Network of Companies

Founded in 1979, CAEN SpA (Costruzioni Apparati Elettroniche Nucleari) is an important industrial spin-off of the INFN.

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

**Spin-off activities:**
- RFID (2003),
- CAENels (2010),
- CAENqS (2012),
- CAEN SyS (2016)

Total Employees: 120
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:
  GE, Siemens, SAIC, L3, Raytheon, Lockheed...
For more than 35 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
Milestones: 1979 - 2016

> 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)
> 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 spin-off (Systems and Spectroscopy Solutions)
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 50 high level Physicists and Engineers who adopt forefront technologies to design innovative products
- Ongoing collaborations with important institutes such as: Elettra, CEA, CNRS (LAL, IRES..), PSI, INFN...
Test

- All assembling activities are outsourced
- Experienced group of 20 engineers dedicated to in-house Test and Calibration of the entire production
- Capability: 500 complex modules/month
- 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 (25 engineers)
- 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 8 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
- 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
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.
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 (±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 = ~2 MB/s/ch
Total aggregate throughput = ~ 1GB/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.
GammaFly: Airborn Gamma Spectroscopy

Aerial monitoring system of environmental radioactivity with applications in:

> Homeland security
> Environmental protection
> Geological and soil mapping
> Uranium and mineral exploration
> Mineral/gas and oil processing
> Environmental radioactivity monitoring

4x4 array of 1 liter NaI detectors
“EASY” Multi Function System

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

Designed with COTS components to work in “hostile” areas
CAEN & LHC Experiments

1998 – 2016
SYNERGY for SUCCESS
18 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
CAEN has always cooperated with universities and research laboratories worldwide to build successful collaborations