Silica Aerogel Radiator for the Belle II ARICH System

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Moscow, Russia

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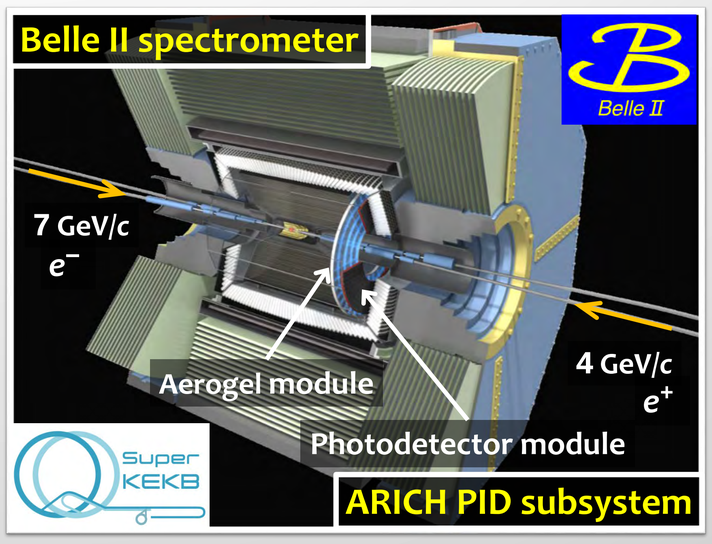
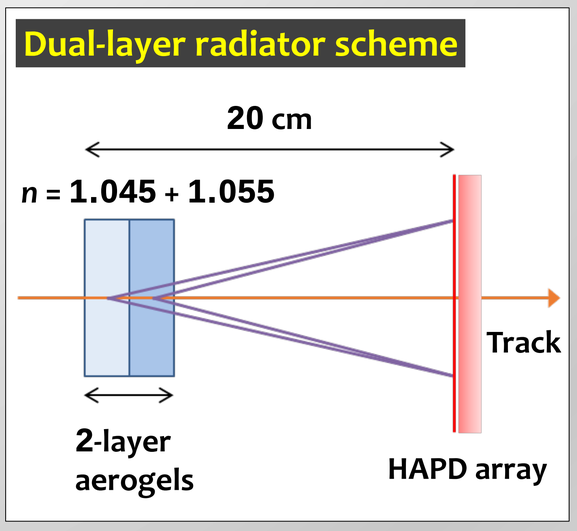
Highlights

- Aerogels mass-produced (–May 2014). Their optical properties confirmed.
- Aerogel radiator module assembled (–Dec. 2016) and installed (Sep. 2017).
- Aerogel radiators functioned in Phase-2 physics runs (Apr.–Jul. 2018).

Belle II experiment

- Super *B*-factory experiment using the SuperKEKB e^+e^- collider at KEK, Japan
  - Search for new physics beyond the Standard Model through flavor physics and precision measurements of *CP* violations





ARICH PID subsystem @forward end cap

- Aerogel-based proximity-focusing RICH detector (ARICH)
  - Goal: 4σ π/*K* separation significance at 4 GeV/*c*
  - Radiators: Custom-made hydrophobic silica aerogel
    - 124 tiles x 2 layers = 248 tiles

    Japan Fine Ceramics Center and Chiba U.

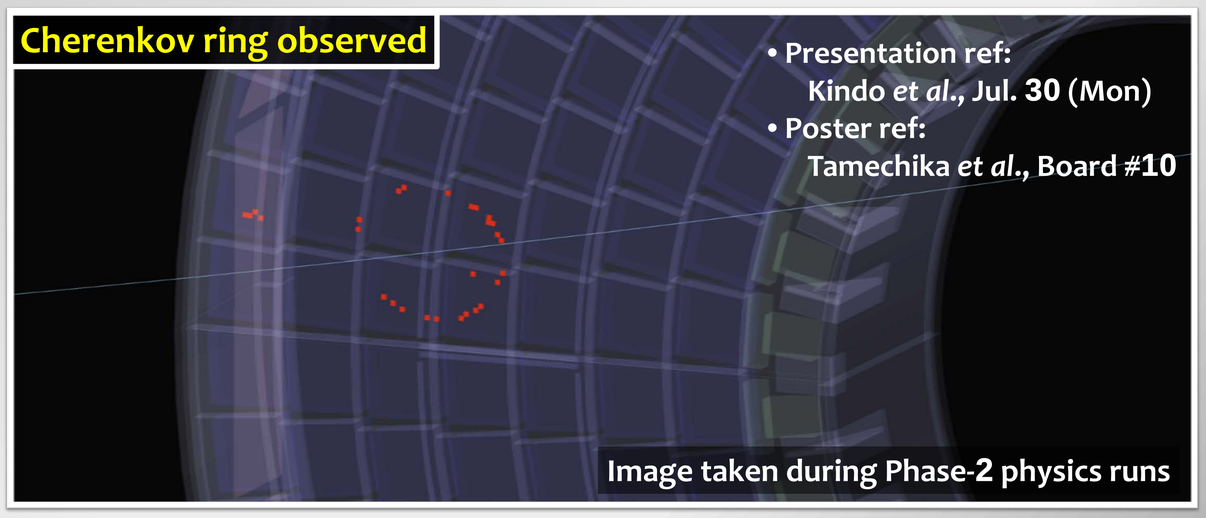
    - Paper refs: Tabata *et al.*, J. Supercrit. Fluids 110 (2016) 183 & NIMA 766 (2014) 212
  - Photo-detectors: 144-ch hybrid avalanche photo-detectors (HAPD)
    - 420 sensors

    HAMAMATSU and KEK

    - Presentation ref: Yonenaga *et al.*, Jul. 31 (Tue) & Poster ref: Pestotnik *et al.*, Board #17
  - Scheme for focusing the propagation pass of Cherenkov photons on the photo-detectors using dual layers of 2-cm-thick aerogel tiles

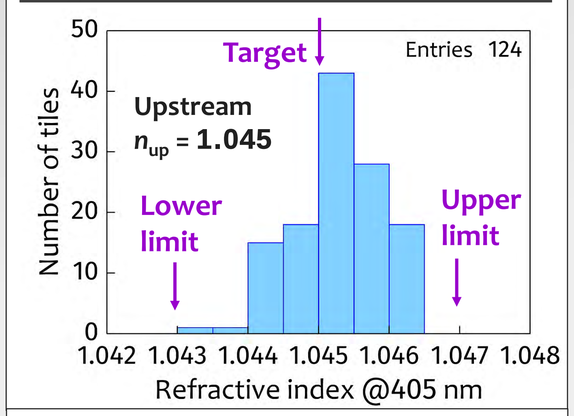
Aerogel radiator module

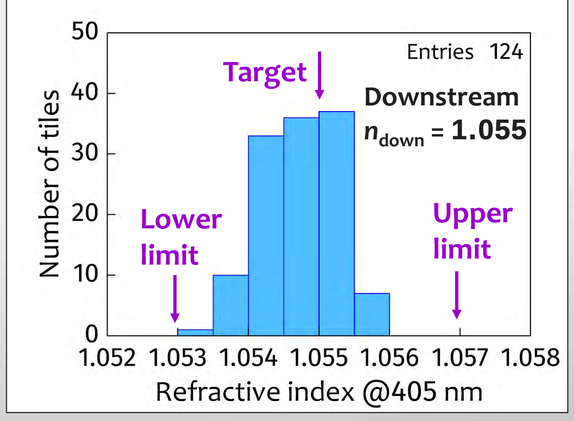
Cherenkov ring observed



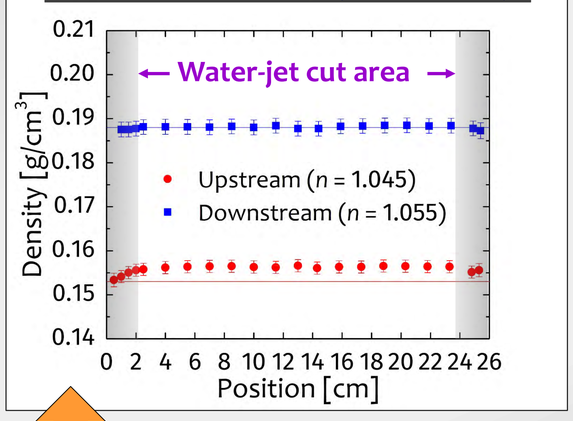
Aerogel optical properties

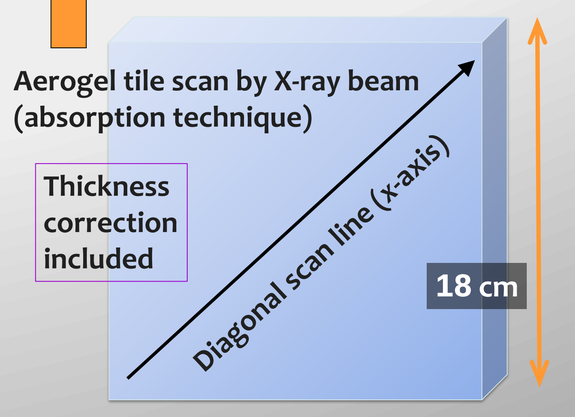
Precise refractive index control



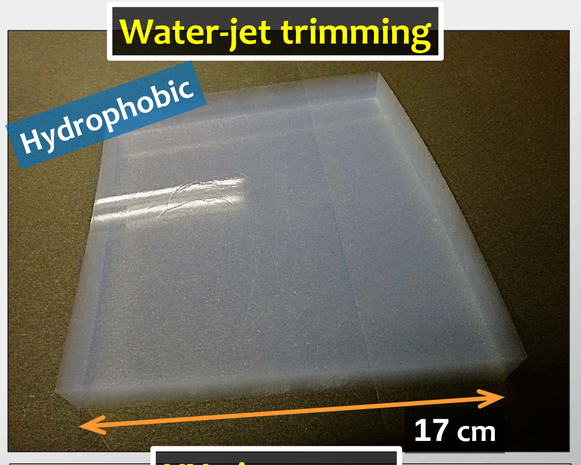


Uniform density (i.e., index)

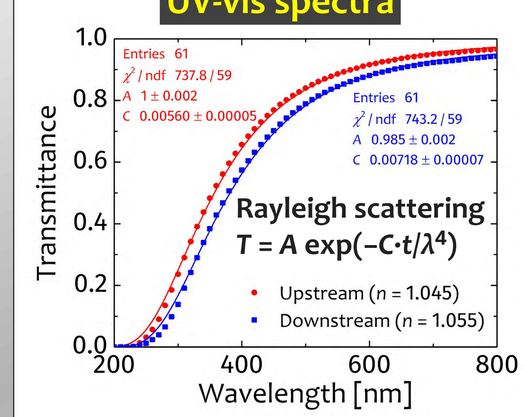




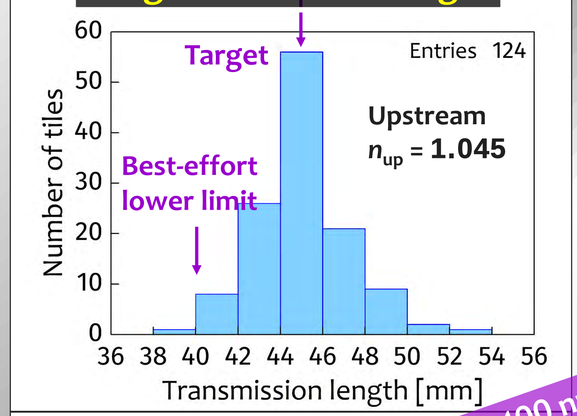
Water-jet trimming

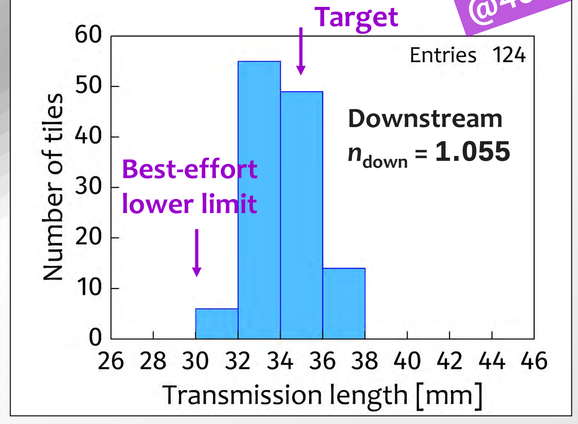


UV-vis spectra

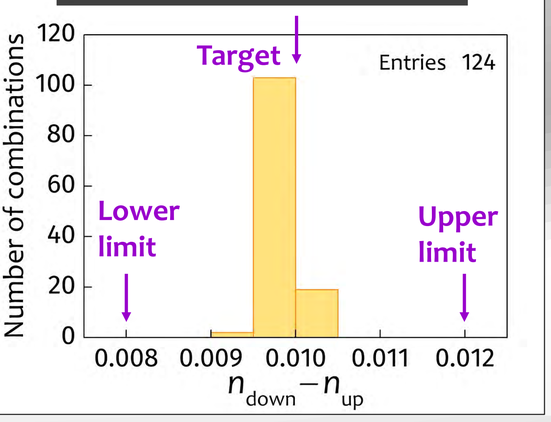


Long transmission length

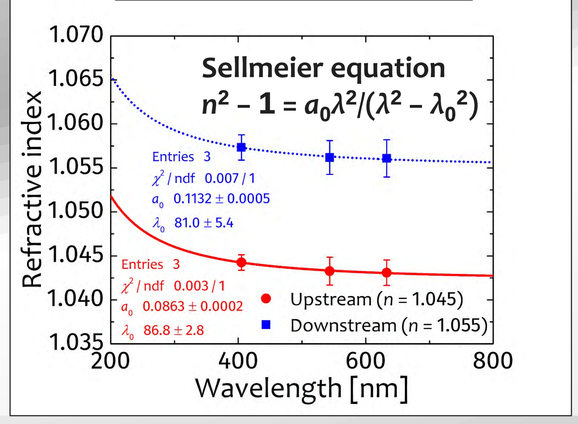




Good index combination



Chromatic dispersion



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