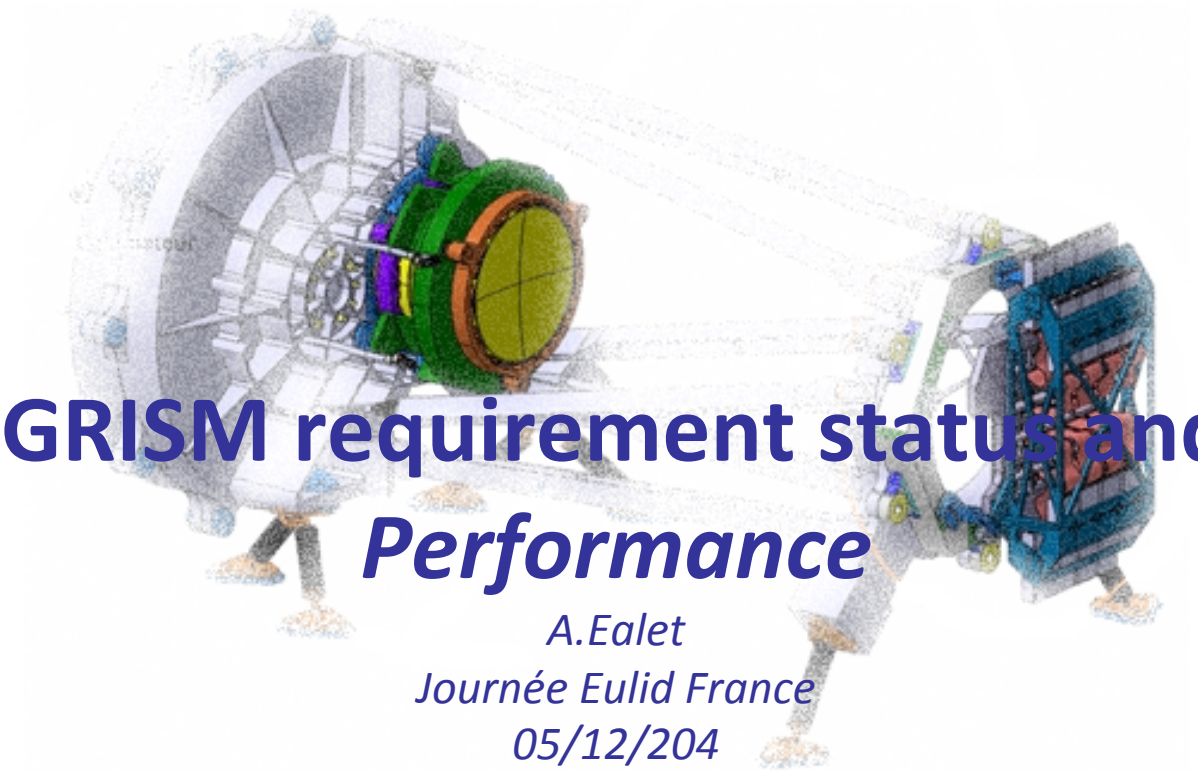

GRISM requirement status and *Performance*

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05/12/204

OVERVIEW

Status of grism configuration end 2013 after the clustering report:

-> 4 identical red grisms 1.25<lambda<1.8 µm

-> 4 orientations P.A. = (0, 90, 180, 270),

-> a best effort to enlarge the red coverage to 1.85 µm

After reaction of the community, a report has been issued in march 2014, led by A.Cimatti , to ask to add back a NISP blue grism.
(EUCL-UBO-RP-8-001_v1.0_legacy_science_report)

It is recommended that the blue grism spectral coverage should be extended to the shortest possible wavelength (0.92 µm), with the constraint of still maintaining some overlap with the red grism. It is important that the blue grism spectroscopy in the deep survey will reach line limiting fluxes of ~5x10-17 erg s-1 cm-2 (at ≥3.5σ) to maintien a high competitiveness level of the Euclid Legacy Science with respect to ground-based surveys

The update of the red grism status

Update of the report of the clustering group

EUCL-OBR-OTH-8-001_v2.0_GalaxyClustering_InterimScienceReview

Study an option with 3 rotations;

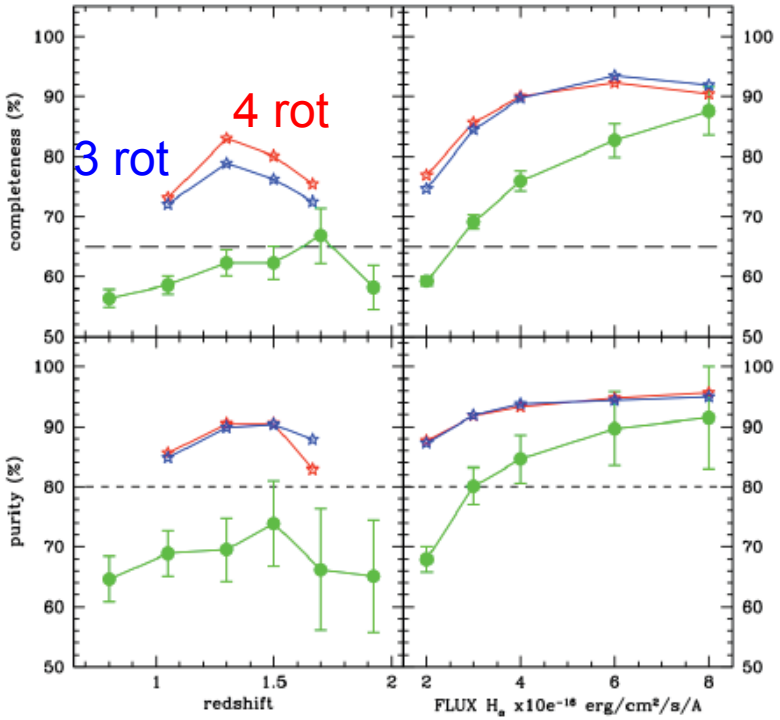
➢replace one red grism by a blue one but keep 4 red exposures during nominal survey ie P.A. = (0, 90, 90, 180)

➢No strong difference

between 4 and 3 rotations

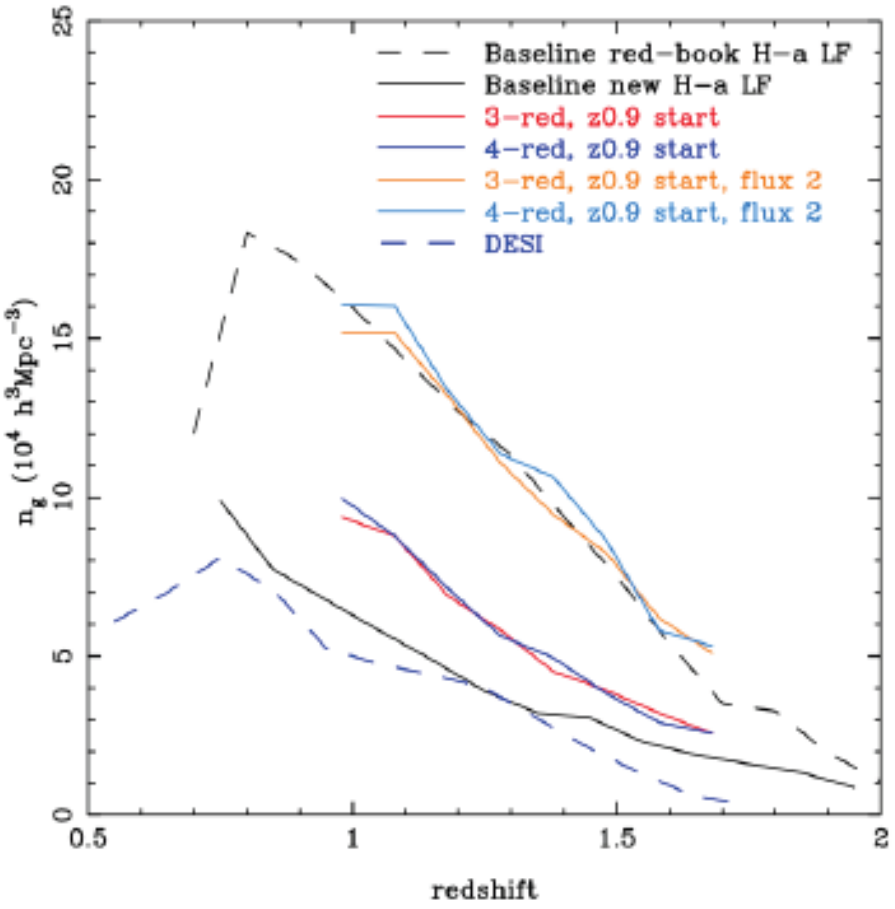
This allows to reach a flux limit of

Hα flux > 2 10^{-16} erg/cm^2/s (instead of 3)



Final estimation for clustering after optimisation

New option (3 or 4 rotations)) :
-Give better performance and a gain of galaxies in the IR
Thsnks to a better flux limit



Proposition

✓ replace one red grism by a blue one

✓ keep 4 red exposures during the wide with 3 rotations ie P.A. = (0, 90, 90, 180)

✓ coverage 0,9 < z < 1.8.
=> 1.25<lambda<1.85 µm

✓ 4 exposures of 560s

Endorsed by the EST

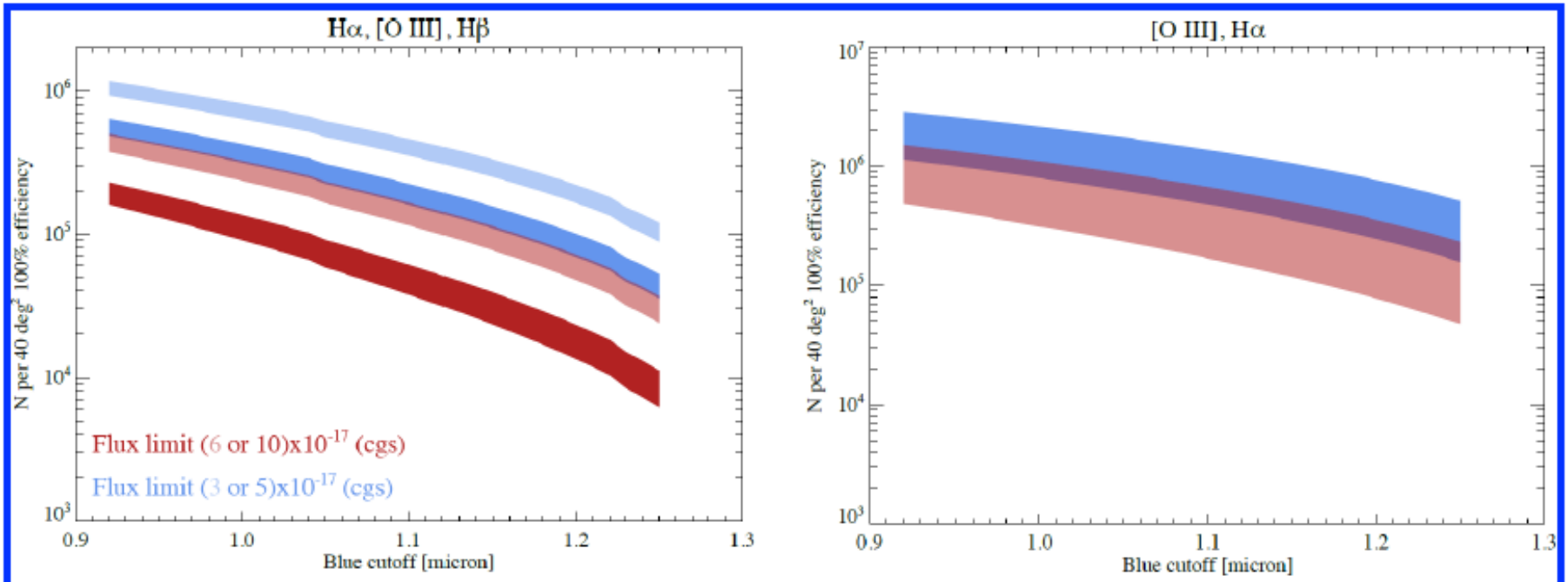
In view of the latest scientific findings the EST recommends to change the baseline grism configuration in NISP, in order to meet the required top level Galaxy Clustering statistics without changing Euclid wide survey parameters and with minimal changes to the NISP optical design.

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 red grism requirements :
1.25<lambda<1.85 μm
-3 red grisms,
-R > 400 at 0.5" object size
Hα flux > 2 10^{-16} erg/cm^2/s at 3.5 sigma in 4 dither exposures

The blue grism

- Wavelength range : **0.92 – 1.30 μm** (allowing some overlap with the red grism, 1.25 – 1.85 μm)
- Emission line limiting flux **~ 5–6 x10^{-17} erg s^{-1} cm^{-2}** (3.5σ)
- Continuum limiting flux: **AB ~ 21-22**
- Spectral **resolution** similar to that of the red grism



Left: the number of galaxies with simultaneous detection of Hβ, [O III]λλ4959,5007 and Hα (left panel), and [O III]λλ4959,5007 and Hα lines (right panel) in the Deep Survey as a function of the blue wavelength cut-off of the blue grism.

What is agreed now to be implemented for the blue grism

-The blue grism is implemented as a facility in the NISP (not a requirement)

-The blue grism will be used during the deep survey to reach the needed flux limit (The flux limit is the one estimated after 40 passes of 560s)

BASELINE :

- Wavelength range : **0.92 – 1.30 µm**
- Emission line limiting flux **~ 5–6 x10^{-17} erg s^{-1} cm^{-2}** (3.5σ)
- Spectral **resolution** similar to that of the red grism

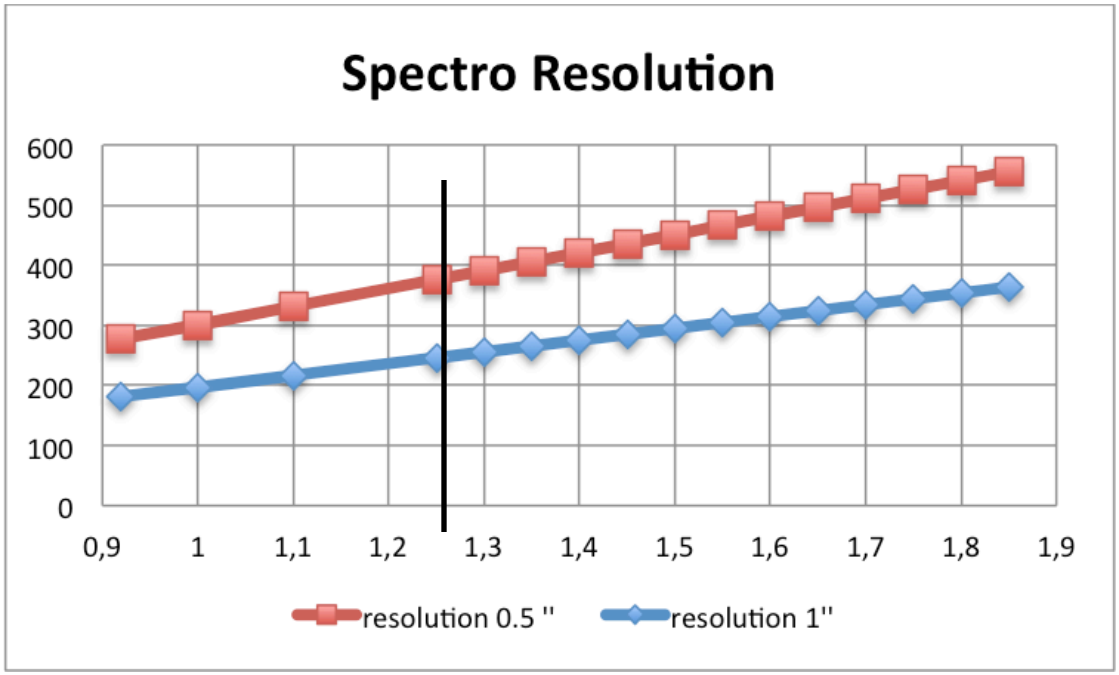
Grism resolution in the blue side

FWHM = 0,55 ‘’
$D\lambda_{pixel}$ = constant = 13.4 A

R = lambda/(N*$D\lambda_{pixel}$)

N = FWHM*object size/0,3’’

Object 0, 5 ‘’ => N = 2.5
Object 1’’ = > N=3,8



R-NISP-P-0XX ***The NISP spectrometric channel spectral effective resolution R considering a reference 0.5’’ diameter source shall be R=λ/Δλ> 260 over the full B-band spectral range.***

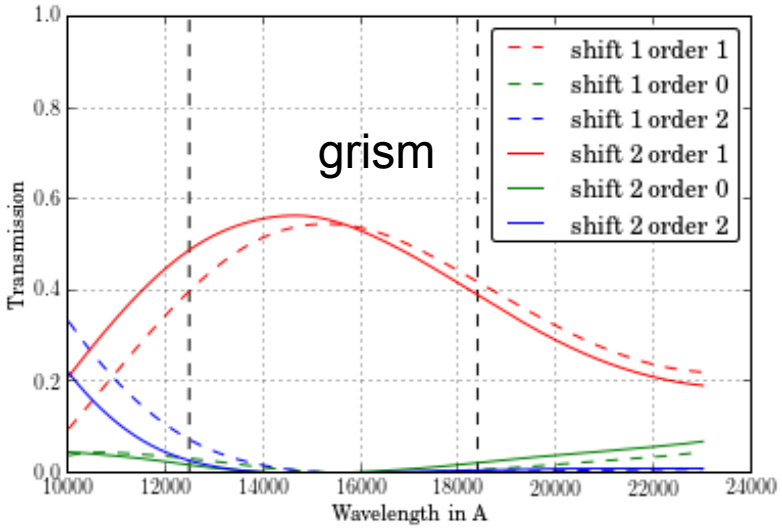
Note: Resolution element (Δλ) is defined as the minimum wavelength separation at which two spectral lines produced by a 0.5’’ object and with the same equivalent width can still be distinguished.

Extension of the red grism

Legacy report to EST in september 2014:

Extension of the red grism	Resolution	Main improvements w.r.t. the current red cutoff of 1.85 μm
1.85 – 2.0 μm	No changes	**Opaque atmosphere !** General competitiveness with ground-based spectroscopic surveys. Unique role at 1.5<z<2 w.r.t. DESI. **Larger discovery space !**

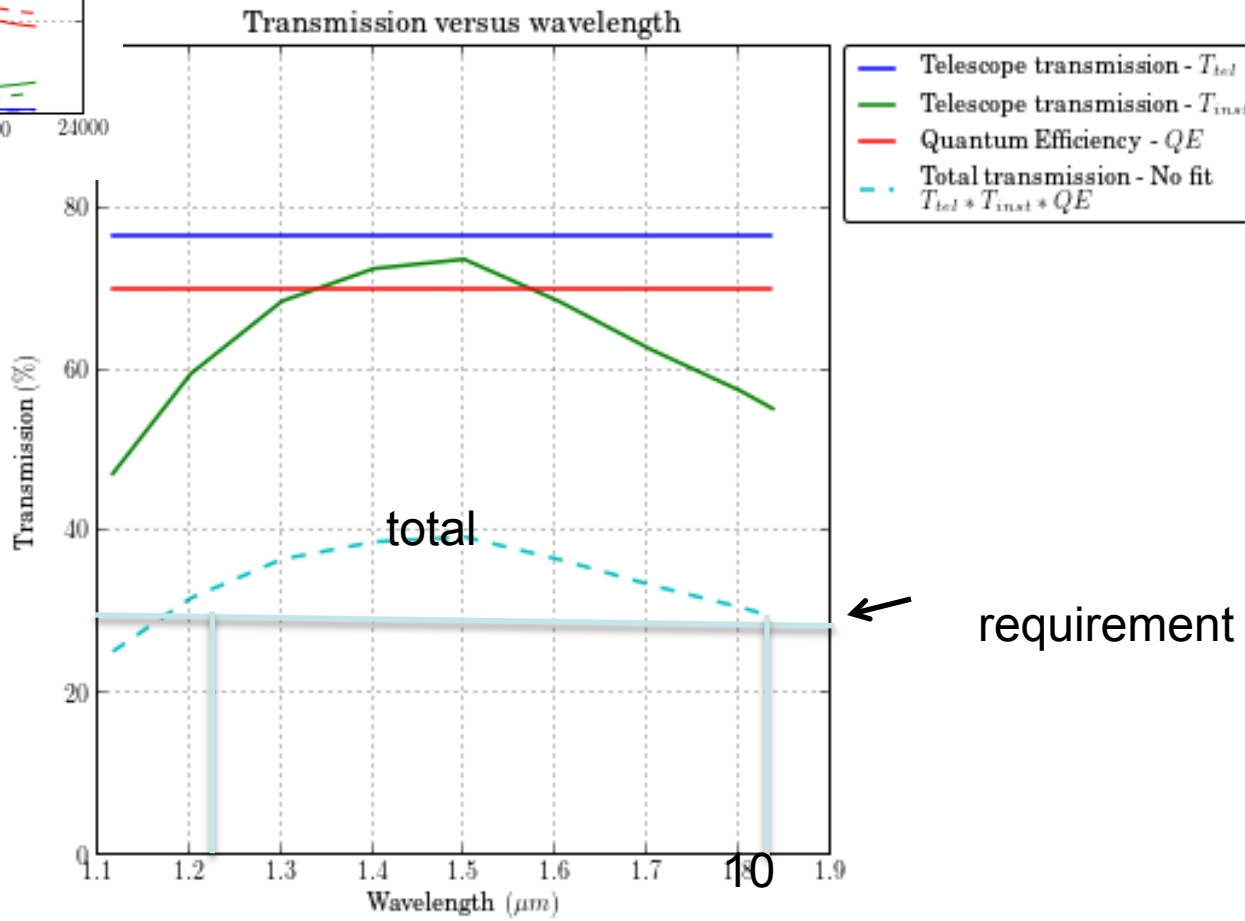
Evaluation of grism performance



NISP cannot accept to extend above 1.85 μm

-worst optical design
-more higher orders
-more noise
-contamination issues

-some technology issues with the filter



NISP new baseline

Red grism:

- 1.25<lambda<1.85 µm
- 3 identical red grisms with 4 orientations

  P.A. = (0, 90, 180, 90)

Blue grism:

- 0.92<lambda<1.3 µm
- identical in performanceas the red grism
- P.A. = 0

The blue grism can be used in the deep survey with a strategy TBD.