

Evolution of dark currents in LYRA detectors - Update 2024

IED 21 Mar 2024

The development of the dark currents was determined with the method described earlier

https://www.sidc.be/users/dammasch/IED_20230403_DarkCurrents2023.pdf

https://www.sidc.be/users/dammasch/IED_20220502_DarkCurrents2022.pdf

https://www.sidc.be/users/dammasch/IED_20210511_DarkCurrents2021.pdf

but once more improved: This time, more data of the bi-weekly calibration campaigns were taken into account and used. These campaigns took place September 2023 - March 2024, and they covered a representative temperature range between 41 and 54 C. From the 14 official campaigns, 3 are considered “failed”, because the doors of unit 2 and 3 stayed open and unit 1 did not observe. So, from these campaigns, only some completely occulted observations were used and considered dark currents for unit 2 and 3. As a replacement for unit 1 measurements, some completely occulted observations of the monthly campaigns of November and January were used.

As in the last years, some data points in ch1-1 and ch1-3 were outliers and had to be excluded from the fitting of the exponential curve that estimates the dark current as a function of temperature. All fits were close to last year’s extrapolation, and the (linear) extrapolation for the next season was done as usual. The method can be considered as stable and converging.

The development of the dark currents from 2010 to 2024 is shown on the next nine pages. 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 red line.

The channels and their detectors are:

ch1-1 (MSM)

ch1-2 (PIN, not shown)

ch1-3 (MSM)

ch1-4 (Si)

ch2-1 (MSM)

ch2-2 (PIN, not shown)

ch2-3 (MSM)

ch2-4 (MSM)

ch3-1 (Si)

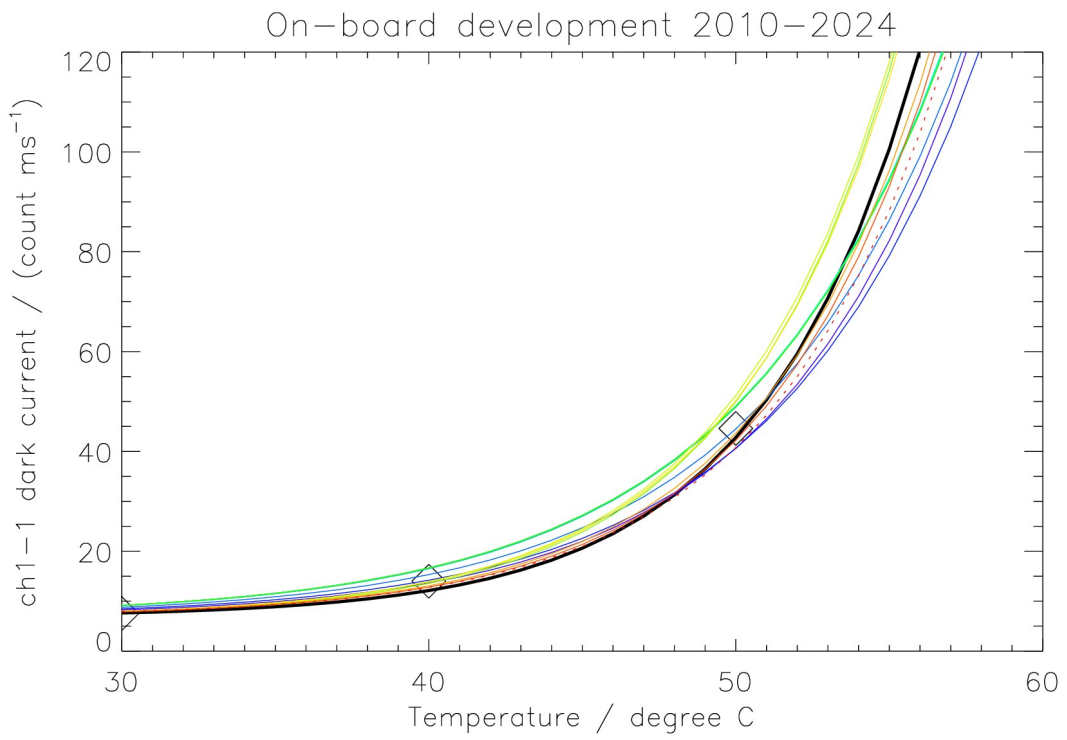
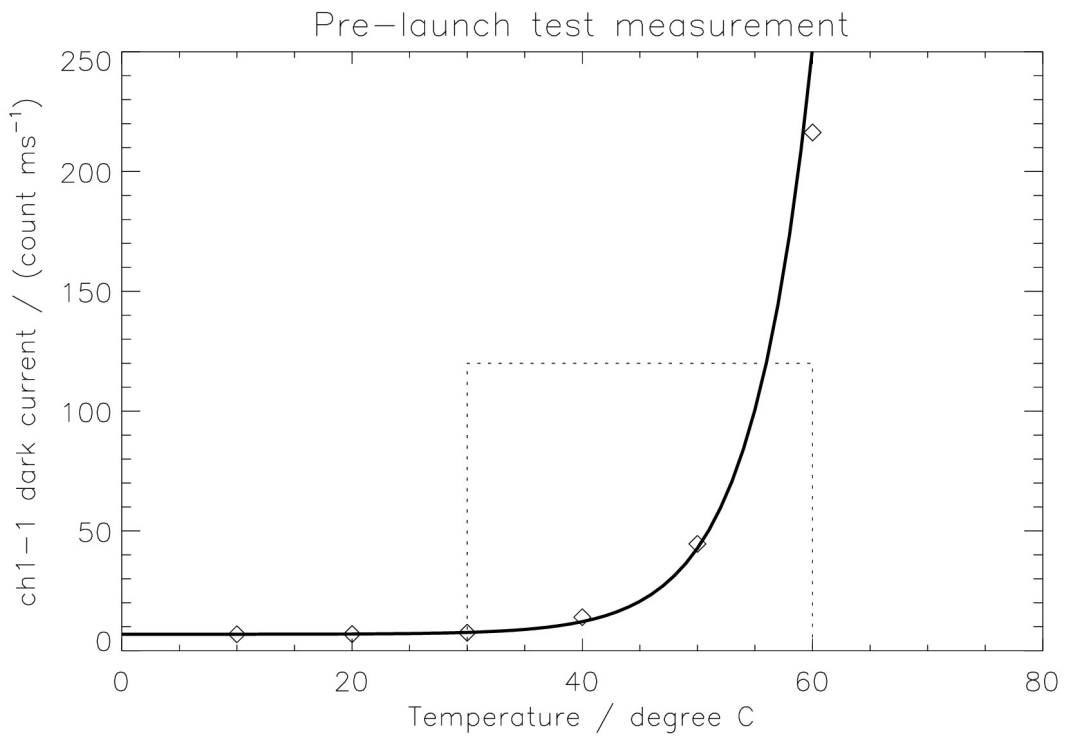
ch3-2 (PIN, not shown)

ch3-3 (Si)

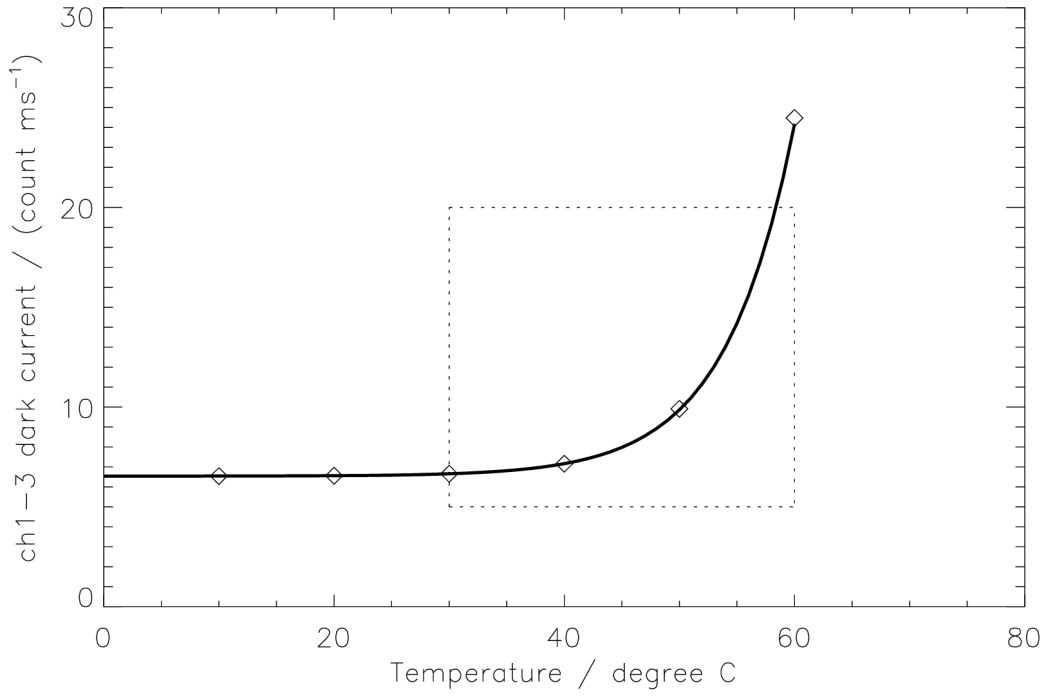
ch3-4 (Si)

Generally, the following results are once again confirmed:

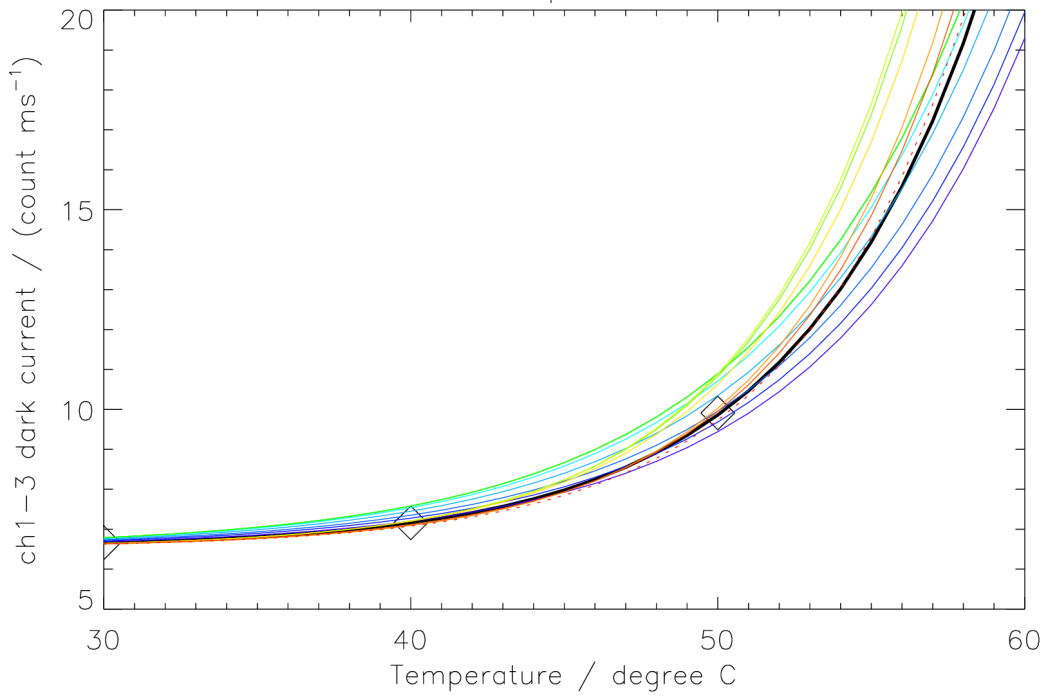
- the curves of Si detectors become steeper with time of mission - this holds essentially also for ch3-3 and ch3-4, although their curves are upside down for possible electronic reasons (but never negative);
- there is practically no change in PIN detectors - their dark currents stay constant with time of mission, closely to the initial lab measurements, practically independent of temperature: $DC(ch1-2)=6.485$ counts/ms, $DC(ch2-2)=6.455$ counts/ms, $DC(ch3-2)=6.402$ counts/ms;
- the curves of MSM detectors become flatter with time of mission, ch1-1 and ch1-3 being somewhat ambiguous: probably the changes were initially over-estimated, and the curves actually stayed quite close to the lab measurements all the time.



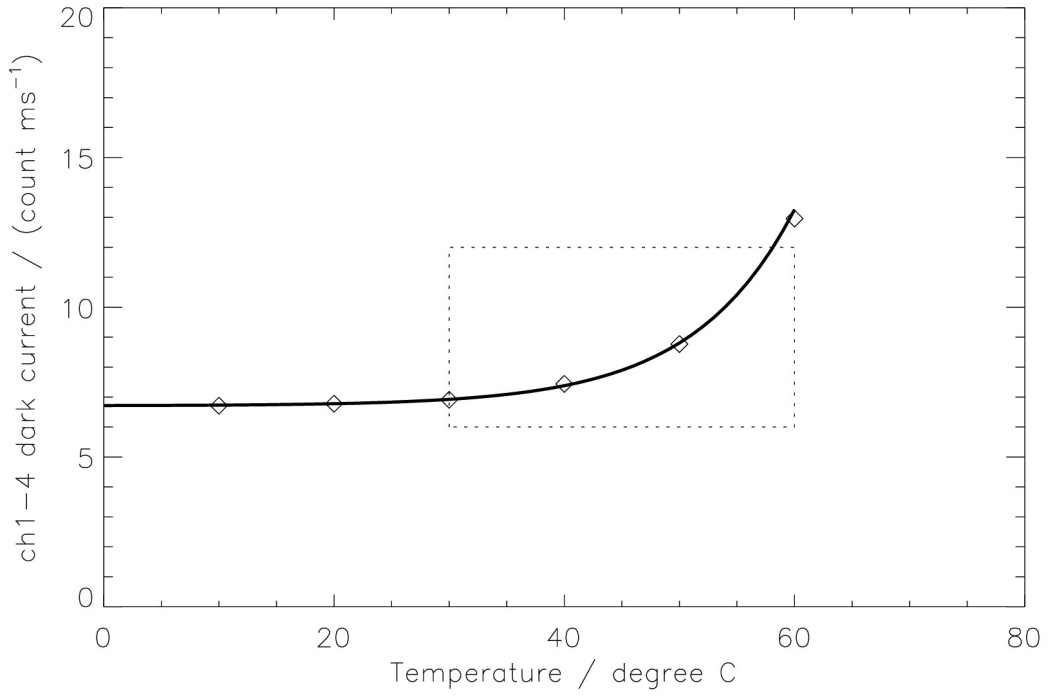
Pre-launch test measurement



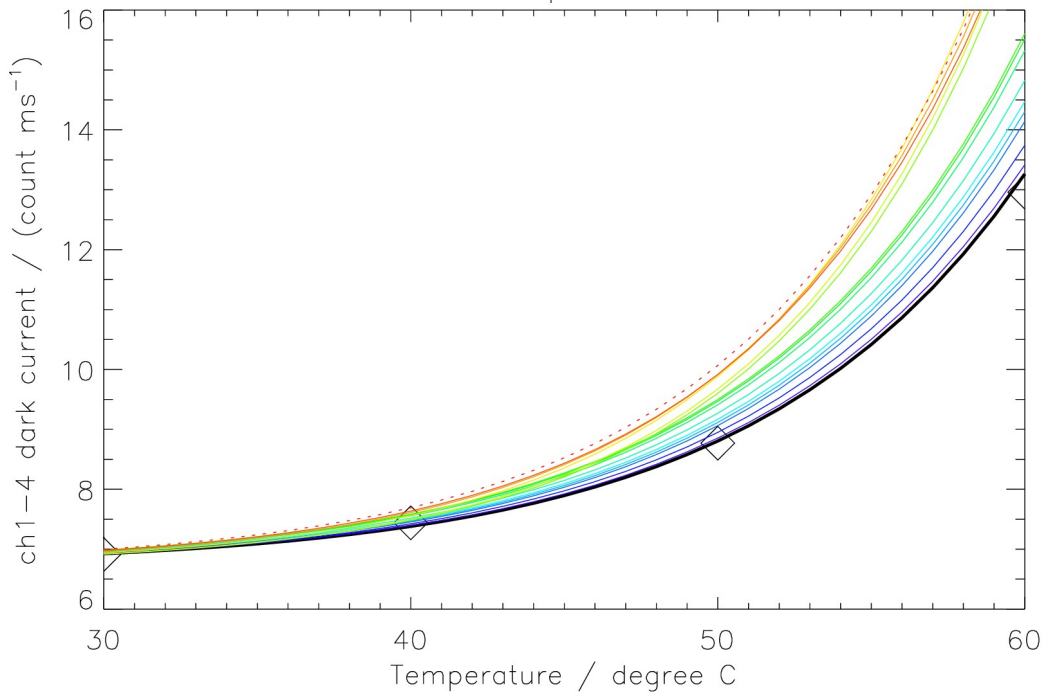
On-board development 2010-2024

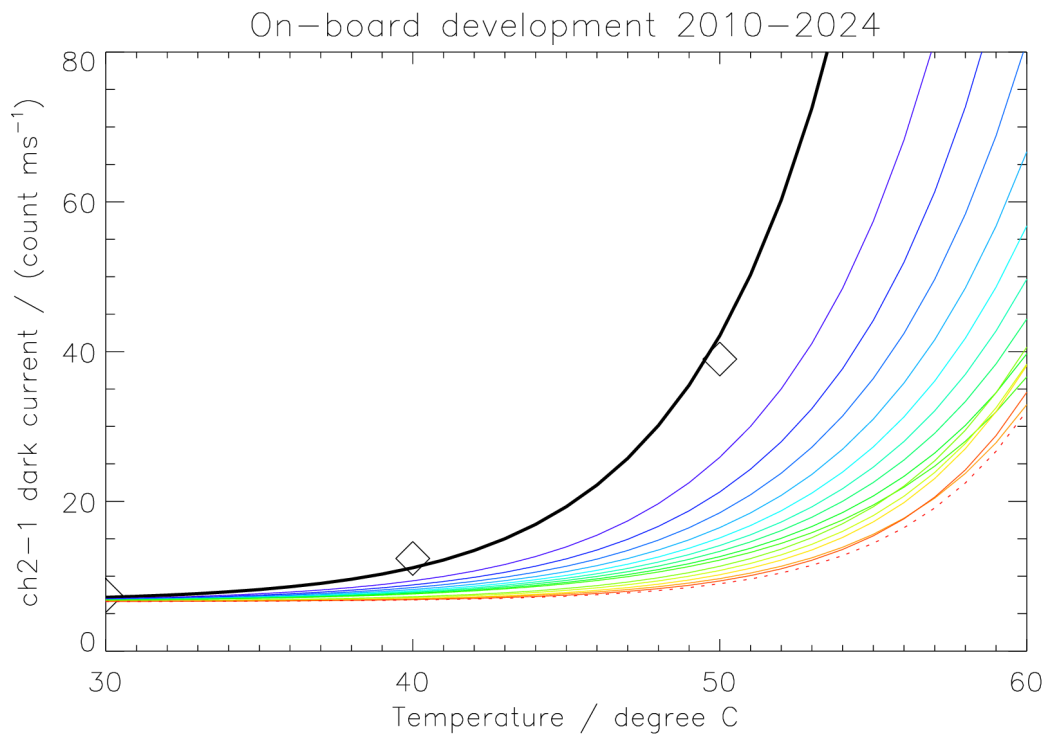
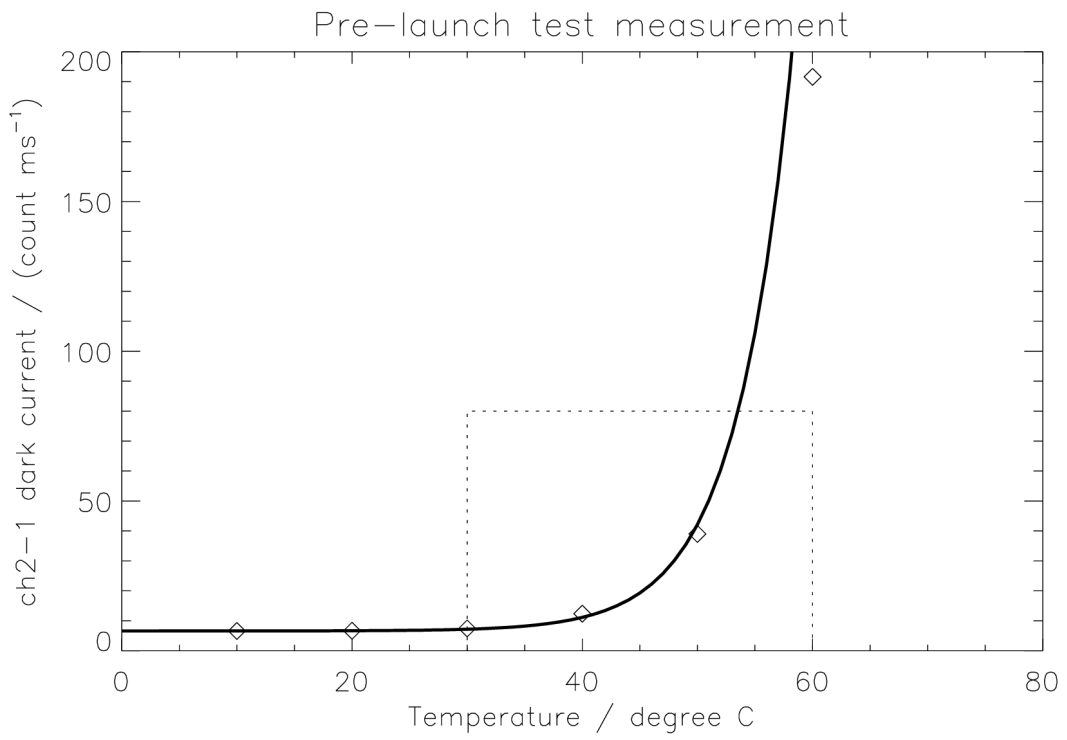


Pre-launch test measurement

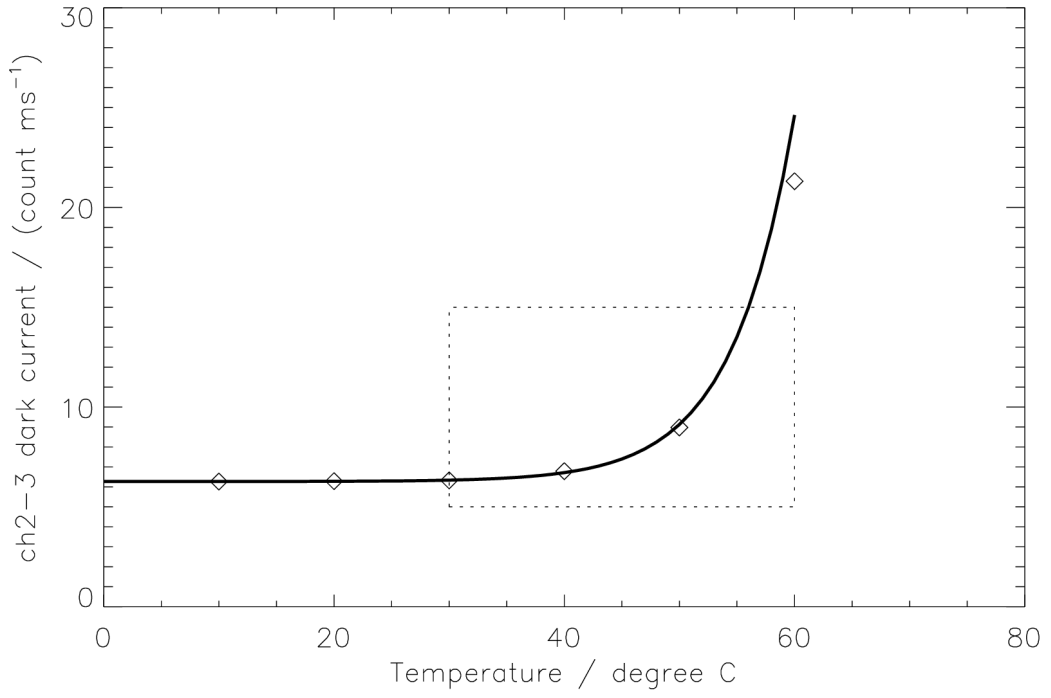


On-board development 2010-2024

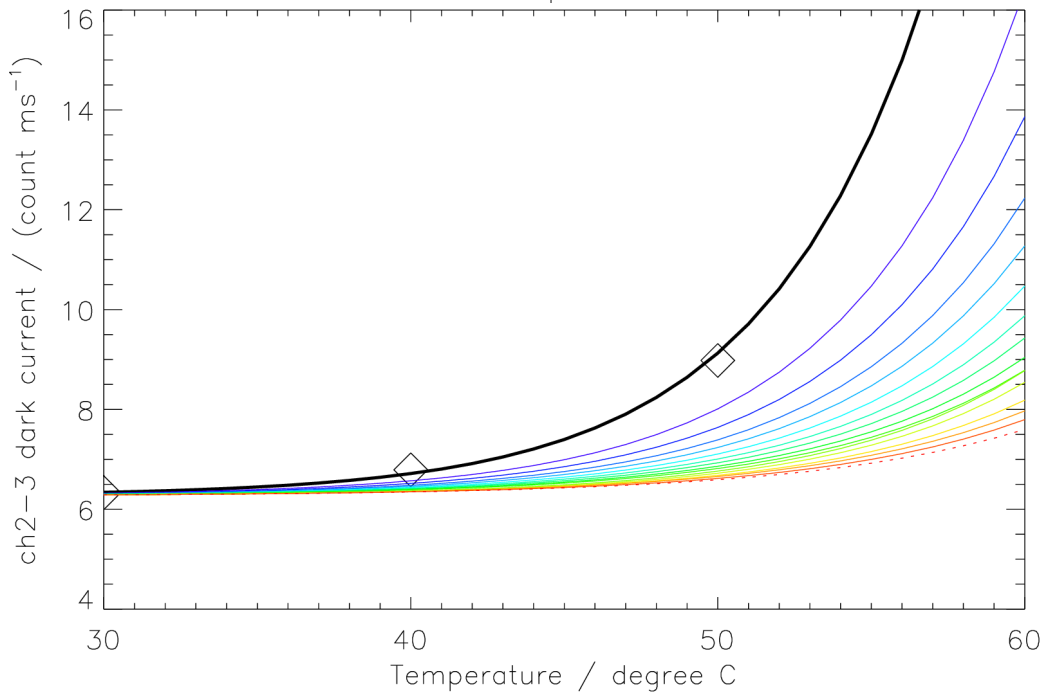




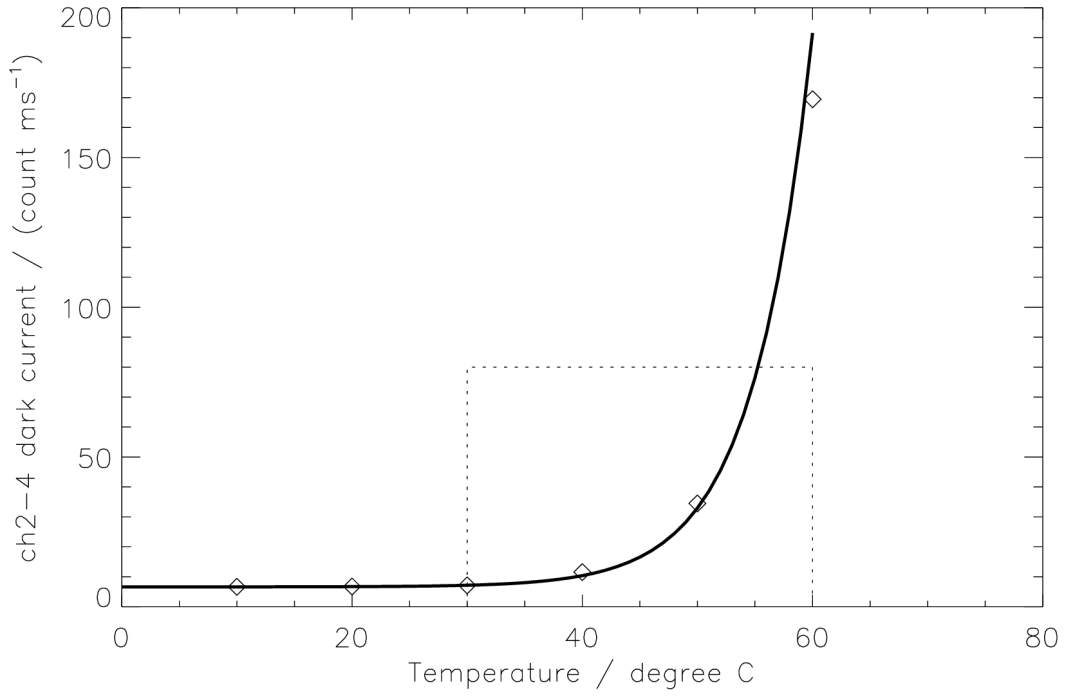
Pre-launch test measurement



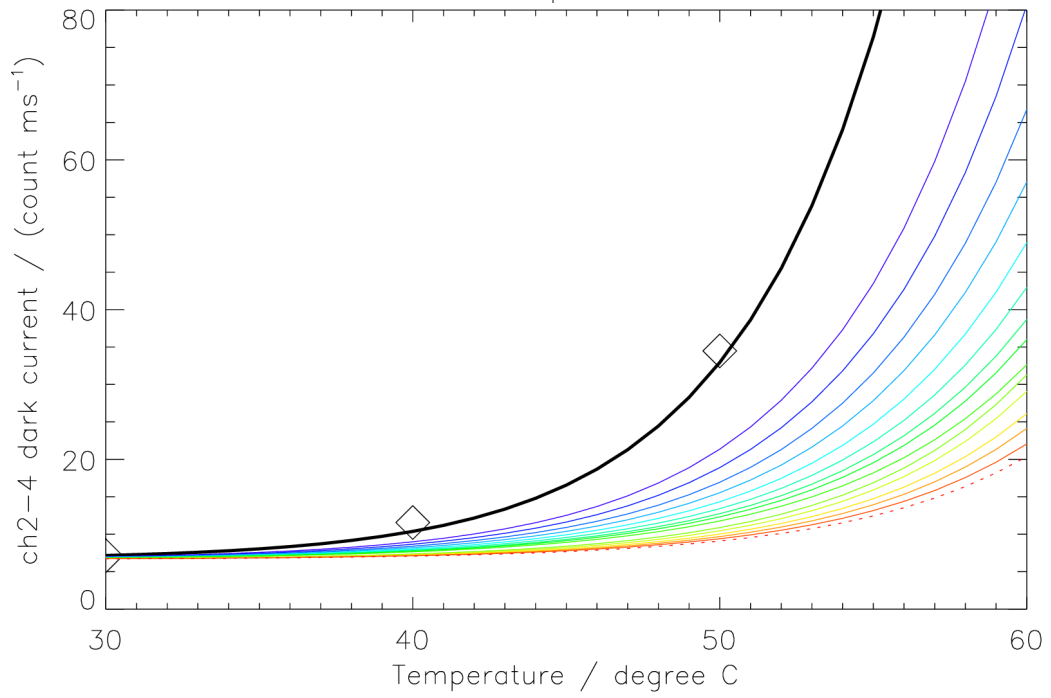
On-board development 2010-2024



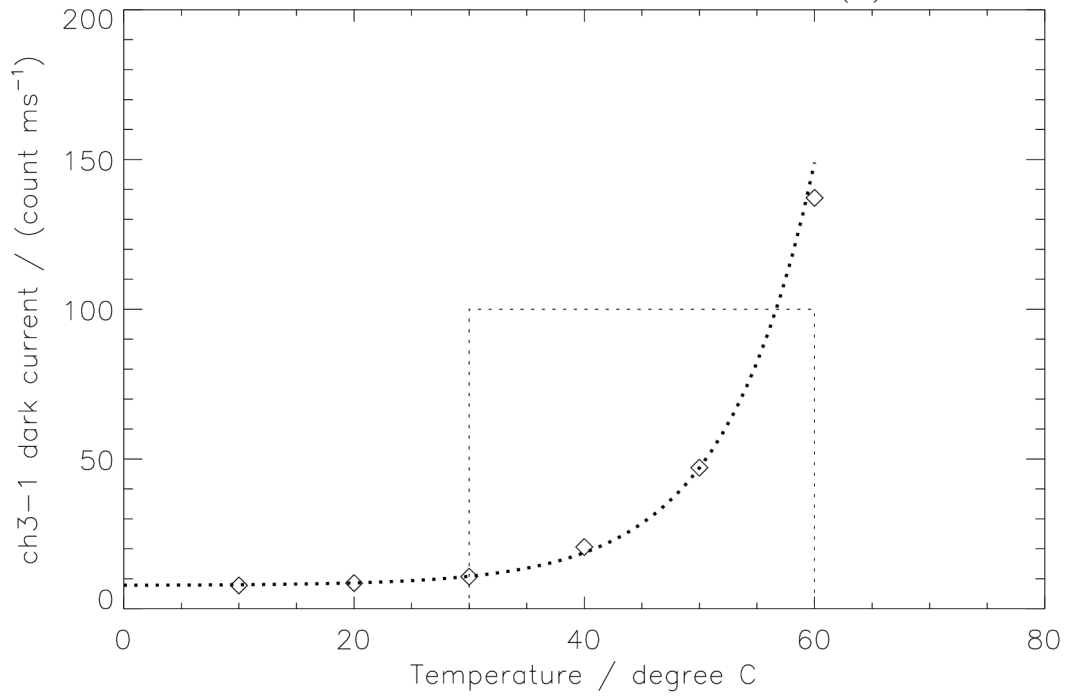
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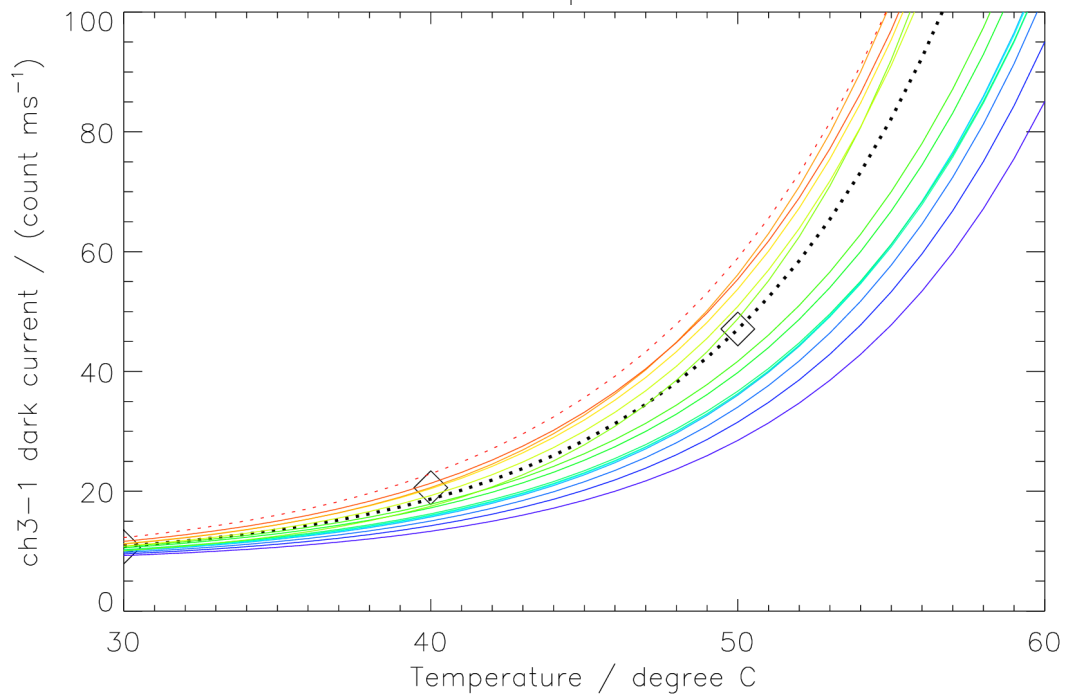
On-board development 2010-2024



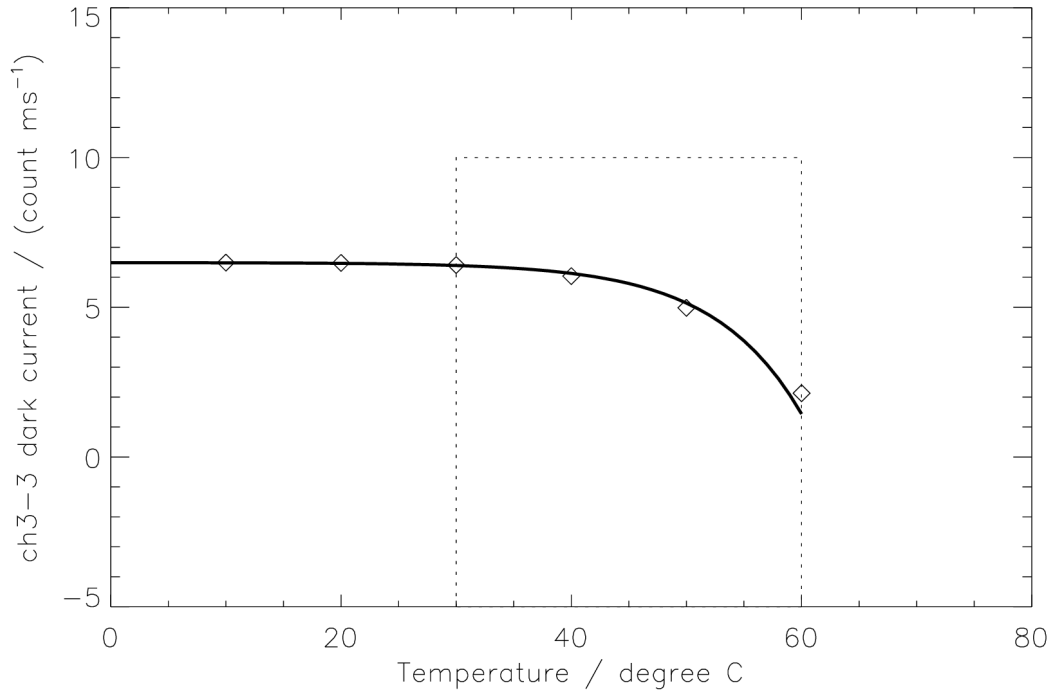
Pre-launch test measurement (?)



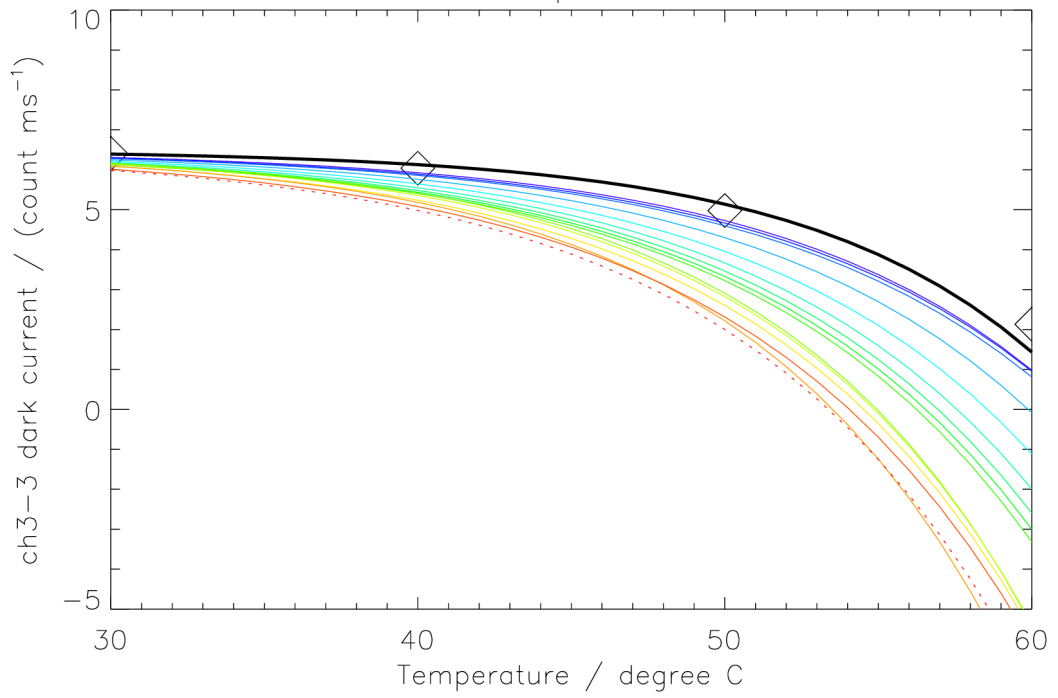
On-board development 2010-2024



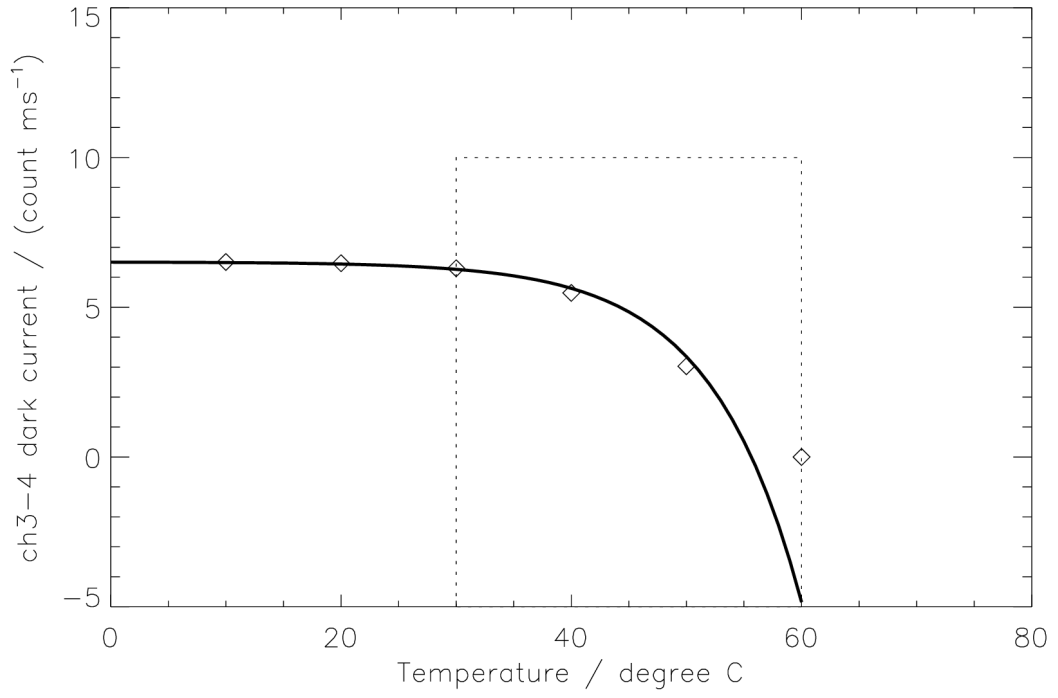
Pre-launch test measurement



On-board development 2010-2024



Pre-launch test measurement



On-board development 2010-2024

