Telescopio Nazionale Galileo

THE CLEAN ROOM AT TNG GROUND FACILITIES

Report

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INAF ISTITUTO NAZIONALE DI ASTROFISICA

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LIST OF ACHRONYMS

TNG, Telescopio Nazionale Galileo
INAF, Istituto Nazionale di Astrofisica
CCD, Charge Coupled Device
CMOS, Complementary Metal-Oxide Semiconductor
ISO, International Organization for Standardization
ESD, Electrostatic Discharge

LIST OF FIGURES

1 Introduction

The realization of experimental apparatus, silicon detector based, needs a clean' 'dust free' environment where cleaning and electrostatic condition are controlled.

CCDs, CMOS, infrared detectors, for example, are classified as both ESD (electrostatic discharge) sensitive and clean – thus they must only be handled whilst observing ESD precautionary procedures and in a clean environment such as the class 100 laminar flow bench in the CCD clean room.

The detectors are normally received individually boxed in durable plastic or metal transport containers, mounted in a zero insertion force socket, with all connection pins shorted together. This container is sealed in a special electrostatic protection polyethylene bag. The packaging into the box is realized in a clean room. For this reason the handling of those detectors must be in a clean room ESD free.

2 General characteristics

A clean room is a work area in which the air quality, temperature and humidity are highly regulated in order to protect sensitive equipment from contamination.
Clean rooms are important features in the manufacturing or scientific research, such as production of silicon chips (semiconductor manufacturing), handling of detectors and other technologies such as satellites, which needs a low level of environmental pollutants such as dust, airborne microbes, aerosol particles and chemical vapours.
The air in a clean room is repeatedly filtered to remove dust particles and other impurities that can damage the production of highly sensitive technologies.
To give perspective, the ambient air outside in a typical urban environment contains 35,000,000 particles per cubic meter, 0.5 μm and larger in diameter, corresponding to an ISO 9 clean room.
The measure of the air quality of a clean room is described in UNI EN ISO 14644-1. Clean rooms are rated as "Class 10,000," where there exists no more than 10,000 particles larger than 0.5 microns in any given cubic foot of air; "Class 1000," where there exists no more than 1000 particles; and "Class 100," where there exists no more than 100 particles. Detector handling requires a Class 100 clean room.
An example of laminar flux in a clean room is shown in Figure 1.
People who work in clean rooms must wear special protective clothing called "bunny suits" that do not give off lint particles and prevent human skin and hair particles from entering the room's atmosphere.

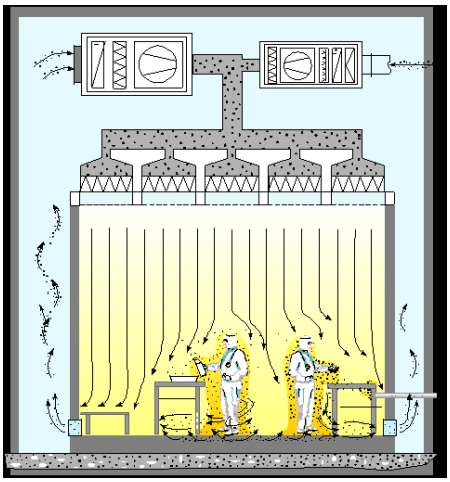

Figure 1 - Typical laminar flux clean room

Class	maximum particles/m³						FED STD 209E equivalent
	≥0.1 µm	≥0.2 µm	≥0.3 µm	≥0.5 µm	≥1 µm	≥5 µm	
ISO 1	10	2					
ISO 2	100	24	10	4			
ISO 3	1,000	237	102	35	8		Class 1
ISO 4	10,000	2,370	1,020	352	83		Class 10
ISO 5	100,000	23,700	10,200	3,520	832	29	Class 100
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293	Class 1000
ISO 7				352,000	83,200	2,930	Class 10,000
ISO 8				3,520,000	832,000	29,300	Class 100,000
ISO 9				35,200,000	8,320,000	293,000	Room air

Figure 2 - ISO classification number

ISO class 6 corresponds to class 1000 clean room, while ISO class 5 is a class 100 clean room.

3 The TNG clean room description

The TNG clean room is located in at the "Fundación Galileo Galilei" building, located in S. Antonio – La Palma. The clean room is a 10 m^2 space (included the airlock zone) integrated into the optical laboratory. In Figure 3 the optical laboratory and the annexed control room are shown. The clean room has been built inside the optical laboratory (Figure 4). In the airlock zone people who work in the clean room wears the protective clothing, the working space of the clean room had a class 100 laminar flow bench, a clean room vacuum cleaner, two seat, a table, telephone, internet connection and power plugs. In Figure 7 the clean room in the optical laboratory environment is shown. A detail of the inside of the clean room is shown in Figure 8. A series of accessories as a vacuum cleaner, stainless-steel table, drawers, stools and tools complete the clean room facilities.

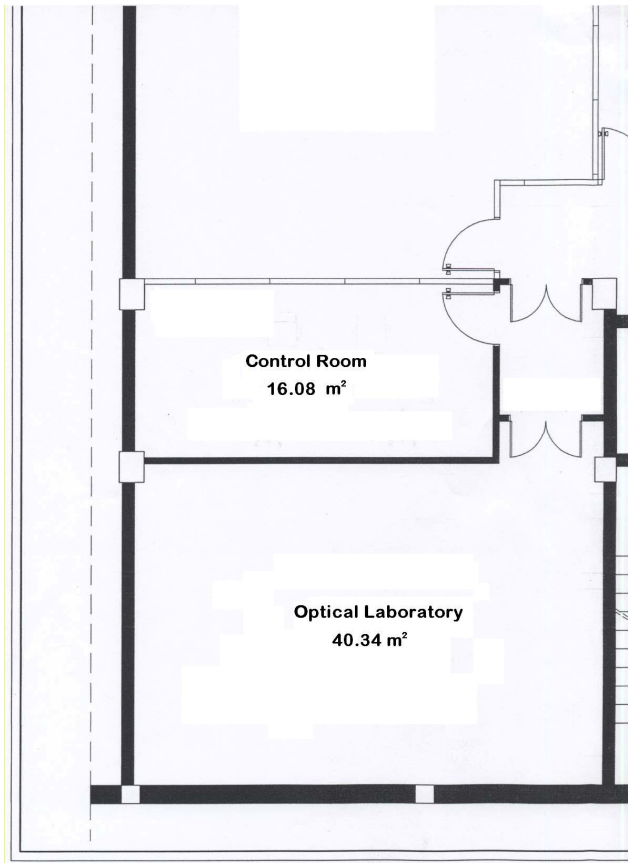

Figure 3 - Optical laboratory and control room

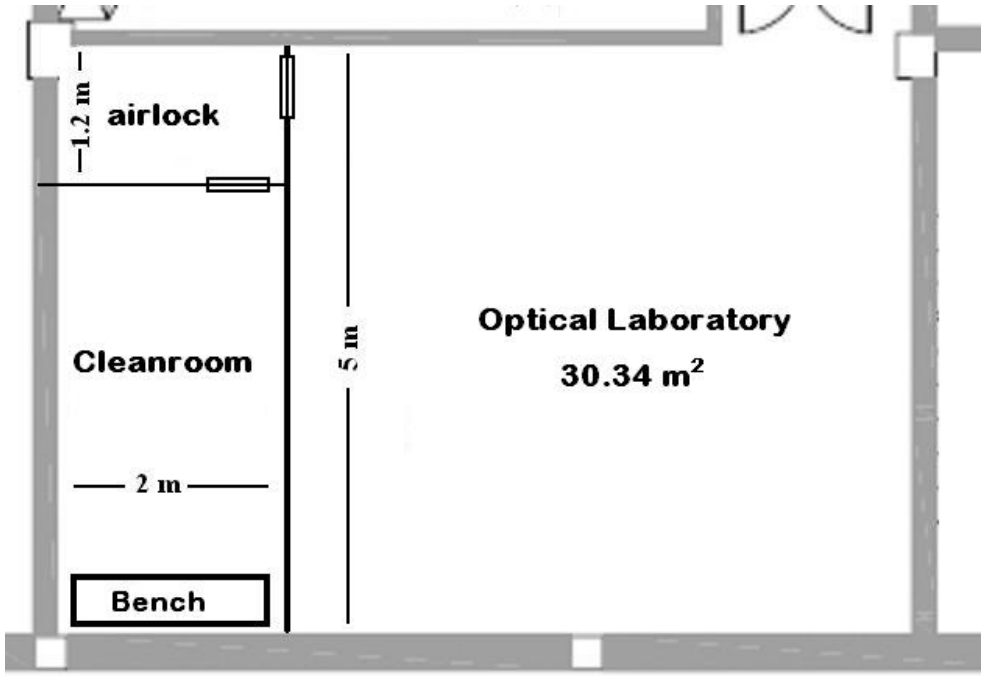

Figure 4 - Optical laboratory and clean room

4 The TNG clean room characteristics

The TNG clean room has been built by Assign s.p.a. at the end of 2009. It is a class 1000 (ISO 6) laminar flux with two motors and four filters. The architecture is very similar to the one shown in Figure 1, being the only difference that the air recycle circulation going from the roof to the holed raised pavement, passes through the floor and return in the clean room after filtering.
The clean room work in positive air pressure, the percentage of external filtered air introduced in the clean room and the motor speed can be selected by the user.

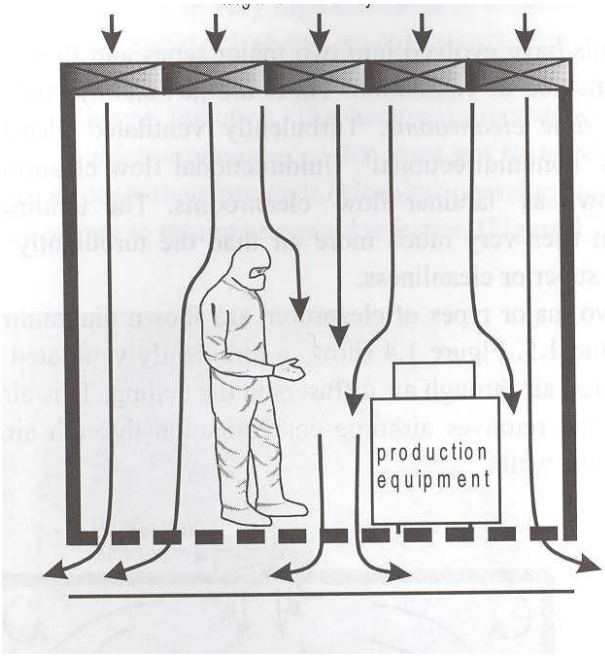

Figure 5 - example of laminar flux through the pavement

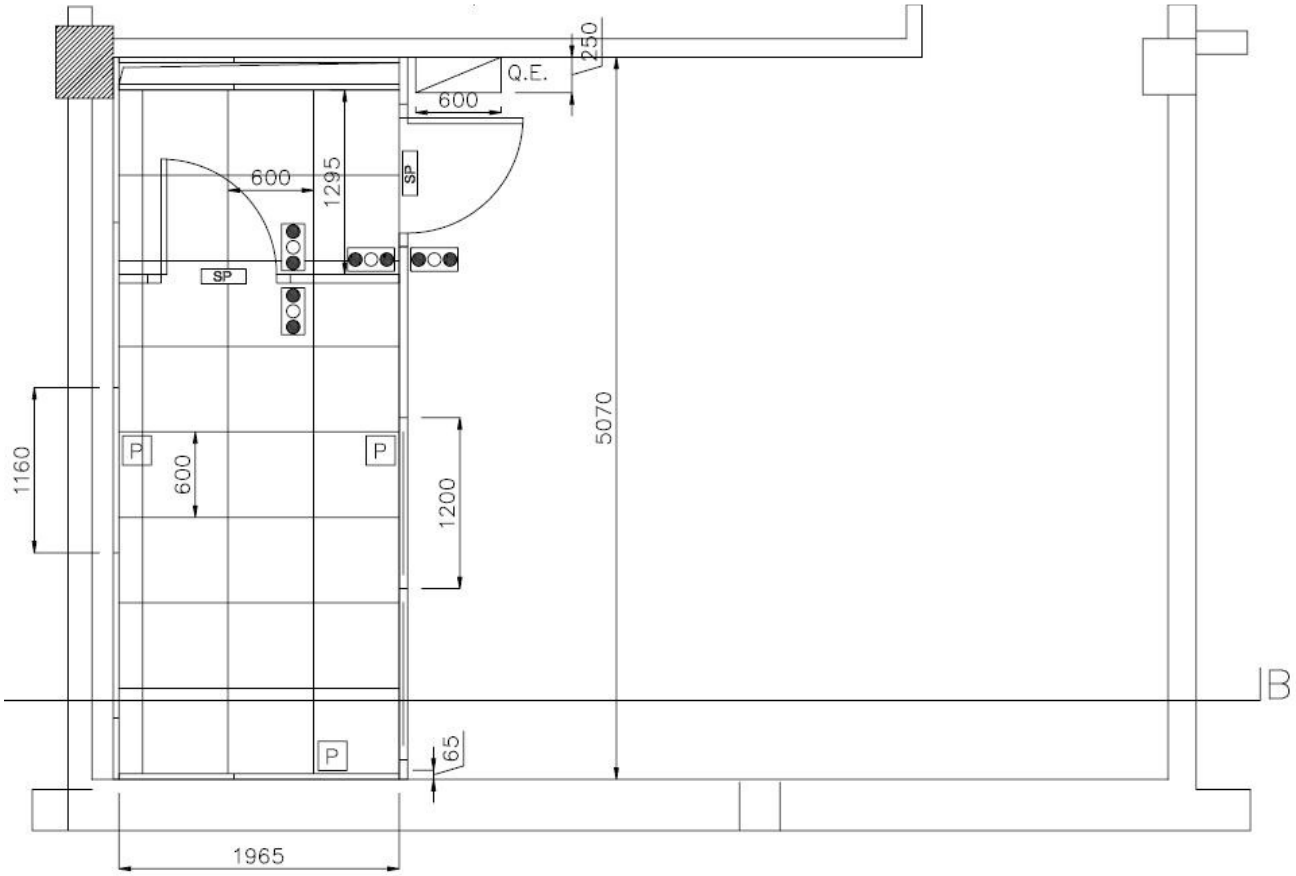

Figure 6 - Optical laboratory and clean room (Cad drawing)

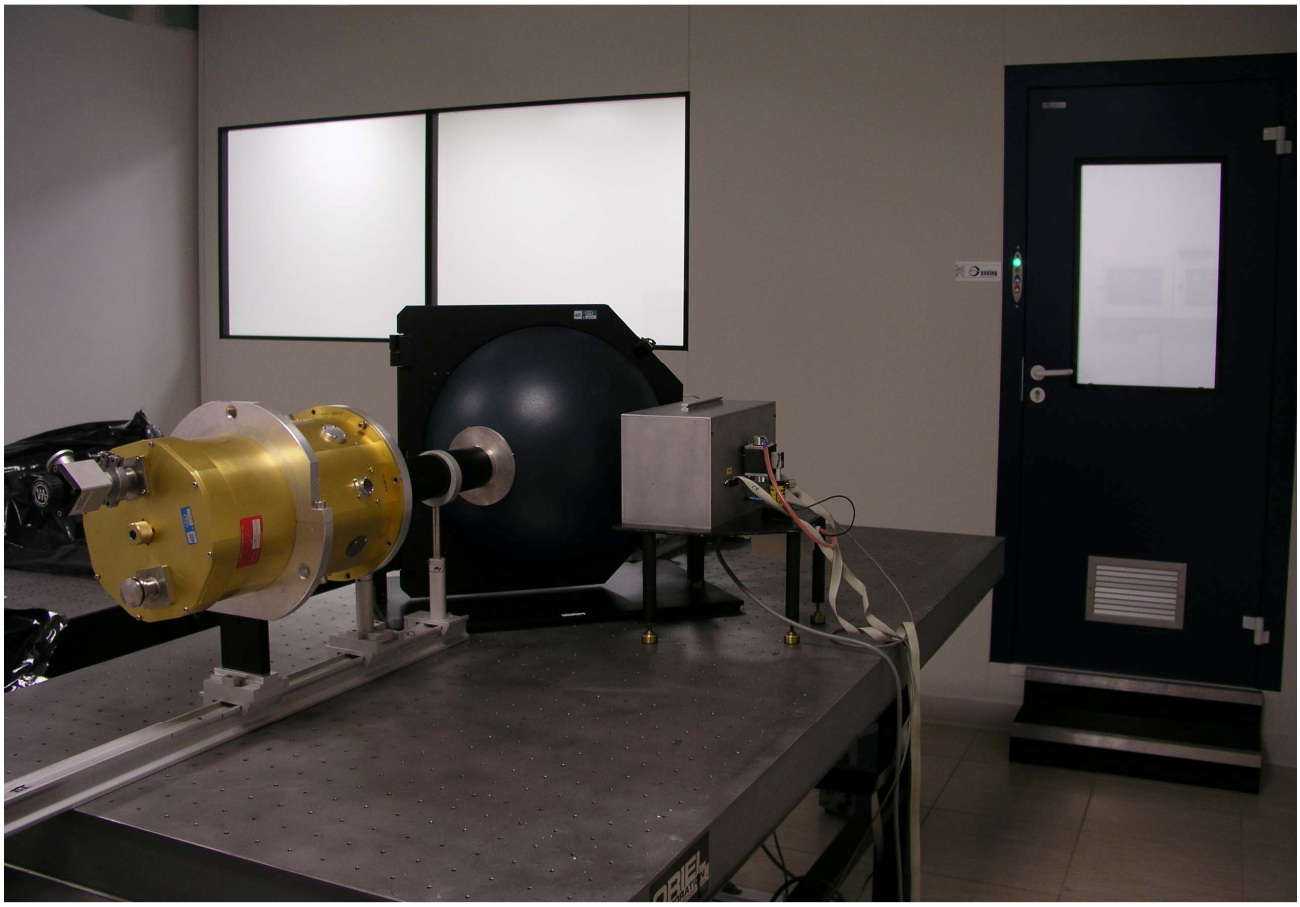

Figure 7 - A clean room view in the Optical laboratory

Figure 8 - The clean room

Figure 9 – Pre change zone