UT – CO_2 cooling discussion

December 6, 2017

Burkhard Schmidt

From the LHCb CO2 cooling kick-off meeting on Wednesday May 28, 2014

CO_2 cooling for the LHCb upgrade

- Due to the strong interplay between the detector design, the requirements for the thermal management, the detector control and safety systems and the design of the cooling plant, close collaboration between cooling experts and detector development groups is mandatory.
  - Cooling lines are part of the thermal / mechanical support structure design and optimization

  → **The detector performance does not stop at the pipe wall!**
  - This most complex part of the cooling system is often under estimated

→ **Detector cooling is a subject not to be neglected even at the very early stages of detector design**

From the LHCb CO2 cooling kick-off meeting on Wednesday May 28, 2014

CO_2 cooling for the LHCb upgrade

- The TDRs for the upgraded VELO detector with micro-channel cooling and the Upstream Tracker have been submitted and are under approval.

→**It is high time to start more formal collaboration between cooling experts and detector groups.**

- This is particularly important because we consider the use of a common cooling plant with its back-up for both sub-detectors.
- As a first step we must understand better the cooling specifications for each sub-detector and document them.

Status I

- Much has been achieved over the past 3 ½ years:
  - Based on the cooling requirements, the cooling plants have been proposed and reviewed → EDR took place in December 2015
  - The detailed design has been carried out for MAUVE and the primary chiller (joint chiller between SciFi and UT/VELO)
  - Construction and installation is ongoing:
    - The transfer line have been installed
    - The junction box has been constructed and tested
    - Components for MAUVE have been ordered.
  - ➢ Paola asked to validate some points regard in the functionality
  - A LUCASZ plant has been proposed early 2016 and construction is in full swing
  - ➢ Does the simple LUCASZ unit meet well the needs of the UT ?

Status II

- We are now finalizing design issues on the detector side
  - The UT box had its EDR in June 2016
  - We completed the integration of the cooling manifolds in the model
  - ➢ Some open questions are still there requiring further discussion (Simone/Bart)
  - We are now preparing for construction and look more carefully in some details of the design …
  - We discovered a few points which require a more in-depth discussion with the cooling team
  - ➢ This triggered the mail of Joao some weeks ago

➢ Some adjustments might be needed, which we should formalize

➢ **All this led to the special meeting today**

UT CO2 cooling discussion

Wednesday 6 Dec 2017, 15:00 → 17:00 Europe/Zurich

20-1-004 (CERN)

Burkhard Schmidt (CERN) , Joao Carlos Batista Lopes (CERN) , Paola Tropea (CERN)

Videoconference Rooms LHCb_CO2_cooling_meeting_ Join

15:00 → 15:05 **Setup and Introduction** 5m

Speakers: Burkhard Schmidt (CERN) , Joao Carlos Batista Lopes (CERN)

15:05 → 15:20 **Cooling system functionalities and resources** 15m

Questions raised by Paola:
- detector power and flow requirements are correct
- update of detector requirement doc (where needed)
- common T set point for operation in backup
- all system is qualified for design pressure of 130 bar, i.e. testing pressure of 187 bar
- all sub detectors will provide via DIP a "reading Temperature" which will be used at cooling system startup to initiate circulation at that T

Speaker: Burkhard Schmidt (CERN)

UT cooling requirements

15:20 → 15:50 **UT box and questions related to the manifold design** 30m

Questions raised by Simone:
- Is it admitted to use Swagelok ferrule compression system to mount the detector cooling circuit?
- What alternative solution if we don't use the valves?
- We propose a simple T and P sensor location on the main CO2 flow. Could we have any control if the measurements indicate not perfect values?
- Are these signals usable from the control system ? Could we have any control if the measurements indicate not perfect values?
- Etc.

Speakers: Bart Verlaat (CERN) , Simone Coelli (Università degli Studi e INFN Milano (IT))

15:50 → 16:20 **MAUVE related questions** 30m

Explanations regarding the operation modes for MAUVE

The aim is to get a better understanding in the UT group for the standard operation modes of the cooling plant, but also for the implications when operating jointly VELO and UT from the same plant.

What are the implications for adding a Back Pressure Regulator or an Impedance in the cooling system?

We have to make sure that we don't operate the detector for an extended period of time (>1h) at very low temperature (<-10 oC) when the electronics are off.

16:20 → 16:50 **LUCASZ related questions** 30m

Explain the operating modes for the standard LUCASZ plant and how could un upgrade of the standard LUCASZ look like (without going to a full local box) to ease UT detector commissioning?

When installing and commissioning the staves, we have frequent cycles in which the electronics are turned on and some cooling is needed for test purposes of a few staves. The system needs then to be emptied again to allow for the installation of further staves, followed by a repetition of the test cycle. How to ease this commissioning phase?

Speaker: Bart Verlaat (CERN)

16:50 → 17:00 **Any other cooling system related questions** 10m