A new pipeline for MIRCx

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Rational for an alternate pipeline

- Transition idl → python to increase the user and contributor community
- Work on large dataset in batch mode
- Clean-up ‘tuned’ algorithms that accumulated over time and upgrades
- Compute Quality Control parameters
- Experience the data myself
Teaser: does it work?? Not quite yet.

- vis2 fit to iotaPeg (reference binary)
- Residuals (reduced chi2 = 6)
Teaser: does it work?? Not quite yet.

- t3phi fit to iotaPeg (reference binary)
- Residuals (reduced chi2 = 2)
Teaser: does it work?? Not quite yet.

- Visibilities
- Closure phase
Example of night sequence

- Consecutive points have well-behaved statistic.
- Target to target fluctuations, still to be understood.
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MIRCx pipeline

RAW DATA
- detector cleanup
- detector cleanup
- detector cleanup

BACKGROUND
- dark-remove
- dark-remove
- crop windows

BEAMMAP
- profiles
- flux ratio
- positions

PREPROC
- extract flux
- kappa-matrix
- FFT

SPEC. CALIB

PRODUCT
- intermediate product written on disk
- association (e.g., same spectral setup...)

RTS
- selection
- average

OIFITS
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MIRCx pipeline

detector cleanup → detector cleanup → detector cleanup

detector cleanup → dark-remove → dark-remove

dark-remove → crop windows

dark-remove → crop windows

dark-remove → crop windows

RAW DATA

BACKGROUND

detector cleanup

dark-remove

crop windows

BEAMMAP

PREPROOC

SPEC. CALIB

RAW DATA

PRODUCT

intermediate product
written on disk

association (e.g same spectral setup...)

extract flux

kappa-matrix

FFT

RTS

OIFITS

wavelength

profiles

flux ratio

positions

selection

average
MIRCx pipeline

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RAW DATA

detector cleanup

detector cleanup

detector cleanup

dark-remove

dark-remove

crop windows

BACKGROUND

BEAMMAP

PREPROC

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PRODUCT

intermediate product
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association (e.g. same
spectral setup…)

extract flux

kappa-matrix

FFT

wavelength

selection

average

OIFITS
From RAW to PREPROC

- Clean raw data from detector behaviour
  - Compute CDS from non-destructive
  - Remove electronic interference
  - Remove background
  - Flag saturation
  - *Non-linearity*

- Output PREPROC
  - Clean, cropped images of fringes
  - Clean, cropped images of x-chan
From PREPROC to Real Time Signals

- From pre-proc images
  - Align spectrally fringes and x-chan
  - Extract x-chan flux from profile
  - \textit{kappa-matrix (x-chan/fringe)}
  - Normalise x-chan to total flux in fringes
  - FFT the image at fringe frequencies
  - \textit{Fringe cross-talk}

- Output RTS
  - Real time fringe fluxes = 15x R(t), I(t)
  - Real time x-chan flux = 6x P(t)
From RTS to OIFITS

- From Real Time Signals
  - Coherent integration
  - Correct for coherence loss due to GD
  - Discard data based on SNR, GD...
  - Ensemble average of VIS2, T3PHI...
  - Read uv and time from CHARA header

- Output OIFITS
  - Uncalibrated interferometric quantities
    (~1min integration time)
Typical interaction with pipeline

- Run the reduction blindly
  
  ```bash
  cd my_data/
mircx_reduce.py
  ```

- Redo last part, with tuned parameter
  
  ```bash
  mircx_reduce.py --preproc=FALSE --rts=FALSE --ncoherent=5 --threshold=2.0 --vis-dir=vis_for_test
  ```

- Calibrate visibilities
  
  ```bash
  cd vis_for_test/
mircx_calibrate.py --calibrators=SAO_108344,0.8,0.1,HD_162757,0.88,0.1
  ```
Example of “Quality Control” analysis
Take away

• Architectures and basic operations are done.
• Download from CHARA gitlab, and run (python 2 or 3)

• Still missing necessary features and algorithms (e.g. saturation).
• Automation is improved compared to current pipeline, but not yet to a ‘blind science-ready’ level.
• Willing to integrate into CHARA archive/pipeline system.