EUCLID +

Since the original proposal it was clear than one of the biggest benefits from Euclid data was to be able to carry multi wavelength studies on large areas.

Mostly for Legacy but also for Cosmology, e.g. X ray clusters and XCMB).

A quantum leap especially for the NIR and morphology

There are several possibilities for multi wavelength studies etc.

1. those enabling for the main goal of the mission (ground based photometry for photoz, spectra, Spitzer in the deep fields)
2. using Euclid data (still proprietary) with other public data
3. using Euclid data (still proprietary) with other proprietary data

over the years there have been several programs which have started/completed by members of EC community, often involving people outside the EC

For the Italian community therefore it is useful to know

A. what is ongoing/planned

B. where

C. why

D. how many people are involved

POLL

PLEASE fill it !!

There are several possibilities for multi wavelength studies etc.

1. those enabling for the main goal of the mission (ground based photometry for photoz, spectra, Spitzer in the deep fields)
2. using Euclid data (still proprietary) with other public data
3. using Euclid data (still proprietary) with other proprietary data

What to do

1. can use when public or can make a proposal for a specific collaboration
2. can list your project and accept other EC members if they want to collaborate
3. cases:
   - i) other data property of other EC members only: same as case 1
   - ii) other data property also of few other people: they can become special members, limited to the particular project(s)
   - iii) other data property also of other large collaborations: you can have a MoU between EC and other collaboration

Just a reminder about DR1 data:

★ a few passes on deep fields

★ planned visits on auxiliary (photoz) fields

★ big areas on the wide

- a fill in program done early in the mission during the PSF stabilisation periods: a proto EMDS (medium deep survey)

Euclid Medium Deep Survey [EMDS]

R. Scaramella & R. Vavrek (ESA) & B. Granett (INAF) & many others

Rationale

Most/all large astronomical surveys have a wedding cake shape with three levels of area x depth:

- wide (large area, small depth)
- medium (…)
- deep (small area, large depth)

In this way one can effectively sample different parts of the discovery space

In his baseline Euclid had the wide (main goal) and the deep parts (also for sample characterisation), so it lacked a medium part by design.

Notwithstanding, the idea was studied in the past (2018+) but it could not fit easily in the base plan and ESA did not want to touch yet the unallocated time. But ECSURV studied what/where could have been observable with N repeats in the unallocated time periods

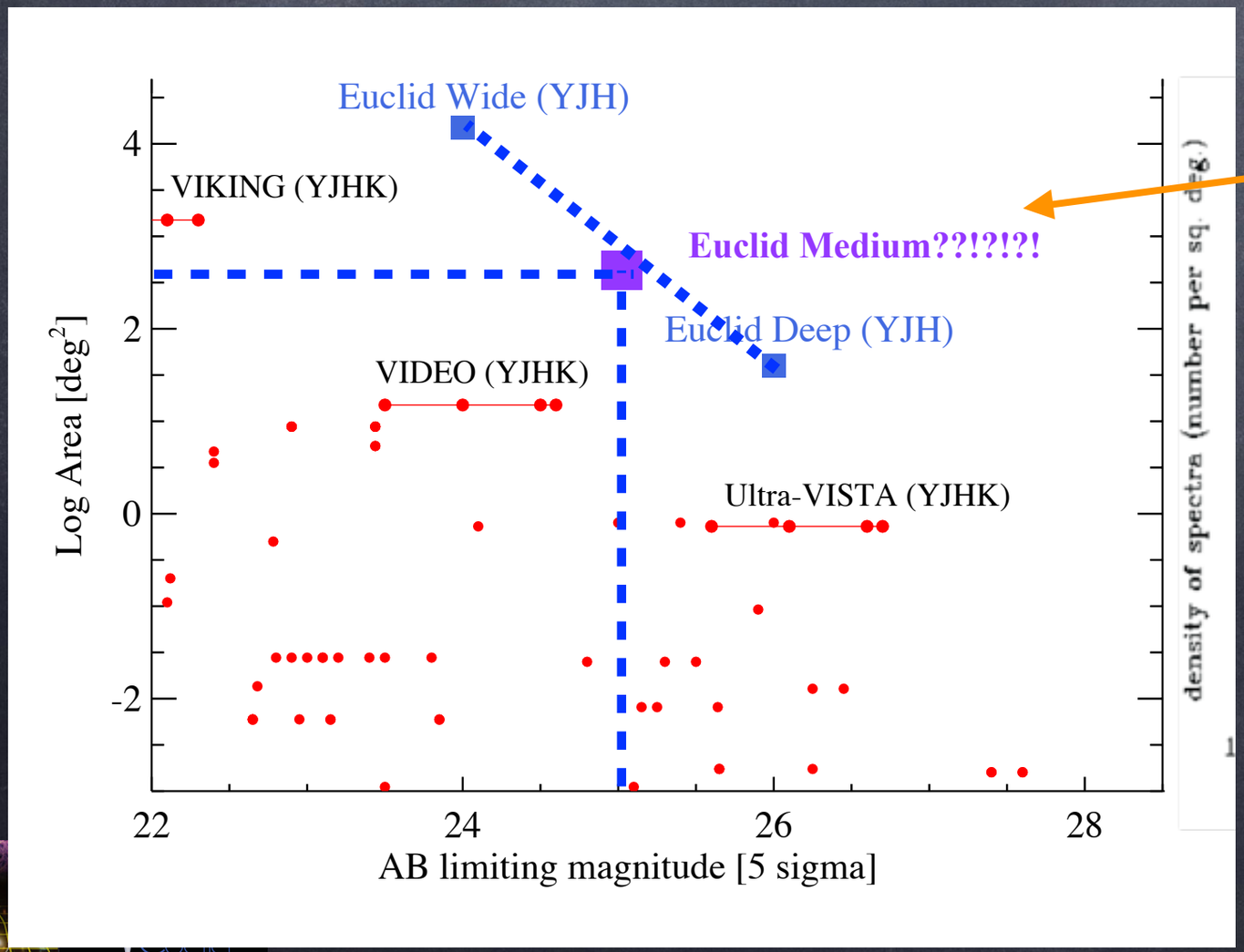
Sesto Meeting on Euclid Survey(s)

Last week of June 2019

DONE

Fantastic place, relaxed & fruitful atmosphere

Get in touch to participate

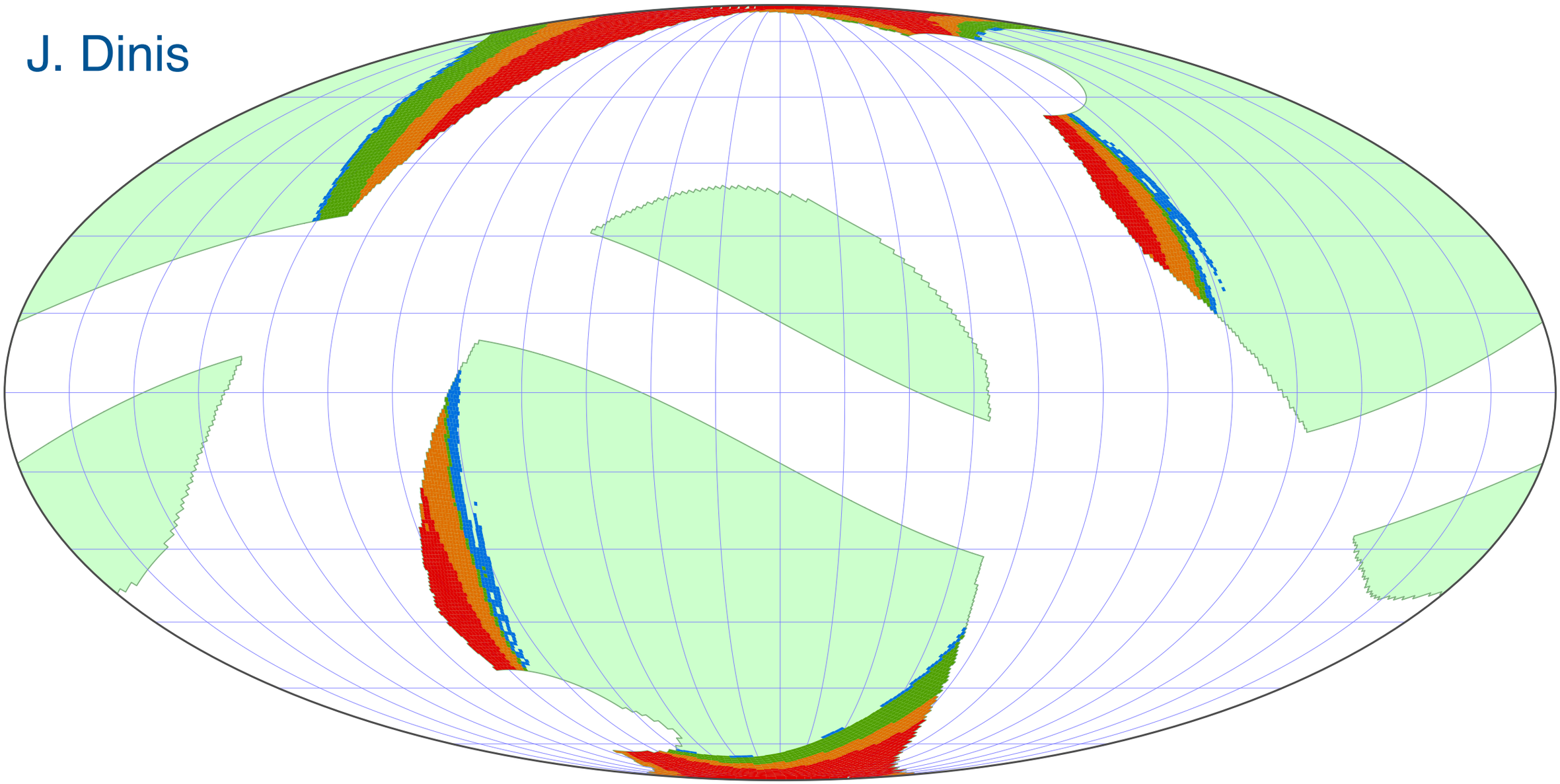


discuss problems and NEW ideas

USUAL WEDDING CAKE: it is "missing" an area mag+1, ~300 sq deg

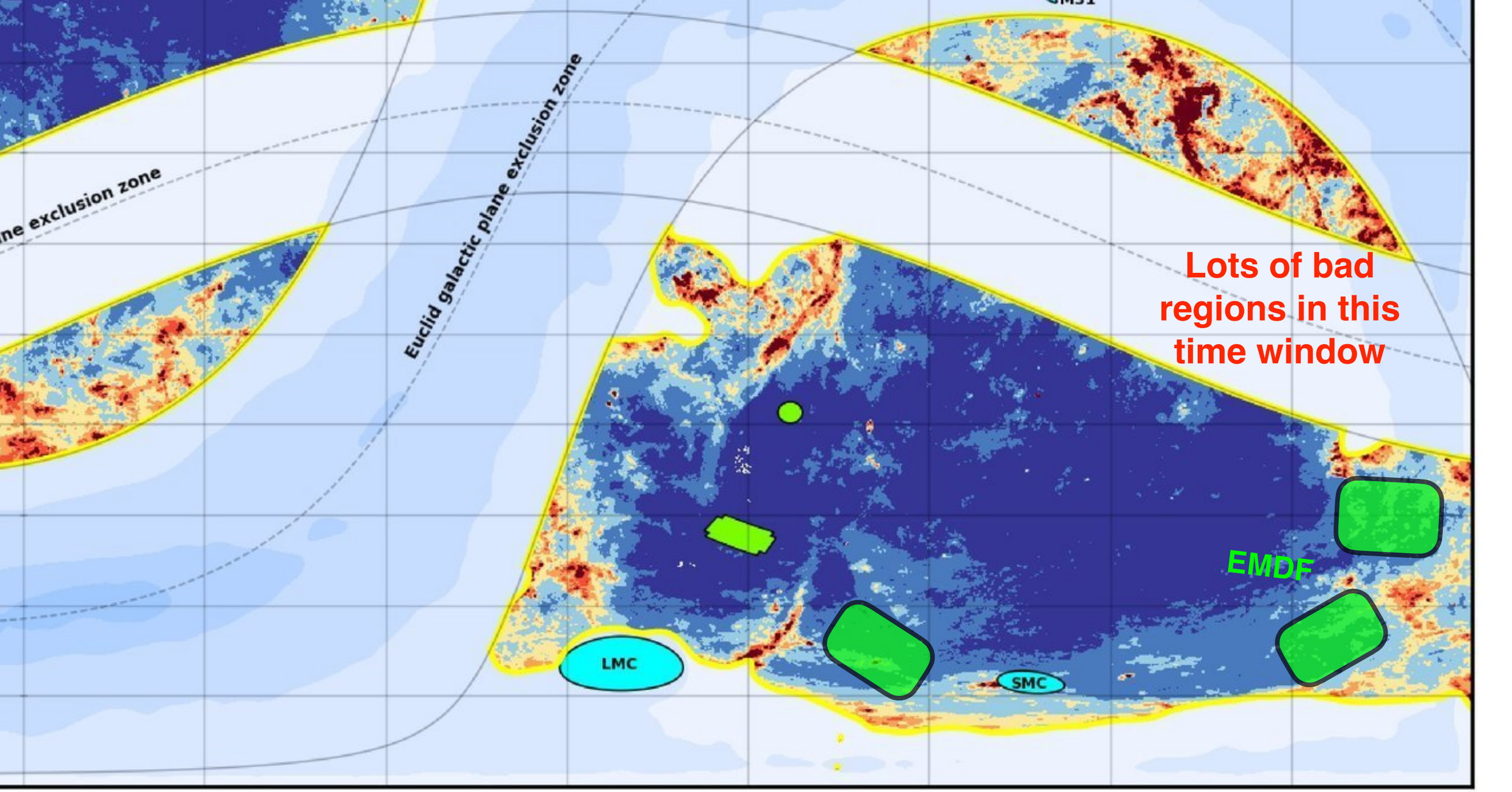
ECSURV TESSELLATION

J. Dinis



EQUATORIAL COORDINATES -- MOLLWEIDE PROJECTION

Different colors:
visibility for additional visits
(total here from 4 -green- to 7 -red-)



alactic light reflection from interstellar cirrus

:0.08, up to 0.15 to avoid holes&islands]

cliptic planes + reddening]

deg.^{2}, South=20 deg.^{2}

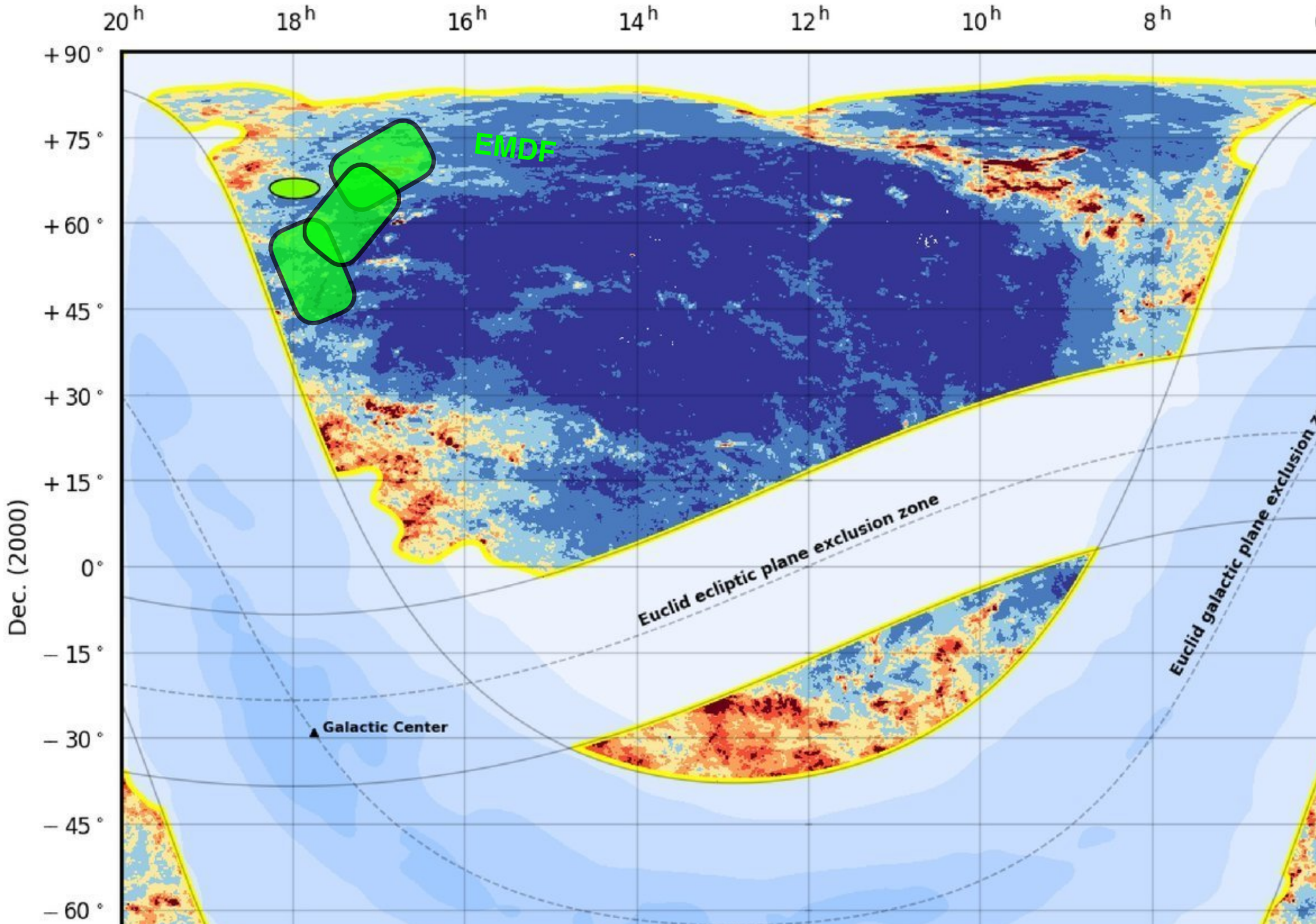
E(B−V) and cirrus surface brightness (mag./arcsec^2)

0.01 ~28 — 0.15 ~26

Dust map: ESA / Planck Collaboration

Need to check feasibility (EMDF not in scale)

Need to check feasibility (EMDF not in scale)



Early 2023: what to do during PDC waiting times? (pointing extremely restricted)

R.S. 31/1/23

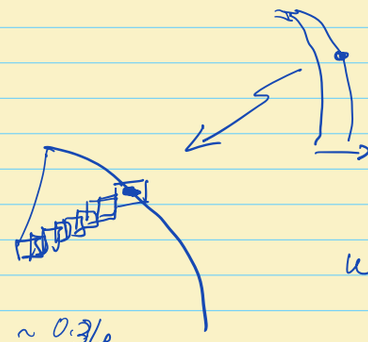
Pointing for the WFE campaign

1) need to stay ~7 days with same S/C attitude and land on a PSF target

⇒ POSSIBLE IMPLEMENTATONS

Problem: blinding ☆

A) MINIMAL:



$\omega = \frac{\Delta\lambda}{\Delta t} \simeq \omega_0 \cos\beta$

$\omega_0 = 1°/day$

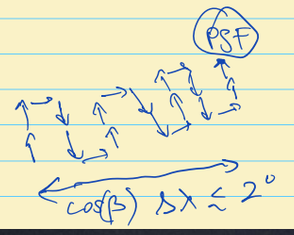
$\cos 70° \sim 0.34$

@ $\beta \sim 70°$ $\omega \simeq 0.34°/day \sim 0.5$ fields/day

1 week ≃ 2.5 fields ≃ 1.75° along $\lambda/\cos(\beta)$

1 day ~ 20 fields

No special software, could do it by hand

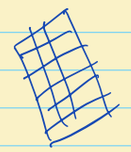


⇒ "up & down"

Single field in β ~ 20 exposures

→ staggered → 40 exposures

B) generic One patch at low β



tilted, separated patches not uniform, photometry from ground?

C) Pointed patches:

- high β:

the shorter in β the deeper (cluster of G? interesting deep field? local galexies?)

- low β: ~10°

~ 7°

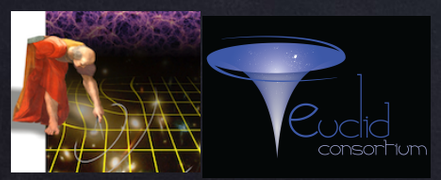
or β ~ 0

could cover some interesting astronomical field even galactic fields (!!) TBD (Gaia, μlensing)

⇒ Problem: planets

Next could be the same pattern for each PSF waiting time.

Problem: blinding ☆ & ground photometry



Will be done by SOC

IF (best effort) will be done by SOST

Simple to implement and useful:
medium depth field resurrected (but split)
+ 1 mag, ~120 sq deg

D) Medium deep field resurrected but fragmented. 7 days ~ 140 pointings

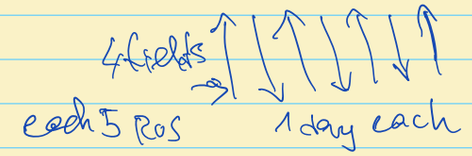
→ Want 1 mag deeper, → 6 visits

1 visit from wide → 5 additional visits

in 1 day ~ 20 RoS ~ 20 fields.

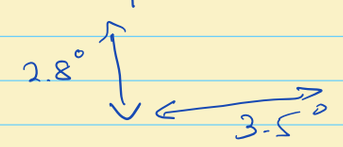
So can do 4(x5) fields in $\beta \lesssim 2.8°$ x 7 days strip

→ want $\omega = 0.7°$/day



$\omega = \omega_0 \cos(\beta) \rightarrow \beta = \arccos(0.7)$

$\beta = 40°$



$\beta = 60°$ $\omega \simeq 0.5°$/day

$\beta = 70°$ $\omega \simeq 0.35°$/day → 1 field ~ 2 days

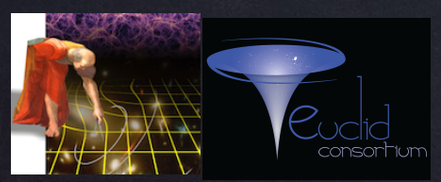
7 days ~ 25 fields

7 days ~ 3 fields ⇒ $\omega \sim 0.3$ ⇒ $\beta = 72°$

140/5 ~ 28 pointings

"Vertical tilted strips" 2.1 x 6.3 1 mag deeper

area ~ 13.3 □ → 9 waiting Times → 119 □



euclid

EMDS two fold goal:

A. Repeats on large areas and before the start of the main survey will help a lot to quantify internal errors and spot early possible problems. **Extremely important and useful so to early "debug" the system**

B. Scientifically useful for a variety of topics, which will use the additional 53 sq deg from the deep so to beat down cosmic variance.

In addition, could (?) complete and extend in future during the unallocated time or mission extensions (on a competition basis)

Notes:

(i) Not all PDC waiting time was allocated to EMDS (other programs done)

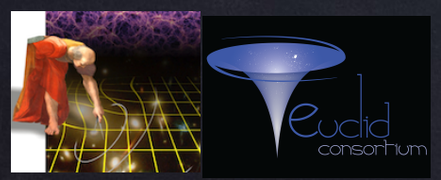
(ii) Unfortunately, only "vertical" movements allowed (—> less efficient in multiple coverage)

(iii) Unfortunately, only partial NISP coverage because of thermal stability requirements

(iv) Observations ended before the start of the wide survey

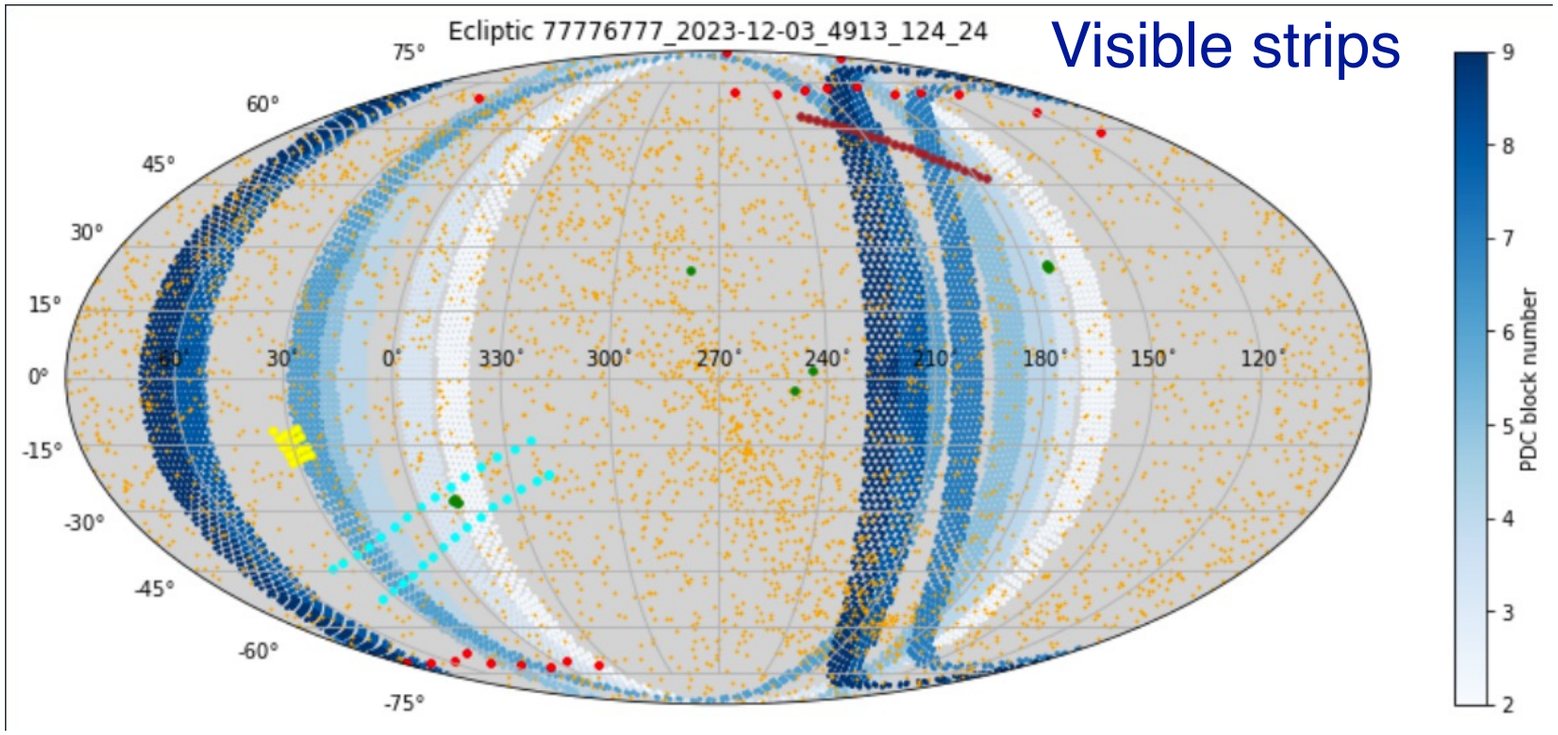
(v) Reduction is heavy for GS

(vi) [TBD!!] Public release for Q2? Aim for internal release to be the same as for DR1 data



euclid

Region of Interest for science during thermalization periods

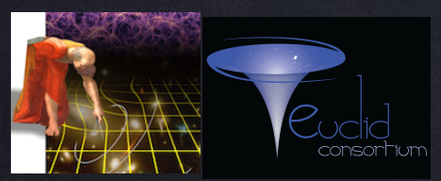


R. Vavrek

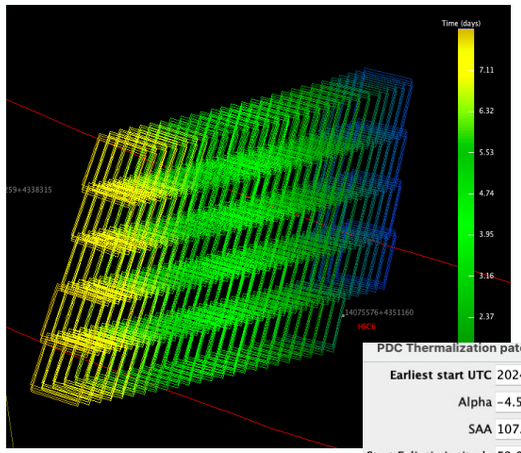
3 programs done during PDC waiting times:

1. Solar System Objects
2. Independent Legacy Scientists
3. Euclid Medium Deep Survey

Fields optimised for position, cadence, area, other available data



SOC planning tool (ESS) updates for tuning science patches



PDC Thermalization patch parameters

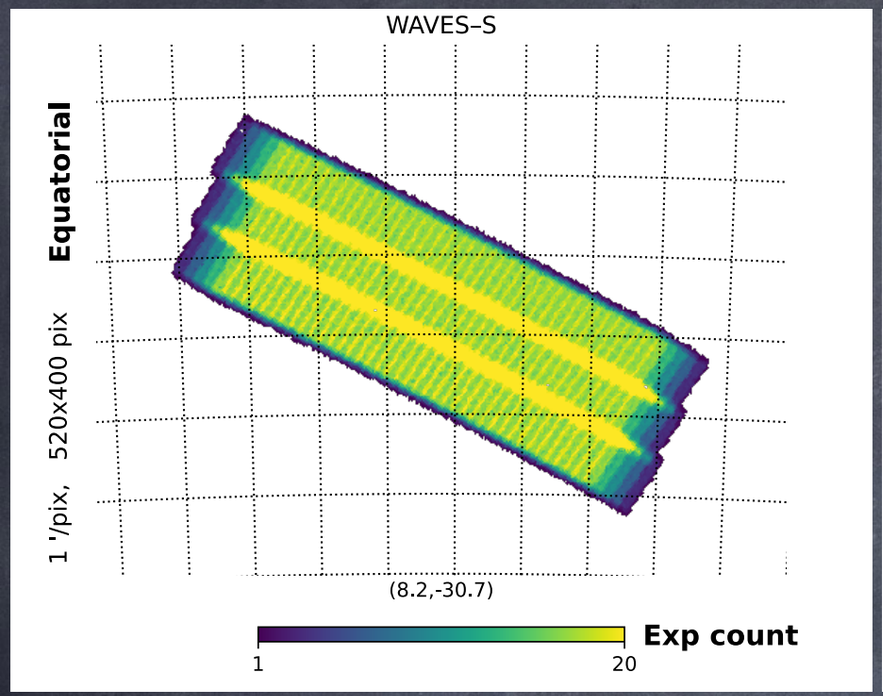
Earliest start UTC	2024-01-25T20:33:32Z
Alpha	-4.5
SAA	107.947
Start Ecliptic Latitude	52.0
Leading	☑
Zig-Zag	☐
Avoid blinding stars	☑
Load ROI	Load ROI
Latitude step (+/-)	0.67
N. Vertical	5
N. Total	142
Execution interval	2024-01-25T20:33:32Z to 2024-02-02T04:08:12Z
Duration(s)	632080.0

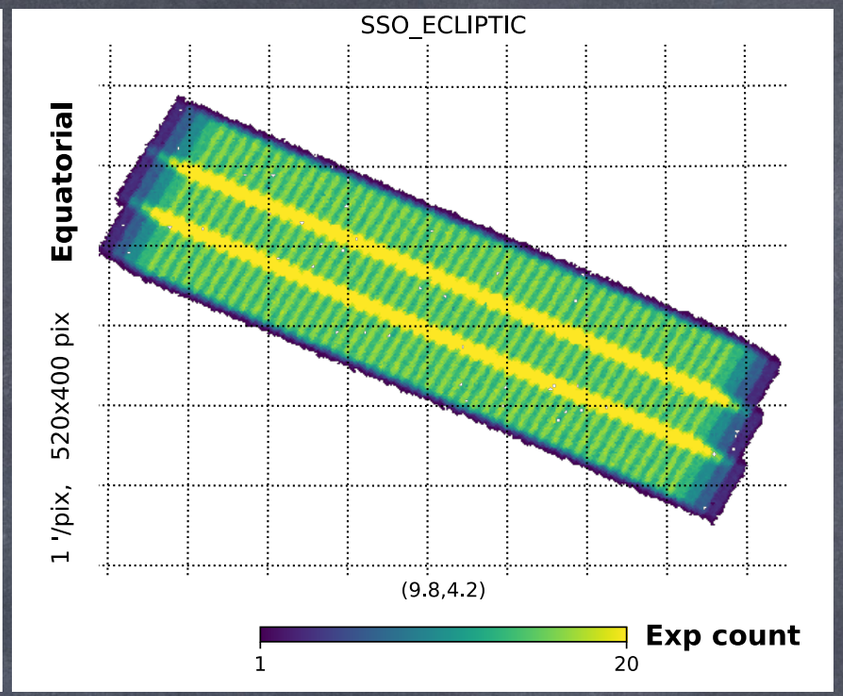
- ESS PDCC patch tool allows to create raster type science observations fully compliant with calibration and operational constraints
- Patches sequencing ROS type observations in a way tha AA/SAA stays constant.
- Different strategies to create deep coverages
- During PDCC operations additional features were added:
  - Bright star avoidance
  - Tilted patch geometry
  - Support for sheduler applying shifts/cuts in the program

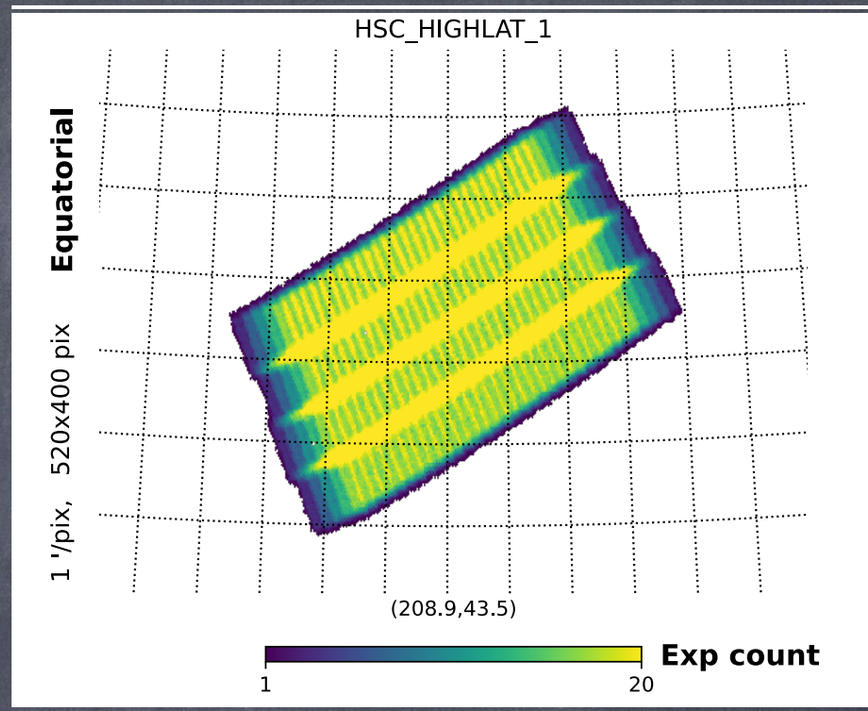
P. Gomez

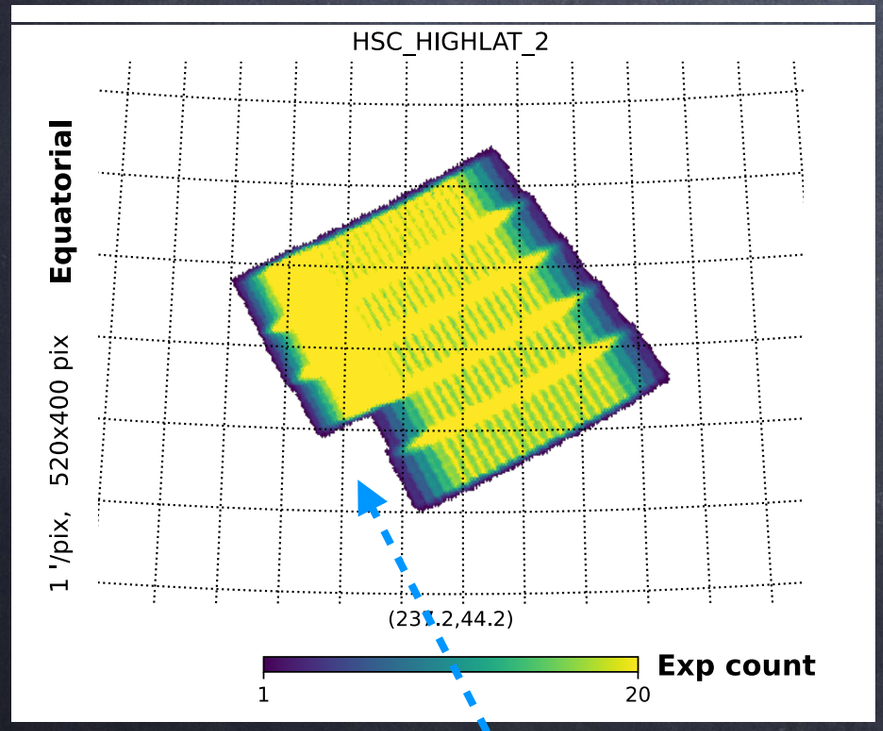
Footprint of the PDC fields

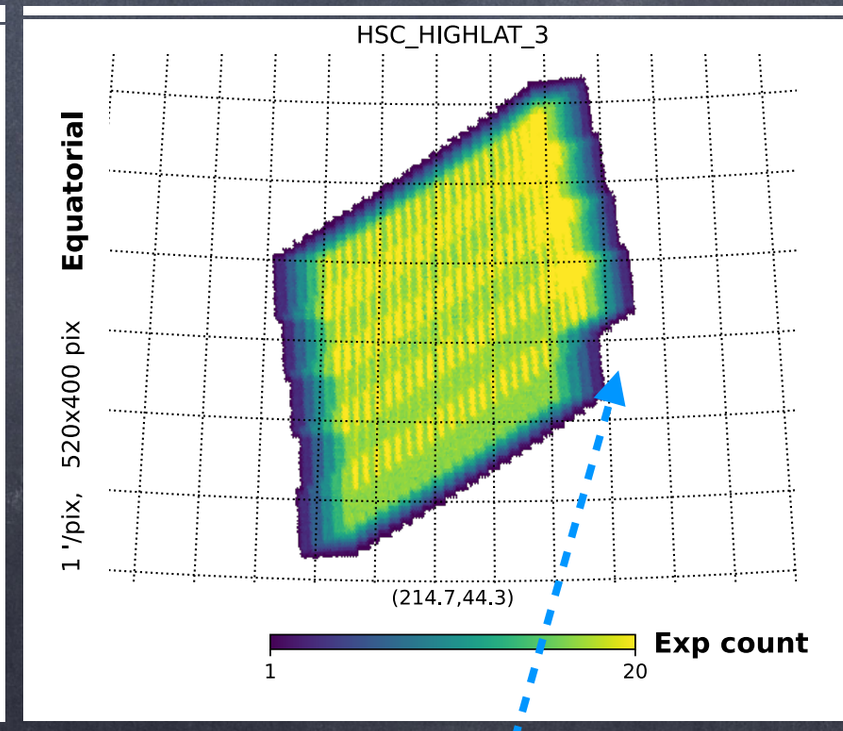
B. Granett

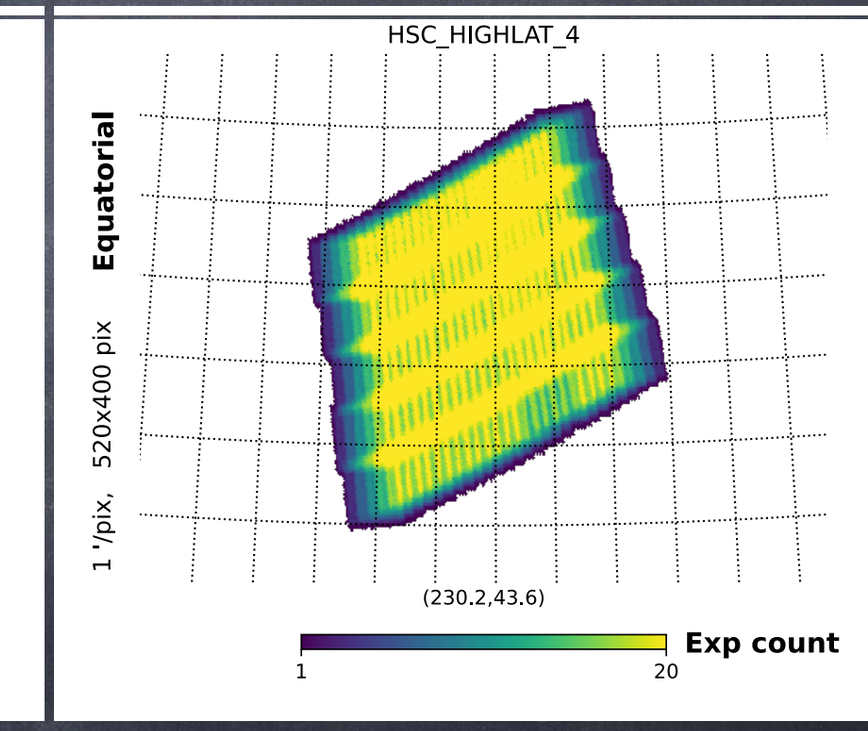




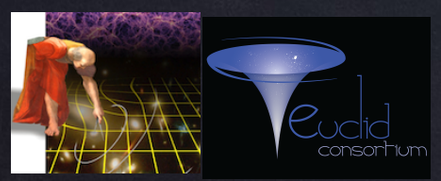




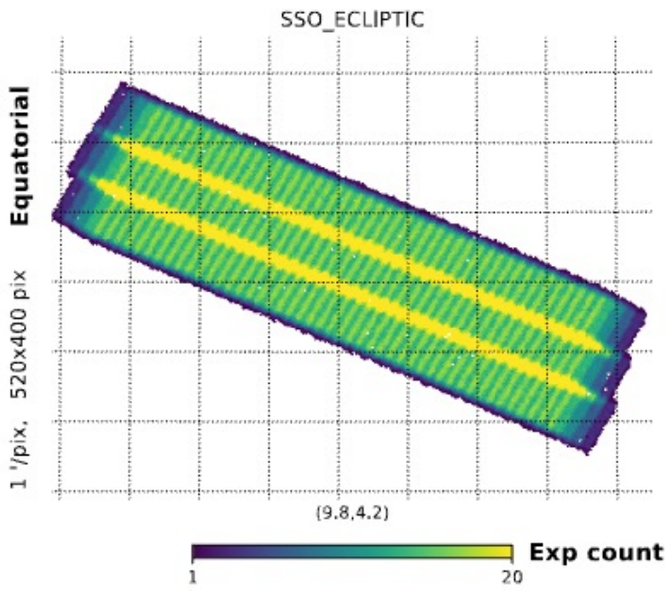




Need to avoid blinding stars



Science program – SSO coverage



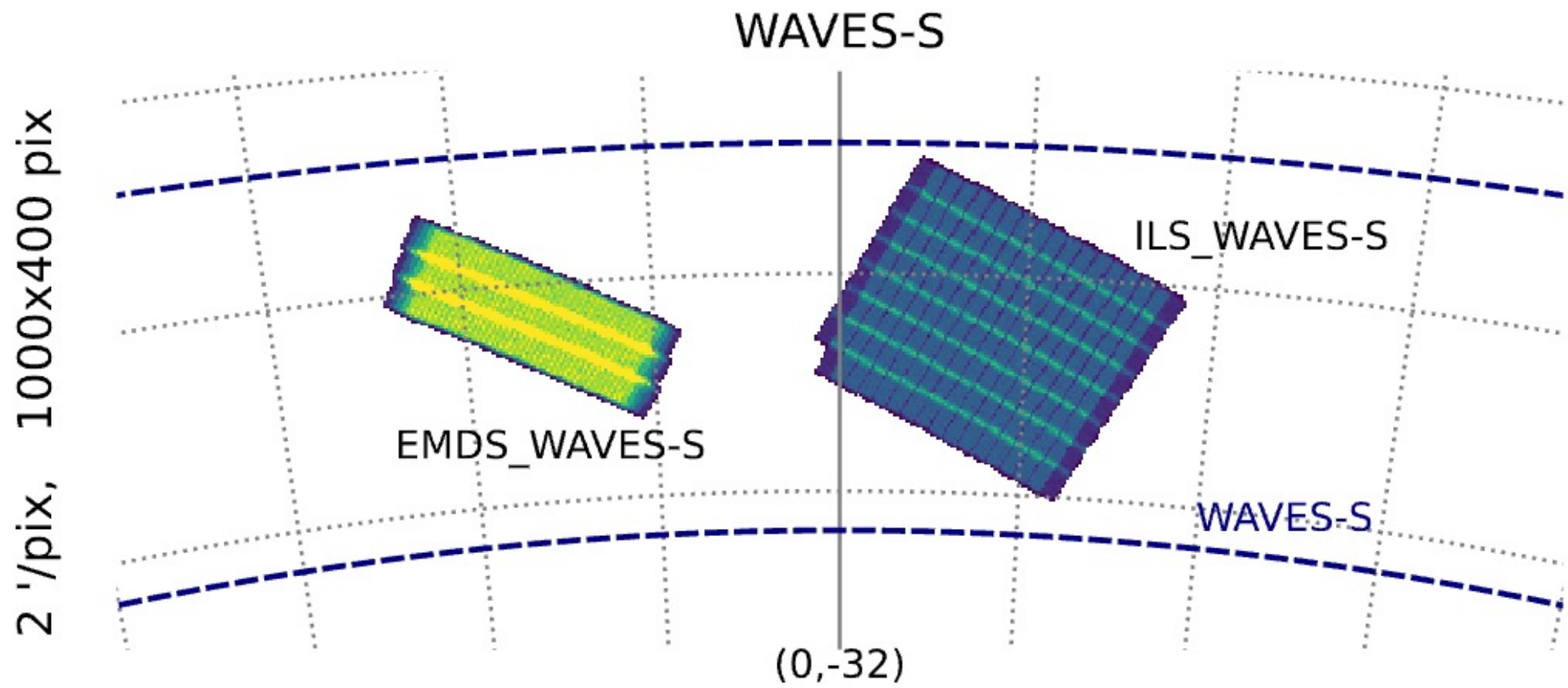
Solar System Objects

- Euclids window to the ecliptic plane, a unique dataset
- Pattern allows up to 4x detection over ~1 day what leads to a major improvement in the detection envelop comparing to single ROS coverage
- LE1 data has been provided to the SSO SWG, data processing is ongoing
- DES simultaneous observations have been obtained

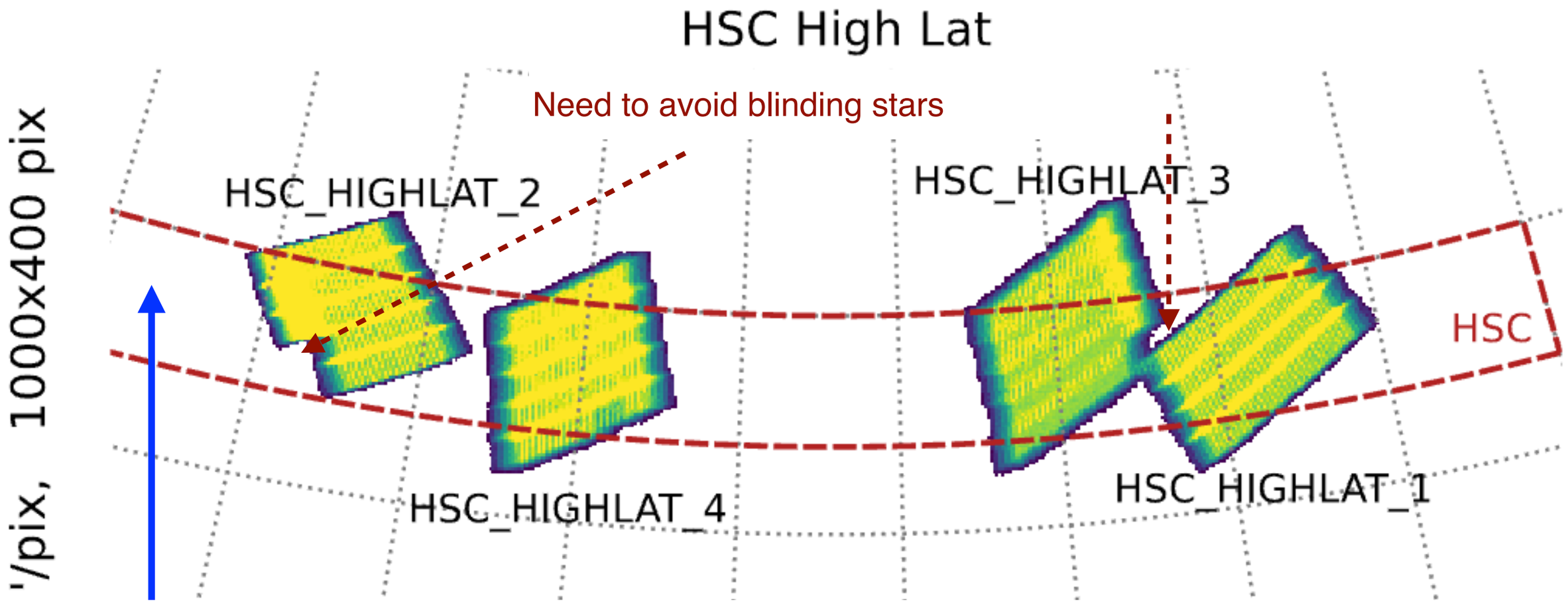
Science program – WAVES-S fields (EMDS and ILS)

Independent Legacy Scientists

B. Granett



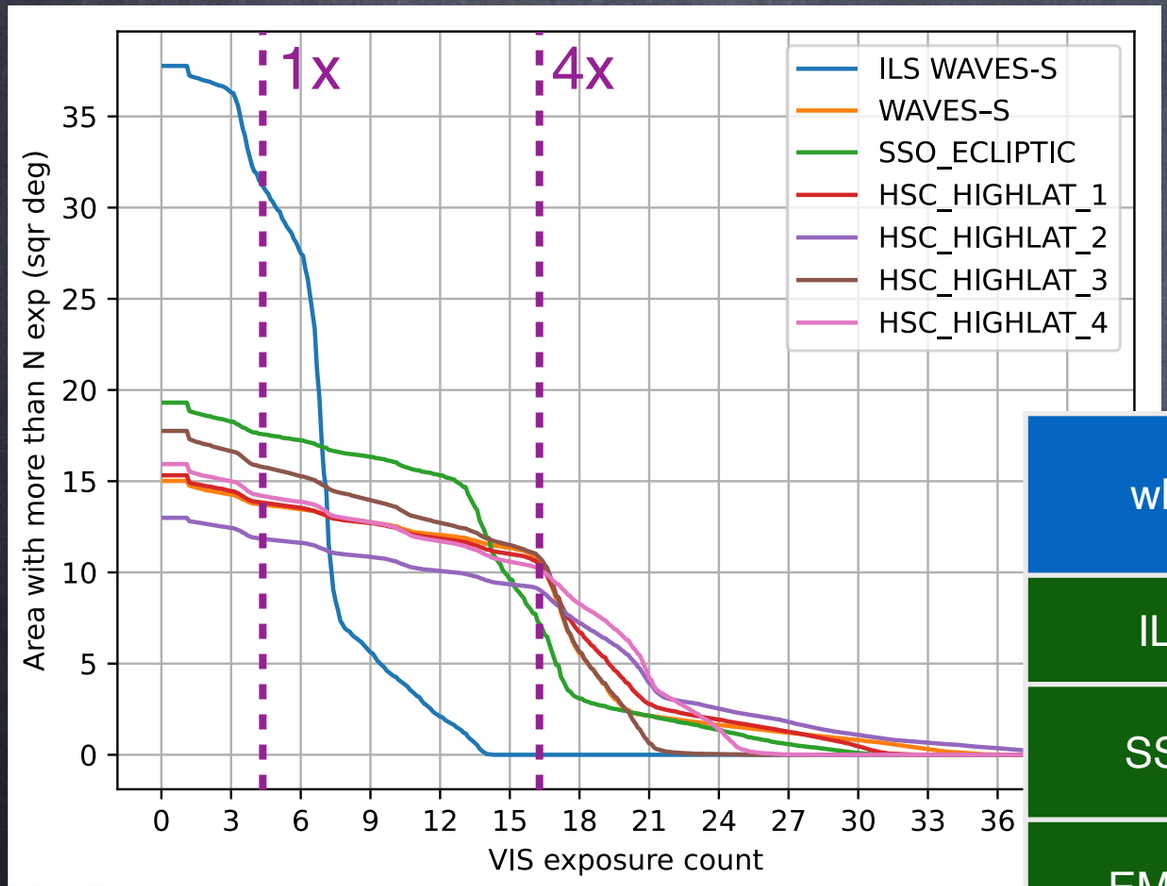
Science program – HSC High-Latitude fields (EMDS)



Subaru High Supreme Cam strip gives deep photometry

SUMMARY

Field	RA h m	Dec °′	RA °	Dec °	Median pass count	Area 4 pass sqr deg	Area 1 pass sqr deg	Notes
PDC2_ILS–WAVES–S–BLOC1	23h 43m	−31°12′	355.7	−31.2	1.7	0	32.0	VIS+NISP
PDC3_EMDS–WAVES–S	00h 33m	−30°44′	8.2	−30.7	4.3	10.9	13.8	VIS
PDC4_SSO_ECLIPTIC	00h 39m	+04°12′	9.8	4.2	3.7	7.7	17.6	VIS+NISP
PDC5_EMDS_HSC_HIGHLAT_1	13h 55m	+43°29′	208.9	43.5	4.3	10.7	13.9	VIS
PDC6_EMDS_HSC_HIGHLAT_2	15h 49m	+44°14′	237.2	44.2	4.7	9.3	12.1	VIS
PDC7_EMDS_HSC_HIGHLAT_3	14h 19m	+44°17′	214.7	44.3	4.2	11.1	15.9	VIS+NISP
PDC8_EMDS_HSC_HIGHLAT_4	15h 21m	+43°37′	230.2	43.6	4.6	10.3	14.3	VIS+NISP



Each wide-like visit has 4 VIS exposures

who	what	Area ≥1x [sq deg]	median # passes	area ≥ 4x [sq deg] VIS/NISP
ILS	GAMA+stars	32/32	1.7	
SSO	asteroids	17.6	1	
EMDS	repeated wide	70/30.2	≥ 4.2	52.3/21.4
Total		~120/60		