

Describing RICH Detectors in Geant4

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Outline

- Use of Geant4 by other experiments
 - BaBar
 - Belle2
- Geant4 physics processes for RICH
 - Production
 - Propagation

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Existing Simulations of RICH

- BaBar - first to use Geant4
 - First to simulate RICH with Geant4
 - Cerenkov rings well-reconstructed and used for π/K discrimination
- Belle2 - most sophisticated use of Geant4 optical photons
 - Two detectors: ARICH and TOP
 - Roughly similar to BaBar

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Belle2

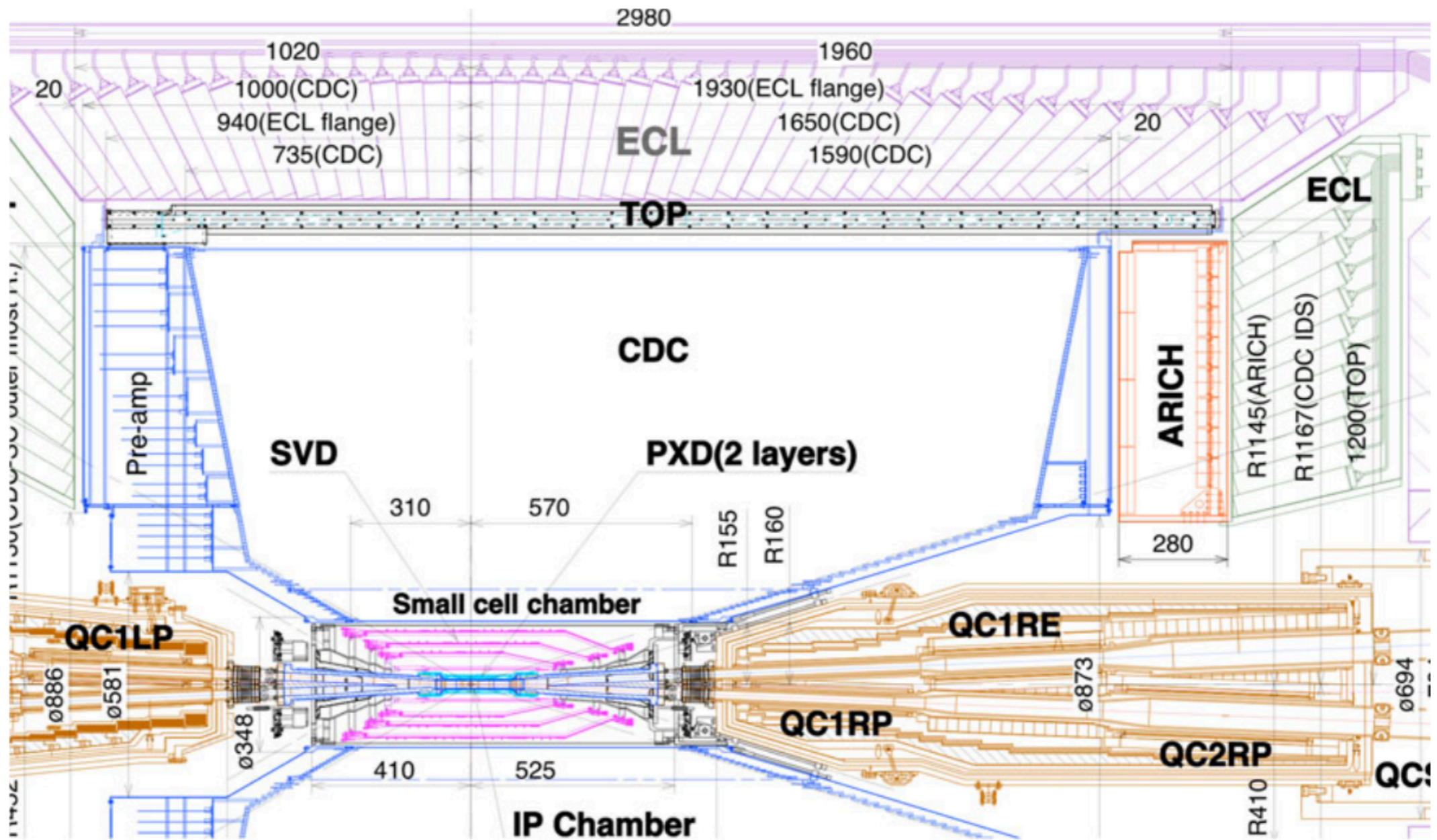
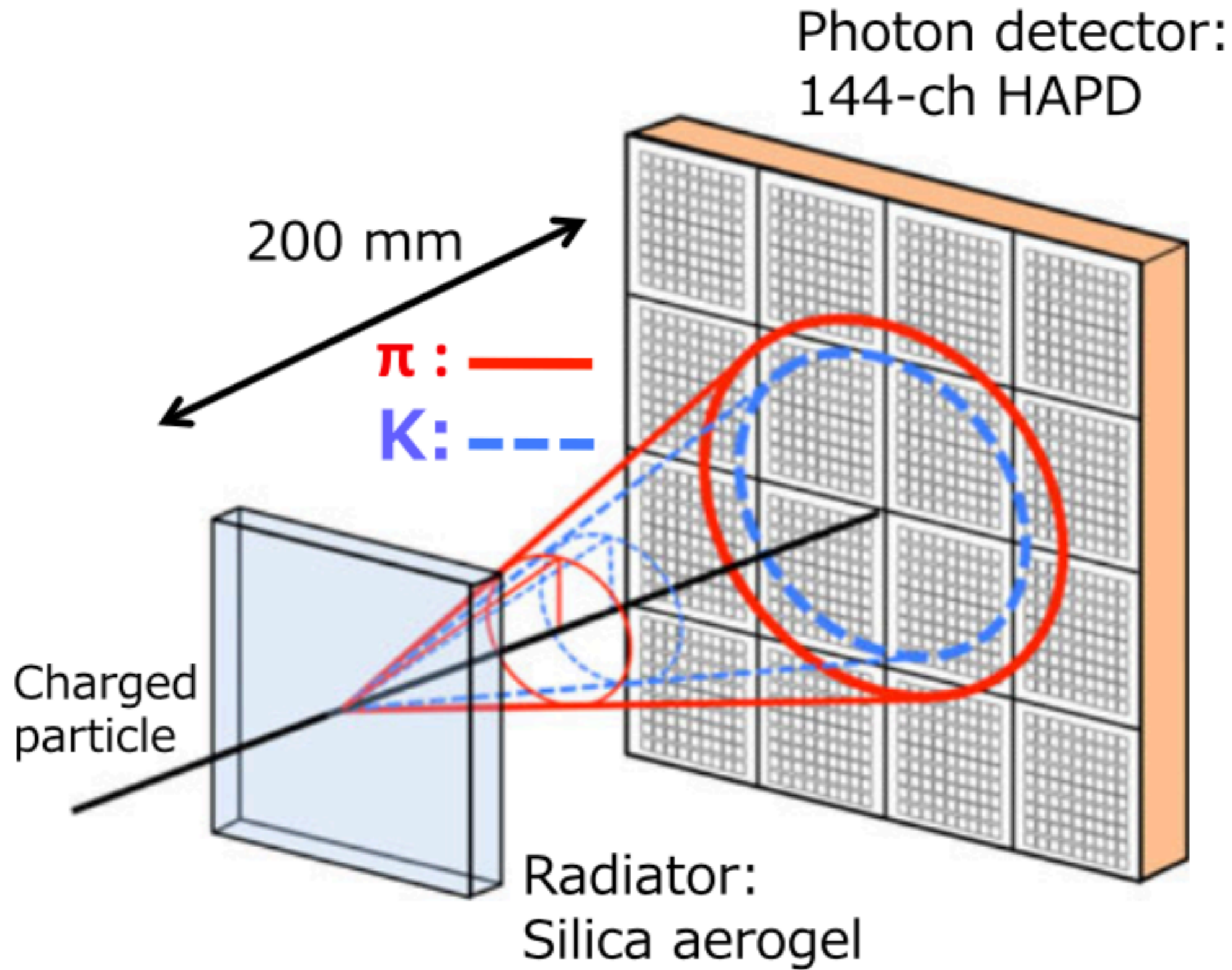
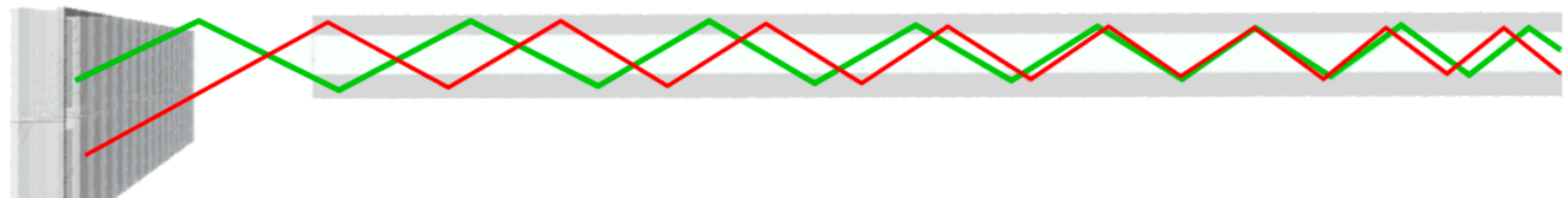
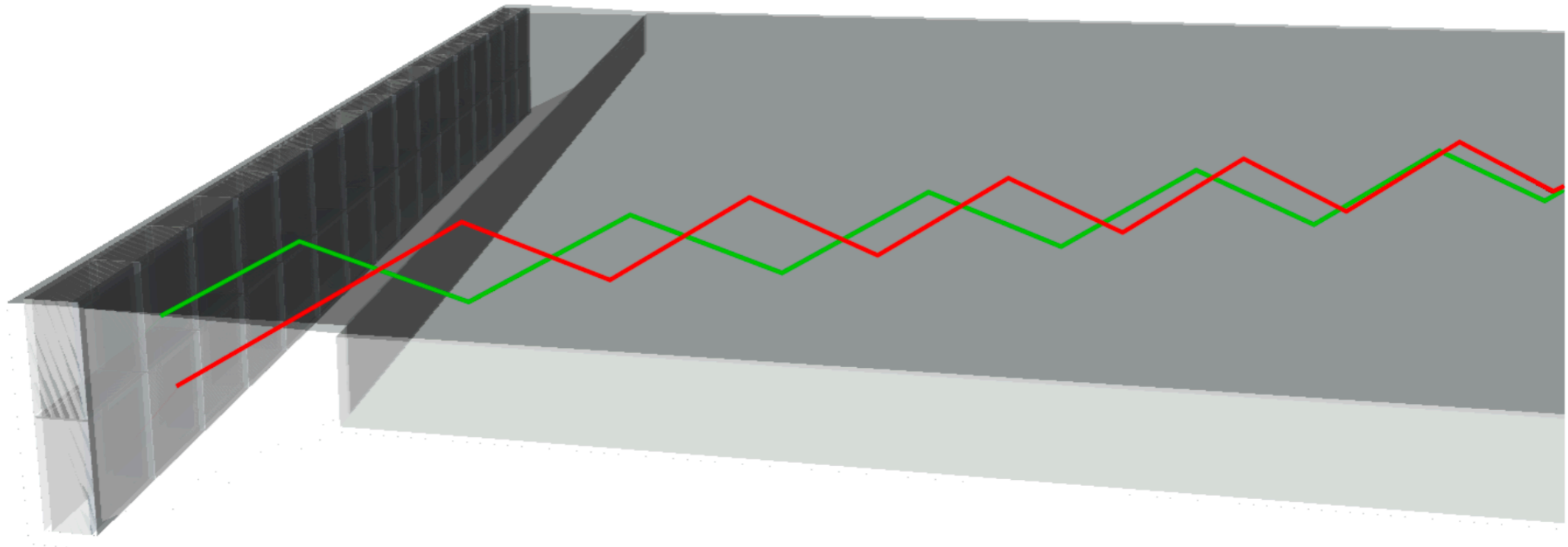
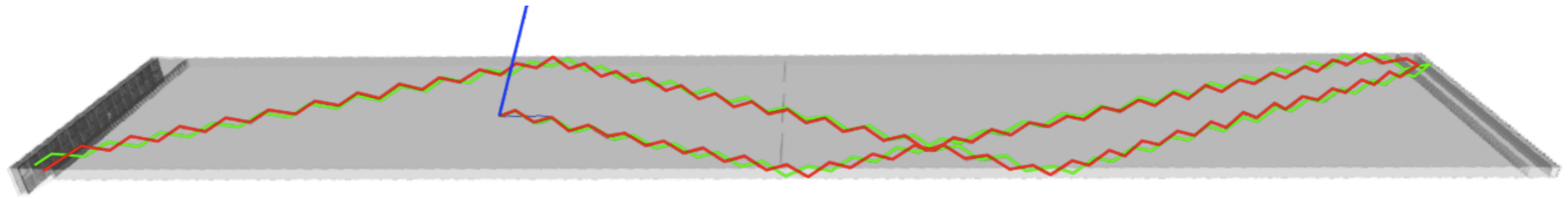


Fig. 1. Horizontal cross-section of the Belle II detector.

ARICH Concept

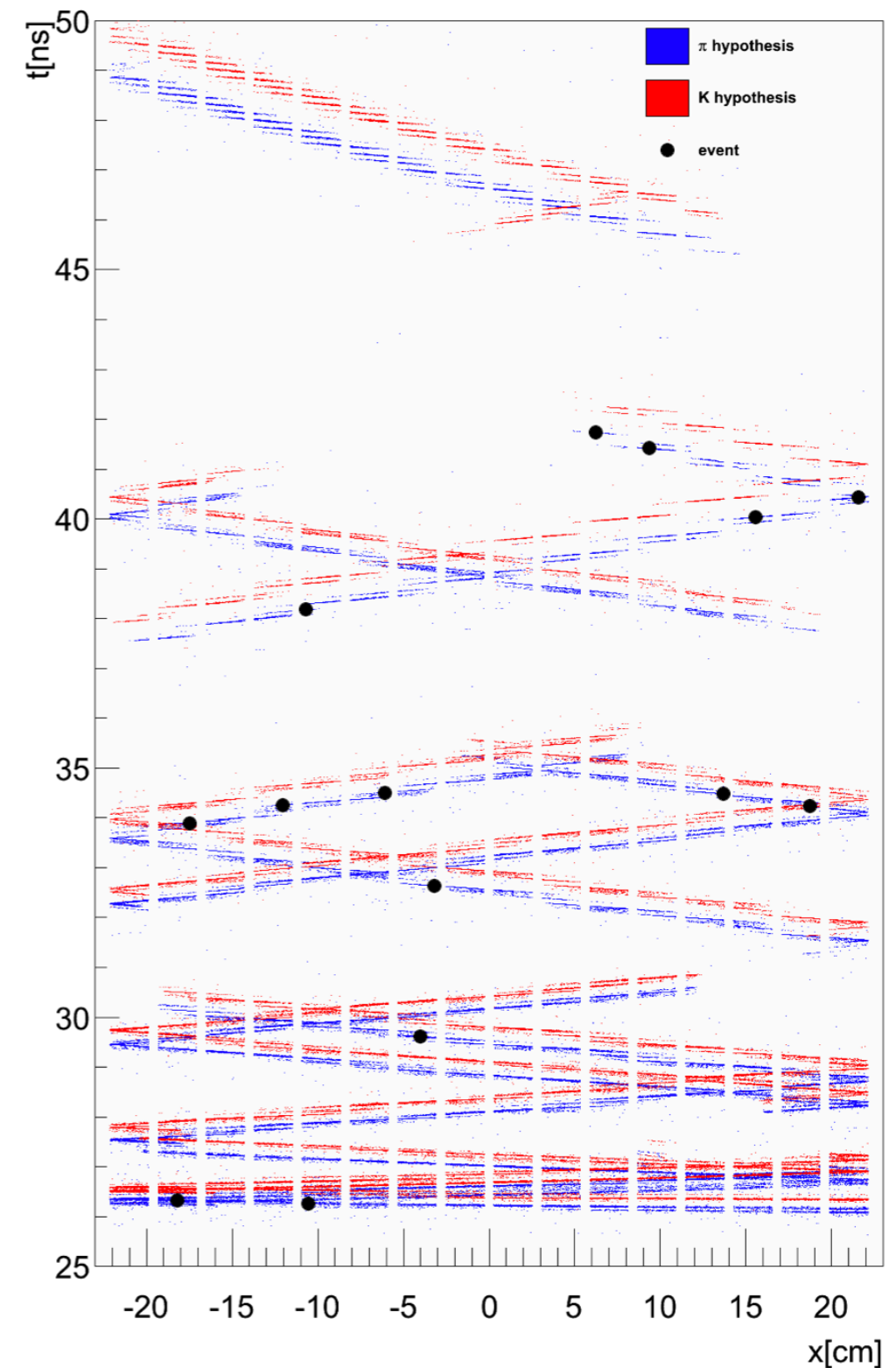


TOP Detector



TOP Signal

- π = blue
- K = red
- Between 100 and 200 total internal reflections
- Most CPU consuming detector for simulation



Optical Photon Processes

- Production
 - Cerenkov
 - Scintillation (user supplies properties in Materials)
 - Transition radiation
- Propagation
 - Reflection/refraction (rich set of boundary treatments)
 - Wavelength shifting
 - Absorption
 - Rayleigh scattering

Summary

- Depending on desired precision and frequencies involved, may need to augment indices of refraction
 - Sellmeier equation - dependence of n on wavelength
 - Cauchy's equation - like above, but for non-resonant frequencies
- Aside from that, Geant4 provides everything needed for simulation of quite complicated RICH detectors

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