Universidade do Porto
FEUP Faculdade de Engenharia

centro de estudos de fenómenos de transporte
CEFT



http://www.fe.up.pt

# TRANSPORT PHENOMENA RESEARCH CENTER

paginas.fe.up.pt/~**ceft**/Welcome.html

PORTO - PORTUGAL

Team Presentation – Annual Workshop, COST Action MP1106
Dublin, September, 2012

**General Topics**:

**FLUID DYNAMICS – MASS AND HEAT TRANSPORT**

**FLUID DYNAMIS** – TWO AND MULTYPHASE FLOWS, BIOFLUIDICS, JETS

**MASS AND HEAT TRANSPORT** – MEMBRANE SEPARATION PROCESSES, JETS

**NEWTONIAN AND NON-NEWTONIAN, MICRO TO MACRO**

**EXPERIMENTAL – NUMERICAL (CFD)**

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## Team

Team leader: João M. Campos, Chemical Engineer

jmc@ fe.up.pt

- 2 research assistants
- 2 post doctoral fellows
- 4 Ph.D. students
- 5 undergraduate students
- 1 technician

- ❖ 13 Chemical Engineers
- ❖ 1 Mechanical Engineer

**<u>OTHER</u> RESEARCH TOPICS INSIDE CEFT RESEARCH CENTER**:

-ENERGY - Fuel-Cells, Combustion apinto@fe.up.pt

-NON NEWTONIAN FLUIDS –Turbulence Modelling of Non-Newtonian Fluids, Computational Reologhy, Instabilities in Viscoelastic Fluids.

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**Research interests related to MP1106 :**

- RESEARCH FIELDS
  - Multyphase Flows
  - Biological Flows.
- TYPE OF WORK
  - Experimental
  - Numerical
- TYPE OF FLUIDS
  - Newtonian
  - Non-Newtonian.
- SCALES
  - Macro to Micro (Nano in the future)
- APPLICATIONS
  - Biotechnology/Biomedical
  - Nanotechnology/Nanomaterials.

# MOST SIGNIFICANT EXPERIMENTAL EQUIPMENT:

Rotational


Extensional

2 PIV+ 1 μPIV

Video - Camara


4 - LDA

VERTICAL EXPERIMENTAL RIG - 6,0 m
LONG FOR MULTIPHASE FLOWS

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# MOST IMPORTANT NUMERICAL EQUIPMENT:

Several Workstations

- FEUP Cluster

IN HOUSE CODES FOR MULTYPHASE FLOWS AND FOR SEPARATION IN MEMBRANES (REVERSE OSMOSIS AND ULTRAFILTRATION)

COMERCIAL CODES

- Ansys FLUENT
- Comsol

# 1st PROJECT

TITLE: Gas-liquid flows in macro, mini and micro channels: experimental and numerical studies.

http:www.fct.mctes.pt/projectos/pub/2006/Painel_Result/vglobal_projecto.asp?idProjecto=69068&idElemConcurso=889

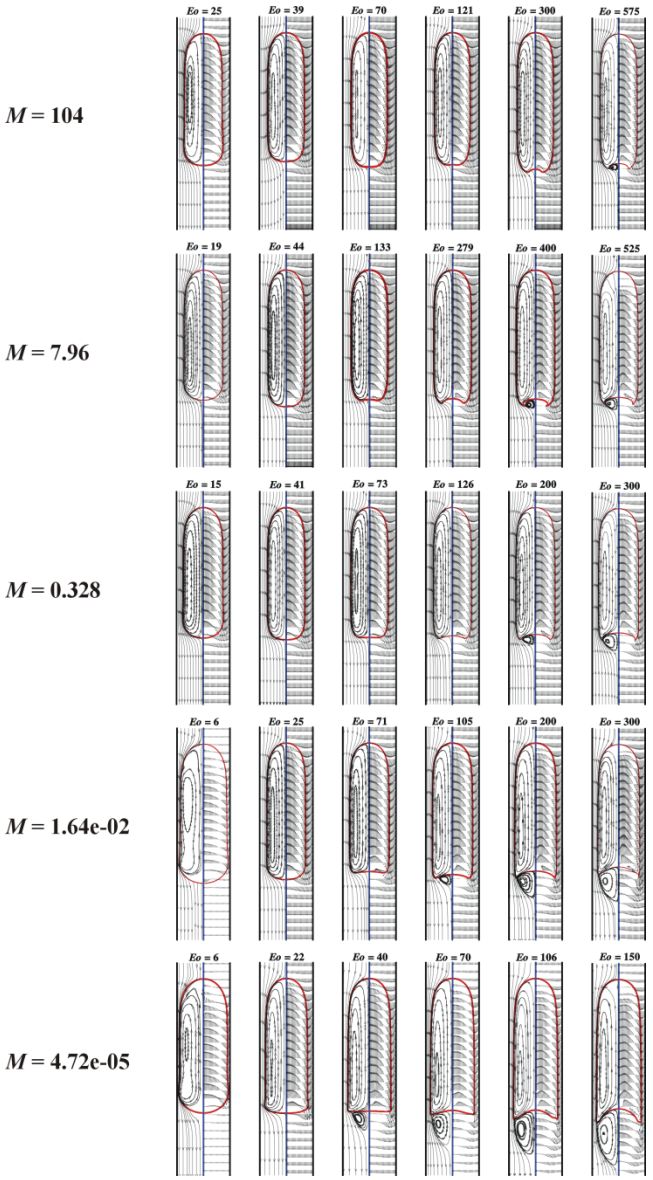
Duration: 3 years (actually on the third) – 143 kEuros
Funding organization: Portuguese Research Foundation (FCT)
People involved -1 *research assistant*, 1 *Post-Doc,* 1 *PhD Student,* 1 *Technician.*

1st PROJECT

# INDIVIDUAL SLUG BUBBLES IN A WIDE RANGE OF MORTON (*M*) AND EOTVOS (*Eo*) NUMBERS

NUMERICAL WORK VALIDATED BY EXPERIMENTAL DATA

NEWTONIAN FLUIDS

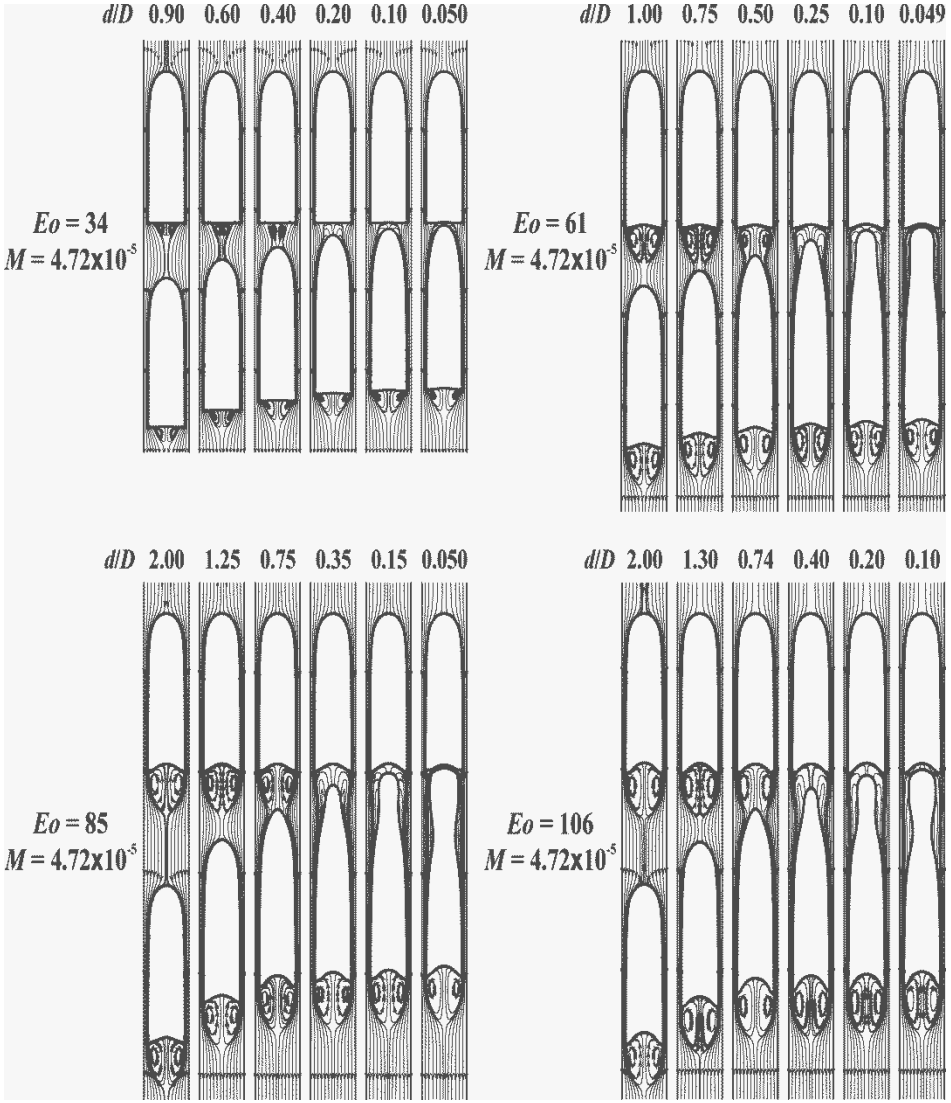


1st PROJECT

# SLUG BUBBLES COALESCENCE IN A WIDE RANGE OF MORTON (*M*) AND EOTVOS (*Eo*) NUMBERS

NUMERICAL WORK VALIDATED BY EXPERIMENTAL DATA

NEWTONIAN FLUIDS

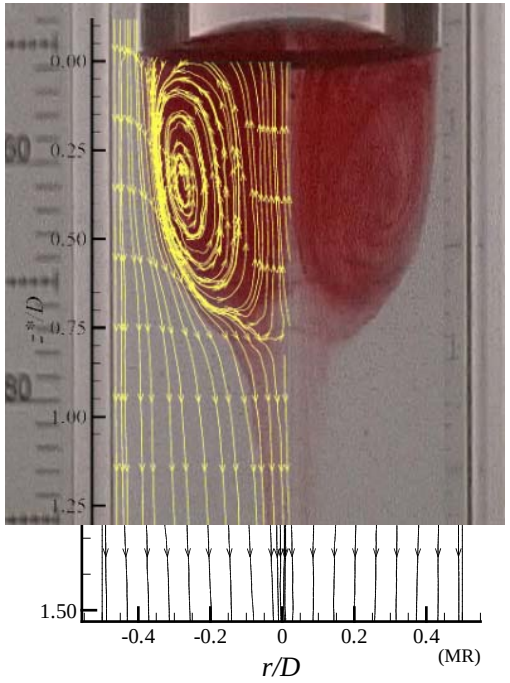


# 1st PROJECT

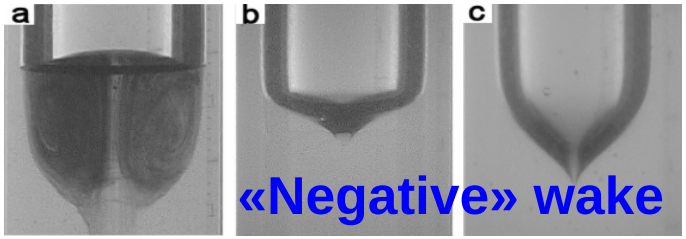
## NUMERICAL WORK VALIDATED BY EXPERIMENTAL DATA

## NON-NEWTONIAN FLUIDS

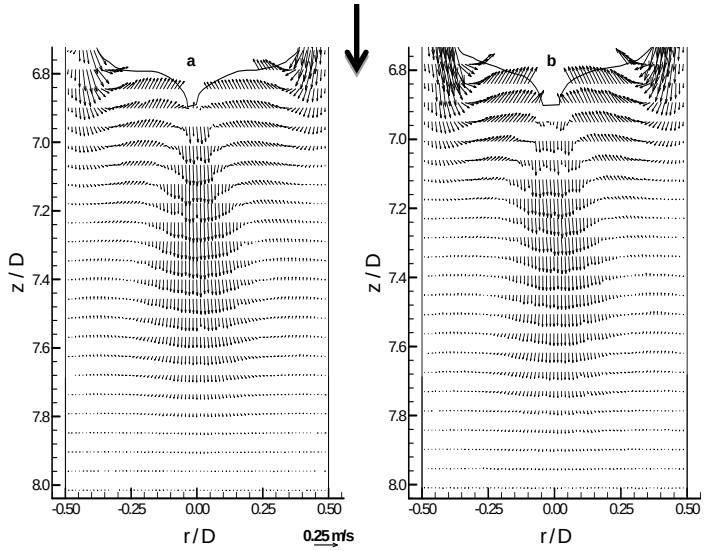
**Shear thinning fluid**




0.4% CMC




**«Negative» wake**




0.8% CMC

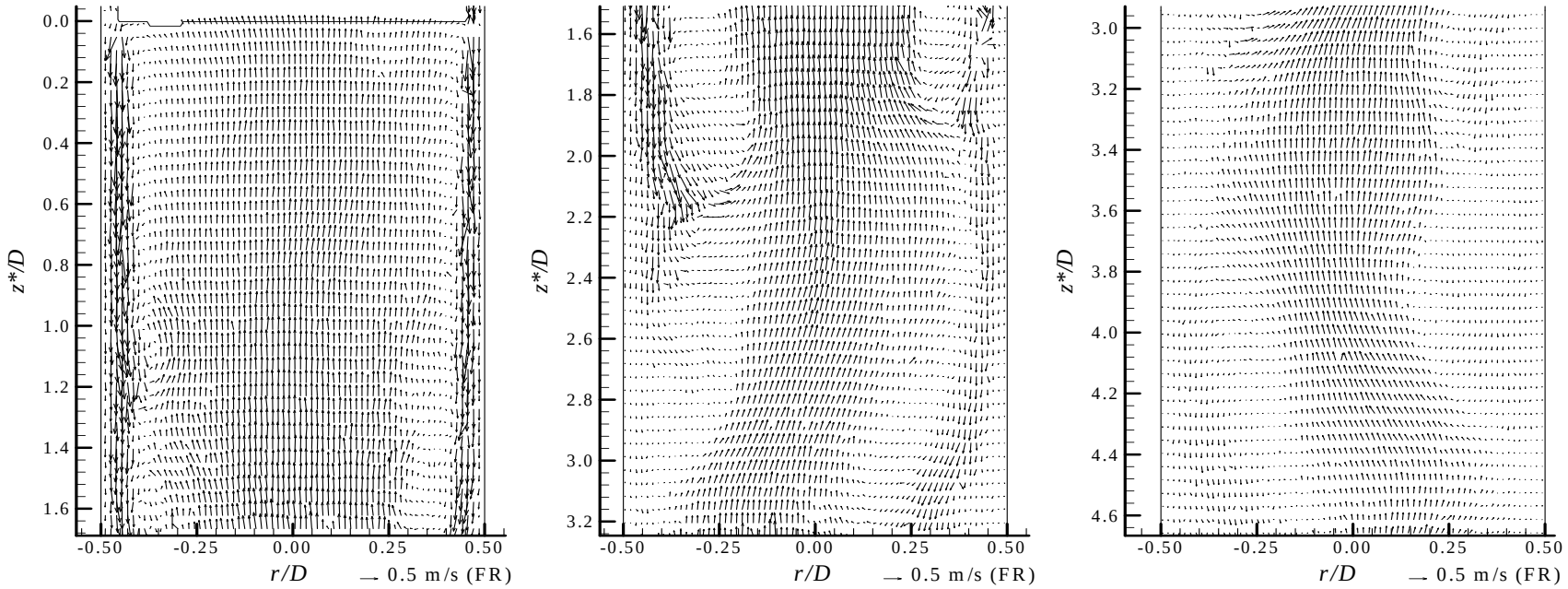
# 1st PROJECT

## EXPERIMENTAL DATA

## NON-NEWTONIAN FLUIDS

**Strong viscoalestic behaviour**

LONG WAKE – 5 COLUMN DIAMETERS 0.10% PAA

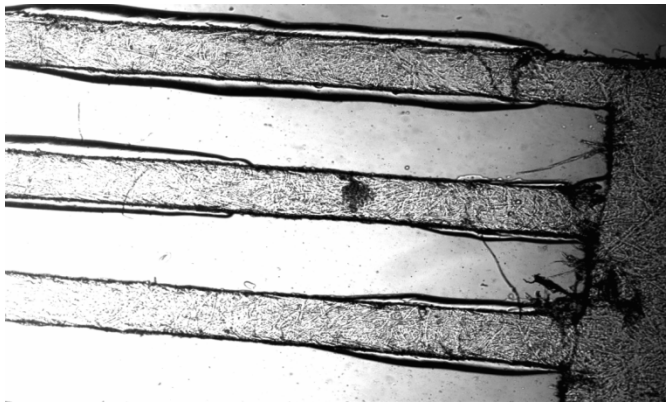


2and PROJECT

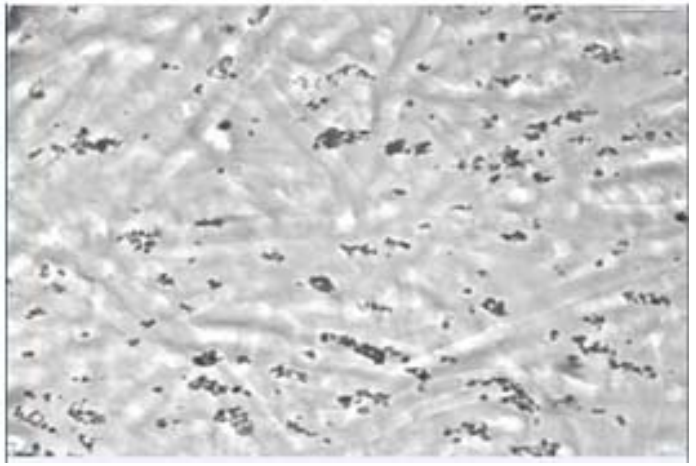
TITLE: Fouling and cleaning of micro channels

http:www.fct.mctes.pt/projectos/pub/2006/Painel_Result/vglobal_projecto.asp?idProjecto=1025535&idElemConcurso=2762

Duration: 3 years (actually on the beginning of the second year) – 140 kEuros
Funding organization: Portuguese Research Foundation (FCT)
People involved -3 *senior researchers*, 1 *research assistant*, 1 *PhD Student,* 1 *Technician.*



BACTERIAL FOULING IN MICRO CHANNELS MANUFACTURED IN PARALLEL



INORGANIC FOULING IN A MICRO-CHANNEL

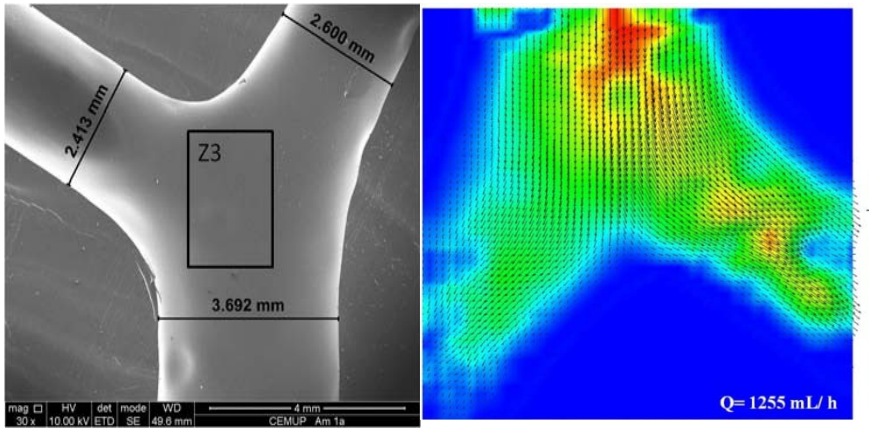
# 3th PROJECT

TITLE: Numerical and experimental studies of blood flow inside coronary artery stents

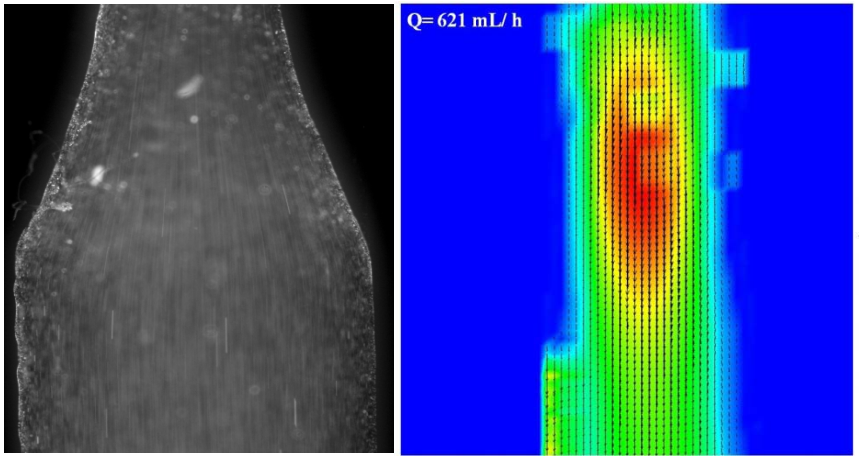
http:www.fct.mctes.pt/projectos/pub/2006/Painel_Result/vglobal_projecto.asp?idProjecto=102974&idElemConcurso=2754

Duration: 3 years (actually on the second) – 100 kEuros
Funding organization: Portuguese Research Foundation (FCT)
People involved -1 *research assistant*, 1 *Post-Doc,* 1 *PhD Student,* 1 *Technician.*

## BRENCH




## STENOSIS



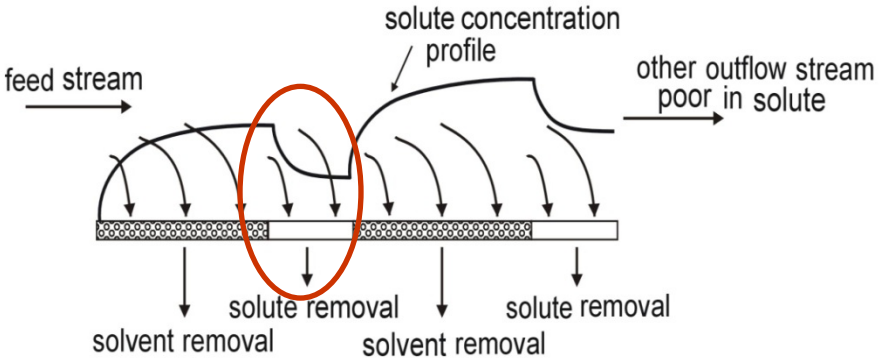
# 4th PROJECT

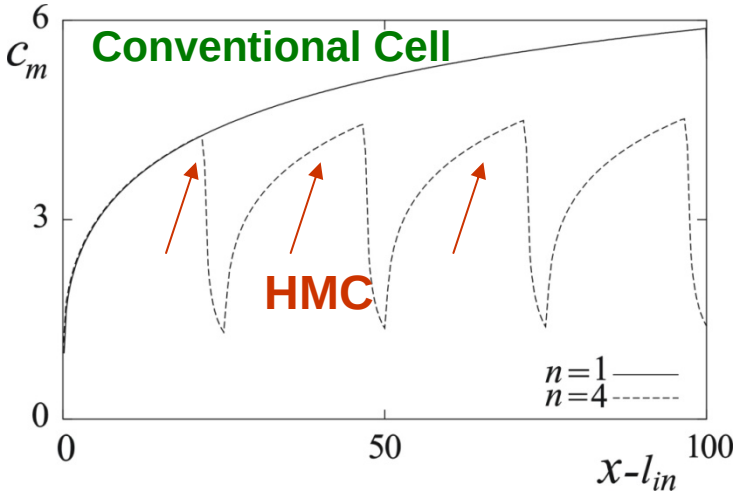
TITLE: Hybrid Membrane Cells for Mass Separation (**HMC**)

http:www.fct.mctes.pt/projectos/pub/2004/Painel_Result/vglobal_projecto.asp?idProjecto=59724&idElemConcurso=44

Duration: 3 years (at the end) – 55 kEuros
Funding organization: Portuguese Research Foundation (FCT)
People involved -1 *research assistant*, 1 *Post-Doc,* 1 *PhD Student,* 1 *Technician.*

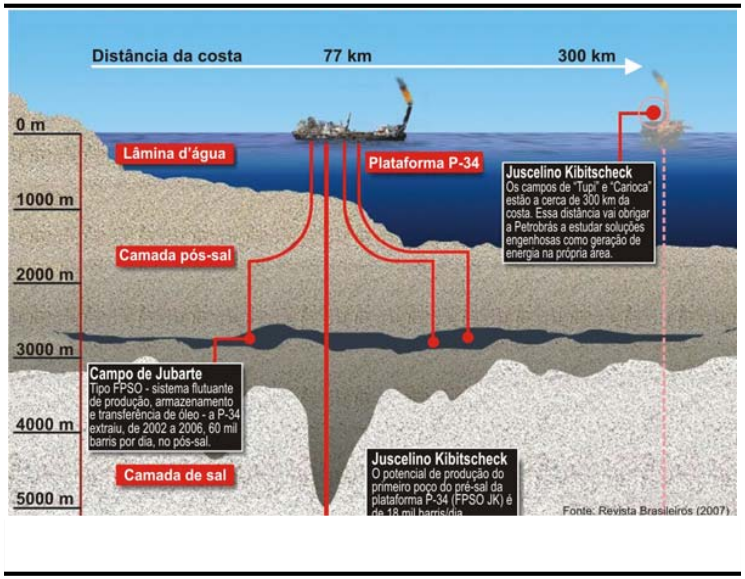
**Mass boundary layer in a hybrid membrane**



# Topics for Research Proposal

## Title: Prediction of two and three-phase flows in deep sea oil wells



Thank you for your attention