Motivation
Hyper-Kamiokande project
- Next generation water Cherenkov detector
- Search for a leptonic CP Violation, mass hierarchy, nucleon decay, super-nova relic neutrinos ...
- Super-K × 25 in fiducial mass
- 99,000 photo-sensors for inner detector
- Photo-coverage is 20%

Need a new photo-sensor which has better cost-performance than the Super-K PMT.
⇒ Hybrid Photo-Detector (HPD)

Performance
We measured the 8-inch HPD prototype.

- Transit time spread (TTS)

![Graph showing TTS](image)

(2.2 ns sigma’s for Super-K PMT)

- Capability of single photon detection

![Graph showing single photon detection](image)

- Dark rate

2 kHz @ 0.5 p.e.

- Linearity

The output is linear up to ~60 p.e.

- Rate tolerance

The output is constant within 5% until a light emission frequency reaches 500kHz.

Conclusion
We developed the prototype of 8-inch HPD.

HPD has better the timing and energy resolution than the Super-K PMT.
The dark rate are enough low.
The linearity will be improved in a next version of the amplifier.
Various performance of HPDs is still under measurement such as,
Uniformity of gain,
Magnetic field tolerance and
Thermal dependence of gain and noise.

R&D goal
Developing a 20-inch High QE HPD
(High QE ... 30% QE)

(High QE option is important because of the low photo-coverage of Hyper-K.)