Contribution ID: **23** Type: **Poster**

# Finding the needle in the haystack. Application of neural networks to track finding on plastic detectors used at CERN.

For many years, " track " nuclear detectors ( Nuclear Track Detectors, NTDs) consisting of sheets of plastic material such as CR39 polymer or Makrofol, have been used to detect highly ionizing particles. These damage the polymer structure, resulting in the formation of conical holes ( " tracks") through chemical attack in a basic solution. In environments with low background radiation, the tracks are easily visible to a normal optical microscope, and it is possible to observe the conical hole ( for particles that do not stop) on both surfaces of the plate at the same time. The MoEDAL experiment at CERN , dedicated to finding magnetic monopoles and other particles beyond the Standard Model, also uses among others about 20 square meters of track detectors. The experimental environment at LHC Interaction Point 8 where the experimental apparatus is located has, as a result of proton or lead nucleus beam collisions, extremely high ambient radiation that makes detector analysis extremely difficult.
In this talk we discuss how it was possible to generate, with the use of a GAN network and diffusion models, synthetic images containing "tracks" and background to train a neural network for object identification and enable automatic detector scanning. These techniques could also find application in other experiments. Part of this work was done using the HPC cluster at INFN-CNAF.

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**Session Classification:** Poster session

**Track Classification:** Esperimenti e Calcolo Teorico