Physics Group Support of Operations - DRAFT

Change History

Version	Changes	Author	Date
1	First draft	C.Rogers	17/12/2014

1 MICE Running

The aim of this note is to describe how the physics group expects to support operation of the MICE experiment.

MICE will run from the summer of 2015 through to the summer of 2016. During this period, MICE may be taking data 24 hours a day 7 days a week. This is expected to be an intense period of running. The MICE physics team will no doubt be required to spend a lot of time on shift in the control room. In this note two issues are addressed:

1. How will the high level physics output of the experiment be monitored for “quality” - i.e. how do we check that the experiment is doing what we expect at the highest level.
2. How can the physics team respond in the case that the physics output of the experiment is not as expected.

There are a number of planned data quality checks put in place by the Software and Computing group.

1.1 Software and computing planned data quality checks

There already exist several planned checks of data quality owned by Computing and Software group:

- **Controls and Monitoring** software will check that the run settings are correct. If the run settings are not correct (e.g. due to a hardware trip or equivalent) an alarm will be raised and a flag will be set in the Configuration Database. This software validates that the experiment is operating with the intended hardware settings.
- **Online Monitoring** software will check that there are no errors in the DAQ stream. The online monitoring software will unpack the DAQ and check that low level numbers like number of triggers per detector, number of TDC hits at either end of a TOF bar, etc are consistent.
- **Online Reconstruction** software will run in the control room and check that there are no errors in the detector output. The online reconstruction will perform reconstruction of the detectors and check that the output from the reconstruction is consistent with expected output. This can provide checks that e.g. detectors are cabled and calibrated correctly, and some limited monitoring of the actual beam (e.g. beam profiles).
- **Offline Reconstruction** software will run within 24 hours of data taking and check that the the data stored on disk can be reconstructed (within the CASTOR tape storage at RAL).

Each subsystem group is expected to staff an on-call rota for their subsystem so that if any of these checks reveal a problem, a reasonably expert person can be called up to fix or triage the issue.

2 Physics Group planned data quality checks

The checks outlined above provide reasonably good cover for the mechanics of making sure the experiment is working. There are no cross-checks for “physics” in the outline above, e.g. the magnetic fields do not perform as expected, due to unexpected misalignments, effects of iron, etc. Additionally, a measurement that is poorly conceived will not be revealed by the checks outlined above. For example, the optics calculations can be wrong or the detector output can fail to meet expectations. Experience shows that without a lot of advanced planning, a given measurement is

likely to be ill-conceived.

The schedule for MICE is very tight; hardware configurations are likely to be changed between user runs (~ every 2-3 months). It is unlikely that MICE will be able to go back to a previously-run configuration.

2.1 Semi-Automated Checks

The physics group will make the following automated checks:

- Beam centroid between upstream and downstream tracker is consistent with intervening fields (needs a beam selection).
- Beam envelope between upstream tracker and downstream tracker is consistent with intervening fields (needs a beam selection).
- Transmission in core of beam is consistent with muon decay (what is core of beam? < 5 mm amplitude? What momentum or maybe it does not matter?).

The physics group will make the following semi-automated checks:

- Transmission overall from upstream to downstream will be reported (needs a human to check, needs a beam selection).
- Emittance change from upstream to downstream will be reported (needs a human to check, needs a beam selection).
- Mean energy loss vs initial momentum will be reported.

We note that the concept of a daily reference run is useful for studying long-term stability of the MICE set-up; the physics group strongly requires the execution of a daily reference run with some fixed settings.

Surely some other stuff?

2.2 Measurement Champion

The physics group will nominate a “champion” for each measurement. Normally, this will be the person proposing the measurement, and they will have responsibility for seeing the data through from conception (MC design) to conclusion (publication).

The measurement champion will be expected to:

- Coordinate the choice of experimental configuration to define a measurement.
- Coordinate Monte Carlo and analysis before the measurement is made; feed back into the experimental configuration.
- Prepare an analysis script for analysing the data before the measurement is made; so that analysis can be performed reasonably quickly. This can be tested against the reconstructed Monte Carlo.
- Be aware of the measurement in the control room (not necessary to be on shift). Coordinate with MOM.
- Make the semi-automated checks outlined above.
- Make a first analysis of the data as soon as possible after data taking. Typically this will mean a calculation of the basic result, without error calculation. This should be done before

the experimental configuration is changed.

- Book any additional data taking that may be required.
- Make a final analysis of the data and write up for publication.

2.3 Physics Group on-call

The physics group does not expect to require an on-call person. It is expected that MOM will act in this capacity (with overall responsibility for figuring out what has happened if the experiment is not doing what it is supposed to).