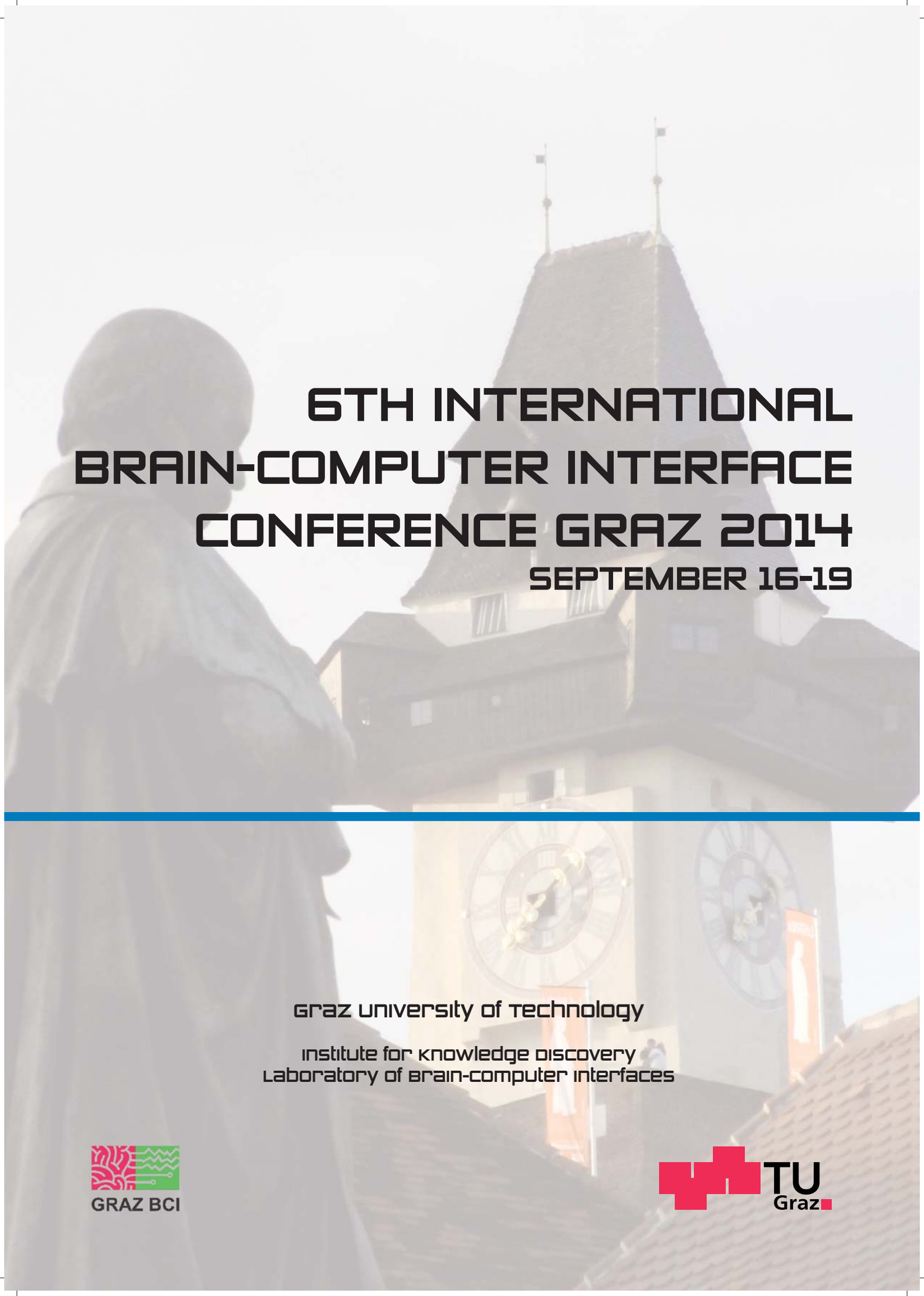

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LABORATORY OF BRAIN-COMPUTER INTERFACES

GRAZ BCI

TU Graz

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Design of Active Dry Electrodes for EEG based BCI systems

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1. Introduction

In the field of EEG-based Brain-Computer Interface (BCI) research, EEG acquisition systems are very important for acquiring high quality EEG signals. Especially, electrodes are the most crucial in these systems because they sense the brain signals at the interface between the user and system. Recently, various types of EEG electrodes such as dry, active, and capacitive electrodes have been developed. In this abstract, we aim to introduce our design of active dry electrodes, show their measured signals, and compare them with that of conventional wet electrodes.

2. Methods

Our active dry electrodes are equipped with spring loaded type probes and buffer circuits using operational amplifier. The spring loaded structure provides geometric flexibility between the sensor and the irregular scalp surface. Thanks to geometric flexibility, the probes are easy to touch with the user's scalp through the hairs. The buffer circuits provide the robustness of acquired EEG signals by conversion of impedance characteristic from high input impedance into low output impedance.

To verify the signal quality, we simultaneously recorded the EEG signals using our active dry electrodes and conventional wet electrodes at Fz positions and calculate correlation coefficient between them. In order to measure the EEG signals, we utilize the EEG acquisition system we designed based on Texas Instrument ADS1299 [1]. Our comparison target is general wet electrodes, named StarDisk (made by Hurev).

3. Results

The proposed active electrodes show similar waveforms compared to conventional wet electrodes. The average correlation coefficient of both the proposed electrodes and the wet electrodes is 0.75 for one minute.

4. Discussion and Conclusion

We show that the proposed active dry electrodes can measure EEG signals with similar quality compared to conventional wet electrodes without using conductive gels. We expect the proposed electrodes to be applied to wireless EEG acquisition systems.

[1] http://www.ti.com/product/ads1299