Purpose of this document

To introduce the accompanying ASCII text files of planetary data with a sample lines for each and a guide to the columns and other contents.

Three ASCII files for each planetary object (1) the primary data reduction output of nightly and seasonal summary values, and the extracted subsidiary files (2) data for individual nights, and (3) seasonal summaries.

Titan_by_season.txt and subsidiary files Titan_nights.txt Titan_summary.txt
Uranus_by_season.txt and subsidiary files Uranus_nights.txt Uranus_summary.txt
Neptune_by_season.txt and subsidiary files Neptune_nights.txt Neptune_summary.txt

Sample season output for the y filter (from Neptune_by_season.txt). Note: b filter is similar

OBJECT NO. 3 = NEPTUNE
MAGNITUDES COMPUTED FOR LINEAR SOLAR PHASE FUNCTION

FILTER NO.55 = Y

SOLAR PHASE COEFFICIENT= 0.0053

COMPARISON MAGS= 8.6780 & 8.7590 MEAN= 8.7185
FOR HD 151451 & 150621 FROM FILE= nepcomp.sv

<table>
<thead>
<tr>
<th>UT DATE</th>
<th>JUL DATE</th>
<th>VAR</th>
<th>ERR</th>
<th>COMP</th>
<th>ERR</th>
<th>N</th>
<th>DEG</th>
<th>DIST</th>
<th>PLANET</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 1 76</td>
<td>12899.903</td>
<td>-0.8913</td>
<td>0.0058</td>
<td>0.0766</td>
<td>0.0044</td>
<td>4</td>
<td>1.09</td>
<td>-0.0433</td>
<td>7.7781</td>
</tr>
<tr>
<td>5 24 76</td>
<td>12923.793</td>
<td>-0.9038</td>
<td>0.0103</td>
<td>0.0750</td>
<td>0.0065</td>
<td>2</td>
<td>0.30</td>
<td>-0.0325</td>
<td>7.7806</td>
</tr>
<tr>
<td>5 25 76</td>
<td>12924.827</td>
<td>-0.9045</td>
<td>0.0033</td>
<td>0.0785</td>
<td>0.0033</td>
<td>4</td>
<td>0.30</td>
<td>-0.0323</td>
<td>7.7801</td>
</tr>
<tr>
<td>5 27 76</td>
<td>12925.856</td>
<td>-0.9068</td>
<td>0.0080</td>
<td>0.0853</td>
<td>0.0084</td>
<td>4</td>
<td>0.20</td>
<td>-0.0321</td>
<td>7.7785</td>
</tr>
<tr>
<td>6 16 76</td>
<td>12945.770</td>
<td>-0.9039</td>
<td>0.0033</td>
<td>0.0801</td>
<td>0.0017</td>
<td>4</td>
<td>0.40</td>
<td>-0.0333</td>
<td>7.7792</td>
</tr>
<tr>
<td>6 18 76</td>
<td>12947.755</td>
<td>-0.8881</td>
<td>0.0041</td>
<td>0.0701</td>
<td>0.0027</td>
<td>4</td>
<td>0.50</td>
<td>-0.0339</td>
<td>7.7939</td>
</tr>
<tr>
<td>6 21 76</td>
<td>12950.762</td>
<td>-0.8915</td>
<td>0.0063</td>
<td>0.0727</td>
<td>0.0050</td>
<td>4</td>
<td>0.60</td>
<td>-0.0353</td>
<td>7.7885</td>
</tr>
<tr>
<td>6 25 76</td>
<td>12954.741</td>
<td>-0.8921</td>
<td>0.0021</td>
<td>0.0756</td>
<td>0.0029</td>
<td>4</td>
<td>0.70</td>
<td>-0.0366</td>
<td>7.7861</td>
</tr>
<tr>
<td>7 4 76</td>
<td>12963.705</td>
<td>-0.8907</td>
<td>0.0030</td>
<td>0.0716</td>
<td>0.0027</td>
<td>4</td>
<td>1.00</td>
<td>-0.0414</td>
<td>7.7811</td>
</tr>
</tbody>
</table>

MEANS 12937.5  0.0051  0.0762  0.0042  7.7829
STD. DEV. FOR N= 9  0.0047  0.0054
STD. ERR. OF MEAN  0.0016  0.0018

MEAN (COMP STAR 2 ONLY) 7.7805
MEAN (COMP STAR 3 ONLY) 7.7853

COLOR-CORRECTED PLANET MAGNITUDES....... BOTH COMPS 7.7835
COMP 2 ONLY 7.7813
COMP 3 ONLY 7.7856

ASSUMED COLOR TERM A2 = -0.0170
ASSUMED B-Y COLORS..... PLANET = 0.370
HD 151451 = 0.320
HD 150621 = 0.354
FILTER
b or y

SOLAR PHASE COEFFICIENT
in units of magnitudes per degree solar phase angle

COMPARISON MAGS
adopted b or y comparison star magnitudes for that season

FOR HD
Henry Draper (HD) catalog identification

UT DATE
month, day, 2 digit year

JUL DATE
Julian Date minus 2,440,000

VAR
raw differential magnitude, planet minus mean of 2 comps.

ERR
std.dev. of the N measurements of VAR

COMP
raw differential mag of COMP3 minus COMP2

ERR
std.dev of the N measurements of COMP3 - COMP2

N
number of cycles of measurement,

COMP2 - PLANET - COMP3

DEG
solar phase angle in degrees

DIST
distance correction (in magnitudes) to standard values of geocentric and heliocentric distances in AU

PLANET
final "raw" (i.e., no color correction applied) planet magnitude corrected for solar phase angle and distance

MEAN, STD. DEV, STD. DEV. OF MEAN
summary statistics for the columns above

MEAN (COMP STAR 2) ONLY
planet magnitude based on COMP2 only

MEAN (COMP STAR 3) ONLY
planet magnitude based on COMP3 only

necessary only if one of the somp stars has been found to be unreliab

COLOR CORRECTED PLANET MAGNITUDES
magnitudes adjusted for the color term determined from independent photometry of the comparison stars

ASSUMED COLOR TERM A2
color term for the y filter.

or....

ASSUMED COLOR TERM C2
color term for the b-y color. the color term for b is A2+C2-1

The correction = color term x diff in b-y color between planet and comp stars)
### Sample from Neptune_nights.txt

<table>
<thead>
<tr>
<th>FIL</th>
<th>M</th>
<th>D</th>
<th>Y</th>
<th>JD</th>
<th>VARSIG</th>
<th>COMPSIG</th>
<th>N</th>
<th>ANG</th>
<th>PRAW</th>
<th>PCORR</th>
<th>P2CORR</th>
<th>P3CORR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>42172</td>
<td>11429.00</td>
<td>0.0024</td>
<td>0.0023</td>
<td>4</td>
<td>1.10</td>
<td>7.8112</td>
<td>7.8130</td>
<td>7.8113</td>
<td>7.8147</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>42272</td>
<td>11430.05</td>
<td>0.0025</td>
<td>0.0023</td>
<td>4</td>
<td>1.00</td>
<td>7.8106</td>
<td>7.8124</td>
<td>7.8111</td>
<td>7.8136</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>572</td>
<td>11443.01</td>
<td>0.0052</td>
<td>0.0013</td>
<td>4</td>
<td>0.60</td>
<td>7.8140</td>
<td>7.8158</td>
<td>7.8142</td>
<td>7.8174</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>5872</td>
<td>11446.00</td>
<td>0.0041</td>
<td>0.0024</td>
<td>4</td>
<td>0.50</td>
<td>7.8134</td>
<td>7.8152</td>
<td>7.8132</td>
<td>7.8172</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>42172</td>
<td>11429.03</td>
<td>0.0027</td>
<td>0.0023</td>
<td>2</td>
<td>1.10</td>
<td>7.9321</td>
<td>7.9333</td>
<td>7.9320</td>
<td>7.9346</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>42272</td>
<td>11430.05</td>
<td>0.0017</td>
<td>0.0023</td>
<td>4</td>
<td>1.00</td>
<td>7.9326</td>
<td>7.9338</td>
<td>7.9316</td>
<td>7.9360</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>572</td>
<td>11443.01</td>
<td>0.0025</td>
<td>0.0033</td>
<td>4</td>
<td>0.60</td>
<td>7.9318</td>
<td>7.9331</td>
<td>7.9293</td>
<td>7.9368</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>5872</td>
<td>11446.00</td>
<td>0.0027</td>
<td>0.0041</td>
<td>4</td>
<td>0.50</td>
<td>7.9325</td>
<td>7.9338</td>
<td>7.9323</td>
<td>7.9353</td>
<td></td>
</tr>
</tbody>
</table>

### Line by line description of the example above

**FIL**
- 55 (y) or 47 (b)

**M D Y**
- UT date month, day, 2-digit year

**JD**
- Julian date minus 2,440,000

**VARSIG**
- Internal error std. dev. of planet minus mean of 2 comp stars

**COMPSIG**
- Internal error std. dev. of comp star2 minus comp star3
- Our naming scheme designates the planet object "1", hence the comp stars are "2" and "3"

**N**
- Number of measurement cycles, normally 4 each night in each filter

**ANG**
- Solar phase angle

**PRAW**
- Planet magnitude based on both comparison stars and corrected for distance and solar phase angle

**PCORR**
- Planet magnitude based on both comparison stars and corrected for distance, solar phase angle and the transformation color terms

**P2CORR**
- Planet magnitude based on comp star2 only

**P3CORR**
- Planet magnitude based on comp star3 only
**Sample from Neptune_summary.txt**

<table>
<thead>
<tr>
<th>FILT</th>
<th>JD</th>
<th>ERRPL</th>
<th>ERRCMP</th>
<th>N</th>
<th>SIGCMP</th>
<th>SIGPL</th>
<th>PRAW</th>
<th>P2RAW</th>
<th>P2CORR</th>
<th>P3CORR</th>
<th>PCORR</th>
<th>P3CORR</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>11461.0</td>
<td>0.0026</td>
<td>0.0025</td>
<td>12</td>
<td>0.0023</td>
<td>0.0023</td>
<td>7.8127</td>
<td>7.8120</td>
<td>7.8133</td>
<td>7.8144</td>
<td>7.8126</td>
<td>7.8163</td>
</tr>
<tr>
<td>47</td>
<td>11461.0</td>
<td>0.0021</td>
<td>0.0029</td>
<td>12</td>
<td>0.0028</td>
<td>0.0018</td>
<td>7.9318</td>
<td>7.9307</td>
<td>7.9330</td>
<td>7.9331</td>
<td>7.9311</td>
<td>7.9350</td>
</tr>
<tr>
<td>55</td>
<td>11829.8</td>
<td>0.0032</td>
<td>0.0039</td>
<td>18</td>
<td>0.0033</td>
<td>0.0043</td>
<td>7.8043</td>
<td>7.8034</td>
<td>7.8053</td>
<td>7.8045</td>
<td>7.8028</td>
<td>7.8063</td>
</tr>
<tr>
<td>47</td>
<td>11829.9</td>
<td>0.0026</td>
<td>0.0026</td>
<td>18</td>
<td>0.0030</td>
<td>0.0042</td>
<td>7.9302</td>
<td>7.9307</td>
<td>7.9298</td>
<td>7.9304</td>
<td>7.9302</td>
<td>7.9306</td>
</tr>
<tr>
<td>55</td>
<td>12209.5</td>
<td>0.0055</td>
<td>0.0051</td>
<td>20</td>
<td>0.0028</td>
<td>0.0042</td>
<td>7.7972</td>
<td>7.7967</td>
<td>7.7977</td>
<td>7.7972</td>
<td>7.7957</td>
<td>7.7987</td>
</tr>
<tr>
<td>47</td>
<td>12209.5</td>
<td>0.0045</td>
<td>0.0056</td>
<td>20</td>
<td>0.0055</td>
<td>0.0030</td>
<td>7.9203</td>
<td>7.9209</td>
<td>7.9196</td>
<td>7.9203</td>
<td>7.9201</td>
<td>7.9206</td>
</tr>
<tr>
<td>55</td>
<td>12549.2</td>
<td>0.0043</td>
<td>0.0050</td>
<td>8</td>
<td>0.0040</td>
<td>0.0049</td>
<td>7.7936</td>
<td>7.7938</td>
<td>7.7933</td>
<td>7.7935</td>
<td>7.7929</td>
<td>7.7942</td>
</tr>
<tr>
<td>47</td>
<td>12549.2</td>
<td>0.0048</td>
<td>0.0054</td>
<td>8</td>
<td>0.0034</td>
<td>0.0040</td>
<td>7.9148</td>
<td>7.9122</td>
<td>7.9175</td>
<td>7.9148</td>
<td>7.9114</td>
<td>7.9183</td>
</tr>
</tbody>
</table>

**Line by line description of the example above**

- **FILT**: filter 55 (y) or 47 (b)
- **JD**: Julian date minus 2,440,000
- **ERRPL**: standard deviation of the planetary magnitudes for N nights
- **ERRCMP**: standard deviation of the comp star differential magnitudes for N nights
- **N**: number of nights
- **SIGCMP**: average intra-night comparison star differential magnitude error
- **SIGPL**: std. dev. of the planetary magnitude for the apparition
- **PRAW**: seasonal average planet magnitude based on both comp stars
- **P2RAW**: seasonal average planet magnitude based on comp star2 only
- **P3RAW**: seasonal average planet magnitude based on comp star3 only
- **PCORR**: color-corrected seasonal average planet magnitude
- **P2CORR**: seasonal average planet magnitude based on comp star2 only
- **P3CORR**: seasonal average planet magnitude based on comp star3 only