



GILDAS **and** CLASS

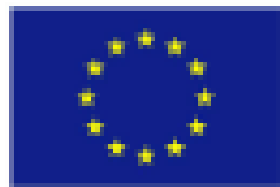
Jérôme PETY

(IRAM/Obs. de Paris)

on behalf of the IRAM Science Software developers

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Presentation partly supported by



People (as of 2018 March)

- People participating in one way or another

IRAM/Grenoble R. Zylka, J.M. Winters, E. Reynier, V. Pietu, J. Pety, E. Chapillon, A. Castro-Carrizo, M. Bremer, J. Boissier, S. Bardeau.

IRAM/Granada H. Ungerechts, A. Sievers, P. Mellado.

IPAG/Grenoble S. Maret.

LAB/Bordeaux S. Guilloteau.

- Large code contributors: ~ 5.0 FTE/yr

R. Zylka MOPSIC.

H. Ungerechts PAKO.

A. Sievers MIRA + MRTCAL.

E. Reynier kernel + OMS.

V. Pietu CLIC + RDI.

J. Pety kernel + MRTCAL + CLASS + MAPPING.

P. Mellado TAPAS.

A. Castro-Carrizo CLIC pipeline + OBS.

J. Boissier ASTRO.

S. Bardeau kernel (including the python binding) + CLASS + MRTCAL.

S. Maret CLASS/WEEDS.

S. Guilloteau Kernel + MAPPING.



Scope: I. Science Software at IRAM

Many different kinds of software at IRAM

1. Proposal (submission, TAC, statistics, ...)
2. Preparation of observations, e.g. setups.
3. Scheduling and monitoring of observed projects (dynamic scheduling, pool observing).
4. Data acquisition:
 - 4.1 Low level, e.g. hardware control (antennas, receivers, correlators, etc...)
 - 4.2 High level, e.g. operator and observer interface.
5. Data archiving.
6. Data reduction and analysis (single dish + interferometry).
7. Generic plot package.

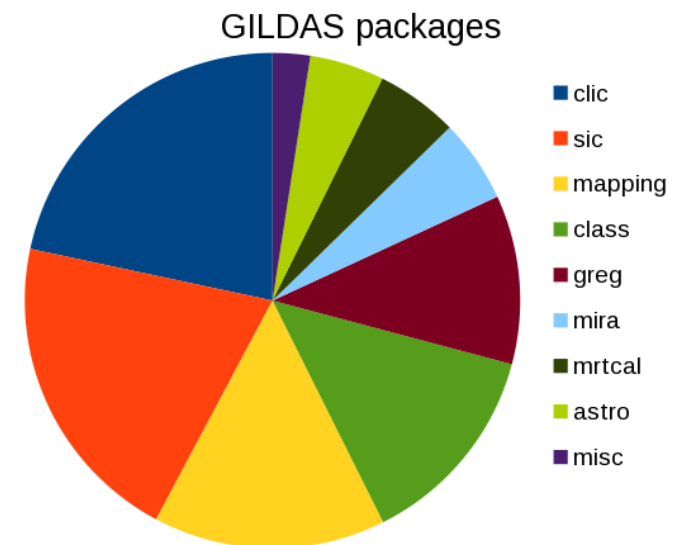
Science software deals only with a subset Points: 1, 2, 3, 4.2, 6, and 7.

GILDAS deals with an even smaller subset Points: 2, 4.2, 6 and 7.

Scope: III. GILDAS at IRAM

450 000 executable lines

- Common facilities
 - Command line interpreter: **SIC**;
 - Graphical possibilities: **GREG**
(1D: curves, 2D: images, 3D: spectra cubes).
 - Preparation of observations: **ASTRO**.
- 30m
 - Spectroscopy: **TELCAL** + **MRTCAL** + **CLASS**.
- NOEMA
 - Calibration: **CLIC**;
 - Imaging + Deconvolution: **MAPPING**.



GILDAS Strengths

Large range of supported systems Linux, Mac/OSX, (Windows).

Light weight Data reduction and analysis possible on laptops.

35 years of history \Rightarrow Accumulated expertise.

GILDAS users

- IRAM AODs: Instrument monitoring, data pipelining.
- IRAM users: Data reduction.
- Other facilities users
 - CLASS is used in many facilities (e.g., Herschel/HIFI, SOFIA/UpGREAT, APEX, NAN-TEN2, 40m, GBT, Effelsberg, PMO/Kosma, ...).
 - 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.

⇒ GILDAS evolutions must be thought with all users in mind.

User support:

I. Documentation

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

Mail to gildas@iram.fr.

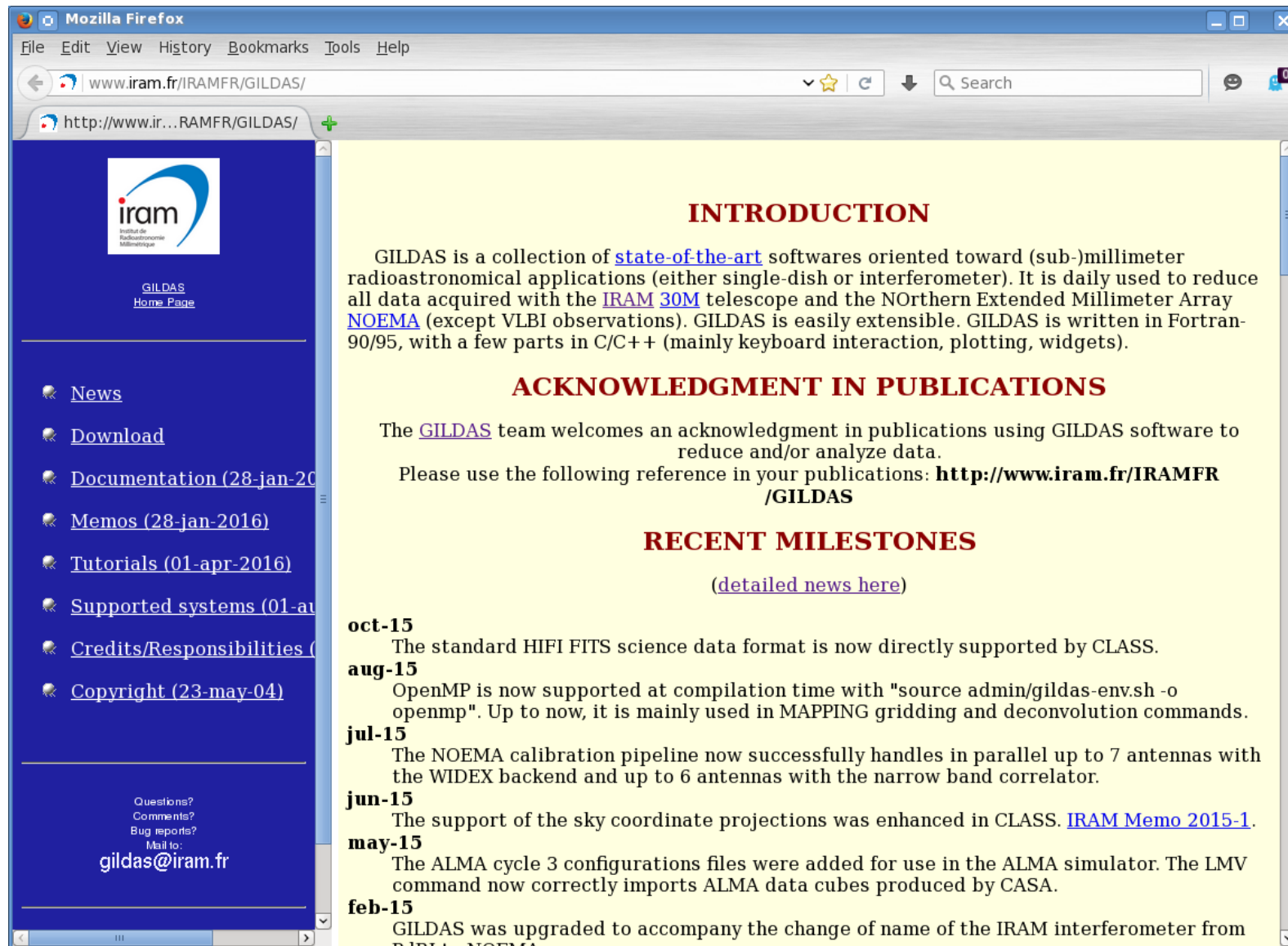


The screenshot shows a Mozilla Firefox browser window displaying the GILDAS Home Page. The address bar shows the URL <http://www.iram.fr/IRAMFR/GILDAS/>. The page features a blue sidebar on the left with the Iram logo and navigation links: [GILDAS Home Page](#), [News](#), [Download](#), [Documentation \(20-feb-2017\)](#), [Memos \(19-sep-2017\)](#), [Tutorials \(23-jun-2017\)](#), [Supported systems \(01-aug-1\)](#), [Credits/Responsibilities \(29-j\)](#), and [Copyright \(23-may-04\)](#). At the bottom of the sidebar, it says 'Questions? Comments? Bug reports? Mail to: gildas@iram.fr'. The main content area has a yellow background and is titled 'MEMOS'. It contains the text: 'The exhaustive list (summary and PDFs) of the IRAM technical memos is available on [the IRAM webpage](#).' Below this is a table with two columns: 'Number' and 'Name'. The table lists 25 entries, each with a year and a description of a technical memo or update.

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 2.0 for POLYFIX)
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

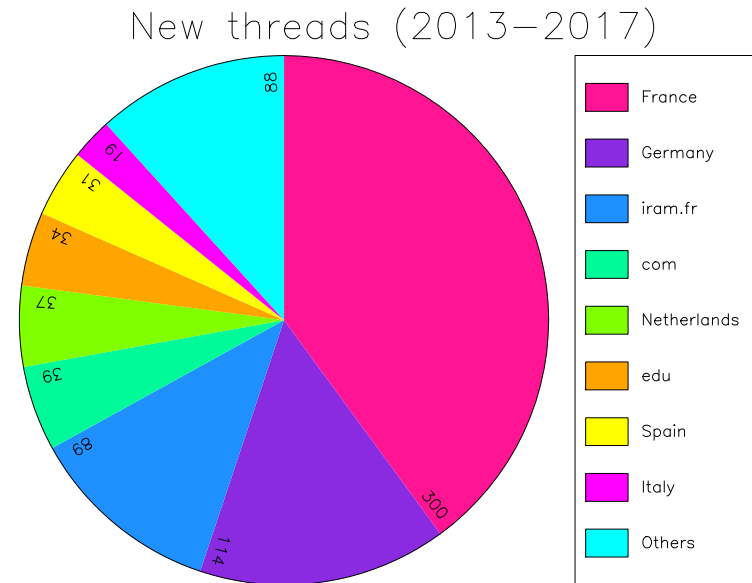
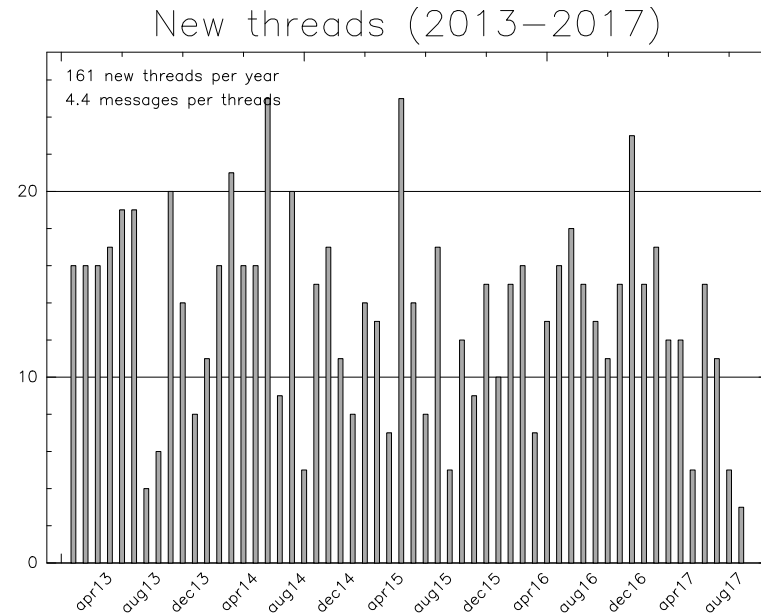
User support:

II. Web page <http://www.iram.fr/IRAMFR/GILDAS>



User support:

III. answers to gildas@iram.fr



- Total number of threads: 161/year.
- Number of emails per threads: 4.4.
- Median time to
 - First answer: 6h;
 - Final answer: 25h.

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: mar18b (x86_64-redhat6.4-ifort) source tree

List of commands:

LAS90> file in test

LAS90> find

Blablabla...

Segmentation fault

Data set attached: test.30m

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 instruments while staying open to outside world

- Focused but generic developments;
- In/out fillers;
- Python binding.

“Short”, “focused” development cycles

- No one-fit-all-use-cases-in-astronomy software.
- Ruptures are possible but exceptional (e.g., data formats) and foresee large timescale for users to adapt.

A good balance between software astronomers and software engineers

- In-house astronomers make the link between the community and the engineers.
- Keeping a science activity is the best way to understand the community needs on a daily basis.
- Prototypes are useful first steps for more professional developments (e.g., IPP \Rightarrow PMS, Weeds \Rightarrow linedb).

Continuous aggregation of functionality without creating black boxes

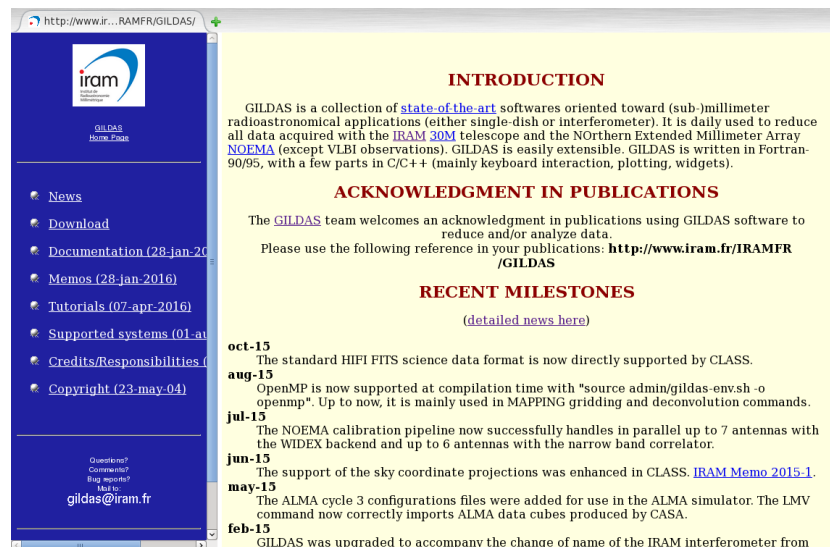
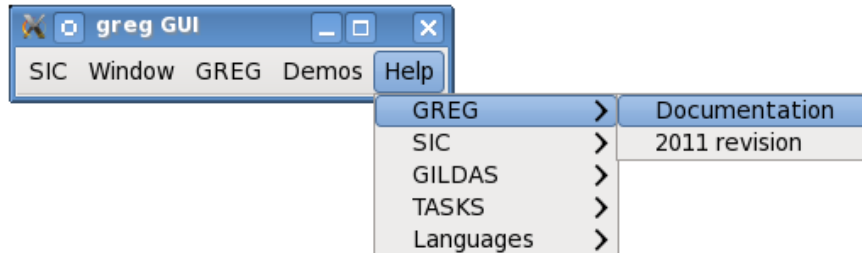
- Integration of functionality enable to simplify the interaction with ever increasing data complexity.
- Viewing the intermediate processing steps enable to keep control of the data reduction.

Professionalization

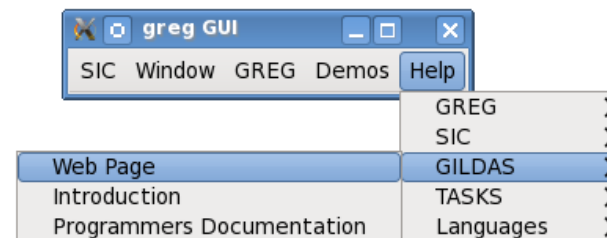
- Prototypes are rewritten to get a better design and an easier medium to long term maintenance.
- Yearly versions for the online acquisition.
- Major developments made in branches (GREG2011) or plug-ins (WEEDS) to avoid disruption.
- Much testing done before releasing new developments (GREG2011, CLIC pipeline, MRTCAL, ...).

Need generic help? I. Browsing the widgets

PDF document opened in
your PDF viewer

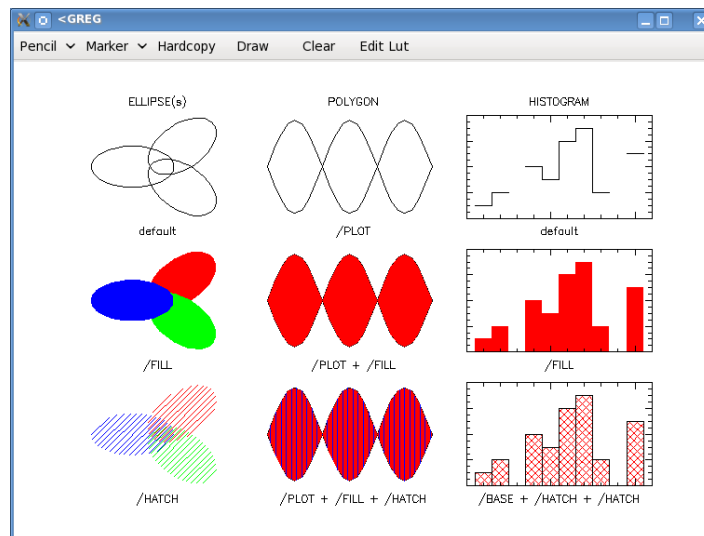
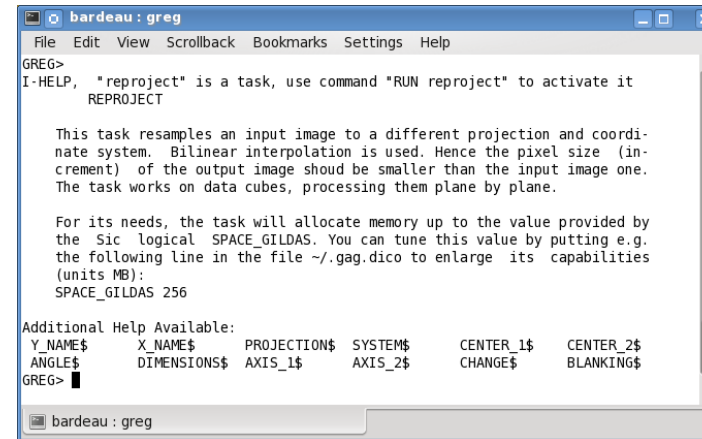
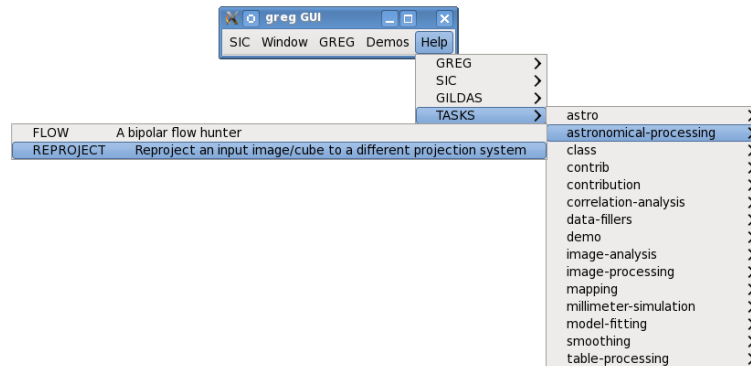


Web pages opened in
your web browser

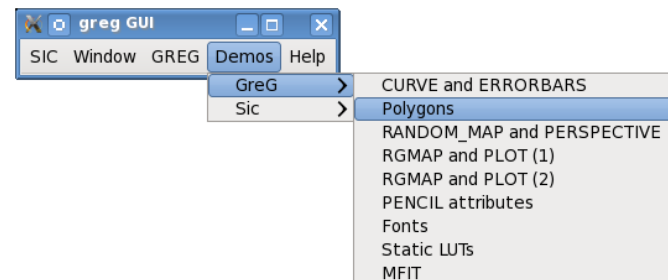


Need generic help? II. Demonstration procedures

Online HELP displayed in the terminal window



Demonstration executed in the terminal and/or the plotting window



Need CLASS help?

GILDAS web page <http://www.iram.fr/IRAMFR/GILDAS/>

CLASS documentations and cookbooks [Widget>Help>Class>...](#)

Online help

```
LAS> HELP ! Summary of all commands, gathered by language
...
LAS\
  ACCUMULATE  ASSOCIATE  AVERAGE  BASE  BOX  CATALOG
  CONSISTENCY COPY      DROP      DUMP  EXTRACT FILE
...
LAS> HELP LAS\ ! (with backslash) Language help with short command description
      LAS\ Command Language Summary
ACCUMULATE      Add R and T observation.
ASSOCIATE       Add an Associated Array to the R observation
AVERAGE        Average all the observations of the current index.
...
LAS> help average ! Command help
      LAS\AVERAGE [/RESAMPLE [NX Xref Xval Xinc Unit]] [/NOCHECK
[ SOURCE|POSITION|LINE|SPECTROSCOPY|CALIBRATION]]

Average all the spectra of the current index using the current weighting
function (see SET WEIGHT).
...
LAS> help average /resample ! Command subtopic help
...
```

Helpdesk (Questions? Comments? Bug reports?): gildas@iram.fr

Data exploration: I. What does the file contain?

```
LAS> file in demo
```

```
LAS> find
```

```
LAS> list
```

```
Current index contains:
```

N;V	Source	Line	Telescope	Lambda	Beta	Sys	Sca	Sub
...								
8600;4	B0355+508	12C0(1-0)	30M-V02-B100	+65.2	+60.0	Eq	9682.	2
8601;4	B0355+508	12C0(1-0)	30M-V02-B100	+68.2	+60.0	Eq	9682.	2
8602;4	B0355+508	12C0(1-0)	30M-V02-B100	+71.3	+60.0	Eq	9682.	2
8603;4	B0355+508	12C0(1-0)	30M-V02-B100	+74.4	+60.0	Eq	9682.	2
8604;4	B0355+508	12C0(1-0)	30M-V02-B100	+77.4	+60.0	Eq	9682.	2
8605;4	B0355+508	12C0(1-0)	30M-V02-B100	+80.5	+60.0	Eq	9682.	2
8606;4	B0355+508	12C0(1-0)	30M-V02-B100	+83.5	+60.0	Eq	9682.	2
8607;4	B0355+508	12C0(1-0)	30M-V02-B100	+86.6	+60.0	Eq	9682.	2
8608;4	B0355+508	12C0(1-0)	30M-V02-B100	+89.7	+60.0	Eq	9682.	2
8609;4	B0355+508	12C0(1-0)	30M-V02-B100	+92.7	+60.0	Eq	9682.	2
8610;4	B0355+508	12C0(1-0)	30M-V02-B100	+95.8	+60.0	Eq	9682.	2
8611;4	B0355+508	12C0(1-0)	30M-V02-B100	+98.8	+60.0	Eq	9682.	2
8612;4	B0355+508	12C0(1-0)	30M-V02-B100	+101.9	+60.0	Eq	9682.	2
8613;4	B0355+508	12C0(1-0)	30M-V02-B100	+104.9	+60.0	Eq	9682.	2
8614;4	B0355+508	12C0(1-0)	30M-V02-B100	+108.0	+60.0	Eq	9682.	2

```
LAS>
```

⇒ Too many information.

Data exploration: I. What does the file contain?

```
LAS> list /scan
```

```
...
```

B0355+508	12C0(1-0)	30M-V02-B100	-108.5:	+108.8	+70.0	Eq	9626	73
B0355+508	12C0(1-0)	30M-V01-A100	-108.5:	+108.8	+80.0	Eq	9627	73
B0355+508	12C0(1-0)	30M-V02-B100	-108.5:	+108.8	+80.0	Eq	9627	73
B0355+508	12C0(1-0)	30M-V01-A100	-109.4:	+107.9	+90.0	Eq	9628	73
B0355+508	12C0(1-0)	30M-V02-B100	-109.4:	+107.9	+90.0	Eq	9628	73
B0355+508	12C0(1-0)	30M-V01-A100	-109.6:	+107.7	+100.0	Eq	9629	73
B0355+508	12C0(1-0)	30M-V02-B100	-109.6:	+107.7	+100.0	Eq	9629	73
B0355+508	12C0(1-0)	30M-V01-A100	-100.0		-109.3: +108.0	Eq	9634	73
B0355+508	12C0(1-0)	30M-V02-B100	-100.0		-109.3: +108.0	Eq	9634	73
B0355+508	12C0(1-0)	30M-V01-A100	-90.0		-109.4: +107.9	Eq	9635	73
B0355+508	12C0(1-0)	30M-V02-B100	-90.0		-109.4: +107.9	Eq	9635	73
B0355+508	12C0(1-0)	30M-V01-A100	-80.0		-109.5: +107.8	Eq	9636	73
B0355+508	12C0(1-0)	30M-V02-B100	-80.0		-109.5: +107.8	Eq	9636	73
B0355+508	12C0(1-0)	30M-V01-A100	-70.0		-109.2: +108.1	Eq	9637	73

```
...
```

```
LAS>
```

⇒ One line per scan and front-end/back-end combination

Data exploration: I. What does the file contain?

```
LAS> list /scan /brief
Current index contains:
 9608: 146   9609: 146   9610: 146   9611: 146   9612: 146   9613: 146
 9614: 146   9615: 146   9616: 146   9617: 146   9619: 146   9620: 146
 9621: 146   9622: 146   9623: 146   9624: 146   9625: 146   9626: 146
 9627: 146   9628: 146   9629: 146   9634: 146   9635: 146   9636: 146
 9637: 146   9638: 146   9639: 146   9640: 146   9641: 146   9642: 146
 9643: 146   9645: 146   9646: 146   9647: 146   9648: 146   9649: 146
 9650: 146   9651: 146   9652: 146   9653: 146   9654: 146   9655: 146
 9665: 146   9666: 146   9667: 146   9668: 146   9669: 146   9670: 146
 9671: 146   9672: 146   9673: 146   9674: 146   9676: 146   9677: 146
 9678: 146   9679: 146   9680: 146   9681: 146   9682: 146
LAS>
```

⇒ Just the list of scans and the number of dumps per scan.

Data exploration: I. What does the file contain?

```
LAS> list /toc
```

equivalent to

```
LAS> list /toc source line telescope
```

Current index contains:

Number of sources..... 1

B0355+508 8614 (100.0%)

Number of lines..... 1

12C0(1-0) 8614 (100.0%)

Number of backends..... 2

30M-V01-A100 4307 (50.0%)

30M-V02-B100 4307 (50.0%)

Number of setups..... 2

B0355+508 12C0(1-0) 30M-V01-A100 4307 (50.0%)

B0355+508 12C0(1-0) 30M-V02-B100 4307 (50.0%)

```
LAS>
```

⇒ Default table of contents.

Data exploration: I. What does the file contain?

```
LAS> list /toc observed scan
Number of observation dates    1
    12-SEP-2005              8614 (100.0%)
Number of scans.....    59
    9608                    146 (  1.7%)
    9609                    146 (  1.7%)
    9610                    146 (  1.7%)
    9611                    146 (  1.7%)
    9612                    146 (  1.7%)
    9613                    146 (  1.7%)
    9614                    146 (  1.7%)
    ...
Number of setups.....    59
    12-SEP-2005              9608          146 (  1.7%)
    12-SEP-2005              9609          146 (  1.7%)
    12-SEP-2005              9610          146 (  1.7%)
    12-SEP-2005              9611          146 (  1.7%)
    12-SEP-2005              9612          146 (  1.7%)
    12-SEP-2005              9613          146 (  1.7%)
    12-SEP-2005              9614          146 (  1.7%)
    ...
LAS>
```

⇒ Customized table of content.