

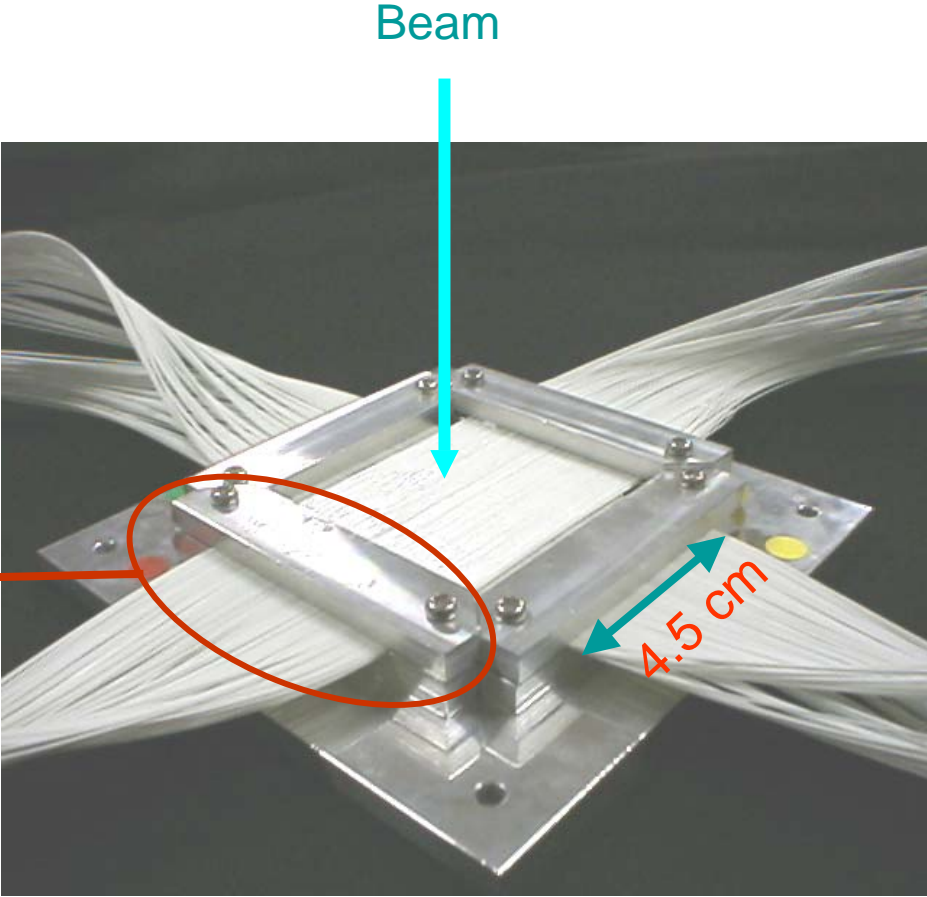
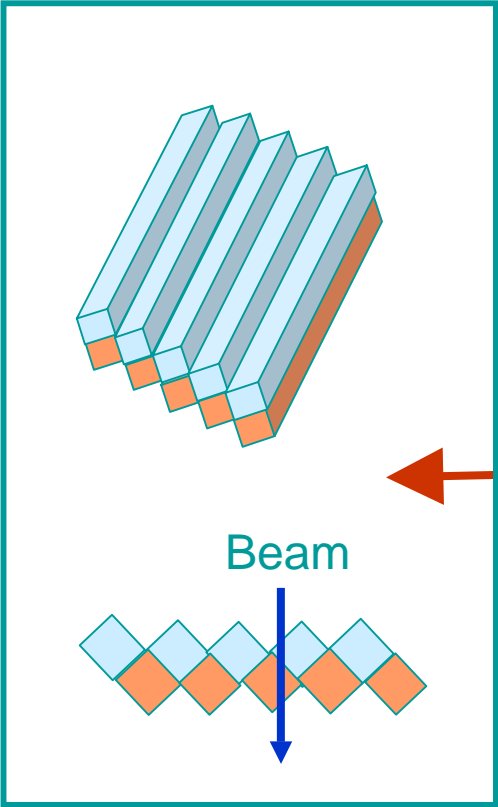
# High resolution scintillation-fiber detector

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Superheavy Element Lab.*  
森本 幸司 (Kouji Morimoto)

シンチ・ファイバーをX,Yに敷いた、荷電粒子用の位置検出器

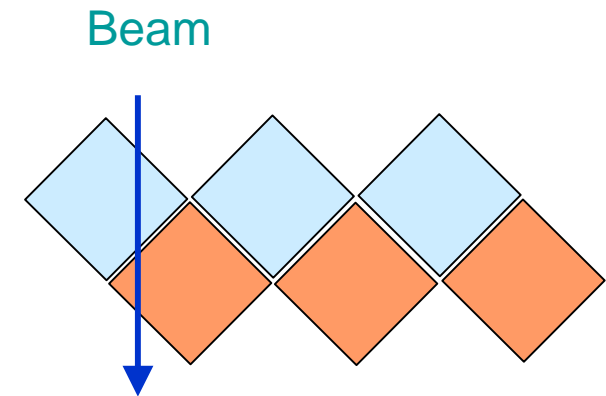
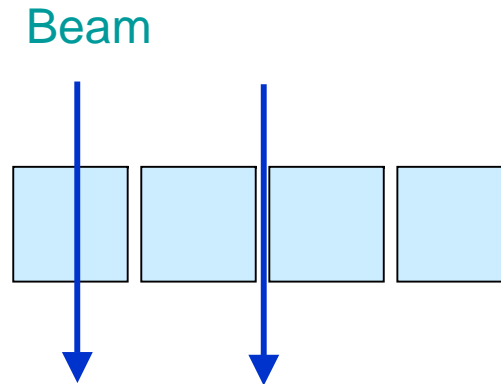
Effective area:  $45 \times 45 \text{ mm}^2$   
Position resolution:  $< 100 \mu\text{m}$  ( $^{40}\text{Ar}$  95 MeV)  
High rate: 47% ( $3.8 \times 10^6 \text{ cps}$ )

# Stacking method



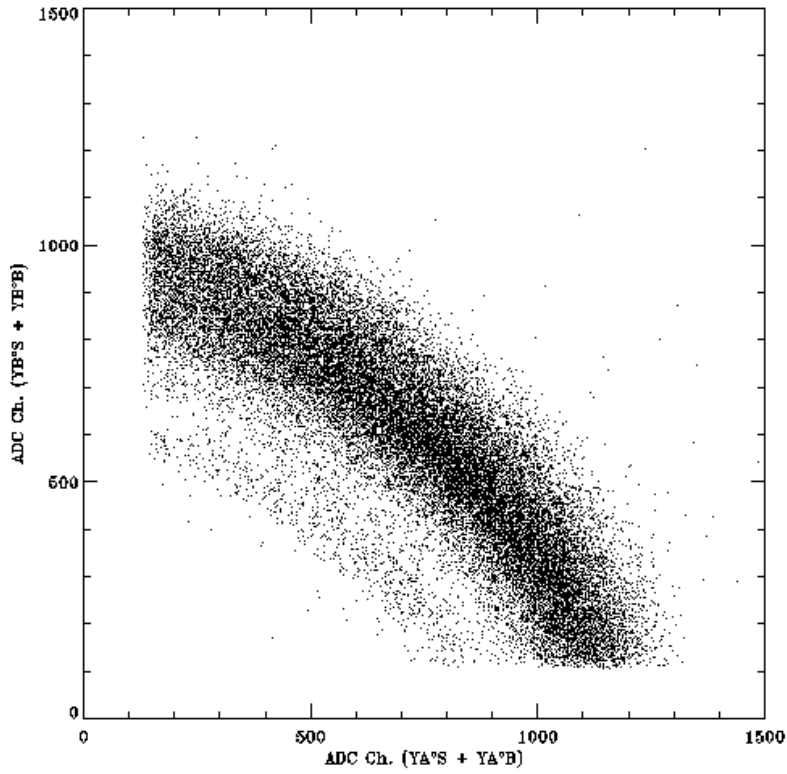
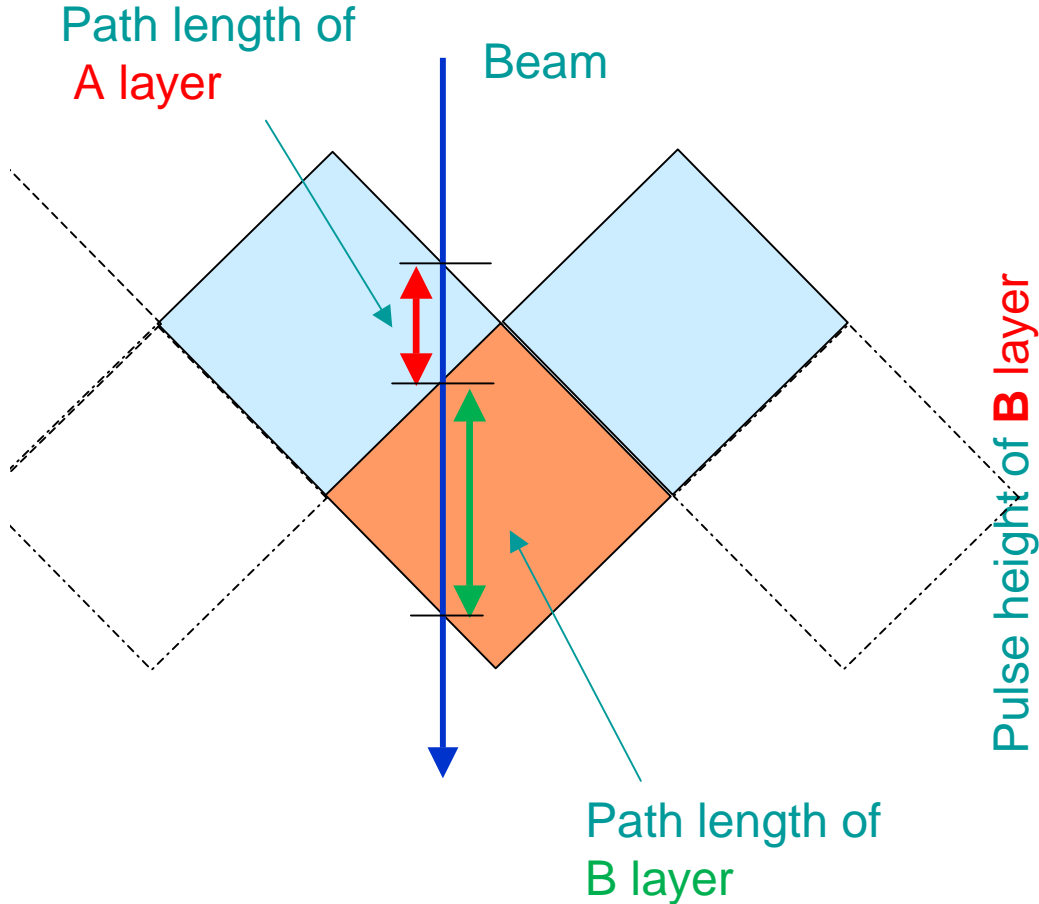
0.5mm角 x 256本

# 斜めにファイバーをスタックする利点 advantages of slant(tilt) stacking



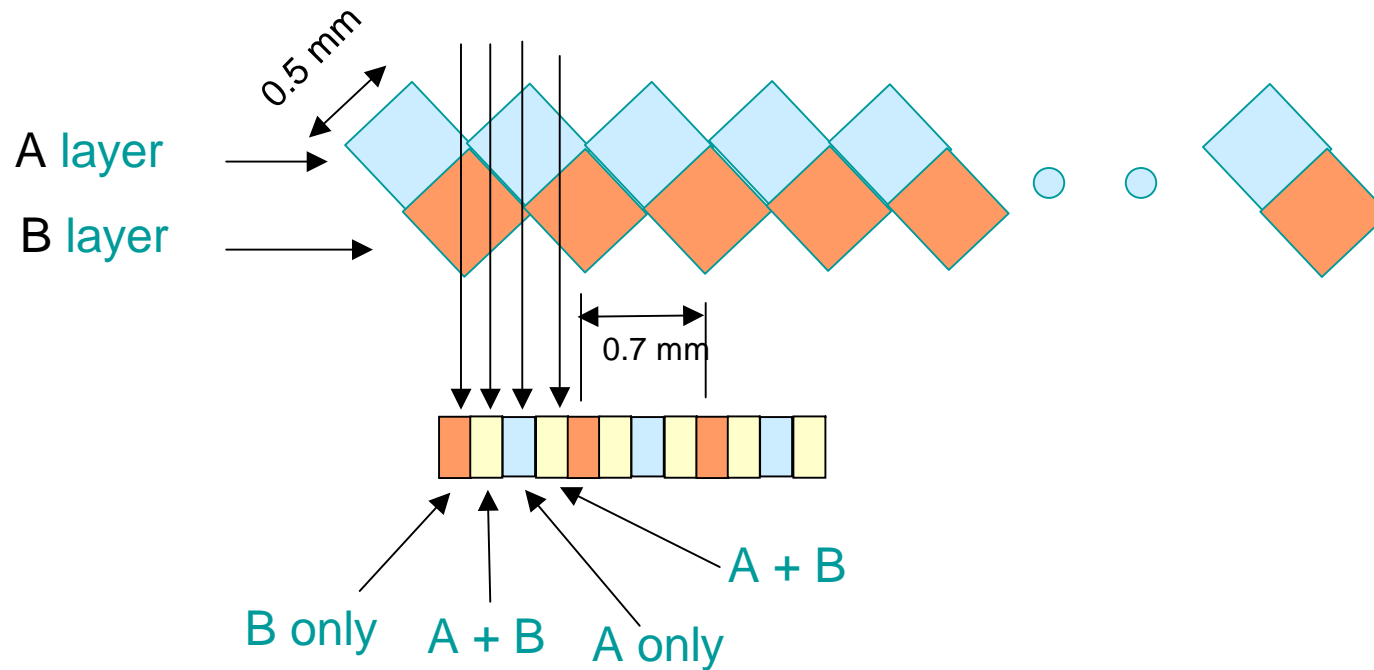
検出効率 Detection efficiency	~ 80%	~ <b>100%</b> (single event)
位置分解能 Position resolution	ファイバーの直径 Same as fiber diameter	less than fiber diameter <b>High resolution</b>
透過物質 Uniformity of passing material	不均一 ununiform	均一性が良い <b>uniform</b>

# Method for High definition



Pulse height of A layer

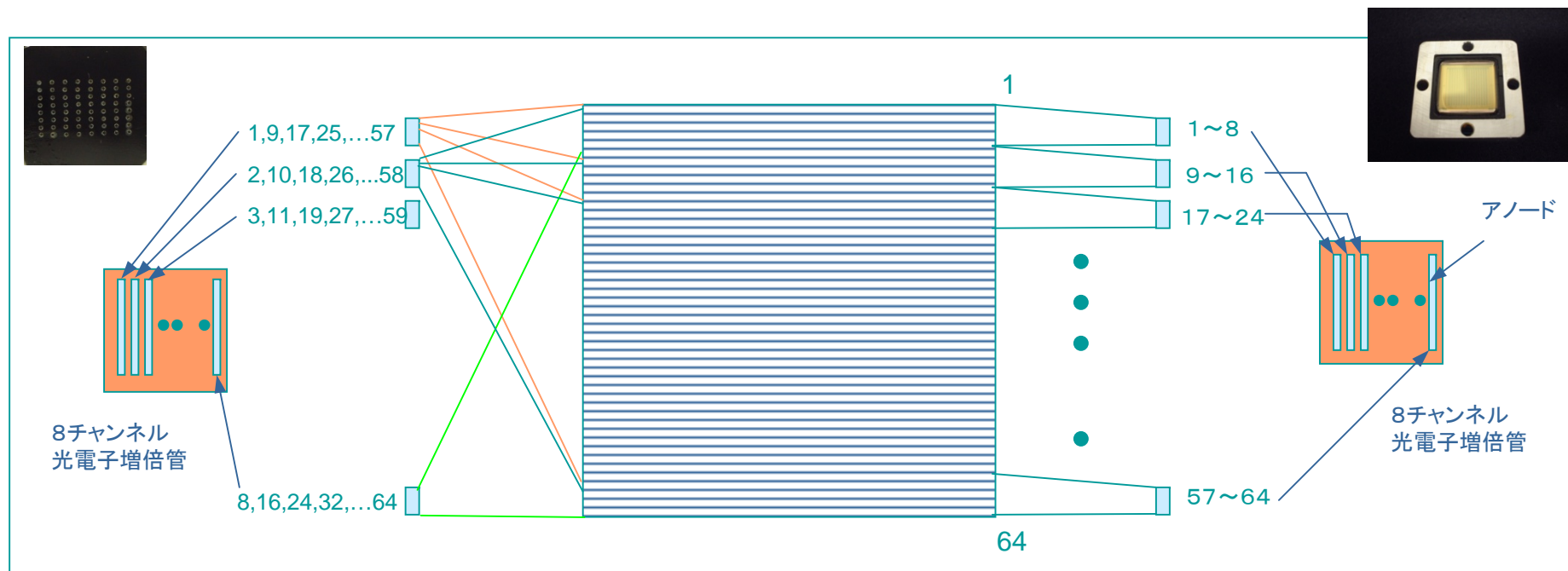
# Position Resolution (low definition)



$$0.7 / 4 = 0.1768 \text{ mm}$$

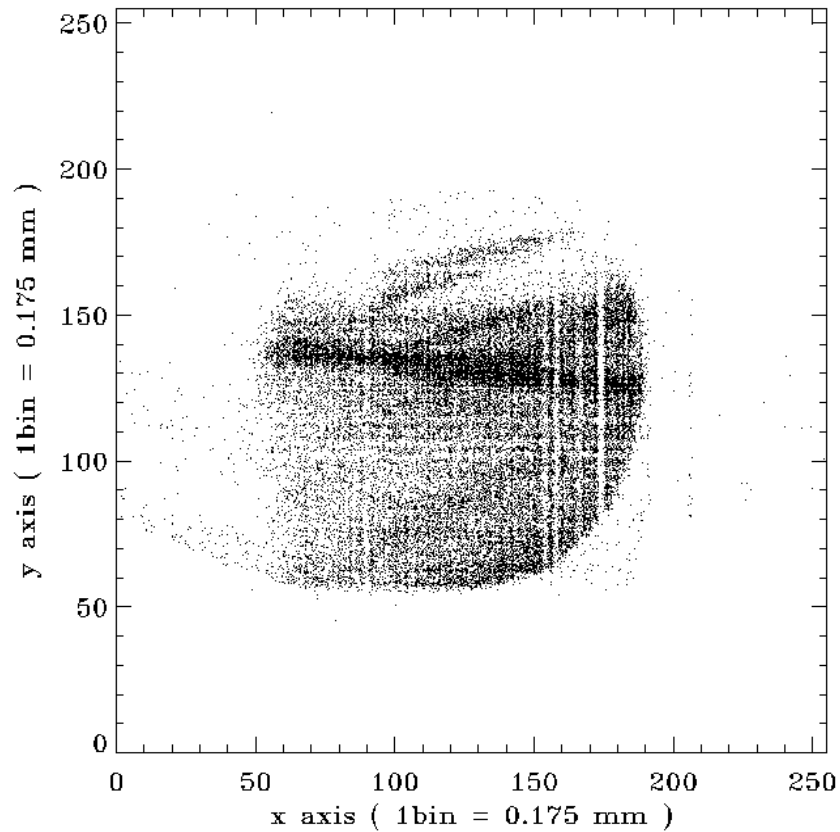
# Encoding readout method using MultiAnode-PMT

- ファイバーからの光子は以下の様に**64本を1組**として、**8ch.x2**のMA-PMTで読み出す。各anode出力はdiscr.で処理され、**hit-pattern**をデータとする。
- 各MA-PMTからは**last-dinode** の出力を引き出し**各層の光量のデータ**とする。



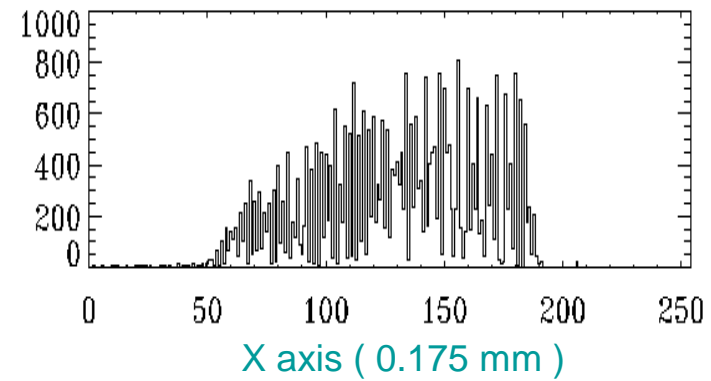
# Beam Image

Beam image at E1-C beam line  
( de-focus )

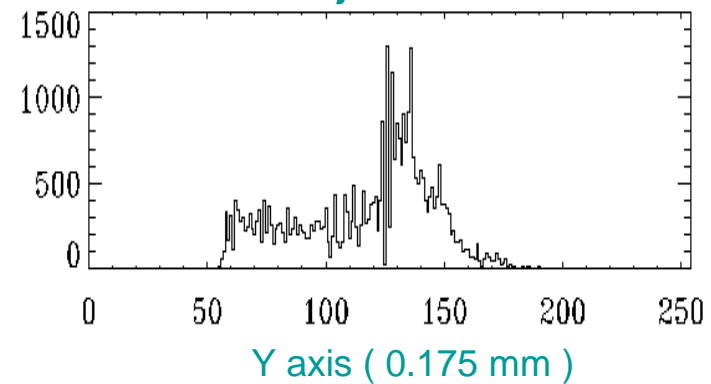


Beam intensity: **500 cps**

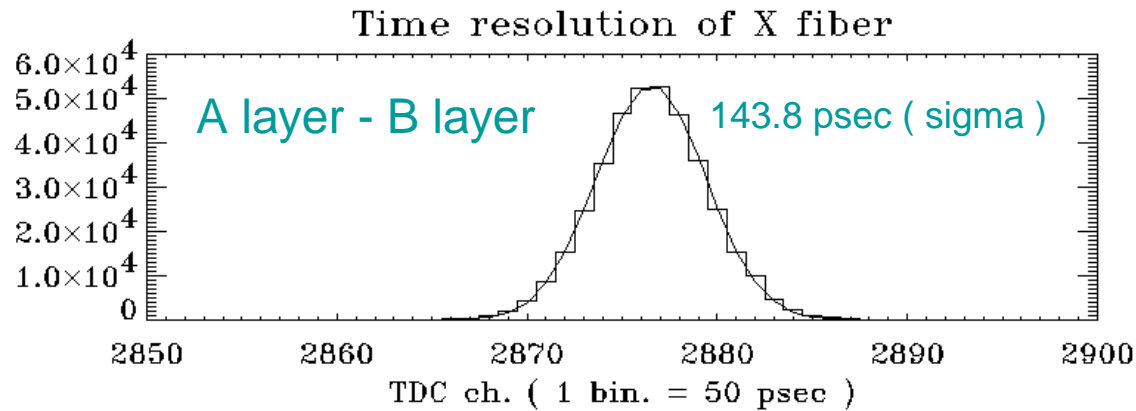
Projection X



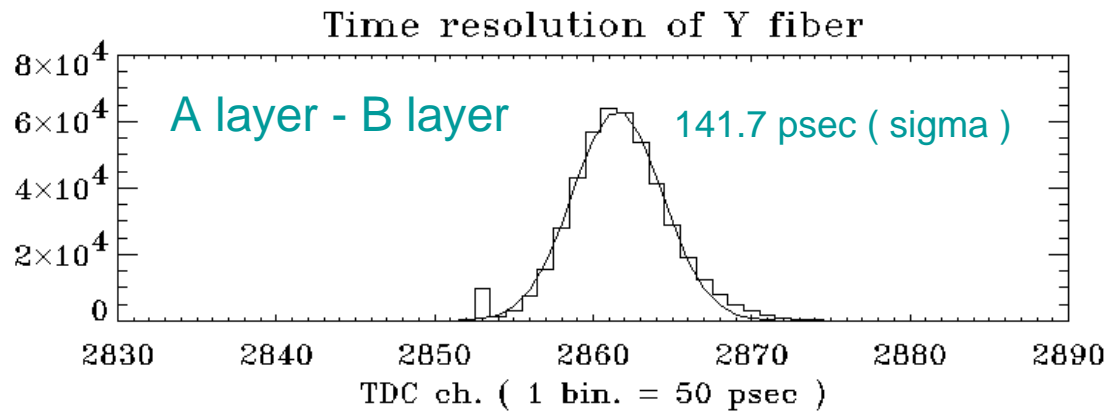
Projection Y



# Timing resolution



X layer:  
 $143.8 / \sqrt{2} = 101.7$  psec



Y layer:  
 $141.7 / \sqrt{2} = 100.2$  psec

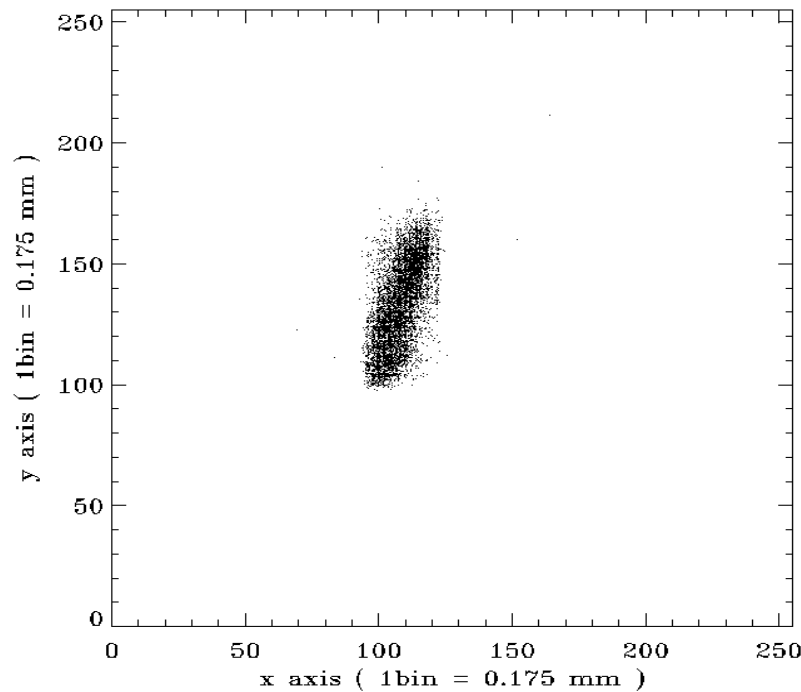
(sigma)



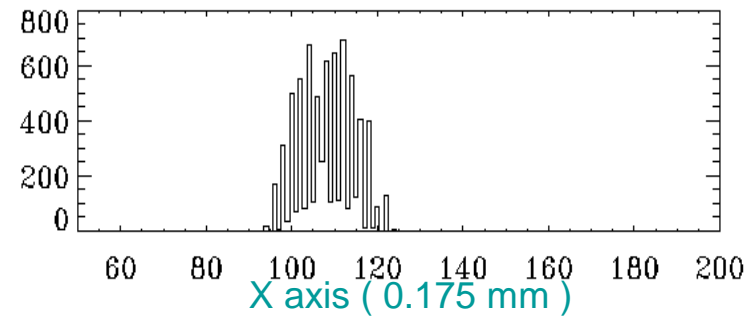
# Detection efficiency (high rate)

Beam intensity:  $3.8 \times 10^6$  cps  
Detection efficiency: 46.7 %

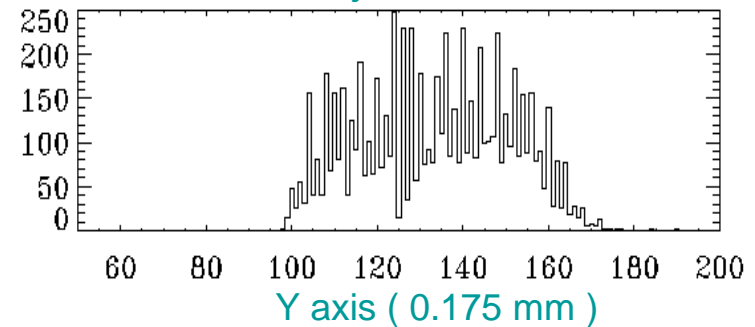
Beam image ( focused )



Projection X

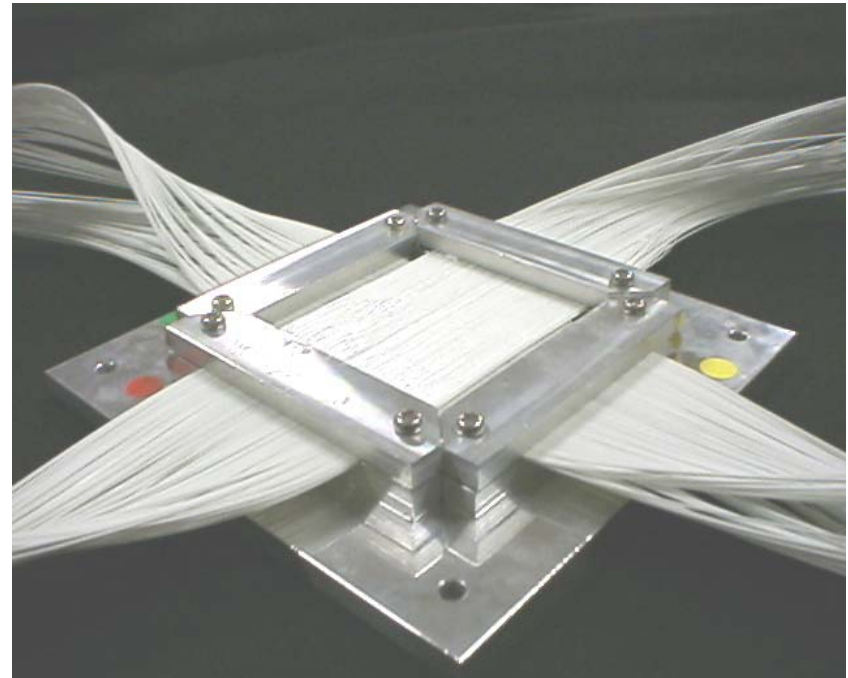
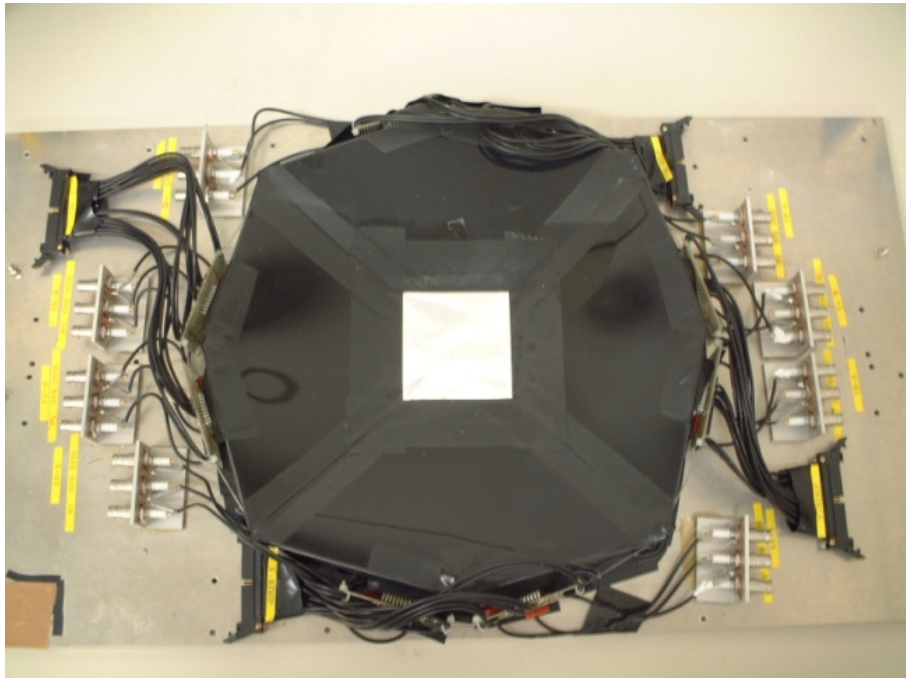


Projection Y



さらにhigh rateに対応させたい場合(マルチヒット、イベントの区別)には、X,Y層に45度傾けたもう一層を加え3層構造にすれば良い。

# High resolution scintillation-fiber detector



# Summary

Fibers:	0.5 mm square x 256
Effective area:	45 × 45 mm <sup>2</sup>
Position resolution:	< 100 μm ( <sup>40</sup> Ar 95 MeV)
Detection efficiency (low rate):	~100% (monochrome beam)
Detection efficiency (high rate):	47% (3.8 × 10 <sup>6</sup> cps)
Timing resolution:	235 psec (FWHM)
Read out electronics:	64ch. Discr. and Coin. Reg. 4ch. Q-ADC