

EL yield of He-CF₄-CH₄ mixtures

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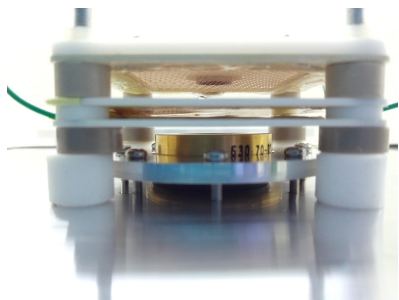
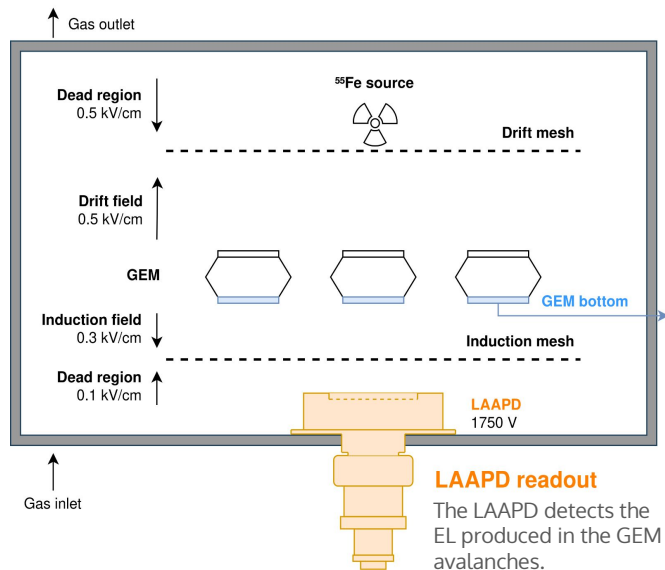
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Topics:

- He-40%CF₄+CH₄ mixtures
- He-60%CF₄+CH₄ mixtures
- Comparing CH₄ and isobutane admixtures

Experimental Setup

Visible EL
300 nm - 1000 nm

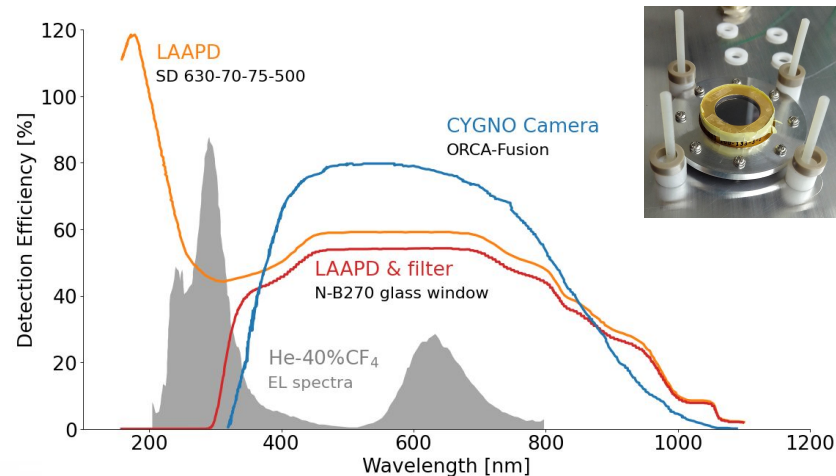


$$\frac{\eta_\gamma}{\text{keV}} = \frac{A_{EL}}{A_X} \times \frac{10^3}{w(\text{Si}) \times QE \times \Omega \times T}$$

EL and ^{55}Fe x-rays peak ratio

w -value (Si) = 3.2 eV, quantum efficiency, solid angle, mesh transparency

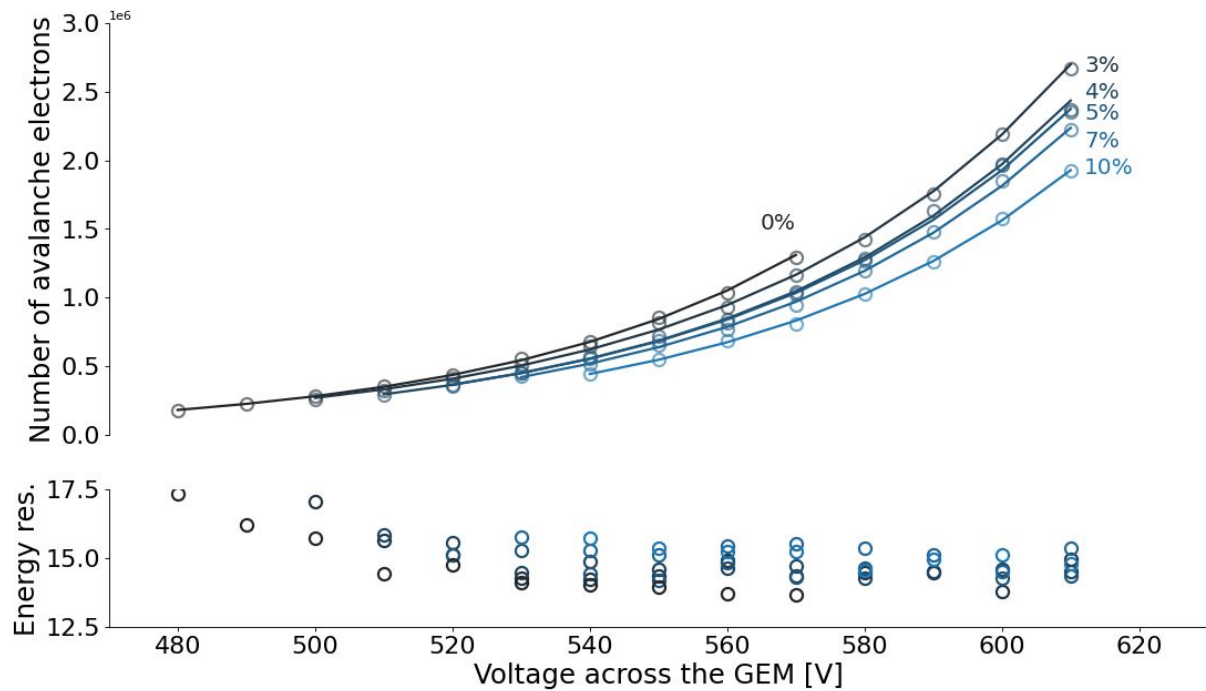
We have placed a **borosilicate glass** window (filter) to **cut off the VUV-UV photons** and evaluate the EL emission in the spectral range from **300 - 1000 nm**.



The following are preliminary results. Not calibrated.

He-40%CF₄+CH₄ mixtures

Charge readout



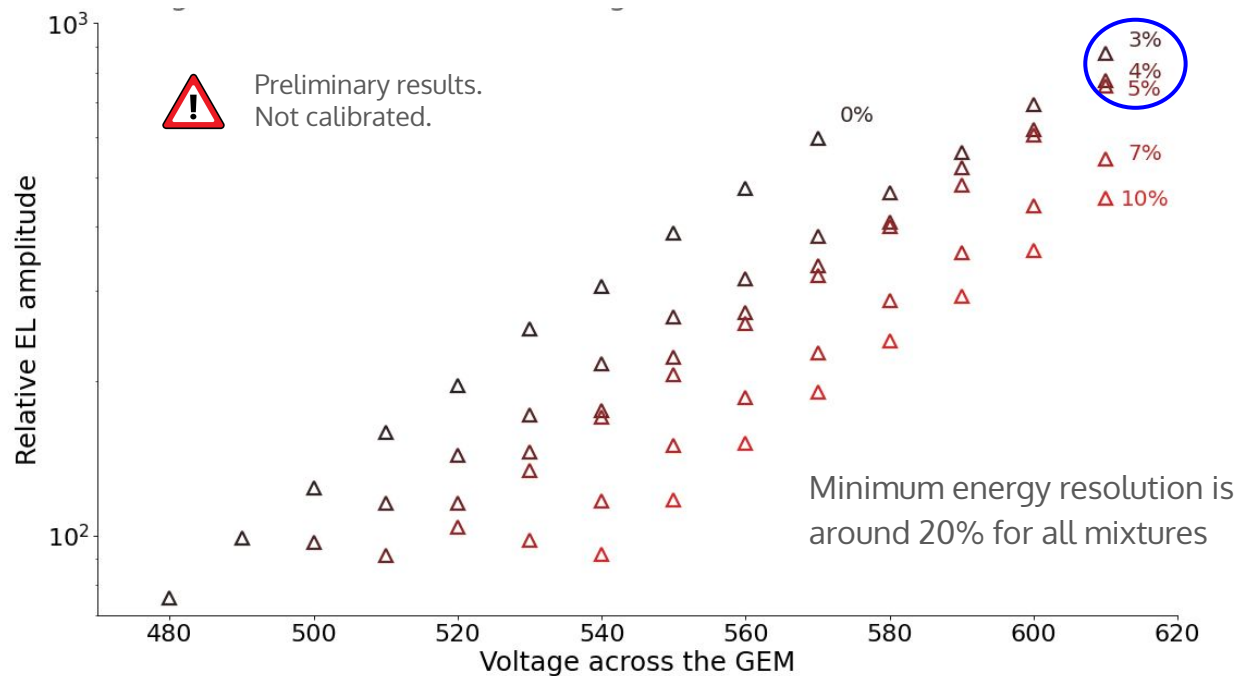
Adding CH₄ increases the sparking threshold relative to He-40%CF₄: we can apply +40V across the GEM before the onset of self-sustained discharges.

Adding CH₄ produces more secondary electrons relative to He-40%CF₄ although for the same V_{GEM} the number of avalanche electrons decreases with increasing CH₄ content.

CH₄ does not degrade the energy resolution of the charge signals: the minimum energy resolution is around 14% for all mixtures.

He-40%CF₄+CH₄ mixtures

EL readout

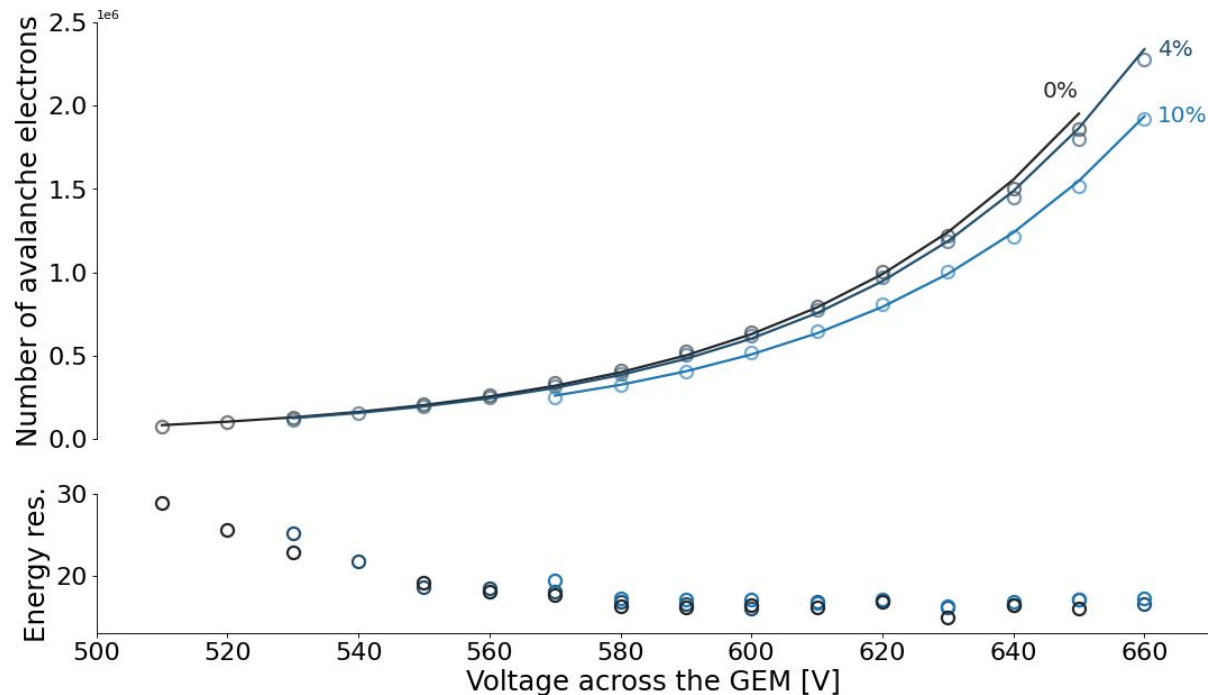


Adding CH₄ increases the maximum EL yield relative to He-40%CF₄:
for 3%, 4% and 5% CH₄, the maximum EL yield is higher than the one measured for the base mixture.

	Max. EL amplitude
0% CH4	596.3
3% CH4	860.6 +44%
4% CH4	766.0 +28%
5% CH4	760.4 +26%
7% CH4	535.3 -10%
10% CH4	454.2 -24%

He-60%CF₄+CH₄ mixtures

Charge readout



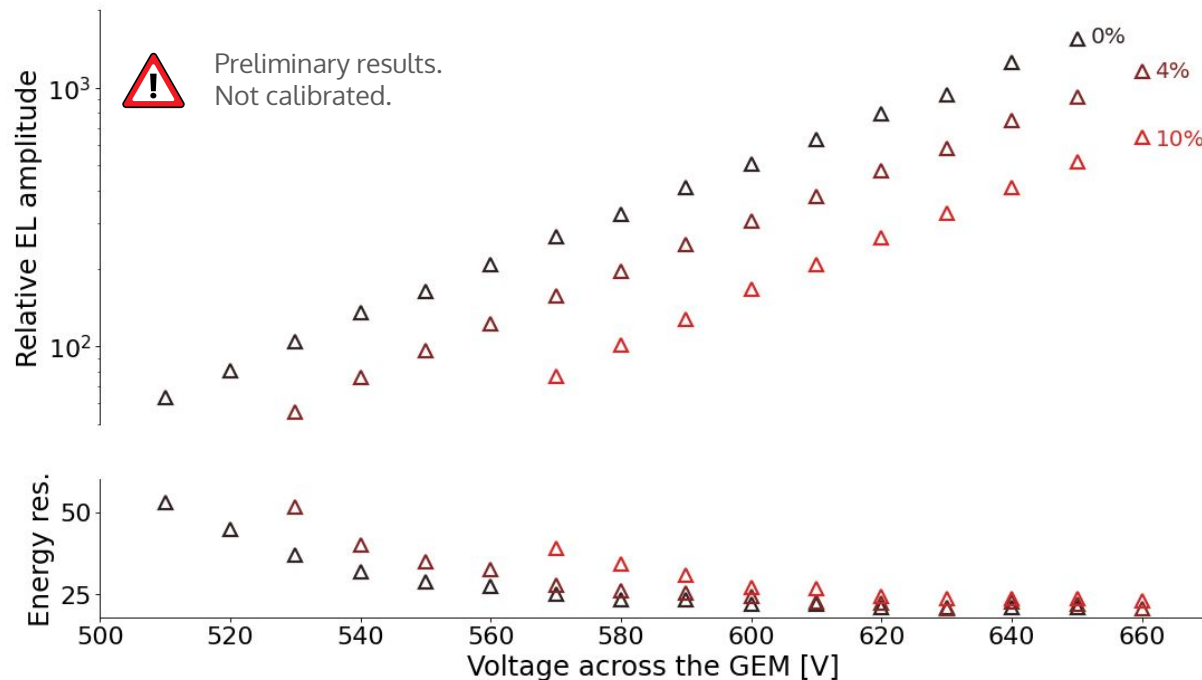
Adding CH₄ increases the sparking threshold relative to He-60%CF₄: we can apply +10V across the GEM before the onset of self-sustained discharges.

Adding CH₄ produces more secondary electrons relative to He-60%CF₄ although for the same V_{GEM} the number of avalanche electrons decreases with increasing CH₄ content.

CH₄ degrades slightly the energy resolution of the charge signals: for He-60%CH₄, the minimum energy resolution is 15%, while for 4% and 10% CH₄, this value increases to 16%.

He-60%CF₄+CH₄ mixtures

EL readout



Adding CH₄ to He-60%CF₄ increases the maximum EL yield relative to He-40%CF₄:

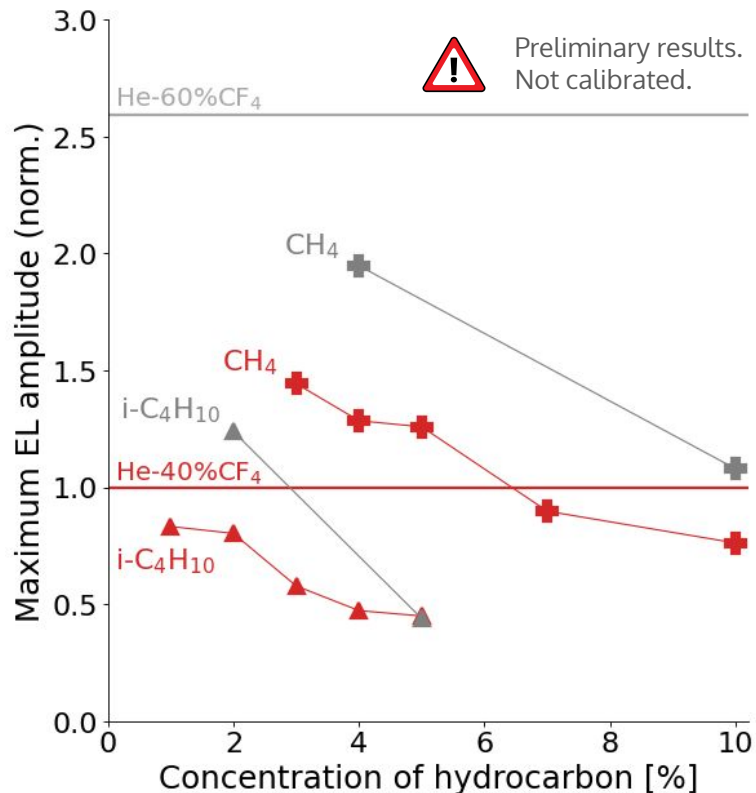
for all He-60%CF₄ based mixtures, the maximum EL yield is higher than the one measured for He-40%CF₄.

	Max. EL amplitude
He-40%CF ₄	596.3
He-60%CF ₄	1544.4 +159%
+ 4% CH ₄	1161.2 +95%
+ 10% CH ₄	643.4 +8%

Minimum energy resolution is around 20% for 0% and 4% CH₄.
For 10%CH₄ this value increases to 23%.

Conclusions

Comparing CH₄ to isobutane admixtures



Adding up to 5% CH₄ to He-40%CF₄ increases the maximum attainable EL yield

in fact, adding CH₄ to He-40%CF₄ is even better than compensating the isobutane quenching with 60%CF₄.

In terms of EL yield, CH₄ seems to be a better alternative than isobutane.

Future Plans:

- **Calibrate the visible EL results** for calculating absolute EL yield values;
- **Measure the total EL yield (UV+visible)** of CH₄ admixtures to double-check our results.

Grazie per l'attenzione

Any questions or suggestions?



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