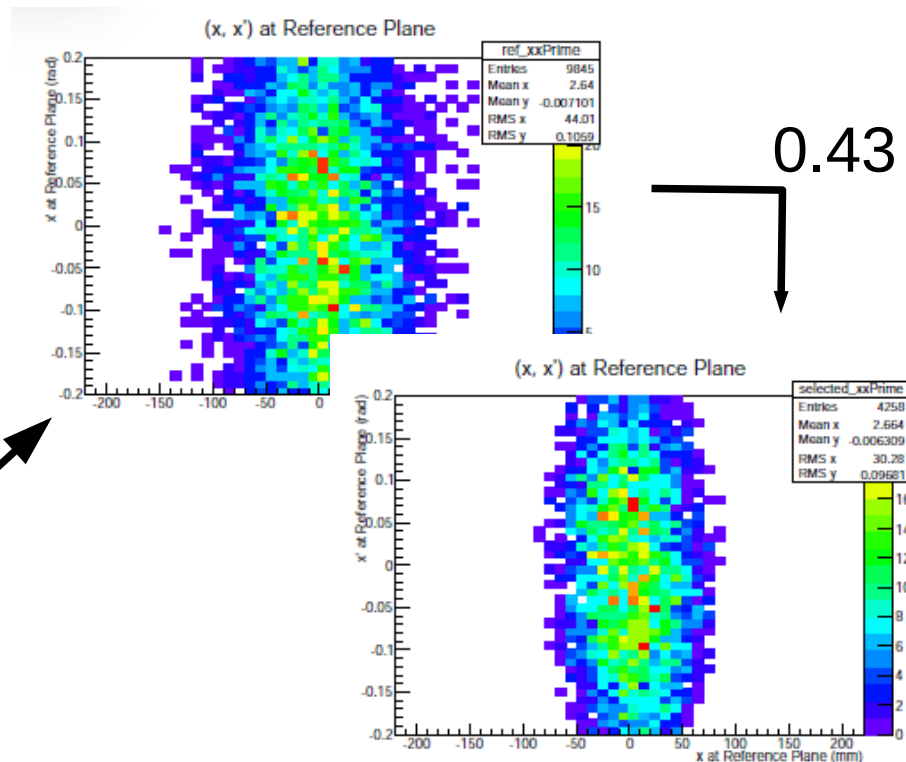
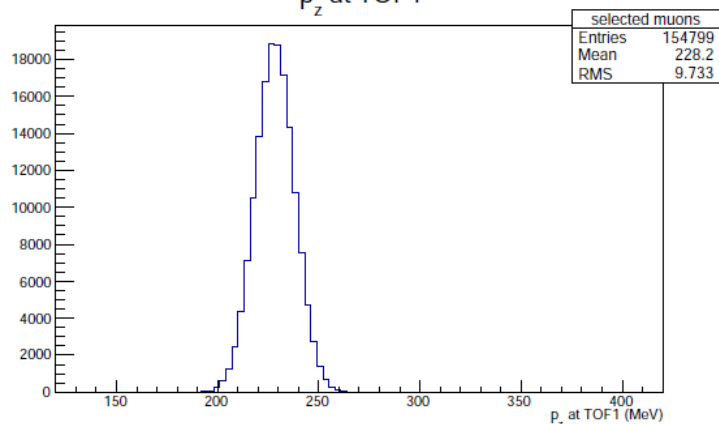
# When is a muon “analysable”?

Choosing an ensemble of input muons



Gaussian  $p_z$  selection

0.27



phase space selection

$$\epsilon_N = 6 \pi \text{ mm rad}; \beta = 333.34 \text{ mm}, \alpha = 0$$

# Measurement Time Estimate

## For Cooling analysis

Based on October 2015 run configuration:

Observed data rate : **31k muons per hour**

*Extra Assumptions:*

▶ Beam physics studies select 12% of this sample to generate a sample of “analyseable” muons ( the fraction of muons which are selected to form a muon bunch from the full upstream sample)

To collect a sample of **10k analysable muons** would take ~ **5 hours** (consistent with estimates derived from Step I analyses).