

Portable surface tracker (muon tagger)

July 8 2008 Calibration phone call

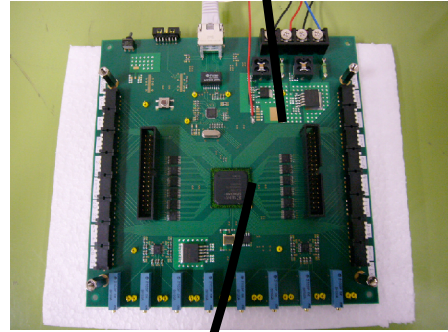
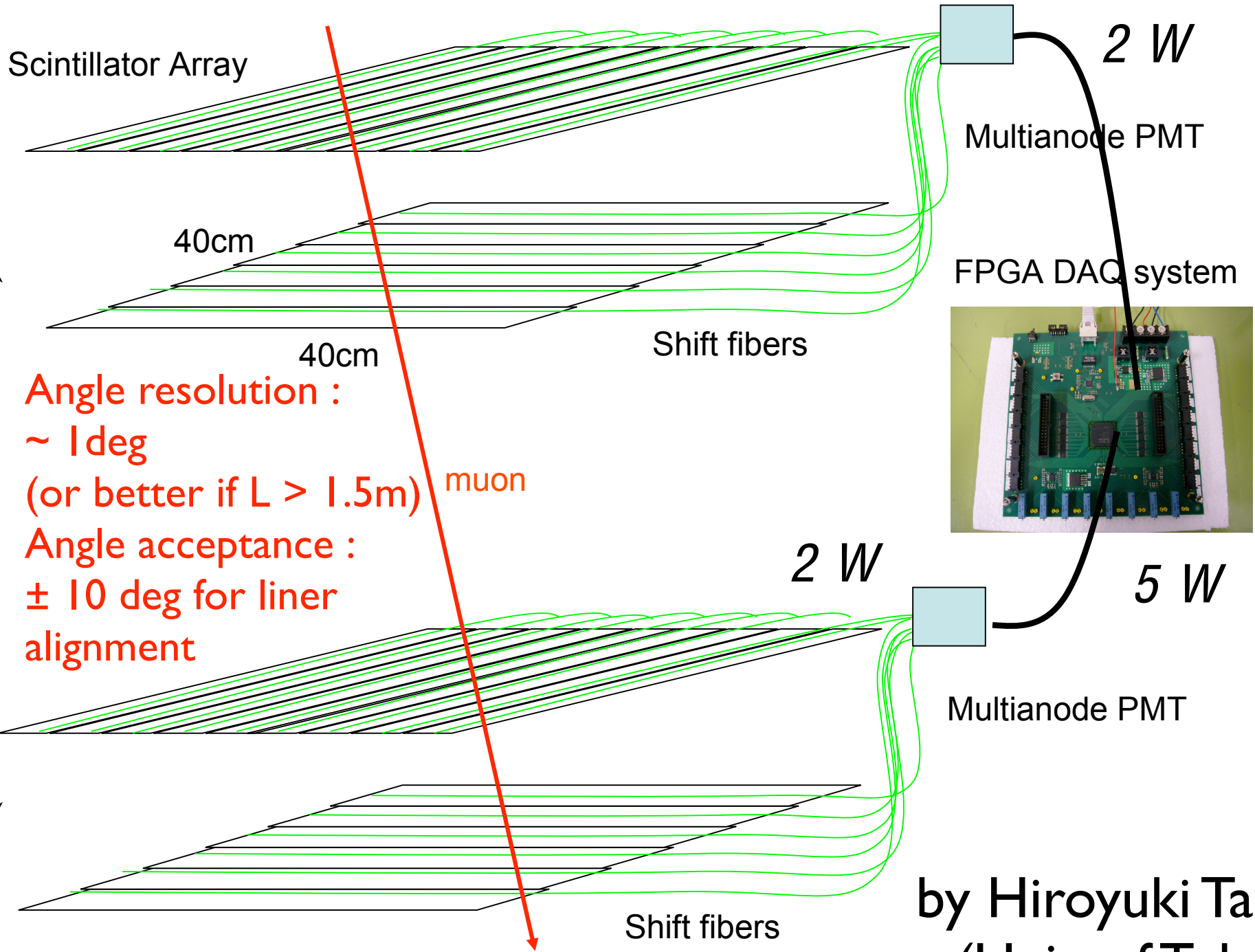
July 11 2008 UW group meeting

(contact person: K.Hoshina)

Motivation

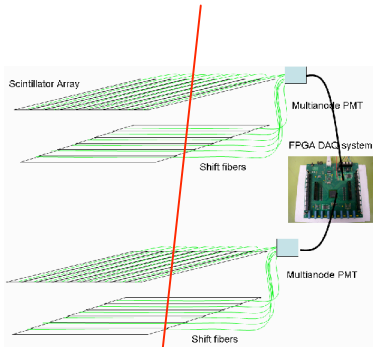
- Considerable disagreement between icesim and real data is not solved yet
- How do we guarantee our reconstruction?
 - for cascade & energy calibration -- use LED and SC as calibration sources
 - for muon track reco -- no calibration beam is available

Use tagged downgoing muon as calibration beam?
-- need high-resolution surface tracker

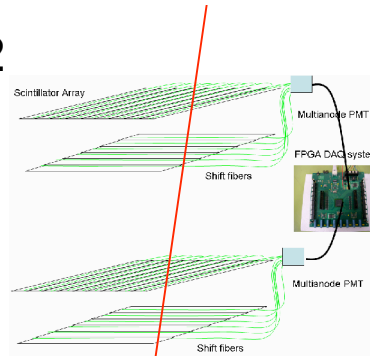


by Hiroyuki Tanaka
 (Univ. of Tokyo)

#1



#2



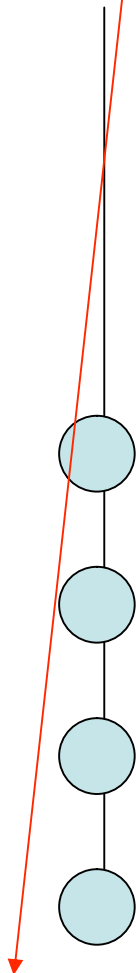
Scintillation detector
Resolution = 1.0 degree

$$(\theta, \phi) = (\theta_1, \phi_1)$$

0m

-1400m

-2400m



event rate:
0.0001 Hz for vertical muons
which reach to -2400m
(trigger rate should be less
than 50Hz)

IceCube

$$(\theta, \phi) = (\theta_2, \phi_2)$$

$$(\theta_2, \phi_2) - (\theta_1, \phi_1) = ?$$

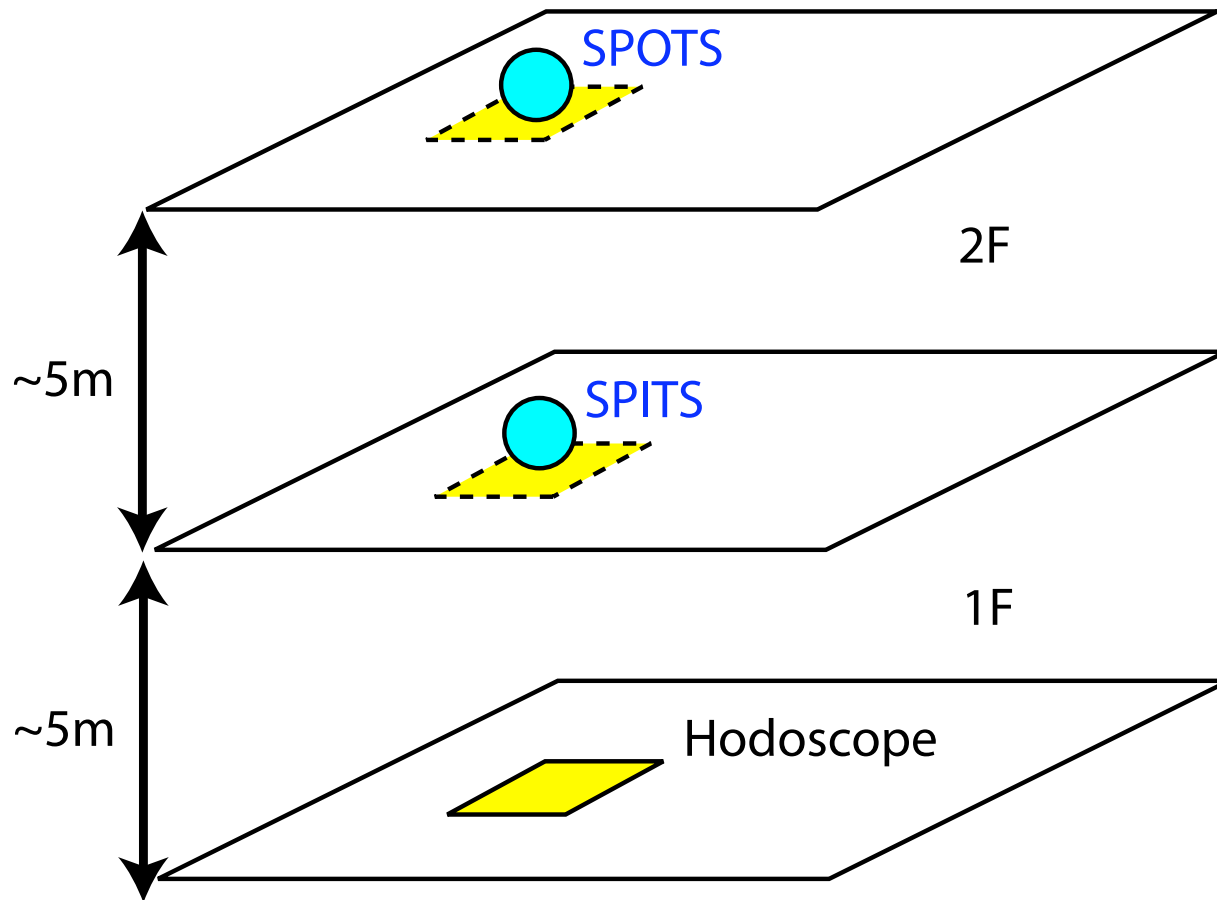
Resolution = ? degree

by Hiroyuki Tanaka
(Univ. of Tokyo)

Deployment option 2

by Albrecht

Counting House



- Put everything in counting house
- easy to get power supply
- better angle resolution ($L > 5\text{m}$)
- possible to combine SPOTS and SPITS

Resolution and acceptance

L [m]	Angle Resolution	Position Resolution at -2000m	Angle Acceptance per module	Event Rate (@ -2400m)
1.5m	~1deg	34m	± 10 deg	>0.001Hz
5m	0.32deg	11m	± 3.2 deg	~0.001Hz
10m	0.16deg	5.6m	± 1.6 deg	0.001Hz (8 evts / day)

vertical muon at -2400m : $7.0e-8$ [$\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$]

detector section : 40cm x 40cm

More about surface tracker I

- Small and portable
 - whole-in-one box
 - easy to deploy or move
 - start from two sets?
- works with low power
 - may work with solar panel (summer only)
 - or requires 5 watt per detector

More about surface tracker 2

- On-Board DAQ
 - almost ready if we use it stand-alone (do not require coincidence trigger with InIce)
- Need access to GPS time for stand-alone operation
- Data storage
 - HD for short time operation
(~3 month : ~720 path-through vertical events)
 - wireless transfer?

More about surface tracker 3

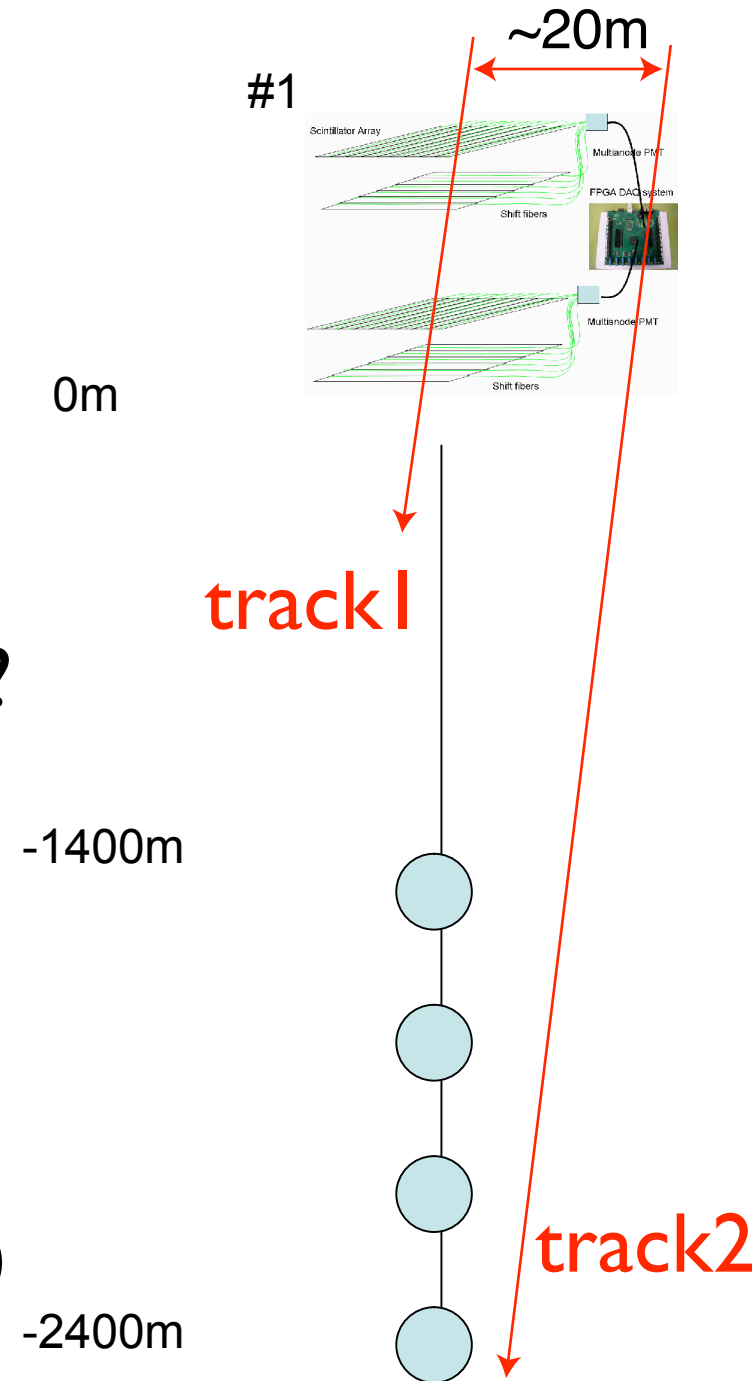
- Devices are almost ready (for muon tomography of volcanos)
- Cold test -- Large freezer is available at University of Tokyo
- Need to open small window in level0 filtering -- for vertically downgoing muons at detector position
- In future, if we want, develop coincidence trigger with Ice trig then we may get non-vertical beam (~20deg if we deploy surface detector within icetop area?)

Open discussion

- The tagged muon does not have energy info. Does it really useful for calibration?
 - YES if we take $L=5\text{m}$ or 10m option (angle resolution $< 0.3\text{deg}$)
- Can we deploy it in this winter?
 - YES if we take option 2

Questions at calib. call

- We need to think about muon bundles
- with $L=10\text{m}$, position resolution at -2000 is $\sim 5\text{m}$. Can we reject track2 with InIce reconstruction?
- Need simulation
- Confirm parameters
 - height of counting hall ($\sim 10\text{m}$?)
 - size of hodoscope strips ($\sim 2\text{cm}$?)



Comments at calib. call

- What's the merit of muon tagger relative to using IceTop alone?
 - lower energy range? (depends on cuts)
 - better angle & position resolution (L=10m option)
- What can we do with ~1000 well-reconstructed vertically downgoing muons?
- Possibility to use stand-alone mainboards for readout? (merge them to pdaq and filter)
- We may get technical know-how from IceTop muon tagger system

Remaining questions

- How do we do alignment? (option2)
- Use downgoing muon to align two sets of hodoscope?
- cf. muon rate for 40cm x 40cm -- 48Hz