

TECHNICAL BULLETIN

The latest news and updates from Buckley Systems



**BUCKLEY
SYSTEMS**

Ingenious at work



Bill Buckley started Buckley Engineering, predecessor to Buckley Systems Ltd, in 1978 with 2 employees and the goal of entering and establishing his company in the U.S. semiconductor market. The company was dedicated to manufacturing electromagnets for ion implanters. Buckley Systems celebrated Bill's 80th birthday recently and his incredible success in becoming a pioneer in electromagnet manufacturing. Today we employ almost 600 staff members and are an established name in the global semiconductor, research, and medical industries.

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CONSULT, DESIGN & BUILD

With over thirty-five years' experience in making precision electromagnets, we have grown from being a manufacturer of products built to our customers' design to now having the ability to design magnets, vacuum chambers and support structures with specific attributes within a strict design envelope.

There are many advantages to allowing us to be involved in the design process. Our physicists and engineers have decades of combined knowledge on not only how to design and shape electromagnets, but how to take full advantage of stock material sizes and well proven construction methods. Field strength and shape can be calculated by our physicists through Opera modelling software along with power, heat and cooling calculations. Solidworks software is used by our designers to model the entire structure plus calculate stresses and load when under power. Modelling also helps with fitting the magnet and support equipment within defined envelopes and to integrate with other components.

As experts in coil winding, we can push the limits of what can be achieved, designing tooling and jigs to form and resin impregnate complex shapes. This can all help to reduce material costs, minimise wastage, speed up production and result in a higher quality product.

It's one thing having the software but applying it to the real world requires another level of skill and experience. Our designers know that specifying a non-critical part a few millimetres thicker than a stock size could greatly escalate the cost of production as a much thicker sheet will need to be ordered and excessive machining required to get it to size. The same applies to specifying a corner radius that cannot be achieved with a standard cutter, instead of one pass to create the radius multiple passes are required to create the profile. Our designers' experience in specifying correct tolerances and fit means that performance critical tolerances can be achieved and easily repeated without the additional cost of over tolerancing non-essential components. Even simple things such as floor mounts, power connections, lifting points and shipping crates can be evaluated to ensure ease of installation and servicing. Complete beamlines can be designed and specified using our partners at D-Pace for additional design resources, peer review, diagnostic equipment and verification, using our co-owned ion source test facility.

We can help you at every stage of your project with our physics and engineering teams, which combine their resources and knowledge. Whether you are looking at a complete design and build package or just wanting us to manufacture to your design, getting our team involved at an early stage can help us help you.



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Chief Technical Officer



Dr Chris Philpott PhD

Chris Philpott started his career at Buckley Systems in 2004 fresh from completing his PhD in Mechanical Engineering at the University of Auckland. His initial role as Advanced Systems Design Engineer involved helping with the setup and testing of the hundreds of magnets destined for the Australian Synchrotron (ALS) project. At the time, Buckley Systems was primarily an engineering and manufacturing workshop, relying on customers to supply magnetic and mechanical design.

Following delivery of the successful ALS project, the design department capability was increased and Opera magnetic simulation software was purchased, enabling Chris and his growing team to help design and validate the 150 magnets for the Brookhaven NSLS-II storage ring against their supplied reference specifications. To test the magnets Chris and his team designed and built a rotating coil field measurement device able to measure field errors down to parts-per-million of the fundamental. This work led to more laboratory contracts and established the company as a leader in the manufacture of high precision electromagnets.

The engineering, design and physics department continued to grow, and in 2015 Chris was appointed Chief Technical Officer. He now looks after a team of fourteen, including two full time physicists. Having a good balance of practical and theoretical knowledge has proved invaluable for the business. With increasing demands for environmental compliance, he is constantly evaluating new materials and processes to minimise exposure to harmful products while ensuring durability and performance are not compromised. Chris enjoys collaborating with customers, using his experience and expertise to help improve initial design proposals, improving accuracy and lowering manufacturing costs wherever possible.

In his spare time, Chris races his 8-metre keel boat in the nearby Tamaki Estuary.

AMERICAN CHAMBER OF COMMERCE EXPORTER OF THE YEAR AWARD

At the 2022 DHL AmCham Awards, held at a black-tie function in Auckland, New Zealand, Buckley Systems won the Best Established Exporter of the Year. The award recognises the longstanding business done with the United States of America and the outstanding growth of exports experienced over the past year.



NEW CNC ROUTER



A production bottleneck has been eliminated with the purchase of a new CNC router. It will be used almost exclusively for cutting out aluminium cooling plates used in our strip coil winding department. Designed specifically for high-speed cutting of aluminium, the machine has a maximum spindle speed of 24,000 rpm and much faster travels than a traditional milling machine, and is fitted with an automatic tool changer that allows machining of cooling tube channels and other features in one operation. Capable of handling a 6.1 metre by 1.8 metre sheet of aluminium up to 12 mm thick means efficient plate use and minimal downtime between operations. Getting the most out of a high-performance machine is not just a matter of purchasing, installing, and loading programs. Our highly experienced machinists have been closely involved in the setup and programming to find the optimum balance between rapid material removal and tool wear.

REDUCE, REUSE, RECYCLE

Buckley Systems is actively looking at reducing waste in our industry. A recent example concerned shipping flanges fitted to vacuum chambers and resonator cavities. Until recently many of these parts were discarded or sent for scrap recycling by the customer. An initiative launched by Buckley Systems International in Massachusetts, U.S.A. has seen collection bins installed at our biggest customers' premises and the used parts collected and sent back to New Zealand for refurbishment and re-use.



CORPORATE SOCIAL RESPONSIBILITY

Buckley Systems has released a Corporate Social Policy to formally encompass many of the fundamental principles within the business. While New Zealand legislation covers employment rights, environmental responsibilities plus workplace health and safety, we feel it is not good enough to just meet our legal obligations, but to ensure our business operates responsibly and ethically towards our staff, environment, community and customers. The policy covers the ways we look after and get the best out of our staff, our ISO 9001 quality management system and our commitments to the environment, and is available to view on our website.

FURTHER EXPANSION

The upgrading of our machine shop continues with excavations being undertaken to accommodate a new CNC machining centre due later this year. The large hole is required as the machine sits part-way in the ground and requires a thick, reinforced concrete base to support its own weight plus the load on the machine table. The new machine will be a welcome addition to our machining capabilities. Further improvements to the machine shop buildings are planned with the aim of increasing the capacity and efficiency of our workshop space without disrupting our current production capability.



To help cope with our increasing workload, we have recently expanded into additional premises in East Tamaki, Auckland. The 4,300 meter square (46,000 square feet) site at 139 Cryers Road features an 860 m2 high roof workshop plus a large office.

It is less than ten minutes' drive from Buckley Systems' main manufacturing base and is already helping relieve some of our space constraints brought on by our rapid expansion over the past few years. The Cryers Road facility is currently home to our new CNC router and our O-ring Department. More machinery will be added as the property is further developed, and plans are already underway to increase the current factory floor area and add more gantry cranes. The size of the site means that future expansion of factory space is possible while still leaving plenty of space for goods handling and staff parking.



SECOND MAZAK I700 WITH PALLETECH



Our recently installed Mazak i700 Variaxis machine with 12 pallet Palletech changer has proven so successful that a second, identical one was ordered and has just been installed alongside it. The compact 5-axis machines are ideal for doing much of the repetitive, high precision work required for many of our magnets. Having the luxury of 12 pallets, means that vices and fixtures for jobs we do regularly can be kept in place rather than being stripped and re-mounted each time. The savings in setup time are considerable and if needed, many pallets can be loaded up for unattended machining overnight or while staff are working on other machines.

DEBURRER



Deburring is repetitive yet necessary job that has been made a whole lot easier thanks to the purchase of an automated abrasive deburring and edge rounding machine. The device employs a powerful vacuum to hold parts in place on a conveyor and passes them under a series of abrasive belts and planetary abrasive drums. Besides removing surface burrs, the planetary drums also round the edges. This is an important step as sharp edges can damage insulation and cause adhesion problems for plating, painting or powder coating.

Able to remove burrs from laser cut, guillotined and stamped parts up to 1200 mm wide, the operation can be finely controlled allowing coated lamination steel to be deburred without damaging the bonding resin. Precision deburring of laminations allows accurate stacking, an extremely important process when thousands of laminations are involved. The machine is another step along our path of constant improvement while greatly increasing throughput and freeing up staff to do more rewarding work.

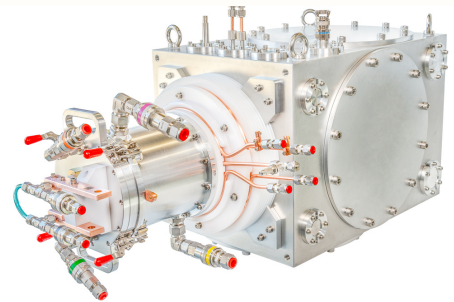
D-PACE

Dehnel-Particle Accelerator Components and Engineering, Inc (D-Pace) was founded by Dr Morgan Dehnel in 1995 as a supplier of specialised components and technical support for beamline systems, beam diagnostic devices, and ion sources for research, industrial, and commercial accelerator systems around the world. Buckley Systems Limited, a major supplier of components to D-Pace, purchased a 50% stake in the company in 2014.

NEW PRODUCTS FROM D-PACE

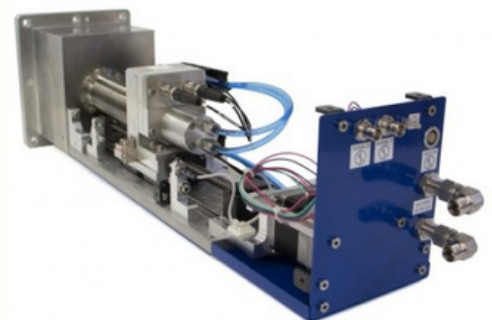
Filament-Powered Positive/Negative Ion Source:

This new ion source can produce both positively and negatively charged direct current ion beams at 20 to 30 keV energies and with normalized 4rms emittances less than 0.5 mm-mrad. It has currently extracted beams of H⁻ and D⁻, as well as H⁺, D⁺, and He⁺. The original baseline technology product is licensed by TRIUMF. The +/- source is a development that leverages the original licensed baseline technology from TRIUMF, and was further developed by D-Pace scientists, primarily Dr. Stephane Melanson. This ion source is low maintenance with long filament lifetimes. More information can be found at www.d-pace.com.



XY Scanning Slits Beam Profiler:

This is a current-measurement system for mapping the spatial variation in intensity along two axes of beams up to 35 mm diameter and 1500 W total power. It can scan X and Y beam profiles with a single probe. Water cooling means it is able to handle a greater maximum power density than other common wire scanners. Mounted at a 45-degree angle, the probe has 2 slits, each with a Faraday cup. When scanning the beam, a small portion of the beam passes through the slits and is measured by the Faraday cups, allowing for beam profile mapping along two transverse axes at once. A graphical user interface plots the results of the scan and allows the operator to control parameters such as the spatial resolution and scan speed. More information can be found at www.d-pace.com.



D-PACE RESEARCH



Andrew Paul is working on a Master's degree at the University of Victoria. His thesis is on a general technique for creating certain negative ions without using alkali metals for charge exchange. His funding is from MITACS in Canada and his academic supervisor professor is Dr. Tobias Junginger.



Phil Jackle is undertaking a Master's degree at Simon Fraser University. His project is on the same topic area as Andrew's but is related to specifically creating He⁻ beams without using alkali metals. His funding is from NSERC in Canada. His academic supervisor professor is Dr. Karen Kavanagh.

WHAT'S IN A BOX?



Most of our products travel thousands of kilometres to reach their final destination. Getting them there in perfect condition is not something we like to leave to chance.

Each magnet or device is carefully packed to protect it from handling damage and ingress of moisture.

Most magnets are shipped in wooden crates, custom made in our dedicated packing workshop. Locally grown, premium grade, kiln-dried pine is used to construct the pallet and skids while custom made steel brackets are used to fasten the magnet to the pallet. Plantation grown plywood is used for the sides and top. The lid is screwed to the box sides which are in turn are screwed to the pallet. This means the lid can be removed for inspection and the sides lifted off without damage in case the magnet needs to be re-boxed for storage.

By designing our own packing, we can include features such as offset forklift slots to ensure balanced lifting and can also keep overall packing dimensions to a minimum. Large magnets are attached to custom made steel shipping frames made by our fabrication department.

Magnets are shrink-wrapped and desiccant material included to control moisture content. All products used in our standard packing can be recycled or re-purposed.

On request we can add additional packing material or wrap items in sealed, vapour barrier material and inject nitrogen into the bag, while shock watch devices and tamper evidence tags can also be included if required.

Boxes may be boring, but they are an extension of the pride we take in handling everything from initial inquiry to final delivery.

CONTACT US

Buckley Systems Head Office
6 Bowden Rd Mt Wellington
Auckland 1060 New Zealand
+64 9 573 2200
info@buckleysystems.com

Buckley Systems International
19 Turcotte Memorial Drive Rowley
Massachusetts 01969 USA
+1 978 948 3403
info@buckleysystems.com

D-Pace Inc
Suite 305 625 Front Street
Nelson B.C. Canada V1L 4B6
+1 250 352 5162
info@d-pace.com

Neutron Therapeutics Inc.
1 Industrial Drive Danvers
Massachusetts 01923 USA
+1 978 777 0846
inquiries@nt-bnct.com

Buckley Systems Technical Bulletin is a 6-monthly publication from Buckley Systems Ltd, distributed free to customers and interested parties.



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please contact us at:
info@buckleysystems.com*