



# L'Observatoire Virtuel HELIO

(HELiophysics Integrated Observatory)

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# Projet

## Projet e-infrastructure FP7 (No. 238969)



- Regroupe tous les grands acteurs mondiaux OV soleil/plasmas
- Collaboration avec les autres projets liés aux données
- Mix chercheurs en informatique, en physique solaire et des plasmas
- Les 3 grands centres français de données sont impliqués :

BASS2000, CDPP et MEDOC

## 13 partenaires

MSSL/UCL (UK)  
FHNW (Suisse)  
Observatoire de Paris (France)  
CESR/UPS (France)  
STFC/RAL (UK)  
IAS/UPS (France) INAF  
Trieste (Italie)  
Univ. Manchester (UK)  
Trinity College Dublin (Irlande)  
NASA/GSFC/HDMC (USA)  
RPI (USA)  
LMTAC (USA)  
ESA (Europe/Espagne)

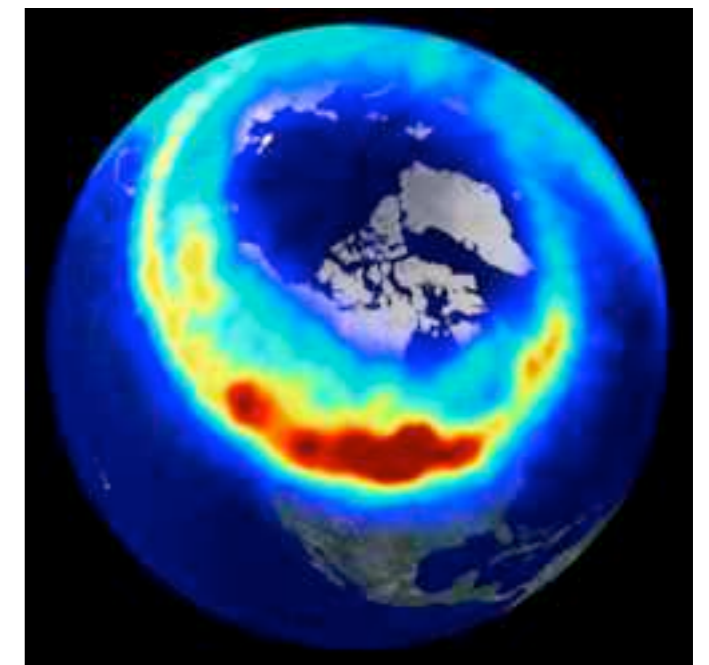
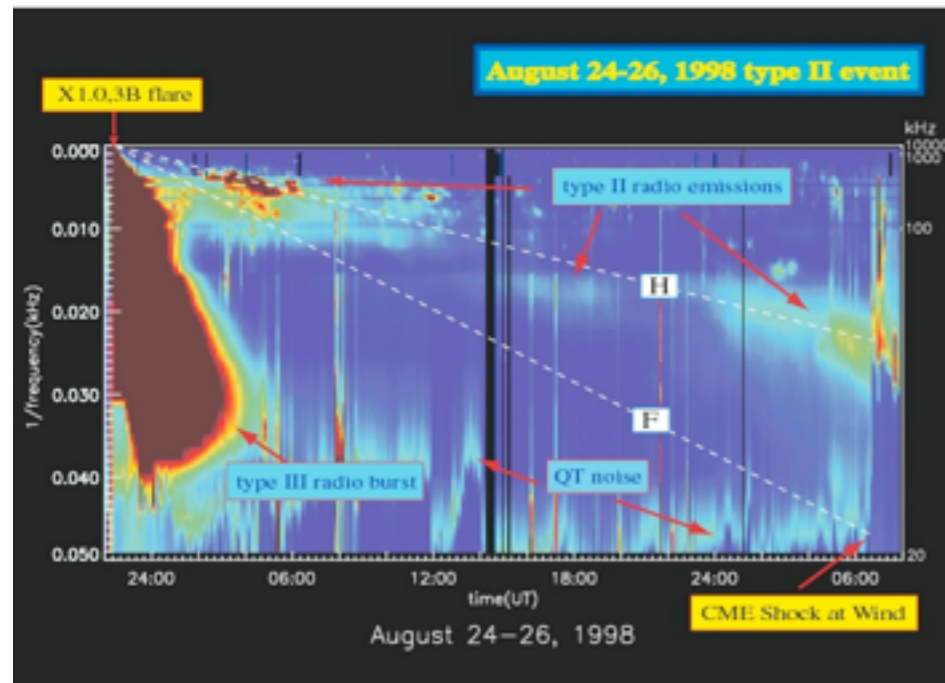
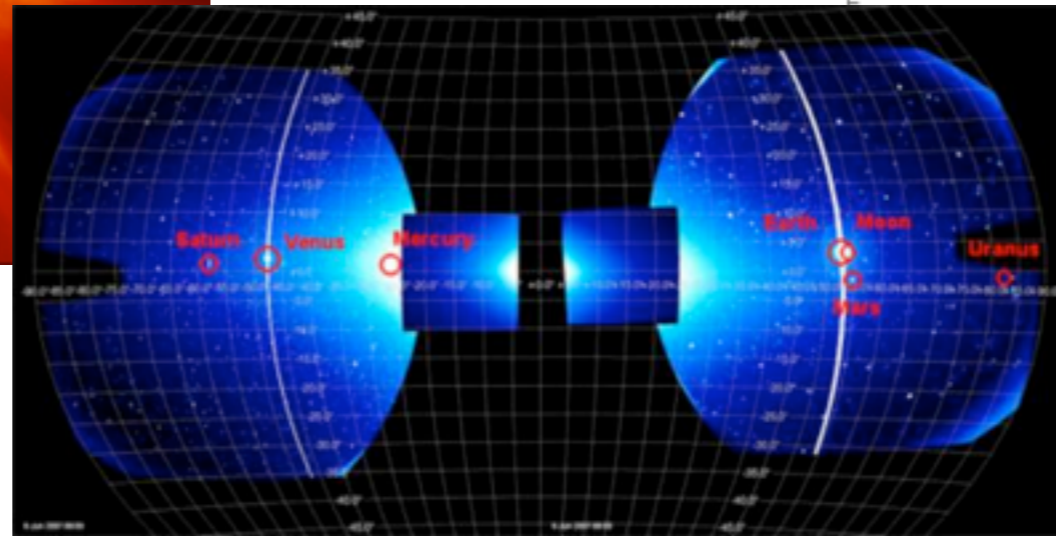
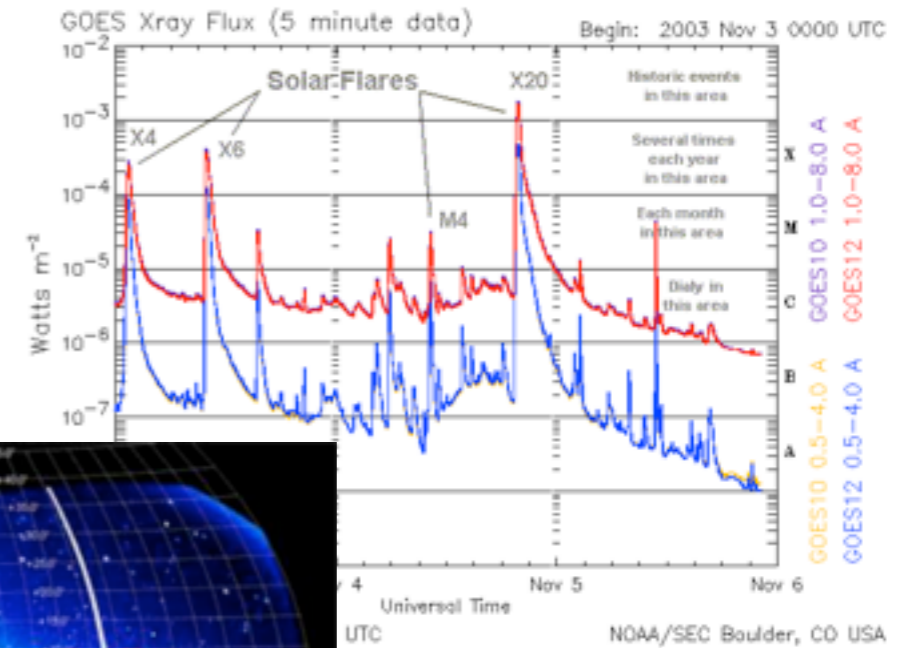
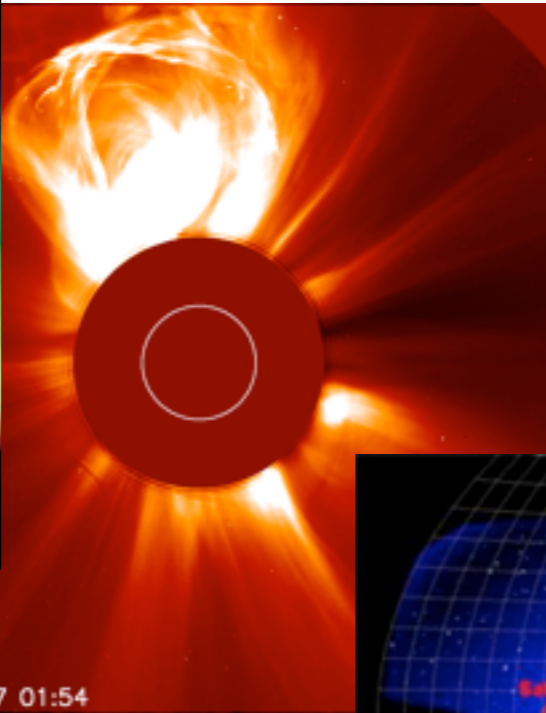
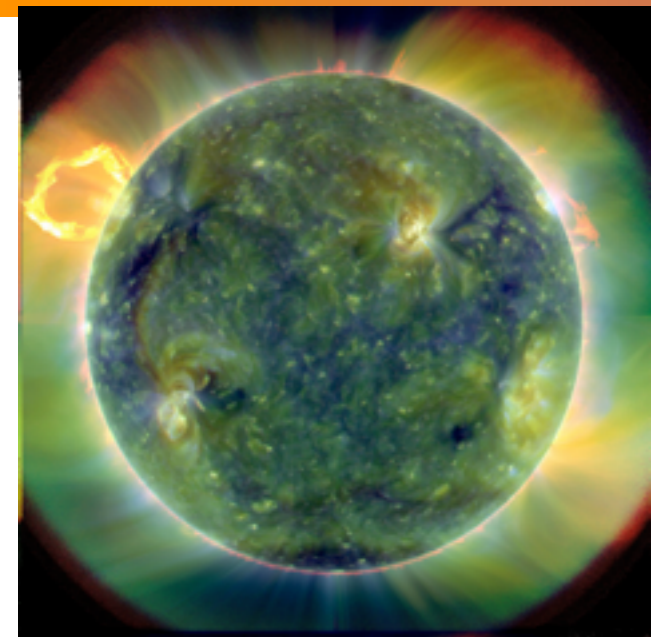
# Programme

- Début : 1er juin 2009 pour 3 ans
- Financement : 3.1 M€
- 3 activités :
  - Networking (resp. B. Bentley) (4 WP) : 135 pm
  - Service (resp. A. Csillaghy) (5 WP) : 235 pm
  - Research (resp. J. Aboudarham) (3 WP) : 162 pm
- Total : 532 pm (soit  $\approx$  15 ETP)

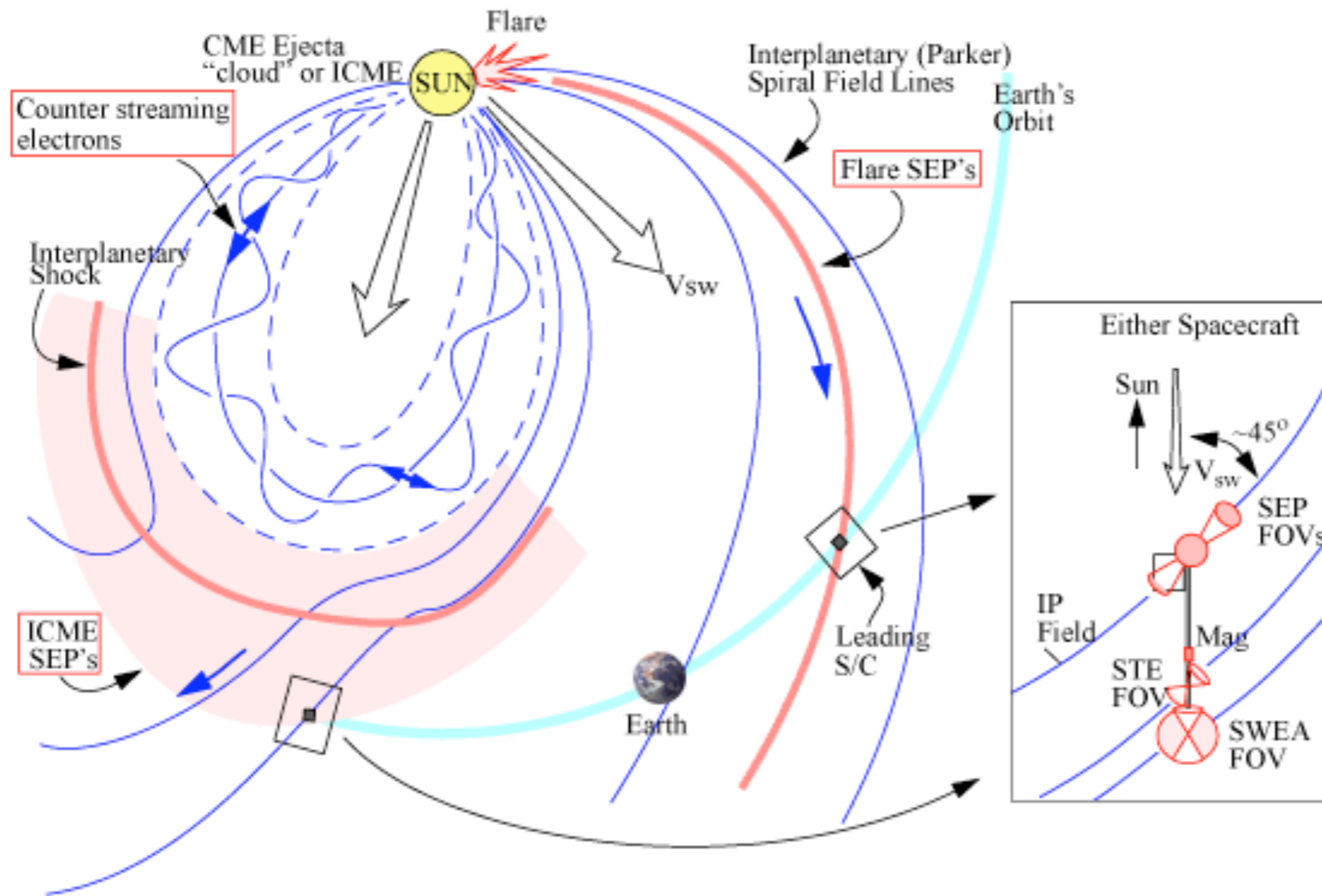
# Objectifs

- Faciliter l'accès et l'analyse des données solaires et héliophysique
- Définir une ontologie commune aux deux domaines
- Développer des interfaces d'utilisation conviviales et simples
- Développer des outils génériques d'extraction automatique de structures et d'événements
- Possibilité d'utiliser des codes de propagation pour relier les événements entre eux
- Capacités et outils OV

# Outils de propagation



# Outils de propagation



## Idée :

Associer les données en fonction de la physique qui les relie



Modèle de propagation associé aux données

# Services

Service Name	Purpose
<i>Search Metadata</i>	
Heliophysics Event Catalogue (HEC)	Maintain and provide access to <i>existing</i> event data from all domains
Heliophysics Feature Catalogue (HFC)	Maintain and provide access to existing feature data from all domains
MetaData Evaluation Service (MDES)	Allows the user to create an auxiliary event list based on a <i>newly-derived</i> parameter, etc.
Context Service (CXS)	Provide context information to help the user make a selection
<i>Review suitable observations</i>	
Instrument Capabilities Service (ICS)	Match required observation type to one or more instruments (each part of an observatory)
Instrument Location Service (ILS)	Determine the location of an instrument (part of an observatory) at a specified time
Observation Coverage Service (OCS)	Provide information on whether an instrument was making suitable observations at a specified time
<i>Locate and Retrieve the Data</i>	
Data Provider Access Service (DPAS)	Provide integrated access to data archives in all domains no matter how the data are stored or accessed
<i>Enabling Services</i>	
HELIO Registry Service (HRS)	Maintain and provide access to a registry that describes all the services available to HELIO
Community Interaction Service (CIS)	Manages interactions with the community, including authentication and usage statistics
Processing Service	Support processing on demand
Storage Service	Provide storage for user information
Ancillary Information Service (AIS)	Provide integrated access to external resources that do not conform to HELIO interface standards
Coordinate Transformation Service (CTS)	Translated between the different coordinate systems used by the communities
Semantic Mapping Service (SMS)	Maps terms used in the metadata from the different communities
HELIO Monitoring Service (HMS)	Keeps track of the status and performance of the services that the HRS knows about
Resource Usage Service (RUS)	Keeps track of usage of HELIO so that the project can provide statistics to users, providers, etc.

→ (> 40 catalogues)

→ (Filaments, ARs, CHs, Sursauts radio, etc)

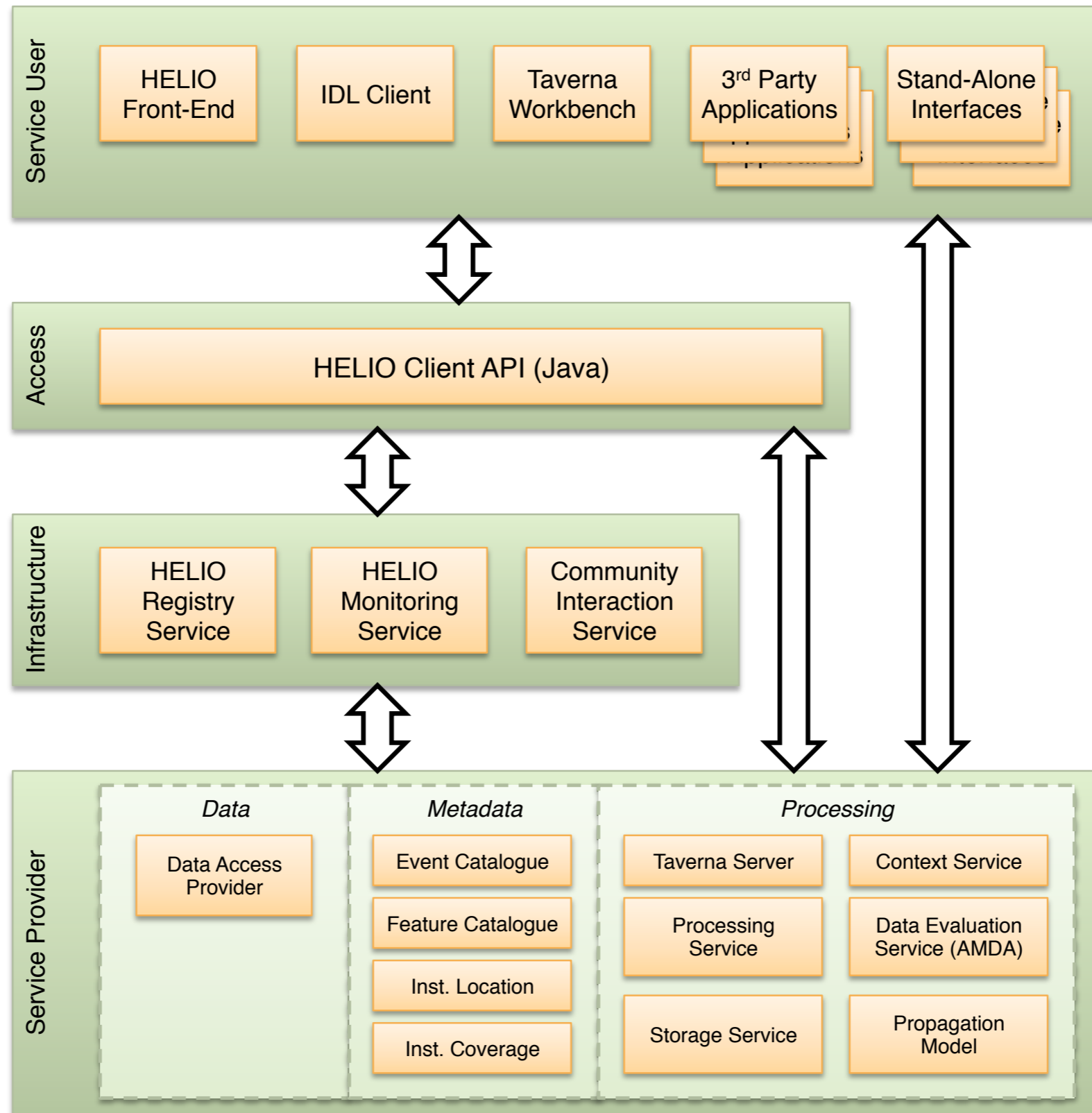
→ (AMDA)

→ (VSO, MEDOC, etc.)

→ «Yellow pages»

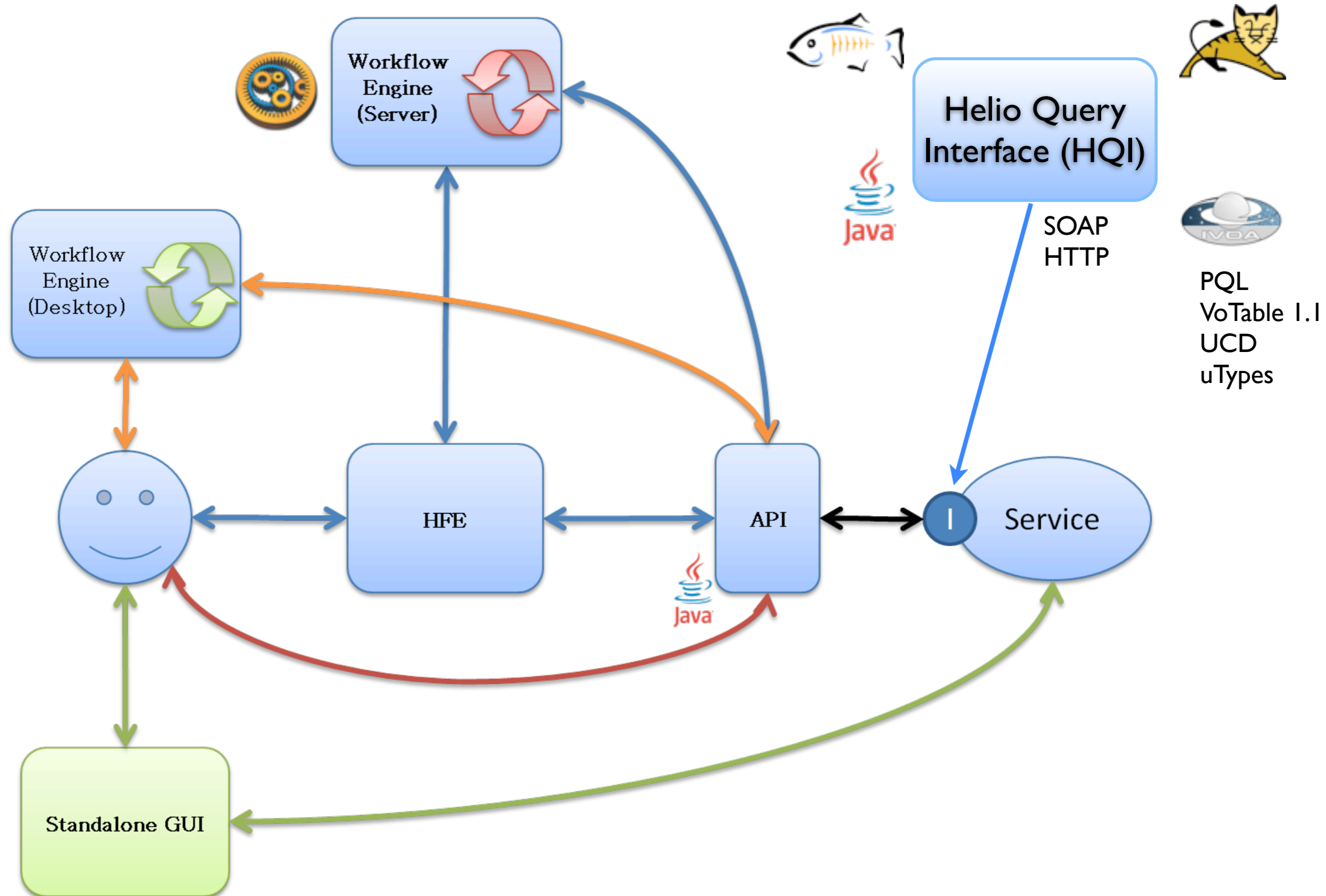
→ (NAGIOS)

# Infrastructure





# Architecture



# HELIO Front End

HELIO FrontEnd

HELIO FrontEnd

http://helio.i4ds.technik.fhnw.ch/Helio-dev/prototype/explorer

HELIO

HELIOPHYSICS INTEGRATED OBSERVATORY

Explorer Help

Services Advanced User

Search Events Search Data Search Instruments by Capability Search Instruments by Location

Data Cart

Events Events

Search Events

Query Form

Result

Save as VOTable

hec-goes\_sxr\_flare

Get Details	hec_id
Get Details	65410
Get Details	65411
Get Details	65412
Get Details	65413
Get Details	65414
Get Details	65415
Get Details	65416

Event Details

Start Date  
2011-01-03T13:44:00

End Date  
2011-01-03T14:11:00

Plots

S00\_AIA\_193A  
31-Dec-2010 06:12:43

Flares from 31-Dec-2010 to 3-Jan-11 12:44 UT

Get GOES Plot

Get Parker Plot

Additional Links

SolarMonitor for 03-Jan-2011 <http://solarmonitor.org/index.php?date=20110103>

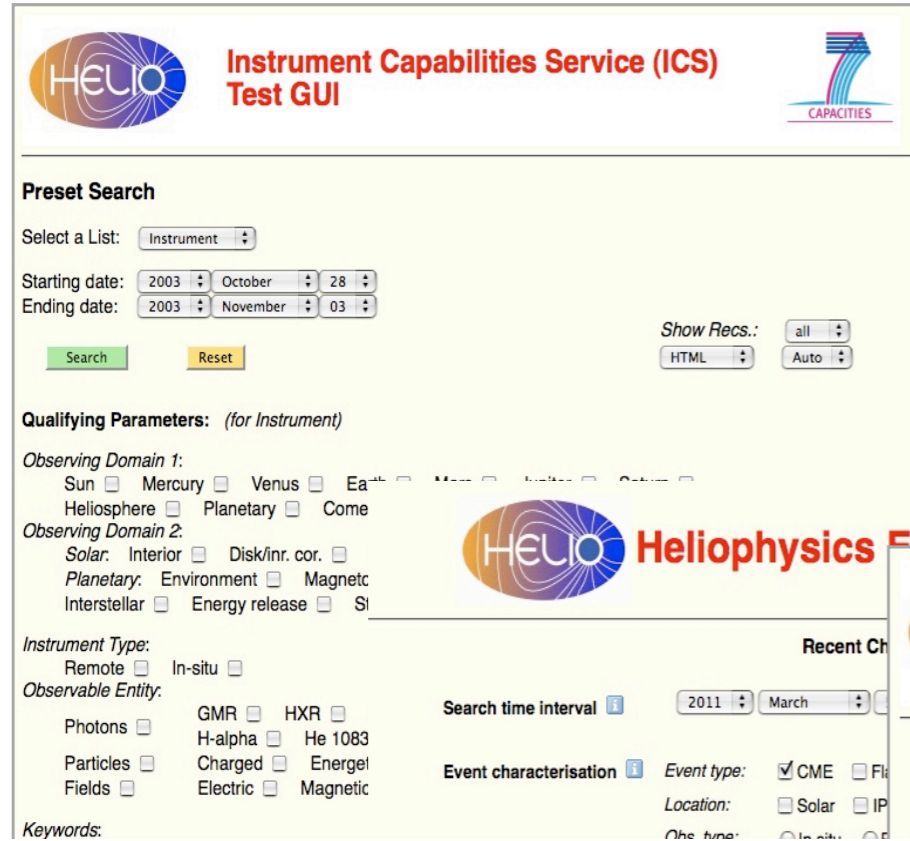
Space Weather for 03-Jan-2011 <http://spaceweather.com/archive.php?view=1&dav=03&month=01&year=2011>

<http://helio.i4ds.technik.fhnw.ch/Helio-dev/prototype/explorer>

Forum VO-Paris, 21 Novembre 2011

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# Standalone GUIs



**Instrument Capabilities Service (ICS) Test GUI**

**Preset Search**  
 Select a List: Instrument  
 Starting date: 2003 October 28  
 Ending date: 2003 November 03  
 Show Recs.: all  
 HTML Auto

**Qualifying Parameters: (for Instrument)**

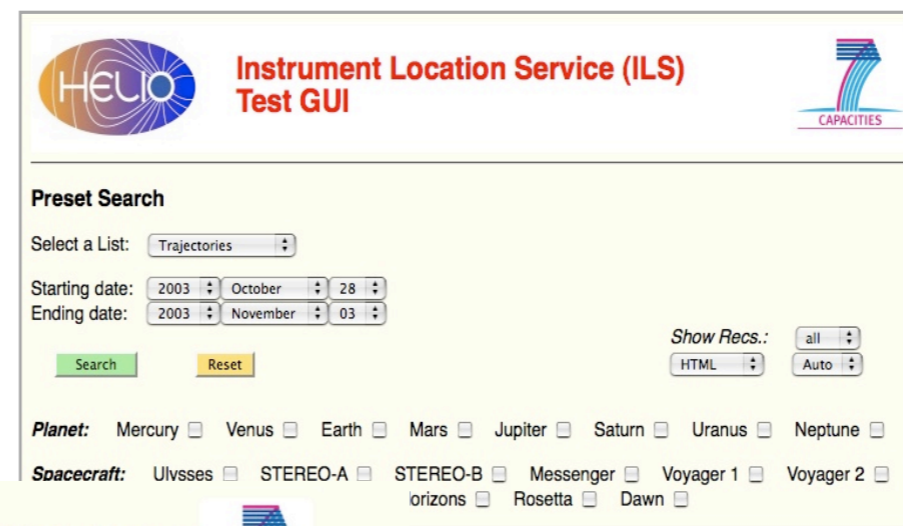
**Observing Domain 1:**  
 Sun Mercury Venus Earth Mars Jupiter Saturn  
 Heliosphere Planetary Comet

**Observing Domain 2:**  
 Solar: Interior Disk/Inr. cor.  
 Planetary: Environment Magnetospheric  
 Interstellar Energy release

**Instrument Type:**  
 Remote In-situ

**Observable Entity:**  
 Photons GMR HXR  
 H-alpha He 1083  
 Particles Charged Energetic  
 Fields Electric Magnetic

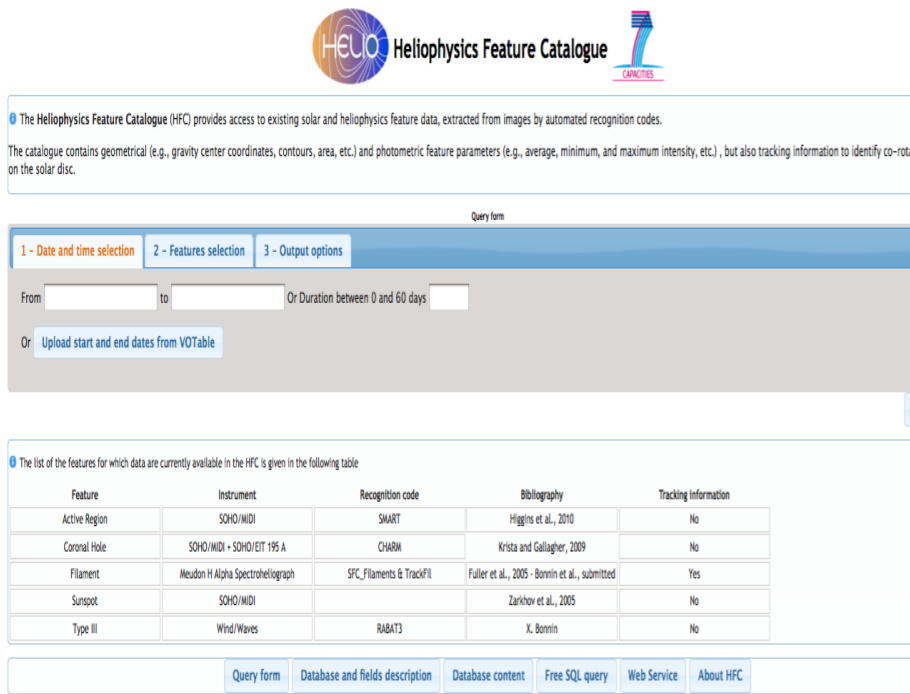
**Keywords:**



**Instrument Location Service (ILS) Test GUI**

**Preset Search**  
 Select a List: Trajectories  
 Starting date: 2003 October 28  
 Ending date: 2003 November 03  
 Show Recs.: all  
 HTML Auto

**Planet:** Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune  
**Spacecraft:** Ulysses STEREO-A STEREO-B Messenger Voyager 1 Voyager 2  
 Orizons Rosetta Dawn



**Heliophysics Feature Catalogue**

The Heliophysics Feature Catalogue (HFC) provides access to existing solar and heliophysics feature data, extracted from images by automated recognition codes. The catalogue contains geometrical (e.g., gravity center coordinates, contours, area, etc.) and photometric feature parameters (e.g., average, minimum, and maximum intensity, etc.), but also tracking information to identify co-rotating feature on the solar disc.

**Query form**

1 - Date and time selection 2 - Features selection 3 - Output options

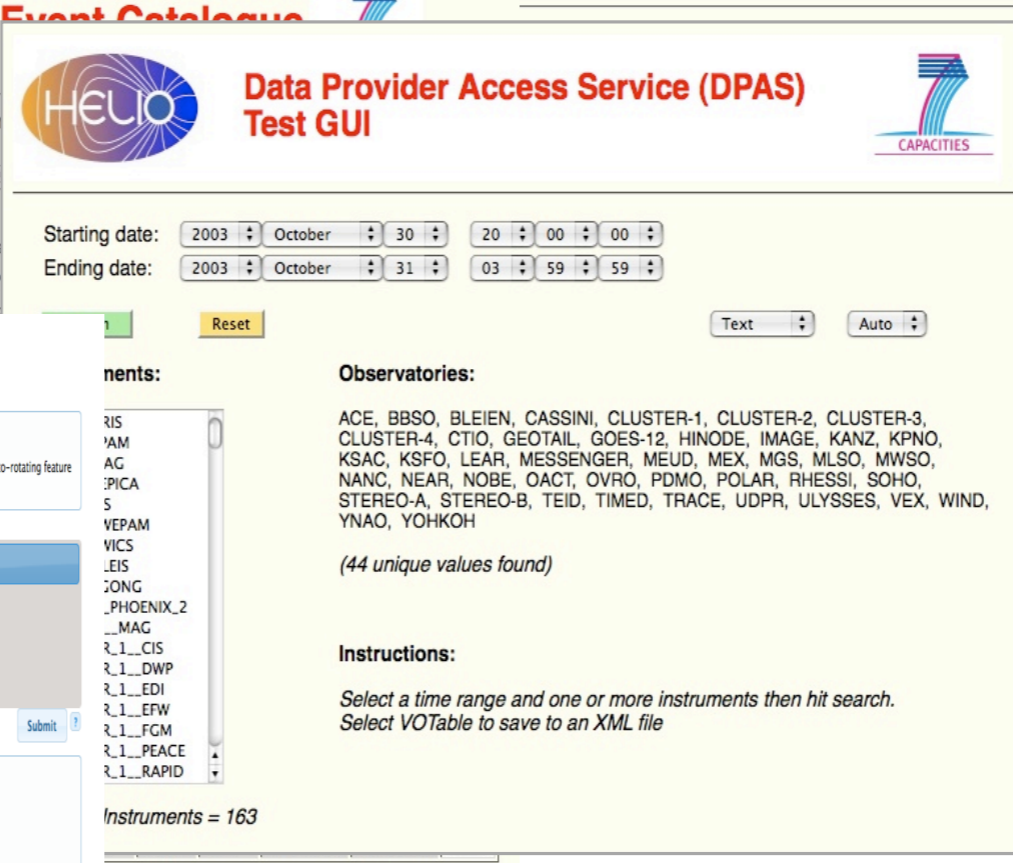
From: to Or Duration between 0 and 60 days  
 Or Upload start and end dates from VOTable

Submit

The list of the features for which data are currently available in the HFC is given in the following table:

Feature	Instrument	Recognition code	Bibliography	Tracking information
Active Region	SOHO/MDI	SMART	Higgins et al., 2010	No
Coronal Hole	SOHO/MDI + SOHO/EIT 195 A	CHARM	Krsta and Gallagher, 2009	No
Filament	Meudon H Alpha Spectroheliograph	SFC_Filaments & TrackFil	Fuller et al., 2005 - Bonnin et al., submitted	Yes
Sunspot	SOHO/MDI		Zarkov et al., 2005	No
Type II	Wind/Waves	RABAT3	X. Bonnin	No

Query form Database and fields description Database content Free SQL query Web Service About HFC



**Data Provider Access Service (DPAS) Test GUI**

**Starting date:** 2003 October 30 20 00 00  
**Ending date:** 2003 October 31 03 59 59

Reset Text Auto

**Instruments:**  
 RIS  
 YAM  
 AM  
 AG  
 :PICA  
 S  
 VEPAM  
 VICS  
 .EIS  
 JONG  
 \_PHOENIX\_2  
 \_MAG  
 R\_1\_CIS  
 R\_1\_DWP  
 R\_1 EDI  
 R\_1\_EFW  
 R\_1\_FGM  
 R\_1\_PEACE  
 R\_1\_RAPID

**Observatories:**  
 ACE, BBSO, BLEIEN, CASSINI, CLUSTER-1, CLUSTER-2, CLUSTER-3, CLUSTER-4, CTIO, GEOTAIL, GOES-12, HINODE, IMAGE, KANZ, KPNO, KSAC, KSFO, LEAR, MESSENGER, MEUD, MEX, MGS, MLSO, MWSO, NANC, NEAR, NOBE, OACT, OVRO, PDMO, POLAR, RHESI, SOHO, STEREO-A, STEREO-B, TEID, TIMED, TRACE, UDPR, ULYSSES, VEX, WIND, YNAO, YOHKOH

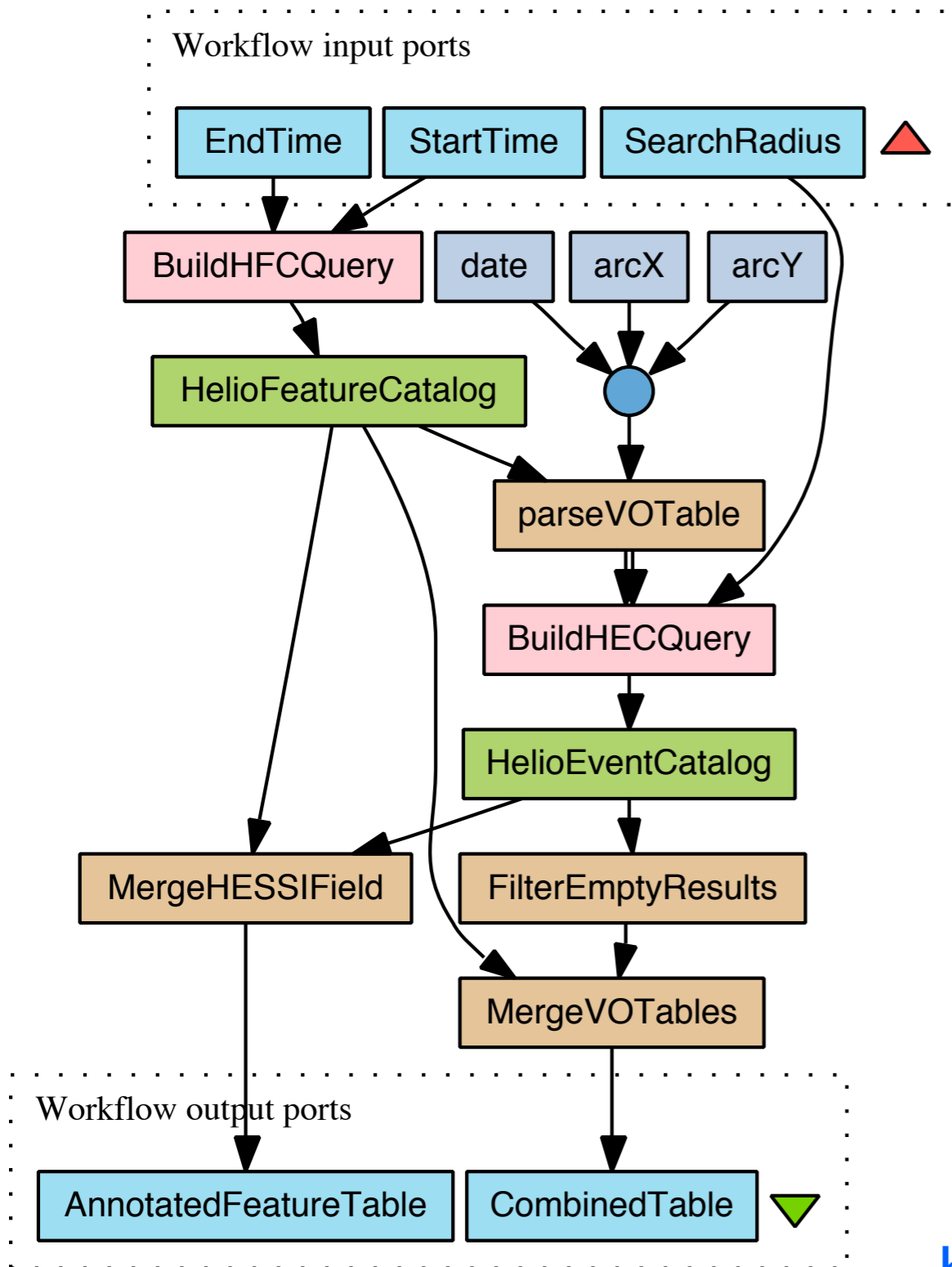
(44 unique values found)

**Instructions:**  
 Select a time range and one or more instruments then hit search.  
 Select VOTable to save to an XML file

Instruments = 163

[http://www.helio-vo.eu/services/service\\_interfaces.php](http://www.helio-vo.eu/services/service_interfaces.php)

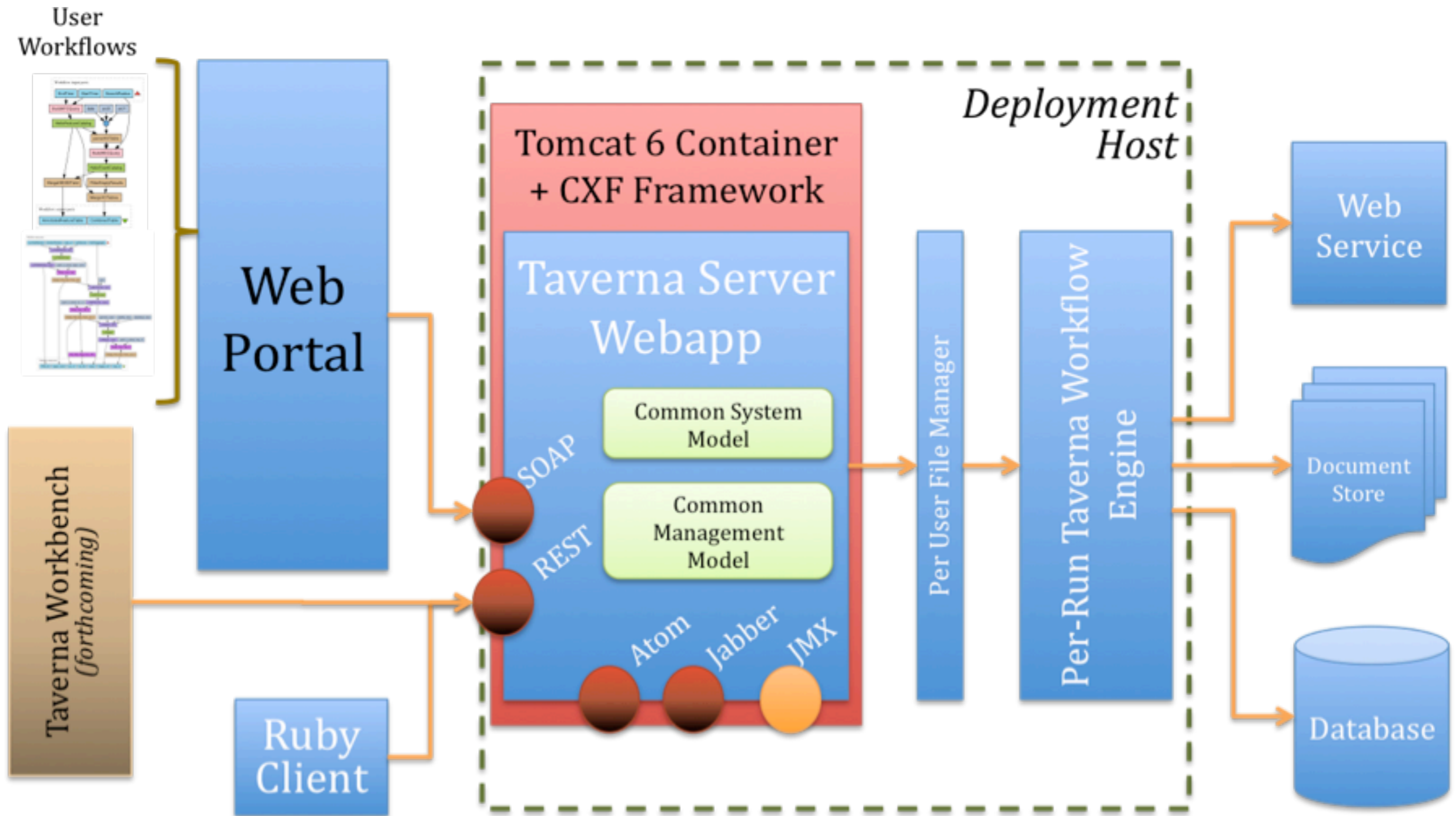
# Workflow



**my** experiment

<http://www.myexperiment.org/groups/101.html>

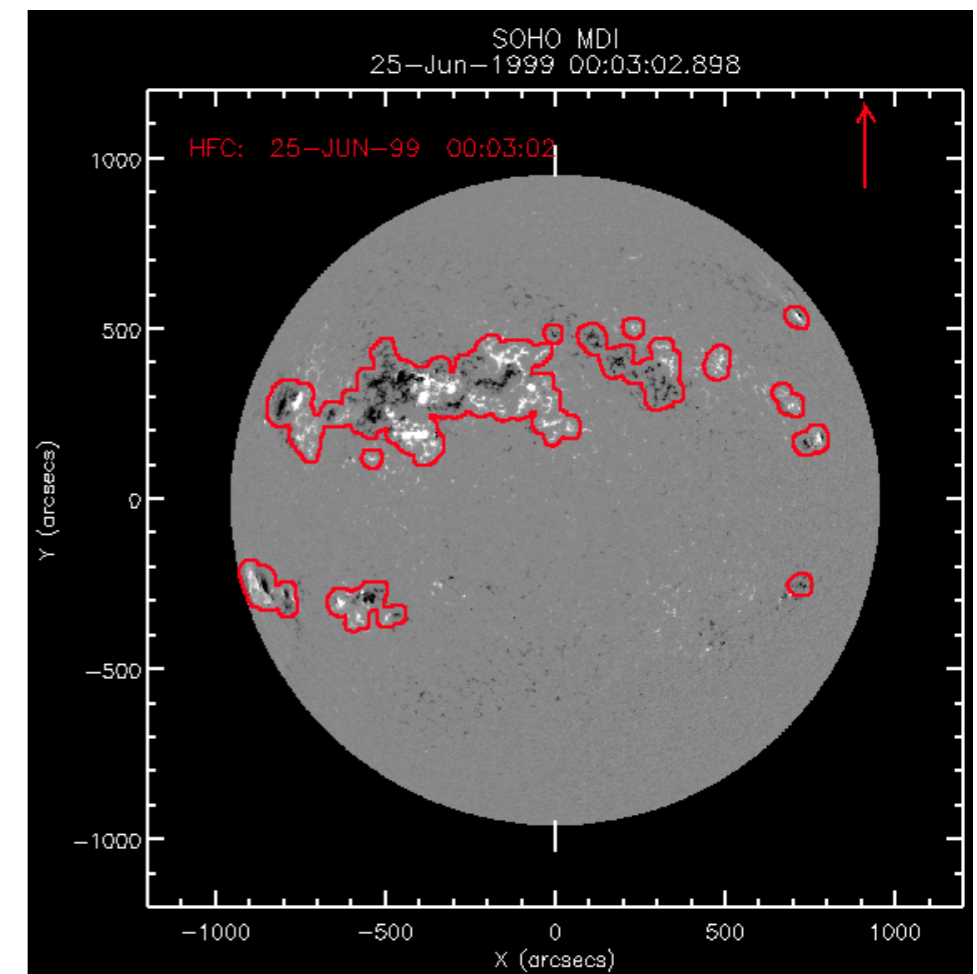
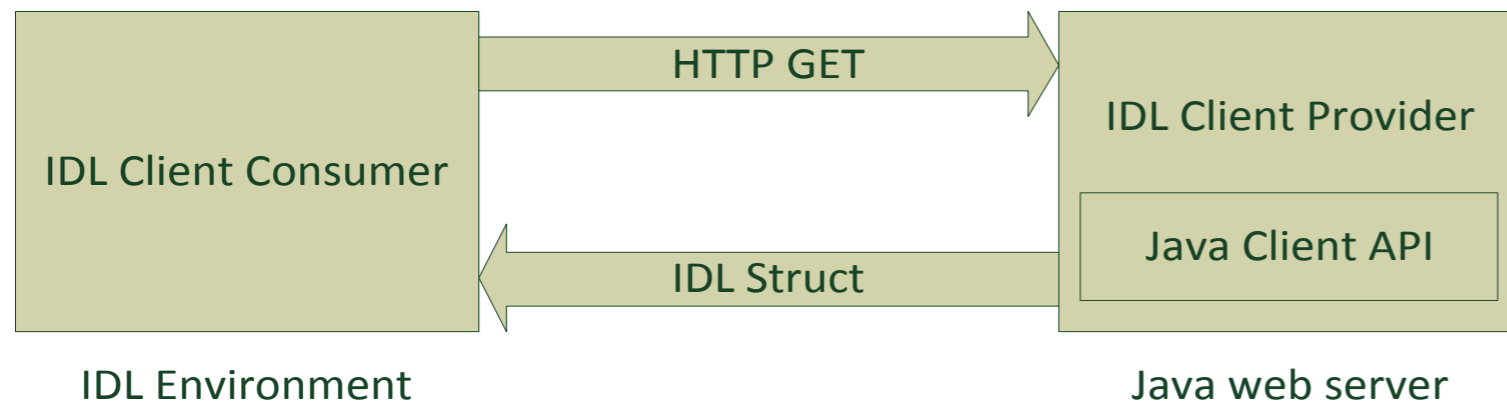
# Workflow Engine



# Clients API

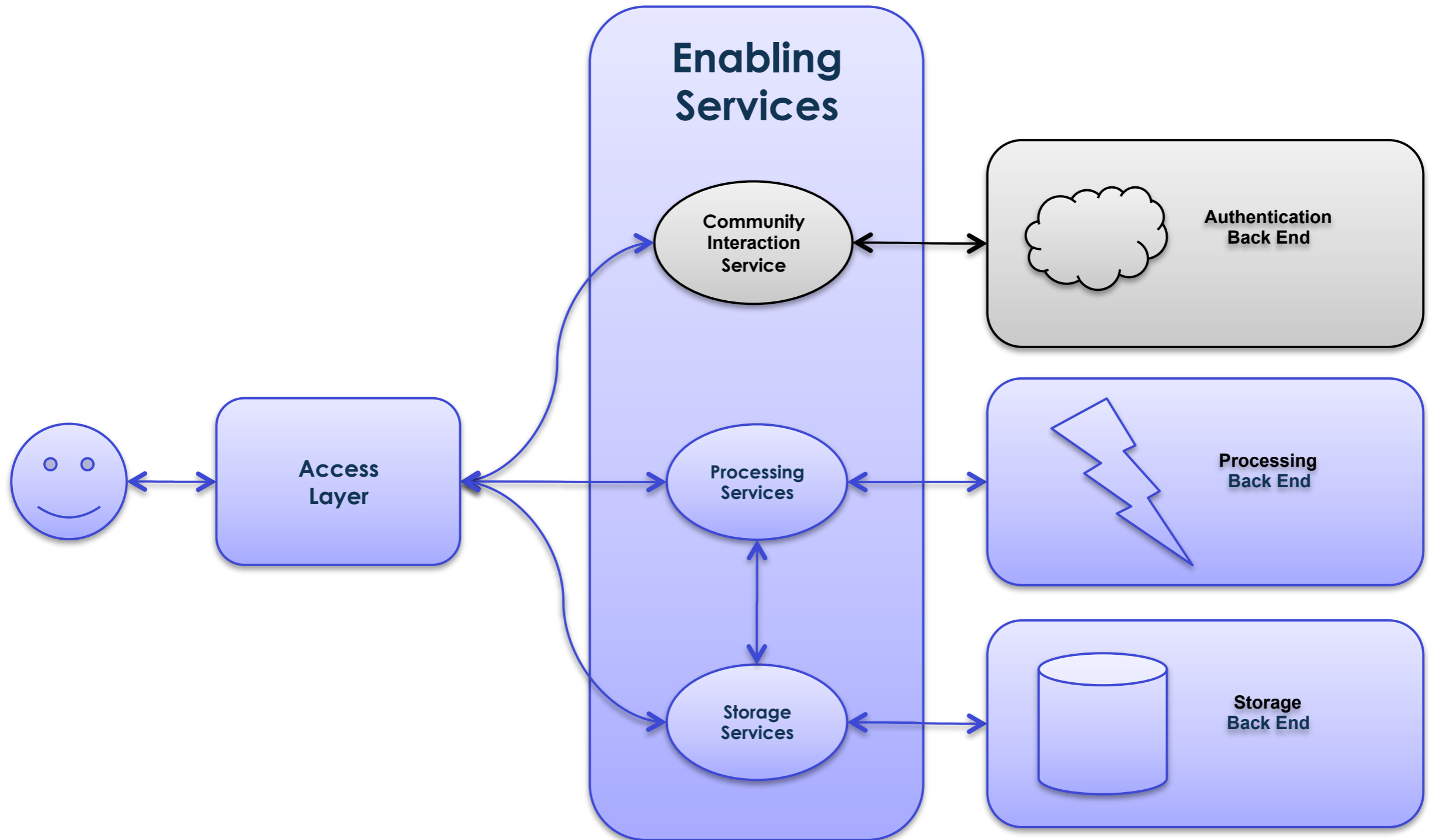
Implémentation dans SSW (package HELIO):

[http://www.helio-vo.eu/documents/help/ssw/helio\\_ssw\\_intro.html](http://www.helio-vo.eu/documents/help/ssw/helio_ssw_intro.html)



Implémentation en Python:  
<http://www.sunpy.org/>

# Enabling Services

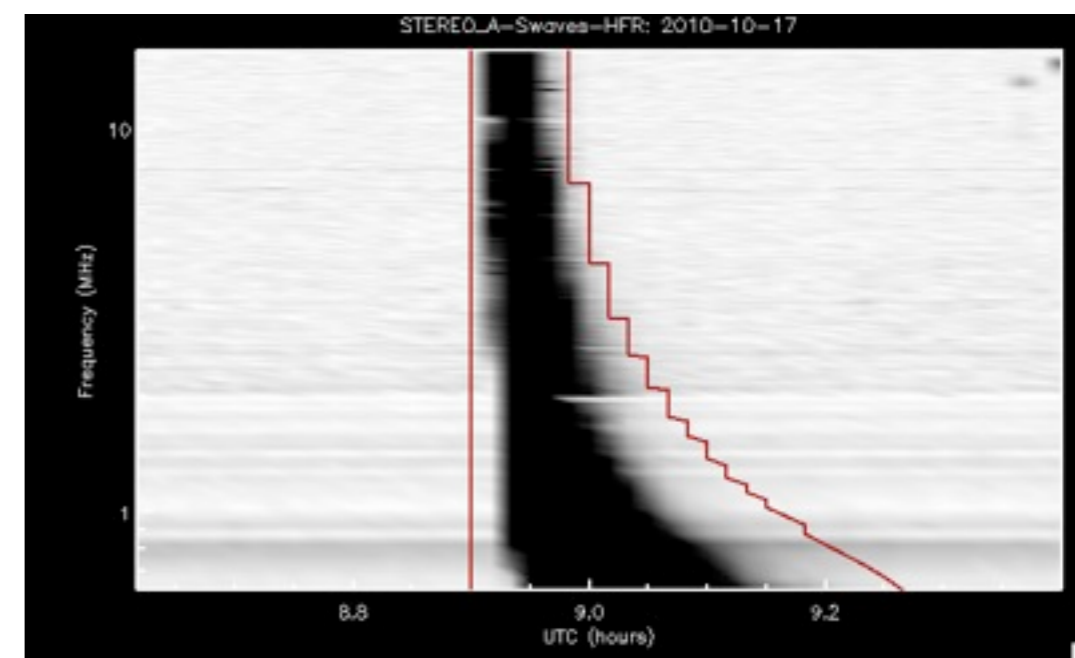
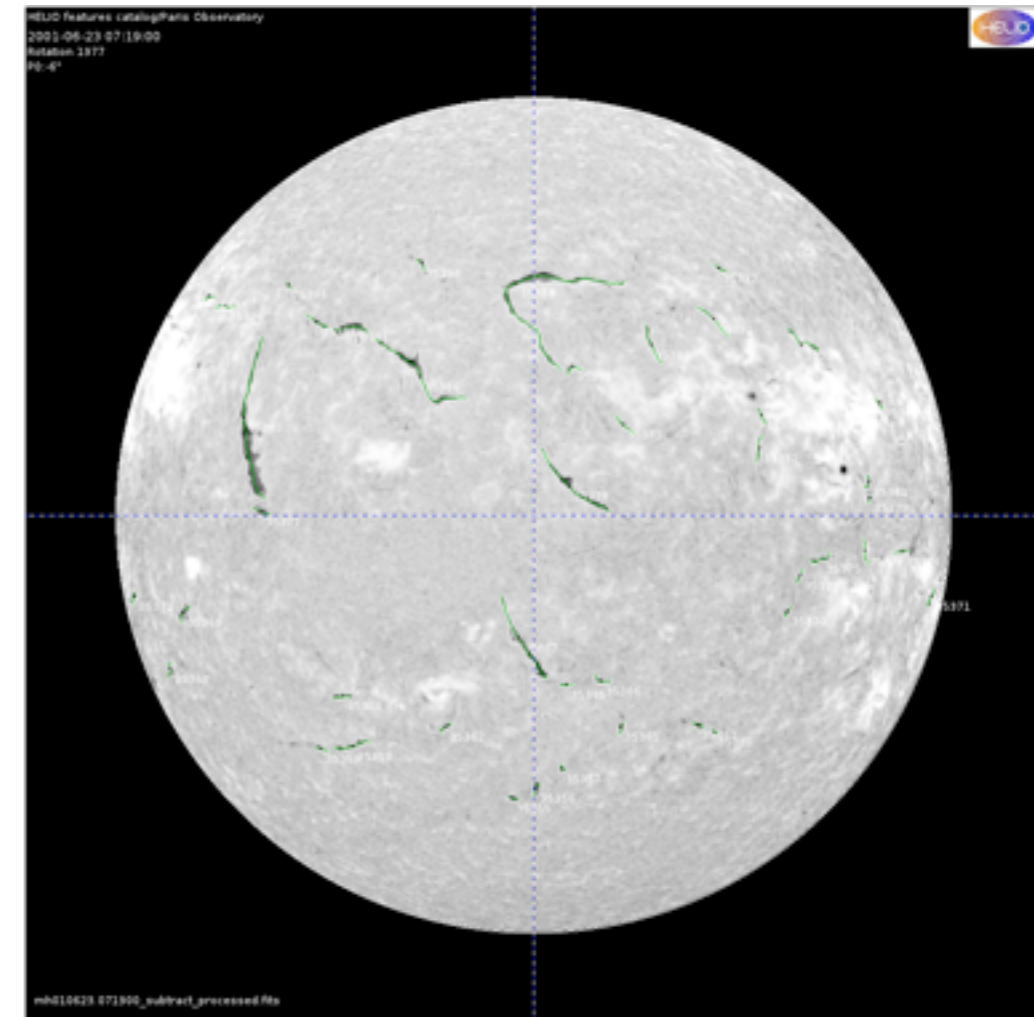


# Implication ObsParis

Développement et exécution de **codes de reconnaissance automatique** des structures solaires et heliosphériques:

- **Filaments** (Fuller et al, 2005, Bonnin et al., Submitted)
- Régions actives (Higgins et al, 2011, Barra et al., 2009)
- Trous coronaux (Krista and Gallagher, 2009, Barra et al., 2009)
- **Sursauts radio (type 3/2)** (Lobzin et al., 2009/2010)

(Sources radio NRH, Emissions radio aurorales, etc.)



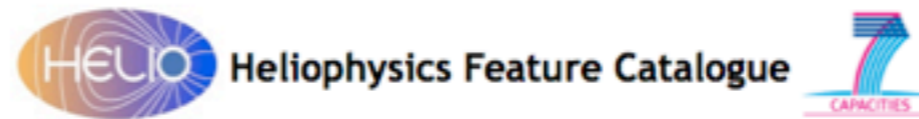


# Implication ObsParis

## Heliospheric Feature Catalogue:

- Base de données de structures (*MySQL*):
  - ↳ <http://voparis-mysql5-paris.obspm.fr>
- Interface de requête Helio (*Tomcat 6*)
  - ↳ <http://voparis-helio.obspm.fr/helio-hfc/HelioService>
- Interface graphique:
  - ↳ <http://voparis-helio.obspm.fr/hfc-gui/index.php>
- (VOSI, SSW, etc.)

# Implication ObsParis



The Heliophysics Feature Catalogue (HFC) provides access to existing solar and heliophysics feature data, extracted from images by automated recognition codes.

The catalogue contains geometrical (e.g., gravity center coordinates, contours, area, etc.) and photometric feature parameters (e.g., average, minimum, and maximum intensity, etc.) , but also tracking information to identify co-rotating feature on the solar disc.

Query form

1 - Date and time selection   2 - Features selection   3 - Output options

From  to  Or Duration between 0 and 60 days

Or

?

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Coronal Hole	SOHO/MIDI + SOHO/EIT 195 A	CHARM	Krista and Gallagher, 2009	No
Filament	Meudon H Alpha Spectroheliograph	SFC_Filaments & TrackFil	Fuller et al., 2005 - Bonnin et al., submitted	Yes
Sunspot	SOHO/MIDI		Zarkhov et al., 2005	No
Type III	Wind/Waves	RABAT3	X. Bonnin	No

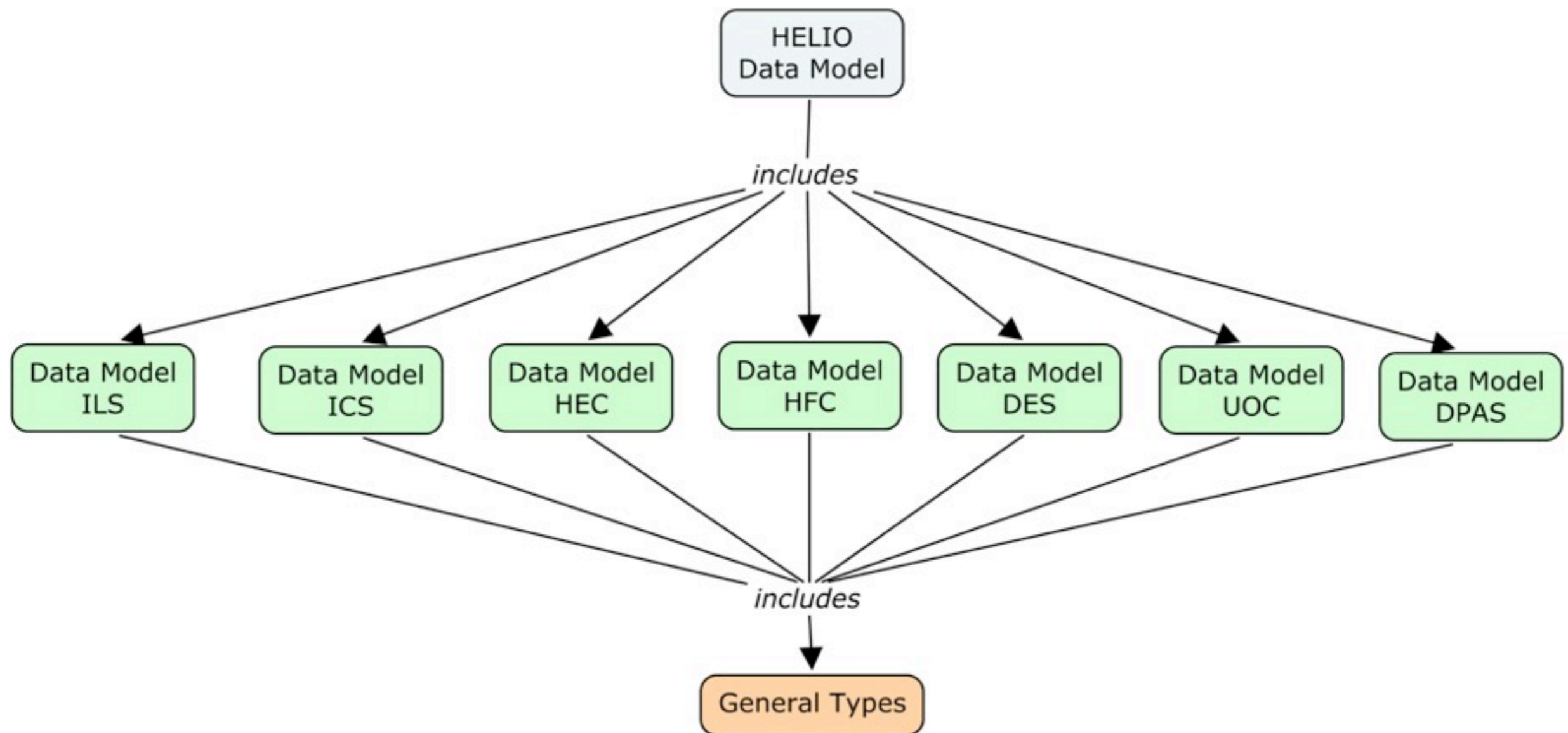
FP7, project No. 238969



<http://voparis-helio.obspm.fr/hfc-gui/index.php>

# Implication ObsParis

- Discussion sur les standards (SPASE)



# Echéances

Mise en place progressive:

<http://www.helio-vo.eu/>



The screenshot shows the HELIO website homepage. At the top left is the HELIO logo, a stylized sun with the word 'HELIO' inside. To its right is the text 'HELIO Heliophysics Integrated Observatory'. Further right is the CAPACITIES logo, a stylized number '7' with the word 'CAPACITIES' below it. Below these logos is a navigation bar with links: Home, Access, Work Plan, Community, About Us, and Internal. The main content area has a sidebar on the left with links: Home, Overview, Science, Interfaces, News, and CDAW-2. The main content area has a heading 'Overview' and several paragraphs of text describing the project. At the bottom of the page are logos for the European Grid of Solar Observations (EGSO), e-infrastructure, and the European Union flag.

**HELIO**  
*Heliophysics Integrated Observatory*

Home Access Work Plan Community About Us Internal

**Overview**

**Heliophysics** is a new research field that explores the *Sun-Solar System Connection*; it requires the joint exploitation of solar, heliospheric, magnetospheric and ionospheric observations.

The **Heliophysics Integrated Observatory, HELIO**, will deploy a distributed network of services that will address the needs of a broad community of researchers in heliophysics.

**HELIO** will provide the most comprehensive integrated information system in this domain; it will coordinate access to the resources needed by the community, and will provide access to services to mine and analyze the data.

**HELIO** is designed around a Service-oriented Architecture. The initial infrastructure will include services based on metadata and data servers deployed by the **European Grid of Solar Observations (EGSO)**. We will extend these to address observations from all the disciplines of heliophysics; differences in the way the domains describe and handle the data will be resolved using semantic-mapping techniques based on an ontology built from data models that exist in the domains. Processing and storage services will allow the user to explore the data and create the products that meet stringent standards of interoperability. These capabilities will be orchestrated with the data and metadata services using the Taverna workflow tool.

**HELIO** will be a key component of a worldwide effort to integrate heliophysics data and will coordinate closely with international organizations to exploit synergies with complementary domains.

**HELIO** is a **Research Infrastructures** funded under the Capacities Specific Programme within the European Commission's **Seventh Framework Programme (FP7)**; Project No. 238969). The project started on 1 June 2009 and has a duration of 36 months.

EGSO e-infrastructure

Implication forte de la communauté  
(CDAW3, IAS, Orsay, Février 2011)