Gerber and Franse Reply: The two Comments [1,2] have in common that they both criticize the evaluation of the temperature gradient inside the sample by the power dissipation due to flux movement. Griessen, Hoekstra, and Wijngaarden [1] are right in pointing out that in calculating the value of 12.01 K for T_i with $T_s = 0.01$ K, we went out of the range of temperatures for which Eq. (1) of our paper gives an approximate solution. According to their calculations, a lowest sample temperature of 83 mK is found and we accept this result. In the Comment by Fruchter, Campbell, and Konczykowski [2], a further reduction of the temperature gradient results from taking into account the noncubic shape of the sample. Using their expression we arrive at a lowest temperature of 35 mK. For the other two bath temperatures mentioned in our paper (100 mK and 1 K), the above considerations do not change the results for T_i very much.

While accepting this criticism in the evaluation of T_i for the bath temperature of 10 mK, we cannot help but repeat that in our "simplified picture" the "qualitative estimate" of T_i is "evidently exaggerated." In our discussion of this gradient, we did not claim more than "the local temperature within the bulk of the superconductor does not scale down with the sample's surface temperature, but rather saturates at a certain nonzero level." This nonzero level is either 83 or 35 mK for the cases discussed above. In this respect our claim that there is "an essential obstacle for the observation of the macroscopic quantum creep in bulk superconductors" is exaggerated since the self-heating constituting this obstacle typically occurs in bulk samples at temperatures below, say, 100 mK. In well chosen samples and in the appropriate temperature range, we agree that the self-heating as evaluated in the "simplified picture" as well as the macroscopic thermomagnetic instabilities can be avoided.

We wish, however, to restate that there is a directly measurable, significant power dissipation accompanying magnetic relaxation which causes temperature gradients inside the sample. These gradients, which might have a more complex character if considered on a microscopic scale, as well as the magnetic instabilities deserve further study. The purpose of our paper was to call attention to the fact that such effects limit the temperature range in which relaxation measurements can meaningfully be evaluated and that they may not be amenable to a steady-state thermodynamical description.

The concept we wish to promote is that the steady-state thermodynamical description is not appropriate for low-temperature flux creep. Individual vortices do not move with a constant velocity and, therefore, do not heat their environment with a constant power. Instead, we imagine a microscopic movement of a vortex as follows: It is pinned for a long time and then, within a short period, hops to the next pinning center. Therefore, (1) since dissipation occurs at a short time fraction during hopping, the corresponding power pulse is orders of magnitude larger than the time-averaged value measured in the experiment. (2) Since flux-flow diffusion in type II superconductors is much faster than thermal diffusion, vortices hop in adiabatic conditions.

These effects could cause a depinning of a large number of neighboring vortices. We expect that these local heatbursts may be present in any bulk type II superconductor, including films with thicknesses larger than the intervortex distance.

A. Gerber and J. J. M. Franse
van der Waals-Zeeman Laboratorium
University of Amsterdam
Valckenierstraat 65, 1019 XE Amsterdam
The Netherlands

Received 3 November 1993
PACS numbers: 74.60.Ge, 74.25.Bt

[1] R. Griessen, A. Hoekstra, and R. J. Wijngaarden, preceding Comment, Phys. Rev. Lett. **72**, 790 (1994).
[2] L. Fruchter, I. A. Campbell, and M. Konczykowski, preceding Comment, Phys. Rev. Lett. **72**, 791 (1994).