4.9 WFS ADC Setting Precision

It is of interest to know the precision necessary for the setting of the WFS ADC prisms to not compromise the quality of the image at the WFS CCD.

A series of 144 optical prescriptions was generated by a ZPL macro (wfsgimbalmotion.zpl) for guide stars around the field of view at different zenith distances and parallactic angles, and the information saved as a table in the file wfsgimbalmotion.out. As a part of this table the prism orientations for the ADC were listed to compensate for the atmospheric dispersion. Also listed were the rms scatter of the multiple wavelengths and the overall image quality.

A ZPL macro (wfsadc_set_prec.zpl) loaded each prescription in turn, and then took the prism positions that gave the best color compensation and adjusted them to the nearest 0.1, 0.5 and 1.0 degrees, and calculated rms color mismatch and rms image size, over the range 0.4 to 0.83 μm. For the 144 prescriptions, Figure 4.18 shows the ratio of the rms color in the image with each setting resolution to that of the prescription for 'perfect' setting resolution. At 0.1, and for many of the 0.5 degree setting resolutions, the effects on image quality were lost in the noise of the calculations. However at 1.0 degree the spectral mismatch rms generally increased in the range of a few percent to 220 percent. It would appear that the 0.1 degree resolution for each prism is acceptable and thus the 0.05 degrees selected is appropriate.
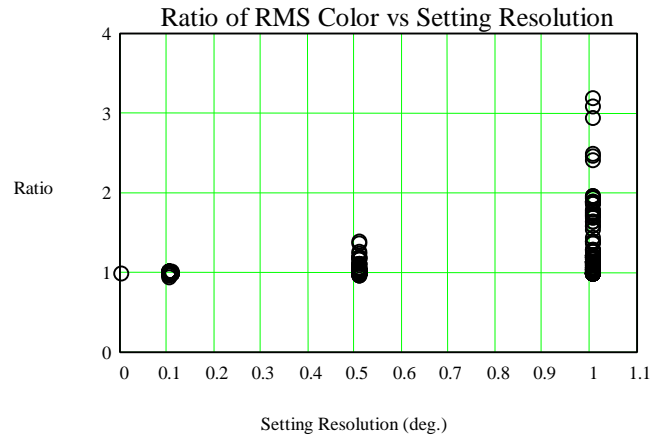
Figure 4.18 - Ratio of RMS Color vs Setting Resolution

Setting resolution is also affected by the amount of backlash in the gears used to drive the prisms. To reduce the amount of wear on the gear teeth a reasonable amount of clearance is desirable. If 0.14 mm of backlash is allowed to accumulate over three meshes of the driving gears, it would cause about 0.1 degrees lost motion at an ADC prism, and thus tolerable.