

Position resolution study [2023.10.04]

Material : Pb

**Fiber : scint
scint&cerenkov**

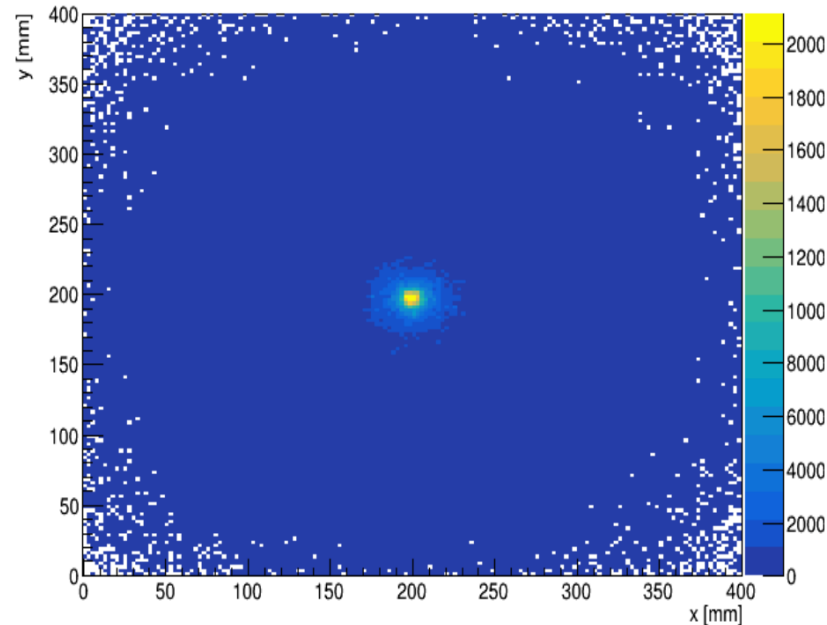
Fiber to fiber 2.5mm

Num of fiber 160 x 160

Tower size Depth 1500

Weight 400

Height 400

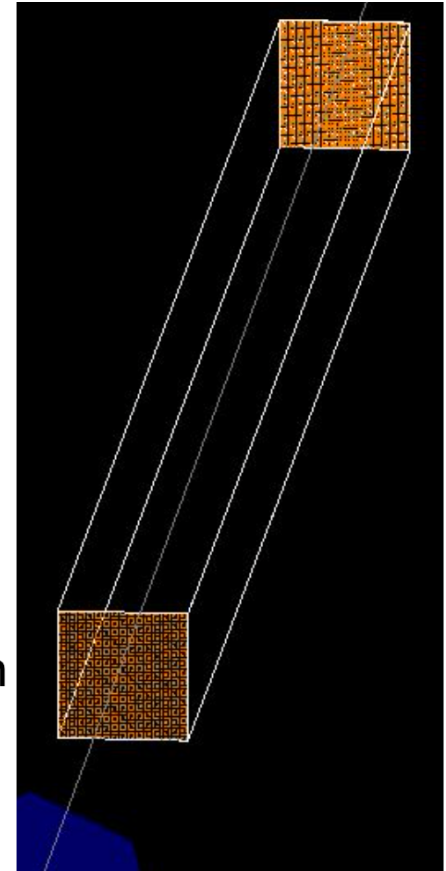


Example response to a 10 GeV single neutron

Beam

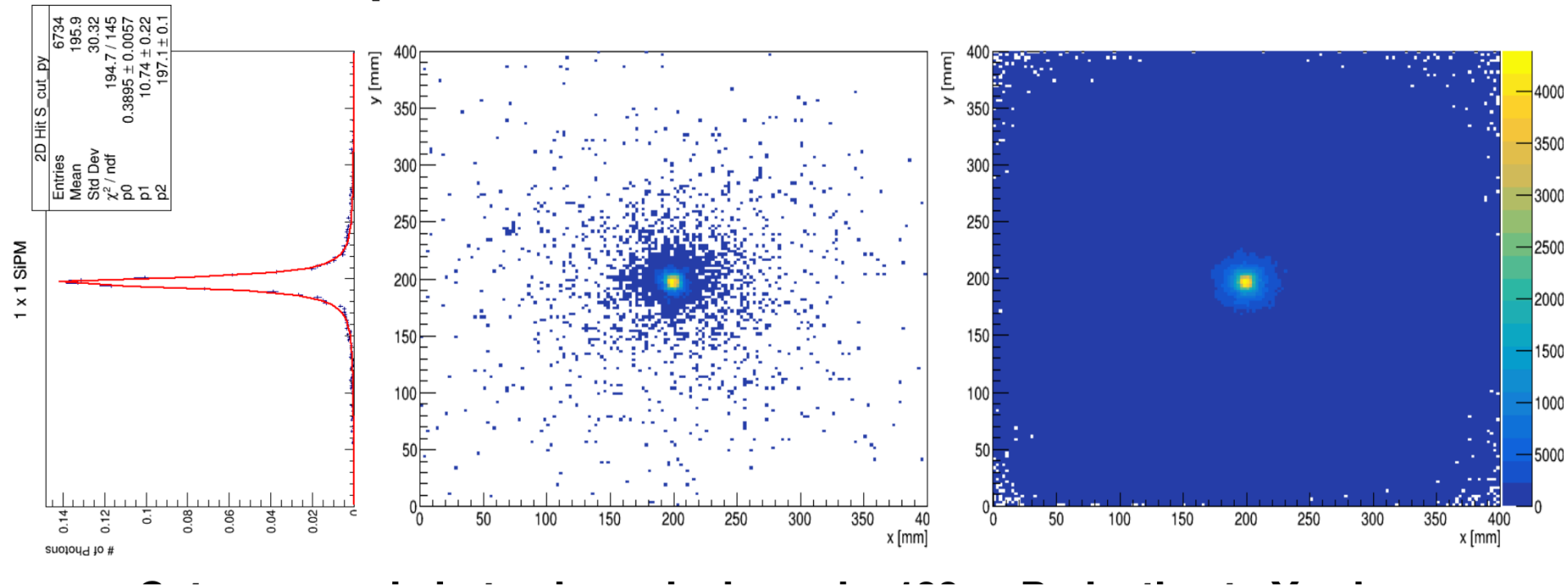
Simulated 8 different neutron energy

10, 20, 50, 70, 90, 110, 130, 150 GeV



Photon Collection

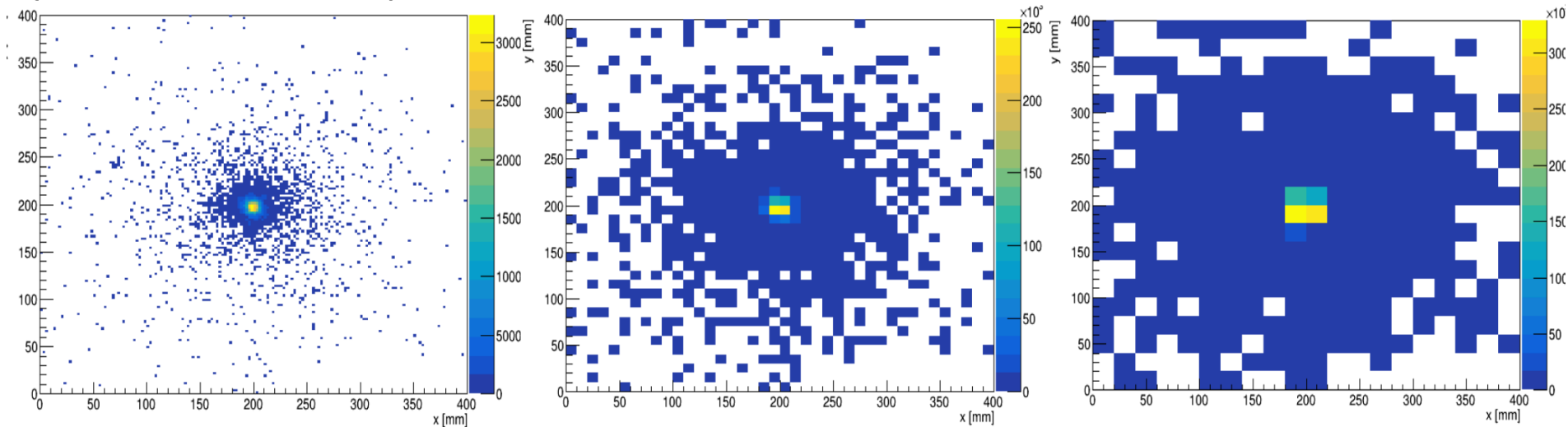
Distribution of photon at the fiber end



Grouping of fibers

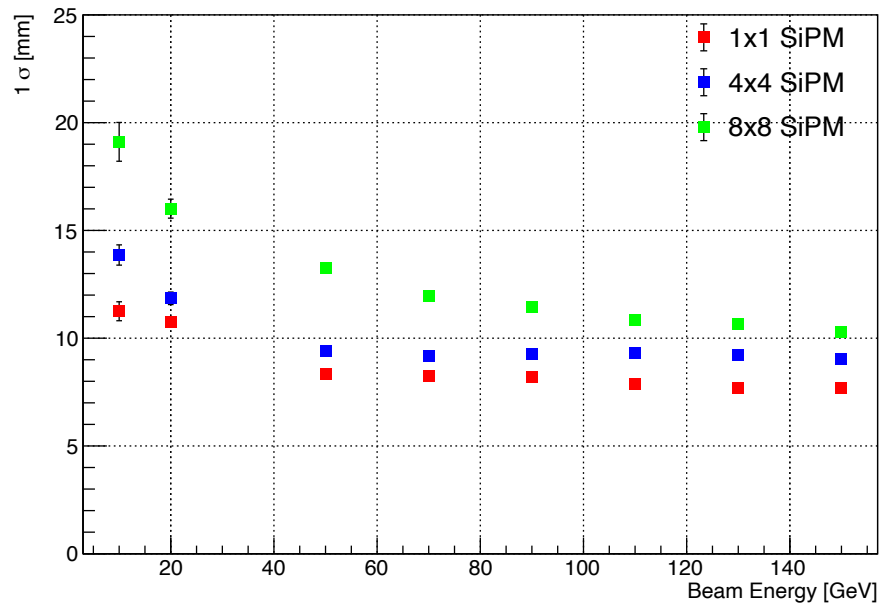
1. SiPM attached to every fibers (SiPM- 1x1 fiber) 160 x 160 SiPM
2. SiPM attached per 16 fiber (SiPM- 4x4 fiber) 40 x 40 SiPM
3. SiPM attached per 64 fibers (SiPM- 8x8 fiber) 20 x 20 SiPM

(Total 160x160 fibers)

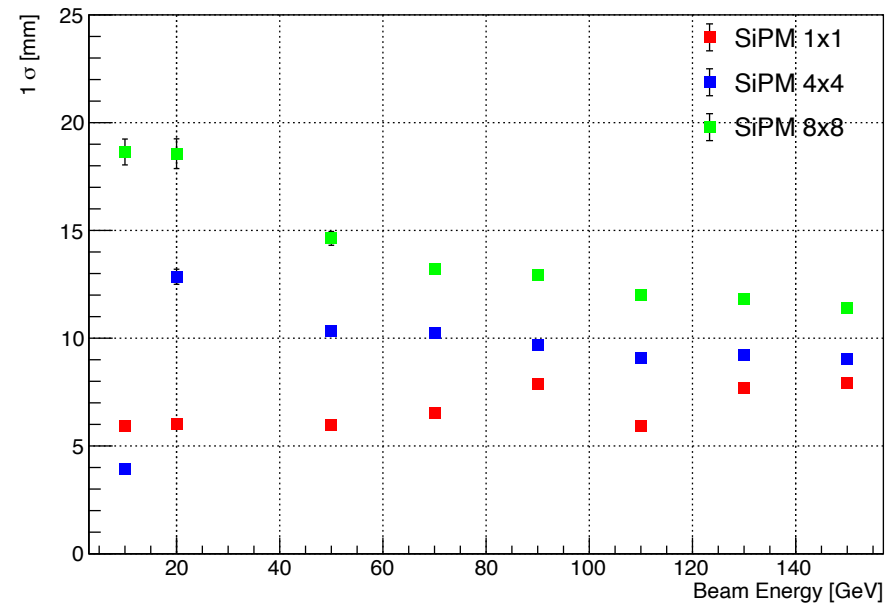


Grouping dependence of Position Resolution

Only scintillator fibers



scintillator + Cherenkov fibers



- Caveat: Don't trust red points in this plot for its bad fit
- This plot just shows that dual-readout scheme slightly degrades the position resolution

PRICE ESTIMATION

ZDC-h: [60cm x 60cm x 150cm]

			Price (\$)		
	Unit price (\$)	Dim	SiPM for each fib	1 per 16 (4x4) fib	1 per 64 (8x8) fib
Fiber-Sc (\$/m)	1.36	240x240x1.5m /2	58752	58752	58752
Fiber-Quartz (\$/m)	0.33	240x240x1.5m /2	14256	14256	14256
Cu capillary (\$/m)	0.15	240*240*2 = 115200 meters	17280	17280	17280
SiPM (piece)	10	240*240 = 57600	576000	36000	9000
SiPM electronics (piece)	10	240*240 = 57600	576000	36000	9000
Total			1242288	162288	108288
		[SiPM+electr]/ Total	0.93	0.44	0.17

- Reference for price

Capillary 0.14Euro/m	https://www.pi.infn.it/~bedeschi/RD_FCC/IDEA_costing/FCC_MidTerm_IDEA_Calo_CostEstimate.pdf Section 2.2
Fibers	https://www.pi.infn.it/~bedeschi/RD_FCC/IDEA_costing/FCC_MidTerm_IDEA_Calo_CostEstimate.pdf Section 2.2

- Need updates for SiPM and electronics