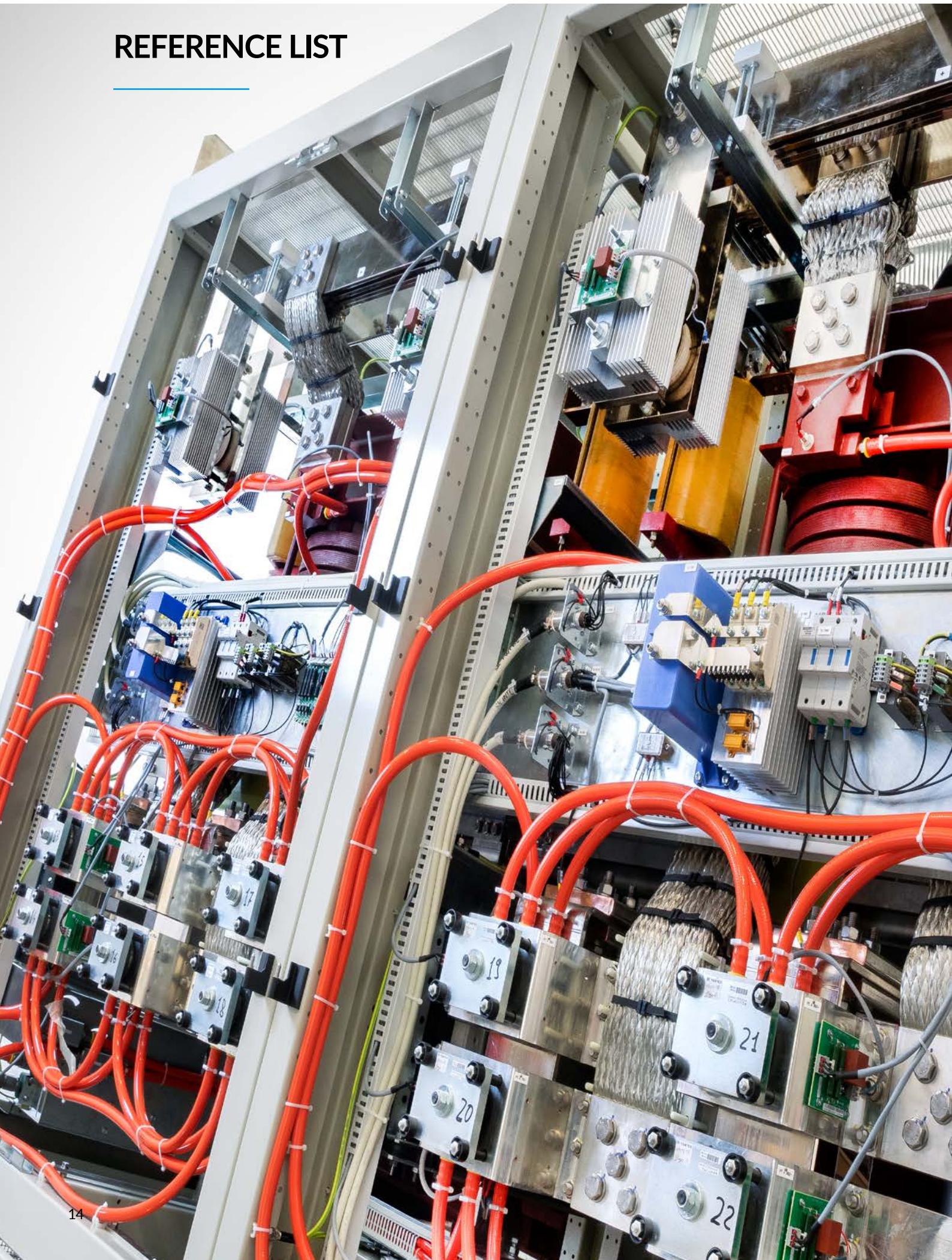
REFERENCE LIST



CERN

The European Organization for Nuclear Research, known as CERN is an international organization whose purpose is to operate the world's largest particle physics laboratory, which is situated in the northwest suburbs of Geneva on the Franco–Swiss border.

The Large Hadron Collider (LHC) is the world's largest and highest-energy particle accelerator, built with the aim of allowing physicists to test the predictions of different theories of particle physics and high-energy physics. The co-operation between EEI R&D office and CERN started in the year 2001 and represents the typical example of the EEI approach to its partners requests. EEI designed and manufactured two different series of fundamental equipment for the LHC particle accelerator.

The 26V - 20kA Power Converter is now used to supply the superconductive magnetic dipoles of the CMS magnet of the laboratory, in the context of subnuclear particle detection. It includes four three-phase SCR rectifiers, 5000 A each one, in parallel connection, where both converter bridge and filter inductances are water-cooled

Main features of the equipment are:
- High current Output: 20.000 A
- High precision and stability through Cern regulation Control Board.
- Water cooling system of semiconductors by 4 indipendent circuits that minimize the power module dimensions.

THE 444 FOUR-QUADRANT AC/DC CONVERTER WITH +/- 600A/10V

output used for the power supply of the superconductive magnetic dipoles placed in the tunnel.
Main features of the equipment are
- High precision and low output noise
- Reduced volume and low weight
- Water cooling system
- Galvanic isolation between mains input and magnet load
- High reliability
- Fast repairability

EEI received from CERN the "CMS Gold Award of the Year 2004" for the best Italian Electrical Supplier of the 2004

MED AUSTRON

MedAustron in Wiener Neustadt is destined to become in the near future one of the major Center for Ion Beam Therapy and Research in Europe. The Center is under construction and treatments will be carried out from 2015 and will involve 1.400 patients every year. The non-clinical research will focus on medical radiation physics, radiation biology and experimental physics.

These operations are planned to be conducted after the treatments of the patients, during the night and at weekends. This research will be conducted in a separate irradiation room.

The planning and development of the technical heart of the system, the particle accelerator (synchrotron), is done in cooperation with the CERN.

The accelerator complex consists of the injector with ion sources and an ion linac that will accelerate particles up to the synchrotron injection energy of 7 MeV/u.

This is followed by a synchrotron capable of accelerating particles to the planned extraction energy, ranging from 60 MeV to 250 MeV for protons and 120 MeV/u to 400 MeV/u for carbon ions, suitable for the medical application.

For non-clinical research only, a proton energy extended up to 800 MeV is also possible.

For MED Austron EEI will supply a complete set of AC/DC Power Supply for the Magnets, with nominal power up to 230 kW, with a Inom current of 3300A at ±70V and a Inom precision up to 10ppm.

RFX

Consorzio RFX is a research organization promoted by CNR, ENEA, Padua University, Acciaierie Venete S.p.A. and INFN, under the patronage of Euratom - ENEA Association.

Reversed Field eXperiment (RFX) is an experiment carried out in the facilities of Institute for Ionized Gas (IGI) of the National Research Council (CNR) in Padova.

The experiment studies the confinement of a plasma for a controlled nuclear fusion, by the use of a magnetic field in a Reversed Field Pinch (RFP) configuration.

Historically RFX is a step forward in the RFP configuration to higher plasma currents.

EEI supplies to RFX experiments includes four power supply units DC bus, each of them containing four section, for a total of:

- 48 DC/DC Chopper
- 48 Magnetic Coils

MAIN FEATURES OF THE EQUIPMENT ARE:

- Syncronized supply of coils creating a rotating corrective field.
- High flexibility in coordination and control, DSP based, with fiber optical signals transmission
- High dynamic DC/DC converters with a current of 450A at 400V, with a control time of 100ms
- Large capacitive energy storage of 1F for each 12 DC/DC group.

INFN – OPERA

LNGS (Laboratori Nazionali del Gran Sasso) is one of the major INFN (Istituto Nazionale di Fisica Nucleare) laboratories and is the largest underground laboratory in the world.

It is located under a 1.400m layer of stone under Gran Sasso d'Italia mountain, in the nearby of the town of L'Aquila.

The OPERA experiment has been designed to perform the most straightforward test of the phenomenon of neutrino oscillations. This experiment exploits the CNGS high-intensity and high-energy beam of muon neutrinos produced at the CERN SPS in Geneva pointing towards the LNGS underground laboratory.

EEI supplied two power supplies for the OPERA experiment spettroscope.

Every magnet power supply is composed by two power supply units (rack), each of them containing a 20Vdc/1700A supply system with the following main features:

- Maximum Output Current: 1700A
- Maximum Output Voltage: 20V
- Current Setting Resolution: ±5*10-4
- Current Reproducibility: ±2.5*10-4
- Current Readout Resolution: ±5*10-4
- Residual Current Ripple: ±5*10-4
- Linearity Error: ±5*10-4
- Current stability: ±5*10-4
- Possibility of reversing the magnet current polarity

EEI supplied also High precision current measurement device for Physics Power Supply Systems.

DESY

XFEL PROJECT AT DEUTSCHES ELEKTRONEN-SYNCHROTRON
The European XFEL is a research facility currently under construction in the Hamburg area, Germany. From 2017 on, it will generate extremely intense X-ray flashes to be used by researchers from all over the world.
EEI has been awarded for the supply of diode rectifiers with nominal voltage 60V or 120V and nominal current from 500A to 2400A.

BEAM DUMP POWER SUPPLIES. A set of switched-mode power supplies were provided to DESY, Germany. They feed the beam dump magnets of the European XFEL. Each free-standing cabinet features two ±140 A, ±130 V outputs. The two output currents are sinusoidal and 90° out of phase, so that the beam follows a circular path on the target. High maintainability was achieved through N+1 redundancy of the key components.

CNAO

CNAO (National Center for Oncological Hadrontherapy) is the first hospital in Italy specifically dedicated to cancer treatment through hadron therapy. The Center is located in Pavia and its aim is to cure solid tumors by the use of protons and carbon ions.

CNAO uses a synchrotron to accelerate protons and carbon ions. Protons and ions are produced in two sources, pre-accelerated by a linear accelerator, followed by an injection line for the transfer of particles in the synchrotron, where the particles beam will be further accelerated and extracted at energies up to 250 MeV for protons and 400 MeV/u carbon ions.

EEI designed and manufactured 7 power supplies for quadrupole and sextupole magnets of the synchrotron accelerator of the CNAO.

The control loop, working at 40 kHz, is managed by a National Instruments PXI chassis with a 3 M-gate FPGA and four DSP.

The current feedback, made of a 24 bit ADC, and the output stage, realized with a mosfet series linear regulator, assures the required precision and speed.

MAIN FEATURES OF THE EQUIPMENT ARE:

- Supply Voltage 400 Vca
- Output current = 650 A
- Output Voltage 160 Vdc
- Output current ripple < 5 ppm
- Output current stability < 5 ppm
- Dynamic response = 1300 A/s

ESRF

SET OF COMPLETE RACKS OF DC POWER SUPPLIES

A set of complete racks of water-cooled, 3U-high, 0-60V, 0-160A, low-ripple (< 10mV peak) DC power supplies were provided to the ESRF (Grenoble, France) to supply an experimental solid-state RF amplifier.

The racks include power and water distribution to the power supplies, a general and individual circuit breakers and a digital flowmeter with a water temperature measurement, interlocked with the power supplies. The power supplies feature an Ethernet interface, along with custom digital I/Os and remote voltage sense.

SINCROTRONE TRIESTE

Elettra is an international multisciplinary laboratory specialized in synchrotron radiation and its use in the science of matter. It is located in Basovizza on the outskirts of Trieste and is operated by Sincrotrone Trieste.
The laboratory features a 2.4 GeV, third-generation synchrotron radiation source, also named Elettra, and a fourth-generation light source based on a free-electron laser, FERMI@Elettra.
For Sincrotrone Trieste EEI designed and manufactures set of 2 AC/DC power supply for the magnets dipoles, with nominal current of 750A at ±55Vdc.

ENEA CNR

The Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile (ENEA) (National Agency for New Technologies, Energy and Sustainable Economic Development) is an Italian Government sponsored Research and Development Agency.
The agency undertakes research in areas which will help to develop and enhance Italian competitiveness and employment, while protecting the environment.

QST (JT-60SA)

Power supply system for resistive wall mode control.
EEI provided the power supply system for the resistive wall mode control of the JT-60SA (advanced superconducting tokamak, Japan). The system comprises a rectifier (fed from a 6.6 kV line) and 18 fast inverters, rated at 300 Apk, 240 Vpk.
The inverters feature a high bandwidth (3 kHz) and low latency (< 50 µs). SiC power semiconductors were employed.

SESAME

Power supply for the main ring dipole magnets
A free-standing, 4-quadrant, 550 A, 800 V switched-mode power supply was delivered to the SESAME project, Jordan.
The power supply feeds the 16 series connected dipole magnets of the main storage ring.

INFN

N. 4 power supplies for dipoles and N.7 power supplies for quadrupoles from 100A to 300A used in the new BTF 2 LINE.