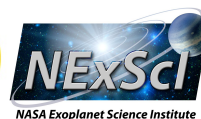# CHAMP Update

Fabien Baron, John Monnier, Stefan Kraus (Univ. Michigan)
Rafael Millan-Gabet (Caltech)
Theo ten Brummelaar (GSU)
Ettore Pedretti (Univ. St Andrews)

CHAMP - Overview

- Separate fringe tracker from science combiner

- Coherencing mode: group-delay tracking

- Cophasing mode:

  - removes atmospheric and mechanically induced phase changes ("freezes the fringes")

  - longer coherence and integration times

    - increased sensitivity

    - for MIRC, ~2-3 magnitudes

  - shorter path length modulation for PP combiners

CHAMP - Overview

- Pair-wise, pupil plane: 1+2, 2+3, 3+4, 4+5, 5+6, 6+1

- Moveable mirror for use with 2 to 6 telescopes
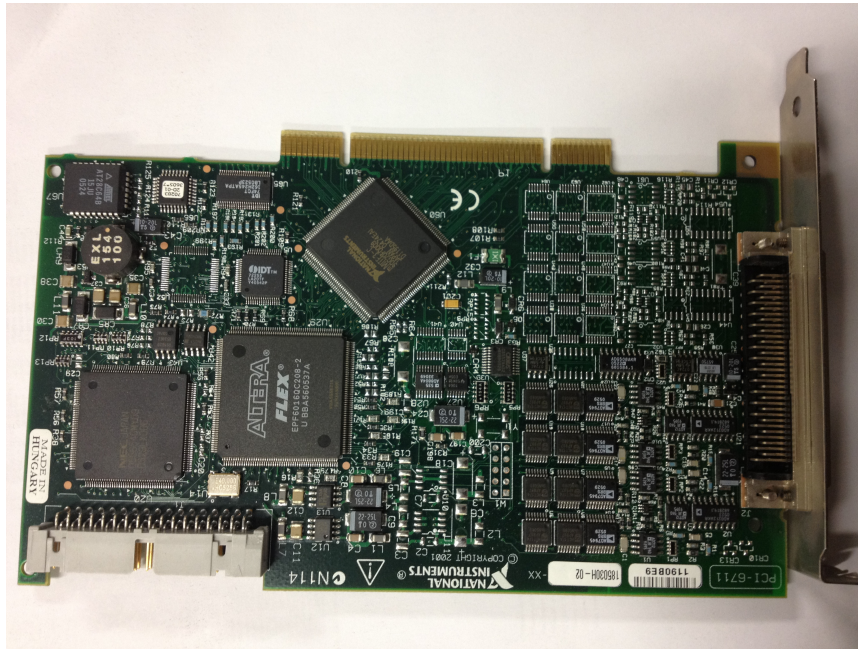
- Works in near-infrared H or K
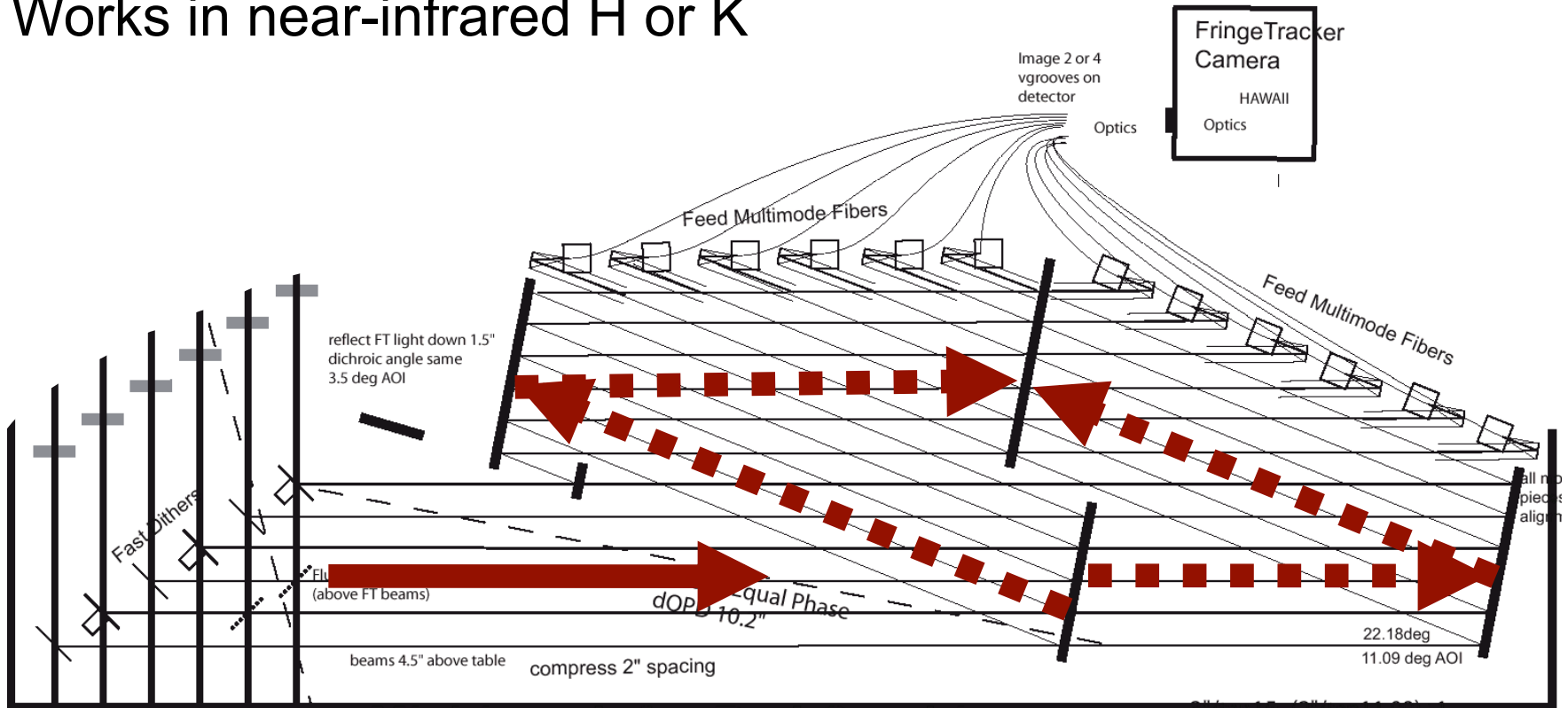
Hardware update: phasing & refocus

- Adjustment of internal delays to phase with MIRC and visible combiners
- Manual refocusing of all spots: close to theoretical values now

Hardware update: a mystery crash

- Camera readout crash due to communication problem
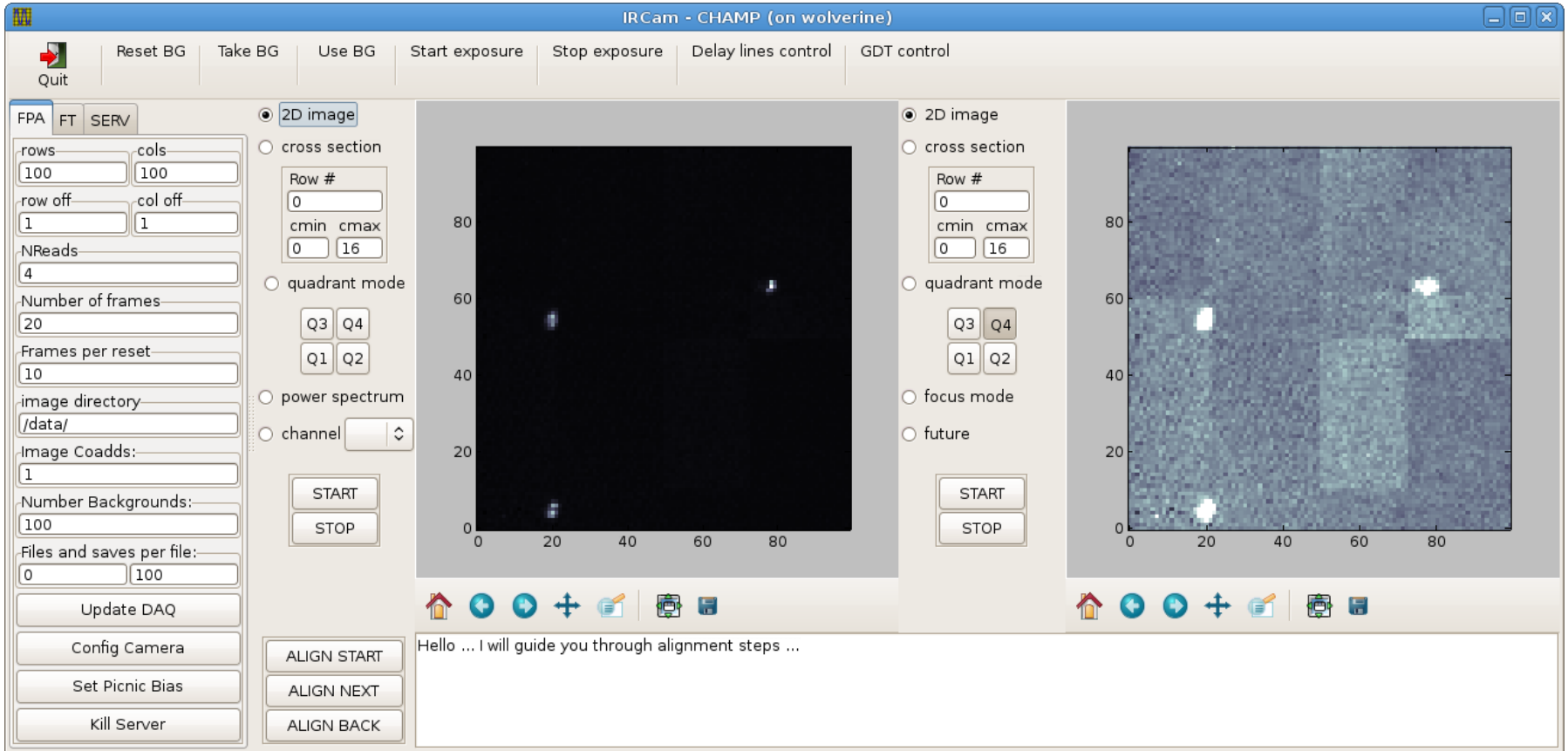
  – Most likely National instrument PCI card

  – CHAMP motherboard ?

Software update: Alignment GUI

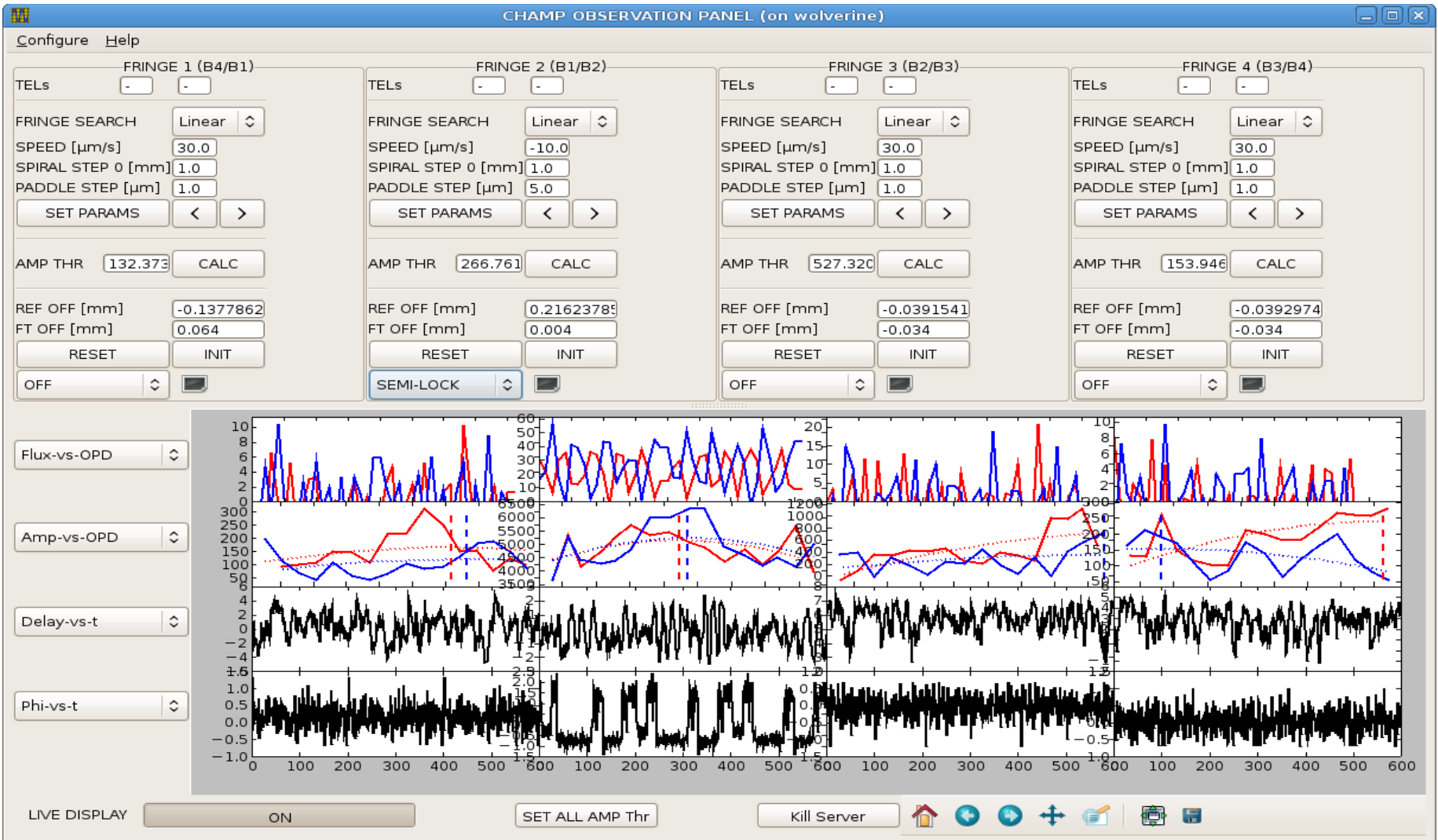- New gui, first step toward automatic spot search and calibration

Software update: Alignment GUI

- Semi-automatic alignment:

  - follows predefined procedure for alignment (18 steps for 6T)

  - "two clicks" system: click to integrate signal, click to move/cancel

Software update: Fringe-tracking GUI

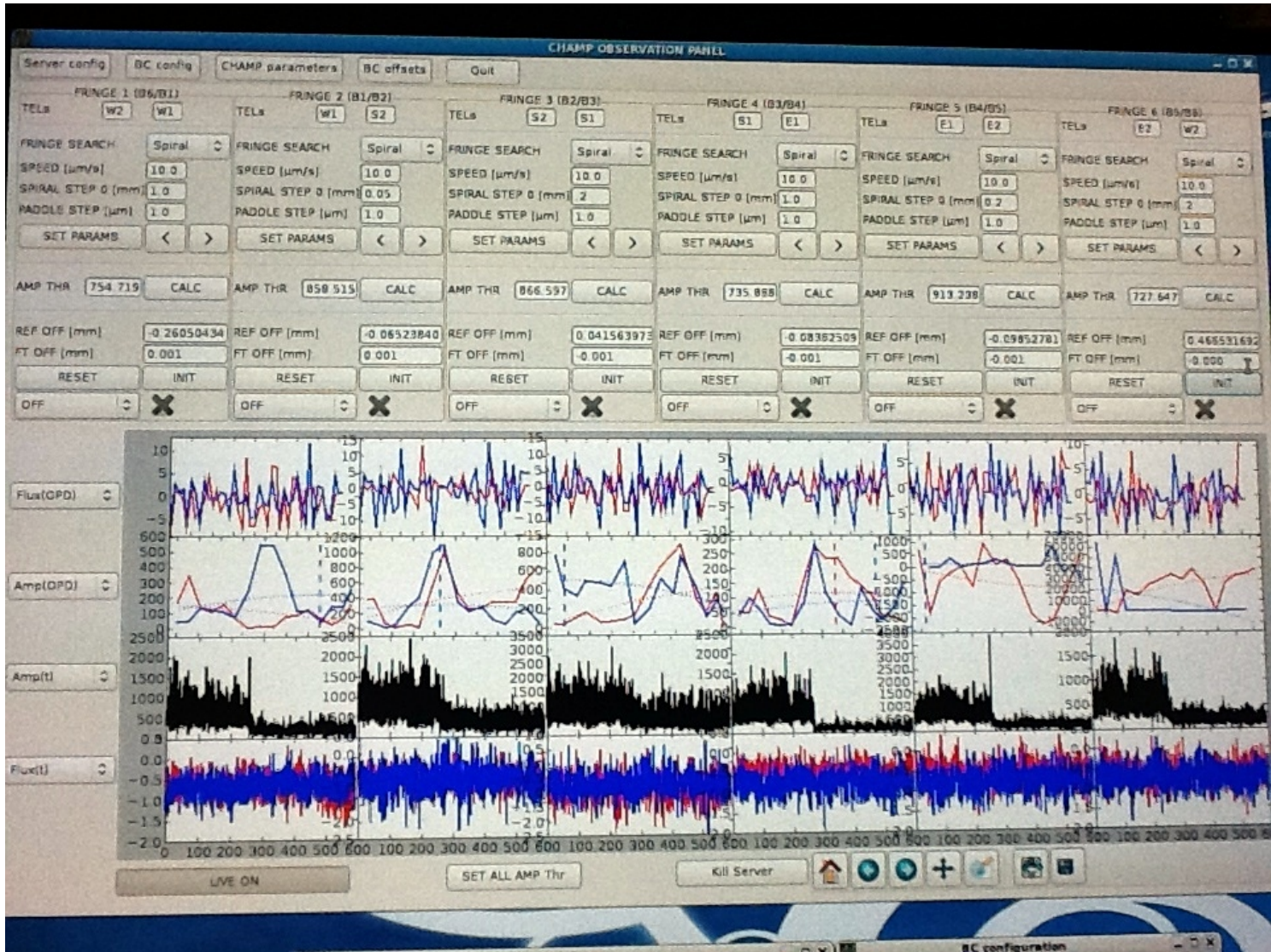- Flux(t), Phase(t), delay(t), delayline positions(t), Flux(opd), Amp(opd)

# Software update: Fringe-tracking GUI (6T version)

Software update: realtime code

- ## New sweep mode

  - Purposeful back and forth scan of the fringe packet

  - Always keeps targets within scan range

    - For faint targets for which coherencing mode fails

    - Rudimentary predictive capabilities based on delay history

- ## ABCD wraparound (DA) code

  - increased tracking stability

- ## Tweaks to cophasing/coherencing parameters

- ## Enhancements to spooler code

  - Robust data saving in FITS format

  - Precise time stamping

MIRC+CHAMP on-sky observations

- MIRC-6T observing in H, CHAMP tracking in K

- Instruments phased using CHAMP internal delays

- Clock/data saving synchronization

  – Non-obvious choice of time stamping

  – Some delays remain...

- Test results on YSO MWC 361 (H=5.5 , K=4.7)

  – ~50 counts on CHAMP in all baselines, good SNR

  – Sweep mode kept MWC 361 in MIRC delay range

  – Coherencing requires more fringes/scan
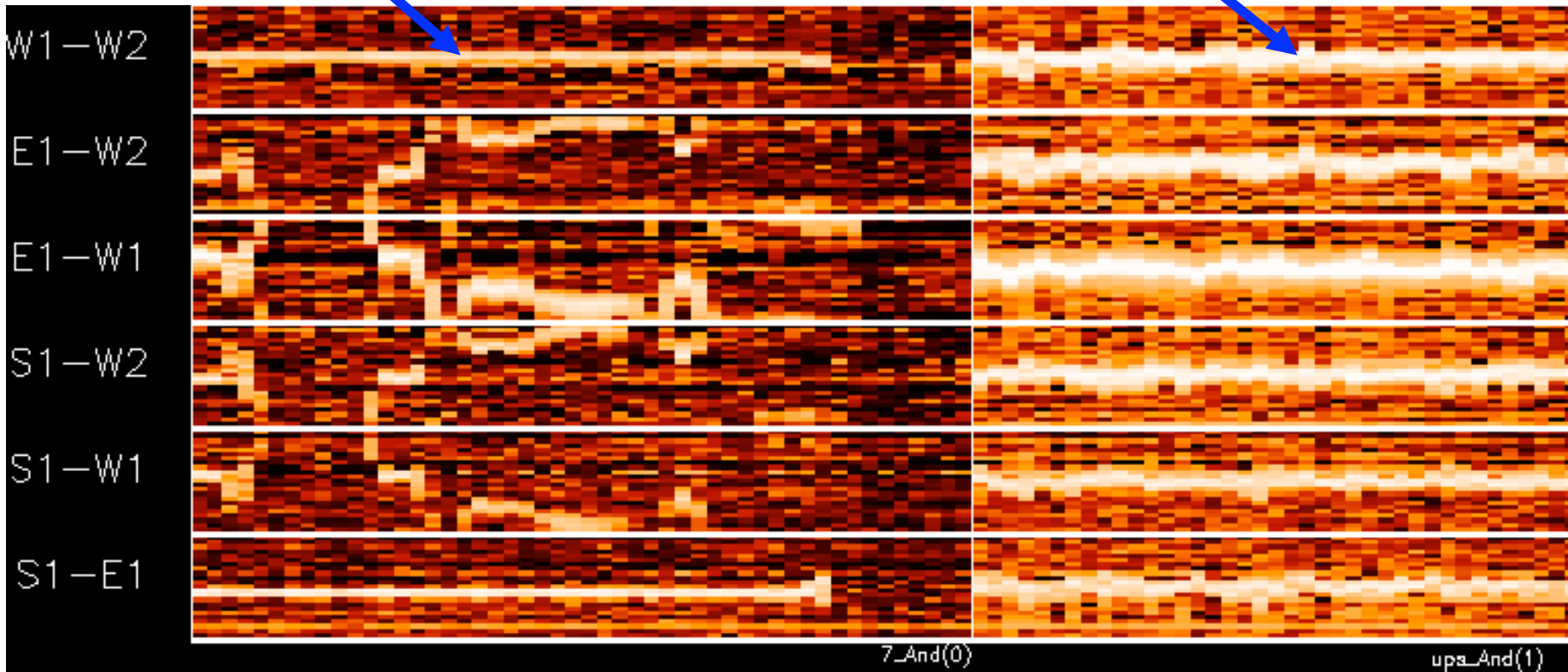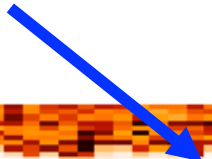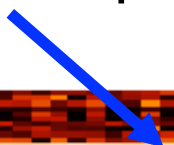
    - longer course PZTs
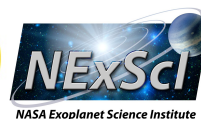
MIRC + CHAMP: fringe stability

CHAMP cophasing
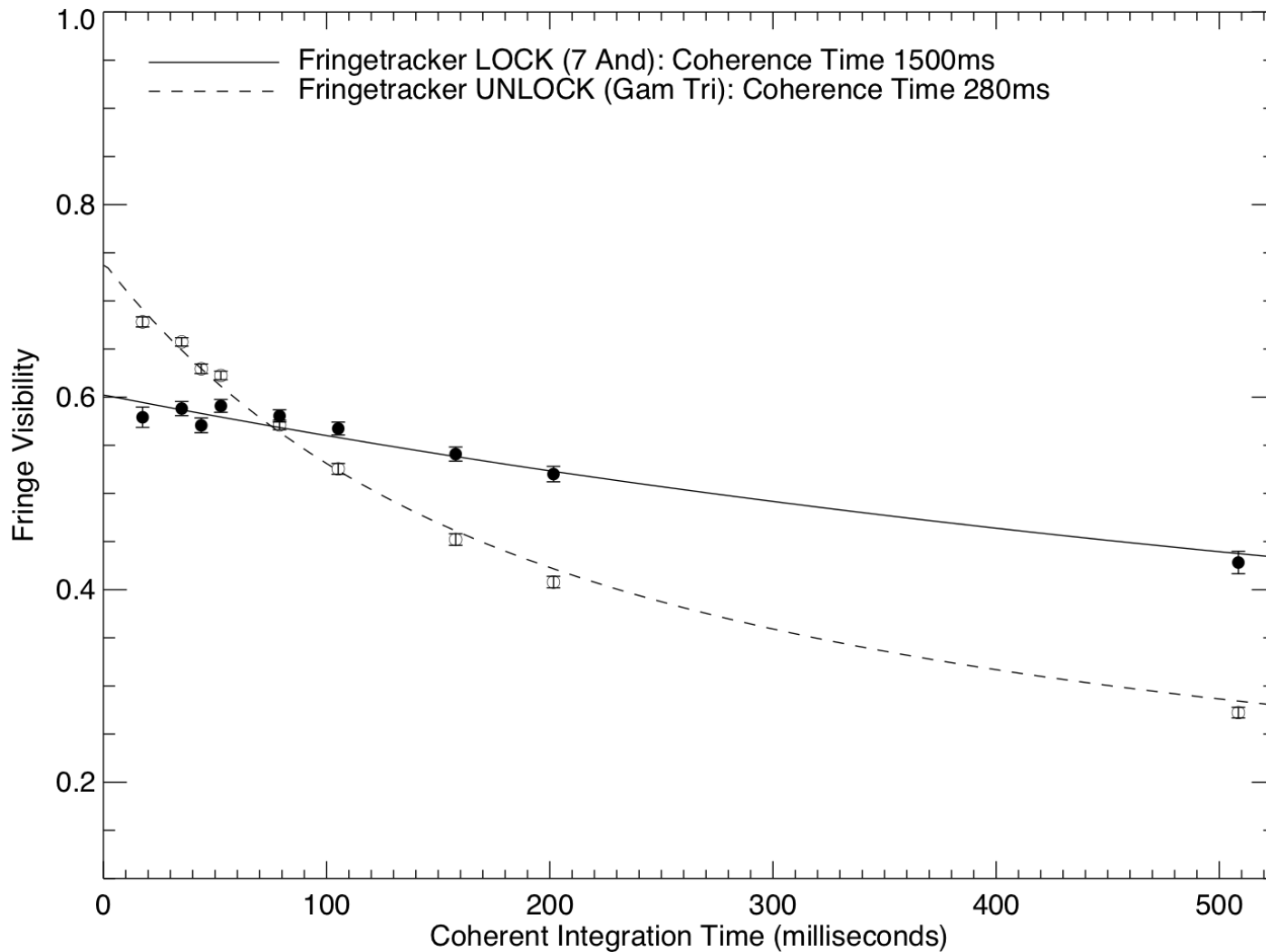
MIRC group delay

*MIRC fringe data*

MIRC+CHAMP: coherence time

CHAMP Fringetracker Test UT2010Aug13
Baseline S1E1

Planned upgrades for 2012 – Hardware

- J band experiment, first tests for J band tracking

  – Contamination by metrology laser

    • Neutral density ~3-5 to reduce counts to 5 on CHAMP

    • Baffling/alignment may reduce by factor x10

    • Scattering on cart secondary

      – "test wedges" by Judit&Laszlo shown to improve CLIMB from saturation to ~800 counts

    • Potentially use a notch filter on CHAMP

- New PZTs

  – Longer course= more fringes

  – Closed loop

    • easier opd vs position calibration

- Fix mystery crash
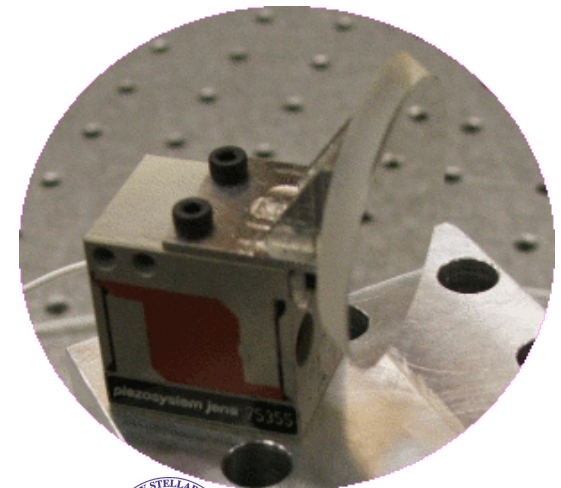
Planned upgrades for 2012 - Software

- Realtime code:

    – Sweep mode: improve predictive abilities

    – Cophasing mode: Kalman filter, better noise de-biasing

    – Better integration with CHARA (common libraries)

    – Better headers for spooler data

- GUIs

    – Complete automatic alignment code

    – Improve responsiveness (multi-threading)

    – Solve remaining communication issues between realtime code and GUI

- User manual and documentation