EEE
Extreme Energy Events

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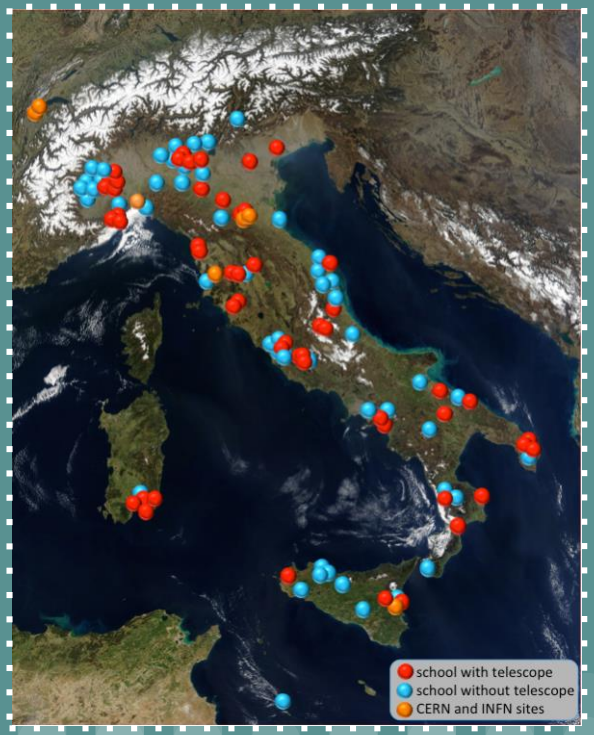
What is the EEE project?

A cosmic ray experiment to detect muons from outer space in order to search for their origin

It takes place in ~50 Italian schools



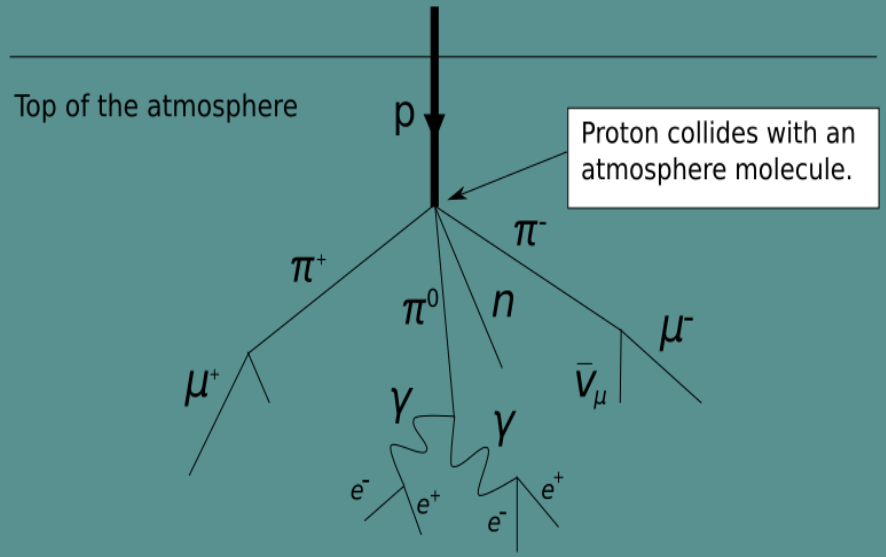
Background

- At first people believed that all radiation originated from the ground

- In 1912, Victor Hess conducted an experiment that proved them wrong

What are cosmic rays?

- High energy-radiation
- Mainly originating outside of the solar system, even from distant galaxies
- Produces showers of secondary particles:
  - positrons
  - electrons
  - photons
  - muons
  - and more...



What we did

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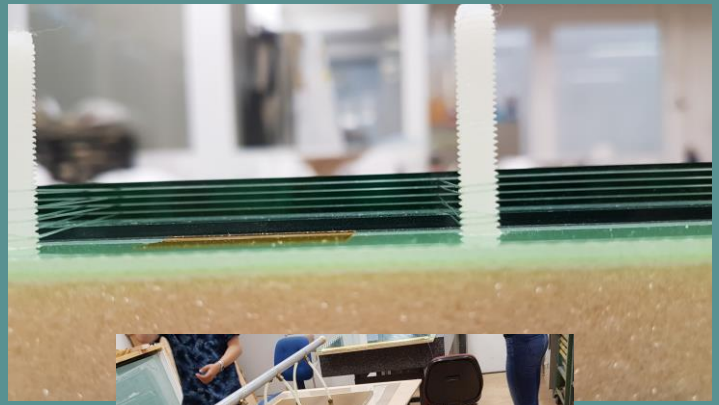

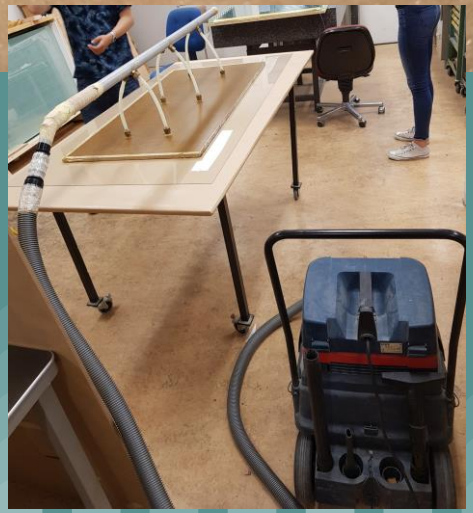

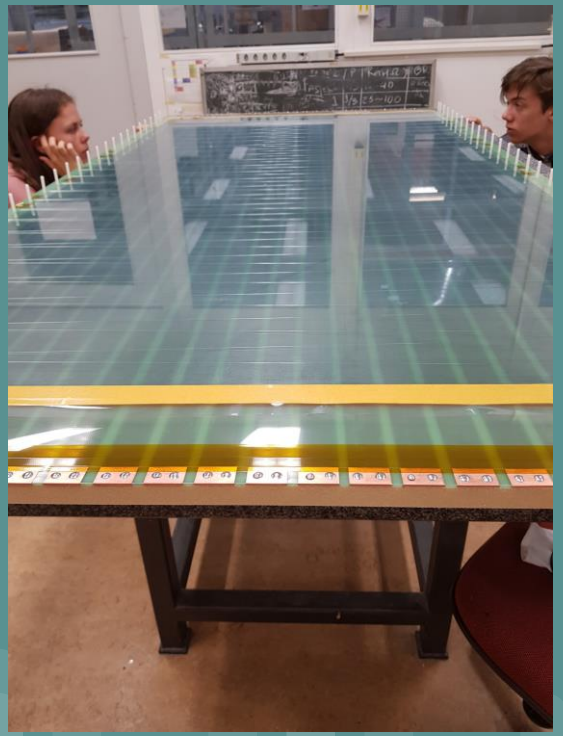

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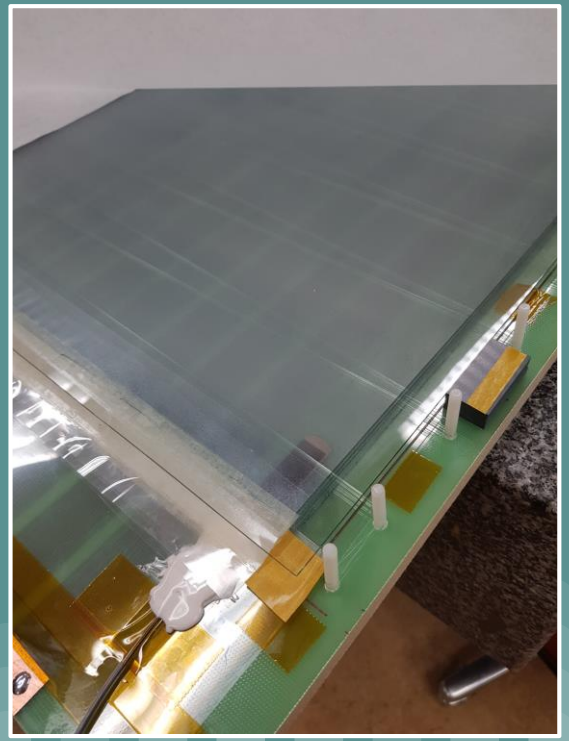

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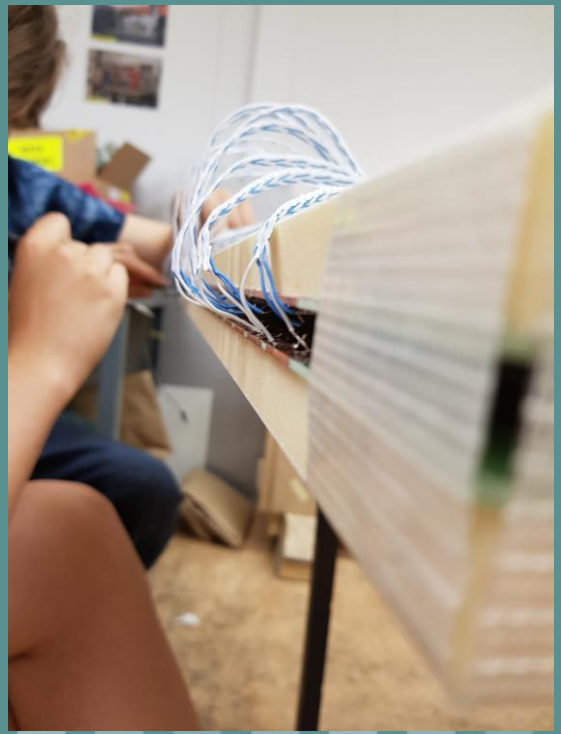

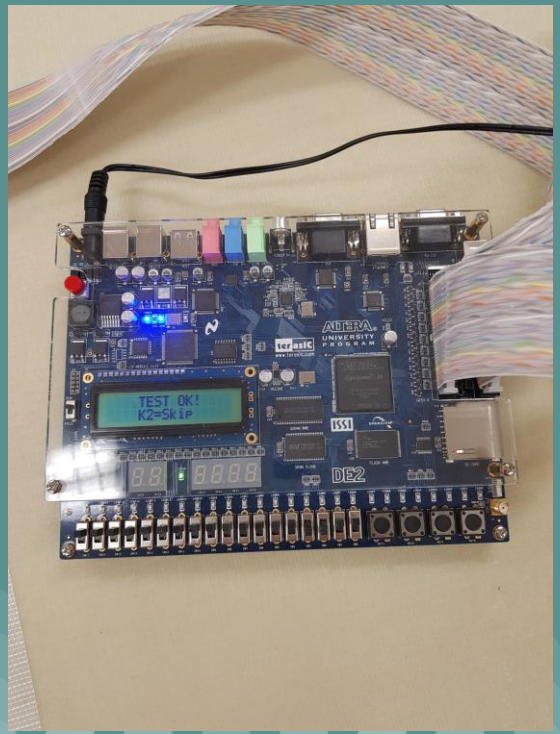

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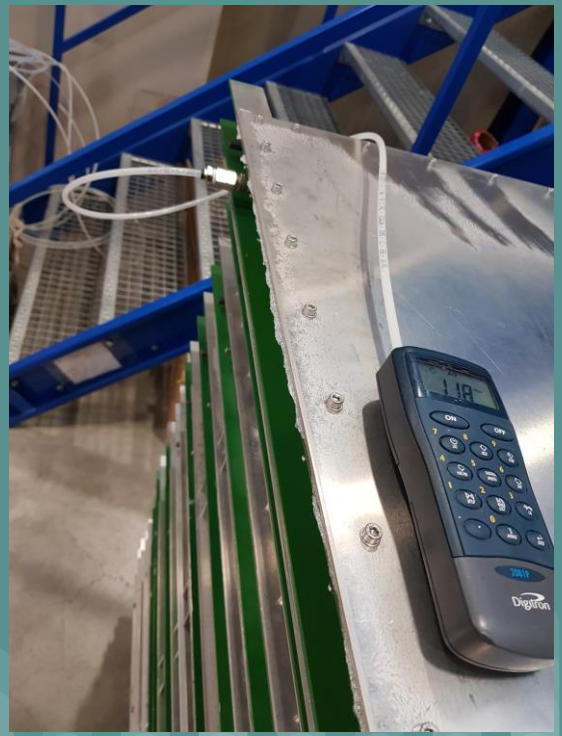
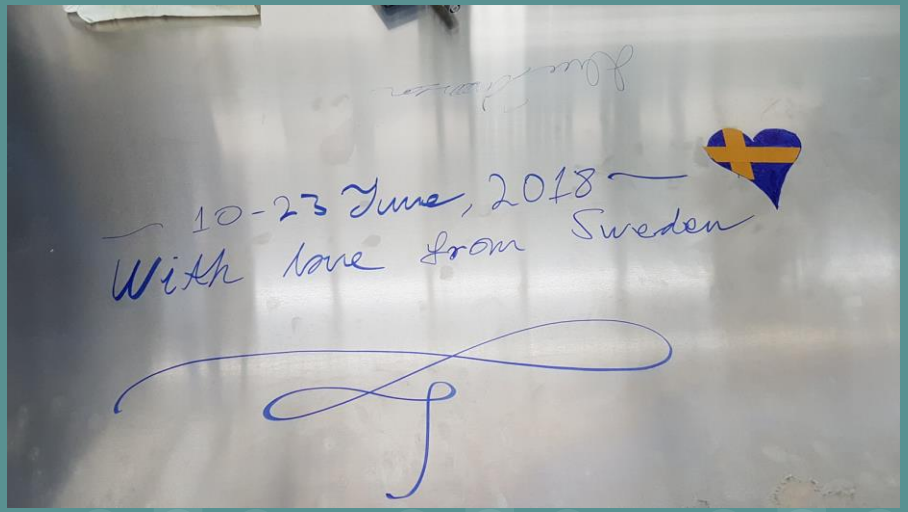
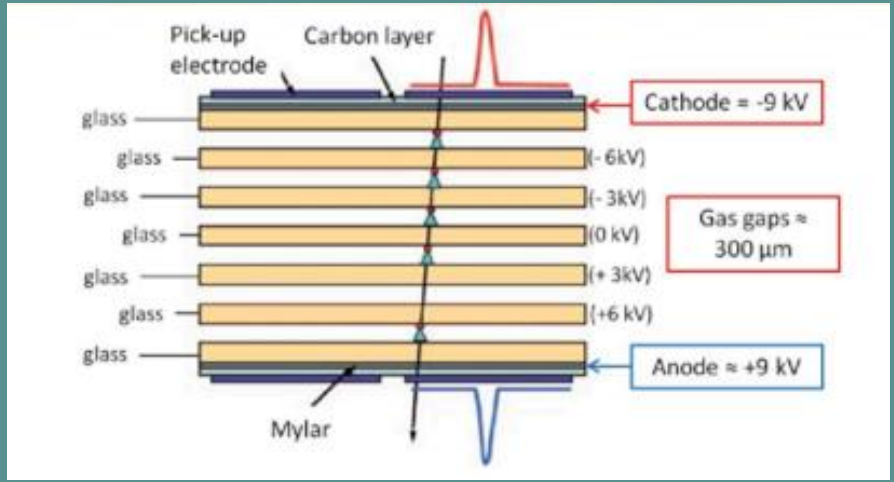




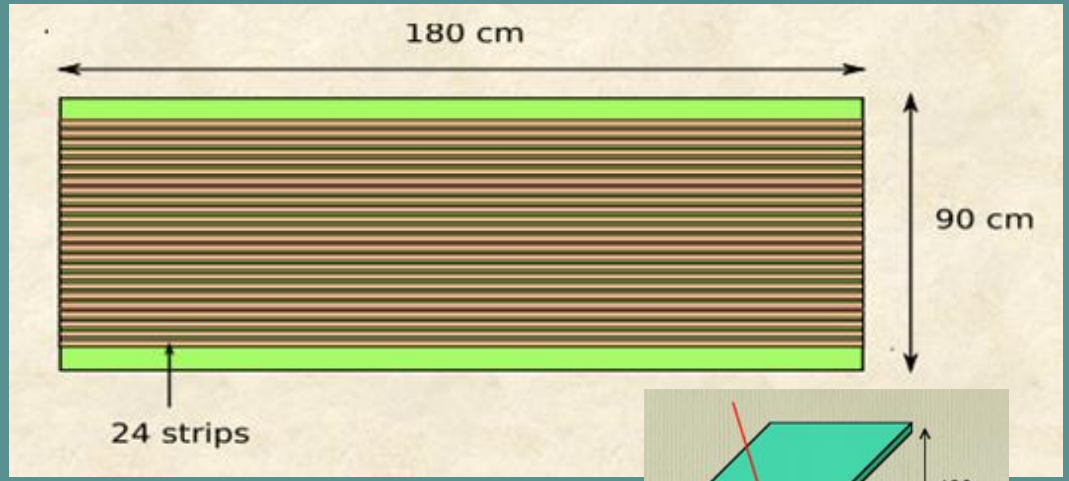
How a muon chamber works

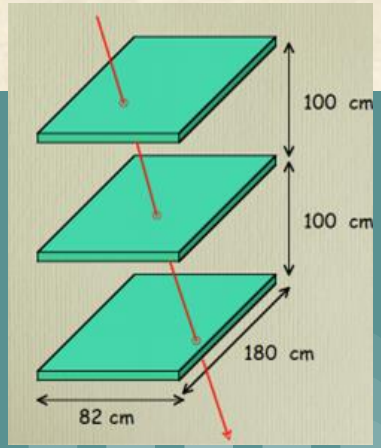
- The high energy muons hit the chamber and ionize the gas in the gaps
- The movement of the electrons creates avalanches
- As charges move inside the chamber, the disruption of the electric field is registered by the copper strips



How a muon chamber works

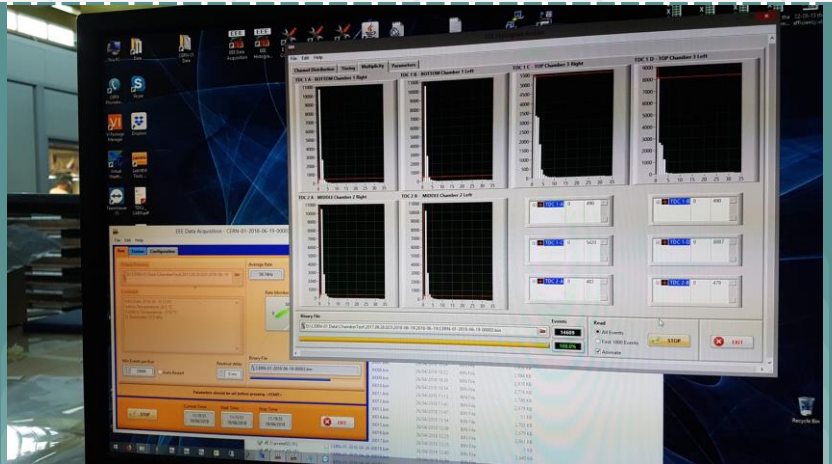
- The location of the hit is recognized by the difference of the times, which it takes for the signal to reach each side of the chamber, as well as which strip has been hit





The Results

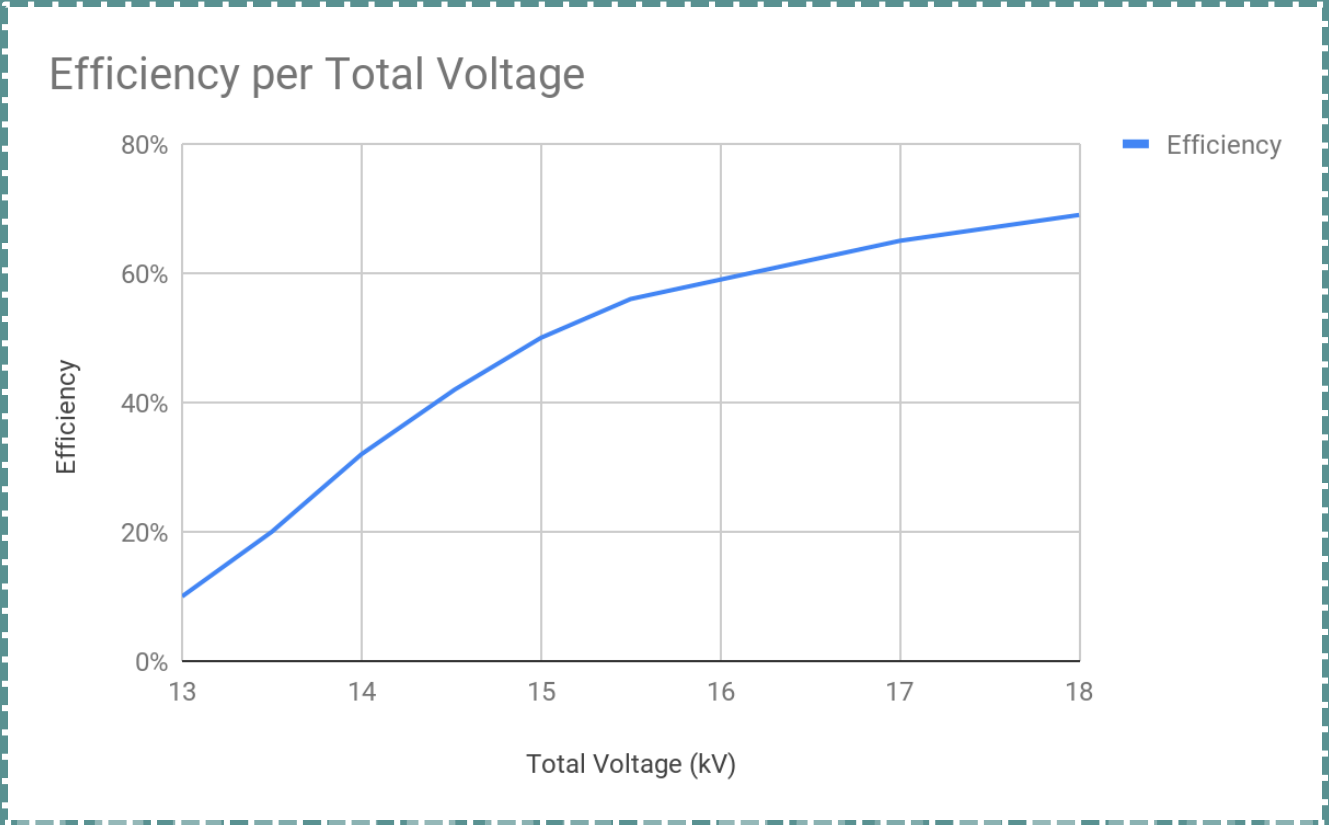
(+)High Voltage (	(-)High Voltage (I	Total Voltage (kV	(+) Current (µA)	(-) Current (µA)	(N) Events	(N) Real	(N) Top-(0 hits)	Inefficiency	Efficiency
6,5	6,5	13	0,63	0,64	20002	20002-653	18100-653	90%	10%
6,75	6,75	13,5	0,65	0,69	20000	20000-661	16150-661	80%	20%
7	7	14	0,68	0,73	20000	20000-662	13900-662	68%	32%
7,07	7,45	14,52	0,7	0,72	20084	20084-660	12000-660	58%	42%
7,5	7,5	15	0,77	0,8	20000	20000-665	10400-665	50%	50%
7,75	7,75	15,5	0,82	0,93	20000	20000-669	9250-669	44%	56%
8	8	16	0,94	1,05	20000	20000-666	8600-666	41%	59%
8,25	8,25	16,5	0,88	1,44	20000	20000-666	7950-666	38%	62%
8,5	8,5	17	1,47	1,66	20000	20000-663	7500-663	35%	65%
8,75	8,75	17,5	1,77	2,01	20000	20000-658	7080-658	33%	67%
9	9	18	2,2	2,56	20000	20000-656	6690-656	31%	69%

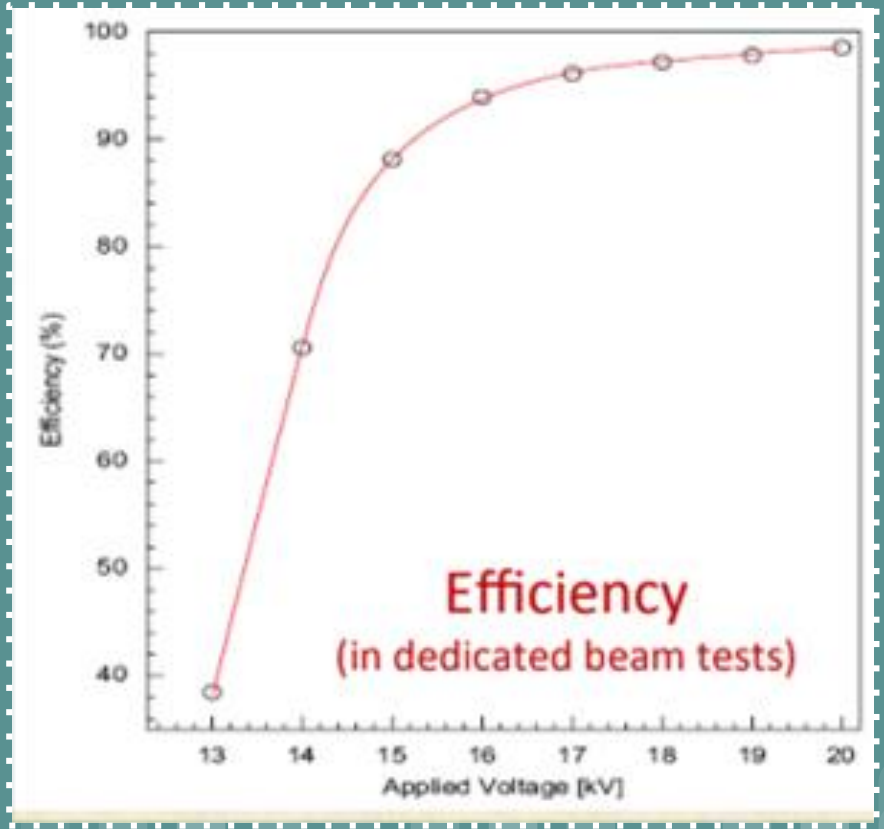


The Results

$$1 - \frac{N_{Top-(0\ hits)}}{N_{Real}}$$

The Results


Efficiency per Total Voltage
80%
60%
40%
20%
0%
Efficiency
13
14
15
16
17
18
Total Voltage (kV)
Efficiency


Efficiency (%)
100
90
80
70
60
50
40
13
14
15
16
17
18
19
20
Applied Voltage [kV]
Efficiency
(in dedicated beam tests)

Thank
You