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Preliminary results from the measurement of creep in Maraging blades.

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We have mounted a GAS spring tuned to 0.86 Hz (i.e. an effective spring elongation of 0.35 m).
The measured K is 2200 N/m and the suspended mass 63 Kg.

The spring is inside an oven that can be tuned at any temperature between room and 200^{o}C. We have cycled the oven between 40^{o}C and several temperature levels, up to 190^{o}C (next and last step will be 200^{o}C) maintaining the high temperature levels for about 2 weeks each time and measuring the droop of the suspension point at 40^{o}C after each cycle.

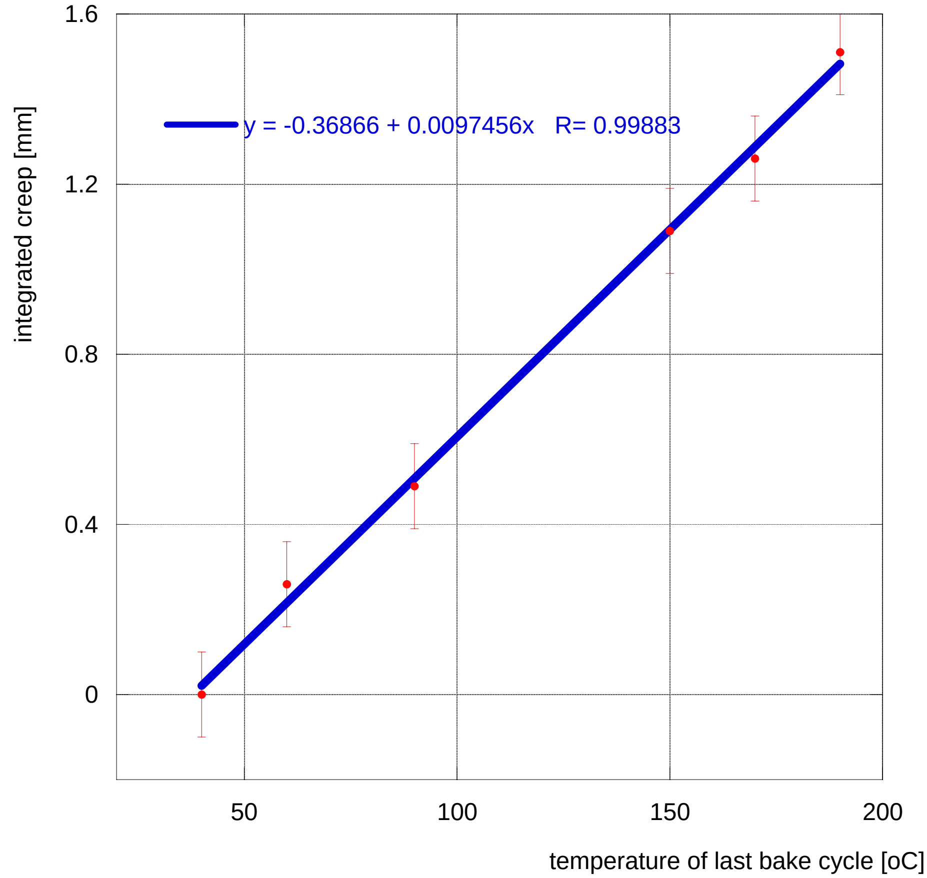
The load is external and its droop can be measured easily with a transducer with precision of 10 microns.

We measured a progressive droop reaching a total of about 1.5 mm after the highest (190^{o}C) cycle, corresponding to 0.42% of the bending under load.

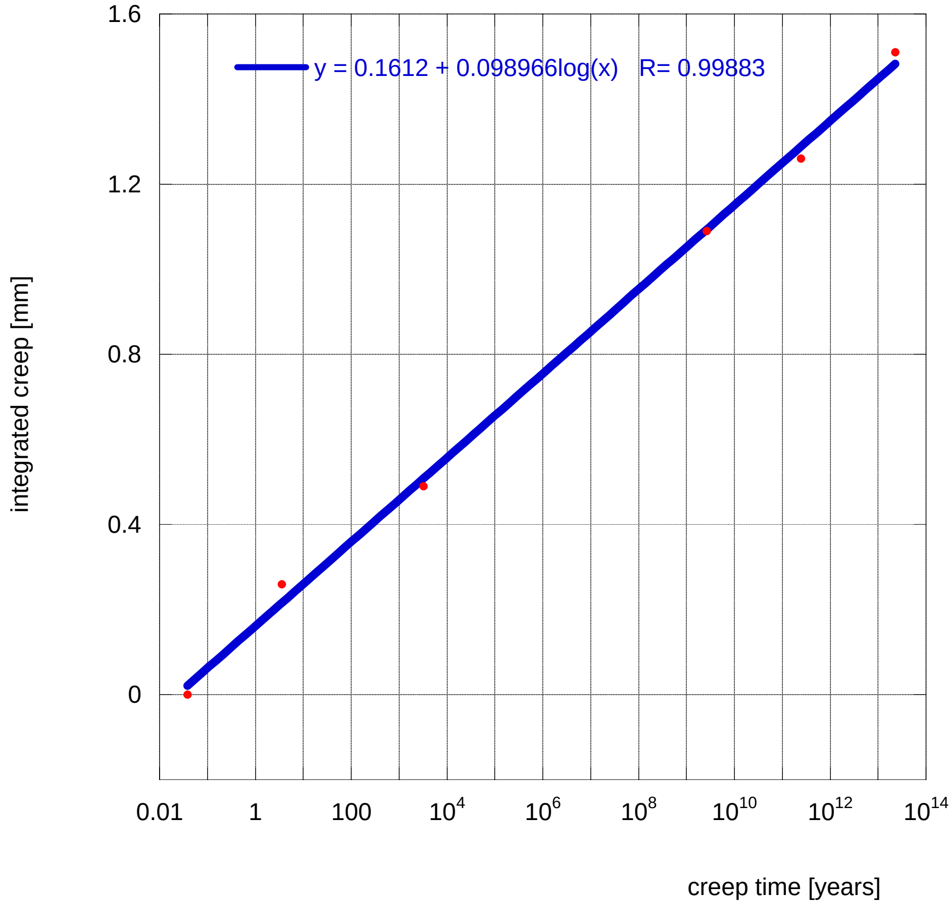
The creep induced droop (elongation) measurements at 40^{o}C (a systematic error +/- 0.2mm is dominant over the statistical errors)

Measurements	Elongation (mm)
start	8.69
After 60^{o}	8.43
After 90^{o}	8.20
After 150^{o}	7.60
After 170^{o}	7.43
After 190^{o}	7.18

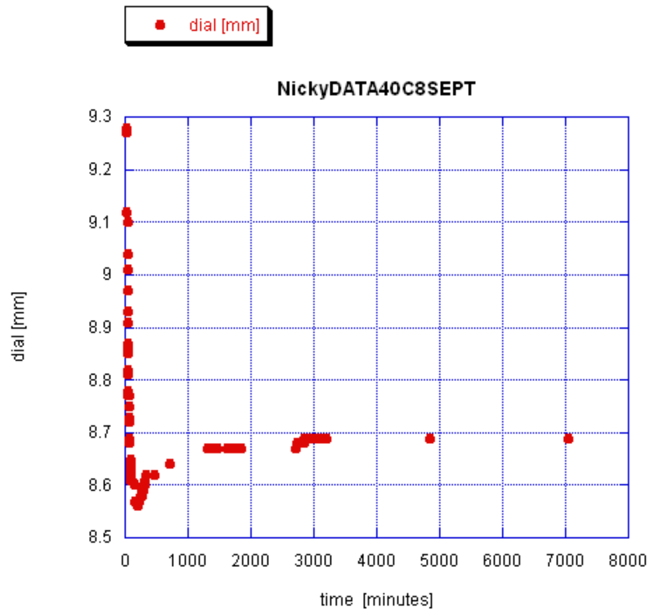
The data is plotted in the following figure. The ±0.1 mm error bars represent our systematic error (to some extent discussed below) that probably is still overestimated.



Baking under load corresponds to leaving the spring under load for a stretched period of time. If we consider that higher temperature induces an exponential stretch of time and that the creep is expected to be a logarithm of time, the measured linear response is an excellent result. If we consider a time expansion of a factor of 30 every step of 15^{o}C (from previous Virgo data), it is equivalent of suspending the payload for 10^{14} years as illustrated by the following graph.



The two graphs below illustrate the systematic limitations of our measurements. The first shows the payload trajectory when the oven temperature is returned to 40^{o}C after a cycle. The second plot illustrate one of several unexpected jumps (typically one per temperature level), probably due to something sticking and slipping inside the oven, is shown. Note that we observe unexpected jumps in both direction, pointing to stick and slip external to the blade structure (possibly in the thermometer wiring attached to the blade) rather than in the blade clamping that, being under intense load, would produce slippages only in the down direction. We will inspect the oven at the end of the measurement period and possibly sole the puzzle.



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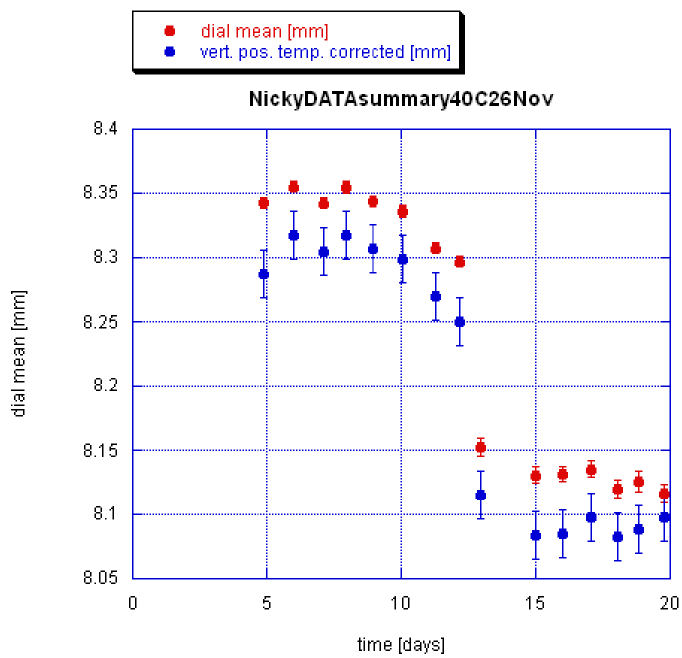

Following these results we recommend baking out all stresses Maraging blades at a temperature comprised between 100 and 200^{o}C for a week (equivalent to a few millions to a few trillion years) to burn out all available creep.

The residual creep rate is expected to be the final creep rate at higher temperature, scaled back by the time decompression factor, and be negligible even in GW detector scales.

The bakeout will also have welcome effects to the outgassing properties of the structure.

To insure the best outgassing results bakeout in Ar or N_2 atmosphere is recommended.