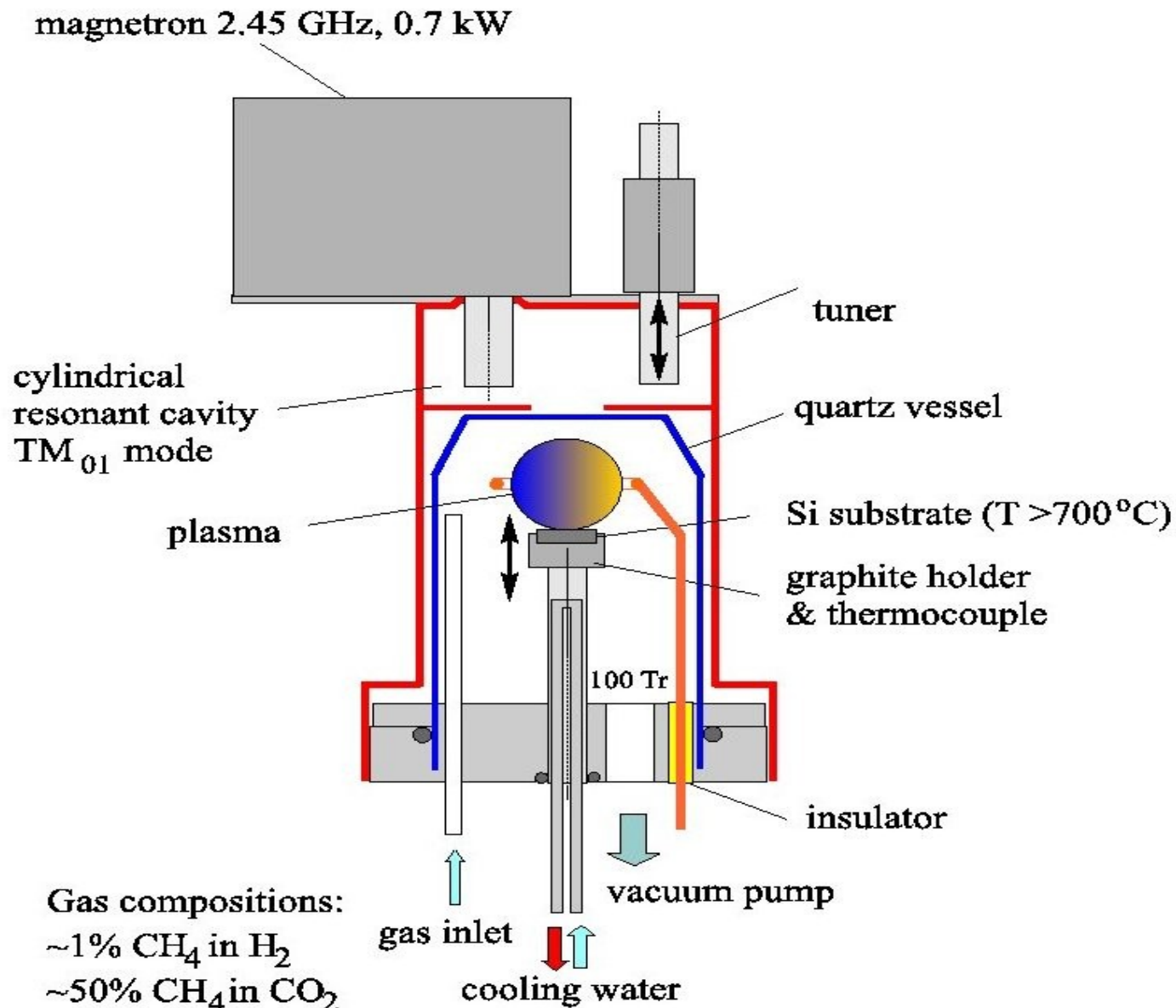


X-ray response of diamond detectors constructed using diamond layers produced by low power Microwave Chemical Vapour Deposition (MWCVD) reactor.

A. J. Kordyasz,
Heavy Ion Laboratory of Warsaw University,
Cracow, 2014

Low power Microwave Chemical Vapour Deposition reactor.



Stabilization systems:

- Gases ratio & pressure.
- Stabilization of target temp.

by:

- optical observation of target &
- magnetron power regulation.

The gases are ionized into active radicals to create diamond and graphite

**Cylindrical
resonant
cavity**

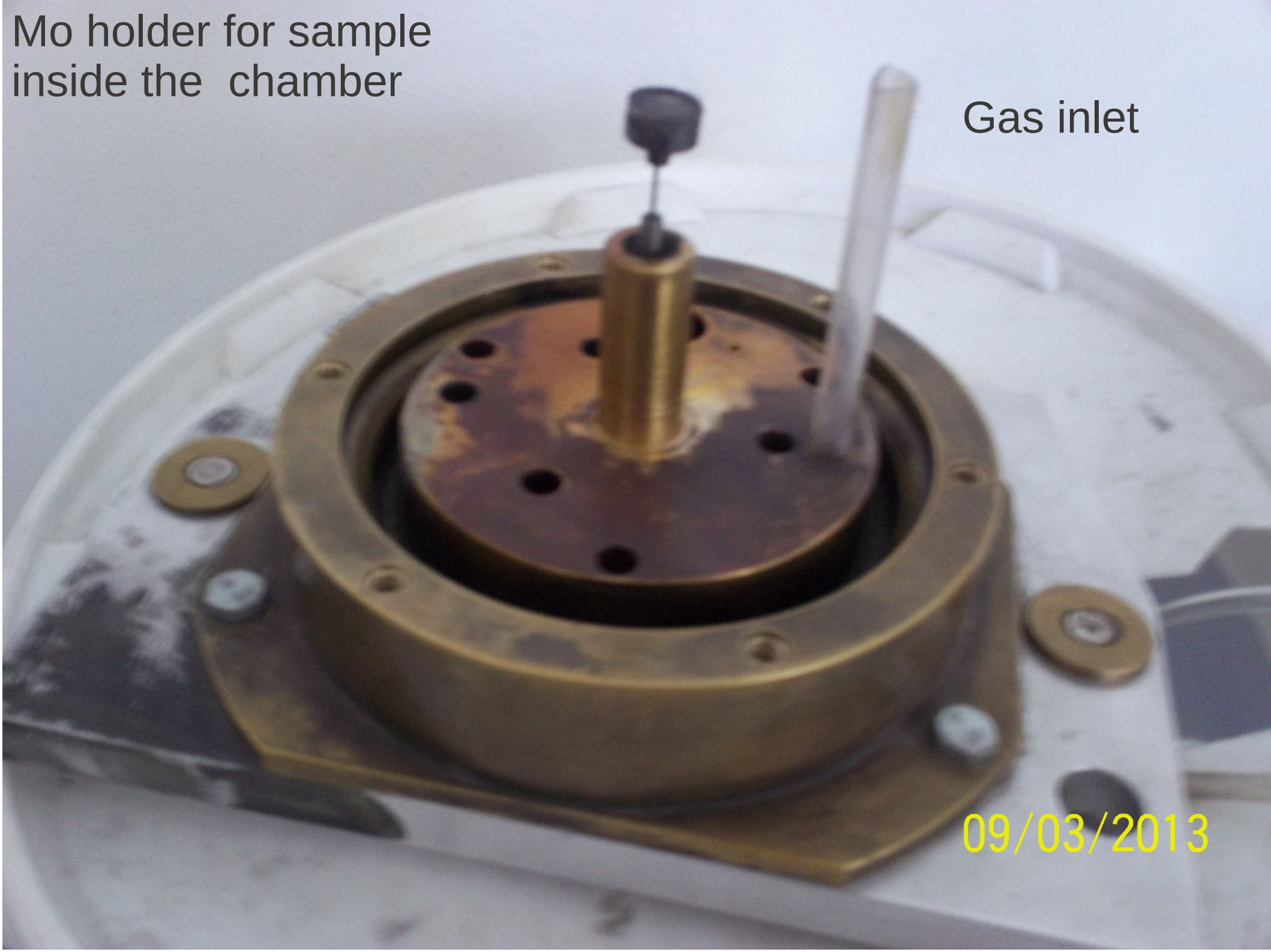
Web Camera

09/03/2013



Mo holder for sample
inside the chamber

Gas inlet



09/03/2013

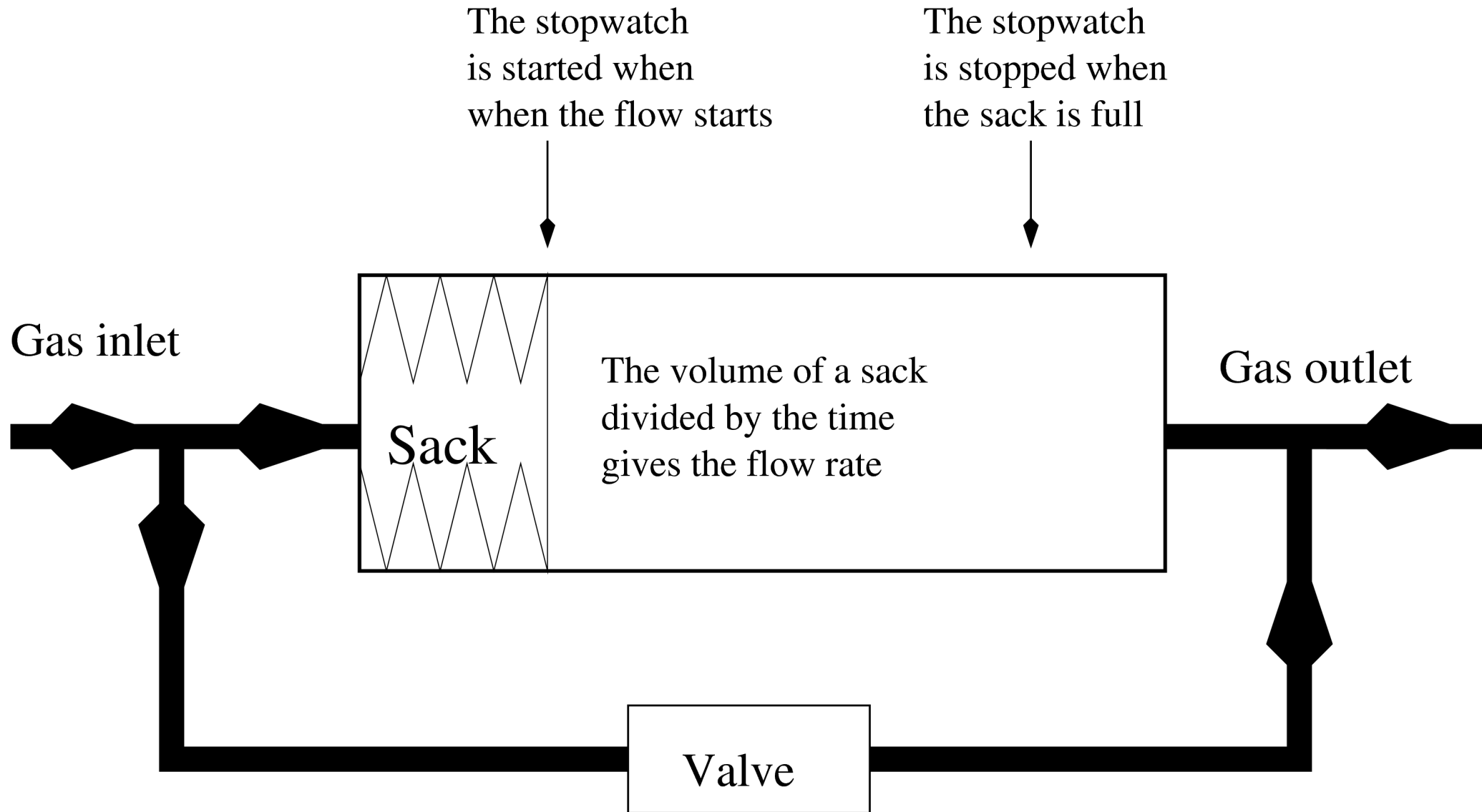


Flowmetes for very low gas flow

We used fermentation locks (which are used for registration carbon oxide in vine fermentation process) for measurement of H_2 and CH_4 flows by counting bubbles with fermentation locks filed by vacuum pump oils.

Bubbles are counted by transoptor and sent to the computer system. Gas flow is proportional to the bubbles counting rate. Typical of flows (at 67 Th) of CH_4 is $0.4 \text{ cm}^3/\text{s}$ and $5 \text{ cm}^3/\text{s}$ for H_2 .

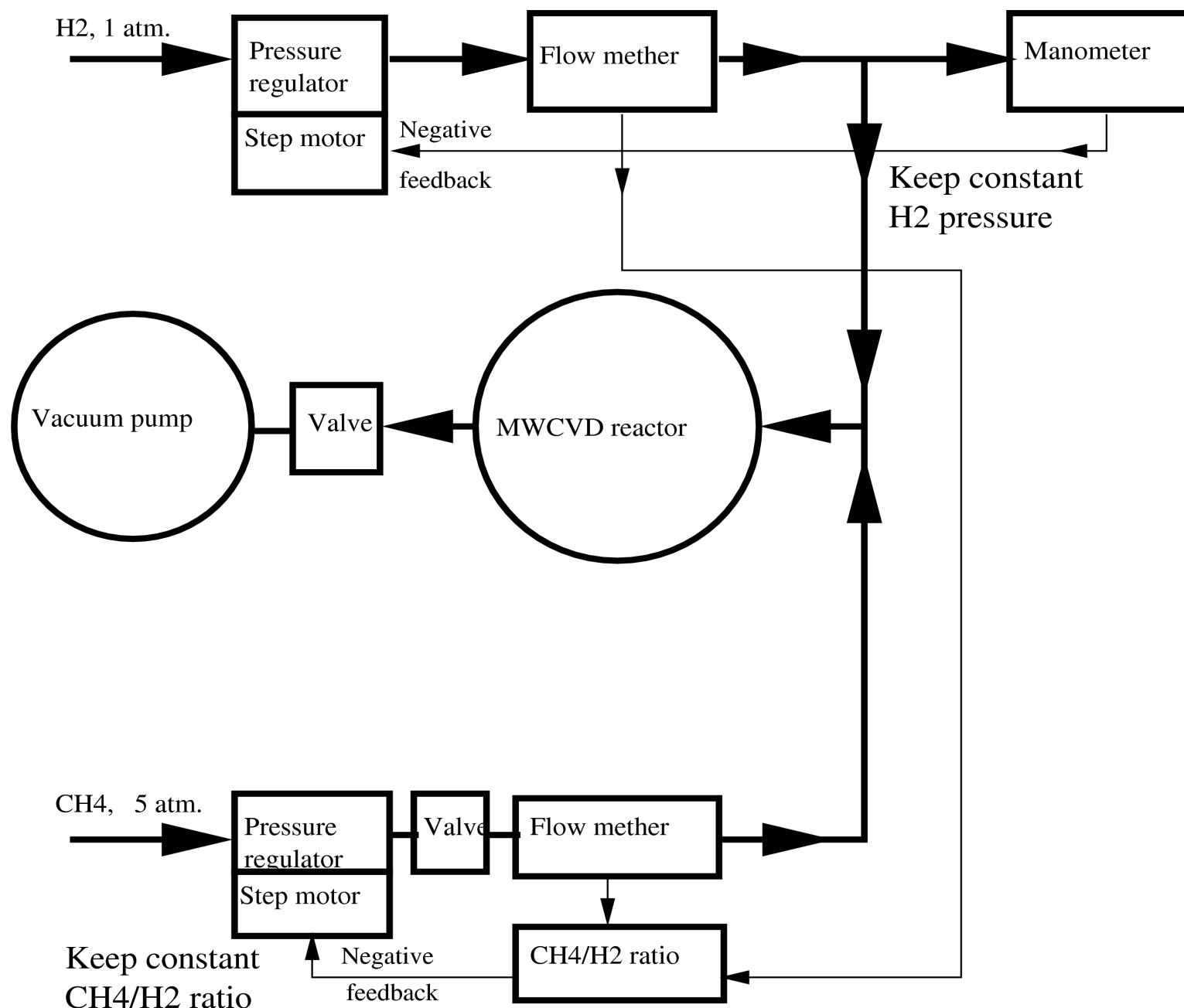
Flow calibrations of CH_4 and H_2 gases have been performed by mechanical flowmeters.



Fermentation locks for measurements flow of H_2 and CH_4



Stabilization of H_2 pressure and CH_4/H_2 gases ratio



Measurement of temperature by radiation registration from the hot Mo holder

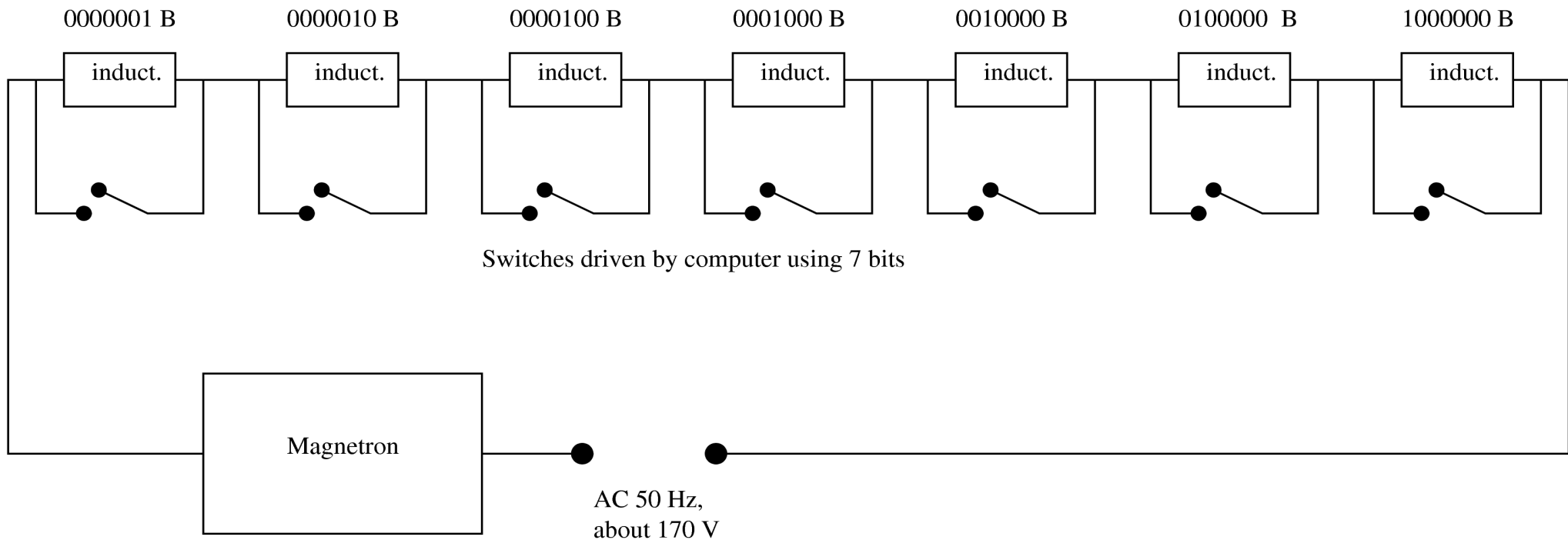
We have used for plasma generation the pulsed magnetron with AC frequency 50 Hz. The plasma is generated when the 2.45 GeV microwaves are emitted. For parts of 50 Hz pulse when the microwaves are stopped the thermal radiation is generated only by hot Mo holder **without light radiation from the plasma.**

Using principles of Web Camera working where pixels are read in series rows by rows it is possible register time regions where plasma radiation is stopped and light is emitted only by hot holder (the method was proposed and elaborated by J. Tarasiuk).

For proper temperature measurements the Web Camera is calibrated by the thermocouple.

Magnetron power regulation by adjusting of AC power supply in the range about 5 V with 7 bits precision

Inductances proportional to 2^n connected in series with magnetron



Results

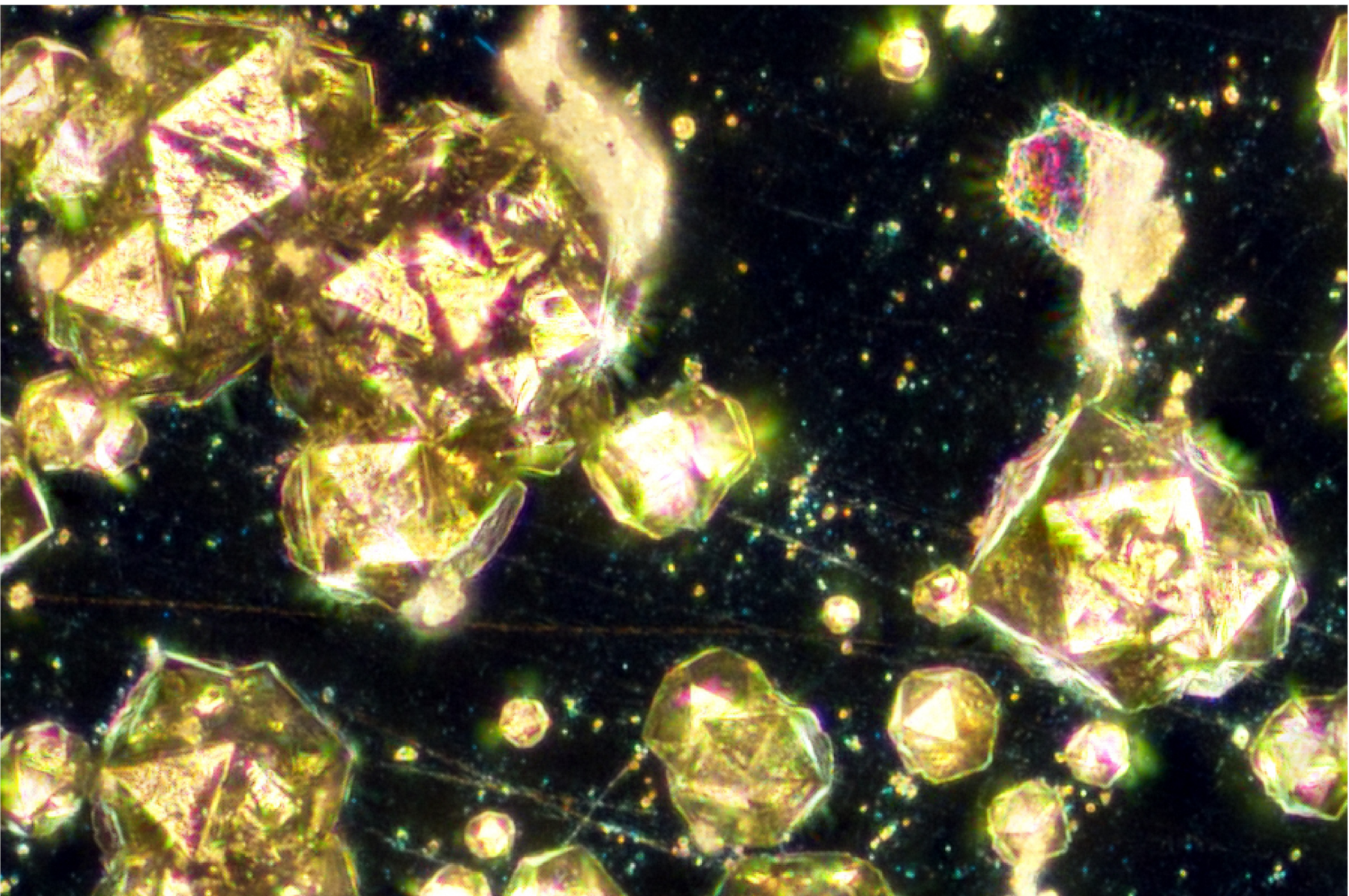


Mono-crystal diamonds about diameter 0.2 mm are grown on Si substrate using the 2% C_4H_{10}/H_2 composition.

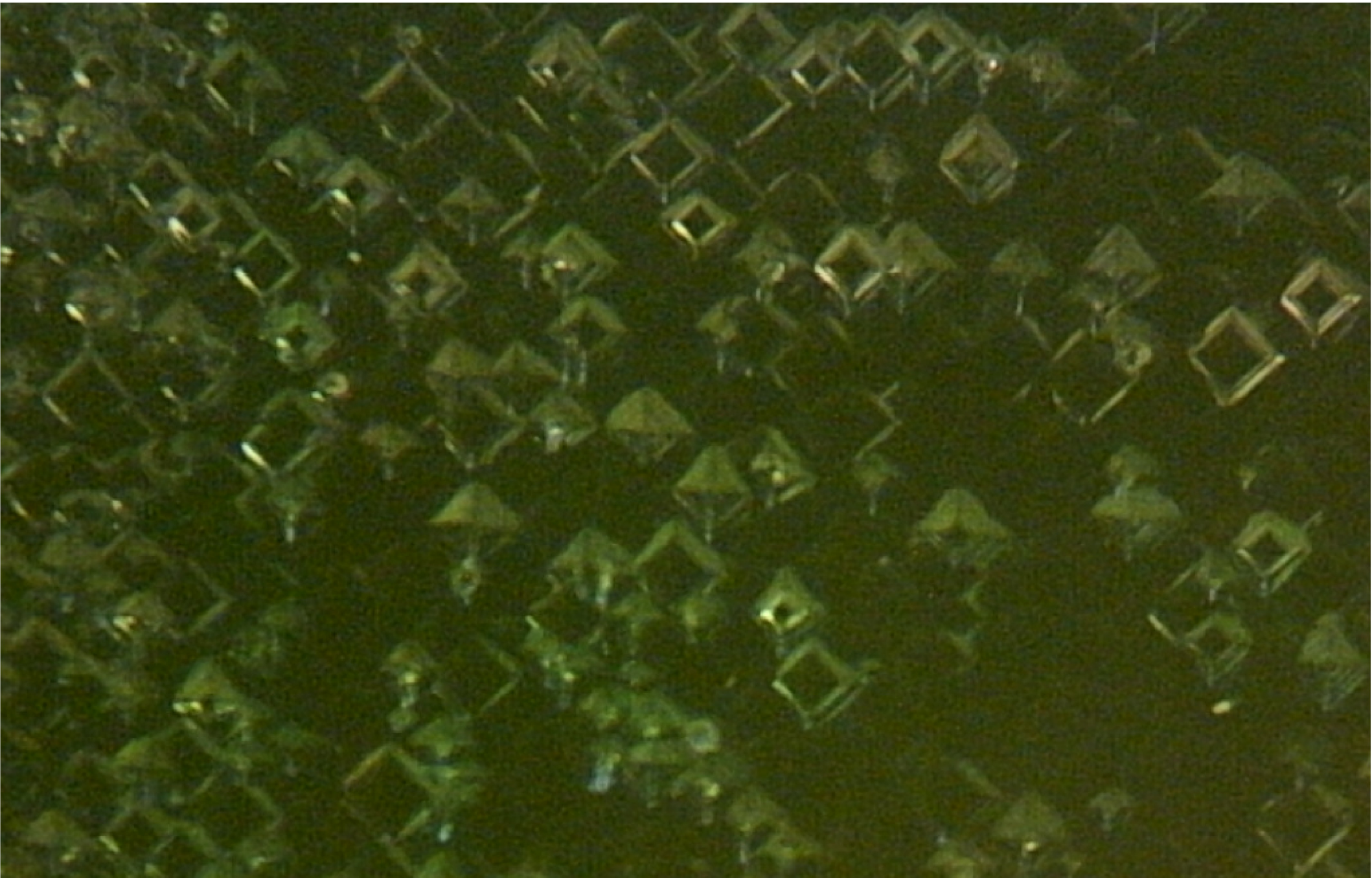
The compositions C_6H_{14}/H_2 is also tested.

Diamond detectors are obtained using 7% CH_4/H_2 compositions.

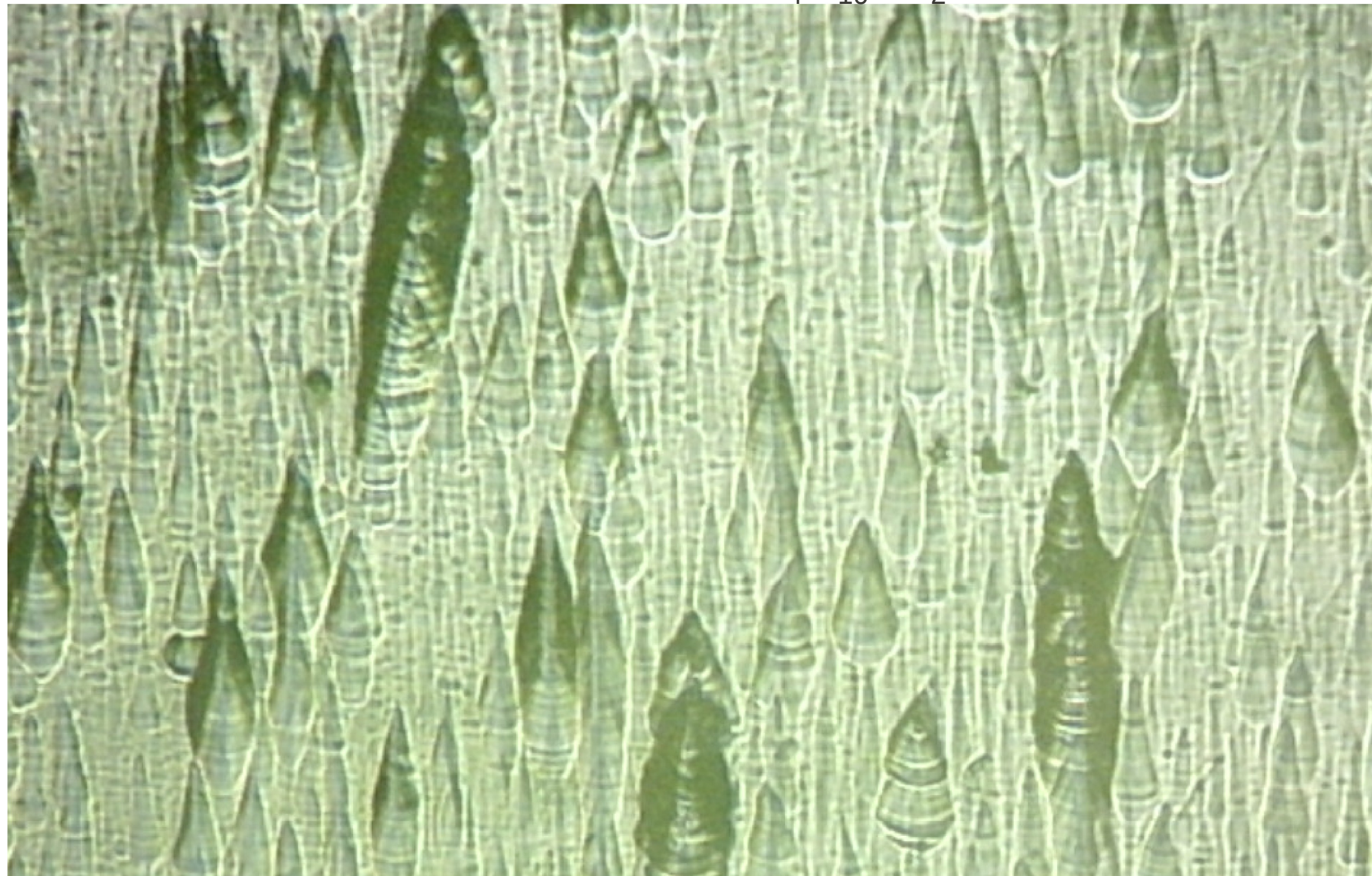
Diamond crystals on silicon, 2% C_4H_{10}/H_2 composition.



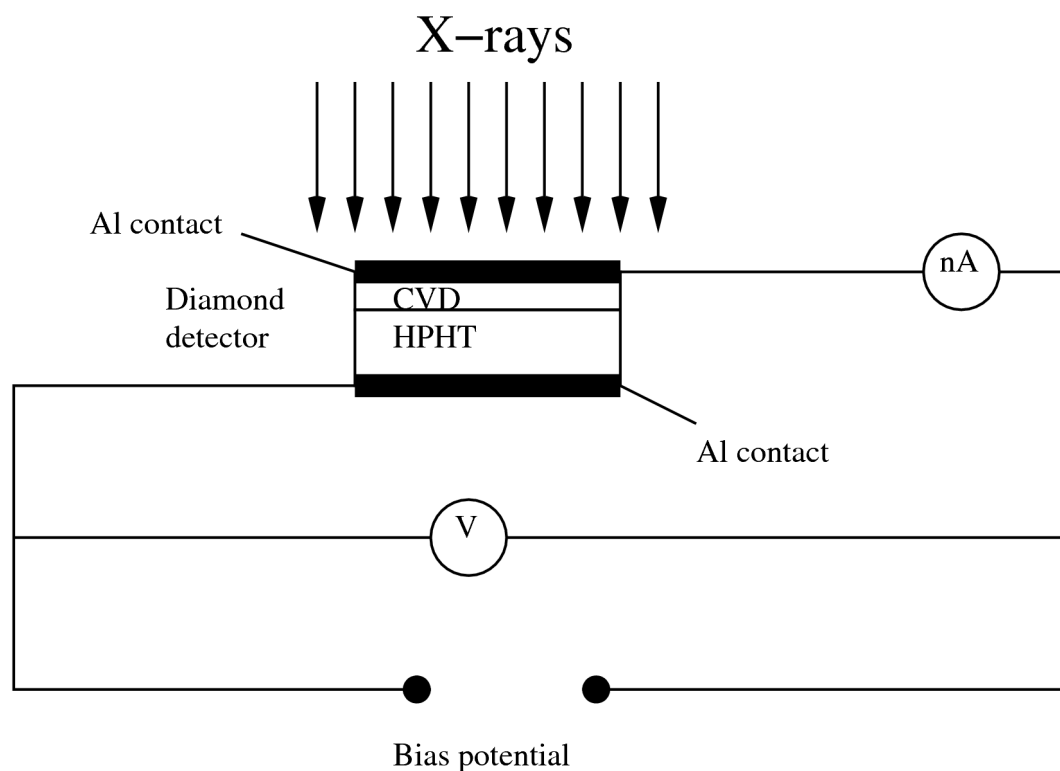
Diamond mono-crystals square pyramids grown on HPHT [100] diamond Sumimoto substrate, 2% C_4H_{10}/H_2 composition.



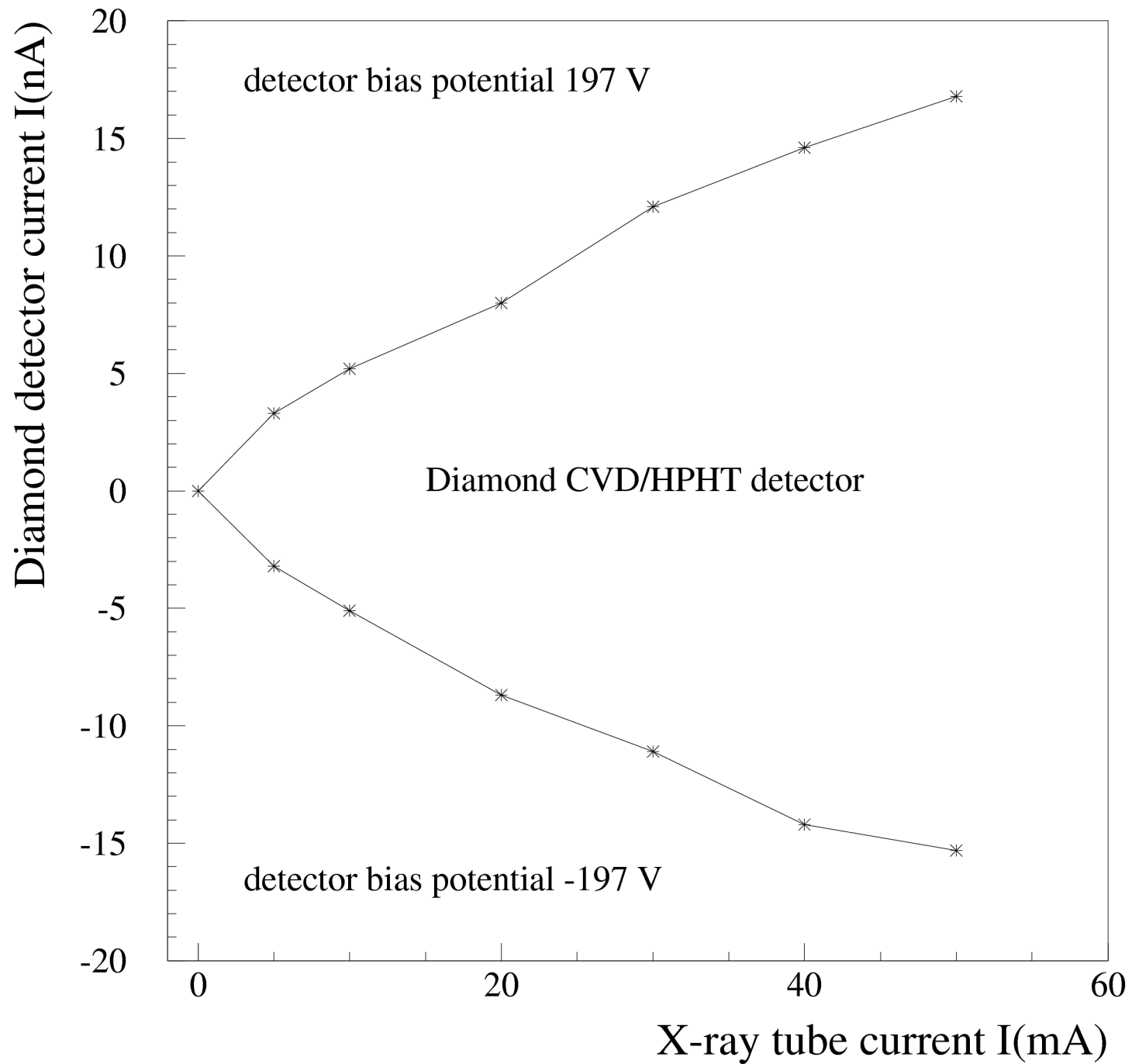
50 μm diamond monocrystal layer grown on HPHT [100] diamond Sumimoto substrate, 7% $\text{C}_4\text{H}_{10}/\text{H}_2$ composition.

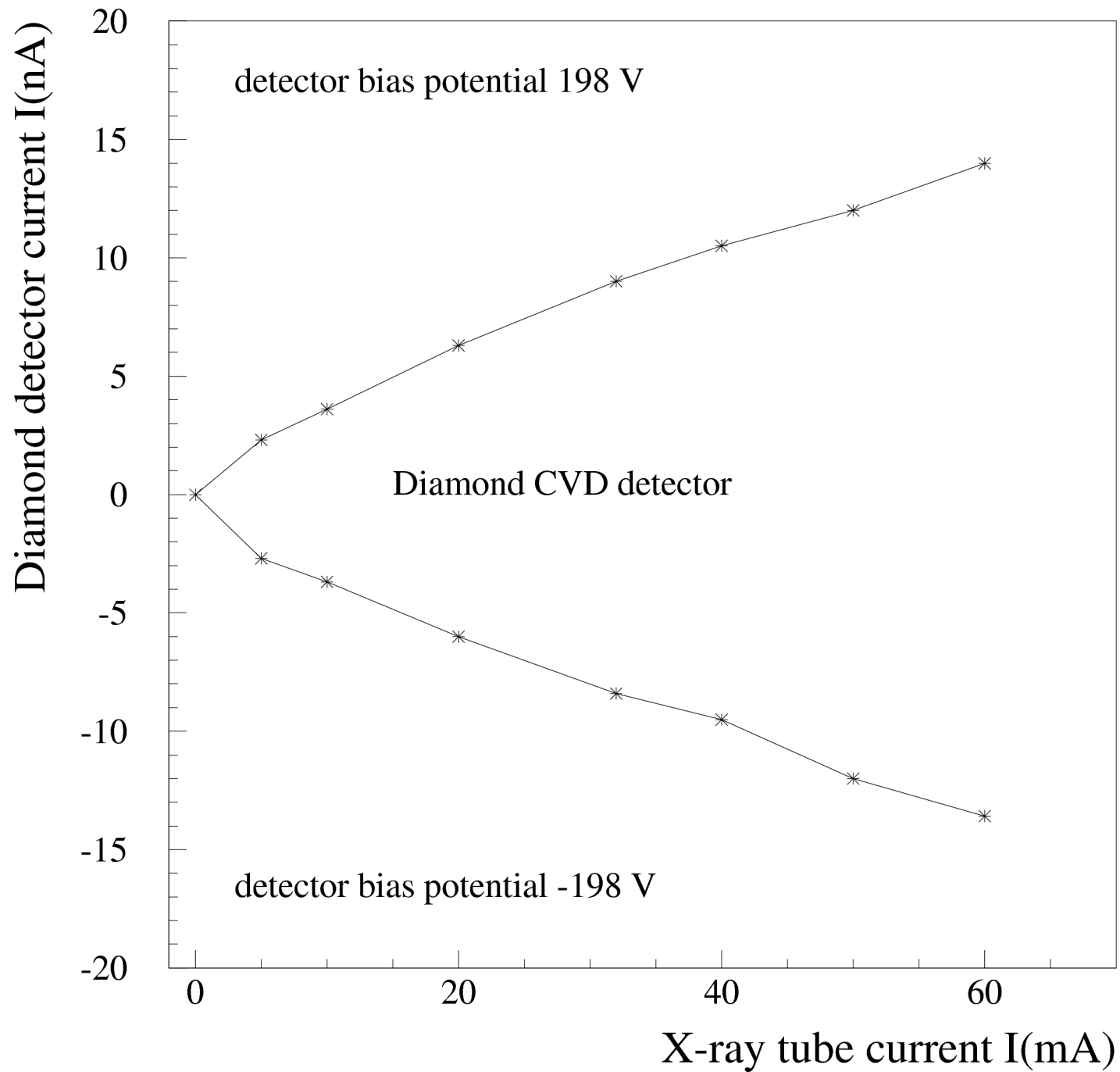


X-ray are measured by diamond detector in the current mode



X-ray tube: 40 kV, 10 mA, dose strength at 1 mm² diamond detector = 2 Gy/s.





Diamond detectors: CVD/HPHT (left) and CVD (right)

