

# PRIN 2012

**Mechanical measurements for the musculoskeletal apparatus:  
novel and standardizable methodologies for metrological  
assessment of measurement systems.**

## **WP1 Summary of 3<sup>rd</sup> meeting**

Date: March the 6<sup>th</sup> 2014

Version: 1.1

# 3<sup>rd</sup> Meeting

The meeting took place on March the 6<sup>th</sup> at Sapienza University of Rome, faculty of Engineering, Via Eudossiana 18, Roma, IT.

The meeting was attended by:

- RM1: Paolo Cappa, Andrea Ancillao
- CBM: Carlo Massaroni
- RM3: Giulia Lupi, Andrea Scorza (teleconference).

The meeting marked the conclusion of the first year of the project. (See the following GANTT).

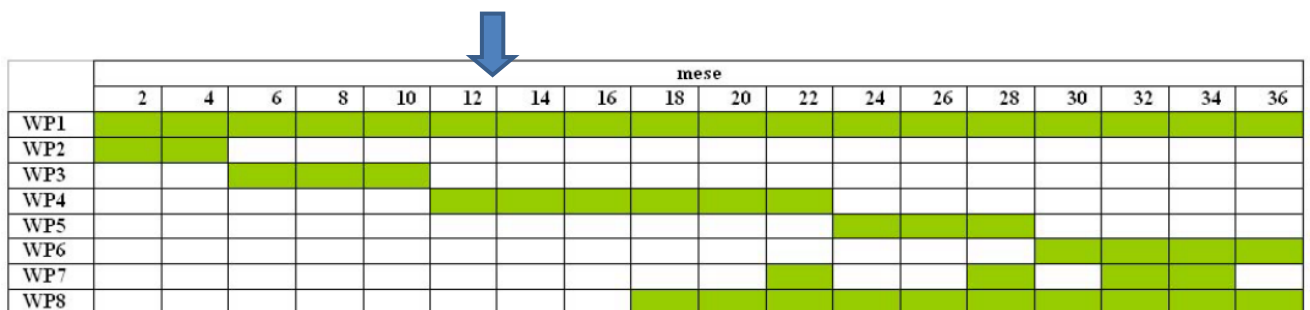


Figure 1: GANTT

### Status of the work:

RM1 Acquired measurement data from motion analysis laboratory of Palidoro. Both kinematics and static-kinetics were acquired. They are ready to conduct measurements in the lab of CBM.

CBM prepared a device that simulates chest movements and that can be used to test and calibrate the optoelectronic system in use with the OEP system.

The prototype is not yet definitive as they are improving the actuator system. The final prototype should be ready by May 2015. The actual prototype can be used for preliminary data acquisition.

RM3 is developing a system that transfers the load from a shaker/actuator to the force platform. They are actually using a one-component load cell mounted on the lever arm and are working on a system to measure the loading angle. They are actually able to apply the following loads to the force platform:

135 kg<sub>f</sub> on the vertical axis and about 30 kg<sub>f</sub> as shear stress. The loading frequency is 2 – 4 Hz. The shakers has some loading issues if used at frequencies higher than 4 Hz.

The system has also some portability issues. As of today it is fixed on a workbench. The final prototype should be ready by May-June 2015.

A further literature analysis is needed to define the maximum frequency of force load on the platform. (Is 4 Hz enough? )

It was observed that the multi-component load cell (ATI-Gamma) owned by RM1 and originally meant to be included in the lever-arm of the system designed by RM3, is not useful for this application as it has limited measurement range (400 N on the main axis and 130 N on the lateral axis).

We then discussed the work about the literature review. We pointed out that a literature review about metrological characteristics of optoelectronic systems was already conducted (Cappozzo et al.). Anyway there may be room for a review of the force platforms.

A literature review about the clinical application of motion analysis laboratory may be interesting, but it is anyway a huge work, considering also the number of people involved in the project (11 people).

Clinical applications of motion analysis laboratories include:

- OEP and plethysmography
- Gait Analysis
- EMG

The review may also consider the different anatomical districts (eg. Upper limb, head, lower limb) on which the analysis is centered.

The review may begin with a description of a motion analysis laboratory and of the instrumentation included.

We then agreed to work on a literature review to revise and extend the literature review already completed in order to use it as introduction for experimental research papers to be organized and produced by the units.

Literature review will be extended according to the following workpackages:

CBM: Characteristics of OEP and plethysmography, clinical application and criticalities.

RM3: Metrological characteristics of force plates and clinical applications

RM1: Calibration methods and metrological characteristics of optoelectronic systems and their application to fine movements.

#### **Next steps and deadlines:**

CBM has a preliminary calibration system that allows micro-movements, up to 4 micrometers. They already acquired data in their lab.

#### Within 15 April 2015:

- Extended literature review about the previously defined workpackages.
- Data acquisitions by means of the prototype produced by CBM in the lab of Palidoro using both vicon systems with different calibrated volumes.

#### Within May 2015

- Preliminary testing of the dynamic force applying system designed by RM3 on the mobile force platform that is now at the lab of Palidoro and may be moved to the lab of RM3.