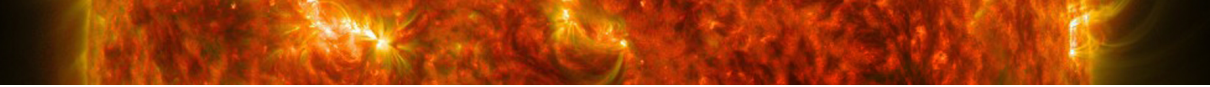

First results of the SA Agulhas II mobile mini-neutron monitor: Instrumental characterization and environmental sensitivity

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ICRC, virtual via Berlin, 2021

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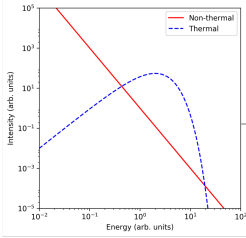
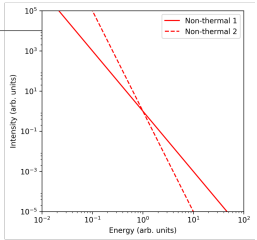
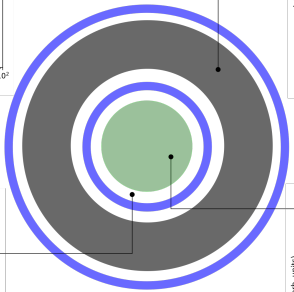
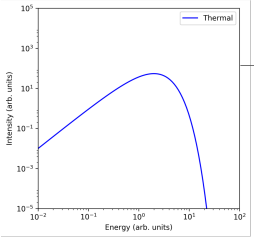
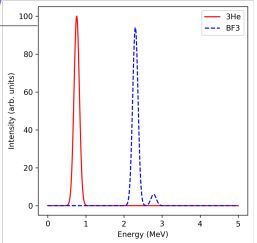
What does a NM measure?



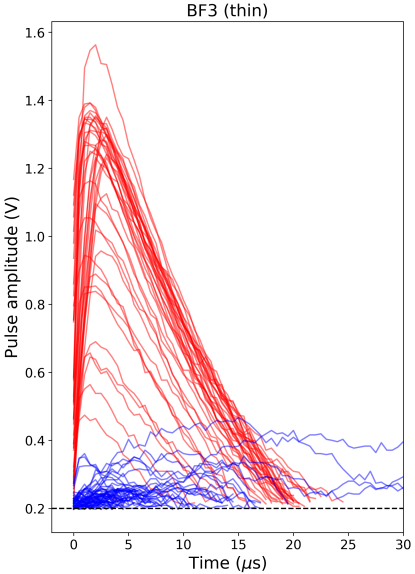


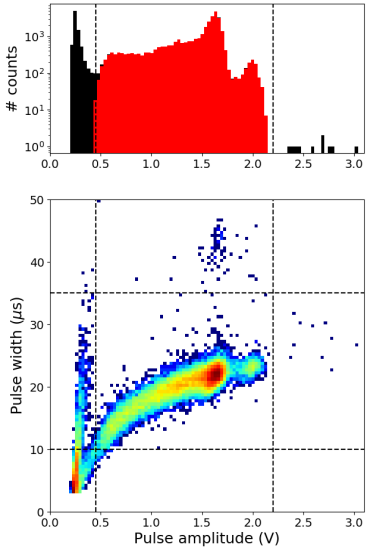






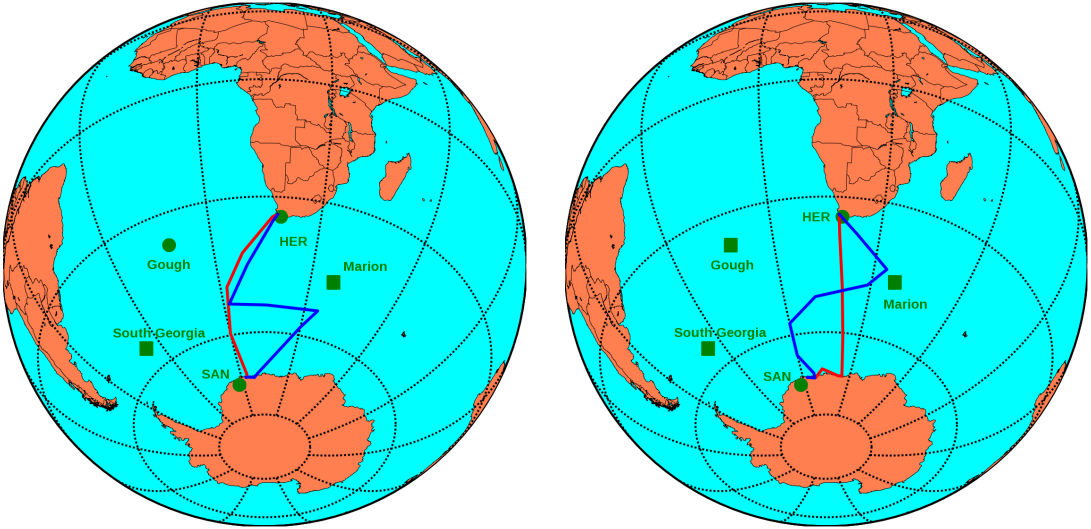
Mini-NM with new electronics featuring sub-μs resolution, *Strauss et al., 2020, Journal of Space Weather and Space Climate*.

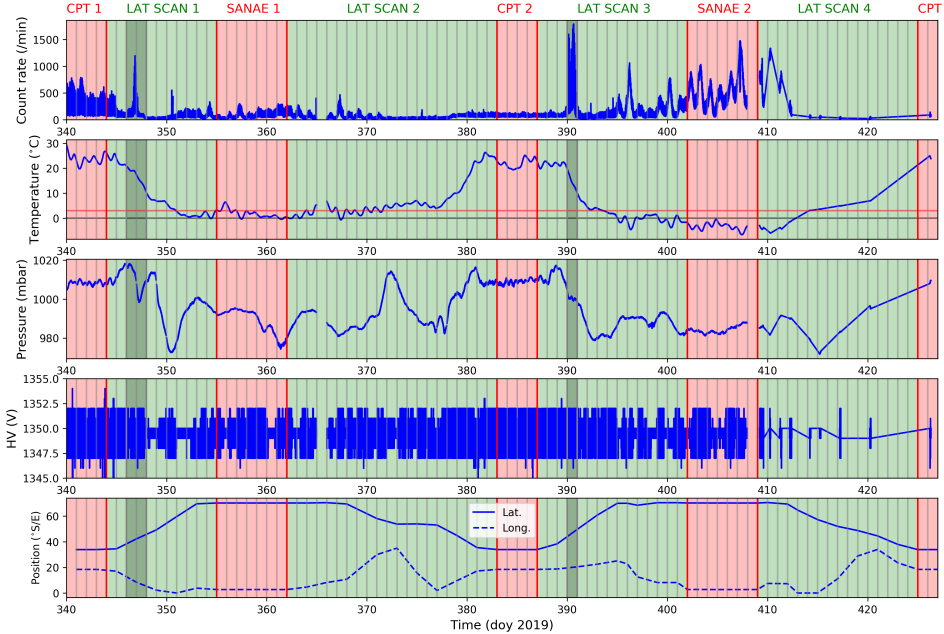




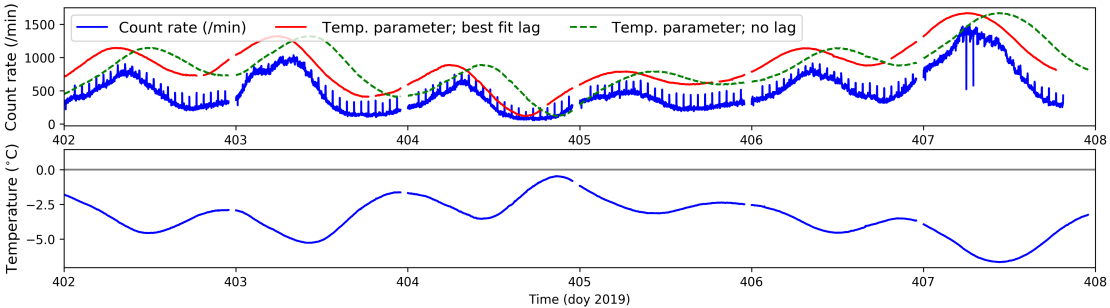
Installed on the South African research vessel, the *SA Agulhas II*, at the end of 2019.

SA Agulhas II 2019/2020 Antarctic relief voyage.




CPT 1
LAT SCAN 1
SANAE 1
LAT SCAN 2
CPT 2
LAT SCAN 3
SANAE 2
LAT SCAN 4
CPT 3
Count rate (/min)
Temperature (°C)
Pressure (mbar)
HV (V)
Position (°S/E)
Lat.
Long.
Time (doy 2019)

Count rate is sensitive to temperature variations. However, these is a lag between measure temperature and count rate.

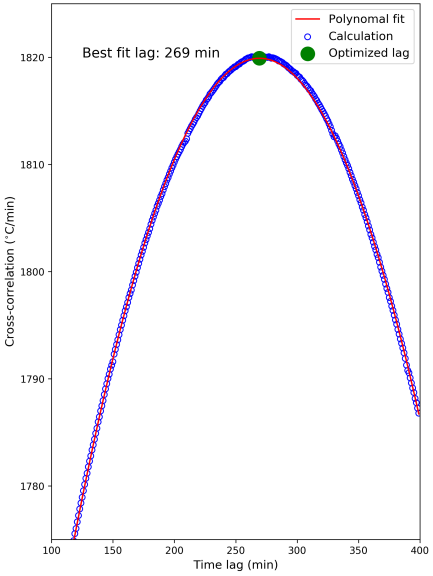


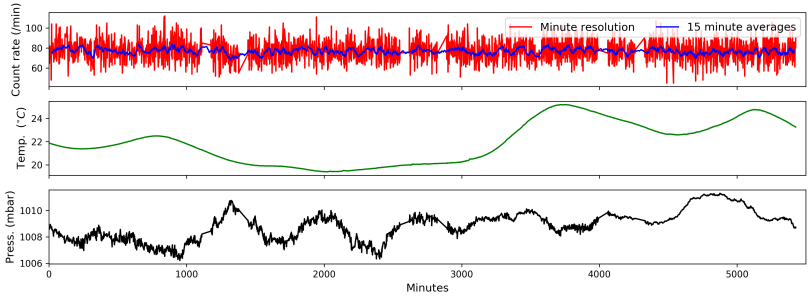
The cross-correlation between the temperature and count rate is calculated

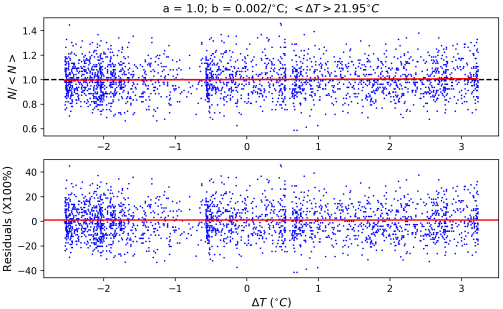
$$(N \star T)(n) = \sum_{m=0}^{m=M} N(m) \cdot T(m+n) \qquad (1)$$

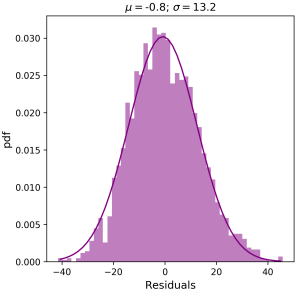
and a best-fit lag of 270 minutes is obtained.

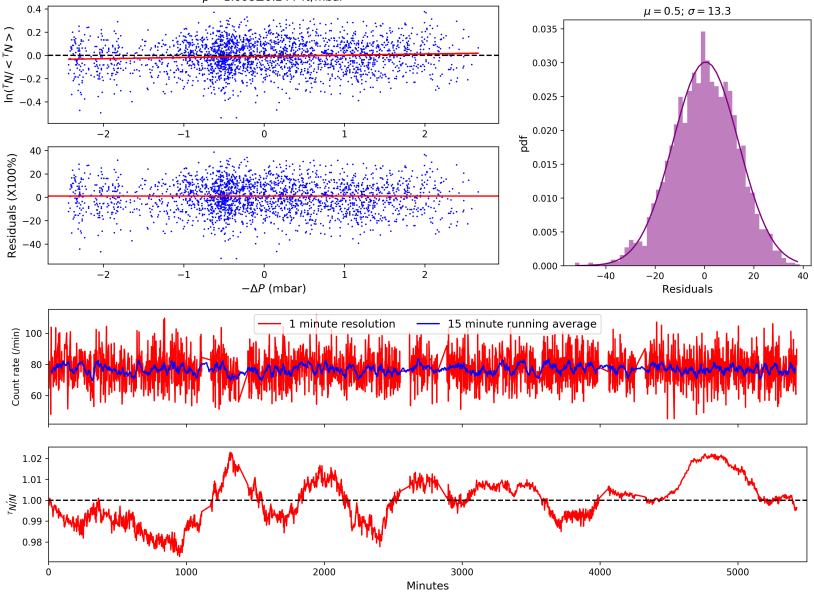
Temperature values of 270 minutes in the past is used for all temperature corrections.



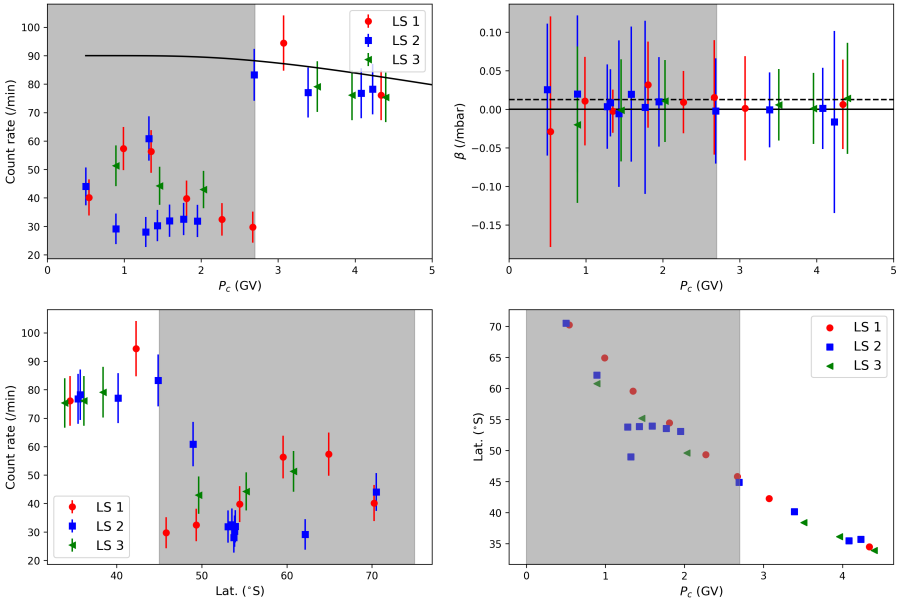

Minute resolution
15 minute averages
Count rate (/min)
Temp. (°C)
Press. (mbar)
Minutes


a = 1.0; b = 0.002/°C; $<\Delta T> = 21.95°C$
$N/<N>$
Residuals (X100%)
ΔT (°C)

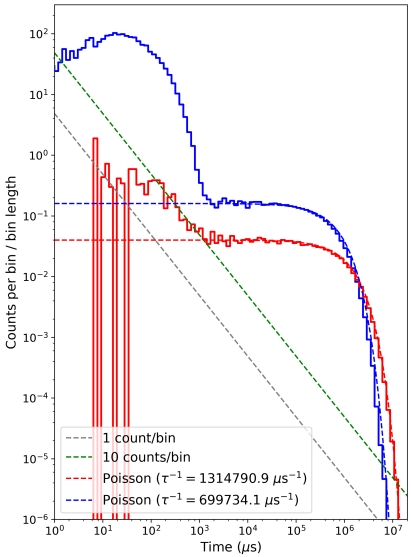

$\mu = -0.8$; $\sigma = 13.2$
pdf
Residuals

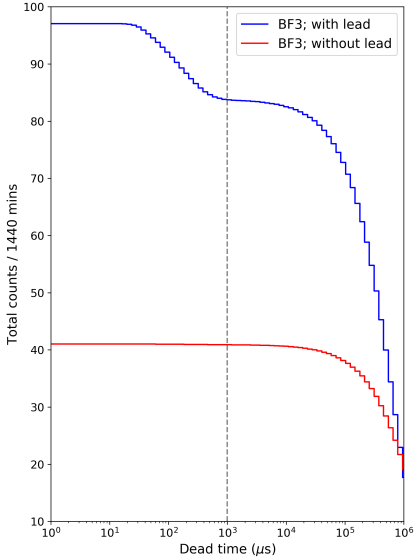

β = 1.008±0.244 %/mbar
ln('N/ < 'N >)
Residuals (X100%)
−ΔP (mbar)
μ = 0.5; σ = 13.3
pdf
Residuals
1 minute resolution
15 minute running average
Count rate (/min)
'N/N
Minutes

Something strange is observed when the shipped passes beyond 45° South....

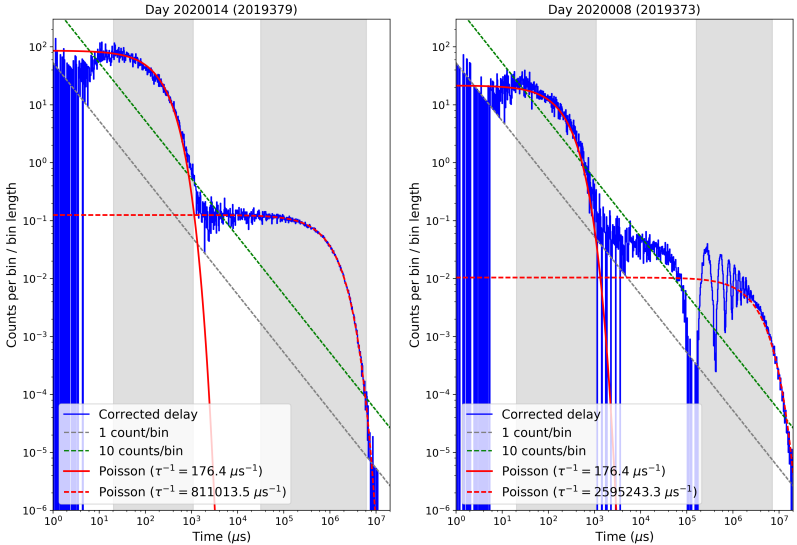


Examine the multiplicity, i.e. the distribution of the waiting time between subsequent counts....
First, notice the effect of the lead producer during tests in the lab:

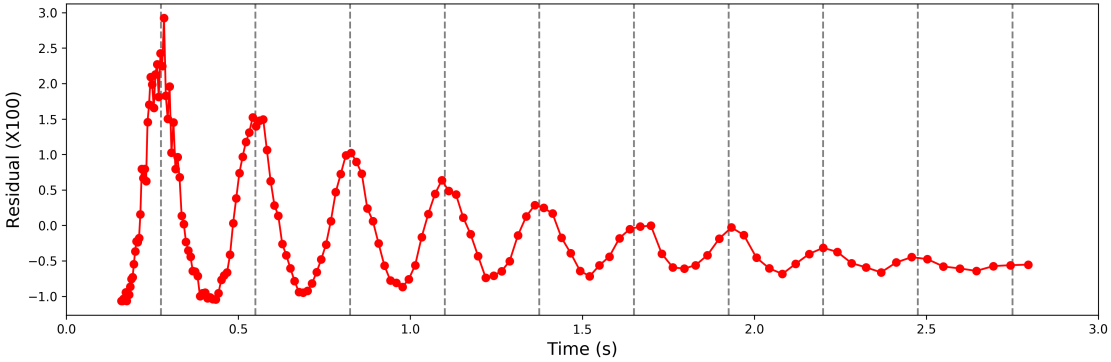




Now look at this for normal (left) data and strange high latitude data (right)...



Residuals between measured multiplicity spectrum and fitted Poisson distribution has a periodic nature:



The frequency seems to match that of the ice radar above the mini-NM which is only switched on when the ship is above 45° latitude!

To summarize:

- Mini-NM with upgraded electronics installed on SA Agulhas II.
- Monitor operated nominally, however:
  – A large temperature dependence was observed when the temperature is less than 3°C; believed to be instrumental effect.
  – A large effect from the ice radar is seen in countrate and confimed from the multiplicity spectrum.

In future:

- Monitor will be moved to more suitable room on ship and semi-permanently installed.
- COVID-19 means that ship is still under quarantine and monitor move is yet to be made.

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