

NEW HOLO LAB: TOWARDS LARGE SIZE ASTRONOMICAL VPHGs

Michele Frangiamore, Manuela Arnò, Andrea Bianco
INAF - Osservatorio Astronomico di Brera - Merate

1 INTRODUCTION

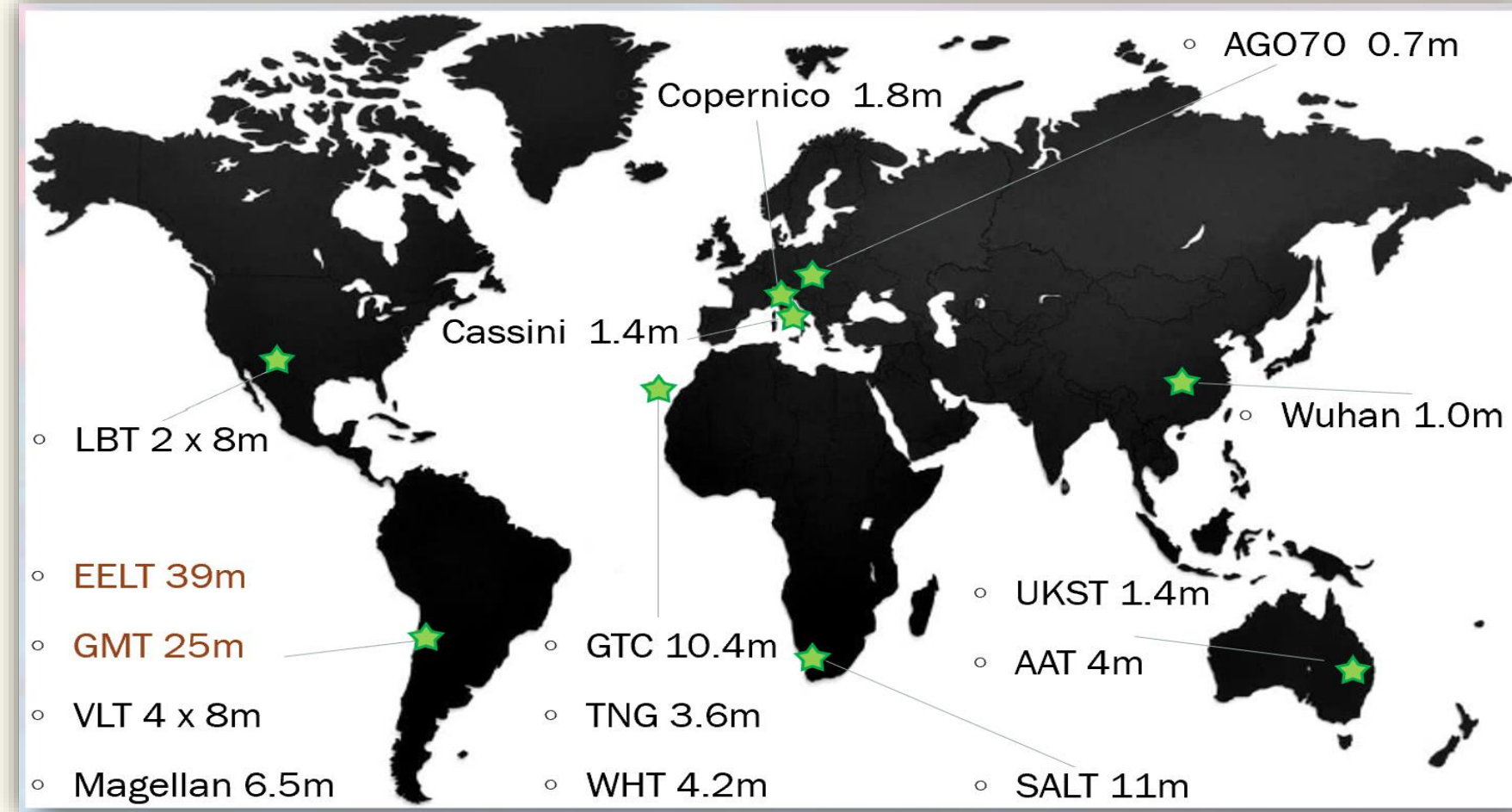


Fig 1. INAF VPHGs around the world

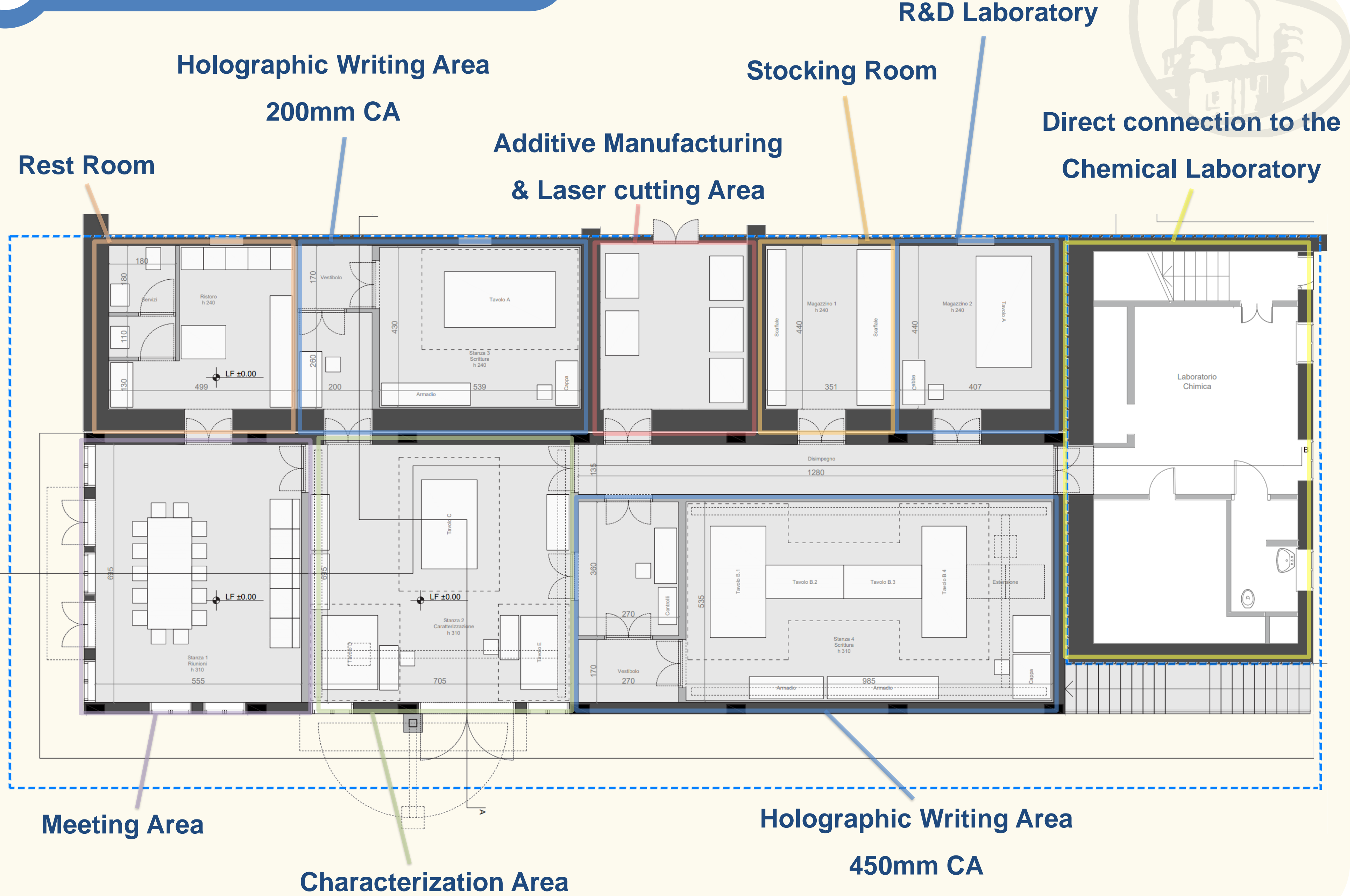
Future spectrographs demand **Large-Scale Gratings** with high diffraction efficiency across broad spectral ranges. Precise control of wavefront distortion in the diffracted beam is essential, while integral field spectrographs often require multiple identical gratings. Volume Phase Holographic Gratings (VPHGs) offer a tailored solution. We discuss the goal of this project to establish a cutting-edge laboratory (in the **PNRR-STILES** framework) at **INAF-Osservatorio Astronomico di Brera**. The laboratory will feature advanced holographic setups and a characterization facility tailored for large VPHGs, ensuring their performance meets stringent astronomical requirements.

Name	Big Writing Setup	Small Writing Setup
Laser source	3W @633nm - fringing Interstage pickoff @1064	0.5W @409nm - 532nm - 660nm
Line density achievable [l/mm]	(150 @2" upgrade, 245 @1" upgrade) 300 - 3500	150 - 3500
Max CA dimension [mm]	450 (for not dispersing direction)	190 (for not dispersing direction)
TWE	1λ PTV over 450mm (to be tested)	1λ PTV over 190mm (λ/4 PTV over 190mm)
Optical Bench length [mm]	7200 + (2000/3000)	2500
Achievable Design	VPHG, GRISM, Dual Order, Multiplexed, Patched	

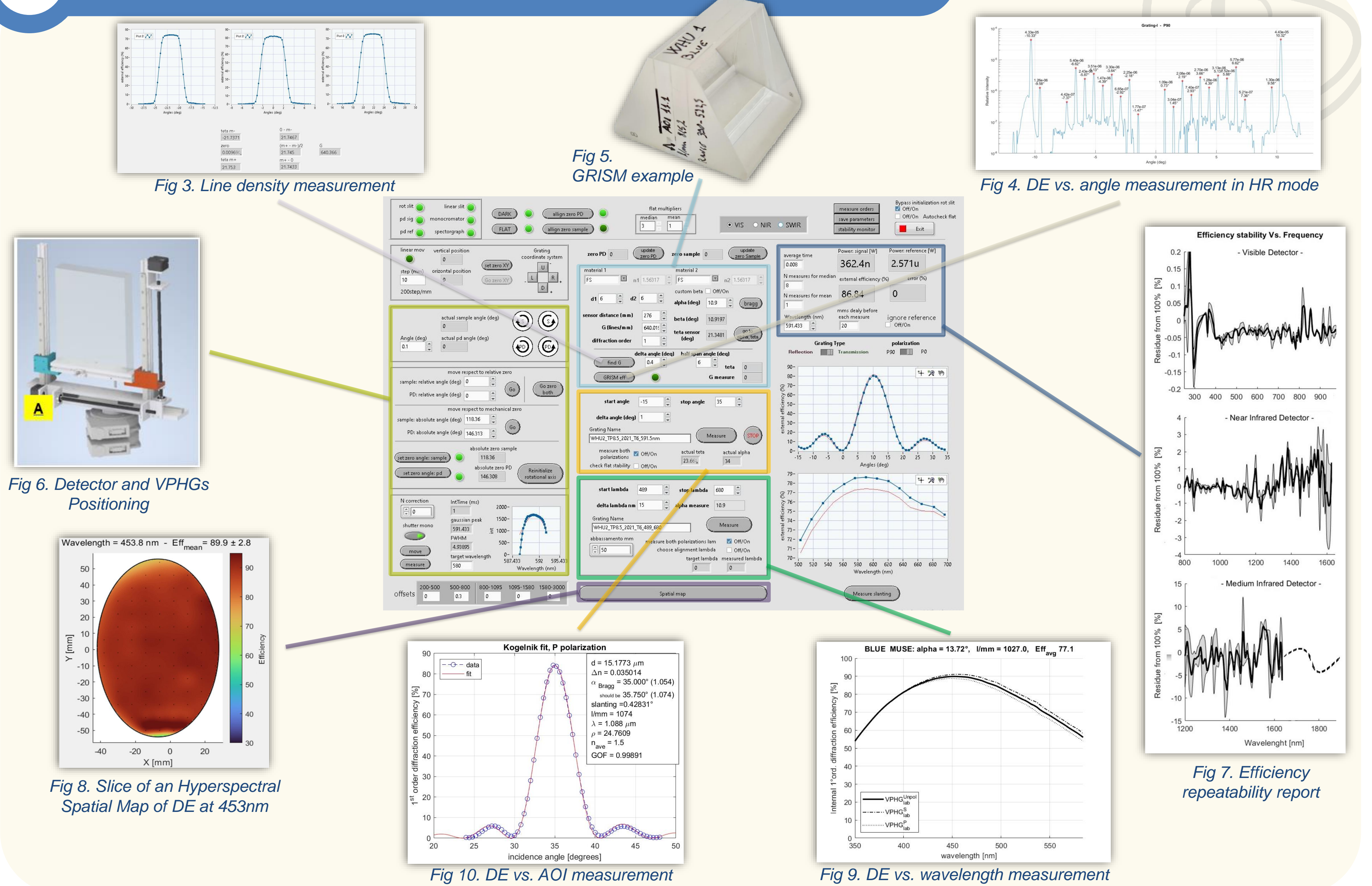
The characterization of VPHGs, and **GRISMs** involves precise measurement of optical properties such as transparency, diffraction efficiency (DE), and line density. A robust and flexible setup developed by the Holography Team at OABr, performs these measurements with high accuracy across **UV-VIS-NIR-SWIR bands**, essential for many international projects such as BlueMuse¹, Weave², FORS-Up³, and MAVIS⁴.

Name	Light Source Property
Monochromatic Source [nm]	300 - 2500
Monochromator bandwidth [nm]	1.7 - 7
Laser source [nm]	409 - 532 - 632.8 - 1550
Beam size [mm]	1 - 15
Polarization selector	TE - TM - Continuous
Accuracy	
Angular resolution [mdeg]	20 (5 in HR mode)
Spatial X,Y resolution [mm]	0.1
Line density accuracy [%]	0.1
Efficiency accuracy [%]	0.5 - 3
Geometrical Property	
Max sample dimension [mm]	200 x 250 (Big version 600x500)
Max Load [Kg]	8 (50 for Big version)

2 NEW HOLO-LAB



3 GRATINGS CHARACTERIZATION



3 CONCLUSION

1. INAF-OABr aims to ensure Europe's leadership in this strategic field and support the development of cutting-edge astronomical technologies.
2. Key activities include the implementation of the large-size VPHG laboratory, development of high-performance photopolymers in collaboration with industry partners.
3. The new laboratory will provide a state-of-the-art facility for researchers to spearhead the next phase of technological advancement in these optical elements.

5 REFERENCES

1. R. Johan (2019), arXiv:1906.01657.
2. A. Bianco (2018), Proc. SPIE 10706, 107064X.
3. M. Frangiamore (2022), Proc. SPIE 12188, V, 1218852.
4. R. François (2020), Proc. SPIE, Volume 11447, id. 114471R 16 pp

