

# Change Request 173: Band 7 Cross-polarization

## Minority Opinion

I do not approve this change for the following reasons:

- 1) No adequate case has been made for the change.
- 2) If the band 7 cartridges achieve only the relaxed specification, ALMA's ability to make accurate polarization measurements at this key wavelength is likely to be significantly compromised. This affects two of the three top-level goals directly.
- 3) The fact that the contract was signed, with the revised specification included, before this CRE was approved and when it was known the Science IPT was strongly opposed to it put me and the CCB in an impossible position.

Expanding somewhat on these points:

1) The original request was based simply on measurements of the prototype which showed that they did not meet the specification of  $-20\text{dB}$  and identified the geometry of the optics as a contributor to the problem. Calculations by both TICRA and IRAM have however shown that the cross-pol arising from the optics should be in the range  $-21.5$  to  $-24\text{dB}$ . In a later note IRAM demonstrated that a large part of the excess cross-pol is arising in the IR filters. It is known that IR-filters with low polarization can be made and it is very likely that using these would bring the performance back within the original specification. If not then a reasonably modest change to the optics which would improve the performance significantly has been identified. It is not appropriate to relax an important specification without investigating such relatively straight-forward steps in terms of cost, schedule and benefit.

Additional arguments in support of the relaxation were introduced at the CCB meeting, including the claim that it is too difficult to measure cross-pol at the level set by the original requirement. This was undocumented and had not appeared in the discussion on EDM. I do not accept it – I am confident that far lower levels can be achieved when making measurements with a polarizing grid and hot and cold loads.

2) For good scientific reasons Band 7 has been selected as the one where the most emphasis should be placed on providing low instrumental polarization. It is therefore particularly damaging for the requirement to be relaxed for this band. Obtaining accurate measurements of the polarization of astronomical sources will in any case require careful calibration to remove the instrumental effects. If these increase by a factor of  $\sim 2$  as implied by the relaxation, this calibration will become that much more difficult and we may find it impossible to reach the scientific goals.

In order to do this calibration it is essential that the instrumental polarization be very stable as the antenna moves to track the source across the sky or to go to objects of known polarization, which are likely to be far away. As pointed out in the discussion of this CRE any relaxation in the specification on instrumental polarization should be accompanied by a tightening of the one on its stability. As far as I know, no such commitment has been given.

3) On this one I would only add that, as someone just joining the Project, I am disappointed and concerned to find that this Change Control process seems to be functioning so poorly. I will do my best to make it work better in future and I trust that everyone else will too.