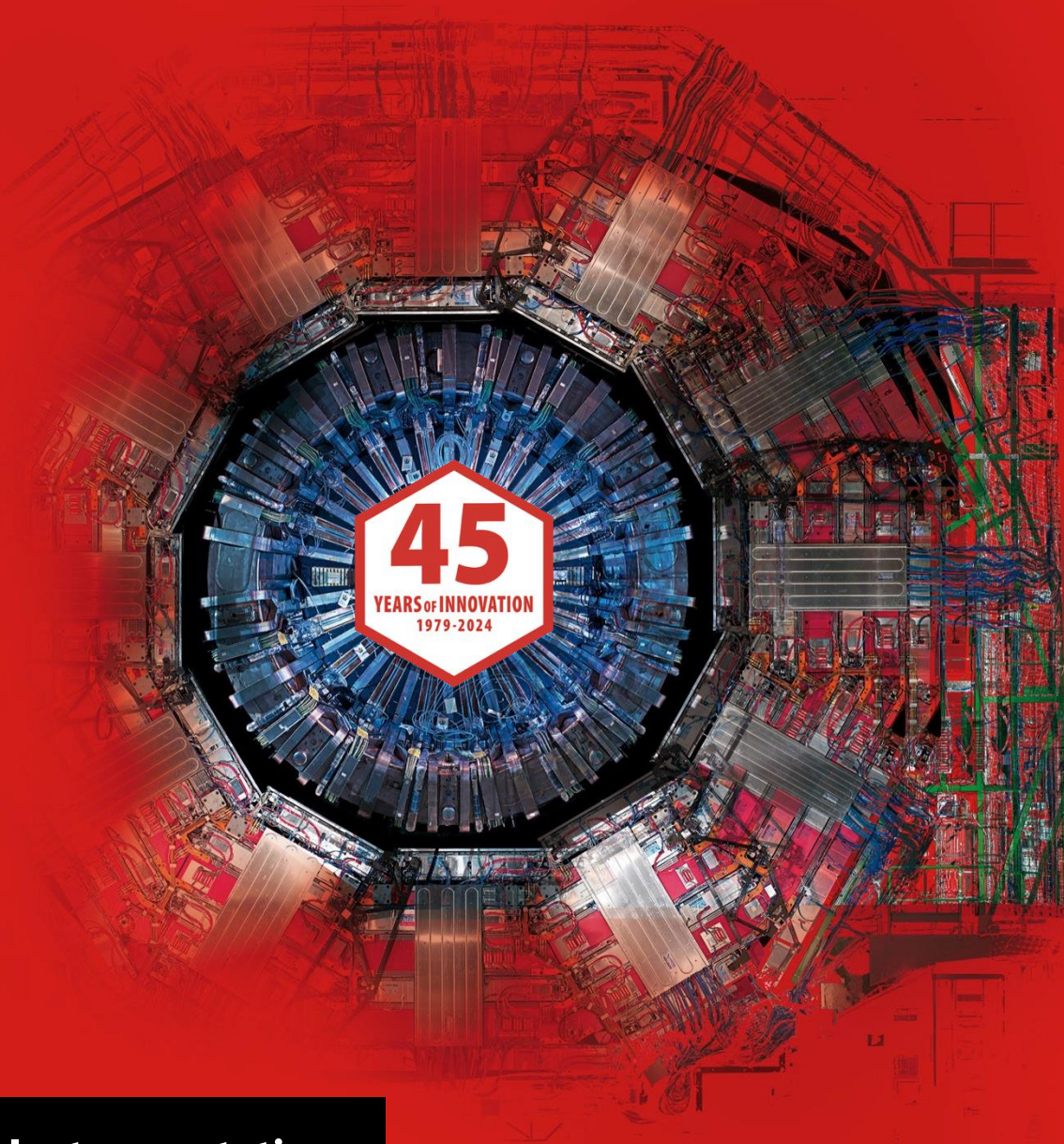




Company Overview



CAEN 
Tools for Discovery

Electronic Instrumentation

CAEN Group

Founded in 1979, **CAEN S.p.A.** (Costruzioni Apparecchiature Elettroniche Nucleari) is an important industrial spin-off of the INFN.

Core business: Electronic Instrumentation for physics experiments (world leader)

Spin-off activities:

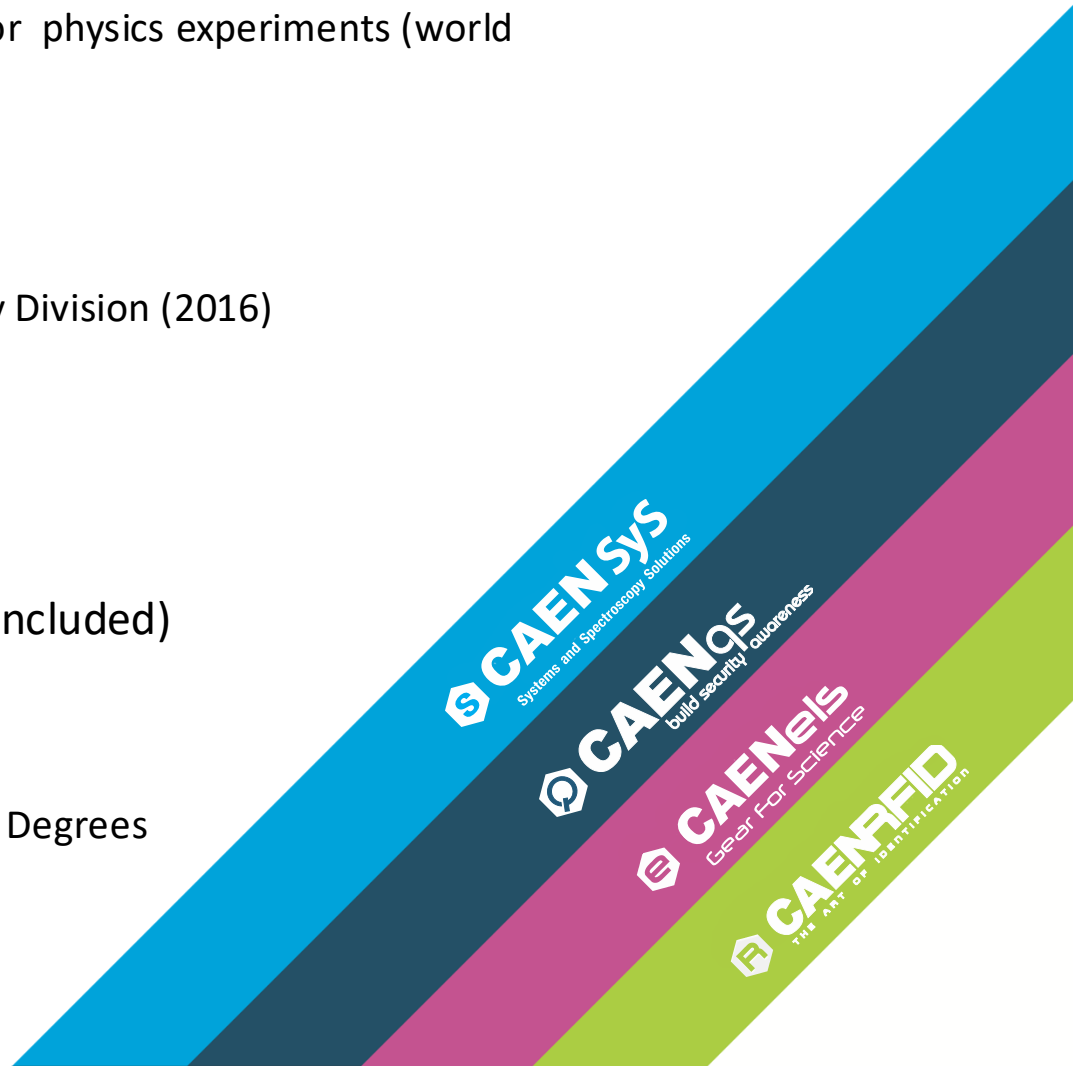
- > **CAEN S.p.A.**
 - > **CAEN** SyS – CAEN Spectroscopy Division (2016)
 - > **CAEN** RFID s.r.l. (2003)
 - > **CAEN**els s.r.l. (2010)
 - > **CAEN**qS s.r.l. (2012)

> **Total Employees** (production not included)

> **197 People**



- > 18 Ph.D.s
- > 96 Bachelor's and Master's Degrees
- > 76 Diploma Engineers
- > 7 Technical Staff



Quality Certification



Worldwide presence

**Worldwide sales network offices in Italy, Germany, USA,
Distributors in more than 30 countries.**

Portfolio: > 5000 customers

Customers Include all world leading research centres as:

**Europe: CERN, INFN, CEA, CNRS; GSI, ESO, ISIS,
Ganil, PSI, ...**

USA: FNAL, SLAC, Los Alamos, BNL, Jlab, ...

Asia: J-Park, KEK, Riken, IHEP, TIFR, ...

Africa: iThemba Labs, ...

And private companies.



CAEN Headquarters

CAEN boasts more than 40 authorized distributors worldwide and maintains four headquarters strategically located across the globe.



- **CAEN** S.p.A. (Italy)
- **CAEN**spa India Private Limited (India)
- **CAEN** GmbH (Germany)
- **CAEN** Technologies (U.S.A.)

Milestones

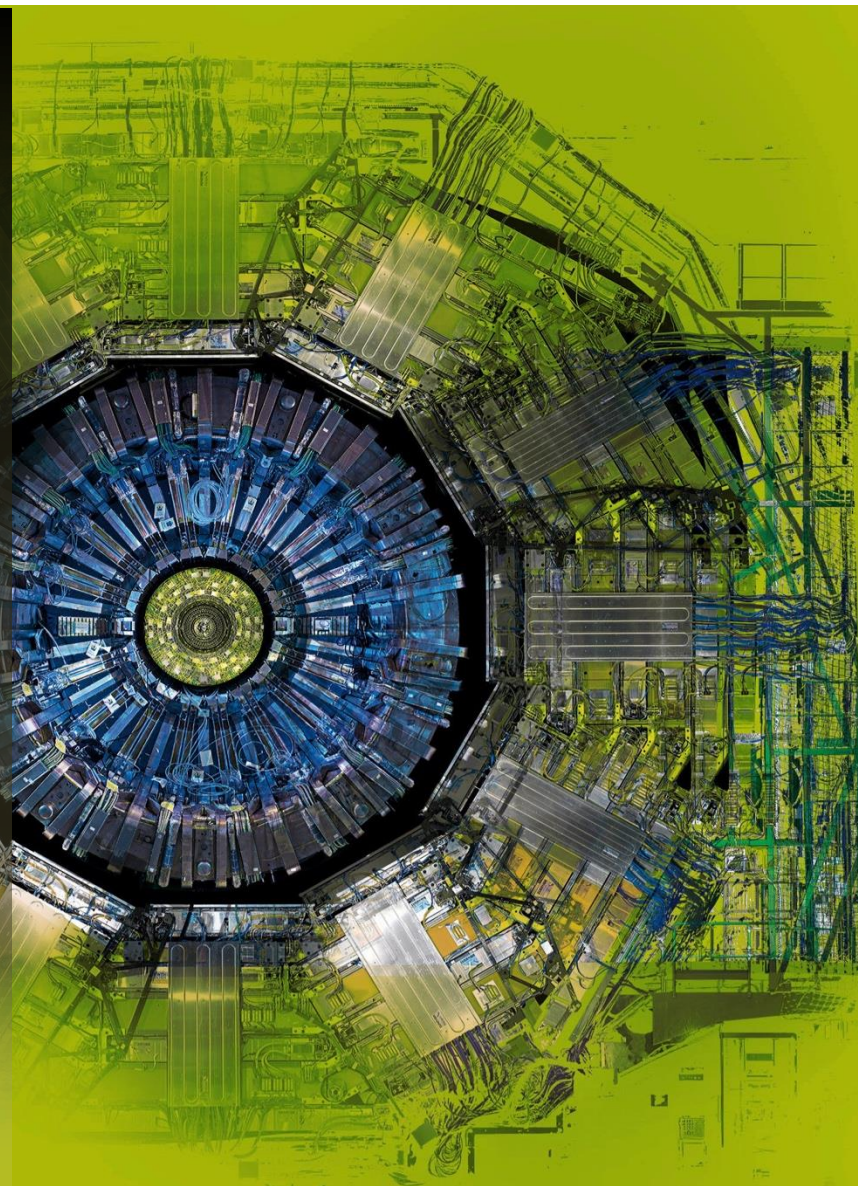
- 
- > **1979:** established in Viareggio by a group of senior engineers from INFN
 - > **1986:** first High Voltage Power Supply System (400.000 HV channels delivered worldwide in 30 years)
 - > **1991:** CAEN started VME design for nuclear market (1991-2016: 600.000 FE & DAQ channels delivered worldwide)
 - > **1994:** CAEN Microelectronics spin-off
 - > **1996:** CAEN Aerospace spin-off
 - > **1997:** UNI EN ISO 9001 quality certification
 - > **1998:** Started electronic design for LHC/CERN experiments (1998-2016: 8.500 electronic devices 250.000 boards/sub-boards)
 - > **2001:** UNI EN ISO 9001: Vision 2000
 - > **2003:** CAEN RFID spin-off (Radiofrequency Automatic Identification)
 - > **2005:** CAEN Technologies Inc., a CAEN branch company in the US
 - > **2006:** CAEN GmbH, A CAEN branch company in Germany
 - > **2010:** CAEN els spin-off (Accelerator Electronic Instrumentation)
 - > **2012:** CAEN qS spin-off (Cyber Security)
 - > **2016:** CAEN SyS started (Systems and Spectroscopy Division)
 - > **2022:** CAEN India Private Limited, a CAEN branch company in India

Market

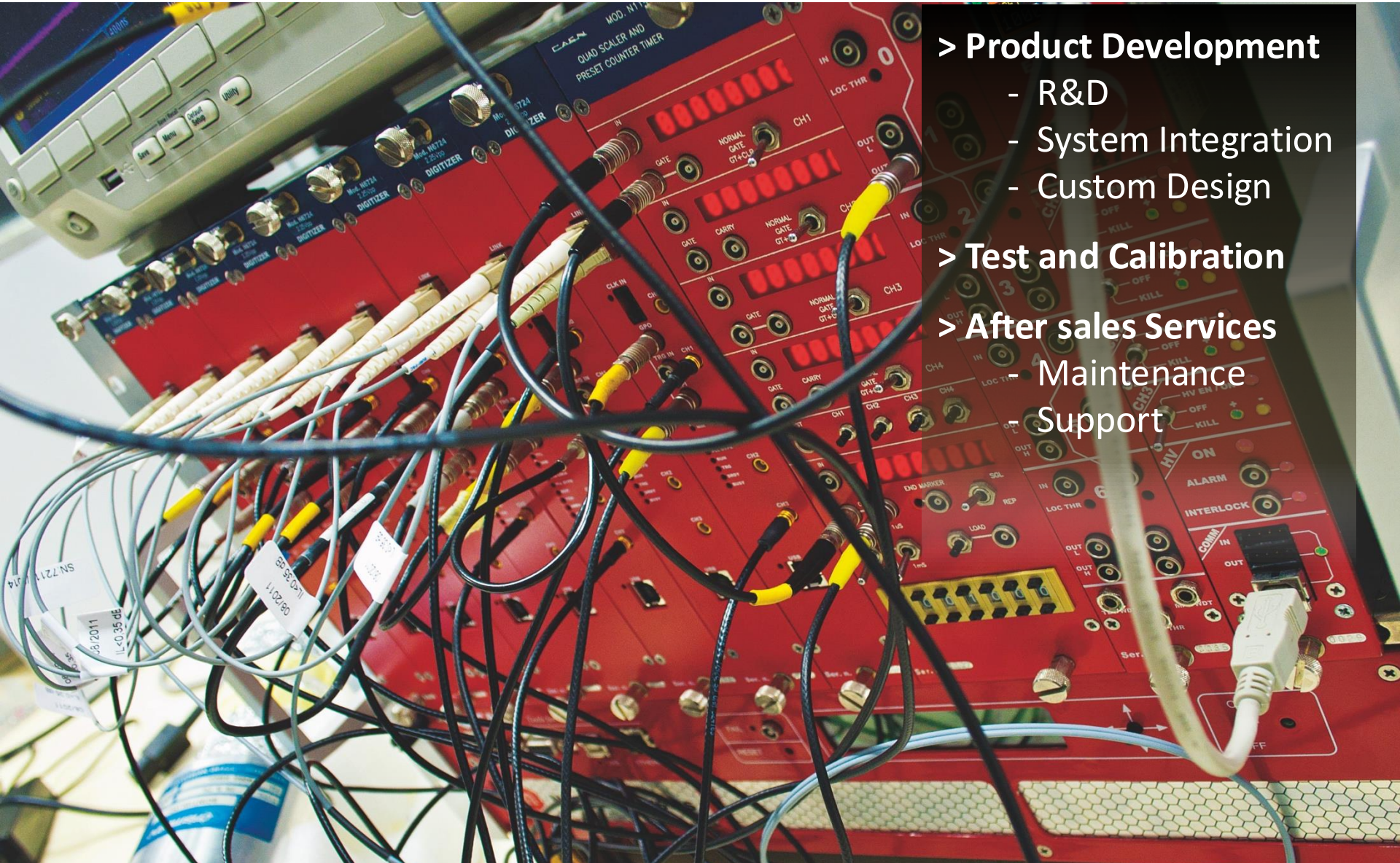
For more than 45 years CAEN has been providing Scientists and Engineers with the most advanced electronic instrumentation for any particle or radiation detectors

Strong of an extremely close collaboration with the world major research laboratories CAEN is proud to produce the best tools for:

- > High Energy Physics
- > Astrophysics
- > Neutrino Physics
- > Dark Matter Investigation
- > Nuclear Physics
- > Material Science
- > Medical Applications
- > Homeland Security
- > Industrial Applications
- > Spectroscopy Applications



Key strengths



> Product Development

- R&D
- System Integration
- Custom Design

> Test and Calibration

> After sales Services

- Maintenance
- Support

Product Development

- > The R&D division is strong of high level Physicists and Engineers who adopt forefront technologies to design innovative products
- > Ongoing collaborations with important institutes such as: CERN, Elettra, CEA, CNRS, PSI, INFN, etc.



Test



- > All assembling activities are outsourced
- > Experienced group of engineers dedicated to in-house Test and Calibration of the entire production
- > All procedures are ISO certified providing the complete traceability of the products

Maintenance and Support services

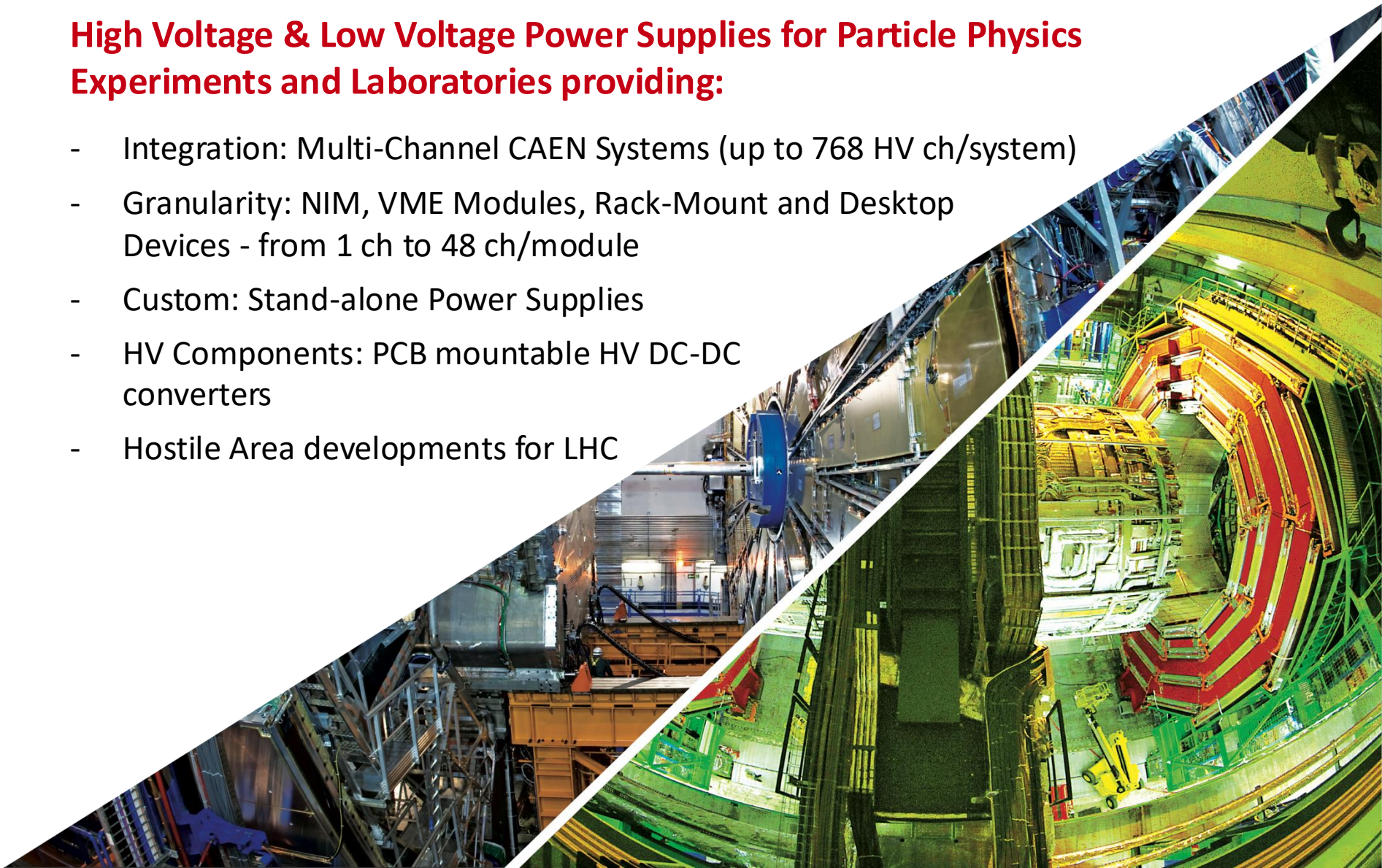
- > Excellent pre - and after - sales support
- > Strong maintenance division
- > Long Term Maintenance Contract (CERN 10 years and more)
- > On line support service
- > Short intervention time (on request, on-site within one day only in Europe)
- > Short delivery (on request worldwide)



Power Supplies Expertise

High Voltage & Low Voltage Power Supplies for Particle Physics Experiments and Laboratories providing:

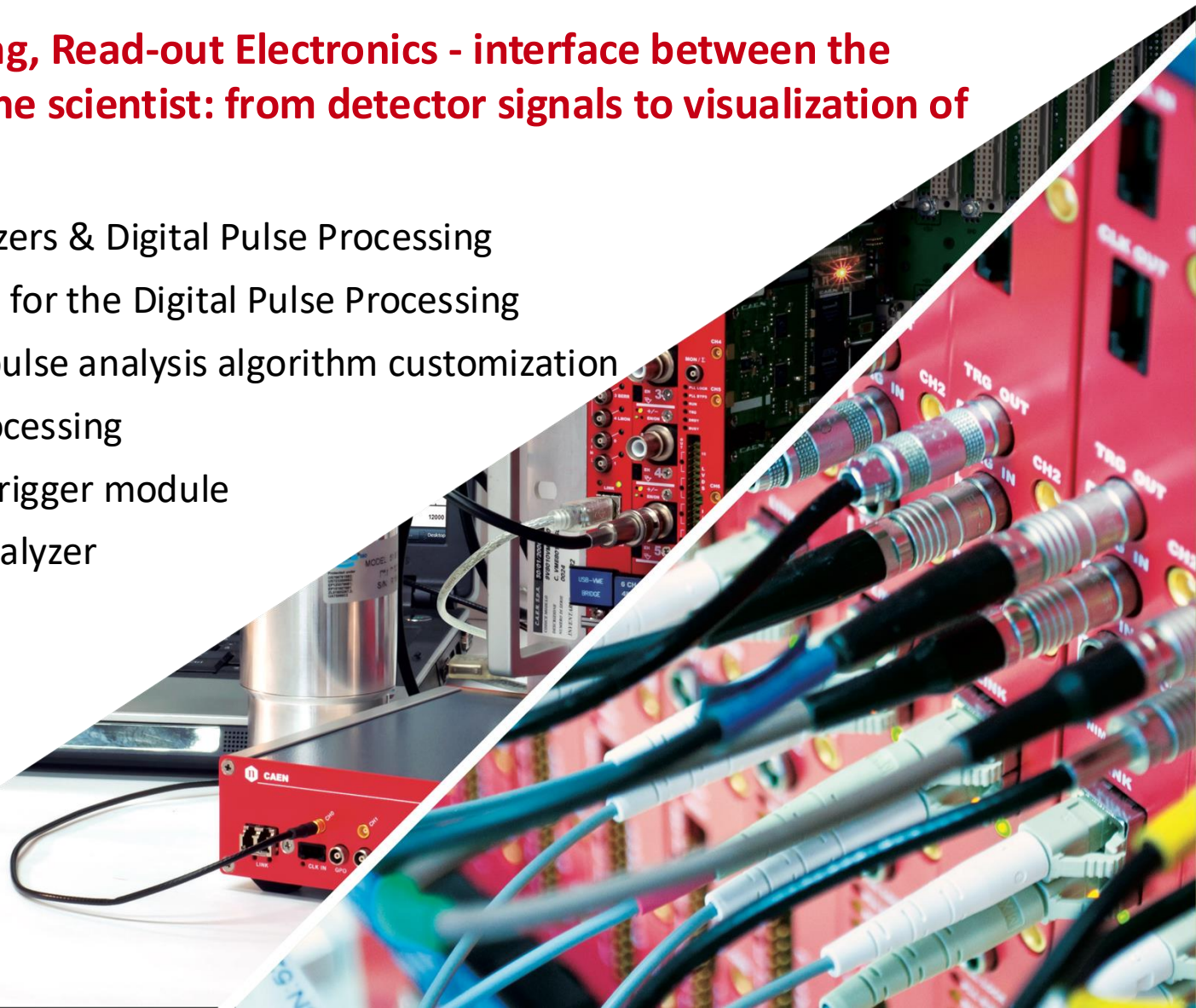
- Integration: Multi-Channel CAEN Systems (up to 768 HV ch/system)
- Granularity: NIM, VME Modules, Rack-Mount and Desktop Devices - from 1 ch to 48 ch/module
- Custom: Stand-alone Power Supplies
- HV Components: PCB mountable HV DC-DC converters
- Hostile Area developments for LHC



Pulse Processing Expertise

Signal Conditioning, Read-out Electronics - interface between the experiment and the scientist: from detector signals to visualization of data!

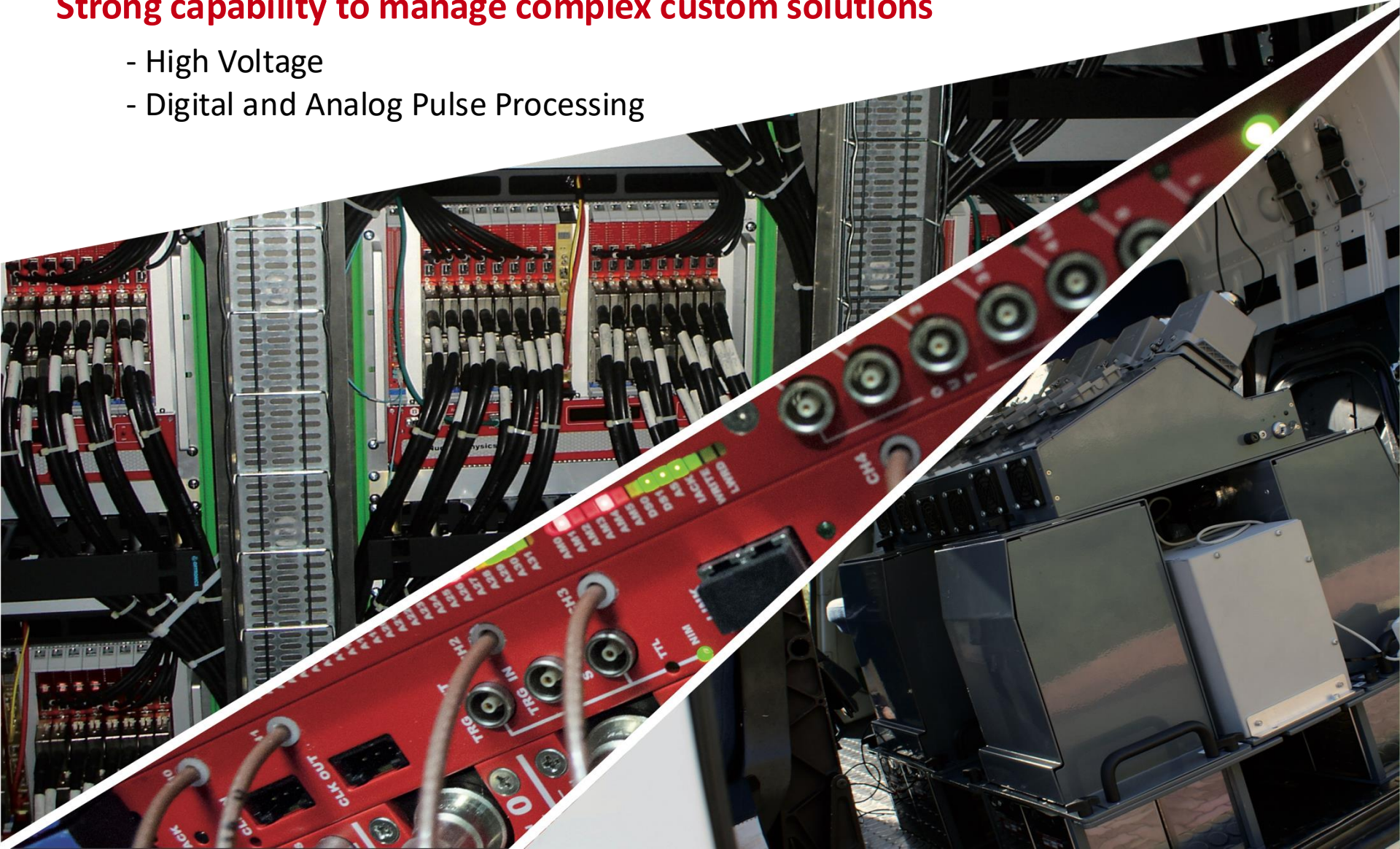
- Waveform Digitizers & Digital Pulse Processing
- FPGA algorithms for the Digital Pulse Processing
- Open FPGA for pulse analysis algorithm customization
- Analog Pulse Processing
- Programmable Trigger module
- Multichannel Analyzer
- Preamplifiers
- Custom project



Custom Developments: Case History

Strong capability to manage complex custom solutions

- High Voltage
- Digital and Analog Pulse Processing



CERN/LHC Electronics in Hostile Environments

"EASY" Multi Function System

- > 2 kGauss magnetic field
- > $1 \cdot 10^{11}$ p/cm² TD - 15 kRad TID
- > $2 \cdot 10^{12}$ n/cm² TD



Designed with COTS components to work in "hostile" areas

CAEN & LHC Experiments

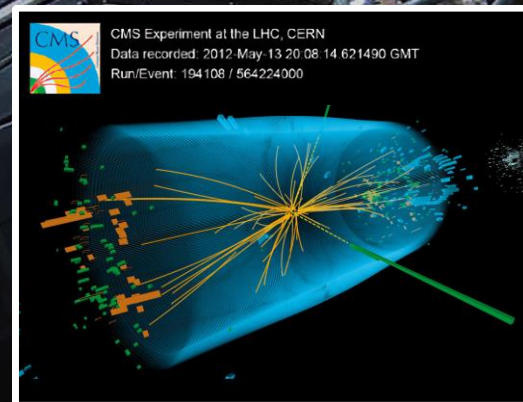
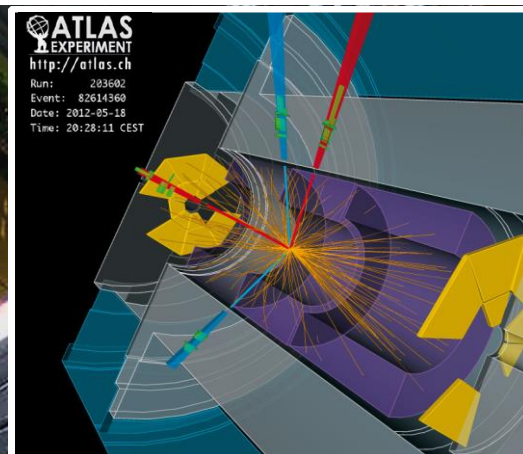
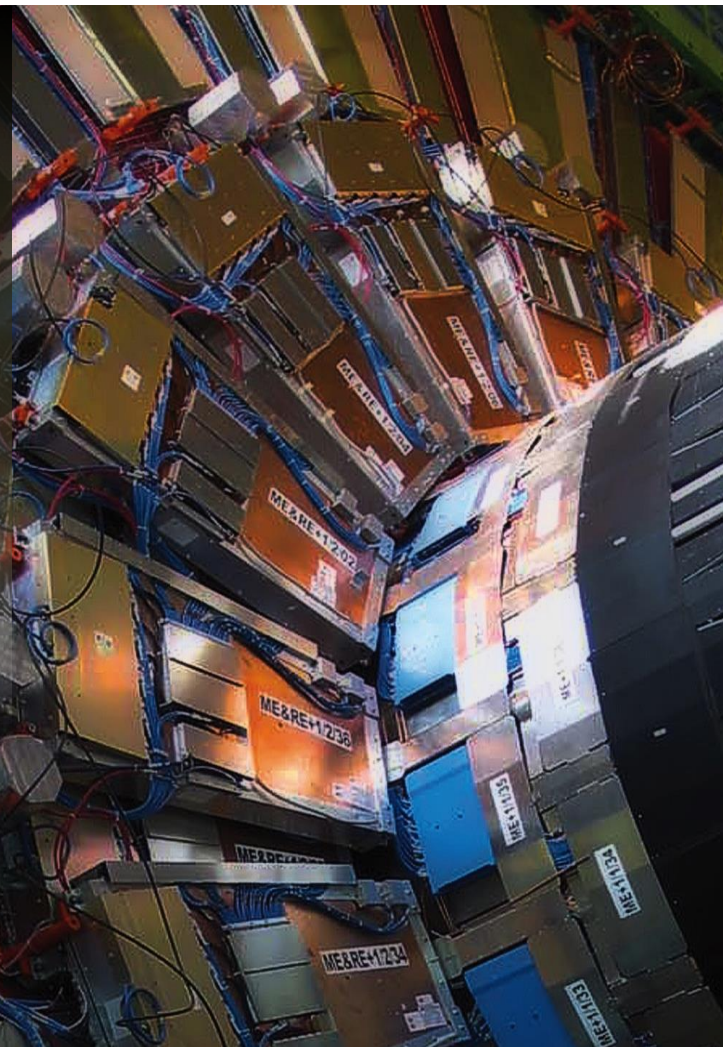
1998 – 2024

SYNERGY for SUCCESS

26 years of joint efforts to achieve top performances

> 8.500
electronic devices

> 250.000
boards/sub-boards

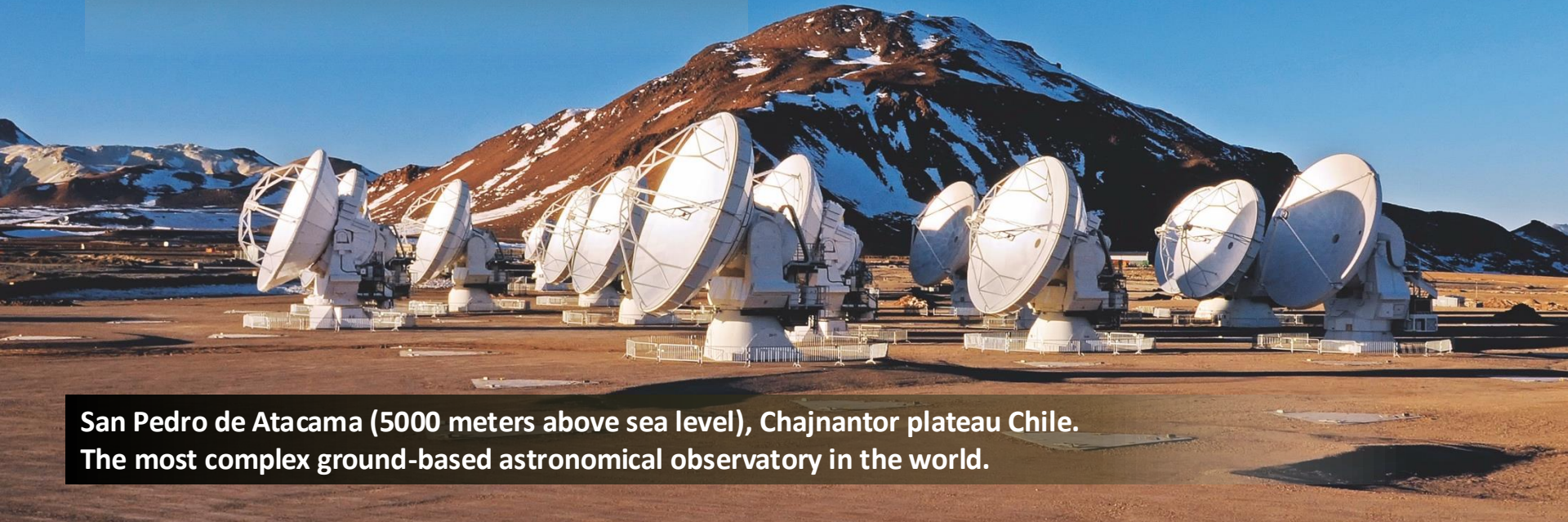
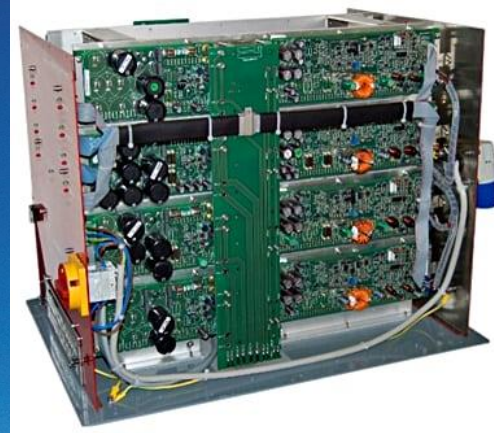


CAEN has received the "CMS Crystal Award" for the development and production of the power system for the CMS/LHC Tracker



LV Power Supply for ALMA (ESO)

- > Design of custom LV Power Supply System for ALMA
- > **86 Complex LV Systems delivered (688 power channels)**
- > **Harsh environmental condition (desert at 5,000 m altitude)**
- > **Designed to operate for at least 30 years; 24/7 (24 hours a day, seven days a week)**



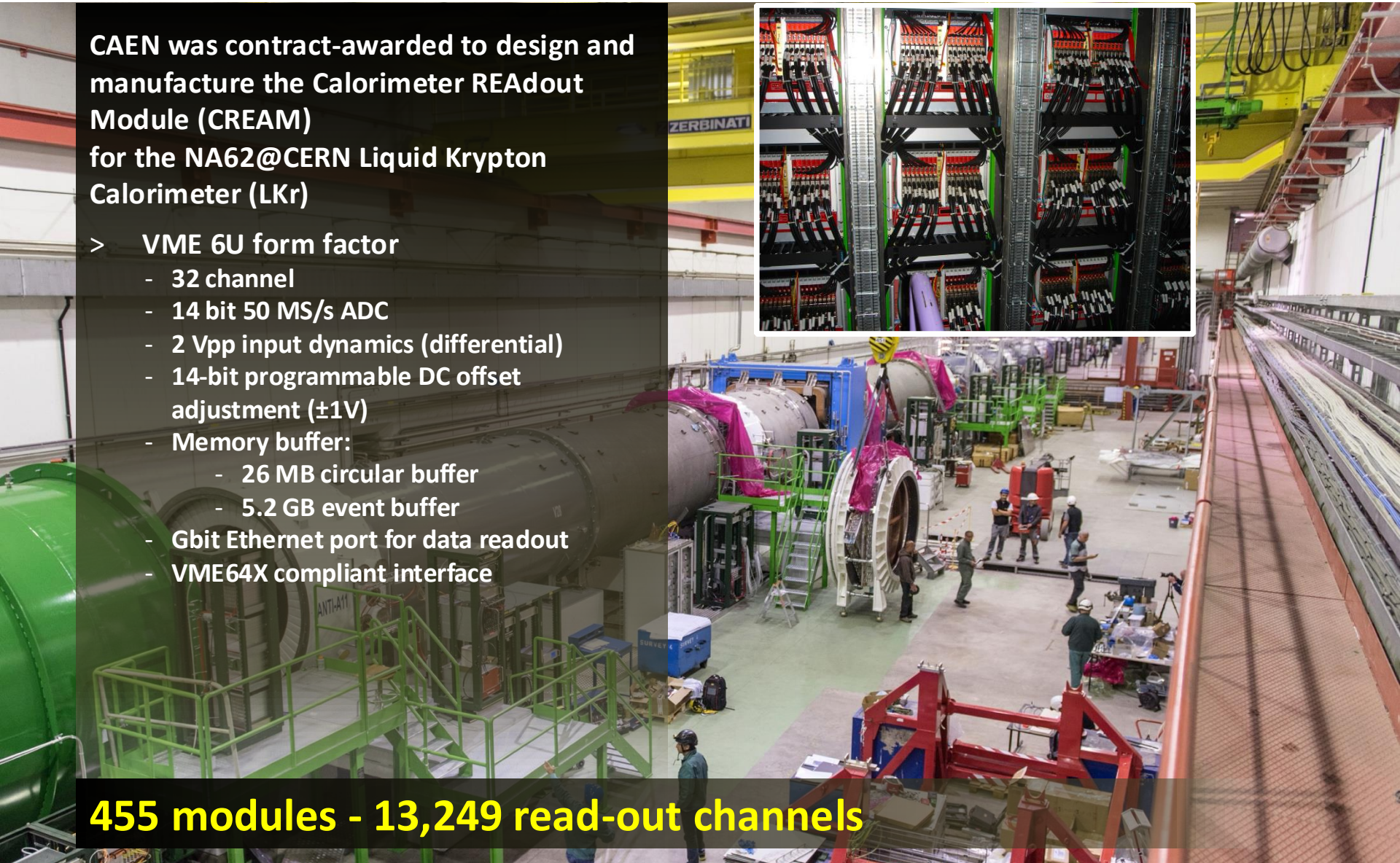
San Pedro de Atacama (5000 meters above sea level), Chajnantor plateau Chile.
The most complex ground-based astronomical observatory in the world.

NA62@CERN

CAEN was contract-awarded to design and manufacture the Calorimeter REAdout Module (CREAM) for the NA62@CERN Liquid Krypton Calorimeter (LKr)

> VME 6U form factor

- 32 channel
- 14 bit 50 MS/s ADC
- 2 Vpp input dynamics (differential)
- 14-bit programmable DC offset adjustment ($\pm 1V$)
- Memory buffer:
 - 26 MB circular buffer
 - 5.2 GB event buffer
- Gbit Ethernet port for data readout
- VME64X compliant interface

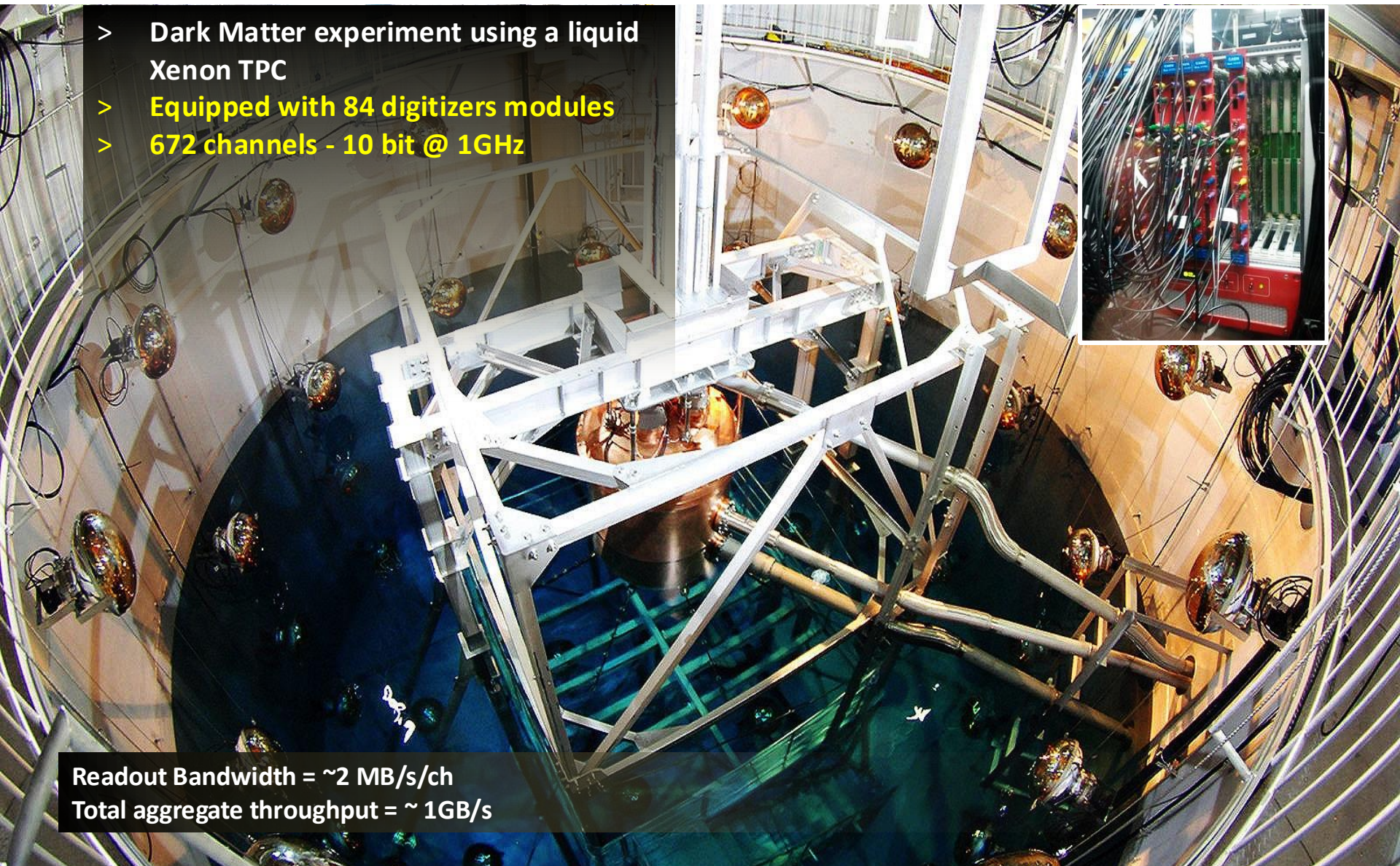


455 modules - 13,249 read-out channels

XMass @ Kamioka, Japan

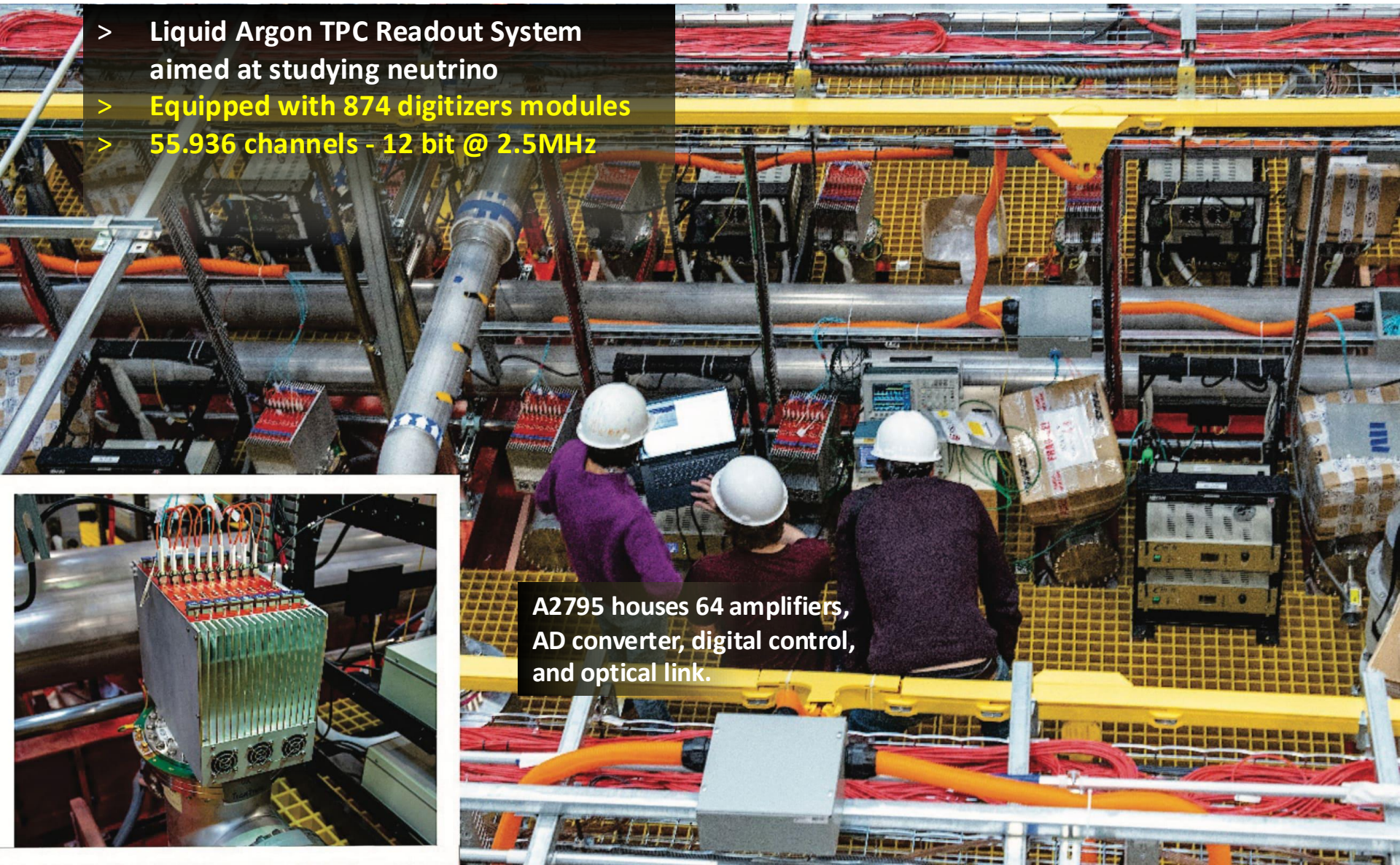
- > Dark Matter experiment using a liquid Xenon TPC
- > **Equipped with 84 digitizers modules**
- > **672 channels - 10 bit @ 1GHz**

Readout Bandwidth = $\sim 2 \text{ MB/s/ch}$
Total aggregate throughput = $\sim 1 \text{ GB/s}$

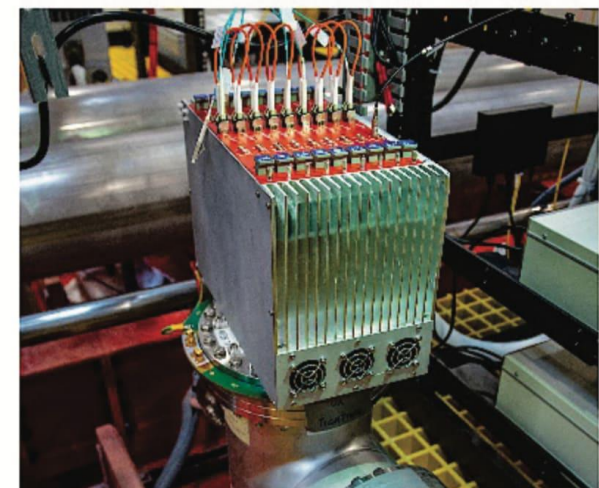


ICARUS @ Fermilab, USA

- > Liquid Argon TPC Readout System aimed at studying neutrino
- > Equipped with 874 digitizers modules
- > 55.936 channels - 12 bit @ 2.5MHz



A2795 houses 64 amplifiers, AD converter, digital control, and optical link.



Pierre Auger Observatory

- > Based on A7501 PCB mount HV DC-DC converter
- > **Extended Temperature working range:**
-10°C ÷ 70°C
- > **Designed for long working life in harsh environment**



- > A detection area of 3.000 km² (the size of Luxembourg)
- > Mendoza Province (Argentina)



- > High efficiency
- > 2100 V/100 µA output ranges
- > Available with positive or negative polarity
- > Stand alone architecture
- > Compact package: 34,5 x 62,9 x 119 mm³



A tailored solution for Large Area experiments in harsh environment: A7501PB

International Atomic Energy Agency

- > 12 liquid scintillators
- > Digital DPP and Waveform readout
- > Sustained throughput: 340 MB/s

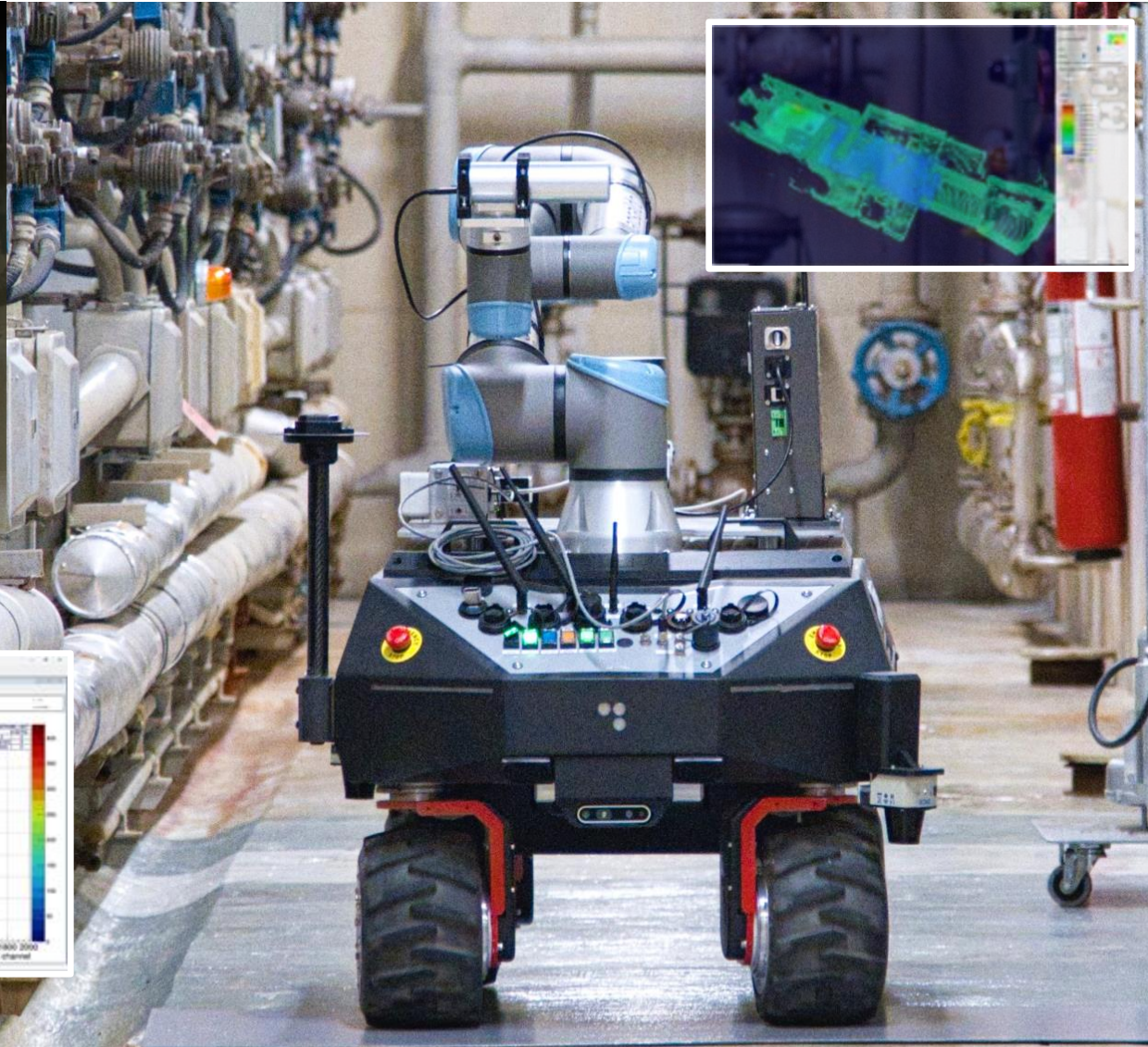
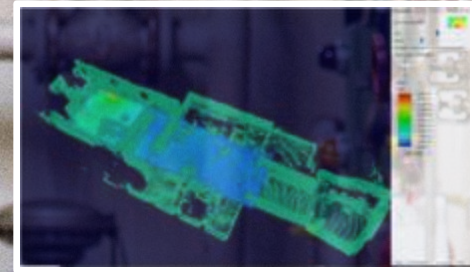
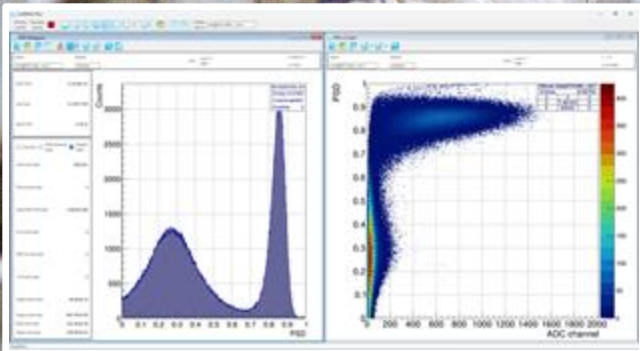
The Fast Neutron Collar (FNCL) is a liquid scintillator-based instrument developed as an efficient NDA (non destructive assay - test) tool for verification of modern NPP's Fresh Fuel Rods



Fast neutron counting System for safeguards and non proliferation activities (IAEA): SD7750

CLEANDEM: Decommissioning and Dismantling UGV

- > Gamma camera for hotspot visualization
- > High resolution Gamma sensors
- > Drone mountable Gamma and Neutron detectors
- > Alpha beta detector for the detection and particle identification
- > Space coordinates determined by the combination of UGV and LiDAR coordinates



CAENets – Gear for Science



Application fields:

- > Oriented and dedicated to particle accelerator facilities, e.g. synchrotron light sources and Free Electron Lasers
- > “Know-how” and “hands-on” large installations and maintenance
- > CAEN industrial capability
- > Customization and dedicated support

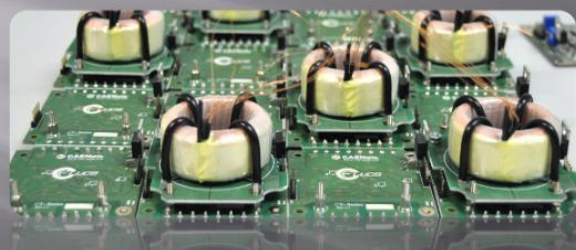
Product Lines

Digital Magnet Power Supplies

Bipolar + Monopolar

from $\pm 5A$ (small correctors) to 135A

Ethernet Interface



DC Current Transducers

Closed-loop Technology

DC + AC monitoring

Current monitoring up to kA

Multi-channel Low Current Measurements

Dedicated Systems (Bipolar HV for Optics)

Beamline Local Feedback Integrated System



MicroTCA for Physics

High-Voltage Board

Collaboration with DESY



Facilities that rely on us

APS – Advanced Photon Source, Argonne (Chicago, USA)
ALS – Advanced Light Source, LBNL (Berkeley, USA)
BNL – Brookhaven National Lab (Brookhaven, USA)
CLS – Canadian Light Source (Canada)
DESY – Deutsches Elektronen-Synchrotron (Germany)
ELETTRA – Elettra Light Source (Italy)
ESRF – European Synchrotron Radiation Facility (France)
JLAB – Thomas Jefferson Lab (Newport News, USA)
KEK – Photon Factory, cERL (Tsukuba, Japan)
PAL – Pohang Accelerator Laboratory (South Korea)
RRCAT – Raja Ramanna Centre for Advanced Technology (India)
SLRI – Synchrotron Light Radiation Institute (Thailand)
SPARC – INFN Frascati (Italy)

and companies:
KYMA Undulators, BRUKER ASC



CAEN SyS - CAEN Spectroscopy Division

What we do

Providing nuclear measurement solutions and technical expertise for a wide array of applications.

SNIPER-GN - Special Nuclear material Portable identifier

- > Search and secure operations
- > Airport security checkpoints
- > Nuclear facilities and radiation-sensitive areas
- > Radiological Dispersal Device (RDD) detection and identification
- > First responder prompt intervention
- Customs border inspections

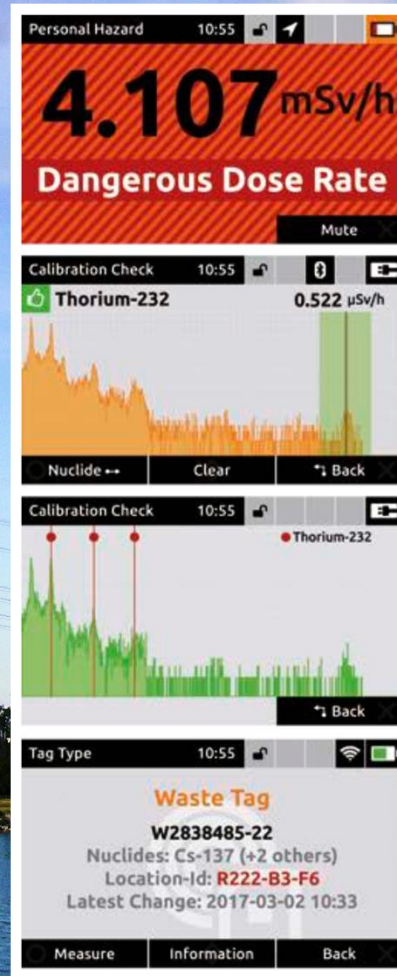


NATO Stock Numbers

Nuclear Safety & Security

DigiWaste - Digital Platform for Nuclear Waste Management

- > Decommissioning & Dismantling
- > Interim Storage of Nuclear Waste
- > Radioprotection
- > Legacy Waste



Nuclear Safety & Security

GAMON - Global Measurement Platform for Nuclear Safety and Security

- > Ring monitor systems around nuclear facilities
- > Nationwide environmental monitoring networks
- > Area monitor system in nuclear research laboratories
- > Portable, mobile measurement stations for emergency response



Different models for applications



CAEN RFID

- > The first Italian company providing UHF RFID products
- > Key player in the EU RFID scenario (EPCglobal, ETSI...)
- > Worldwide customers in manufacturing, logistics, transport, healthcare, fashion, retail...
- > Totally in-house HW, SW & support skills
- > Key partner in EU funded projects
- > An “added value manufacturer”



CAEN RFID



UHF RFID is an enabling technology for several fields of applications:

- > Embedded
- > Fashion - Retail
- > Cold Chain - Pharma
- > Waste Management
- > Access Control
- > Industrial Manufacturing
- > Transportation - Logistics
- > FMCG - Supply Chain
- > Leisure
- > We are the Technology provider & design center for Datalogic Spa



• Solutions

- Next Generation Security
- Threats and vulnerabilities Protection
- Mobility and endpoint Security
- Next Generation Network

• Services

- Managed Security Services
- Technologies Consulting
- Risk & Vulnerability Assessment
- Compliance Consulting

CAENqS Solutions

Security Architecture

- IT security strategy definition, roadmap and approach
- Definition and design of security controls and solutions
- People, process, technology and data security assessment
- Security policies and processes
- Operations and monitoring
- Business impact analysis
- Security risk assessment

Threats and Vulnerabilities

- Vulnerability assessment
- Penetration test
- Wireless security test

Managed Security Support

- SOC Support Call
- Professional Assistance
- Service On-Site

Winning Synergies

CAEN is always open to cooperate with its Partners and Customers to evaluate new projects and partnerships

