Heavy Ion Fusion Sciences Virtual National Laboratory

Issue Number 2, June 2010

HIFS News

UMER successfully uses induction focusing to reach a new milestone in beam transport

The University of Maryland Electron Ring (UMER) [1] is a scaled experiment using low-energy electrons at 10 keV to access the physics of high-intensity ion beams. We recently have significantly lengthened the propagation distance of the UMER beam [2] by introducing longitudinal focusing from a single induction cell [3], fired approximately once every six turns (see Figure 1). For an injected current of 0.55 mA, the tune shift due to space charge is of the order of 1.0, which is several times larger than the standard tune shift limit for storage rings. The propagation of the UMER beam for over 1000 turns, or 11.5 km, suggests the possibility of operating storage rings with significantly higher space charge intensities than previously assumed possible.

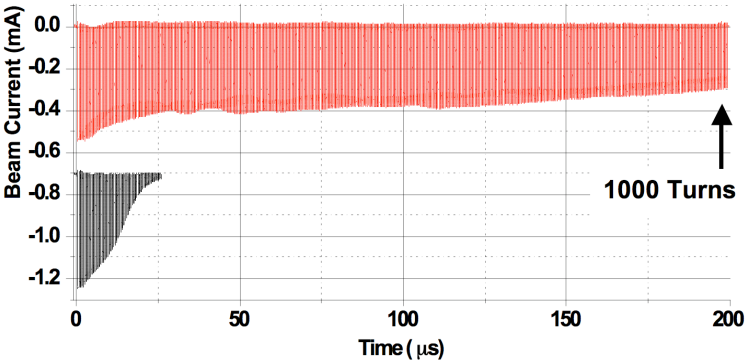

Figure 1. UMER beam current at a fixed location as a function of time, with (red) and without (black) the confining ear-fields (signals are vertically separated by 0.6 mA for clarity).

Attainment of this long beam lifetime further opens the door for new experimental studies on beam dynamics of interest to the Heavy Ion Fusion community. Research is ongoing on the topics of beam halo and emittance growth, ring resonances, and longitudinal physics (including induction focusing). Design studies are also underway to add an acceleration stage to UMER, so that we can perform experiments on the dynamics of resonance crossing. Finally, work on UMER has led to the development of several novel diagnostics including phase-space tomography, dynamic core-masking for halo studies, and multi-turn measurements by rf beam excitation.

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Workshop on Beam Driven High Energy Density Physics

The 2010 Ion Beam Driven High Energy Density Physics (HEDP) Workshop was held in Pleasanton, California, from June 22-24, 2010. The workshop was hosted by the University of California's Institute for Material Dynamics at Extreme Conditions and the Heavy Ion Fusion Science Virtual National Laboratory (HIFS VNL). The focus of the workshop was on experiments that are being, or could be, performed on the VNL's present Neutralized Drift Compression Experiment I (NDCX-I) and the next generation of this type of accelerator (NDCX-II) now being constructed at LBNL, and on experiments that could be carried out in collaboration with scientists at other HEDP facilities, such as the Linear Coherent Light Source (LCLS; located at SLAC), the Jupiter Laser Facility (JLF; located at LLNL), GSI, the National Ignition Facility, the University of Maryland Electron Ring experiment and others.

The meeting informed HEDP scientists and potential users about the beam characteristics of NDCX-I and NDCX-II, and diagnostic capabilities. There were also presentations representing other HEDP facilities including LCLS, GSI, and JLF. The workshop consisted of lectures and discussion groups. The topics of the discussion groups were: Warm dense matter theory and experiments; inertial fusion energy and shocks; beam dynamics; and a cross cutting group on collaborative experiments. A tour of the NDCX-1 experiment and other VNL facilities at LBNL in Berkeley was given in the afternoon of Thursday, June 24th.

Forty nine participants from seven nations (USA, Germany, Japan, Canada, Russia, France, and Austria), seven laboratories (LLNL, LBNL, PPPL, Sandia National Laboratory, SLAC, Germany's GSI accelerator laboratory, Japan's National Institute of Fusion Science), seven universities (U.C. Berkeley, Princeton, University of Electrocommunication, University of Michigan, University of Maryland, Technische Universitat Darmstadt, and University of British Columbia) and one corporation (General Atomics) took part in the workshop. The Department of Energy's Office of Fusion Energy Science Acting Research Division Leader Mark Koepke was also in attendance.

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For comments about the content of the HIF News, contact Jean-Luc Vay (Cell 248-961-9115) or JLVay@lbl.gov
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For more information, visit our website at http://www.umer.umd.edu/ and feel free to contact us. The work has been supported by the Department of Energy, the Joint Technology Office, and the Office of Naval Research.

- Rami Kishek on behalf of the UMER team

[1] M. Reiser, *et al.*, Proc. PAC '99, p. 234 (1999); P.G. O'Shea, *et al., Laser and Particle Beams* **20**, 599 (2002); R.A. Kishek, et al., Proc. PAC '07, p. 820 (2007); S. Bernal, *et al.*, Proc. PAC '09, paper ID FR5PFP059 (2010).

[2] B. Beaudoin, *et al.*, to be published (2010).

[3] B. Beaudoin, *et al.*, Proc. PAC '09, paper ID FR5PFP058 (2010).

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Many scientific disciplines were represented including accelerator physics, laser physics, equation of state physics, ion stopping, radiative hydrodynamics, target physics and computational physics.

The presentations and other information about the workshop may be found on the web at:
http://hifweb.lbl.gov/public/BeamHEDP2010

--John Barnard and Frank Bieniosek

18th HIF Symposium announcement

The 18th International Symposium on Heavy Ion Inertial Fusion will be held in Darmstadt, Germany, from August 30 to September 3, 2010.

For more information, visit the symposium web site at http://www.gsi.de/forschung/pp/dates/HIF2010.html.

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