The Euclid Consortium Newsletter - Spring 2016

News from the Bridge

The Euclid mission was selected by ESA in October 2011 and we are today half way towards the (expected) launch of the satellite in Kourou. Looking back down the path and the accomplishments made we can be realistically happy and confident as we look ahead. It will be a pleasure to travel to Lisbon next week and attend the Euclid Consortium Annual Meeting in this context.

As you may know the preparation of the satellite, the telescope, the instruments and the space and ground segments keep hundreds of people at ESA, Thales Alenia Space Italia, Airbus Defence and Space and the Euclid Consortium very busy and under strong pressure. I would like to praise the excellent work and the tenacity of all the teams and laboratories involved in these hard and most challenging day-to-day work to make Euclid happen in due time.

We have still a lot to due in all fronts, not only on the technical developments of the mission, but also on the scientific preparation of the Euclid mission in general, under the auspices of the Science Working Groups and the Science Coordination Group. The preparations of the cosmological simulations and the ground based observations are among the most challenging issues the Euclid Consortium is confronted today. Remarkable progress was made over the last six months on these issues.

Thanks to the Science Performance Verification Group and the Cosmological Simulation Science Working Group led by Pablo Fosalba and Romain Teyssier Euclid will release its official Euclid Cosmological Simulations by January 15, 2017.

The Euclid Survey Working Group has almost definitely selected the three official Euclid Deep Fields. With the important selection process completed, the Euclid Consortium will have to organise and coordinate all ancillary observations in the Euclid Deep Fields. A working group entirely dedicated to this activity will be set in the Consortium before the end of this year. Lisbon will be an excellent opportunity and a wonderful place to discuss all these challenges altogether.!

Yannick Mellier

Euclid on Social Media - an update from COMS

You can now follow Euclid on social media, and please do so and encourage your associated laboratories or departments and colleagues and friends to do so:

Twitter: @EC_Euclid. Please follow us and at the 2016 EC conference in Lisbon do use the hashtags #ECEuclidLisbon2016 and #ESAEuclidSpaceMission.

Facebook: Euclid Consortium

Instagram: euclidconsortium

The Instagram account will be a collaborative display. Please send images to consortiumeuclid@gmail.com, along with any needed credit, your name and supporting short text.

Contents

Introducing the Inter-SWG Taskforce

The Inter-SWG Taskforce (IST) responds to the need of having a common forecasting recipe within Euclid. It is meant to be a cross-entity where different Science Working Groups can cooperate to define a reliable pipeline to build-compare-share forecasting codes and provide validated forecasts until launch. Science Working Groups remain the key holders of Euclid Science and the IST provides them with a framework to interact and agree on a common analysis.

The IST includes at present almost 100 Euclid members, active in different WGs. Its structure is fluid and driven by specific tasks, limited in time. Two main paths have been identified. On one side, the IST compares available numerical codes for the weak lensing and galaxy clustering Euclid core probes to define a validated prescription, with direct input from all SWGs involved; in parallel, the IST develops its own, module-structured, Euclid CosmoBox (including Boltzmann codes and eventually the likelihood). A further specific task is probe combination, which aims at identifying problems and solutions related to the combination of different probes.

Our team-communication strategy makes use of tools that allow us to work collaboratively and remotely, whenever possible: Slack, Google drive, github and video-conferencing systems. The first 2-day virtual kick-off meeting took place on 24-25th February, followed by periodic telecons. The virtual meeting has allowed us to advance in tasks quite rapidly, producing an overall document that summarises IST goals and updated achievements, thanks to the joint effort of all people involved. The IST will host a splinter session during the Euclid annual meeting in Lisbon on Thursday June 2 14:30-18:00..

Tom Kitching & Valeria Pettorino

Links relevant to the IST effort:

The redmine: http://euclid.roe.ac.uk/projects/isu

The GitHub: https://github.com/tdk111/EuclidIST

The Slack channel: https://euclidist.slack.com/

Do you want to know more about Slack and how to use it?

- Contact Valeria or Tom during the breaks at the EC meeting in Lisboa
- Come to the IST “hack session” from 1630 to 1800 on Thursday June 2 in Lisbon

An update on the survey

Last Autumn the Survey successfully passed the Mission Primary Design Review (PDR). For that an updated reference survey was produced, which was shown to meet all the requirements and not violate any constraint. It must be reminded that the reference survey is a proof of concept (a feasible solution does exist) and is not yet the final survey to be implemented. But to show that all the needed calibrations with their time constraints and the wanted area can be observed fulfilling the limits on pointing angles, number of slews and so forth, it has been a non-trivial step.

This year the work of will concentrate on the optimization of the survey, still within the feasibility boundary. For the latter ESA will provide an update of the constraints which should be more relaxed than the one used so far. On this matter an important improvement is given by the adoption of reaction wheels for the pointing, which will in part relax the current stringent limit on the maximum size of dither step and the maximum number of large slews.

We show some illustrative plots of the reference survey from the third quarter of 2015 in Figure 1 and 2.

The optimization activity has already started on the Deep Fields (looking at number, exact location, depths, blue grism) and will soon extend to the wide as well (number and size of dithers, specific areas).

At the EC meeting we will report on the ongoing work, arrabge a splinter session on Survey optmisation on Friday June 3, and have ample discussions with all the interested parties.

Roberto Scaramella

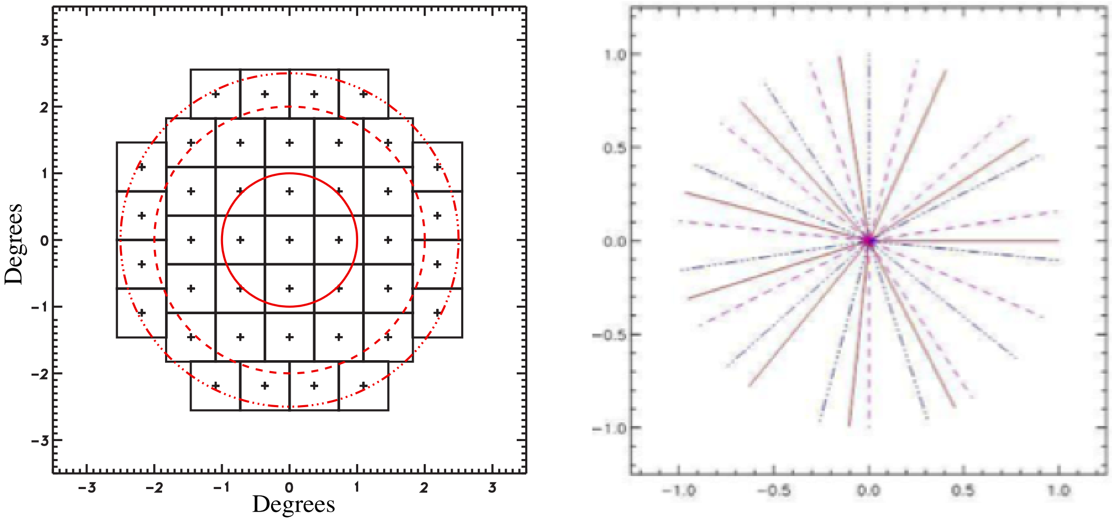


Figure 1: Left: The basic pattern for the Euclid Deep Field North (41 fields centred at the North Ecliptic Pole). Right: the main angles for the spectra calibrations are shown in red. The dashed lines show the orthogonal dispersion directions.

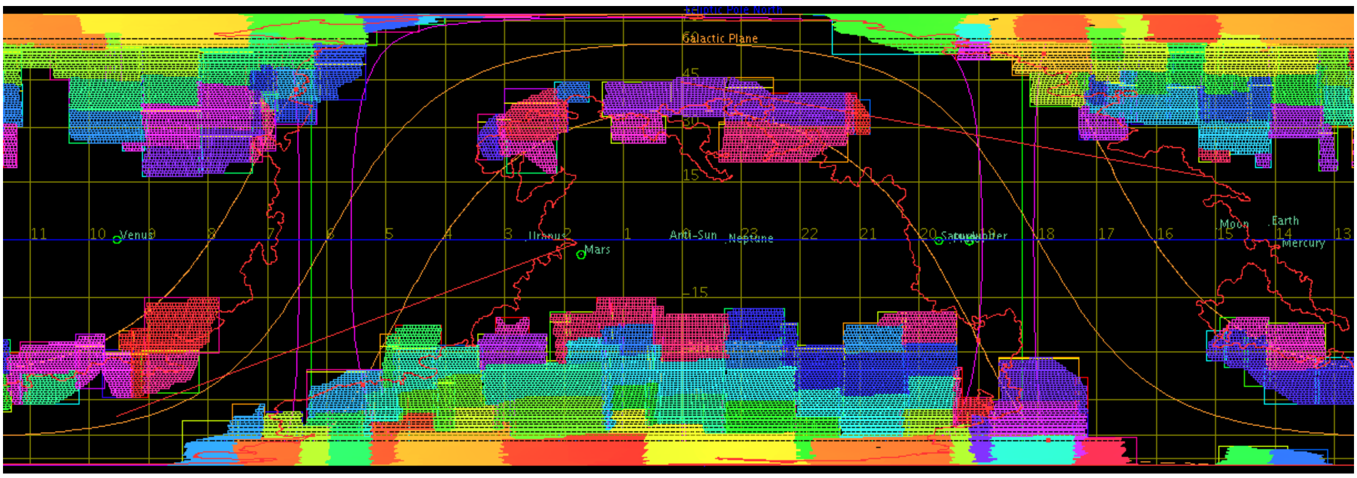
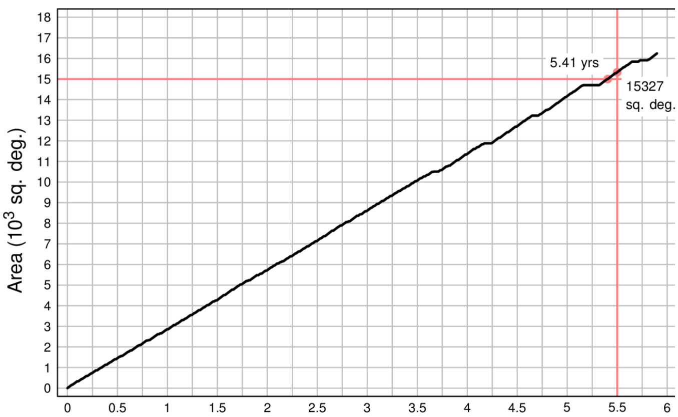


Figure 2: Left: The wide survey coverage in ecliptic coordinates. The colors reflect the temporal progression. The Ecliptic and the galactic plane are unfavourable regions. Right: the area covered along the mission. The exposure time per field is ~4400s.

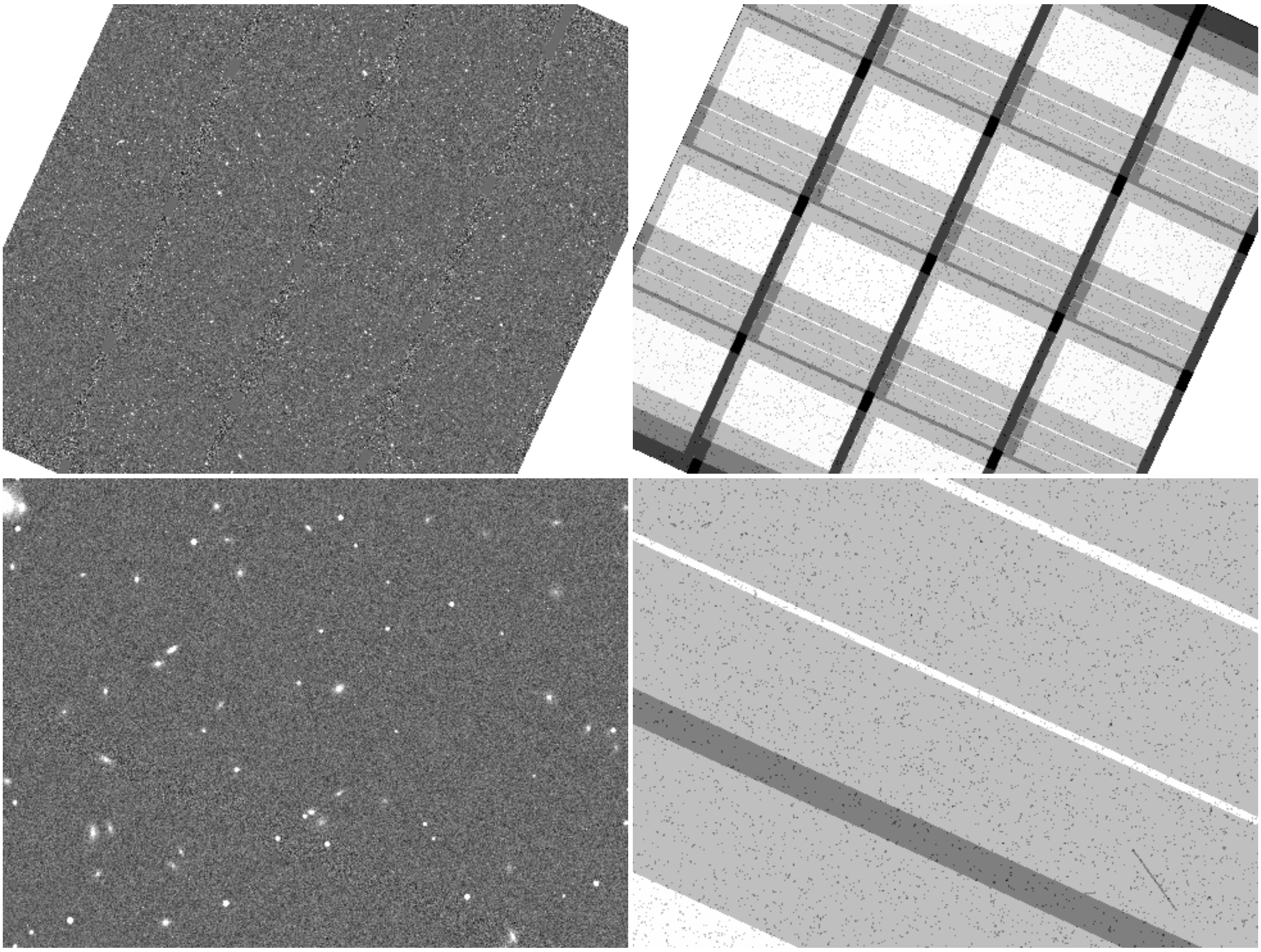


An update from the Ground Segment

The Science Ground Segment (SGS) has nearly completed the SGS Challenges (SCs) that integrate prototype versions of all major elements of the SGS infrastructure with the VISible imager (VIS), Near InfraRed imager (NIR) and Spectral InfraRed (SIR) Processing Functions. Processing simulation data from the simulation organisational unit (OU-SIM), it will demonstrate the good development progress at the SGS Technical Keypoint 1, an ESA-led peer review of the SGS status to held in ESTEC 22-24 June.

The image below represents a reconstructed NIR Y band stacked image of a SC#2 simulated field. The top panels show the image obtained by stacking the four dithers (left) and the corresponding weights (right) that reproduce the dithering pattern on the large scale. Bottom panels show closer a look to the image where simulated sources (left) and impact of pixel flagging (right) are clearly visible. Courtesy of OU-SIM and OU-NIR.

Andrea Zacchei, Marc Sauvage, John Hoar, Christophe Dabin



A reconstructed NIR Y-band image. Top left: stacked image, top right: weight map. Bottom images: zooms of top images.

Euclid on Horizon

On 30th March 2016 the flagship BBC documentary show, Horizon, had a programme on dark energy called “The Mystery of Dark Energy”. In Euclid we were very fortunate to have our mission featured prominently on show with some of our EC scientists interviewed for the programme. In particular the VIS instrument was featured the science behind weak lensing explained. Filming took place at the EC meeting in Lausanne in 2015, and if you were in the Consortium photograph then you appear in the programme!

This Horizon programme came about as result of Tom Kitching’s Royal Society BBC secondment in 2015. Below is a behind-the-scenes picture of some of the filming at MSSL.

Horizon on BBC two has done a fantastic job on “The Mystery of Dark Energy”, explaining how it came about, its discovery in 1998 and its current status. We hope that the BBC will film us again in Euclid once we resolve this mystery with our fantastic experiment.

Tom Kitching

An update from NISP

NISP progress report

The last report on NISP progress in the newsletter was in issue 3 back in the spring of 2013 and it is striking to see that what then existed only as drawings now exists and is in the process of being tested and evaluated. Overall, work on NISP has progressed well and all technical issues have been resolved and tests done so far have shown good to excellent performance.

To recall, the NISP instrument consists of three main assemblies:

1- the opto-mechanical assembly (NI-OMA), which consists of a SiC structure supporting the optics (a Corrector Lens and a Camera assembly), the filter and the grism wheels assembly, the calibration unit and the thermal control

2- the detector system assembly (NI-DS) contains the focal plane array and the sensor chips system

3- the warm electronics assembly (NI-WE) consists of the instrument control unit as well as the instrument data processing and control units.

The Structural Thermal Model

The NISP team and industries were working hard to prepare the next steps: a first model of NISP had to be produced, where "model" refers to a full sized NISP, but for the first step, without functionality except to mimic the final structure and thermal properties. Materials, masses and thermal conductivity therefore had to resemble the flight model design in this Structural and Thermal Model (STM).

All NI-OMA and NI-DS subsystems have realized STMs that have been integrated together in the first months of 2016 at LAM to build the NISP STM. In May the STM was successfully put through the vibrating tests that demonstrated that NISP indeed was designed with the necessary mechanical strengths. This vibration test was a crucial point since up to then the NISP strength was only modelled in a computer analysis, but of course did not exist for an actual test. This model will be delivered to ESA by July.


Figure 3. Images of structural termal models. On the left the filter wheel assembly (FWA), and on the right the grism wheel assembly (GWA). .

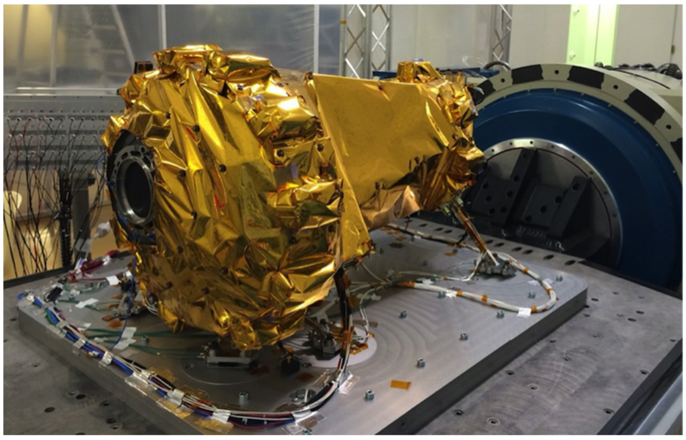
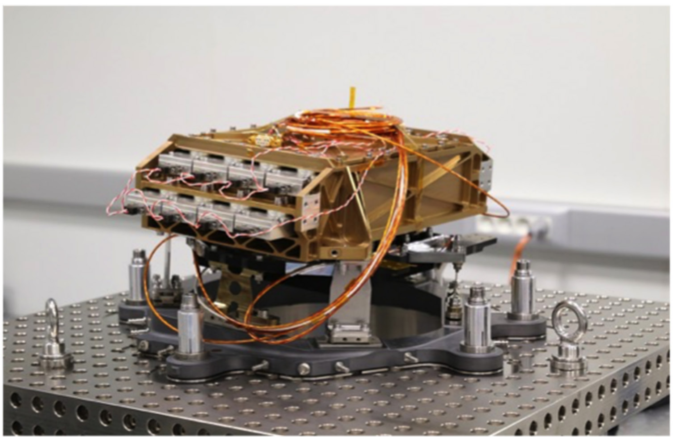



Figure 4. Left: The structure and thermal model (STM) of the optical assembly at AIT. Right: a model of the STM of the focal plane.

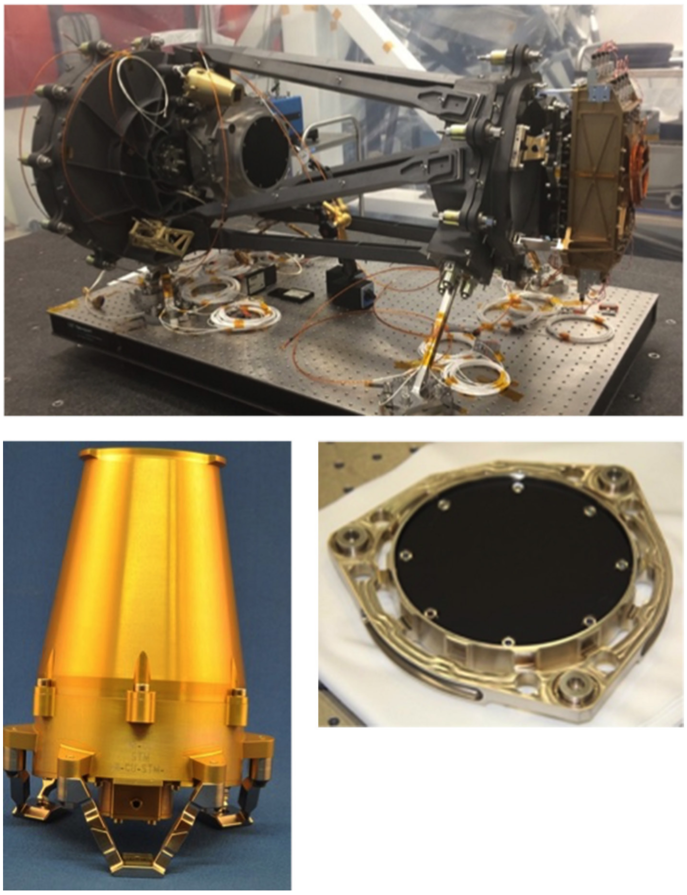


Figure 5Further images of structural thermal models, including the calibration unit in the lower left.

Demonstration / breadboards models (DM/ BBM):

All subsystems have produced DM/BBM's showing good performances.

The Instrument Control Unit (ICU) and Data Processing Unit (DPU) software developments are progressing well with integration tests with the electronic hardware ongoing.

Ground Support Equipment (GSE):

The development of Mechanical, Thermal, Optical, and Electrical GSE needed for the NISP end to end performance measurement tests is progressing well

Engineering and qualification models (EQMs):

Many subsystems have started the production of EQM's.

Flight Models (FM):

Many subsystems have also started the production of FM's. The measurements done on different optical elements (lenses and grism) and on the first FM detectors shows that they are at or better than requirements.

The NISP project is now gearing up for the instrument Critical Design Review (CDR) which will start in September 2016.

On the detector side, the first flight elements are under test at NASA and are showing very good performance both in quantum efficiency and noise. The final characterization effort will be done in France in 2017 and will allow preparing the ground calibration products at pixel level, which are needed to develop the flight calibration procedures. The characterization facilities are ready and a pilot run to verify all the chain of characterization will be done during this summer. We are expecting then the first flight detectors to be delivered in France end 2016, tested in 2017 and their final integration on the focal plan of the NISP instrument will be done at autumn 2017.

On the NISP instrument side, most of the tests to verify the instrument sequence and its performance will be done directly on the flight model starting end 2017.

Many prior tests will be done first at sub system level next year. Then, prior to the final integration, an electrical model will be build mid 2017, and will allow to test the warm electronic and the focal plan with 4 detectors. This will give a first global verification of the full detector chain. A full performance campaign will be done on the flight model and will allow to verify first the instrument functionalities but also to perform measurements needed to prepare flight calibration, as for example PSF measurements (both photometric and spectroscopic) or a full characterization and validation of the spectroscopic wavelength solution of the grism

Overall the project is performing well with very good performances measured and all within budget.

The NISP photometry channel

The NISP photometry channel has progressed with a slight change in filter bandpasses. The blue cutoff of the Y-bandpass was before set to be at 920nm, given by a fast transition of the dichroic splitting the light by wavelength and reflection into VIS and transmission into NISP. However the switch between these two modes was not as fast as originally hoped so that at 920nm still substantial light would not yet be passed into NISP. Together with the finite edge width of the Y-filter in NISP this would have created the uncomfortable situation of the Y-bandpass being defined by a superposition of dichroic and filter edge, potentially varying over the field-of-view. To regain control it was decided to shift this edge by some 30nm to the red and only start the complete in-band at around 965nm. The other filter edges remain unchanged, although to optimise the filter manufacturing the flight filters might show very steep edges but become slightly wider, so that they slightly overlap. In any case the filter bandpasses will be finely measured in the lab before flight.

Calibration design progressed as well, with iterations on the Calibration plans and underlying concepts. Specific work revolves around understanding the detector properties better, with specific focus on dark current (likely very low), persistence effects (to be better characterized), and nonlinearity (characterization and the question of which science this actually impacts how much). The latter also has impact on the exact performance of the NISP Calibration Source and how much light its LEDs need to be able to emit and how stable its flux has to be on which timescale. As necessary for the CDR these issues are mostly settled. The plans for detector assessment and characterization progress in discussions between NASA Goddard (DCL), JPL, and Europe.

The instrument performance and calibration are also central topics of discussions between the NISP instrument team and the ground segment. While early in planning the mission calibration requirements were written by the instrument and calibration scientists rather on the instrument side, in the last year or two these were more and more concretely implemented in the SGS pipeline prototypes. In this context it was necessary to reiterate several times to whether the assumptions on both sides on what a specific term actually means (e.g. “impact of effect X on photometric calibration shall be less than 0.2%”) and whether the information on the instrument and detector system that the SGS assumes to receive before launch and during the mission is actually what will be provided. Several fruitful meeting have since taken place to cross-check these expectations and to inject into the process of NISP instrument characterization all measurement that are actually needed from the SGS side.

The NISP spectroscopic channels.

On the spectroscopic side, a lot of activities have been related in 2015 and 2016 also to verify the performance of the clustering science using end to end simulation and the best instrument models, including straylight and persistence. Clustering science is indeed very much impacted by the noise in each exposure and straylight will be a major component in it.

To avoid such effects, an optimization of the survey fields is very important and should avoid as much as possible large star density. The study of the best approach for the survey is under investigation.

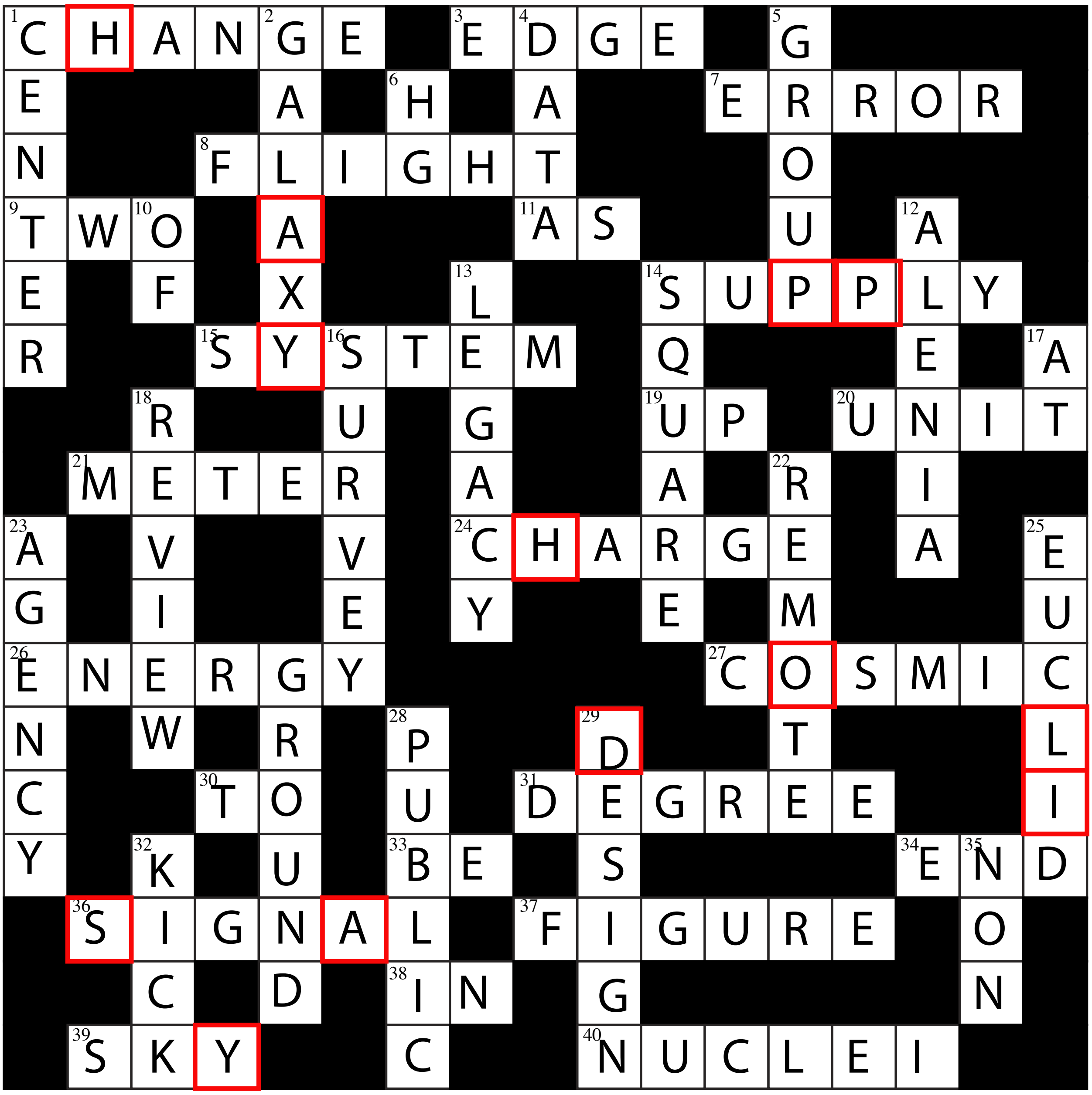
The clustering is also crucially dependent on an accurate calibration both in wavelength, to allow a very high precision in redshift measurement , and also in relative spectro-photometry to control any non-cosmological fluctuations in all the survey. Full estimation of procedures and of products needed on ground and flight have been done. For spectrophotometry, the best approach and method are always debated and include a plan to come back on the same objects all along the survey with a self calibration field, or to optimise the dithering strategy to increase field overlaps and then add a control of the needed precision. All these evaluations will be discussed in the calibration working group this year and with the NISP Instrument Development Team (IDT) to allow to define a better plan to control all these effects during the mission.

Planning for operation during the mission

First meetings have also taken place in the past year on future operations of NISP during the mission. Formally, the NISP Instrument Development Team (NISP IDT, all NISP people now) are responsible up to the point when Euclid launched and NISP has been checked out in orbit. In principle all of the NISP IDT could disperse at that point and a mechanism for transition to the NISP Instrument Operations Team (NISP IOT) needs to be found. While some people from the IDT will clearly be part of the IOT, mechanisms for knowledge transfer beyond IDT individuals and ahead of launch has to be found. The mission should not get into a position where NISP (or VIS) show some unexpected effect say two years into the survey and insufficient knowledge on the instrument side is available to diagnose this. These discussions are well under way, with increasing involvement of the IOT in NISP tests and characterization the closer to launch Euclid gets.

Thierry Maciaszek, Anne Ealet, Knud Jahnke
on behalf of the NISP team

The Acronym Crossword - the solution



Across

1. SCR
3. EPER
7. APE
8. IFAR
9. 2dF
11. ABCL
14. PSU
15. SCS
19. UTR
20. CDMU
21. TMT
24. CCD
26. LET
27. CV
30. TBW
31. KiDS
33. TBC
34. EOL
36. LVDS
37. FOM
39. ESSWG
40. AGN

Down

1. CDS
2. AGES
4. F-CDPU
5. DWG
6. HgCdTe
10. MOS
12. TAS
13. ELA
14. SKA
16. DES
17. CaC
18. GSDR
22. RT
23. ECA
25. EIQT
28. LGPL
29. CDR
32. KO
35. NCR

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