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Development of FARICH technique for the Super Charm-Tau Factory project

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The Super Charm-Tau (SCT) Factory project is a future electron-positron colliding beam experiment with unprecedented high luminosity $10^{35} \text{cm}^{-2} \text{s}^{-1}$ at the interaction energy range from 3 to 7 GeV. The physics program of the experiment is aimed to search the phenomena beyond the standard model and its precise calibration in this energy range. The main features of the SCT Factory project are presented. To perform the broad physics program at the ultimately high beam intensity the high performance universal detector is proposed. One of the proposed detector subsystems is the PID system based on Focusing Aerogel RICH (FARICH) technique. The proposed FARICH scheme combined with abilities of tracking system will provide the excellent π/K -separation for the whole operation momentum range and μ/π -separation up to momentum of 1.5 GeV/c. The idea of FARICH detector based on dual aerogel radiator (focusing aerogel tile with maximal refractive index 1.05 and high optical density aerogel with refractive index of 1.12) is described. Results of GEANT4 simulation and beam test results are in good agreement. PID capabilities of this approach is demonstrated with help of numerical simulation. In 2023 two multilayer focusing aerogel samples with overall sizes $230 \times 230 \times 35$ mm were produced in Novosibirsk for the first time all over the world. The results of the first beam tests of these aerogel samples and comparison with simulation are presented. Conceptual design and some technical issues of the PID system based on FARICH technique are discussed as well.

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