VO Activities
@ Space Science Data Center

M. Giardino
C. Leto
Italian Space Agency

ASTERICS European Data Provider Forum and Training Event 2018
The Space Science Data Center is a Research Infrastructure of the Italian Space Agency

**MAIN GOAL**

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

SSDC adopts international standards ensuring both the long term preservation of archives and the interoperability with other data centers.
SSDC Scientific Expertise

At present, SSDC team involves around 40 people: scientists from ASI, INAF, INFN and SW engineers from Telespazio & SERCO, experts in different fields.

Effective approach: Developers and Users belong to same communities.
SSDC Experience

Data Processing

Big Data & Data Mining

Science Mission Mirroring & Archiving

Long term data preservation

Support to the Scientific Community

Data Fusion
Multi-wavelength context

Data Distribution Virtual Observatory

Online Tool Analysis Development

High impact of scientific return in terms of publications
Science Tools allow the on-line access to data within a multifrequency environment.
The Multi-Mission Interactive Archive
The Multi-Mission Interactive Archive
The Multi-Mission Interactive Archive
The Multi-Mission Interactive Archive

Summary of the observations on the Crab 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
AGILE-LV3 Data

Query results for: 83.632977, 22.014434 (in RA, DEC)
Details: query by COORDINATE & TIME with RA = 83.632977; DEC = 22.014434; L = 184.557455; B = -5.784478; Lon = 84.097402; Lat = -1.294493; EQUINOX = 2000; RADIUS = 30 degrees; Start date = 01-12-2007; End date = 03-11-2017; Duration = 28 day(s); Min EXP = 100 cm² s sr; sort by START DATE; max lines retrieved 5000;

Modify AGILE-LV3 query parameters

Export Current view of Table in: Latex format FITS format Raw text format CSV text format Browse table

This view includes 111 entries

<table>
<thead>
<tr>
<th>Entry number</th>
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<th>GRID LV3 data retrieval</th>
<th>GRID Interactive Analysis</th>
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<th>DEC (J2000)</th>
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The Multi-Mission Interactive Archive

AGILE-LV3 Data

Query results for: 83.632977, 22.014434 (in RA, DEC)
with RA = 83.632977; DEC = 22.014434; L = 184.557453; B = -5.784478; Lon = 84.097402; Lat = -1.294493; EQUINOX = 2000; 12-2007; End date = 03-11-2017; Duration = 28 day(s); Min EXP = 100 cm² s⁻¹; sort by START DATE; max lines retrieved 5000;

Modify AGILE-LV3 query parameters

Make Light Curve: [LC likelihood]

Export current view of Table in: [Latex format, FITS format, Raw text format, CSV text format, Browse table]

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AGILE-LV3 Data

Modify AGILE-LV3 query parameter

Make Light Curve: LC Likelihood

Export Current view of Table in: Latex format, Key format, New text format, CSV text format, Browse

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The Multi-Mission Interactive Archive

Query results for: CRAB
RA = 83.632977 (deg); DEC = 22.014434 (deg); EQUINOX = 2000
Source name resolved by ASDC

Bibliographic search

Source Names

PKS B0531+219

in time range between 1500 and 2017

By name via NERD

By coordinates via ADS

MISSION | ENTRIES
---------|--------
PLANCK  | 0
HERSCHEL| 10
SWIFT   | 91
ASCA    | 7
BeppoSax NFI | 16
BeppoSax WFC | 124
EINSTEIN | 6
EXOSAT  | 0
NUSTAR  | 61
ROSAT   | 16
AGILE   | 70
AGILE-LV3| 111
EGRET   | 4
FERMI   | 1

NUSTAR
61 entries (12%)
The Multi-Mission Interactive Archive

Query results for: **83.632977, 22.014434** (in RA, DEC)
Details: query by COORDINATE with **RA = 83.632977; DEC = 22.014434; EQUINOX = 2000; RADIUS = 10 arcmin**; sort by RA; max lines retrieved: **5000** (on BROWSE catalog numaster)

Export current view of table in: Line format XML format Raw text format CSV text format Browse table

Previous Page Next Page Page Size (# of lines) 200 $ fullscreen filters Show all entries

View includes 61 entries

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The Multi-Mission Interactive Archive

Query results:
Details: query by COORDINATE with RA = 83.633977; DEC = 22.0207

Export Current view of Table in: Excel
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view includes 61 entries

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- Color: blue
- Color scaling: hist
- Minimum level displayed: 0.000
- Maximum level displayed: 7.000
- Skygrid: Off
- Smoothing filter: wave
- sigma: 5
- background level: 1

Image centered on:
- RA (deg): 83.5454
- Dec (deg): 22.0207
- L1: 184.5
- B1: 5.85
- Source name: Search

Image half size (pixel): 300
- Emiss (keV): 3
- Erange (keV): 79

Catalog Overlay:
- X axes: X Pixels
- Y axes: Y Pixels

NUSTAR Imaging Tool
- Crate: CRAB
- Run: 0104
- Exposure: 611 s

ARCHIVED entries:
- CRAB CAL15: 3.0
- CRAB CAL08: 3.0
- CRAB CAL04: 3.0
The Multi-Mission Interactive Archive

Direct access to the SSDC Data Explorer tool
The Multi-Mission Interactive Archive

Access to the SEDBuilder tool
The Multi-Mission Interactive Archive

Access to the SEDBuilder tool
TAP Services @SSDC

- ASDC TAP service is **online**
- SAMP link from catalogs, VOTable export **online**
- Collaboration with INAF-IAPS and INAF-OAT for the EPN-TAP service (Europlanet 2020) for planetary data **online**
- Development of GAIA service **in progress**
- New catalogs are **missing**
ASDC TAP Service catalogs

Currently hosting 15 catalogs, multidisciplinary and multifrequency

- Bzcat (4°) : Multi-frequency blazars
- Agilegrid1 : Agile Grid 1 AGLR gamma ray
- Bat54mcat : Palermo Swift-BAT Hard x-ray
- Xrtgrbdeep : Swift serendipitous XRT (GRB) x-ray
- Egret3 : EGRET Source gamma
- Fermi: 1LAC (AGN), FGL (sources), BSL (bright sources), PSR (pulsar) gamma
- BeppoSAX : Wide field cameras GRB X-ray catalog, wide field cameras sources X-ray
- Roxa : Multifrequency (Radio+Optical+X-ray) blazars
- Sedent : Multifrequency extreme high energy peaked BL Lac (AGN)
- Wmap3, Wmap5 : Radio microwave point sources (3 years and 5 years)
- many more to come ...
An example of SAMP integration
An ambitious mission to chart a 3D map of our Galaxy, in the process revealing the composition, formation and evolution of the Galaxy.
GAIA TAP service

- Requirements on Sept. 2016:
  - A VO-compliant service
  - Able to query a MySQL DB
  - Able to manage multiple connections
- Starting point: TAPLib 2.0 (AUG 2016 - G. Mantelet) based on PostgreSQL
- Inclusion of a MySQL translator task
  - Mathematical and trigonometric functions
  - JOIN and subqueries
  - Search conditions (WHERE, HAVING, ORDER BY, GROUP BY)
- Two phase selection
  - Geometrical functions based on MySQL_SPHERE (A. Partl)
  - Geometrical functions based on dynamic index facility (dif) a tool able to se both HTM and HEALPix pixelization schemas and it allows a faster query execution on big table (Calderone and Nicastro)
- Management of multiple connections by using the same DB structure of GaiaPortal (http://gaiaportal.ssdc.asi.it): “sharding”
  - Tables (catalogs and auxiliary) are divided in consistent declination strips
  - A given strip, for all tables, is stored in the same independent server: shard (N=22)
  - Queries and tables joins are ran on each shard in parallel execution and without hardware sharing. No joins between shards are required.
  - The outputs are redirected on a single DB table
  - The output table have to be converted in the final user desired format
GAIA TAP service
EPN-TAP service @IAPS

- SEM image and EDS spectra of dust grains
- Wavelengths, species and transitions of emission lines
- Vesta&Ceres observation spectra IR+VIS

**NASA dust catalogs**

**Comet emission lines catalogs**

**VIR spectra**

**EURO VO**

**DACHS**

**MATISSE**

**vo-node1.iaps.inaf.it**

**tools.ssdc.asi.it/matisse.jsp**

**TOPCAT+SAMP**
MATISSE

TAP URL = http://vo-node1.iaps.inaf.it/tap
MATISSE

Multi-purpose Advanced Tool for Instruments for the Solar System Exploration

For support and info please contact Angelo Zinzi
3D interactive shape model

2D projected maps

MATISSE
Next steps

• Update TAP service with new version of catalogs (i.e. Fermi, AGILE) and new catalogs
• Publish GAIA TAP service
• Add original geometry data to EPN-TAP service (datalink)
• Space Weather Data Center @ ASI (assessment) : INAF+INFN+ASI
  • AMS (INFN)
  • Limadou/HEPD (INFN)
  • BepiColombo/SERENA(INAF)

*Data heterogeneity, multidisciplinary approach*