



PyWD2015 – A New GUI for Wilson – Devinney Code

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What is PyWD?

- **Graphical user interface for Wilson – Devinney (WD) 2015**
 - Generates dcin and lcin files
 - Runs DC and LC programs
 - Visualises the outputs
- **Covers nearly all features of WD2015**
 - With the exception of subsets (will be included)
- **Has Additional User Tools**
 - Drawing critical Roche potentials, solution history, project management etc.

What is PyWD?

- Why?

- **2 Main Reasons:**
 - Currently, no GUI for WD2015
 - WD is a great “dedicated study” code

What is PyWD?

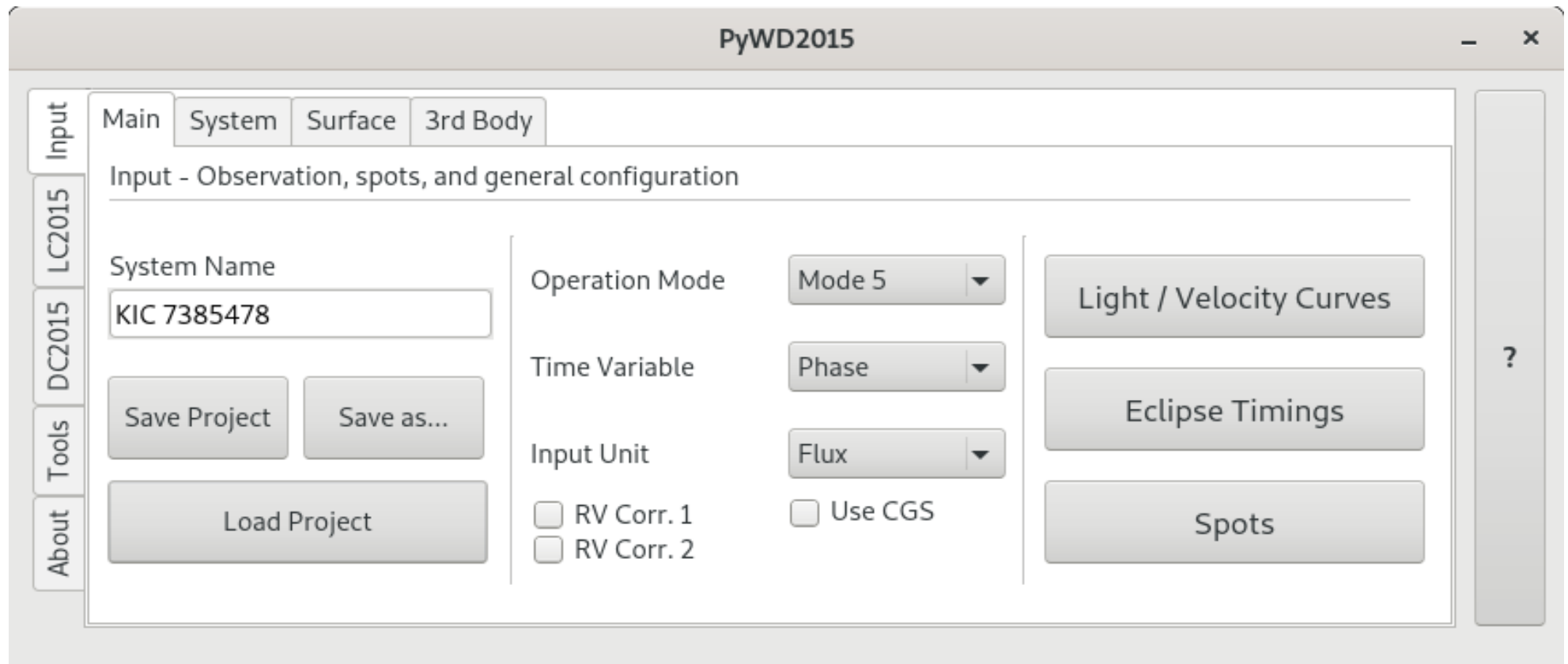
- How?

- **Written in Python 2.7**
 - Matplotlib
 - Numpy
 - Scipy
- **Qt4 GUI Framework**
 - Cross-platform (Linux and Windows tested)

A Simple Example

- Modelling a System

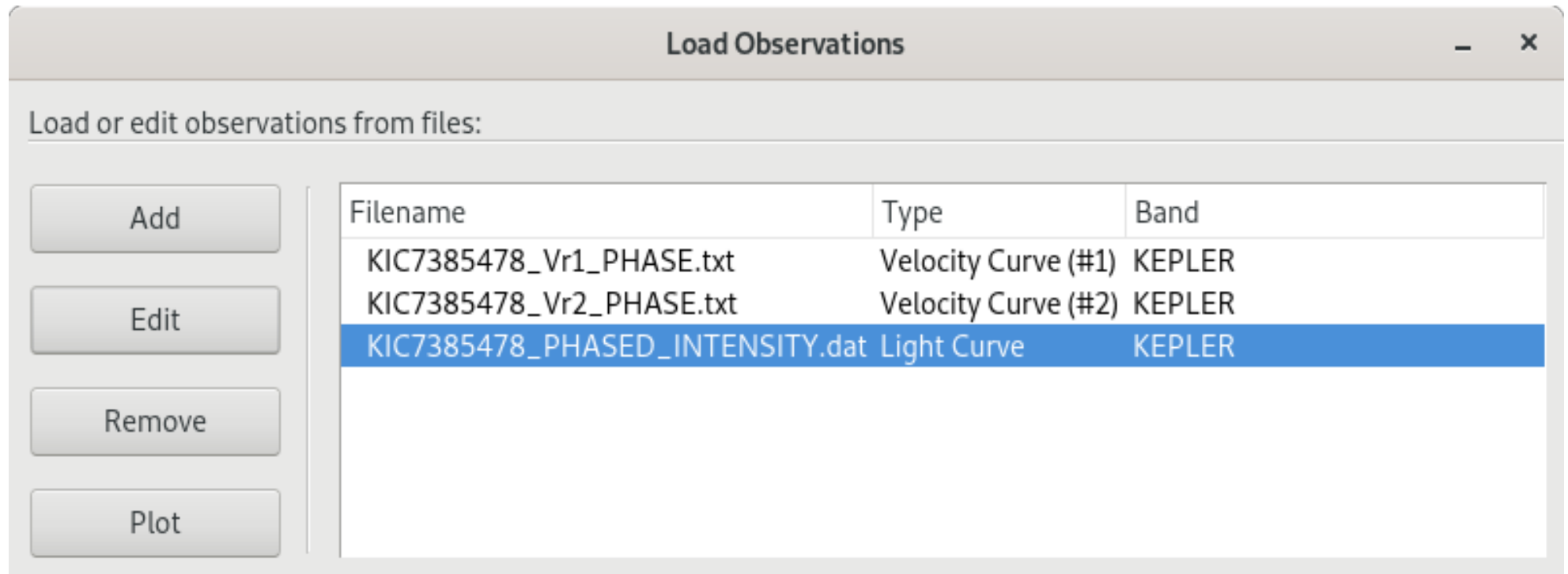
- Main Window



A Simple Example

- Modelling a System

- Loading Observations



The screenshot shows a software window titled "Load Observations" with a close button (X) in the top right corner. Below the title bar, the text "Load or edit observations from files:" is displayed. On the left side of the window, there are four buttons: "Add", "Edit", "Remove", and "Plot". The main area of the window contains a table with three columns: "Filename", "Type", and "Band". The table lists three observation files, with the third row highlighted in blue.

Filename	Type	Band
KIC7385478_Vr1_PHASE.txt	Velocity Curve (#1)	KEPLER
KIC7385478_Vr2_PHASE.txt	Velocity Curve (#2)	KEPLER
KIC7385478_PHASED_INTENSITY.dat	Light Curve	KEPLER

A Simple Example

- Modelling a System

- Loading Observations

Curve Properties

Load or edit a light curve

Band # KSD

L1 L2

X1 X2

Y1 Y2

E1 E2 E3 E4

EL3A SIGMA

OPSF NOISE

WLA AEXTINC XUNIT CALIB

Data Preview of file:
/home/varnani/Documents/PyWD/mod5/KIC7

Time/Phase	Observation	Weight
0.00102125	0.821711	1.000
0.00301974	0.822117	1.000
0.00502172	0.822912	1.000
0.00700831	0.824311	1.000
0.00900415	0.827086	1.000
0.01105012	0.830251	1.000
0.01304003	0.834537	1.000
0.01497126	0.839371	1.000
0.01698936	0.844083	1.000
0.01901417	0.850066	1.000
0.02101108	0.856911	1.000
0.02302340	0.863287	1.000

A Simple Example

- Modelling a System

- Adding spots

Configure Spots

Configure spot parameters

Drift Rate for Star 1 Spot A Movement Aging Aging Profile

Drift Rate for Star 2 Spot B Movement Use "VFA"

Star 1							Star 2							
#	A	B	LAT TSTART	LON TMAX1	RADSP TMAX2	TEMSP TEND	#	A	B	LAT TSTART	LON TMAX1	RADSP TMAX2	TEMSP TEND	
<input type="button" value="Add Spot"/>							<input type="button" value="Add or Remove Spots"/>							
Spot 1	<input checked="" type="radio"/>	<input type="radio"/>	<input type="text" value="0.89"/>	<input type="text" value="5.24"/>	<input type="text" value="0.94"/>	<input type="text" value="0.98"/>	Spot 1	<input checked="" type="radio"/>	<input type="radio"/>	<input type="text" value="0.89"/>	<input type="text" value="5.24"/>	<input type="text" value="0.94"/>	<input type="text" value="0.98"/>	<input type="button" value="Remove"/>
			<input type="text" value="52794"/>	<input type="text" value="52794"/>	<input type="text" value="52825"/>	<input type="text" value="52825"/>				<input type="text" value="52794"/>	<input type="text" value="52794"/>	<input type="text" value="52825"/>	<input type="text" value="52825"/>	<input type="button" value="Remove"/>
Spot 2	<input type="radio"/>	<input checked="" type="radio"/>	<input type="text" value="0.96"/>	<input type="text" value="2.01"/>	<input type="text" value="0.4"/>	<input type="text" value="0.90"/>	Spot 2	<input type="radio"/>	<input checked="" type="radio"/>	<input type="text" value="0.96"/>	<input type="text" value="2.01"/>	<input type="text" value="0.4"/>	<input type="text" value="0.90"/>	<input type="button" value="Remove"/>
			<input type="text" value="52794"/>	<input type="text" value="52794"/>	<input type="text" value="52825"/>	<input type="text" value="52825"/>				<input type="text" value="52794"/>	<input type="text" value="52794"/>	<input type="text" value="52825"/>	<input type="text" value="52825"/>	<input type="button" value="Remove"/>
<input type="button" value="Add Spot"/>							<input type="button" value="Add Spot"/>							

A Simple Example

- Modelling a System

- Eclipse timings

Eclipse Timings

Load eclipse timings from a file

IFTIME - Write eclipse timings

KSD 1 SIGMA 0

Data preview of file:
/home/varnani/Documents/PyWD/mod3/O_C_1

Time	Eclipse Type	Weight
51832.5518	2	1.0
51837.3523	2	1.0
51877.5481	1	1.0
52591.4541	1	1.0
52606.4543	2	1.0
52634.4492	2	1.0
52963.4075	1	1.0
52964.4052	2	1.0
52976.4034	2	1.0
53001.4001	1	1.0
53020.5985	1	1.0
53020.5977	1	1.0
53624.5198	1	1.0
53625.5179	2	1.0
53649.5159	2	1.0
53650.5159	2	1.0

Load

Clear

A Simple Example

- Modelling a System

- System Parameters

The screenshot shows the PyWD2015 software interface. The window title is "PyWD2015". The interface has a sidebar on the left with buttons for "Input", "LC2015", "DC2015", "Tools", and "About". The main area has tabs for "Main", "System", "Surface", and "3rd Body". The "System" tab is selected, and the title of the main area is "System Parameters - Eclipsing system's orbital and physical values".

Ephemeris	Period	dP/dt	Phase Shift	Duration of Obs.	Gaussian abs.
54954.534784	1.655473	0	0.0015983790	0	1
Semi-major axis	Eccentricity	Omega (ω)	d ω /dt	Inclination	V Gamma
7.51	0	1.570796327	0	70.966	-16.2446
Q (M2/M1)	Metallicity	T1	T2	Pot1	Pot2
0.21	0	7000	4293	4.9582	2.2574164139
F1	F2	Eclipse semi-dur.	V Unit	Log(distance)	Conjunction
1	1	0	1	1.83714	

A Simple Example

- Modelling a System

- Surface Parameters

The screenshot shows the PyWD2015 software interface with the 'Surface' tab selected. The window title is 'PyWD2015'. The interface has a sidebar on the left with buttons for 'Input', 'LC2015', 'DC2015', 'Tools', and 'About'. The main content area is titled 'Surface Parameters - Parameters that control atmosphere, darkening, grid sizes and reflection'. It is divided into four sections: 'Atmosphere', 'Grids', 'Limb Darkening', and 'Reflection Computation'. Each section contains various input fields, dropdown menus, and checkboxes for configuring the simulation parameters for two stars.

Atmosphere		Star 1	Star 2
IFAT1	Stellar Atmosphere	ALB 0.500	0.699
IFAT2	Stellar Atmosphere	GR 0.320	0.270

Grids		Star 1	Star 2
Fine		90	90
Coarse		90	90

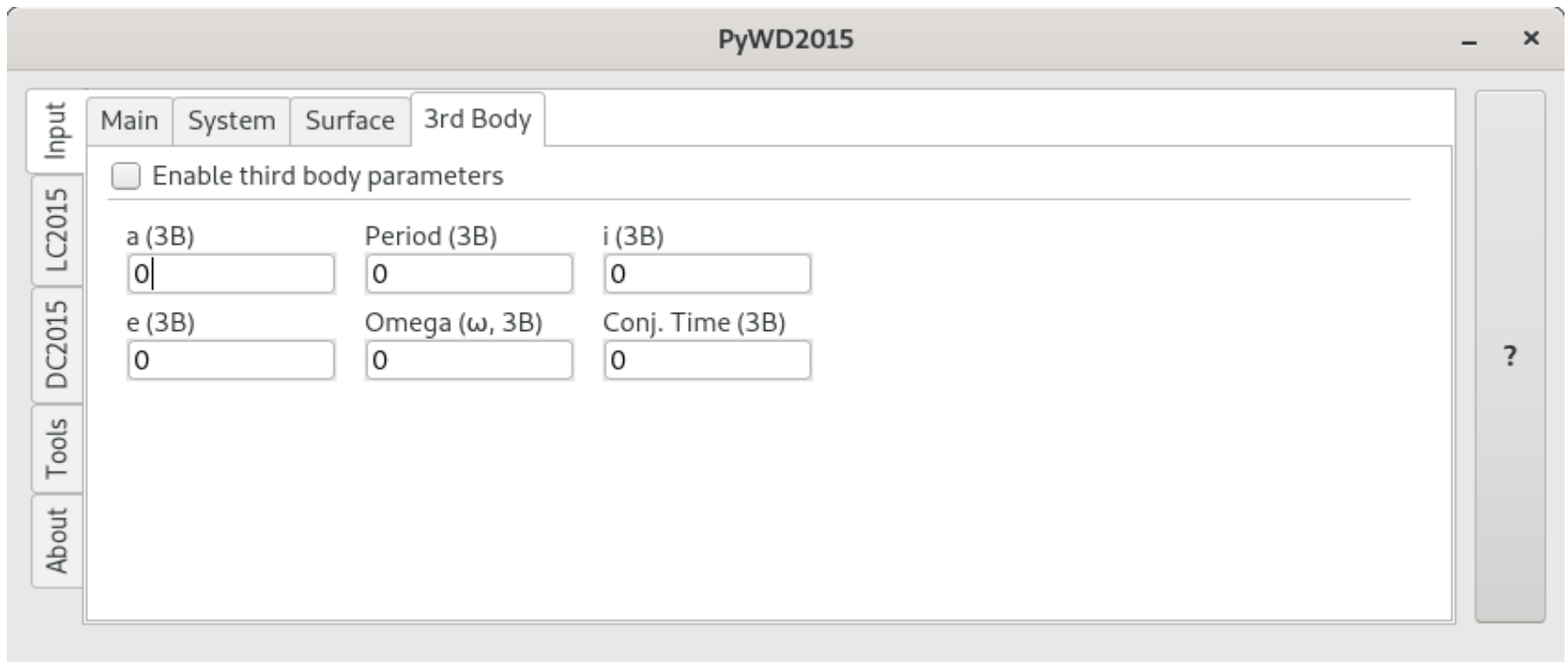
Limb Darkening		Star 1	Star 2
LD1	Linear Cosine <input checked="" type="checkbox"/> Set Fixed	XBOL 0.471	0.531
LD2	Linear Cosine <input checked="" type="checkbox"/> Set Fixed	YBOL 0	0

Reflection Computation	
<input type="checkbox"/>	Decouple L2 from T1 and T2
<input type="checkbox"/>	Use detailed reflection computation
1	Number of reflections

A Simple Example

- Modelling a System

- Third Body Parameters



The screenshot shows the PyWD2015 software interface. The window title is "PyWD2015". The interface has a sidebar on the left with buttons for "Input", "LC2015", "DC2015", "Tools", and "About". The main area has four tabs: "Main", "System", "Surface", and "3rd Body". The "3rd Body" tab is selected. At the top of the tab, there is a checkbox labeled "Enable third body parameters" which is currently unchecked. Below this, there are six input fields arranged in a 2x3 grid:

Parameter	Value	Parameter	Value	Parameter	Value
a (3B)	0	Period (3B)	0	i (3B)	0
e (3B)	0	Omega (ω , 3B)	0	Conj. Time (3B)	0

A Simple Example

- Modelling a System

- LC Tab

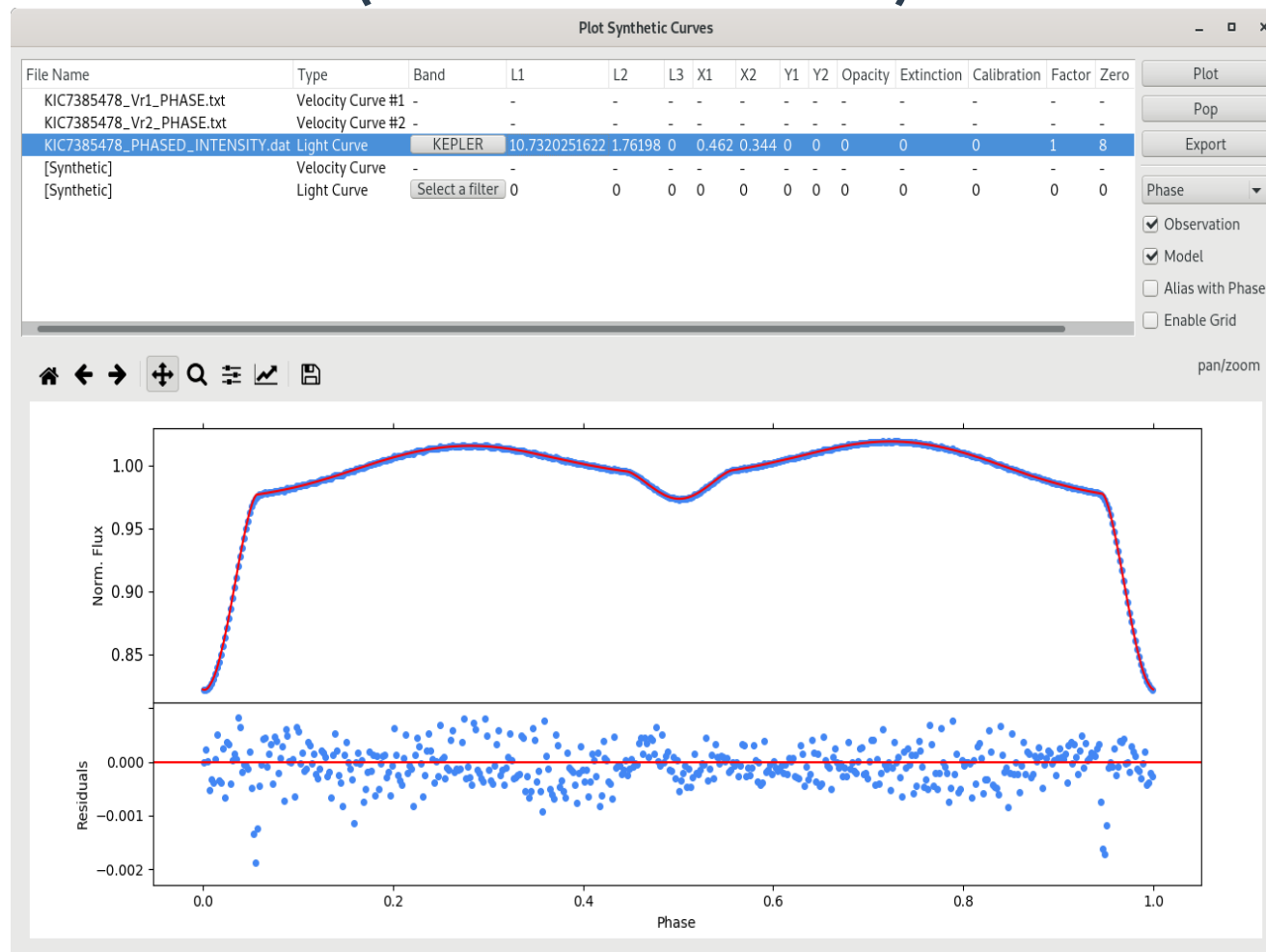
The screenshot shows the PyWD2015 software interface with the LC2015 tab selected. The window title is "PyWD2015". The interface is divided into several sections:

- Input:** "LC2015 - Configure LC parameters and compute synthetic data".
- LC2015:**
 - Fract. Sd. Noise
 - Seed
 - JD Start JD Stop JD Increment
 - Phase Start Phase Stop Phase Incr.
 - Star # Spectral Temp. Spec. T. Phs. Phase Norm.
- Tools:**
- About:**

A Simple Example

- Modelling a System

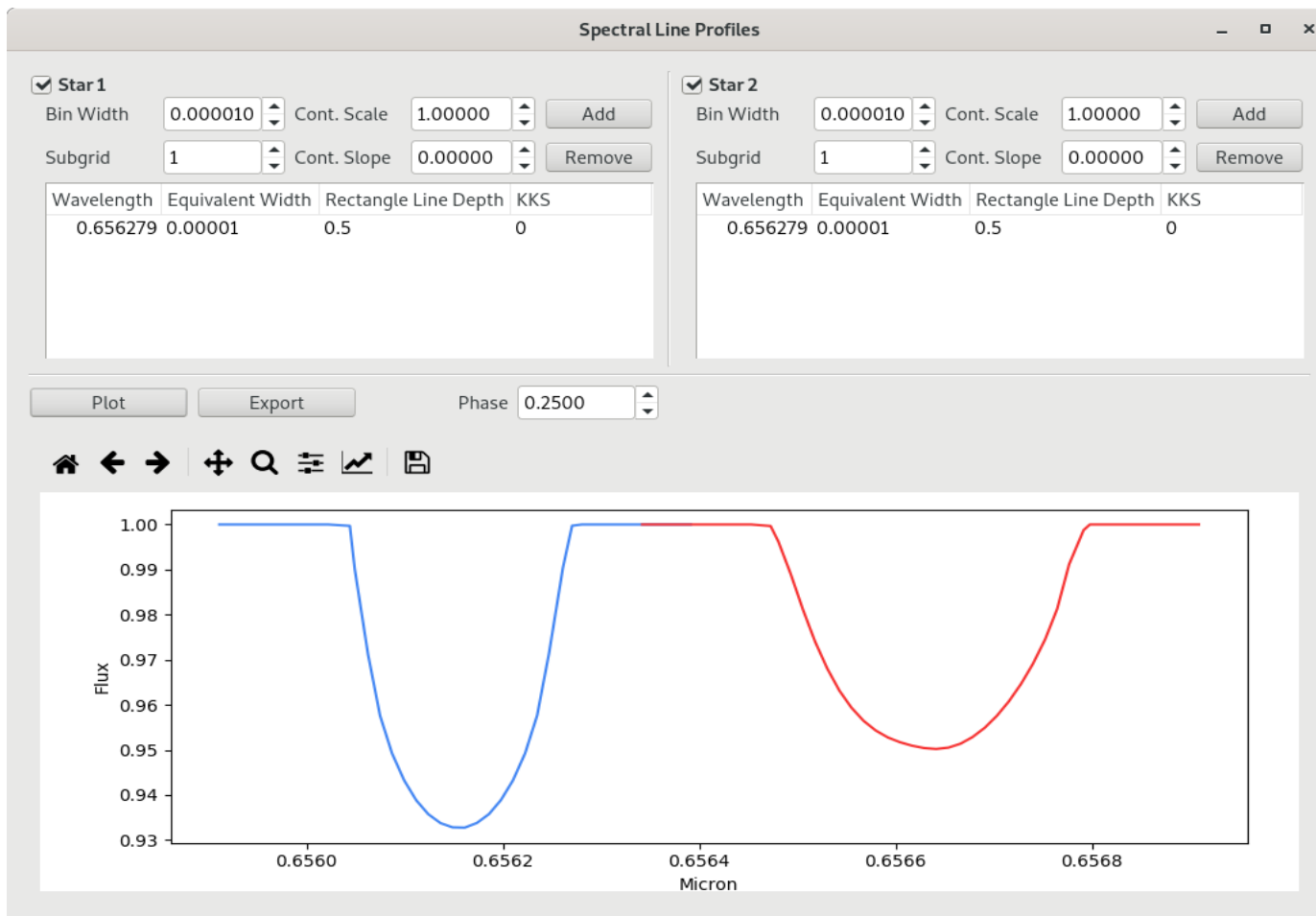
- Synthetic Curves (MPAGE 1 and 2)



A Simple Example

- Modelling a System

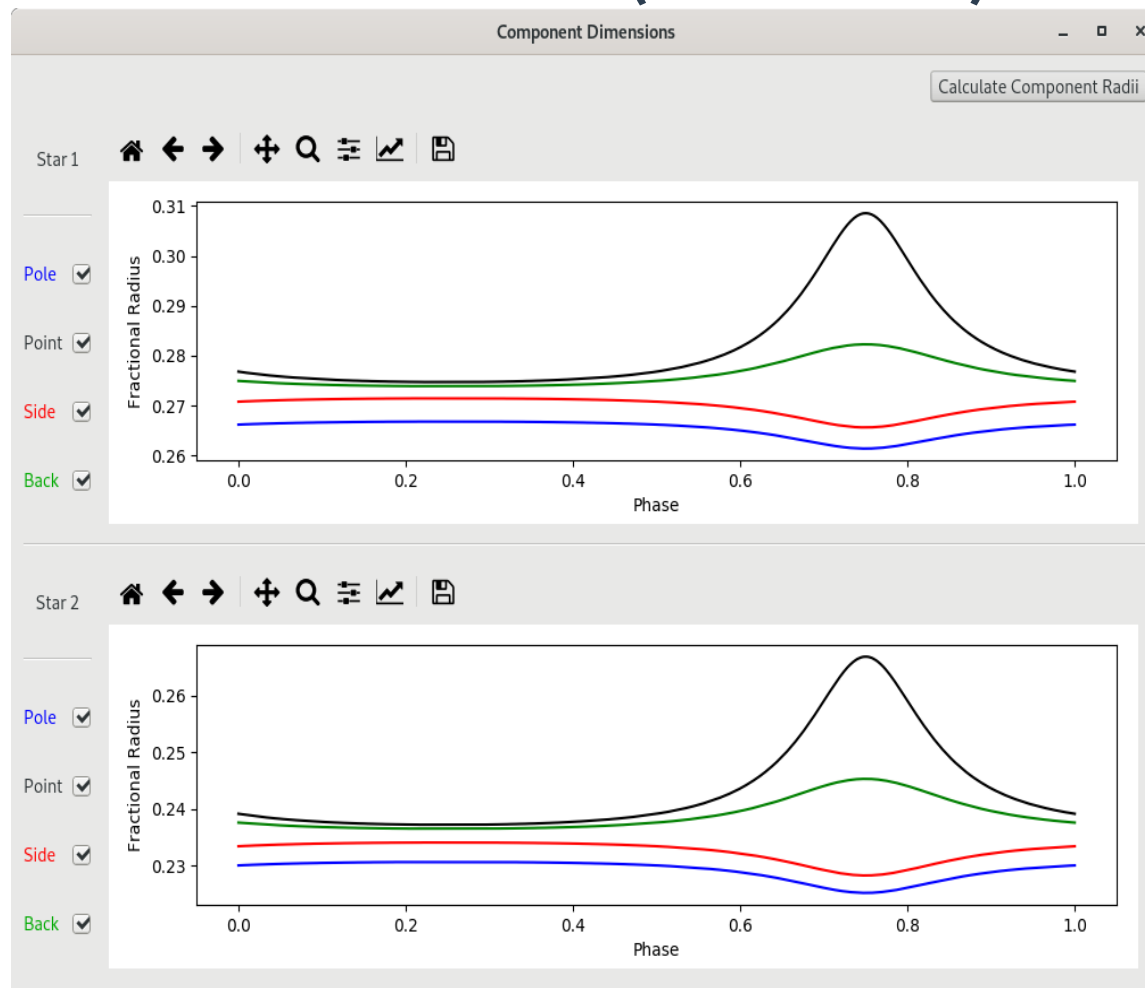
- Spectral Line Profiles (MPAGE 3)



A Simple Example

- Modelling a System

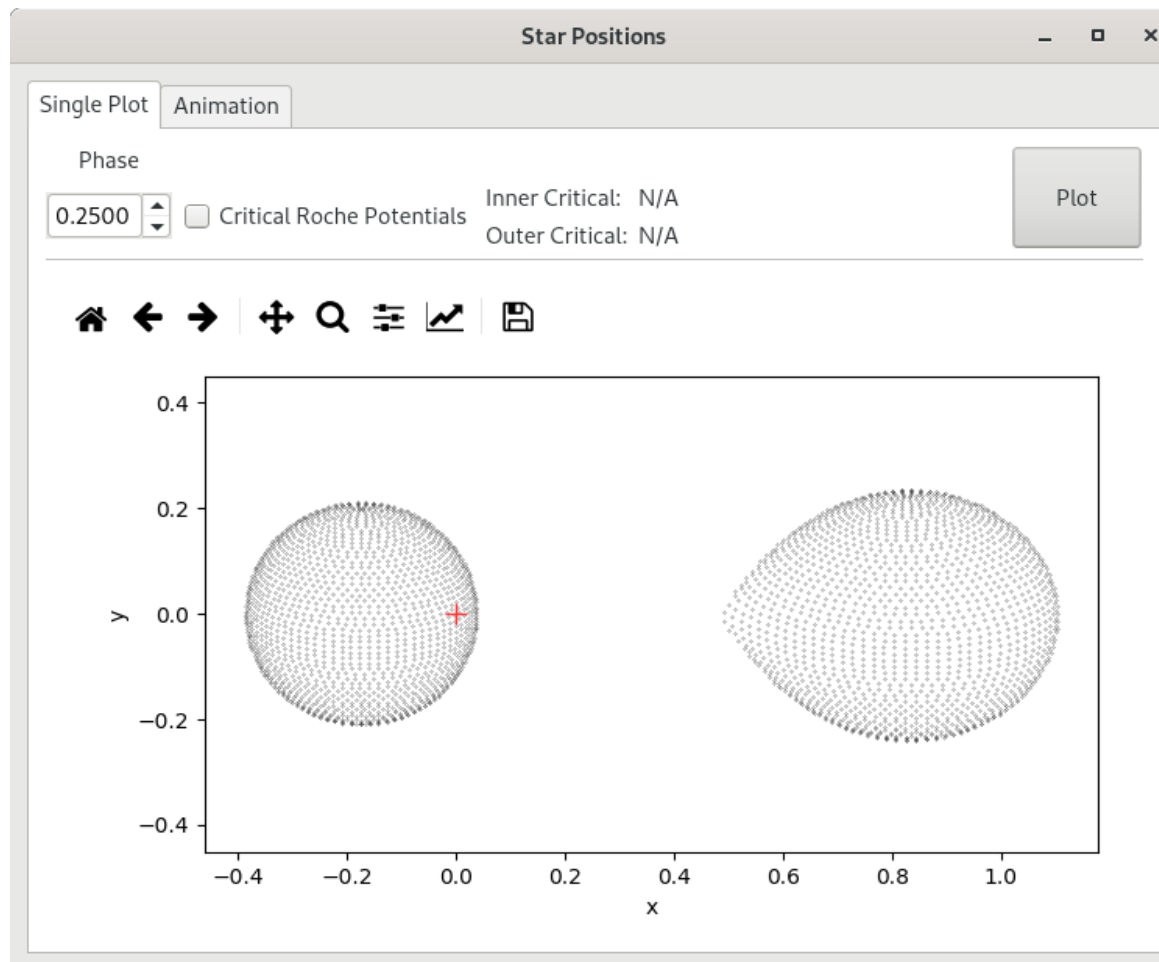
- Component Dimensions (MPAGE 4)



A Simple Example

- Modelling a System

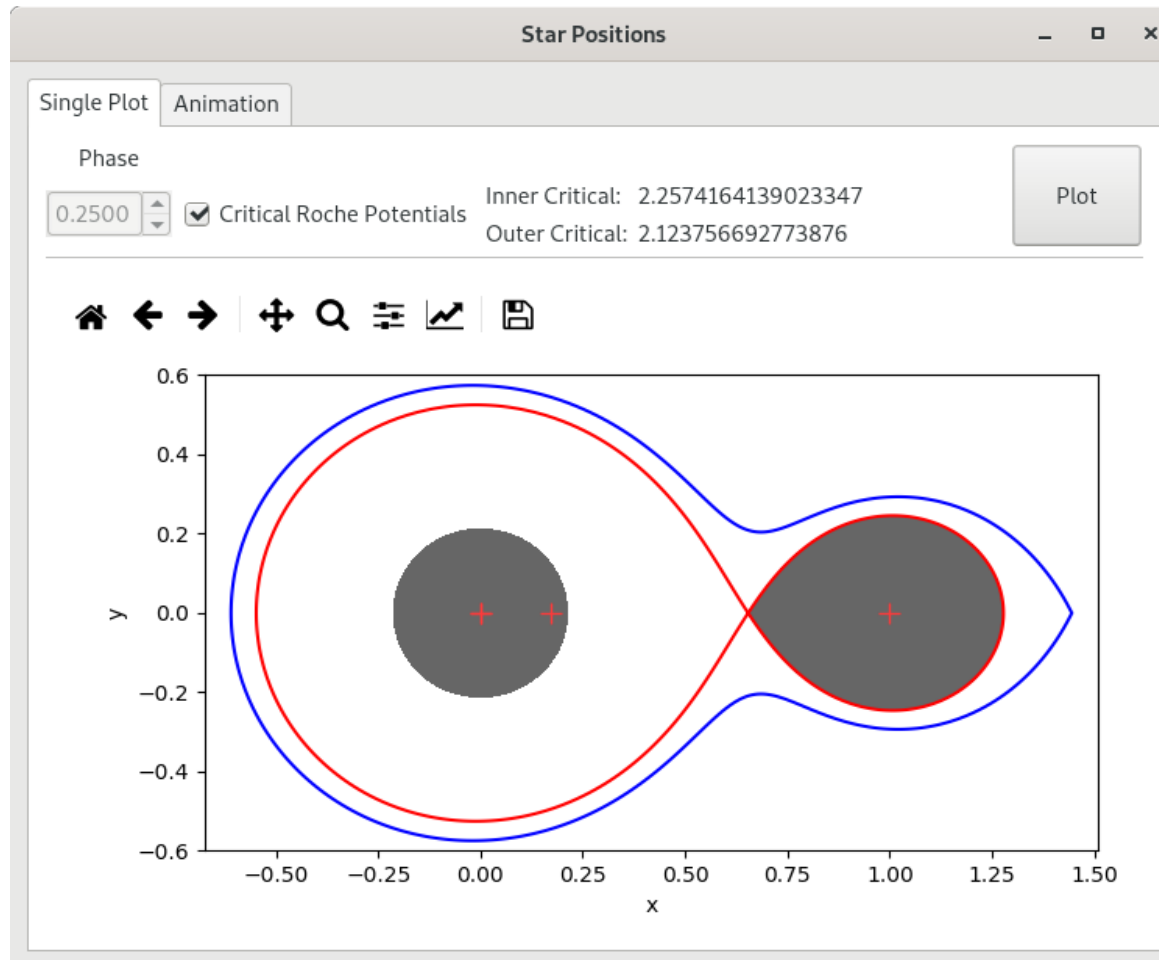
- Star Positions (MPAGE 5)



A Simple Example

- Modelling a System

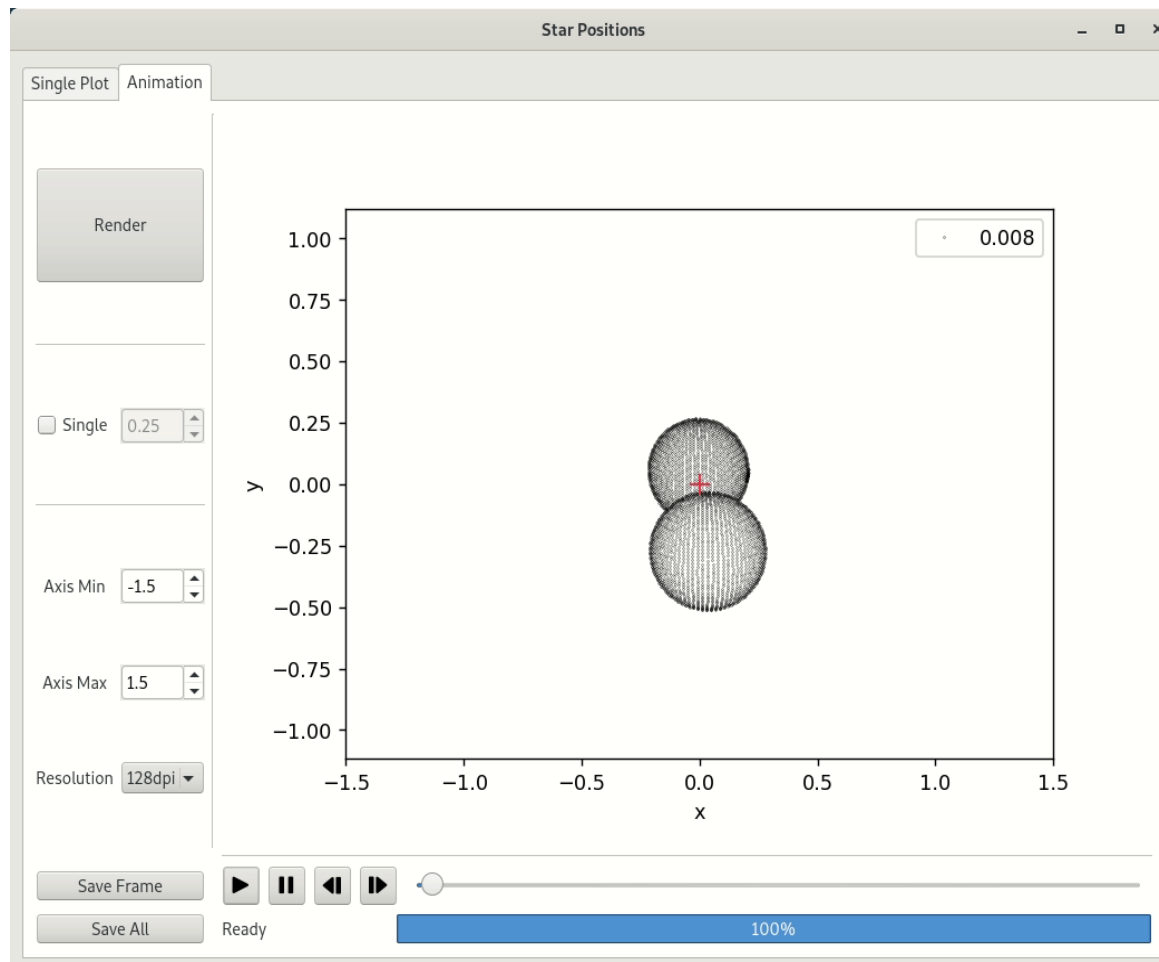
- Roche Potentials



A Simple Example

- Modelling a System

- Star Positions (MPAGE 5)



A Simple Example

- Modelling a System

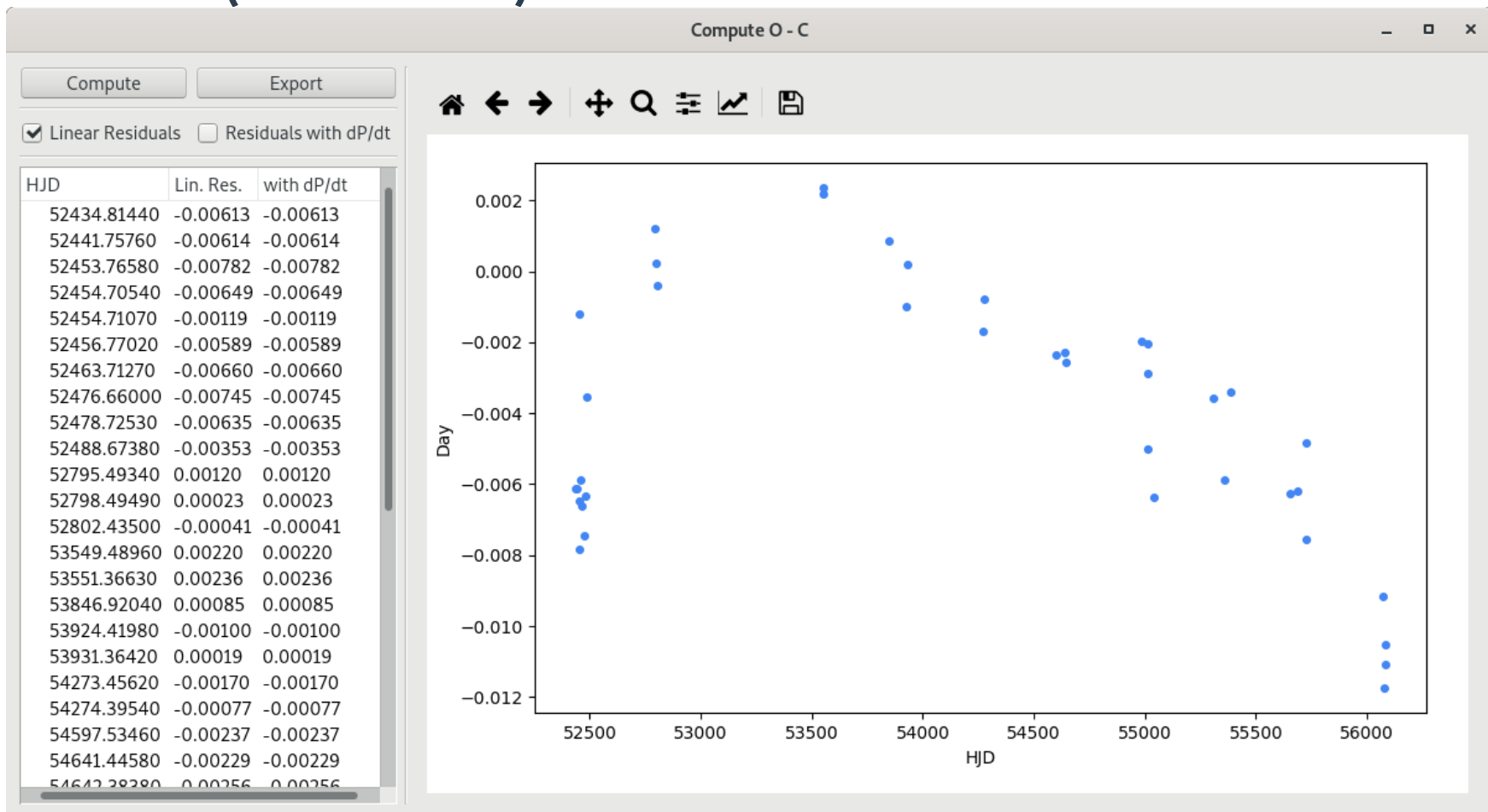
- Conjunction (MPAGE 6)

HJD	Min Type	Date (D/M/Y) - Time (H:M:S)
58729.01322	1	2/9/2019 - 12:15:24.71
58730.66870	1	4/9/2019 - 3:59:20.97
58732.32417	1	5/9/2019 - 19:43:16.55
58733.97964	1	7/9/2019 - 11:27:12.29
58735.63512	1	9/9/2019 - 3:11:9.06
58737.29059	1	10/9/2019 - 18:55:5.13
58729.84096	2	3/9/2019 - 8:7:22.82
58731.49643	2	4/9/2019 - 23:51:18.31
58733.15191	2	6/9/2019 - 15:35:14.83
58734.80738	2	8/9/2019 - 7:19:10.65
58736.46285	2	9/9/2019 - 23:3:6.64
58738.11833	2	11/9/2019 - 14:47:3.65

A Simple Example

- Modelling a System

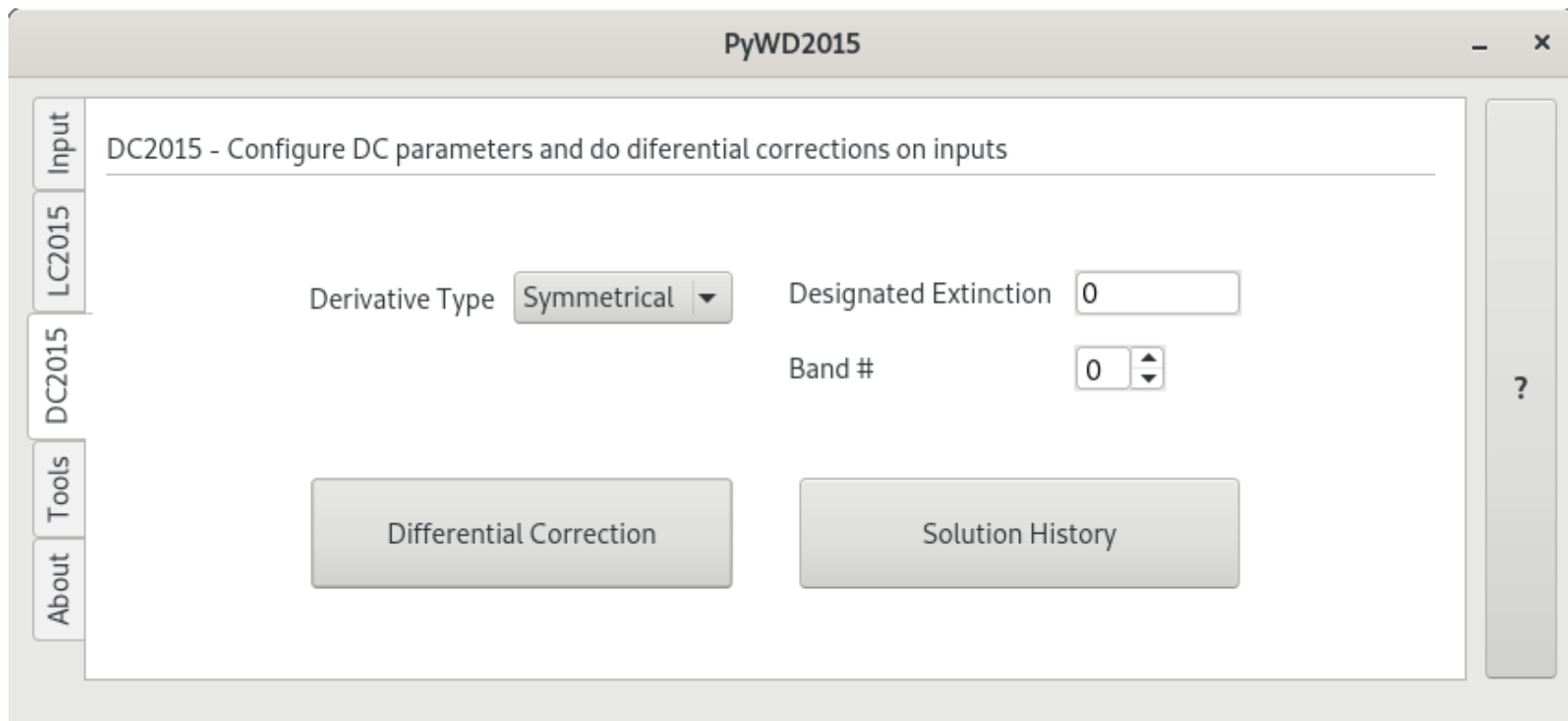
- O - C (MPAGE 6)



A Simple Example

- Modelling a System

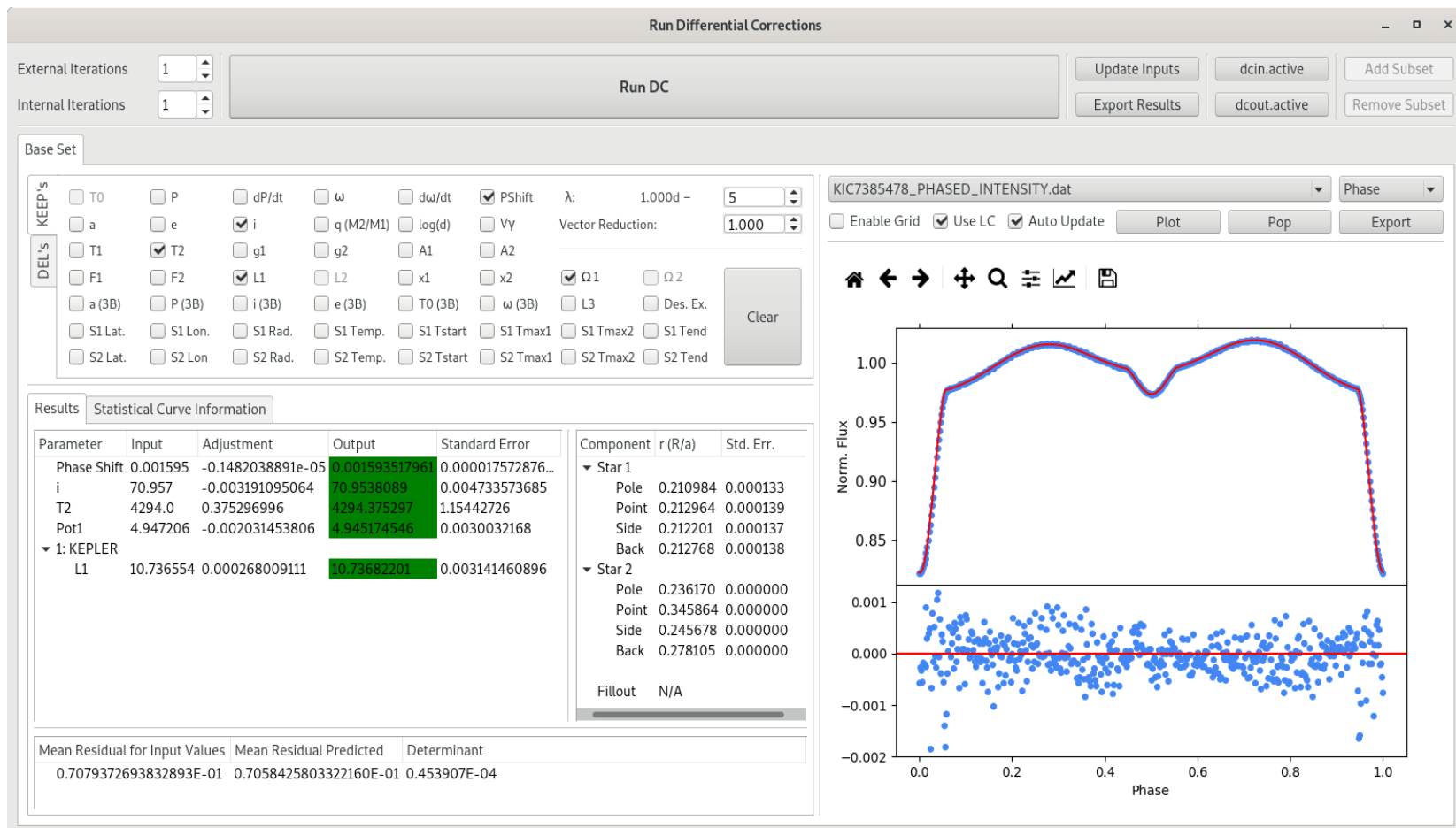
- DC Tab



A Simple Example

- Modelling a System

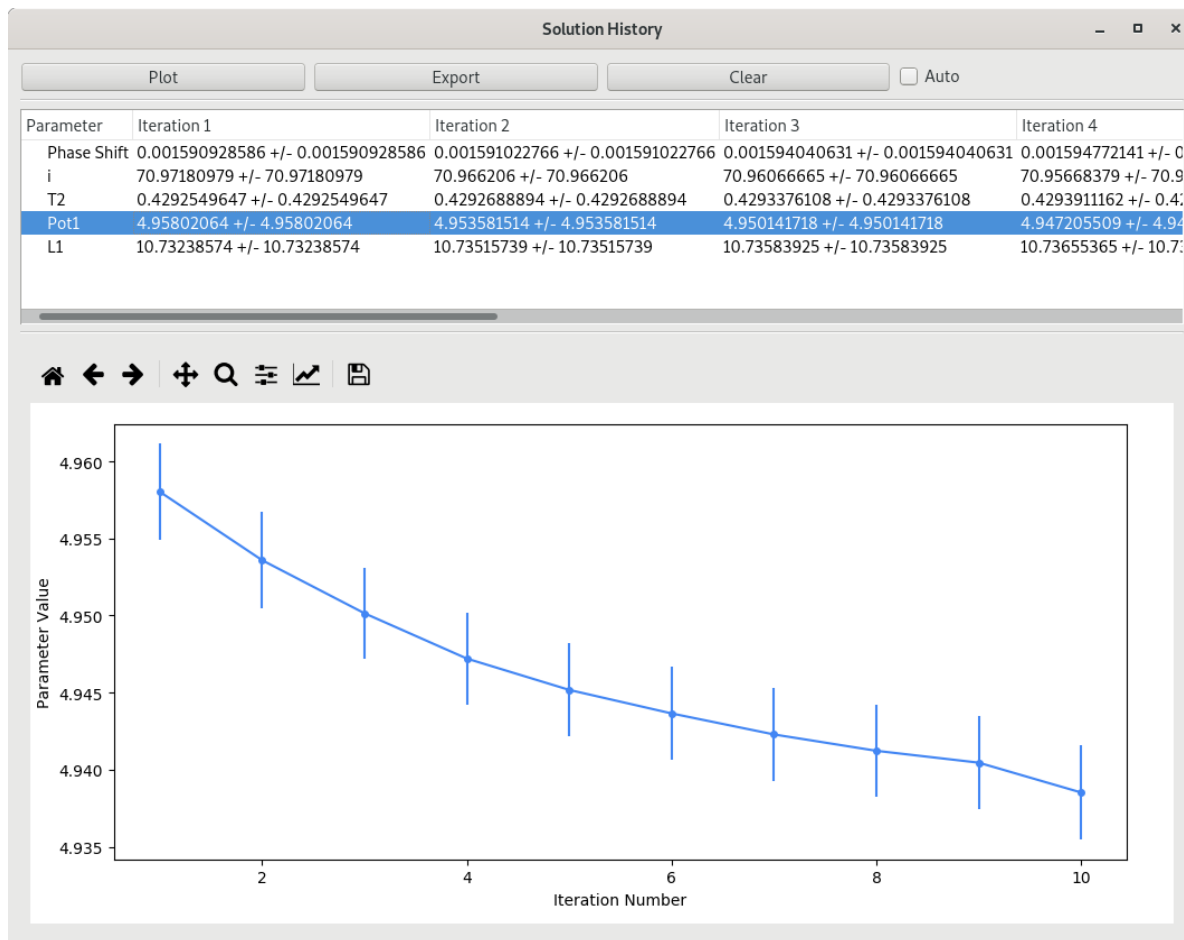
- Differential Corrections



A Simple Example

- Modelling a System

- Solution History



A Simple Example

- Additional User Tools

- Radius to Potential Conversion

PyWD2015

Radius to Ω Conversion | Temperature Estimation | JD - UT Conversion

Q = M2/M1: 0.21000000

Fract. Radius: 0.21327

F: 1.0000

d: 1.0000

Ω Potential: 4.938550853624833

Calculate

Input | LC2015 | DC2015 | Tools | About

A Simple Example

- Additional User Tools

- Temperature Estimation

The screenshot shows a software window titled "PyWD2015" with three tabs: "Radius to Ω Conversion", "Temperature Estimation", and "JD - UT Conversion". The "Temperature Estimation" tab is active. On the left, there is a vertical sidebar with buttons for "Input", "LC2015", "DC2015", "Tools", and "About". The main area is split into two columns. The left column has an input field for "B - V (mag)" with the value "0.600" and a range of ± 0.100 , followed by a "Calculate Temperature (K)" button. Below this are four rows of model names and their corresponding temperature estimates with error ranges: Gray (2005) with 5910 \pm 339, Flower (1996) with 5895 \pm 361, Drilling and Landolt (2000) with 5876 \pm 431, and Popper (1980) with 5947 \pm 360. The right column has a dropdown menu set to "V - K" with "(mag)" next to it, an input field with "0.600" and a range of ± 0.100 , a "Calculate Temperature (K)" button, and a "Tokunaga (2000)" model with a temperature estimate of 7339 \pm 245. A question mark icon is visible on the right side of the window.

A Simple Example

- Additional User Tools

- JD – UT Conversion

The screenshot shows a software window titled "PyWD2015" with a sidebar on the left containing buttons for "Input", "LC2015", "DC2015", "Tools", and "About". The "Tools" section is active, displaying three tabs: "Radius to Ω Conversion", "Temperature Estimation", and "JD - UT Conversion".

The "JD - UT Conversion" tool is divided into two main sections:

- Left Section:** A text input field labeled "JD" contains the value "2458737.187500". Below it is a "Convert" button. The output field, labeled "D/M/Y - H/M/S (UT)", displays "10/9/2019 - 16:30:0.00".
- Right Section:** A form for entering a date and time. It has fields for "Day" (10), "Month" (9), "Year" (2019), "Hour" (16), "Minute" (30), and "Second" (0). Below these is another "Convert" button. The output field, labeled "JD", displays "2458737.1875".

A vertical scrollbar on the right side of the window contains a question mark icon.

Future

- **Code Refactoring**

- Upgrading from Qt4 to Qt5
- Major code rewrites
- Still Python 2.7 (3.* ?)

- **Release & Beyond**

- GitHub for releases, bug tracking and manuals
- ???

Thanks to:

- Dr. Robert E. Wilson
 - Dr. Walter van Hamme
 - Dr. Dirk Terrell
- Dear listeners, for your patience