Contribution ID: **61** Type: **Poster and book of abstract**

MEMPHYS - MEMristive-CMOS hybrid electronics for experimental PHYSics

Future high-energy physics experiments require advanced trigger systems to handle unprecedented data rates and efficiently identify rare processes. Simply scaling current computing power will not suffice; new paradigms, including on-detector artificial intelligence (AI), are needed to reduce data transfer and power consumption.

Current CMOS-based AI systems lack efficient hardware representations of synapses and neurons, limiting their real-time processing capabilities. This proposal explores memristive technology for low-latency, low-power AI-based triggering and radiation-tolerant on-detector data storage. Memristive crossbars could cut neural network power consumption by three orders of magnitude compared to CMOS while maintaining decision latencies of 10–100 ns.

This approach paves the way for beyond-CMOS application-specific integrated circuits (ASICs) for on-detector intelligence.

Primary authors: DI NOLA, Alessandro (Istituto Nazionale di Fisica Nucleare); FIACCO, Davide (Istituto Nazionale di Fisica Nucleare); IACOANGELI, Francesco (Istituto Nazionale di Fisica Nucleare); Mr TARIQ, Junaid (Istituto Nazionale di Fisica Nucleare); GIORDANO, Raffaele (Università di Napoli - 'Federico II'); BOCCI, Valerio (Istituto Nazionale di Fisica Nucleare); IPPOLITO, Valerio (Istituto Nazionale di Fisica Nucleare)

Presenter: FIACCO, Davide (Istituto Nazionale di Fisica Nucleare)