

## **BIBLIOGRAPHY: Selected References on Heavy Ion Fusion**

### ----- **Heavy Ion Fusion Symposia and Workshops** -----

*International Heavy Ion Fusion Symposia and Workshops have occurred since 1976 on a nearly biennial schedule. Each begins with overviews of the various programs on HIF and related areas worldwide; information on almost all topics in HIF research is available in this series. The proceedings have been formally published since 1986. Here, the most recent Proceedings are listed. The earlier proceedings are listed at the end of this Bibliography.*

[12<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion](#) (Heidelberg, Germany, Sept 24-27, 1997), *Nucl. Inst. and Meth. in Phys. Res. A* **415** (1998).

[13<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion](#) (San Diego, CA, March 13-17, 2000), *Nucl. Inst. and Meth. in Phys. Res. A* **464** (2001).

[14<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion \[first part\] \[second part\]](#) (Moscow, Russia, May 26-31, 2002), *Laser and Particle Beams* **20** (2003).

[15<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion](#) (Princeton, NJ, June 7-11, 2004), *Nucl. Inst. and Meth. in Phys. Res. A* **544** (2005).

[16<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion](#) (St. Malo, France, July 9-14, 2006), *Nucl. Inst. and Meth. in Phys. Res. A* **577** (2007).

[17<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion](#) (Tokyo, Japan, August 3-8, 2008), *Nucl. Inst. and Meth. in Phys. Res. A* **606** (2009).

18<sup>th</sup> International Symposium on Heavy-Ion Inertial Fusion (Darmstadt, Germany, August 30 – September 3, 2010) [Proceedings in preparation].

### ----- **Background on U.S. induction accelerator approach** -----

R. O. Bangerter, "The Induction Approach to Heavy-Ion Inertial Fusion: Accelerator and Target Considerations," *Il Nuovo Cimento* **106 A** No. 11, 1445 (1993).

### ----- **HIF targets** -----

M. Tabak, D. A. Callahan-Miller, D. D.-M. Ho, and G. B. Zimmerman, "Design of a distributed radiator target for inertial fusion driven from two sides with heavy ion beams," *Nuclear Fusion*, **38**, 509 (1998).

D. A. Callahan-Miller and M. Tabak, "Progress in target physics and design for heavy ion fusion," *Phys. Plasmas*, **7**, 2083 (2000).

D. A. Callahan, M. C. Herrmann, and M. Tabak, "Progress in heavy ion target capsule and hohlraum design," *Laser and Particle Beams*, **20**(3), 405 (2002).

B. G. Logan, L. J. Perkins, and J. J. Barnard, "Direct drive heavy-ion-beam inertial fusion at high coupling efficiency," *Phys. Plasmas* **15**, 072701 (2008).

E. Henestroza, B. G. Logan, and L. J. Perkins, "Quasi-spherical fuel compression and fast ignition in a heavy-ion-driven X-target with one-sided illumination," *Phys. Plasmas* **18**, 032702 (2011).

### ----- **Systems studies for HIF** -----

#### **IBeam driver systems models:**

W. R. Meier, R. O. Bangerter, and A. Faltens, "An integrated systems model for heavy ion drivers," *Nucl. Inst. and Meth. in Phys. Res. A*, **415**, 249 (1998).

J. J. Barnard, R. O. Bangerter, E. Henestroza, I. D. Kaganovich, B. G. Logan, W. R. Meier, D. V. Rose, P. Santhanam, W. M. Sharp, D. R. Welch, and S. S. Yu, "A final focus model for heavy-ion fusion driver system codes," *Nucl. Inst. and Meth. in Phys. Res. A* **544**, 243 (2005).

#### **The Robust Point Design induction linac driver study:**

S. S. Yu, W. R. Meier, R. P. Abbott, J. J. Barnard, T. Brown, D. A. Callahan, C. Debonnel, P. Heitzenroeder, J. F. Latkowski, B. G. Logan, S. J. Pemberton, P. F. Peterson, D. V. Rose, G.-L. Sabbi, W. M. Sharp, and D. R. Welch, "An Updated Point Design for Heavy Ion Fusion," *Fusion Science and Tech.* **44** (2), 266 (2003).

J. F. Latkowski and W. R. Meier, "Shielding of the Final Focusing System in the Robust Point Design," *Fusion Sci. and Tech.* **44** (2), 300 (2003).

**The European HIDIF concept for an ignition facility used RF linacs and multiple storage rings:**

C. R. Prior, "Status of the HIDIF Study," Proc. 1998 European Particle Accelerator Conference (EPAC '98), <http://accelconf.web.cern.ch/accelconf/e98/PAPERS/WE0B03A.PDF>

**The HYLIFE power plant study:**

R. W. Moir, *et al.*, "HYLIFE-II: A Molten-Salt Inertial Fusion Energy Power Plant Design--Final Report," *Fusion Technology* **25**, 5-25 (1994).

**The Heavy Ion Fusion Systems Assessment (HIFSA study):**

G. Miley (Editor), *Fusion Technology* **13** (2), 189-396 (Feb. 1988); multiple articles are of interest, for example: J. Hovingh, V.O. Brady, A. Faltens, and D. Keefe, and E.P. Lee, "Heavy-ion linear induction accelerators as drivers for inertial fusion power plants," *Fusion Technol.* **13**, 255 (1988).

----- **Experimental studies of space-charge-dominated beams** -----

**Single-Beam Transport Experiment (SBTE):**

M. G. Tiefenback and D. Keefe, "Measurements of Stability Limits For A Space-Charge-Dominated Ion Beam in a Long A.G. Transport Channel," *IEEE Trans. Nucl. Sci. NS-32* (1985) 2483, [http://accelconf.web.cern.ch/AccelConf/p85/PDF/PAC1985\\_2483.PDF](http://accelconf.web.cern.ch/AccelConf/p85/PDF/PAC1985_2483.PDF)

M. G. Tiefenback, "Space-Charge Limits on the Transport of Ion Beams in a Long Alternating Gradient System," *Thesis (PH.D.)--University of California, Berkeley*, and *LBNL Report LBL-22465*, 1986

**Multiple Beam Experiment – 4 (MBE-4):**

W. M. Fawley, *et al.*, "Beam dynamics studies with the heavy-ion linear induction accelerator MBE-4", *Phys. Plasmas* **4** (1997) 880. [http://pop.aip.org/resource/1/phpaen/v4/i3/p880\\_s1](http://pop.aip.org/resource/1/phpaen/v4/i3/p880_s1)

**Scaled Final-Focus Experiment:**

S. A. MacLaren, A. Faltens, P. A. Seidl, and D. V. Rose, "Results from a scaled final focus experiment for heavy ion fusion", *Phys. Plasmas* **9**, 1712 (2002) <http://link.aip.org/link/doi/10.1063/1.1464894>

**Transverse merging of four beams into a single alternating gradient channel:**

P. A. Seidl, C.M. Celata, A. Faltens, E. Henestroza, "Scaled beam merging experiment for heavy ion inertial fusion" *Phys. Rev. ST Accel. Beams* **6**, 090101 (2003), <http://link.aps.org/doi/10.1103/PhysRevSTAB.6.090101>

**High-Current Experiment (HCX), for driver-scale beam injection, transport, and electron-cloud studies:**

L. Prost, *et al.*, "High current transport experiment for heavy ion inertial fusion", *Phys. Rev. ST Accel. Beams* **8**, 020101 (2005). <http://prst-ab.aps.org/abstract/PRSTAB/v8/i2/e020101>

**Driver-scale injector:**

F. M. Bieniosek, *et al.*, "2-MV electrostatic quadrupole injector for heavy-ion fusion," *Phys. Rev. ST Accel. Beams* **8**, 010101 (2005). <http://prst-ab.aps.org/abstract/PRSTAB/v8/i1/e010101>

**Compact merging-beamlet injector for multi-beam systems:**

J. W. Kwan, F. M. Bieniosek, D. P. Grote, and G. A. Westenskow, "Compact multibeamlet high-current injector for heavy-ion fusion drivers", *Rev. Sci. Instrum.* **77**, 03B503 (2006) <http://link.aip.org/link/doi/10.1063/1.2164947>

**Neutralized Transport Experiment (NTX):**

E. Henestroza, *et al.*, "Design and characterization of a neutralized-transport experiment for heavy-ion fusion," *Phys. Rev. ST Accel. Beams* **7**, 083501 (2004).

P. K. Roy, S. S. Yu, S. Eylon, *et al.*, "Results on intense beam focusing and neutralization from the neutralized beam experiment," *Phys. Plasmas*, Vol. 11, No. 5, (2004), pp 2890-2898.

### Neutralized Drift Compression Experiment (NDCX-I):

A. B. Sefkow, R. C. Davidson, E. P. Gilson, I. D. Kaganovich, A. Anders, J. E. Coleman, M. Leitner, S. M. Lidia, P. K. Roy, P. A. Seidl, W. L. Waldron, S. S. Yu, and D. R. Welch, "Simulations and experiments of intense ion beam current density compression in space and time," *Phys. Plasmas* **16**, 056701 (2009).

P. K. Roy, S. S. Yu, E. Henestroza, A. Anders, F. M. Bieniosek, J. Coleman, S. Eylon, W. G. Greenway, M. Leitner, B. G. Logan, W. L. Waldron, D. R. Welch, C. Thoma, A. B. Sefkow, E. P. Gilson, P. C. Efthimion, and R. C. Davidson, "Drift Compression of an Intense Neutralized Ion Beam," *Phys. Rev. Lett.* **95**, 234801 (2005).

### ----- Scaled experiments modeling long-distance beam transport -----

#### University of Maryland Electron Ring (UMER):

I. Haber, S. Bernal, B. Beaudoin, M. Cornacchia, D. Feldman, R.B. Feldman, R. Fiorito, K. Fiuza, T.F. Godlove, R.A. Kishek, P.G. O'Shea, B. Quinn, C. Papadopoulos, M. Reiser, D. Stratakis, D. Sutter, J.C.T. Thangaraj, K. Tian, M. Walter, and C. Wu, "[Scaled electron studies at the University of Maryland.](#)" *Nucl. Inst. and Meth. In Phys. Res. A* **606**, 64 (2009).

B. Beaudoin, I. Haber, R.A. Kishek, S. Bernal, T. Koeth, D. Sutter, P.G. O'Shea, and M. Reiser, "[Longitudinal Confinement and Matching of an Intense Electron Beam.](#)" *Phys. Plasmas* **18**, 013104 (2011).

#### Paul Trap Simulator Experiment (PTSX):

Use of a Linear Paul Trap to Study Random Noise-Induced Beam Degradation in High-Intensity Accelerators, M. Chung, E. P. Gilson, R. C. Davidson, P. C. Efthimion, and R. Majeski, *Phys. Rev. Lett.*, *102* 145003 (2009).  
[http://w3.pppl.gov/~egilson/pub/Chung%20-%20Phys.%20Rev.%20Lett.%20102%20145003%20\(2009\).pdf](http://w3.pppl.gov/~egilson/pub/Chung%20-%20Phys.%20Rev.%20Lett.%20102%20145003%20(2009).pdf)

Paul Trap Simulator Experiment to Model Intense-Beam Propagation in Alternating-Gradient Transport Systems, E. P. Gilson, R. C. Davidson, P. C. Efthimion, and R. Majeski, *Phys. Rev. Lett.* *92*, 155002 (2004).  
[http://w3.pppl.gov/~egilson/pub/PTSX\\_PRL\\_155002.pdf](http://w3.pppl.gov/~egilson/pub/PTSX_PRL_155002.pdf)

### ----- NDCX-II -----

A. Friedman, J. J. Barnard, R. H. Cohen, D. P. Grote, S. M. Lund, W. M. Sharp, A. Faltens, E. Henestroza, J.-Y. Jung, J. W. Kwan, E. P. Lee, M. A. Leitner, B. G. Logan, J.-L. Vay, W. L. Waldron, R. C. Davidson, M. Dorf, E. P. Gilson, and I. D. Kaganovich, "Beam dynamics of the Neutralized Drift Compression Experiment-II, a novel pulse-compressing ion accelerator," *Phys. Plasmas* **17**, 056704 (2010).

### ----- Ion beam transport limits -----

E. P. Lee, T. J. Fessenden, and L. J. Laslett, "Transportable Charge in a Periodic Alternating Gradient System," *IEEE Transactions on Nuclear Science* **NS-32** No. 5, (1998) 2489

S. M Lund and S. R. Chawla, "Space-charge transport limits of ion beams in periodic quadrupole focusing channels" *Nucl. Inst. & Meth. A*, **561** (2006) 203 <http://dx.doi.org/10.1016/j.nima.2006.02.195>

### ----- Ion beam simulation -----

A. Friedman, "Simulation of intense beams for Heavy Ion Fusion," *Nucl. Inst. and Meth. in Phys. Res. A* **544**, 160 (2005).

D. R. Welch, D. V. Rose, C. Thoma, A. B. Sefkow, I. D. Kaganovich, P. A. Seidl, S. S. Yu, J. J. Barnard, and P. K. Roy, "Integrated simulation of an ion-driven warm dense matter experiment," *Nucl. Inst. and Meth. in Phys. Res. A* **577**, 231 (2007).

### ----- Drift compression of ion beams to short pulses -----

H. Qin et al., "Drift compression and final focus for intense heavy ion beams with nonperiodic, time-dependent lattice" *PRST-AB* **7**, 104201 (2004).

M. J. L. de Hoon, E. P. Lee, J. J. Barnard, "Drift Compression of Space Charge Dominated Beams" *Proceedings of the 2001 Particle Accelerator Conference*,  
<http://accelconf.web.cern.ch/AccelConf/p01/PAPERS/FOAC006.PDF>

### ----- Chamber transport -----

W. M. Sharp, D. A. Callahan, M. Tabak, S. S. Yu, P. F. Peterson, D. R. Welch, D. V. Rose, and C. L. Olson, "Modeling Chamber Transport for Heavy-Ion Fusion," *Fusion Science and Tech* **43**, 393 (2003); updated in: W. M. Sharp, D. P. Grote, D. A. Callahan, M. Tabak, E. Henestroza, S. S. Yu, P. F. Peterson, D. R. Welch, and D. V. Rose, "Realistic Modeling Of Chamber Transport for Heavy-Ion Fusion," *Proc. 2003 Particle Accel. Conf.*, <http://accelconf.web.cern.ch/AccelConf/p03/PAPERS/WPPG022.PDF>

### ----- Ion beams in plasmas -----

I. D. Kaganovich, R. C. Davidson, M. A. Dorf, E. A. Startsev, A. B. Sefkow, E. P. Lee, and A. Friedman, "Physics of neutralization of intense high-energy ion beam pulses by electrons," *Phys. Plasmas* **17**, 056703 (2010). [http://pop.aip.org/resource/1/phpaen/v17/i5/p056703\\_s1](http://pop.aip.org/resource/1/phpaen/v17/i5/p056703_s1) .

### ----- Ion stopping in target plasma -----

R. M. More, "Plasma Processes in Non-Ideal Plasmas," in *Laser-Plasma Interactions 3: Proc. 29th Scottish Universities Summer School in Physics*, M. B. Hooper, Ed. (Scottish Universities Summer School in Physics, St. Andrews, 1985).

Z. Zinamon, "Ion Beams-Target Interactions," in *Nuclear Fusion by Inertial Confinement -- A Comprehensive Treatise*, G. Velarde, Y. Ronen, and J. Martinez-Val, Eds. (CRC Press, London, 1993; ISBN 0-8493-6926-6).

### ----- HIF technologies -----

A.W. Molvik and A. Faltens, "Induction accelerator efficiency at 5 Hz," *Nucl. Inst. and Meth. in Phys. Res. A* **464**, 445 (2001).

A. W. Molvik and A. Faltens, "Induction core alloys for heavy-ion inertial fusion-energy accelerators," *Phys. Rev. ST Accel. and Beams* **5**, 080401 (2002).

R.O. Bangertter et al., "Parameters and Requirements of Superconducting Focusing Quadrupoles for Heavy Ion Fusion" *IEEE Transactions On Applied Superconductivity*, **13**, NO. 2, 1530 (2003)

P.F. Peterson, "HIF liquid hydraulics scaling and pocket design," *Nucl. Inst. and Meth. in Phys. Res. A* **464**, 159 (2001).

### ----- Sources and Injectors -----

D. P. Grote, E. Henestroza, and J. W. Kwan, "Design and simulation of a multibeamlet injector for a high current accelerator," *Phys. Rev. ST Accel. and Beams* **6**, 014202 (2003).

J. W. Kwan, D. Baca, E. Henestroza, J. Kapica, F. M. Bieniosek, W. L. Waldron, J.-L. Vay, S. Yu, G. A. Westenskow, D. P. Grote, E. Halaxa, I. Haber, and L. Grisham, "Ion source and injector experiments at the HIF/VNL," *Nucl. Inst. and Meth. in Phys. Res. A* **544**, 134 (2005).

J. W. Kwan, "High Current Ion Sources and Injectors for Induction Linacs in Heavy Ion Fusion," *IEEE Trans. on Plasma Science* **33**, 1901 (2005).

J. W. Kwan, F. M. Bieniosek, D. P. Grote, and G. A. Westenskow, "Compact multibeamlet high-current injector for heavy-ion fusion drivers," *Rev. Sci. Instruments* **77**, 03B503 (2006).

### ----- WDM -----

F. M. Bieniosek, J. J. Barnard, A. Friedman, E. Henestroza, J-Y. Jung, M. A. Leitner, S. Lidia, B. G. Logan, R. M. More, P. A. Ni, P. K. Roy, P. A. Seidl and W. L. Waldron, "Ion Beam-Driven Warm Dense Matter Experiments," *Journal of Physics Conference Series*, 032028 (2010). doi: 10.1088/1742-6596/244/3/032028.

J. J. Barnard, J. Armijo, R. M. More, A. Friedman, I. Kaganovich, B. G. Logan, M. M. Marinak, G. E. Penn, A. B. Sefkow, P. Santhanam, P. Stoltz, S. Veitser, and J. S. Wurtele, "Theory and Simulation of Warm Dense Matter Targets," *Nucl. Inst. and Meth. in Phys. Res. A* **577**, 275 (2007).

----- **Earlier HIF Symposia and related Proceedings** -----

[\[LBL-5543\] ERDA summer study of heavy ions for inertial fusion, Berkeley, \(1976\). Final report](#) LBL-5543

[BNL-50769] Heavy Ion Fusion Workshop held at Brookhaven National Laboratory, Upton (1977) BNL-50769

[\[LBL-9332\] The Development of Heavy-Ion Accelerators as Drivers for Inertially Confined Fusion, \(1979\)](#)

[ANL-79-41] Heavy Ion Fusion Workshop held at Argonne National Laboratory, Argonne (1978) ANL-79-41

[\[SLAC-R-542\] Proceedings of the Heavy Ion Fusion Workshop, Berkeley, Calif., October 29 - November 9, 1979](#) SLAC-R-542

Symposium on Accelerator Aspects of Heavy Ion Inertial Fusion, Darmstadt (1982), GSI-Report GSI-8-28

INS Symposium on Heavy Ion Accelerators and their Applications to Inertial Fusion, Tokyo (1984)

[International Symposium on Heavy Ion Inertial Fusion, Washington, DC \(1986\)](#) *AIP Conference Proceedings* **152** (1986).

[International Symposium on Heavy Ion Inertial Fusion, Darmstadt \(1988\)](#) *Nucl. Inst. and Meth. in Phys. Res. A* **278** (1989).

International Symposium on Heavy Ion Inertial Fusion, Monterey (1990), *Particle Accelerators PLACBD* **37-38** (1992).

International Symposium on Heavy Ion Inertial Fusion, Frascati (1993), *Il Nuovo Cimento* **A106** (1993).

[International Symposium on Heavy Ion Inertial Fusion, Princeton \(1995\)](#) *Fusion Eng. & Design* **32-33** (1996).