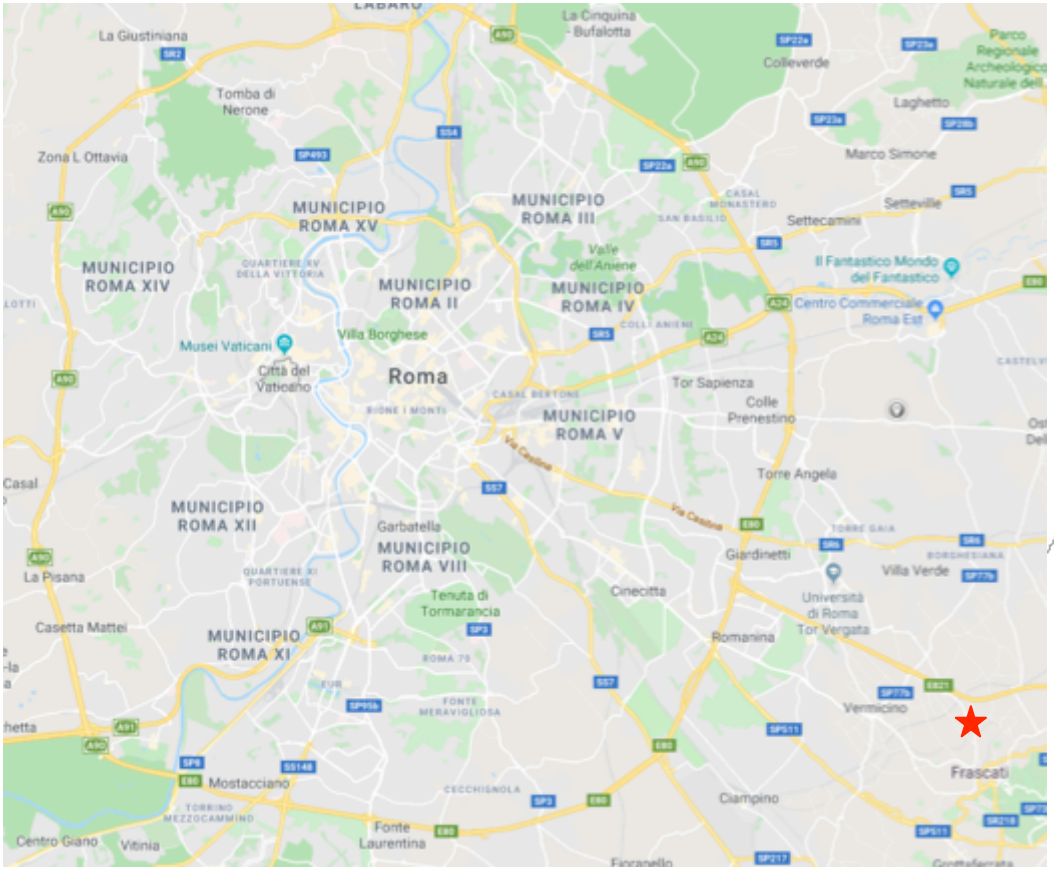
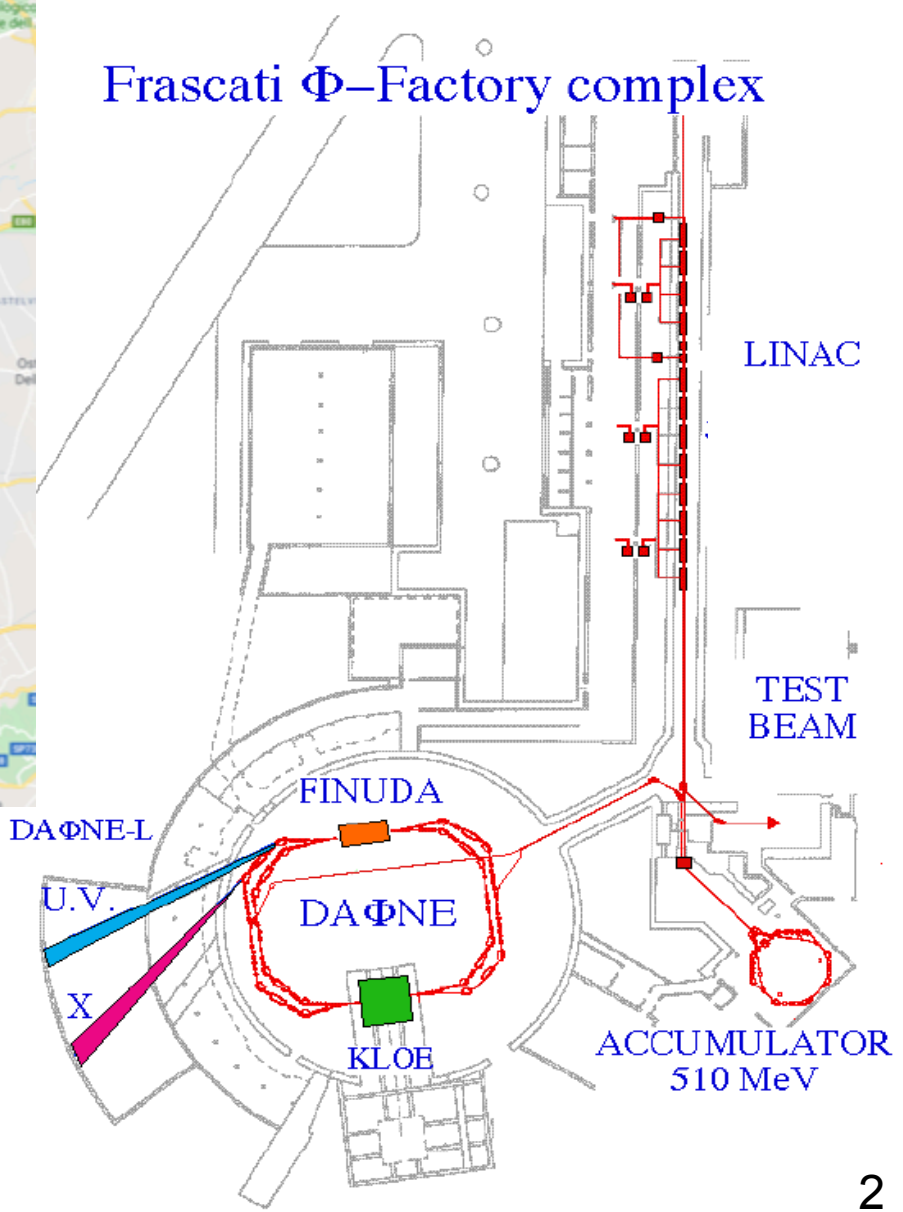
The Frascati Beam Test Facility

G. Morello on behalf of the Beam Test Facility crew

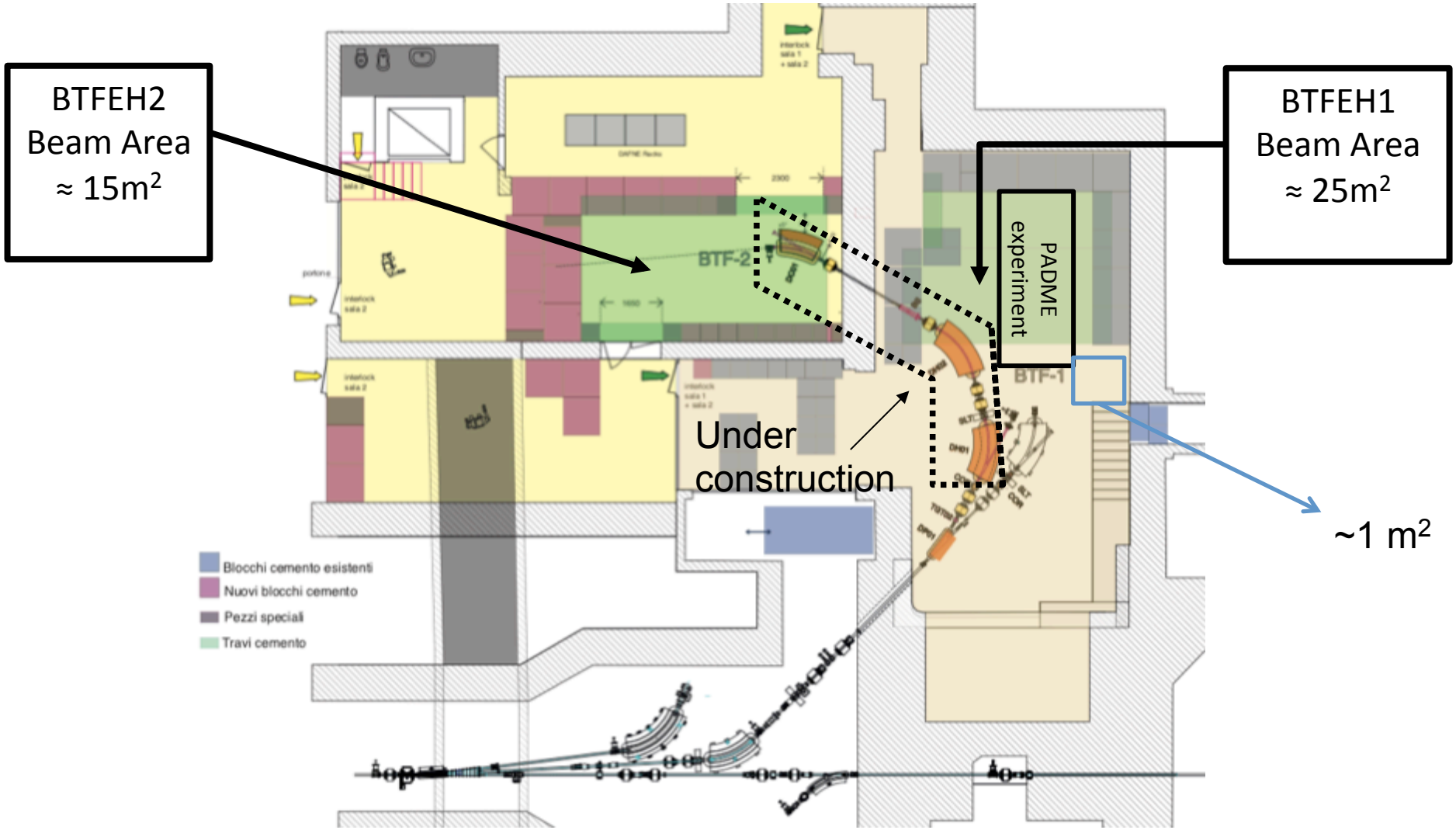
RD51 Collaboration Meeting – WP7
October 23rd 2019

The LNF accelerator complex



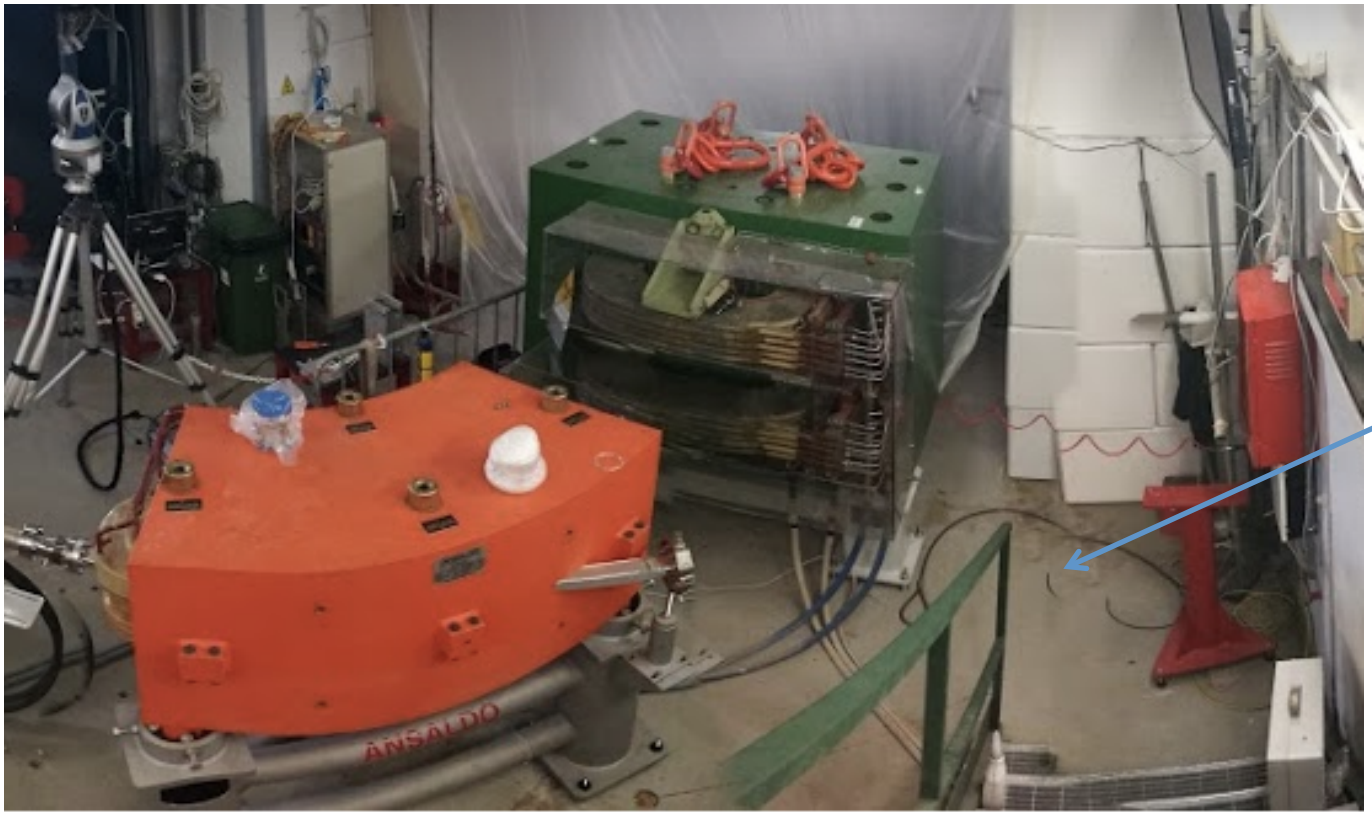


The BTF



The construction of the BTF second line is part of the AIDA-2020 project in the EC Horizon 2020 Framework Program, WP15(JRA3) – Upgrade of the beam and irradiations tests infrastructure

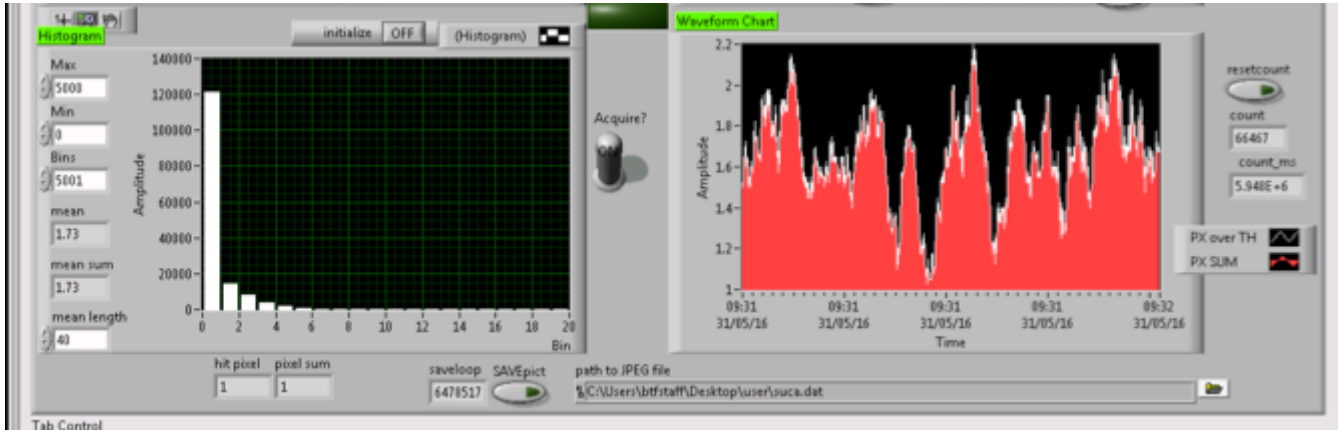
The BTF

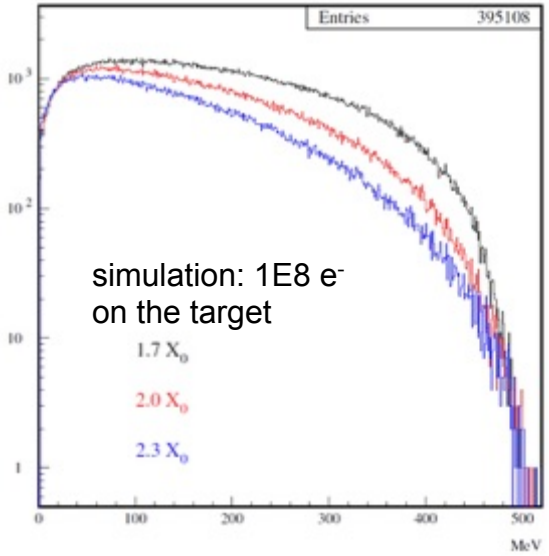


available space

The BTF beam

- The beam is extracted from LINAC by a pulsed dipole and sent to a transfer line
- Two modes of operation in BTF:
  - "Low intensity secondary beam": a copper step target is inserted in the line. The beam is then produced with spanned energy from 30 MeV up to 510 MeV but a proper value can be selected by magnets. The particle multiplicity can be lowered down to follow a Poisson distribution.





  - "High intensity primary beam": the beam is directly steered in the transfer line. From 10^4 to 10^{10} particles per bunch, depending on the DAFNE operations. The energy is fixed to 510 MeV.

The pulse length ranges from 1.4 ns to 250 ns, depending on DAFNE requirements: tipically 10 ns

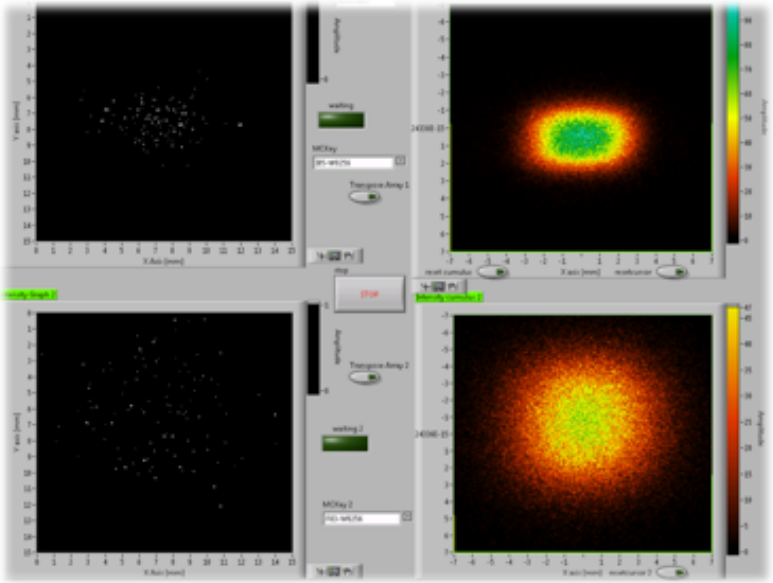
BTF Parameter summary

Parametri	Parasitic		Dedicated	
	With Cu target	Without Cu target	With Cu target	Without Cu target
Particle	e^+ or e^- (User)	e^+ or e^- (Dafne status)	e^+ or e^- (User)	
Energy (MeV)	25–500	510	25–700 (e^-/e^+)	250–730 (e^-) 250–530 (e^+)
Energy Resolution	1% at 500 MeV	0.5%	0.5%	
Repetition rate (Hz)	Variable from 10 to 49 (DAFNE status)		1–49 (User)	
Pulse lenght (ns)	10		1.5–40 (150) (User)	
Intensity (particle/bunch)	$1–10^5$ (Energy dependence)	$10^7–1.5\ 10^{10}$	$1–10^5$ Energy dependence	$10^3–3\ 10^{10}$
Max # of partic.	$3.125\ 10^{10}$ part./s			
Beam size(mm)	0.5–25 (y) × 0.6–55 (x)			
Divergence (mrad)	1–1.5			

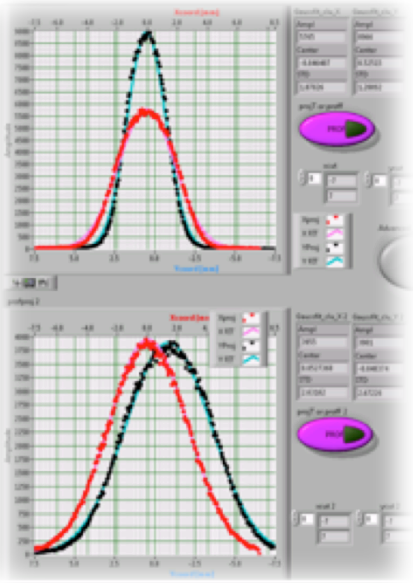
BTF equipment

2 FITPIX:
readout speed of up to 90 frames per second for single de-tector layer, square pixel of 55 μm side arranged in a 256×256 pixels matrix (side length about 15 mm), square sensitive area of about 2 cm² and 300 μm of thickness.

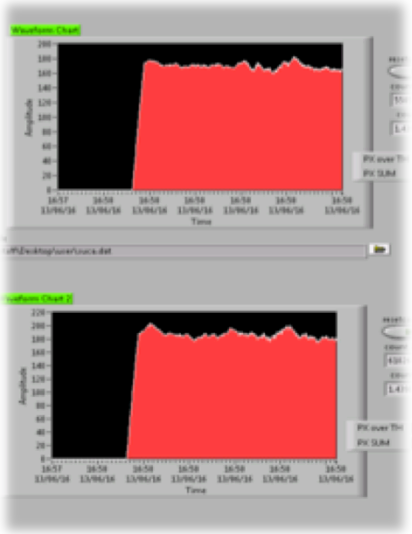
Shot-by-shot and integral spot monitoring



Spot size and position



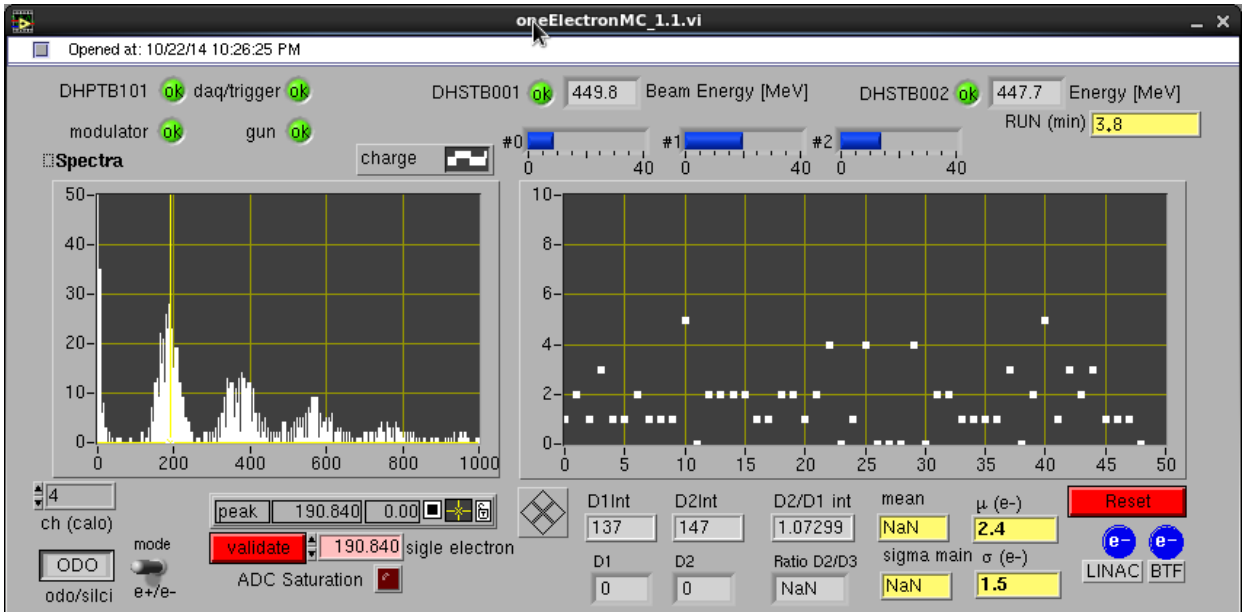
Intensity



BTF equipment

OPAL lead-glass module calorimeter, read out by a QDC

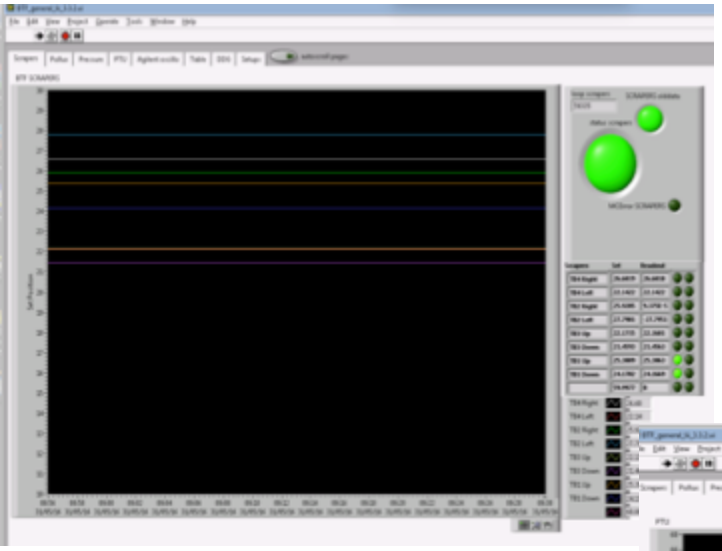
Software for online monitoring

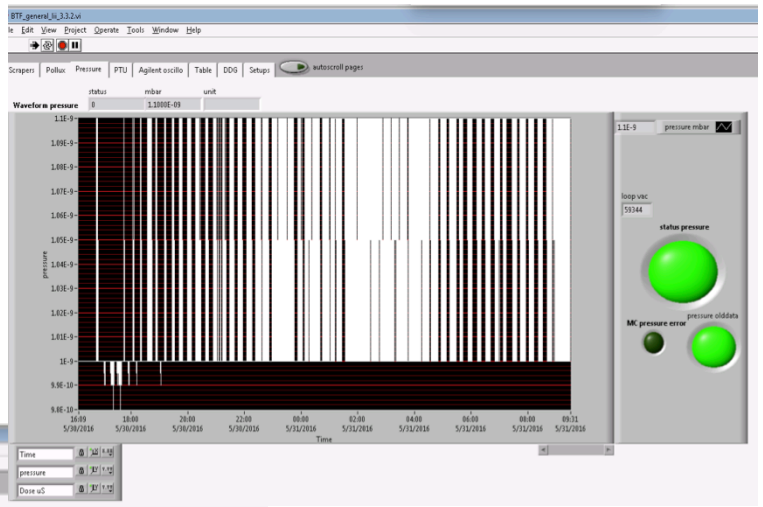


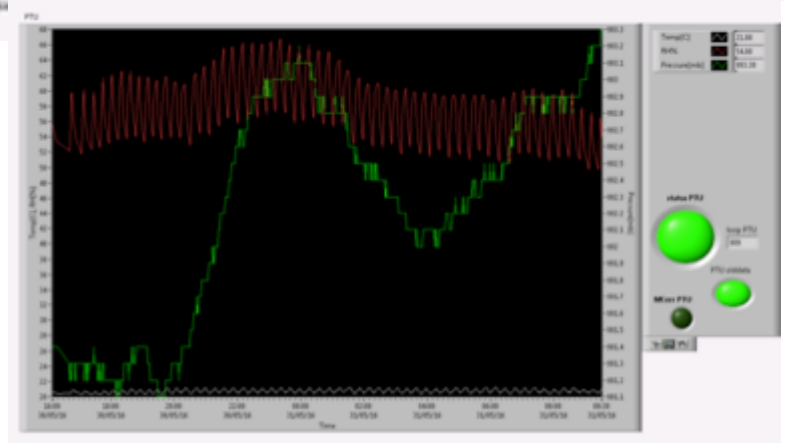
BTF diagnostic

The users can monitor and store several parameters of the beam line:

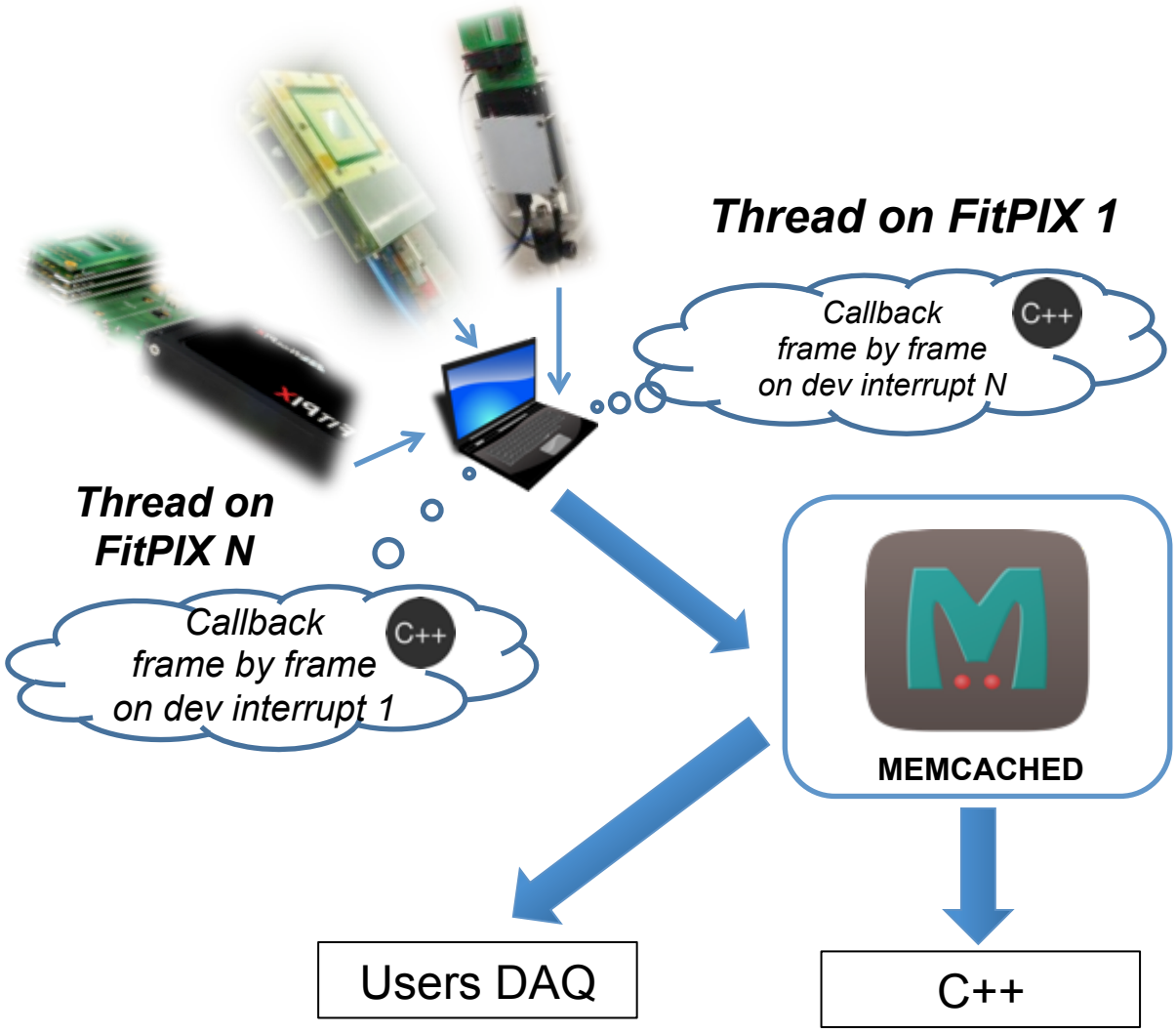
- Scrapers
- pressure in the pipe
- Pressure Temperature and Humidity in the BTF experimental hall







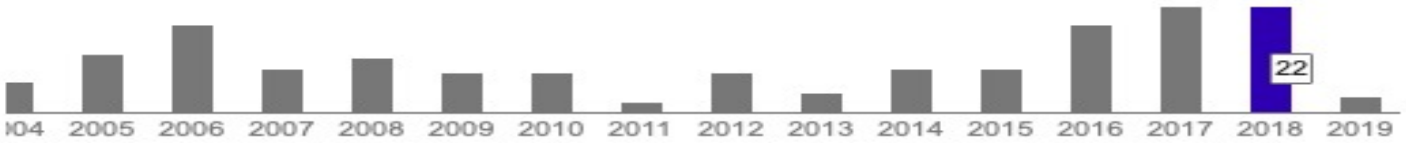
BTF daq



The users can exploit Memcached functions to integrate their DAQ.
The integration needs a NTP synchronization on their PC and then the data matching can be done offline

Users publications from BTF TB in **2018**

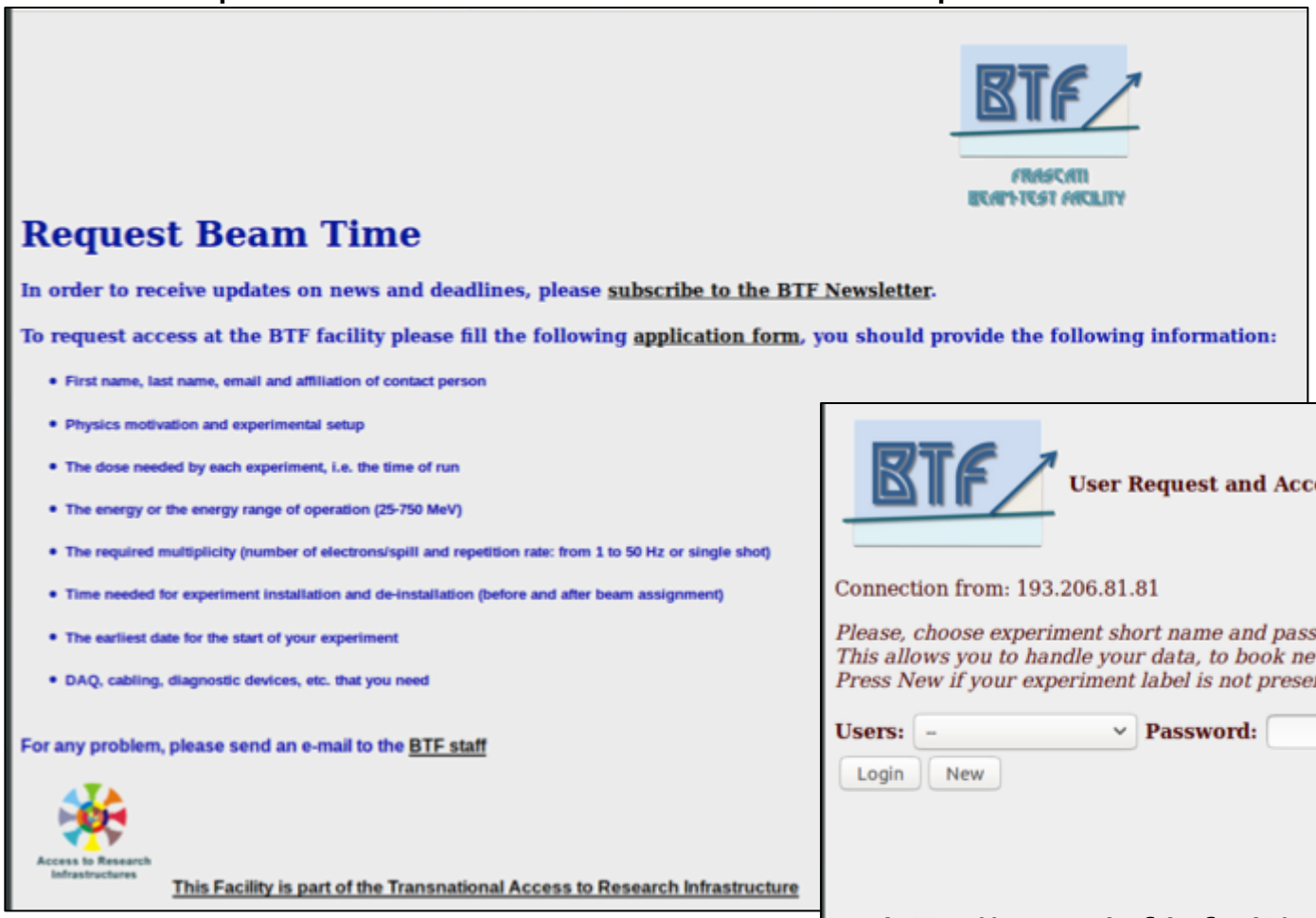
1. **Performance of the prototype of the charged particle veto system of the PADME experiment**, F. Ferrarotto et al., IEEE TNS 99 (2018).
2. **Performance of the diamond active target prototype for the PADME experiment at the DAΦNE BTF**, R. Assiro et al., Nucl. Instrum. Meth. A898 (2018) 105.
3. **Study on the High Energy Particle Detector calorimeter,** B. Panico et al., PoS ICRC 2017 (2018) 172
4. **Study of the Performance of an Optically Readout Triple-GEM**, M. Marafini et al., IEEE TNS 65 (2018) 604.
5. **Response of microchannel plates in ionization mode to single particles and electromagnetic showers**, A. Yu. Barnyakov et al., Nucl. Instrum. Meth. A 879 (2018) 6.
6. **Study of the performance of the NA62 small-angle calorimeter at the DAΦNE Linac**, A. Antonelli et al., Nucl. Instrum. Meth. A 877 (2018) 178.
7. **Study on the high energy particle detector calorimeter**, B. Panico et al., PoS ICRC2017 (2018) 172.
8. **The PADME Tracking System**, G. Georgiev et al., arXiv:1804.00618 [physics.ins-det].
9. **Dark Photon Search with PADME at LNF**, G. Piperno, Int. J. Mod. Phys. Conf. Ser., 46, 1860047 (2018).
10. **Status and prospects for the PADME experiment at LNF,** P. Gianotti et al., EPJ Web of Conferences 166, 00009 (2018).
11. **Design, status and perspective of the Mu2e crystal calorimeter**, N. Atanov et al., arXiv:1801.03159 [physics.ins-det].
12. **Combined readout of a triple-GEM detector**, V. C. Antoci et al., arXiv:1803.06860 [physics.ins-det].
13. **The AMY (Air Microwave Yield) experiment to measure the GHz emission from air shower plasma**, J. Alvarez-Muniz et al., arXiv:1807.08174 [astro-ph.IM]
14. **Proposal for Using DAΦNE as Pulse Stretcher for the Linac Positron Beam**, Susanna Guiducci et al., J.Phys.Conf.Ser. 1067 (2018) no.6
15. **Fast Ramped Dipole and DC Quadrupoles Design for the Beam Test Facility Upgrade**, Lucia Sabbatini et al., IPAC2018 proc.
16. **The PADME calorimeters for missing mass dark photon searches**, F. Ferrarotto et al., JINST 13 (2018) no.03
17. **The Mu2e undoped CsI crystal calorimeter**, N. Atanov et al., JINST 13 (2018) no.02
18. **An Active Diamond Target For The Padme Experiment,** F. Oliva et al., 19th Frascati Spring School “Bruno Touschek” proc.



Citations of Nucl. Instrum. Meth. A515 (2003) 524

BTF: beam request

http://www.lnf.infn.it/acceleratori/btf/request.html



Request Beam Time

In order to receive updates on news and deadlines, please subscribe to the BTF Newsletter.

To request access at the BTF facility please fill the following application form, you should provide the following information:

- First name, last name, email and affiliation of contact person
- Physics motivation and experimental setup
- The dose needed by each experiment, i.e. the time of run
- The energy or the energy range of operation (25-750 MeV)
- The required multiplicity (number of electrons/spill and repetition rate: from 1 to 50 Hz or single shot)
- Time needed for experiment installation and de-installation (before and after beam assignment)
- The earliest date for the start of your experiment
- DAQ, cabling, diagnostic devices, etc. that you need

For any problem, please send an e-mail to the BTF staff

Access to Research Infrastructures

This Facility is part of the Transnational Access to Research Infrastructure

User Request and Account Handling

Connection from: 193.206.81.81

Please, choose experiment short name and password for registered user.
This allows you to handle your data, to book new shifts, and to see the status of approval
Press New if your experiment label is not present

Users: – **Password:**

Login New

http://www.lnf.infn.it/acceleratori/btf/php/btfLogin.php

The request undergoes BTF Users Committee decision

Conclusions

- The Beam Test Facility in Frascati offers several beam conditions
- Compact setups are welcome
- The users are provided with many tools for the control of the beam conditions: these data are written and accessible
- Waiting for any of you at LNF!

Recent publications

1) DAΦNE BTF Improvements of the Transverse Beam Diagnostics
By Paolo Valente, Bruno Buonomo, Claudio Di Giulio, Luca Gennaro Foggetta.
10.18429/JACoW-IPAC2017-MOPAB061.

2) Long beam pulses with SLED compression in DAΦNE LINAC
By Paolo Valente et al..
10.18429/JACoW-IPAC2017-TUPAB048, 10.1088/1742-6596/874/1/012017.
J.Phys.Conf.Ser. 874 (2017) no.1, 012017.

3) A Hardware and Software Overview on the New BTF Transverse Profile Monitor
By Bruno Buonomo, Claudio Di Giulio, Luca Gennaro Foggetta, Paolo Valente.
10.18429/JACoW-IBIC2016-WEPG73.

4) The Frascati LINAC Beam-Test Facility (BTF) Performance and Upgrades
By Bruno Buonomo, Claudio Di Giulio, Luca Gennaro Foggetta, Paolo Valente.
10.18429/JACoW-IBIC2016-TUPG29.

5) Frascati Beam-Test Facility (BTF) High Resolution Beam Spot Diagnostics
By Paolo Valente, Bruno Buonomo, Claudio Di Giulio, Luca Gennaro Foggetta.
10.18429/JACoW-IBIC2016-MOPG65.

6) The Frascati LINAC beam test facility performances and upgrades
By B. Buonomo, Claudio Di Giulio, L. Foggetta, P. Valente.
10.1393/ncc/i2017-17069-6.
Nuovo Cim. C40 (2017) no.1, 69.

7) DAΦNE LINAC: Beam Diagnostics and Outline of the Last Improvements
By Bruno Buonomo, Luca Gennaro Foggetta.
10.18429/JACoW-IPAC2015-TUPWA057.

8) Beam Optimization of the DAΦNE Beam Test Facility
By Luca Gennaro Foggetta, Bruno Buonomo, Paolo Valente.
10.18429/JACoW-IPAC2015-MOPHA048.