

## **Cryogenic safety case for MICE Step IV**

There are three cryostats in Step IV: upstream spectrometer solenoid (SSU); downstream spectrometer solenoid (SSD); and the focus coil (FC). The two solenoids (SSU and SSD) can each contain approximately 300 litres of liquid (helium during normal operation or nitrogen during the cool-down) around the cold-mass. The FC can contain about 20 litres of liquid helium. For all three cryostats, the thermal shields contain no liquid but are cooled by cryocoolers. During normal operation, there should be no helium boil-off due to the 4K cryocoolers (five on each SS and two on the FC).

### **Focus Coil**

On the vacuum system there is a poppet-type relief valve ( $p = 1.2$  bar abs.) and a burst disc ( $p = 2.7$  bar abs), to prevent any condensed gases becoming a high pressure gas when the vessel warms up.

On the helium circuit, there are two relief valves and one burst disc ( $p = 4.0$  bar abs). The low-pressure relief valve ( $p = 1.07$  bar abs) is isolated by a manual ball-valve from the helium circuit during normal operation so that the helium pressure is maintained at about 1.2 bar abs. This manual ball-valve is open during helium transfers to facilitate the filling of the helium circuit. The higher pressure relief valve (Oxford Instruments, A3-202: KF40,  $p = 1.36$  bar abs.) is always open to the helium circuit.

### **Spectrometer Solenoids**

On the vacuum system there is a poppet-type relief valve (Circle Seal, 532T1-6M-12,  $p = 12$  psi.) and a burst disc ( $p = ???$ ). There is also a burst disc (Caburn MDC, DN40CF, part number 420036,  $p = 1.4$  bar abs.) on the pumping line.

On the helium circuit, there are two poppet-type relief valves (Circle Seal, 532T1-6M-12,  $p = 8$  psi.) and a large-bore (dimension ???) relief valve.

### **Evaporated gases**

An ODH assessment has been done.