BTO Data Products for 2006 05 16

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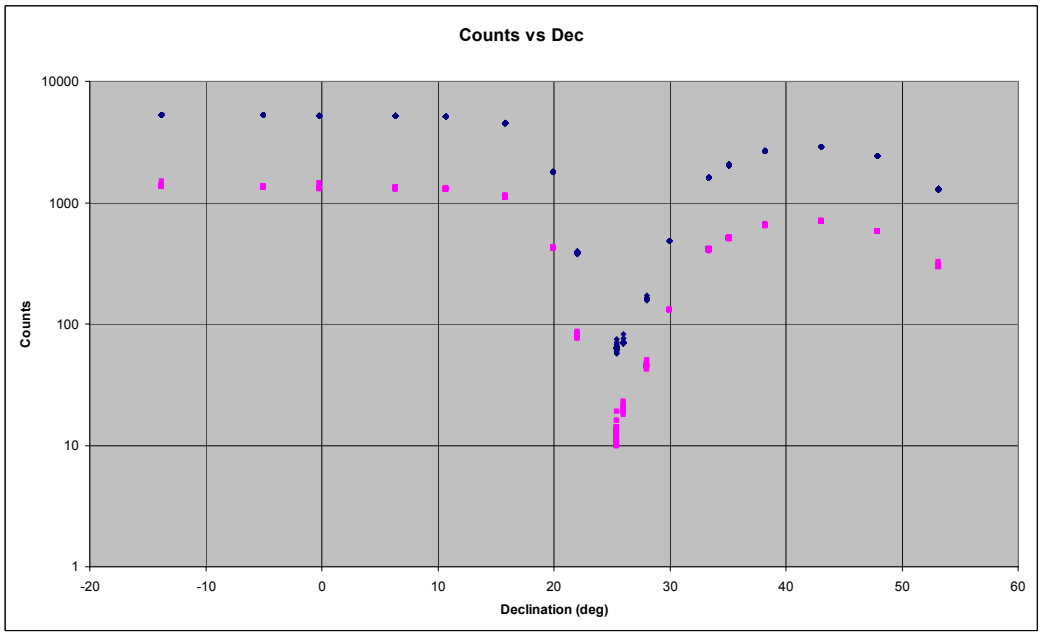
Summary

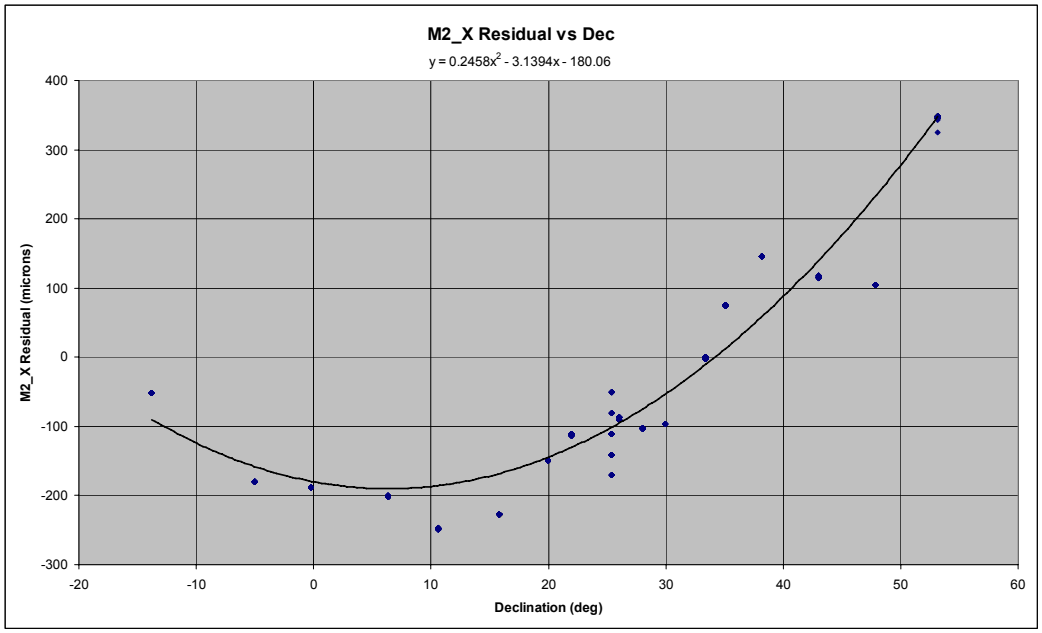
Here are the graphs from the "BTO 2006 05 16 locked.xls" spreadsheet, along with a copy of the graphs and residuals from Antonin and Viswa's 9/16/2005 results. There isn't a lot of time before leaving for SPIE, so the discussion in this note is cut short.

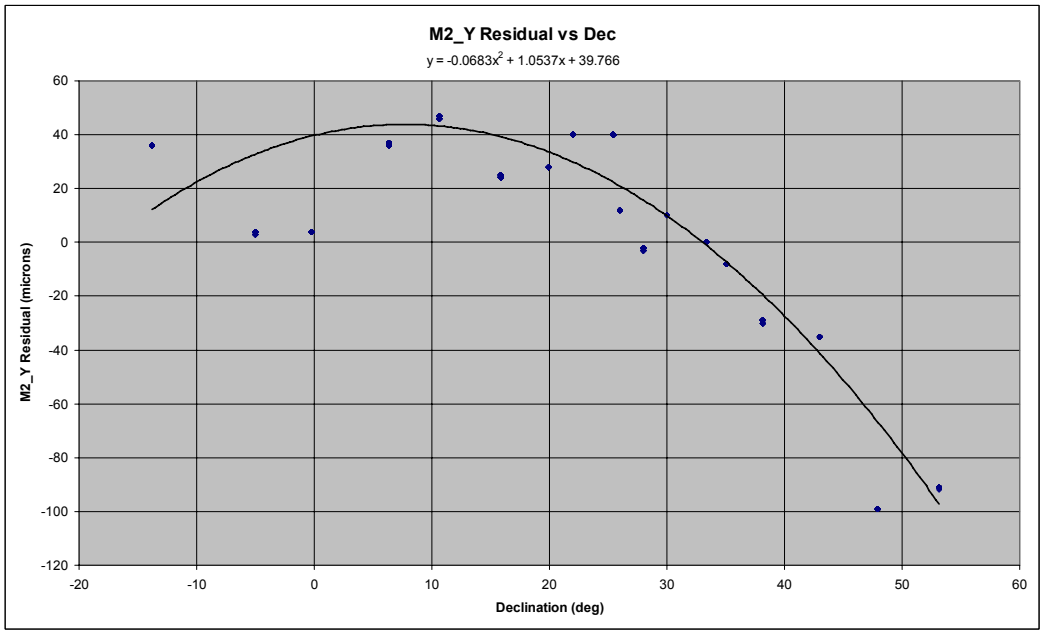
Graphs from 5/16/2006



Notice the loss of light in the dec = +22 to +28 range. This turned out to be M2 turning transparent – the laser beam went right through it with little reflection. The red laser polarization was P, leading to the possibility that this is just the effective brewster angle for this wavelength.

The next two figures are the M2_X and M2_Y residuals, using the same convention as Antonin and Viswa used in their 9/16/05 paper. The general shape and trend look quite similar. The quadratic fit on M2_X has more quadratic term, probably because of the new data at negative dec bends back up again. The M2_Y quadratic fit is remarkably similar in the two runs.


M2_X Residual vs Dec
y = 0.2458x2 - 3.1394x - 180.06
M2_X Residual (microns)
Declination (deg)
400
300
200
100
0
-100
-200
-300
-20
-10
0
10
20
30
40
50
60


M2_Y Residual vs Dec
y = -0.0683x2 + 1.0537x + 39.766
M2_Y Residual (microns)
Declination (deg)
60
40
20
0
-20
-40
-60
-80
-100
-120
-20
-10
0
10
20
30
40
50
60

Results from 9/16/2005

dec	trolley	m2_rot	m2_x	m2_y
5.002	-2022600	20.005	-250.1	59.7
15.000	-1378400	15.006	-248.0	64.9
25.000	-677900	10.006	-108.2	45.6
33.356	0000	5.829	0.0	0.4
45.003	1207200	0.005	131.8	-33.8
53.030	2366900	-4.008	300.2	-90.1

Table 1: Trolley and M2 stage positions used in experiment

The measured M2_x and M2_y offsets are given in Table 1, and displayed as a function of declination δ in Fig 1. First- and second-order fits in encoder counts to these points are given below:

$$M2\_x = -282.2 + 2.42947\ \delta + 0.159770\ \delta^2$$
$$M2\_y = 59.9 + 1.01558\ \delta + -0.072098\ \delta^2$$

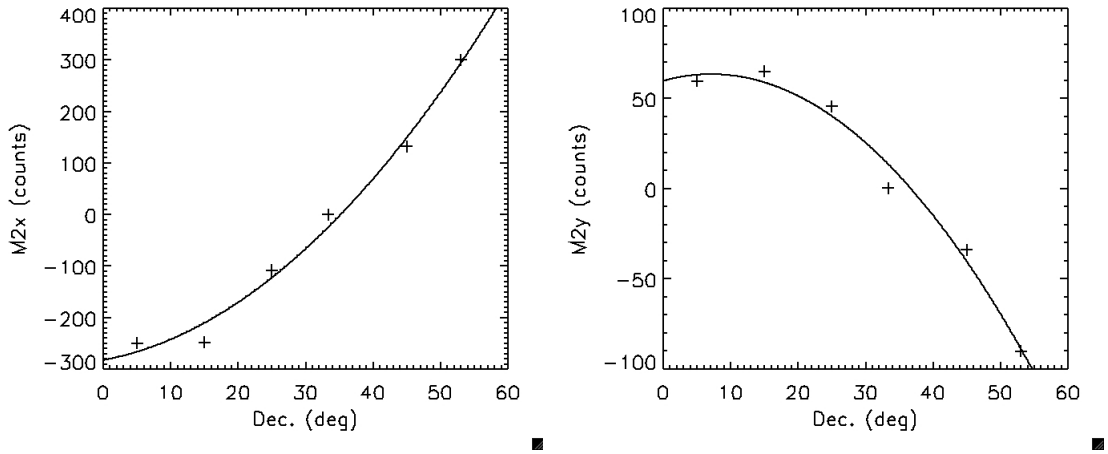


Figure 1: M2_x and y offsets as a function of declination. Second-order fit is shown.

Conclusions

I suggest replacing the M2 mirror with an enhanced aluminum version, such as CVI part EAV-PM-4050-C ($730). This will get rid of the red dropout, and has >99% reflectivity for S pol 589 nm. The red data suggests there may be a yellow dropout on the current mirror. We have no data on this yet, but it may be prudent to get a mirror on order. The EAV mirror will also eliminate the need for a backstop on M2, as there should be no appreciable light leak through it.

The similarity of the polynomial fits between the two runs suggests that writing a correction equation as John Angione has requested would work.