This is a photo gallery of the production of the 19 LCGT standard filters at Galli & Morelli, Lucca Italy.

JGW-T1200804

The parts of the standard filters were first machined, then sent for cleaning and electropolishing

The cleaned and electropolished parts come back wrapped in UHV compatible aluminum foil and plastic foil.

All screws are silver plated and prepared for baking.

All parts are inspected counted and prepared for baking in air at 200oC for 2 days or 220oC for a day.

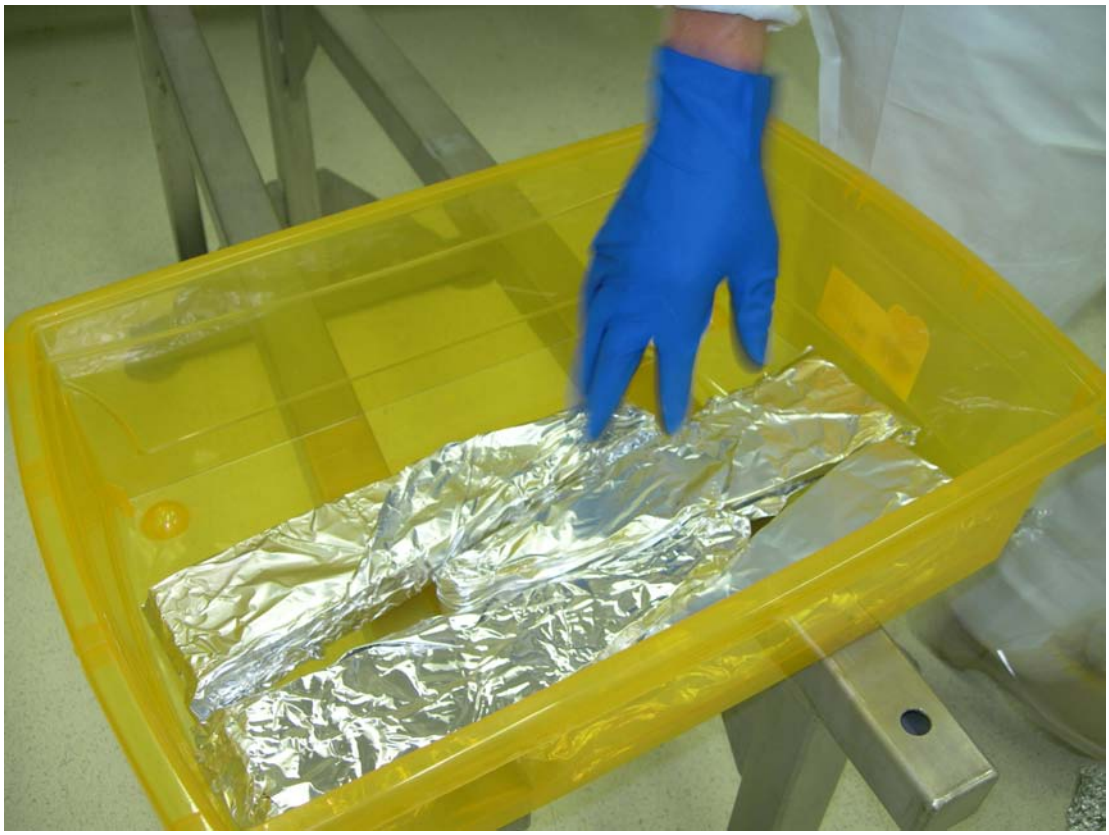
After inspection and counting the parts are piled up in a large oven, using standard filter caps as baskets. The caps are moved out of the clean room and lowered into the oven with the help of chains attached below the oven cover.

after the bakeout the parts are packaged in small groups of 2 to 10 pieces, or pre-grouped for each specific use.

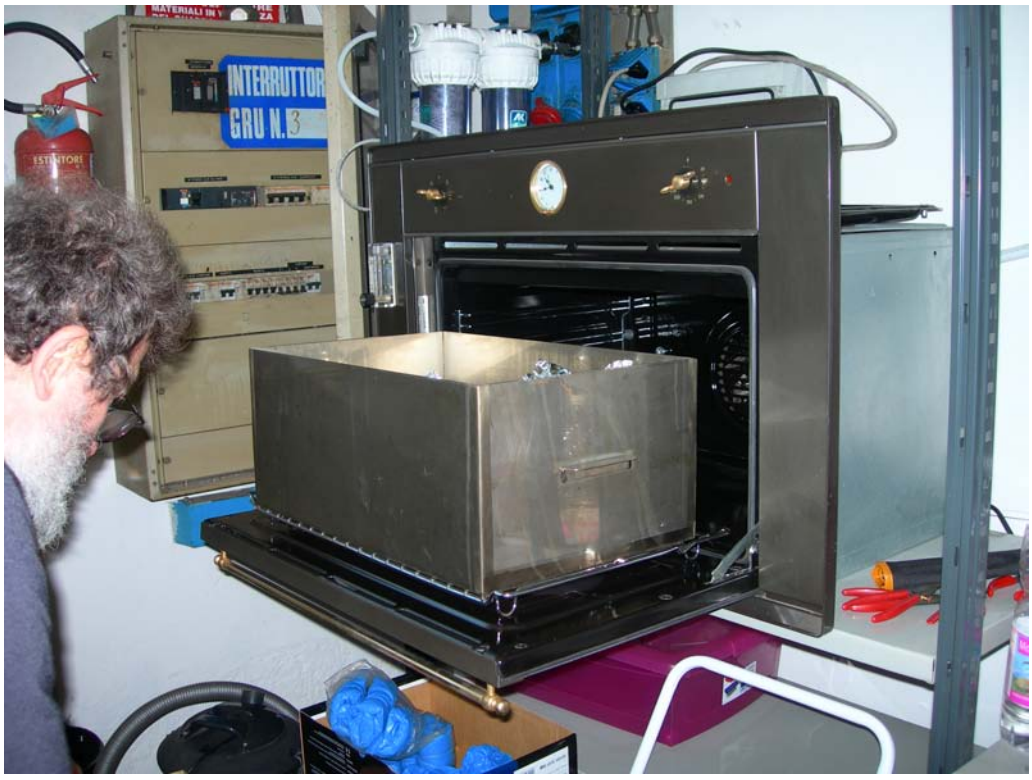
The Maraging blades need precipitation hardened at 435oC for 100 hours in Argon atmosphere. were They are first sandwiched between rigid plates and wrapped in aluminum foil.

then the blade packages are put in a very clean and almost air tight insert in the oven. Argon is flown directly in the insert, from which it leaks in the oven and finally outside

After the hardening the blades are inspected and repackaged in groups of 10

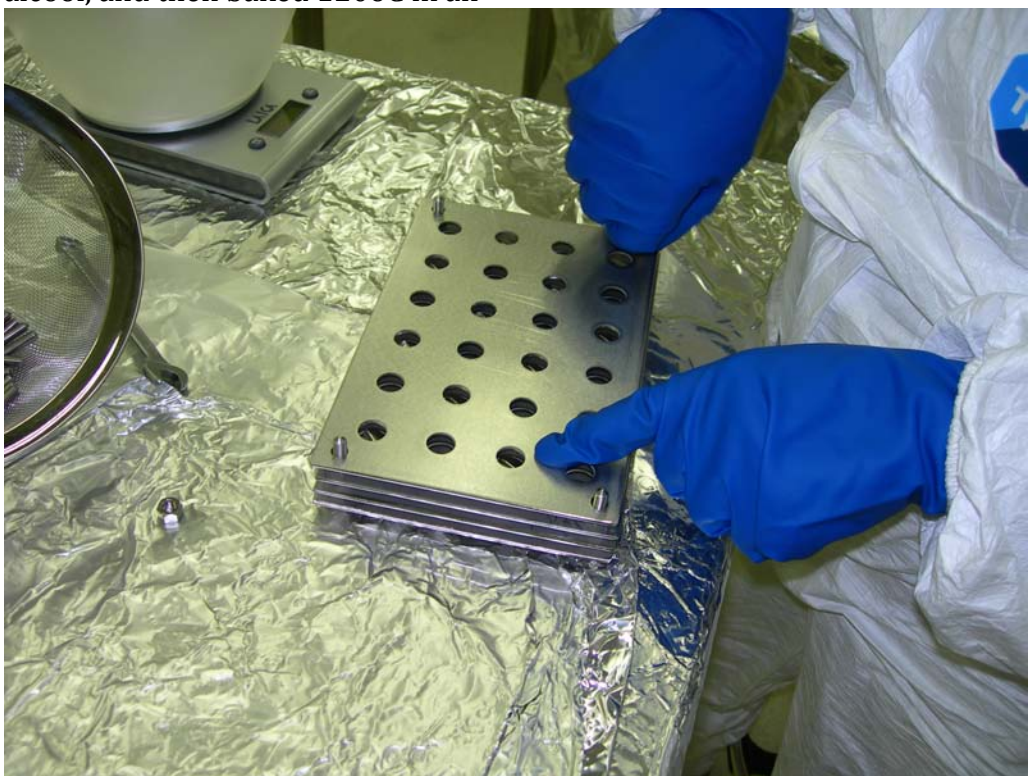


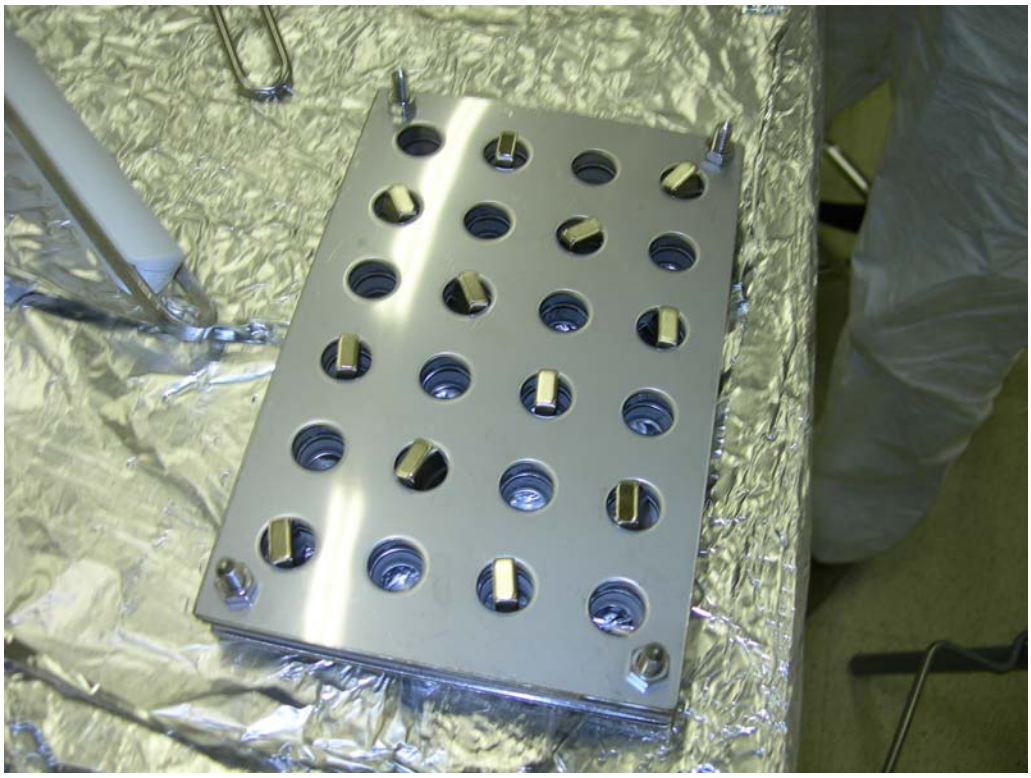
coils, magnets SiC bars and other small parts are baked in a modified kitchen oven, with a stainless steel insert, in which either Argon or air are flown. An activated carbon filter eliminates al hydrocarbons from the air flow, and a fiber filter all carbon dust.



coils are baked in the small oven, 120oC in air

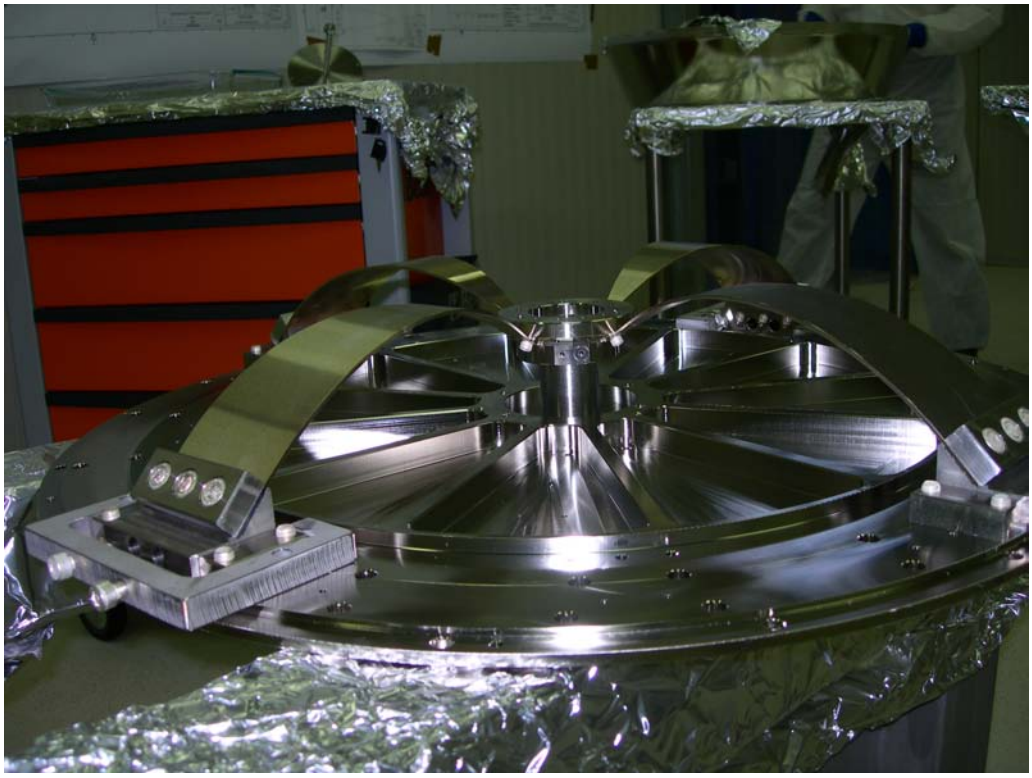
magnets have to be positioned in eggcrates, to be washed in analysis grade propylic alcool, and then baked 120oC in air





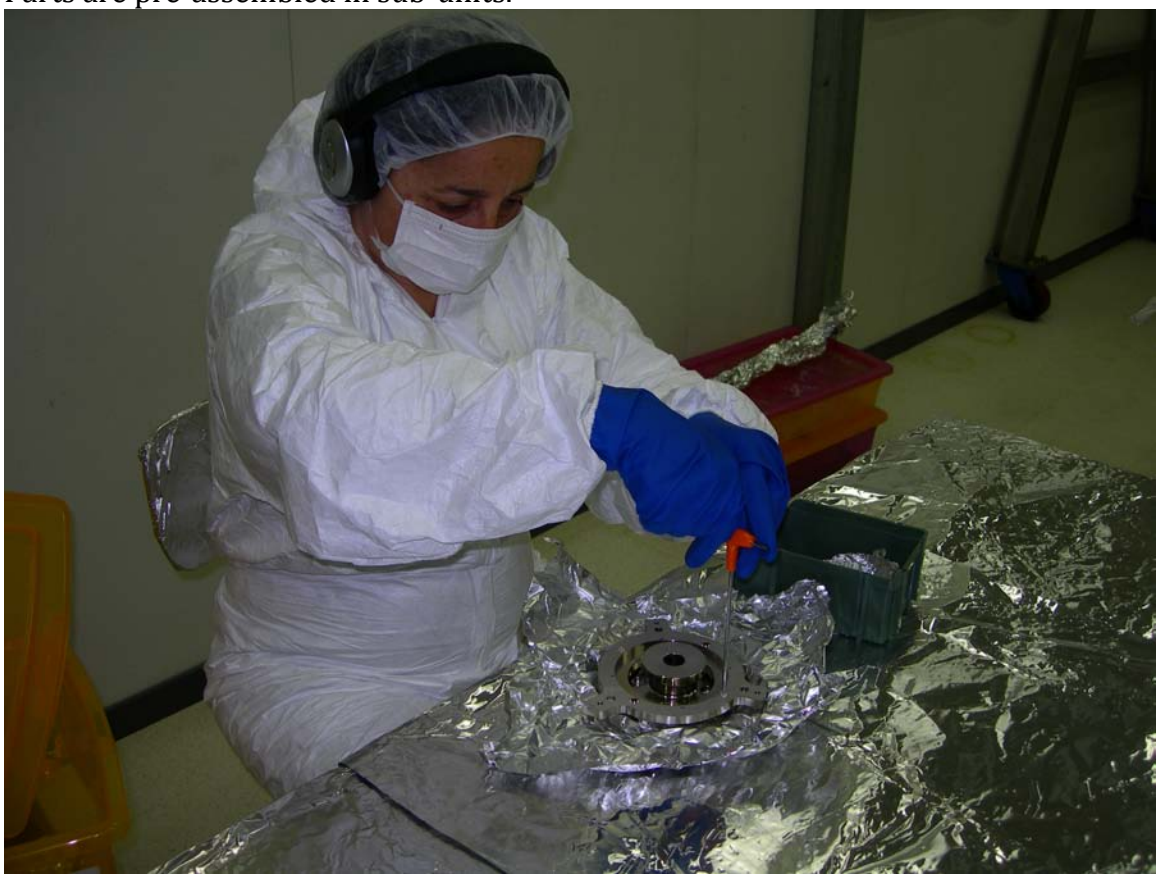
all assembly are made in a clean room closed by a curtain

inside 5 fans continuously suck in air, purify and recirculate it, while a sixth fan sucks external air and pumps it in the room to generate a small overpressure, and keep dust out of the curtain.

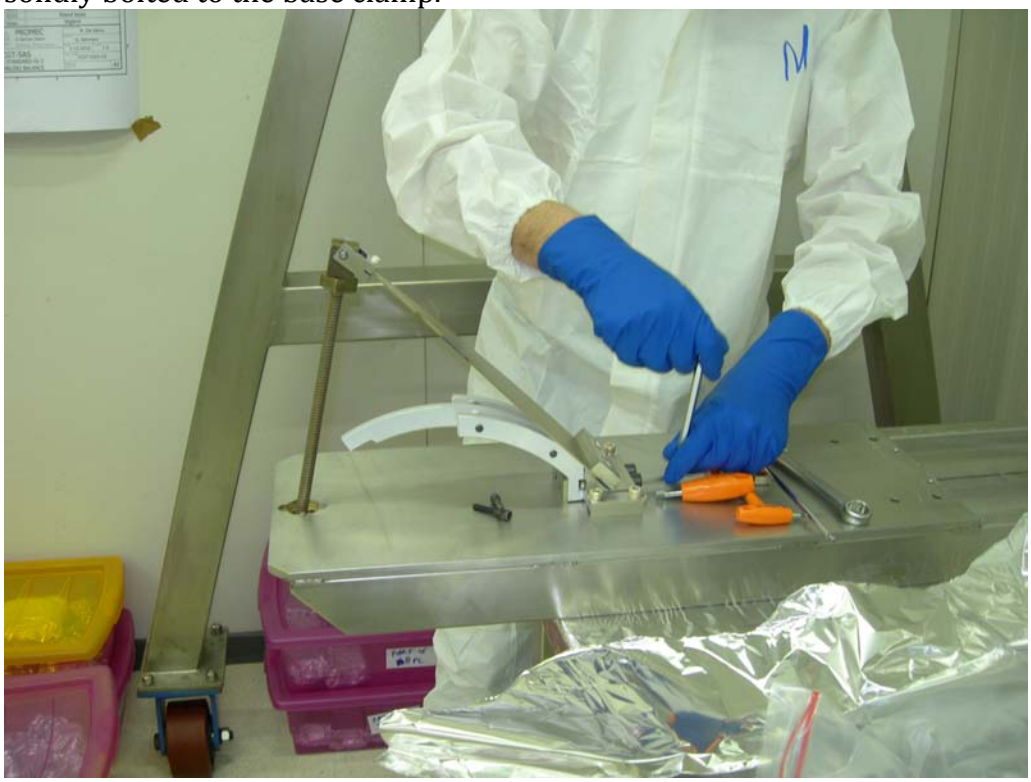


people change in a small vestibule

Parts are pre-assembled in sub-units.



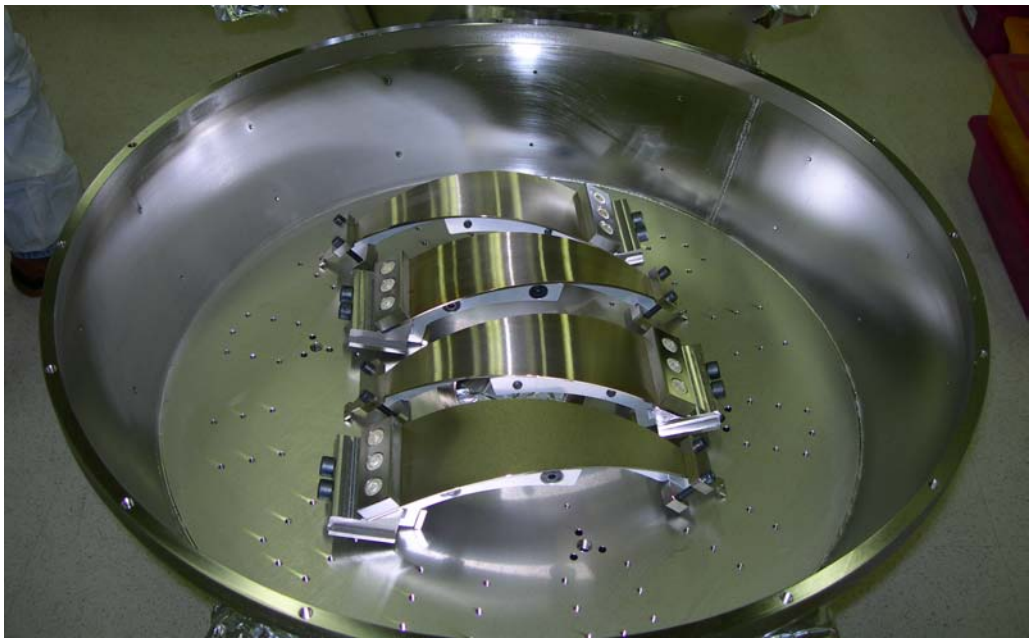
To mount a blade on a filter it needs to be pre-stressed. To do this it is first mounted on its base clamp, and then on a stressing stand, a temporary stress holding arch is solidly bolted to the base clamp.



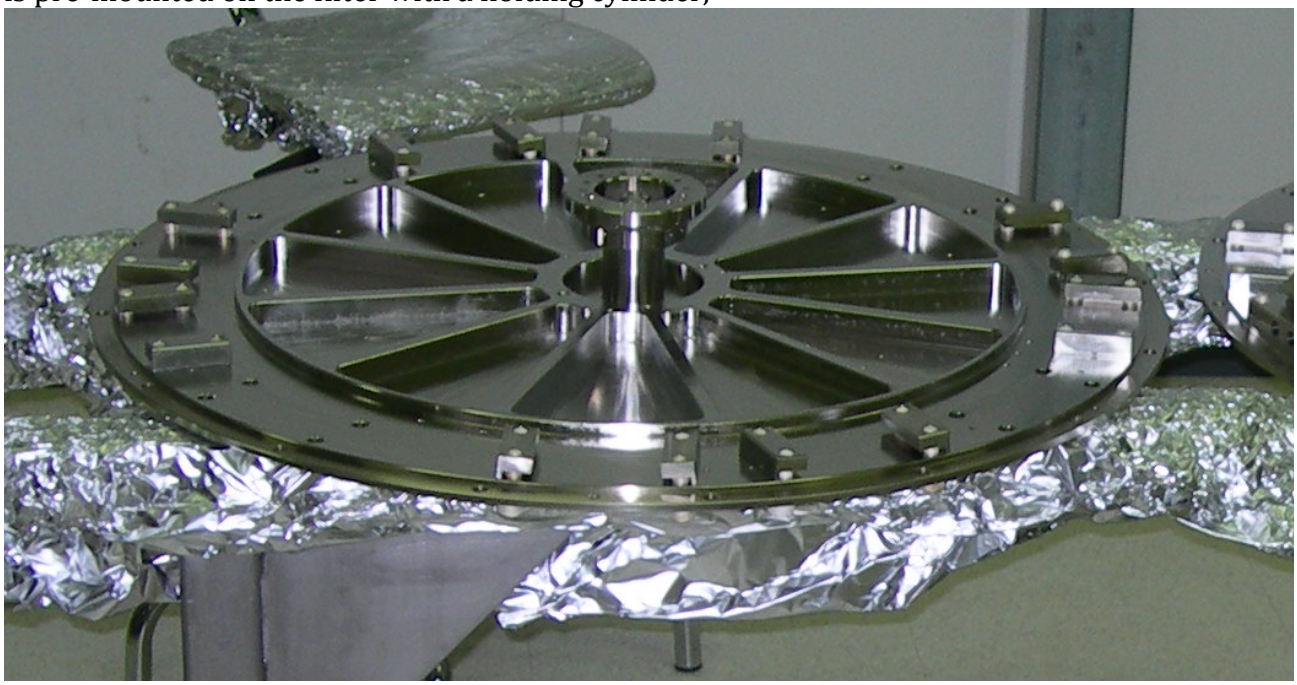
A hinged threaded rod is attached to the tip of the blade

a power tool is used to pull on the tip of the blade until it bend on a the require bending radius

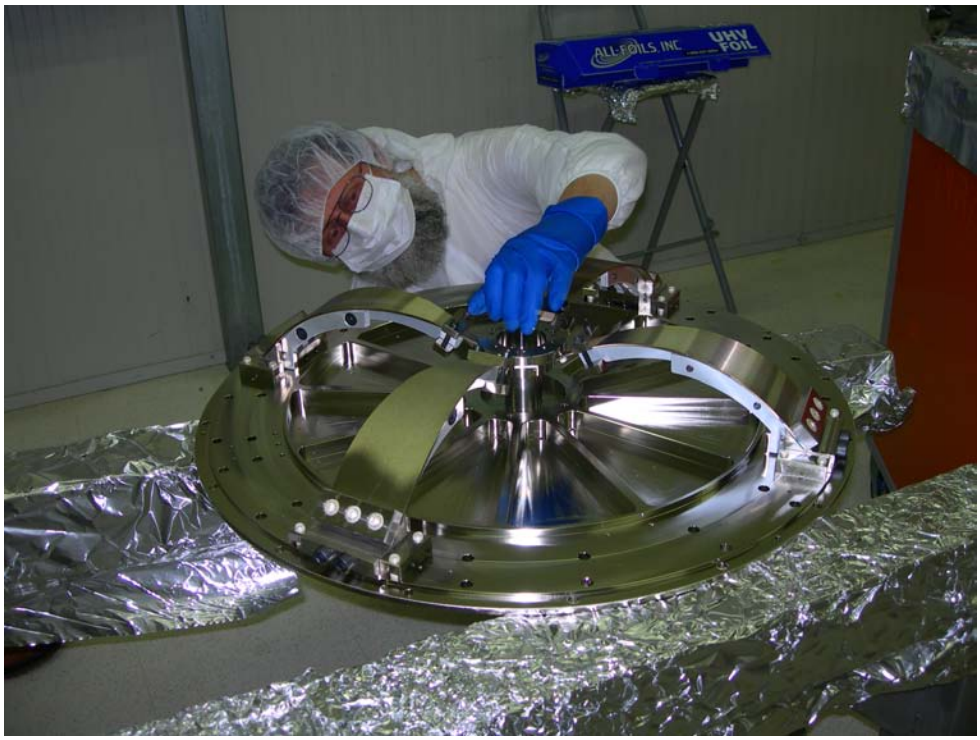
when the blade is stressed a tip clamp is mounted to hold the blade on its stressing arch, the assembly is removed from the stressing stand. Several blades are thus bent.



when four blades are bent they can be mounted on a filter. First the filter's keystone is pre-mounted on the filter with a holding cylinder,

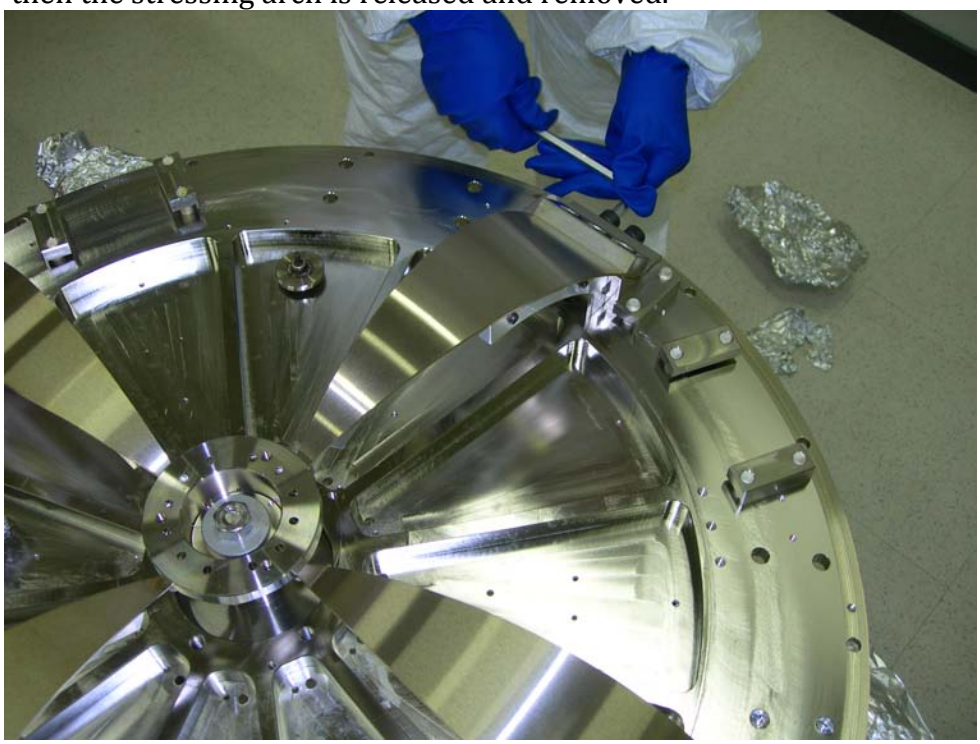


then the four blades are presented in front of the keystone, the tip of the blade is loosely screwed to the keystone, and the blade's base clamp is solidly bolted to the filter's base.

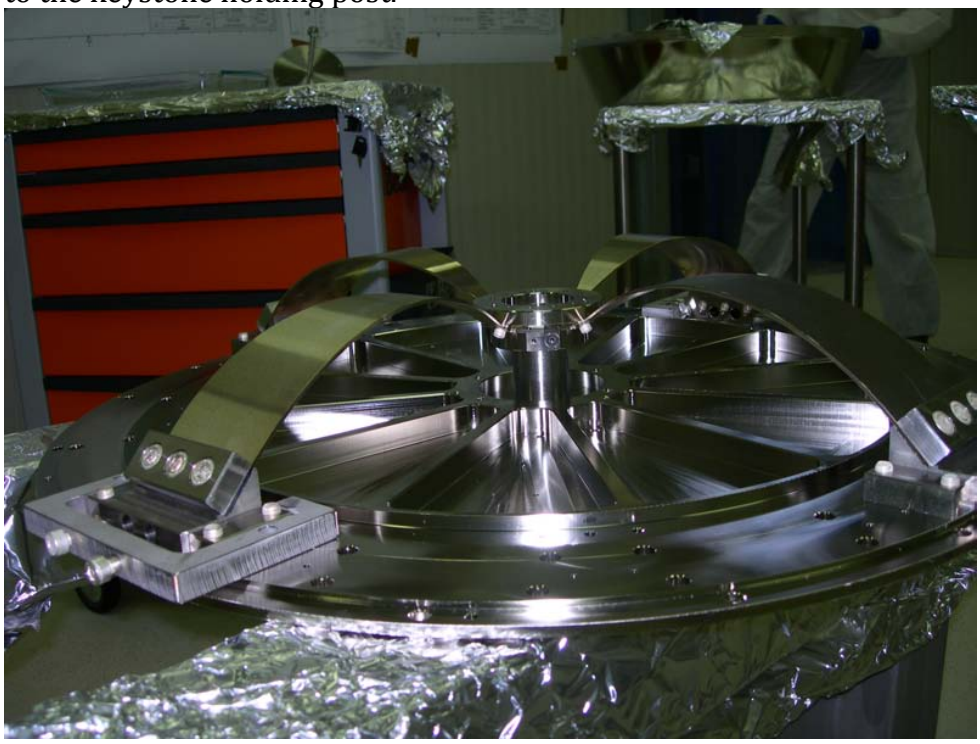


The tip clamps are symmetrically removed allowing the stress to discharge on the keystone without transversal stress,

then the stressing arch is released and removed.

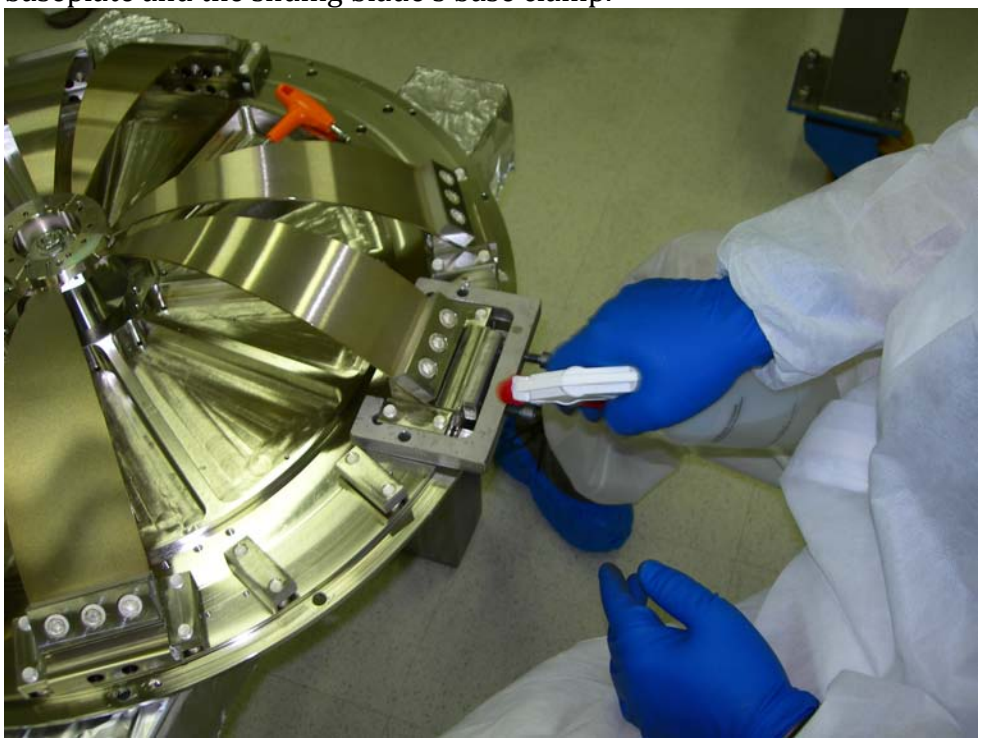


At this point the blades rest under stress on the keystone. The stress is transferred to the keystone holding post.

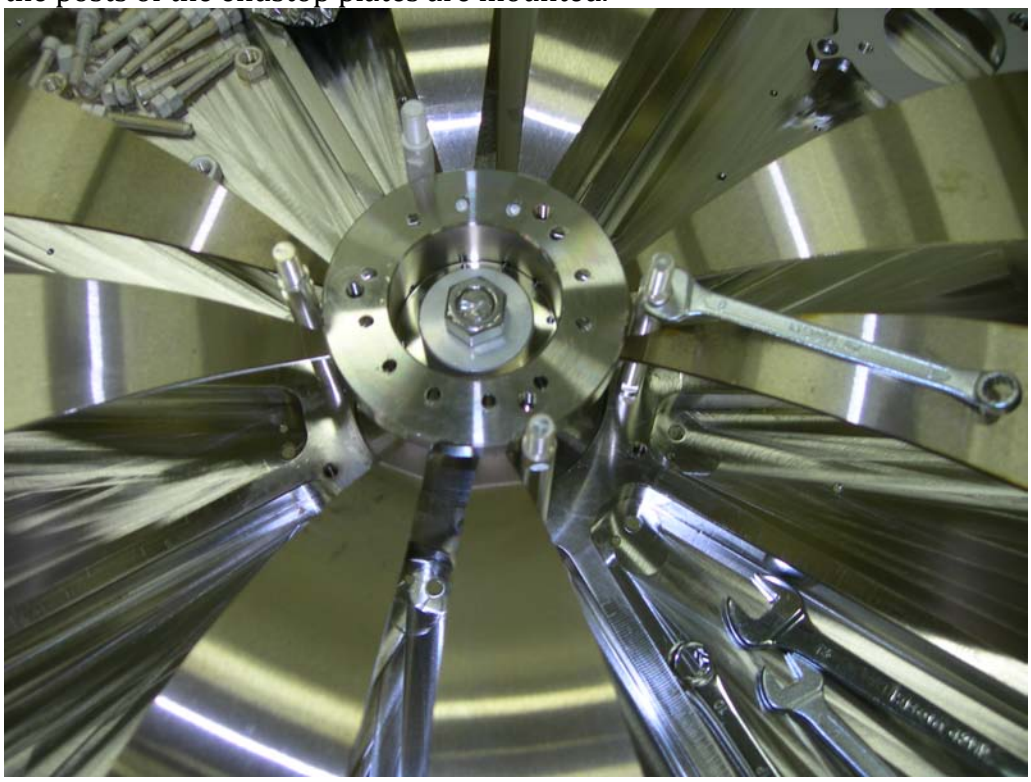


Additional blade pairs can be added, according to the required payload.

When the required number of blades is mounted the blade's radial compression can be adjusted by means of a horseshoe clamp, after releasing the clamps holding the base clamp. Propyl alcohol is used as a lubricant to avoid cold welding between the baseplate and the sliding blade's base clamp.

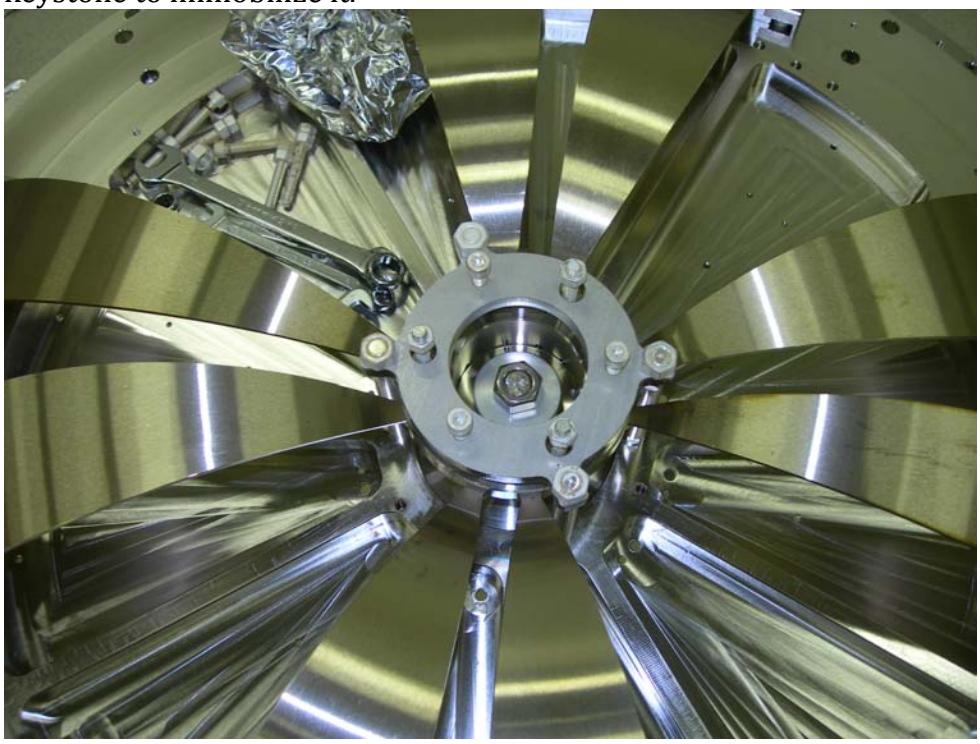


the posts of the endstop plates are mounted.



Then the endstop plate

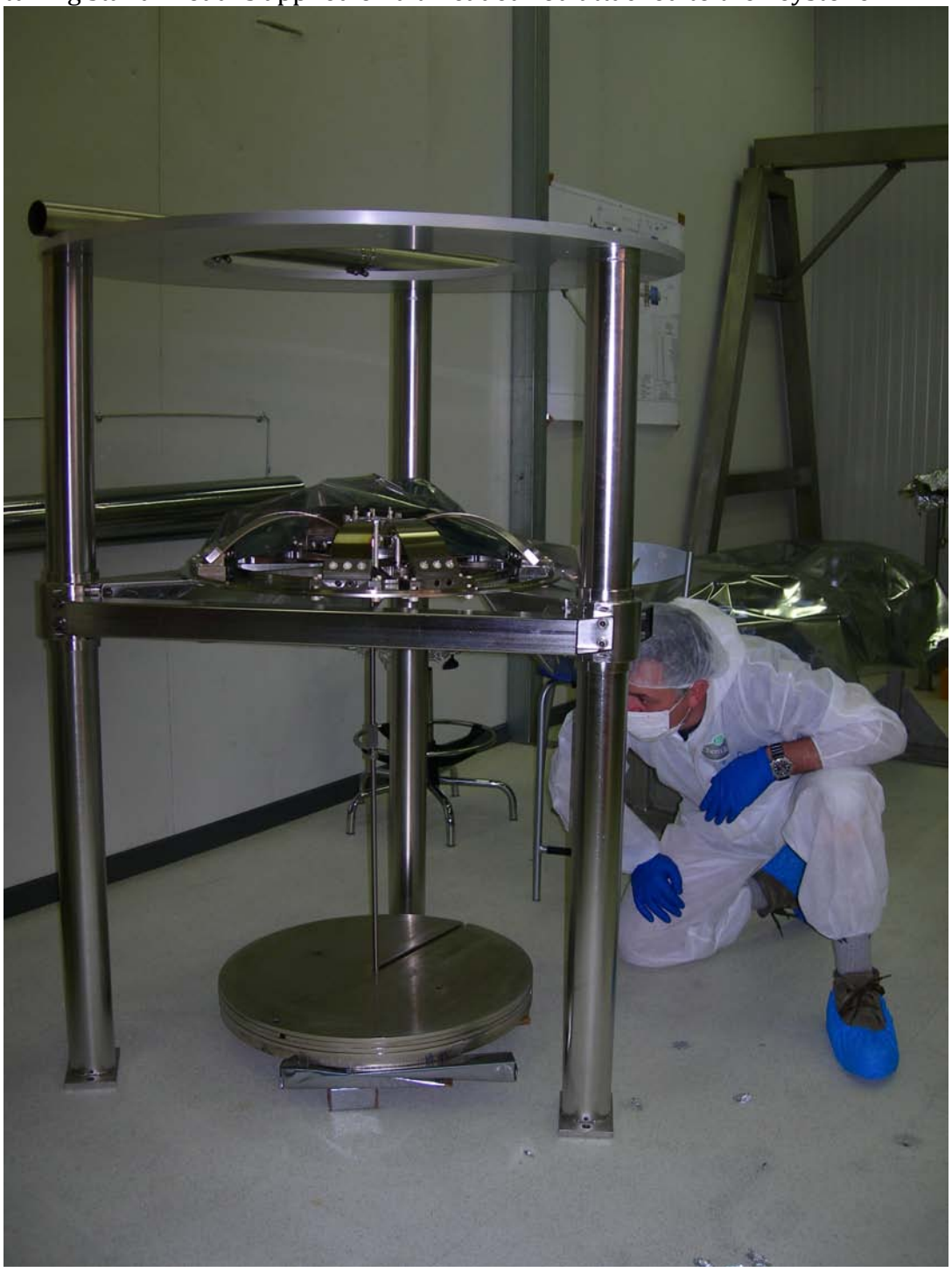
Then the range limiting screws, normal screws on the plate for the upper limit and studs mounted on the keystone with nuts for the lower limit. The screws are lowered to push on the keystone, finger-tight. The nuts are equally lowered to the keystone to immobilize it.



the post holding the keystone is removed, at this point the stress is fully transferred to the endstop ring.

many filters are prepared.

Once the filter is loaded with its blades, it is mounted on a testing and frequency tuning stand. Load is applied on a threaded rod attached to the keystone.



Load is added until the filter floats.

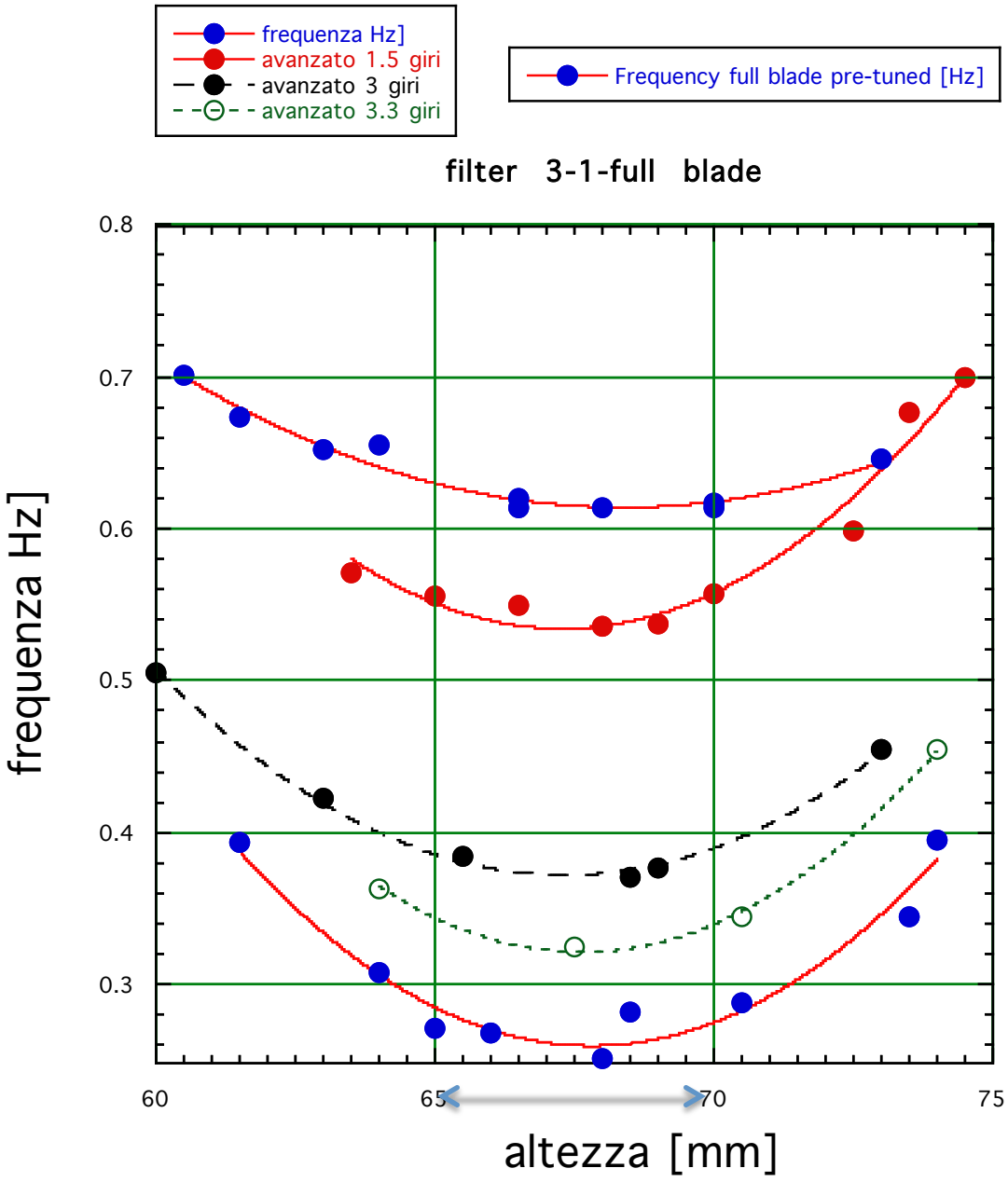
the end stop screws and nuts are progressively released

The filter is made oscillate to measure its frequency as a function of height.

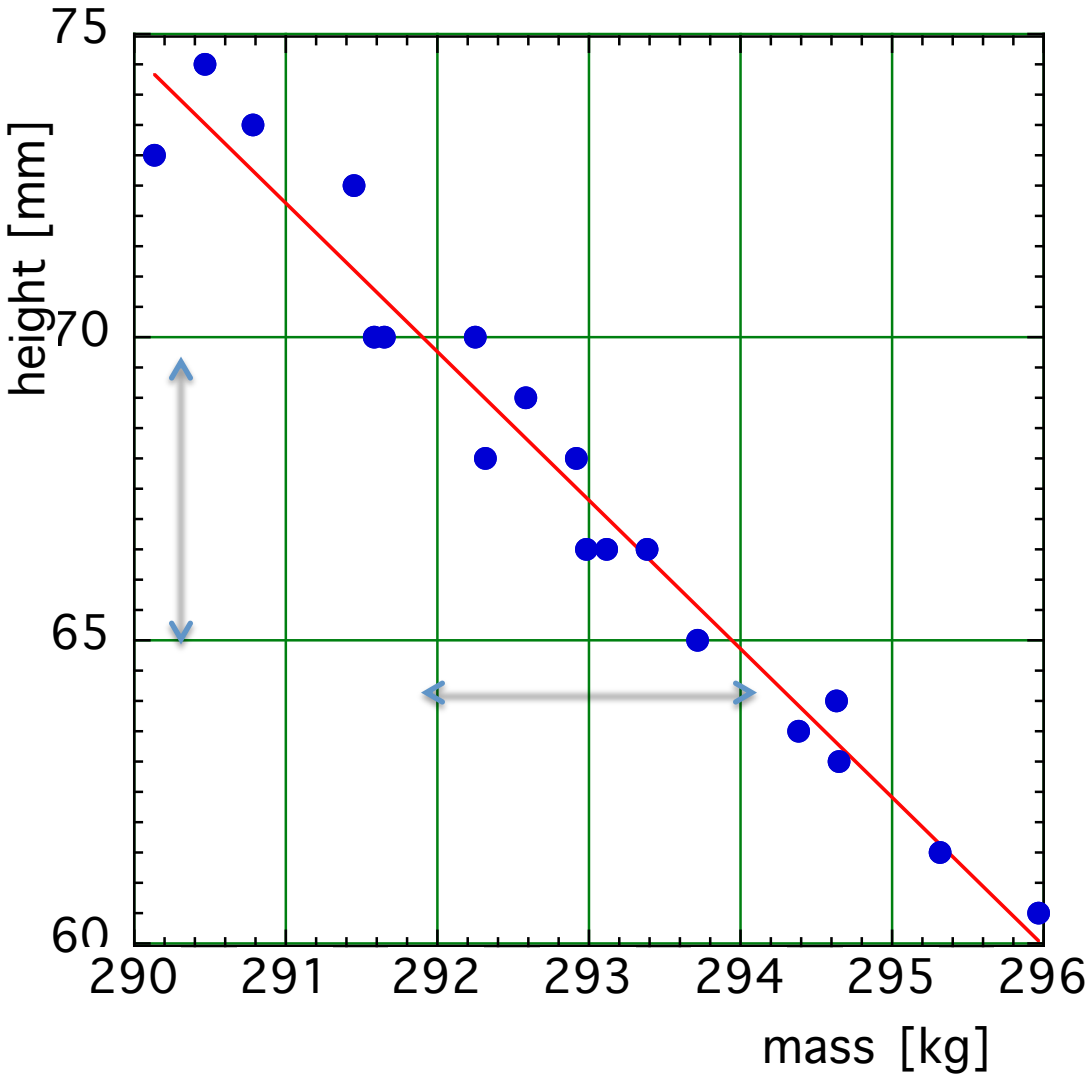
if need be the radial compression can be changed to adjust the frequency tune.

or reprofiled blades can be exchanged to adjust to the required payload.

the tuning is measured for different radial compressions until the filter is pre-tuned to ~ 250 mHz. a useful working range of at least 5 mm is available.



The payload mass is checked; at least a couple of kg of payload variation is acceptable within the frequency tuning range



The cap is mounted on the filter. At this point the LVDT and actuator coils still have to be mounted on the filter, as well as the magic wands. The filter will be re-opened for implementation.

At night all filters are covered to avoid pollution. Even if the clean room air is very clean, at night the floor is swept.