**Introduction:** Stroke often results in impaired balance which is a major cause of locomotor disability and may decrease the performance of many activities of daily living. Patients who suffered a stroke are trained to recover adequate control over their movements with the objective to optimize their daily-life functional performance. Continuous daily-life monitoring of balance control of stroke survivors, is essential for optimal guidance of rehabilitation therapy by medical professionals and coaching of the patient. Schepers et al. (IEEE Trans. Biomed. Eng., 2009) developed instrumented force shoes (IFS) for the ambulatory assessment of the ground reaction force and the estimation of the position of centre of mass (CoM). They demonstrated the evaluation of dynamic balance control in stroke patients.

**Purpose:** For the assessment of body balance, foot placement (i.e. relative foot position), is a crucial variable. However, the inertial sensing in the IFS does not provide information about relative foot positions. Relative foot positions could only be estimated when starting with a known initial value. In that case, the relative foot positions estimated by inertial tracking drifted over time. The purpose of this study is to evaluate the estimation of relative foot positions during double stance using inertial and magnetic sensors on the leg segments and pelvis, combining orientation estimation and tracking.

**Methods:** In order to estimate the relative foot position, the Xsens (Enschede, the Netherlands) MVN Biomech measurement system was used, which contains 17 inertial magnetic measurement units. Position information of all sensors was estimated with Xsens’ software, MVN studio Pro. Three healthy subjects walked repeatedly in a gait lab with VICON as a optical reference measurement system.

**Results:** The results of the measurements with the MVN system and the reference system, show a good correspondence of the relative foot positions during the double stance phases (RMS value = 0.048 meters) in healthy subjects.

**Discussion:** The estimates of the relative foot positions with MVN will be of added value to the IFS, when used in combination. Although the IFS need to be redesigned to make them applicable for measurements during daily life as an ambulatory setting, the combination of them with MVN allows to assess qualitative parameters of balance control in stroke patients: step width (variability), symmetry of load distribution per foot and movement of the CoM related to the position of both feet. However, a detailed evaluation in stroke survivors needs to be conducted to demonstrate expected different parameter values (Kuo et al., Phys Ther, 2010) in stroke patients.