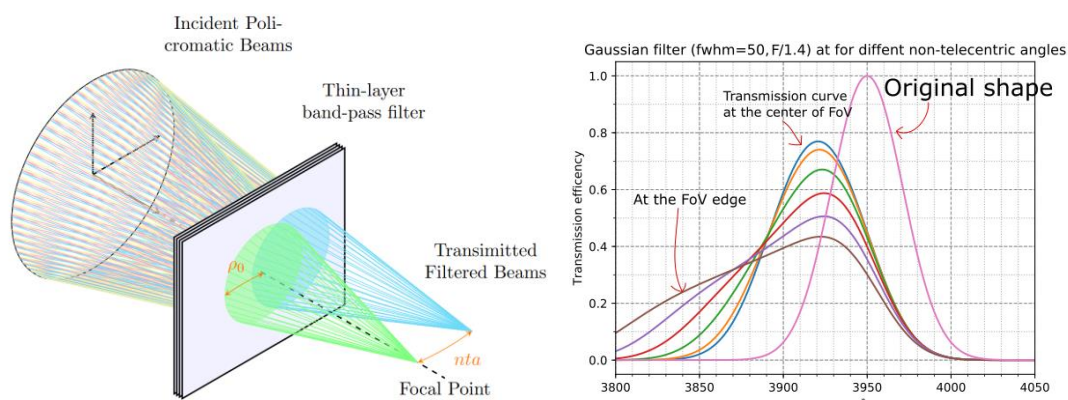


A narrow-band filter at LBC for multiple stellar populations detection in globular clusters

Scheda MultiPoP@LBC
INAF MiniGrant 2022

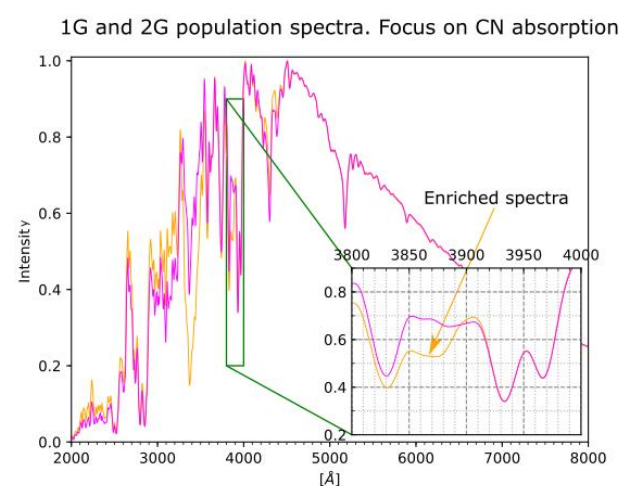
Federico Battaini et al. INAF – Osservatorio Astronomico di Padova, Università degli studi di Padova

Narrow band thin-layer transmission curve are **deformed** in fast and large-FoV instrument



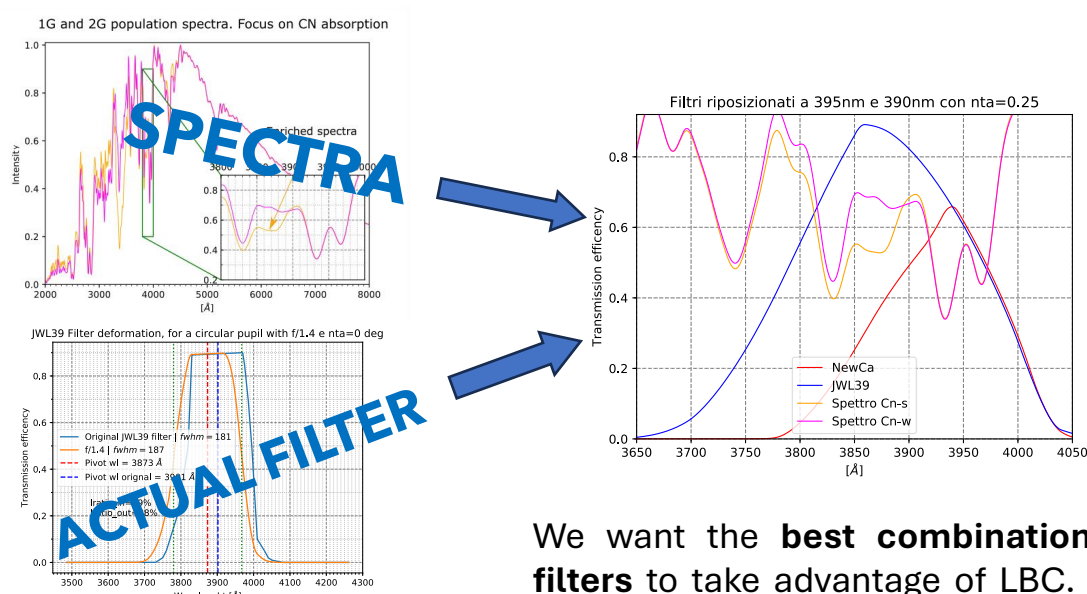
Two deformations. A symmetric one, depends on F-number of the instrument. A second introduce skewness and depends on the position in the FoV. It is related to the non-telecentric angle.

Scientific rationale



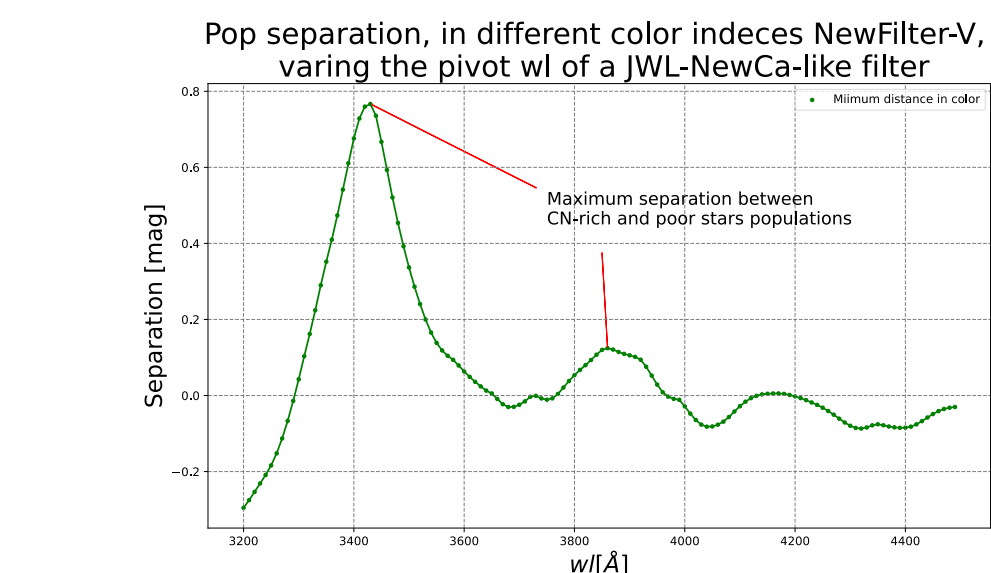
Jae-Woo Lee (2017) introduced a set of filters able to **separate multiple populations** in globular clusters using the CN molecular band at 385nm. The resulting color index is very effective to highlight different light-elements abundances among the stars, in a CMD. Using such an index on a large-FoV, 8-m class telescope can dramatically improve the galactic GCs multiple-populations studies from ground-based telescopes.

Simulations to find the best filter

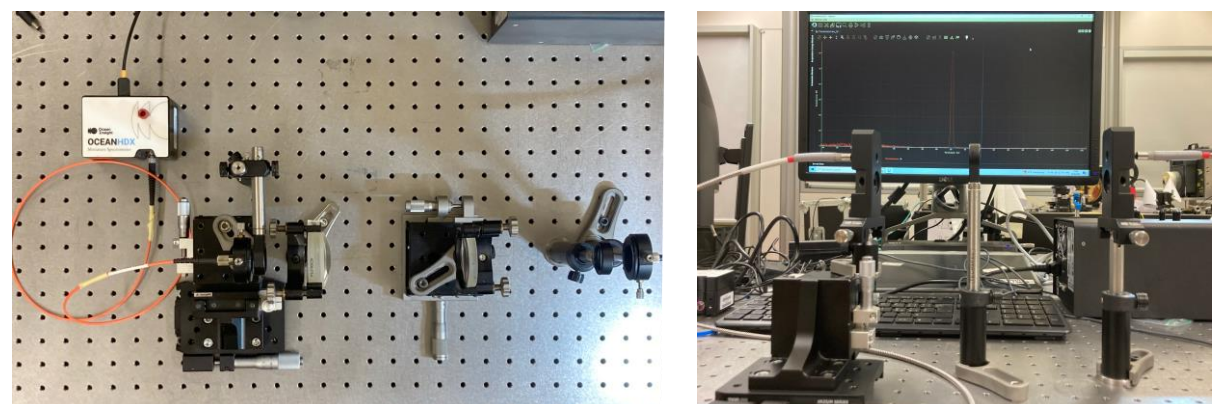


We want the **best combination of filters** to take advantage of LBC. The filter that maximize the minimum separation between the populations considering the optical design of the instrument. We convolved two spectra respectively poor and rich in CN with a large set of filters to scan the spectral region of our interest.

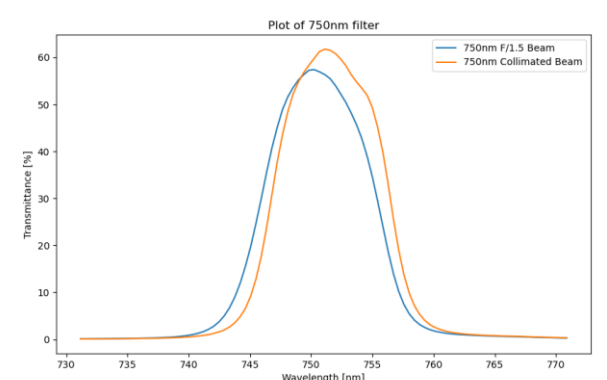
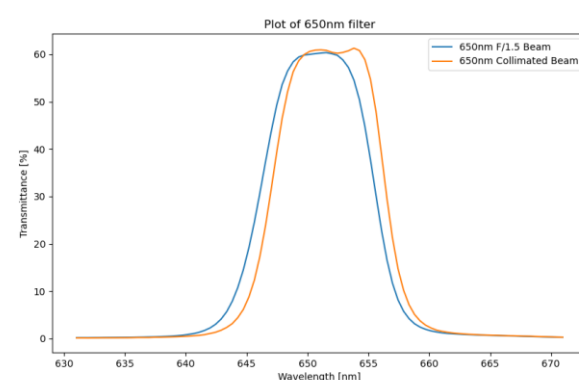
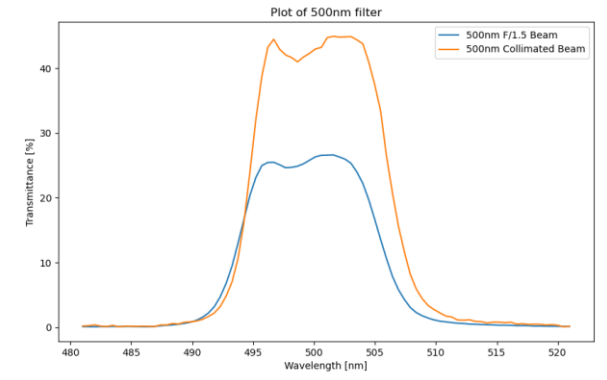
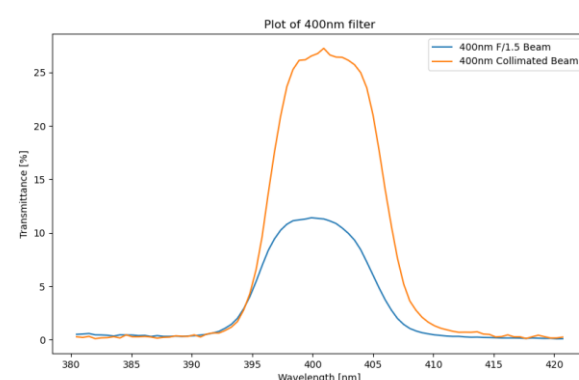
We modeled a 10nm-width filter and we moved its central wavelength from 320nm to 450nm. In the plot is the computation of the minimum separation between population, considering the spread due to the filter deformation, in a custom index.



Laboratory tests



We built an optomechanical set-up to test the filter behavior in a LBC-like configuration. Both to assess the reliability of our simulation and to prepare a future acceptance test for the real procured filter. We used components and instruments, like the OceanOptics spectrometer, available in the OAPD labs.



Some example of the transmission curve in the collimated and in the converging beam. Differently from the telescope our set-up is w/o central obstruction.

Future developments and challenges for the MultiPoP@LBC minigrant

The project is making steady progress, albeit slowly, as time constraints and the prioritization of larger projects present challenges to achieving the planned schedule. The next steps include simulating the separation of theoretical populations by taking advantage of the LBC's binocularity, using a NIR broadband filter alongside the 386nm filter, which remains the best candidate thus far. We have initiated an inquiry with companies capable of producing this filter. In the coming weeks, we expect to iterate with LBTO to determine if and how the filter can be installed in the available slot on the LBC-B filter wheel. Additionally, we have begun discussions regarding the initial scientific targets.

References:

Battaini et al., 2024, SPIE Proc., Advancement in narrow-band filters at LBC-like instruments for multiple star populations
Battaini et al., 2022, SPIE Proc., Transmission curves of narrow-band filters in large-FoV and fast astronomical instruments

federico.battaini@inaf.it

2° Forum della Ricerca Sperimentale e Tecnologica – Bologna, 1-3 October 2024