The Wide-field Spectroscopic Telescope

P. Schipani[1], S. Randich[2], A. Bianco[3], B. Garilli[4], A. Brucalassi[2], M. Fumana[4], L. Magrini[2], S. Savarese[1], A. Tozzi[2]
on behalf of the WST Consortium
[1]INAF – Capodimonte, [2]INAF – Arcetri, [3] INAF – Brera, [4]INAF – IASF Milano

Abstract

The WST is a global project proposed by a consortium of 26 research institutes spread over 9 countries in Europe plus Australia (PI: R. Bacon). The Italian core team got the INAF "Astrofisica Fondamentale" grant to support some Italian preparatory activities. Specifically, the grant supports technological and scientific aspects, including science support and managerial activities, operations model, high resolution spectrographs design, grating technology developments. This contribution is presented within the INAF "Astrofisica Fondamentale" all projects show at the INAF 2024 technological forum by the grant proposers on behalf of the large international team.

WST is designed as a 12m aperture active telescope that covers from the UV to the H band and operates in seeing limited conditions (*R. Bacon, Proc. SPIE 13094, 1309410, 2024*). The field-of-view (FoV) of 3.1 deg² will be the largest of any 8-10m-class telescope equipped with a MOS. A central circular area with a diameter of 13 arcmin is available for simultaneous IFS observations. The IFS will have a FoV of 3x3 arcmin2 (9 times larger than MUSE), and can be used to mosaic the larger central area of 13 arcmin diameter, which is larger than the entire FoV of the ELT. The WST is supposed to be operated in survey mode, with several surveys addressing the various science cases (from cosmology to stars) carried out simultaneously in an optimized way. The operational model will also implement Target of Opportunity operations at both the telescope and MOS fibre levels to support time domain science cases.

WST shows corrected Cassegrain configuration. The refracting field corrector also provides for atmospheric dispersion compensation. The central 13 arcmin is extracted shortly before the MOS focus and sent towards a Nasmyth relay, then through a Coudé train down to the gravity-stable IFS station located in the telescope pier. This station consists of 144 identical, serially produced spectrographs. The MOS low- and high-resolution instruments are located on the azimuth platform, for minimal fiber length. As-designed optical quality is in the range of 80% encircled energy within 0.80 arcsec at MOS focus, full wavelength range, zenithal distance ≤ 60°, worst case. At the IFS station, it is 80% encircled energy within less than 0.20 arcsec.

The enclosure consists of a multi-level building with room to host the instrumentation at two critical locations: the telescope rotating platform, for minimal fibre length, and the lower floor of the enclosure where a large central room is dedicated to the IFS station. Below the telescope's rotating platform, the pier is hollowed out to host the Coudé beam sent from a relay on the Nasmyth platform. Along the vertical path down to the IFS instrument, the beams are propagated through the optical de-rotator installed on a dedicated floor. The dome is designed to minimize the footprint of the building which has a total height of 37 m and a diameter of the 38 m.
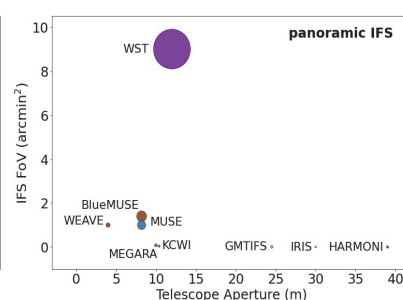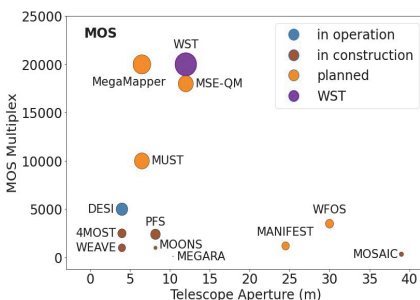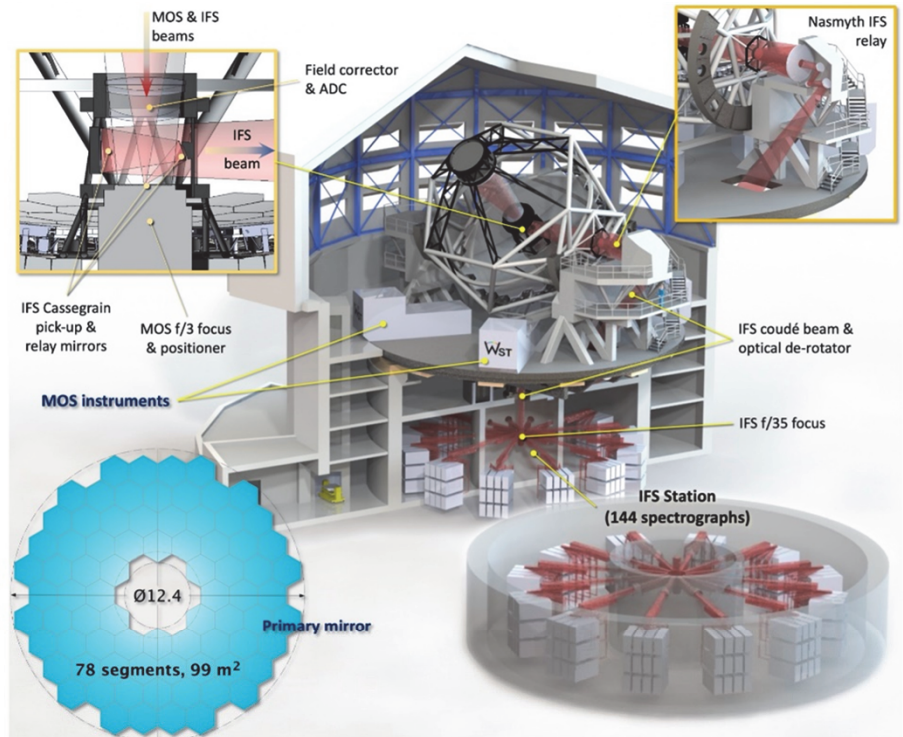
Comparison of WST MOS (left panel) and IFS (right panel) capabilities with existing and proposed ground-based spectroscopic facilities. Circle areas are proportional to the etendue (i.e., aperture times field of view area). For clarity, MOS or IFS with small multiplex or field of view are not shown in these figures.

Telescope Aperture	12 m, seeing limited
Telescope FoV	3.1 deg²
Tel. Spec. Range	350-1600 nm
MOS LR Multiplex	20,000
MOS LR Resolution	3,000-4,000
MOS LR Spec Range	370 - 970 nm
MOS HR Multiplex	2,000
MOS HR Resolution	40,000
MOS HR Spec Range	3-4 regions in 370-970 nm
IFS FoV	3x3 arcmin²
IFS Resolution	3,500
IFS Spec Range	370-970 nm
IFS Mosaic	9x9 arcmin²
MOS & IFS simultaneous operation	ToO implemented at telescope and fibre level

pietro.schipani@inaf.it   ***https://www.wstelescope.com/***