



OCRA

An outreach program on cosmic rays for teachers and students

Sabine Hemmer | INFN Sezione di Padova
for the OCRA collaboration

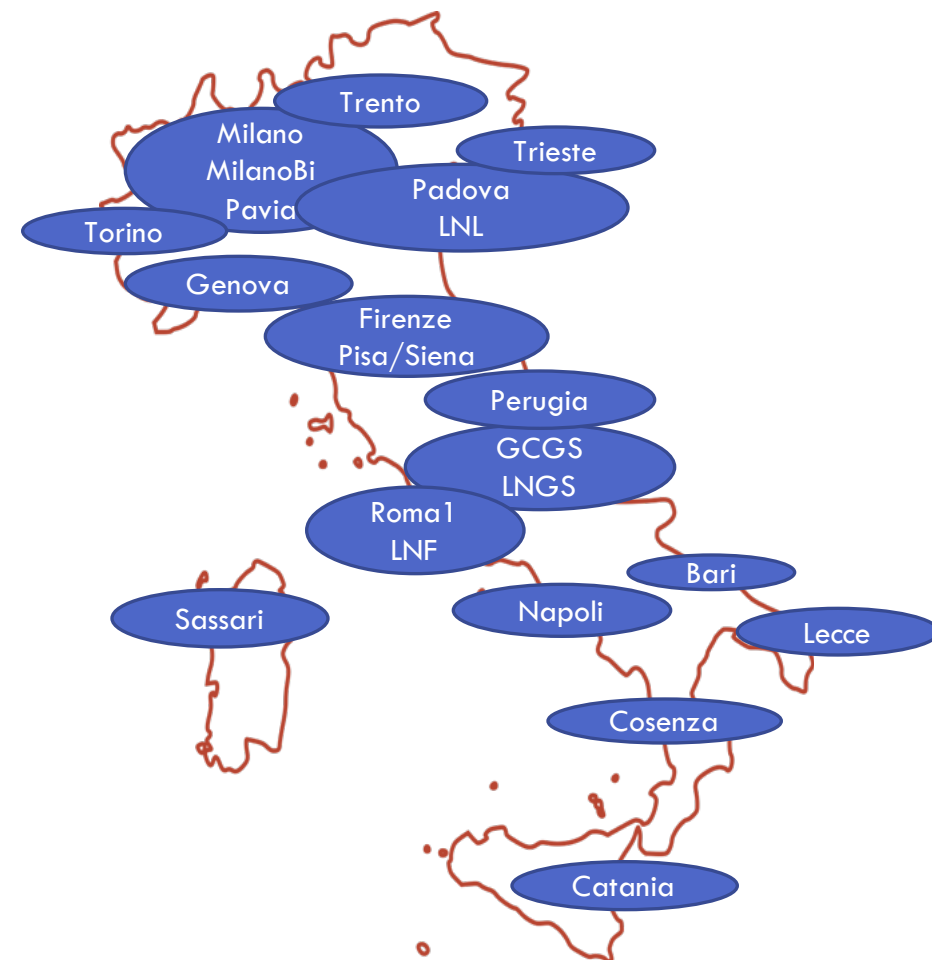
12th Cosmic Ray International Seminar - Naples
September 12 -16, 2022

OCRA – Outreach Cosmic Ray Activities

Born in 2018 as a **national outreach project of INFN** with the aim of collecting, within a national framework, the numerous **public engagement activities in the field of cosmic ray physics** already present at a local level.

Today OCRA counts 22 of the INFN divisions and laboratories as its members.

<https://web.infn.it/OCRA/>



OCRA activities

For students:

- International Cosmic Day
- Online laboratories
- Local activities: internships, labs, competitions
- Science camps

For teachers:

Online course on interactive labs on OCRA webpage

For the public:

Participation in events like the European Researchers' Night etc.





International
Cosmic Day at
OCRA



International Cosmic Day (ICD) organized every year by DESY

- Seminars
- Measurements with a muon telescope
- Data analysis
- Video call and discussion of the results

**10th edition of ICD:
10 November 2021**

Slowly going back to normal...

OCRA participated to the ICD 2021 in two ways:

- National online event, organized and carried out by the INFN division in Lecce

- 12 local events in presence

In addition: participation to the organization of the international event with DESY, production of introductory videos for the ICD webpage (Elisa Prandini and Michele Doro from University and INFN Padova: <https://icd.desy.de/e35439>)



4241 students



61 schools



49 cities



1508 participants



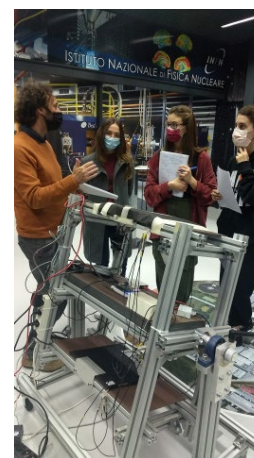
443 students



76 schools



52 cities



The logo features a large blue circle with the text "OCRA Science Camp 2022" centered inside. To the left of the circle is a dashed teal line, and at the bottom right of the circle is a smaller purple circle.

OCRA Science
Camp 2022

Science camp for students

First edition: April 2019 at LNGS laboratories

About 30 students between 16 and 18 years and 5 teachers spent three days with introductory seminars, measurements of the cosmic ray flux at different altitudes around the Gran Sasso massif, data analysis and visit to the underground laboratories



OCRA science camp 2022

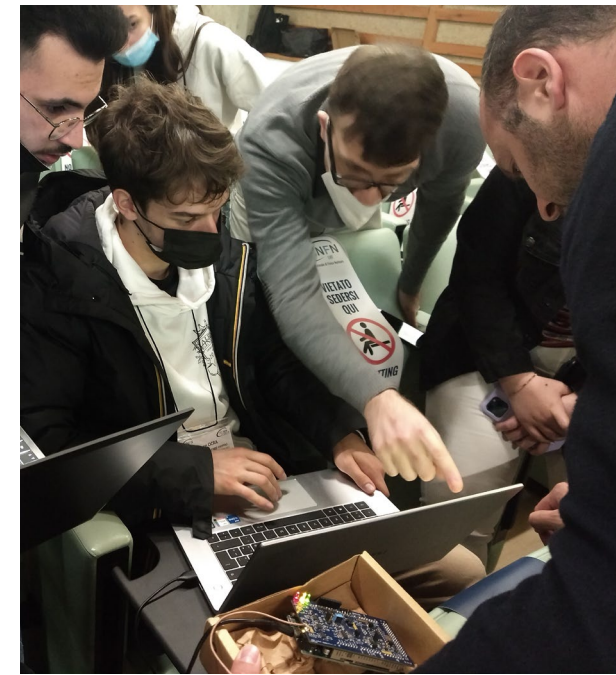
at INFN Laboratori Nazionali di Frascati (LNF)

3-6 May 2022

The camp was foreseen to take place in spring of 2020 and was cancelled due to the Covid19 pandemic. Now we finally succeeded in realizing it!

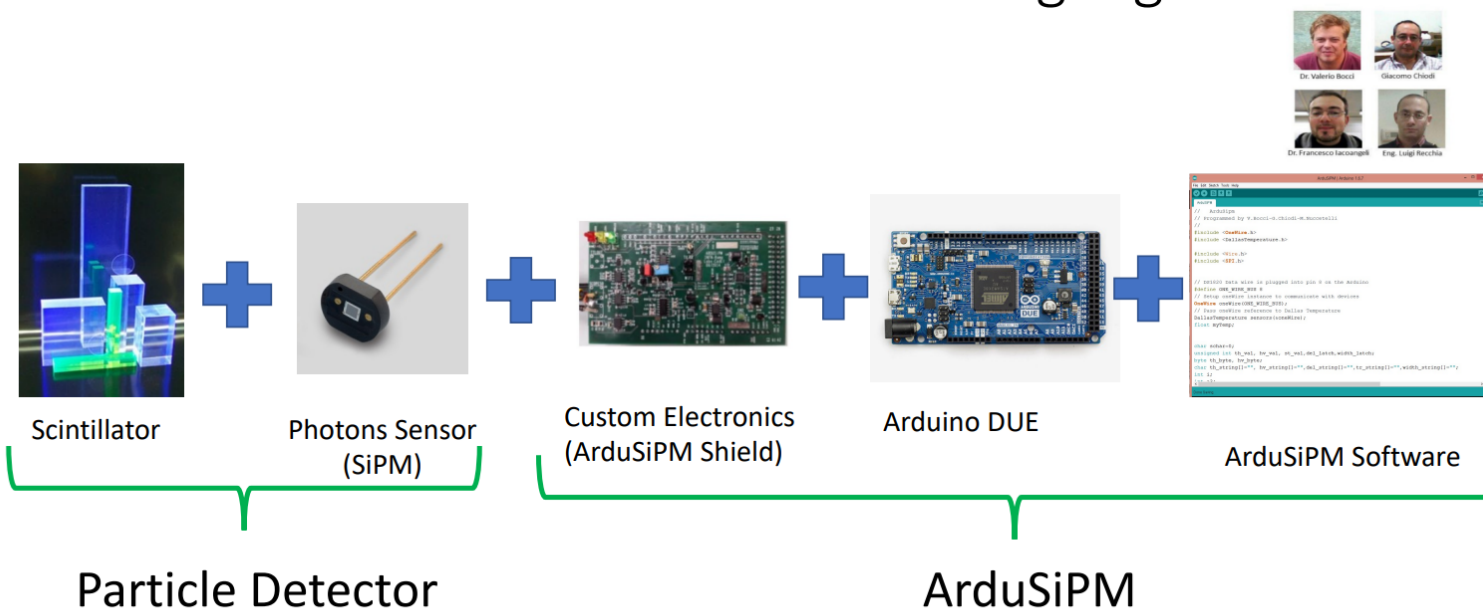
- 28 students from all over Italy, selected by local competitions in 14 INFN divisions during/after the ICD 2021
- 5 teachers
- 8 researchers
- 4 balloon flight experts

The program contained **lectures** on cosmic rays and cosmic ray experiments, a **visit** to an INAF observatory and to the LNF. The core of the experience was the **flight of a stratospheric balloon** with instrumentation to measure the muon flux during the flight and the **analysis of the data collected during the flight**.



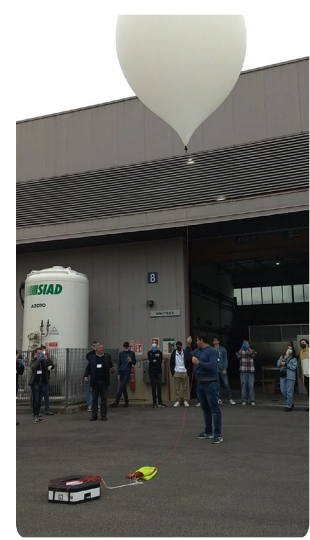
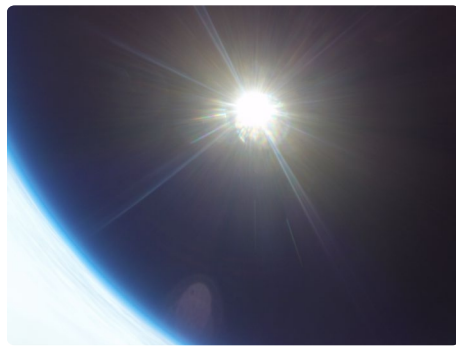
The particle detector used during the flight

Is it possible to build a complete particle detector and data acquisition system using Arduino microcontroller and Arduino Language ?



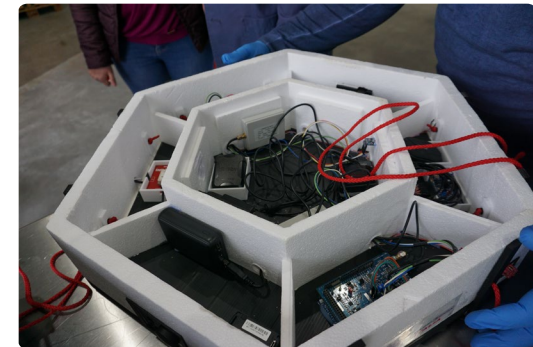
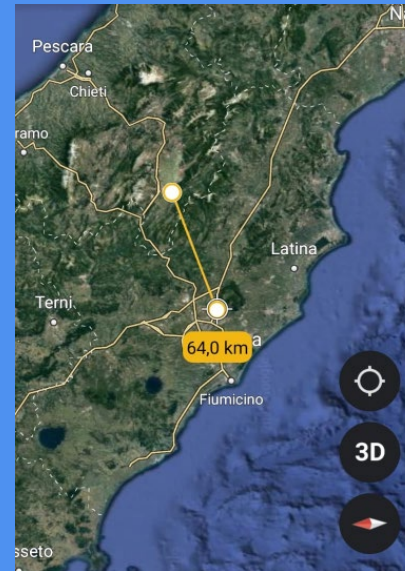
- consumption < 1W
- weight < 200 g
- independent system, no need for external computer
- small volume

Taken from slides by Valerio Bocci for OCRA Science Camp 2022



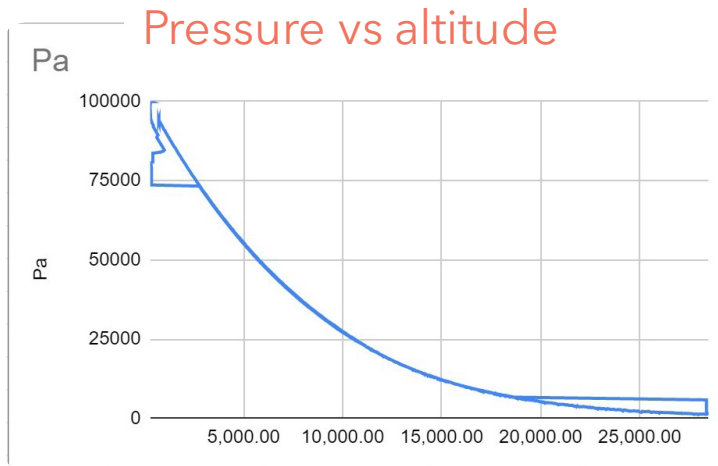
The flight

Max altitude: 28.4 km
Distance from starting point: about 64 km
Time of flight: about 1.5 hours

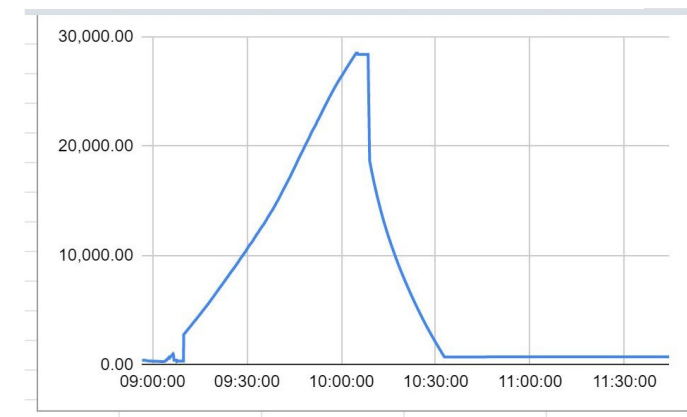


The instrumentation for the flight was designed and built by INFN Rome Division and ABProject

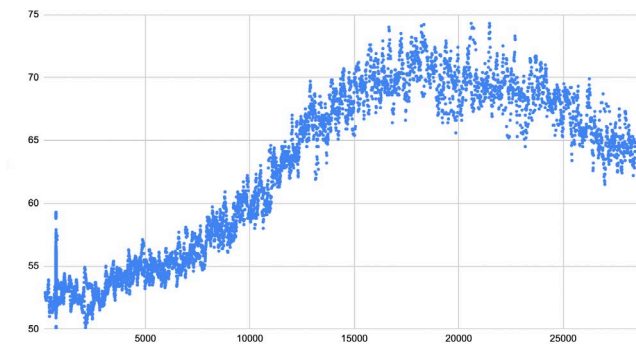
Data analyzed by the students



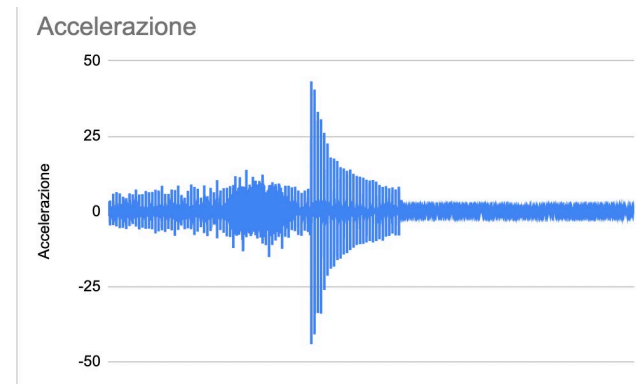
Altitude vs time



Average counts vs altitude



Acceleration vs time



Pre- and post-event questionnaires

Pre- and post:

- questions about idea of a physicist and what research in physics is
- meaning of the camp for their studies and future
- expectations and if they were fulfilled
- some basic knowledge questions on cosmic rays

Only post:

- Questions on level of satisfaction about the experience, its organization, contents, etc.



Analysis of questionnaires to be done!

“Describe the experience of the camp in three words:”

Intense,
formative,
creative

learn,
understand,
physics!

stimulating,
demanding,
tiring

Excel,
technologies
and
discoveries

tiring,
stimulating, to
be done again

Immersive,
engaging,
exciting

Stupendous,
captivating,
useful

collaboration,
new things and
discovery

thorough,
demanding,
original



Other OCRA activities

OCRA Cosmic Ray ONLINE Educational Activities

- Interactive labs dedicated to the description of muon measurements
- Materials for teachers for implementation in the classroom
- Spring 2021: online course for teachers



1. Particelle dallo spazio
2. La conferma di Hess
3. Cosa sono i raggi cosmici
4. Dove si studiano i raggi cosmici
5. I Muoni
6. L'astronomia multi-messaggio
7. Ricadute tecnologiche
8. In laboratorio con noi

<https://web.infn.it/OCRA/>

IN LABORATORIO CON NOI
percorsi didattici di INFN OCRA

Outreach Cosmic Ray Activities - OCRA vi invita alla scoperta della sua proposta online: un percorso in diretta sui raggi cosmici e l'analisi di veri esperimenti scientifici per voi e i vostri studenti, con la moderazione di Davide Coero Borga

RIVOLTO A TUTTI I DOCENTI DI SCIENZE, MATEMATICA E FISICA DELLE SCUOLE SUPERIORI DI SECONDO GRADO

20 GENNAIO
ORE 17.00 - 18.30
▶ canale INFN Edu Physics
f OCRA INFN

PER INFORMAZIONI:
OCRA.INFN@GMAIL.COM

Corso presente sulla piattaforma S.O.F.I.A. Id.52875

S. Hammer | CRIS 2022

corso presenta una breve introduzione

MISURA DELLA RATE DI MUONI COSMICI
Modifica

Cosmic Ray Cube

Ai Laboratori Nazionali del Gran Sasso (LNGS) è stato progettato e realizzato un telescopio di raggi cosmici, ideato per essere utilizzato in eventi pubblici e didattici. Il telescopio, utilizzando le più innovative tecnologie che normalmente si impiegano negli esperimenti di fisica delle particelle, è in grado di visualizzare il passaggio di particelle contenute nello sciame di raggi cosmici che continuamente arrivano sul suolo terrestre. Lo strumento, chiamato Cosmic Rays Cube (CRC), grazie alla sua struttura compatta ed alla possibilità di essere alimentato a batteria è di facile portabilità e consente di misurare il flusso di particelle a varie altitudini, la loro distribuzione angolare, l'efficienza del rivelatore al variare di alcuni parametri di funzionamento.

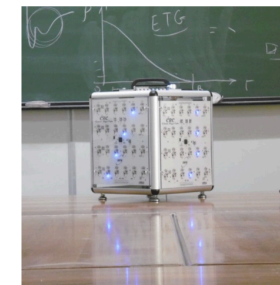
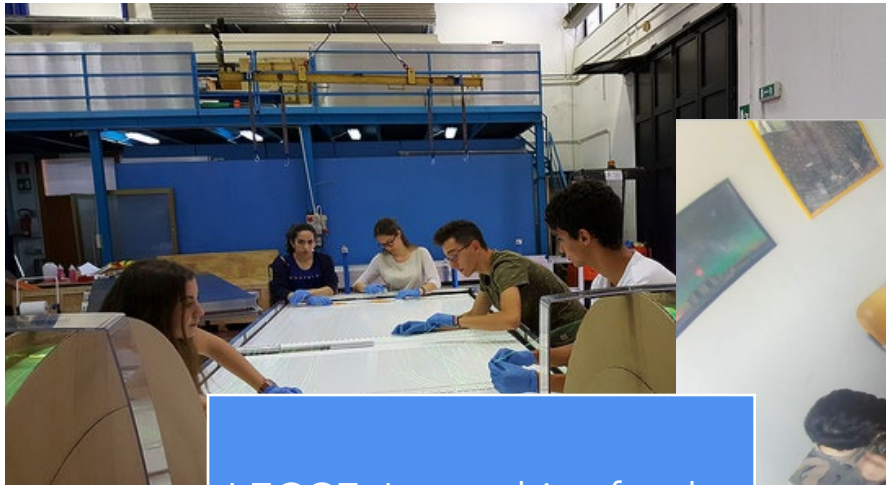
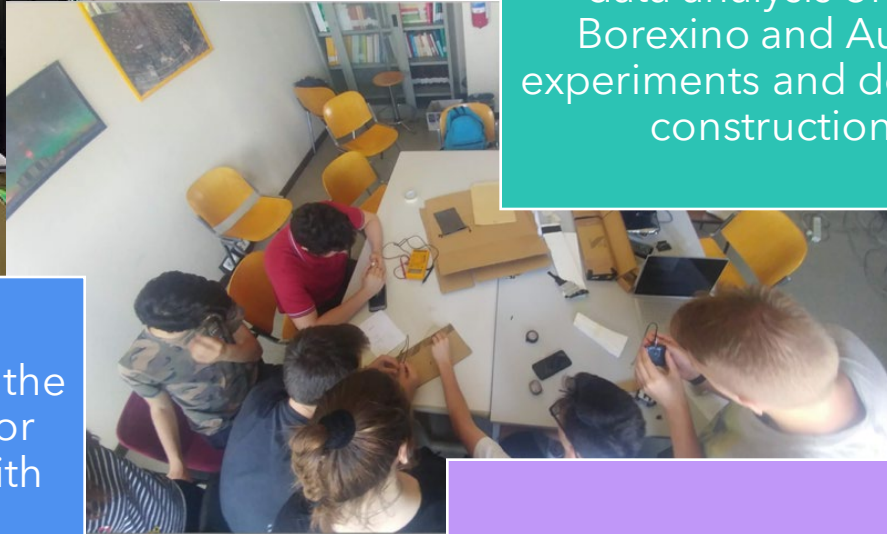


Fig.1: Il Cosmic Ray Cube realizzato ai LNGS



MILAN: Internships with data analysis of the Borexino and Auger experiments and detector construction

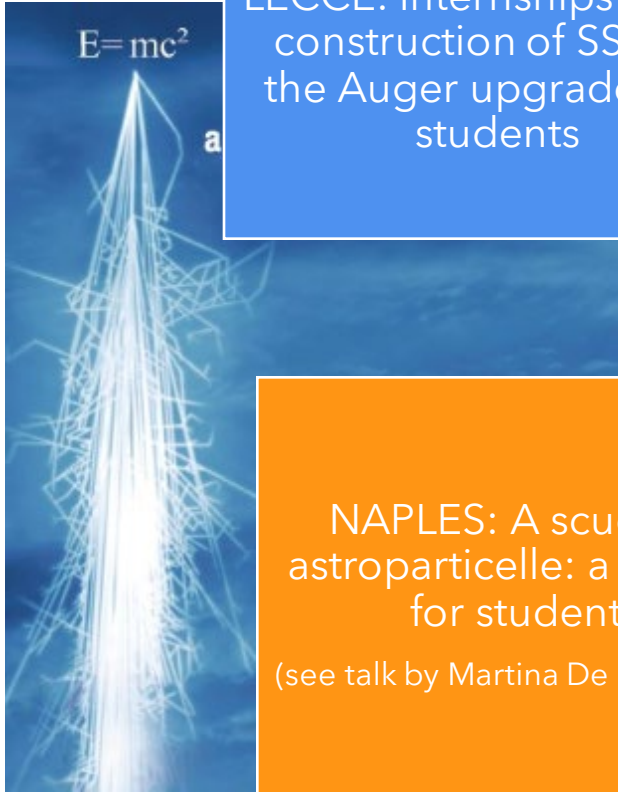


LECCE: Internships for the construction of SSD for the Auger upgrade with students

COSENZA: Measurement of the cosmic radiation rate in water
(see talk by Marco Schioppa)

Local activities

Numerous local activities round up the outreach events by OCRA. The images show just a small number of them.



NAPLES: A scuola di astroparticelle: a contest for students
(see talk by Martina De Laurentis)



Conclusions

OCRA has been growing constantly since 2018 and has reached its goal of providing a national framework for the INFN cosmic ray outreach activities.

The ICD remains as core activity and new topics like the science camp and the creation of educational materials are being tackled, in parallel with a multitude of local activities of various nature.

