Manual for Processing of the Coravel – Type Observations

Vilnius 2002

Content

Content	. 2
Quick Guide for Using Zurkon II	. 3
ŻurkonII analysis	. 4
ZurkonII preview	. 5
Quick Guide for Using jr2	. 8
Quick Guide for Using Sphinx	10
Other programs	12

Quick Guide for Using Zurkon II

The Zurkon II analyzes database of individual observations and rejects flaw scans. The program imports "*.idz" files (this file is generated by the "acora.exe") and creates "*.dat" files.



Figure 1 Structure of the "*.dat" file

STAR ST			100 March 1997		
nit Properties			Sum Preview		0 0 0 79
Blogi matavimai				A. 6	0 0 0 0 84
I ciklas: 2			8000	1	0 0 084
	Save	ini		S 240	0 0 0 083
Il ciklas: 1			40 and	°	0 0 0 87
					1 0 0 079
Siloni skanai	Skanu tiesinim	A8	1 S A		0 0 0 0 75
I ciklas 2	I Param: 0.06	56	S 🕺 🥇		
1-	1				Consid
Il cikles: 1	Il Param 9e-0	05	<u> </u>		special
			Import baze	review	
Kini damai	Statut			8 8	1. *
l ciklas: 2		0K	Next>>	1	· · · · ·
in la la				· · · · ·	0
Il ciklas 1	1 d		Sava		
				1. Sec. 1. Sec	• •
Save for (1)		2			• *
in the second seco			<< Back	%	
DB Properties		ZUR Properties		Suskaicu	ota
Aax Irasu Sk.: 34 Esm. irasas: 2	RecNum: 4	Bloku Sk: 184	GrSk: 6.00043402		tas: 13.43589271774
		-		- Contractor	
Metar 2002 Menuo: 5	Diena: 8	Zingsnis: 840	Cikt 4	Like ska	mat 673
Valanda: 19 Minutes: 28 S	iekundes: 48	Zings. Sk: 50	_		
		and the second second			

Figure 2 Interface of the Zurkon

ZurkonII analysis

There are three methods to analyze individual scans:

1. Bad measurements.

l ciklas: 2	
, Il oiklas: I	
II CIKIAS.	

Figure 3 Parameters of bad measurements

When the left-hand part of the following inequality is larger than the right-hand part, then this measurement is treated to be wrong and it is substituted by the interpolated value between the nearest points:

$$\left| n_{ij} - \frac{1}{J_n} \sum_{j} n_{ij} \right| < C \cdot \sqrt{\frac{\sum_{j} \left(\frac{1}{J_n} \sum_{j} n_{ij} - n_{ij} \right)^2}{J_n - 1}},$$

where *i* is the index of the step, *j* is the index of the scan, n_{ij} is the individual measure, J_n is the number of scans, and *C* is the constant from the CORAVEL interface. There are two iterations foreseen in this method (if both check boxes are marked) so that two different constants (I ciklas) and (II ciklas) can be used.

2. Weak scan:



Figure 4 Parameters of weak scans

When the left-hand part of the following inequality is larger than the right-hand part, then the scan is too weak due to low S/N ratio and it is rejected:

$$\left|\frac{\sum_{j}\sum_{i}n_{ij}}{J_{n}} - \sum_{i}n_{ij}\right| < C \cdot \left|\frac{\sum_{j}\sum_{i}n_{ij}}{J_{n}} - \sum_{i}n_{ij}\right|^{2}}{J_{n} - 1}\right|$$

where *i* is the index of the step, *j* is the index of the scan, n_{ij} is the individual measure, J_n is the number of scans, and *C* is the constant from the CORAVEL interface. There are two iterations foreseen in this method (if both check boxes are marked) so that two different constants (I ciklas) and (II ciklas) can be used.

3. The noisy scan:

1	
T CIKIAS: 2	V
II ciklas: 1	

Figure 5 Parameters of noisy scan

When the left-hand part of the following inequality is larger than the right-hand part then this scan is rejected as noisy.

$$\left|\frac{\sum_{j} \frac{A_{j}}{B_{j}}}{J_{n}} - \frac{A_{j}}{B_{j}}\right| < C \cdot \left|\frac{\sum_{j} \frac{A_{j}}{B_{j}}}{J_{n}} - \frac{A_{j}}{B_{j}}\right|^{2}}{J_{n} - 1}\right|$$

where *i* is the index of the step, *j* is the index of the scan, n_{ij} is the individual measure, J_n is the number of the scans and *C* is the constant from the interface and

$$A_j = \sum_{i=1}^{10} n_{ij}$$
, $B_j = \sum_{i=J_n-10}^{J_n} n_{ij}$.

There are two iterations foreseen in this method (if both check boxes are marked) so that two different constants (I ciklas) and (II ciklas) can be used.

4. The straightening of the scan:

- Skanu tie	esinimas	
l Param:	0.0656	Ĩ
II Param:	9e-005	

Figure 6 Parameters of straightening of scan

$$n_{ij}^{new} = n_{ij} \cdot \left(1 + \frac{STEP_i - STEP_0}{100} \cdot \left([IParam] - [IIParam] \cdot STEP_0\right)\right)^{-1},$$

where *i* is the index of the step, *j* is the index of the scan, n_{ij} is the individual measure and *STEP_i* is the number of the steps.

ZurkonII preview

There are two preview windows, the "sum preview" and the "preview":



Figure 7 The "sum preview" window

The "Sum preview" window shows the sum of the individual cross correlation functions.



Figure 8 The "preview" window

The "preview" window shows the individual cross correlation function. Green circles indicate results from the initial data, and red circles marks the data after the scan analysis and correction.



Figure 9 The individual measurement

- The sequence of the program execution
 1. Open the ZurkonII program window.
 2. Set desirable analysis parameters and click Save ini.
 3. Click Import baze to import the data.
 4. Click Save

 - 5. Repeat step 4 down to the end of the file.

Quick Guide for Using jr2

This program uses data from "*.dat" files, fits them with Gaussian profile and finds cross correlation function parameters: the radial velocity, the depth and the width (FWHM). Results of this program are saved to the "*.jr2" files.



Figure 10 Structure of the "*.jr2" file



Figure 11 Interface of jr2

The sequence of the program execution

- Open the jr2 program window.
 Click Import data.
 Select the observational data files of the night to be processed in the browse window.
- Click Save to fit the Gaussian profile and save the result.
 Click Read to read the next record.
- 6. Repeat 4 and 5 steps down to the end of the file.7. Save results.

Quick Guide for Using Sphinx

Sphinx calculates radial velocities from "*.jr2" and creates the file "*.lst".

Star nr	Julian day	Radial velocity	FWHM	contrast	Number of counts
HIP 1110	52142.457	-47.4	0.9 9.95	15.4	2.1
HIP 1131	52141.463	-1.7	0.7 8.58	24.4	2.4
HD 1326	52145.473	10.4	0.8 8.57	13.4	2.8
HD 7351	52145.492	3.8	0.7 8.19	27.2	3.5
HD 7351	52147.570	4.4	0.7 8.49	26.6	3.5

Figure 12 Structure of the "*.lst" file

The sequence of the program execution

1. Load Sphinx program. Click **File**, then click **Open**, or press F3.



Figure 13 Interface of sphinx

2. Browse the *.jr2 file and click **OK**. The sphinx will import your jr2 file and display in the window. If necessary you can modify data in this window, then click **Calculation**.

File About	
020316.	
Jurnal-	
*HD 37160 17 43 68173 0 612.792 6 8.45 18.87 0 758.122	2 s 1 3 16 5.3409 👗
¹ HD 37160 17 50 73522 0 611.779 7 8.48 19.92 0 758.023	3 S 1 3 16 5.3409
*HIP 33369 18 05 217 0 646.927 33 10.51 21.18 0 758.03	0 13166.5341
HIP 35681 18 22 1478 0 769.638 21 11.69 18.34 0 757.9	77 1 3 16 7.162
HIP 21059 18 37 1729 0 764.945 15 9.86 20.44 0 757.66	54 1 3 16 4.2608
¹ HD 49368 18 56 1596 0 669.677 16 10.38 24.42 0 757.57	7 1 3 16 6.4542
¹ HD 61913 19 10 11978 0 749.797 6 9.45 23.78 0 757.789	1 3 16 7.3914
¹ HIP 44812 19 26 147 0 716.211 44 9.56 22.18 0 757.684	1 3 16 9.0505
¹ HD 62509 20 12 1202980 0 727.951 4 8.09 24.52 0 757.4	193 S 1 3 16 7.421
¹ HD 62509 20 18 1209922 0 728.034 5 8.12 23.99 0 757.3	867 s 1 3 16 7.421
Ins Mask InsAll	Options
Calculation Delete	Cancel
	a de la companya de la
Ali-X Exit Alt-C ChDir	

Figure 14 Journal view window in the sphinx

HD 37160	52350.238	98.3	0.6 8.45	18.9	4.8
HD 37160	52350.243	99.0	0.6 8.48	19.9	4.9
HIP 33369	52350.255	71.4	0.7 10.51	21.3	2.3
HIP 35681	52350.266	-24.4	0.6 11.69	18.4	3.2
HIP 21059	52350.275	-23.1	0.6 9.86	20.5	3.2
HD 49368	52350.290	51.8	0.6 10.38	24.4	3.2
HD 61913	52350.301	-13.9	0.6 9.45	23.8	4.1
HIP 44812	52350.314	20.1	0.8 9.56	22.3	2.2
HD 62509	52350.344	3.7	0.6 8.09	24.5	6.1
HD 62509	52350.348	3.5	0.6 8.12	24.0	6.1
HD 62509	52350.348	3.5	0.6 8.12	24.0	6.1

3. In Output window you can view all calculated results. Then click Save

Figure 15 Sphinx output window

4. Click **Cancel** to quit the output window, then click **Cancel** to quit the Journal window. Repeat all steps or press **Alt+x** to quit the program.

Other programs

<u>Libsp2.exe</u> This program sorts all records in the increasing order of RA and excludes the standard stars. Program load format: libsp2.exe data.lst where data.lst - any "*.lst" type file.

Radvid.exeThis program calculates the average radial velocity for every star.Program load format:radvid.exe data.lst result.vidwhere data.lst - "*.lst" type file and result.vid - result file.



Figure 16 Structure of "*.vid" type file

Values given in the columns are calculated using formulas presented below.

where \boldsymbol{W}_{i} is the weight of a measurement, v_{i} is the weighted mean velocity for N

$$\boldsymbol{w}_{i} = \frac{1}{\boldsymbol{e}_{i}^{2}}$$

$$< \boldsymbol{v}_{r} >= \frac{\sum \boldsymbol{w}_{i} \boldsymbol{v}_{ri}}{\sum \boldsymbol{w}_{i}}$$

$$E = \sqrt{\frac{\sum \boldsymbol{w}_{i} (\boldsymbol{v}_{ri} - \langle \boldsymbol{v}_{r} \rangle)^{2}}{\frac{n-1}{n} \sum \boldsymbol{w}_{i}}}$$

$$I = \frac{\sum \boldsymbol{w}_{i} \boldsymbol{e}_{i}}{\sum \boldsymbol{w}_{i}}$$

$$\boldsymbol{e}_{i} = \sqrt{\boldsymbol{e}_{i}^{2} + \boldsymbol{e}_{i}^{2} + \boldsymbol{s}_{rr}^{2}}$$

measurements, E is the standard deviation of the observed velocities (external error), I is the weighted mean uncertainty of the measurements of a specific star (internal error), $\mathbf{e}_i^{'}$ is the radial velocity error from the Gaussian profile fit, $\mathbf{e}_i^{''}$ is the error of the repeatability, \mathbf{s}_{st} is the zero point error determined from the measurements of the radial velocity of the standard stars.