



Update from the PolarquEEEst2018 analysis

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Outline

- **1° polar paper** (short period)
 - MAIN PHYSICAL MESSAGE: constant cosmic ray flux at latitude greater than 66° N.
 - Update on the analysis
 - Figures for the paper
 - Discussion on systematics
- **Other preliminary results** (long period)
 - Rate vs latitude
 - Seasonal effect
 - Approval in view of **ICRC19**

New reconstructed data

All data were reconstructed to provide additional information:

- Temperature inside the electronic box
- Trigger event id (for a comparison with reconstruction event id) → to tag decoding problems

gps information recovering → for the problems occurred after May 2019 in POLA-03 (not covered in this presentation).

Data

Data are available:

- As DST at CNAF
- Grouped in 60 s intervals at CNAF
 - /home/noferini/polar/outPOLA-0X.root
 - Information: **status**(==0), **rateRaw**, rate4c(4 SiPM requested), **pressure**, temperature, ...

Macros in Centro Fermi github → e3papers (WIP)

Figures for the 1° polar paper

Statistics used

- Period: from 22nd July18 to 4th September18
- Telescopes: POLA-01 (nanuq), POLA-02 (Oslo), POLA-03 (Bra)
- Other data sources: OULU neutron monitor

Data selection

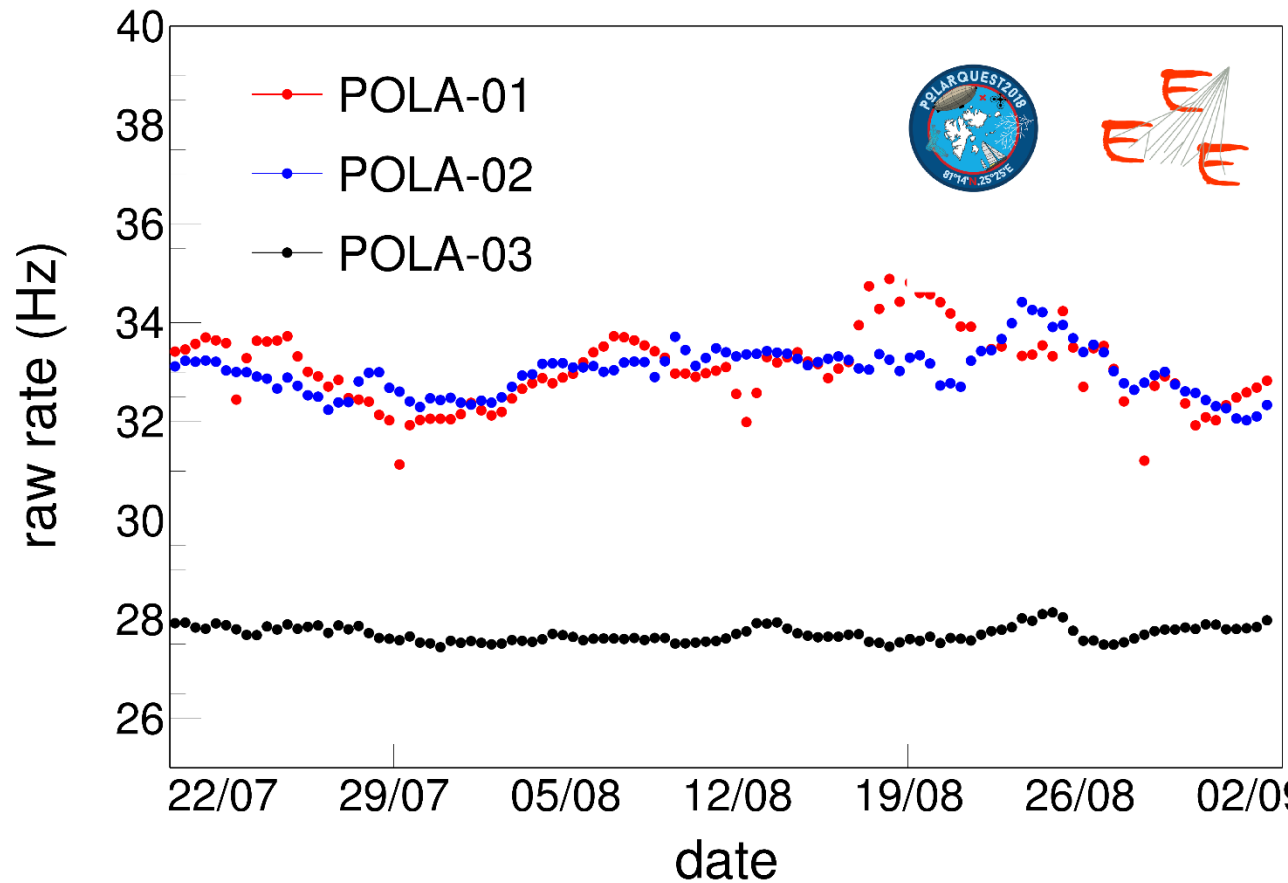
Rates are measured by grouping events in 60 seconds intervals.

Intervals are discarded if:

- The 60 s interval is not completely covered within the run
- If the number of reconstructed events differs from the number of triggered events (decoding problems)
- If the sensor information is not available (pressure=0)

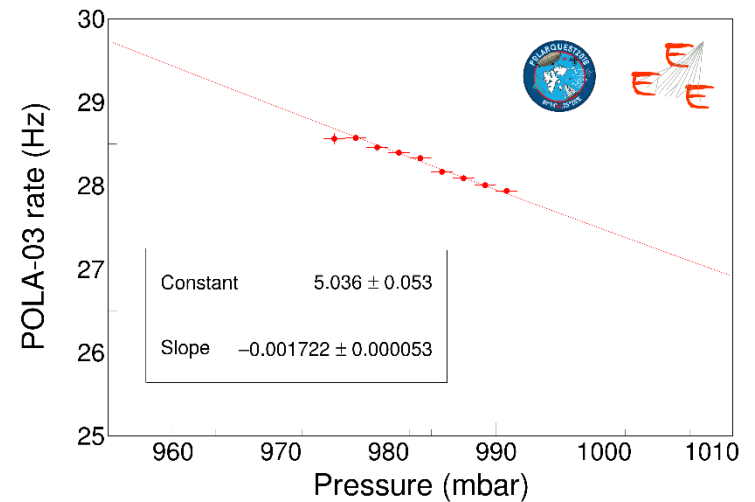
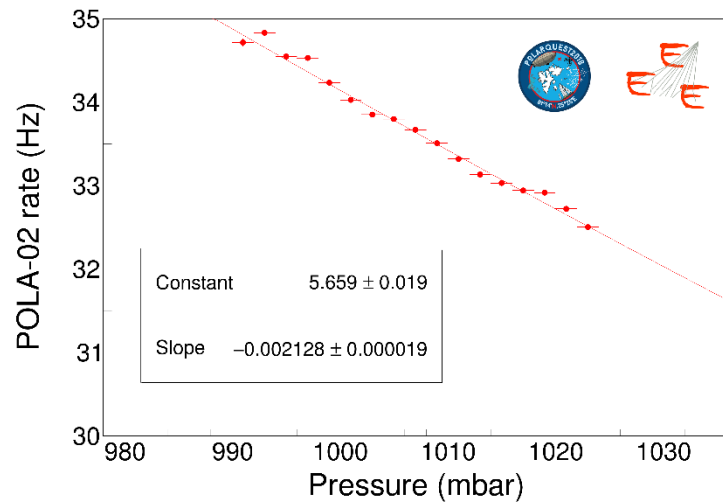
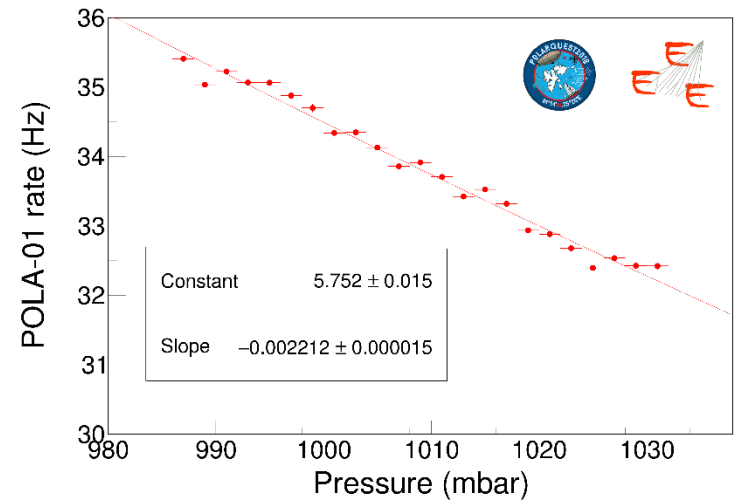
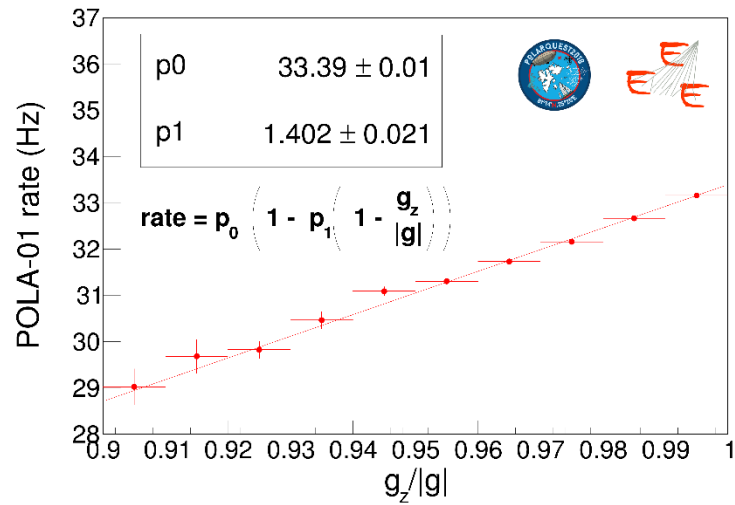
Fig. 1

Raw rates
for the
three polar
telescopes



Shell we
convert it in
rate/Area?
 $\rightarrow \text{Hz/m}^2$
Area = 0.24 m^2
Angular
acceptance?

Fig. 2

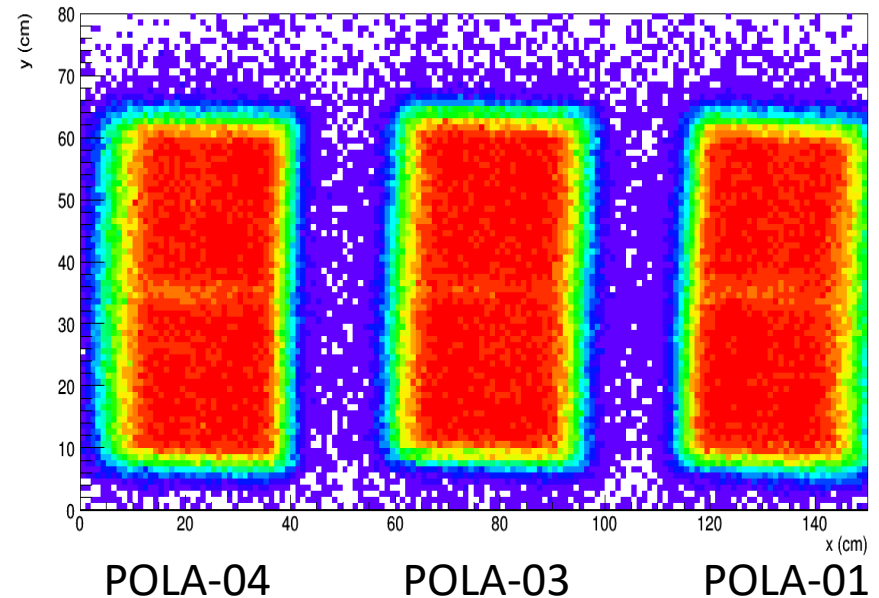
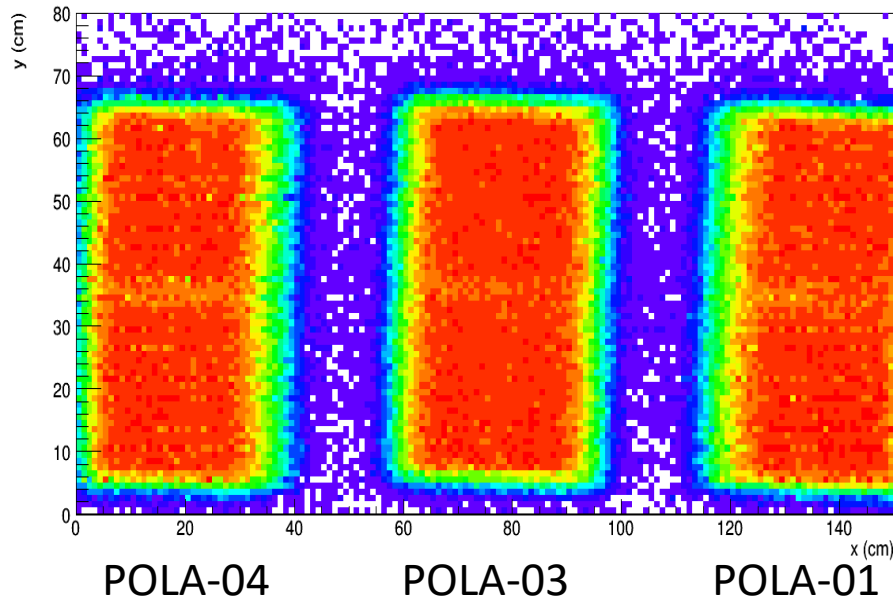


Efficiency scan at CERN

BOTTOM

LOCAL CERN-01 coordinates

TOP



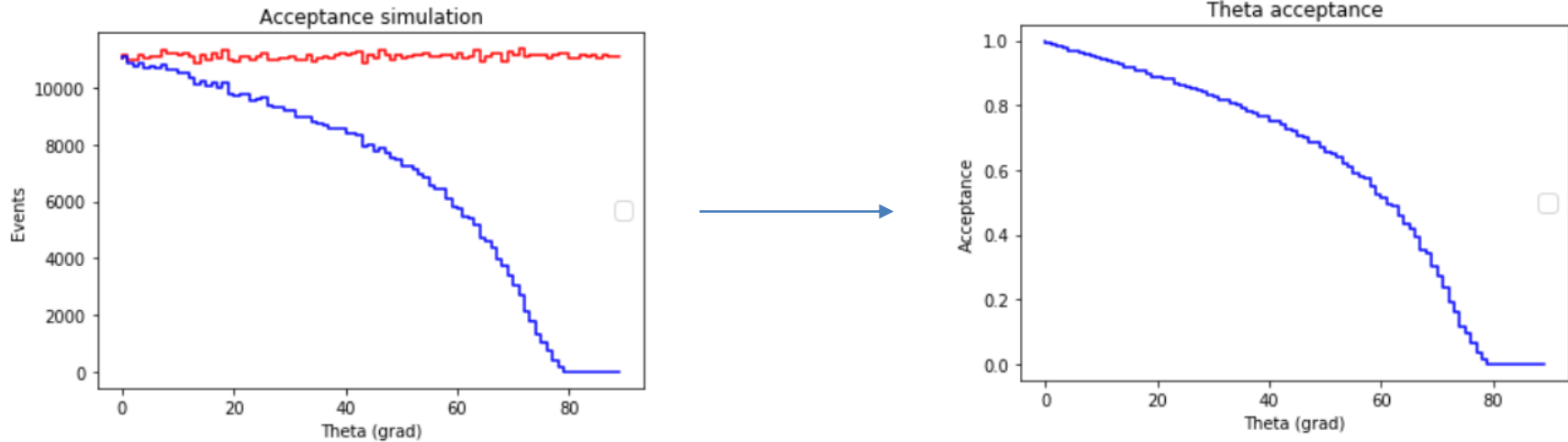
TEST AT CERN ON 25-26/04/2019

POLA-01 Efficiency Majority = 0.970 ± 0.001 Efficiency AND-4-ch = 0.908 ± 0.001

POLA-03 Efficiency Majority = 0.974 ± 0.001 Efficiency AND-4-ch = 0.939 ± 0.001

POLA-04 Efficiency Majority = 0.970 ± 0.001 Efficiency AND-4-ch = 0.891 ± 0.001

Angular acceptance

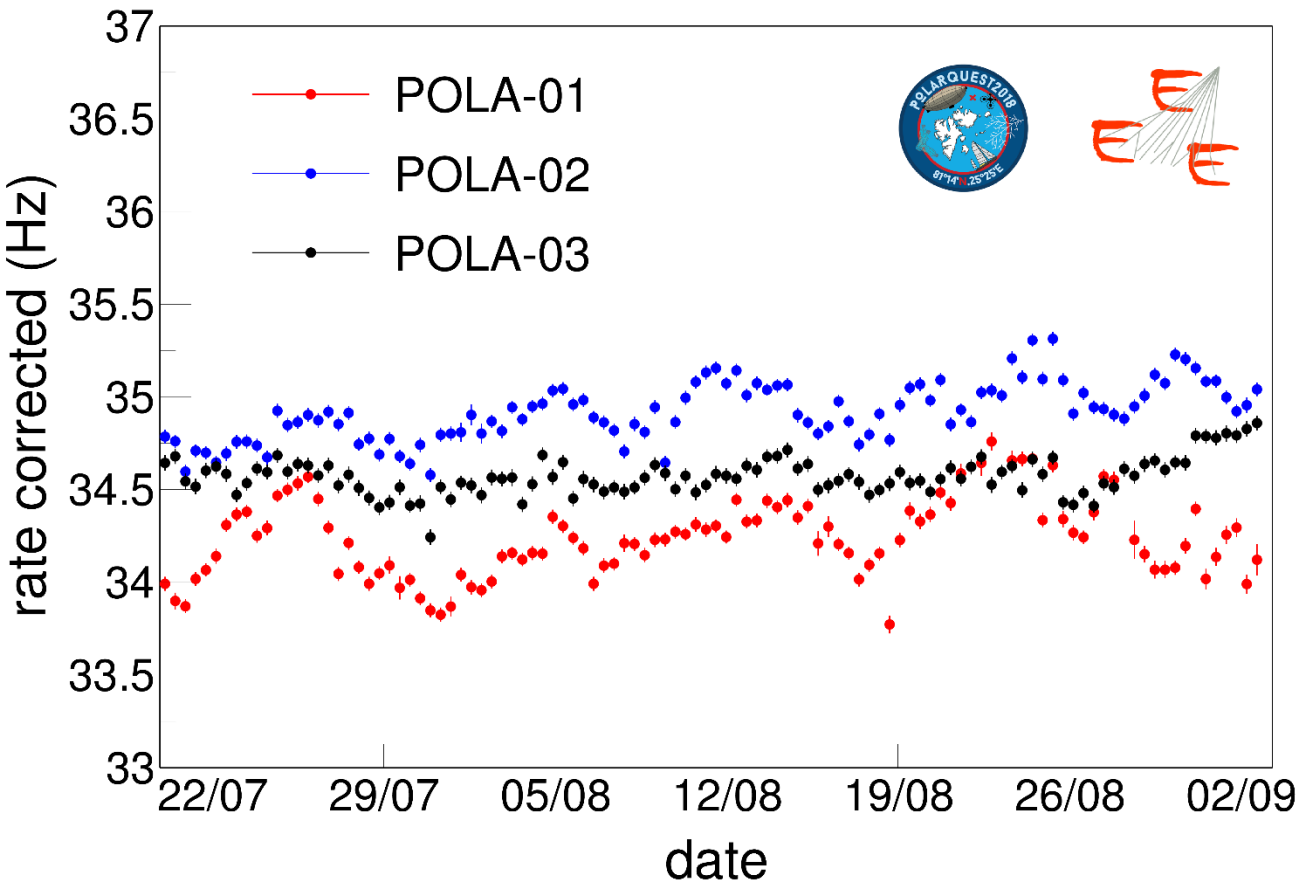


By reweighting assuming a \cos muon distribution \rightarrow Acc = 0.655

By reweighting assuming a \cos^2 muon distribution \rightarrow Acc = 0.741 (0.287 for EEE telescopes)

By reweighting assuming a \cos^3 muon distribution \rightarrow Acc = 0.788

Fig. ?



Rates corrected for:

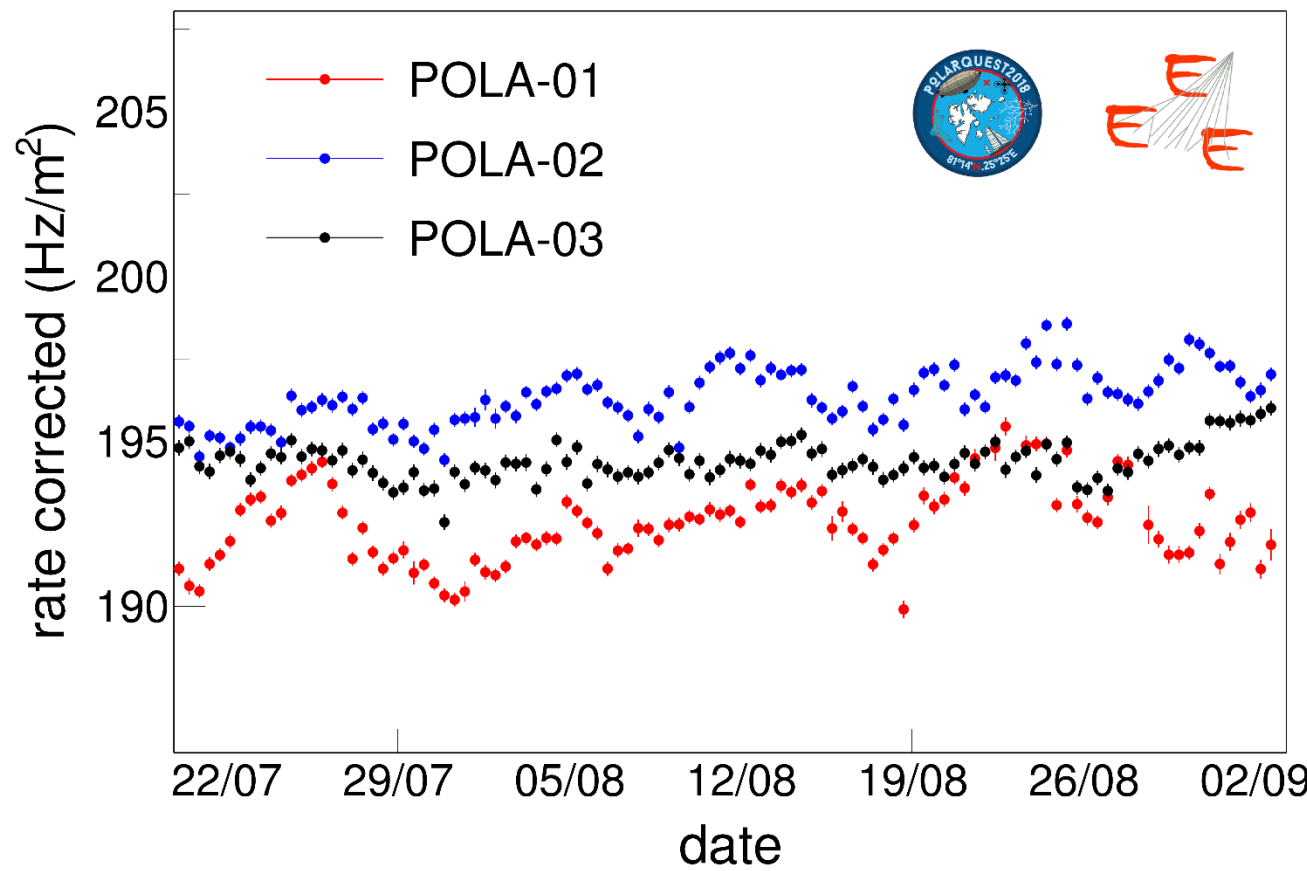
- pressure (@1000 mbar)
- orientation (POLA-01)
- material (P2 → ~3%, P3 → ~20%)
- material POLA-01?
- eff POLA-02 = POLA-01?

POLA-01 avarage rate @ 1013 mbar = 34.232388 Hz
POLA-02 avarage rate @ 1013 mbar = 34.919834 Hz
POLA-03 avarage rate @ 1013 mbar = 34.572186 Hz

10 hours bin

Not ready for a paper

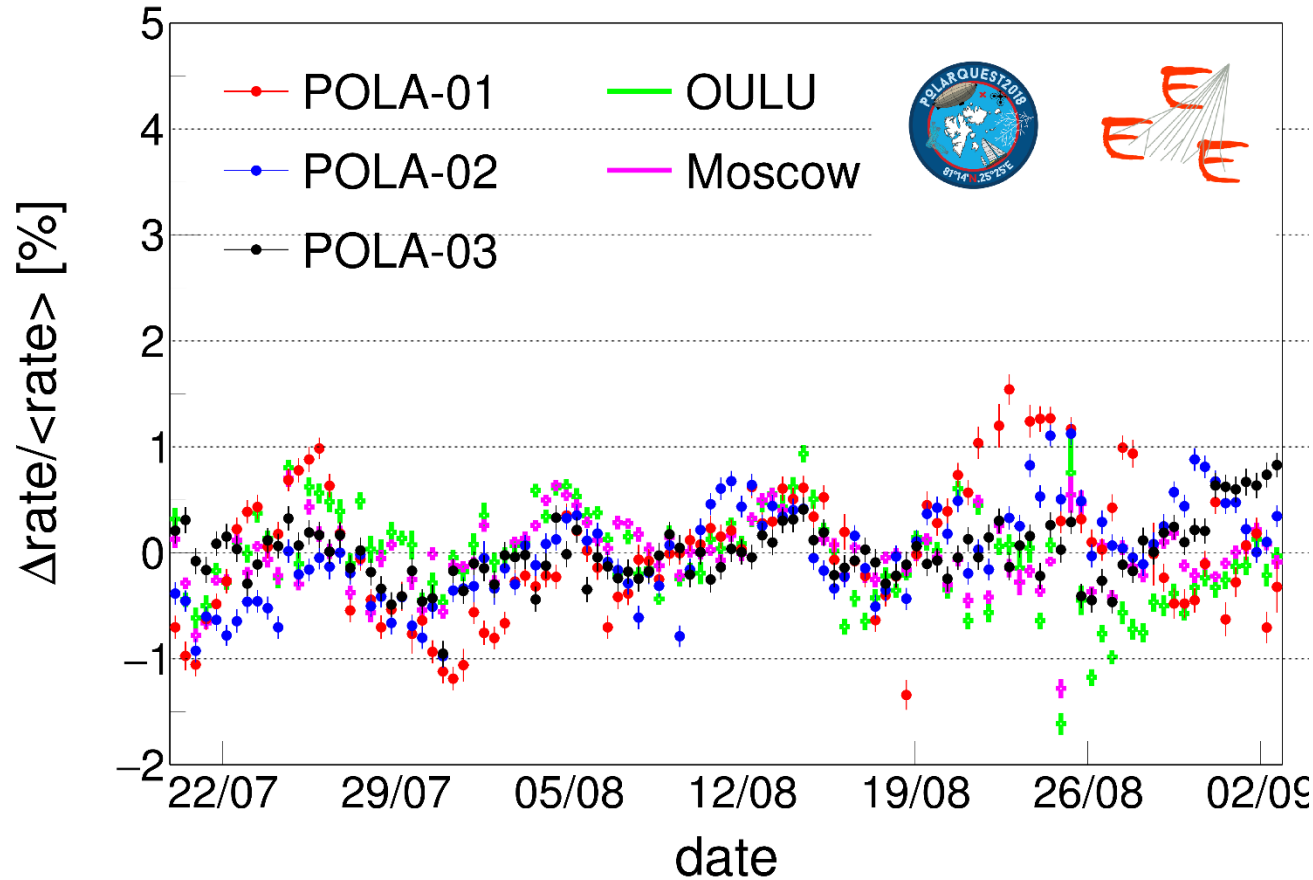
Fig. ?



If we add the acceptance of the detector (assuming \cos^2)

- POLA-01 average rate @ 1013 mbar = 192.5 Hz/m^2
- POLA-02 average rate @ 1013 mbar = 196.4 Hz/m^2
- POLA-03 average rate @ 1013 mbar = 194.4 Hz/m^2

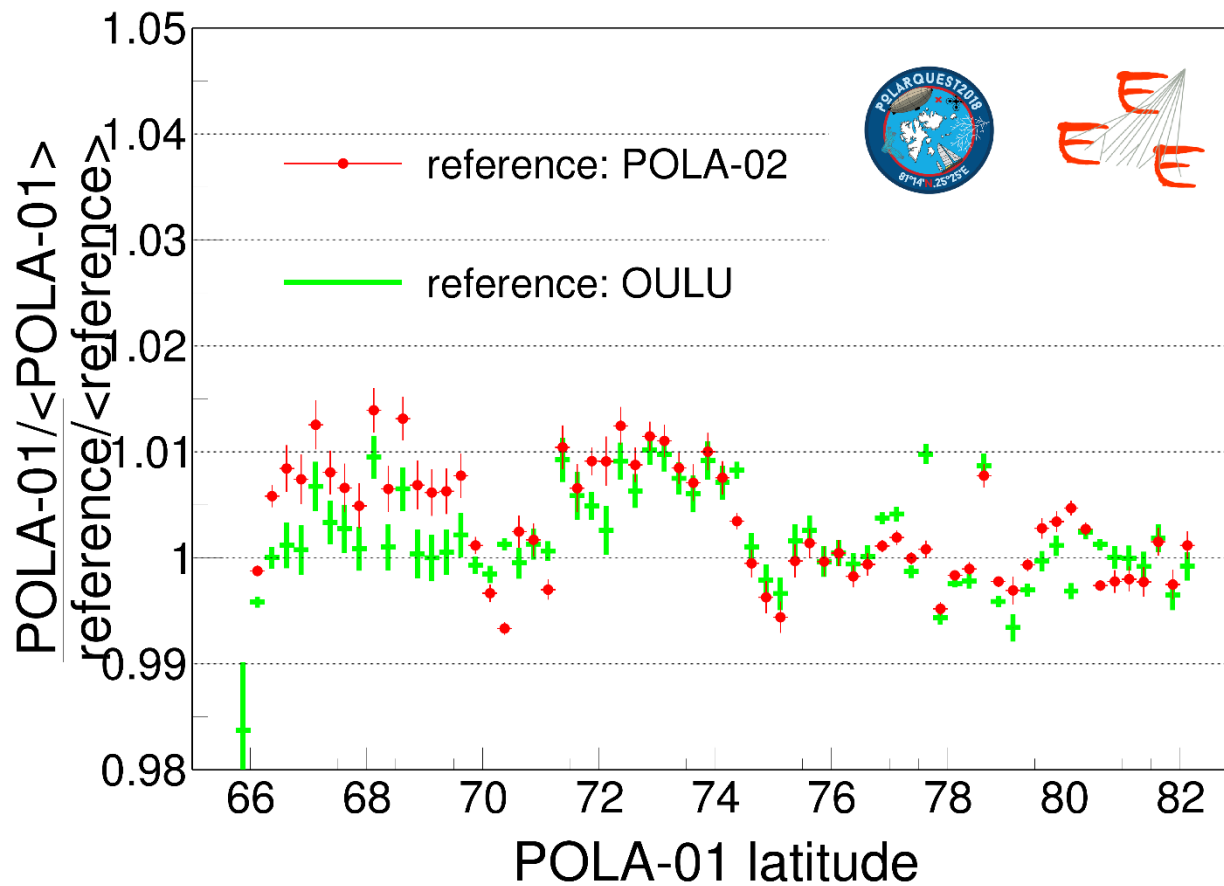
Fig. 3



Rate variation
vs time

I would keep
only OULU
data for
comparison

Fig. 4



Rate vs lat
ratios

Systematics

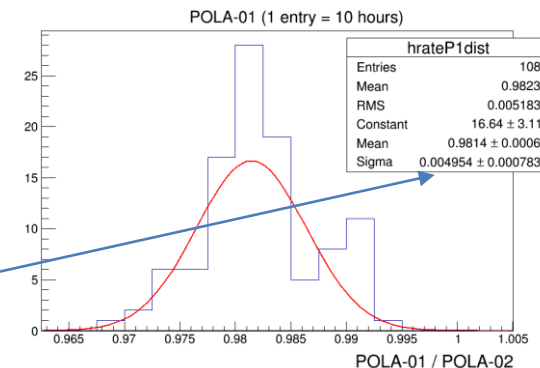
Input for a discussion

Absolute rates:

- Efficiency 1.5% = $(1-\varepsilon)/2$ ($\varepsilon=97\%$ as measured at CERN for POLA-01,03,04) (common to all telescopes)
- Material budget: derived by statistical errors in the outdoor measurements (only for POLA-02 and POLA-03)

Relative rates:

- Ratio fluctuations = 0.5%



Other preliminary polar results

The POLA-01 trip



POLA-01 Cern_26/06/2018-28/06/2018

POLA-01 Svalbard2018_21/07/2018-05/09/2018

POLA-01 VignaDiValle_27/11/2018

POLA-01 Cosenza_04/12/2018-05/12/2018

POLA-01 Cefalù_06/12/2018

POLA-01 Catania_31/01/2019

POLA-01 Lampedusa_07/03/2019

POLA-01 Lampedusa_08/03/2019

POLA-01 Bologna_08/04/2019

POLA-01 Germania_10/04/2019-12/04/2019

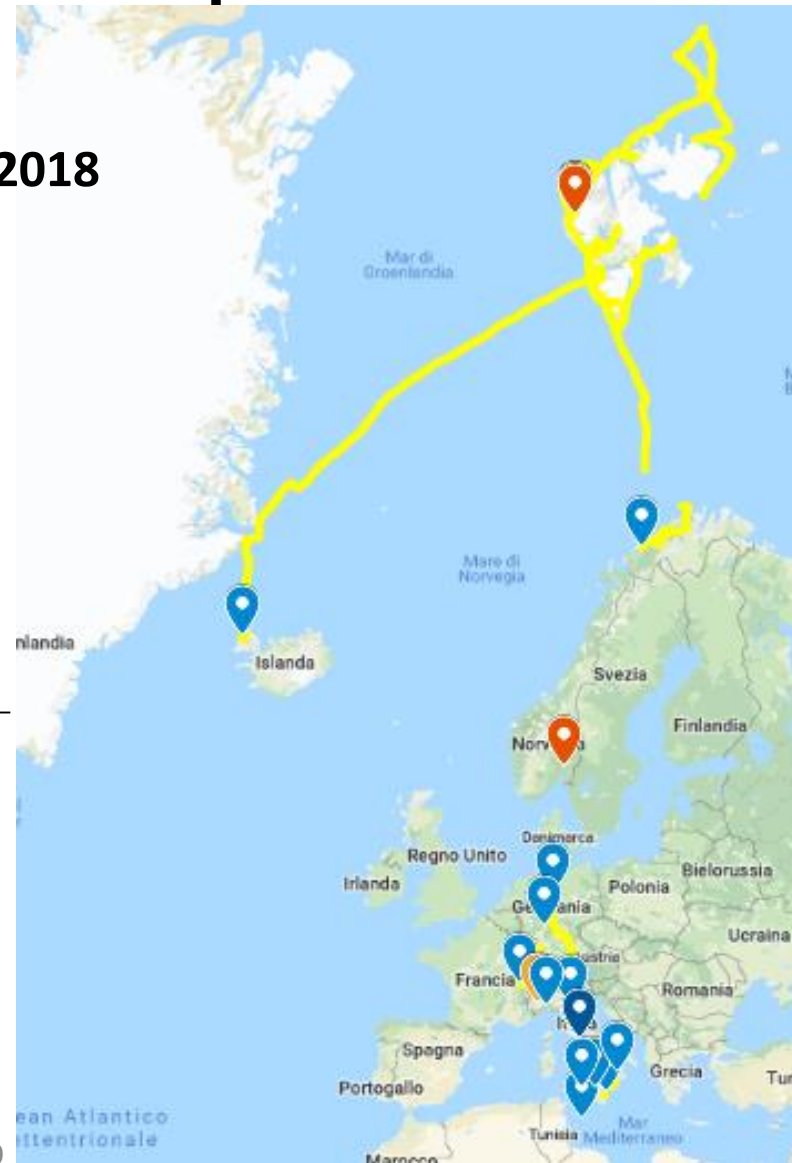
POLA-01 nyalesund_26/05-2019-...



= current telescope locations

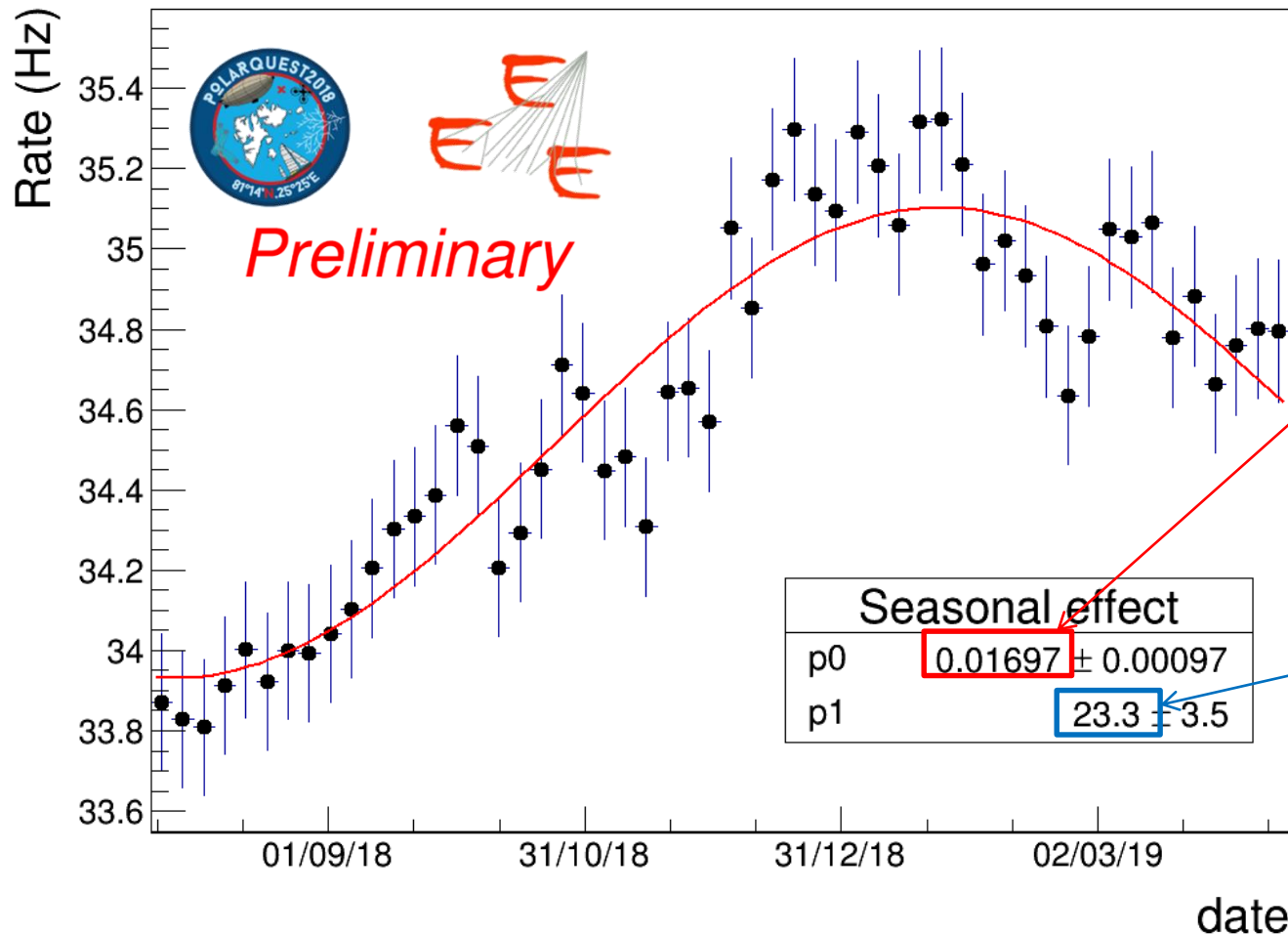


= touched by POLA-01

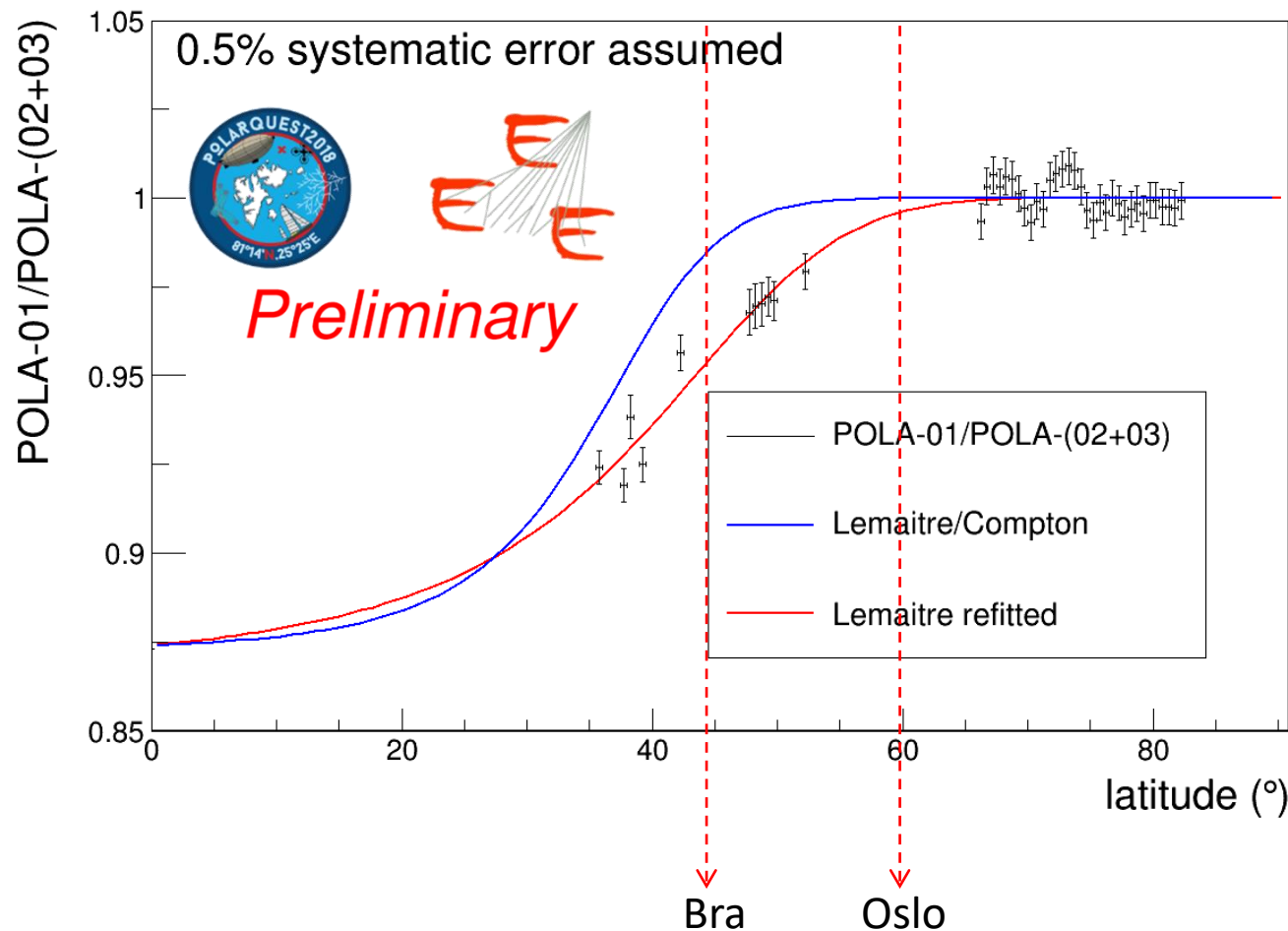


Seasonal effect

Rate vs Time (POLA-02 + POLA-03)



Latitude effect



Absolute rates
only for the
next paper
In order to
add POLA-02
and POLA-03
data