



Project Manager's Report

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MICE FAC

8th March 2017

STEP IV: Status

Completed data taking for –

- Field off LiH scattering program
- Field on LiH scattering program
- Study of normalised transverse emittance evolution in LiH in solenoid mode

Ongoing currently/just completed

- Study of normalised transverse emittance evolution in LiH in flip-mode .

Next

Liquid hydrogen system ready for installation

– starts this week



Key Dates

- Magnet Readiness review - planned May 2016
 - Completed Tues 28th June 2016. – O. Kirichek (ISIS) chair.
- Commissioning complete - planned end June 16.
 - MICE running for data ISIS 2016/03 Mid Sept 2016
- H2 available September 16.
 - H2 planned installation moved to Jan '17
- Data-taking complete September 17
 - ISIS 2017/02 in July cancelled
 - now planned for mid Sept to end Oct 17.
 - Requires 3 month extension to STFC staffing at £125.02k
- Analysis complete March 18.
 - Remains target date.

Not shown (not in original schedule)

- Preparation of cooling demo paper for summer '16
- Bid for funding for RF in 2017 from STFC underspend.



Cooling water system

Split system

- 'plain' water for cryo-coolers
- De-ionised water for conventional magnets – heat/ex in MICE hall trench with pumpset mixing valve and controller – ISIS.
- Installation completed summer 16
- Not without incident – solvable within 'a few hours'
- New 'manager' for roof system.
- Recent 'mains surge' several chiller systems on site compromised including MICE system.
- Conventional magnet moved to Loading bay chiller – high power testing complete ~150kW.
- Loading Bay chiller still available as 'fail-over' for roof



Schedule: Step IV. Commissioning

QPS

- New system designed by FNAL
- More complex
 - Energy extracted from magnet– protects internal components.
 - di/dt measurement.
 - quench ‘validation interval’.
- Installed by DL – commissioning started May 2016.
- Found all missing voltage taps in SSD.
- Noisy voltage taps in both SSU and SSD – raised thresholds
- SSD earth leakage path – remove trims

ISIS 2016/04 excellent running

- Additional 60% data taken above target.
- MICE uptime ~100% of ISIS uptime.
- Windows update – post completion.



Safety

Two 'SoPS' events.

1. Power supply enclosure – reported, investigated, appropriate action, closed.
2. 'Autonomous ramp'
 1. Reported
 2. Initial investigation report
 3. C&M review – now close to completion
 4. Review of 'MICE safety management' by PPD. – now complete awaiting written feedback, but panel were satisfied MICE had handled the issues well and had robust procedures in place.

Hydrogen safety proceeds as before - MICE/ISIS working group.



Current Data-taking

Limit FC to SSU force to 15T due to SS strap tension

Solenoid mode

- Superconducting magnets stable and voltage taps signals quieter during long periods of consistent running.
- Plan data-taking to minimise changes to SC magnet settings.

Flip-mode

- FC ramped to 165A no other magnets powered.
- FC quench at 160A on way to 165A and ~12T force.
 - Forces on FC coil packs higher than in solenoid mode because of higher currents required due to field cancellation.
 - Possibly training quench, but this FC did not train predictably in R9
- Decision to limit FC currents and forces to below those during quench event.
- Successful running to date.



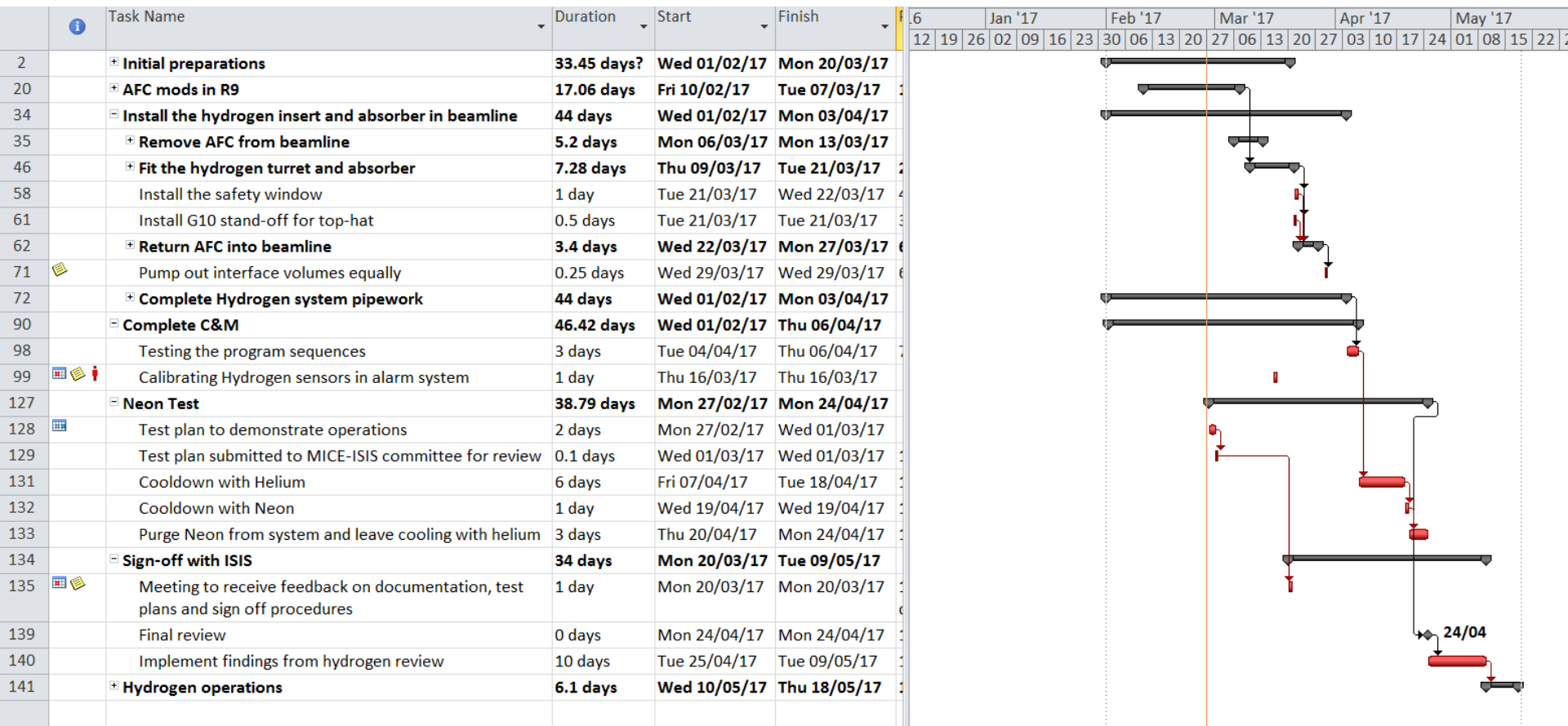
Liquid hydrogen

Decided to delay installation until 2017 taken in summer 2016.

- Excellent progress
 - Reduced heat loads in both turret and absorber.
 - Absorber cooled to below 20K.
 - Temperature regulated operation at 27K with liquid Neon.
 - Delta T between condenser and absorber reduced to 1K.
- Now ready for installation in MICE Hall
- Schedule has limited slack.
- Additional resource secured.
- Safety organisation is critical.
- Staff cover required and agreed.



Hydrogen Schedule- Critical Path



Step IV: Schedule

Funded to 31st July 2017 end ISIS 2017/02.

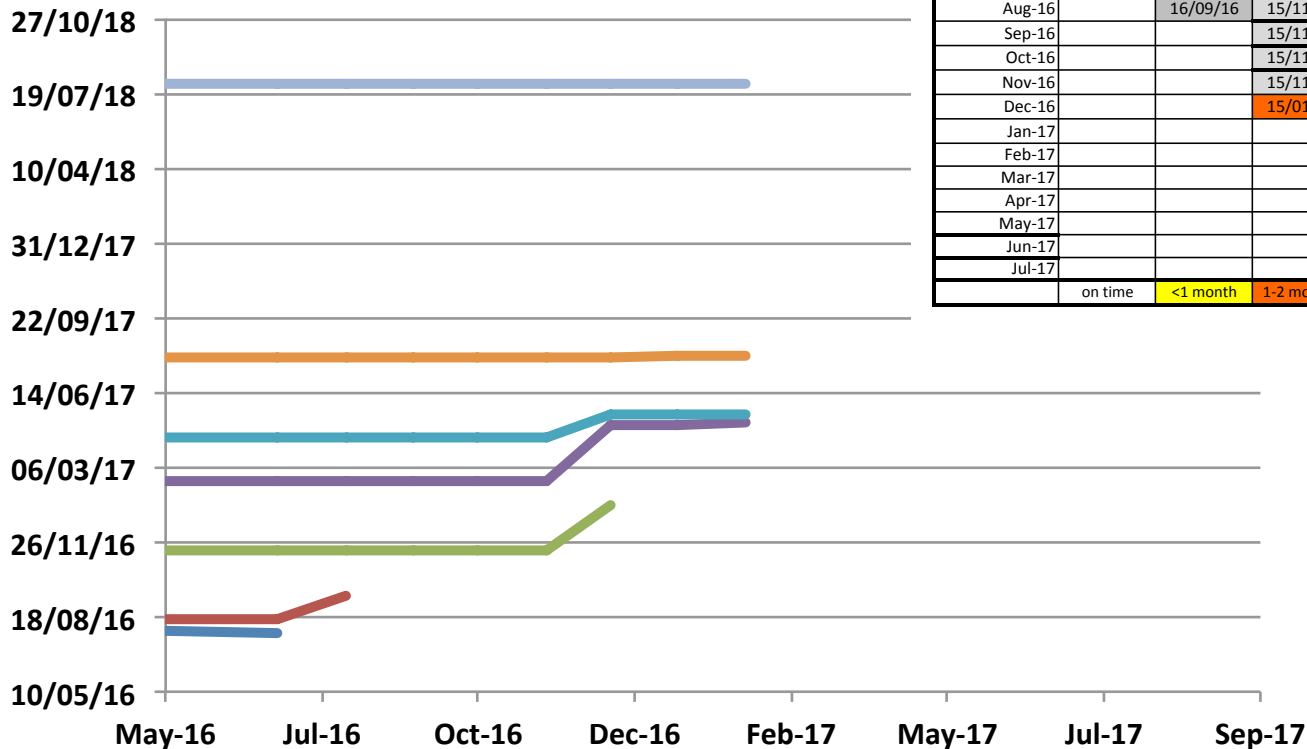
- July ISIS run now cancelled – ISIS 2017/02 mid Sept to end Oct.
 - MICE propose continue with Step IV until end ISIS 2017/02.
 - Requires extension to STFC staff of 3months, £125.02k increment over approved funding.
 - Additional running to provide contingency for H2 system
- MICE has provided ISIS with 3 off 4616 tetrodes from MICE stock to cover shortage caused by run of short lifetime tubes. ISIS willing to replace with new tubes or cash equivalent £120-180k



Milestone Slipchart

31st July 2017	Combined magnet operational tests to 2T complete	Combined magnet operational tests to 3T complete	LiH operational	Liquid Hydrogen system operational	1st operation of M2D	End of Step IV Operations	End of Analysis
	May-16	31/07/16	15/08/16	15/11/16	14/02/17	15/04/17	31/07/17
Jul-16	26/07/16	15/08/16	15/11/16	14/02/17	15/04/17	31/07/17	31/07/18
Aug-16		16/09/16	15/11/16	14/02/17	15/04/17	31/07/17	31/07/18
Sep-16			15/11/16	14/02/17	15/04/17	31/07/17	31/07/18
Oct-16			15/11/16	14/02/17	15/04/17	31/07/17	31/07/18
Nov-16			15/11/16	14/02/17	15/04/17	31/07/17	31/07/18
Dec-16			15/01/17	02/05/17	15/05/17	31/07/17	31/07/18
Jan-17				03/05/17	16/05/17	01/08/17	01/08/18
Feb-17				04/05/17	17/05/17	02/08/17	02/08/18
Mar-17							
Apr-17							
May-17							
Jun-17							
Jul-17							
	on time	<1 month	1-2 months	2-4 months	4+ months	Complete	

Mice Step IV Milestone Evolution

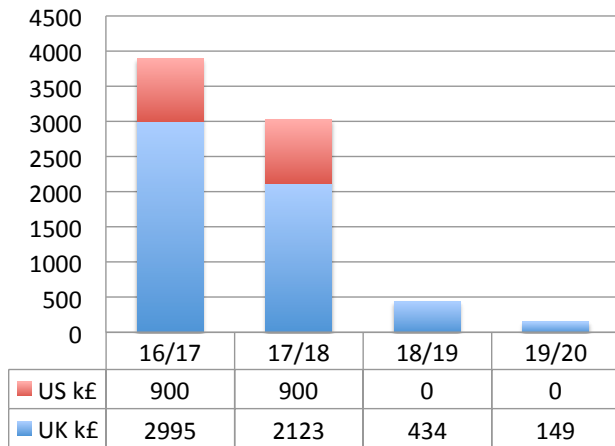


	UK financial year April to March			
	16/17	17/18	18/19	19/20
UK spend (k£)	2995	2123	434	149
Cumulative UK spend (k£)	2995	5118	5552	5702
UK spend (k\$)	3744	2654	543	187
Cumulative UK spend (k\$)	3744	6398	6940	7127
US spend (k£)	900	900	0	0
Cumulative US spend (k£)	900	1800	1800	1800
US spend (k\$)	1125	1125	0	0
Cumulative US spend (k\$)	1125	2250	2250	2250

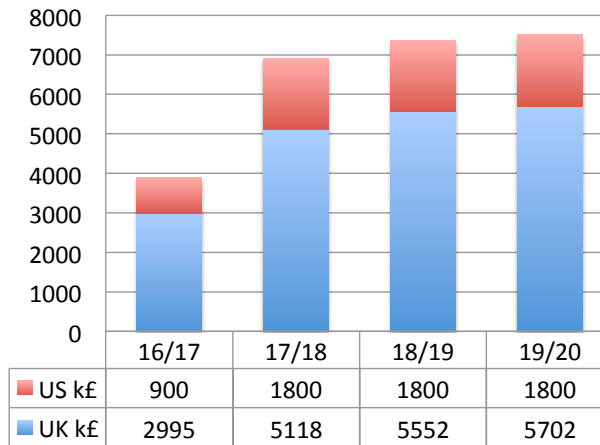
Exchange Rates	
£/\$	1.25
\$/£	0.8

Cost

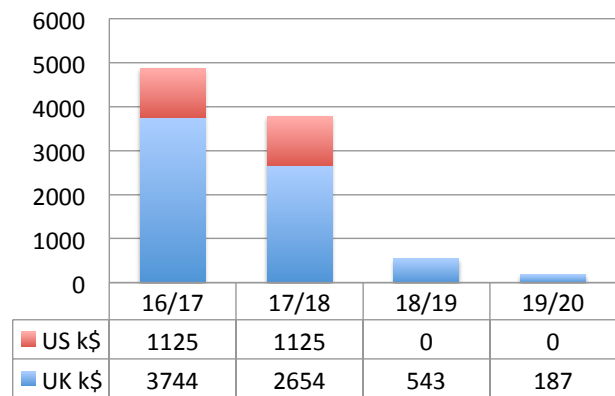
MICE annual spend k£



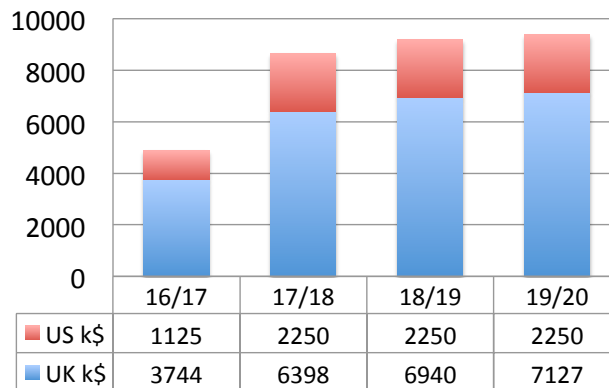
MICE cumulative spend k£



MICE annual spend k\$



MICE cumulative spend k\$



Risk Register

Active Risk		15									
Retired Risk		13									
ID	Risk Description	Potential impact on project	Risk score			Ownership	Proposed Action	Post-action risk score			Comment / Conclusion
			L	I	LxI			L	I	LxI	
MICE 3	Magnetic field effecting operation of electrical equipment relating to the continued operation of the cooling channel magnet systems and detectors.	Inability to operate the cooling channel	5	5	25	MICE - UK / MAP	Installation of a partial return yoke has mitigated the major risk. Movement of the control and power supply equipment to a dedicated room outside of the magnetic field.	1	4	4	Much work has been completed. Non staff risk persists in the event of additional material being required.
MICE 4	Extended period of re-training for the lattice of magnets.	Timescales for the training period, cost of the amount of LHe required to carry out the training. Expert personnel required to be available for magnet operations over a protracted period of time.	4	5	20	MICE-UK / MAP	Magnet integration task force to define commissioning method to keep schedule and cost to a minimum.	4	4	16	Each re-cool and fill of the Spectrometer Solenoid can take upto 500l LHe, AFC remembers it's training. Each full lattice quench could cost in the region of £7K.
MICE 8	Resourcing issues from the STFC and national labs	inability to complete significant sections of work on agreed time or cost scales.	4	5	20	MICE - UK / MAP	Realised. Escalation of the issue to the STFC and DOE.	2	4	8	Project scope has changed leading to a different labour profile required to complete the project.
MICE 16	Failure of a Focus Coil Magnet	Internal cold mass or associated equipment deep within the assembly. LTS leads.	3	5	15	MICE UK	Follow all specific operational aspects as defined by the experts for the superconducting magnet	1	5	5	Investigation and fix would be extremely costly and extensive with regard to schedule.
MICE 17.1	Failure of Upstream Spectrometer Solenoid Magnet	Internal cold mass or associated equipment deep within the assembly. LTS leads.	4	5	20	MAP	New quench protection system	1	5	5	Has the same design issues as SSD, confidence improving with operation and testing with forces.
MICE 19	Failure of M2 in SSD.	Reduction in scientific output and resulting cooling effect.	3	4	12	MICE-UK / MAP	Maximise data collection before running M2.	2	4	8	Consider completing data set for one absorber.
MICE 20	Failure of Helium space feedthrough in SSD.	Reduction in scientific output and resulting cooling effect.	3	4	12	MICE-UK / MAP	Limit number of quenches	2	4	8	
MICE 23	Risk of equipment failure/breakage	Cost of repair/replacement. Time lost during recovery	3	3	9	MICE UK	Spares inventory / proper planned maintenance	3	1	3	to some degree inevitable due to age of equipment
MICE 24	Problems during magnet string commissioning	Further compromise of SSD / Delays to program	3	5	15	MICE UK	Conservative magnet settings.	3	3	9	Always recognised as a challenge - complicated and exacerbated by SSD situation
MICE 28	Inability to cool absorber to required temp	No H2 absorber / reduced science	3	5	15	H2 Group	Heat load modelling/design revision	2	5	10	improvements to heat load design.
MICE 29	Further compromise of SSD performance	Slower data-taking, more remedial action required	3	5	15	MICE-UK / MAP	Power supply improvements, feedthrough heating improvements.	3	5	15	Anomalous earth leakage and noise seen - now absent, but as yet unexplained.
MICE 30	Insufficient international manpower available.	Delay in remediation of non-UK assets and associated reduction in effort on other tasks.	4	3	12	MICE-UK / MAP	Discussion with international management to maximise staff availability.	3	3	9	Long standing issue.
MICE 38	Decreased in depth knowledge of controls and monitoring system.	Higher fraction of 'lost time' during data-taking due to longer time to troubleshoot	5	3	15	MICE	Support new team, extended period for 'run-up' in advance of ISIS run.	3	3	9	Anticipated difficulty with directing staff effort during changeover has been realised. New team in place, excellent co-operation and effort now bearing fruit.
MICE 39	Inability to install Liquid Hydrogen system in time for ISIS 2017/01	Loss of data/reduced science	4	3	12	MICE management, H2 group	Stop data-taking in ISIS 2016/05 early. Extra vacuum/cryo resource from PPD. Integration of ISIS safety to install. Top level co-operating from ISIS and PPD.	2	3	6	Schedule is very tight. Some slip likely. Possible some of ISIS 2017/01 will be lost for hydrogen but other data- taking is required (empty absorber/alignment)
MICE 40	Inability to certify pressure rating of hydrogen safety volume at sufficiently high pressure for safe operation	No safety approval, no liquid hydrogen in MICE hall	4	5	20	H2 group	Model improvements to exhaust path. Finite element model of enclosure volume to assign pressure rating beyond current Tesla spec	2	5	10	Recently uncovered discrepancy between Tesla enclosure rating (1.25bar) and thin window rating (7 bar). Require data on build from Tesla.

Risk

MICE 4: Extended period of re-training for the lattice of magnets.

MICE 19&20: Failure of M2 in SSD, failure of helium space feed-through in SSD

MICE 29: Further compromise of SSD performance

Still significant and not considered significantly reduced despite excellent QPS improvements and upgrades

MICE 30: Insufficient international manpower available.

MICE 23 Risk of equipment failure/breakage.

Trackers. Cooling system. Air conditioning.

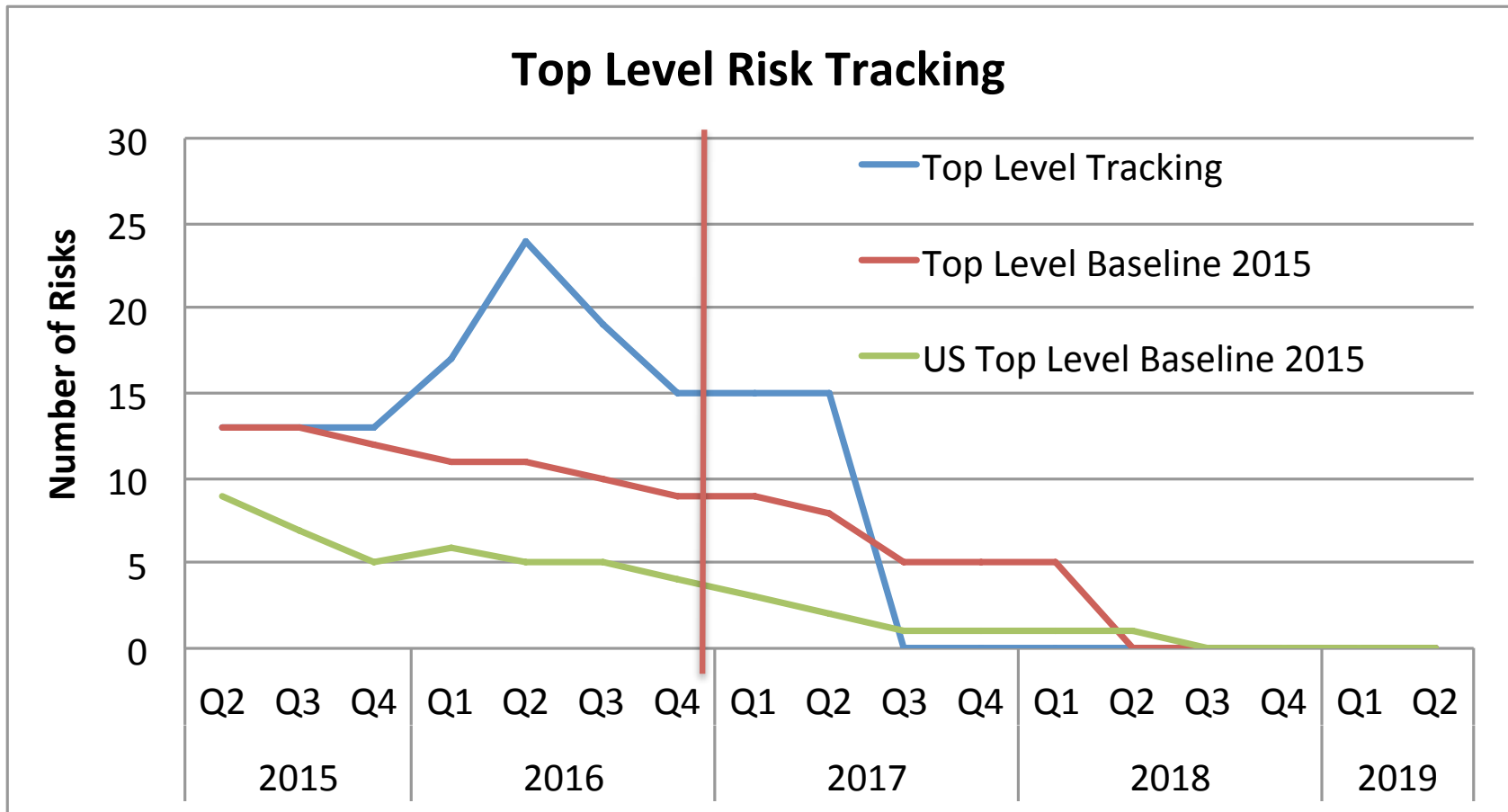
MICE 28 Inability to cool absorber to required temp.

See V Bayliss, much mitigated



New Risks

MICE 38 Decreased in depth knowledge of controls and monitoring system.
MICE 39 Inability to install Liquid Hydrogen system in time for ISIS 2017/01
MICE 40 Inability to certify pressure rating of hydrogen volume at sufficiently high pressure for safe operation.



Conclusions

Step IV data-taking to date – LiH. Excellent progress.

- Scattering with and without field
- Normalised transverse emittance reduction
 - Solenoid and flip mode.

Liquid Hydrogen install

- New test using Neon.
- Challenging schedule.
- Additional resource secured.
- New risks recently discovered, but look manageable.
- Schedule risk to project mitigated if ISIS 2017/02 can be used for data.
 - Incremental cost £125.02k.
 - Cost neutral options exist.

