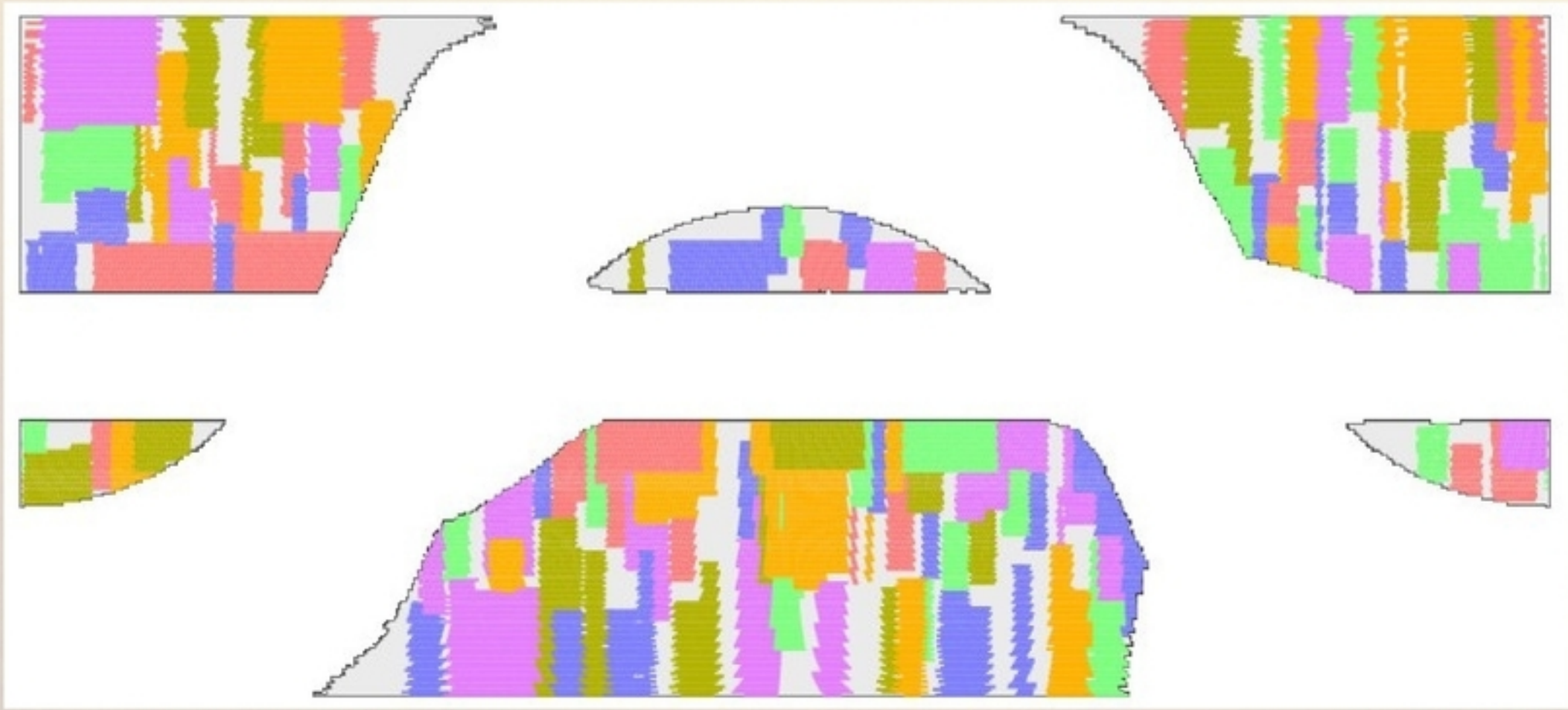
Euclid survey status report (2014 news)

by the EC SURVey (ECSURV) Group

Updates and contributions from:

R. Scaramella, C. Burigana, E. Mairano, M. Maris – Italy
I. Tereno, C.S. Carvalho, J. Dinis – Portugal
J. Amiaux, J.–C. Cuillandre – France
A. Benoit–Lévy – UK



Euclid–France 2014, Lyon – Dec. 4–5 2014

The Euclid reference survey: 3 distinct components

Wide survey + Deep survey + Calibrations

15,000 sq.deg. in 6 years

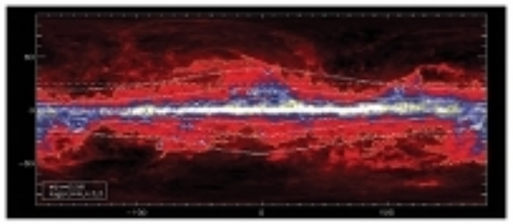
40 sq.deg. in split fields
+
Time constraints

Misc. locations, many repeats
+
Time constraints

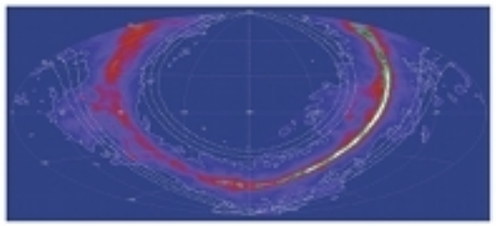
Scheduling priorities: 1) Calibrations, 2) Deep, 3) Wide

Page credits: I. Tereno

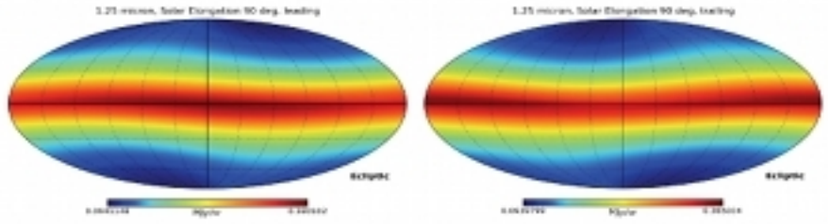
The Euclid Reference Survey



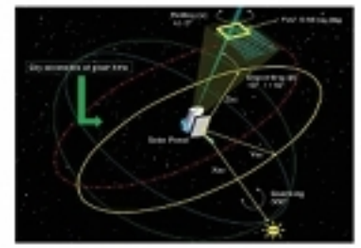
DUST : Extinction in the galactic plane (E(B-V) contours)



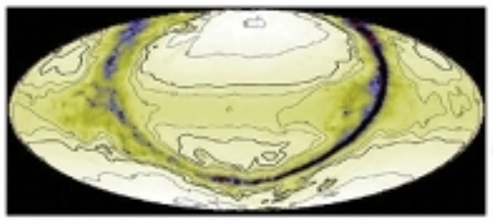
STAR DENSITY: Contamination in galactic plane



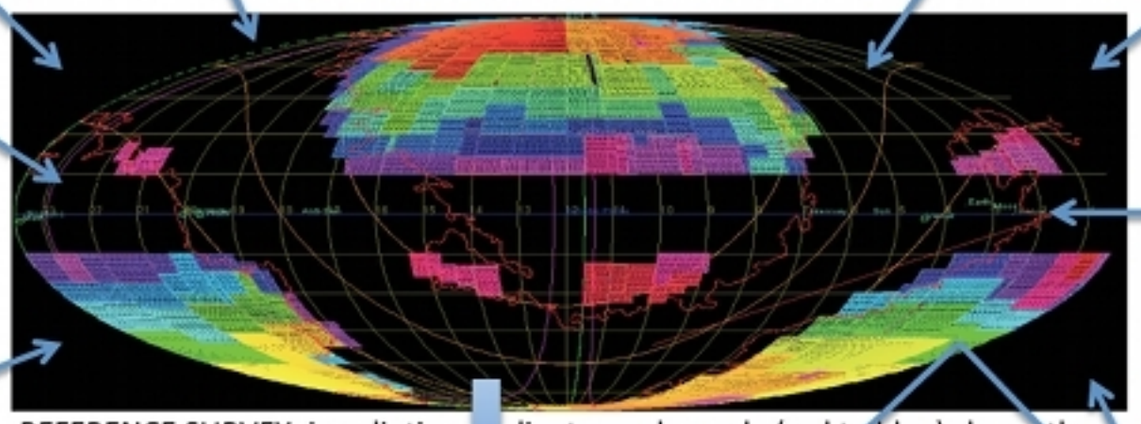
ZODIACAL LIGHT emission maps: Contamination in the ecliptic plane (with leading/trailing asymmetry)



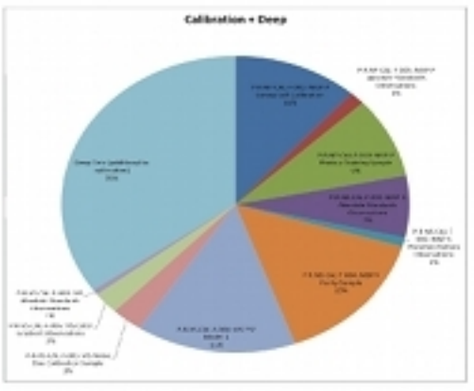
SPACECRAFT: limited range of rotations (in pitch ~ SAA and roll ~ α) ; limited propeller



WEAK LENSING SAMPLING: galaxy density contours (arcmin^{-2})

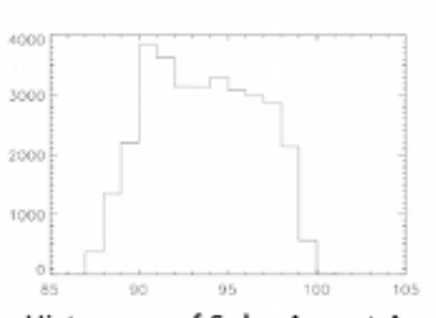


REFERENCE SURVEY: in ecliptic coordinates; color code (red to blue) shows the scheduled observation sequence. Released in the Mission Operations Concept Document, Dec 2013)

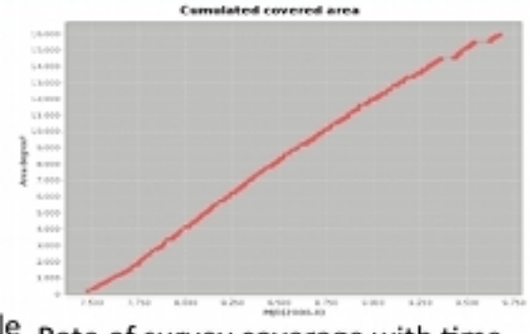


CALIBRATION PLAN: distribution of science and instrument calibrations, including targets and cadences

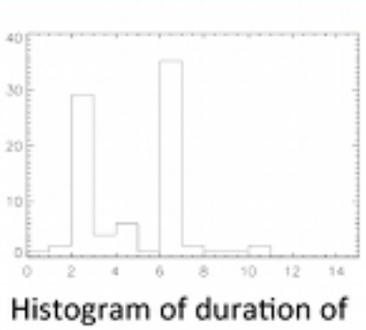
GALAXY CLUSTERING SAMPLING: galaxy density contours (arcmin^{-2})



Histogram of Solar Aspect Angle over the total 40 000 pointings

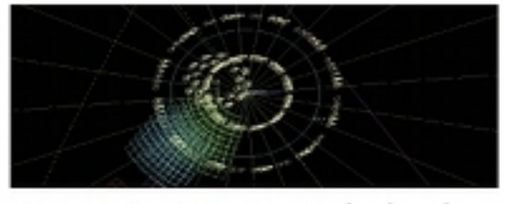


Rate of survey coverage with time. 15000 deg^2 are reached in 5.5 years



Histogram of duration of calibration sequences (in days) over the total time

INTEGRATION TIME maps: number counts per pixel over the dither sequence for 1 FoV



CALIBRATION TARGETS: high ecliptic latitudes; Deep fields; HST fields

Sources of input for the reference survey

Wide survey + Deep survey + Calibrations

Mission Operation Concept (MOCD–A)

+

Calibration Concept Document (CalCD–B)

+

Euclid Science Teams

+

ECSURV group & ESA’s Euclid Sky Survey Working Group

Building a most flexible schedule for the Wide vs Cals+Deep

Calibrations constraints of various nature:

Time constraints (e.g. NISP–S purity = cadencing)

Fixed targets (e.g. HST fields)

Goal: schedule the best observing periods to enable the Wide

Avoid calibrations leaving just a 5–days window for the Wide

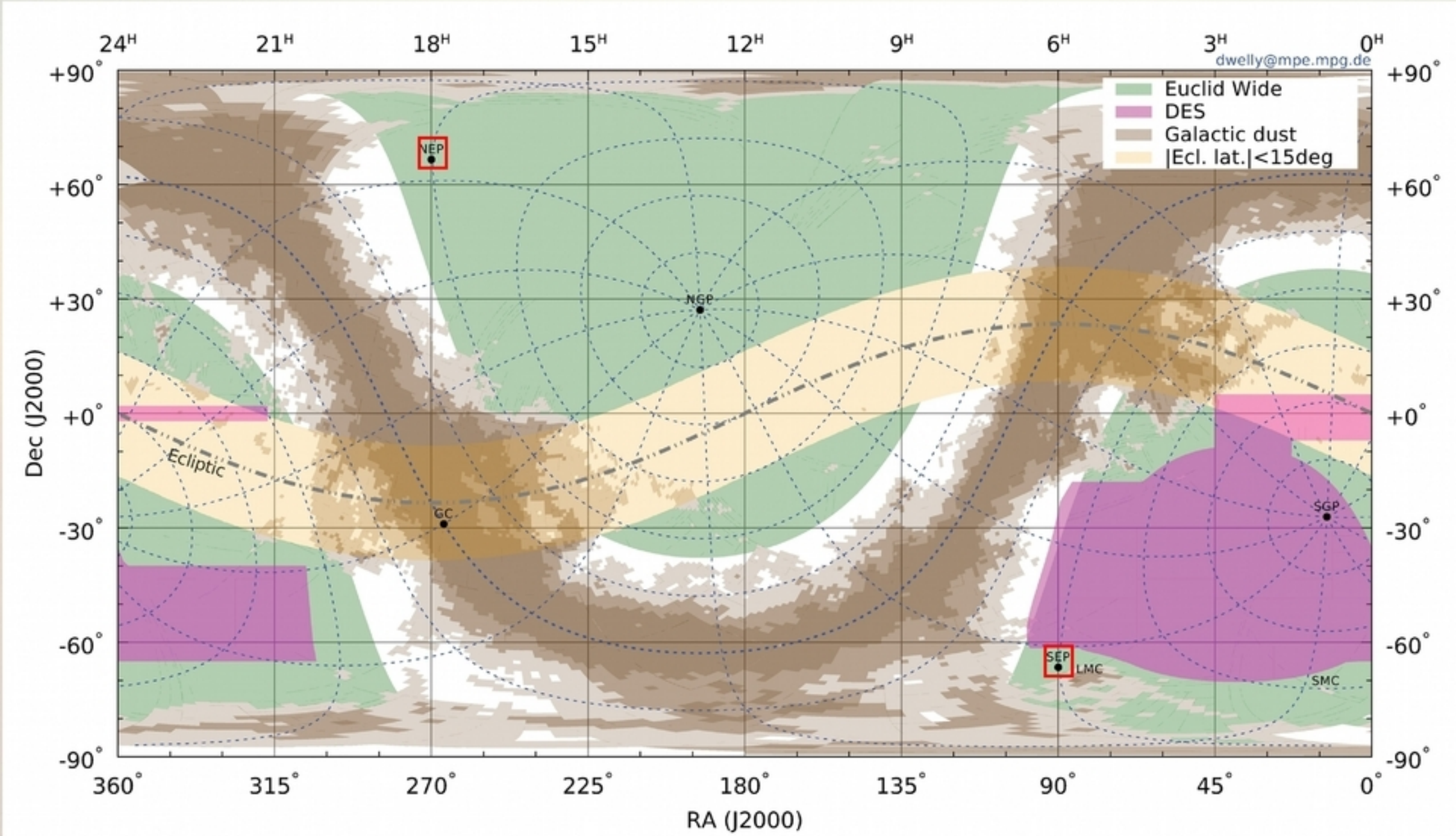
Avoid given calibrations at the same time of the year over 6 years

Keeping the number of slews low (so the Wide can use them)

The end result of Cals+Deep scheduling is a fixed time chart

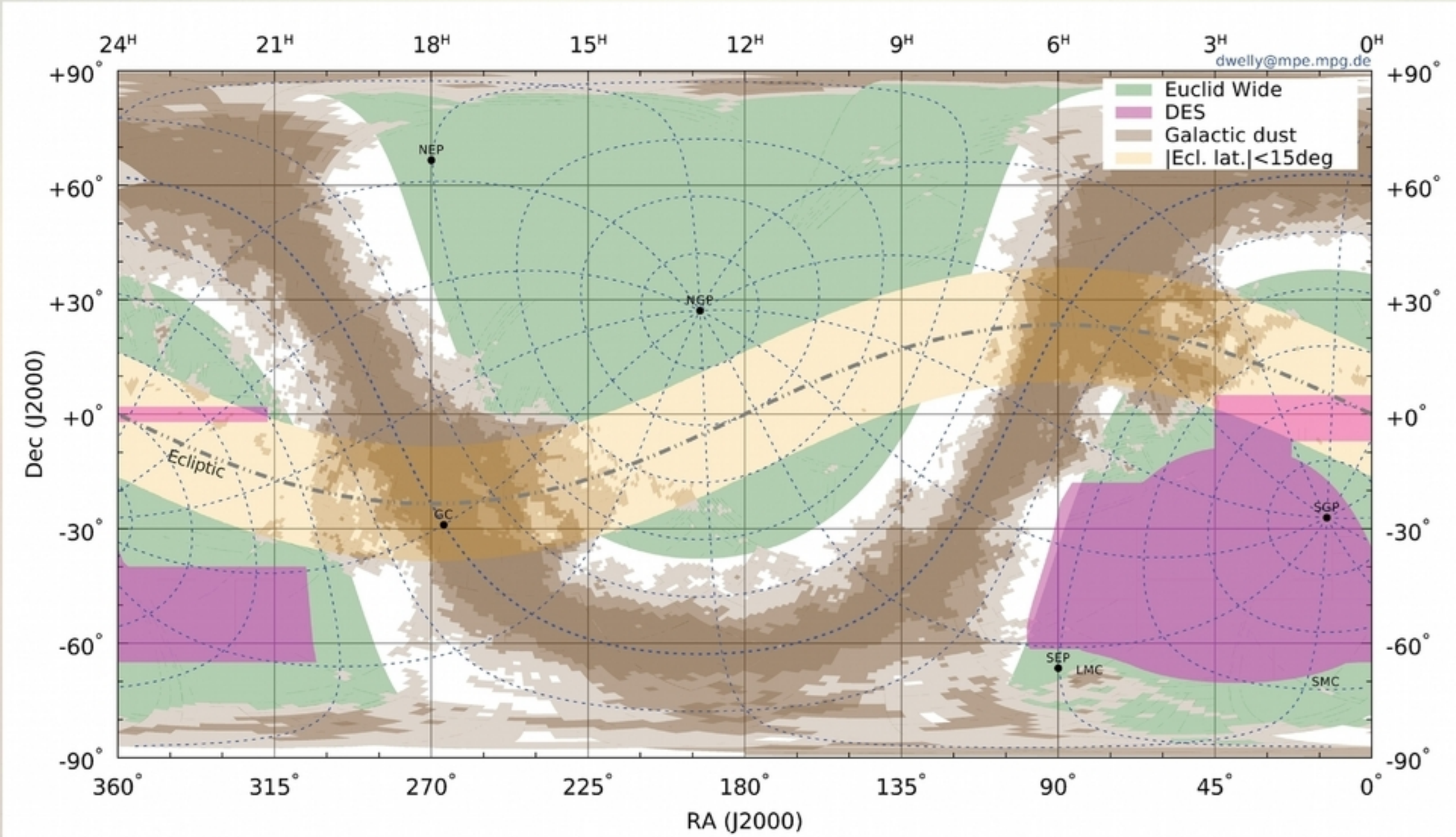
The Wide survey must adapt accordingly: need for a dynamic tool

Location of the Euclid deep fields



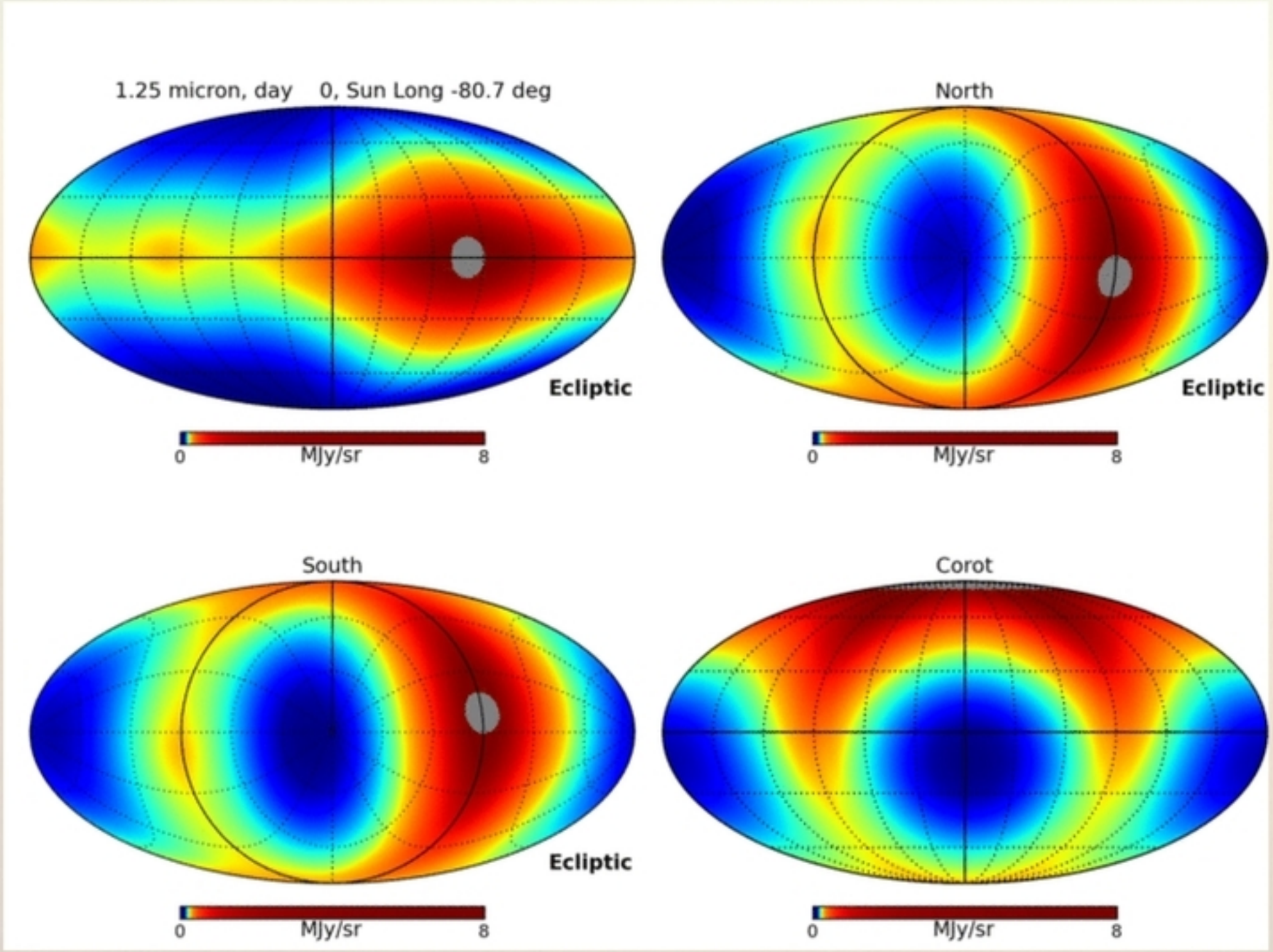
Both ecliptic poles are at high equatorial latitudes with reduced visibility from the ground
South ecliptic pole very close to the LMC: split in 2x10 sq.deg. + move one up (VLT viewing)

The Euclid wide survey: optimizing the 15,000 sq.deg.



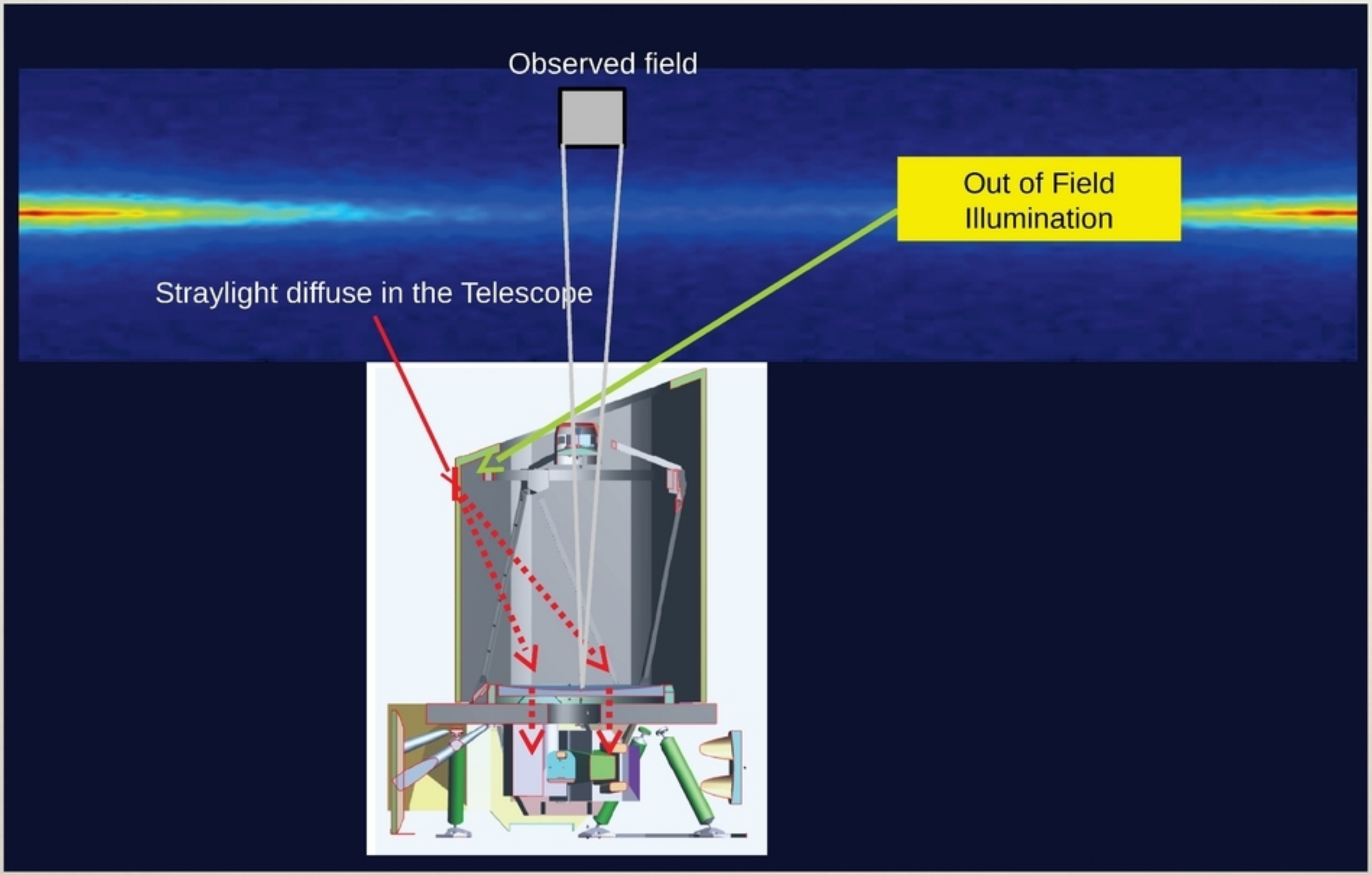
The Euclid survey covers ~15,000 square degres, avoiding the galactic and ecliptic planes
Core cuts: E(B–V) < 0.08, Galactic lat. higher than +/–25, Ecliptic lat. higher than +/–15

Time modulation of the zodiacal light as seen from L2



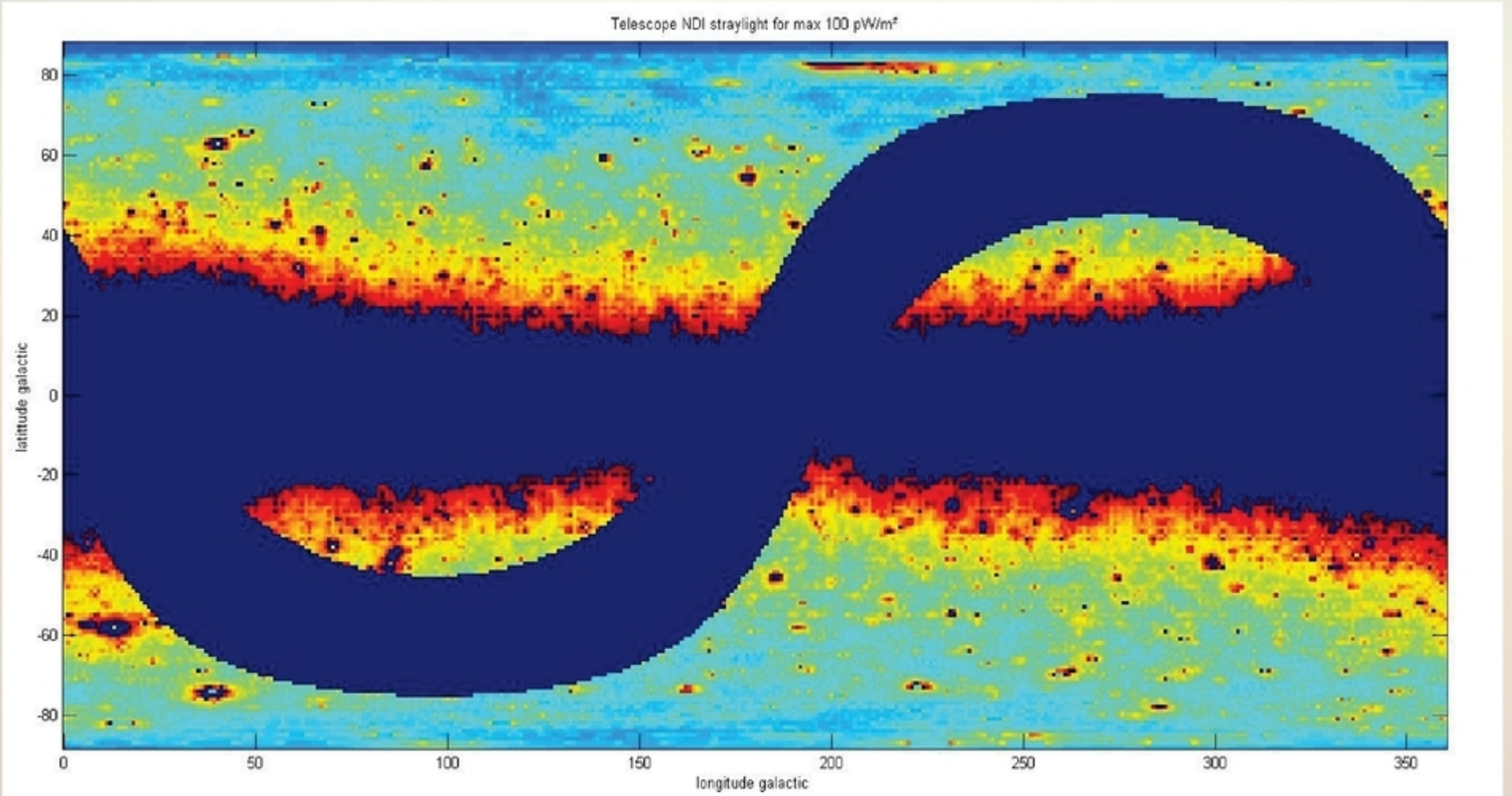
Sun position = gray spot (at top in corotating model)

Straylight to become a survey input weight map



Only considering the off–axis light (excluding imaged field)

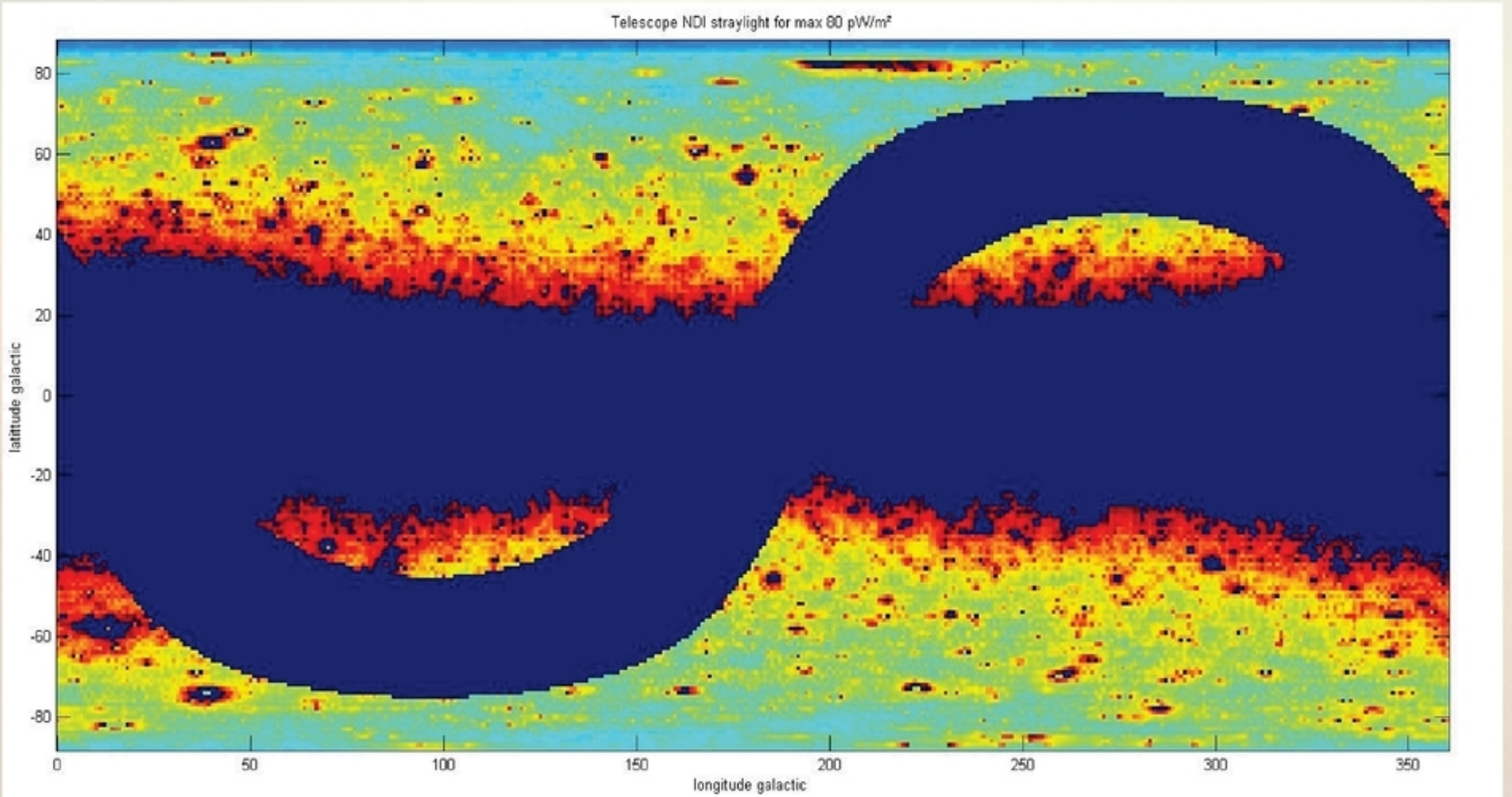
Weight map appearance with a high tolerance threshold



Area remaining for 100 pW/m² allocation=17306 deg²

Only considering the off–axis light (excluding imaged field)

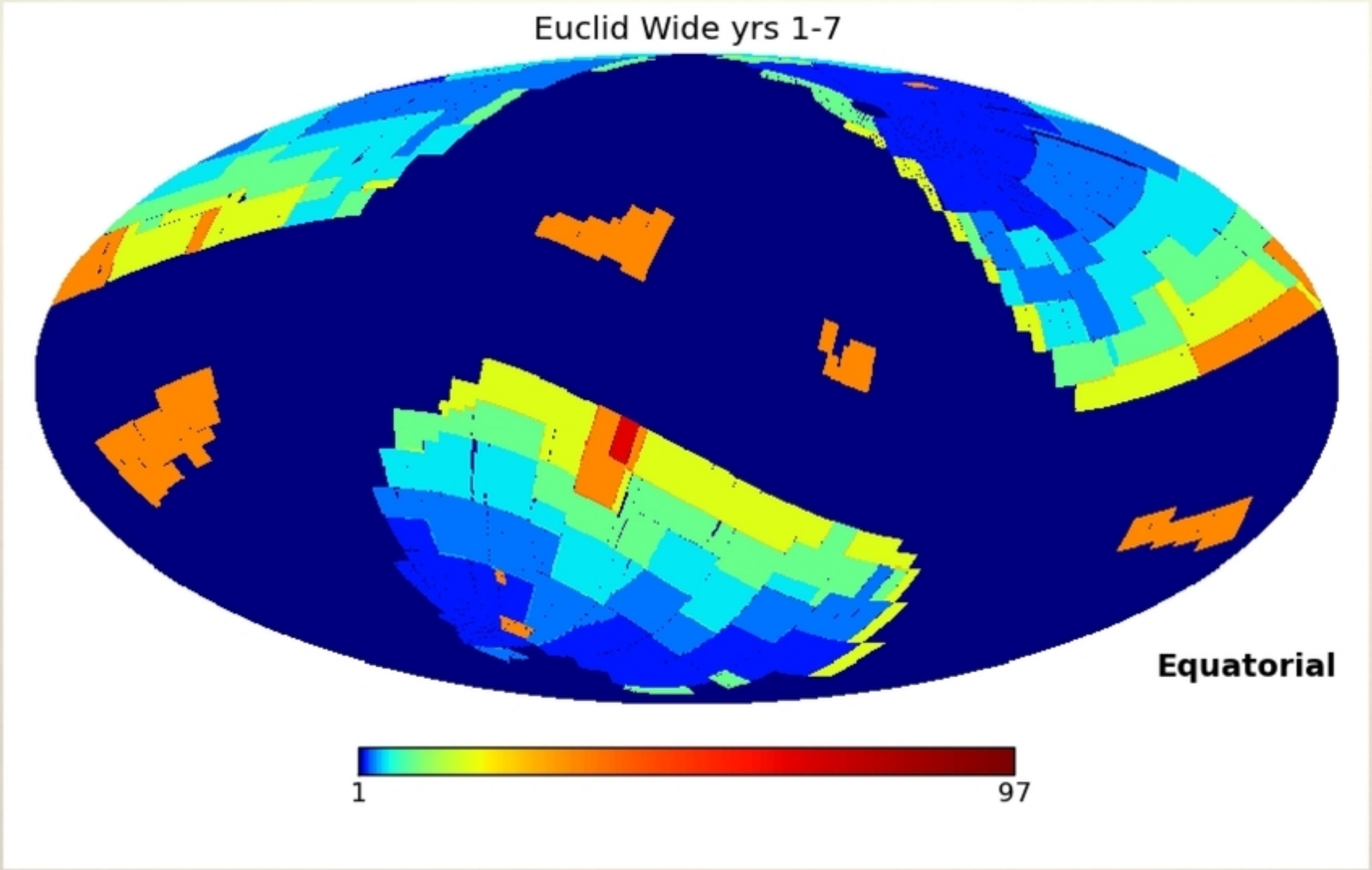
Weight map appearance with a lower tolerance threshold



Area remaining for 80 pW/m² allocation=14328 deg²

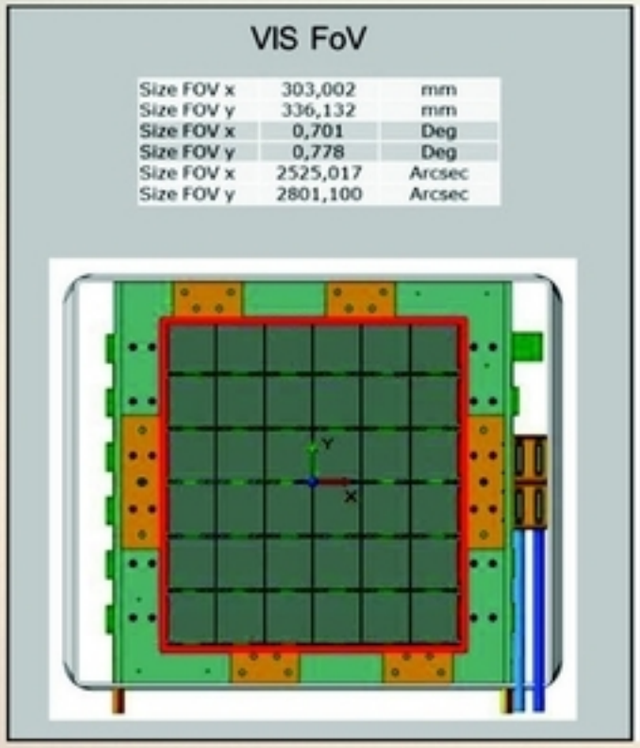
Only considering the off–axis light (excluding imaged field)

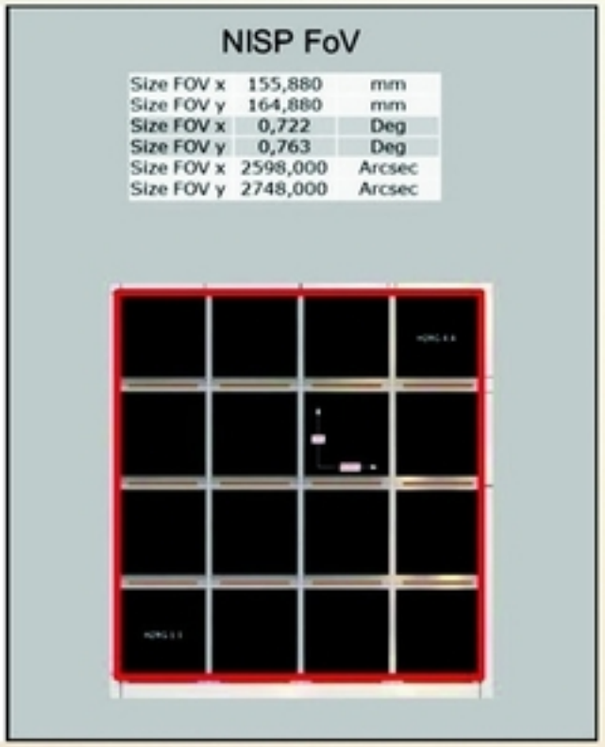
Integrated (all inputs) maps to originate from ECSURV



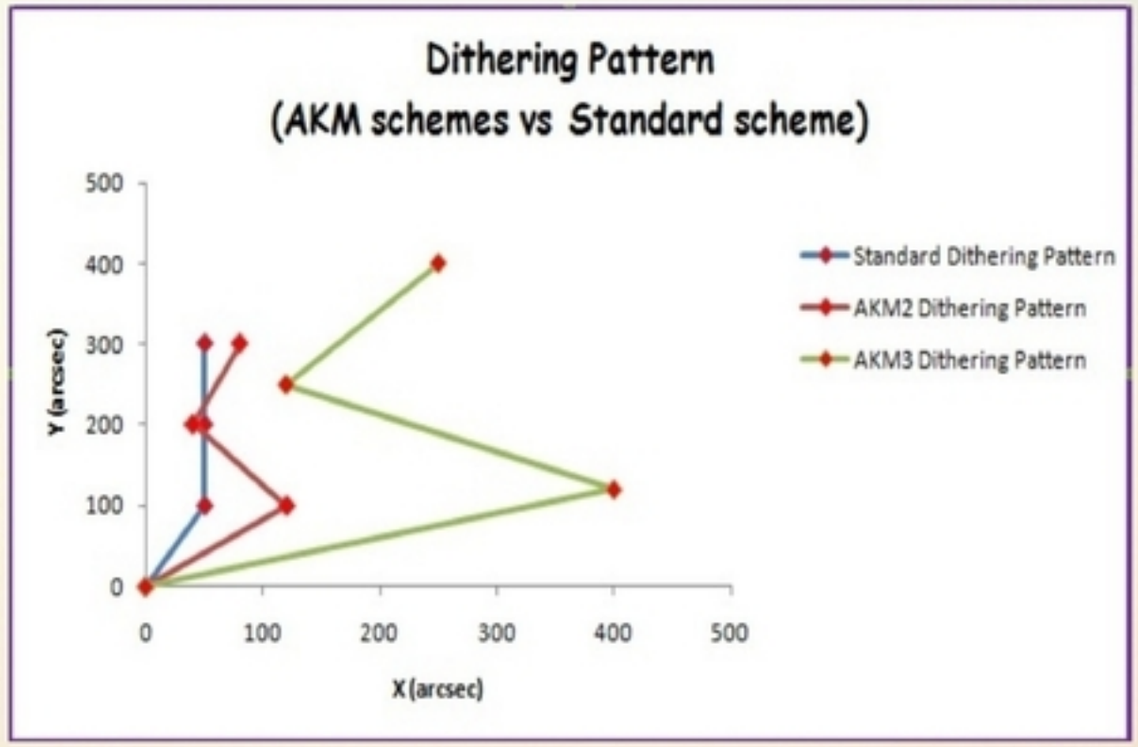
Example of a coverage map produced by Mangle

Fine quality control of dithering patterns





VIS (6x6) & NISP (4x4) focal planes

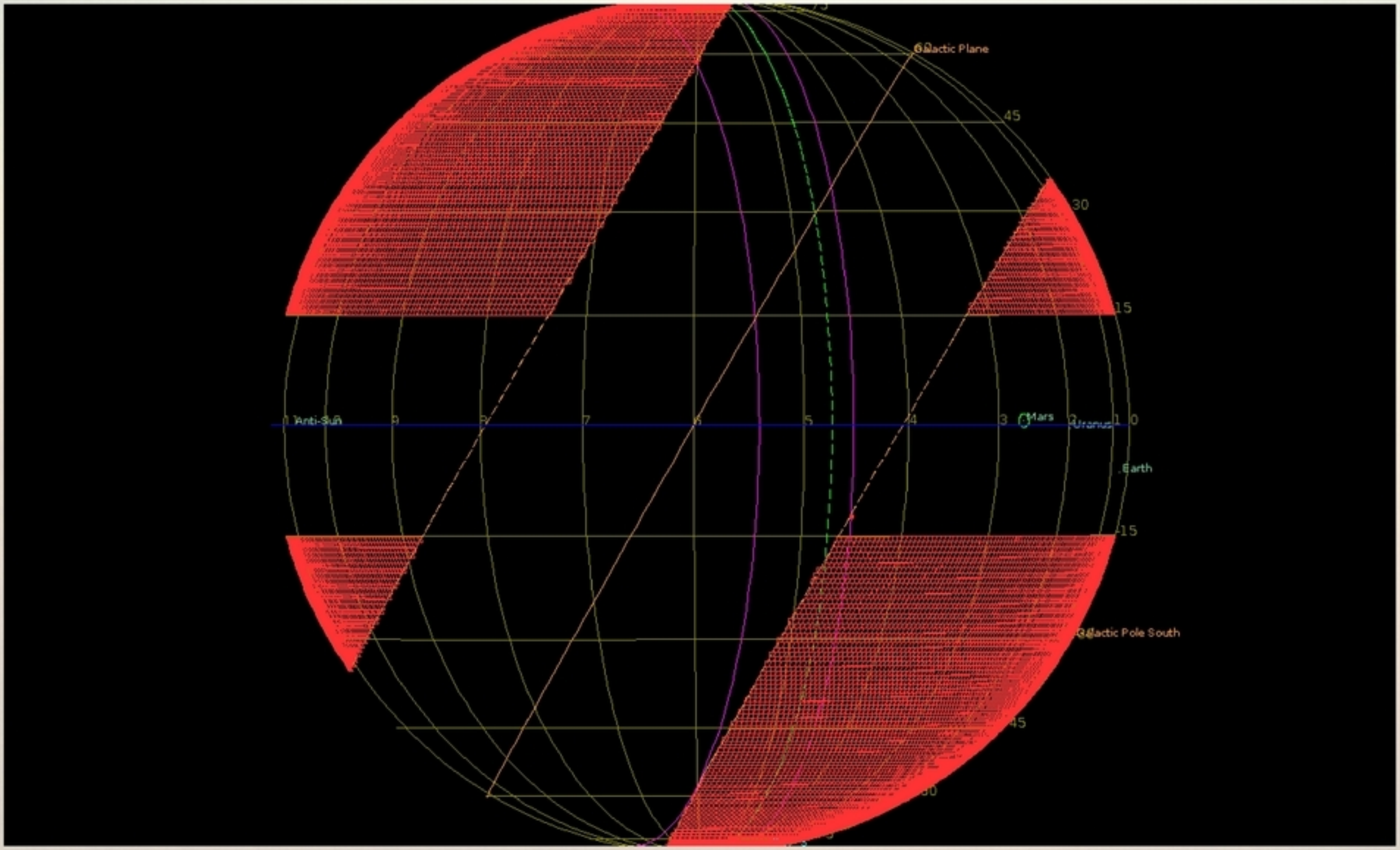


Original and proposed patterns

VIS	X=0	X=1	X=2	X=3	X=4	X>4	X≥3
% of pixels that see more than X frames (std dith.)	0	0.2943	4.396	47.64	35.89	11.78	95.31
AKM dithering Plan 2	0	0.02375	4.417	48.18	35.69	11.68	95.55
AKM dithering Plan 3	0	0.2319	6.146	40.41	45.31	7.903	93.62

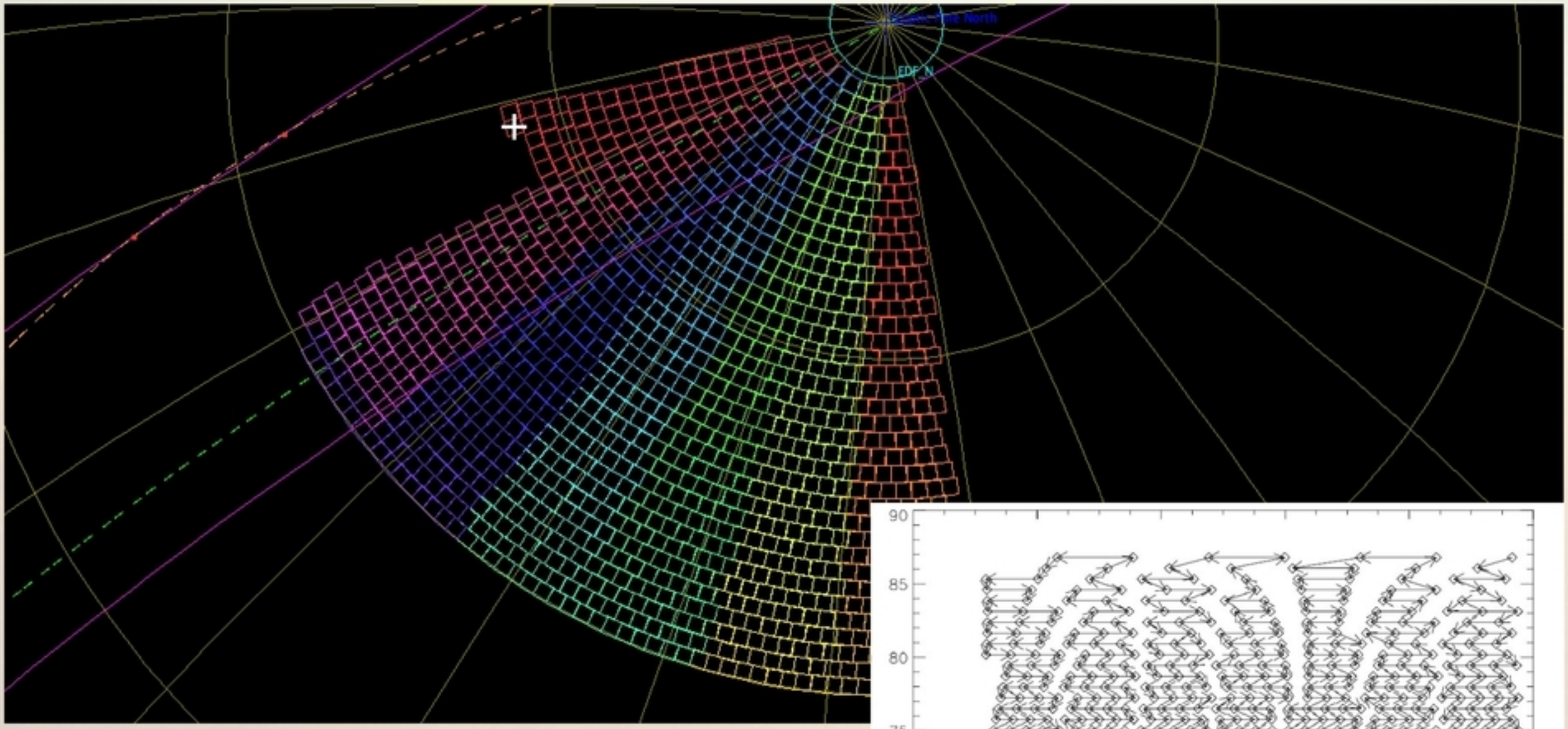
Upon checking all pixels, the tool delivers global statistics

Automated survey generation: approach 1 = pre–tiling

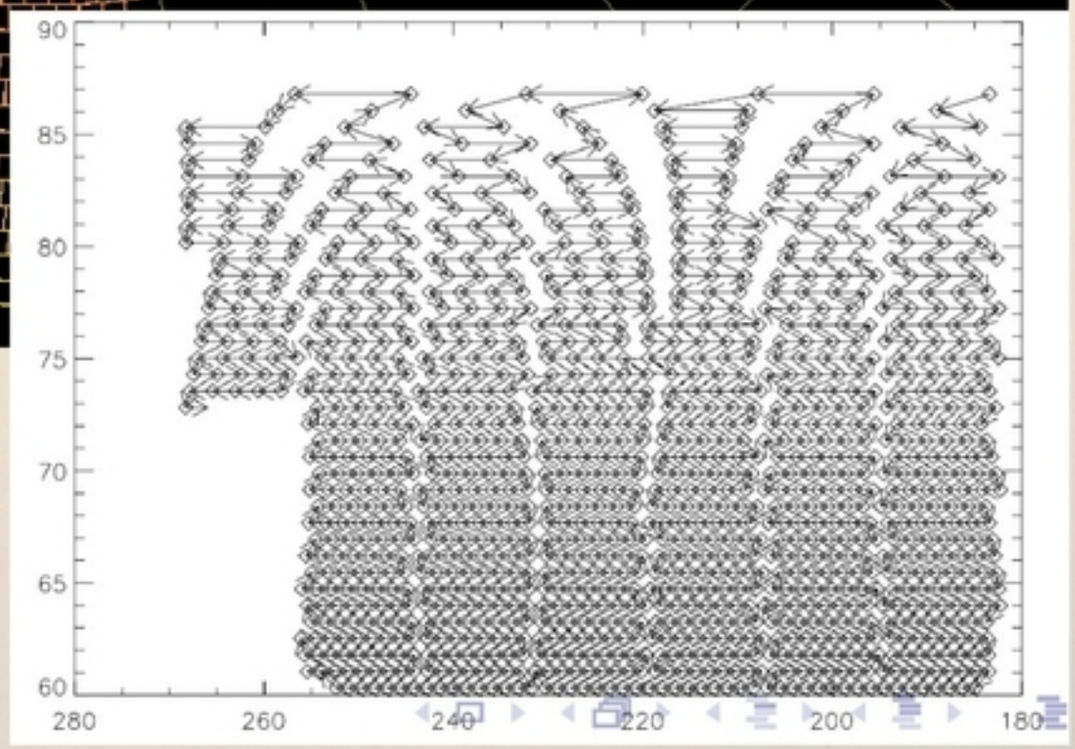


ESSPT rendering of the core (basic) Wide survey cut

Automated survey generation: approach 1 = pre–tiling

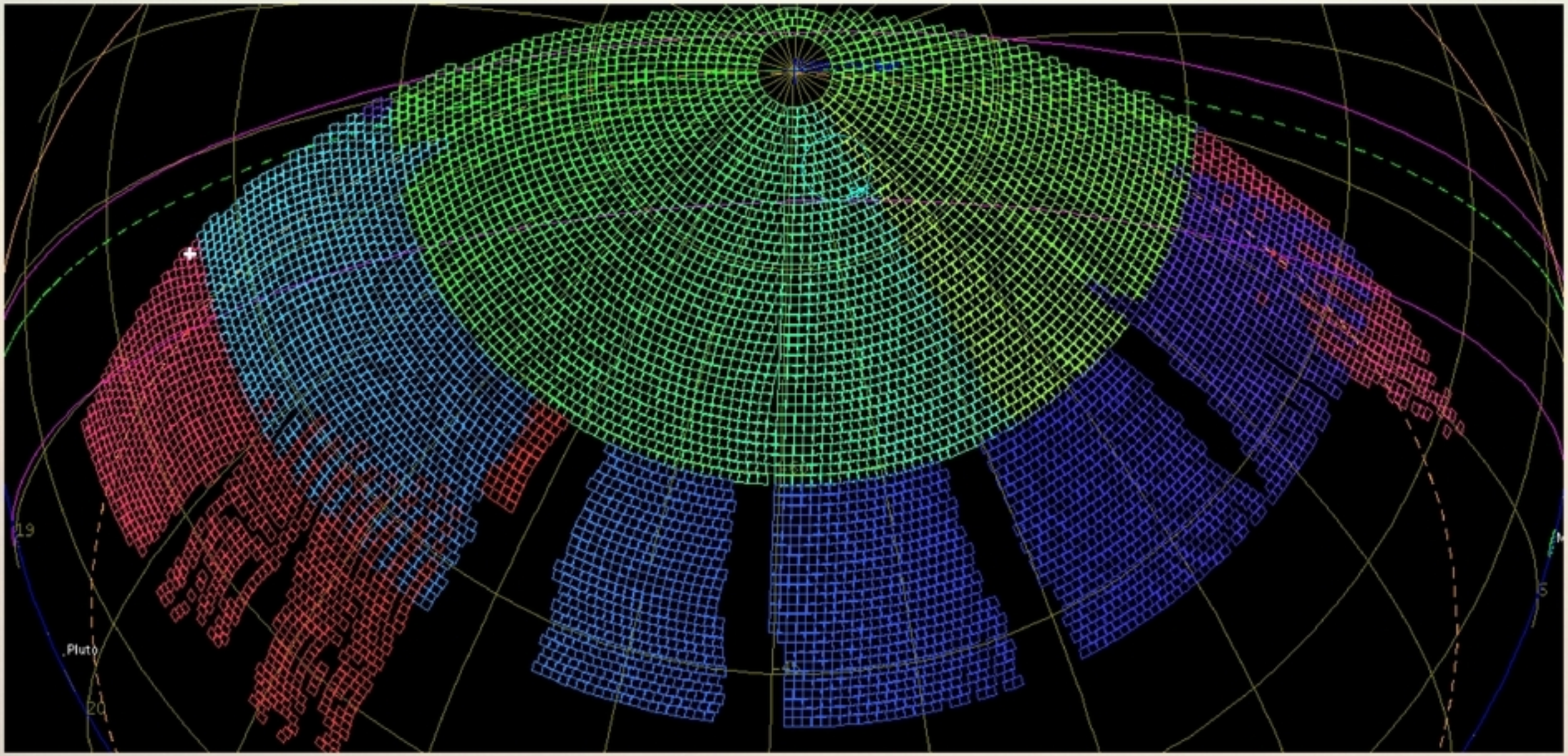


Example of a contiguous pole patch
(between two calibration windows)



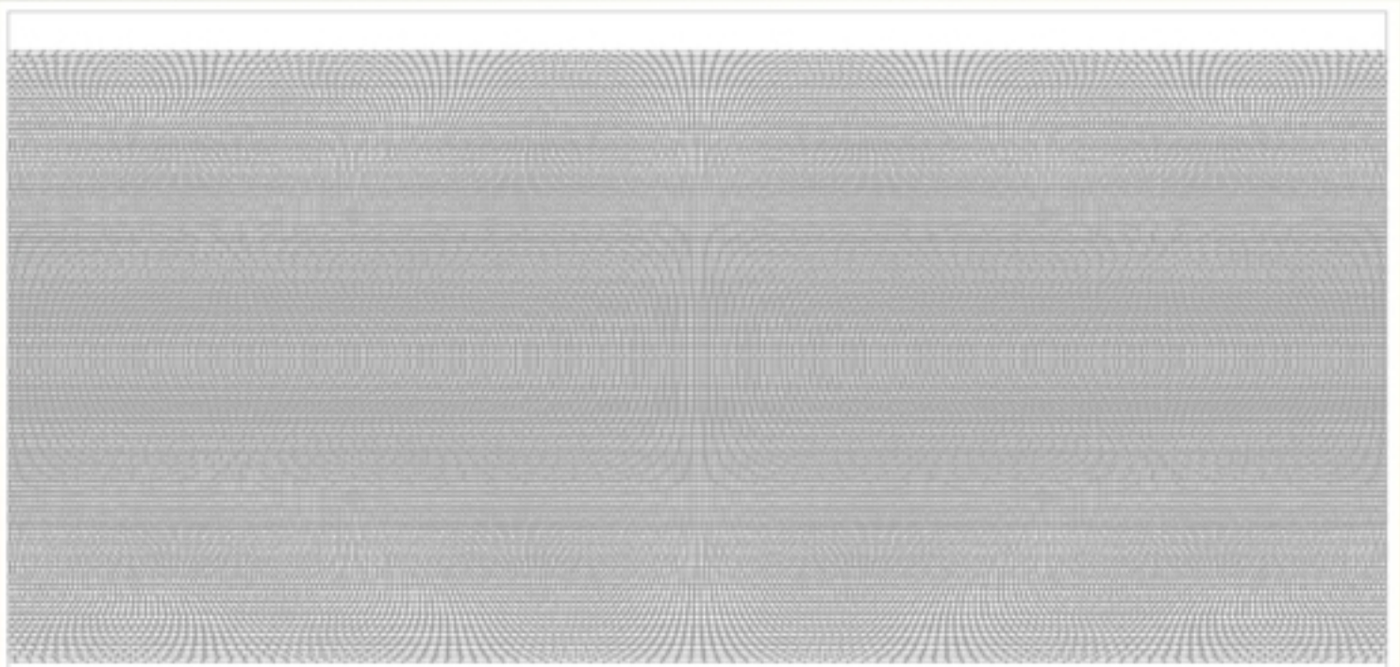
Moves N–>S,..,S–>N, then steps E–>W

Automated survey generation: approach 1 = pre–tiling

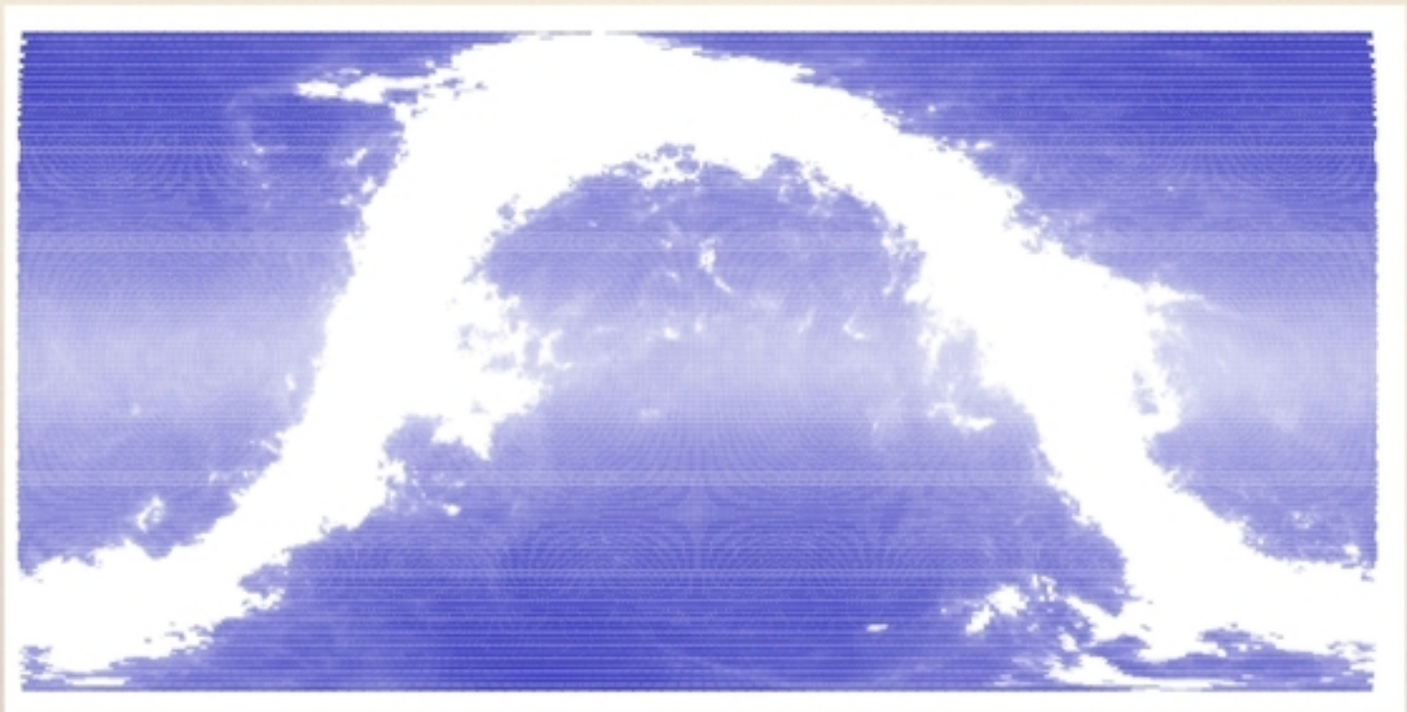


Conflicting rules currently lead to unfilled areas [work in progress]
Introduction of weight maps ought to help

Automated generation 2nd approach: simulated annealing

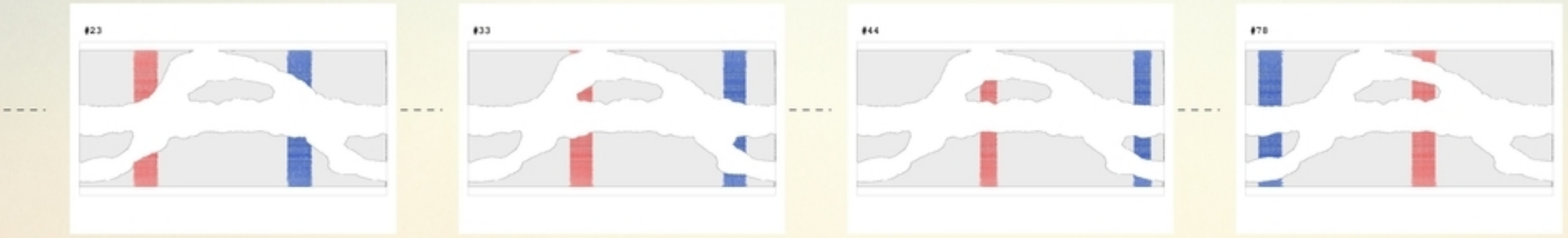


First step: map the whole sky with Euclid FOVs

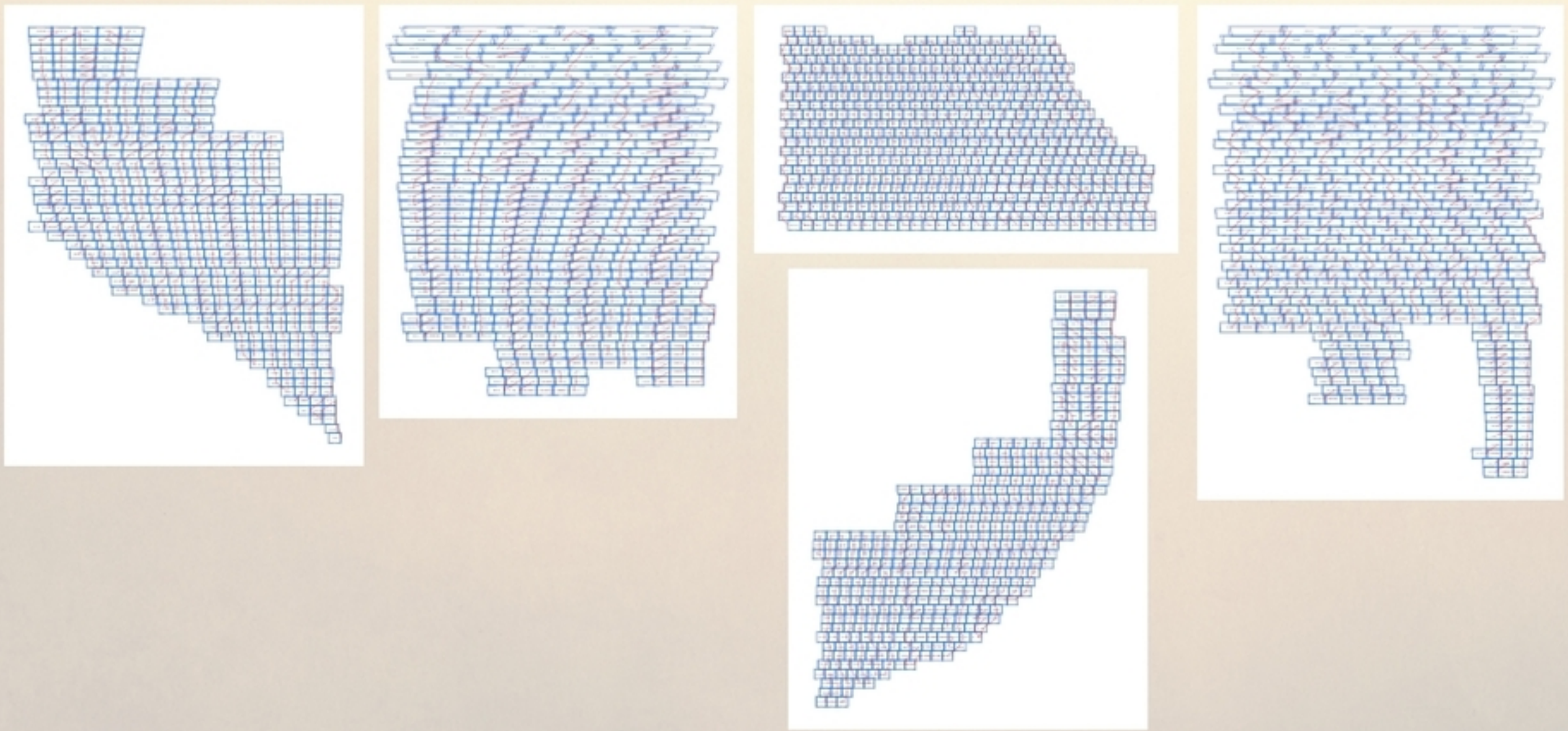


Second step: consider various weight maps

Automated generation 2nd approach: simulated annealing

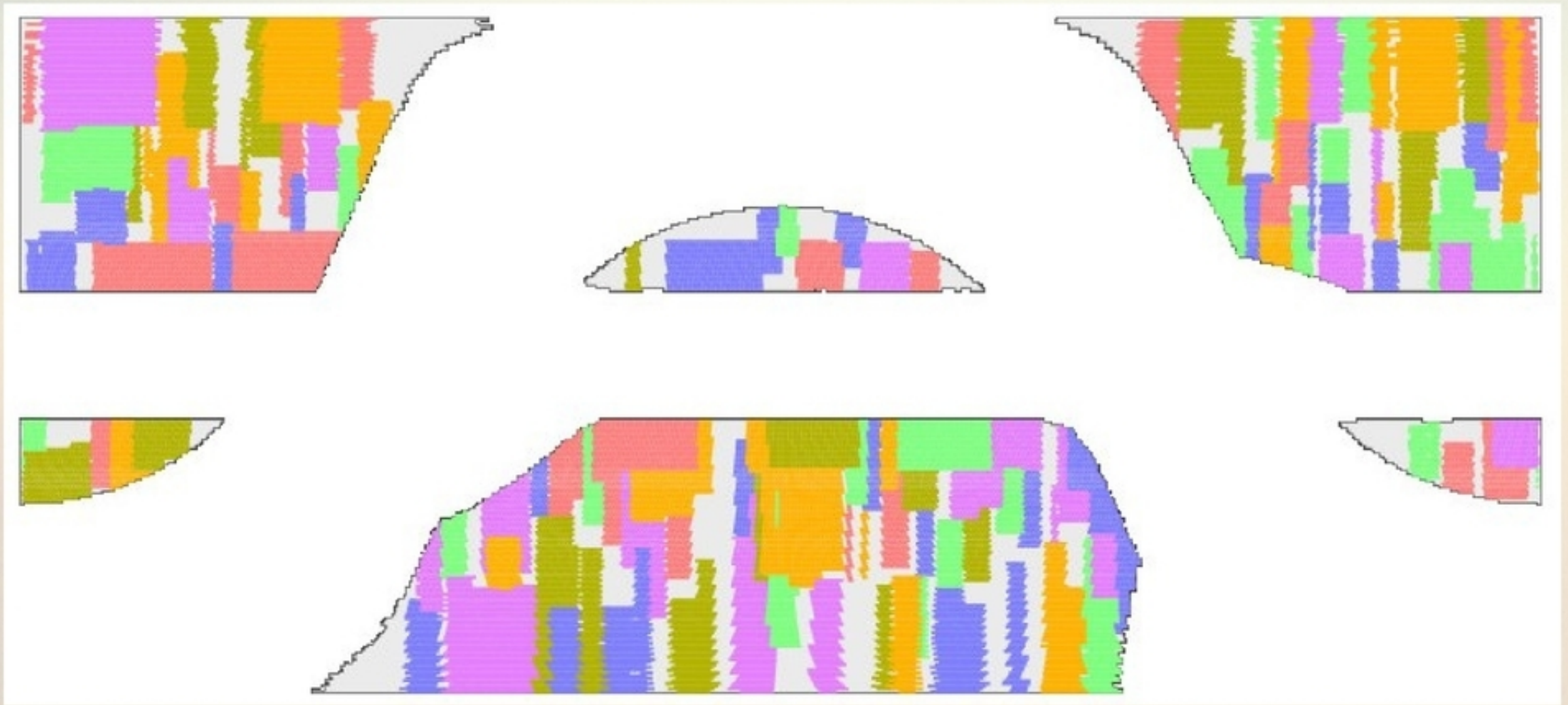


Third step: create the 78 Wide windows constrained by Cals+Deep observations



Fourth step: create iteratively time optimal patches of FOVs (examples for W#23)

Automated generation 2nd approach: simulated annealing



Fifth step: iteratively optimally place the patches over the weighted footprint

The tool converges on the coverage keeping the Euclid idle time as low as possible

This can be done according to various rules (time, slews, starting point, ...)

Work in progress: goal = a 1st automated reference survey for the ESA 2015 review