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A polystyrene-based scintillator production process involving additive manufacturing

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Plastic scintillator detectors are widely used in high-energy physics, often as an active neutrino target, both in long and short baseline neutrino oscillation experiments. They can provide 3D tracking with 4π coverage and calorimetry of the neutrino interaction final state combined with very good particle identification capabilities and sub-nanosecond time resolution. Moreover, the large hydrogen content makes plastic scintillator detectors ideal for detecting neutrons. However, new experimental challenges and the need for enhanced performance require the construction of detector geometries that are challenging using current production techniques. The solution can be found in additive manufacturing, able to quickly make plastic-based objects of any shape. In this talk, the applicability of 3D-printing techniques to the manufacture of polystyrene-based scintillator will be discussed. We will report the feasibility of 3D printing polystyrene-based scintillator with light output performances comparable with that of detectors manufactured using standard production techniques. The latest advances in R&D aim at combining the 3D printing of plastic scintillator with other materials, such as optical reflectors or absorbers. The status of the R&D and the latest performance results will be presented.

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