

## An astronomy virtual research community based on the STARnet Gateway Federation

### *Pilot Project*

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## **SCI-BUS** (<http://www.sci-bus.eu/>)

- VisIVO Portlet Liferay+Workflows
- VisIVO iPhone

## **ER-FLOW** (<http://www.erflow.eu/>)

- Building a European Research Community through Interoperable Workflows and Data

## **EGI-Inspire** (<http://www.egi.eu/projects/egi-inspire/> )

- Application porting on the grid
- HPC on the grid

**The STARnet project/design was started in April 2013**

# STARnet Federation

- Scientific Community support → New Science Gateways

- INAF (**3 stars**)

Astrophysical Obs. of Catania – **VisIVO**



Astronomical Obs. of Trieste – **Plank Mission**



Astronomical Obs. of Teramo – **Franec/Basti**



- University of Portsmouth (UoP) (**1 stars**)



- **Cosmological Support (ICG)**

- Slovak Academy of Sciences (**1 stars**)

- **Interstellar Comets**



# STARnet Federation

## Points to be fixed

### - **Technology.**

- Liferay/WS-PGRADE, gUse
- Local clusters, DCIs and Clouds

### - **Maintenance.**

- FrontEnd/BackEnd Virtual Machine
- Master Virtual Machine with Local Customization included (configuration file Enab/Disab. Portlets and services)
- Master maintenance/update → INAF (OACT)
- Some problem need to be solved to maintain the same versions depending on local version of OS, Database, SW licenses, etc...

### - **Shared and centralized services**

- Single Sign On (SSO based on LDAP)
- Workflows and Portlets sharing (SHIWA, SCI-BUS repositories)
- Cloud Data

# STARnet Federation

## Points to be fixed

### - Local user data

- Data will be preserved: each Virtual Machine mounts external DB exported by the physical machine (e.g. /mnt/STARnet)

### - Local and shared applications

- Each star define a set of applications that are common and can be shared across all stars.
- Each star defines a set of applications that are specific. Normally these components *characterize* the specific SG.
- Specific applications could require resources that are available only for the SG (i.e. specific DCIs, clusters, licenses, etc.).

### - Local and shared computational resources

- DCIs are connected to each SG. Depending on specific agreements with local authorities DCIs and computational cluster will be shared between stars.

# STARnet Federation Management

## - **Management Board (a responsible for each site)**

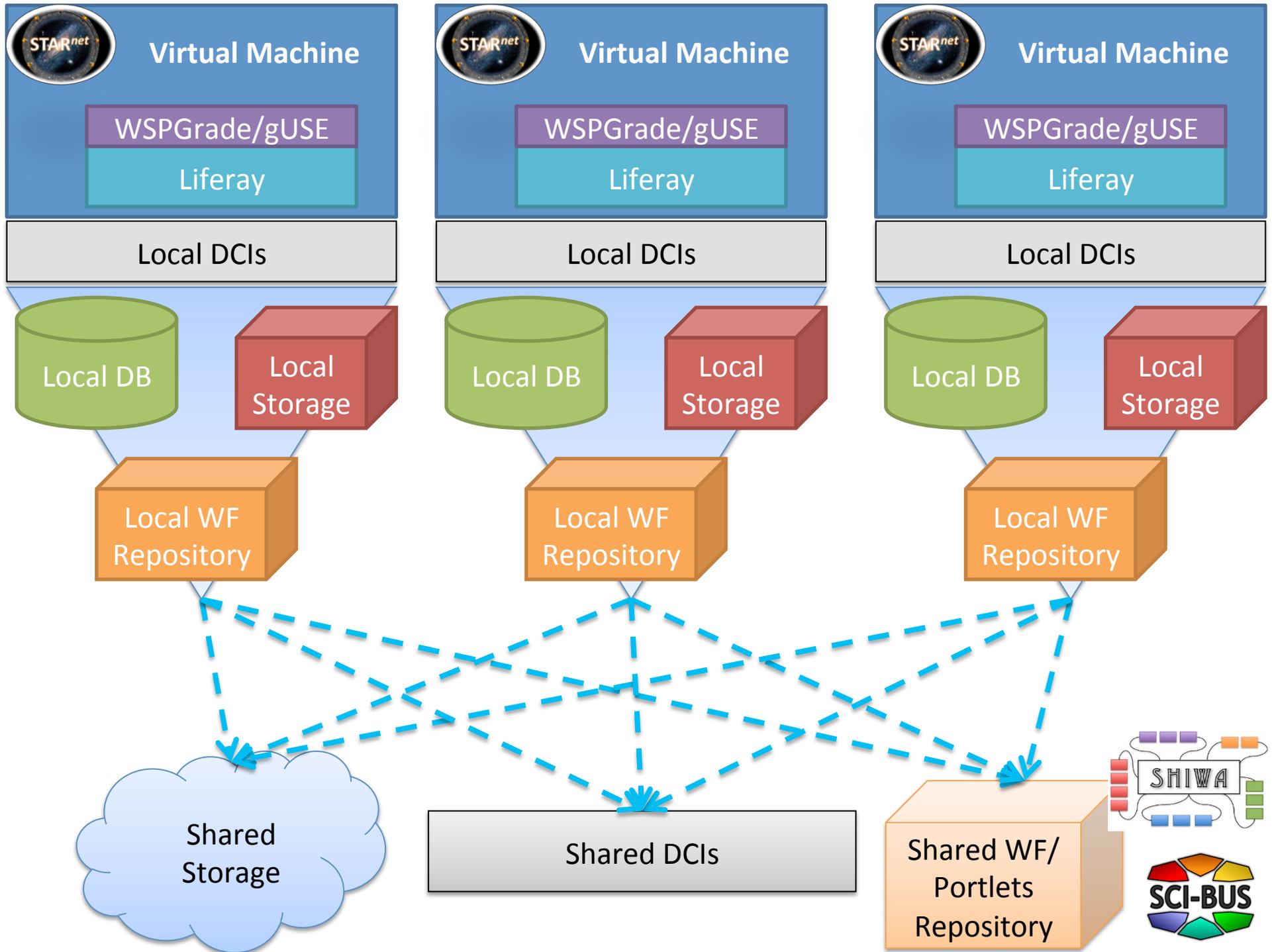
- Define the Federation policy
- Define the local choice (Hw and Sw)
- Define the upgrade policy and new communities support policy

## - **Community Manager.**

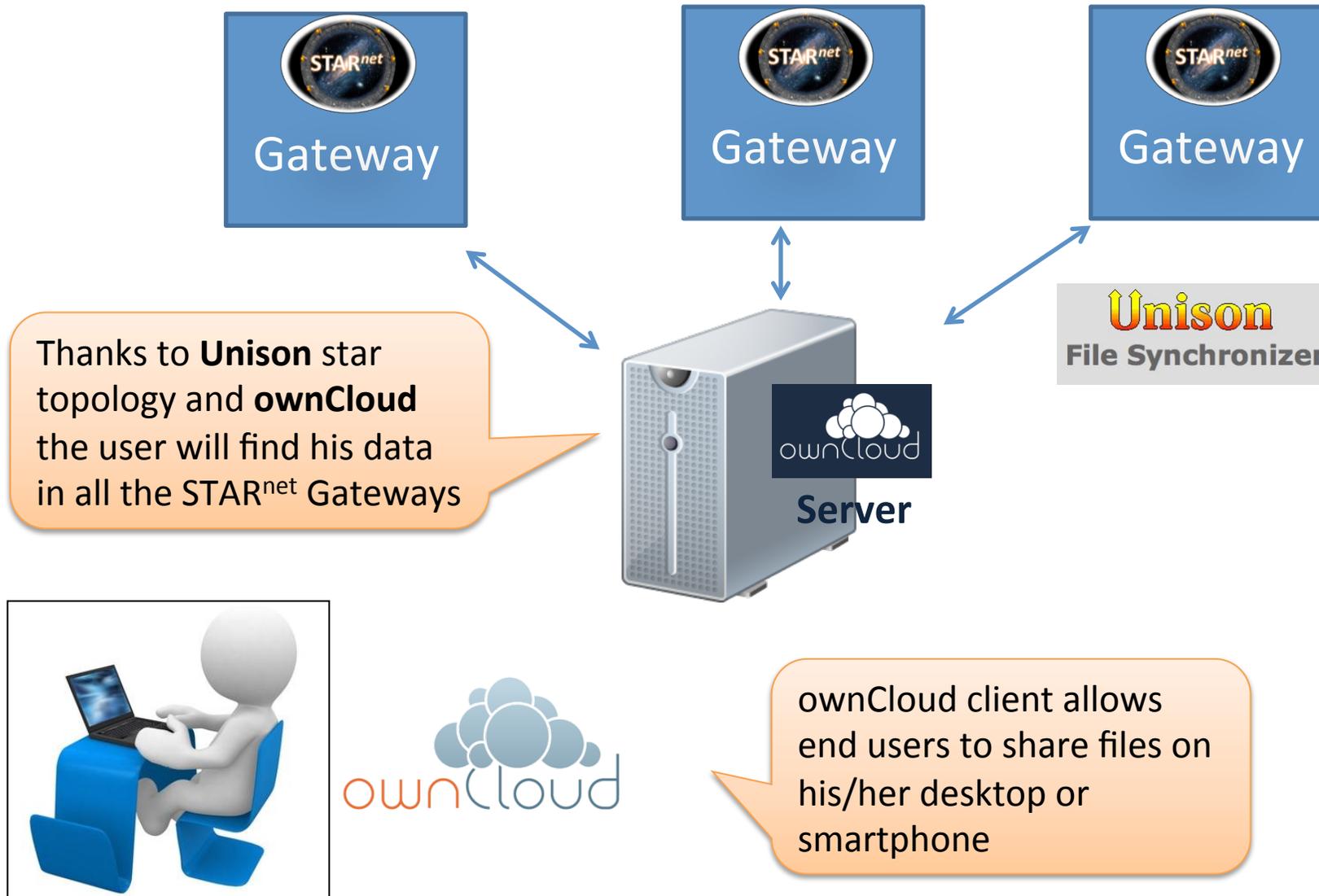
- Developer: Workflows and Portlets
- Validation of User Created Workflows and Portlets
- Workflow upload on SHIWA Repository
- Community user support (mailing list, user forum, discussion list etc.)

## - **Site Manager (centralized).**

- Update common Workflows and Portlets
- Shared WF deployment on DCIs
- Community user support for SGs



# Shared Storage



Thanks to **Unison** star topology and **ownCloud** the user will find his data in all the STAR<sup>net</sup> Gateways

ownCloud client allows end users to share files on his/her desktop or smartphone

**STARnet Production Period 2014-2016 → 3 years**

→ **STARnet Meeting in October in Sicily**

→ **New *stars* are welcome (but limited number)**

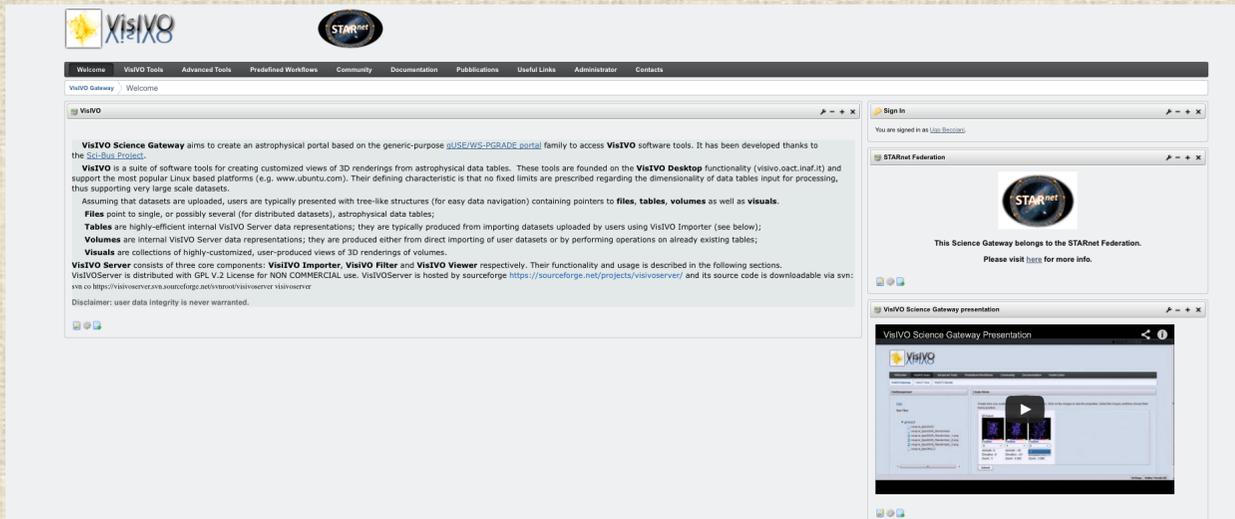
**REQUEST → Specific support from Projects and/or Institutions**

SG design is limited by the STARnet policy → Few SGs (“*stars*”) can be added

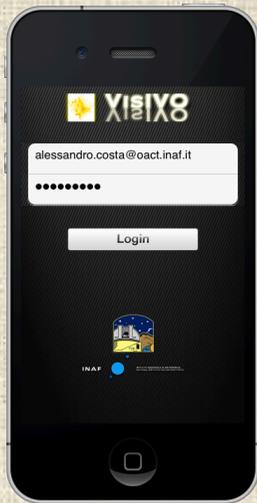
Pros and Cons

**Central Service and Maintenance:** Upgrades, Problem Solving, New Features impl.,

# STARnet Federation INAF OACT SG: VisIVO

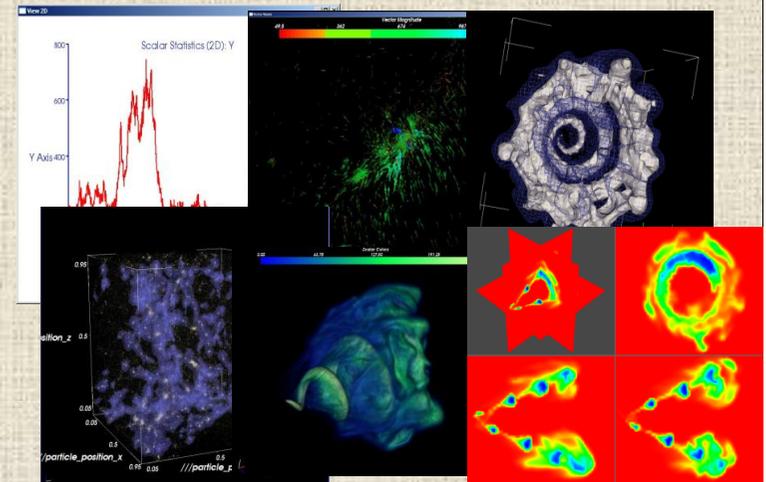


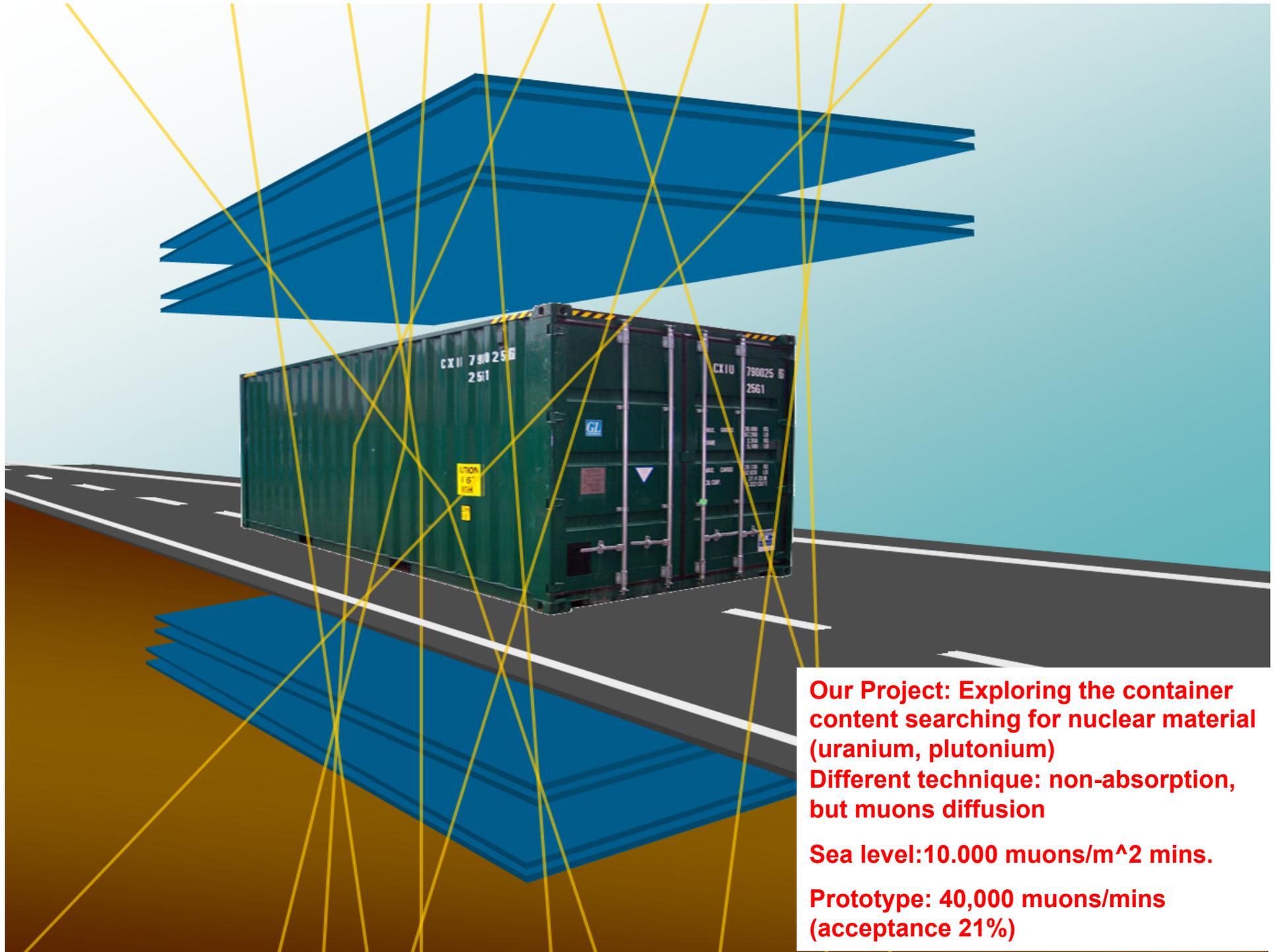
**VisIVO: 3D tool for  
data exploration  
and visualization**



**VisIVOMobile iOS application  
allows user to log in into  
VisIVO Gateway to:**

- Manage his data
- View/create image/movie
- Execute predefined WFs  
and will create new WFs

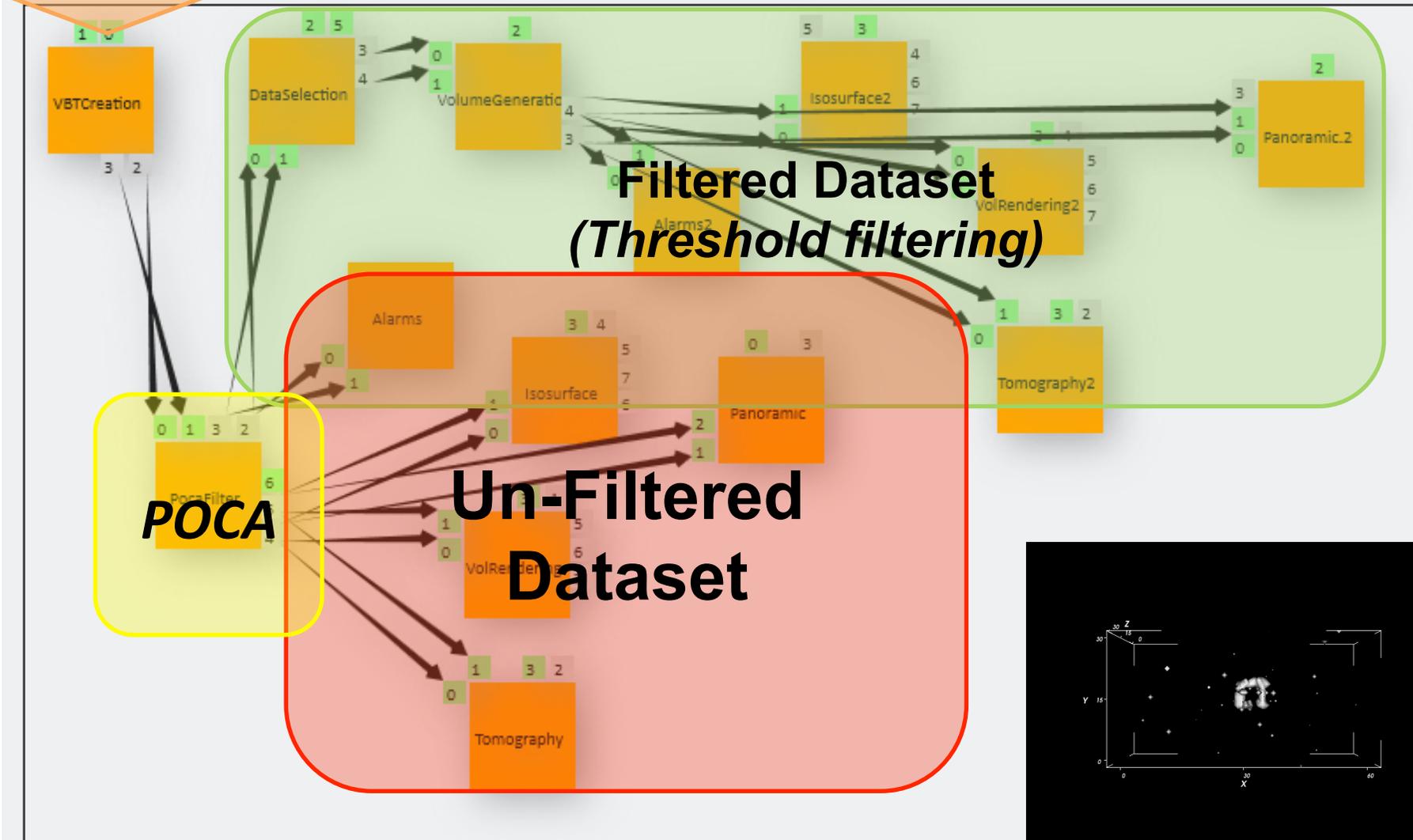




**Our Project: Exploring the container content searching for nuclear material (uranium, plutonium)  
Different technique: non-absorption, but muons diffusion  
Sea level: 10.000 muons/m<sup>2</sup> mins.  
Prototype: 40,000 muons/mins (acceptance 21%)**

# INAF OACT SG: Muon Portal Community

Input  
Dataset



# STARnet Federation

## INAF OATS SG: Planck



The screenshot shows the OATS Science Gateway website. At the top left is the OATS logo and the text "OATS Science Gateway". To its right is the STARnet logo. A navigation bar contains links for "Welcome", "Documentation", "Publications", "Useful Links", and "Contacts". Below this is a breadcrumb trail "STARnet > Welcome". The main content area is divided into three columns. The left column, titled "Planck", contains text describing the satellite and its simulations, along with a disclaimer. The middle column, titled "STARnet Federation", features the STARnet logo and a message stating "This Science Gateway belongs to the STARnet Federation. Please visit [here](#) for more info." The right column, titled "Sign In", includes a login form with fields for "Email Address" (containing "@liferay.com") and "Password", a "Remember Me" checkbox, and a "Sign In" button. Below the form are links for "OpenID", "Create Account", and "Forgot Password". A "Sign In" link is also present in the top right corner of the page.

**Planck**

**Planck** is the ESA satellite aimed at mapping the microwave sky through two complete sky surveys. It was an extremely demanding space mission in terms of computing power and data storage. **Planck simulations** mimic the whole mission starting from a virtual sky (ideal or contaminated by introducing several noise sources). Their main goal is the validation of the acquisition and reduction procedure.

The DCI technology is a promising answer to data storage and processing needs of the satellite. In the framework of the EGEE grid infrastructure, a number of experiments aimed at designing and defining an application specific environment for the simulation software and data sharing were run. Successful experiments demonstrate that the "gridification" of Planck pipelines is not only possible but even extremely convenient in terms of data processing speed and data sharing.

Disclaimer: user data integrity is never warranted.

**STARnet Federation**

This Science Gateway belongs to the STARnet Federation.  
Please visit [here](#) for more info.

**Sign In**

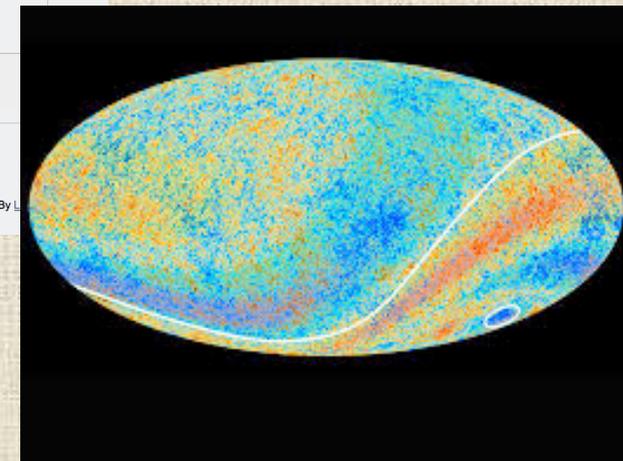
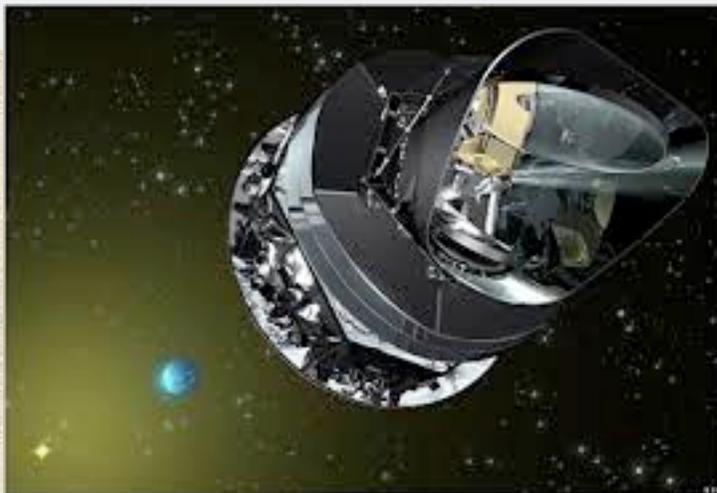
Email Address  
@liferay.com

Password

Remember Me

Sign In

[OpenID](#) [Create Account](#)  
[Forgot Password](#)



Powered By L

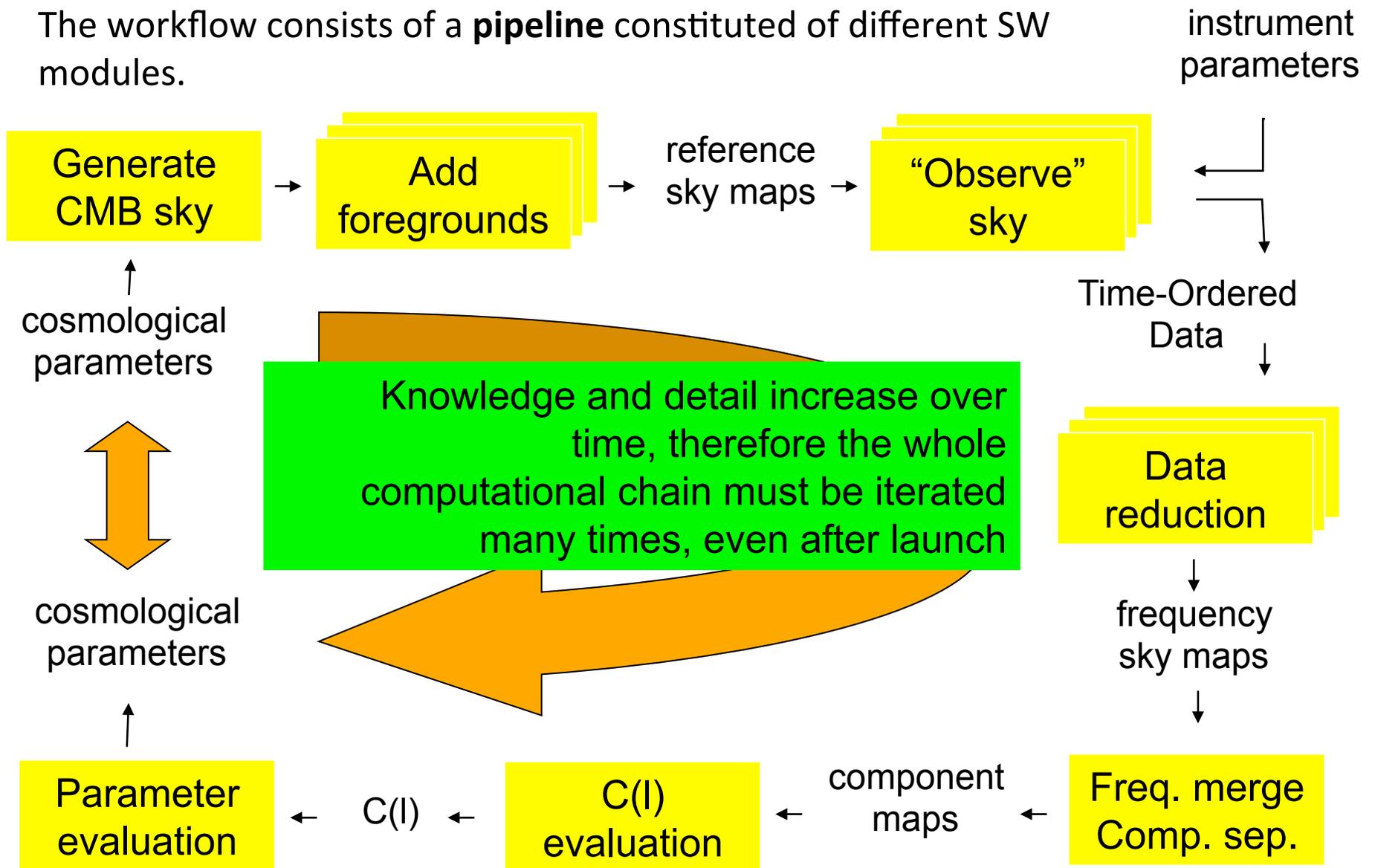
# INAF OATs SG: Simulations of the Planck mission

**A simulation starts from a set of values for cosmological parameters and builds an ideal sky.**

**The whole mission is then simulated on this sky and the final results (cosmological maps) are compared with the observed sky to evaluate the goodness of the pipelines that will be used on actual observed data**

# Simulations of the Planck mission (I)

The workflow consists of a **pipeline** constituted of different SW modules.



# STARnet Federation

## INAF OATe SG: Stellar Community -Franec

**FRANEC** is a state-of-art, numerical code for stellar astrophysics, *This code is perfectly suited for computing the evolution of a star* on the basis of a number of different physical inputs and parameters. Parameters are listed in one input file. *A single run of FRANEC produces one synthetic model (SM)*. To produce an isochrone, for a given chemical composition, through a FIR (Full Isochrone Run), it is necessary to execute **a large number of SMRs (SM runs)** varying the initial mass of the stellar models. Once these evolutionary tracks and **isochrones** (as well as additional data describing the simulated stellar structures) **are computed**, they can be distributed in datasets over different sites.

The simulations of stellar models produce simulation output files with a set of associated metadata. Such metadata are linked to all parameters concerning the numerical evolutionary code. In this way it is possible to store and easily search and retrieve the obtained data by many set of stellar simulations, and also get access to a huge amount of homogeneous data such as tracks and isochrones computed by using FRANEC.

All stellar model simulations and their characterizing parameters, the produced output files and their metadata and the relationships (links) between them are stored and maintained in BaSTI. **BaSTI** allows in this way to **archive and publish the data of many stellar evolution simulations**; it also offers to the scientific community the possibility of reusing a large number of stellar model computations.

# STARnet Federation

## INAF OATe SG: Stellar Community -Franec

EOS:

- 0) Metallicity
- 1) Mixture type
- 2) Status Equation Table

Opacity:

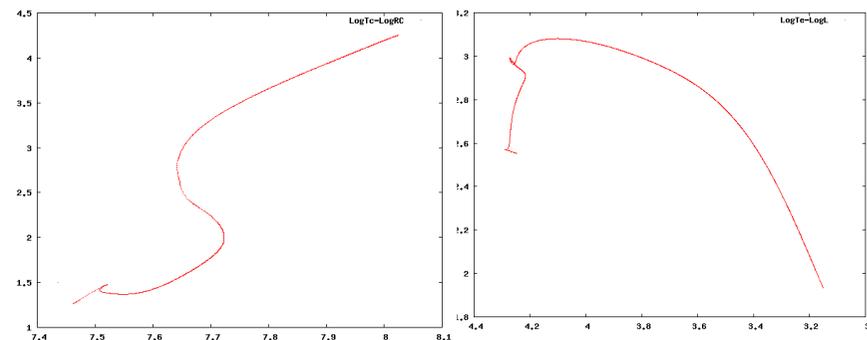
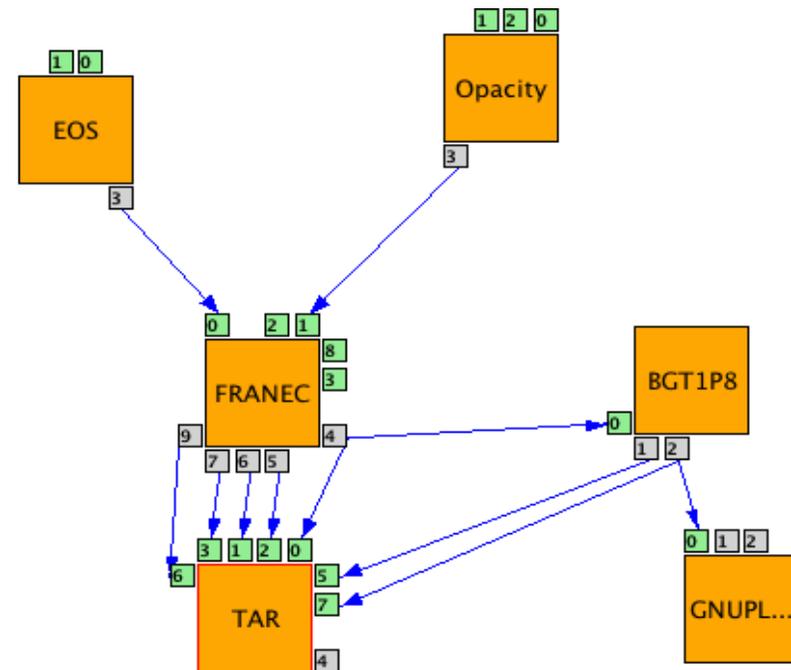
- 0) Metallicity
- 1) Mixture type
- 2) set of per-computed opacity tables
- 3) Final interpolated opacity table

Franec:

2) Network (scaled Solar or Alpha Enhanced)

3,8) User parameters for the evolution

Output: stellar evolutionary model



# STARnet Federation

## UoP SG: IC Community *LaSMoG*

To understand the acceleration of the universe a new component is introduced, called dark energy, in the framework of General Relativity (GR). Alternatively, *one can modify GR itself on cosmological scales to realise the acceleration without introducing dark energy.* If GR gets modified, *the structure formation will be very different from that in GR, although the expansion history remains the same as in an LCDM universe (i.e. the universe made up of about 70% dark energy and 30% matter).*

**Observing the large scale structure of the universe could in principle provide a new test of *General Relativity* on cosmic scales.**

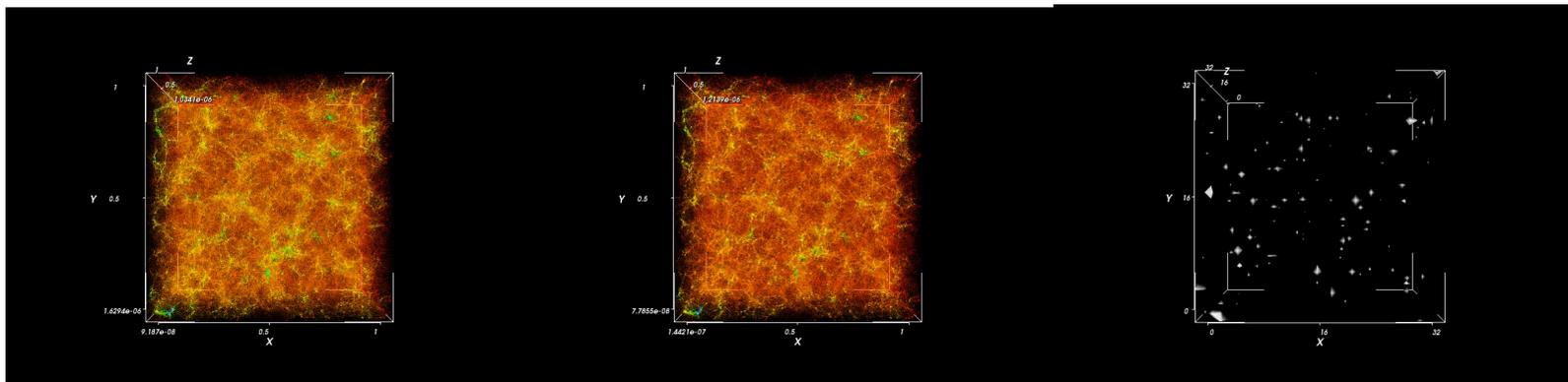
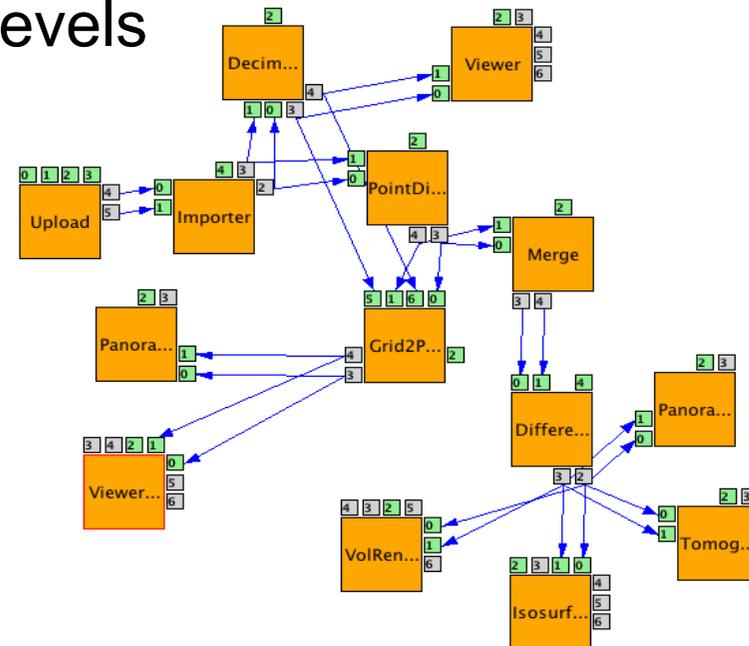
This kind of test cannot be done without the help of simulations as the structure formation process is highly nonlinear. **Large-scale simulations are thus required for modified gravity models, and these are performed on the SCIAMA supercomputer** (<http://www.sciama.icg.port.ac.uk/>). The scientists need customised visualisations for analysis of these simulations, more specifically for inspecting datasets **to discover anomalies by comparing appropriately with datasets coming from standard gravity models.**

# STARnet Federation

## UoP SG: IC Community *LaSMoG*

Comparison between Std and Modified Model in a LSS simulations with different resolution levels

1. Points 1 Std Upload
2. Points 2 Mod Upload
3. Volumes 1 and 2 creation
4. Subtract  $V1 - V2$
5. Difference Statistics
6. Isosurface Visual
7. Change Parameters Models
8. New Simulations



# STARnet Federation

## UoP SG: IC Community *SNFitting*

***Surveys of cosmologically distant Type Ia supernovae*** (SN) indicates the presence of “*dark energy*”, that opposes the self-attraction of matter and *causes the expansion of the Universe to accelerate*

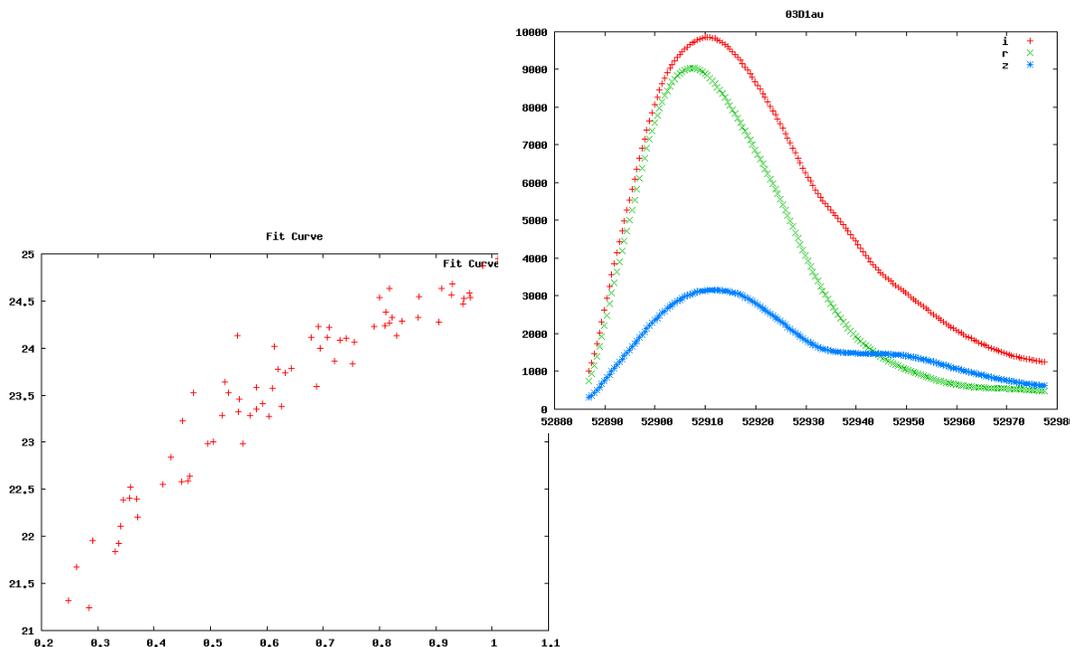
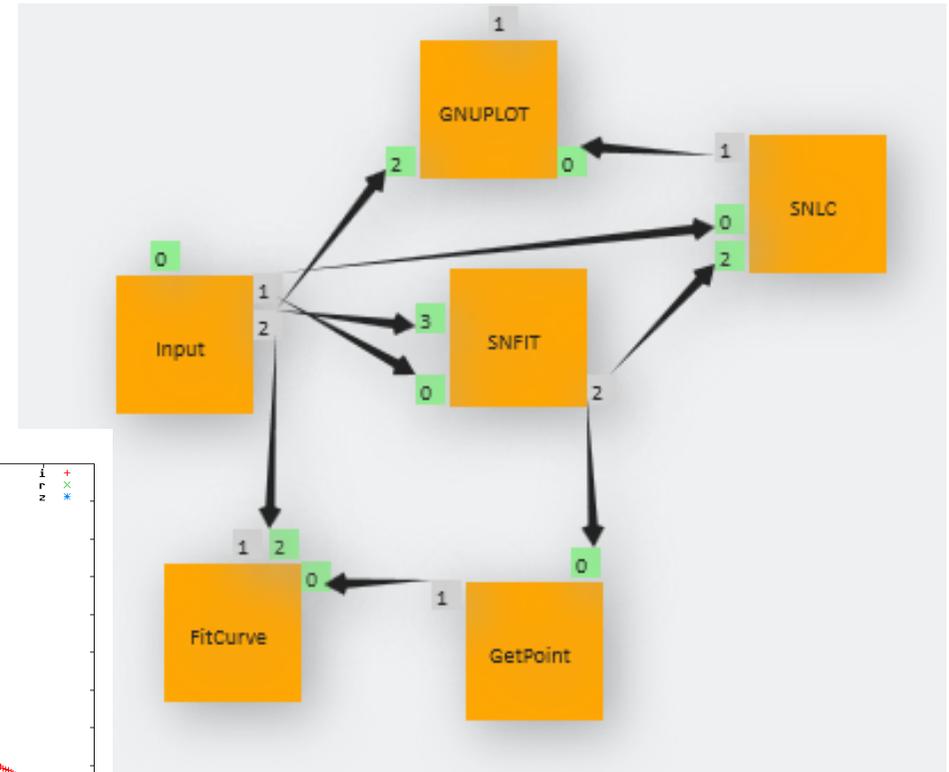
**The application generates customised plots, so that users can visually discover any anomaly quickly:**

- *Observed light-curves points* for each of the SNs in gM, rM, iM and zM bands, along with the multi-color lightcurve model. *Those curves are obtained using the SALT light-curve model.*
- Cosmological fits curve obtained from the fits to the light-curves, representing a rest-frame-B magnitude, which, for perfect standard candles, should vary with redshift according to the luminosity distance.

# STARnet Federation

## UoP SG: IC Community *SNFitting*

**input data format:** an archive containing SNs data  
**output data format:** 2D plot images to discover anomalies.



# STARnet Federation

## SAS SG: Interstellar Comets Community *COMCAPT*

The trajectories of ***interstellar comets*** passing the Solar System are gravitationally influenced by the ***Galactic tide***. A combination of this influence and gravity of the Sun can change the trajectories in the way that the comets become bound to the Solar System, i.e. they become a part of the comet Oort cloud. For the current position of the Sun in the Galaxy and considering its relatively high peculiar velocity, the intervals of the comet orbital phase space, where the “capture” happens, occur to be extremely narrow. In addition, a preliminary analysis of the problem revealed that the problem is non-linear. So, the appropriate “capture window” can appear for an unexpected combination of comet orbital parameters (one cannot simply look for a mathematical local minimum).

**The application calculates the critical parameters of the capture for a huge number of interstellar-comet trajectories** (of order of magnitude equal to  $10^{16}$ ) and evaluates if the condition of the capture is satisfied for the given combination of 4-D orbital characteristics or not. The application is expected to be re-run for various combinations of two input values: distance of the Sun from the Galactic center and magnitude of the peculiar velocity of the Sun.

# STARnet Federation

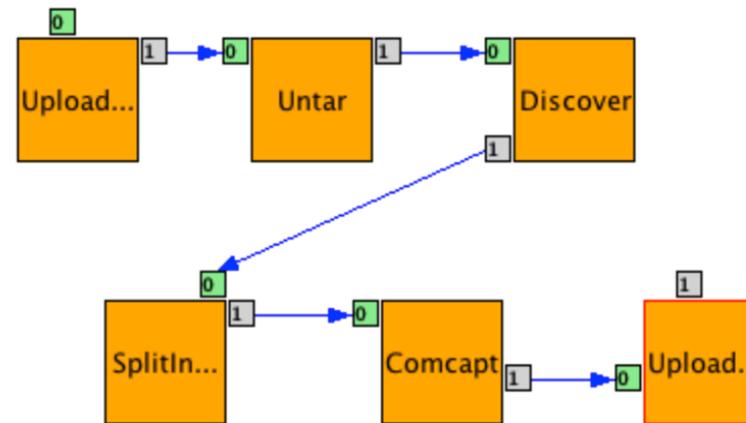
## SAS SG: Interstellar Comets Community *MESTREAM*

The aim of planned simulation is the *study of meteor showers* situated in the orbital phase space of the orbit of asteroid 2003 EH1.

**DCI:** Grid

**INPUT.** The numerical integration of orbits of bodies in the system (Sun, 8 planets and 10,000 massless test particles) is performed using the standard MERCURY software package (3 static executables). Moreover, the input for a given task includes 3 ASCII data files with the basic parameters of integration, masses, initial position and velocity vectors of planets, and initial positions and velocity vectors of the part of test particles which is integrated by the given task.

**OUTPUT.** The position and velocity vectors of planets and given part of the test particles are recorded for chosen output times in the single binary file



VO VOCE. Central Europe EGEE Grid.

Each run can last several days



Alessandro Costa



Ugo Becciani



Piero Massimino



Mel Krokos



Costantino Pistagna



Fabio Vitello



Simone Riggi



Eva  
Sciacca

Marilena Bandieramonte