

ChAMBRé – the development of an atmospheric simulation chamber for bioaerosol studies and aerosol optical properties investigation

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Environmental simulation chambers are small to large-scale facilities where atmospheric conditions can be monitored in real-time under control to reproduce realistic environments and to study interactions among their constituents. Up to now, they have been used mainly to study chemical and photochemical processes that occur in the atmosphere, but the high versatility of these facilities allows for a wider application covering all fields of atmospheric aerosol science.

ChAMBRé (Chamber for Aerosol Modelling and Bioaerosol Research) is the stainless steel atmospheric simulation chamber (volume approximately 3 m³, see Figure 1) recently installed at the National Institute of Nuclear Physics in Genoa (INFN-Genova) in collaboration with the Environmental Physics Laboratory at the Physics Department of Genoa University (www.labfisa.ge.infn.it).

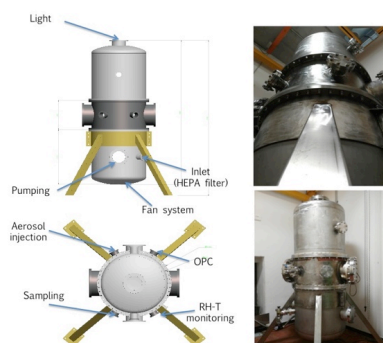


Fig.1 ChAMBRé layout structure and pictures

The scientific activities at ChAMBRé focus on the following topics:

1) **Bioaerosol properties** A strong improvement in the understanding of bioaerosol behaviour can be provided by atmospheric chamber experiments, that allow for a scientific intermediate approach between “in vitro” and “in vivo” analysis. Aerosol with realistic composition, including living micro-organisms, can be injected in artificial environments with controlled physical and chemical parameters and then accurately analyzed. In particular, a systematic approach can be used for a better description of micro-organisms viability, of colonies growing modulation and other issues relevant to their spread and their pathogenicity. Very promising results in this direction were obtained by the authors at the CESAM facility at CNRS-LISA (Brotto *et al.* 2015), while similar results were obtained nearly at the same time at AIDA chamber at KIT (Amato *et al.* 2015).

ChAMBRé experiments are carrying on this path to contribute in getting a deeper understanding of the still unclear mechanisms that control the evolution of bioaerosols in atmosphere and in particular of their bacterial components.

2) **Aerosol optical properties – methodologies and instruments testing**

The instrumental development efforts at the Environmental Physics Laboratory of the University of Genoa, recently resulted in a new Multi Wavelength Absorbance Analyser (Massabò *et al.* 2015) which measure the light absorption on aerosol loaded filters at five wavelengths from UV (absorption bands of organic compounds, mineral dust) to near infrared (carbon soot,...). Furthermore, a new data reduction methodology has been introduced to disentangle the concentration of Black and Brown carbon in atmospheric aerosol, demonstrating the need to mitigate not only exhaust but also non-exhaust emissions, as a potentially important source of PM10. The atmospheric chamber is an effective tool to produce known aerosol mixtures and to test the performance of the optical technology. Actually, there is an on-going collaboration with the CNRS-LISA team working at CESAM following that procedure that will be soon replicated at ChAMBRé facility.

ChAMBRé has recently joined the Eurochamp consortium, the European atmospheric chamber facilities network. The network activities have been included in an infrastructure-oriented research project proposal that is going to be submitted within March 2016 to the H2020-INFRAIA call within EU Horizon 2020 Programme.

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Amato, P., Joly, M., Schaupp, C., Attard, E., Möhler, O., Morris, C. E., Brunet, Y., and Delort, A.-M., *Atmos. Chem. Phys. Discuss.*, **15**, 4055-4082, doi:10.5194/acpd-15-4055-2015, 2015

Brotto P, Repetto B, Formenti P, Pangui E, Livet A, Boussherrine N, Martini I, Varnier O, Doussin JF, Prati P (2015), *Aerobiologia*, **31**, 445-455 doi:0.1007/s10453-015-9378-2

Massabò D, Caponi L, Bernardoni V, Bove MC, Brotto P, Calzolari G, Cassola F, Chiari M, Fedi ME, Fermo P, Giannoni M, Lucarelli F, Nava S, Piazzalunga A, Valli G, Vecchi R, Prati P (2016), *Atmospheric Environment*, doi:10.1016/j.atmosenv.2015.02.058