MOSAIC focal plane leveling

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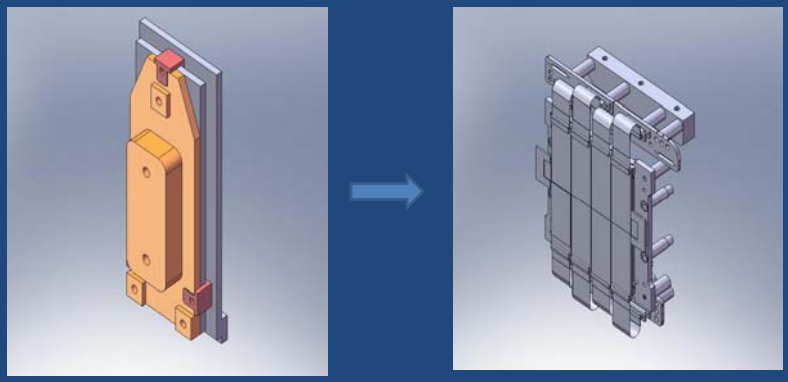
Aim

- Level focal plane to better than 5 um RMS over the ~125 x 200 mm array. (current RMS flatness is ~10 um)



Unknowns

- How to polish TZM (Moly) boats – use current make new pieces?
- How the CFH (INVAR) back plate behaves at cold temperatures.
- The clip mechanism
- Chip (AlN)-TZM interface (need Indium?, if so how to level?)

Tools

- Non-contact profilometer
- Metrology of individual TZM boats
- Definition of reference plane
- Definition of Detector plane

Profilometer options (Zygo, Veeco, Micromap etc.) – cost $70-170K

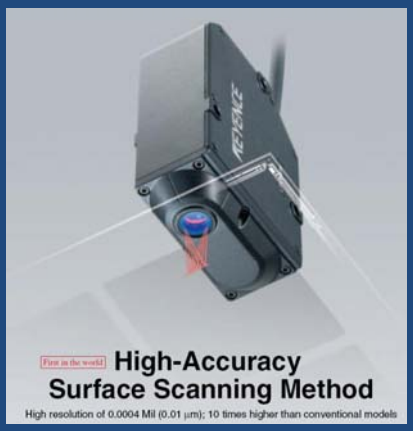
Profilometer

Confocal ($22K)

Triangulation ($10K) 0.1 um, 10 Hz

More info.

Confocal sensor



Triangulation sensor

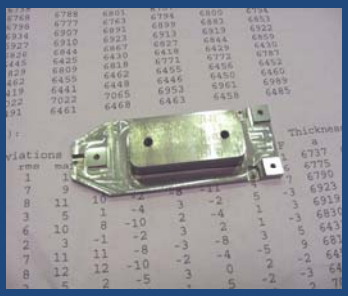
Our own profilometer?

1. One big XYZ stage with a bracket for sensor.
2. Working distance is 30 mm.
3. Will move the sensor (constant load).
4. Can be used to characterize detectors – charge diffusion, intra-pixel scans.
5. Available wavelengths – 670 nm, 780 nm diode lasers
6. Need to write some S/W to map XYZ co-ordinates (but that can't be so hard).
7. Stage cost $12,000 (including controller, cables, encoders, RS232 interface etc.)

Product Description | Specifications | Order Information | Motor Options | Dimensions | CAD Files

Specifications		
Travel		2.5 inches, 4 inches, 6 inches, 8 inches, 10 inches, 12 inches
Resolution	0.062 in/rev lead	0.03 µm @ 50,000 steps/rev motor resolution
	0.250 in/rev lead	0.13 µm @ 50,000 steps/rev motor resolution
	0.062 in/rev lead with Encoder	0.4 µm @ 4,000 counts/rev encoder resolution (-E1 option
	0.250 in/rev lead with Encoder	1.6 µm @ 4,000 counts/rev encoder resolution (-E1 option)
Maximum Travel Speed	0.062 in/rev lead	0.5 inches/second
	0.250 in/rev lead	2 inches/second
Maximum Load	Horizontal	50 lbs

Testing tools (sans profilometer)



Accuracy of indicator = 0.0015 mm, resolution = 0.0005 mm

Tentative FPA leveling procedure

1. Get an accurate model of the back plate. (Hal)
2. Order profilometer parts (keyence sensor, XYZ stages with encoders), take delivery, build profilometer, write software and calibrate. (2 man-weeks from delivery of all parts). Buy Mitutoyo test indicator with mount and granite baseplate.
3. Learn how to polish TZM @ 0.2 um level. (1 wk)
4. Build fixtures to repetitively measure boats.(1 wk shop time)
5. Make a *make shift* back plate – heat treat along with MOSFIRE parts. Also make fixtures to handle CCID20s (PTFE threaded rods, slotted storage pieces etc.) (2 weeks – shop time)
6. Obtain dead chips. Make 3 or 4 boats (and 12 clamps) out of TZM and align using fixture – learn how to handle chips and align them. (2 weeks shop time)
7. Take the CFH back-plate assembly out and put in storage, try some thermal tests with the make-shift backplate. Check for flatness in cryogenic temperatures. (4 weeks)
8. Take off chips from CFH back plate and measure the boats individually and polish as necessary. Mount all chips on the Caltech back plate. (4 weeks)
9. Repeat profilometry and repeat latter part of step 8. (2 weeks)
10. Do cold tests. (2 weeks)
11. Cold path optimization – if needed (graphite straps, Indium bits, Mylar insulation?)

Total : 20 weeks!

Recommendation:

- Buy Keyence triangulation sensor and build our own profilometer. This gives us a versatile platform to do other detector tests in the future, even though this requires more COO than-power than buying a commercial product. Making it ourselves makes it cheaper and enables us to test inter pixel and intra-pixel charge diffusion, pixel-to-pixel intensity variation etc.