CURRICULUM VITAE

BAARTMAN, Richard A.

Degrees

Simon Fraser University	1975	B.Sc.
Simon Fraser University	1981	M.Sc.

Employment History

1980-1988	Staff Scientist, TRIUMF
1988-1995	Research Scientist, TRIUMF
1995-present	Senior Scientist, TRIUMF
2005-present	Head, Accelerator Physics group, TRIUMF

Awards, Committees, Service to the community

1975	Governor General's Gold Medal (SFU)
1996	Visiting scientist at KEK (Japan Society for the Promotion of Science fellowship)
1997-2004	Member, DOE review committee for SNS construction project (Oak Ridge)
1998	Convenor ICFA WS on Beam Loading
2001, Oct.	Visiting scientist, CERN-ISOLDE
2002-2005	Member, DOE review committee for Fermilab's Run 2 progress
2003, Dec.	Visiting Scientist MSU.
2004	Member, EBIT review at Brookhaven National Lab
2005, Jan.	Visiting Scientist, CIAE (China).
2005	Convener, Beam Dynamics session, HPSL2005
2006-2009	Member, Editorial Board, Physical Review Special Topics - Accelerators and Beams
2008	Convener, Beam Dynamics session, HB2008
2008-2009	Program Committee PAC09 (BDEMF session chair)
2009-2012	Vice-Chair, Publications Committee of the Division of Physics of Beams, APS
2009-	Member, Int. Collaboration on Future Accelerators (ICFA) Beam Dynamics Panel
2009	Award: Fellow, American Physical Society
2009	Invited talk, DESIR High Resolution Separator Workshop
2010	Invited talk, Daedalus Workshop on MegaWatt Cyclotrons, MIT
2011	Award: Outstanding Referee, American Physical Society
2011	Appointment to Program Committee Chair, Int. Cyclotron Conference 2013

Highly Qualified Personnel Supervised

Undergraduate students:	5
M. Sc students:	0
Ph. D. students:	1
Post-Doctoral:	2

Publications

Refereed Journal Publications:	29
Invited Conference Talks:	5
Seminars & Colloquia:	5
Conference Publications:	78

Most Significant Research Contributions.

In reverse chronological order

(Also, consult Google Scholar citations under author: "R Baartman".)

- Have devised a new method of calculating optimal pole shapes of standard charged particle focusing elements (quadrupoles)[1]. Used this method to design the 77 quadrupoles for the transport of electrons from the ARIEL electron linac to the targets.
- [2, 3, 4, 5, 6, 7] Oversee beam dynamics issues, and have contributed personally to the theory of electron envelopes from rest[8], the optics layout of the low energy section, and quadrupole design[9].
- Designed a new vertical section of the beam line between the ion source and matching to the cyclotron. This line is 12 m in length and contains 26 quadrupoles. It has been installed, commissioned, and performs in agreement with theory.[10]
- Developed new differential algebra mathematical tools for particle beam optics.[11, 12]
- Developed and implemented a tomography technique to reconstruct 2-dimensional current density from 1-dimensional projections.[13, 14, 15]
- Designed and commissioned new beam lines for the electron cyclotron resonance (ECR) charge state booster[16, 17, 18, 19], the TITAN mass measurement experiment[20], the ISAC-2 experimental hall (MAYA, TUDA, TIGRESS experiments)[21, 22].
- Developed a new technique for matching to cyclotrons[23, 24]. The technique used is to calculate the 3D beam envelopes (6 phase space dimensions) including space charge, axial magnetic field, and acceleration at the dee gaps in the cyclotron. The calculation is first order, but contains all the relevant physics of that order: in the cyclotron it includes electric focusing, the gap-crossing resonance, and the radial-longitudinal coupling (vortex) effect of space charge.
- [25] Designed the beam optics to inject into the β-NMR facility at TRIUMF. Special features that complicate the design are: (1) Deceleration electric field to slow the ^{8}Li ions down from 30 keV to 300 eV, and (2) axial magnetic field up to 9 T. These result in resp. radial electric and magnetic fields that strongly perturb the ion beam.
- [26] For all the main types of charged particle optics elements, canonical transformations were found that eliminate the lowest order derivatives of the strength function. The benefit is that forces do not become singular in the hard-edge limit, so simple formulas can be derived for the lowest order aberrations, and aberration-free beamlines can be designed without resorting to tedious high order transfer maps.
- [27] Up to this time, most efforts to try to understand space charge effects in synchrotrons were based upon the frequencies of motion of the individual particles. This work demonstrated that this is an incorrect picture; the collective modes of oscillation are key and the details of the motion of the individual particles in the beam core are not relevant.
- [28] With Ph. D. student, developed a new technique and understanding of finding stability threshold of synchrotron bunches, due to mode coupling of longitudinal eigenmodes.

- [29] A spiral inlector is an optical element used in injecting a particle beam into a cyclotron. We found the canonical momenta in the magnetic field of the cyclotron, and used the standard optics technique of expanding about the (spirally-rotating) reference trajectory. We thus derived the Hamiltonian for linear motion. This advance allowed for quicker calculations plus the incorporation of space charge.

References

[1] R. Baartman. Quadrupole shapes. *Phys Rev Special Topics Accelerators and Beams*, 15:074002–074011, 2012.

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