

# **ASTRO-WISE**

**An e-science project for  
large surveys**

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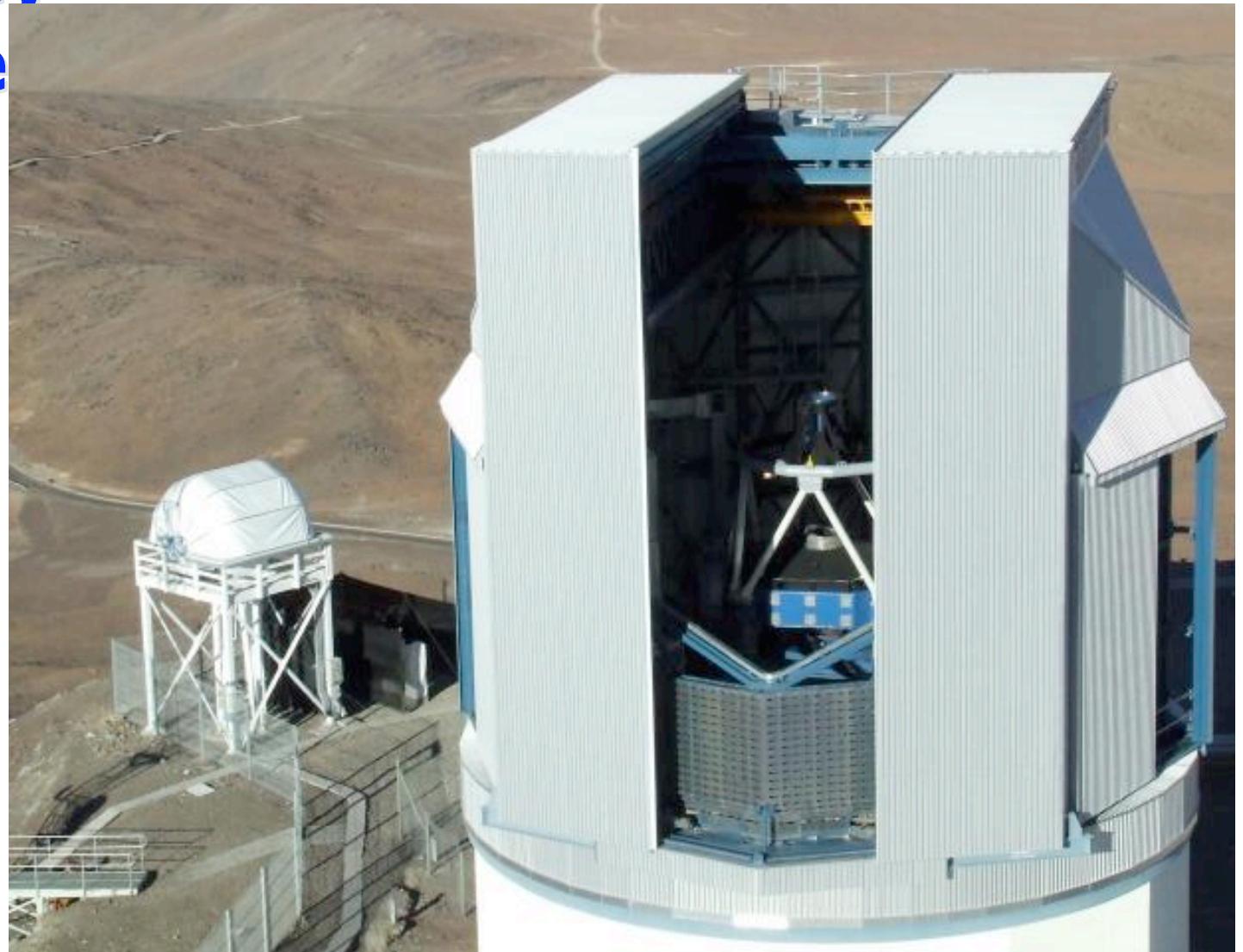
**Argelander Institut für Astronomie, Bonn**

# What is Astrowise?

- The Astronomical Wide Imaging System for Europe
- An ensemble of tools to
  - reduce (e.g flat-field) and
  - analyse (e.g derive morphology) images.
- It provides:
  - data mining, data selection/retrieval
  - Quality controls of data product
  - VO services
- 5 nodes federated via the database.
- The answer to the problem set by the amount of data produced by the VST and other telescopes.

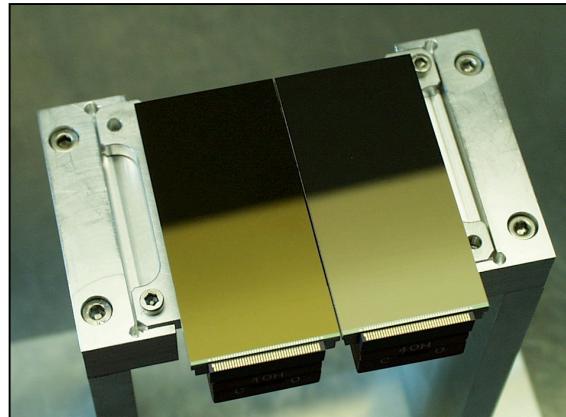
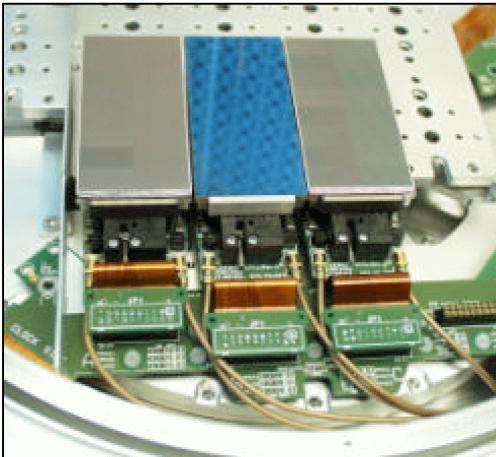
# VLT survey Telescope

- 2.61 diameter, f/5.5 Ritchey-Chretien
- Built by ESO and the Capodimonte Astronomical Observatory, Naples
- Goal: provide targets to the VLT next door

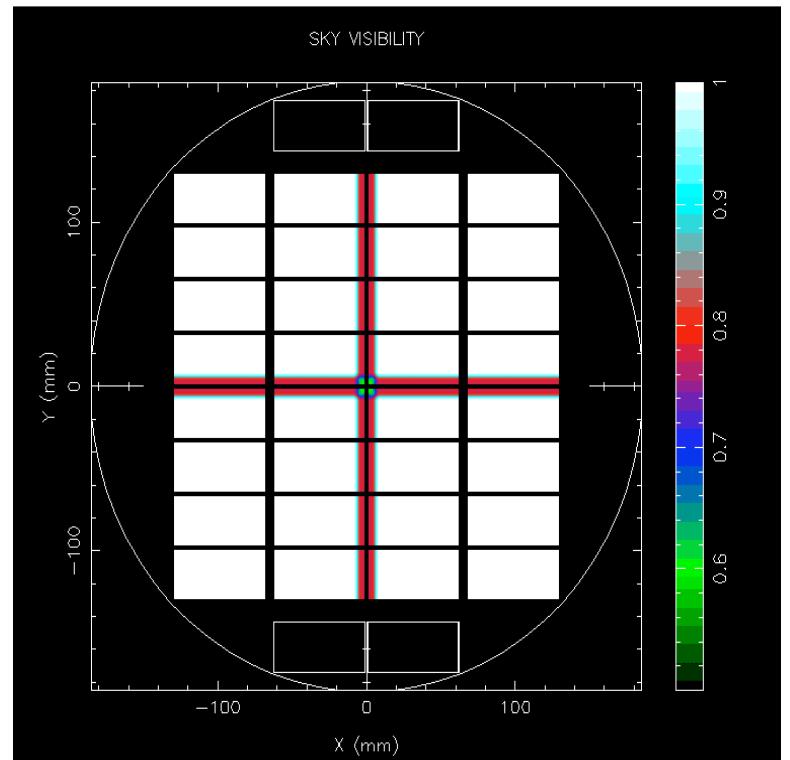


# OmegaCAM

- Science array 1 x 1 degree, 32 CCDs
  - ✓ 15  $\mu\text{m}$  pixels – 0.21 arcsec/pixel
  - ✓ Marconi 2k x 4k = 8 Mpix
  - ✓ 16k x 16k pixels = 256 Mpix
  - ✓ Very sensitive in blue
  - ✓ Uniform PSF over the FOV (KIDS)
- Auxiliary CCD's – 4 CCDs
  - ✓ For guiding
  - ✓ On-line Image analysis



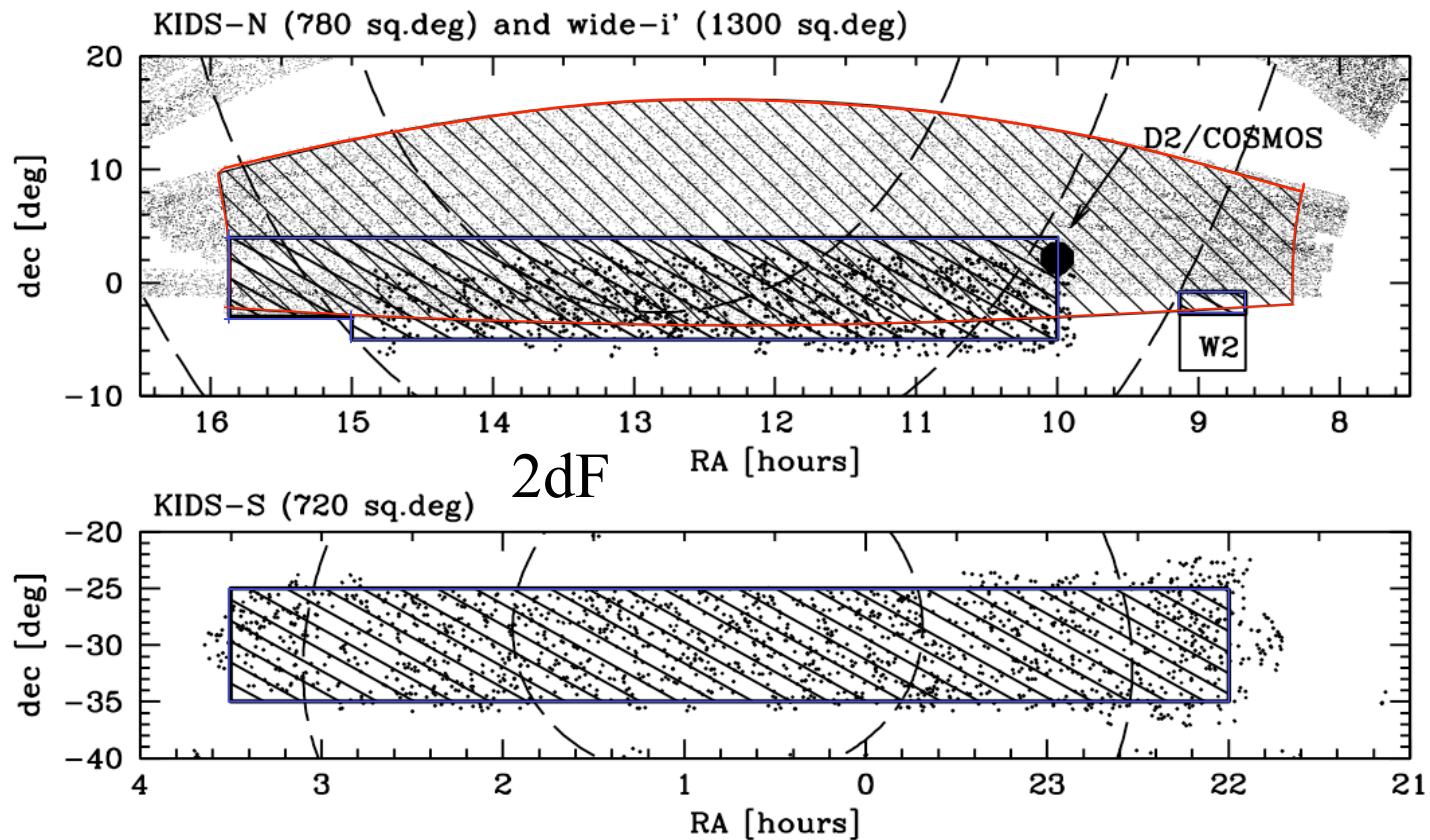
P.I.: K.Kuijken  
(Groningen, Leiden)



# KIDS: Kilo Degree Survey

## An ESO public survey

SDSS + UKIDSS



1500 sq.deg. in [ugrizYJHK](#)  
+2000 sq.deg. in [i](#) (+UKIDSS YJHK)

2.5 mag deeper than SDSS  
Main driver: weak lensing

# Large amount of data

- Wide-field imaging = Vast amount of data
  - VST ~50-100 Gb of raw data/night
  - **10s Tbyte/year** \* 3 or 4 for data reduction
  - KIDS: 40 000 individual survey images, >8000 stacks
- Handling of the data is non-trivial
  - Data reduction
  - Calibration and re-calibration
  - Image combinations
  - Working with large source lists/associate catalogues
  - Visualization
- Science on these data must be **archive**-based
- ASTRO-WISE aim: allow and facilitate data handling

# **AW consortium**

## **FUNDED BY EU FP5 RTD programm**

- **The Netherlands**  
Kapteyn Institute, Groningen. E. Valentijn (Manager)  
Sterrewacht Leiden
- **Germany**  
Universitäts-Sternwarte München/MPE/ESO, Munich  
Argelander-Institut für Astronomie, Bonn
- **Italy**  
Observatorio Astronomico di Capodimonte - Naples
- **France:**  
Institut d'Astrophysique de Paris / TERAPIX

# Software content

- **1) Fundamental softwares :**
- **Oracle:** database
- **Eclipse/CFITSIO:** image manipulation
- **SExtractor:** Source extraction, sky subtraction->astrometry, photometry
- **Swarp:** Co-addition, sky subtraction
- **LDAC/Scamp:** Astrometry
- **Skycat, DS9, fv, Stiff:** visualisation tools
- **Configuration files:** Swarp.conf, SExtractor.conf, Idac.conf..
- **Python:**
  - ✓ glue to all these programmes
  - ✓ Connection User-softwares via CVS (Concurrent Version System)

# Software content

- **2) Tools :**
- **SExtractor:** Source extraction
- **SAssociate:** associate source lists
- **PhotZ:** Photometric redshifts
- **VODIA, MDia:** VST OmegaCAM Differential Image Analysis
- **WEB interface:** search for data, inspection (history), flagging, retrieval
- **VO tools:** connection to ALADIN, TOPCAT
- **Galfit, Galphot:** Source fitting algorithms, surface photometry
  
- **3) To be added**
- **PSF homogeneisation**
- **Everything else we need!:** writing python interface to existing codes

# Database content

- **Raw data**
  - ✓ Observations
  - ✓ Ancillary data (exposure time, coordinates, filters...)
- **Calibration frames**
  - ✓ Bias, flatfields (dome, twilight), Hot and Cold pixel maps, satellite maps..
- **Reduced images**
  - ✓ Unique observations
  - ✓ Co-added images
- **Astrometric and photometric parameters**
- **Catalogues**
  - ✓ Source parameters
  - ✓ Association with other observations, other filters...
- **Complete history tracking**

# Full history tracking

Accessible with DBViewer for each frame:

- All frames which went into a Coadded frames are in the history
- All calibration files: Raw and Master Bias/Dome/Twilight, MasterFlat, weight maps...
- All parameters e.g. overscan parameter, Swarp & SExtractor configuration files...

History tracking allows to :

- check what happened
- find/solve problems at any step of the data reduction
- quickly reprocess from where necessary if a new better method is found

# Share and Federate

- Hardware resources + storage : Bonn (36 nodes, 240TB) Groningen, Munich, Naples, Paris
- Methods (programmes) for processing
- Raw data
- Calibration results
- Reduced images
- Source lists - Catalogues - Associations

Simplifies/divides the task

Guaranties homogeneity of data products

# **Supported data sources**

- **WFI@2.2m**
- **WFC@INT**
- **MDM8K@MDM**
- **SUP@Subaru**
- **OmegaCAM@VST**
- **WENSS radio data**  
Westerbork Northern Sky Survey
- **ESO-LV data Catalogues**  
and images
- **LOFAR**
- **ACS@HST**

# VO services

## Simple Cone Search

Cone Search

world

Cone Search protocol realization for Astro-Wise.

## Simple Image Access

Simple Image Access

world

Simple Image Access protocol for Astro-Wise

## Registry

Registry

world

Local publishing registry of Astro-Wise

## Pubs

Publication Server

aw partners

The service designed to help publishing of Astro-Wise data both inside Astro-Wise and Virtual Observatory

## Aladin

Aladin

world

How to patch Aladin to make available Astro-Wise data browsing

## Google Sky

Google Sky

world

The skymap web service of Google is used to overplot frame and source information from the Astro-WISE database

# Conclusion

- AW= ensemble of tools to reduce (e.g flat-field) and analyse (e.g derive morphology) images.
- AW provides data reduction pipelines+data mining+QC tools+documentation+web interface+VO services
- Nodes are federated via the database to share everything (methods and data) and ensure homogeneity.
- AW is very flexible:
  - Many instruments already included
  - new tools can be added to the system.
- [www.astro-wise.org](http://www.astro-wise.org)

**Thank you**