

PK4 Lab Notes 02-08-20

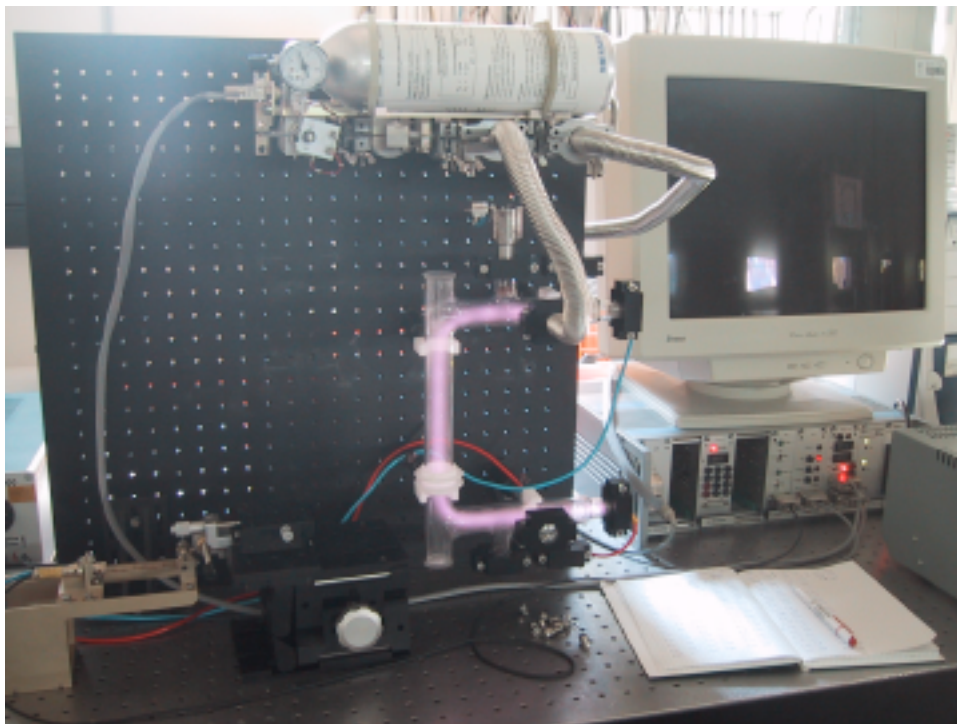
These notes are from 'playing around' with the PK4 prototype on 08/20, 2002.

Three sets of experiments have been conducted:

- I. The pressure increase with time and the electrical (and 'optical') behavior were observed,
- II. The gas system was used to jump randomly to a certain pressure, electrics and optics were recorded,
- III. The 'step' at low pressure was better resolved.

The supply voltage was always set to 1.35 kV with a 'Vorwiderstand' (resistor) R_v of 340 kOhm.

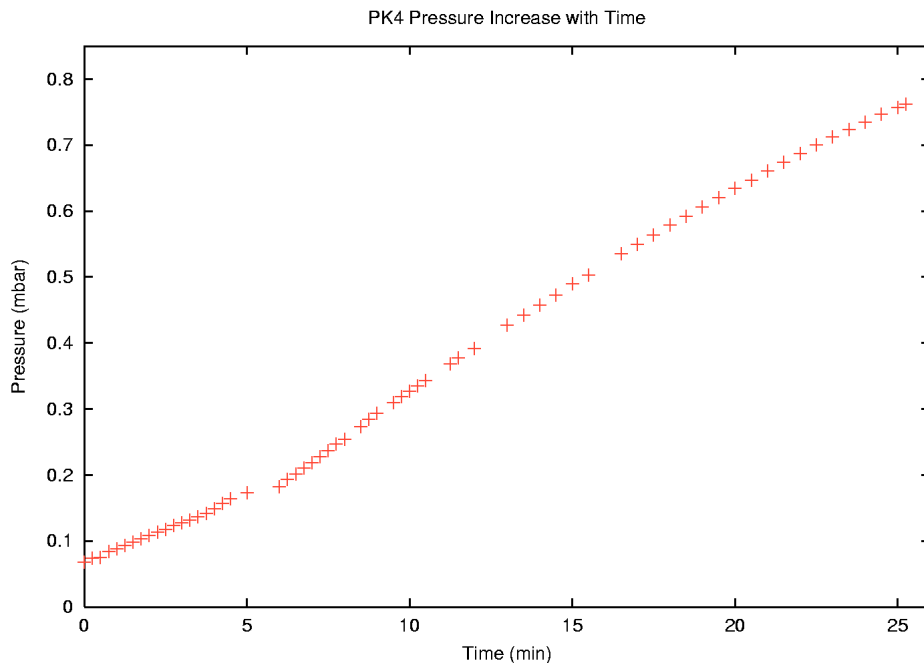
The main tube was in an vertical orientation, the setup looked like this:



Observations:

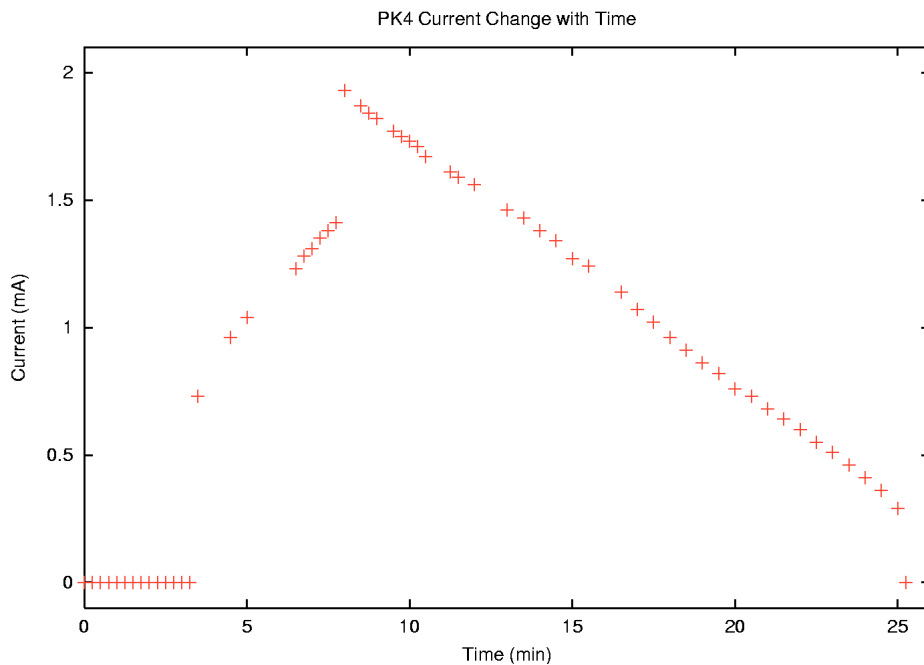
I. After evacuating the system for about 15 minutes the pressure does not fall below 0.065 mbar.

The pressure increases rapidly with time: ~ 0.03 mbar/min.

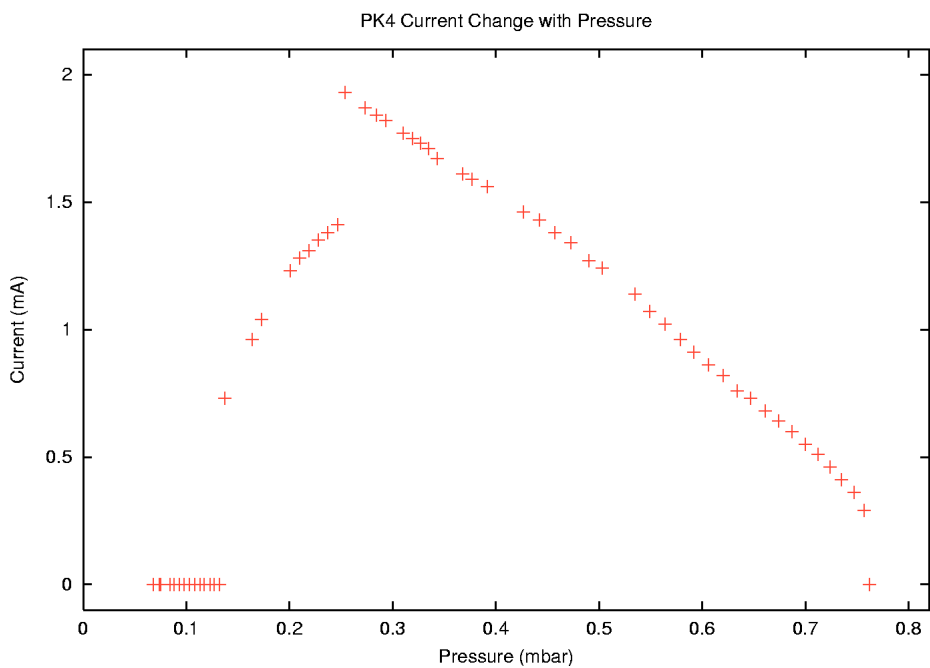


3.5 minutes after the experiment start, at a pressure of 0.137 mbar, the discharge ignited spontaneously *with strong striations*. After 8 minutes (at 0.254 mbar) there was a sudden increase of the discharge brightness.

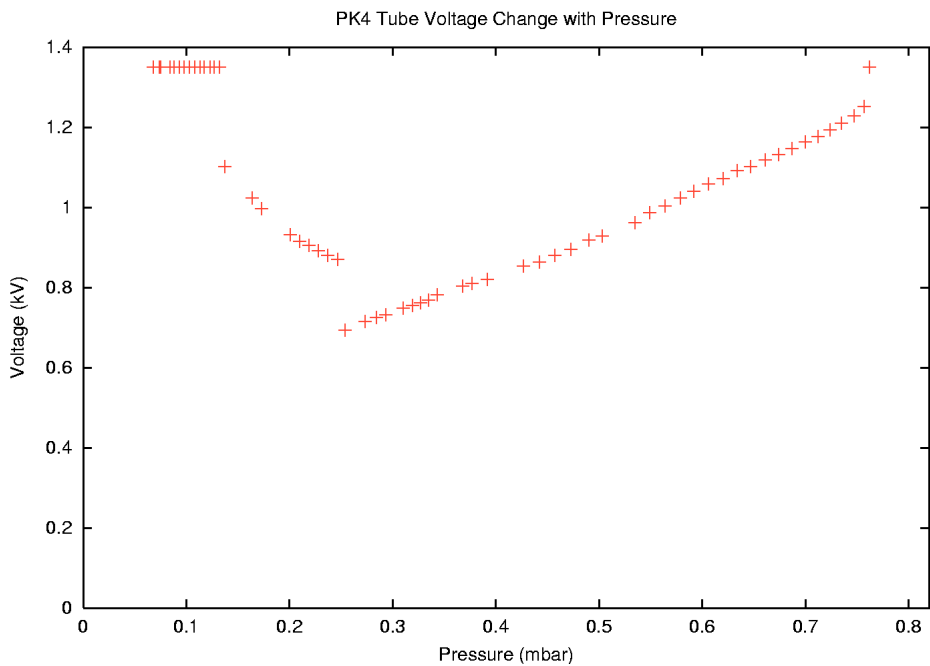
This is how the current changed with time:



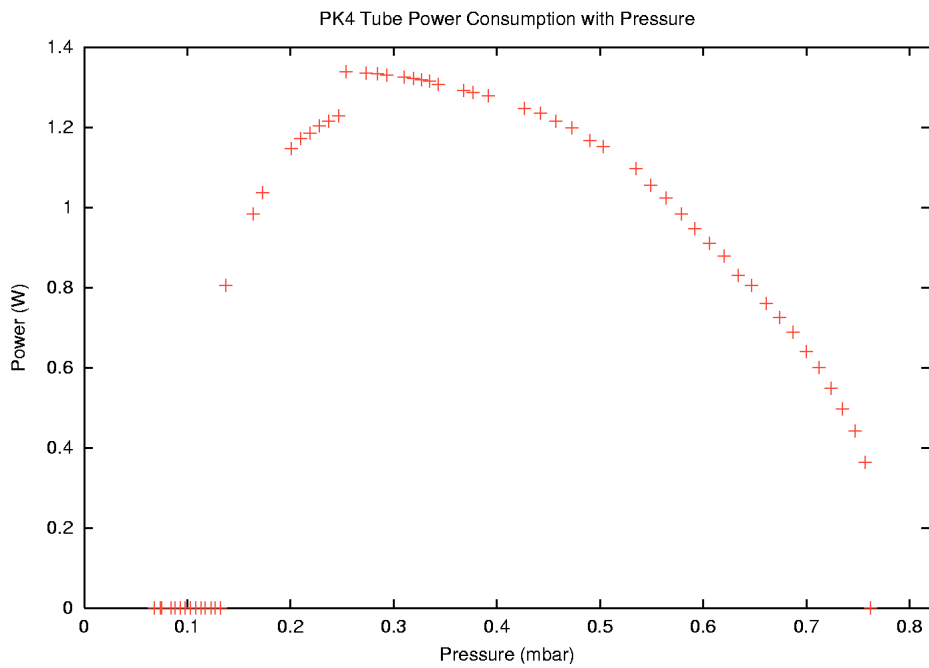
The current with changing pressure looks like this:



With the 'Vorwiderstand' of 340 kOhm the voltage at the tube was:



So, the power consumption of the tube in this 'leakage experiment' was:

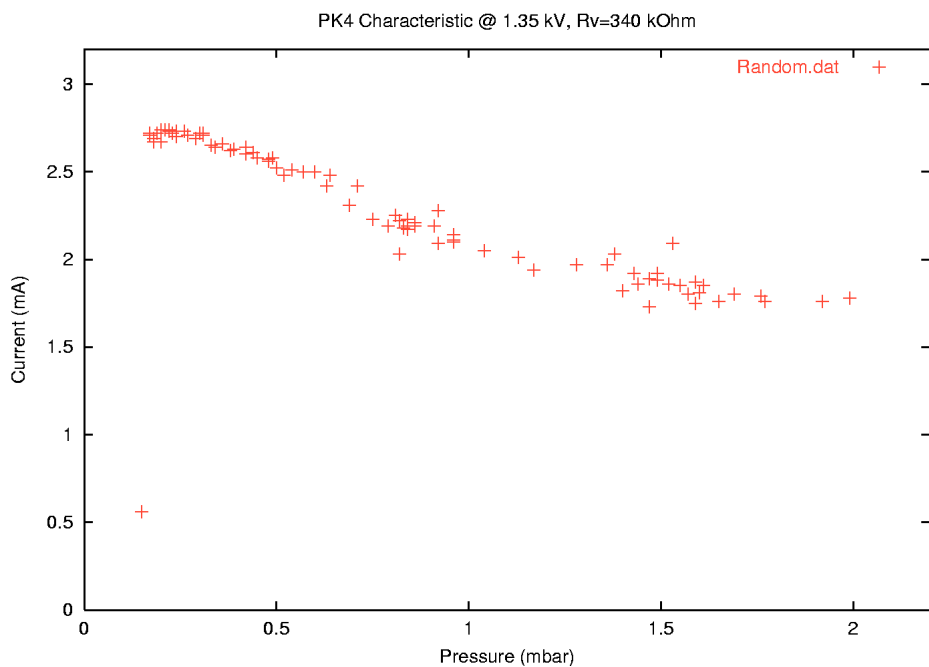


II.

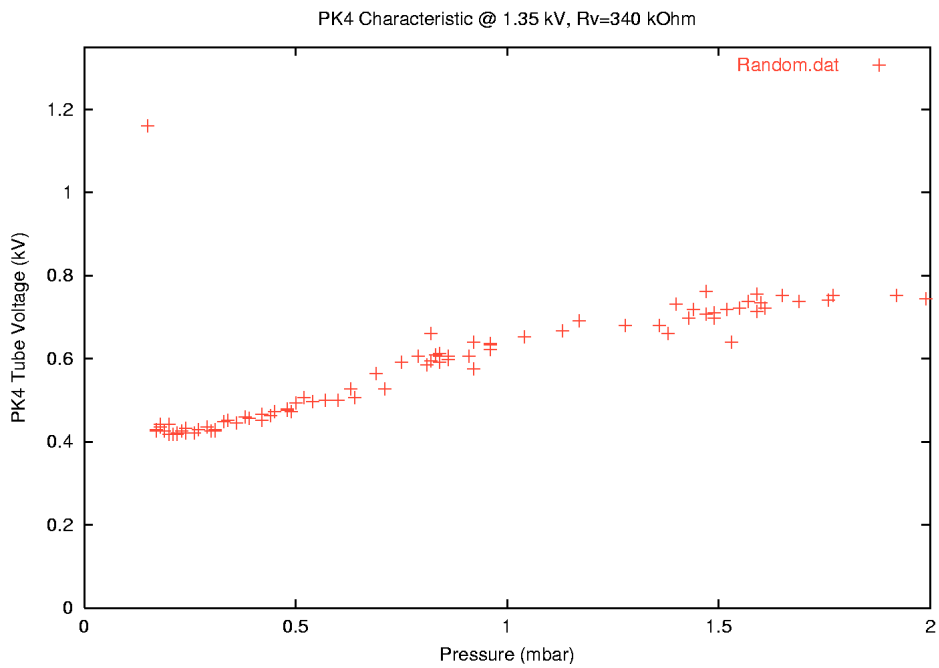
In the next step the pressure values were set randomly with the Argon gas inlet valve and the voltage/current values were read immediately to avoid contamination of the 'pure' gas with leaking air (Nitrogen).

In these 'pure Argon' measurements there were mostly *no striations* visible.

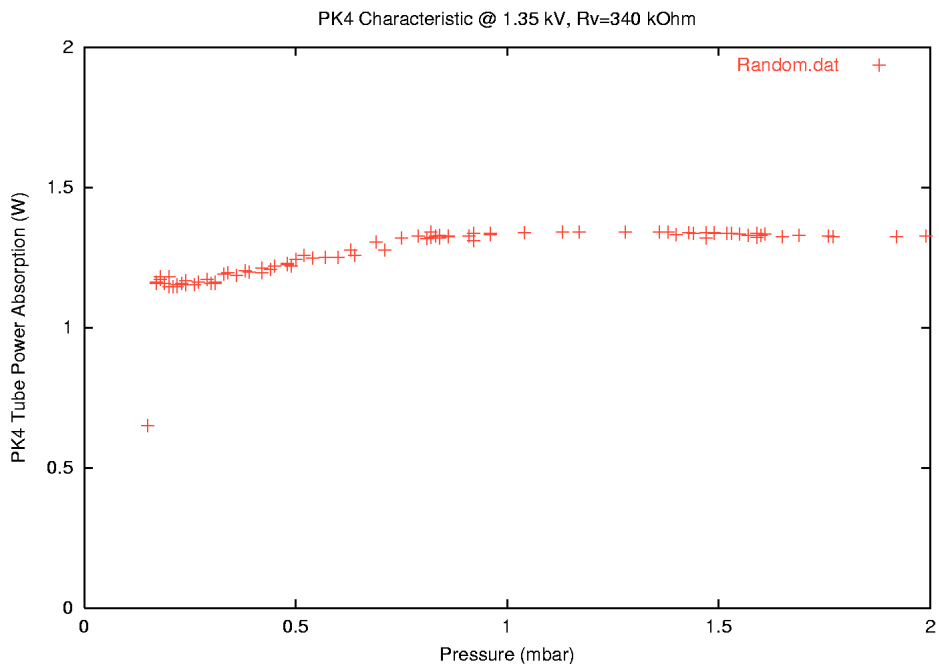
The current at different pressures, where a discharge was present, was:



With the resistor of $R_v=340$ kOhm the tube voltage calculates to:



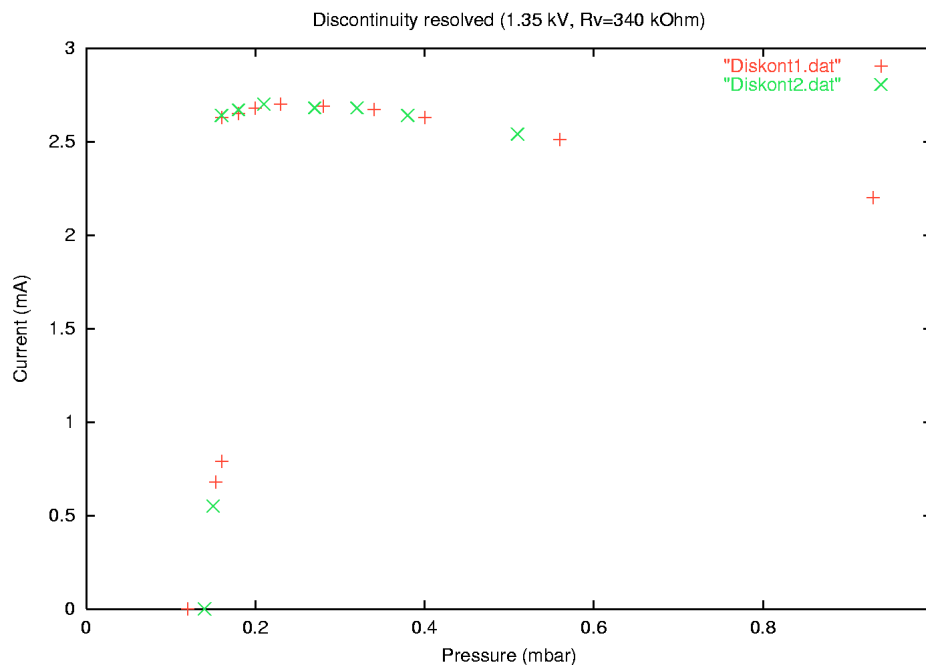
This results in a power consumption of the tube:



So, in contrast to the former 'leakage experiment' the power consumption of the discharge tube was roughly constant over the whole pressure range.

III.

In the low pressure range there was a clearly visible step in discharge brightness and current: The plasma went mostly (but not fully) off, a dim glow remained and the current reduces to $\sim 1/4$. In the next experiment in two runs this pressure range was investigated with higher resolution:



This discrete step before the plasma turns off may be due to contamination of the argon with air.(?)

Conclusions:

These were the results from just 'playing around' with the PK4 prototype setup. More serious and more elaborate experiments are necessary.

At the 'leakage experiment' the discharge behaves different than in the 'pure Argon' experiment (different power consumption, with/without striations).

PS: At the pictures taken during the experiment the distortion of the glasstube was clearly visible. Behind the glass there was a row with the sequence hole - screw - hole - screw - hole. The screw which is just visible at the edge behind the tube is also visible clearly inside of the tube again. This distortion has to be taken into account for the data analysis or has to be corrected with a optical setup.

