Title: "Analysis of the W 44 Supernova Remnant and its surroundings with *Fermi*-LAT and MAGIC"

Authors: Di Tria R., Di Venere L., Giordano F., Green D., Hahn A., Pantaleo F.R., Strzys M., on behalf of the Fermi-LAT and MAGIC collaborations

Presenter: Di Venere Leonardo

Executive summary:

The well-known supernova remnant (SNR) W 44 is observed in high-energy gamma rays and widely studied to investigate cosmic ray (CR) acceleration. Several analyses of the W 44 surroundings showed the presence of gamma-ray emission offset from the radio SNR shell. This emission is thought to originate from escaped high-energy CRs. We present a detailed analysis of the W 44 region as seen by Fermi-LAT, focusing on the spatial and spectral characteristics of both the W 44 SNR and its surroundings. The spatial analysis limited to energies above 1 GeV in order to exploit the improved angular resolution of the Fermi-LAT, provided a detailed description of the region morphology.

Several spatial template were tested to describe the W 44 morphology and the best one was chosen based on the Akaike Information Criterion. In the surrounding region, two small extended sources were found and modelled as spatial disks. An additional large disk was added to the model to describe a residual background emission, likely associated with CO gas distribution in the surroundings of W44.

Furthermore, observations of the north-western region of W 44 were conducted with the MAGIC telescopes in the very high-energy gamma-ray band. We analysed MAGIC data and searched for a VHE signal coincident with the North-western source derived in our Fermi-LAT analysis at GeV energies. No signal was found in this case and upper limits were derived, providing useful information to constrain the diffusion of escaped CRs.