The VKS (Von-Karman Sodium) experiment leads to the observation of a self-sustaining dynamo, with a turbulent constrained flow of liquid sodium, a magnetic field is produced, by an instability mechanism. When the two counter rotating disks drag the liquid sodium fast enough to reach the instability threshold, the magnetic field measured by Hall sensors grows. Numerous dynamical behavior of the magnetic field was recorded, when the rotation frequencies of each disk are different. We can see here, for two different examples (a stationary dynamo and a bursting dynamo), the fast fluctuations of magnetic field B.

How does the high level of turbulence of the flow act on the magnetic field?

Example one: Stationary dynamo, main component of B parallel of the axis of cylinder recorded in the bulk of the flow. F1=F2=22 Hz

The rate of fluctuation of the flow is very large compared to the other dynamo experiment and direct time measurement seems quite irregular.

Power density Spectrum: The power density spectrum shows three power laws:

- \( f^{-5/3} \) for \( 5 < f < 50 \) Hz (as the passive scalar or for a fully turbulent behavior of magnetic field)
- \( f^{-11/5} \) for \( 50 < f < 150 \) Hz (often linked with the ohmic dissipation)
- \( f^{-6} \) for \( 150 < f < 400 \) Hz

But the traditional interpretations call upon a Taylor hypothesis for the magnetic field, which would lack out in our range of parameter.

Intermittency: We observe a shape deformation of the probability density function of increments by decreasing the scale, for the domain of frequency corresponding to the -5/3 power law. The intermittency of magnetic field stay quite low and would be linked with the intermittency of the flow. The exponents of structure function evaluated by a discrete wavelets decomposition are the same as those for homogeneous isotropic turbulence.

The fluctuations of B seems to be lead by the fluctuations of the flow integrated on the scale of magnetic field. B is a marker of the turbulence of the flow.

Example two: Bursting dynamo, main component of B azimuthal recorded on the frontier of the flow. F1=22 Hz F2=15 Hz

With this choice of rotation frequencies of disks, the dynamic of magnetic is very amazing. We recorded some bursts which are coherents at low frequency between two measurements points separated of 300 mm. Probability function of direct time measurement of B shows an exponential tail (not displayed).

Power density Spectrum: Very good power law \( f^{-2} \) between 0.01 Hz and 100 Hz (four decades). Beyond 100 Hz a \( f^{-6} \) power law is observed. The signal seems to be scale invariant in time and so monofractal.

Intermittency: There is no deformation of the probability density function of increments, that confirms the monofractal character.

In this case the high rate of low frequencies fluctuations should not be linked with the turbulence of the flow. An interpretation as an interaction between two dynamo modes is on preparation.