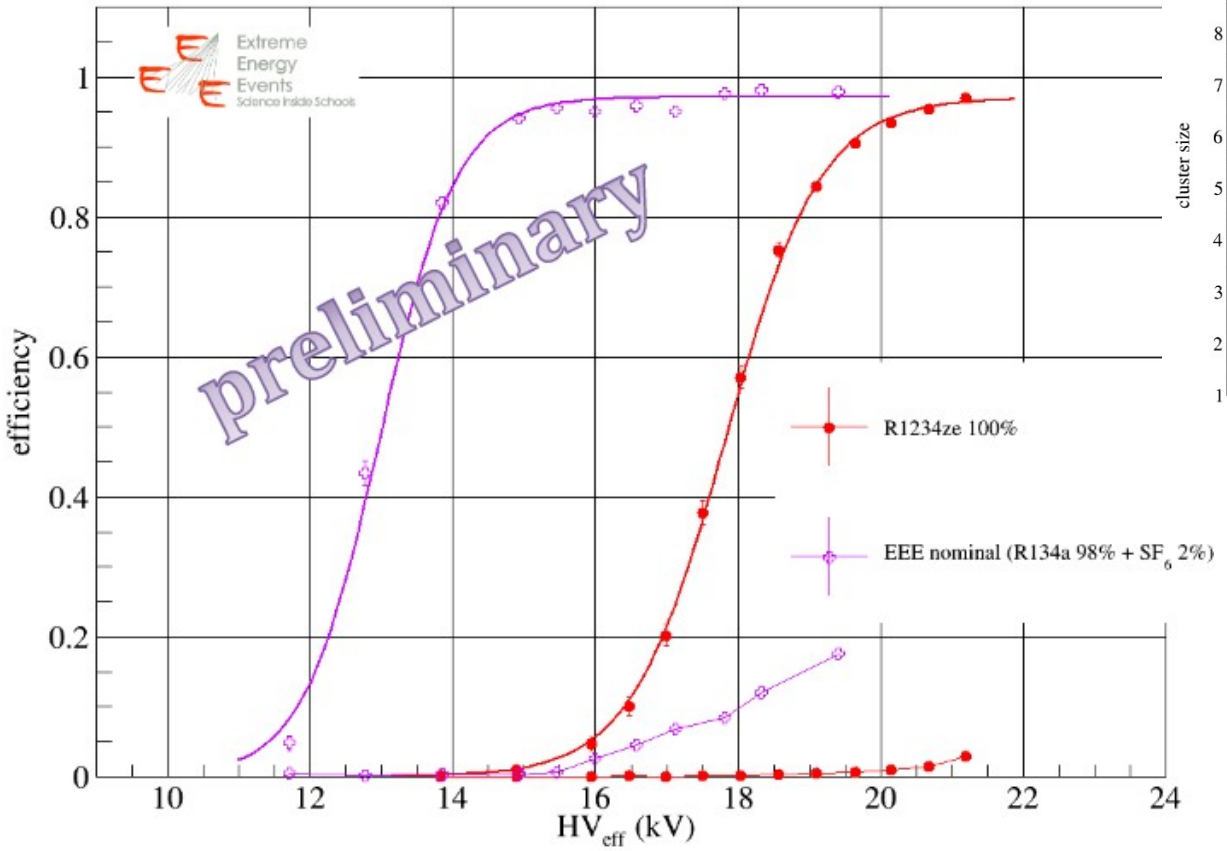
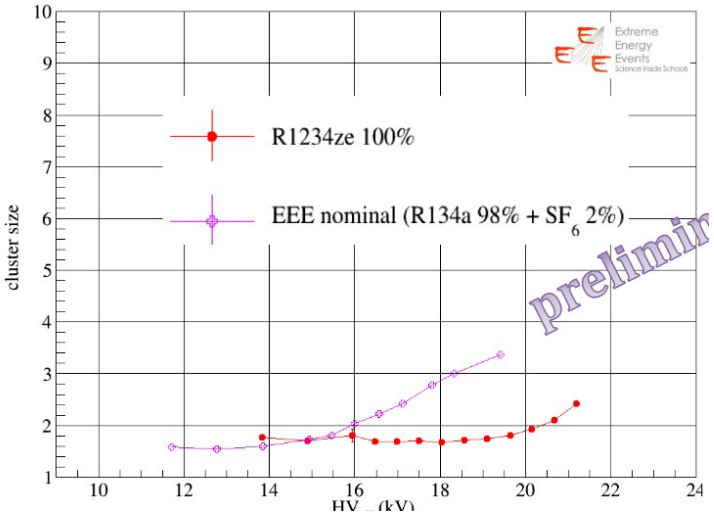
EEE Upgrade

Status and Test Plans

Results at the CERN-01 with cosmics

Pure R1234ze





Most striking result:

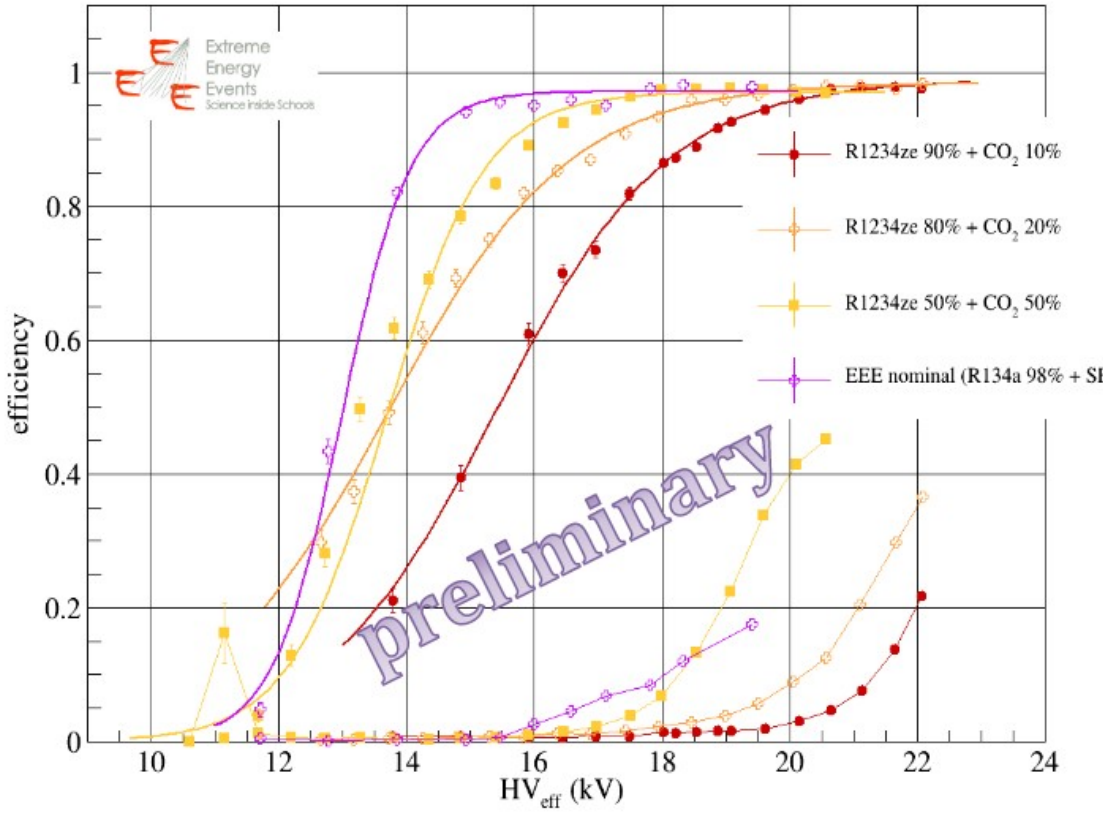
- pure R1234ze is better than nominal!

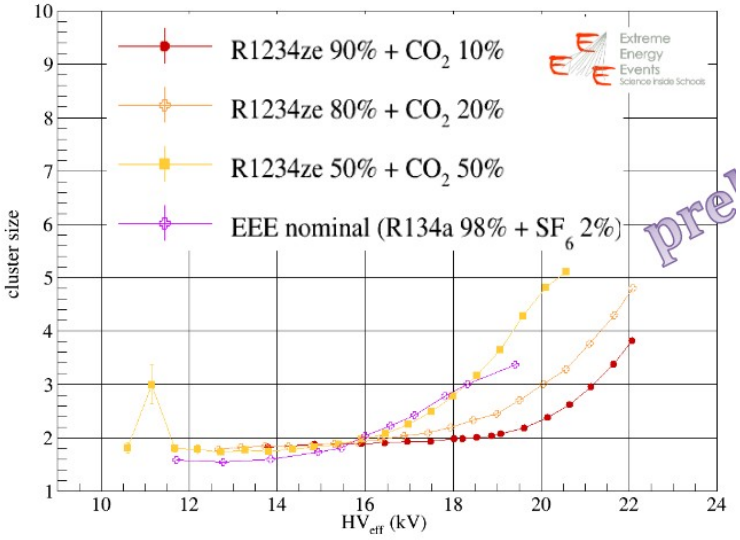
- no saturation

- strong HV shifts

Results at the CERN-01 with cosmics

R1234ze + CO2



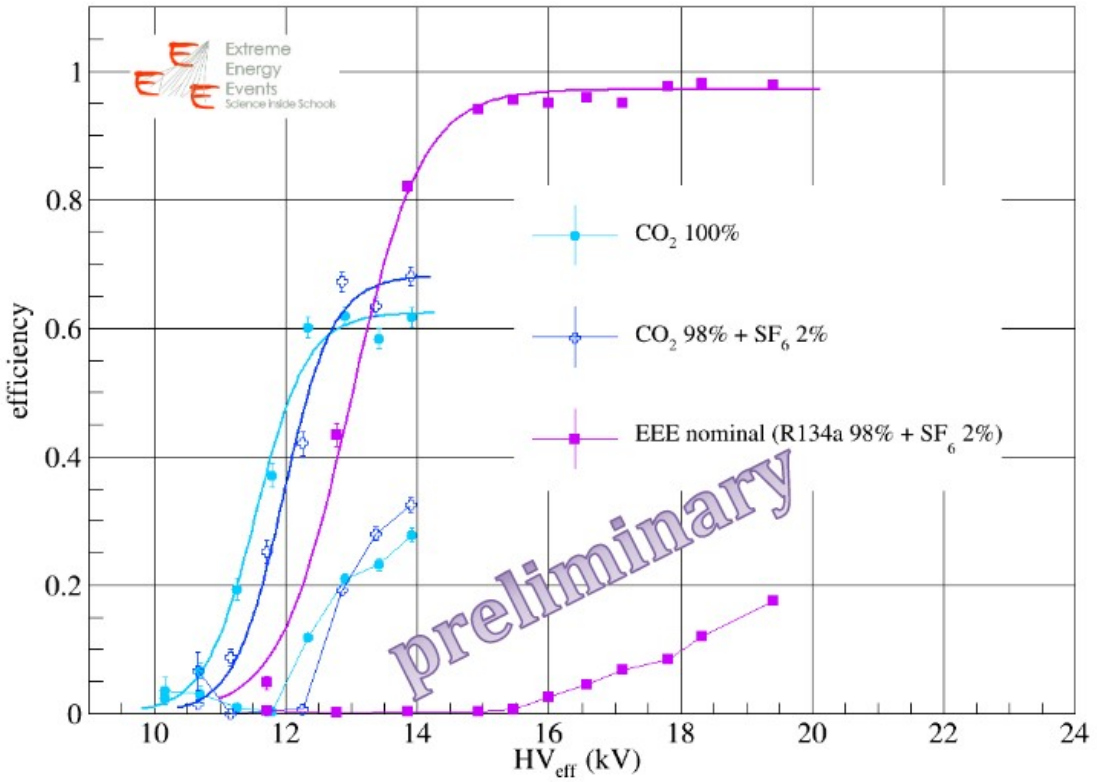


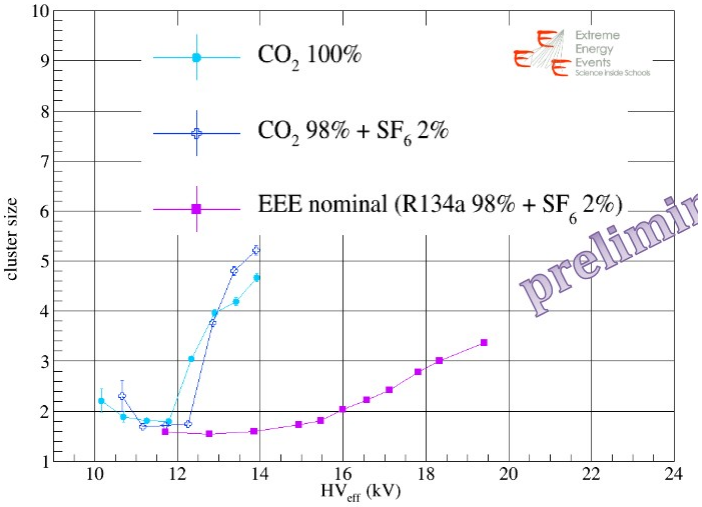
- 50% CO2 similar to nominal

- within our DCDC dynamics

Results at the CERN-01 with cosmics

Pure R1234ze





Excluded:

Low efficiency

Highly noisy

Summary and test plans

Pure R1234ze → - Very good
- high HV required
- costs (factor 7) → Gain a fact 2 by reducing to 1 l/h

R1234ze + CO2 (50/50) → - good (similar to EEE)
HV compatible → Gain a fact 4 by reducing to 1 l/h and using 50% CO2

R1234a + CO2 (5,10,20,50%) → Gain a fact 4 by reducing to 1 l/h and using 50% CO2

Ar + CO2 (3,5,10,20%)
Ar + SF6 (1,2%) → Ar ~ 120 euro/ (200 bar – 20 l bottle)

N2 + CO2 (3,5,10,20%)
N2 + SF6 (1,2%)

Maybe also:

Ar(or N2)
+
CO2/isobutane premix?

Results on

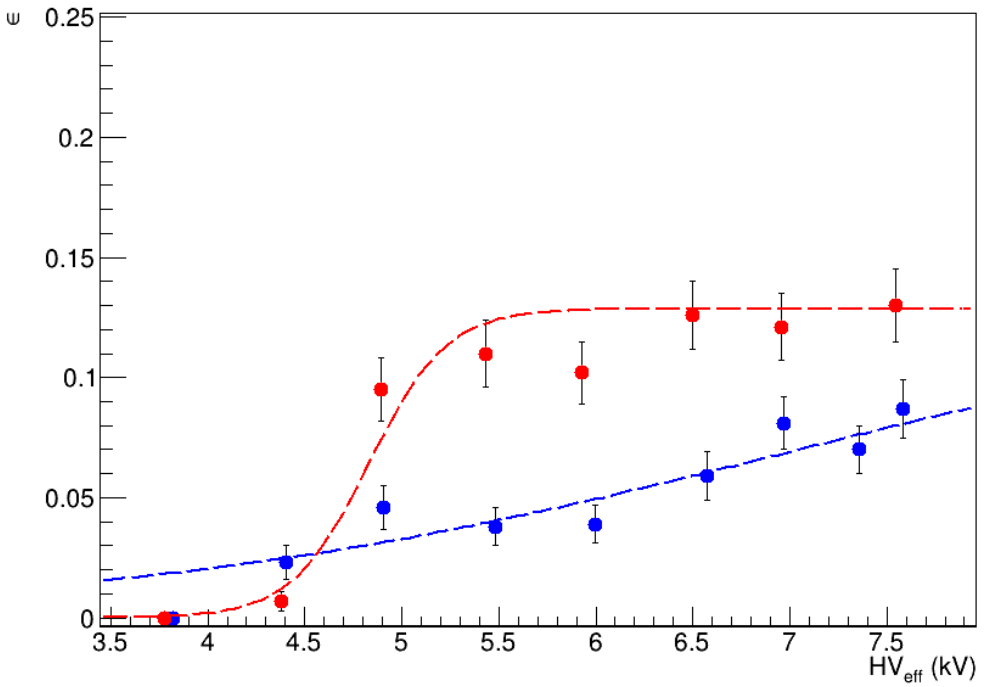
Ar/CO_2

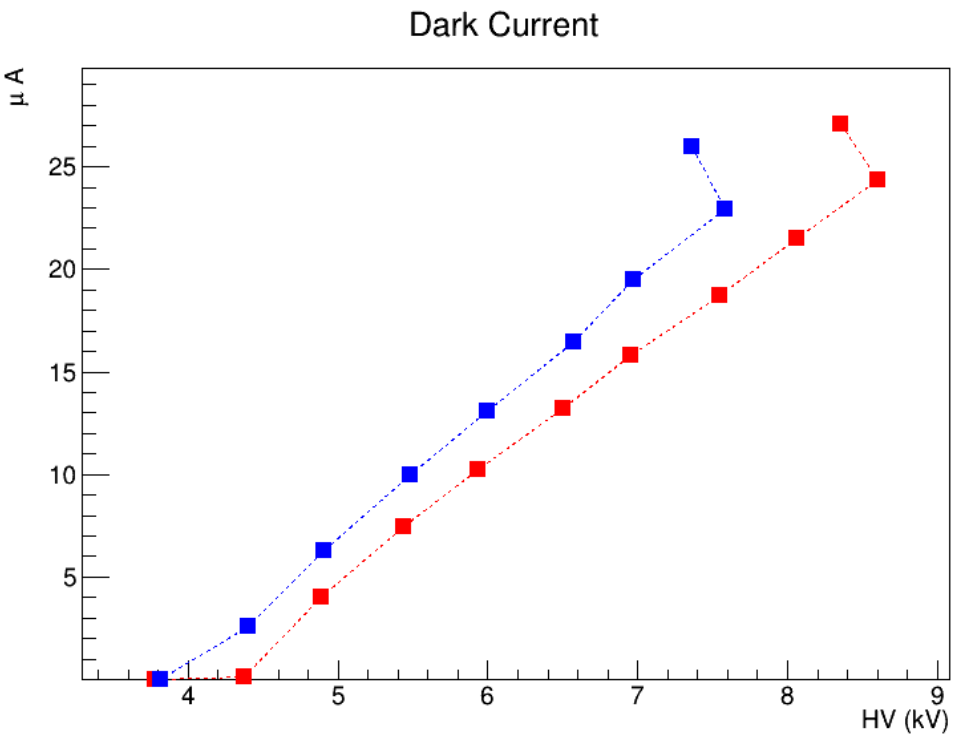
Ar/SF_6

mixtures

Ar/SF_6

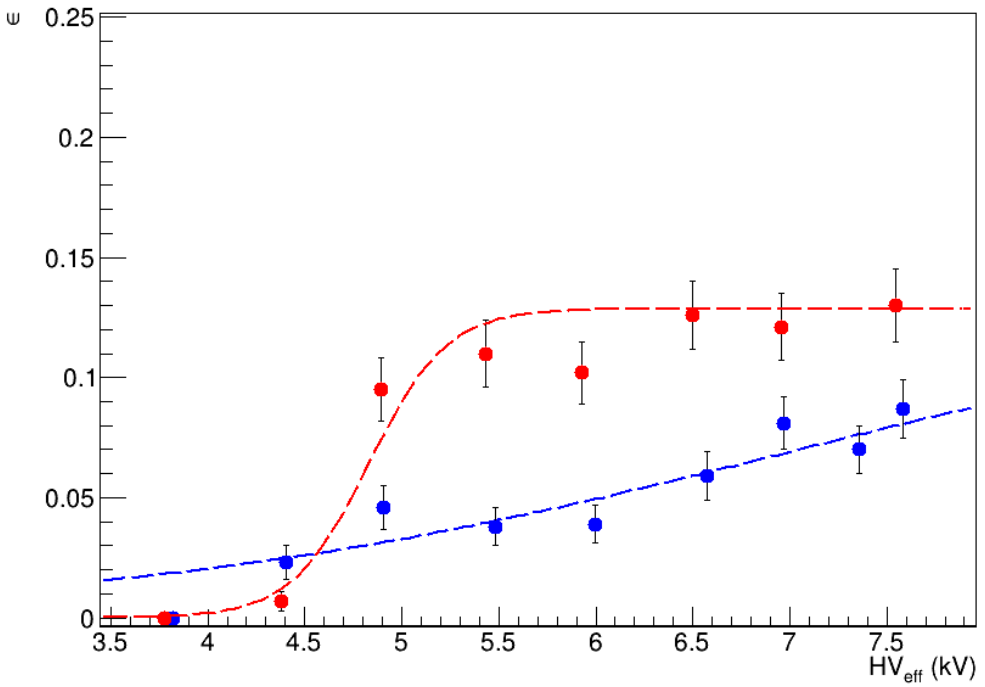
98/2
99/1

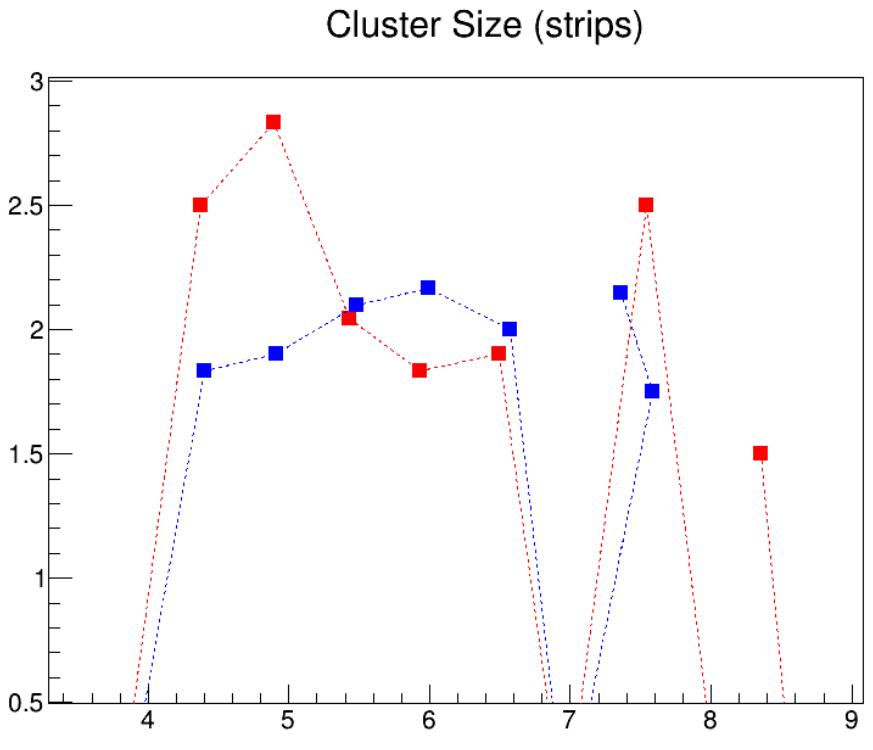




Ar/SF_6

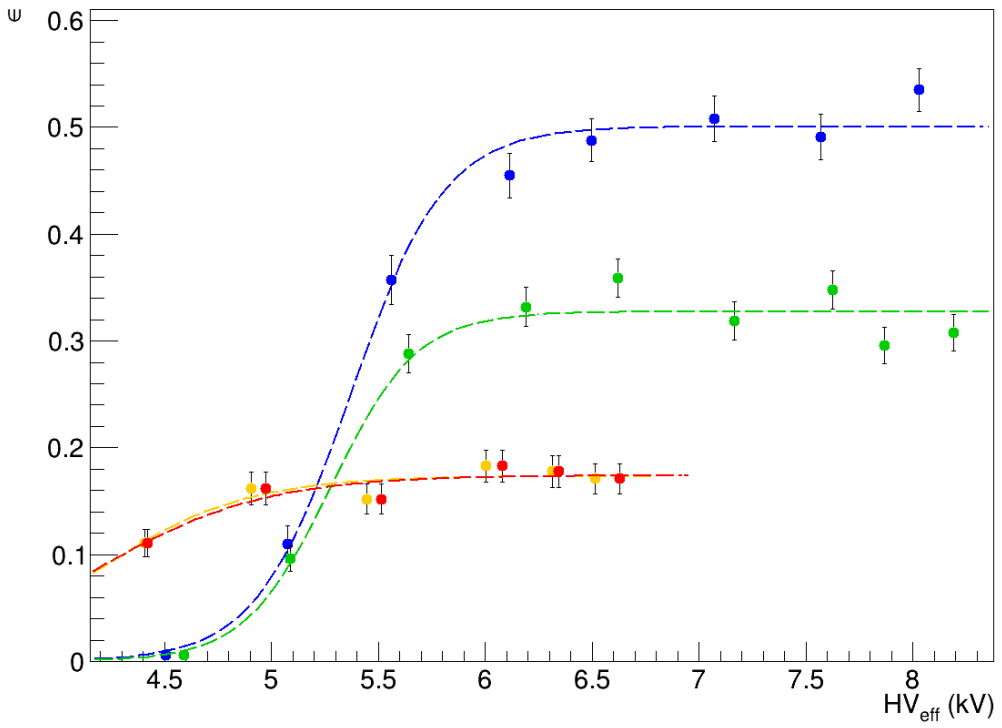
98/2
99/1

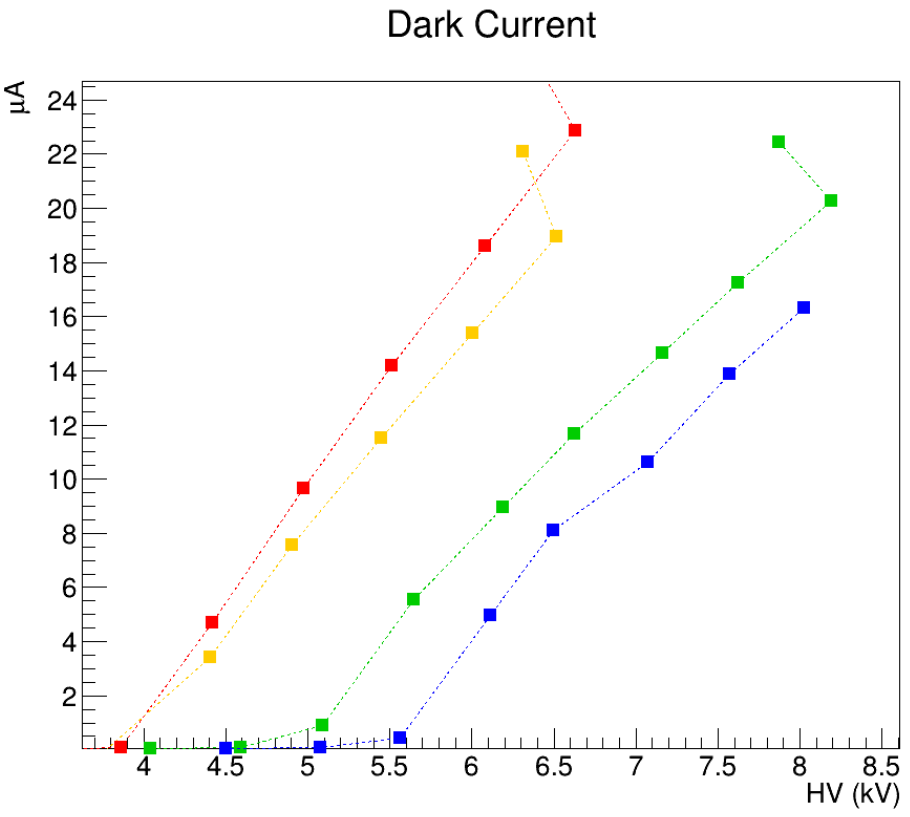




Ar/CO_2

97/3
95/5
90/10
80/20





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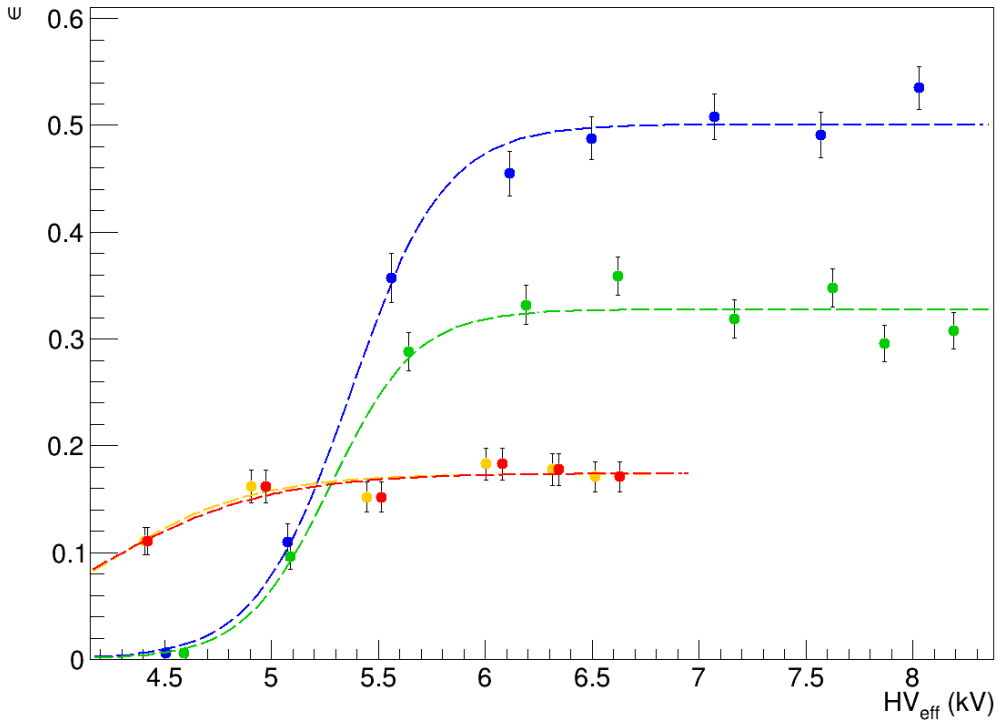
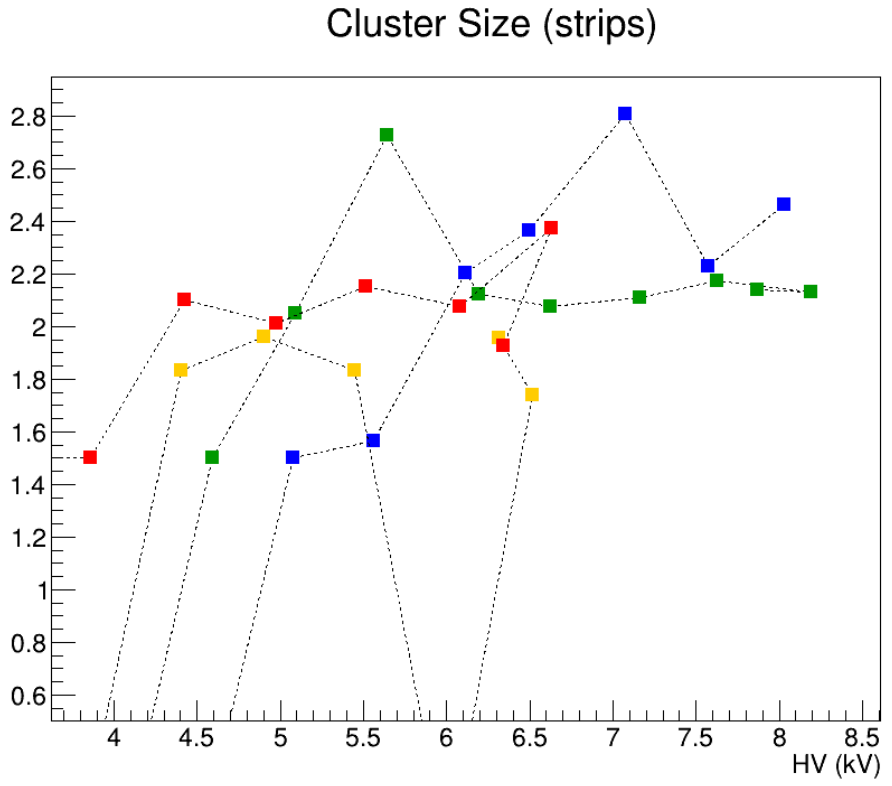




Ar/SF6 not feasible

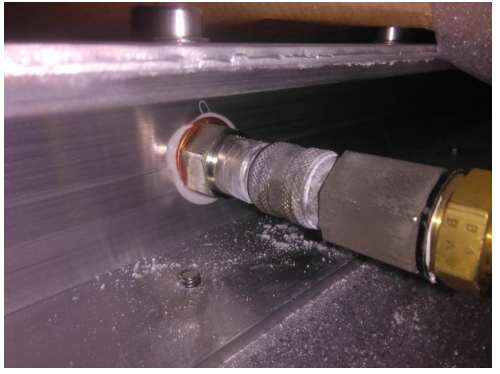
- ArCO2
  - Currents 1.5 times the EEE std mix
  - Cluster Size 1.5 times the EEE std mix (to be checked)
  - Improving with higher CO2 fraction
  - According to previous CO2/HFO results we can try to increase the CO2 fraction
  - Electronics:
    - Test with highest thrs available (dead time?)

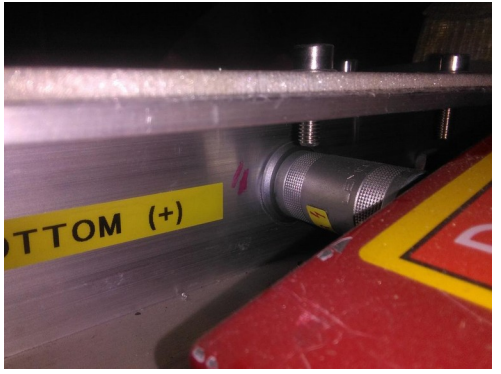
- New tests on N2CO2 or N2SF6 next weeks
- Dry Air?
- Ternary mixtures (with quencher/secondary photons abs?)

- We should measure the RH

Gas ricirculation system test

- CERN-02 leak search were done with a ppm sniffer
  - Found leakages on
    - HV connectors
    - Gas connectors
    - Screws

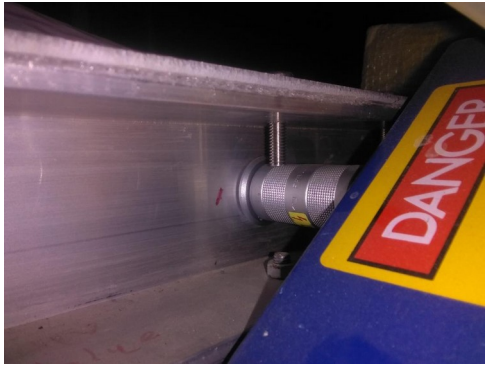


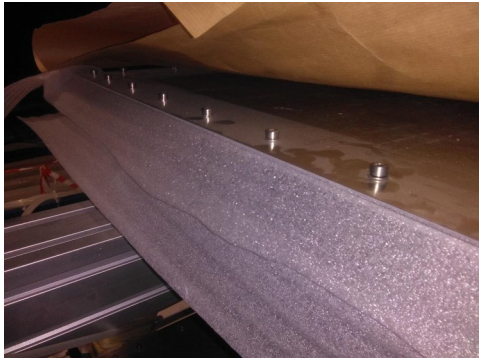


A new chamber is Not leaking

Huge F-salts found

RH?





Material for leak test

Delivered this week

Leak test procedure attached in Indico

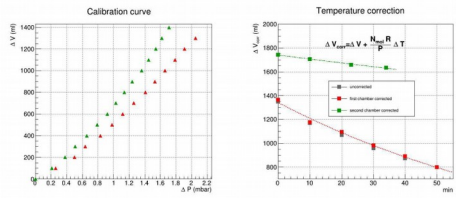
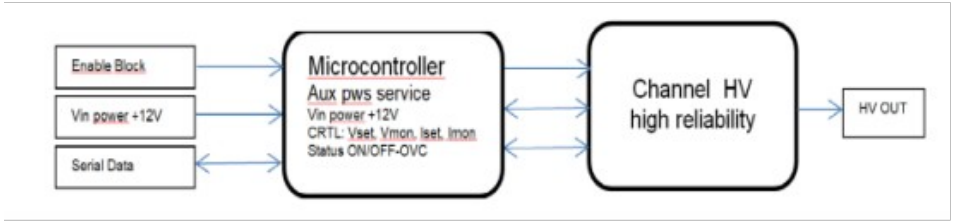


Fig.4: left: calibration curves for two different EEE MRPCs. Right: Air volume drop due to chambers leak. Temperature correction is applied as given in the plot.

Gas Tightnes Calibration Curve			Gas Tightnes Test					
P(mbar)	V(ml)	T©	P(mbar)	V(ml)	Vcorr	T©	RH(%)	Time (min)
0	0	28.7	2.17	399.67	399.67	28.7	25	0
1.28	100		1.18	68.41	68.41	28.7	25	10
1.69	200		1.16	64.30	55.99	28.8	25	10
1.94	300		1.14	60.30	51.99	28.8	25	10
2.17	400		1.13	58.34	41.71	28.9	26	10
2.4	500		1.12	56.40	31.46	29	26	10
2.54	600		1.11	54.49	29.54	29	26	10

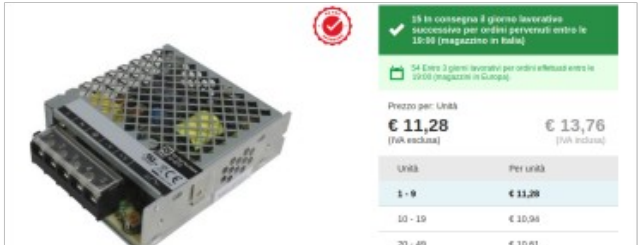
Fig.5: a typical data set. First two columns: calibration curve. P(mbar): pressure measured at the different time with the chamber isolated. V(ml) remaining air volume given by the second order polynomials for the actually measured pressure value. Vcorr: temperature corrected volume (according to formula in Fig. 4 right plot). T: temperature during the measurement. RH(%): relative humidity (not essential). Time: time span between two subsequent

HV standalone modules



data connector RS 485 (usb/coaxial adapter available)

power supply 12 V, available, low cost, maybe we can ask a distributor



Voltage Supply (Vin)	+12V ±10%
Voltage set/mon resolution	Set:200mV / mon:100mV
Max Output Voltage	12KV
Max Output current	20uA
Current set/mon resolution	Set:1nA / mon :500pA
Rump UP/Down	1:500V/sec
Vmon vs Vout Accuracy	Typical ±0,2% ±0,5% Max ±0,3% ±0,5%
Imon vs Iout Accuracy	Typical ±0,5% ±20nA Max ±0,5% ±20nA
Ripple 10H:1000Hz >1000Hz	Typical ±30mV ±50mV Typical ±25mV ±40mV
Output Power	240mW
Power requirement	<3Watt
Serial data	Rs485
HV connectors	Lemo HV connetor:FFB.3S.451.CLAC62

12 kV (we can use them with HFO 1234ze)
- single gas!!!
remotely controlled - USB
we can store HV in DAQ easily for analysis
very low ripple (30 mV)
no need of LV (integrated)
Power also the FEA cards
Needs single power line 220V 50 Hz

Let's decide if we want
- adjustable FEA LV (2-3.5 V)
- fixed 3 V (no voltage drop)

First prototypes in October
To be tested at CERN

	1 pz	10 pz 6%	20 pz 9%	50 pz 18%
HV+ 12 kV 20 uA	600	564	546	492
HV- 12 kV 20 uA	600	564	546	492