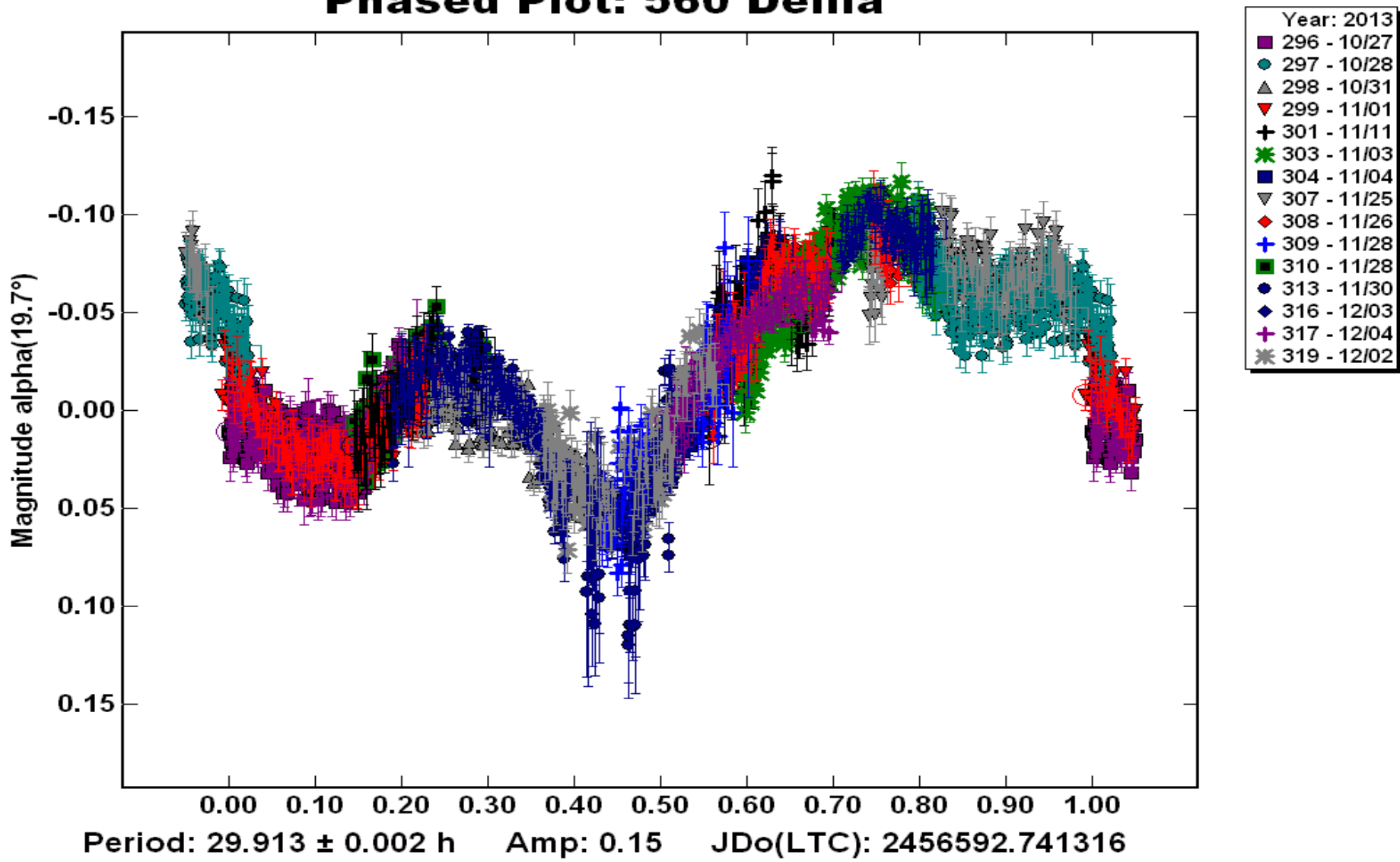


### Phased Plot: 560 Delila



**Summary**

Assumptions ..... 2

Organ Mesa Observatory collaboration request..... 2

Initial data..... 2

Analysis ..... 18

Conclusion ..... 27

**Assumptions**

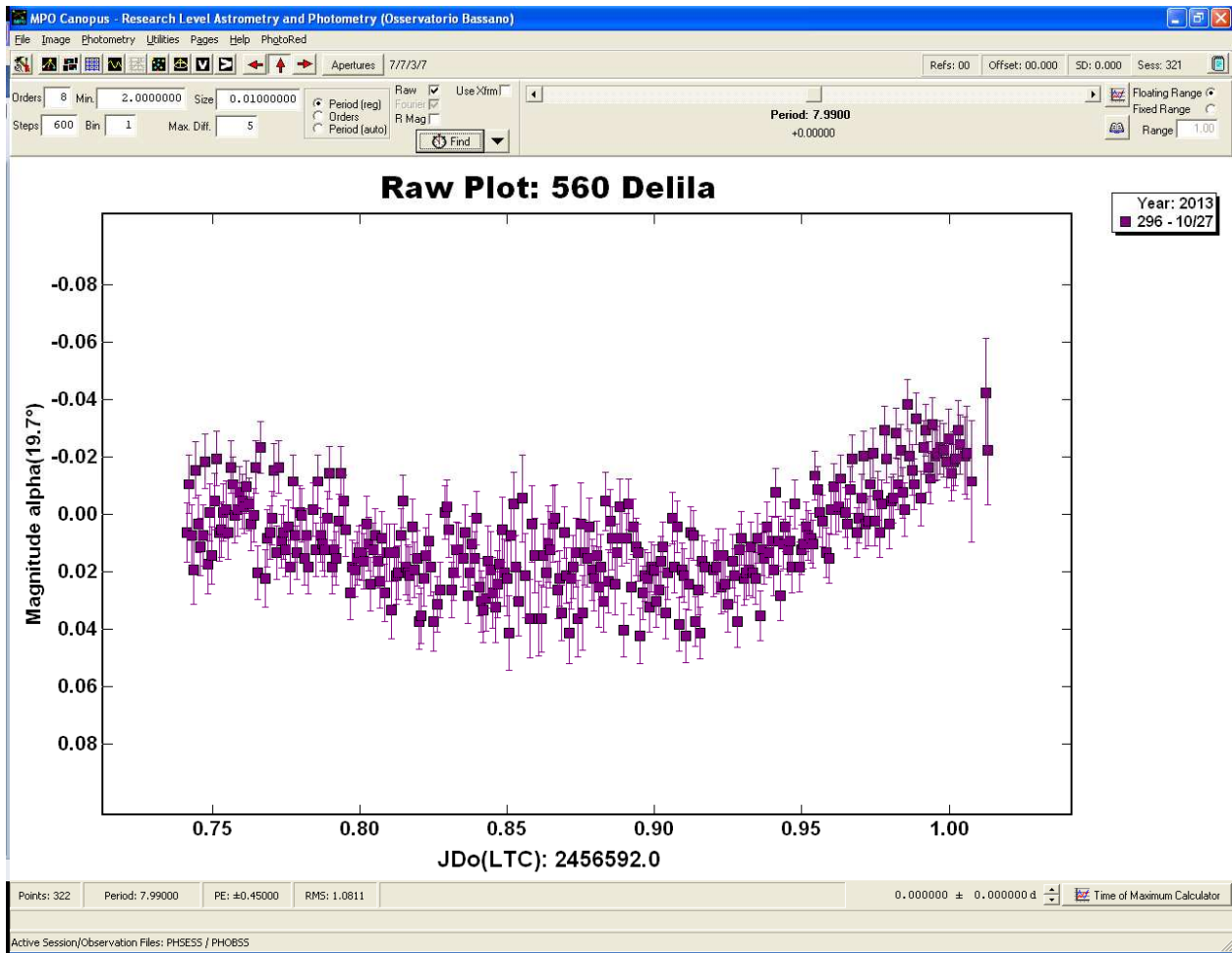
Discovered 13/03/1905 at Heidelberg observatory by Max Wolf  
 Semi-major axis: 2.7518UA  
 Orbital eccentricity: 0.1598  
 Orbital inclination: 8.4673°  
 Diameter 37.2 Km

**Organ Mesa Observatory collaboration request**

On November 2013 we received request from Mr. Frederick Pilcher (Organ Mesa Observatory) about observation on this minor planet. Preliminary observations have arose a period near to 30 hours and amplitude 0.15 Mag. For a complete curve coverage he needed help from observer with different longitude. We was pleased to have this collaboration and we took 16 sessions between November 6<sup>th</sup> and December 7th. No previous period is available.

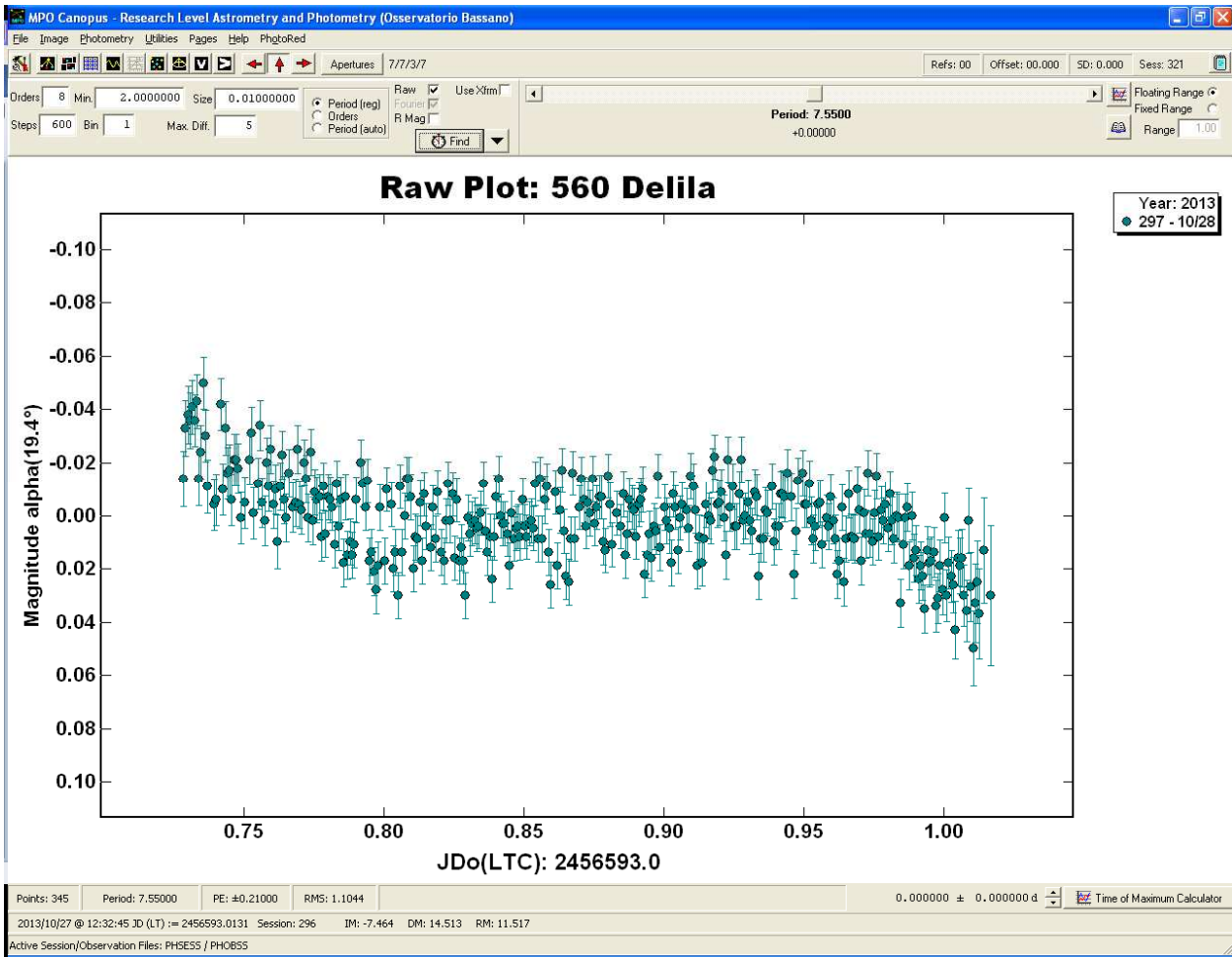
**Initial data**

Analysis was done taking measurement taken between 27/10/2013 and 04/12/2013.  
 Magnitude was converted in R using CMC14 catalog, VizieR Service on web site and the formula:  $R=r'mag-0.22$   
 Observations cover 38 days span.  
 These sessions was included

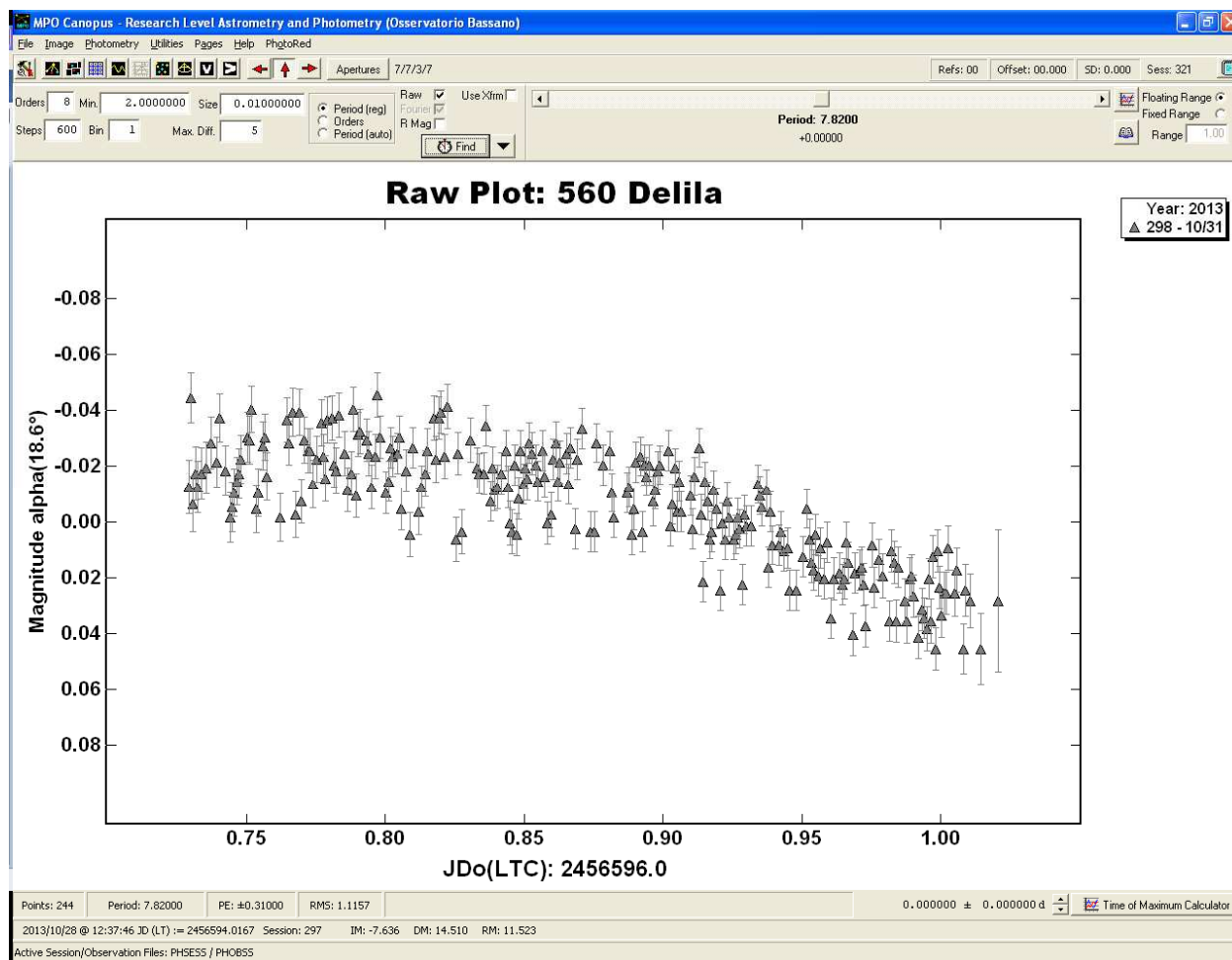


Session 296 from Organ Mesa Observatory

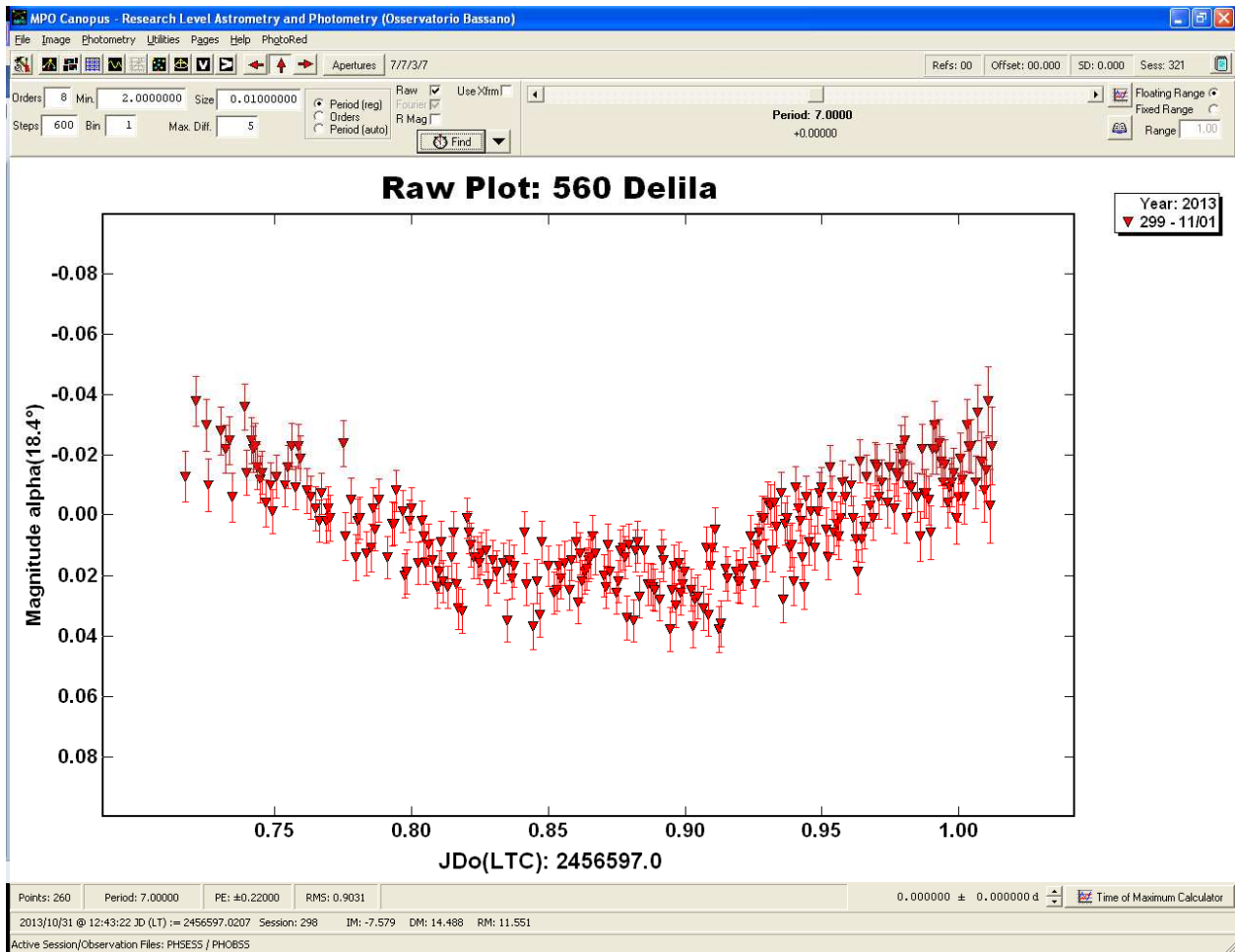
322 points in 6:30 hours



Session 297 from Organ Mesa Observatory  
345 points in 7:00 hours

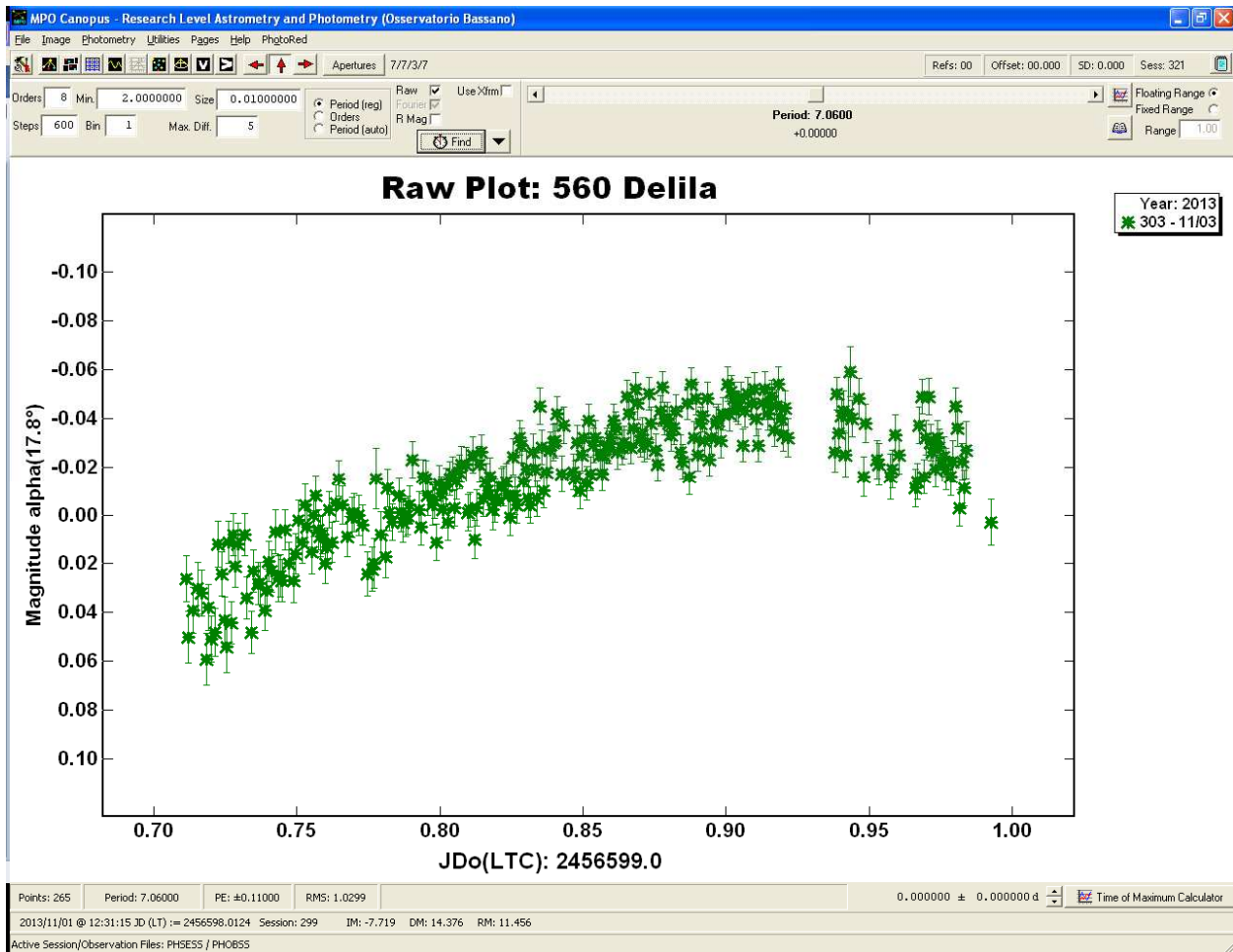


Session 298 from Organ Mesa Observatory  
244 points in 6:00 hours

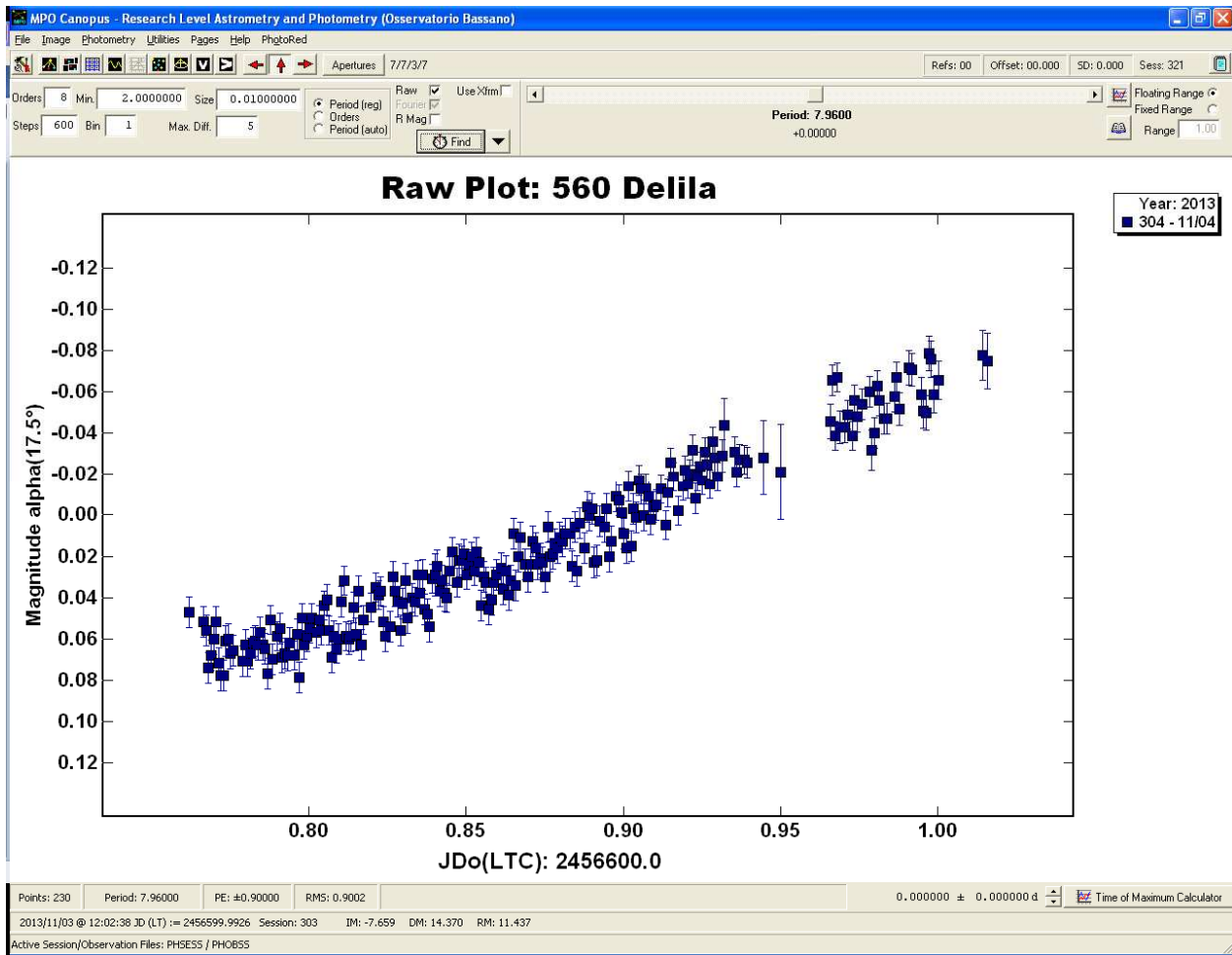


Session 299 from Organ Mesa Observatory

260 points in 7:00 hours

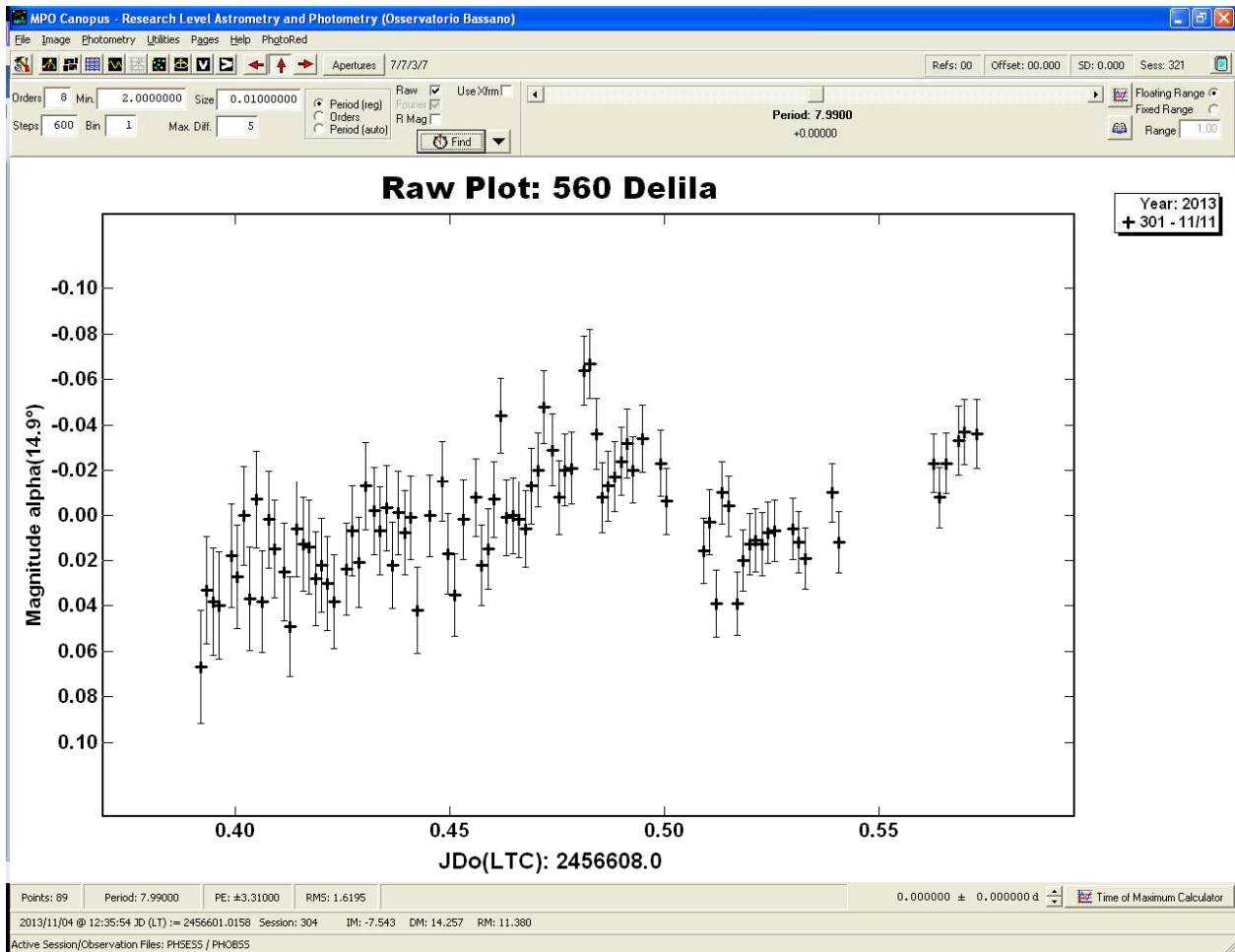


Session 303 from Organ Mesa Observatory  
265 points in 6:40 hours

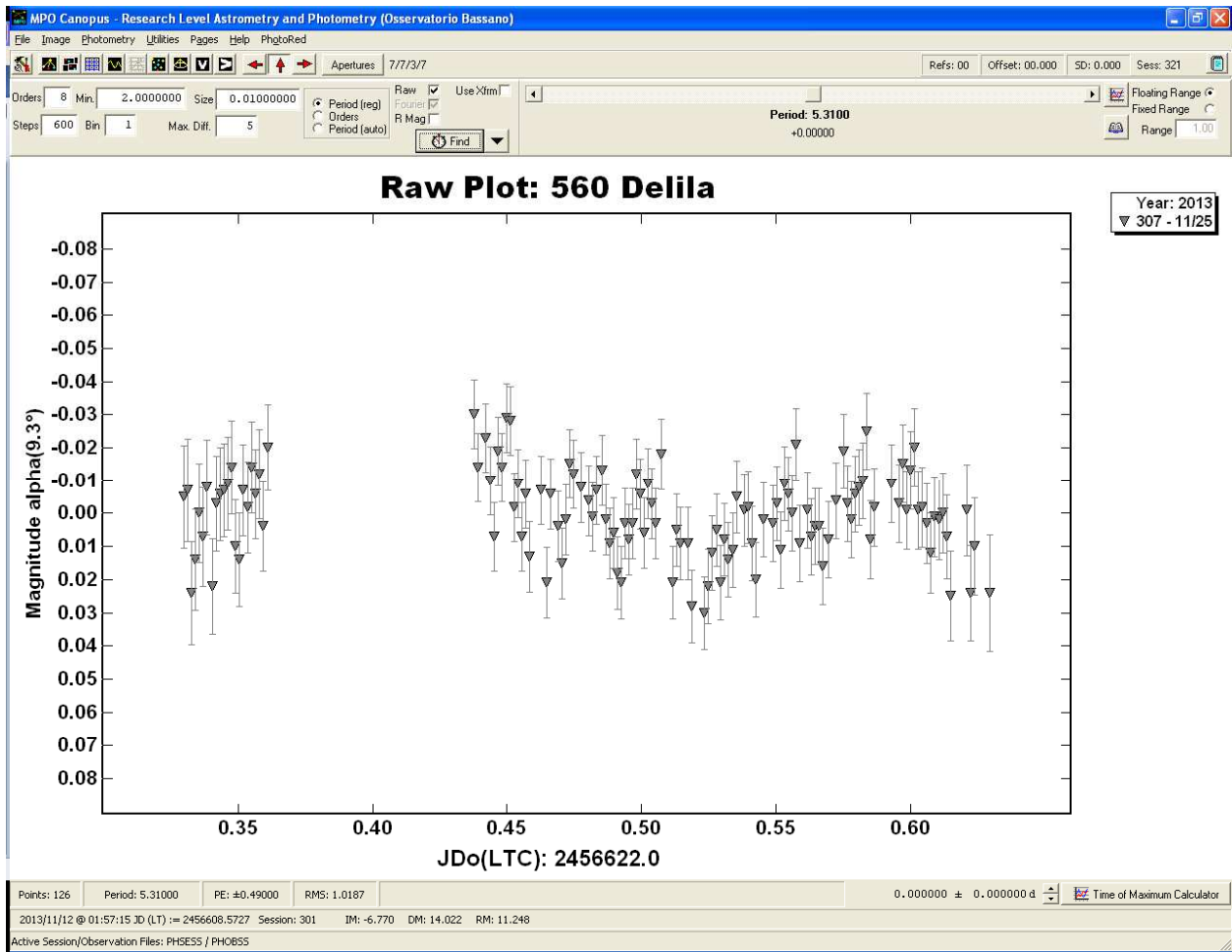


Session 304 from Organ Mesa Observatory  
230 points in 6:00 hours

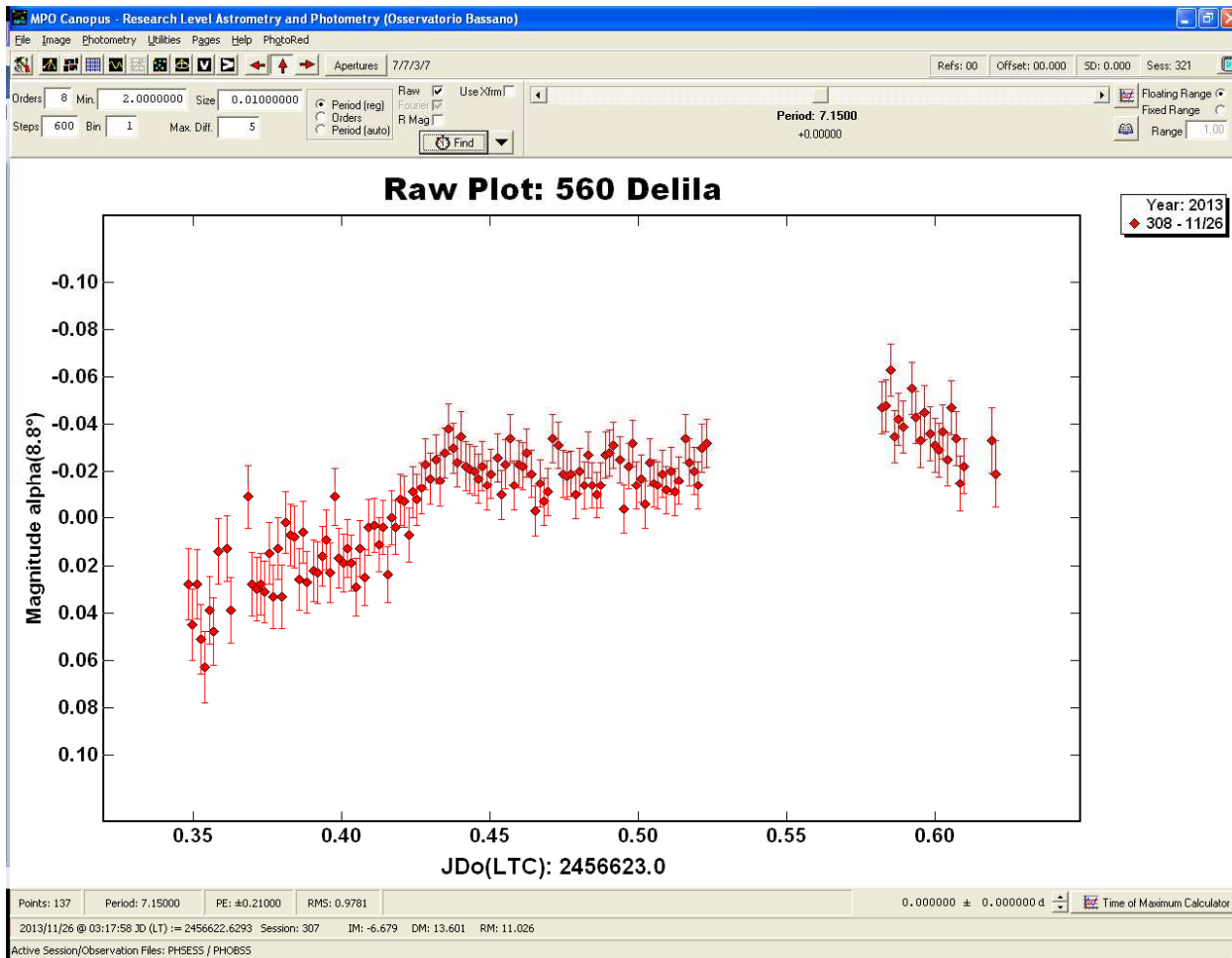




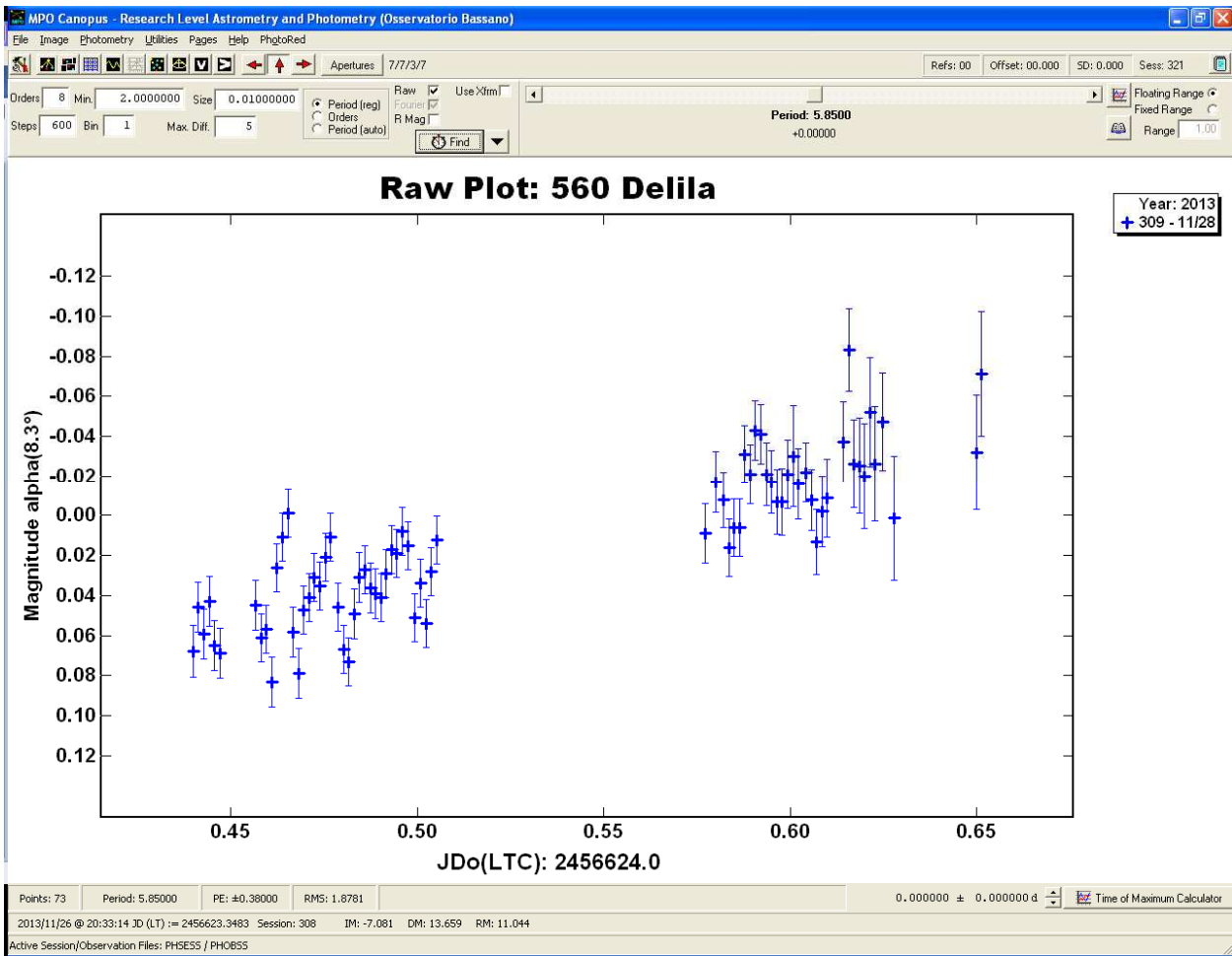
Session 301 from Bassano Bresciano Observatory  
89 points in 4:20 hours



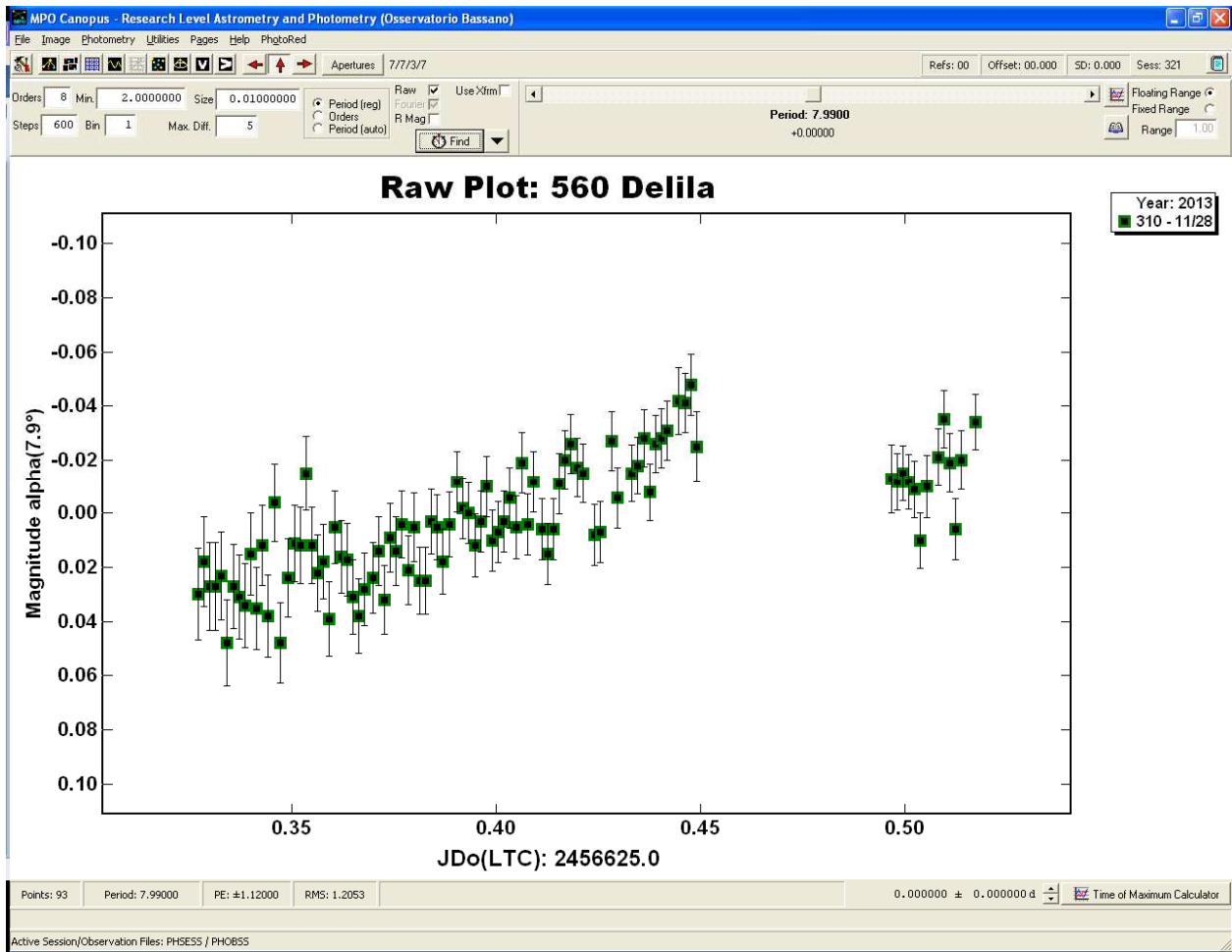
Session 307 from Bassano Bresciano Observatory  
126 points in 7:10 hours



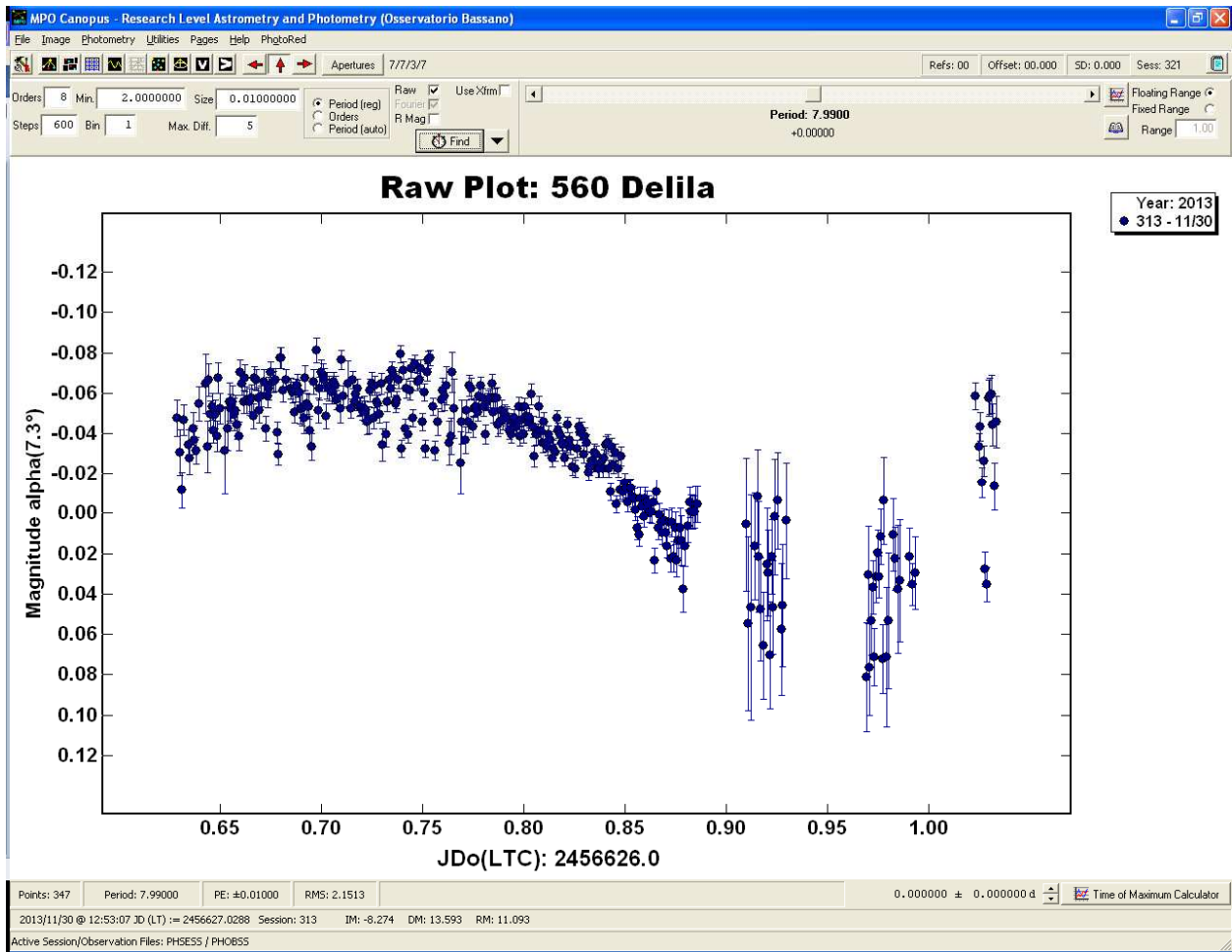
Session 308 from Bassano Bresciano Observatory  
 137 points in 5:30 hours



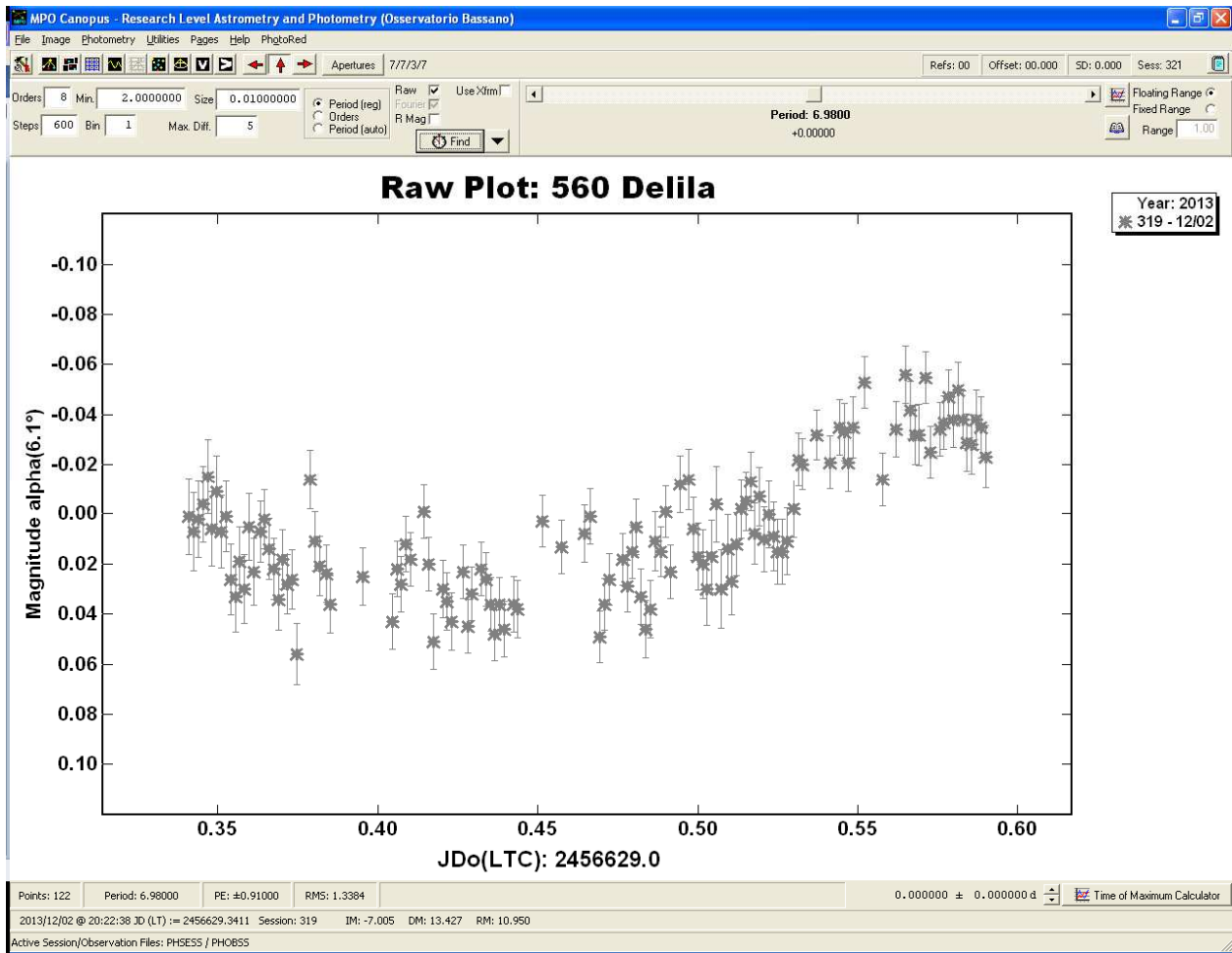
Session 309 from Bassano Bresciano Observatory  
73 points in 5:00 hours



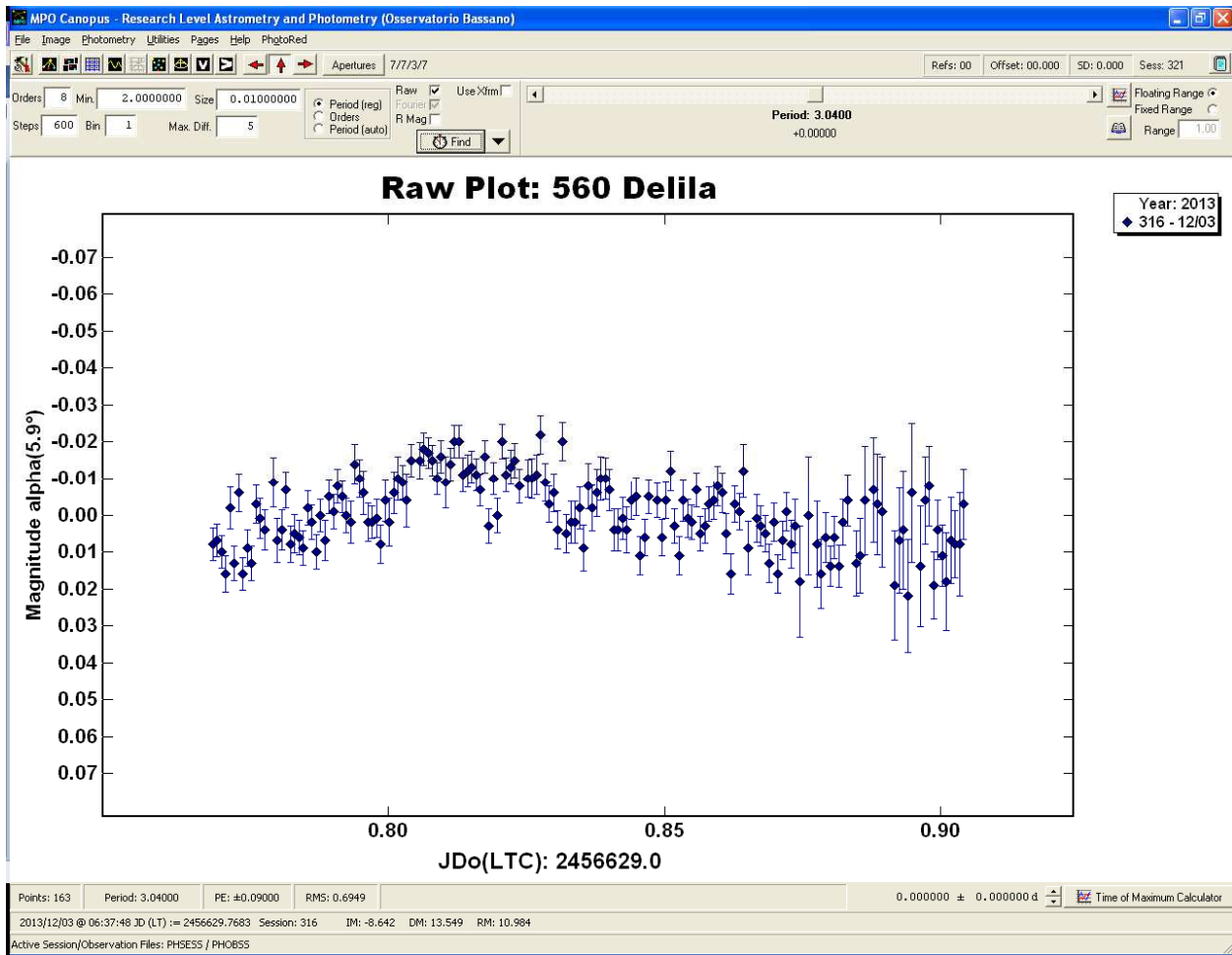
Session 310 from Bassano Bresciano Observatory  
 93 points in 4:30 hours



Session 313 from Organ Mesa Observatory  
 347 points in 9:00 hours

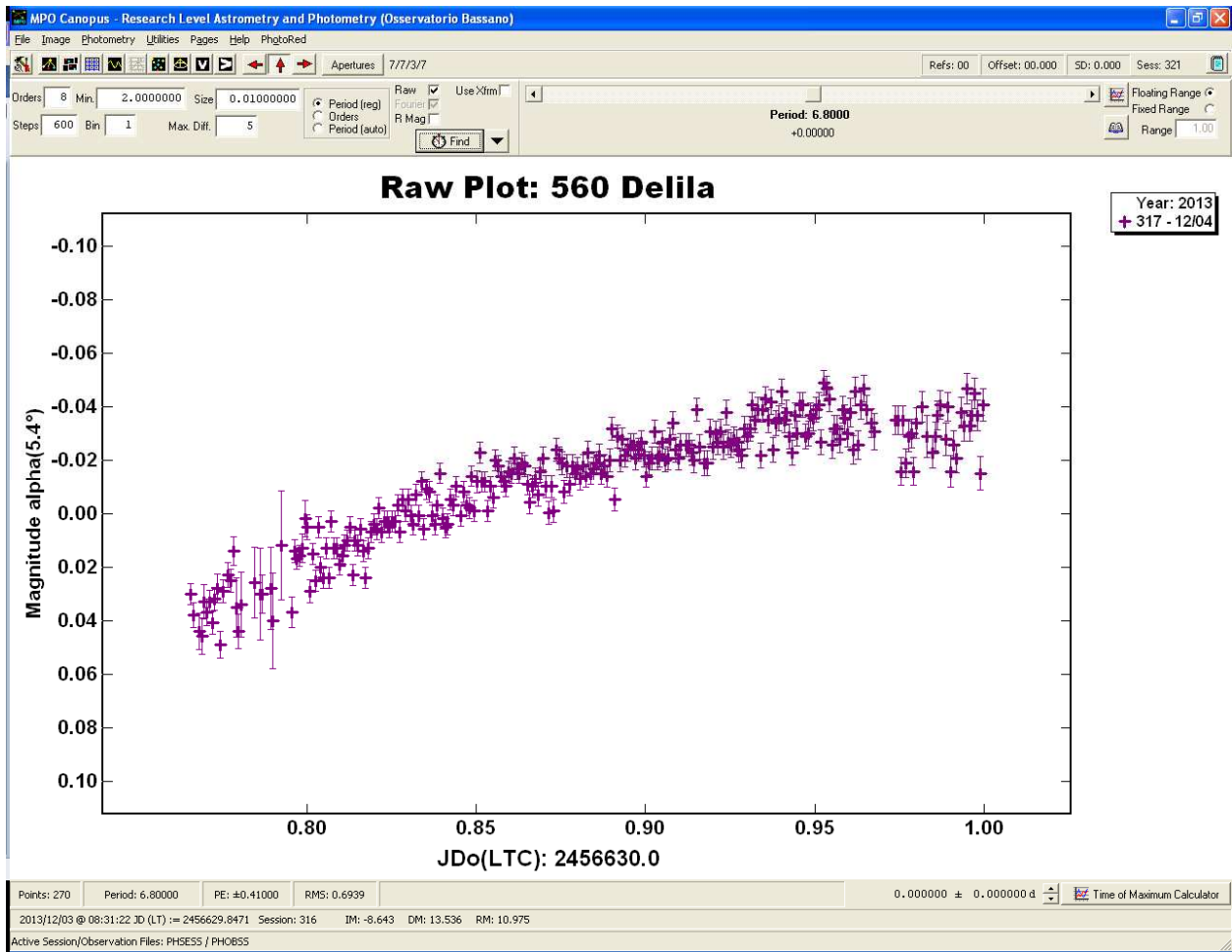


Session 319 from Bassano Bresciano Observatory  
122 points in 6:00 hours



Session 316 from Organ Mesa Observatory  
163 points in 3:20 hours

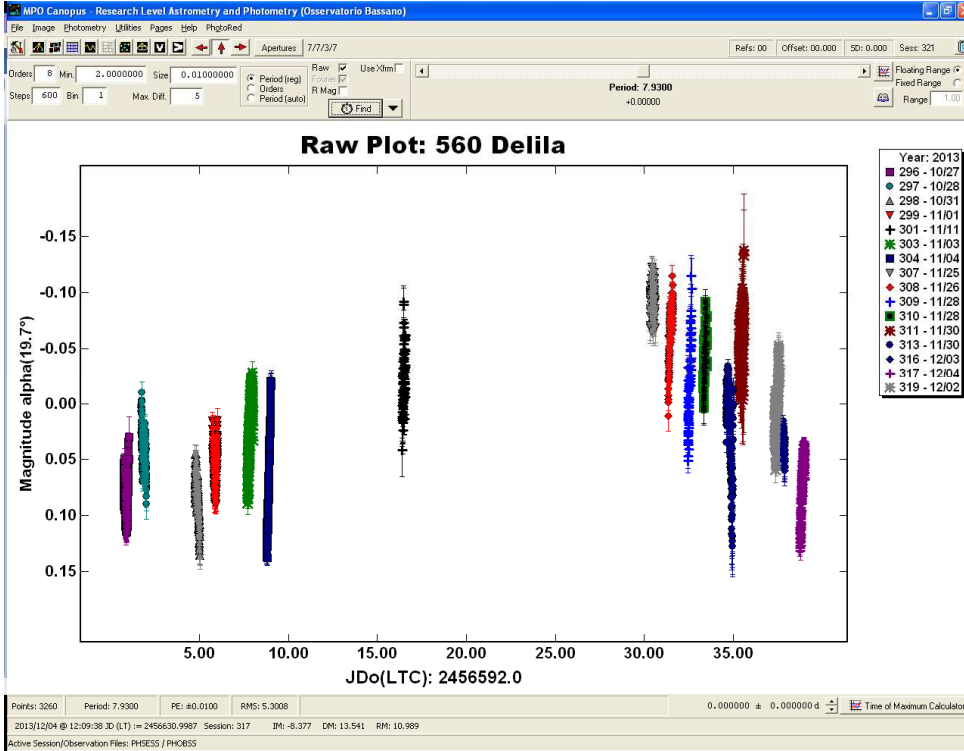




Session 317 from Organ Mesa Observatory  
270 points in 5:40 hours

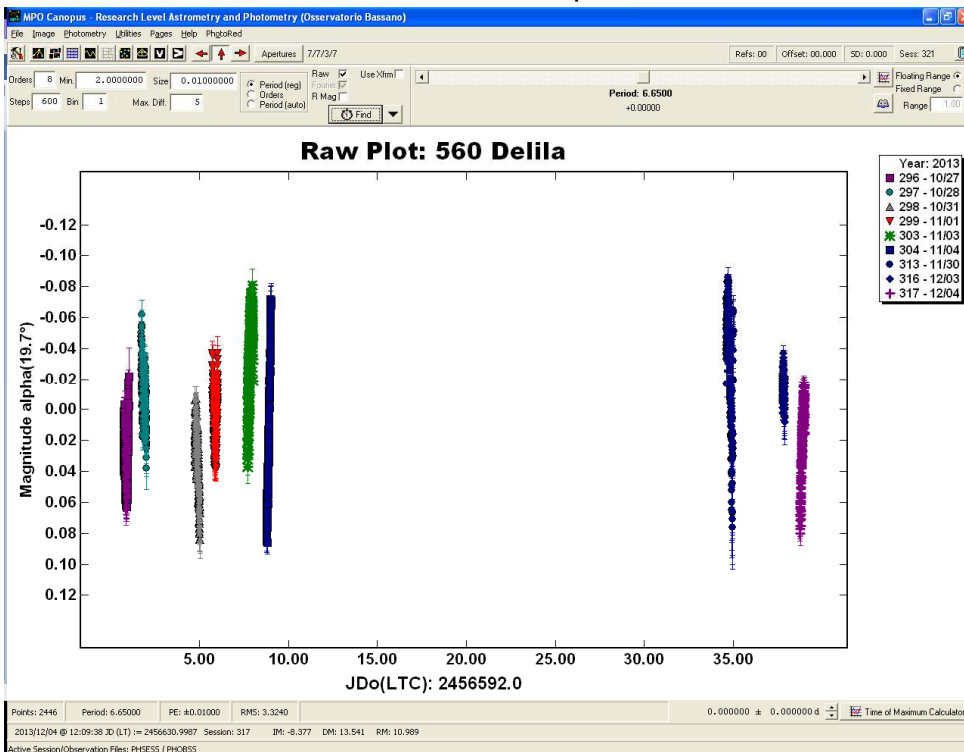
## Analysis

A first check was done with all raw values.

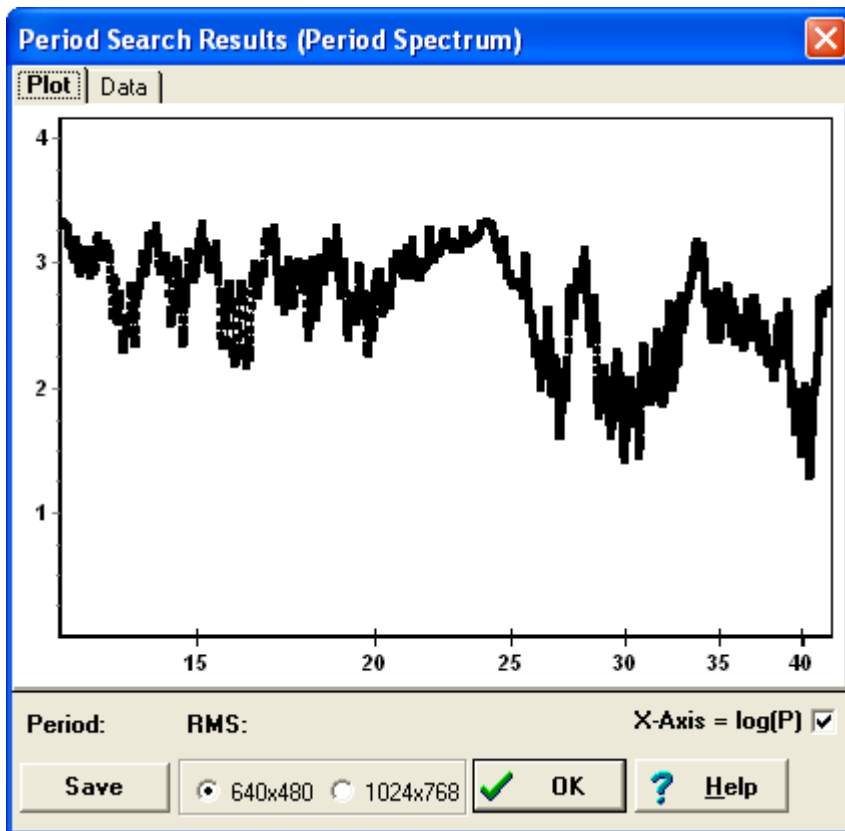


Amplitude is very low and there is a systematic shift up on Bassano Bresciano magnitudes compared with Organ Mesa ones. This can compromise the period search.

In a preliminary stage only Organ Mesa sessions was used. From these sessions 313 was excluded because it seems too shifted up.

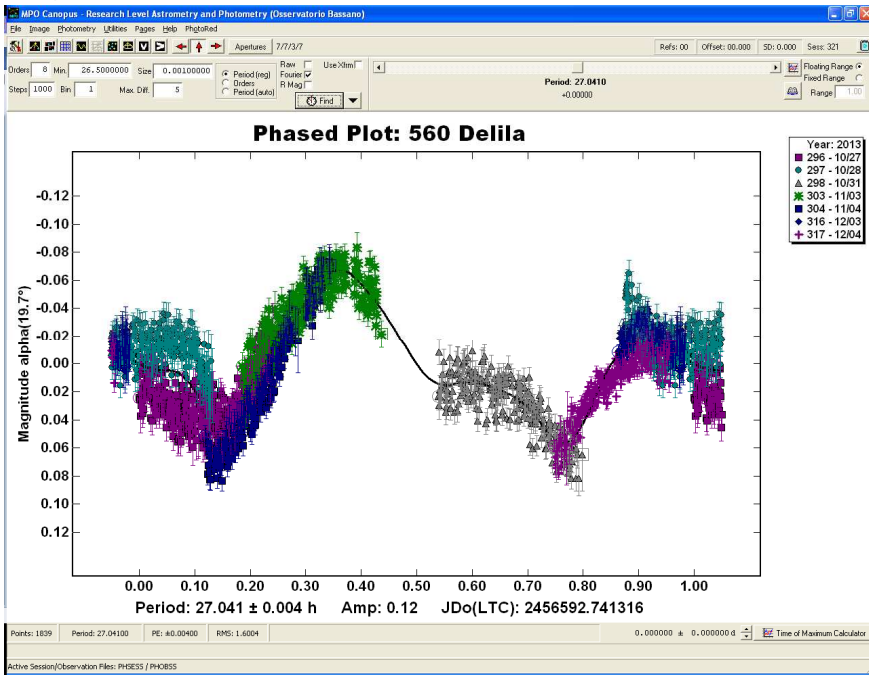


Longest session don't show only a part of period so it should be greater than 12 hours  
A first analysis was done in the range between 12 and 42 hours with step 0.01.  
This is period spectrum.

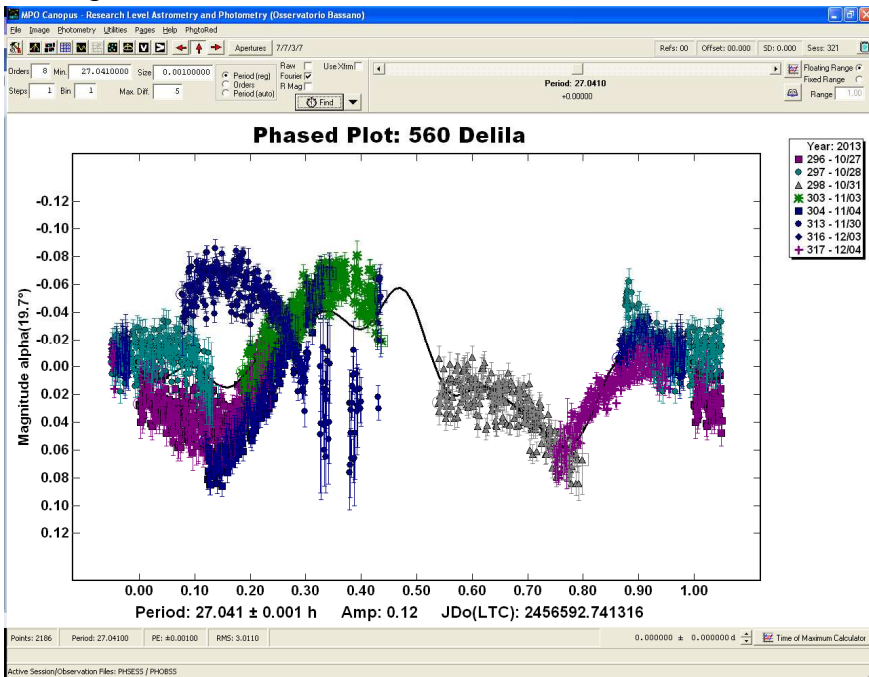


It shows possible rotation time at: 27.0, 30.0, 40.5 hours

An analysis in the range between 26.5 and 27.5 hours with step 0.001 shows this phase diagram.

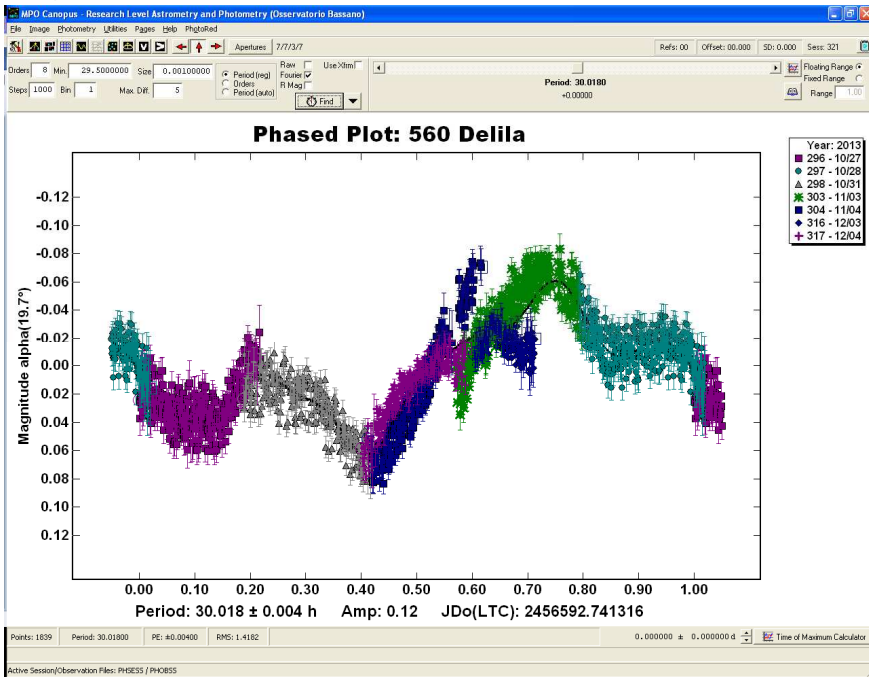


Adding session 313

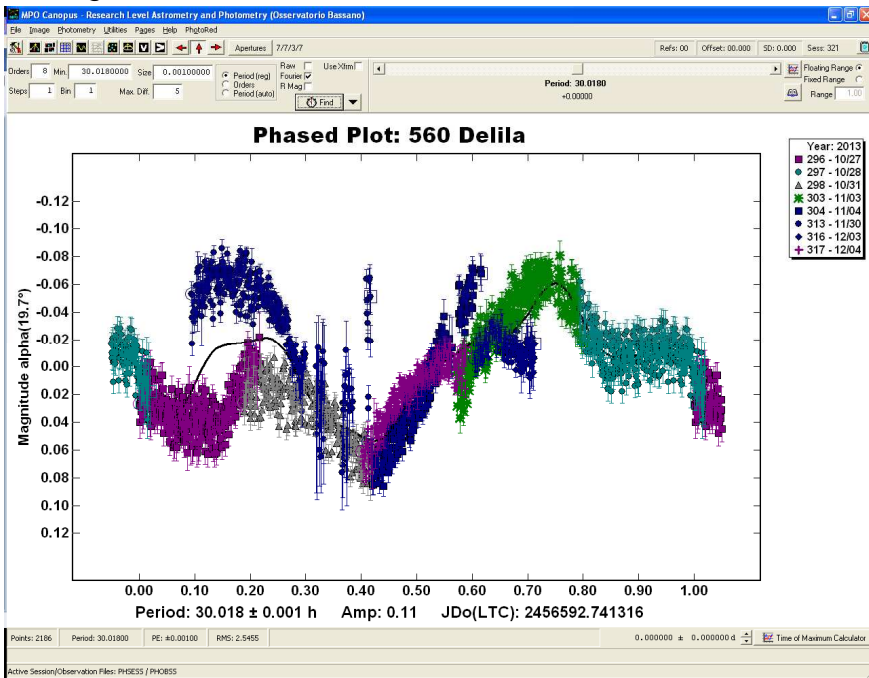


No correlation

An analysis in the range between 29.5 and 30.5 hours with step 0.001 shows this phase diagram.

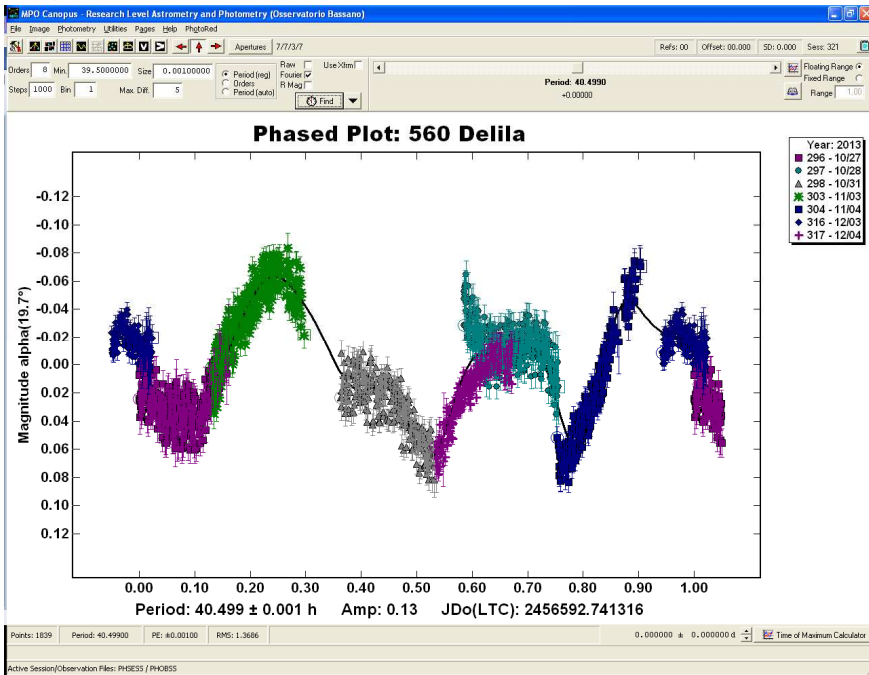


Adding session 313

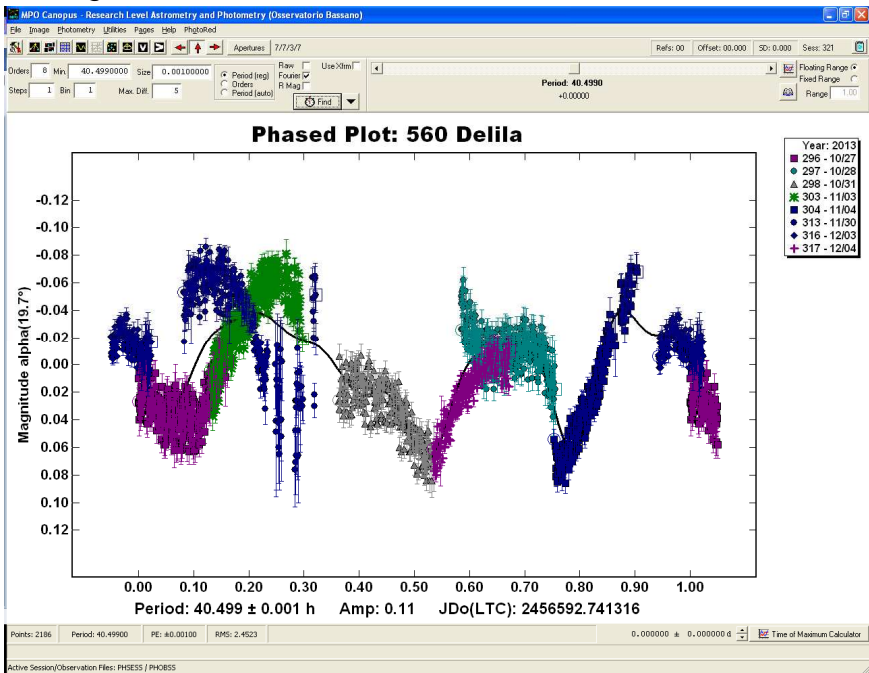


Correlation seems be possible applying a shift down to session 313

An analysis in the range between 39.5 and 40.5 hours with step 0.001 shows this phase diagram.



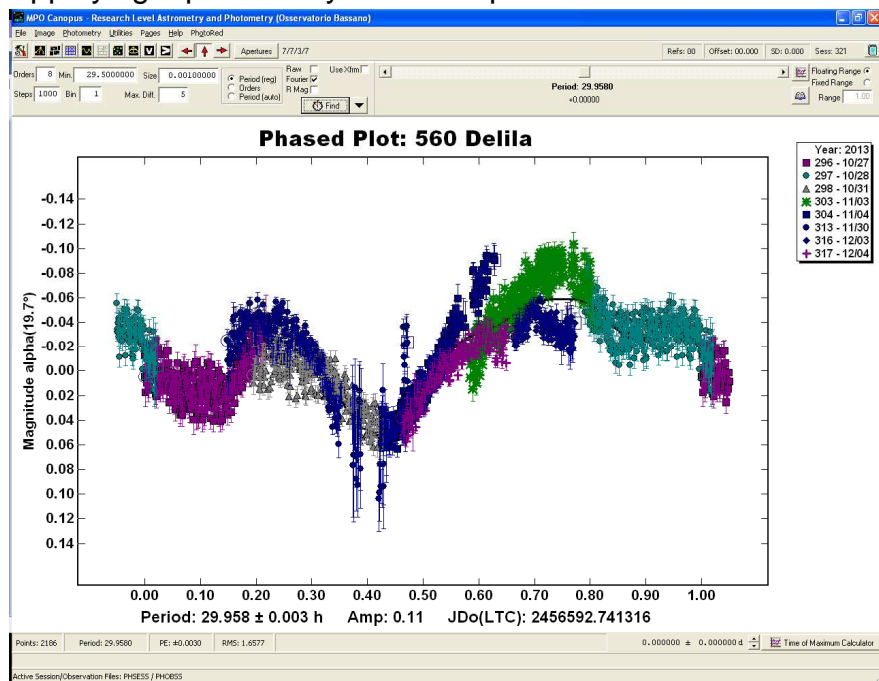
Adding session 313



Three maximum lightcurve

The only possible period is near 30 hours.

Applying a preliminary delta comp. 0.050 to session 313

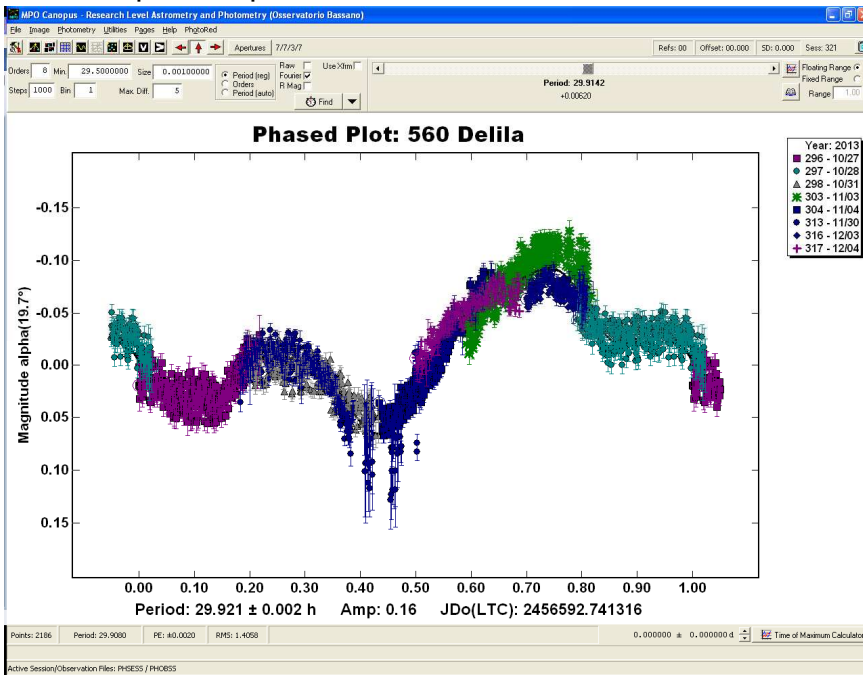


After that we adjusted delta comps roughly. These was set assuming as reference the session 304. Others sessions was adjusted running many time period finding trying different delta comp. values util RMS decrease. These was done for all sessions. Each time was found a value minimizing RMS the operation was replied on all other sessions. Process was stopped when any change in any session would make RMS greater.

At the end delta comp sessions is

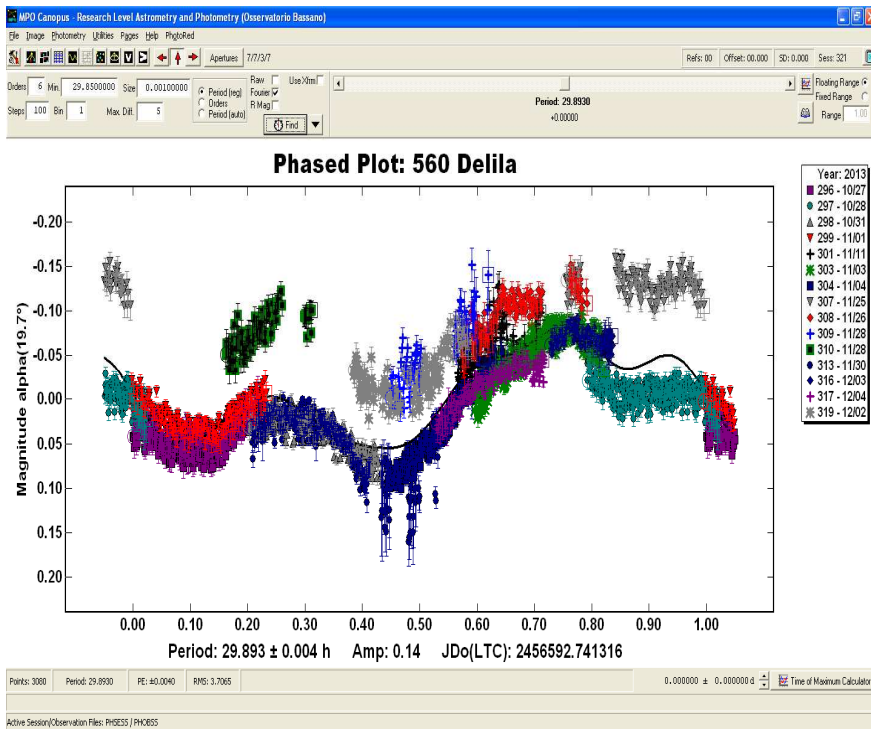
296	0.010
297	0.000
298	0.000
303	-0.030
304	0.000
313	0.070
316	-0.040
317	-0.050

With this phased plot.



Including sessions from Bassano Bresciano observatory





It is a very good correlation even if Bassano Bresciano sessions are shifted up round about 0.010 mag. This enforce the period = 29.92 hours

After that we adjusted delta comps strongly. These was set assuming as reference the session 304. Others sessions was adjusted running many time period finding trying different delta comp. values util RMS decrease. These was done for all sessions. Each time was found a value minimizing RMS the operation was replied on all other sessions. Process was stopped when any change in any session would make RMS greater.

At the end delta comp sessions is

296	0.000
297	-0.030
298	-0.010
299	0.020
301	0.040
303	-0.020
304	0.000
307	0.090
308	0.070
309	0.100
310	0.100
313	0.060
316	-0.060

With this phased plot.

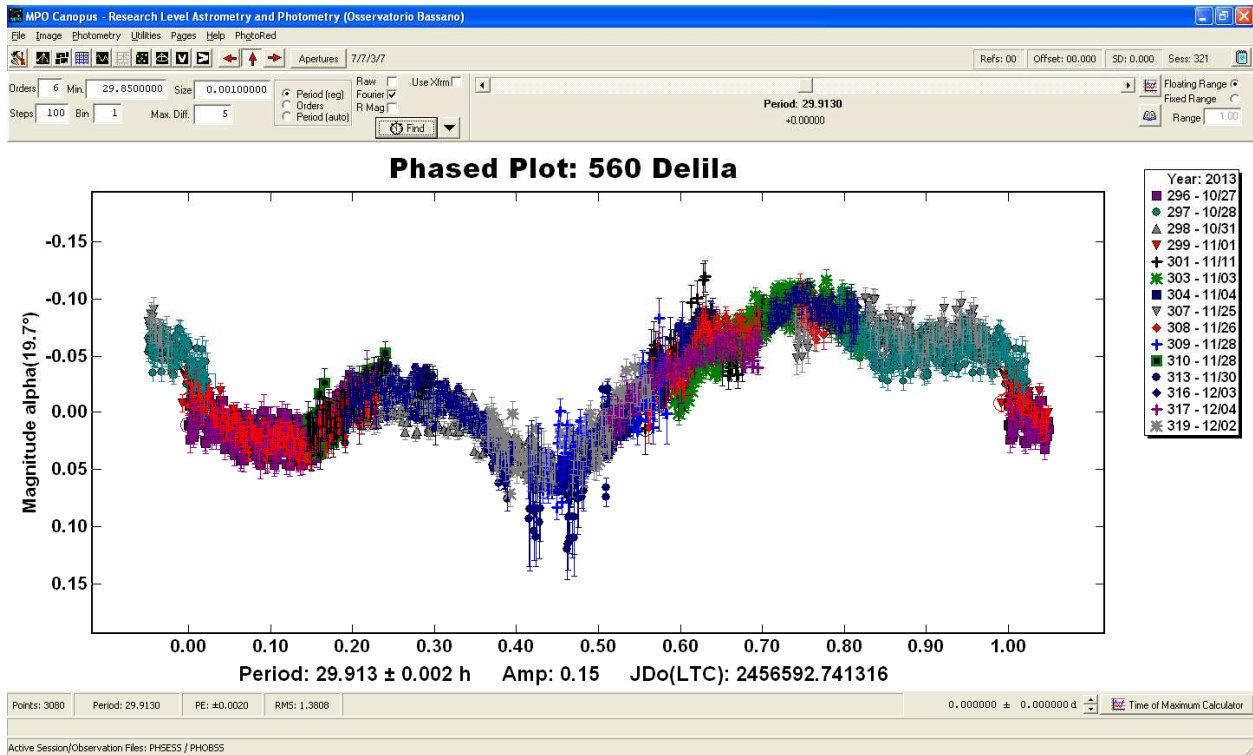


Diagram shows a period 29.913 hours and amplitude 0.15 Mag.

**Conclusion**

Tank to Mr Frederick Pilcher for our involvement on this collaborative masurement.  
Lightcurve coverage is full. Organ Mesa and Bassano Bresciano measurement agree with a very good confidence level with period 29.913 hours and amplitude 0.15 Mag.