Alternative Transportable Digitizing Device

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astro **PLATE**

Plate Digitization

- **Why to digitize the plates?**
- **The photographic emulsions can be damaged**
- **To enable evaluation by dedicated software and powerful computers**
- **The access to the info in the plates is otherwise very difficult**
- **What positional accuracy is needed?**
- **What resolution (pixelsize in microns) is needed?**

Plate Digitization II

- **Very high astrometric positional accuracy 0.1 microns only with custom made scaners, very expensive**

- **Most applications do not need such high accuracy**

- **Pixelsize: emulsion 5 microns, Sonneberg 25 microns. Smaller pixelsize = very large size of image files = more difficult to store, to access, and to evaluate**

Plate Digitization III – Cost and Time Factor

- **Dedicated custom made accurate scanner - very expensive, difficult to move, 1 plate > 100 Euro**

- **Commercial flatbed scanners – moderately expensive, 1 plate >> 10 Euro**

- **Digital camera - inexpensive, fast – 1 plate < 1 Euro**

- **Cost of purchasing instrumentation not included**

3 basic digitization techniques

- **Custom made scanner. Very accurate but very expensive, expensive use, problems with maintenance and service later**

- **Commercial Plate/Negative flatbed scanner.**

- **Digital camera**

Comparing Digital Camera vs Scanner

- Digital Camera
- Very fast (2 sec/plate)
- Very low-cost scanning
- No waves caused by irregular movement
- Easy transportable
- Satisfactory resolution for small and medium sized plates (5-20 microns)
- Need to apply automated algorithms for lens distorsion and edge cutting - solved

Damages to plates: need to digitize fast
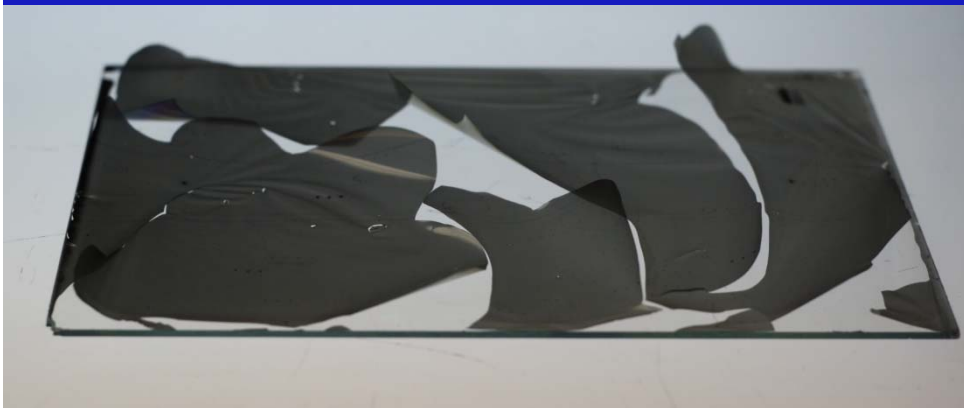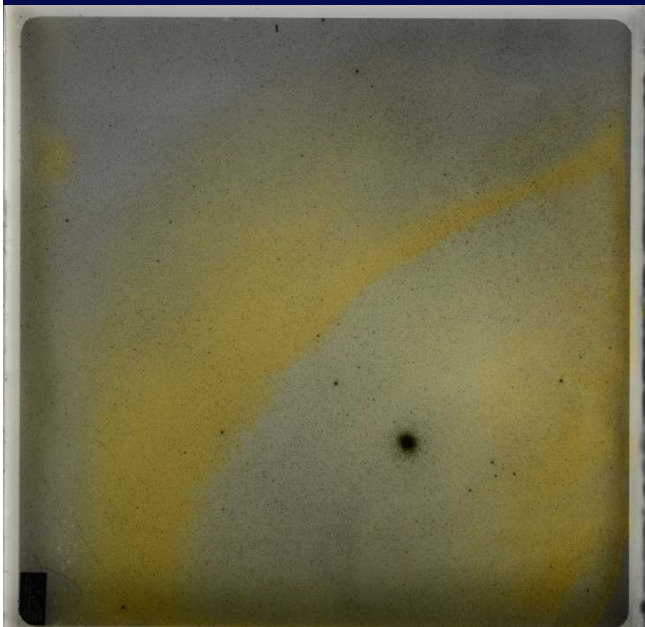
Gold disease and damage by humidity
Collaboration with IChT Prague in recovery damaged plates

Transportable plate scanning device

Plate collections visited:
Carnegie Observatories Pasadena
Lick Observatory
Yerkes Observatory
Mt Palomar Observatory
PARI NC
KPNO Tucson
CFHT Waimea, Hawaii
IfA Manoa, Hawaii
USNO Flagstaff, AZ
USNO Washington, DC & 7 more
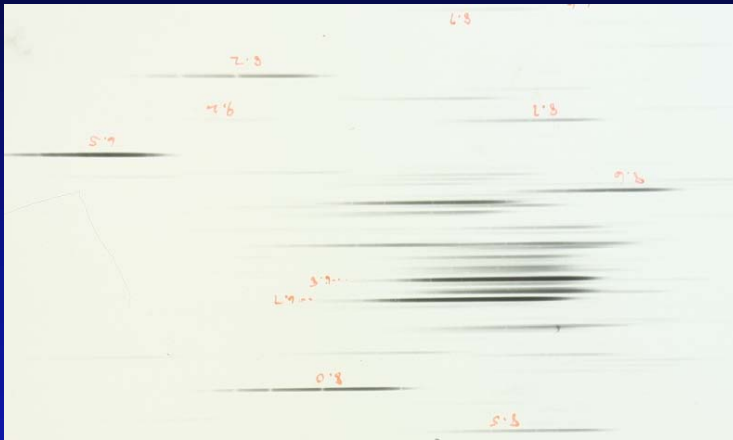
About 2 million plates in these archives
Preferences: transportable, very fast scanning, high repeability (no moving scanner parts)
Used equipment:
Camera: 21 MPx Canon EOS 5D Mark II (in 2012 replaced by 39 Mpx) Lenses: Canon EF 24-70 f/2.8 L USM & Canon 70-200mm F4
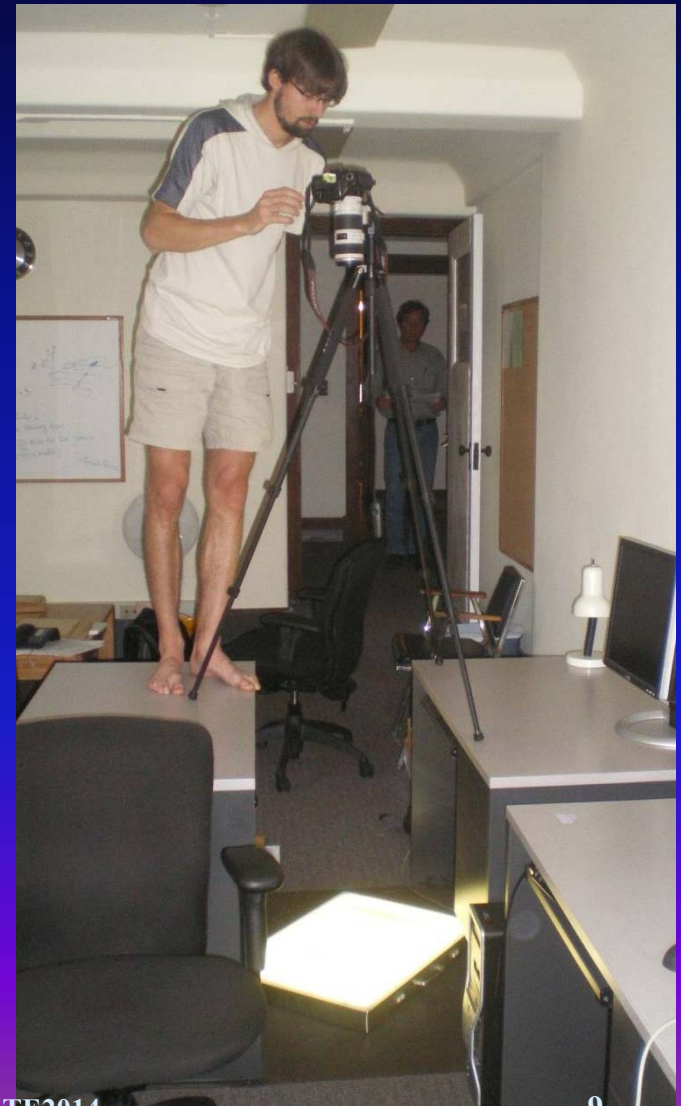
Carnegie Observatories Pasadena, ~ 500 000 plates

Scanning US collections of LDS plates

LDS (Low Dispersion Spectroscopy) plates from 1909 at Carnegie Obs, Pasadena, CA, USA

The North Mt Wilson – Michigan Halpha survey plates are deposited here
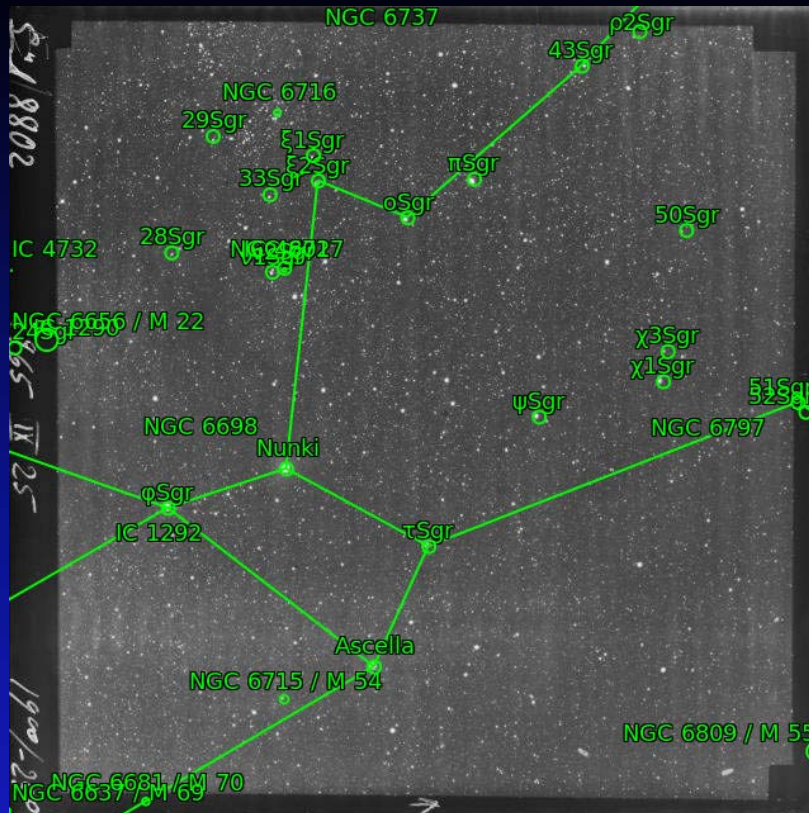
CFHT Waimea Hawaii

Valuable plates taken by 3.6 m CFHT telescope Very deep lim magn
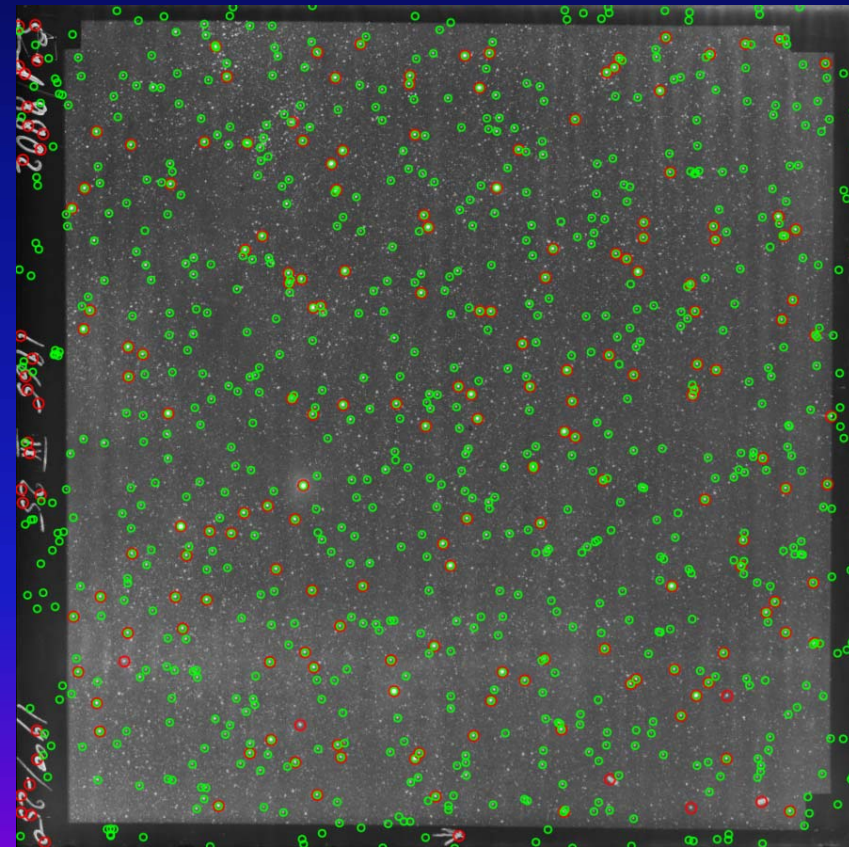
Test plate digitization
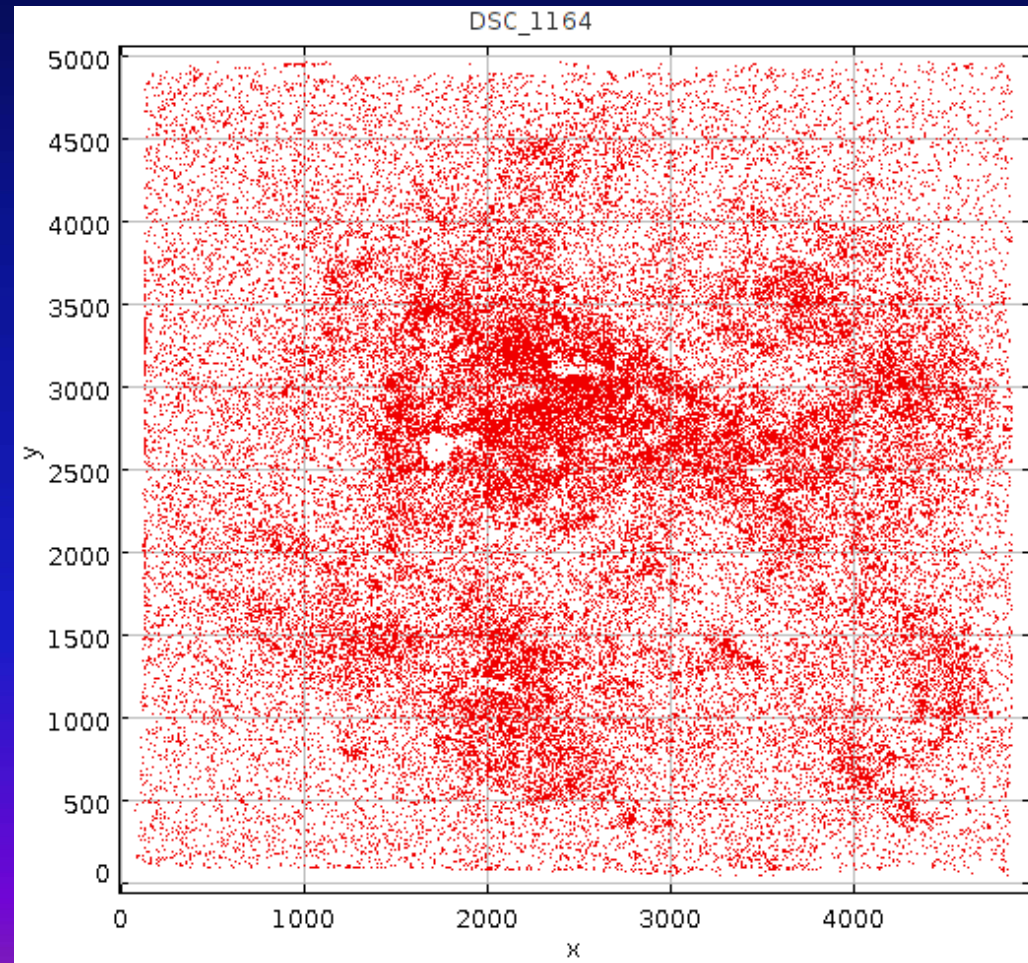
Uppsala, Monterey, Table Mountain

Astrometry Tests of digitized plates

- Center (RA, Dec): (286.397, -25.253)
- Center (RA, hms): 19h 05m 35.189s
- Center (Dec, dms): -25° 15' 09.472"
- Size: 14.7 x 14.7 deg
- Radius: 10.416 deg
- Pixel scale: 10.8 arcsec/pixel

# The Bamberg Plate digitized by digital camera

The procedure (Taavi Tuvikene)

The images were run through solver script, which calls SExtractor for extracting all stars, then astrometry.net for an initial solution, and finally does solving in sub-fields recursively.

Two sets RA and Dec were obtained: one from astrometry.net (with SIP order 3) and second from the SCAMP software in sub-fields. The resulting coordinates were matched with the UCAC4 catalogue in TOPCAT and plotted the residuals (in arcsec).

The SIP3 solution shows wobbles from the scanner arm movement (in Dec). These wobbles are missing from the digital camera image.

Comparing Camera vs. Scaner (the residual plots)
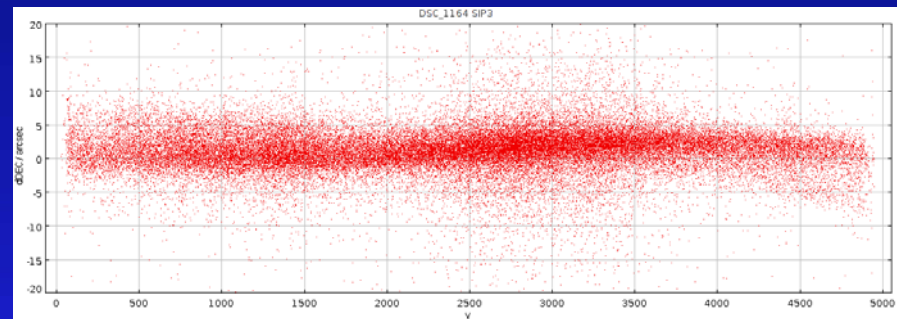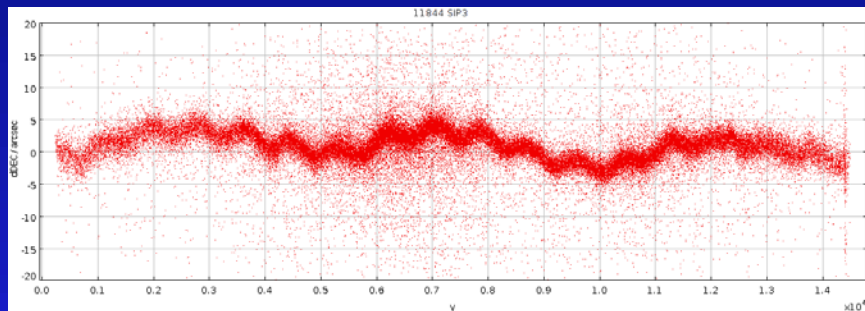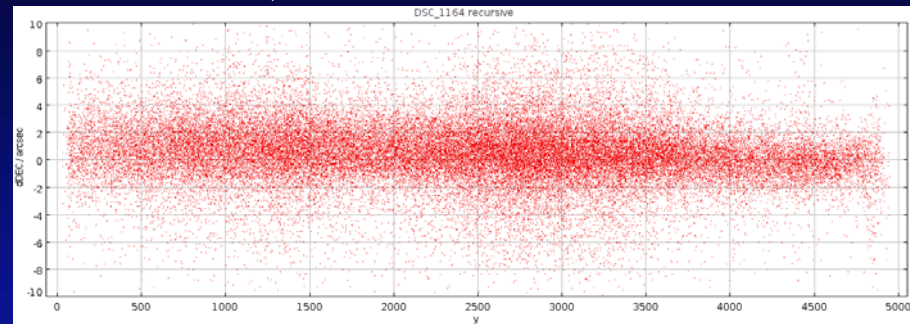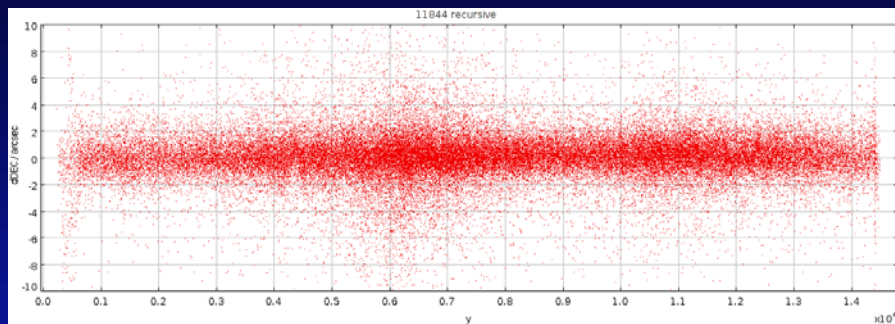
Scaner   **Camera**

Bamberg Southern Sky Survey Plate NZ 11844

- The "recursive" solution eliminates the distortions. The standard deviation of the residuals with the scanner method are 1.8 and 1.6 arcsec (plates 11844 and 11855, respectively). Stddev with the digital camera are **2.4 and 2.2 arcsec. Pixel scale is 1.77 arcsec with scanner and 5.36 arcsec with camera.**

- The photometric accuracy was also investigated and will be presented by Petra Skala

- Comparison with scaner not trivial as similar studies are, to our knowledge, not available

- **Details on photometric accuracy see next talk by P. Skala.**

- **Not trivial to compare with scaner as no such study available.**

Offering full service

- We offer full service to users / Institutes with astronomical plates)

- The service includes plate digitization, metadata extraction and recording, lens distorsion treatment, and storage of clean deconvoluted images in data archive with easy access and searching tools

Conclusions

- The use of digital camera with high quality lens tripod and light table together with lens distorsion solving offers alternative inexpensive (0.25 USD) and fast (2 sec) plate scanning method

- Typically, small plate archives with about 10 000 plates can be digitized within about one week

- The equipment can be easily trasferred

The End