Proposed Surface Error Budget for mmA Antennas

James Lamb
NRAO, Tucson
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Introduction

For high-quality imaging, the surface of the antennas is required to be better than $\lambda/40$, which corresponds to 22.0 μm at 350 GHz. The following table gives the proposed breakdown of the surface error budget for the 8 m mmA Antennas. This list should be used only as a guideline, and may be changed as we increase our understanding of the various contributions. All the individual components have been added quadratically, but it should be borne in mind that some of the contributions may need to be added directly, such as gravitational and thermal deformations of the panels, or wind and gravitational deformations of the backing structure, while some, such as thermal and wind deformations, might not often occur simultaneously (if the wind reduces thermal gradients, for example). These relationships should be investigated in the design process.

It should be noted that one of the major contributions is the panel setting using holography. The recent holographic measurements of the 12-m antenna on Kitt Peak already indicate that rms accuracies better than 10 μm should readily be achieved, even using a transmitter at 30 GHz.

Effective Surface Error Budget

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Backing Structure		
Gravity (Ideal)	5	
Gravity (Departures from Ideality)	3	
Absolute temperature	4	
Temperature gradient	4	
Wind	4	
Total		9.1
Panels		
Manufacturing	8	
Absolute Temperature	4	
Temperature gradient	4	
Gravity	4	
Wind	4	
Total		11.3
Panel Mounting		
Absolute temperature	3	
Temperature gradient	3	
Panel location in plane	3	
Panel adjustment perpendicular to plane	3	
Gravity	5	
Wind	3	
Total		8.4
Secondary Mirror		
Manufacturing	5	
Absolute temperature	2	
Temperature gradient	2	
Gravity	2	
Wind	2	
Ageing	2	
Alignment	5	
Total		8.3
Tertiary, Quaternary, etc.		
Manufacturing	5	
Gravity	5	
Alignment	5	
Total		8.3
Panel Setting (Holography)		
All contributions	10	
Total		8
TOTAL (rss, μm)		21.9