Evolution of dark currents in LYRA detectors - Update 2022

IED 02 May 2022

Occultation season 2021/22 is the third time that the evolution of dark currents was determined with an improved method, taking into account a larger number of campaigns to better estimate the parameters of the various exponential functions. For a description of this method, see here:

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

In this season, the following campaigns and measurements between 15 Sep 2021 and 02 Mar 2022 were used:
   11x "LYRA Short Biweekly calibration" (covers closed)
   2x "Long Lrep2 calibration" (covers closed)
   8x measurements during total occultations (covers open)
thus, up to 21 data points to estimate the exponential functions.

These data points cover a temperature interval between ~ 41 C and ~ 57 C, see following figure, leading to a more stable estimation of the exponential functions "dark currents vs. temperature". The figure also shows that the temperature of unit 1 is usually above the temperature of unit 2 and 3 (calibration campaigns), except in those occultation measurements when only unit 2 and 3 are switched on. The highest temperatures are observed on 02 Feb 2022 during the occultation measurements of the flare campaign.
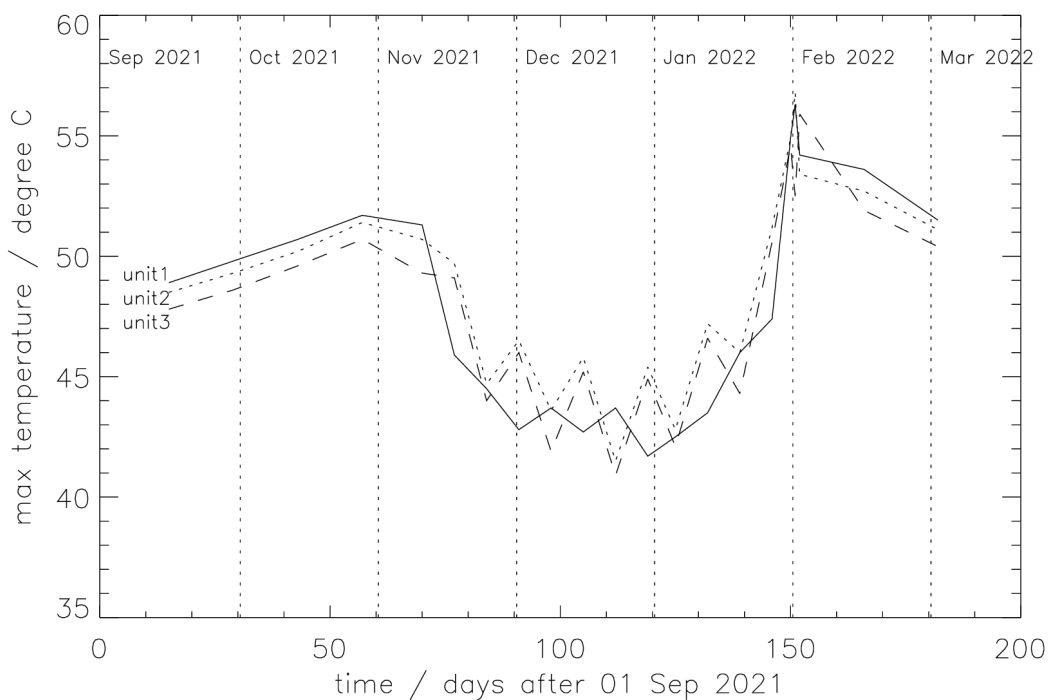

Most cases lead to consistent parameter estimations. For unknown reasons, the "long" calibration campaigns sometimes lead to problematic data points which had to be excluded. Also for unknown reasons, the dark-current development of channels 1-1 and 1-3 seems to change direction. Fortunately, these channels have not changed much lately, and they are the only problematic ones.

The dark currents of the PIN detectors (channels 1-2, 2-2, and 3-2) again did not change significantly.

The next two figures show one example of a straightforward estimate (channel 2-4) and one example for a problematic estimate (channel 1-1) of the exponential curve.
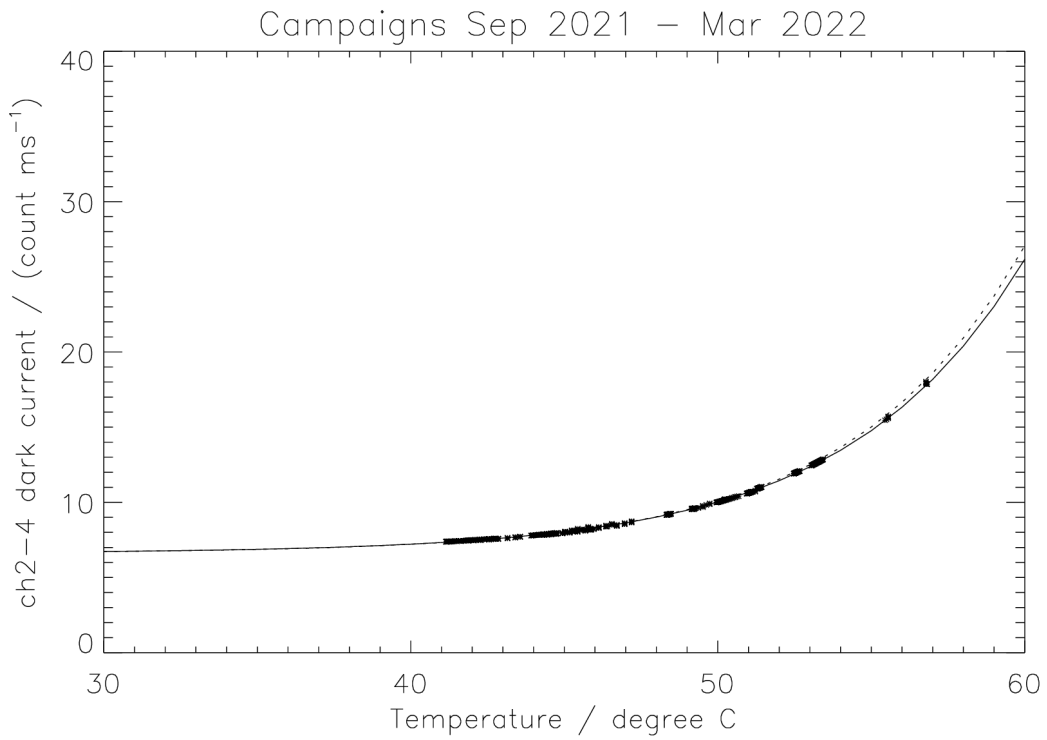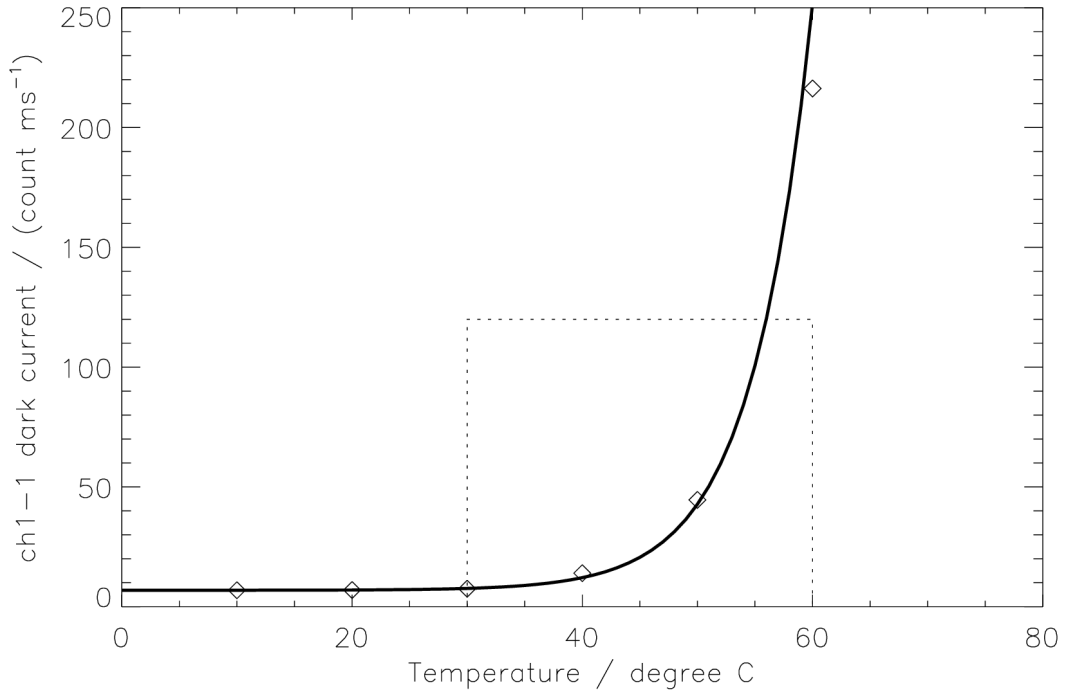
"Unproblematic" example (channel 2-4): Asterisks show the data points, the straight line shows the estimated exponential curve, the dotted line shows the old extrapolation based on last season's results.
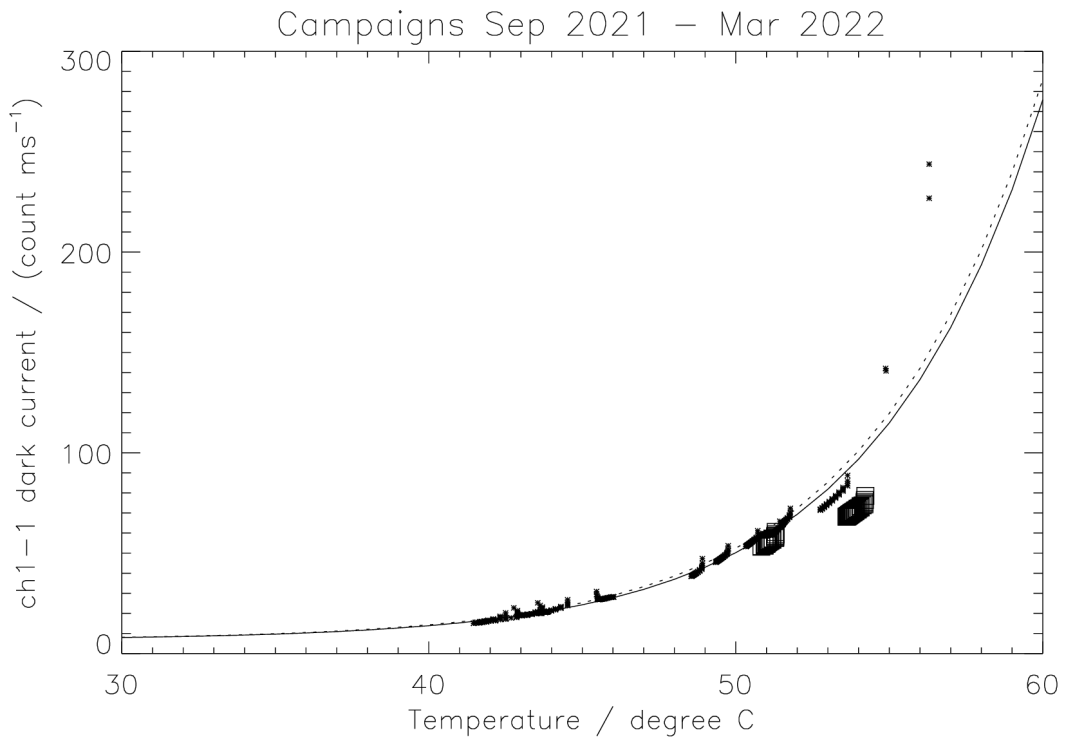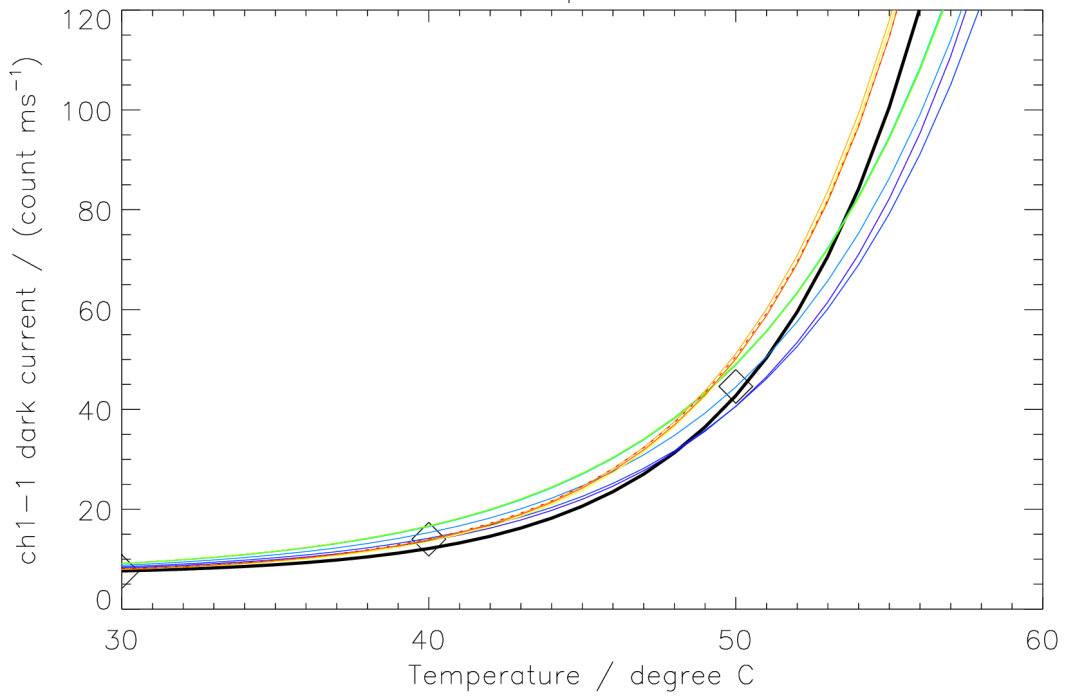

"Problematic" example (channel 1-1): Squares are data points from "long" calibration campaigns, excluded from the estimate. Some data points are below, some are above the estimated exponential curve, which is thus questionable for high temperatures as measured during flare campaign occultations 31 Jan and 02 Feb 2022.

The following nine pages show the development of the dark-current vs. temperature curves from the laboratory tests (black), Jan 2011 estimates (blue), up to Jan 2022 estimates (red) and Jan 2023 extrapolations (red dotted).
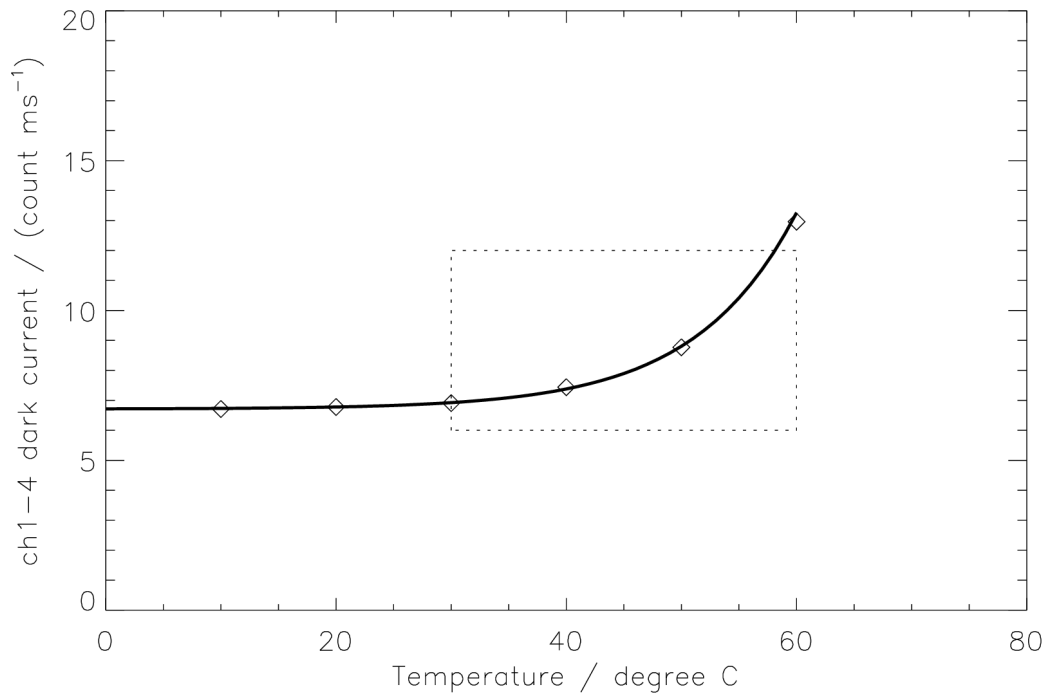
Pre-launch test measurement
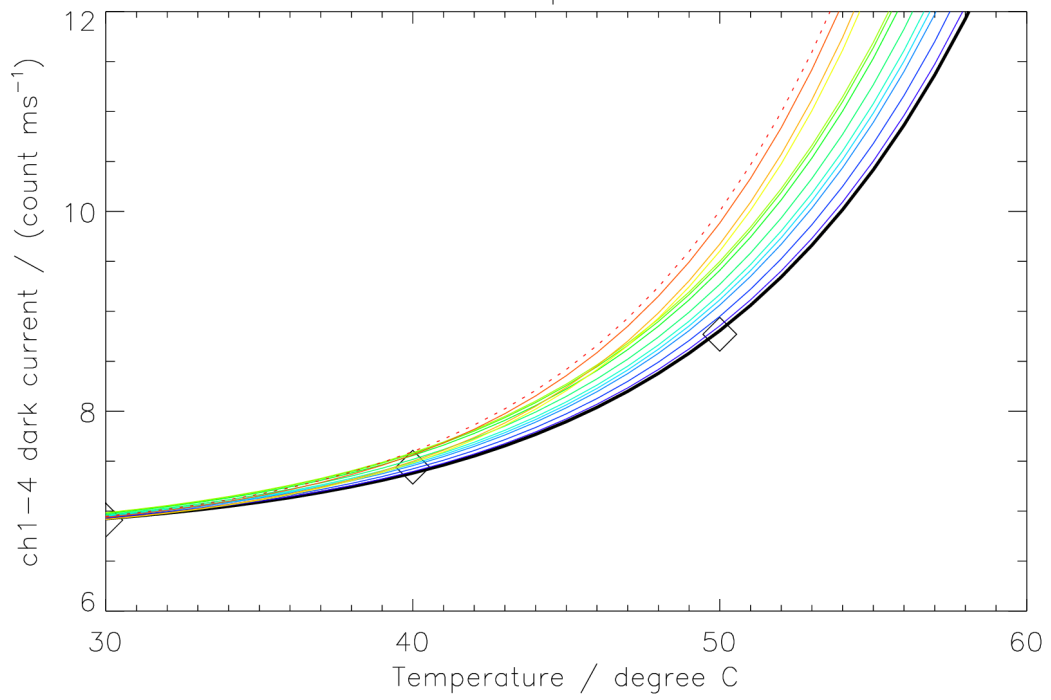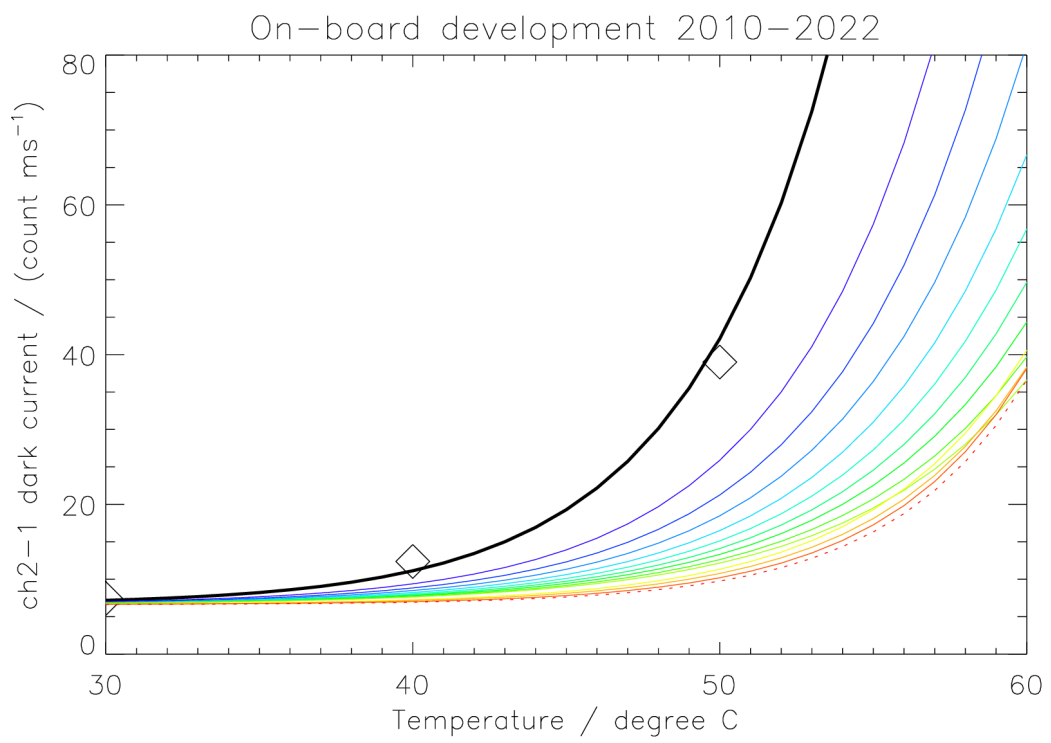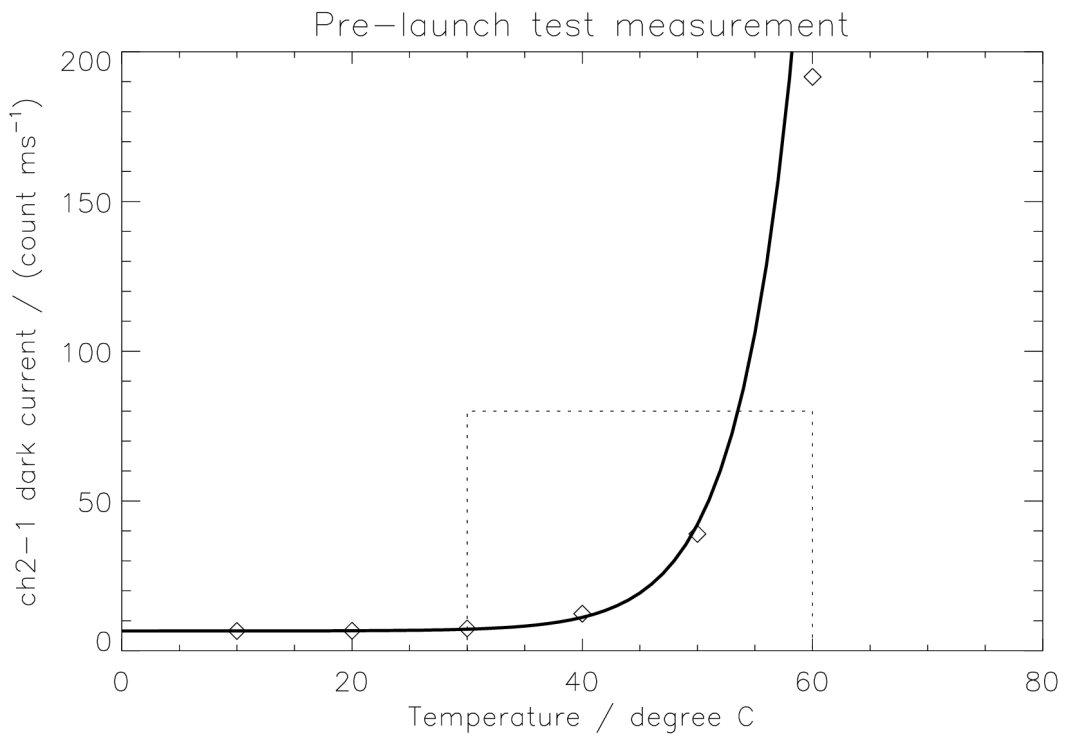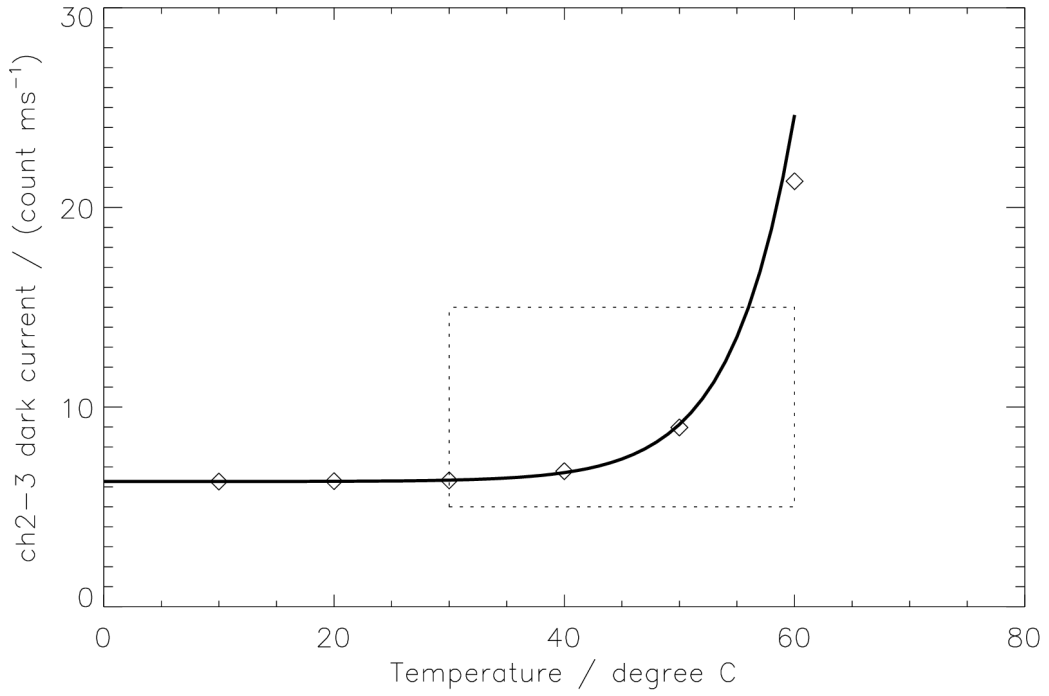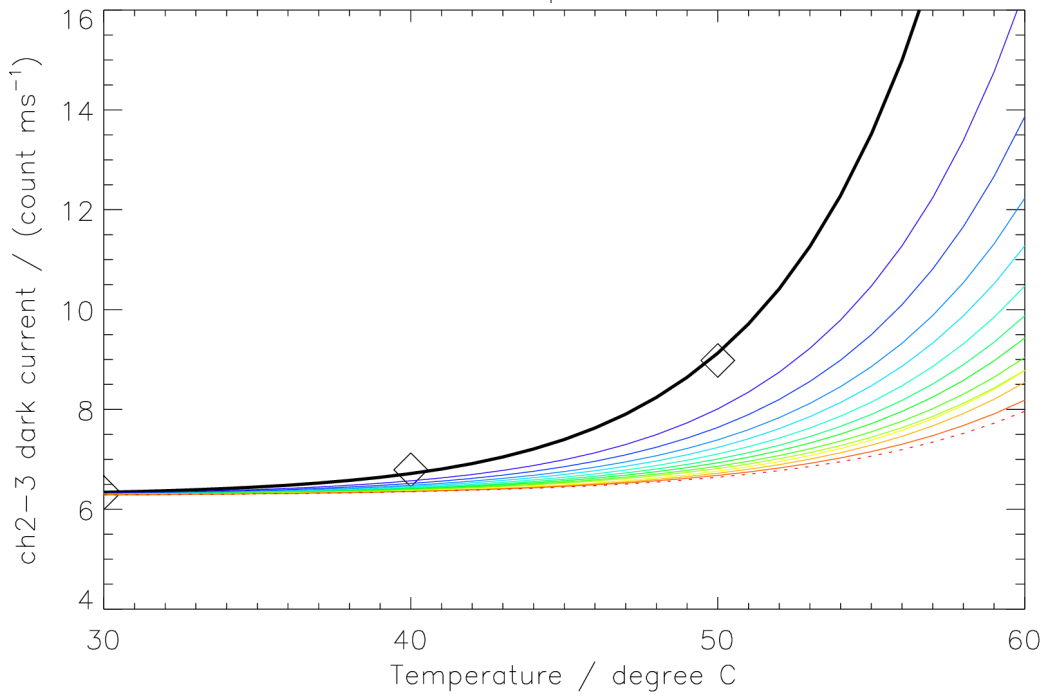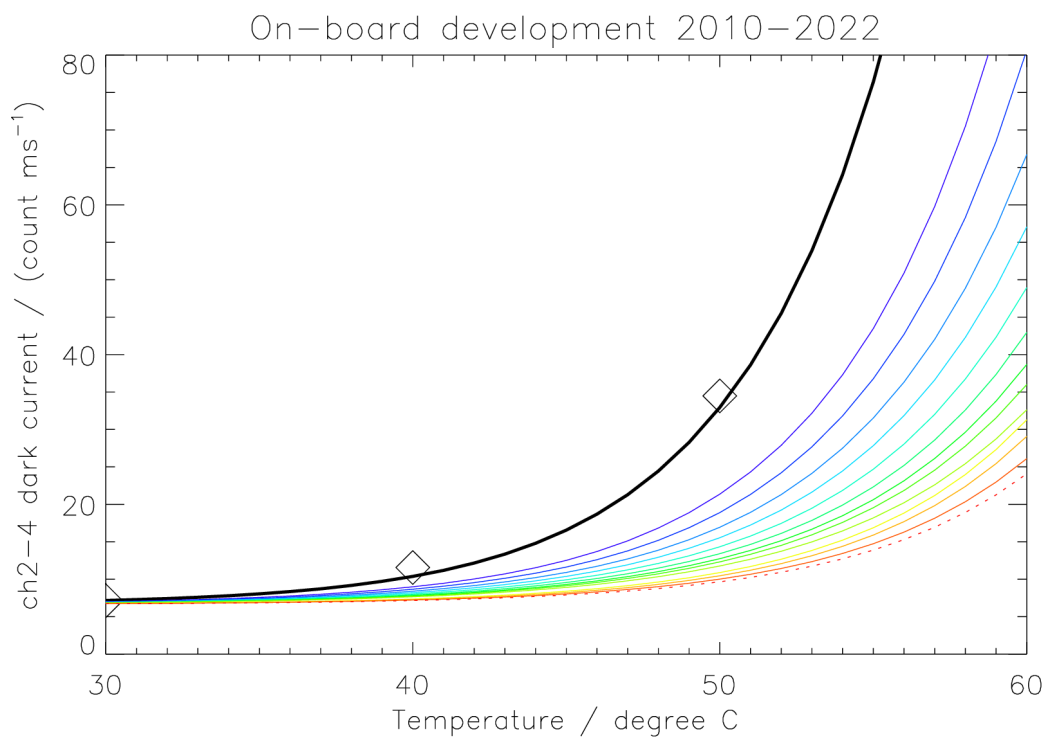
On-board development 2010-2022

Pre-launch test measurement

ch1−3 dark current / (count ms⁻¹)

Temperature / degree C

On-board development 2010−2022

ch1−3 dark current / (count ms⁻¹)

Temperature / degree C
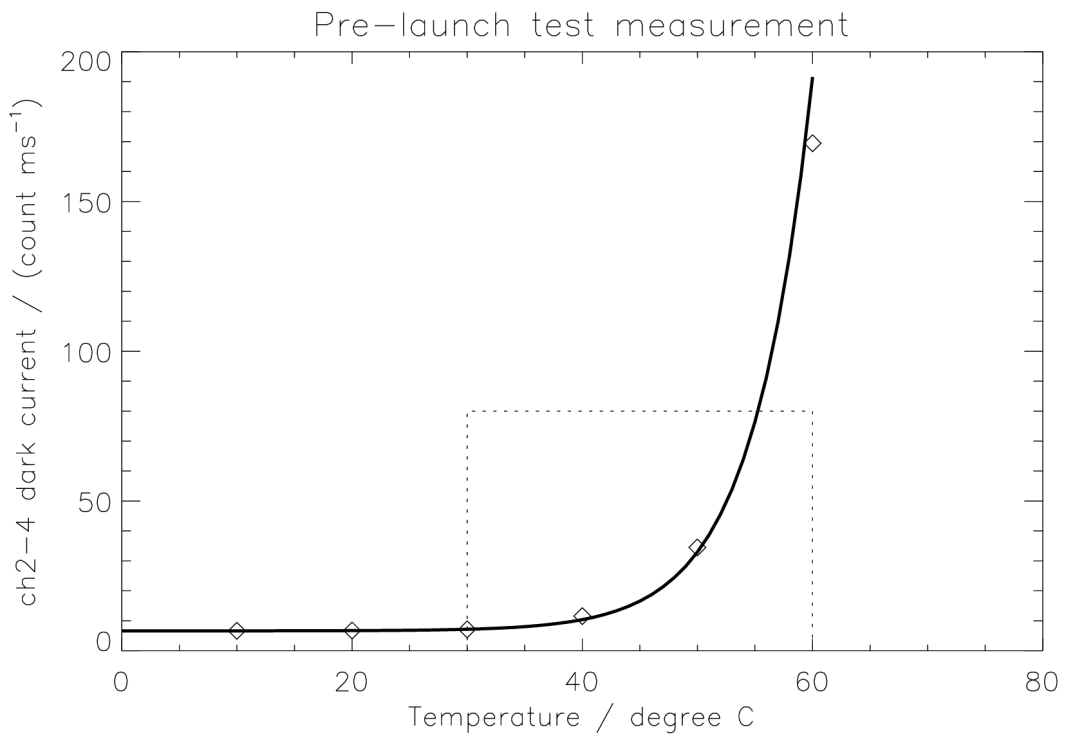
Pre-launch test measurement

On-board development 2010–2022

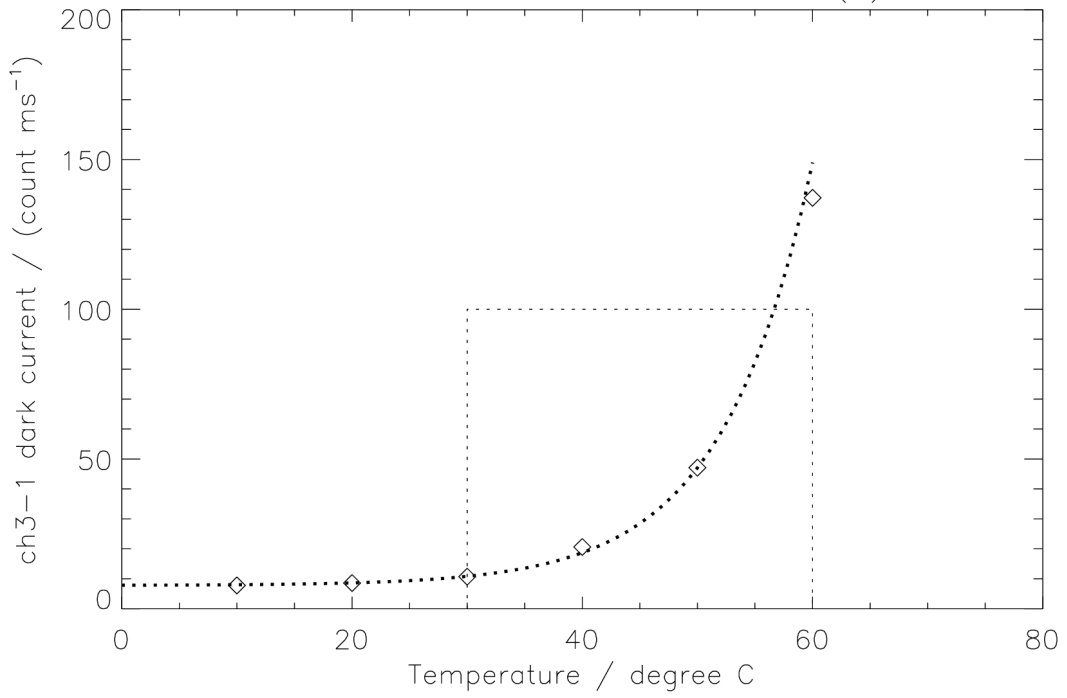Pre-launch test measurement

On-board development 2010-2022

Pre-launch test measurement

On-board development 2010-2022

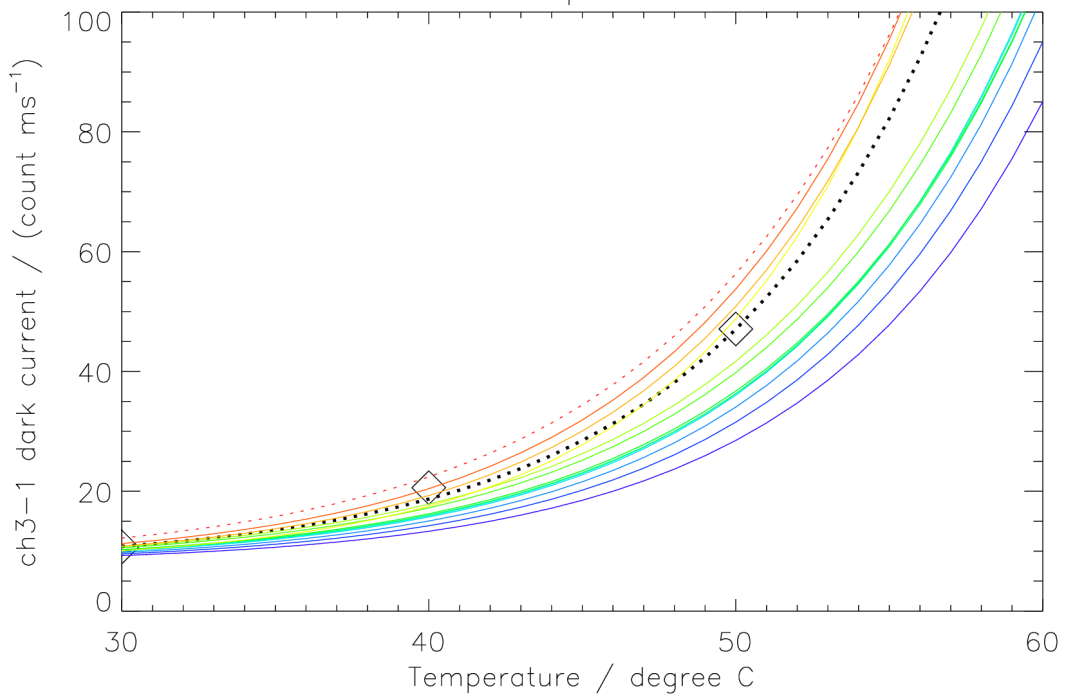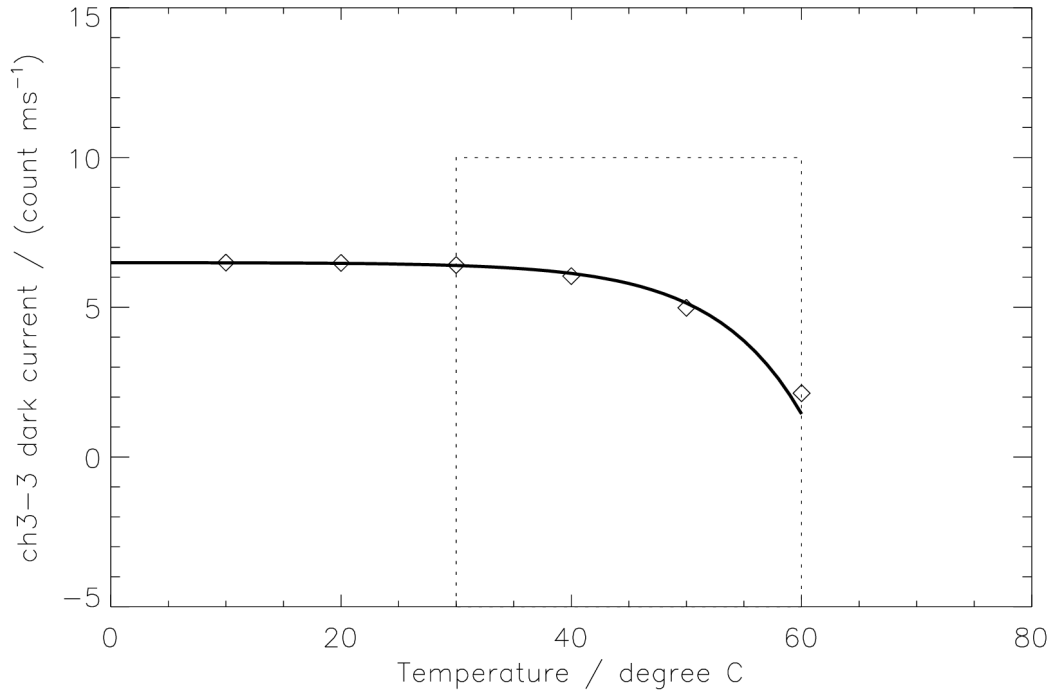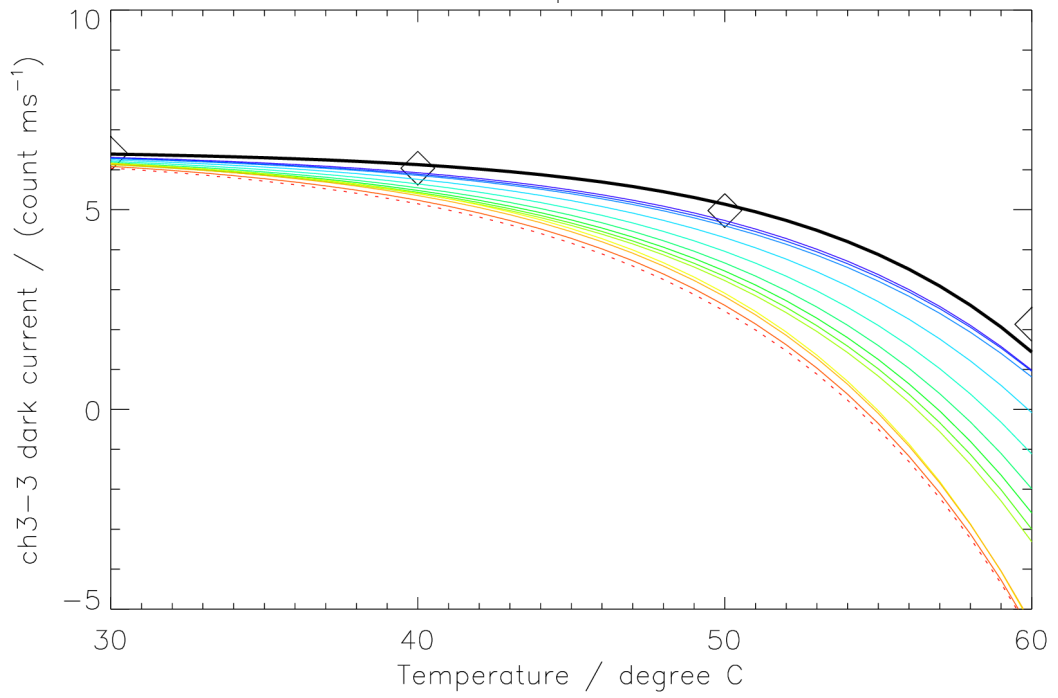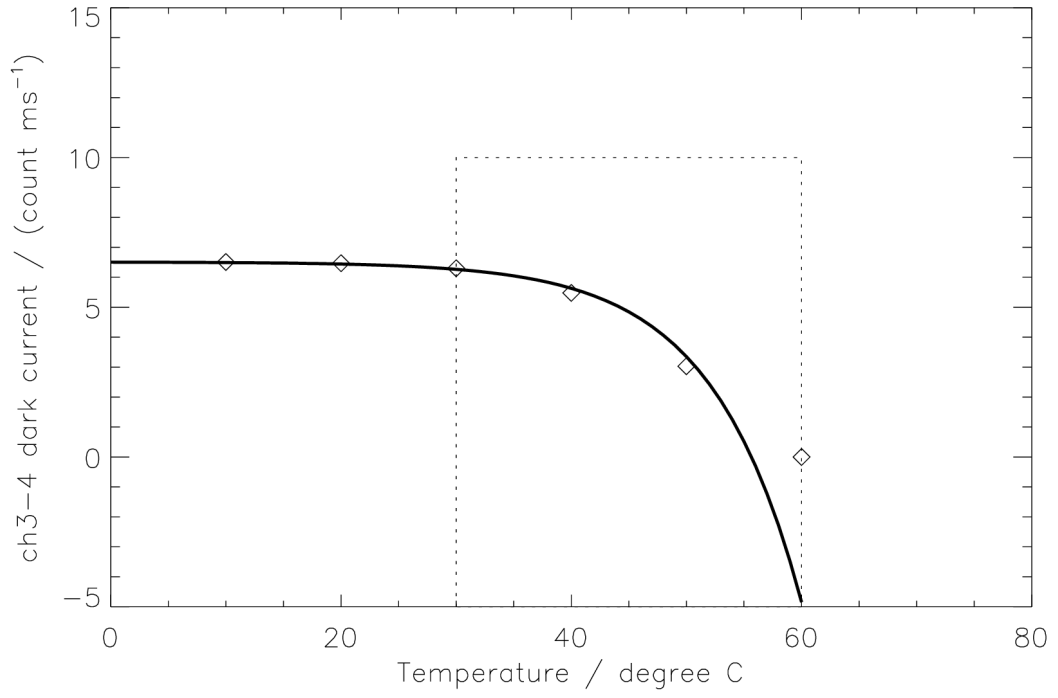Pre-launch test measurement

On-board development 2010-2022

Pre-launch test measurement (?)

ch3−1 dark current / (count ms⁻¹) vs Temperature / degree C

On−board development 2010−2022

ch3−1 dark current / (count ms⁻¹) vs Temperature / degree C

Pre-launch test measurement

On-board development 2010-2022

Pre-launch test measurement

On-board development 2010–2022