

RTA

What is the difference between LFPs ($A\sqrt{k}$) derived from analytical and numerical RTA?

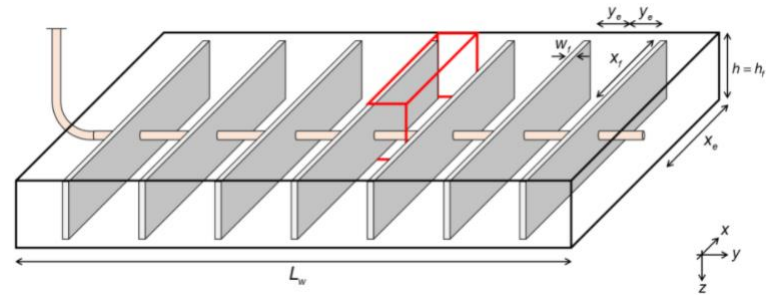
Difference between Analytical and Numerical RTA

Let's assume we have a given surface area we have contacted with our completion.

The $A\sqrt{k}$ resolved should not be a function of the fluid.

In other words, no matter what ratio of **oil**, **gas** and **water** a well is producing, the same $A\sqrt{k}$ should be derived from the analysis, if it's the same.

Let us look at an example.



Difference between Analytical and Numerical RTA

Example:

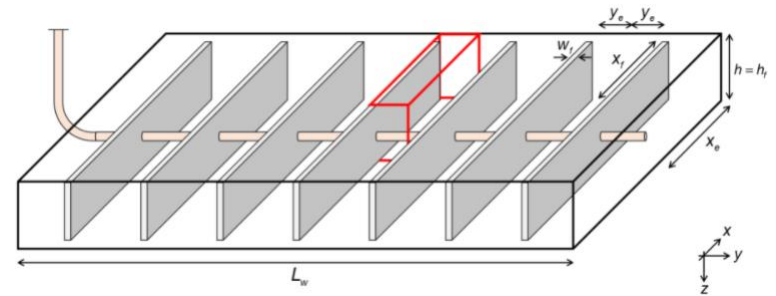
$$\text{LFP} = A\sqrt{k} = 450,000 \text{ ft}^2\text{md}^{1/2}$$

$$\text{Pore volume } (V_p) = 7150 \text{ MRB}$$

Let's fill the pore volume with different ratios of fluids.

1. $S_{wi} = 20\%$, $S_{oi} = 80\%$
2. $S_{wi} = 50\%$, $S_{oi} = 50\%$
3. $S_{wi} = 70\%$, $S_{oi} = 30\%$

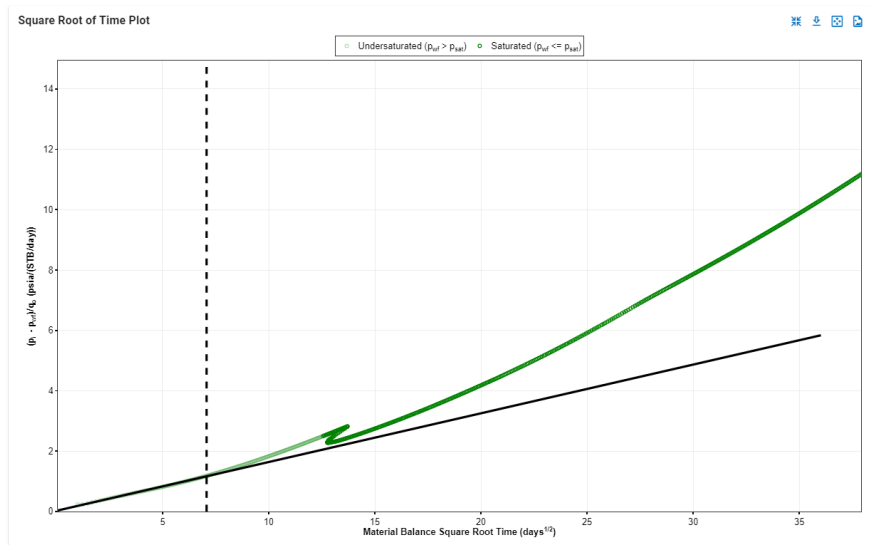
$$(S_{wc} = 20\%)$$



Case 1: ARTA vs NRTA ($S_{wi} = 20\%$, $S_{oi} = 80\%$)

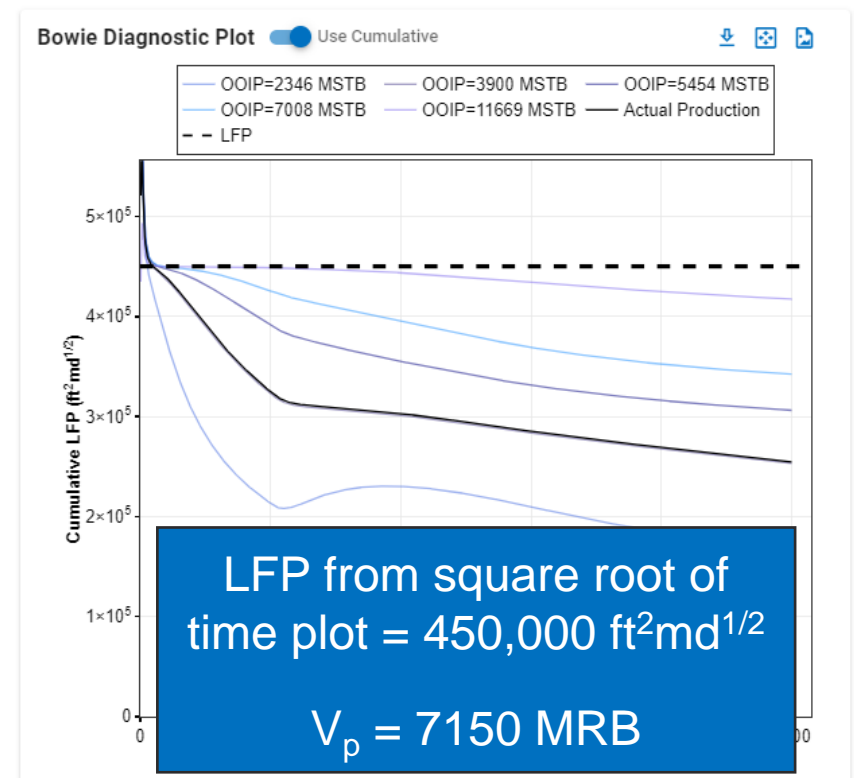
True LFP = 450,000 ft²md^{1/2} | Pore volume (V_p) = 7150 MRB

Analytical



LFP from square root of time plot = 425,000 ft²md^{1/2}

Numerical



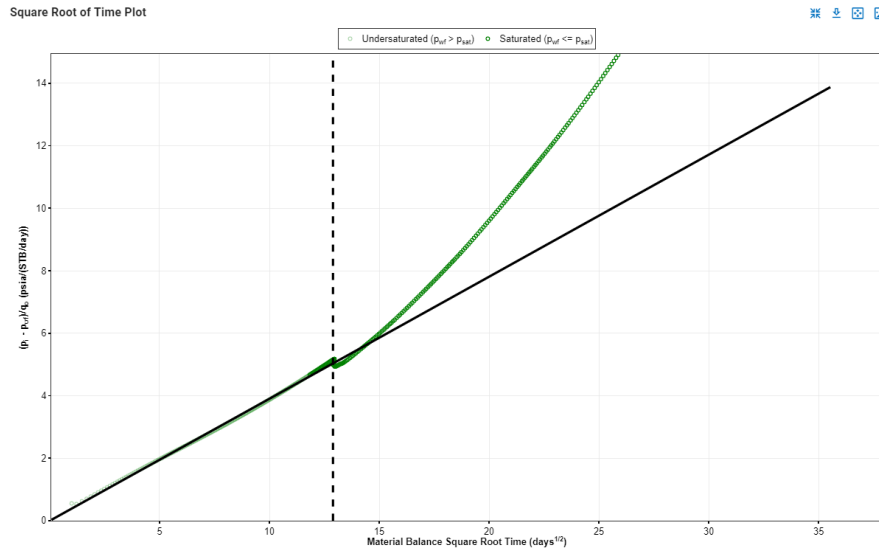
LFP from square root of time plot = 450,000 ft²md^{1/2}

$V_p = 7150$ MRB

Case 2: ARTA vs NRTA ($S_{wi} = 50\%$, $S_{oi} = 50\%$)

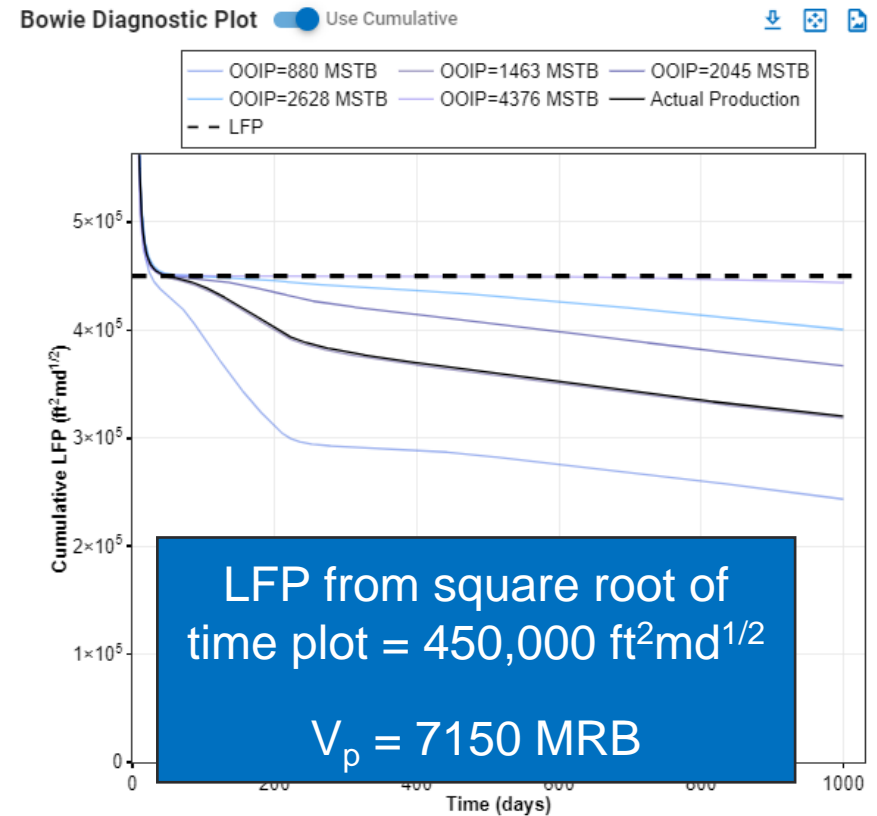
True LFP = 450,000 ft²md^{1/2} | Pore volume (V_p) = 7150 MRB

Analytical



LFP from square root of time plot = 200,000 ft²md^{1/2}

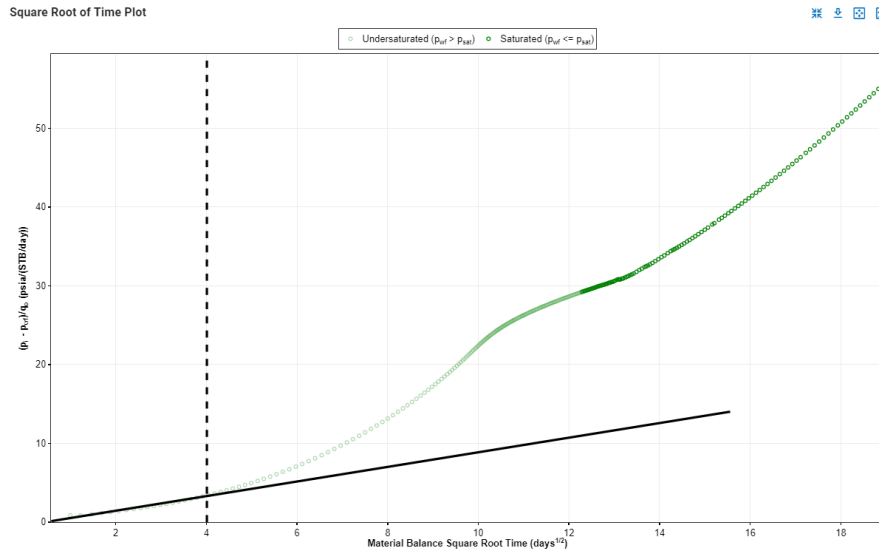
Numerical



Case 3: ARTA vs NRTA ($S_{wi} = 70\%$, $S_{oi} = 30\%$)

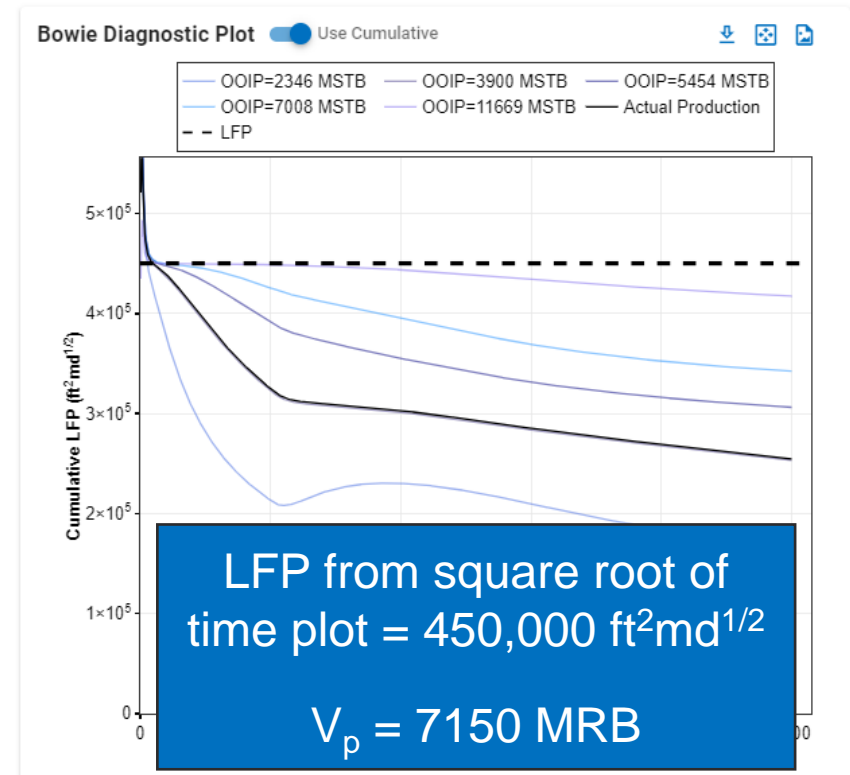
True LFP = 450,000 ft²md^{1/2} | Pore volume (V_p) = 7150 MRB

Analytical



LFP from square root of time plot = 90,000 ft²md^{1/2}

Numerical



ARTA vs NRTA: Summary

- Analytical RTA resolves “single-phase” $A\sqrt{k}$ (“LFP”), $LFP_{\text{analytical}}$
- Numerical RTA resolves “multi-phase” $A\sqrt{k}$ (“LFP”), $LFP_{\text{numerical}}$
- If a well produce substantial water, then $LFP_{\text{numerical}} > LFP_{\text{analytical}}$
- To honor this, one would have to match the water cuts in the numerical RTA workflow
- Hence, a good consistency check of NRTA should be that the LFP from analytical RTA $<$ LFP from numerical RTA
- In general, LFP and pore volume, should not be a function of fluid.