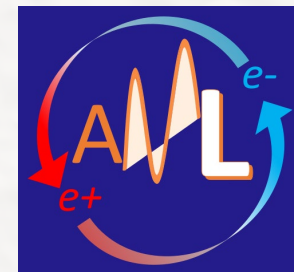


Upgrade of HV catching system



Collaboration meeting
6-9 May 2024 - Torun

Luca Penasa



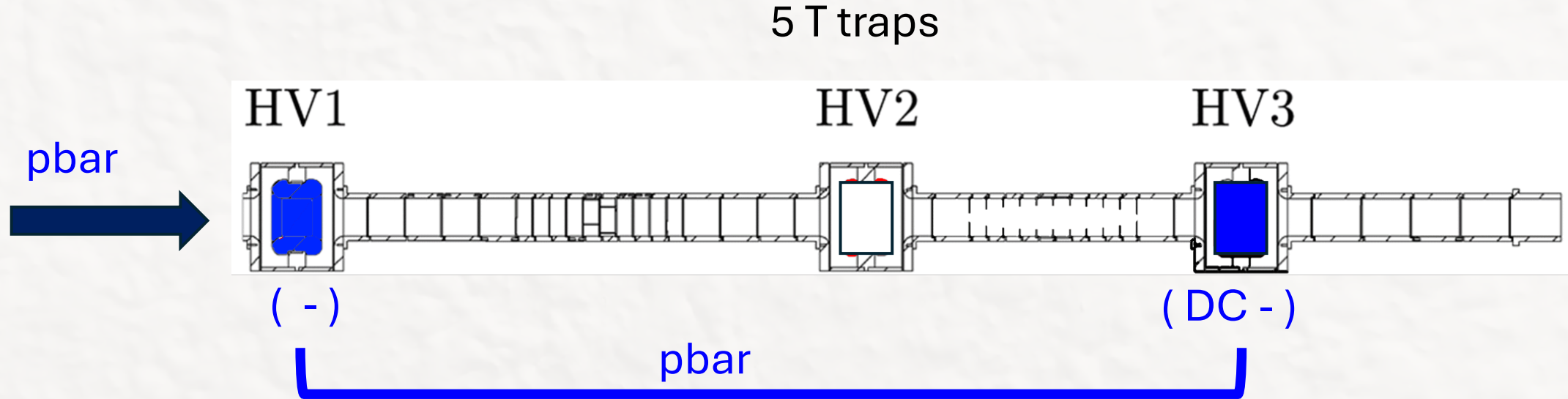
AntiMatter-Lab



TIFPA

Upgrade of HV catching system

- Actual HV catching system



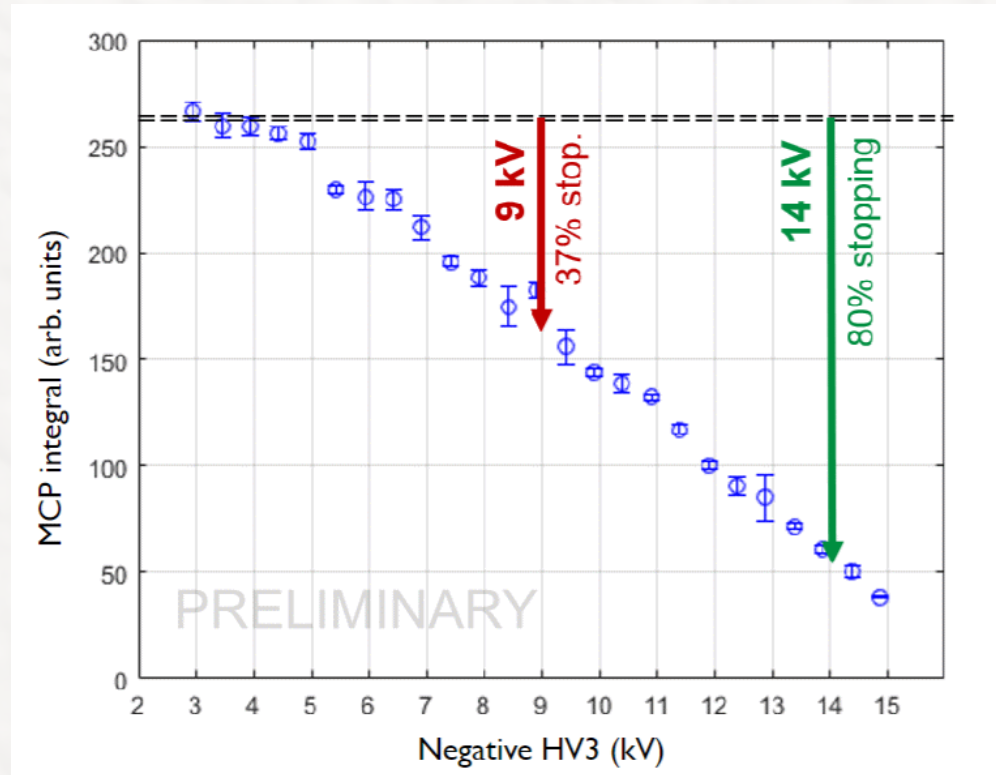
HV1 - pulsed electrode
 $V_{max} = 14 \text{ kV}$ (limited by the specs of Behlke switch)

HV3 - DC voltage, high-voltage Power Supply



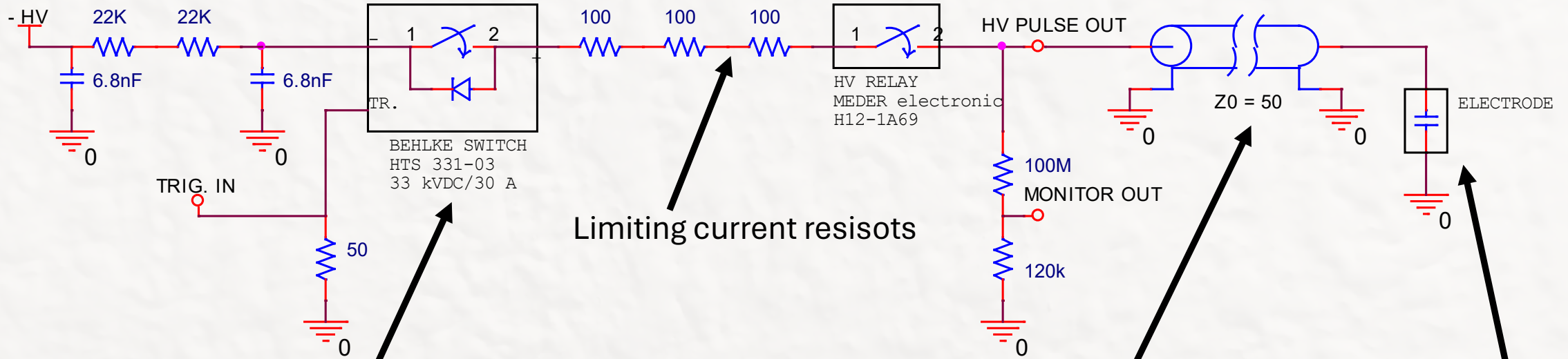
Upgrade of HV catching system

- **HV1 voltage**
- From analyzed data (Ruggero/Saiva/Tassilo):
“we can reach best catching efficiency with thin degraders or higher HV1/HV3 voltage (**20 kV**)”



Actual HV catching system

- HV1 pulser schematics



Limiting current resistots

Behlke HV switch
HTS 331-03

Coaxial cable:
Lenght => about 3 m
Capacitance => about 300 pF

HV electrodes_
C = about 50-100 pF

$$\tau = R_{tot} * C_{tot}$$



Proposed new HV switch

- We need a new Behlke that can withstand more current

Present Behlke HV switch

HTS 331-03:

33 kV / 30 A

$t_r = 15 \text{ ns}$ (@ $0.1 \times I_p(\text{max})$)

$R_{\text{stat}} = 180 \ \Omega$ (@ $1 \times I_p(\text{max})$)



Using $R_{\text{limit}} = 300 \ \Omega$:

$I_{\text{max}} \approx 30 \text{ A}$

$\tau = R_{\text{tot}} \cdot C_{\text{tot}} \approx 190 \text{ ns}$

Proposed new Behlke HV switch

HTS 401-10-LC2:

40 kV / 100 A

$t_r = 56 \text{ ns}$ (@ $0.1 \times I_p(\text{max})$)

$R_{\text{stat}} = 15\text{-}18 \ \Omega$ (@ $1 \times I_p(\text{max})$)



Using $R_{\text{limit}} = 250 \ \Omega$:

$I_{\text{max}} \approx 75 \text{ A}$

$\tau = R_{\text{tot}} \cdot C_{\text{tot}} \approx 110 \text{ ns}$

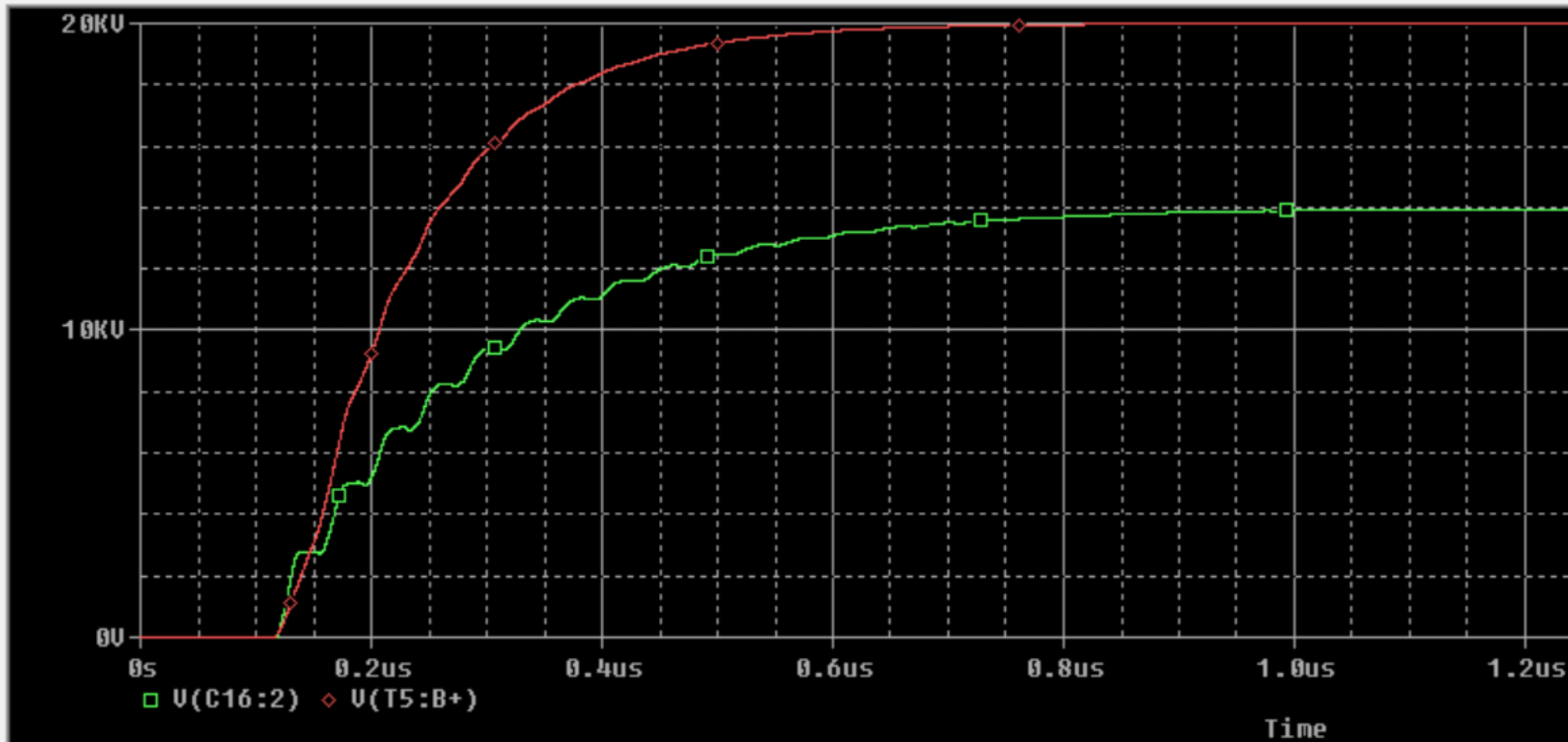
LC2 model:

they can resist sparkovers, short circuits and overvoltage transients within their thermal capabilities.



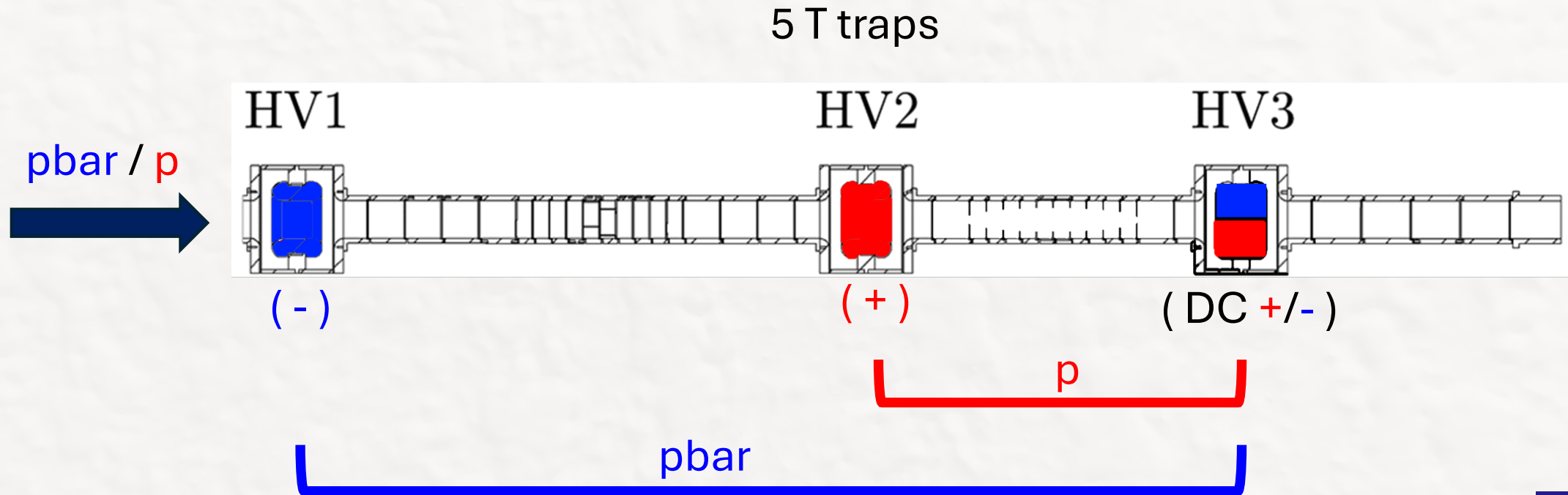
Proposed new HV switch

- Voltage comparison (simulation) between **present** and **new** HV switch



Request to capture positive particles as well (p)

- The more convenient way is to pulse HV2, using twin HV switch with positive voltage:
 - It is safer
 - The two system HV1 and HV2 are independent and always ready without any change/connection/disconnection



Budget needed

- **Behlke switch quotation:**

Pos.	Qty.	Code	Description	Date / Time of delivery	Unit price EUR	Total amount EUR
1	1	HTS 401-10-LC2	MOSFET Switch Trade Code: 85423190 Country of origin: DE	8 - 9 weeks	4.784,01	4.784,01
**I-FWDN						
2	1	FDA 400-75	Fast Diode Assembly Trade Code: 85423190 Country of origin: DE	8 - 9 weeks	1.193,00	1.193,00
3	1	FDA 10-75	Fast Diode Assembly Trade Code: 85423190	8 - 9 weeks	71,87	71,87
Freight EUR						45,00
Net total EUR						6.093,88
Total amount EUR						6.093,88

- 2 x HV switches ≈ 9600 euro (12100 euro with «fast diode assembly»)
- 2 x HV connectors ≈ 400 euro
- 1 x HV Power Supply -20 kV (already available in the present system)
- 1 x HV Power Supply +20 kV needed for the positive voltage system
- 1 x Box + some electronic componets (resistors, capacitors) ≈ 200 euro

