TAXI

Status and Recent Developments with TAXI

Samridha Kunwar
for the TAXI Group
DESY - Zeuthen

HAP Workshop | The Non – Thermal Universe
Erlangen, 21 – 23 September 2016

HELMHOLTZ | ASSOCIATION
Alliance for Astroparticle Physics

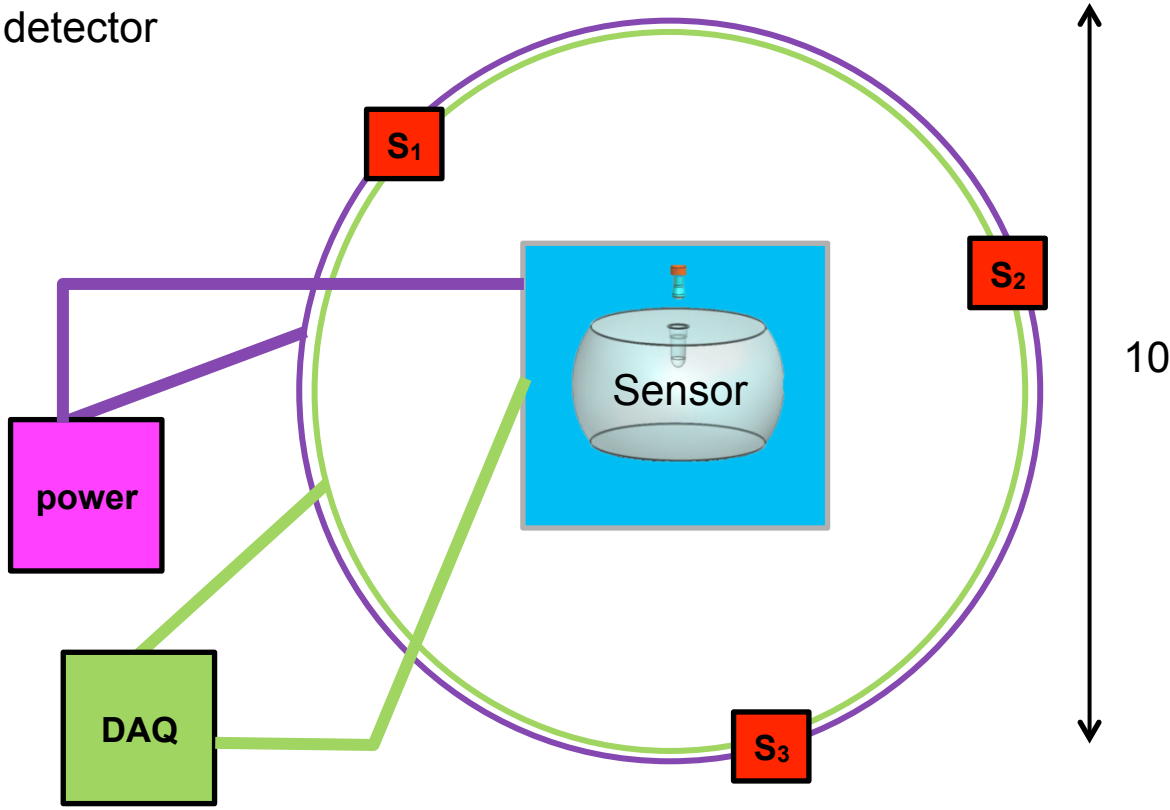
KIT
Karlsruhe Institute of Technology

DESY

TAXI – Transportable Array for eXtremely large area Instrumentation studies

Stand alone **air shower** detector

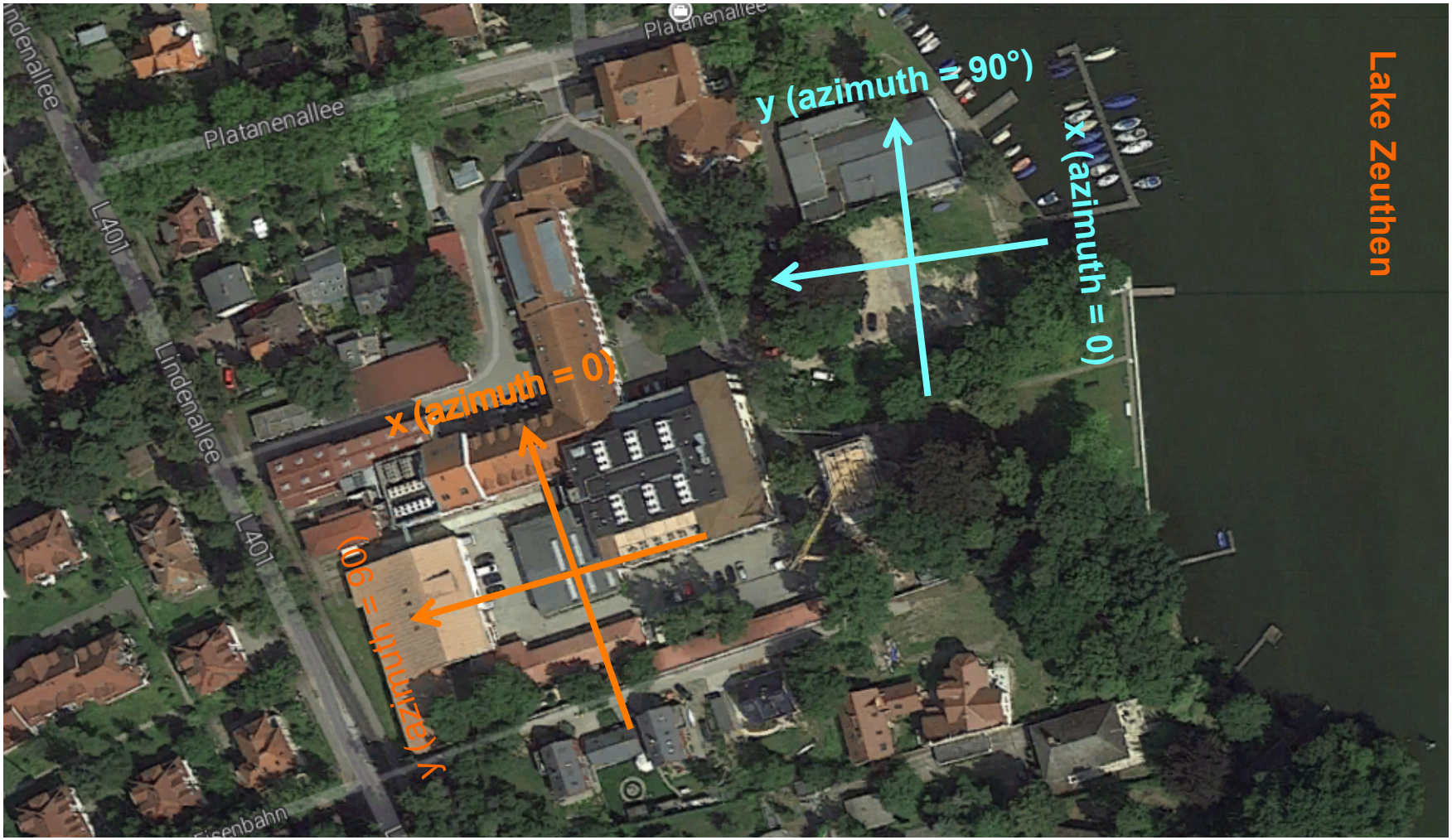
- Modular
- Transportable
- Scalable



24 Channels
Timing via GPS (PPS & NMEA)
Nano - second Resolution for Triggering (sampling discriminator output, SERDES)
Waveform & Charge Information (DRS4 & ADC)
External Trigger Out (currently AERA)
IO Test Pins Available

DESY

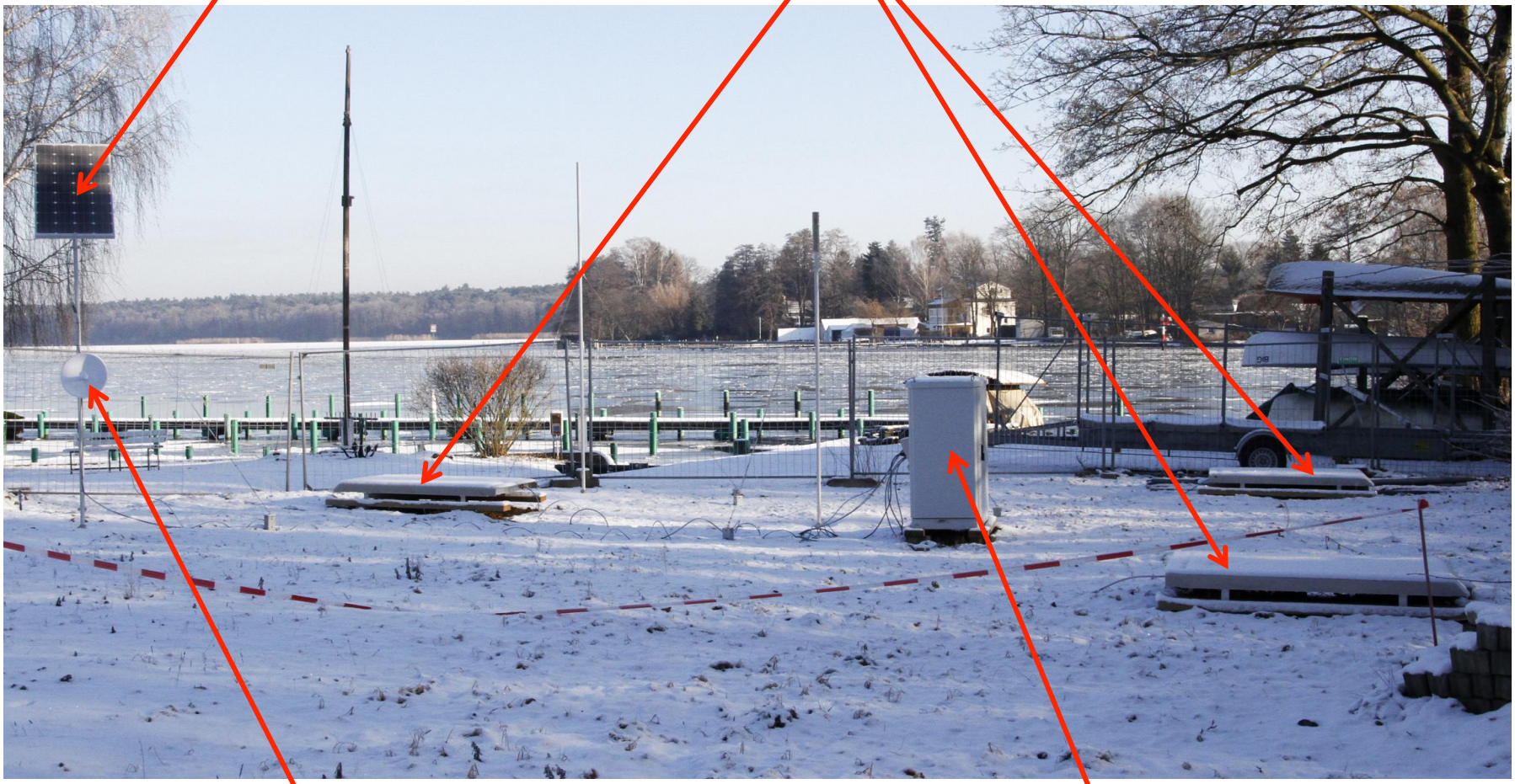
Definition of Coordinate System



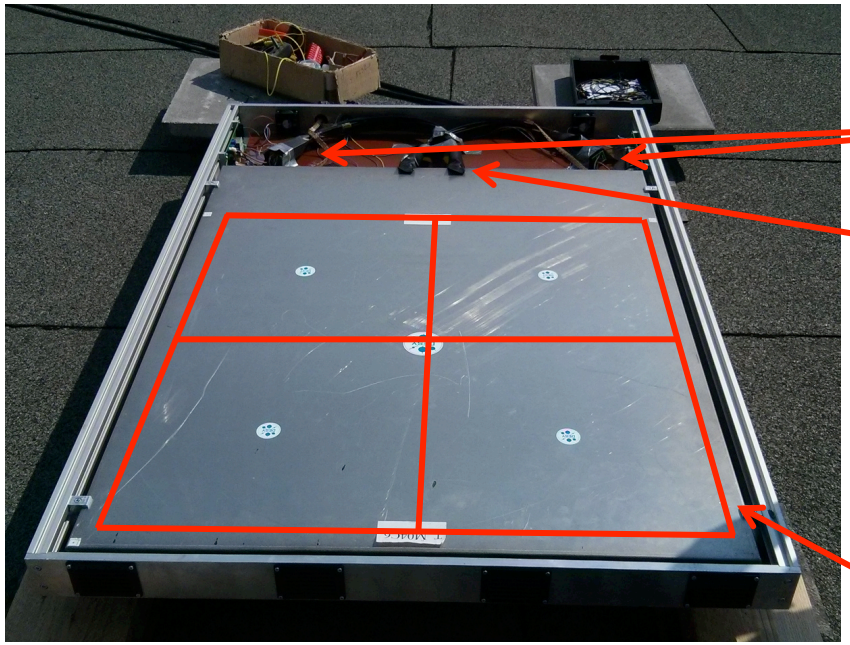
Two Stations Operational : 1) VME and 2) FPGA – MCU based

Current DAQ in operation since Nov 2015

TAXI Station 2



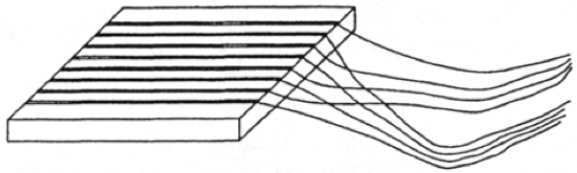
Scintillation Detector



Hamamatsu R 5900-3-M4
2 × 2 multi-anode PMT

optical fibers
each tile read out by 2 sets of fibers

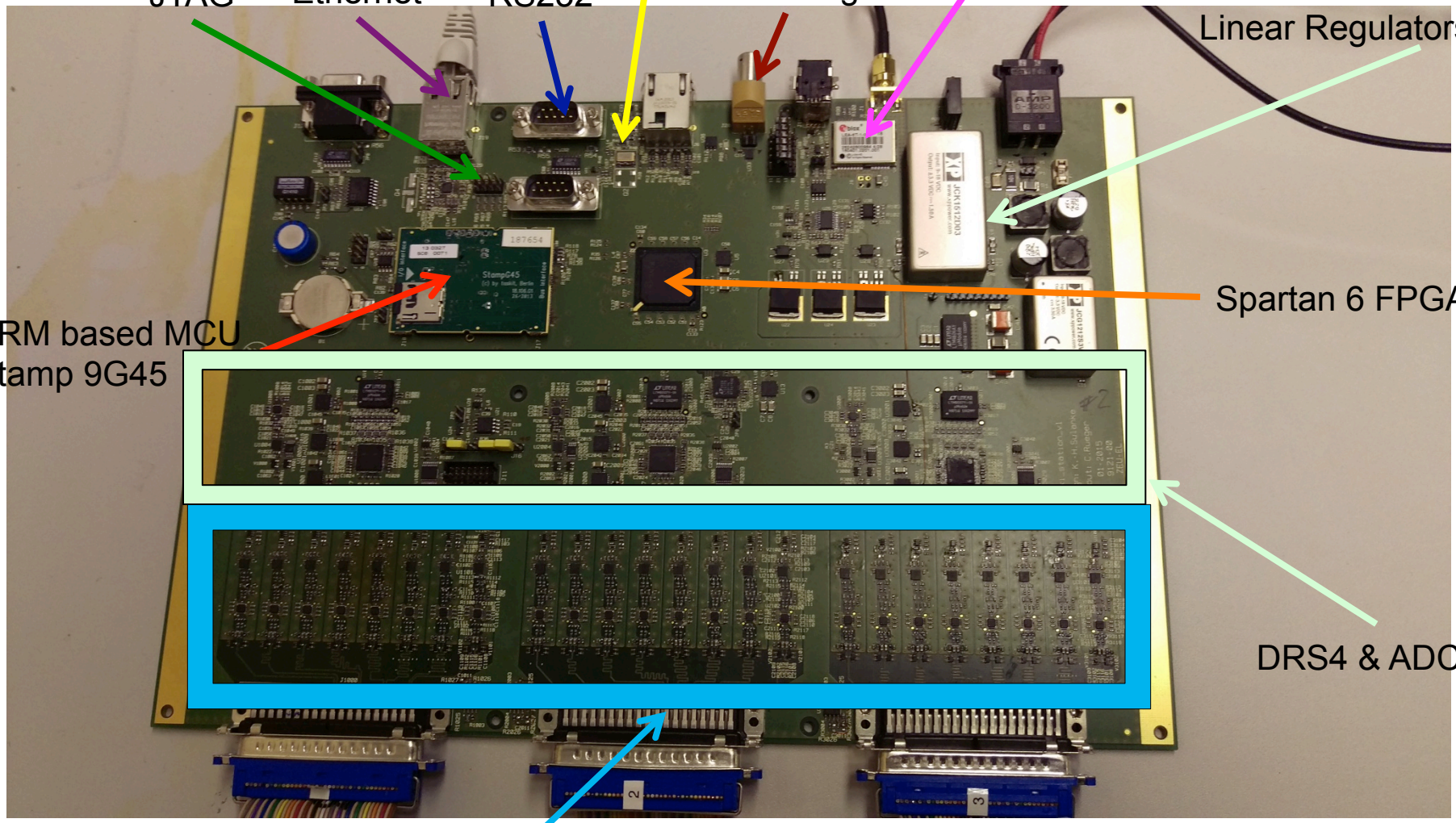
1 m^2 tiled plastic scintillator
16 tiles, 25 × 25 cm each



combined to 4 segments
of 50 × 50 cm for readout

- Input: ± 12 V
- Output: differential,
  analog PMT signal (8 channels)

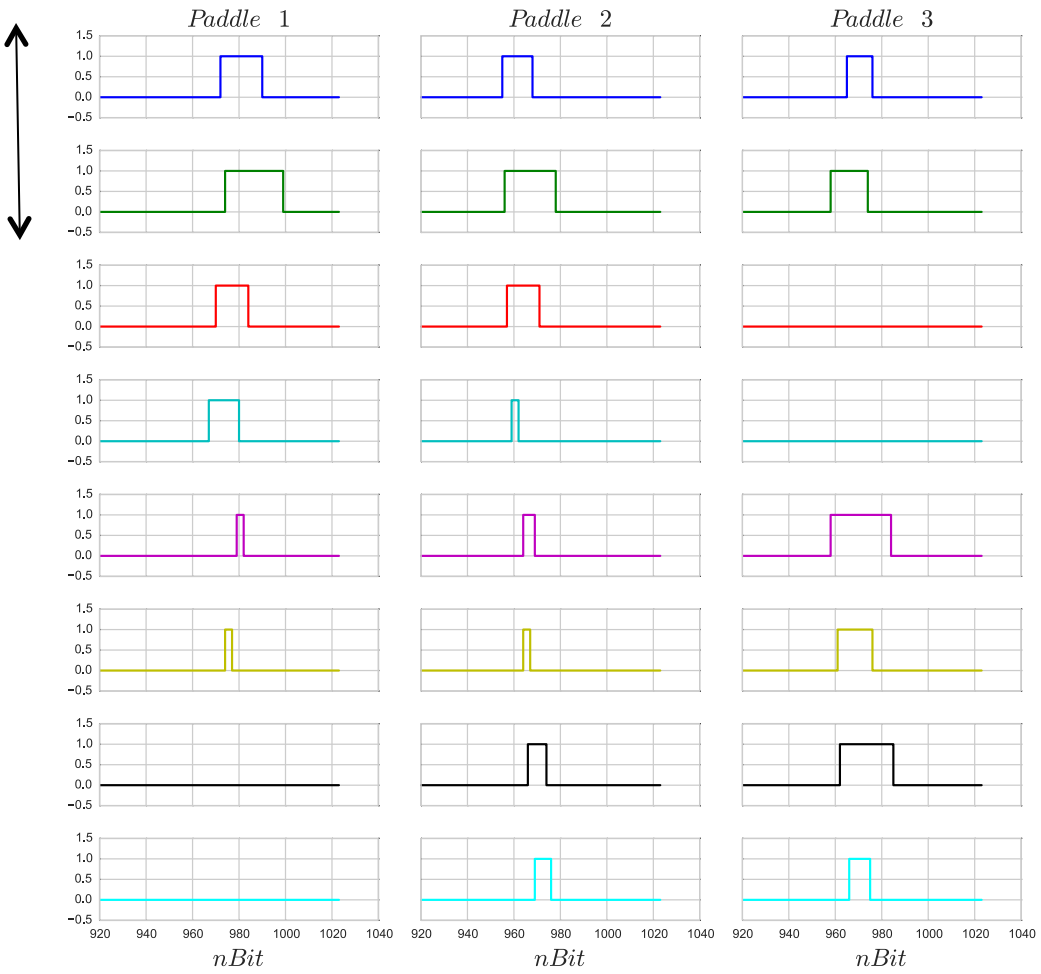
TAXI Main Board



3 Scintillators X 8 discriminators per Scintillator = **24 channels**

Discriminator Output

Tile 1

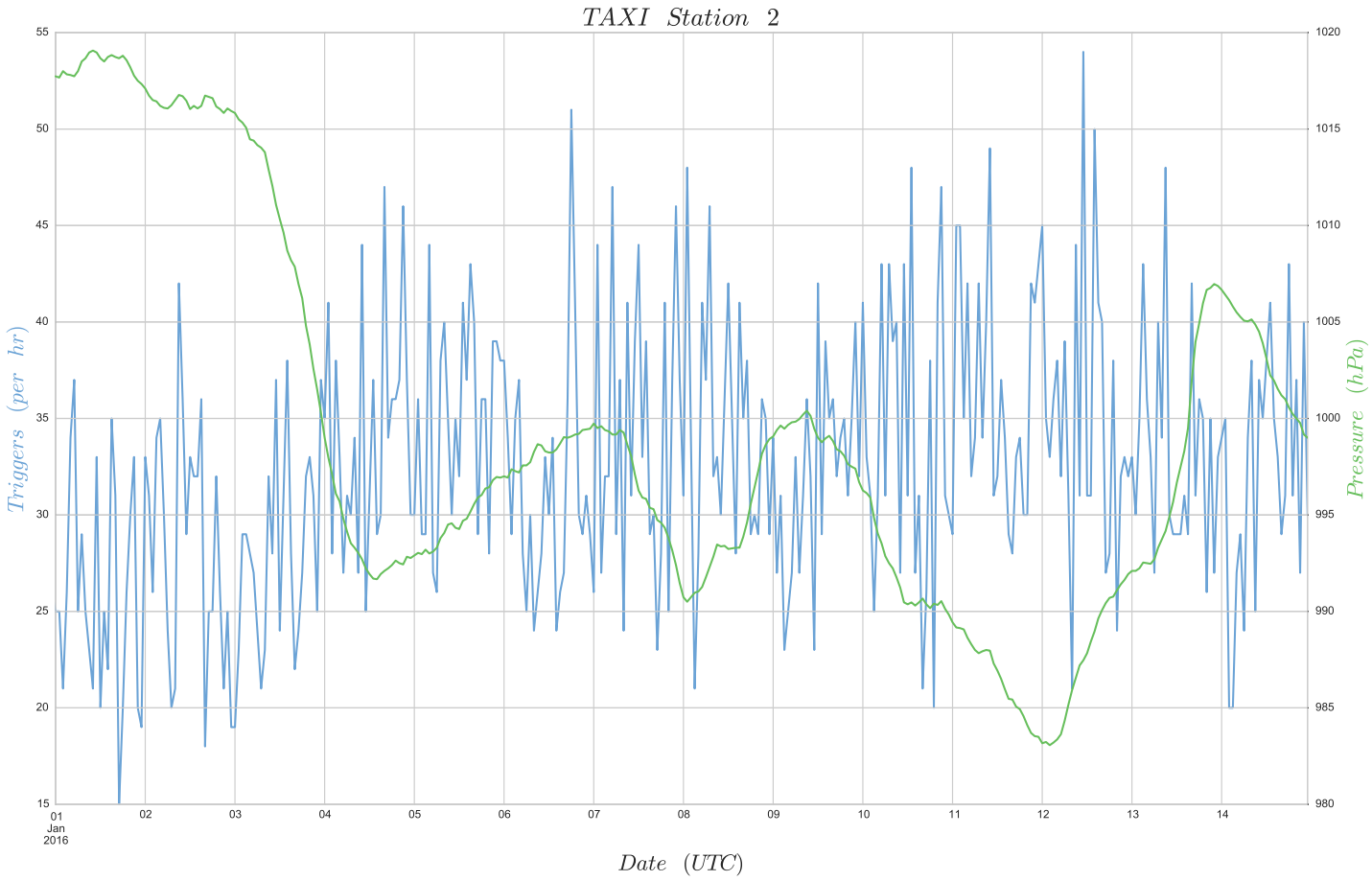


1 bit ~ 1.05 ns

Tile Trigger : Both PMT channels trigger

Station Trigger : At least 1 Tile per scintillator triggers

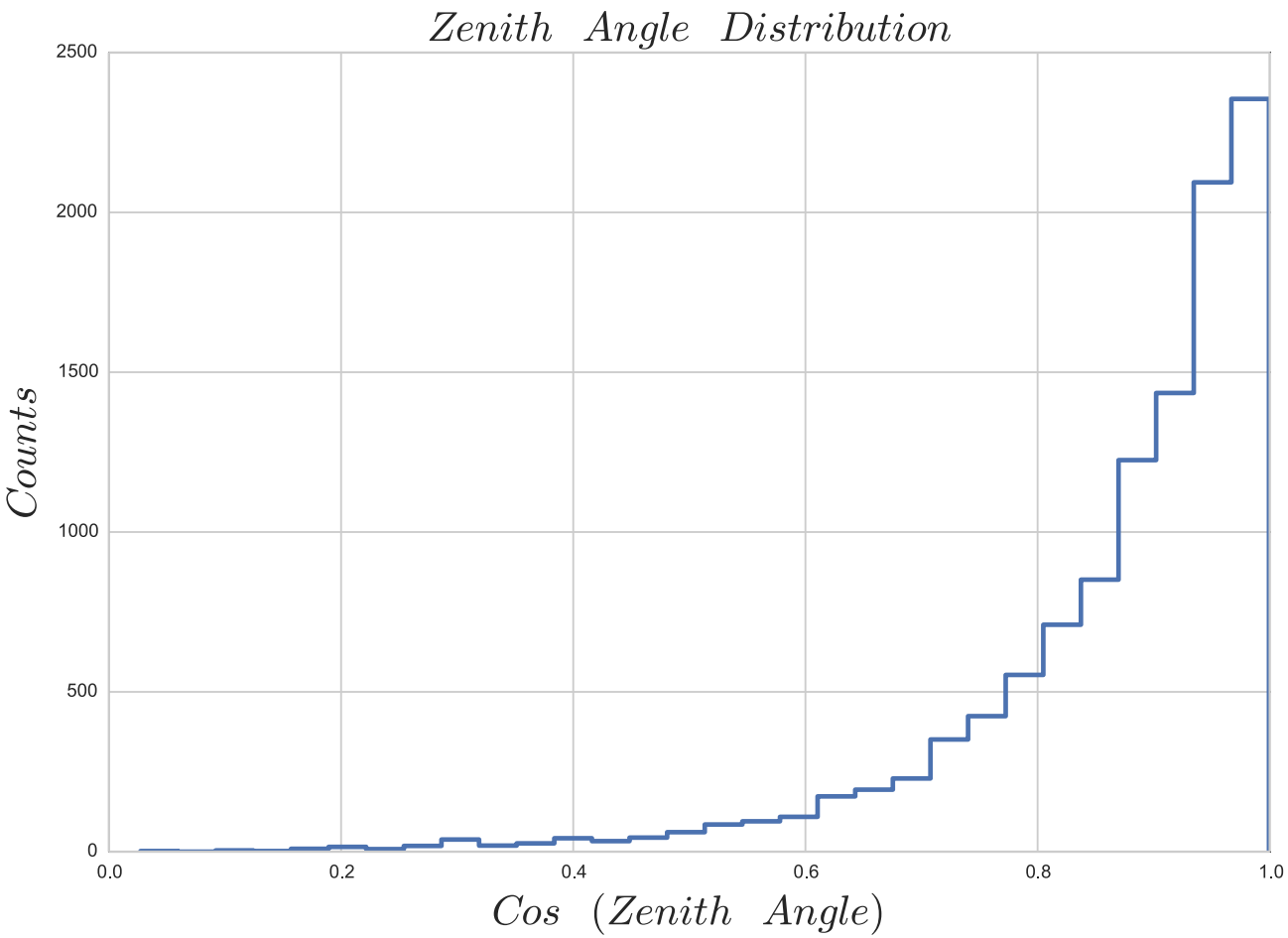
Trigger Rates



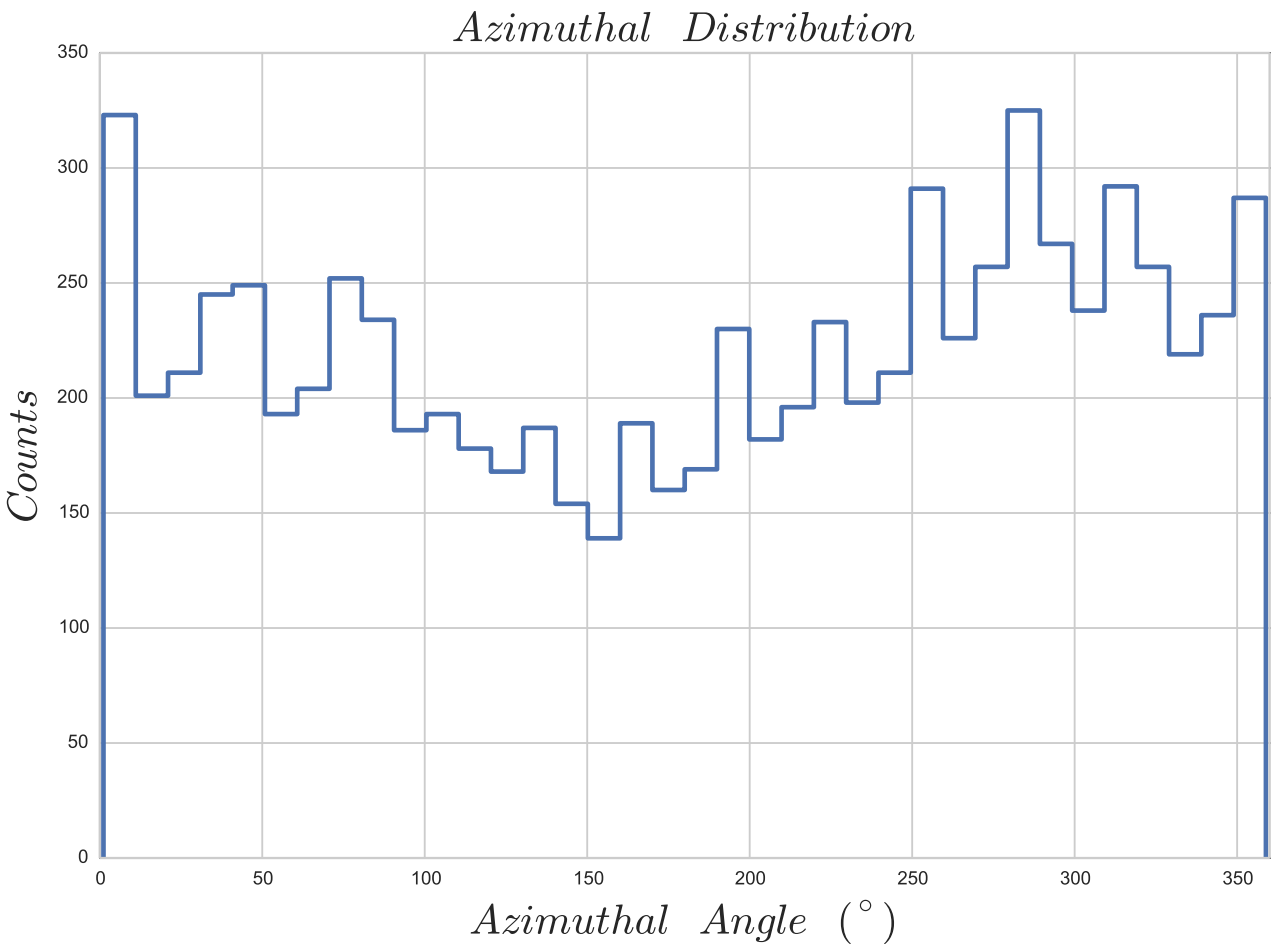
~ 11 K events

1 tile from each scintillator triggered

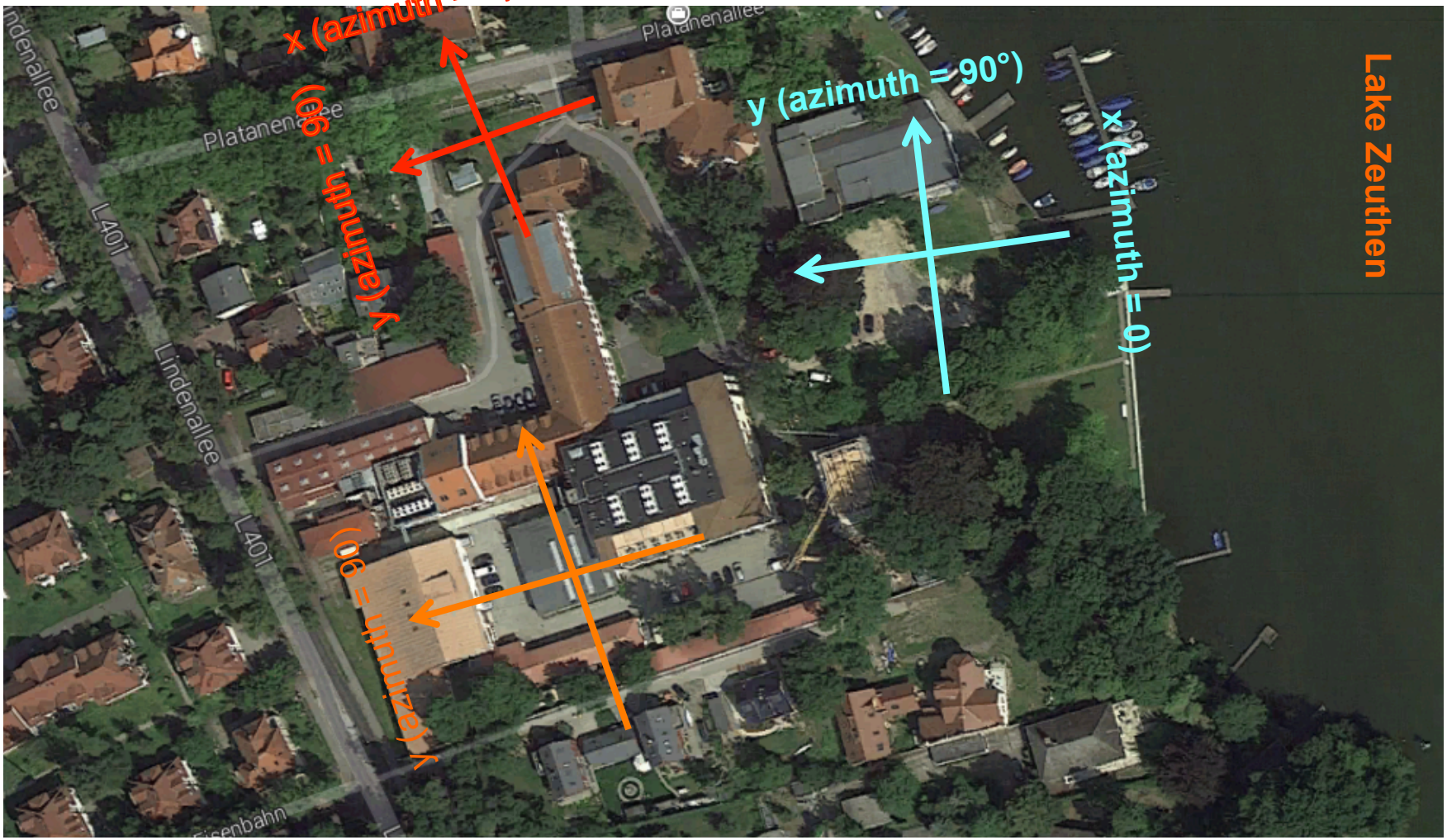
Zenith Distribution



Azimuthal Distribution



Third Station (in Preparation for Fall 2016 Deployment)



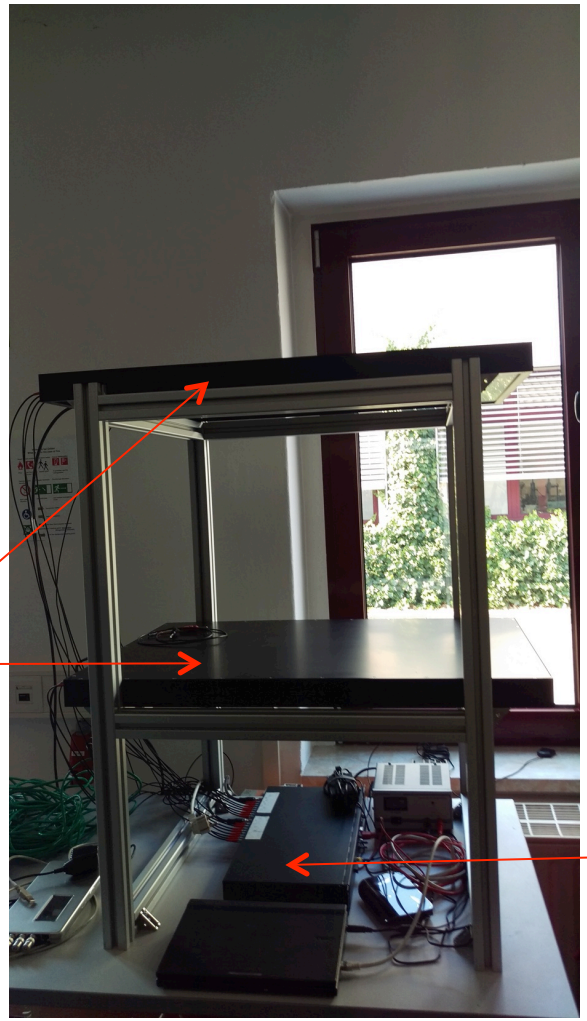
Two Stations Operational

TAXI 03

TAXI 02

TAXI 01

2 / 3 TAXI (16 channels) as a Muon Detector on board the Polarstern

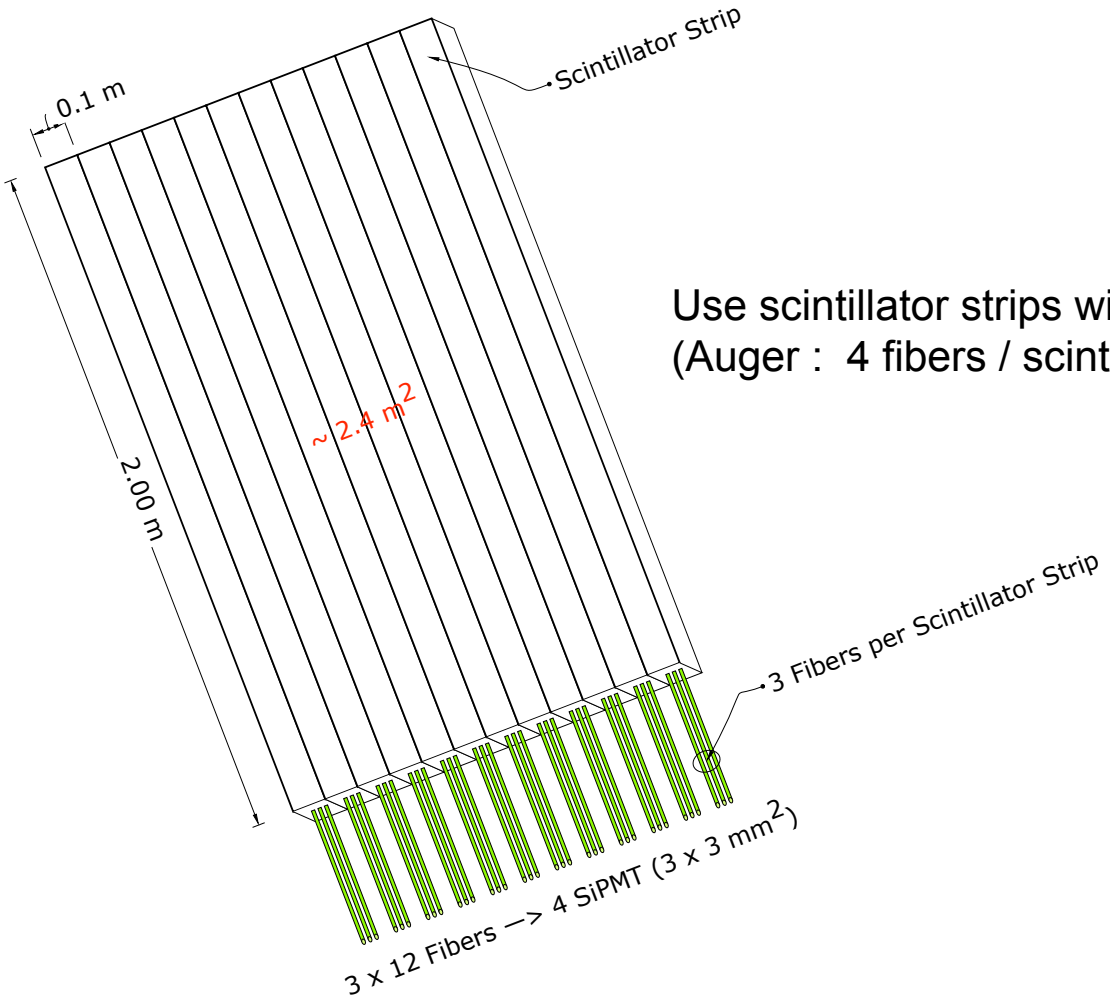


Scintillator(s)

DAQ

1 / 3 TAXI (8 Channels) as a Preliminary Surface Array Readout Design for IceCube

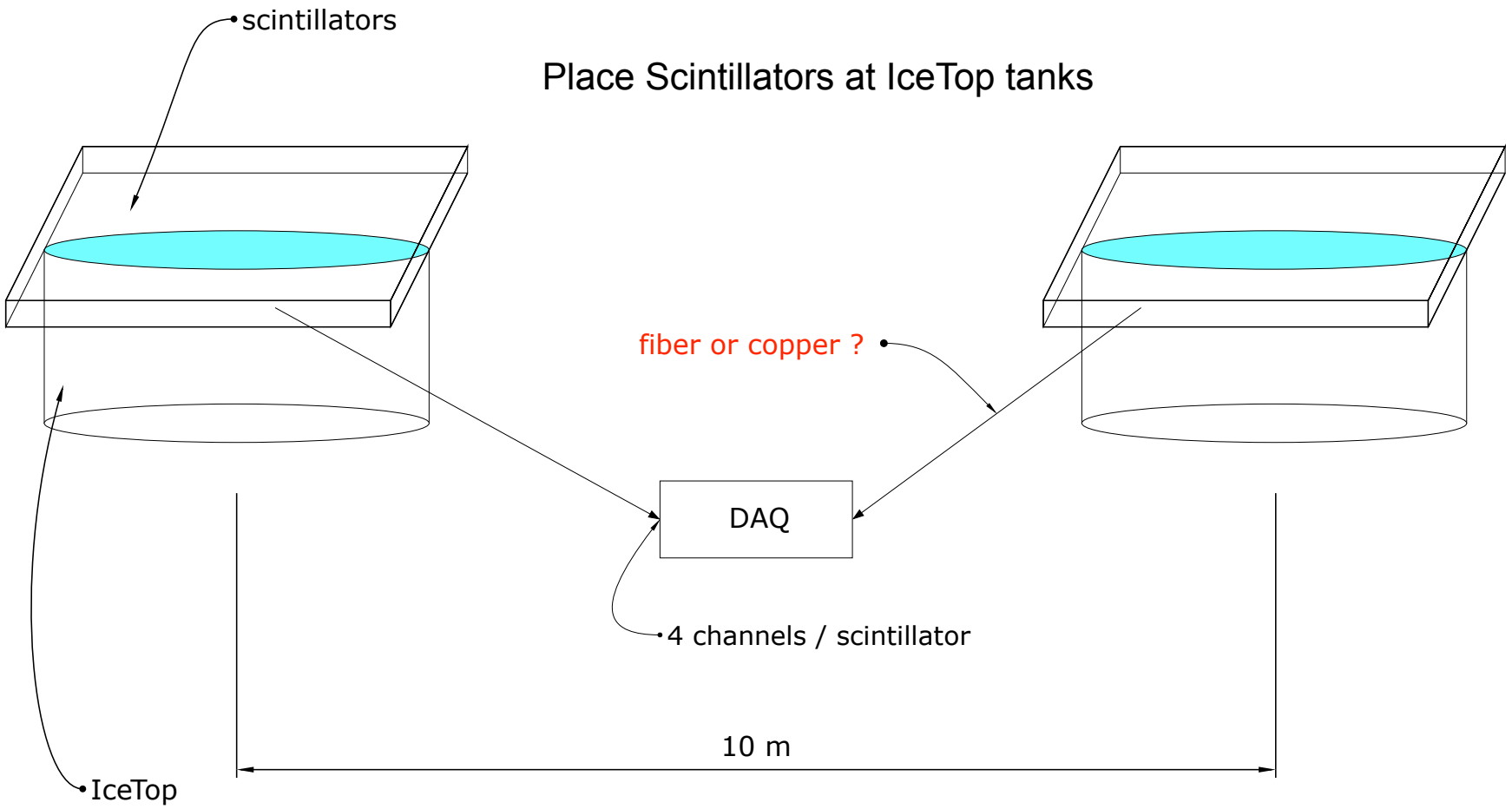
Assumption : Use scintillator strips



Use scintillator strips with **3 fibers each**
(Auger : 4 fibers / scintillator strip)

Cover ~ 2.4 m² with 12 **scintillator strips**
And 4 3x3 mm² **SiPMs**

Scintillators



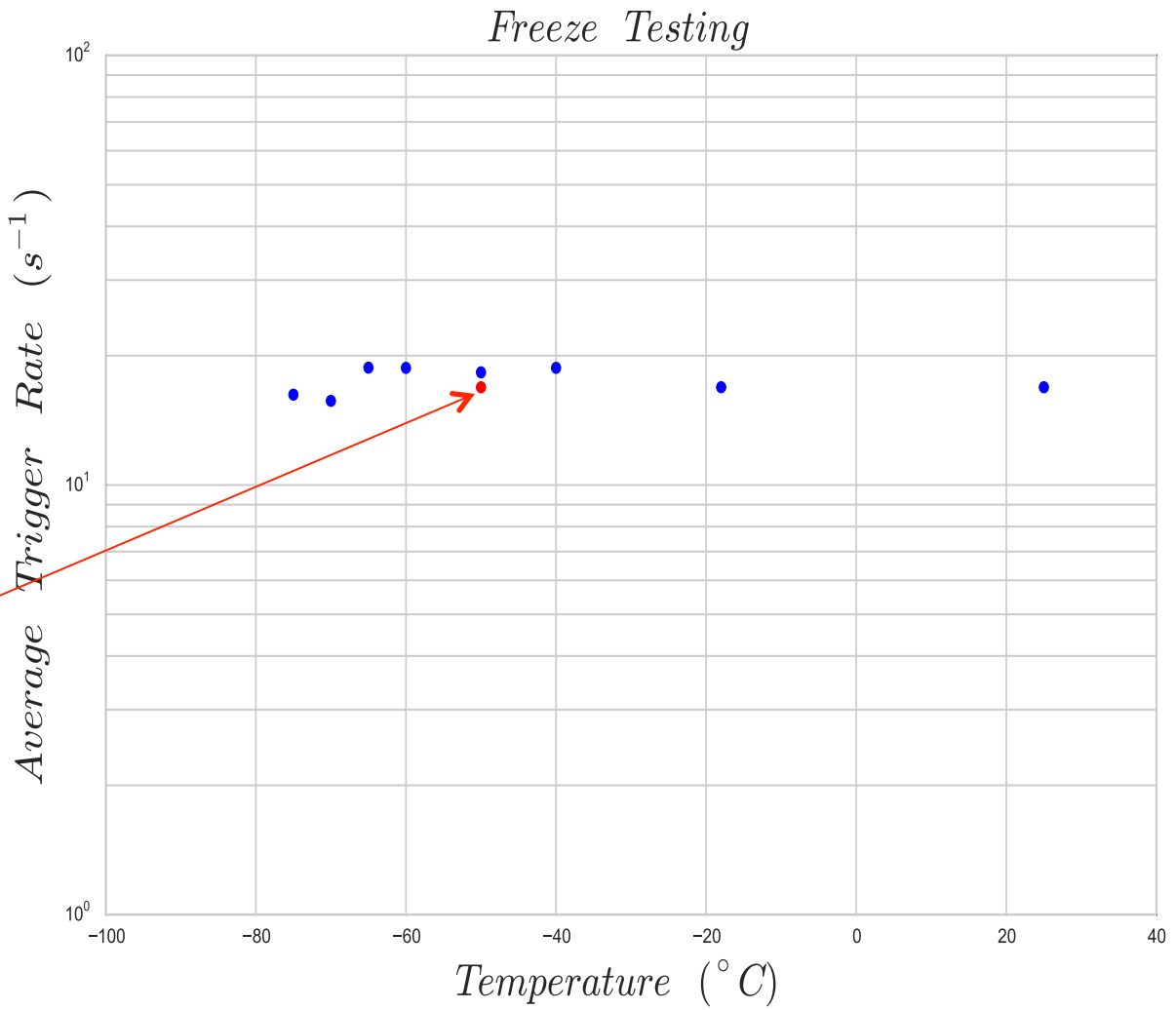
1 station -> 8 SiPM channels connected to DAQ

Option 1 : SiPMs placed at scintillator: (diff signals + power + i^2c)
Option 2 : SiPMs placed at DAQ box : couple clear fibers to WLS fibers

Freezer Testing

Tested down to **- 75 C**

Cold Boot
(after 12 hrs @ - 50 C)



Summary and Outlook

- TAXI is an Autonomous R&D detector capable of stand alone air shower measurements.
- Test, characterize & calibrate sensors/detectors
- Modified design (2/3 TAXI) to serve on the German Research Vessel (Polarstern)
- Modified version (1/3 TAXI) to serve as a potential Surface Veto Array.