

BAARTMAN, Richard A.

Employment History

1980-present TRIUMF scientist
2005-present Head, Beam Physics group, Accelerator Division, TRIUMF

Awards

1975 Gold Medal, Graduating class Simon Fraser University
2009 Fellow, American Physical Society
2011 Outstanding Referee, American Physical Society

Recent Research Contributions

Grants

2011-2014 Cyclotron Space Charge Physics,
Natural Sciences and Engineering Research Council of Canada
2016-2020 Canada's Contribution to AWAKE - a plasma wakefield experiment at CERN,
Natural Sciences and Engineering Research Council of Canada

Committees, Service to the community

2006-2009 Member, Editorial Board, Physical Review Special Topics - Accelerators and Beams
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
2011-2013 Program Committee Chair, Int. Cyclotron Conference 2013
2011- Reviewer, FNAL Project X, PIXE, PIP, P2MAC
2014 Design Study, Future Circular Collider Design Study, CERN
2017 Adjunct Professor, Dept. Physics and Astronomy, University of Victoria, B.C. Canada

Invited Talks; last 5 years

2013 *Space Charge Limit in Separated Turn Cyclotrons*,
Cyclotrons2013, Vancouver, Canada, 2013-09-16
2013 *Optimal 3D Quadrupoles Shapes*, NA-PAC13
(North American Particle Accelerator Conf.), Pasadena, USA.
2014 *Status of Superconducting Electron Linac Driver*, LINAC2014, Geneva, Switzerland.
2015 *TRIUMF 300 keV Vertical Injection Line*, European Cyclotron Progress Meeting,
Louvain-la-Neuve Belgium.
2016 *Linac Envelope Optics*, LINAC2016, East Lansing, Michigan, USA.
2017 *Lecturer: Low Energy Beam Transport*, CERN Accelerator School, Erice, Italy.

Research Summary; last 10 years

N.B. Technical notes can be accessed [here](#).

Head of the design team of the CANREB High Resolution Separator[15]. Recently, invented a new kind of multipole corrector for high resolution separators[6].

Have overseen design of many disparate beamlines and charge breeders[5, 2, 7, 22, 17, 13, 11].

Member of team designing a megawatt-class electron accelerator. [16, 28, 31, 32, 33, 34, 27] Oversee beam dynamics issues, and have contributed personally to the theory of electron envelopes from rest[26], and for the linac[14]. For the latter, developed the envelope technique for tracking statistical beam parameters through electron linacs, including space charge, invited talk LINAC2016, MSU[10]. See also related beam optics code development[12].

Have invented and co-developed a new kind of simpler permanent magnet lens[1].

Have devised a new method of calculating optimal pole shapes of standard charged particle focusing elements (quadrupoles)[24], invited talk[18]. Used this method to design the 77 quadrupoles for the transport of electrons from the ARIEL electron linac to the targets.

Aided in the design of transfer lines for the CERN ELENA project[20, 23], and in the design of the high resolution separator for the GANIL DESIR project[21]

Developed a new technique for matching to cyclotrons[30, 29]. 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.

Used this technique to design 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.[25]

Further research on space charge limits in cyclotrons, see invited talk [19], and [4]. Also made progress on resonance correction[3].

Contributed to the Proton Electric Dipole Moment international collaboration, in particular the theory of completely electrostatic storage rings[9, 8].

Supervised to completion (May 2018), Ph.D. candidate Dr. Marco Marchetto.

References

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- [2] M Pereira-Wilson, R Baartman, and S Saminathan. Envelope calculations on the ion beam injection and extraction of canreb ebis. In *International Particle Accelerator Conference*, 2018.
- [3] Y-N Rao, R Baartman, and T Planche. Correction of $\nu_r - \nu_z = 1$ resonance in triumph cyclotron. In *International Particle Accelerator Conference*, 2018.
- [4] Y-N Rao, R Baartman, and T Planche. Improved simulation for centre region of triumph 500 mev cyclotron with space charge. In *International Particle Accelerator Conference*, 2018.
- [5] YN Rao, R Baartman, Y Bylinskii, and FW Jones. New proton driver beamline design for ariel project at triumph. In *International Particle Accelerator Conference*, 2018.
- [6] D Sehayek, R Baartman, C Barquest, Maloney, M Marchetto, and T Planche. Multipole tuning algorithm for the canreb hrs at triumph. In *International Particle Accelerator Conference*, 2018.
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- [12] R. Baartman. TRANSOPTR: Changes since 1984. Technical Report TRI-BN-16-06, TRIUMF, 2016.
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