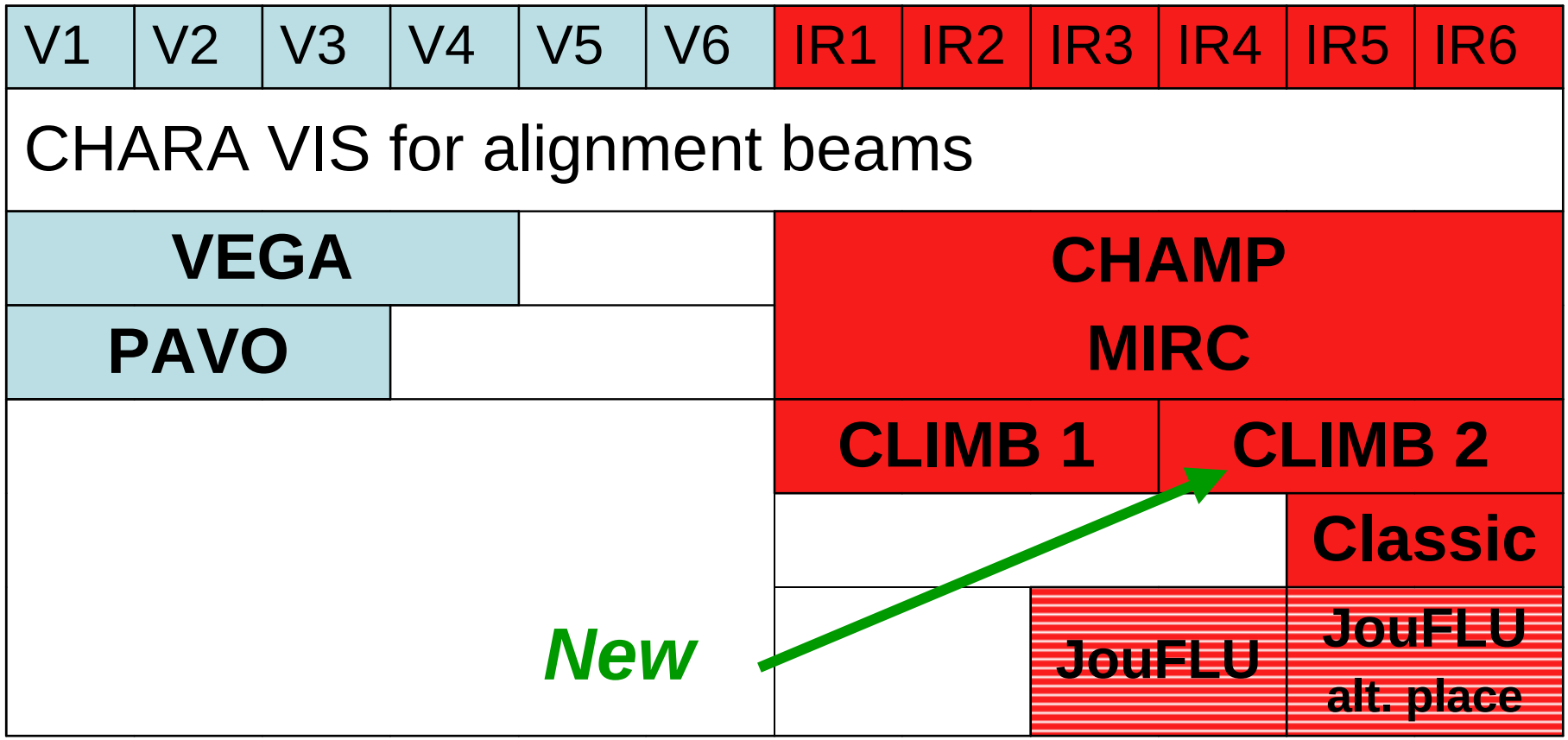
Upgrades in the Laboratory

Judit Sturmann

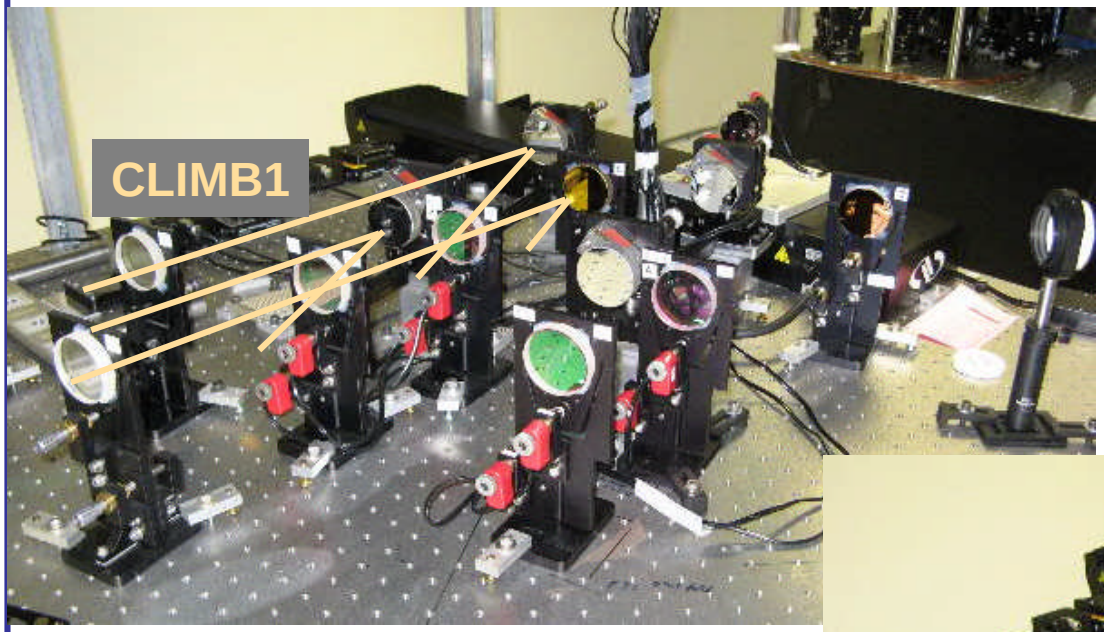
Outline

- *CLIMB 2, the 9th beam combiner*
- *Encoded motors for tip/tilt adjustments*
- *Main source of pupil motion*
- *J band update*

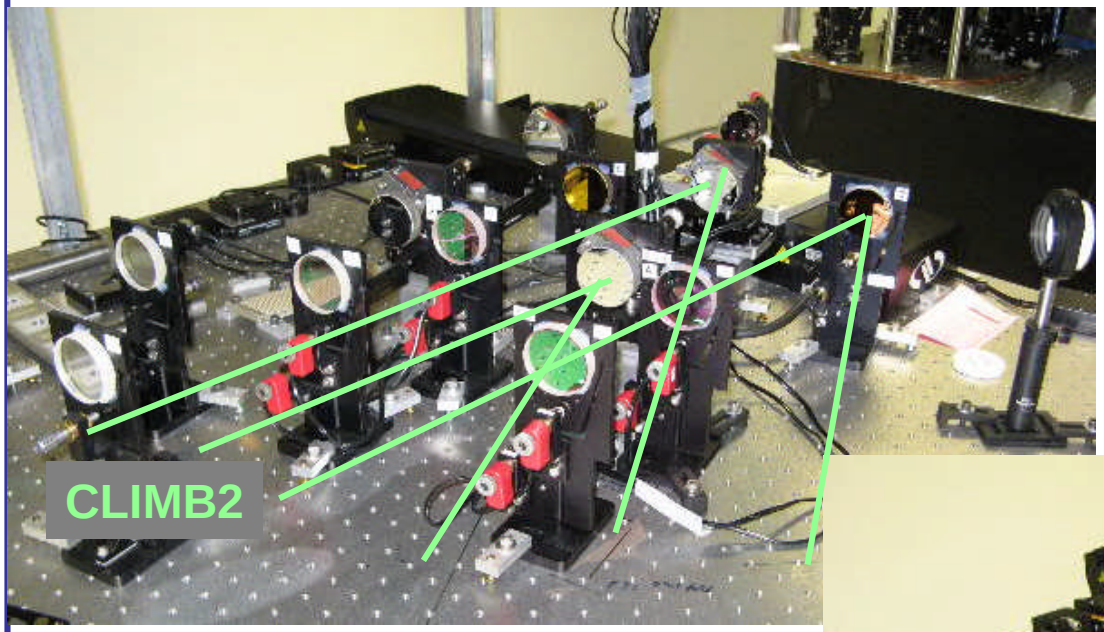
Overview of Beam Combiners

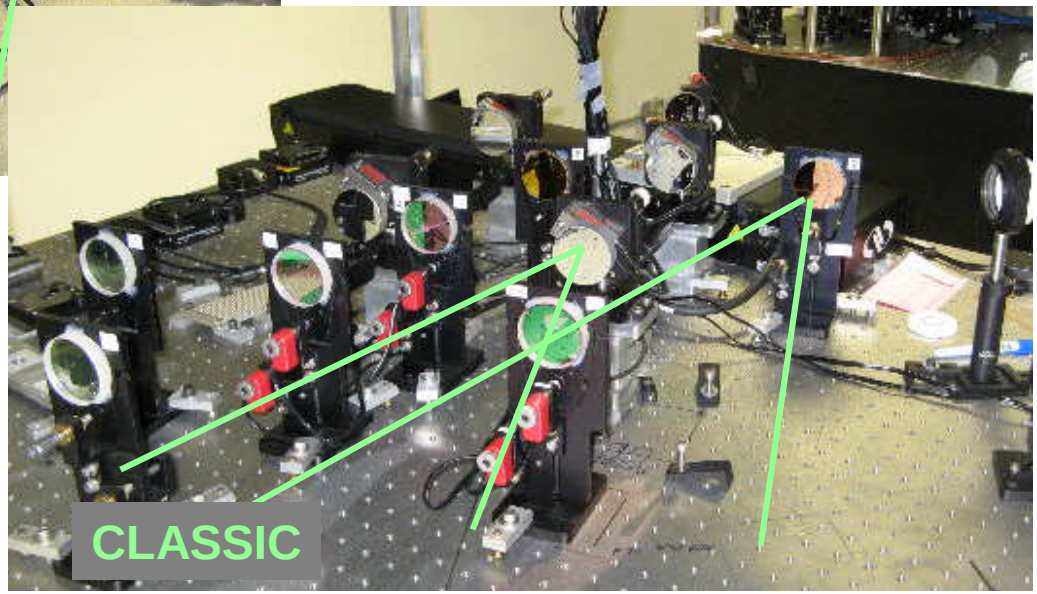


CLIMB 1

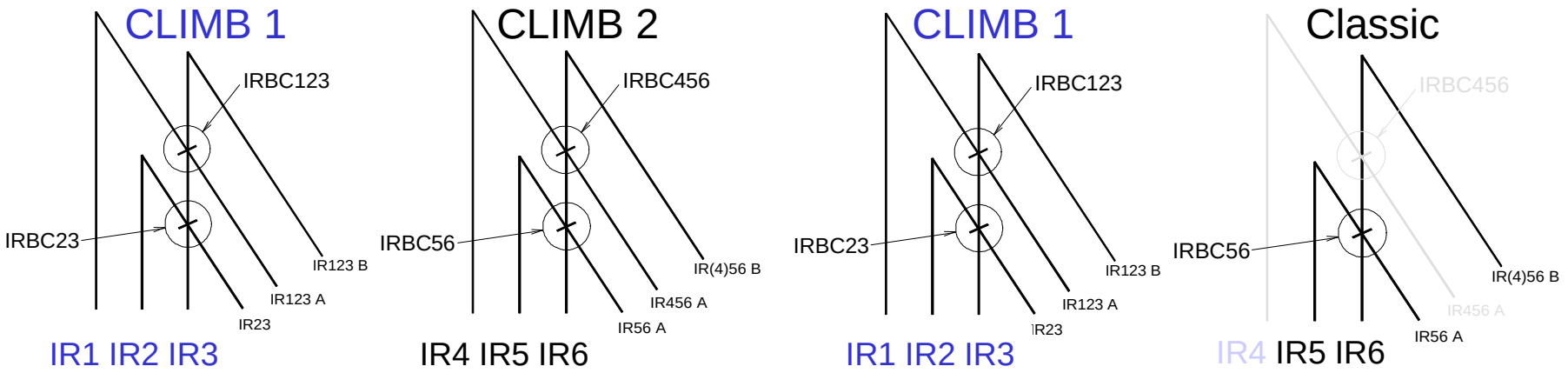


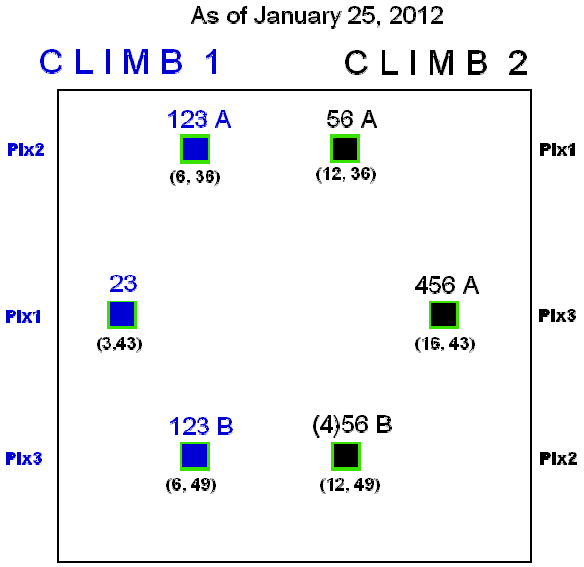
CLIMB2 or Classic Setup

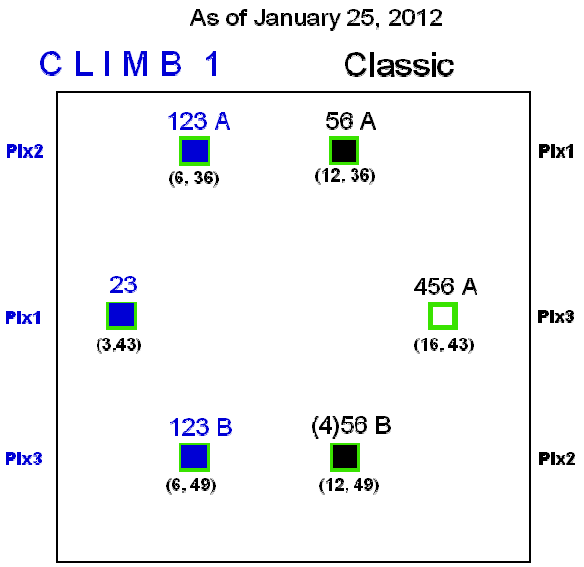




CLIMB Outputs on Detector Pixels

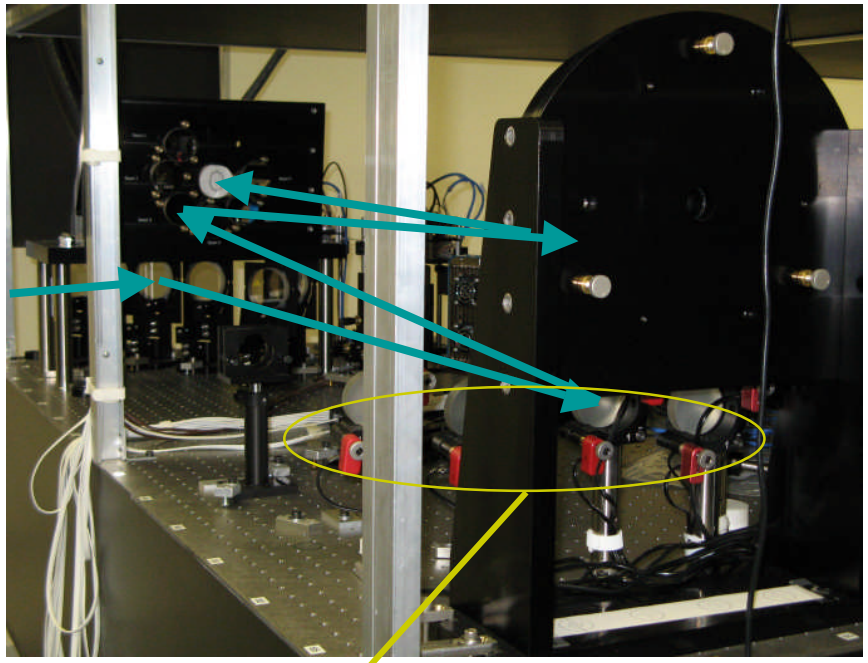






Tip/tilt Detection System

Picture taken in 2007,
when 6-beam tip/tilt was first installed



Remotely controlled adjustments using open loop pico-motors.

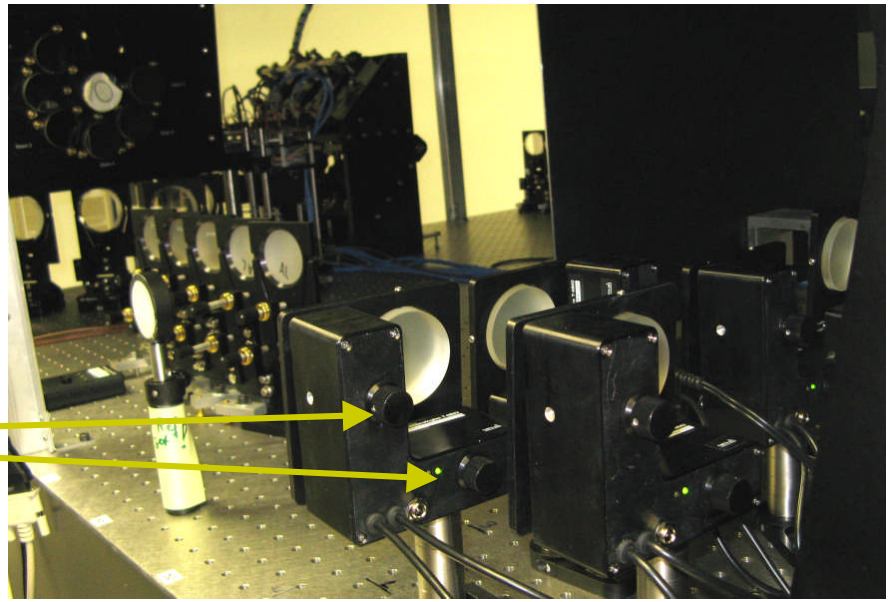
- Tip/tilt detection is in the VIS band – many combiners in IR
- There is angular difference between IR and VIS beams depending on elevation →IR star image changes position on IR detectors
- If you try adjust the tip/tilt beam to keep the IR image, tip/tilt could loose the star easily
- Once a beam is lost from the designated four pixels, the pico-motors cannot take it back

The field of view of a quad-pixel on the tip/tilt detector is 7 arcsecs (Acquisition ~ 3 arc minutes)

Tip/tilt Detection System

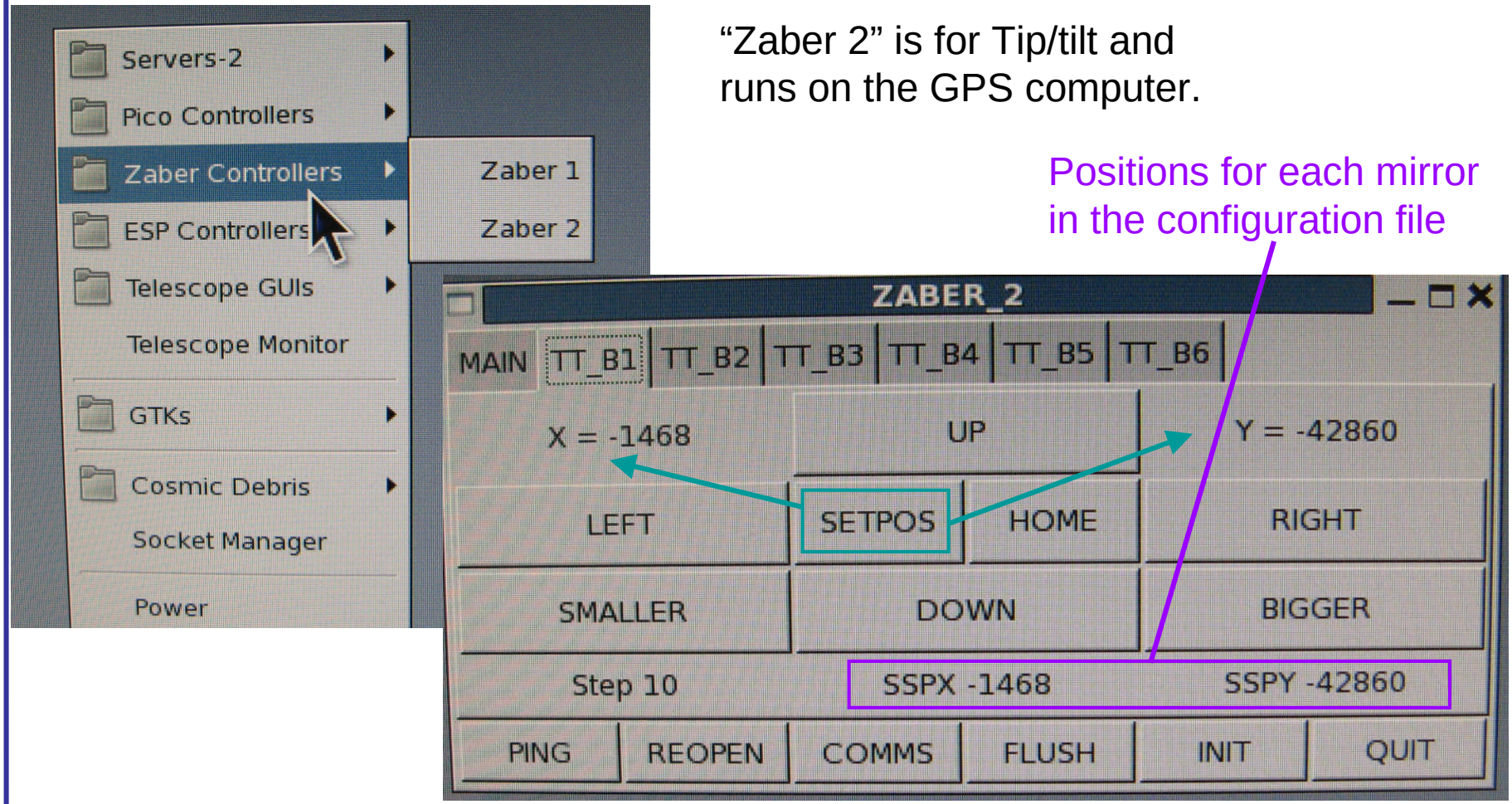
Upgraded

Picture taken in 2012



Mirror mounts were replaced with mounts with encoded actuators. (Zaber)

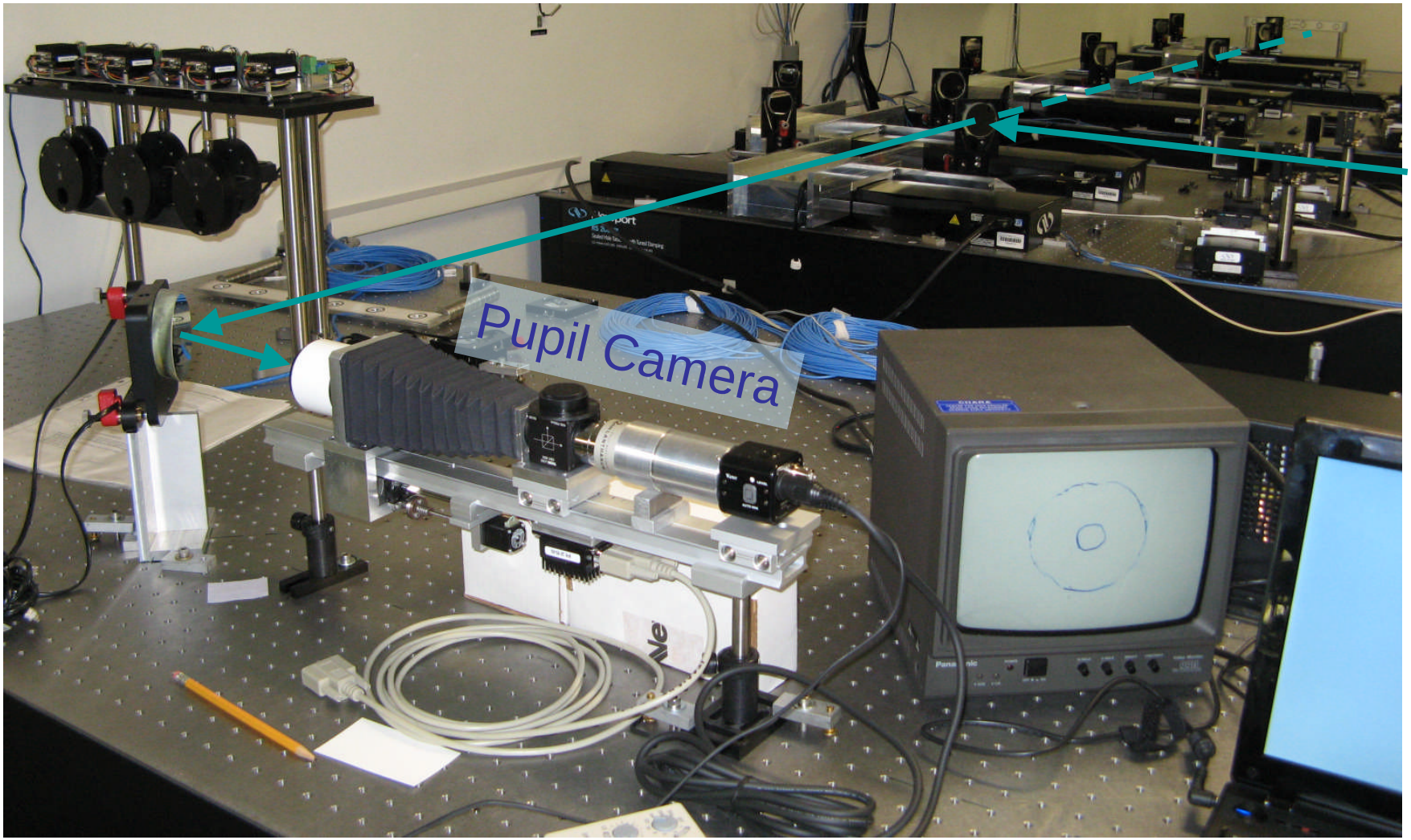
New User Interface to Adjust Tip/Tilt Beams



"Zaber 2" is for Tip/tilt and runs on the GPS computer.

Positions for each mirror in the configuration file

Checking Pupil Motion



Checking Pupil Motion

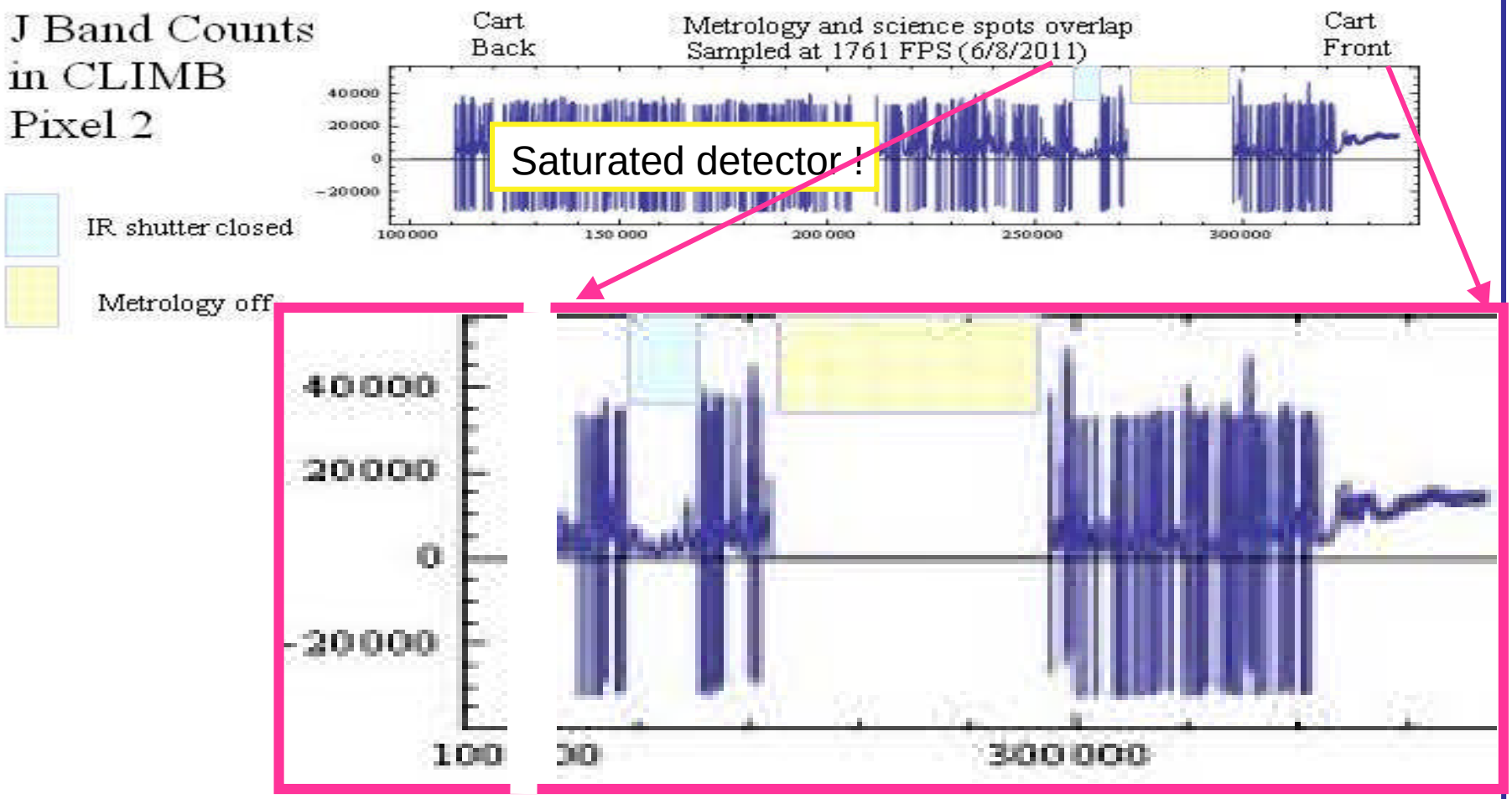
Findings:

• Telescope moving in EL or AZ → pupil motion is small (< 10% of diameter), if the Coude alignment is within the usual tolerance (laser spot moves < 25 pixels in Acquisition TV)

• Cart is moving on the rail → Rail trouble spots could cause significant pupil motion.

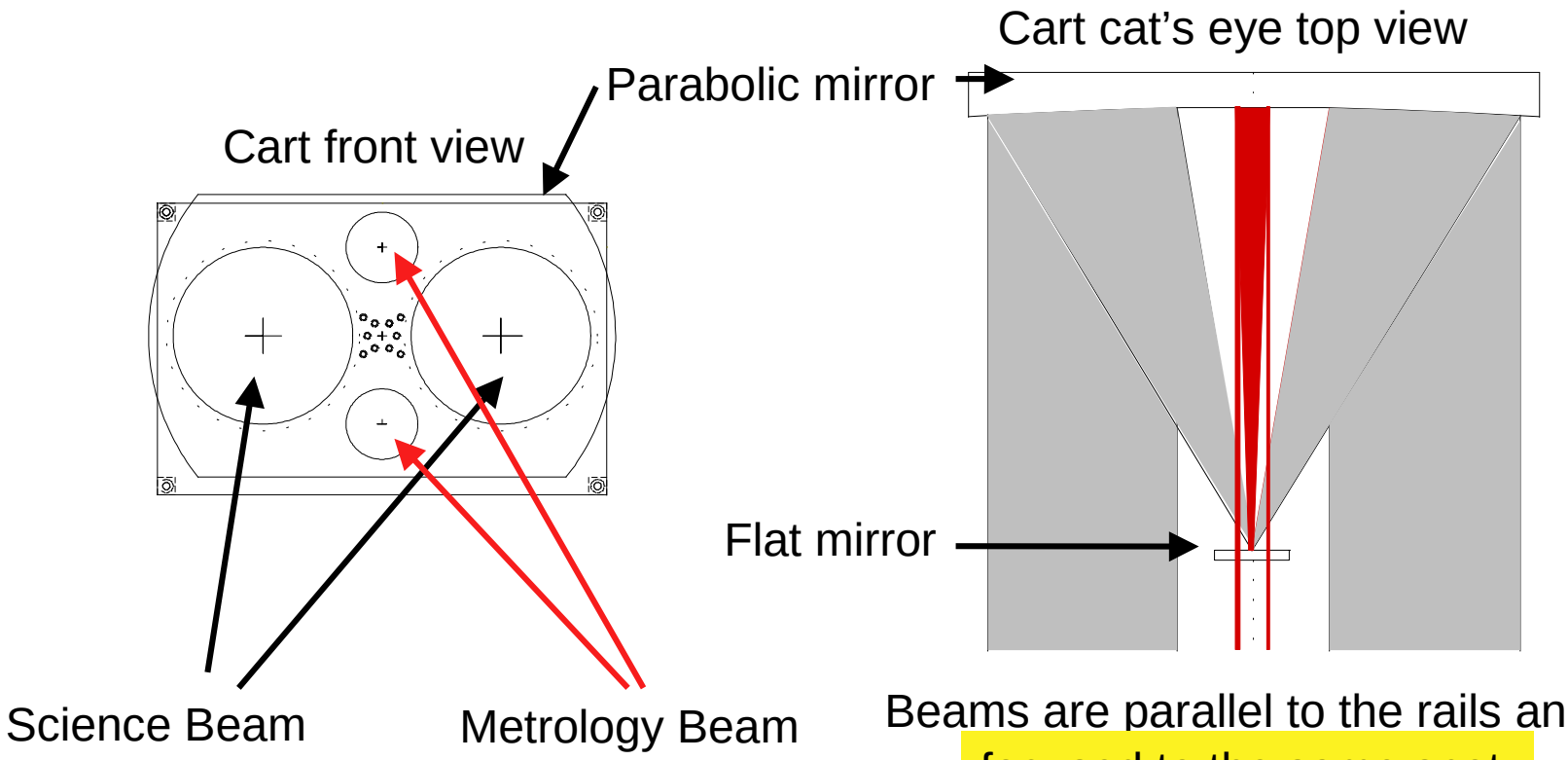
It is possible to keep the rails well aligned with some adjustments a few times a year, except the front part between the periscope and home sensor.

Metrology Laser: λ=1319nm Kills J-Band Observations



Metrology Laser: λ=1319nm Kills J-Band Observations

Original arrangement of metrology and science beams



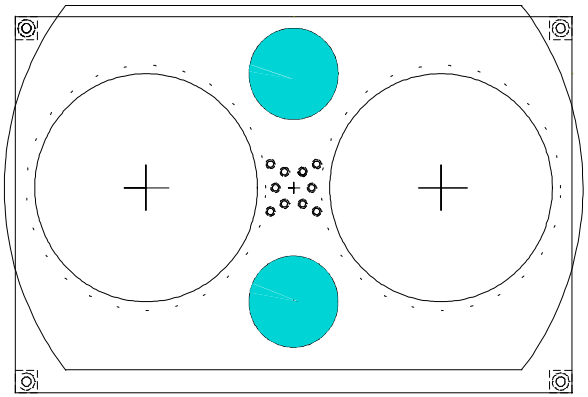
Beams are parallel to the rails and focused to the same spot.

Changing the Metrology Path Inside the Cart

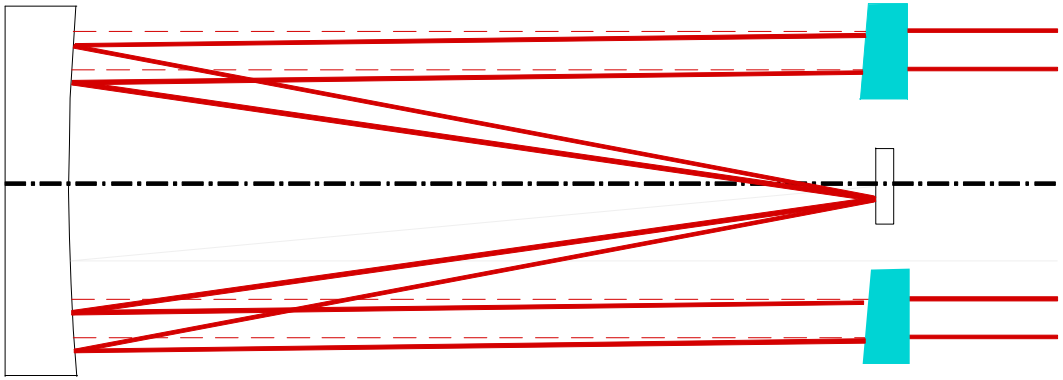
Modified metrology beam path:

The metrology beam enters and exits the cart through a slight wedge.

Cart front view

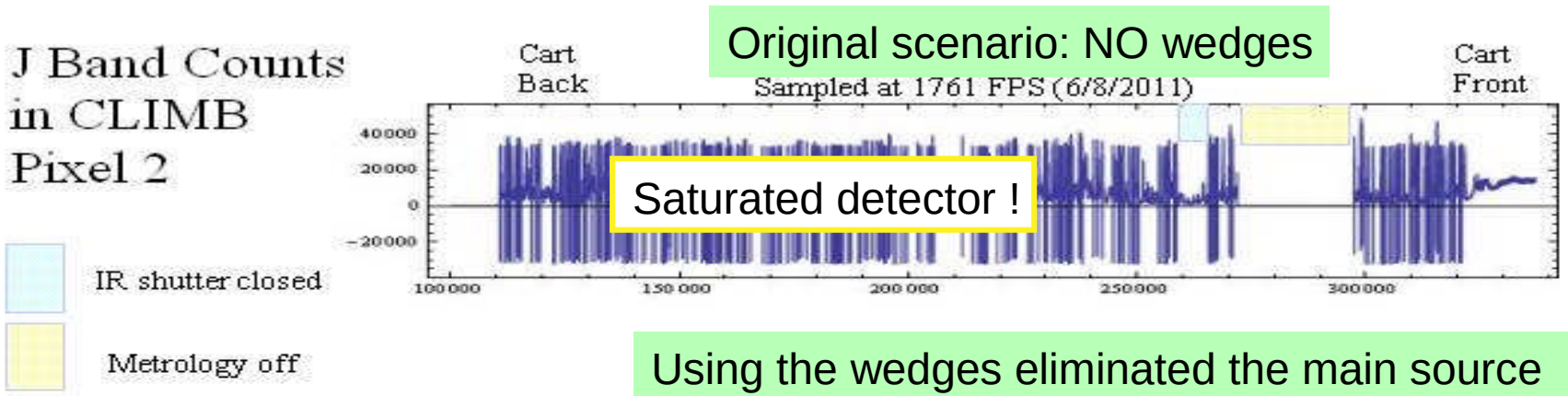


Cart cat's eye side view



The metrology beam is focused to a different spot on the flat mirror.

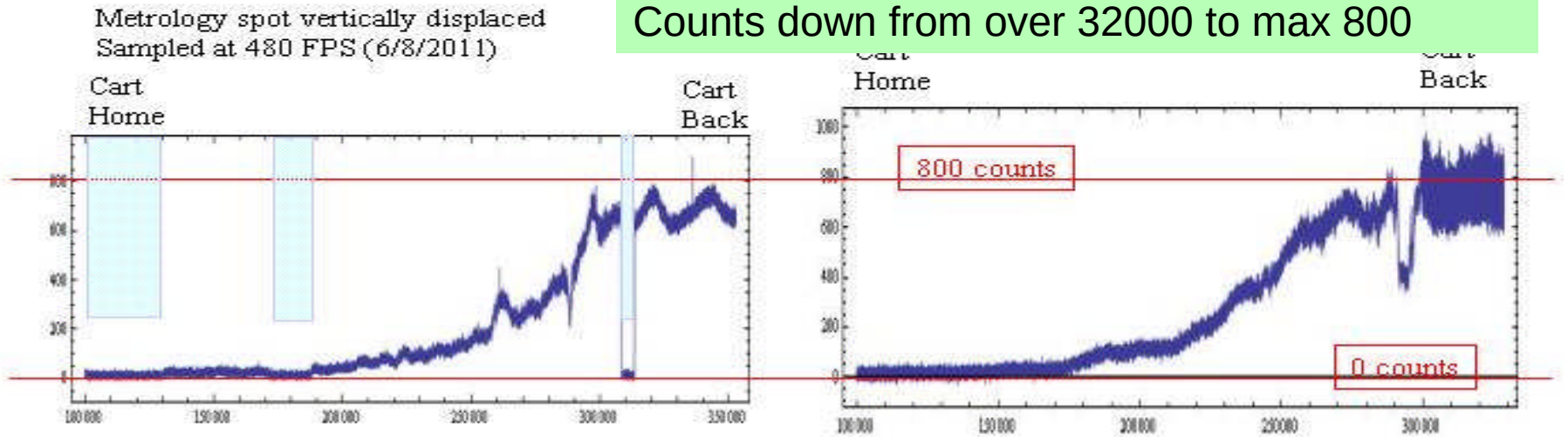
Greatly Reduced Counts With Test Wedges



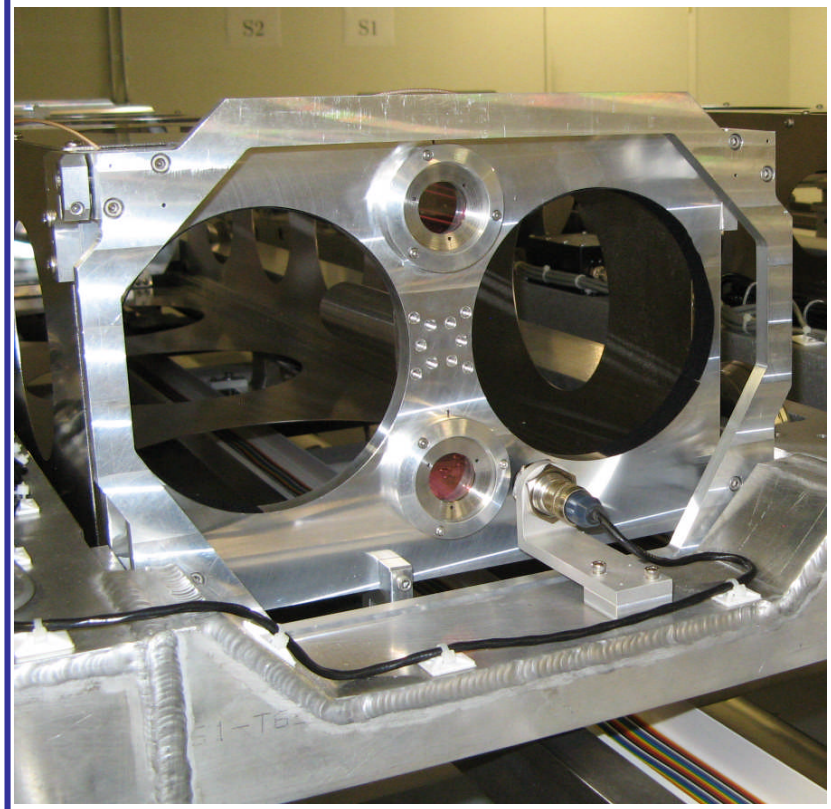
Original scenario: NO wedges

Saturated detector !

Using the wedges eliminated the main source of metrology light leak.
Counts down from over 32000 to max 800



Custom Wedges Installed at W2



- Science and metrology beam spots are now ~ 5 mm apart on cart secondary.
- AR coating on wedges optimized at 1319 nm.
  Wedges produced by ARW Optical Co.
- Wedge mount
  Design by Laszlo Sturmann
  Fabricated at GSU Machine Shop

Experiments with Custom Wedge

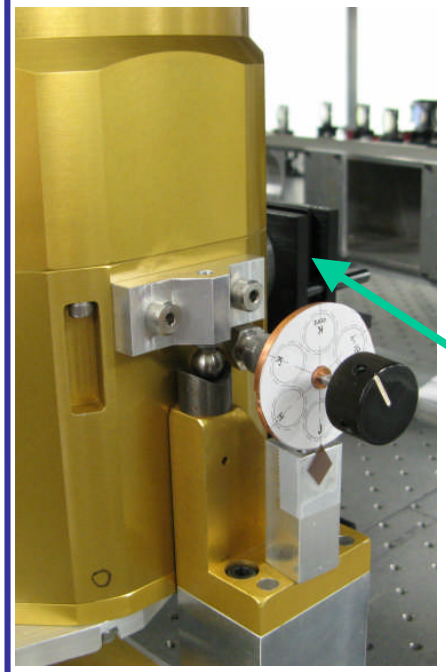
• No detectable counts in NIRO above the noise in J band when the metrology is ON, and the cart is closer than 20 m to the Home sensor.

• Counts gradually increase as the cart moves toward the back.

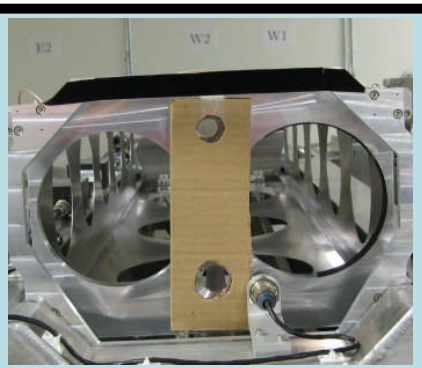
• Masking cannot eliminate the counts seen when the cart is at the back of the rail.

Testing with ND filters

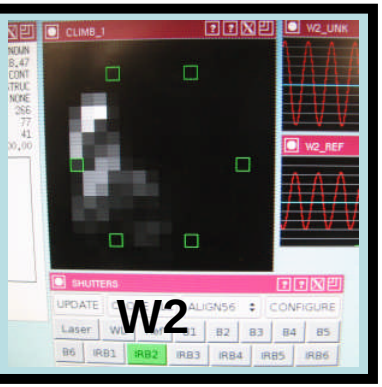
Cart is at 45 m in all pictures, NIRO read at 618 Hz,
CLIMB 1 was aligned (W1,W2,E2) with WL source, Corner cubes out
Met OFF → Lab background -50 < Counts < 50



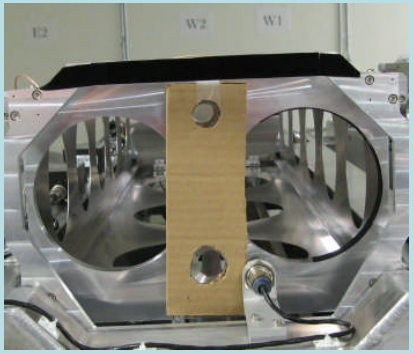
NO ND filter at camera window.



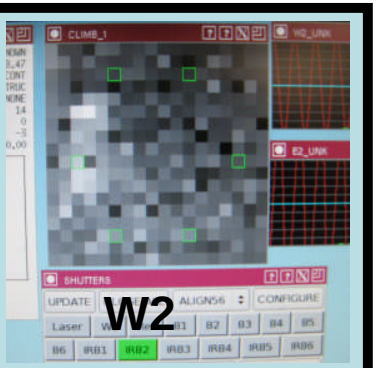
~ 77
~266
~ 41



ND = 2 filter at camera window.



~ 0
~14
~ -3



Options in J-band

- *Wedge + Masking + OD >= 2 Notch Filter*

  Not ideal, but fastest solution

  loosing otherwise usable photons,

  narrow one may be doable at reasonable cost.

- *Wedge + Fixing the metrology "Black Box" for better beam quality*

- *Wedge + Lowering metrology beam power*

- *Finding a different λ for metrology outside science bands*

The End