

# Guaranteeing the Measurement Accuracy in Em#

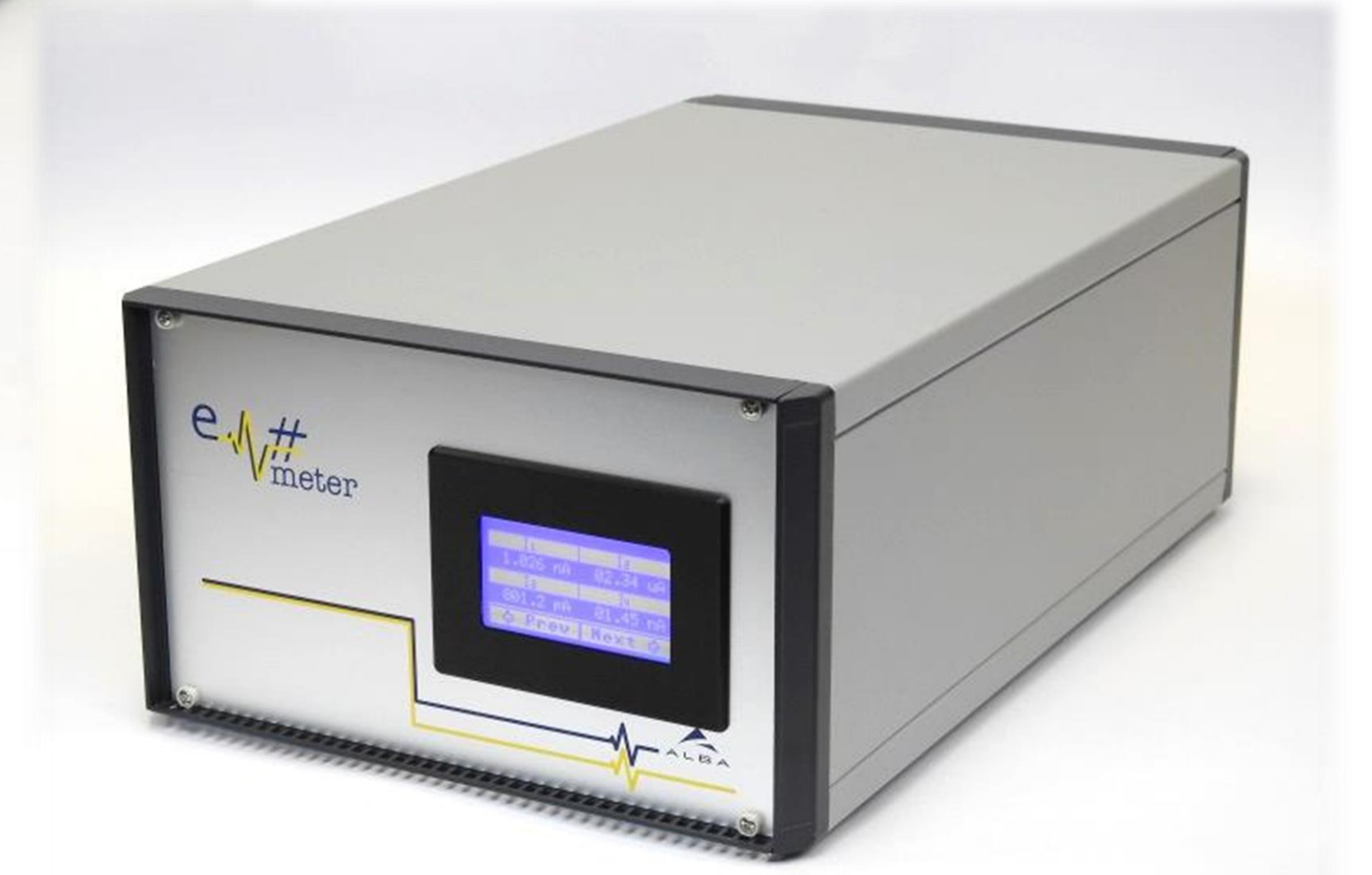


Xavier Serra-Gallifa\*, J.A. Ávila-Abellan, M. Broseta, G. Cuní, O. Matilla, CELLS-ALBA

Em# is a 4-channel electrometer designed by ALBA in collaboration with MAXIV. The performance of the Em# is equivalent or better than state-of-art electrometers. This poster shows characterization studies and correction algorithms to achieve its performance.

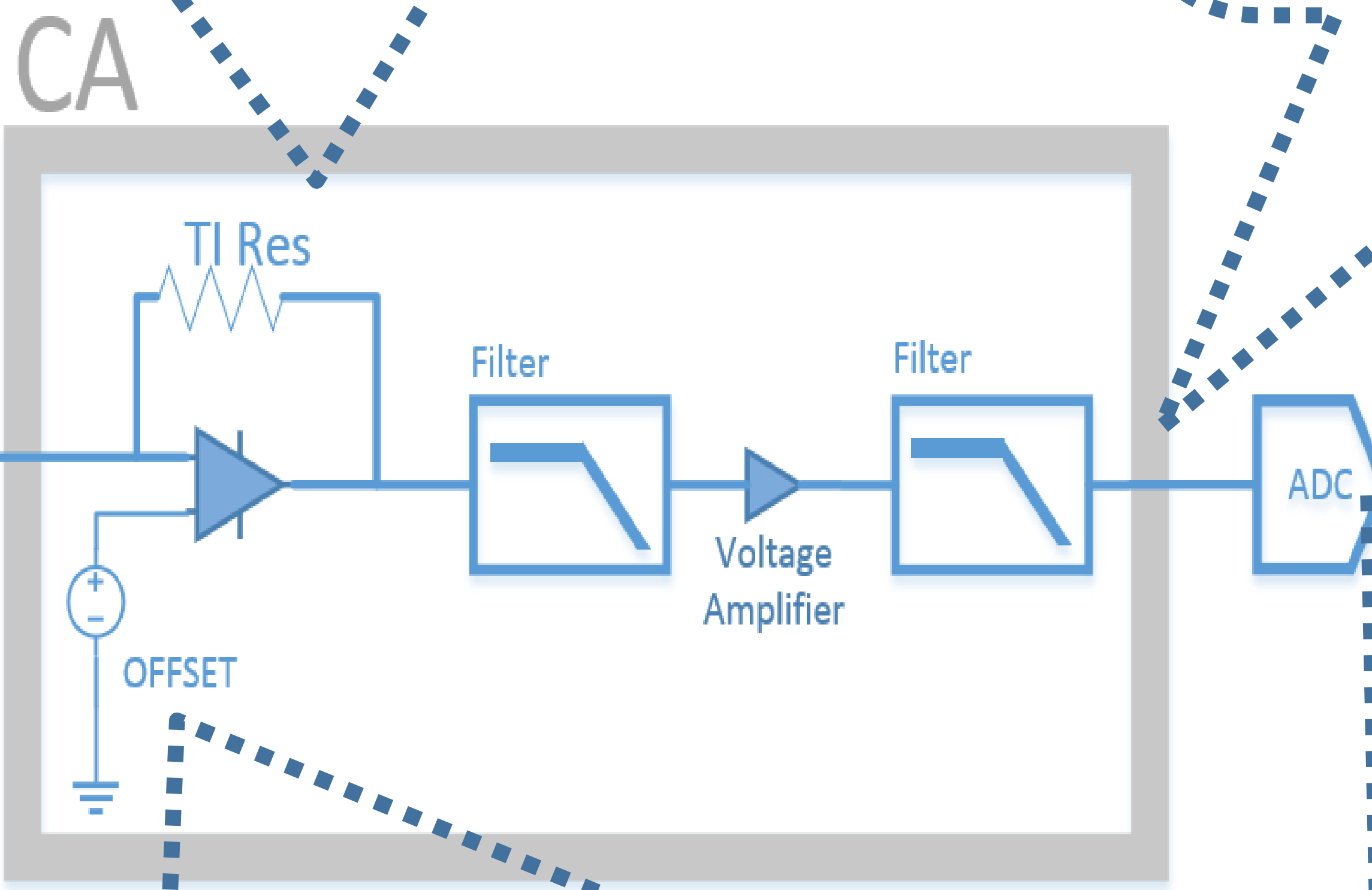
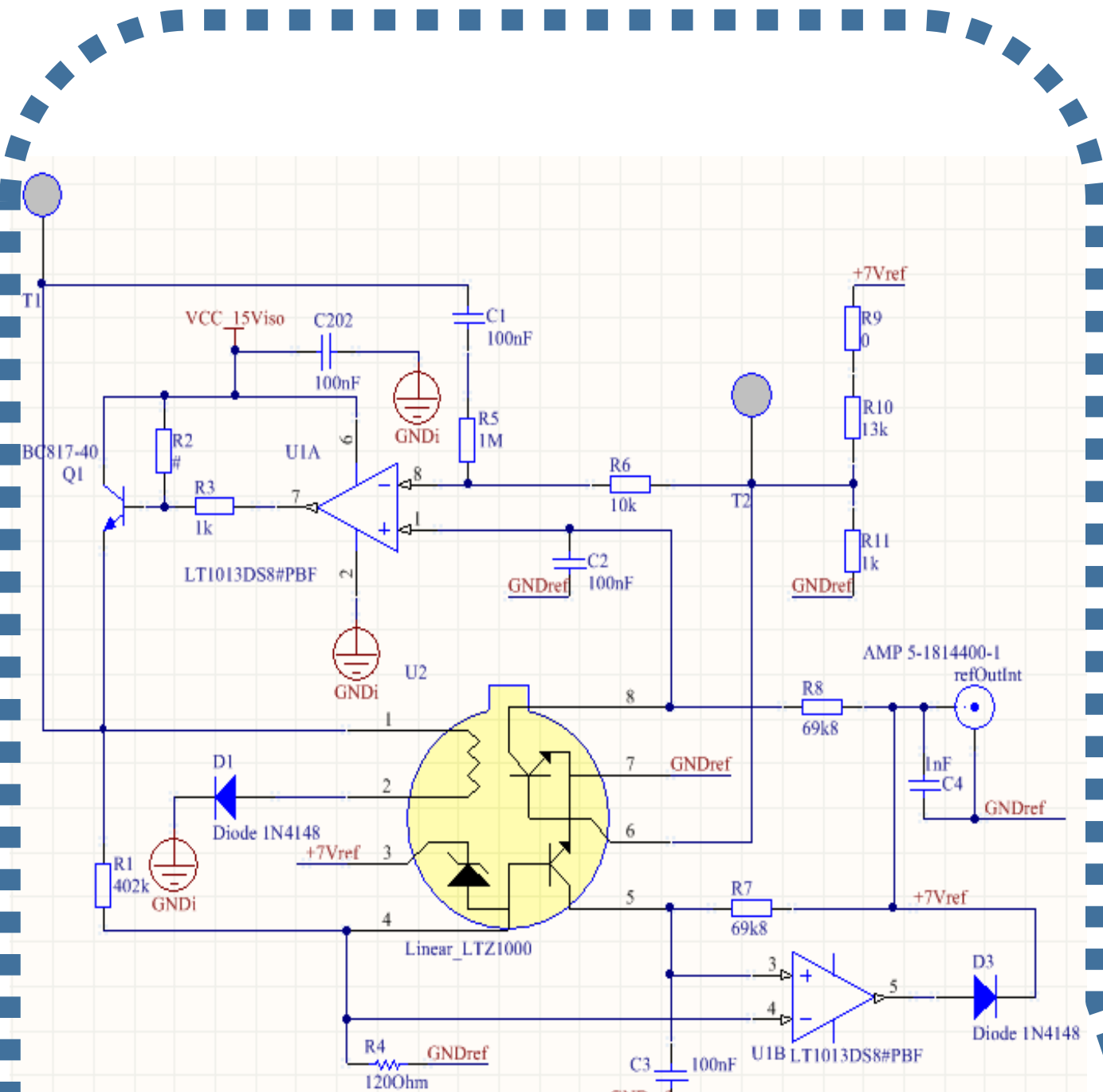
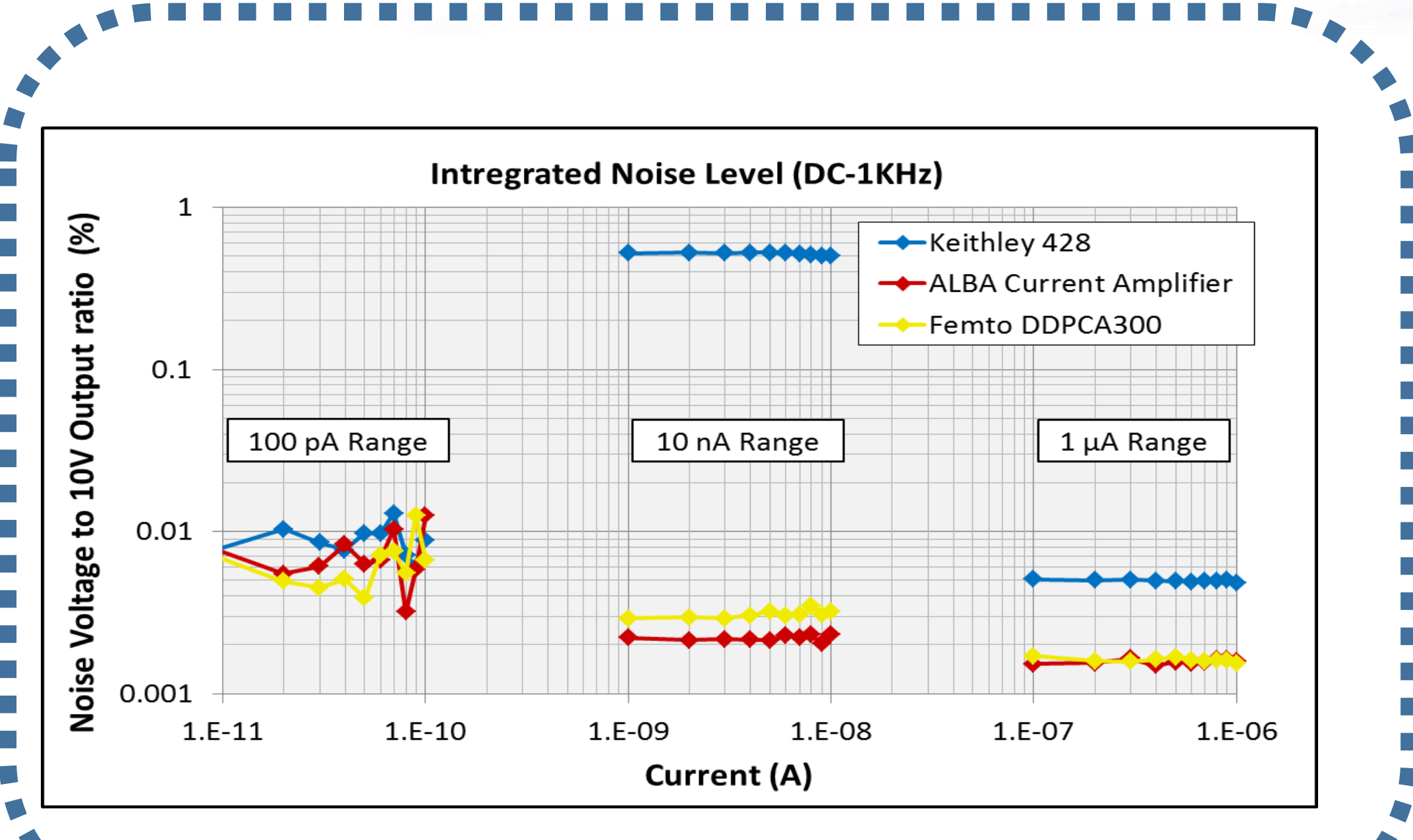
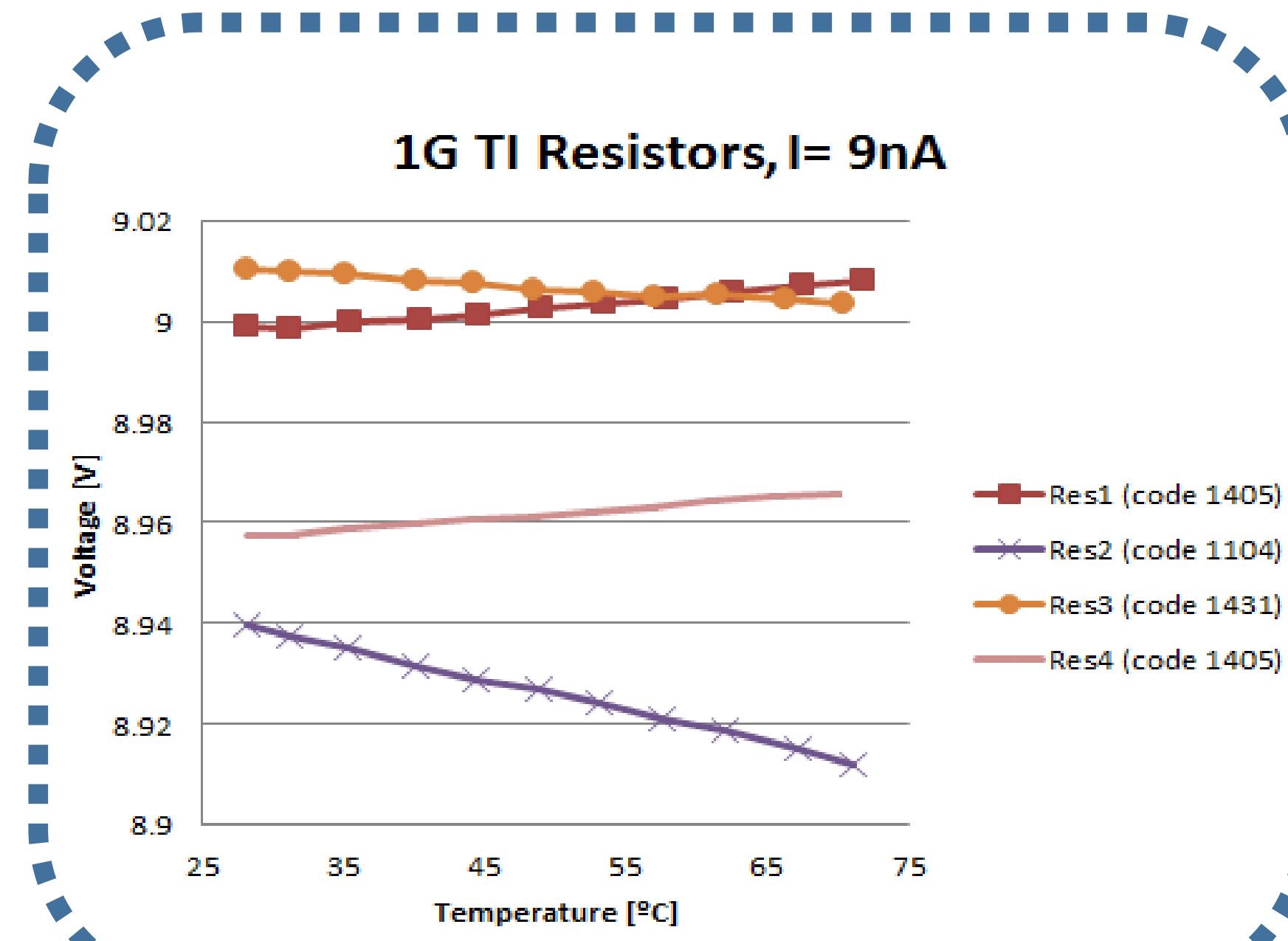
## Em# Specs Summary :

- SCPI and web interface control
- Four current amplifiers with 8 ranges from 1mA to 100pA
- 14 digital IO for triggers and counters
- 4 Direct Analog output +/-10V
- 4 Programmable Analog Output 100kHz.
- Independent temperature sensor in each channel for automatic offset and gain calibration.
- Analog-to-Digital Conversion in isolated area.
- Possible to input up to 1kV HV Bias (ADC ground reference at the same potential)



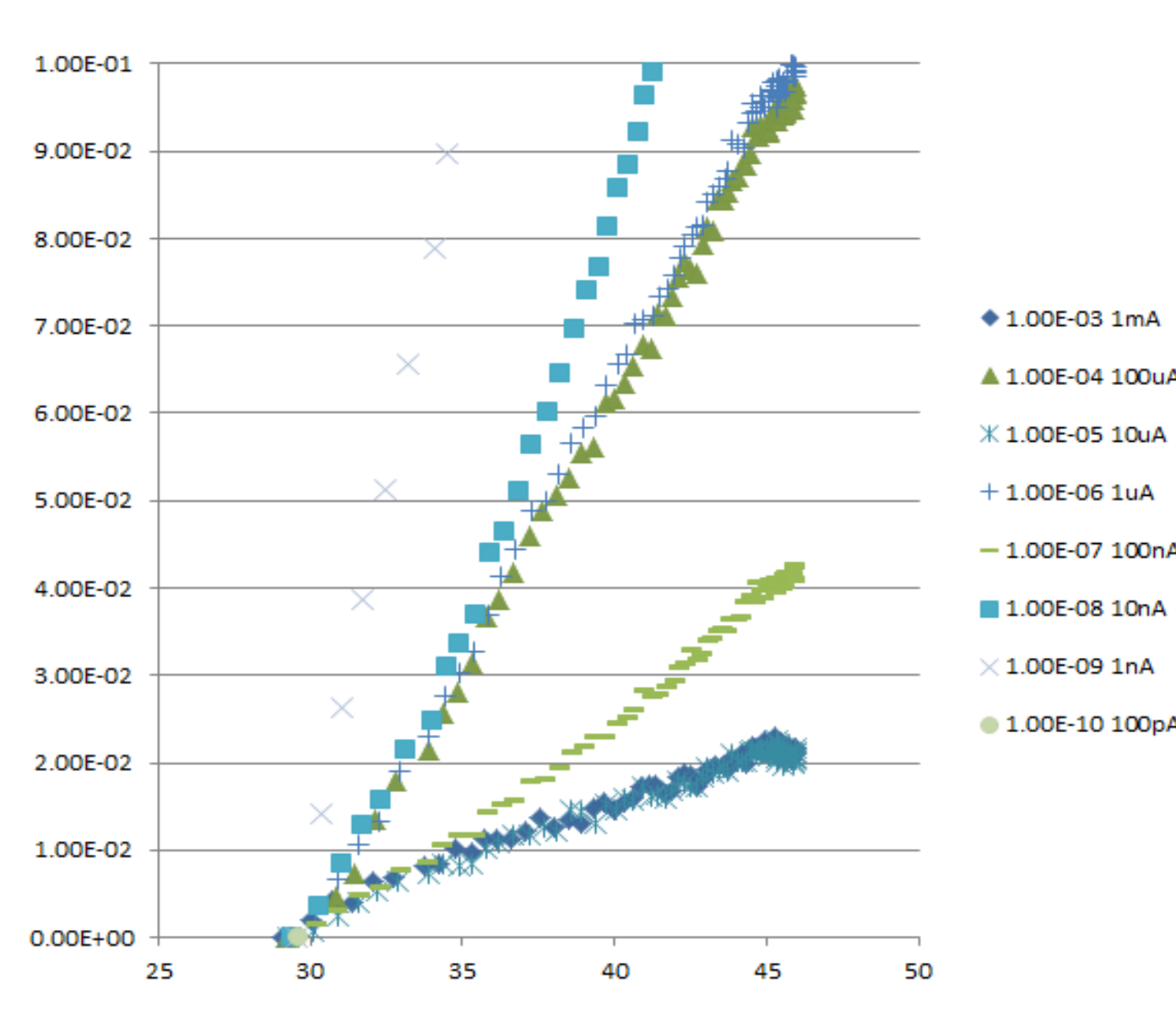
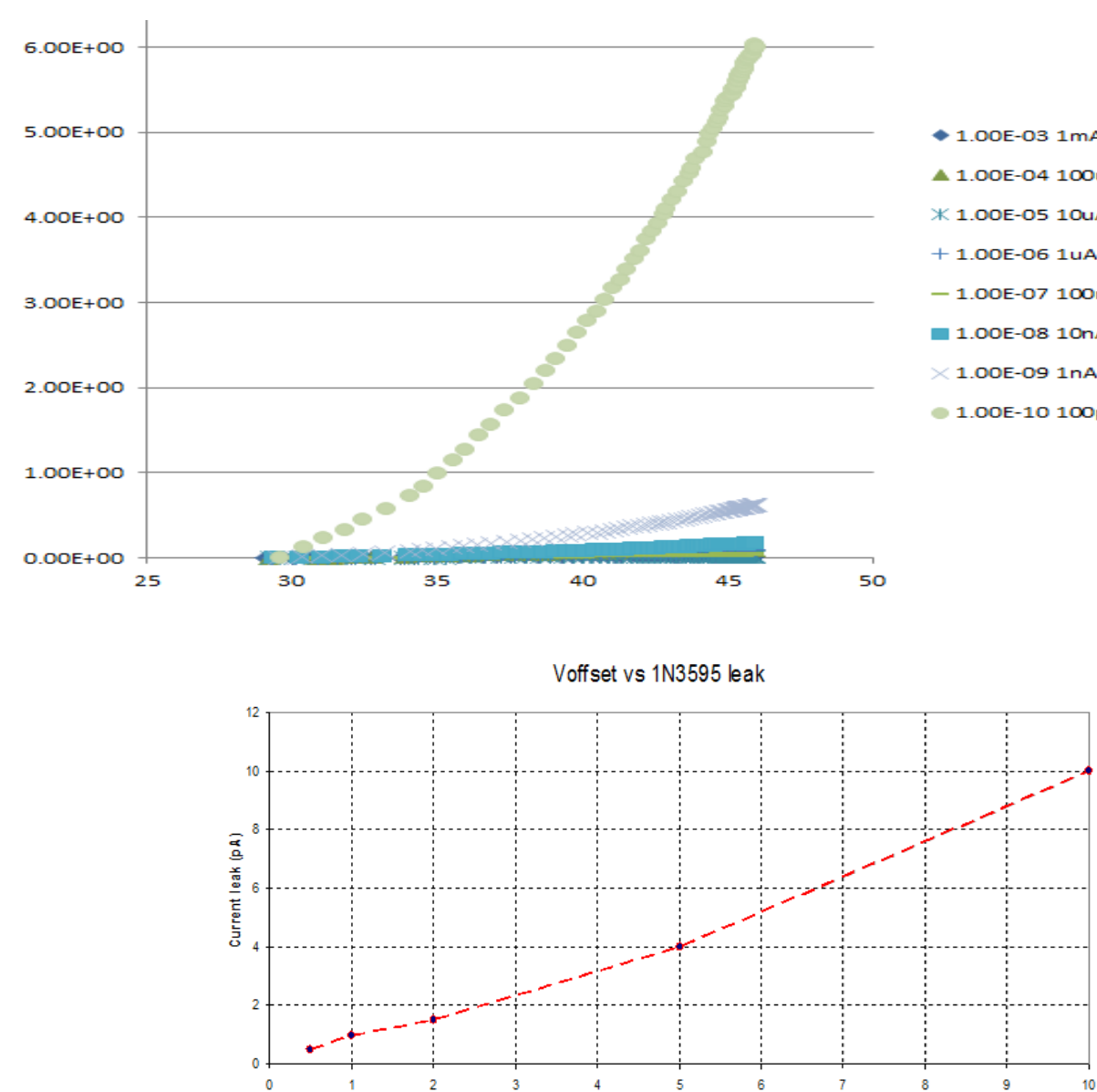
## Main limiting factors in the accuracy:

- Transimpedance resistor
- Voltage Offset circuit
- Discharge protection diodes

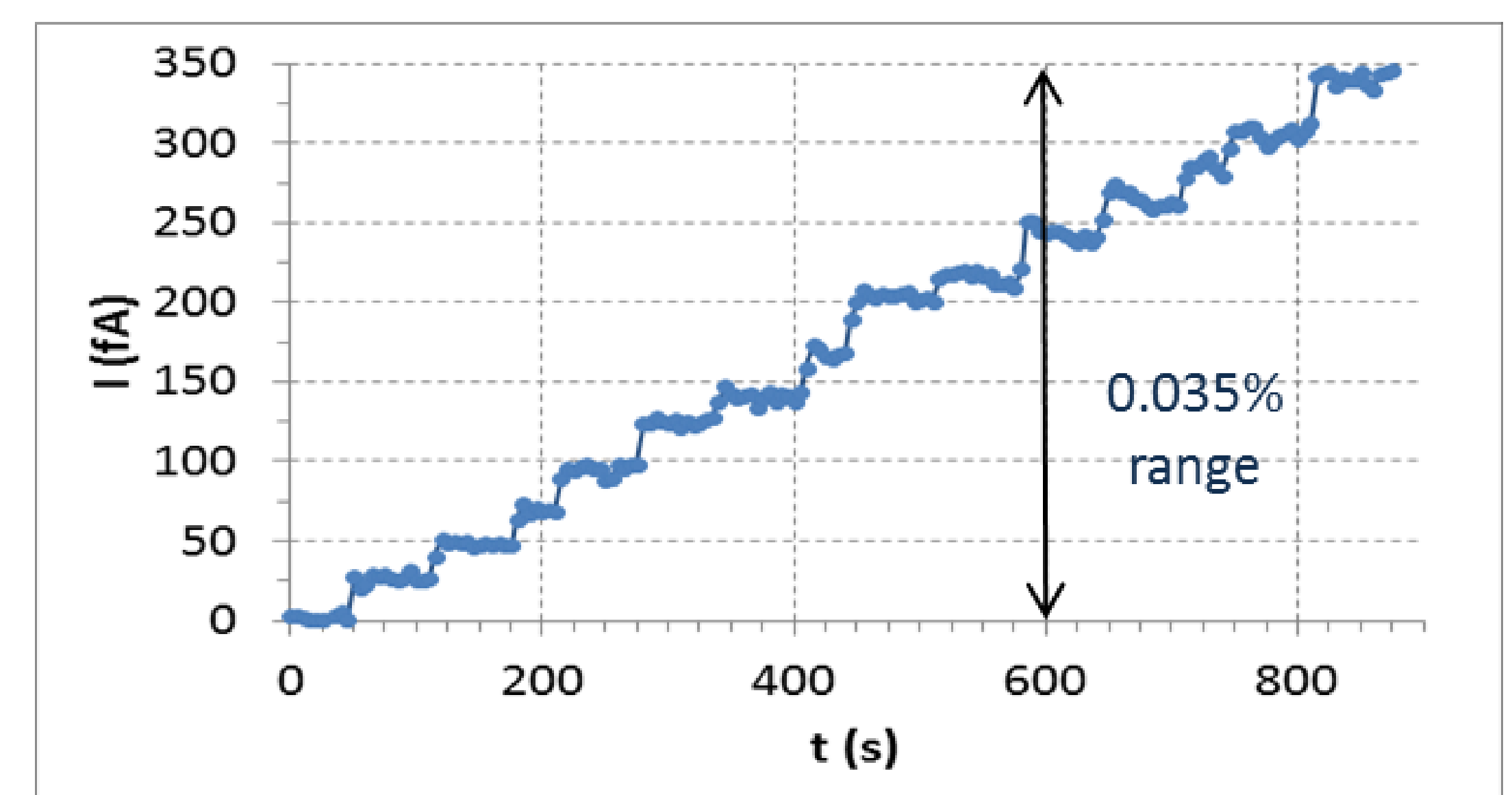


Each CA stores calibration and software corrects the temperature dependences applying a offset voltage and compensating gain.

Offset Correction  $V_{OF} = V_0 \cdot (1 + m \cdot (T - 20))$



$G_{TI} = R_N \cdot (1 + \beta) \cdot (1 + \alpha \cdot (T - 20))$



Input current signal with 25fA steps, 1nA range used , 0.5Hz filter, 4.8s integration time. Dynamic Range ~10<sup>5</sup>



xserra@cells.es

J.A. Avila-Abellan et al., "Em# Electrometer Comes to Light", in Proc. 16th Int. Conf. on Accelerator and Large Experimental Control Systems (ICALPCS'17), Barcelona, Spain, Oct. 2017, paper TUAPL04, pp. 137-142, ISBN: 978-3-95450-193-9, <https://doi.org/10.18429/JACoW-ICALPCS2017-TUAPL04>, 2018.  
M. Broseta et al., "Present and Future of Harmony Bus, a Real-Time High Speed Bus for Data Transfer Between FPGA Cores", in Proc. 16th Int. Conf. on Accelerator and Large Experimental Control Systems (ICALPCS'17), Barcelona, Spain, Oct. 2017, paper WEAPL01, pp. 1012-1016, ISBN: 978-3-95450-193-9, <https://doi.org/10.18429/JACoW-ICALPCS2017-WEAPL01>, 2018.