
# Space Science Data Center

A research infrastructure of the Italian Space Agency

Gianluca Polenta

## IVOA May 2023 InterOp Meeting

Agenzia Spaziale Italiana

# SSDC – Space Science Data Centre

## ASI - Italian Space Agency

BeppoSAX SDC — **2000** — ASI Science Data Center — **2017** — Space Science Data Center

BeppoSAX

Multi-mission - astrophysics

+ EO, ICT, Space weather, NEO, Multi-messenger

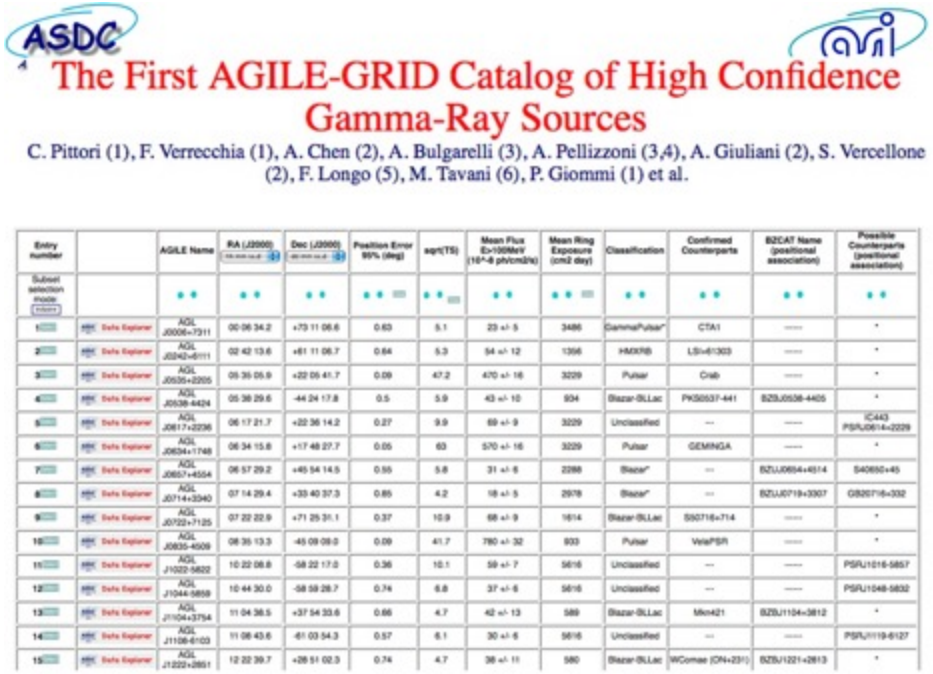




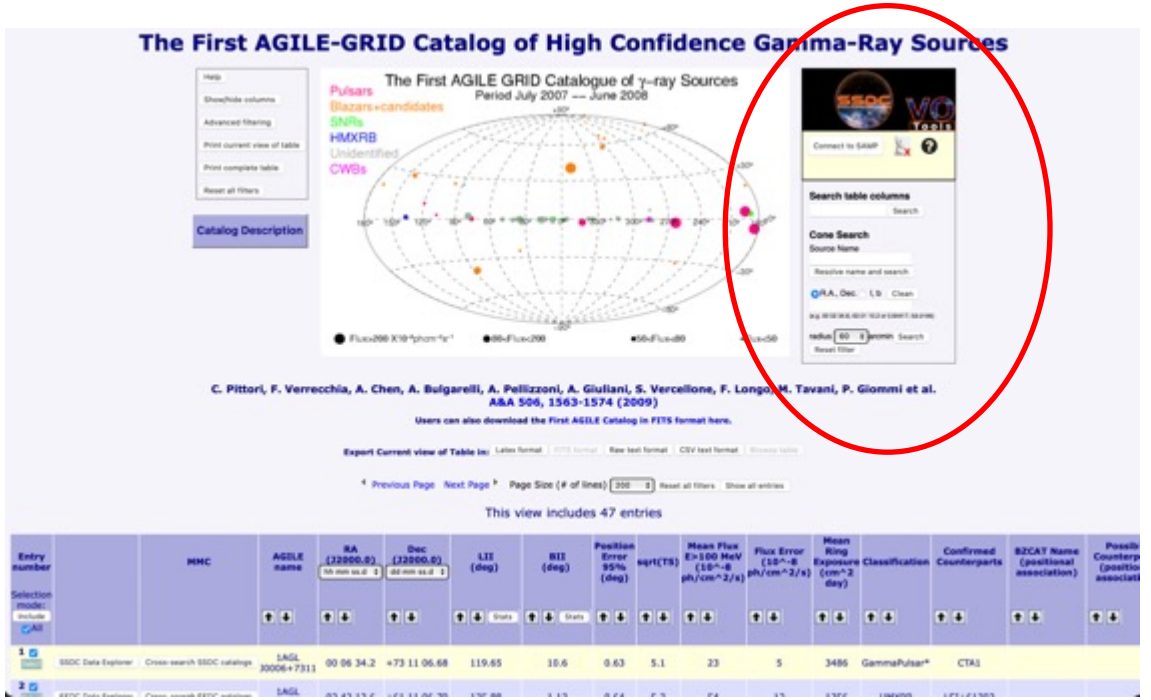
# SSDC – Space Science Data Centre

## ASI - Italian Space Agency

BeppoSAX SDC — **2000** — ASI Science Data Center — **2017** — Space Science Data Center




Standard data formats and resident data




Targeting Interoperability

# SSDC – Space Science Data Centre

**ASI - Italian Space Agency**


## MAIN GOAL

acquire, manage, process and distribute data from (mainly) space based missions adopting the FAIR (*Findable, Accessible, Interoperable, Reusable*) principles.

SSDC adopts and proposes international standards to ensure both the long term preservation of the archives, and the interoperability with other data centers.

FAIR data is now part of SSDC mandate

# SSDC Partners

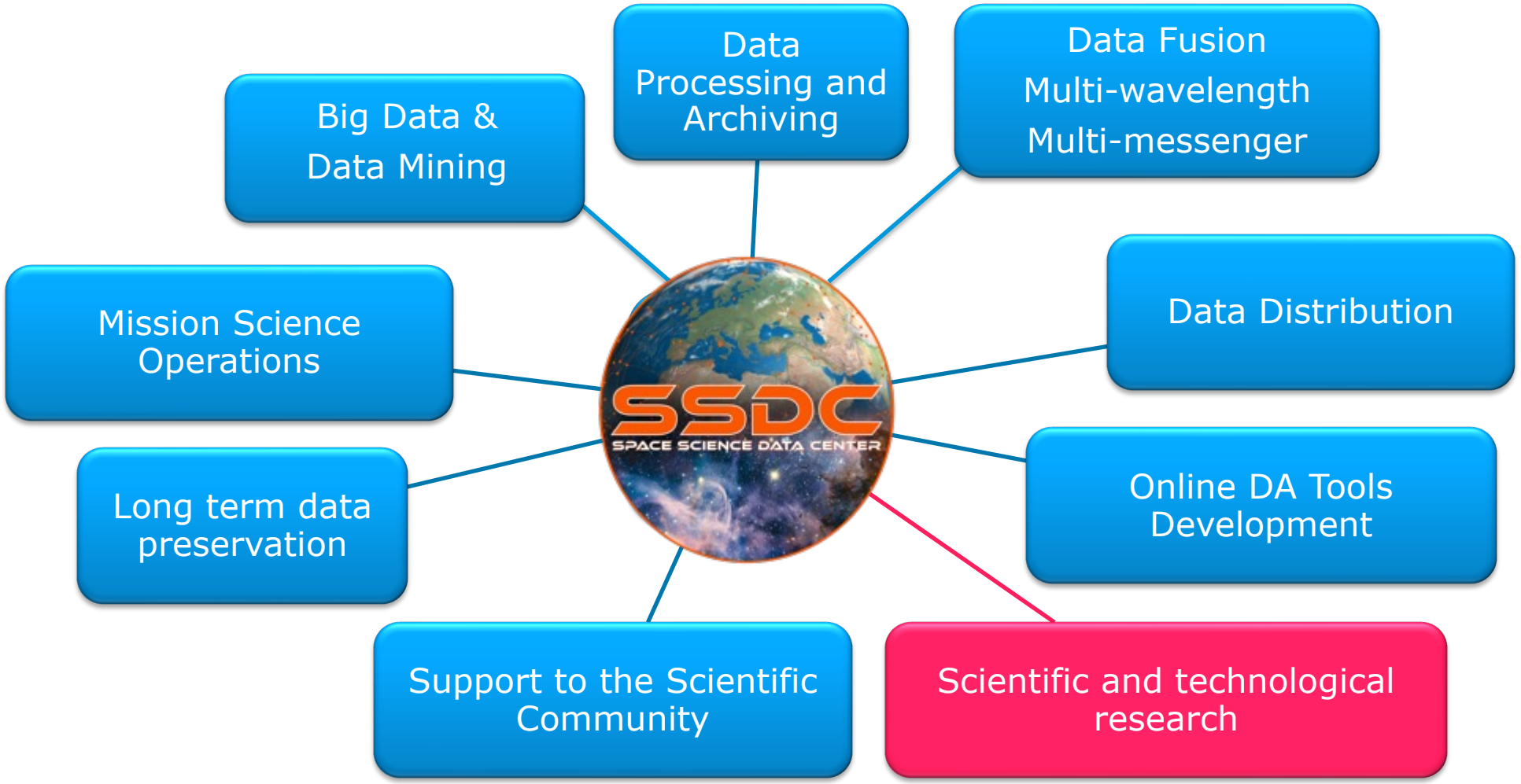
SSDC organization includes:

**ASI** – Italian Space Agency
**INAF** – National Institute for Astrophysics
**INFN** – National Institute for Nuclear Physics
Industries are involved for ICT support.

At present, SSDC team involves ~40 people that are expert on different fields: **scientists** from ASI, INAF, INFN and SW **engineers** from Telespazio & SERCO

Science oriented approach:
Developers and Users/Researchers working together

# SSDC – Activities



# SSDC Science Gateway

Science Tools to allow on-line access to multimission DA resources


On-line access to mission-specific resources

# Space Science Data Center

Home | About SSDC | News and Communication | Quick Look | Missions | Multimission Archive | Catalogs | Tools | Links | Bibliographic services | Helpdesk | Privacy


**Astrophysics/Cosmology** | Exploration of the Solar System | Particle Astrophysics Cosmic rays | Atmospheric Physics TGF

**all missions** ☑

**Radio-Micro wave** ☑
- ☑ Planck

**IR-Optic-UV** ☑
- ☑ Herschel
- ☑ Swift-UVOT

**X ray** ☑
- ☑ ASCA
- ☑ BeppoSAX
- ☑ Einstein
- ☑ Exosat
- ☑ NuSTAR
- ☑ ROSAT
- ☑ Swift-XRT

**Gamma ray** ☑
- ☑ Agile
- ☑ Agile-LV3
- ☑ Egret
- ☑ Fermi
- ☑ Swift-BAT

*Target*
- *1 Ceres*
- *4 Vesta*
- *Mars*
- *Mercury*
- *Venus*

Natural Glass Spectra

*all missions* ☐
- *AMS-01*
- *AMS-02*
- *BESS-Polar I*
- *BESS-Polar II*
- *CALET*
- *CREAM*
- *Fermi-LAT*
- *Pamela*
- *TS93*
- *Chang'E 1 (soon available)*
- *Chang'E 2 (soon available)*

*all missions* ☐
- *Agile*

**Spectral band (** Energy (keV) **):** from 1e -8 to 1e 9 **[1.00e-8 keV -- 1.00e+9 keV]**

**Sensitivity (mCrab):** 1e 3 **[1.00e+3 mCrab]**

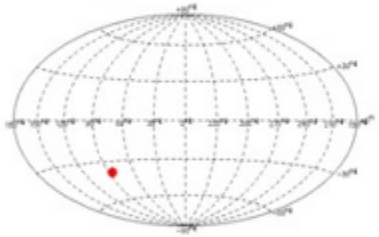
**Temporal range (Year):** from 1975 to 2023 **[1975 -- 2023]**

Submit

**Source name:** Type name and wait for name resolver (e.g. CYGX-1)

**Name Resolver:** ☑ SSDC Name Server ☑ SIMBAD ☑ NED

Source name resolved by **SSDC**



Source Names

Bibliographic search

3C454.3

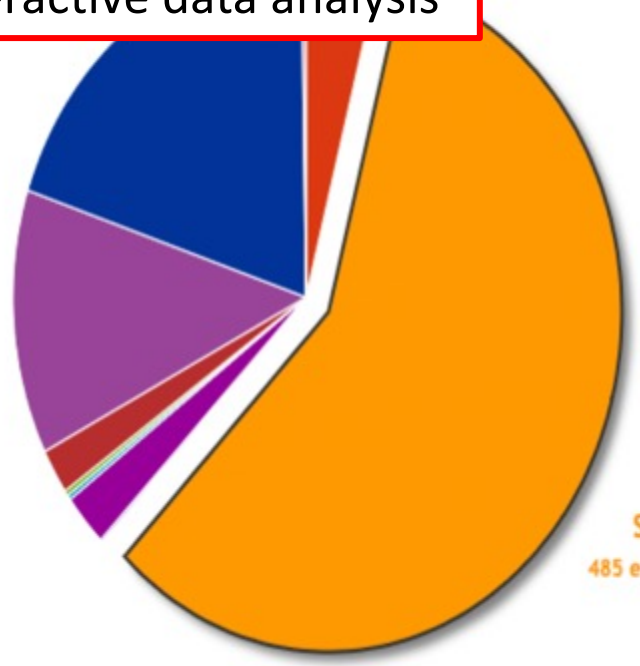
in time range between 1900 and 2023

By name via NED

By coordinates via ADS

Summary of the observations on the 3C454.3 position considering all the data available @ SSDC

Clicking on each of the “piece of cake” you have access to the corresponding data and the interactive data analysis




| MIS | |
|---|---|
| PLANCK | 0 |
| HERSCHEL | 34 |
| SWIFT | 485 |
| ASCA | 0 |
| BeppoSax NFI | 1 |
| BeppoSax WFC | 21 |
| EINSTEIN | 2 |
| EXOSAT | 0 |
| NUSTAR | 2 |
| ROSAT | 18 |
| AGILE | 105 |
| AGILE-LV3 | 164 |
| EGRET | 1 |
| FERMI | 1 |

| Entry number | | Interactive Analysis | | Archive | Target Name | obsid | RA (J2000) | Dec (J2000) | start_time | processing_date | xrt_exposure | uvot_exposure | bat_exposure | archive_date | Dist. from searched position |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Selection mode: Include All | | XRT | UVOT | | | | hh mm ss.d | dd mm ss.d | | | | | | | arcmin |
| 1 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030165 | 22 53 57.21 | +16 08 55.64 | Dec 10, 2010 04:26:00 | Aug 19, 2016 | 939.454 | 913.018 | 872 | Dec 21, 2010 | 0.1 |
| 2 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030148 | 22 53 57.95 | +16 09 00.28 | Nov 25, 2010 07:51:00 | Aug 19, 2016 | 1334.618 | 1307.236 | 1350 | Dec 6, 2010 | 0.1 |
| 3 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030002 | 22 53 58.34 | +16 08 57.73 | Apr 26, 2005 22:54:00 | Oct 18, 2014 | 52.709 | 0 | 68 | May 7, 2005 | 0.1 |
| 4 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00032872011 | 22 53 56.8 | +16 08 53.26 | A | | | | | | |
| 5 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00031216053 | 22 53 57.29 | +16 08 37.89 | Se | | | | | | |
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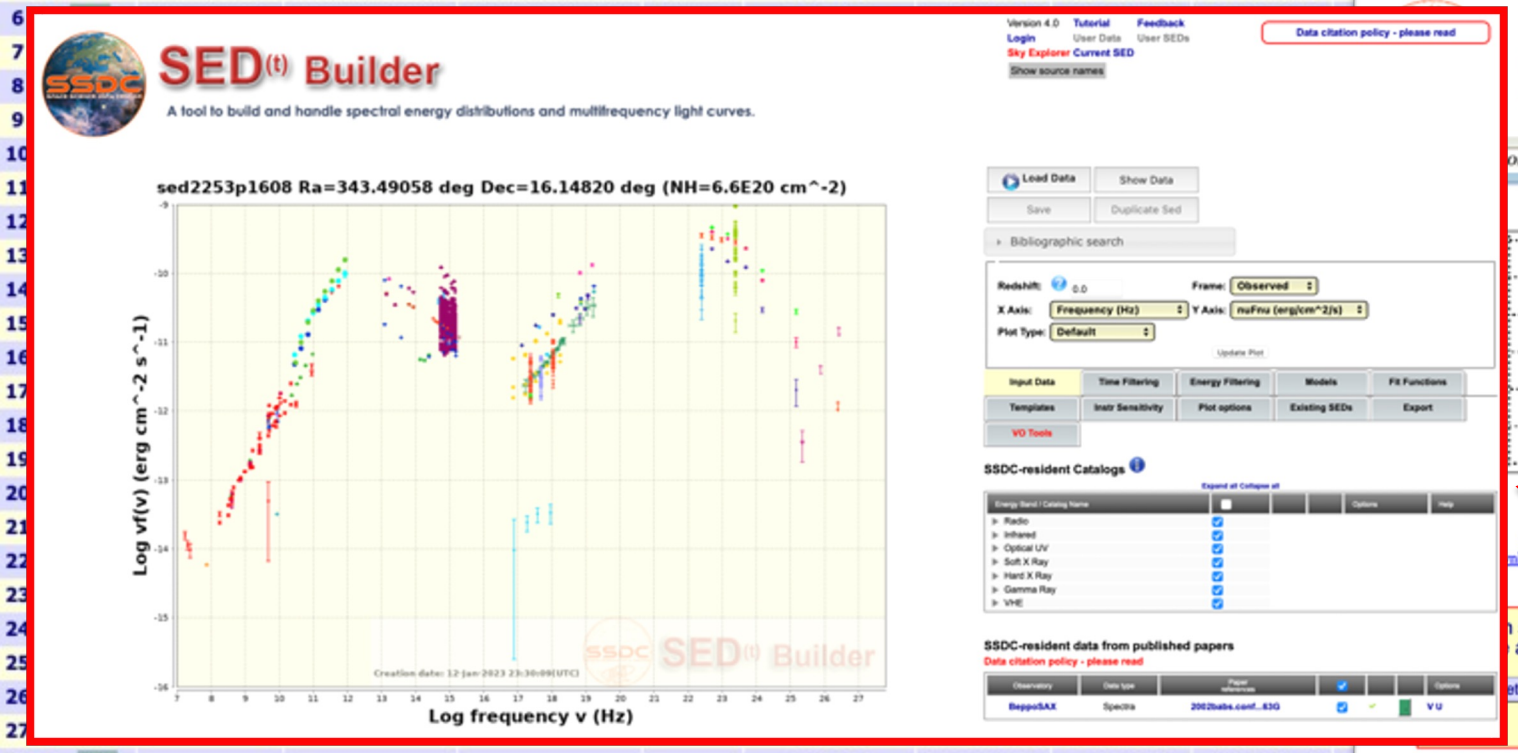
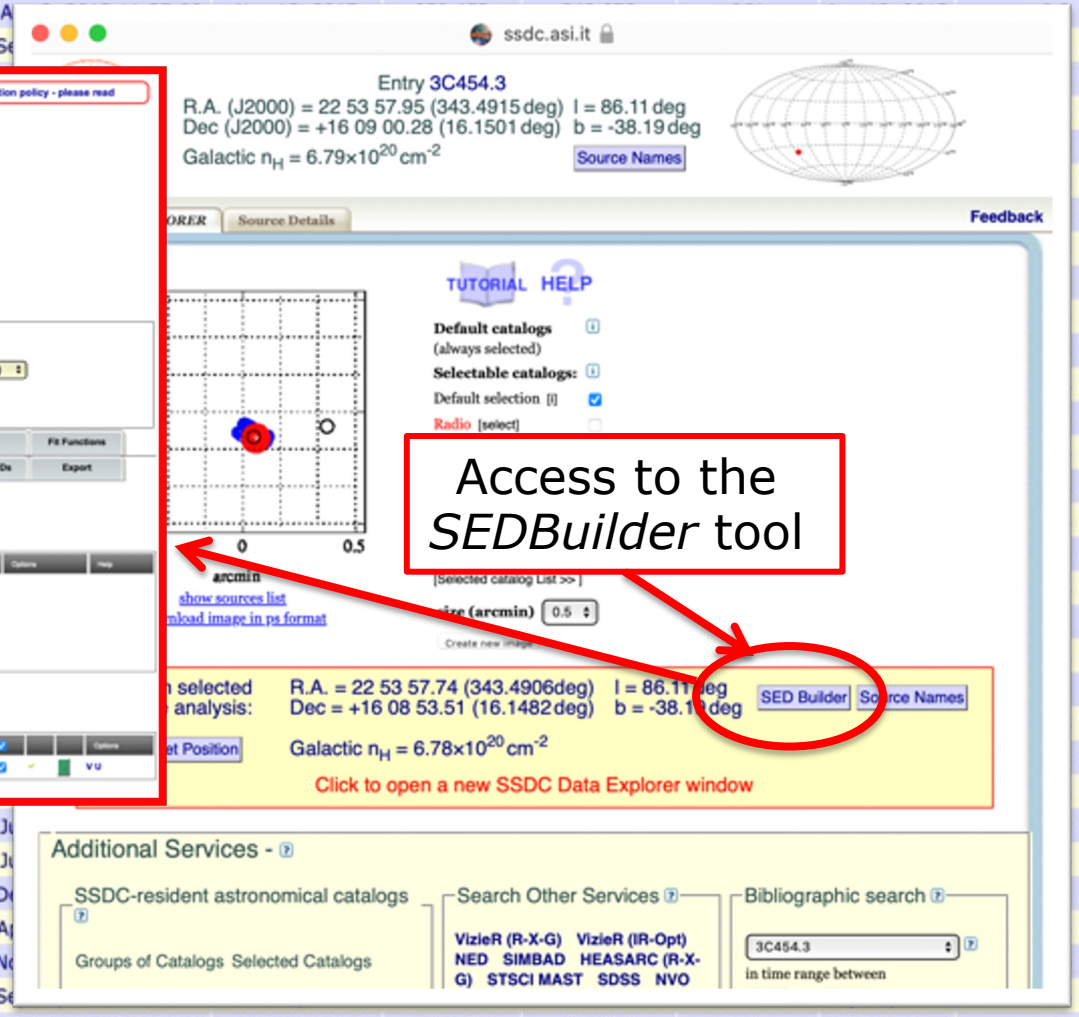
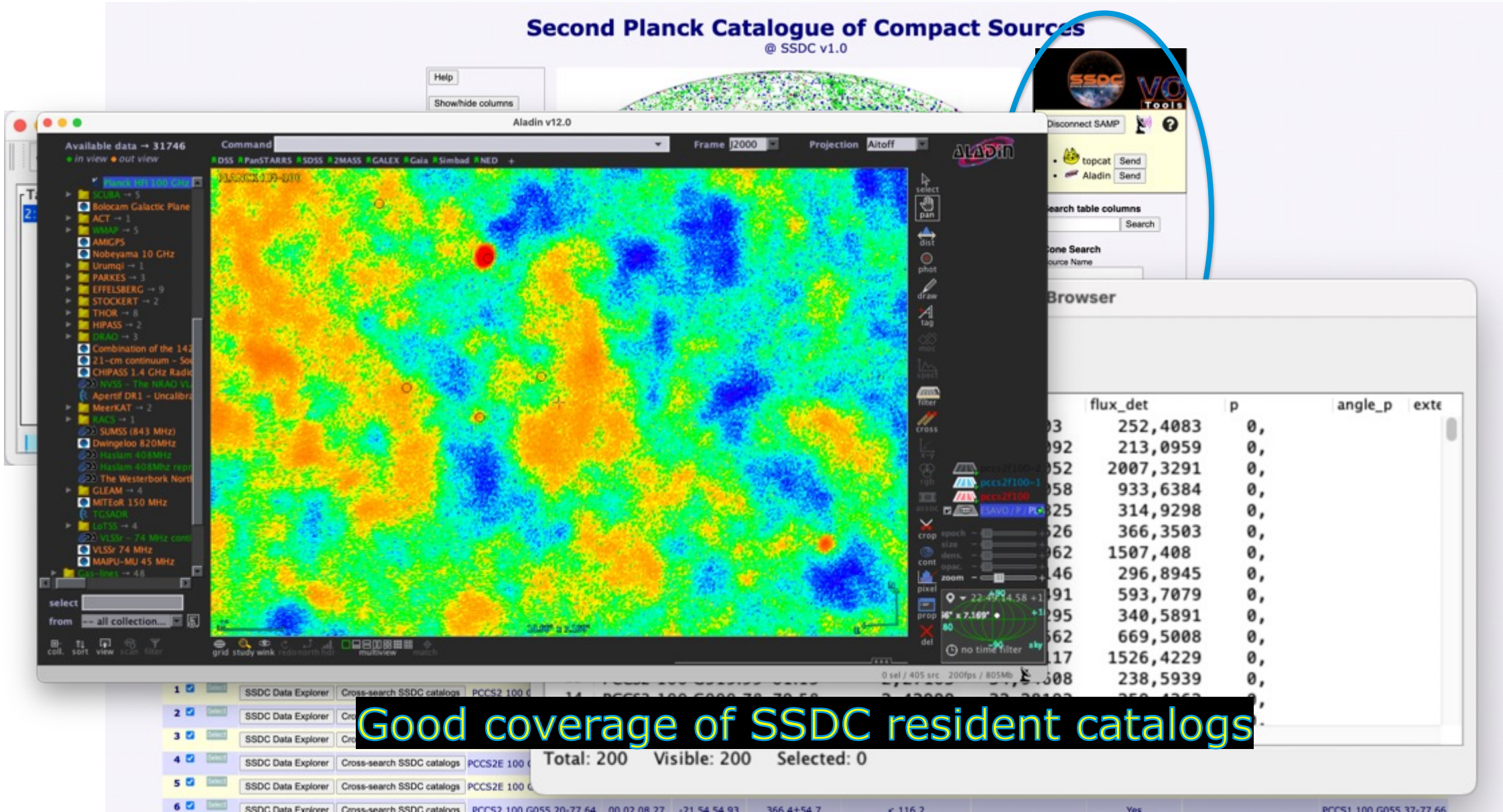
| 28 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00032872007 | 22 53 58.46 | +16 08 18.77 | J | | | | | | |
| 29 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030006 | 22 53 58.52 | +16 08 21.62 | J | | | | | | |
| 30 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030166 | 22 53 59.13 | +16 08 24.39 | D | | | | | | |
| 31 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | SAA-COLD-115-18 | 00067147002 | 22 53 59.18 | +16 09 17.85 | A | | | | | | |
| 32 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00031018004 | 22 53 54.92 | +16 08 59.89 | N | | | | | | |
| 33 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00031216048 | 22 53 55.03 | +16 08 50.06 | Se | | | | | | |
| 34 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00096562006 | 22 53 55.13 | +16 08 53.84 | May 31, 2022 15:24:00 | Jun 10, 2022 | 846.929 | 822.349 | 854 | Jun 11, 2022 | 0.6 |
| 35 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00031216006 | 22 53 55.27 | +16 08 38.72 | Jun 4, 2008 18:51:00 | Oct 3, 2015 | 1995.271 | 1972.289 | 2012 | Jun 15, 2008 | 0.6 |
| 36 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030031 | 22 53 55.45 | +16 09 09.54 | Jan 21, 2009 17:05:00 | Dec 23, 2015 | 1436.44 | 1389.94 | 1472 | Feb 1, 2009 | 0.6 |
| 37 | SSDC Data Explorer | XRT Interactive Analysis | UVOT Interactive Analysis | Data Access | 3C454.3 | 00035030114 | 22 53 55.48 | +16 09 10.69 | Nov 3, 2010 17:08:00 | Aug 18, 2016 | 995.927 | 994.143 | 1012 | Nov 14, 2010 | 0.6 |

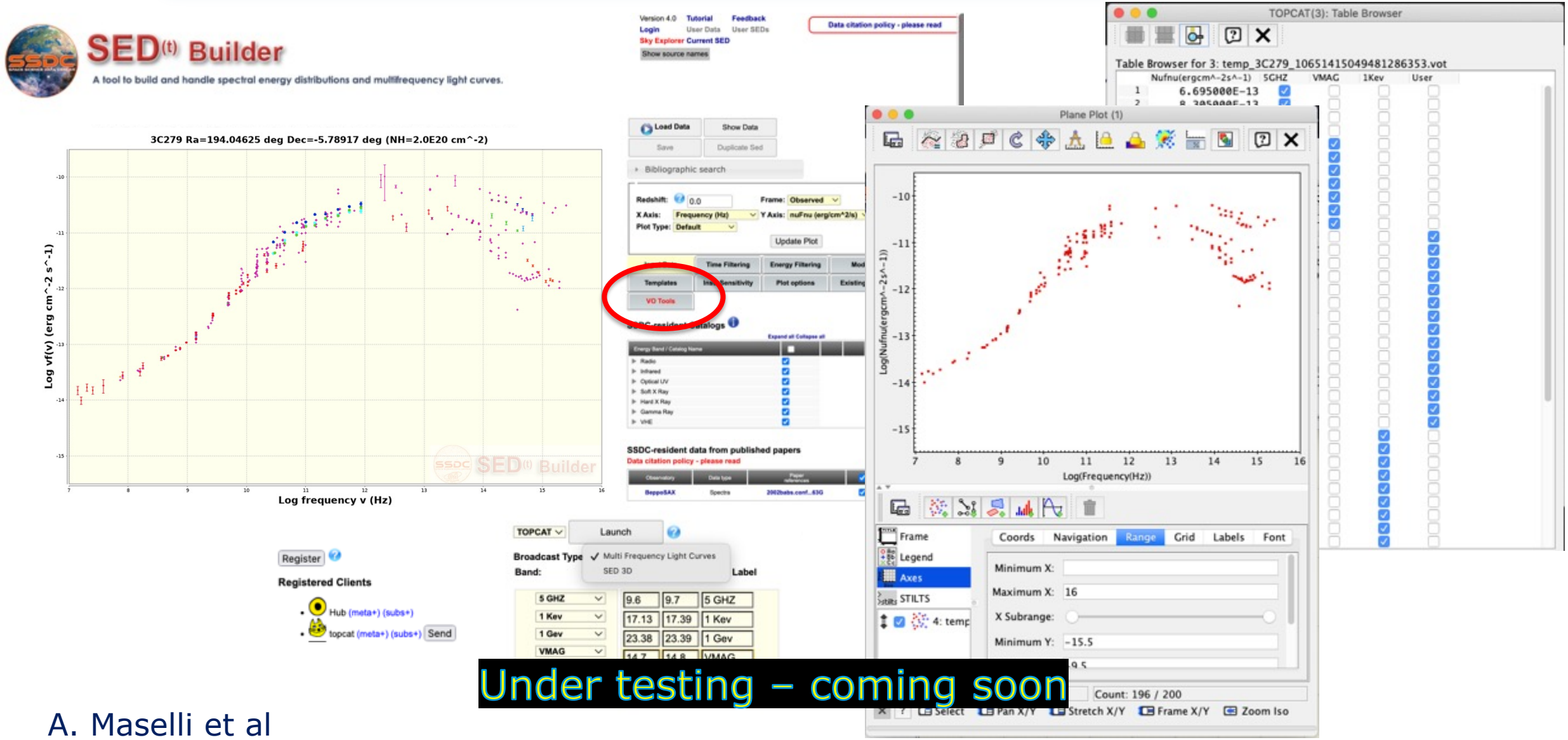


# Interoperability and VO tools: SAMP



# Interoperability and VO tools: SAMP




Under testing – coming soon

A. Maselli et al

# Interoperability and VO tools: TAP

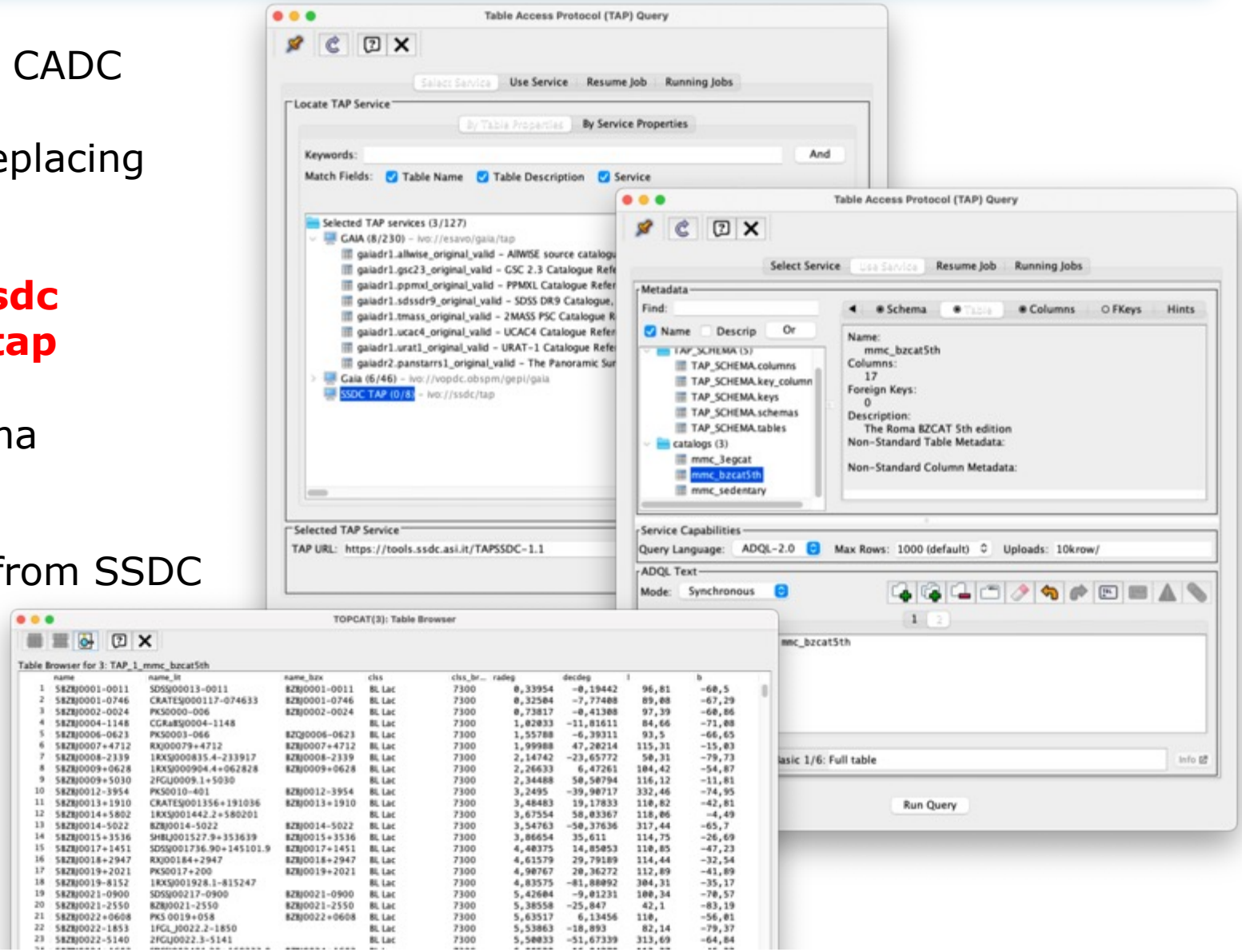
Service based on TAP library by CADC

Latest TAP version used **1.1** (Replacing previous ASDC TAP 1.0 service)

New authority created **ivo://ssdc**
Euro-VO Registry **ivo://ssdc/tap**

Using TASMAN by IA2 for schema management

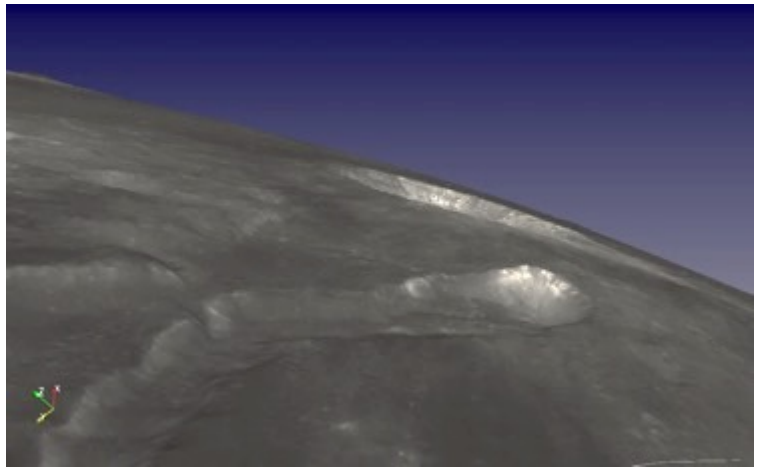
Only a few test cases, starting from SSDC owned catalogs




M. Giardino et al

# MATISSE: the SSDC webtool for the solar system exploration data


**Nature Astronomy July 2019 cover!**



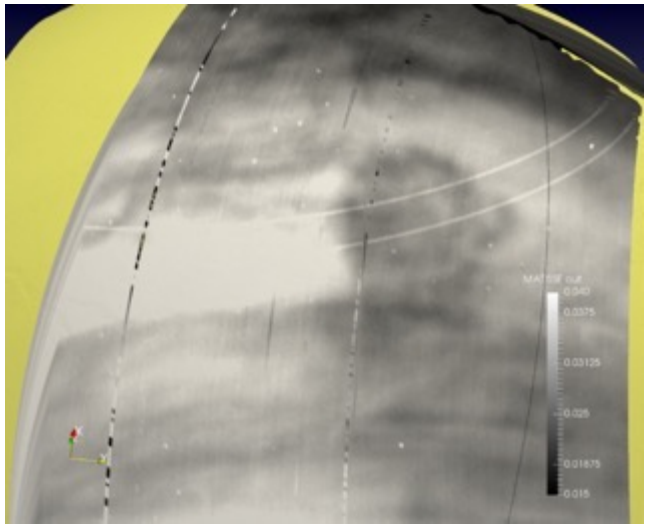
## https://tools.ssdc.asi.it/Matisse

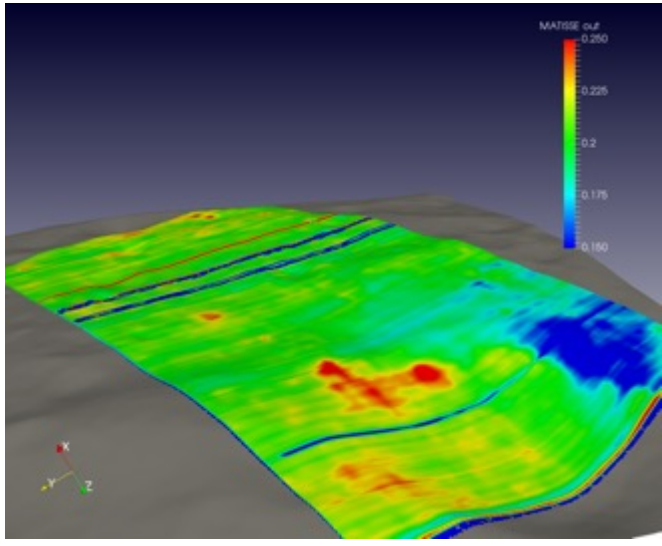
1. 2013: First MATISSE release
2. 2016/17: Open data (VESPA)
3. 2019: MATISSE 2.0: Python 3, New DBMS, Servlet based
4. 2020-22: +Thermophysical model, Geological maps

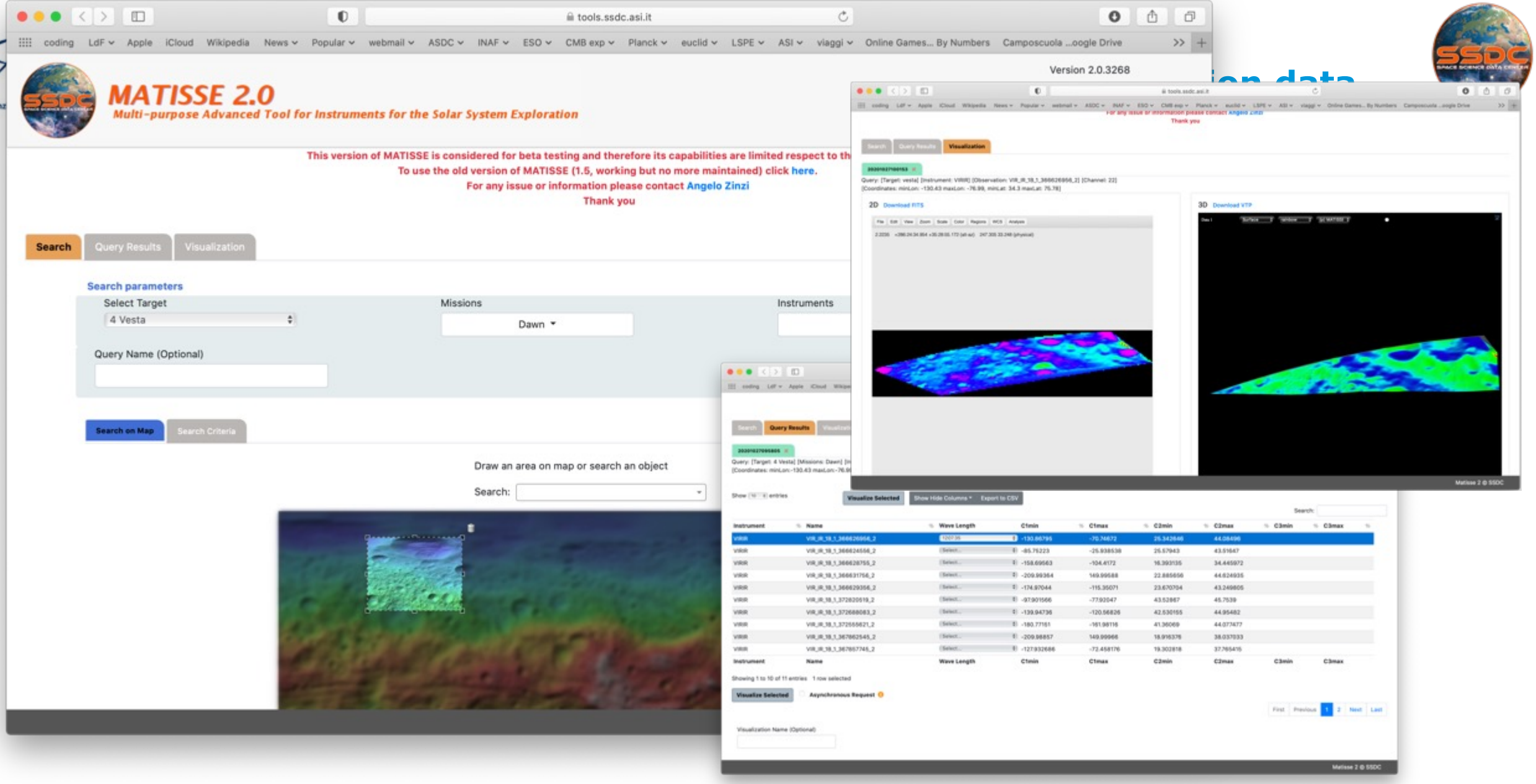
- VIR Vesta
- VIR Ceres
- CRISM Mars (via PlanetServer)
- VIRTIS Venus (via EPN-TAP)
- Airless bodies thermophisical model
- MARSIS (restriced access)
- MESSENGER MDIS-NAC (via NASA ODER ETS)

MARSIS public observations ready to be published (via EPN-TAP)

Zinzi et al., 2016, A&C






tools.ssdc.asi.it
MATISSE 2.0
Multi-purpose Advanced Tool for Instruments for the Solar System Exploration
Version 2.0.3268
This version of MATISSE is considered for beta testing and therefore its capabilities are limited respect to th
To use the old version of MATISSE (1.5, working but no more maintained) click here.
For any issue or information please contact Angelo Zinzi
Thank you
Search
Query Results
Visualization
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Search on Map
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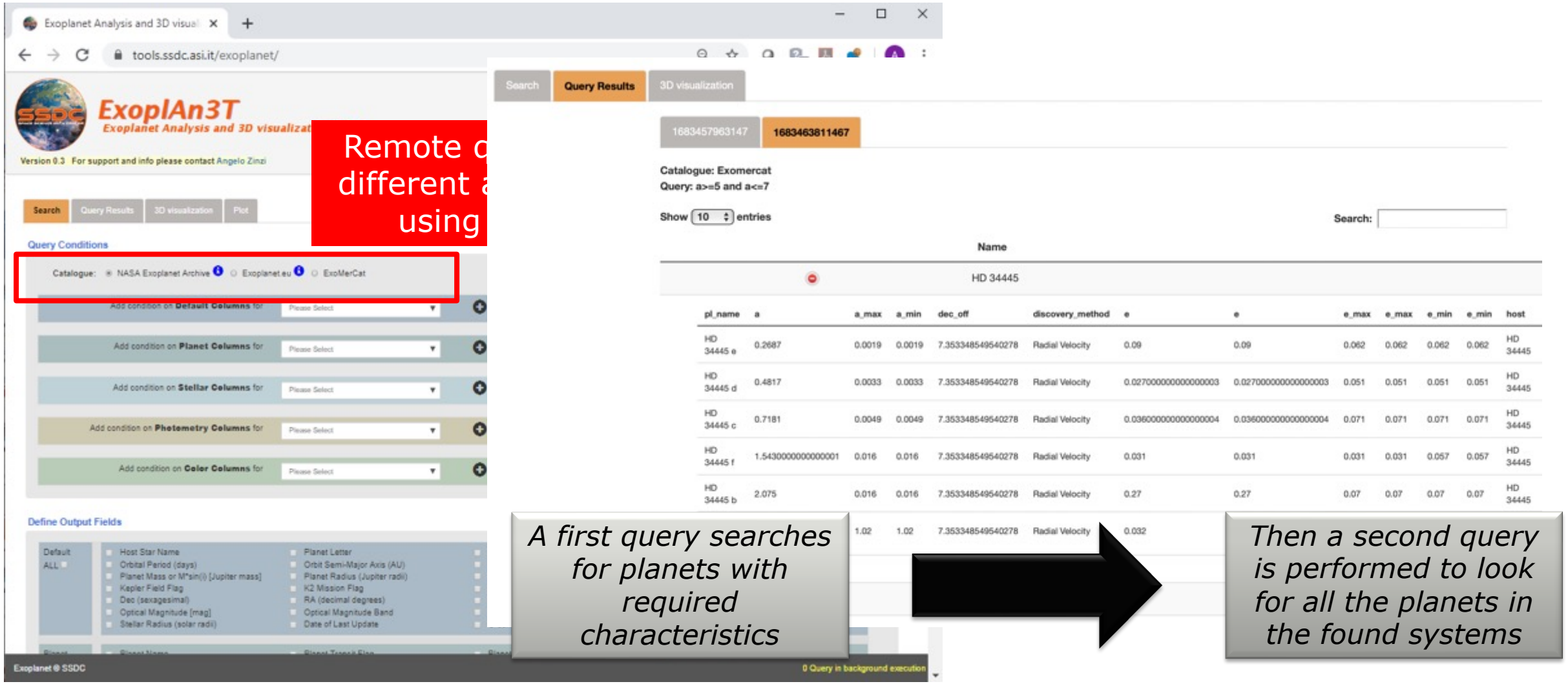
3D Download VTP
Visualize Selected
Show Hide Columns
Export to CSV
Asynchronous Request
Visualization Name (Optional)

# ExoplAn3T

**https://tools.ssdc.asi.it/exoplanet**

A. Zinzi et al



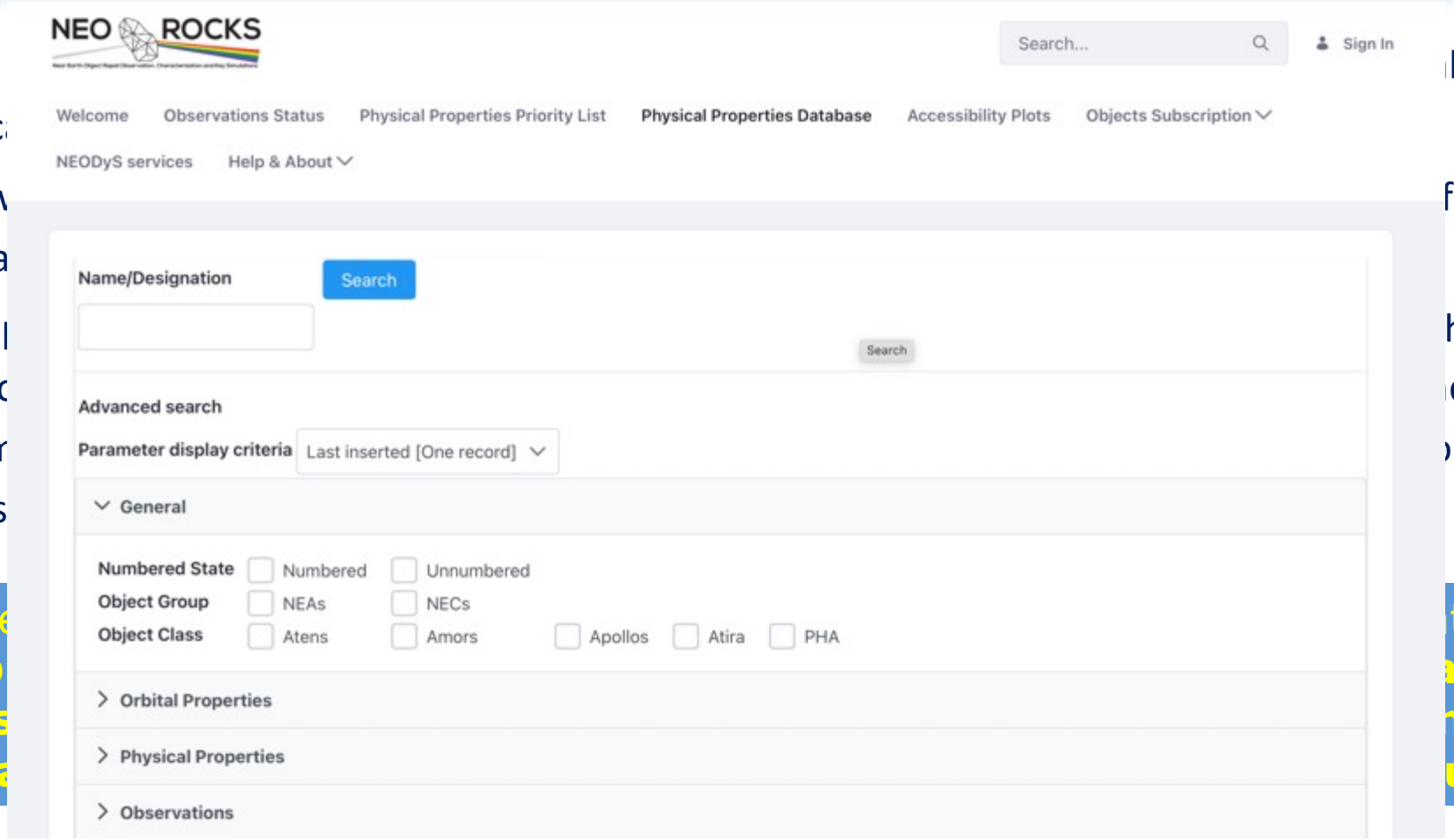
# NEOROCKS (or "My FAIR Planetary Defense")

To date, only l properties, because physic

The key issue, v f a direct link between orbita

The proposed hich deserve attention as pc e associated orbit improvem successfully attempt an obs

It appe ta on NEO p **alized access nsure the ma ucts**

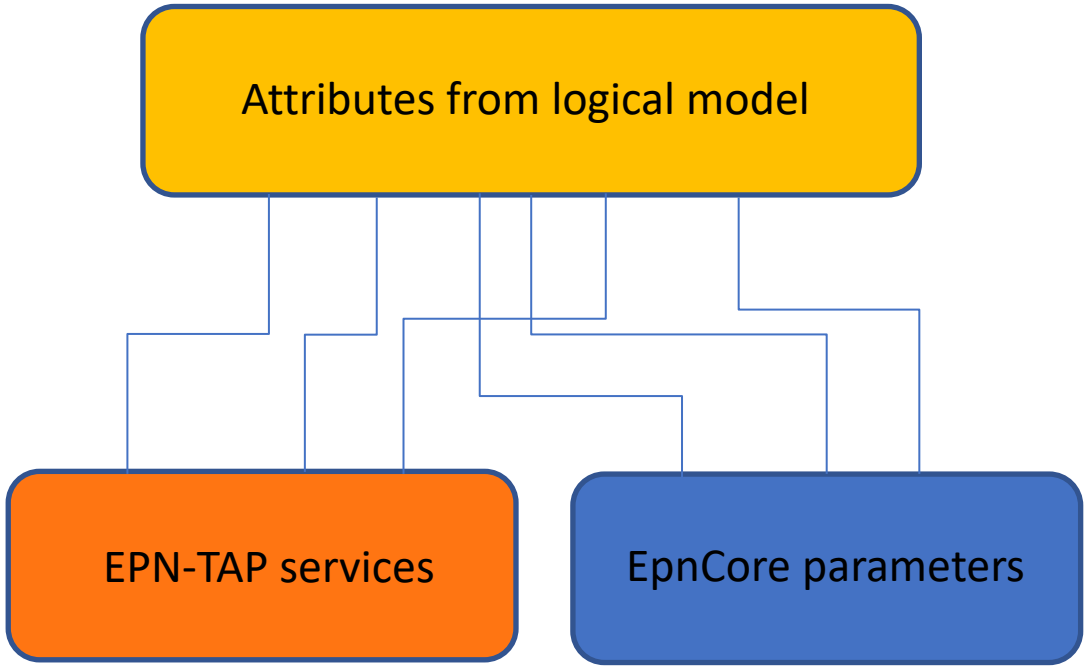


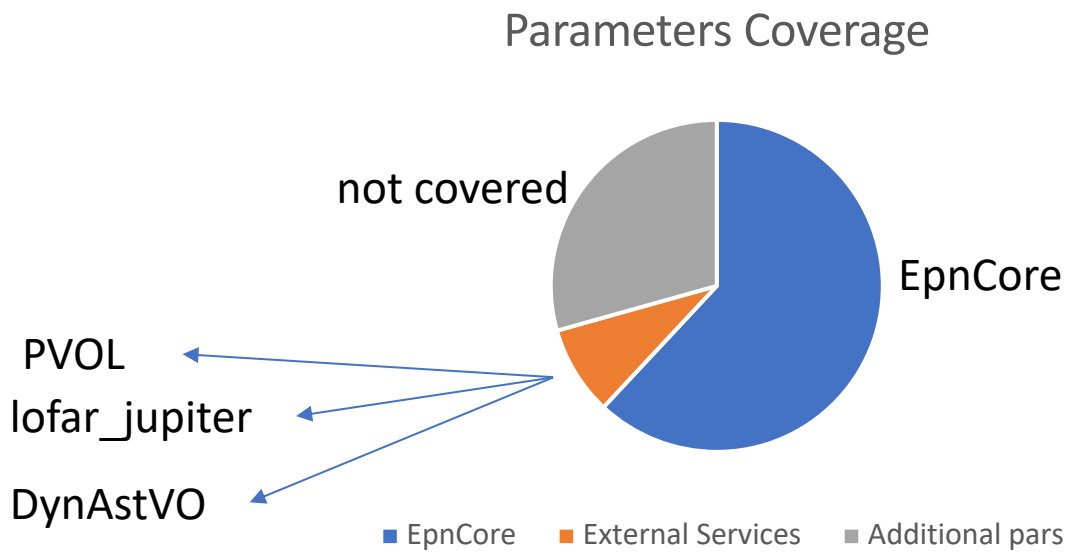

See A. Zinzi's talk on SSIG splinter

NEO ROCKS
Near Earth Object Rapid Observation, Characterization and Key Simulations

# NEOROCKS - Data Model definition and EpnCore

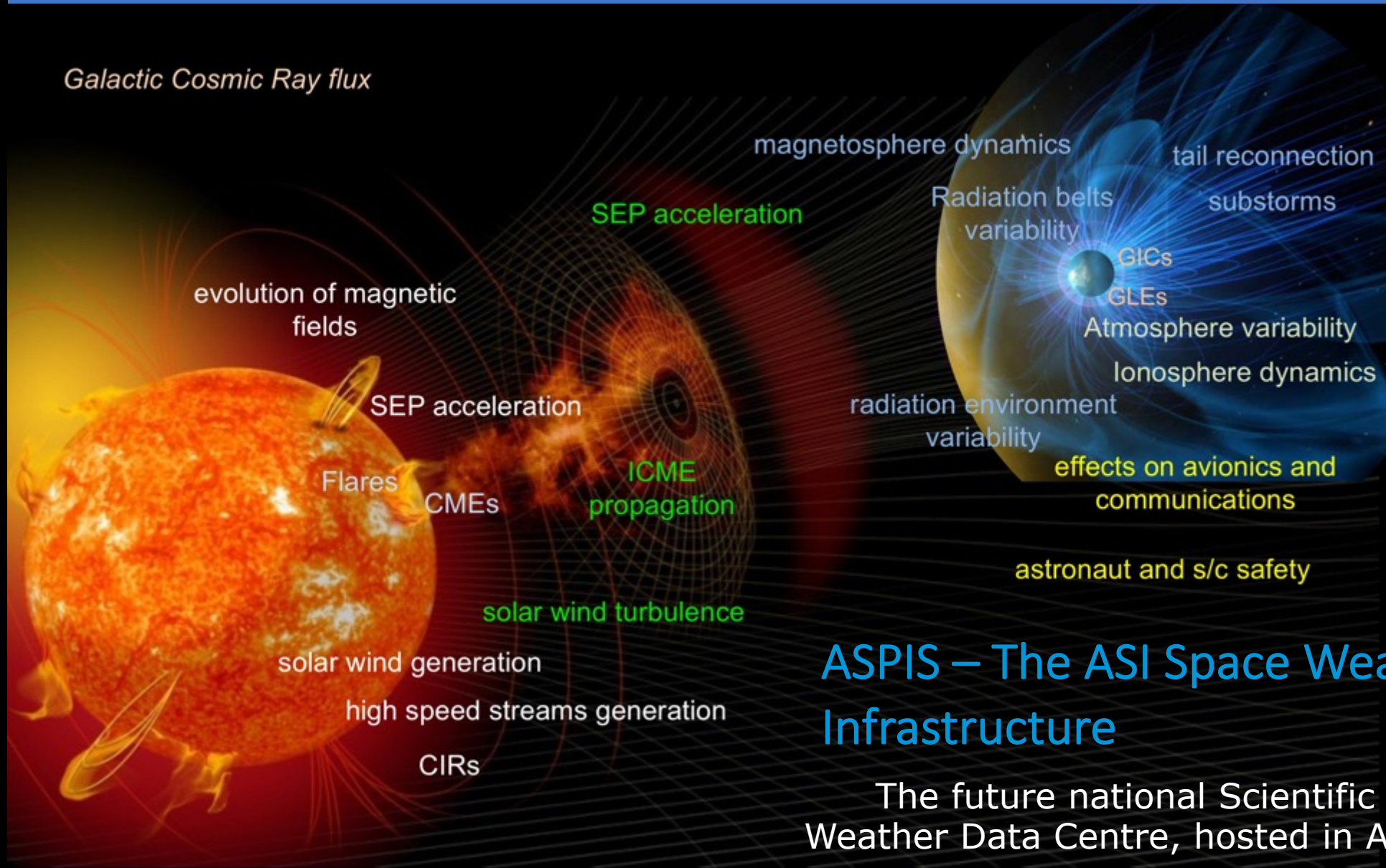
Matching parameters used by the NEO community to the EpnCore, finding a nice correspondence.
Picking also from thematic extensions, 70% coverage of total parameters coming out from NEOROCKS community.




See A. Zinzi's talk on SSIG splinter

# Space Weather phenomena resulting from Sun-Earth connection and/or its interplay with the GCRs



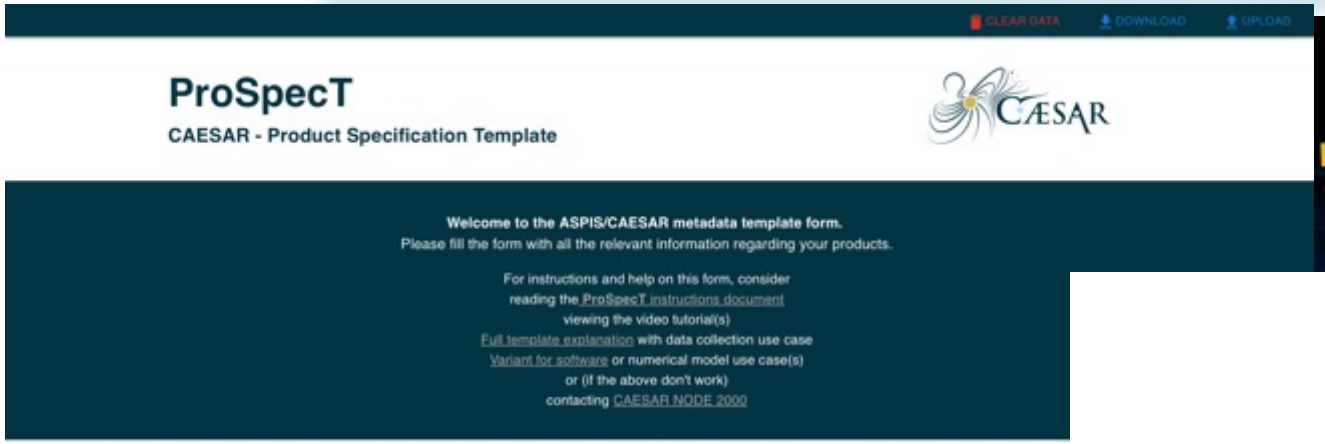

Plainaki et al., JSWSC-*Agorà*, 2020

## ASPIS – The ASI Space Weather Infrastructure

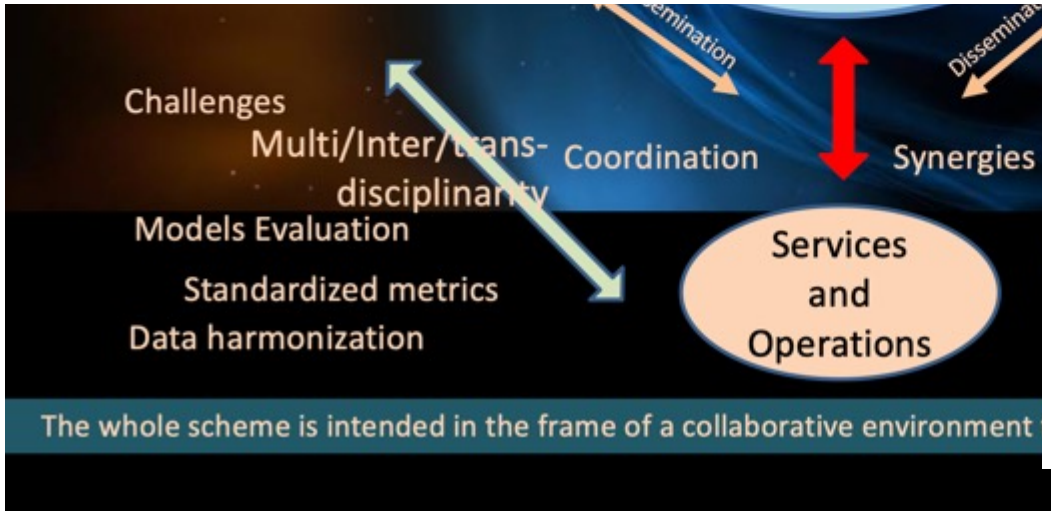
The future national Scientific Space Weather Data Centre, hosted in ASI's SSDC

Background figures are from NASA

# Space Weather – ASPIS: Caesar project






**CAESAR WP2310 - Product Specifications Definition**

## *ProSpecT* Repository Template

## Instructions to fill in the product template form

Version 0.91, 14 April 2022
Author(s): Marco Molinaro, Dario Del Moro
Contributor(s): Monica Laurenza, Rossana De Marco, Valerio Formato, Carmelo Magnafico

### Introduction

A metadata schema has been defined to help standardise the description of the various products that will be included in the CAESAR ASPIS archive prototype. Those metadata need to be filled in by the science working groups. As a help in doing so, a web-based form solution has been prepared, named ***ProSpecT*** as ***Pro***duct ***Spec***ification ***T***emplate. This document provides a quick overview of the web form and its usage and a guide to help filling in the required metadata elements.

JniToV)

ata

# SSDC Team

Material for this presentation has been made possible thanks to the work of several SSDC members (incomplete list, apologies!):

- Current MF and VO team: A. Maselli, V. D'Elia, M. Giardino, A. Giunta, C. Pittori, F. Verrecchia, M. Vicinanza
- Other teams: A. Zinzi, I. Di Pietro, M. Fabrizio, +all SSDC teams and SW eng

  https://www.ssdc.asi.it/ssdc_staff.php
- Former SSDC staff: P. Giommi, M. Capalbi, B. Gendre, C. Leto, G. Stratta, + …

- Mixture of scientific+technical expertise not easy to find:
  - Too technical for researchers: very often this work is not properly evaluated in career recruitment/advance procedures
  - Data scientist needed everywhere, with much better career opportunities outside academic research

# Conclusions

ASDC->SSDC is also a transition from local data in standard formats to full interoperability

- Easier to implement for new projects, harder to convert 20+ yrs of work, keeping at the same time all services available, operations, etc.
    - Catalogs: SAMP good coverage; TAP: few test cases - small catalogs
    - Images: coming next, some HIPS attempts for Swift XRT@OpenUniverse
    - developing guidelines to explain all SSDC teams (scientists, not VO expert) how to make interoperable their fits/pds4 compliant data
- Newest tools (NEOROCKS, MATISSE, ExoplAn3T, ASPIS) are more VO oriented:
    - Heterogenous data: Astro+CR, TGF, space weather, planetary, exoplanets
    - Significant efforts on Data Modelling
- HR issue: technological activities in Italy not rewarding for career advancements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**www.ssdc.asi.it**

Agenzia Spaziale Italiana