Evolution of dark currents in LYRA detectors - Update 2023

IED 03 Apr 2023

Once again, the evolution of dark currents was determined with the improved method as described in earlier reports, see here:
  https://www.sidc.be/users/dammasch/IED_20220502_DarkCurrents2022.pdf
  https://www.sidc.be/users/dammasch/IED_20210511_DarkCurrents2021.pdf

15 calibration campaigns between September 2022 and March 2023 were taken into account, sufficiently covering a temperature range between approx 40 and 53 C.

Most cases lead to consistent parameters and perfect exponential functions of dark-current values vs. temperature. Some observations had to be excluded from the exponential fit: For unknown reasons in ch1-1 and ch1-3, for obvious reasons (zero values for high temperatures) in ch3-3 and ch3-4.

Generally, the following results are again confirmed:
- the curves of Si detectors become steeper with time of mission;
- there is practically no change in PIN detectors (ch1-2, ch2-2, ch3-2), their dark currents stay constant with time of mission, closely to the initial lab measurements, practically independent of temperature;
- the curves of MSM detectors become flatter with time of mission, with ch1-1 and ch1-3 being somewhat ambiguous.

Again, two cases are shown on the next page: The problematic case of ch1-1 (which is similar to ch1-3), and the unproblematic case of ch2-4 (which is similar to all other channels).

The following nine pages show the dark current development for ch1-1 (MSM), ch1-3 (MSM), ch1-4 (Si), ch2-1 (MSM), ch2-3 (MSM), ch2-4 (MSM), ch3-1 (Si), ch3-3 (Si), ch3-4 (Si). Each time, the upper figure shows the lab measurements before launch. The lower figure shows the lab measurement in black and the evolution color coded: early observations in blue, recent observations in red, the extrapolation for next year as a dotted curve.

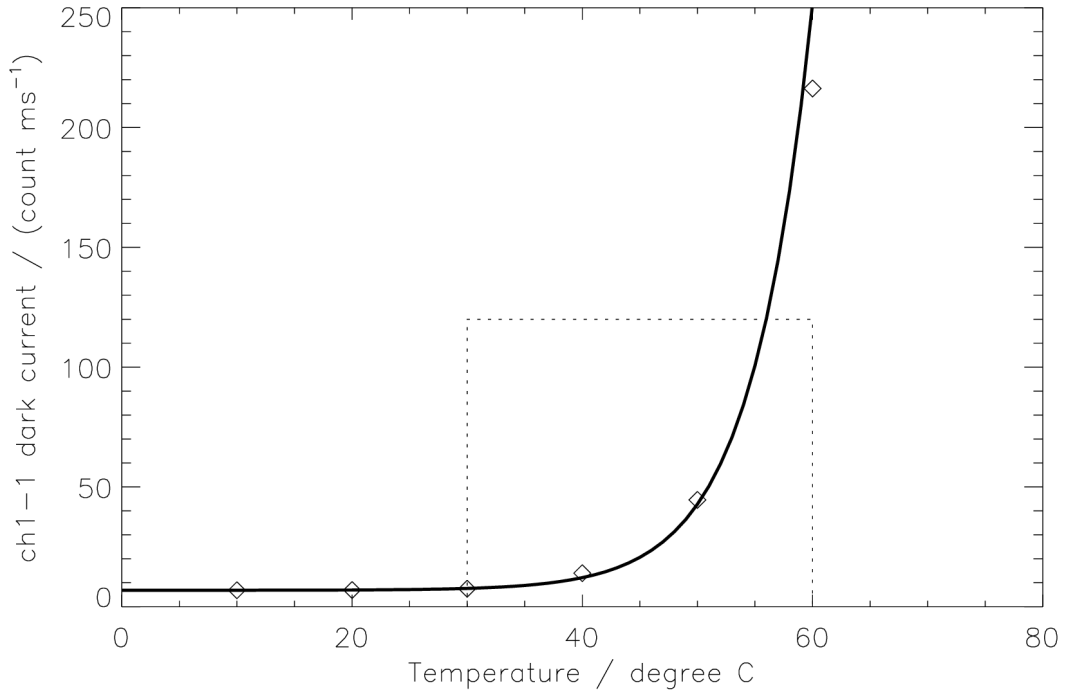The calibration software will be consequently updated.

Campaigns Sep 2022 — Mar 2023
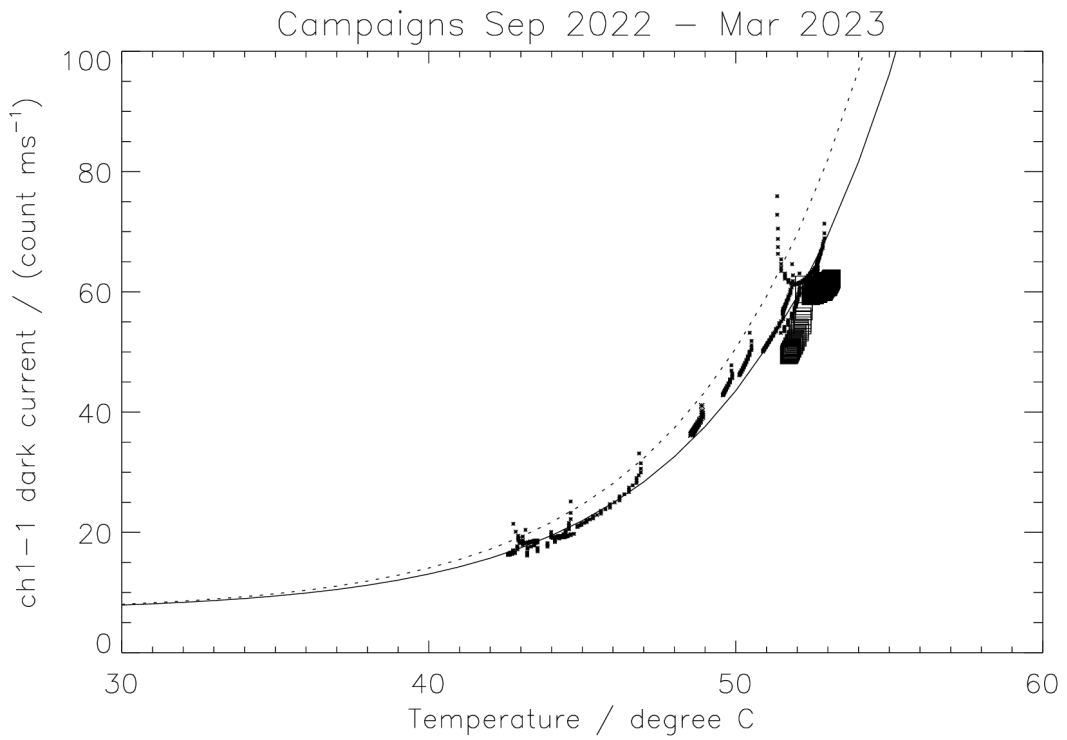
Problematic case: Some observations (squares) were excluded, last year's extrapolation (dotted curve) differs from actual result.
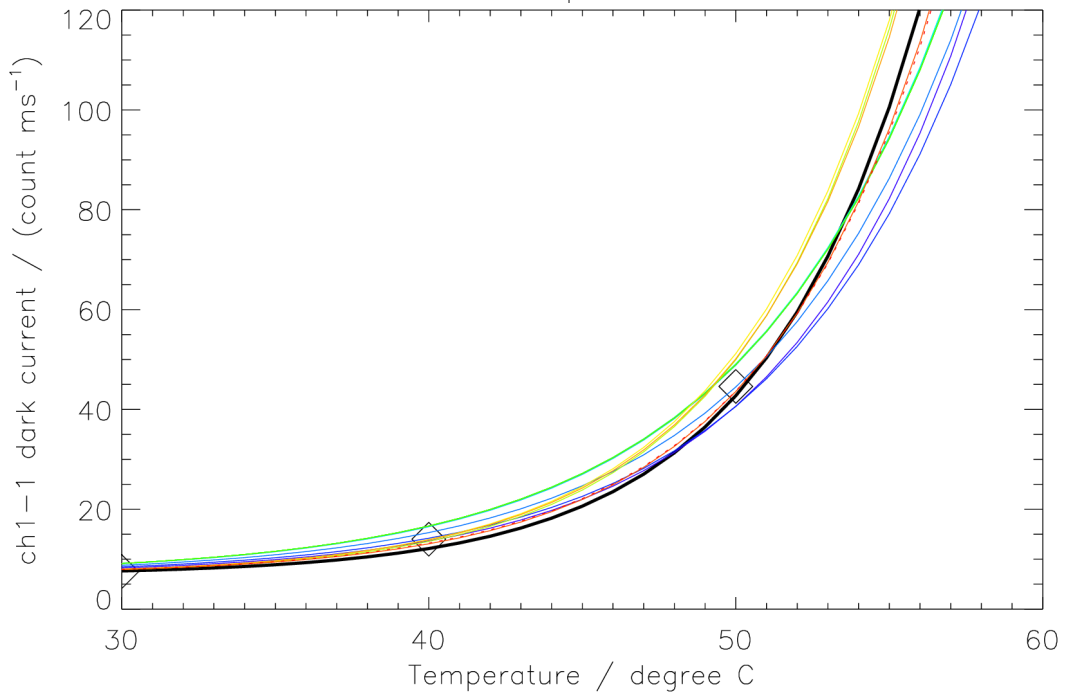

Campaigns Sep 2022 — Mar 2023
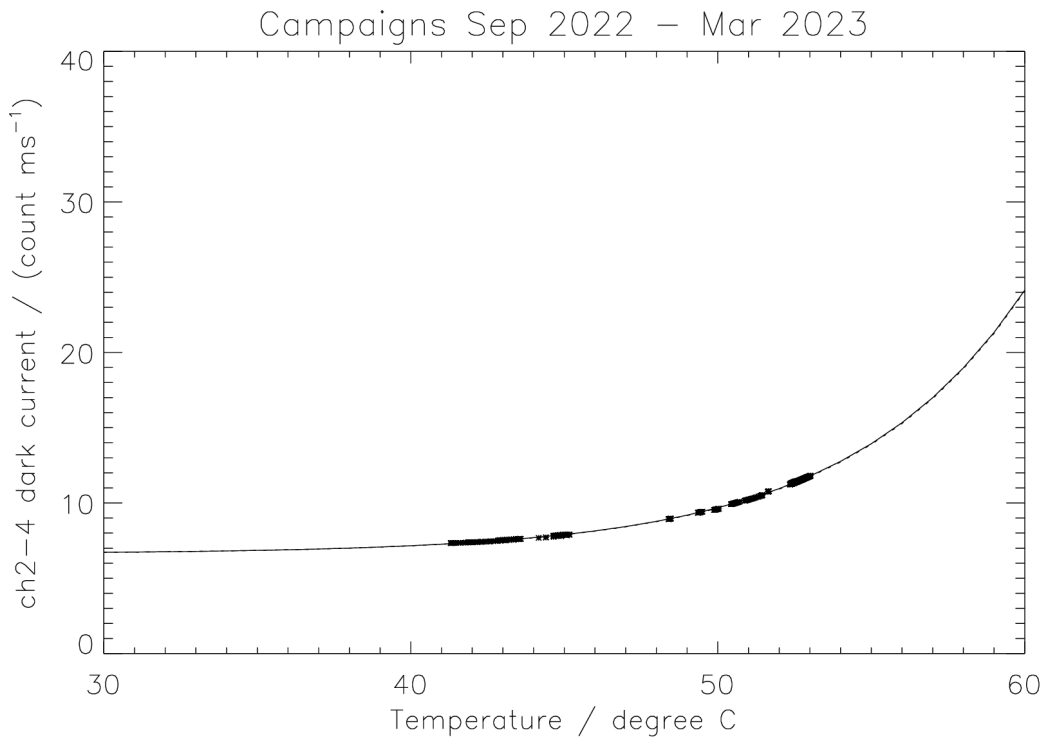
Unproblematic case: All observations are perfectly situated on the fitted curve, which in turn is almost exactly like extrapolated last year (dotted curve).
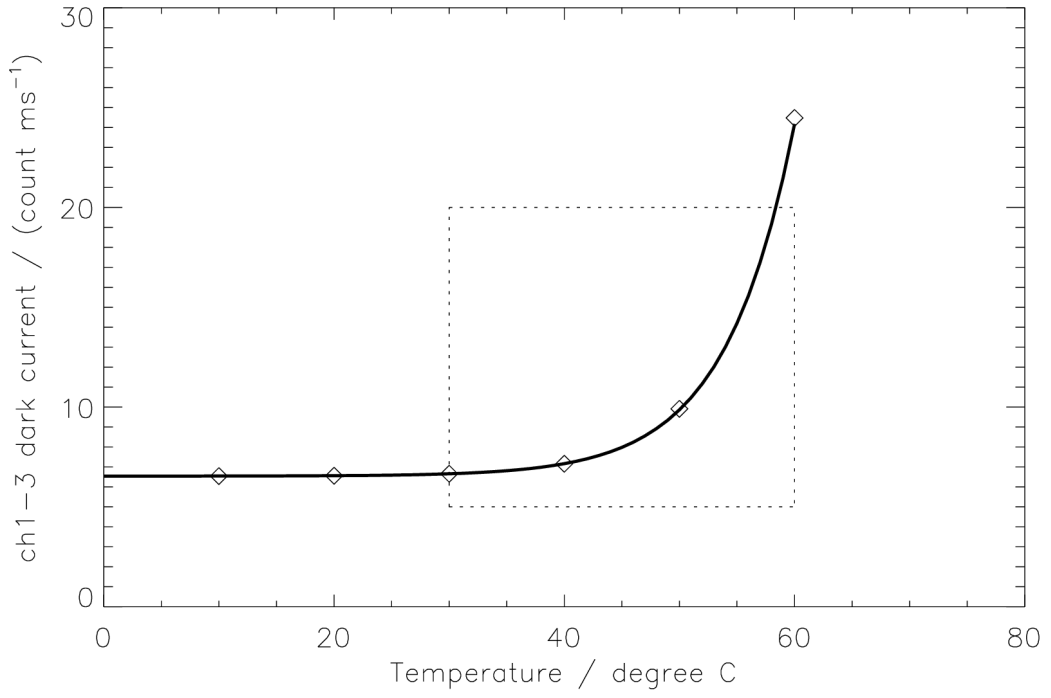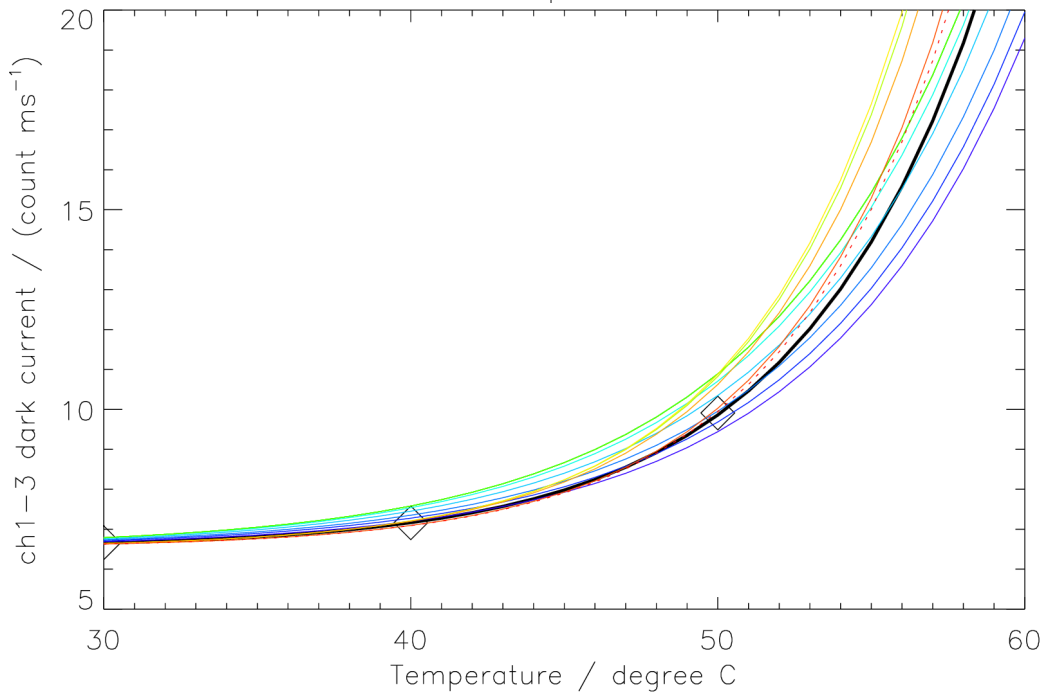
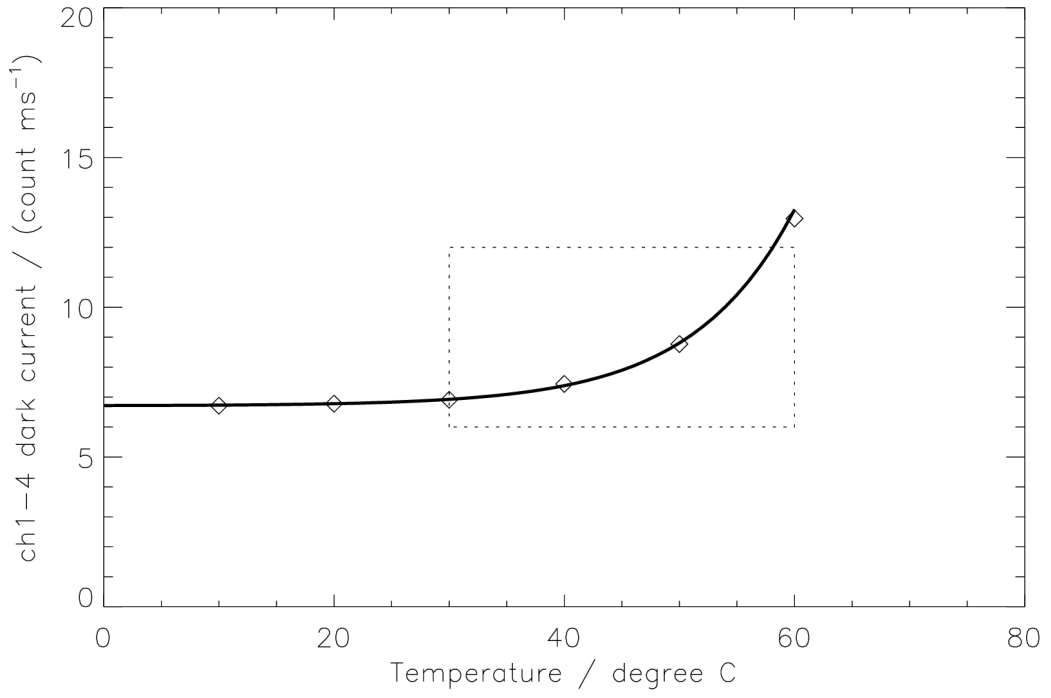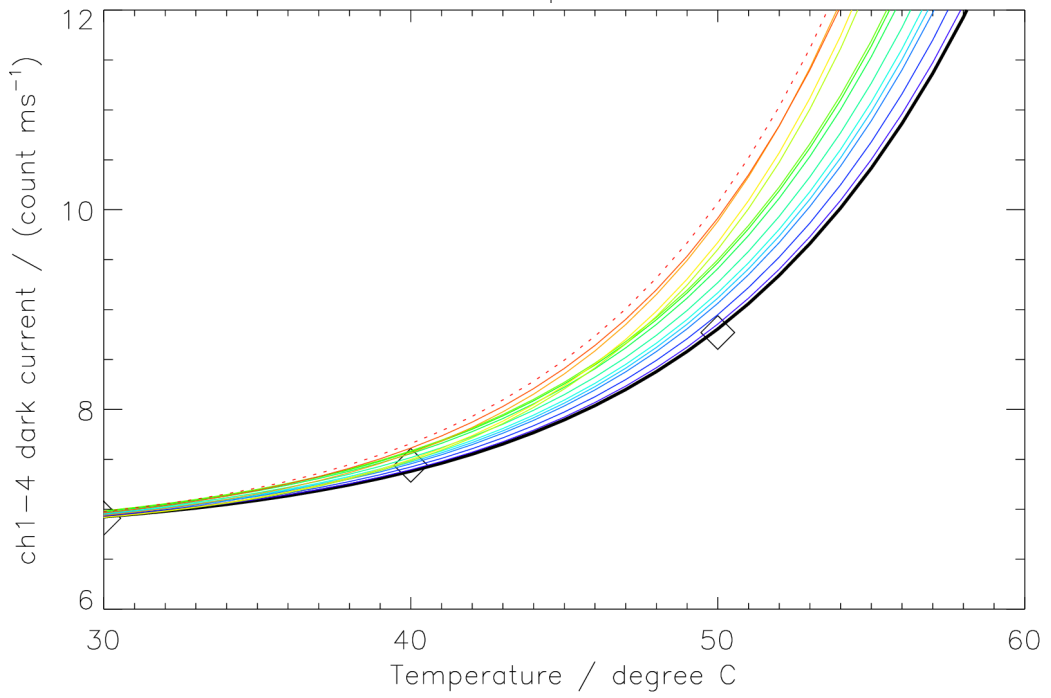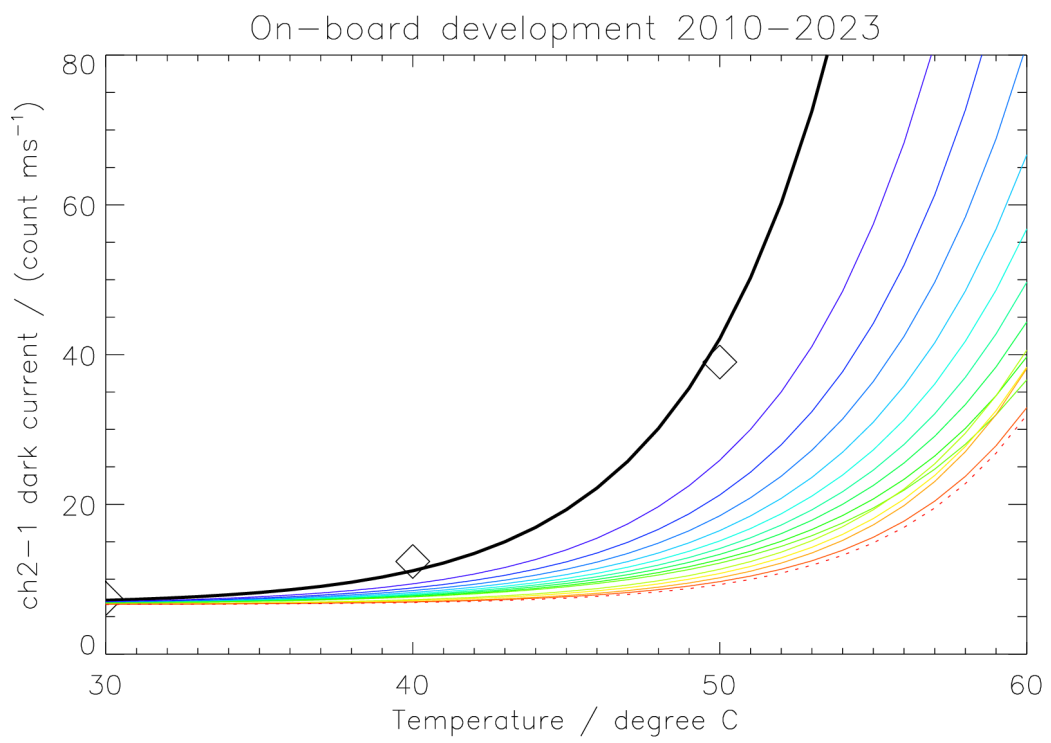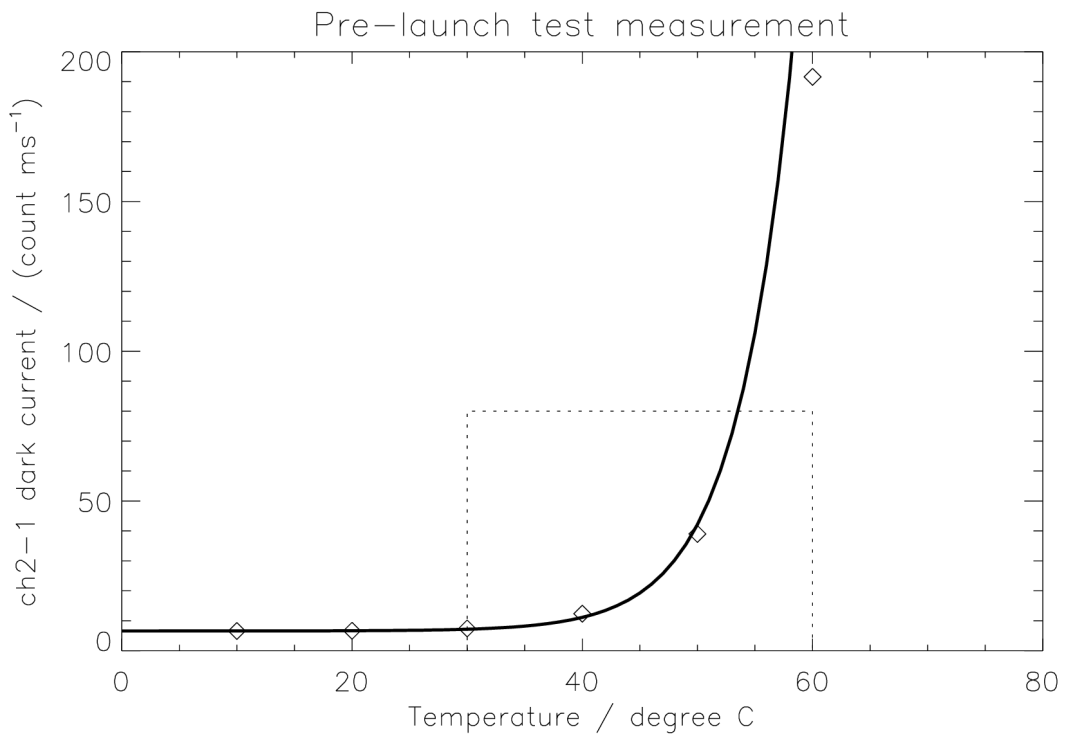**Pre-launch test measurement**
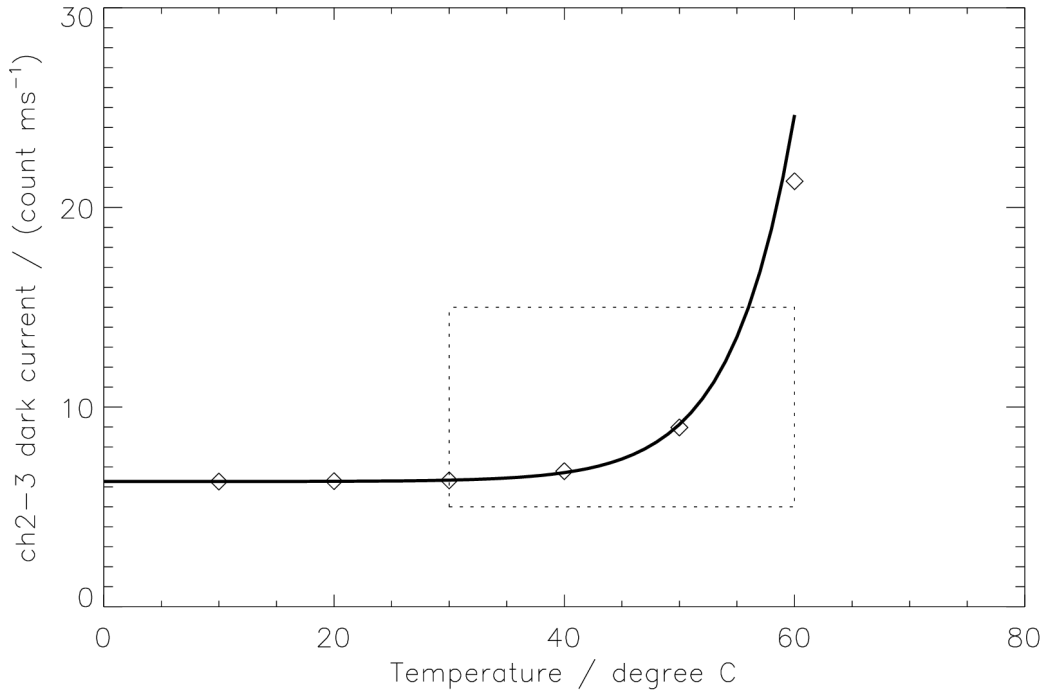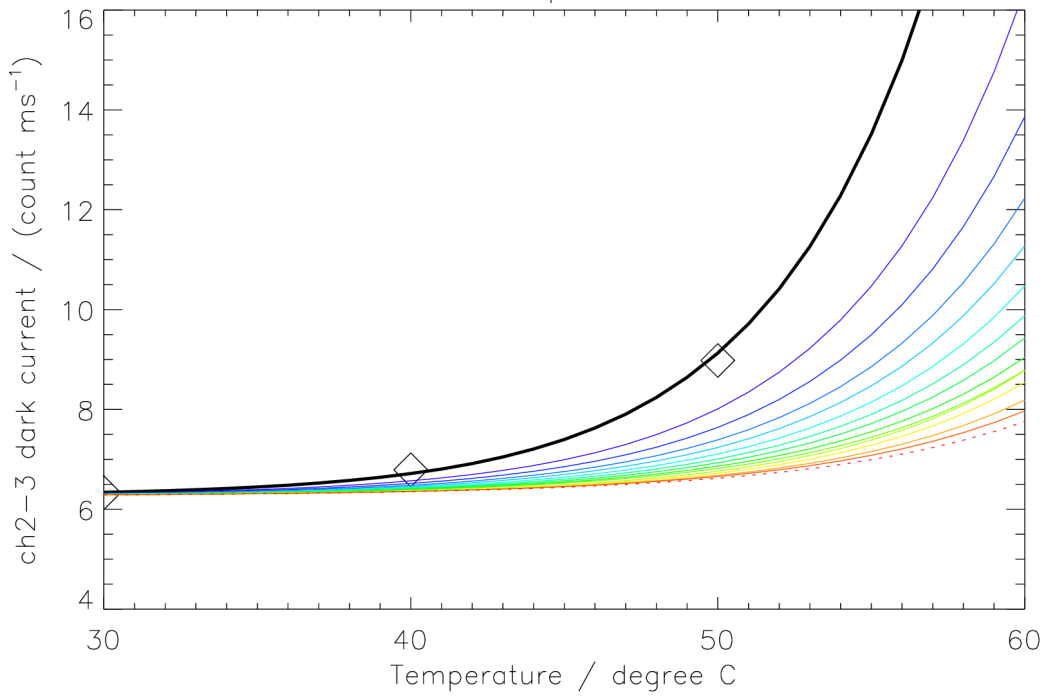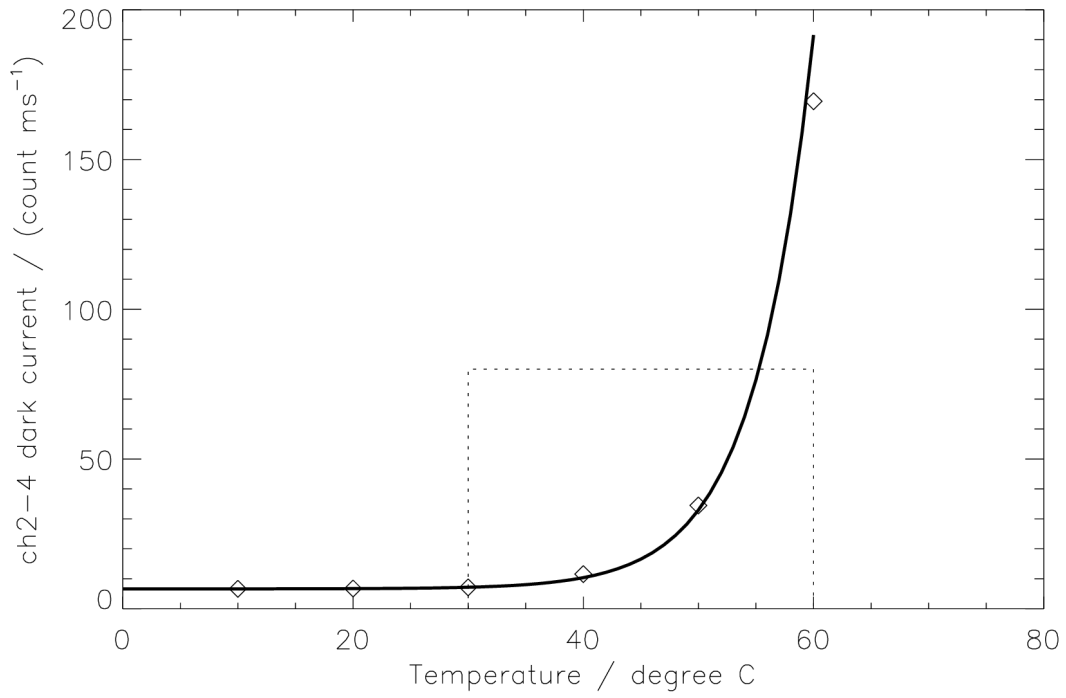
On-board development 2010−2023

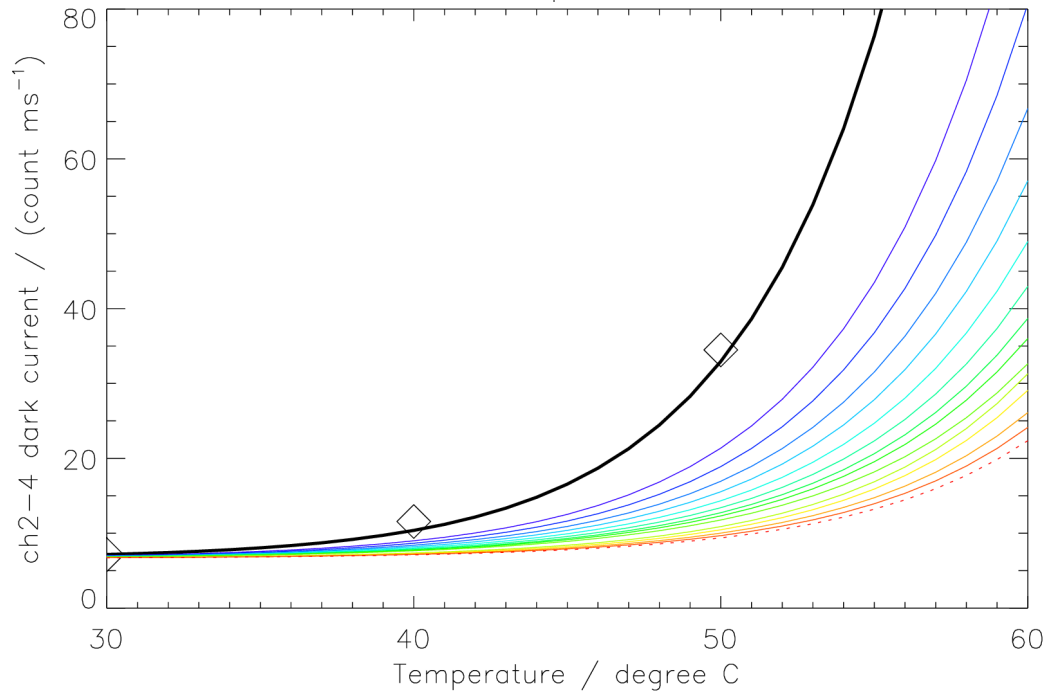Pre-launch test measurement

On-board development 2010-2023

Pre-launch test measurement
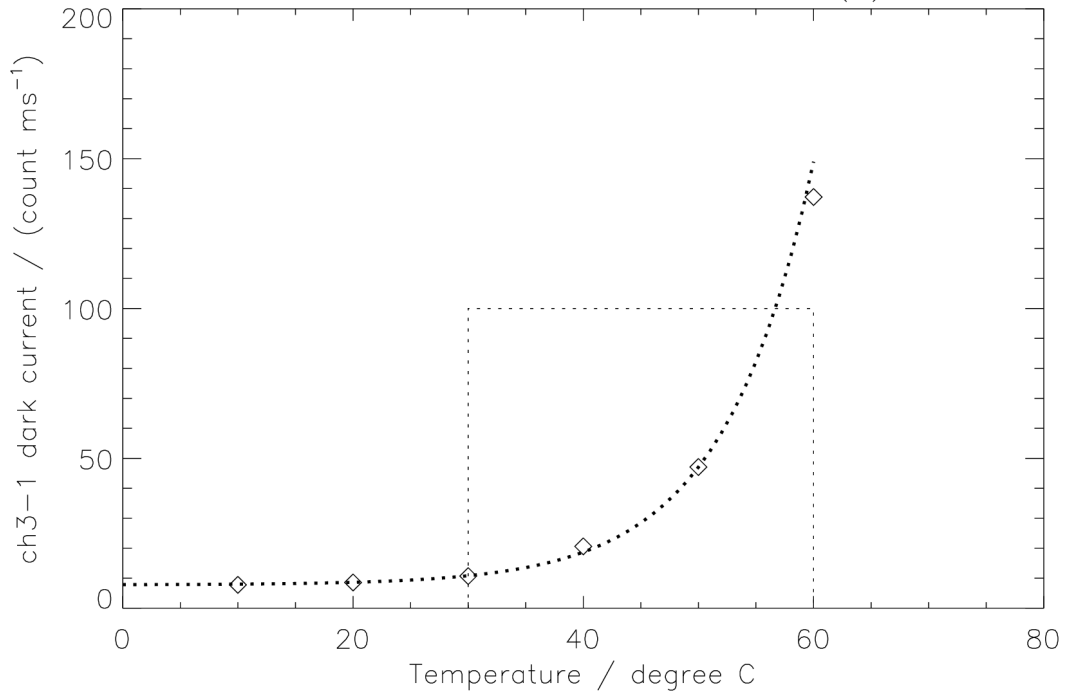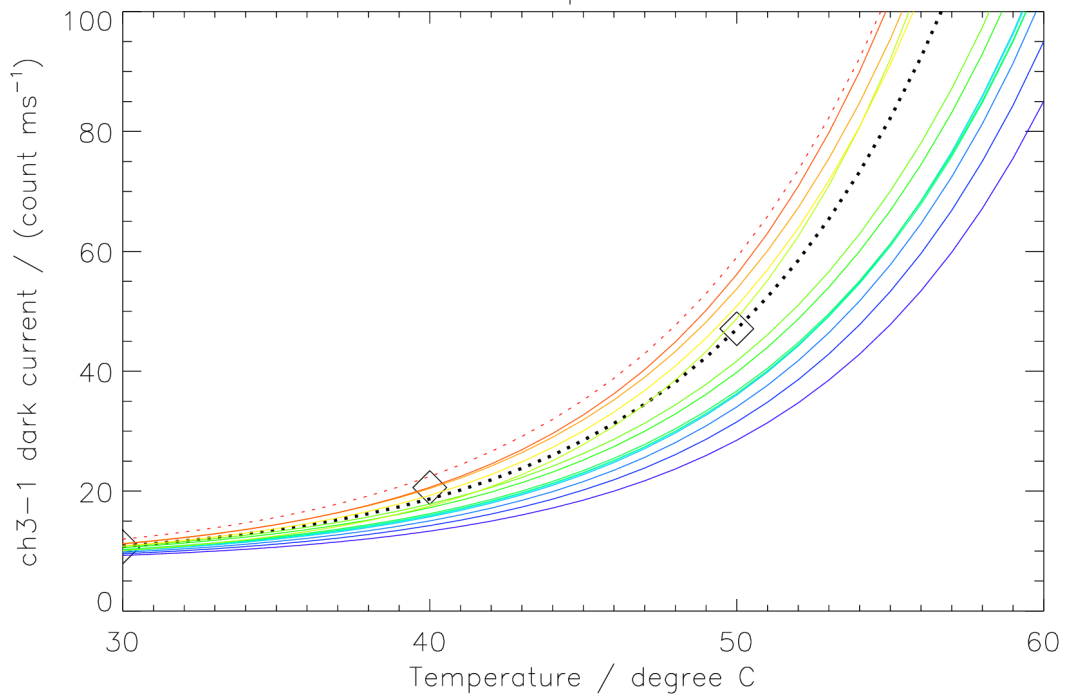
On-board development 2010−2023

Pre-launch test measurement

On-board development 2010−2023

Pre-launch test measurement

On-board development 2010–2023

Pre-launch test measurement

ch2-4 dark current / (count ms^{-1})

Temperature / degree C

On-board development 2010-2023

ch2-4 dark current / (count ms^{-1})

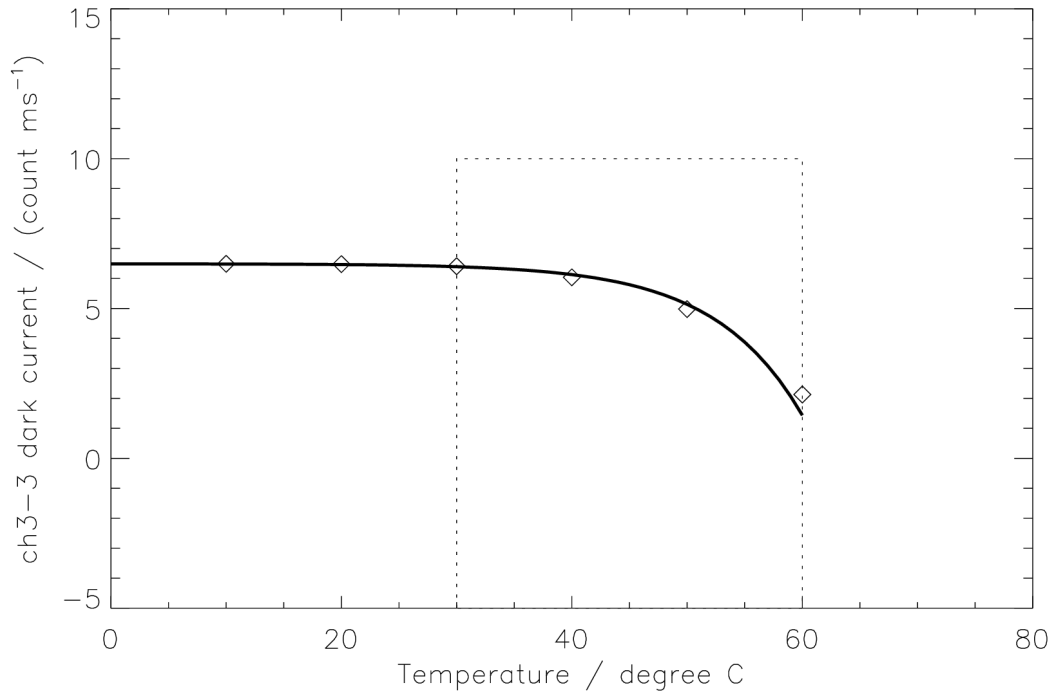Temperature / degree C

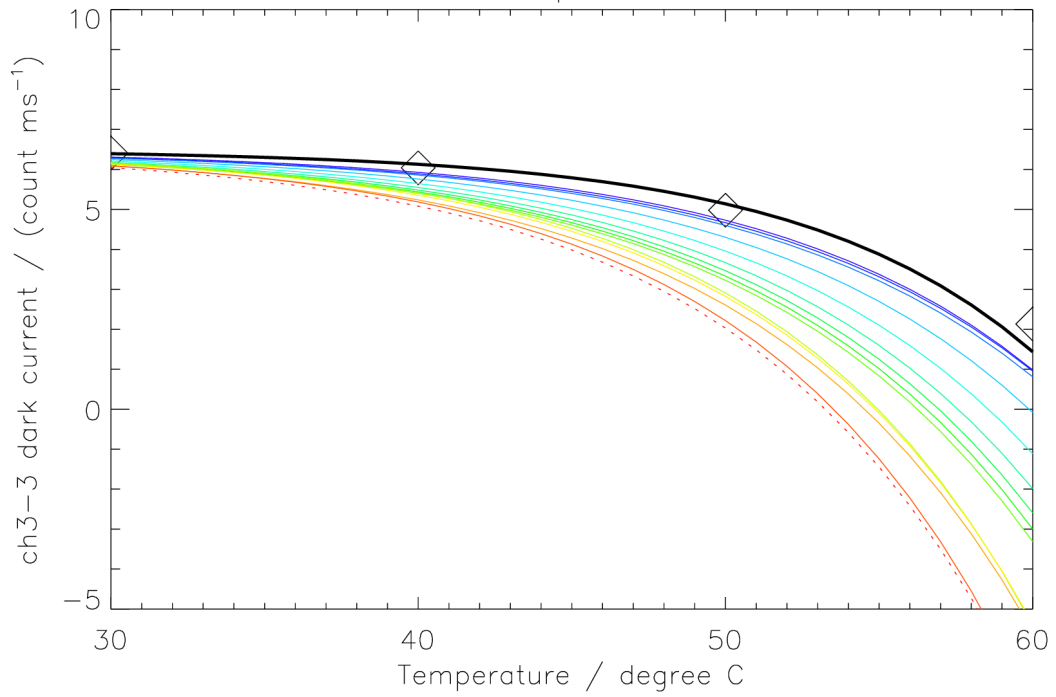## Pre-launch test measurement (?)
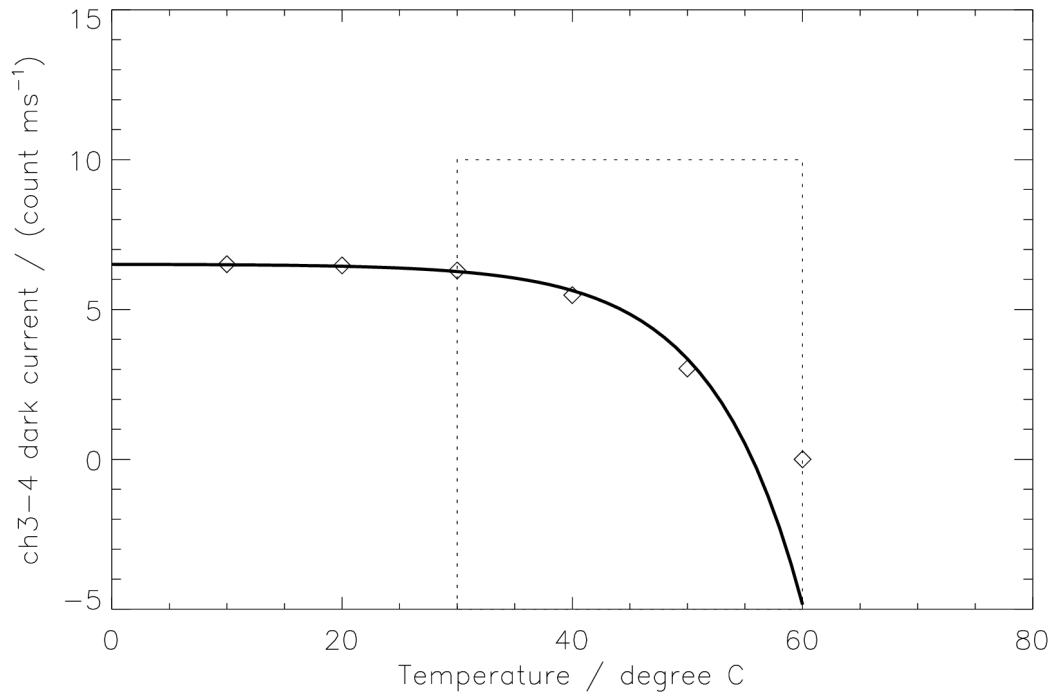
On-board development 2010−2023

Pre-launch test measurement

On-board development 2010−2023

Pre-launch test measurement

On-board development 2010–2023