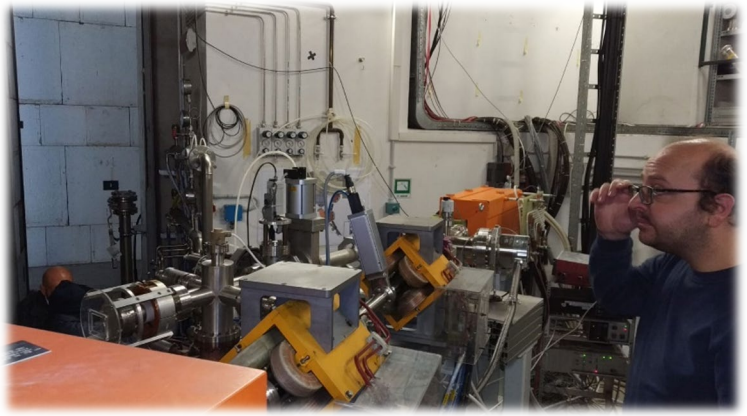
BTF STATUS REPORT



BTF group

Bruno Buonomo, Claudio Di Giulio, **Luca Foggetta**, Gianfranco Morello, Paolo Valente

PEOPLE

BTF group

Bruno Buonomo, Claudio Di Giulio, **Luca Foggetta**,
Gianfranco Morello, Paolo Valente

LINAC staff

Maurizio Belli, Riccardo Ceccarelli, Alberto Cecchinelli , Renato Clementi*,
Graziano Piermarini, Luis Antonio Rossi, Serena Strabioli, Raffaele Zarlenga

* Retired

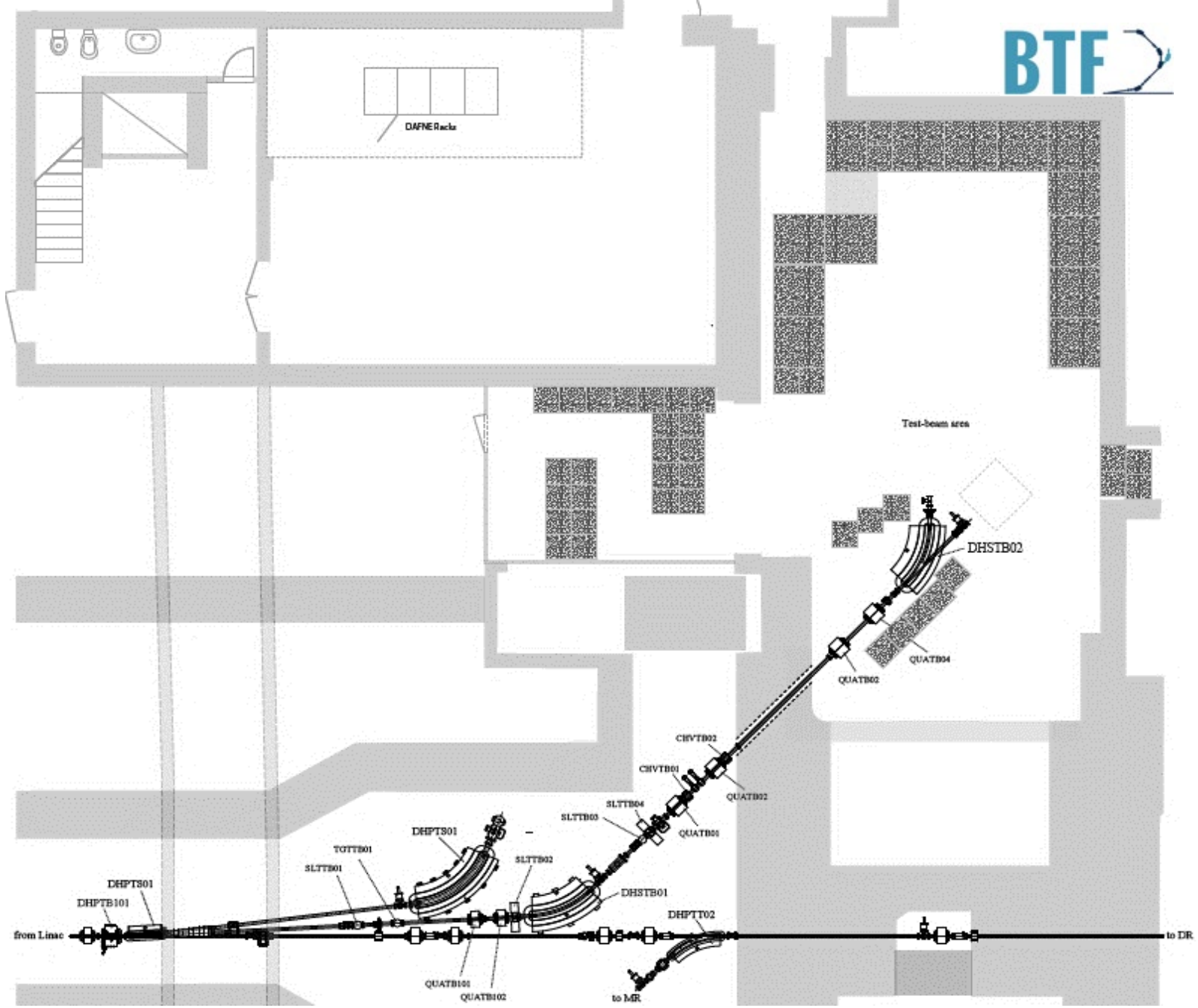
Technical and Accelerator Divisions services

Sergio Cantarella, Oreste Cerafogli*, Enrico Di Pasquale, Alessandro Drago, Adolfo Esposito, Oscar Frasciello, Andrea Ghigo, Simona Incremona, Franco Iungo, Stefano Lauciani, Roberto Mascio, Stefano Martelli, Marco Paris, Stefano Pioli, Luigi Pellegrino, Francesco Putino, Ruggero Ricci, Ugo Rotundo, Lucia Sabbatini, Claudio Sanelli, Franco Sardone, Giancarlo Sensolini, Alessandro Stecchi, Angelo Stella, Alessandro Vannozzi & DAFNE operators for runs

* Retired

ACTIVITIES

- Build a **second beam-line** and experimental hall
- **PADME run**
- Preparation of new **test beam campaign**
- **Consolidate the LINAC**: extend lifetime of 10 years

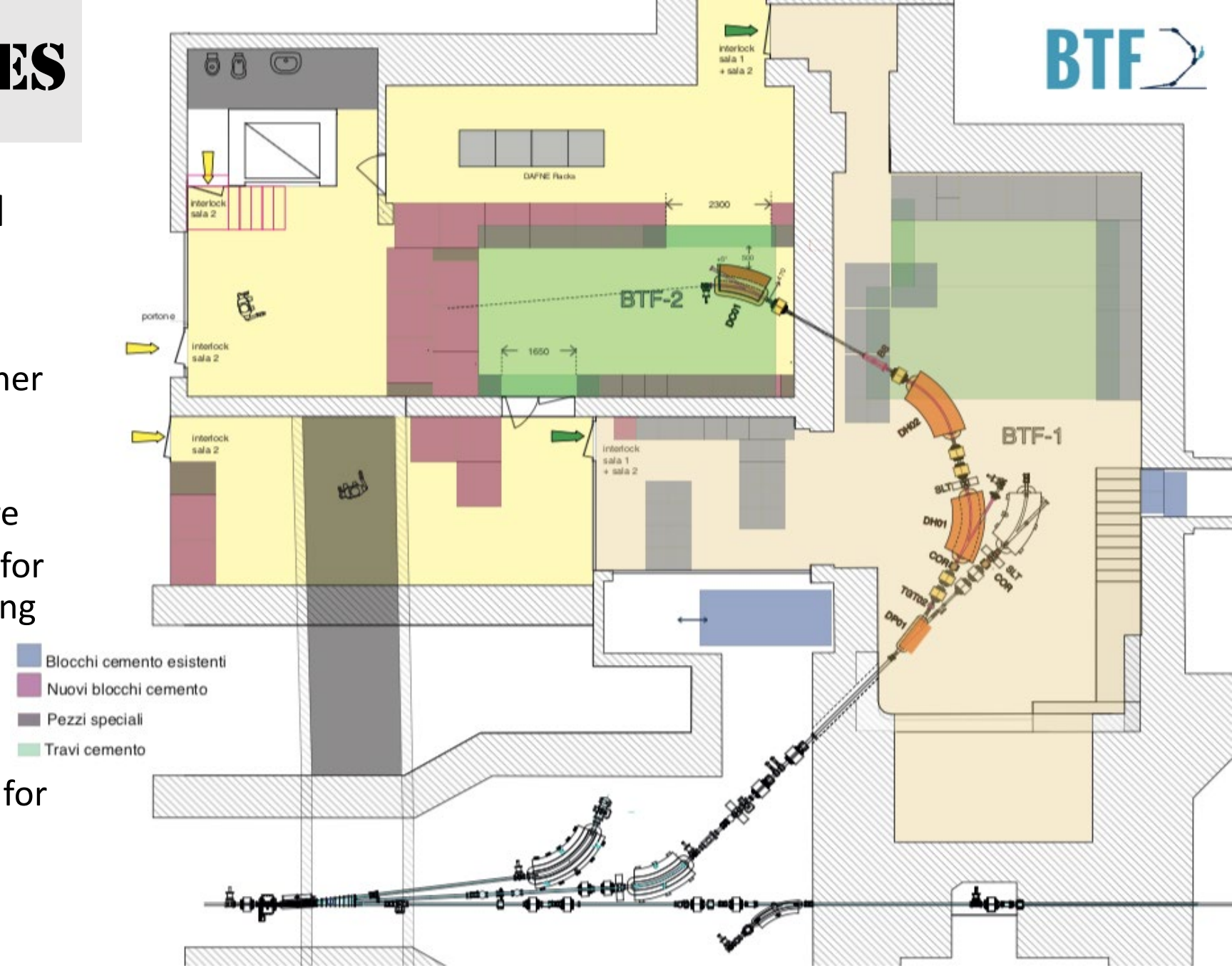


ACTIVITIES

- Build a **second beam-line** and experimental hall

Hard handshaking with all the other DAFNE-BTF-LINAC activities:

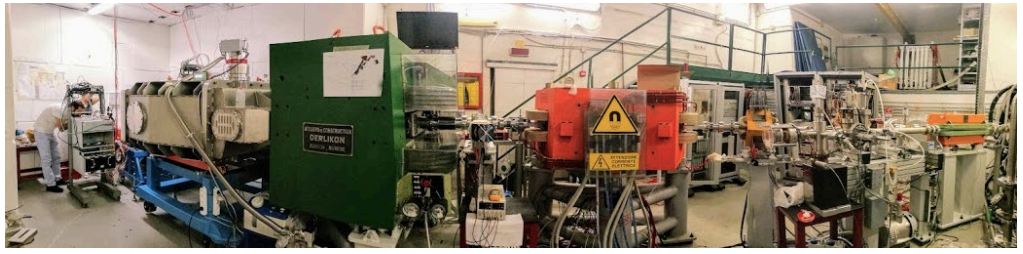
- Essentially people for implementing the infrastructure
- BTF Experimental hall 1 closed for PADME run => no joint upgrading during it
- Not touching existent DAFNE subsystem, racks, cables…
- Non interlocking activities also for SIDDHARTA 2

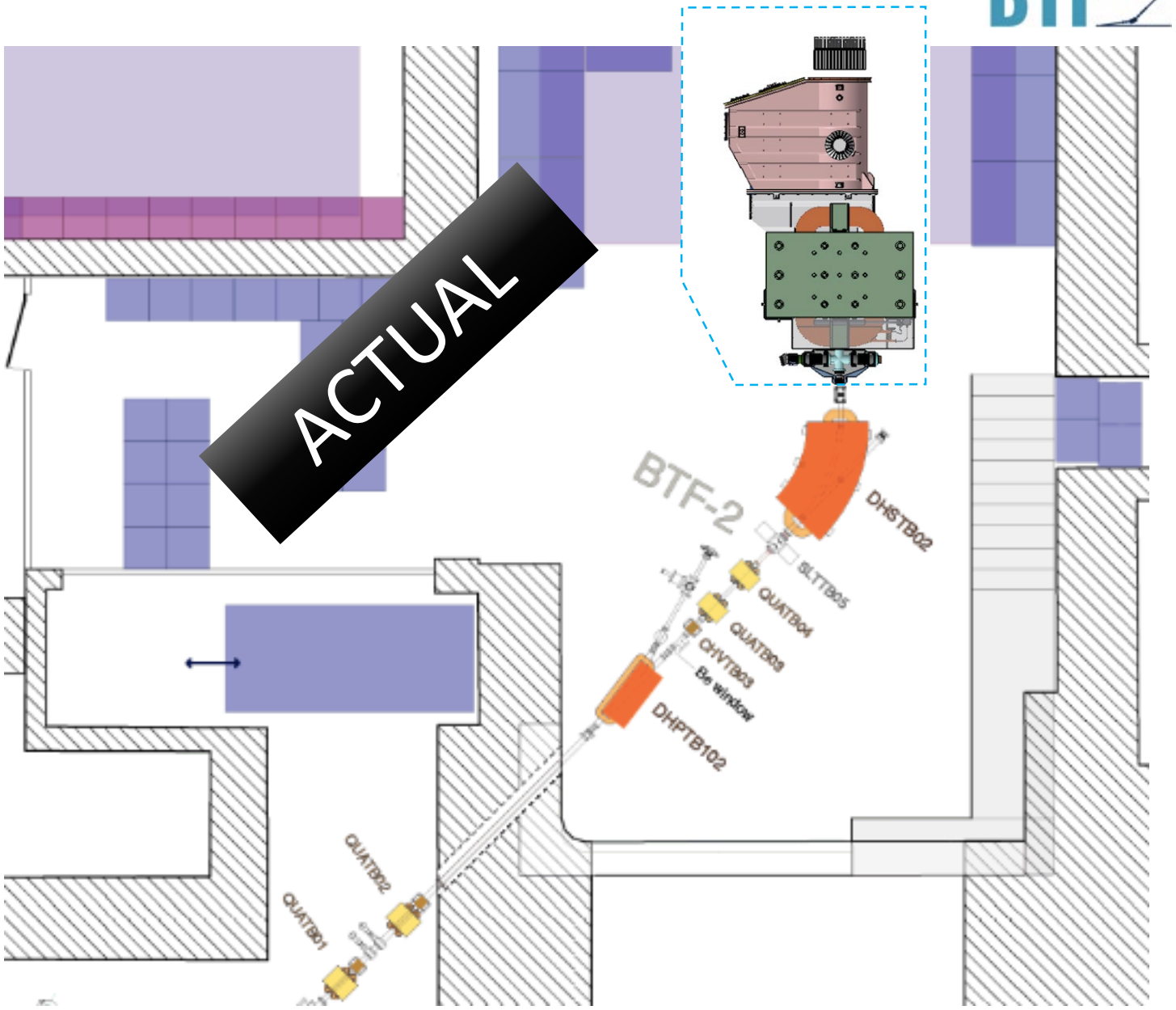


ACTIVITIES

- Restart with long positron pulses for the **PADME run**
  - Implementing the **setup for BTF1 and PADME**
  - Make the joints for both (slow control, signals, intercalibrations)
  - Setup LINAC+BTF for the PADME requirement
  - Assuring a stable run for months (10^{13} good cooked positrons)

- Restart **test-beam access**
  - **AIDA 2020 duties**





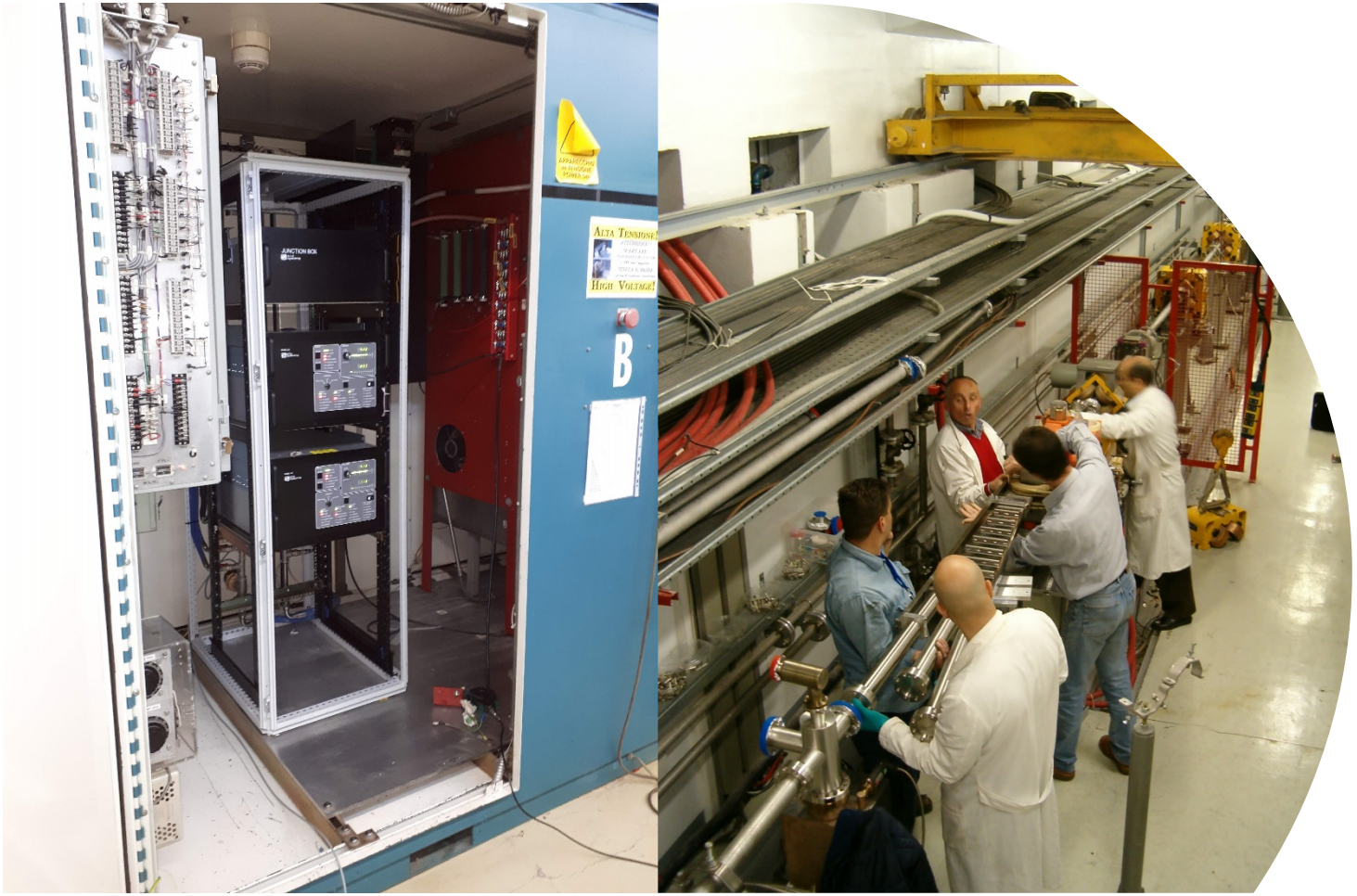
ACTIVITIES

- **Consolidate the LINAC**: extend lifetime of 10 years
  - Implementing HVPS on 4 mod's
  - Substituting mod's and subsystem old electronics with a new embedded one
  - Improved Maintenance and Diagnostics

- Critical implementation for just one reason

  LINAC has to be ready for all of the scheduled activities (and we got it):
  - BTF user run
  - DAFNE in SIDDARTHA run
  - PADME run

Two completely different beams
Cannot be currently overlapped



TIMELINE

12/11/2015: 1st proposal to INFN MAC

16/03/2016: Conceptual design INFN-16-04/LNF, Review of INFN MAC

22/06/2016: Review with CERN warm magnets group

10/10/2016: Final layout of beam-lines

17/01/2017: Meeting with INFN LASA magnets group

01/03/2017: Workshop with industries and ILO in Bologna

06/04/2017: First part of funding available (1.6 M€)

22/06/2017: Status report to INFN MAC

20/09/2017: Start of BTF shutdown

01/10/2017: Second part of funding available (350 k€)

19/12/2017: Start of civil engineering

01/04/2018: Start of beam line dismounting

04/07/2018: Third part of funding available (650 k€)

12/07/2018: First beam in BTF-1 line beam setup

20/07/2018: END of beam commissioning

Aug. 2018 : Summer shutdown

15/09/2018: Restart LINAC op. and PADME RUN1

23/10/2018: Status report to INFN MAC

21/12-07/01 2019 : Winter shutdown and maint.

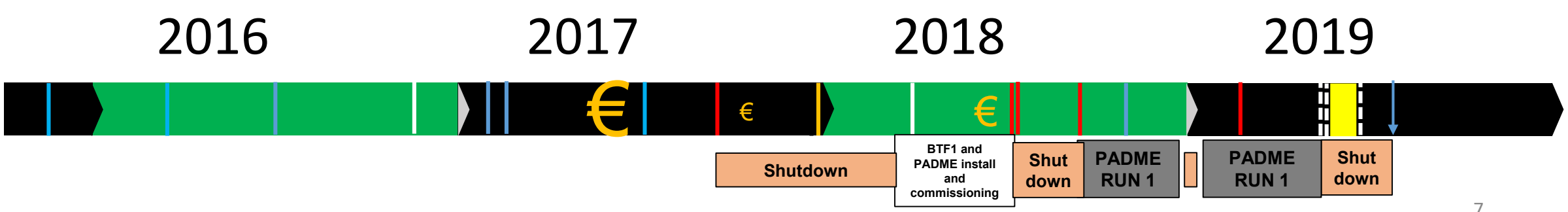
26/02/2019: First beam in BTF-2 line beam setup

01/03/2019: END of PADME RUN1

04/03/2019: LINAC available for DAFNE

06-29/03/2019: LINAC HVPS Mod.B installation

30/03/2019: LINAC ready for DAFNE



USER STATUS

Users publications related to BTF activities **2018**

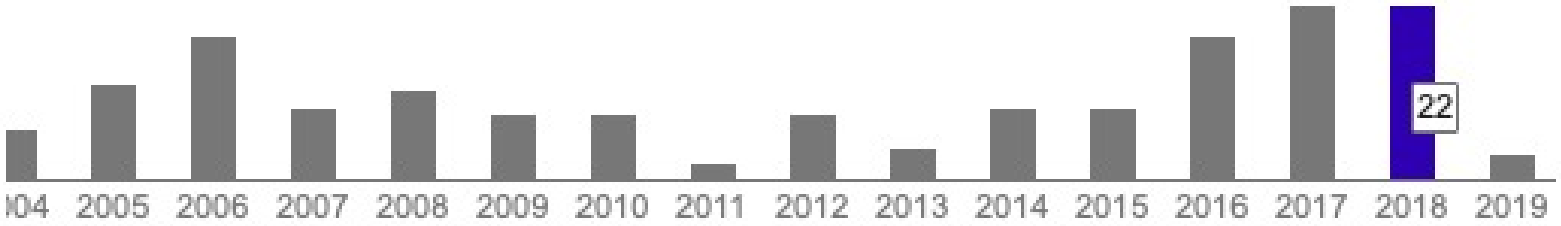
1. Performance of the prototype of the charged particle veto system of the PADME experiment, F. Ferrarotto et al., IEEE TNS 99 (2018).
2. Performance of the diamond active target prototype for the PADME experiment at the DAΦNE BTF, R. Assiro et al., Nucl. Instrum. Meth. A898 (2018) 105.
3. Study on the 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.

19.…

USER STATUS

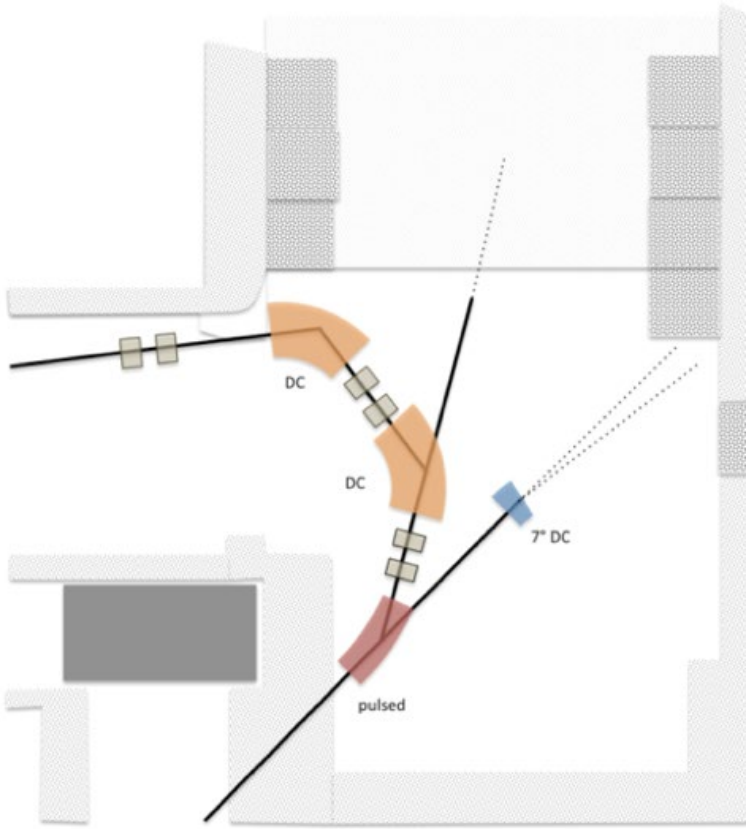
Users publications related to BTF activities **2019**

1. **Electron beam test of the large area Mu2e calorimeter prototype,** N. Atanov et al, J.Phys.Conf.Ser. 1162 (2019)
2. **Development of the SLRI beam test facility for characterization of monolithic active pixel sensors**, K. Kittimanapun et al, Nucl.Instrum.Meth. A930 (2019)
3. **The Investigation on the Dark Sector at the PADME Experiment**, Fabio Ferrarotto , Universe 5 (2019) no.2
4. **Characterization and performance of PADME's Cherenkov-based small-angle calorimeter,** A. Frankenthal et al., Nucl.Instrum.Meth. A919 (2019) 89-97

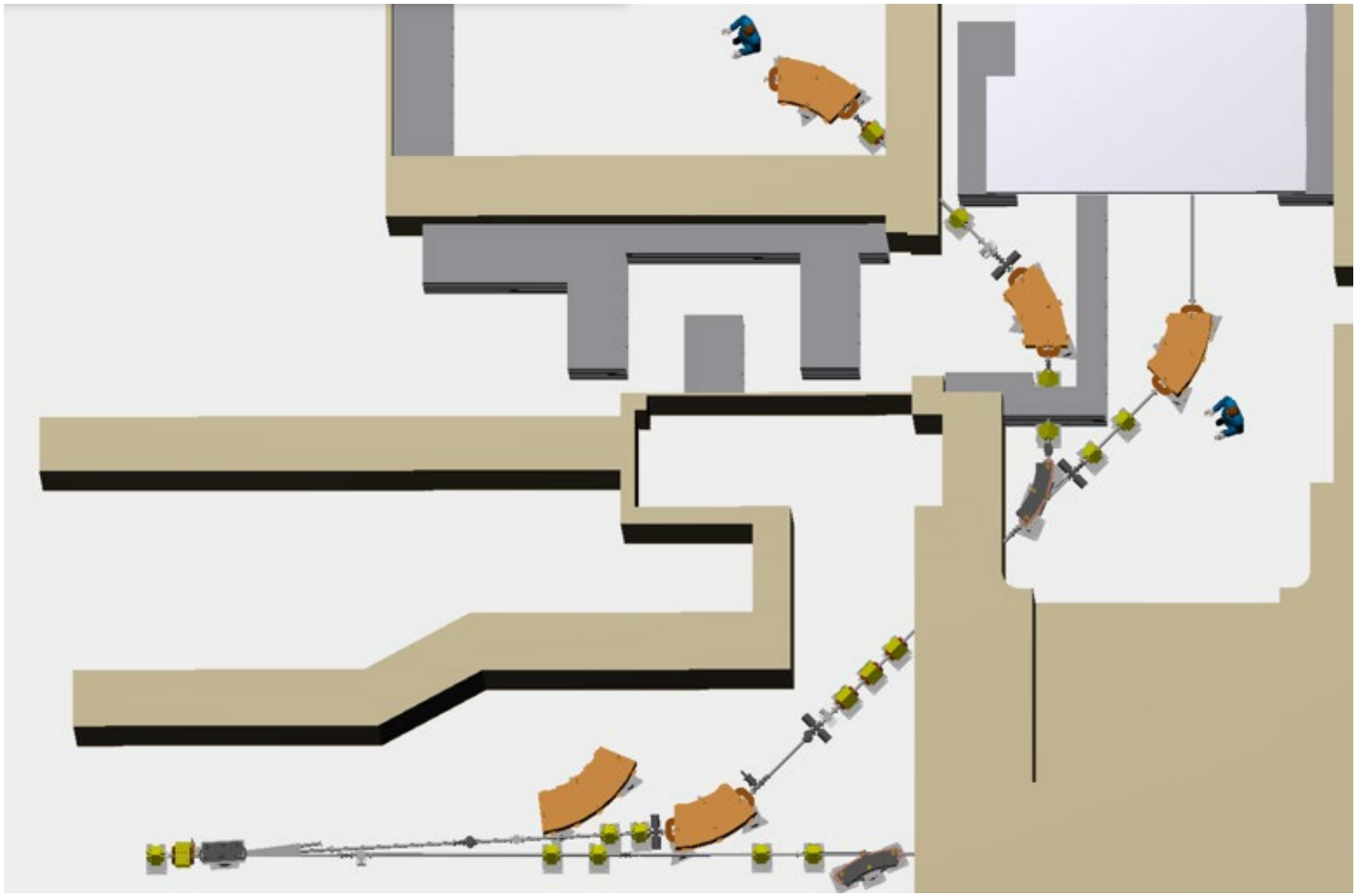


Citations of Nucl. Instrum. Meth. A515 (2003) 524

LAYOUT



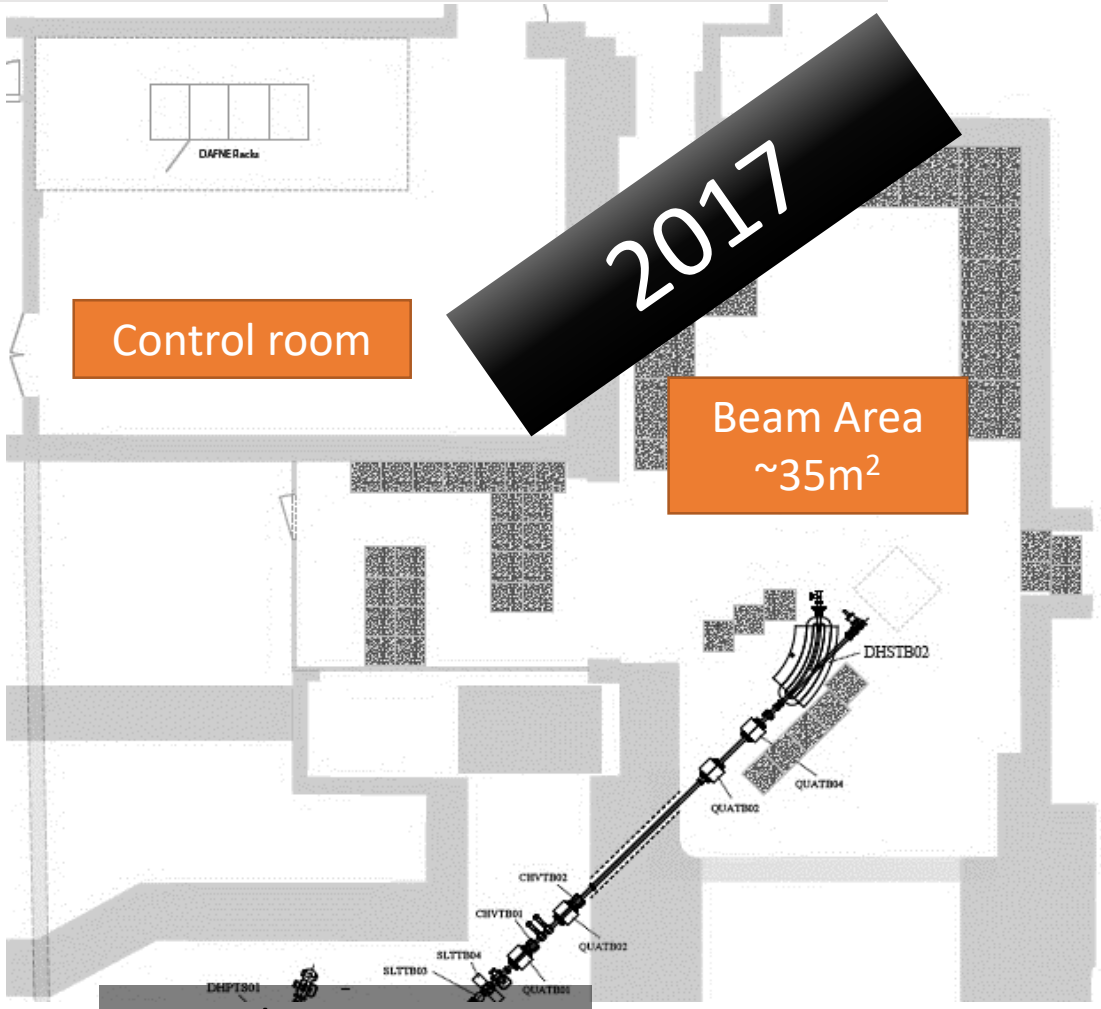
First sketch, May 2014



Conceptual Design Report, March 2016

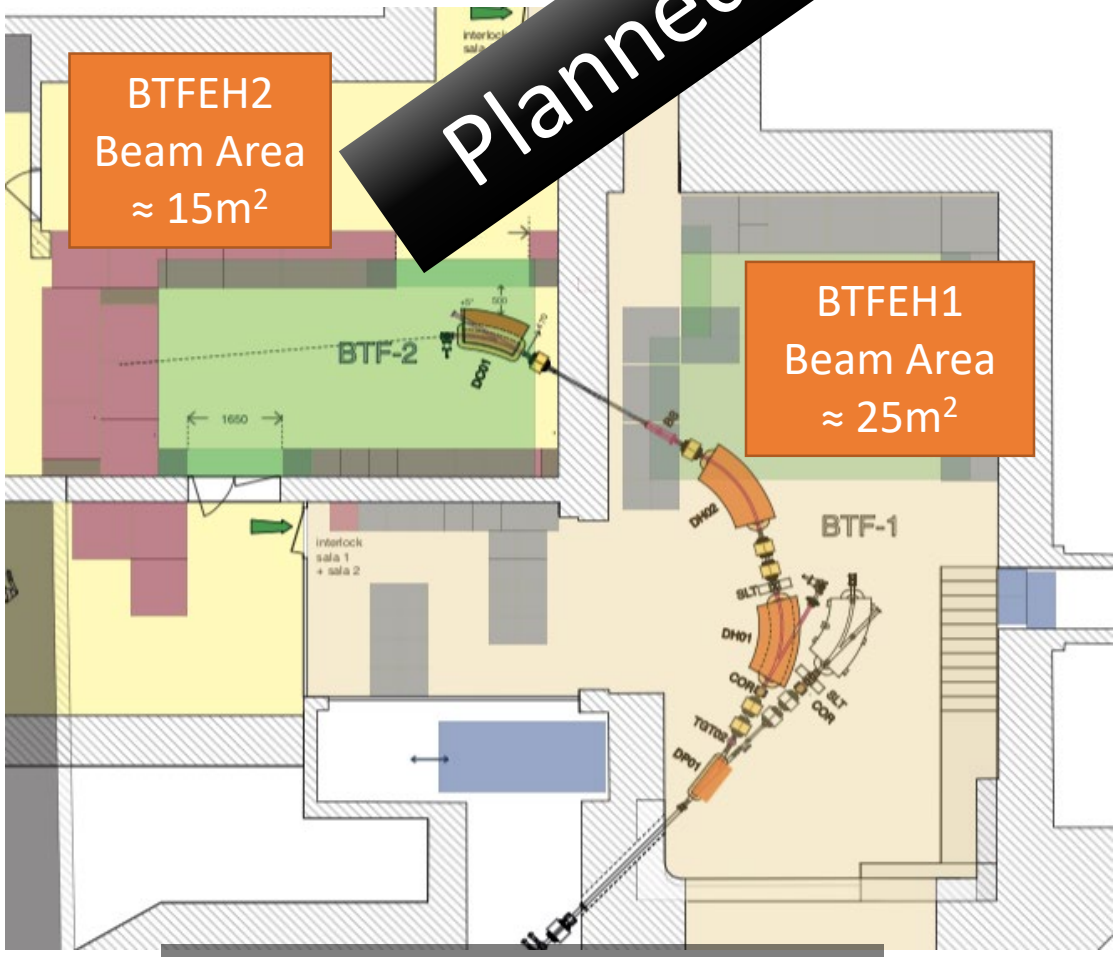
LAYOUT

2017



- Single Beam Line
- Near to BTF-CR

Planned

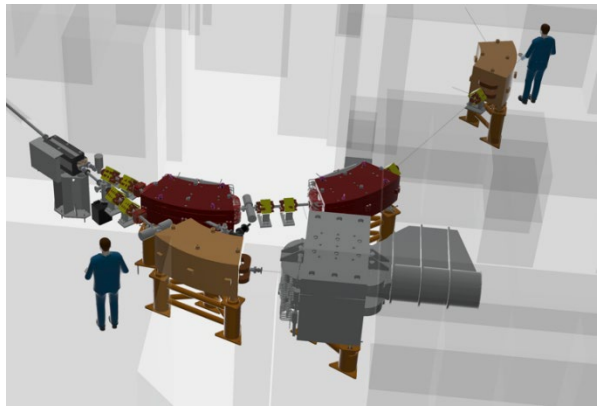


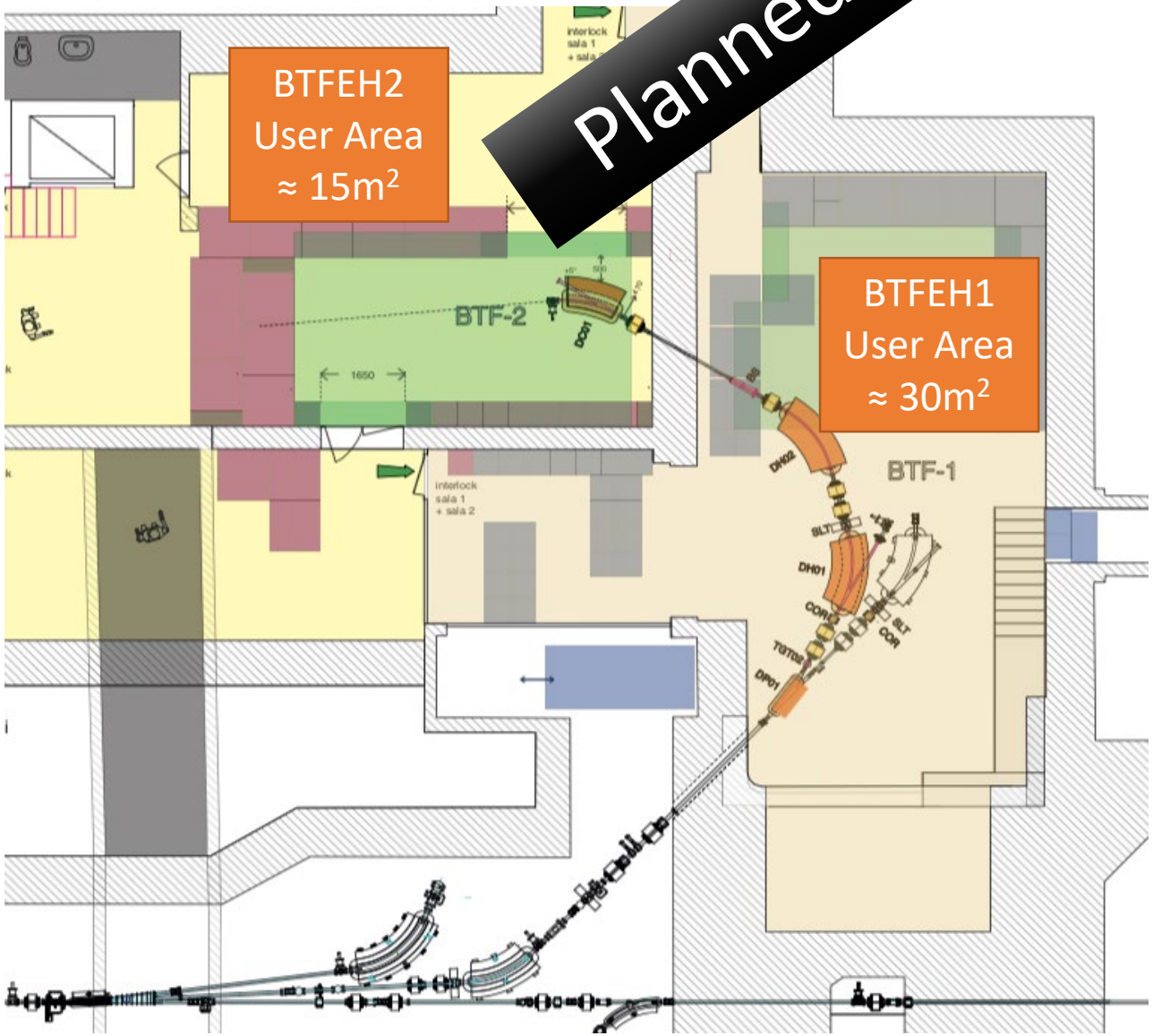
- Two Alternative Beam Line
- CR moved to different location
- Duty cycled operations

LAYOUT

	Old BTF	Planned BTFs
Magnets number	11 (3Dip,6Qua,2Cor)	+ 12 (+4Dip,6Qua,2Cor)
Scrapers (axes)	8	+4
Beam stoppers	1	+1
Targets	1	+1
ICTs	3	+2
DAQ	1	+1
Ion Pumps	4 (2 for user vac)	+3

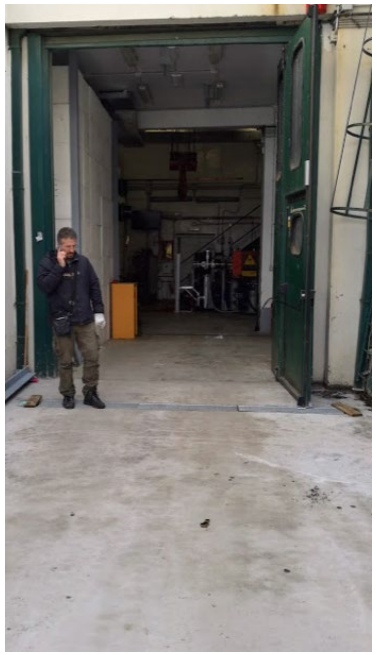
- Increased water cooling capability
- Increased stability air conditioned system
- Big control room
- New Power Supply hall





BTF EXP. HALL 2

End civil w. Phase 1 (Winter 2018)

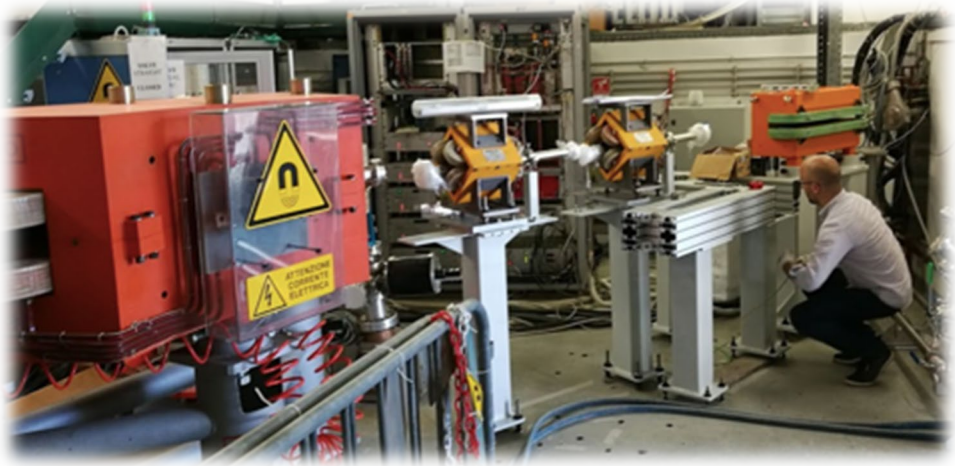


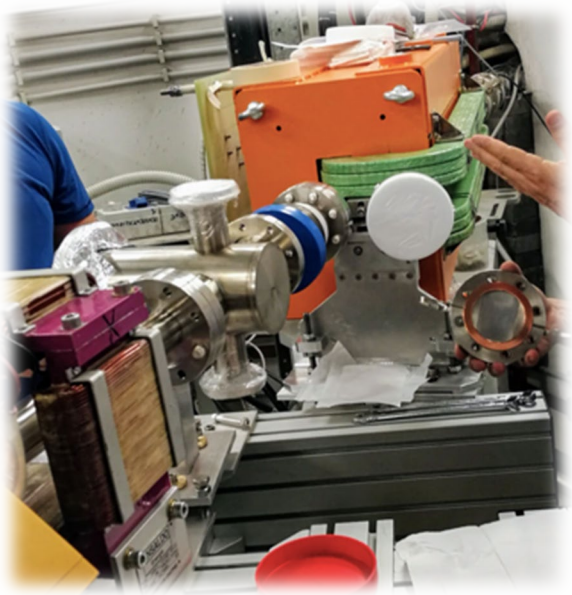
- New main entrance
- BTF-2 Secondary entrance
- Improving floor strength for BTF2 shielding chicane
- External shielding blocks ready to be installed
- Largely used in the past months

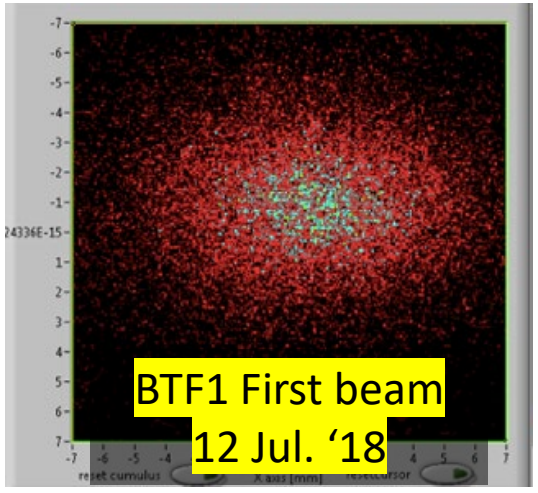
=> A very good result

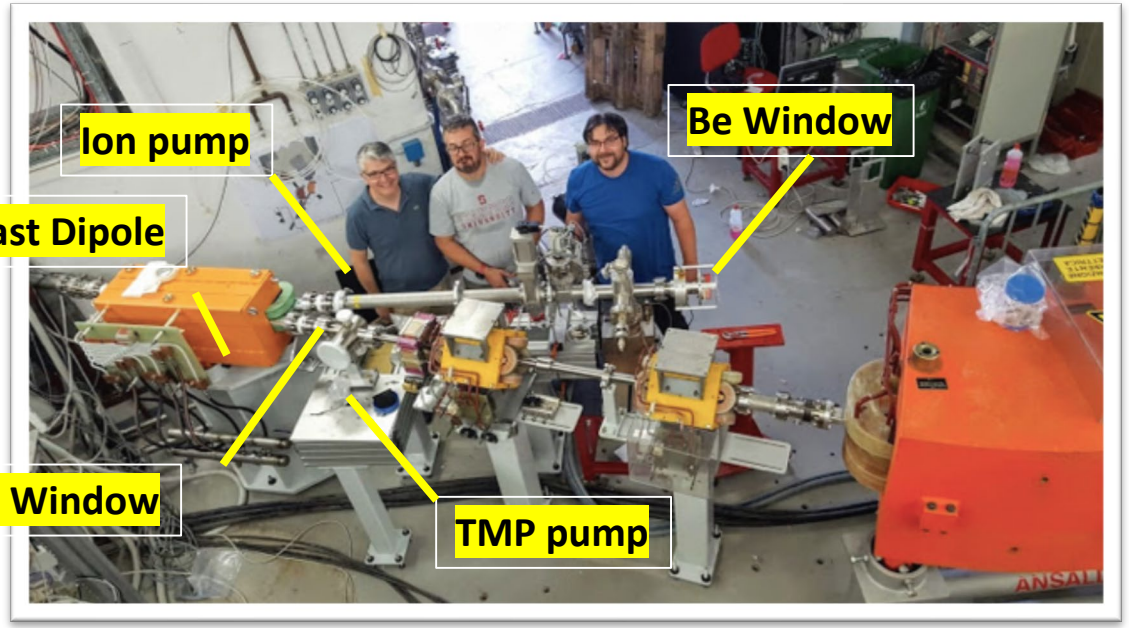
BTF1&PADME INSTALLATIONS

BTF 1 Commissioning (June2018)





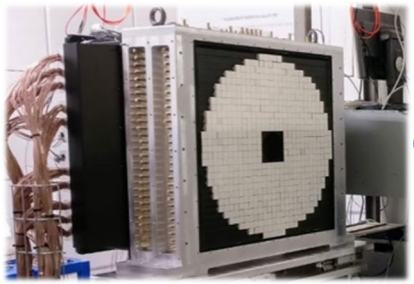


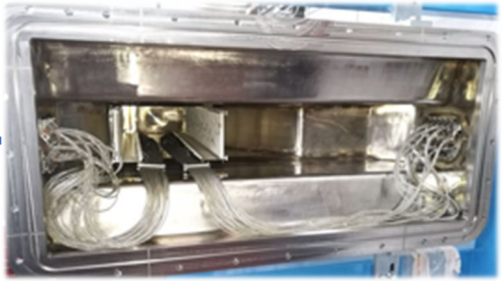


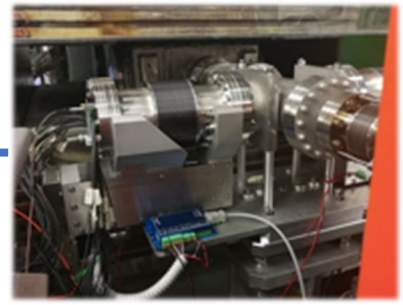
- Very quick installation:
  One month from scratch to BTF-1 beam
- Doubled the line
  Ready for PADME beam commissioning

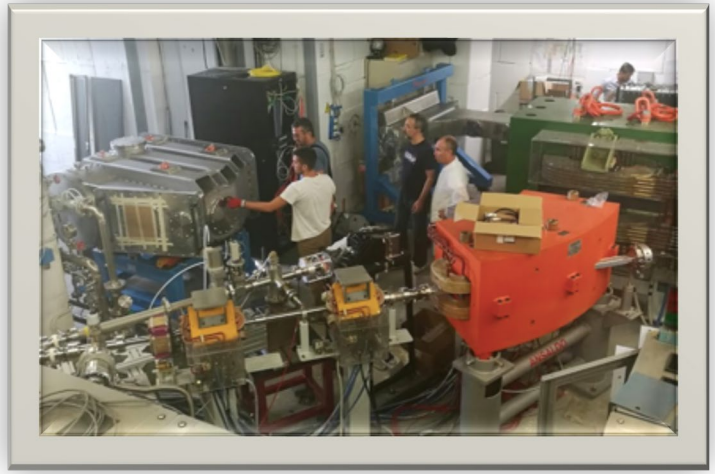
BTF1&PADME INSTALLATIONS

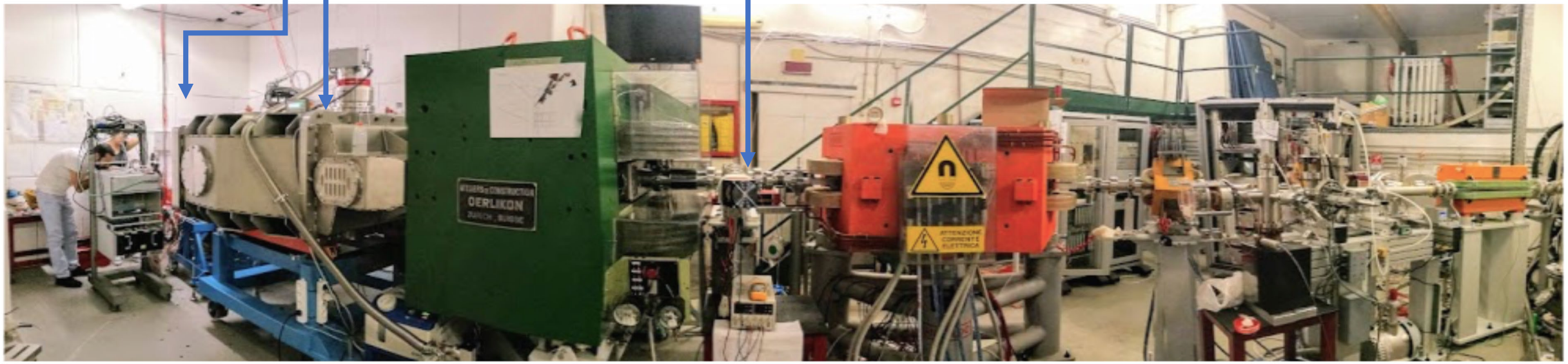
Parts Commissioning (June2018)





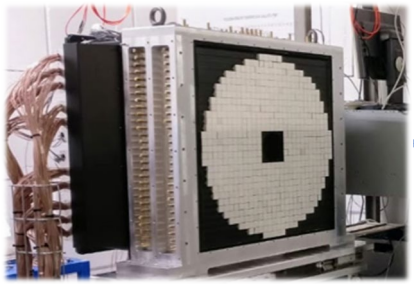


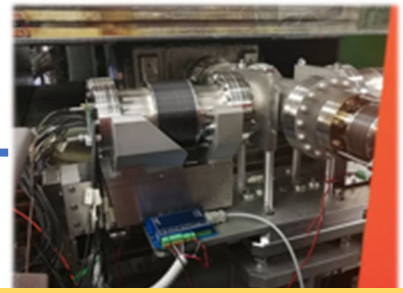


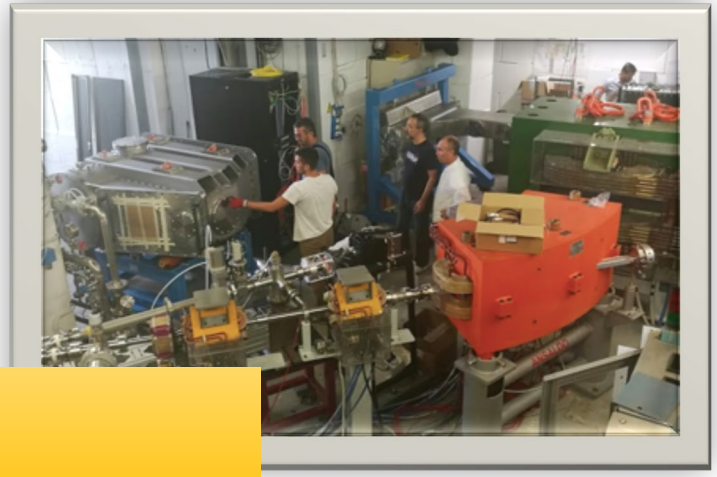


BTF1&PADME INSTALLATIONS

Parts Commissioning (June2018)







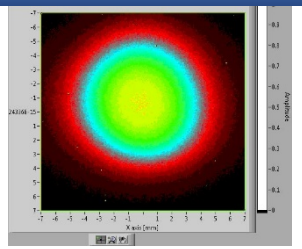
Ready for beam commissioning

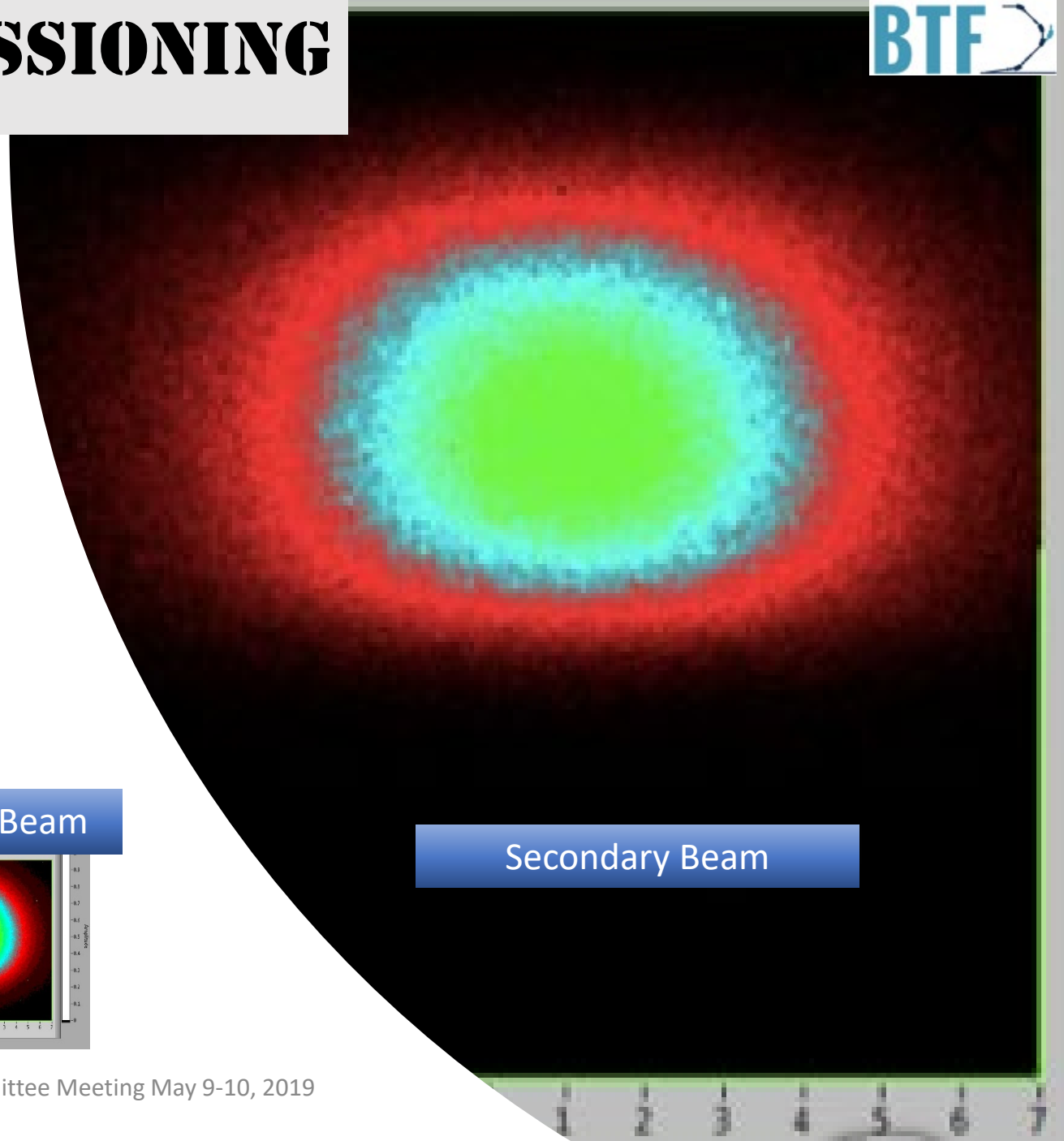
PADME BEAM COMMISSIONING

- Commissioning **BTF1 beam** with secondary electron beam (450 MeV): July 2018

- Commissioning **PADME beam** with secondary positron beam (550 MeV): Sep. 2018
- **First user on new BTF-1 line, PADME** (dark photon searches) experiment: Oct. 2018 – end of Feb. 2019
- Commissioning **PADME beam** with primary positron beam (490 MeV): end of Feb. 2019
- End **of PADME RUN1:** 1st March 2019

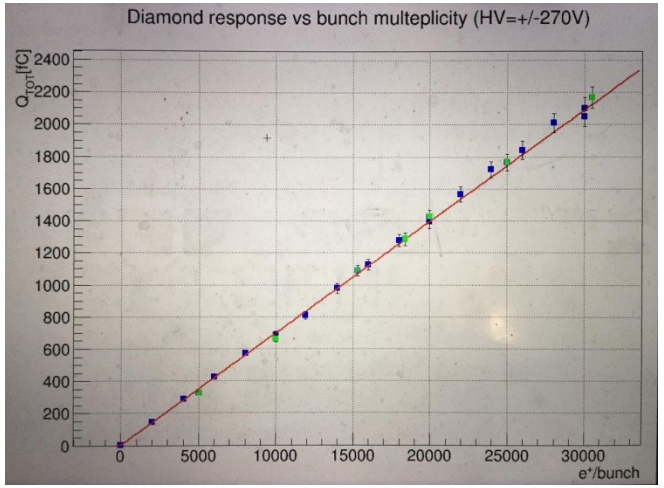
Primary Beam

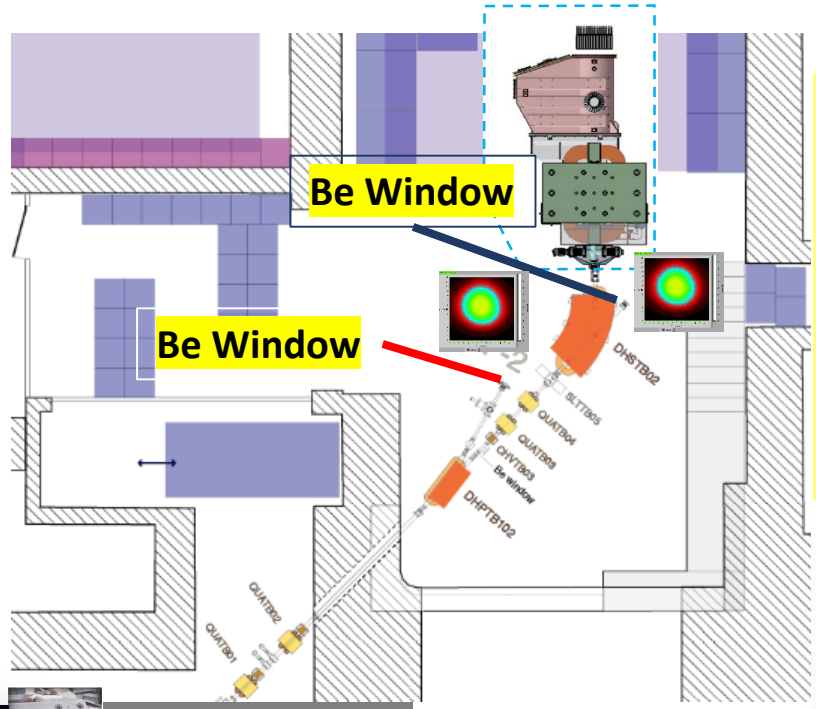


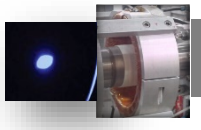


Secondary Beam

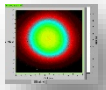
BTF Hall 1 - BTF diagnostic layout

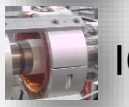





Before target

- Impossibility to have BTF diagnostic in PADME run
  - Big vacuum vessel with its own => using alternative measurement paths
- PADME-Decoupled diagnostic for essentially:
  - charge, position and transverse dimensions
- Used for PADME initial data validation, beam setup, background studies and afterwards for fast beam checking


Fitpix (pixel det) and calorimeter

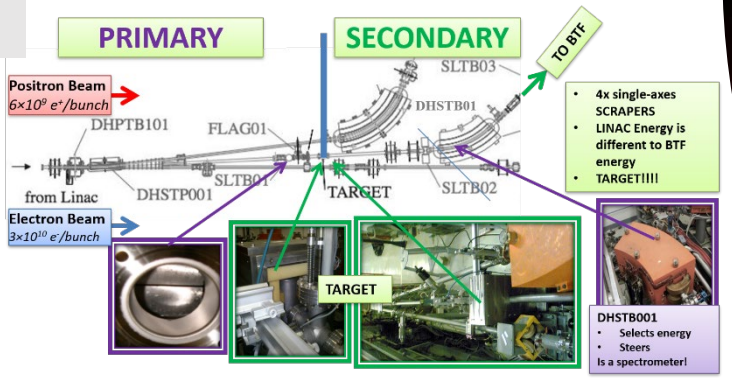

ICT & Resistor BCM (current monitor) LINAC-tunnel

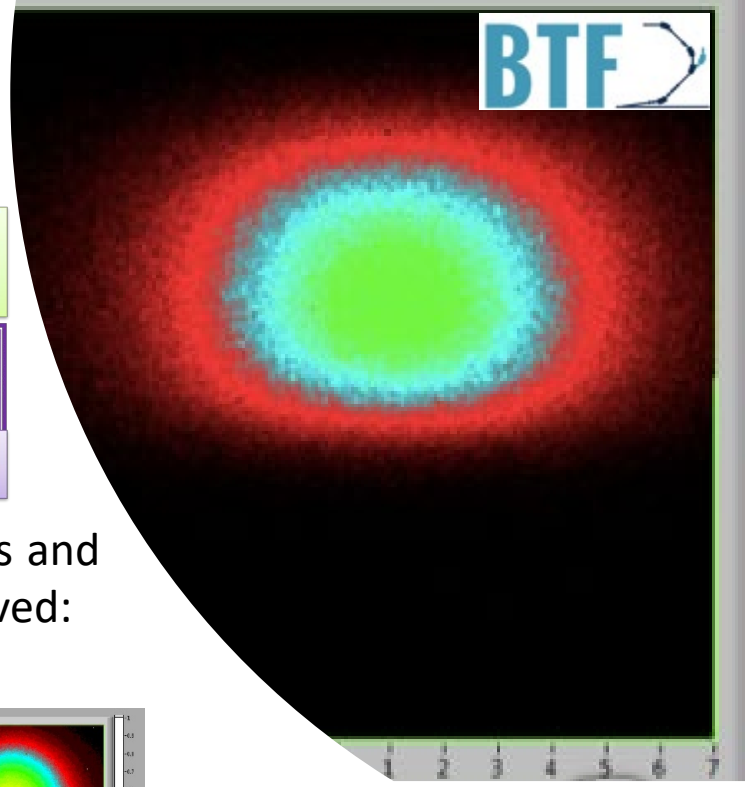

YAG:Ce and Nd FLAGS

BTF SHORT RECAP

BTF beam transport

Primary or secondary beams

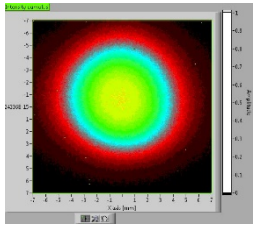


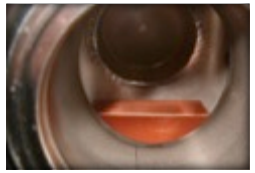


The beam can be delivered in different modes: **dedicated** or **opportunistic** operations and **with** or **without** attenuating target. Different ranges of beam parameters can be achieved:

LINAC Conditioned Primary Beam, E_0

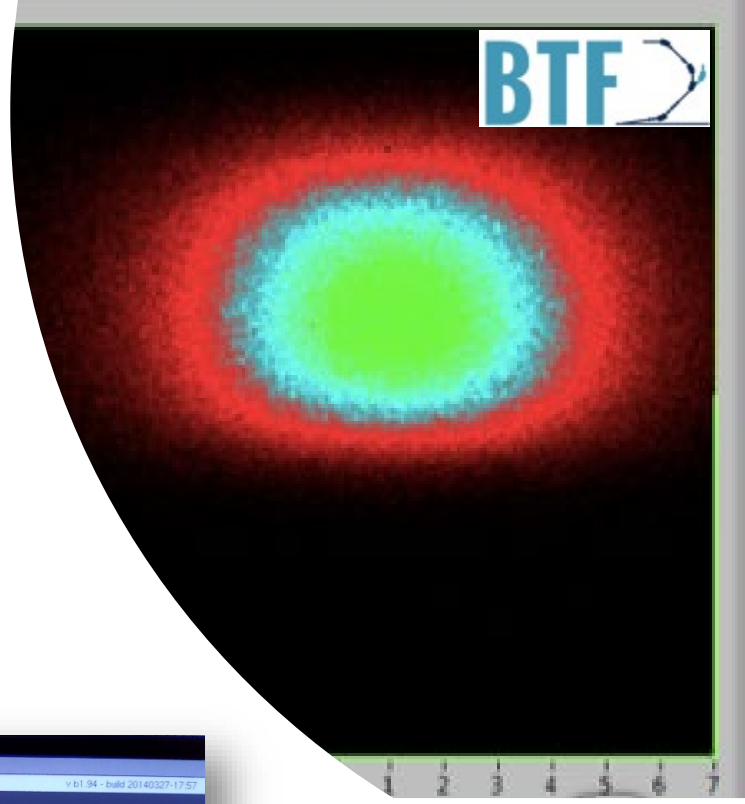
- Fixed energy, E_0
  - Steering and transverse tuning
- High current
  - from top current
  - tunable in 6 orders of magnitude from 10^{10} prim/bunch





Cu target, 1.7-2-2.3 x_0

- Tunable energy
  - All energies from E_0 to ≈30 MeV
- Tunable multiplicity
  - From max(E) to single particle per shot
- Particle type decoupled from LINAC



BTF **secondary** beam commissioning

July 2018

Request changed due to increased capability in PADME detection

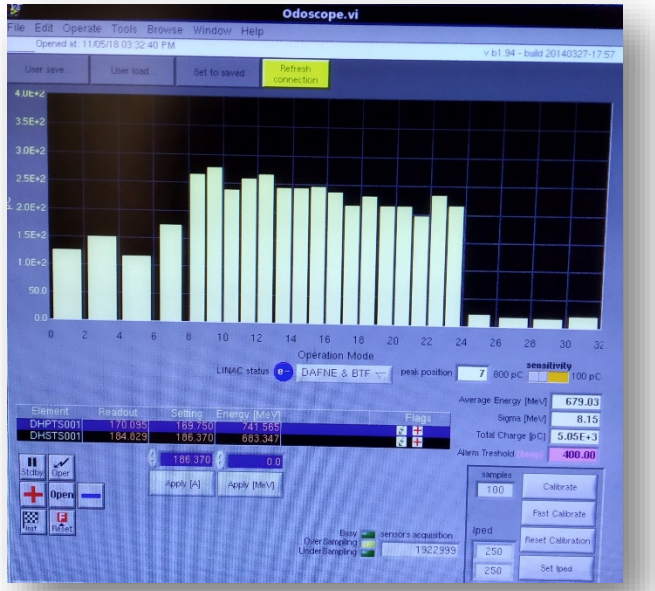
- Longer pulse = from 150ns up to 350ns (trials) => set default on 250ns
  averaged on SAC measured charge to time readout
- More multiplicity = from 10k up to 30k => set default on 25k

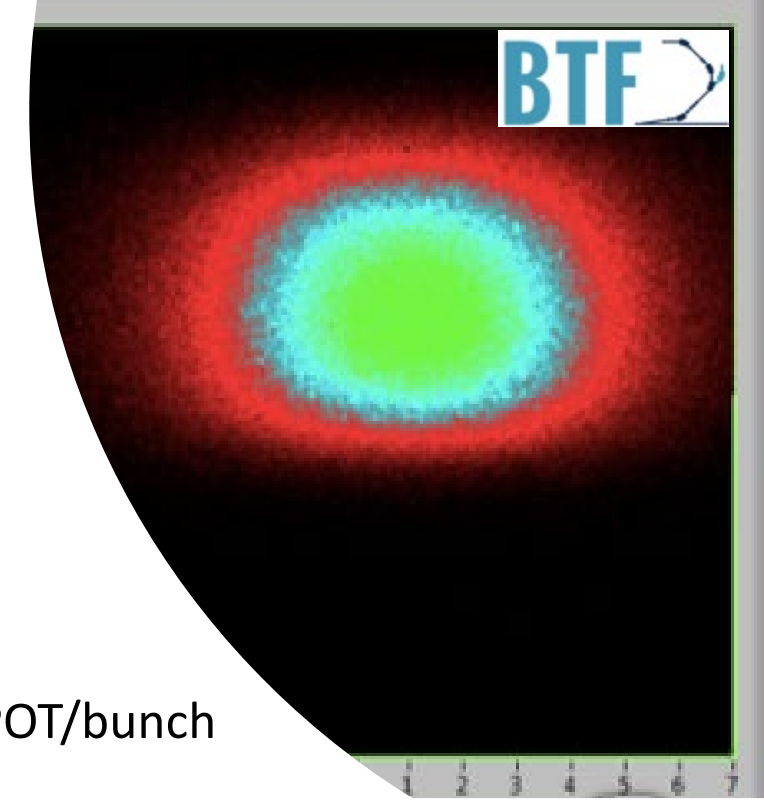
Actual **Secondary Beam configuration** for PADME:

- Secondary Positron Beam Production at the **BTF target**
  - Electron Primary energy 670MeV
  - LINAC current higher than DAFNE ops
  - Multiplicity max(545MeV, scraper'd) above 25k
  - Very good beam control and run stability for PADME

Drawbacks

- **Primary beam energy spread more than 6%, beam losses**
- Background and some diagnostic ageing
- Implementation of safety rules (i.e. cool down of target)





BTF **primary** beam commissioning

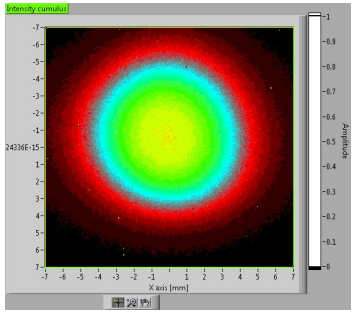
Mar 2019

Actual **Positron Primary Beam configuration** for PADME:

- Beam Production at the LINAC converter **target**
  - Primary transported energy 490MeV
  - Very low LINAC current (10^7 pos/bunch) then scraping to reach 25k POT/bunch
    - lower background
  - No rad damage issues
  - Higher multiplicity is not a problem
  - Seems better beam energy spread

Drawbacks

- Low max beam energy (under PADME needs) => still working on
- Not so good beam control and run stability for PADME => still working on
- **No (or very low sensitivity) LINAC current monitor (BCM, BPM)** => still working on
- **Beam stability in position (less) and multiplicity** => still working on

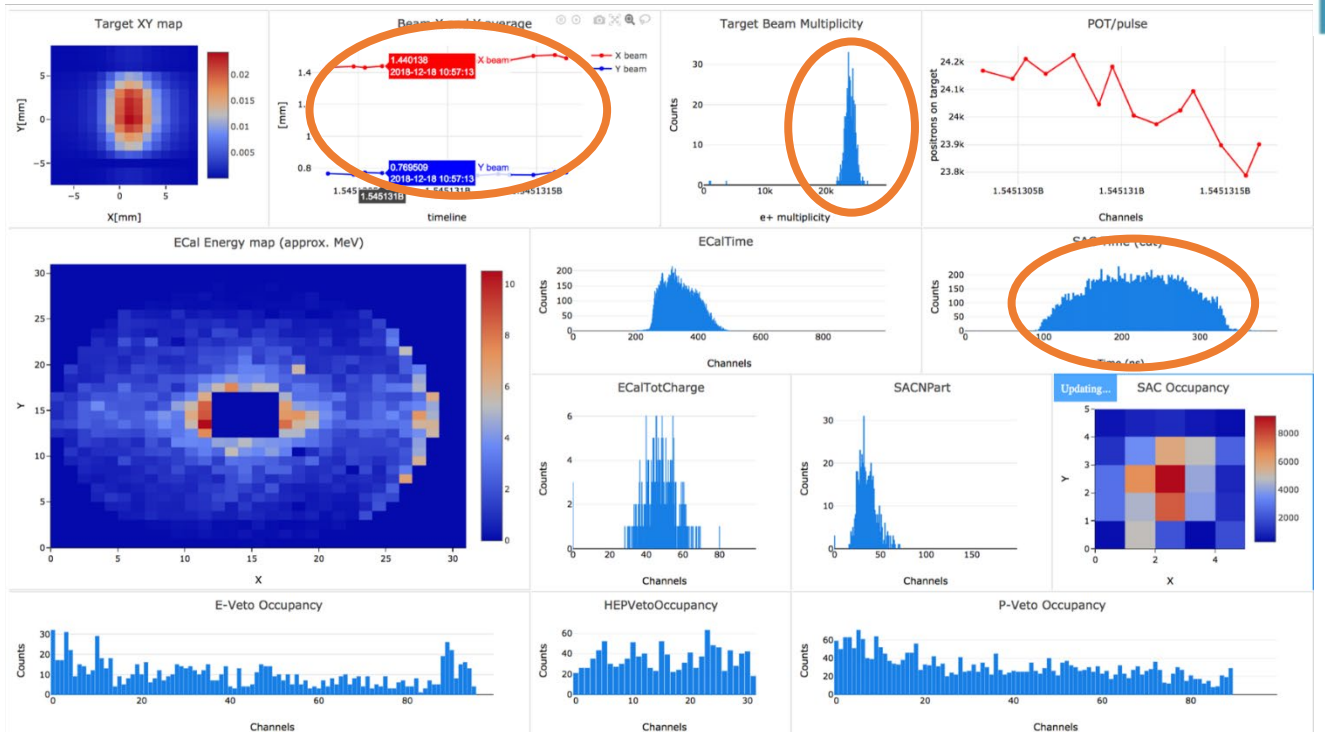


PADME RUN1

- Start online activities on Sep. 2018, initially with a standard secondary beam in order to
  - fix magnets fields,
  - Improving data exchange from BTF to PADME (exp. slow control, vacuum and LINAC),
  - BTF data and software developing for matching on-field PADME needs
  - improving safety rules for PADME team access, improving H24 operation

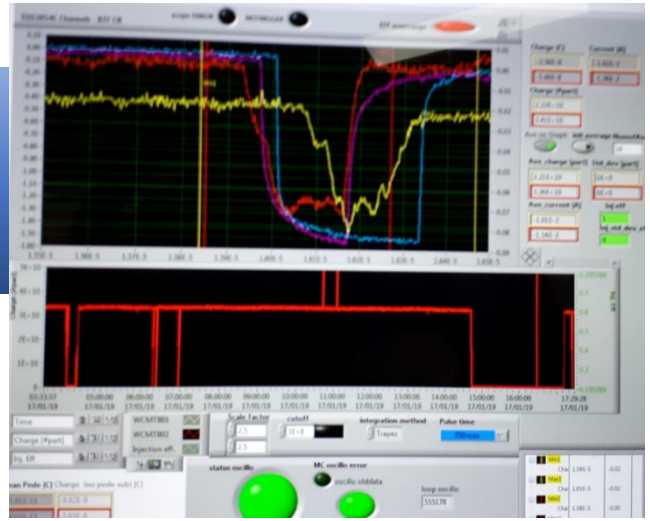
- In Oct. 2018 trials with different beam transport setup, energy and timing to increasing knowledge with PADME data online for beam fine tuning on PADME detectors.
  - Sharing knowledge and defining operational parameters to DAFNE operators for H24 ops
  - PADME detector and data debugging

- Fixing a complete set of nominal parameter, so starting beam on in Nov. 2018 for PADME RUN1
  - Optimal background dose reached on target



Final focus beam parameters detection are mutually exclusive (starting from the point of view of network delivery to the DAQ/detectors involved) for PADME and BTF diagnostics

a good way for a non interleaved cross-calibration and powerful debugging



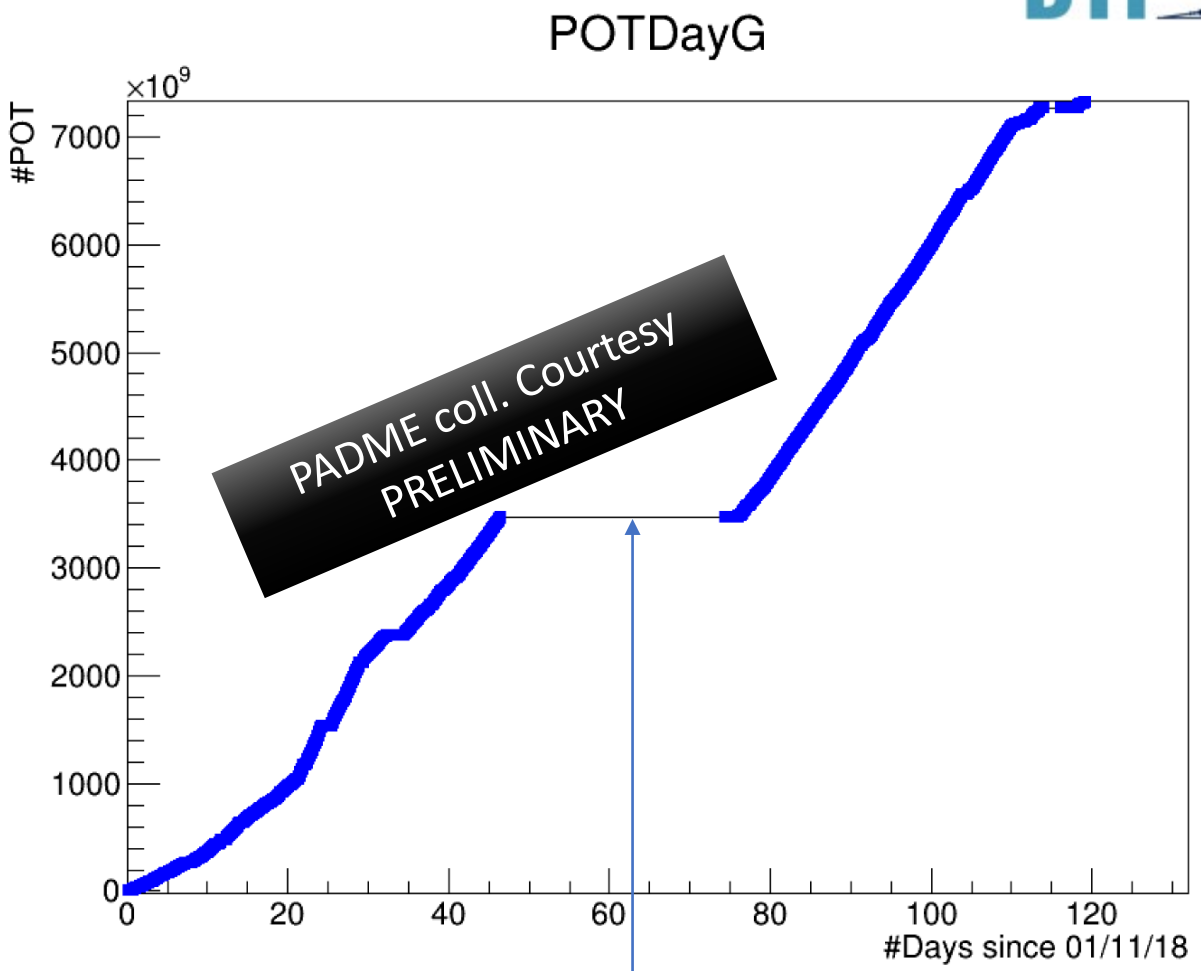
PADME RUN1

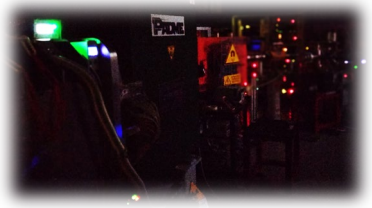
PADME RUN 1 calendar

- The beam delivery, in the major part of the involved configurations, run smoothly
- Some stops for minor problems/setup for PADME (see Mauro Raggi presentation)
- Two stops involving vacuum opening/major problem for PADME has been taken in a opportunistic way together the other LINAC-BTF improvements

- Highly charged LINAC beam promoted improvements in safety rules in shielding and LINAC access:
  - Experiences of few faulty detectors in the area of BTF target: two flag cameras and power supply in hodoscope and target area
  - Some scraper encoders, but open loop command remains completely operative (and not so much used)
  - Increasing shielding in the target area to reduce background in BTFEH1 and related areas

- Using every minutes until the scheduled shutdown (Winter 2018 and safety checks)
  - Official RUN1 ends on Feb. 21st and then we start primary beam and fast dipole test



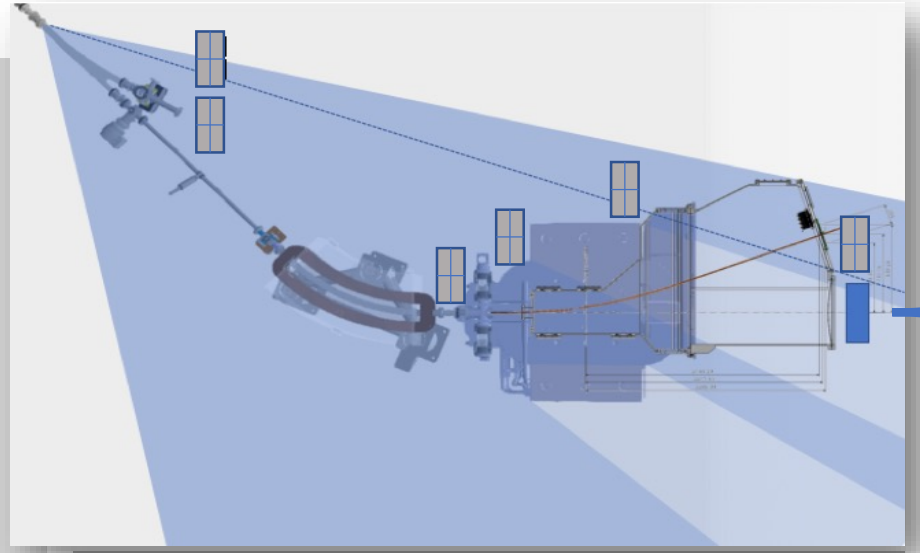


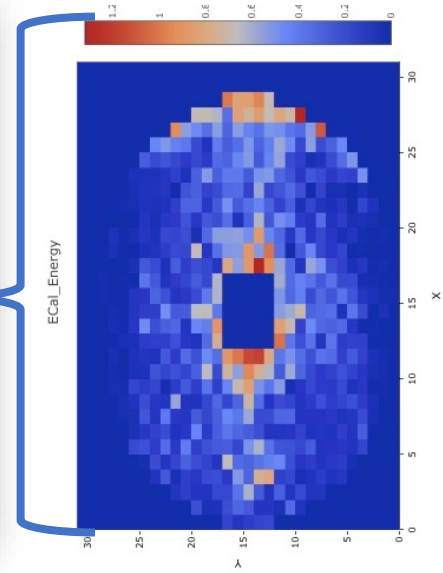
PADME BACKGROUNG

During initial PADME RUN 1 phase

Calibrating the assembly of detectors and analyzing the background impact on PADME detectors

- Hypothesis on different sources
  - Outer bkg
    - BTF target (photons and neutrons)
    - Scrapers
  - Inner bkg
    - Be window (multiple scat & bremsstrahlung)
    - PADME target holders
    - Negative differential aperture joints
    - Pipe hitting
- Hot witness are
  - Ecal outer X>0 bkg for outer photons
  - Ecal inner for bremsstrahlung'd positrons scraping the inner surface of former PADME chamber



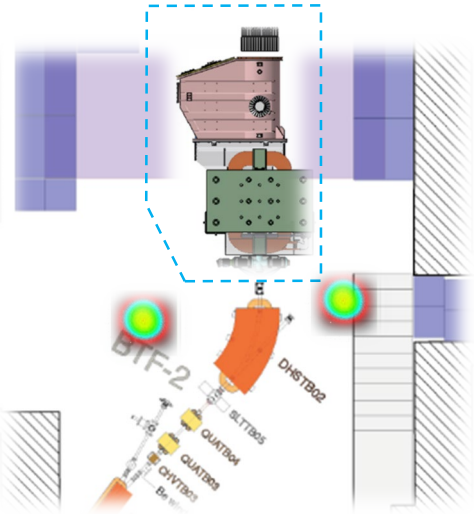


- Trials in 7 different position with Pb bricks shielding
- Y = beam plane (1240mm) ± 300mm
- Not found a significant BKG variation with these trials

PADME BACKGROUNG

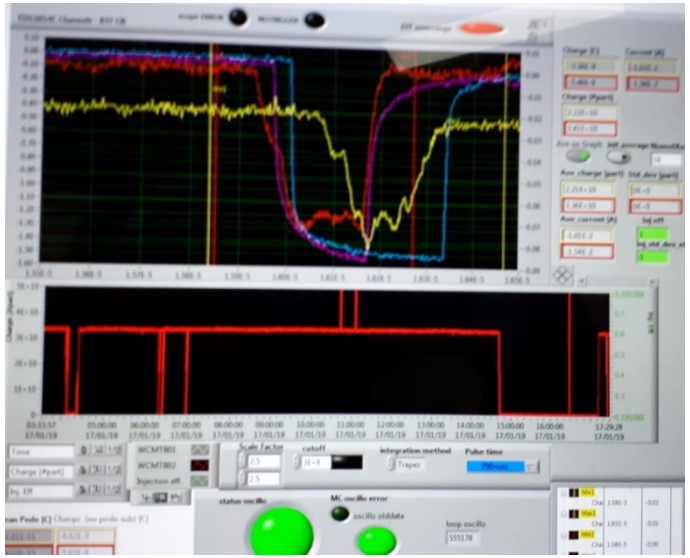
Actual **Positron Secondary Beam configuration** for PADME:

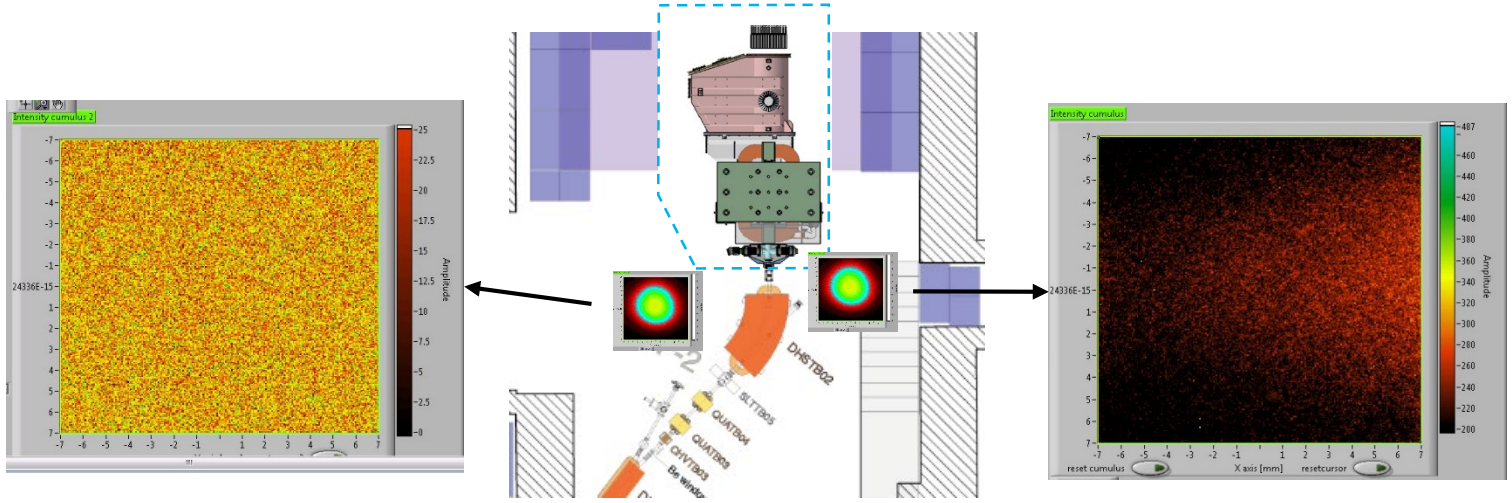
- Diffused low energy photon (≈10 MeV) background in BTFEH1 coming from target
- Some not fully understood background sources coming from pipes/Be-window



Strategies:

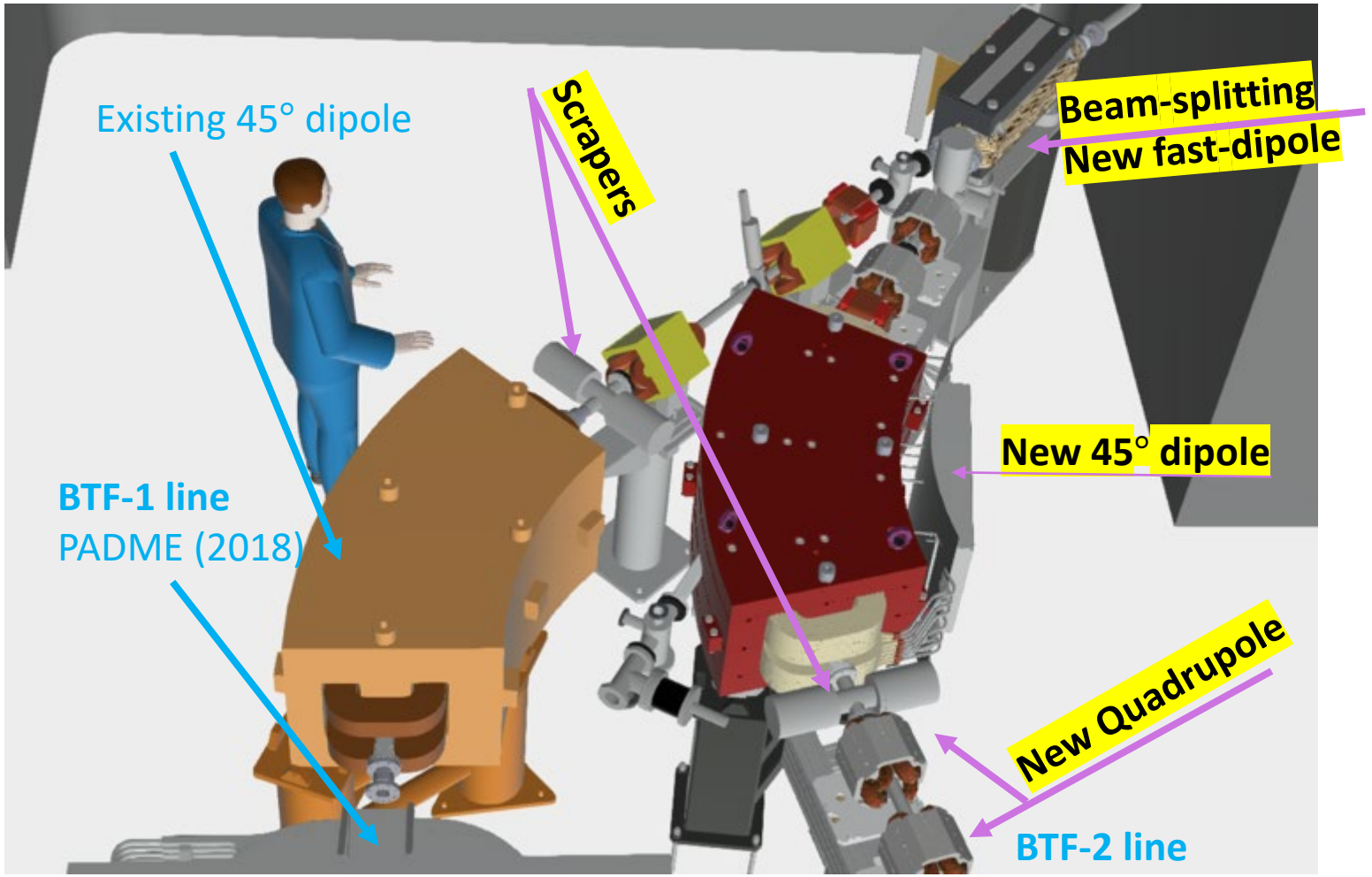
- Limited use of scraper
- Minimization on LINAC current density on target
- Modulator Timing studies to exploit X-Z coupling due to energy spread
- Beam Line and PADME MC simulations



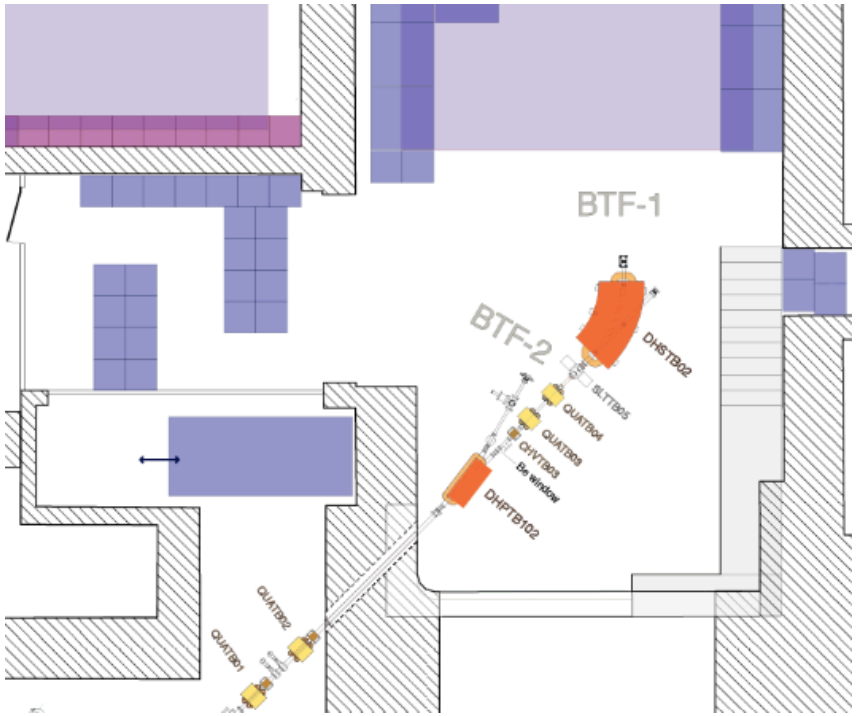


BTF DOUBLING LINE IN DETAIL

In the meantime of PADME run…

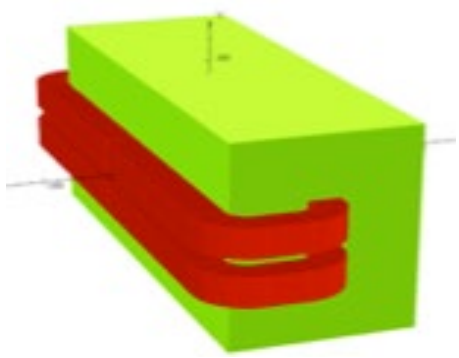


ACTUAL (w/o PADME)

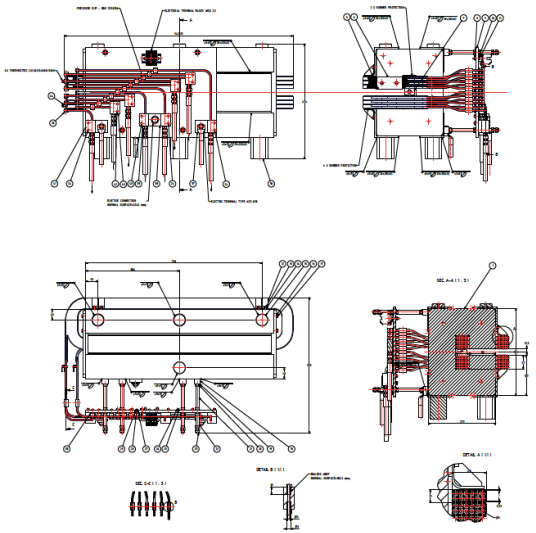


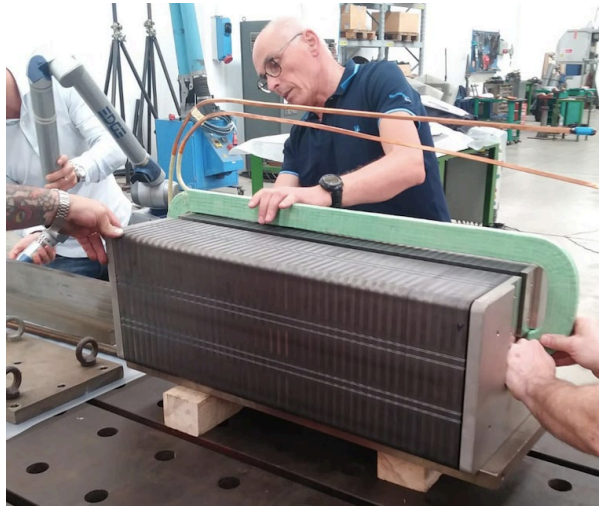
BTF DOUBLING LINE / MAGNETS

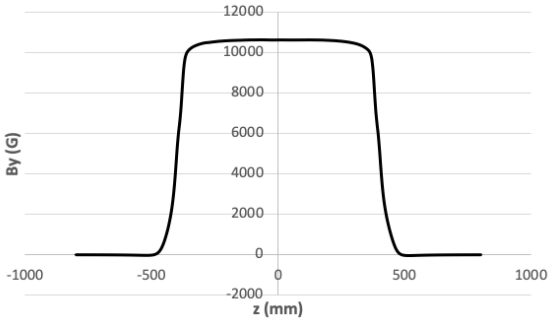
Fast C-dipole

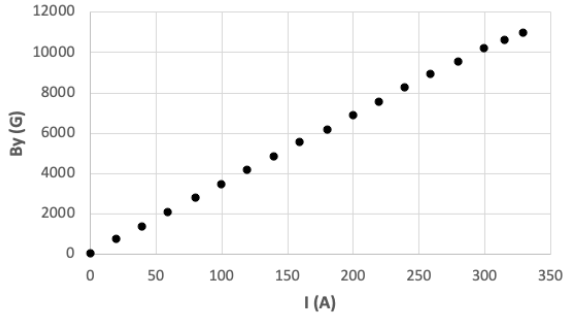


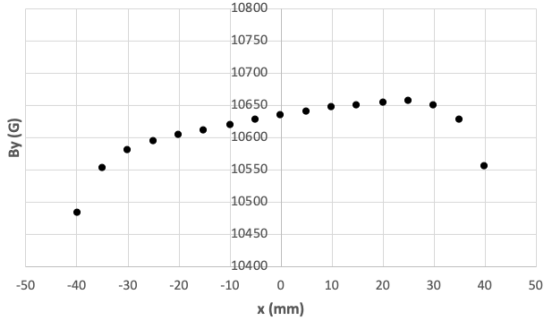
- Fast dipole - In house design (Late 2017)
- Construction at ORMET (Genova)
- Some issues on pole but seems ok
- Assembly in strong collaboration with LNF technicians
- Delivering, characterization and installation in June 2018
- Just used for BTF-2 beam commissioning



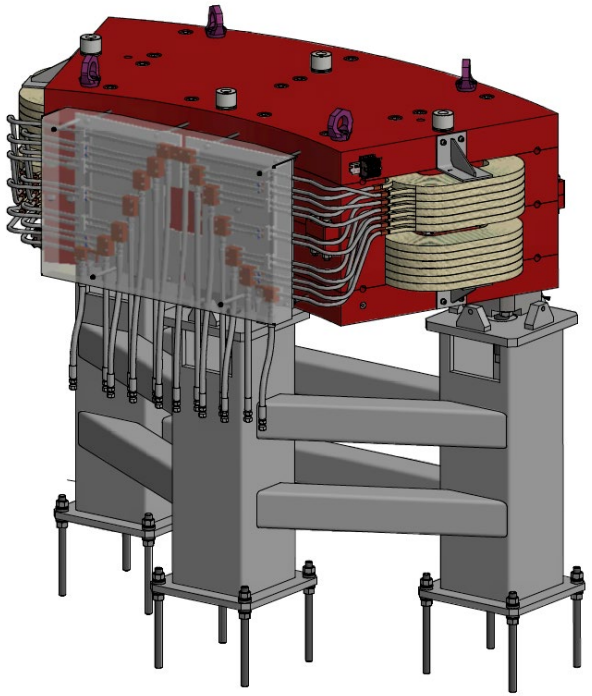






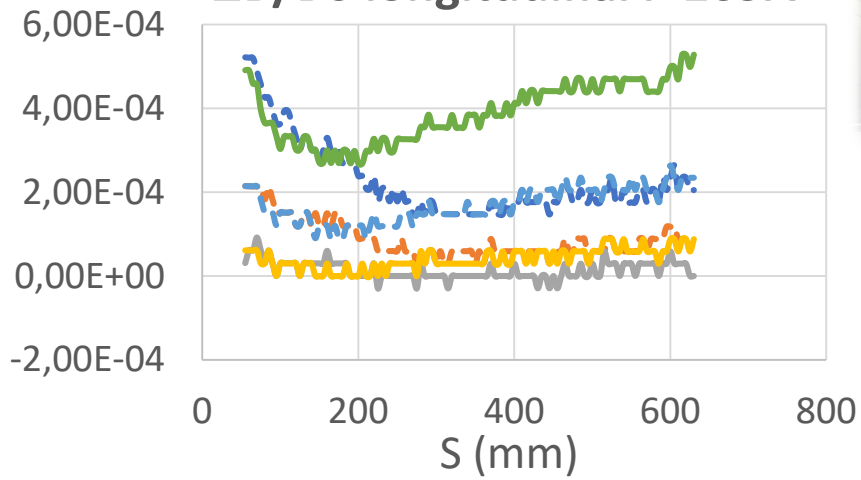


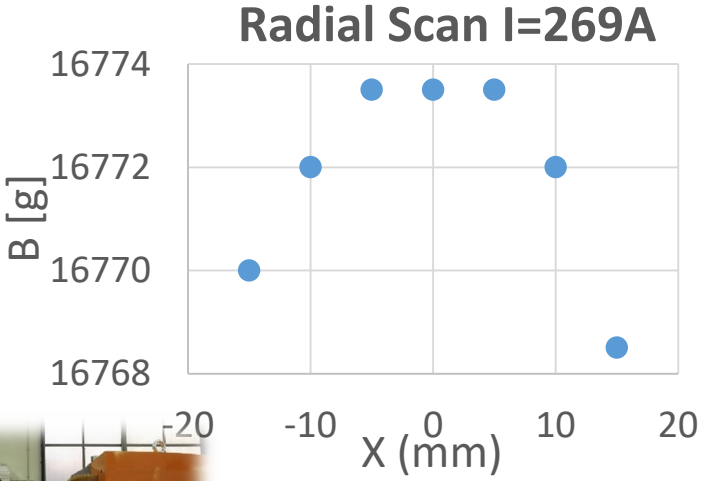
BTF DOUBLING LINE / MAGNETS

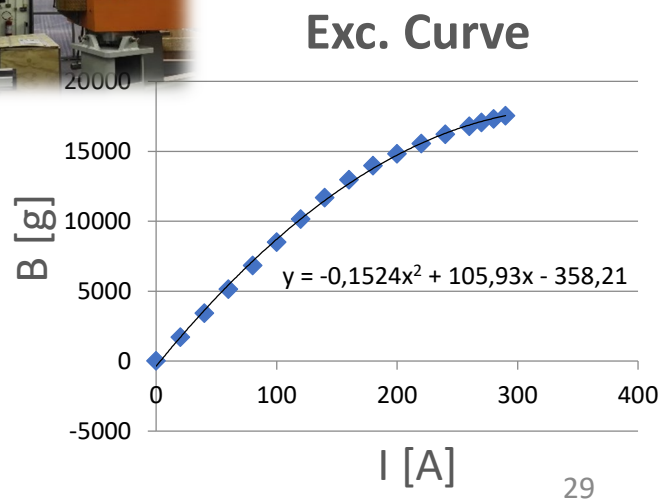


H-dipole

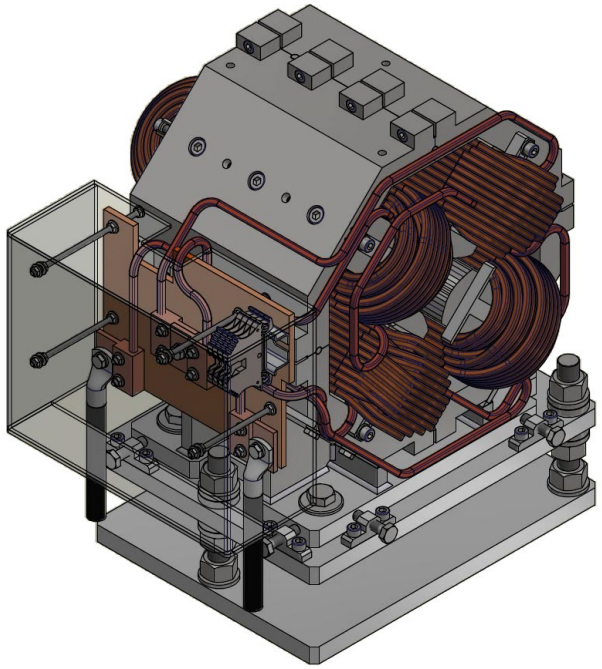
- H dipole - In house design and assembly (Late 2017)
- Construction at SIGMAPHI
- Delivering&characterization complete: March 2019
- Very good result in field measurement
- Installation prob Autumn 2019





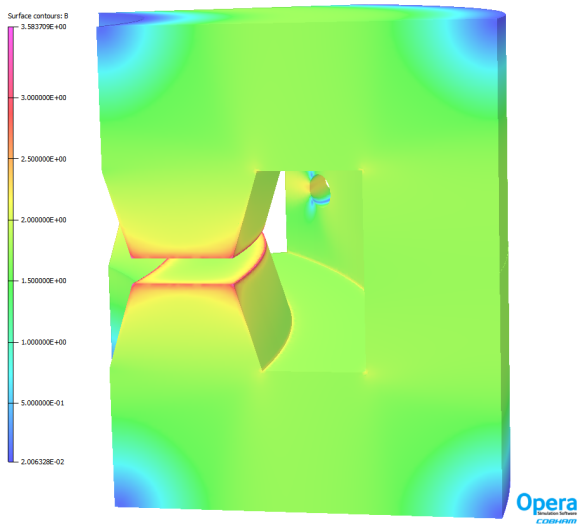


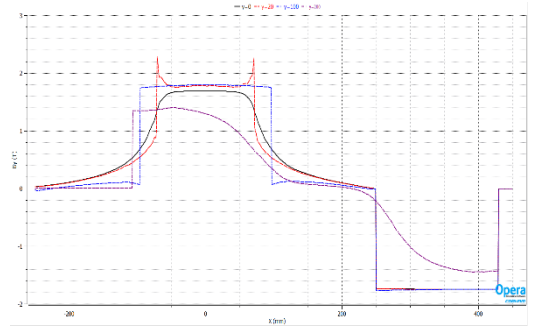
QUADS and C-Dipole



QUADS

- QUANTITA' 7
- Gradiente nominale 20 T/m
- Diametro Apertura 45 mm
- Lunghezza del nucleo magnetico 180 mm
- Larghezza del nucleo magnetico 270 mm
- Altezza del nucleo magnetico 270 mm
- Corrente Nominale 93 A
- Numero di spire per polo 45
- Resistenza del magnete 116 mΩ
- Induttanza del magnete 22 mH



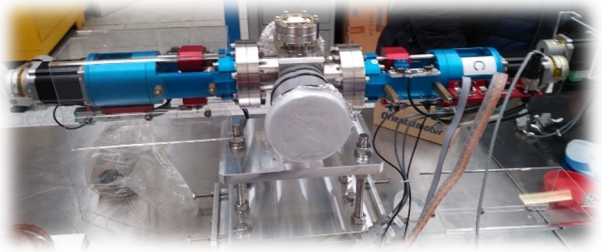


MAIN SPECIFICATIONS		
	Unit	**Value**
Beam Energy	MeV	920
Maximum Field	T	1,6878
Bending Radius	m	1,8
Magnet Lenght	mm	1108
Bending Angle	deg	35
Pole Iron Gap	mm	35
Integrated Field Quality		$1.3*10^{-3}$ over ±15mm
Number of turns per coil		104
Conductor dimensions	mm	9,5x9x5/ bore 5,5

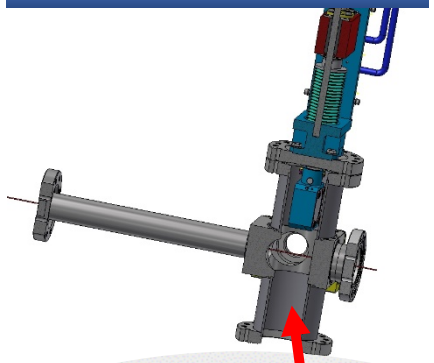
- Quads - In house design and assembly (Late 2017)
- Construction at SIGMAPHI
- Bid complete, in production
- Delivery expected at July 2019
- Installation prob. Autumn 2019

- Design and Construction at DANFYSIK
- Bid complete, in production
- Delivery expected at November 2019

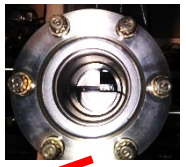
Scrapers, target, beam stopper and pipes

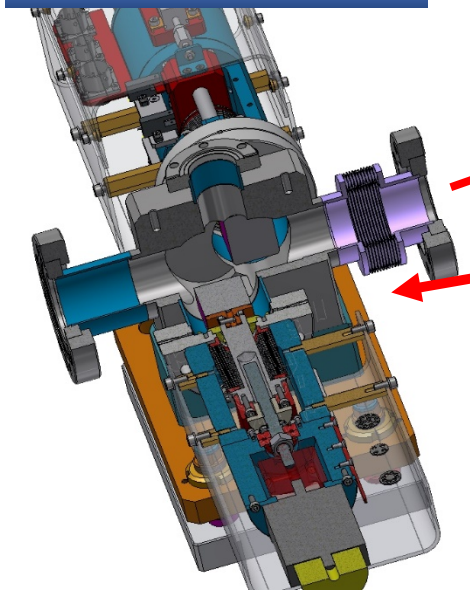


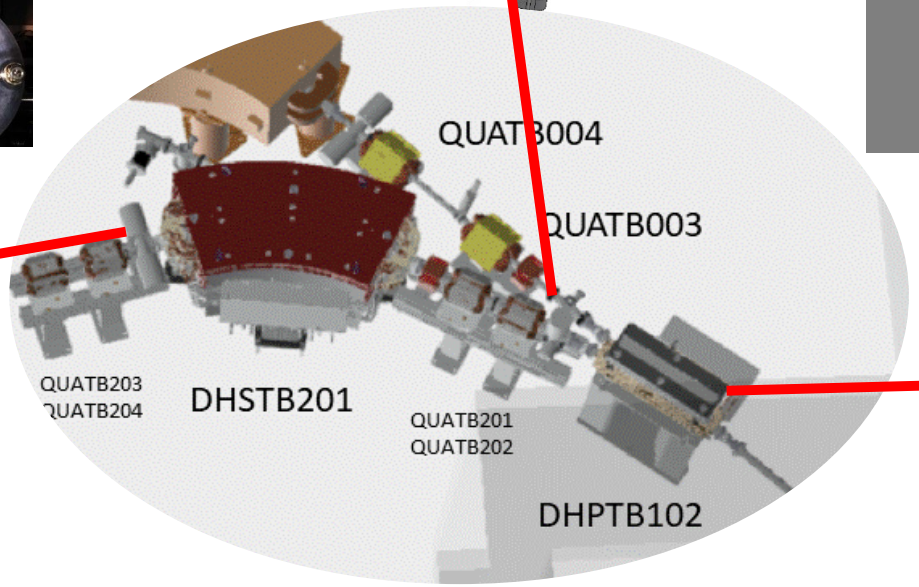
Beam stopper and target



Overlapped blade scrapers





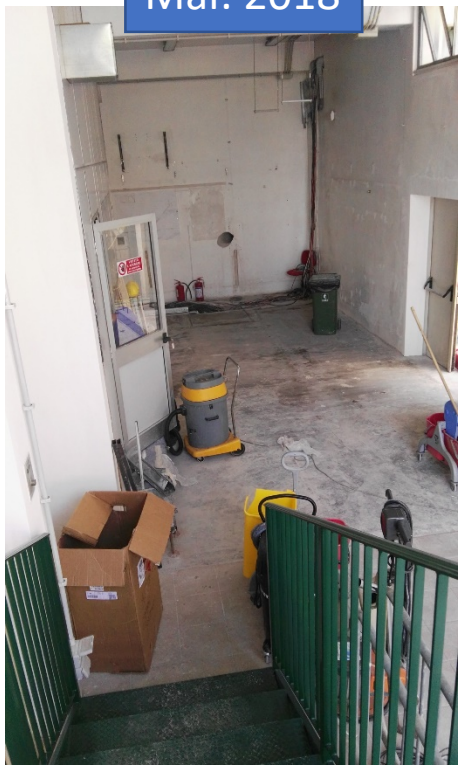


- In house new design of:
  - overlapped blade scraper (10um step)
  - two position, thin Cu target
  - thin walled pipes for DP(installed) and DC(working) magnets
- For the scrapers and target:
  - Electronics, controls, vacuum OK!
  - Ready to be installed

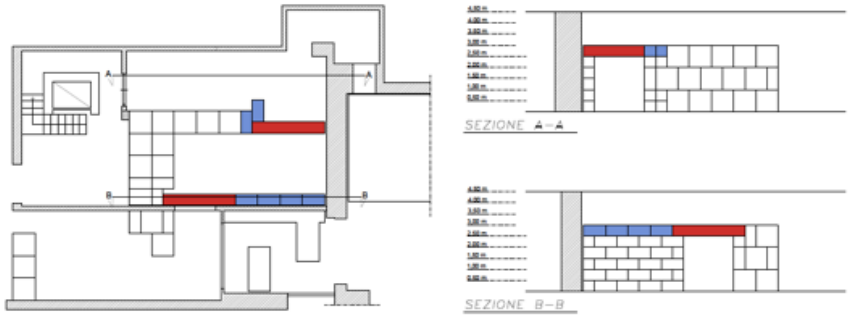
Aluminium thin wall DP01

BTF DOUBLING LINE / BTF-2 BUNKER

Mar. 2018



- Completely mapped with overall BTF+LINAC placing network
- Not totally complete due to waiting remaining magnets and cooling pipeline
- All of the remaining concrete blocks are ready
- Not so much problems in deploying



Mar. 2019

BTF DOUBLING LINE / SERVICES

AIR and COOLING

Sep. 2018

Apr. 2019

Apr. 2019

Used for PADME RUN1 and BTF2 commissioning
Improved project for both the hall
Close to commissioning :

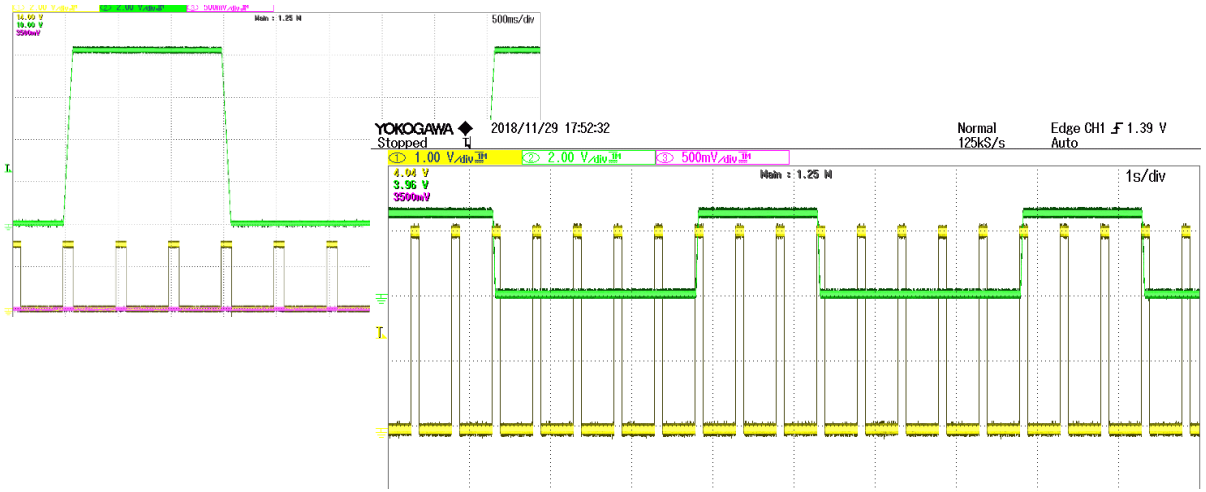
- Final connection to the upgraded capability LINAC cooling tower (now using the old one)
- Ventilation machine group on the BTF roof (next week commissioning)

BTF DOUBLING LINE / POWER SUPPLY

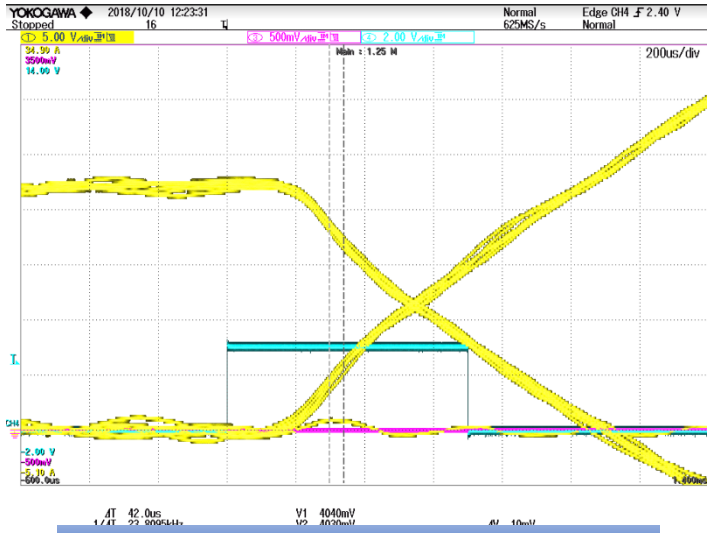
Fast C-dipole

- Used for BTF-2 beam commissioning with DAFNE timing sequence signal
- EEI manufactured in strong collaboration with LNF
  - Implementation of an automated beam delivery machine in the PS firmware, initially for debugging purposes
- Cable routing complete for all of the magnets in the new BTF PS hall
- Delivered in December 2018
- Installation in June 2019 after fixing the new BTF PS hall, not ready due to needed floor enhancement

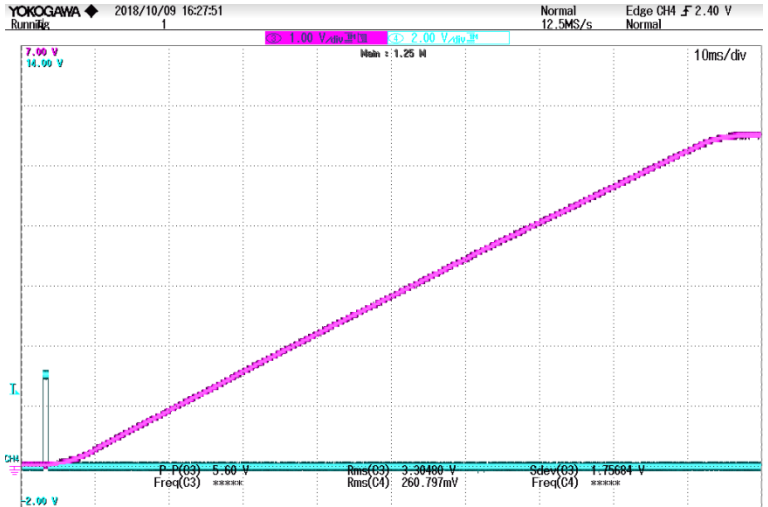
Temporary location of pulsed dipole power supply (waiting for final cooling system)



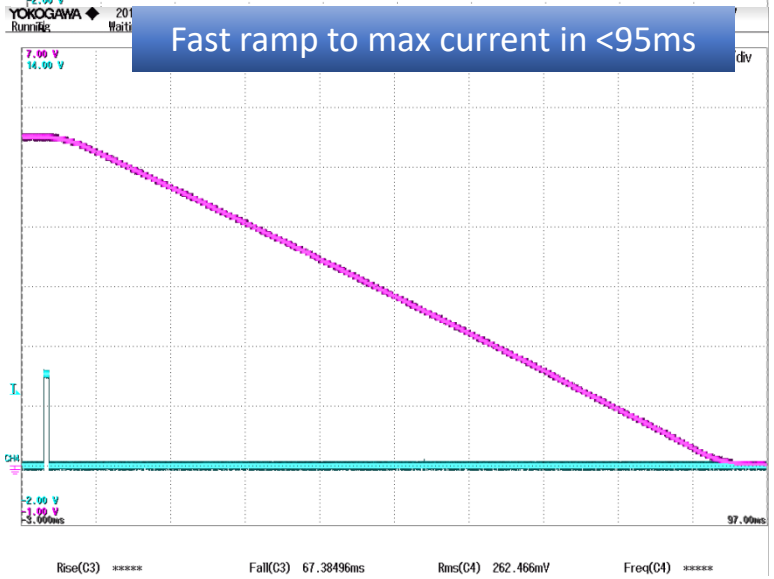
BTF D. L. – FAST DIPOLE POWER SUPPLY

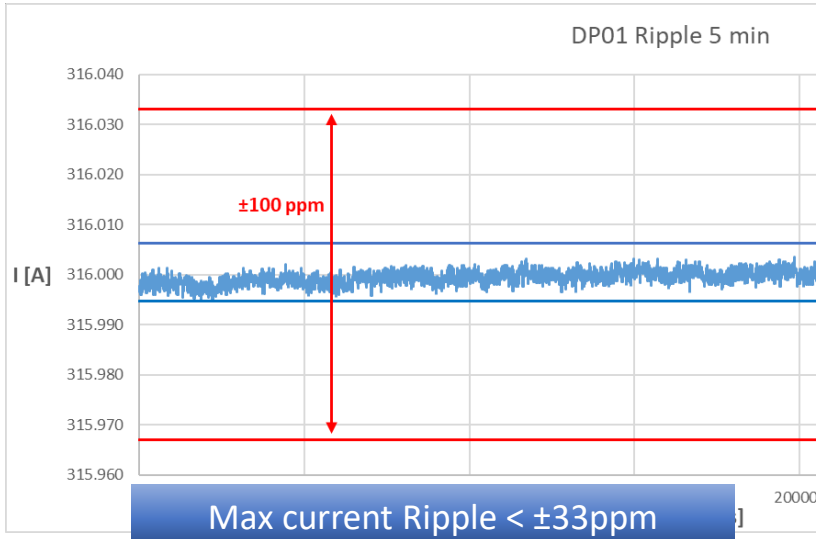


Ramp start time jitter < 50µs

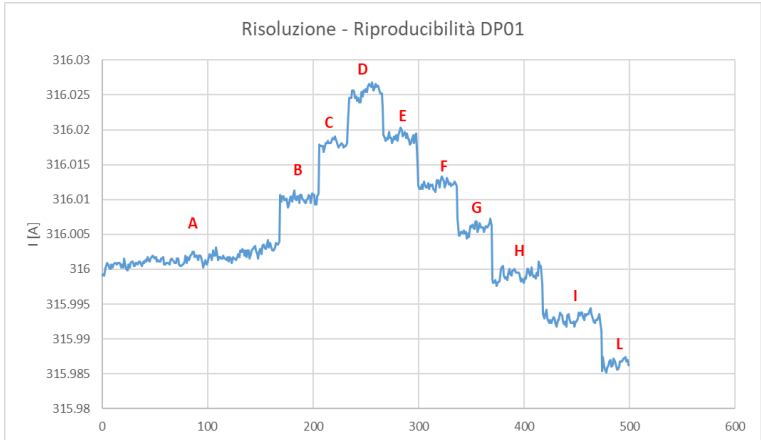


Fast ramp to max current in <95ms

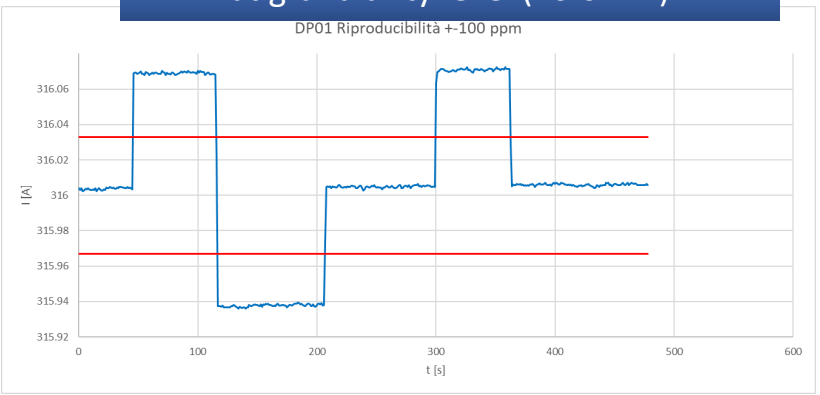




Max current Ripple < ±33ppm

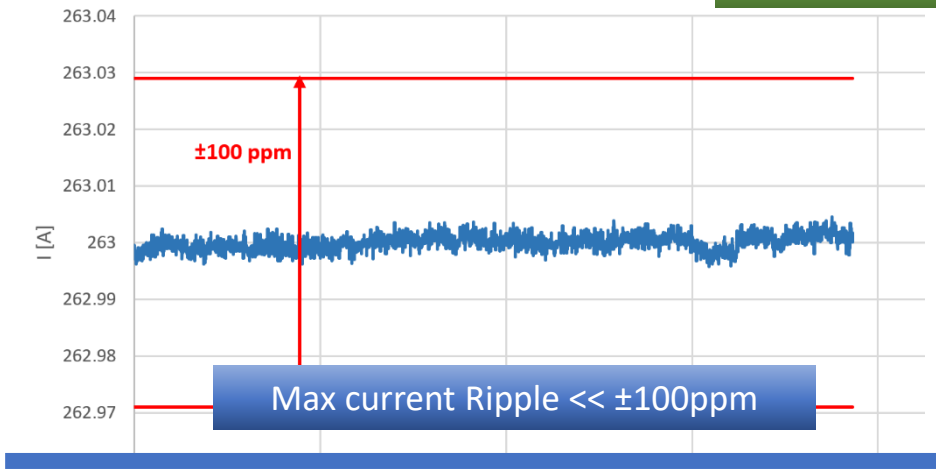


Current Resolution and reproducibility at granularity level (±6.6 mA)

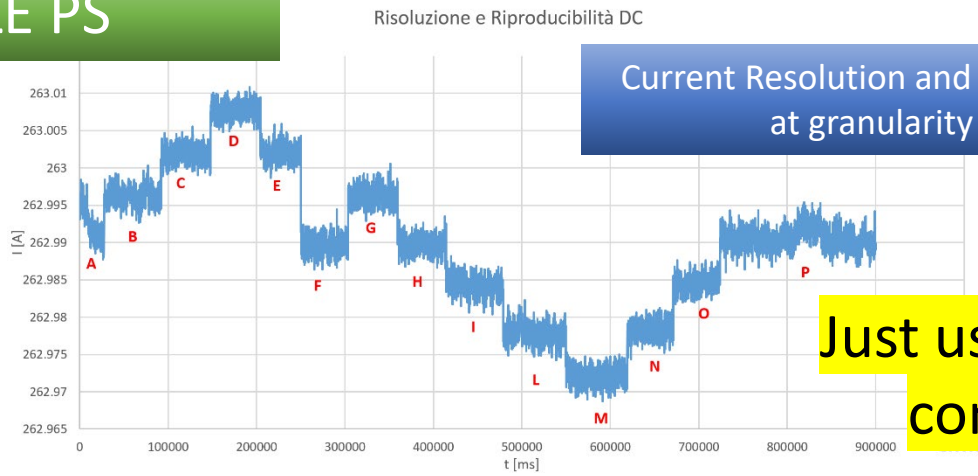


BTF D. L. – DIPS&QUADS POWER SUPPLY

DIPOLE PS



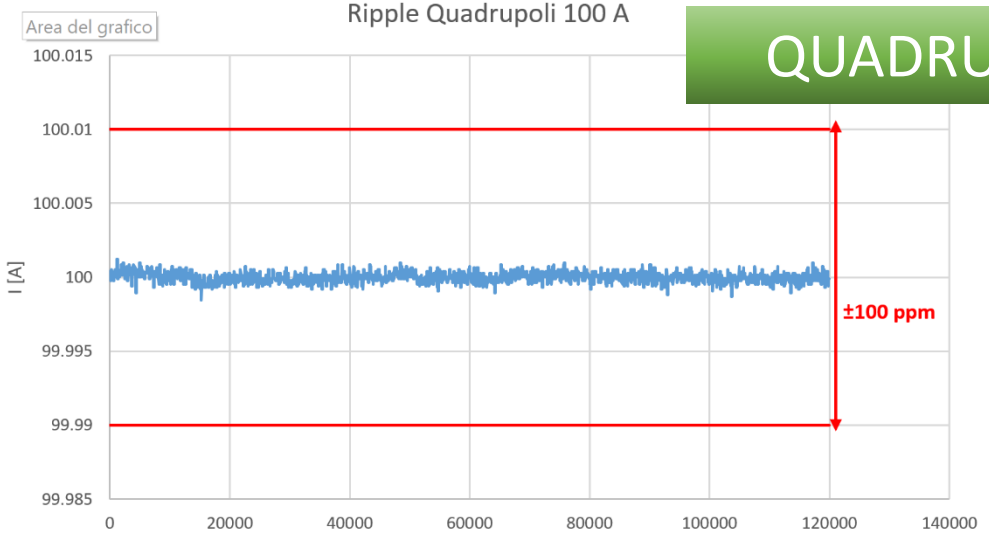
Max current Ripple << ±100ppm



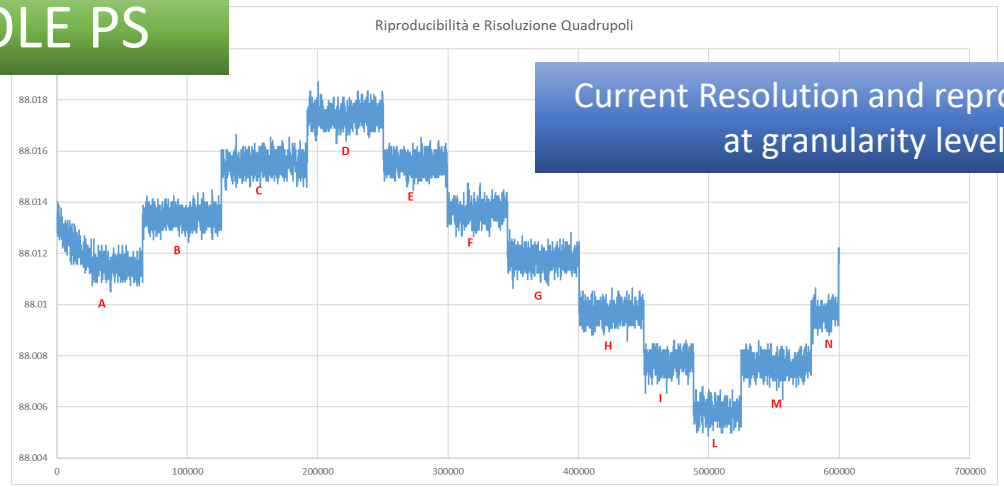
Current Resolution and reproducibility at granularity level

Just used for H-dipole commissioning

QUADRUPOLE PS



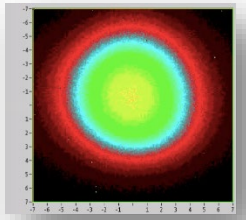
Max current Ripple << ±100ppm



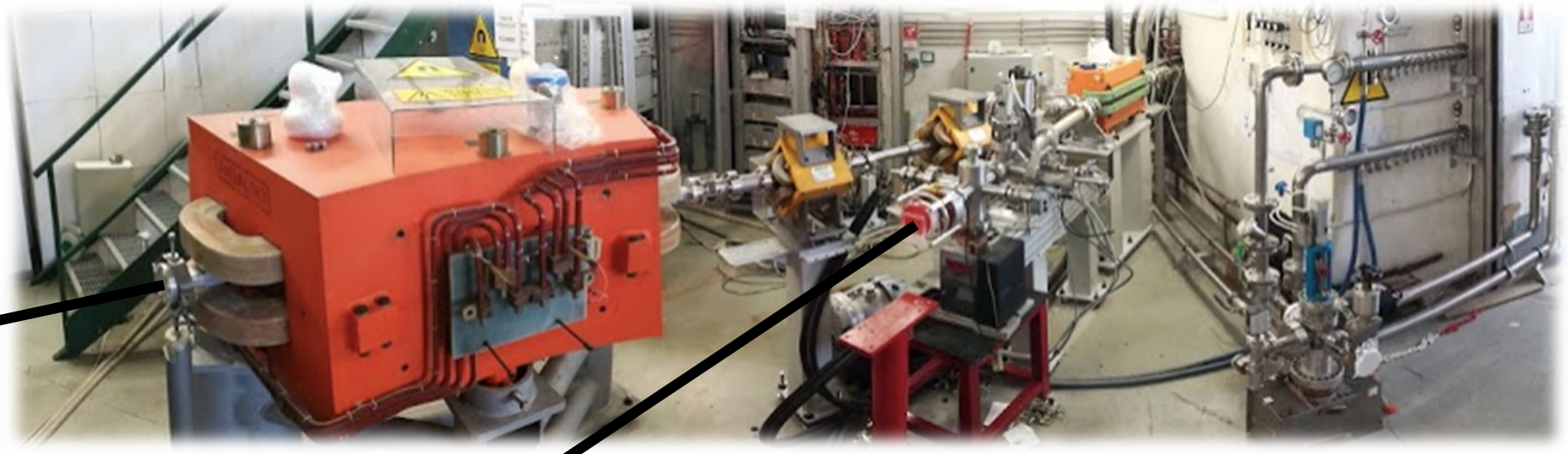
Current Resolution and reproducibility at granularity level

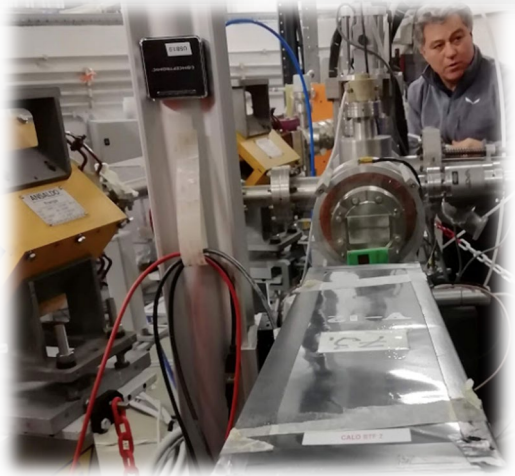
BTF-2 BEAM COMMISSIONING

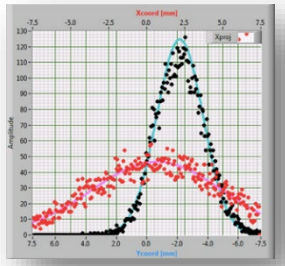
In the PADME run meantime…

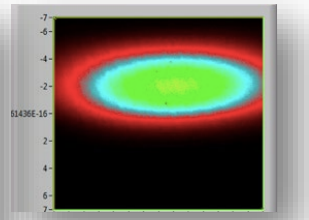


3×3 mm² RMS









4×1.5 mm² RMS

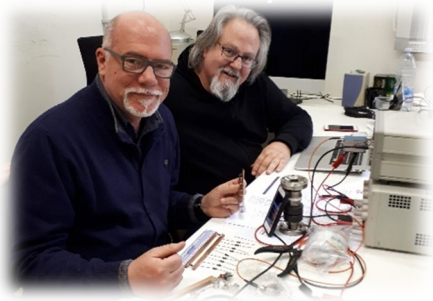
- Two days in the last end of PADME RUN1
- 490 MeV primary positron beam
- Same upstream optics, no optimization
- Few shot due to some needed fix and to permit RUN1 test with positron

- Second set of beam diagnostics (Silicon pixel, calorimeter) available

LINAC ACTIVITIES

- SPARC modulators management
- LINAC up for PADME from Sept 2018 up to the end of Febr. 2019
- *Few problems during the run, mostly opportunistic maintenance*
  - Few stop due to electronic board fake interlock
  - Thyratron substitution on Mod. A and EOL resistors in Mod C.
  - New BCM installed

- *Linac Consolidation*
  - New thyratron cooling system
  - New cooling circuit for the HVPS mods

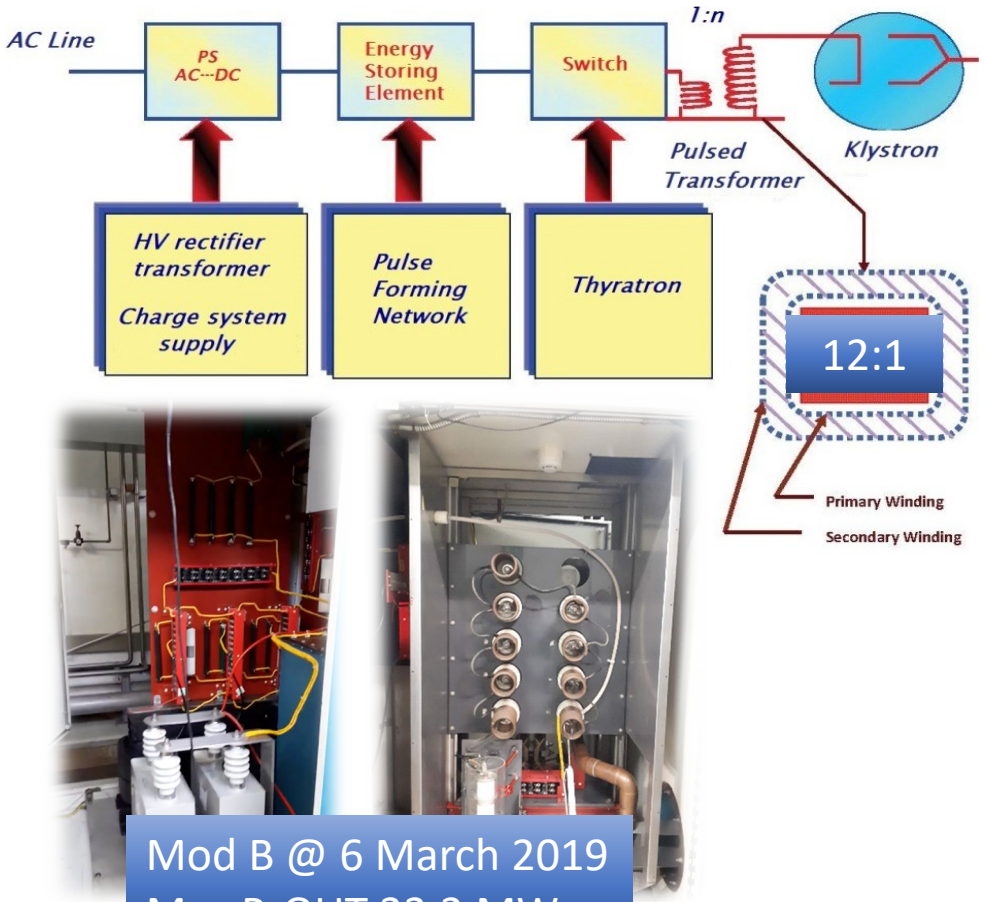


- *Linac Upgrade*
  - Rush to save time in the switching period from PADME to SIDDHARTA2 (got it, sharing time with SPARC requirements)
  - Installation of second couple new solid state TDK M.303 (Master+Slave) + Junction Box + 15:1 transformer -> final setup in mod racks
  - Trials on new embedded modulator control system (Mod.B)

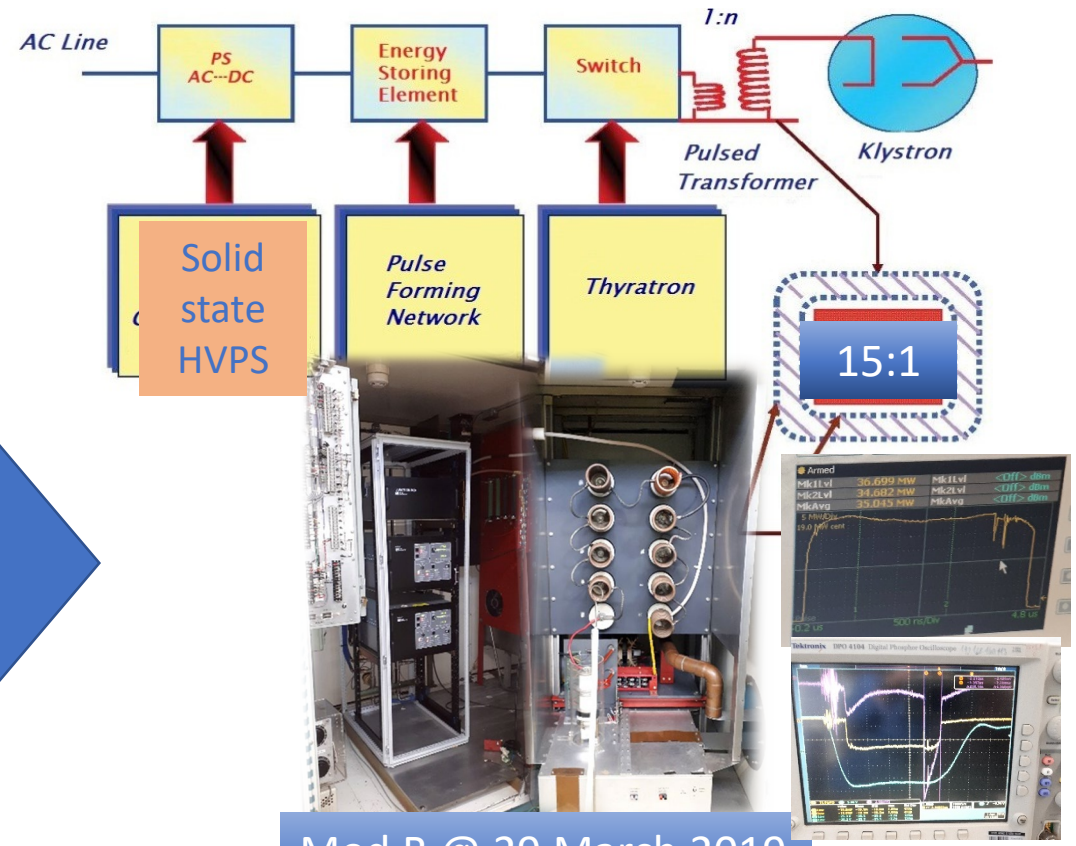
LINAC UPGRADE – MOD.B FINAL SETUP

Old fashioned HV 3-p rectifier to solid state cap charging HVPS

- Bid assigned to TDK -> bunch of couple Mod.303, at each arrival prompt installation to mods
- Fully operational on mod D in test setup from March 2018.
- Fully operational from 29th March of 2019 in final setup in modulator B.



Mod B @ 6 March 2019
Max P. OUT 33.2 MW



Mod B @ 29 March 2019
Max P. OUT 36.1 MW

LINAC UPGRADE – MOD.B FINAL SETUP

Huge retrofit effort to match the previous TITAN BETA HVPS installation, both for aged electronics and safety implementation philosophy

Mod. **D** test setup

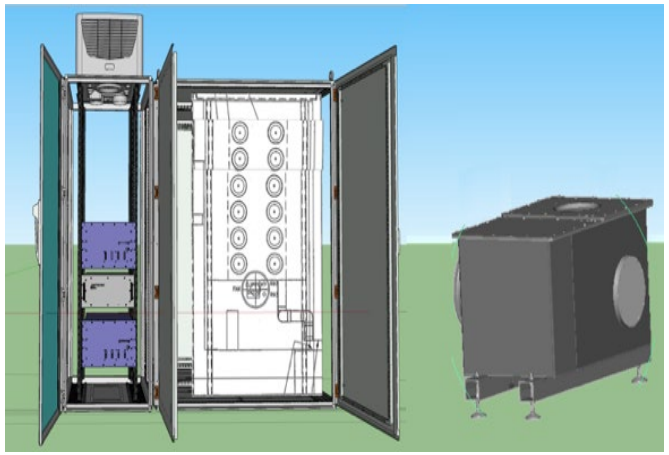
Mod. **B** HVPS final setup

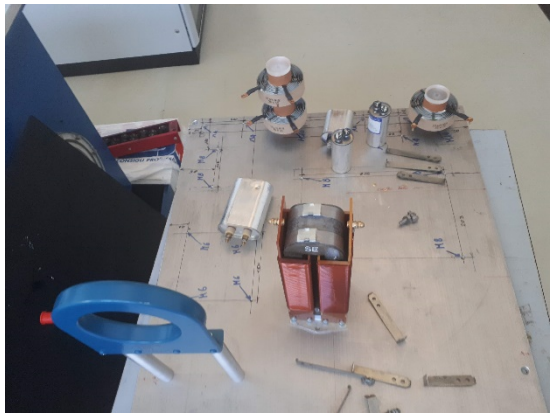
Mod. **B** LCS test setup

New Local Control System installed on mod B in «spy» mode:

- Based on NI C/RIO+PXI
- Software development in progress
- The FPGA DAQ runs monitoring the modulator, without controlling it.
- Working since beginning of Oct: ’18
- The fault statistics detected between old control system and new ones are consistent at 98%. In investigation the differences.
- Test on the Analog and Digital Signal on-going and **first try to control** the modulator with new system tested for 1h in April 2019.
- Still to be tested in dedicated mode for safety issue on Mod B

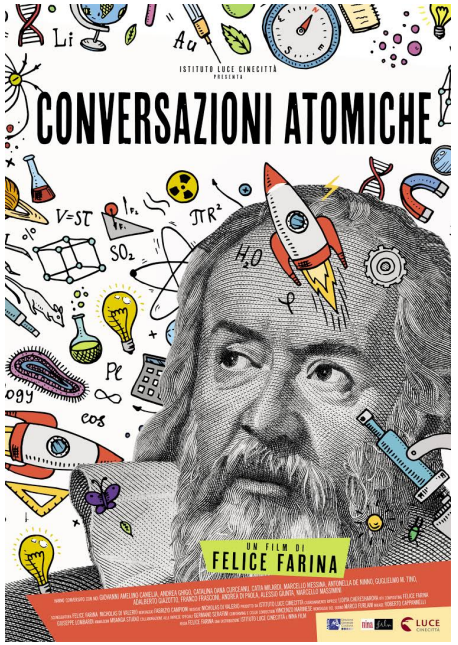
LINAC UPGRADE - NEW E MODULATOR





- Using test experience will optimize the design for the new modulator in house installation
- All of the Tank elements are in preparation for installation
- Some re-machining in the tank due to construction errors
- These items are in slow but constant implementation

DISSEMINATION&EVENTS



- Several Local and National TV&Radio News
- Consultants for a science based movie “Conversazioni Atomiche” Istituto Luce prod., Felice Farina director
- Public conference for Fermhamente Exbition
  - Educational Cosmic ray stand
- LNF educational days and events

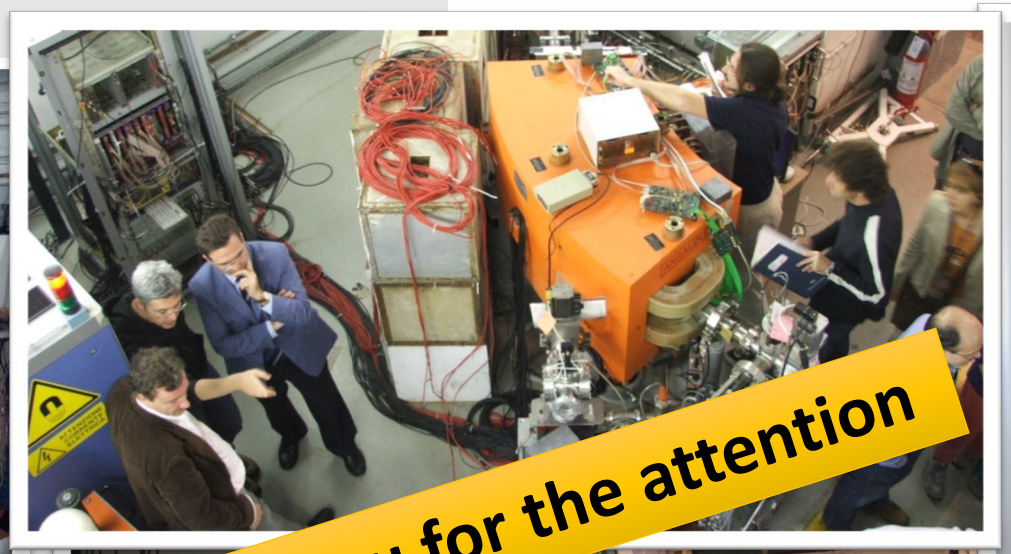
CONCLUSIONS

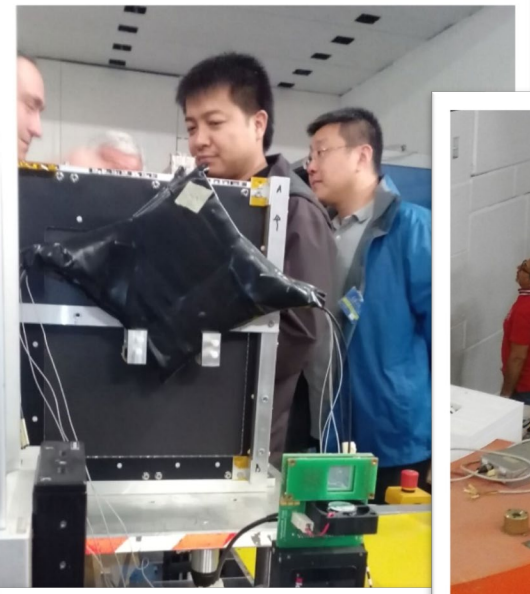
- BTF-1 routinely operational since September 2018
- PADME RUN1 accomplished
- Beam delivered also on the new BTF-2 line, operating the beam switching dipole
- Users test-beam call opened in February 2019
  - First week of June 2019: users on BTF-2 line foreseen

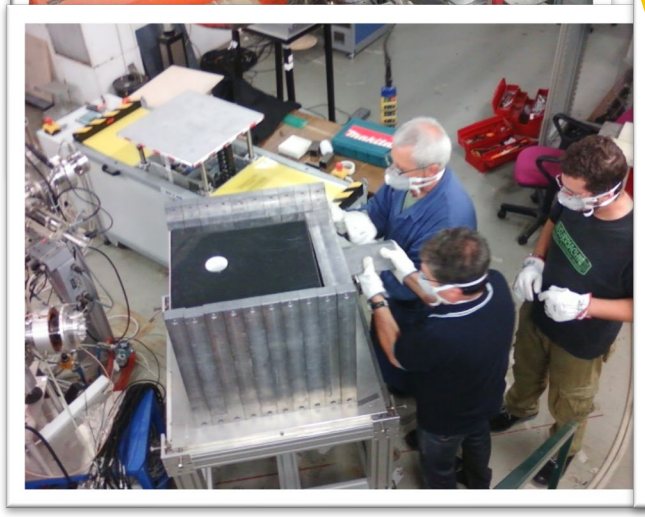
- Mar. 2019: LINAC long maintenance (refurbishing of modulators' PFN charging power supplies) done

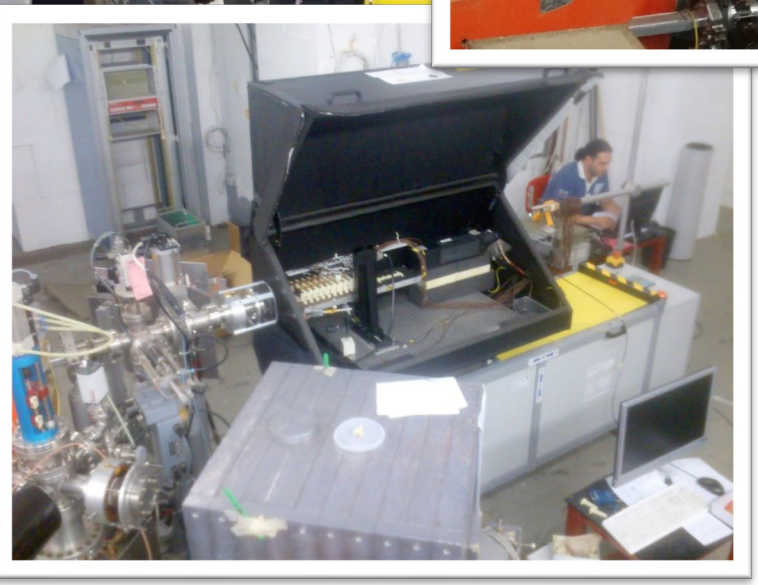
- Magnets, supports, etc. for transporting the beam in the second bunker are available or in final production
- Waiting for authorization of bunker BTFEH-2 (still pending at the Ministry, hopefully last step)
- Installation of last part of BTF-2 branch possible in September 2019
  - In this case, PADME restart possible from October 2019

BTF AMARCORD







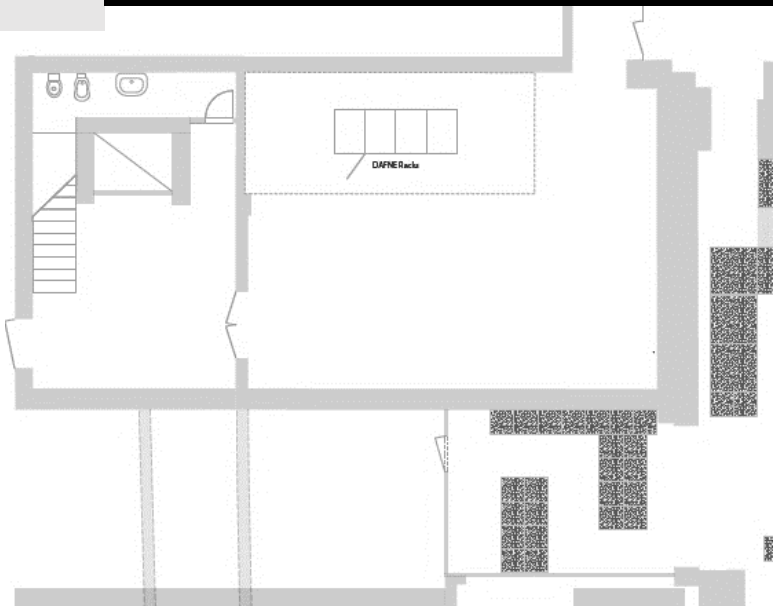


Thank you for the attention

SPARE SLIDES

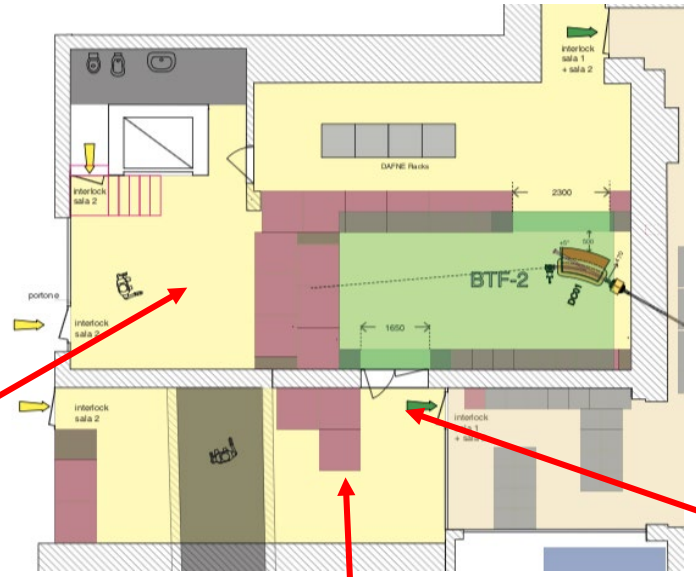
EXTERNAL BTF EXP. HALL 2

Starting point civil w.
(Winter 2018)



EXTERNAL BTF EXP. HALL 2

Start Civil w. Phase 1 (Winter 2018)

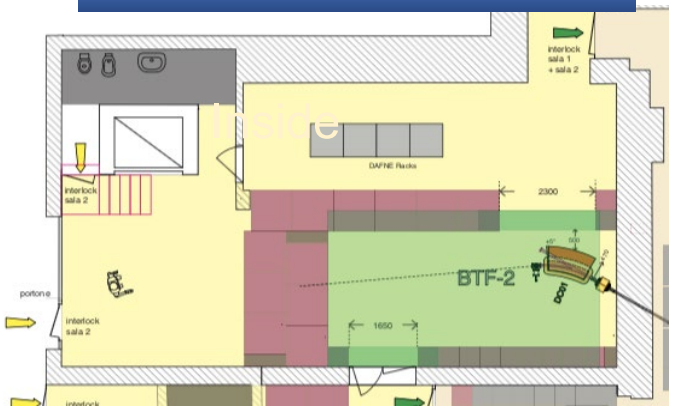


- New main entrance
- BTF 2 Secondary entrance
- Improving floor strength for BTF2 shielding chicane

INTERNAL BTF EXP. HALL 2

Start & Preparation (Winter 2018)

formerly BTF control room

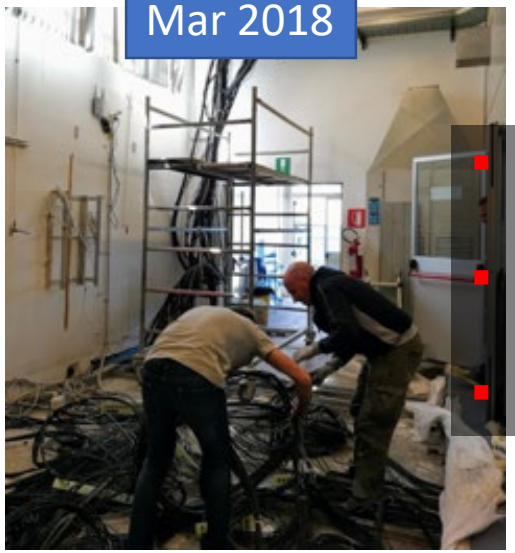


Dec 2017

Jan 2018

Feb 2018

Mar 2018



- Dismantling control room equipment
- Fixing interference with DAFNE subsystems
- Remove false floor

- Deeply joined with very fragile DAFNE subsystem
- Re-organize **all cables routing**
- Prepare demolitions

INTERNAL BTF EXP. HALL 2

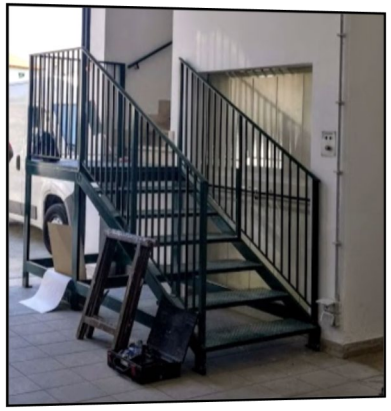
Civil w. Phase 2 (Spring 2018)

- Make room for the bunker in the second experimental hall
- Remove internal wall

INTERNAL BTF EXP. HALL 2

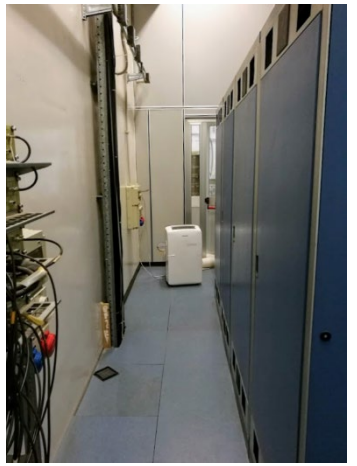
Civil w. Phase 2 (Spring 2018)

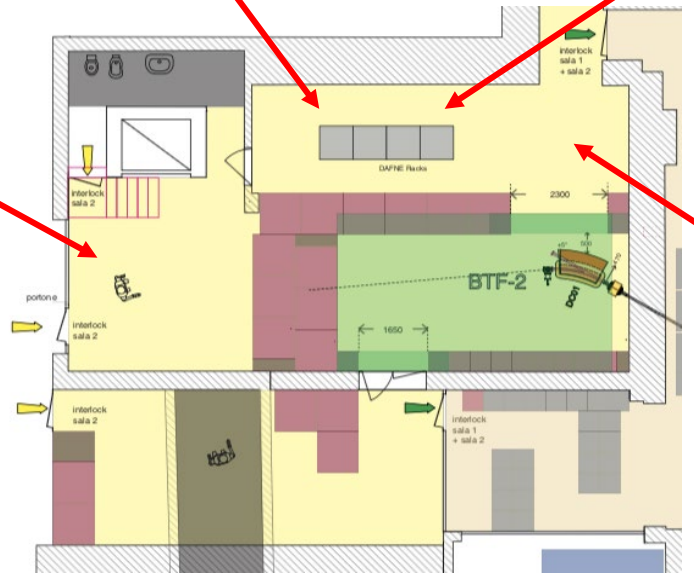
- Reinforcing pavement for magnet installation
- Working over on cable pit for 9 years…

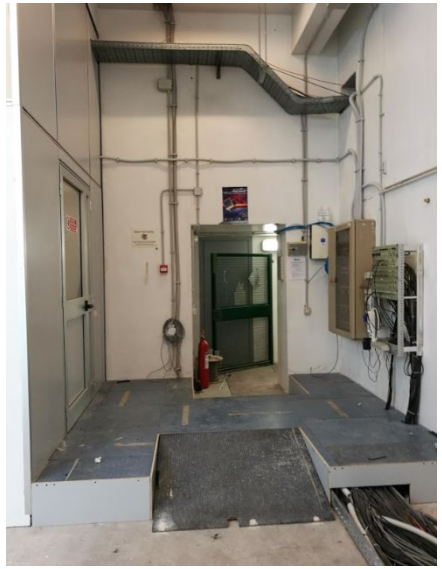


INTERNAL BTF EXP. HALL 2

Civil w. Phase 2
(Summer 2018)



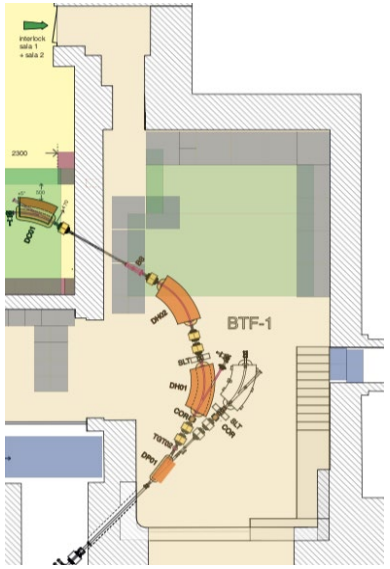




- Maintaining a conditioned space for DAFNE racks
- Make a comfortable passage for BTF1 and racks op.s
- Deeply accordance with RSPP and Rad Safety group

INTERNAL BTF EXP. HALL 1

Preparation & start (Winter/Spring 2018)

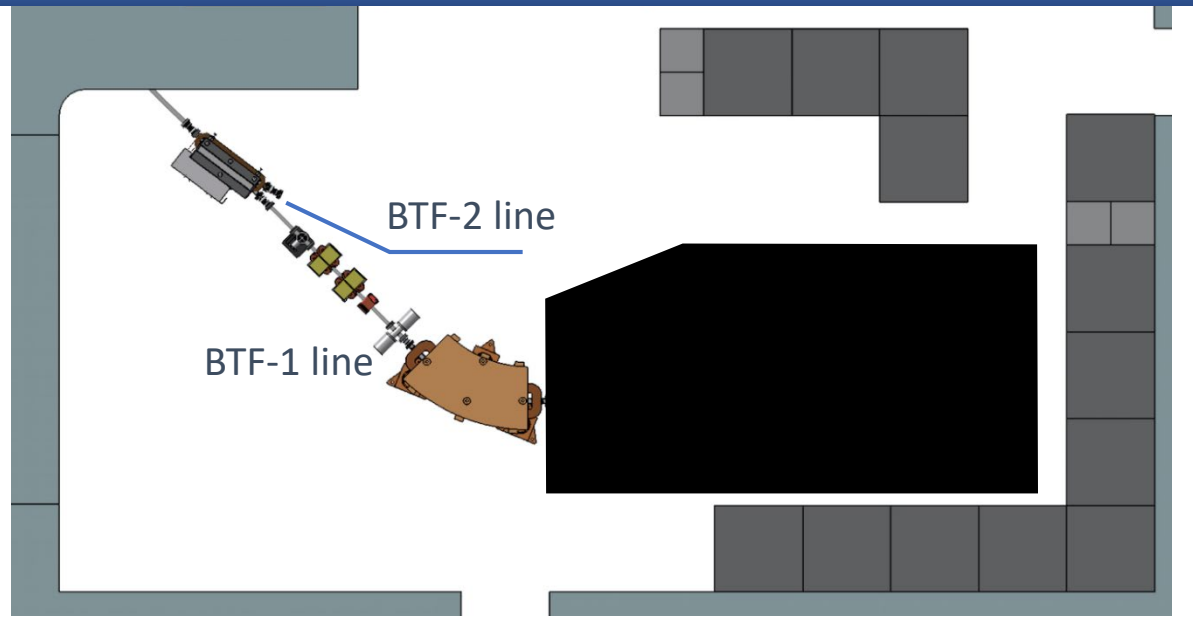


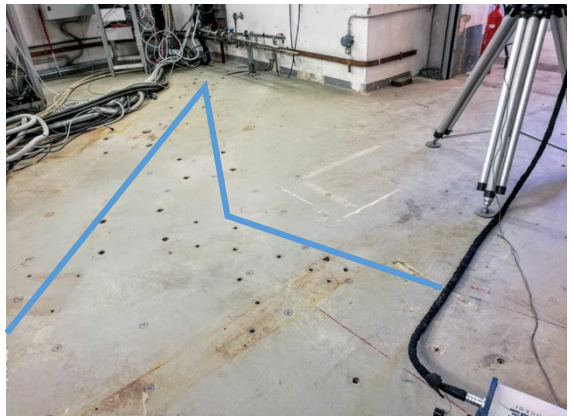
- Dismantling (almost all) cables, shielding, services
- Removing vacuum pipe and pumps, magnets and girder
- Has been found the perfect match with the assembly operation in BTFEH 2

INTERNAL BTF EXP. HALL 1

Civil w. Phase 2
(End Spring 2018)

Ready for hosting PADME (Init Summer 2018)

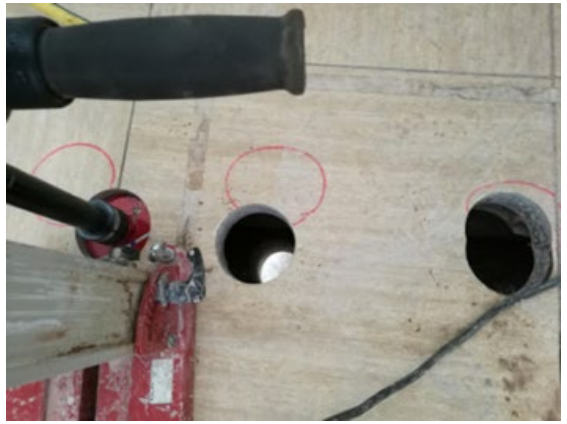




- Both of the halls prepared for a fresh installation
- Blue lining and hole drilling
- New services started to be implemented in (supervisor endpoint, new compressed air and water cooling pipeline)
- Restoring the fixed alignment sight point for the entire BTF1 and BTF2 alignment network

INTERNAL BTF EXP. HALL 1&2

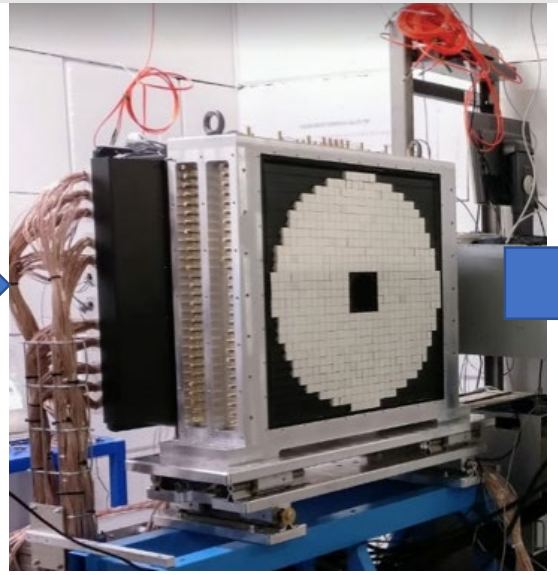
Civil w. Phase 2
(End Spring 2018)

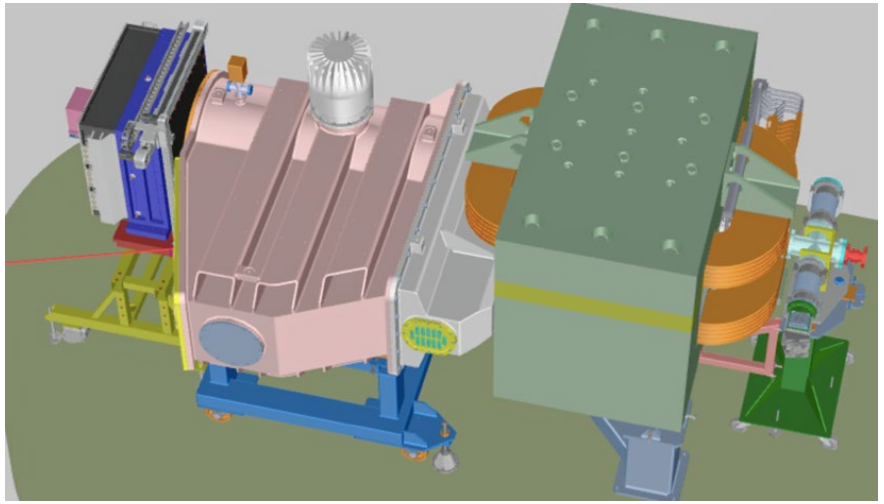


- Drilling hole for pipe in BTFEH2
- Holes also for a new Power Supply hall, second floor
- Implementation of a new routing for cables (safety, interlocks, power supply)
- Implementation of the upgraded safety system

BTF1&PADME INSTALLATIONS

BTF 1 Commissioning (June2018)





- Very strong collaboration between PADME team and LNF-AD-BTF staff to match PADME detectors in BTF environment (network, air, cooling, power, safety, controls and rad interlocs…)
- Implemented safety rules for BTF access by PADME user

DP01

Quads

QUADS

- QUANTITA’ 7
- Gradiente nominale 20 T/m
- Diametro Apertura 45 mm
- Lunghezza del nucleo magnetico 180 mm
- Larghezza del nucleo magnetico 270 mm
- Altezza del nucleo magnetico 270 mm
- Corrente Nominale 93 A
- Numero di spire per polo 45
- Sezione del conduttore 5mmx5mm (foro diametro 3 mm)
- Resistenza del magnete 116 mΩ
- Induttanza del magnete 22 mH
- Tensione nominale 11 V
- Potenza nominale 1020 W
- Peso del ferro 48 kg
- Peso del rame 16 kg
- Peso totale 64 kg
- Numero di circuiti dell’acqua per magnete 2
- Aumento di temperatura dell’acqua 18 °C
- Portata totale nominale 0.015 l/s
- Velocità nominale dell’acqua 1 m/s
- Perdita di pressione nominale 3.7 bar

DC01

Magnet type	DC01
Quantity	1
Beam Energy (MeV)	920
Deflection Angle (°)	35
Gap Aperture (mm)	35
Curvature radius (mm)	1800
Nominal flux density (T)	1.71
Maximum Integrated Field Quality	1E-3 over ±15 mm
Maximum $\Delta B/B_0$	1E-3 over ±15 mm
Hollow Copper Conductor Dimension provided by INFN (mm)	9.5x9.5 hole diameter 5.5
Beam trajectory height from the floor (mm)	1240
Maximum coils overhang from the iron yoke end faces (mm)	250
Minimum Clearance Between the two Coils (mm)	60

PARAMETER	VALUE
Beam Energy (MeV)	926
Deflection Angle (°)	35
Nominal flux density (T)	1.7099
Maximum Integrated Field Quality	7.7E-4 over ±15 mm
Maximum $\Delta B/B_0$	2.4E-4 over ±15 mm
Overall Width (mm)	855
Overall Height (mm)	686
Overall Length (mm)	1440
Mechanical iron yoke aperture angle (°)	33.77
Turns per pole	130
Pancake per pole	5
Pancake turns configuration	13horizontal 2vertical
Hollow conductor cross section (mm)	9.5x9.5mm hole diameter 5.5mm
Magnet resistance (mΩ)@25°C	209
Magnet inductance (mH)	436
Nominal current (A)	235
Nominal voltage (V)	60
Nominal power (kW)	12
Iron weight (kg)	1800
Copper weight (kg)	480
Total weight (except the magnet support) (kg)	2280
Nominal water temperature drop ΔT (°C)	15
Nominal total water flow (l/min)	14.5
Nominal water velocity (m/s)	1.02
Nominal pressure drop ΔP (bar)	3