Von: **Joao Carlos Batista Lopes** Joao.Carlos.Batista.Lopes@cern.ch
Betreff: FW: TT N2 flushing volume
Datum: 11. Juli 2018 um 15:05
An: Heinrich Schindler Heinrich.Schindler@cern.ch

Fyi, Joao

From: Jeroen van Tilburg <jtilburg@nikhef.nl>
Sent: 11 July 2018 13:57
To: Eric Thomas <eric.thomas@cern.ch>
Cc: Joao Carlos Batista Lopes <Joao.Carlos.Batista.Lopes@cern.ch>
Subject: Re: TT N2 flushing volume

Dear Joao,

We have used the N2 supply from the cavern. There is a gas supply panel on the C-side of the TT detector (one floor lower on the cavern wall). From there we run flexible (blue) hoses through the cable chain to the TT detector. There are two inlets for the TT: one on the A side, one on the C-side. There is no dedicated outlet. The box is probably most leaky around the beam pipe hole (which is far away from the inlets). I think that the inner diameter of the hoses is 4 mm, but I am not completely sure.

Concerning the safety, we have installed two N2 flow switches that are connected to the DSS. I have attached two pictures where you can see the panel and the flow switches. The flow switches do not work when the magnet is on. The stray field at this location is about 4mT. For this reason we had to enclose the flow switches in a mu-metal box (the thickness of the metal was at least 0.5 mm, maybe more). In the pictures you can see that one flow switch is covered with a provisional sheet of mu-metal (which was later replaced by a more elegant design). The flow switches are set to 2 liter per minute per side. The actual flow is around 3 liter per minute per side. This is more than enough to keep the detector dry when it is cooled at -15 C. After opening and closing the detector, we used the bypass (blue hose) to quickly flush the TT box to bring the relative humidity down before starting the cooling. I do not know the flow when the bypass is used, but I guess it could be more than 60 liter per minute per side. We have humidity sensors in the TT box as well (HMX2000). However, they are not really accurate for low RH values. From experience, it was found sufficient that the RH was below 5% before cooling down from room temperature to -15C.

I copied some more relevant info from EDMS 929560:
The detector volume is continuously flushed with nitrogen in order to keep the relative humidity low. Each detector half has one nitrogen inlet to which the nitrogen is supplied via a flexible pipe that is routed through the flexible cable chain. There are no dedicated outlets for the nitrogen.

Before setting the coolant temperature back to –15 °C, the relative humidity inside the box must have decreased below the 5% level. The relative humidity in the detector box can be monitored by ECS. At standard nitrogen flow, it can take several days until this humidity level is reached. In order to speed things up, the nitrogen flow can be temporarily increased by opening the nitrogen bypass. Before opening the nitrogen bypass valve, the DSS alarm for the nitrogen flushing must be disabled and the valve for the flow switch must be closed. The two valves must never be open at the same time, as this might damage the flow switch. With the bypass open, it will typically take about two hours before the detector volume is dry enough to cool down. When the relative humidity inside the detector box has decreased to below the 5% level, close the nitrogen bypass valve, open the flow-switch valve and enable the DSS alarm. Only then set the coolant temperature back to –15 °C.