

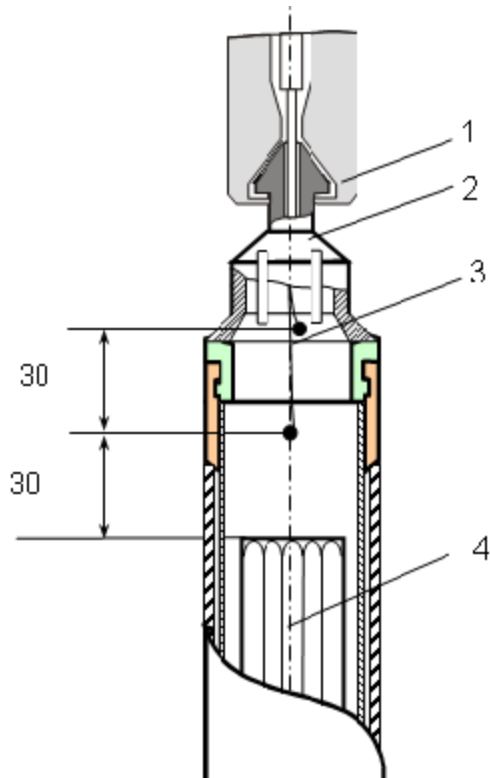
# Research of time history of thermal-physical behavior of fuel rods during in-pile tests

V.D.Grachyov, V.A.Kisly, S.V.Trekhonin

# Goals

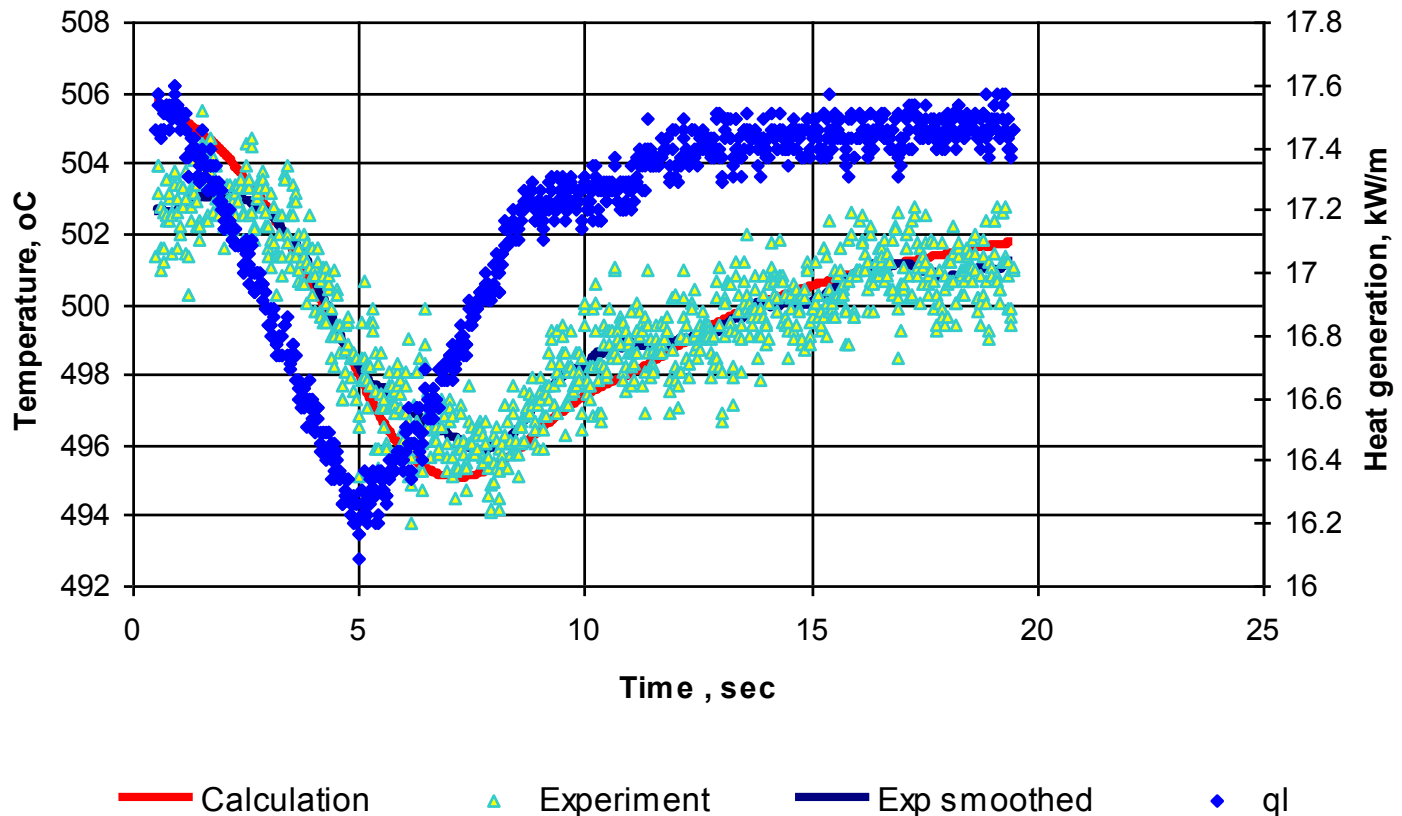
- research of thermal physical behavior of standard fuel rods of the FA during long-term operation
- alternate diagnosing of various FAs in different operating stages
- investigations of thermal physical behavior of fuel rods with advanced fuel compositions, either during the whole irradiation or selectively in different operating stages

# FA with thermal probe

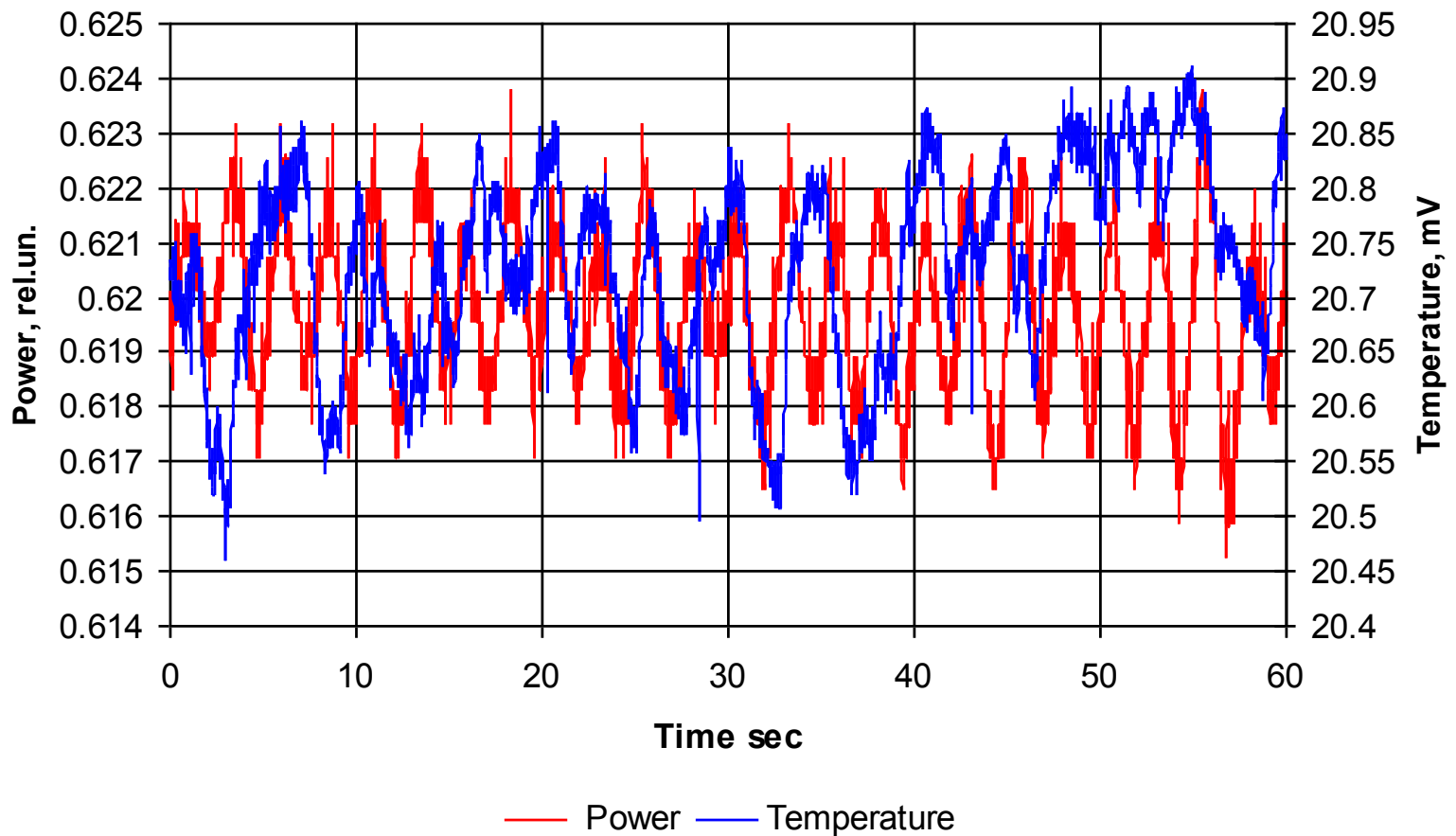


- 1 - thermal probe;
- 2 - FA head;
- 3 - thermocouple of the probe;
- 4 - bundle of fuel rods.

# Time history of power and temperature under transient conditions



# Power and temperature noises



# Working equations

Components of the time constant of the fuel rod

$$\tau_f = [ R / (4\lambda_f) + 1 / \alpha_k + d_{o\delta} / \lambda_{o\delta} + 1 / \alpha ] R c \rho / 2$$

Working equations

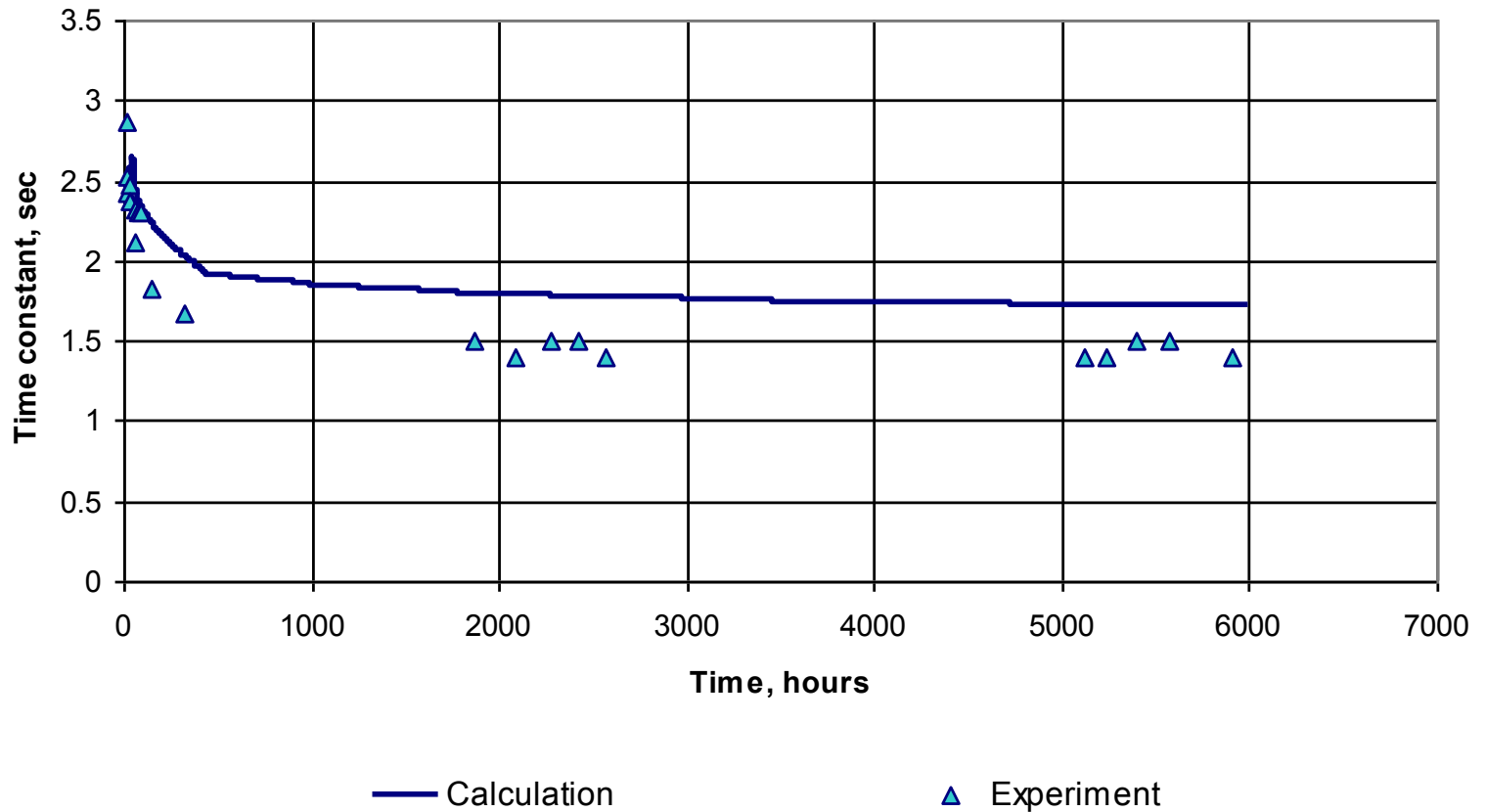
$$dT^i/d\tau + G/(\rho V) T^i = G/(\rho V) T^{i-1} + G_f C_f / (C_c \tau_f \rho V) (T_f^{i-1} - T^{i-1})$$

$$dT_f^i / d\tau = P - 1/\tau_f (T_f^i - T^i), \quad i=1, \dots, N_z$$

$$F(\tau_f) = \sum_{i=1}^n [ T^p(\tau_i) - T^u(\tau_i) ]^2 \longrightarrow \min$$

$$\Delta t_{1/2} = \tau_f q_v / (C_f \rho)$$

# Time history of cumulative thermal resistance of the fuel rod during operation



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