



New large machining centre

To keep up with demand, a new \$3.5 million Mazak V100N CNC machining centre has just been commissioned. With a footprint of 24.3m (80ft) x 9m (30ft) and weighing over 70 tons, it is the third and largest machine of this series to be purchased by Buckley Systems.

Two 5,000 mm x 2,100 mm (196" x 82") pallet change tables allow work to be loaded and unloaded on one table while the machine is working on the other.

The rigid two-column design has a vertical movement of 1,250mm (59") plus an additional 710mm (28") vertical spindle travel. This feature combined with a fully articulating spindle means large items such as vacuum boxes can be machined on up to five faces in one, seamless operation.

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

Upcoming 2019/20 Conferences and Events

Buckley Systems and/or D-Pace will have a presence at all these events. Please contact us if you would like to arrange a specific meeting with us while we are there.

• April 1-5 IMRP19: Strasbourg, France

International Meeting on Radiation Processing, Organised by the International Irradiation Association (iia)

• May 5-10 ECAART: Split, Croatia

13th European Conference on Accelerators in Applied Research and Technology

• May 19-24 IPAC19: Melbourne, Australia

10th International Particle Accelerator Conference

• June 22-25 SNMMI19: Anaheim, California, USA

Society of Nuclear Medicine and Molecular Imaging annual meeting

• July 9-11 Semicon West: San Francisco, California, USA

International conference for the semiconductor industry

• September 1-6 NAPAC 2019: Lansing, Michigan, USA

North America particle accelerator conference

• September 8-12 IBIC 2019: Malmö, Sweden

International beam industry conference

• September 22-27 CYC19: Cape Town, South Africa

22nd international conference on cyclotrons and their applications

• September 22-27 MT26: Vancouver, Canada

Magnet technology conference

• October 13-18 IBA2019: Antibes, France

24th International Conference on Ion Beam Analysis

• October ICIS2019: Lanzhou, China

18th International Conference on Ion Sources

NIBS 2018 highlights

Among the presentations at NIBS 2018 was a poster by Anand George who is researching the effects of the magnetic filter on a volume-production multi-cusp ion D⁻ sources. Stephane Melanson presented a poster on reducing negative carbon ion glitching and Dave Potkins from D-Pace gave an oral presentation on recent ion source research for Siemens. The NIBS award, sponsored by D-Pace, was awarded to Dr. Anatoli Zelenski (Brookhaven National Laboratory), Prof. Vladimir Davydenko (Budker Institute of Nuclear Physics - BINP), Prof. Aleksandr Ivanov (BINP) and Mr Anton Kolmogorov (BINP). For the development of the high-intensity polarized H⁻ ion source for RHIC SPIN physics.



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If you would like to subscribe to an email edition, please contact us at: info@buckleysystems.com

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

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**BUCKLEY
SYSTEMS**
Ingenious at work

Buckley Systems Technical Bulletin

Factory visits

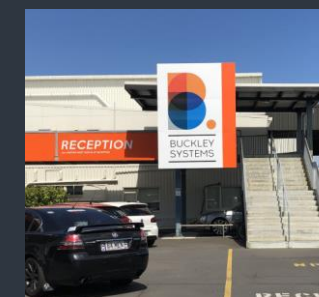
Buckley Systems' main manufacturing hub and research centre is based in Auckland, New Zealand. Being a long way from many of our customers, we always appreciate people who make the effort to come and visit us to discuss requirements, check on their project being manufactured or discover why so many businesses choose us to manufacture their equipment.

To maximise the benefit of your visit we will do our best to arrange for you to meet our key people including physicists, design engineers and compliance/testing/quality staff.

We can show you around our coil winding, machining, assembly and testing workshops plus you will be able to see our Ion Source Test Facility (ISTF) and the scientific work that has come from it.

As we are a busy site and often undertake confidential work, we do need to schedule visits and reserve the right to qualify visitors before extending a formal invitation.

Please contact us if you would like to visit and we will do our best to make sure you maximise the benefit of your time in our corner of the world.



7th International Symposium on Negative Ions, Beams and Sources (NIBS'20)

AUCKLAND, NEW ZEALAND



This issue

U. Auckland to host NIBS'20 **P.1**

PhD Student – Tobin Jones **P.2**

Manufacturing agility **P.3**

Japanese representative Hakuto **P.3**

Conferences and events **P.4**

University of Auckland to host 2020 NIBS conference

At the 2018 International Symposium on Negative Ions, Beams and Sources (NIBS) conference held in Novosibirsk, Russia, the University of Auckland won the hosting rights for the 7th NIBS conference to be held in New Zealand in September 2020. This will be the first time a major accelerator physics conference has been held in New Zealand and reflects the historical ground-breaking work done through the University's collaboration with the Ion Source Test Facility (ISTF) research group at Buckley Systems' manufacturing headquarters.

Buckley Systems CSIO, Dr Morgan Dehnel, was one of the main drivers behind the bid and is very excited about the event. "Hosting NIBS'20 brings the world experts in negative ion beams to New Zealand, which facilitates exposure to this field for professors and students in the Australasia region and provides a huge boost to our own negative ion beam collaboration with the University of Auckland, University of British Columbia, Buckley Systems Ltd and D-Pace Inc."

A key highlight of the conference will be a tour of Buckley Systems' impressive manufacturing facility with a chance to meet with the physics, design and operations teams, see the ISTF in action and talk to the researchers working on it.

Buckley Systems' founder Bill Buckley has been involved in manufacturing particle

physics equipment since 1968 and built his business on manufacturing specialist, high precision electromagnets, vacuum chambers and support equipment for research institutes and industry. Realising that if you are the very best in your field, people will seek you out no matter where in the world you are. Bill takes a hands-on role in his business, continually developing custom-made machinery and manufacturing techniques in addition to increasing plant capacity in innovative ways, ably supported by a highly experienced team of specialists.

Bill comments, "Many people don't realise how big Buckley Systems is in terms of manufacturing capability until they see it for themselves. The volume of steel, aluminium and copper that is processed every month is enormous. We even have a regional steel mill make our own, 'Buckley's Recipe' low-carbon, low coercivity, steel. To maintain the accuracy and quality demanded by our clients, we have made a conscious decision to be able to manufacture all our key components in-house. This allows us to take on multiple large projects knowing we won't be let down on supply or quality."

Buckley Systems is proud to be associated with the NIBS'20 conference and we look forward to opening our doors to the visiting delegates.

Aluminium resonator can welding

With over 5,500 RF resonators produced from our Auckland factory to date, we are always looking at ways to streamline our production and improve quality. Long production runs have allowed us to invest in custom jigs to mass-produce aluminium resonator cans of the highest quality. Specially made brackets, clamps and heat-sinks accurately position the can and minimise heat distortion while digital controlled, rotary and linear drives offer precision positioning of the welding torch and workpiece. Latest technology welding machines allow control of the start and finish cycle - areas that often cause problems for traditional, manual welding. A smooth weld is cosmetically nice on the outside but is absolutely vital on the inside of the cans which are copper plated. Our advancements have eliminated rejects from porosity and have produced thousands of metres of smooth, leak-free weld in these critical components.



A sign of the times

After many years of operating anonymously out of their headquarters in Nelson, Canada, D-Pace has put a sign on their building. The partnership with Buckley Systems has allowed the business to grow to a staff of thirteen and offer a wide range of products and services such as ion sources, beam measuring components, design, software and training.



Tobin Jones

Physicist and Ph.D. student at University of Auckland

Developing a time of flight mass spectrometer

worked in IT for a short while before starting at Buckley Systems in 2012. Among his early projects was the design and development of a very compact steering magnet for use in proton oncology.

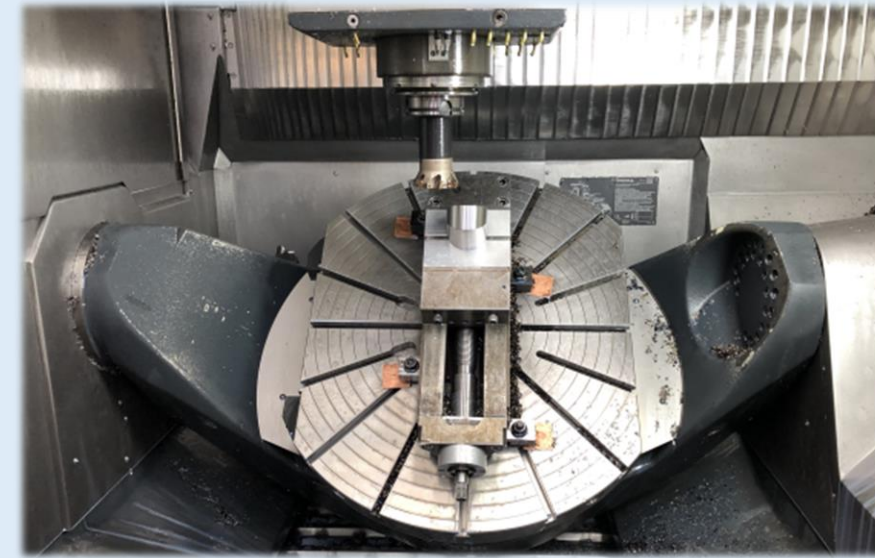
Tobin Jones has worked at Buckley Systems for six years and is currently working on a PhD thesis at the University of Auckland. Originally from New Zealand, Tobin spent much of his youth in Europe when his parents' careers took the family to Belgium. He completed an MSc in physics at the University of Nottingham in the UK before returning to New Zealand where he

In 2016, an opportunity to help develop a Time of Flight (TOF) mass spectrometer alongside World renowned expert, Professor Peter Derrick, provided Tobin an ideal subject for a PhD thesis. Professor Derrick's untimely death in 2017 was a huge loss and setback but under the supervision of Dr Det Rost and Dr Neil Broderick, the project has been

able to continue. Tobin's physics theory, practical engineering knowledge and IT experience have all been called on to get the spectrometer to its current state of development.

The University of Auckland and UniServices (a commercial offshoot from the university) are helping fund the project while Buckley Systems has provided space and engineering services.

Once it has been proven and validated, Tobin expects the spectrometer to be of considerable interest to science and industry.



Developing manufacturing agility for a changing world

The world of manufacturing electromagnets and associated equipment for particle physics has many challenges. The specialized nature of the industry can be volatile, with new technologies suddenly demanding high volumes that can taper off rapidly once demand is met. Likewise, large light source and other major physics projects may require large numbers of magnets and vacuum components but only for the duration of the contract.

To cope with fluctuations in demand, Buckley Systems has now developed a strong presence in the silicon wafer, medical device and discovery science industries and, with its partnership with D-Pace, is now manufacturing beamline monitoring instruments and ion sources. Catering to several diverse but related markets reduces exposure to individual industry fluctuations and enables

us to maintain a large, skilled workforce with a sophisticated manufacturing base that can rapidly scale up to meet demands of large projects when required. The NZTE International Growth fund is aiding Buckley Systems in promoting its capabilities to new markets around the world through to 2021.

We are currently focusing on developing our planning capabilities to identify potential bottlenecks and vulnerabilities within our manufacturing chain. Where possible, critical operations such as resin batching and large capacity machining are being doubled up to increase potential production and provide seamless back-up during maintenance periods.

Things don't stay still for long at Buckley Systems with the machine-shop recently extended and four, high-precision CNC machines installed. The largest machine has

travels of 6,000 x 3,600 x 1,935 mm (263" x 141" x 76") and 5 axis machining capability meaning large, complex shaped structures can be machined with minimal repositioning. A 400-ton press has also been purchased for rapid stamping of lamination steel, complementing our two laser cutting machines.

We are in the process of upgrading our factory lighting to low-power consumption, LED lighting. This provides a softer, flicker-free, more natural light, helping make the factory environment more pleasant for our night shift. The new factory extension has also been fitted with smart lighting that adapts lighting levels according to the natural light coming through the clear roof panels, offering long-term power savings over conventional lighting.



The second resin batching and vacuum infusion plant used primarily for large, hollow core conductor coils but also for overflow work from the strip and wire coil departments.

Hakuto Company Ltd to represent Buckley Systems in Japan

Hakuto Co Ltd has signed an agreement to represent Buckley Systems' products in Japan. Founded in 1953, Hakuto is one of Japan's leading agents for high-tech, international companies with sales of over US\$ 1.2 Billion. As agents for companies such as ACSI, NEC, Pfeiffer Vacuum, Group 3 and D-Pace plus having their own manufacturing facilities, the new relationship with Buckley Systems complements their existing business in the electronics sector and gives Buckley Systems a strong presence in this important market.



Yuji Shimabukuro

In January 2019 we hosted Mr Yuji Shimabukuro from Dr Motoi Wada's Plasma Physics Lab at Doshisha University Kyoto, Japan. Using the ISTF and assisted by PhD student, Anand George, he conducted experiments on inductive and capacitive coupling of an RF source to plasma for better power transfer efficiency.



Technology topics

Penning ion source under development

PhD student Nicholas Savard is conducting research into a penning source design intended for creating α particles to produce isotopes such as ^{211}At and $^{117\text{m}}\text{Sn}$ for use in radioimmunotherapy. During his research he will also be testing the viability of heavier positive ions such as Ar^{9+} and Kr^{9+} which can be considered as proxy particles for important ions used in semiconductor implantation. Other experiments on the source will involve reversing polarity to test its capability of producing H^+ and D^+ . For the project, D-Pace has designed a 270 mm diameter magnet producing a confined dipole magnetic field of 0.4 to 1.1 Tesla. Initial simulations illustrate good resolution of He^{++} (inner trajectory) and He^+ (outer trajectory), refer to Figure 1.

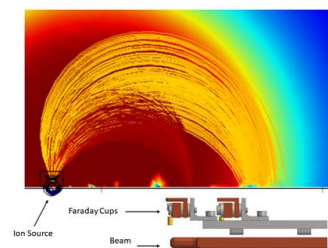


Figure 1

The second simulation (Figure 2) illustrates the trajectory plots of Ar^{9+} and Ar^{8+} showing that the magnet can also be used to measure heavy ion beams of high-charge state.

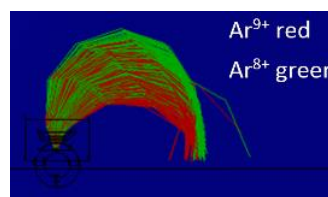


Figure 2

Dr Steve Thompson visits from the UK

To assist PhD candidate Tobin Jones with his thesis project, Dr Steve Thompson flew over from the

UK for a two week visit to help with the setup of a Matrix Assisted Laser Desorption Ion source (MALDI) to be used in a new design of Dynamic Analysis of Ion Masses (DAIM) spectrometer. Dr Thompson has over 30 years experience in industrial research, specialising in mass spectrometers. He now works as a consultant and has been involved in the DAIM project for over eighteen months, working closely with Tobin and Dr Det Rost from the University of Auckland.

Lecture in Japan

Buckley Systems' CTO, Dr Chris Philpott, recently travelled to Japan and gave a lecture to a group of company representatives about the design and manufacturing capabilities of Buckley Systems. New Zealand Trade and Enterprise organised the event which was hosted at the New Zealand embassy in Tokyo.