



VC 4th May 2017

Project Manager's Report

Schedule - Liquid Hydrogen



2 issues.

1. Pressure rating of hydrogen safety volume envelope.
2. Pressure relief in event of freezing at condenser.

HAZOP required – scheduled for 16th and 17th May.
Milton Hill house?

Agreed to continue with current programme to complete Neon test – opportunity to fully test and de-bug system including controls.

Required mods to be pursued in parallel.

- Hazop will consider no-mod option for short term run
- LOPA analysis of proposed run scenarios.

Schedule - Liquid Hydrogen

Pressure rating of hydrogen safety volume

- Windows are rated minimum 6 bar, mounting structures are not. Must rigorously respect 1.25 bar differential pressure rating.
 - Tesla did not consider asymmetric loading case – were not asked to.
 - Potential to damage FC if pressures are not managed – have experimental verification that 1 bar pressure differential with hydrogen safety volume positive does compromise FC thermal stability but change is reversible.
 - ‘Top hat’ is flexible, but adequate.
- Upgrade to ‘quench’ pipework.
 - Capacity / Bends.
 - Routing at turbo / backing line / burst disc. Now complete for Neon test.
 - New blow off valve x2 – in review with ISIS hydrogen working group.
 - Additional lines for blow off valves installed.
- Hazop will inform scenarios for consideration.

Schedule - Liquid Hydrogen

Pressure relief in case of freezing

- New pipe added. Runs from close to absorber to above condenser near hydrogen return.
- New pipe will be heat sunk to radiation shield at 50K minimum, well above 12K freeze temperature of H₂.
- Thermal break below turret to minimise heat load.
- No active components added - all functions provided in cabinet.
- 2nd turret has been opened and dis-assembled for modifications.
- Welding and x-ray testing agreed.

Tracker

Service of cold heads for cryos 1&2 complete.

- Extensive precautions to 'dry' cassettes
- Cryo 2 cooled down – cassettes show 12% & 28% 'dead' channels - reduced track finding efficiency.
- RGA measurement of cassette volume unsuccessful due to poor ultimate vacuum achievable. Yesterday, sampled gas from cassette volume analysis by RGA (Chris Pulker) or GC.

Previously decided to leave 3 & 4 alone as 4 has thermal contact issues which mitigate against thermal cycling

– however - Sunday 2nd April (not April 1st) cryo 4 cold head failed.

- Cryos 3&4 warmed and extensive precautions taken to 'dry' cassettes
- Sumitomo have reconditioned recovered cold heads and serviced cryos 3 & 4 on 27th April.

Tracker

Forward plan

- Test all cryo volumes for water – re-evaluate if not dry – possible RTV degradation.
- Cool cryos 1,3 & 4 once confirmed ‘dry’
- Hope cassettes are all 12% or better, prepare for worse.
 - Assemble US team to recondition cassettes in R9.
 - Correct expert staff required
 - Recall process is ‘try and test’ – verification of performance is only possible after 2 day cool down period – no option to verify post re-build. Previous re-builds did require some re-work after initial cooling.
- Run ISIS 2017/01

Then

- If required re-build cassettes as necessary over long summer shutdown.