UC Davis f1.2 LSST Optical Beam Simulator:

Midline Astrometric Shifts as a Function of CCD Integrating Phase

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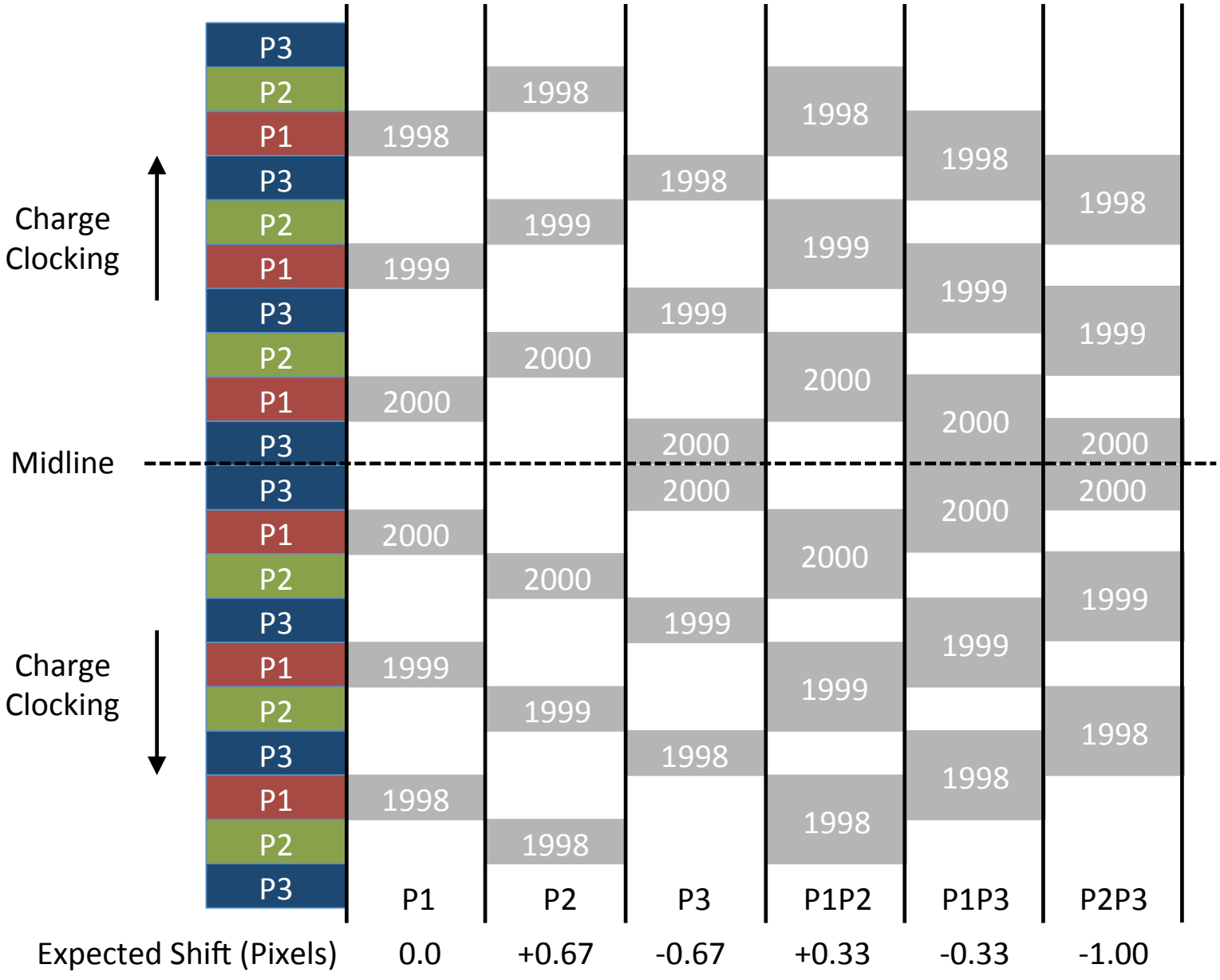
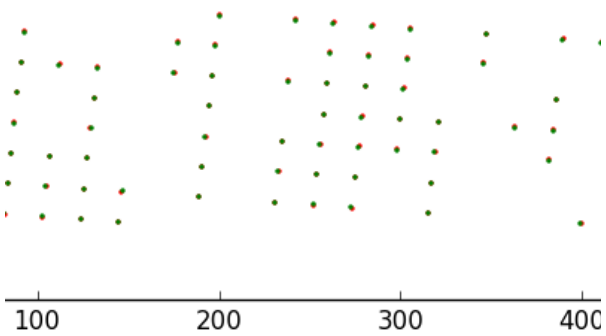
Charge Storage Locations vs Integrating Phase



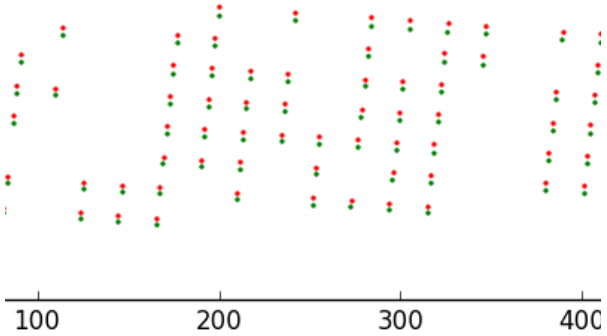
Methodology

- Generate timing files for different phase integration. Verify with oscilloscope.
- Collect images using f1.2 Imager. R band; Light Intensity - 10%; Exposure = 4 sec.
- Find spot locations using sextractor.
- Build model of spot location in one segment (Lx, Ly, Theta, ...).
  - Typical model fit - Mean = .03 pixels, Std = .03 pixels.
- Extrapolate model across the midline and compare with measured spot locations in adjacent segment. Segments 05 and 15 were used.

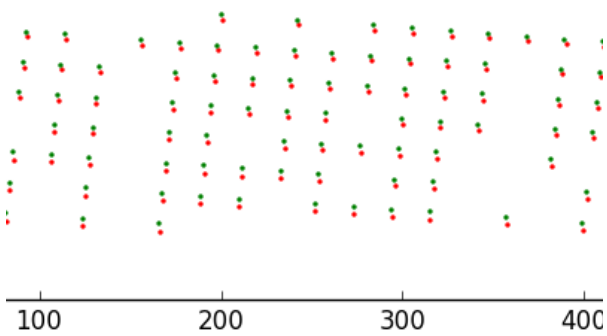
Predicted vs Measured Spot Locations



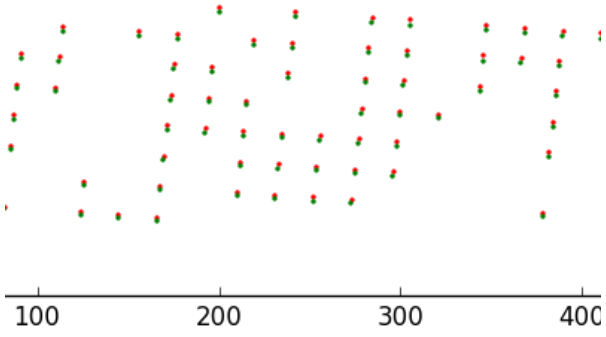
P1



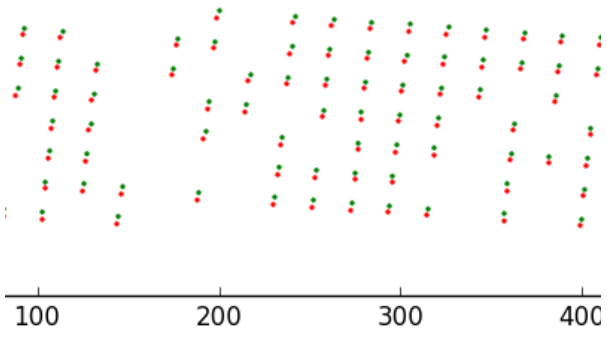
P2



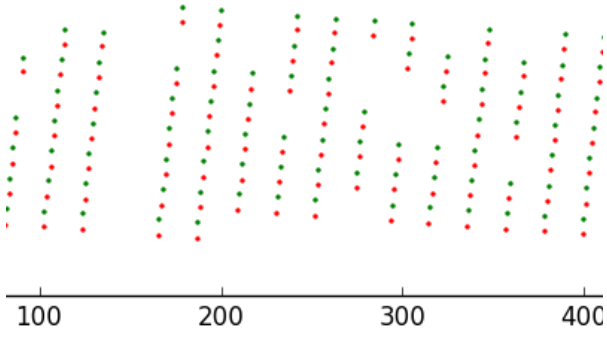
P3



P1P2



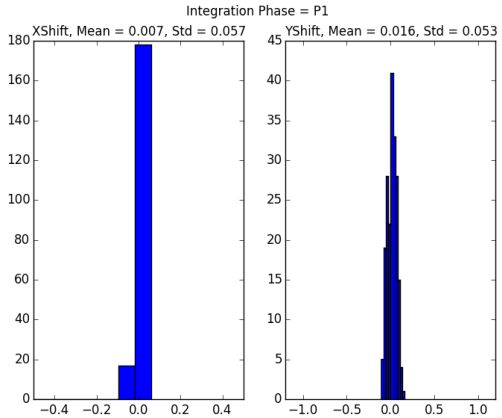
P1P3



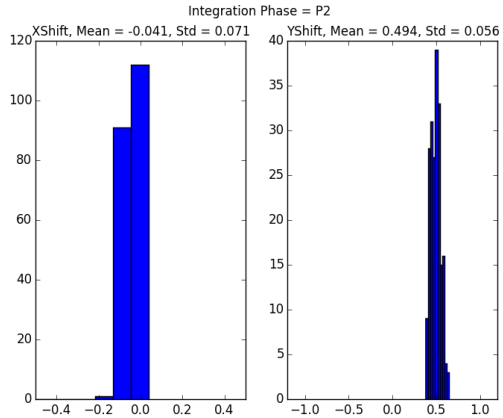
P2P3

Green = Measured; Red = Predicted; Displacements magnified by 10X.

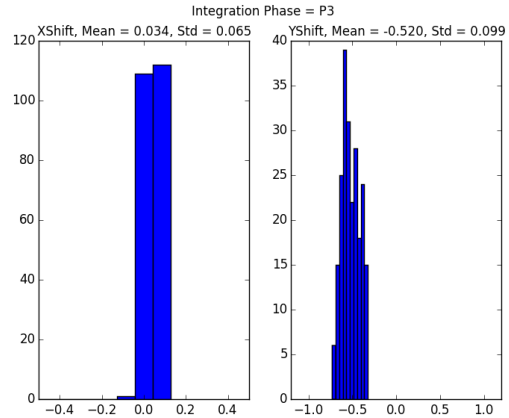
Histograms of Spot Shifts in Pixels



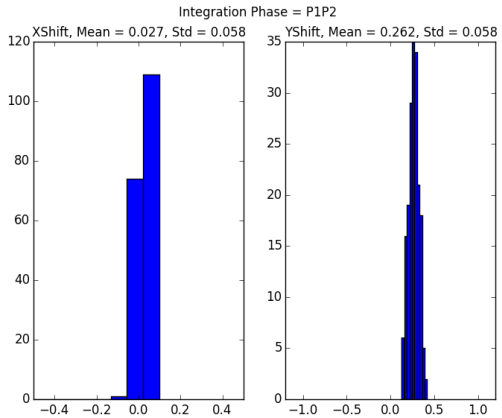
P1



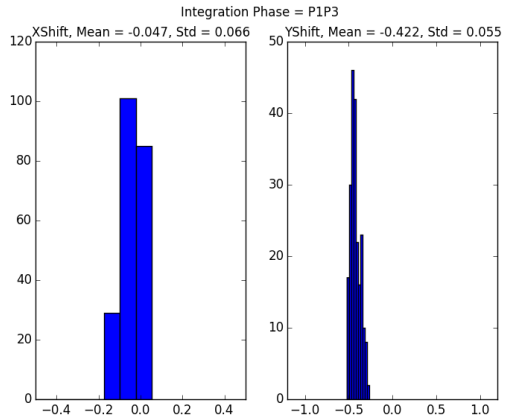
P2



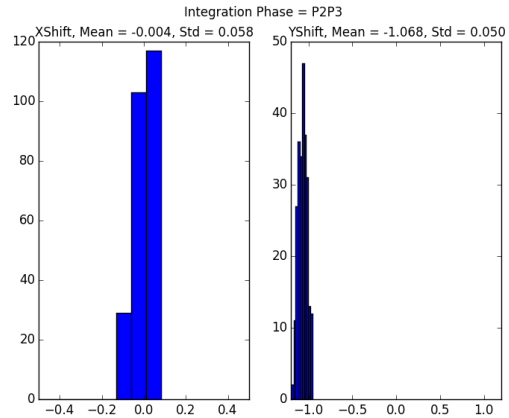
P3



P1P2



P1P3



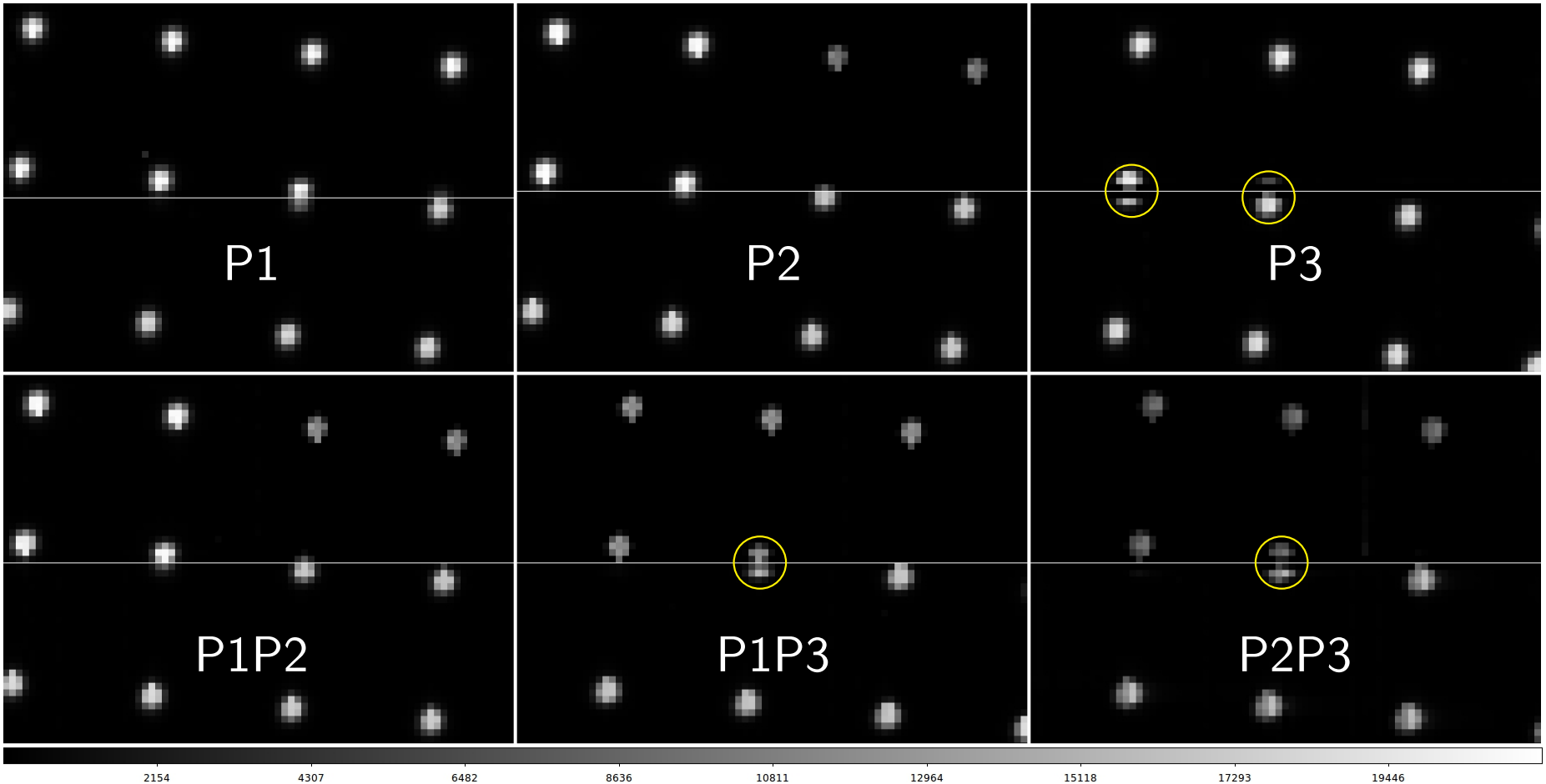
P2P3

Results vs Expectations

Phase	Y_{pred}	$\overline{Y}$	σ_Y	X_{pred}	$\overline{X}$	σ_X	N
P1	0.00	+0.02	0.05	0.00	+0.01	0.06	195
P2	+0.67	+0.49	0.06	0.00	-0.04	0.07	205
P3	-0.67	-0.52	0.10	0.00	+0.03	0.06	224
P1P2	+0.33	+0.26	0.06	0.00	+0.03	0.06	184
P1P3	-0.33	-0.42	0.06	0.00	-0.05	0.07	215
P2P3	-1.00	-1.07	0.05	0.00	-0.00	0.06	249

X and Y units are in Pixels.

“Weak” Pixels Using P3 Integration



- Pixels adjacent to the midline which use P3 during integration are “weak” due to reduced collection area and charge sharing.

Summary

- Mirror symmetry of top/bottom causes astrometric shifts as a function of integrating phase.
- Measured shifts agree well with expectations.
- For the STA3800, P1 is the optimal collecting phase to minimize astrometric shifts.
- E2V250 should have a similar effect, but will probably be different in detail.
- Can DM software accomodate these abrupt shifts at the midline?