EIC_NET
dRICH Meeting
2022-05-30

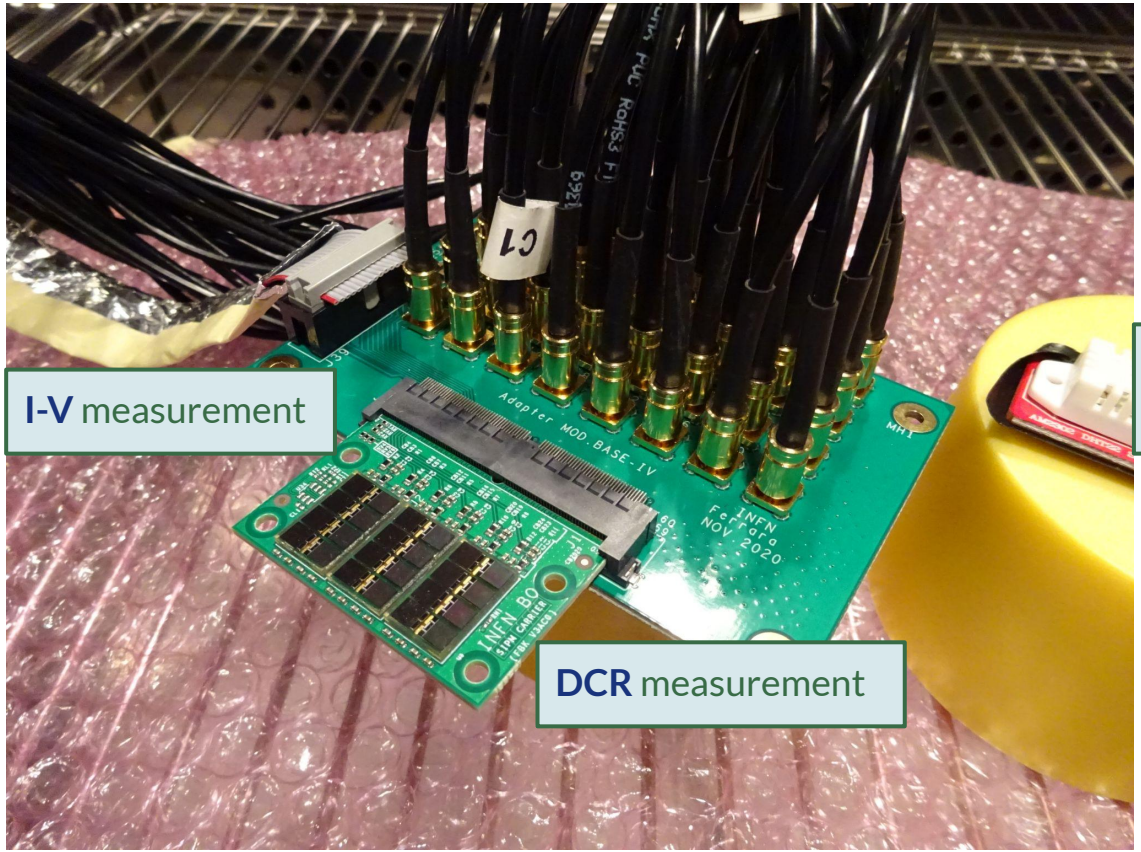
Update: R&D on SiPM Annealing and characterisation

Bologna Group

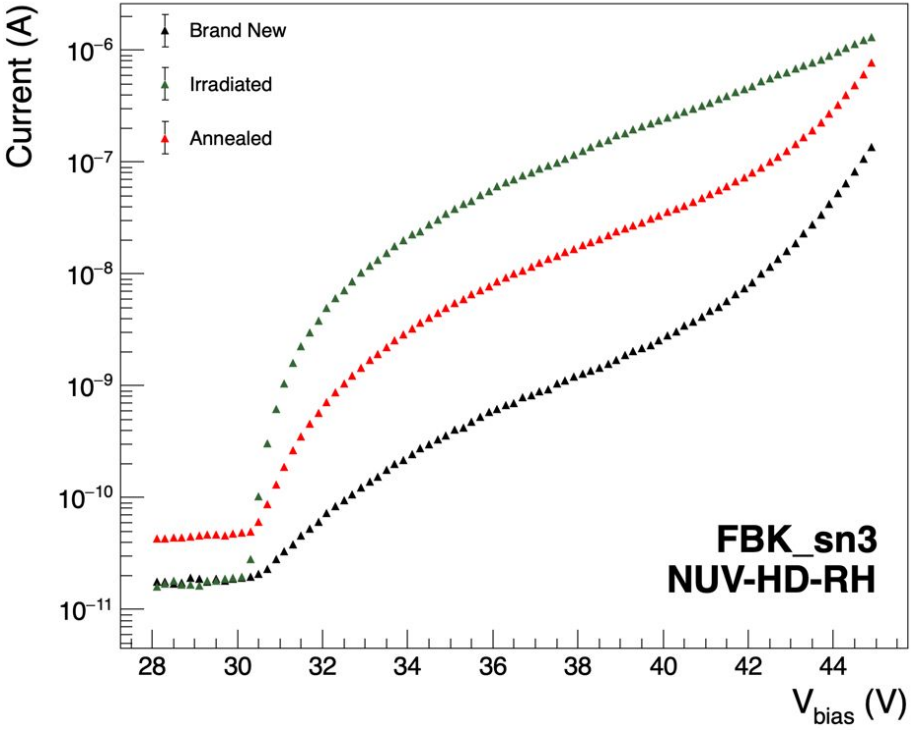
Nicola Rubini,
University and INFN Bologna

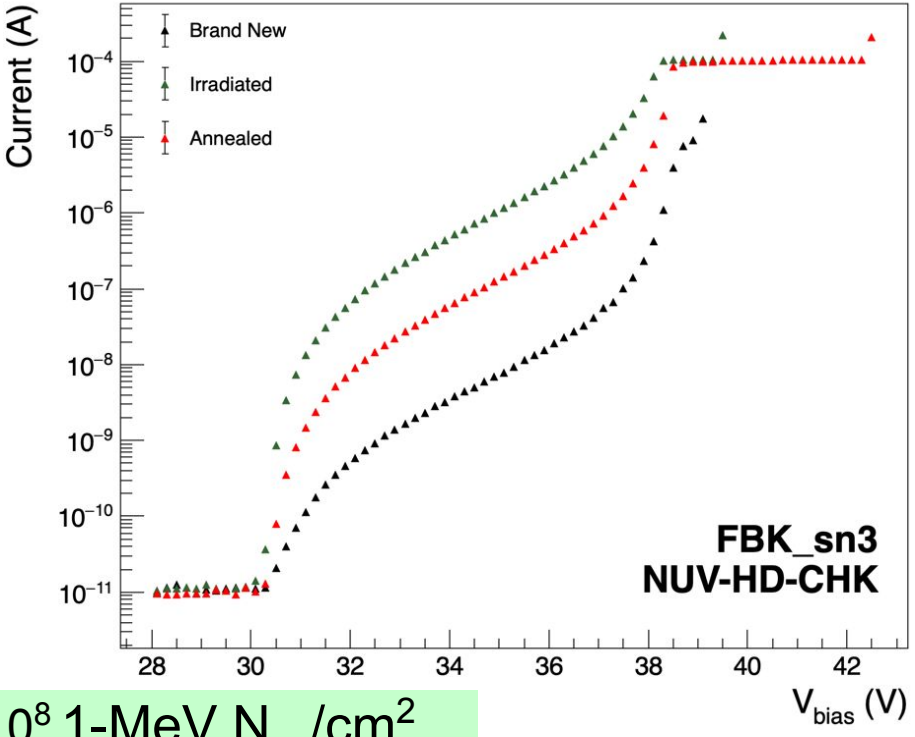
nicola.rubini@bo.infn.it

Characterising SiPMs response



I-V changes

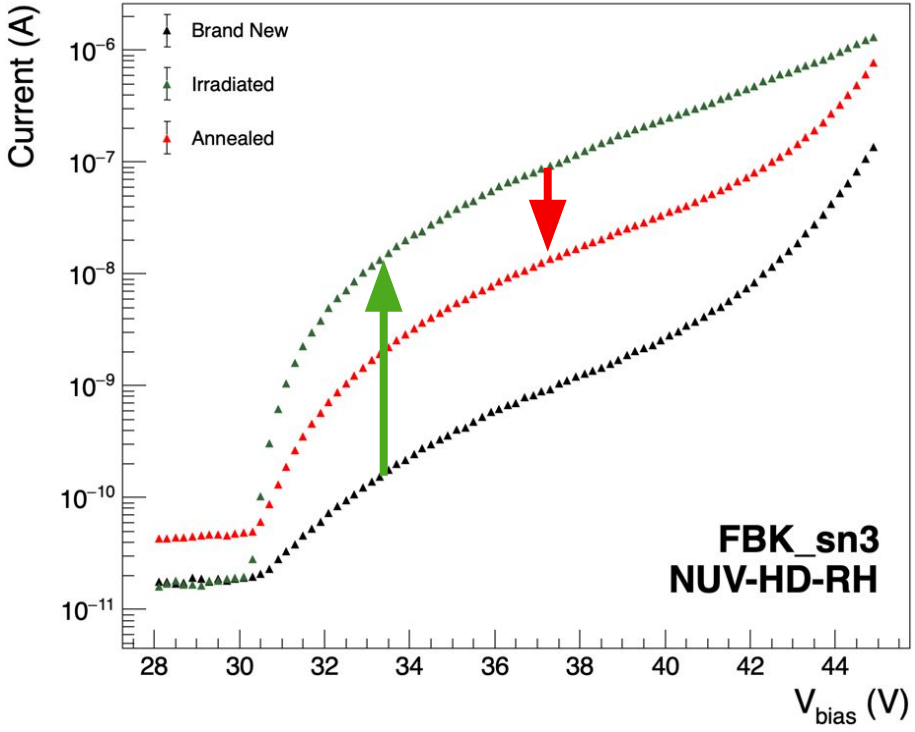


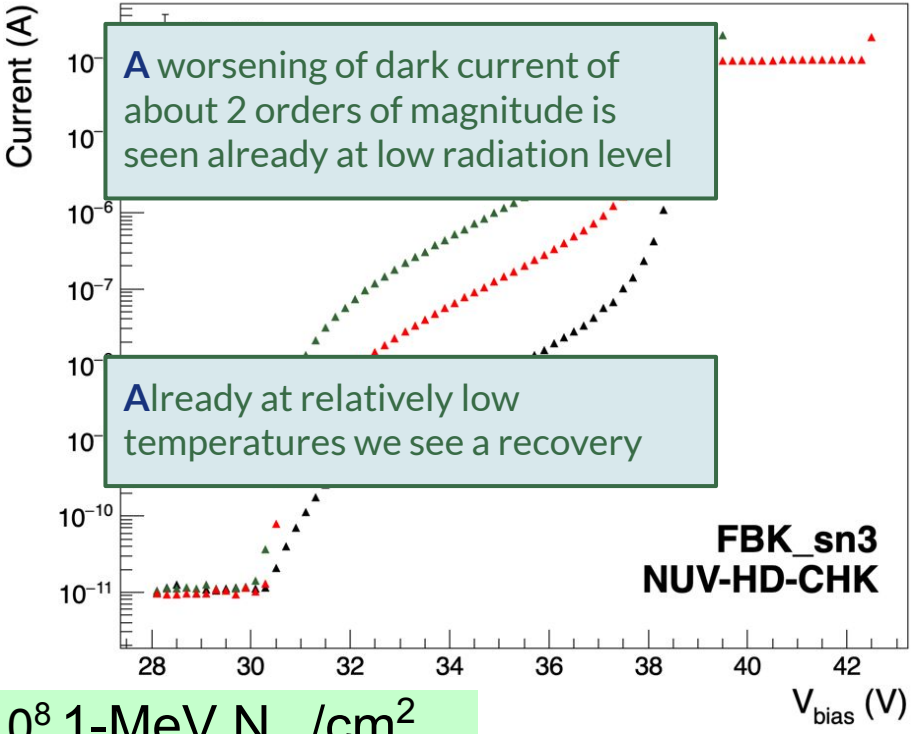


10^8 1-MeV N_{eq}/cm^2

I-V changes

24h at 100°C and for 168h at 125°C.





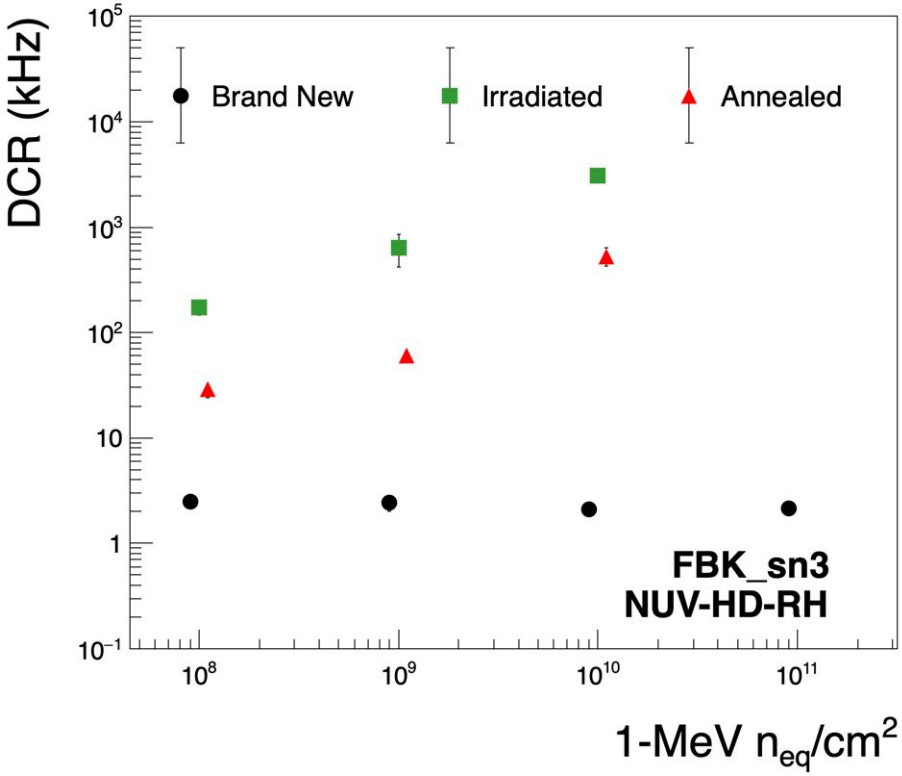
A worsening of dark current of about 2 orders of magnitude is seen already at low radiation level

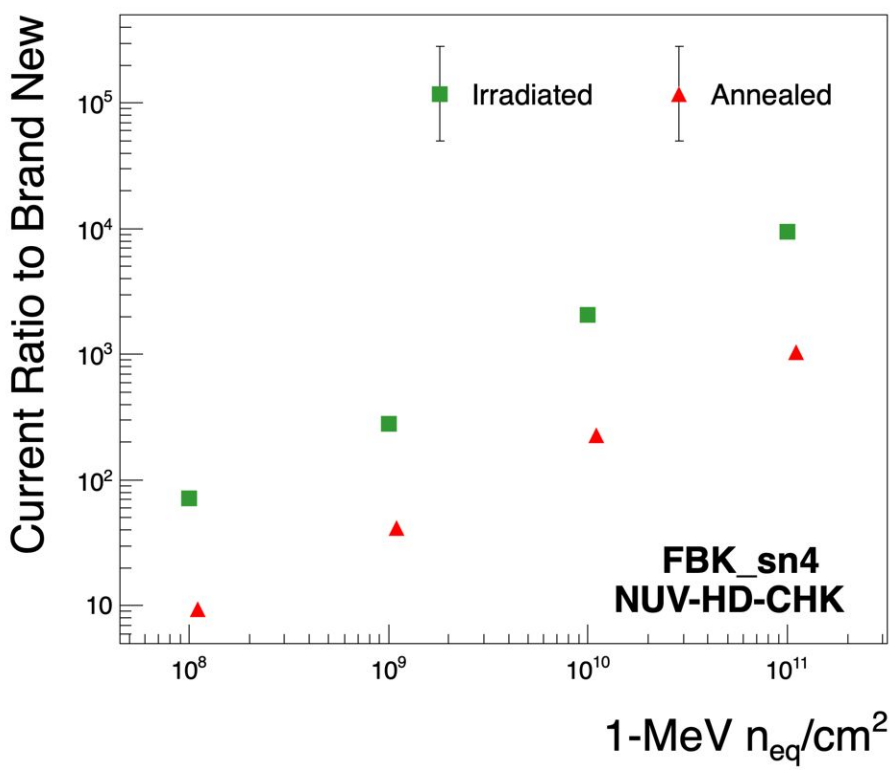
Already at relatively low temperatures we see a recovery

10^8 1-MeV N_{eq}/cm^2

Dark Current and Count

T = -30C V_{over} = 3V





Dark Current and Count

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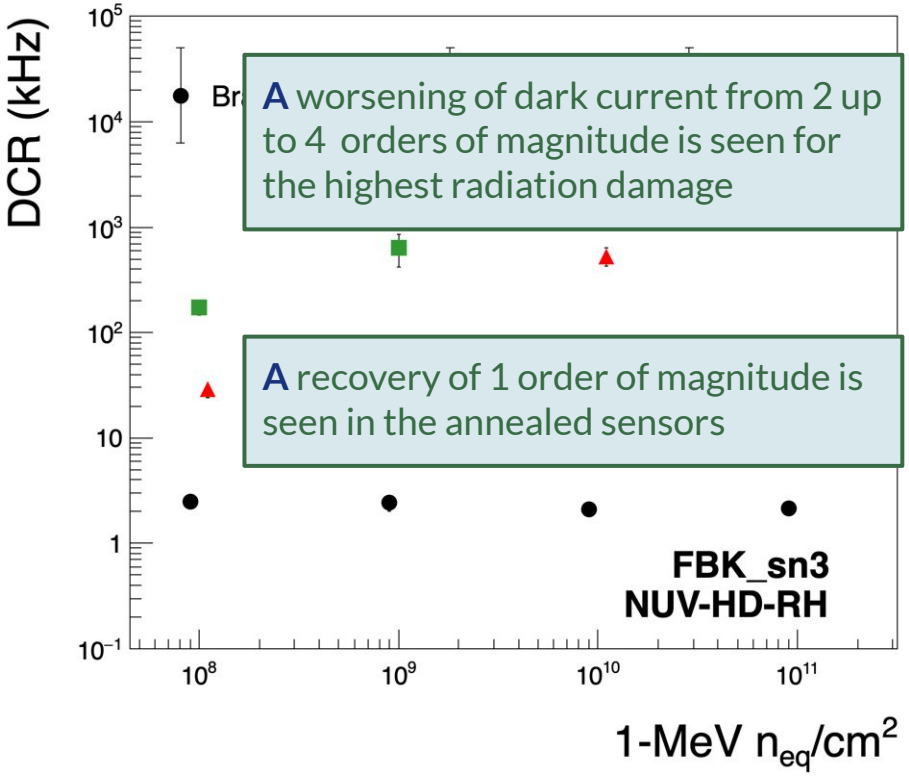
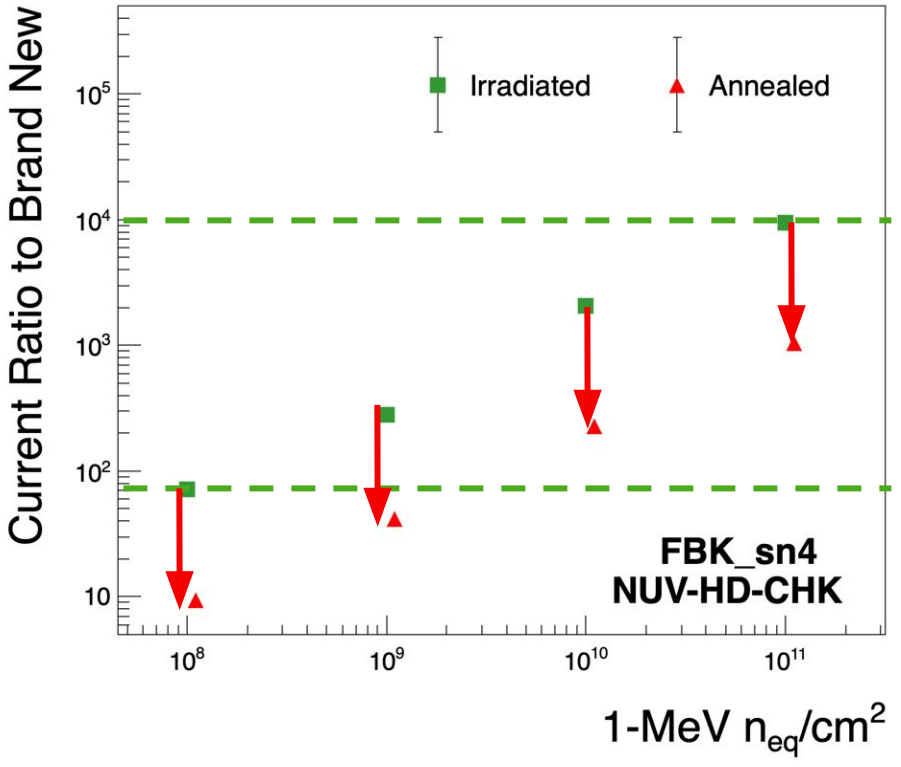
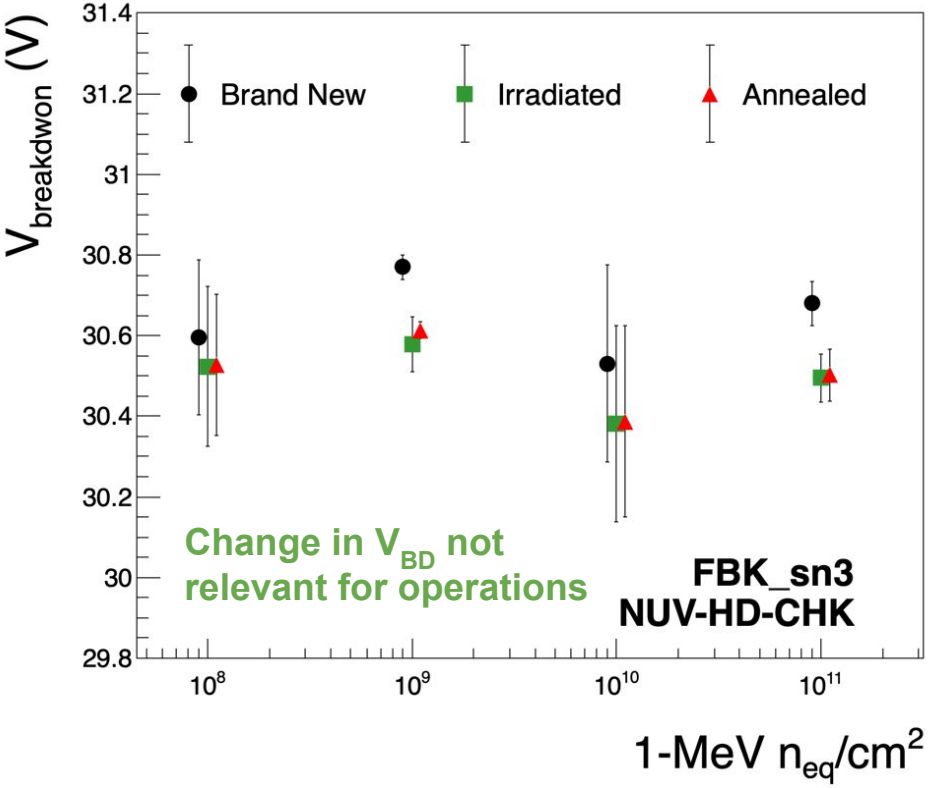




Bias Voltage

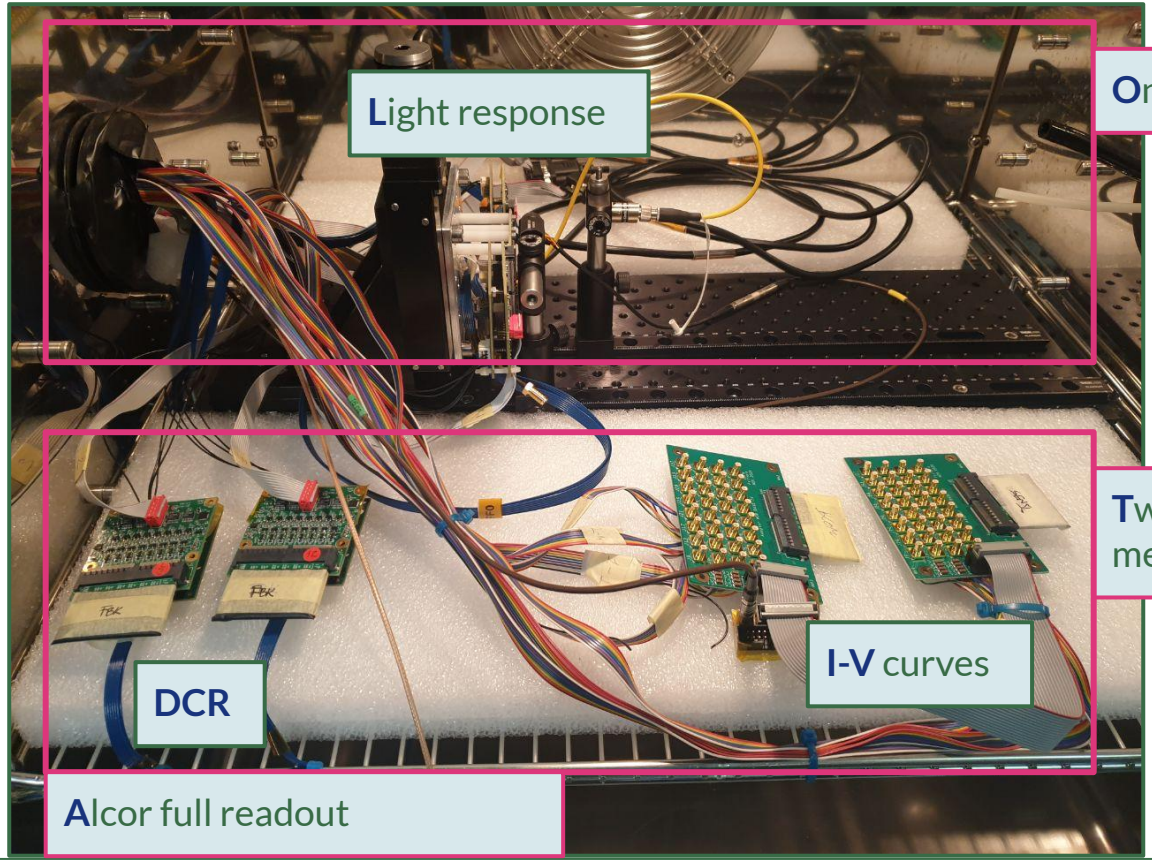
T = -30C



The error bar represents the dispersion of the distribution

Characterising SiPMs

NEW!



One separate measurement

Two simultaneous measurements

Measuring plan

	DCR		IV		LED	
	CHIP2	**CHIP3**	**MUX1**	**MUX2**	**CHIP0**	**CHIP1**
1	FBKa	FBKb	HAMA1	HAMA2	not running	
2	HAMA1	HAMA2	SENSL	HAMA1L	not running	
3	SENSL	HAMA1L	FBKa	FBKb	not running	
4	not running		not running		HAMA1	reference

Measuring plan

	DCR		IV		LED	
	CHIP2	CHIP3	MUX1	MUX2	CHIP0	CHIP1
1	FBKa	FBKb	HAMA1	HAMA2	not running	
2	HAMA1	HAMA2	SENSL	HAMA1L	not running	
3	SENSL	HAMA1L	FBKa	FBKb	not running	
4	not running		not running		HAMA1	reference

DONE!

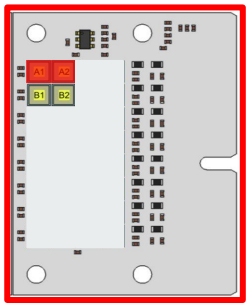
DONE!

DONE!

Ongoing

Next Step Irradiation at TIFPA on June 4th for 10^9 1-MeV N_{eq}/cm^2

Next Step Annealing tests on site between irradiations



Measuring plan

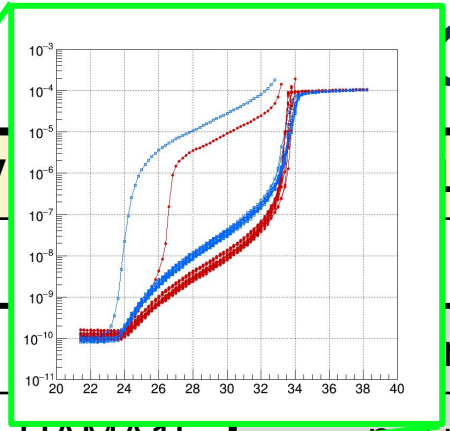
	DCR		IV		LED
	CHIP2	CHIP3	MUX1		CHIP1
1	FBKa	FBKb	HAMA1		running
2	HAMA1	HAMA2	SENSL	HAMA1L	not running
3	SENSL	HAMA1L	FBKa	FBKb	
4	not running		not running		H

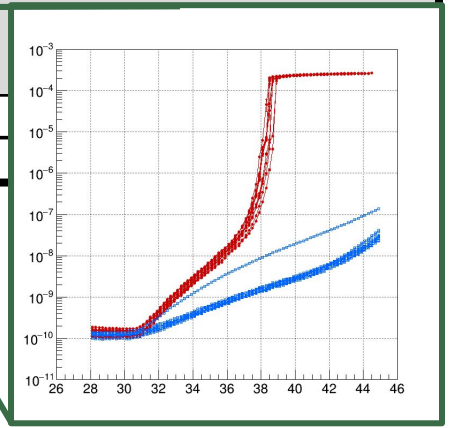
DONE!

DONE!

DONE!

Ongoing





Measuring plan

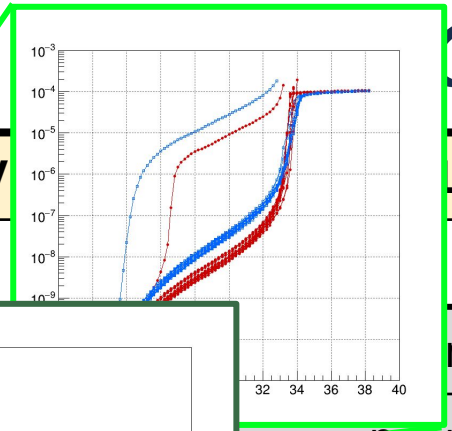
	DCR		IV	LED
	CHIP2	CHIP3	MUX1	CHIP1
1	FBKa	FBKb	H	running
2	HAMA1	HAMA2	S	not running
3	SENSL	HAMA1L		
4				H

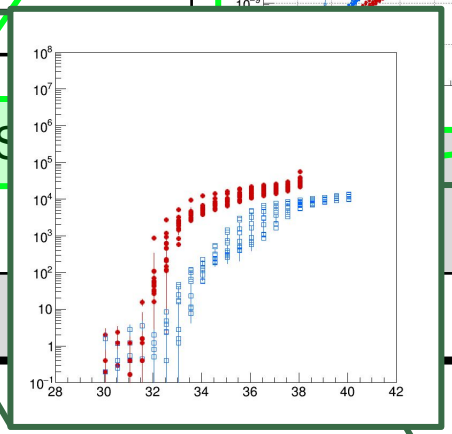
DONE!

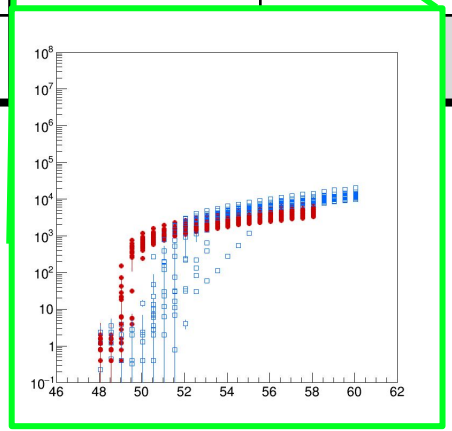
DONE!

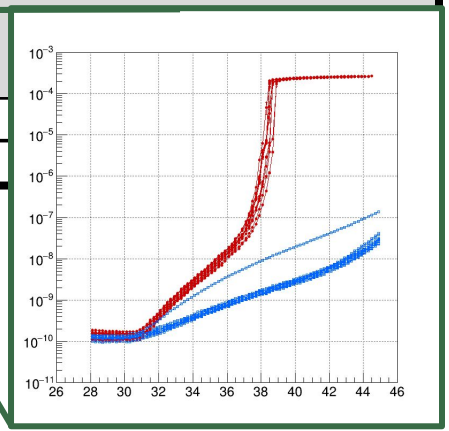
DONE!

Ongoing









Measuring plan

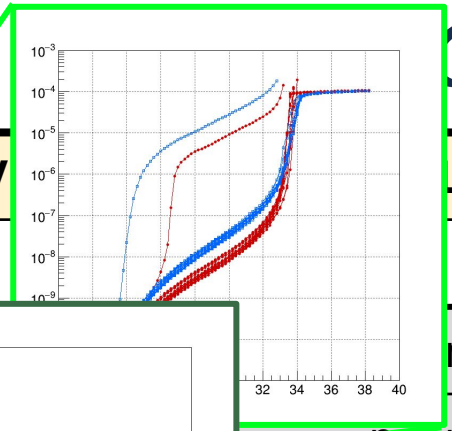
	DCR		IV	LED
	CHIP2	CHIP3	MUX1	CHIP1
1	FBKa	FBKb	H	running
2	HAMA1	HAMA2	S	not running
3	SENSL	HAMA1L		
4			H	

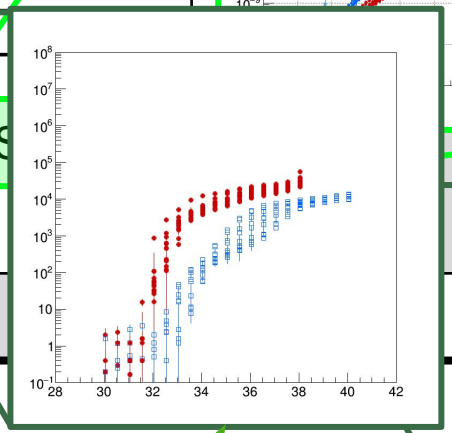
DONE!

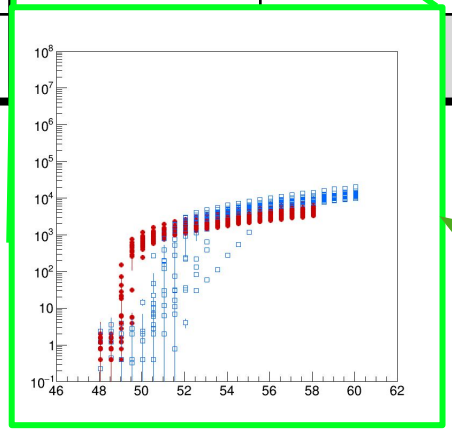
DONE!

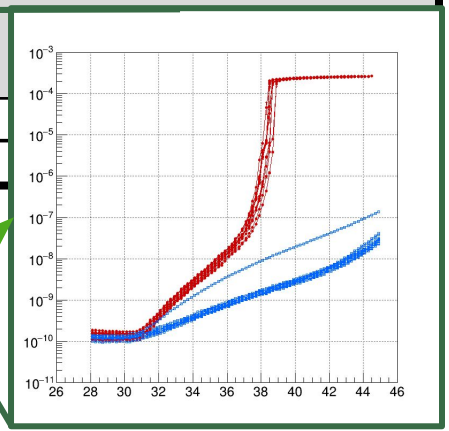
DONE!

Ongoing









Automatic check via mail

Measuring plan

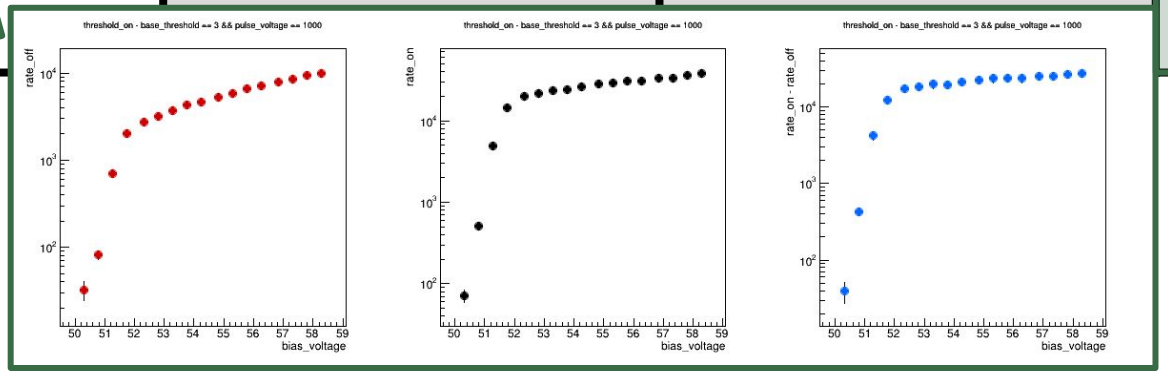
	DCR		IV		LED	
	CHIP2	CHIP3	MUX1	MUX2	CHIP0	CHIP1
1	FBKa	FBKb	HAMA1	HAMA2	not running	
2	HAMA1	HAMA2	SENSL	HAMA1L	not running	
3	SENSL	HAMA1L	FBKa	FBKb	not running	
					HAMA1	reference

DONE!

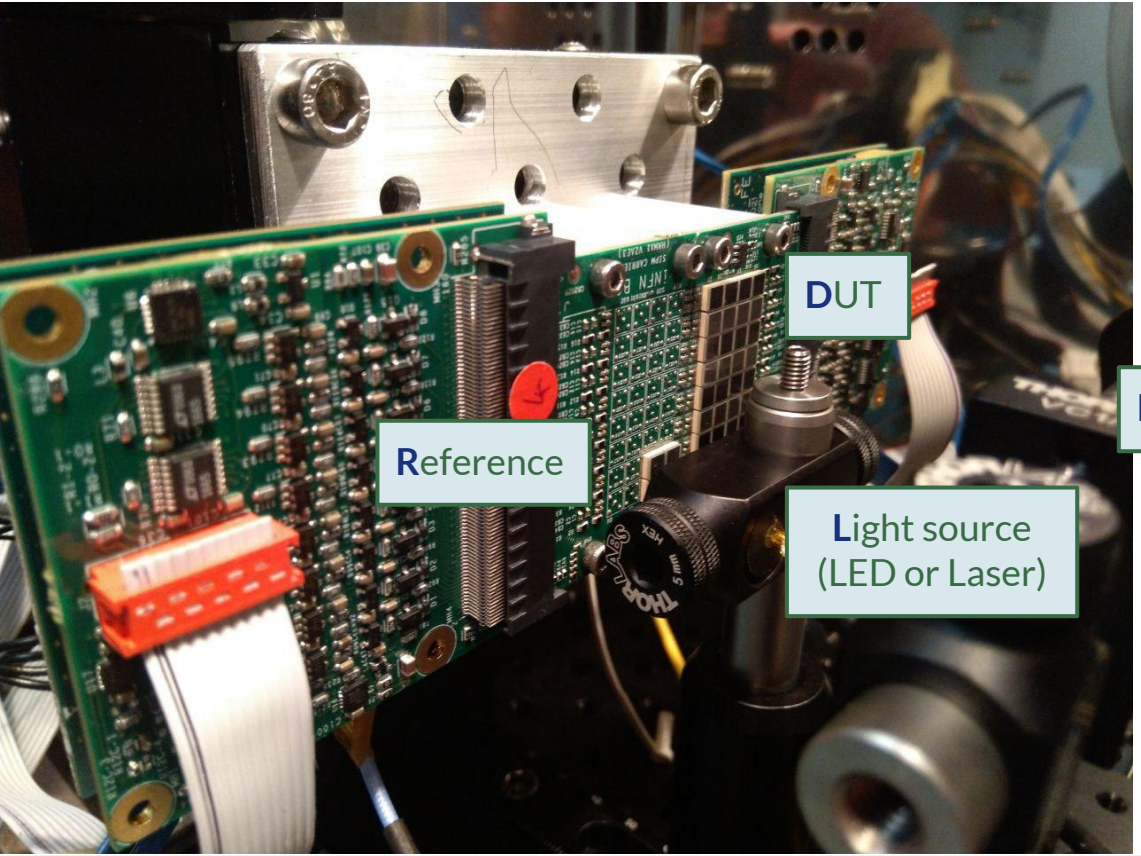
DONE!

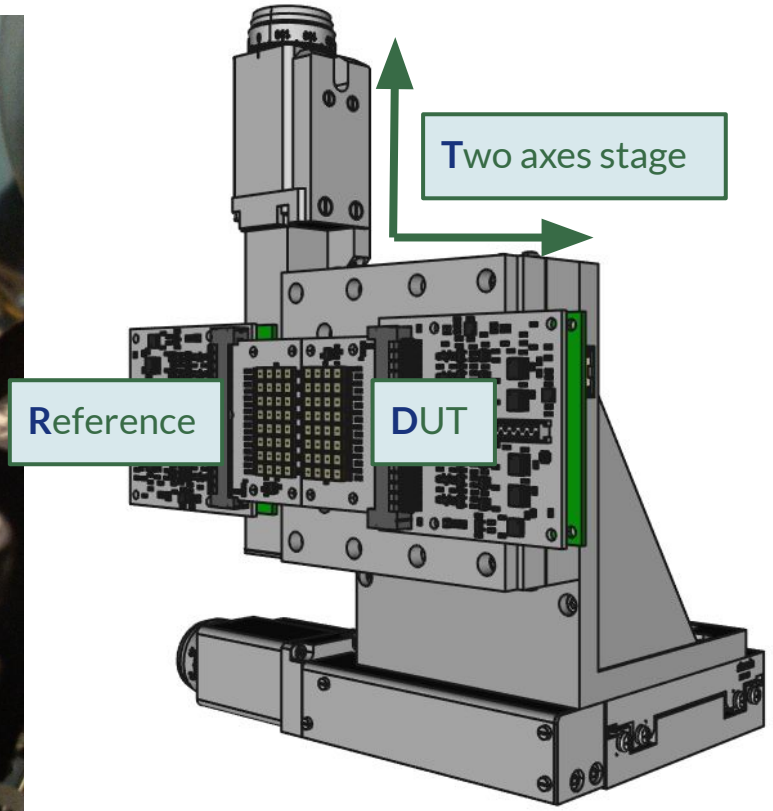
DONE!

Ongoing



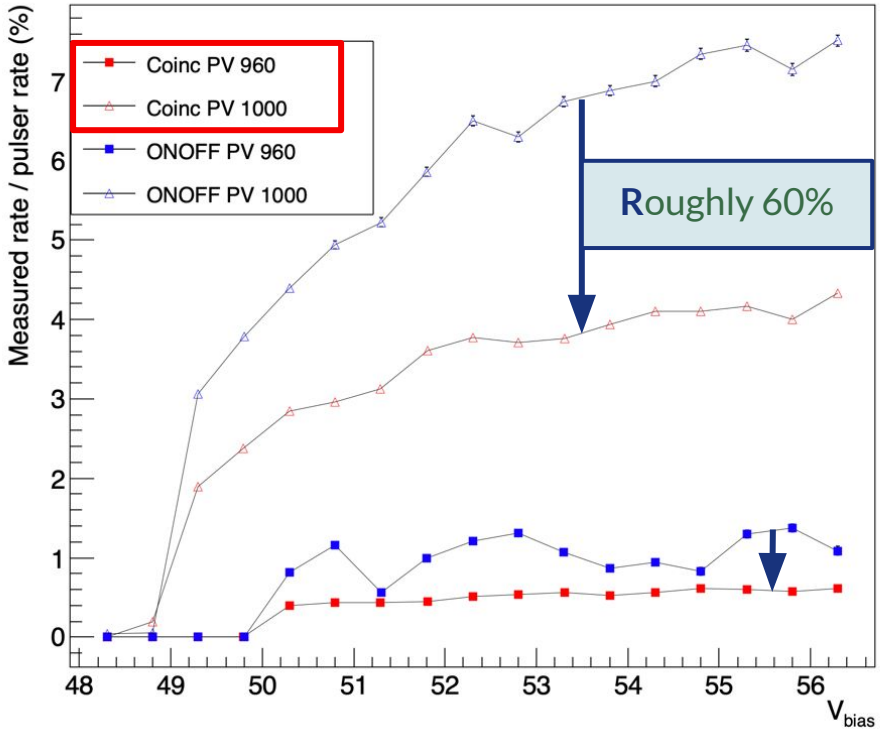
Characterising SiPMs

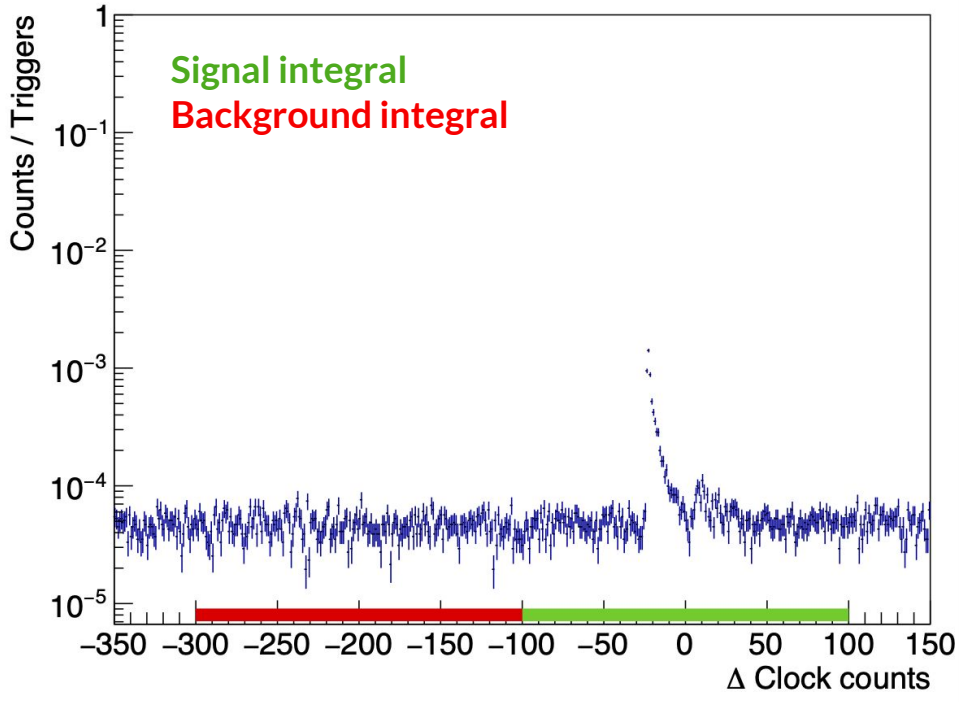




Characterising SiPMs

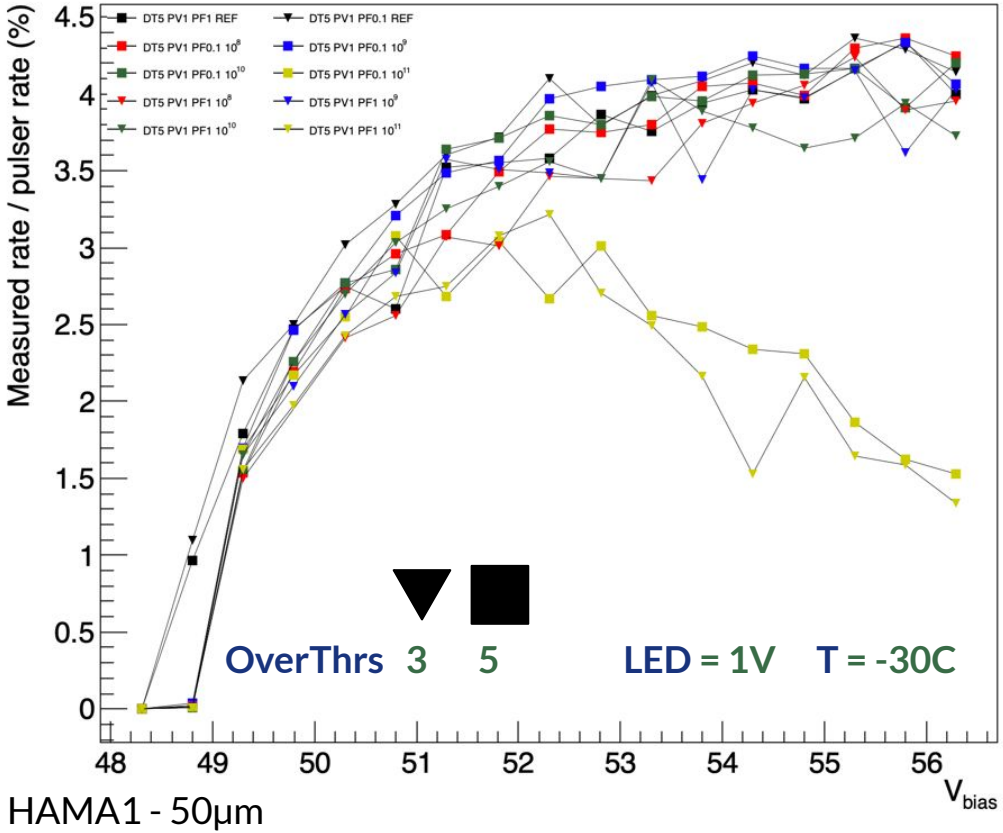
NEW!





Characterising SiPMs

Preliminary!



HAMA1 - 50µm

For 10^8 10^9 10^{10} irradiation the light response seem to be consistent with the **reference**

For 10^{11} irradiation the light response seem to start deviate from **reference**

Analysis done with the coincidence method

Summary & prospects

Summary

1. A consistent factor of 10 for recovery has been found for the 1-week 125°C annealing cycle
2. Radiation damage does not seem to affect light response noticeably up to 10^{10}
3. We have a new quick, automated system w/ parallel measurement
4. We see a difference for two different methods for evaluating light response, ON-OFF and coincidence

Prospects

1. Finish the measuring cycles on all sensors to characterise all matrices.
2. Evaluate effects on Breakdown voltage, DCR and light response of next irradiation and annealing cycles

Thank you for your attention!
Any questions?

BACK-UP