Data validation beyond Big Data

Edwin A. Valentijn

Kapteyn Astronomical Institute

6 June 2018 VST in the era of large sky surveys- Napoli

STORY LINES

- processing/archiving/distribution:

  - AstroWISE- KiDs - Ou-Ext – Euclid

- data validation:

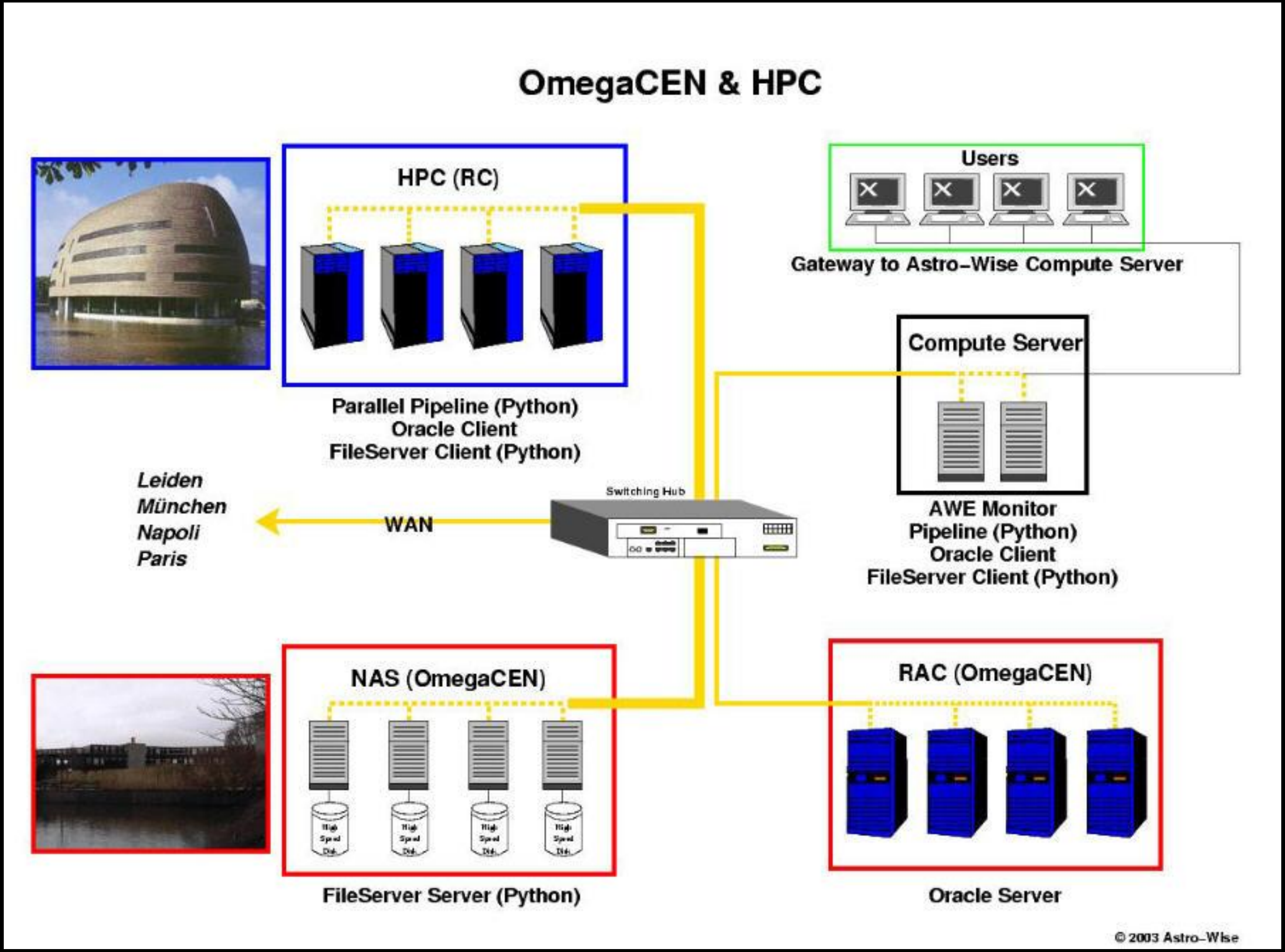
  - lineage - OU-Ext - Euclid- Facts and Fakes

Sequence of hypes:

GRID - Big Data - Machine learning -> data validation

The Datacentric approach

local networks and distributed



2003
RUG-CIT

Astro-WISE – Data federations

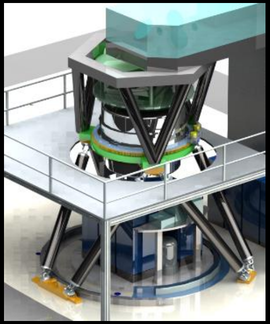
Distributed Information Systems - handling surveys

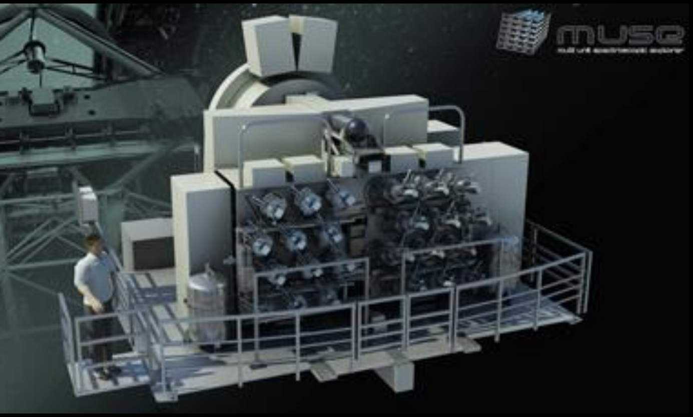
since 2003 - it works

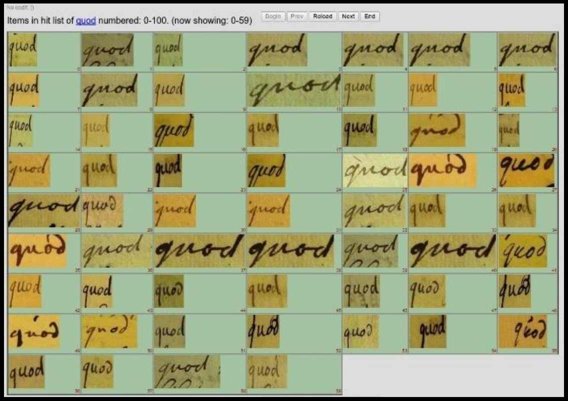
OmegaCEN@Kapteyn datacenter ~15-20 fte

KiDS - ESO – OmegaCAM@VST
MUSE - ESO - VLT
Lofar - LTA - Astron
Glimps - AI Handwritten text – Lifelines DNA
Target Holding

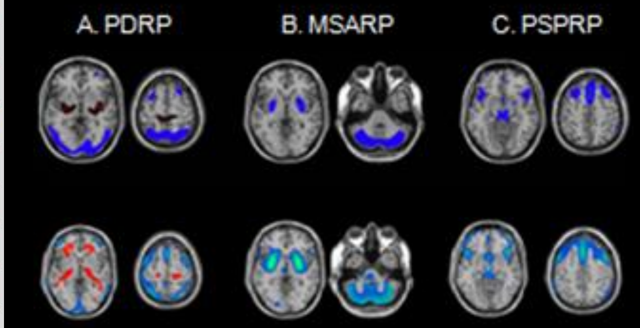
-> Euclid - ESA
-> Micado - ESO - ELT







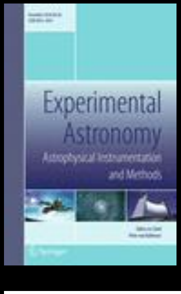
Items in hit list of quod numbered: 0-100. (now showing: 0-59)



all published

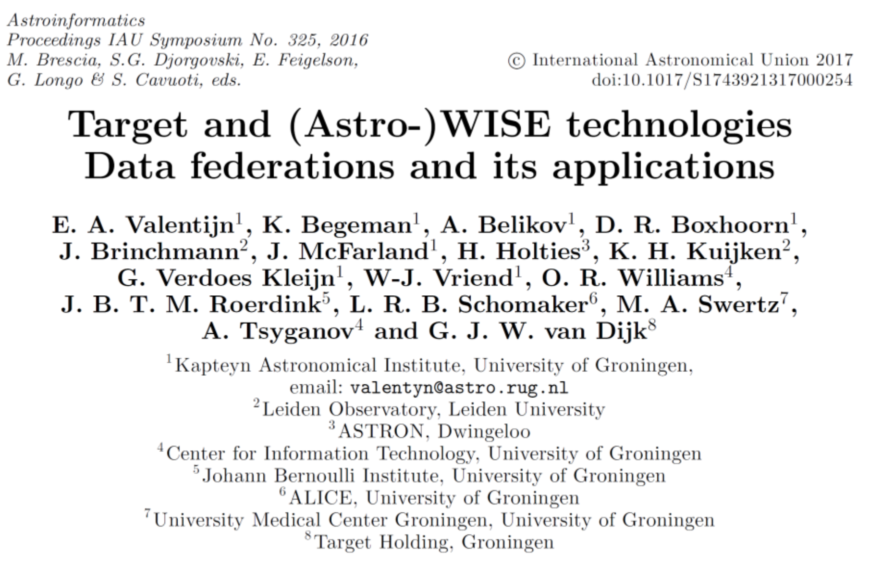
http://www.astro-wise.org Manuals & tutorials

http://www.rug.nl/target Target Consortium



Experimental Astronomy - Vol. 35, 2013

All papers are online



Astroinformatics
Proceedings IAU Symposium No. 325, 2016
M. Brescia, S.G. Djorgovski, E. Feigelson,
G. Longo & S. Cavuoti, eds.

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doi:10.1017/S1743921317000254

Target and (Astro-)WISE technologies
Data federations and its applications

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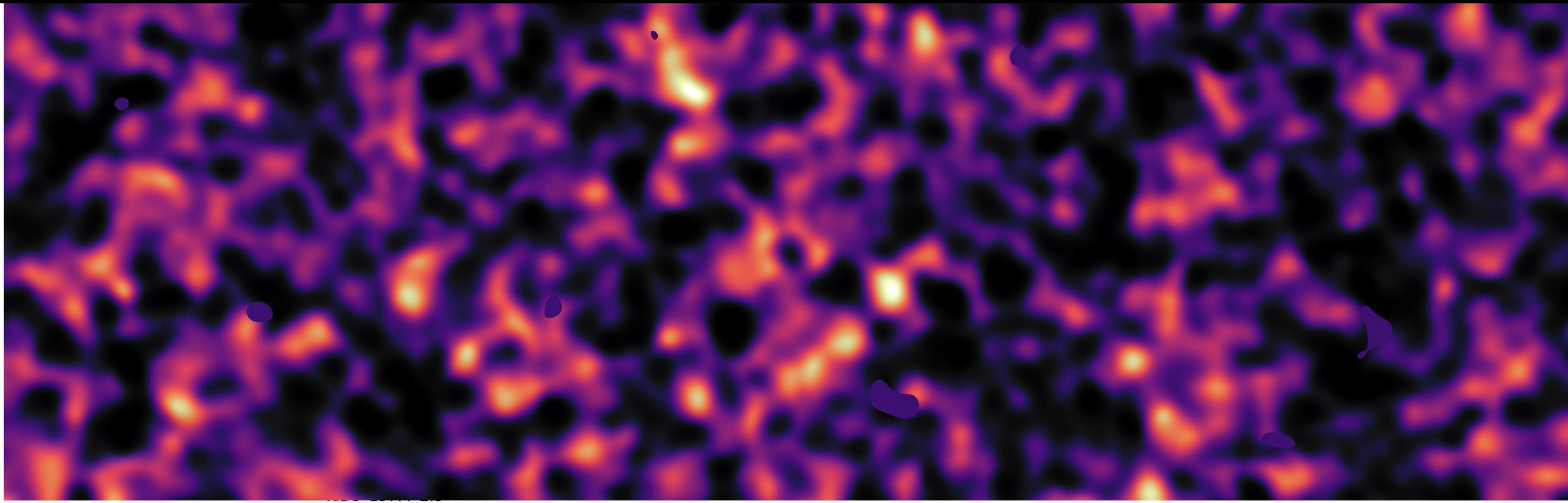
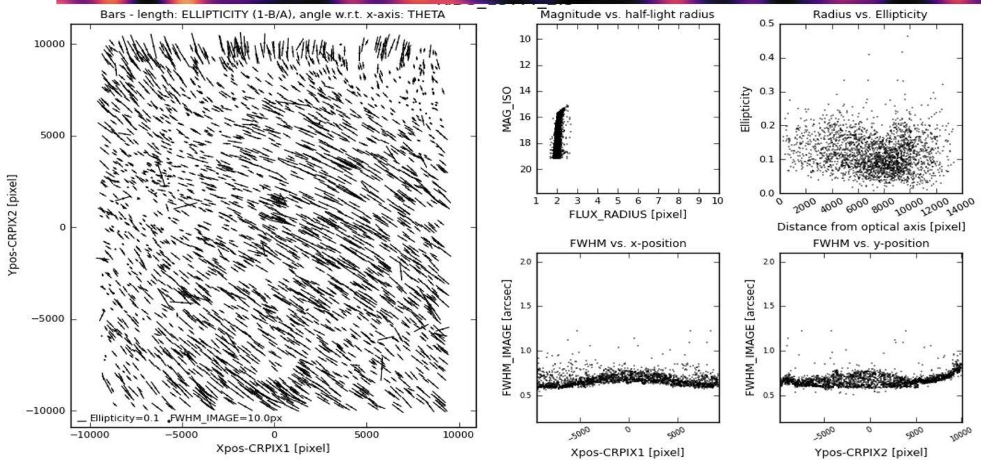
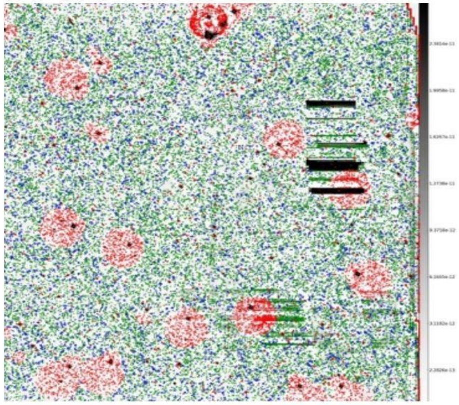
[8]Target Holding, Groningen

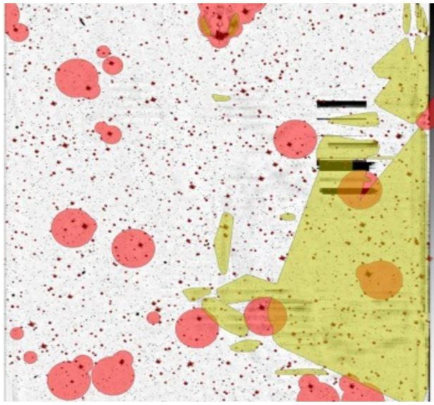
Astroinformatics 2016
IAU symposium 325
Datafederations
Valentijn et al. 2017

KiDS Quality control DR1-DR2-DR3
OmegaCAM@VST 740 sq deg









Links as workhorse in data federations

The Universe as a spreadsheet

ERCIM News 2006

AstroWISE *Chaining to the Universe*

ADASS XVI ASP Conference Series,

15-18 October 2006 in Tucson, Arizona, USA.

- Distributed Information Systems
  - Users, computers, storage
- Processing and Quality control
- Reproducable (re-processing)

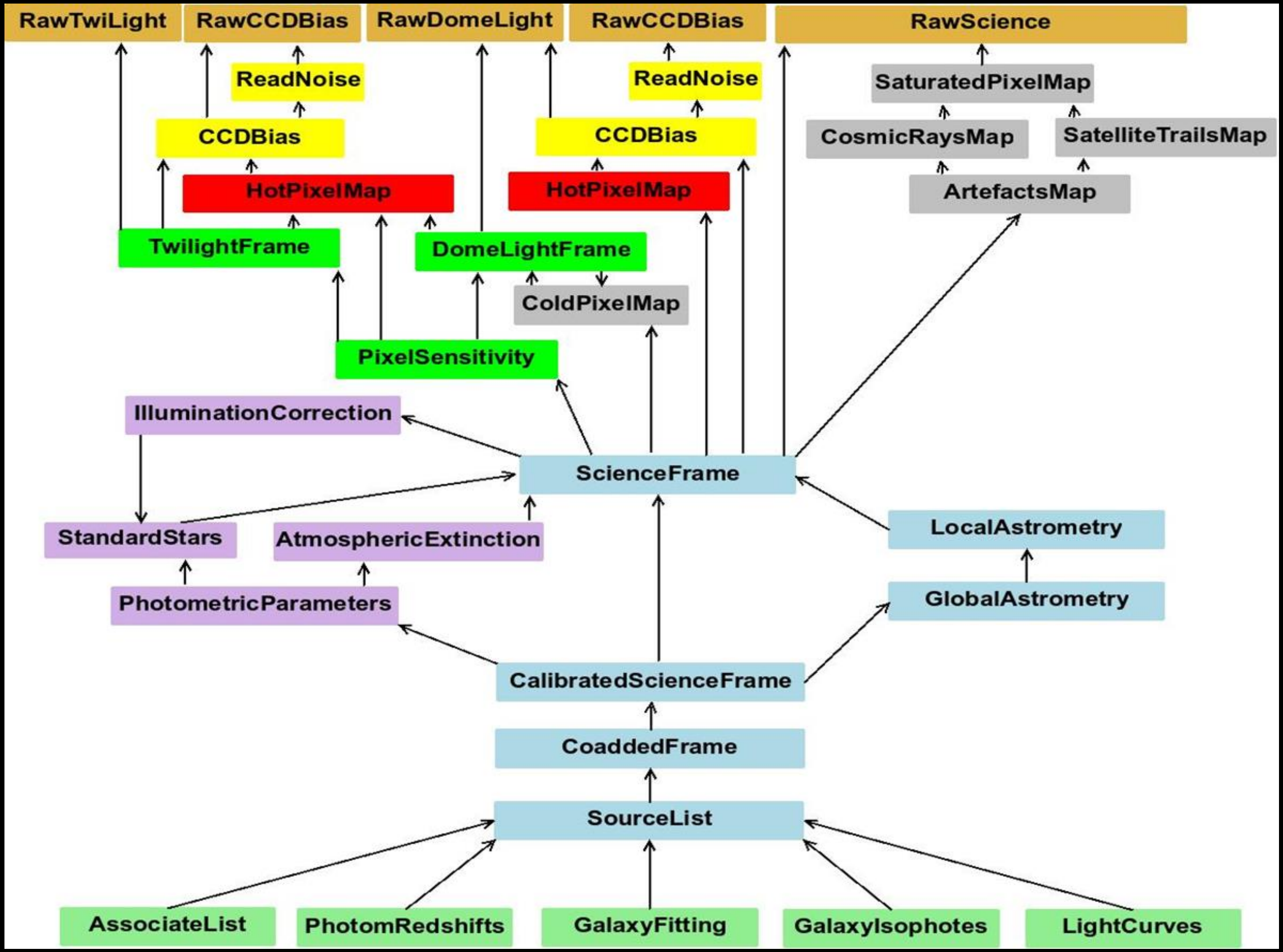
2018: Open Science - **FAIR** principles

Findable **A**ccessable **I**nteroperable **R**eproducable

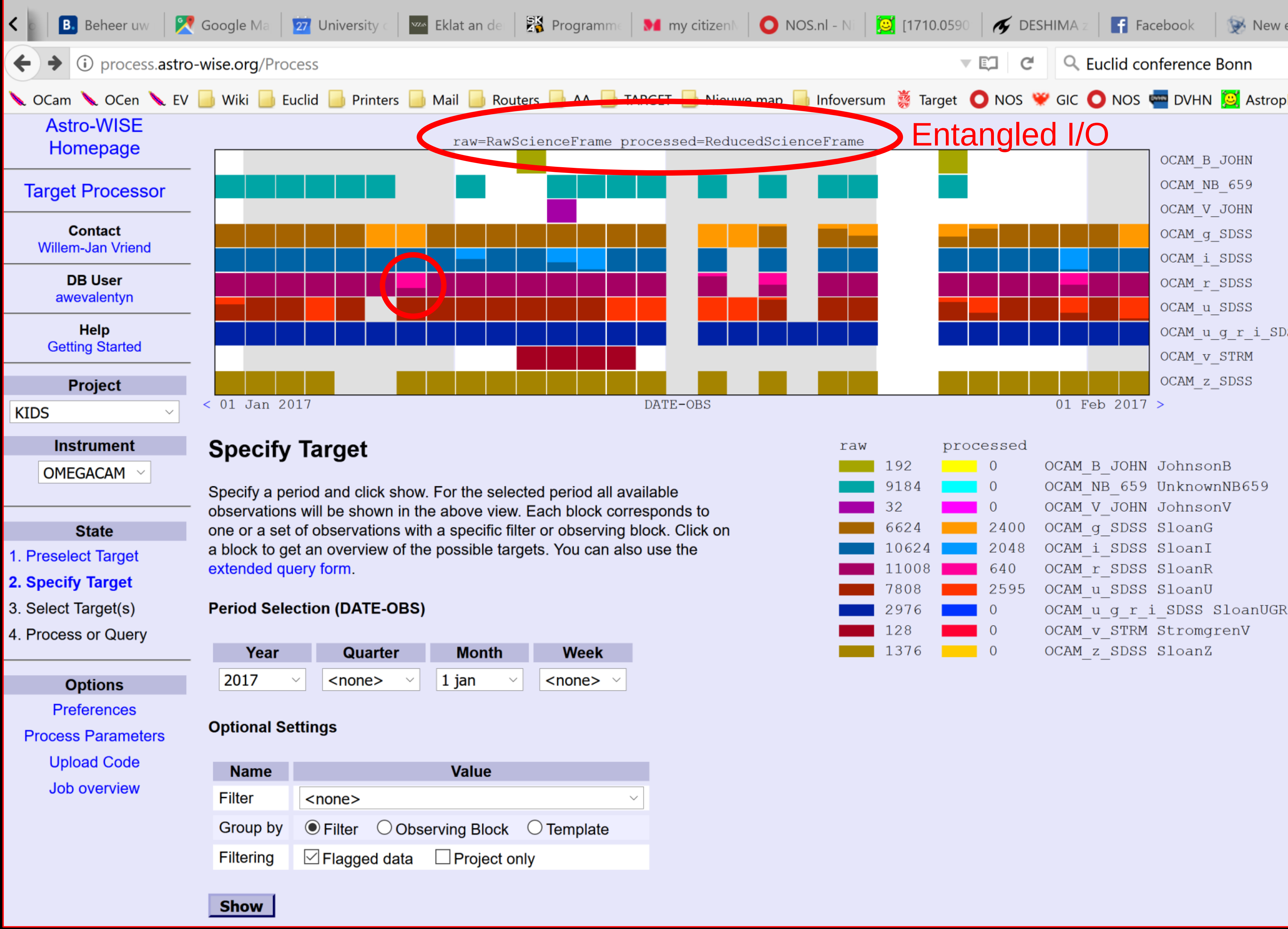
The universe as a spreadsheet

Target Diagram/Data lineage /backward chaining ++ programming - dependencies

QUERY / INFORMATION



PROCESSING



Entangled I/O

raw=RawScienceFrame processed=ReducedScienceFrame

Astro-WISE Homepage

Target Processor

Contact
Willem-Jan Vriend

DB User
awevalentyn

Help
Getting Started

Project
KIDS

Instrument
OMEGACAM

State
1. Preselect Target
2. **Specify Target**
3. Select Target(s)
4. Process or Query

Options
Preferences
Process Parameters
Upload Code
Job overview

Specify Target

Specify a period and click show. For the selected period all available observations will be shown in the above view. Each block corresponds to one or a set of observations with a specific filter or observing block. Click on a block to get an overview of the possible targets. You can also use the extended query form.

Period Selection (DATE-OBS)

Year	Quarter	Month	Week
2017	<none>	1 jan	<none>

Optional Settings

Name	Value
Filter	<none>
Group by	● Filter ○ Observing Block ○ Template
Filtering	☑ Flagged data □ Project only

Show

raw		processed			
■	192	■	0	OCAM_B_JOHN	JohnsonB
■	9184	■	0	OCAM_NB_659	UnknownNB659
■	32	■	0	OCAM_V_JOHN	JohnsonV
■	6624	■	2400	OCAM_g_SDSS	SloanG
■	10624	■	2048	OCAM_i_SDSS	SloanI
■	11008	■	640	OCAM_r_SDSS	SloanR
■	7808	■	2595	OCAM_u_SDSS	SloanU
■	2976	■	0	OCAM_u_g_r_i_SDSS	SloanUGR
■	128	■	0	OCAM_v_STRM	StromgrenV
■	1376	■	0	OCAM_z_SDSS	SloanZ

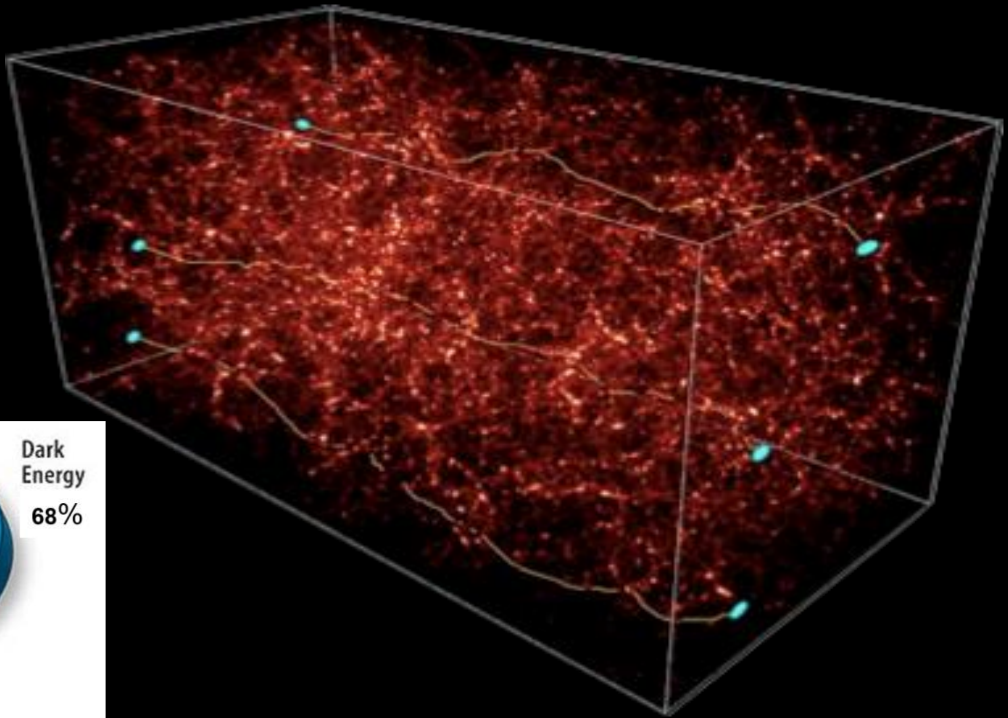
Euclid

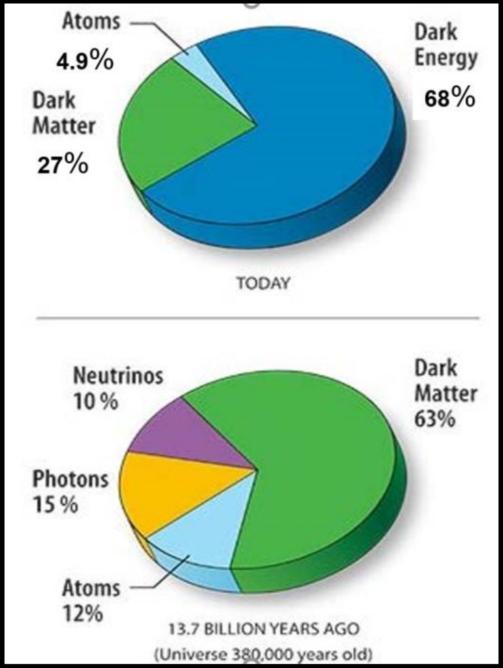
ESA launch in May 2021

Euclid Archive System (EAS)

- data centric information system
- many of the WISE concepts
- prototype uses Astro-WISE
- db hosted in the Euclid SDC-NL in Groningen

Weak gravitational lensing as probe of dark matter





KiDS: < 100 10^6 redshifts

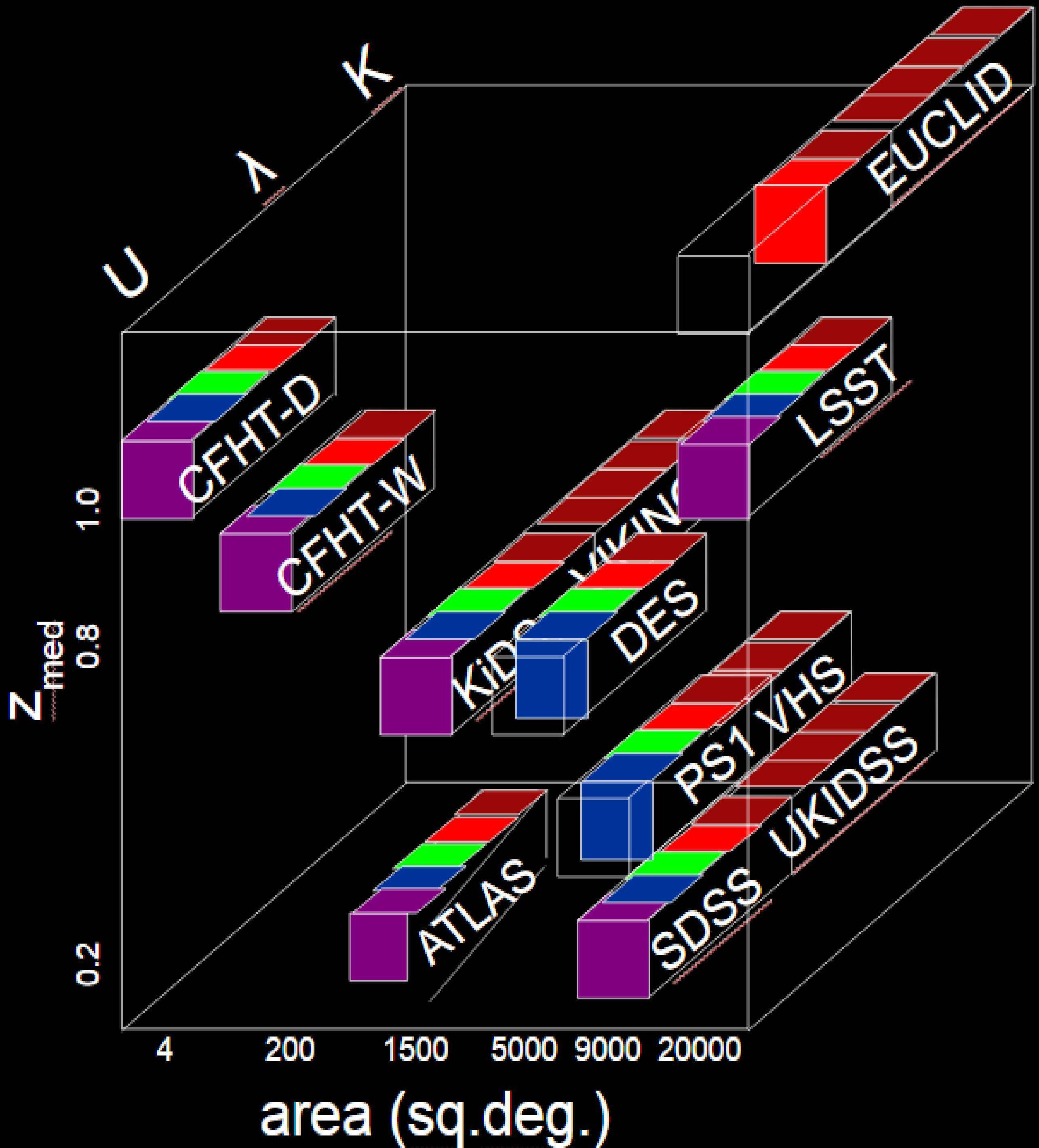
EUCLID: 1.5 10^9 redshifts - phot- z

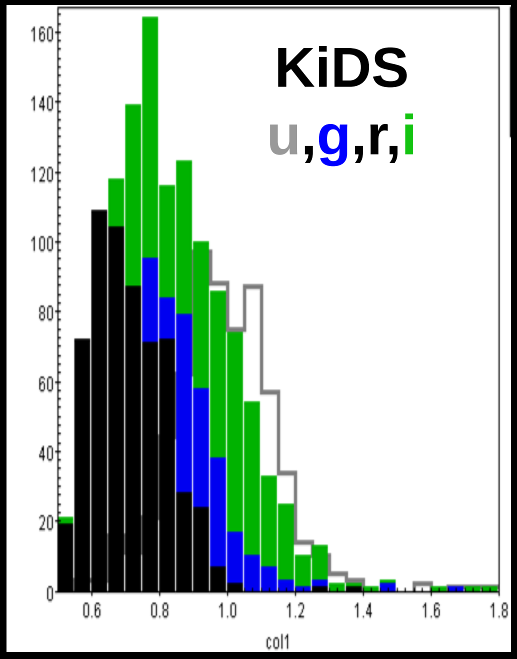
Ground based data – OU-Ext

Every galaxy has its own 4 PSFs

QC- bias – re-processing

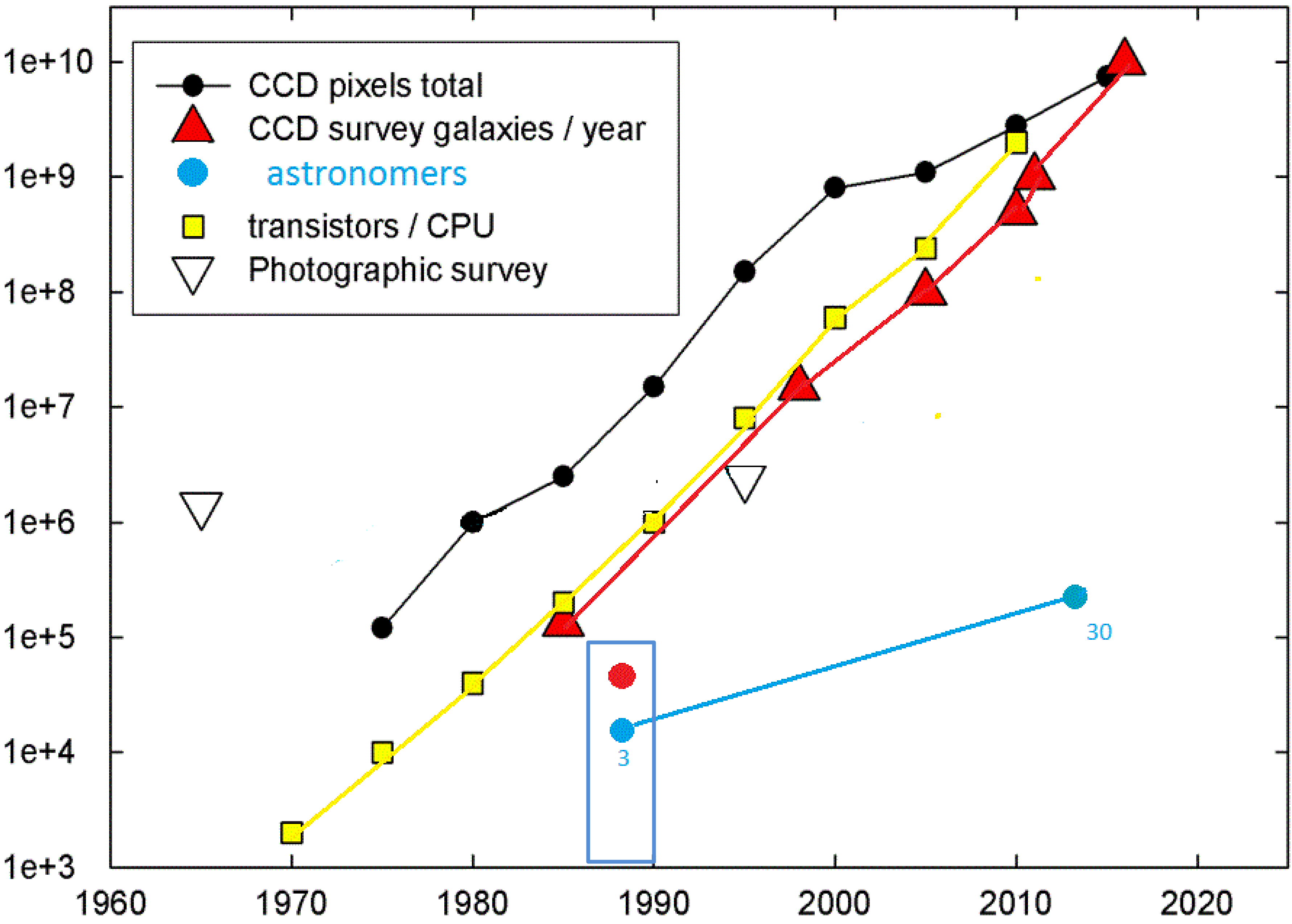
KiDS/VIKING





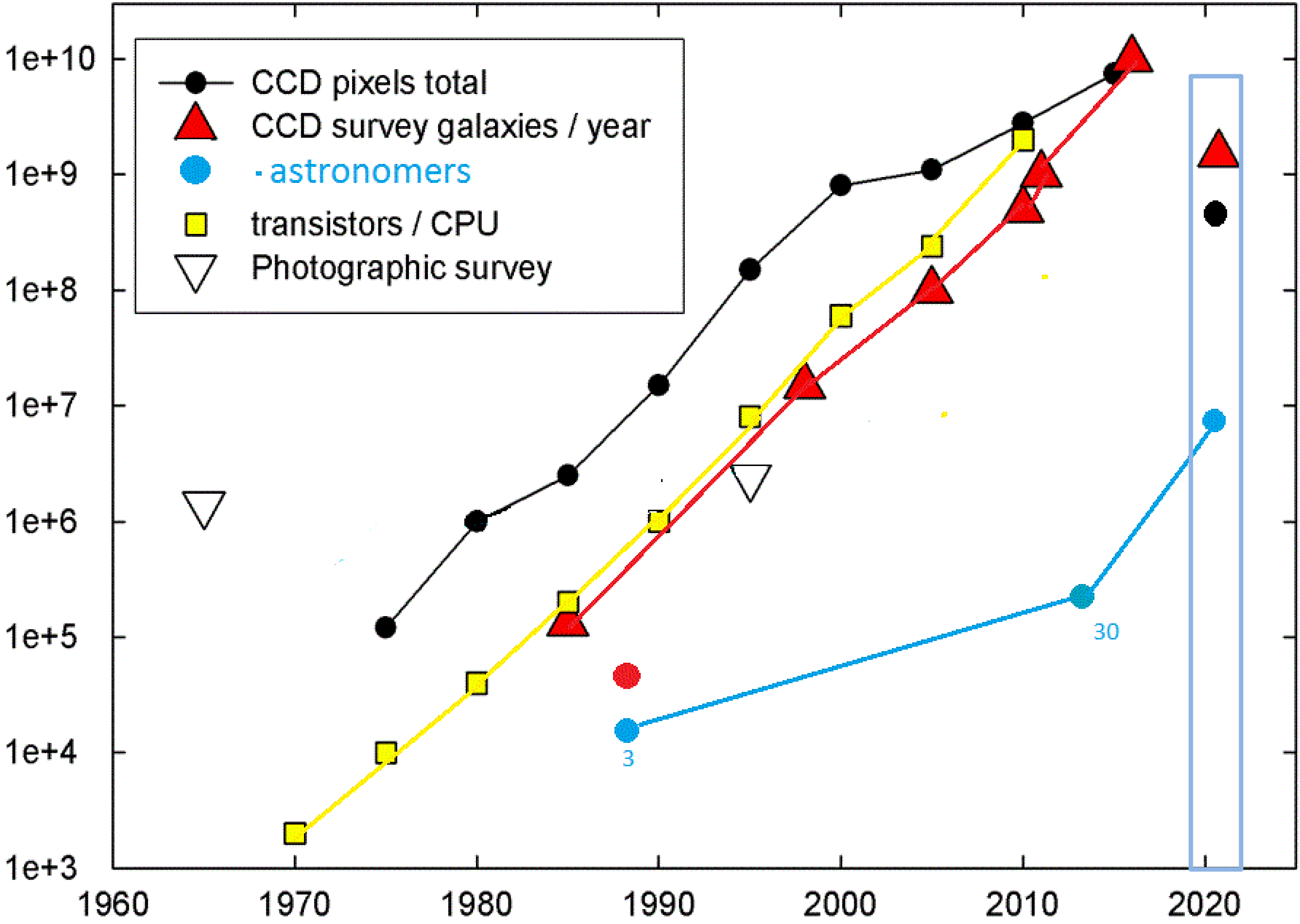
Seeing (“)

Trends in Optical Astronomy Survey Data



after Tyson- Szalay

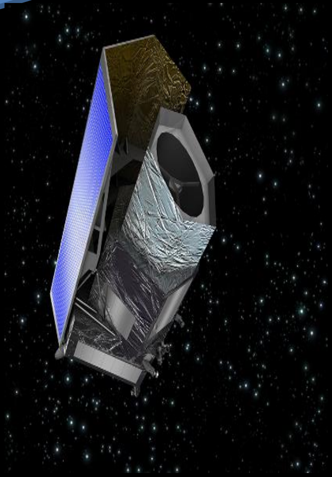
Trends in Optical Astronomy Survey Data



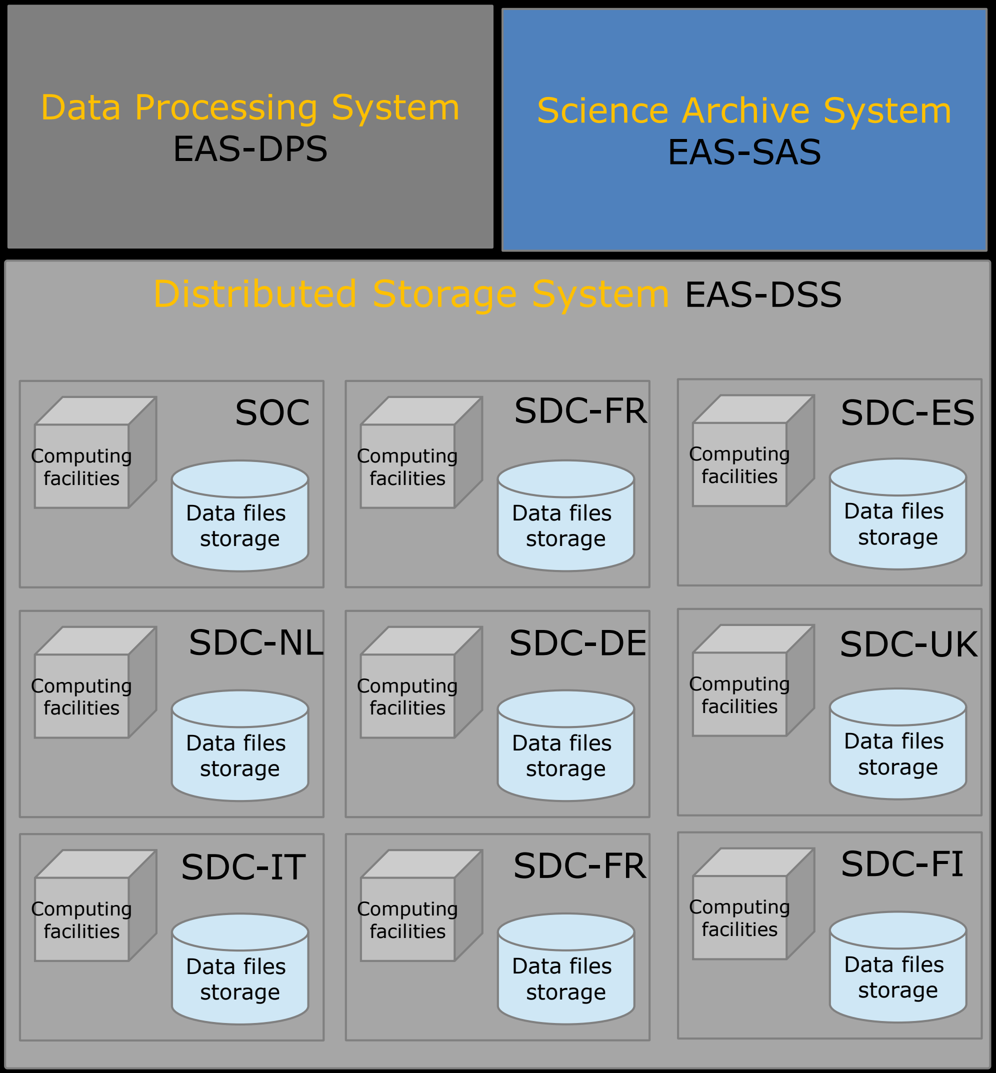
Distributed communities acces-proces-calibrate-analyse publish

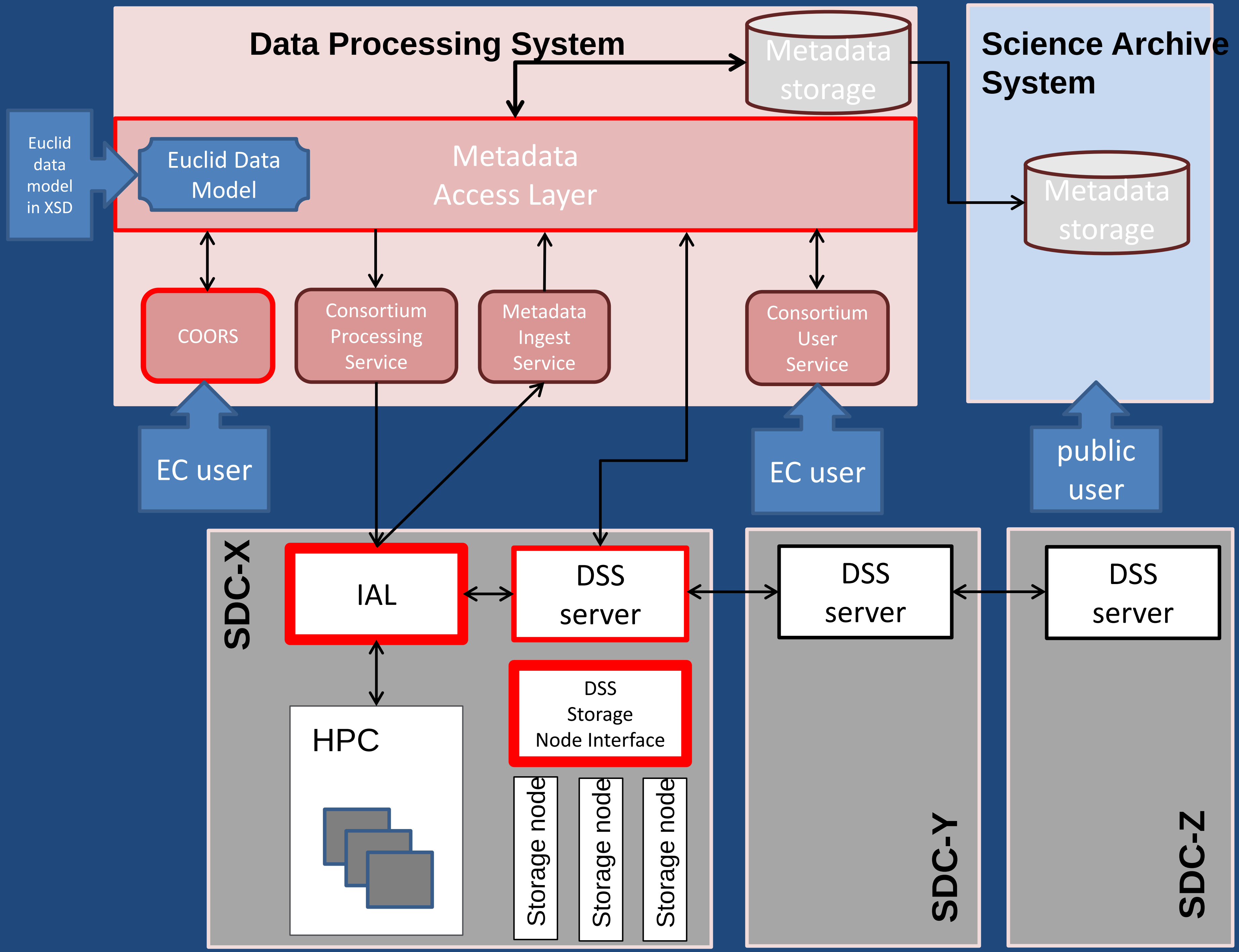
Euclid:

- 1500 registered members and growing
- 200 laboratories/departments
- 16 countries contributing
- NASA/US: provides the IR detectors.



Euclid Archive system – EAS – lay out





Data Processing System

Metadata storage

Science Archive System

Metadata storage

Euclid data model in XSD

Euclid Data Model

Metadata Access Layer

COORS

Consortium Processing Service

Metadata Ingest Service

Consortium User Service

EC user

EC user

public user

SDC-X

IAL

DSS server

HPC

DSS Storage Node Interface

Storage node

Storage node

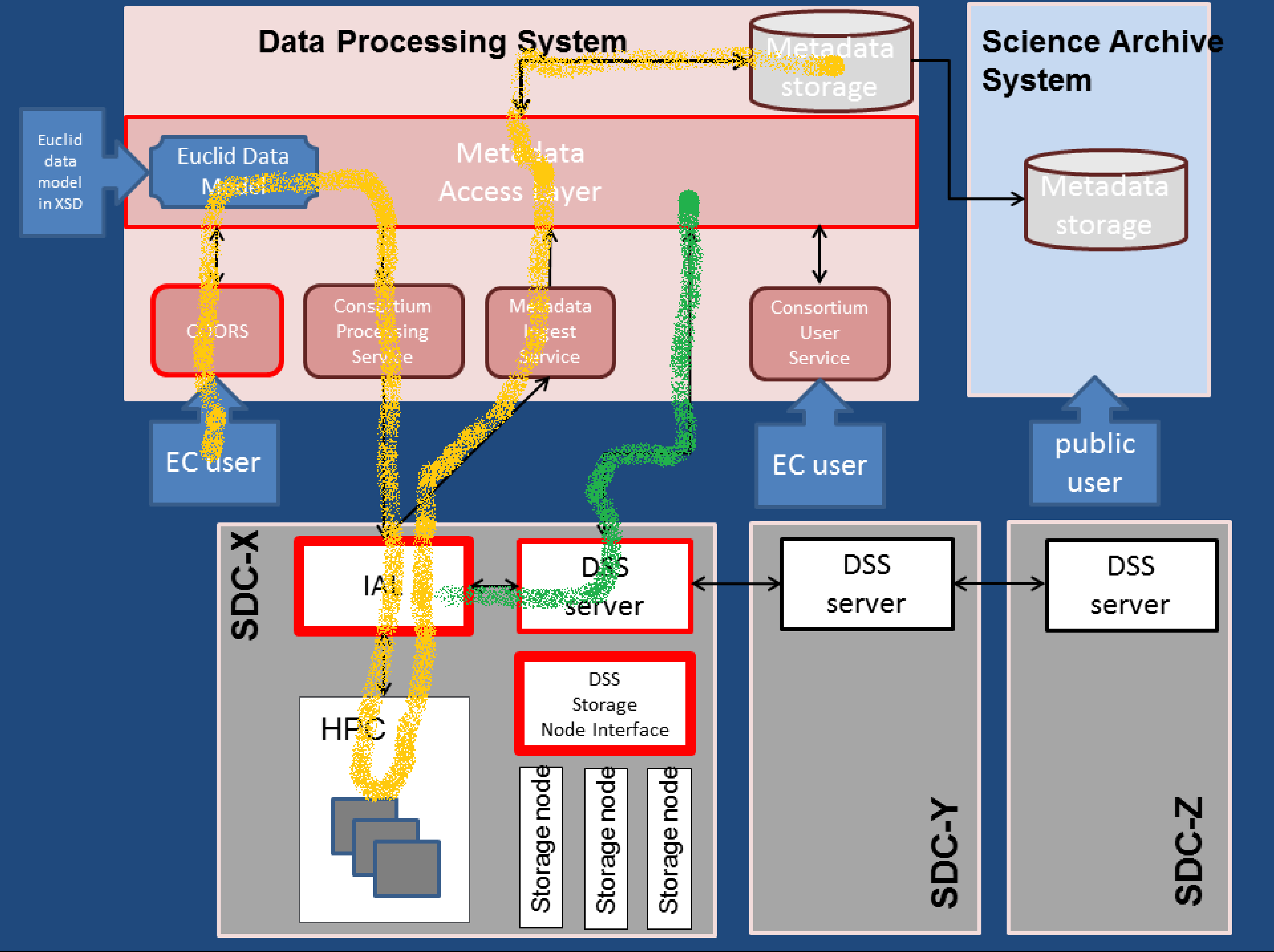
Storage node

DSS server

SDC-Y

DSS server

SDC-Z



Data Processing System

Metadata storage

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Euclid data model in XSD

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Consortium User Service

EC user

EC user

public user

SDC-X

IAL

DSS server

HPC

DSS Storage Node Interface

Storage node

Storage node

Storage node

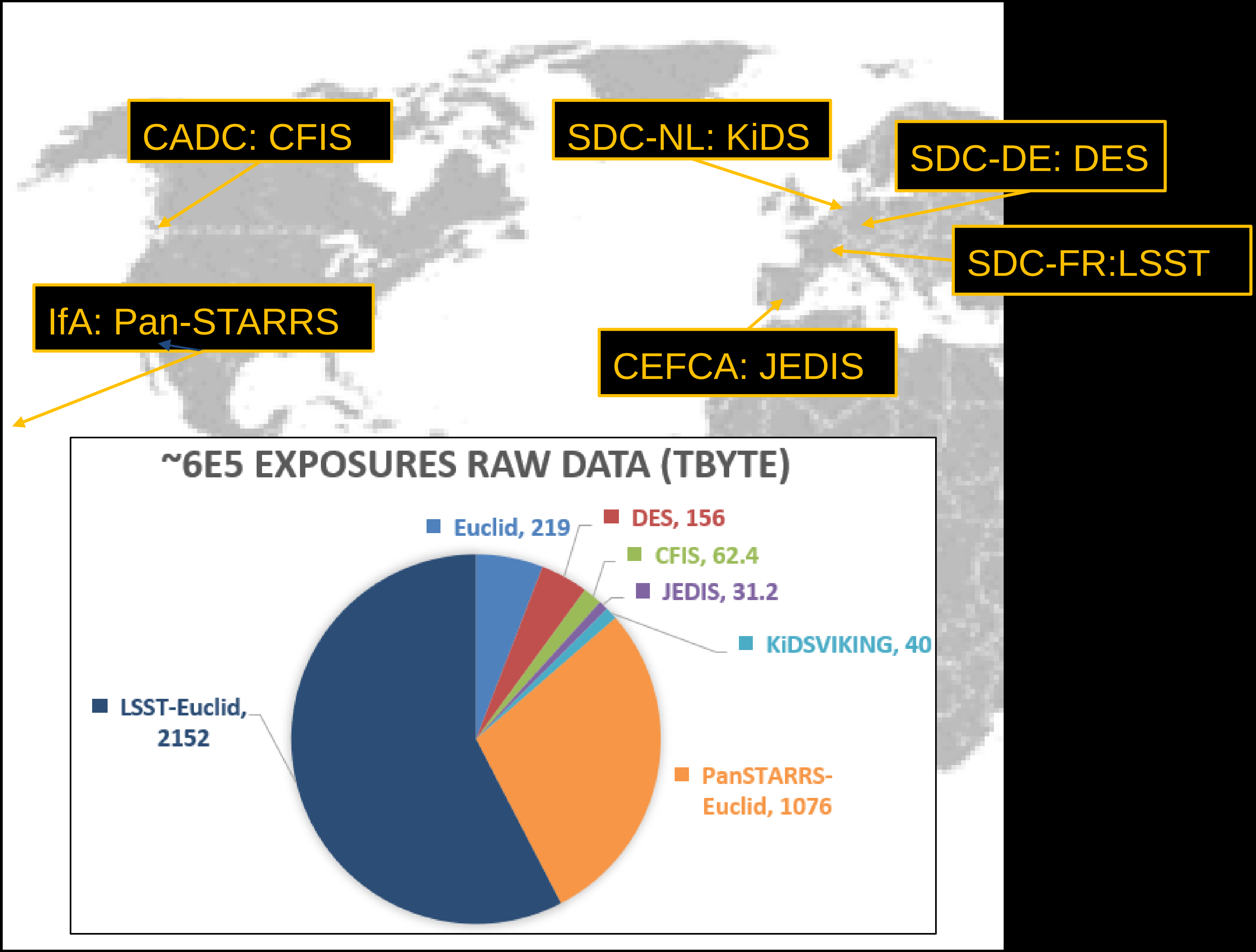
SDC-Y

DSS server

SDC-Z

DSS server

Euclid-EXT: massive pixel volumes - distributed archives



CADC: CFIS

SDC-NL: KiDS

SDC-DE: DES

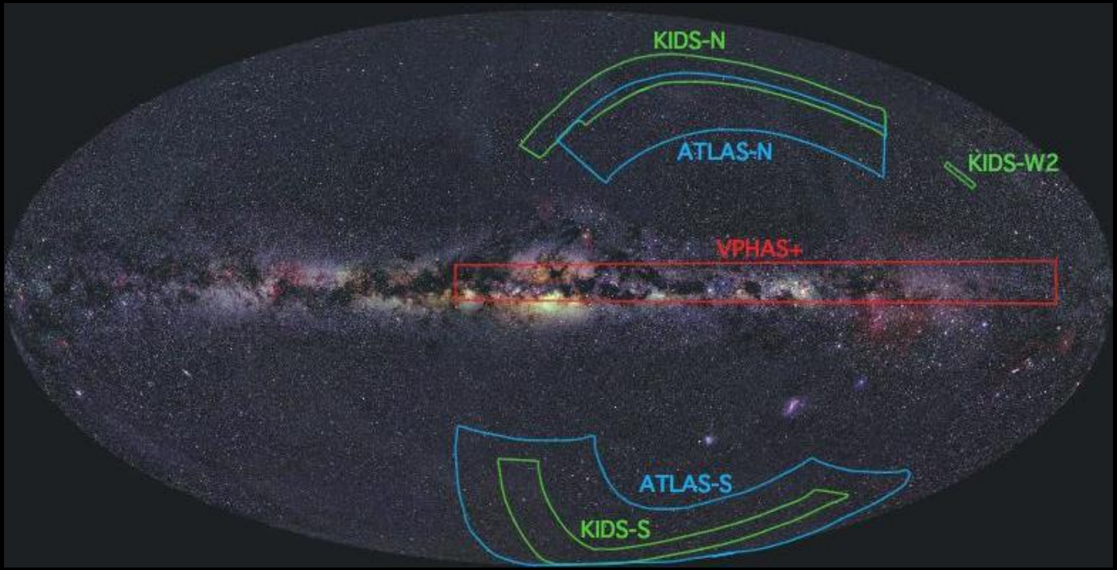
SDC-FR:LSST

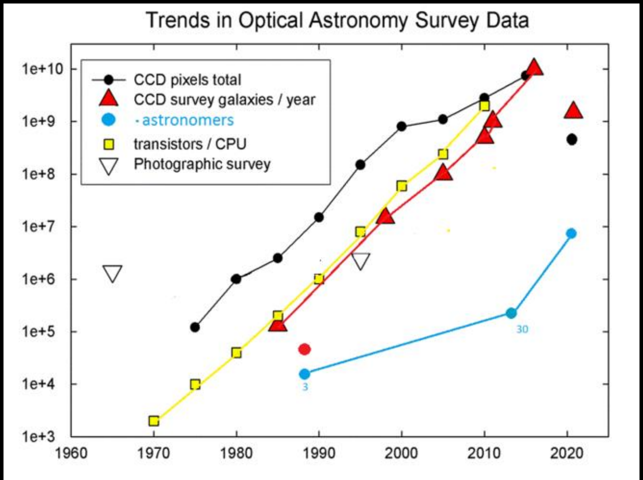
IfA: Pan-STARRS

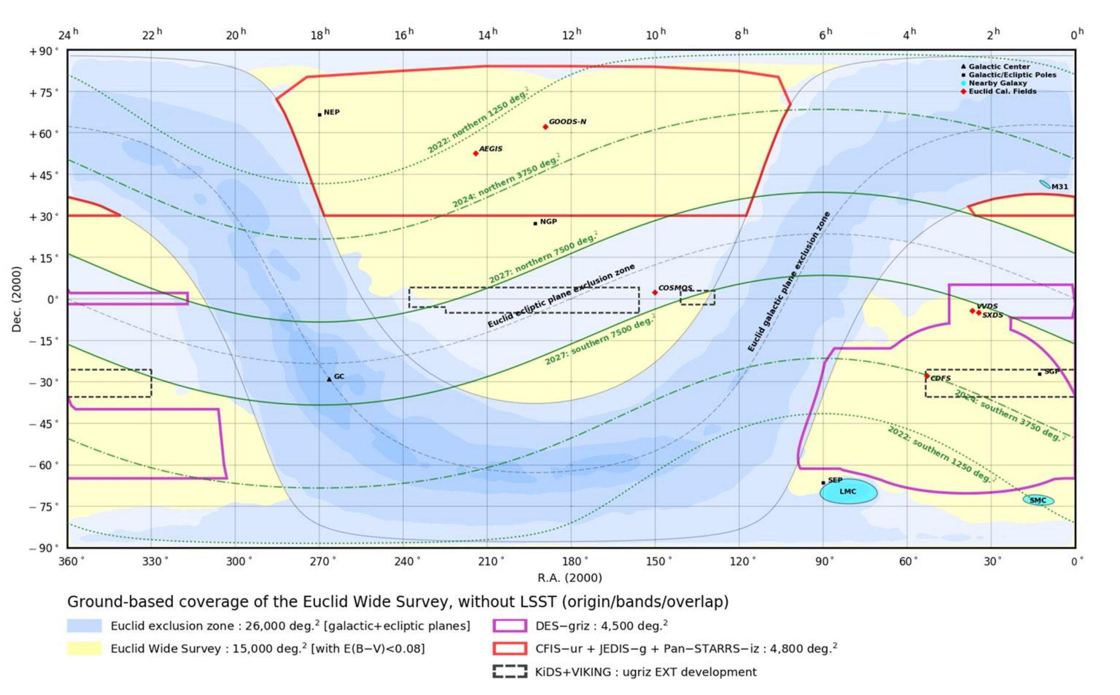
CEFCA: JEDIS

~6E5 EXPOSURES RAW DATA (TBYTE)

From KiDS to Euclid-EXT






Ground-based coverage of the Euclid Wide Survey, without LSST (origin/bands/overlap)

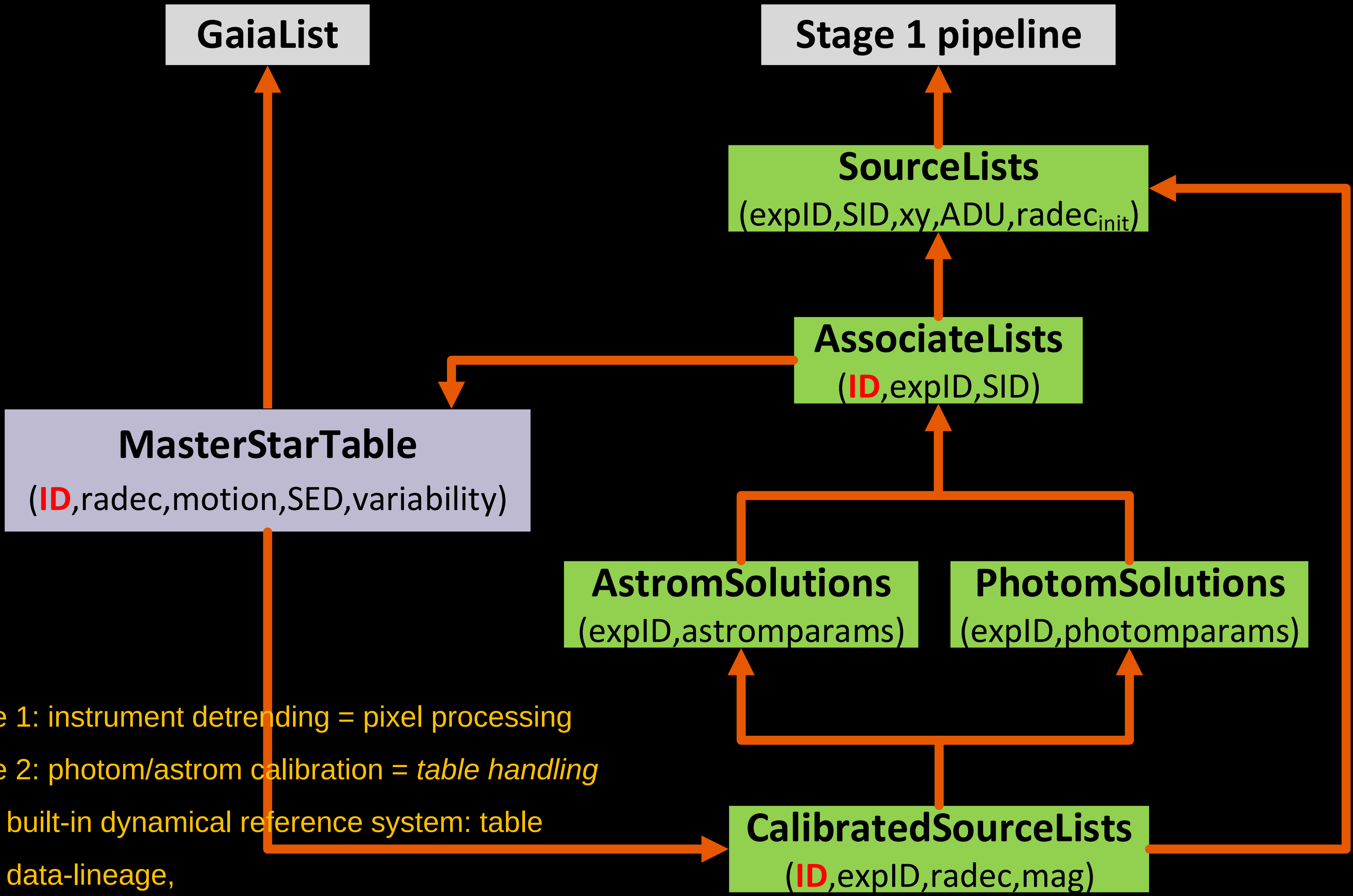
24h
22h
20h
18h
16h
14h
12h
10h
8h
6h
4h
2h
0h
+90°
+75°
+60°
+45°
+30°
+15°
0°
−15°
−30°
−45°
−60°
−75°
−90°
Dec. (2000)
360°
330°
300°
270°
240°
210°
180°
150°
120°
90°
60°
30°
0°
R.A. (2000)
Galactic Center
Galactic/Ecliptic Poles
Nearby Galaxy
Euclid Cal. Fields
NEP
GOODS-N
AEGIS
NGP
M31
COSMOS
VVDS
SXDS
CDFS
SGP
GC
SEP
LMC
SMC
2022: northern 1250 deg.²
2024: northern 3750 deg.²
2027: northern 7500 deg.²
2027: southern 7500 deg.²
2024: southern 3750 deg.²
2022: southern 1250 deg.²
Euclid ecliptic plane exclusion zone
Euclid galactic plane exclusion zone
Euclid exclusion zone : 26,000 deg.² [galactic+ecliptic planes]
Euclid Wide Survey : 15,000 deg.² [with E(B−V)<0.08]
DES−griz : 4,500 deg.²
CFIS−ur + JEDIS−g + Pan−STARRS−iz : 4,800 deg.²
KiDS+VIKING : ugriz EXT development

Euclidization

Changing reference systems

Astrometry- photometry

Target diagram (++ dependencies) for OU-EXT – Euclid external data - stage 2- dynamic Euclidization



GaiaList

Stage 1 pipeline

SourceLists
(expID,SID,xy,ADU,radec$_{init}$)

AssociateLists
(ID,expID,SID)

MasterStarTable
(ID,radec,motion,SED,variability)

AstromSolutions
(expID,astromparams)

PhotomSolutions
(expID,photomparams)

CalibratedSourceLists
(ID,expID,radec,mag)

Stage 1: instrument detrending = pixel processing

Stage 2: photom/astrom calibration = *table handling*

- built-in dynamical reference system: table data-lineage,
- QC, re-processing

Beyond Big Data

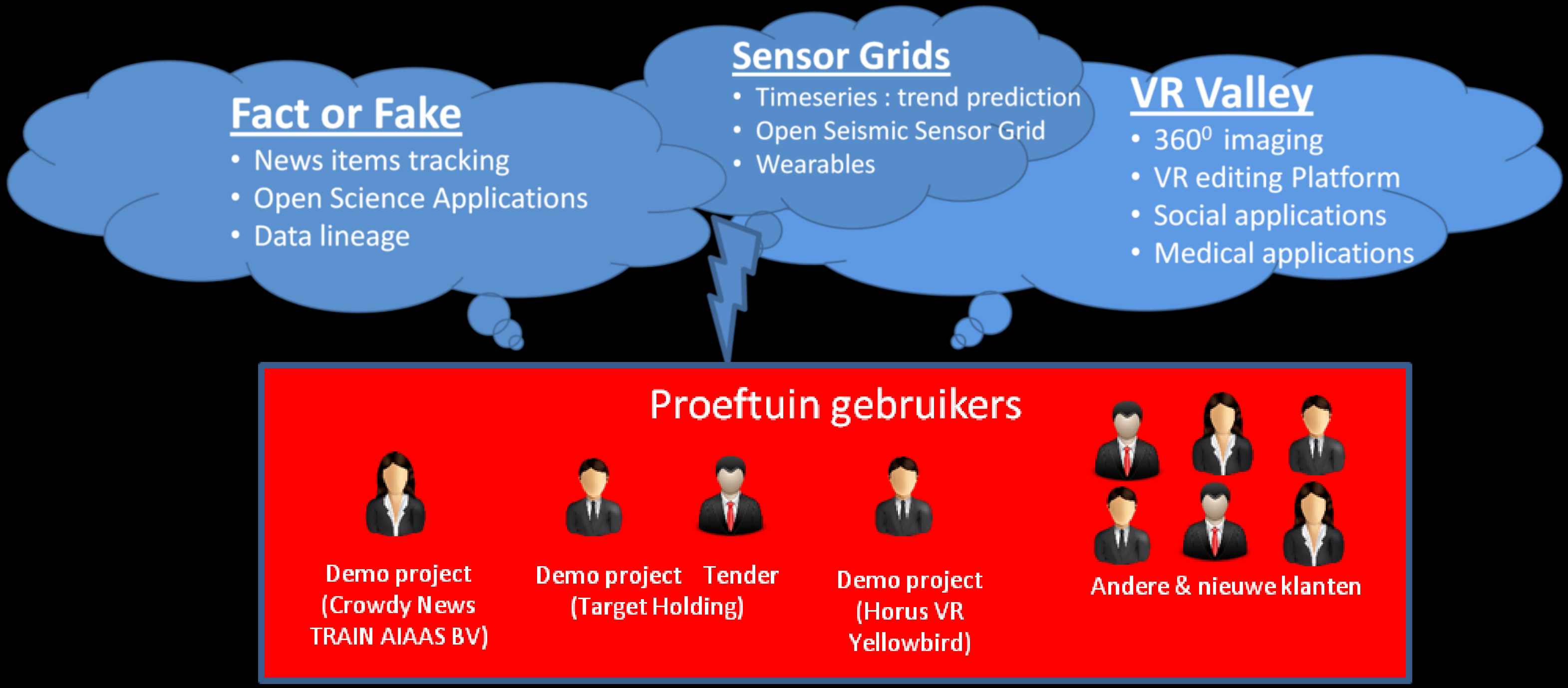
- QC and re-processing – Kids Euclid **FAIR**
- OU EXT > Billion – dynamic tables

All techniques go back to the source

Scientists and journalists- > Fact and Fakes

Structured data and unstructured data

TARGET Fieldlab



Fact or Fake

- News items tracking
- Open Science Applications
- Data lineage

Sensor Grids

- Timeseries : trend prediction
- Open Seismic Sensor Grid
- Wearables

VR Valley

- 360^0 imaging
- VR editing Platform
- Social applications
- Medical applications

Proeftuin gebruikers

Demo project (Crowdy News TRAIN AIAAS BV)

Demo project Tender (Target Holding)

Demo project (Horus VR Yellowbird)

Andere & nieuwe klanten

Media scanner

Focus on domains

ML Lineage builder

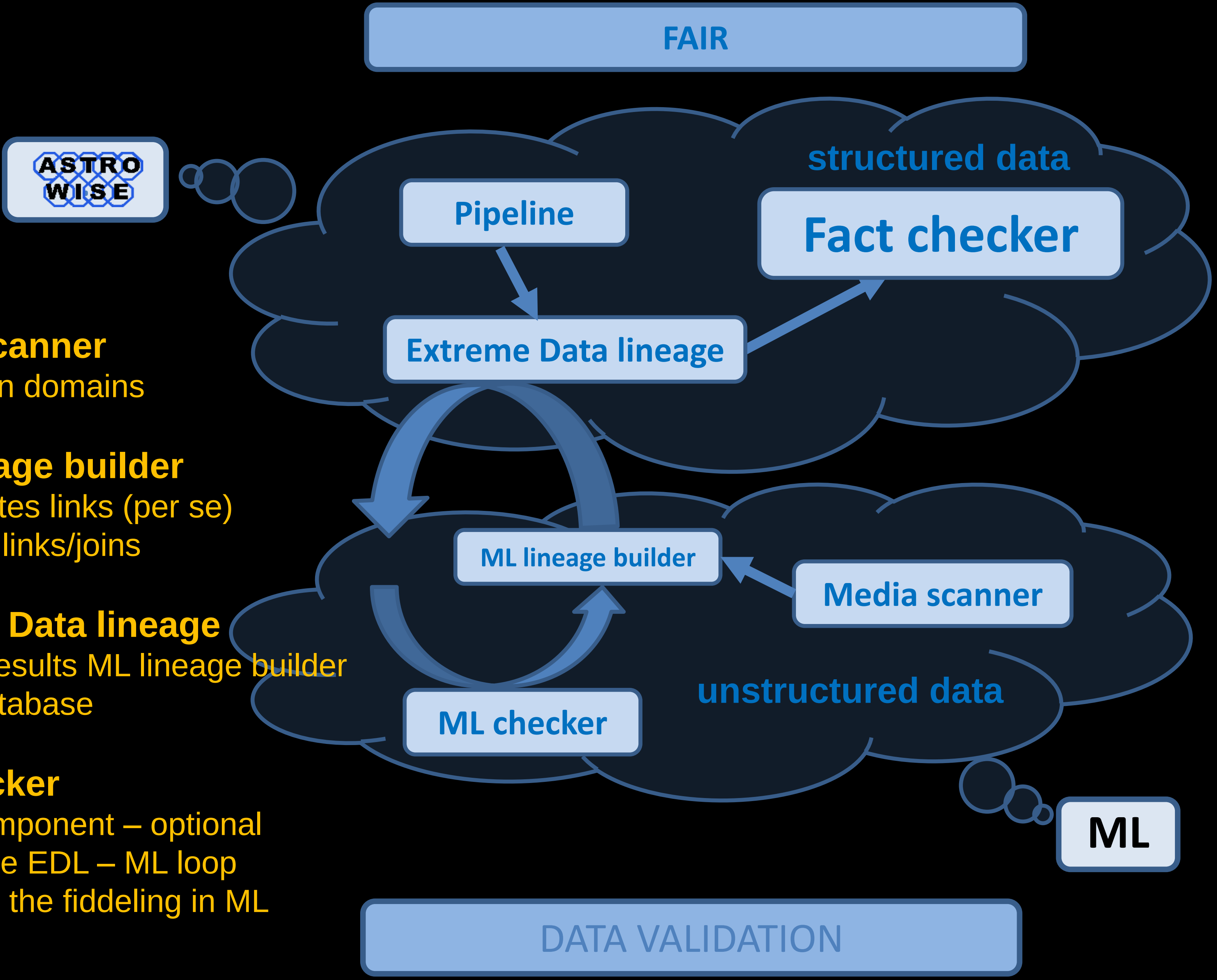
ML creates links (per se)
multiple links/joins

Extreme Data lineage

Import results ML lineage builder
AWE database

ML Checker

New component – optional
Close the EDL – ML loop
Replace the fiddeling in ML



conclusions

Next level is all about Data validation

- check ML
- QC
- systematics in data sets
- OU-ext dynamic Euclidization
- unstructured data: ML + lineage

Almost all about going back to the source

Facts and Fakes