estec

European Space Research
and Technology Centre
Keplerlaan 1
2201 AZ Noordwijk
The Netherlands
T +31 (0)71 565 6565
F +31 (0)71 565 6040
www.esa.int

# MEMO

| | | | |
|---|---|---|---|
| **Date** | 2014-03-07 | **Ref** | EUCL-EST-MM-8-002 |
| **From** | Euclid Science Team / R. Laureijs | **Visa** | |
| **To** | Euclid Collaboration | **Copy** | A. Parmar (H/SRE-S) |

## Subject: Recommended NISP grism configuration

At its plenary meeting EST#7, held on 11 and 12 Feb 2014, the Euclid Science Team has considered the proposal by the Euclid Consortium to revisit the grism definition for the NISP instrument. The proposal is supported by the EC document "Euclid Galaxy Clustering Interim Science Review" (Version 2.0, 2014-01-05) and the ECB summary of conclusions (2014-02-05).

The EST acknowledges the conclusion based on the latest observational data that the base-line NISP spectroscopic mode with 2 blue and 2 red grisms is sub-optimal for the Galaxy Clustering (GC) core science. It is very likely that NISP will not meet the mission Level 1 requirement of 3500 galaxies/deg$^2$, which was based on an old best-estimate of the space density of galaxies. The latest prediction indicates a drop in galaxy density by a factor two assuming the required spectroscopy detection limit.

The EST agrees that the implied loss in core science as presented in the Definition Study Phase Report (Red Book) can be recovered to a large extent by changing the definition of the grisms such that the wide survey spectroscopy consists of 4 dithers with a red grism and with at least 3 different dispersion directions. The red wavelength range must cover a minimum redshift range ($0.9 < z < 1.8$) for the H-alpha line, which gives the optimum galaxy clustering measurements with Euclid based on the effective volume sampled, providing an accuracy only a space-based experiment can accomplish.

The EST understands that the GC results do not significantly improve by applying 4 instead of 3 grism orientations with 4 dithers. This finding opens the opportunity to keep one blue grism in the NISP grism wheel, which has room for 4 grisms, thereby keeping an optimum GC performance for the wide survey and enabling legacy science with a blue grism.

The EST therefore considers two viable options for a new grism definition and configuration in NISP:

**Option 1**: NISP will contain 3 red grisms and 1 blue grism. The wide survey spectroscopy will have 4 dithers using red grisms in three dispersion directions. The blue grism will only be used for the deep survey and will be part of a dedicated observing mode.

**Option 2**: NISP will contain 4 red grisms with 4 different dispersion directions.

Both options improve the wide survey spectroscopy detection limit compared to the baseline design and make Euclid's slitless spectroscopy observing technique more efficient. The proposed change shall bring the number of confirmed redshifts closer to the mission Level 1 requirement and at the same time maximise the constraining power of the BAO cosmological probe.

***The EST concludes:***

In view of the latest scientific findings the EST recommends to change the baseline grism configuration in NISP, in order to meet the required top level Galaxy Clustering statistics without changing Euclid wide survey parameters and with minimal changes to the NISP optical design. The EST fully supports implementation of Option 1 with 3 red grisms and 1 blue grism. This option gives the best GC performance for the wide survey and enables a large additional scientific return for the deep survey from the spectroscopic capabilities in the "blue" near-infrared wavelength range.

The EST requests ESA Project and the NISP instrument team to consider this option for implementation. The EST understands that a number of issues driven by science are further to be explored, these have been covered by internal EST actions.

In case the recommendation causes a serious invalidation of the existing mission requirements, including the scientific operations, such that it cannot be implemented, the EST recommends to consider Option 2 as the best alternative.

On behalf of the Euclid Science Team,

René Laureijs

Rene Laureijs
2014.03.07 12:10:52 +01'00'

7 March 2014.