Extreme Energy Events Project: construction of the detectors

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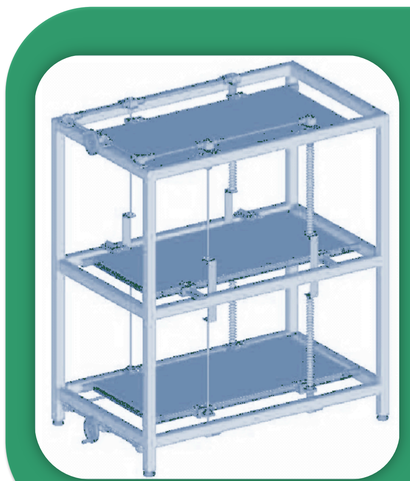
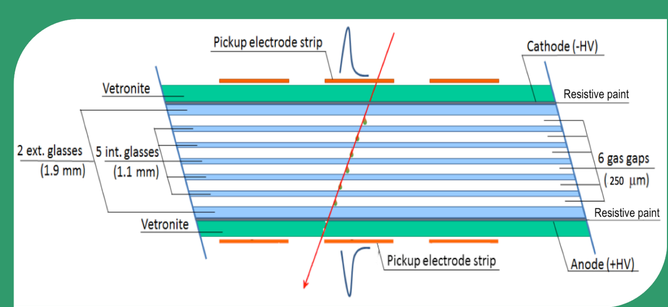
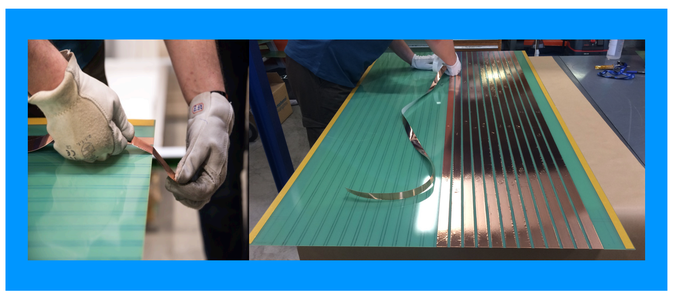


- **The Extreme Energy Events Project (EEE) is a cosmic ray experiment devoted to the study of High Energy Cosmic Rays (HECR), detecting Extensive Air Showers produced by primary interaction in atmosphere.**
- **EEE is a network of cosmic muons GPS synchronized tracking telescopes made of three large area (160x80 cm^2) Multigap Resistive Plate Chambers (MRPC).**
- **Each MRPC consists of six gas gaps obtained by stacking glass sheets with voltage applied only to the external surfaces, and leaving the inner ones floating; it is similar, conceptually, to the chambers developed for the Time-Of-Flight system of the ALICE experiment at LHC.**
- **MRPCs are used in many experiments due to their excellent efficiency and time resolution.**

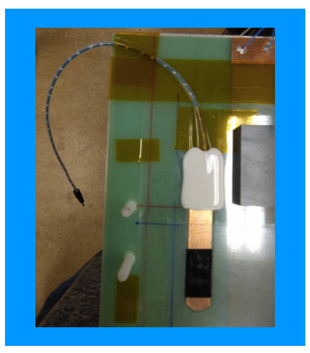


Strong innovative outreach approach → **High school students are directly involved in the experiment** → **Each school team build the three detectors needed for their school telescope under supervision of Centro Fermi, INFN and CERN researchers** → **From simple materials to a particle detector**

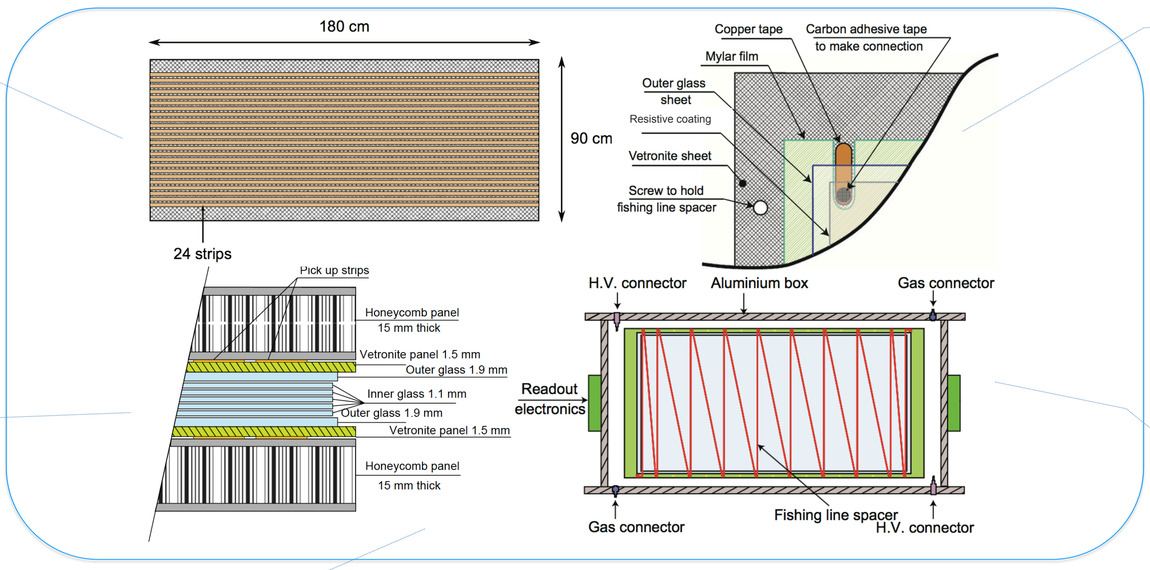


The MRPC signal pick-up electrodes are segmented into 24 strips, obtained by applying copper tape on vetronite panels. The strips are read out by NINO ASIC based front-end cards.

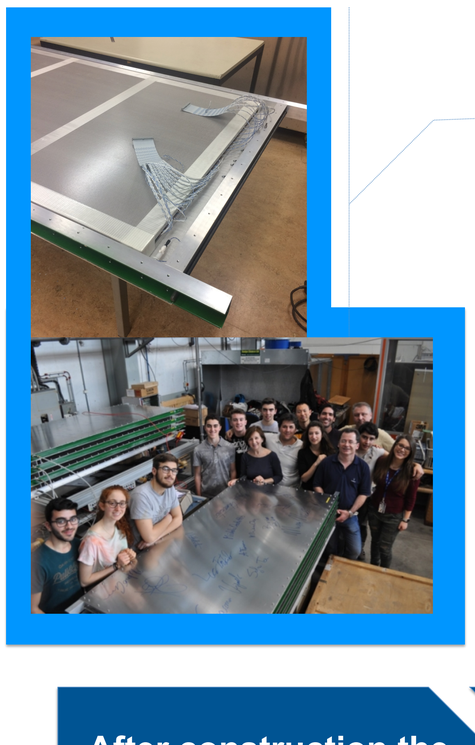
The outer glass sheets are placed on the vetronite panels and a connection is made to the resistive coating, so that a high voltage can be applied.

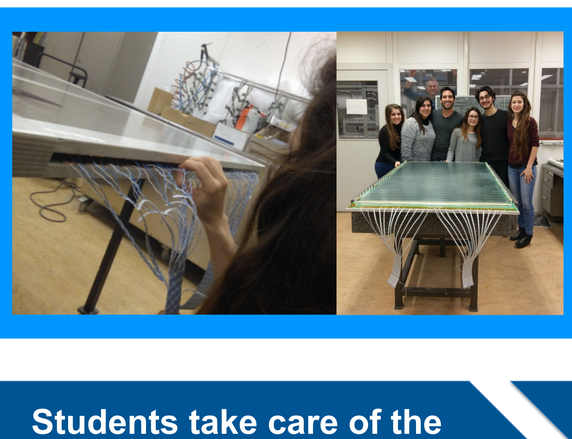


Two honeycomb panels ensure the rigidity of the structure. The MRPC is then placed inside an aluminum box that is eventually sealed to make a gas-tight enclosure.

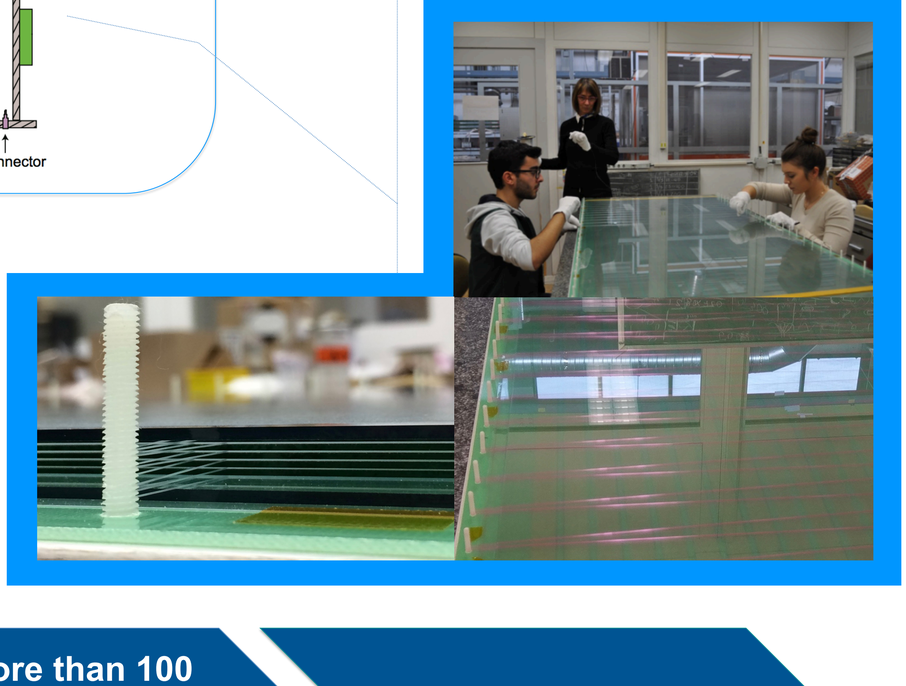


Commercial nylon fishing line (250 µm thick) is used as spacer between glass sheets. The fishing line is stretched across the surface of the glass, and around plastic screws.





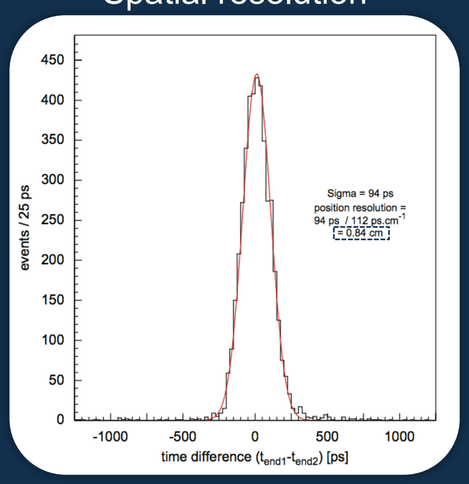
Twisted pair cables are soldered to the two ends of the strips for connection to the front-end electronics.



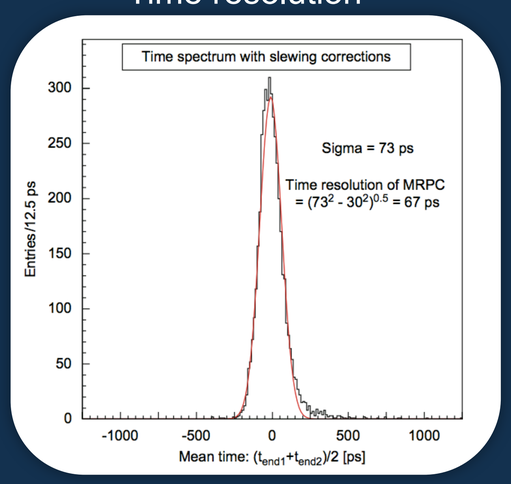
After construction the telescopes are installed in schools → **Students take care of the operation, monitoring and maintenance of the telescopes** → **In the last three years more than 100 teachers and several thousands of students have been involved in the EEE Project** → **They play a primary role in the experiment**

- Operated in avalanche mode
- fluxed with 98% $C_2H_2F_4$ + 2% SF_6

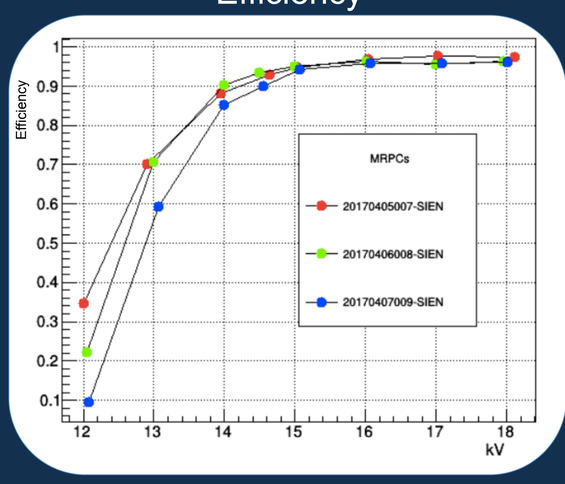
Spatial resolution



Time resolution



Efficiency



Extended array over 3 10^5 km^2

More than 50 telescopes are installed mostly in high schools distributed over the whole of Italy → **Students participate in data analysis with masterclasses focused on EEE Project** → **The EEE Project is still expanding with the aim of enlarging the network and involving more schools in the EEE network**