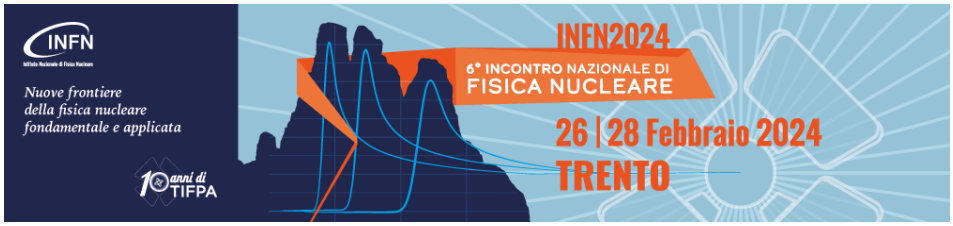

Contribution ID: **109** Type: **Oral**

Exploring the multidimensional structure of the nucleon (Invited)

Monday, 26 February 2024 09:00 (30 minutes)

Protons and neutrons are among the basic building blocks of ordinary matter and account for more than 99% of the mass of the visible universe. They have been discovered about a century ago and, since then, their properties and composition have been studied both theoretically and experimentally with an increasing level of precision and accuracy. With the advent of the quark model and of QCD their structure in terms of elementary constituents became evident and was eventually established by the first DIS experiments in the late ‘60s. In more than fifty years of DIS experiments, performed with different beam particles and energies and covering complementary kinematic regions, we have learned a lot on the complex dynamical structure of nucleons. Today we have a rather precise knowledge of the longitudinal momentum and longitudinal spin distributions of quarks, encoded by the collinear *momentum* and *helicity* Parton Distribution Functions (PDFs). These objects, however, provide only a 1-dimensional description of the nucleon structure, in terms of the longitudinal momentum fraction carried by the partons. New fundamental insights and a rich phenomenology arise when we expand our studies by including the dependencies on the (originally neglected) parton transverse degrees of freedom: transverse polarization, transverse momentum, and transverse position across the nucleon. An immediate consequence of this novel approach is the appearance of two new families of partonic distributions: the Transverse-Momentum Dependent distribution functions (TMDs) and the Generalized Parton Distribution functions (GPDs). The former provide a 3-dimensional representation of the nucleon structure in momentum space, the latter in a space spanned by the parton longitudinal momentum and transverse coordinates. Together they thus allow for a complementary multi-dimensional description of the nucleon structure (nucleon tomography) and provide a new ground for studying the strong interaction in the non-perturbative regime of QCD. An overview of recent experimental highlights on both TMDs and GPDs is reported, along with some perspectives for future measurements at existing and future facilities.

Primary author: PAPPALARDO, Luciano Libero (Istituto Nazionale di Fisica Nucleare)

Presenter: PAPPALARDO, Luciano Libero (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronic Physics II