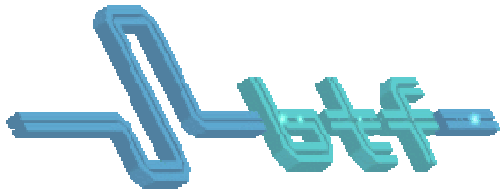
Task M6: Study of thermo-elastic effects caused by absorption of cosmic rays

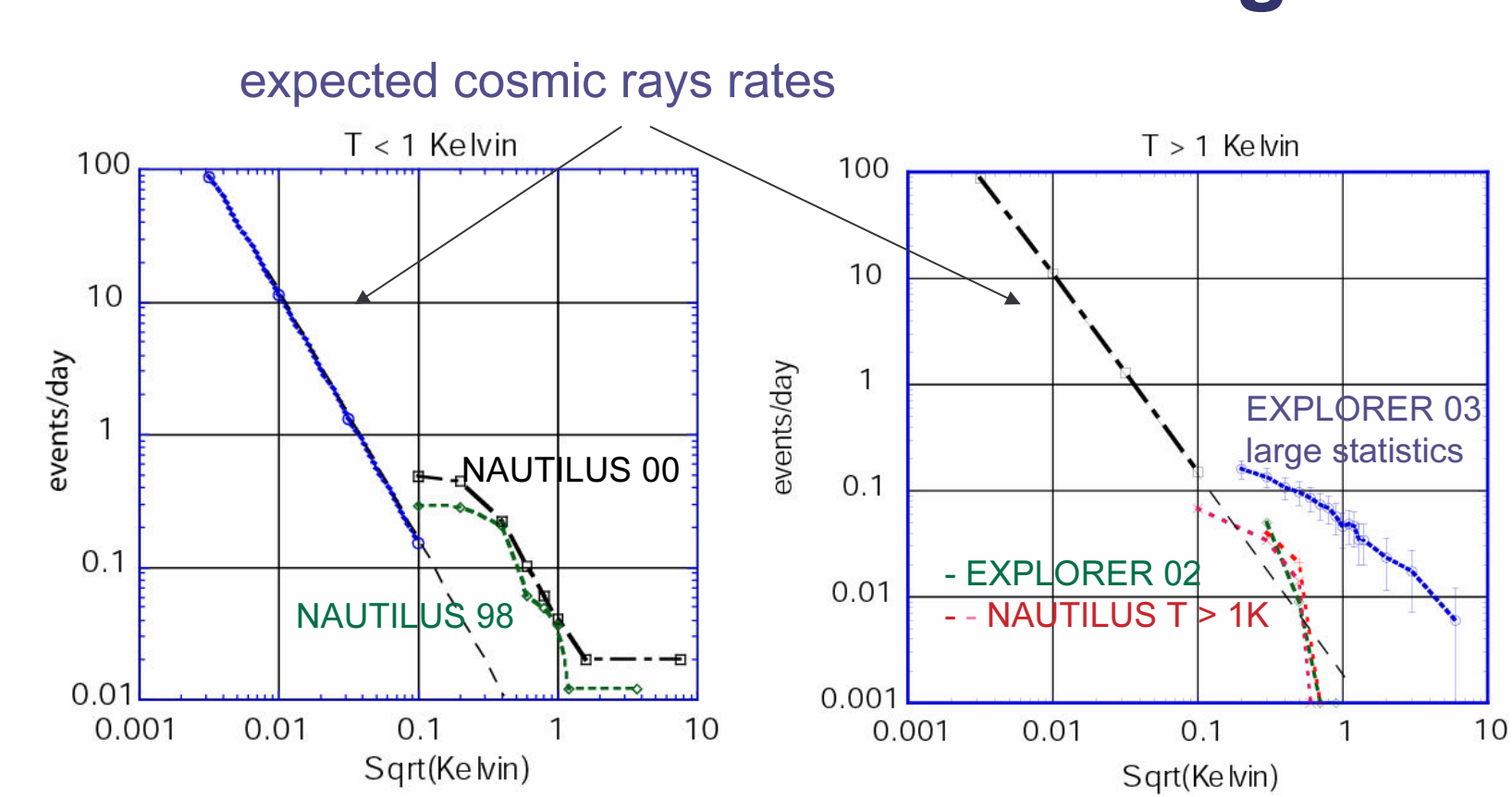


Task M6 plan

9.R3 - Table 2 – STREGA - First 18 months Implementation Plan						
Tasks and Deliverables	1st To 6th Month		7th To 12th Month		13th To 18th Month	
WP 1 - Task M 6: Study of thermo-elastic effects caused by absorption of cosmic rays						
Tasks:						
6.1 - Modification of the cryogenic facility in Frascati		completed		→ waiting for refrigerator		
6.2 - Design and implementation of the acoustic emission detector		completed				
6.3 - Room temperature acoustic measurements on Al			completed			
6.4 - Starting of low T measurements on Al and Si					started	
Deliverables:						
- Modified cryogenic facility in Frascati operative - Report on room temperature measurements on Al using an electron beam				In progress		

Task M6 have completely achieved the milestones. We have already started part of the low temperature measurements, and by the beginning of 2005 we will start the ultralow temperature test and final measurements.

unexpected cosmic rays noise non super-conducting state

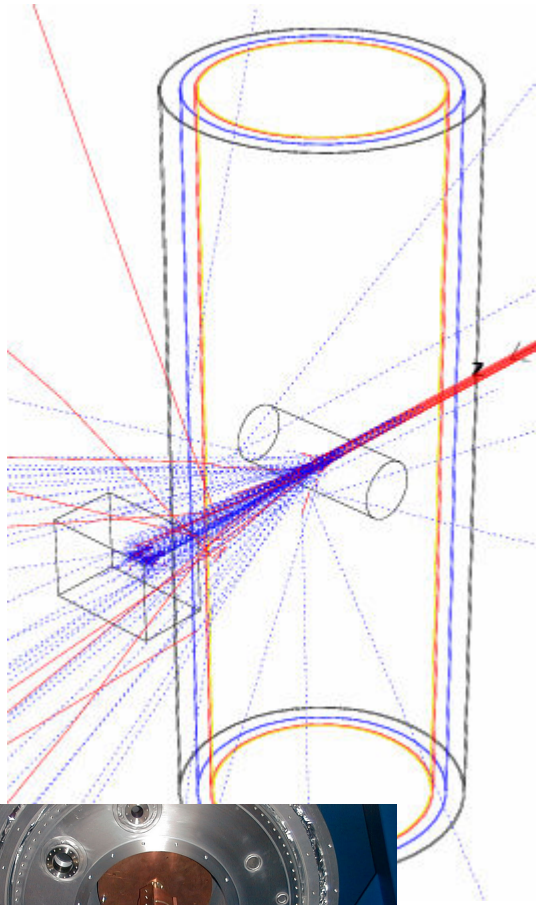


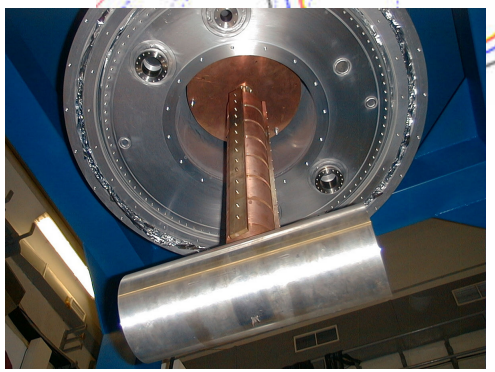
2003 EXPLORER data are in disagreement with the NAUTILUS data when detectors are in non super-conducting state

The RAP Experiment

thermal and mechanical | energy lost | Geometric factor

$$E_n \propto \gamma^2 \cdot (dE/dx)^2 \cdot F^2_n$$





In order to understand:

γ enhancement of Grüneisen factor in super-conducting or low temperature state

(dE/dx) enhancement of energy conversion in super-conducting or low temperature state

(dE/dx) exotic component of cosmic rays (nuclearites, monopoles)

…

The thermo-acoustic model has been proven effective at room temperature by previous experiments

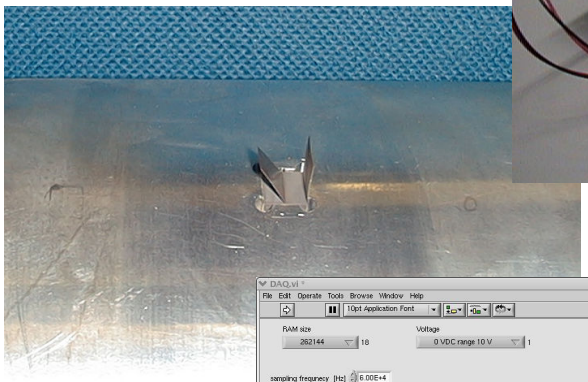
Rev.Sci.Instrum.71:1345-1354, 2000 and pervious papers

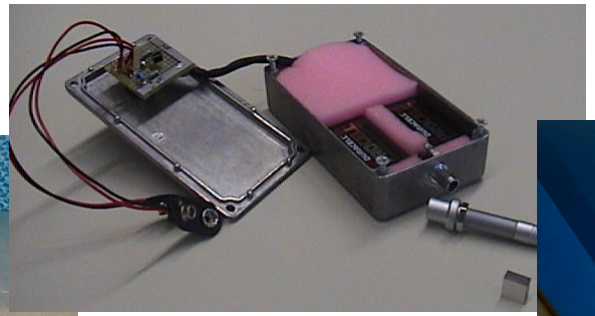
Phase 1: 300K test

installation and test of full detector at room temperature: suspension, electronics, DAQ, mechanical structure, first measurement at room temperature

Suspension:
7 OFHC copper masses
1 OFHC copper tube
Attenuation: –200db@ 5KHz

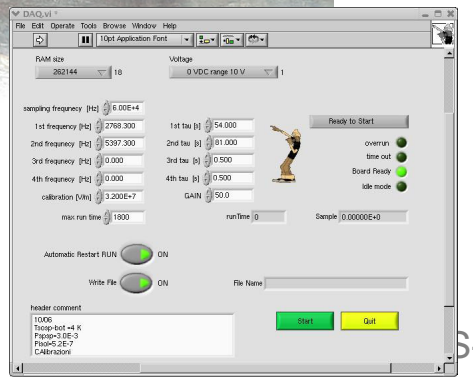
2 piezo-electric ceramics (PZT24, 1cm^{2}x0.5cm) embedded in the test mass





JFET amplifier
1nVHz$^{-1/2}$@ 5KHz
bandwidth 25KHz

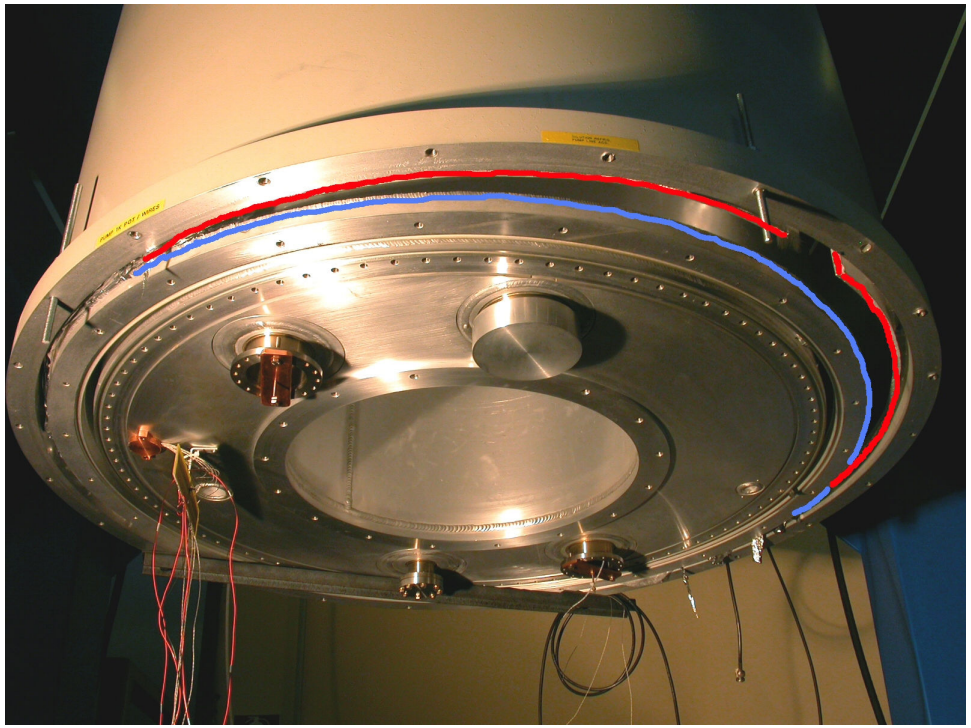
100 KHz DAQ, controls and Aux I/O



measurement/theory = 0.70 +/- 0.11

Phase 2: 300-4K test

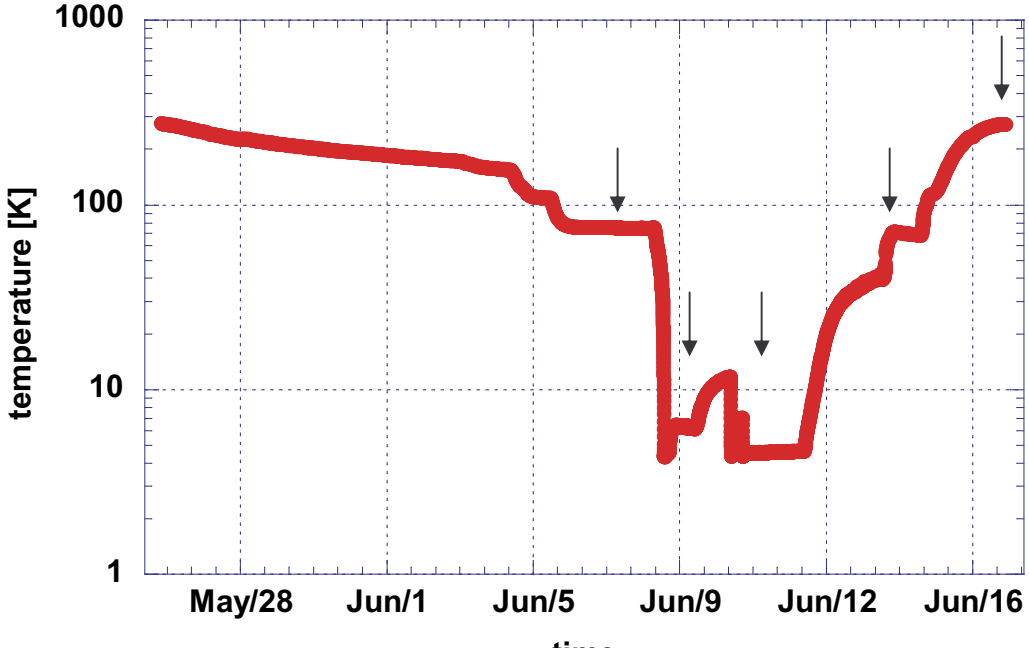
cryogenic test, and low temperature measurement in non super-conducting state



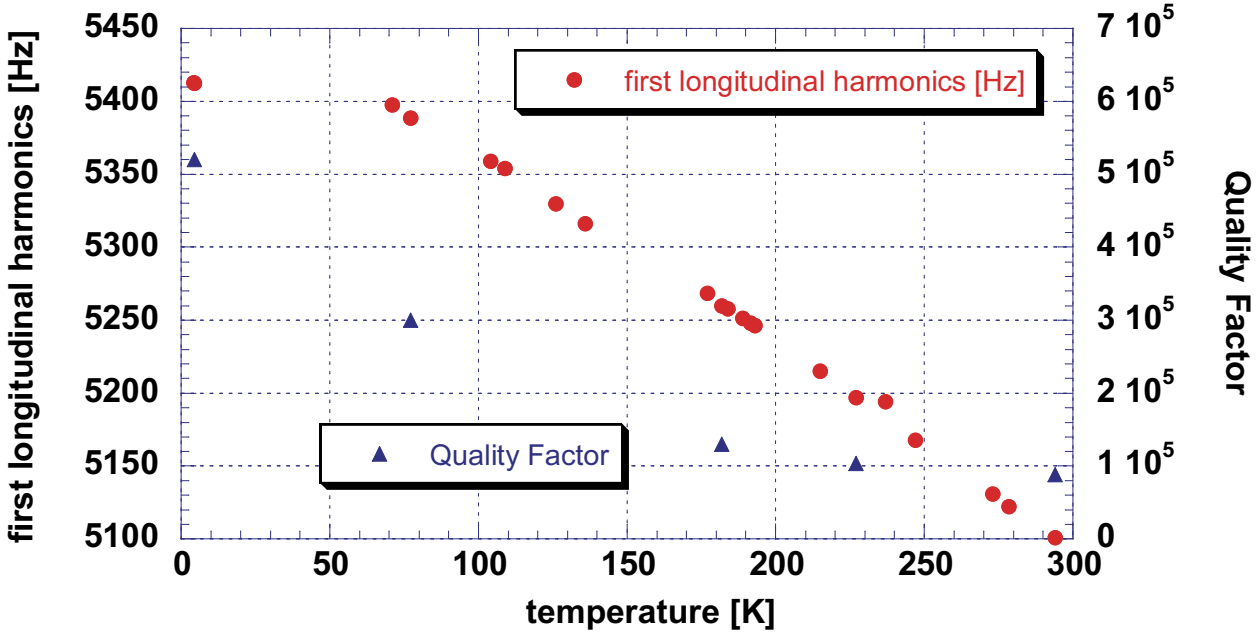
A cryostat failure during the second nitrogen cool down stops the scheduled runs on February. The problem has been recovered in May when RAP started cool down directly in the BTF experimental hall

done in 2004 according to the milestones

RAP first Cool Down

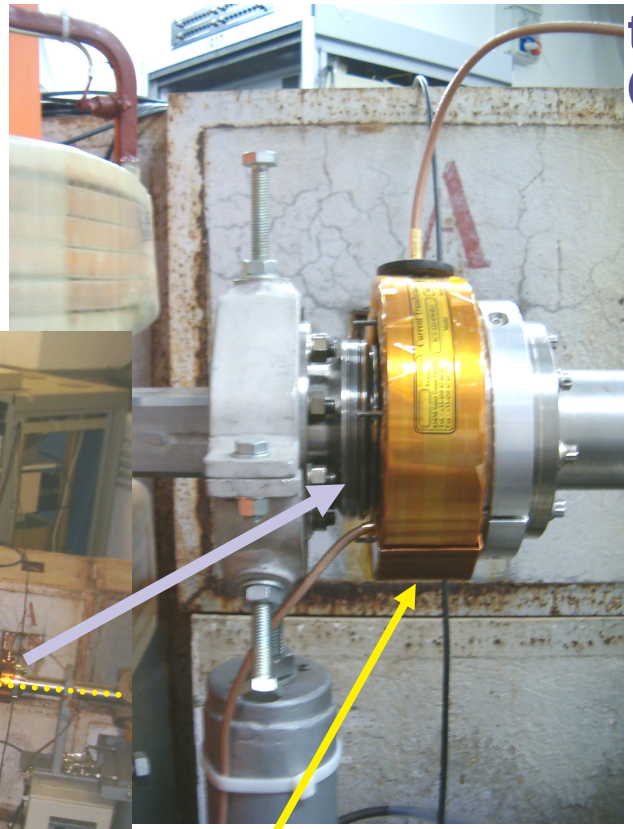


data taking

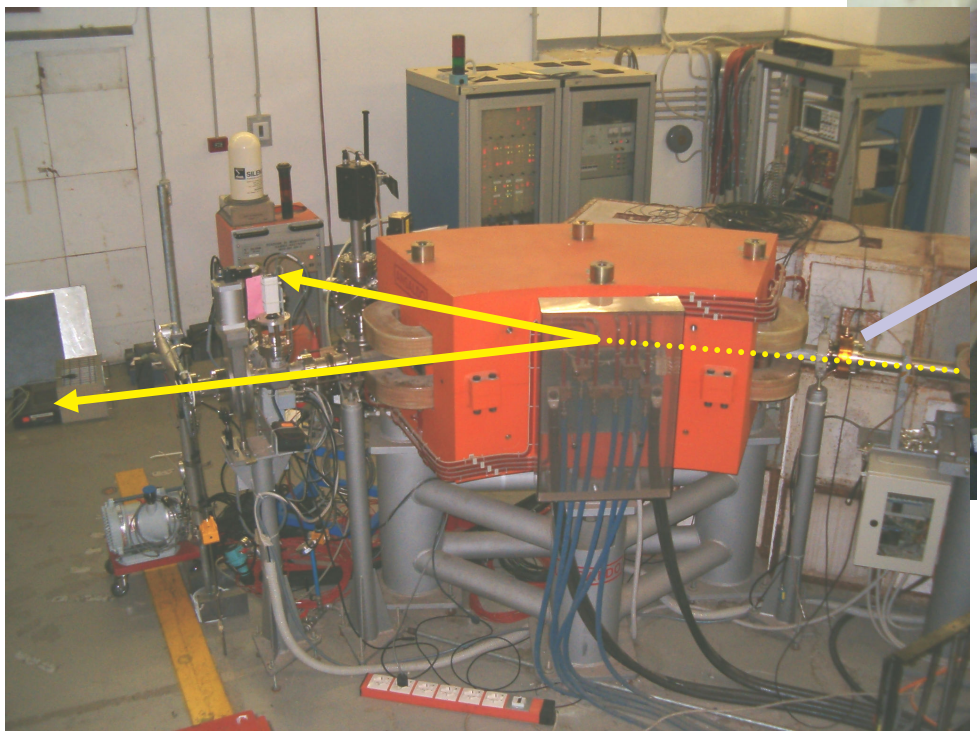


High intensity monitor

Beam Charge Monitor (BERGOZ)
noise < 550 fC ~ 3*10^6 e$^-$

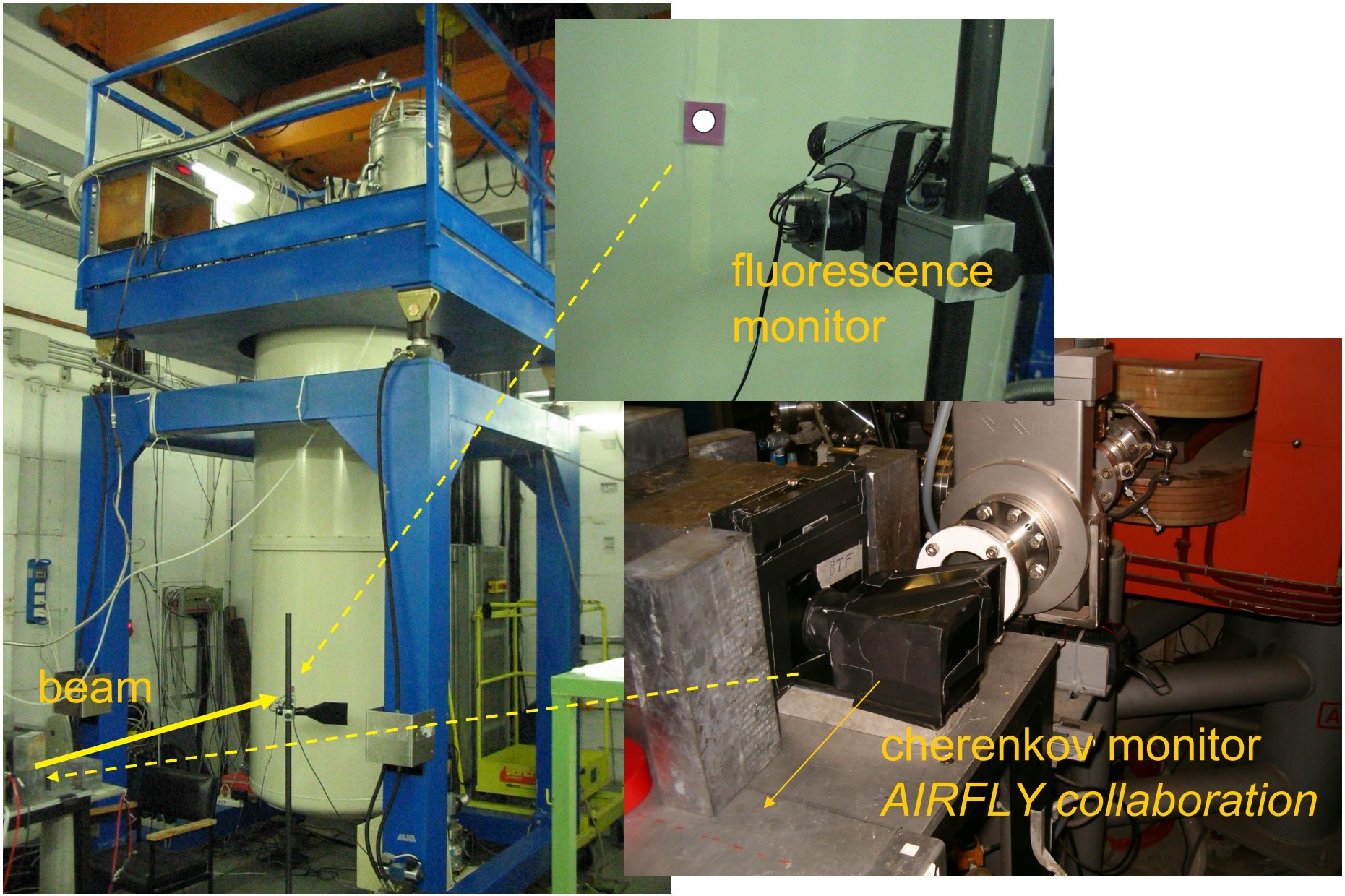


to QDC
(100 fC resolution now improved 25 fC)

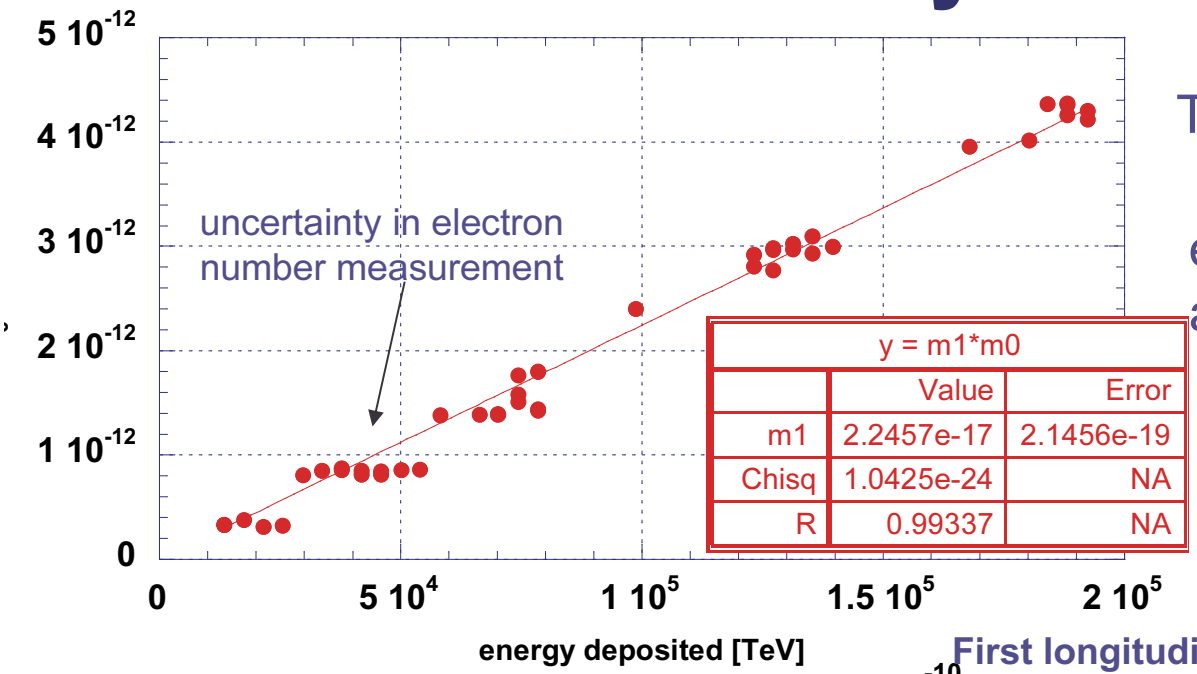


calibration coil

Intensity and position monitor



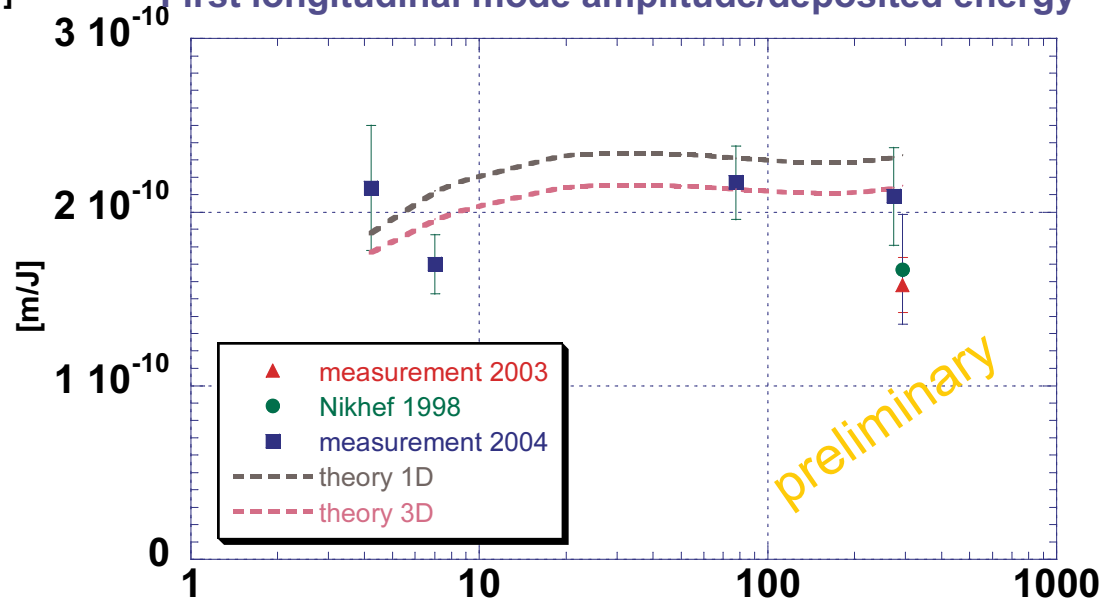
Data analysis in progress…



T ~ 77 K

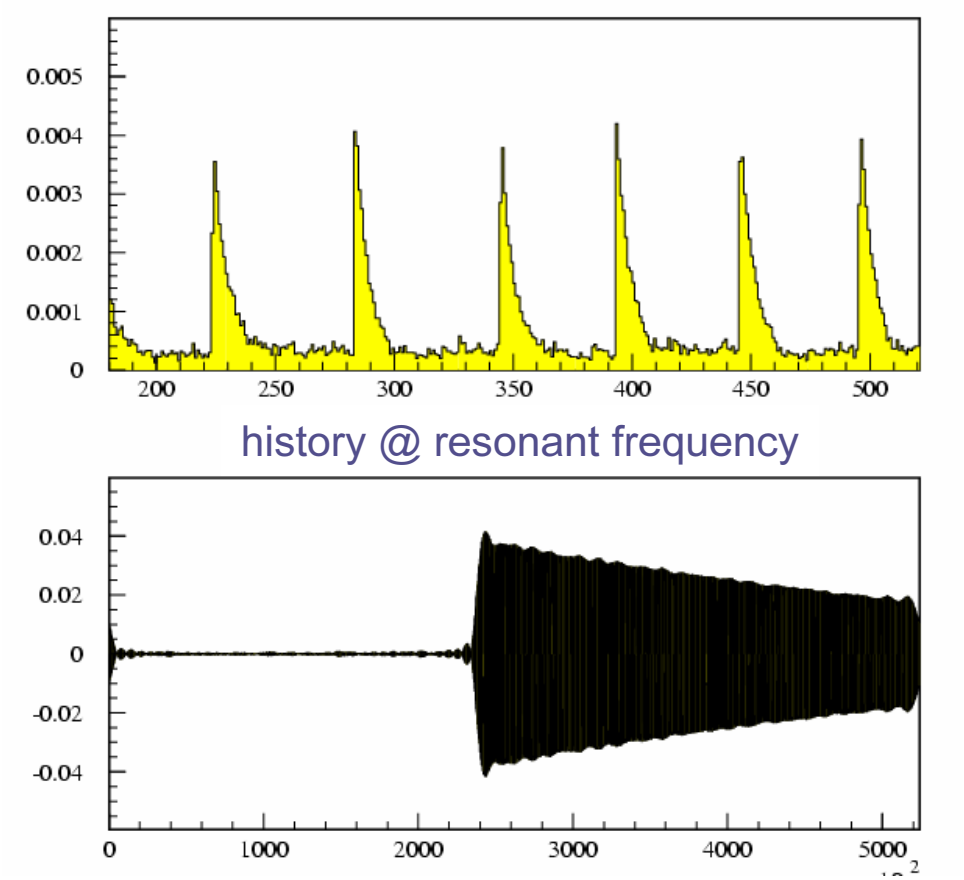
example of data correlation amplitude measured

First longitudinal mode amplitude/deposited energy



comparison between experimental data and theory for pure amorphous Aluminum

Data analysis target



- detailed analysis of signal characteristics (timing, noise, calibration, etc)
- evaluation on measurement and systematic errors due to beam intensity at low current

Conclusion and future plans

- *Results:*
  - first measure at low temperature. Good agreement with previous experiments (room temperature) and theory.

- *Work in progress:*
  - back-end software improvements
  - quasi on-line data monitoring and filtering implementation
  - accurate data analysis and errors evaluation

- *Phase 3:*
  - dilution refrigerator delivering by the end of 2004
  - installation and characterization (late spring 2005)
  - measurement in super-conducting state before the end of 2005

6 months delay on the planned general schedule of the experiment is due to the dilution refrigerator delivery