




Frontiers has been funded within the framework of the European Union Erasmus+ programme

# The Impressive sensitivity of Virgo and LIGO

Imagine to drop a glass of wine (or water) in the ocean…….

**Ocean Surface (S):**
70% x 4π x R_terra^2 =
0.7 x 4 x 3.14 x (6.37e6 m)^2
~ 3.6e14 m^2

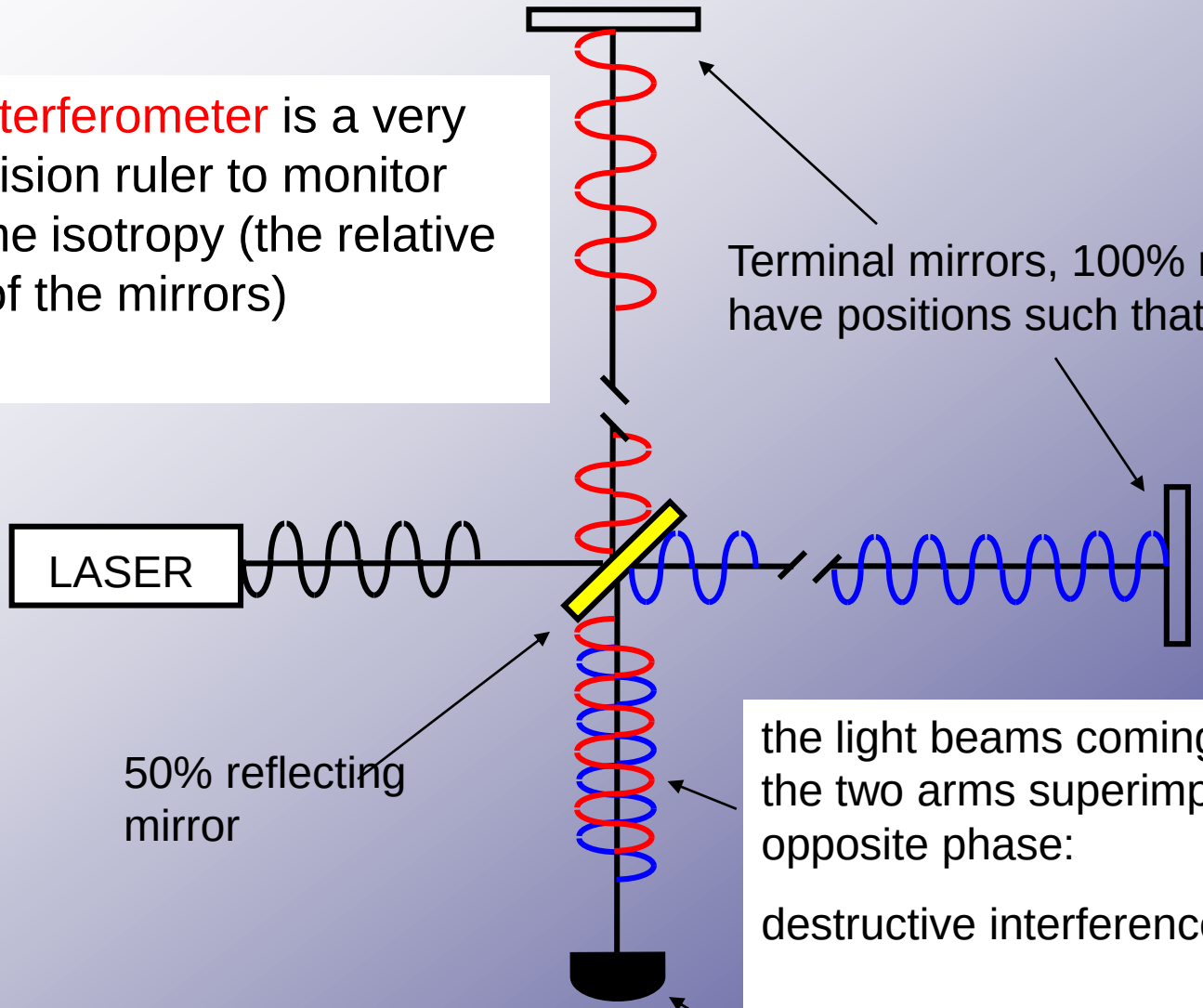
**Volume of the glass (V):**
~ 0.25e-3 m^3

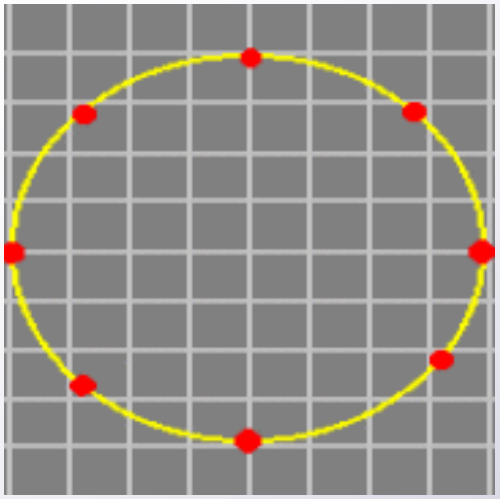
**Increase of the global sea level:**
**h ~ V / S ~ 1e-18 m**

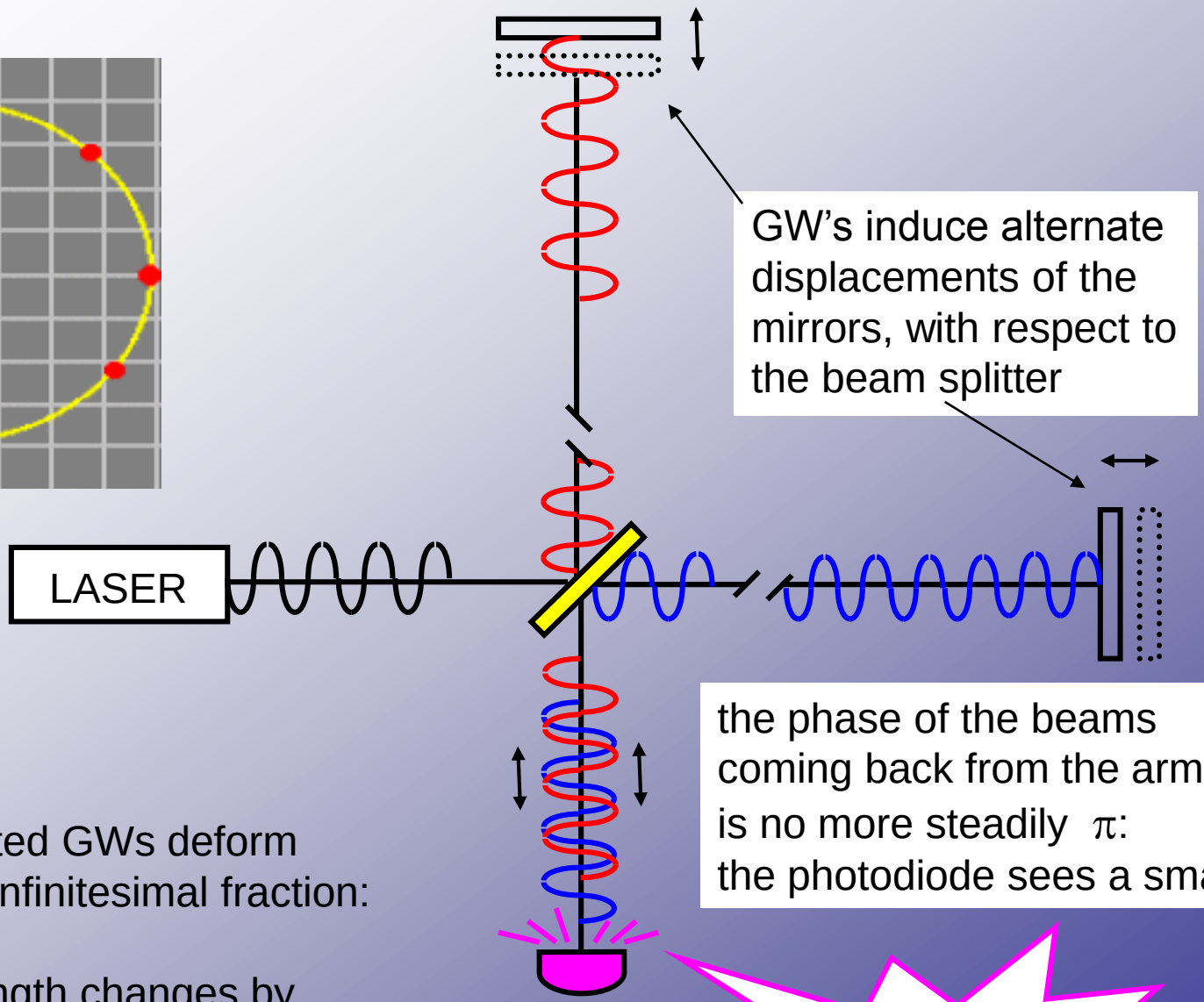
This is the level of sensitivity we need to reach with GW detectors !!

# Michelson Interferometer

A laser interferometer is a very high precision ruler to monitor space-time isotropy (the relative position of the mirrors)








GW's induce alternate displacements of the mirrors, with respect to the beam splitter

the phase of the beams coming back from the arms is no more steadily $\pi$: the photodiode sees a small

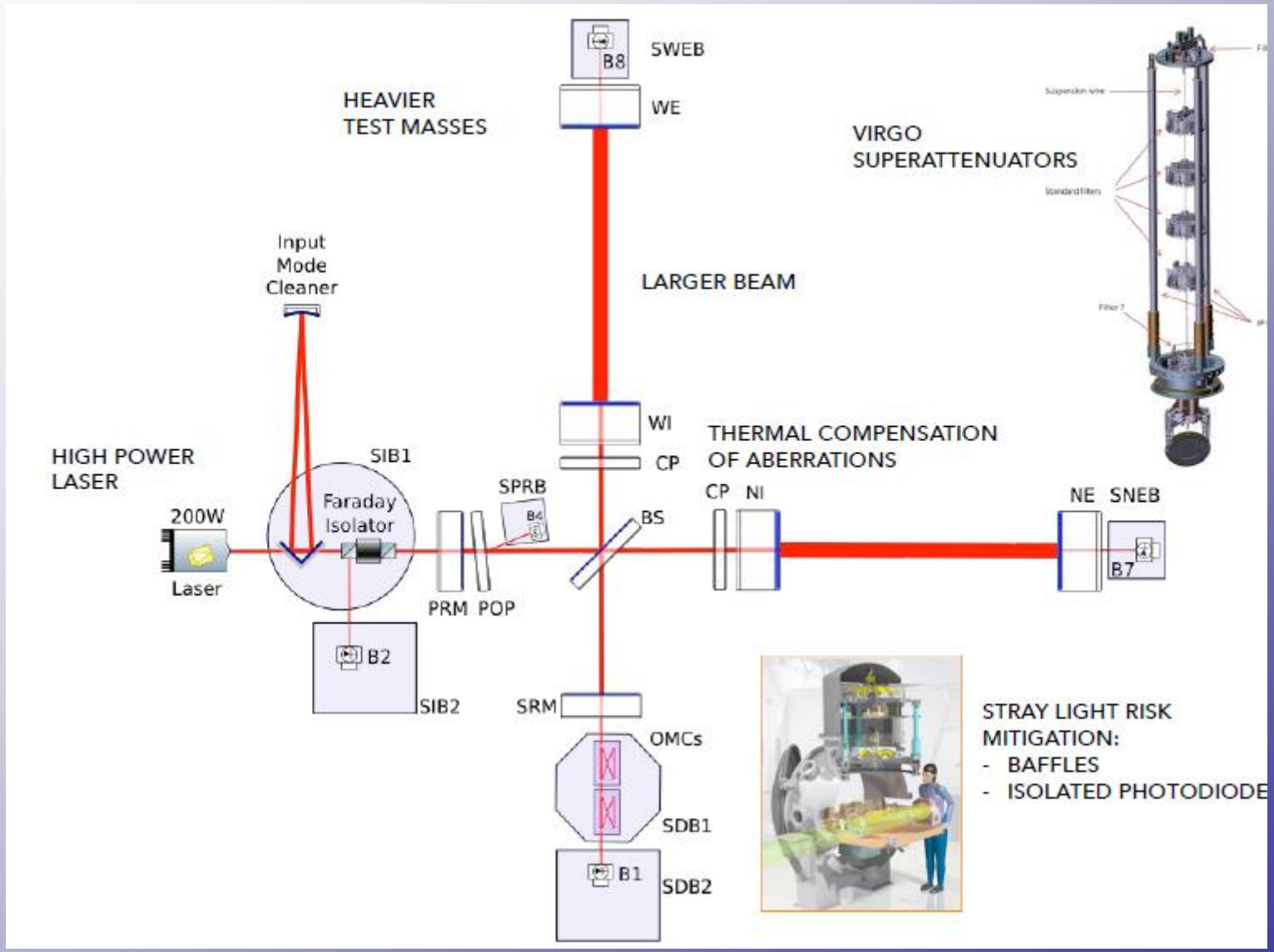
oscillating light signal

The largest expected GWs deform space-time by an infinitesimal fraction:
***$10^{-21}$***

Virgo 3 km arm length changes by
***$3 \times 10^{-18}$ m:***
***one thousands of a proton radius !!!***

# Advanced Virgo

Current optical scheme is a little bit more complex ☺ ...



# Advanced Virgo

http://www.virgo-gw.eu

Istituto Nazionale di Fisica Nucleare

Florence-Urbino
Naples
Perugia
Pisa
Rome
Rome-Tor Vergata

Centre National de la Recherche Scientifique

Annecy
Lyon
Nice
Orsay
Paris

> 400 physicists, engineers, technicians !

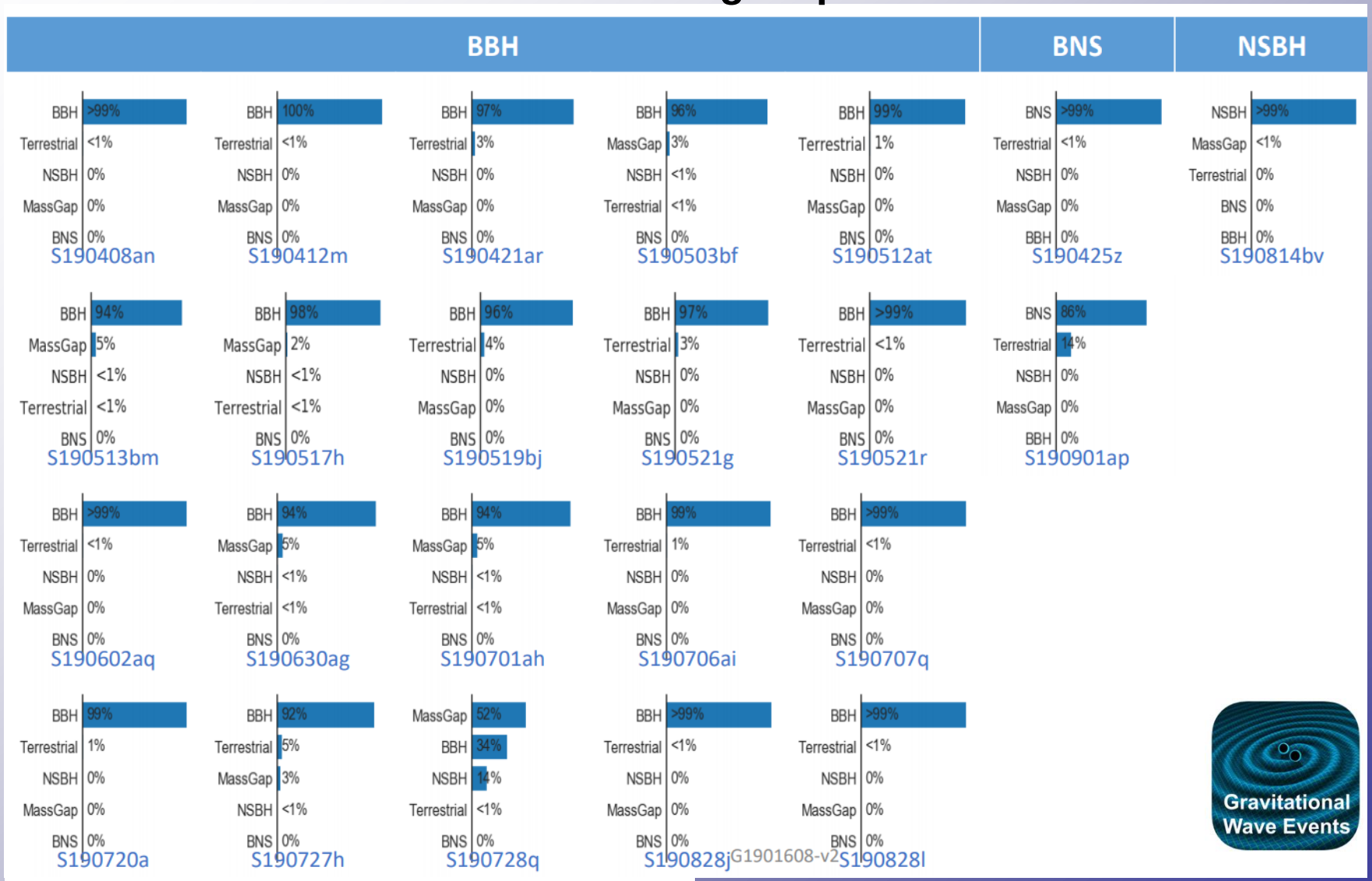
**EGO** – European Gravitational Observatory

# O3 Science Run

## April 1st, 2019

# O3 Science Run

## More than a GW signal per week !!



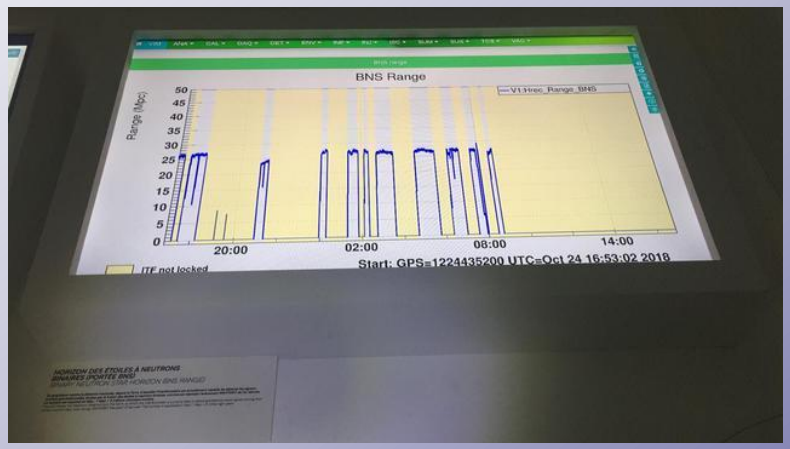

https://gracedb.ligo.org/latest/

# Control (class)room

Whether you are detecting gravitational waves or measuring colliding particles, the control room is where all the magic happens !!

# Control (class)room

Using simply a set of PCs or Raspberry PIs you can have all the data shown in the control room in your class !!




**Now let's visit the real control room…**

# Virgo Virtual visit

You can also visit the inner part of the detector using our 3D virtual visit

http://pub9.virgo.infn.it/WebGL/