Detailed first look & validation: single transit (DFLst)

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Spectroscopic Sciences alerts

Second CU6 meeting
12 - 13 October 2006
Royal Observatory of Belgium

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GWP-S-650-00000 Single transit analysis

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- 01000 Management, configuration management & interfaces
- 02000 Definition of test campaigns & comparison of algorithms perform.
- 03000 Detailed functional analysis of single transit
- 04000 Overview of existing techniques for spectra analysis
- 05000 Manufacture CC masks
- 06000 Coarse characterization of sources
- 07000 Radial & rotational velocity CC w. template/mask in data space
- 08000 Radial velocity by CC in Fourier space.
- 09000 Rotational velocity by Fourier transform
- 10000 Radial and rotational velocity by minimum distance method
- 11000 Rotational velocities by Neural network
- 12000 Radial and rotational velocities for multi-l by TODCOR like method
- 13000 Radial and rot. velocities for multi-l by spectrum subtraction method

- **14000 Detailed first look & validation: single transit**
- **15000 Science alerts**

Detailed first look & validation: single transit (DFLst)

Objective:

- Check and validate the one day single transit analysis within a day
- Minimize the data loss

Mean:

- Perform precise and statistical data and instrument sanity check
- Test the résults of the different Rv methods
- Diagnosis sent to the satellite control

Location:

- SOC (or CNES TBD)

Main DFL tasks

➢ **Here come the main general DFL tasks:**

- Number of downloaded windows
- Proportion of empty windows
- Image centroids
- Image widths
- Background
- Noise
- Faint stars tests
- Line detections
- Calibration tests
- **Single transit tests (DFLst)**

➢ **The following tests are envisaged:**

Bright stars:

- These objects are all well known and can be identified easily in a catalogue.
- Localisation of calcium lines: absolute (for quality of the windowing) and relative (dispersion)
- Width of calcium lines (focus)
- Overall flux (selection)

Intermediate stars:

- Similar to bright stars with reduced precision.

Faint stars:

- Noise properties
- Background
- Overall flux (selection)

What can we get from the Rv?

- Comparaison of the different Rv*rad* and Rv*rot* method (systematics, etc…)
- Check the stability, derive of the instrument within a day, or few days…
- Check the data sanity
- Get precise informations from line width, depth/contrast and position (wavelength calibration)

What do we have to do?

- Define the single transit DFL and validation methods and their corresponding algorithms
  - (a) Define monitor and evaluator output and responsibilities (the monitor will be run at CNES and the evaluator at SOC).
  - (b) Describe algorithms for both monitor and evaluator.
- ~~Create template for the Rv methods~~ no ouput from DFLst
- Develop, test and provide algorithms for DFL monitor, DFL evaluator and single transit validation.
- The output is composed of diagnostics of the single transit DFL. Those diagnosis will be sent to the satellite control (SOC Evaluator), and some information will also populate the database (flags).

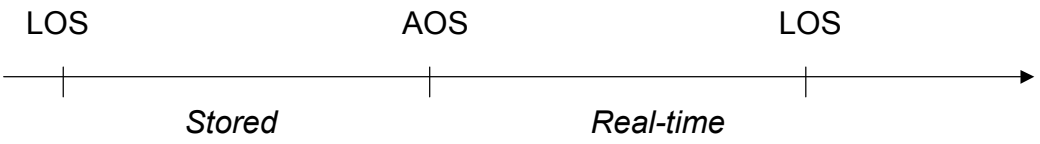
Virtual Channels

Shared by all the instruments

	Virtual Channel	used by	data contained:
0	Real-time Essential S/C HK	QL	AOS – LOS
4	Real-time Routine S/C HK & Routine Science HK	QL, ~~S-QL, DFL~~	AOS – LOS
2	Stored S/C HK & Science HK	QL, ~~S-QL, DFL~~	LOS – AOS
1	Real-time Science Data	DFL, community	all data needed by DFL, ~~"Real-time"~~ here means high-priority data
3	Stored Science Data	community	rest of science data, "Stored" here means low-priority data
7	Idle Frames	not used	
5		not used	
6		not used	

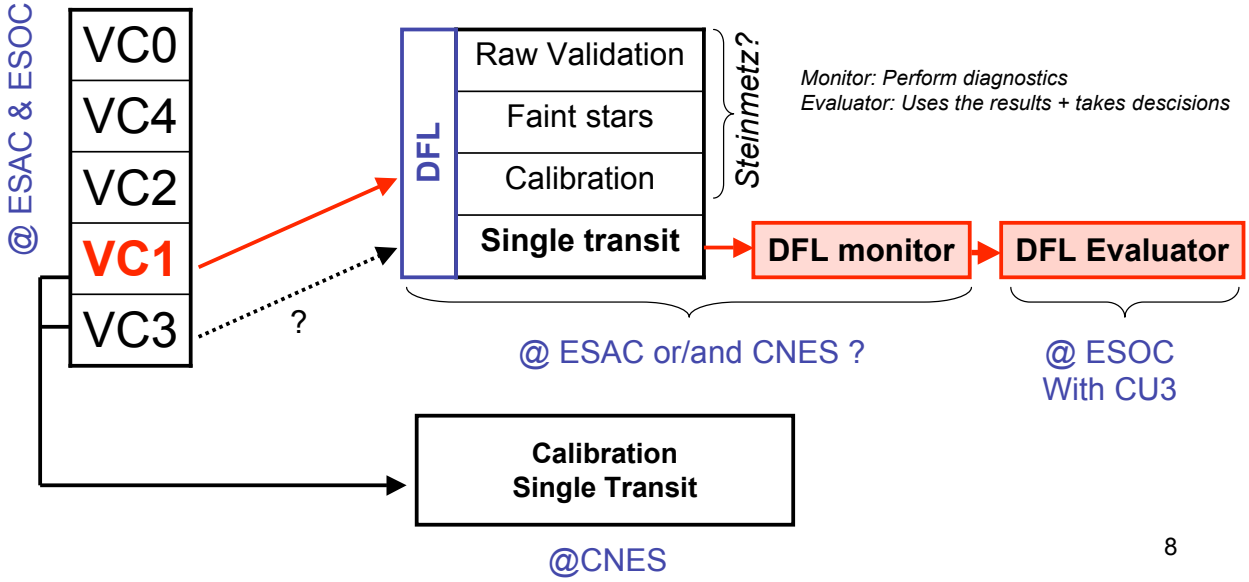
Priority

AOS: Acquisition of signal
LOS: Lost of signal



DFL channel(s)

VC1 = DFL dedicated virtual channel
VC4 = Onboard selected windows – Real time
VC2 = Onboard selected windows – Stored
VC2 & VC4 duplicated in VC1
VC1+VC3=Total science data



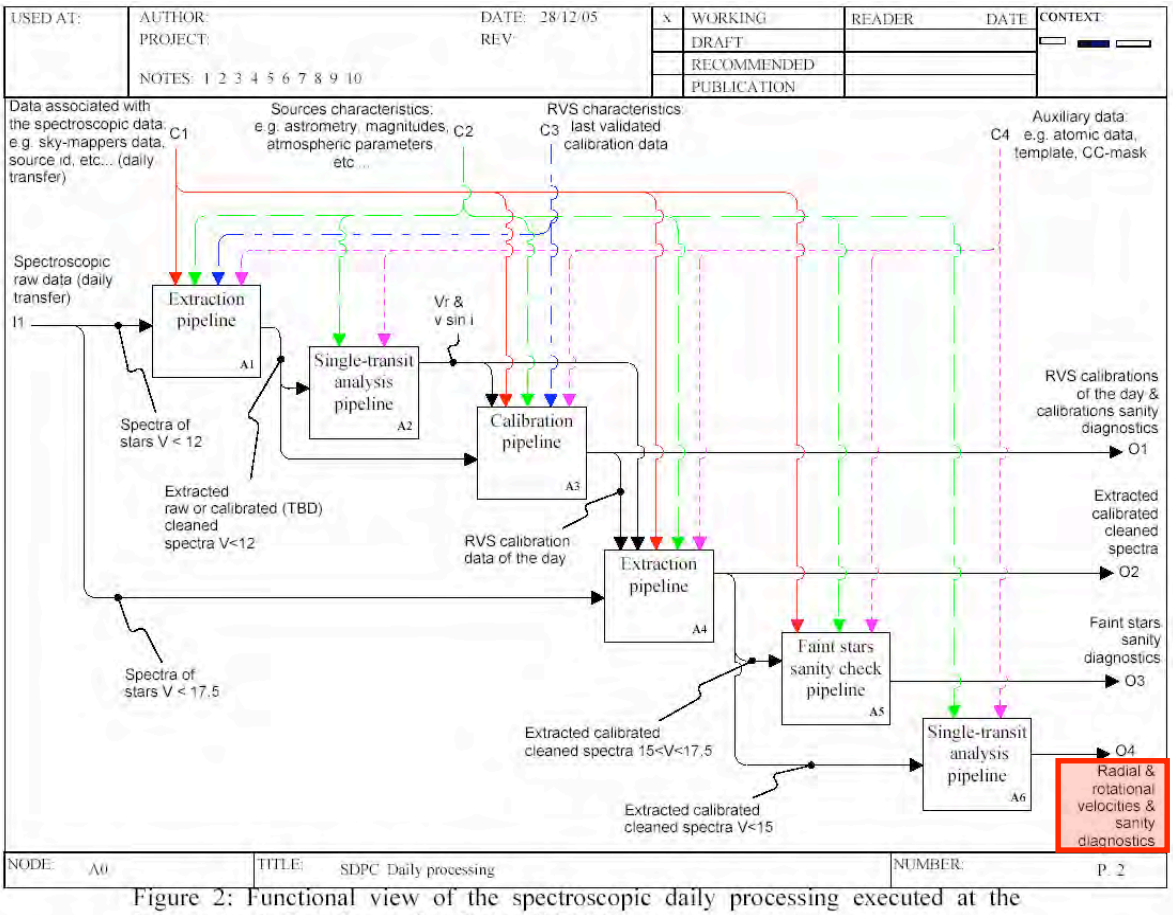


Figure 2: Functional view of the spectroscopic daily processing executed at the Spectroscopic Data Processing Centre (SDPC).

Star counts and data rates for all stars in the [4; 16[V magnitude range

V magnitude	4-5	5-6	6-7	7-8	8-9	9-10	Comments
Star counts	1085	3400	10 000	30 000	85 000	295 000	Tycho2 (entire sky)
SNR	< 312	< 196	< 122	< 75	< 49	< 30	per 1×10 pixels
Frequency	120		270	810	2295	6075	number of stars/day
Frequency	$\frac{1}{2880}$		$\frac{1}{1280}$	$\frac{1}{428}$	$\frac{1}{152}$	$\frac{1}{56}$	number of stars/s/row
Period	48		21.3	7.1	2.5	0.9	interval between stars (min/row)
RVS1	10350	10350	10350	1035	1035	1035	samples/image
RVS2-RVS3	10350	10350	345	345	345	345	samples/image
Data rate	172.5		388.1	64.5	181.6	492.9	bits/s/row/mag (RVS1-3)
Total	0.69		1.552	0.258	0.726	1.972	kbits/s/mag (RVS1-3, row 1-4)
Total				5.198			kbits/s

To be update

V magnitude	[10;11[	[11;12[	[12;13[	[13;14[	[14;15[	[15;16[	Comments
Star counts (*1e6)	0.75	1	3	6	14	30	Tycho2 (entire sky)
SNR	< 18	< 10	< 5	< 3	< 2	< 2	per 1×10 pixels
Frequency (*1e4)	2	3	8	16	38	81	number of stars/day
Frequency	$\frac{1}{17}$	$\frac{1}{11}$	$\frac{1}{7}$	$\frac{1}{3.2}$	$\frac{1}{1.4}$	$\frac{1}{0.6}$	number of stars/s/row
Total	4.	6.	10.	40.	100.	300.	kbits/s (RVS1-3, row 1-4)
Total				0.5			Mbits/s

New sampling:

1104x10 (1x1) 5<G_RVS<7 0.26 A/pixel
1104x1 (1x10) 7<G_RVS<10 reduce RoN 0.26 A/pixel
368x1 (3x10) 7<G_RVS<10 0.78 A/pixel

*Ex: The samples are 1035 pixels for high resolution and 345 pixels for low resolution, so a star is contained in 27.6 kbits ((1035+2*345)*16 bits) / 29.44kbits for new sample.*
The sky coverage per day is around 2.7%.

Sciences alerts

- **Objective:**
  provide a quick scientific diagnosis for specific objects for which it would be scientifically interesting to have a quick follow-up with other astronomical facilities.

  Rare and unusual events is equivalent of panning for gold-dust in rivers.

- **Tasks:**
  Define the list of possible scientific alerts with RVS and their associated criteria.

- **Output:**
  Alerts at the standard of the VO-events.

- **Mean**
  We are going to deliver a Java program that reveal Alerts.
  Production of a list of objects, alerts and their corresponding priority.
  Probably in collaboration with CU5 (Belokurov & Evans)

We are open to any comments or suggestions…

Work plan for DFLst and Science Alerts

Within the next 6 months
cycle 2 [mid-oct 06;mid-may 07]
« Second séries »

- Define list of Science Alerts
  - Articles
  - Contact with CU5
- Define requirements
- Define design
  - SADT, DM
- Define tests
- Description of the software
- Integration + validation

Deadlines

- 15dec06 Feedback de l'analyse fonctionnelle (F. Thévenin)
- Cycle 2 mid-oct2006-Mid-May2007(Y. Viala):
  - Specification (prototype) Software requirements and design.
- Cycle 3 Mid-May2007-mid-oct2007 (Y. Viala):
  - Specification Software requirements,design and products