



Finalizing the Separated Fringe Packet Survey with the CHARA Array

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CHARA 2007
AMNH, NYC, NY





Agenda

- Basic Project Info
- Locating true position/completeness
- Overview of 2005
- Observing runs 2006/2007
- Observing this year
- Stars with SFPs
- What is left with the project?



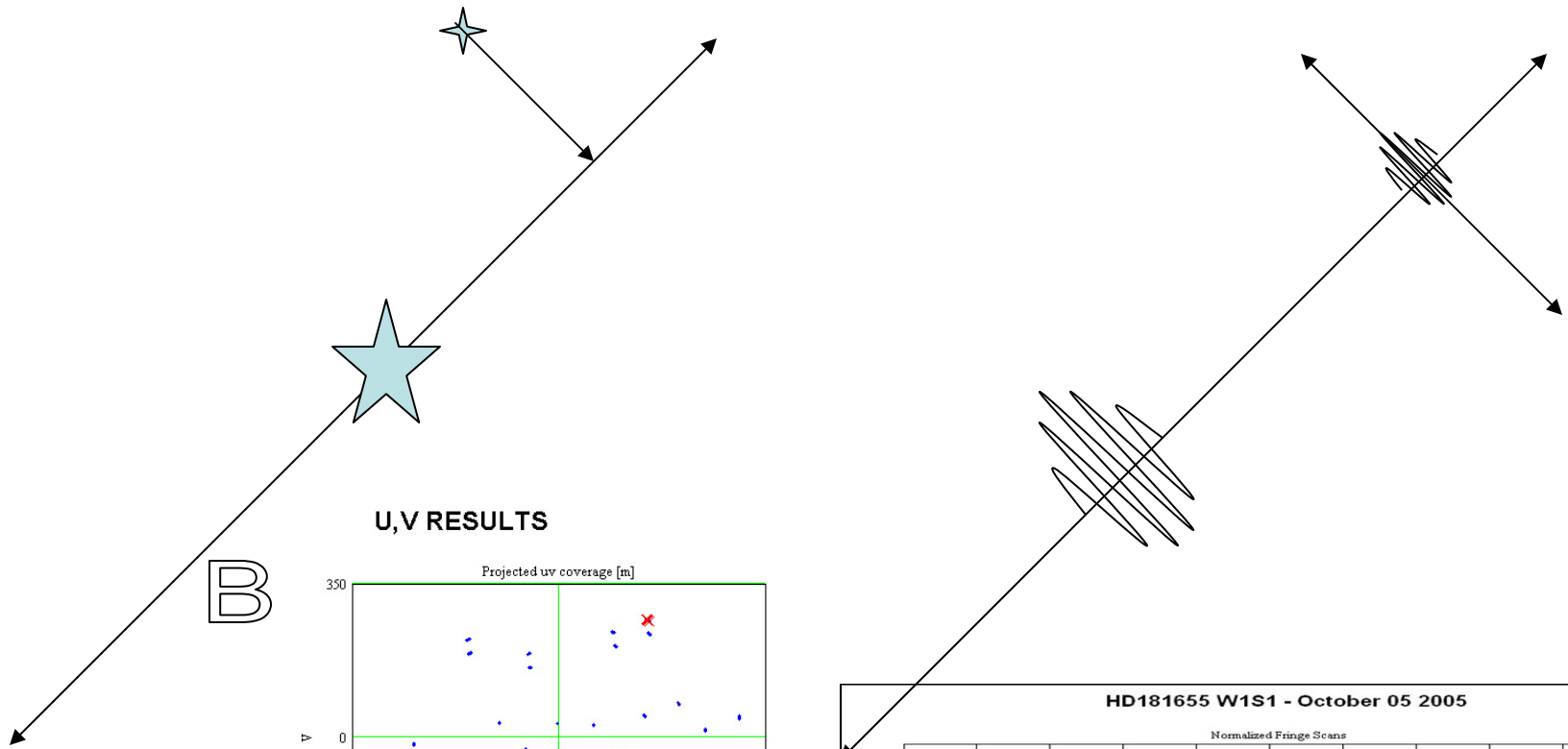


The Project

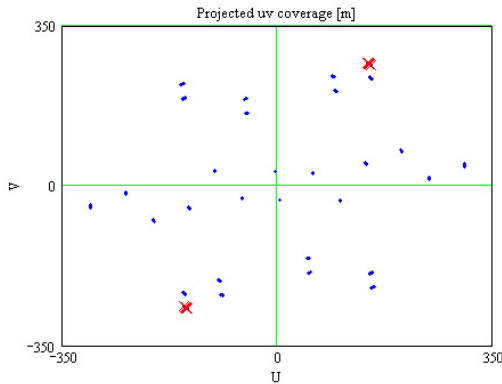
- An update of Duquennoy & Mayor's spectroscopic survey for multiplicity in solar type (F0-G9) stars
- To assume no personal selection bias, I started with the entire 291 system sample (some original targets found to be further than known)
 - Removed all targets south of -2° to remove atmospheric problems near horizon
 - Eliminated all targets dimmer than $V_k=5$ (at the time a reasonable sensitivity limit for the CHARA array)
 - Discarded all known giants (Lum class I-III)
 - Process resulted in 145 target stars
- Additionally, 28 double and single lined spectroscopic binaries were added that fell within the separation range predicted for this project
 - Of these 13 were already part of the original list, so 15 new targets were added to bring the total to 160



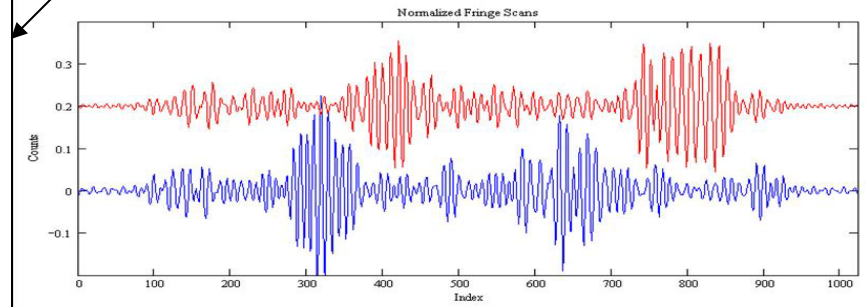
Vector Separation of Fringes



U,V RESULTS

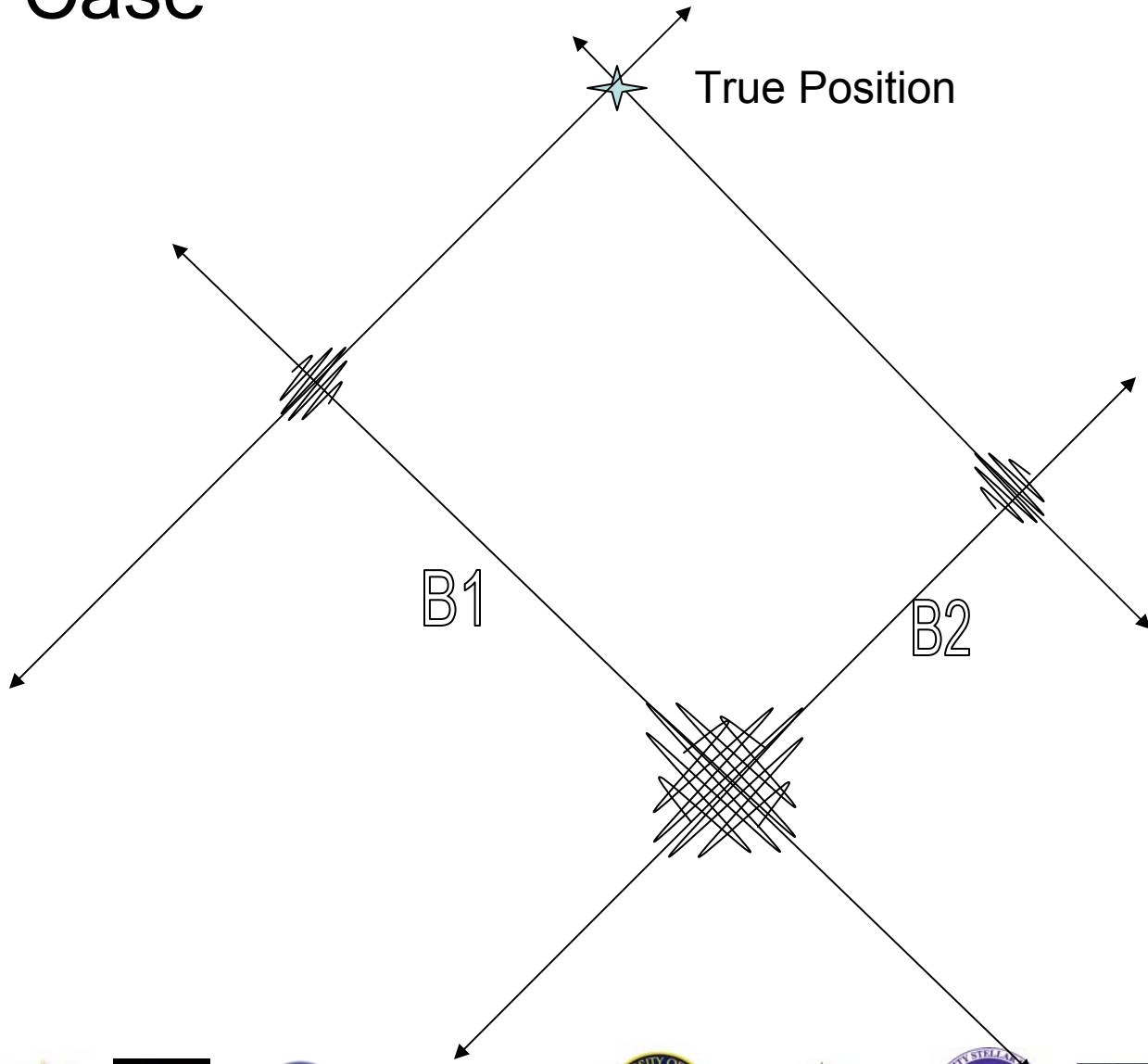


HD181655 W1S1 - October 05 2005





Ideal Case



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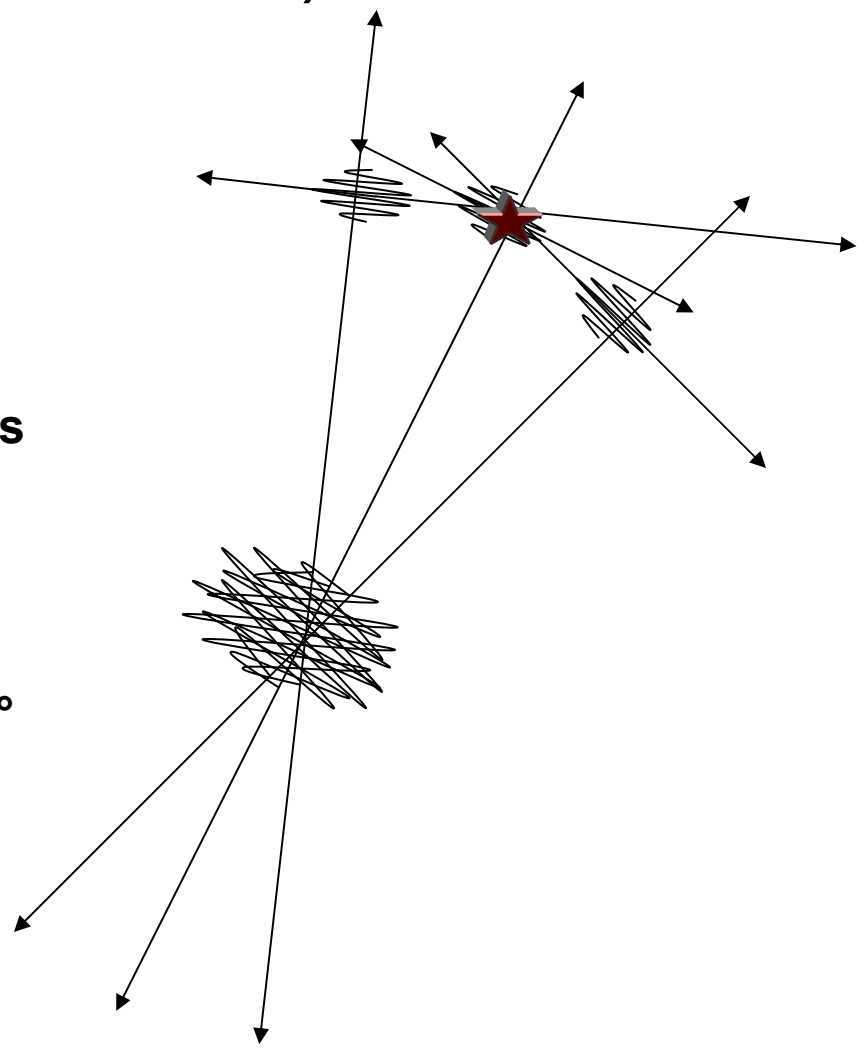


Realistic Case (1 baseline)

**Nightly baseline rotation varies:
10-60°**

**First run in fall 2005:
Rotation of 2-3° through 3 data files
Not good enough**

**Summer run 2006:
Average of 35° each night
In addition to second baseline ≈60°**

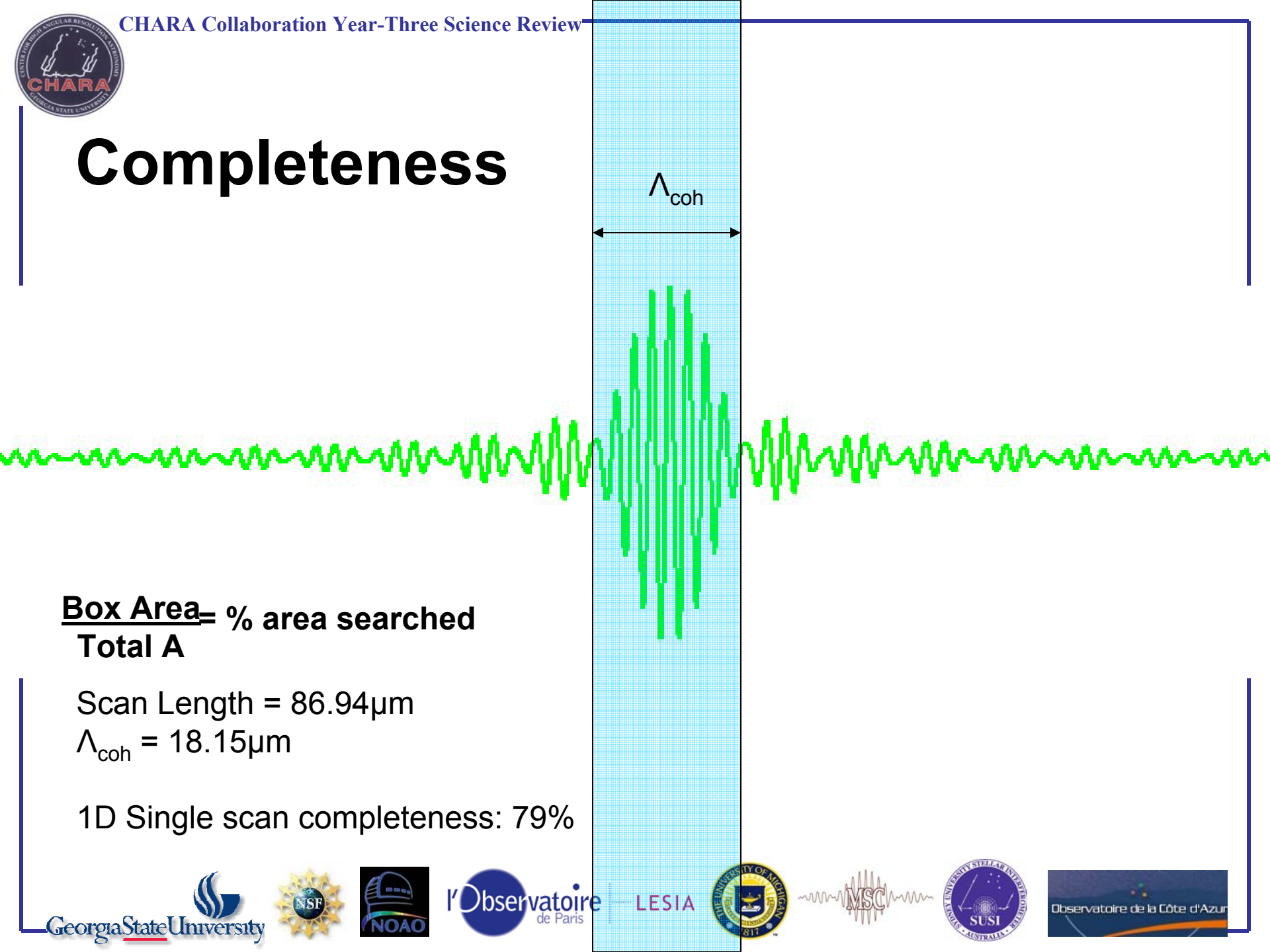


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Completeness



Box Area = % area searched
Total A

Scan Length = 86.94 μm

$\Lambda_{\text{coh}} = 18.15 \mu\text{m}$

1D Single scan completeness: 79%



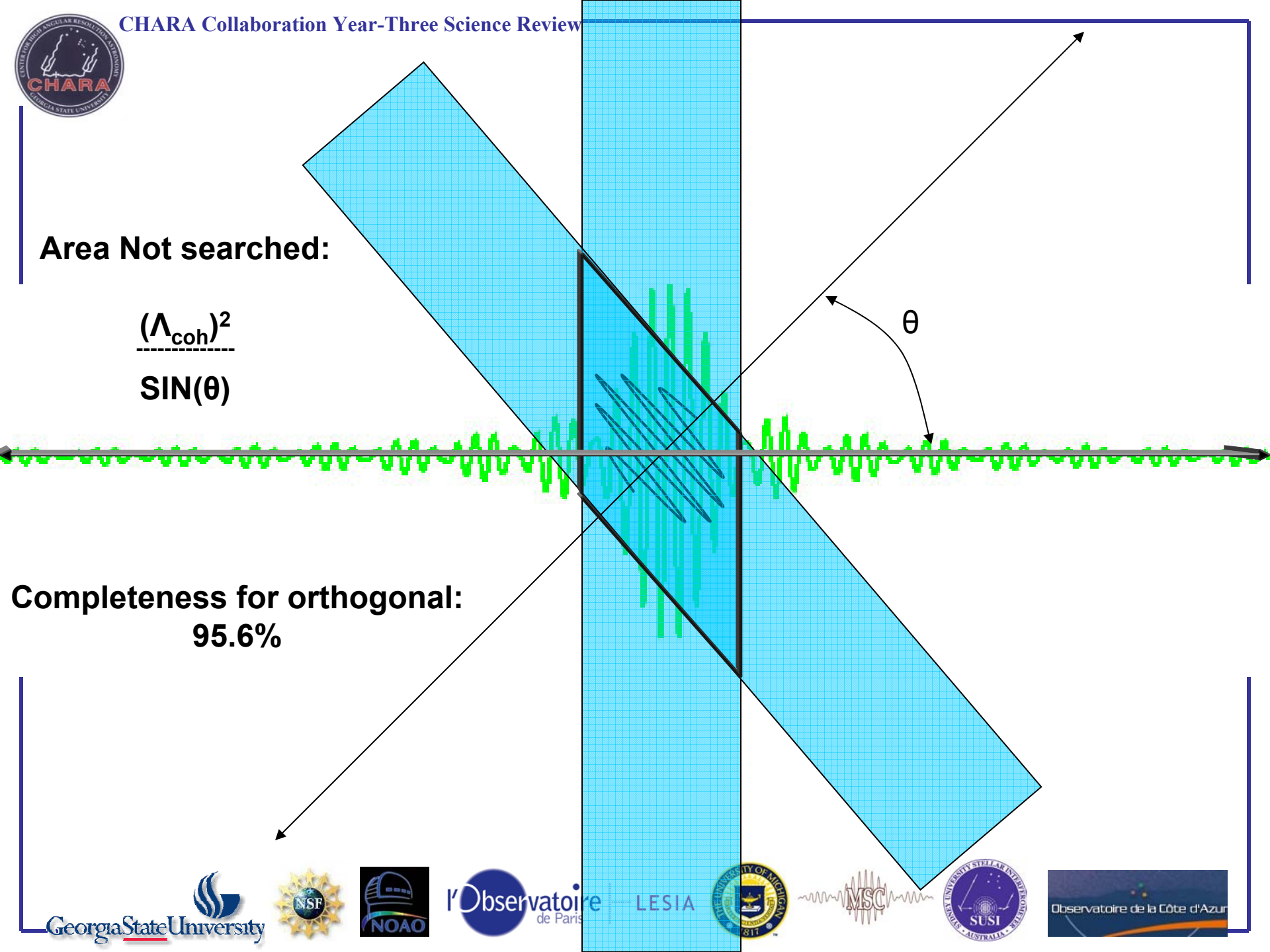
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Area Not searched:

$$\frac{(\Lambda_{\text{coh}})^2}{\text{SIN}(\theta)}$$



Completeness for orthogonal:
95.6%



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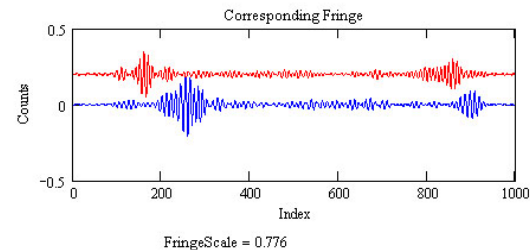
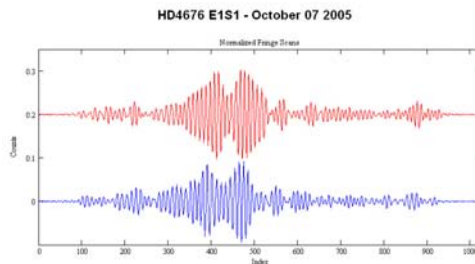
SFP Resolution Limits

| Baseline | Max B | Min B | Wide on Max B | Close on Max B | Wide on Min B | Close on Min B |
|----------|--------|--------|---------------|----------------|---------------|----------------|
| E2-S2 | 248.13 | 155.56 | 103.58 | 13.28 | 165.22 | 21.18 |
| W1-S2 | 249.39 | 144.66 | 103.06 | 13.21 | 177.68 | 22.78 |
| W1-E2 | 251.34 | 113.45 | 102.26 | 13.11 | 226.54 | 29.04 |
| W1-S1 | 278.50 | 172.80 | 92.29 | 11.83 | 148.74 | 19.07 |
| E2-S1 | 278.77 | 169.33 | 92.20 | 11.82 | 151.78 | 19.46 |
| E1-S2 | 302.34 | 202.89 | 85.01 | 10.90 | 126.68 | 16.24 |
| W1-E1 | 313.54 | 134.27 | 81.97 | 10.51 | 191.42 | 24.54 |
| E1-S1 | 330.67 | 215.92 | 77.73 | 9.96 | 119.03 | 15.26 |

Conservative estimate of limits for SFP surveys (dependant on proj baseline):

E1-S1: 10-110 mas

W1-S1: 15-150 mas



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List Components

| Type | Total |
|-------------------------|------------|
| Multiple systems | |
| Dbl/Mult Visual | 20 |
| DSB | 13 |
| SSB | 16 |
| Spec Binary | 15 |
| RS CVn Variable | 3 |
| W UMa Eclipsing | 1 |
| Single Systems | |
| Flare star | 2 |
| High Proper Motion | 48 |
| Star | 18 |
| T Tauri | 1 |
| Variable | 20 |
| BY Draconis Var | 3 |
| totals | 160 |

Total:

Single: 92 systems : 57%

Multiple: 68 systems: 43%

Of all 160 targets:

40% (64 objects) have

0-1 speckle observations

Twelve SFPs observed

Two possibles

One unknown companion



Fall 2005

- Of the 160 targets, 73 were available in Sept-Oct 2005
 - At least one baseline: 51 targets
 - Two baselines: 39 of those the 51
 - Unobserved: 22 targets
- Of these 73, eighteen have never been observed with interferometry of any kind.
- Data collected: 267 files



Observing 2006

- Since Tucson, allotted 3 observing runs
 - First two weeks in April (rained out)
 - Obviously no data
 - Four days in June
 - Twenty targets (all observed on both baselines, 84 files)
 - Mostly DSB and SSB (6 show SFP behavior)
 - Two weeks in September
 - Only 7 nights of data due to fires and ash
 - 75 targets available, some additional data on previously observed targets from 2005.
 - Observed 68 targets: 25 on both baselines, 43 on one
 - 25 objects that had not been observed in 2005
 - Remote observing during October MIRC run
 - Mostly for testing with not much coverage.
 - Made way for Jan – March Grad Observing

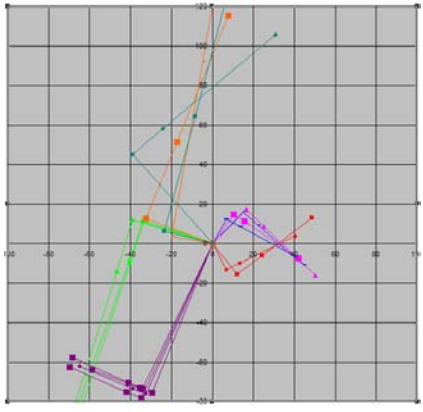
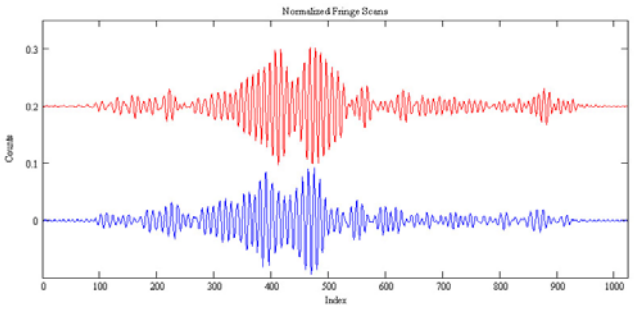


Previous SFPs (2005)

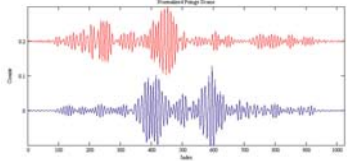
HD 4676

HD 198084

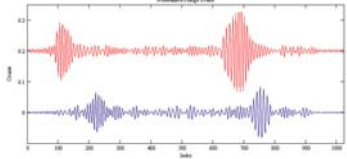
HD4676 E1S1 - October 07 2005



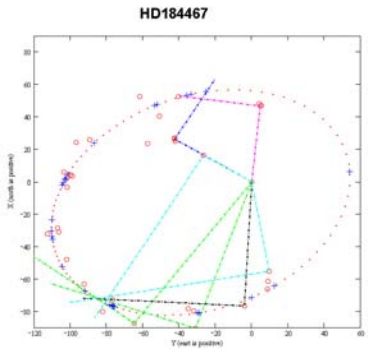
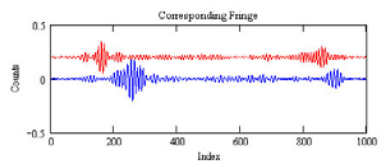
HD198084 W1S1 - October 05 2005



HD198084 E1S1 - October 11 2005



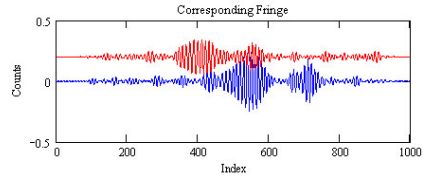
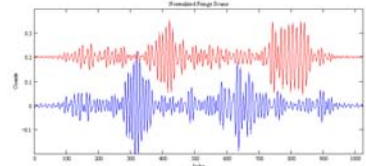
HD 184467



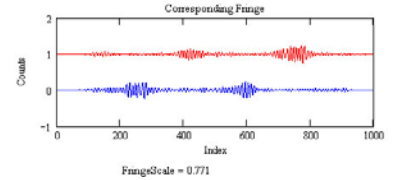
FringeScale = 0.746

HD 181655

HD181655 W1S1 - October 05 2005



FringeScale = 0.741



FringeScale = 0.771



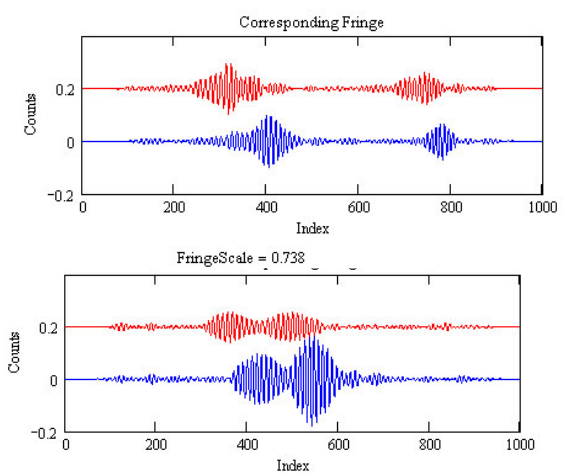
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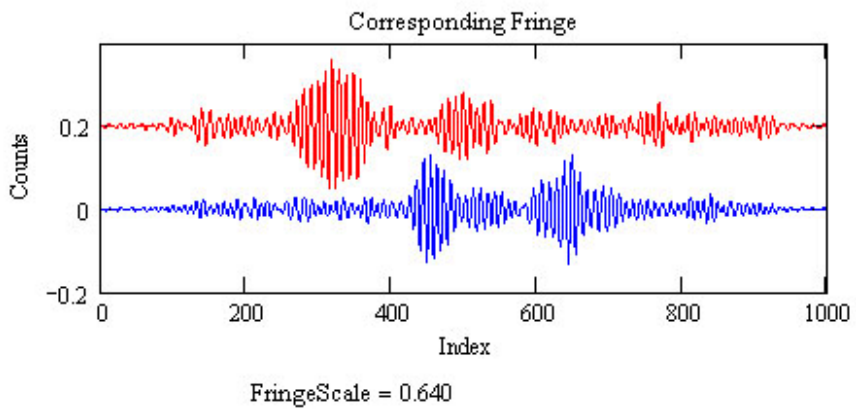


Additional SFPs 2006/2007

HD 170153



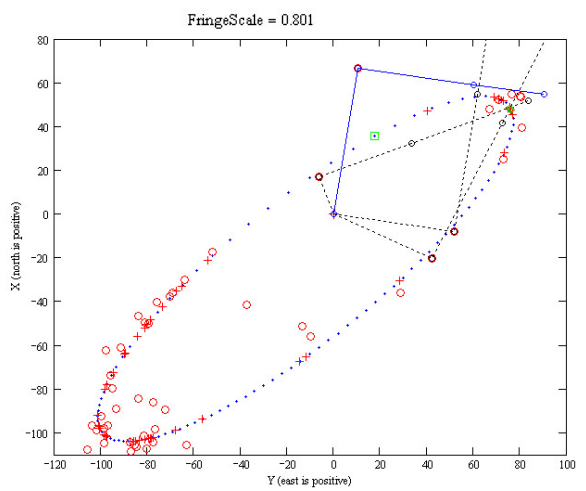
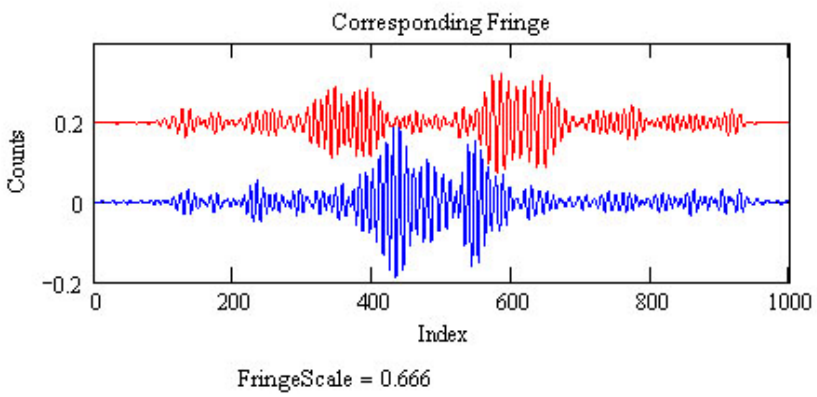
HD 101606



Others needing better

- seeing:
- HD 9021
- HD 24546
- HD 48682
- HD 58946
- HD 107700
- HD 202275

HD 131511





Totals So Far (including AROC)

- Both baselines: 61 (38%)
 - Does not include non-concurrent observations.
- At least one: 118 (73.5%)
- Still left: 42 (26.5%)
- Total Objects with SFPs: 12
- New companions: 1
- Data files (individual observations): 501



Observing 2007

- Single night baseline switching
 - Target finished on one night
 - Working on shared nights with Deepak
- Time allotted in 2007
 - 15 nights spread over 4 months to cover remaining missing objects



What's left?

- Observing 2007
- Mass data reduction
- Fringe modeling
- Writing as much as possible in addition to observing for CHARA
- Freak out
- Graduate