CCTVal

Centro Científico
Tecnológico de
Valparaíso

UNIVERSIDAD TECNICA
FEDERICO SANTA MARIA

EX UMBRA IN SOLEM

Agencia
Nacional de
Investigación
y Desarrollo

Ministerio de Ciencia,
Tecnología, Conocimiento
e Innovación

Gobierno de Chile

CCTVal

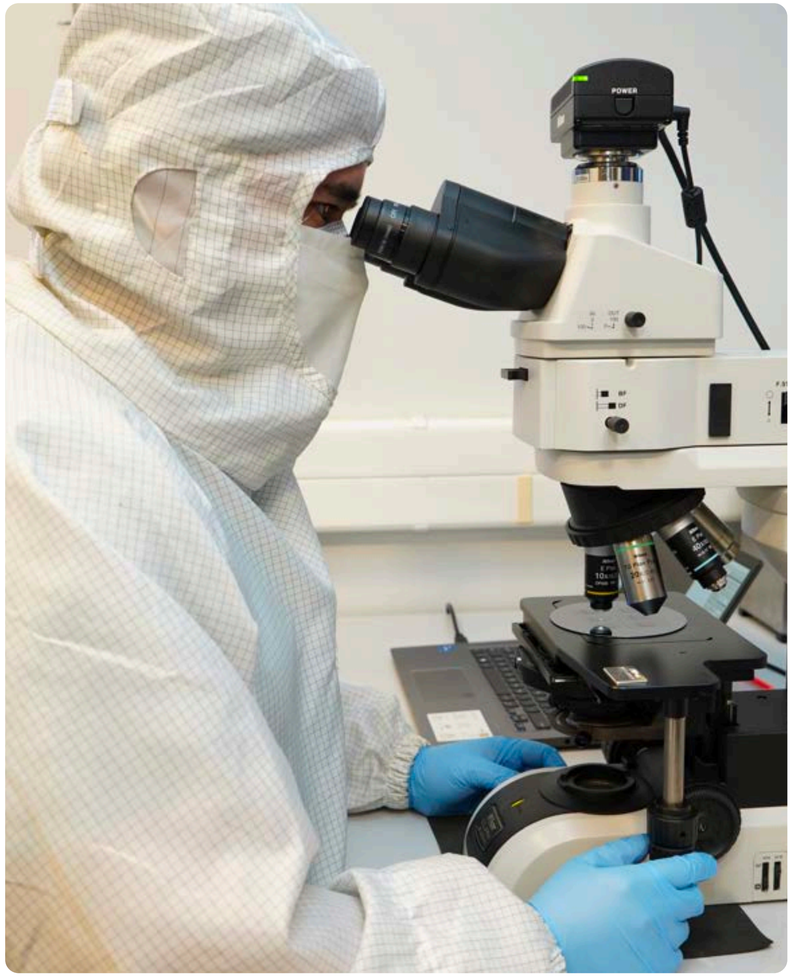
At CCTVal, we work on **comprehensive scientific-based developments**, from **concept** to the delivery of **solutions**.

CCTVal

SINCE 2009

We create science, technology, and innovation for Chile and the world.

We aim to contribute to economic growth, the optimization of productive processes, and the improvement of people's quality of life.

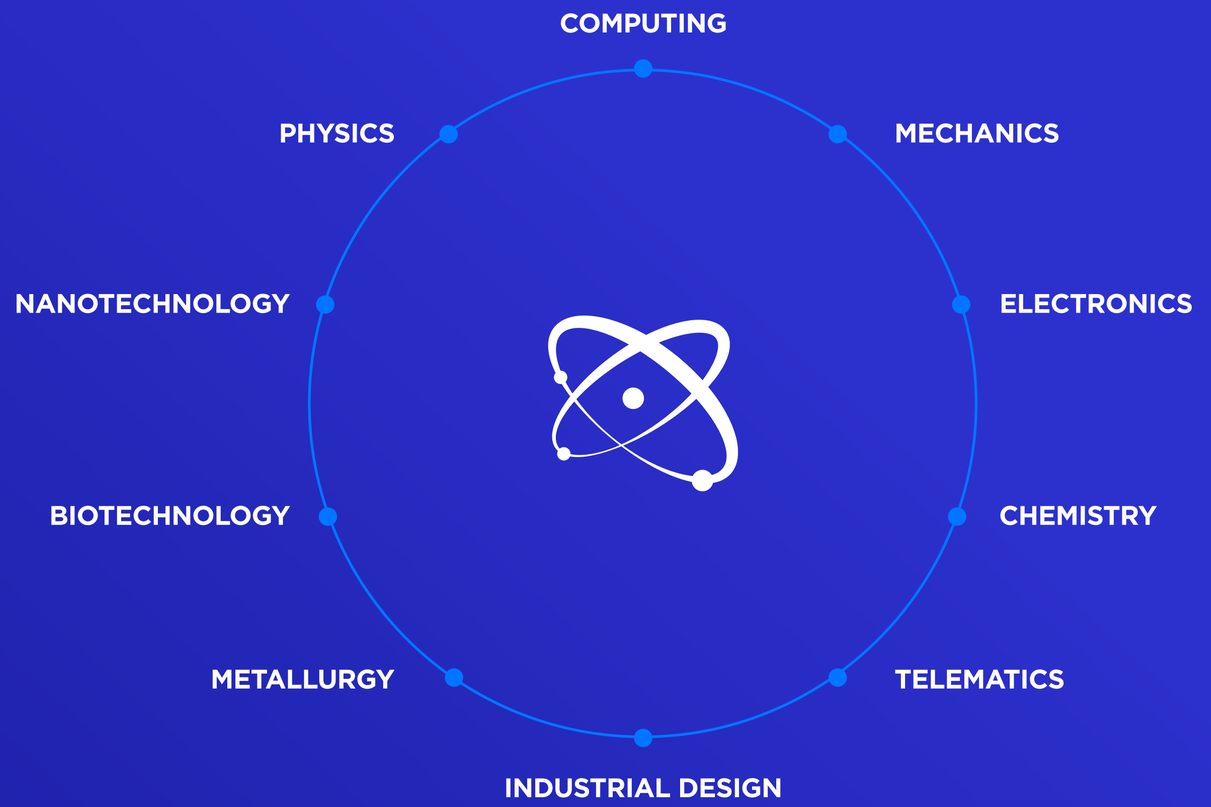


Interdisciplinary team

Our strength lies in the diversity of our team, which combines a wide range of **skills and approaches** to every challenge we face.

36
RESEARCHERS

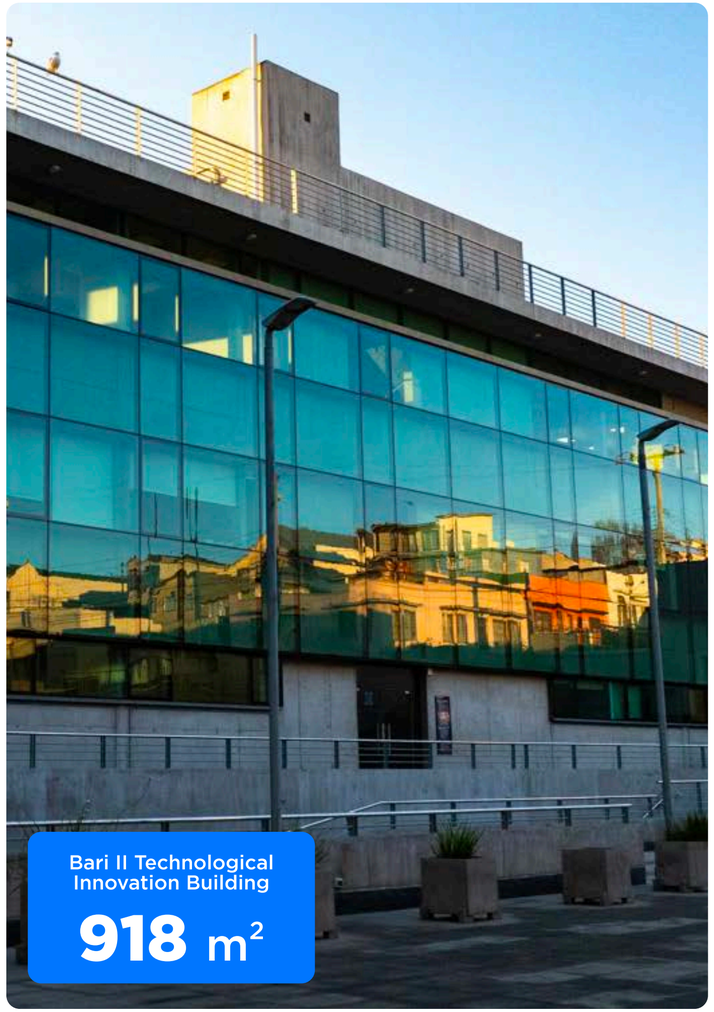
53
TECHNICAL AND ADMINISTRATIVE STAFF

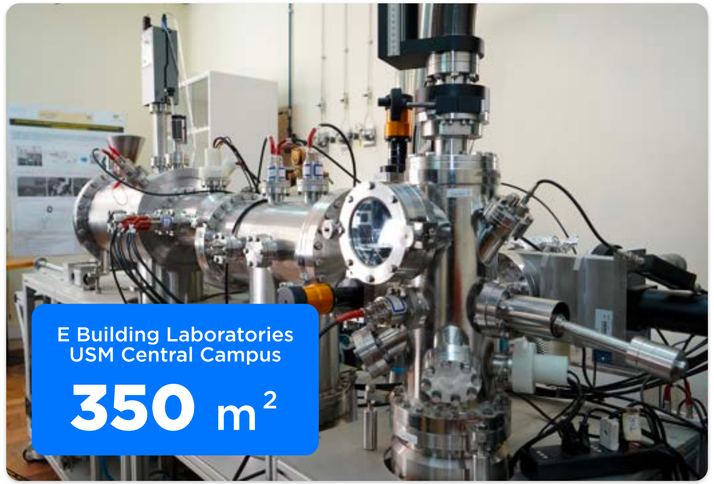


Infraestructure

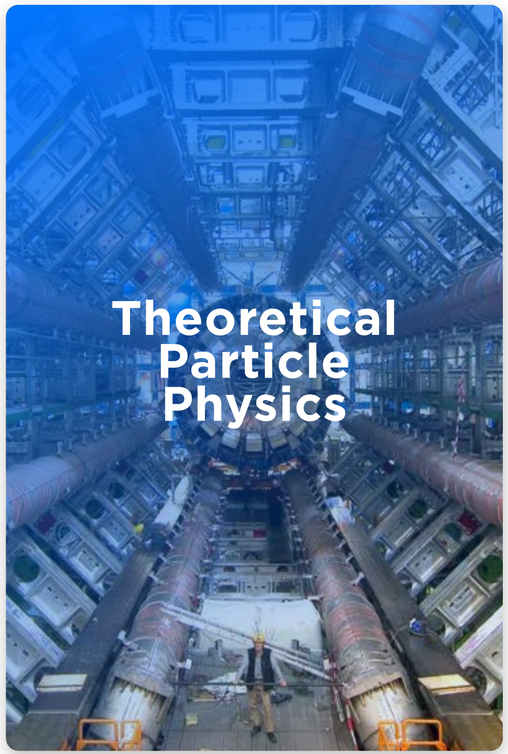
First class laboratories and equipment.

1732 m²

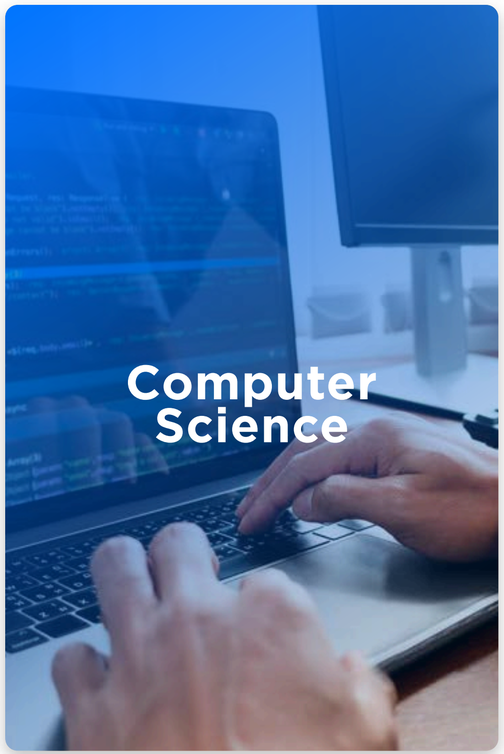


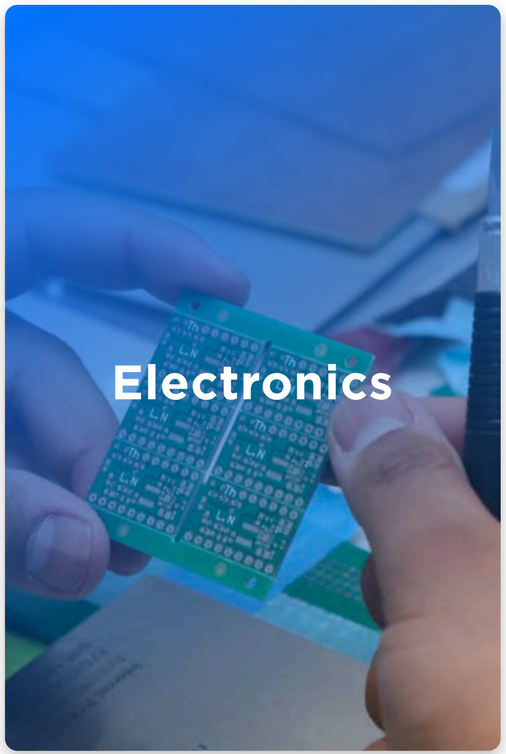


Lines of research



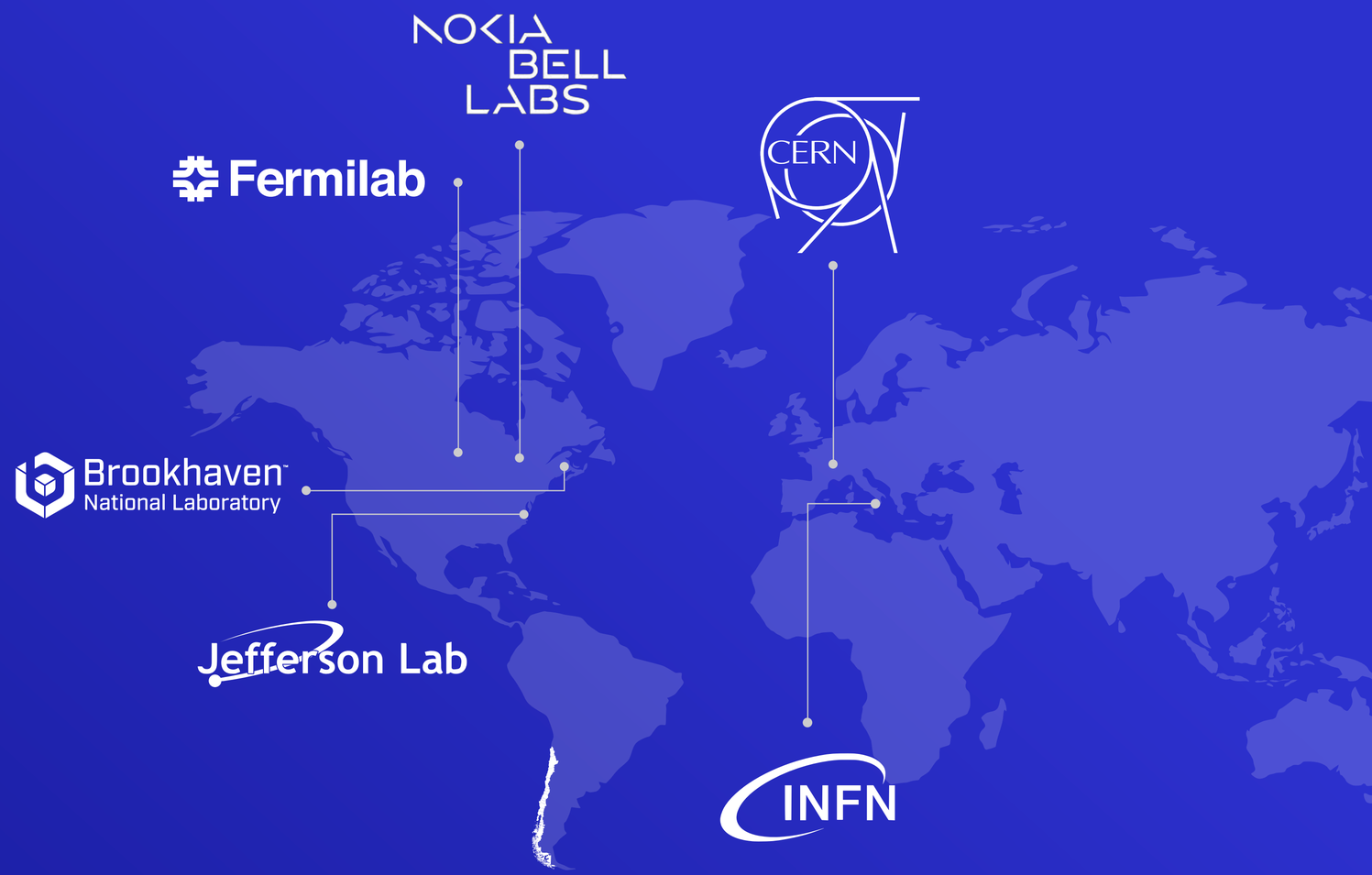
Experimental
High Energy
Physics





International collaborations

Applied research projects in collaboration with the **world's leading** scientific and technological organizations validate our performance on the **international stage.**



Training of Human Capital

Thanks to our **alliances** and **collaborations**, we have enabled researchers, professionals, and undergraduate and postgraduate students to attain **prominent positions** in prestigious national and international institutions.

As a **training hub**, we have made significant contributions to the consolidation of the field of **particle physics in Chile** and to the development of a **multidisciplinary team** specialized in **cutting-edge technological innovation**.

National institutions

Pontificia Universidad Católica de Chile
Pontificia Universidad Católica de Valparaíso
Universidad de Valparaíso Chile
Universidad de Tarapacá Universidad del Estado
USACH
Universidad de la Serena Chile
Universidad Andrés Bello

International institutions

CERN
Jefferson Lab
INFN
University of Cincinnati
University of Southampton
University of Oxford
Idaho State University
Technische Universität München
University of California
USC University of Southern California
Google
Caltech
TRIUMF
UC Riverside

Technology Transfer Areas

CCTVal

TECHNOLOGY TRANSFER AREA

Our services

- Hardware and software
- Artificial intelligence
- Computer vision
- Big Data
- ioT
- Automation

- Thermal processes
- Energy efficiency
- Fluid mechanics
- Solid mechanics and mechanical design

CCTVal

TECHNOLOGY TRANSFER AREA

Our services

R&D&I in process engineering

- Mining-metallurgical and chemical industry
- Electrochemistry
- Water purification and management

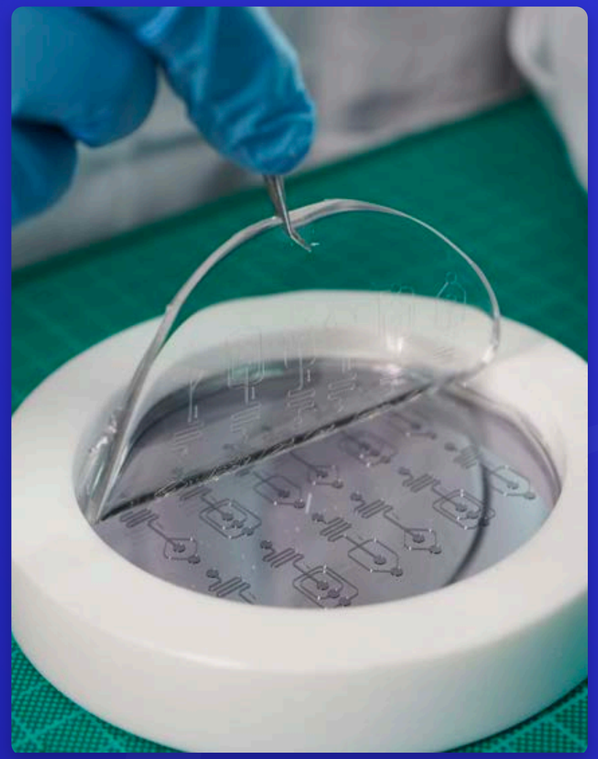
R&D&I in materials engineering

- Innovation and characterization of materials
- Composite materials
- Polymeric waste management

- *Organ on a chip*
- *Lab on a chip*
- Synthesis of lipid nanoparticles
- Cell culture systems

CCTVal

Applied research projects



CCTVal

COLLABORATION

CERN

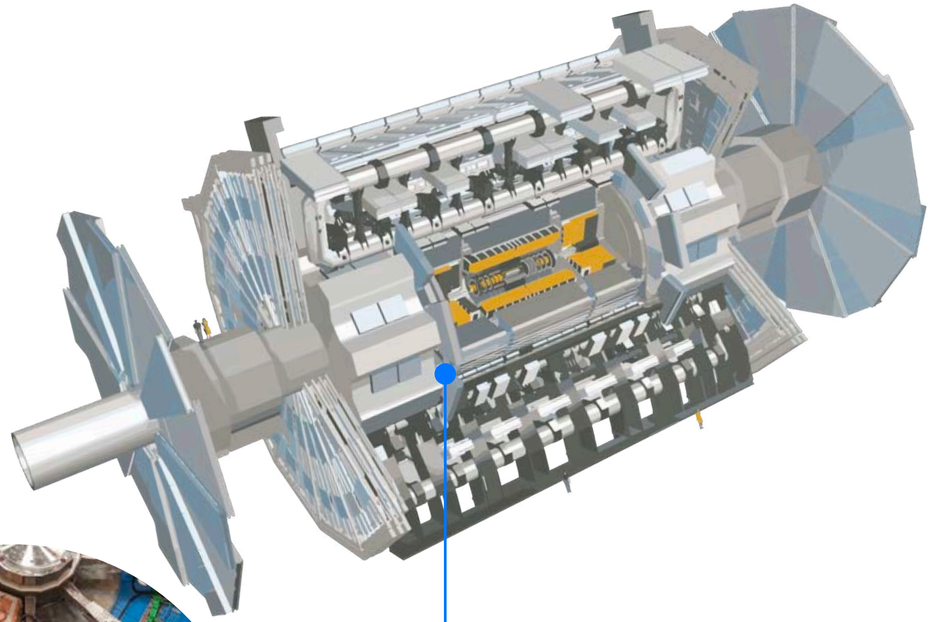
ATLAS EXPERIMENT

ATLAS

Research, experimental data collection, detector calibration, and technical coordination for its proper operation.

In addition, **we manufactured 33 muon detectors**, which were installed in 2021. This upgrade allowed for greater precision in data capture and higher intensity operations.

- HARDWARE AND SOFTWARE
- MANUFACTURING
- MACHINE LEARNING
- SENSING TECHNOLOGY



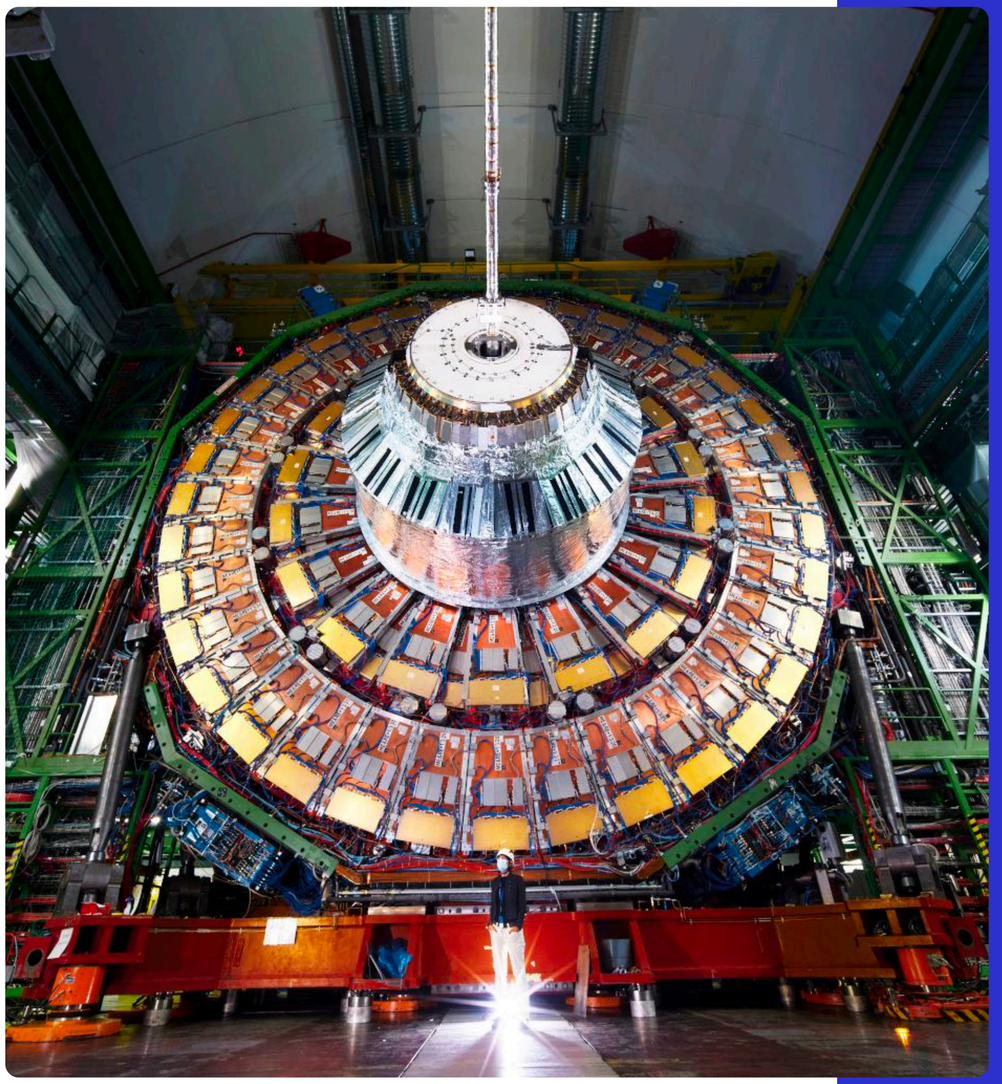
COLLABORATION

Compact Muon Solenoid (CMS)

A **scientific and technological** alliance that enhances the country's research capabilities and supports the potential development of **high-precision particle detectors** in Chile.

Through this collaboration, we have established a presence in two of the four large collaborations at the **LHC**, in addition to forming a significant connection with **Fermilab** in the United States.

INVESTIGATION



PARTICLE PHYSICS

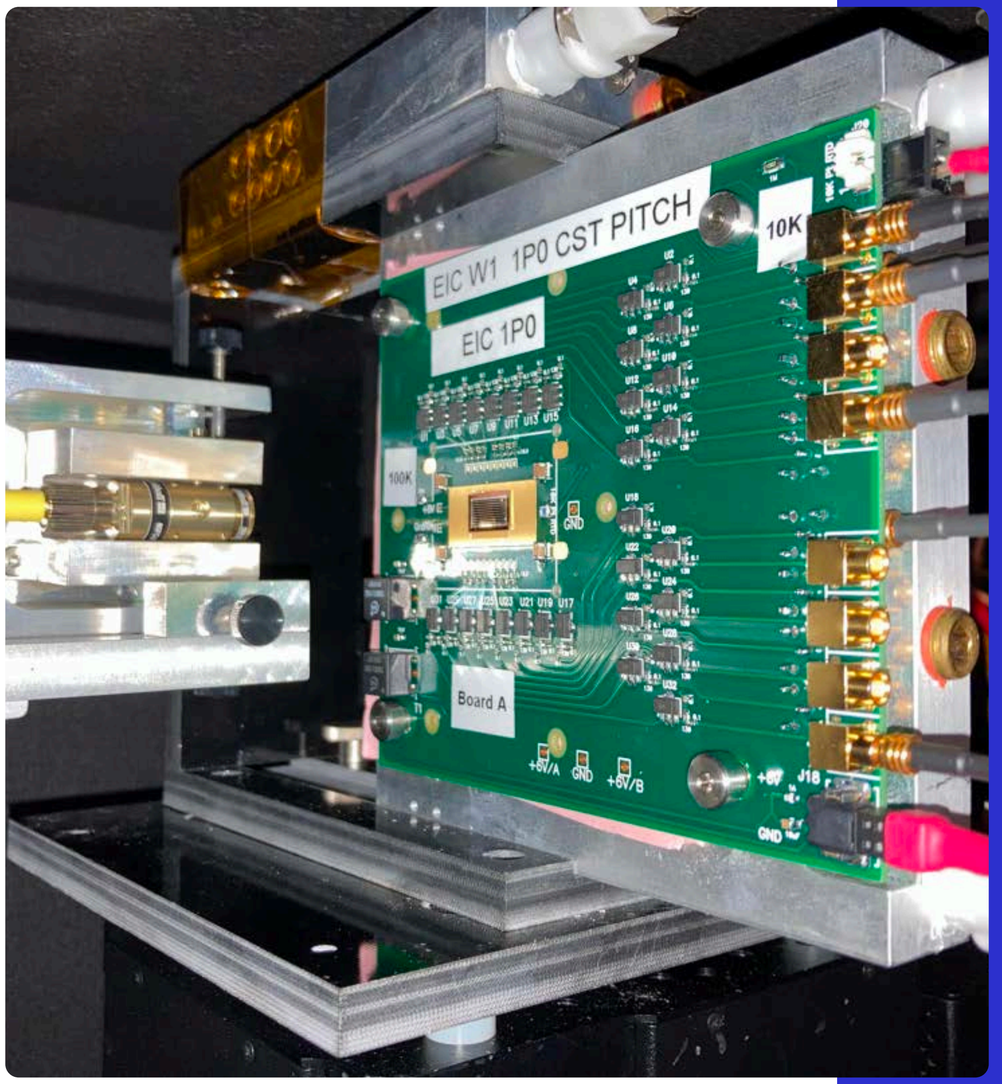
CCTVal

COLLABORATION

Fermilab

Four-Dimensional Tracking Technology

Detectors with high resolution and efficiency for the four-dimensional analysis of ionizing particle collisions in high-luminosity experiments, incorporating time measurement. This allows for **obtaining precise information on the charge, motion, and trajectory of particles**, making significant contributions to the field of experimental physics.



- HARDWARE AND SOFTWARE
- COMPOSITE MATERIALS
- BIG DATA
- HIGH ENERGY PHYSICS
- RADIATION

PARTICLE PHYSICS

CCTVal

COLLABORATION

Jefferson Lab

Double Target

Development of an **electromechanical device** that allowed the remote movement and exchange of nuclear targets in the **RG-E experiment**, under extreme conditions of high vacuum, intense magnetic field, ionizing radiation, and cryogenic temperatures.

- HARDWARE AND SOFTWARE
- MECHANICS
- AUTOMATION
- CRYOGENICS AND THERMODYNAMICS
- COMPOSITE MATERIALS
- RADIATION
- SIMULATION
- BIG DATA

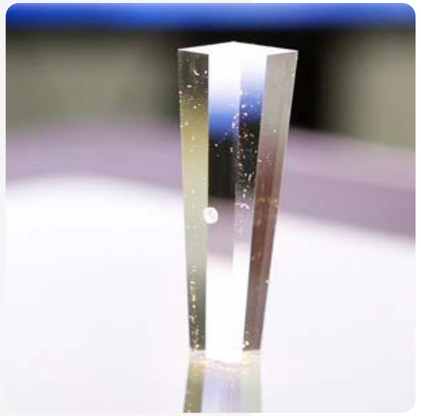
PARTICLE PHYSICS

COLLABORATION

Jefferson Lab

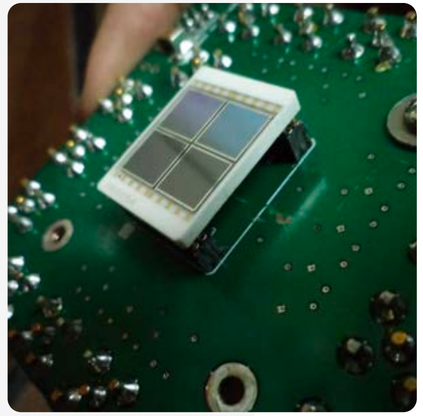
4,000 Light Guides

Devices manufactured for the **GlueX subdetector** that transmit light to sensors to help detect the presence of new particles.



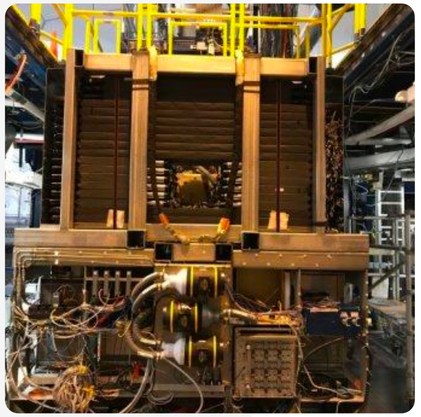
Characterization of 2,800 MPPC

Silicon photomultipliers, or photon counters, with 16 measurement channels still used in the **GlueX experiment**.



BAND - Back Angle Neutron Detector

A detection system for the CLAS12 Spectrometer at JLab.
It enables the detection of neutrons moving in the direction opposite to the electron beam. A collaborative project between CCTVal, MIT, JLab, and Tel Aviv University.



TELECOMMUNICATIONS

CCTVal

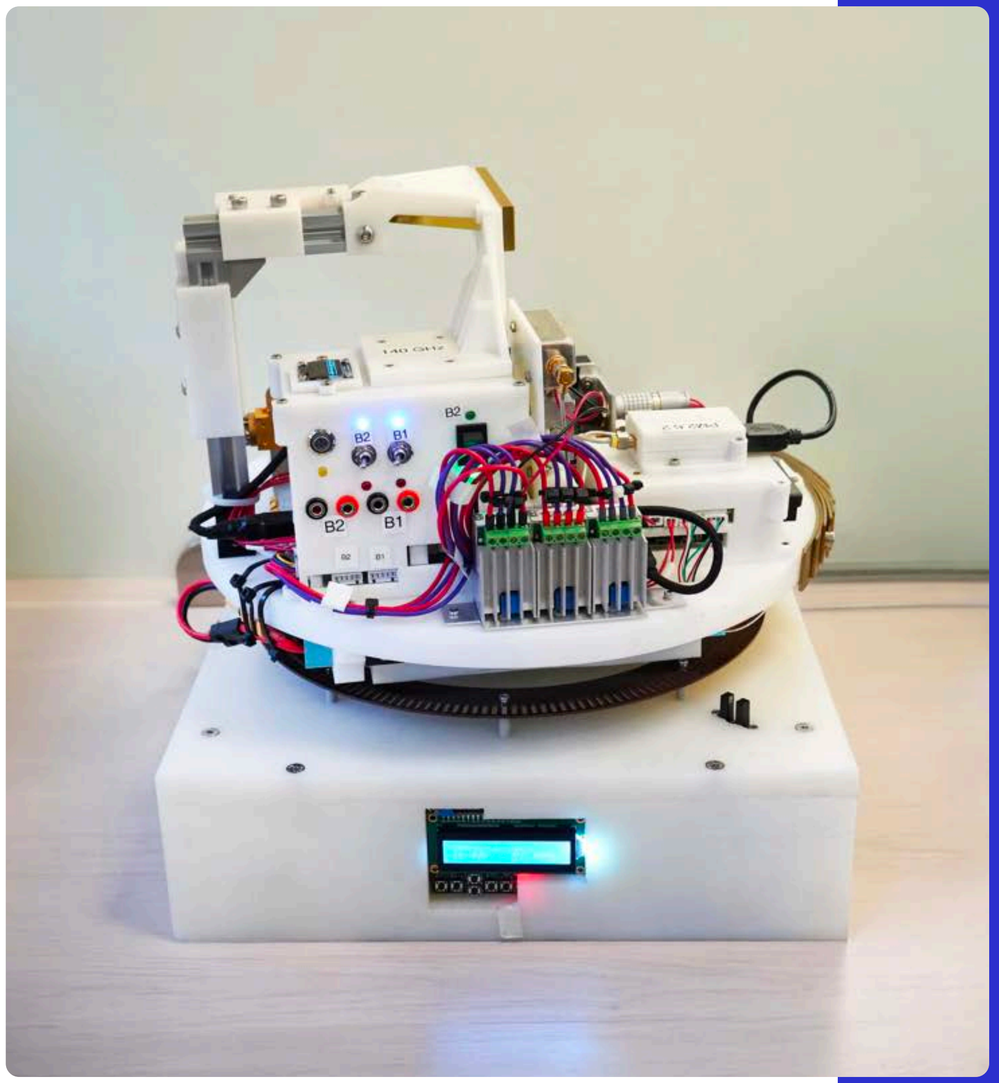
COLLABORATION

NOKIA BELL LABS

Channel Sounders

Development of statistical models for predicting wireless network coverage. As part of this work, we designed and manufactured **millimeter wave measurement equipment** for 28 GHz, 60 GHz, and 140 GHz, which is expected to be used in 5G networks and the deployment of 6G technology.

- HARDWARE AND SOFTWARE
- MODULAR DESIGN
- FIRMWARE
- MECHANICS
- MANUFACTURING
- SCIENTIFIC RESEARCH



ASTROPARTICLES

CCTVal

The Southern Wide-field Gamma-ray Observatory

The first gamma-ray observatory of its kind in the **Southern Hemisphere** (using water tanks instead of telescopes). It will be located in the **Atacama Astronomical Park**, Chile, and its design will allow for the detection of the **highest-energy light** arriving from outer space.

The collaboration involves over **200 scientists** from **15 countries.**

SCIENTIFIC RESEARCH

ASTROPARTICLES

CCTVal

COLLABORATION

CONDOR OBSERVATORY

UC RIVERSIDE

R&D for **CONDOR Observatory**

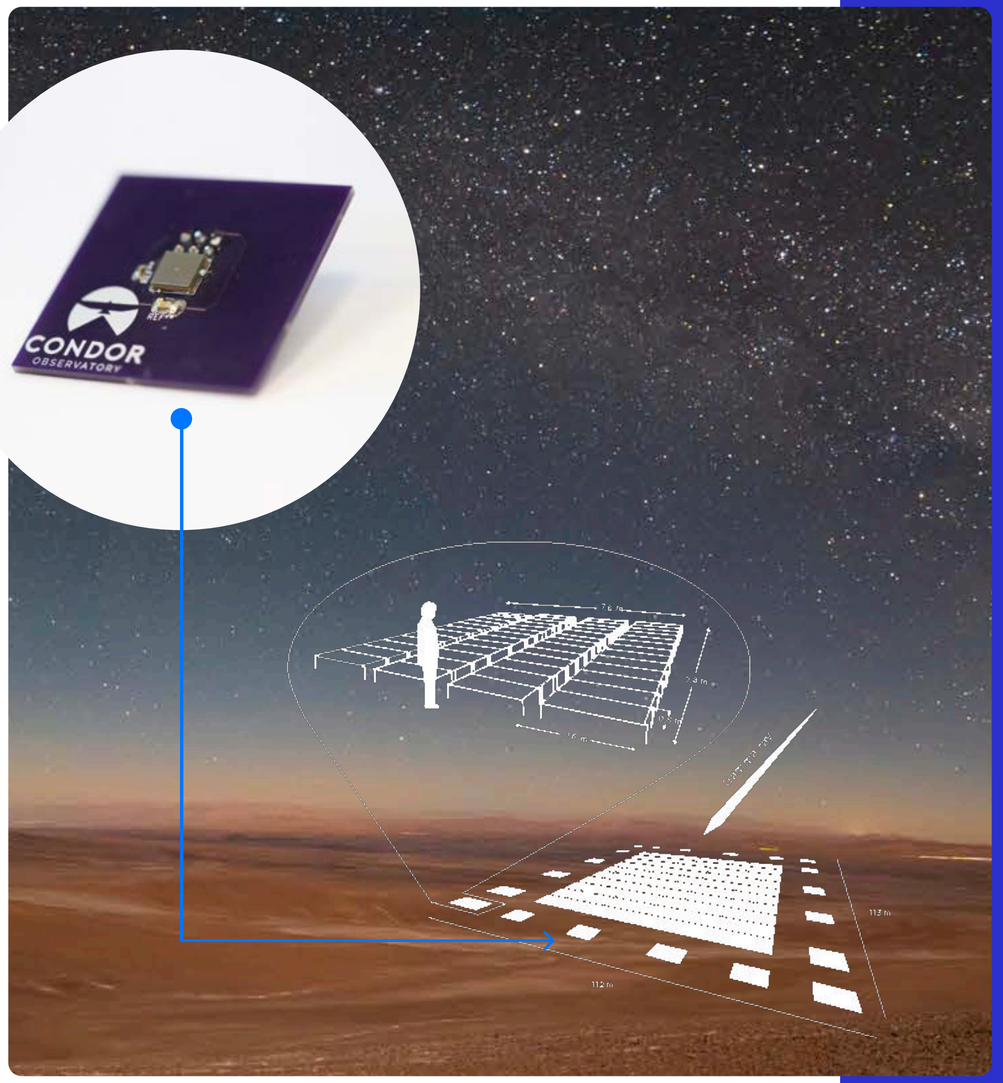
A data capture system based on CERN's **White Rabbit** technology (featuring sub-nanosecond precision) for the **CONDOR** astronomical project, the world's **highest-altitude gamma-ray observatory**, which will be constructed at the Atacama Astronomical Park in Chile.

HARDWARE AND SOFTWARE

SENSORIZATION

MACHINE LEARNING

MANUFACTURING



MINING

CCTVal

Muon Tomography

Device capable of generating three-dimensional images of terrain, specific underground sectors, or high-density objects.

Applications:

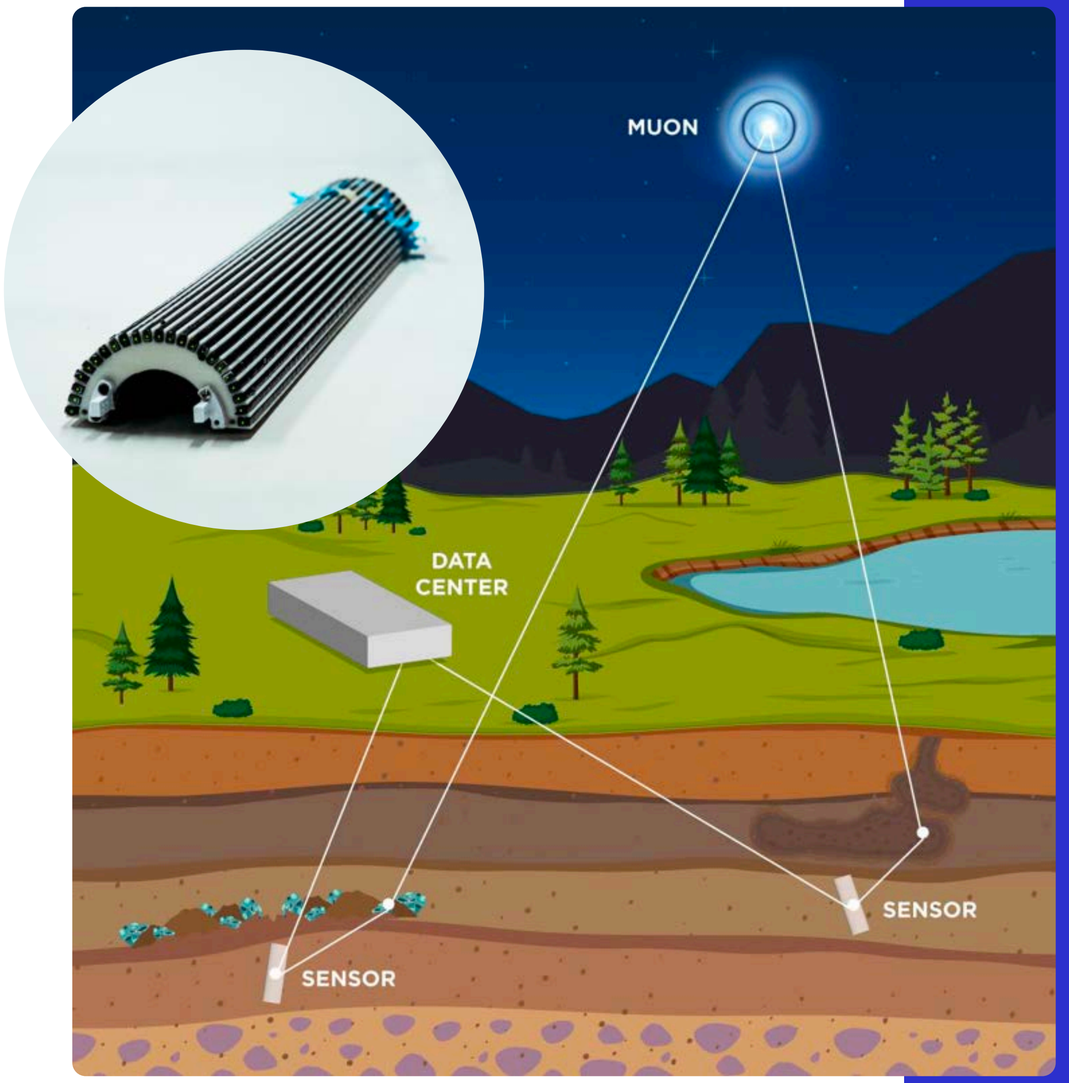
- Detection of mineral veins.
- Identification of water-bearing areas.
- Location of underground cavities.
- Evaluation of the condition of walls or supports.

BIG DATA

SENSING

TOMOGRAPHY

IMAGE PROCESSING



MINING

CCTVal

COLLABORATION

SQM

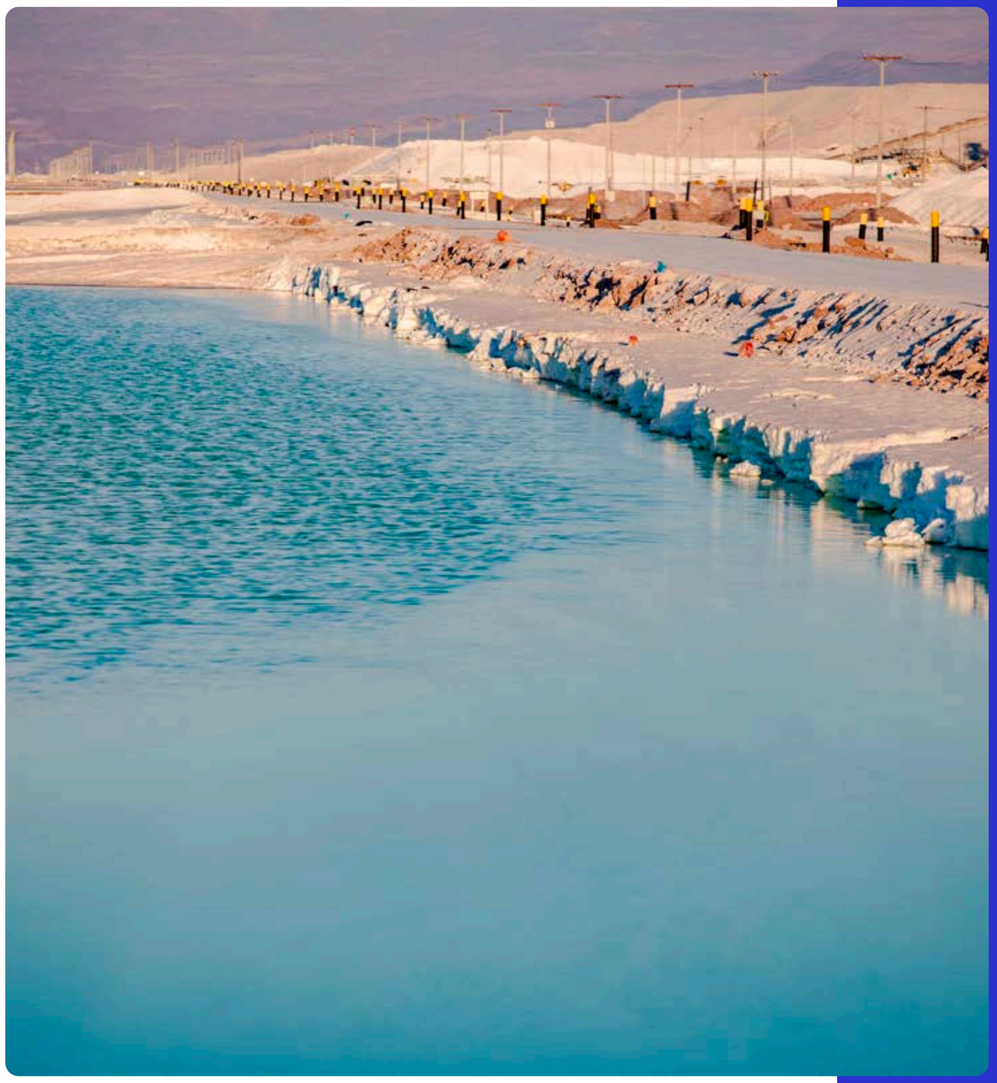
Nanobiotechnology for the lithium purification process

A sustainable membrane capable of removing impurities from lithium brine and reducing water consumption in the process. Made from nanomaterials and a biopolymer derived from the invasive microalgae Didymo.

MATERIAL DESIGN

SUSTAINABLE MINING

BIOPOLYMERS



ENERGY

CCTVal

SPIN OFF

CHEX

Compressed Hydro Energy Storage

A simple, economical, and sustainable energy storage system. It operates using water and gas, providing electrical energy at any time of day and ensuring reliability and integration into the grid.

- ENERGY EFFICIENCY
- INDUSTRIAL ELECTRICAL SYSTEMS
- AUTOMATION

Patented technology in Chile, Argentina, Europe and Australia

In **2024**, CHEX received the **National Innovation Award in the Colbún Energy** category, honoring its efficient, sustainable, and cost-effective solution.

ENERGY

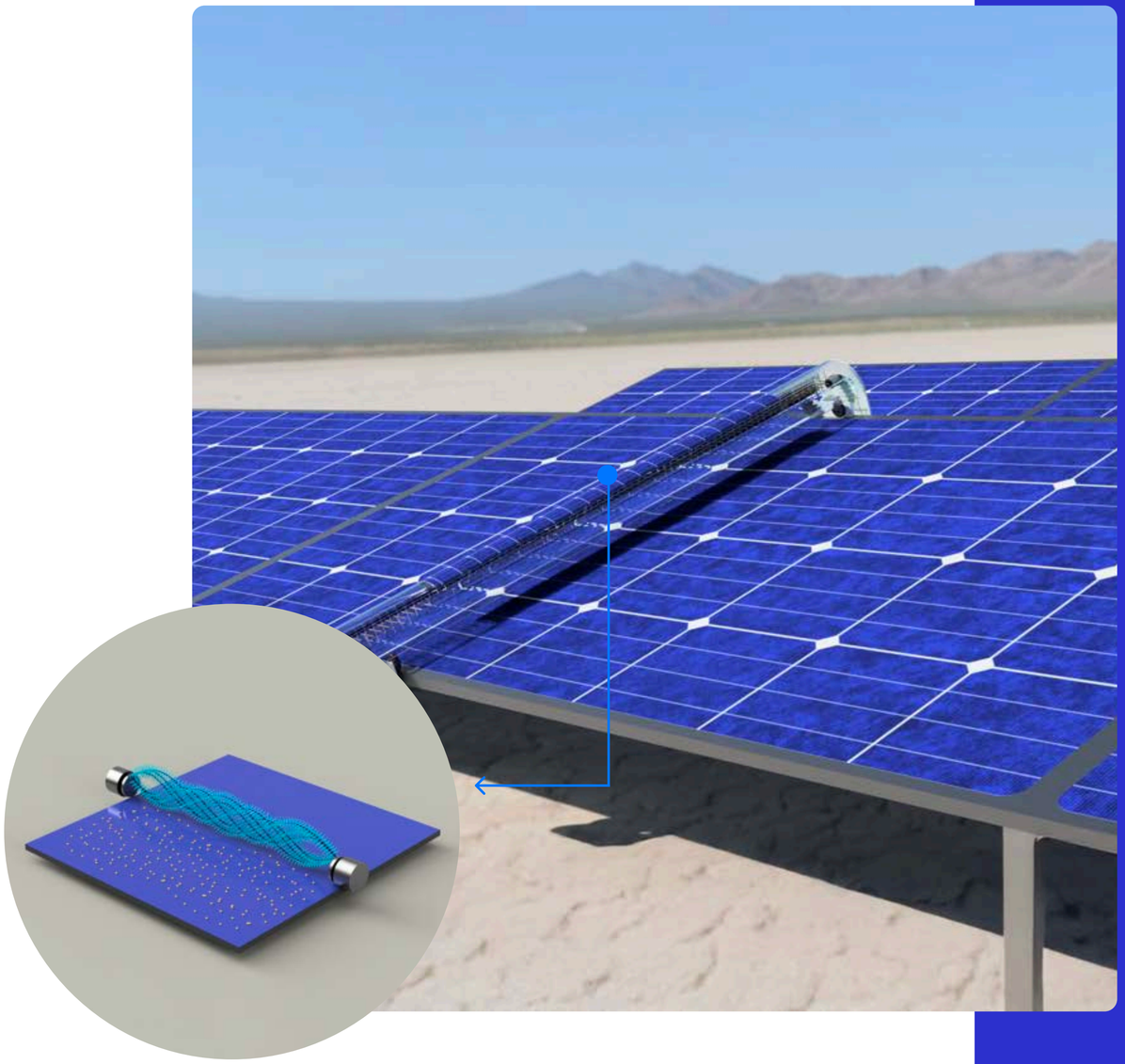
CCTVal

SPIN OFF

Robot for cleaning photovoltaic panels

This device uses a vibrating wire brush to increase the efficiency of solar plants by up to 10%. It works without water and, thanks to its **simple and innovative design**, operates autonomously without the need for supervision or constant maintenance.

- WATER FREE
- LIGHTWEIGHT
- SELF-POWERED
- FULLY AUTOMATIC



start up ciencia

This project was selected in the **Startup Ciencia 2025** competition.

ENERGY

CCTVal

Low-temperature desalination system

We developed a **microdroplet evaporation system** that mimics the hydrological cycle, reducing particle size to enhance the **evaporation rate** and increase the **efficiency** of the process.

- ENERGY EFFICIENCY
- SENSING
- AUTOMATION
- FLUID MECHANICS

CONCURSO ANID IDeA I+D 2025

Winner of the **IDeA I+D 2025** competition.

INDUSTRY

CCTVal

SPIN OFF

AquaRov Remote Technology

WILDSENSE

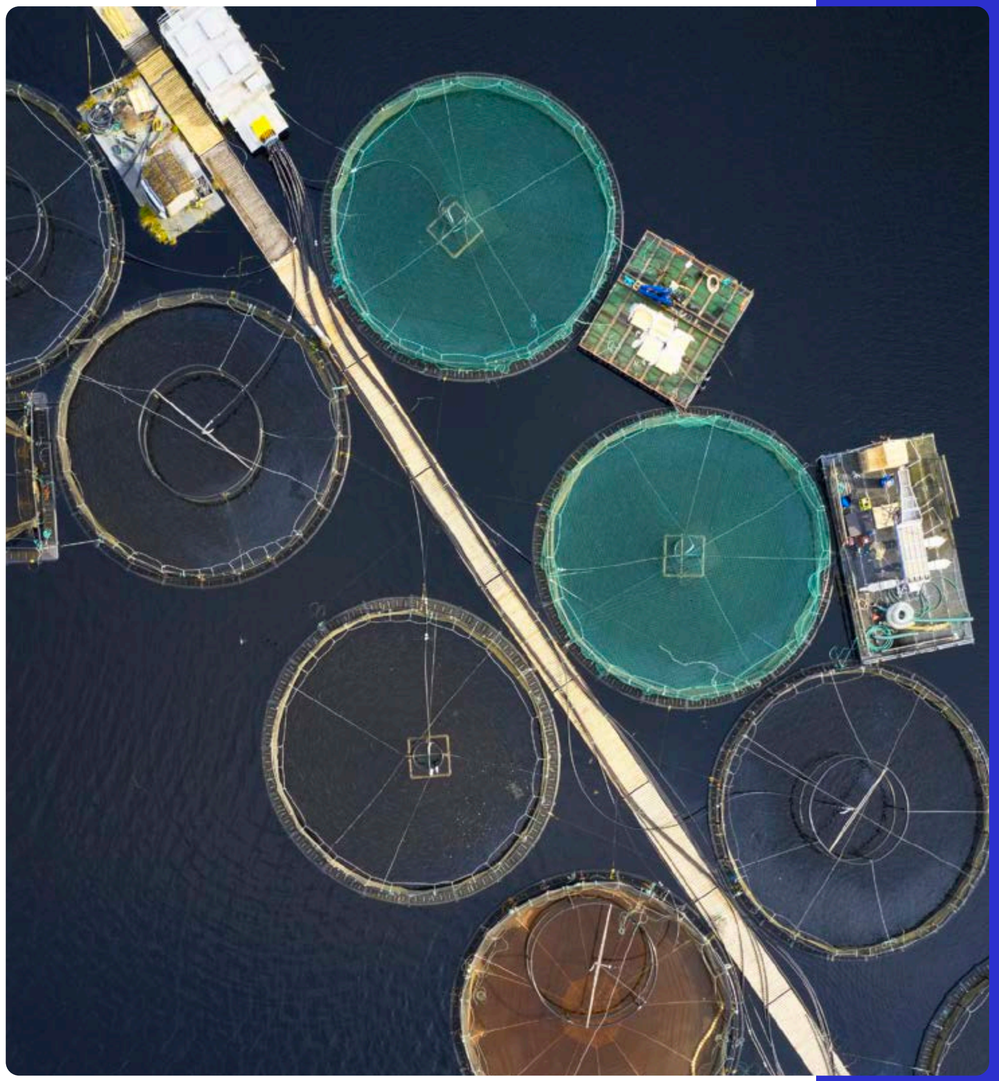
Submarine robotic inspection system for aquaculture cages

It enables the **monitoring** and **collection of relevant data** for fish farming and processing, providing the industry with **decision-making capabilities** based on high-precision information.

- ARTIFICIAL VISION
- ROBOTICS
- IoT
- COMPUTER VISION

PATENTED

Patented technology in Chile.



INDUSTRY

CCTVal

HOMME
Hydrodynamic Ocean Models for Maritime Emergencies

A system that estimates the **trajectory of floating objects**, pinpointing tracking areas and reducing search time.
It offers **movement forecasts** for particles of interest and provides specialized support for search operations and maritime emergencies.

SOFTWARE

SIMULATION

BIG DATA

WEB DEVELOPMENT

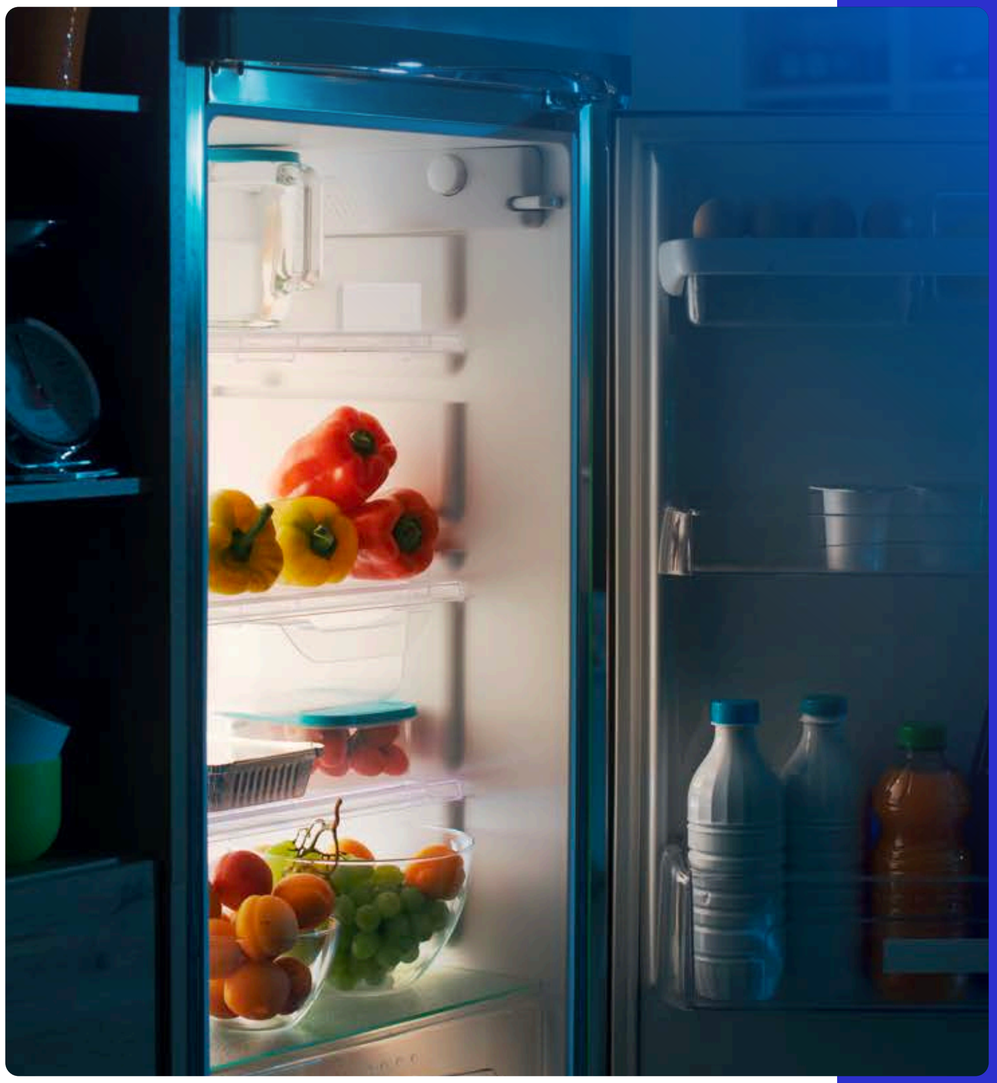
INDUSTRY

CCTVal

Datalogger
Optical Sensor

A device designed to capture **ambient light** and internal refrigerator temperature data, registering and storing timestamps, sample numbers, and a binary value that indicates the state of the refrigerator (open or closed) during measurement.

- HARDWARE AND SOFTWARE
- SENSING TECHNOLOGY
- ELECTRONICS
- EMBEDDED SYSTEMS
- MICROCONTROLLERS



INDUSTRY

CCTVal

Copper Nanoparticles

Produced using a **low-cost, cutting-edge method**, they ensure the chemical quality required by the market. Their **strong interaction** with microorganisms enables a wide range of applications in medical technology, while also offering **industrial advantages** in fields such as electronics and environmental protection.

- ELECTROCHEMISTRY
- ANALITYCAL CHEMISTRY
- PHYSICAL METALLURGY
- PROCESS DESIGN

HEALTH

CCTVal

Technological Platform for Medical Physics

Design and manufacturing of devices and advanced materials with biomedical applications. Our team of researchers is currently developing **biomaterials** and **nanobiomaterials** as a base for **skin implants.**

- SCAFFOLDS
- BIOMATERIALS
- BIOPHYSICS
- MEDICAL PHYSICS

PATENTED PATENTED

Patented technology in Chile

GANADOR AVONNI
Premio Nacional de Innovación 2022

The project **"Mammal Component-Free Skin Implants"** won the **National Innovation Award Avonni 2022** in the Costamar ISA Intervial category. To date, this project has successfully passed preclinical tests.

HEALTH

CCTVal

Microfluidic devices for biotechnological applications

Our **Photolithography Laboratory** team has achieved significant innovations in this field, focusing on the creation of double-layer **master molds** for the fabrication of chips with variable cross-section channels. The benefits of these devices include:

- Improved cell separation and sorting.
- Recreation of biological microenvironments.
- Optimization of chemical and biological reactions.
- Advances in clinical diagnostics.

MICROFLUIDICS

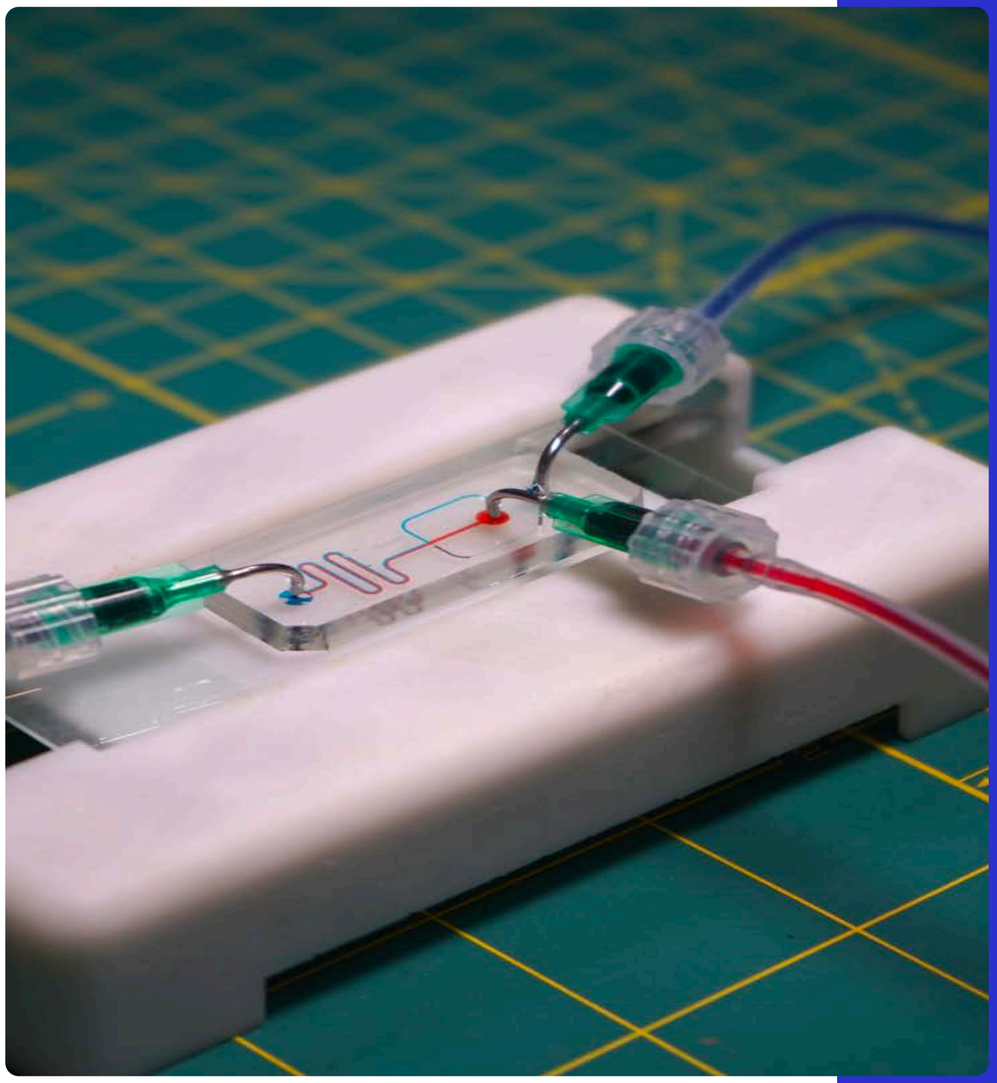
BIOTECHNOLOGY

PHOTOLITHOGRAPHY

ORGAN ON A CHIP

LAB ON A CHIP

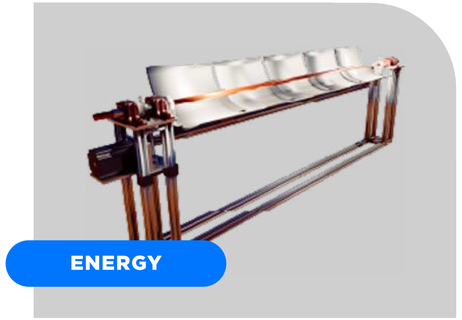
MEDICAL DEVICES



CCTVal

Carbon Fiber

We have explored its **potential** through the design and manufacture of new products **since 2015**.



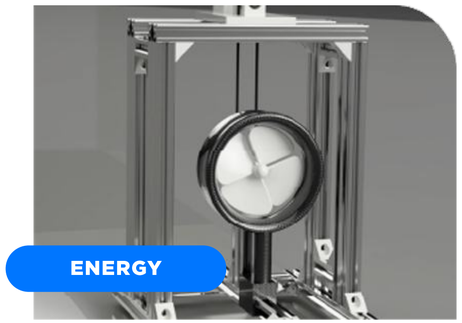
ENERGY

Parabolic Collector
for solar energy concentration plants.

ENERGY

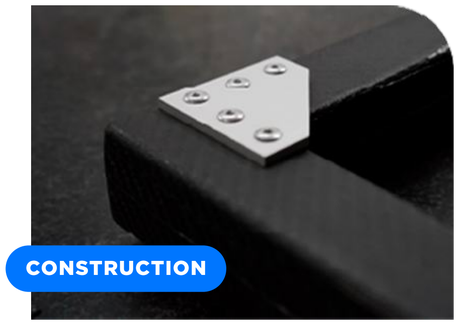
Aerodynamic Rings
for wind turbines.

UP TO 20% MORE EFFICIENCY



ENERGY

Hydraulic Turbine
for rivers and tributaries with low discharge and flow speed.



CONSTRUCTION

Structural Beams and Profiles
for modular housing

LIGHTER AND MORE RESISTANT

ASTRONOMY

High-Resolution Mirrors
for astronomical observation instruments

ADVANTAGES

- Stronger than steel, and lighter than aluminum.
- High thermal insulation capacity and corrosion resistance.
- High resistance for the reinforcement of structures.
- Flexible, maneuverable, and easy to install.

We promote **technology transfer** by supporting national and international **R&D&I** industry challenges.

We can assist you with:

CCTVal

cctval.usm.cl

UNIVERSIDAD TECNICA
FEDERICO SANTA MARIA

EN UMBRA IN SOLEM

Agencia Nacional de Investigación y Desarrollo

Ministerio de Ciencia, Tecnología, Conocimiento e Innovación

Gobierno de Chile