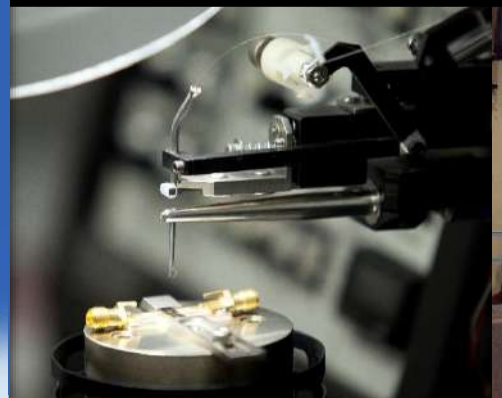
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES

CBPF
Centro Brasileiro de Pesquisas Físicas
UNIDADE DE PESQUISA DO MCTI

Márcio P. de Albuquerque

CBPF

17 nov. 2022





RESEARCH

Push forward the frontiers of knowledge

INNOVATION

Develop new cutting-edge technologies

EDUCATION

Train scientists and engineers of tomorrow

OUTREACH

Promote Science in Society

MANAGEMENT FOR S&T&I

CBPF

1949-2022

73

2022

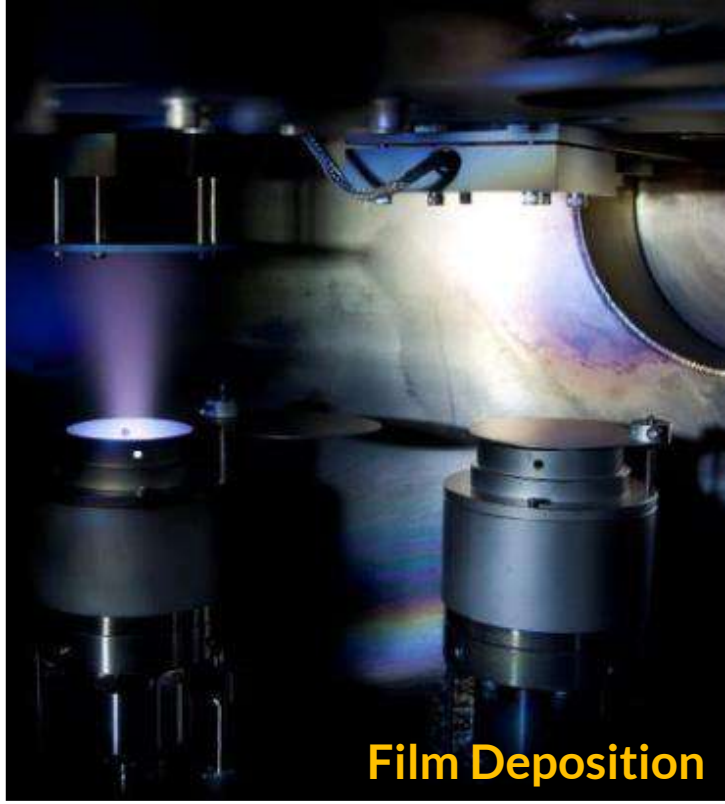
CBPF – R&D

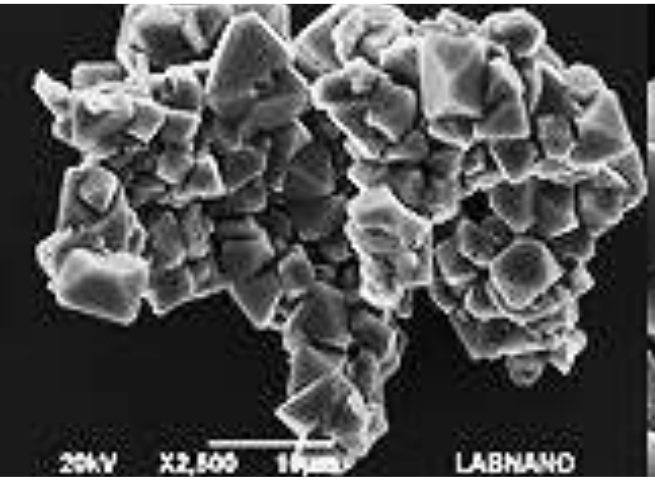
Experimental, Theoretical and Applied

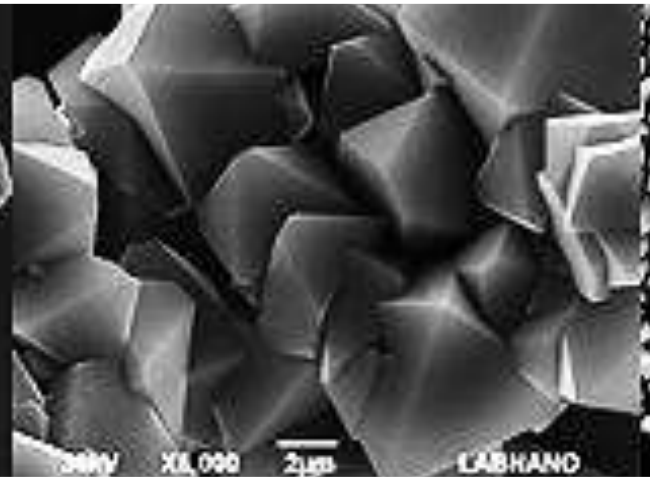
- High Energy Physics and Astroparticles
- Materials and Condensed Matter
- Nanoscience and Nanotechnology
- Biophysics and Biomaterials
- Statistical Mechanics and Complex Systems
- Quantum Information and Quantum Computing
- Cosmology and Gravitation
- Signal Processing and Artificial Intelligence
- Scientific Instrumentation

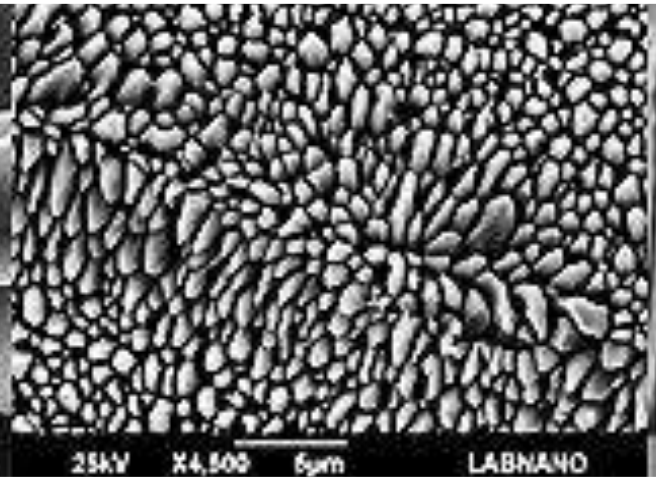
Push forward the frontiers of knowledge

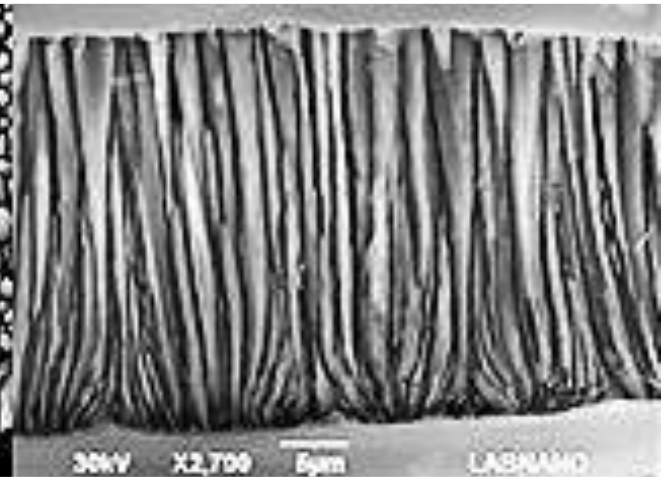
SCIENCE

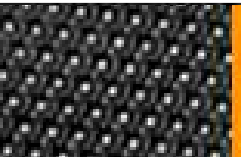












LABNANO/CBPF

Multi-User Lab
of Nanoscience and Nanotechnology

- Division of Electron Microscopy
- Division of micro and nanofabrication
- Division of Film Deposition

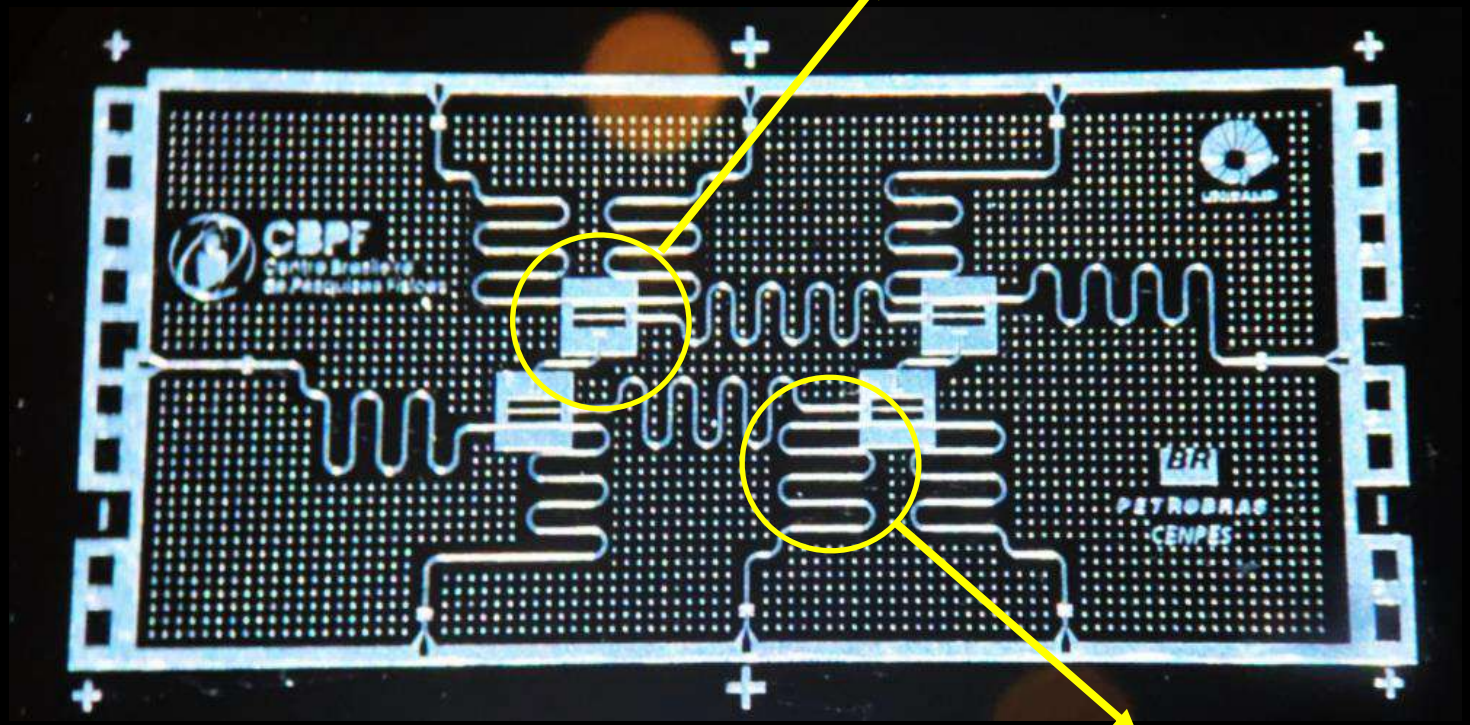
CBPF

Quantum Information & Quantum Computing

The CBPF laboratory develops circuits and adiabatic quantum computing and their applications – *including for petrophysics.*

The Lab. interacts with industry and promotes debates and events on quantum hardware and quantum algorithms

q-bits: Josephson Junctions - superconducting q-bits



CBPF´s quantum chip showing four q-bits.

Control and read-out resonator

Cosmology, Astrophysics and Gravitation

Image:
Hubble Telescope (2015)

The CBPF works in **phenomenological and observational** research in the area of **Cosmology, Astrophysics and Gravitation**, working in major international collaborations such as J-PAS, S-PLUs, SWGO and in projects using the SOAR and Blanco Telescopes, with highlights in the areas of **Gravitational Lensing, Extragalactic astrophysics and gravitational wave**. Over the last 40 years, it has promoted the **Brazilian School of Cosmology and Gravitation**.

Statistical Mechanics and Complex Systems

Possible Generalization of Boltzmann–Gibbs Statistics

Constantino Tsallis[1]

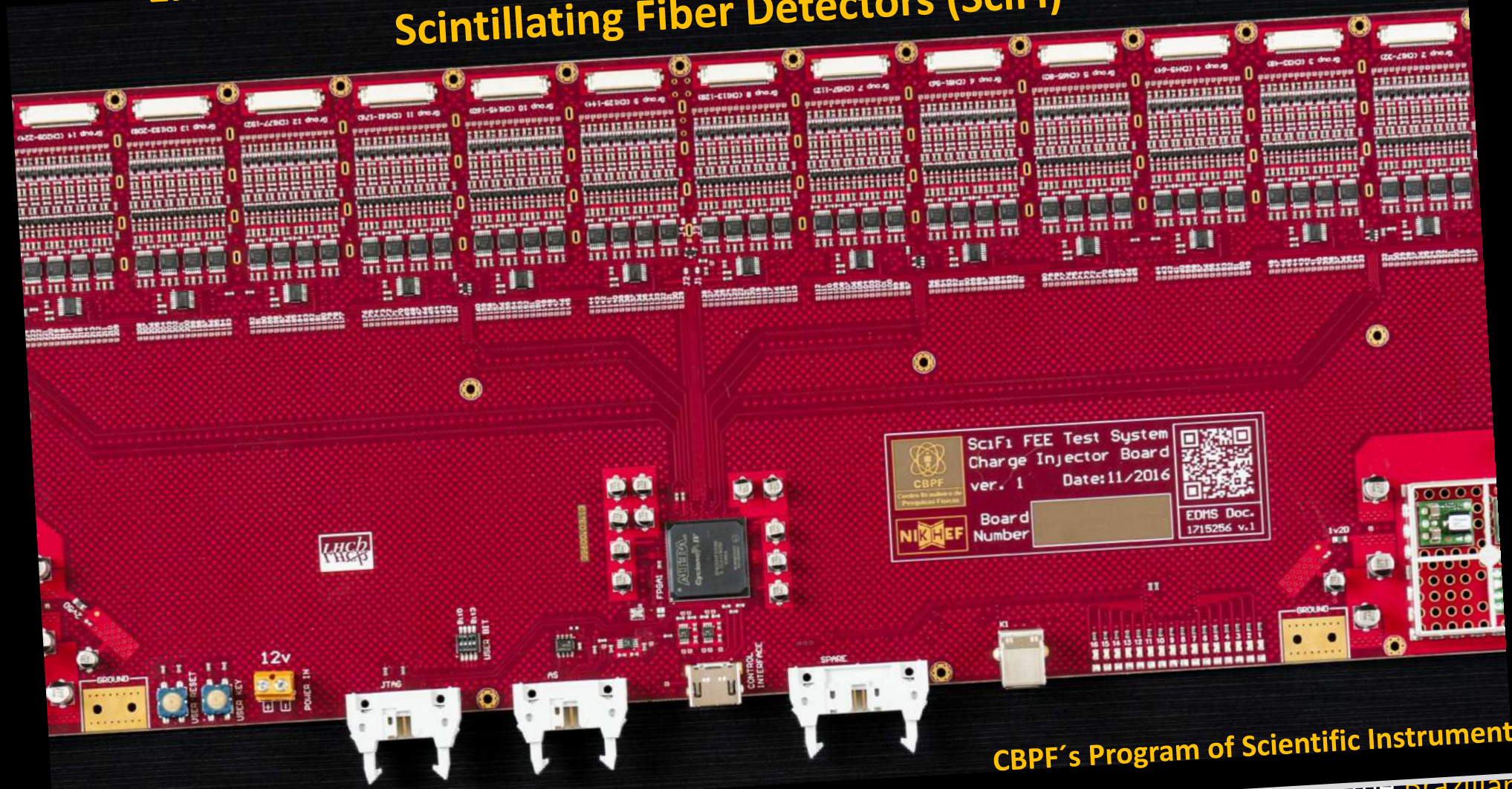
Received November 12, 1987; revision received March 8, 1988

With the use of a quantity normally scaled in multifractals, a generalized form is postulated for entropy, namely $S_q \equiv k[1-\sum_{i=1}^{W} p_i^q]/(q-1)$, where $q \in \mathbb{R}$ characterizes the generalization and $\{p_i\}$ are the probabilities associated with W (microscopic) configurations ($W \in \mathbb{N}$). The main properties associated with this entropy are established, particularly those corresponding to the microcanonical and canonical ensembles. The Boltzmann–Gibbs statistics is recovered as the $q \to 1$ limit.

KEY WORDS: Generalized statistics; entropy; multifractals; statistical ensembles.

The CBPF develops research in the areas of statistical mechanics and complex systems, in biological and economic systems, theory and applications of non-extensive statistical mechanics and signal detection and prediction. The CBPF is the headquarters of the National Institute of Science and Technology for Complex Systems

Electronic device - designed to test the electronics used in Scintillating Fiber Detectors (SciFi)



CBPF´s Program of Scientific Instrumentation

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for high
collabora

quarters of the Brazilian National Network for High Energy Physics (RENAFAE)

EDUCATION

Train scientific personnel,
ensuring access to advanced infrastructure and
international laboratories

Graduate programs in Physics

Master's and Doctorate in Physics

Professional Master's in Scientific Instrumentation

CBPF was the First Brazilian institution to officially grant master's and Ph.D. degrees in Physics in Brazil.

The CBPF graduate program celebrates 60 years this year (2022).

More than 1,000 graduate students, with around 50% of them coming from other Brazilian states and Latin American countries

Considered among the best graduate program in the country

Develop new cutting-edge technologies

INNOVATION

Innovation Office

nit rio
NÚCLEO DE INOVAÇÃO TECNOLÓGICA

Contribute to the technological innovation system, with activities related to intellectual property management, technology transfer, partnerships with companies and industries

@cientista_empreendedor programacientistaempreendedor

Entrepreneurial Scientist

Program: **Transforming researchers into innovation leaders and entrepreneurs.**

Explore the opportunities and challenges in entrepreneurship as an alternative career path for scientists

Workshop

16 to 18 November (CBPF)

From Basic Science to Industry

Associated Research Institutes

CBPF 70 ANOS
CETEM CENTRO DE TECNOLOGIA MINERAL
ibict Instituto Brasileiro de Informação em Ciência e Tecnologia
impa
INSTITUTO NACIONAL DE TECNOLOGIA INT
Laboratório Nacional de Computação Científica
MUSEU DE ASTRONOMIA E CIÊNCIAS AFINS
Observatório Nacional

CBPF/R&D in partnership with Industry
(Brazilian Framework for Innovation)

- Quantum Computing for Petrophysics
- Artificial Intelligence and Deep Learning for Petrophysics and Geophysics
- Nanotechnology for the O&G industry

- New materials and techniques for medical implants

- Micro and nanoscale magnetic resonance devices

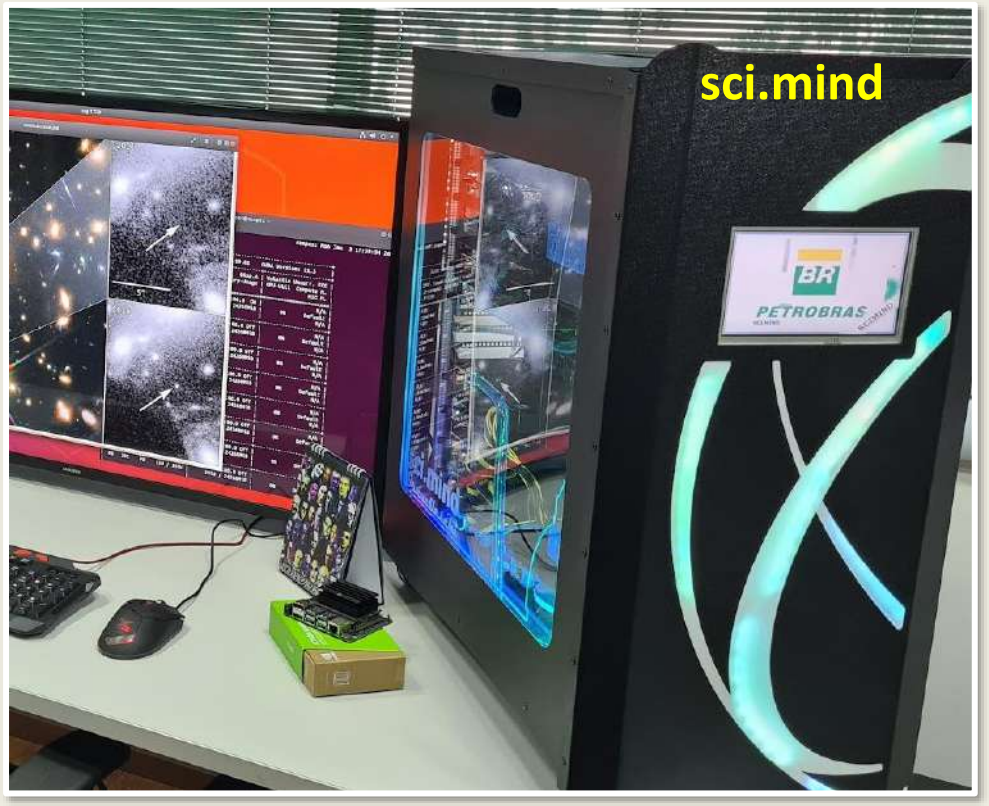
- New Materials, Nanotechnology and Magnetic Devices

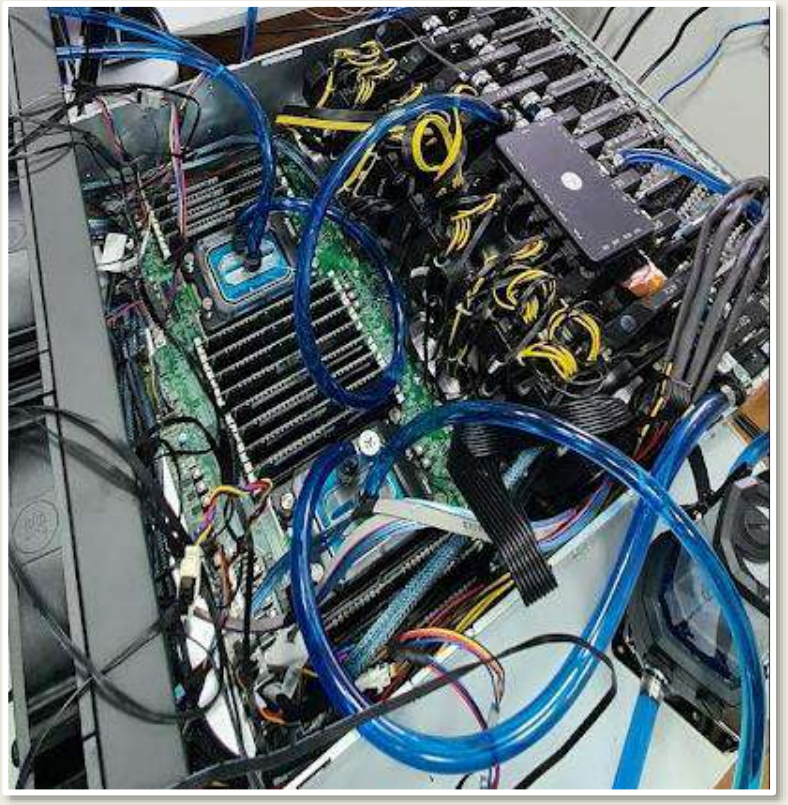
- Mechanical Structure for the Cherenkov Telescope Array

- Technologies for Surface and Interface characterization

CBPF: Computing infrastructure

Instrumentation & Computing Technologies





Multi-GPU Desktop HPC (*water cooled*) for
Artificial Intelligence and Deep Learning Neural Network

BR PETROBRAS

CBPF

MCTI

Rede-Rio: Rio Research & Education Network infrastructure

First network for **Experimentation of Quantum Communication** in the country

RIO
CITY HALL

Promote Science in Society

OUTREACH

Specialized Library – Science & Society

Teacher training program for high schools in Rio

Physicist for one day

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