



Abstract

Elettra is a third generation synchrotron light sources, located in Trieste, Italy. A superconducting third harmonic cavity was installed in 2002 in the storage ring in order to lengthen bunches and improve Touschek lifetime. This has implied a change in the operation, enlarging the operators knowledge in the superconducting environments. Even if a cryogenics specialized group has not be formed just for a single RF cryogenic plant, the operators are going to completely manage the plant.

Operating S3HC

With a control system the operator set the suitable frequency by tuning the cavity and HOMs dumping. During a cryogenic systems fault follows a procedure, written with a operator specialist support, for quickly recovery (basic for this kind of system).

Systems overview

Component	Load	Comments
3 RF cells	22 W	Density in LHe bath
2 L-couplers	3 W	Cooled by conduction
4 T-couplers	8.5 W	Cooled by conduction
2 Extremity tubes	0.2 W	With 2 x 0.03 g/s cold GHe
Cryomodule static losses	5.1 W	With 0.071 g/s cold GHe in thermal shield (60 K)
Transfer-lines	6.5 W	Absorbing 0.5 W/m load
Total refrigeration power at 4.5 K: 45.3 W		
Total GHe flow: 0.171 g/s → 5.2 l/h of liquidation duty		

Helial 1000

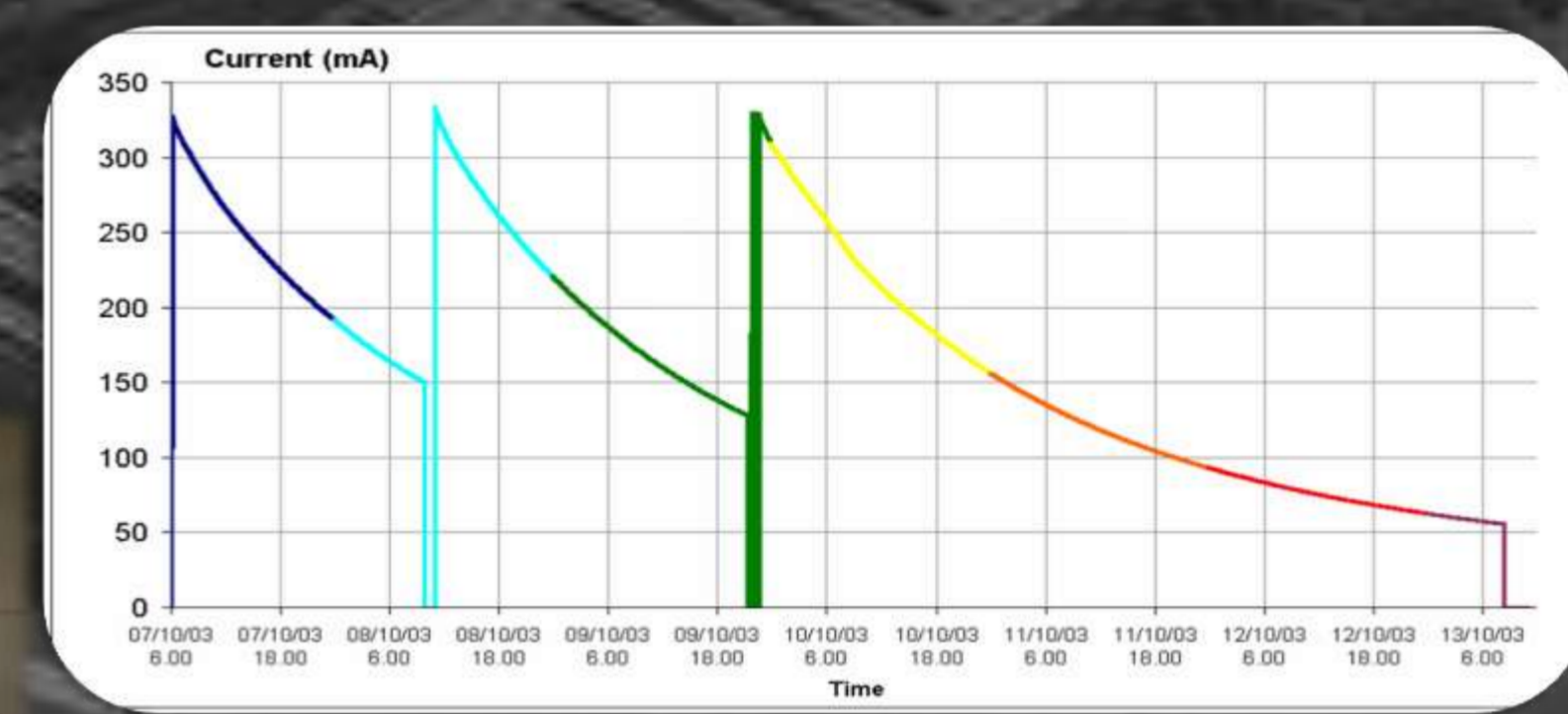


Goals

- Ensure efficiency and reliability.
- Form a team of experts that can operate completely independently.

S3HC Effect

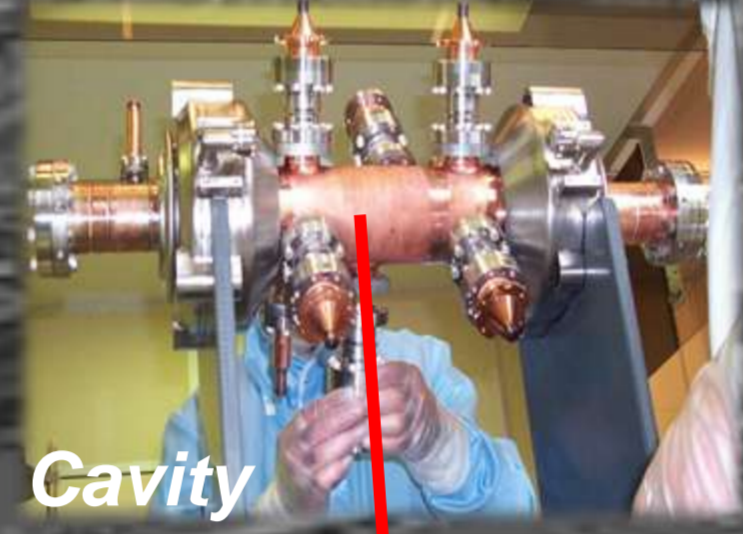
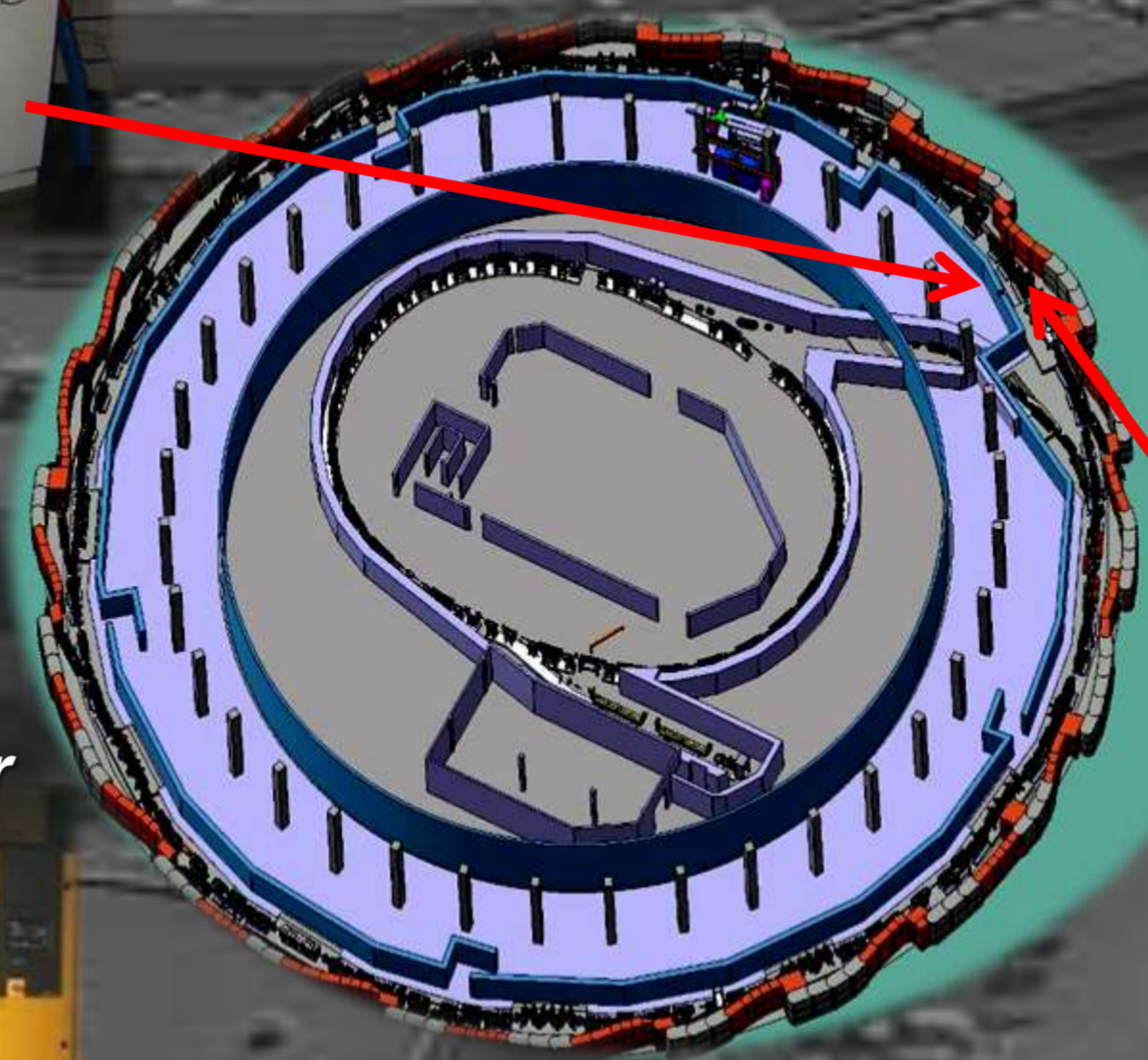
Before top-up injection with the new booster, the activation of the 3rd harmonic cavity allowed to inject in the ring each 2days instead of every day. Comparison between a typical day with 3HC tuned (beam longitudinally stable) and a day when it is parked (controlled longitudinal excitation).



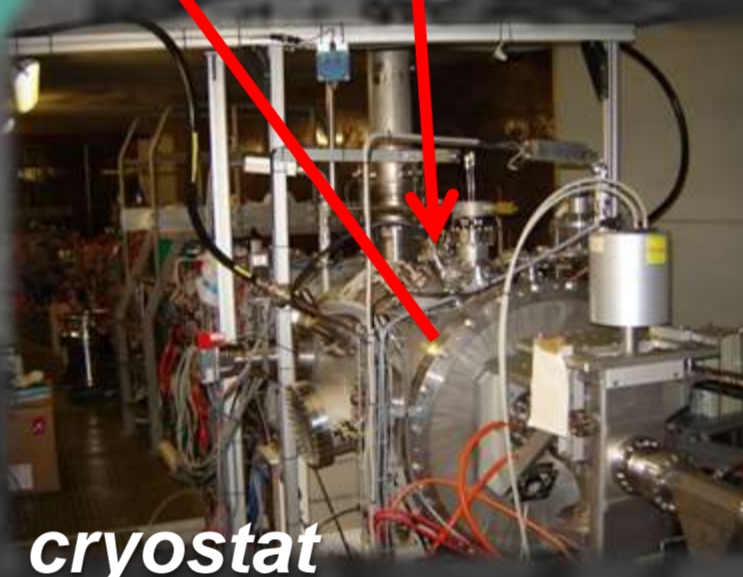
Standard Settings:

- 3rd harm. freq. 1498.955 MHz
- Cavity freq. at 320 mA 1499.015 MHz
- Parking Position 1499.200 MHz
- Δf at 320 mA +60kHz
- Nominal Voltage per cell 300 kV

Kaiser Compressor



Cavity



cryostat

Operator training

After the commissioning, a training phase on the field has been carried on. Operators were involved in various activities including training courses organized at Elettra, routine maintenance of the system and extraordinary interventions.

Ordinary and Extraordinary maintenance

The cryogenic plant (Helial 1000) needs an annual maintenance, which is provided by Air Liquide technicians. Operators follow the maintenance, giving support to all the activities. During the last shutdown they participated in the replacement of the screw compressor.



Air Liquide technician on Helial 1000 during the maintenance

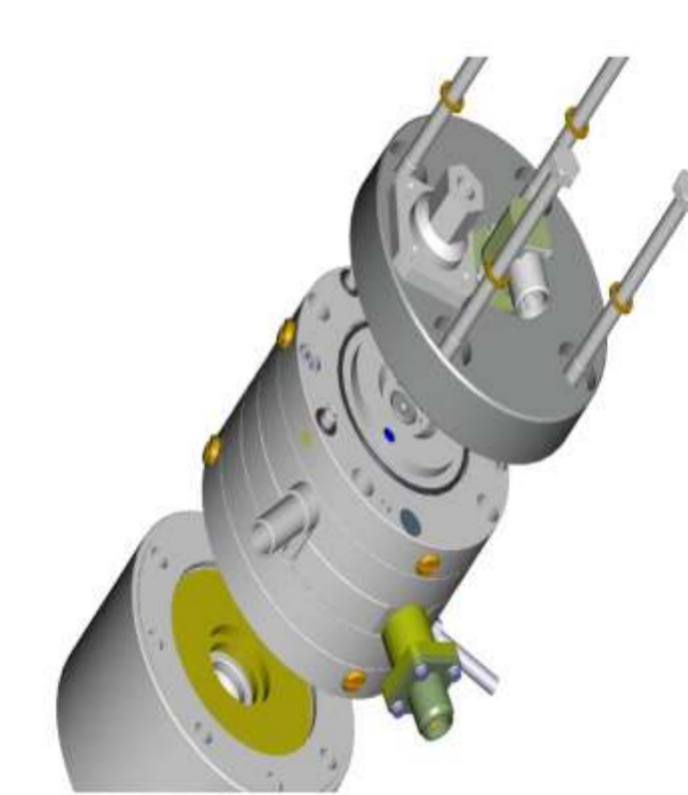
View of the screw compressor from the inside



Cryogenic Turbine training



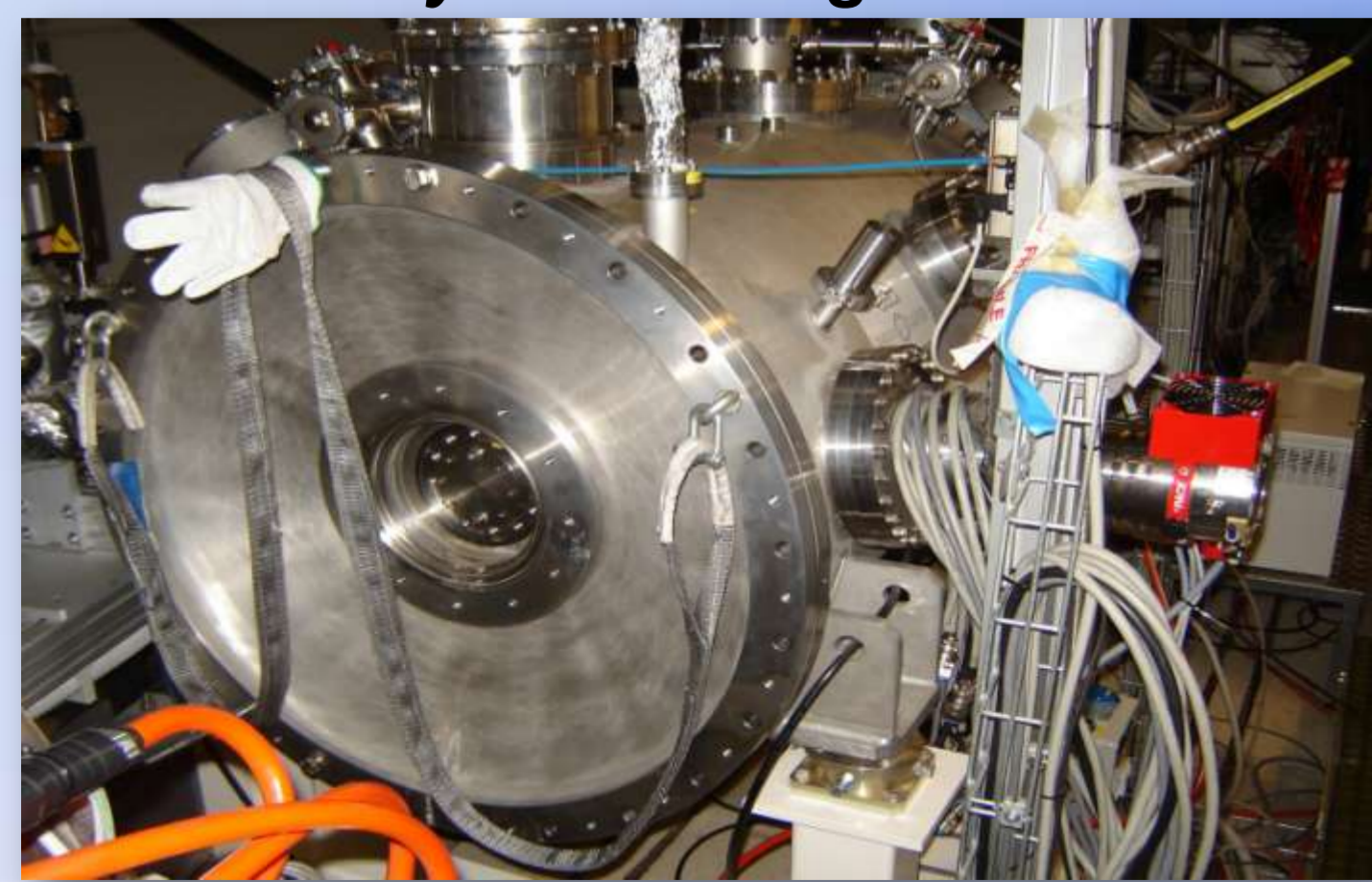
Detail view of the turbines during the course



Vacuum insulation problem

Last year a leak on the the cryostat vacuum insulation was detected and this led to a bad cryogenic efficiency. An important intervention was scheduled in the last shutdown, consisting in venting dry nitrogen in the cavity with a slow controlled flux, removing the main flange and fix the leak by a new TIG welding torch. The SC cavity did not suffer any pollution and it has been now operating.

Reassembly of the flange



View of the welding



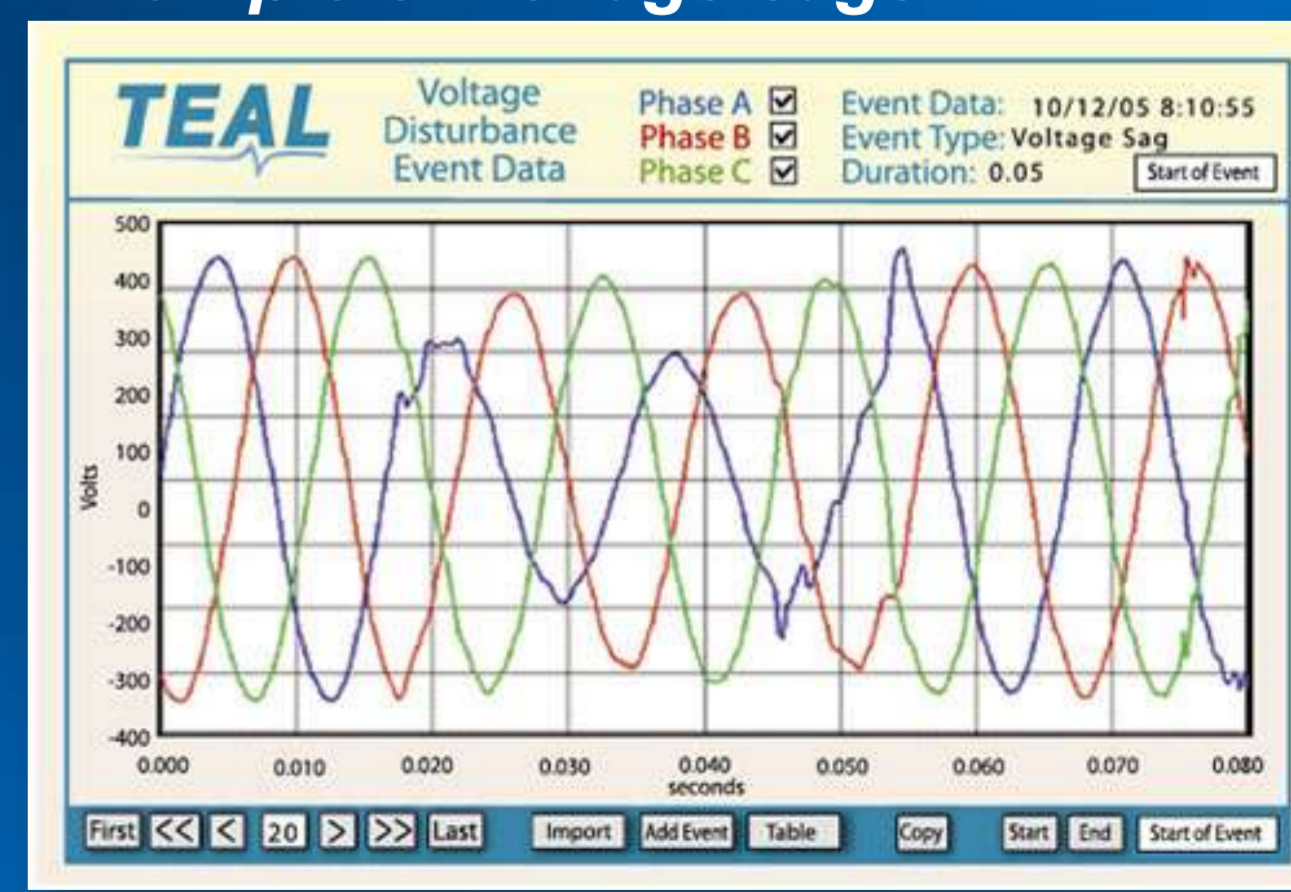
UPS

In 2011 we connected all the system of S3HC directly to the trigeneration plant (CHCP: Cogeneration of Heating, Cooling and Power). This unit was designed as a no-break system and to sustain the UPS electric loads (250KW only for the main compressor) during micro-interruptions or interruptions of the external electric power supply. This was very useful for system reliability, faults due to voltage sags are almost forgotten!

UPS systems



Example of voltage sags



Time vs Fault

