

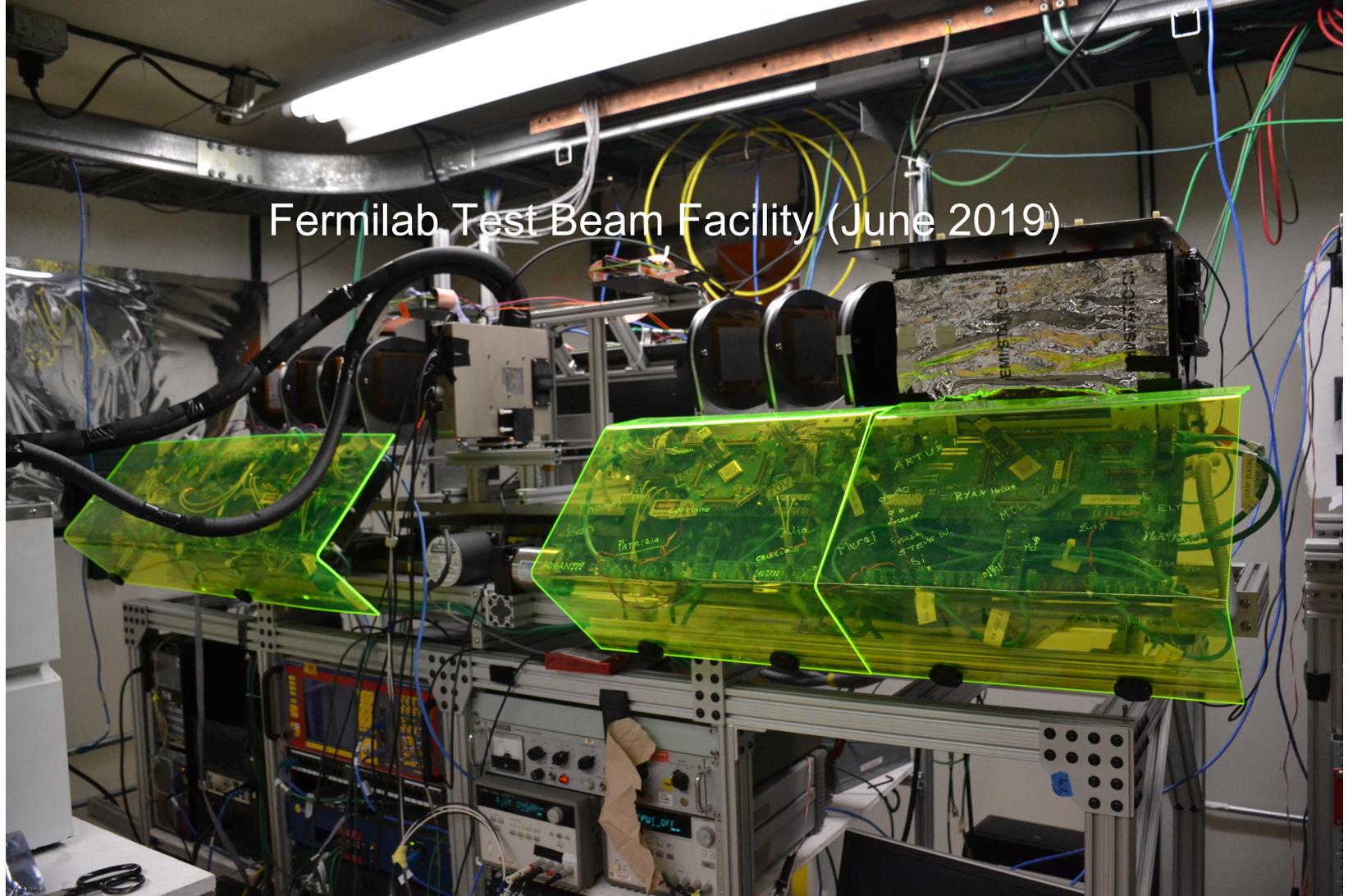
# Test Beam Needs for HEP

**CPAD, Stony Brook University**

**March 19, 2021**

Chris Tully (Princeton)

# Fermilab Test Beam Facility (June 2019)



# My Favorite Watering Holes

- Fermilab Test Beam Facility beamlines MTest and Mcenter reopened. We have started the schedule December 2, 2020. The website is also up to date: <https://ftbf.fnal.gov/fy21-mtest-schedule/>. Parasitic users will be considered on a case by case basis, as long as they are fully remote. Fermilab Test Beam Facility and Irradiation Test Area (ITA).
- CERN PS/SPS: [\\*\\*https://espace.cern.ch/PS-SPS-User-Documents/2021](https://espace.cern.ch/PS-SPS-User-Documents/2021) beam time requests/ <<https://espace.cern.ch/PS-SPS-User-Documents/2021%20beam%20time%20requests/>>
- CERN IRRAD beam operation during this year will follow the CERN Injectors Schedule 2021 <[https://edms.cern.ch/ui/file/2442568/1.0/2021-injector-schedule\\_v1.0.pdf](https://edms.cern.ch/ui/file/2442568/1.0/2021-injector-schedule_v1.0.pdf)> approved on 02.12.2020 and it is submitted to the completion of the ongoing consolidation works in the PS East Area.
- DESY schedule posted: [https://particle-physics.desy.de/test\\_beams\\_at\\_desy/](https://particle-physics.desy.de/test_beams_at_desy/)

# Why do we need test beam?

- HEP continues to push the limits of what detectors can do
  - Precision performance
  - Maximum information systems – granularity and multi-readout
  - High rate capabilities
  - Background rejection – timing and algorithmic pattern recognition
  - DAQ/Trigger development
  - Environmental chambers, Cryogenic and CO<sub>2</sub> cooled systems
- Being always pushed to the limit, the margin of what is not known about a system continues to be an order one fraction of the whole system
  - Test beams are needed to keep up with the rapid pace of deploying new technologies to tackle new challenges and to rapidly respond to new ideas in the physics program

# What do we also need from test beam?

- Test beam is the primary opportunity to train outstanding students, physicists, technicians in the areas of hands-on experimental work
- CERN has successfully extended this opportunity to be an avenue for High School students from around the Globe to think big and be awarded beam time for explore a new topic: BL4S (<https://beamlineforschools.cern/home>)
- We can do more to make our beamlines and decay pipes available for special need industrial use, for example, for muon computed tomography [1]
- Medical/Industrial partners also provide opportunities for beam time (proton therapy beam in Warrenville, IL) and others
- Opportunity to invest in DOE-supported SBIR developments for readout ASICs, etc. – share common equipment when needed

[1] <https://iopscience.iop.org/article/10.1088/1748-0221/11/02/P02015>

# Experimental room



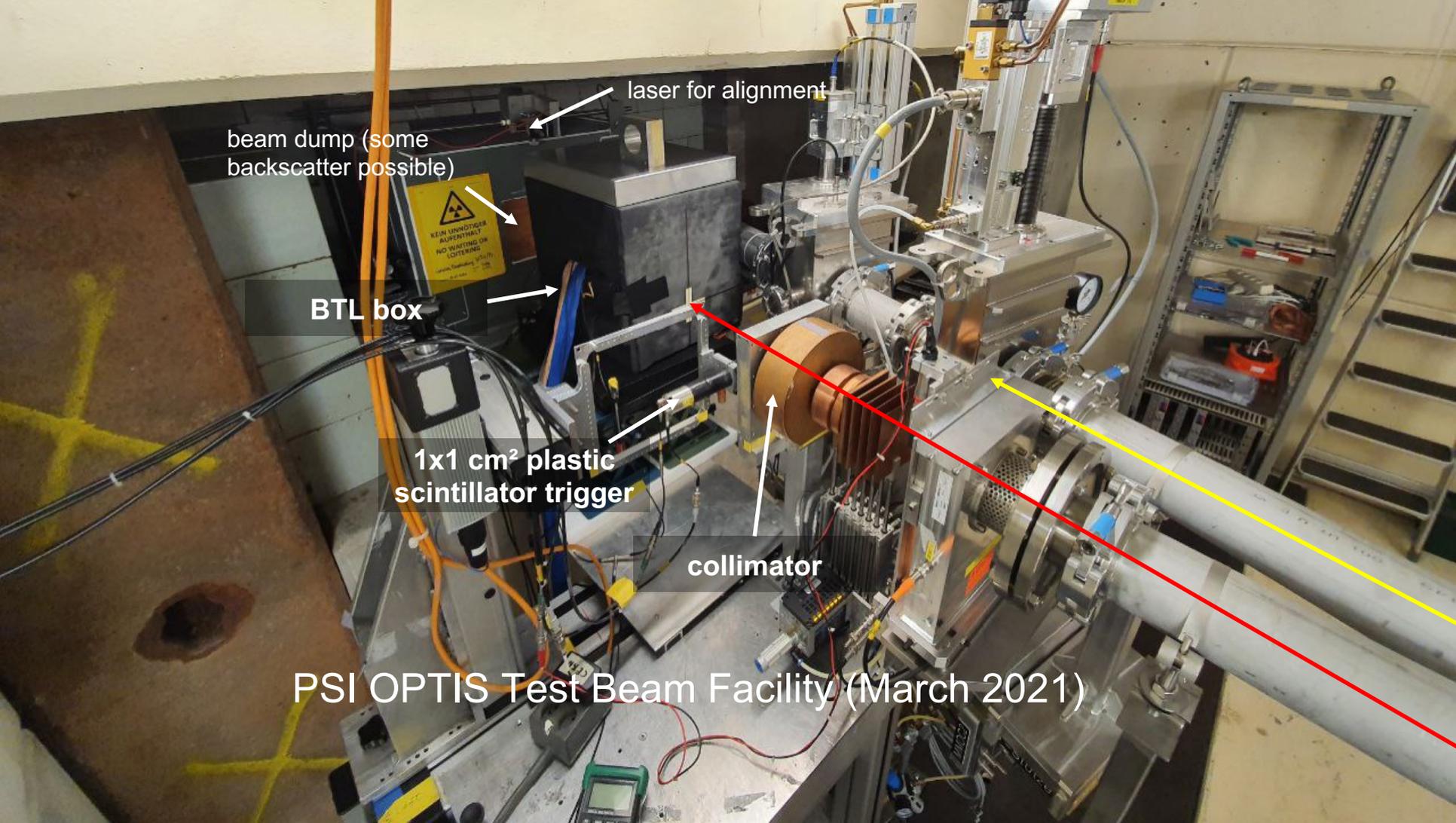
Magnet

Patch panel to  
control room

beam line for BTL

beam pipe for  
medical treatment

PSI OPTIS Test Beam Facility (March 2021)



laser for alignment

beam dump (some backscatter possible)



BTL box

1x1 cm<sup>2</sup> plastic scintillator trigger

collimator

PSI OPTIS Test Beam Facility (March 2021)

# Current Future Needs

- Beyond the ongoing LHC Phase 2 Upgrades, collider detectors are embarking on transformational changes in the level of information gathering in spatial granularity and in timing precision
  - Higgs Production at Lepton Colliders look to maximize physics output – and for every particle in an event that can be successfully identified and correctly associated with the correct parton/final-state, the measures of uniqueness and uncertainty on that final state become more distinct
  - Muon collider environments are whole new game – tracking across the entire detector with high precision timing the particles comes from the Interaction Point and from the Beam Collimation means an entirely new focus for detector design
- Test Beam facilities continue to manage high rate data throughput, associated beam monitoring and beam configurations that may be able to simulate background conditions

# Suggestions

- Continue to maintain the excellent staff operating the beams and providing control room training and beam monitoring in the test beam areas
- Keep access open to the whole community, setting reasonable expectations for training, setup inspections and access requirements – always maintaining a safe environment
- Try to accommodate the needs of new technologies with setup space for new back-ends, cabling and associated infrastructure needed for environmental controls
- Think about a potential award opportunity for High School students to use beam lines for advanced science projects