

LINAC-BTF ACTIVITY REPORT 2023

B. Buonomo, F. Cardelli, D. Di Giovenale, E. Diociaiuti, C. Di Giulio, L. G. Foggetta, and Linac Service Staff

1 Experimental Activities, Beam Time, and Outreach abstract

The Beam Test Facility (BTF) significantly increased beam availability to approximately 240 days, despite some interruptions due to maintenance and user cancellations. Over 200 users benefited from the beam, the beam line scientist 24/7 assistance and new booking software.

BTF involved a wide range of users, with 46% from INFN and 32% from Italian universities and institutions. Foreign institutions and universities accounted for 19% of users, with a small percentage of companies and non-EU institutions involved. The facility served as a base for numerous international and national projects, including FOOT, LIMADOU, HERD, PADME/X17, and R&D for the Muon Collider. These projects involved collaborations with various institutions, contributing to graduate and PhD theses. The scientific areas covered by these BTF runs included satellite/in-orbit detector development and calibration, new active dosimetry methods, and emittance measurement methods, as well as typical HEP detector calibration and R&D. Notably, in a few hours of beam time, during the FLASHMOB activity, a new method based on the electronuclear reaction was used to produce $^{99\text{m}}\text{Tc}$ from a thin foil Mo target.

The diversity of users highlights the BTF's role as a crucial facility for a broad spectrum of scientific research. The involvement of both national and international institutions underscores its importance in fostering collaborative research efforts. The facility's ability to support a wide range of projects, from fundamental physics to applied research, demonstrates its versatility and the high demand for its capabilities.

BTF became a partner in the EUROLABS Project for transnational funding and participated in projects like PNRR Rome Technopole and ASIF-2. Several maintenance and upgrade activities were carried out, including the replacement of a faulty klystron and the installation of new vacuum services.

The LINAC/BTF group dedicated efforts to tutoring around 30 university, PhD, and high school students in dedicated BTF runs and lessons, and guided visits for around 800 students. Online lessons received over 1600 views.

For 2024-2025, funding needs were discussed, estimated at 2 million euros, to extend closed calls and schedule autumn activities, as well as to define the allocation of EUROLABS funds for BTF diagnostics.

2 Experimental Activities, Beam Time, and Outreach Summary

2.1 BTF Uptime

The Beam Test Facility (BTF) had a busy year, significantly increasing beam availability to approximately 240 days divided between few internal booked slots and external user beam-time. This was achieved through week-long beam-time proposals selected in two external calls for experiments,

with research teams averaging eight people. The beam-time was delivered as planned throughout the year, despite losing four weeks. Fortunately, these losses occurred practically between planned maintenance stops and user cancellations, affecting only one shift, which was restored a few weeks later by rescheduling maintenance weeks. Two user withdrawals were replaced by others in the BTF user queue. More than 200 users benefited from the submission and booking phase of BTF beam-time, using a newly operational release of booking software and related user guidelines. This led to a significant reduction in effort from the secretariat and management, balancing non-human workflow control and human assistance.

2.2 User Distribution

BTF involved a wide range of users, with 46% from INFN and 32% from Italian universities and institutions. Foreign institutions and universities accounted for 19% of users, with a small percentage of companies and non-EU institutions involved. The facility served as a base for numerous international and national projects, including FOOT, LIMADOU, HERD, PADME/X17, and R&D for the Muon Collider. These projects involved collaborations with various institutions, contributing to graduate and PhD theses. The scientific areas covered by these BTF runs included satellite/in-orbit detector development and calibration, new active dosimetry methods, new detector developing based with Perovskivite and emittance measurement methods, as well as typical HEP detector calibration and R&D. Notably, in a few hours of beam time, during the FLASHMOB activity, a new method based on the electronuclear reaction was used to produce ^{99m}Tc from a thin foil Mo target.

2.3 National and International Projects

BTF became a partner in the EUROLABS Project for transnational funding for scientists from foreign institutions. Alongside the PNRN national implementation, the LINAC service is involved in the PNRN Rome Technopole with 1.2 FTE/year. In the same year, BTF completed the ERAD project grant in the LAerospaZIO co-funded by the Lazio region (10/06/2020 - G06734) and the EU, and discussed 2024 BTF participation in the ASIF-2 project related to the same research area. A consistent effort from the LINAC group was dedicated to the LNF-INFN projects TEX and SPARCLAB. The facility became the base for the developed INFN-A subgroup "INFaN," a network of INFN Charged Irradiation Facilities.

2.4 Maintenance and Upgrades

Several maintenance and upgrade activities were planned and executed for the LINAC, mainly the KlyC substitution due to a faulty klystron replaced under warranty in the first part of the year to respect the planned BTF beam time for the first call and the DAFNE running for SID-DHARTA. These activities included the installation of new vacuum valves, pumps, and related vacuum services, as well as enhancements to data acquisition systems. During the same period, the BTF was prepared for improvements to gas safety and technical services, which will be installed in 2024 after the 2023 user activity. A set of internal runs was devoted to new methods of emittance measurement, where the first LINAC positron beam was substantially achieved by developing and upgrading the triggered fast camera layout, used for all high-intensity experiments performed during the year.

2.5 Dissemination

The LINAC/BTF group dedicated effort to tutoring around 30 university, PhD, and high school students in dedicated BTF runs and lessons, and around 800 university, high school, and primary

school students as visit guides and tutors. Online lessons received more than 1600 views.

2.6 People, Funding, and Requests

Funding needs for 2024-2025 were discussed, with an estimated intervention cost of 2 million euros. The need for funds to extend closed calls and schedule autumn activities was emphasized, along with defining the allocation of EUROLABS funds for BTF diagnostics. Using the ERAD funding, one researcher was added to the team.