



AIP

Building up APPLAUSE: Workflow for plate digitization, data extraction and publication

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German Research Foundation (DFG) project: Digitization of astronomical photographic plates and their integration in the international Virtual Observatory

Handling digitized plate data

- How to ...
 - ... organize and store digitized metadata?
 - ... extract sources from plate images?
 - ... calibrate astrometry and photometry?
 - ... publish images and the resulting catalogues?

Handling digitized plate data

- Available tools and literature:
 - programs by the WFPDB team:
 - tif2fits, header2011, timetool, epochtool
 - SExtractor, Astrometry.net, ...
 - description of the DASCH pipeline – web page, papers
- It takes lots of efforts to make it all work

APPLAUSE database

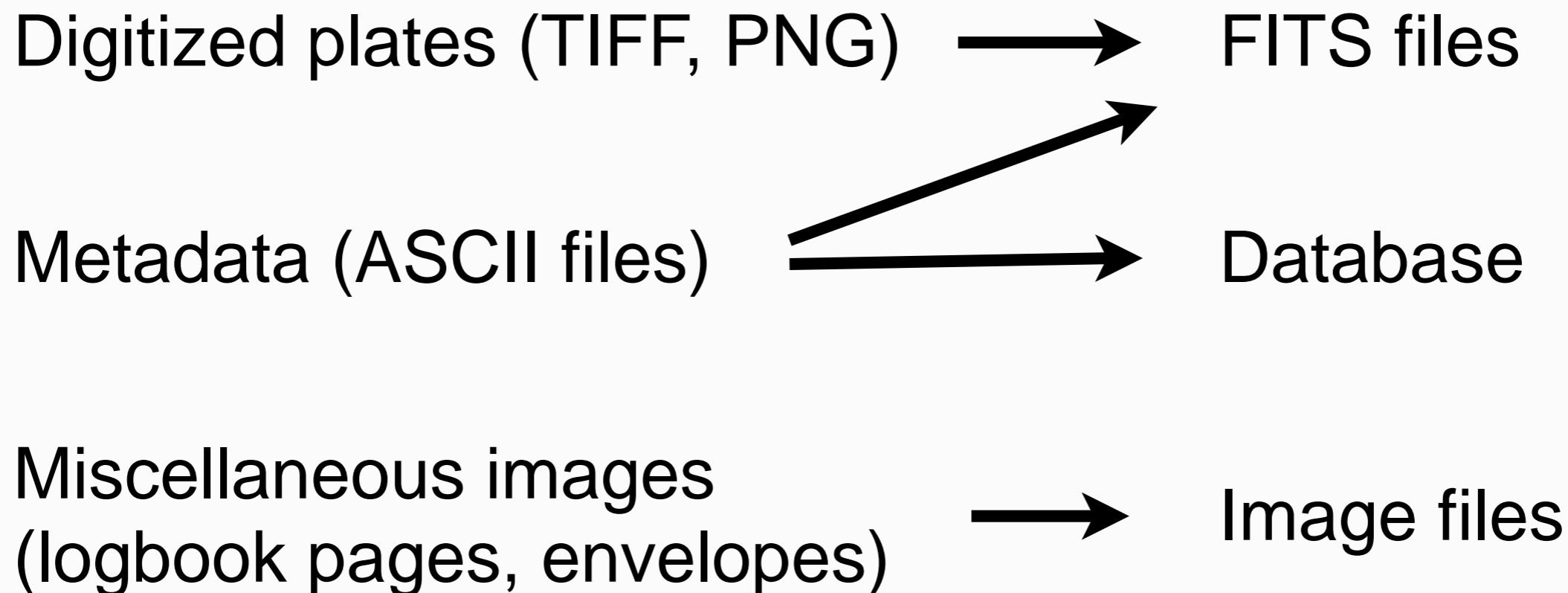
- Archives of Photographic PLates for Astronomical USE
- Bamberg, Hamburg and Potsdam collections:
 - Bamberg ~ 40 000
 - Hamburg ~ 35 000
 - Potsdam ~ 10 000
- APPLAUSE website (currently beta version):

www.plate-archive.org

APPLAUSE outcomes

- Workflow for digitized plates
 - based on experience with inhomogeneous archives
- PyPlate software package
- FITS header format
- Database structure
- Data publishing with Daiquiri

APPLAUSE workflow



Metadata processing

- Input files:
 - WFPDB format (VizieR: VI/90)
 - CSV files
 - FITS headers
- Processing:
 - structuring data
 - calculation of timestamps (UT, JD), ICRS coordinates
- Output:
 - FITS headers
 - database entries

Database structure

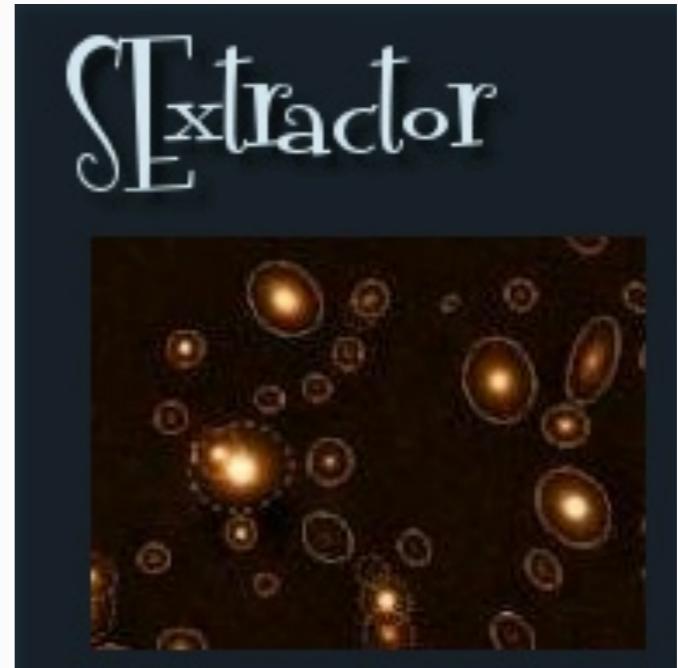
- Database tables:
 - archive
 - plate
 - exposure, exposure_sub
 - scan
 - log, plate_log
 - source, source_calib
- Will be documented at www.plate-archive.org

FITS header format

- Starting point:
 - Kirov et al. (2012) – Serdica Journal of Computing
- Improvements:
 - FITS Standard 3.0 compliant
 - Keyword groups (original and calculated data separate)
 - Support for multi-exposures, sub-exposures
 - Additional keywords
- Will be published at www.plate-archive.org

Data extraction from images

- Positions of sources,
fluxes (magnitudes)
 - SExtractor = Source Extractor
 - using CCD mode
 - cleaning → flagging
- Objective-prism spectra
 - planned for the future
 - available tools for slitless spectroscopy?



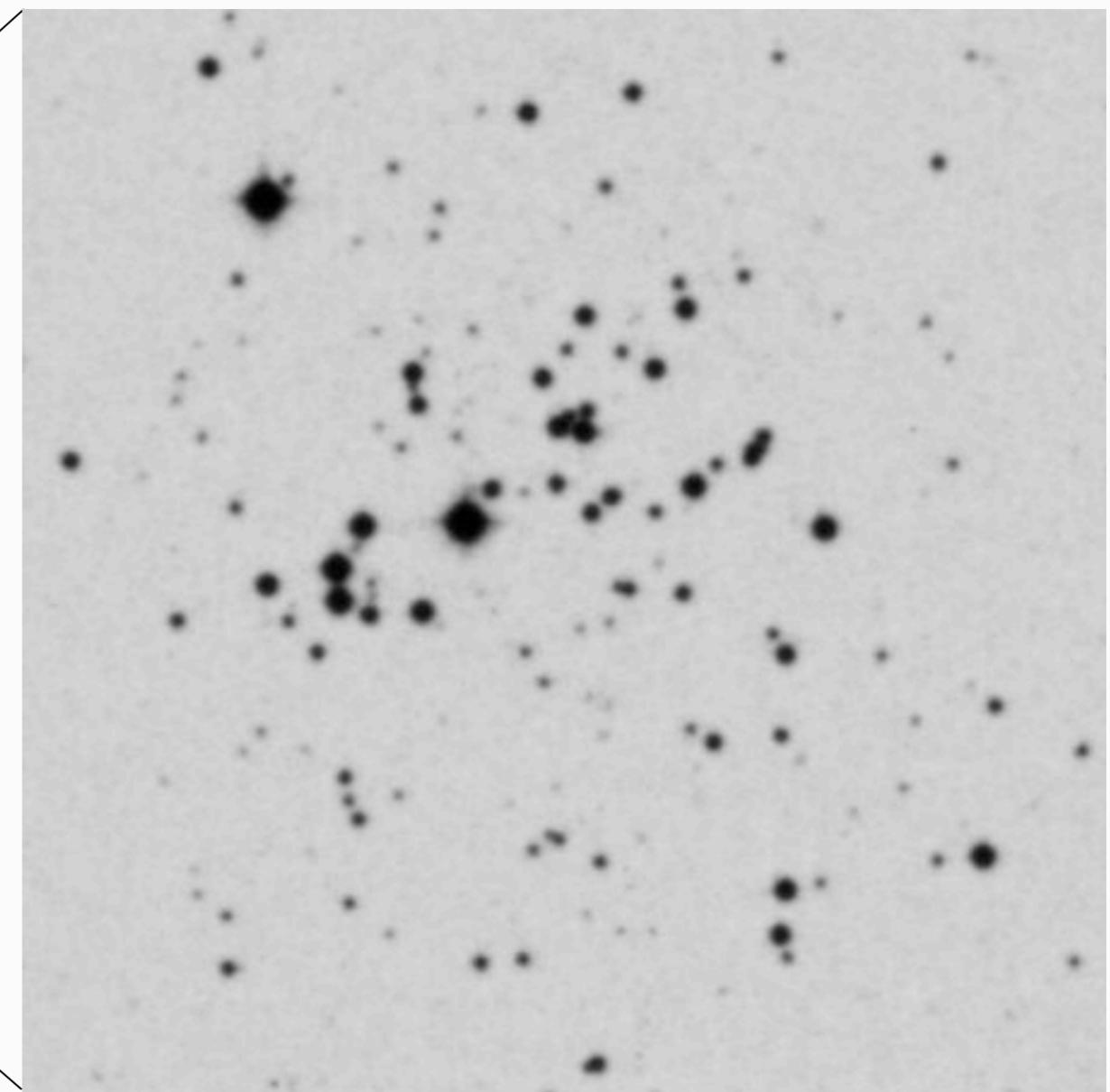
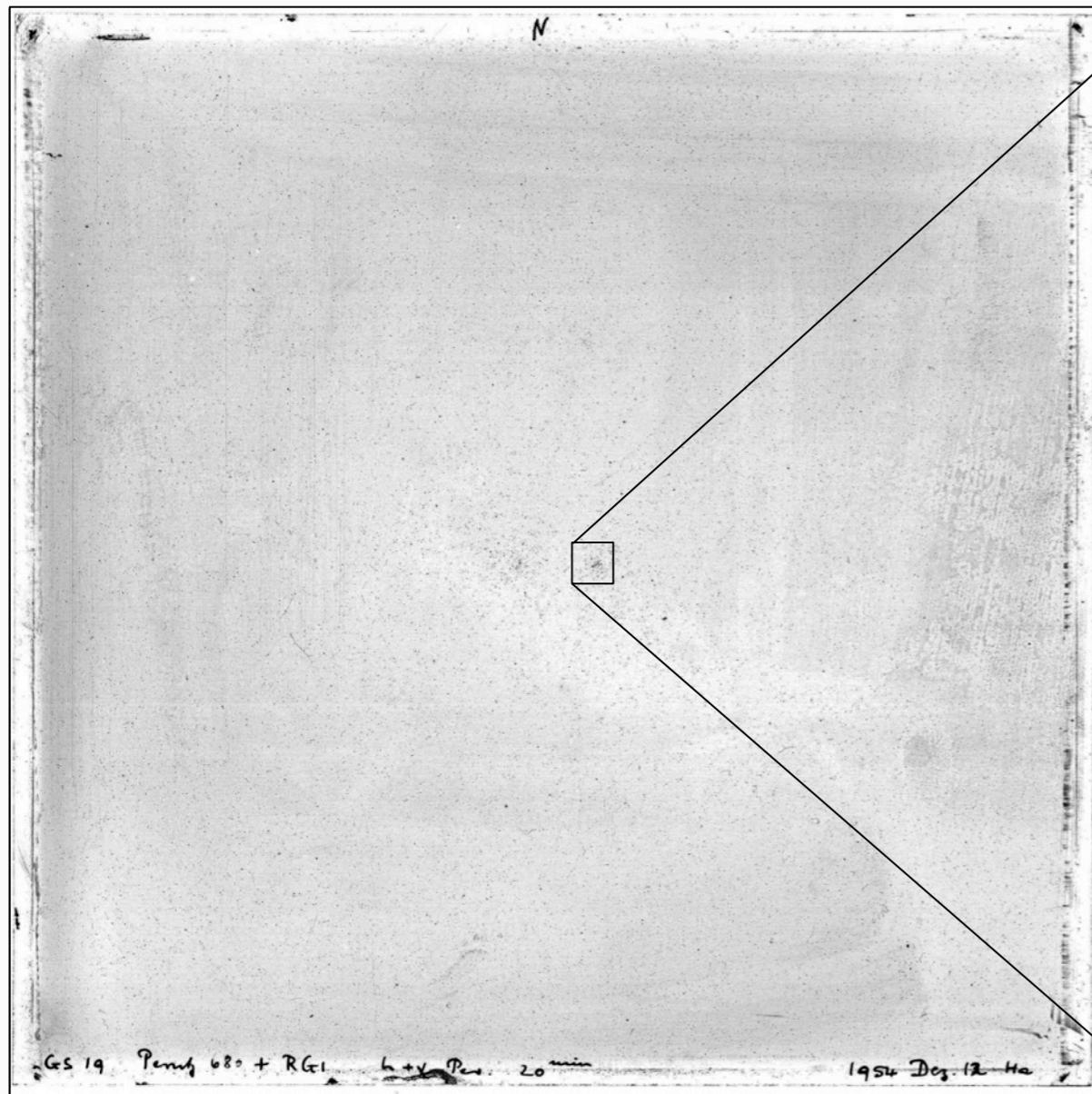
Astrometric calibration

- $X, Y \rightarrow RA, Dec$
- Astrometry.net software
 - + works blindly
 - + supports SIP convention for distortions
 - does not refine solution
- SCAMP
 - needs first guess
 - does not support SIP
 - + refines solution
- Orchestrating programs with a Python script



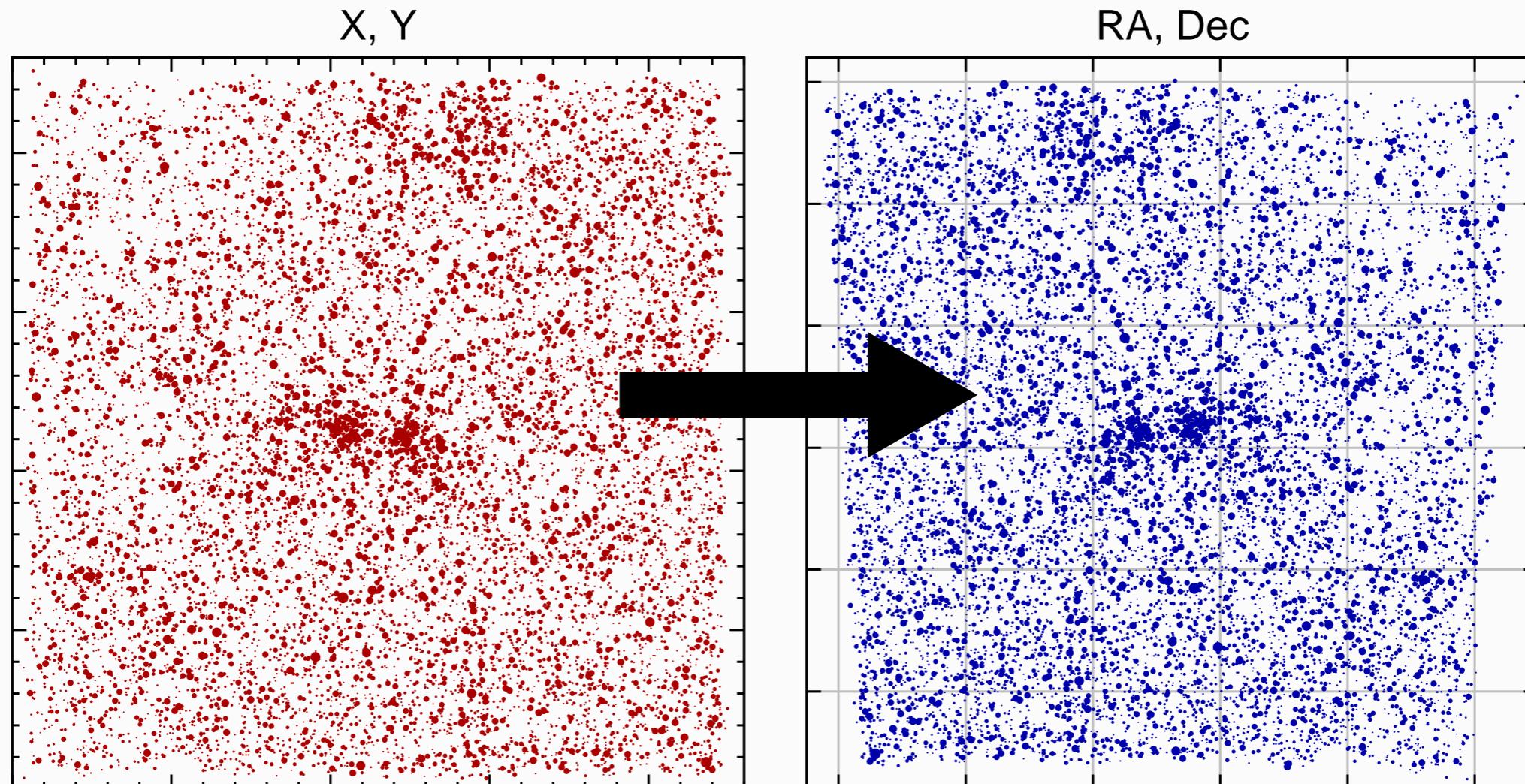
AIP

Astrometry: sample plate



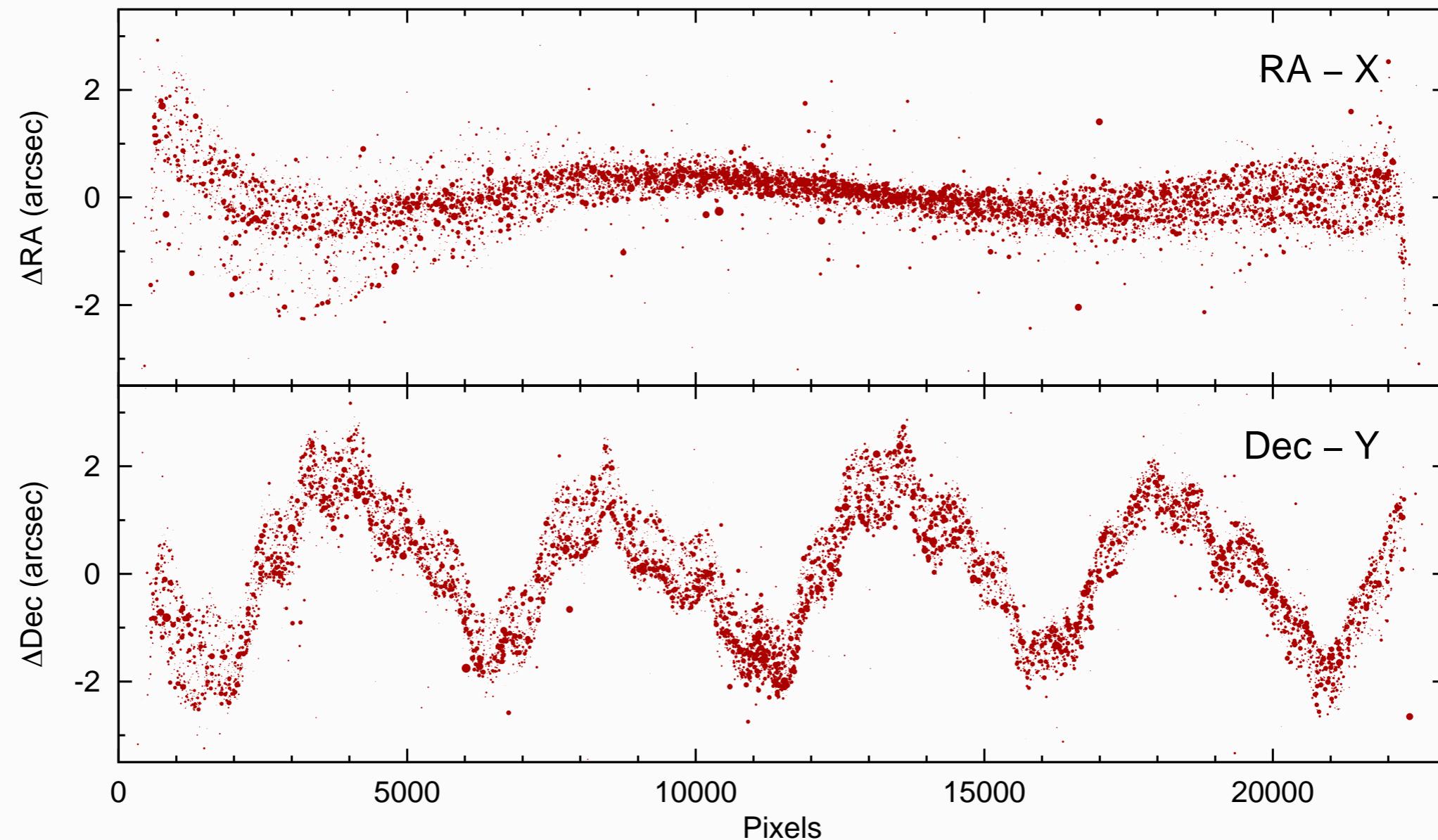
1954-12-12

Astrometry workflow



Initial solution with Astrometry.net software

Astrometry workflow



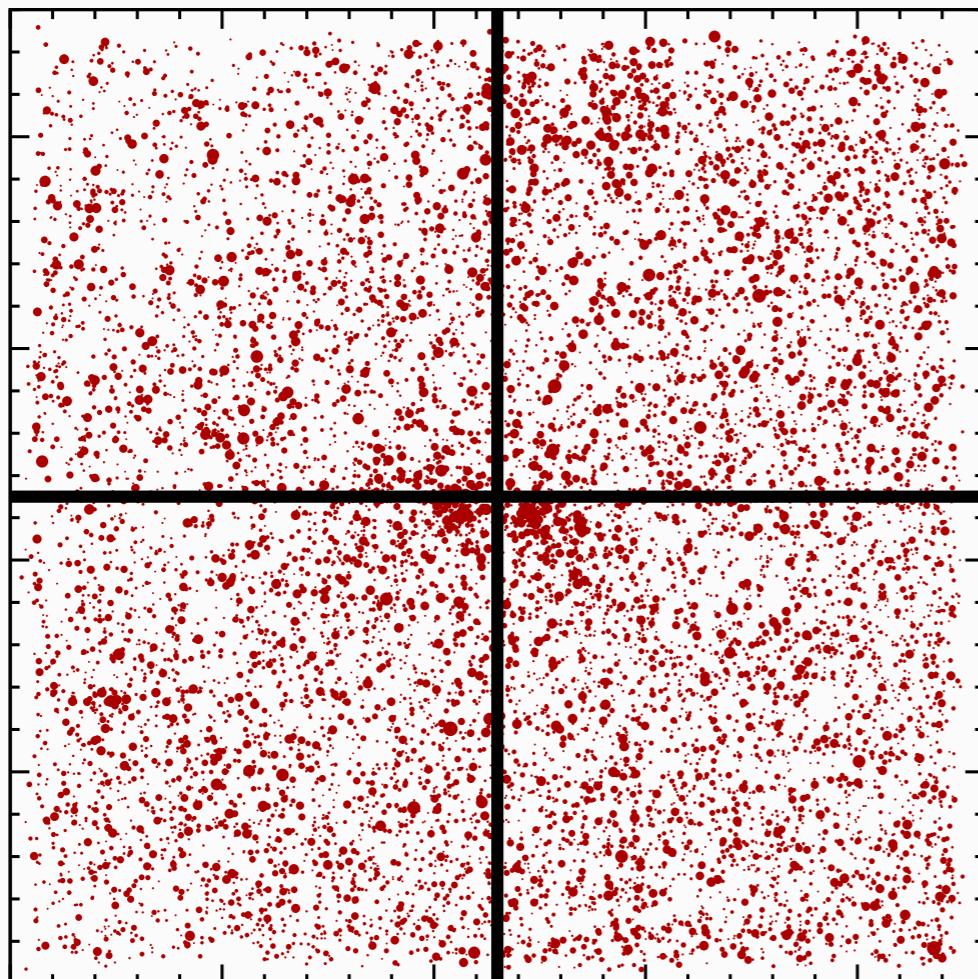
Initial solution with Astrometry.net software



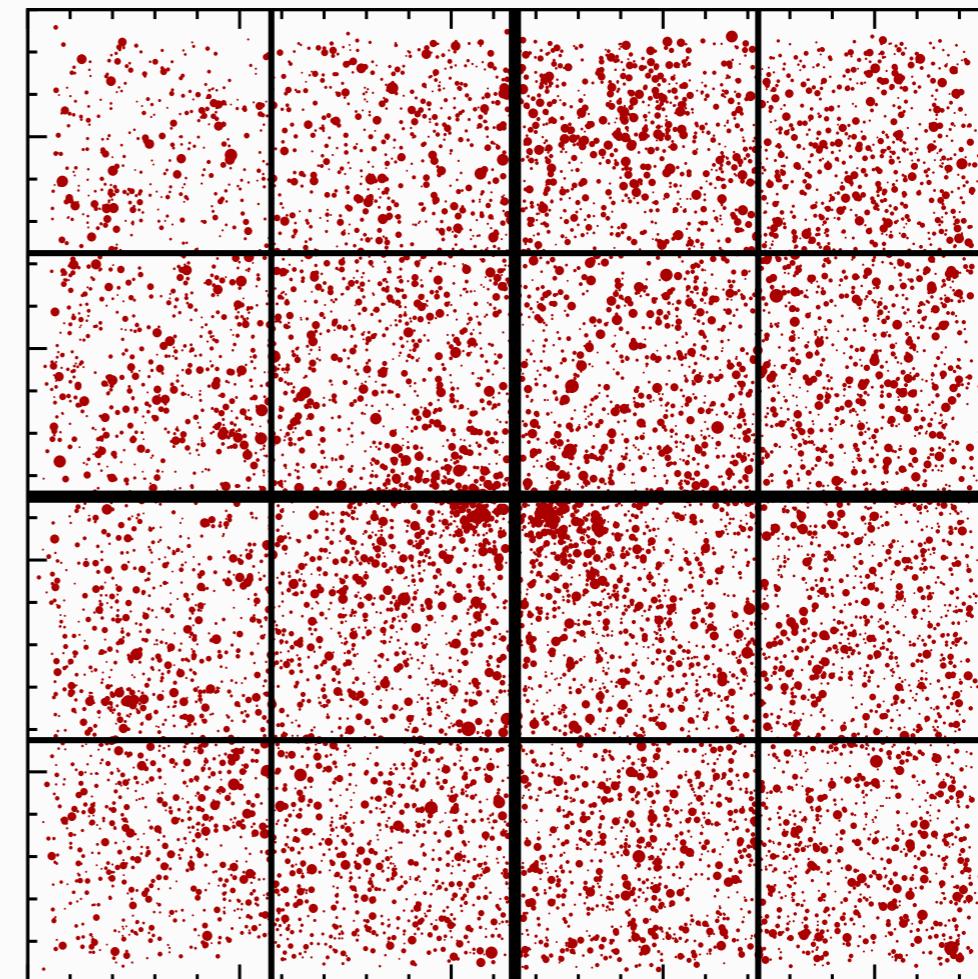
Astrometry workflow

AIP

2×2



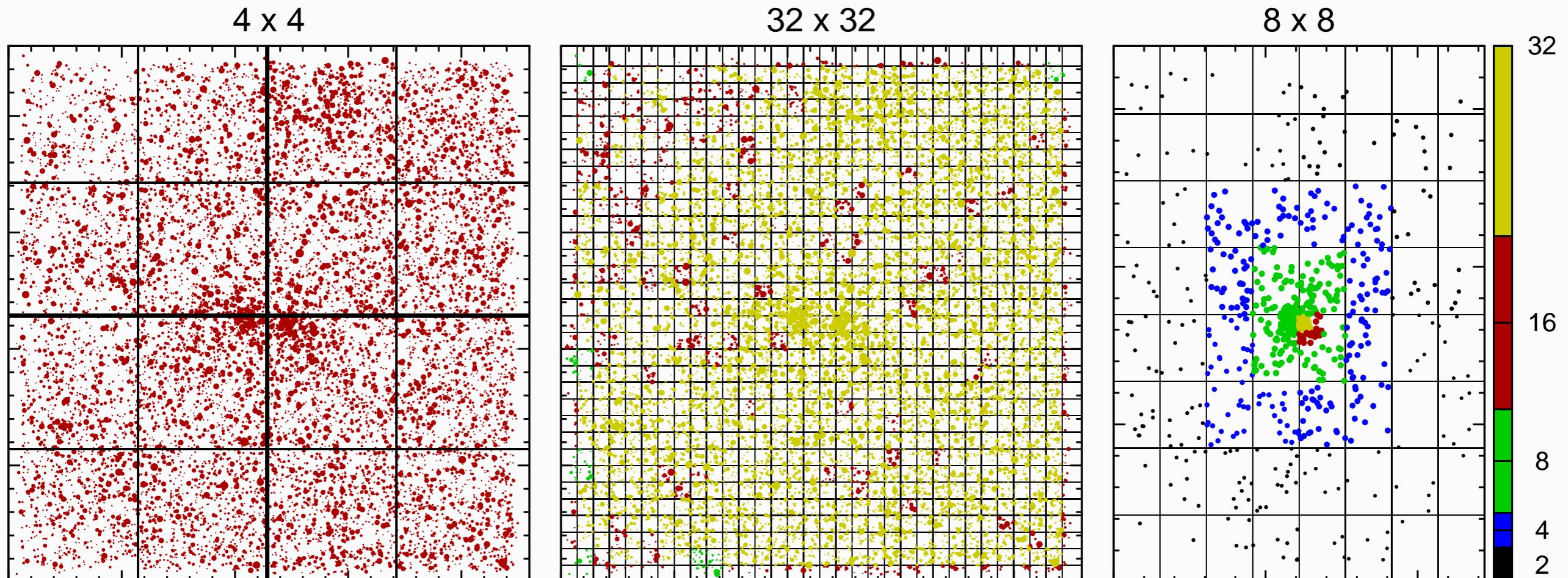
4×4



Improving solution with SCAMP software in sub-fields

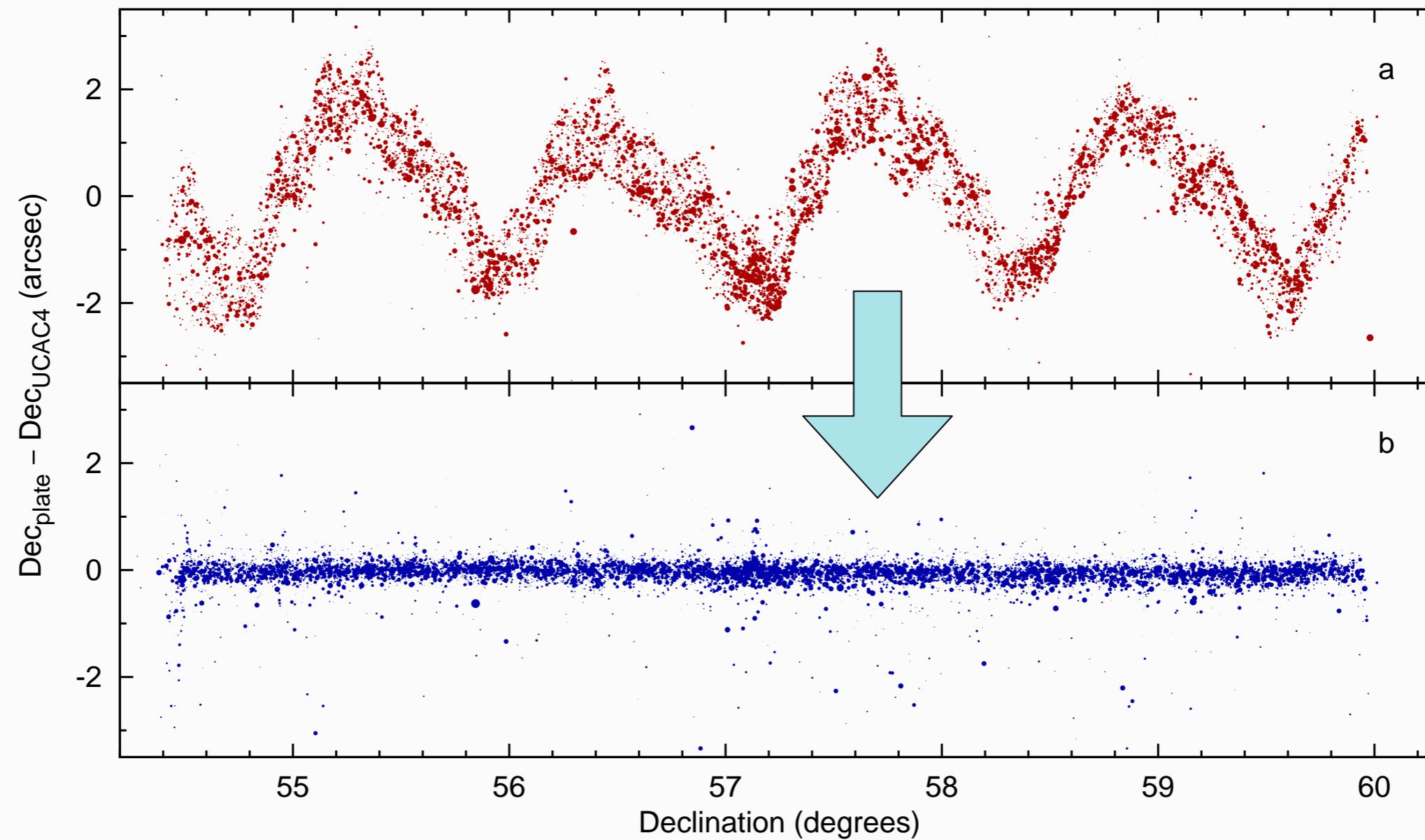


Astrometry workflow



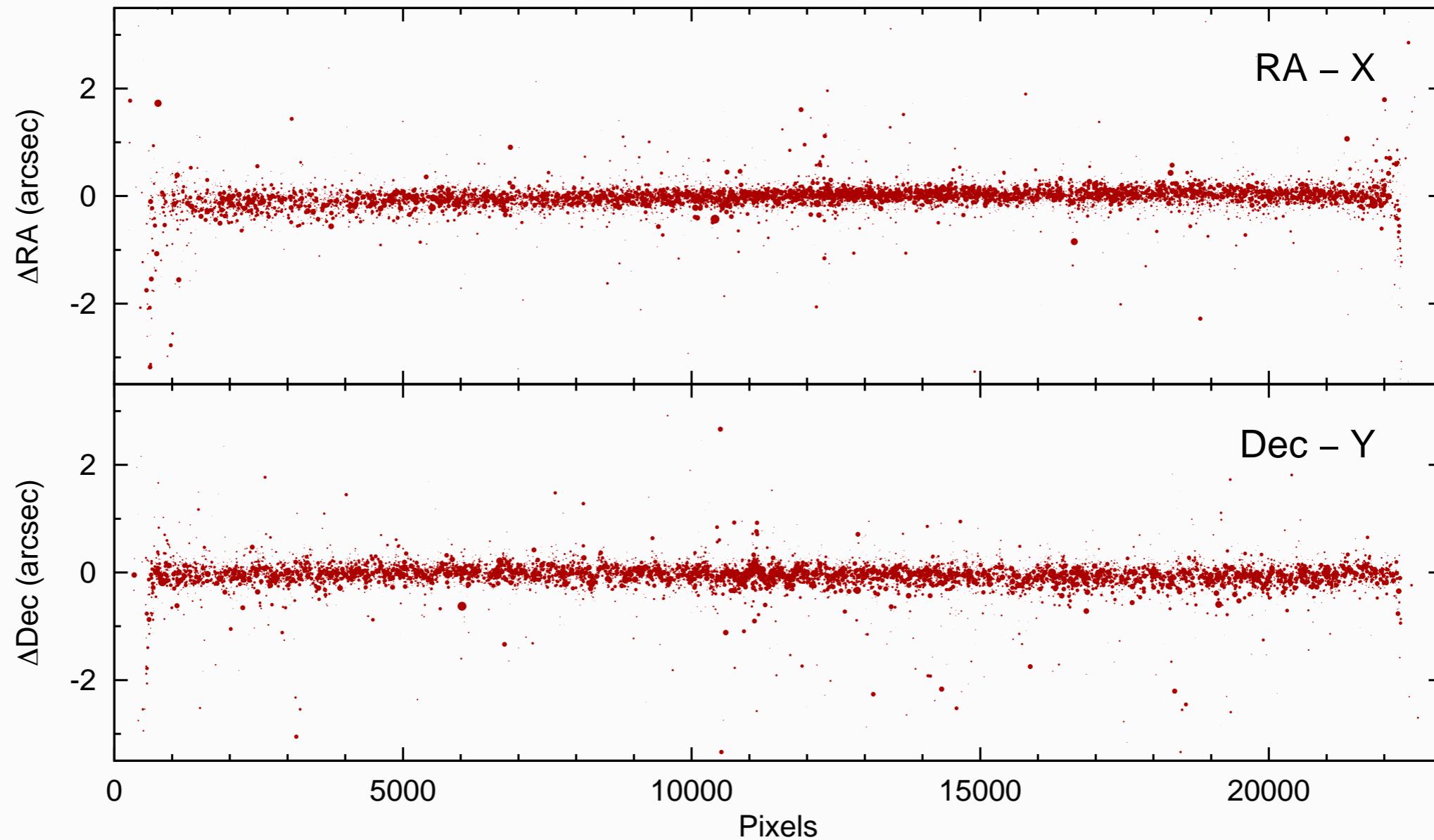
Improving solution with SCAMP software in sub-fields

Astrometry workflow



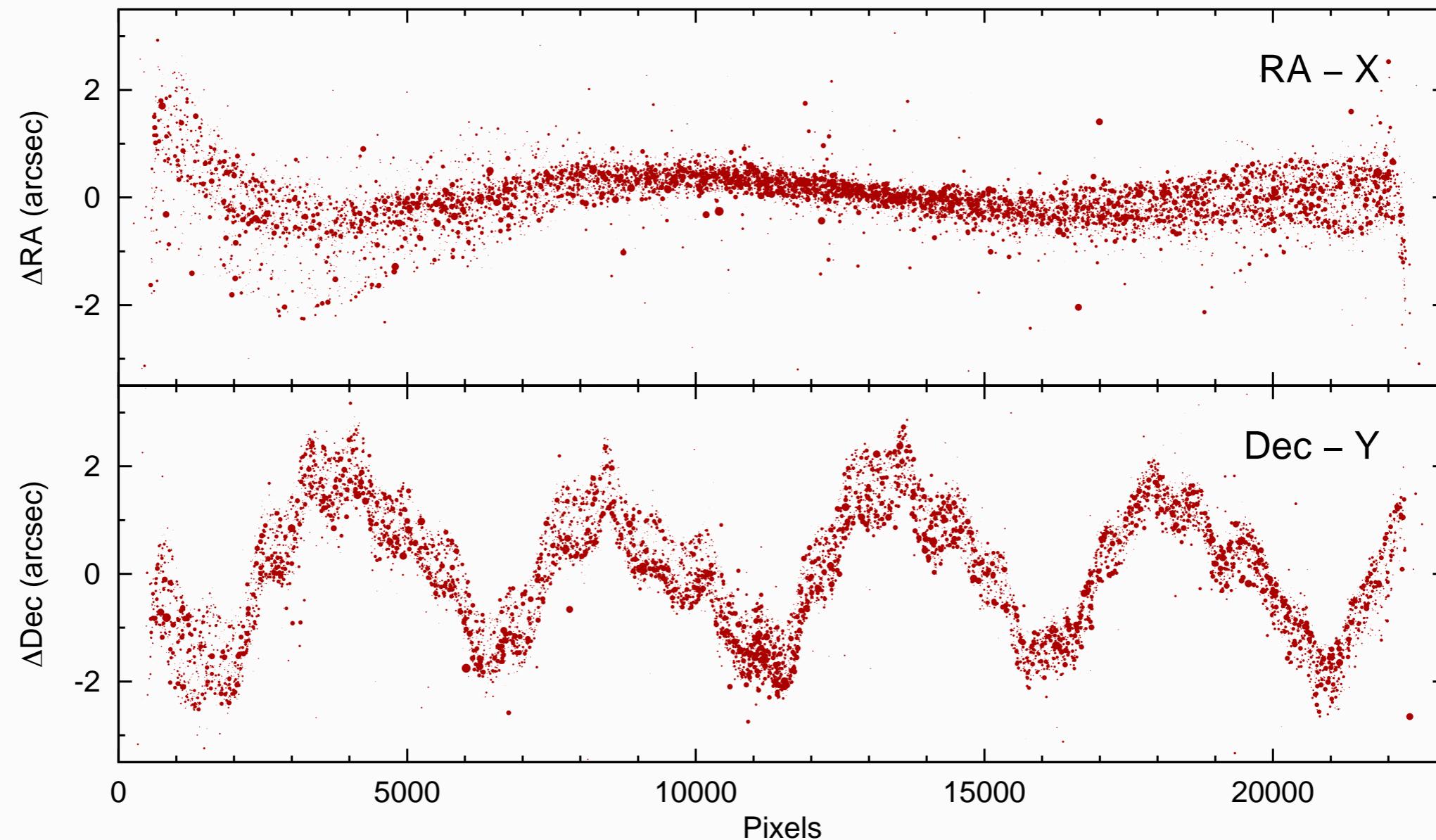
Improved solution with SCAMP

Astrometry workflow



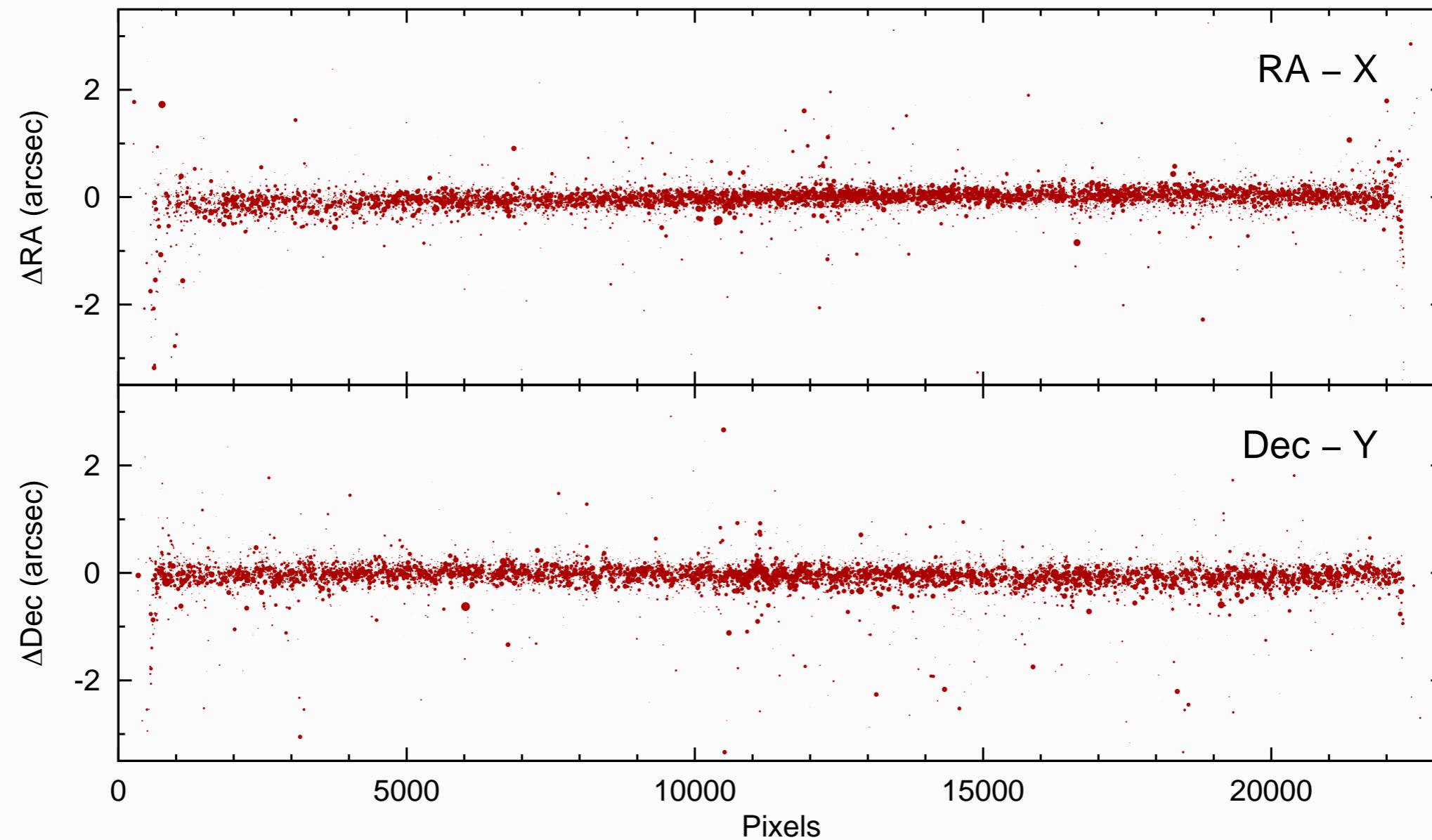
Improved solution with SCAMP

Astrometry workflow



Initial solution with Astrometry.net

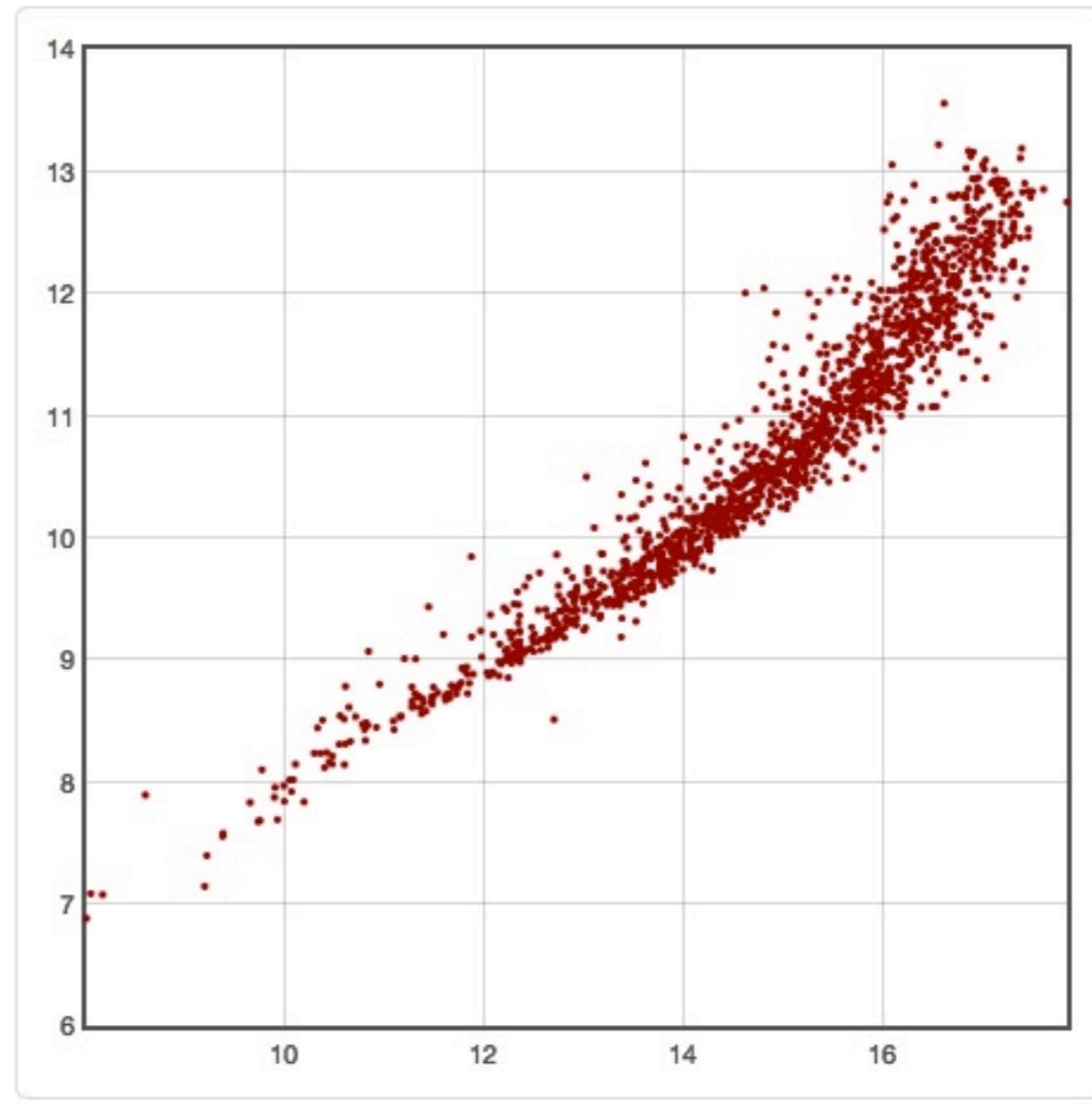
Astrometry workflow



Improved solution with SCAMP

Photometric calibration

- Cross-matching with an all-sky catalogue
 - Tycho-2
 - UCAC4 – APASS
- Work in progress



PyPlate

- Software package written in Python
- Modules:
 - `pyplate.metadata`
 - `pyplate.solve`
- Preparations to go public in April
- www.plate-archive.org/pyplate/
- Open source – contributions are welcome

Data publishing

- Daiquiri framework
 - intended for publication of scientific databases
 - developed and maintained by the E-Science group at the Leibniz Institute for Astrophysics Potsdam (AIP)
 - Virtual Observatory compliant
 - open-source
 - <http://escience.aip.de/daiquiri>





AIP

www.plate-archive.org

https://www.plate-archive.org/applause/ — APPLAUSE - Archives of Photographic Plates Reader

APPLAUSE (beta)

Archives of Photographic PLates for Astronomical USE



Home Database Query Contact Login

Welcome to the APPLAUSE archives

German astronomical observatories own considerable collection of photographic plates. While these observations lead to significant discoveries in the past, they are also of interest for scientist today and in the future. In particular, for the study of long-term variability of many types of stars, these measurements are of immense scientific value.

There are about 85000 plates in the archives of Hamburger Sternwarte, Dr. Karl Remeis-Sternwarte Bamberg, and Leibniz-Institut für Astrophysik Potsdam (AIP). The plates are digitized with high-resolution flatbed scanners. In addition, the corresponding plate envelopes and observation logbooks are digitized, and further metadata are entered into the database. The work is carried out within the project "Digitalisierung astronomischer Fotoplatten und ihre Integration in das internationale Virtual Observatory", which is funded by the DFG.

On this page, you can get access to the plate data that are processed so far. Please use the [registration form](#) to get a user account. Then you can [browse](#) the entire database or you can submit SQL queries or cone-search queries using the [query interface](#).



Example of a photographic plate.

Recent News

September 21st, 2013 [Plate Archive presented at the annual AG meeting](#)

The Plate Archive and the digitization project will be presented in two talks at the Annual Meeting of Astronomische Gesellschaft:

- Taavi Tuvikene – High-mass stars in the digital archive of photographic plates (Splinter meeting D, September 24)
- Heinz Edelmann – The Bamberg photographic plate archive – the digitization project (Splinter meeting A,

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
2013-09-13T15:44:01:2294	✓
2013-09-13T15:56:25:4528	✓
All_plates	✓
All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query

SQL query

Place your SQL statement directly in the text area below and submit your request using the button.

1

Name of the new table (optional):

Submit new SQL Query

Clear input window

[Example Queries](#)

[Database browser](#)

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
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All_plates	✓
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OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query

SQL query

Place your SQL statement directly in the text area below and submit your request using the button.

```
1 SELECT * from `digiplates`.`plate`;
```

Name of the new table (optional):

Submit new SQL Query

[Clear input window](#)

[Example Queries](#)

[Database browser](#)

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
2013-09-13T15:44:01:2294	✓
2013-09-13T15:56:25:4528	✓
All_plates	✓
All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query

Plate cone search

Please specify a coordinate in right ascension (RA) and declination (DEC). The query will result in plates which cover this point.

RA_{deg}

DEC_{deg}

Radius_{deg}

Name of the new table

Submit new cone search

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
2013-09-13T15:44:01:2294	✓
2013-09-13T15:56:25:4528	✓
All_plates	✓
All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query Job Details Results Table Plot

Download

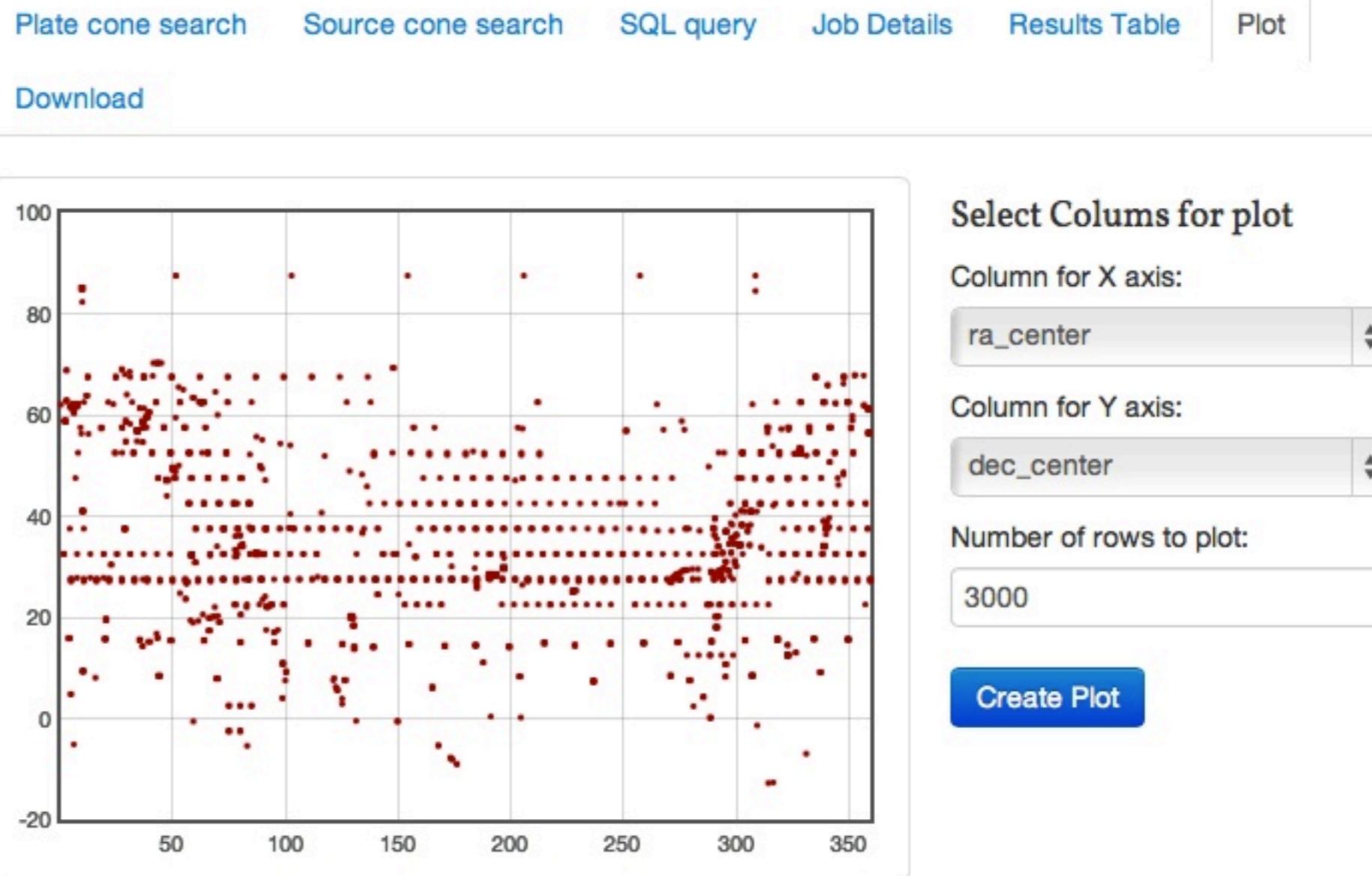
Search  First Previous Next Last Reset Page 1 of 240 Show 10 rows ▾

plate_code	date_orig	plate_format	filename_prescan
POT015_000317	1910-08-02	20x20	POT015_000317_pre.jpg
POT015_000318	1910-08-02	20x20	POT015_000318_pre.jpg
POT015_000319	1910-08-10	20x20	POT015_000319_pre.jpg
POT015_000320	1910-08-10	20x20	POT015_000320_pre.jpg
POT015_000321	1910-08-14	20x20	POT015_000321_pre.jpg
POT015_000322	1910-08-14	20x20	POT015_000322_pre.jpg
POT015_000323	1910-08-14	20x20	POT015_000323_pre.jpg
POT015_000530	1910-10-25	20x20	POT015_000530_pre.jpg
POT015_000534	1910-10-27	20x20	POT015_000534_pre.jpg
POT015_000537	1910-10-27	20x20	POT015_000537_pre.jpg

Download files from selected rows
Download files from the selected column
Register with SAMP

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
2013-09-13T15:44:01:2294	✓
2013-09-13T15:56:25:4528	✓
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All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
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All_plates_2	✓

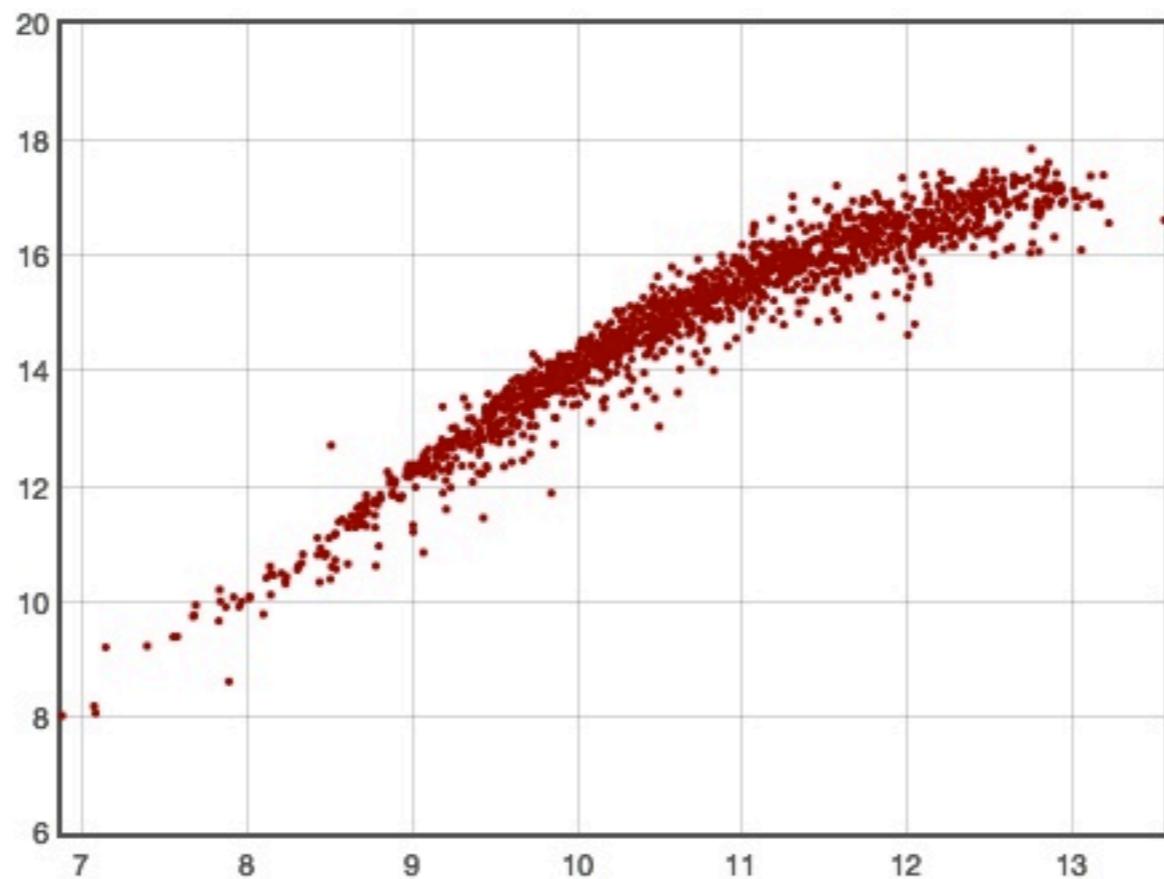


Query interface

JOBS	
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2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
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2013-09-13T15:44:01:2294	✓
2013-09-13T15:56:25:4528	✓
All_plates	✓
All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query Job Details Results Table Plot

Download



Select Columns for plot

Column for X axis:

rawmag

Column for Y axis:

ucac4_bmag

Number of rows to plot:

2000

Create Plot

Query interface

JOBS	
CdC	✓
2013-09-13T15:03:01:0713	✓
2013-09-13T15:06:03:6602	✓
2013-09-13T15:10:38:3468	✓
2013-09-13T15:20:58:8170	✓
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2013-09-13T15:56:25:4528	✓
All_plates	✓
All_logs	✓
OP_plate_scans	✓
All_OP_plates	✓
Comparison_star_1	✓
All_plates_2	✓

Plate cone search Source cone search SQL query Job Details Results Table Plot

Download

Download table

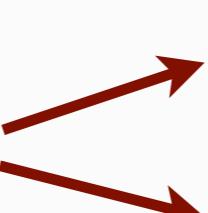
Please select the format for your download:

Select format:

IVOA VOTable XML file - BINARY 1 Forma

Download

Downloaded data



Analysis

Cross-matching with
other catalogues

Summary & Future

- APPLAUSE – www.plate-archive.org
 - Bamberg, Hamburg and Potsdam collections
 - workflow implemented in PyPlate package
 - developed FITS header format, database structure
- Future plans:
 - April: publish first batch of data + PyPlate
 - photometric calibration
 - extraction of spectra – collaboration with Tartu Observatory (Estonia)