

# Ondřejov Southern Sky Photometry Survey

## Dynamic Light curves

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- ▶ **Introduction**
  - ▶ Data
  - ▶ Continuous identification
- ▶ **Identification**
  - ▶ Constructing identifiers
  - ▶ Crossmatching
- ▶ **Light curve publication**
  - ▶ SSAP + Datalink
- ▶ **Practical**



- ▶ Data from several working groups
  - ▶ e.g. small planet light curves
- ▶ 99 % of data is not used
- ▶ Image coverage
  - ▶ Project objectives can move
  - ▶ No fixed survey grid
  - ▶ Image coverage can shift randomly
- ▶ ~ 300 mil measurements (several bands)
- ▶ ~ 8 mil sources and growing



## Overlap images (standard)

- ▶ Need previous images
- ▶ Exactly same regions
- ▶ Working with images, not objects
- ▶ Differential photometry, astrometry
- ▶ Specific for one survey

## Process individually (ours)

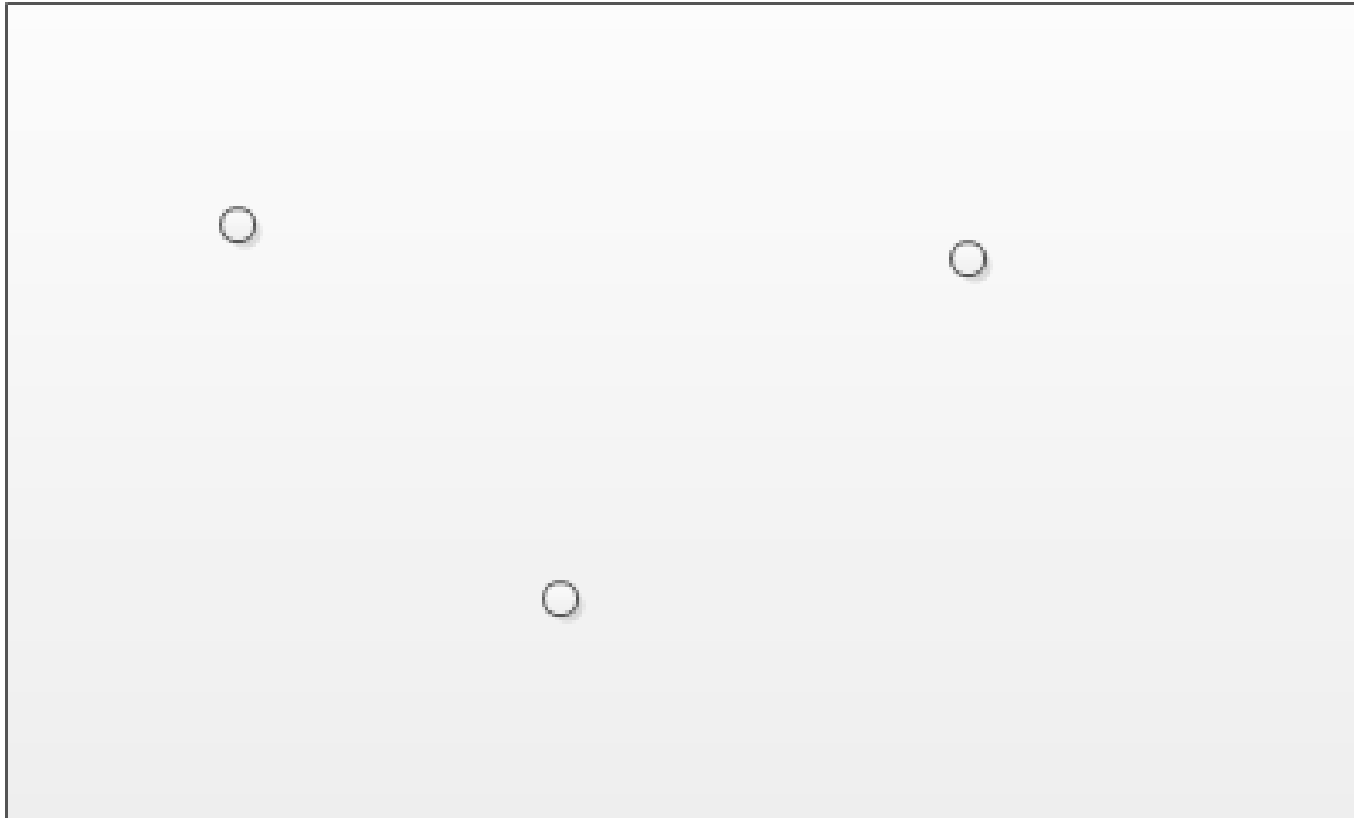
- ▶ Needs only identifiers
- ▶ Images can shift
- ▶ Working with actual data on the images
- ▶ Aperture photometry, astrometry (individual for each frame)
- ▶ Reusable for any image ever taken



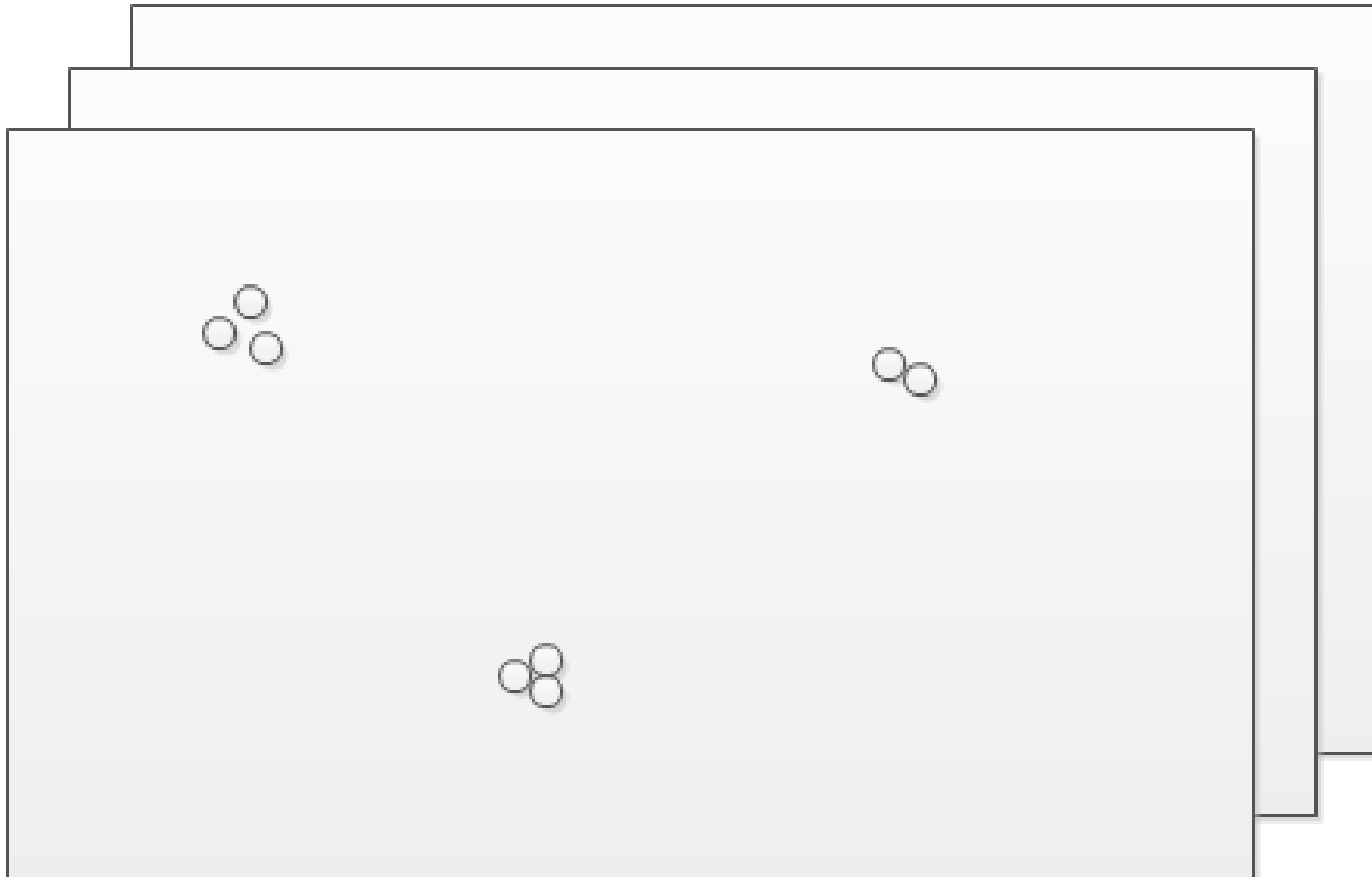
1. **Identify light dots on images with Munipack**
  - ▶ Astrometry + Photometry for individual images
2. **Generate common identifiers for actual objects**
  - ▶ Assigning the light dots to identifiers
3. **Dynamically construct light curve**
  - ▶ Possible cutout or any other post-processing



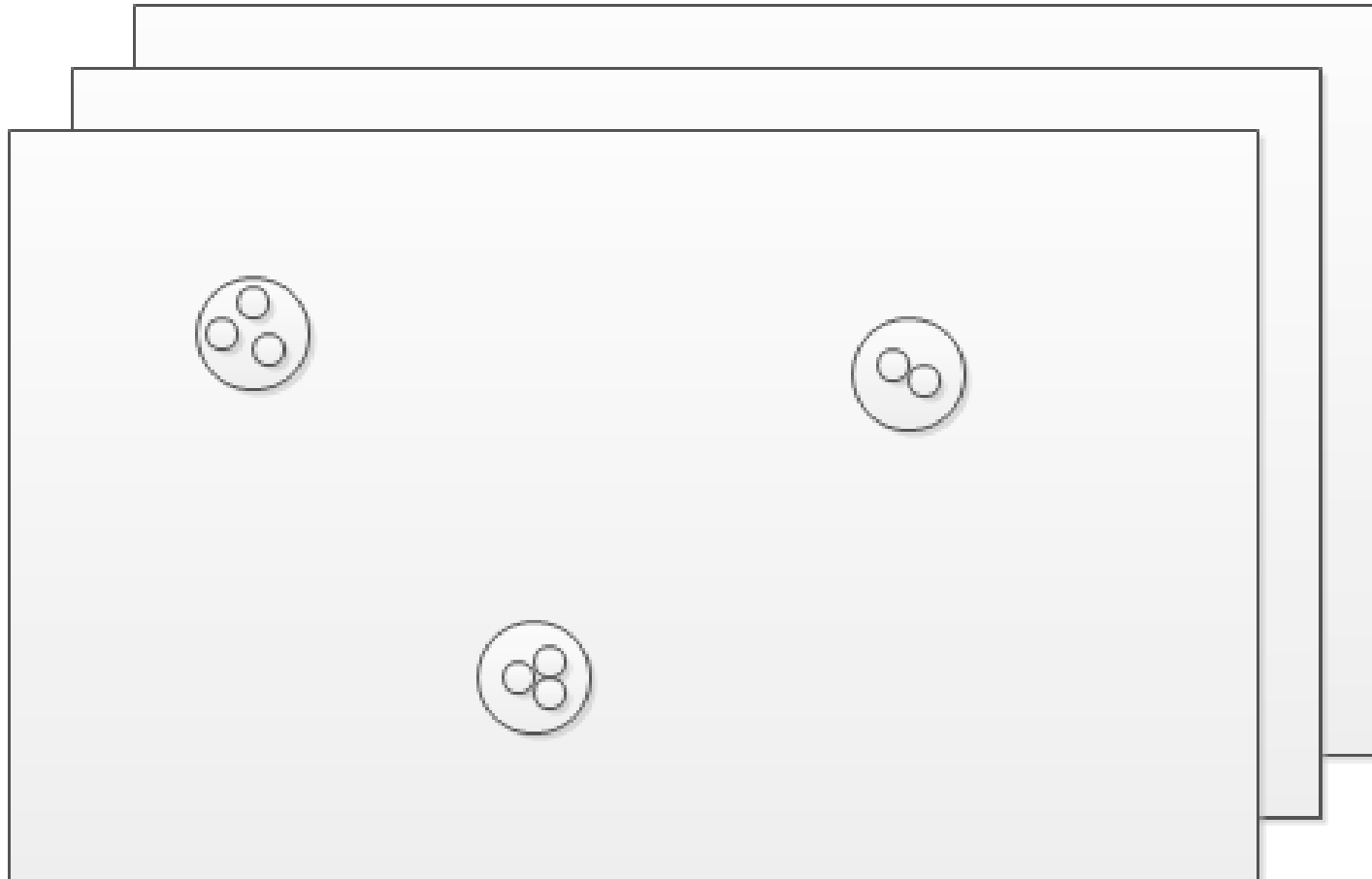
- ▶ Identified objects on one image (Munipack result)



- ▶ Identified objects overlapped (error in astrometry)

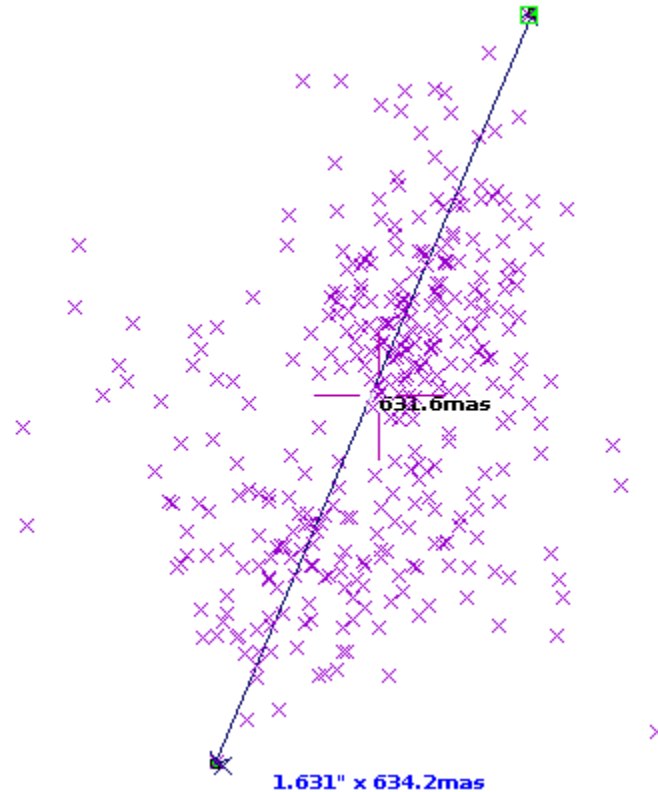


- ▶ Identifying clusters of positions of light curves





## ► Identifying cluster



- ▶ **Strategy (version 2)**
  1. Generate catalog
  2. Cross-match observations
- ▶ **Continuous identification (updating catalog)**
  1. Is there catalog identifier?
    - ▶ No => Add identifier
    - ▶ Yes => Cross-match
  2. Possible Alerts
    - ▶ Mocks – is this object a nova?



- ▶ Technology for catalog generation
  - ▶ PostgreSQL with PgSphere + Q3C (indexing)
  - ▶ Python for parallelizing CPU-heavy parts
- ▶ Process
  1. Pick observation in center of the cluster
  2. Generate average coordinates from neighbors
  - ▶ Sophistication question? (need optimization)
    - ▶ Lightweight iterative (95 % accuracy) ~ linear complexity
    - ▶ Self-join all (>99,9 % accuracy?) ~ quadratic complexity
    - ▶ Need combination



## ▶ SSAP service

- ▶ Slightly different from spectral data
- ▶ `ssap.xml?REQUEST=queryData&POS=13.15,-72.86&Band=I`
- ▶ Result: list of lightcurves

## ▶ Datalink post-processing

- ▶ Identified by catalog ID (ipix) + Bandpass (U,B,V,...)
- ▶ SDM model for light curve transfer
- ▶ Cutout on MJD
- ▶ `dlget?ID=6667183574623977470R`
- ▶ Result: Cutouted light curve in SDM



► **Absolutely dynamical (SQL + Python)**

```
SELECT
    hjd, mag
FROM
    \schema.objjobs_complete
WHERE
    ipix=...
AND
    band=...
ORDER BY
    hjd
```



▶ **SPLAT SSAP 00 52 42.75 -72 48 04.6**

Search parameters:

Simple Query

Object:

RA:  Dec:

Radius:

Band:  /

Time:  /

Query Format:  ▼

Wavelength calibration:  ▼

Flux calibration:  ▼



## ▶ SPLAT SSAP result

Query: <SERVER>?REQUEST=queryData&POS=13.178125,-72.80127777777778&FORMAT=COMPLIANT&SIZE=3.333333333333333E-4 SEND QUERY

Query results:

vos2 lc\_test ✂

...	ssa_score	location_ra	location_dec	location_arr	target_arr	ssa_publisher	raj2000	dej2000	min_da
1	0.	13.1784	-72.8013	(13.178449, -72.801285)	(NaN, NaN)	ASU CAS	13.17845	-72.80128	5621
2	0.	13.1784	-72.8013	(13.178449, -72.801285)	(NaN, NaN)	ASU CAS	13.17845	-72.80128	5621
3	0.	13.1784	-72.8013	(13.178449, -72.801285)	(NaN, NaN)	ASU CAS	13.17845	-72.80128	5620
4	0.	13.1784	-72.8013	(13.178449, -72.801285)	(NaN, NaN)	ASU CAS	13.17845	-72.80128	5621

Display selected
Display all
Download selected
Download all
Deselect table
Deselect all
DataLink Services



## ▶ SPLAT SSAP length

Query results:

vos2lc\_test ✂

on	ssa_aperture	ssa_dateObs	ssa_timeExt	ssa_specmid	ssa_specext	ssa_specstart	ssa_specend	ssa_length
RS 13.1784485384...								169
RS 13.1784485384...								85
RS 13.1784485384...								357
RS 13.1784485384...								108

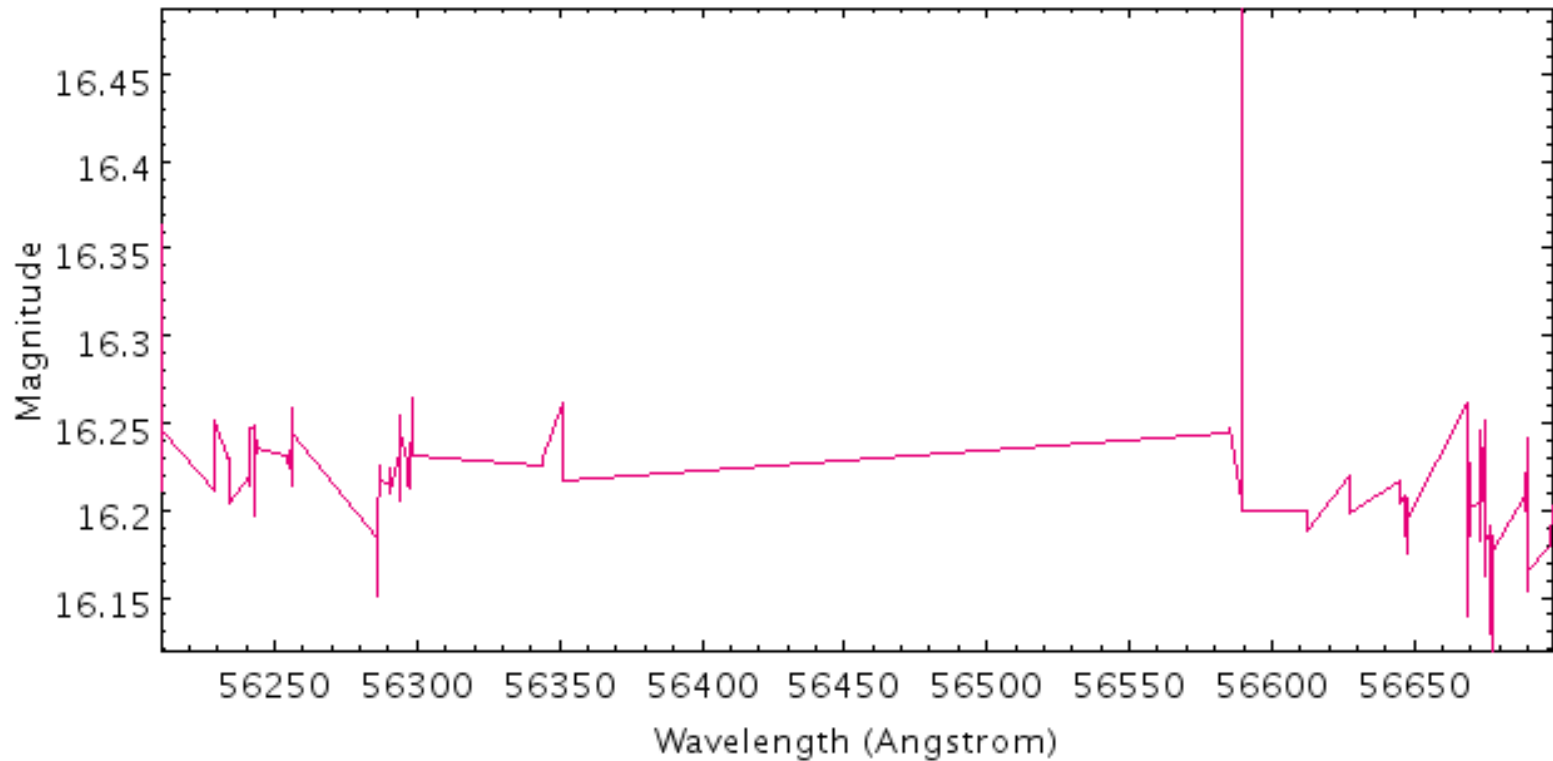
Display selected    Display all    Download selected    Download all    Deselect table    Deselect all    DataLink Services





## ▶ Whole light curve

2-d compound coordinate system



## ▶ SPLAT datalink

Parameters for Server-Generated data processing

DATE\_MIN:

DATE\_MAX:  Time epoch cutout interval, lower limit values: [56210.0535832..56698.1533136]

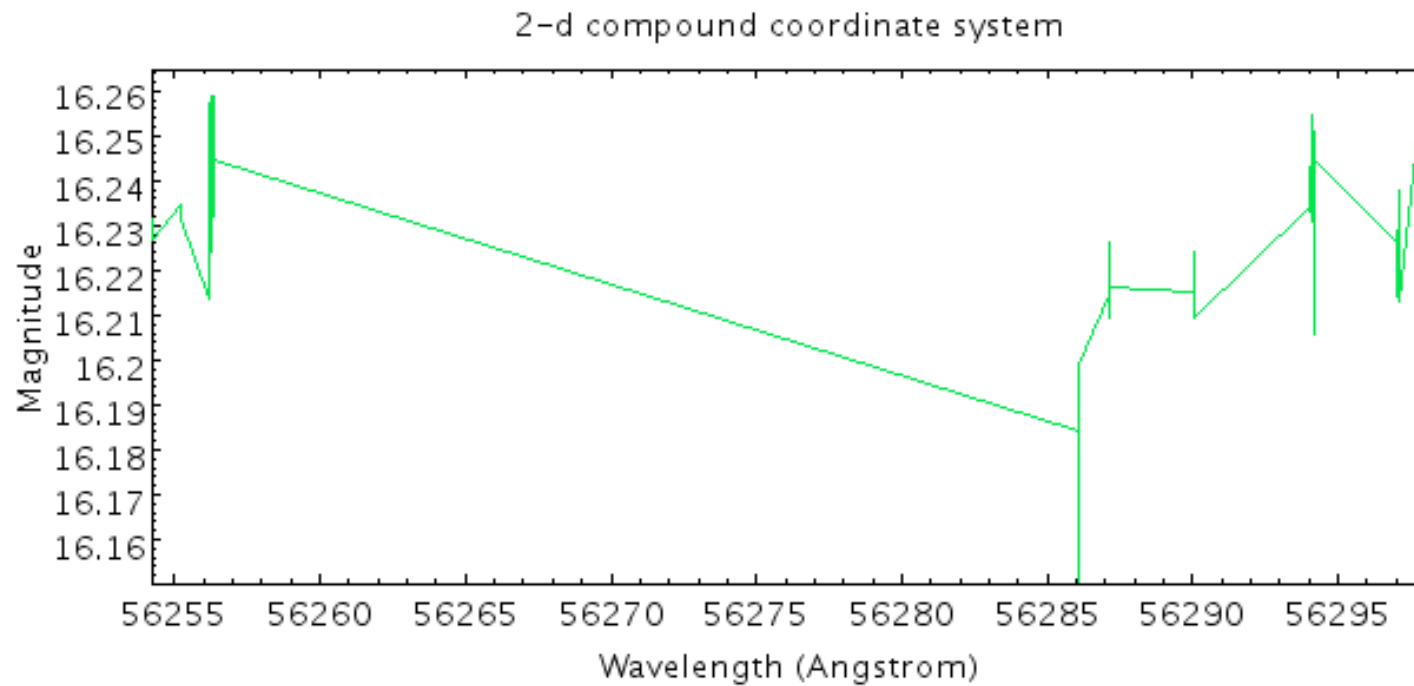
FORMAT:

77777778&FORMAT=COMPLIANT&

ssa\_specmid | ssa\_specext | ssa\_



## ► Light curve cutout



▶ Aladin SIAP

The screenshot shows the Aladin SIAP web interface. At the top, there are navigation tabs: "Others", "Allsky", "File", "all VO", "Watch", "FoV...", and "Tools...". The main content area is titled "Ondrejov DK154 SIAP reduced" and contains the following fields:







- Target (ICRS, name):** 013.17042 -72.80300 (with a "Grab co..." button)
- Radius:** 16.81"
- Filter:** ex: 14' or 1.5deg or 12'x16'
- Format:** image/fits

Below these fields is a list of search results, each with a checkbox and a tree view icon:










- I
- 0SPS 2012-10-10T01:17:34.904 I smcfield03 14.3' x 13.6'
- 0SPS 2012-10-10T01:14:09.896 I smcfield03 14.3' x 13.6'
- 0SPS 2012-12-09T05:33:11.632 I sc3 14.3' x 13.6'
- 0SPS 2012-12-09T02:52:06.452 I sc3 14.3' x 13.6'
- 0SPS 2012-12-09T03:04:35.240 I sc3 14.3' x 13.6'
- 0SPS 2012-12-09T02:58:20.360 I sc3 14.3' x 13.6'
- 0SPS 2012-12-09T05:39:26.624 I sc3 14.3' x 13.6'
- 0SPS 2012-12-09T05:45:40.544 I sc3 14.3' x 13.6'
- 0SPS 2013-12-01T05:25:18.086 I SMC\_field03 14.3' x 13.6'

At the bottom of the interface, there are buttons for "Reset", "Clear", "SUBMIT", "Close", and a help icon (?). An "INFO on this serv..." button is also present.








## ▶ Aladin SCS

Others      

**Image servers**

-  Aladin images
-  SkyView
-  UKIDSS
-  Sloan
-  DSS...
-  VLA...
-  Archives..
-  DK154
-  Others...

**Catalog servers**

-  All VizieR
-  Surveys
-  Missions
-  SIMBAD
-  NED
-  iSee SkyBot
-  Others..

○ Gavo application in Ondrejov ?

Fill in all these fields and press the SUBMIT button

Target (ICRS, name)

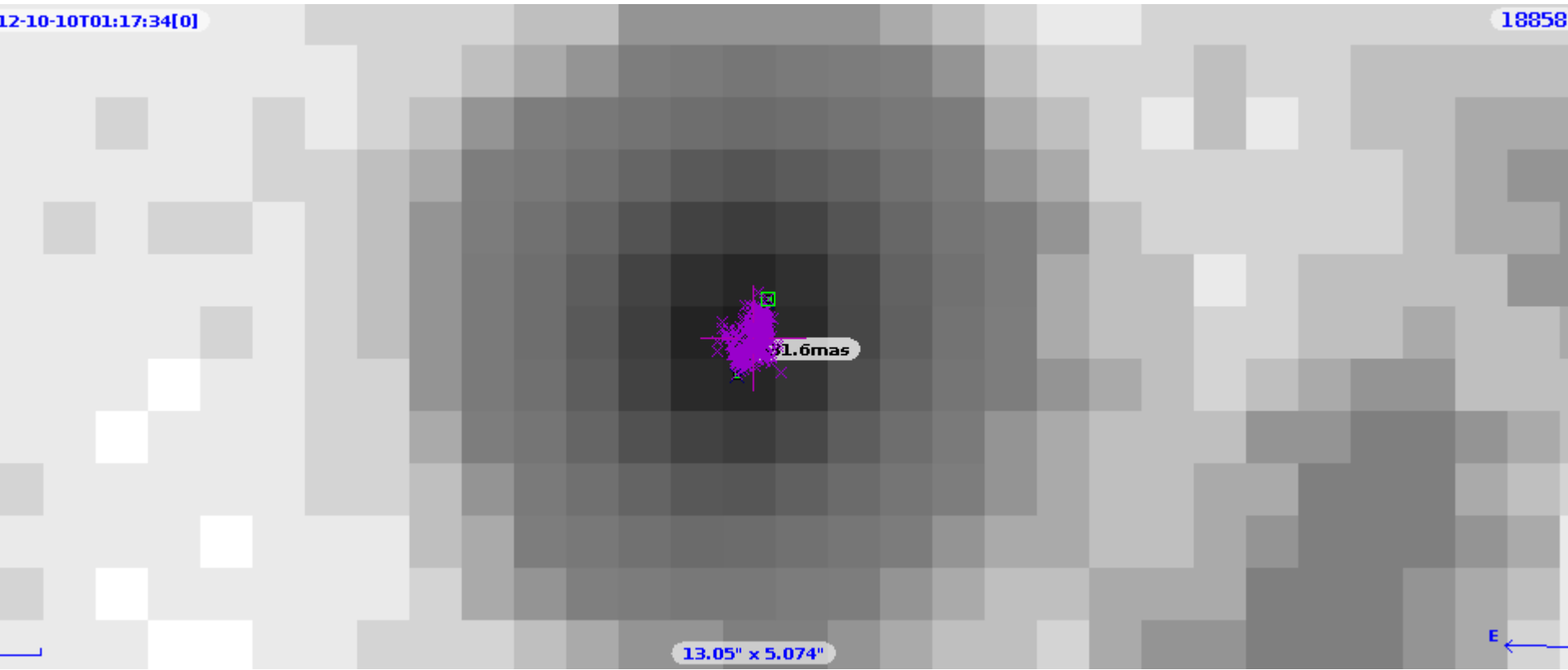
Radius

Filter

Minimum Date

Maximum Date

▶ Aladin cluster



- ▶ **Dynamic light curves**
  - ▶ PostgreSQL access
- ▶ **SSAP**
- ▶ **Datalink**
- ▶ **SIAP**
- ▶ **SCS**



- ▶ Special thanks to Markus





- ▶ **Munipack, Filip Hroch**
  - ▶ <http://munipack.physics.muni.cz/>
- ▶ **Q3C paper, Sergey Kuposov**
  - ▶ <https://code.google.com/p/q3c/>
- ▶ **GAVO Dachs, Markus Demleitner**
  - ▶ <http://vo.ari.uni-heidelberg.de/soft/>



- ▶ Room for discussion

