



# Eushaw Dynamic Simulator-Isothermal

## The new generation of multiphase flow simulators

The Eushaw Dynamic Simulator is Parallel-Dynamic Software that handles the complex non-linear flow surrounding the producer in all applications. Eushaw-Isothermal can solve most of the challenges associated with Flow-Control-Device modelling and design. The Eushaw-Isothermal simulator is continuously improved and many modules in Eushaw-Thermal are state-of-art, and in many respects, it is 10-20 years ahead of competitors.

### Key Features

- The simple completion data input interface is designed on the basis of segments/joints mostly used by completion engineers
- FCD library and also CFD modelling capability for different configurations
- Automated history matching
- Erosion material library for Vickers hardness, impingement effect for ductile and brittle materials

The screenshot displays the Eushaw Dynamic Simulator interface, divided into three main sections:

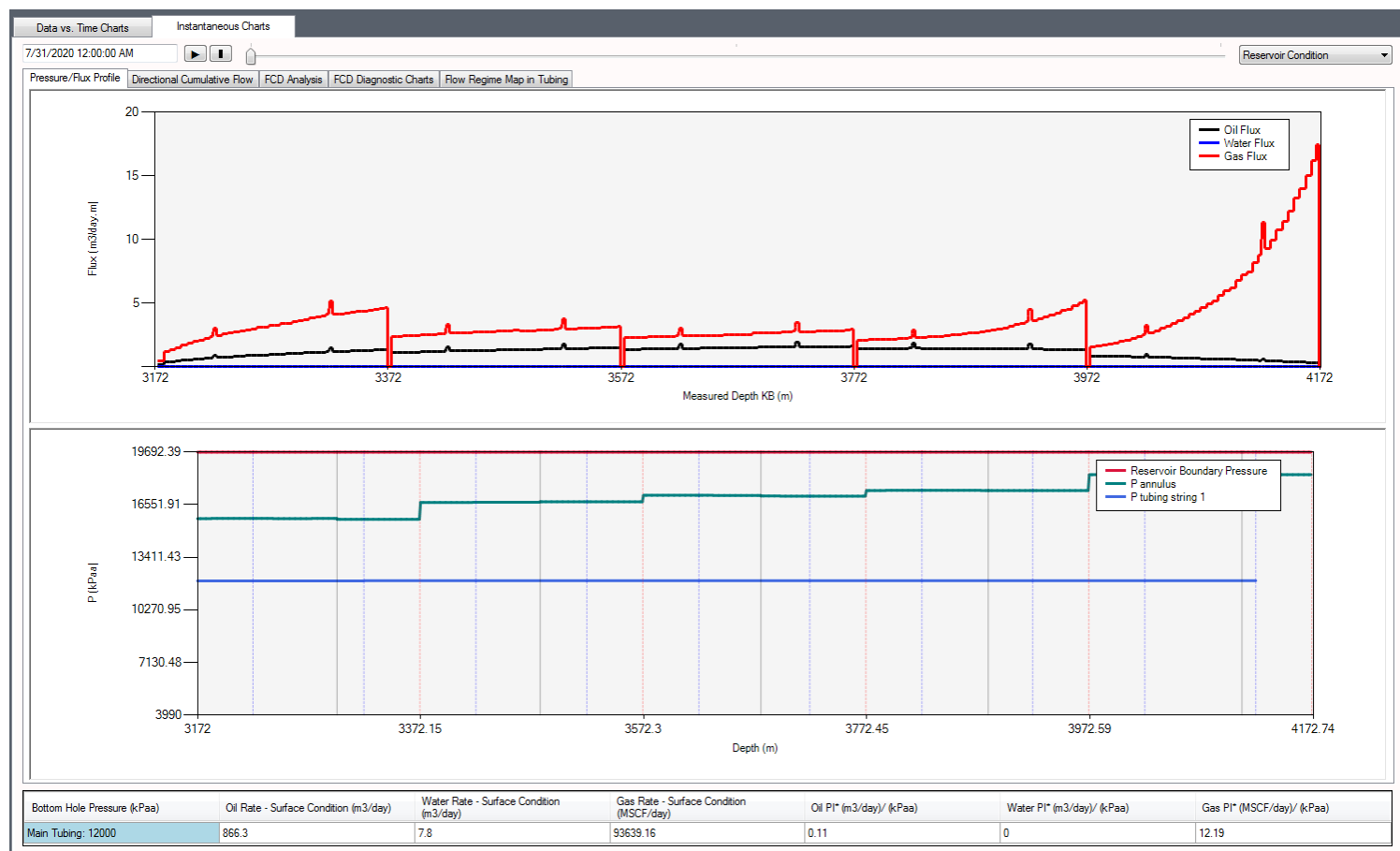
- Properties:** Model Type is set to Computational Fluid Dynamics, and FCD Type is set to Chamber.
- Chamber Properties:** Dimensions are defined as follows:

Parameter	Value
Width (cm)	5
Heights (cm)	50
Offset Height (cm)	1
Channel Height (cm)	2
Wall Width (cm)	0.5
Thickness (cm)	1
Number of Chambers (>=2)	2
Nozzles per Joint (>=1)	1
- Chamber Schematic:** A 2D schematic diagram of a chamber with a central channel. Labels include Chamber width, Chamber height, Offset, Channel height, and Wall width. Blue arrows indicate flow direction.

A 3D perspective view of the chamber is shown below the Chamber Properties section, with a red 'Modified Section' and a blue 'Mainstream' indicated.

Eushaw-**Isothermal** is a Parallel-Dynamic software that handles the complex non-linear flow surrounding the producer in all applications. It can solve most of the challenges associated with Flow-Control-Device modelling and design. Modelling options include predictions of Gas-Cusping and Cresting; Formation Capillary pressure effects on stabilizing the gas fingering; FCD erosion (Oka-erosion module); and automated history-matching.

Eushaw-**Isothermal** provides a platform for operators to keep all their data in a digital format and to easily analyze and model their wells with a state-of-art simulation engine. This helps to integrate complex modules and modeling into all areas of a business. Such digital transformation fundamentally changes how you operate and deliver value to share-holders. It is also a cultural change into comfortable manner. The software that keeps the operator data, all service providers tools and most recent researches in academia into fully parallelized software, and user have access to such platform in a fraction of a second.



## FCD Advanced Design and Analysis

The Eushaw Dynamic Simulator is only software that can handle erosion and use history matching to calculate the FCD half-life. This unique capability enables proactive planning and a unique way to understand their FCD capability in long run.

Eushaw Dynamic Simulator provides a capability to match and calibrate parameters that mimic the designed FCD. Also user can simulate the FCD configuration using the computational fluid dynamic (CFD) module, and use the same FCD in the reservoir.

## Shale-Gas Design and Analysis

One of novel capabilities is to design and model hydraulic-fractures in shale gas reservoirs. In Eushaw HF models are developed such: P3D, EP3D, CP3D, ILSA and DDM. These models are highly capable to capture the complexity of stress variation in the reservoir and also track the tip of the fracture that grows into reservoir and leak-off rates.

For proppant transport also can be modeled by simple and complex models such as CFD. The HF is coupled with reservoir engine that handles the phase changes such as condensation and gas-liberation.

**Properties**

Model Type: Correlation

FCD Type: AICD/AICV

**Properties**

Dimensions

ID (cm): 0.01

Calibration Density (kg/m<sup>3</sup>): 1000

Calibration Viscosity (cp): 1

Calibration Rate (m<sup>3</sup>/sec): 0.001

AICD/AICV Strength: 4.55E-06

Flow Rate Exponent, x: 2.13

Viscosity Exponent, y: 0.13

Water Density Exponent, b: 1

Water Viscosity Exponent, e: 1

Gas Density Exponent, c: 1

Gas Viscosity Exponent, f: 1

Oil Density Exponent, a: 1

Oil Viscosity Exponent, d: 1

$$\Delta P_{FCD} = \left[ \frac{\bar{\rho}_{mix} \bar{P}_{mix} \left( \frac{\mu_{oil}}{\bar{\mu}_{mix}} \right)^y \alpha_{AICD} \left( \frac{q_{FCD}}{q_{cal}} \right)^{x-2}}{\rho_{mix} q_{FCD}^2} \right]$$

$$\bar{\rho}_{mix} = \alpha_w^a \times \rho_w + \alpha_g^b \times \rho_g + \alpha_o^c \times \rho_o$$

$$\bar{\mu}_{mix} = \alpha_w^d \times \mu_w + \alpha_o^e \times \mu_o + \alpha_g^f \times \mu_g$$

**Properties**

Model Type: Correlation

FCD Type: Helical Channel

**Properties**

Dimensions

Channel ID (cm): 1

Channel Length (cm): 1

a1: 0.007118704

a2: 1.278922809

b1: 0.238248119

b2: 0.000186341

c: 1.405507151

d: 0.05449507

t: 3.60271E-06

$$\Delta P_{FCD} = f_{re} \frac{L_{channel}}{2g \times D_{channel}} \frac{16}{(\pi D_{channel})^2} \times \rho_{mix} q_{FCD}^2$$

$$f_{re} = a_1 Re^{b_1} + \frac{a_2 Re^{b_2} + a_3 Re^{b_3}}{1 + \left( \frac{Re}{t} \right)^c}$$

The Eushaw simulator also provides the standard type-curves for user to design the initial configuration of fracturing along the producer.

