Virtual Solar Observatory (VSO)

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What I will touch on

- VSO Web Interface
- VSO Query Path (Now and in the future)
  - Interaction with JMD
- Programmatic Interface
  - IDL (Most development effort)
- Interaction with HEK / (J)Helioviewer
  - or what we want it to be!
- What still needs to be done in the VSO?

SDO Status: The AIA and HMI data are not yet fully calibrated, but test series are available for scientists to see the headers and otherwise test their compatability with their tools. We have not yet started on EVE integration.

Search VSO Help or enter Cart Id: Go

Search for Solar Physics Data Products:

If you're new to the VSO, see How To Search, the FAQ or click the ⓘ icons for online help.

Please select which values you wish to use to search for data products:

- [x] **Time**
  Search by time interval.
  Derive time intervals from event catalogs
- [ ] **Observable**
  Search based on physical observables ⓘ
- [x] **Instrument / Source / Provider**
  Search based on instruments ⓘ or data archives ⓘ
  - [ ] Compact listing
  - [ ] Instrument / Source (not provider dependent)
  - [ ] Instrument Only (not source or provider dependent)
- [x] **Spectral Range**
  Search based on a spectral range
- [ ] **Nicknames**
  Search based on common terms used to describe data products
  Note: Nicknames generate an intersection with other search terms, so searching for a nickname, and a physical observable (or other parameter) when a nickname defines other physical observables will result in no matches.
  - [ ] Show Nickname Definitions

Searching against current VSO instances

Generate VSO Search Form

http://virtualsolar.org

Start Date/Time: 2010 Jul 01 / 00 : 00
End Date/Time: 2010 Jul 01 / 00 : 01
All Month All Day

Search Clear

All from Provider	All from Source	Instrument	Date Range
☐ JSOC	SDO	☑ AIA	2010.05.23 →
		☐ HMI	2010.03.29 →

Search Clear

Spectral Range

- ☐ soft X-rays [1 - 100 Å]
- ☐ extreme UV [100 - 1000 Å]
- ☐ ultraviolet [900 - 3800 Å]
- ☐ visible [3500 - 10000 Å]
- ☐ radio [0.3 - 30 GHz]
- ☑ **OR** select spectral range:
  - min 193
  - max 193
  - unit Angstrom

Search Clear

All from Provider	All from Source	Source	Instrument	Date Range
HANET		BBSO	BBSO	2000.07.05 →
		KANZ	KANZ	2001.02.07 →
		OACT	OACT	2002.02.26 →
		OBSPM	OBSPM	2004.10.22 →
		YNAO	YNAO	2000.11.27 →
HAO		MLSO	chp	1996.04.20 →
			dpm	1994.02.20 →
			mk4	1998.10.01 →
JSOC		SDO	AIA	2010.05.23 →
			HMI	2010.03.29 →
LSSP		RHESSI	RHESSI	2002.02.12 →
MSU		YOHKOH	BCS	1991.09.01 – 2001.12.14
			HXT	1991.09.03 – 2001.12.14
			SXT	1991.09.03 – 2001.12.14
			WBS	1991.09.01 – 2001.12.14
MWSPADP		MtWilson	60-ft SHG	1915.08.10 – 1985.12.31
NGDC		GOES-12	SXI-0	2001.09.10 →
NSO		Evans	spectroheliograph	1996.02.05 – 1999.05.28
		GONG	Big Bear	2005.04.11 →
			Cerro Tololo	2005.02.24 →
			El Teide	2005.02.25 →
			Learmonth	2005.02.25 →
			MERGED GONG	2001.07.22 →
			Mauna Loa	2005.04.11 →
		KPVT	512-channel magnetograph	1974.02.01 – 1993.04.10
			spectromagnetograph	1992.04.19 – 2003.09.21
		McMath	solar fts spectrometer	1976.03.31 – 2002.08.11
		O-SPAN	O-SPAN	2002.12.11 →
		SOLIS	vsm	2004.01.02 →
OBSPM		Nancay	Decametric Array	2003.03.10 →
			Radioheliograph	1996.10.20 →
		OBSPM	Meudon Spectroheliograph	1995.12.01 →
		Pic du Midi	Coronagraph	1995.10.20 →
OVRO		OVRO	OVSA	2000.03.16 →
SAO		Hinode	XRT	2006.10.23 →
SDAC		Hinode	EIS	2006.10.23 →
			SOT	2006.10.23 →
		SOHO	CDS	1996.01.19 →
			CELIAS	1995.12.02 →
			COSTEP	1995.12.07 – 2003.05.01
			EIT	1996.01.01 →
			ERNE	1996.05.08 – 2001.06.01
			GOLF	1996.01.01 →
			LASCO	1995.12.08 →
			MDI	1996.05.01 →
			SUMER	1996.01.22 →
			SWAN	1996.01.12 →
			UVCS	1996.01.20 →
			VIRGO	1995.12.06 →
		TRACE	TRACE	1998.02.16 →
SFO		SFO	CFDT1	1986.05.26 →
			CFDT2	1992.01.11 →
SHA		GONG	Big Bear	2001.03.14 →
			Cerro Tololo	2001.04.20 →
			El Teide	2001.07.30 →
			Learmonth	2001.04.30 →
			Mauna Loa	2001.06.16 →
			Udaipur	2001.10.25 →
		JSPO	MOTH	2003.01.01 – 2003.01.20
		MtWilson	MOF/60	1996.05.01 →
		SOHO	MDI	1996.01.30 →
		TON	Big Bear	1996.06.01 – 1996.08.31
			Tenerife	1996.06.03 – 1996.08.06
SSC		STEREO_A	IMPACT	2006.10.01 →
			PLASTIC	2006.10.01 →
			SECCHI	2006.11.06 →
			SWAVES	2006.10.27 →
		STEREO_B	IMPACT	2006.10.01 →
			PLASTIC	2006.10.12 →
			SECCHI	2006.11.07 →
			SWAVES	2006.10.27 →

VSO Search Results

Select view type to display additional columns

Sorts based on order the table column was ticked

Check box you want to sort by

Show Search Params :: [show]

total entries: 9

<< prev - 1 - next >>

Sort Only | Rearrange only | Sort & Rearrange

Views: Basic | Thumbs | Links | **Long**

Search VSO Help or enter Cart Id:

Go

VSO Glossary

VSO FAQ

Click on the icons for online help.

Query Menu [hide]

New Search

Edit Search

Search Status [show]

No Errors; No Warnings

Rows Returned [hide]

JSOC • 9 Records Found • 9 Returned

Add/Remove Columns [show]

CheckBox Tools

Select ...

All Above this box

All Below this box

Just this box

Select All | Clear

Request Data

Add to Shopping Cart

Export to Text

Thumbnail	Time Start	Time End	Min Spectral Range	Max Spectral Range	Wave Type	Observable	Source	Provider	Instrument	Extent	File Size	File url	Info Misc.	Provider Product Id
	2010.07.01 00:00:06	2010.07.01 00:00:07	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	4200	N/A	N/A	N/A
	2010.07.01 00:01:30	2010.07.01 00:01:31	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	4200	N/A	N/A	N/A
	2010.07.01 00:00:42	2010.07.01 00:00:43	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:00:54	2010.07.01 00:00:55	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:01:06	2010.07.01 00:01:07	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:01:18	2010.07.01 00:01:19	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:01:30	2010.07.01 00:01:31	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:01:42	2010.07.01 00:01:43	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A
	2010.07.01 00:01:54	2010.07.01 00:01:55	193 Å	193 Å	NARROW	intensity	SDO	JSOC	AIA	FULLDISK	66200	N/A	N/A	N/A

Comments? Help us improve VSO

VSO @ Home NSO Stanford

Thursday, 09 September 2010 about 1:27 PM E

CART ID: VSO-SDAC-100909-134256
CART Data Request

Search VSO Help or enter Cart Id:

Go

VSO Glossary
VSO FAQ
Click on the ⓘ icons for online help.

Query Menu [hide]

New Search ⓘ
Edit Search ⓘ
Continue Adding to Cart ⓘ
Click & Bookmark
Email This Cart
Track Your Request
Back to Cart

Search Status [show]

Sessions : 09-Sep-2010 17:26:23 UTC

Provider	Select Transfer Method
JSOC ⓘ	(•) URL-FILE ⓘ ( ) URL-FILE_Rice ⓘ

Request Data

CART ID: VSO-SDAC-100909-134256
Request Status

Session 1 : 09-Sep-2010 17:26:23 UTC

Provider	Time	State	Comments
JSOC	09-Sep-2010 17:44:59 UTC	DONE	• http://kurasuta.cfa.harvard.edu/cgi-bin/VSO/prod/drms_export.cgi?series=aia_synoptic2;record=193_11744640-11744640 • http://kurasuta.cfa.harvard.edu/cgi-bin/VSO/prod/drms_export.cgi?series=aia_synoptic2;record=193_11744641-11744641

Search VSO Help or enter Cart Id:

Go

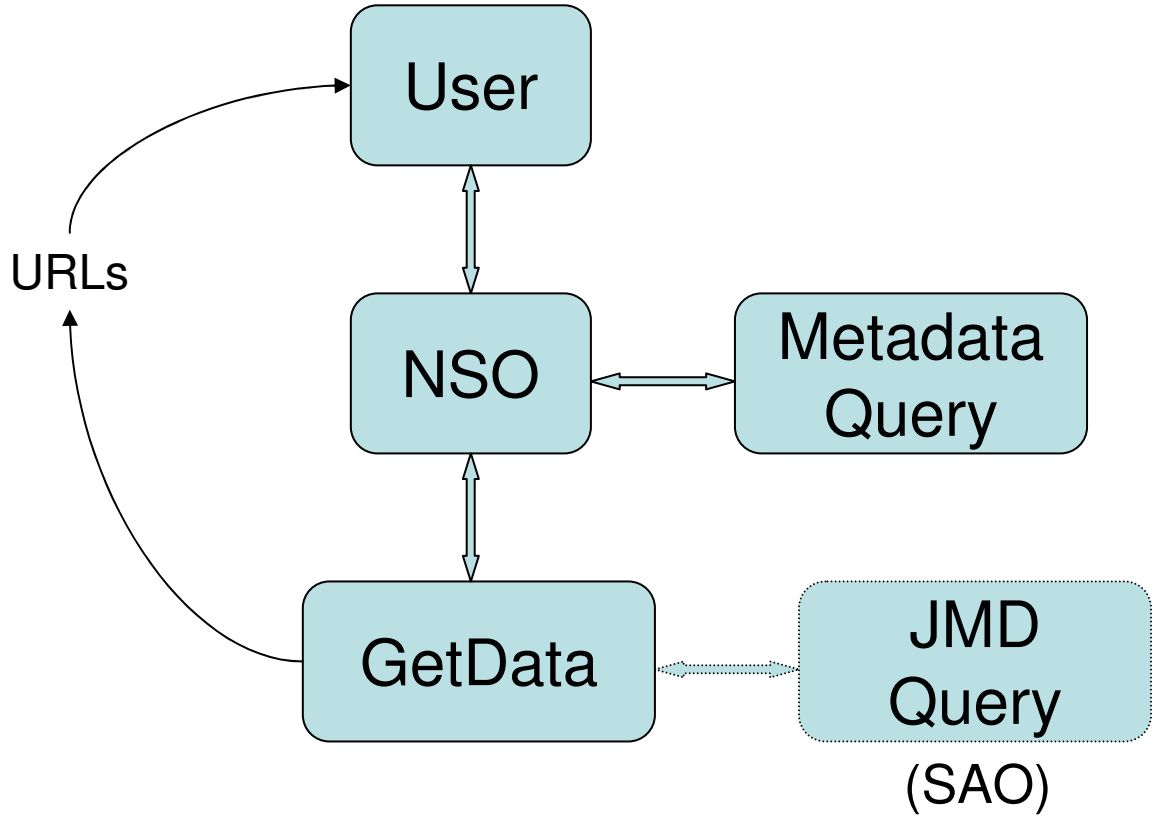
VSO Glossary
VSO FAQ
Click on the ⓘ icons for online help.

Query Menu [hide]

New Search ⓘ
Edit Search ⓘ
Continue Adding to Cart ⓘ
Click & Bookmark
Email This Cart
Track Your Request
Back to Cart

Search Status [show]

Export Links



Current VSO Download
Scheme

VSO programmatic interface

- Why using the VSO in a programmatic way?

Because you can:

  - Embed VSO calls in existing code
  - perform complex queries
  - Query on fields that the GUI might not implement.
  - Engage in querying providers that offer specific extended interfaces. E.g. XRT

- Use the WSDL Luke!

Java sample code

```
// Create SOAP service handler class
VSOiServiceStub service = new VSOiServiceStub();

// Create and populate request block
QueryRequestBlock block = new QueryRequestBlock();
Time timeParam = new Time();
timeParam.setStart("20100909000000");
timeParam.setEnd(  "20100909000002");

block.setTime(timeParam);       // Set Time
block.setPixels("1024");        // Set Pixel resolution
block.setProvider("jsoc");      // Set Provider
block.setInstrument("aia");     // Set Instrument

QueryRequest request = new QueryRequest();
request.setVersion(new Float("0.6").floatValue());
request.setBlock(block );       // Set block query

Query query = new Query();
query.setBody(request);         // Set request message in SOAP body

//Finally perform the request.
QueryResponseE response = service.query(query);

//Request is sent and received.
//The request is type array.
ProviderQueryResponse qReturn[] = response.getBody().getProvideritem();
```

Perl interface

- The simplest one (Native interface)
  - Just needs SOAP::Lite
  - An end point
  - A perl structure
    - Example:

```
my $client = SOAP::Lite
-> proxy('http://sdac.virtualsolar.org/cgi-bin/vsoi')
-> uri('http://virtualsolar.org/VSO/VSOi')
my $results = $client->Query(
{ version=>'1.0',
  block => { provider=>'jsoc',
        instrument=>'aia',
        time=>{
             start=>'20100701000000',
                    end=> '20100701000000'
            }
       }
 });
```

Further Documentation can be found at:
http://sdo1.nascom.nasa.gov/drms/idl/vso_search.pro

- Just two IDL (SSWIDL) routines
  - vso_search
  - vso_get

- IDL > doc_menu, 'vso_search'
  - Gives you lots of info

IDL VSO

```
;+
; Program     : vso_search()
;
; Syntax      : IDL> records = vso_search( start_time, end_time, ... )
;               IDL> status = vso_get( records )
;
; Examples    : IDL> a = vso_search(date='2010-05-01', provider='jsoc')
;               IDL> a = vso_search(date='2010-5-4 - 2010-5-4T07:05', inst='hmi')
;               IDL> a = vso_search(date='2010/5/4T07:40-2010/5/4T07:45', inst='aia')
;               IDL> a = vso_search(date='2010-5-1', extent='FULLDISK', wave='171')
;               IDL> a = vso_search(date='2010-5-1', physobs='los_magnetic_field')
;               IDL> a = vso_search(date='2010/5/1', inst='aia', /DEBUG)
;               IDL> a = vso_search('2010/4/30','2010/05/31', wave='304 Angstrom', inst='aia')
;               IDL> a = vso_search('2010/5/1','2010/5/15', wave='94-211 Angstrom', inst='aia')
;               IDL> a = vso_search('2010-MAY-1', inst='aia', /FLAT, /URL)
;               IDL> a = vso_search(near='2010-05-24 02:00', inst='aia', wave='171', level=1)
;               IDL> a = vso_search('2010-05-01', inst='hmi', physobs='los_velocity', sample=3600)
;               IDL> a = vso_search(inst='aia', pixels=4096, /latest)
;
;               IDL> print_struct, a
;               IDL> print_struct, a.time       ; if not called with /FLATTEN
;               IDL> sock_copy, a.url           ; if called with /URLS
;               IDL> b = vso_get(a)             ; attempt to download products
;               IDL> b = vso_get(a[where(...)]) ; attempt to download a subset
;
; Inputs :
```

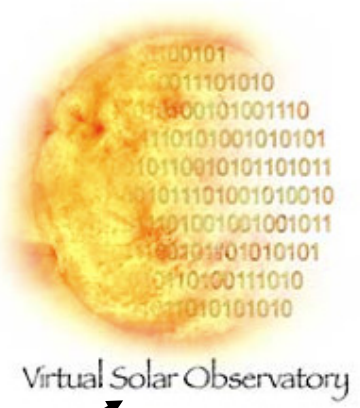
Specific Querying

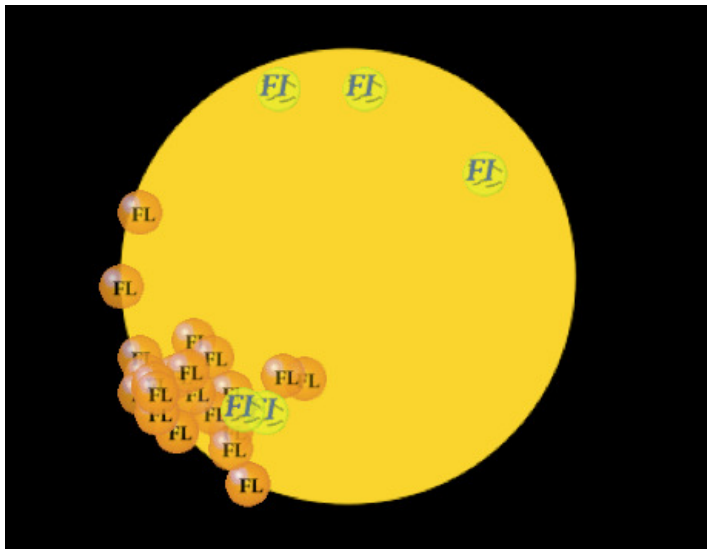
- Sampling: returns records per “sampling” period
  Sampling is in seconds
  E.g. Get records every hour
  - Xml:
    - <sample>3600</sample>
  - IDL
    - sample=3600
- Near querying: returns records closest to specified time
  Specify the time you want the closest product to be:
  - XML:
    - <near>20100909001001</near>
  - IDL:
    - near_time=“20100909001001”
  - Last record
    - You can get the last record by setting the start time a couple of hours in the past and the end time and near time to be now or slightly in the future.
    - IDL:
      - This is achieve simply by setting the flag : /latest

Specific Querying

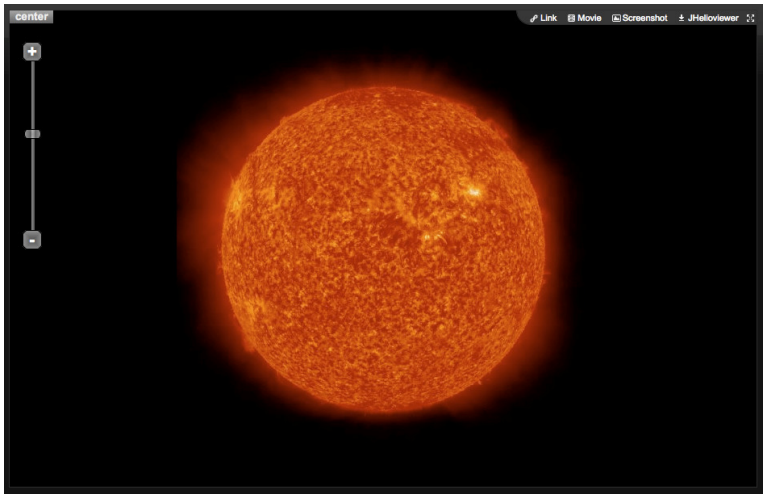
- Other filters
  - Requesting data by :
    - Processing level: level / quicklook
    - Pixel resolution : pixels
    - Resolution: resolution
    - Pixel Scale: pscale
    - Detector: detector
    - Layout : layout

Interaction between VSO and HEK and (J)Helioviewer





HEK



(J)Helioviewer

VSO / HEK

- VSO queries HEK for features and events
- HEK can use VSO to get data
- VSO uses HEK as AIA cutout data provider
    - Results that can be provided locally

VSO / (J)Helioviewer

- VSO can use (J)Helioviewer to visualize (images / movies) from metadata results
- (J)Helioviewer hands off a data request to VSO

What still needs to be done in VSO?

- Spatial searches - HEK

- Extend time search to include seconds
- Finish new web interface
    - Keith - shared with Helioviewer
- API to the cart
- Handle movies / JPG images
- Handle more complex queries

- Fully distribute searches / Geo-location
- VSO installation at other sites
- Solve ‘tar-on-the-fly’ problem
    - Email for later downloads
- Better summary row / full results interaction
- Implement thumbnails JPG / JPEG2000
- Parallel Downloads