Project Initiation Document

TESS Red Giant asteroseismic predictions with Kepler data - TRG

Author: Mat Schofield

Date: 31/05/17

Version History

V0.1 - Document created - 31/05/17

V1.0 - Document circulated to board - XX/XX/XXXX

# Introduction

## Background/Case

TESS needs to select Red Giants with the highest probability of detecting oscillations, in order to get the most useful data from the mission. This method is a potentially quick and robust way of making a selection.

## Costs and funds

Time

## Benefits

This method will be applicable for TESS, PLATO, K2 and CoRoT. Predictions can be made for these missions with minimal extra work.

# Project Definition

## Scope

To make predictions for Red Giant stars as observed by TESS, using adjusted Kepler data. Find correlations between asteroseismic parameters and detection probability in TESS.

## Exclusions

Only using Kepler data

## Deliverables

Produce a polynomial/data cube/KDE which can estimate the detection probability of Red Giants in TESS, given a set of parameters.

## Constraints

main time constraint: Data will need to be selected and fitted to identify modes

## External dependencies

## Assumptions

1. TESS light curves can be accurately estimated from Kepler data. 2. Modes can be fitted correctly. 3. The detection test is a reliable tool

# Project Plan

## Initial project plan/Milestones

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Label** | **Description** | **Start** | **End** | **Actual End** |
| 1. Get data | Get sets of Kepler data to test and run the code on | 31.05.17 | 20.06.17 |  |
| 2. Make like TESS | Remove white noise, change length of data set, add TESS noise, correct for change in bandpass | 20.06.17 | 10.08.17 |  |
| 3. Detection test | Run the detection test | 10.08.17 | 10.09.17 |  |
| 4. Parameters-to-Pdet | Create a polynomial/data cube/KDE to estimate Pdet from numax, dnu, Tmag | 10.09.17 | 10.10.17 |  |
| 5.  Code to run it all | Put the pieces together | 10.10.17 | 10.11.17 |  |

In stage 1, either get data from K2pipes or the Kepler gold standard data for all q0-q17 on RDS.

In stage 3, this can either be done in the time domain or the frequency domain. For either method, use the templates given in K2data.py.

In the frequency domain, K2data.py power\_spectrum() function:

- Turn madVar on.

- Use a moving mean filter over 30 bins, or a Svitsky-Golay filter, or use astropy.convolution.gaussian1D (see <http://docs.astropy.org/en/stable/convolution/>) to remove chi^2 2 DOF noise from signal

- Then use high frequency PSD to reduce the scale of the entire PSD.

- Add TESS noise in the frequency domain

- Use a linear interpolation across all frequencies in the PSD to take the power at the frequency bins of the reduced 27 day data set.

- draw from np.random.gamma with k=1 to add chi^2 2 DOF noise.

In the time domain, in K2data.py read\_timeseries() function:

- Change the start date, the length to 27 days (i.e 27\*48). **Take data without gaps. Where there are gaps in the data, make sure to not take data from more than 27 days**

- Add a bandpass correction kewarg of 0.85. Multiply the time series signal by the bandpass kewarg to change bandpass.

- Use stars with very low noise levels, then just ignore the noise already there when adding the white noise from TESS in the time domain

## Contingency

# Organisational structure

## Team

|  |  |  |
| --- | --- | --- |
| **Level** | **Title** | **Person** |
| Board | Project Manager | Mat Schofield |
| Board | Executive | Bill Chaplin |
| Board |  | Guy Davies |
| Team |  | Tom North |
| Team |  | Dan Huber |
| Team |  |  |
| Contributor |  |  |

## Filing structure

Git

# Communication and stakeholders

## Communication methods

email & Git projects

## List of key stakeholders

|  |  |  |  |
| --- | --- | --- | --- |
| Stakeholder | Interest | Needs | Attitudes |
| Andrea Miglio | Potential application for PLATO | To make the method valid for PLATO | Positive |
| Tiago Campante | Follow up from his detection work | NA | Positive |
| TESS seismology community | Relevant for TESS asteroseismic target selection | Access to the code | Positive |
| Andrew Tkachenko | Wants to create a TESS Red Giants selection function | Access to the code | Positive? |

Dennis Stello selection function for K2 NA Positive

TESS Target Selection Relevant for TESS Access to code Positive

asteroseismic target

selection

# Reporting cycle

## Reporting periods

The first day of each month

# Risk assessment

## Risk log