Data reduction for PIONIER

1 INSTALLATION

1.1 Declare the installation directory and set the PATH variable correctly:

```
export INTROOT=/home/user/INTROOT
export PATH=$PATH:$INTROOT/bin:$INTROOT/yorick/bin
```

1.2 Unpack and install (compile) the two software packages:

```
cd $INTROOT
tar -xvzf pndrs-last-src.tgz
tar -xvzf yoco-last-src.tgz
cd yoco/distrib
./install.sh
```

During the installation process, press "y" for all questions.

```
cd ../../pndrs/distrib
./install.sh
```

Again, press "y" for all questions.
That's it! Ready to go!

2 DATA REDUCTION

The data taken during this run contains the following data ("observing log"):

57059.01803	HD59066	CAL	D0-G1-H0-I1	GRISM	
57059.02477	**HD59435**	**SCI**	**D0-G1-H0-I1**	**GRISM**	**binary star**
57059.03086	HD59066	CAL	D0-G1-H0-I1	GRISM	
57059.03611	**HD59435**	**SCI**	**D0-G1-H0-I1**	**GRISM**	**binary star**
57059.04015	HD59066	CAL	D0-G1-H0-I1	GRISM	
57059.20745	HD102089	CAL	D0-G1-H0-I1	FREE	
57059.22502	**WW_CHA**	**SCI**	**D0-G1-H0-I1**	**FREE**	**faint binary**
57059.23914	HD93326	CAL	D0-G1-H0-I1	FREE	
57059.34159	HD81502	CAL	D0-G1-H0-I1	GRISM	
57059.34694	**L_CAR**	**SCI**	**D0-G1-H0-I1**	**GRISM**	**well resolved Cepheid**
57059.35165	HD90853	CAL	D0-G1-H0-I1	GRISM	
57059.35644	**L_CAR**	**SCI**	**D0-G1-H0-I1**	**GRISM**	**well resolved Cepheid**
57059.36211	HD81101	CAL	D0-G1-H0-I1	GRISM	

2.1 Move to the data directory and check what is in there:

```
cd ~/pndrs/data/2015-02-05
ls -la
```

2.2 Execute the data reduction:

```
pndrsReduce
```

This script performs the following steps:

1) Loop into files to build a log of the night
2) Compute the kappa-matrix from all shutter-sequences taken
3) Compute the wavelength tables of each spectral calibration taken (internal light)
4) Loop on all raw FRINGE files and compute uncalibrated OIFITS

2.3 Check the results of the data reduction:
A few general calibration data are stored in 2015-02-05_v3.30_calib:

```
cd ../2015-02-05_v3.30_calib/
ls -la
```

There is the kappa-matrix recorded into OIFITS files as well as the spectral calibration files (wavelength tables), with some plots to check the reduction.
The main results of the data reduction are stored in another directory:

```
cd ../2015-02-05_v3.30_abcd/
ls -la
```

For every data set, the OIFITS file and many plots of the intermediate steps of the data reduction are produced. The files are order by the steps of the data reduction. The most important of these files are:

1) Averaged Power Spectral Densities `evince ./PIONI.2015-02-06T00:25:57.389_027_psd0.pdf`
2) SNR and piston per scan `evince ./PIONI.2015-02-06T00:25:57.389_028_psd0.pdf`

3 CALIBRATION

3.1 Change to the directory with the reduced data (if not already done in the previous step):

```
cd ../2015-02-05_v3.30_abcd/
```

3.2 Run the calibration:

```
pndrsCalibrate
```

This script performs the following main steps:

1) Load all the uncalibrated OIDATA_RAW files (*oidata.fits) & find the calibrators
2) Execute the user-defined script 2015-02-05_pndrsScript.i if any.
3) For each instrument setup, compute discrete estimates of the transfer function using the calibrators (taking into account their diameters); interpolate this transfer function and calibrate all object (science & calibrators).
4) Write plots about the calibration sequence of each setup as well as all setups.
5) For each object, write a single calibrated OIFITS file.
6) Plot overall summary of the calibrated data for each object (vis2, t3phi, uv-plane).

3.3 Check the result of the calibration:

```
ls -la 2015-02-05_*
ls -la 2015-02-05_*.pdf
evince 2015-02-05_TF_*_lbdBinAvg.pdf
```

These plots contain a summary of the calibration of all setups of the night. It shows an average of a few spectral channels in the middle of the band.

4 EDIT THE CALIBRATION

4.1 Create and edit the script file:

```
gedit 2015-02-05_pndrsScript.i
```

Insert the following:

```
/* Change SCI and CAL */
oiFitsSetTargetAsCalib, oiDiam, oiTarget, target="HD59066", diam=0.32, diamErr=0.1;
oiFitsSetTargetAsScience, oiDiam, oiTarget, target="L_CAR";
```

Then re-run the calibration:

```
pndrsCalibrate
```

--> Now the the calibrators and science are properly assigned.

4.2 We add a few further data reduction steps by adding them to the pndrsScript.i:

```
/* Flag some data */
oiFitsFlagOiData, oiWave, oiArray, oiVis2, oiT3, oiVis, tlimit=[57059.2102,57059.2104];

/* Change interpolation function */
vis2TfMode = 3;

/* Average consecutive data */
oiFitsGroupAllOiData, oiVis2, oiVis, oiT3, oiLog;
```

Then re-run the calibration:

```
pndrsCalibrate
```

5 RUN LITpro to fit the resulting data

5.1 Run LITpro and load the calibrated OIFITS files of
HD59435 and
L Carinae
Fit the data with a binary and a uniform disk, respectively.

What is the separation, flux ratio and angle of the binary, what is the diameter of the Cepheid?