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A Novel Simultaneous Plan Quality and Beam Delivery Time SPArc Optimization Platform Using Primal Dual Active Set with Continuation (PDASC)

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data and the necessary computing power to manipulate these data in real time. As a natural tool builder, Dr. Sherouse grasped the potential to leverage and merge these technologies to improve the management of cancer patients undergoing radiation therapy. Never one to "color within the lines," Dr. Sherouse learned about and incorporated emerging technologies in formal software development and interactive computer graphics to provide new and powerful tools not only to clinicians but also to other tool builders through his distribution of GRATIS™, greatly amplifying the impact and reach of his work. This presentation will highlight the seminal role that Dr. Sherouse played in the design and evolution of some of the most fundamental tools of our trade.

Dr. Sherouse was a firm believer in understanding every aspect of your job as a medical physicist. As you will see in the presentations in this symposium, that covered many areas. He viewed medical physics not as just a job, and even the word professional did not seem to describe his view of how to embrace the role fully. He often used the words craft and mastery when discussing the topic. He felt that to master the craft of medical physics, you need to explore each topic with great attention to the details to really get into the inner workings rather than just obtaining a superficial understanding. The process by which this is achieved involves a mindset of continual questioning and learning. This presentation focuses on how he viewed education and mastering the craft of medical physics and how to pass that on to the next generation of medical physicists.

Dr. Sherouse had a gift for explaining complex or abstract concepts with clarity and eloquence. In his own words: "How you understand your role in the workplace directory informs how you act. Make a personal connection to patients. Remember, you are professional leadership, not one of the guys." A different perspective: "You are empowered to cause great harm. If you never disagree, then they didn't need you. Do not compromise ethics, quality or safety" This presentation reflects Dr. Sherouse's firm conviction that we must explore and understand our role to best serve the clinical mission.

Learning Objectives:
1. To understand Dr. Sherouse's contributions and impact on many essential tools for modern treatment planning.
2. To understand Dr. Sherouse's view on becoming a medical physicist and how to train a medical physicist.
3. To understand Dr. Sherouse's view of the medical physicist's role in patient care.

Room 206: Therapy SNAP Oral; Advances in Treatment Planning I

SU-E-206-01, A Novel Simultaneous Plan Quality and Beam Delivery Time SPArc Optimization Platform Using Primal Dual Active Set with Continuation (PDASC): L Zhao[1]*, J You[2], G Liu[1], X Lu[3], X Ding[1],(1) Department of Radiation Oncology, Beaumont Health System, Royal Oak, MI, (2) Department Of Mathematics, Hong Kong University Of Science And Technology (3) School Of Mathematics And Statistics, Wuhan University

Purpose: Proton arc is a new treatment modality that delivers proton beams while continuously rotating the gantry. This study proposed a regularized l0-minimization primal dual active set with continuation (PDASC) algorithm for proton arc spot sparsity optimization to simultaneously optimize the plan quality and the beam delivery time (BDT)**. Methods:** Based on the previously published beam delivery sequence model of IBA ProteusONE®, proton treatment delivery time is actually dominated by spot switching time (SSWT). SSWT is approximately linearly dependent on spot numbers. So we used a non-convex l0-norm to control the sparsity level of the regularized solution. The clinical objective is formulated as an l2-norm. The algorithm couples the primal dual active set method with a continuation strategy on the regularization parameter. Each inner iteration first identifies the active set from both primal and dual variables, then updates the primal variable by solving a (typically small) least-squares problem defined on the active set, from which the dual variable can be updated explicitly. Two representative clinical cases, including an intracranial and a lung target, were used for testing purposes. l2-norm value is calculated for evaluating the clinical objective. And DVH is plotted. Both the objective value and optimization time are compared with Spot-Scanning Proton Arc (SPArc-original) algorithm. **Results:** The results showed that PDASC can ensure both spot and plan quality. This new planning framework could effectively improve the optimization speed by a factor of about three hundred (8.8 times to 536.5 times from 20%-80% sparsity) compared to the SPArc-original implemented in RayStation**. Conclusion:** This study introduced the first simultaneously optimize the plan quality and BDT SPArc optimization platform utilizing the PDASC. Additionally, the successful implementation of the PDASC algorithm into SPArc can significantly improve the optimization time, which is a critical step forward in the era of proton arc therapy.

