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From Bonner Spheres to real-time single-moderator neutron spectrometers

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Since 1960, Bonner Spheres (BS) admirably served as operational neutron spectrometers with wide energy interval in a variety of fields, from industry to medicine and research. They respond up to GeV energies, their operation is simple and their accuracy is well established. Nevertheless, they are cumbersome and very time consuming. In the last decade an INFN-based international collaboration led the evolution of Bonner spheres into a new class of single-moderator neutron spectrometers (SMNS). These devices condense the functionality of BS in a single moderator with specific geometry, embedding multiple solid-state thermal neutron detectors in previously optimized positions. SMNS are similar to BS in terms of energy interval, operation, unfolding and performance, but they require only one exposure to determine the whole neutron spectrum. According to the specific measurement needs, various isotropic or directional SMNS have been developed. This work presents this evolution with special focus on the use of SMNS in large accelerators.

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