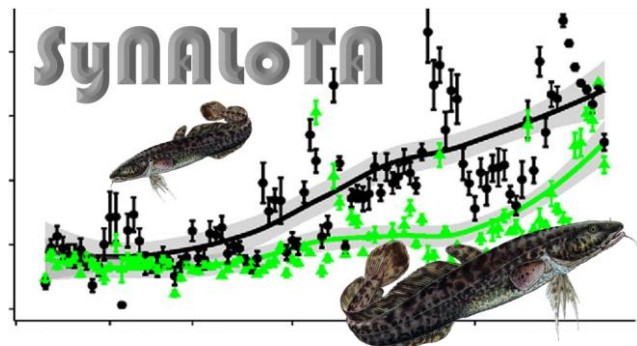




## Systems from NAPles for Long Term Analysis



# Prototype & Design proposals

*G. Riccio, S. Cavuoti, M. Brescia*

*Workshop Laboratorio Spettroscopia INAF, Rome, June 11 2019*


# Design & Prototype



The SyNALoTA web app is designed for Euclid Instrument Operations monitoring.

The work in progress prototype is accessible here:

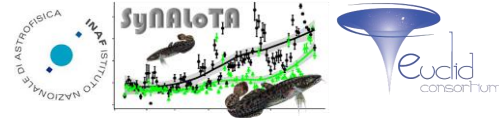
<http://dame2.na.astro.it/euclidiot/>

 **So What?** 

**SyNALoTA**

IOT monitoring, analysis & visualization web app  
fully accessible through network connection  
(via PC, laptop, tablet, smartphone...)

# Main Functionalities



The web app for IOT Monitoring has three main use cases:

## ★ IOT monitoring report generation and delivery

- periodic report generation on a pre-defined parameter list and delivery of the link to EAS;
- on demand customised report generation on a user selected parameter list, locally stored;

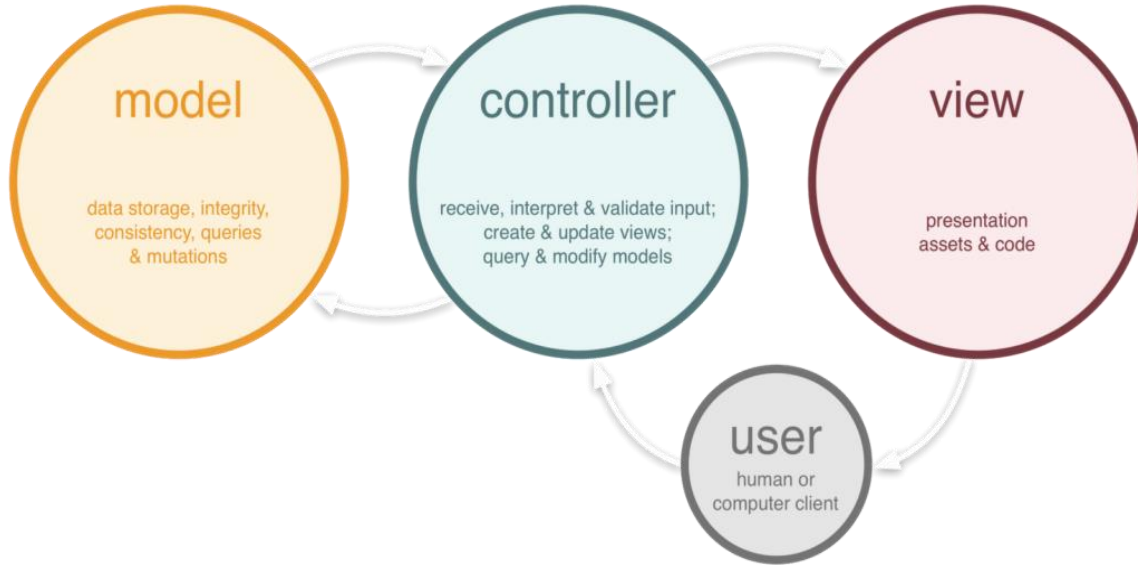
## ★ Visualization/Exploration

- series of plots on user selected parameters/data products and ranges
  - dynamic histograms, scatter plots, trend plots
- observed images (static view and dynamic windowing)

## ★ Statistics

- base (default) estimators (automatically produced with the plots)
  - mean, median, RMS,  $\sigma$ , variance, min-max, MAD, NMAD, kurtosis, skewness, ...
- special estimations (tables/images)
  - mode, percentiles, map counting, thresholding maps, biweight,  $\sigma$ -clipping, ...

# Internal Architecture



The web app internal architecture is based on the MVC design pattern

(modular and easy to maintain/update)

## ★ Client-side technologies

- HTML5 & CSS3
- Javascript & JQuery

## ★ Server-side technologies

- PHP 7
- Python 3.6

## ★ Client-Server Com

- Ajax
- JSON

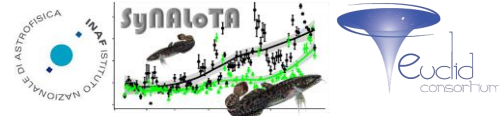
## ★ Local DBMS

- MySQL

## ★ Special Libraries

- Plotly.js
- JS9

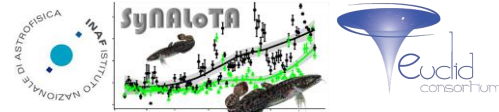
# GUI Structure



The web app for IOT Monitoring is basically composed by:

- **An Intro page**
  - brief description of the web app
  - help and contact information
  - user access (login/password) with two user levels (admin/user)
- **Main page (multi-tab structure)**
  - functionality menu options
  - new data loading (from EAS) and locally storing
  - local (on IOT server) data handling (navigation, selection, removing)
  - plot setup and visualization (histograms, scatter plots, trend plots)
  - image view, pixel/region analysis and dynamic windowing
  - statistics setup, calculation, visualization and locally storing
  - history logging (permanent full and runtime user's history)

# Operation Interface - Intro Page

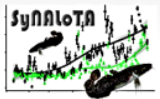


The Intro page is mainly the access point to land on the web app.

We foresee two user levels, i.e. normal user and administrator:

“who has an administration account acquires the full control of the system functionalities available through the web app”

Once logged in, the user name will appear on the top right corner of the main page and a history logging window will appear and scrolled in the bottom right corner of the page (under the menu left tab)



## SyNaLoTA

*Systems from Naples for Long Term Analysis*



## What is SyNaLoTA?

SyNaLoTA is a IOT monitoring, analysis & visualization web app fully accessible through network connection

## Main Functionalities

- **IOT monitoring report generation and delivery**
  - periodic report generation on a pre-defined parameter list and delivery of the link to EAS;
  - on demand customised report generation on a user selected parameter list, locally stored;
- **Visualization**
  - series of plots on user selected parameters/data products and ranges
    - dynamic histograms, scatter plots, trend plots
  - observed images (static view and dynamic windowing)
- **Statistics**
  - base (default) estimators (automatically produced with the plots)
    - mean, median, RMS,  $\sigma$ , variance, min-max, MAD, NMAD, kurtosis, skewness, ...
  - special estimations (tables/images)
    - mode, percentiles, map counting, thresholding maps, biweight,  $\alpha$ -clipping, ...

# Operation Interface

# Intro Page

### Useful Links

- ESA/Euclid Project
- Euclid Mission
- ESA
- ASI
- Euclid Redmine

SyNaLoTA is an ESA/Euclid project for IOT monitoring, analysis & visualization



### Credits & Contacts

For Infos and technical support:

- G. Riccio - giuseppe.riccio@inaf.it
- M. Brescia - massimo.brescia@inaf.it
- S. Cavuoti - stefano.cavuoti@gmail.com

Name

E-mail Address

Role

Password

Password Confirmation

[Sign Up](#)

# Operation Interface

## New User Signup

After signing up, the system will automatically send an e-mail confirmation, but the account enabling will be done by the appointed DB administrator.



# Operation Interface - Main page



Once logged in, user lands on the main page.

The screenshot displays the SyNaLoTA dashboard interface. The header includes the SyNaLoTA logo and the text 'Systems from Naples for Long Term Analysis'. The user is logged in as 'testTest', with a last access time of '2019-05-30 10:24:38'. The main content area is divided into several sections: 'Data' (User and Stored), 'History' (User and Global), and 'Reports' (Available Reports and Configuration Files). A dark blue sidebar on the left contains a 'Main menu' with categories like Data, HKSTM, Science, Images, and Reports. Callouts point to the 'User & Stored Filesystem', 'Header with user info', 'Main menu', 'Reports & Configuration Files List', and 'User & Global History'.

**Header with user info**

**User & Stored Filesystem**

**Main menu**

**Reports & Configuration Files List**

**User & Global History**

**Data**

Welcome to SyNaLoTA Dashboard, testTest!

**User**

- testTest
  - EUC\_SIM\_NIP-CR-FLAT-H-1-028-5\_0AC...
  - EUC\_SIM\_NIP-DARK-3\_0AC162DABE1E-1...

**Stored**

- stored
  - snr.png
  - stored1.fits
  - stored2.fits
  - stored3.fits

**History**

**User**

- 2019-05-29 T12:40:09 - Statistics
- 2019-05-29 T12:29:55 - Histogram
- 2019-05-29 T12:28:34 - Trend analysis
- 2019-05-28 T18:11:26 - Upload on-demand config file
- 2019-05-28 T17:19:51 - Upload on-demand config file
- 2019-05-22 T13:50:31 - logout
- 2019-05-22 T13:45:47 - login
- 2019-05-22 T13:45:47 - login

**Global**

- 2019-05-29 T12:40:09 - testTest : Statistics
- 2019-05-29 T12:29:55 - testTest : Histogram
- 2019-05-29 T12:28:34 - testTest : Trend analysis
- 2019-05-28 T18:11:26 - testTest : Upload on-demand config file
- 2019-05-28 T17:19:51 - testTest : Upload on-demand config file
- 2019-05-22 T13:50:31 - testTest : logout
- 2019-05-22 T13:45:47 - testTest : login
- 2019-05-22 T13:45:47 - testTest : login

**Reports**

**Available Reports**

- report
  - lot-report-234-monthly-2019-01-01...
  - lot-report-210-weekly-2019-01-01\_...
  - lot-report-111-ondemand-2019-05-1...

**Configuration Files**

- config
  - config\_template.json
  - dummy\_config.json
  - dummy\_config2.json
  - config\_ondemand\_dummy.json
  - NEW\_ondemand\_dummy.json

**Image Explorer**

- Image Explorer

**List Reports**

- List Reports
- Manage Periodic Reports
- Generate On-Demand Report
- List Configuration Files

# Operation interface - Menu options



There is a menu including all main foreseen operations. Depending on the selected action, the effect could be shown in the main tab (and its sub-tabs) or in a new browser tab:

general data handling

→ **Home**

→ **Dashboard**

→ **Data**

- ◆ Load new data
- ◆ View local data

→ **HKSTM**

- ◆ New plot
- ◆ Statistics

→ **Science**

- ◆ New plot
- ◆ Statistics

HKSTM data handling

Scientific data (mostly L1) handling

→ **Images**

- ◆ Image Explorer

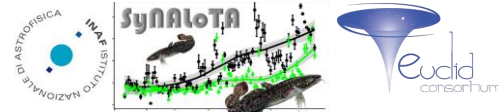
→ **Reports**

- ◆ List Reports
- ◆ Manage Periodic Reports
- ◆ Generate On-Demand Report
- ◆ List Configuration Files

Image data handling

IOT reports (automatic/on-demand) handling

# Operation interface - Menu **DATA** (1/3)



The menu option Data is dedicated to the local (IOT server) data navigation, with the possibility to download user-selected new data through EAS direct interface.

## → **Data**

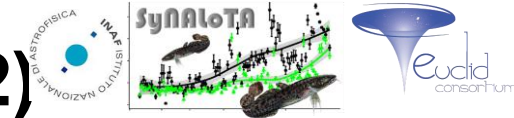
### ◆ Load new data

Through a form tab, user can specify date range and type to be downloaded from the EAS. The download is foreseen asynchronous.

### ◆ View local data

navigation through the local data archive tree (data, images, saved plots and statistics, reports, ...). User can list and open selected data.

# Operation interface - Data Analysis (1/2)



SyNaLoTA is designed to perform the analysis both of HouseKeeping and Science Telemetry data and Scientific Data. Input data can consist of **JSON files** (for ex. from QLA) or **FITS tables** (from NISP) **automatically downloaded from di Mission Archive.**

## → **HKSTM / Science**

### ◆ New plot

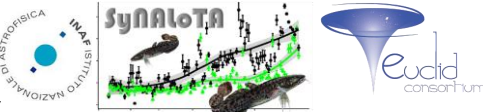
Through a form tab, user can setup and select data subject of a plot, chosen among dynamical histograms, scatter and trend plots. A new browser tab is open for each selected plot. Any created plot can be edited, navigated, incremented and stored in the local DB.

### ◆ Statistics

Whenever a plot is generated, a basic set of statistical estimations is automatically generated for the selected data. Besides this, in addition, the user can select and generate a specific set of advanced statistical measures. The choice may depend upon the specific type of data.

**Machine Learning and/or other analysis modules  
can be easily integrated in the framework**

# Operation interface - Data Analysis (2/2)



SyNaLoTA is designed to perform the analysis both of HouseKeeping and Science Telemetry data and Scientific Data. Input data can consist of **JSON files** (for ex. from QLA) or **FITS tables** (from NISP) **automatically downloaded from di Mission Archive.**

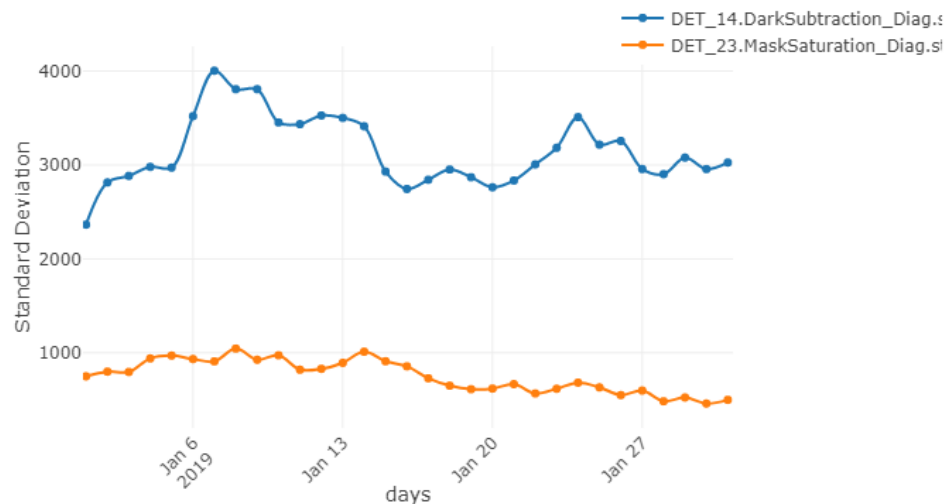
## → HKSTM / Science

- ◆ New plot
- ◆ Statistics

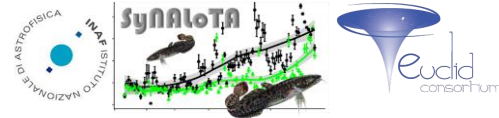
Trend Analysis Global Statistics

NISP-DARK.DET_14.DarkSubtraction_Diag.std	
Mean	4212.887621970262
Standard Deviation	592.9680770720561
Median	4077.0877547286836
Min	3151.56737043869
Max	6071.341830764724
RMS	4254.413385624013
Variance	351611.1404265319
Kurtosis	1.466591705677284
Skewness	0.9953185756397102
MAD	290.02263690392556
NMAD	429.9816707248711

NISP Dark Subtraction & Saturation trend analysis - monthly report



# Operation interface - Menu **IMAGES**



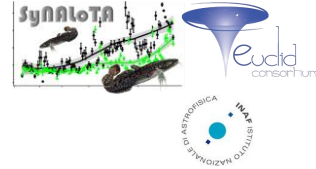
The menu option IMAGES is dedicated to perform analysis on data images gathered from EAS in the local DB.

## Features:

- ◆ Visualization Selection and visualization of an image already locally available or from EAS. Suitable for a quick overall view of the image/spectrum.
- ◆ Navigation Selection and visualization of a navigable image already locally available or from EAS. Suitable for snapshot selection and storage, internal coords capture, statistics on multiple thumbnails.
- ◆ Image Analysis and Statistical Plugins Some image analysis plugins are already available. Additionally plugins for advanced statistical measures specific for image analysis (map counting, threshold masking, etc.), derived from DQCT package are foreseen.

The related tool has been implemented by using the JS9 APIs, provided by the Center for Astrophysics (Harvard & Smithsonian)

*G. Riccio, S. Cavuoti, M. Brescia*



- Home
- Dashboard

## Data

- Load New Data
- View Local Data

## HKSTM

- New Plot
- Statistics

## Science

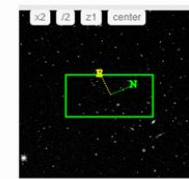
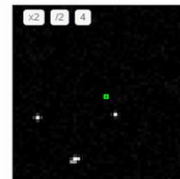
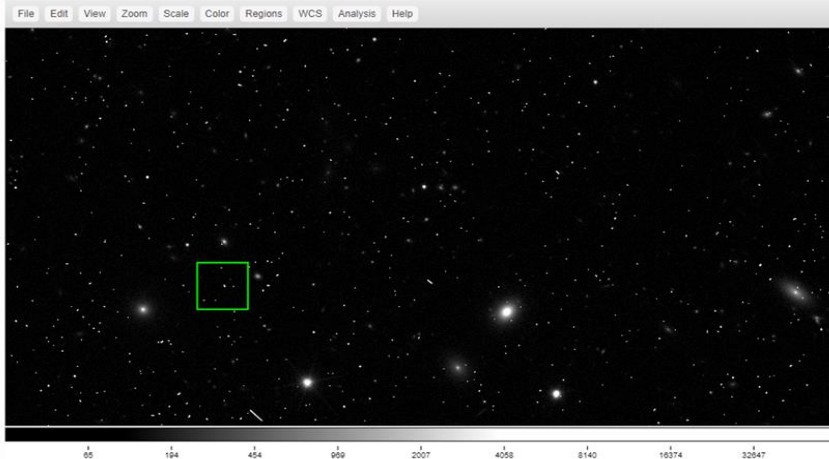
- New Plot
- Statistics

## Images

- Image Explorer

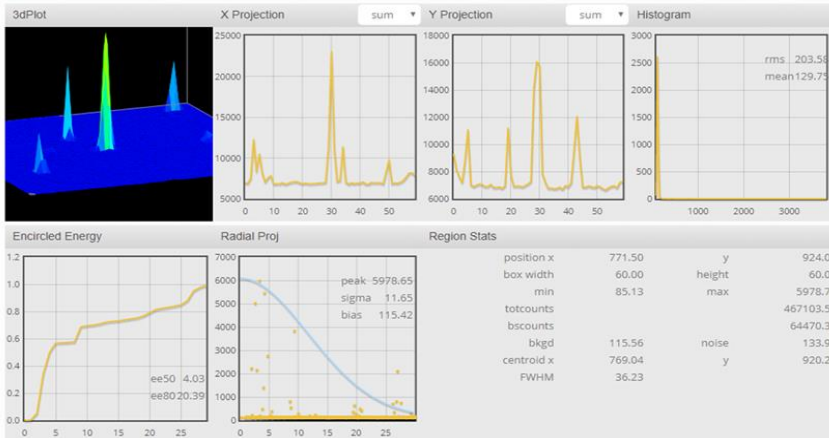
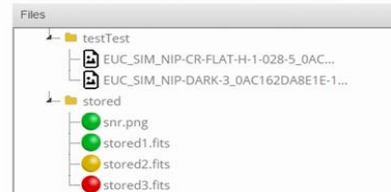
## Reports

- List Reports
- Manage Periodic Reports
- Generate On-Demand Report
- List Configuration Files



file	EUC_SIM_NIP-SCI-H-52929-5_0C434	
object		
fov	294° x 153° (0.299° / pixel)	
center	00:42:50.366	-18:58:19.95
FKS	00:42:52.752	-19:00:10.27
image	623.00	948.00
physical	924.10	628.25
value	139.000	

Open new panel



# Operation Interface

# Image Explorer

# Operation interface - Menu **REPORTS**



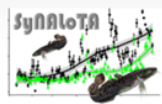
Dedicated to setup, production and handling of both **periodic** and **on-demand** IOT reports. Each report is based on a configuration file (JSON format), listing data to be collected. Periodic type is based on a pre-defined config file, automatically executed at a chosen frequency, locally stored and indexed in the EAS. On-demand type is user-defined and executed, locally stored but not indexed in EAS.

## → Reports

- ◆ List reports  
list view, selection and opening of any stored report (regardless its type, periodic or on-demand).
- ◆ Manage Periodic Reports  
submit and replace a periodic report config file (in case of any change of frequency and/or parameter list).
- ◆ Generate On-Demand Report  
upload of a configuration file listing parameters/data to be gathered and collected in a IOT report, locally stored. This is for on-demand type of IOT reports, not linked in EAS, but for IOT internal use only.
- ◆ List Configuration Files  
list view, selection and opening of any report configuration file (regardless its type, periodic or on-demand).



# Operation Interface - List Reports



## SyNaLoTA

Systems from Naples for Long Term Analysis



testTest

Reports

- Home
- Dashboard
- Data
  - Load New Data
  - View Local Data

### HKSTM

- New Plot
- Statistics

### Science

- New Plot
- Statistics

### Images

- Image Explorer

### Reports

- List Reports
- Manage Periodic Reports
- Generate On-Demand Report
- List Configuration Files

#### Periodic Reports List

10 records per page

Search

Report	Creation date	Owner	Recurrence	Start date	End date	Config file	
<a href="#">lot-report-210-weekly-2019-01-01_2019-01-07</a>	2019-05-07 01:00:00	GiuseppeRiccio	weekly	2019-01-01 08:00:00	2019-01-08 08:00:00	<a href="#">dummy_config.json</a>	
<a href="#">lot-report-234-monthly-2019-01-01_2019-02-01</a>	2019-02-01 09:25:58	testTest	monthly	2019-01-01 00:00:00	2019-02-01 00:00:00	<a href="#">dummy_config2.json</a>	

Showing 1 to 2 of 2 entries

< 1 >

#### On-Demand Reports List

10 records per page

Search

Report	Creation date	Owner	Recurrence	Start date	End date	Config file	
<a href="#">lot-report-111-ondemand-2019-05-12_2019-05-16</a>	2019-05-20 00:00:00	testTest	ondemand	2019-05-12 00:00:00	2019-05-16 00:00:00	<a href="#">config_template.json</a>	

Showing 1 to 1 of 1 entries

< 1 >

# Operation Interface - List Config Files



## SyNaLoTA

Systems from Naples for Long Term Analysis



Configuration Files

testTest

- Home
- Dashboard

### Data

- Load New Data
- View Local Data

### HKSTM

- New Plot
- Statistics

### Science

- New Plot
- Statistics

### Images

- Image Explorer

### Reports

- List Reports
- Manage Periodic Reports
- Generate On-Demand Report
- List Configuration Files

#### Periodic Configuration Files

10 records per page

Search

Configuration File	Creation date	Owner	Recurrence	Start date	End date	
<a href="#">dummy_config.json</a>	2019-05-16 00:00:00	testTest	weekly	2019-05-16 00:00:00	-	 
<a href="#">dummy_config2.json</a>	2019-05-15 00:00:00	GiuseppeRiccio	monthly	2019-05-15 00:00:00	-	 







Showing 1 to 2 of 2 entries

< 1 >

#### On-Demand Configuration Files

10 records per page

Search

Configuration File	Creation date	Owner	Recurrence	Start date	End date	Sampling (h)	
<a href="#">config_ondemand_dummy.json</a>	2019-05-28 17:24:17	testTest	ondemand	2019-05-01 00:00:00	2019-05-18 00:00:00	15	 
<a href="#">config_template.json</a>	2019-05-16 00:00:00	testTest	ondemand	2019-05-16 00:00:00	-	24	 
<a href="#">NEW_ondemand_dummy.json</a>	2019-05-28 17:58:19	testTest	ondemand	2019-03-01 00:00:00	2019-04-30 00:00:00	30	 

Showing 1 to 3 of 3 entries

< 1 >

# History logging



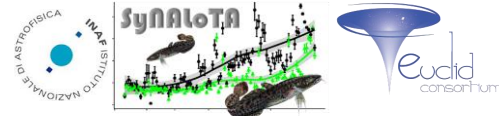
The history about the interaction user-webapp is persistently collected along time, tracking all user actions and commands done.

Suitable to keep track of who did what and when.

It is foreseen a history box in the bottom-left corner of the browser page, under the Menu option list, where the last 100 commands are reported.

The whole history list will be shown in a dedicated tab by selecting the Menu option **History**.

# General features & constraints



- ❑ IOT monitoring, analysis & visualization app, fully accessible through network;
- ❑ In principle compliant with all SGS data flow levels (from HKSTM to L3);
- ❑ Any data produced by the web app can be always stored and/or downloaded by any authorized user. Admin user(s) may also remove data (except IOT reports)
- ❑ The history about the interaction user-webapp is persistent along time, tracing all user actions and commands done;
- ❑ Any report configuration file is in the *JSON* format and must be prepared by the user offline before to upload it in the web app;
- ❑ Any produced plot is saved in a double format, *PNG* and *JSON*. The latter format is suitable to resume same plot at any time by the user.
- ❑ IOT reports are saved in a double format, *XML* and *PDF*. The EAS link will refer to the XML file, while the PDF is locally available for easy readout;
- ❑ A double user level preserves the right maintenance of the local DB.