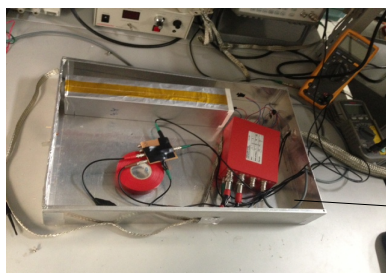


# Research of pure CsI crystal readout by APD for ECL end cap of BELLE II

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A scintillation counter consisting of a pure CsI crystal ( $6 \times 6 \times 30 \text{ cm}^3$ ) and avalanche photodiodes (Hamamatsu S8664-1010 and S8664-55) is studied.

Aluminized mylar



Teflon

CAEN-amplifier

Shaper

ADC

PC



charge pre-amplifier  
CAEN A1422B045F3  
45 mV/MeV (1 V/pC)



CP 4467A  
Fast Shaping  
Amplifier (NIM)  
 $\tau = 20\text{--}500 \text{ ns}$



Hoshin C008  
16ch peak hold  
ADC (CAMAC)

Belle II, as upgrade of Belle, aims at searching for New Physics with 40 times higher luminosity. Fast pure CsI scintillation crystals ( $\tau = 30$  ns) have been proposed to cope with the high luminosity. Silicon avalanche photodiodes are considered as one of the upgrade options.

At the University of Tokyo, we studied a counter consisting of a pure CsI crystal ( $6 \times 6 \times 30$  cm<sup>3</sup>) and avalanche photodiodes (Hamamatsu S8664-1010 and S8664-55) .

The shot noise, thermal noise and additional noise were measured under shaping time ranging from 20 nanoseconds to 500 nanoseconds respectively. The total equivalent noise charge (ENC) has been calculated and compared with the value measured experimentally. The ENC is suppressed at theoretical limit.

With help of the cosmic muons, the equivalent noise energy (ENE) of the counter with several APDs has also been measured. Further studies on wrapping materials, optical grease have been done to enhance the light collection efficiency. Optimal scheme was established.

The application of new wavelength shifting (WLS) material, matching the emission spectrum of pure CsI and APD's quantum efficiency perfectly, increase the signal substantially.

We confirm that by using several APDs coupling to pure CsI scintillation crystal and innovative WLS, the required electronic noise of 0.5 MeV can be obtained.