Questions, Comments and Answers following the presentation

MUSE monitoring and calibration
Fernando Selman, presented by Evelyn Jonston and Frédéric Vogt

<u>Hanuschik</u>*: Related to the Raman scattering lines: they might be removable in post-pipeline processing in the reduced datacube because we can expect a well-defined pattern. Also it might be useful to have dedicated sky pointing close to the beam which you then use for removal.*

Indeed, the Raman signal is spectrally complex but well understood theoretically, so we ought to be able to "deal with it" in the data reduction, esp. if we also implement suitable observing strategies (e.g. propagating the lasers during dedicated sky observations). In any case, we will need further tests once GALACSI is installed to fully assess the impact of laser-induced Raman scattering on MUSE observations, and devise suitable corrective strategies.

<u>Kerber</u>*: Raman scattering from LGS. For test: detune 2 of the lasers. 4 LGS experiment: operate individually to explore spatial distribution*

The laser de-tuning test is already on our to-do list. We do not expect any surprises, in the sense that the Raman lines ought to be affected in the exact same way as the main laser line. Testing the influence of individual lasers is also planned, but once again, the final characterization of the impact of laser-induced Raman scattering on MUSE observations requires GALACSI to be installed, and thus the optical path ahead of the instrument to be complete.

<u>Osip</u>: *This is a wonderful, ambitious instrument but I will limit to one question. You are operating 24 cryo-systems and have been for 2 years. How reliable do you find your systems? How often do you need to swap a cryo-head, a compressor, or cryo-lines?*

The instrument was installed at UT4 3 years ago. Since then we have had a total of 261 tickets reporting problems. Of these, 144 have been for the instrumentation group, and 62 have been related to the Vacuum and Cryogenic System, (VCS). These last figure corresponds to approximately 1.7 events per month, close to my top of the head figure of 2 events per month. In these 3 years the total night time lost to VCS problems have been 1.75 h, corresponding to 21% of the total night time MUSE loss.

Most of the problems that we experience are related to contaminated vacuum gauges giving false alarms. Very few real pressure or temperatures events. Only one cryostat has been changed, and it was done because the CCD detector output amplifier was glowing. There are no cryoheads or compressors in MUSE as it uses a Continuous Flow Cryostat which are very reliable. The cryo-lines are maintained once per year.

<u>Gilliotte</u>*: Vibration effect on relative PSF in between the 24 spectro paths.*

I am not aware of any such effect.

<u>Modigliani</u>:

1. *STD reduction: I saw only 3 STD stars listed, there are 7 available. Flat lamp changes with time: Have you thought about lamp aging effect? Response computation: ESO is working on a project for common accurate response computation.*
2. Pipeline success: What was the key element?
    a. people scared by complexity of instrument, data;
    b. people committed to the project;
    c. FTE involved?
    d. other reasons?

1. Indeed we have 7 standard stars. What we show at the presentation were the standards used to check the overall system efficiency before and after the DSM installation. A proper comparison between overall system efficiency for different nights, separated by large amounts of time, using different standards is something that the pipeline developers have been working on. The problem has to do, as you mention, that there are lamp paging effects, together with other flat field changes with time. Initially we dealt with this issue by just not flat fielding the data. Now the pipeline developers have modified the standard star recipe to carry out the flat field all the way up to the computation of zero points. This will allow us to monitor the full path, sky to detector, which is one of the observatory requirements.
2. This should be answered by Peter Weilbacher. What I can say is that a good part of the success of the MUSE commissioning was due to have a mature pipeline working properly at the time of commissioning, around Feb 2014.
   From an email from Peter Weilbacher, which I transcribe completely we have the f following answer:

a. I would reformulate as "People aware at an early time of the instrument complexity and data rate." (and "people" is mostly the PI and the software manager, i.e. Roland and Arlette).

b. is probably the main reason and your phrasing is good. (Basically I pushed aside all my scientific ambitions for 8 years to do that and I had help in Ole Streicher who had some very clever ideas, like the Python interface.)

c. Some people might add that having the INM was instrumental, but while it made us aware at an early time about some instrument properties which would otherwise have been noticed only at the telescope (like flipped spatial axis on the slice level, and the need to implement gnomonic projection), it also made us chase its own bugs for a long time as we then learned during commissioning (like wrong atmospheric refraction implementation).

d. The pipeline could be even better (especially regarding sky subtraction), if we had managed to engage the larger MUSE science team at some deeper level. This only came after GTO started, and then everybody implemented their own stuff, and the small pipeline team couldn't keep up any more, so that most of the tricks are implemented outside the pipeline."