Al Conrad <aconrad@lbto.org>

Temperature of cooling liquid SHARK-NRI technical camera

10 messages

Marafatto, Luca <luca.marafatto@inaf.it> Mon, Jan 16, 2023 at 3:32 AM
To: Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, jhill@lbto.org, Mark Smithwright <msmithwright@lbto.org>
Cc: Jacopo Farinato <jacopo.farinato@inaf.it>, Maria Bergomi <maria.bergomi@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Dear all,

We recently had a likely frost issue on SHARK-NIR technical camera, during the Com-1 run.
We discussed this with First Light (manufacturer of the technical camera) and we were told to check the temperature of the cooling liquid, as a non-optimal temperature might cause condensation (and frosting) on the camera window,
Could you please share with us what is the temperature of cooling liquid (in input, of course) serving SHARK-NIR?
In case, would it be possible to regulate its temperature?

Thank you!

Ciao!

Luca

--
e-mail: luca.marafatto@inaf.it

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James Riedl <jriedl@lbto.org> Mon, Jan 16, 2023 at 6:11 AM
To: "Marafatto, Luca" <luca.marafatto@inaf.it>
Cc: Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, Al Conrad <aconrad@lbto.org>, jhill@lbto.org, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Maria Bergomi <maria.bergomi@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Hi Luca, We supply instrument cooling on the telescope (ICS) at two degrees C ***below ambient telescope air temperature.*** It can be changed as long as it's set safely above dewpoint. Here's our internal document describing the system.

-James

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303s011a.pdf
287K

John Hill <jhill@lbto.org> Tue, Jan 17, 2023 at 9:53 AM
To: James Riedl <jriedl@lbto.org>
Cc: "Marafatto, Luca" <luca.marafatto@inaf.it>, Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, Al Conrad <aconrad@lbto.org>, jhill@lbto.org, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Maria Bergomi <maria.bergomi@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

To clarify what James wrote:
We supply instrument cooling on the telescope (ICS) at two degC
below ambient telescope air temperature, but the supply temperature is
always at least two degrees above the dewpoint.

(It says that in the reference document that James supplied, but you
had to read for a while.)

So ICS cooling alone should never cause condensation on optics or electronics.

We should check that ICS is working correctly.

Ciao,
John

On Mon, Jan 16, 2023 at 07:11:31AM -0700 or thereabouts, James Riedl wrote:
> Hi Luca, We supply instrument cooling on the telescope (ICS) at two degrees
> C *below ambient telescope air temperature. *It can be changed as long
[Quoted text hidden]
--
Dr. John M. Hill Large Binocular Telescope Observatory
jhill@as.arizona.edu University of Arizona
phone: (520) 621-3940 933 N Cherry Avenue
fax: (520) 626-9333 Tucson, Arizona 85721-0065

John Hill <jhill@lbto.org> Tue, Jan 17, 2023 at 12:34 PM
To: "Marafatto, Luca" <luca.marafatto@inaf.it>
Cc: Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, jhill@lbto.org, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Maria Bergomi <maria.bergomi@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Luca,

I checked the temperature of the left and right ICS coolant loops for
the interval Jan 1-17, 2023. ICS seems to be working just fine.
It reliably follows the chamber ambient temperature minus 2 degC.
Most of the time ICS coolant was at least 10 degC above the
chamber dewpoint. For a few hours on the morning of 20230106
the ICS coolant was within 2.5 degC of the chamber dewpoint - not
triggering the dewpoint compensation, but close.

Ciao,
John
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[Quoted text hidden]

Maria Bergomi <maria.bergomi@inaf.it> Wed, Jan 18, 2023 at 2:53 AM
To: John Hill <jhill@lbto.org>, "Marafatto, Luca" <luca.marafatto@inaf.it>
Cc: Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Hi John,

thanks a lot for your feedback. Just to be supersure, do you use UTC when saying morning of the 6th?

On January 6th our TECCAM was kept at -15°C, which is a condition were the company of the camera (Firstlight) says should be safe from the issue.

Humidity has also an impact on our issue, as you see from the email Jacopo forwarded.

We have noticed the frost issue on out TECCAM on Jan 11th at 11:15 UTC. Do you see anything strange around that time?

Thanks again!

Maria
[Quoted text hidden]

Dr. Maria Bergomi

e-mail: maria.bergomi@inaf.it

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Maria Bergomi <maria.bergomi@inaf.it> Wed, Jan 18, 2023 at 3:18 AM
To: John Hill <jhill@lbto.org>, "Marafatto, Luca" <luca.marafatto@inaf.it>
Cc: Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Also, in case it can be useful, we have reconstructed from our logs that the camera was kept at -40°C (the newly identified risky regime, depending on external conditions) between Jan 9th, 08:03 up to Jan, 11th 11:34, always UTC times
[Quoted text hidden]

John Hill <jhill@lbto.org> Wed, Jan 18, 2023 at 9:05 AM
To: Maria Bergomi <maria.bergomi@inaf.it>
Cc: "Marafatto, Luca" <luca.marafatto@inaf.it>, Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Hi Luca, Maria, Jacopo, et al.,

Here's a plot of the ICS coolant temperature from 10 UT on 20230108 until 16 UT on 20230111. Indeed the observing chamber dewpoint was highest near 11 UT on Jan 11, but not at the level that I would expect to see the window frosting.

Aren't you still pressurizing the instrument with a flow of compressed air? I verified that the compressed air dewpoint was below -100 degC during this interval. That should be dry enough inside the instrument carter to avoid frost even without a window on the camera. Or is the technical camera outside of the enclosed section?

This makes me worry a bit that there is moisture inside the camera, or that there is a coolant leak inside the

instrument.. We can test the hypothesis of moisture inside the camera by setting it to -40 degC on a very dry cold night on the mountain (not the weather of recent days).

In any case, you should return the camera to have the mechanical modification made in order to reduce the chances of frosting.

Another thing to think about is whether the camera has O-ring seals that have degraded in the ozone of the mountain. SHARK has already been at the summit long enough to kill a butyl O-ring.

Ciao,
John

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John Hill <jhill@lbto.org> Wed, Jan 18, 2023 at 9:06 AM
To: Maria Bergomi <maria.bergomi@inaf.it>
Cc: "Marafatto, Luca" <luca.marafatto@inaf.it>, Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

With the plot
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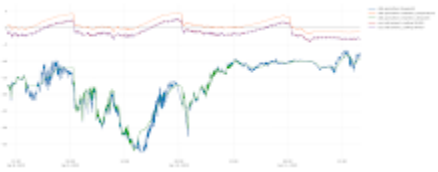

ics_20230111.png
184K

James Riedl <jriedl@lbto.org> Wed, Jan 18, 2023 at 9:45 AM
To: John Hill <jhill@lbto.org>
Cc: Maria Bergomi <maria.bergomi@inaf.it>, "Marafatto, Luca" <luca.marafatto@inaf.it>, Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>, Dan Cox <dcox@lbto.org>

Dan and I discussed this today as well. We put a diagram together. We have new staff at the observatory that might benefit from seeing how the ICS system works.

-James

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ICS and Shark NIR example.pdf
398K

Marafatto, Luca <luca.marafatto@inaf.it> Wed, Jan 18, 2023 at 9:50 AM
To: John Hill <jhill@lbto.org>
Cc: Maria Bergomi <maria.bergomi@inaf.it>, Patrick Hartley <phartley@lbto.org>, jprothro@lbto.org, Joe Ornelas <jornelas@lbto.org>, James Riedl <jriedl@lbto.org>, Al Conrad <aconrad@lbto.org>, Mark Smithwright <msmithwright@lbto.org>, Jacopo Farinato <jacopo.farinato@inaf.it>, Elena Carolo <elena.carolo@inaf.it>, Luigi Lessio <luigi.lessio@inaf.it>

Hi John,

Thanks for the plot! Here below a few answers:

Actually, we did not keep the camera pressurized during observations, to avoid introducing turbulence inside the instrument.
Thus, I expect the humidity inside SHARK-NIR to be not too far from the chamber humidity that night.
Looking at a plot provided by CRED2 providing company, there is risk of condensation/frost when the cooling liquid temperature is close to ambient temperature, the detector temperature is -40deg and when humidity is above 50%, which was the case on January 11th.
The CRED2 was kept at -40deg since January 9th, when ambient humidity was below 20%, and we did not notice any issue till January 11th whan humidity raised above 40-50%, so we already have a (very short) test on camera behavior in drier condition.
In any case, it might be worth it to repeat the test in the future when ambient humidity is <30%.
I honestly do not know about o-rings, for sure the detector is sealed in neutral gas, we have to double check with First Light.

Ciao,

Luca

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