Summary of the documents replying the reports from the GISMO team about the October 2008 run at Pico Veleta

Samuel Leclercq, September 2009

In “GISMO sensitivity at Pico Veleta” replying to Dominic Benford’s “Atmospheric emission at Pico Veleta” I redo all the theoretical calculations giving the expected sensitivities at the 30m telescope, in a manner that is totally independent to Dominic’s calculations. I provide all the explanations, formulas and coefficient values allowing the reader to check these calculations.
The bottom line of my document is that for similar atmospheric opacities I obtain sensitivities roughly similar to Dominic’s results. But the details of the equations and the values of the various coefficients show big discrepancies with Dominic’s document. So it appears that the compatibility of the final results is only due to a hazardous compensation of the various discrepancies. It is therefore necessary that the GISMO team and us at IRAM agree on the details of the calculations before accepting the results with a good confidence. Another problem is that according to the atmospheric model I used (based on ATM) the opacities used by Dominic seem pessimistic for typical observations with GISMO at the 30m telescope. It is necessary that we agree on the definition of “typical atmospheric” conditions for the calculations (a value for the amount of water vapor and a value for the elevation) knowing that in reality it happens to see the opacity τ ranging from ~0.05 to >1 at Pico Veleta.

In “Comments about GISMO Run #2 at Pico Veleta” replying to Johannes Staguhn’s “Report on GISMO Run #2”, I comment and ask for clarifications about several sentences and arguments described in his document.
The bottom line is that GISMO did encouraging observations knowing the poor quality of the weather during run #2, therefore it could be interesting to make it available to the users community in parallel to MAMBO 2, while waiting for the future bigger multicolor instrument. The improvements compared to run #1 were significant, and even if there are still some doubts about the actual sensitivity of the instrument (see “GISMO sensitivity at Pico Veleta”) it is credible that it is not far from being background limited when used without neutral density filter. Some efforts have been made to implement a user-friendly control of the instrument and to improve its dynamic range. However, there are important remarks that we would like to be addressed before giving our support to keep GISMO at the 30m:

1. The skydips are ignored in Johannes document, although they are known to be a standard reliable method to characterize the atmospheric opacity and deduce the instrument sensitivity. We insist that skydips must be reduced and present in the report, showing clearly the atmospheric correction they provide (as the GISMO team has experienced, the calibration of data on quasars is not reliable enough in practice). If the skydips can’t be reduced because GISMO can’t deal with the variation of atmospheric emission for different elevations it must be said clearly (the instrument should be able to observe the Galactic Center at 20deg, and also Cygnus sources rising high in Elevation up to 80deg).
2. We remind that GISMO was meant to be a summer instrument, hence with a big dynamic range allowing handling big variations of atmospheric opacities. It’s a shame that a neutral density filter had to be used with the conditions encountered during run #2. This is not only a pity that there’s about 20% instantaneous loss of sensitivity when reaching the limit where the background load makes it necessary to use the neutral density filter, but this raises questions

about the capacities of the instrument to perform correct background rejection (see point 1 about skydips). Is there no way to avoid using a “discontinuous” solution like the neutral density filter? For example a more powerful fridge could handle a bigger dynamic of background power, couldn’t it?

3. How do we perform a dual installation of MAMBO 2 and GISMO without affecting the quality of the observations? Catherine Marx from the GISMO team proposed an elegant optical design with a dual installation on the anti-vibration table. However there are still some problems of dimensions and room available to be fixed before endorsing this design. Additionally a serious issue concerns the capacity the anti-vibration table to work efficiently with more than twice the weight it was designed to support. It is possible that using appropriate shock absorbers could do the job, but this must be studied before taking a decision.
4. Several advantages of the Lissajou scan mode were listed. However we would appreciate clarifications answering two possible critics. First, the repartition of the integration time on maps is very inhomogeneous (see R.Zylka plot), hence looking detrimental. Second, it would be interesting to know whether variations of accelerations create excess noise in GISMO data, whether this can be identified and corrected, and whether this doesn’t ruin the advantages of the Lissajou scans compared to other standard OTF modes. Indeed as said above, for the Lissajou scans used in run #2 were built with pieces of straight lines refreshed at a rate of 8Hz, and including 16 interpolation points (128Hz rate).
5. We would appreciate more details about the determinations of the filters transmission, the instrument throughput ($A\Omega$), optical efficiency (η_{sys}), the instrument intrinsic NEP, and the calculation of the modulations efficiencies (γ).