



Domestic U.S. Proton Access Status – Update for >200 MeV Sites

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Abstract

This presentation will document the current state of high energy (>200 MeV) proton access in the U.S. for Single Event Effects (SEE) testing. This is continuation of efforts since the shutdown of the Indiana University Cyclotron Facility (IUCF).

What's New with Protons

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- **While the COVID-19 pandemic was a major factor in limiting access over the past year, the good news is that access is opening up.**
- **That said, there are a few general items:**
 - **Several sites have “met their quota” – in other words, there are very limited opportunities for new customers at those facilities,**
 - **Some are highly utilized with either a several month wait to get in or sold out for the calendar year,**
 - **MGH has been double-struck between the pandemic and a major repair (it's expected that by the time this is presented, they'll be back online),**
 - **Business models are still evolving and new players from the medical sites are “working through the process” versus patient payment models, and,**
 - **Volatility of access remains high with changing access profiles and personnel at the sites.**
- **With Canadian border still mostly closed, we're hopeful that access resumes before this is presented.**

Those Who Sell Time

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<u>Organization</u>	<u>Location</u>	<u>POC(s)</u>	<u>Email(s)</u>	<u>Current status</u>	<u>Through</u>	<u>Notes</u>
James M. Slater MD Proton Treatment & Research Center	Loma Linda, CA		beamusers@llu.edu	<u>Open</u>	<u>6/9/2021</u>	We have the following dates open: (as of today) August 6 & 7 September 3,4, 5 17, 18, 19 24, 25, 26 October all weekends open November all weekends open, but not 11/26, 27 & 28 December all weekends open, but not 12/24, 25 & 26 or 12/31, 1/1 & 1/2
Mayo Clinic Proton Beam Facility - Phoenix	Phoenix, AZ	Daniel Robertson	Robertson.Daniel@mayo.edu	<u>Open</u>	<u>6/9/2021</u>	Mayo Clinic Arizona is open for electronics and space testing on weekends (we're never available during the week due to patient care activities). I anticipate this will continue through the rest of 2021. Most weekends for the rest of the year are available. We can typically fit about 16 hours per weekend, so I suppose we could support up to about 400 hours (although I doubt we'll get there, as our contracting process can take a while).
Mayo Clinic Proton Beam facility - Rochester	Rochester, MN	Nicholas Remmes	Remmes.Nicholas@mayo.edu	<u>Open - Limited</u>	<u>6/9/2021</u>	We have limited availability that is mostly being used by current customers with existing contracts. We only do electronics testing on weekends. We might have a several weekends available in 2021 for new customers. New customers should allow at least a month lead time for contract review.
MGH Francis H. Burr Proton Beam Therapy Center	Boston, MA	Ethan Cascio	ecascio@partners.org	<u>Closed</u>	<u>6/9/2021</u>	Things are going as planned so far for repairs. We removed the RF cavities & vacuum chamber (and all of the functional bits as well). Once the vault was cleared the deconstruction, heavy rigging, and re-construction commenced. I have included a set of photos of that process, bear in mind that the upper magnet yoke weighs ~ 110 tons, and each of the 4 coils weighs 5 tons. We replaced all 4 coils as well as the RF cavities. As of last Wed the new coils were in place and aligned, the cyclotron was back in its native hydraulic jacks, and the shielding blocks/ceiling was back in place. By the end of Sat we had the vacuum chambers back in place, and leak tested. Over the last 3 days we got the new RF cavities in and we are about to begin testing of the cavities with a network analyzer. Then we can re-build the RF transmission lines and test on full power. After that is re-installing the bits that bring the beam out of the cyclotron, the exit focusing magnets and vacuum seal, and a bunch of other peripherals. Then we try to get beam out.... Given that we have all new magnet coils and RF cavities there may be considerable tuning to get beam out. Then we need to ascertain if the beam parameters have changed enough to require the clinical physics group to do extensive re-commissioning (we hope not). So it looks like we might be back in business around when NSREC happens... After that I expect that I will be back in operation as before, with ~ 40 – 50 hrs. of test time available each month.
Northwestern Medicine Chicago Proton Center	Warrenville, IL	Steven Laub	steven.laub@nm.org	<u>Open</u>	<u>6/10/2021</u>	Northwestern Medicine Proton Center is open for business this year. However, fully booked through CY21. Schedule-wise, we are not yet booking into 2022.
Provision CARES Proton Therapy Center	Knoxville, TN		candace.davis@provisionhealthcare.com ; jewell.overton@pronovasolutions.com	<u>Open</u>	<u>6/9/2021</u>	Facility Rental Costs: \$1,500 per hour with a 4-hour minimum each day. Fairly high load through the summer. Yes, we are starting to book runs that overlap weekdays with weekends. So for example, I encourage customers to come on Thursday to setup only or setup and take ~ 4 hours or more of beam then 8 or 9 hours each of Friday, Saturday and Sunday. I can do more hours on the weekends if needed. On a case by case basis I can schedule other days as well. We need to keep the room open for our R&D staff at least two days a week. With NASA, they could come in on a Thursday morning and set up (or Wednesday evening set up only), get 8 hours of beam on Thursday, then Friday and Saturday get 8 or 9 hours of beam or more for example. Vaccinations required for those working during the week since immuno-compromised patients are often in the hallway adjacent to the testing area. We have pretty much all Thursdays through Saturdays booked into October with occasional longer runs from Wednesday through Sunday. Occasionally we have a cancellation and one occurred for the week and weekend of July 17th. So we do have July 14th/15th through July 18th available. The Wednesday if needed would preferably be only for evening setup.
Tri-University Meson Facility (TRIUMF) Proton Irradiation Facility	Vancouver, CAN	Ewart Blackmore, Mike Trinczek	ewb@triumf.ca , trinczek@triumf.ca	<u>Open</u>	<u>6/10/2021</u>	Expectation is that borders to the U.S. open up on 9 August and U.S. access will again be possible. Further international border access expected to open in September.

Domestic Protons – The “Maybes”

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<u>Organization</u>	<u>Location</u>	<u>POC(s)</u>	<u>Email(s)</u>	<u>Current status</u>	<u>Through</u>	<u>Notes</u>
California Protons Cancer Therapy Center	San Diego, CA	Andrew Chang	andrewlchangmd@gmail.com	<u>Not yet</u>	<u>4/21/2021</u>	Management is in discussion regarding opening post-COVID to outside users: summer to fall? Two caveats: with affiliation with UCSD as a portion of the "partnership" for test access must include academic interests such as publish/present or possibly workforce development. 2nd caveat before reopening will be related to facility safe exposure levels, beam intensity, etc.
Hampton University Proton Therapy Institute (HUPTI)	Hampton, VA	Alejandro Carabe	a.carabe@hamptonproton.org		<u>6/9/2021</u>	Once we receive the answers, we will review internally and get back to you with to let you know if we will be able to accommodate the experiment in our beam time. 1. Name of Project 2. Brief description of the purpose 3. Collaborators 4. Potential or actual Funding Agency 5. Potential length of time engaged on project (1mo, 6mo, 1yr?) 6. Proposed days/hours dedicated to working on the project 7. Proposed use of HUPTI resources Once we receive the approval from Hampton University, we will then let you know the cost of the facility and personnel needed for the experiment.
Johns Hopkins Proton Therapy Center	Washington, DC	Heng Li	hengli@jhu.edu	<u>Not yet</u>	<u>6/9/2021</u>	Potential weekend access; still working on developing cost structure/contract means
Proton International at UAB	Birmingham, AL	Lindsay Pruett	lindsaypruett@uabmc.edu	<u>Not yet</u>	<u>6/1/2021</u>	We are currently in the process of discussing/re-modeling with the clinical team treatment hours and when they need the machine. This will help us determine how much "extra" time we have for letting groups such as yourself use our facility.
South Florida Proton Therapy Institute	Delray Beach, FL	Andrew Barbosa	abarbosa@sfpti.com	<u>Not yet</u>	<u>4/15/2021</u>	We currently have no capacity for testing. We are single gantry and running around 40 patients a day. We use the weekends for preplanned maintenance and running QA. Right now with patient volumes we don't have the beam time to spare.
University of Florida Health Proton Therapy Institute	Jacksonville, FL	Stuart Klein	sklein@floridaproton.org	<u>Not yet</u>	<u>6/10/2021</u>	Our Director of Medical Physics resigned a number of months ago so we're somewhat in flux until our new Director gets installed - awaiting acceptance of offer letter. Once we're back up to speed, we would love to resurrect discussions about doing onsite testing - especially since we now have two accelerators. - Ken may be near there in late August (personal) and may swing by - expect this is about the right time frame for new discussions.
Orlando Health Cancer Institute	Orlando, FL	Omar Zeidan	Omar.Zeidan@orlandohealth.com			Technically not selling protons, but willing to discuss access with local organization

The Others (So Far)

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<u>Selling time</u>	<u>Organization</u>	<u>Location</u>	<u>POC(s)</u>	<u>Email(s)</u>	<u>Current status</u>	<u>Through</u>	<u>Notes</u>
Recently contacted	Inova Schar Cancer Institute	Fairfax, Va					Recently contacted
Recently contacted	McLaren Proton Therapy Center	Flint, MI	Vahagn Nazaryan	Vahagn.Nazaryan@McLaren.org			Recently contacted
Recently contacted	Ohio State University	Columbus, OH					Recently contacted
Recently contacted	ProCure Proton Therapy Center in Oklahoma City	Oklahoma City, OK					Recently contacted
Recently contacted	Texas Center for Proton Therapy	Irving, TX					Recently contacted
Not at this time	Emory Proton Therapy Center	Atlanta, GA	Katja Langen	katja.langen@emory.edu		4/15/2021	We are very busy clinically and currently do not have any spare capacity for electronics testing.
Not at this time	Roberts Proton Therapy Center	Philadelphia, PA	Lei Dong	Lei.Dong@uphs.upenn.edu		Indefinite	No electronics testing currently due to biology research load
Unknown	Georgetown Lombardi Comprehensive Cancer Center	Washington, DC					
Unknown	Maryland Proton Therapy Center	Baltimore, MD					Recently contacted
Unknown	MD Anderson Proton Therapy Center	Houston, TX	TBD				Recently contacted
Unknown	Miami Cancer Institute Proton Therapy Center	Miami, FL	Alonso Gutierrez	AlonsoG@baptisthealth.net			Recently contacted
Unknown	Proton Therapy at University of Cincinnati Medical Center	Liberty Township, OH	Abram Gordon, Anthony Mascia	Abram.Gordon@cchmc.org , Anthony.Mascia@cchmc.org			Recently contacted
Unknown	Seattle Cancer Care Alliance (SCCA) Proton Therapy Center	Seattle, WA	Unknown				
Under construction	Levine Cancer Center	Charlotte, NC					Recently contacted
Under construction	Providence Proton Therapy	Providence, RI					Recently contacted
Under construction	UAMS Radiation Oncology Center	Little Rock, AR					Recently contacted
Under construction	University of Kansas Health System	Kansas City, KS					Recently contacted

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Acronyms

Acronym	Definition
CARES	Provision CARES Proton Therapy Center
CY21	Calendar Year 2021
GSFC	Goddard Space Flight Center
HUPTI	Hampton University Proton Therapy Institute
IUCF	Indiana University Cyclotron Facility
MGH	Mass General Francis H. Burr Proton Therapy
NASA	National Aeronautics and Space Administration
QA	Quality Assurance
R&D	Research and Development
RF	Radio Frequency
Sat	Saturday
SCCA	Seattle Cancer Care Alliance
SEE	Single Event Effects
SSAI, Inc.	Science Systems and Applications, Inc.
TRIUMF	Tri-University Meson Facility
UAB	University of Alabama at Birmingham
UCSD	University of California San Diego