

New eco-friendly gas
mixture:

Status and Test Plans

Results at the T10 test beam

T10 East Area

7 GeV, 60 mrad

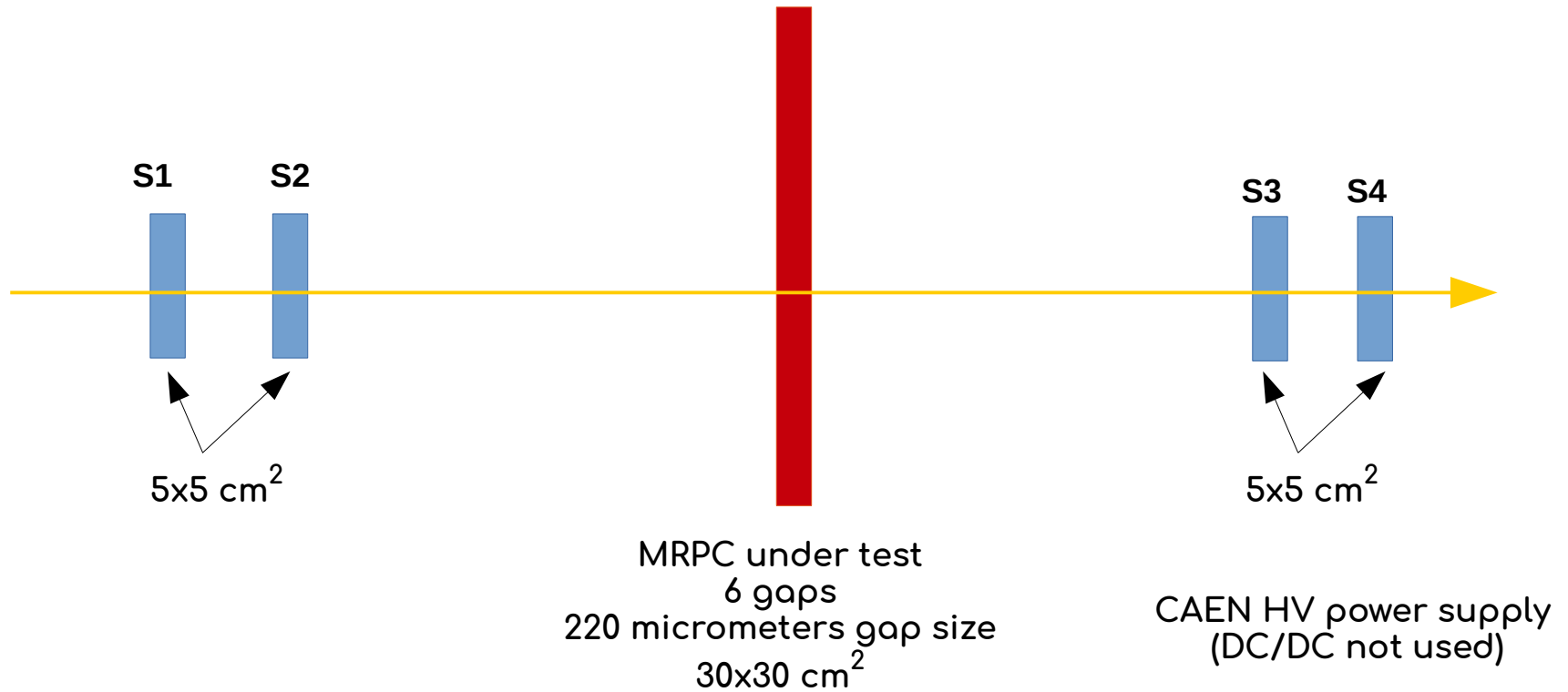
Spill: 0.3 s, max intensity 10^6 /s

Pions (protons and muons also available)

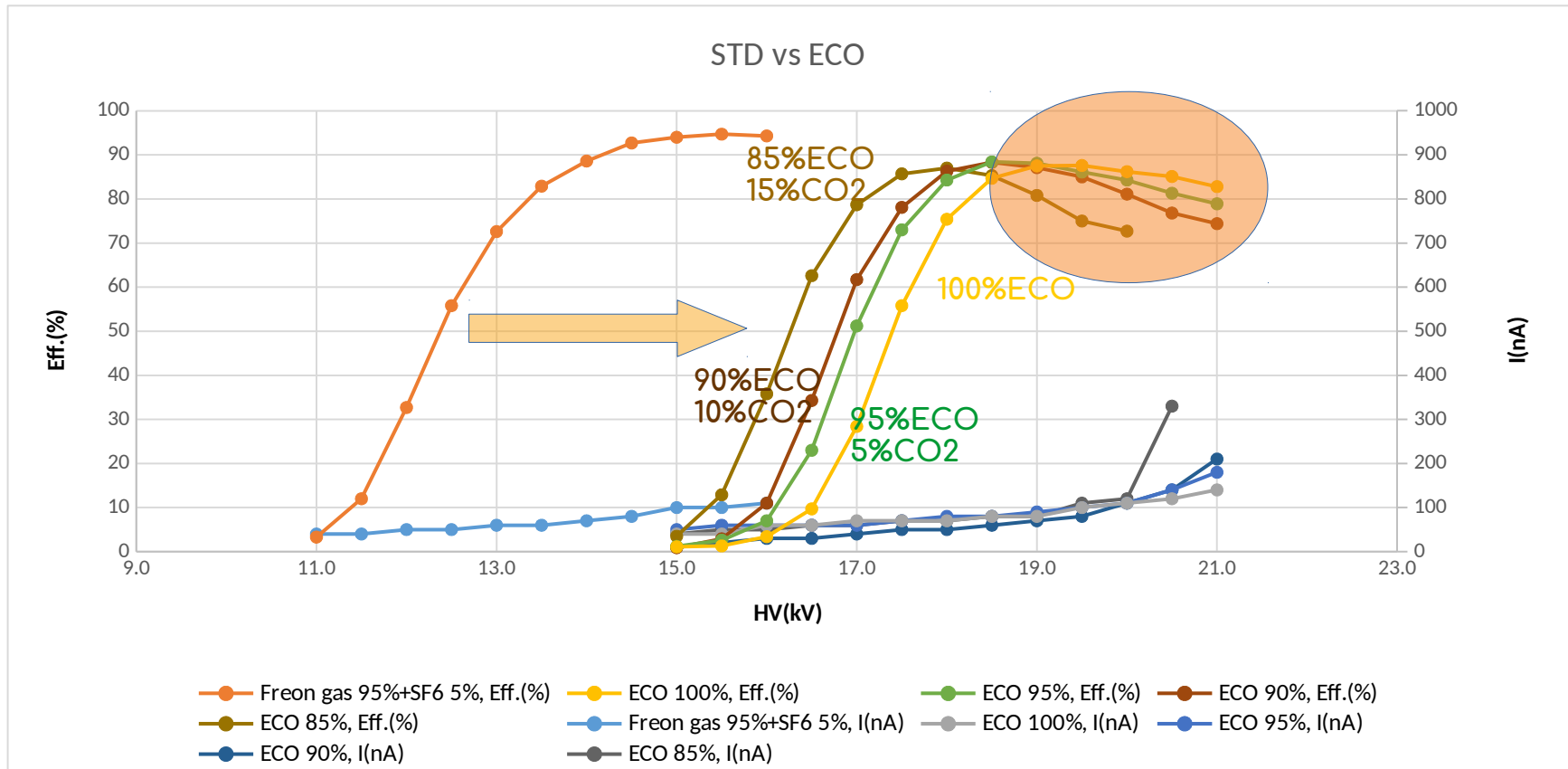
Nominal 10^3 /s- 10^4 /s

400 events per spill acquired (sw limit)

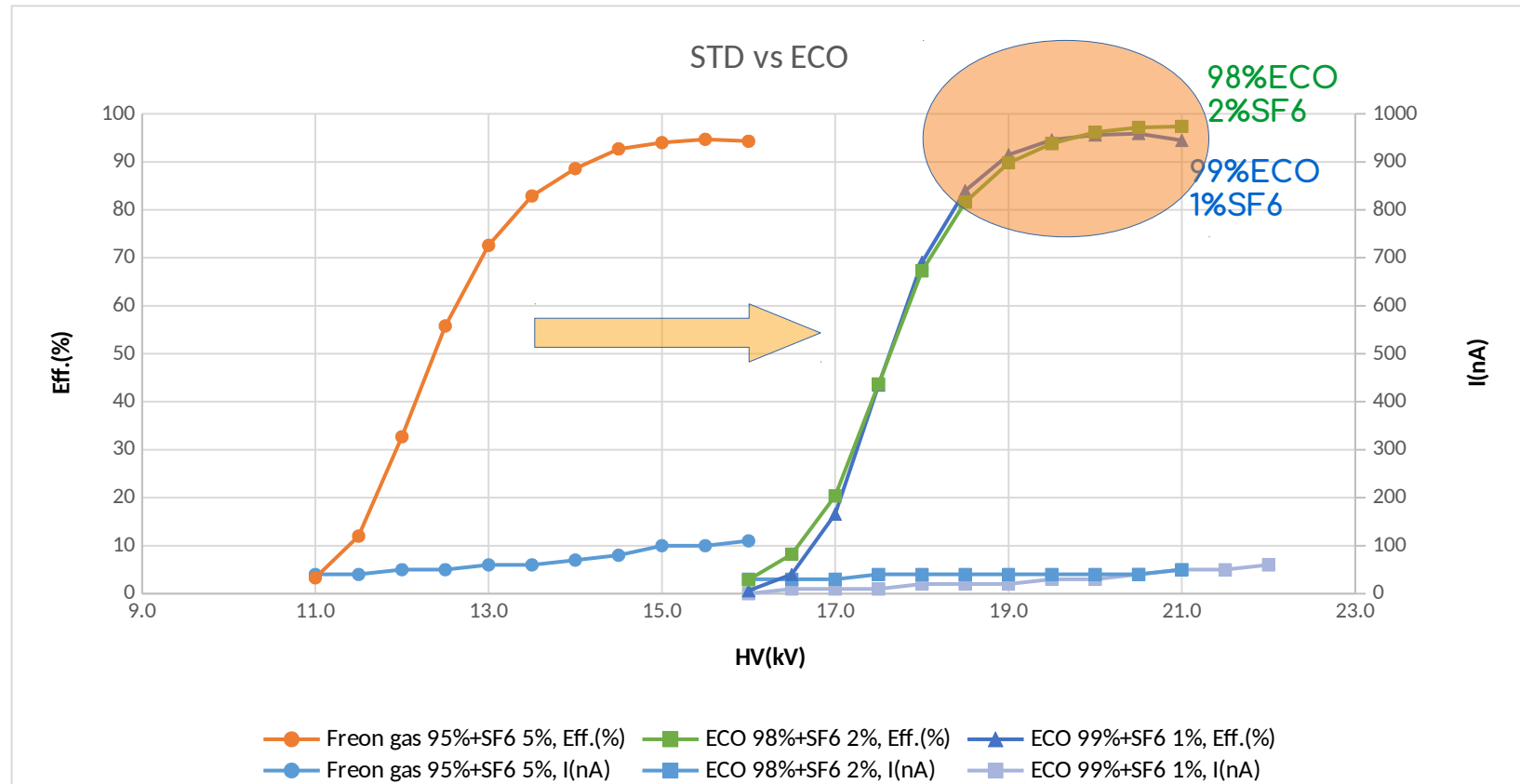
Experimental Set-up



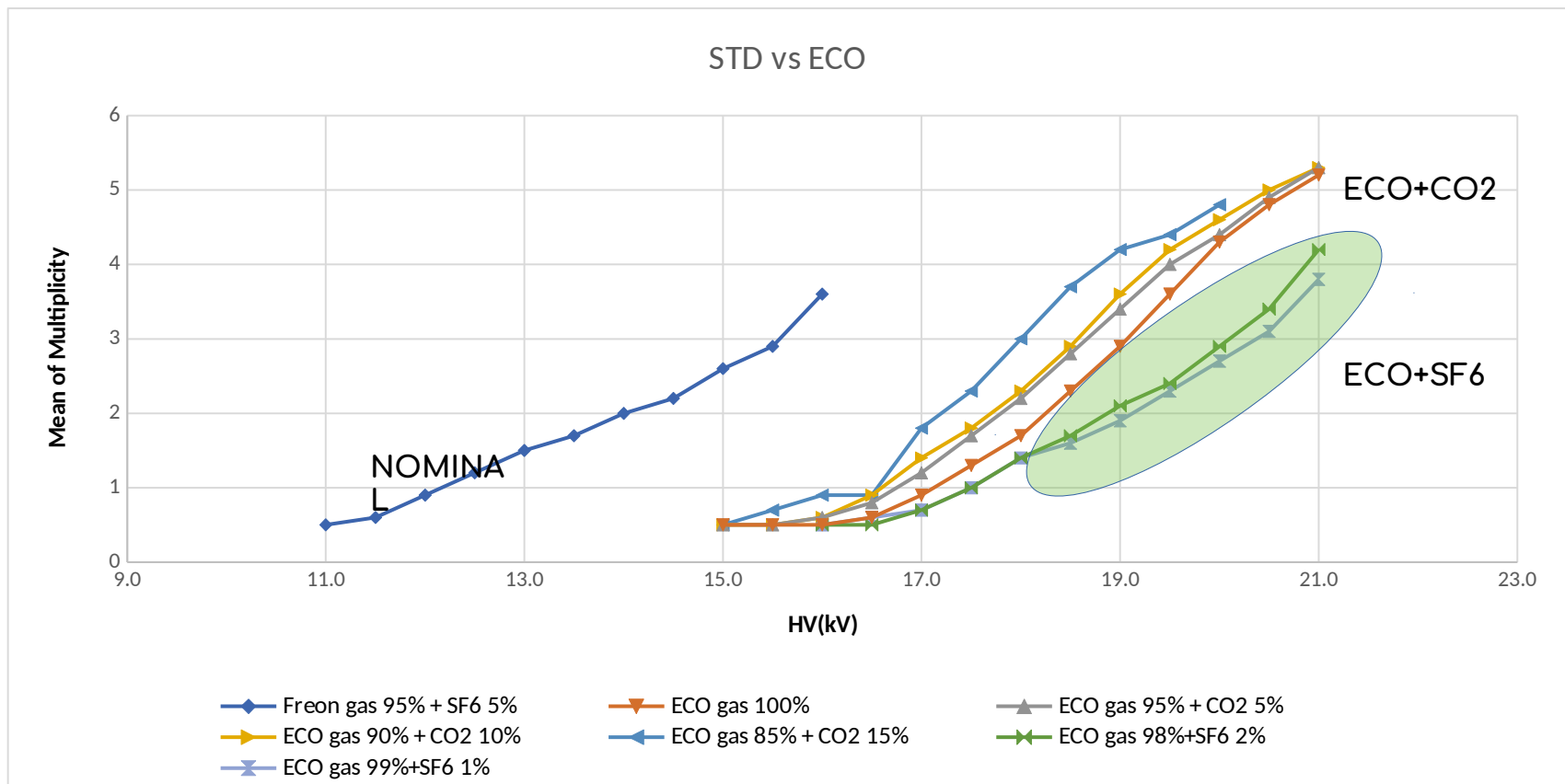
Nominal vs R1234ze (new freon) + CO2 mixture



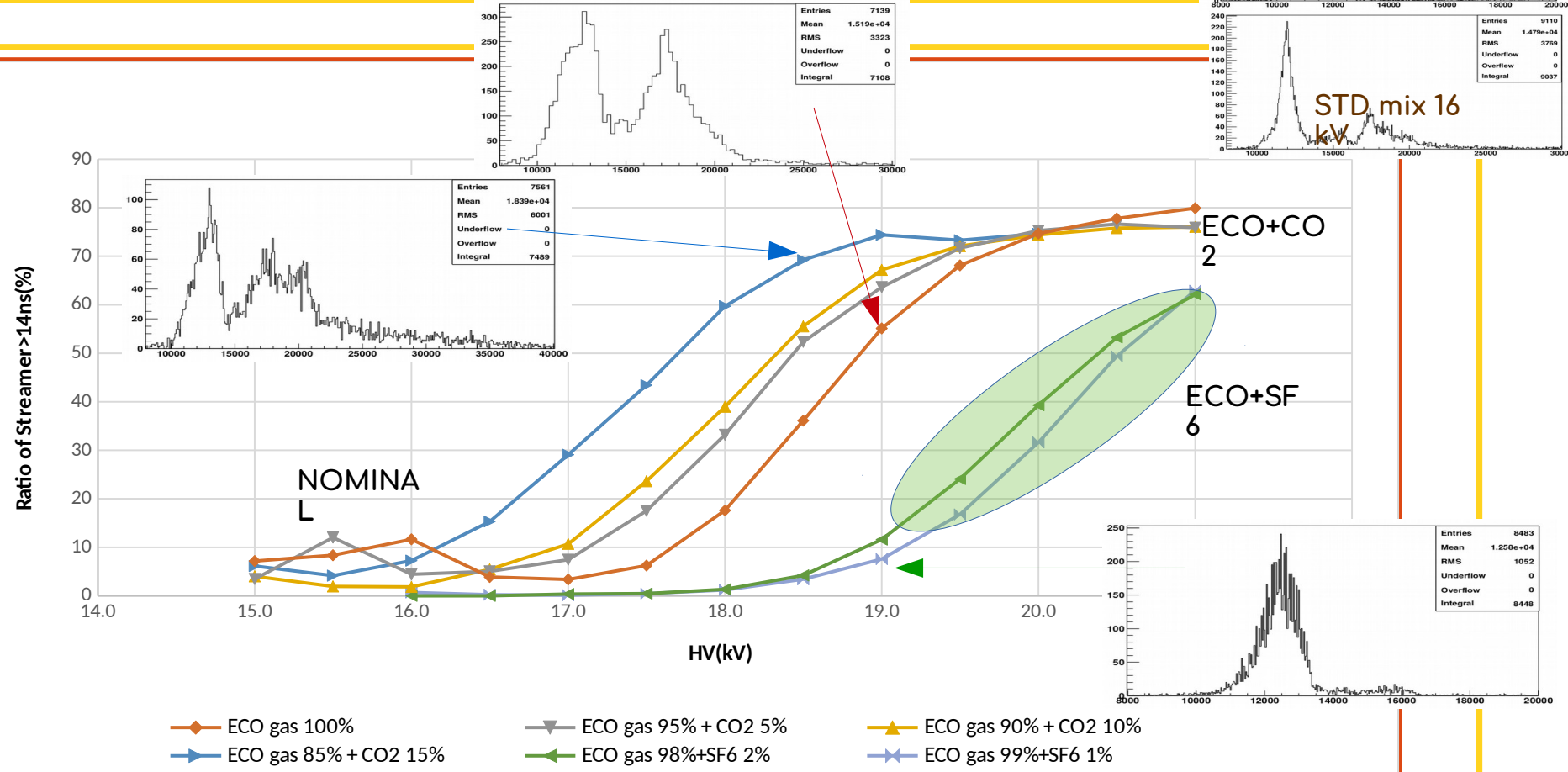
Nominal vs R1234ze (new freon) + SF6 mixture



Mean Multiplicity



Streamer %



Summary and Perspectives

ECO+CO₂

- streamer
- HV at limit for DC/DC

ECO+SF₆

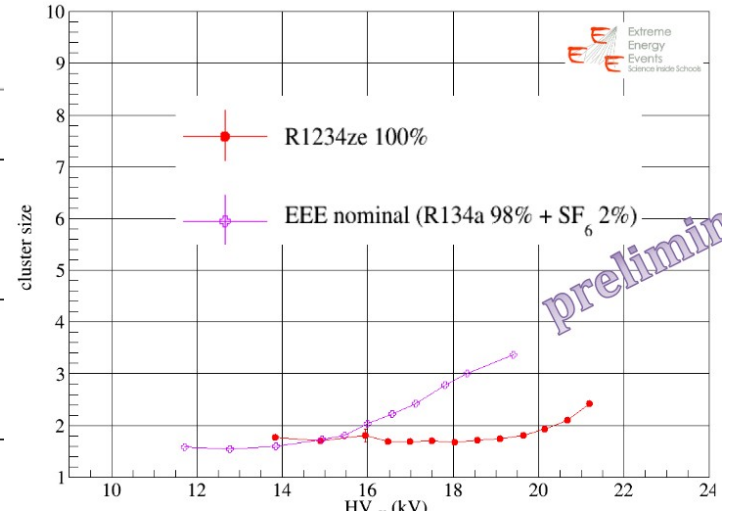
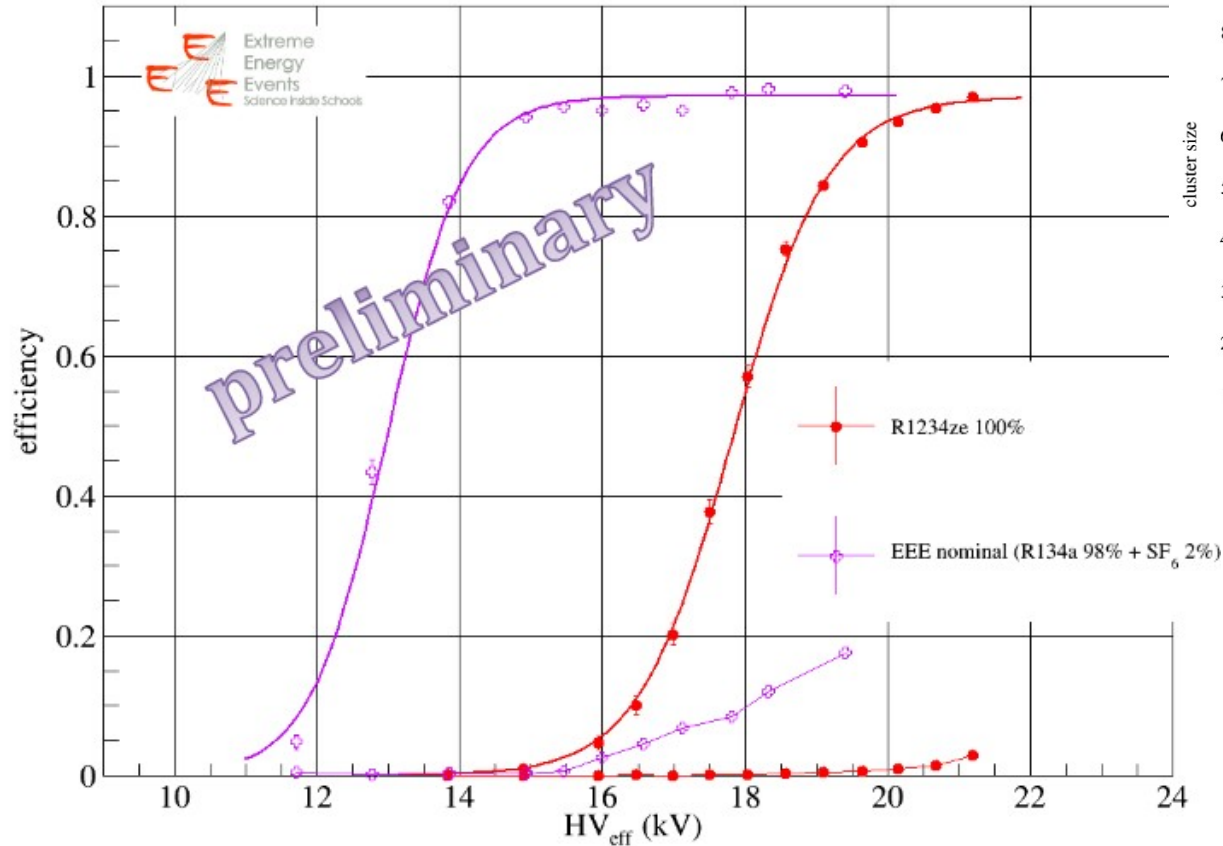
- seems **better than standard (no saturation effects)**
- HV above the **DC/DC limits**

Proposals:

- both mixtures: adding a 3rd gas for lowering the plateau HV (He4?)
- trying new mixtures on CERN-01 and real EEE chambers?
 - Quenchers: NF₃, F₂ (both GWP < SF₆, but toxic)
 - Main gases: N₂? (Trying maybe N₂+CO₂ or N₂+SF₆)

Results at the CERN-01 with cosmics

Pure R1234ze



Most striking result:

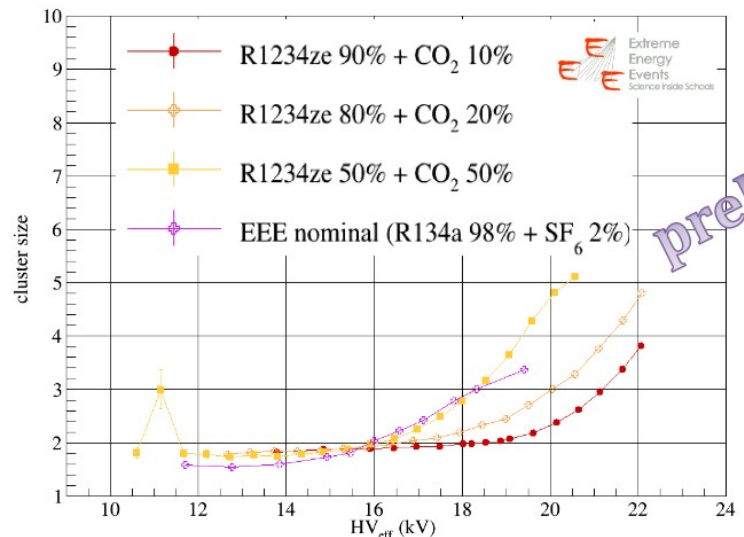
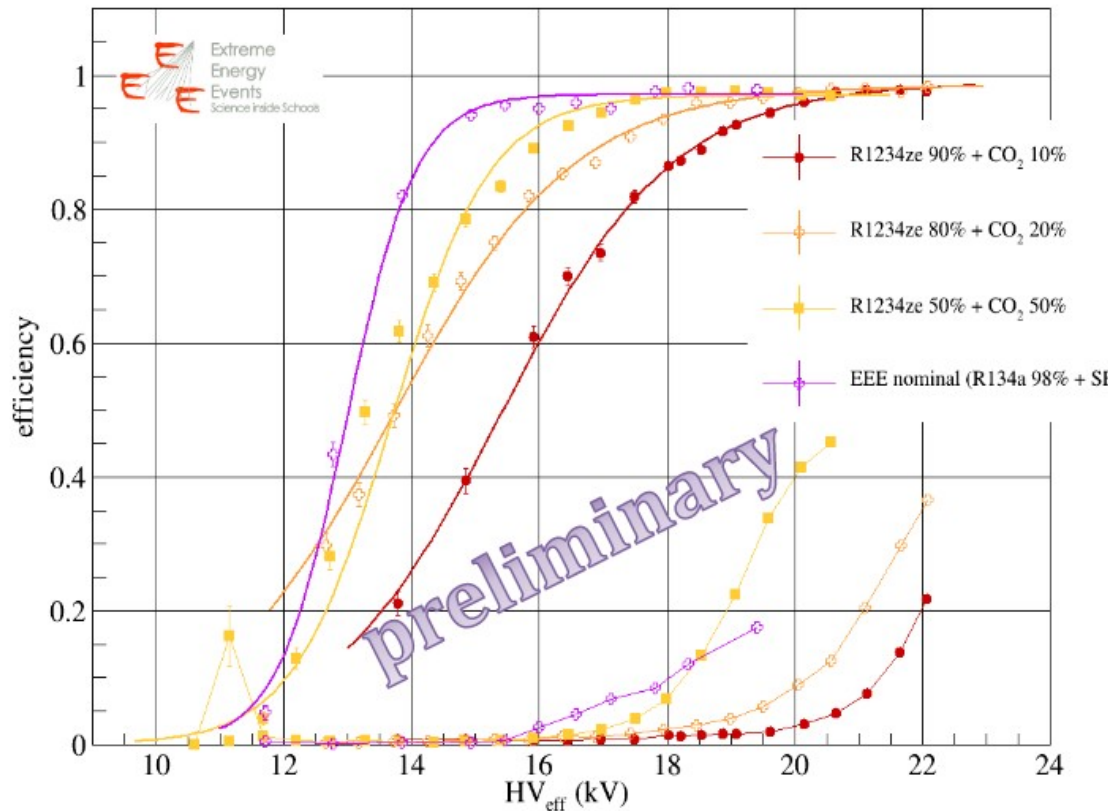
- pure R1234ze is better than nominal!

- no saturation

- strong HV shifts

Results at the CERN-01 with cosmics

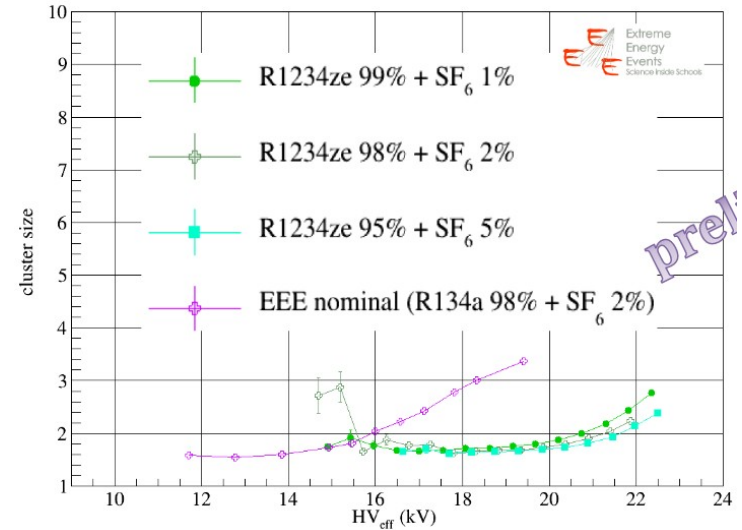
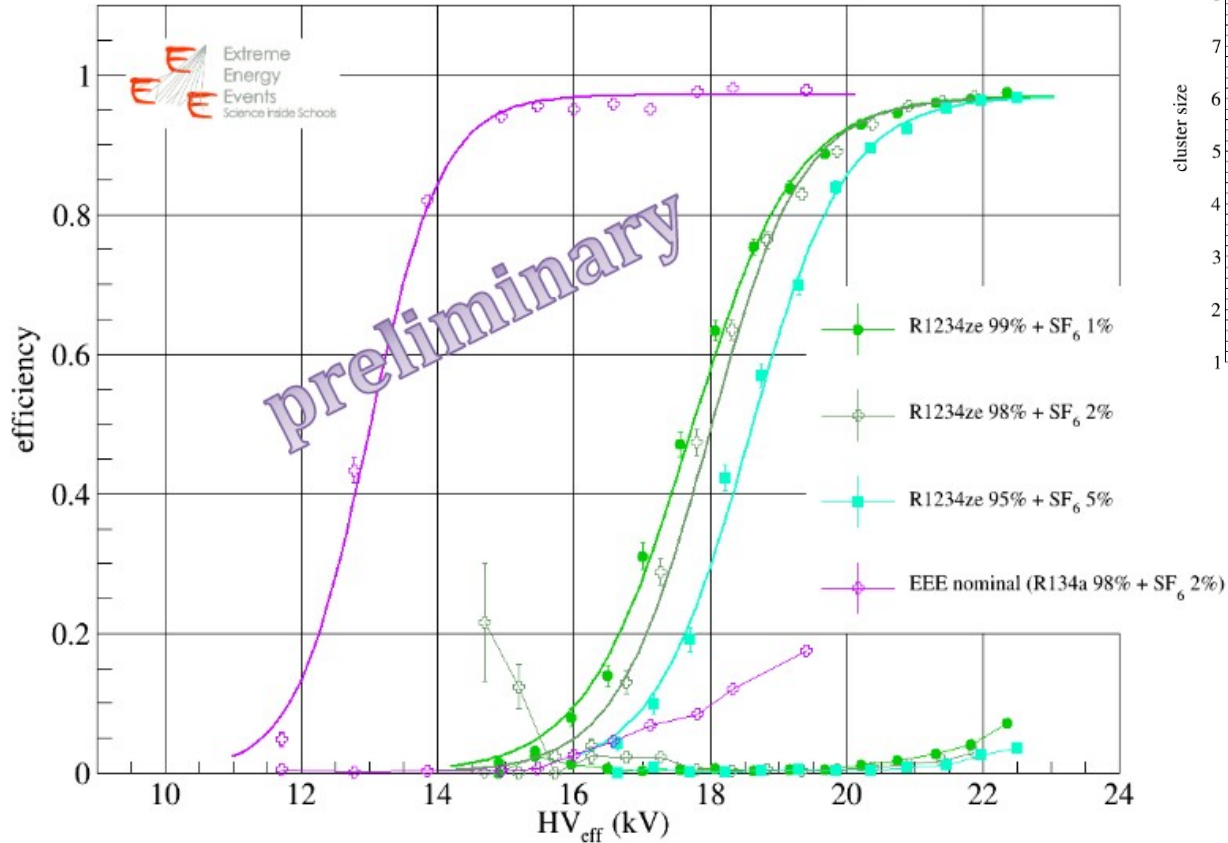
R1234ze + CO₂



- 50% CO₂ similar to nominal
- within our DCDC dynamics

Results at the CERN-01 with cosmics

R1234ze+SF₆



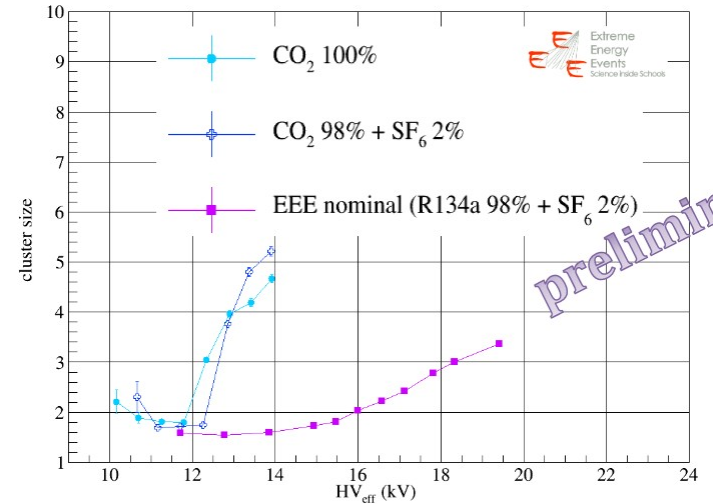
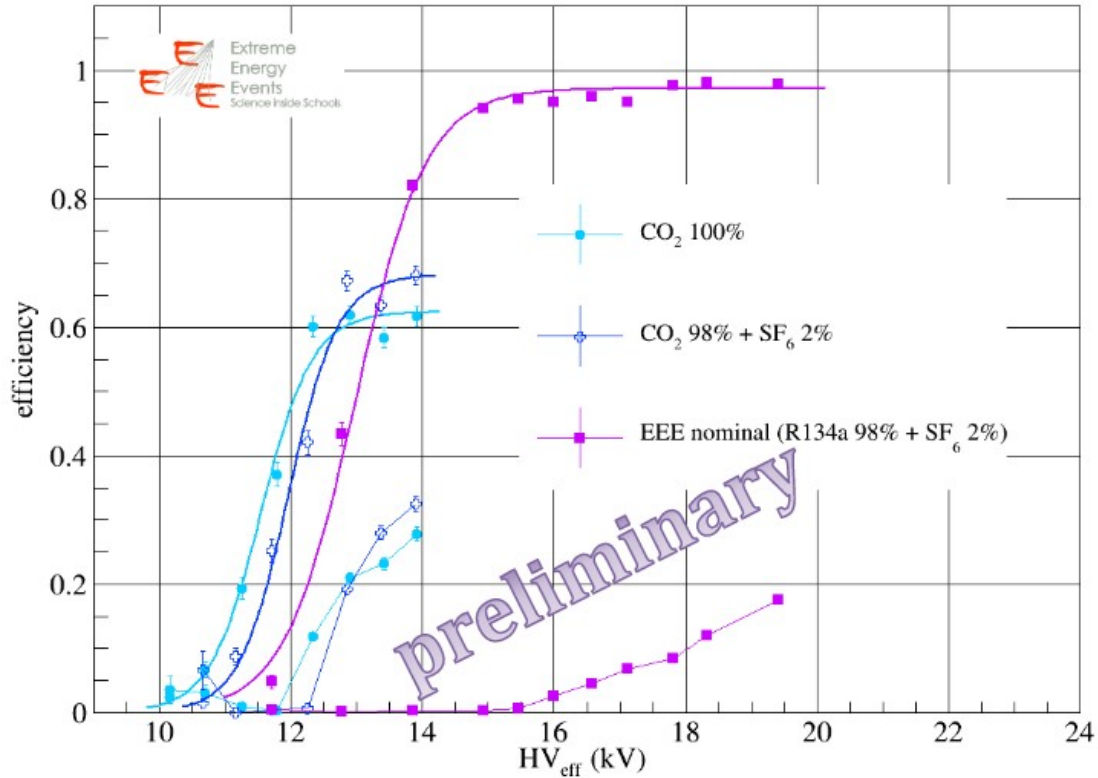
Not sizeable
improvements

w.r.t.

Pure R1234ze

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%)



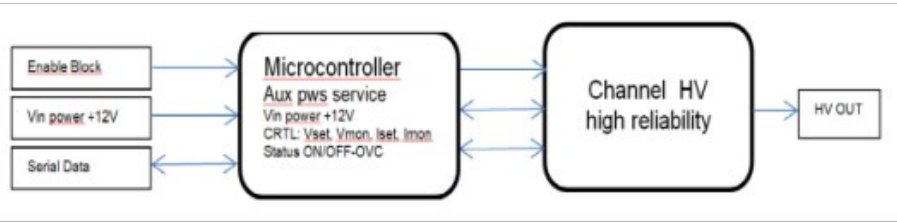
Ar ~ 120 euro/ (200
bar - 20 l bottle)

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

Maybe also:

Ar(or N2)
+
CO2/isobutane premix?

HV standalone modules



data connector RS 485 (usb/coaxial adapter available)



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

✓ 15 In consegna il giorno lavorativo successivo per ordini pervenuti entro le 18:00 (magazzino in Italia)
✓ 34 Euro 3 giorni lavorativi per ordini effettuati entro le 12:00 (magazzino in Europa)

Prezzo per: Unità **€ 11,28** (IVA esclusa) **€ 13,76** (IVA inclusa)

Unità	Per unità
1 - 9	€ 11,28
10 - 19	€ 10,94
20 - 49	€ 10,61

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	<3 Watt
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

we can store HV in DAQ easily for analysis

very low ripple ($\ll 1$ V!!!)

no need of LV (integrated)

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

On monday I'm going to CAEN to check the design

Investigations on GAS purchase at CERN and delivery to Italy

Transport rules for privates

Compressed gases transport can be **self-managed** following these limitations: (defined by the ADR European Agreement concerning the International Carriage of Dangerous Goods by Road)

- R1234a is within Class 2 Category: Compressed Gases, liquids or liquified under pressure
- the weight should not exceed:
 - 300 kg for liquid gases
 - 300 l for compressed gases – non liquid
- the transport van should be equipped with:
 - Fire extinguisher > 2 kg
 - Packaging with the ADR class 2 labels
 - Transport documents with the label "within limits 10011 ADR"
 - Security cards (Trem Card) by the seller
 - Conditioning in case of closed van
 - Fall-proof system

Responsibility is charged to the driver

An **authorized company** can exceed limitations in weight.

Customs requirements seems to be the same listed within the ADR regulations.

I asked for specific restriction to greenhous gases transport within EU. I should get the answer within 15 days.