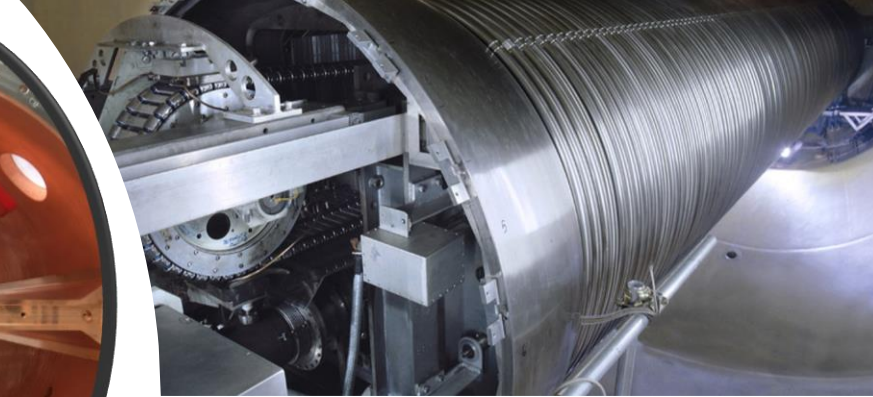


Stable beam at LNL

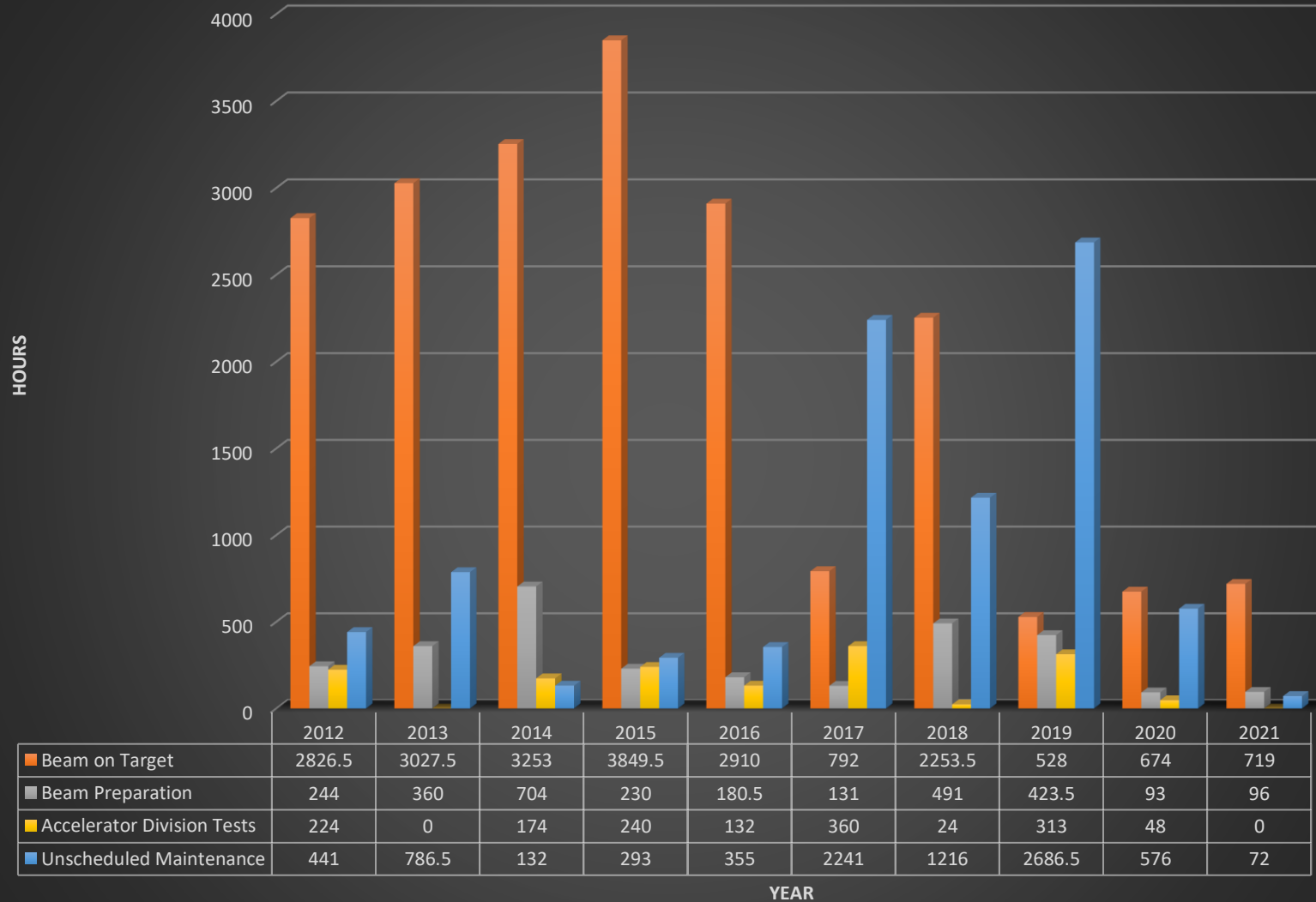
E. Fagotti

Summary

- PTA accelerators status before maintenance
- Next years goals for stable beams
- Extraordinary maintenance 2021-2022 results
- SPES RFQ status

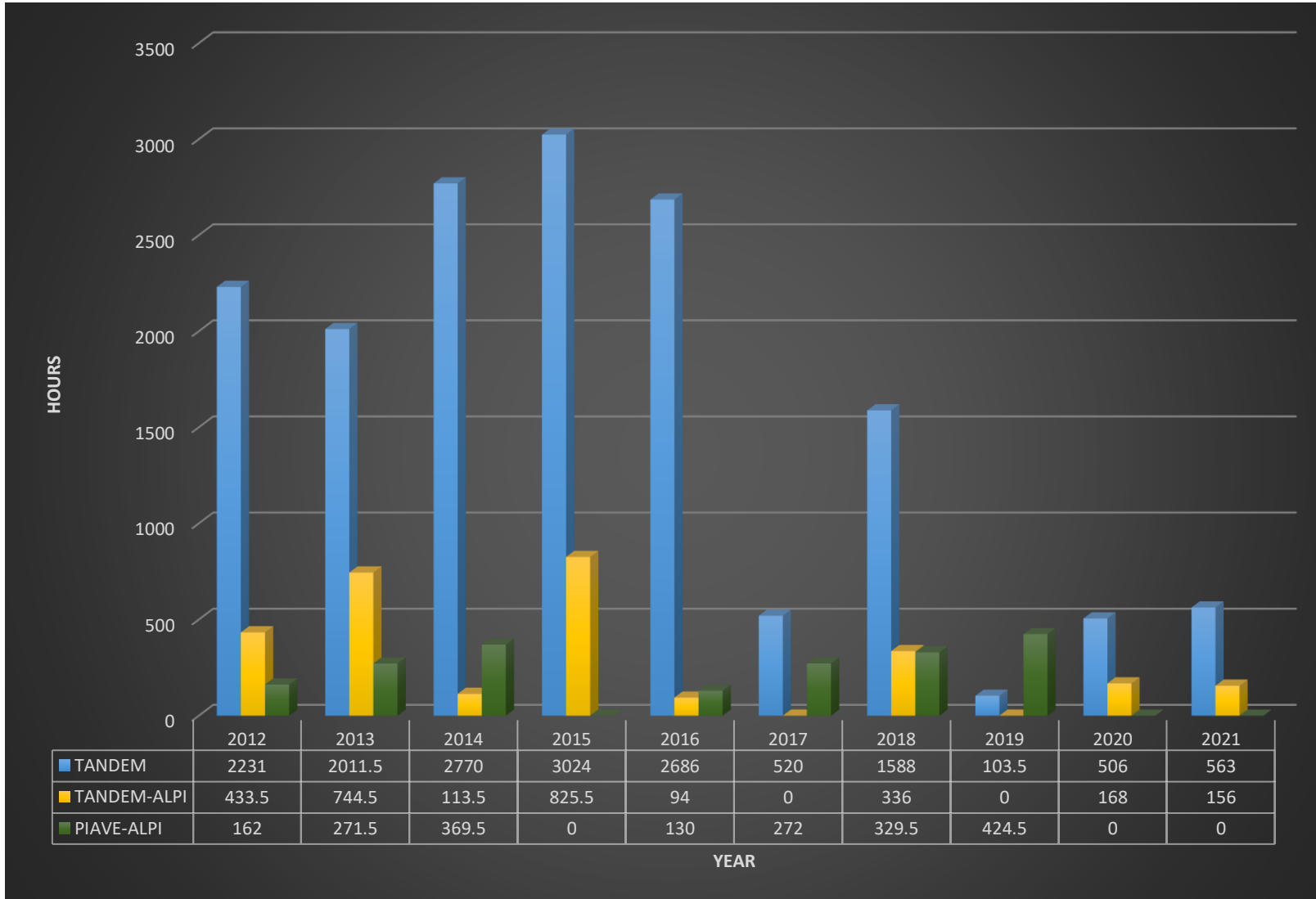


Last years overview



- Since 2017 beam on target time on PTA accelerator complex suffers a strong reduction due unscheduled maintenances.
- 2020 exception due to Covid pandemic.

Last years overview



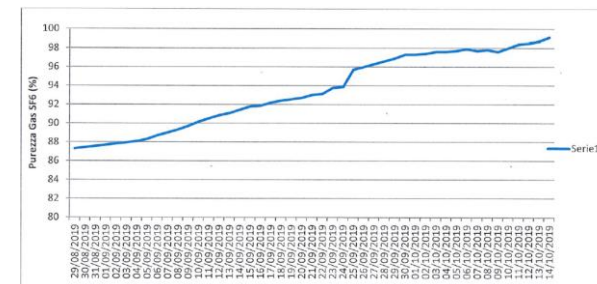
- Issues related to Tandem accelerator.
- Some of the scheduled shifts on Tandem-ALPI complex moved to PIAVE-ALPI but unexpected failure of PIAVE SRFQ.

“Too simple” conclusion

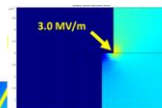
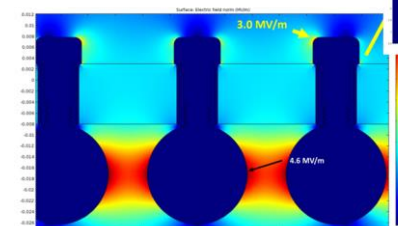
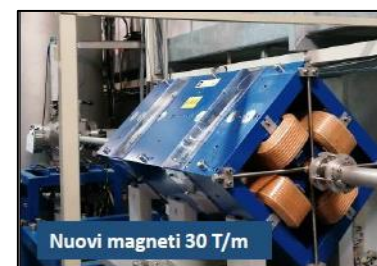
- TANDEM is a very old accelerator that must be replaced
- PIAVE availability is not comparable with TANDEM one even during the latter worst period

Main issues solved before extraordinary maintenance

- Tandem SF6 gas contamination solved in 2019 improving SF6 percentage from 87% to 99%
- Electrostatic design improved to avoid frequent resistors damage
- ALPI quadrupole magnets on high energy side replaced with high gradient version during 2018 - 2019
- PIAVE QWR cryostats moved to ALPI low energy side in 2019 to avoid longitudinal emittance increase at ALPI injection



- Electrostatic design improved to avoid frequent resistors damage



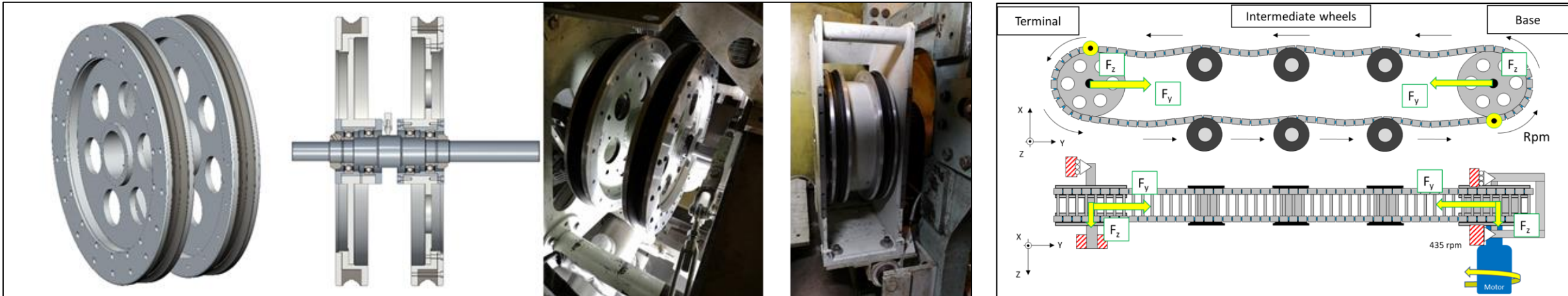
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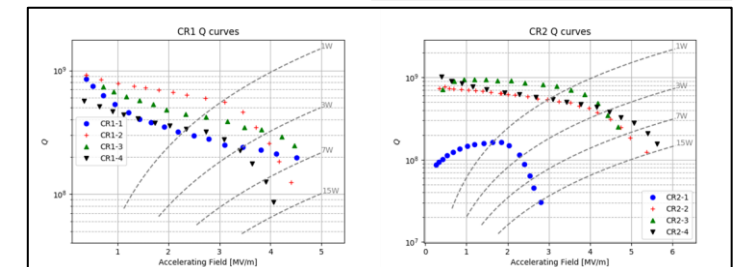
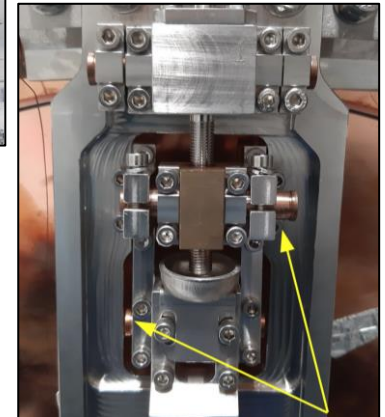
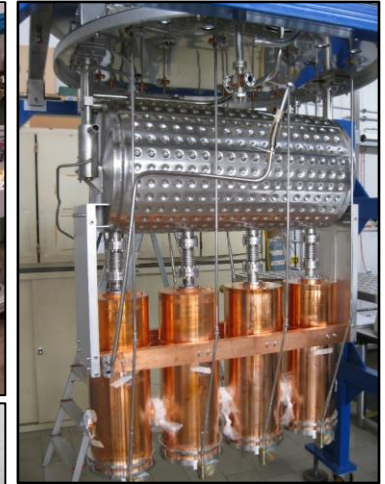
Main issues faced but not solved

- Laddertron mechanics improved – revision needed
- Conductive rubber wheels replaced with new ones (old model no more available on the market) – new ones still to be improved

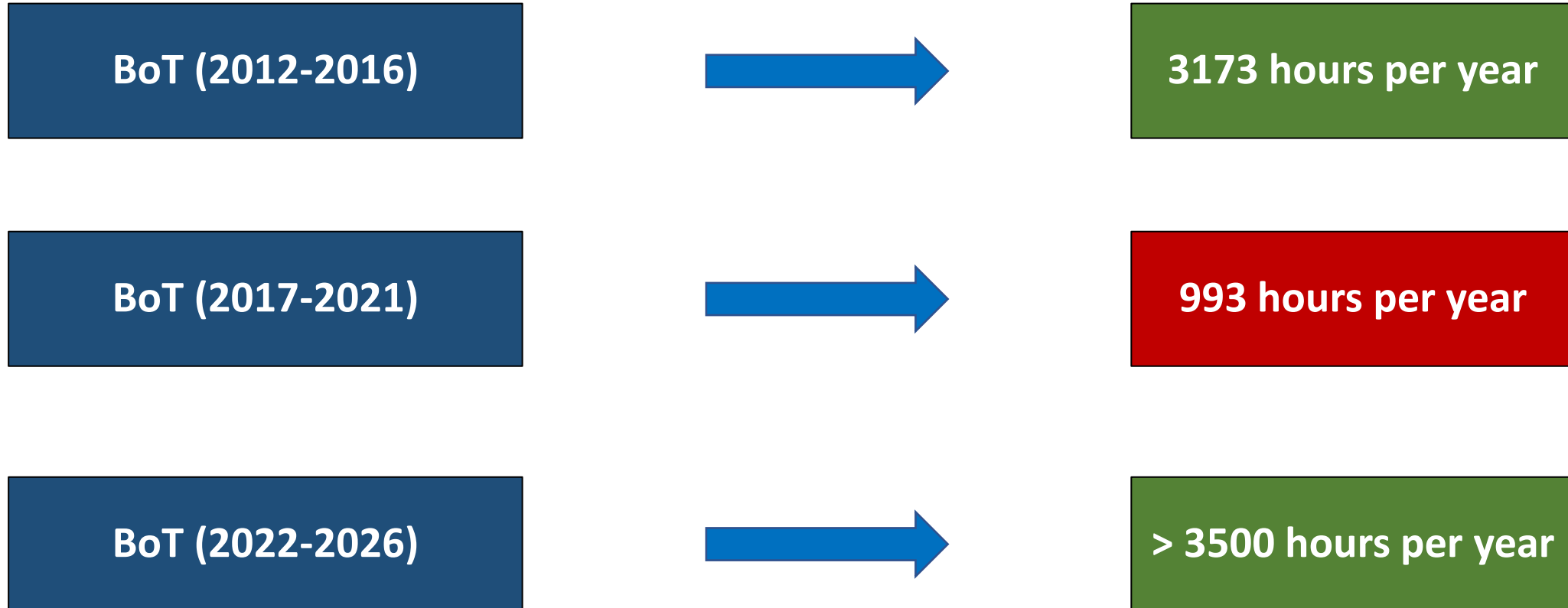


Main issues to be solved (summer 2020)

- Anomalous powder production during operation – related to new wheels material and mechanics
- Too high frequency of injector engine-alternator system need for maintenance
- ALPI low beta cavities characterized by too low availability and reliability
- ALPI cryostats safety to be improved
- CR1 and CR2 under performant after ALPI installation
- SRFQ tuning system, already modified to be compatible with piezo-tuner, was not reliable



Global Beam on Target: past, present and future goal



PTA performances: current and future goal

- ALPI longitudinal acceptance: 30 deg-MeV/A -> **60 deg-MeV/A (+100%)**
- PIAVE-ALPI maximum energy (ex. **98Mo**¹³⁺, A/q = 7.5): 6.5 MeV/A -> **7.7 MeV/A (+18.5%)**
- Tandem-ALPI maximum energy (**90Zr**¹²⁺, A/q = 7.5): 6.0 MeV/A -> **6.25 MeV/A (+4.2%)**
- PIAVE-ALPI maximum energy (ex. **238U**³²⁺, A/q = 7.5): **7.7 MeV/A (new beam)**
- SPES-ALPI maximum energy (ex. **132Sn**²¹⁺, A/q = 6.3): **8.7 MeV/A (new SPES RFQ injection)**
- LINAC transmission (TANDEM or PIAVE injection): 10% - 20% -> **30% - 40%**
- LINAC transmission (SPES injection): **40% (1 Y) -> 60% (5 Y) -> 80% (10 Y)**

2021-2022 maintenance results



TANTED injector fully upgraded

- Safety upgrade
- New high voltage transformer
- New control system
- New electrical and hydraulic distribution



Laddertron handling system upgraded

- Wheels design optimization
- Wheels grinding and dynamic balancing
- New conductive rubber wheels with enhanced hardening
- Laddertron lateral deviation from ± 3.0 to ± 0.5 mm
- Chain tension loss from 500 g/hr down to 100 g/hr
- Bars inclination from 4 mm to 1.8 mm

Last opening in march 2022 after about 1000 working hours -> no visible powder production

2021-2022 maintenance results

CR07 upgrade

- Alignment
- Piping and safety
- New thermal shielding, joints and sensors
- Closure plates and tuners connections

CR01 and CR03 upgrade

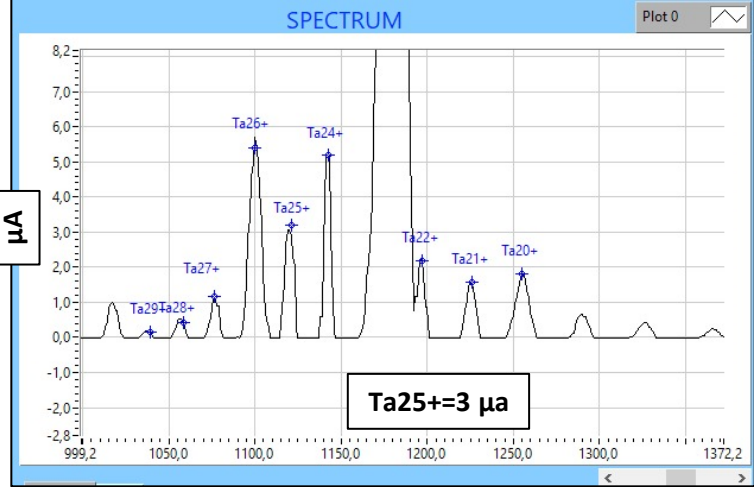
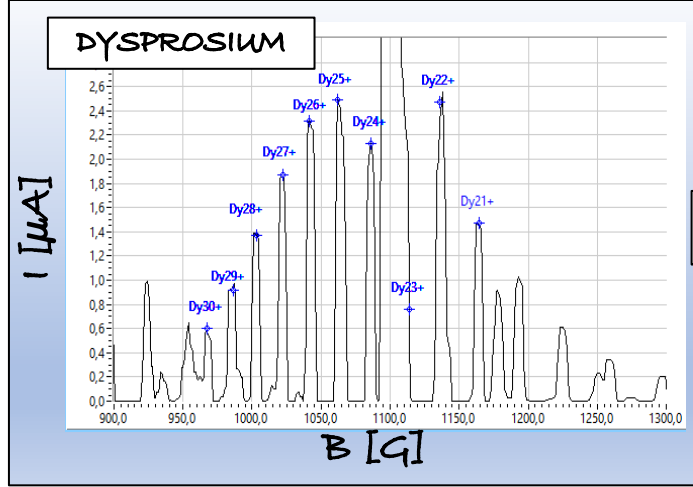
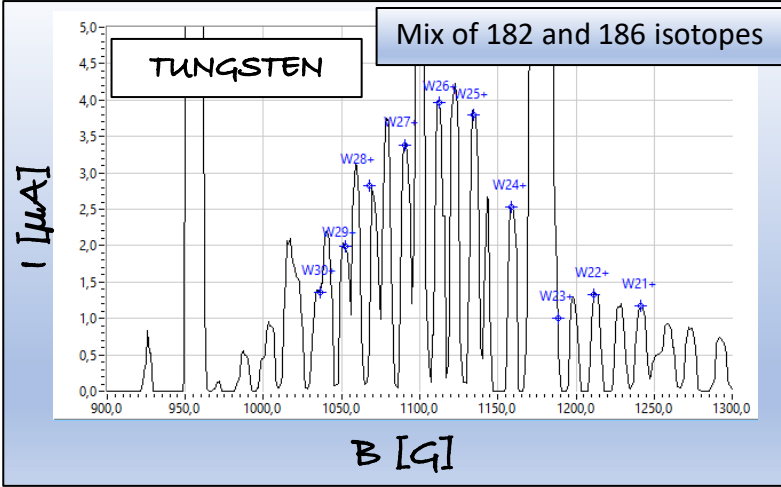
- Alignment
- Tuner revision
- Plate characterization
- New shielding and LN2 circuit replacement
- Safety



2021-2022 maintenance results

CR01 upgrade

- Alignment
- Tuner revision
- Plate characterization
- New shielding and LN2 circuit replacement
- Safety



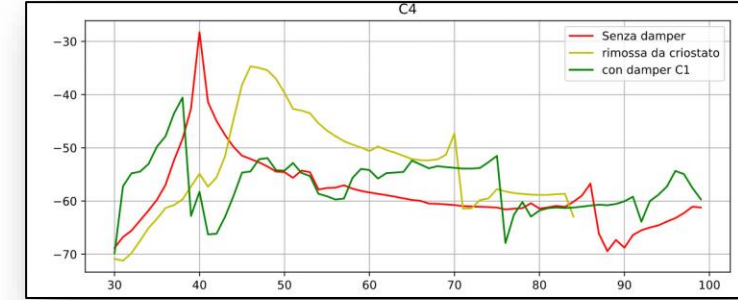
ECR source development

- New beam developed: W, Dy and Ta (the latter in view of U production)
- Ta goal: 4 μA

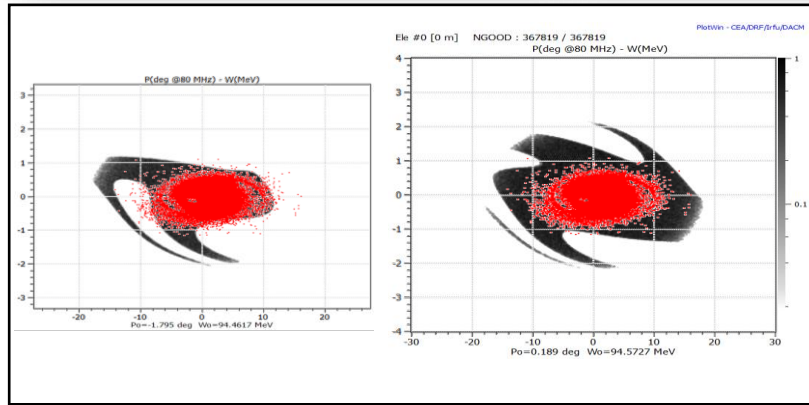
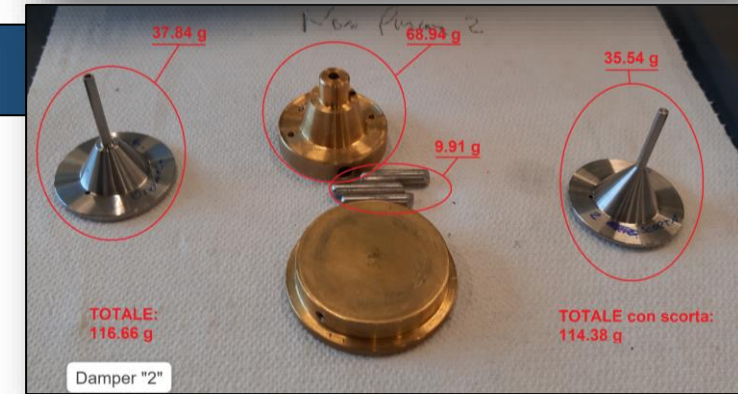
2021-2022 maintenance ongoing



SRFQ cleaning

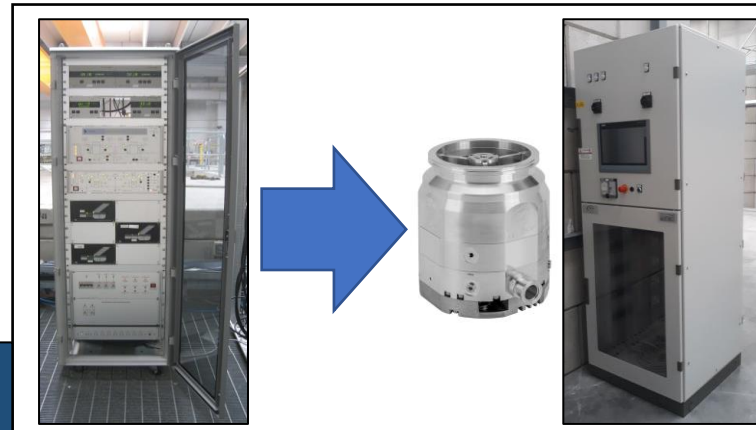


CR6 dumpers check



ALPI beam dynamics improval

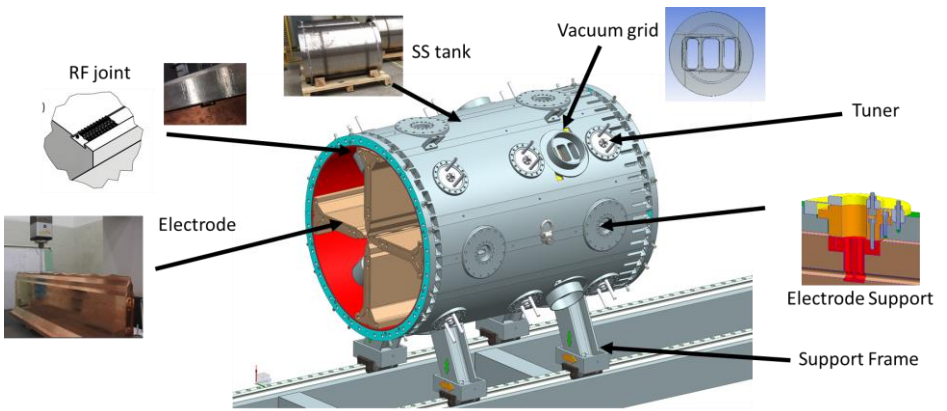
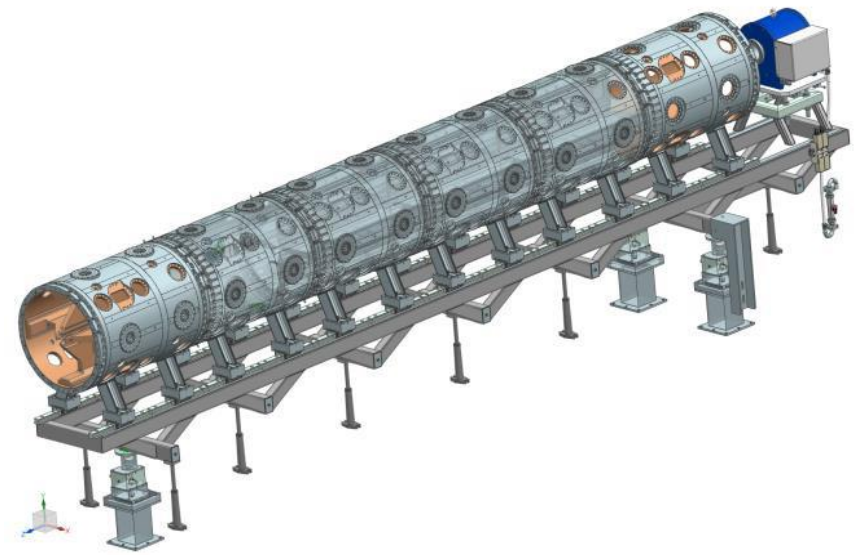
ALPI vacuum system upgrade



AGATA beamline upgrade



SPES RFQ status



SPES TAC 5 May 11th and 12th 2017, INFN-LNL



SPES RFQ status

One module completely assembled, characterized and installed on support
Two modules, already copper plated, are on their way for assembly and characterization
A further tank copper-plated at CERN and awaiting to be delivered at LNL in forthcoming days
Two tanks waiting for copper-plating at CERN



Offers presentation phase for 200 kW solid-state amplifier tender concluded. Contract start foreseen in July.



Electric power plants, general cooling system and RF-RFQ skid upgrades are underway.

THANK YOU



CN - AN2000



TANDEM



PIAVE-ALPI

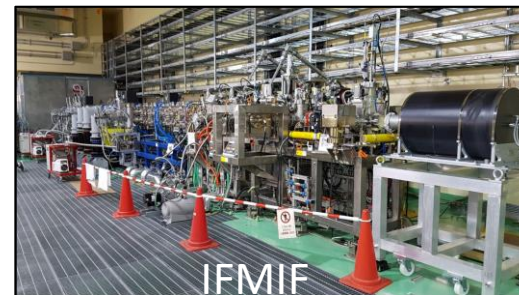


SPES Cyclotron



ADIGE-SPES

The image displays two control panels for the SPES facility. The left panel, titled "SPES -Controls", shows a "COUPLING TABLE CONTROL SYSTEM" with various status indicators and a small 3D schematic of a component. The right panel, titled "SPES-Transport", shows a schematic of the transport line with various magnets and detectors labeled, such as "Magnetic Dipole", "Electromagnetic Dipole", "Estimation Lens", and "Electromagnetic Dipole".



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