Kraków gas gain measurements

On behalf of Tadeusz Kowalski
<Tadeusz.Kowalski@fis.agh.edu.pl>
and Bartosz Mindur
<bartosz.mindur@agh.edu.pl>

Context

- Gas gain and UV emission calculations rely on accurate measurements in *simple* detectors.
- Many measurements exist, but only few have been performed specifically for calibration purposes.
- Measurements at a range of pressures give insight in the time scale of excitation energy transfer.

Experimental setup

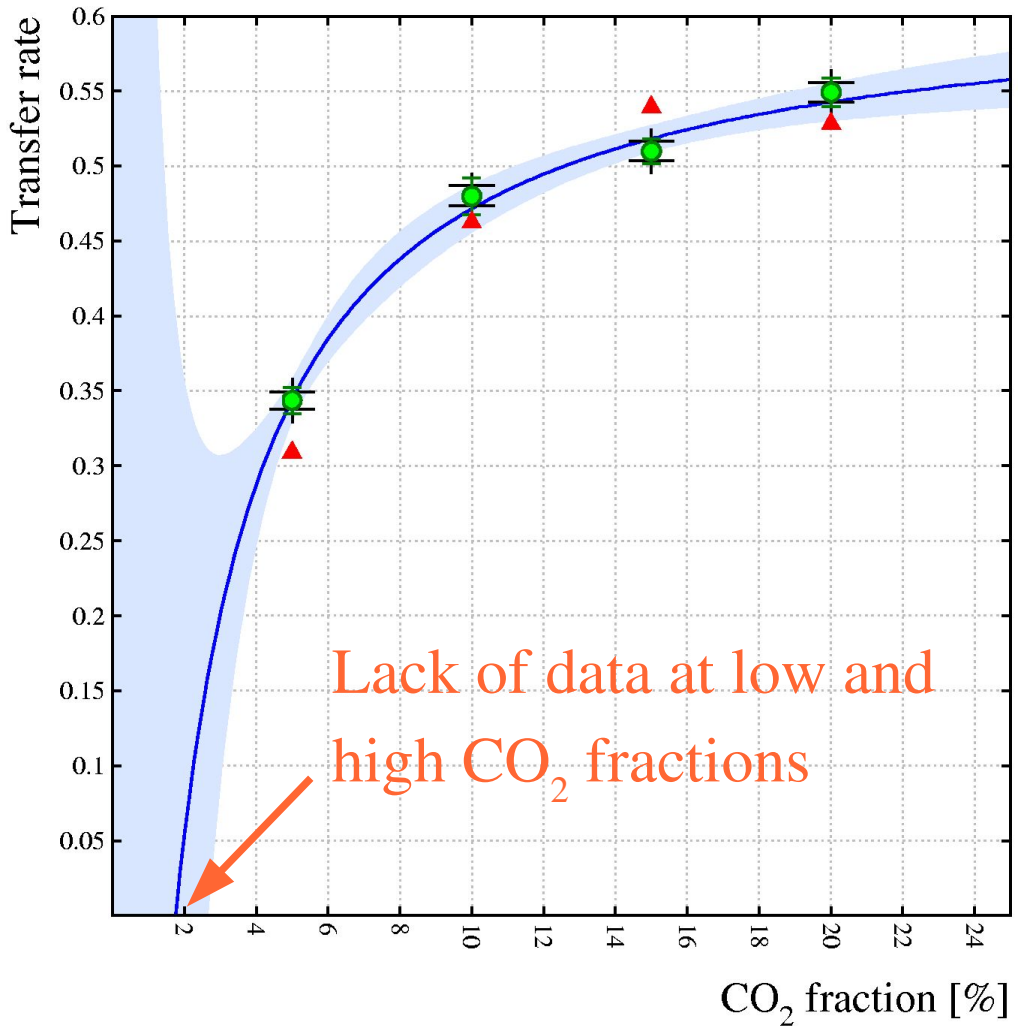
- Single anode, cylindrical counters:
  - r_{anode}: 10-50 μm
  - $r_{cathode}$: 2 mm (Atlas TRT straws) to 26 mm;
  - p_{gas}: 50 hPa - 0.6 MPa;
  - in some cases, guard rings were added.
- Available gases:
  - Ar, Xe, Kr;
  - Ne can be an option;
  - i-C_5H_{12}, C_6H_{12}, C_2H_5OH, C_2H_6, H_2, N_2, CF_4, CO_2, O_2, DME.

Wishlist

- GEMs:
  - Ar-CO_2 [low CO_2 fractions and 30 % CO_2]
  - Ar-CO_2-CF_4
- Alice:
  - baseline: Ne-CO_2 [90-10];
  - alternatives: Ne-CO_2-N_2 [90-10-5], Ne-CF_4 [90^--10^+];
- TPCs:
  - Xe-TMA

Ar-CO_2

- Note unphysical fit at low CO_2 percentages



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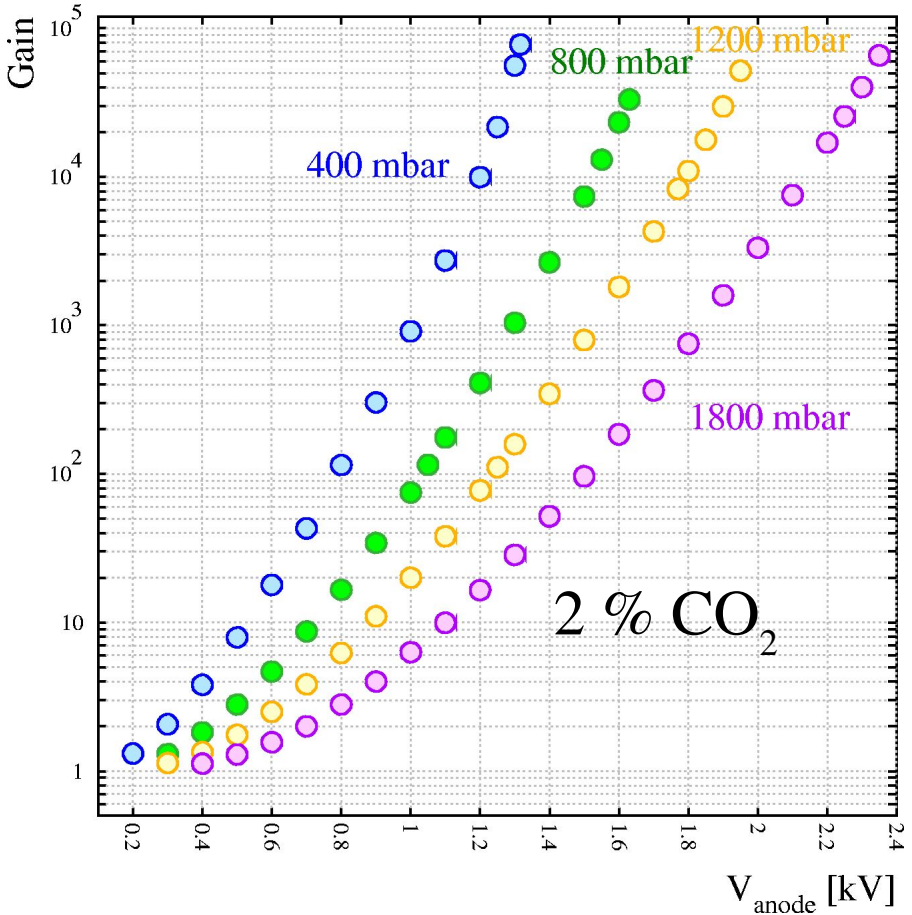
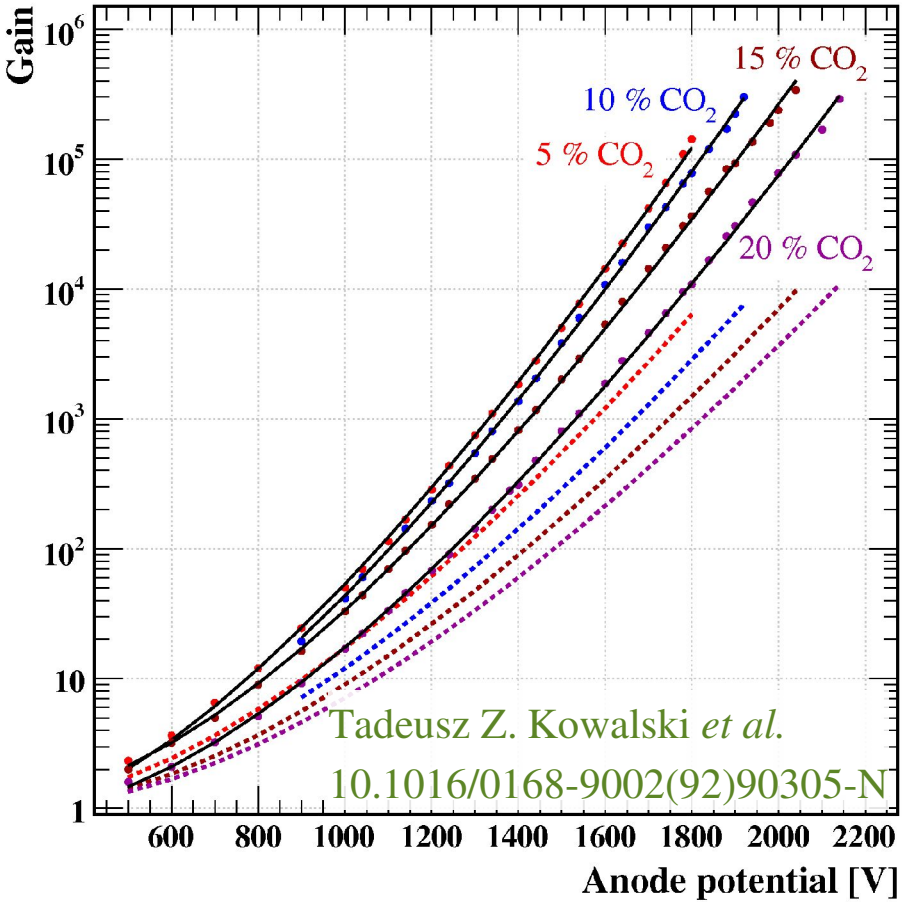
Ar-CO_2 gain curves

- New: 2 % and 4 % CO_2 at a range of pressures.
- Earlier measurements





Measurement method

- Performing current measurements:
  - pA-nA range;
  - current usually kept < 5 nA to avoid space charge;
  - ^{55}Fe, ^{109}Cd and ^{90}Sr sources.

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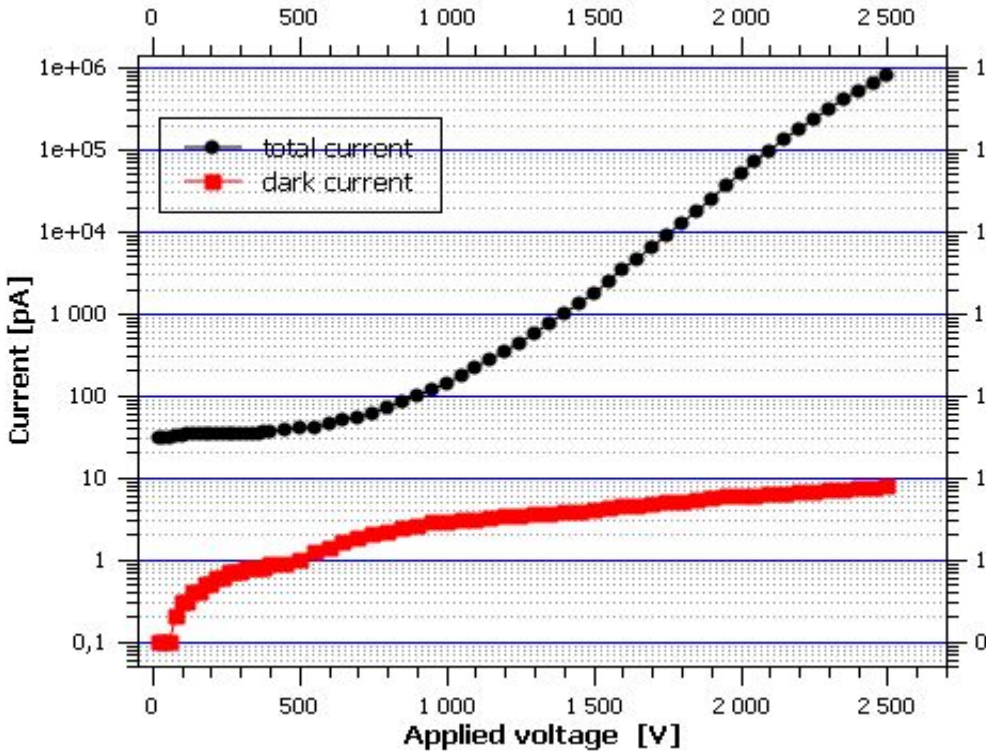
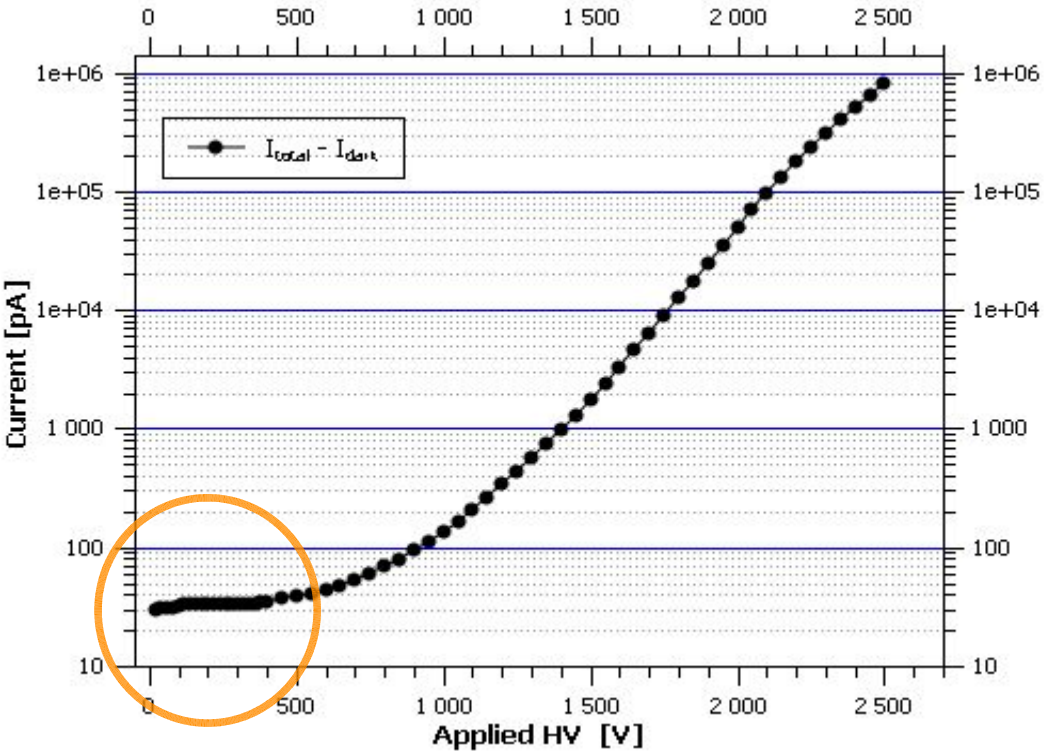
Example of measurements

- Ar-CO_2-N_2 [91.1-6.4- 2.5] at p = 0.2 MPa;
- dark current measurement and subtraction:





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Example

- Current reference is taken at the ionisation level.
- Main source of error: ~5 %.