

**The study on the mechanism of  
reading out scintillator by fiber.**

**Purpose**

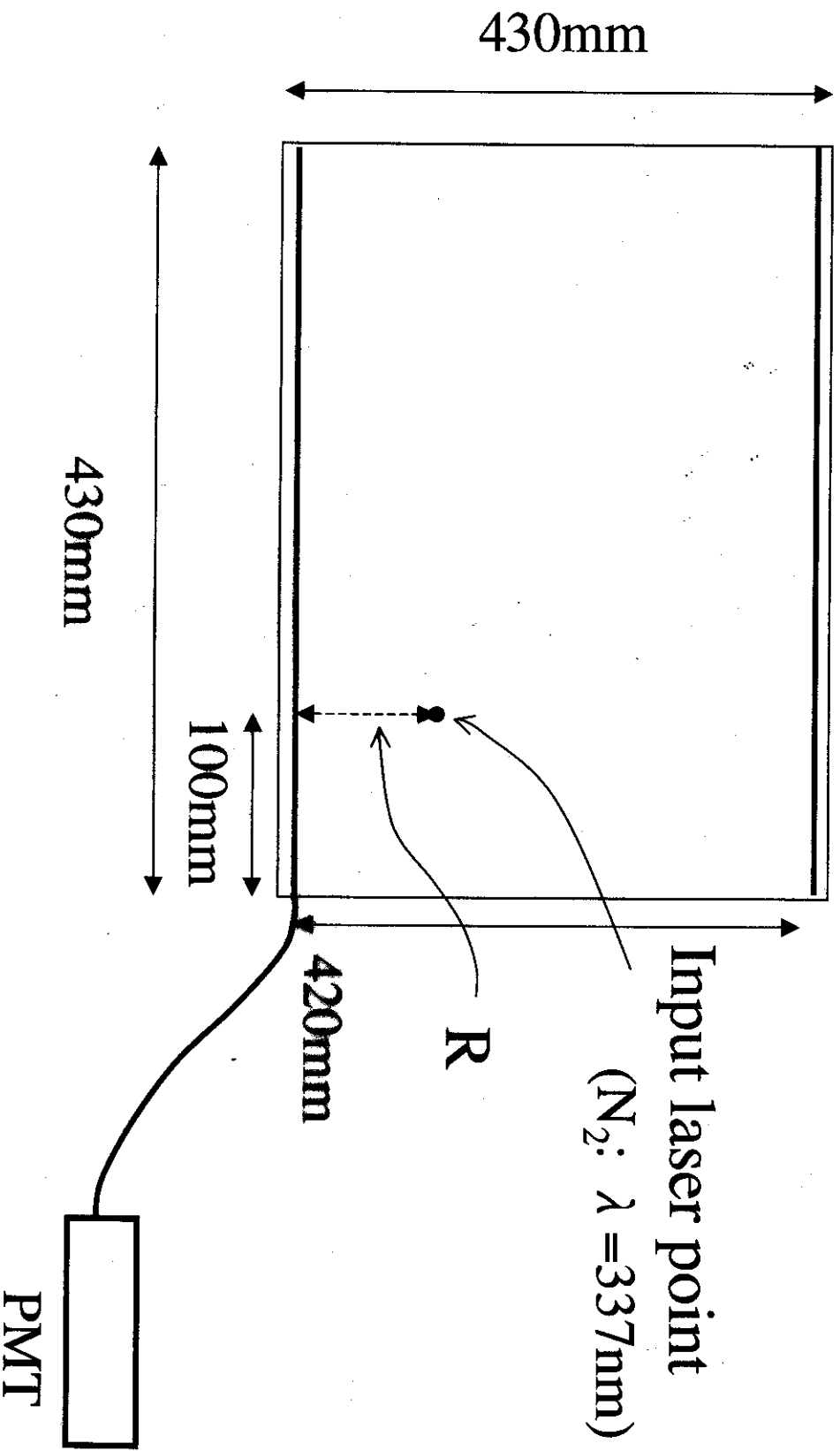
**To find an efficient way to collect light.**

**(The photon veto counter is very important in KAMI  
experiment.)**

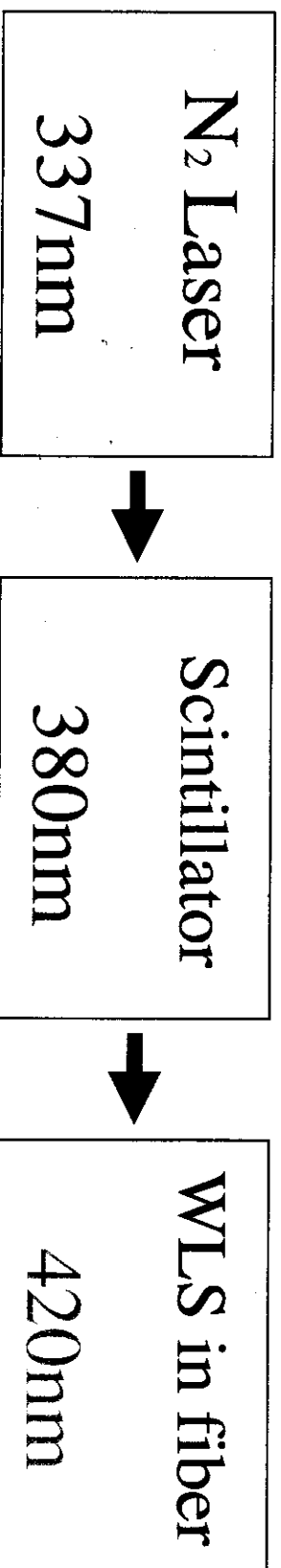
**Once we understand fundamental mechanism,  
we can use it in many cases.**

*Osaka Univ. Katsushige Kotera*

# The outline of experimental equipments

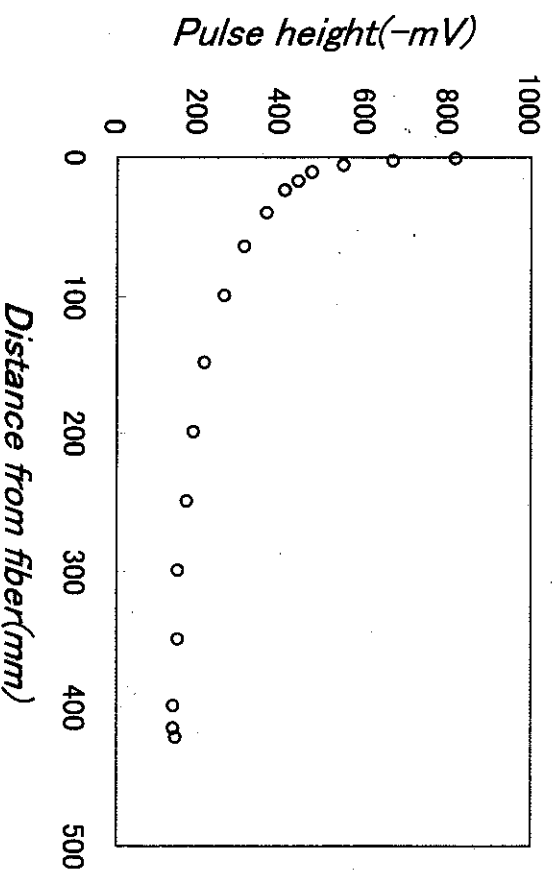


# Transformation of light in this experiment.



WLS: wave length shifter

$\Delta$ groove 422mm



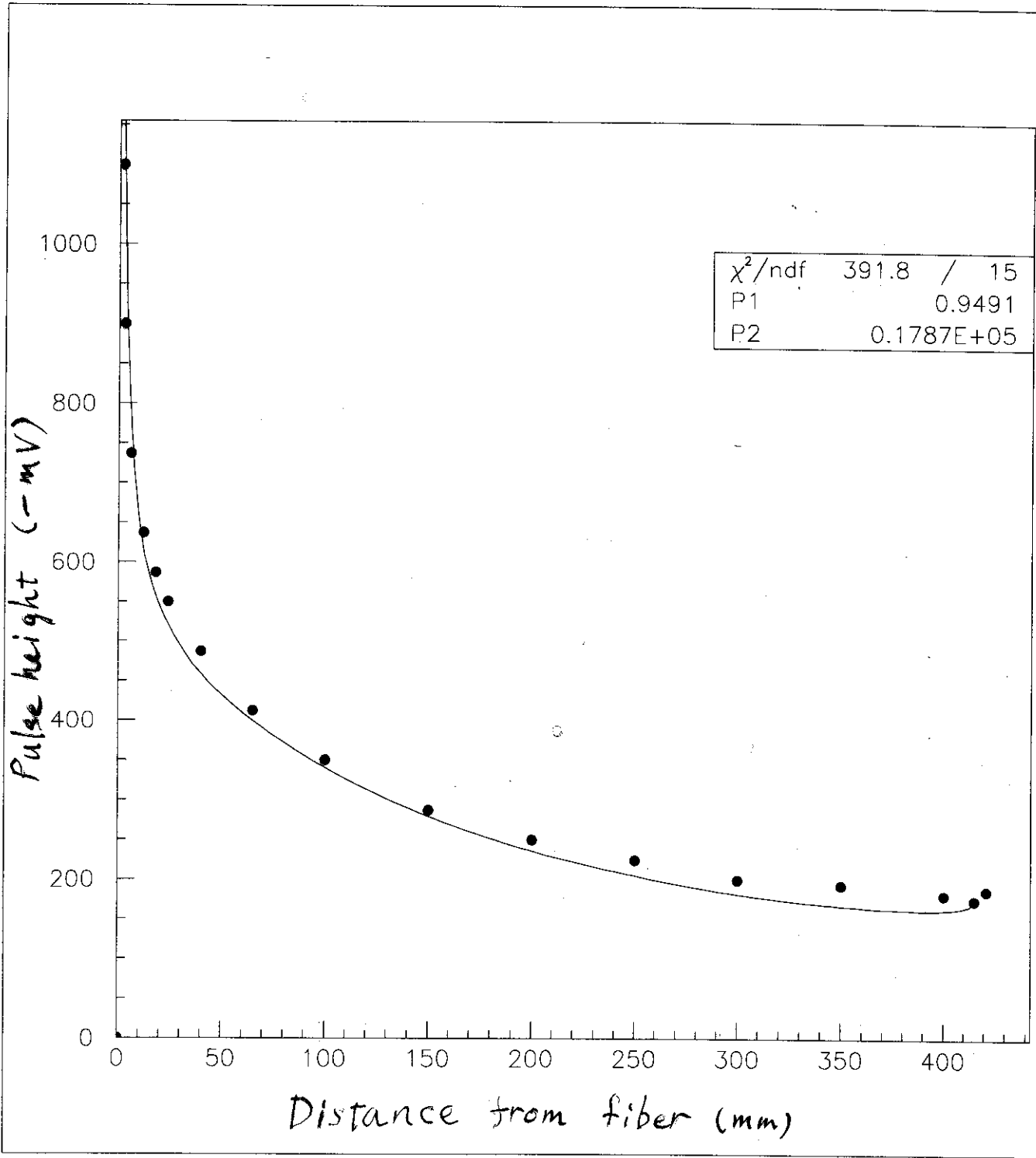
### Three main effects

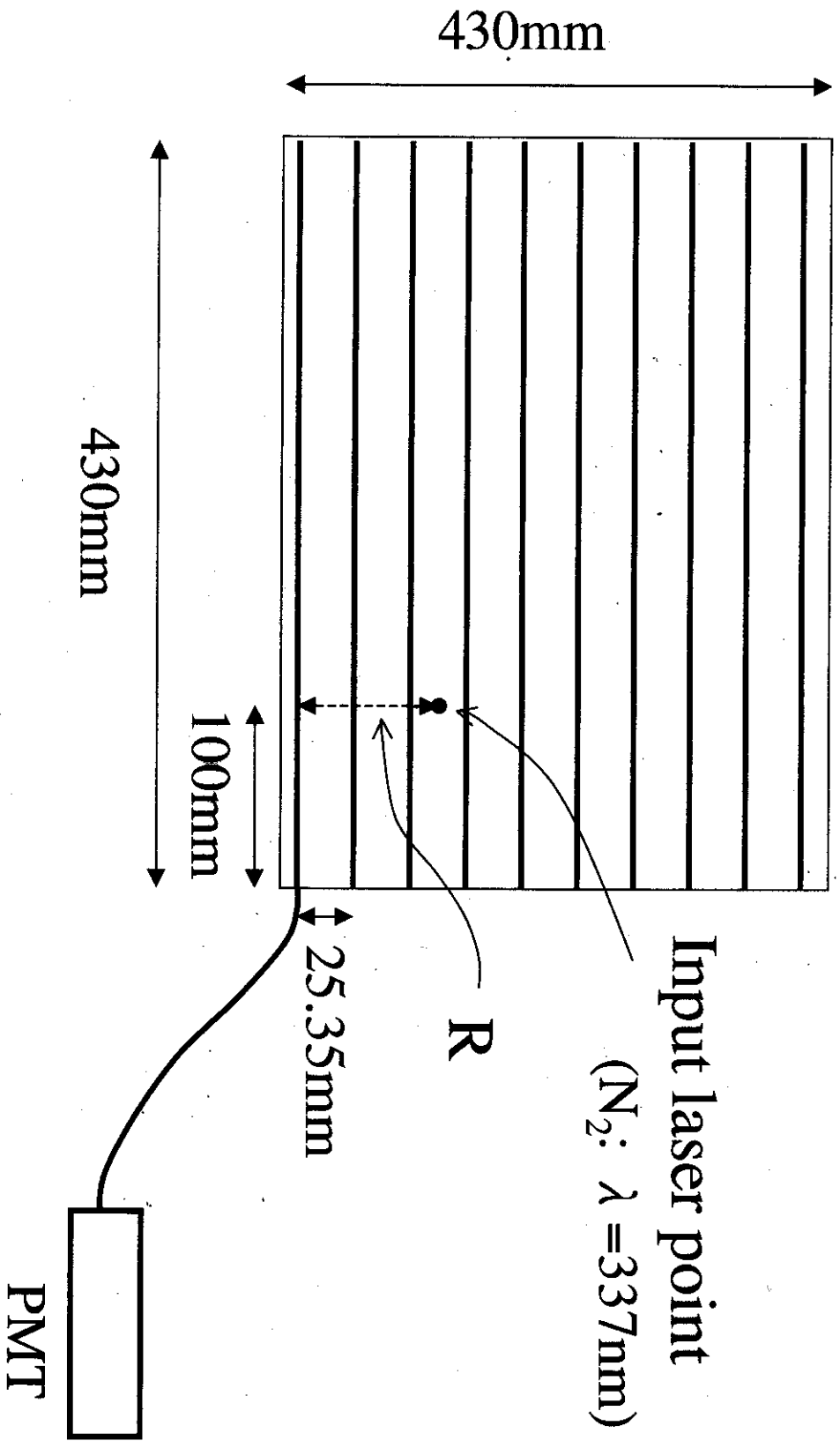
- The fast drop down of angular coverage of real fiber
- The total reflection at the face of scintillator.
- with light loss at every reflection.

# The total reflection effect

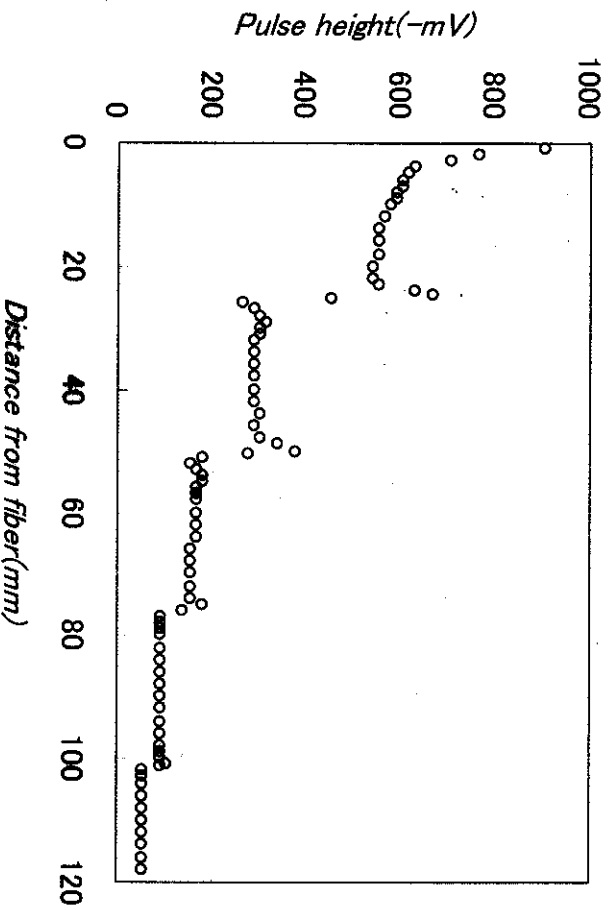


	High intensity
	Rapid fall down
	Density of #fiber almost becomes constant



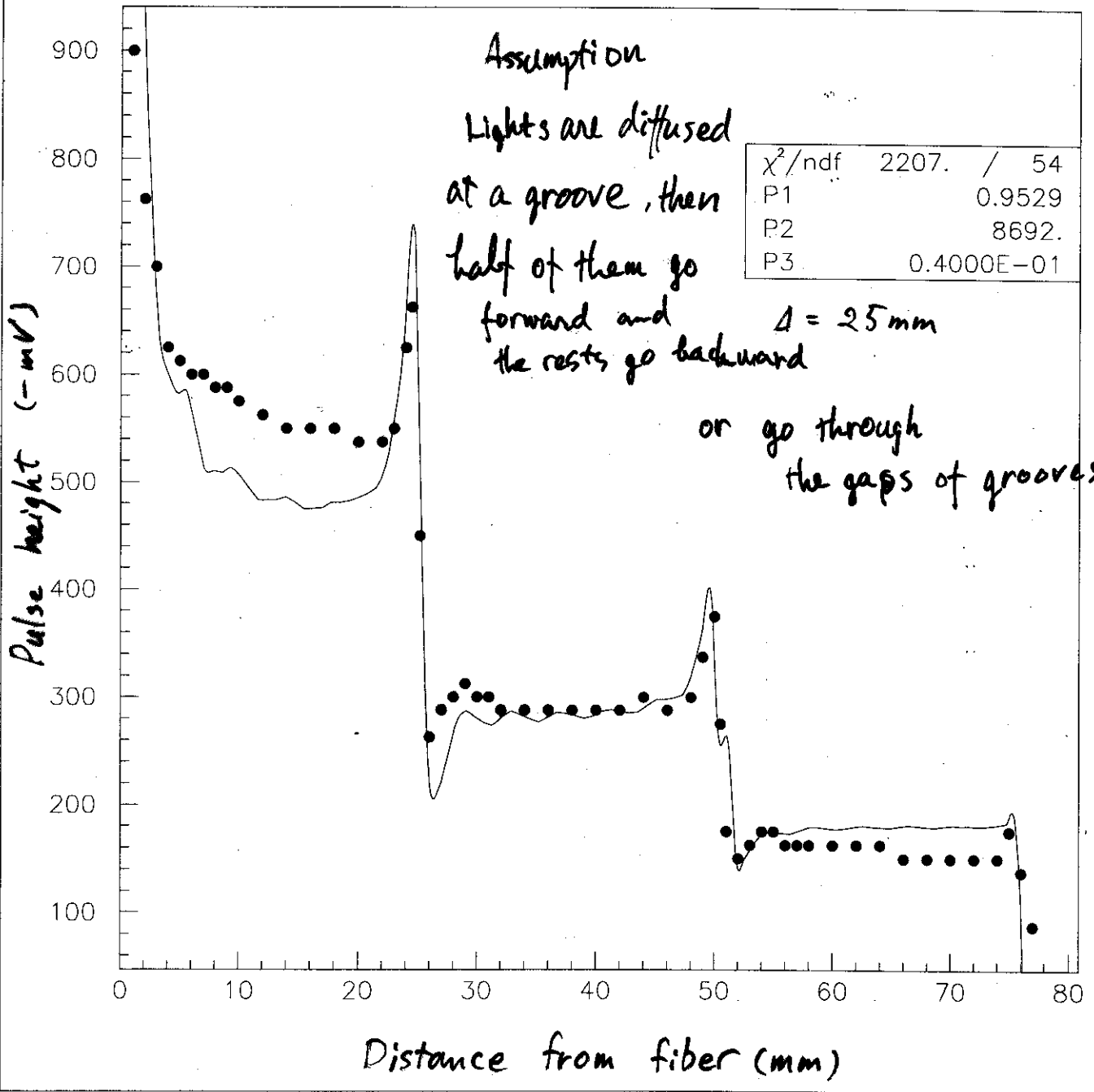


$\Delta$ groove 25mm

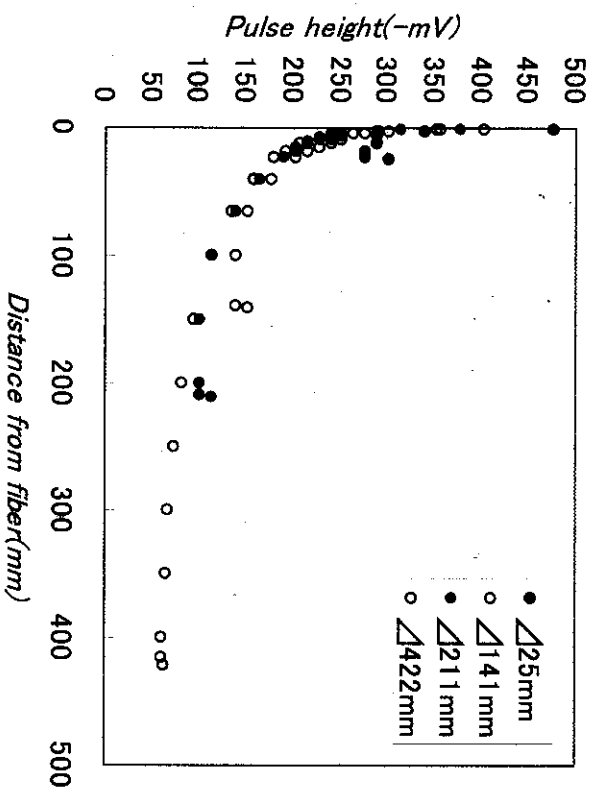


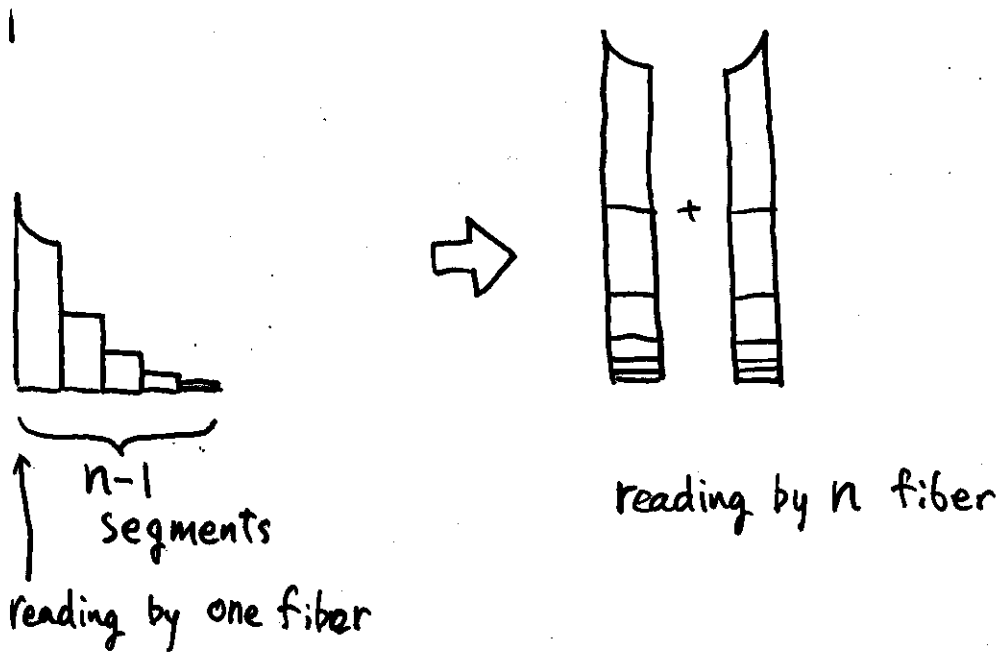
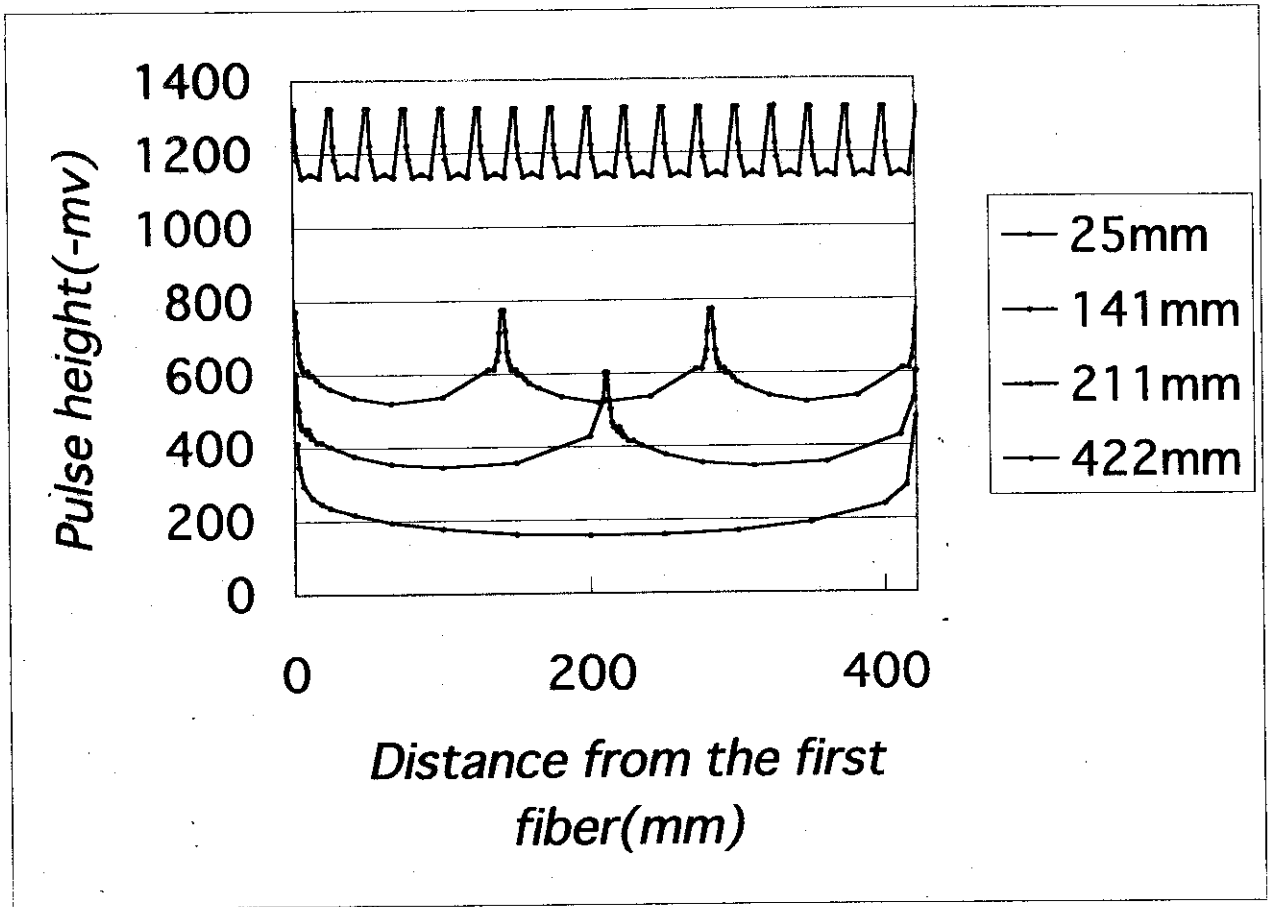
## The effects by a groove

- Light is diffused at the wall of groove having the ratio as its angular coverage.
- As a hindrance for light emitted at just behind groove.



How many segments shall we divide the scintillator ?



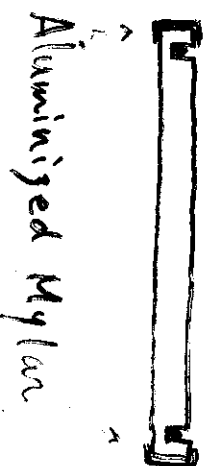
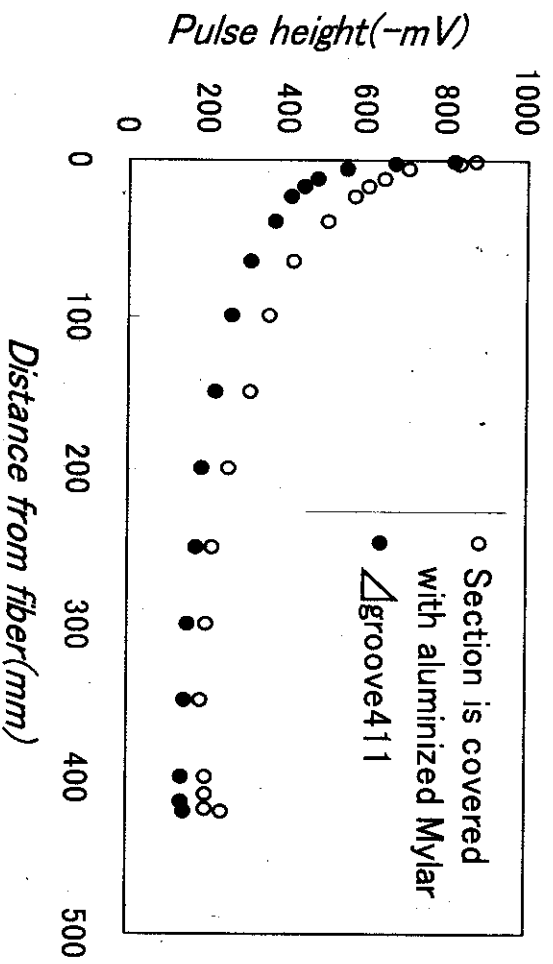


Four main mechanism for the reading out by fiber.

1. The solid angle of the real fiber.
2. Total reflection at the face of scintillator (with light loss at every reflection).
3. Light is diffused at the wall of a groove.
4. Hindering at the shadow of a groove.

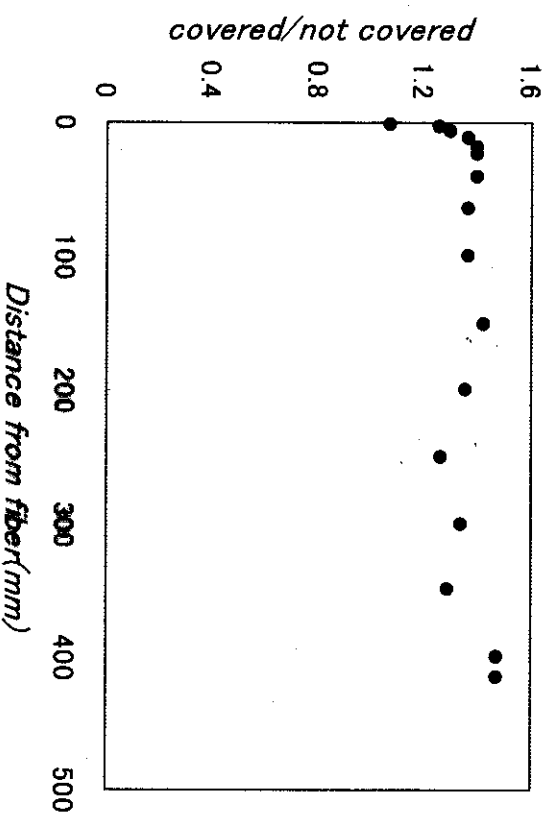
# The effect of covering with aluminized Mylar

$\Delta$ groove 422mm



Both sides of edges are covered with aluminized Mylar.

# Light increase by covering the edge with aluminized Mylar

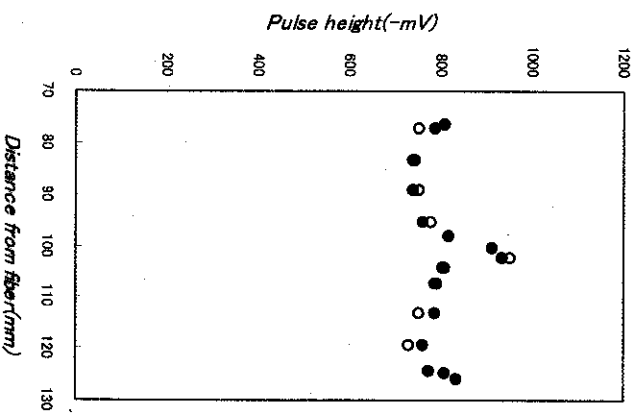
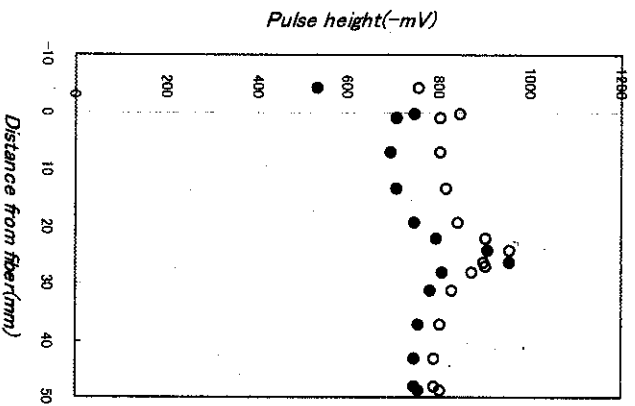


∇422mm

Full cover : Section : no cover  
||  
1.6 : 1.5 : 1  
∇211mm  
at 150mm from fiber

The effect ratio becomes 1.4 ~ 1.5 at > 4mm from the fiber.

# The effect of Al/Mylar to inner fibers.



- The aluminized Mylar at the edge makes the shape symmetric.
- The shape is symmetric at inner segments without Al/Mylar.

## Conclusion

- The uniformity of light output is determined by 4 contribution.
- The light output  $\propto \sum_{i=1}^N (1/2)^i$  : n = #fiber - 1
- Reflecting the light at the edge of scintillator by aluminized Mylar is effective (1.4 ~ 1.5)

## Next steps

- Will determine the deviations depend on the given threshold of energy of coming particles into various scintillators measuring the amount of collected light for MIP.
- Will try to find an efficient way to collect light for KAMI.