



# Checks for paper2

Analysis people: Francesco N., Marco G.,  
Nicola M., Carmelo P., Daniele D.

Paper: Rosario N., Marcello A.

# The plan

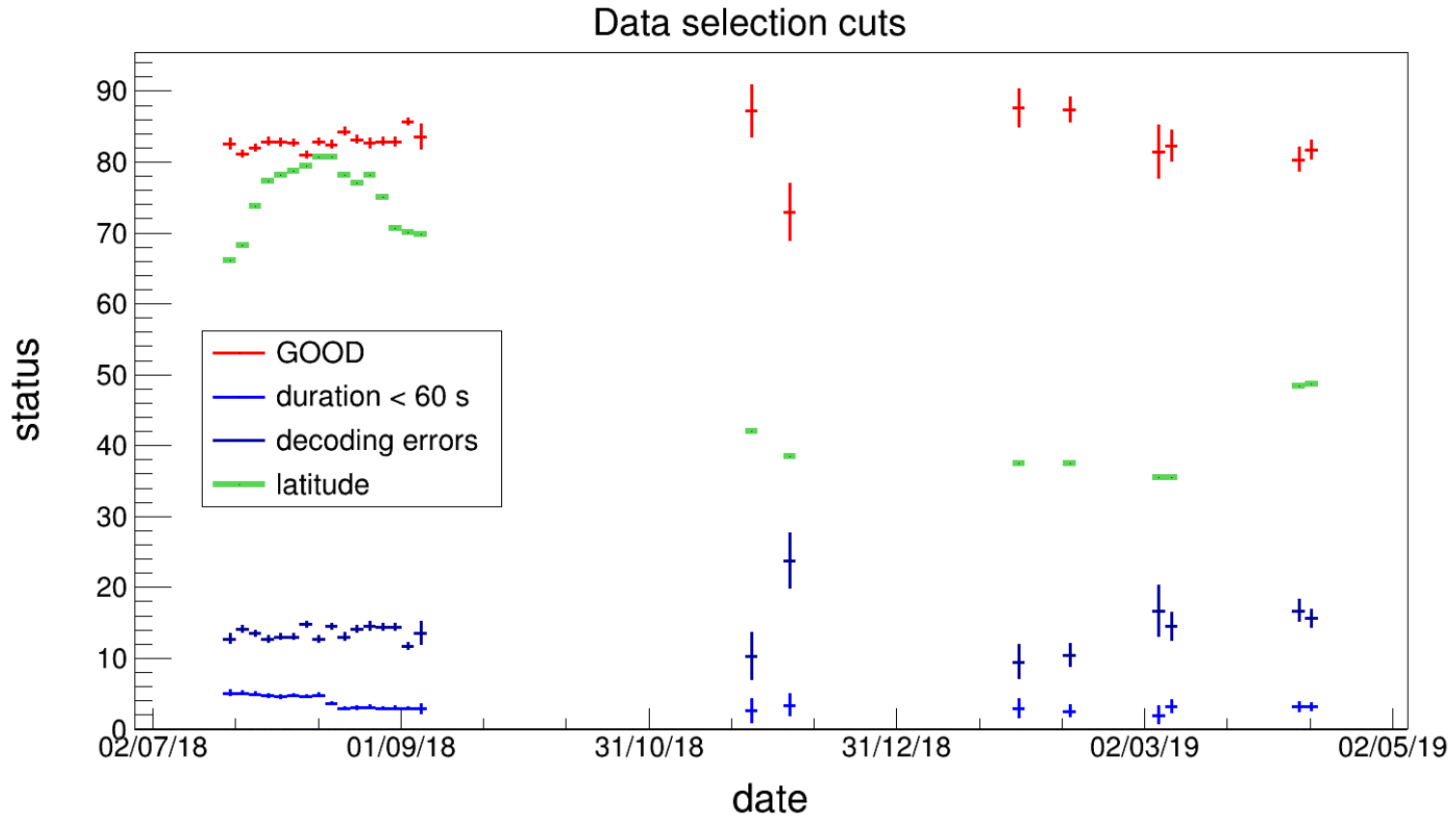
- We published the first results of polarquEEEest with the data collected in 2018 during the expedition with Nanuq@Svaldbard.
- We are preparing a new paper including the measurement in Italy and Germany → rate vs. latitude.
- We would like to submit the paper before of ICRC (July21) → one abstract submitted

# The measurements

Table 1: The different places where POLA-01 took data.

Place	Period	Latitude (°)	Height (m)
<i>CERN</i>	26/06/18 - 28/06/18	46.23	441
<i>Nanug</i>	21/07/18 - 05/09/18	66.82	0
<i>Vigna di Valle</i>	27/11/18	42.1	153
<i>Cosenza</i>	04/12/18 - 05/12/18	39.3	222
<i>Cefalu</i>	06/12/18	38.0	0
<i>Catania</i>	31/01/19	37.5	158
<i>Lampedusa</i>	07/03/19 - 08/03/19	35.5	10
<i>Bologna</i>	08/04/19	44.5	81
<i>Bologna-Hannover</i>	10/04/19	44.6-51.0	200-700
<i>Hannover-Frankfurt</i>	11/04/19	52.3	60
<i>Frankfurt-Geneva</i>	12/04/19	50.0-46.0	100-500

# Event selection



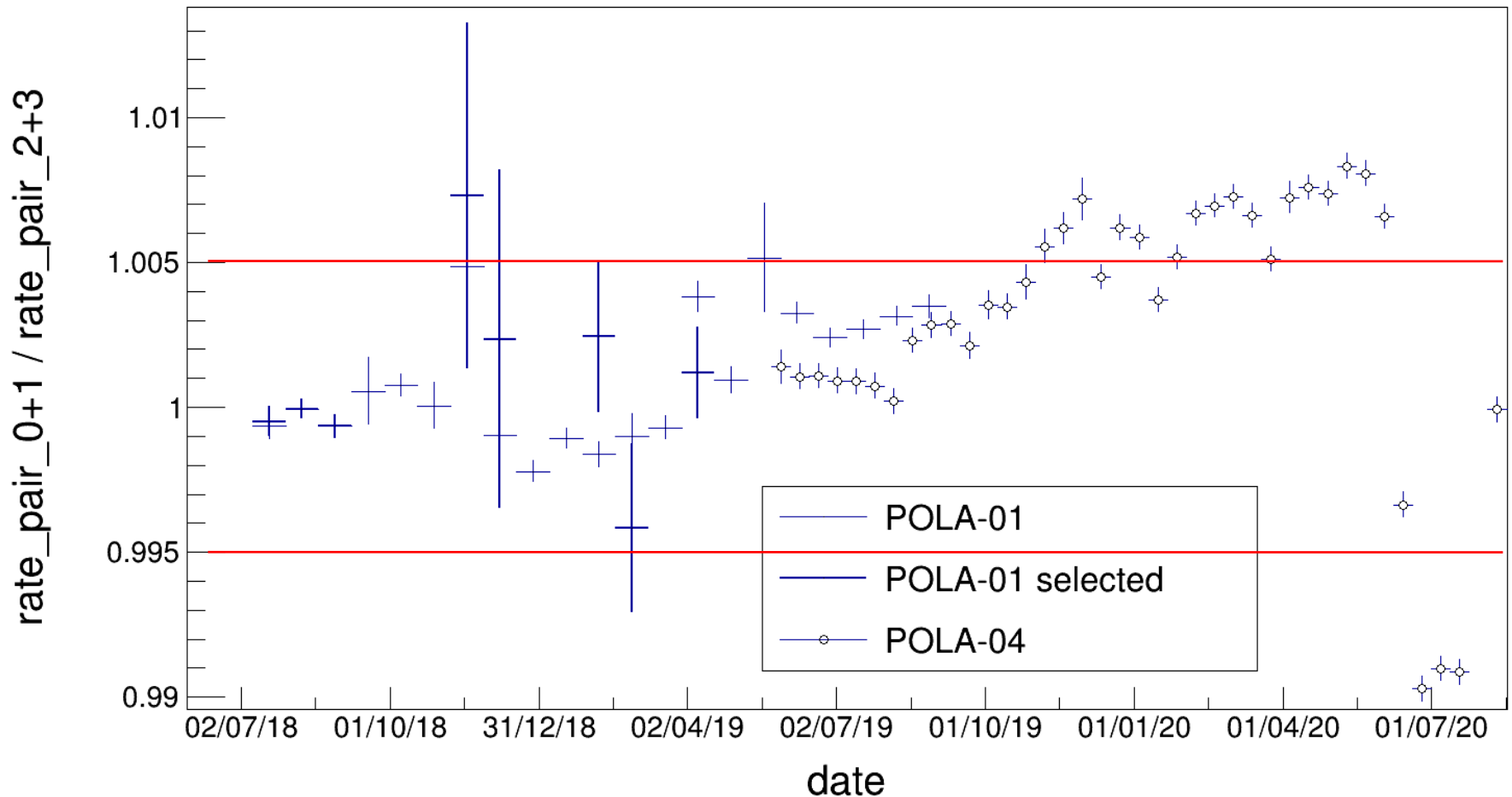
Few requirements applied for event selection:

- rate is compute in 1-minute interval → full minute required to be in the run
- If a decoding error occurs the time interval (1 minute) is discarded

# Systematic errors

We started to estimate the systematic errors by varying conditions on the way we extract the measurements.

# SiPM stability

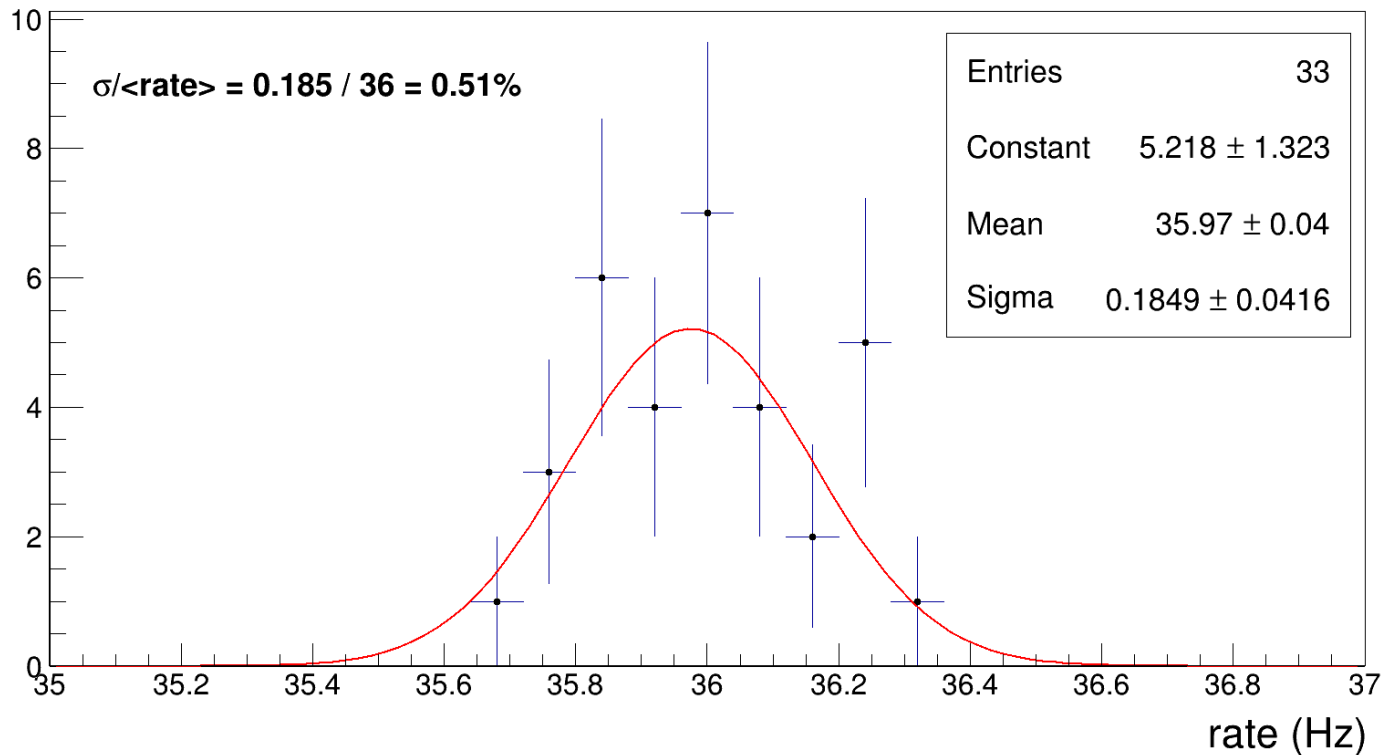


Detector is divided in two halves and the rate of each half is compared with the other one to check variation in SiPM efficiencies.

For POLA-01 difference are observed at the level of 0.5.

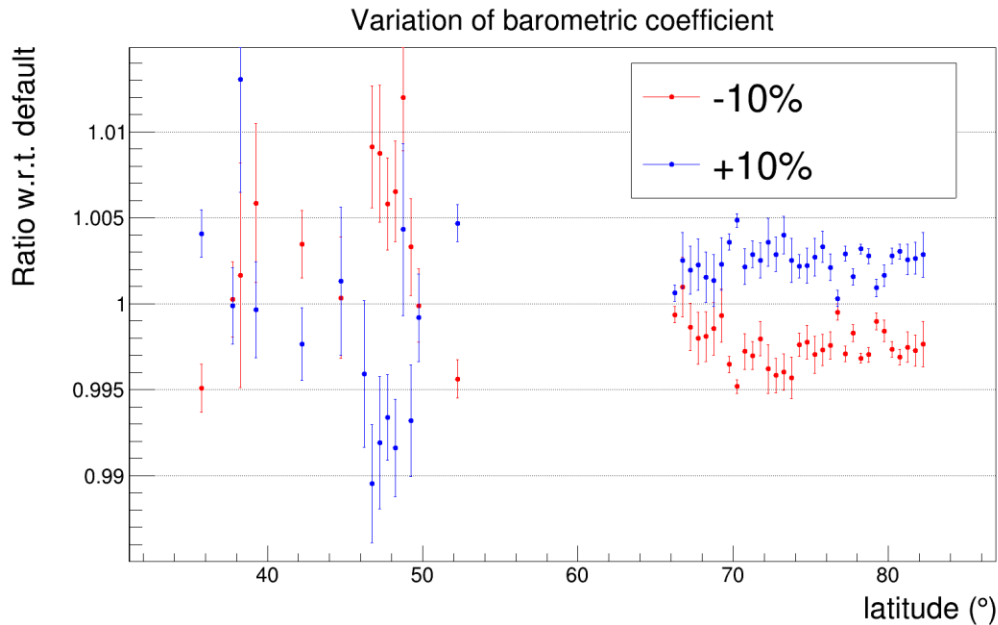
# “external” fluctuations

@Svalbard (latitude > 60°)



We checked fluctuations in the measurements in the plateau region to estimate the impact of non-undercontrol effect (day-night, ...)

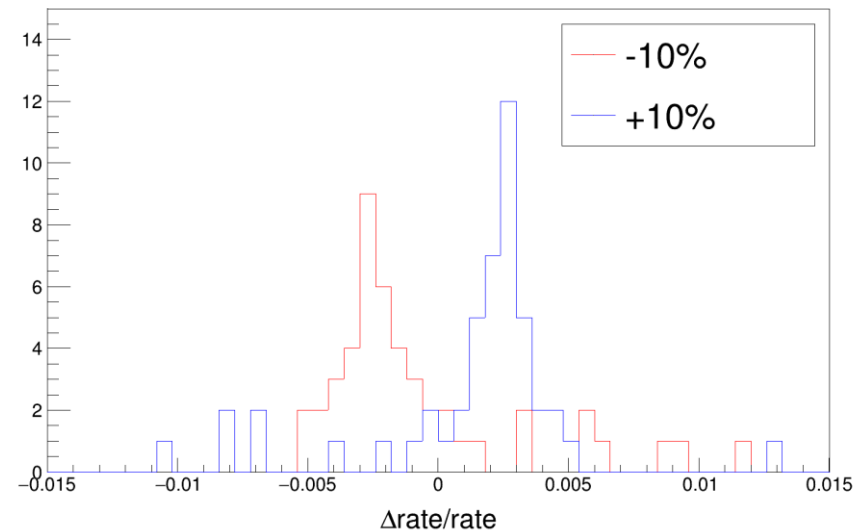
# Barometric coef. variation



Syst update = 0.86%

We varied the barometric coefficient of 10% to see the impact on the measurement  $\rightarrow$  0.5%.

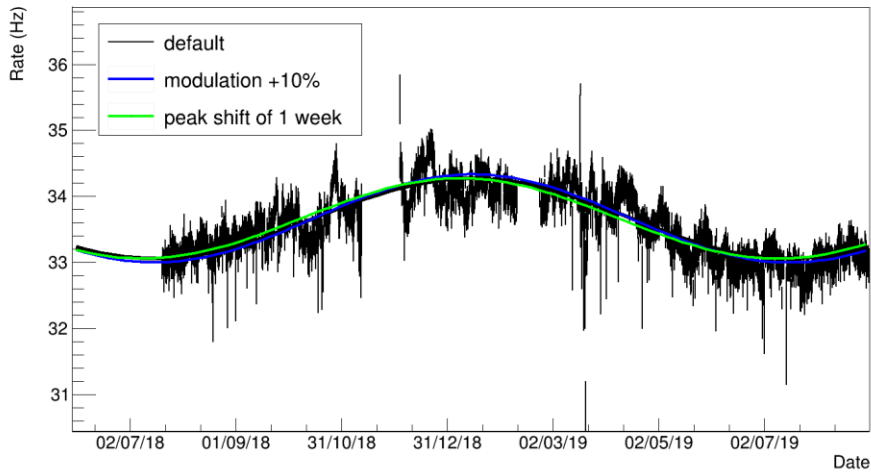
Default value =  $2.2\text{E-}3 \text{ mbar}^{-1}$





# Seasonal correction

POLA-02



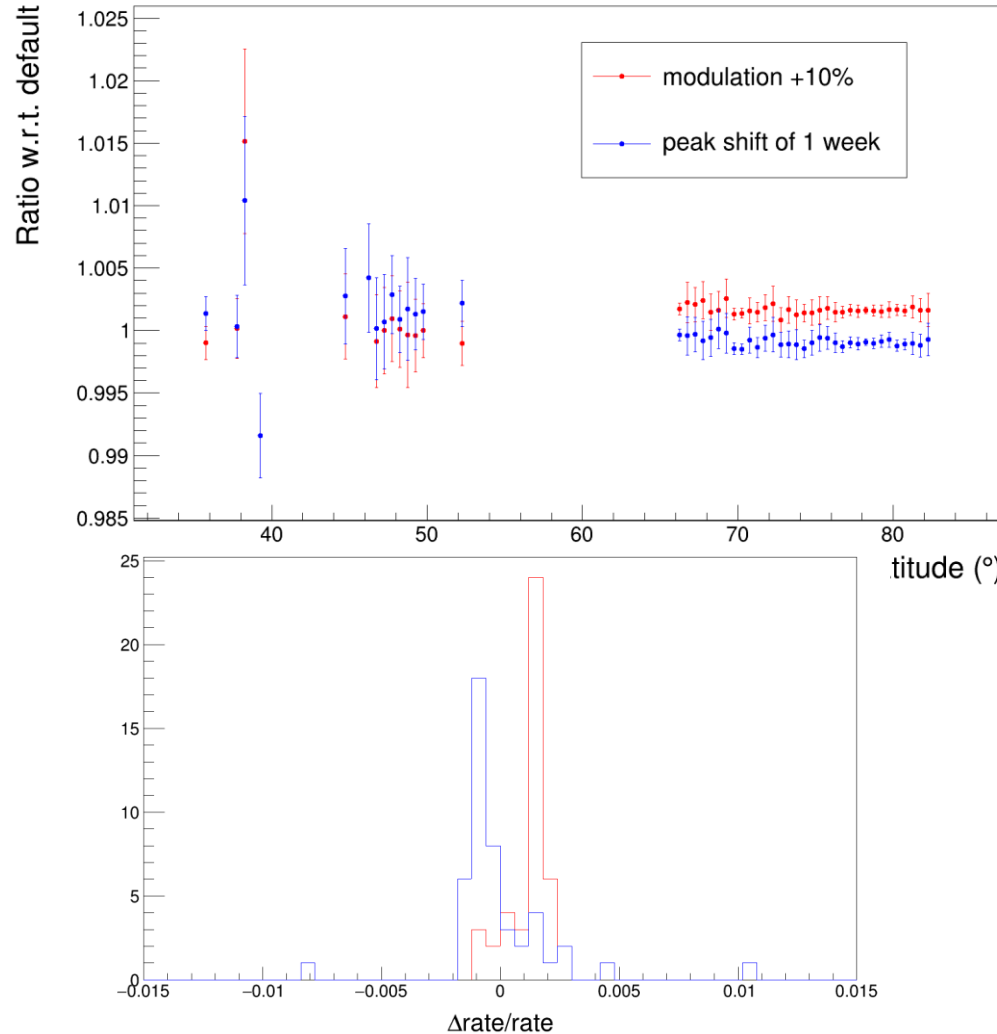
Parameterization varied:

Modulation: at the level of 0.2%  
(default=1.8%)

Shift: at the level of 0.1%  
→ 0.25% syst

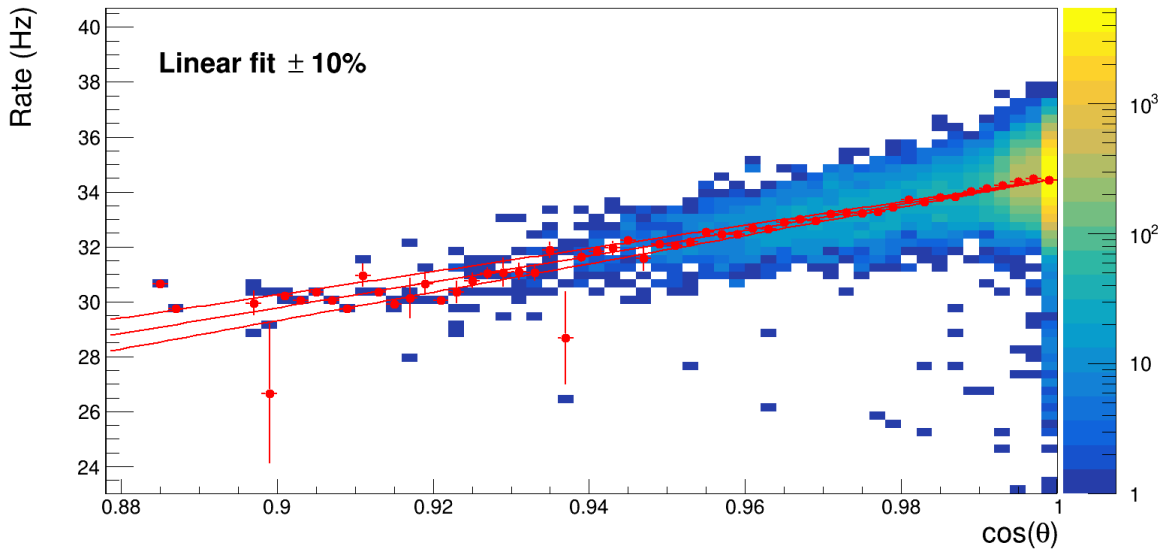
**Syst update = 0.9%**

Variation on seasonal effect

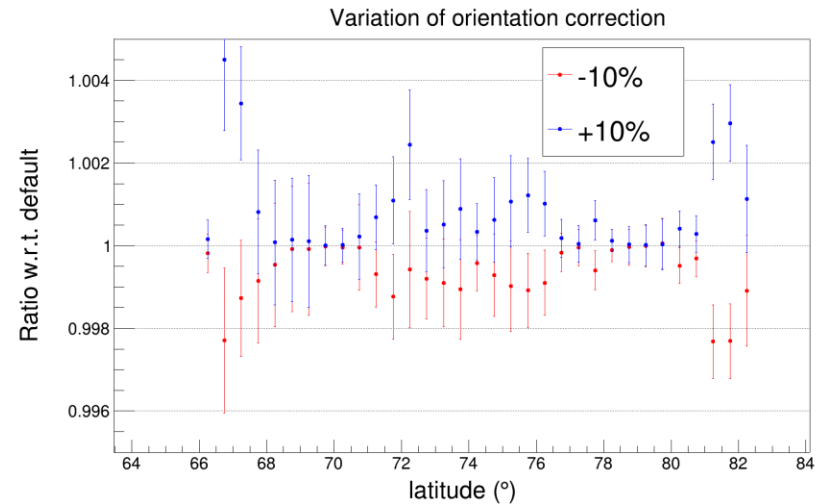


# Telescope orientation

POLA-01@Svalbard



Only for Svalbard measurements.  
Negligible wrt other sources.



# Altitude

To be assigned to:

- **Cosenza → 222 m**
- **Catania → 158 m**
- Bologna → 80 m
- **Vigna di Valle → 150 m**
- Germany
  - Hannover → 50 m
  - Francoforte → 100 m
  - **On the road → 150-500 m**

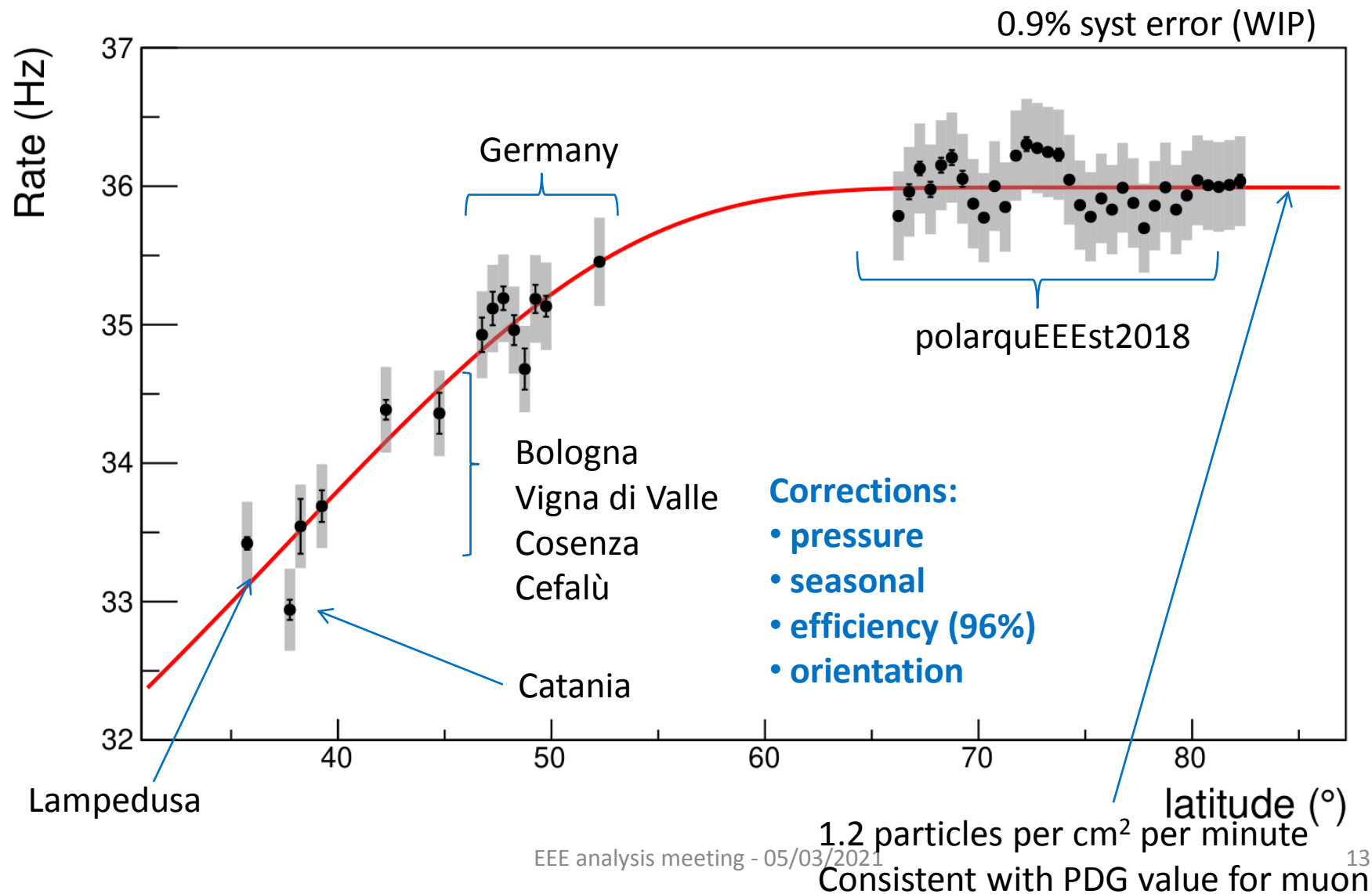
**To be evaluated**

# Our result

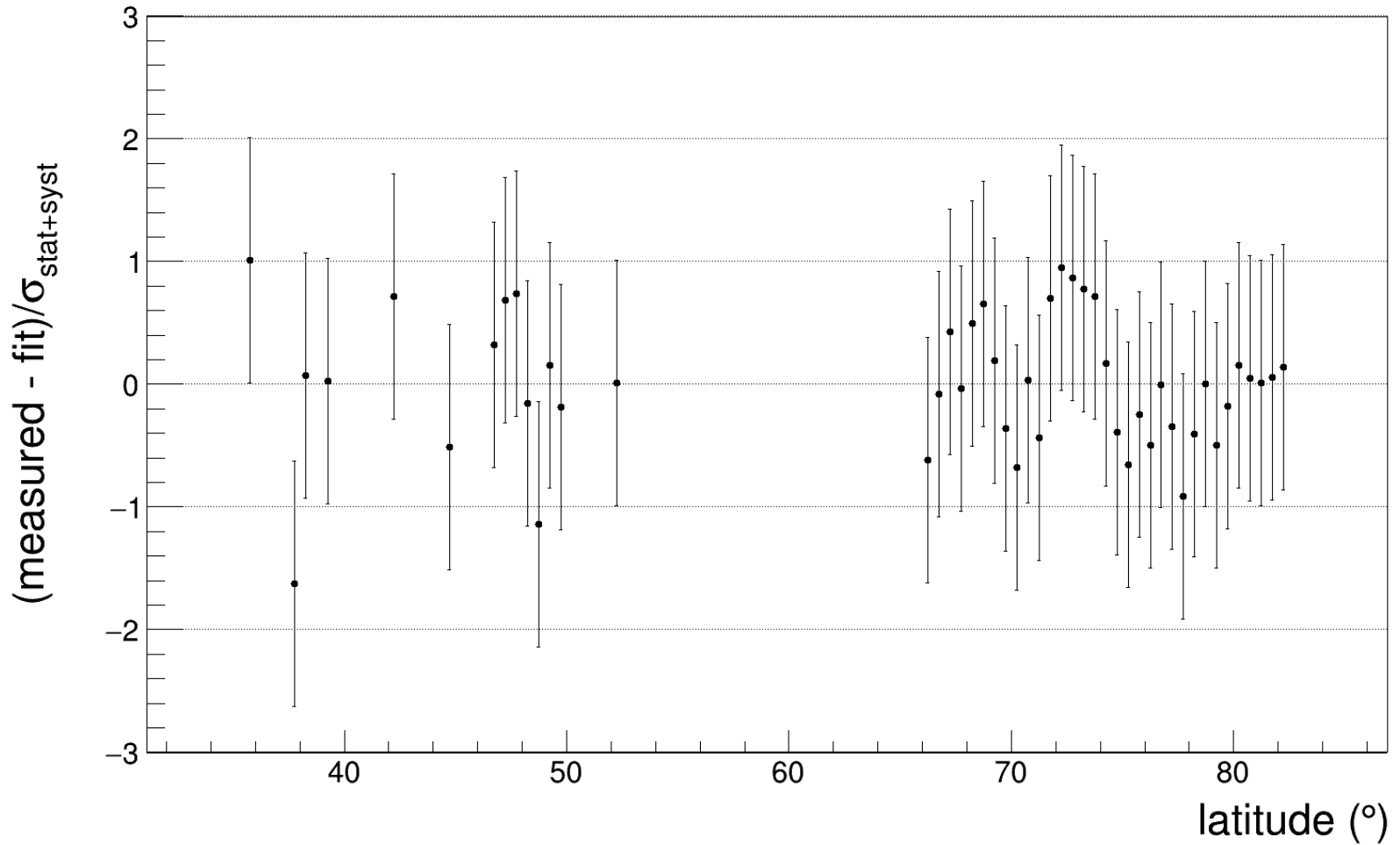
Acceptance (assuming  $\cos^2\theta$  distribution) =  $0.741 \times (40 \times 60 \text{ cm}^2)$

<https://pdg.lbl.gov/2011/reviews/rpp2011-rev-cosmic-rays.pdf>

# Current status



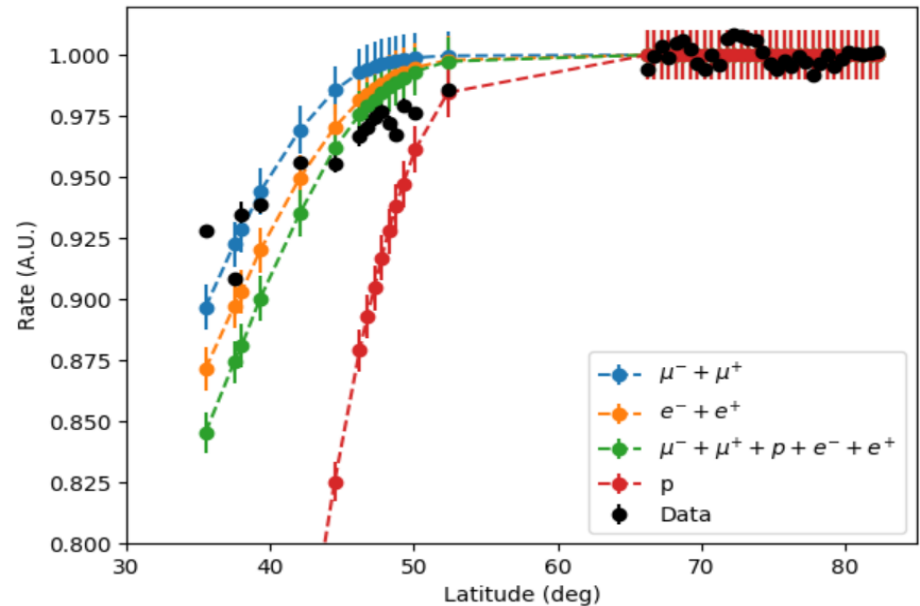
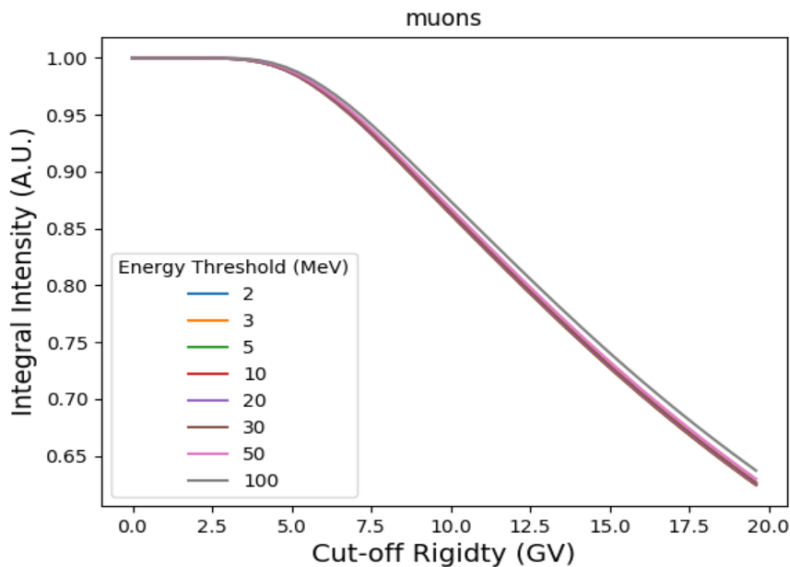
# Measurement vs Fit



# Simulation of geomagnetic effect

More details in <https://agenda.centrofermi.it/event/178/> → N. Mazziotta

- $r(lon, lat) = \int d\Omega dE_S I_S(E_S, \Omega; lon, lat) A(E_S, \Omega)$
- $A(E_S, \Omega) = H(E_S - E_{th})$
- $r(T_{cut}) \propto \int dE_S dT Y_S(E_S | T) I_{CR}(T) f(T; T_{cut})$
- $T_{cut} = T_{cut}(lon, lat)$  (i.e. IGRF vertical cut-off at 20km)



# Summary and TP DO list

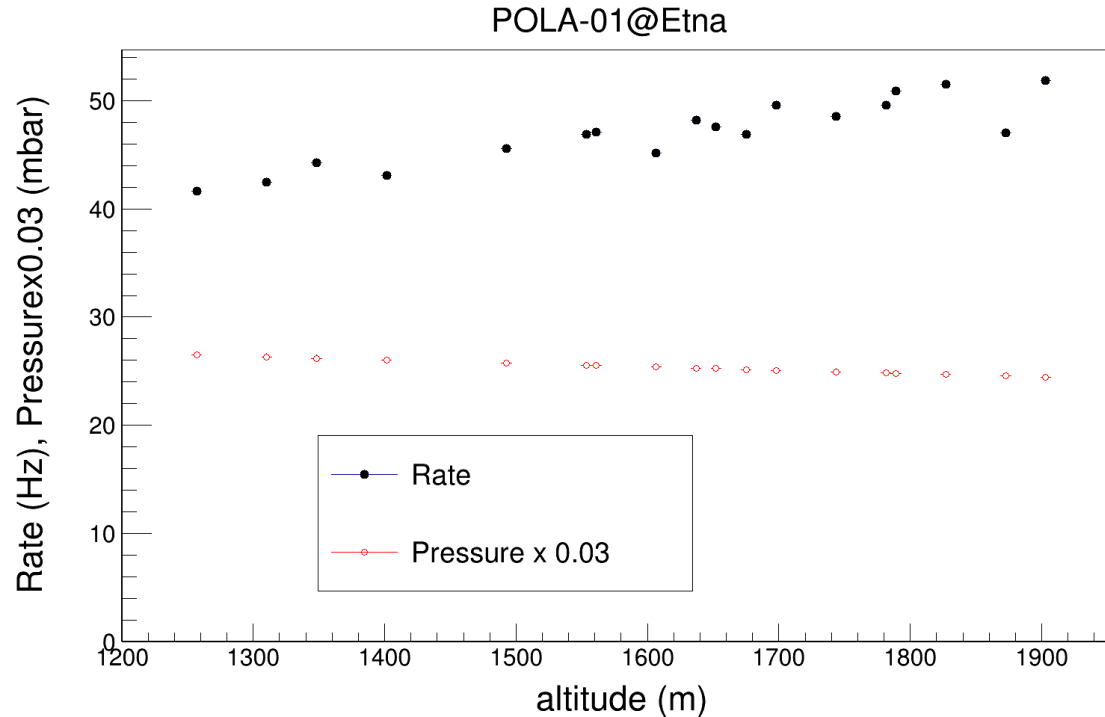
We started to evaluate the systematic errors and the comparisons with models (see also Marcello's talk).

TO DO:

- comparison with rate extracted with a complete different method based on the summary rate attached to each run → WIP: to check the proper run list.
- Altitude effect: trying to evaluate the impact of altitude when greater than zero → see next slide.



# Rate vs altitude



Data collected @Etna should give us an idea on how to disentangle pressure and altitude effect → to be done (to be check if we can recover data also at altitude < 1200 m).

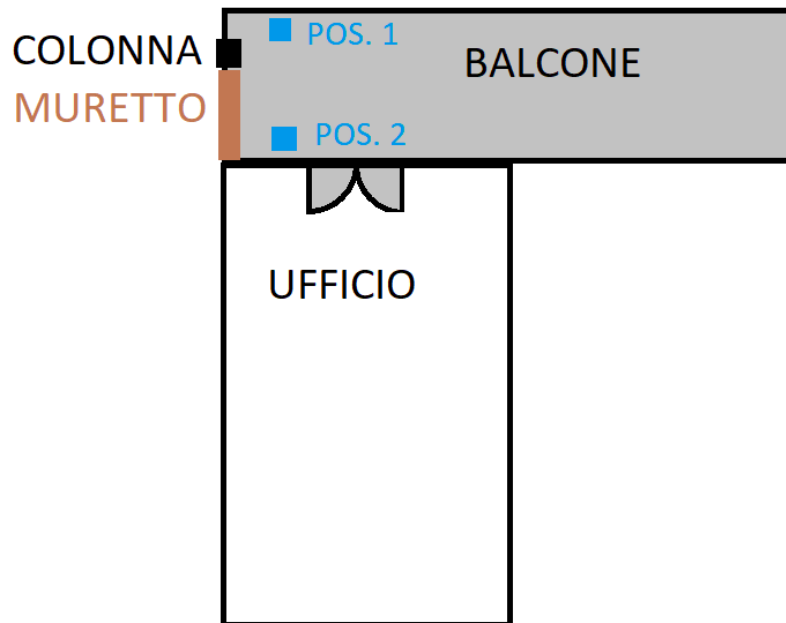
# backup

# Catania update

A Catania (Paola, Chiara e Franco) hanno fatto alcune misure con cosmic box per stimare possibili effetti di materiale nella zona in cui POLA-01 aveva preso dati.



# Lista misure CB a Catania

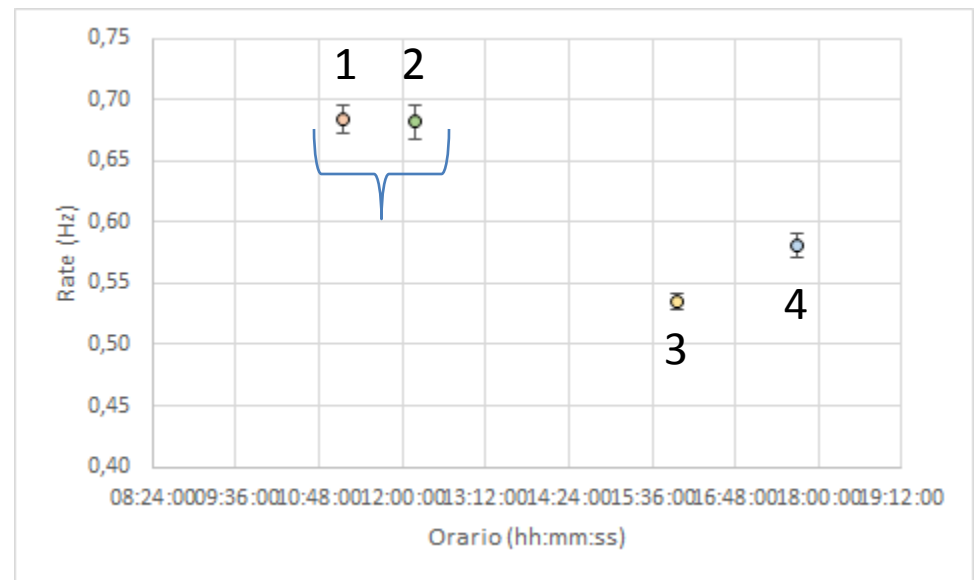
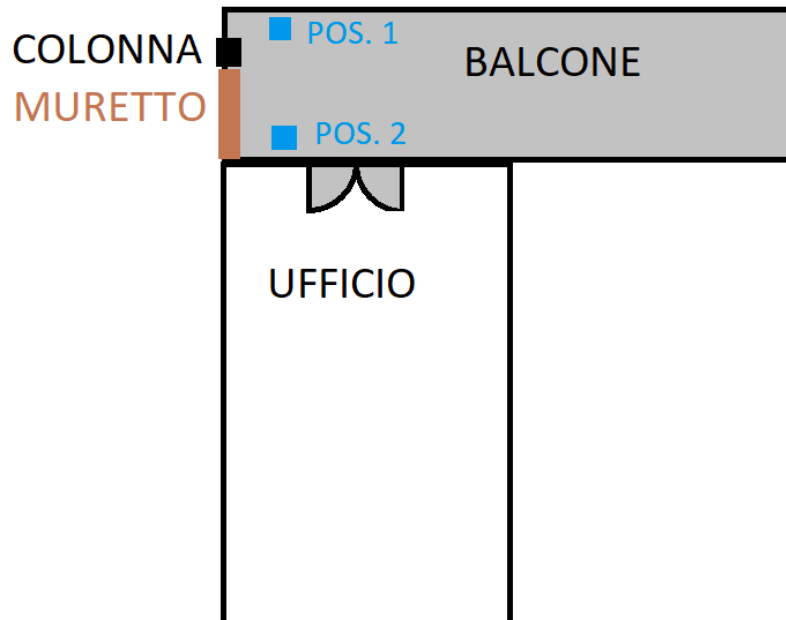


Abbiamo quindi posizionato la CB in 3 luoghi diversi:

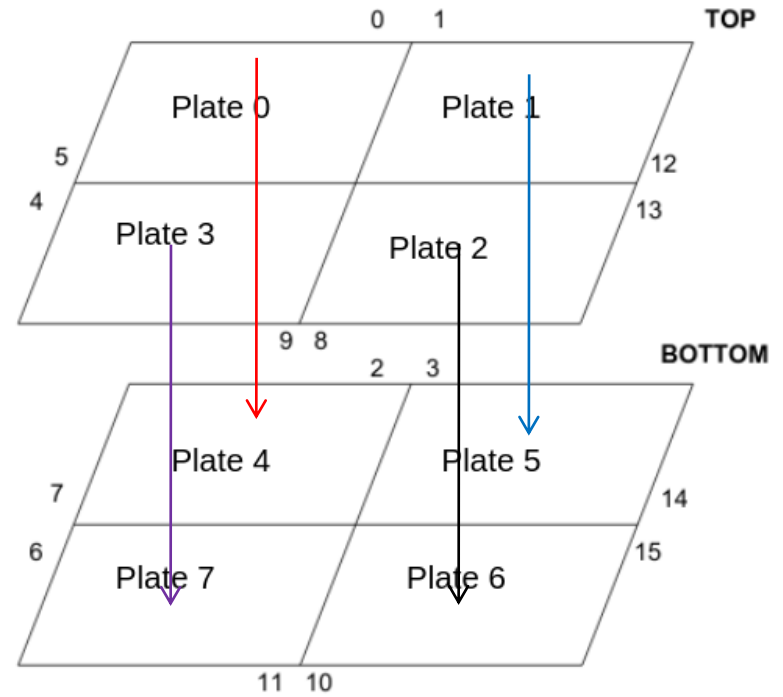
1. Balcone, in prossimità della ringhiera, a circa 3 m dalla parete dell'edificio (siamo al terzo piano, quindi la parete è alta 3,5 m e poi sopra non c'è nulla)
2. Balcone, in prossimità (a 30 cm) dalla parete
3. In un laboratorio a piano terra, con 3 solai sopra il rivelatore
4. In un ufficio al terzo piano, con un solaio sopra il rivelatore

# Misure finali

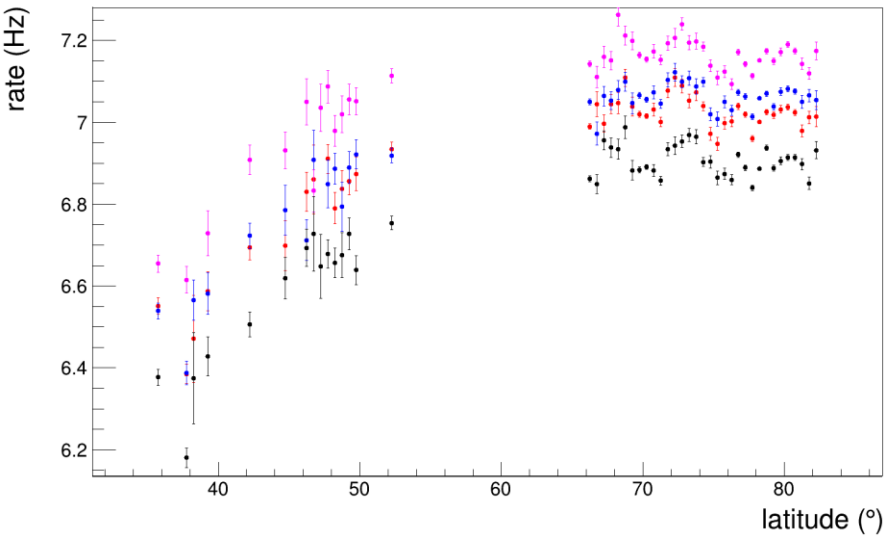
Tra la posizione 1 e la posizione 2 si apprezza una differenza inferiore al 1% con una precisione statistica del 2% circa su ciascuna misura.



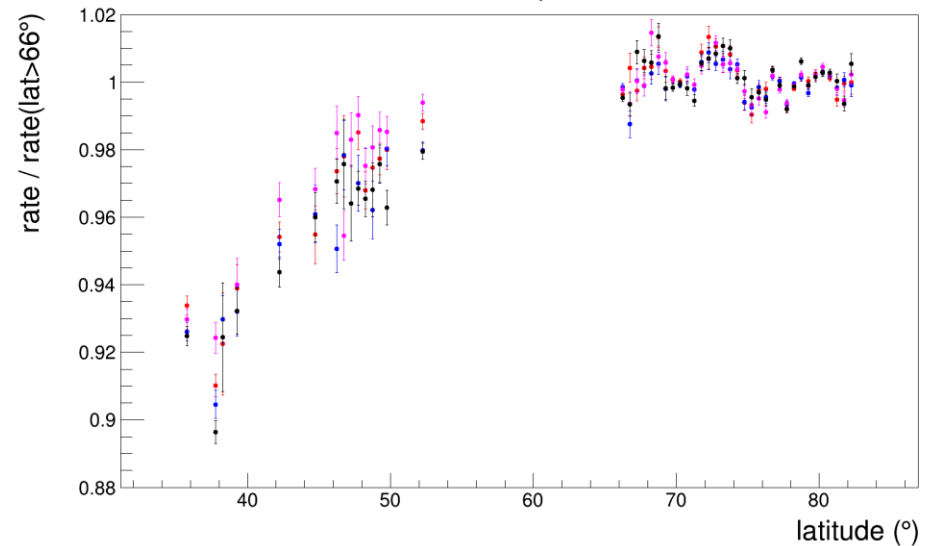
# Check for each vertiacal pair



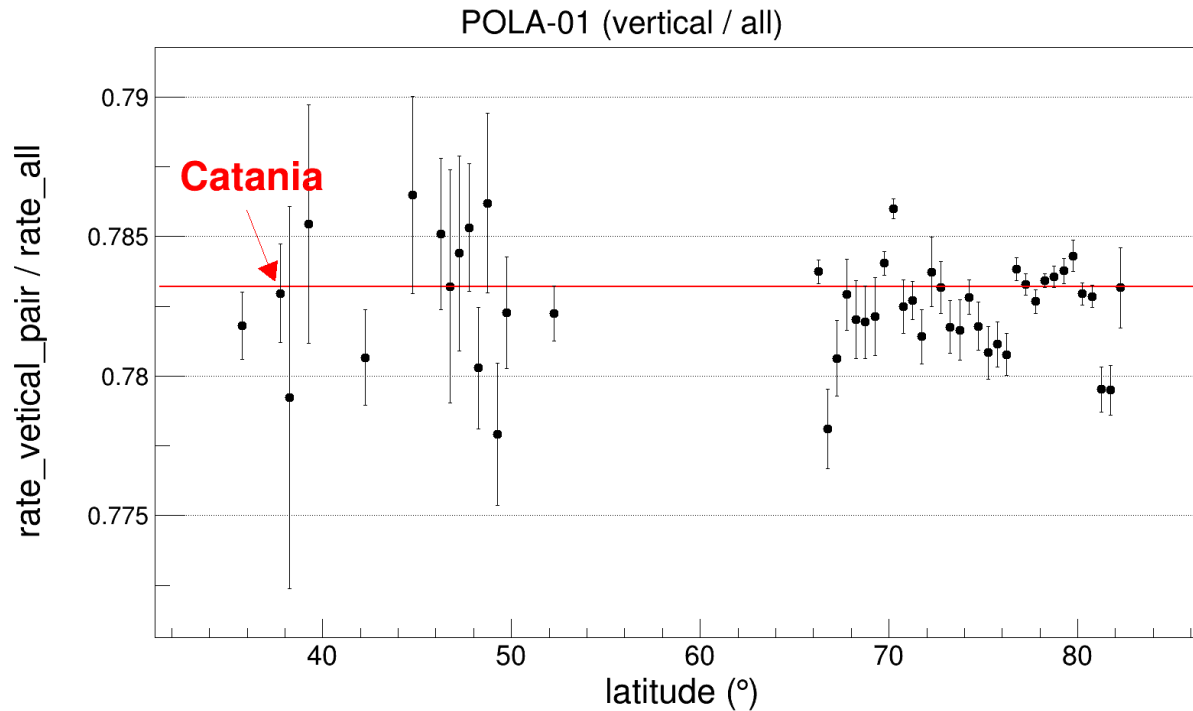
Vertical pairs



Vertical pairs



# Effetto della direzione



Rapporto (coppie verticali/tutte) delle misure di rate vs. latitudine.