

Increasing the accuracy of IR light curves. Close to habitability ?

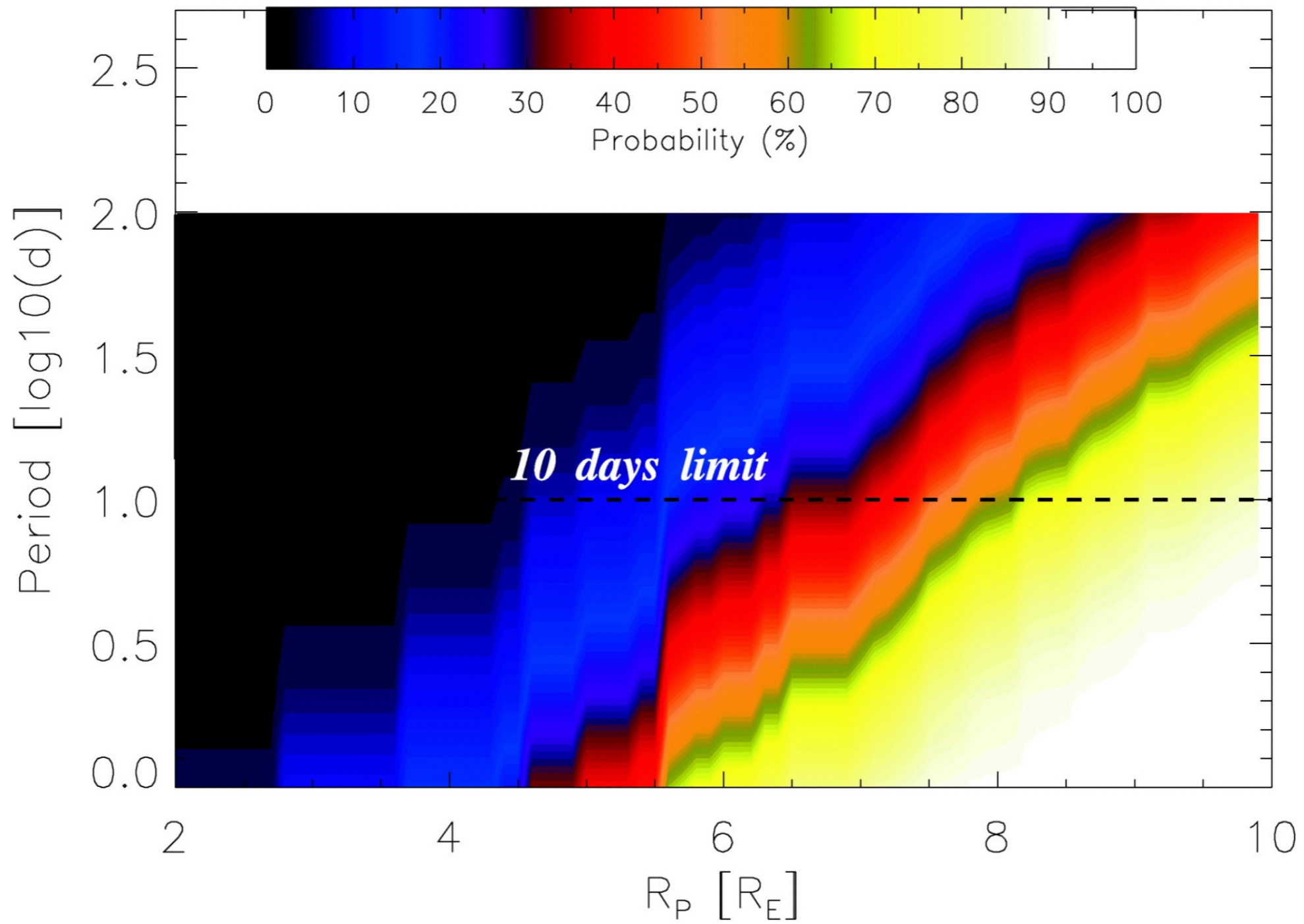
Dimitris Mislis
IoA - Cambridge

RoPACS Workshop
Lisbon 2010

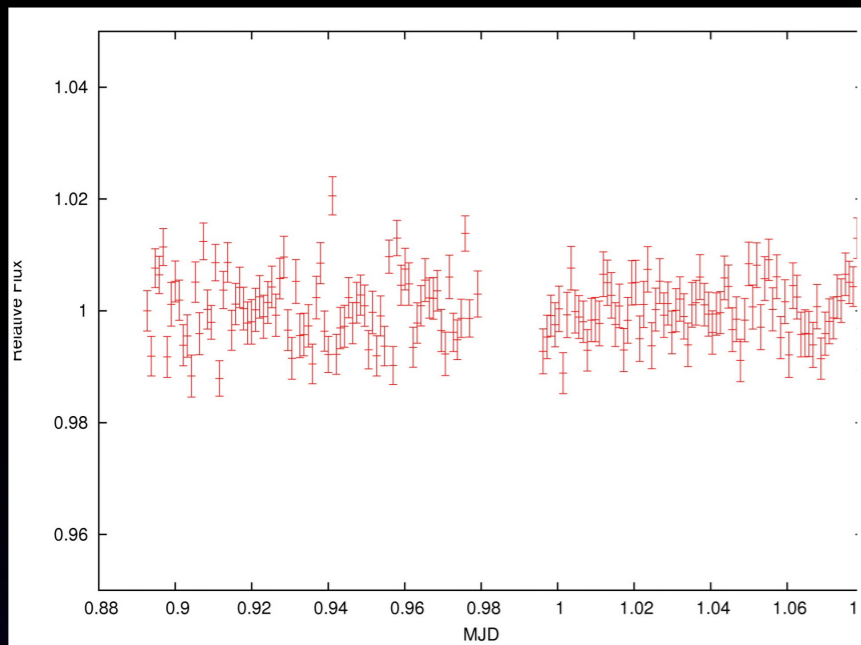
Outline

- RoPACS probability map : What we expect
- Increasing the accuracy : Detrend Survey Transiting Light-curves (DSTL)
- DSTL - Step by step : Examples
- Detection algorithm : Searching with OCC-fit
- Habitability : HZ probabilities - 19h field
- Conclusions - Future work

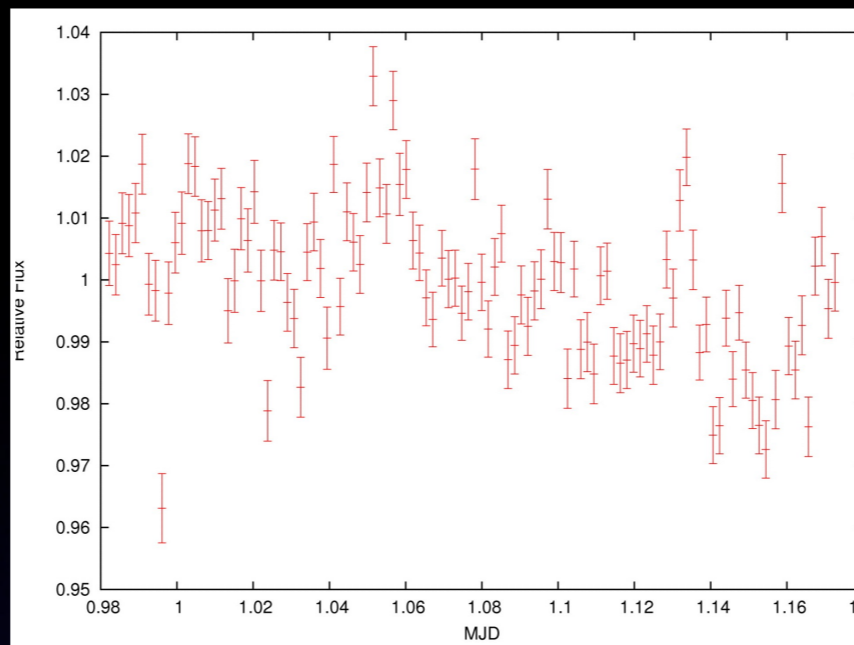
- RoPACS probability map : What we expect
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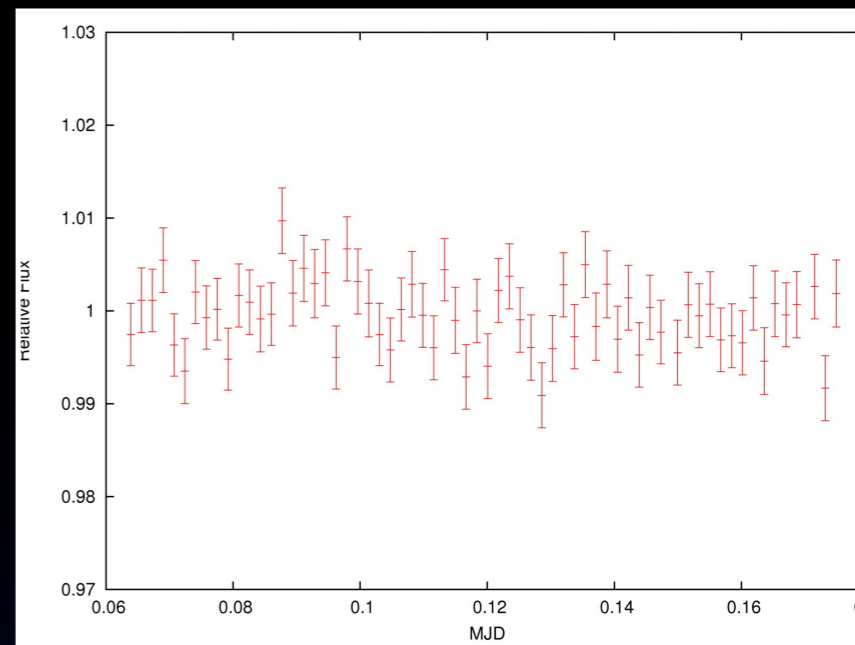
Probability map - 19h field



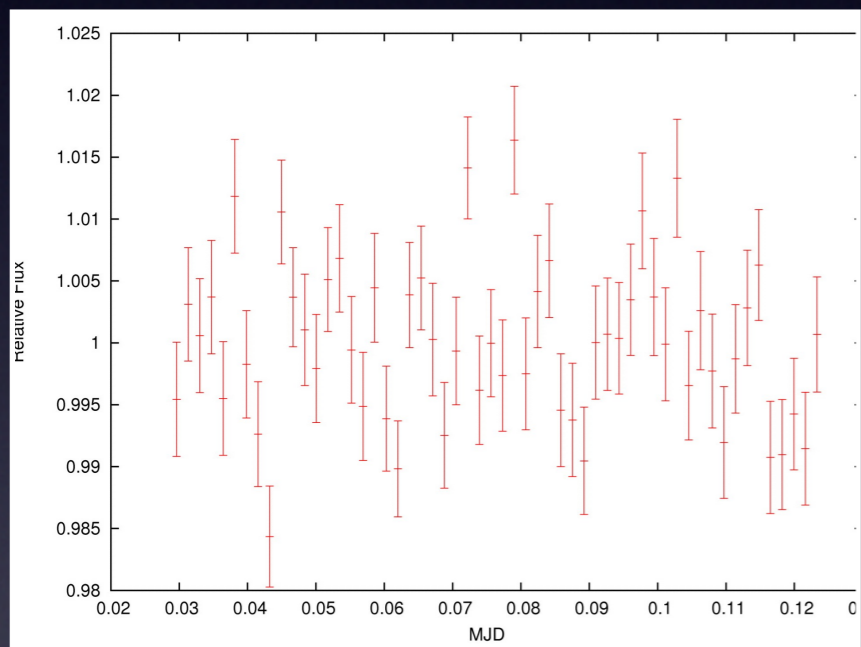
19b_1_02311



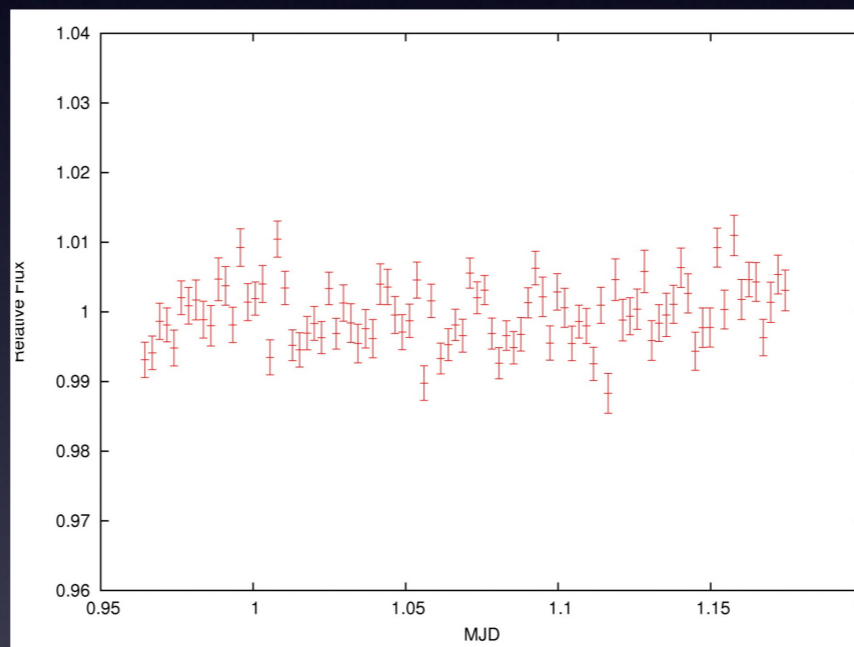
19f_2_02883



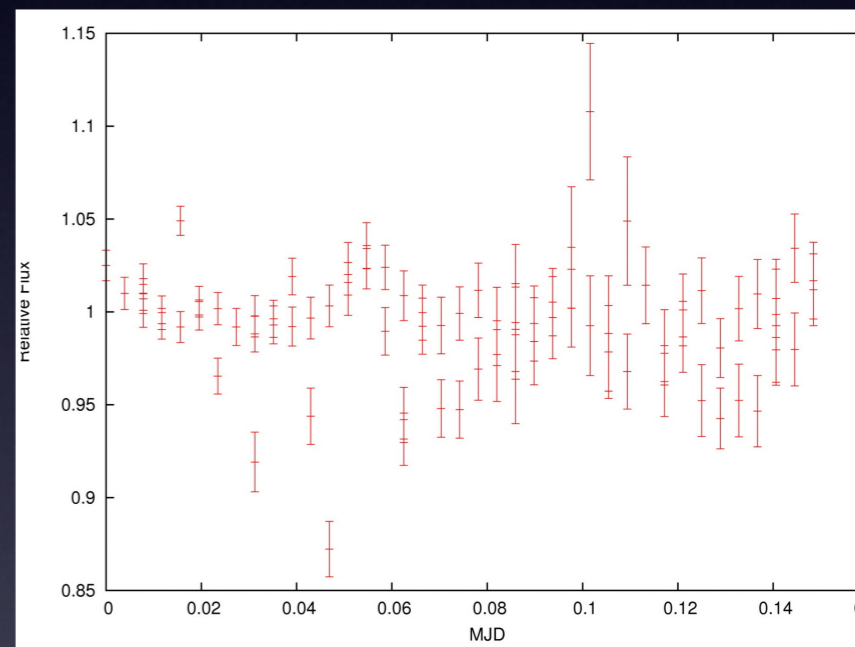
19b_3_11113



19e_3_12062

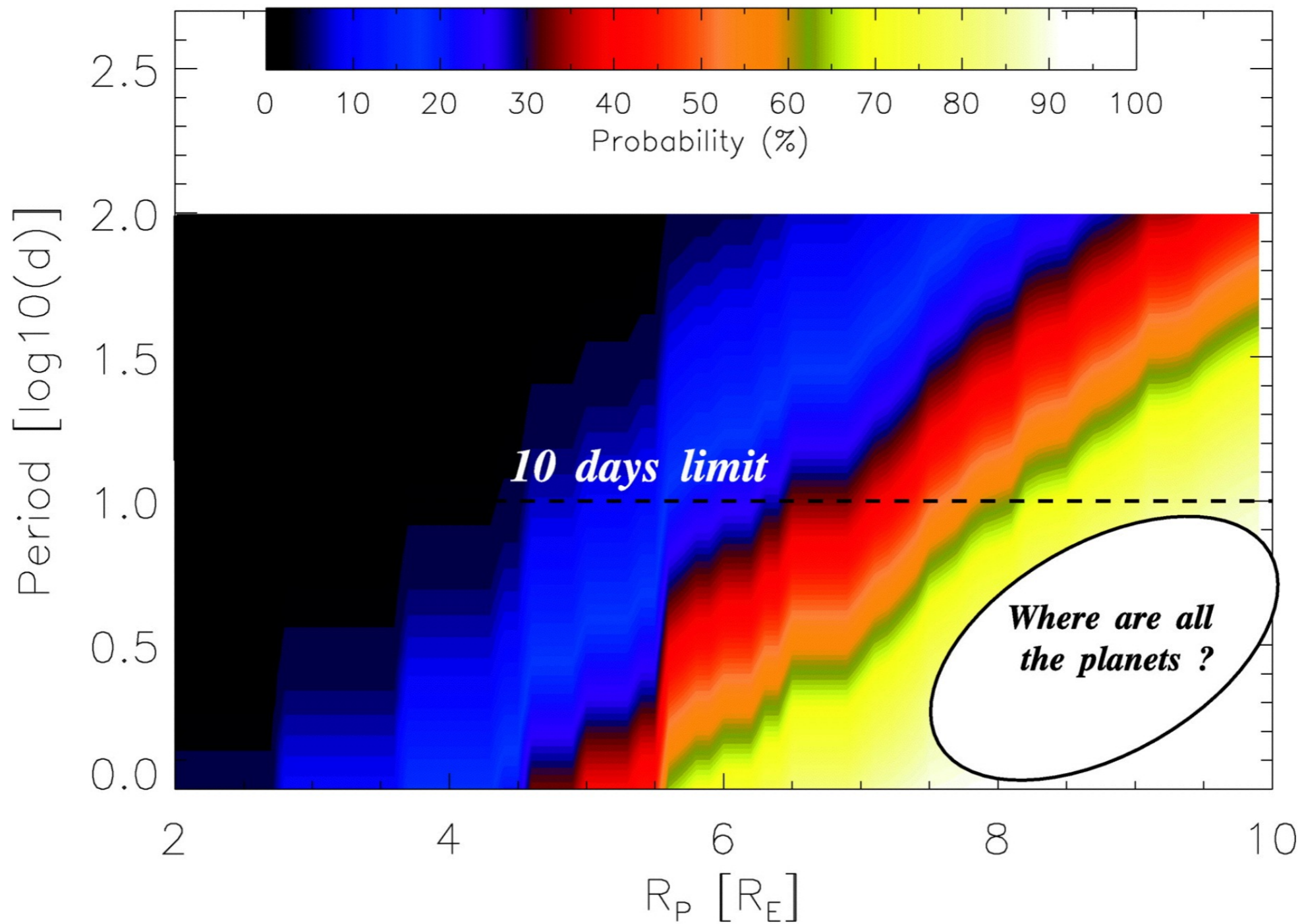


19b_3_12432



19d_2_12626

INT follow-up : July 2010



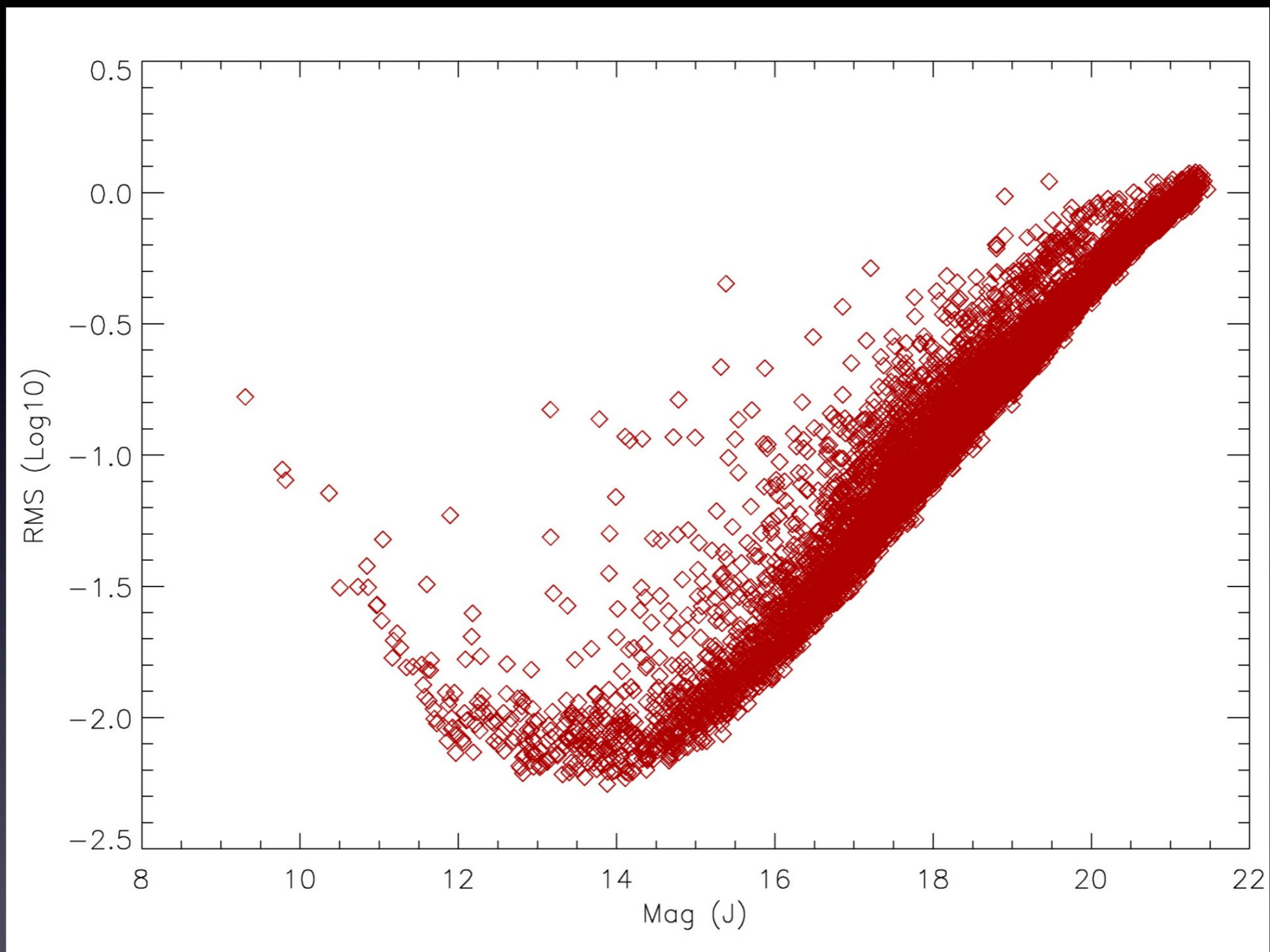
Probability map - 19h field

Three main reasons

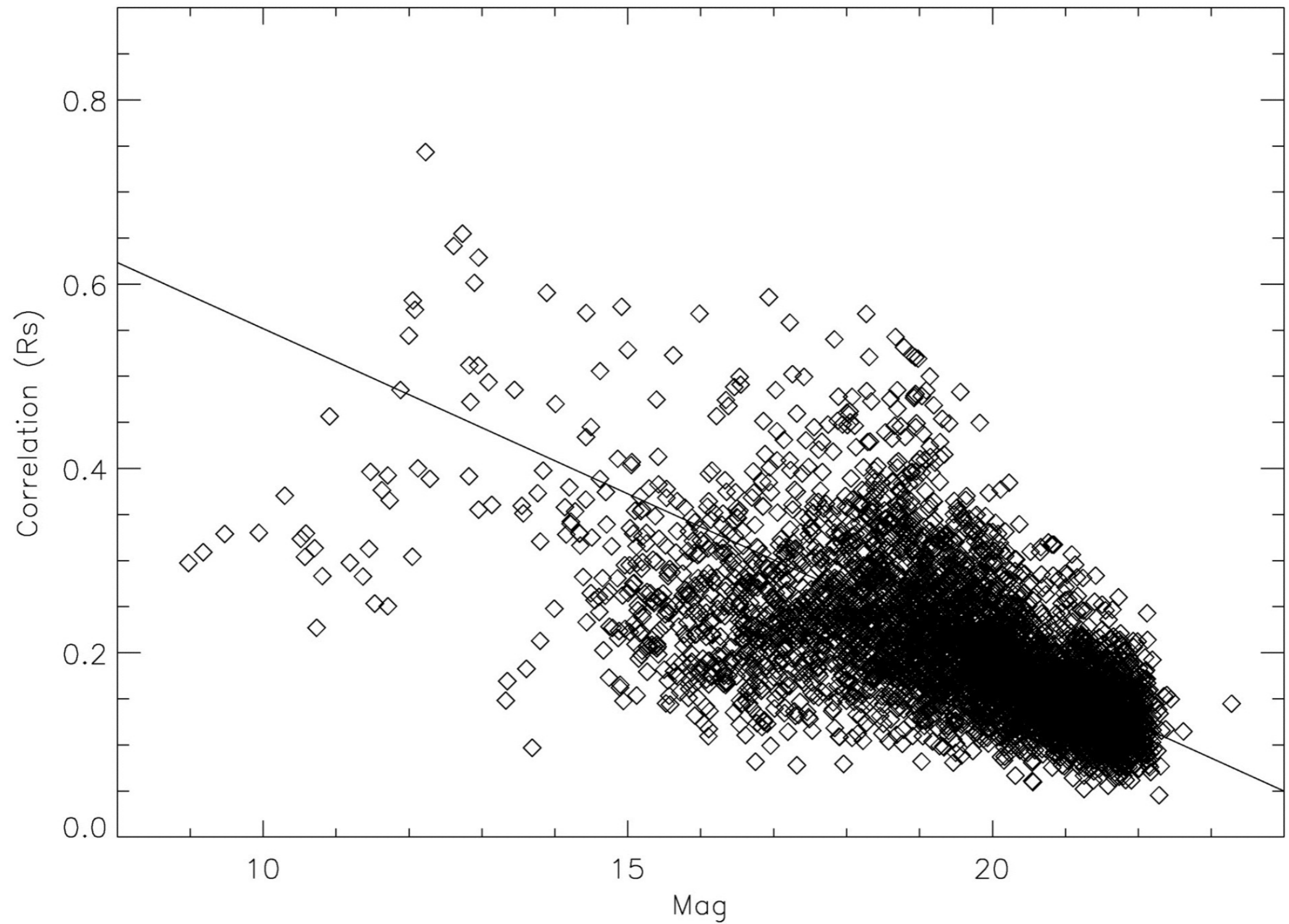
- Nature
- Noise
- Detection algorithms

- RoPACS probability map : What we expect
- Increasing the accuracy : De-trend
Survey Transiting Light-curves (DSTL)
- DSTL - Step by step : Examples
- Detection algorithm : Searching with OCC-fit
- Habitability : HZ probabilities - 19h field

RMS diagram -19h field

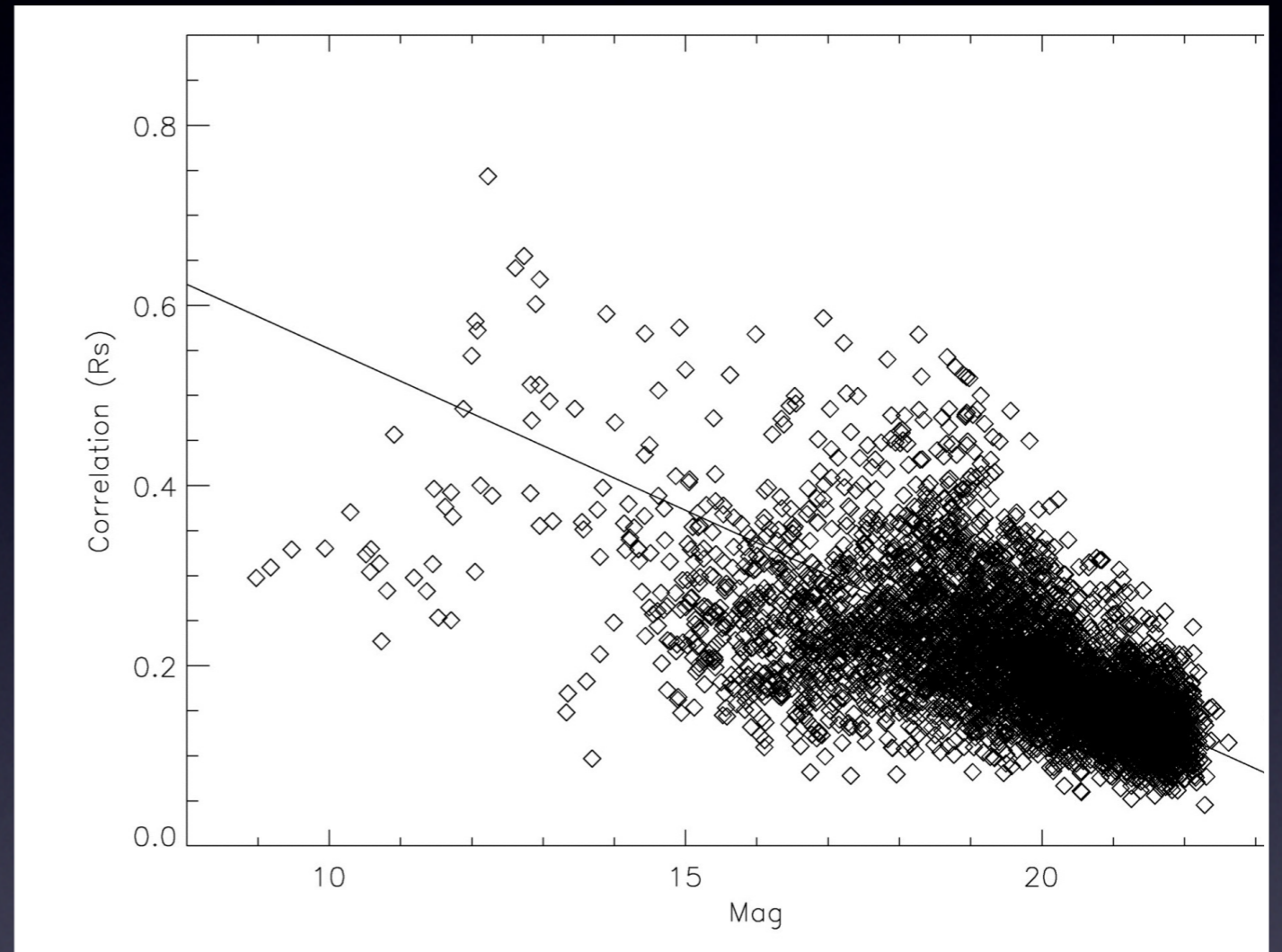


Correlation diagram - 19h field

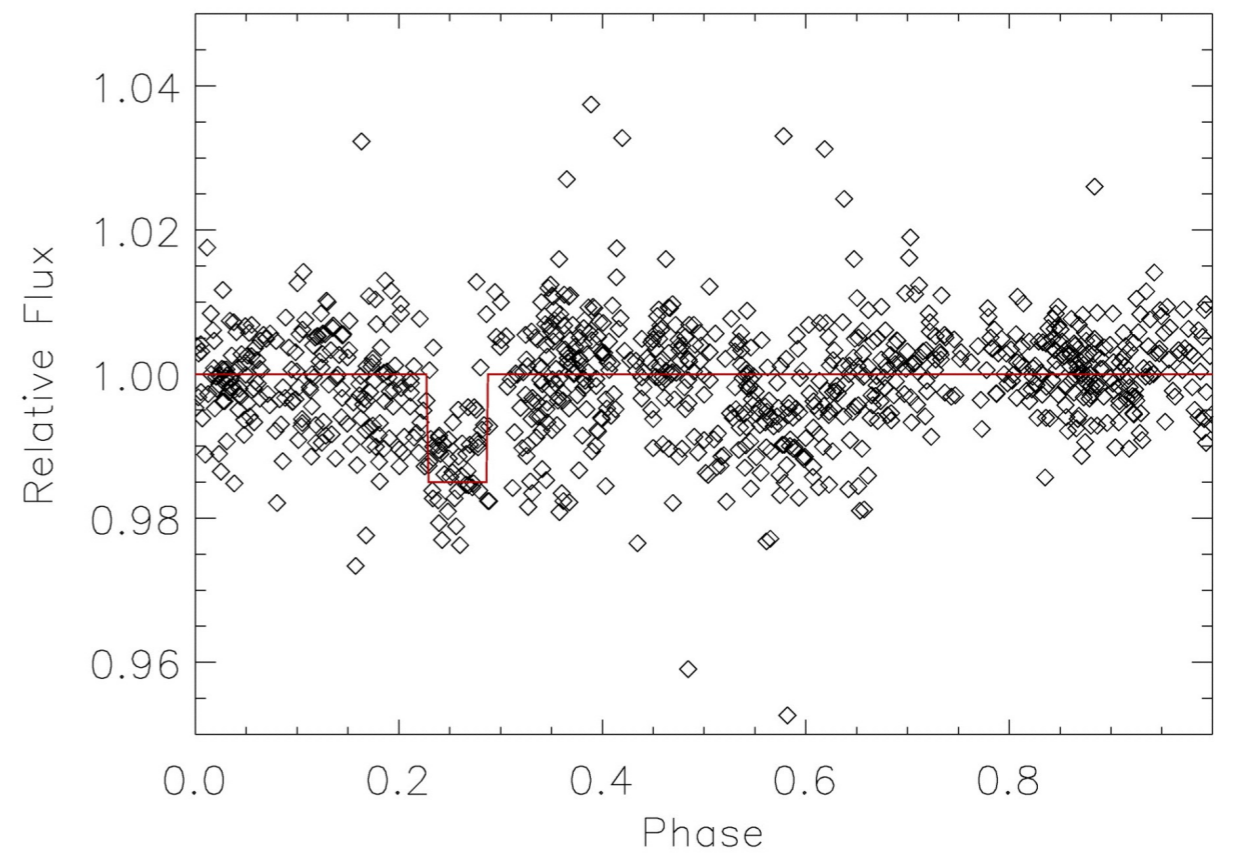
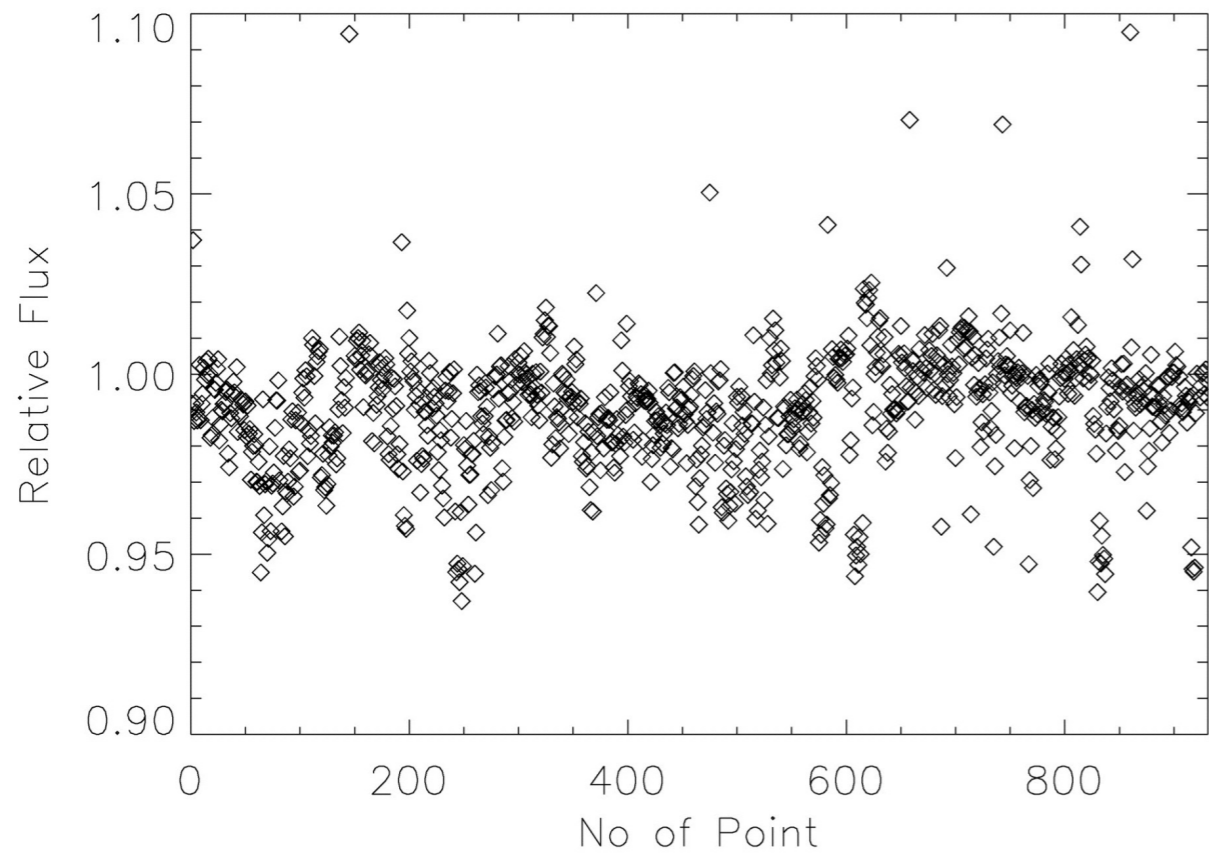


Correlation diagram - 19h field

- Correlation (red noise)
- Bright stars show higher correlation (linear distribution)

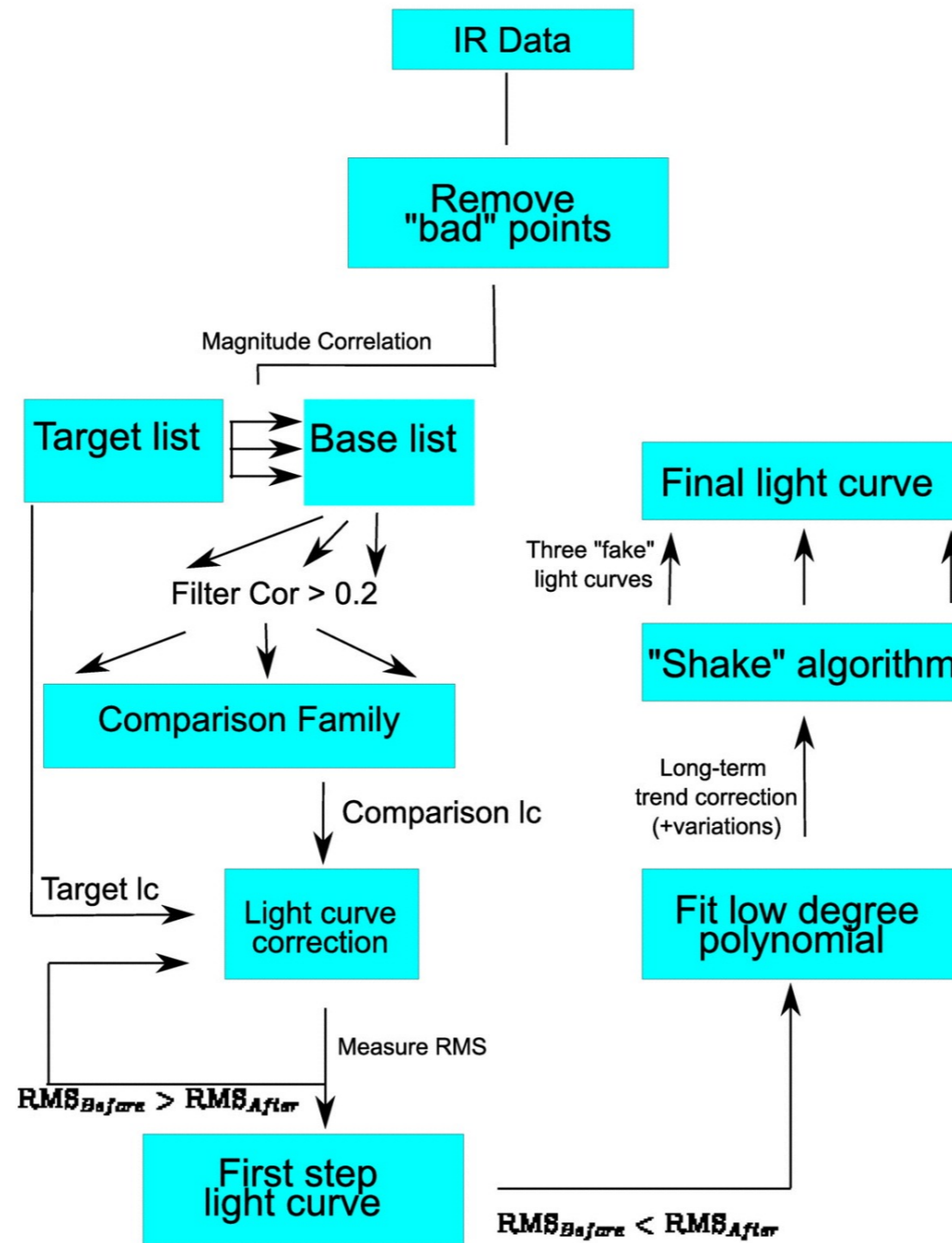


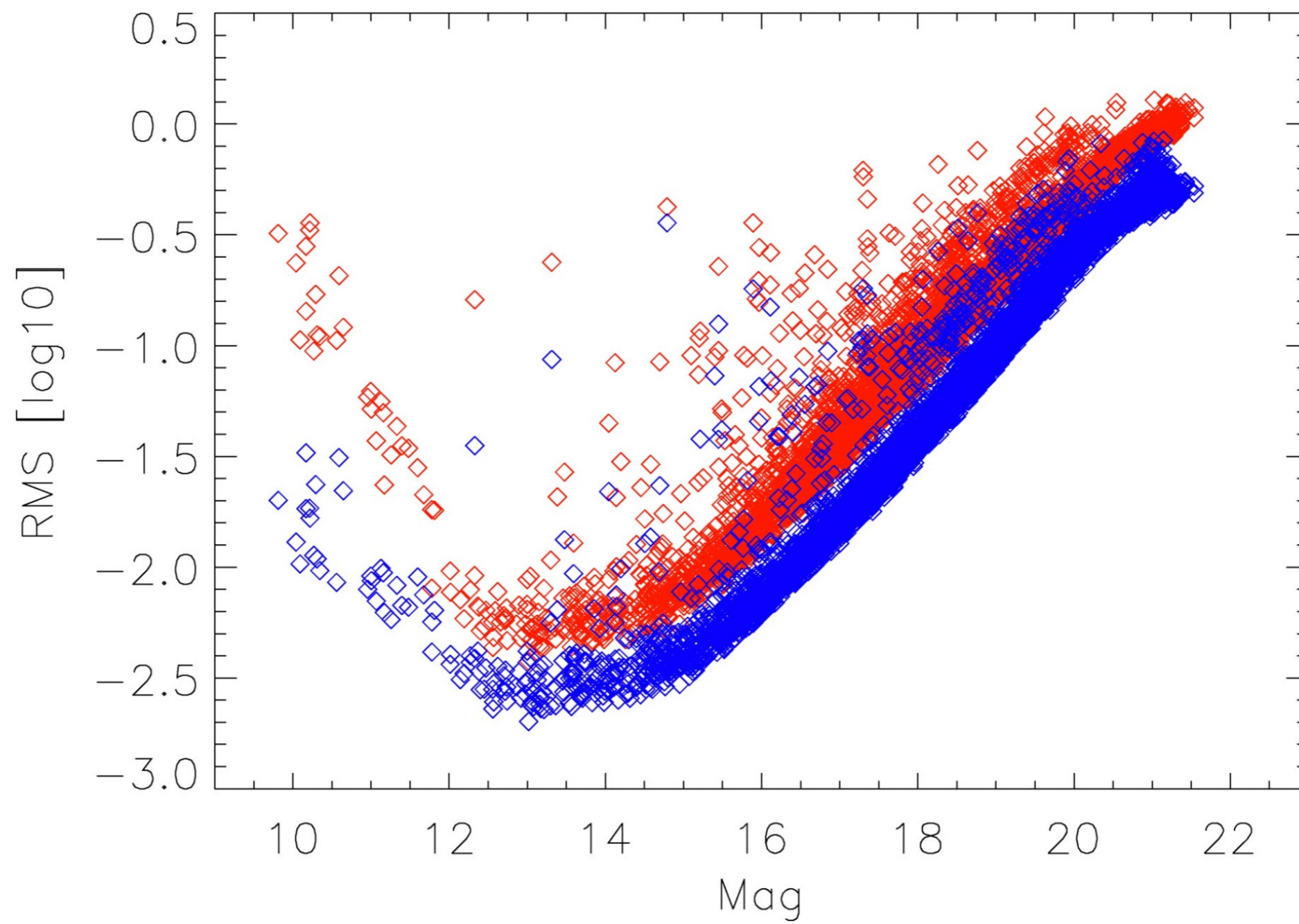
Median light curve + BLS



Period \sim 4.62 days

Detrend Survey Transiting Light-curves (DSTL)

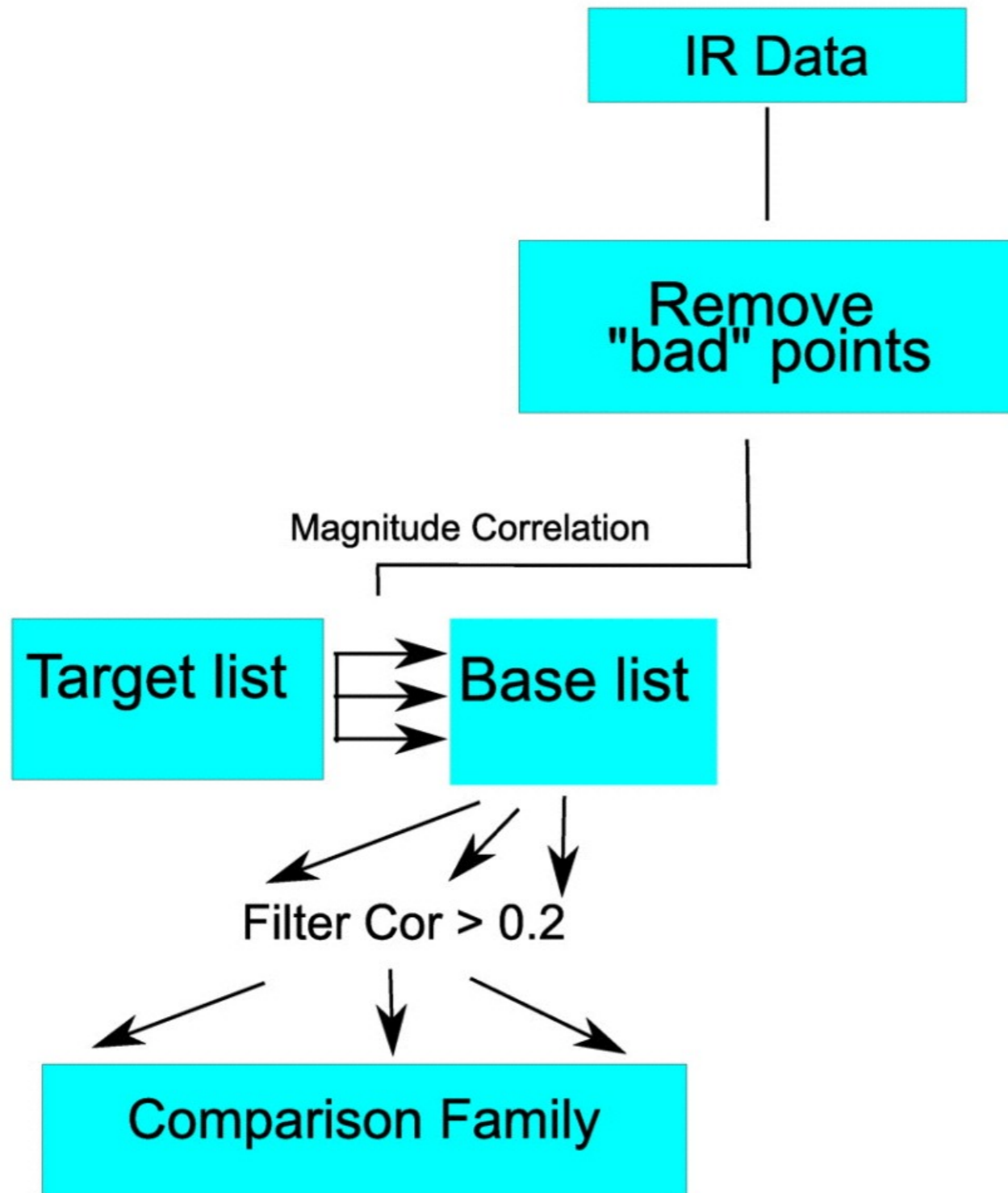


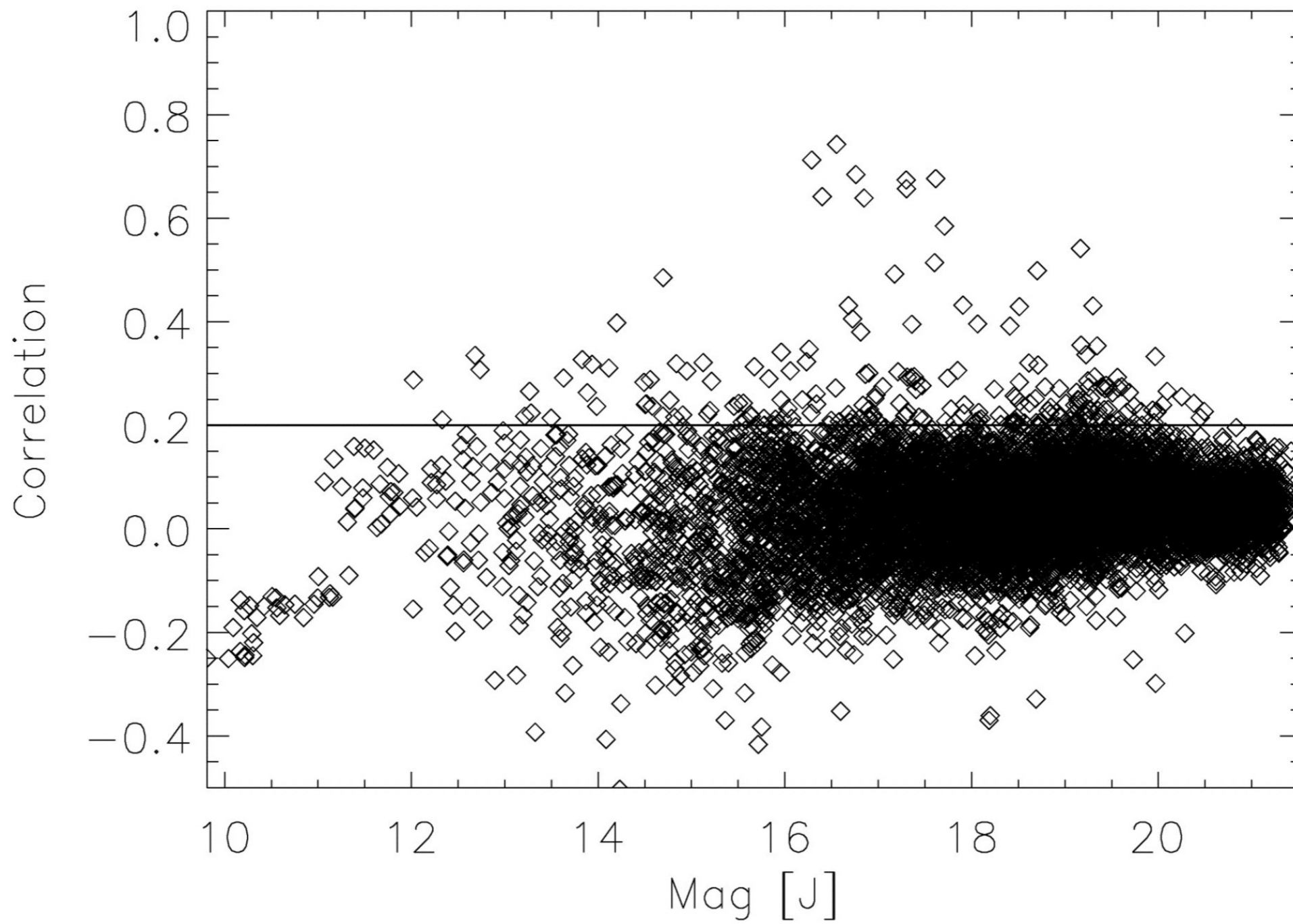


DSTL - RMS diagram

- RoPACS probability map : What we expect
- Increasing the accuracy : De-trend Survey Transiting Light-curves (DSTL)
- **DSTL - Step by step : Examples**
- Detection algorithm : Searching with OOC-fit
- Habitability : HZ probabilities - 19h field

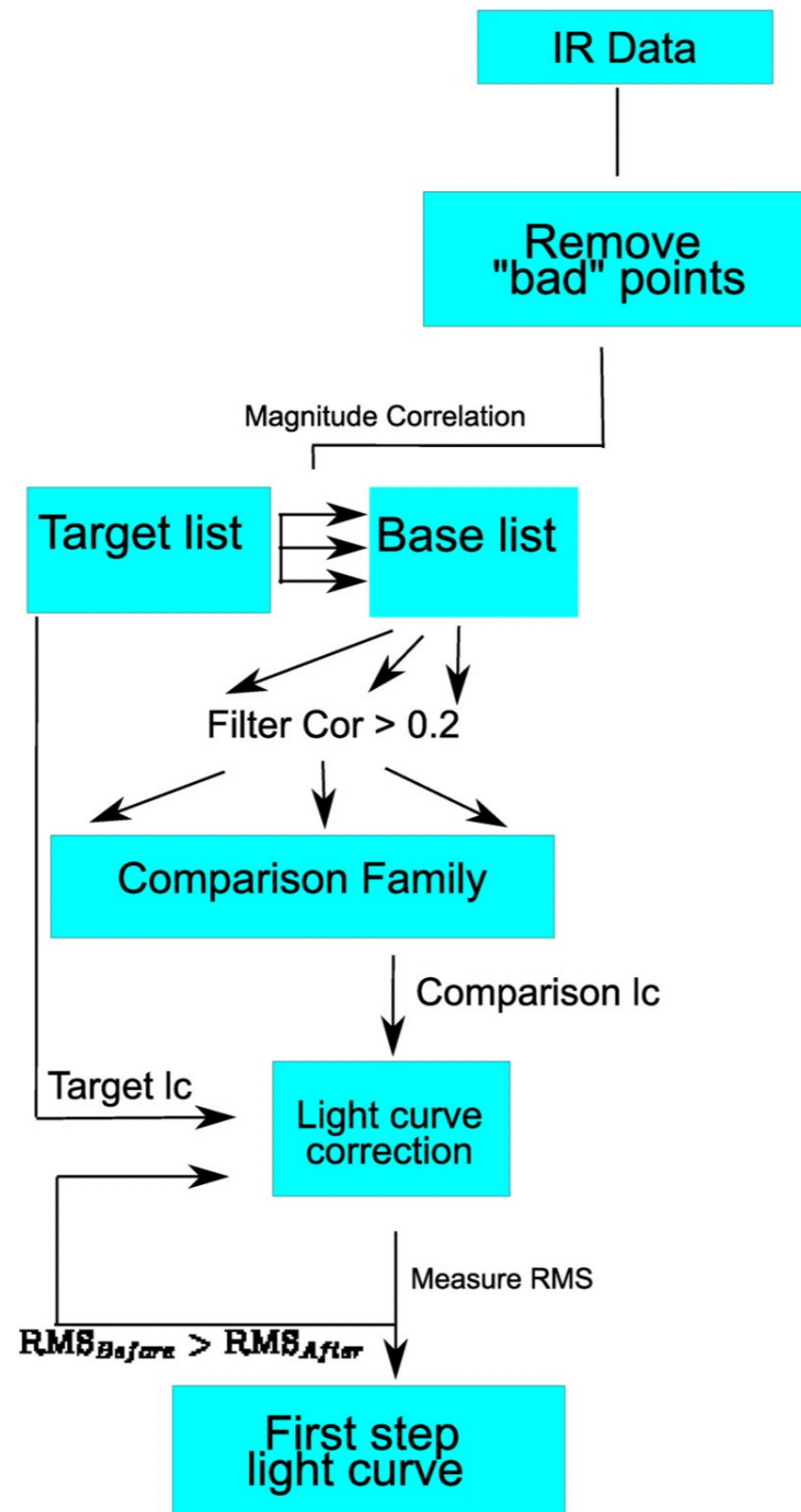
Detrend Survey Transiting Light-curves (DSTL)





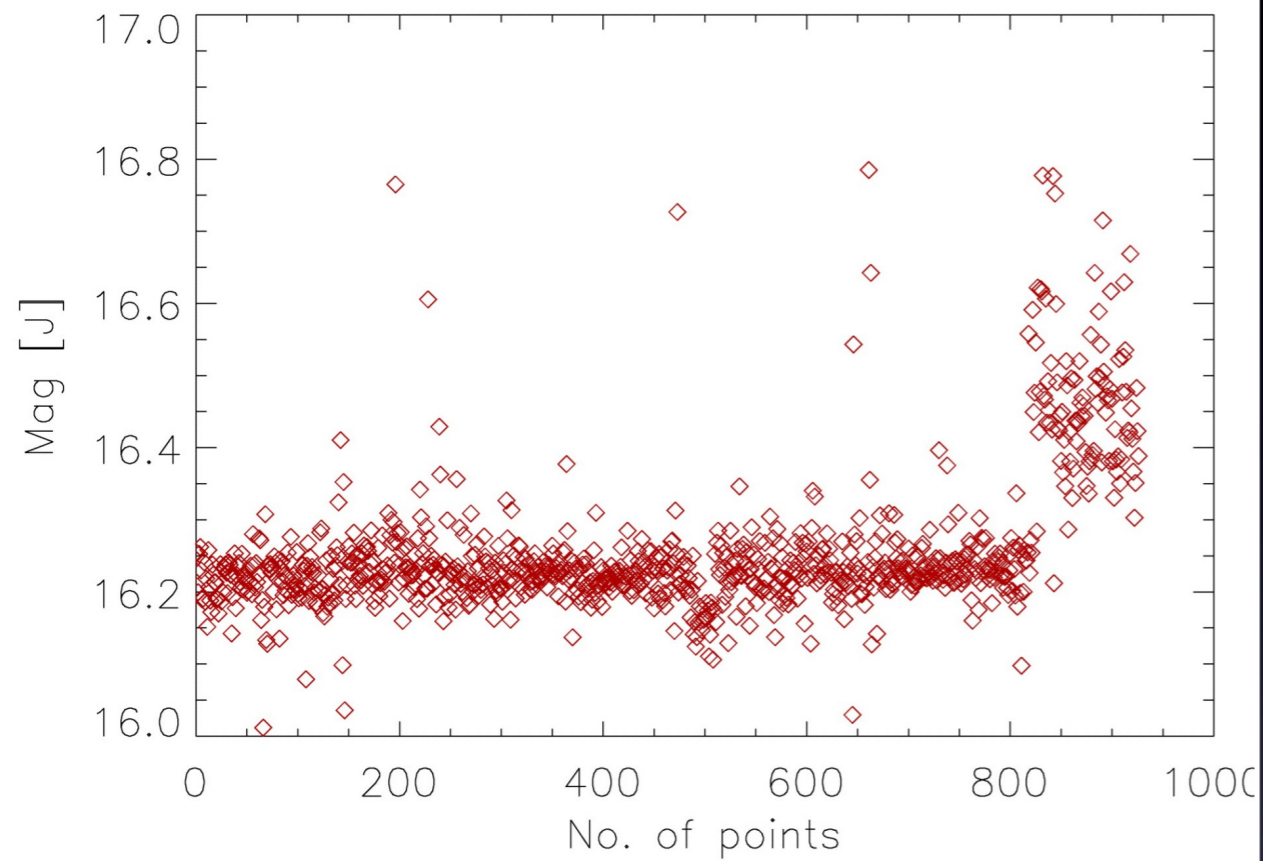
Example 19e_2_00100 : Correlation plot

Detrend Survey Transiting Light-curves (DSTL)

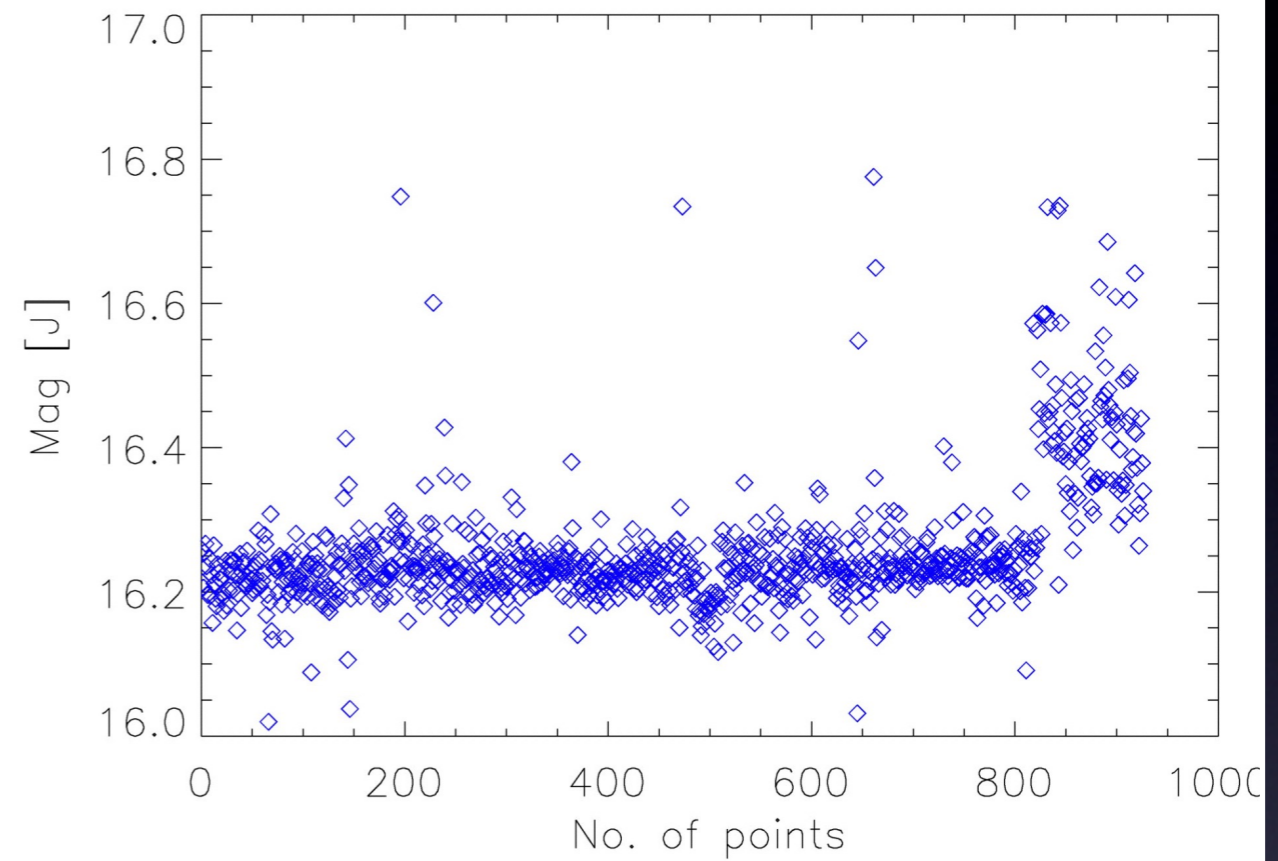


19e_2_00100

Loop # 1

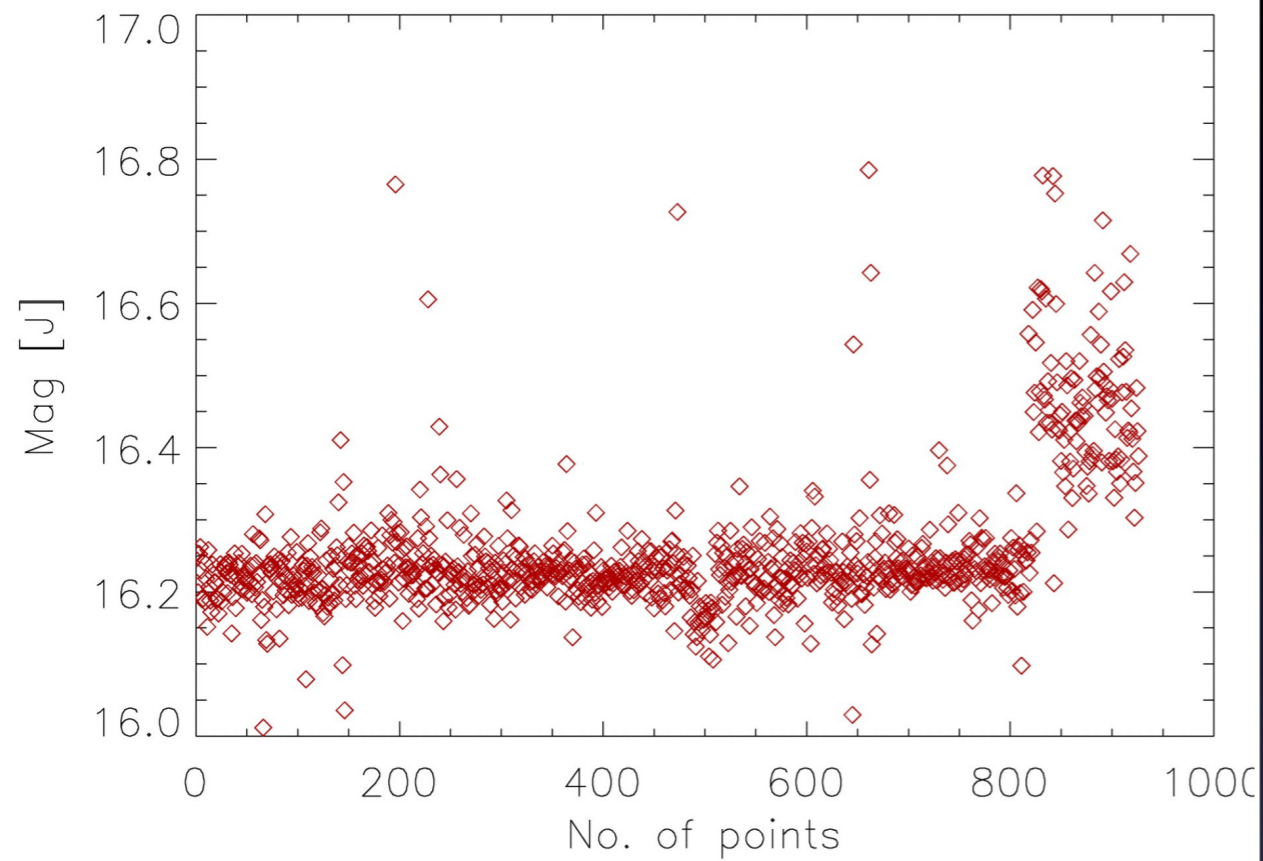


RMS = 0.110

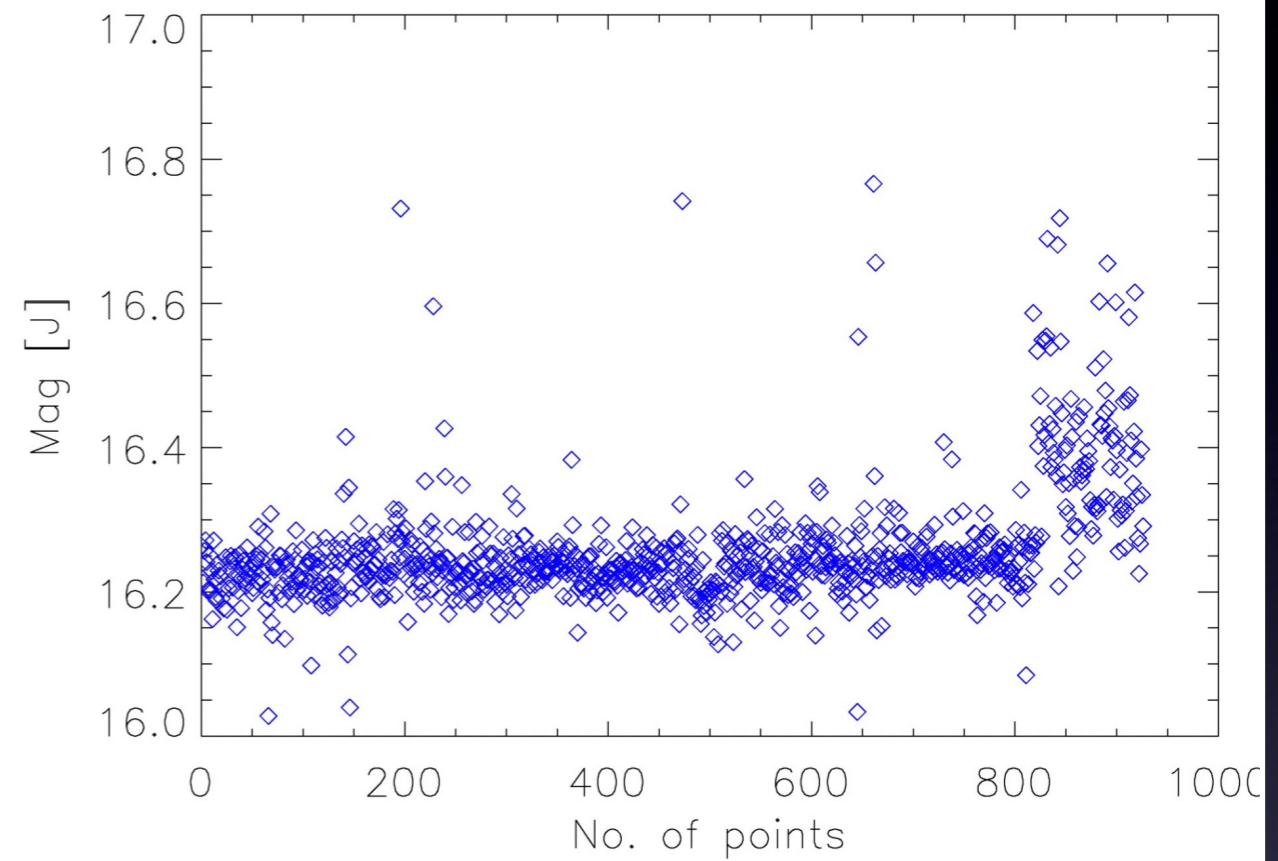


RMS = 0.102

19e_2_00100
Loop # 2

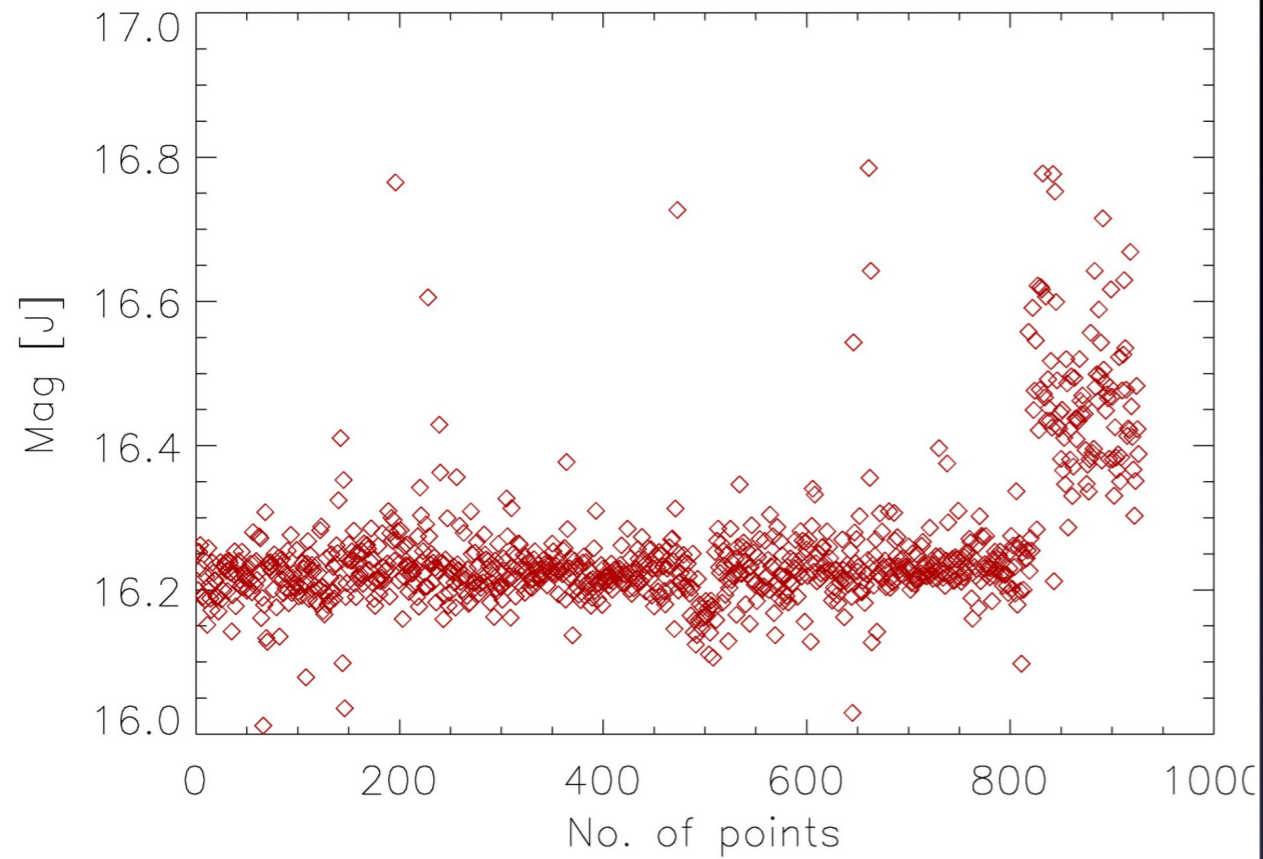


RMS = 0.110

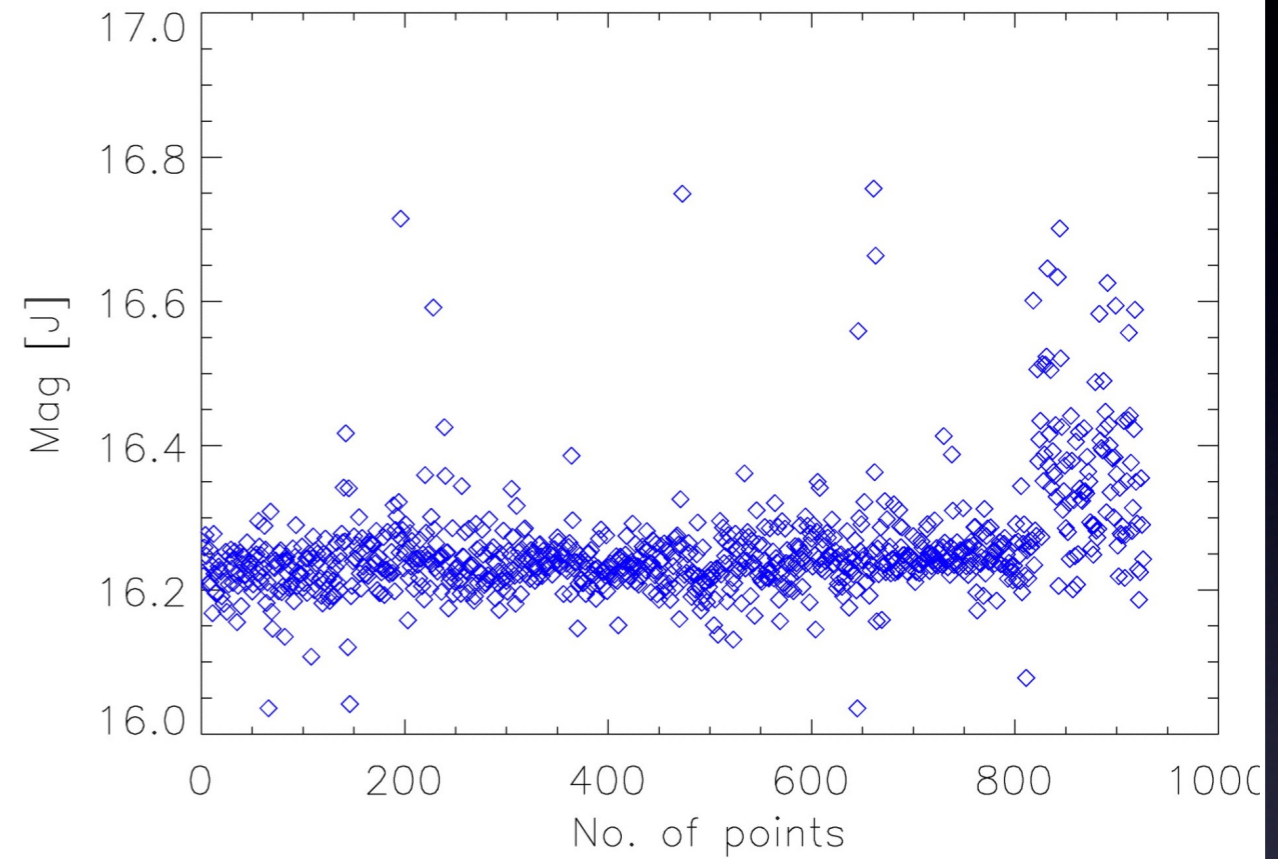


RMS = 0.094

19e_2_00100
Loop # 3

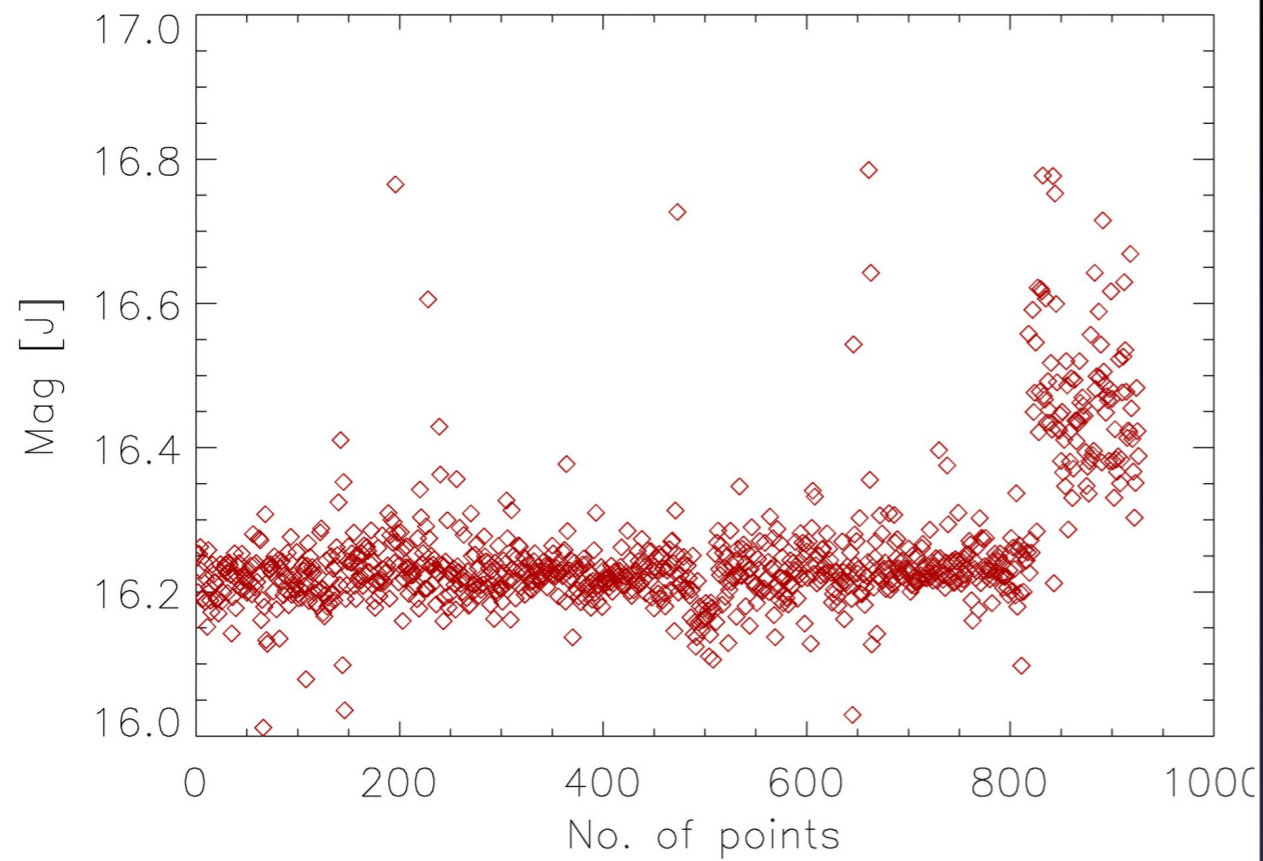


RMS = 0.110

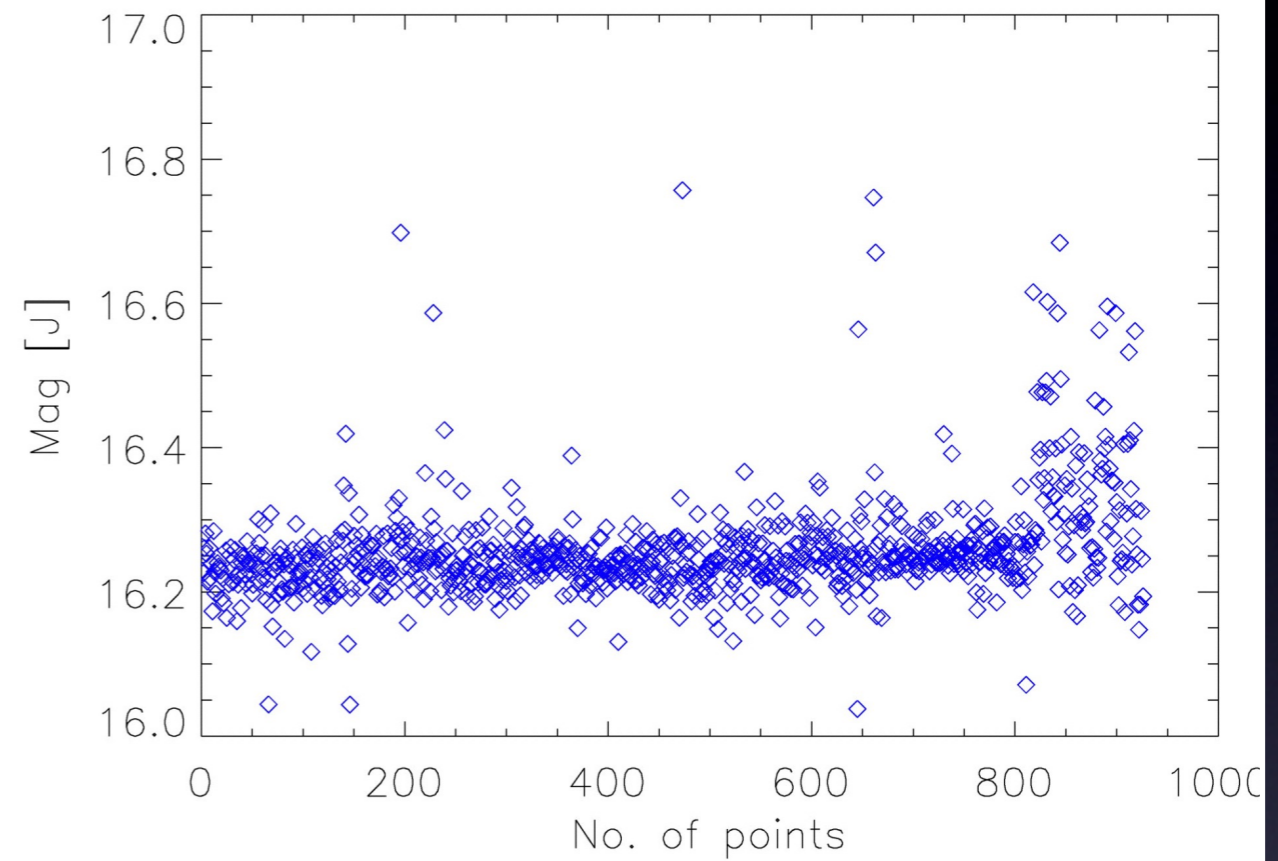


RMS = 0.082

19e_2_00100
Loop # 4

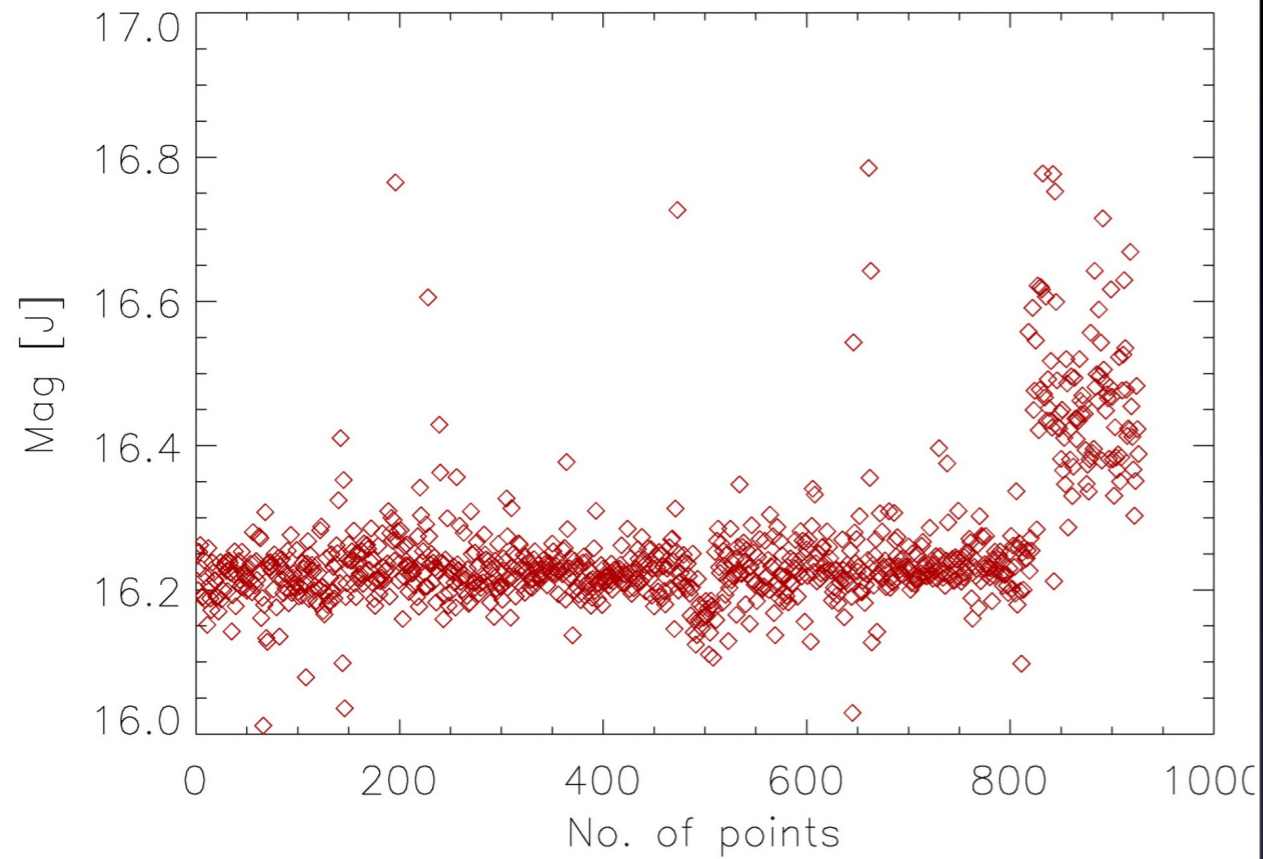


RMS = 0.110

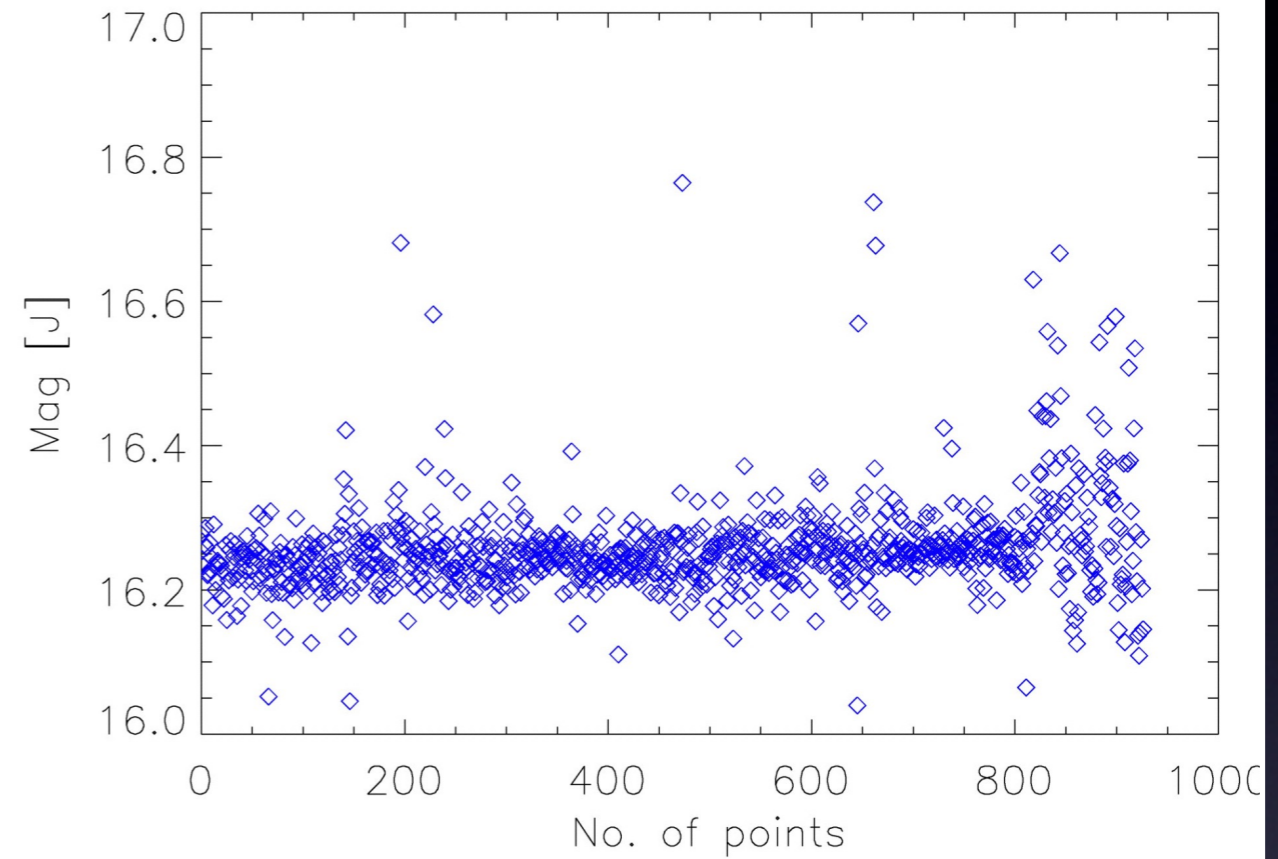


RMS = 0.078

19e_2_00100
Loop # 5

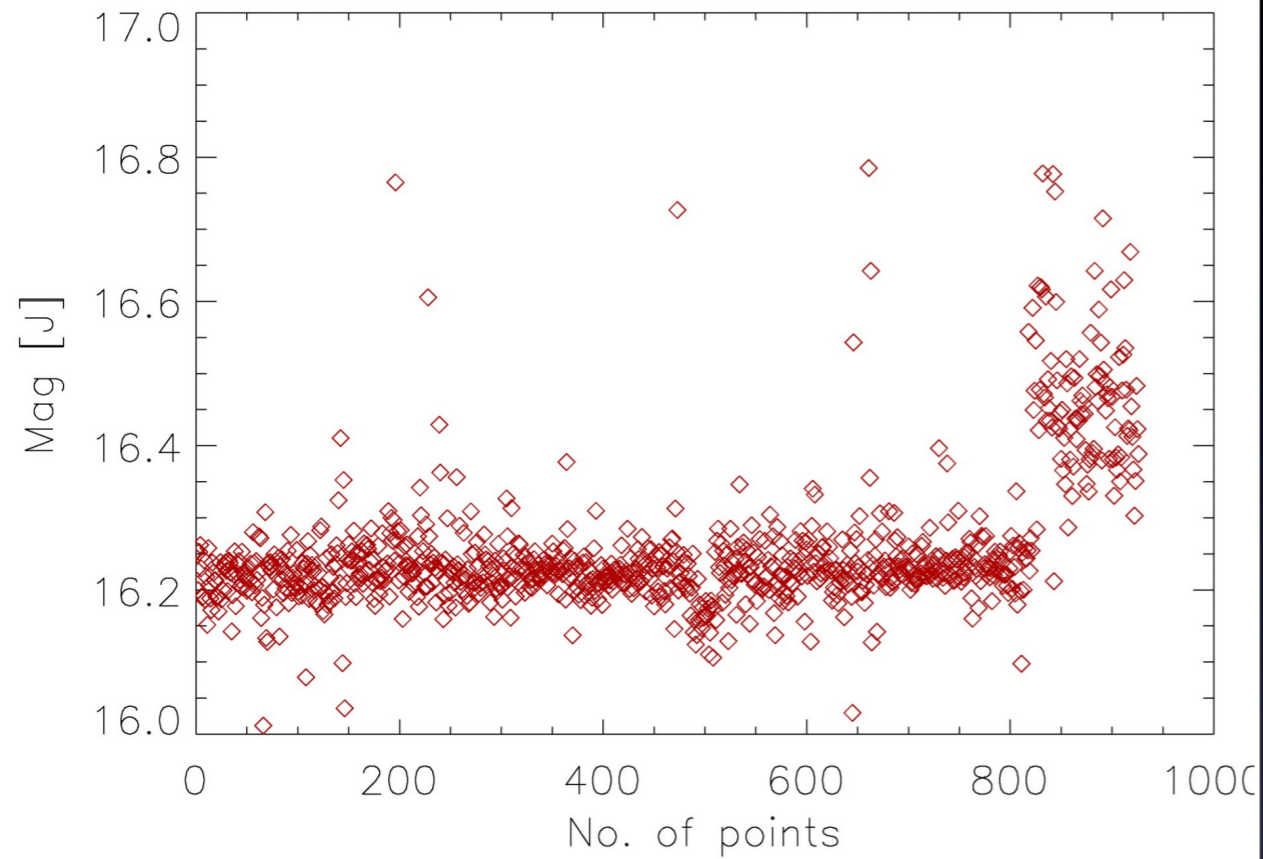


RMS = 0.110

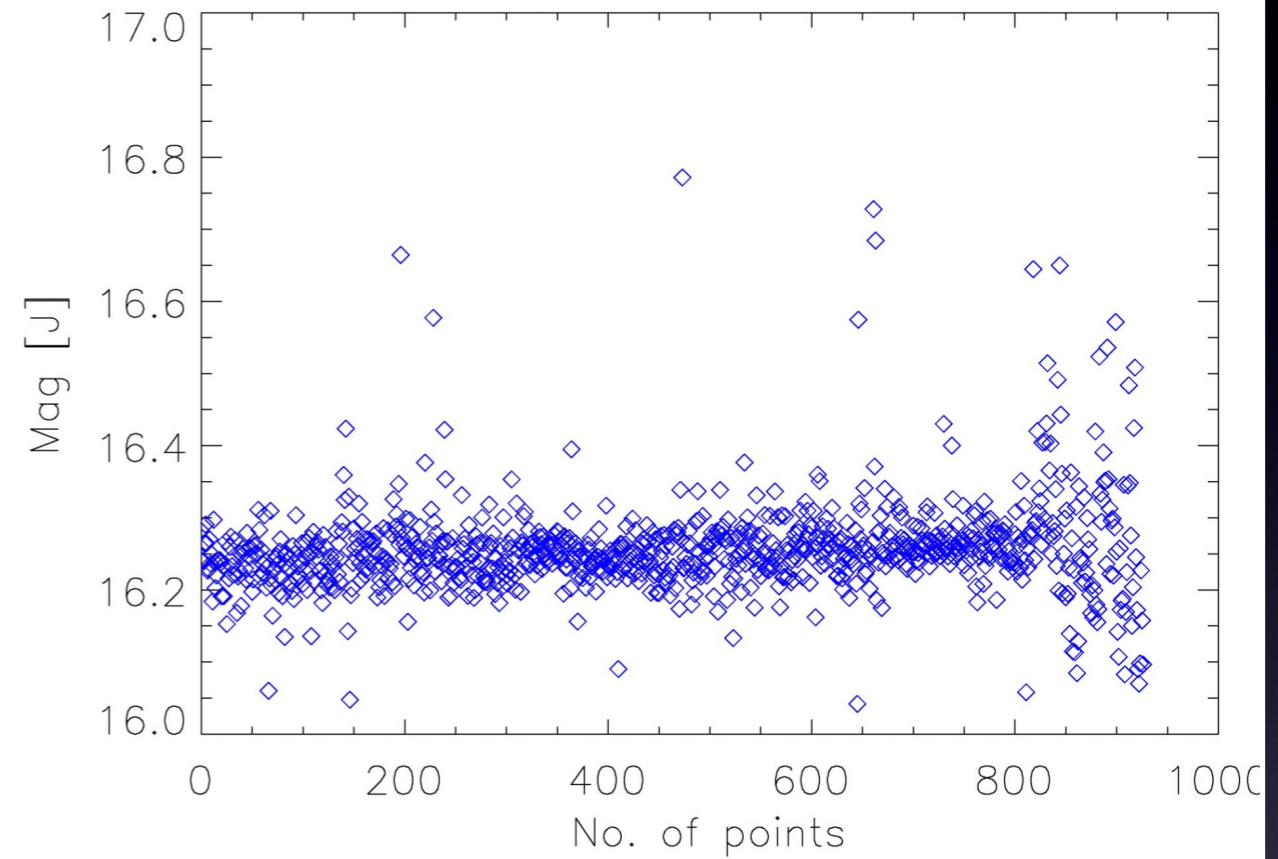


RMS = 0.07633

19e_2_00100
Loop # 6

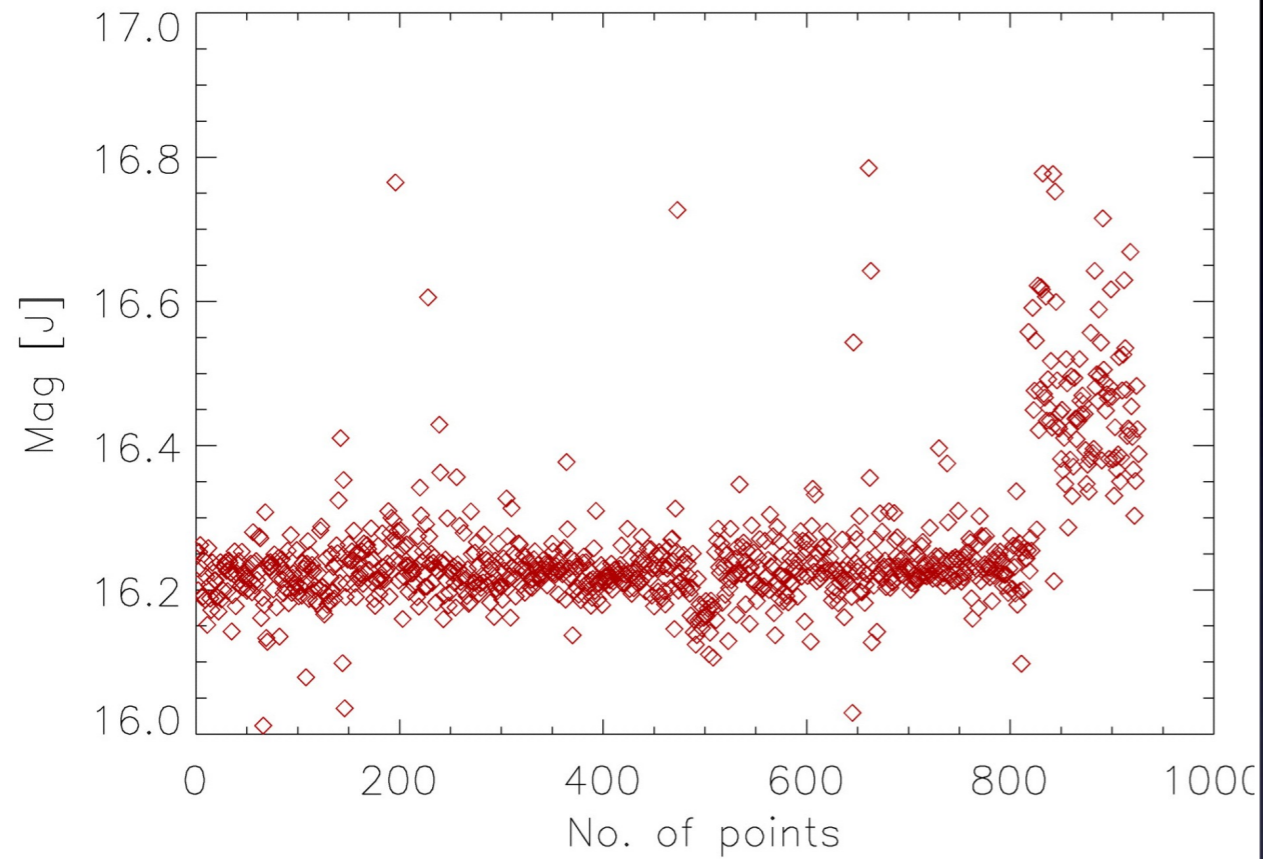


RMS = 0.110

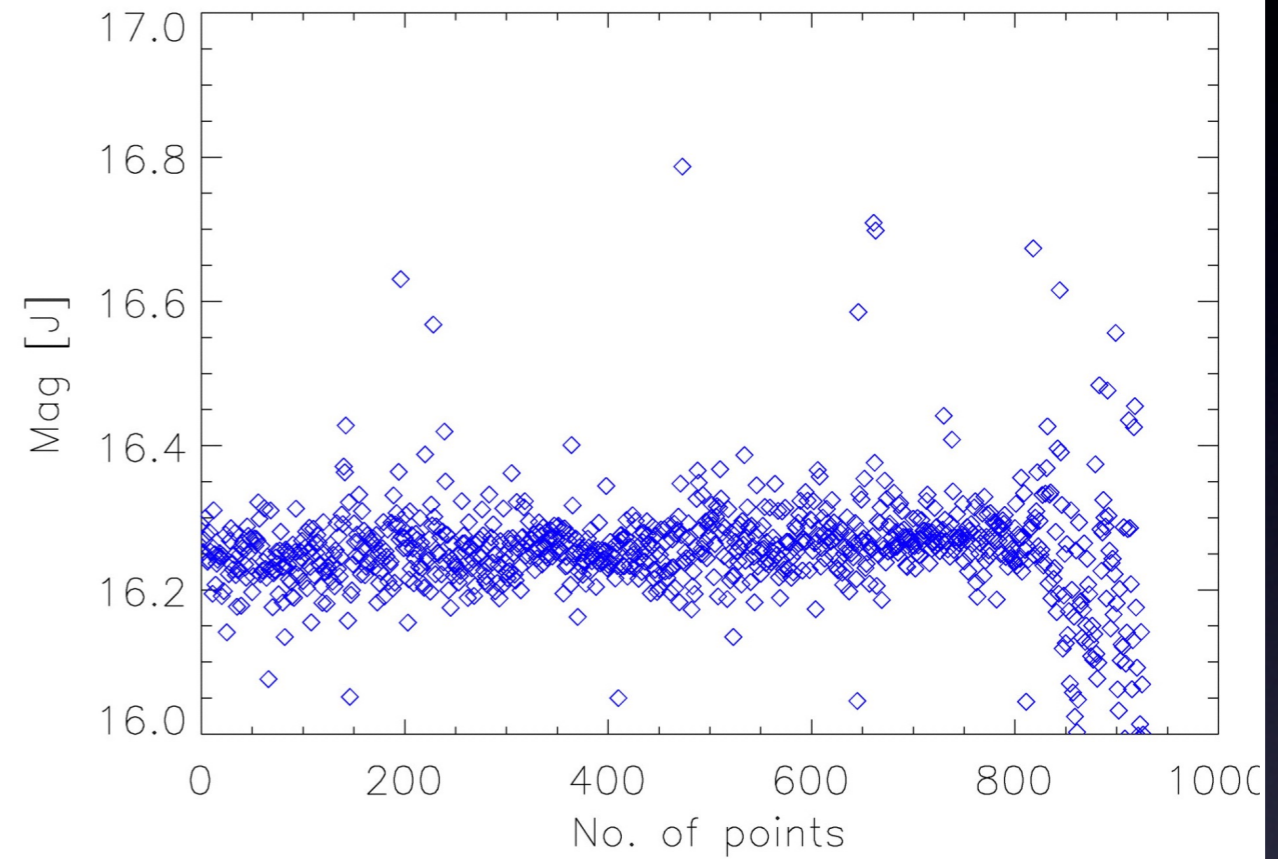


RMS = 0.07631

19e_2_00100
Loop # 7



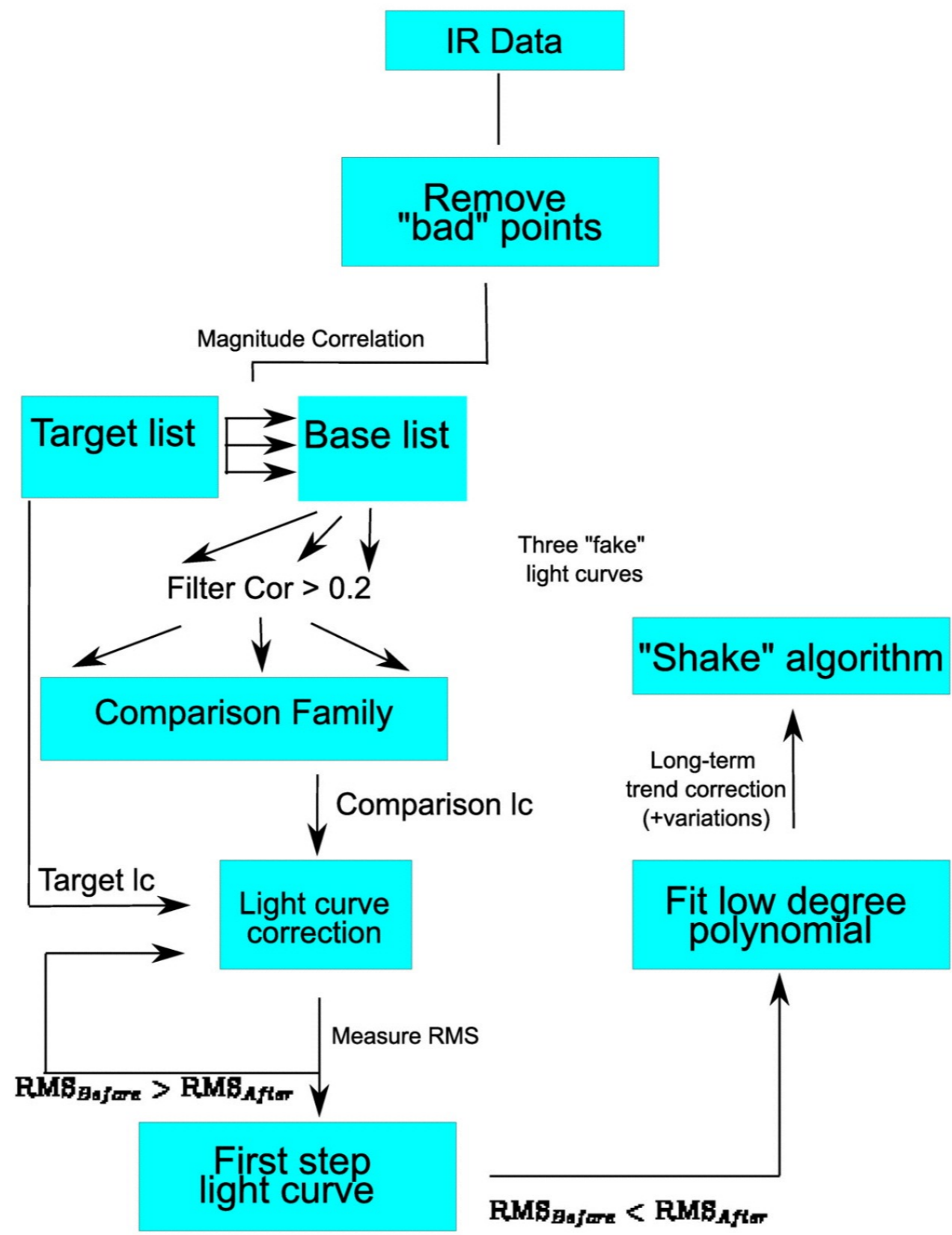
RMS = 0.110



RMS = **0.078**

STOP !!!

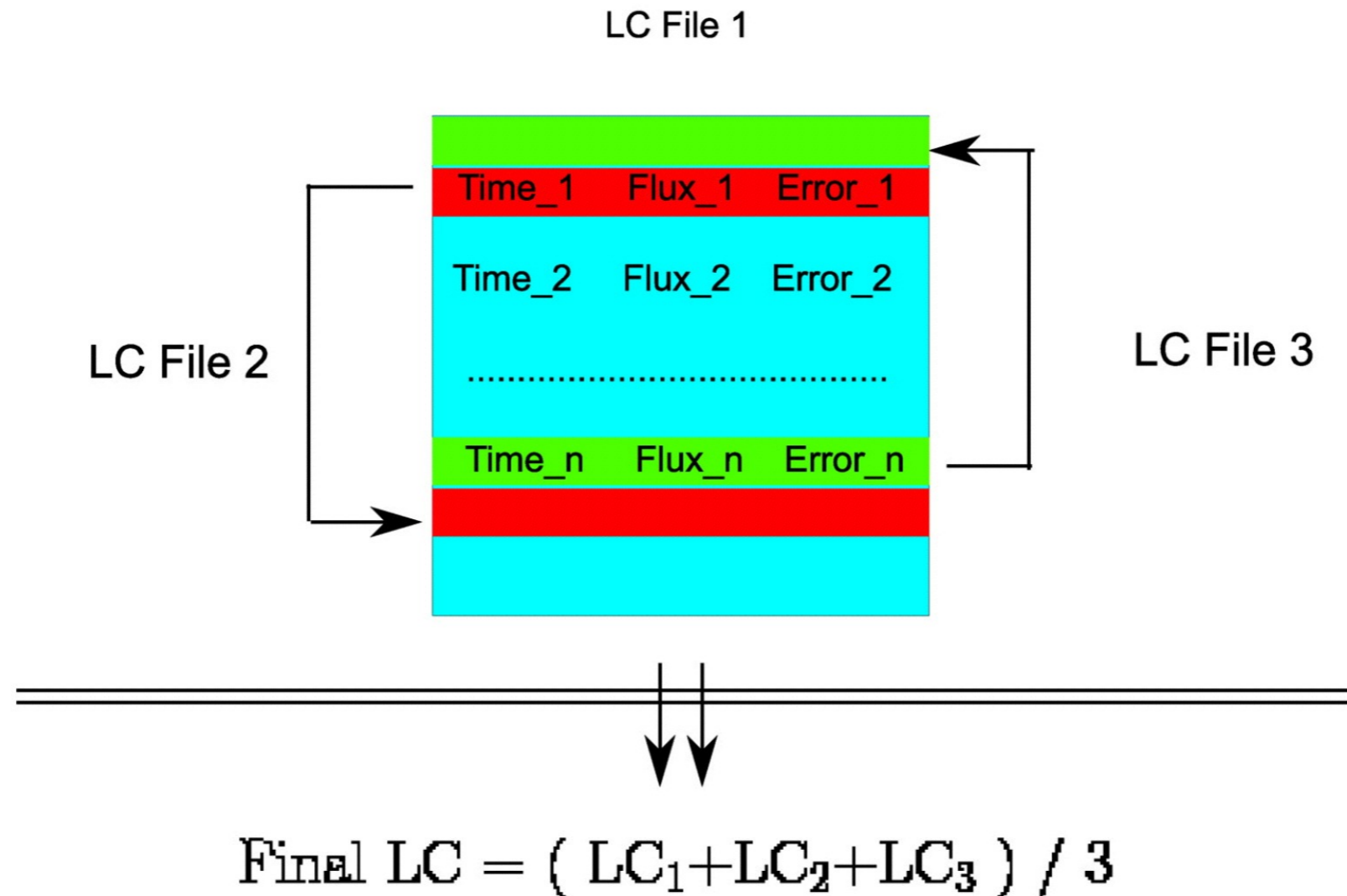
Detrend Survey Transiting Light-curves (DSTL)



Shake Algorithm

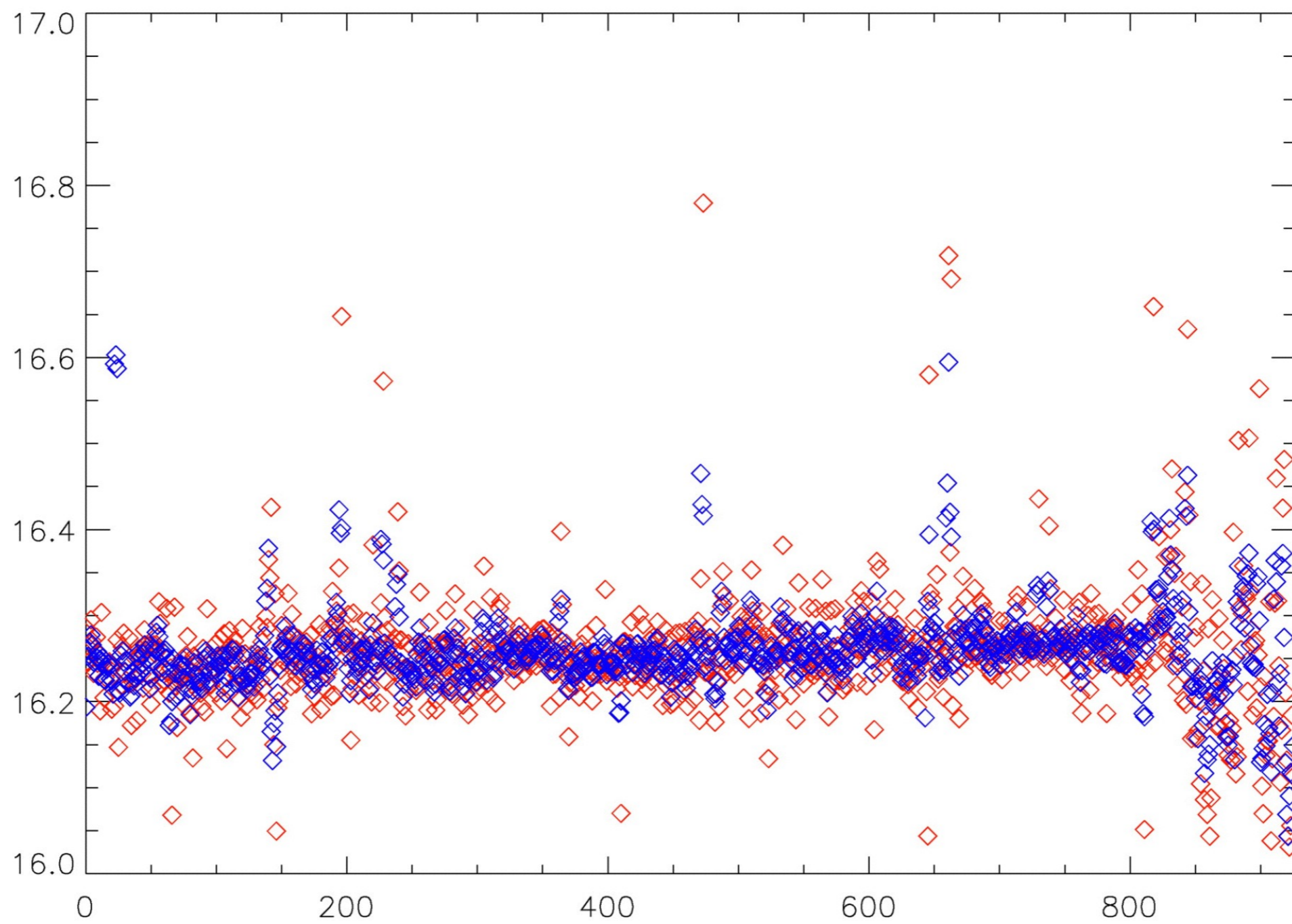
Detrend Survey Transiting Light-curves (DSTL)

Shake algorithm



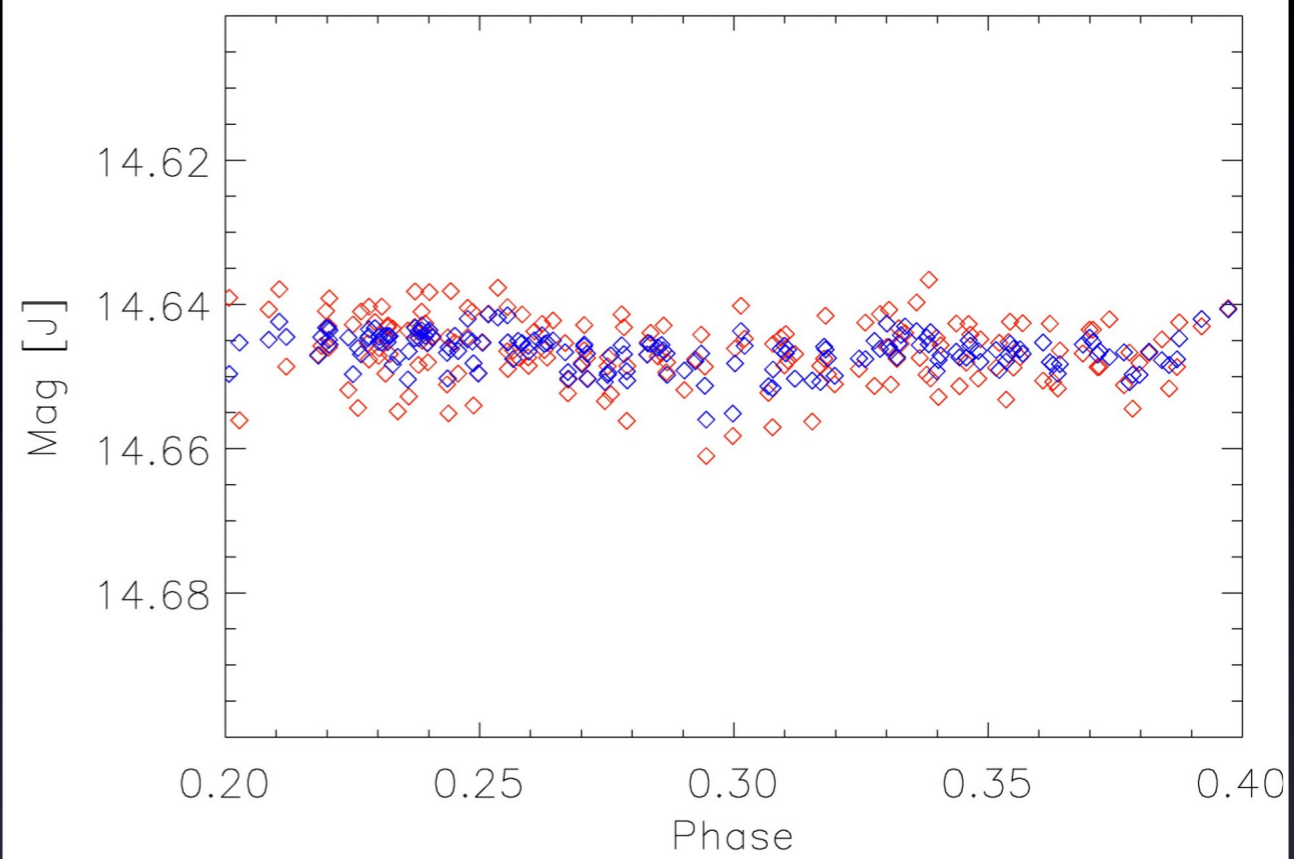
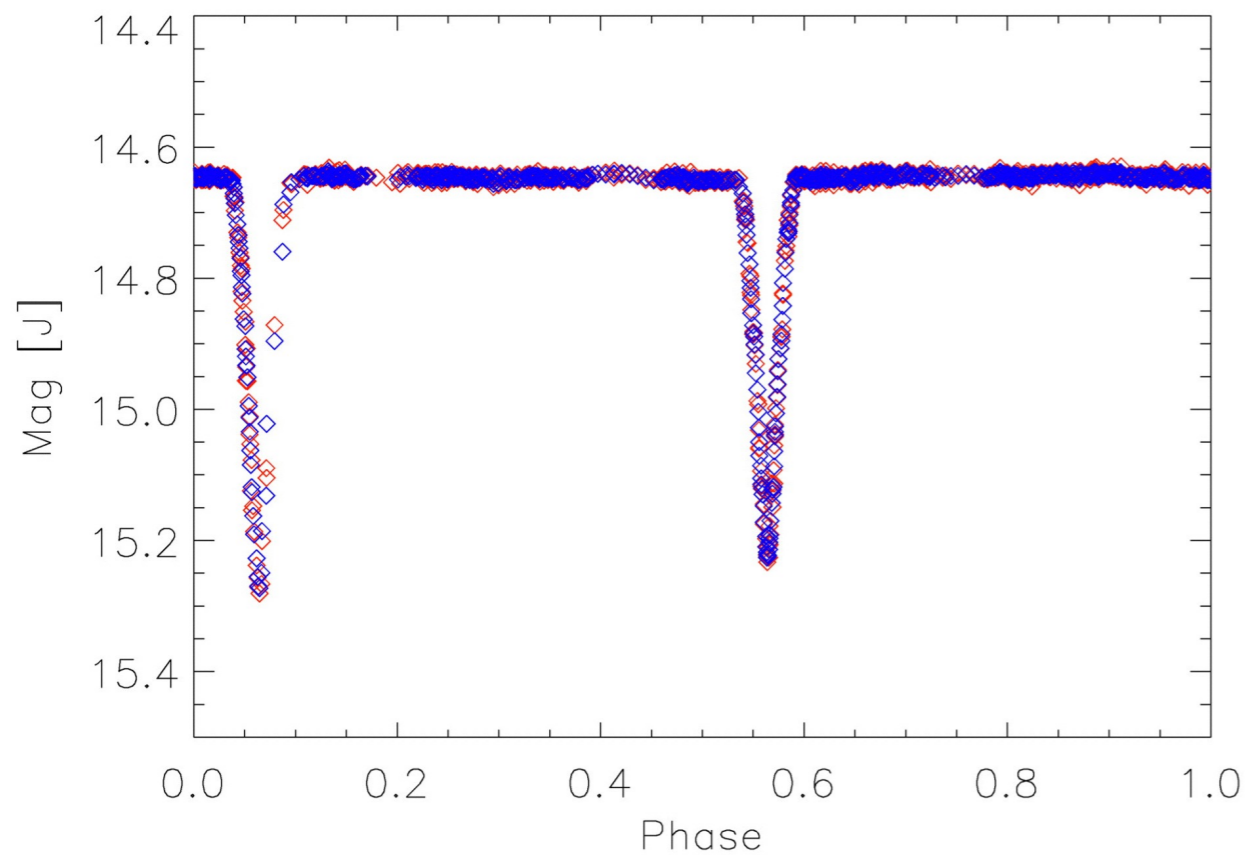
Shake Algorithm

19e_2_00100



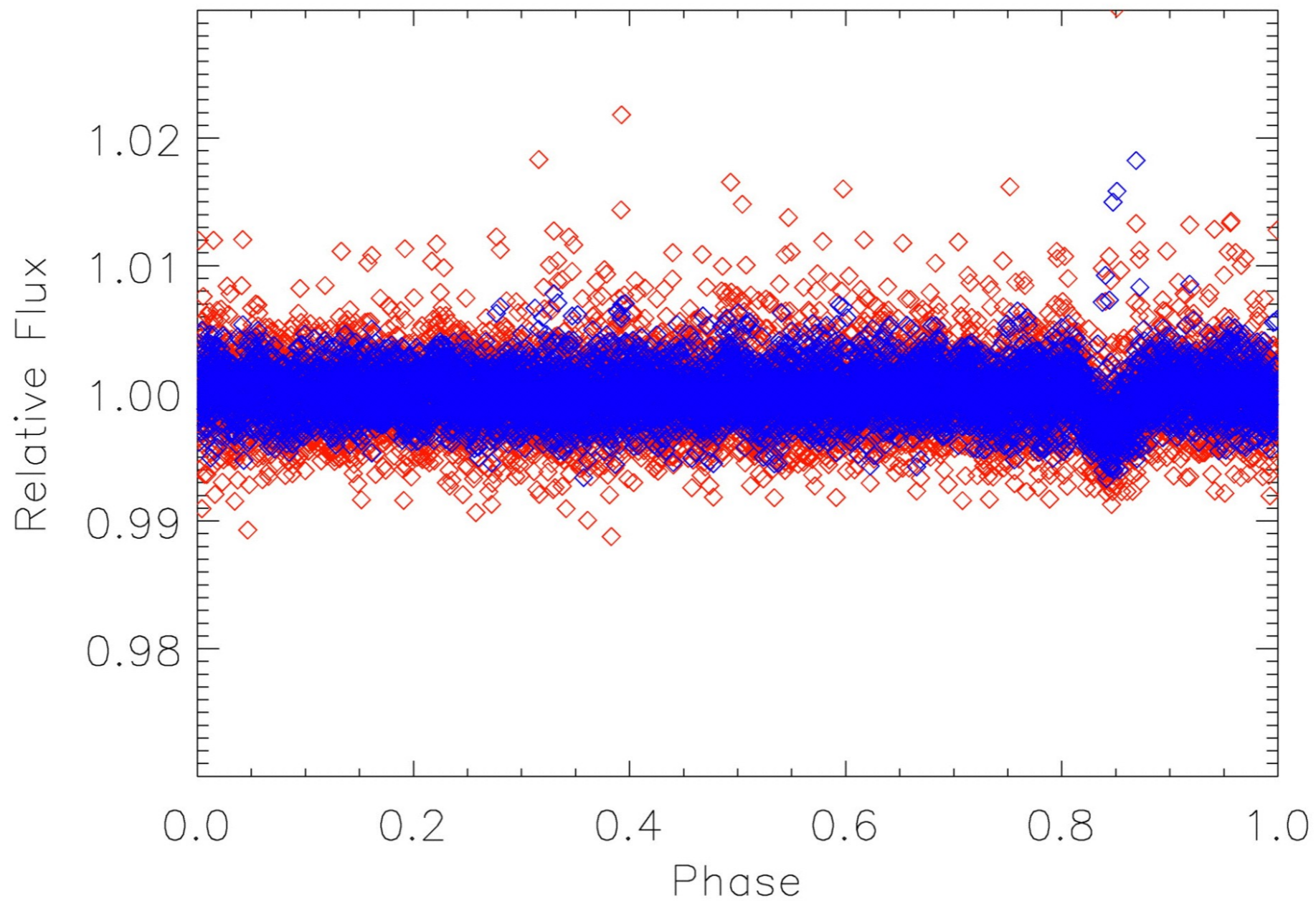
Shake algorithm example

IR data



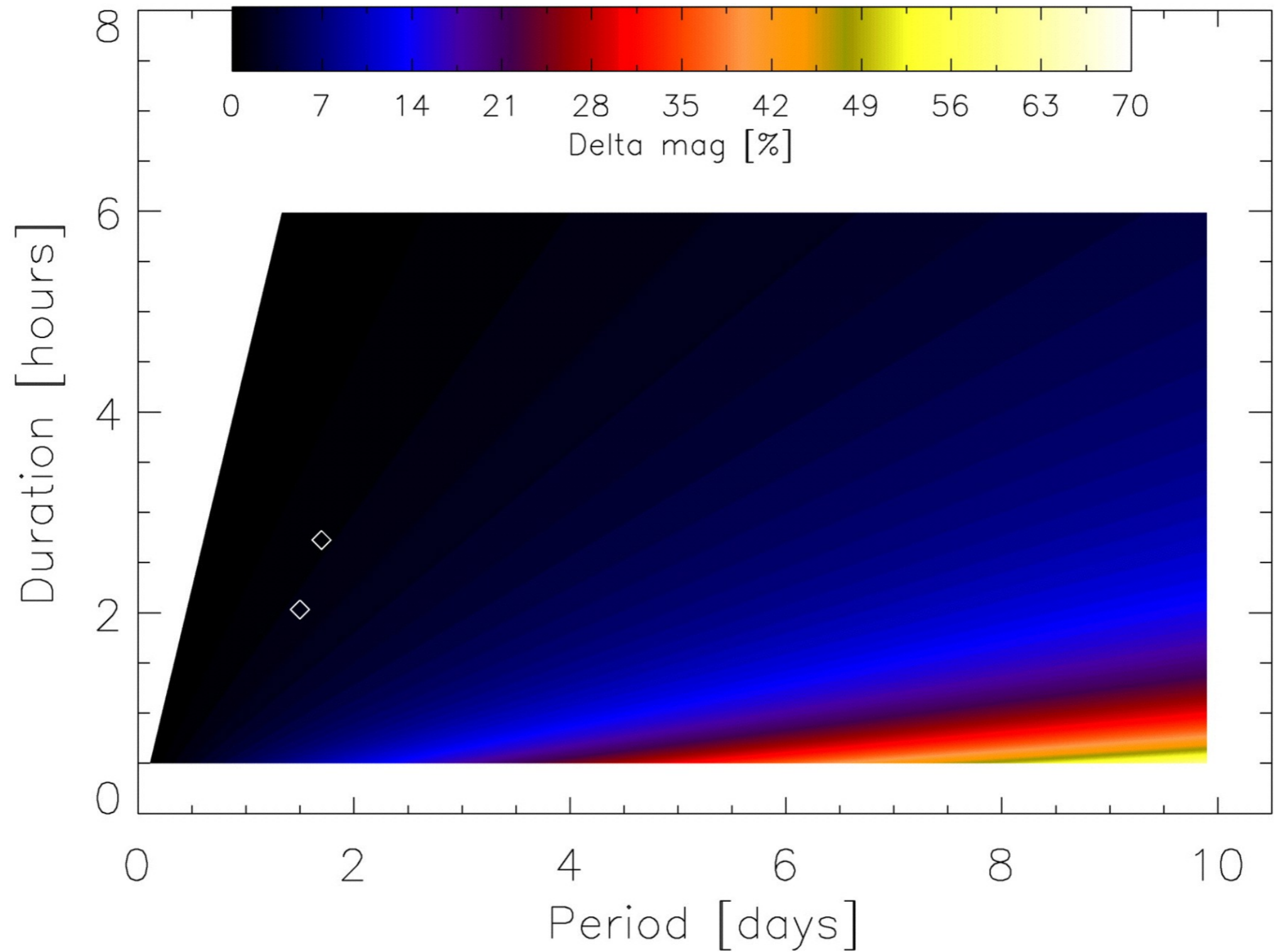
RMS - before = 0.3214
RMS - after = 0.2071

Shake algorithm example CoRoT data



RMS - before = 0.0030
RMS - after = 0.0019

Does the "Shake Algorithm removes real events ?

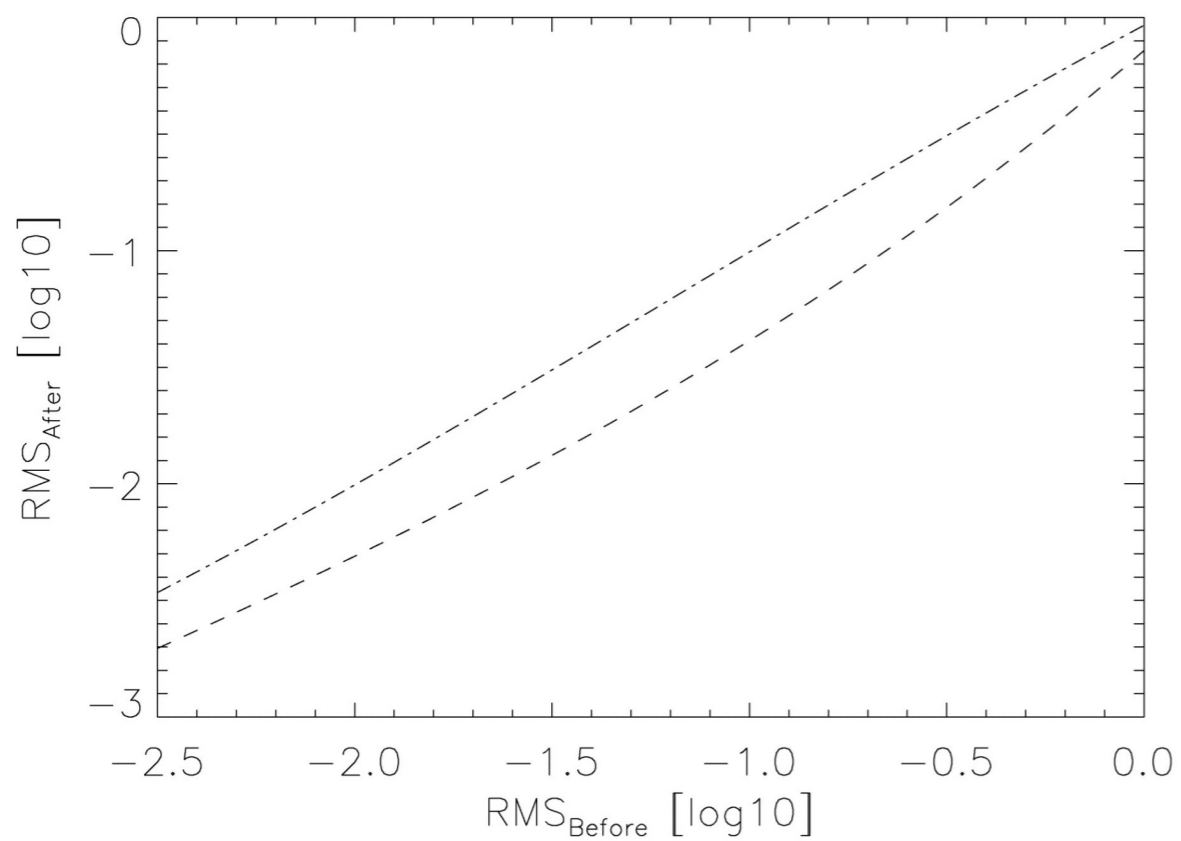


Why not other algorithms ?

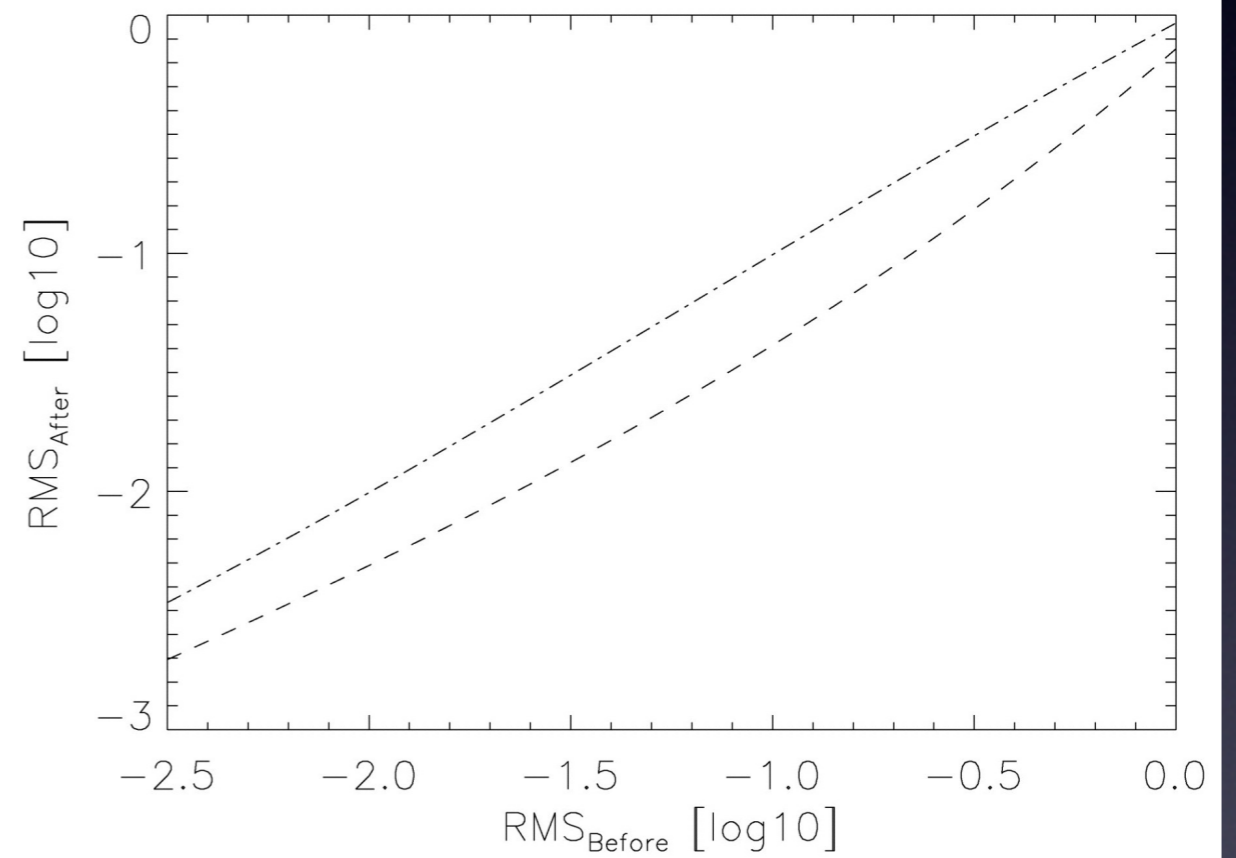
- TFA (Kovacs 2002)
- SysRem (Tamuz)

... TFA & SysRem are looking for
general systematic errors

DSTL vs TFA

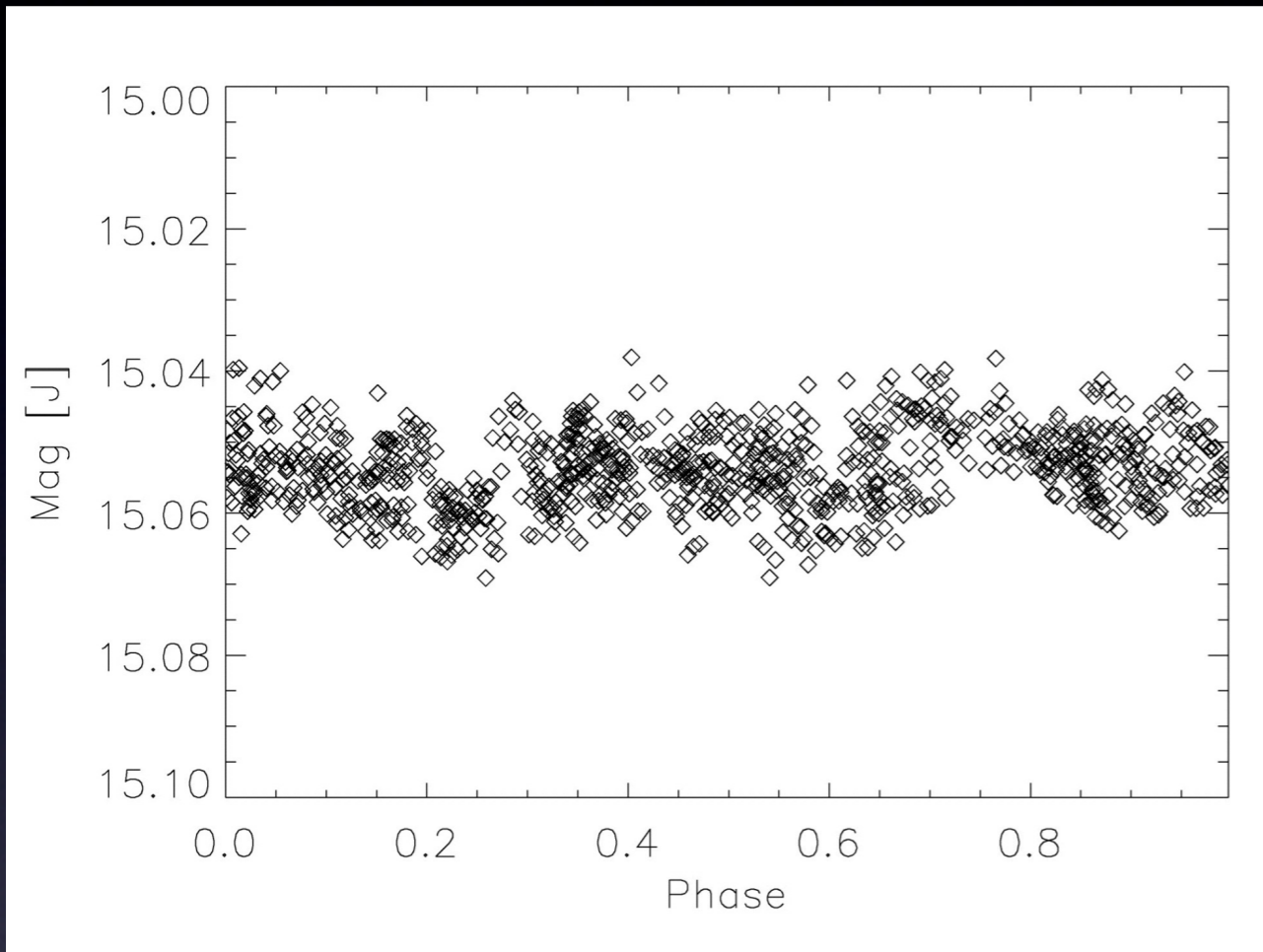


DSTL vs SysRem

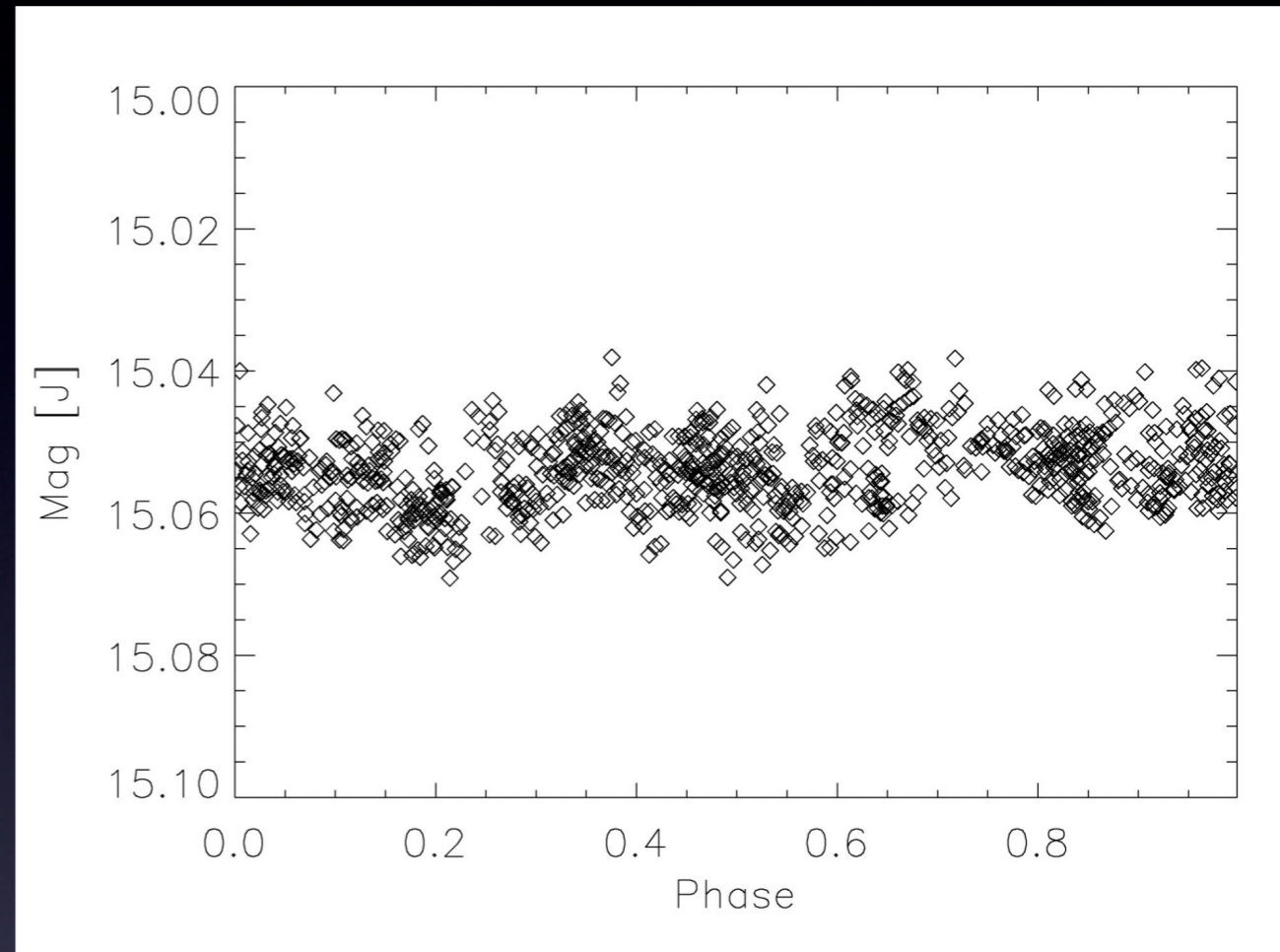


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Does the OCC-Fit detect the new light curves ?

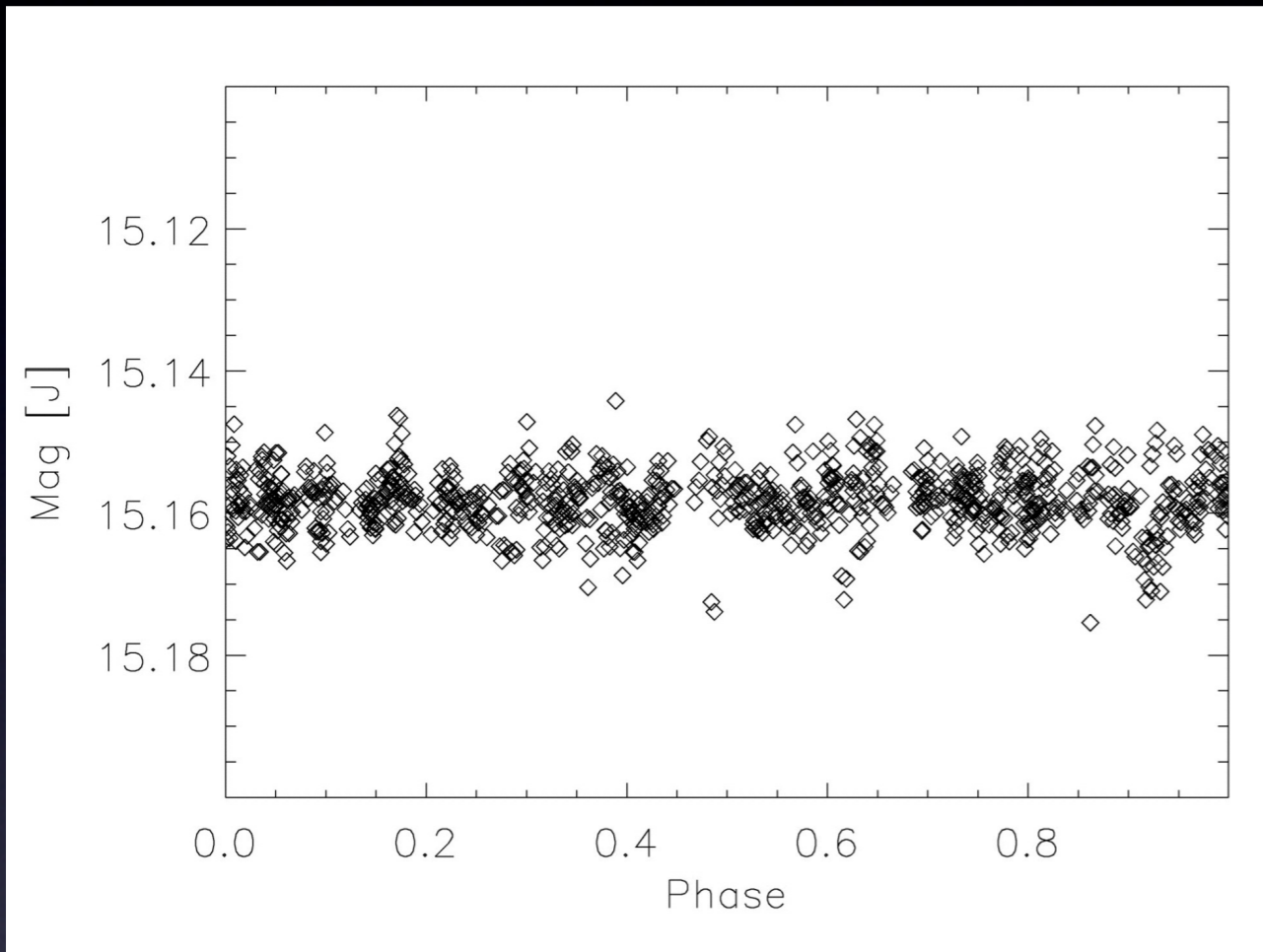


19f_2_04302
Before DSTL
Period = 2.0291 d

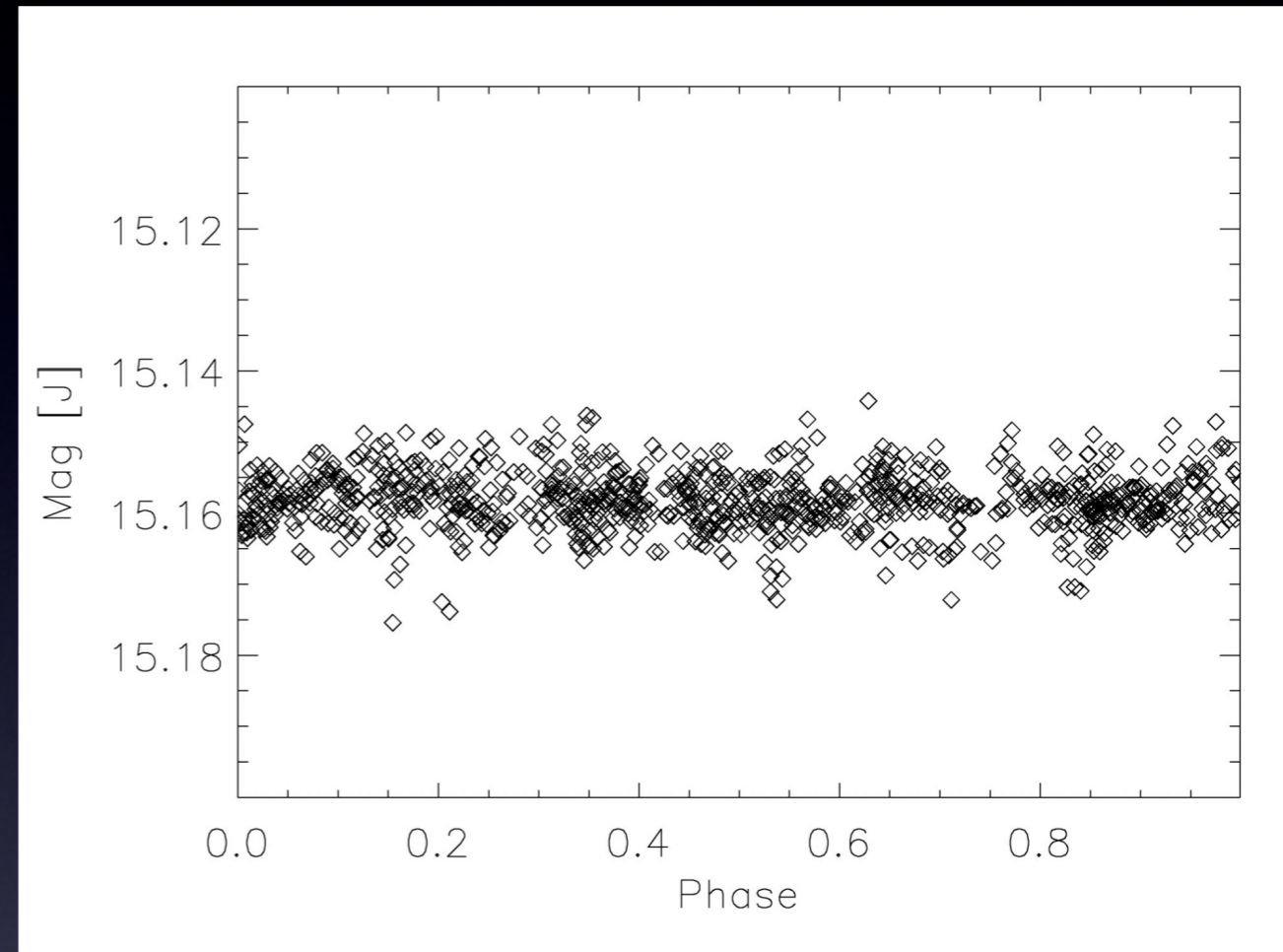


19f_2_04302
After DSTL
Period = 2.0294 d

Does the OCC-Fit detect the new light curves ?



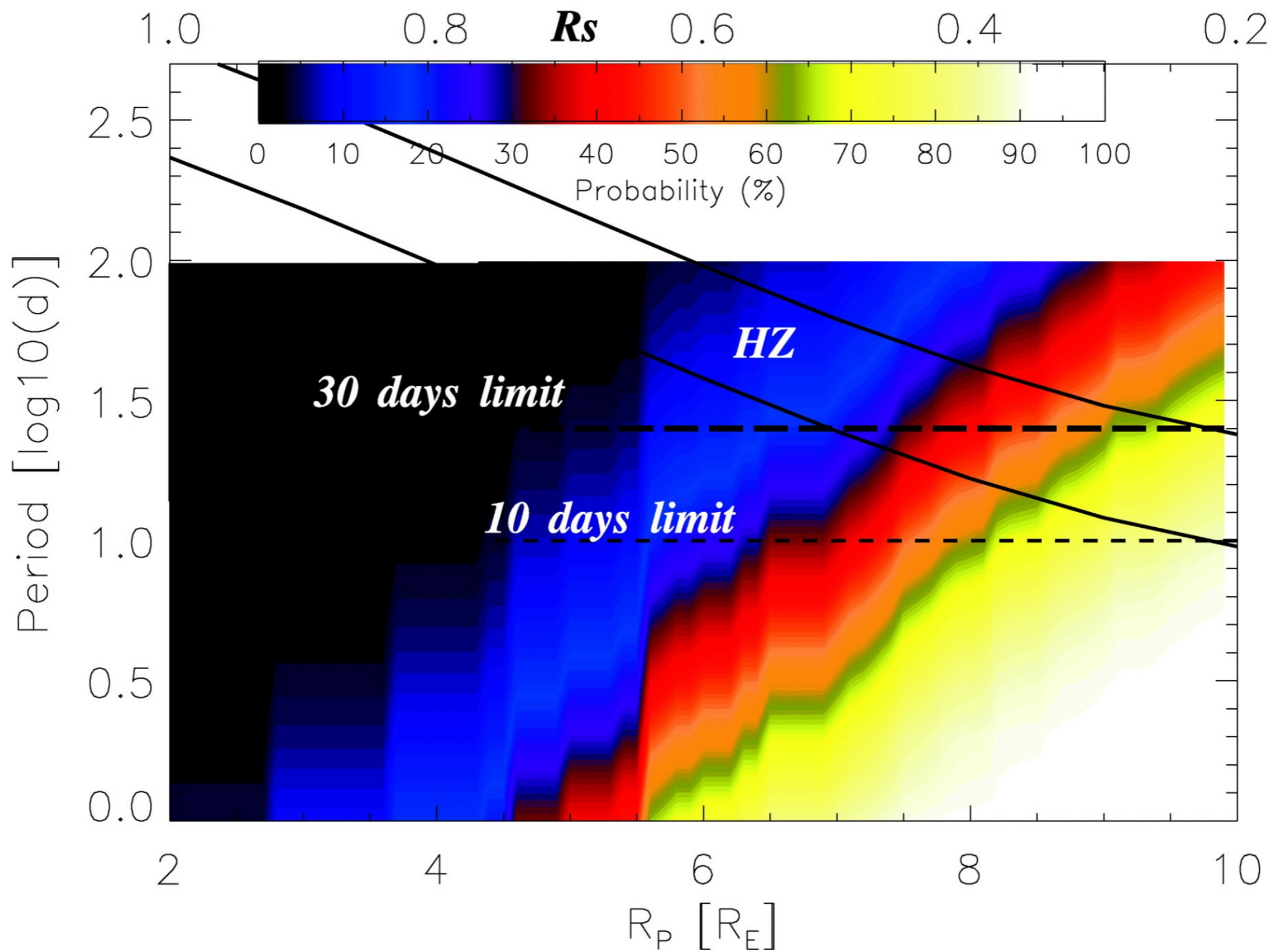
19f_2_05853
Before DSTL
Period = 5.1067 d



19f_2_05853
After DSTL
Period = 2.0291 d

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Habitable zone & RoPACS fields



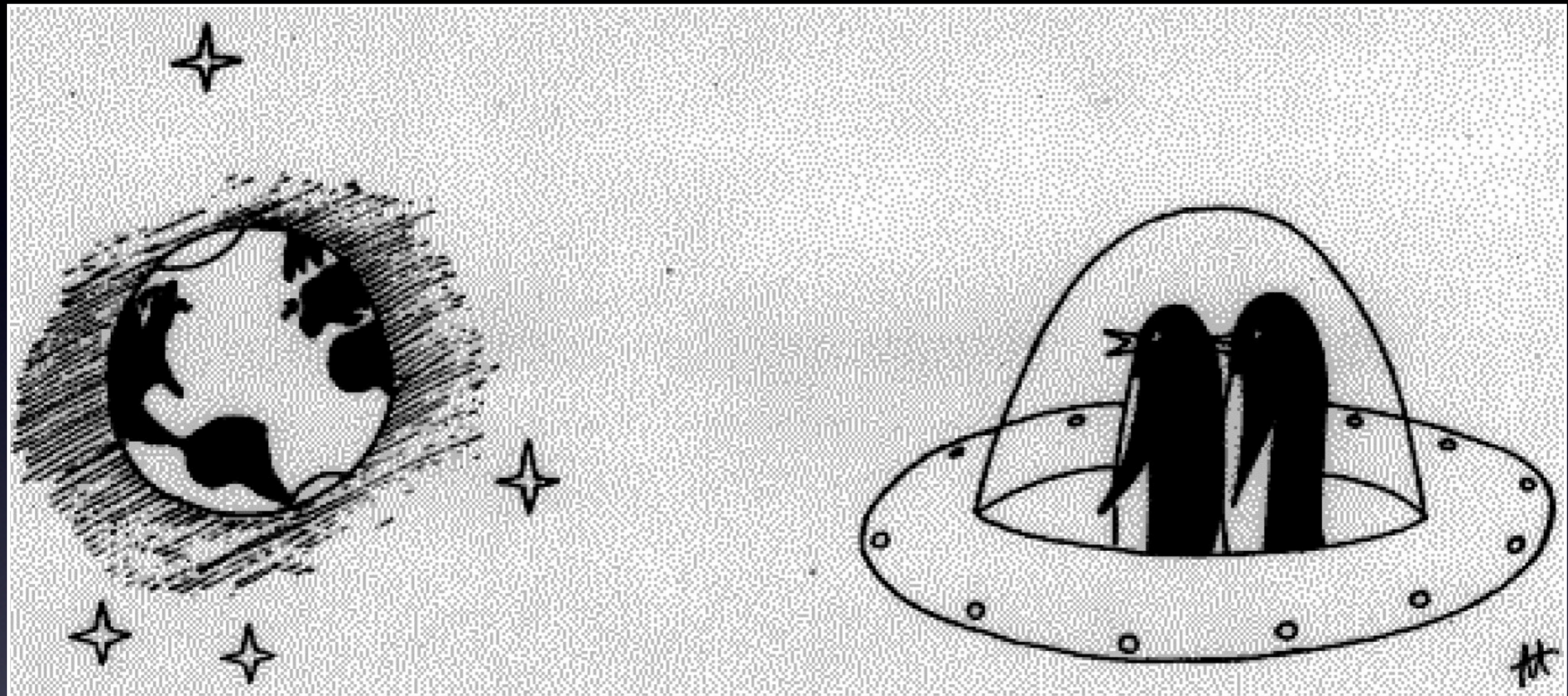
Conclusions

- IR LCs suffer by systematic errors (high correlation)
- We can improve these LC using algorithms or modify the pipeline
- Probability map is very promising for hot Jupiters but we need more data to reach HZ

Future work

- Improve DSTL
- More tests
- Check detection algorithms & thresholds

Thank you



" I see only a little snow at the poles. Obviously, this planet can't support intelligent life "