- Title: **Development of an advanced millimeter-wave front-end system for glucose monitoring**

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- Introduction / Goal

  The number of people suffering from diabetes is growing and forecasts exceed 500M cases worldwide in 2018. People living with diabetes need to test their glucose levels several times per day. A glucose test is today not convenient, accessible or even inexpensive and it is highly invasive, most certainly it is using metal needles for skin puncture. Recent advances in detection techniques using microwaves [1], allows foreseeing new promising devices for glucose monitoring. A particularly important problem that microwaves sensing may solve is that of reliably determining blood glucose levels, in a painless manner.

- Methods

  A glucose sensor based on a microwave cavity resonator was designed, manufactured and characterized. The design of the cavity resonator sensor is based on miniaturization techniques [2] and HFSS was used for RF simulations. The manufacturing was realized in Ångströms' mechanical workshop and the characterization involved standardized measurements of deionized (DI) water, and DI water with different glucose concentrations. In addition, the front-end circuitry around the new glucose sensor was developed using off the shelf components (COTs).

- Results

  The microwaves sensor is implemented as a microwave cavity filter, with a central frequency of 16 GHz. A capillary tube, of internal diameter 15 mils, protrudes the cavity filter in its centre, maximizing sensitivity. The read out circuit implements phase detection, using an RF mixer. The sensing signal is down mixed with a reference signal into a DC voltage, to be measured with an oscilloscope or a simple voltmeter.

- Summary

  A novel microwave based glucose measurement sensor system was developed, allowing measuring glucose concentrations within the clinical range.

- Acknowledgements

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References

[1] M. Hofmann et al."A novel approach to non-invasive blood glucose measurement based on RF transmission," Medical Measurements and Applications Proc. (MeMeA), pp.39-42, May 2011.

[2] D. Dancila et al. "Investigation of internal non homogenous volumes of perturbation as tuning and miniaturization elements for cavity resonators," Microw. Opt. Technol. Lett., 54: 491–496. doi: 10.1002/mop.26578