

# Characterization of irradiated SiPM for the TOP detector at the Belle II experiment

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# Content



## New:

- Dark count rates as function of irradiation level
- Dark count rates results including irradiation after annealing

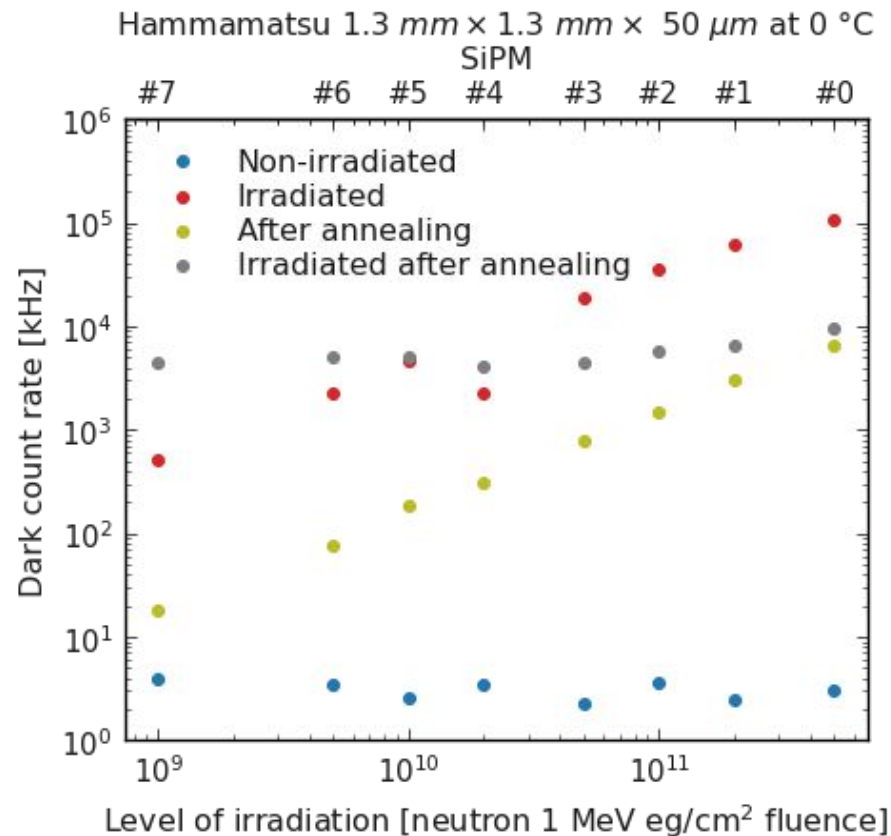
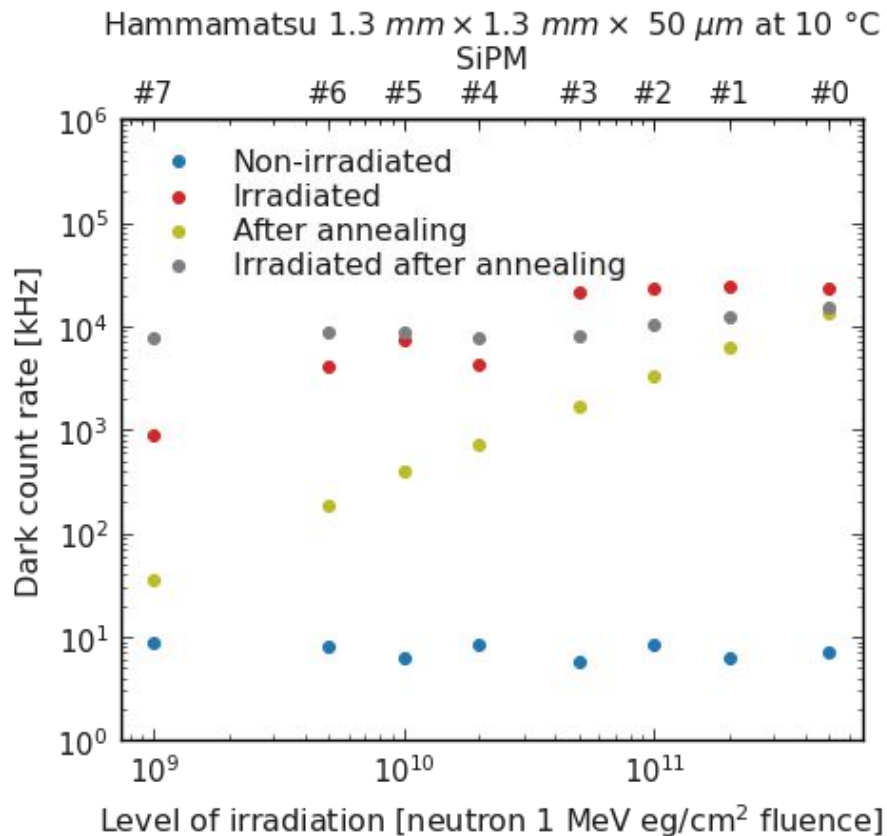
# Tests with irradiated modules in Padova



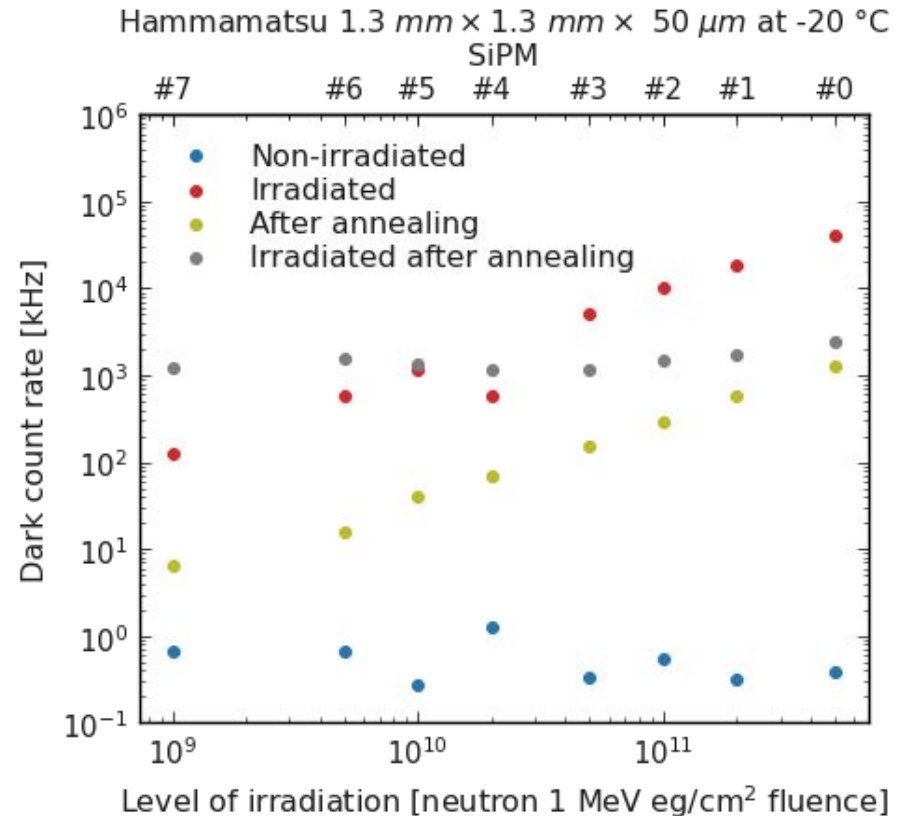
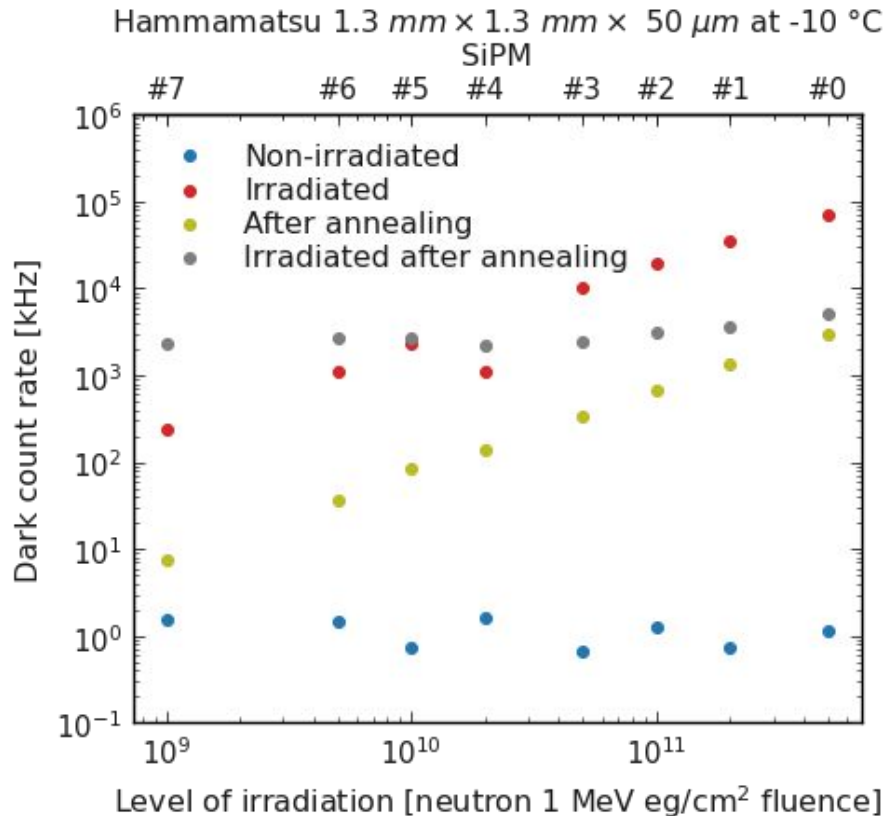
- In Belle II, MCP-PMTs with extended lifetime have been installed and they have limited lifetime depending on accumulated charge.
- We are trying to understand if they eventually can be replaced with SiPMs.
- We irradiated 24 SiPMs modules with different neutron fluxes and tested by laser.
- Sixteen of them are processed to study their response.
- Collected data are read from modules and analyzed.

Index	Producer	Dimension [mm×mm]	Pitch [ $\mu$ m]	Neutron 1 MeV eg/cm <sup>2</sup> fluence
0	Hamamatsu	1.3 × 1.3	50	5.0·10 <sup>11</sup>
1	Hamamatsu	1.3 × 1.3	50	2.0·10 <sup>11</sup>
2	Hamamatsu	1.3 × 1.3	50	1.0·10 <sup>11</sup>
3	Hamamatsu	1.3 × 1.3	50	5.0·10 <sup>10</sup>
4	Hamamatsu	1.3 × 1.3	50	2.0·10 <sup>10</sup>
5	Hamamatsu	1.3 × 1.3	50	1.0·10 <sup>10</sup>
6	Hamamatsu	1.3 × 1.3	50	5.0·10 <sup>9</sup>
7	Hamamatsu	1.3 × 1.3	50	1.0·10 <sup>9</sup>

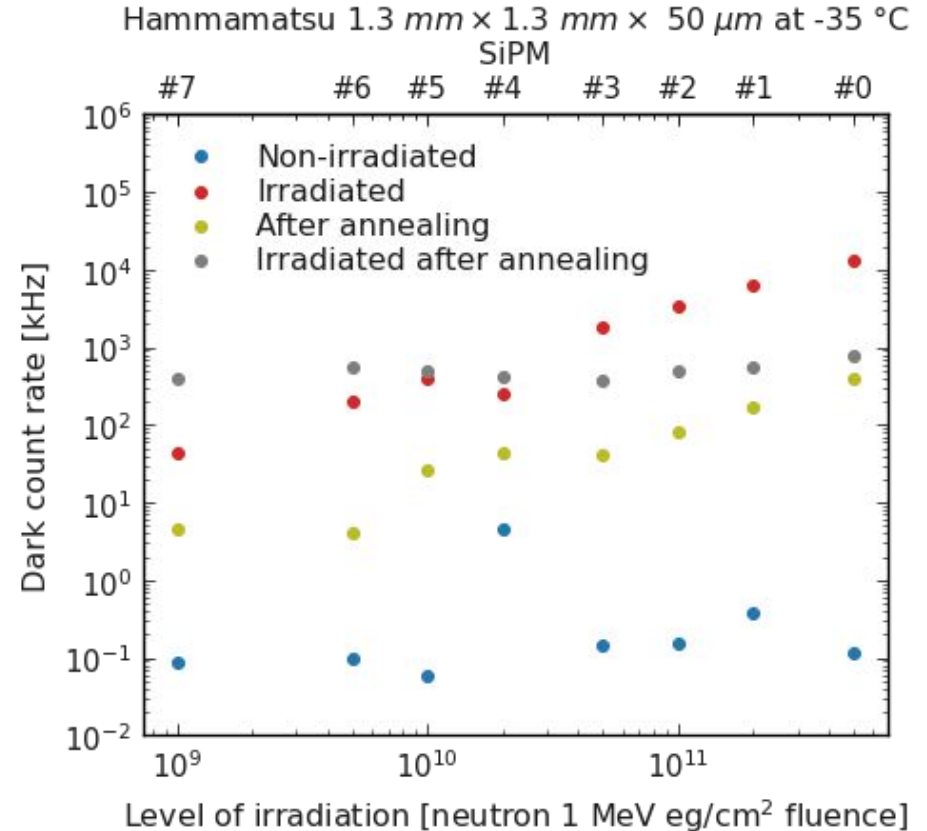
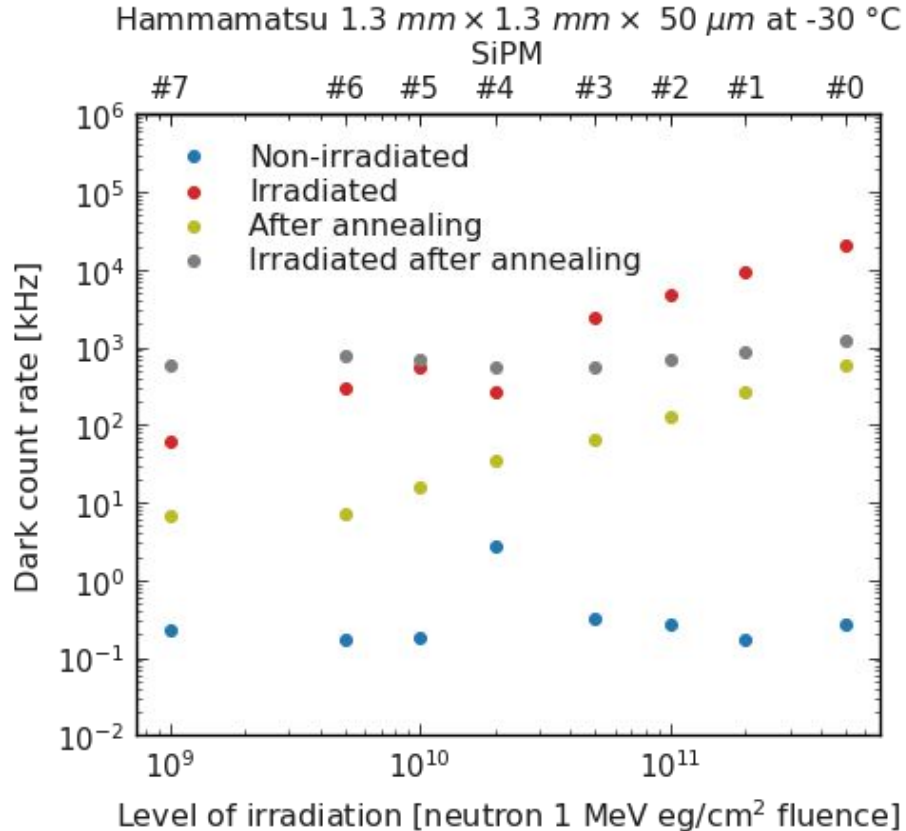
# Dark count rate as function of level of irradiation



# Dark count rate as function of level of irradiation



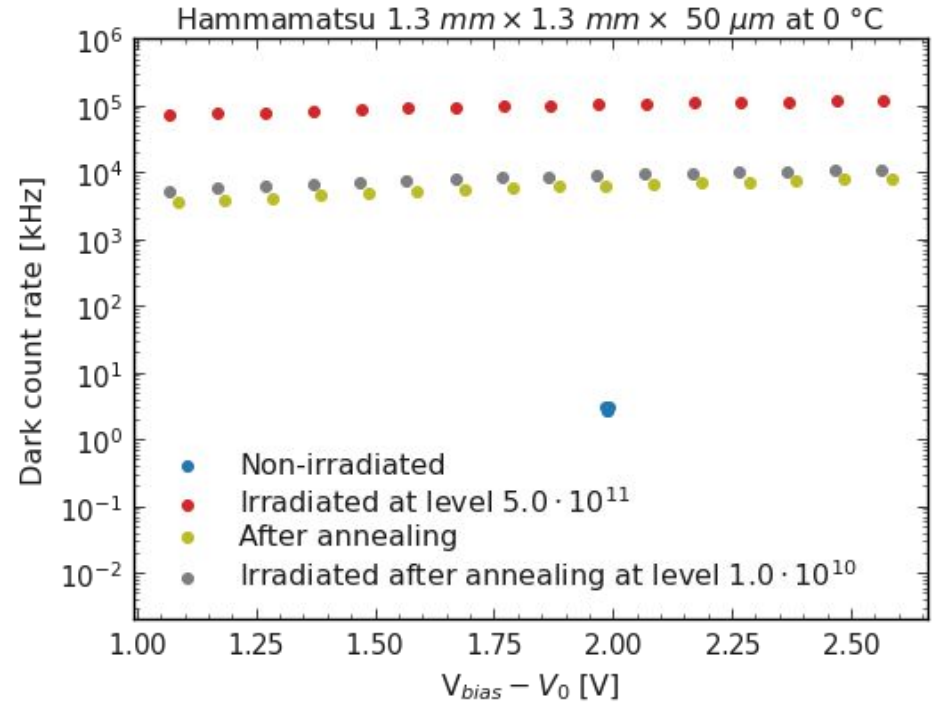
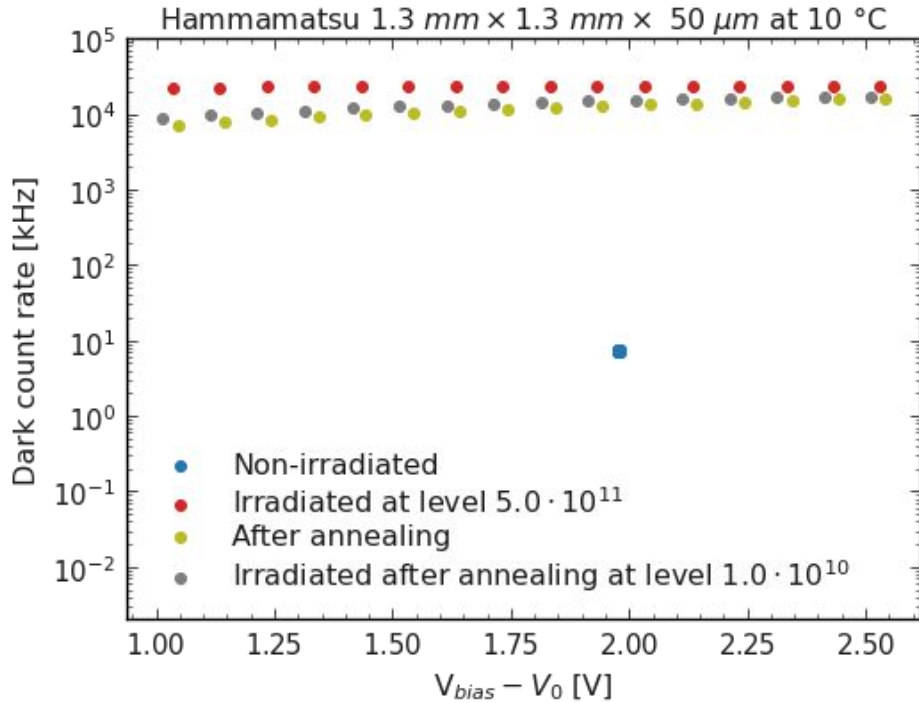
# Dark count rate as function of level of irradiation





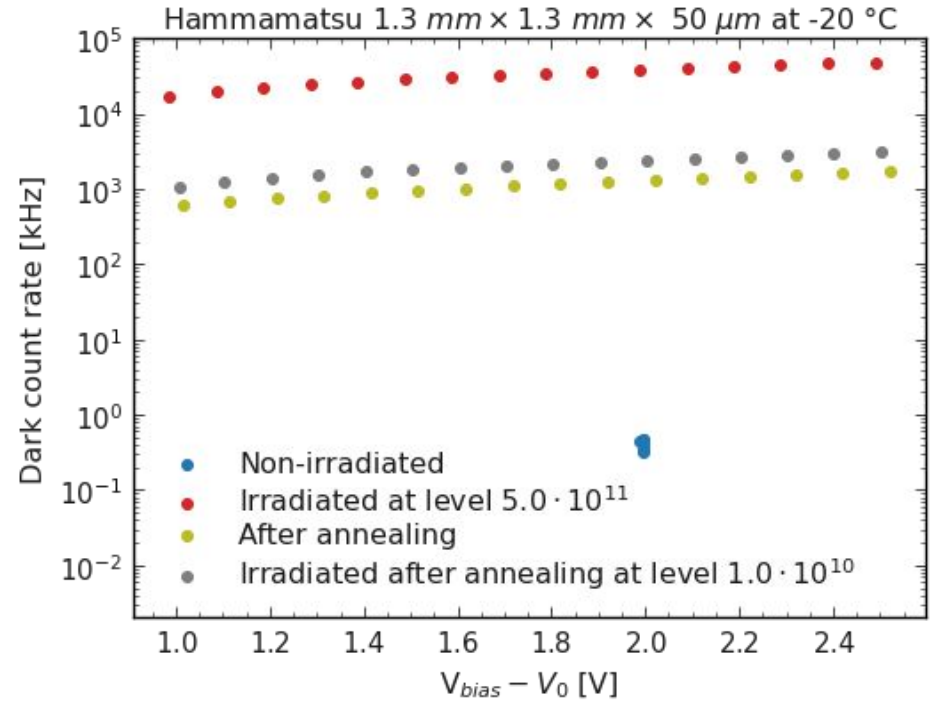
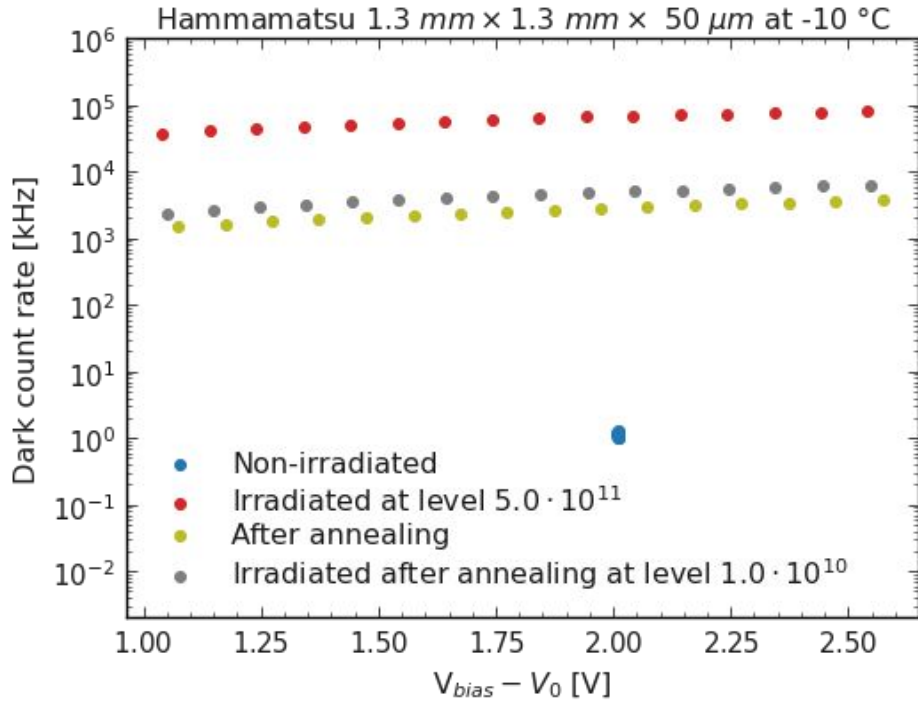
# SiMP #0

# Dark count rate

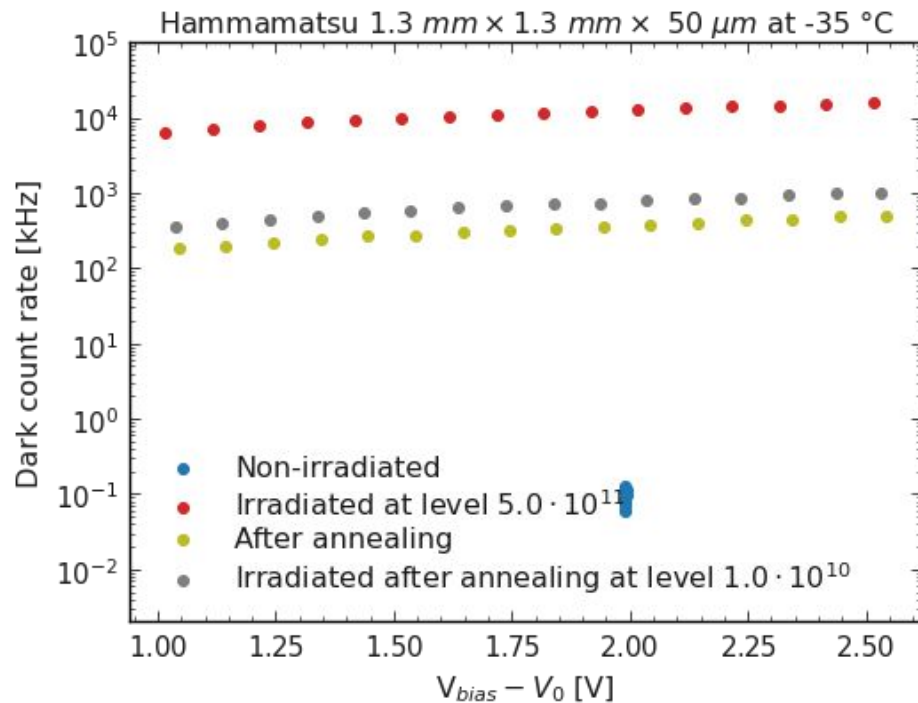
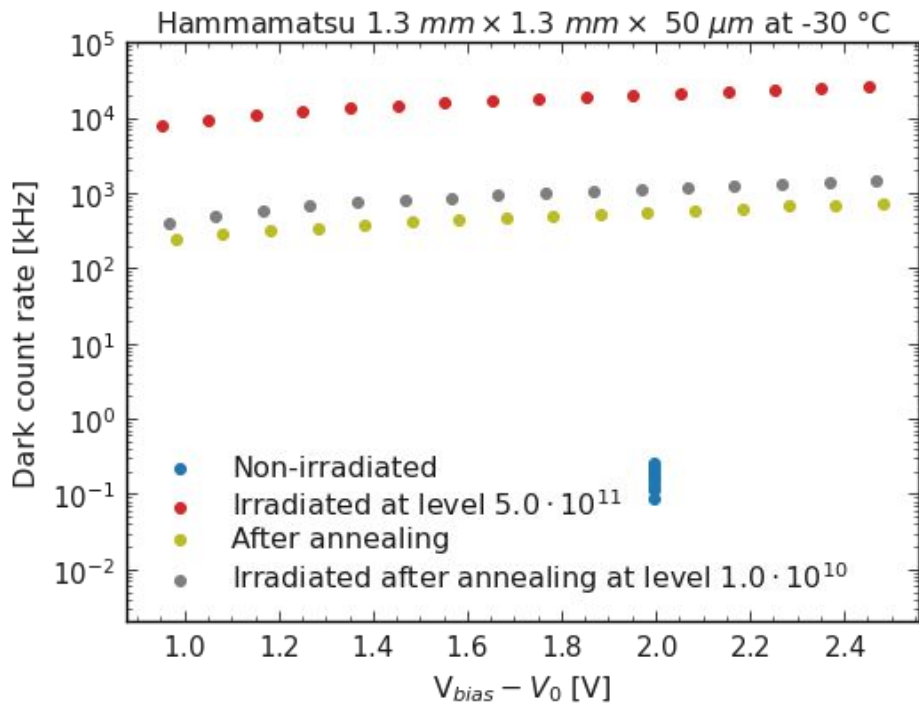




# Dark count rate



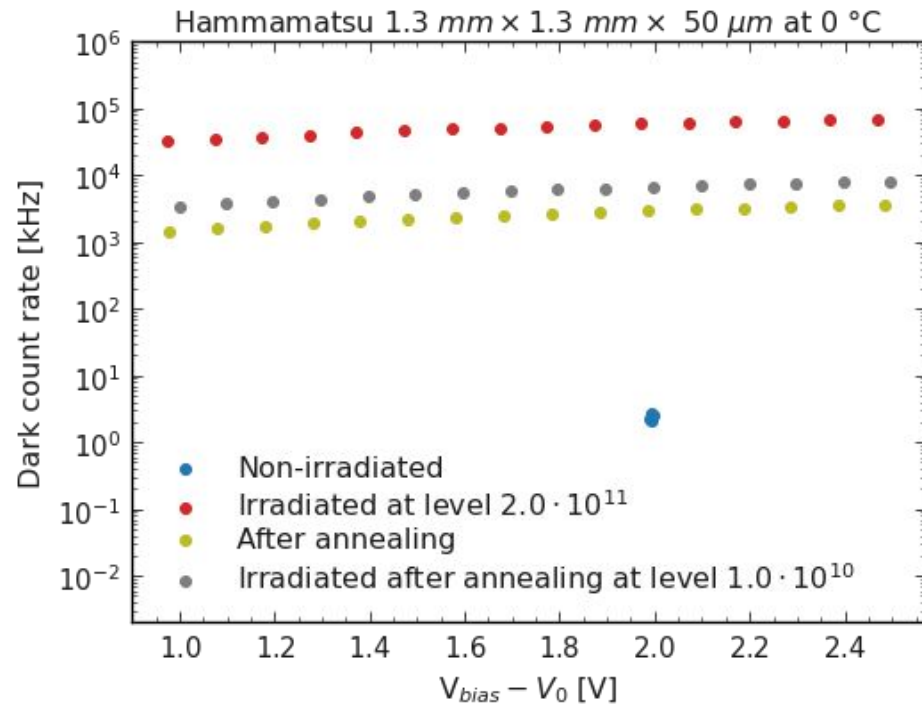
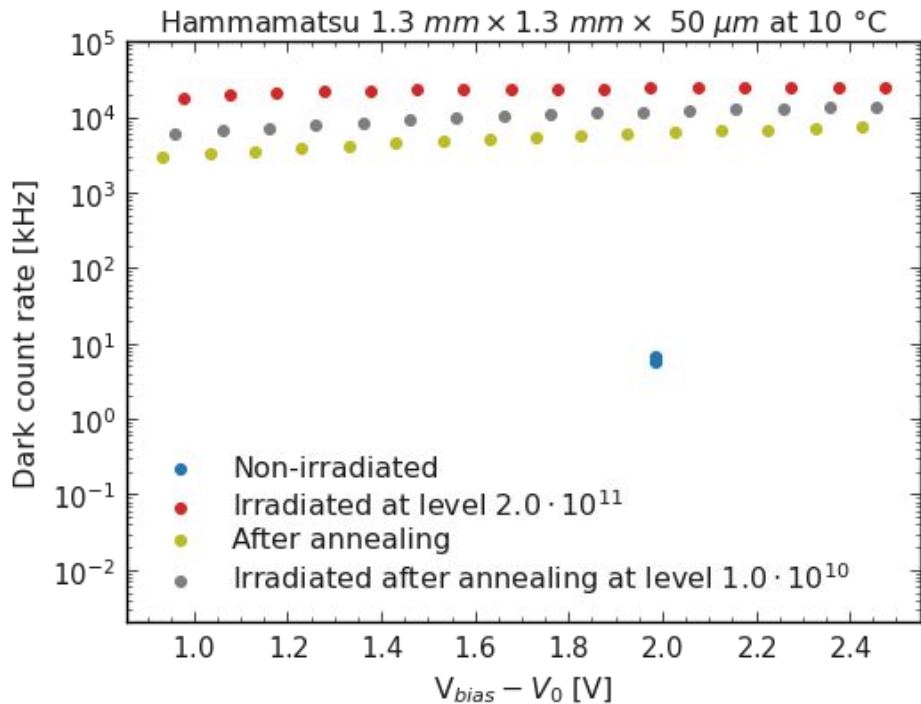
# Dark count rate



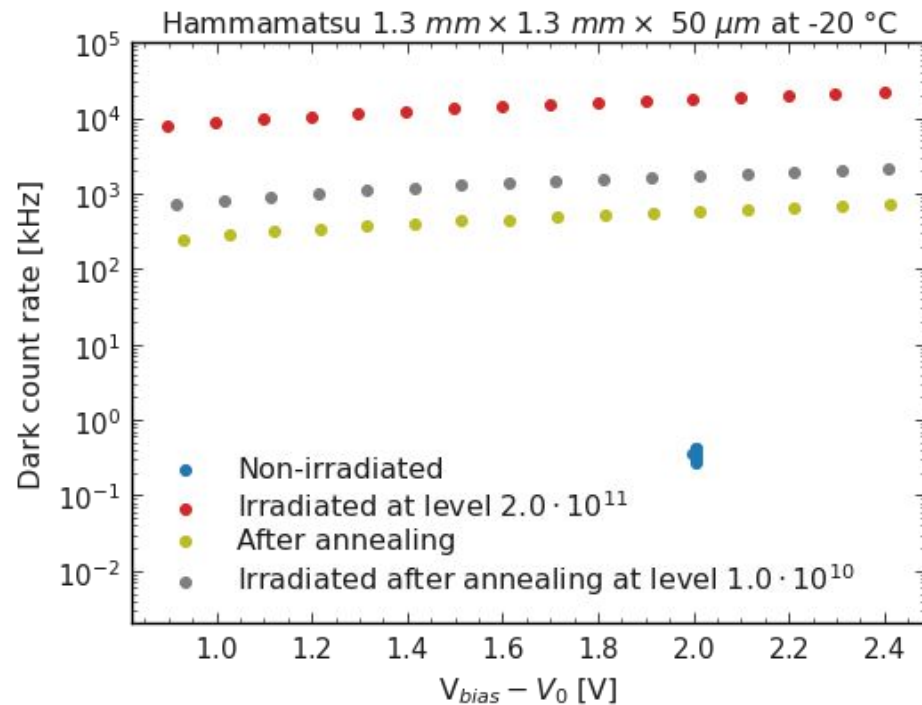
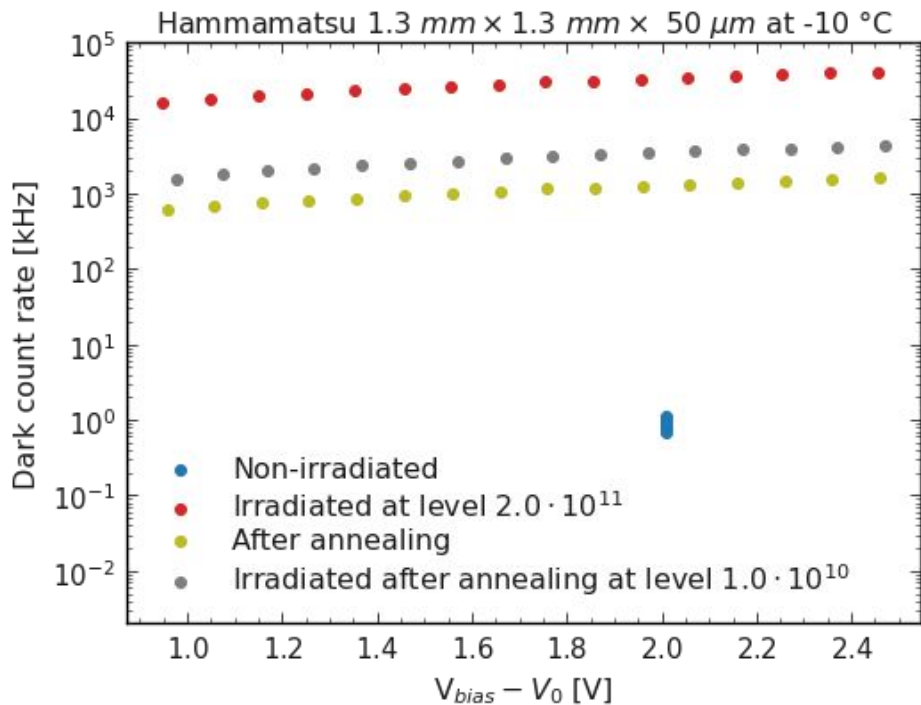


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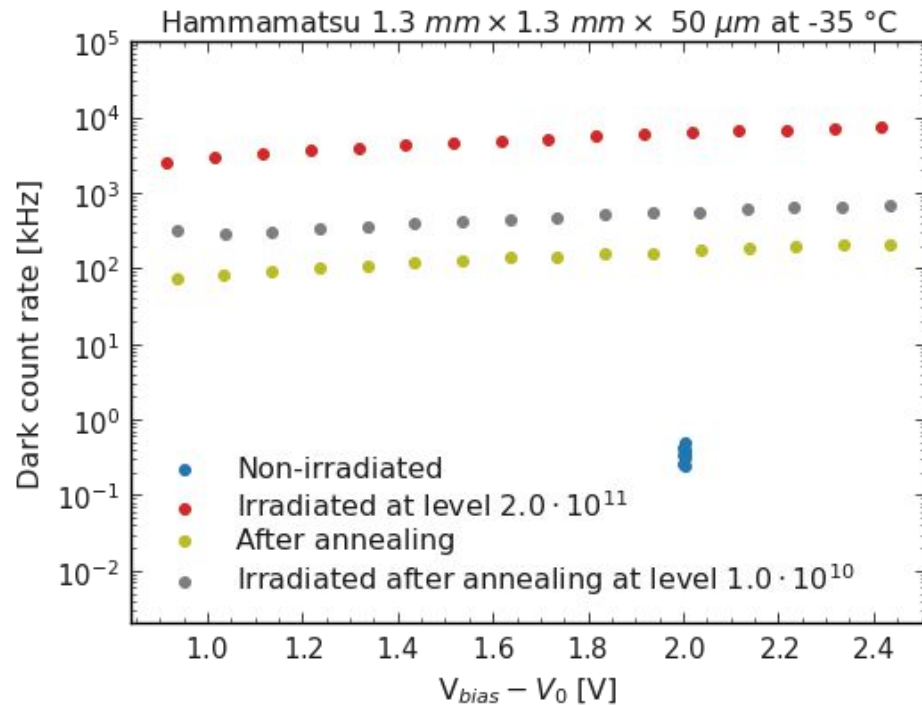
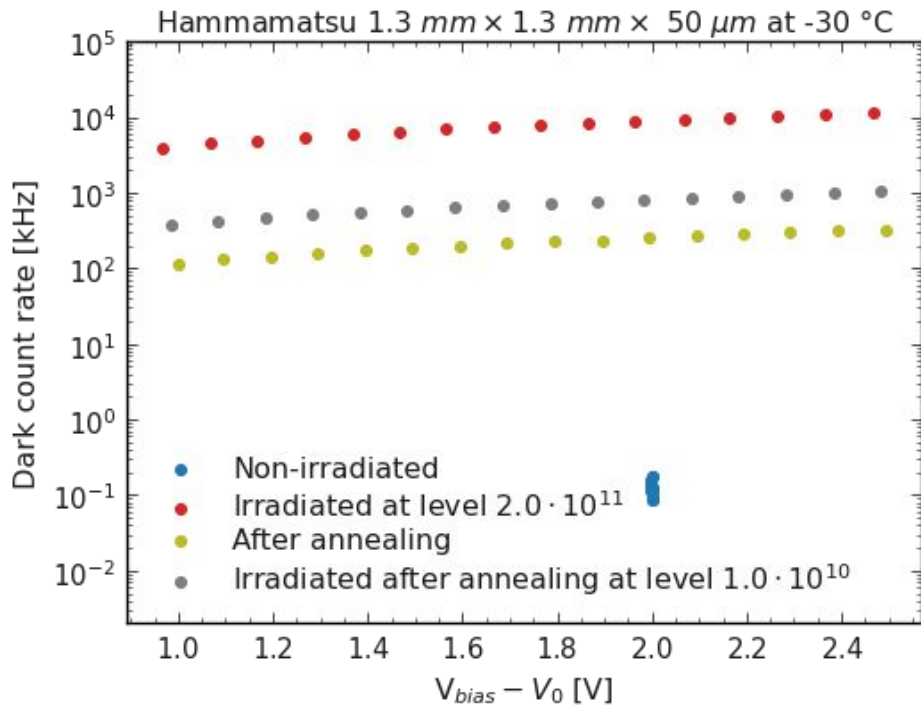
# Dark count rate



# Dark count rate



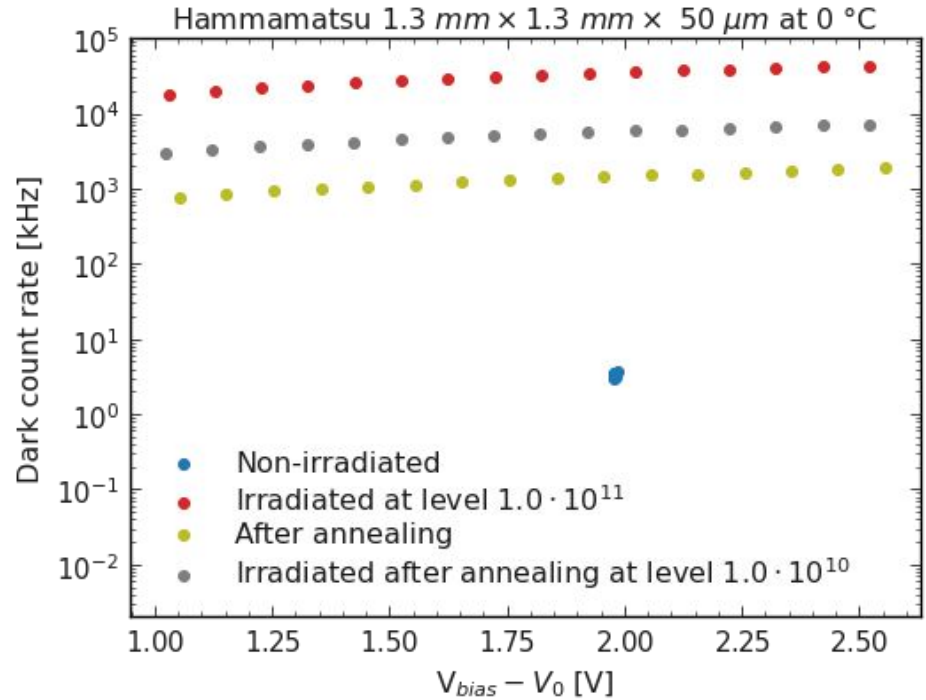
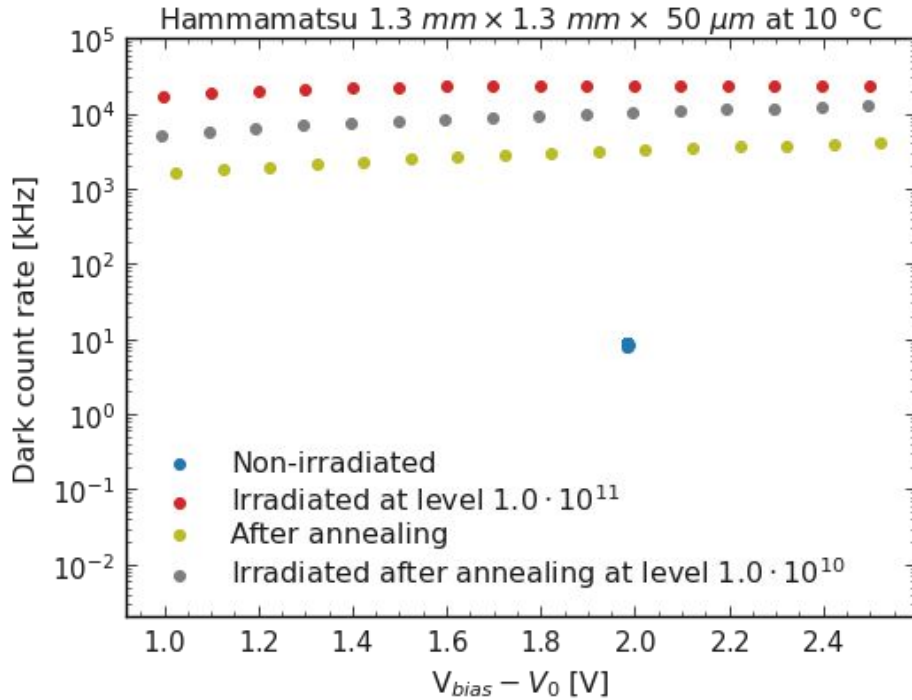
# Dark count rate





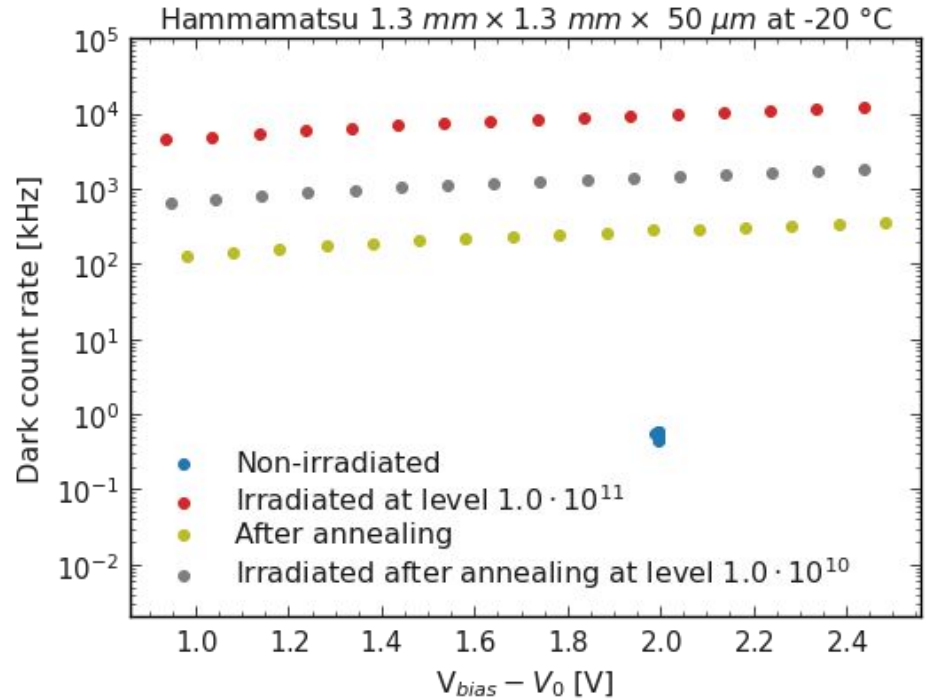
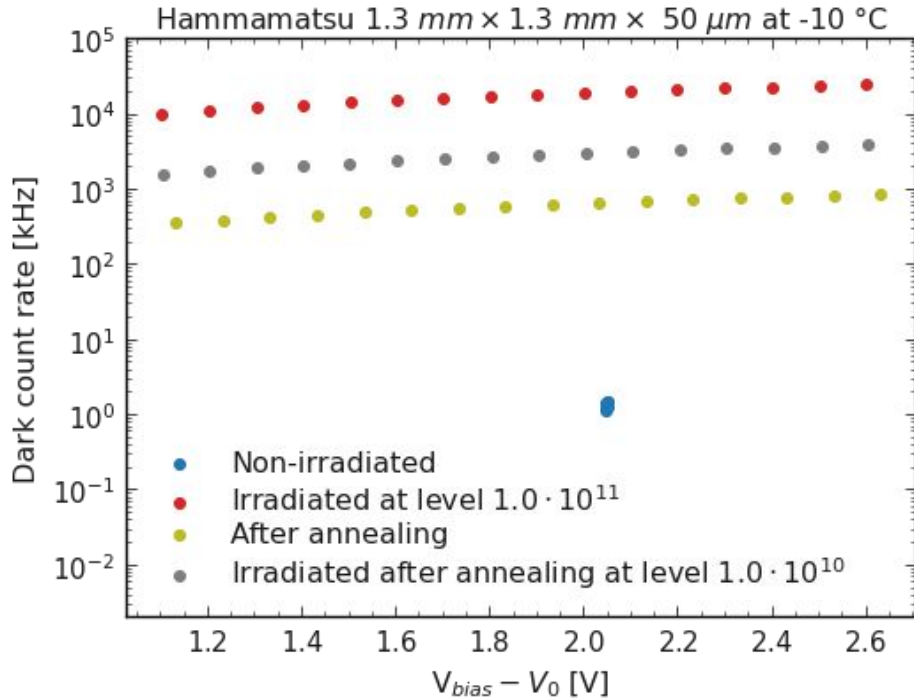
# SIMP #2

# Dark count rate

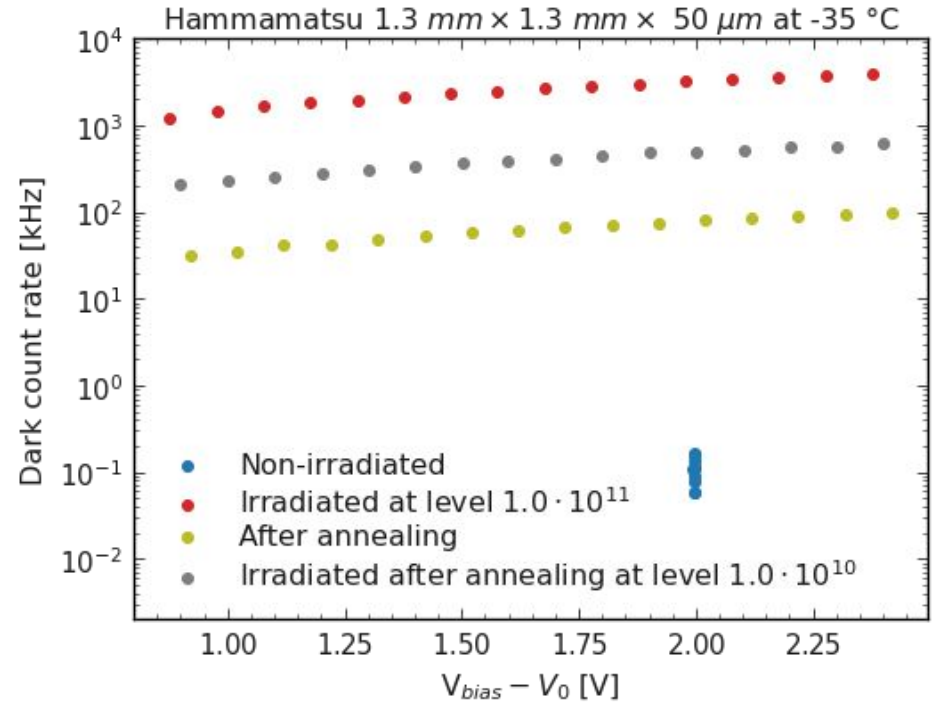
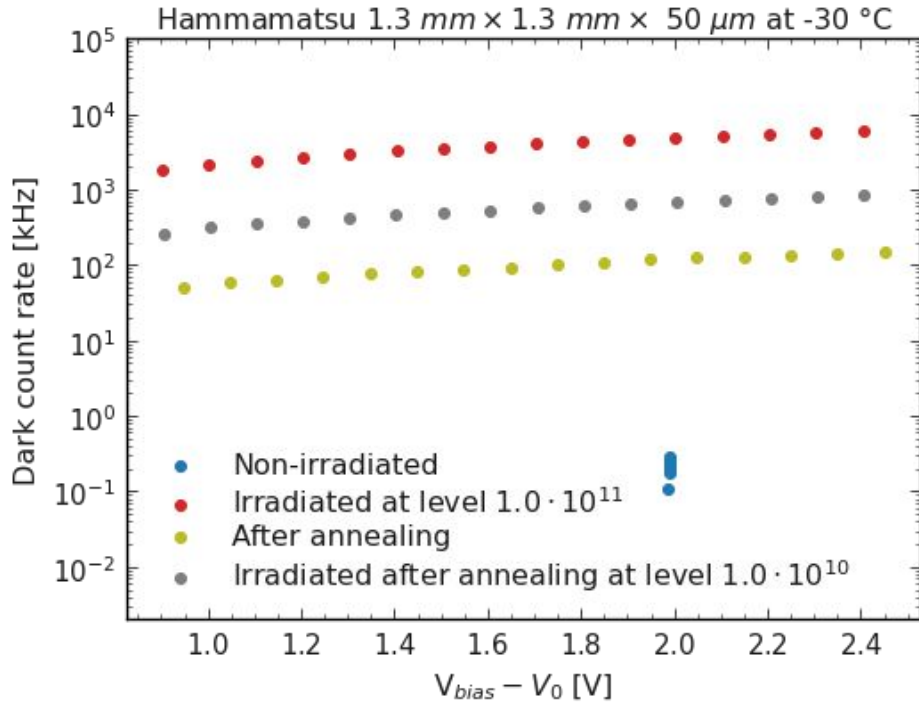




# Dark count rate



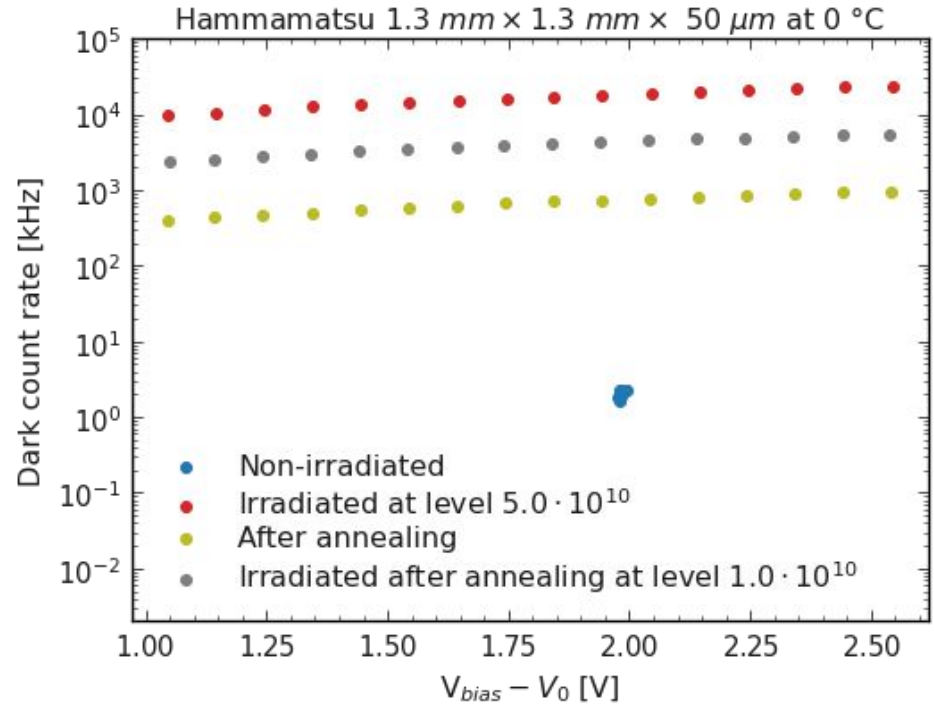
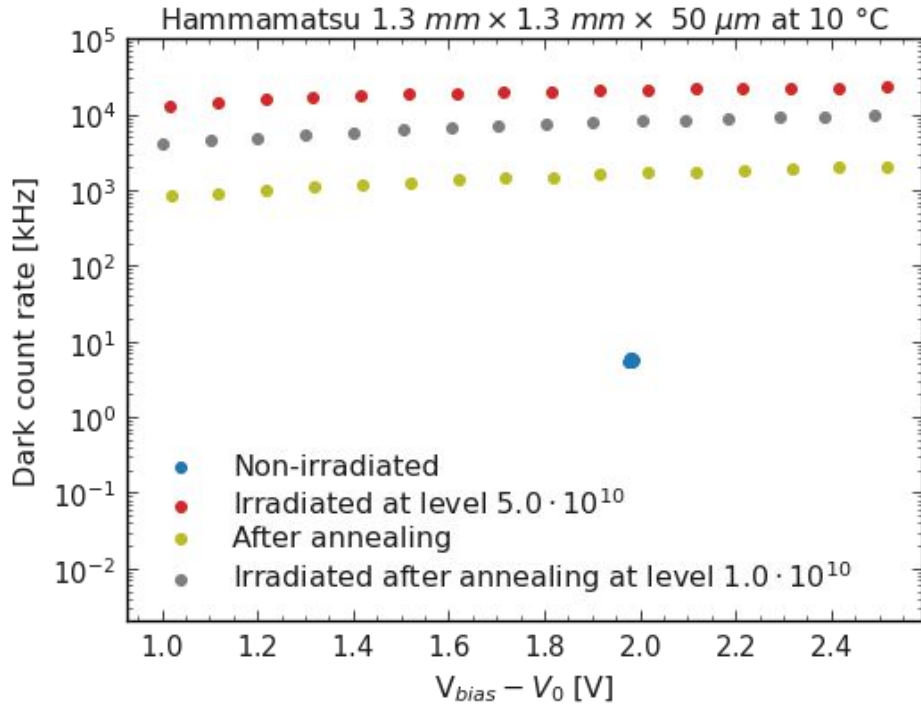
# Dark count rate



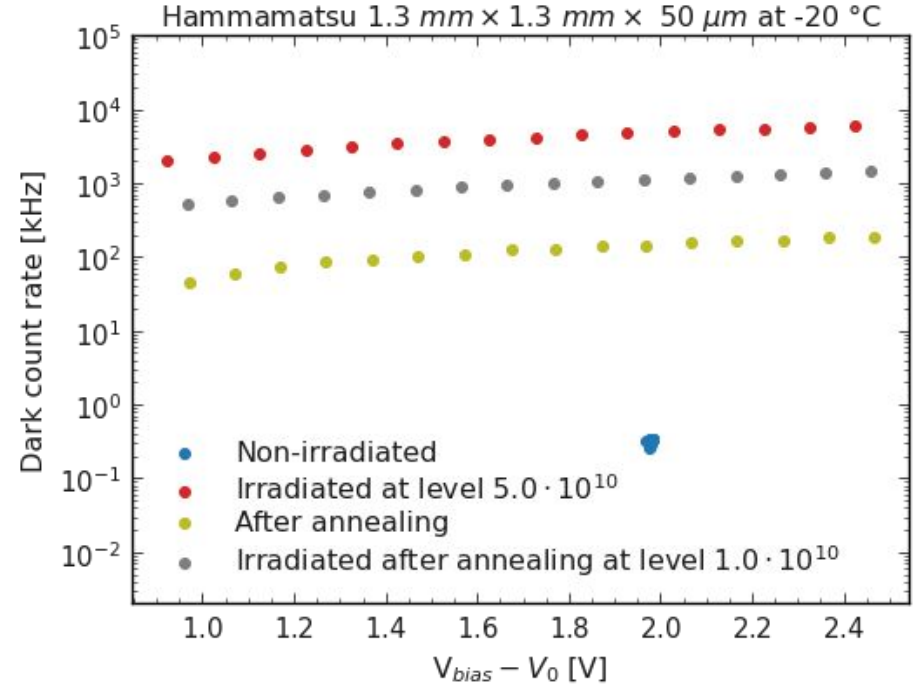
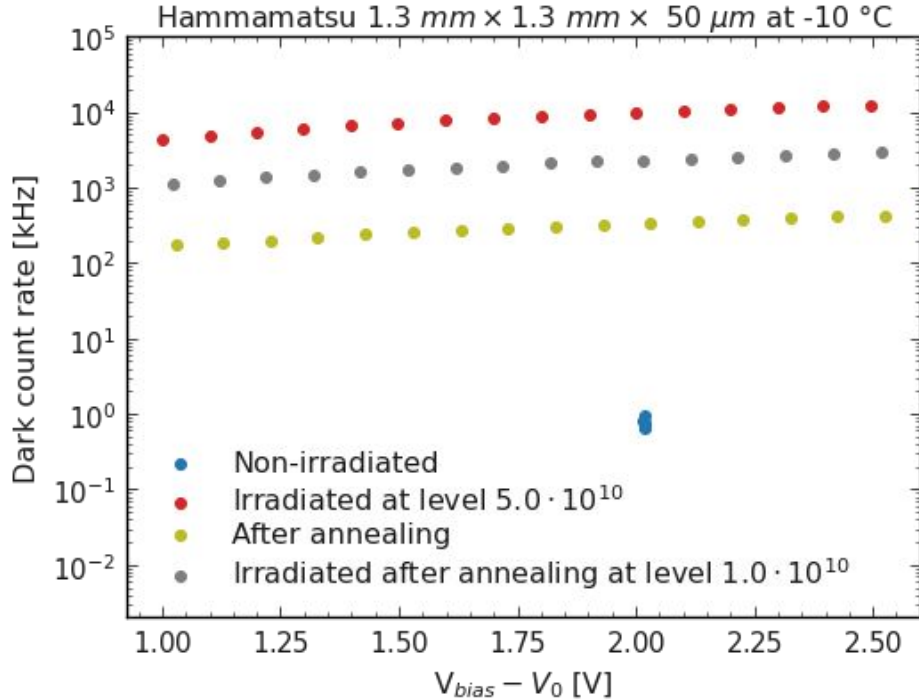


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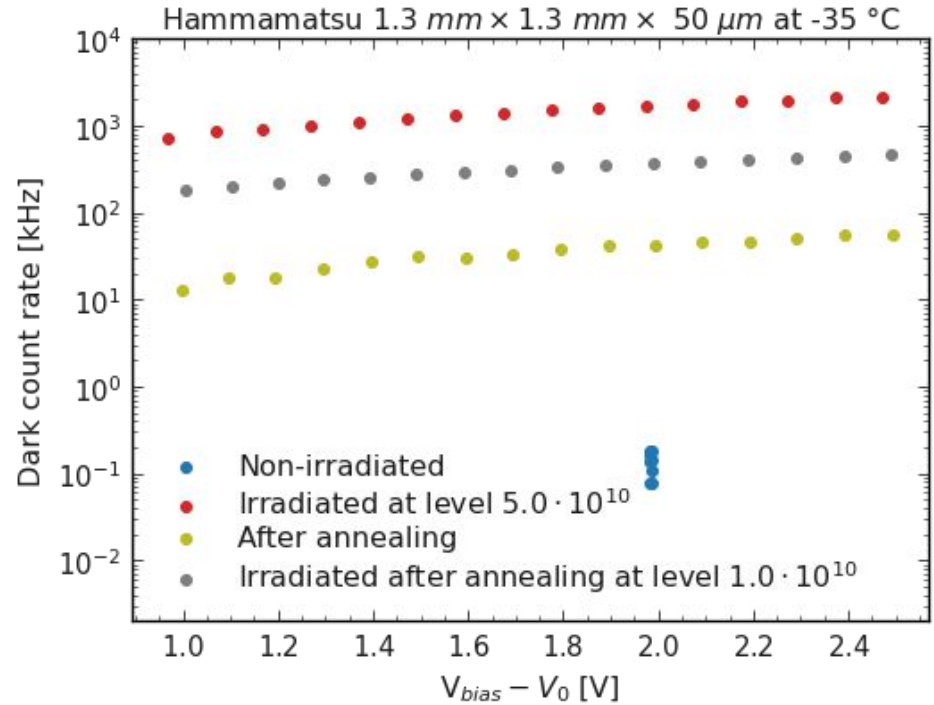
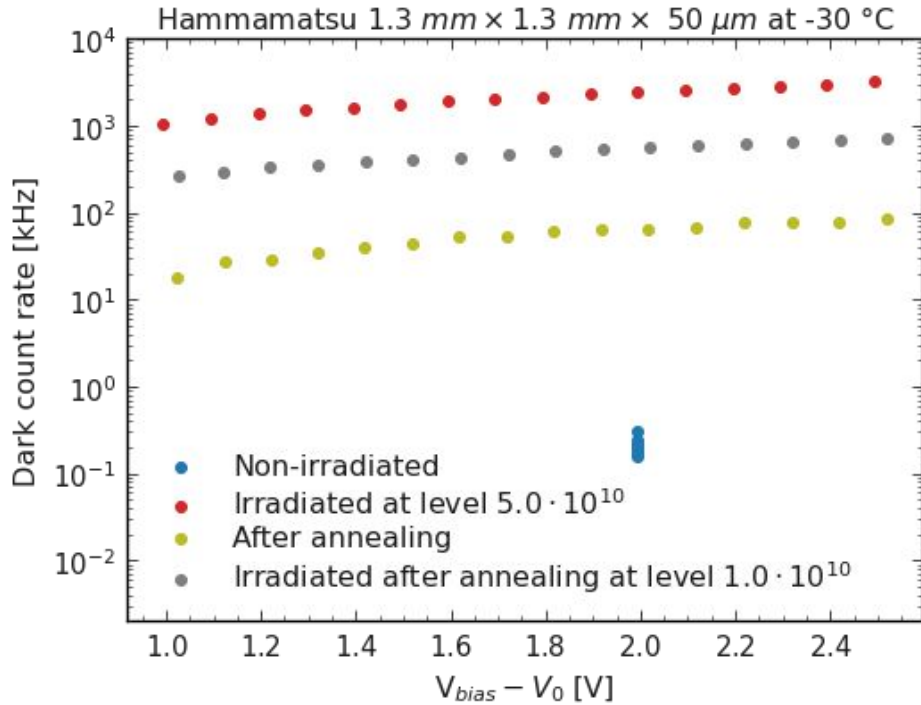
# Dark count rate



# Dark count rate

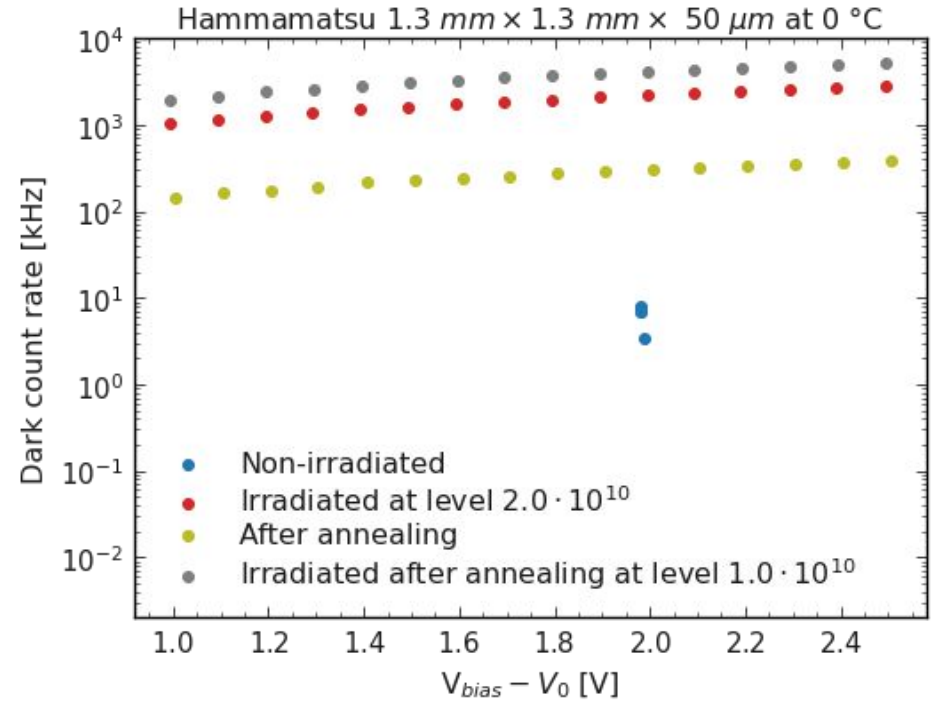
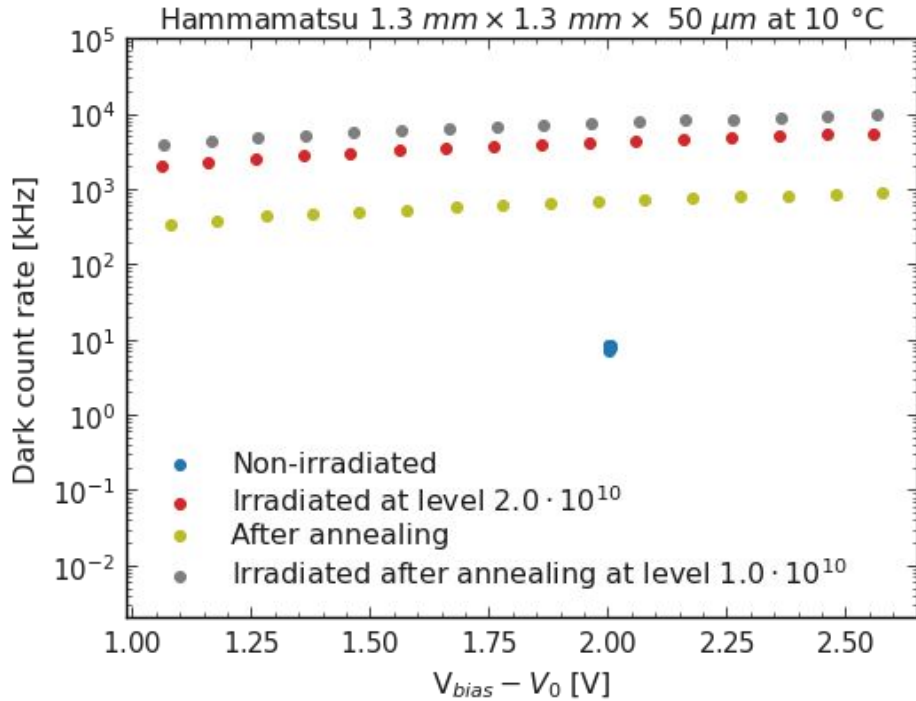


# Dark count rate



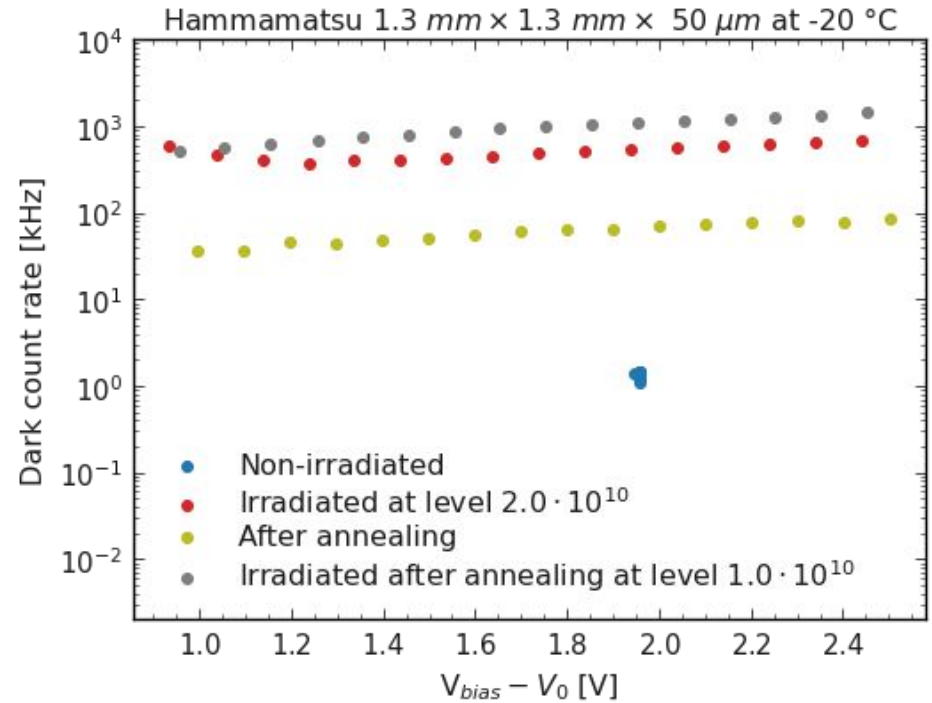
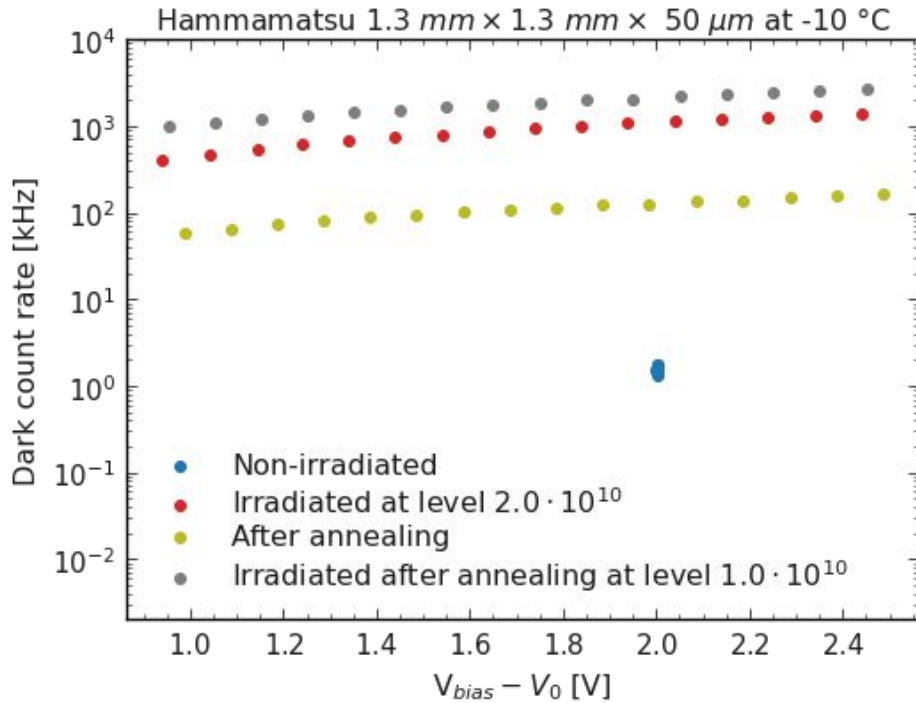
# SIMP #4

# Dark count rate

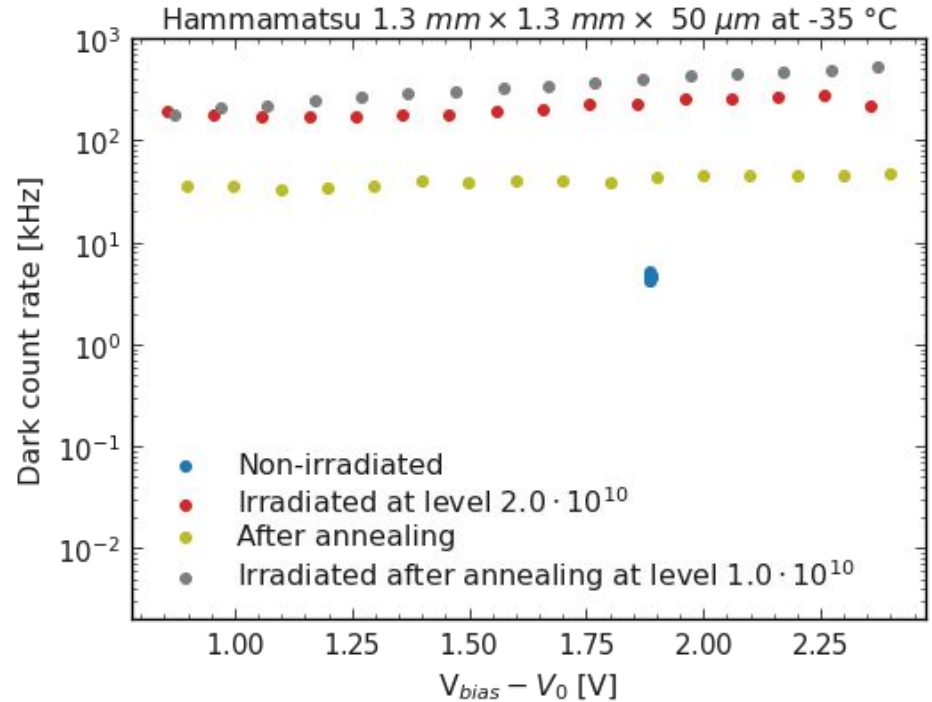
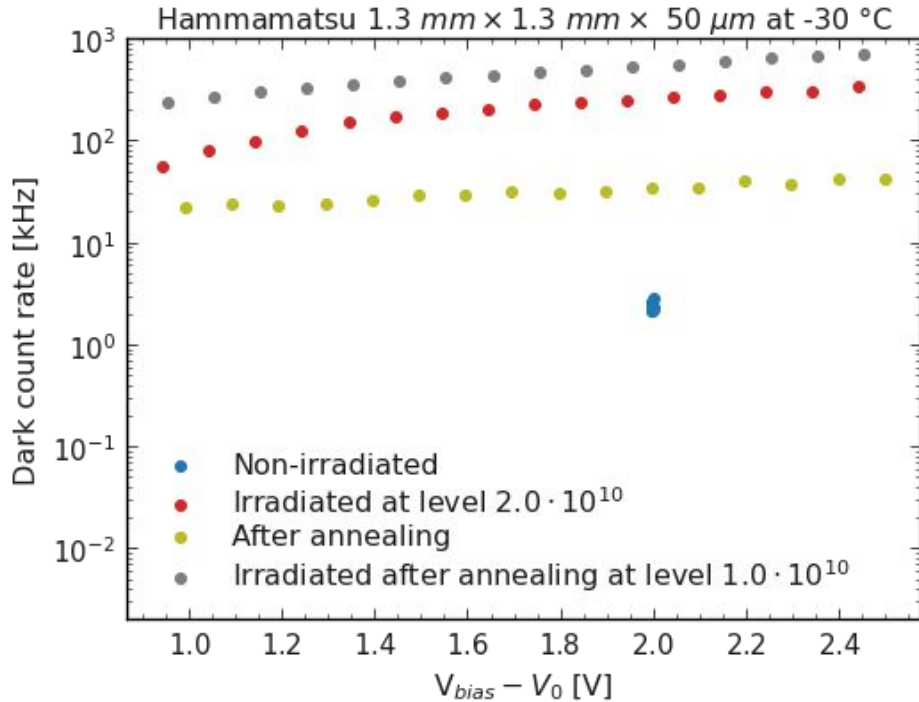




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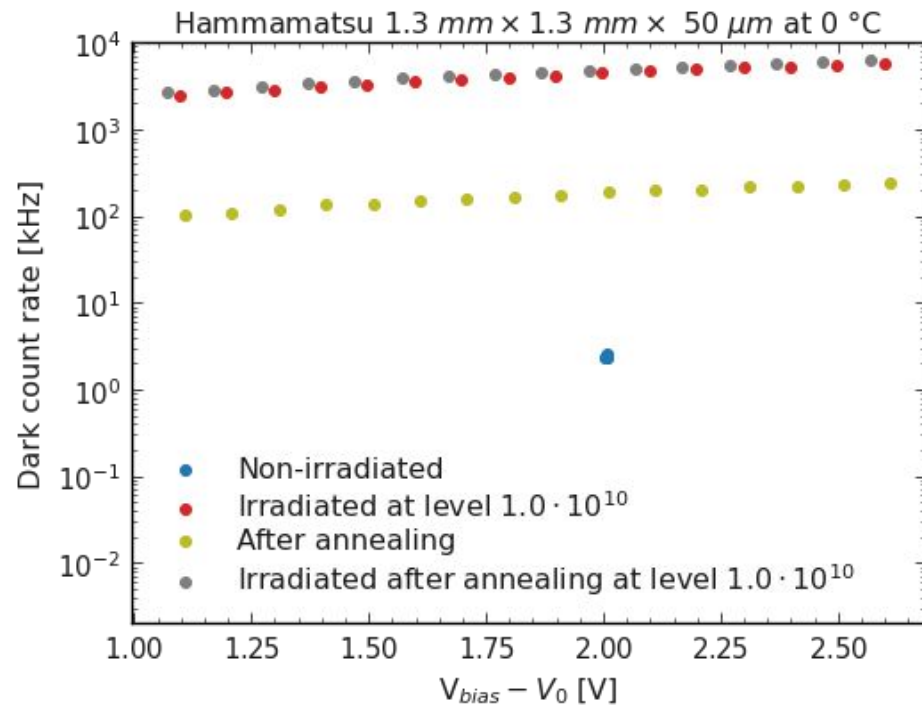
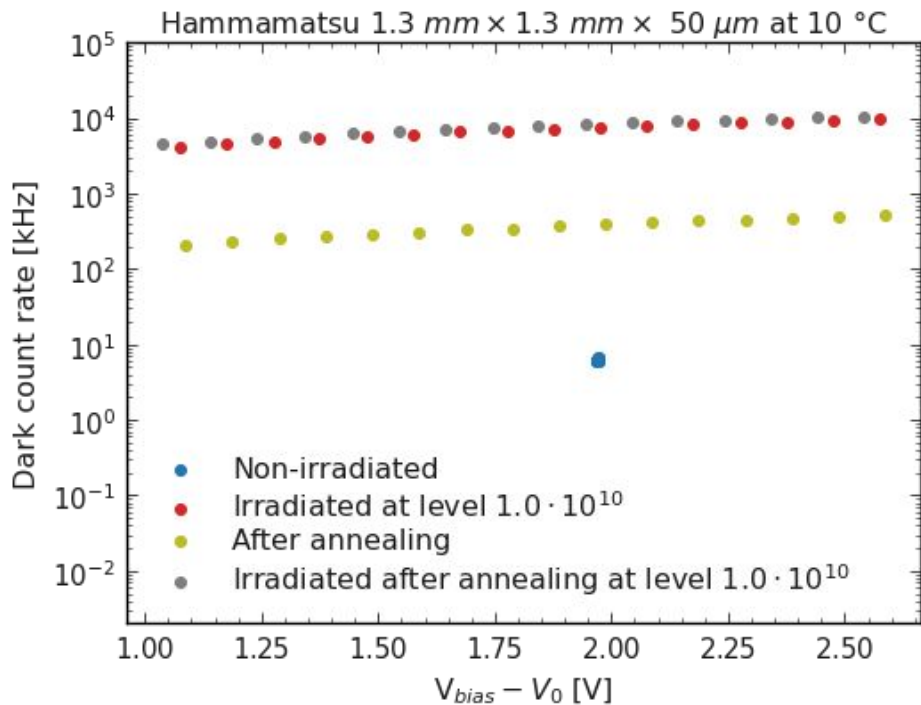


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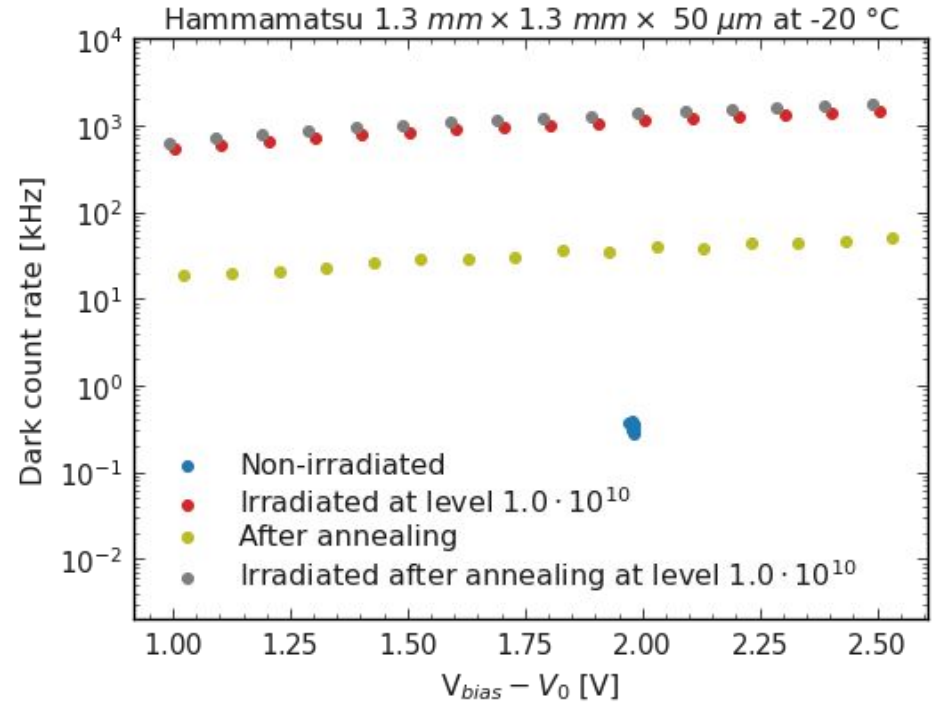
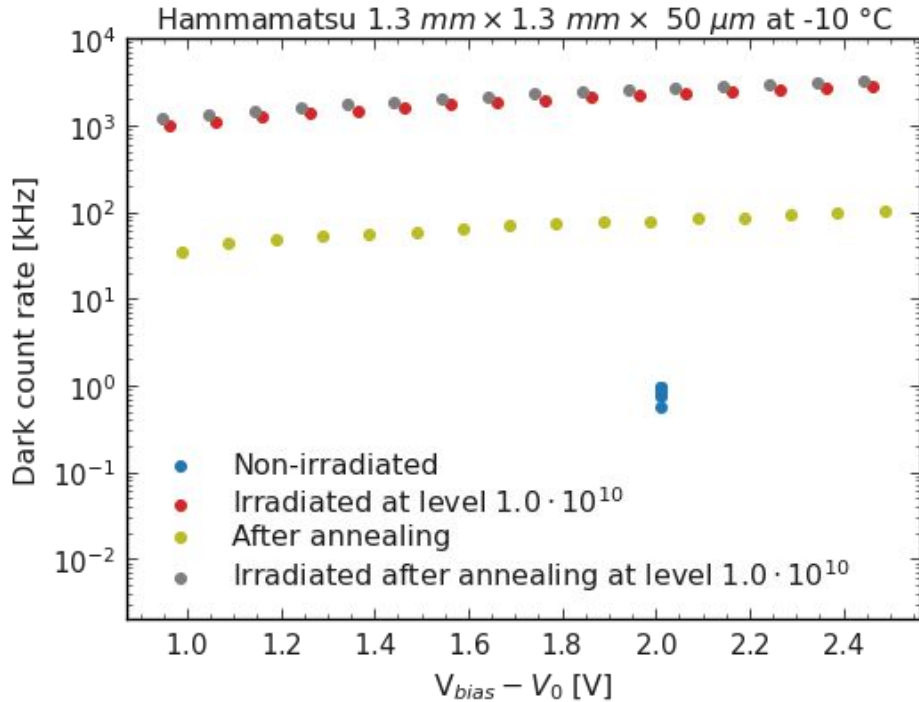


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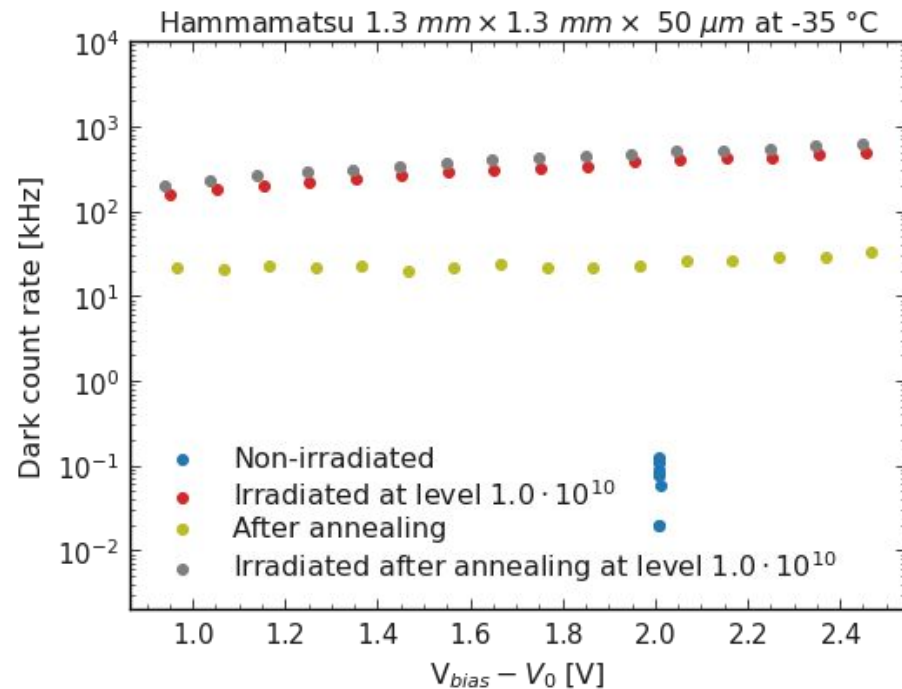
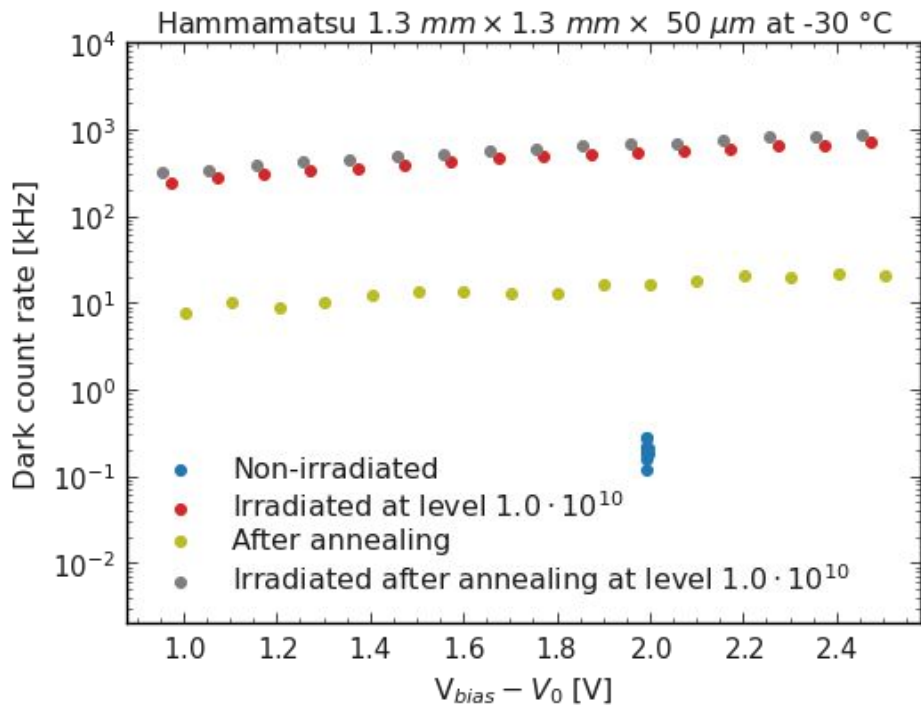
# Dark count rate



# Dark count rate

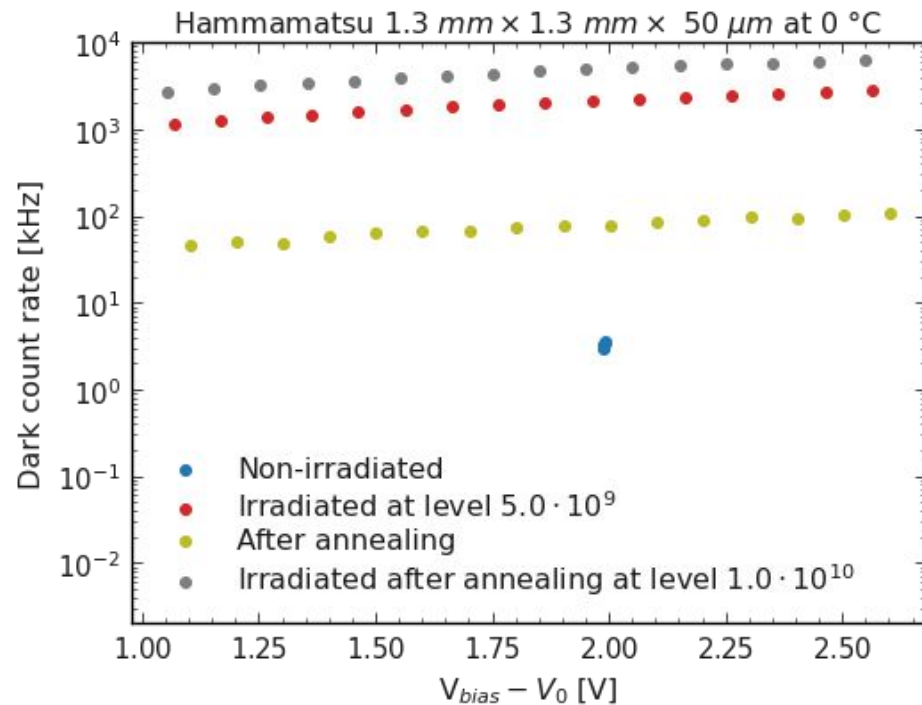
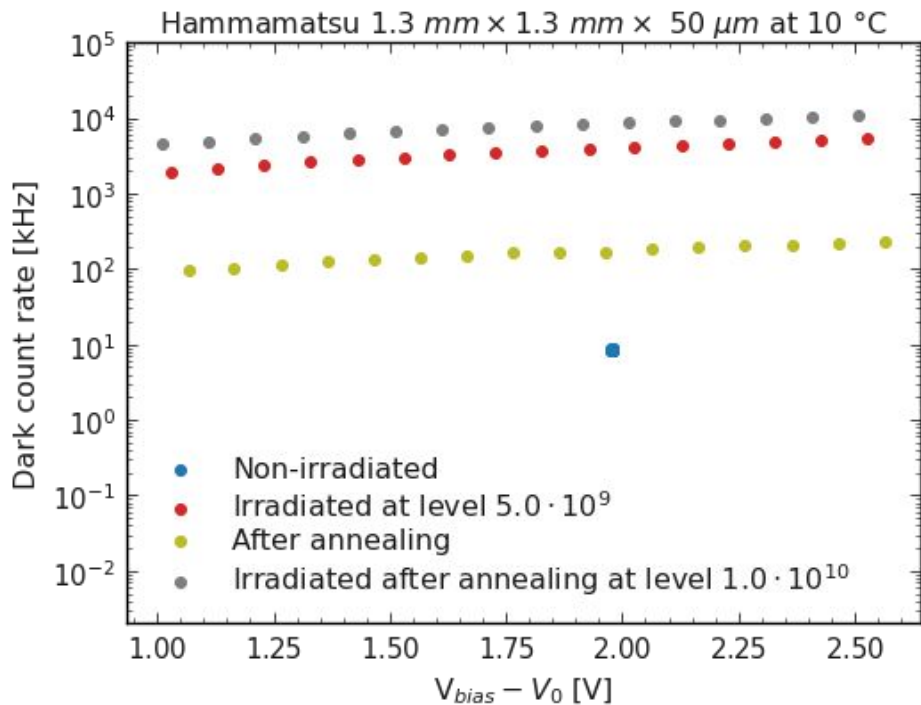


# Dark count rate



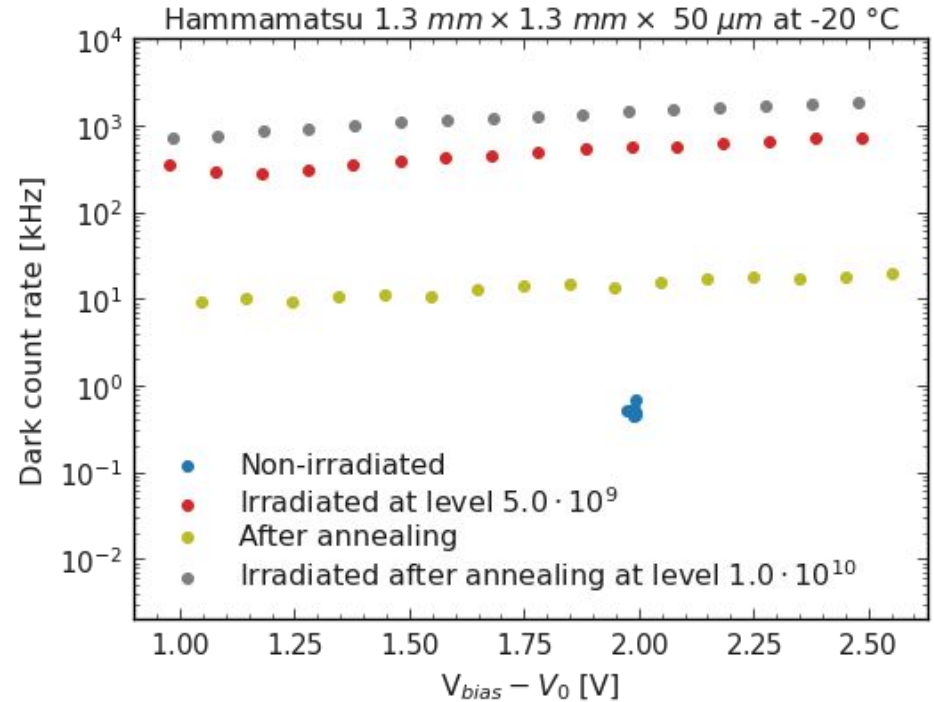
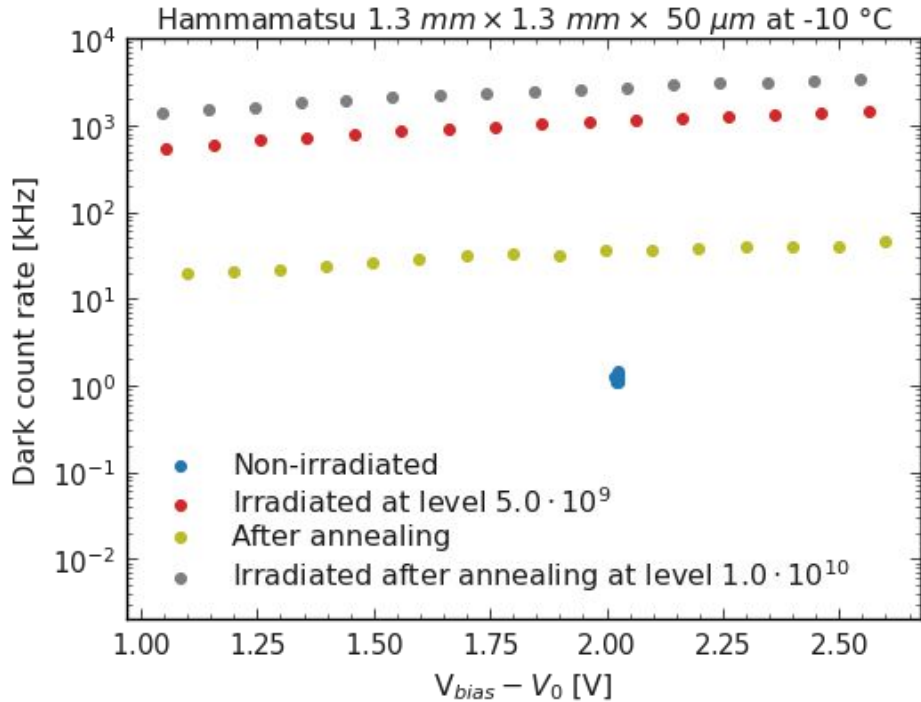
# SIMP #6

# Dark count rate

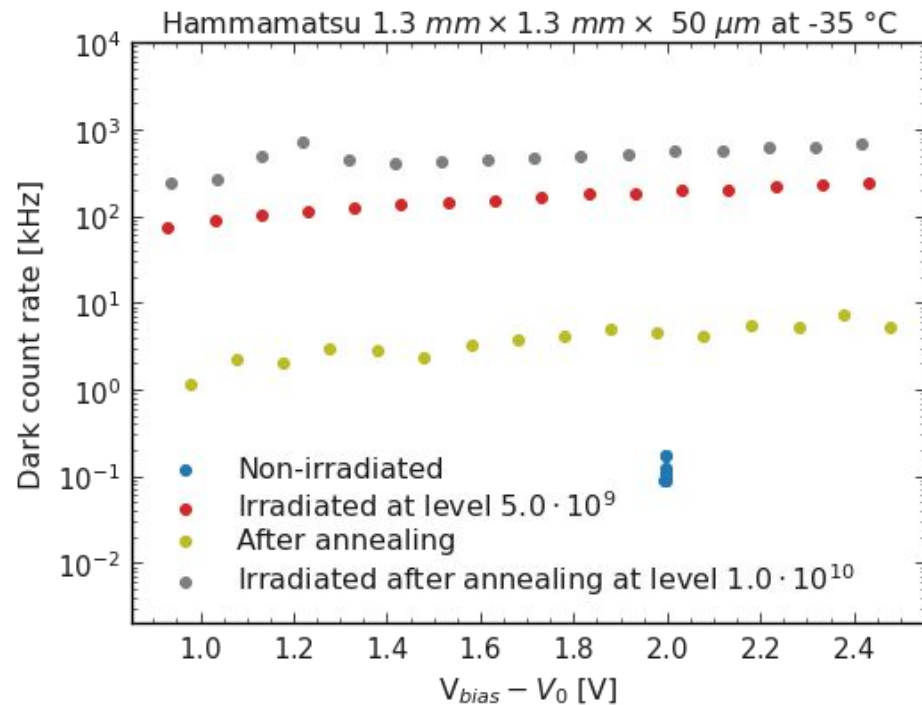
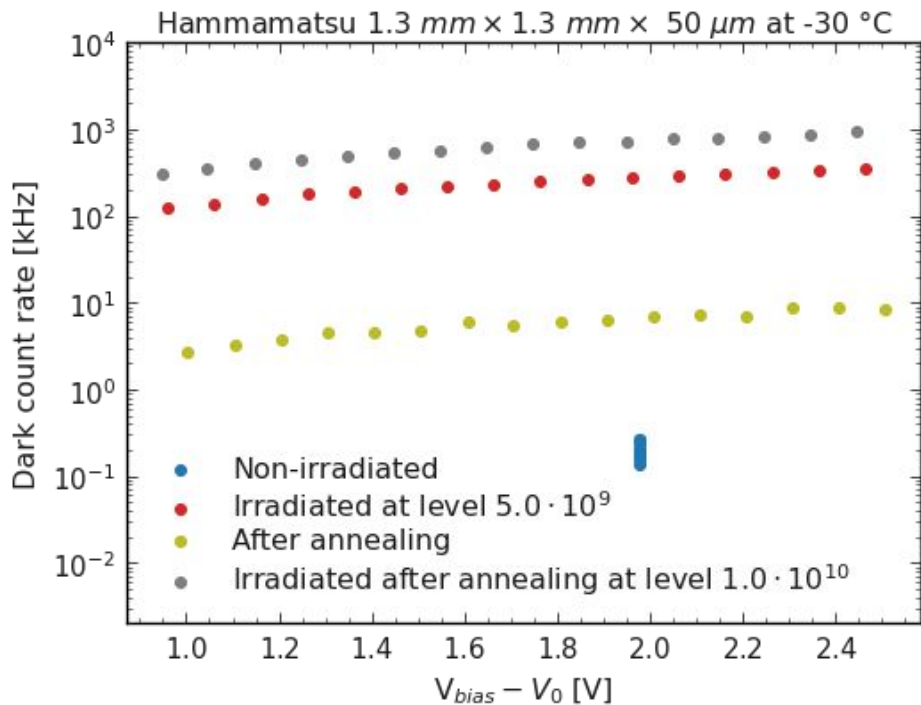




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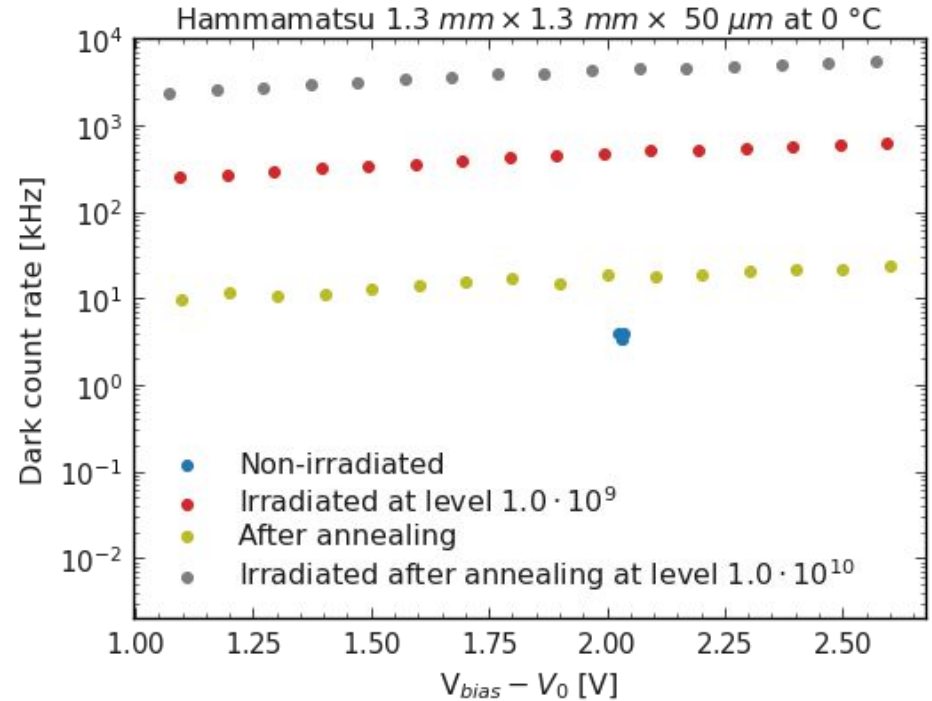
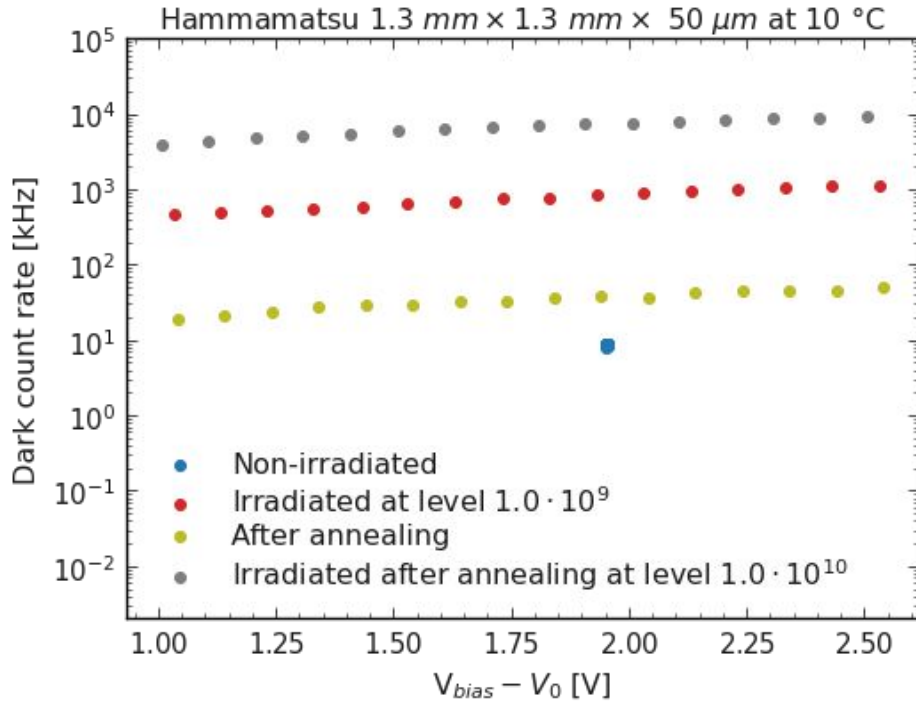


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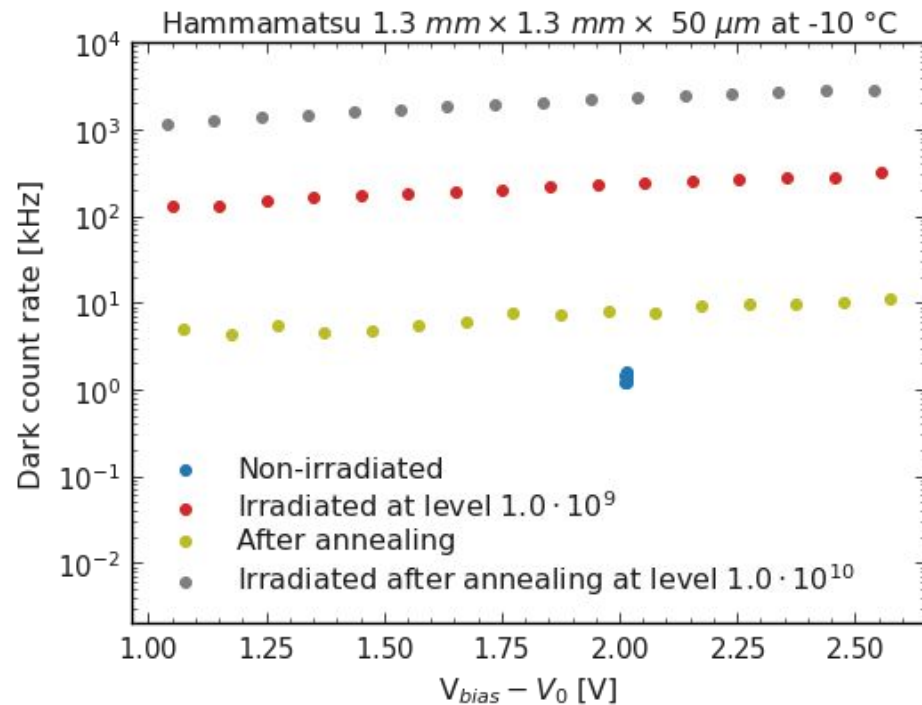
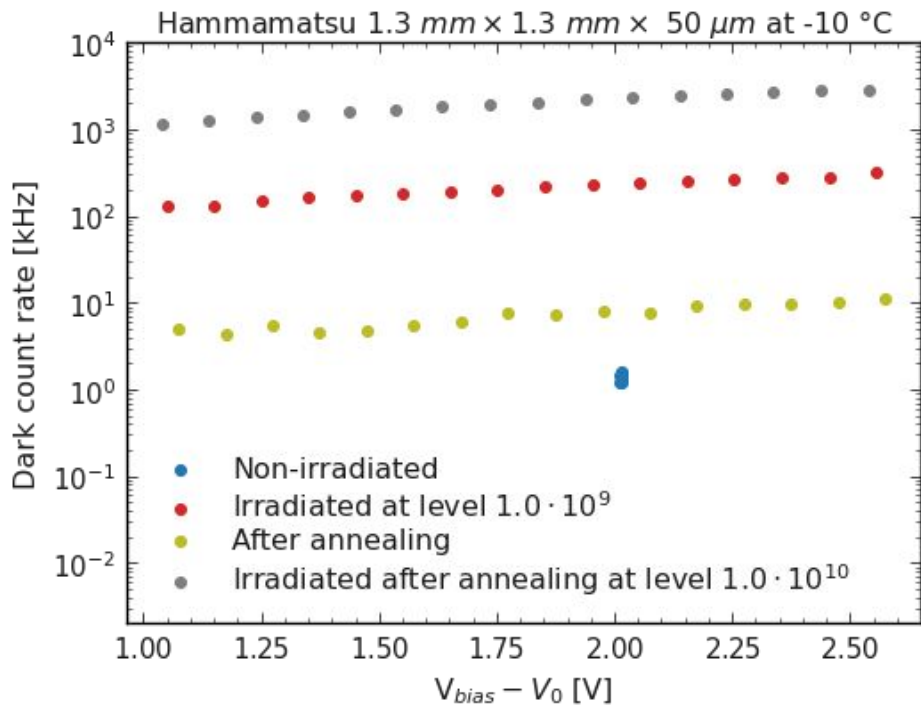


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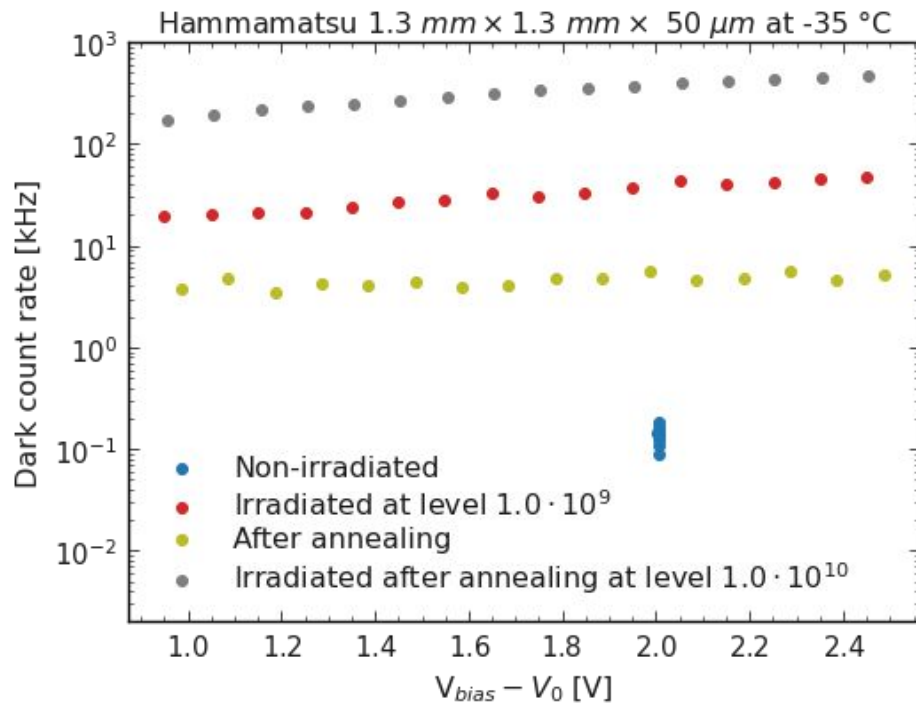
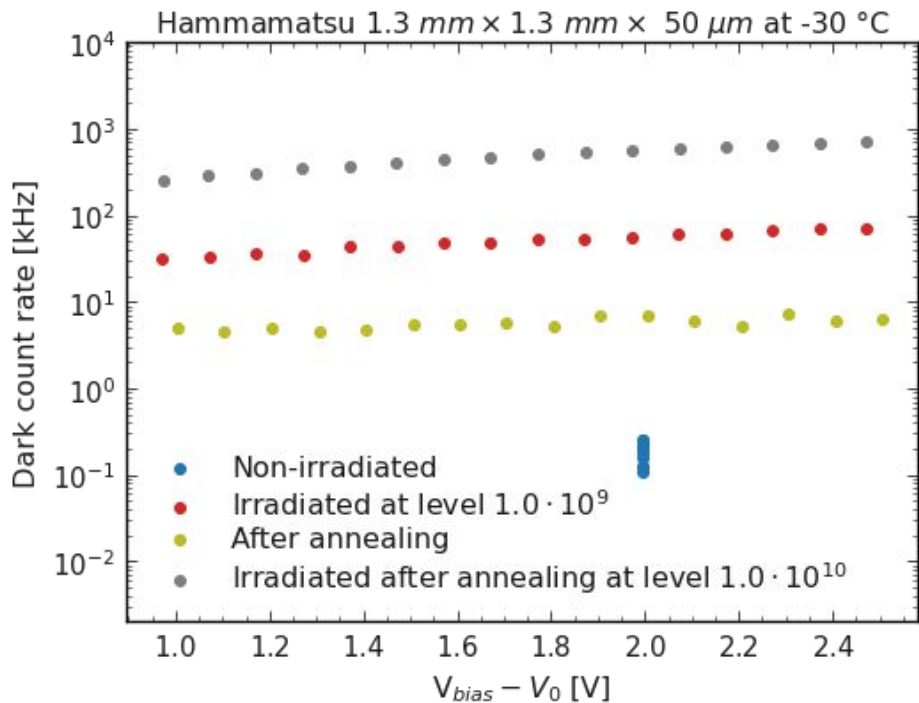
# Dark count rate



# Dark count rate



# Dark count rate



# Backup