GILDAS

Jérôme PETY
(IRAM/Obs. de Paris)
on behalf of the IRAM Science Software developers

IRAM Millimeter Interferometry Summer School
Oct. 1 - 5 2018, Grenoble

Contributors: I. People (as of 2018 October)

Large code contributors ~ 5.0 FTE/yr

- **R. Zylka** PIIC.
- **A. Sievers** MRTCAL and PAKO.
- **E. Reynier** OMS + kernel.
- **V. Pietu** CLIC + RDI.
- **J. Pety** kernel + MRTCAL + CLASS + MAPPING.
- **V. de Souza Magalhaes** MAPPING.
- **A. Castro-Carrizo** CLIC pipeline + OBS.
- **J. Boissier** ASTRO.
- **S. Berta** PIIC.
- **S. Bardeau** kernel (including the python binding) + CLASS + MRTCAL.
- **S. Maret** CLASS/WEEDS.
- **S. Guilloteau** MAPPING + Kernel.

Many other IRAM staff slightly contributing, or advising, or testing.

Contributors: II. Recent collaborations

`python-GILDAS` **binding** IRAM/Bordeaux.

HIFI FITS support (`CLASS`) IRAM/LERMA/IRAP/ESAC.

DSB deconvolution (`CLASS`) IRAM/IPAG/Cologne.

Analysis of line surveys (`WEEDS`) IRAM/IPAG/Bonn.

Imaging and deconvolution (`MAPPING`) IRAM/Bordeaux

What my daughters think I do at IRAM

Actual activity: Helping people to make sense of

Hexadecimal representation of the $^{12}CO(1\text{-}0)$ LMV cube of
the south-western edge of the Orion B molecular cloud...

4c7225bfa4b317bff31e063f21fab6bd7846db3e0e4d5abf2f20803ed28e
b53e23910dbfa730babe1bbe2a3f8c2aa5be1e7f49bfcc4fe93e4bafe83e
46948b3f916efebe6984ae3e9798a23ecf39bb3f0d91e0be23fb423d4213
b93e2c81e8bb5caf18bff30531beccd7fabee326e7bc46a2d53e2da3963d
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7abcbede96bf42af0abf7f6d54be3c37c9be6d1c06becae9d0be314e72bd
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0abfcfc050bf3b56dfbeb315123f35b80b3dfbfb7abda62325bf8356bcbf
df2834bf8b27a73f6105823f41881b3f75a00d3fedfea83fce354abf81bb
c33f8dc0053ea521343faba63a3fa0d037be3fcbaa3efe025e3f63fa2c3f
d91ffa3ea3bad13e3efd60bf4817073f11e714be1cf28ebc5a885dbf8dc5
8bbf88a339bd3f4d9d3f8cbc03bf9374dcbec0ef683e0368273f19e0453e
9e8fec3d0d93943ef5b085bfd0948e3f9980823fbbff7bbff2a55dbe9e6a
973de216d8befb3704bff2a88f3d761c71bfe6cb80be8b75003fbd59f63e
e8cc0a3fe8b24bbd2a7efabeea72313f2906a83edcdad1bbe0209dbd8625
fabda6f426be4a5e6e3ea91305bf3497233d5a3d783ee02e653f6cdc913f
071b99beef73ebbe17cfd83eb503783f962aae3efd2a93be8e64fc3edf58
4fbe33d70e3f448fb93e65e5be3d4b98b63e78b7173ecb4c7d3e492b063e
18e5373ec55eef3d924a5d3ec354583f9ce2f4bdca6e16bf59683cbe9598
223fda2a643e77bb8c3ed520193f1175a43e73e5b73ef992763dcb68c53e
6fa5b63e7dfc15bfb832063e25ab06bec64f10bf9c4d4abe8b6f83be451f
883d848e17be720c2c3f45d65e3fac91293f590dfd3eca0ca73e86acbc3e
294ed83edfa03a3f3f07b23eb99a143f7fc4483fcab724beb0318fbe69e8
283f4289b73e025d1a3d824c68bef42c423e53df0cbef420db3e62dda13e

Scope: I. Softwares developed at IRAM

Goals

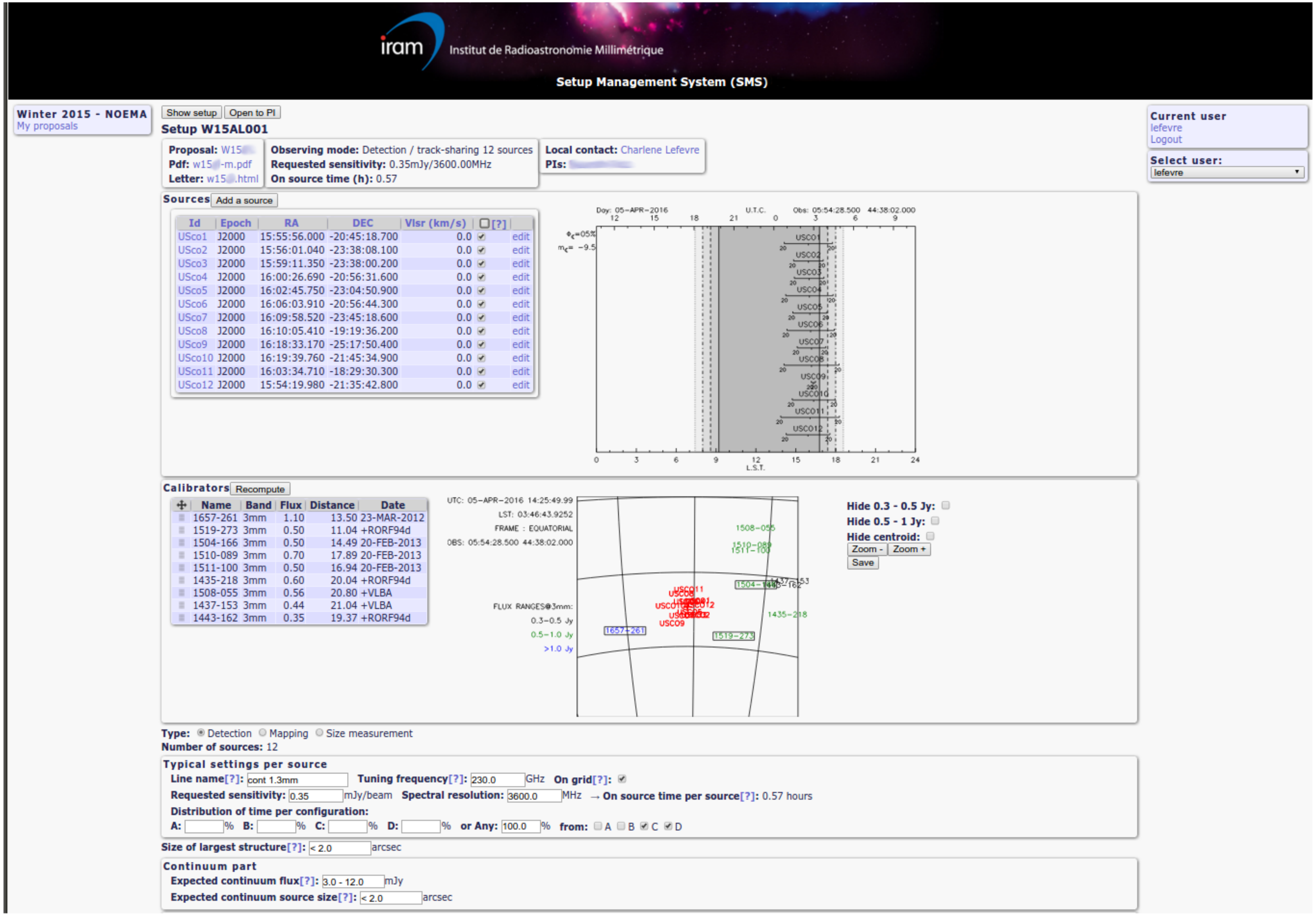
1. Handling of proposals and scheduling (statistics, dynamic scheduling, pool observing).
2. Preparation of observations, *e.g.* setups.
3. Data acquisition:
   - **3.1** Low level, *e.g.* hardware control (antennas, receivers, correlators, etc...)
   - **3.2** High level, *e.g.* operator and observer interface.
4. Data archiving.
5. Data reduction and analysis (single dish + interferometry).
6. Generic facility (plot package).

This talks deals with points 1, 2, 4, 5, and 6

`GILDAS` A collection of state-of-the-art software oriented toward (sub-)millimeter radioastronomy (points 2, 5, and 6).

Observation Management System (OMS) Set of independent tools to manage a project along its lifetime from submission to delivery of data (points 1, 2, and 4).

Scope: II. Observation Management System
40 000 executable lines



Scope: III. GILDAS in a nutshell

A collection of state-of-the-art software oriented toward (sub-)millimeter radioastronomy

Common facilities

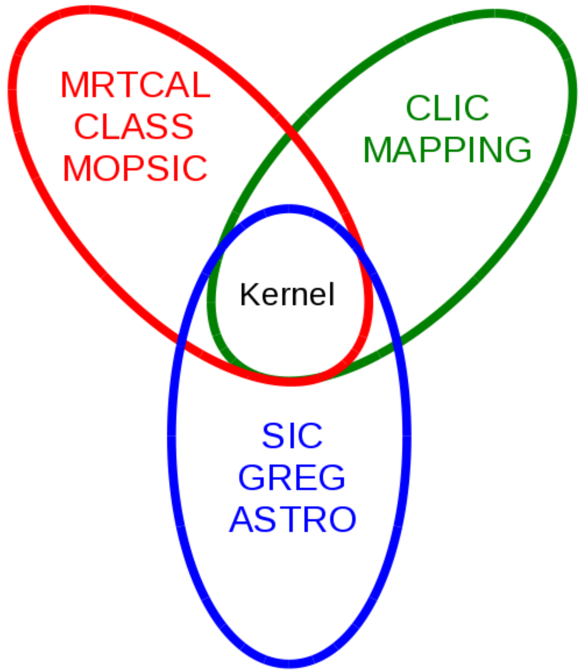
- Command line interpreter: SIC.
- Graphical possibilities: GREG (1D: curves, 2D: images, 3D: spectra cubes).
- Preparation of observations: ASTRO.

30m

- Spectroscopy: MRTCAL + CLASS.
- Continuum camera: PIIC.

NOEMA

- Calibration: CLIC;
- Imaging + Deconvolution: MAPPING.

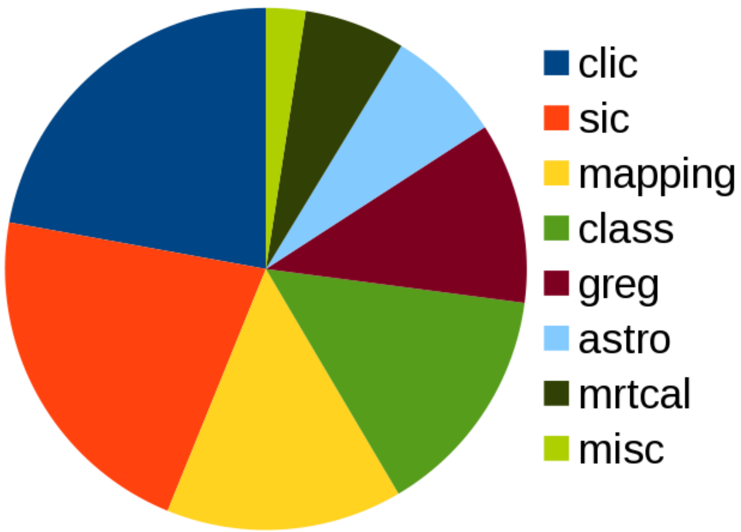


35 years of accumulated expertise

470 000 executable lines

Crafted power tools

Light weight



GILDAS users

IRAM AODs Instrument monitoring, data pipelining.

IRAM users Data reduction.

Other users

- GILDAS (e.g., CLASS) is used in many observatories.
- Science analysis, and publication quality figures.

All kind of public from beginners to data specialists.

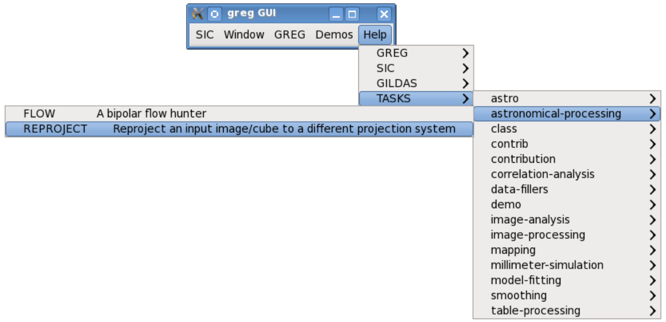
- Easyness of use for new users.
- Flexibility for data specialists.

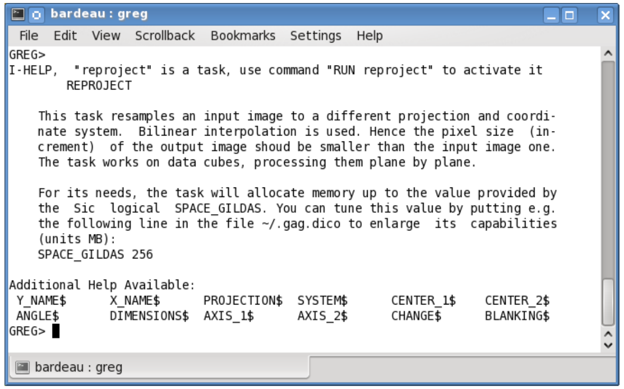
⇒ Evolutions must be thought with all users in mind.

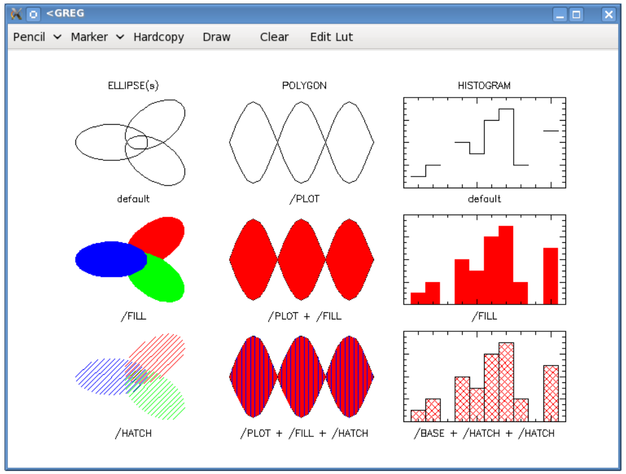
User support:

I. Documentation

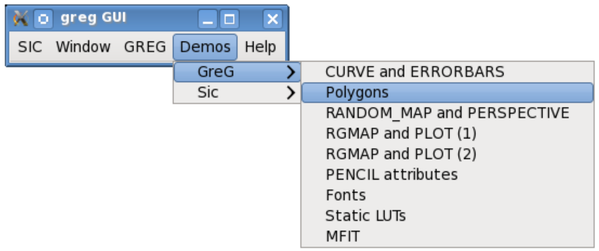
Online HELP displayed in the terminal window







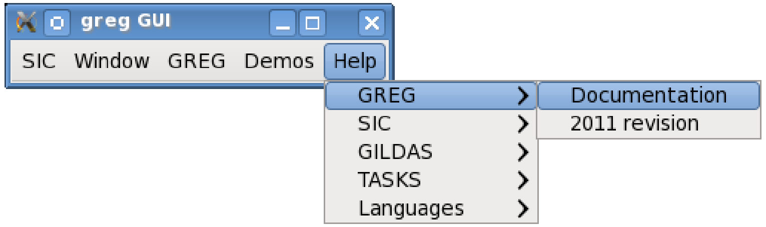
Demonstration executed in the terminal and/or the plotting window

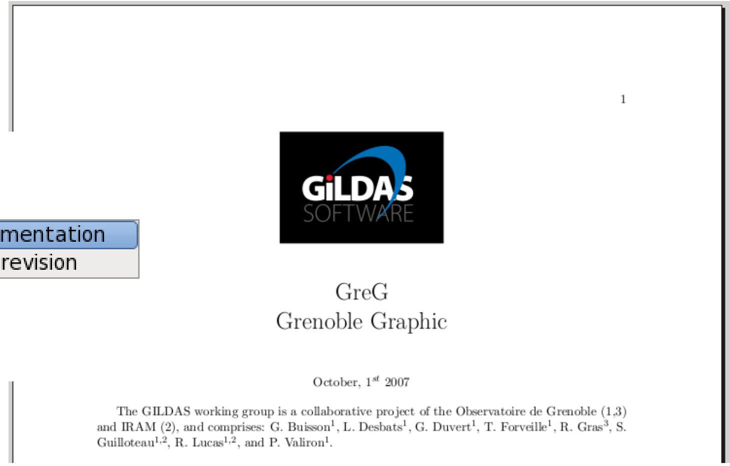


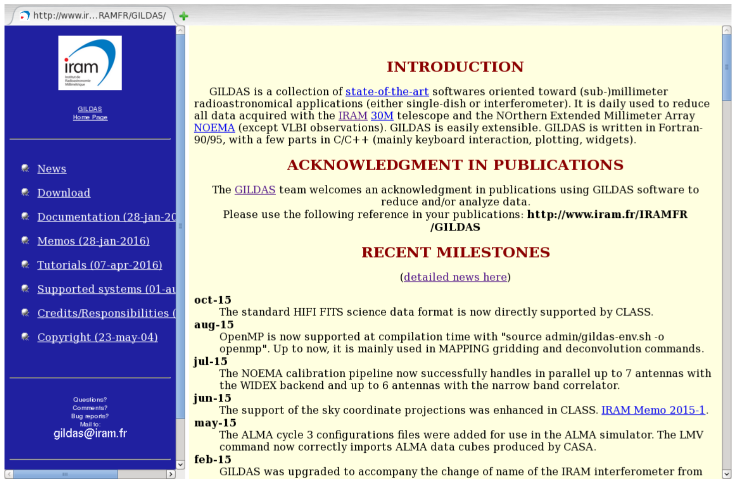
User support:

I. Documentation (Cont'd)

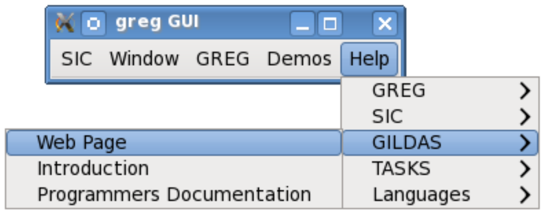
PDF document opened in your PDF viewer







Web pages opened in your web browser



User support:
I. Documentation (Cont'd)

Web page http://www.iram.fr/IRAMFR/GILDAS.


Mozilla Firefox
http://www.ir...RAMFR/GILDAS/

GILDAS
Home Page

- News
- Download
- Documentation (20-feb-2017)
- Memos (23-feb-2018)
- Tutorials (23-jun-2017)
- Supported systems (01-aug-1
- Credits/Responsibilities (29-ja
- Copyright (23-may-04)

Questions?
Comments?
Bug reports?
Mail to:
gildas@iram.fr

MEMOS

The exhaustive list (summary and PDFs) of the IRAM technical memos is available on the IRAM webpage.

Number	Name
2017-1	Observational examples of spectral line calibration at the 30m telescope with MRTCAL and MIRA
2016-1	MAPPING for NOEMA: Concepts and Usage
2015-4	Introducing Associated Arrays in CLASS
2015-3	Importing Herschel-FITS into CLASS
2015-2	NOEMA time/sensitivity estimator (version 2.1 for POLYFIX, 07-feb-2018)
2015-2	NOEMA time/sensitivity estimator (version 1.1)
2015-1	Extended support of sky spherical coordinates in CLASS
2014-1	CLASS Data Fillers
2013-3	CLASSIC Application Programming Interface
2013-2	CLASSIC Data Container
2011-3	CLASS User Section
2011-2	WIFISYN: The GILDAS implementation of a new wide-field synthesis algorithm
2011-1	Preparing GILDAS for large datasets. I - GREG 2011
2010-2	IRAM-30m MAMBO time / sensitivity estimator
2010-1	IRAM-30m HERA time/sensitivity estimator
2009-6	Read-write optimization in CLASS
2009-5	Comparison of ATM versions: Impact on the calibration of IRAM instruments
2009-4	Averaging spectra with CLASS
2009-3	A simulator of interferometric On-The-Fly observations
2009-2	Imaging of interferometric On-The-Fly observations (I): context and discussion of possible method
2009-1	IRAM-30m EMIR time/sensitivity estimator
2008-2	Single-dish observation and processing to produce the short-spacing information for a millimeter
2005-1	CLASS evolution: I. Improved OFT support
2003-4	Case for interoperability as an ALMA off-line model
2003-3	Complementarity of the AIPS++, GILDAS and MIRIAD packages as seen from evaluations for ALM
2003-2	Evaluation of the GILDAS Package for ALMA Off-line Data Processing
2003-1	Evaluation of the MIRIAD Package for ALMA Off-line Data Processing

User support:
I. Documentation (cont'd)

Web page http://www.iram.fr/IRAMFR/GILDAS.

IRAM Memo 2013-2

CLASSIC Data Container

S. Bardeau[1], V. Piétu[1], J. Pety[1,2]

1. IRAM (Grenoble)
2. LERMA, Observatoire de Paris

October, 3rd 2013
Version 1.0

Abstract

The **CLASS**/**CLIC** Data Format are digital formats used to describe single-dish/interferometric radio-astronomy data. They can be described in two layers: 1) a **CLASSIC** Data Container, which is generic enough to store many kind of data, typically several *observations* which gather observational parameters with actual data, and 2) the **CLASS**/**CLIC** Data Format itself, which make a particular use of the **CLASSIC** Data Container.

The size of the datasets produced by the IRAM instruments experience a tremendous increase (because of multi-beam receivers, wide bandwidth receivers, spectrometers with thousands of channels, and/or new observing mode like the interferometric on-the-fly). This implied that the **CLASS**/**CLIC** Data Format were reaching common limits in the size of data which could be stored. To solve these issues, the **CLASSIC** Data Container standard was revised. This documents aims to describe the new standard. A companion document describes the **GILDAS** library which implements this standard and which is now used by **CLASS** and **CLIC**.

Related documents: The **CLASSIC** Library, IRAM memo 2013-3

Original version at http://iram-institute.org/medias/uploads/mrtcal-check.pdf

IRAM Memo 2017-1

Observational examples of spectral line calibration at the 30m telescope with **MRTCAL** and **MIRA**

C. Marka[1], J. Pety[2,3], S Bardeau[2], A. Sievers[1]

1. IRAM (Granada)
2. IRAM (Grenoble)
3. Observatoire de Paris

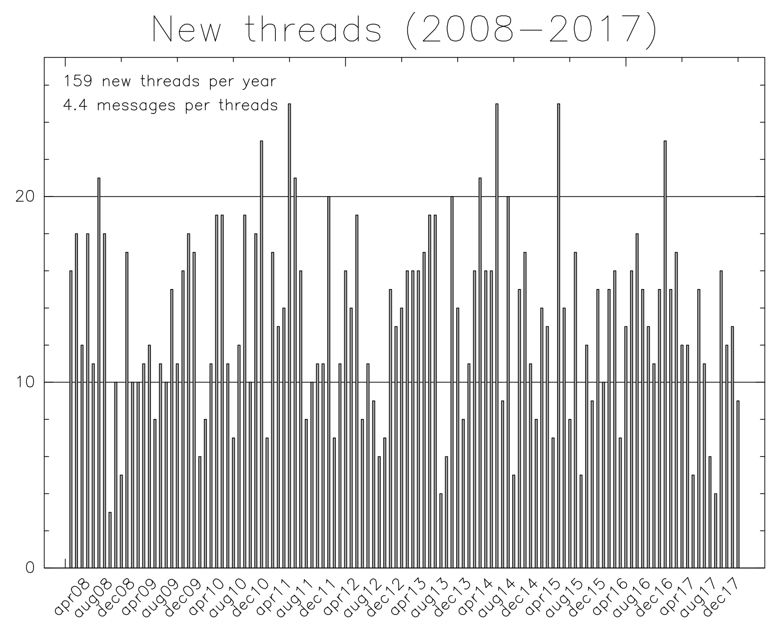
Sep., 14th 2017
Version 1.0

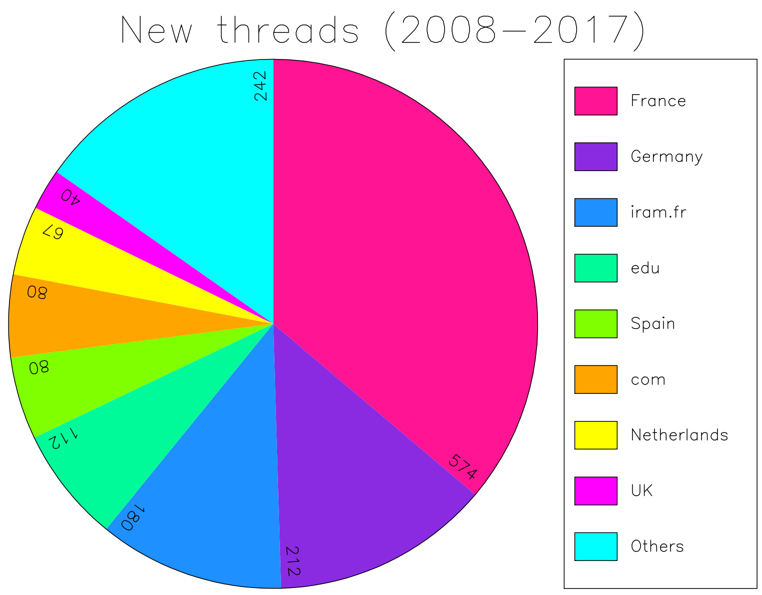
Abstract

Since February 2017, **MRTCAL** has replaced **MIRA** as the software for spectral line data calibration (except polarimetry and continuum) at the 30m-Telescope. Slight changes in the calibrated spectra are expected, for example in form of an improved calibration accuracy at the edges of the atmospheric windows as result of the narrower calibration bandwidth used by **MRTCAL** (20 MHz by default, compared to up to about 1.35 GHz for **MIRA**). This report demonstrates the practical performances of **MRTCAL** by a systematic comparison of observations calibrated with both softwares.

Keywords: **MRTCAL**, **MIRA**, 30m calibration
Related documents: **MRTCAL** documentation, **MIRA** documentation, **CLASS** documentation.

User support:
II. On-line helpdesk (gildas@iram.fr)





- Total number of threads: 159/year.
- Number of emails per threads: 4.4.
- Median time to
  - First answer: 6h;
  - Final answer: 25h.

User support:
III. Face-to-face training

User Meetings 35 participants in Apr. 2016 + Another one in 2019.

Lectures and tutorials in IRAM schools

- Eight 30m-schools = 326 participants.
- Nine NOEMA-schools = 521 participants.

Participations to the European Radio Interferometry Schools (ERIS)

Other tutorials Bonn, Cologne, Garching (ESO).

Bug report: I. Wrong way

Hi,

I have just stumbled on an obnoxious bug which prevents me from making the discovery of the century. I will defend my PhD thesis tomorrow. Fix this bug in the coming minutes.

Toto.

Bug report: II. Right way

Dear Gildas team,

Your software is great. For the first time in my life, I encountered a segmentation fault using it. I succeeded to reproduce the bug with a simple list of commands. I attach the following information: version of gildas I am currently using, list of commands and the data set to reproduce the bug. I hope this will help you solve the bug in the coming months. Continue the great work.

Best regards, Toto.

****

gildas version: `sep15b (x86_64-redhat6.4-ifort) source tree`

List of commands and messages:
`LAS90>` file in test
`LAS90>` find
Blablablabla...
Segmentation fault

Data set attached: test.30m

****

Coping with the NOEMA project: Challenges

Changes of technology

- **Receiver** 2 polar, 4GHz, SSB ⇒ 2 polar, 8GHz, 2SB.
- **Backend** XF ⇒ FX.

New operation modes *e.g.* double-array.

Increased complexity More antennas + More frontend/backend chunks.

Increased data rates by a factor 32 to 6000.

- **Number of baselines** PdBI-2010 $\times N_{\mathrm{ant}}(N_{\mathrm{ant}} - 1)/30$, *i.e.* 1.9, 3, and 4.4 for 8, 10, and 12 antennas.
- **Channels** PdBI-2010 $\times 32$.
- **Shorter integration times** PdBI-2010 $\times 1 - 45$.
- **Typical data rates** at the end of phase 1, *i.e.* end of 2017
  - **Average (Single-field, 10 antennas)** 2.8 MB/s, *i.e.*, at most 77 GB for 8-hrs observation.
  - **Peak (Wide-field, 10 antennas)** 63.0 MB/s, *i.e.*, 1.7 TB for 8-hrs observation.

Bigger delivered data products Large 3D data cubes.

Increased scientific capabilities

- **Wide bandwidth.**
- **Higher sensitivity.**
- **Higher brightness dynamic.**

⇒ Discovery of subtle, previously undetected "artifacts".

No software is the answer to all these:

- Best (*i.e.* most recent) computing technology.
- Best portability.
- Best speed.
- Best ease of use (CLI and GUI).
- Best (*i.e.* shortest) learning curve.
- Best functionalities.
  - Best data calibration methods.
  - Best data mapping methods.
  - Best (*i.e.* most complete) analysis methods.
  - Best graphical possibilities.
- Best cost.

IRAM Science Software Strategy

Maintain high-quality software for IRAM while staying open to outside world

Large projects divided into "Short", "focused" development cycles

A good balance between software astronomers and software engineers

Continuous aggregation of functionality without creating black boxes

Yearly versions for the online acquisition

Monthly releases to the community