MICE RF Installation at RAL – Project Update

- Need to install, integrate, commission and operate:
  - 2 X 2 MW RF Amplifiers systems
  - 2 X 10 MV/m cavities
  - RF TX lines
  - Operating Control system

- LLRF amplitude, timing and phase control system – separate subject and speakers

RF Amplifiers

- **RF Amplifier System #1 re-assembled** at Daresbury for proving of 2nd 116-tube 2 MW amplifier, and RF operating control system.

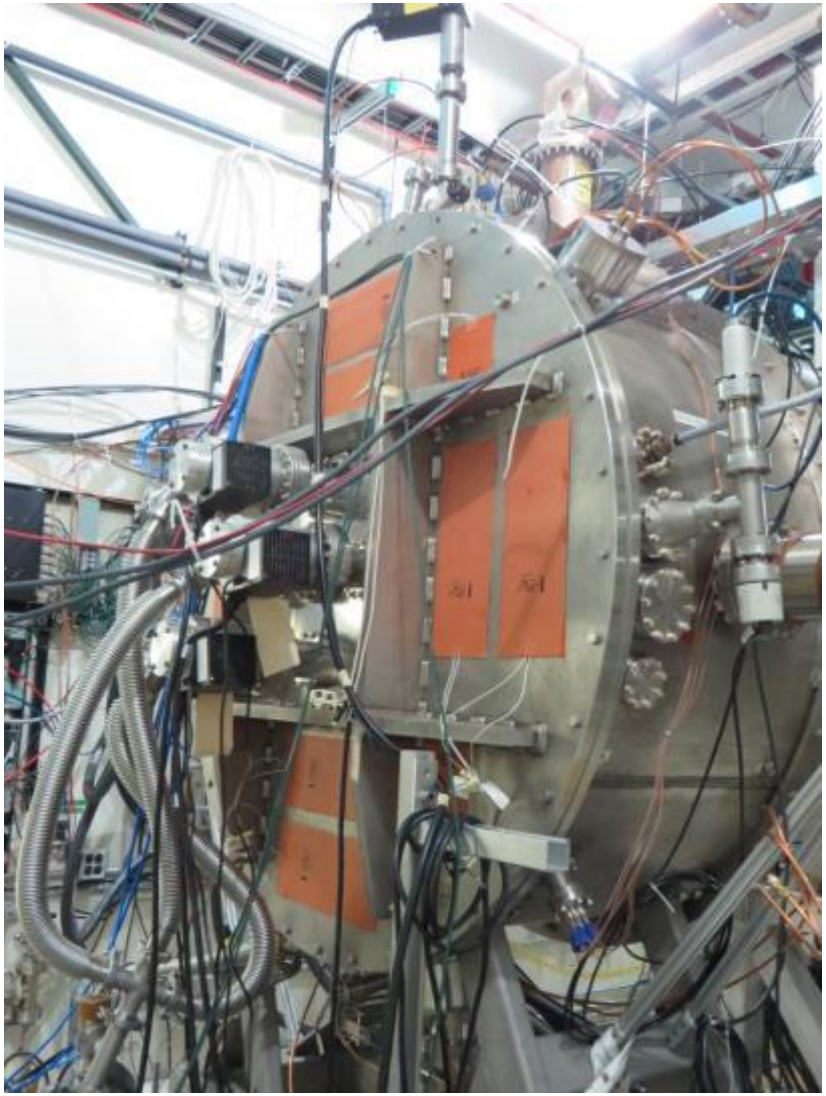
RF Amplifiers

- Equipment run-up two weeks ago, up to 4616 driver-stage at 100 kW RF; further tuning tweaks required for ~ 200kW to drive 2nd 116 stage to 2 MW
  - Good experience for TS in the multi-parameter tune-up iteration!
  - Decision that remote-control of tuning the 4616 driver stage is unneccessary after manual tune-up in-situ in the MICE Hall at RAL.
  - Remote tuning motors in 116-tube 2 MW stages are already fitted and remote-control expected to be implemented as a contingency to help mitigate against unexpected small deviations in cavity impedance.

RF Amplifiers

- **2nd 116-tube amplifier** has been assembled, electrically fitted and is almost ready for transfer to the MICE RF test area at DL.

RF Cavities



Singe Cavity Test Stand during tests at FNAL

Cavities – installation issues

- Services:
  - Vacuum – inner and outer; fail-safe system required to avoid stress on Be windows.
  - Water – tight temperature-control for frequency stability; avoids real-time tracking mechanical tuners during operational running, after initial tune-up. Dissipation 2 kW per cavity. Aim to run at ~ 35 degrees C to discourage water condensation within cavity.
  - Compressed air – for actuation of mechanical tuners
  - Electrical supplies for instrumentation etc.

Cavities – installation issues

- Definition of instrumentation for monitoring and control to be agreed with LBNL
- Detail of all interfaces to be defined
- RF pre-test at low-level before shipping to RAL
- To minimise preparation activity in the MICE Hall:
  - Cavities to be delivered within vacuum vessel as complete units, including RF coupler-arms fitted, purged with N2.
- RF high-power test (2 MW) in MICE Hall outside beamline.
- Clean-room tent required for installation to beam-line, and for any intervention of vacuum-vessel or cavity
- Support, in-person at RAL, from LBNL, very welcome

Cavities – Radiation Protection

Shield-wall required on south-side of cavity

Definition, by RAL Radiation Protection Advisor , to be informed by latest results from FNAL (preliminary results have not caused particular concern).

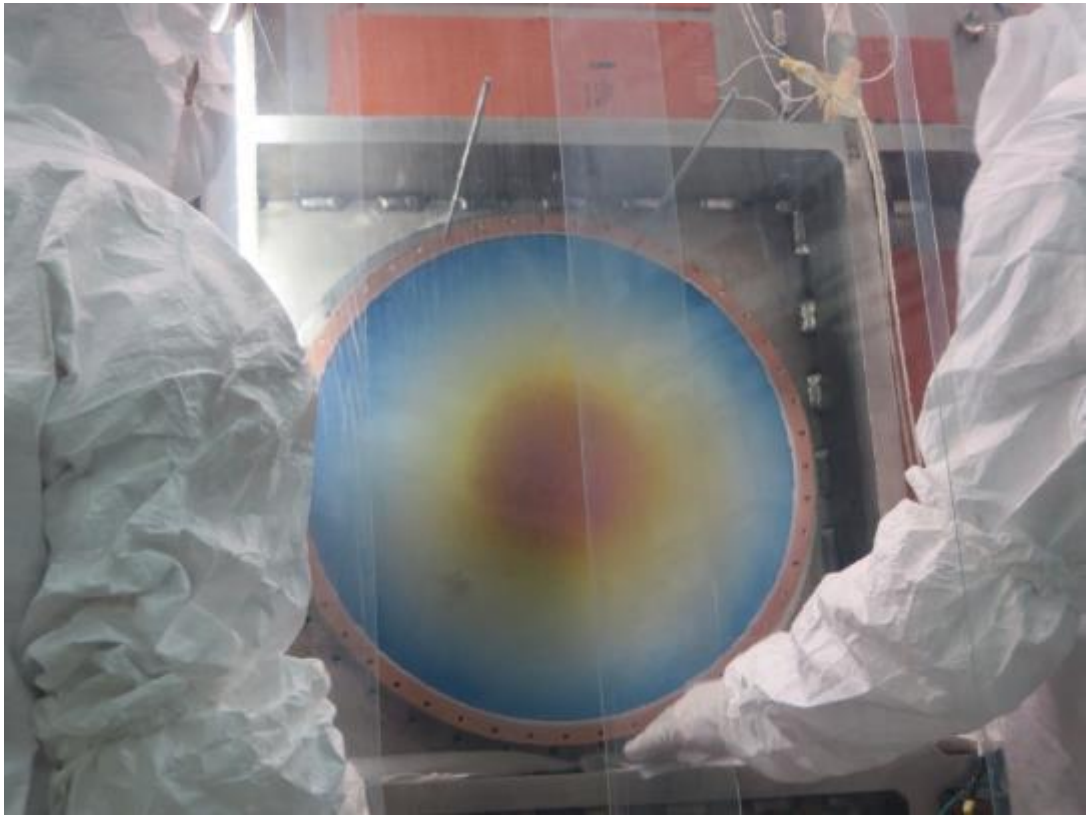
Monitoring at the two (three?) MICE Hall entrances to be by sodium iodide detectors, feeding into overall MICE control. Options to trip MICE beam(!) and/or RF at safety threshold.

Initial monitoring also inside wall by several absorption detectors (rad. badges)

TS suggests also real-time radiation sensor, in proximity of cavities, for indication on GUI, and for logging.

Cavities – Vacuum System

- Imperative that Be windows are not exposed to significant stress by differential pressure by inner and outer vacuums; RAL target <<1 p.s.i?

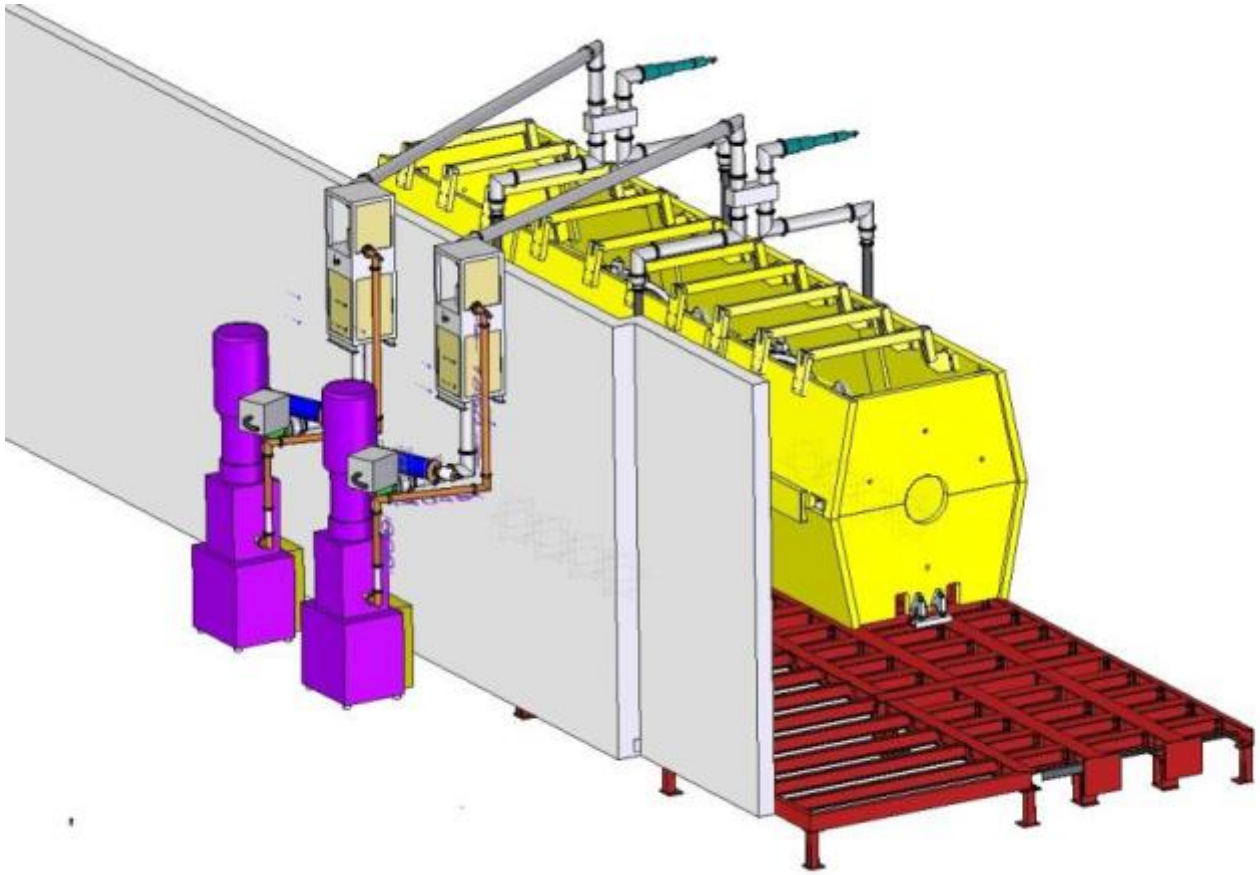


RF Cavities

- Design of vacuum system is outside the responsibility of RF group; RAL PPD Department expertise – Mark Tucker
- Issue of siting vacuum gauges and pumps away from B-field as necessary – FNAL experience can inform.

RF Transmission Lines

- Proposed new layout:



RF Transmission Lines

- Hardline requires accurate installation survey and drawings - DL (&RAL?) DO effort.
- Some mechanical cuts and re-flanging by RAL/DL workshops, to existing stock, considered feasible.
- Risk of need of structural mods to mezz floor.
- SF6 pressurisation, for voltage stand-off, required as per original MICE design brief.

Operating Control System

- Channels-list – appended
- Architecture:
  - Local PLCs already implemented in PSU racks - fast protection
  - CAN bus modules in local control – quite fast protection
  - EPICS control system, MLCR-based – not so fast
- Build:
  - Technical design and build by DL
  - Pre-Test at DL
- Modus Operandi in operations:
  - Should not be necessary to have constant RF expert presence, once system has been through start-up procedure.
  - Envisaged to have expert and non-expert operating modes in operator GUI.
  - RF expert on-call rota.

RF Installation Programme

Now that cavities have been proven in high B-field, definitions, as described above, must be finalised quickly; preparations for installation, and build of controls system, must progress quickly.