## Ear-located heart rate monitoring

**Brief:**
PULSEAR is a fully integrated heart-rate measurement system located in an earphone. The system is based on an optical measurement of the subcutaneous blood flow, coupled with an accurate measure of the motion provided by a set of accelerometers. Thanks to csem’s key expertise in signal processing for biomedical applications, PULSEAR does not require any additional probe or chest belt and therefore fills the gap left by existing heart rate monitors. The PULSEAR heart rate monitor, integrated into an earphone, does not affect the sound quality of audio signals and does not further limit the design of the headsets. A distinguishing factor is that the PULSEAR technology is complementary to existing consumer electronics products concerning functionality and market segments and its product roadmap integrates other features such as activity classification, jogging speed, etc.

**Applications:**
With a strong industrial partner, csem plans to industrialize and commercialize the PULSEAR technology and to develop a successful high volume commercial product for the sports or consumer market. csem owns a patent portfolio for both PULSEAR concept (ref. PULSEAR) and signal processing (ref. SP-Pulse) as followed:

**Expertise:**
Heart-rate monitors for sport applications are usually based on the measurement of ECG (see, e.g., the POLAR chest belt). The method is popular because of its robustness against motion artifacts. However, people find it rather uncomfortable and would prefer not to have a belt around their chest. Photoplethysmography is another known technique to get the heart rate, but photoplethysmography is difficult to use when people are not at rest because of its strong sensitivity to motion artifacts. Therefore, photoplethysmography is not effective for sports activities.

**Partners:**
- Industrial

**Publications and Patents:**
- SP-Pulse European patent (published): EP 1,297,784 A1
- P. Celka, C. Verjus, R. Vetter, P. Renevey, and V. Neuman, *Motion resistant earphone located infrared based heart rate measurement device*, LASTED Biomedical Engineering (BioMed2004), Innsbruck 2004