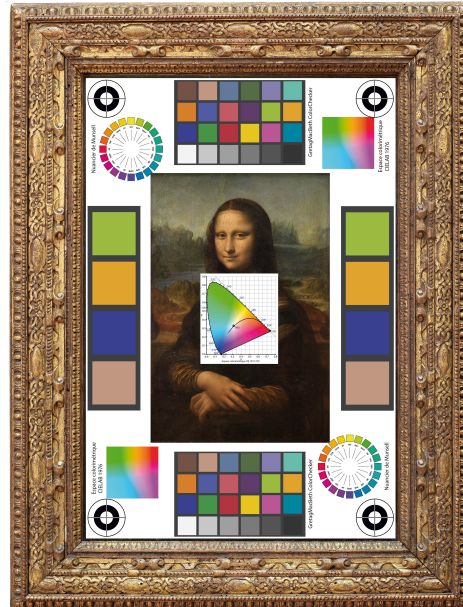


## Note on the revolutionary lamp designed to light Mona Lisa, Louvre Museum, Paris (June 2013)

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*The new lighting of Mona Lisa which will be inaugurated June 4. 2013 uses 34 LEDs of various colours, a sophisticated optical system to blend the light uniformly over the painting, and an advanced control system to compensate colour changes due to protective glazing and ambient light.*

### Introduction

Through the patronage of TOSHIBA Lighting (Japan) various innovative lighting have been developed for the Louvre Pyramid, the Louvre Facades, and some Louvre exhibition rooms. On June 4. 2013, a specific lighting will be inaugurated. It deals with a specific lamp designed exclusively to light the painting of Mona Lisa, the most known painting world wide, a 500 years old painting by Leonardo Da Vinci. The lighting designer Marc Fontoynt, who was associated to the design of the refurbishment of the room in 2005 by architect Lorenzo Piqueras, was invited by Museum of Louvre, through the patronage of TOSHIBA corporation, to set up a team to develop a revolutionary lamp to be installed in 2013.

The design team eam consists of:

Marc Fontoynt, Professor at Aalborg University, Denmark (expert in vision science and lighting system optimization)

Jean-Pierre Miras, CEO, Arkanz Lighting, Frankfurt, Germany (co-developer with Marc Fontoynt of the first lamp installed in 2005, electrotechnical specialist, expert in LEDs)

Marco Angelini, Director Fraen Optics, Milano, Italy (design of optics, optimization)

Jean Chanussot, AELSYS, LED power supplies and controls

Leonid Novarovski, Director, PHAROS-ALEF, Moscow, Russia, (optimal mixing of colours)

Christophe Marty and Gregory Duchêne, INGELUX, Lyon, France (LED control optimization, software development, colour control, calibration)

## **A LED lamp for Mona Lisa : summary of innovations.**

The proposed lamp is installed in a tablet designed by the architect of the room (Lorenzo Piqueras, 2005) and operates upward. The lamp uses 34 LEDs (single chip and multichips) Three optical systems have been developed to allow high uniformity over the painting: the primary optical system on the chips (optimized for single chips and multichips) , the exclusive colour mixing system (Scheib) , and the double lens, asymmetrical optical component providing uniformity of lighting over the painting, with correction using a specific FS3 filter. Framing, adjustment is built-in, and the projection lens allows adjustment of illuminance distribution at the edges.

An innovative, and versatile control system of the lamp has been developed. It allows to vary colour temperatures (between 2500 K and 6000 K), but more usefully between 2700 K and 3800 K keeping a Colour Rendering Index higher than 95 for all configurations. For all tuning within this range, colour gamut is optimized, to keep colours vivid (for instance the CQS index is kept above 95 .

The lamp does not produce any Infra-Red nor Ultra-Violet radiation. An intelligent control system has been implemented, allowing the Louvre to make corrections of colours with both high precision and great simplicity in the operation.

These adjustments have been found essential to compensate for the coloration due to the protective glass, or the effect of the ambient lighting, as well as to improve rendering of colours. With the use of latest generation of LEDs, the lamp consumes about 20W watts of electricity.



*During the colour tests of the lamp prototype, in February 2013, with curators, architect, Museum directors, co-developers, and TOSHIBA representatives.*



*During the test of colours (continued)*