The Faculty of Medicine of Harvard University
Curriculum Vitae

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Education:

10/2008-06/2011	BS	Physics	University of Warsaw (Poland)
10/2011-06/2013	MS	Physics	University of Warsaw (Poland)
08/2013-06/2017	PhD	Physics (Thesis advisor: Antonio Ereditato)	University of Bern (Switzerland)
01/2021-05/2022	CAMPEP Accredited Graduate Program in Medical Physics	Medical Physics	Harvard Medical School

Postdoctoral Training:

07/17	Postdoctoral Fellow	Medical Applications of Particle Physics (Mentor: Saverio Braccini)	University of Bern (Switzerland)

09/17-11/19	Postdoctoral Fellow	Proton Therapy (Mentor: Jacobus M. Schippers)	Paul Scherrer Institute (Switzerland)
12/19-11/20	Postdoctoral Fellow	Proton Therapy (Mentor: David Meer)	Paul Scherrer Institute (Switzerland)
12/20-11/22	Research Fellow	Radiation Oncology (Mentor: Harald Paganetti)	Massachusetts General Hospital and Harvard Medical School

Faculty Academic Appointments:

2022-	Instructor	Radiation Oncology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions:

2020-2022	Research Fellow	Radiation Oncology	Massachusetts General Hospital
2022-	Assistant Radiation Biophysicist	Radiation Oncology	Massachusetts General Hospital

Committee Service:

Local

2010-2013	Faculty Council	University of Warsaw (Poland)
	2010-2013	Member - student representative
2015-2016	Promotion Committee of the Physics Institute	University of Bern (Switzerland)
	2015-2016	Member - mid-staff representative
2023-	Physics DE&I Committee	Massachusetts General Hospital
	2023-	Member

Professional Societies:

2008-	Polish Physical Society
2014-2023	Swiss Physical Society

2018-	Particle Therapy Co-Operative Group	
2021-	European Society for Radiotherapy and Oncology (ESTRO)	
2021-	American Association of Physicists in Medicine (AAPM)	
	2023-	Guest Member, Work Group on Particle Beams (WGPB)
	2024-	Member, Awards Selection Subcommittee (AS)
2022-	New England Chapter of the American Association of Physicists in Medicine (NEAAPM)	
	2024-	Officer-At-Large, NEAAPM Board

Editorial Activities:

Ad hoc Reviewer

Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

Frontiers in Oncology - Radiation Oncology

Instruments

International Journal of Modern Physics A

Journal of Physics: Conference Series

Machine Learning: Science and Technology

Medical Physics

Physica Medica

Tomography

International Journal of Particle Therapy

Scientific Reports

Therapeutic Radiology and Oncology

Scientific Instruments

Physics in Medicine and Biology

Radiation Oncology

Cancers

IEEE Transactions on Nuclear Science

Health and Technology

Other Editorial Roles

2022-	Editorial Board Member (Review Editor)	Frontiers in Oncology - Radiation Oncology
2022-	Guest Editor	Cancers, Special Issue: Carbon Ion Radiotherapy (Vol. I and II)

Honors and Prizes:

2010	The Rector Scholarship	University of Warsaw (Poland)	Excellent academic results
2011	Scholarship within Operational Programme "Human Resources Development" cofounded by the European Union	University of Warsaw (Poland)	Excellent academic results
2012	Scholarship of the Minister of Science and Higher Education	Ministry of Science and Higher Education (Poland)	Outstanding scientific achievements
2012-2013	Master's student scholarship within the grant "Forward Physics - a New Window on the	Foundation for Polish Science	

	Quantum ChromoDynamics"		
2014	Best Oral Presentation Award	Warsaw Medical Physics Meeting 2014 (Warsaw, Poland)	
2015	Student Award	International Beam Instrumentation Conference (IBIC) 2015 (Melbourne, Australia)	
2019	Start-up Training, Business Creation in Medtech	Innosuisse - Swiss Innovation Agency	
2020	Travel Fellowship Award	Particle Therapy Co-Operative Group (PTCOG)	
2021-2022	Leadership Development Program for Researchers	Massachusetts General Hospital	
2023	Top Cited Article 2021-2022	Wiley (publisher)	My 1st author paper *Commissioning of a clinical pencil beam scanning proton therapy unit for ultra-high dose rates (FLASH)* has been recognized as a top cited paper among work published in an issue between 1 January 2021 - 15 December 2022 in Medical Physics.
2023	Top Downloaded Article	Wiley (publisher)	My 1st author paper *Commissioning of a clinical pencil beam scanning proton therapy unit for ultra-high dose rates (FLASH)* was one of the most downloaded papers in its first 12 months

		of publication in Medical Physics.
2023-	Full Membership	Sigma Xi - The Scientific Research Honor Society
2024	National Institutes of Health MERIT Award (R37)	National Cancer Institute

Report of Funded and Unfunded Projects

Past

2020-2022	Online Adaptive Proton Therapy Using Different Imaging Techniques Swiss National Science Foundation; Mentored training grant ("Postodoc.Mobility") No. 191125 PI ($143,000 (CHF 135,400)) This project aims to explore the use of fast Monte Carlo dose calculation for online adaptive proton therapy utilizing various imaging techniques. Within this project, the suitability of the CBCT and in-room CT for daily adaptations will be compared, and corresponding workflows will be validated experimentally with anthropomorphic phantoms. One of the aims is also a proof-of-concept study for potential proton-MRI adaptation based on synthetic CTs.

Current

2024-	A compact beam delivery system enabling ultra-fast dose delivery for upright proton therapy NIH/NCI; R01/R37 CA288343 PI ($1,948,663.00) This project aims to develop a compact fixed beamline solution incorporating Fixed-Field Alternating Gradient (FFA) technology and a novel ultra-fast energy degrader for ultra-rapid dose delivery in proton therapy. By leveraging the unique capabilities of this system, we seek to enhance the quality of proton therapy for patients and significantly reduce the treatment time and cost of proton therapy. In particular, by delivering each field in a few seconds, this system will enable effective and more efficient treatment of moving targets. At the same time, the higher patient throughput and significantly reduced costs of facilities hosting this compact system will improve the accessibility of proton therapy in the United States and

worldwide. Moreover, up to 50% shorter treatment times will significantly improve patient comfort. Successful completion of the specific aims defined in this project will pave the way for the translation of the FFA technology combined with an ultra-fast energy degrader into a pre-commercial prototype of the compact beamline, offering a promising solution to expedite treatments, improve patient outcomes, and address the limited availability and high cost of proton therapy.

Unfunded Current Projects

2022- Developing MRI-guided proton therapy based on deformable image registration
PI
This project aims to test the hypothesis that obtaining electron densities from daily MRI images using deformable image registration will be suitable for adaptive proton therapy - offline (with currently available MRI scanners) and online (with future in-room MRI imaging). This project is a continuation of my previous grant. Currently, I am supervising a PhD student working on the project.

Report of Local Teaching and Training

Teaching of Students in Courses:

2023	HST.533: Medical Imaging in Radiation Therapy Graduate students	Harvard/MIT Health Sciences and Technology (HST) Program 2 hours / year

Research Supervisory and Training Responsibilities:

2023	Co-supervisor of a visting postdoctoral fellow Postdoctoral Fellow	Massachusetts General Hospital 20 hours / year
2023-	Research project co-mentor PhD Student	Massachusetts General Hospital 2 hours / week
2023-	Primary research supervisor, chair of the dissertation committee PhD Student	Massachusetts General Hospital 2 hours / week

2023-	Co-supervisor PhD Student	Remote 1 hour / week

Mentored Trainees and Faculty:

2023	Pierluigi Casolaro, PhD / Postdoctoral Fellow / University of Bern (Switzerland) Carrer stage: postdoctoral fellow. Mentoring role: co-supervisor during a research stay at Mass General Hospital. Obtained experimental results for a paper in preparation, two conference contributions incorporating the results.
2023-	Mislav Bobić / Graduate Research Assistant / Massachusetts General Hospital Career stage: graduate student. Mentoring role: research project co-mentor at MGH, senior author of the resulting paper Designed and successfully conducted experimental validation of a proton therapy adaptive workflow, first-author paper published, another paper in preparation.
2023-	Debora De Souza Antonio / PhD Student / University of Massachusetts Lowell Career stage: graduate student. Mentoring role: research mentor at MGH, chair of the dissertation committee Developed a PhD research proposal which the student has successfuly defended at the UMass Lowell. The student is currently working on the first steps of this project.
2023-	Hang Zhao / PhD Student / Osaka University Career stage: graduate student. Mentoring role: remote co-supervisor

Local Invited Presentations:

☒ *No presentations below were sponsored by 3rd parties/outside entities*

2021	Commissioning of a former clinical PBS proton therapy unit for FLASH and first experiments with cells / Invited seminar Department of Radiation Oncology, Massachusetts General Hospital
2022	Novel beam delivery systems and techniques for proton therapy / Invited seminar Department of Radiation Oncology, Massachusetts General Hospital

2022	Online adaptive proton therapy using different imaging techniques / Invited seminar Department of Radiation Oncology, Massachusetts General Hospital
2022	Online adaptive proton therapy using different imaging techniques / Invited seminar Department of Radiation Oncology, Brigham and Women's Hospital and Dana Farber Cancer Institute

Report of Regional, National and International Invited Teaching and Presentations

☒ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

Regional

2022	Developing MRI-guided upright proton therapy to allow novel adaptive treatment strategies / Invited seminar Physics Department, University of Massachusetts Lowell Lowell, MA

National

2013	Universal beam monitor detector based on doped silica and optical fibers (selected oral abstract) Warsaw Medical Physics Meeting 2013 Warsaw, Poland
2014	Emulsion detectors for dose distribution characterization in the halo of proton pencil beams (selected oral abstract) 18th Annual SASRO (Scientific Association of Swiss Radiation Oncology) Meeting Lugano, Switzerland
2014	Research activities at the new Bern PET cyclotron (selected oral abstract) Annual Meeting of the Swiss Physical Society Fribourg, Switzerland
2019	New concepts for proton-therapy gantries / Invited seminar Albert Einstein Center for Fundamental Physics, University of Bern Bern, Switzerland

2023 The Power of Protons: Unleashing Precision in Cancer Treatment / Invited seminar
Fundamental Physics, Directorate, SLAC National Accelerator Laboratory
Menlo Park, CA

2023 The Power of Protons: Unleashing Precision in Cancer Treatment / Invited seminar
Physics Division, Lawrence Berkely National Laboratory
Berkeley, CA

International

2013 Inclusive hadron production in p-p collisions in CMS / Workshop
Low X 2013 - the international workshop on low x physics
Rehovot and Eilat, Israel
Selected to speak on behalf of the CMS collaboration

2013 The new Bern cyclotron laboratory: production and research activities after one year of operation / Workshop
CYCLEUR 2013 - meeting of the European Cyclotron Network
Ispra, Italy

2014 Accelerator and detector physics at the 18 MeV cyclotron and its beam transfer line (selected oral abstract)
Warsaw Medical Physics Meeting 2014
Warsaw, Poland

2016 Activities at the Bern cyclotron laboratory / Workshop
CYCLEUR 2016 - meeting of the European Cyclotron Network
Bern, Switzerland

2016 UniBEaM: a wide intensity range ion beam monitor based on silicafibers (selected oral abstract)
16th International Workshop on Targetry and Target Chemistry (WTTC16)
Santa Fe, NM

2018 Gantry design and experience at PSI / Invited presentation
Ideas and technologies for a next generation facility for medical research and therapy with ions - Ions 2018
Archamps, France

2018	Gantry design optimization for medical hadron accelerators / Invited presentation Optimization of Medical Accelerators (OMA) Network Topical Workshop Villigen, Switzerland
2018	Superconducting gantry for proton therapy with a large momentum acceptance (selected oral abstract) PTCOG 57 - annual meeting of Proton Therapy Co-Operative Group Cincinnati, OH
2018	Large momentum acceptance beam optics of a superconducting gantry for proton therapy (selected oral abstract) 10th International Conference on Charged Particle Optics (CPO-10) Key West, FL
2020	A novel static beam delivery system for fast proton arc therapy (selected oral abstract) PTCOG 2020 - annual meeting of Proton Therapy Co-Operative Group Virtual
2022	A novel static beam delivery system for fast proton arc therapy / Invited presentation Particle Arc Therapy: from concept to clinical reality, 2022 ESTRO Physics Workshop Lisbon, Portugal (virtual)
2022	Group leader, Treatment delivery workgroup, Particle Arc Therapy: from concept to clinical reality Particle Arc Therapy: from concept to clinical reality, 2022 ESTRO Physics Workshop Lisbon, Portugal (virtual)

Report of Clinical Activities and Innovations

Practice Activities:

2022-	Quality assurance measurements for proton radiation therapy treatment	Massachsuetts General Hospital	40 hours / year
2023	Clinical workflow improvements	Gordon-Browne Proton Therapy Center, Massachusetts General Hospital	2 hours / week

Clinical Innovations:

Ripple filter for optimal dose delivery (2023)	I led the design of a ripple filter, including its detailed simulations and experimental testing. A ripple filter smears the energy of the proton beam. This allows reducing the number of energy layers per irradiation field and the number of spots per beam. As a result of it, dose delivery is up to 30% faster, and treatment planning is more efficient. The use of a ripple filter also makes the treatment plans more robust against range errors. The designed ripple filter will be part of the dose delivery system at the Gordon-Browne Proton Therapy Center at MGH. As the design and application of the filter include innovative components, a publication and conference contribution are planned to increase the impact of this project.
Treatment delivery diagnostic tool at Francis Burr Proton Therapy Center (2023)	I contributed to the development of a tool that analyzes treatment log files to help confirm accurate dose delivery.

Report of Technological and Other Scientific Innovations

Ion beam monitor (2016)	I was one of the main contributors to the development of an innovative ion beam monitor (hardware and software) - Universal Beam Monitor (UniBEaM), proposed by Dr. Saverio Braccini (University of Bern, Switzerland). It is a simple and versatile beam profiler that can be deployed to monitor ion beams in a wide intensity range. The UniBEaM detector covers a wide spectrum of applications, from radiobiological research to the production of novel PET (Positron Emission Tomography) isotopes. It is also suitable to monitor proton-therapy beams. (Auger M et al. J Instrum. 2016;11:P03027) I also contributed to the commercialization of the detector under the license of the University of Bern by the Canadian company D-Pace, Inc. (Potkins DE et al. Physics Procedia. 2017;90:215-222).
Compact system for online beam emittance measurement (2017)	Based on the UniBEaM detector mentioned above, I designed and fully developed a new compact system called 4PrOBeaM (4-Profiler Online Beam Emittance Measurement) with integrated statistical analysis for fast online measurement of beam emittance, the primary physical quantity used to characterize an accelerated particle beam. (Nesteruk KP et al. J Instrum. 2018;13:P01011) With this system, I performed the first comprehensive study of beam

	dynamics of a medical cyclotron. It was also deployed for emittance measurements of the TR24 cyclotron in Strasbourg, France (Bouquerel et al. Nucl Instrum Methods Phys Res A: Accel Spectrom Detec. Assoc Equip. 2019;931:151-157). The system can be installed at any location along a beamline or directly at an accelerator outport, and therefore it can be easily employed in the characterization and optimization of medical cyclotron beams.
Superconducting proton therapy gantry with a large momentum acceptance (2019)	I was one of the key contributors to the design of a new superconducting gantry for proton therapy with an unprecedentedly large momentum acceptance enabled by specifically designed achromatic beam optics (PI: Dr. Jacobus M. Schippers) (Nesteruk KP et al. Phys Med Biol. 2019;64(17):175007, Nesteruk KP et al. Int J Mod Phys A. 2019;34(36):1942024). It is combined with a 2D lateral scanning system and a fast degrader mounted in the gantry so that this treatment unit will be able to perform pencil beam scanning with very rapid energy variations at the patient, allowing a significant reduction of the irradiation time. A very fast proton beam delivery sequence may be of advantage for treatments in moving tissue. The gantry will be up to 10 times lighter than the standard systems, and a new cyclotron-based facility with this gantry will have a significantly smaller footprint. The design is based on previous work carried out at the Paul Scherrer Institute (Gerbershagen A et al. Z Med Phys. 2016;26(3):224–237, Patent US-10463881-B2).
Research platform for preclinical studies of FLASH irradiation with protons (2020)	As a postdoctoral fellow at the Center for Proton Therapy at PSI, I played a key role in establishing a flexible research platform for preclinical studies of ultra-high dose rate (FLASH) irradiation with protons (PIs: Dr. David Meer, Dr. Serena Psoroulas). The FLASH effect (enhanced normal tissue sparing at ultra-high dose rates) became one of the hottest topics in radiation therapy, with the potential to revolutionize radiation oncology. I was given the opportunity by the PIs of the project to lead our activities to establish an experimental FLASH program at one of PSI's proton therapy gantries. Our team has successfully commissioned the former clinical unit Gantry 1 for FLASH research. (Nesteruk KP et al. Med Phys. 2021;48(7):4017-4026)
Static beam delivery device for fast proton arc therapy (2020)	I worked on the design of a new static beam delivery device for fast proton arc therapy (PI: Dr. Jacobus M. Schippers). The concept is based on a configuration of concentric magnetic fields with a fixed orientation and position in space to deliver a proton beam to the patient from many angles without mechanical movements of a beam delivery system. Therefore, large gantries used to move heavy magnet systems are replaced by this arc system. I have proven the feasibility of delivering pencil beams to the isocenter from

all the angular directions by changing the scanning magnets' settings only. The same magnets are used for pencil beam scanning. I proposed and tested several solutions to address beam-optics challenges. Changing the settings of those can be done so rapidly that a substantial arc can be covered within a fraction of a second. This opens the way to new fast delivery techniques. (Nesteruk KP et al. Phys Med Biol. 2021;66(5):055018)
US-20210001150-A1 (Inventor: Jacobus M. Schippers)

Report of Education of Patients and Service to the Community

☒ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

Activities

2014	Night of Research (Nacht der Forschung) in Bern (Switzerland) / Presenter Presented medical applications of physics to general public
2017	Science Festival (Festiwal Nauki) in Siedlce (Poland) / Speaker Outreach lecture: "Protons against cancer" (in Polish)

Report of Scholarship

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Peer-Reviewed Scholarship in print or other media:

Research Investigations

1. Braccini S, Ereditato A, Giacoppo F, Kreslo I, **Nesteruk KP**, Nirkko M, Weber M, Scampoli P, Neff M, Pilz S, Romano V, A beam monitor detector based on doped silica and optical fibres. J Instrum. 2012;7:T02001, https://doi.org/10.1088/1748-0221/7/02/T02001

2. Ariga A, Ariga T, Braccini S, Giacoppo, AEF, **Nesteruk KP***, Pistillo C, Scampoli P. Characterization of the dose distribution in the halo region of a clinical proton pencil beam using emulsion film detectors. J Instrum. 2015;10:P01007, https://doi.org/10.1088/1748-0221/10/01/P01007
(* denotes main contributor; authors are listed in alphabetical order)

3. Braccini S, Ereditato A, **Nesteruk KP***, Scampoli P, Zihlmann K. Study of the radioactivity induced in air by a 15-MeV proton beam. Radiat Prot Dosimetry. 2015 Feb;163(3):269-275. PMID: 24982259, https://doi.org/10.1093/rpd/ncu199
(* denotes main contributor; authors are listed in alphabetical order)

4. Auger M, Braccini S, Ereditato A, Haeberli M, Kirillova E, **Nesteruk KP***, Scampoli P. Accelerator and detector physics at the Bern medical cyclotron and its beam transport line. Nukleonika. 2016;61:11-14, https://doi.org/10.1515/nuka-2016-0009
(* denotes corresponding author and main contributor; authors are listed in alphabetical order)

5. Auger M, Braccini S, Ereditato A, **Nesteruk KP***, Scampoli P. Low current performance of the Bern medical cyclotron down to the pA range. Meas Sci Technol. 2015;26:094006, https://doi.org/10.1088/0957-0233/26/9/094006
(* denotes main contributor; authors are listed in alphabetical order)

6. Auger M, Braccini S, Carzaniga TS, Ereditato A, **Nesteruk KP***, Scampoli P. A detector based on silica fibers for ion beam monitoring in a wide current range. J Instrum. 2016;11:P03027, https://doi.org/10.1088/1748-0221/11/03/P03027
(* denotes main contributor; authors are listed in alphabetical order)

7. Potkins DE, Braccini S, **Nesteruk KP**, Carzaniga TS, Vedda A, Chiodini N, Timmermans J, Melanson S, Dehnel M. A Low-cost Beam Profiler Based on Cerium-doped Silica Fibers. Physics Procedia. 2017;90:215-222, https://doi.org/10.1016/j.phpro.2017.09.061

8. Carzaniga TS, Auger M, Braccini S, Bunka M, Ereditato A, **Nesteruk KP**, Scampoli P, Türler A, van der Meulen N. Measurement of 43Sc and 44Sc production cross-section with an 18MeV medical PET cyclotron. Appl Radiat Isot. 2017 Nov;129:96-9102. PMID: 28830022. https://doi.org/10.1016/j.apradiso.2017.08.013. Epub 2017 Aug 10

9. **Nesteruk KP**, Auger M, Braccini S, Carzaniga TS, Ereditato A, Scampoli P. A system for online beam emittance measurements and proton beam characterization. J Instrum. 2018;13:P01011, https://doi.org/10.1088/1748-0221/13/01/P01011

10. **Nesteruk KP**, Ramsayer L, Carzaniga TS, Braccini S. Measurement of the Beam Energy Distribution of a Medical Cyclotron with a Multi-Leaf Faraday Cup. Instruments. 2019; 3(1):4, https://doi.org/10.3390/instruments3010004

11. Bouquerel E, Traykov E, **Nesteruk KP**, Braccini S, Carzaniga TS, Mathieu C, Pellicioli M, Rousseau M, Ruescas C, Schuler J, Vichi S. Transverse beam emittance studies of the CYRCe TR24 cyclotron, Nucl Instrum Methods Phys Res A: Accel Spectrom Detec. Assoc Equip. 2019;931:151-157, https://doi.org/10.1016/j.nima.2019.04.028

12. Vichi S, Zagni F, Cicoria G, Infantino A, Riga S, Zeller M, Carzaniga TS, **Nesteruk KP**, Braccini S, Marengo M, Mostacci D. Activation studies of a PET cyclotron bunker, Rad Phys Chem. 2019;161:48-54, https://doi.org/10.1016/j.radphyschem.2019.04.001

13. **Nesteruk KP**, Calzolaio C, Meer D, Rizzoglio V, Seidel M, Schippers JM. Large energy acceptance gantry for proton therapy utilizing superconducting technology. Phys Med Biol. 2019 Aug 28;64(17):175007. PMID: 31272087, https://doi.org/10.1088/1361-6560/ab2f5f

14. **Nesteruk KP**, Calzolaio C, Seidel M, Schippers JM. Beam optics of a superconducting proton-therapy gantry with a large momentum acceptance. Int J Mod Phys A. 2019;34(36):1942024, https://doi.org/10.1142/S0217751X19420247

15. Rizzoglio V, Adelmann A, Gerbershagen A, Meer D, **Nesteruk KP**, Schippers JM. Uncertainty quantification analysis and optimization for proton therapy beam lines. Phys Med. 2020 May 27;75:11-18. PMID: 32473518. https://doi.org/10.1016/j.ejmp.2020.05.013. Epub 2020 May 27

16. **Nesteruk KP**, Bolsi A, Lomax AJ, Meer D, van de Water S, Schippers JM. A static beam delivery device for fast scanning proton arc-therapy. Phys Med Biol. 2021 Feb 24;66(5):055018. PMID: 33498040, https://doi.org/10.1088/1361-6560/abe02b

17. Christensen JB, Togno M, **Nesteruk KP**, Psoroulas S, Meer D, Weber DC, Lomax T, Yukihara EG, Safai S. Al2O3:C optically stimulated luminescence dosimeters (OSLDs) for ultra-high dose rate proton dosimetry. Phys Med Biol. 2021 Apr 15;66(8). PMID: 33571973, https://doi.org/10.1088/1361-6560/abe554

18. Winterhalter C, Togno M, **Nesteruk KP**, Emert F, Psoroulas S, Vidal M, Meer D, Weber DC, Lomax A, Safai S. Faraday cup for commissioning and quality assurance for proton pencil beam scanning beams at conventional and ultra-high dose rates. Phys Med Biol. 2021 Jun 8;66(12). PMID: 33906166, https://doi.org/10.1088/1361-6560/abfbf2

19. **Nesteruk KP**, Togno M, Grossmann M, Lomax AJ, Weber DC, Schippers JM, Safai S, Meer D, Psoroulas S. Commissioning of a clinical pencil beam scanning proton therapy unit for ultra-high dose rates (FLASH). Med Phys. 2021 Jul;48(7):4017-4026. PMID: 33963576, https://doi.org/10.1002/mp.14933

20. **Nesteruk KP**, Bobić M, Lalonde A, Winey BA, Lomax AJ, Paganetti H. CT-on-Rails Versus In-Room CBCT for Online Daily Adaptive Proton Therapy of Head-and-Neck Cancers. Cancers (Basel). 2021 Nov 28;13(23). PMID: 34885100, PMCID: PMC8656713, https://doi.org/10.3390/cancers13235991

21. Nenoff L, Buti G, Bobić M, Lalonde A, **Nesteruk KP**, Winey B, Sharp GC, Sudhyadhom A, Paganetti H. Integrating Structure Propagation Uncertainties in the Optimization of Online Adaptive Proton Therapy Plans. Cancers (Basel). 2022 Aug

14;14(16). PMID: 36010919, PMCID: PMC9406068, https://doi.org/10.3390/cancers14163926

22. **Nesteruk KP**, Bobić M, Sharp GC, Lalonde A, Winey BA, Nenoff L, Lomax AJ, Paganetti H. Low-Dose Computed Tomography Scanning Protocols for Online Adaptive Proton Therapy of Head-and-Neck Cancers. Cancers (Basel). 2022 Oct 21;14(20). PMID: 36291939, PMCID: PMC9600085, https://doi.org/10.3390/cancers14205155

23. Togno M, **Nesteruk KP**, Schäfer R, Psoroulas S, Meer D, Grossmann M, Christensen JB, Yukahira EG, Lomax AJ. Weber DC, Safai S. Ultra-high dose rate dosimetry for pre-clinical experiments with mm-small proton fields. Physica Medica. 2022 Dec;104:101-111, https://doi.org/10.1016/j.ejmp.2022.10.019

24. Zhang Q, Gerweck LE, Cascio EW, Yang Q, Huang P, Niemierko A, Bertolet A, **Nesteruk KP**, McNamara AL, Schuemann J. Proton FLASH effects on mouse skin at different oxygen tensions. Phys Med Biol. 2023 Feb 2. PMID: 36731139, https://doi.org/10.1088/1361-6560/acb888

25. Zhang Q, Gerweck LE, Cascio EW, Gu L, Yang Q, Dong X, Huang P, Bertolet A, **Nesteruk KP**, Sung W, McNamara AL, Schuemann J. Absence of Tissue-Sparing Effects in Partial Proton FLASH Irradiation in Murine Intestine. Cancers (Basel). 2023 Apr 13;15(8), https://doi.org/10.3390/cancers15082269

26. Bobić M, Lalonde A, **Nesteruk KP**, Lee H, Nenoff L, Gorissen BL, Bertolet A, Busse PM, Chan AW, Winey BA, Sharp GC, Verburg JM, Lomax AJ, Paganetti H. Large anatomical changes in head-and-neck cancers - A dosimetric comparison of online and offline adaptive proton therapy. Clin Transl Radiat Oncol. 2023 May;40:100625. PMID: 37090849, PMCID: PMC10120292, https://doi.org/100625

27. Bobić M, Christensen JB, Lee H, Choulilitsa E, Czerska K, Togno M, Safai S, Yukihara EG, Winey B, Lomax AJ, Paganetti H, Albertini F, **Nesteruk KP**, Optically stimulated luminescence dosimeters for simultaneous measurement of point dose and dose-weighted LET in an adaptive proton therapy workflow. Front Oncol. 2024 Jan 8; 13:1333039, https://doi.org/10.3389/fonc.2023.1333039

Other peer-reviewed scholarship

1. **Nesteruk KP**. Beam monitor detectors for medical applications. Rep Pract Oncol Radiother. 2014 May;19(Suppl):S32-S36. PMID: 28443196, PMCID: PMC5394728, https://doi.org/10.1016/j.rpor.2014.04.014

2. Auger M, Braccini S, Carzaniga TS, Chiodini N, Ereditato A, **Nesteruk KP***, Scampoli P, Vedda A. UniBEaM: A silica fiber monitor for charged particle beams. AIP

Conference Proceedings 2017;1845:020015, https://doi.org/10.1063/1.4983546
(* denotes corresponding author and main contributor; authors are listed in alphabetical order)

3. **Nesteruk KP**, Psoroulas S. FLASH Irradiation with Proton Beams: Beam Characteristics and Their Implications for Beam Diagnostics. Applied Sciences. 2021;11(5):2179, https://doi.org/10.3390/app11052170

Non-peer reviewed scholarship in print or other media:

Other non-peer reviewed scholarship

1. **Nesteruk KP**, Auger M, Braccini S, Carzaniga T, Ereditato A, Scampoli P. Study of the Transverse Beam Emittance of the Bern Medical Cyclotron. Proceedings of the 4th International Beam Instrumentation Conference IBIC2015. Melbourne, Australia. JACoW (Geneva, Switzerland). 2016;MOPB041:134-138, https://doi.org/10.18429/JACoW-IBIC2015-MOPB041

2. Lasi D, Tulej M, Neuland MB, Wurz P, Carzaniga TS, **Nesteruk KP**, Braccini S, Elsener HR. Testing the radiation hardness of thick-film resistors for a time-of-flight mass spectrometer at Jupiter with 18 MeV protons. 2017 IEEE Radiation Effects Data Workshop (REDW). New Orleans, LA. 2017;1-9, https://doi.org/10.1109/NSREC.2017.8115474

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(selected oral abstract presented by Casolaro P)

Narrative Report

I am a physicist with a passion for research and innovation focused on medical applications, particularly radiation cancer therapy. My background includes fundamental particle physics, beam diagnostics for medical applications, beam dynamics and accelerator physics, technology development, and dose delivery in proton therapy.

Investigation

My area of excellence is investigation. I have published 30 peer-reviewed research papers (> 550 citations, H-index 14), 18 of them as the main contributor, 12 as the first author, and 1 as the last (senior) author. I have presented my research in 22 talks (11 invited) worldwide. My current research interests focus on better exploitation of proton therapy capabilities through improvements in beam and dose delivery and the increase of worldwide accessibility of proton therapy. As a PhD student and during more than 5 years of postdoctoral training, I played a pivotal role in several scientific and technological innovations. My doctoral research focused on medical particle accelerators and their beam dynamics. It resulted in the development of beam diagnostic instruments, one of which is now a commercially available product, and in the first comprehensive study of the beam dynamics of a medical cyclotron. My subsequent career has been entirely focused on proton therapy, with the goal of optimizing dose delivery, reducing the size of future facilities, and enabling new dose delivery techniques. In this vein, I played a key role in the design of a new lightweight superconducting proton therapy gantry with an unprecedentedly large momentum acceptance. Such a gantry would enable rapid tumor irradiation, allowing efficient and more clinically effective treatment of moving targets. With a reduced footprint, 10 times less weight, and a factor of 2 increase in patient throughput, this development would also reduce

the cost of proton therapy and improve its global availability. I also conducted a proof-of-concept study of a novel gantry-less beam delivery device for fast proton arc therapy, which allows a substantial arc to be covered in a fraction of a second. Subsequently, I led research activities to establish a flexible research platform for preclinical studies of ultra-high dose rate (FLASH) proton irradiation. The FLASH effect, associated with enhanced normal tissue sparing at ultra-high dose rates, has the potential to revolutionize radiation oncology. As the PI of a prestigious Swiss National Science Foundation fellowship for the most promising young researchers, I worked on assessing the suitability of different imaging modalities for online adaptive proton therapy and validating the corresponding workflows using Monte Carlo simulations and dedicated experiments. Image guidance with adaptation to daily changes in patient geometry is essential to fully exploit the capabilities of proton therapy, which is in line with my core research interests. As an instructor at HMS, I remain active in the above research areas and devote substantial effort to research activities. I am the head of a research lab focused on dose delivery technology R&D in particle therapy. In particular, I am leading a research project on MRI-guided adaptive proton therapy based on deformable image registration and supervising a PhD student working on this project. Recently, I have received an NCI R01 grant, which has been converted to the MERIT Award (R37) reserved for the most meritorious R01 applications from early-stage investigators. The project aims to develop a compact beam delivery system enabling ultra-fast dose delivery for upright proton therapy. In this project, I am the Program Director/Prinicpal Investigator of a multi-institutional international consortium.

Clinical Innovations

Clinical innovations supplement my accomplishments in the core area of excellence and represent a significant supporting activity. As a proton therapy physicist in the Department of Radiation Oncology at Massachusetts General Hospital, I lead various technology upgrade projects at our two proton therapy centers to improve their usability and functionality. These upgrades often involve technology development that aligns with my academic area of excellence (investigation) and represent innovative solutions that significantly impact clinical care.