

Executive Summary: Observing with MUSTANG-2

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1 Introduction

As more projects have been observed with MUSTANG-2, we have accumulated better quantification of its performance using different scan methods. Our default scan pattern is a Lissajous Daisy (LJD), with which we can vary the scanning radius. We have predominantly worked with scanning radii of 2.5' or 3.0', but larger scan size are also possible. (2.0' is likely the smallest one could consider.)

Some other scan patterns (not LJD) have also been used, but are not referenced here.

We have performed simulated observations of galaxy clusters with $1.0' < \theta_{500} < 4.0'$ to assess trade-offs between the 2.5' and 3.0' scans. (For simplicity, θ_{500} can be taken as the radius interior to which nearly all of the signal originates). There is certainly room for MUSTANG-2 to observe structures that are outside this characterization, and the information here may help the proposer formulate an initial assessment of feasibility. The MUSTANG-2 team is happy to entertain all potential science with MUSTANG-2 and can assess the technical feasibility of other projects that fall outside of the regime discussed here.

2 Executive Summary

While noise performance is an essential part of estimating time, we stress that signal filtering should also be given equal consideration. The amount of signal filtering is non-trivial, but it is closely related to the scales of the signal. Figure 1 shows the rather dramatic filtering for very large objects on the sky (the cluster at $z=0.1$). The filtering improves (diminishes) rapidly, but never becomes negligible. Broadly, how much signal lies beyond (outside) of the instantaneous field of view (FOV) of MUSTANG-2 (4'). However, scan size also matters, where larger scans result in less signal filtering. For objects whose signal lies predominantly (e.g. θ_{500} for galaxy clusters) within 3', the trade-offs between the 2.5' and 3.0' scans are minimal. We propose the following guidelines:

- Use the 2.5' scan
 - if you are primarily interested in (detecting/quantifying) the peak signal, or
 - if the entire signal (e.g. θ_{500}) falls within 2.0'.
- otherwise, the 3.0' scan should perform equivalently or better.

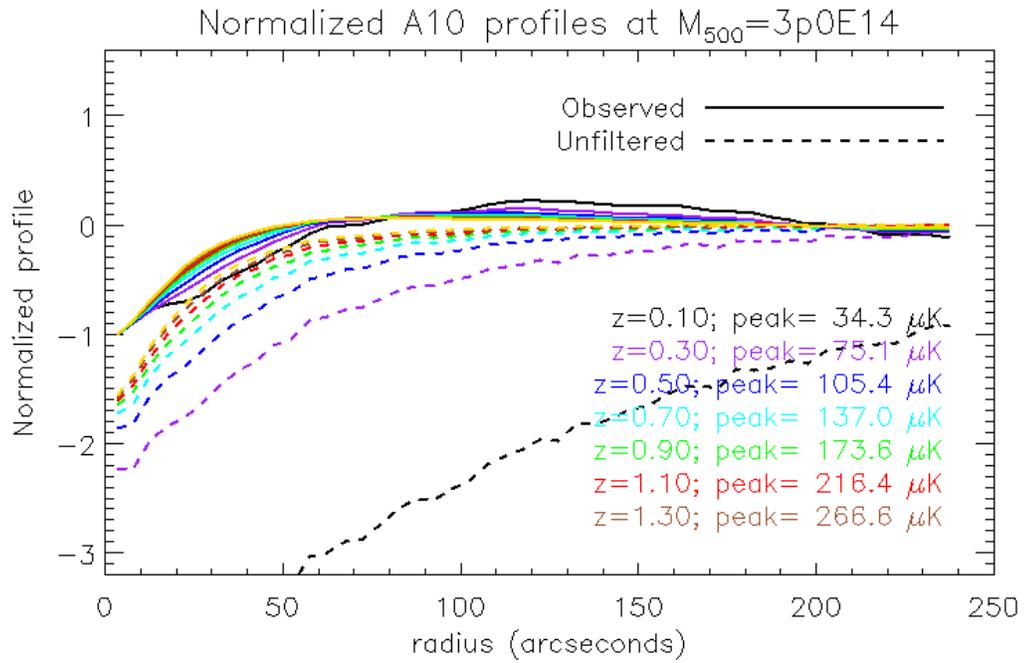


Figure 1: A selection of normalized surface brightness profiles across a range of redshifts for $M_{500} = 3.0 \times 10^{14} M_{\odot}$. The dashed lines show the profiles before filtering and the solid lines show the profiles after filtering; both profiles are normalized by the respective peak of the filtered (observed) profiles.

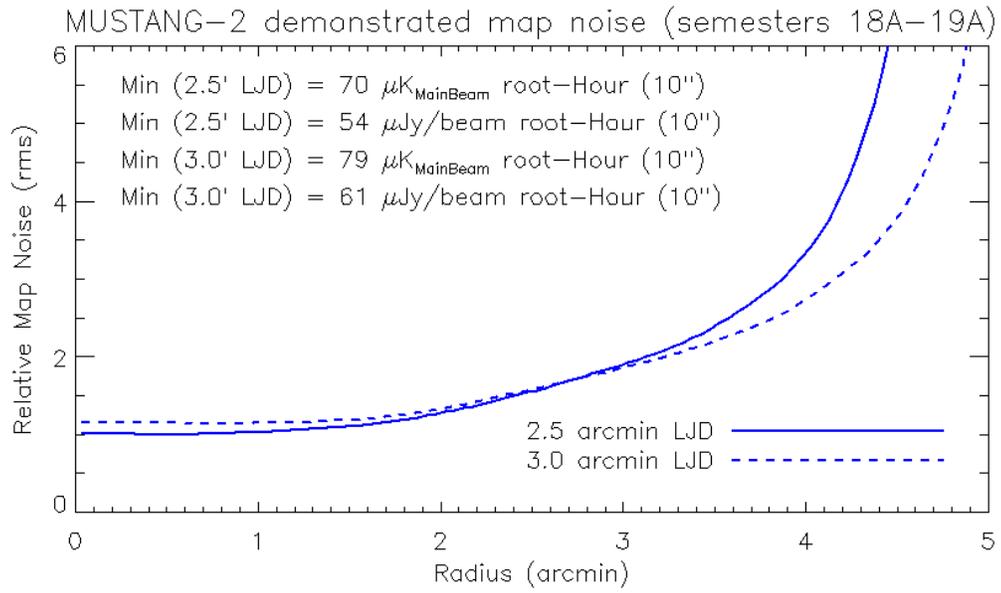


Figure 2: Mapping speed values (in this figure) refer to the RMS within the inner $2'$ of a map smoothed by $10''$. The difference in the central $2'$ is just over 10%, however beyond $3'$, the difference becomes more pronounced.