



TRE
ALTAMIRA
A CLS Group Company

Dagli script a linguaggio di programmazione

Una GUI per il team di produzione

Marco Basilico, Xavier Balague
Milano, 24 Giugno 2019

- » Introducing TRE ALTAMIRA
- » TRE ALTAMIRA products
- » Why MATLAB?
- » MATLAB (a long journey)
 - MATLAB as a script for R&D
 - MATLAB as a tool for production
 - MATLAB as a programming language
- » A GUI/application for production
- » Conclusions and next steps



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Introduction to TRE ALTAMIRA


TRE ALTAMIRA

The global leader in satellite
radar data processing for the
measurement of ground and
structural movements



TRE and ALTAMIRA have joined forces to become the largest InSAR group worldwide, as part of the CLS Group company.

<p>1999</p>  <p>POLITECNICO DI MILANO</p> <p>PSInSAR®, the first advanced InSAR technique, is patented by POLIMI.</p>  <p>TRE Sensing the Planet</p>  <p>Established in 1999 in Barcelona, ALTAMIRA starts providing the market with an InSAR service in 2003.</p>	<p>2000</p>  <p>New subsidiaries</p> <table border="1"> <tr> <td>TRE</td> <td>ALTAMIRA</td> </tr> <tr> <td>2008 Vancouver</td> <td>2009 Calgary</td> </tr> </table>  <table border="1"> <tr> <td>TRE</td> </tr> <tr> <td>2012</td> </tr> </table> <p>Inventors of PSInSAR® and co-founders of TRE are awarded by ENI.</p>	TRE	ALTAMIRA	2008 Vancouver	2009 Calgary	TRE	2012	<p>$\Delta\phi = \frac{4\pi}{\lambda} \Delta R + \alpha$</p> <table border="1"> <tr> <td>TRE</td> </tr> <tr> <td>2010</td> </tr> </table> <p>TRE launches SqueeSAR® as the new industry standard of advanced InSAR techniques.</p>  <table border="1"> <tr> <td>TRE</td> <td>ALTAMIRA</td> </tr> <tr> <td>2015</td> <td>2010</td> </tr> </table> <p>Joining the CLS Group company.</p>	TRE	2010	TRE	ALTAMIRA	2015	2010	<p>2015</p>  <p>TRE ALTAMIRA A CLS Group Company</p> <table border="1"> <tr> <td>TRE ALTAMIRA</td> </tr> </table> <p>TRE and ALTAMIRA join together to become TRE ALTAMIRA with main offices in Milano, Barcelona and Vancouver.</p>	TRE ALTAMIRA	<p>2018</p>  <p>TRE ALTAMIRA is a routine provider of nation-wide databases of InSAR measurements using Sentinel-1 imagery.</p>
TRE	ALTAMIRA																
2008 Vancouver	2009 Calgary																
TRE																	
2012																	
TRE																	
2010																	
TRE	ALTAMIRA																
2015	2010																
TRE ALTAMIRA																	



is a global company and pioneer provider of space-based solutions. It works in six strategic areas of activity: from sustainable fisheries management, maritime surveillance, fleet management, to environmental monitoring, energy & mining and space & ground systems.

19 YEAR'S ★★★★★
EXPERIENCE



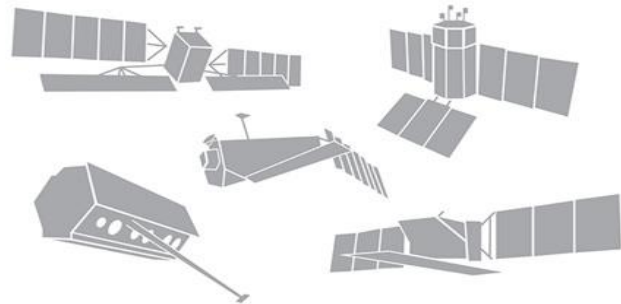
120,000
Satellite Radar
IMAGES PROCESSED

Facts

~5,000,000 km²
analysed everywhere in the world



1mm 
PRECISION
on single displacement
measurements



SAR satellites
PAST AND PRESENT
Ready for future platforms

600+ InSAR
PROJECTS



in different market sectors

International
PATENTS



on radar data processing

SqueeSAR® DespeckKS®
Double-Geometry Corner Reflectors



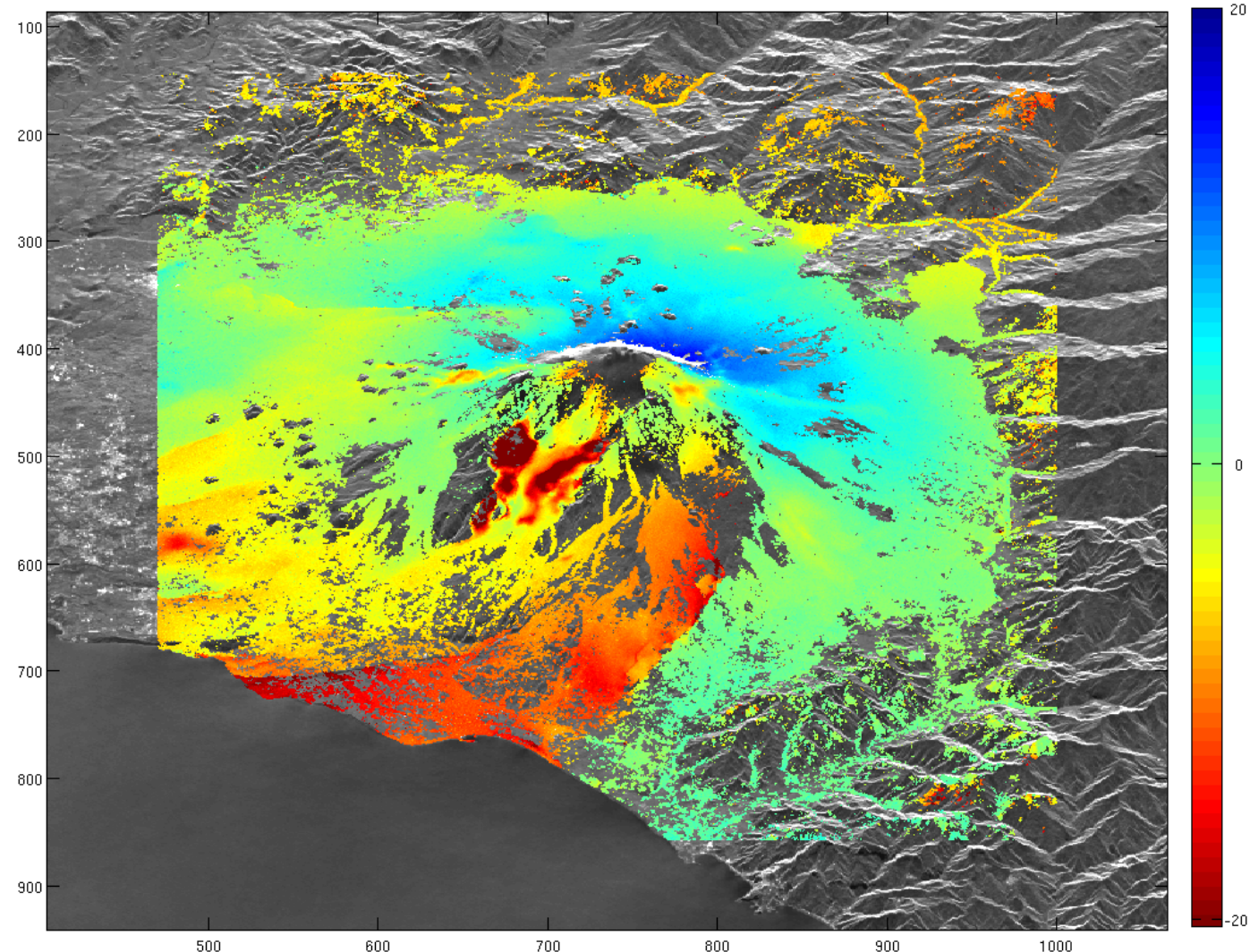
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TRE ALTAMIRA PRODUCTS

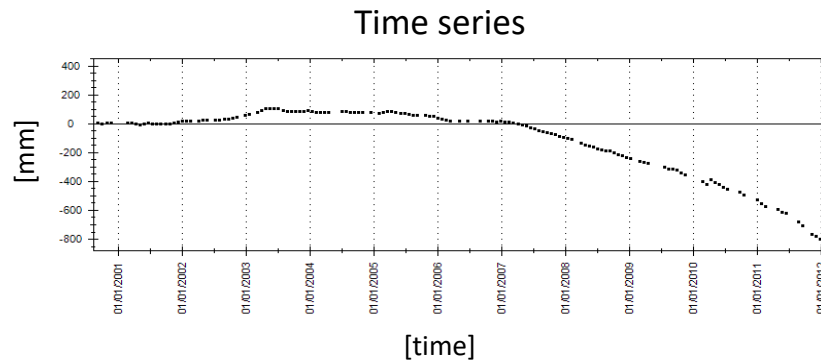
We provide deformation maps with millimetric precision using a technique called SqueeSAR®.

Deliverables are in shapefiles format.

Generally shapefile contains millions of points with hundreds of attributes.



For every measurement we provide: geolocalization (lat, lon, height), annual deformation rate, acceleration, standard deviations and all the displacement.



→ This huge amount of data must be displayed and edited in MATLAB ←



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WHY MATLAB?

- » Most of the employees learnt MATLAB at university (a well known tool)
- » We need high computational performances.
- » We need to easily display/interact data while process them
- » We need to develop complex tool; we need a programming language
- » *Mathworks* customer care
- » A large community of developers (also important events such as: MATLAB expo, Advisory Board)
- » Many online how2/training resources





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MATLAB ... A LONG JOURNEY

All users initially developed independently its own tool and set of MATLAB functions.

No standardization,
no proper comments
into functions, no
documentation, no
common best
practices

Many functions for
the same
action with slightly
different results

Reinvent the wheel



moving toward ... a tool for production

- » Remove duplicated functions
- » Organize code in an homogenous way
 - Set up a repository with proper guidelines for users
 - Organize function in modules with a version
 - Create collection of modules into releases

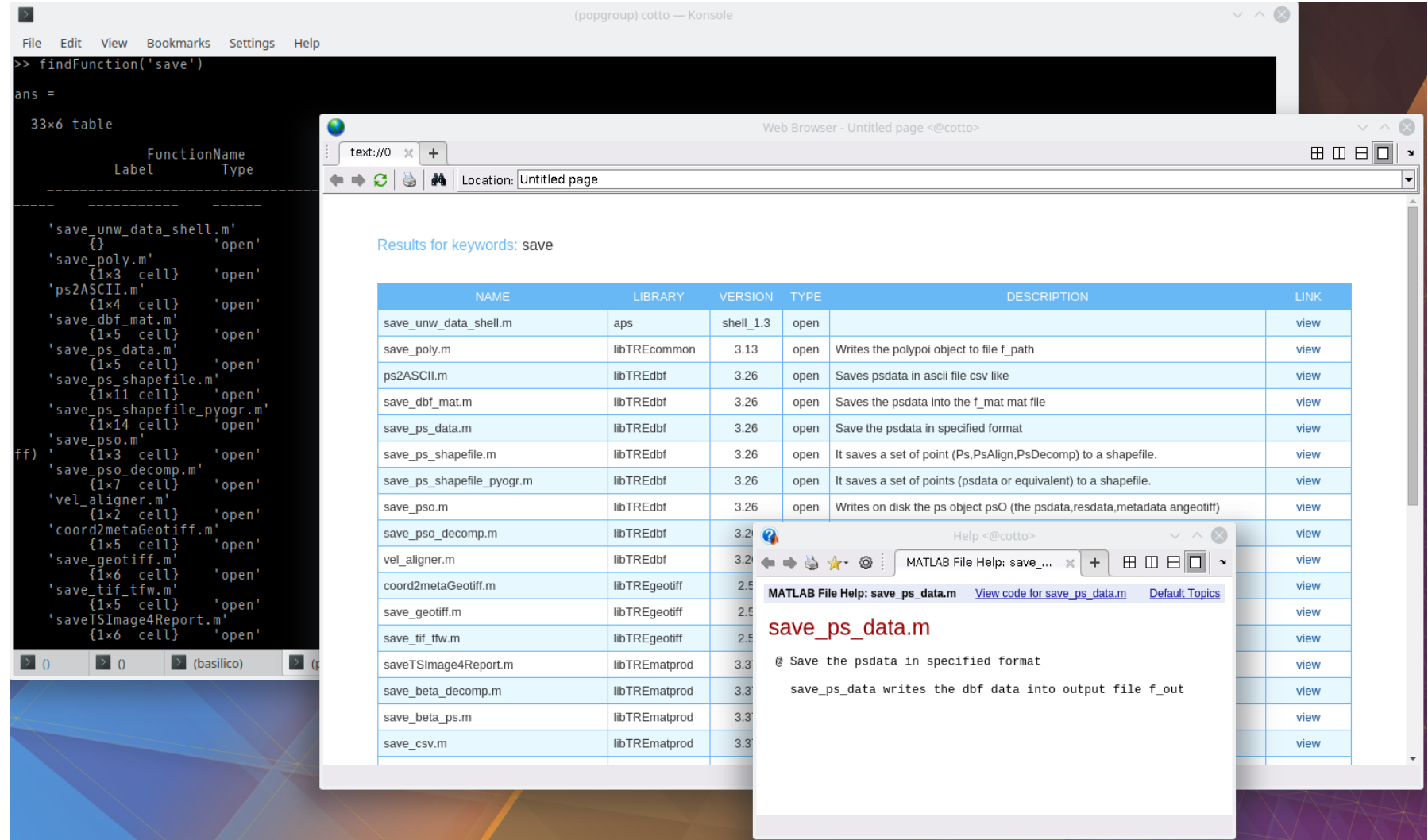
- » Oblige data scientist to use a code repository (CVS, git)
- » It is forbidden to edit production code
- » Oblige data scientist to test the code in an extensive way
- » Work in a team

... a tool for production

Function are collected in module (libraries) with a proper version number. A release in production is a collection of modules version. Any release has a xml configuration file to specify the release modules. The MATLAB path is set automatically choosing the production release.

```
<?xml version="1.0" encoding="utf-8"?>
<LibrariesVersion>
  <ProfileName>POSTPROD_4.137</ProfileName>
  <ProfileVersion>v4.137</ProfileVersion>
  <lib>
    <name>factotum</name>
    <ver>v4.29</ver>
  </lib>
  <lib>
    <name>libTREcommon</name>
    <ver>v3.13</ver>
  </lib>
  <lib>
    <name>libTREdbf</name>
    <ver>v3.27</ver>
  </lib>
  ...
  ...
  <lib>
    <name>libTREpso</name>
    <ver>v2.21</ver>
  </lib>
  <lib>
    <name>libTREsgiye</name>
    <ver>v2.3</ver>
  </lib>
  <lib>
    <name>libTREtcs</name>
    <ver>v2.8</ver>
  </lib>
  <lib>
    <name>libTREvisual</name>
    <ver>v3.10</ver>
  </lib>
  <lib>
    <name>lib_geocode</name>
    <ver>v1.5</ver>
  </lib>
  <lib>
    <name>lib_interp</name>
    <ver>v1.5</ver>
  </lib>
  <lib>
    <name>user_tools</name>
    <ver>v1.10</ver>
  </lib>
  <ProfileFunctionTable>/box/MATLAB/POSTPROD_4.137/functionTable.mat</ProfileFunctionTable>
</LibrariesVersion>
```

findFunction is a tool to retrieve function thanks to some keywords. The documentation is build automatically from some comments added to the code



The screenshot shows a MATLAB console window on the left and a web browser window on the right. The console displays the output of the `findFunction('save')` command, which returns a 33x6 table of function names, labels, and types. The web browser shows the search results for the keyword 'save', displaying a table with columns for NAME, LIBRARY, VERSION, TYPE, DESCRIPTION, and LINK. A pop-up window shows the MATLAB File Help for the `save_ps_data.m` function, including its description and usage.

NAME	LIBRARY	VERSION	TYPE	DESCRIPTION	LINK
save_unw_data_shell.m	aps	shell_1.3	open		view
save_poly.m	libTREcommon	3.13	open	Writes the polypoi object to file f_path	view
ps2ASCII.m	libTREDbf	3.26	open	Saves psdata in ascii file csv like	view
save_dbf_mat.m	libTREDbf	3.26	open	Saves the psdata into the f_mat mat file	view
save_ps_data.m	libTREDbf	3.26	open	Save the psdata in specified format	view
save_ps_shapefile.m	libTREDbf	3.26	open	It saves a set of point (Ps,PsAlign,PsDecomp) to a shapefile.	view
save_ps_shapefile_pyogr.m	libTREDbf	3.26	open	It saves a set of points (psdata or equivalent) to a shapefile.	view
save_pso.m	libTREDbf	3.26	open	Writes on disk the ps object psO (the psdata,resdata,metadata angeotiff)	view
save_pso_decomp.m	libTREDbf	3.2			view
vel_aligner.m	libTREDbf	3.2			view
coord2metaGeotiff.m	libTREGeotiff	2.5			view
save_geotiff.m	libTREGeotiff	2.5			view
save_tif_tfw.m	libTREGeotiff	2.5			view
saveTImage4Report.m	libTREmatprod	3.3			view
save_beta_decomp.m	libTREmatprod	3.3			view
save_beta_ps.m	libTREmatprod	3.3			view
save_csv.m	libTREmatprod	3.3			view

MATLAB File Help: save_ps_data.m

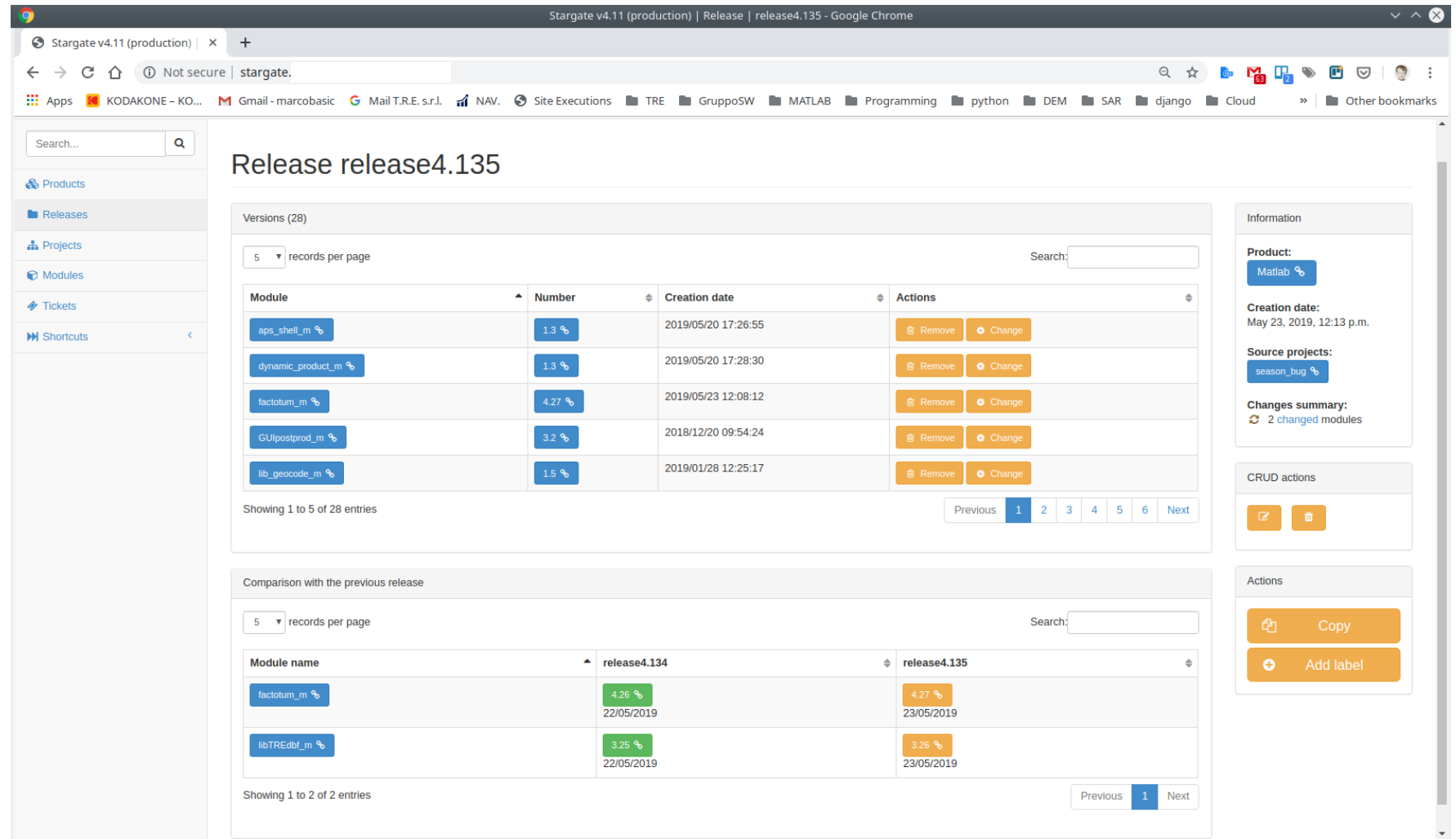
[View code for save_ps_data.m](#) [Default Topics](#)

save_ps_data.m

@ Save the psdata in specified format

save_ps_data writes the dbf data into output file f_out

A web-app to drive the team into repository and versioning (CVS and git command suggestions, mail notifications, version numbers stored into database)



The screenshot shows a web browser window with the URL 'stargate.' and the page title 'Release release4.135'. The interface includes a sidebar with navigation options: Products, Releases, Projects, Modules, Tickets, and Shortcuts. The main content area is divided into two sections:

Versions (28)

Module	Number	Creation date	Actions
aps_shell_m	1.3	2019/05/20 17:26:55	Remove Change
dynamic_product_m	1.3	2019/05/20 17:28:30	Remove Change
factotum_m	4.27	2019/05/23 12:08:12	Remove Change
GUIpostprod_m	3.2	2018/12/20 09:54:24	Remove Change
lib_geocode_m	1.5	2019/01/28 12:25:17	Remove Change

Showing 1 to 5 of 28 entries

Comparison with the previous release

Module name	release4.134	release4.135
factotum_m	4.26 22/05/2019	4.27 23/05/2019
libTREdbf_m	3.25 22/05/2019	3.26 23/05/2019

Showing 1 to 2 of 2 entries

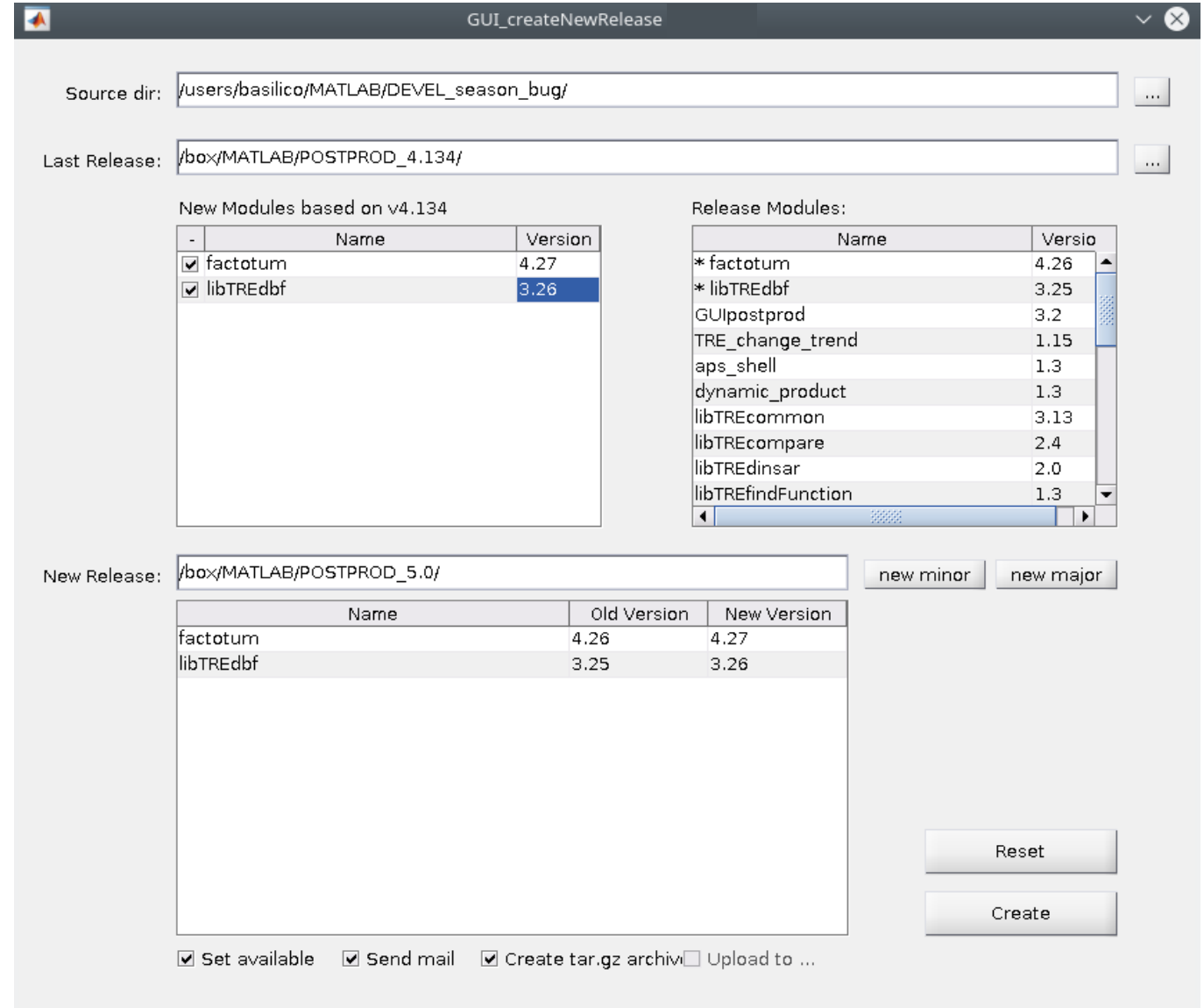
Information sidebar:

- Product: Matlab
- Creation date: May 23, 2019, 12:13 p.m.
- Source projects: season_bug
- Changes summary: 2 changed modules

CRUD actions: Edit, Delete

Actions: Copy, Add label

Some MATLAB GUI were created to let code deploying automatic and easy.



The screenshot shows the 'GUI_createNewRelease' window with the following configuration:

- Source dir: /users/basilico/MATLAB/DEVEL_season_bug/
- Last Release: /box/MATLAB/POSTPROD_4.134/
- New Modules based on v4.134:

-	Name	Version
<input checked="" type="checkbox"/>	factotum	4.27
<input checked="" type="checkbox"/>	libTREdbf	3.26
- Release Modules:

Name	Version
* factotum	4.26
* libTREdbf	3.25
GUIpostprod	3.2
TRE_change_trend	1.15
aps_shell	1.3
dynamic_product	1.3
libTREcommon	3.13
libTREcompare	2.4
libTREdinsar	2.0
libTREfindFunction	1.3
- New Release: /box/MATLAB/POSTPROD_5.0/

Name	Old Version	New Version
factotum	4.26	4.27
libTREdbf	3.25	3.26
- Buttons: new minor, new major, Reset, Create
- Options: Set available, Send mail, Create tar.gz archiv, Upload to ...

switch_path and ***switch_stable*** are tools that lets the user change the release used in a MATLAB session; the MATLAB path is updated automatically.

```
< M A T L A B (R) >
Copyright 1984-2017 The MathWorks, Inc.
R2017a (9.2.0.538062) 64-bit (glnxa64)
February 23, 2017

To get started, type one of these: helpwin, helpdesk, or demo.
For product information, visit www.mathworks.com.

Matlab Team welcomes you to the magic world of his wonderful profile selector

The available online profiles today are:

(01) LATEST RELEASE -> POSTPROD_4.137
(02) POSTPROD_4.136
(03) POSTPROD_4.135
(04) POSTPROD_4.134
(05) POSTPROD_4.133
(06) POSTPROD_4.132
(07) POSTPROD_4.131
(08) POSTPROD_4.130
(09) POSTPROD_4.129
(10) POSTPROD_4.128
(11) POSTPROD_4.127
(12) POSTPROD_4.125
(13) DECOMP
(14) DECOMP_1.0
(15) DECOMP_1.1
(16) LIBRARY

Default users dirs:

(17) Alessio
(18) Alfio
(19) Basic
(20) Locatel
(21) Xavier
(22) Fabrizio

Other optional choices are:

(23) User defined

please make your choice: █
```

using MATLAB ... as a programming language

- » A powerful editor (even for GUI developing)
- » Debugging tools
- » Profiling tools
- » Tests
- » A large community of developers (also important events such as: MATLAB expo, Advisory Board)
- » Easy to learn
- » *Mathworks* customer care
- » Training opportunities

→ We need a programming language to develop a challenging project as GUI factotum ←

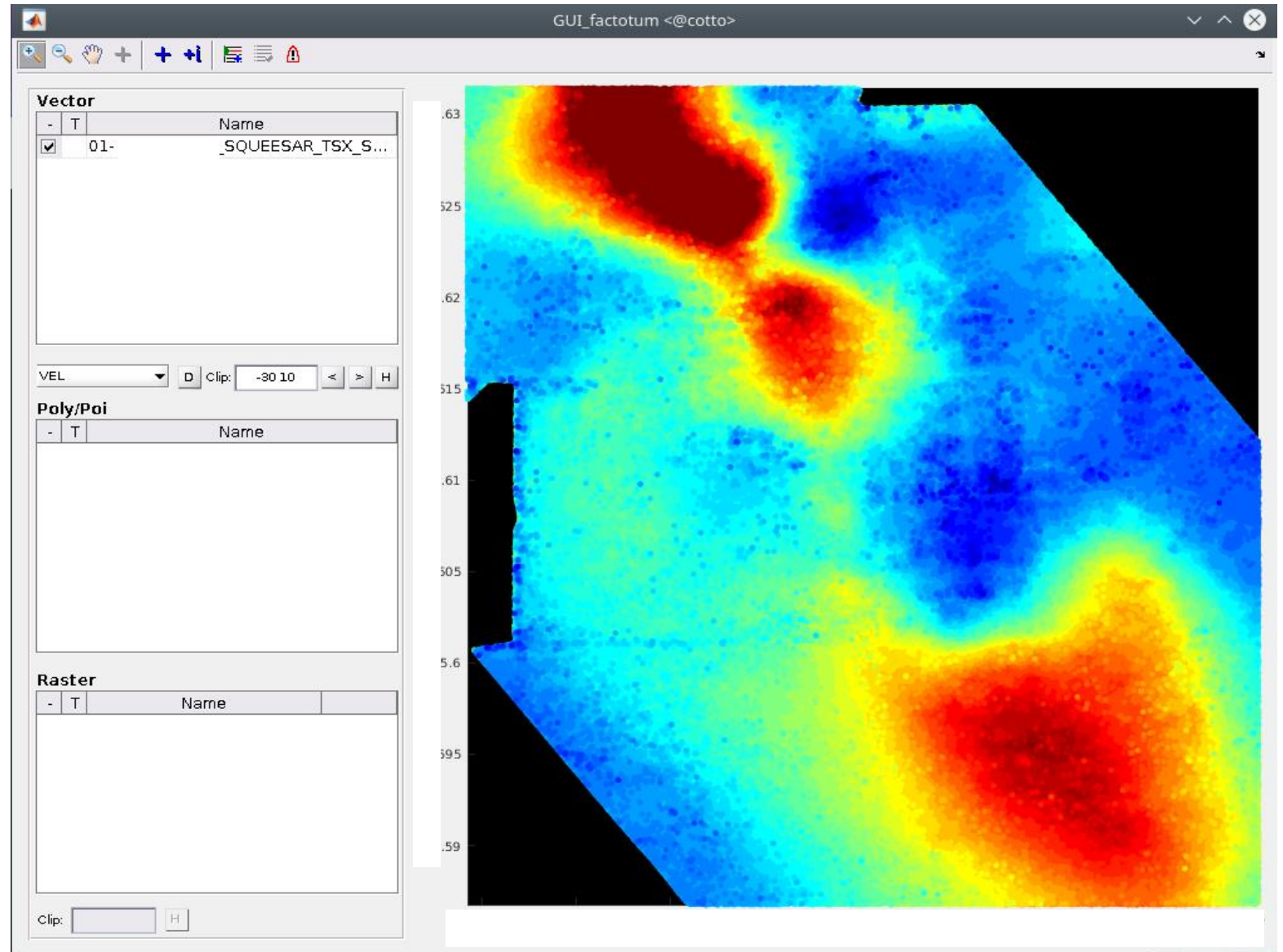


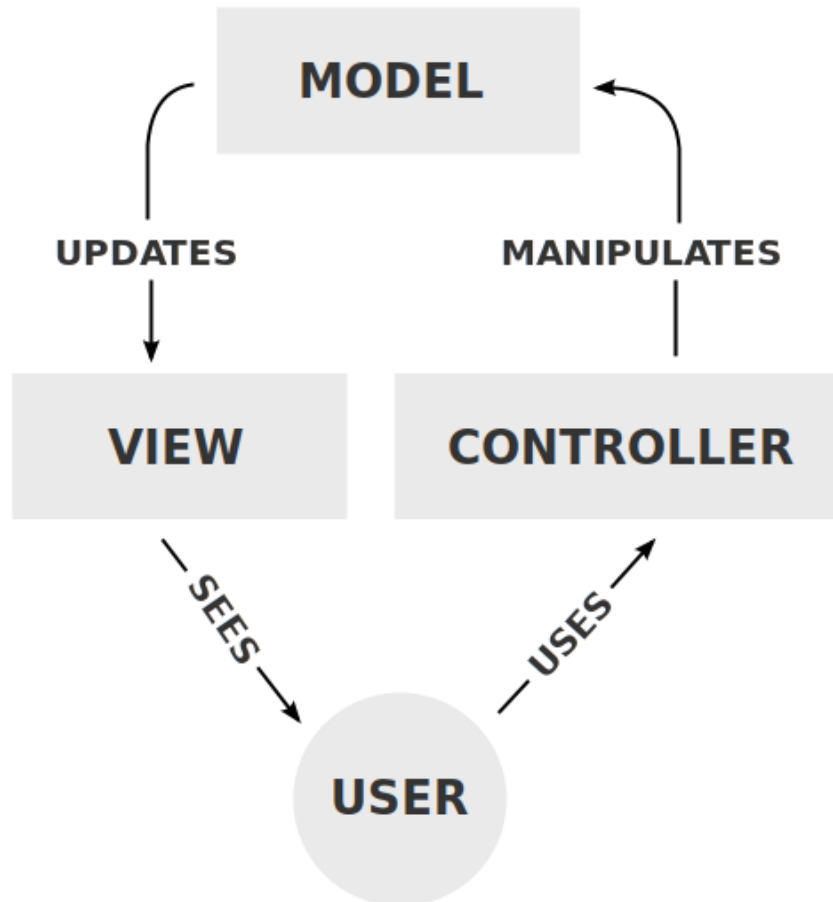
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GUI FACTOTUM

- » From scripting to a professional user interface
- » Users will not need to learn MATLAB scripting/developing
- » Users are more focused on the quality of the products
- » The need to see/inspect results during the processing
- » Product creation is guided and for sure:
 - more standardized
 - actions are register/logged

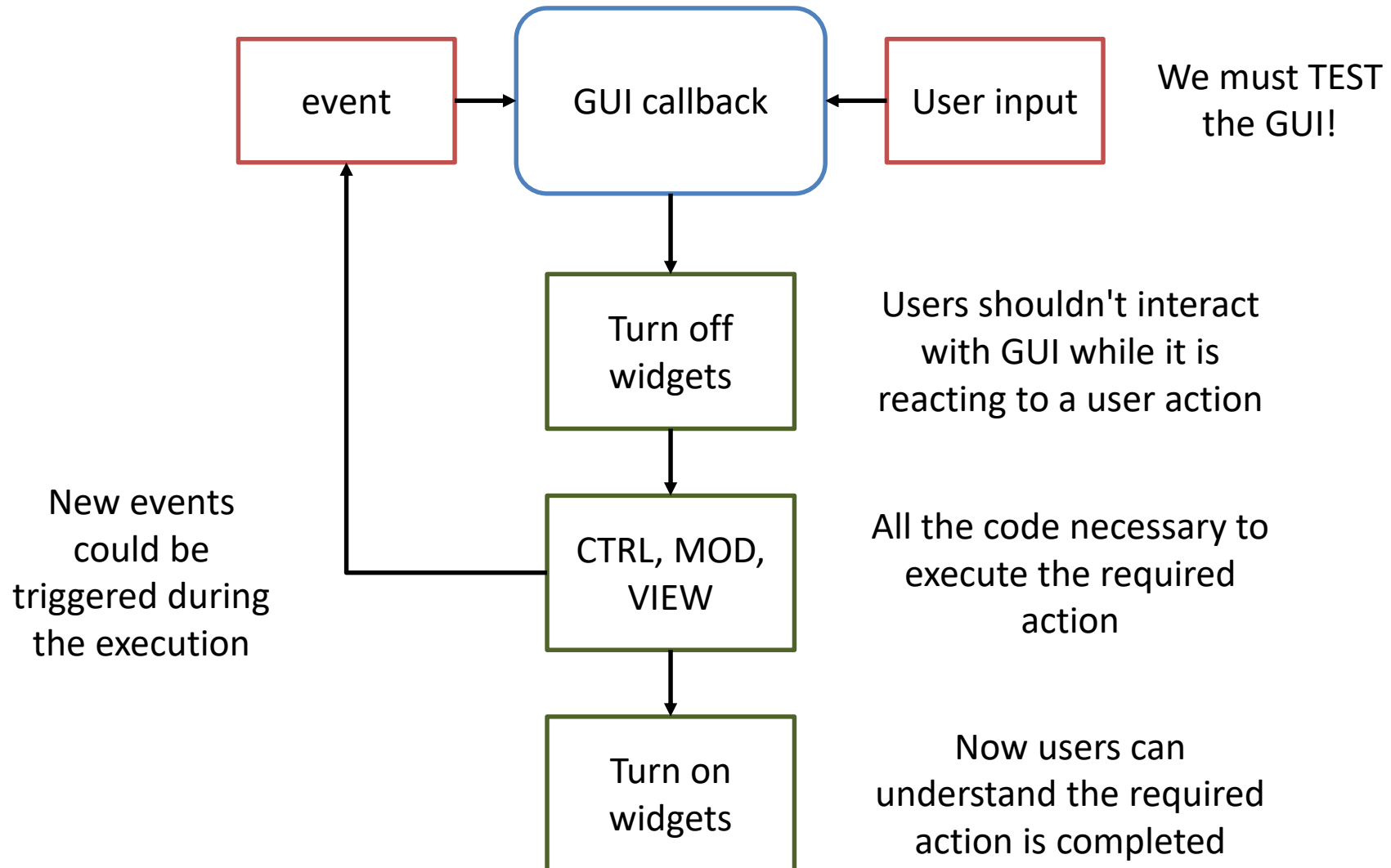
Millions of points must be displayed and processed. The GUI must be optimized to guarantee good performances.





- » Code must reflect this model
- » Function naming follows a rigid schema
- » No direct access to MODEL data (GET/SET)
- » Unit and integrity tests
- » Code must be re-used easily

By RegisFrey - Own work, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=10298177>



treai1@treailog5: ~

File Edit Tabs Help

treai1@treai... x treai1@treai... x treai1@treai... x treai1@treai... x

```
>> handlesFactotum=benchmark_GUIfactotum(f_benchmark_xml);
```

```
{
```

- » MATLAB is the “tool” of the production team
- » MATLAB is a “programming language”
- » It is mandatory to set tools/procedures for development and deployment
- » Work always in team

Conclusions and Next steps

Next steps are usually driven by important events such as MATLAB expo or MAB

- » Move to the cloud (AWS EC2 and S3)
- » Use MATLAB Coder to improve performances
- » Move to MATLAB OOP ?
- » Move to App Designer and/or Live Editor?
- » Use MATLAB Compiler?



MILANO

Ripa di Porta Ticinese, 79
20143 Milan - Italy
Tel: +39 02 4343 121

BARCELONA

C/ Corsega, 381-387
E-08037 Barcelona - Spain
Tel.: +34 93 183 57 50

VANCOUVER

Suite #410 475 W. Georgia Street
Vancouver, BC V6B 4M9 - Canada
Tel: +1 604 331 2512



sales@tre-altamira.com

Regional offices

FRANCE

Parc Technologique du Canal
11, Rue Hermès
F-31520 Ramonville St Agne
Tel.: +33 561 39 47 19

CHILE

Almirante Señoret 70, Oficina 74
Valparaíso
Tel:+56 32 225 2843

AUSTRALIA

Suite 207 – 122 Toorak Road | South Yarra
Melbourne
Tel: +61 455 154552