Contribution ID: **44** Type: **Physical Poster shown at the Meeting**

Detection and Study of Space Debris using TNG and SiFAP2 within the IDL Project

In this abstract, we present the development of an integrated system with tools for Space Situational Awareness (SSA) within the Interoperable Data Lake (IDL) project. Among system's capabilities, we report a proof-of-concept study on optical debris detection using SiFAP2, an ultra-fast optical timing instrument installed at the Telescopio Nazionale Galileo (TNG).

We implemented a dedicated data-processing pipeline, based on Two-Line Element (TLE) sets propagated via the SGP4 model, to schedule observation sessions and to measure orbital objects transits with high precision.

Observational campaigns conducted in February, March and September 2025 targeted a curated set of orbital objects based on their trajectory accuracy, visibility, altitude and physical characteristics. Across three sessions, out of 20 detection attempts, 7 successful transits were confirmed, demonstrating the feasibility of optical debris monitoring with SiFAP2 despite its narrow field of view and a limited orbital propagation precision.

The results validate the methodology of correlating optical signals with predicted passes and open opportunities for debris morphology studies, as well as for *a posteriori* analyses of previous optical campaigns using deterministic and machine learning techniques to distinguish astrophysical signals from noise generated by artificial object transits.

INFN OpenAccess Repository link

Author: COLANGELO, Umberto (INAF-OAR)

Co-authors: STAMERRA, Antonio (INAF-OAR and INFN-Roma); CAMPA, Carlo (INAF-OAR); Dr BERUCCI, Carolina (Leonardo SpA); AMBROSINO, Filippo (INAF-Osservatorio Astronomico di Roma); Dr CASELLA, Piergiorgio (INAF-OAR)

Session Classification: POSTER AND VIDEO UPLOAD