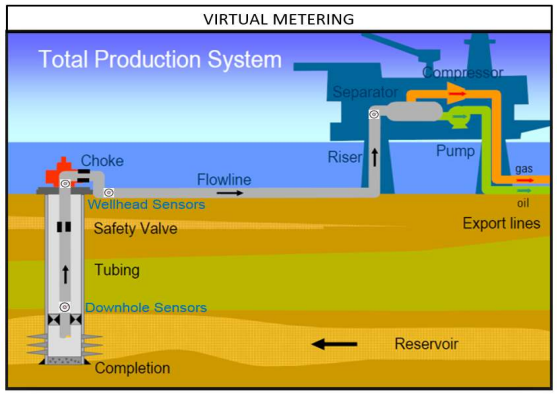
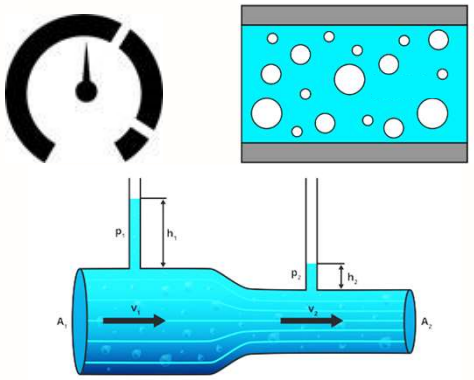
Thesis subject: Real-Time Production Surveillance and Optimization by means of Virtual Metering techniques applied on production networks 1/2

Eni Tutors: F. Ursini, E. Vignati (REMP)





Background

- Nowadays, the data acquisition technology enables the measurement of well parameters, like pressure and temperature, in real time with high frequency. The reliable estimation of the well production flow rates is of fundamental importance for real-time monitoring of the production asset, for proper management of the reservoirs and production optimization.
- An inexpensive technology for estimating well flows in real time is Virtual Metering, which integrates real-time data and thermo-fluid dynamic models

Thesis subject: Real-Time Production Surveillance and Optimization by means of Virtual Metering techniques applied on production networks 2/2

Tasks and activities

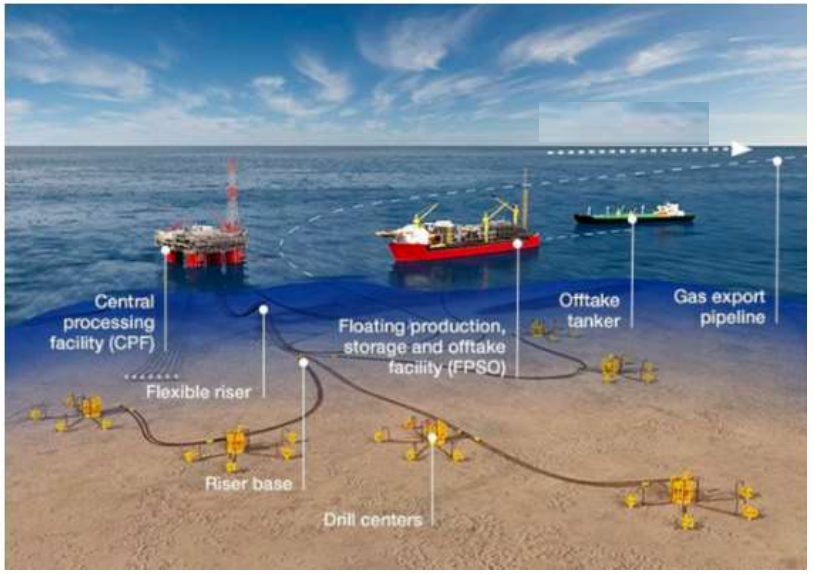
- Initial assessment of existing technologies and proposal of innovative ideas for Virtual Metering.
- Development and testing on a real case of virtual metering tools applied throughout the production network, from the wells to the treatment plant by means of physical models (fluid dynamics in steady state and transient flow conditions) and machine learning models (neural network or similar).
- The output of the project is the development of a pilot tool and the comparison of the different methodologies, their reliability and applicability in different flow regimes and production conditions.

Educational Requirements

- Topics: fluidodynamics
- Skills: numerical analysis, coding skills

Deliverables

- Pilot tool
- Presentation

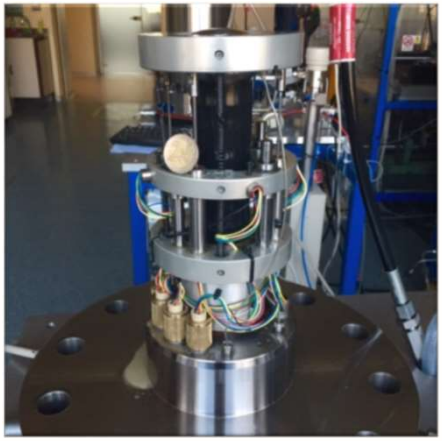


Thesis subject: Experimental protocol for permeability measurements at elevated pressure conditions (1/2)

Eni Tutors: N. Bona, G. Volonté

Background

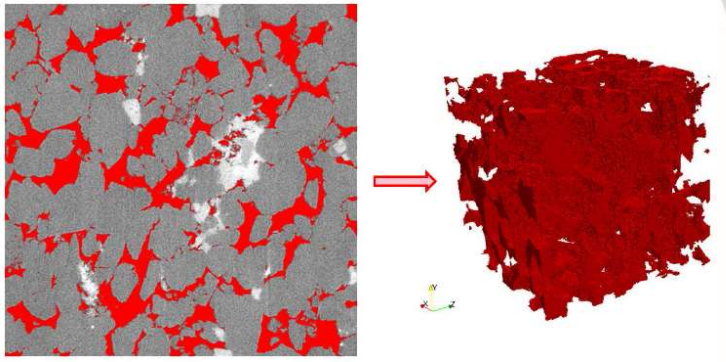
- The main goal of the thesis is to develop a protocol for rock permeability measurements at elevated pressure conditions by using dedicated, recently developed, triaxial systems (see picture).
- The new protocol will be complemented by NMR spectroscopy and Hg injection measurements aimed at characterizing the geometry of the pore space of the investigated samples.
- All the experimental results will be validated through comparison with estimates from digital petrophysics (micro CT), electronic microscopy (SEM) and numerical simulation (codes developed by Eni).
- The activity will be performed at Eni's R&D center (upstream laboratories)

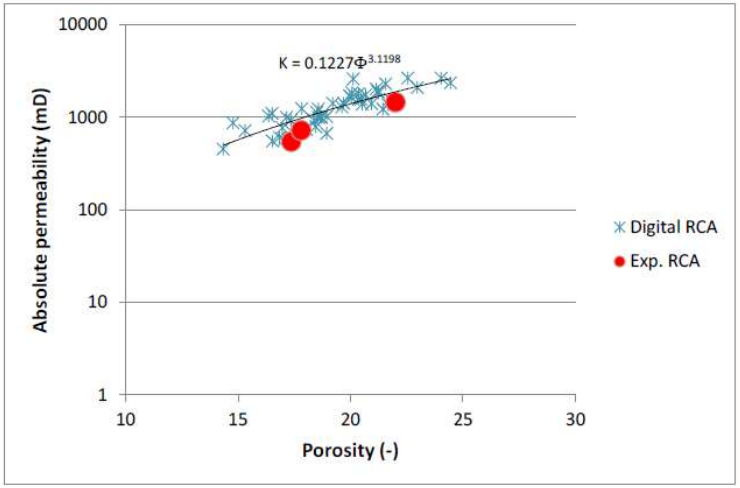


Thesis subject: Experimental protocol for permeability measurements at elevated pressure conditions (2/2)

Tasks and activities

- Definition of an experimental protocol for triaxial permeability measurements
- Analytical estimation of permeability from pore size distribution functions obtained from NMR T2 spectroscopy and Hg injection tests (published models will be used, which are based on statistical descriptions of the pore space and percolation theory)
- Comparison with permeability estimates from Digital Rock Physics (i.e. permeability estimates obtained from numerical simulations of flow in 3D images of the pore space of the investigated rock samples: see pictures)





Educational Requirements and Skills

- Exams/knowledge: Geomechanics, Fluid dynamics, Physics of porous media
- Strong attitude to experimental work

Deliverables

- Final report and Methodological Guidelines