Advanced Next Generation Spectroscopic Analysis Systems

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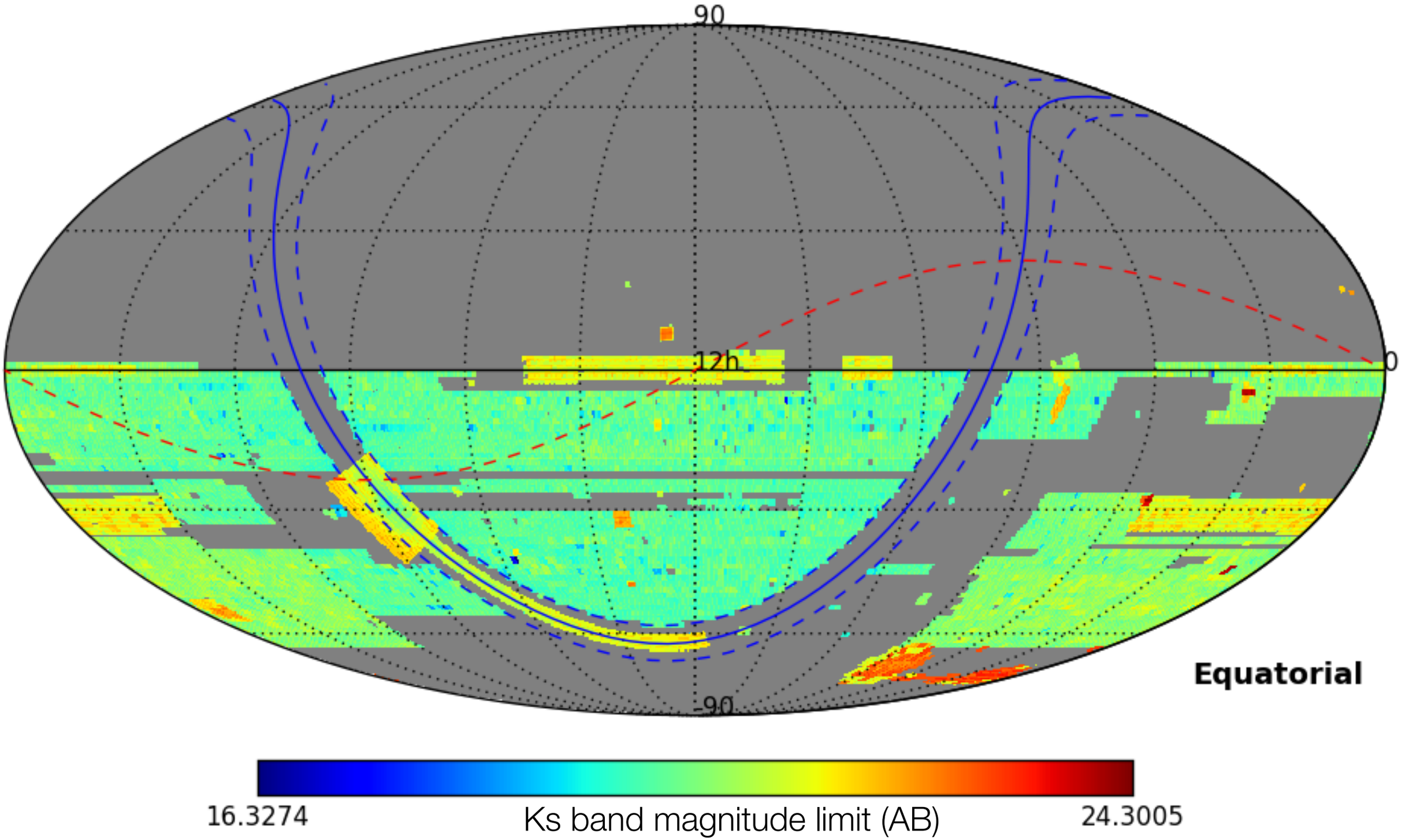
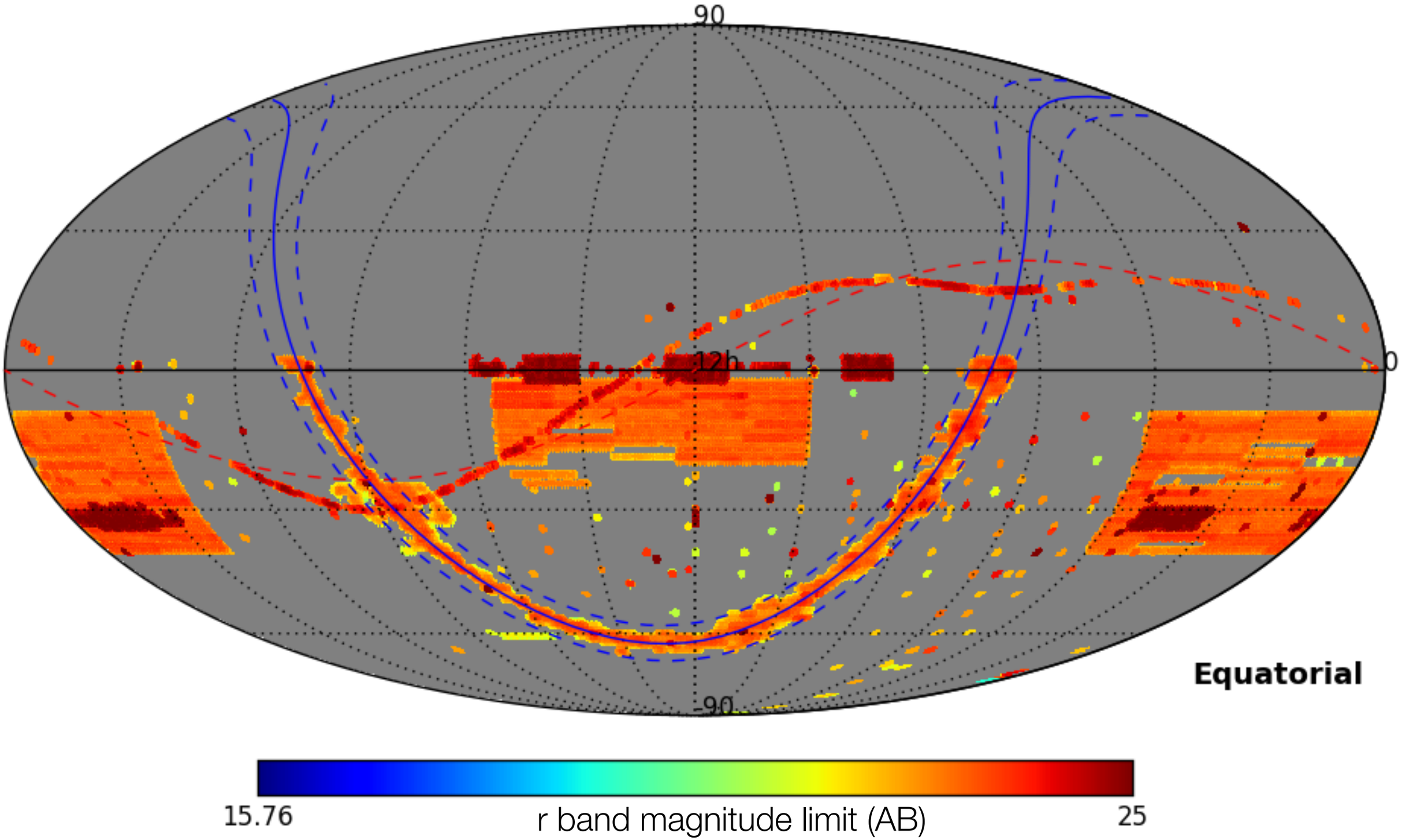
- Current ESO public imaging surveys: VISTA, VST
    - Together with DES, PAN-Starrs, … construct input catalogue to be used in next generation spectroscopic surveys
- Current spectroscopic survey: Gaia-ESO
- By 2018: WEAVE
- By 2021: 4MOST

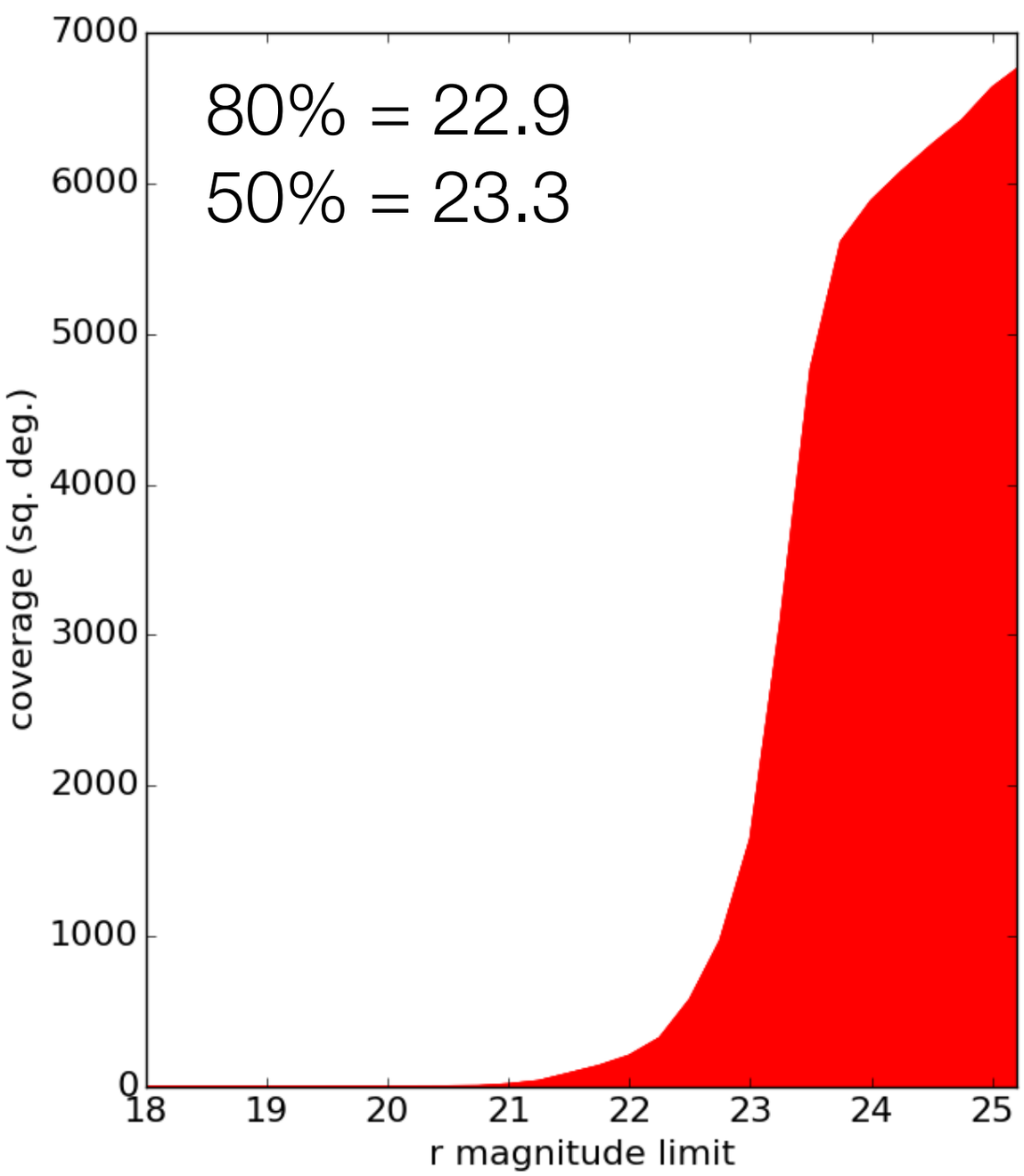
VISTA Observations

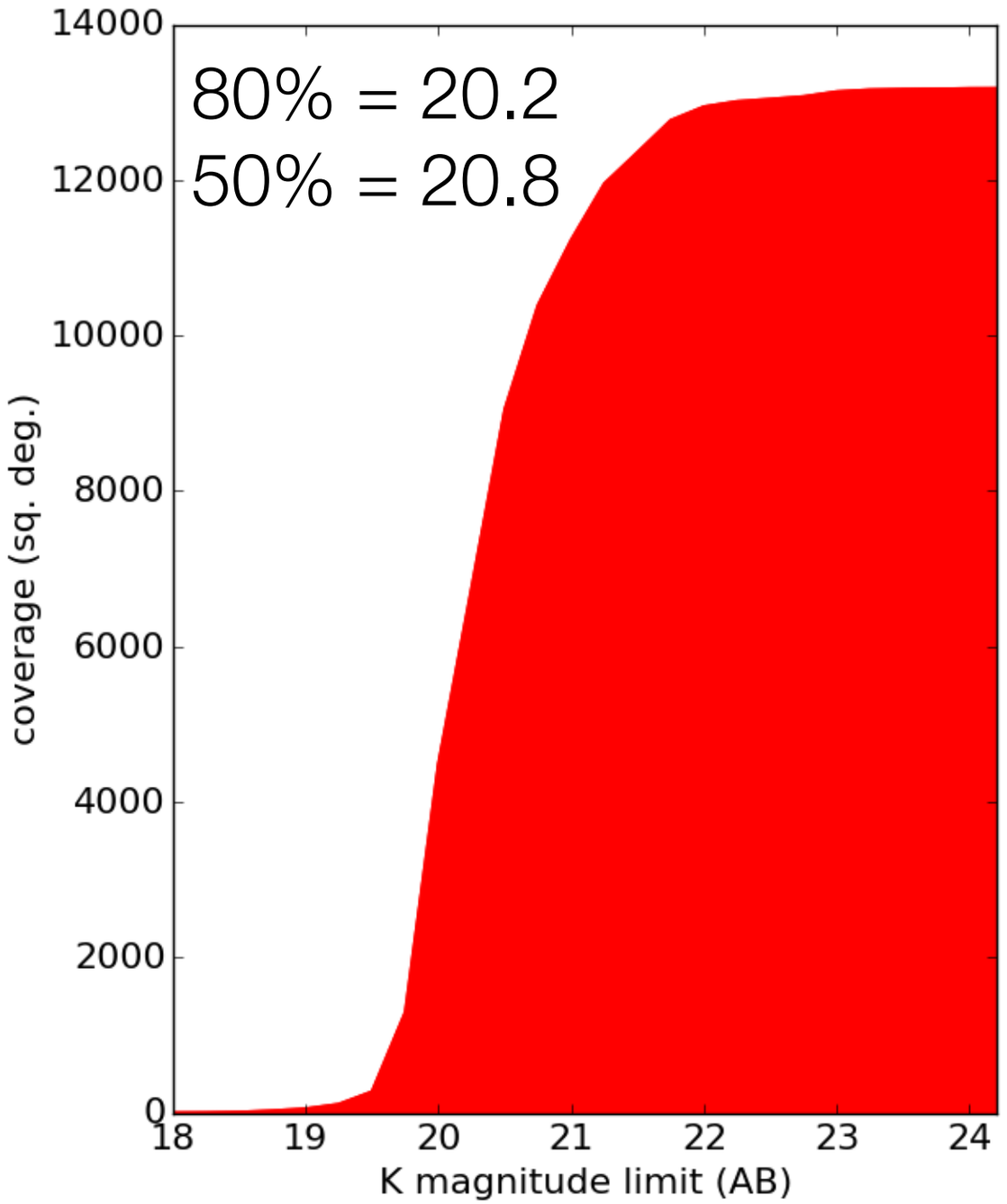


VST Observations



VST & VISTA area vs magnitude



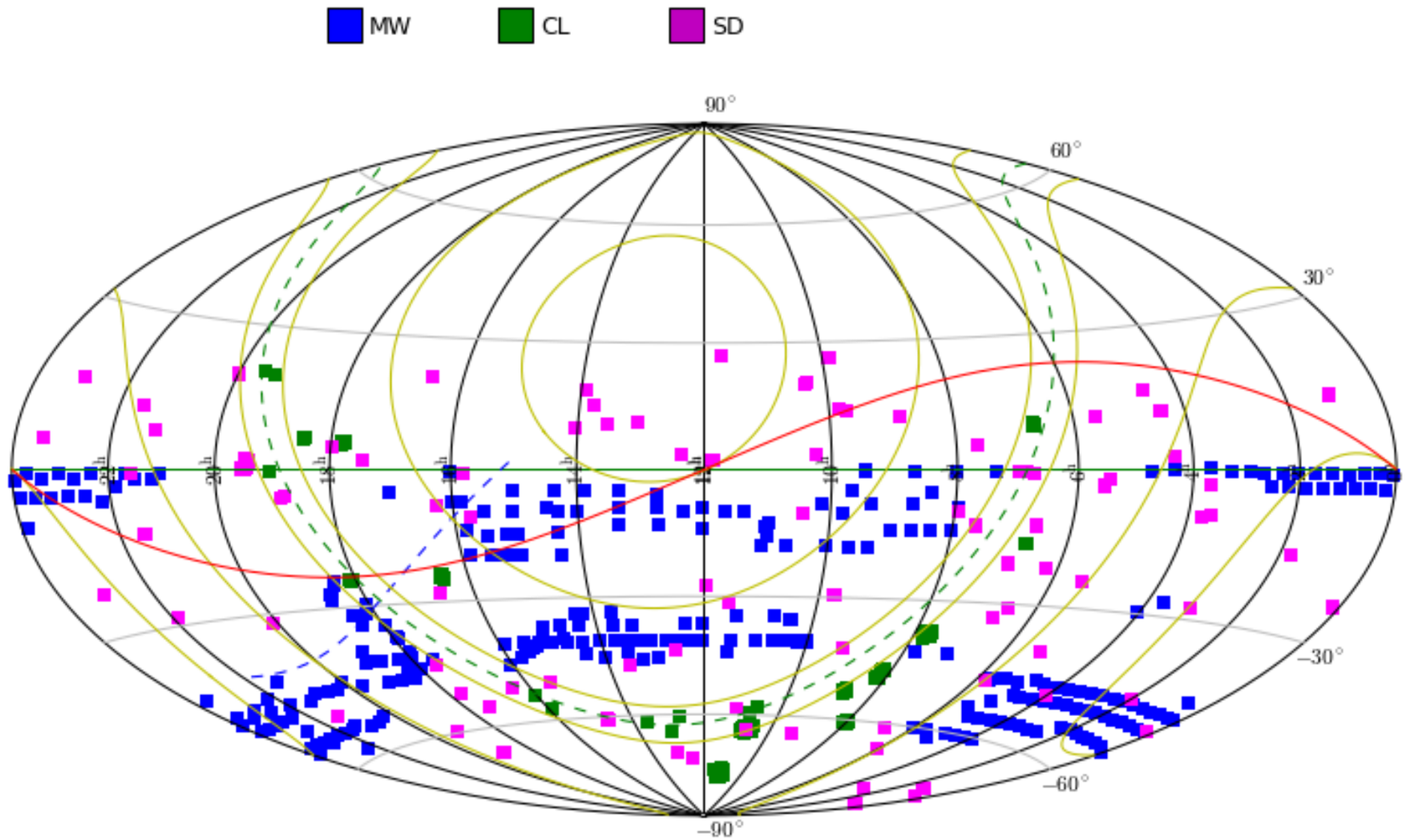


GAIA-ESO Survey (GES)

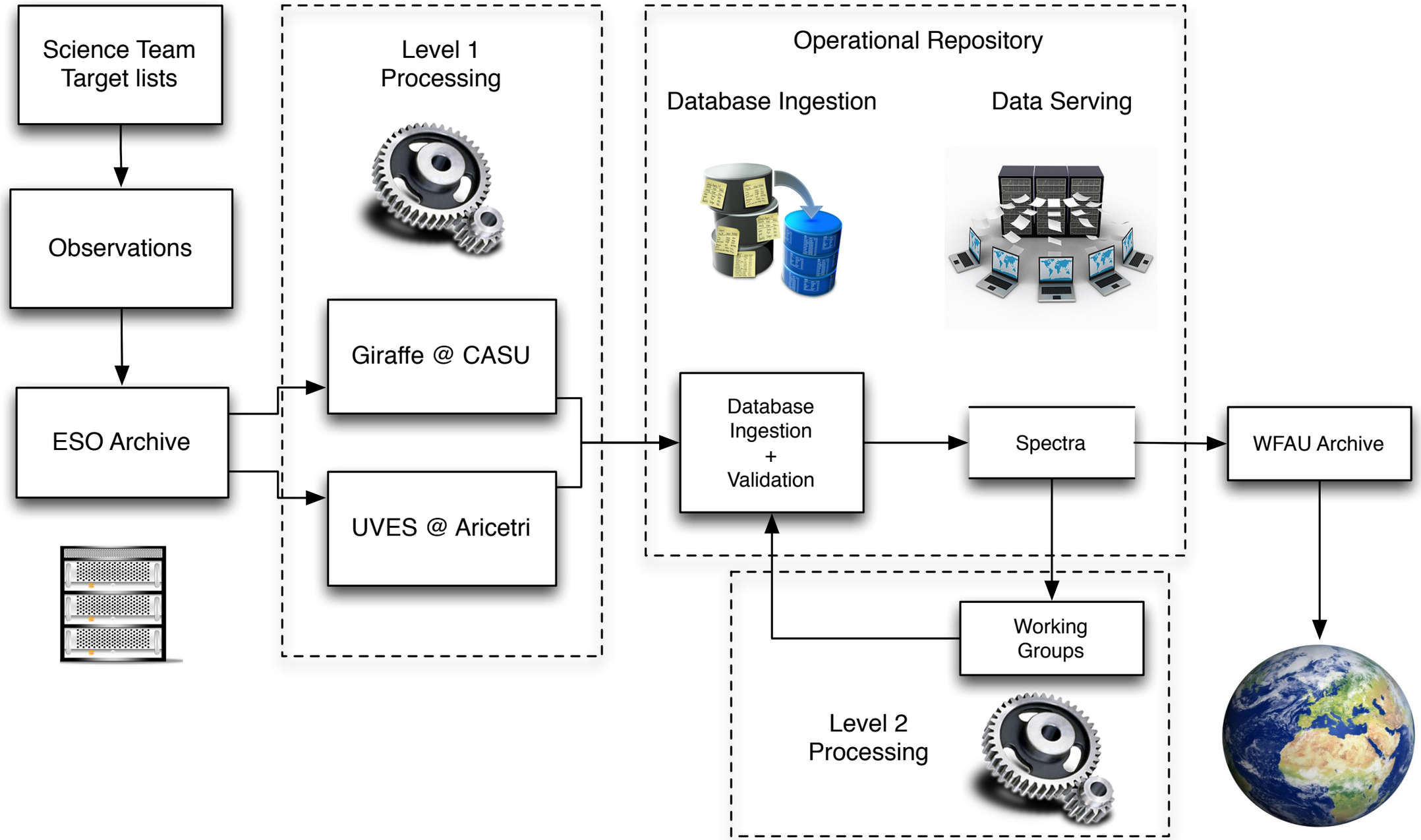
- P.I. G. Gilmore & S. Randich
- FLAMES (Giraffe and UVES) @ VLT
- 300 nights, ~100,000 stars in the Milky Way r<19
- Input catalogues:
  - VISTA for field stars
  - 2MASS or ESO/WFI for clusters

GES Survey Components

- Bulge survey (K giants)
- Halo/ thick disk survey (F+G stars)
- Outer thick disk, 2-4 kpc from the Sun
- Thin disk dynamics
- Solar neighbourhood
- Open clusters
- Calibration fields
- + Archival data



GAIA-ESO Data Flow



Gaia-ESO Survey Archive

Home | Overview | Fields | Objects | Inventory | Archive Tar Files | Help | My requests | Admin | Logout

Query form

Query manyspec files.

Search e.g. 20111231: GES_MW_03_04,gestype:GE_MW

Submit

ts of the Milky Way, from halo to star forming regions, undances. This alone will revolutionise knowledge of formation history and evolution of young, mature and

Quick links

- List of targets observed – Browse by field name and request data.
- Search for observations – Query the database for observations and download FITS files containing all

- A FITS file with a single image ext from a single exposure of that ob reduction.

In order to download data you need a us

Cambridge Astronomy Survey Unit – Institute o

Showing 100 items per page of a total of 1000 : 1 2 3 4 .. 10 > (Page 1 of 10)

	GES Field	Name	Cname	Coords	Grating	Vel	Log g	Log Teff	S/N	SP Class	Instrument	Version
M	GES_MW_12_13	G_2_r_149_175	12000006-1413426	12:00:00.1 -14:13:42	H548.8	51.1	4.24	3.67	26.2	STAR	Giraffe	4.0
M	GES_MW_12_13	G_2_b_51_184	12000040-0910081	12:00:00.4 -09:10:08	H548.8	35.1	5.74	3.80	3.3	STAR	Giraffe	4.0
M	GES_MW_12_13	G_1_b_11_301	12000128-4102296	12:00:01.3 -41:02:29	H548.8	234.6	4.57	3.74	13.3	STAR	Giraffe	4.0
M	GES_MW_12_13	G_2_b_185_278	12000135-3715011	12:00:01.4 -37:15:01	H548.8	19.2	3.69	3.77	12.5	STAR	Giraffe	4.0
M	GES_MW_12_13	G_1_b_11_314	12000136-4059299	12:00:01.4 -40:59:29	H548.8	247.5	3.69	3.76	28.7	STAR	Giraffe	4.0
M	GES_MW_12_13	G_1_br_11_356	12000138-4054[illegible]									
M	GES_MW_12_13	G_2_r_149_279	12000152-1350									
M	GES_MW_12_13	G_2_b_185_270	12000193-3653									
M	GES_MW_12_13	G_1_b_11_304	12000201-4100									
M	GES_MW_12_13	G_2_e_51_186	12000234-0909									
M	GES_MW_12_13	G_2_b_185_171	12000251-3713									
M	GES_MW_12_13	G_2_b_149_277	12000263-1351									
M	GES_MW_12_13	G_2_b_185_376	12000276-3712									
M	GES_MW_12_13	G_2_b_185_232	12000287-3700									
M	GES_MW_12_13	G_2_r_185_6	12000290-3659									
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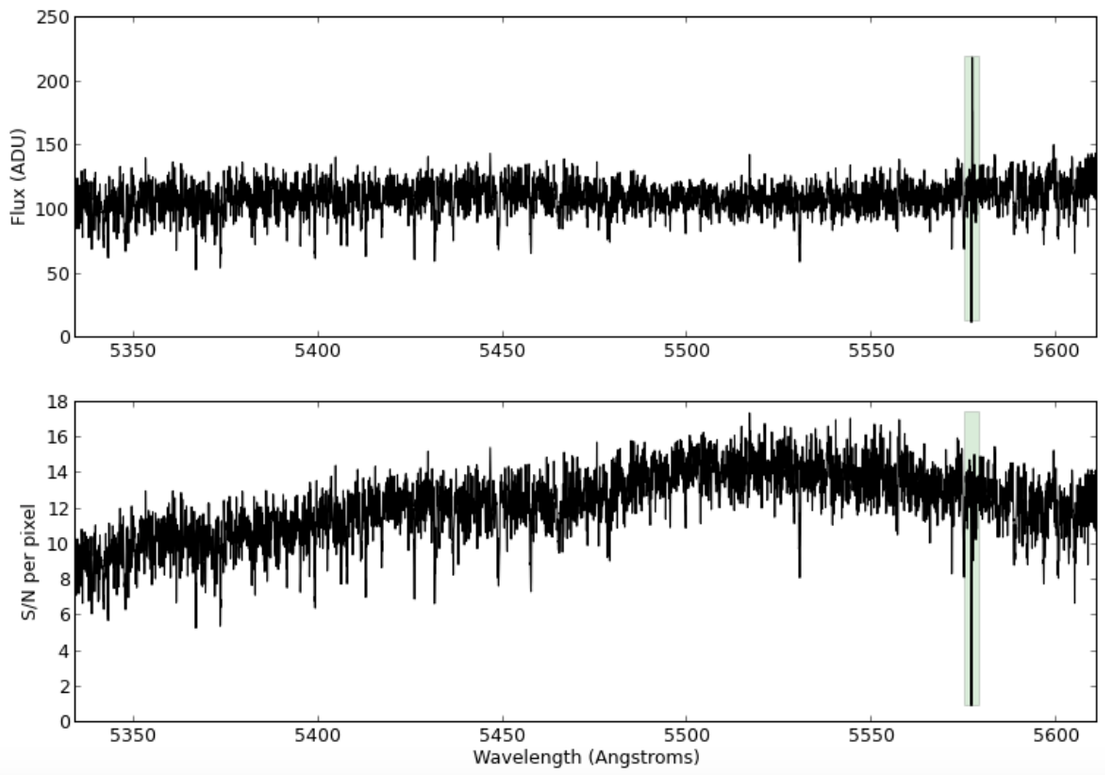
M	GES_MW_12_13	G_1_b_11_377	12000338-4048									
M	GES_MW_12_13	G_2_r_51_197	12000347-0906									
M	GES_MW_12_13	G_1_b_11_303	12000347-4101									

GES_MW_12_13 : 12000193-3653422



WEAVE

- P.I. Gavin Dalton (RAL), P.S. Scott Trager (Groningen)
- Multiobject spectrograph at the WHT 4.2m, La Palma
- ~1000 fibres, 3 square degrees
- First science light: Q4/2017
- Surveys begin: Q1/2018
  - 5 years at 70% of total available nights

WEAVE Characteristics

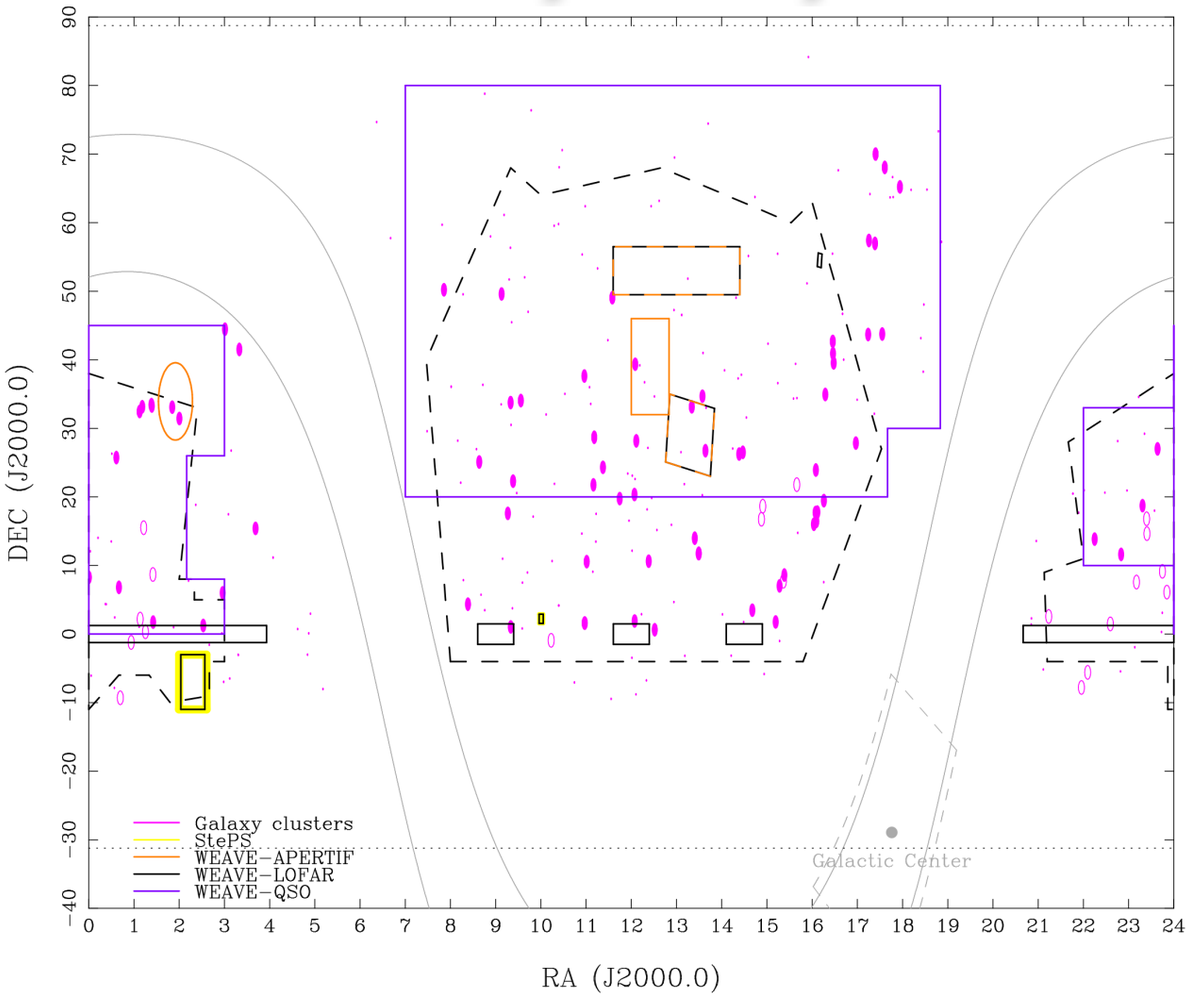
Telescope, Diameter	WHT, 4.2m
Field of View	2 degrees
Number of fibres	960
Fibre size	1.3”
Small IFUs	20 x 11” x 12” (1.3” spaxels)
Large IFU	1.3’ x 1.5’ (2.6” spaxels)
Low resolution	5750 (4000 - 7250)
Low resolution coverage	3660 - 9590
High resolution	20000 (15000 - 25000)
High resolution coverage	4040-4650, 4730-5420, 5950-6850
Spectra / night	~ 20000 - 30000

WEAVE Surveys

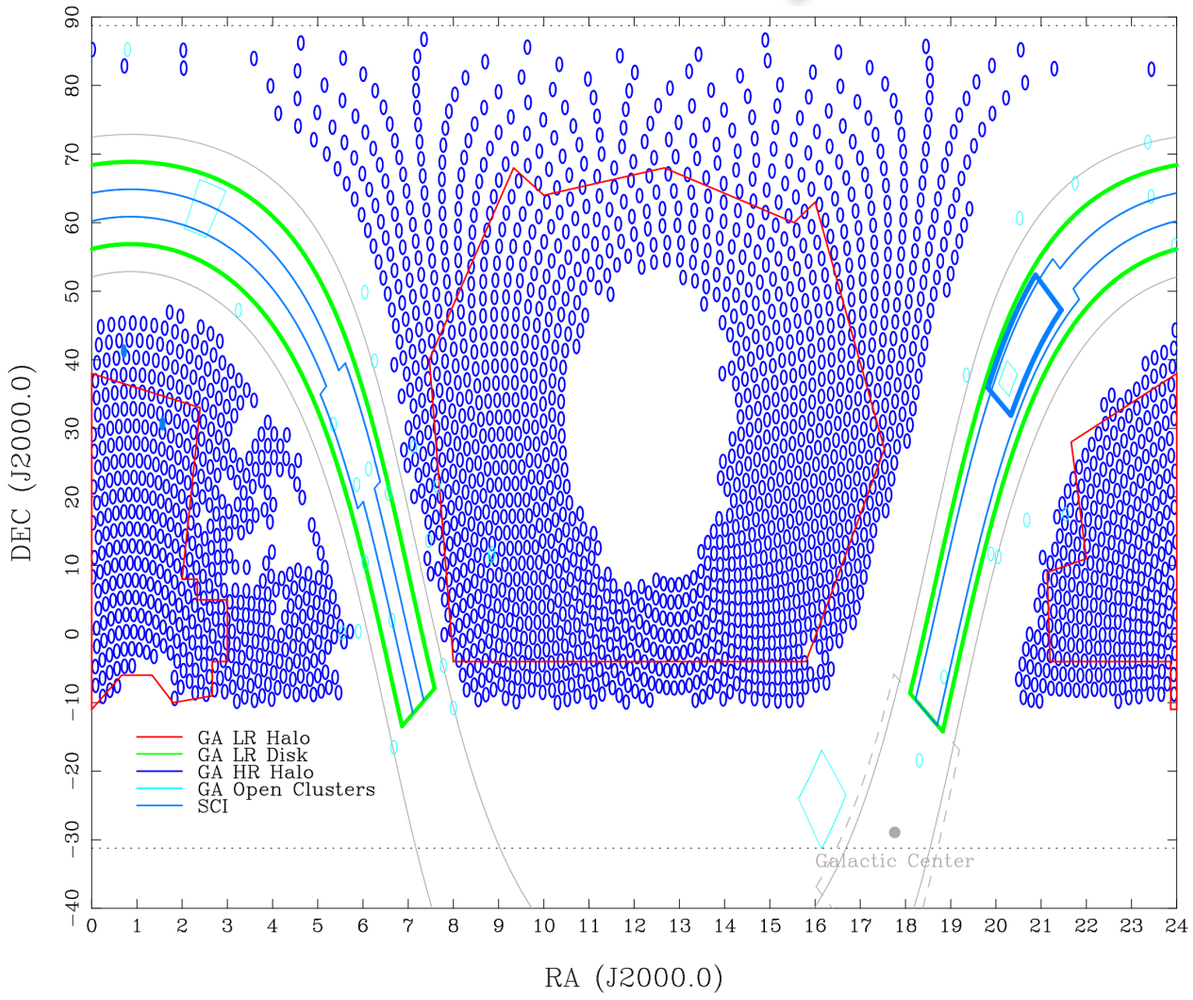
- Galactic archaeology
- Stellar, circumstellar and interstellar physics
- Galaxy clusters
- Galaxy evolution
- WEAVE-LOFAR
- WEAVE-QSOs

WEAVE Survey Areas

Galaxy surveys

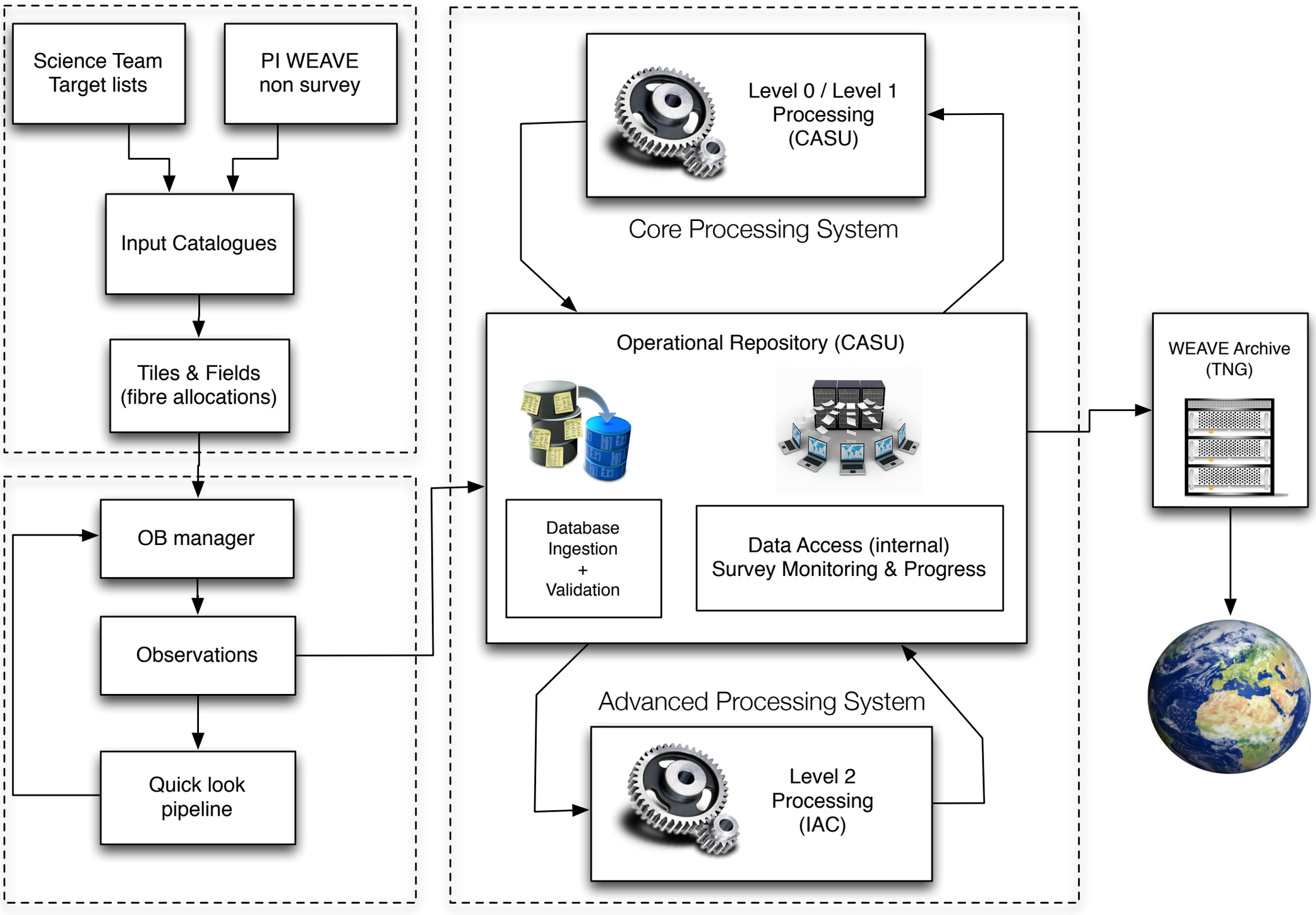


Stellar surveys



(figures from Scott Trager)

WEAVE Data Flow *(simplified)*



4MOST

- P.I. Roelof de Jong (AIP)
- Multiobject spectrograph at the VISTA telescope
- ~2400 fibres, 4 square degrees
- Complement GAIA, Euclid, eROSITA
- 5 year public survey over 15000 square degrees
- Start science operations in 2021

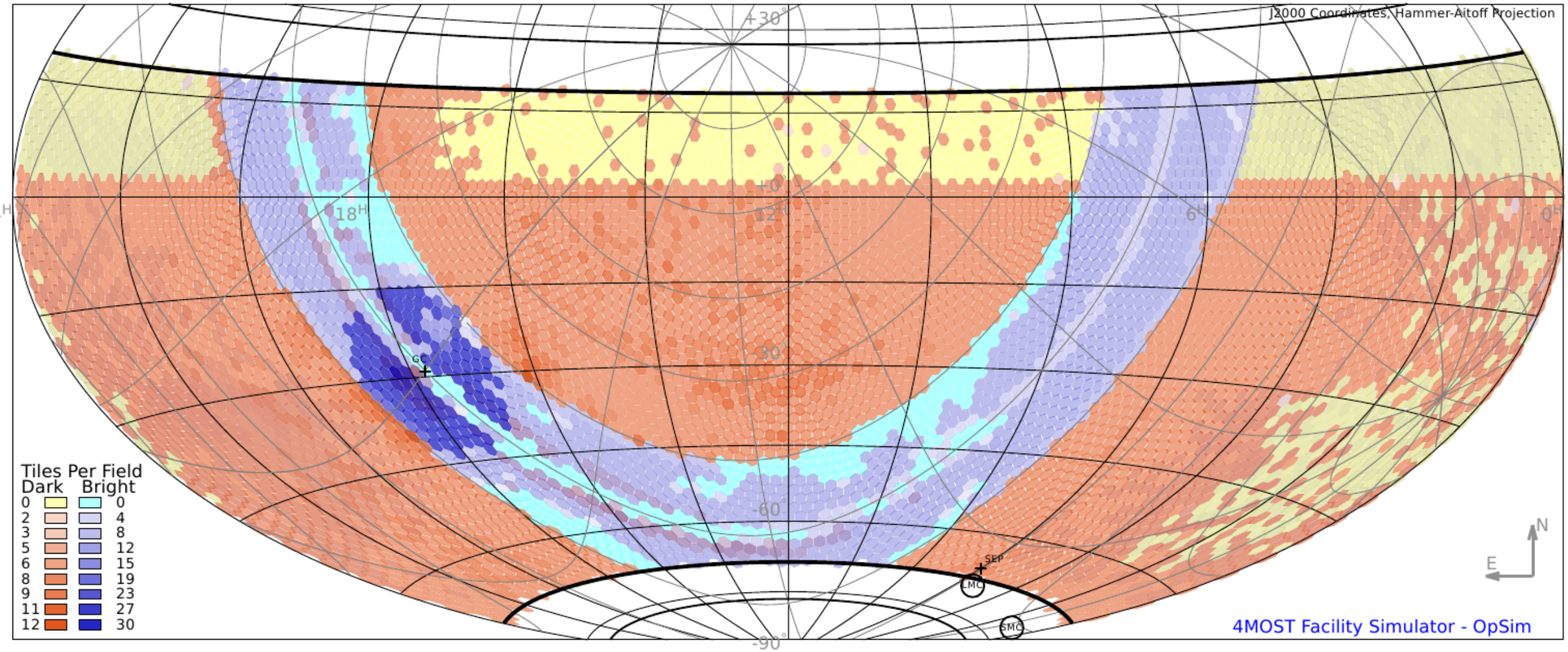
4MOST : Characteristics

Telescope, Diameter	VISTA, 3.7m
Field of View	2.5 degrees
Number of fibres	1600 (LR) + 800 (HR)
Fibre size	1.45”
Low resolution	5000
Low resolution coverage	3950 - 8950
High resolution	18000
High resolution coverage	3950-4400, 5000-5550, 6050-6750
Spectra / night	~ 50000

4MOST Surveys

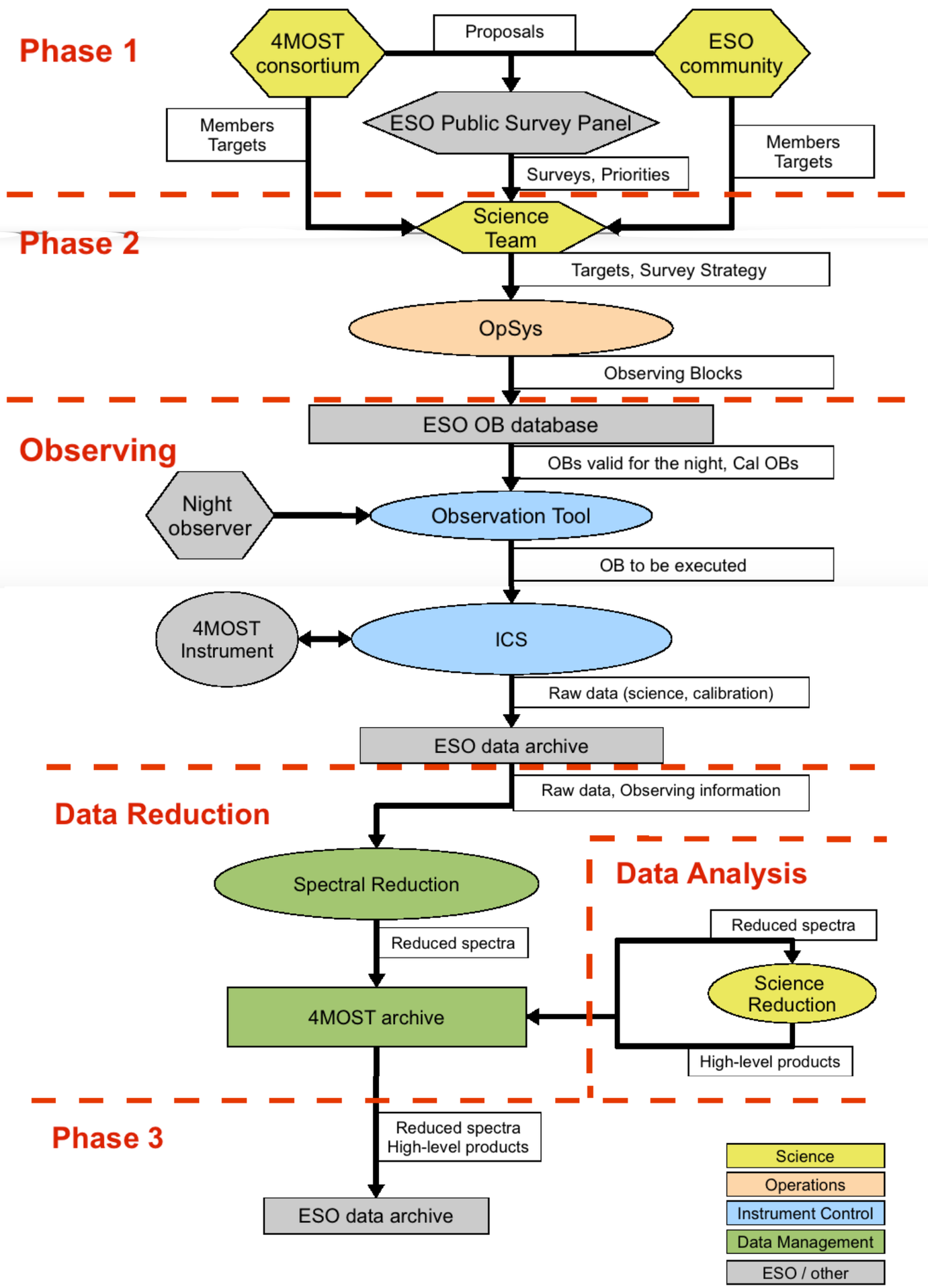
- Milky Way Halo (LR + HR)
- Milky Way Bulge/Disk (LR + HR)
- AGN
- Galaxy Clusters
- WAVES
- Cosmology

4MOST Survey Areas

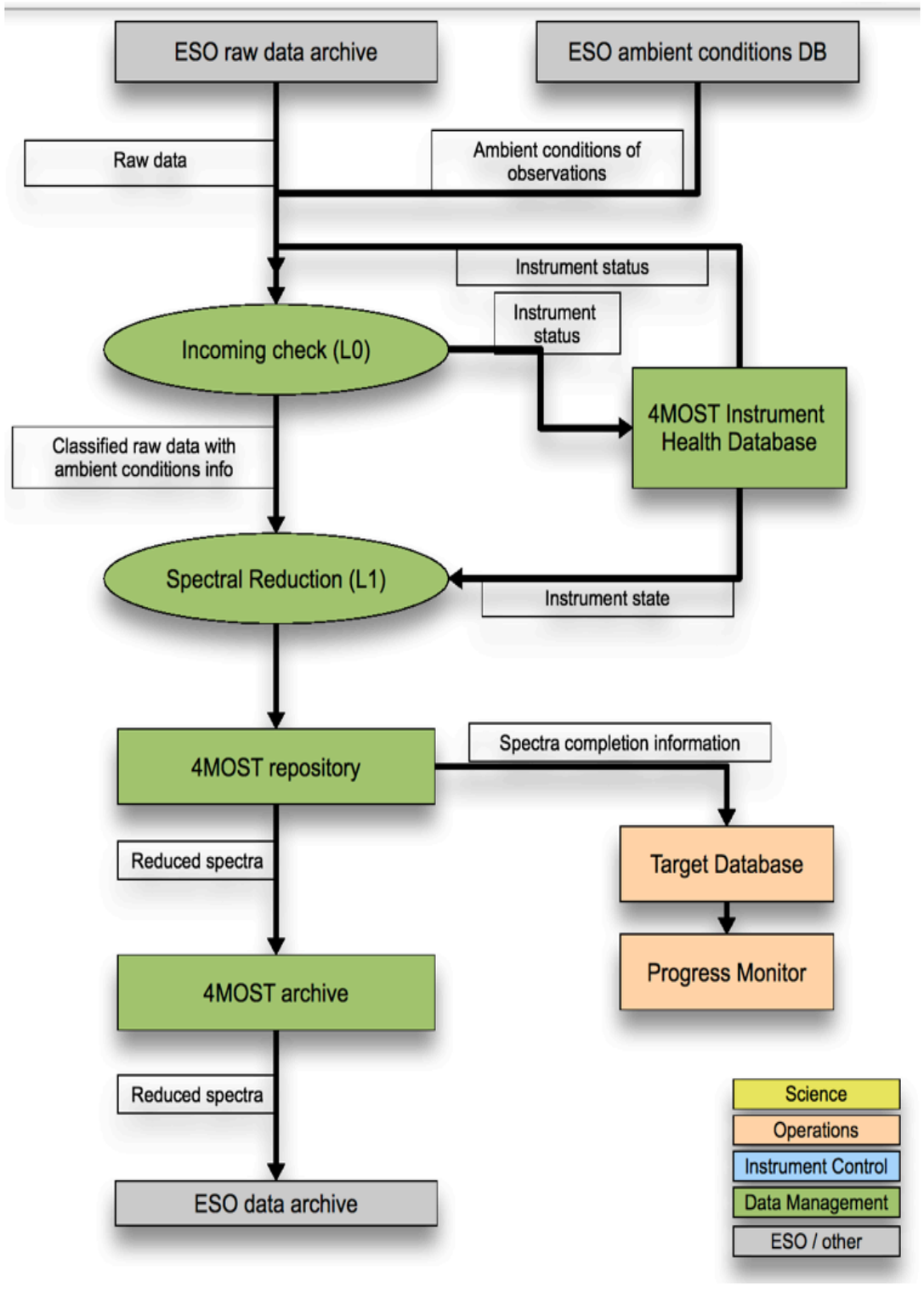


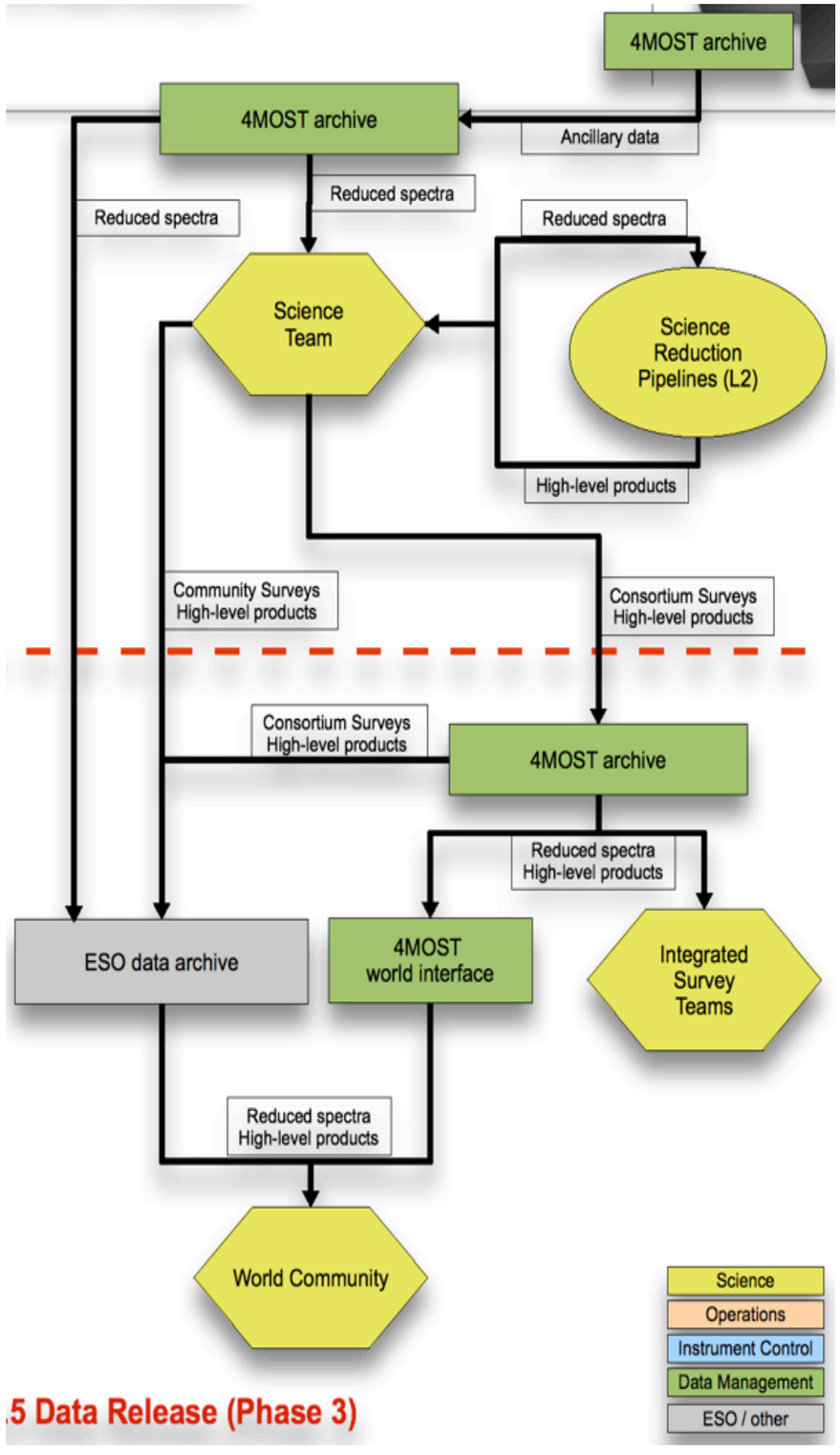
Survey Operations

- Phase 1 - Survey preparation and selection
- Phase 2 - Scheduling
- Observing
- Data Reduction
- Phase 3 - Submission to ESO archive



4MOST Data Flow





.5 Data Release (Phase 3)

- CASU development of the WEAVE pipeline acts as 4MOST pilot
    - Definition of output formats and data model
    - Improvements to spectral extraction method (tested on GES and WYFFOS)
    - Improvements on scattered light correction
    - Sky subtraction

Pipeline processing (L1)

- Electrical crosstalk
- Linearity correction
- Bias correction
- Dark correction
- Flat field 2D correction
- Scattered light correction
- Fibre profile and cross talk modelling
- Spectral extraction
- Flat field 1D correction
- Wavelength solution and calibration
- Sky background correction
- Flux calibration
- Stacking
- Data cubes for IFUs

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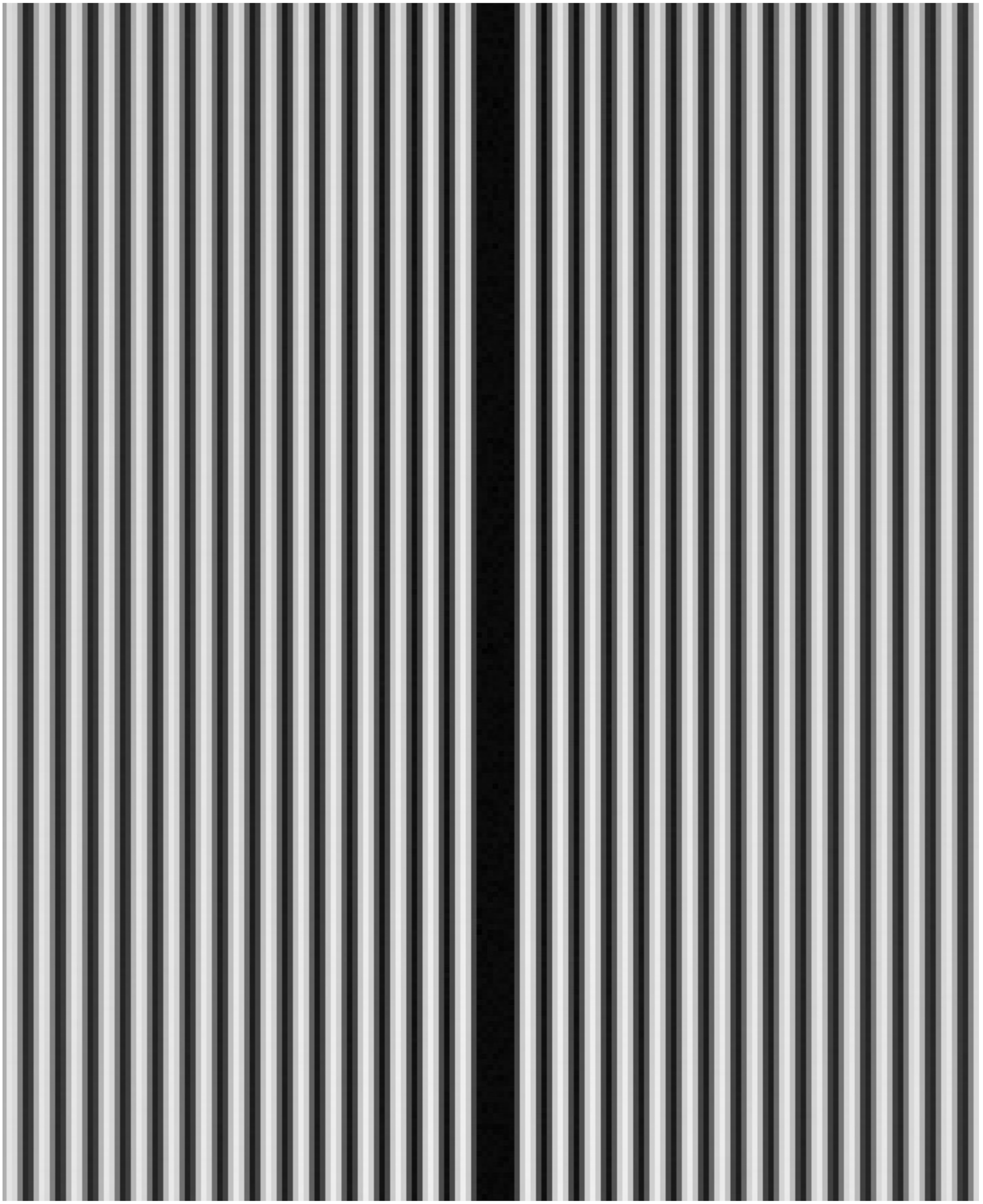
WEAVE Simulations (Gavin Dalton)



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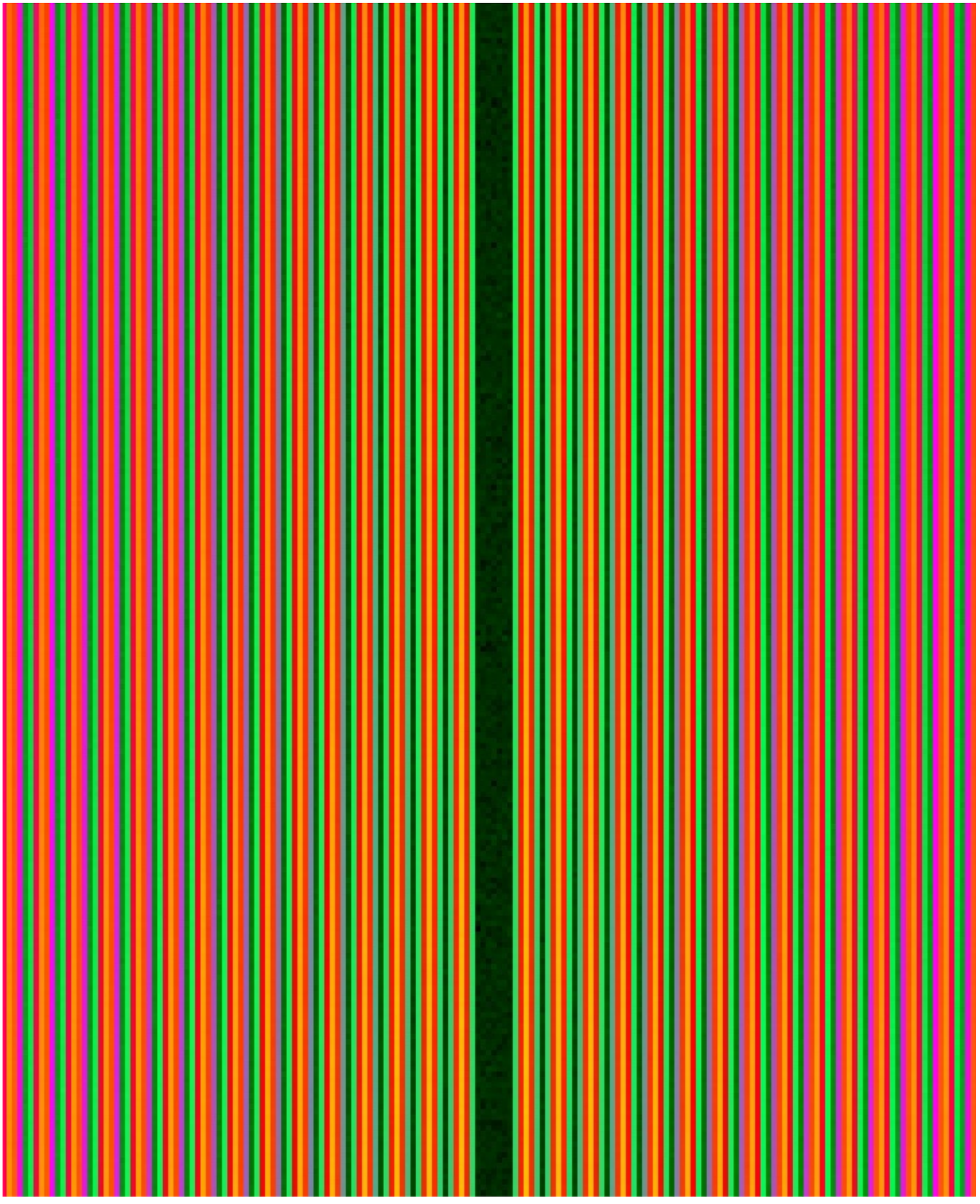
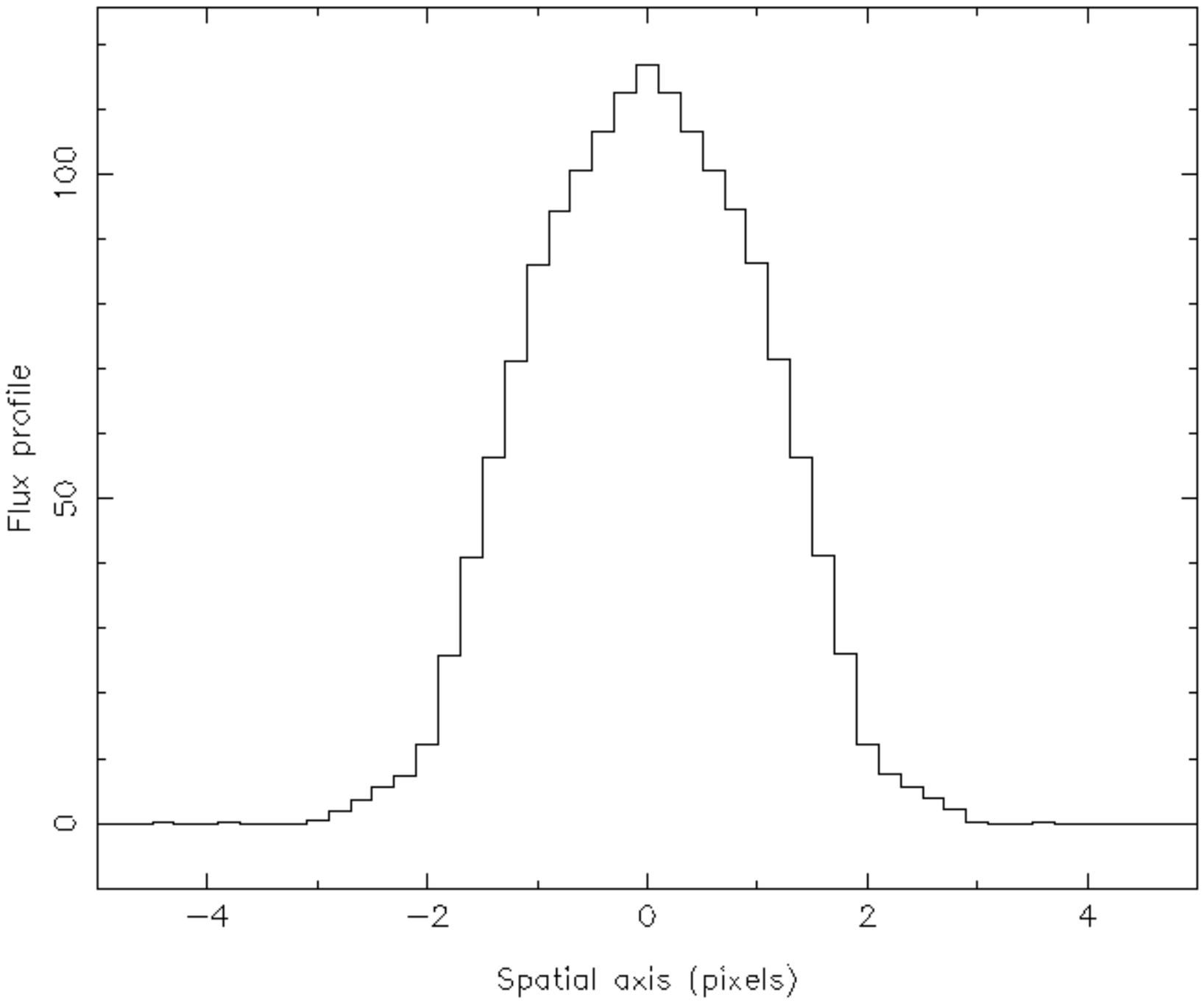
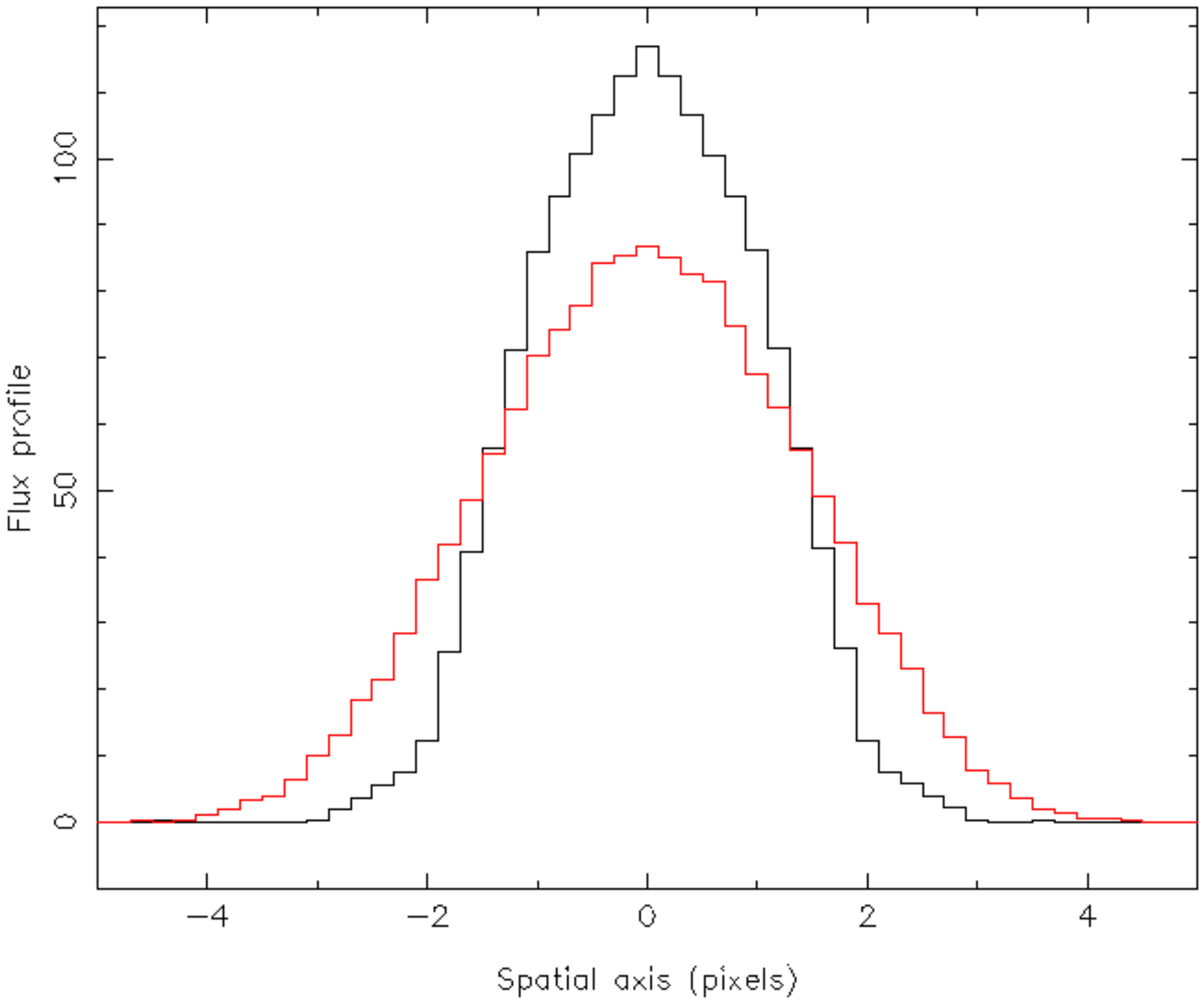



Flux profile
100
50
0
−4
−2
0
2
4
Spatial axis (pixels)


Flux profile
100
50
0
−4
−2
0
2
4
Spatial axis (pixels)

Requirements: Stable & robust pipeline

- Calibrated 1-D spectra produced at twice the rate of data production (~15 GB/ night, 70,000 spectra/night)
- Quick look pipeline to operate on a daily basis
- Pipeline to deliver flux calibration accuracies to 95% of the theoretical photon noise limited maximum
- Pipeline to deliver wavelength calibration accuracies to 95% of the theoretical photon noise limited maximum
- DMS to produce survey progress metrics for each survey
- Archive to support access by the astronomical community to 4MOST science products
- All products to be packaged in a form suitable for long term preservations

Summary

- New spectroscopic surveys 10x million objects
- Data pipelines stable, robust and well documented
- Legacy data and archives