

ZEB0562
CÁLCULO NUMÉRICO



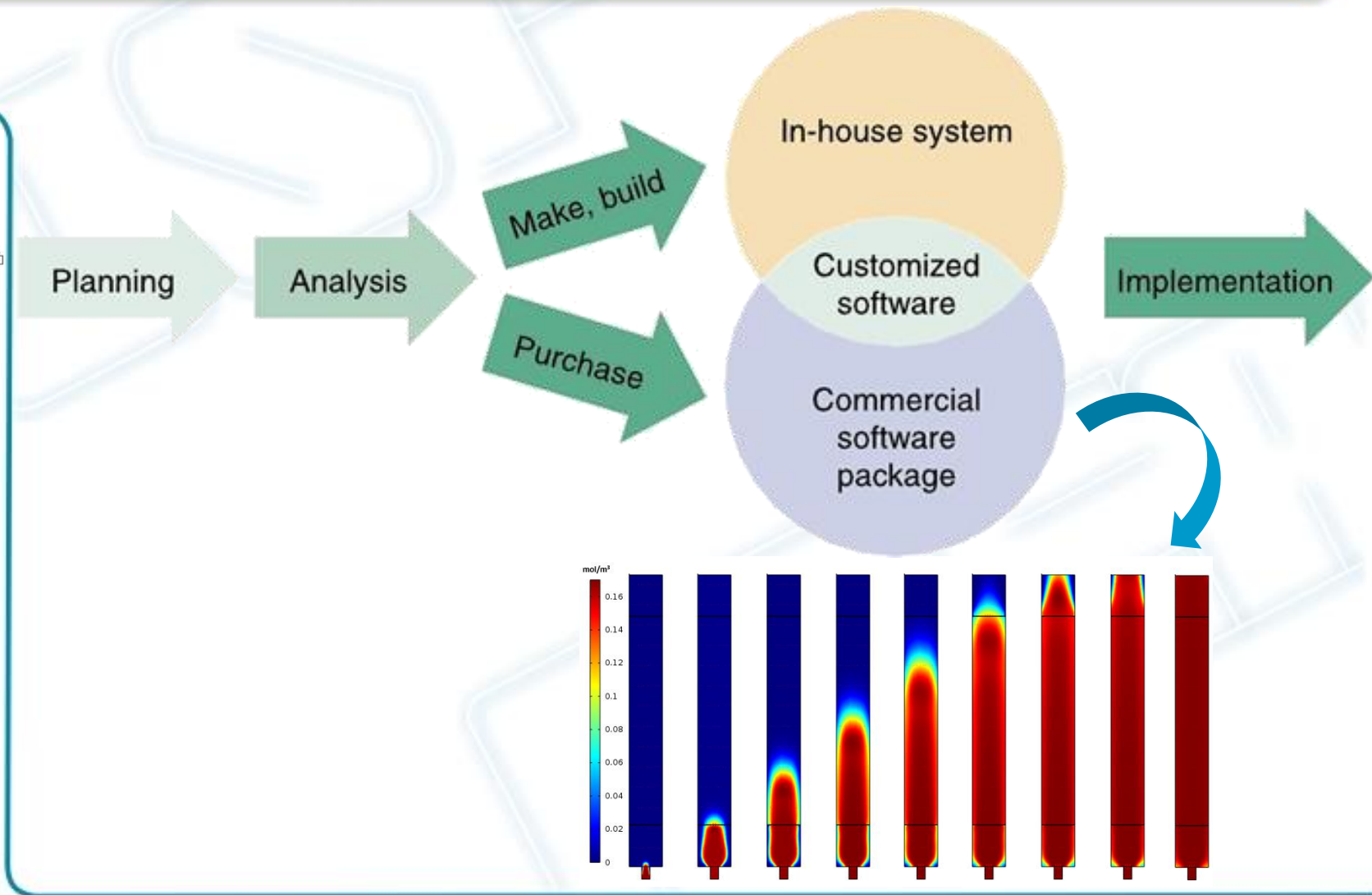
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COMPUTATIONAL FLUID DYNAMICS: OFF-THE-SHELF



- SOFTWARE CFD OFF-THE-SHELF – EXEMPLO
- ↓
- DESCRIÇÃO DO PROBLEMA → BIORREATOR
- MALHA COMPUTACIONAL → GERAÇÃO E TESTES
- SIMULAÇÃO → CONCENTRAÇÕES NO EFLUENTE

CFD software: in-house / off-the-shelf



CFD software off-the-shelf: mercado

COMSOL
MULTIPHYSICS®



EXN/Aero



FLOW-3D®

ParaView



EnSight

POINTWISE®

esi
get it right®

simFlow



AVL

SU2 Altair
The Open-Source CFD Code

Intelligent Light

Exa

OpenFOAM

HelyxOS

AUTODESK®
CFD



ANSYS®



3D SOLIDWORKS

CONVERGE
CFD SOFTWARE

Fluent

STAR-CCM+

XFlow

QUICKERSIM

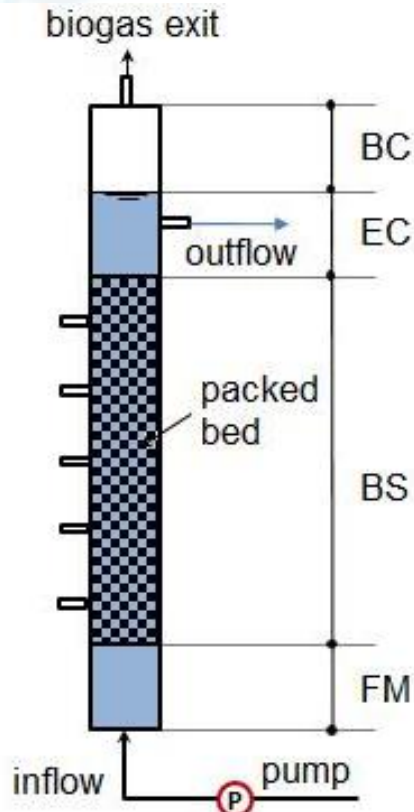
Symscape
CFD for All

6Sigma
DCX

SIMSCALE

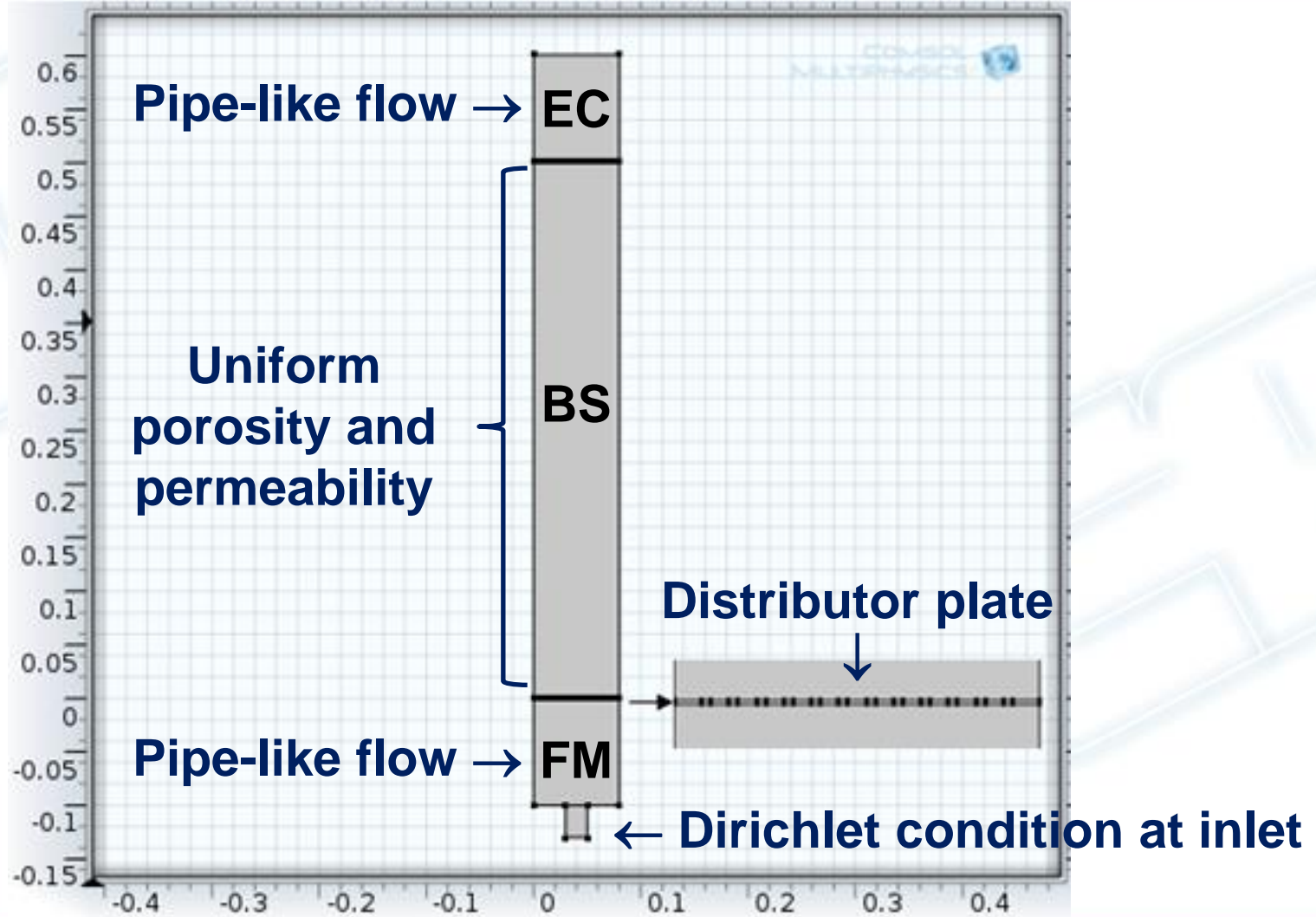
CFD software off-the-shelf: exemplo

- Definição do problema / metas (mensuráveis):
 - Biorreator: geometria e dimensões → cada compartimento
 - Modelo: efluente (vinhaça), meio poroso, cinéticas químicas
 - Meta: simulação da hidrodinâmica do efluente no biorreator

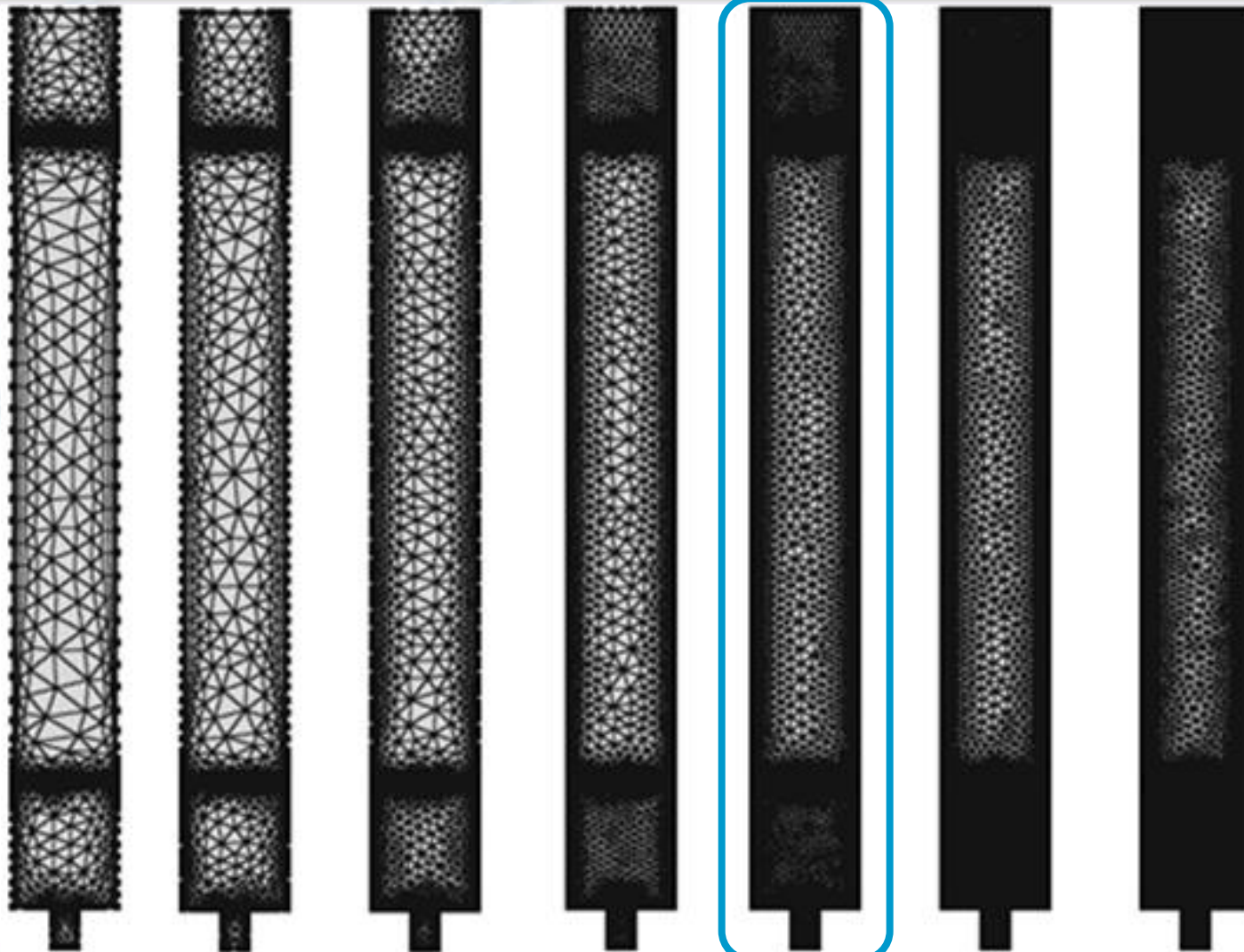


APBR compartment	Length (m)	Diameter (m)	Volume (L)
BC - biogas collection	0.050	0.080	0.2513
EC - effluent collection	0.100	0.080	0.5027
BS - bed section	0.500	0.080	2.5133
FM - feeding module	0.100	0.080	0.5027

Biorreator: modelo computacional



Análise de sensibilidade de malha



normal mesh (12352 elements)

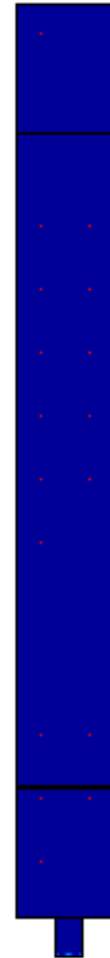
FZEA

Exemplo: CFD software off-the-shelf



Comparing HRT

Experimental APBR	11.6 h
CFD, porosity = 0.47	10.46 h
CFD, porosity = 0.54	11.38 h



(OKIYAMA, D.C.G.; RABI, J.A.; RIBEIRO, R.; FERRAZ, A.D.N.; ZAIAT, M. CFD simulations of fluid dynamics inside a fixed-bed bioreactor for sugarcane vinasse treatment. In: MANNINA, G. (org.) **Lecture Notes in Civil Engineering**, v.4, p.684-690, 2017)