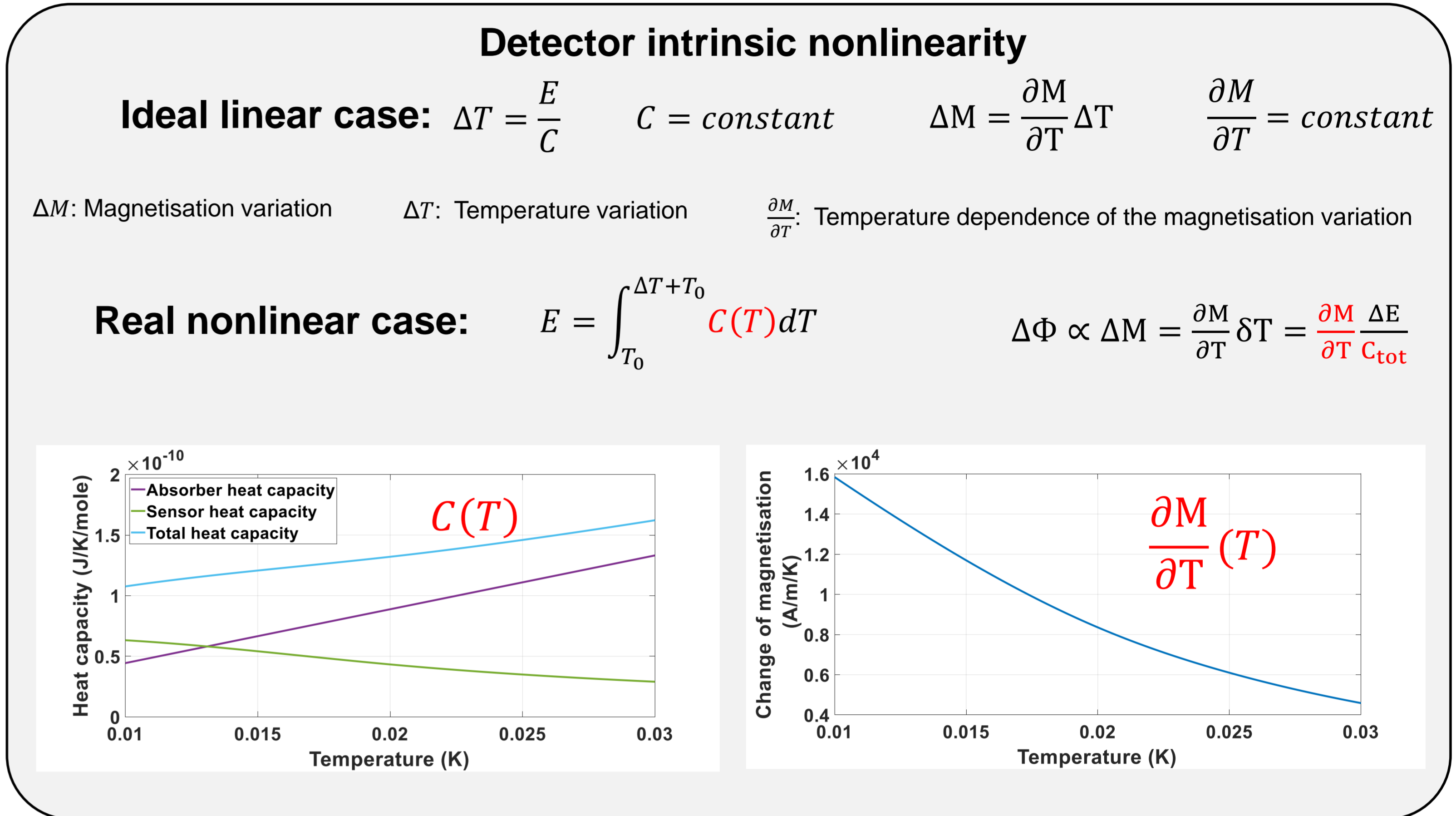
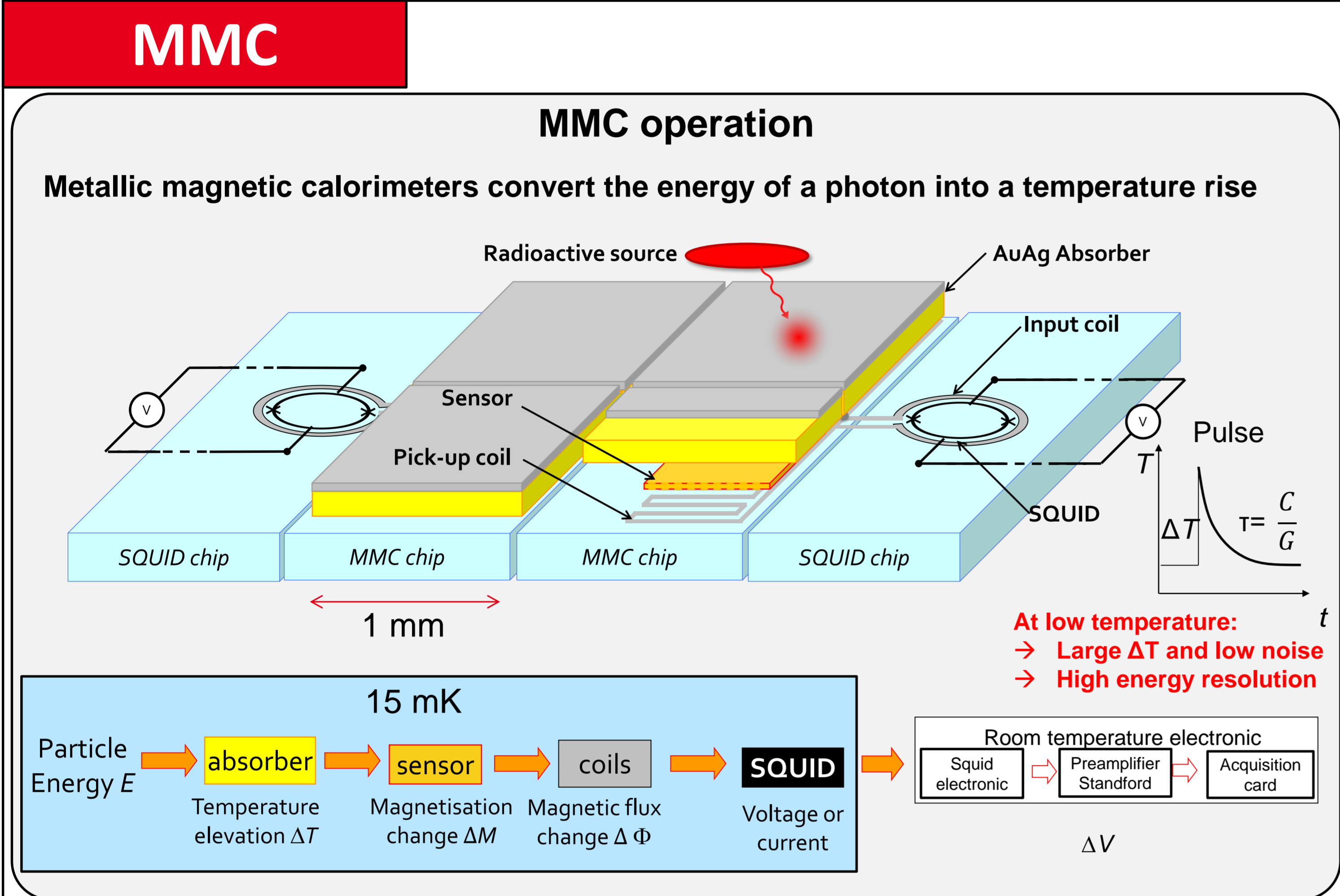


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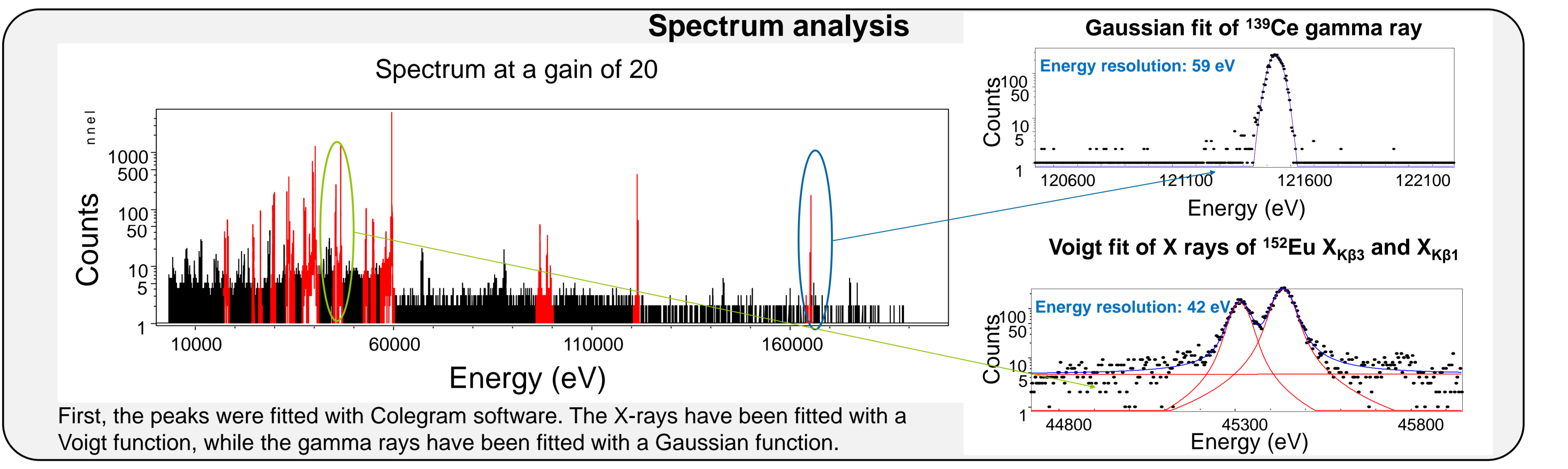
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Precise measurements of X-ray and  -ray energies are important for the study of atomic and nuclear structure. They contribute to the advancement of our fundamental knowledge in physics. Cryogenic detectors offer excellent energy resolution and are ideal for precise energy measurements, but they have intrinsic and extrinsic nonlinearities. It is crucial for cryogenic detector to correct their nonlinearity in order to accurately interpret the measured energies. The main nonlinearity is intrinsic to the detector. Other contributions to nonlinearity can arise from the electronics and the signal processing. Therefore, it is important to assess the impact of these contributions for the subsequent nonlinearity correction.



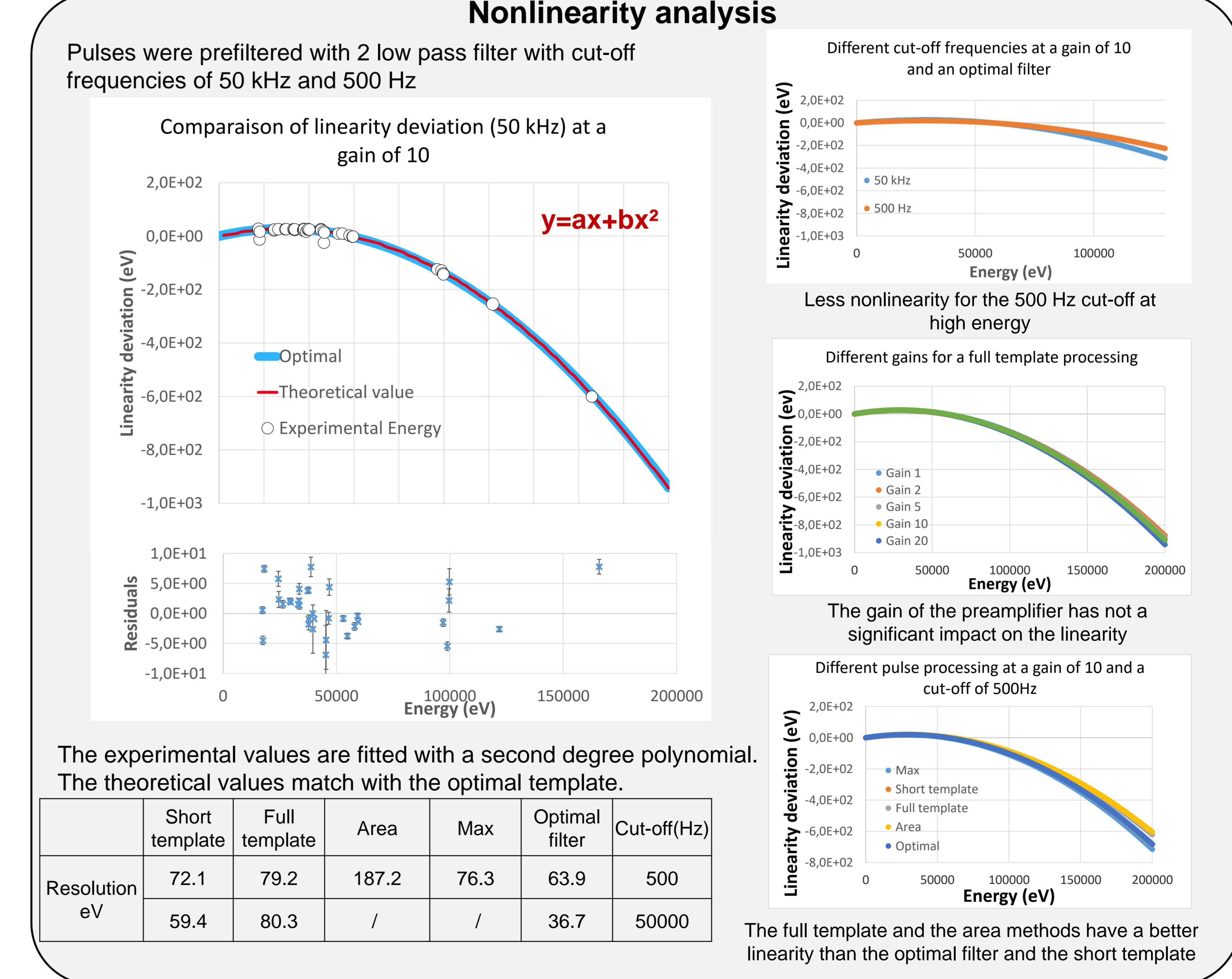
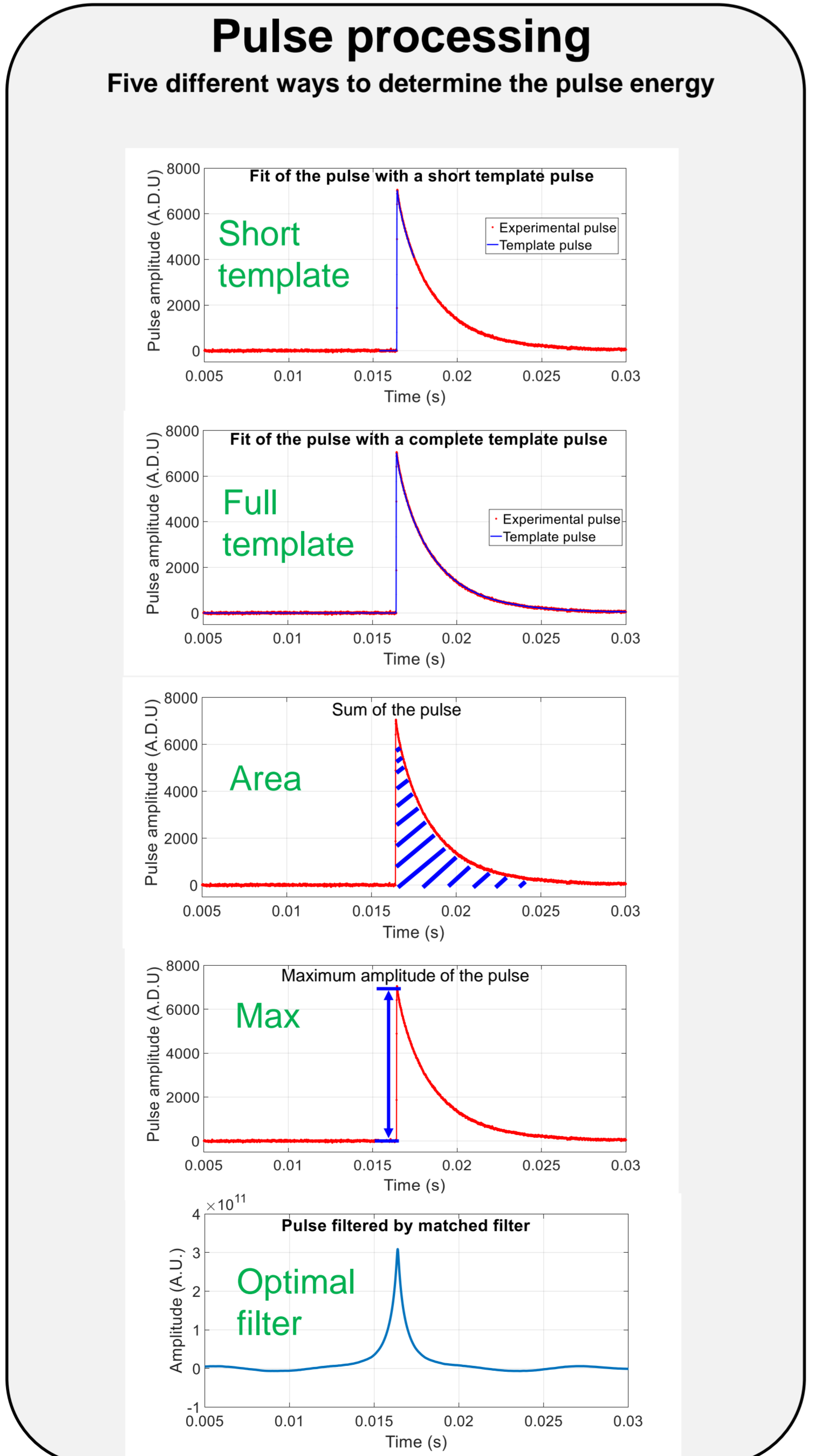
## Method and analysis

- We measured energies between 17 keV and 165 keV to determine the energy nonlinearity from:
- The detector
  - Different pulse processing
  - The electronics (different amplification gain)



### Reference energies

	Energie	Origine (X, �, �chappement)
241Am	26.3446(2)	Y
	59.5409 (1)	Y
	37.377983(105)	Ech
	37.55060(14)	Ech
210Pb	46.539(1)	Y
	24.3761(11)	Ech
	24.5487(11)	Ech
152Eu	45.2886(49)	X
	40.118481(60)	X
	39.52339(10)	X
	45.4130(49)	X
	121.7817(3)	Y
	18.128181(117)	Ech
	17.955564(67)	Ech
	52.97720(35)	Ech
	54.79097(38)	Ech
	99.79140(32)	Ech
129I	99.61878(31)	Ech
	17.36047(11)	Ech
	17.53309(15)	Ech
	29.458250(50)	X
	29.77878(10)	X
	33.62424(12)	X
139Ce	33.56320(12)	X
	39.578(4)	Y
	33.03438(26)	X
	33.44212(27)	X
	37.80145(51)	X
	37.72060(68)	X
	165.8575(11)	Y
	38.7303(13)	X
	97.05300(22)	Ech
	98.866770(25)	Ech
Echappement X Au d'un absorbeur	46.641583(183)	Ech
	46.81420(21)	Ech
X plaque en Tungsten	57.98177(14)	X
	59.318847(50)	X



## Conclusion

The detector nonlinearity remains predominant. We observe a small impact on the linearity due to signal processing. For now, the gain does not have any impact on the nonlinearity which means that we do not observe nonlinearity from the electronics. However if in the future we are able to correct the intrinsic nonlinearity of the detector, it is possible that the electronics becomes a source of nonlinearity. The theoretical calculation of the nonlinearity is consistent with the experimental data using the optimal method. This shows that the calculations are reliable enough to be used for correcting the nonlinearity in subsequent measurements. However, it is still important to confirm the calculations' reliability using additional data.