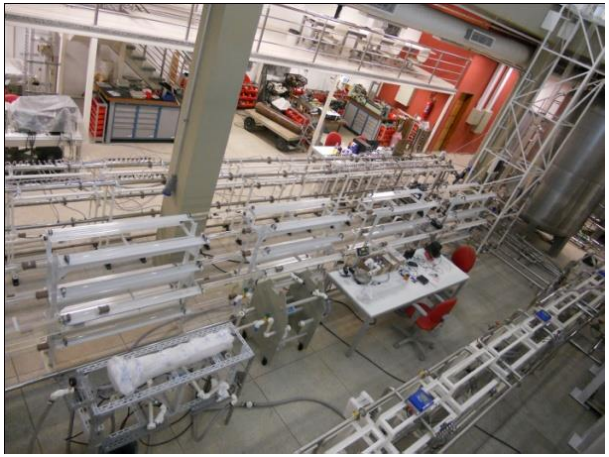
# Laboratory of Compact Separators

Federal University of Rio de Janeiro
Mechanical Engineering Program

CENPES 15852
2012/00012-6

# Overview of the Laboratory

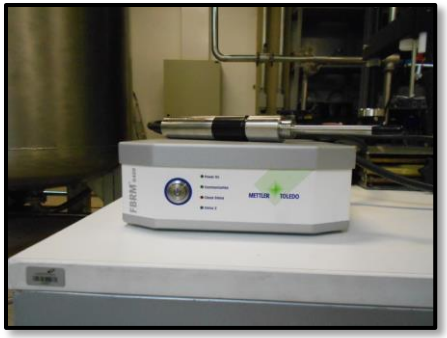
- Scientific research and technological development on compact flow separation
- State of the art techniques for measurement of global and local properties of the flow
- Mathematical and physical modeling of the flow separation principles
- Ongoing research: flow on hydrocyclones, cyclonic valves, compact gas-liquid separators

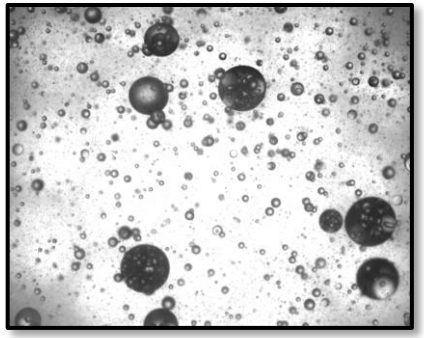


http://www.separadorescompactos.coppe.ufrj.br

# Experimental facilities

- Infrastructure:
  - Five progressive cavity pumps with flow ranges from 0.1 to 20 $m^3/h$
  - Three dosing pumps
  - Compressed air supply ($150m^3/h$)
  - Ten different reservoirs for working fluids ($30m^3$)
  - Variety of flowmeters and pressure transducers
- Measurement techniques:
  - Phase-Doppler Anemometry
  - Particle Image Velocimetry
  - Shadow Sizer
  - Focused Beam Reflectance Measument
  - Malvern Mastersizer





# Hydrocyclones

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## LDA and PIV characterization of the flow in a hydrocyclone without an air-core

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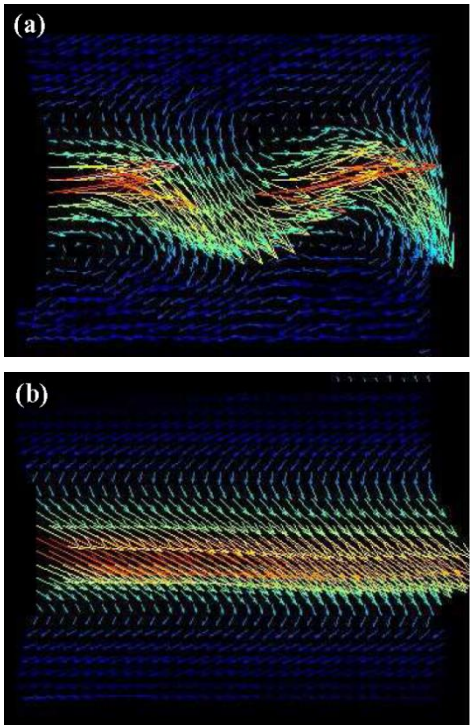
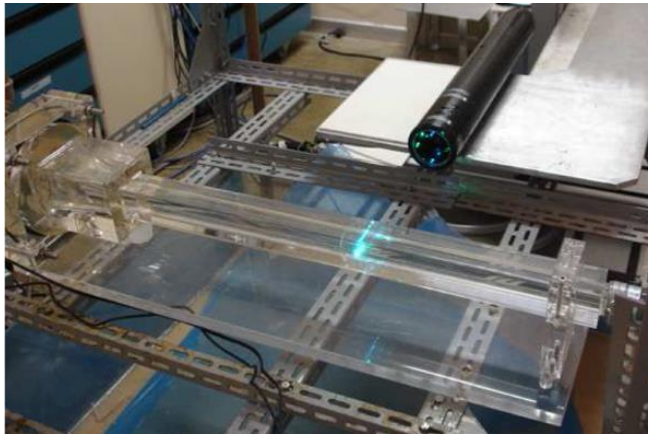
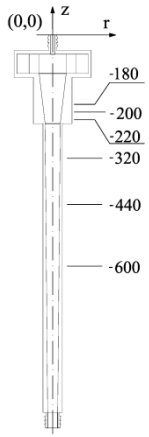
ABSTRACT

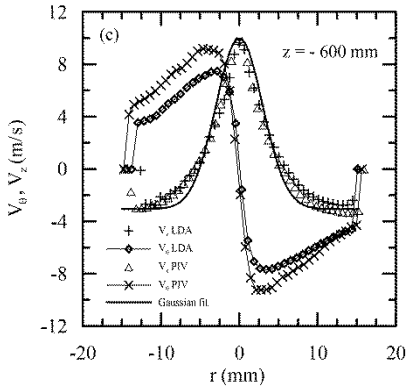
The three-dimensional flow in a hydrocyclone especially developed for application in the petroleum industry has been investigated through the LDA and PIV techniques for one experimental condition. In the present physical simulation, the hydrocyclone is set to operate without an air-core. The tangential ($V_\theta$) and axial ($V_z$) mean velocity profiles are analyzed through both measuring techniques. Radial ($V_r$) mean velocity profiles are only accounted for through PIV. The exponent $n$ in the tangential velocity equation, $V_\theta r^n = C$, was determined to be about 0.61. For the radial profile, $V_r r^m = -D$, $m$ was found to be 1.59. The rms-values of two-velocity components — tangential and axial — were evaluated via LDA. Turbulence in the axial direction is observed to be slightly higher than turbulence in the tangential direction. Approaching the axis of symmetry of the cyclone, however, this trend is reversed. The fluctuations in the tangential direction are found to be at least twice higher than the axial fluctuations.

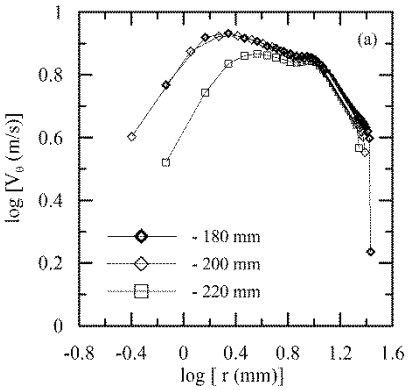




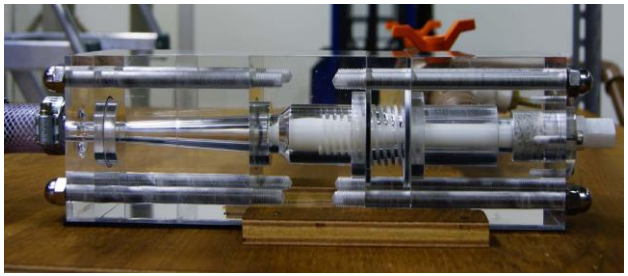



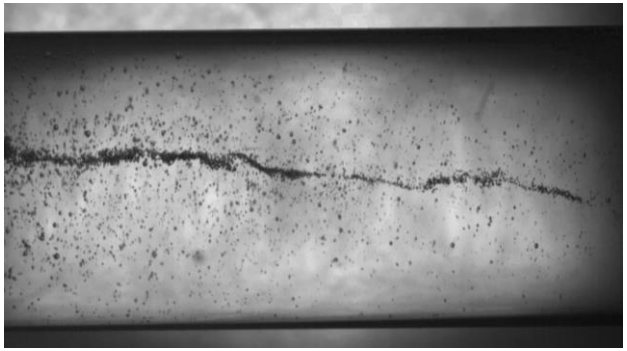


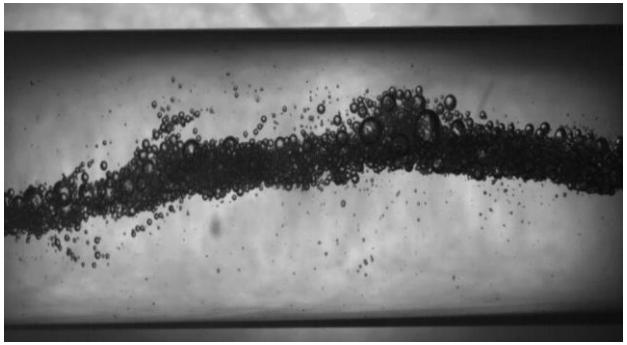



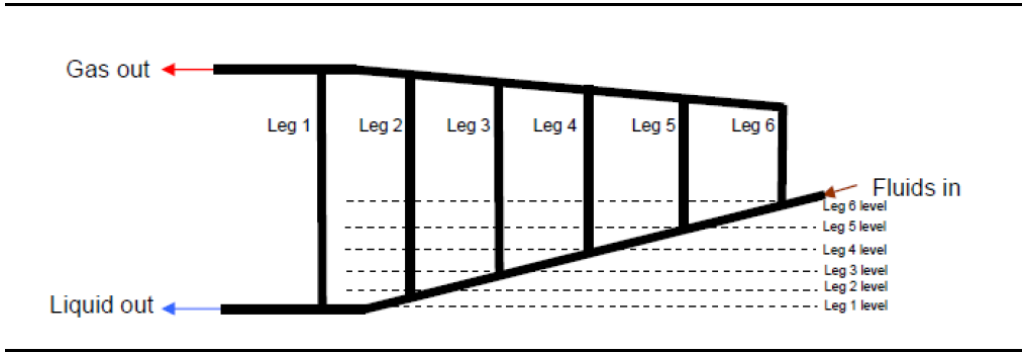
# Cyclonic Valve

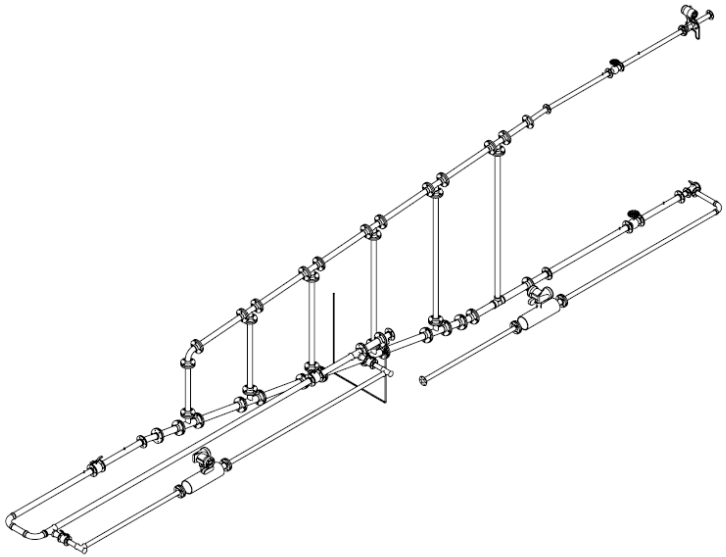


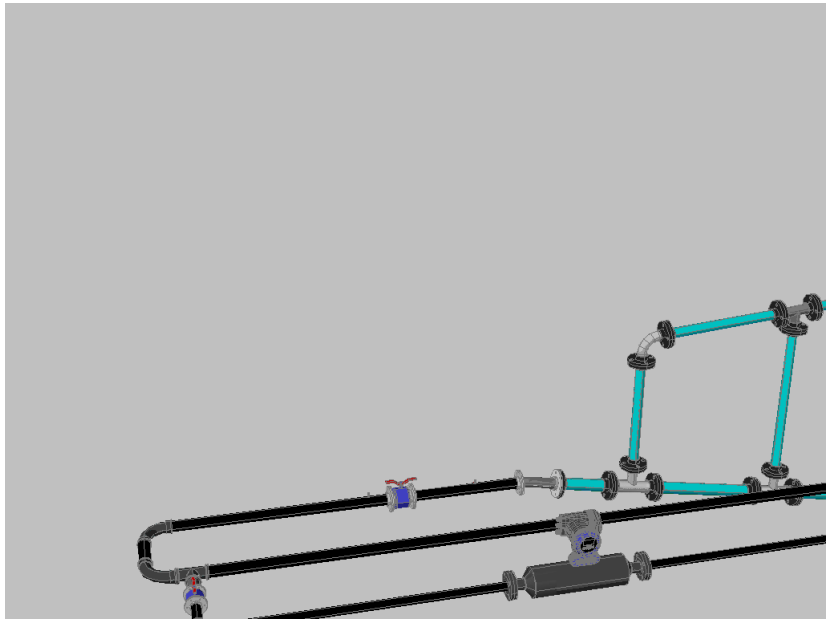




# Gas-liquid separators for high liquid volumes





# Gas-liquid separators for high volumes of gas