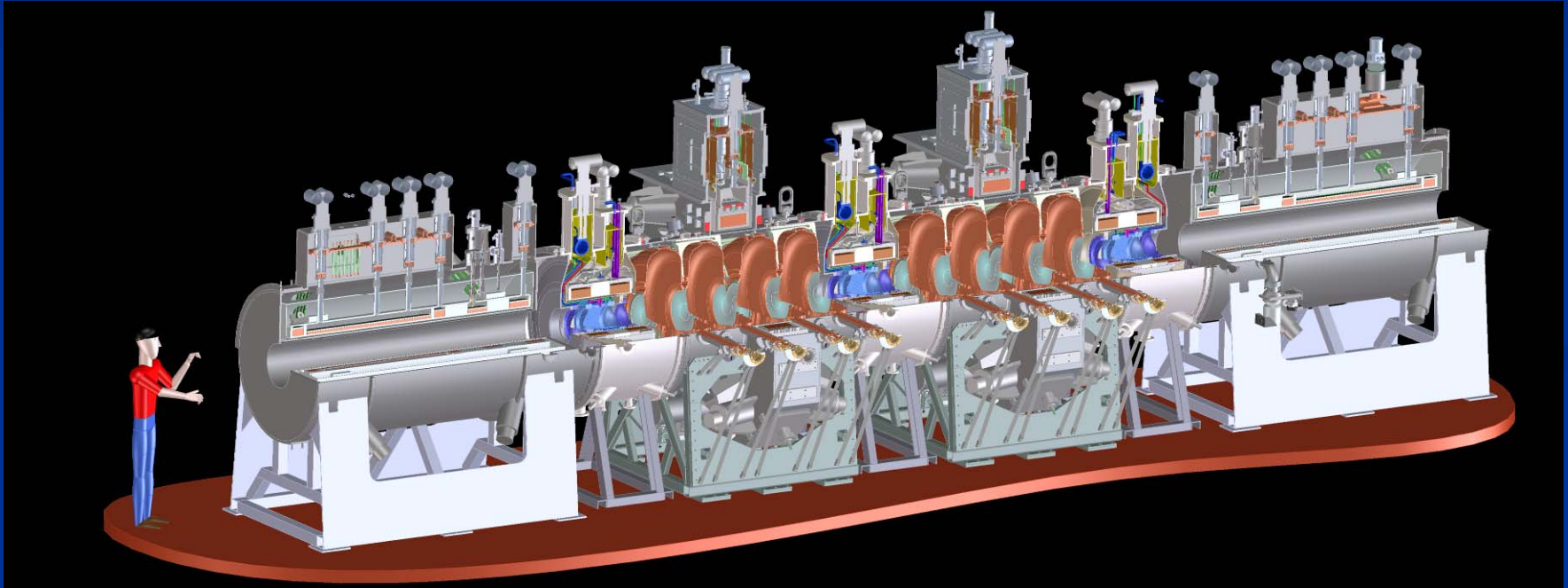


# MICE Operations



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# Outline

- **Current Operations**
  - Recent data-taking
  - Shifter & MOM training
  - Ongoing Operations efforts
  
- **Step IV and VI Operations**
  - Organization
  - Operational plan
  - Operations Risks
  
- **Conclusions**

# Current Operations: Recent Running

## ■ October 2012

- Test upgrades to online systems, train shifters, magnet study and proton absorber study data
  - New operating system on all DAQ, C&M, Online Reconstruction machines, new master server for online system
  - Upgraded DATE DAQ, new interface with C&M, zero-suppression of fADCs, new unpacking code, higher trigger rate
  - Testing read/write from configuration database (CDB), testing/development of Run Control
  - New MLCR version of MAUS software, improved TOF/CKOV online plots
- Trained
  - Ian Taylor (Warwick University postdoc), Celeste Pidcott (Warwick grad student)

## ■ December 2012

- Continue work from October, train shift personnel
- Trained or partially trained:
  - David Adey (FNAL – local), Yagmur Torun (IIT/FNAL)
  - Craig Macwaters (RAL – local), Chris Rogers (RAL – local)
  - Paul Smith (Sheffield)

# Current Operations: Recent Running

- February 2013 – Activation run, CKOV commissioning data
  - 14 hours running MICE target with ISIS beam bump at 4V beam loss
  - Double previous limit on beam loss – investigate effects (if any) on activation of beam line components
  - PPS modifications in progress required beam to DSA only – acceptable for this run
  - Successful test – after post-run analysis, ISIS agreed to new standard loss limit of 4V
- Due for another training/testing run prior to EMR commissioning in July

# Current Operations: Training

## ■ Shifter training

- Continue & refine shifter training
  - Difficult to train while taking data – difficult to train fully without running
- Increasing pool of trained personnel
- Upcoming EMR commissioning run
  - 3+ weeks of running
  - Organizing staffing now

## ■ MOM training

- Institute formalized MOM training
- Better prepare wide range of MICE collaborators for duties/expectations during MOMing
- Solicited feedback from recent MOMs
- Developing off/on-site training protocols
  - Includes documentation, in-person handover, online tools, possible remote training

# Ongoing Operations Efforts

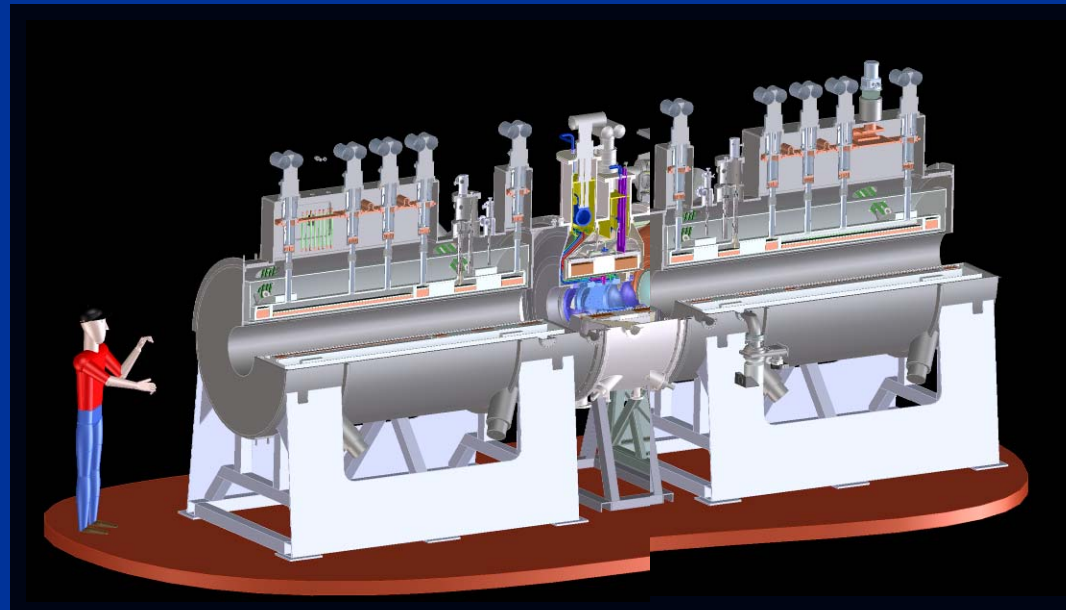
- Continued development of all Online systems for incoming equipment
  - DAQ, C&M, Online reconstruction/Data Quality, Computing
  - Necessary emphasis on reliability and longevity
- Improve/integrate C&M systems
- Develop operational protocol/procedure for new beamline components
  - Will have significant impact on data-taking
  - Ex. SS ramp time = several hours
    - How we are able to use it? Overnight procedure and reestablishment of running will effect data-taking efficiency
  - Ex. LH2 requires 24/7 on site coverage
  - Ex. What required for magnet commissioning & RF tests?
  - Tied in with C&M – confidence in a comprehensive C&M system enables us to rely on the system for automated use w/o external intervention
  - In process of determining local support level required for each system
- Establish consistent safety procedures/culture with long term stability
- Understand implications of field mitigation plan – new rack room and expanded MLCR

# Extending Operations to Step IV

- **Current running experience feeds into Step IV/Step VI preparation**
  - Commission final detector systems (EMR, full trackers)
  - Gain experience operating beam line & equipment
  - Refine initial procedures & extend to new equipment
- **Current run personnel**
  - **MOM (MICE Operations Manager)**
    - Rolling monthly appointment
    - Responsible for meeting scientific goals of MICE
    - Safety responsibility delegated from Project Manager
  - **BLOC – BeamLine On Call expert**
    - Trained member of MICE collaboration
  - **2 shifters for ~9 hour shift**
    - Trained members of MICE collaboration
  - **SOC – Software On Call expert – often remote**
- **Procedures & preparation**
  - Run during ISIS User Runs – Normal working hours (plus weekends)
  - Run planning, beamline testing, online system testing, and software preparation understood

# MICE Step IV

- Change operational mode
- Define for rest of experiment (Step IV, Step VI)
- Equipment:
  - Both Spectrometer Solenoids
  - Two trackers installed in the SS magnets
  - One AFC (Focus Coil magnet & LH2 system)





# Step IV Operations

- **Operational support plan in development**
  - **New positions being defined**
    - **Run Coordinator/SuperMOM/Beamline Physicist**
      - Understands STFC safety and operational environment
      - Provide link between MOMS
      - Local – full time – not necessarily STFC employee
    - **Integration Physicist**
  - **Will use system-expert professional operators**
    - **RF – *this person has now joined MICE***
    - **Cryogenics**
    - **Magnets**
    - Work in cooperation with MICE collaborators as shifters
    - 1 in MLCR on shift during running
- **Retain MOMs – *on call* for 1 month**
  - Continues current role – responsible for daily experimental planning & running duties
- **Retain on call experts**
  - BLOC (beam line), SOC (software), TROC (tracker), and more

# Step IV Operations

## ■ Data-taking operations

- *Run requirements – max 12 hr/day, 5 days/week*
- Need two of each type of shifter/day
- Long term running will be focused – no multitasking of Hall use
- Single purpose during ISIS cycles – Hall secured/equipment in steady state

## ■ For Step IV

- Assume 100k muons in 2 hrs
- Remember
  - For each configuration – empty absorber, full LH2 absorber, solid absorber, wedge absorber, etc.
  - We have 3 momenta, 3 emittances, 2 field configurations, 4  $\beta$  functions  
→ 72 measurements at 2 hours/measurement
- **Therefore it takes 144 hrs for 100k muons at each point**
- *Each configuration requires 12 days at 12 hrs/day → 2.5 weeks in calendar time*

# Step IV Operations

- **Original (spring 2012) estimate for Step IV run time was 1 year**
  - Commission/calibrate detectors, check alignment
  - Magnet performance and alignment, Diffuser and beam matching
  - Empty channel measurements
  - First demonstration of cooling, empty absorber, full set of LH2 absorber measurements
  - Cooling measurements with LiH solid absorber
  - Cooling with solid absorbers, multiple scattering, energy loss
  - Wedge and half-wedge absorbers
- **Some can be accomplished without beam or with selected magnets**
- **However, practically speaking, our Step IV run requirements extend the original estimate for run time from ~1 year to ~1.5 years**
  - 5 ISIS cycles/year, average 5 weeks/cycle = *25 weeks of running/year*
  - 5 days/week, 12 hrs/day with 2 MICE collaborators for each shift
  - *Therefore → 25 weeks \* 2 shifters = 50 person-weeks of shift each year*
  - Would assume a similar case for Step VI

# Step IV & VI Operations

## ■ Safety

- Understand implications under STFC rules of new equipment
  - Operations review of LH2 system completed
- Will negotiate other system requirements for commissioning & operations

## ■ PPS

- Understand implementation of system with SC magnets
  - Recently reviewed/approved at Technical Board meeting
- Step VI – understand implementation with RF
- Recent annual PPS functional testing exercised SC permit and RF permit portions of system

## ■ Step VI – includes everything from Step IV + RF

- Full time RF engineer now in place in MICE
- TIARA test summer 2013

# Step IV Operations Risks

- **Personnel (on several levels)**
  - **Step IV requires three new expert positions**
    - Mitigation: 1 in place now, other two likely to be recruited starting ~ April 2014
  - **Will run 50 person-weeks of MICE shifters each year for Step IV/VI**
    - Mitigation: must recruit/require standard shift requirement for each collaboration member/institute
  - **Will train all MICE collaboration shifters**
    - Training procedures in place; however, need to ramp up numbers
    - Difficult to maintain shifter knowledge w/o consistent operation of experiment
  - *MICE experiment largely working with shifters who are volunteers from universities when running/doing data analysis – we cannot lose this effort*
  
- **Smooth operations requires robust and comprehensive C&M system**
  - Mitigation: see presentation by Pierrick Hanlet

# Step IV Operations Risks

- **Unknown effect of magnets operating in proximity to each other for purposes of both training and experimental use**
  - It may take longer to take desired data
  - Mitigation – not clear how to predict this – need magnets at RAL and operational
  
- **Delays or loss in data-taking time**
  - Accelerator down-time – scheduled or unscheduled
  - MICE equipment maintenance/lifetime
  - Mitigation – increase efficiency of running – increase beam loss, target rate, online analysis

# Conclusions

- **Current running provides solid foundation for extending into Step IV operations**
- **Many changes coming for Step IV**
  - New equipment, new procedures, long periods of running
- **Making progress toward meeting challenges of Step IV Operations**
  - Developing operational plan – support and scope
  - Identifying/hiring necessary personnel
  - Making solid advances on technical handling of new hardware (DAQ, Controls, magnet integration, upcoming EMR commissioning)