

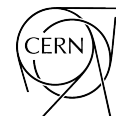
Ecogas resistivity scan

Mattia Verzeroli, Stefania Juks, Gianluca Rigoletti



EP-DT

Detector Technologies



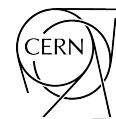
Outline

- Resistivity scan (Dec. 2023 - May 2024)
- Resistivity from TB data (Jul. 2023 - Apr. 2024)
- Conclusion

Resistivity scan

- Introduction to the data analysis
- 2023 data
- 2024 data
- Comparison between 2023 and 2024

Introduction to the analysis



1. The mean and deviation for each HV applied are considered
2. A linear fit is performed on the data, considering all the point after the knee
3. However, loss of linearity for high HV:
-> the data are limited to the linearity range

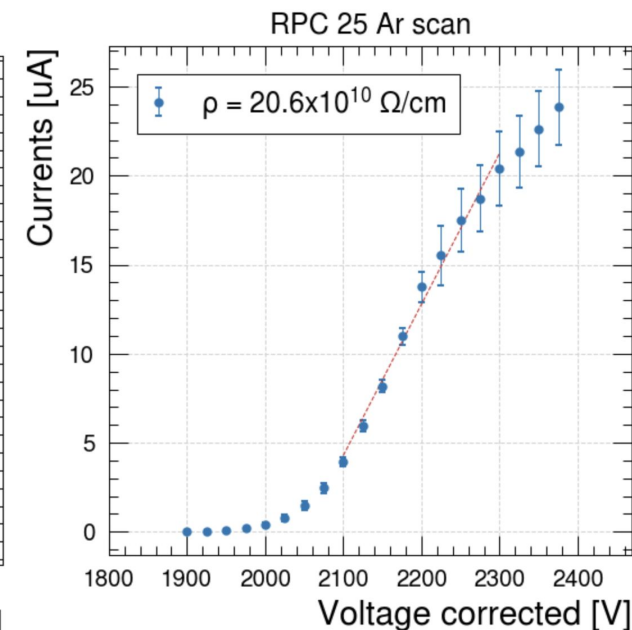
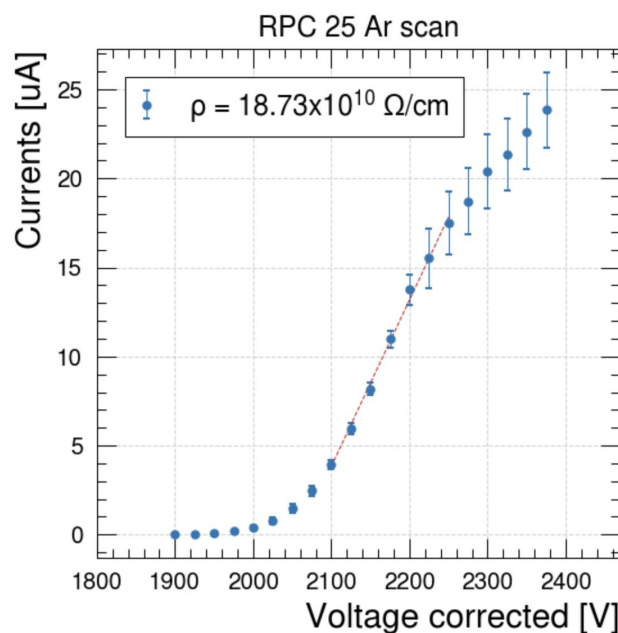
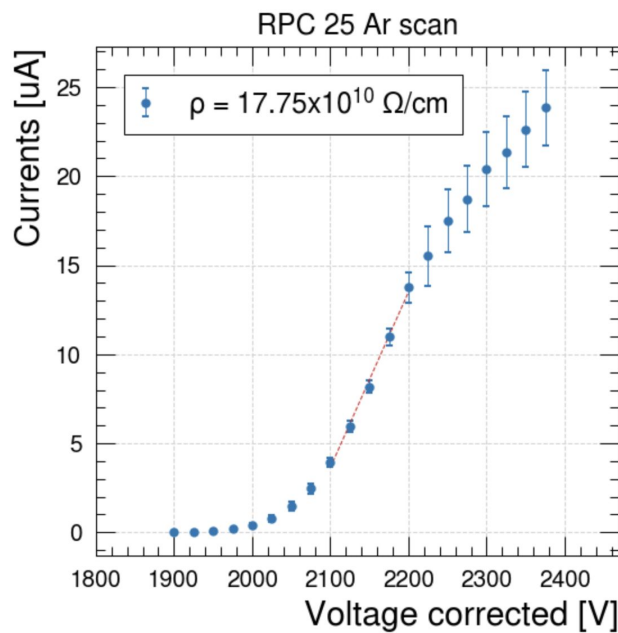
Installed on 14th June 2023

Length = 70 cm

Width = 100 cm

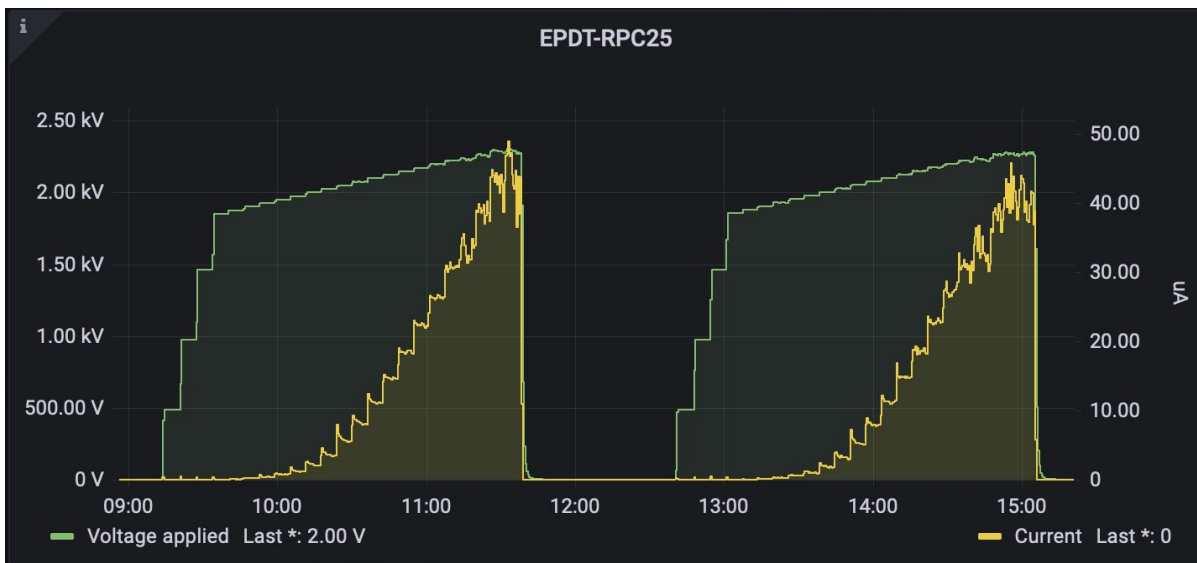
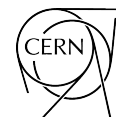
Electrode thickness = 0.2 cm

Gap thickness = 0.2 cm



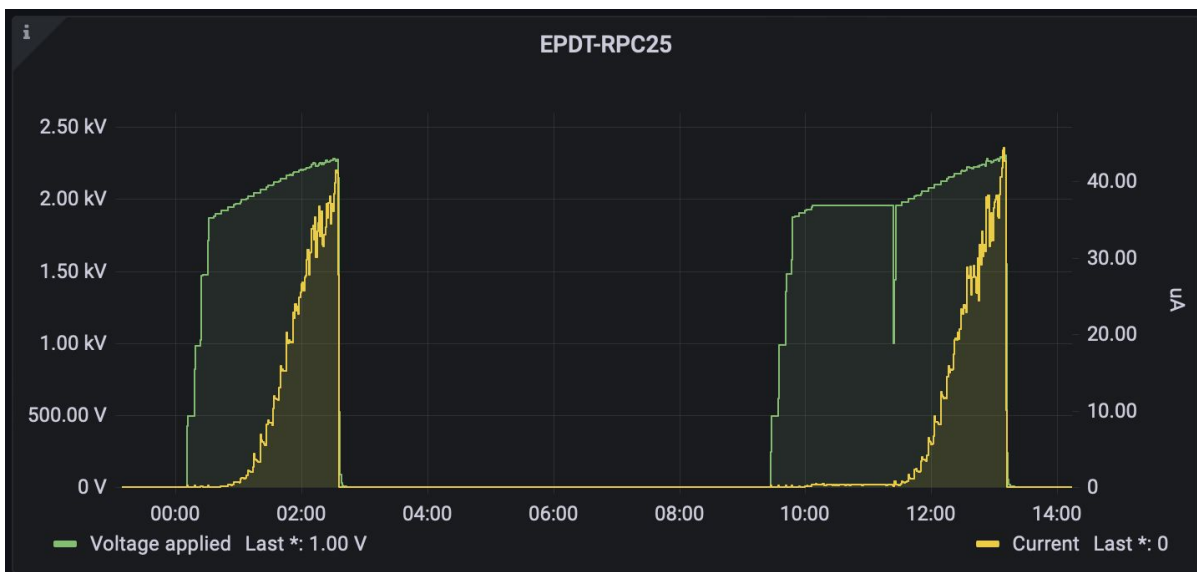
Example: the first fit attempt is used for the analysis

Resistivity scan 2023



Grafana overview of the 4 scans performed

14/12/2023



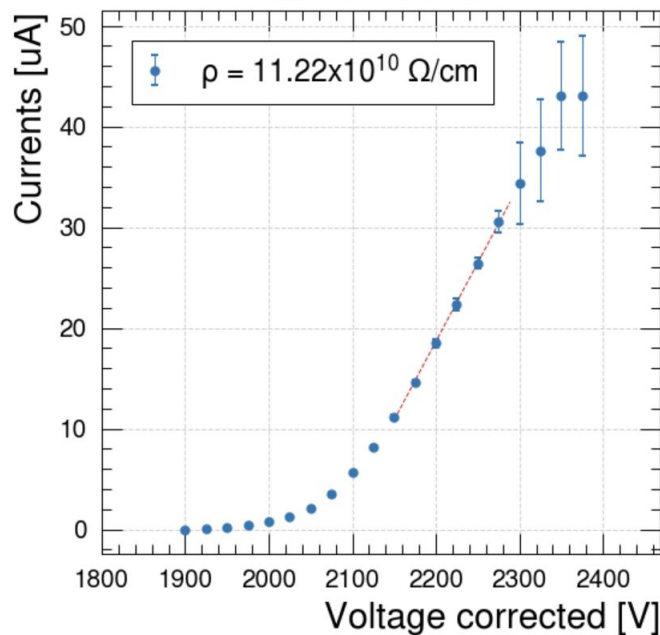
15/12/2023

Resistivity scan 2023



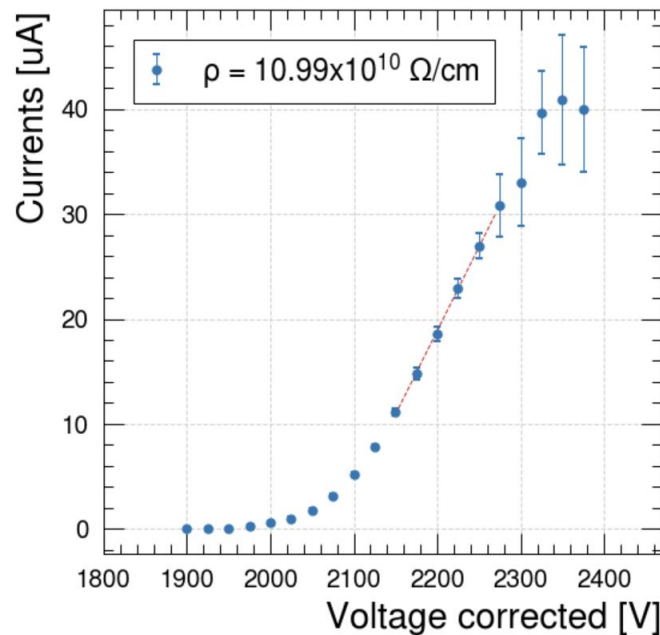
14/12/2023

Morning scan
RPC 25 Ar scan



Resistance [Ω]	$(0.64 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(11.22 \pm 0.01) \times 10^{10}$
V switch on [V]	2080 ± 50

Afternoon scan
RPC 25 Ar scan



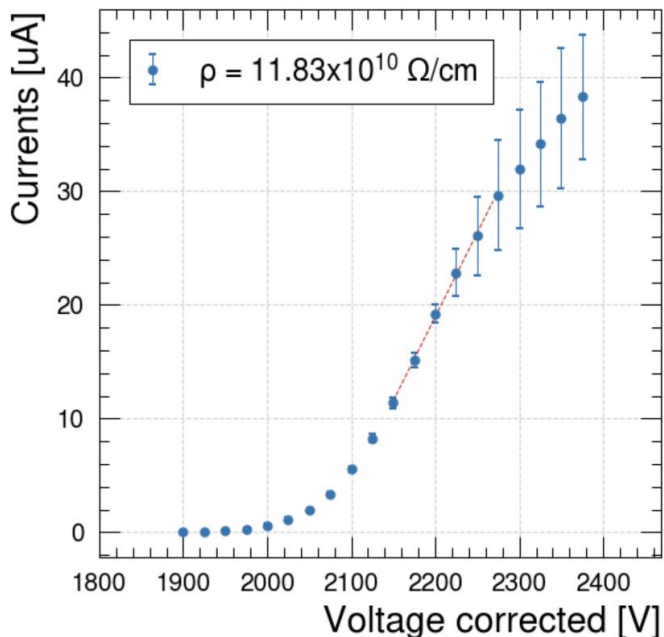
Resistance [Ω]	$(0.63 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(10.99 \pm 0.01) \times 10^{10}$
V switch on [V]	2081 ± 60

Resistivity scan 2023



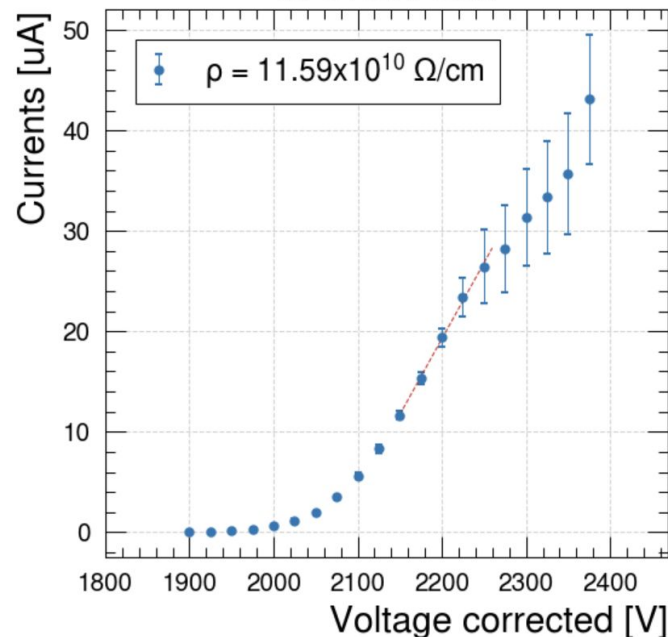
15/12/2023

Night scan
RPC 25 Ar scan



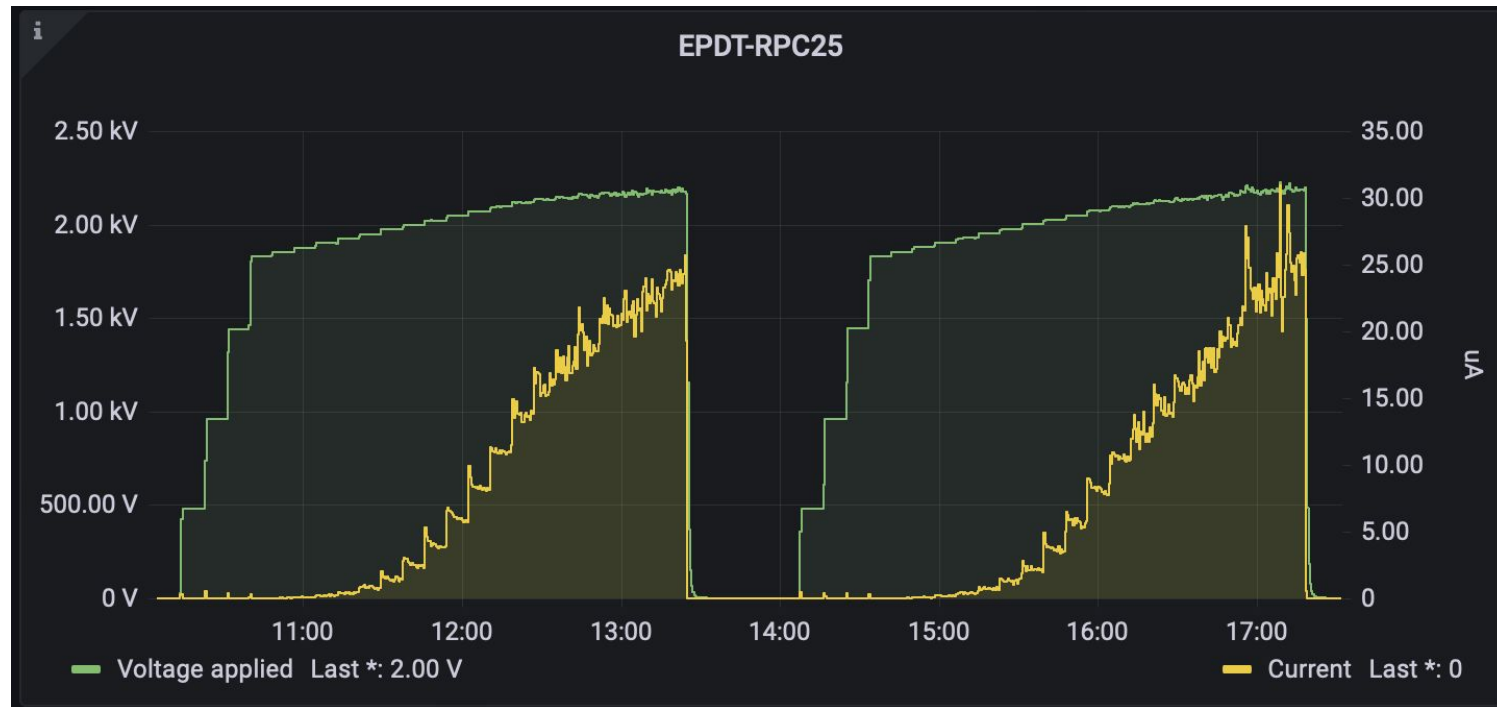
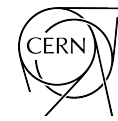
Resistance [Ω]	$(0.68 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(11.82 \pm 0.01) \times 10^{10}$
V switch on [V]	2072 ± 70

Morning scan
RPC 25 Ar scan



Resistance [Ω]	$(0.66 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(11.59 \pm 0.01) \times 10^{10}$
V switch on [V]	2072 ± 80

Resistivity scan 2024



Current less stable during the second run;
also here is possible to see a not excellent current increase.
-> currents limited by HV module?

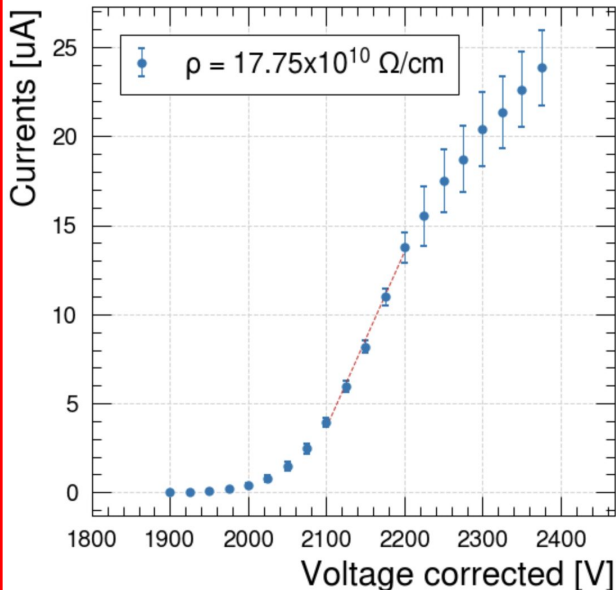
Resistivity scan 2024



2024/05/02

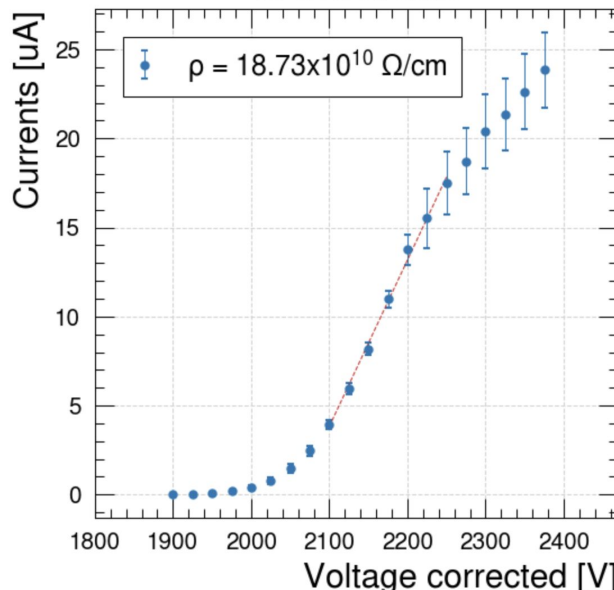
First scan, different number of fit points

RPC 25 Ar scan



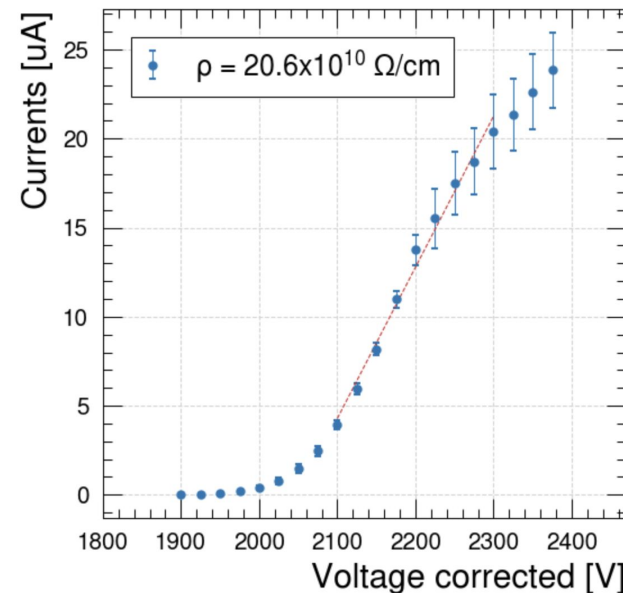
Resistance [Ω]	$(1.01 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(17.75 \pm 0.01) \times 10^{10}$
V switch on [V]	2063 ± 130

RPC 25 Ar scan



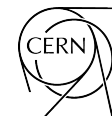
Resistance [Ω]	$(1.07 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(18.72 \pm 0.01) \times 10^{10}$
V switch on [V]	2059 ± 85

RPC 25 Ar scan



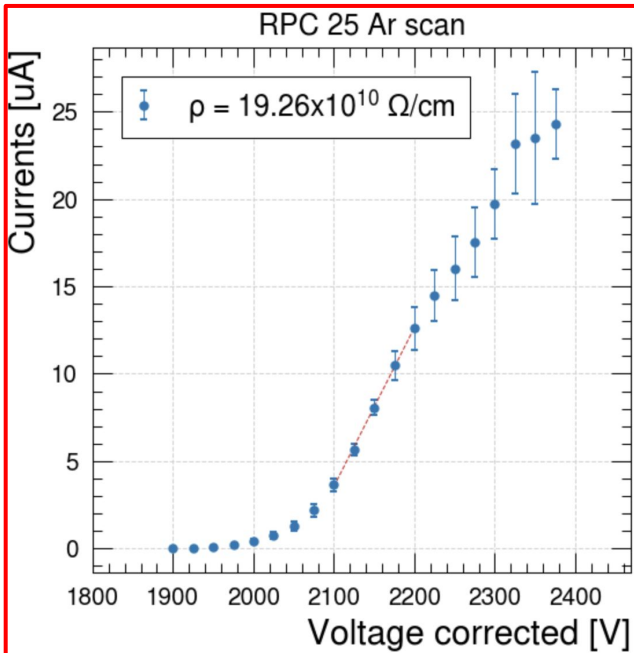
Resistance [Ω]	$(1.18 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(20.60 \pm 0.01) \times 10^{10}$
V switch on [V]	2049 ± 120

Resistivity scan 2024

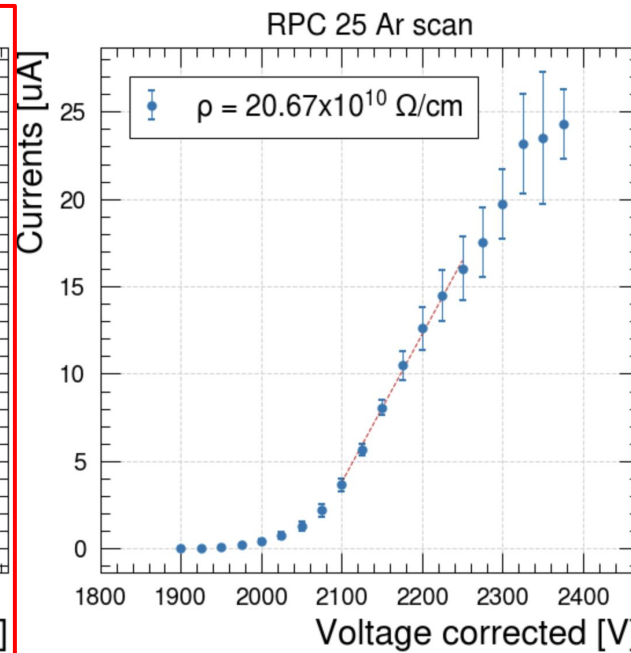


2024/05/02

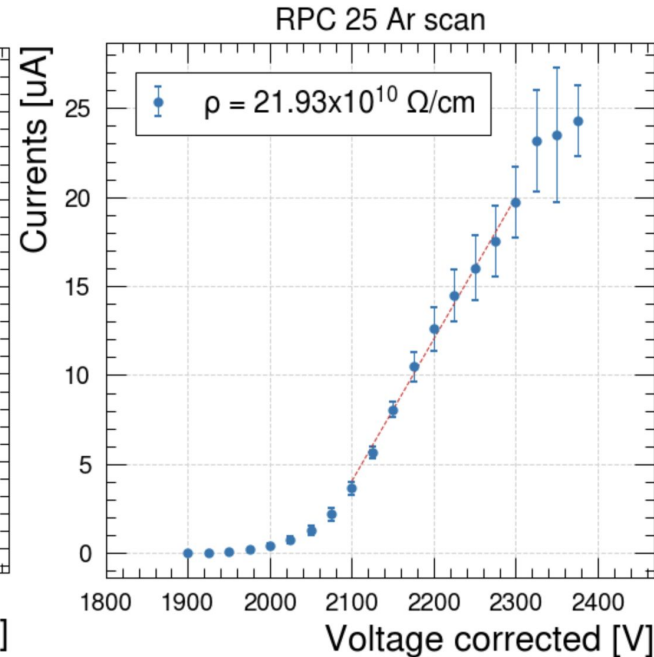
Second scan, different number of fit points



Resistance [Ω]	$(1.10 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(19.26 \pm 0.01) \times 10^{10}$
V switch on [V]	2060 ± 50

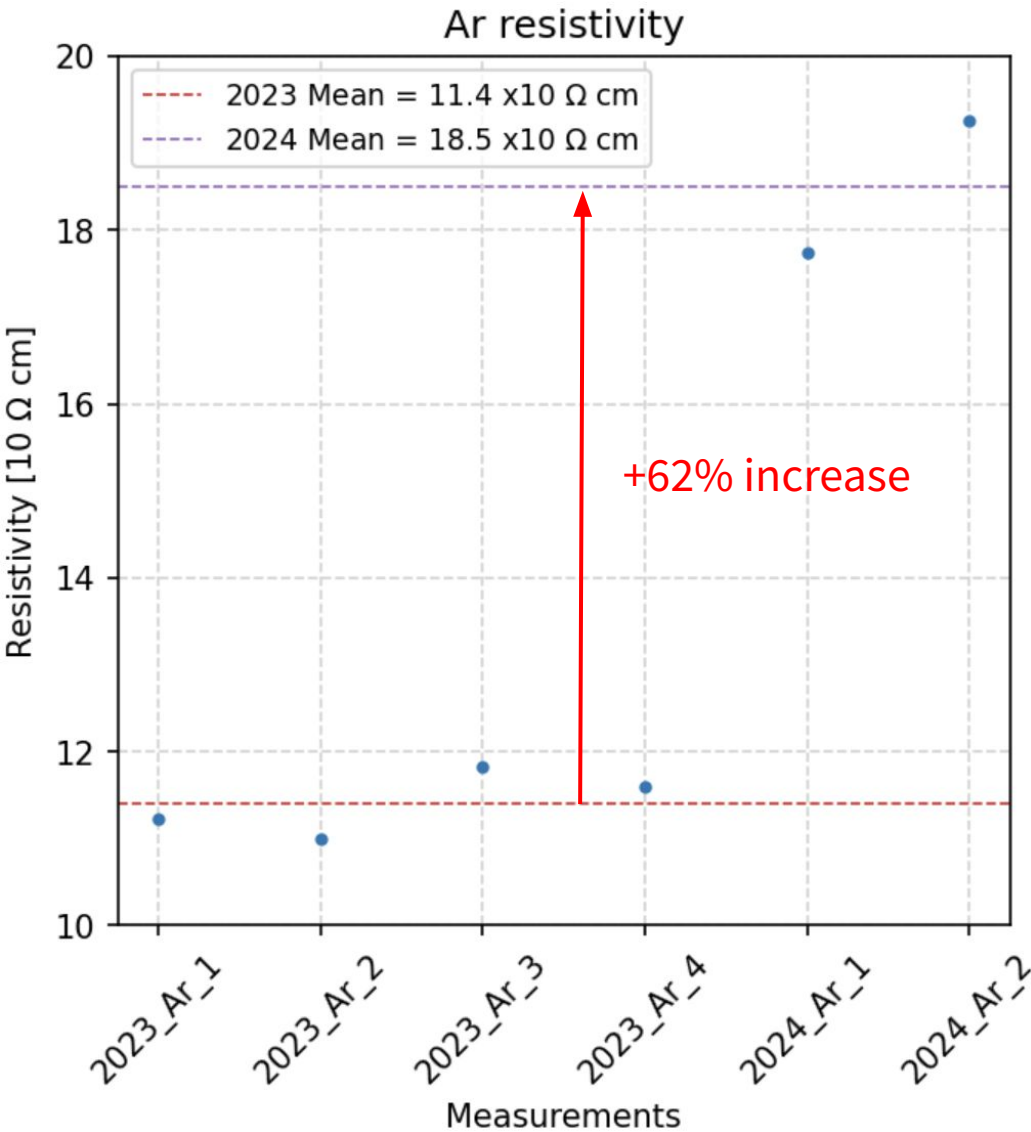
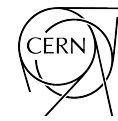


Resistance [Ω]	$(1.18 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(20.67 \pm 0.01) \times 10^{10}$
V switch on [V]	2055 ± 80



Resistance [Ω]	$(1.25 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(21.93 \pm 0.01) \times 10^{10}$
V switch on [V]	2049 ± 80

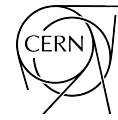
Comparison 2023-2024



From Ar measurements, 60% increase in the resistivity wrt 2023 data

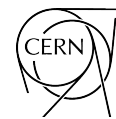
-> Is the same increase visible in the resistivity estimation from TB data?

Resistivity from TB data

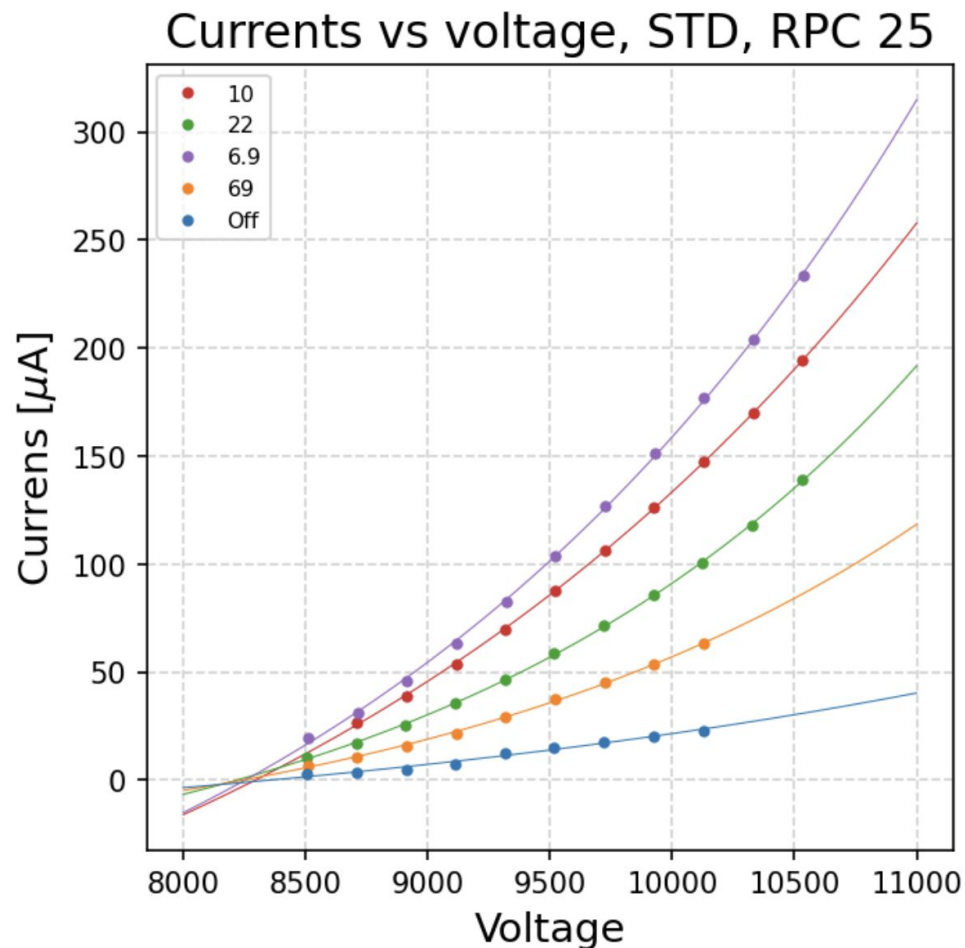
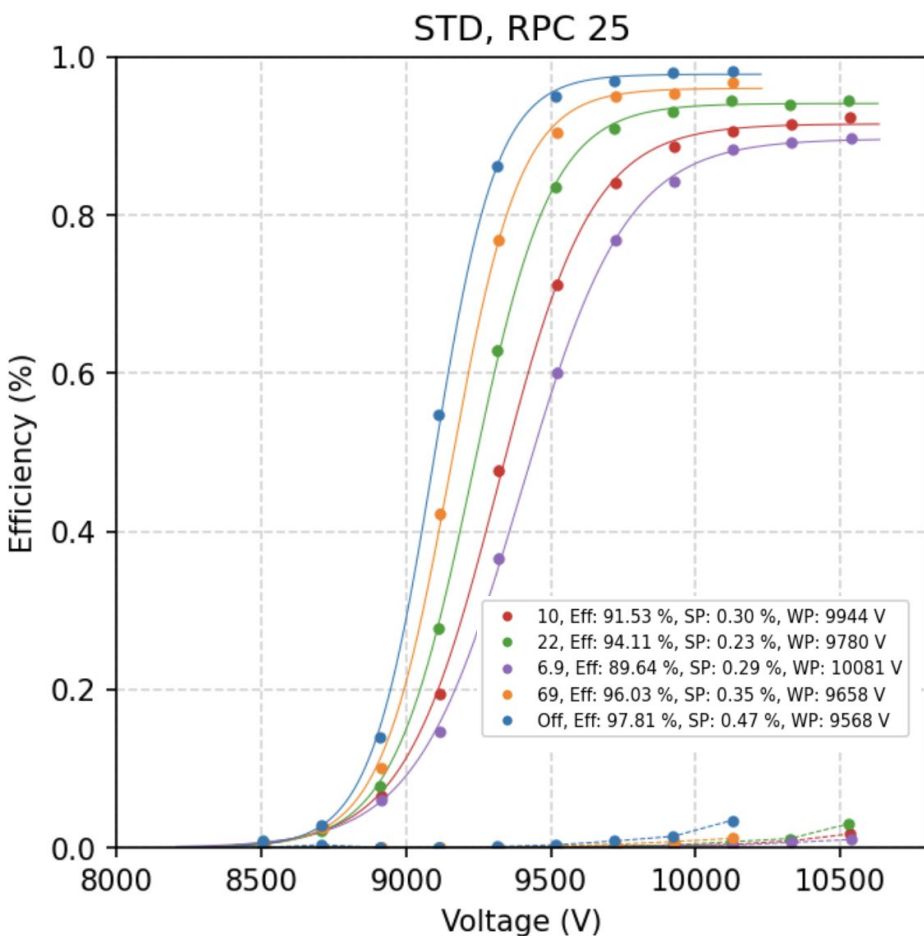


- Introduction to the data analysis
- 2023 data
- 2024 data
- Comparison between 2023 and 2024

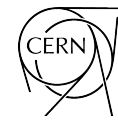
Introduction to the analysis



1. Perform and extract fit parameters from the **efficiency curve** (sigmoid)
2. Perform and extract fit parameter from the **currents** (exponential)



Introduction to the analysis



3. Applying the correction:

$$\Delta V_{\text{CORR}} = \Delta V_{\text{ABS}} - R (I_{\text{ABS}} - I_{\text{OFF}})$$

where:

- ΔV_{CORR} should be similar to the source off ΔV
- ΔV_{ABS} is the effective ΔV for the ABS considered
- R is the resistance
- I_{ABS} is the current for the ABS considered
- I_{OFF} is the current for source off

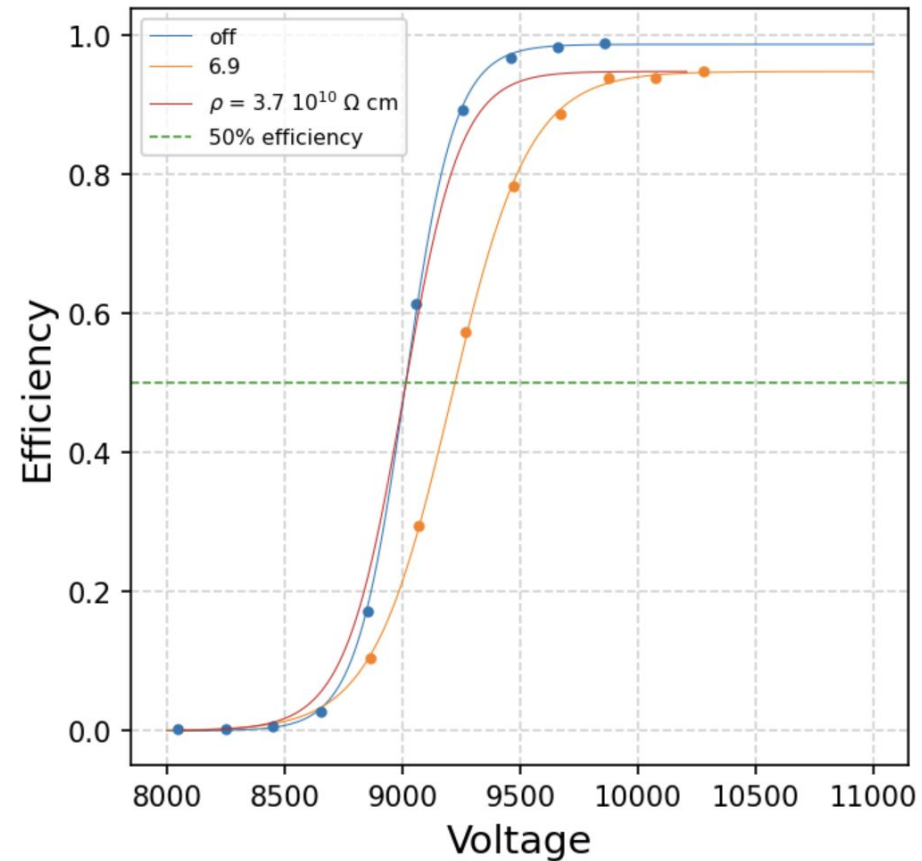
The value for ΔV and I are obtained from the fit function, R is found minimizing the difference of HV_{50} from source off and the considered ABS

4. To obtain the resistivity:

$$\rho = R \cdot A_{\text{det}} / (2 \cdot W_{\text{el}})$$

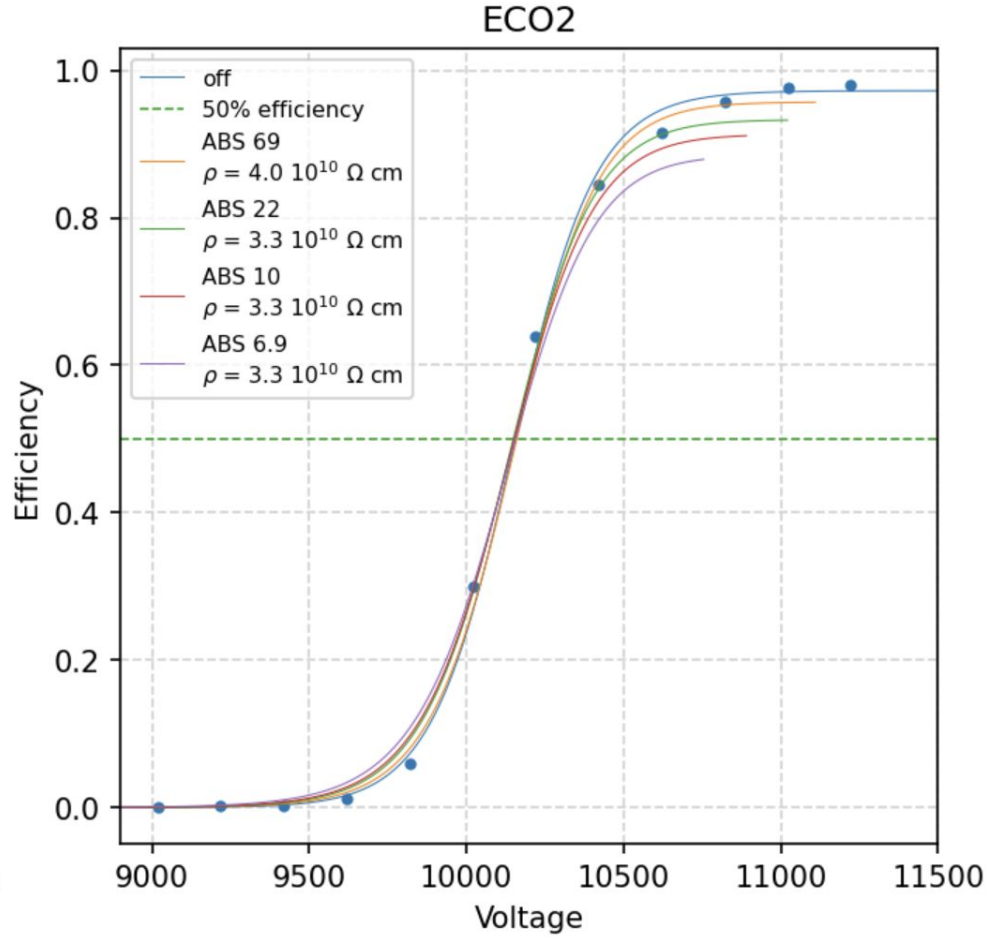
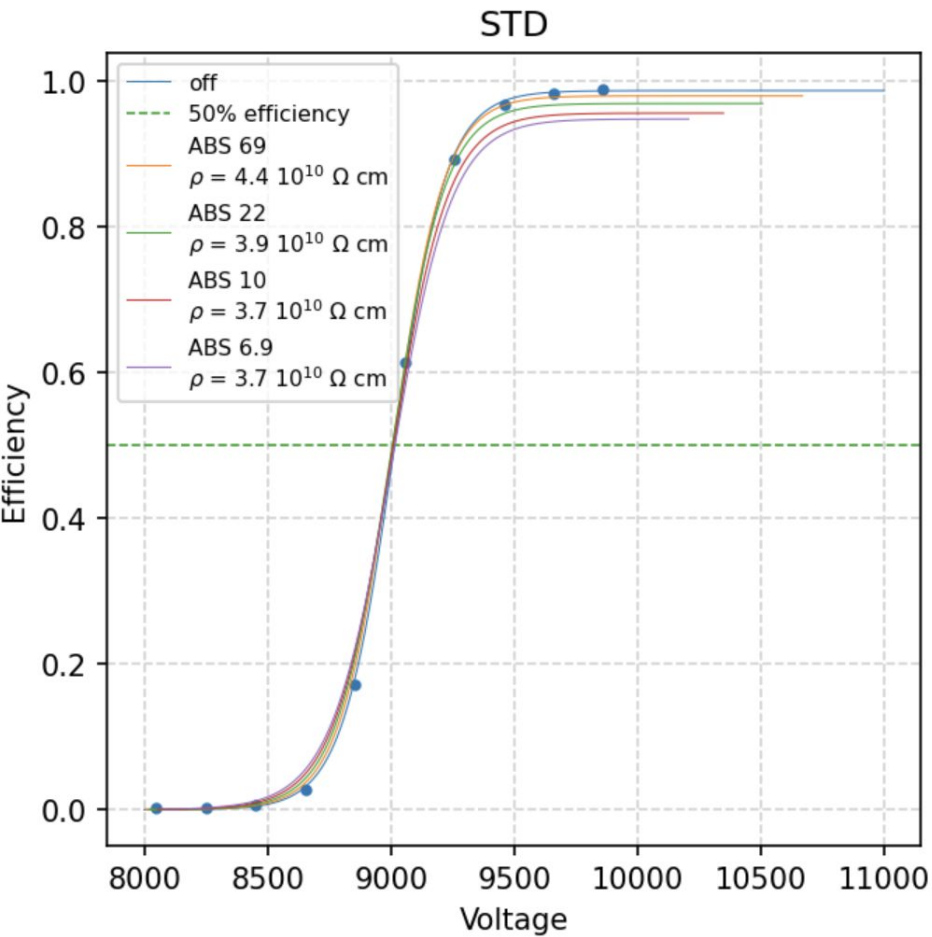
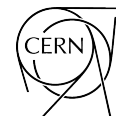
Where A_{det} is the detector area (0,7 m²) and W_{el} is the electrode thickness (0.2 cm).

Correction for ABS 6.9, STD



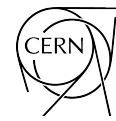
Example for a single ABS

2023 TB data resistivity

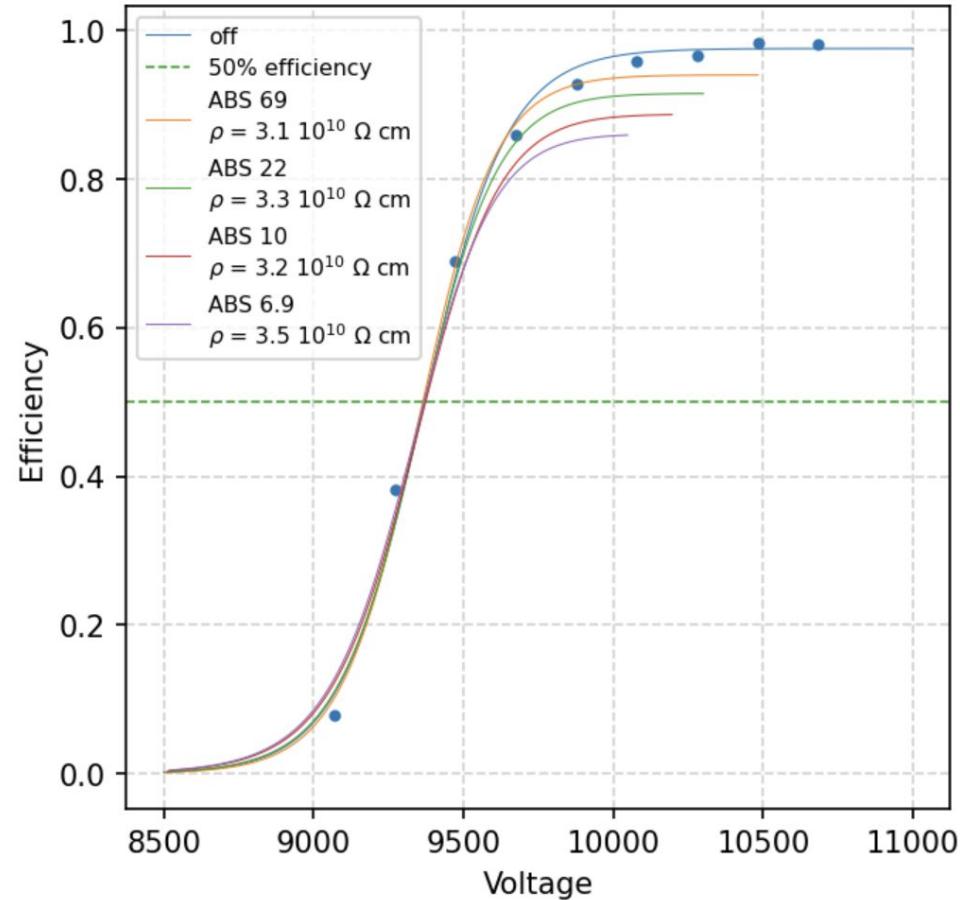


2023/07

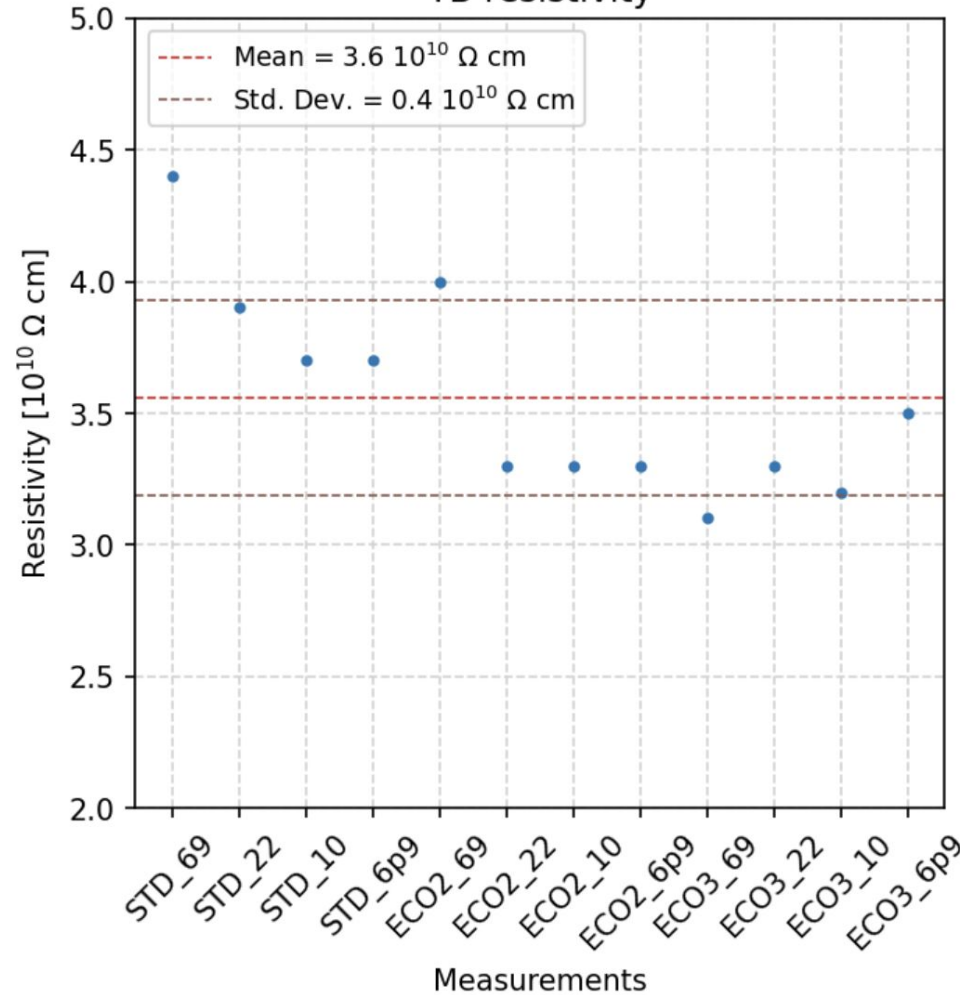
2023 TB data resistivity



ECO3

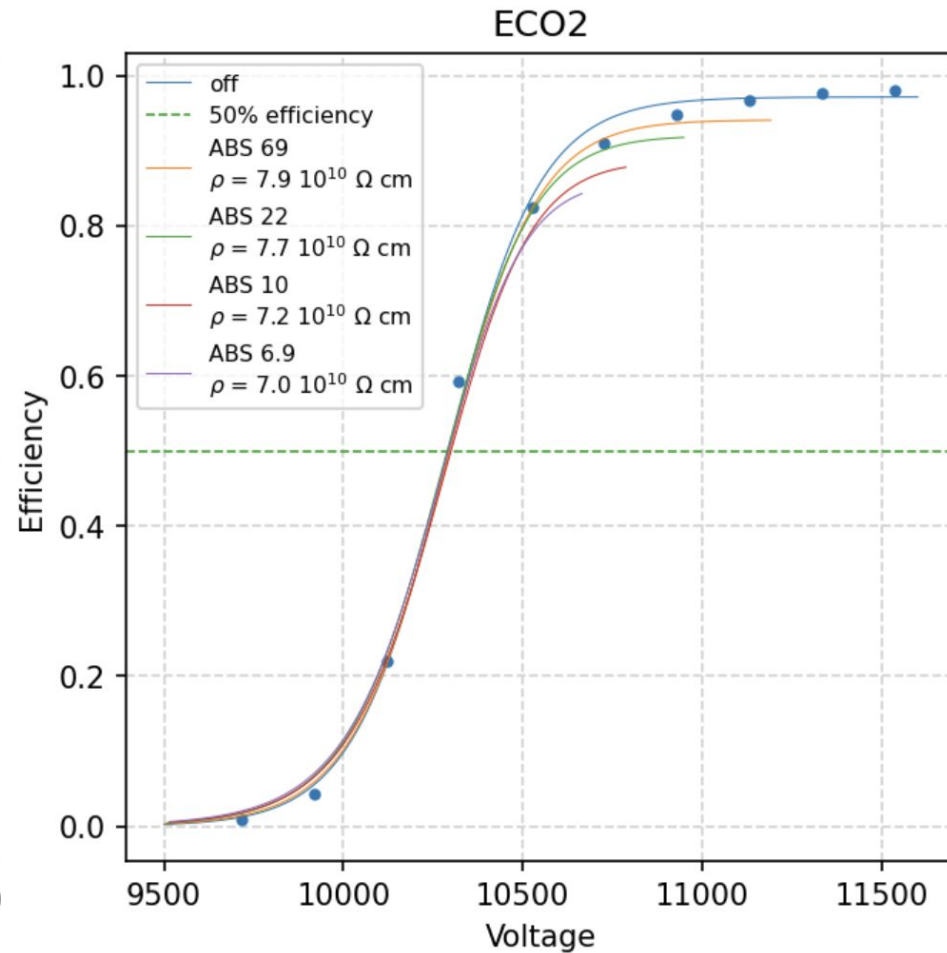
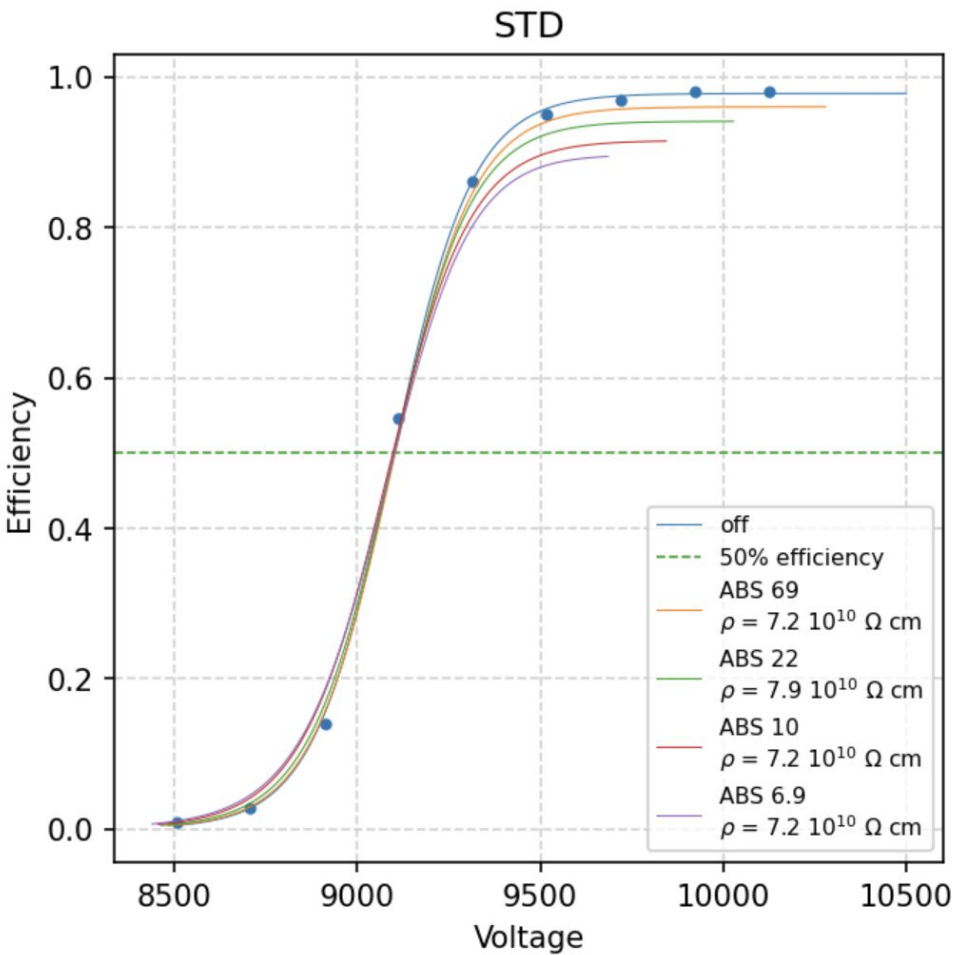
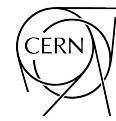


TB resistivity



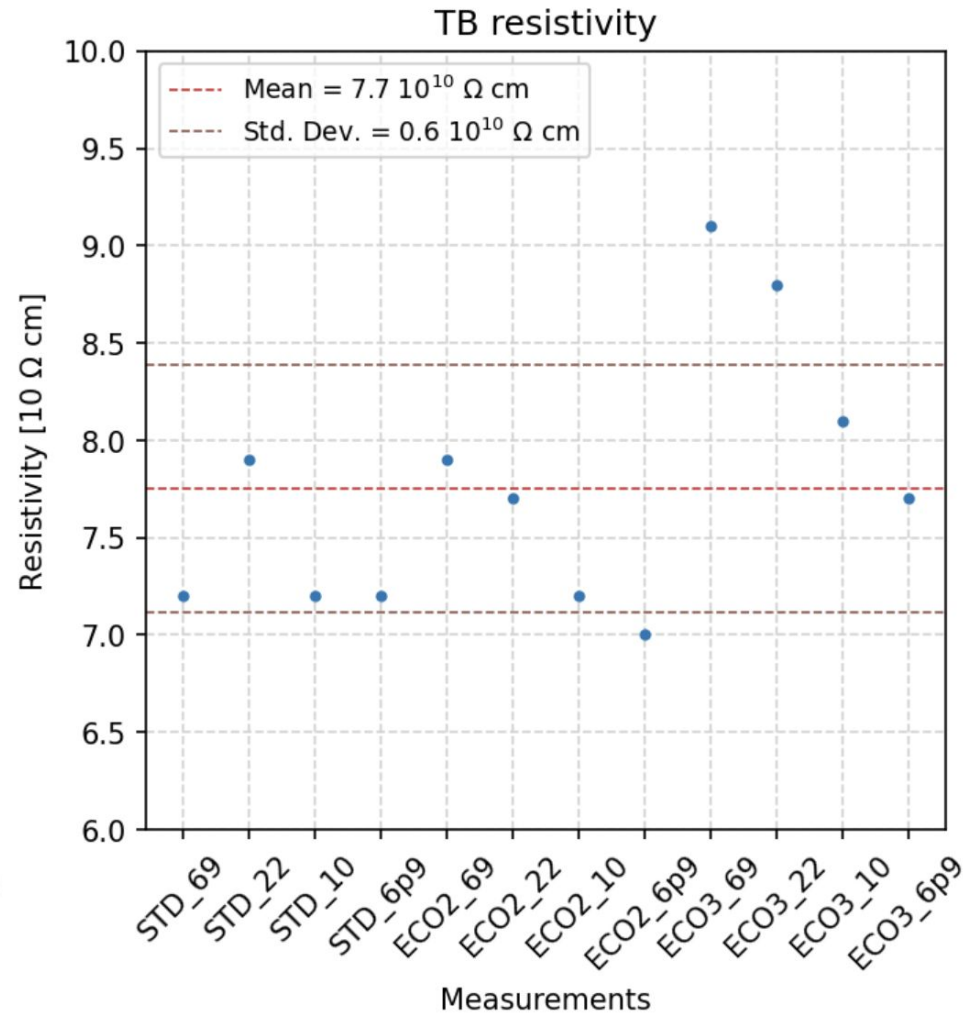
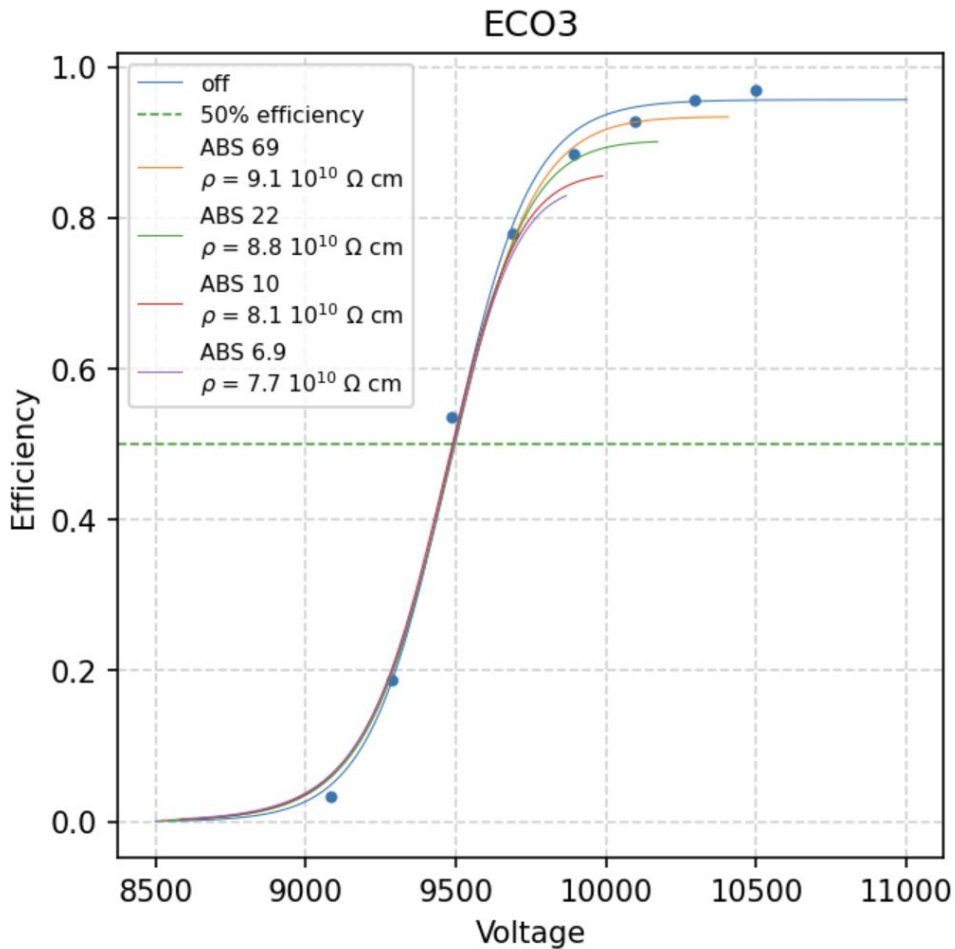
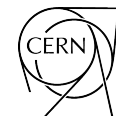
2023/07

2024 TB data resistivity



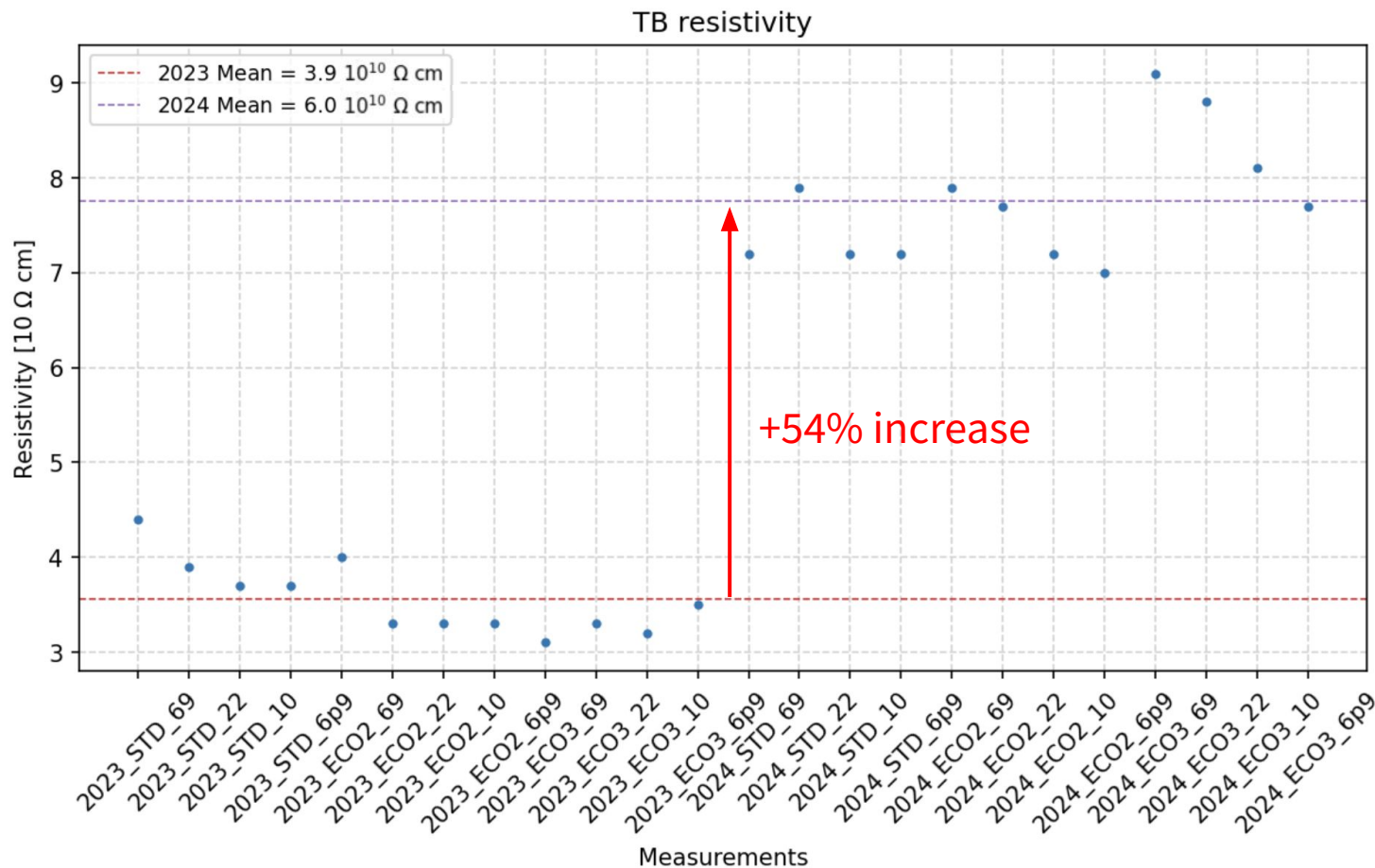
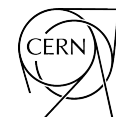
2024/04

2024 TB data resistivity



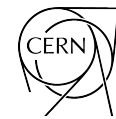
2024/04

Comparison 2023-2024



From TB estimation, 50% increase in the resistivity wrt 2023 data.

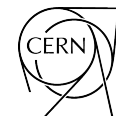
Conclusion



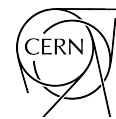
	Ar measurement [$10^{10}\Omega\text{ cm}$]	TB estimation [$10^{10}\Omega\text{ cm}$]	Ar / TB
2023	11.4	3.9	2.9
2024	18.5	6.0	3.0
% 2024 vs 2023	62	54	

- The ratio between the **Ar measurements and the TB estimation** is around 3 for both the years;
- The **increase of resistivity** is between the 54% and 62% between 2023 and 2024.

Backup

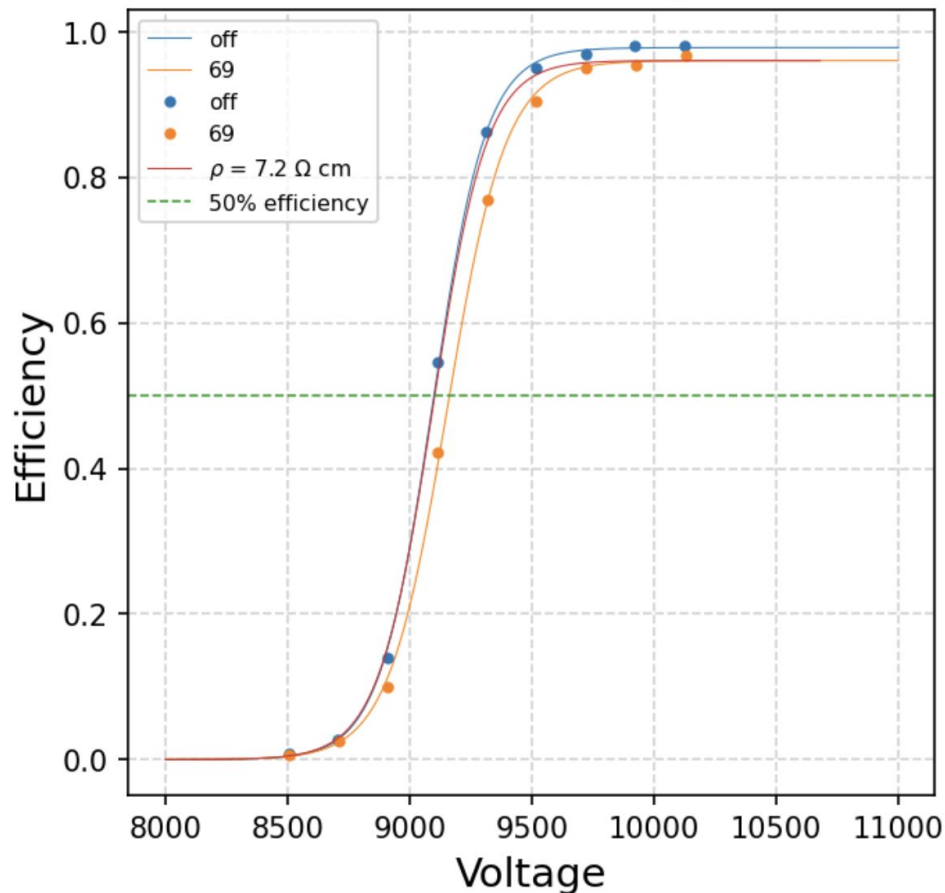


Resistivity from TB data: STD

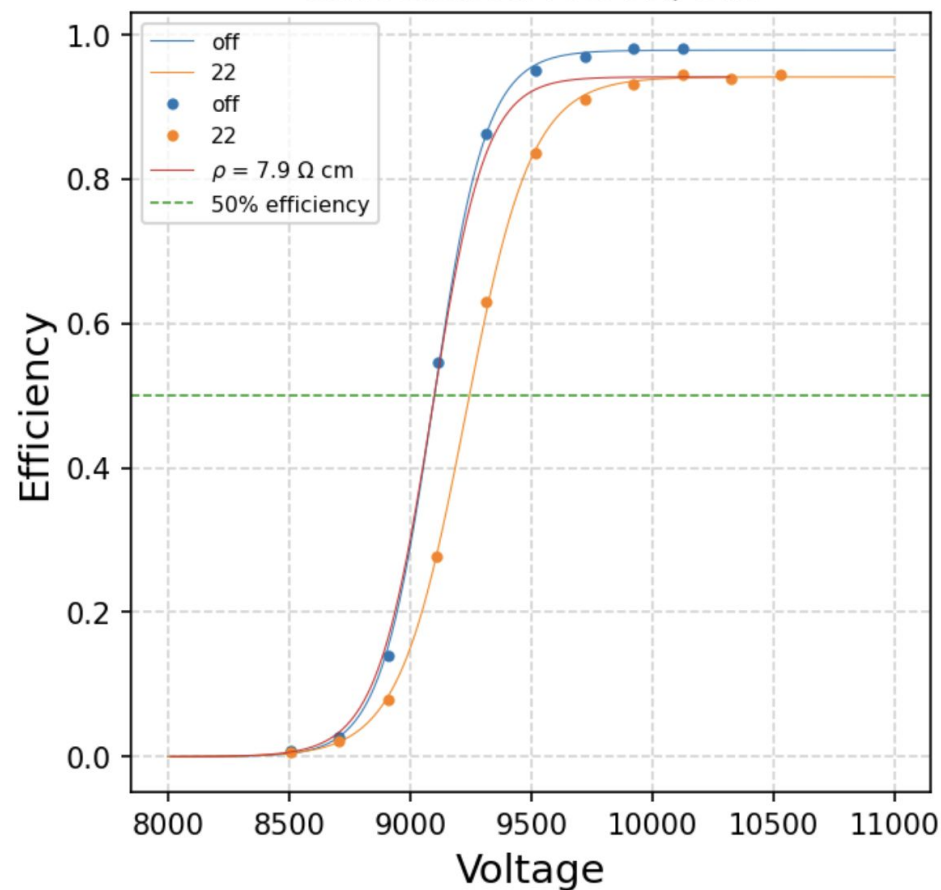


2024/04

Correction for ABS 69, STD



Correction for ABS 22, STD

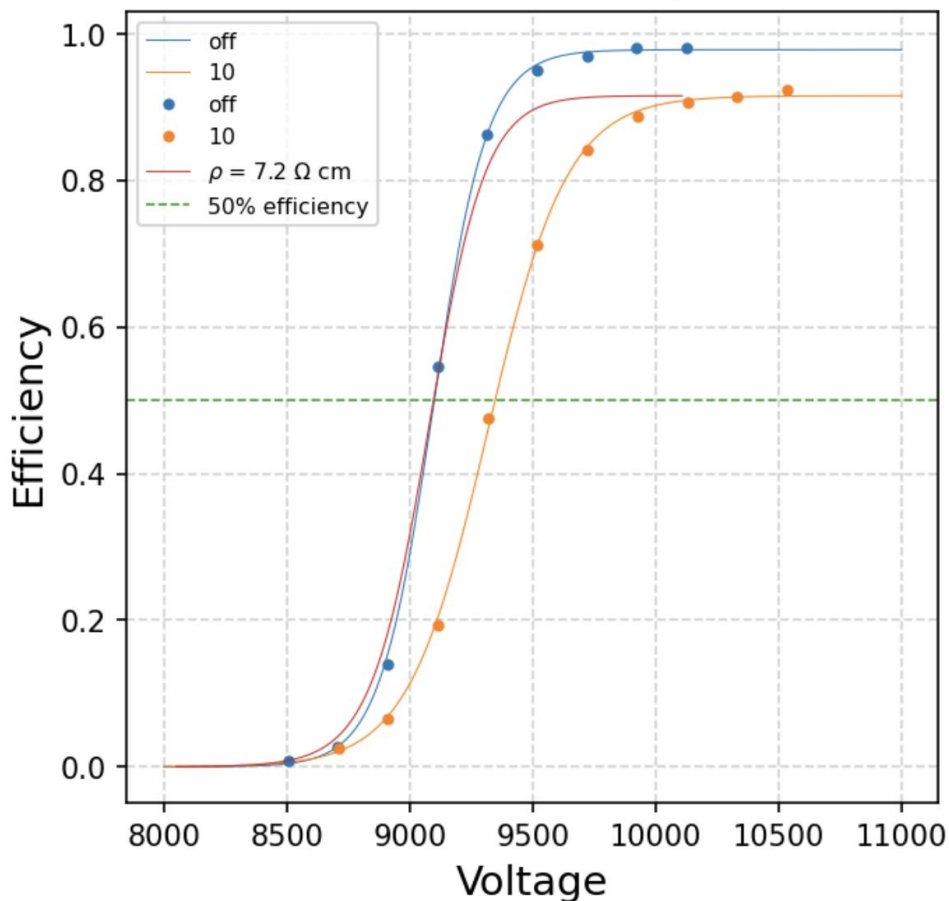


Resistivity from TB data: STD

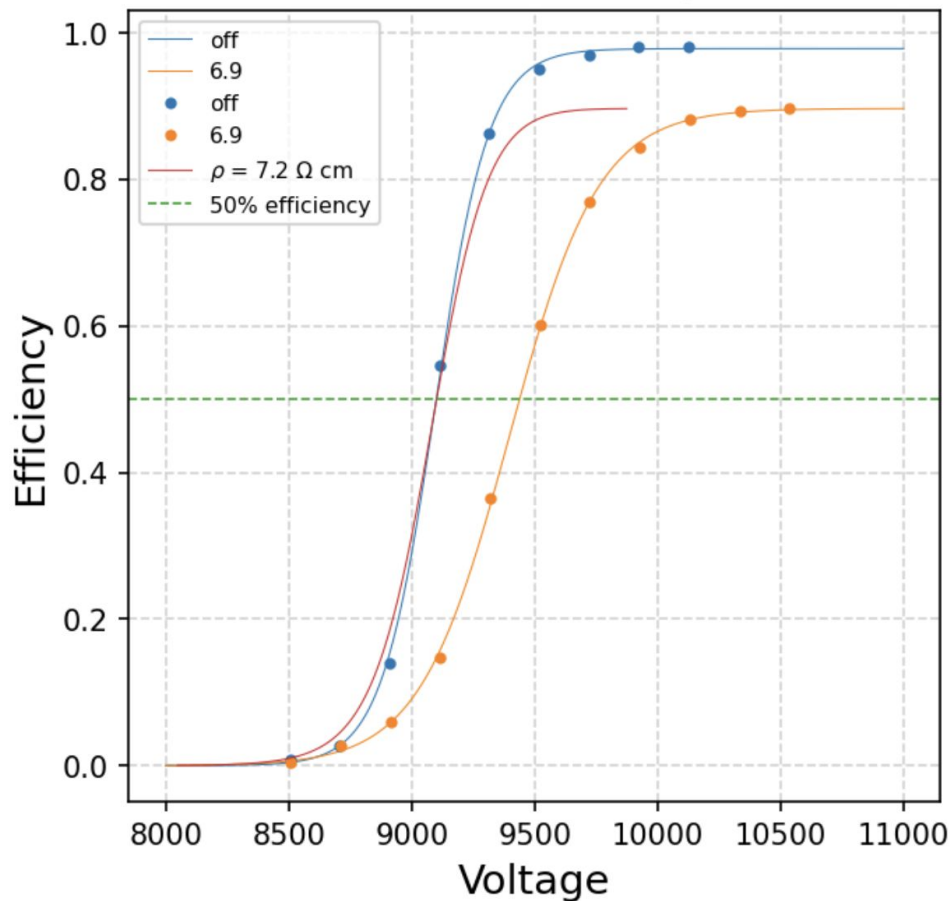


2024/04

Correction for ABS 10, STD



Correction for ABS 6.9, STD

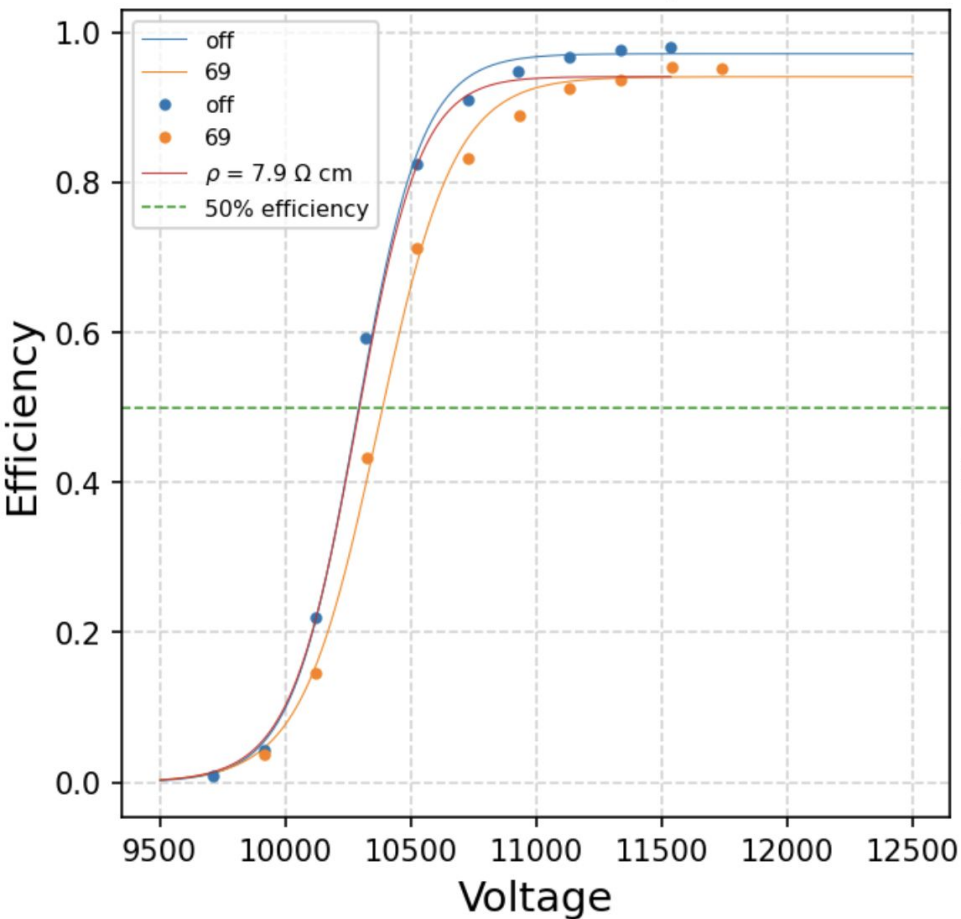


Resistivity from TB data: ECO2

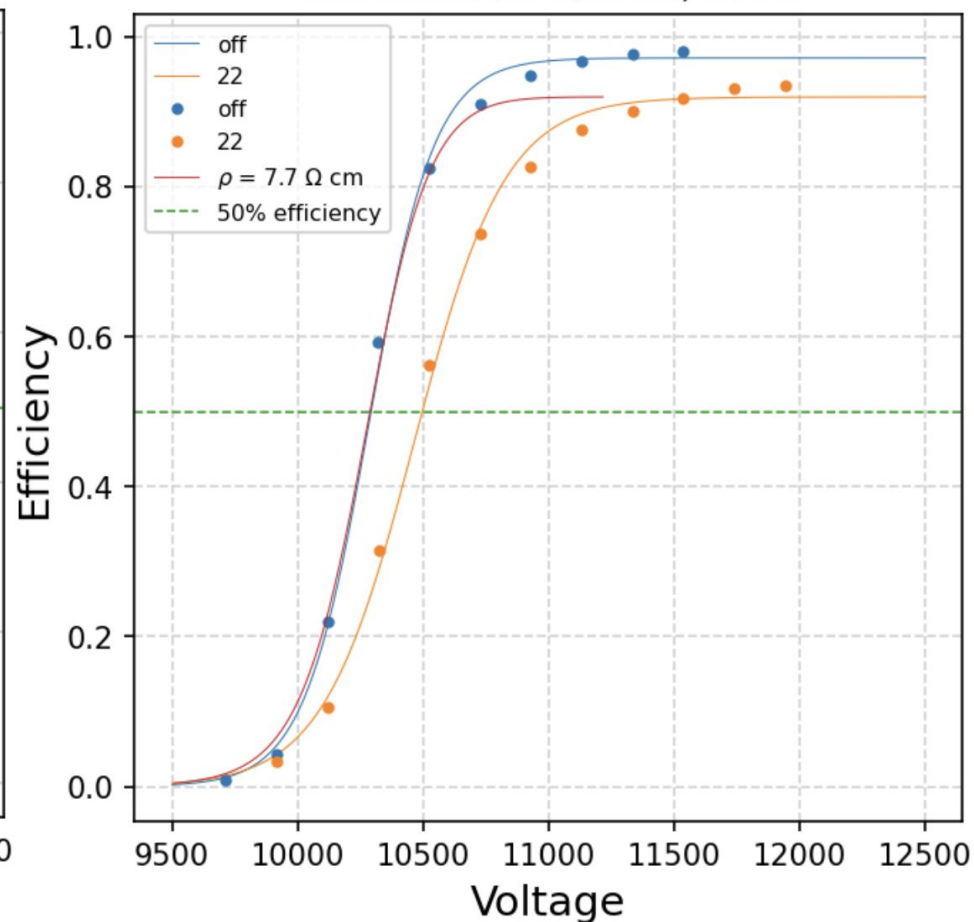


2024/04

Correction for ABS 69, ECO2



Correction for ABS 22, ECO2

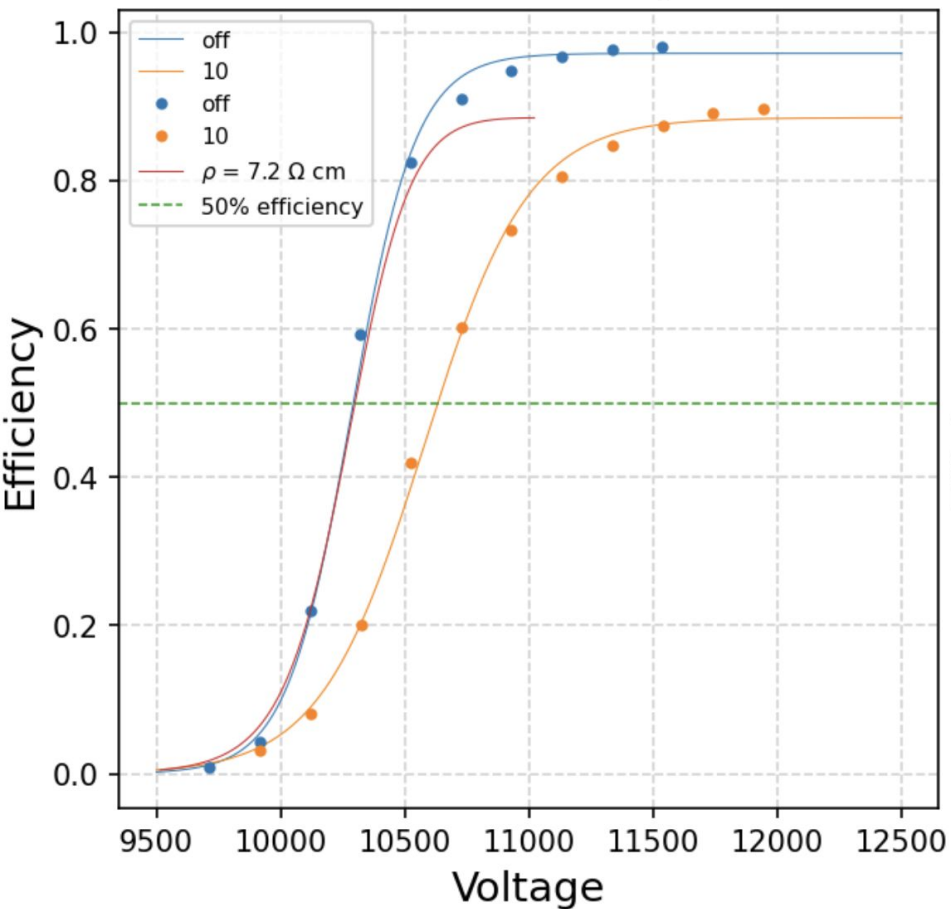


Resistivity from TB data: ECO2

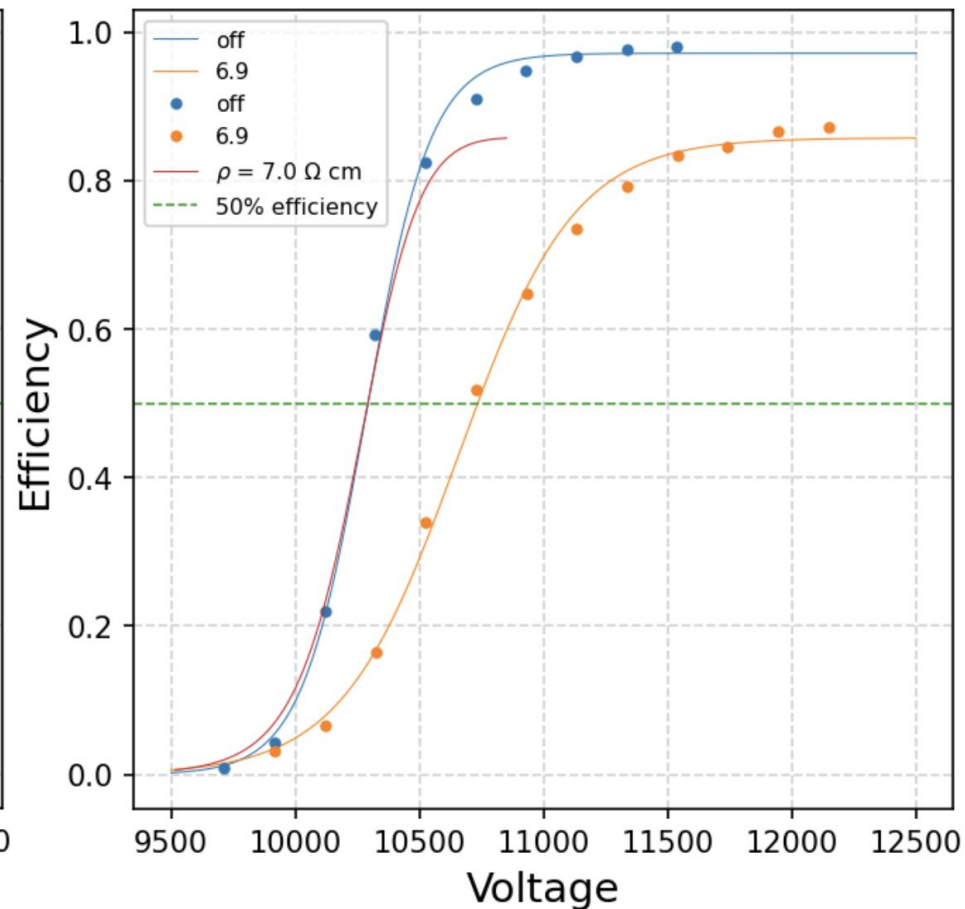


2024/04

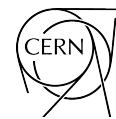
Correction for ABS 10, ECO2



Correction for ABS 6.9, ECO2

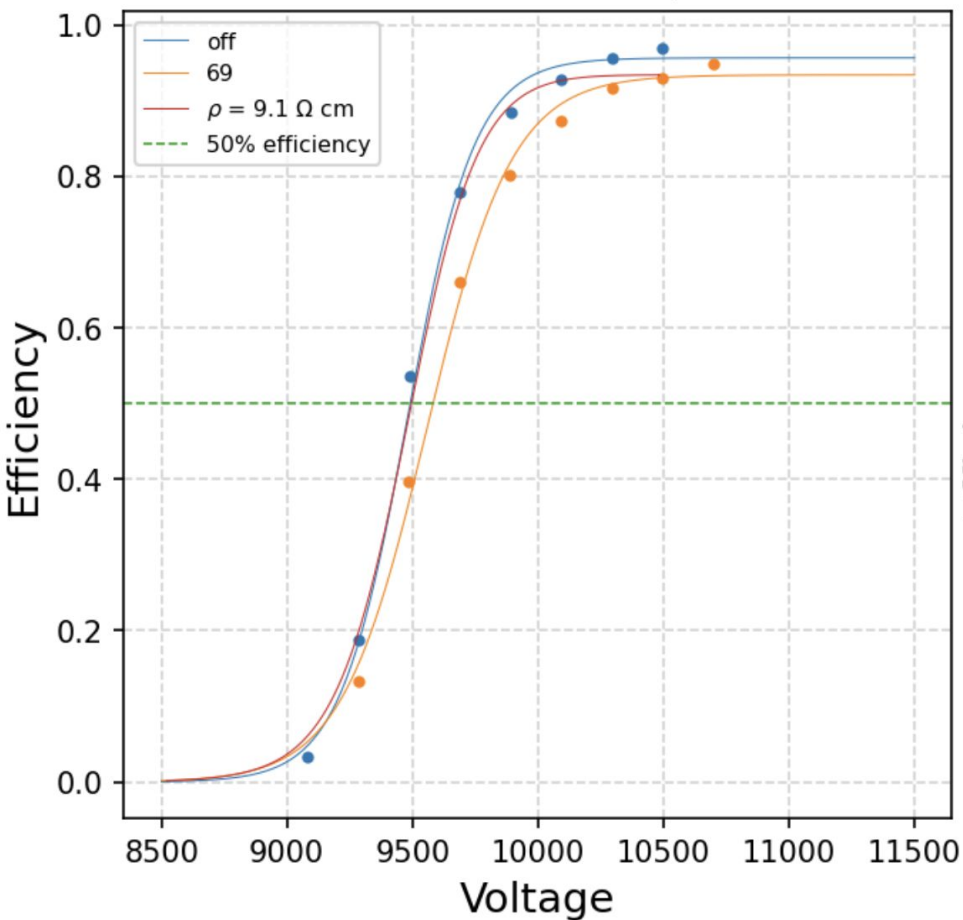


Resistivity from TB data: ECO_3

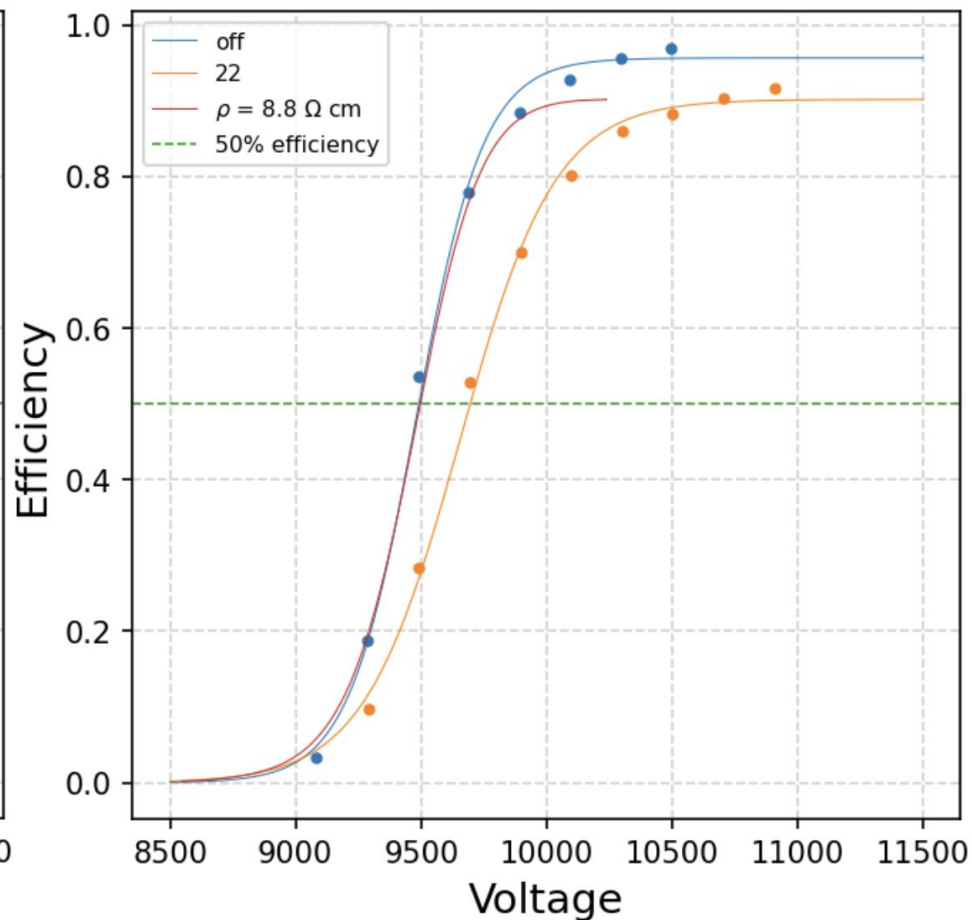


2024/04

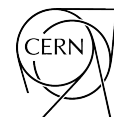
Correction for ABS 69, ECO_3



Correction for ABS 22, ECO_3

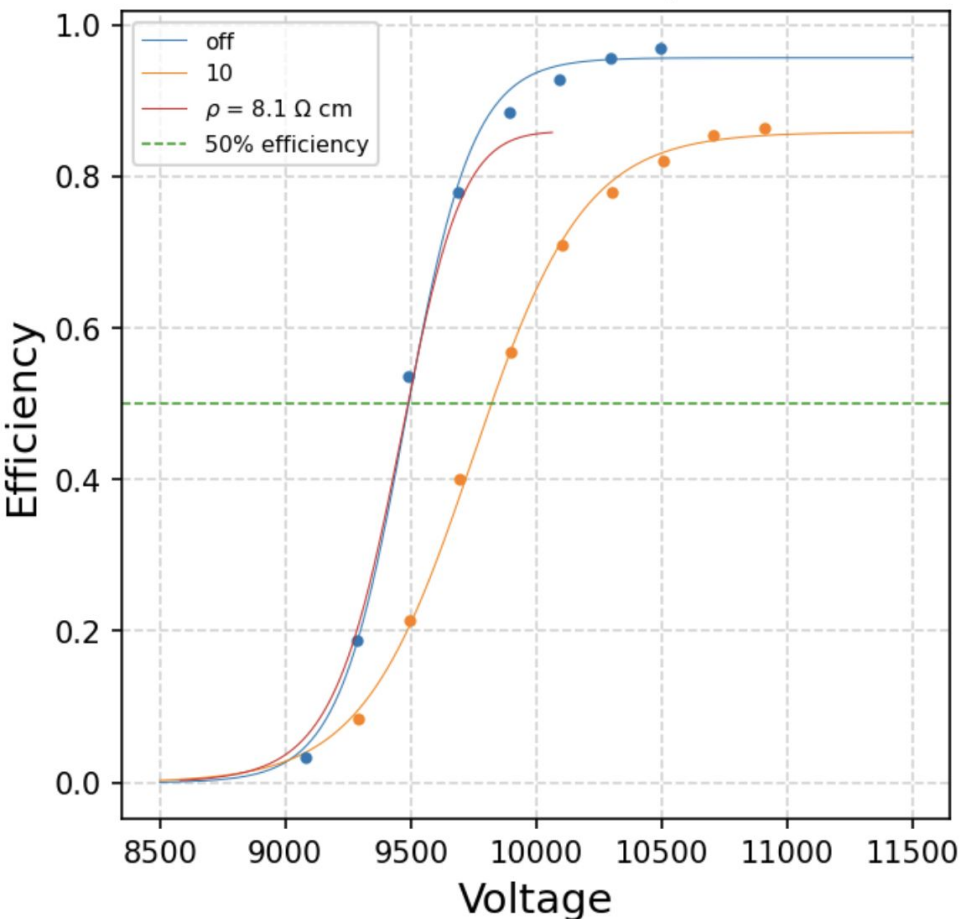


Resistivity from TB data: ECO_3

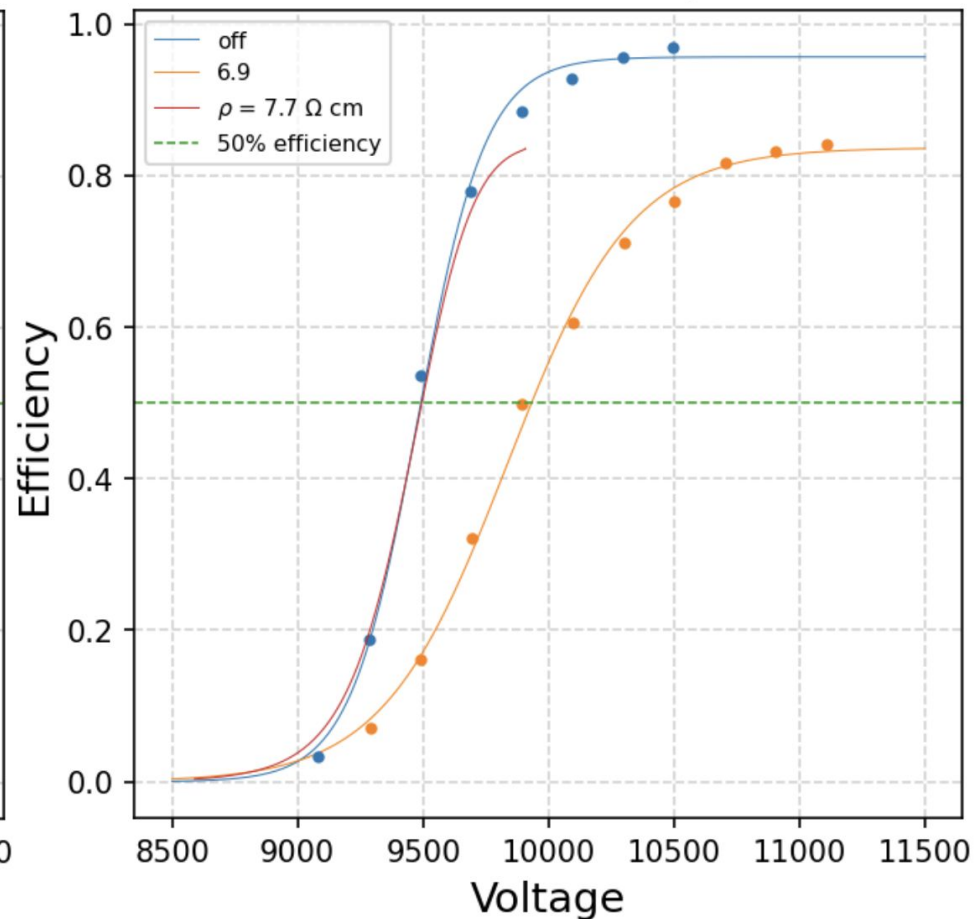


2024/04

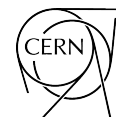
Correction for ABS 10, ECO_3



Correction for ABS 6.9, ECO_3



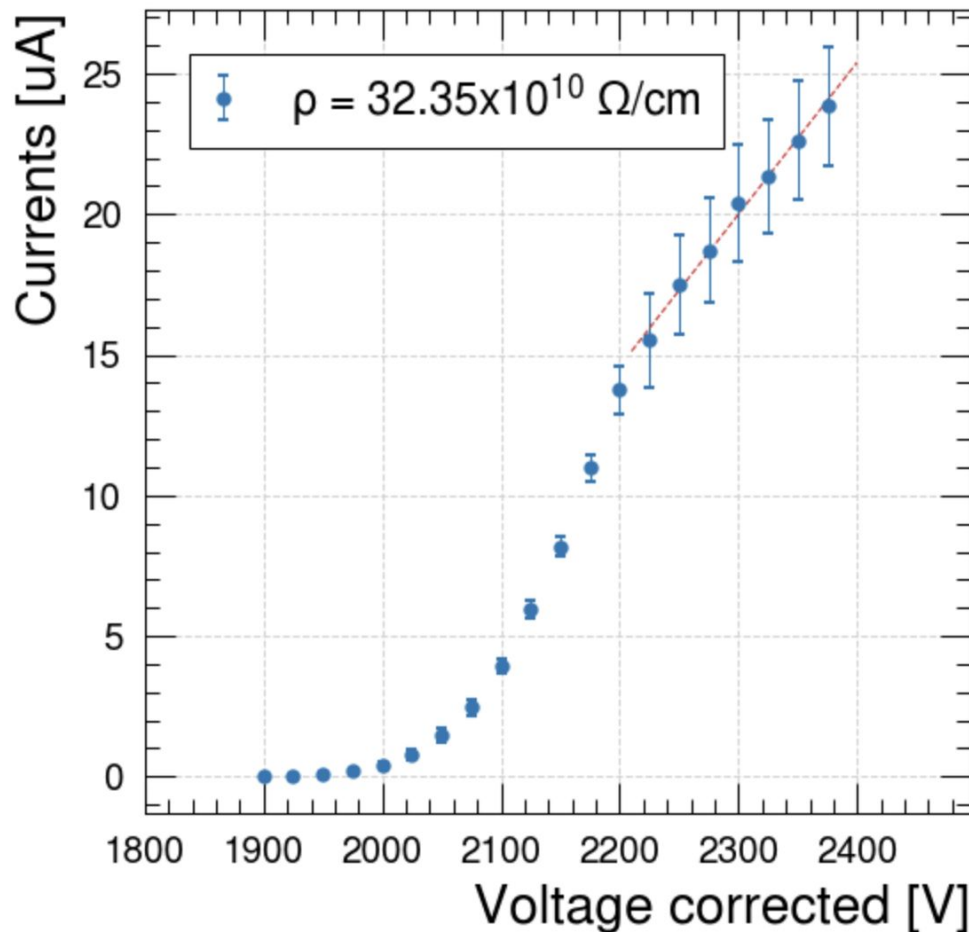
Resistivity scan 2024



2024/05/02

First scan, fit only on the change of shape

RPC 25 Ar scan



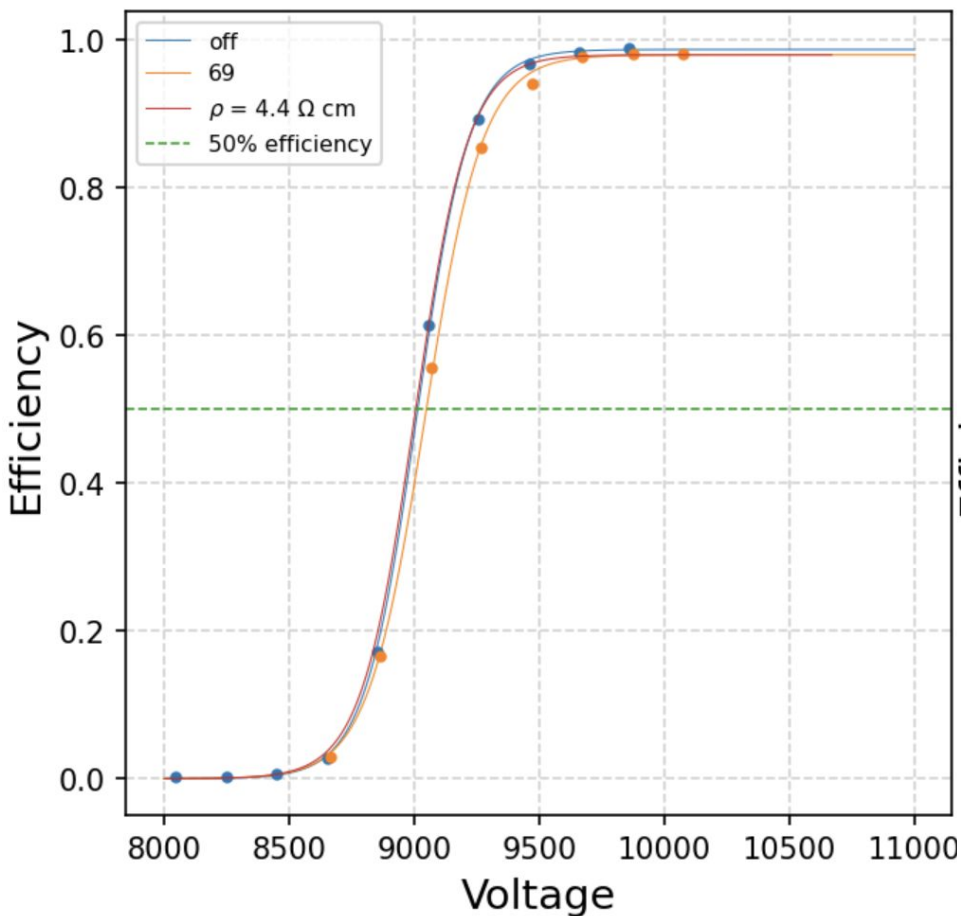
Resistance [Ω]	$(1.84 \pm 0.01) \times 10^7$
Resistivity [Ω/cm]	$(31.28 \pm 0.01) \times 10^{10}$
V switch on [V]	1930 ± 126

Resistivity from TB data: STD

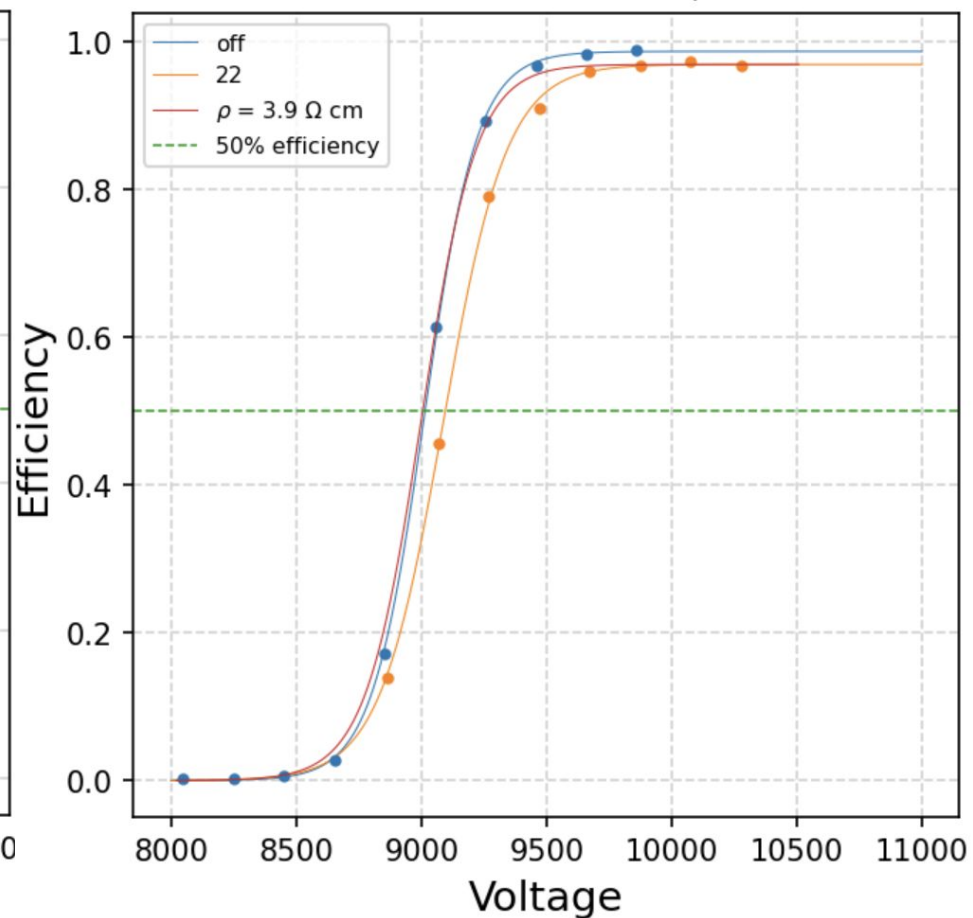
2023/07



Correction for ABS 69, STD

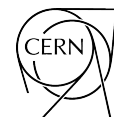


Correction for ABS 22, STD

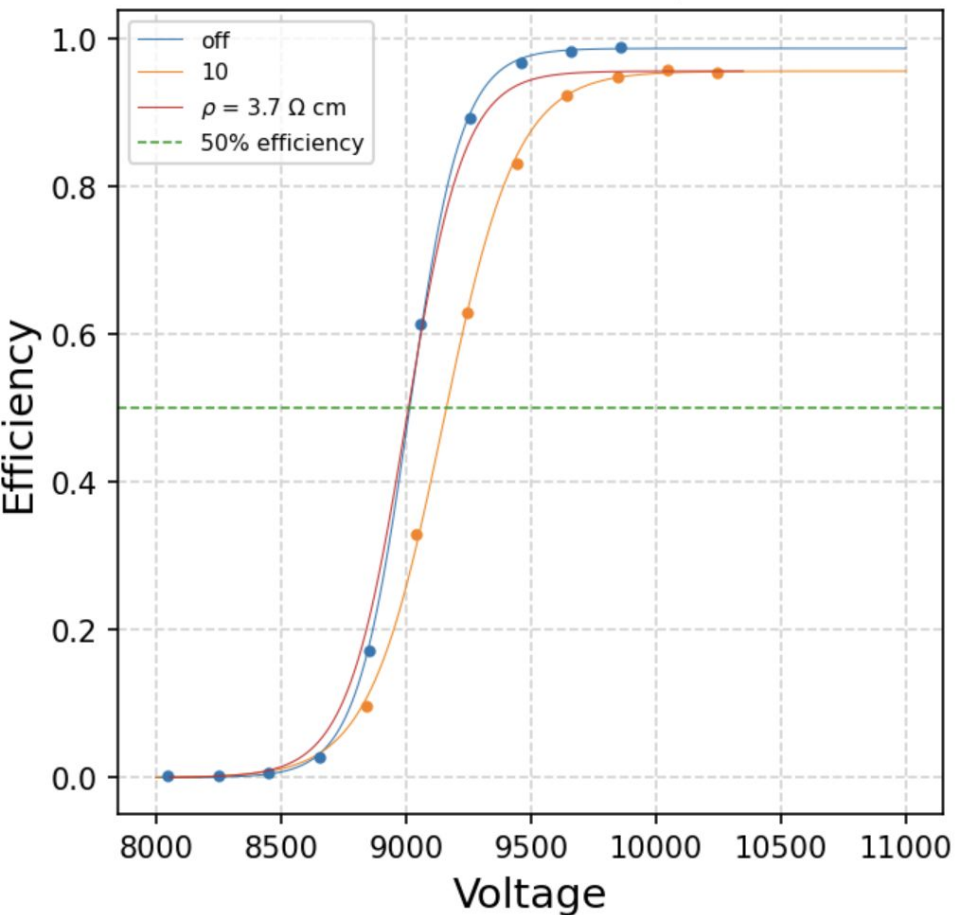


Resistivity from TB data: STD

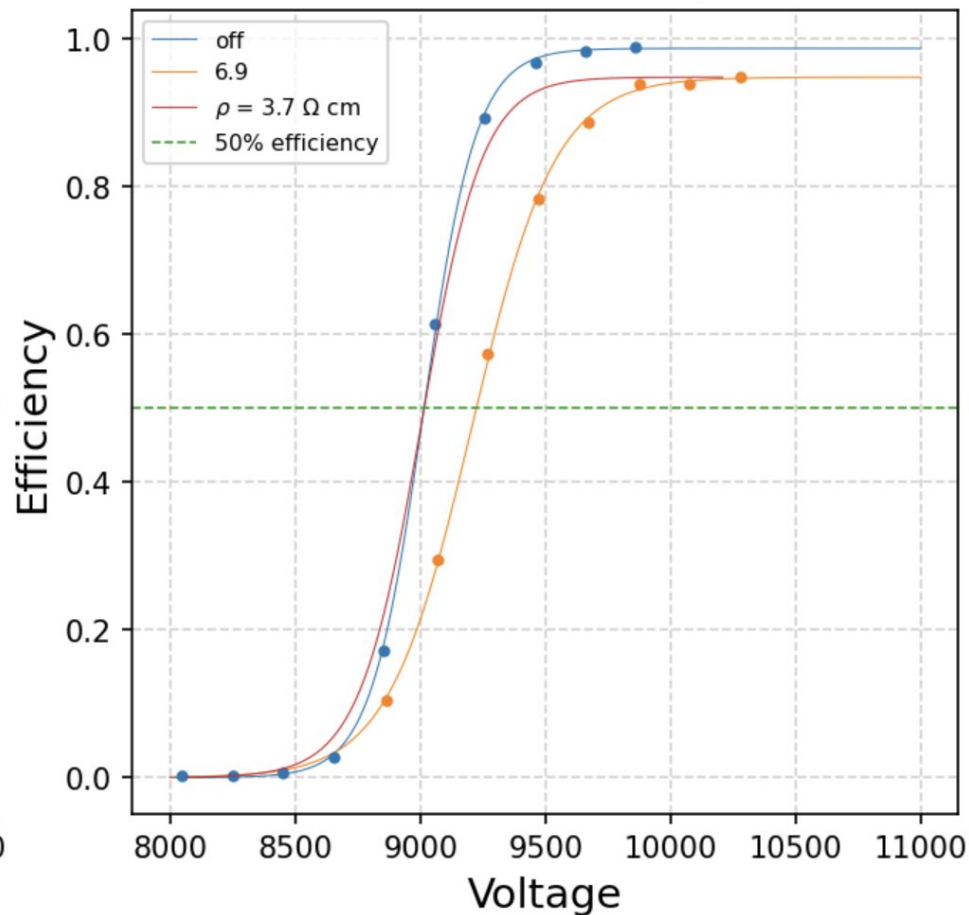
2023/07



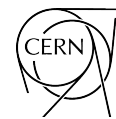
Correction for ABS 10, STD



Correction for ABS 6.9, STD

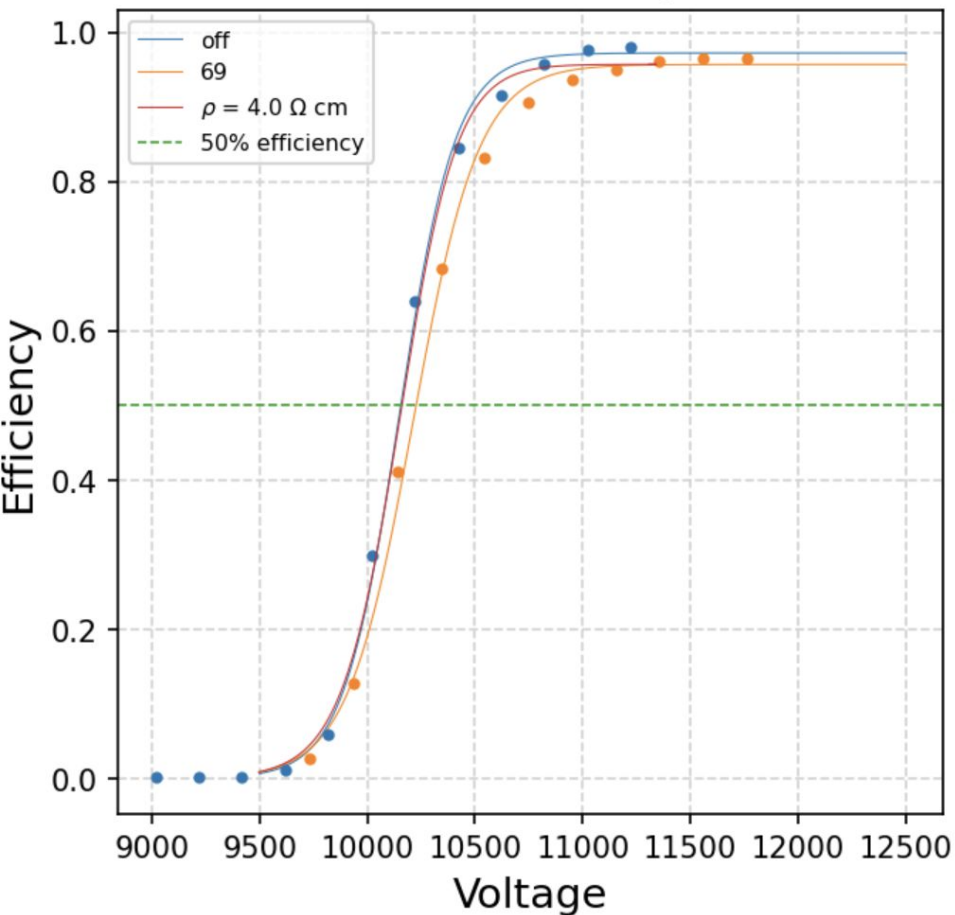


Resistivity from TB data: ECO2

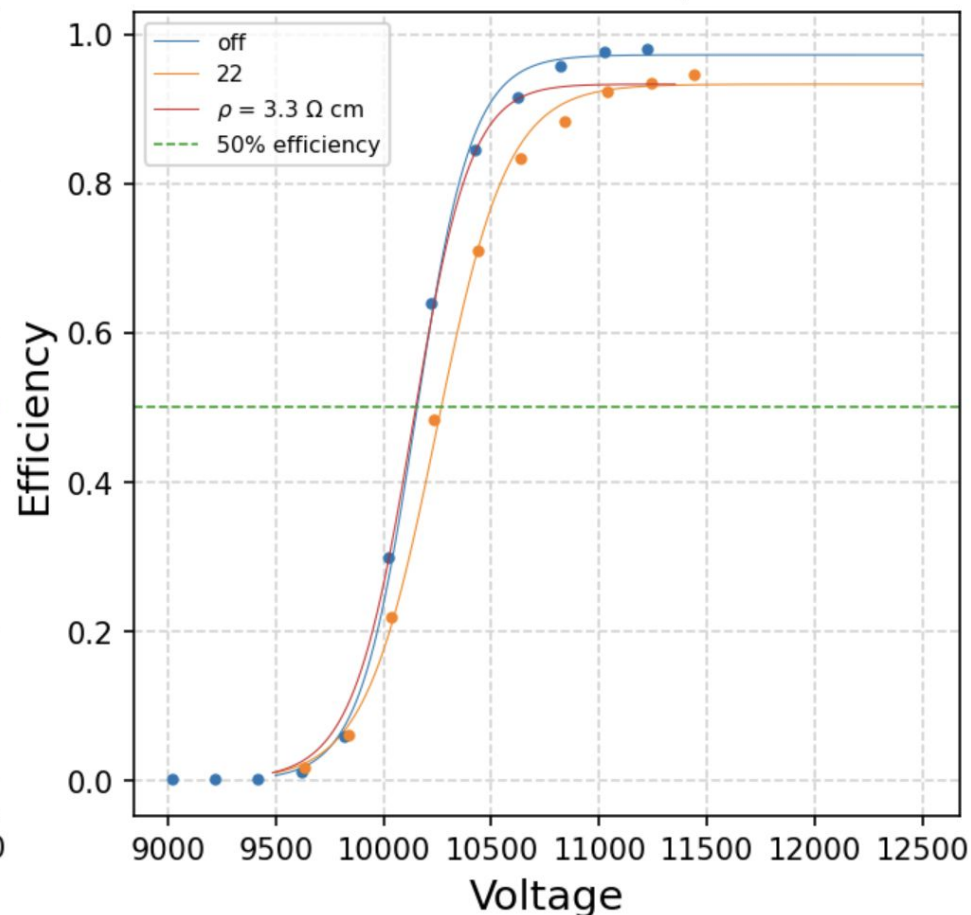


2023/07

Correction for ABS 69, ECO2

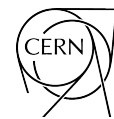


Correction for ABS 22, ECO2

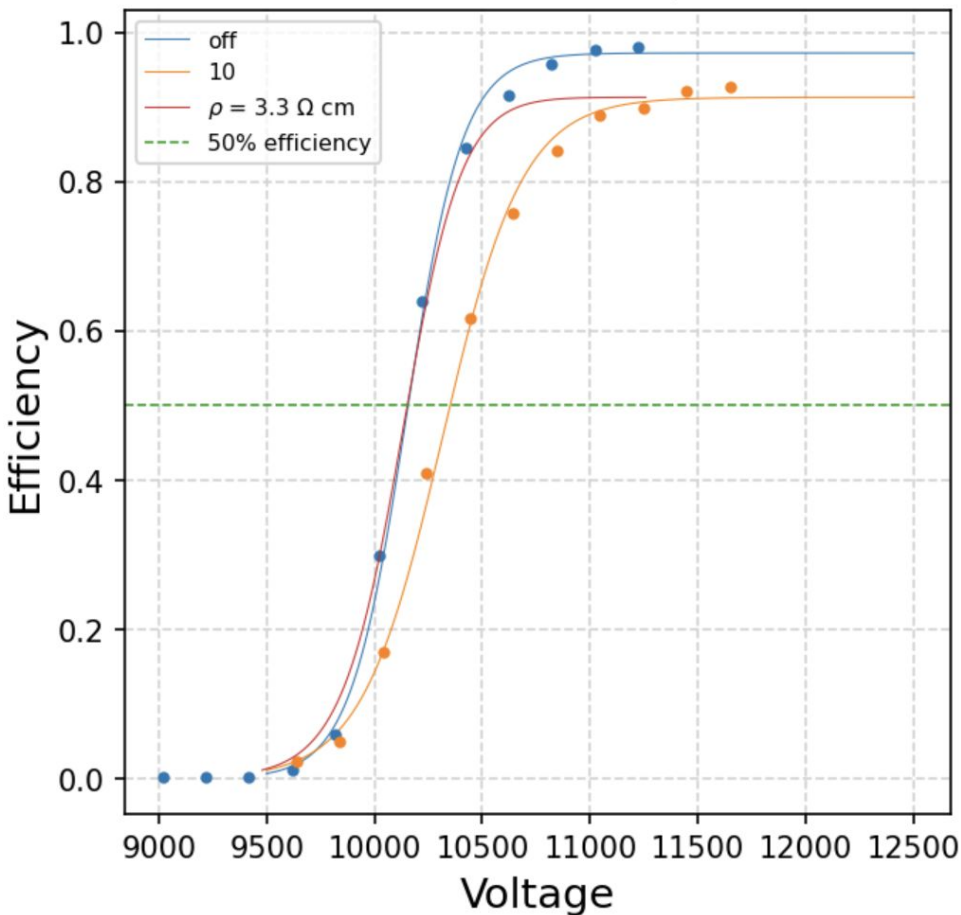


Resistivity from TB data: ECO2

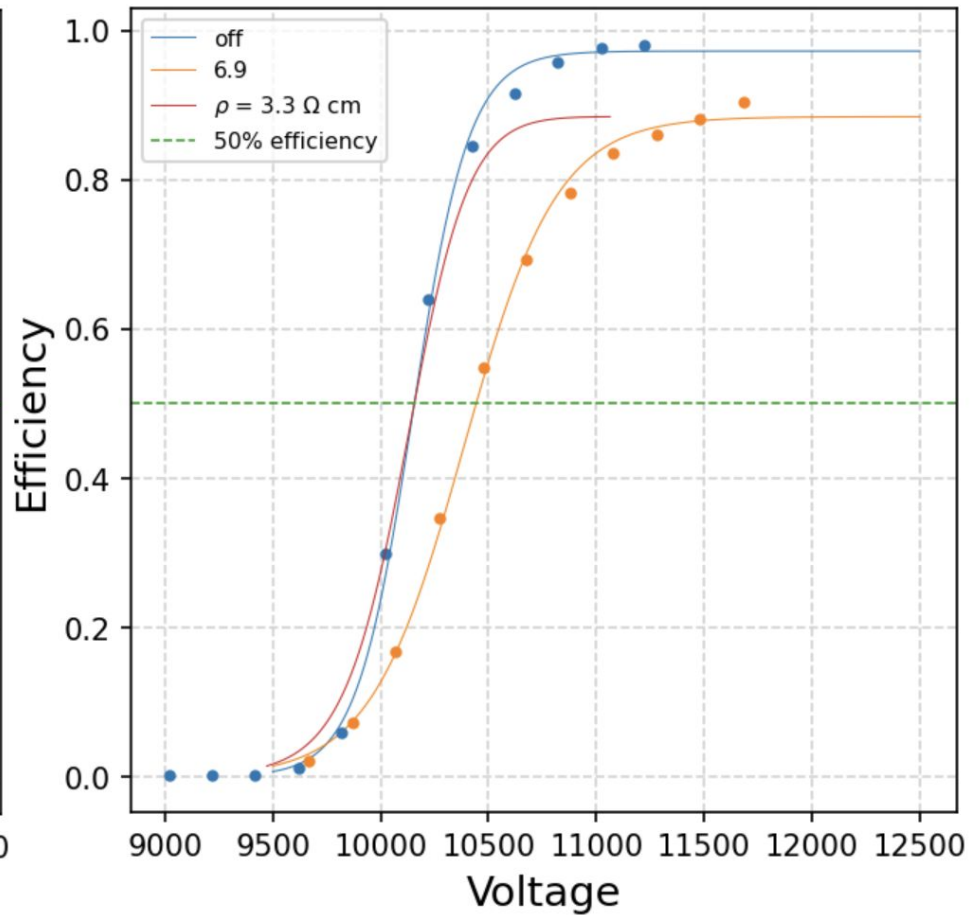
2023/07



Correction for ABS 10, ECO2



Correction for ABS 6.9, ECO2

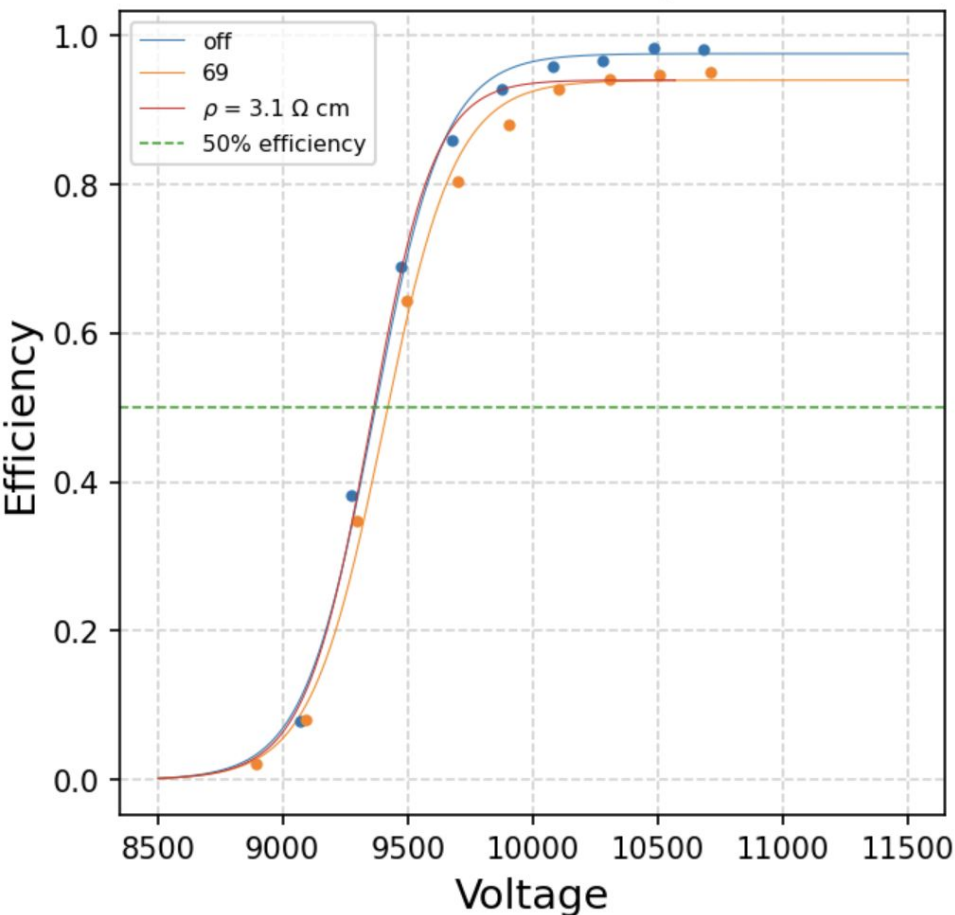


Resistivity from TB data: ECO_3

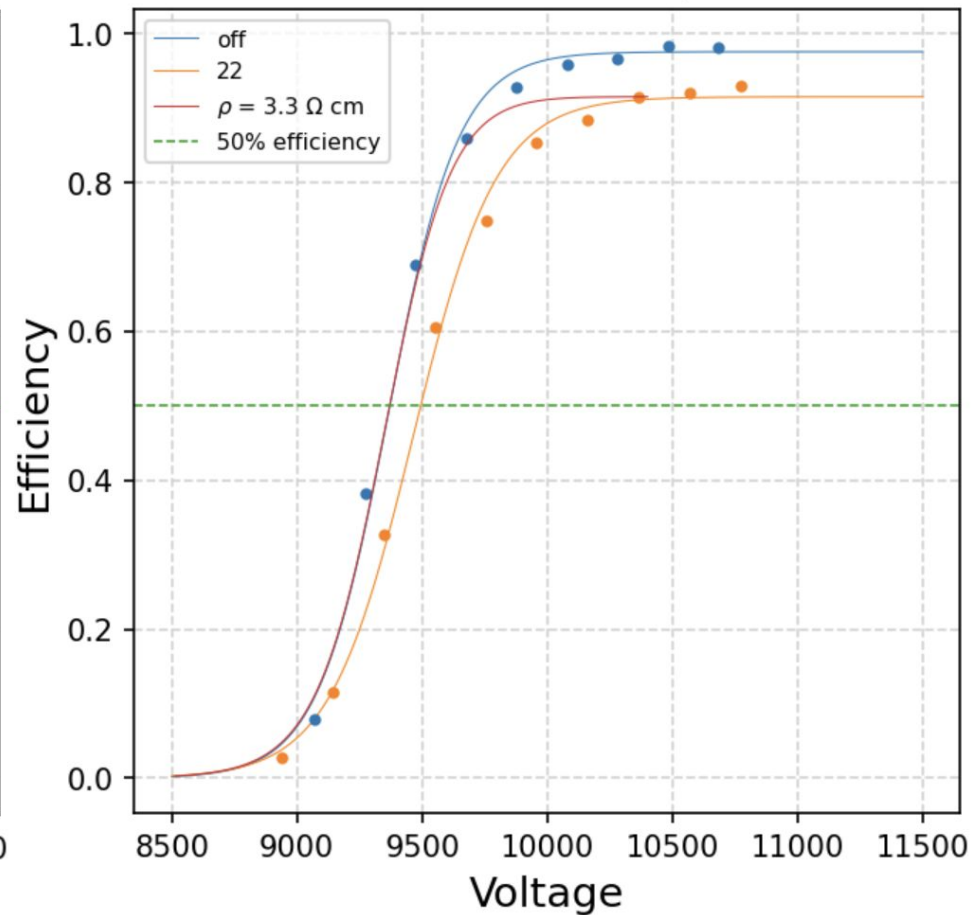
2023/07



Correction for ABS 69, ECO_3

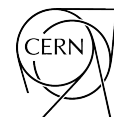


Correction for ABS 22, ECO_3

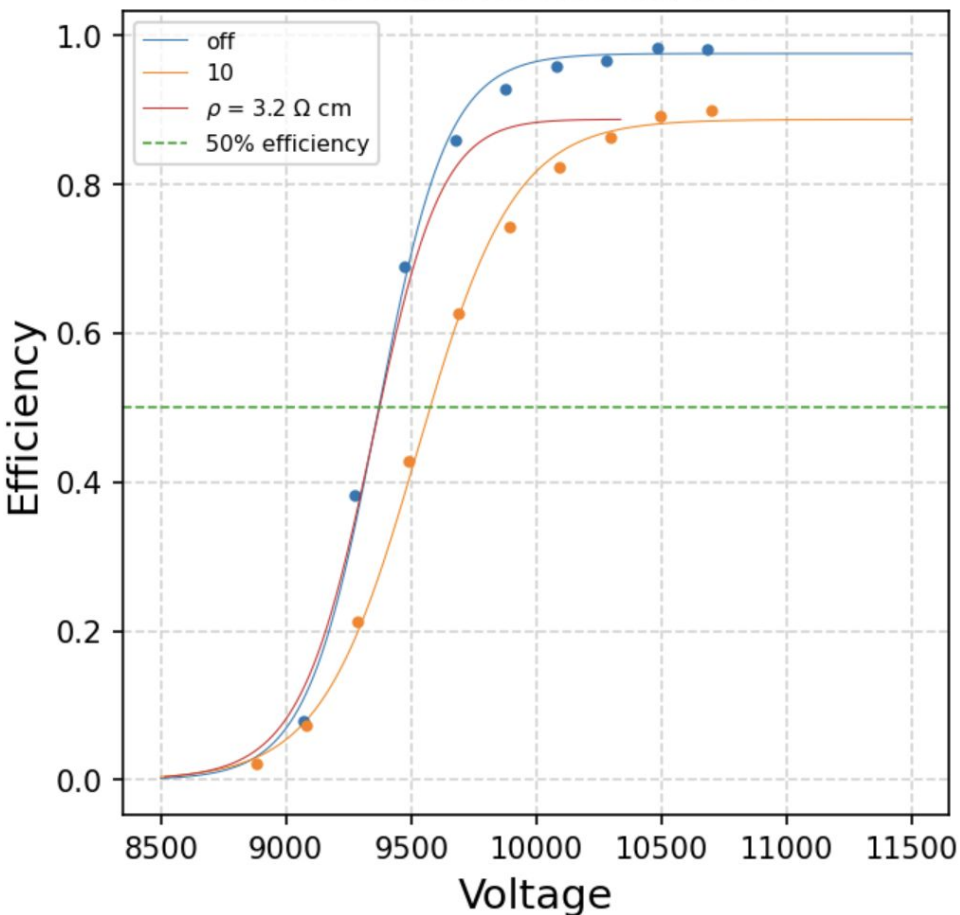


Resistivity from TB data: ECO_3

2023/07



Correction for ABS 10, ECO_3



Correction for ABS 6.9, ECO_3

