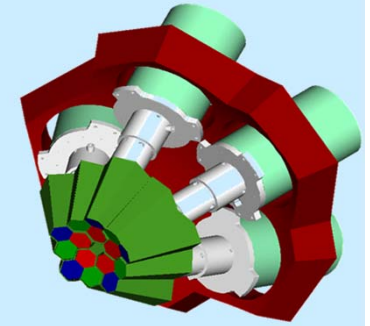




INFN - Milano
University of Milano
Department of Physics



Status of the AGATA preamplifiers

§ °, ~B-1# ° °E°

12th AGATA Week
June 11-13, 2012, GSI, Germany

June 13, 2011

Oscillation issue in double cluster

In January 2012 I received a request for help from CTT

The first double cluster could not be fully populated with Milano segment preamplifiers because of incipient system oscillations @ 8 and/or 10MHz.

➔ From 9 to 11 February 2012 I was in Koeln ←

Problems found in preamps

- Quite a few preamps with incorrect/incompatible modifications

Problems found in preamp motherboard:

- Bad or no soldering of the ground wires (soldering very hard),
- Too weak PS decoupling filters, consisting of single 100nF ceramic capacitors tied to ground

No LC EMI filters used!
Neither tantalum nor
aluminum-foil capacitors used!



Preamp-to-preamp cross-talk and EMI through PS occur

How to address this issue ?

Option 1: redesign the preamp motherboard with LC filters

pros → professional and clean, ultimate

cons → requires time, money, work ----- 

Option 2: add LC filters in the preamps

pros → fast to test and implement ----- 

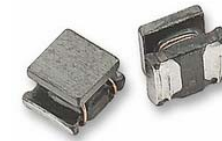
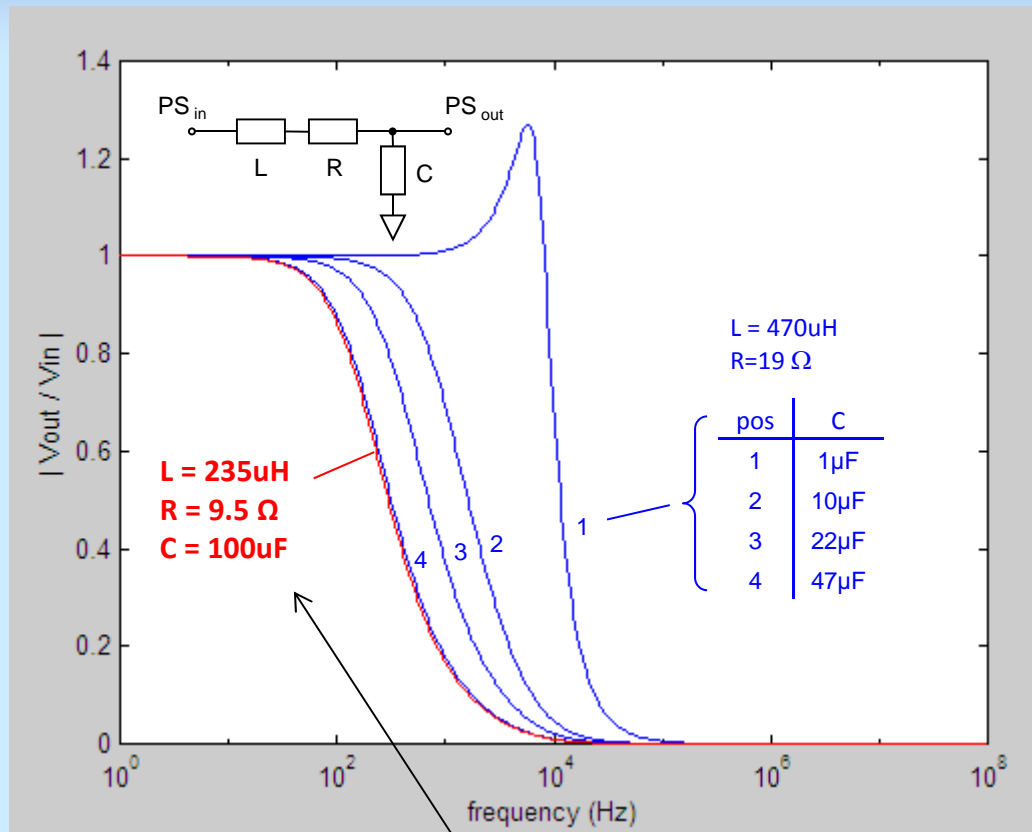
cons → preamp working environment keeps imperfect



Among the four used power supplies the +6V is the most power eager @ ~50mA per triple → I firstly and mostly worked on the filter for the +6V PS

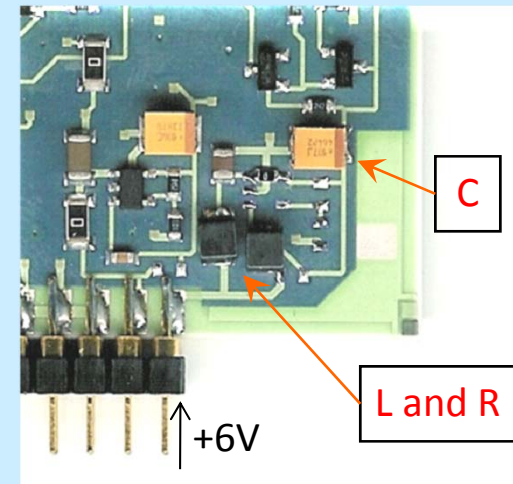
✓ Oscillations removed after adding LC filter on +6V

Sizing the LC filter of the +6V PS



Chip inductors non-idealities:

- coil resistance
- maximum DC current



Two 470uH inductors in parallel:

- $L_{eq} = 470\mu\text{H} / 2 = 235\mu\text{H}$
- $R = 19\ \Omega / 2 = 9.5\ \Omega$
- $I_{MAX} = 2 \times 60\ \text{mA} = 120\ \text{mA}$

Segment preamplifier LC rework

→ 25 preamps reworked in Koeln (Feb 2012)

👉 single-inductor solution, ok but close to the DC current limit of inductor

→ 75 new preamps sent to CTT on May 9, 2012

✓ double-inductor solution,

→ 45 used preamps received from CTT, checked/modified in Milano and resent to CTT on May 11, 2012, of which

✓ n. 11 with double-inductor solution,

👉 n. 34 could not be modified (because of incompatible layout version)

→ 48 used preamps received from CTT, checked/modified in Milano and hand delivered to detector group in this AGATA week, of which

✓ n. 48 with double-inductor solution

Two used preamps needed a fix up:

- defective BJTs (Q4, Q5)
- defective opamps (U1)

Summary

- Oscillation issue found in double cryostat when many preamps are plugged in
- The cause has been identified as a board-to-board cross-talk through the +6 power supply
- PS cross-talk caused by too weak decoupling filters in preamp motherboard
- Bad or no soldering of ground wires on motherboard
- Oscillations removed adding LC Power-Supply filter on +6V
- Modification implemented in 159 triples so far