

## Meeting on g-2, Mu2e laser calibration systems FNAL, 4 August 2016

Attendees: S. Donati, C. Ferrari, S. Giovannella, S. Miscetti

This meeting is a follow up of the discussion started after the training seminar of C. Ferrari on the Muon g-2 laser calibration system, presented on August 2<sup>nd</sup> 2016 to European University students participating to the FNAL Summer School.

The meeting continued with S. Miscetti delivering a dedicated talk to summarise the requirements of the Laser monitoring system for the Mu2e detector and the differences on physics goals and precisions between Mu2e and g-2 calibration systems. In particular:

1. The existence of a dedicated calibration source in front of the Mu2e calorimeter suggests to design the laser mainly to achieve a gain calibration of the photosensors with a precision of 0.5% (with respect to 0.5 per-mil in g-2).
2. The laser will also be used, together with the FEE pulsing system, to synchronise the digitizers readout and to calibrate the timing delays. This work will be cross-checked during data taking with Cosmic Rays and Decay in Orbit events. This is a demanding job since we aim for a timing calibration of the offsets at the level of  $O(10)$  ps/channel.
3. The laser will be crucial also to follow the slow trend of changes of the gain, timing and resolution of photosensors along the day time and between source calibrations, that are expected to be run weekly. Deterioration of the photo-sensors response and resolution due to irradiation will be controlled in this way in cooperation with the dedicated photosensor cooling system.
4. Variation of the response due to the incoming beam will be tested with special runs by centring the arrival of the laser beam pulse into the “beam-on” gate.

A technical description of the system followed. During this presentation a list of items to be clarified have been spot in the open discussion with the g-2 expert, C. Ferrari.

This is the list of the action items:

- precise quantification of the laser pulse energy needs;

- study of Safety Class for the selected laser;
- decision to be made on maximum repetition rate and long term reliability;
- optimization of optical distribution system: dimensions of integrations spheres, number of ports, connection of fiber bundles, study of diffusion lenses;
- monitoring system: PIN vs photodiode, pro and contra;
- COTS of Laser Wheel;
- test of temperature damage of fibers.

It was agreed that this meeting was just the start-up of a series of technical discussions where all material learnt on the g-2 side and the related people expertise should be used to cross-fertilise the knowledge of the Mu2e calibration group and help in optimising the system.