1177A Quarry Lane
Pleasanton, CA 94566-4757
Tel: (925) 462-6949
Fax: (925) 462-6993
email: rhamm@linacs.com

Company History

AccSys Technology, Inc. (AccSys) is a California corporation located in the San Francisco Bay Area. The company was incorporated in June 1985 in response to a growing interest in compact ion linear accelerators (linacs) and is the world's leading commercial supplier of these state-of-the-art systems. Hitachi Ltd. became the majority shareholder (80%) of the company in May 2002. As a design and manufacturing company, AccSys specializes in the development, production, installation and servicing of ion linac systems for medical, industrial and research applications using radiofrequency quadrupole (RFQ) linacs and drift-tube linacs (DTL). AccSys has also established itself as a leader in the development of ion linac technology.

The company is dedicated to the design and production of high-quality, reliable systems to meet the needs of commercial applications. AccSys is uniquely qualified to serve this market due to its in-house rf ion linac design capability and its R&D partnerships with a number of research laboratories to continue development of state-of-the-art linac technology. Since demonstrating its first prototype linac in 1987, AccSys has delivered numerous turn-key systems and components to research facilities and commercial customers worldwide.

Using technology transferred from several premier US national research laboratories, AccSys has devoted its past efforts to translating these R&D concepts into cost-effective, reliable products through innovation and engineering. These efforts have resulted in numerous unique concepts, patented designs and trade-secret techniques that have been incorporated into three major product lines: the LANSAR® line of high-flux neutron generators, the PULSAR™ line of positron tracer isotope productions linacs, and the LINSTAR™ line of synchrotron injector linacs. In addition, the company has a wide range of linac designs for other pulsed ion beam applications.

Notable milestones and achievements at AccSys since its inception in 1985 include:

- Three technology transfer and four cooperative R&D agreements with Los Alamos National Laboratory, Fermi National Accelerator Laboratory, Argonne National Laboratory, Lawrence Berkeley National Laboratory, Brookhaven National Laboratory, and Lawrence-Livermore National Laboratory.
- Strategic Defense Technology Applications Award (joint with Los Alamos National Laboratory) for commercial application of dual-use accelerator technology.
- Twenty-five rf linac systems delivered to customers worldwide.
- Listed in the 1991 and 1992 “Inc. 500” (500 fastest-growing, small private US companies).
- Over $8 million of product development funding through the SBIR program, including 9 Phase II/Phase III contracts.
- Six patents awarded on rf linac technology and applications.

Capabilities

Research and Development

AccSys was formed to make advanced accelerator technology available and cost-effective for commercial applications. Research and development at the forefront of accelerator technology continues to be an integral part of the company's activities. Research projects have included the study of superconducting RFQ technology and the design and low-power modeling of interdigital and other advanced accelerator structures. Major collaborative R&D programs with national laboratories such as Argonne, Los Alamos, Brookhaven, and Lawrence-Livermore have and will continue to supplement the company's leading edge expertise in accelerator technology and research applications. AccSys believes that these programs will benefit its commercial product lines by keeping the company at the forefront of this unique technology.

Design and Manufacturing

AccSys has complete in-house design capability for all of the components of its rf ion linac systems. This includes proprietary versions of all of the established rf accelerator design codes and full CAD capability for design of mechanical parts and electronic circuits. Specialized tooling has been developed for the precision measurements required for these compact accelerators. The company's manufacturing facilities include:

- CMM inspection system, with a 40" x 24" x 18" capability at 6 micron accuracy
- Fully equipped accelerator and amplifier tuning and measurement labs
- Electronics fabrication and assembly area
- RF and accelerator system assembly, testing and commissioning areas
- Machine shop for in-house fabrication, including 2-axis CNC mill with a 54" table.

Large mechanical parts and those requiring CNC precision-machining are fabricated to AccSys' specifications by qualified outside shops using CAD drawings generated by the engineering design group. Most electronics fabrication, assembly and testing is done in the company's facility. All accelerator system design, assembly, testing and factory acceptance is done in-house.

AccSys' staff includes full-time technical and support positions covering a wide range of skills and expertise. When required, consultants provide additional specialized technical knowledge. The senior scientific and engineering staff includes a team of highly qualified physicists and engineers who form the technical foundation of the company. They have extensive experience in the design, production and testing of rf ion linacs and rf amplifier systems.

More than Just Equipment

AccSys Technology, Inc. has a proven record of providing the highest quality of global customer support before, during and after an equipment purchase. This support includes, system design assistance, facility planning, flexible financing plans, equipment installation, operator training, a one year warranty, and a full line of service options.

Linac Technology

With extensive experience in the design and implementation of ion linac systems, AccSys can provide assistance with any ion beam requirements. Whether it be for design consultation or a turn-key ion beam system, the project-oriented team at AccSys can satisfy customers' needs in the following technologies:

- Radio Frequency Quadrupoles (RFQ)
- Drift Tube Linacs (DTL)
- RF Power Systems
- High Current Ion Injectors
- Neutron Generators
- Proton Linac Systems
- Research and Development Support

AccSys' advanced beam dynamics and rf structure codes provide state of the art design capability. A dependable network of qualified shops and specialized vendors ensures on-time parts delivery. An in-house prototype shop, rf tuning lab, and specialized tooling and fixturing expedite system assembly and commissioning under stringent quality standards.

Radio Frequency Quadrupoles

AccSys' patented Univane* design provides a robust, cost-effective solution for low-velocity ion beams. This unique geometry incorporates four captured rf seals; is easy to machine, assemble and tune; and is inexpensive to fabricate. Cooling passages in the extruded structure permit operation at duty factors up to 20%. Available in lengths up to three meters, a single assembly can accelerate ions injected at 20 to 50 keV up to several MeV.

Drift Tube Linacs

Drift Tube Linacs provide a cost-effective solution for ion beam energies above a few MeV. Designed to accelerate ions from an RFQ, the DTL's permanent magnet focusing and high rf efficiency result in a minimum cost per MeV. AccSys' patented drift tube mounting scheme,** which is integral to a twin-beam welded vacuum tank, provides maximum mechanical stability and minimum beam loss.

RF Power Systems

AccSys' high peak power UHF rf power systems (250 to 600 MHz) are ideal for use with cavity accelerators and other resonant loads. Based on parallel planar triode arrays, these systems are smaller, less expensive and easier to operate and maintain than other types of rf amplifiers. Load-breakdown, high VSWR and fast load changes are handled by protection circuitry. Isolators are not required in most applications. Systems are available with peak powers from 25 to 360 kW and duty factors up to 2.5%.

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* US Patent Number 5,315,120

** US Patent Number 5,179,350

Ion Injectors

AccSys' linac systems incorporate compact ion injectors based on conventional duoplasmatron sources for H^+ and D^+ ions or on a cusped-field rf volume production source for H^- ions. These injectors operate at moderate 25 to 35 kV voltages, with all high voltage equipment isolated inside grounded enclosures. The ion source is housed in its own vacuum chamber which normally includes an isolation valve to allow easy access for routine maintenance without disturbing the accelerator vacuum. A dedicated pump provides a nominal operating vacuum of 10^{-6} torr in the ion source chamber during operation.

Turn-key Systems

AccSys offers a broad range of compact ion linac systems based on proprietary, patented technology. Both standard models and semi-custom configurations are available in the following product lines:

- The LANSAR™ line of high-flux neutron generators
- The PULSAR™ family of linacs for the production of short-lived positron emitters
- The LINSTAR™ line of proton synchrotron injectors
- The PL- and DL-Series for general proton or deuteron beam applications
- Other configurations available for heavier ion applications

The LANSAR® family of linear-accelerator-based neutron generator systems have been developed specifically to provide reliable long-term operation for non-destructive inspection applications in research and industrial environments. These are compact systems based on AccSys' patented compact ion linac technology and rugged beryllium neutron production targets. A broad range of configurations are available to provide outputs ranging from 10^8 to 10^{13} neutrons/second at the target for fixed or mobile applications. Key features of LANSAR® neutron generators include:

- No radioactive materials
- Target lifetime of many years at full neutron output
- Field serviceable with low maintenance and operating costs
- Rugged units that are transportable in most configurations
- Reduced shielding and moderator size
- Easy to operate and maintain
- Computerized control and monitoring
- Variable intensity and pulse structure
- Reduced shielding and moderator size
- Thermal, epithermal or fast neutron beams configurations available

PULSAR™ is s family of compact proton linac systems for the cost-effective production of radiopharmaceuticals for Positron Emission Tomography (PET) imaging applications. These systems set a new standard for the production of positron radionuclides and are now a proven alternative to cyclotrons for PET radiopharmaceutical production. The PULSAR™ systems incorporate the latest in patented compact accelerator technology integrated with high production yield targets and advanced chemistry process units. The combination of optimum energy and beam current, coupled with the inherent compact size, light weight and minimal shielding of these accelerators also make PULSAR™ the only mobile systems available for the routine production of FDG and other PET radiopharmaceuticals. The features of PULSAR™ systems make them the superior alternative to cyclotron-based systems:

- Lowest life-cycle cost (=capital costs + facility costs + operating costs + residual value)
- Minimum space requirements <1000 ft^2
- Available as mobile unit installed in a Medical Coaches trailer
- Proven performance and demonstrated reliability
- Simple operation and maintenance
- Low-cost feature, function and performance upgrades available

The LINSTAR™ is a family of ion linac systems, including the beam line components, designed for injection of ion beams into synchrotrons for use in cancer therapy and physics research. This series of proton linac systems is designed to provide moderate-energy proton beams (typically from 2 to 7 MeV) for injection into these high energy proton synchrotrons. These fully integrated systems typically consist of a carefully designed and selected combination of a radiofrequency quadrupole (RFQ)linac, a drift tube linac (DTL) for injection energies of >3 MeV, AccSys' standard rf power system, a high energy beam transport system tailored to the specific requirements of the facility and an optional debuncher cavity. They can accelerate either H+ or H- ion beams and are also available for polarized H+ or H- beams. Standard LINSTAR™ units can provide pulsed beam currents up to 25 mA at pulse widths from 3 to 300 μsec. Operation at pulse repetition rates from 0.1 to 30 pulses per second have been demonstrated, including on-demand pulsing for breath-mode synchronization in proton cancer therapy.

LINSTAR™ systems are currently in use at facilities around the world:

A Model PL-2i has been operating at Loma Linda University Medical Center since 1990 as the injector to the high energy proton synchrotron cancer treatment facility. The synchrotron system operates 24 hours a day, 6 days a week and has been described in a number of technical publications. Complete proton therapy systems based on the Loma Linda installation are commercially available from Optivus Technology, Inc.

Two systems have been commissioned in Japan: a Model PL-3i is the injector to the proton synchrotron cancer treatment facility at the Shizouka Cancer Center, being built by Mitsubishi Electric Company, and a Model PL-7i is the injector for the proton synchrotron cancer treatment facility at the Tsukuba Medical Center which was provided by Hitachi, Ltd.

A Model PL-7i has been operating at the Indiana University Cyclotron Facility since 1997 as the injector for the CIS compact synchrotron which is in turn the injector for the high energy physics cooler ring.

CUSTOM LINACS can be provided through a wide range of systems and subsystems customized for specialized ion beam applications, including proton, deuteron and heavy ion beams. AccSys' proprietary and patented linac technology can provide a wide range of ion beams and energies for specialized applications in research and industry. AccSys experts will design a system to customer specifications consisting of a carefully selected combination of our standard modular subsystems: radiofrequency quadrupole (RFQ) linacs, drift tube linacs (DTL), rf power systems and/or other components such as high energy beam transport (HEBT) systems and buncher cavities. Examples of these custom systems include a heavy ion booster for a tandem electrostatic accelerator, a high energy gamma source for detector calibration, and a specialized accelerator mass spectrometry system for tritium.