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# ***ESO Reflex (FinReflex)***

## **A Graphical Workflow Engine for Data Reduction**

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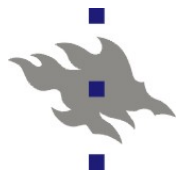
CSC - Scientific Computing Ltd



Observatory, University of Helsinki



SSF - Space Systems Finland Ltd.



## Motivation



- ESO provides pipeline “recipes” for all VLT instruments
- They remove the instrumental signature and are used for quality control at ESO and distributed to the community
- All newer recipes are compiled C code using the **CPL** library and tools to run them offline are available (**Gasgano** and **EsoRex**)
- Many older general purpose reduction and analysis systems remain in wide use (**MIDAS/IRAF** etc)
- Sampo
  - Finland joined ESO in July 2004. As part of its joining fee resources were made available to perform a three year study of future needs for the ESO community in the area of data reduction and analysis environments.
  - The project started in January 2005 and was managed by ESO with the staff based in Finland.



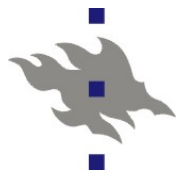


## The Sampo Approach



- A data reduction system for the end user requires:
  - Modular recipes to provide access to intermediate products
  - Interactive tools, defined or customized by the user, to analyze intermediate and final data products
  - Effective access to legacy software
  - A user-friendly, intuitive and flexible interface
  - Simple access to external VO (etc) services within the same workflows?
- Sampo, and specifically the **ESO Reflex** tool, tries to address the interface issue, with a focus on the use case of ESO data:
  - Common front-end interface to cope with the potentially large number of ESO instruments in a uniform and maintainable way
  - General invoker for CPL-based recipes
  - General invoker for Python scripts (hence **PyRAF** & **PyMidas**)
  - Easy incorporation of other tools (including WebServices)



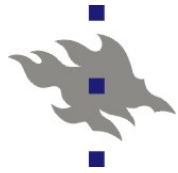


## ESO Reflex

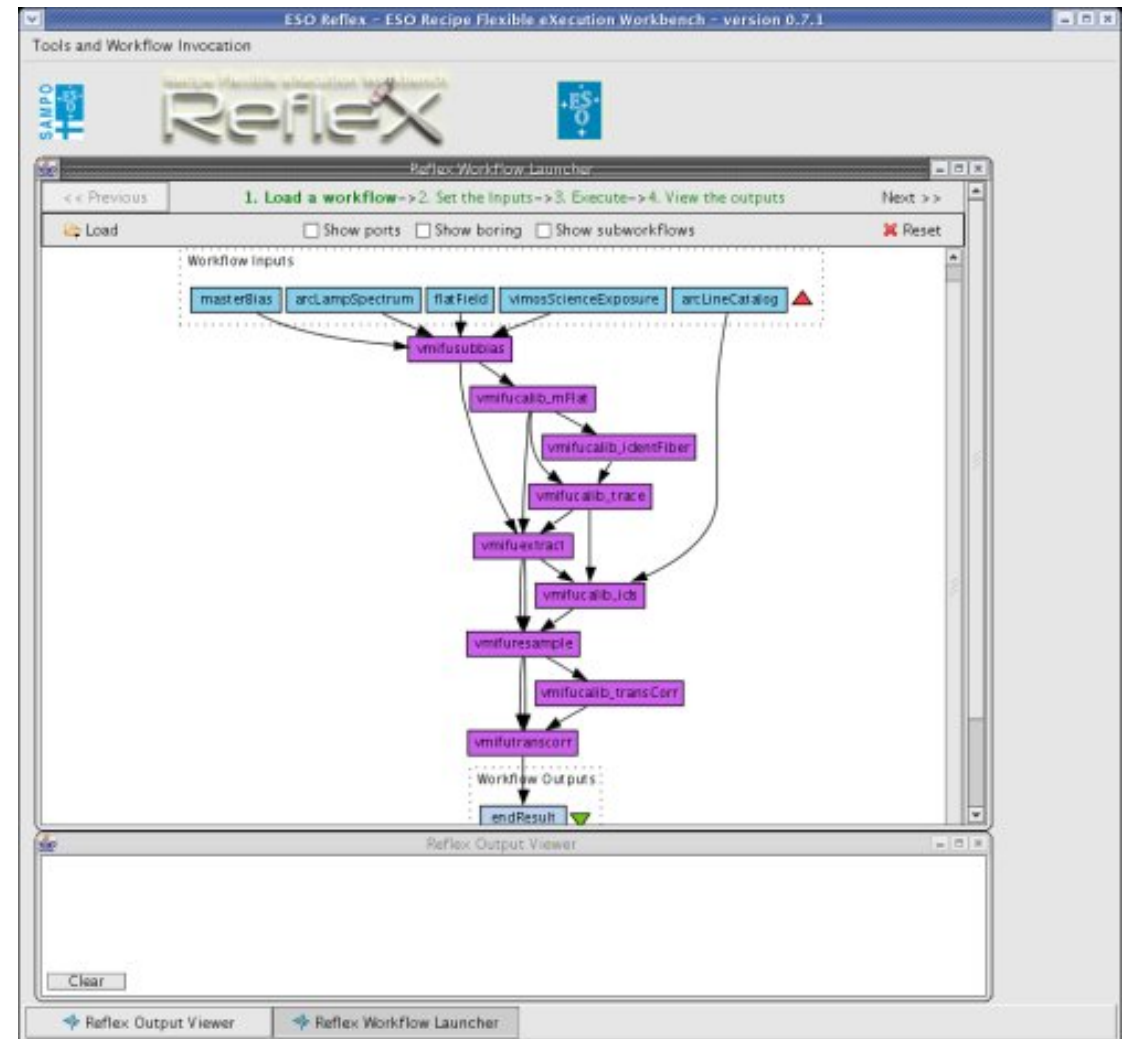


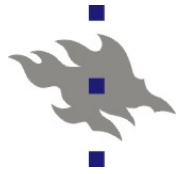
- **ESO Reflex** is a graphical workflow engine for executing CPL Recipes and other tools
  - Not instrument specific
  - Easy inclusion of external tools and scripts
  - Allows user interaction during execution
  - Based on **Taverna**
- **The Taverna** workbench
  - a free software tool for designing and executing workflows
  - an open source Java workflow system created by **the myGrid** project,
  - allows users to integrate many different software tools, including web services
  - provides a desktop authoring environment and enactment engine for scientific workflows expressed in **Scufl** (*Simple Conceptual Unified Flow* language).
  - allows a user with limited computing background and limited technical resources and support to construct highly complex analyses over public and private data and computational resources, all from a standard PC, UNIX box or Apple computer.





- **Reflex** allows the user to define and execute a sequence of recipes using an easy and flexible GUI.
- A sequence of recipes can be run as a workflow where the output of a recipe is used as an input to another recipe.
- The workflow defines the pipeline from raw data to reduced data.
- The user can either use the application to execute standard workflows provided by ESO or define workflows of his/her own.
  - The standard workflows can also be easily modified to suit any particular needs the user might have.

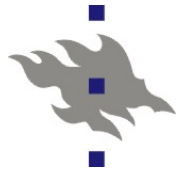




- Error detection and recovery
  - Errors on during recipe execution are detected by **Reflex**

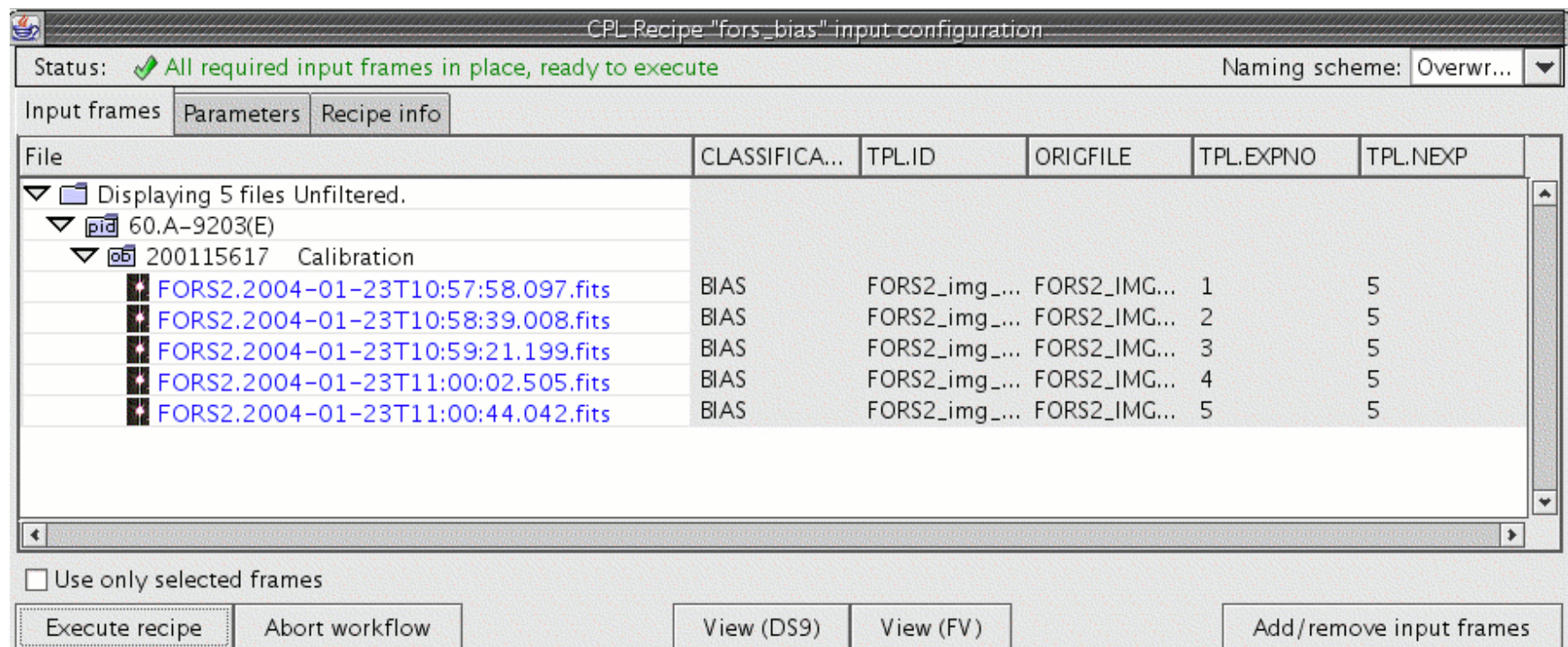


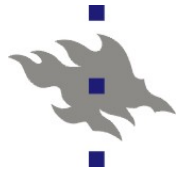
- Appropriate actions can be taken by the user



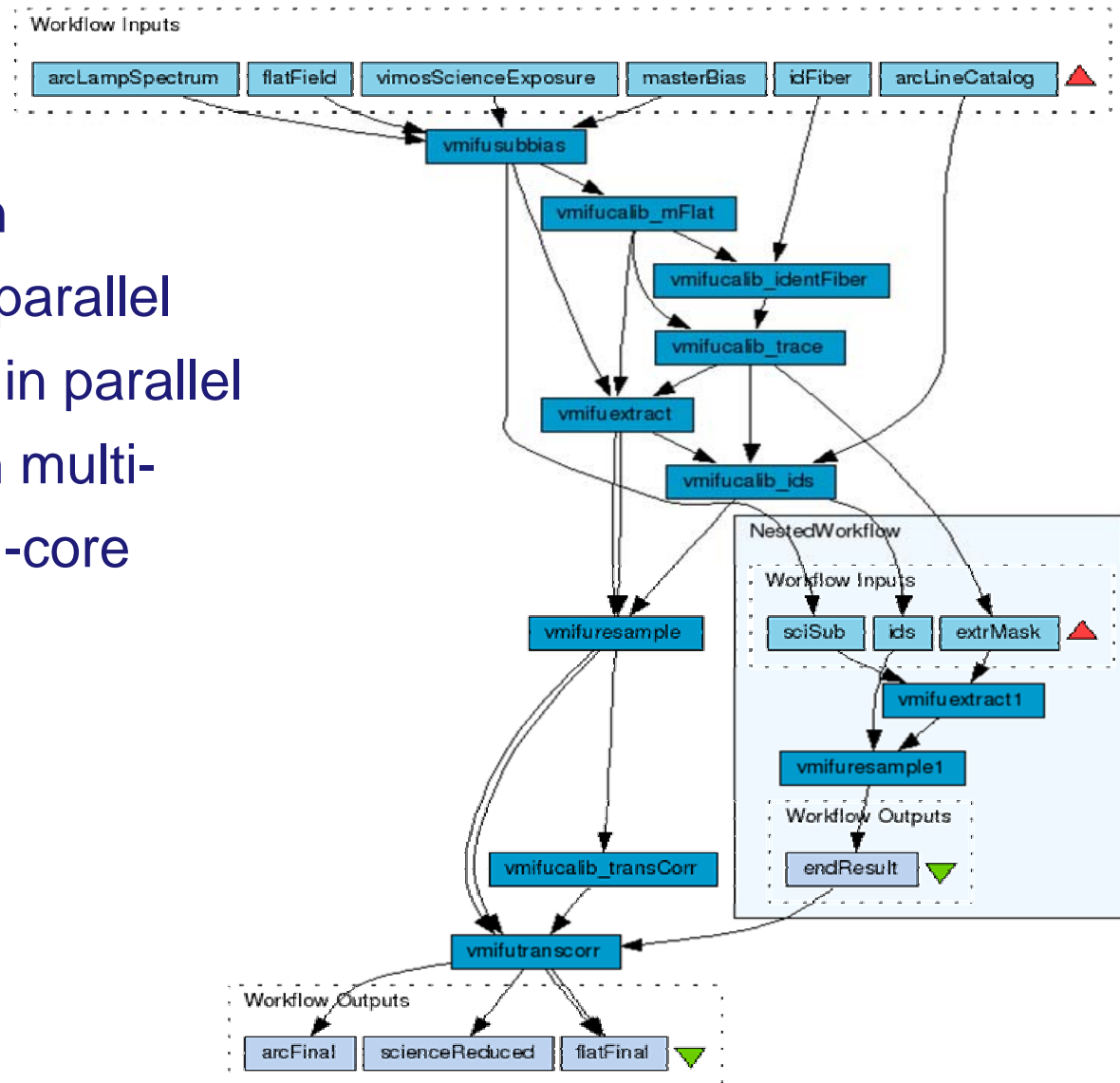
## ■ Step-by-step execution

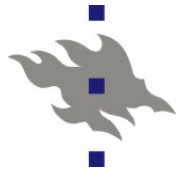
- In interactive mode the user can make changes to input data and parameters during execution



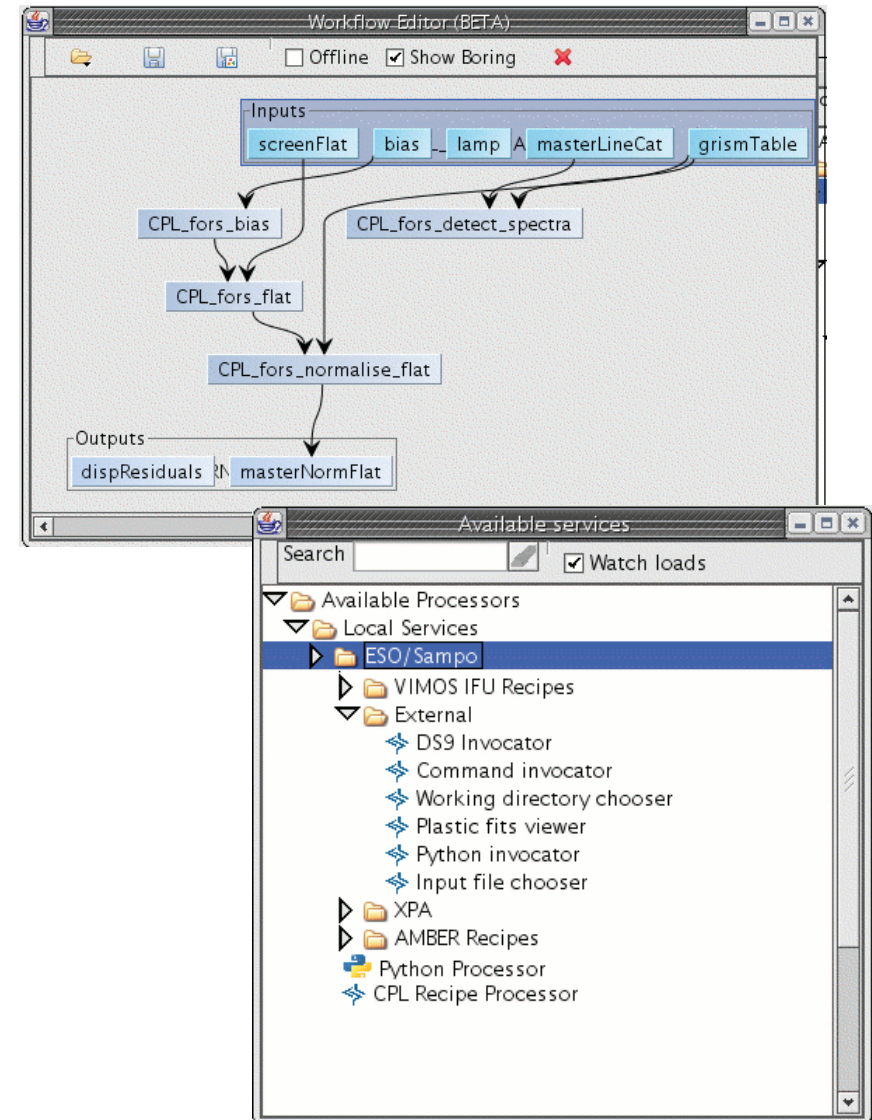


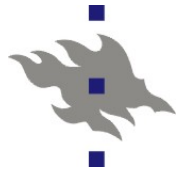
- Parallel Execution
- The recipes on a parallel workflow execute in parallel
- Full advantage on multi-processor or multi-core machines



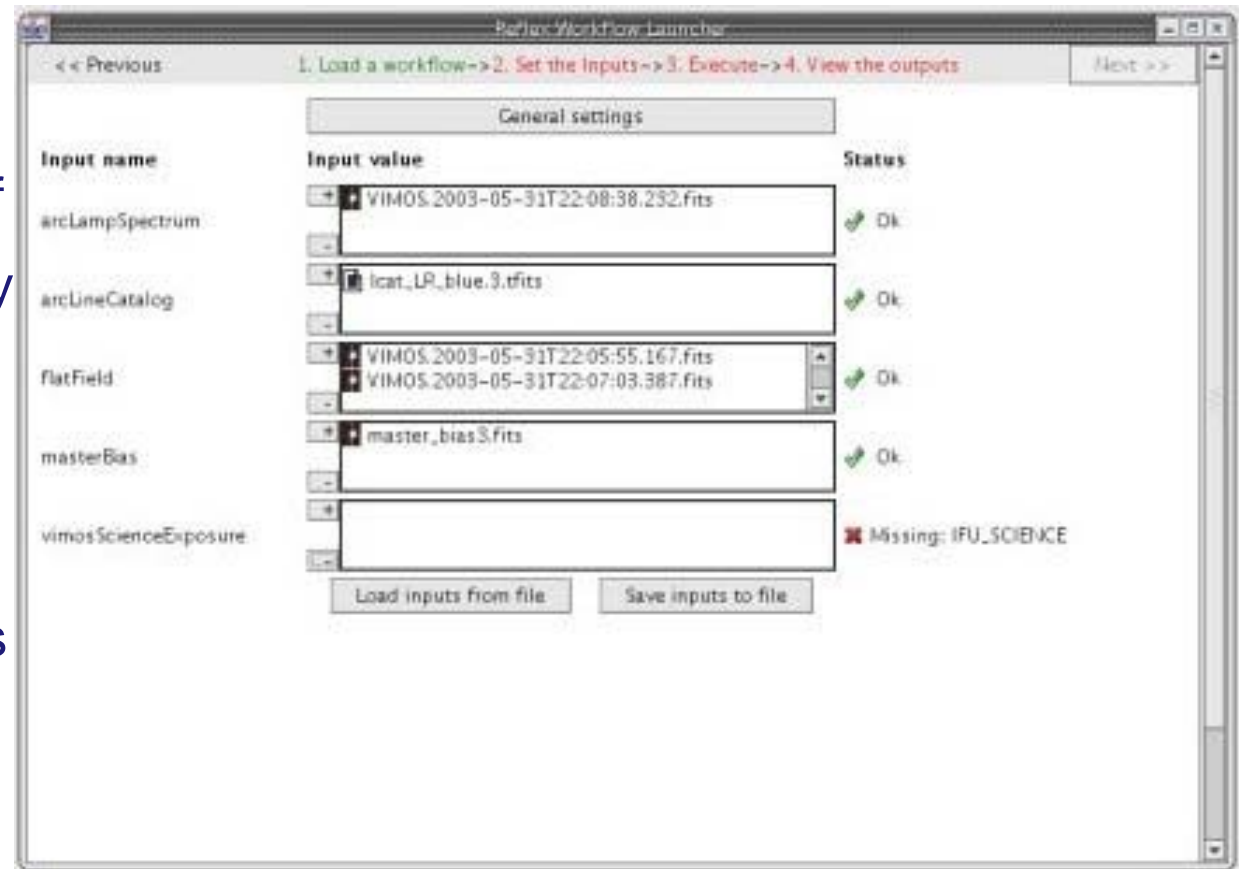


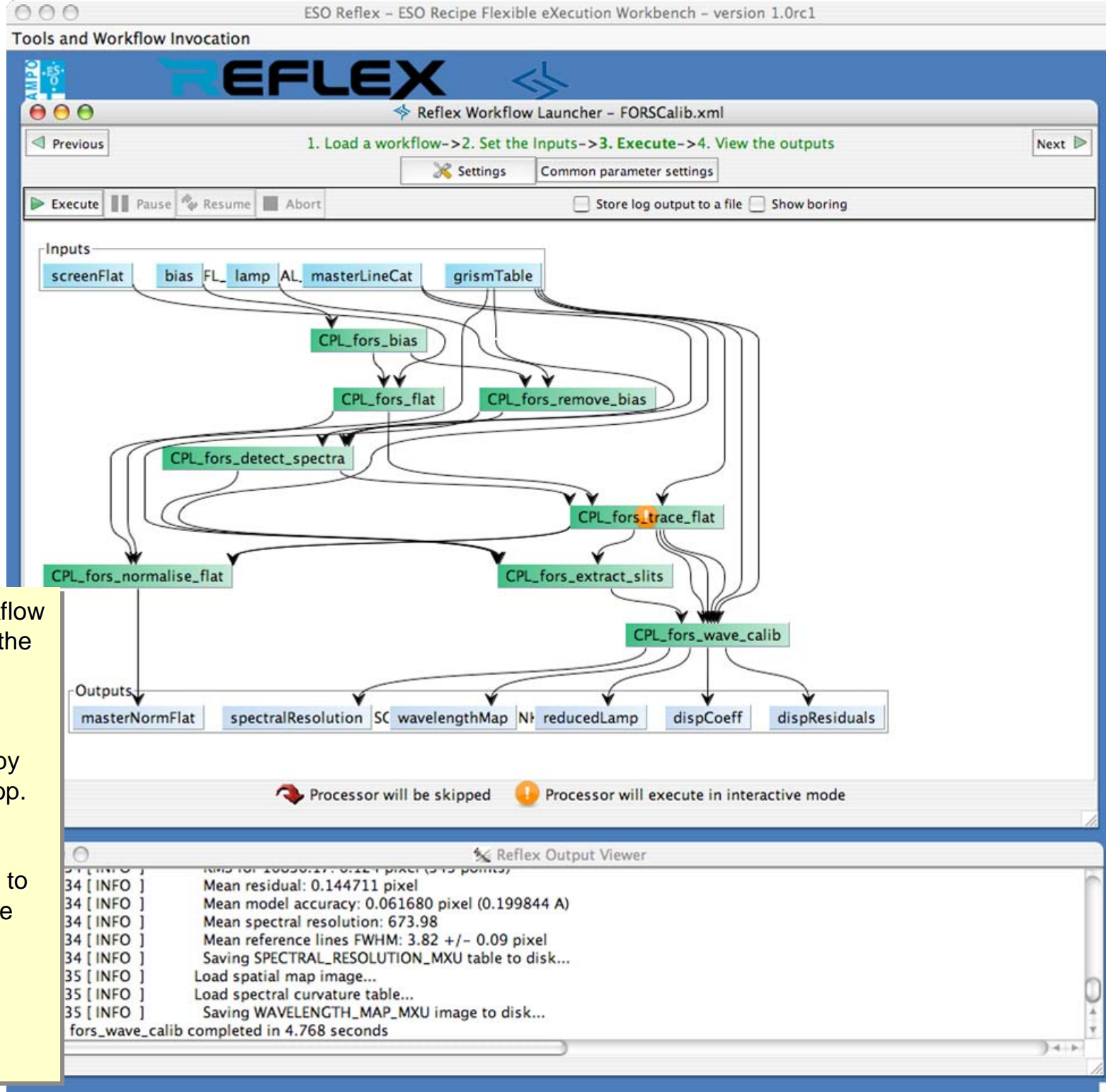
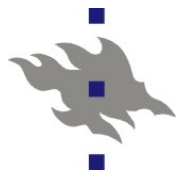
- Customisability
- The user can easily modify the workflows
- Python and IDL scripts can be included in the workflows
- Any system command can also be invoked from the workflows
- Easy access to VO and other web services





- FITS-file handling
- Based on *Gasgano*
- The instrument-specific tags of the FITS-files are automatically extracted from the FITS-headers
- Tag-checking: only compatible FITS-files are allowed in inputs



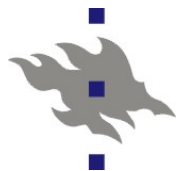


Example of an ESO Reflex workflow based on calibration recipes for the VLT FORS2 instrument in MXU mode.

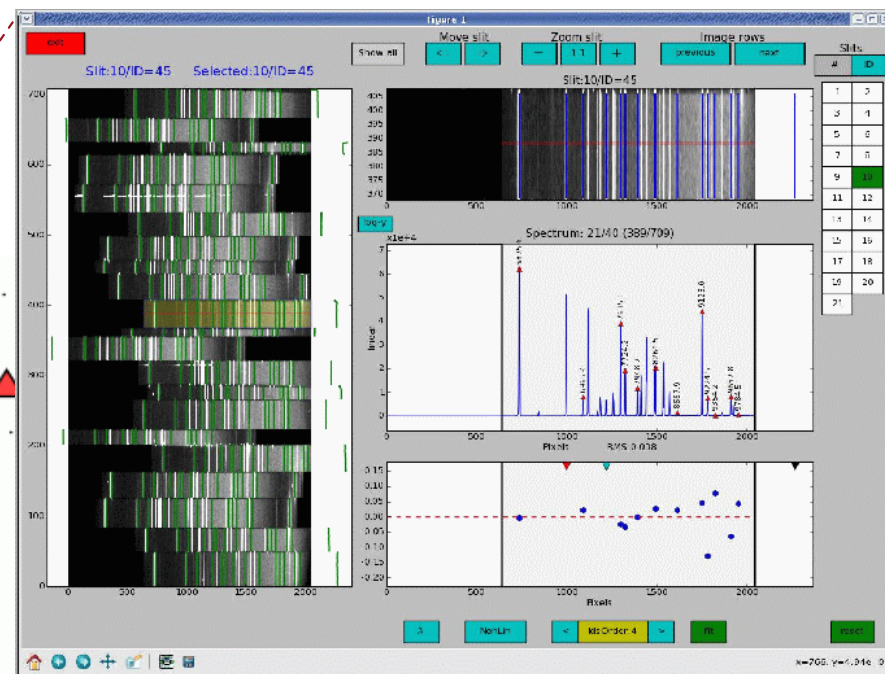
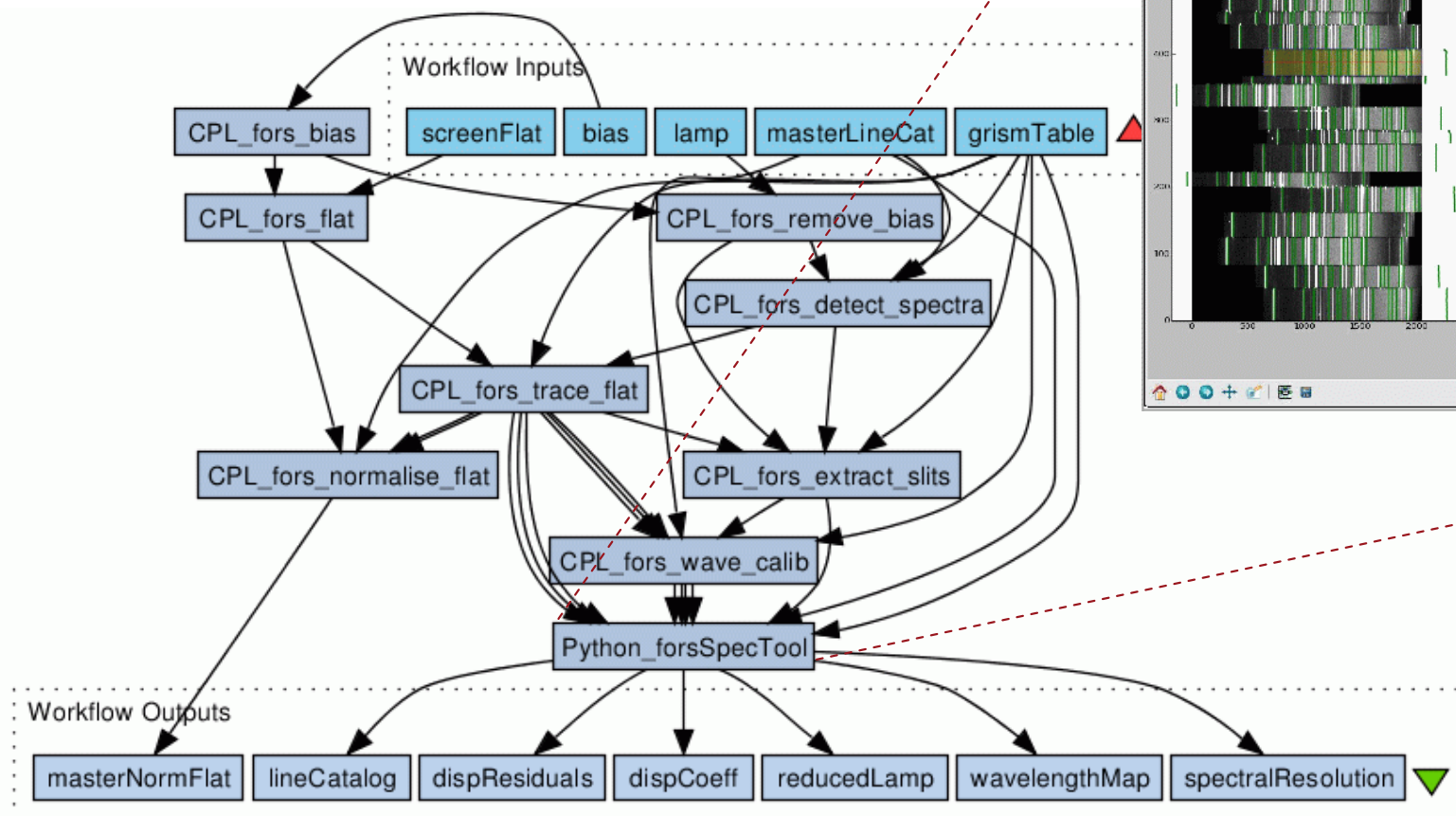
The input data are represented by the light-coloured boxes at the top.

The data flow through the processors in the middle section to produce the outputs shown at the bottom.

The orange circular symbol indicates that one recipe will execute in interactive mode



## ■ FORS Spectroscopic Calibration





## How to get an *ESO Reflex*?

### ■ Required hardware for Reflex

- A modern Linux or Mac OSX computer with at least 1 GB memory and sufficient disk space for data
- Supported Operating systems:
  - Fedora Core 3/4/5/6
  - Red Hat Enterprise Linux 4
  - Ubuntu Linux
  - Mac OSX Intel \*\*/\*
  - Mac OSX Power PC \*

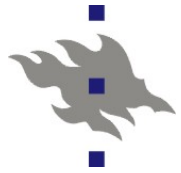
### ■ Required software for Reflex

- Java 1.5 SDK including Java Runtime Environment (or later)
- ***ESO Scisoft VI*** (or later)

### ■ Download Reflex kit

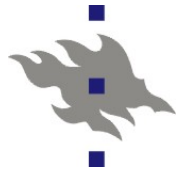
- The Reflex kit contains all necessary pipeline products and third-party software.
- The disk space required for installation is approximately 95 MB.

- If you would like to test the current ESO Reflex beta release please contact **reflex@eso.org** in order to get a link to the kit.



## **FinReflex**

- **FinReflex** is a new version for Finnish environments
  - Project 1.2.2008 – 31.1.2009
  - Based on **ESO Reflex (Taverna)**.
  - Will be customized for Finnish astronomers & other customers
- Migration to **Taverna 1.7/2.0**
  - **ESO Reflex** is based on **Taverna 1.6**
    - Changes to building process (Maven builder) & Core API & UI
- **General Interfaces**
  - WebServices, Data Mining, Remote subworkflows
  - Better integration to specific tools
- **Data Manager**
  - Currently depend on code from **ESO Gasgano**.
  - Two main tasks: Data Organizer & Data Viewer



## More info

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### ■ ESO

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