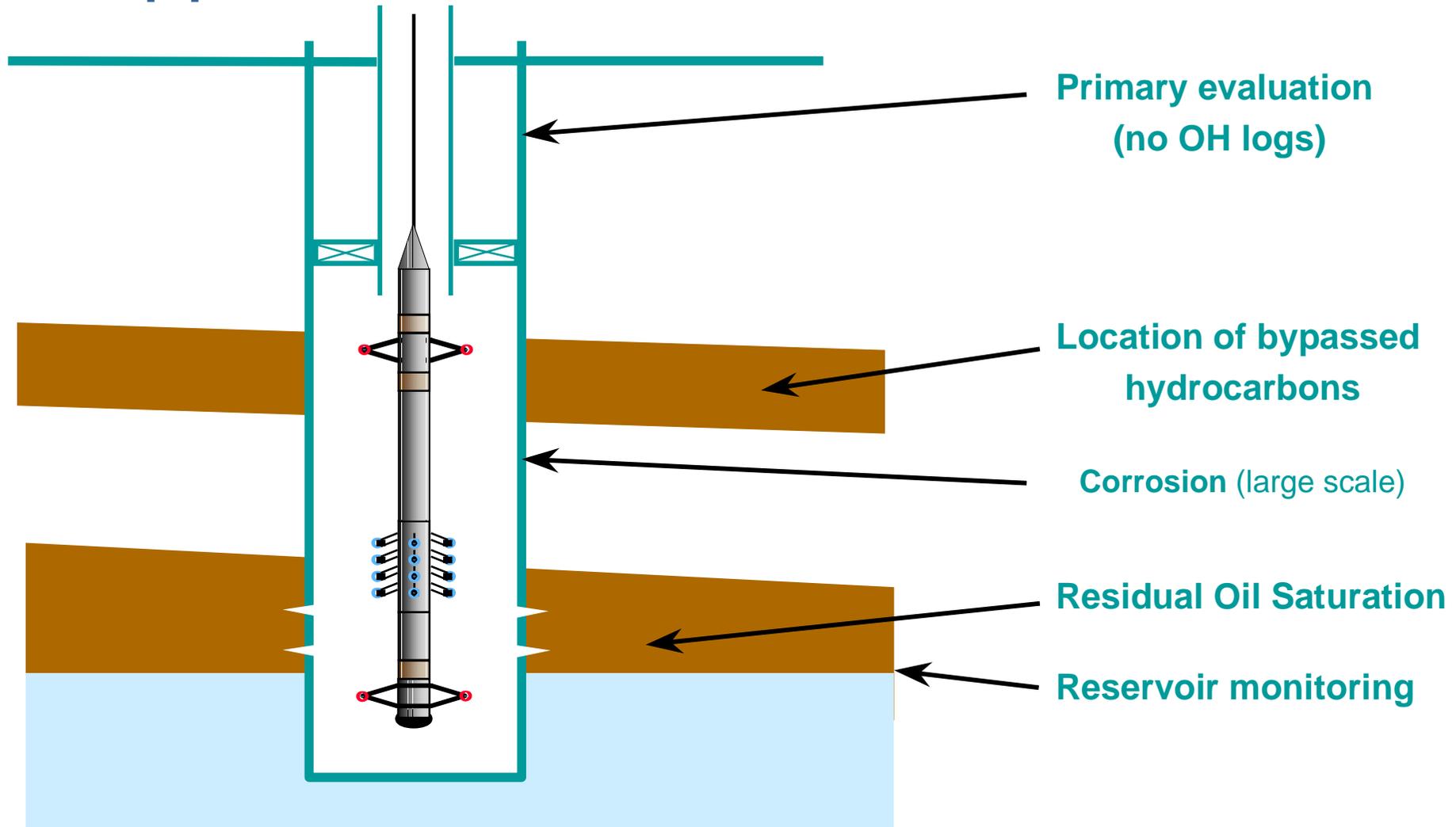
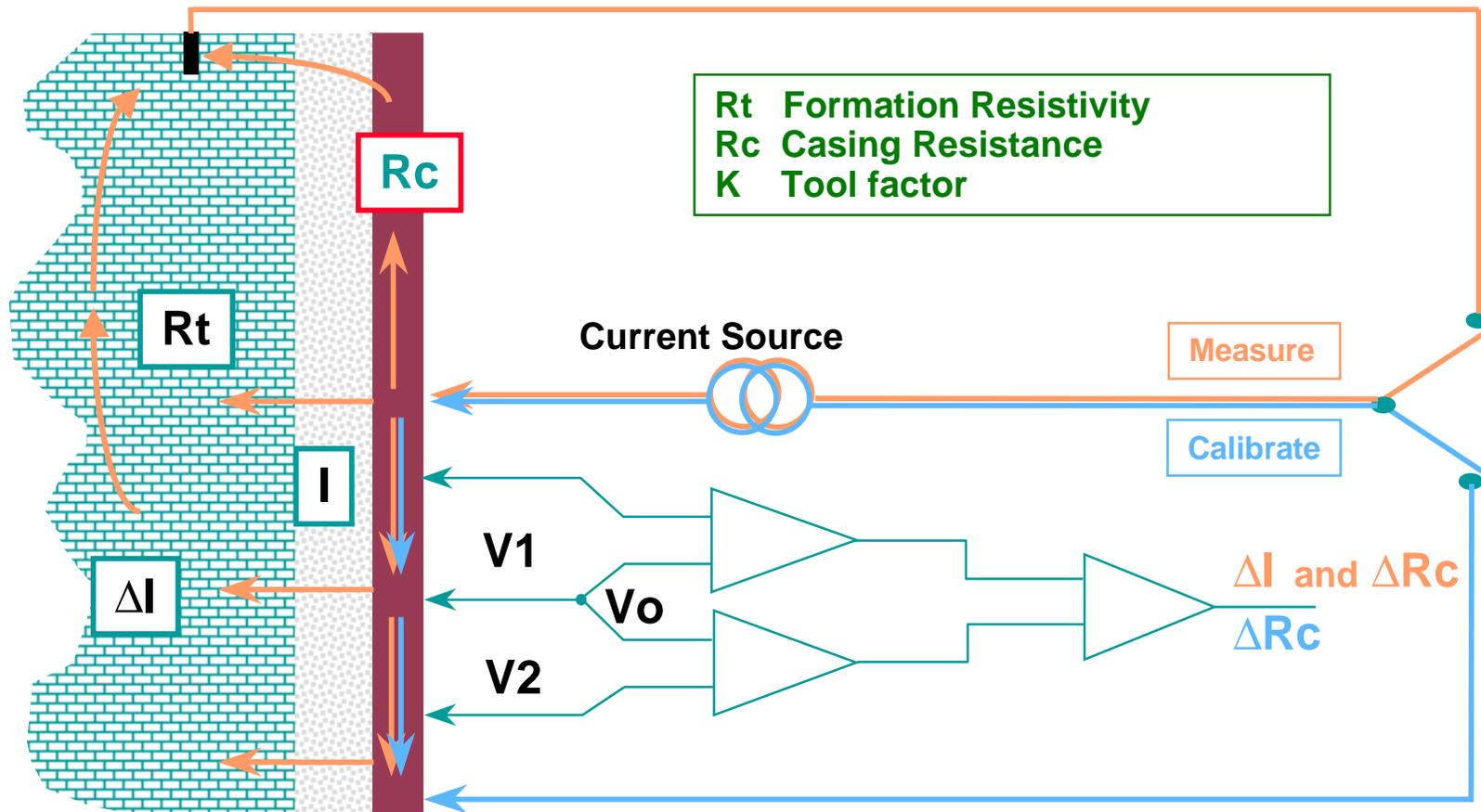


Cased-Hole Formation Resistivity Applications



CHFR Principle

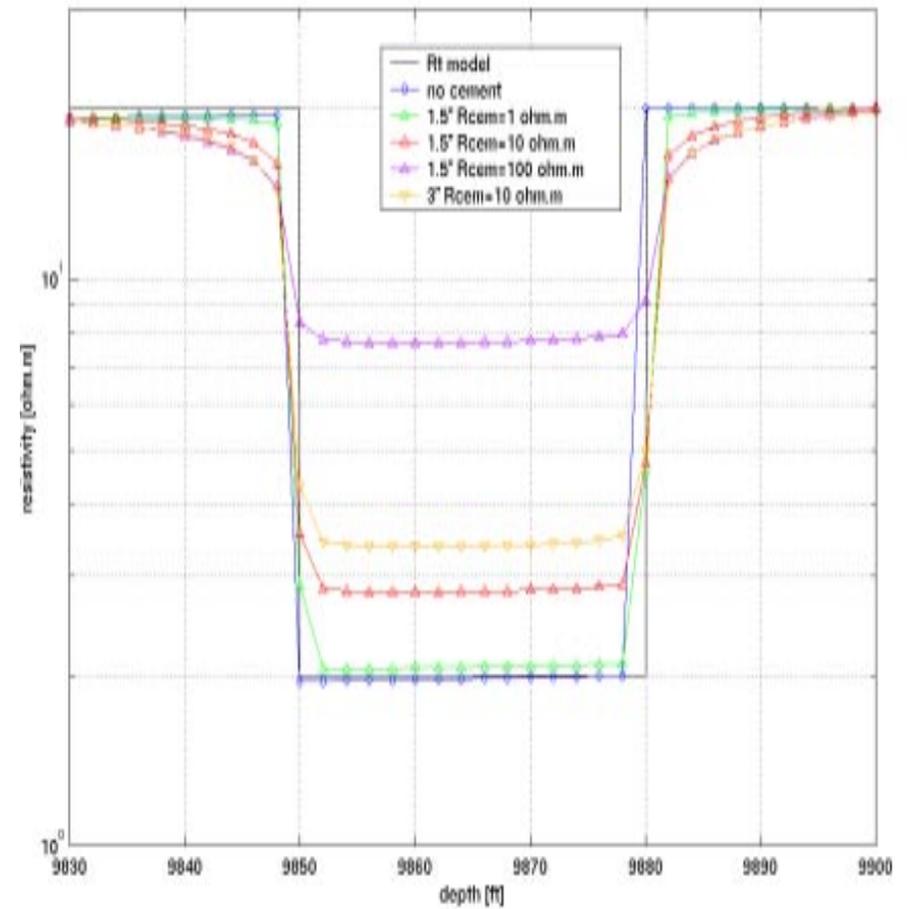
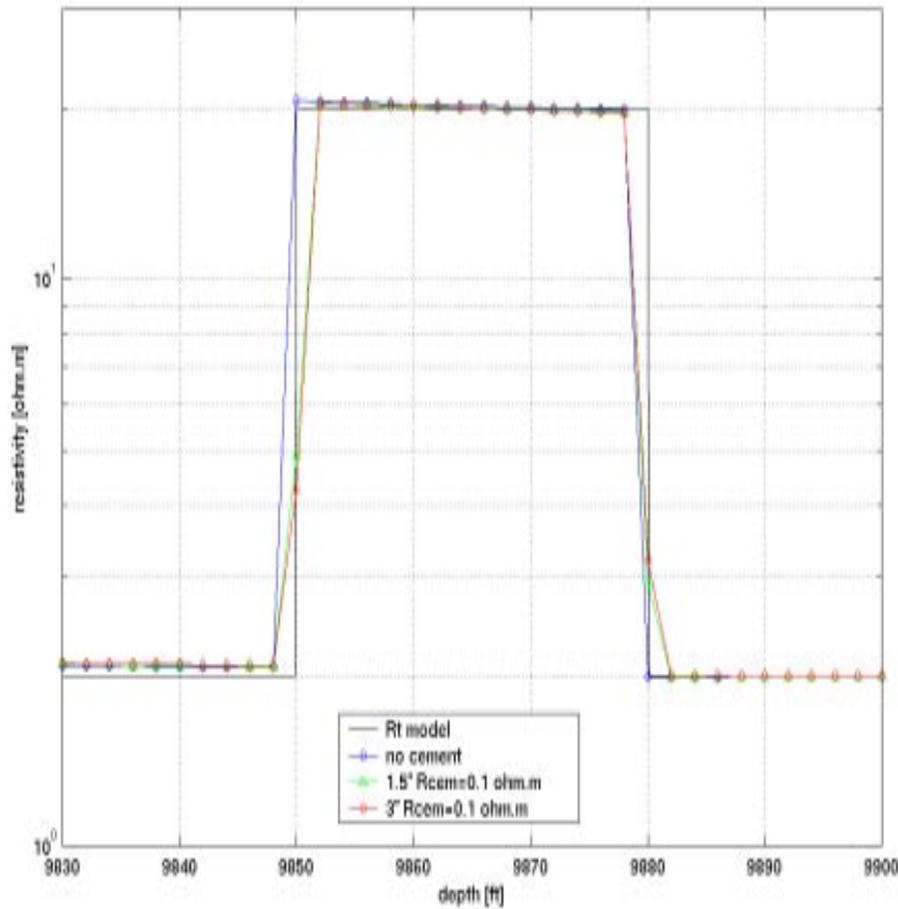


$$R_t = K \cdot V_o / \Delta I \quad \text{where} \quad \Delta I = (V_1 - V_2) / R_c$$

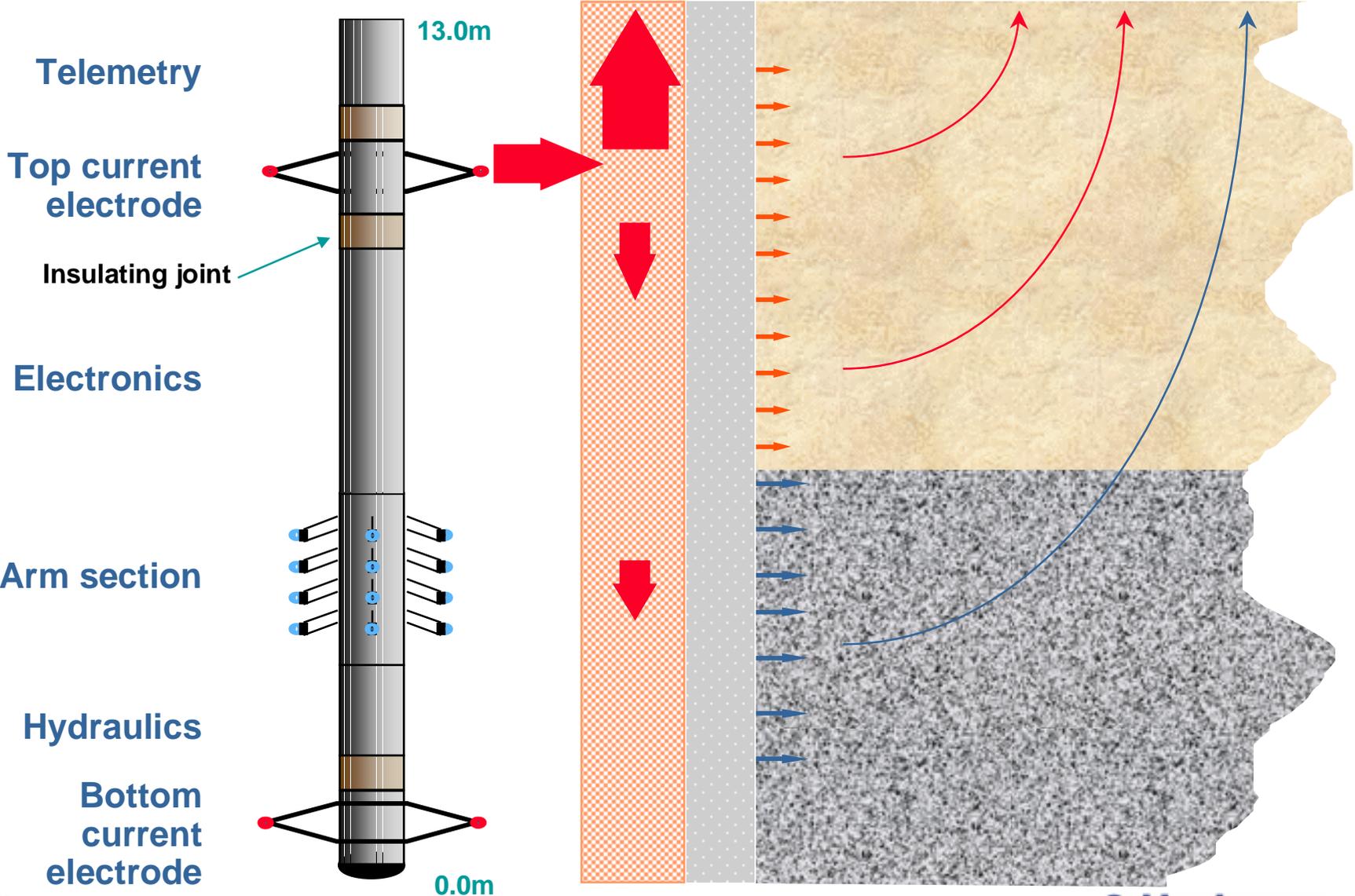
The CHFR measurement challenges

- Low casing resistivity $\sim 2 \cdot 10^{-7} \Omega\text{m}$.
- Measured/total current ratio: $\Delta I/I \sim 10^{-3}$ to 10^{-5}
- Voltages to handle are in the **nanoVolt** range
- Frequency of operation limited around 1Hz
- Good electrical contact essential
- Cement layer may require correction

Cement effect on CHFR



CHFR tool string



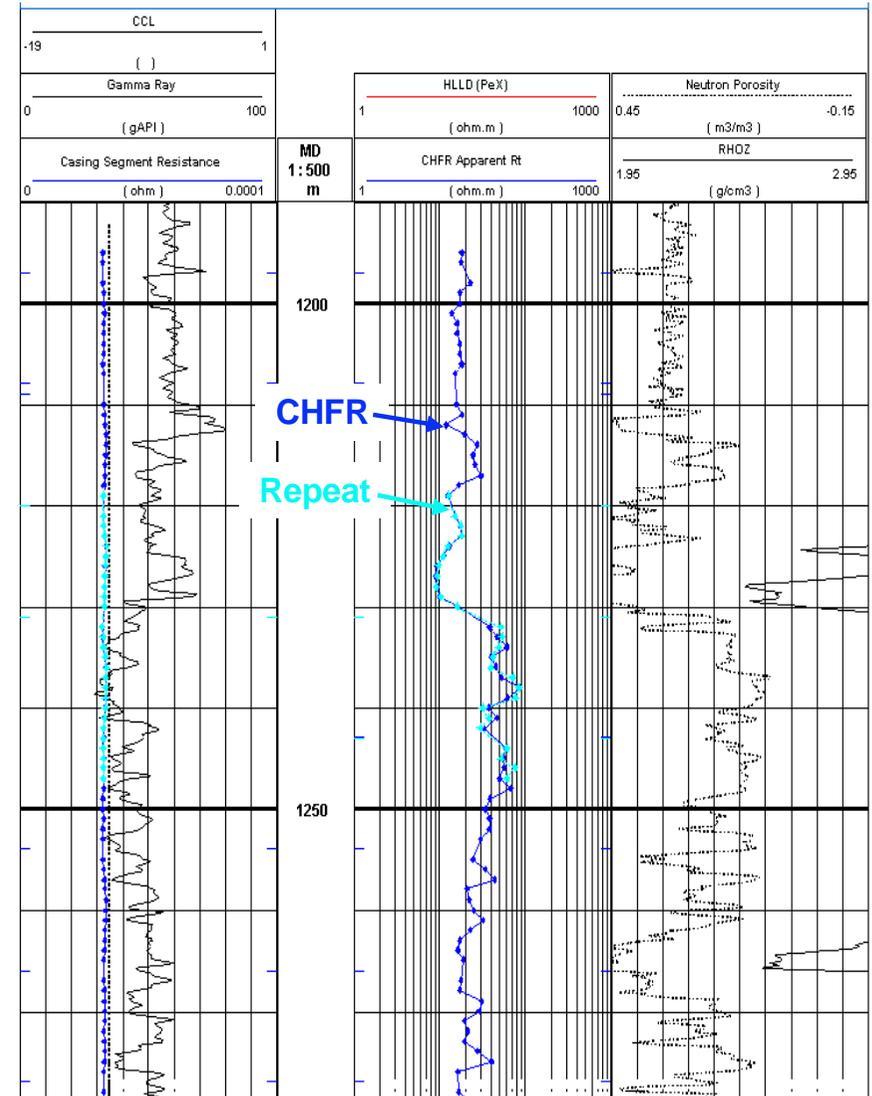
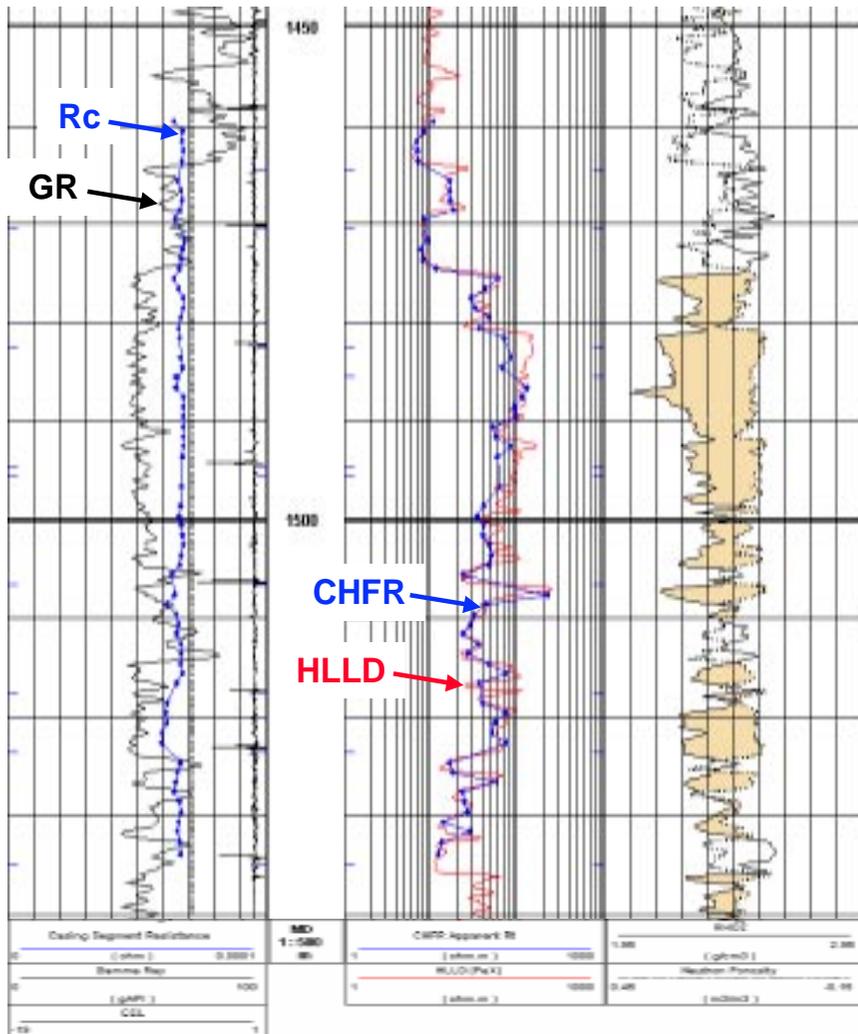
CHFR Major Specifications

- Tool dimensions 3-3/8", 43' long
- Pressure/Temperature 20000psi / 150°C
- Casing O.D. Range 4.5" to 9-5/8"
- Maximum Well Deviation 70 degrees
- Stationary measurement ~ 2 minutes
- Resistivity range 1 - 100 Ω m
- Vertical Resolution 4 feet
- Depth of investigation 2m typ.

CHFR EXP field test current results

- Good results in 75% of wells (repeatability, sensitivity), calibration in virgin zones needed
- Failures: mainly due to very bad electrical contacts

Log example in a new well



RAG - Austria

10 CHFR
November 1999

Schlumberger

CHFR directions

- Field test 2 EXP's
- Launch a small series of 3-3/8" tools
- Start feasibility study of slim-hole version of the measurement (1-11/16")