Motivation
Photon detector for a proximity focusing RICH in the forward region of the upgraded BELLE detector.

Required: operation in 1.5 T field, preferably excellent timing (advantageous for an additional TOF functionality of the RICH counter)

SiPM: photon detector candidate for the Belle RICH
SiPM is an array of APDs operating in Geiger mode. Characteristics:
- low operation voltage ~ 10-100 V
- gain ~ 10^6
- peak PDE up to 65%(@400nm)
- PDE = QE x ε_geiger x ε_geo
- ε_geo: dead space between the cells
- time resolution ~ 100 ps
- works in high magnetic field
- dark counts ~ few 100 kHz/mm^2

SiPMs give ~5 x more photons than PMTs per photon detector area – in agreement with expectations

RESULTS: PHOTON YIELD
SiPM Cherenkov angle distribution

First attempt: use the top of a blue LED

Cherenkov photons appear in the expected time windows – First Cherenkov photons observed with SiPMs!

RESULTS: IMPROVING THE SIGNAL-TO-NOISE RATIO
- Reduce the noise by a narrow (few ns) time window
- Increase the number of signal hits per single sensor by using light collectors and by adjusting the pad size to the ring thickness

Results: Photon Yield Results: Improving the Signal-to-Noise Ratio
Currently in a beam test at KEK