Table of Contents

Perfluoroketone C6K (Novec 649) as coolant for

Tasks

- Test C6K with the thermal mockup, compare the cooling performance with C6F14
- Collect published information about C6K
- Organize C6K validation for SciFi project
- Longer-term project: C6K as a replacement for C6F14 in cooling applications at CERN

Participants, contacts

- Michele Battistin, EN-CV-PJ (section leader, Detector Cooling Project leader, Novec WG coordinator) 164251
- Petr Gorbounov, PH-LBO (PJAS, Novec fluids chemical and radiolytical characterisation, purification) 166503
- Eric Thomas, PH-LBO-DO (deputy LHCb coordinator) 162029
- Dina Giakoumi, PH-DT-DI (ATLAS Novec test bench) 73405
- Lukacz Zwalinski, PH-DT-DI (ATLAS Cooling Coordinator) 162008
- Olivier Crespo-Lopez, EN-CV-DC (section leader) 161042
- M. Ferro-Luzzi, PH-LBD (C6K for BGV project) 164615
- TS-VSC-SCC
    - Mauro Taborelli (section leader) 163890
    - Radu Setnescu (PJAS, PH chemist, consultant) 78056
    - Benoit Teissandier (chemical laboratory) 78822
- CERN Irradiation Facilities
    - Julien Mekki (CHARM project leader) 168964
    - Markus Brugger (coordinator)
- PH-DT
    - Roberto Guida PH-DT-DI (gas group leader) 162146
- HSE
    - Fernando Baltasar Dos Santos Pedrosa DGS-SEE-XP 70975 162237 (contact person for LHCb)
    - Dora Rio, DGS-SEE-EN (environmental safety) 169751

Events

- September LHCb week in Orsay, SciFi session
- 30.09.2014 ROB design meeting at NIKHEF (Amsterdam)
- 09.10.2014 formal launch of the "C6K project"
- 21.11.2014 First discussion with M.Battistin
- 04.11.2014 First meeting at TS-VSC - minutes
- 15.11.2014 Meeting with J.Mekki (CHARM irradiation facility) - minutes

Documents

- *Summary Report* at the 73rd LHCb week (slides)
- *Thermal measurements with the SciFi read-out box mockups*CERN LHCb-INT-2014-048, internal note in preparation (Abstract)

- *Project Note 1*: a compilation of published information about C6K, draft plan of the validation study (latest version, PDF)
    - v. 15.11.2014 .
    - v. 23.01.2015
    - v. 16.03.2015 minor corrections, typos, the draft WP plan is replaced with a reference to EDMS document
    - v. 31.03.2015 minor corrections, general reformatting to improve readability
- *Project note 2:* assesment of the radiation damage to the coolant in SciFi tracker (latest version, PDF)
    - v. 23.11.2014
    - v. 10.03.2015
    - v. 17.09.2015
- *Project note 3:* Comparison of liquid coolants suitable for single-phase detector cooling (latest version, PDF)
    - v. 9.06.2015
- Work package specs (latest version, PDF)
    - v. 16.12.2014 early draft
    - v. 27.02.2015 EDMS version 0.1
    - v. 05.03.2015 EDMS version 0.2 TE-VSC-SCC as consultants/technical support only
    - v. 16.03.2015 EDMS version 0.3 Appendix 3 (work plan) added
    - v. 21.03.2015 EDMS version 0.4 minor corrections, polishing
- Work package Annex 1: Commentaries to C6K validation tasks (latest version, PDF)
- Work package Annex 2: Questions to 3M, with their responses (latest version, PDF)
- Project Note 3: a comparison of alternative coolants for single-phase applications (latest version, PDF)
    - v. 23.01.2015
    - v. 09.06.2015
- Novec 649 safety aspects, a compilation by PG (latest version, PDF)
    - v. 01.09.2015
- Presentations
    - 18.06.2015 C6K and water
    - 25.06.2015 The validation tasks
    - 02.09.2015 Summary for NIKHEF

Status, summary:

November 2014

- Detailed mockup measurements with C6K: cooling properties very close for C6F14
- The expected radiation damage to C6K in SciFi is very small, at 1-10 ppm level.
- The pilot study has to focus on chemical properties of C6K: reactivity with water and potential filters
- Irradiation and radiolysis study will be next step in 2015
    - new test containers
    - mixed irradiation at CHARM
    - gamma irradiation at GIF++
- Summary_11.11.2014.pdf

December 2014

- Workpackage proposal
- Novec memo update
- 22.12: First batch of chemical compatibility tests is launched (C6F14, Novec 649)
    - 10 vials, 40 ml of test fluid + 0, 0.4 and 1 ml of water

January 2015

- work on the coolants comparison memo
- HFE fluids added to the list of candidates
- Another FK fluid (Novec 774) and PFC fluid (FC-84) are added to the list of candidates
- 12.01: 2nd batch of compatibility tests is launched (C6F14, Novec 649, Novec 7200), with SS 316L samples
    - ♦ 18 vials, 40 ml of test fluid + 0, 0.4 and 1 ml of water
- 22.01: 3rd batch of compatibility tests (Novec 7100), with Ti, 316L and silicone rubber
    - ♦ 10 vials, 40 ml of test fluid + 0, 0.4 and 1 ml of water
- 24-28.02 PG: work on the Note 3 "Comparison of coolants"
- 28.01: the draft work package is reported by E.Thomas at the meeting with the DRC S.Bertolucci (EDMS 1479814 v.1)

February 2015

- 1-12.02 PG absence for vacations
- 13-20.02 PG: Work on the EDMS version of the Work Package
- 25.02 First draft WP document
- 27.02 First meeting with L.Zwalinski, P.Tropea et al. on the "Novec 649 for ATLAS" initiative

March 2015

- 04.03 TE-VSC-SCC refused to directly participate in the project, remainig consultants
- 05.03 First EDMS-version of the WP
- 06-13.03 PG: work on the validation plan (or specs for sub-contractors)
- 11.03 PG meeting with B.Kaiser (3M Switzerland). BK offered help in establishing a collaboration with 3M USA
- 17.03 PG meeting with S.Sgobba (EN-MME-MM). SS recommended Cetim-Cermat as a sub-contractor. Once the WP is approved, a micro-workshop will be arranged with EN-CV-PJ, EN-MME-MM, TE-VSC-SCC and PH-LBO, to finalize the work plan
- 17-20.3 PG search for alternative C6K suppliers, quotations by Chinese companies
- 23.03 1st meeting with TE-VSC-SCC to discuss the validation plan, containers for irradiation
- 26.03 SciFi general meeting. NIKHEF group delegates resonsibility for N649 validation to SciFi management
- 27.03 First set of question to 3M is out (sent to bkaiser@mmmNOSPAMPLEASE.com)
- 31.03 First contact with Ph. Tuma of 3M (he agreed to participate in N649 discussions)

April 2015

- Regular (weekly) meetings with E.Thomas and M.Battistin
- PG: Discussions with NIKHEF (N649 purchase, its compatibility with Ti, Ti brazing, chiller and booster pump for their test bench). I proposed to test the cooling bar at CERN
- Containers for irradiations: design finalized, procurement of materials, production launched at EN/CV
- NDA with 3M, the saga begins
- Moving the old 156 lab to B. 169 (28.04: new lab inspection with B.Chadaj)
- ~13.04 Procurement of material for the test strips
- 21-24.03 Receipt of the 3M replies, 1st teleconference with Ph. Tuma and J.Owens
- Discussions of the 3M informations with TE-VSC-SCC and the ATLAS cooling group
- Inquiries abour ion-exchange resins (replies: Dow 24.03, Dynalene: 29.04)
- 29.04 First contacts with Dynalene (P. McMullen) on the R&D cooperation (Novec cleaning, reasins)
- 30.04 E. Thomas meets with S.Bertolucci, on the approval of the Novec validation project
- 30.04 SciFi general meeting, NIKHEF announces the "copper" alternative to Ti cooling bar;

discussion with G.Haefeli

May 2015

- Intense exchange with Dynalene, to shape the R&D program. Procurement of the N649 sample for Dynalene.
- 6.05 First version of the NDA is sent to 3M
- 7-21.05 discussions with NIKHEF: the pump for the test bench (final: GATHER gear pump)
- 19.05 discussion with Ph.Tuma of the desiccants for N649
- 21.05 Discussion with E.Ferfecki (Dow) on the resins at low T.
- 22-30 Preparation mini-WS with LHC cooling coordinators (failed)
- pushing the 3M NDAM. M. Battistin is appointed to supervise the Novec validation program
- 28.05 M. Battistin is appointed to supervise the Novec validation program

June 2015

- 1-5.06 First test results on the hydrolysis from Dynalene (pH=1!). Frequent phone discussions with Dynalene.
- Turbine flowmeter is transfered to NIKHEF
- 2.06 The Dynalene story is presented to Michele. 03.06 Michele talks with P. McMullen
- 05.06 Discussion of Dynalene results with Ph. Tuma (3M). Decision to analize the irradiated samples at 3M (US)
- 05.06 The containers are ready
- 10.06 1st general meeting of the Novec WG
- 11.06 BGV temporarily(?) switches to C6F14. I get 1 bottle of fresh N649 from Massi.
- 11.06 Proposal of the R&D work from Dynalene. Discussion of the "vapor test" concept.
- 16.06 1st contact with Vaisala on the RH measurement with capacitive sensors
- 18.06 2nd general meeting of the Novec WG. PG presentation: "C6K and Water"
- 23-24.06 PG poll: why water is undesirable inside cooling circuits
- 25.06 3rd general meeting of the Novec WG. PG presentation: draft list of tasks to be outsourced

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This topic: LHCb > C6K
Topic revision: r24 - 2016-04-06 - PetrGorbounov