



Contribution ID: 33

Type: **Poster**

Aerogel characterization for RICH applications

Monday, September 15, 2025 3:50 PM (1 hour)

Silica aerogel has gained increasing popularity over the past few decades as a Cherenkov radiator, thanks to its exceptional properties. One of its most distinctive features is the ability to finely tune its refractive index to meet the specific requirements of various RICH detectors for future HEP experiments, such as the ALICE 3-RICH and the ePIC-dRICH detectors. At the INFN Bari laboratories, a detailed optical characterization of hydrophobic silica aerogel tiles is currently underway, using an Agilent Cary 4000 spectrophotometer. The study involves aerogel tiles of varying thicknesses and sizes. The measured physical quantities include total and diffuse transmittance, total reflectance, as well as derived linear transmittance and specular reflectance. Results indicate that intensive use and surface degradation significantly affect the optical performance of the tiles, reducing both linear transmittance and transmission length. High-precision refractive index measurements were carried out using both the dispersion law and the minimum deviation angle method, with an experimental uncertainty of approximately 0.01 percent. This level of accuracy enables the detection of possible refractive index gradients across the tile thickness, a feature beneficial for Cherenkov photon focusing. This optical characterization lays the groundwork for further studies aimed at optimizing tile configurations and enhancing the overall performance of future RICH detector systems. The results obtained will be presented and discussed.

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Session Classification: Poster Session

Track Classification: Technological aspects and applications of Cherenkov light detectors