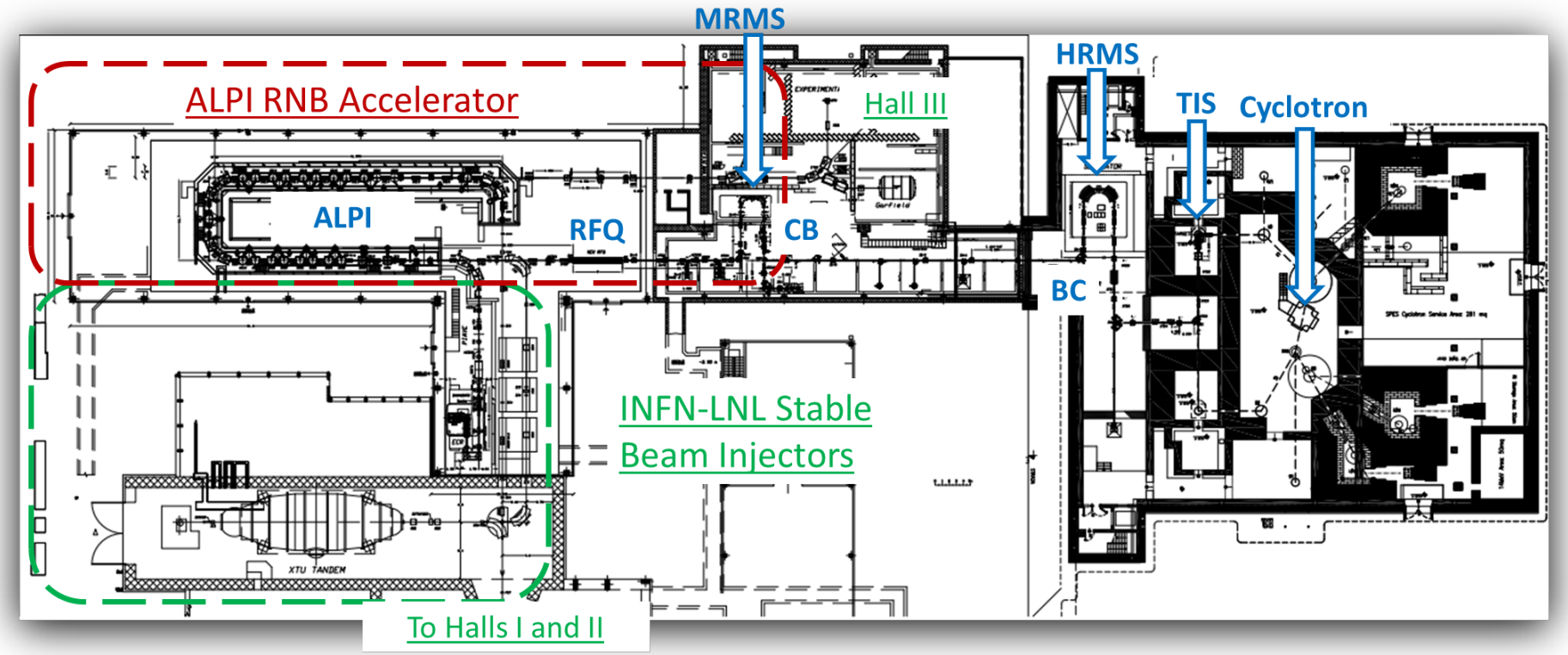
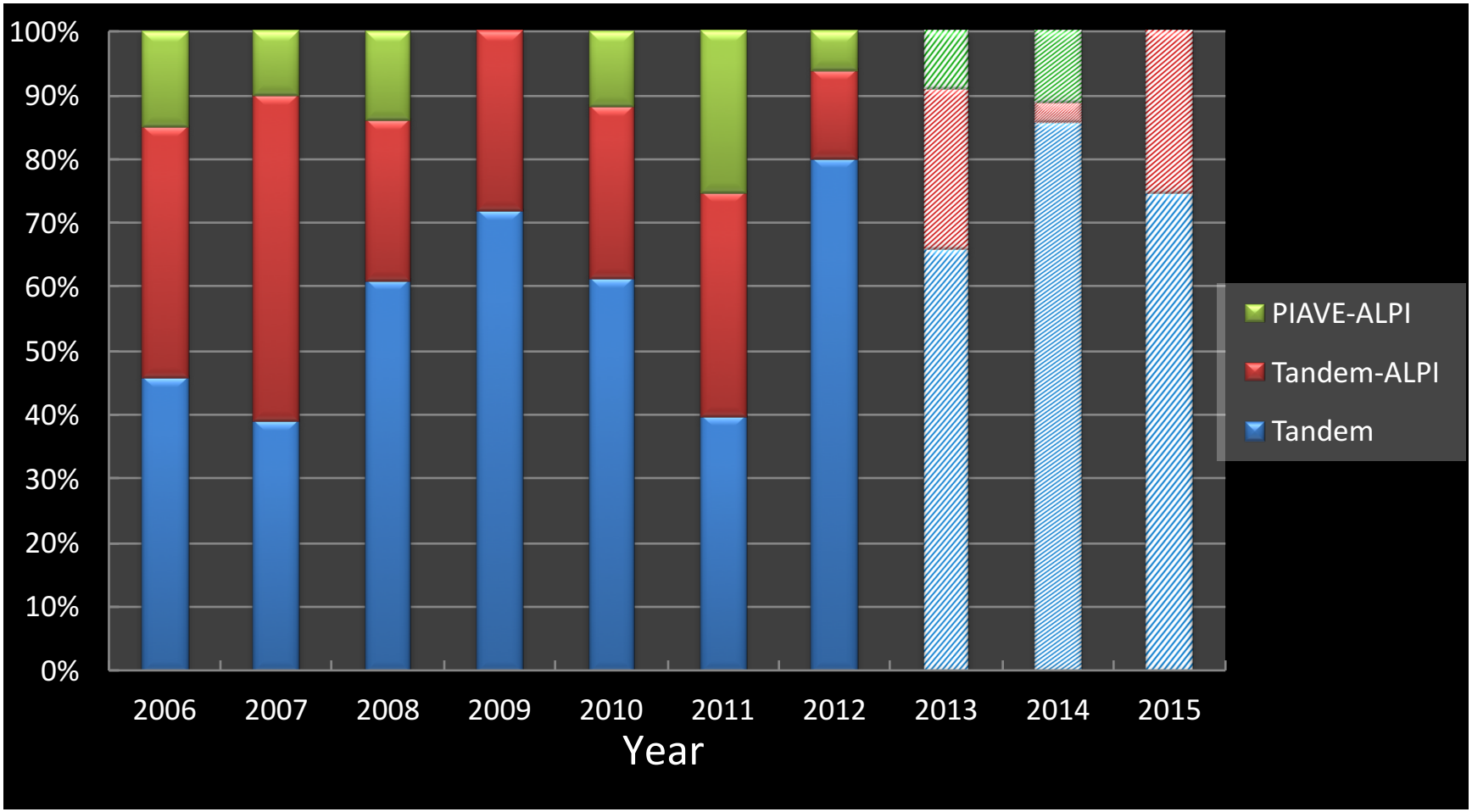
Status of the Tandem-ALPI-PIAVE/SPES accelerators

G. Bisoffi, Accel. Division, *Users' Committee Meeting October 13, 2016*

1. Statistics 2.Tandem 3. ALPI and PIAVE 4. Next semesters

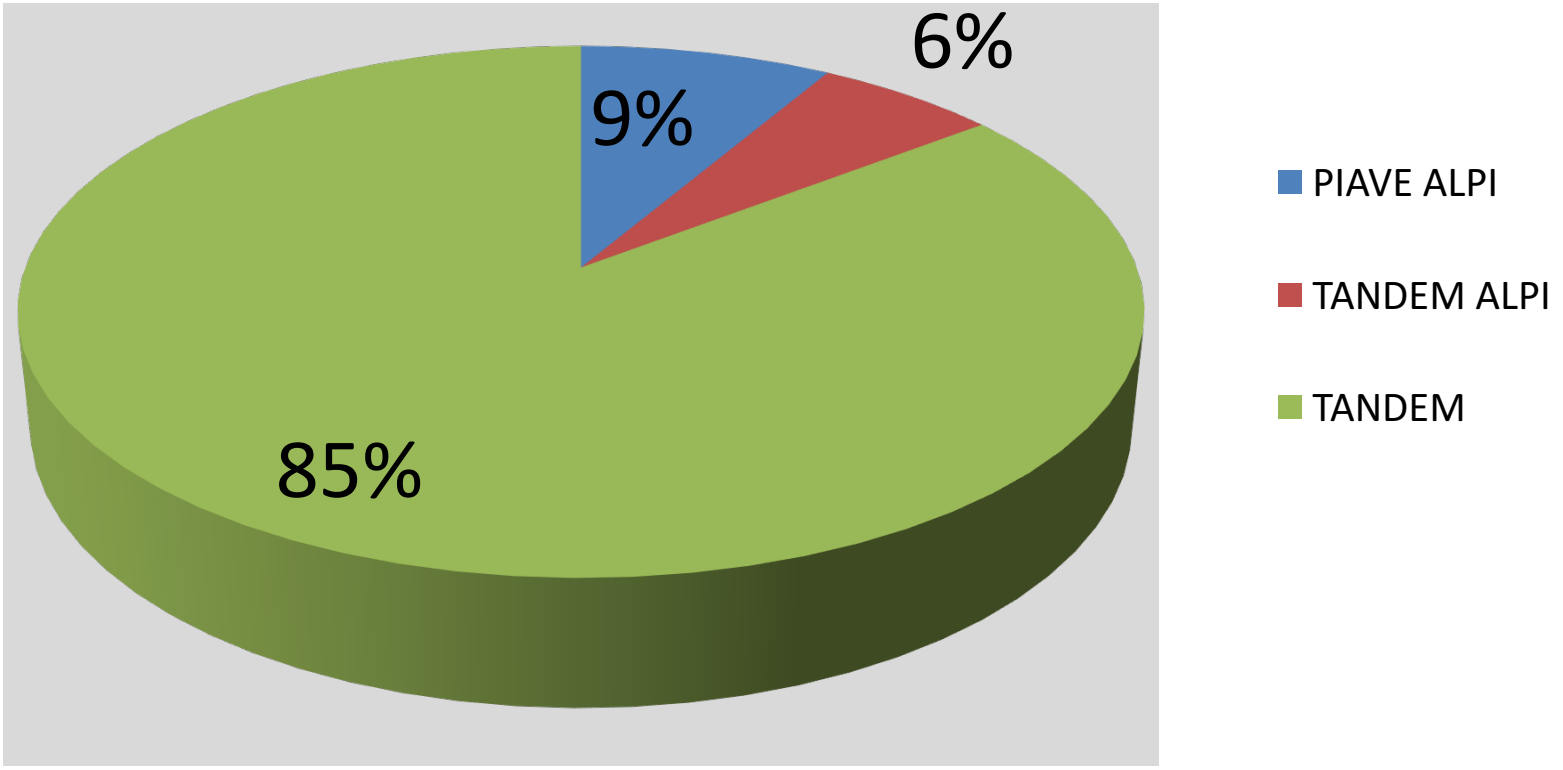


Sharing between T, T-A and P-A



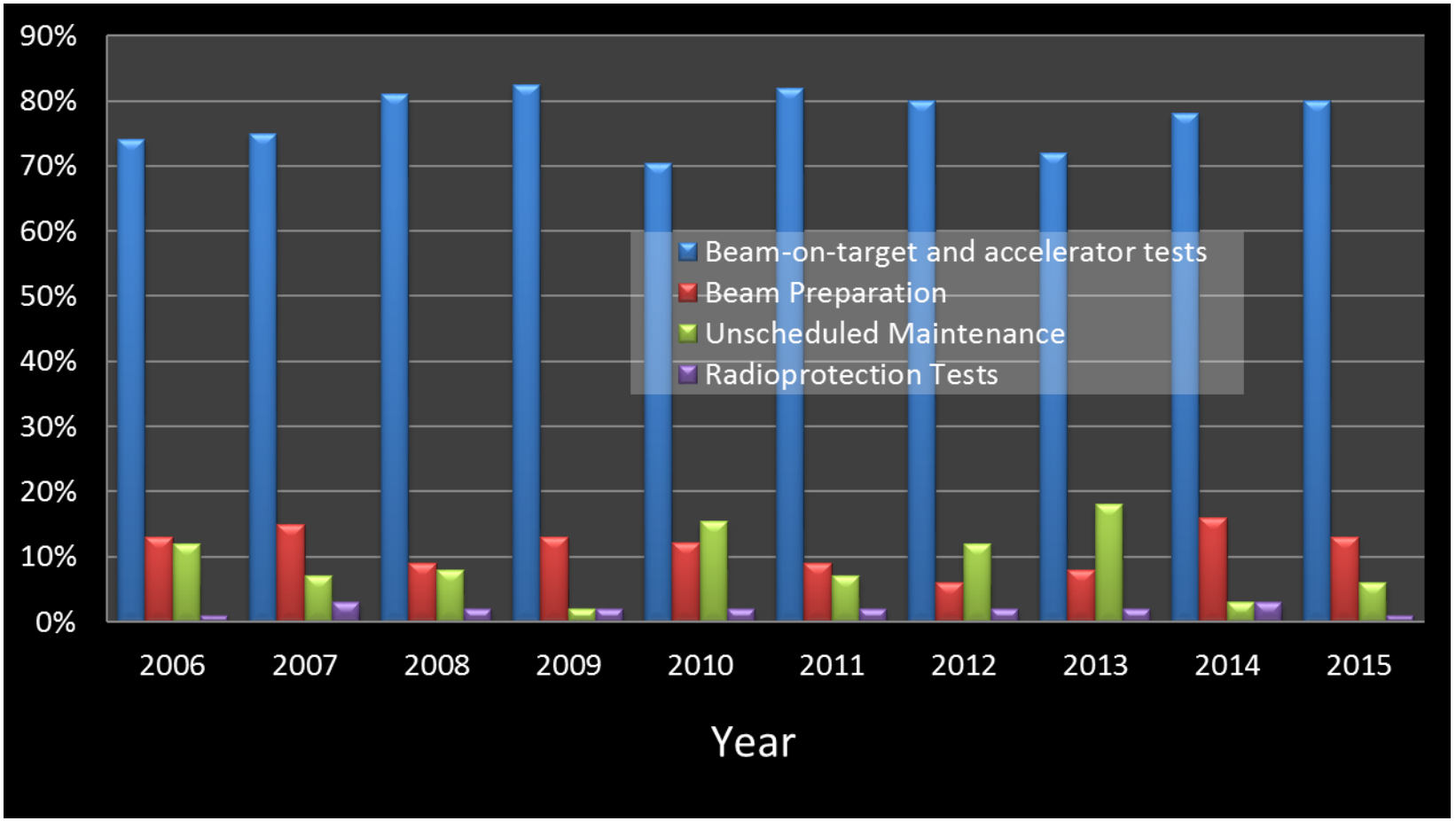
From 2013, PIAVE and ALPI operation 50% of the time: contributes to **15% of the residual Budget** (spare on electricity bill) and concentrates **work force on the SPES project**.

Sharing between T, T-A and P-A Jan-Jul 2016



D. Crivellaro

Available beam (for users and accelerator tests) vs (…)



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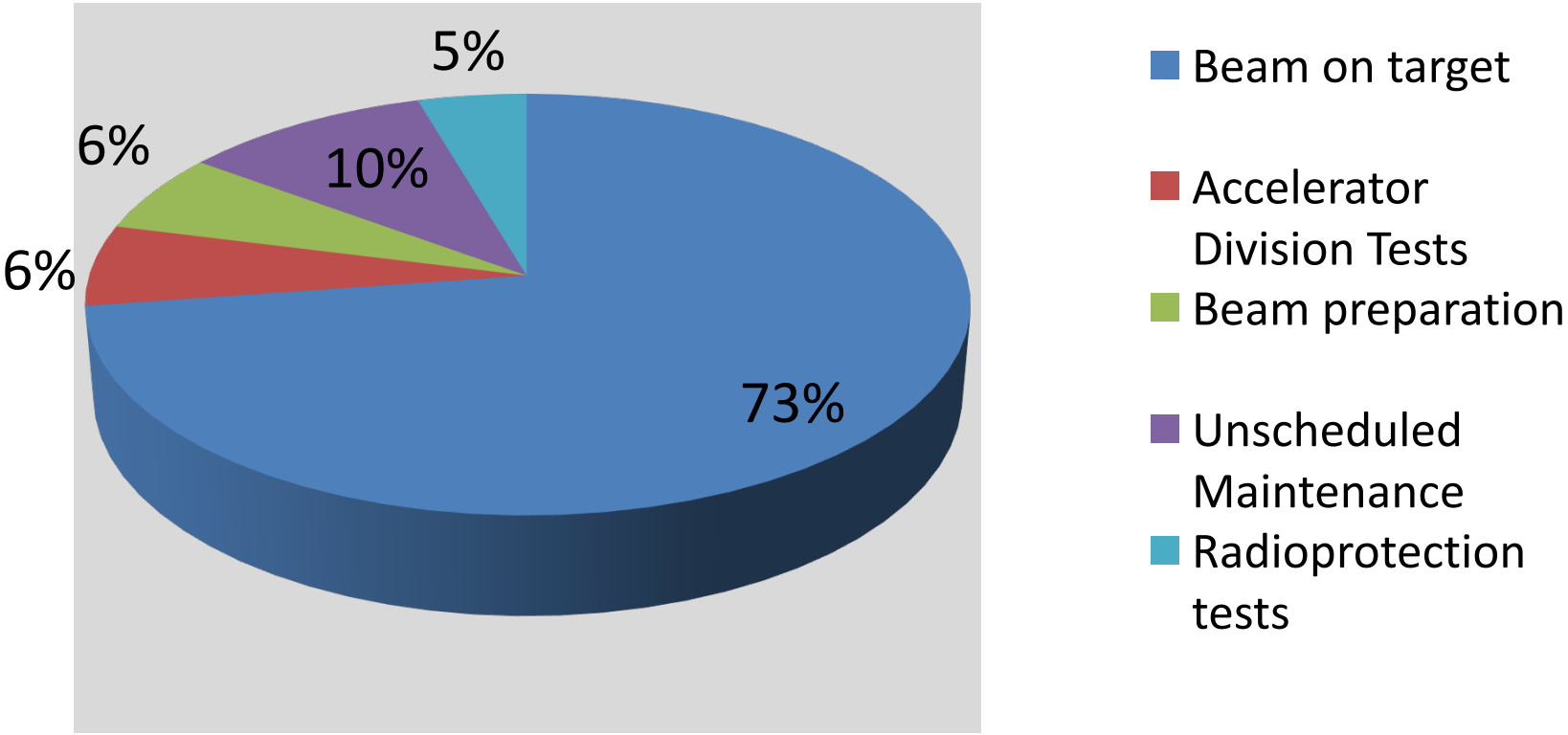
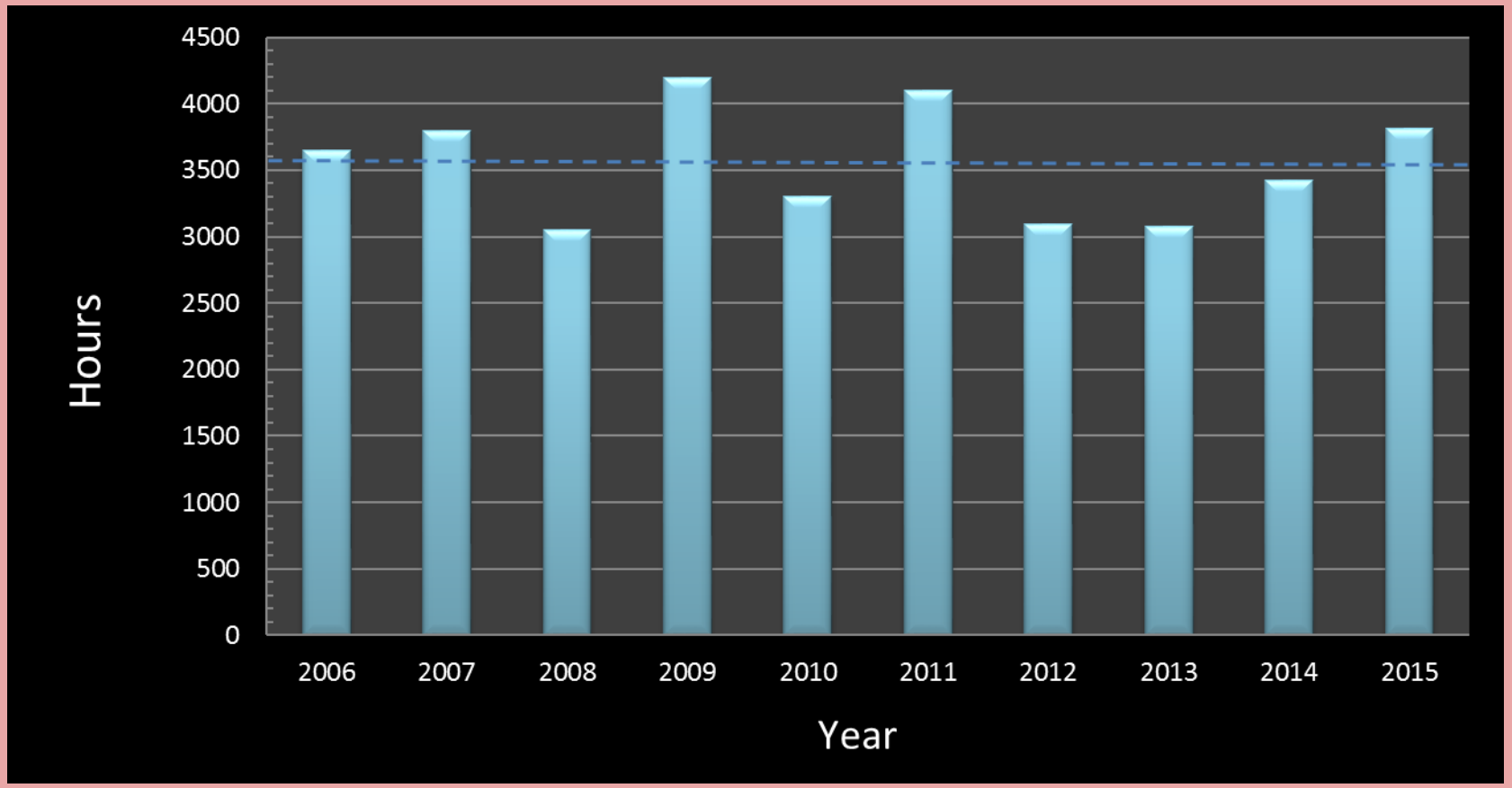
Available beam (for users and accelerator tests) vs (…) Jan-Jul 2016



D. Crivellaro

Operation with Stable Beams 2006-2015



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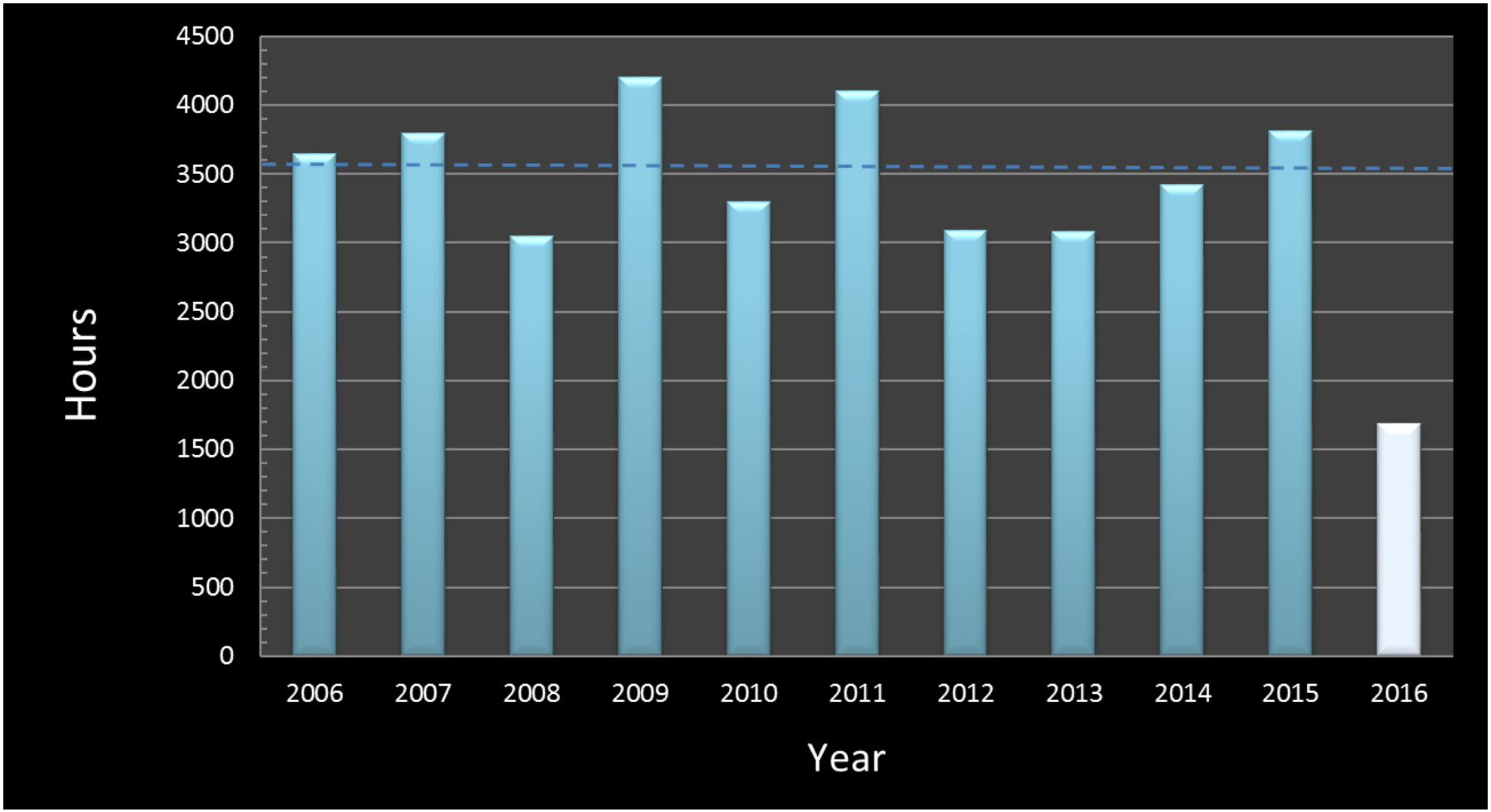
Operation with Stable Beams 2006-2016



As of July 2, 2016 (3,5 months out of 7 /year)

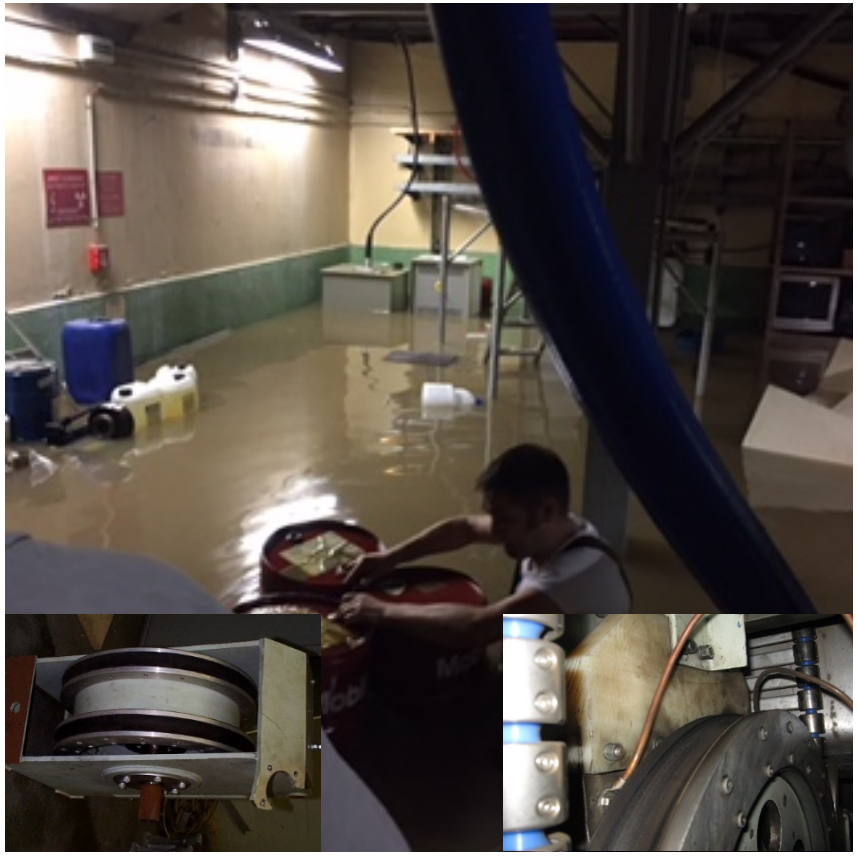
XTU-Tandem – Status Feb 2016

- Tandem: operational at standard V_T (new conductive wheels of the laddertron charging belt, tested at IPNO (Orsay), ordered, ~~installation in 2016~~)

XTU-Tandem

- Sent: Wednesday, June 1, 2016 10:04 PM
  To: carletto
  Subject: Hi

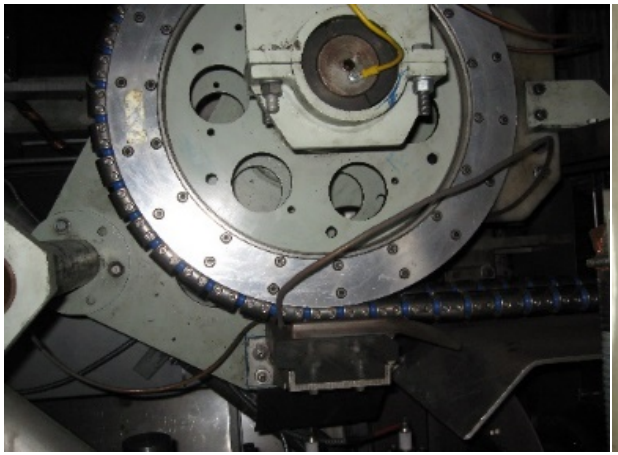
  Dear Osvaldo, This morning the building of ALTO was flooded. We are under water, the conductives wheels are in the water. It's a big catastrophe for us.
  I call you tomorrow morning.
  With my best regards
  Abdelhakim



- Now the **laddertron** needs urgent repalecement, perhaps in July, in anticipation of the planned replacement in September, but the wheels are not ready yet

Tandem Maintenance Plan 2016/17





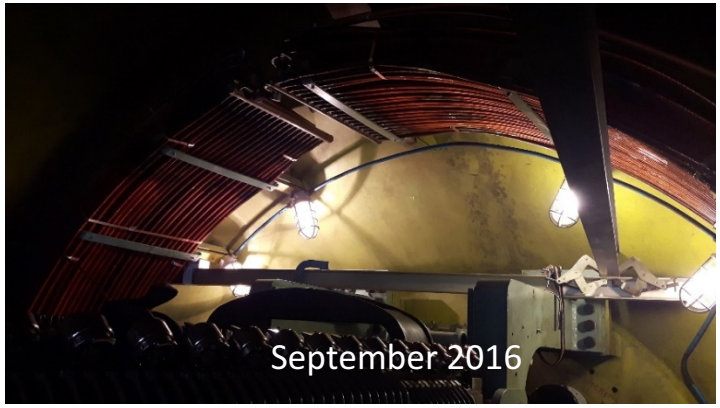

Extraordinary maintenance till mid October 2017:

- Replacement of the laddetron charging belt – 2 weeks
- Replacement of the second heat exchanger in the SF6 tank (previous one was replaced in 2011) – 2 weeks, not in parallel due to interference

Extraordinary Maintenance 2017 or 2018:

- Replacement of the conductive inserts of the belt wheels at ground and on the terminal (preferably at the next laddertron change, 2018)

Indeed they have been mounted…



Till October 7: Extraordinary maintenance had extended beyond its expected slot, but within margins
October 12: unexpected misalignment of the laddertron chain requires 1 additional week of work (!),
beginning of beam time must be postponed from Nov 2 to Nov 9
In addition: it can be that – due to lack of budget for operator shift hours in 2016 (communicated last week by INFN (!)) – tandem operation will be stopped on December 9 (**- 2 wks**)

PIAVE and ALPI Status

- ALPI: ok, with published performance; 3 of 4 low-E cryostats available; upgrades in SPES framework are progressing (cryogenic plant and cryomodules, BI, RF, magnets, …)
- PIAVE: started operation but at 50% of the accelerating field, for issues on tuners and Q-curve of SRFQ2 (going to be investigated)

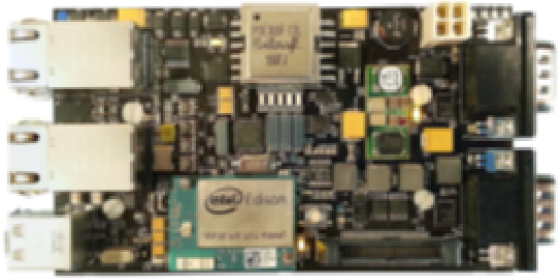
New RF Controllers (for SPES, ALPI, PIAVE, …)

- «Universal» type RF controller, working between 10 and 352 MHz
- Validated on ALPI 80 and 160 MHz QWRs (2 cryomodules, preseries) in May 2016
- Successful, minor PCB bug fixing required, ready for production in Fall 2016

VME HW being replaced

- VME hardware will be replaced by commercial standard HW by Beckhoff (inc. digital IO, Slow Analog IO, Motion Controllers – for tuners, couplers, BI)
- Recabling will be minimized vs. current installations (same modularity)

ALPI-PIAVE HW Upgrade



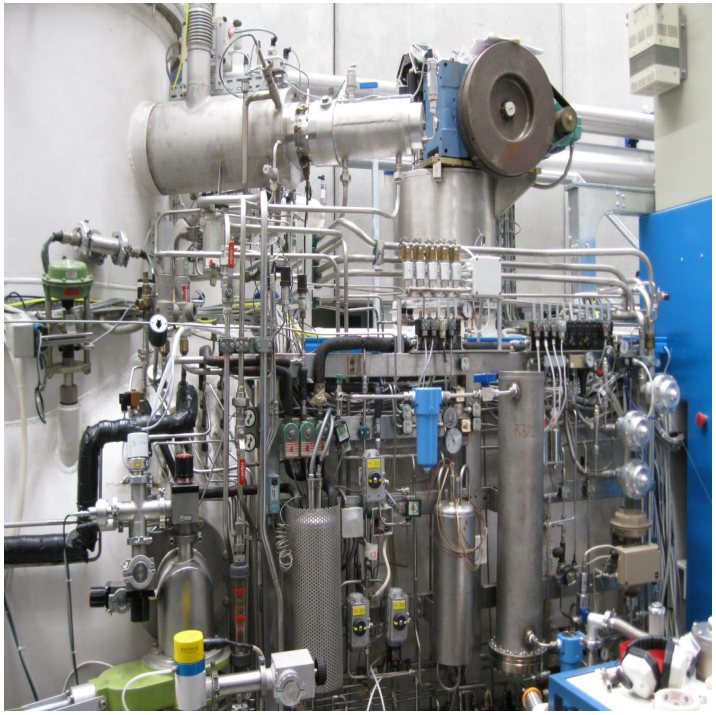
- General purpose EPICS IOC developed and tested: replaces 20-yrs old NIM-based HW for BI
- EPICS based control SW was developed in LNL in 2014 for RNB BI, now adapted to new HW
- PCBs need minor bub-fixing, then pre-production will start

D. Bortolato

Refurbishment of ALPI Cryoplant Cold-Box Control

Being performed at low investment cost on CERN-UNICOS standard (4 LNL t-FTE, 9 months). Know-how will be in-house!

1. Prototype work on LNL liquifier TCF20: successfully completed in 2012 (by CERN experts)
2. Training of LNL cryogenic expert at CERN in 2014-2015 (HIE-Isolde group)
3. Migration from old-fashioned to CERN-UNICOS control system on going (April –December 2016) is somewhat delayed.



Check point on Nov 15, 2016: to start with still old or new system in January 2017 for ALPI operation with stable beam.

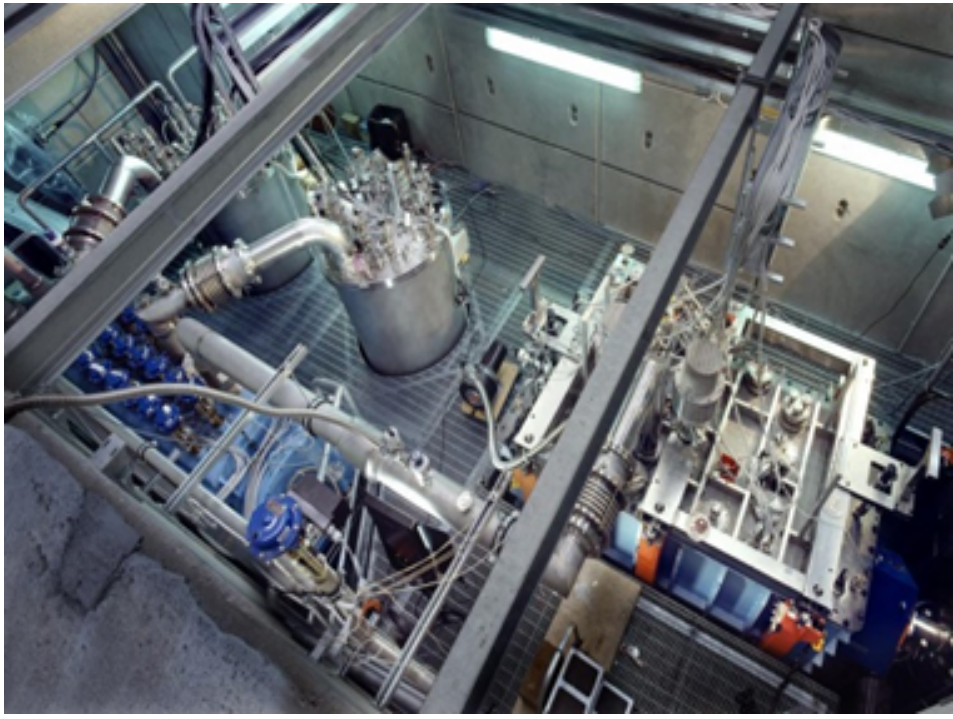
Plan A: new CS, ALPI operational for users in June, July, October 2017

Plan B: still old CS, ALPI operational for users in May-July 2017

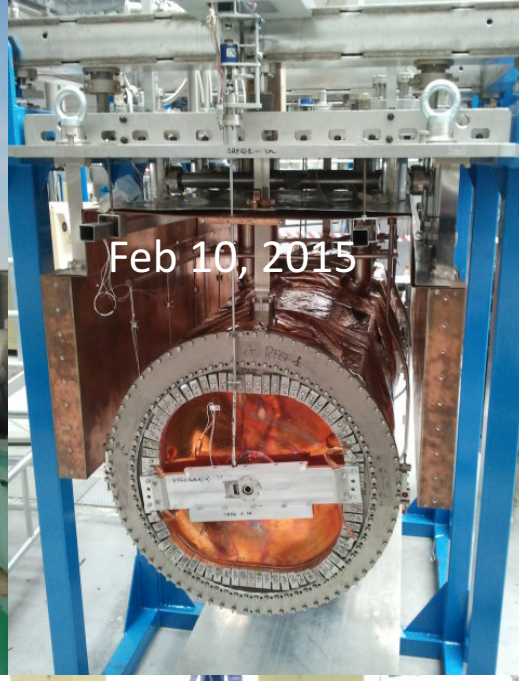
P. Modanese

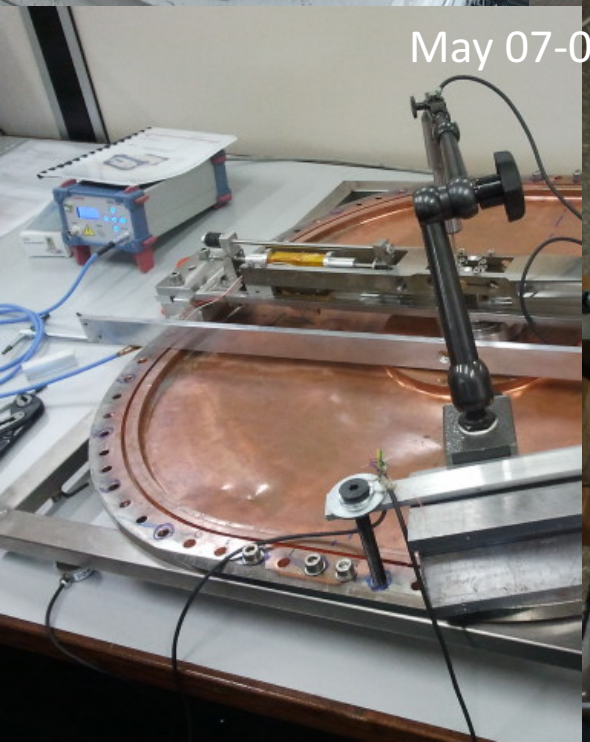
Planned Maintenance on the SRFQ Cryomodule

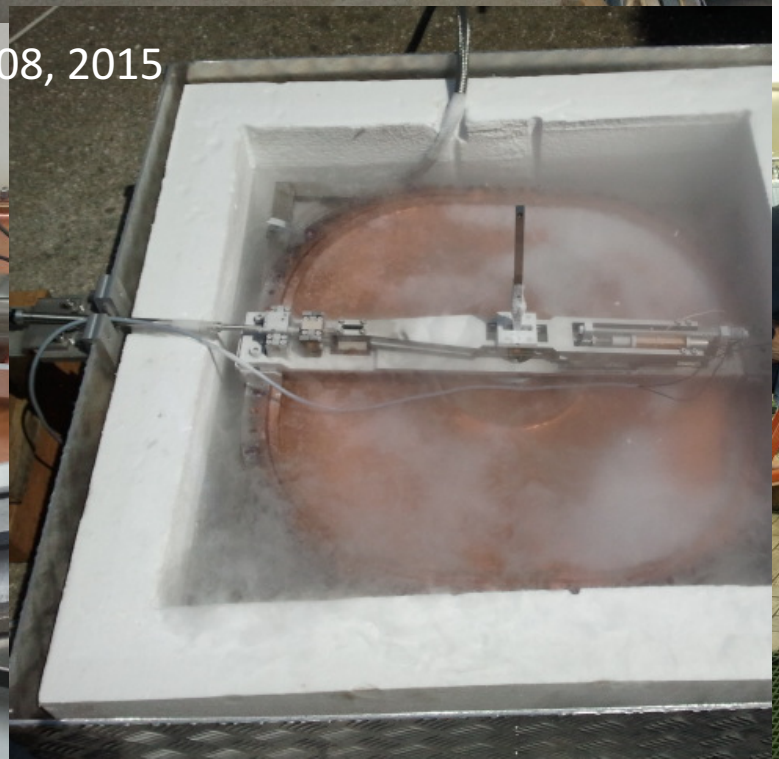
1. $E_{acc,max}$ by around 20% larger (larger A/q values accel.ted);
2. Reparation of heating resistors, T sensors, level meters (He and N);
3. New slow+fast frequency tuning system (more efficient and reliable);
4. Increase of He gas draining capability of the resonators (→ more efficient RF conditioning);
5. Laser alignment onto the beam line (better transmission).




Jan 14, 2015

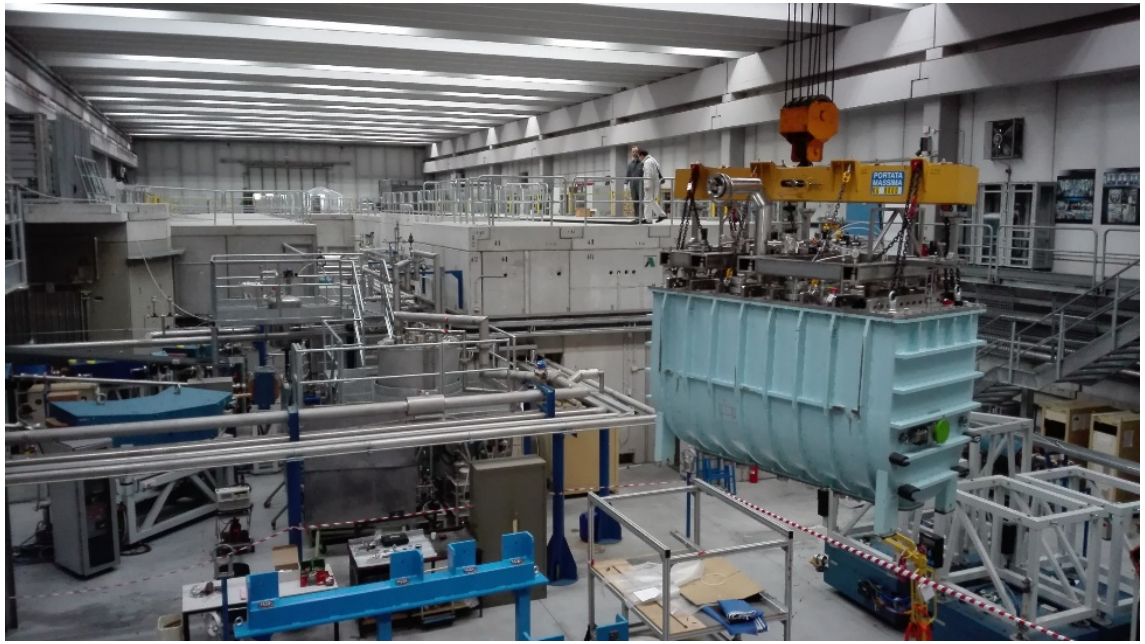

Feb 10, 2015


May 07-08, 2015



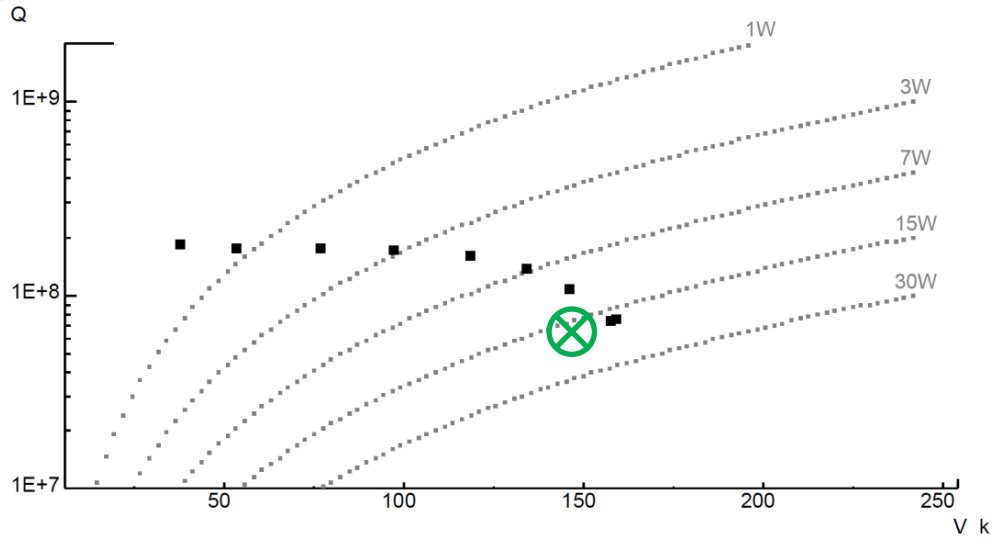

June 24, 2015

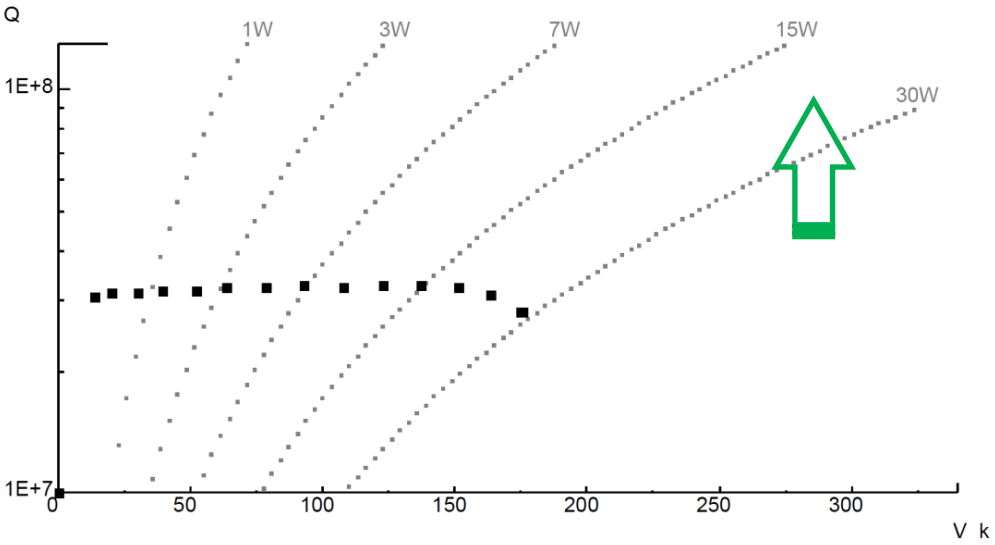
PIAVE SRFQs Status



- Maintenance was not fully successful: on SRFQ1 - slow tuner issues; on SRFQ2 – Q curve is anomalous (evidence of RF load outside the 4K environment)
- PIAVE could operate only with SRFQs (globally) at 50% of their design field, and was used with a 20Ne experiment
- New shorter maintenance started (Fall 2016)

Q-curves



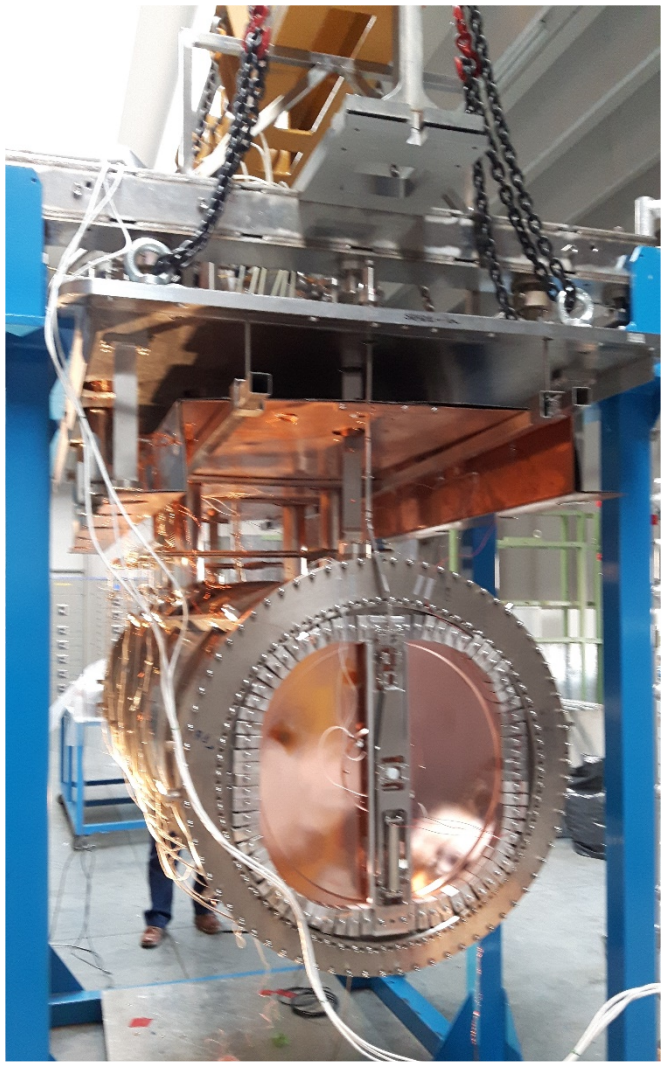


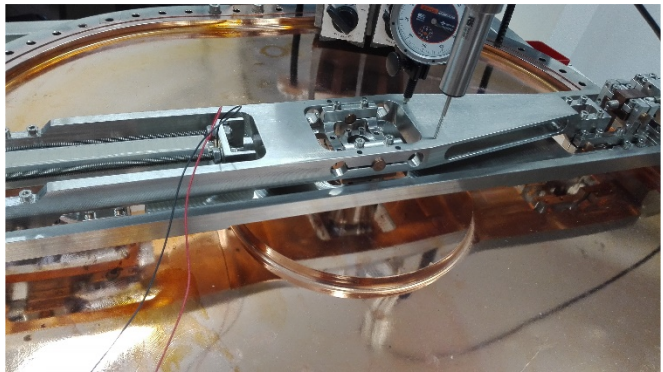
- SRFQ1 Q-curve: the desired performance was achieved, after a few days of RF conditioning (also with He in the $1x10^{-5}$ mbar range) – sign that sputtering on end-plates was fine and Chemical Etching fruitful. Issue on slow tuners.
- SRFQ2 Q-Curve: lower by factor 5 (RF load not on the SC mass, … antennas and FT suspected). Slow tuners seem fine.

D. Bortolato, F. Chiurlotto

Issues – Slow Tuners

- End-plates were re-engineered, aiming at better linearity of the curve f vs. deformation.
- The slow-tuning mechanism was re-designed, to reduce mechanical backlash and to integrate a piezo element for fast-tuning (ms response to mechanical vibrations).
- Tuning range is too small and non-linear, especially on SRFQ1
- Main suspect: deformation on the moving arm, likely the weakest part

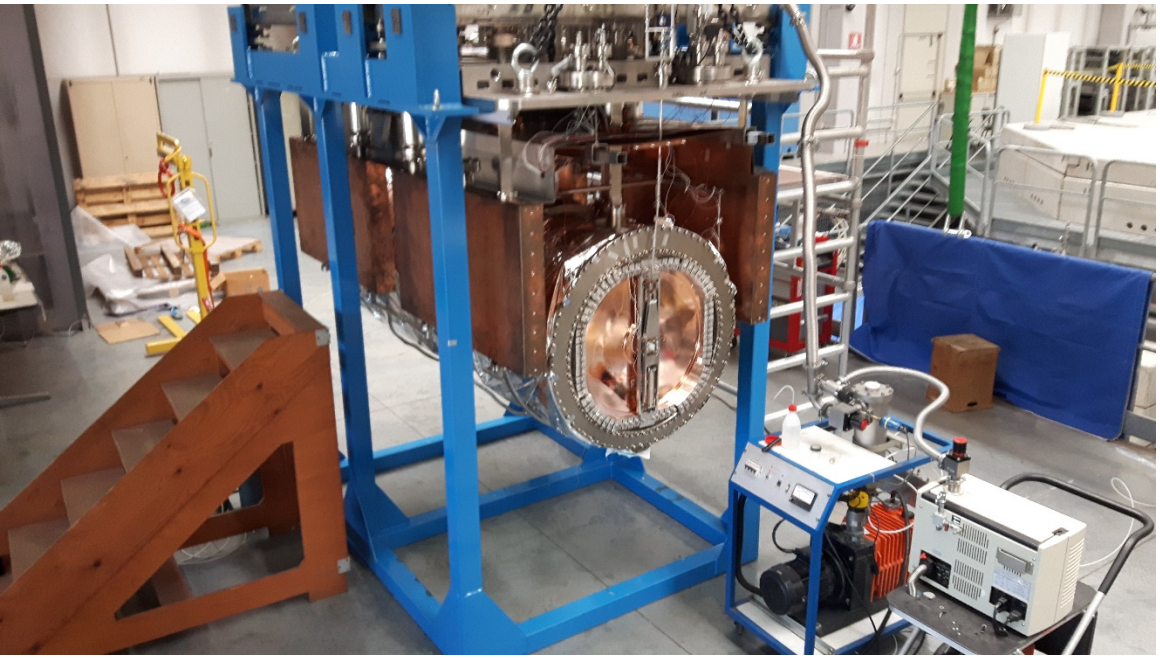




Issues – Fast Tuner

- It ensures fast (ms) f-control via coupling of RF power in quadrature
- It is the component which has to be replaced by the piezo tuning system.
- There is some evidence that it may be too much RF-coupled to the resonator, thus dissipating eccessive RF-power and lowering the Q-curve (*to be confirmed*)

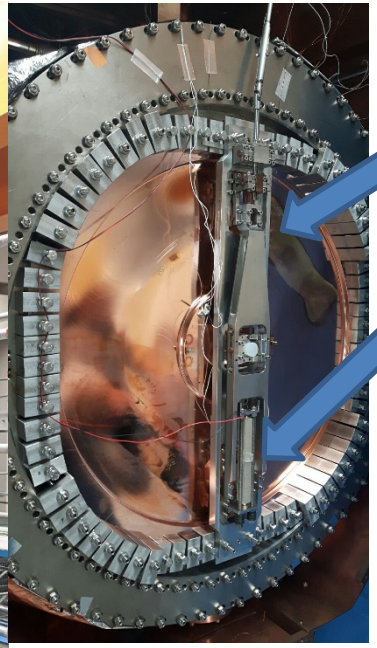
«In fieri» plan

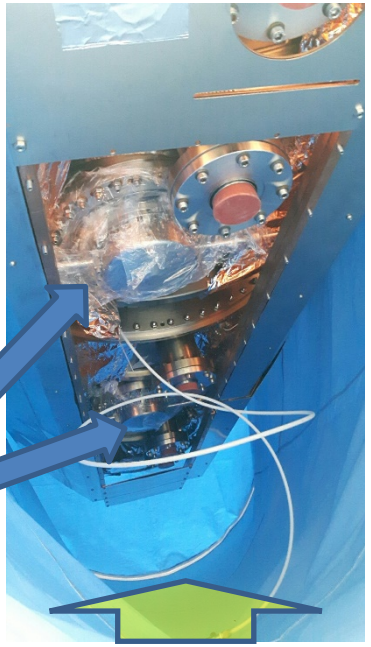


- Fast tuners can be maintained at the level of disassembly shown here.
- Depending on the problem, we hope that all 4 slow tuners can be fixed at this disassembly level too, thus minimizing the time of intervention

- Cryostat was delivered to the maintenance area on July 14, opening expected in the first half of September
- Target: complete 2nd maintenance within 2016 and be operational in the next semester (April-July 2017)

Present status (October 12, 2016…)





Slow tuner and piezo tuner

Fast tuners

- Two vacuum leaks were identified and fixed (on the outer tank; on the liquid He circuit)
- LT characterization of the tuner motion ongoing
- Fast tuners will be removed and diagnosed in 2 weeks time
- After full problem identification of all problems, a schedule will be prepared. Confidence to be **back for shifts in the May-July 2017 period**

Next semester calendar

- **Tandem only in the next semester**
- September 5 –November ~~1~~ 8: Tandem maintenance
  - Ordinary maintenance;
  - Laddertron replacement and running in;
  - Heat exchanger (high energy side) replacement
  - Tandem conditioning
- **Experiments: November ~~2~~ 9 – December ~~22~~ 8**
- Winter break: December 23 – January 6
- Tandem ordinary maintenance and conditioning: till February 5
- **Experiments: February 5 – April 13**
- **Tandem-ALPI-PIAVE in May-July 2017 (or Jun, Jul, Oct 2017).**

What happens next?

- *In principle, one could have PTA beams 03/17-07/17*
- *However, this shall be probably more clear at the next PAC, with respect to **major preparation for SPES phase 2A and 2B**, which might suggest stopping either PIAVE and ALPI or all machines, for probably one semester.*
- *A second interruption would then follow for phase 3.*