The main scientific activity of Jean-Pierre Zendri is on the field experimental gravity. In particular his attention is focused on the development of acoustic gravitational wave (gw) detectors.
Since the beginning of the project (1990) he collaborated at the development of the ultra-cryogenic acoustic gw detector Auriga, located at the INFN National laboratories of Legnaro (I). The main resonator of this detector is a 2 ton aluminum bar cooled at about 0.1 K. In agreement with the general relativity in the most optimistic case the gw induced vibration of the bar is of the order of 10^{-19} m. JPZ spent e relevant fraction of his activity at the development of low noise (attometers sensibility) displacement readouts and to the reduction of mechanical thermal noise below the required sensitivity.

First Auriga run

Since 1990 JPZ worked at the development and the optimization of a capacitive transducer equipped with a dc-SQUID amplifier for the Auriga detector. The whole readout has been installed in the main cryostat in 1995 and operated during all the first scientific run (May '95 November '99). During this period the JPZ was charged to preserve the detector data quality and to coordinate actions devoted to the improvement of the overall sensitivity.

Second Auriga run

The JPZ had the responsibility of the development of the new capacitive readout for the second gw hunt campaign. The developed readout, compared to the pre-existing ones, is strongly innovative as for the first time incorporate an electrical resonating matching line and very low noise (sensitivity only 20 time above the quantum limit at ultracryogenic temperature) double stage SQUID amplifier. In order to test the new transducer line, before the final assembling in the main cryostat, a transducer test facility (TTF) has been developed. The TTF can be used to cool down below 0.1 K paylods of about 50 Kg of mass and 40 dm3 of volume. Moreover the TTF is equipped with cryogenic suspensions which provide an overall mechanical attenuation of about 200 dB in the kHz region.
The new transducer line has been installed in the Auriga detector (2004) reconfirming all the noise specifications obtained in the TTF. Thus, after an initial debug period, thanks to the new readout the Auriga detector began his second scientific run in May 2005 with an overall sensitivity much more better than ever obtained by any other gw acoustic detector.

Developement of new acoustic detectors

The JPZ is one of the proposers of a new kind of broad band acoustic detector called *Dual*. The detector geometry is designed in order to minimize the thermal noise and the back-action noise of the readout. The calculated overall sensitivity should be comparable with the next generation of interferometric detectors in the frequency region of 2-5 kHz.
Presently JPZ is involved on the development of the transducers for *Dual* and has the responsibility of the R&D activity for the *Dual* materials. In particular, in order to do a complete low temperature thermo-mechanical characterization of the candidate materials, the TTF has been recently up-graded. In this apparatus using a nodal suspension, developed on the purpose to minimize the camping losses effects, the best achieved quality factor of silicon disks is of the order of 10^8. As concerning the other candidate, the Silicon Carbide, regardless of the manufacturing modality, the best achieved quality factor is of the order of 10^6, still to low for Dual. Finally bonded silicon wafer has been lately tested allowing a first estimation of the low temperature mechanical dissipation of the bonding layer which result of the order of 10^{-2}, still 10 time higher than what required for Dual.

Other activities

- 1994, Comparative calculation, on order by ESA, of the sensitivity of the capacitive and inductive accelerometers for the missions STEP and GEM
- 1995-1996 Systematic investigation of the mechanical dissipations of copper based alloys at ultra-cryogenic temperature. On order of the Dutch acoustic detector *Grail*