

SPE 135039

**Analytical Tools Aid Understanding of
History-Matching Effort in a
Fractured Reservoir**

Shah Kabir

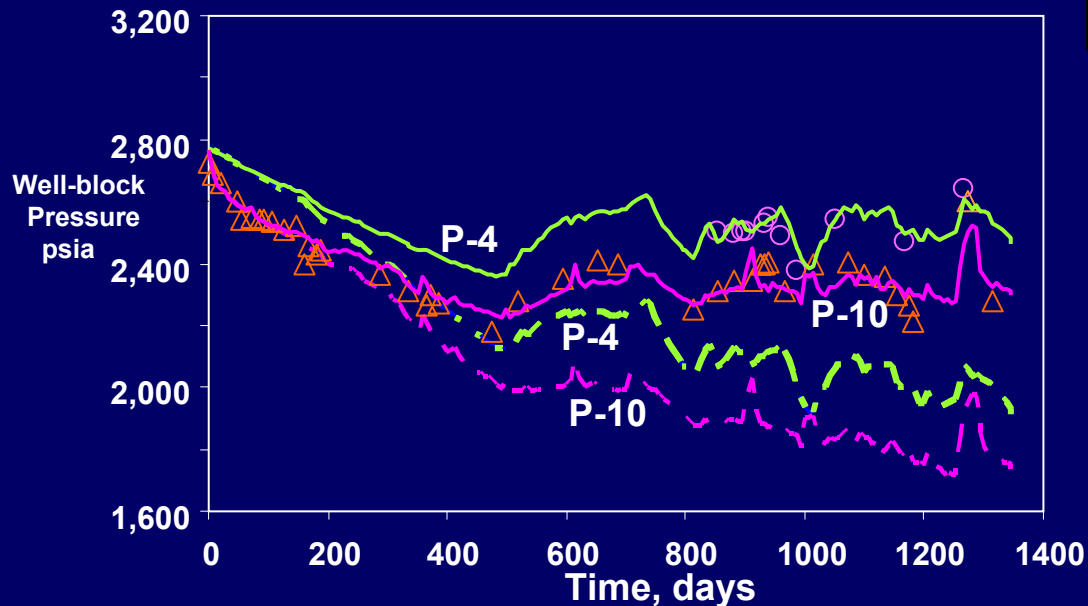
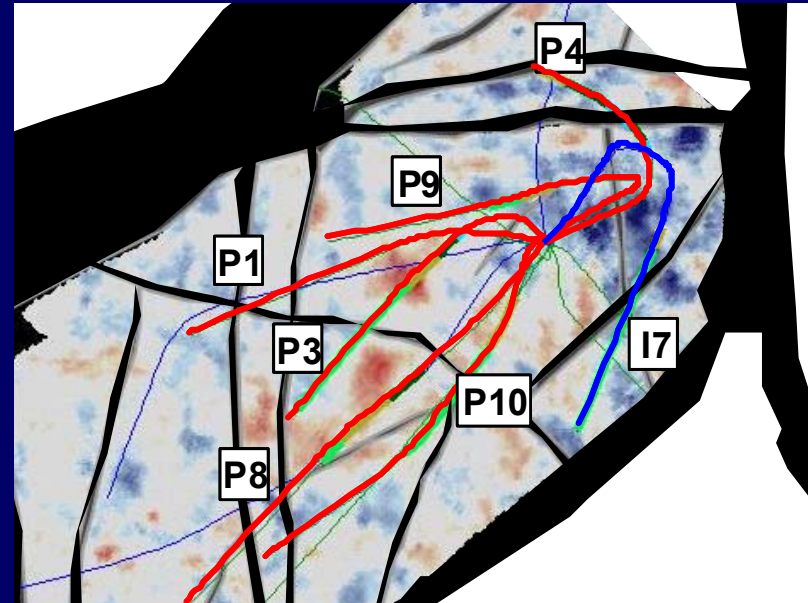
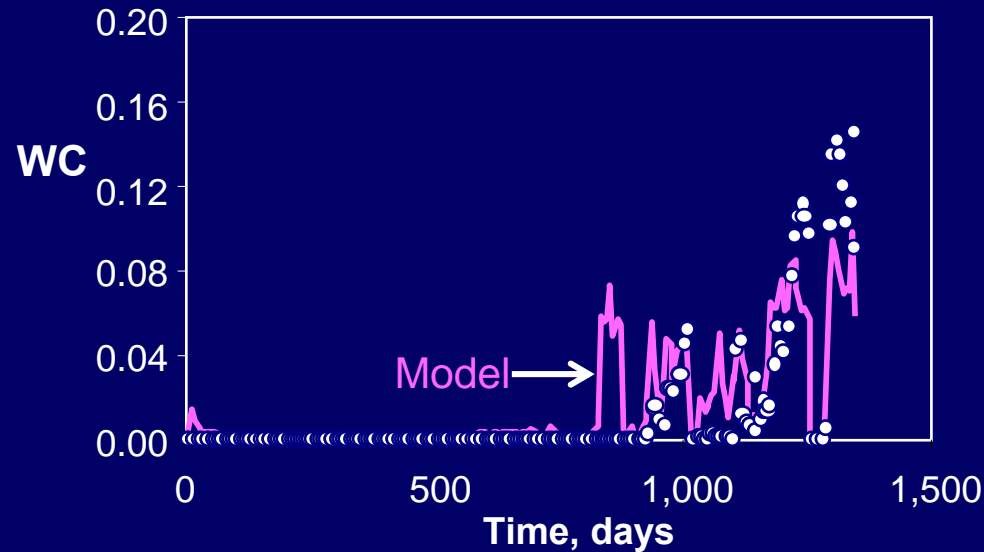
Francis Boundy

Hess Corporation

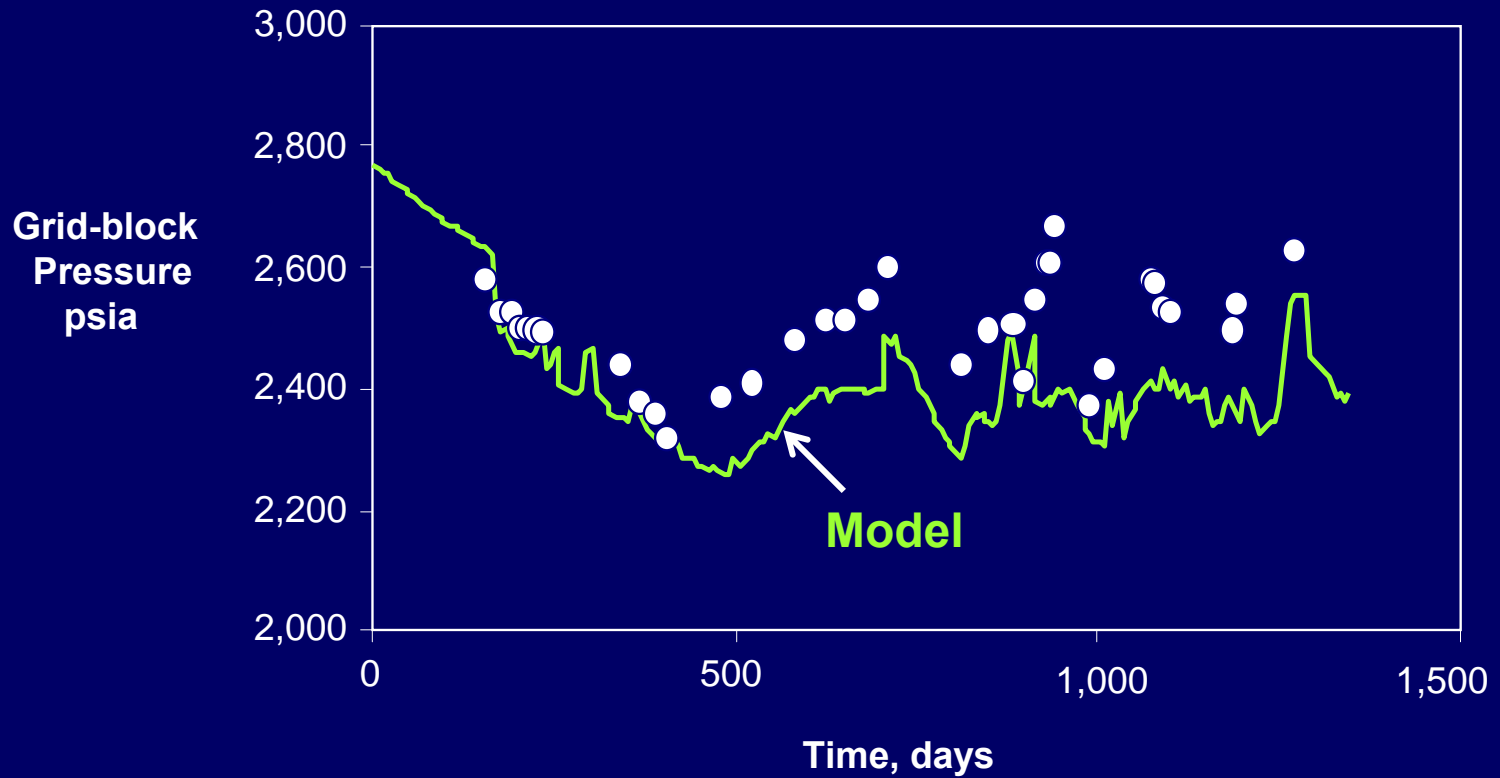
Presentation Outline

- Overall History-Matching
- Analytical Tools Used for Understanding Single-Well & Inter-Well Behavior
 - > PTA & RTA
 - > modified-Hall
 - > Reciprocal-Productivity Index (RPI)
 - > Capacitance-Resistance Model (CRM)
- Conclusions

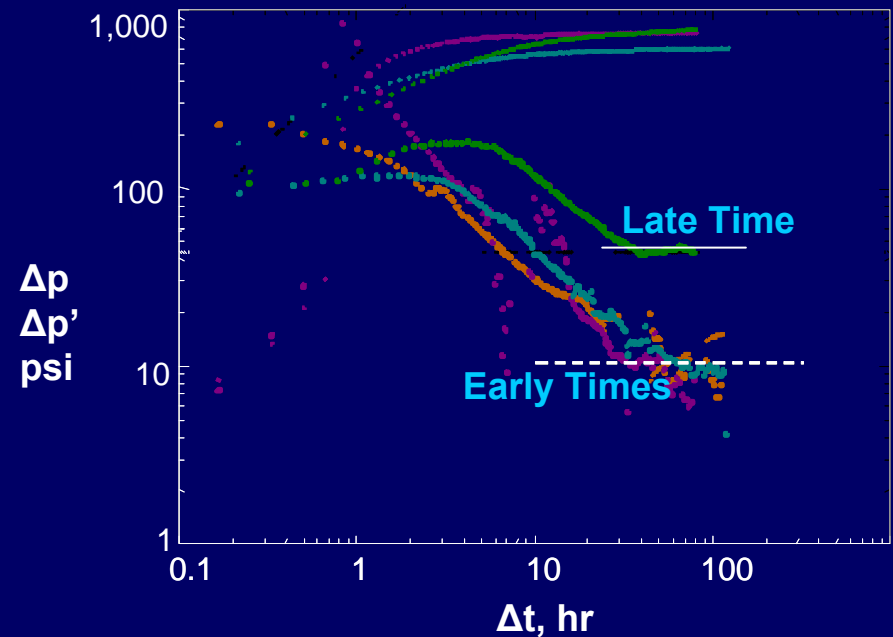
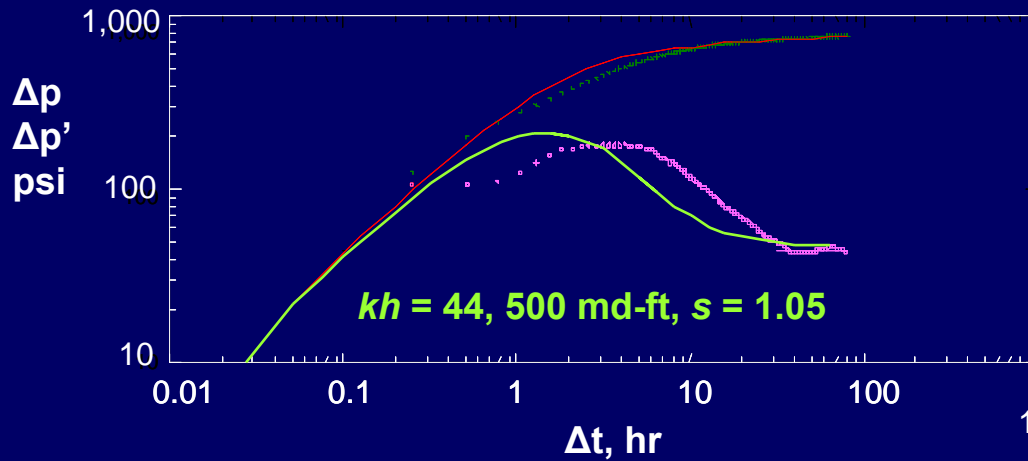
Field/Well Performance Overview



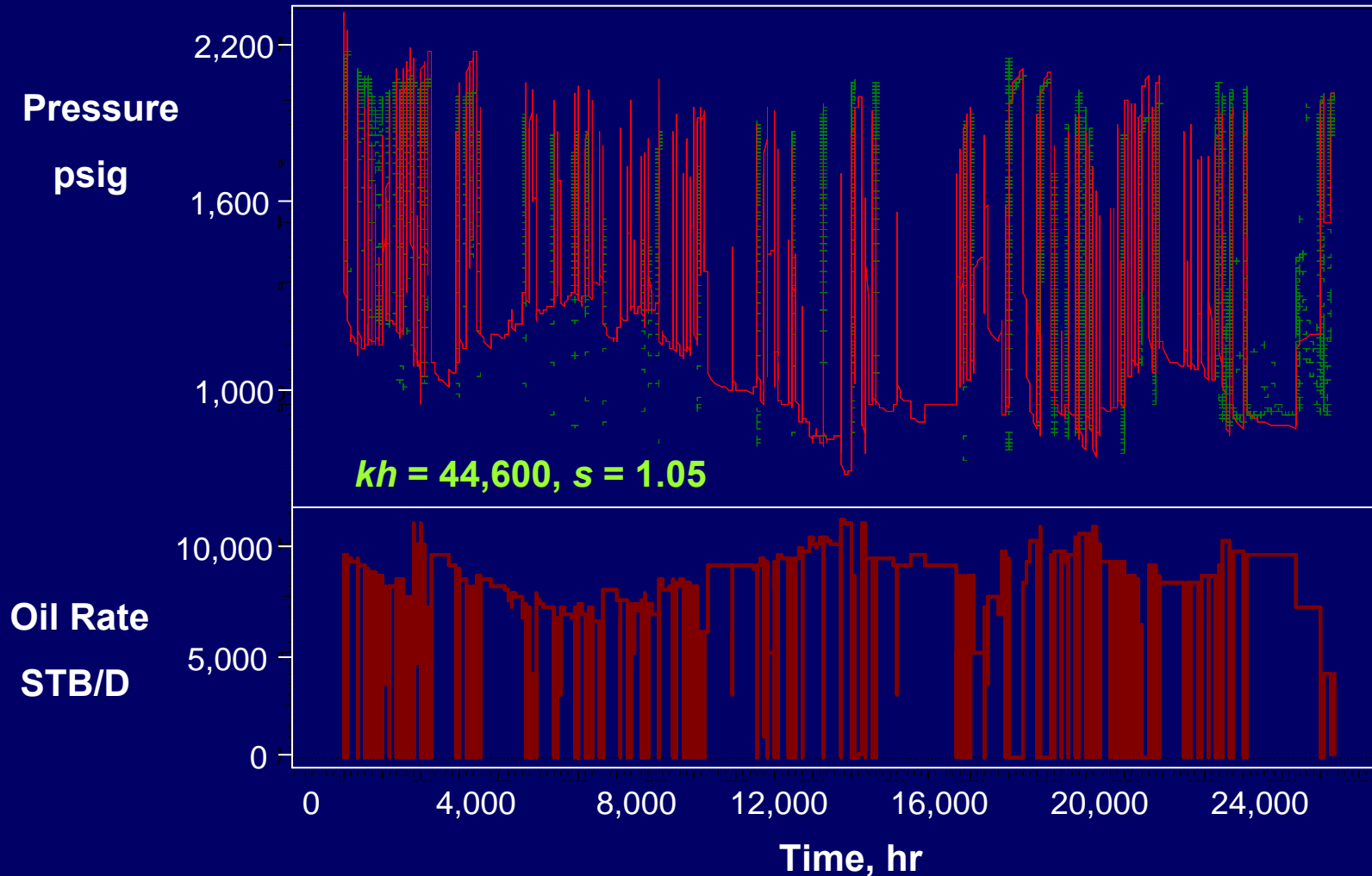
History Matching P-9 Producer



Deriving Proxy Model: P-9 Producer

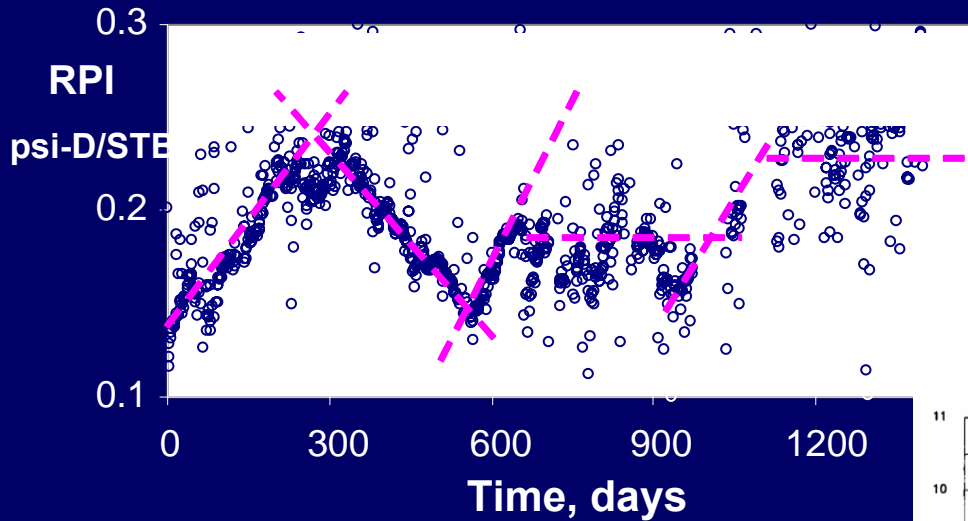


History Matching w/Proxy Model: P-9



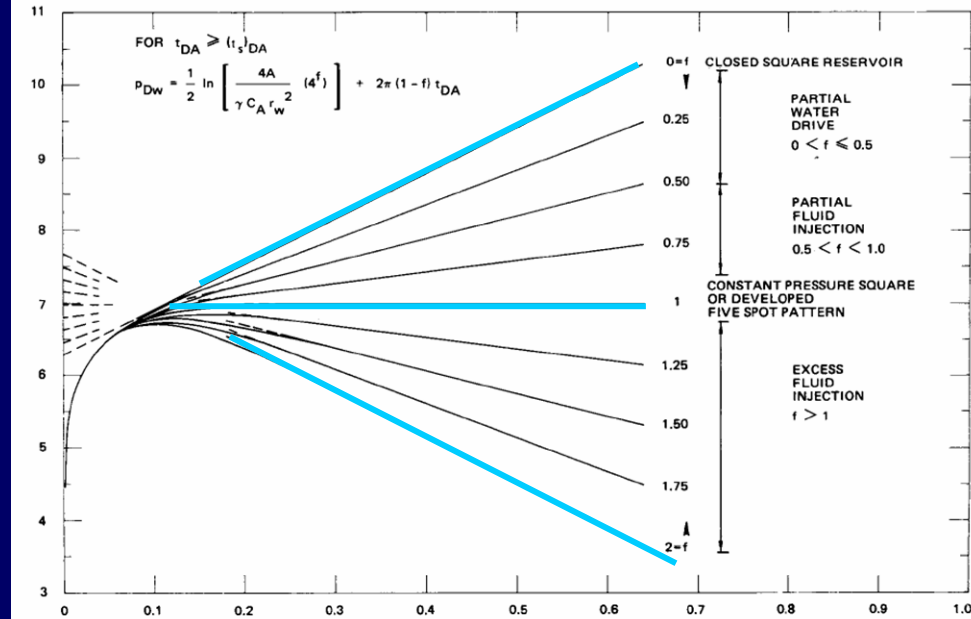
Assessing Pressure Support w/RPI

P-9 Well



(after Kumar, *JPT*, Nov. 1977)

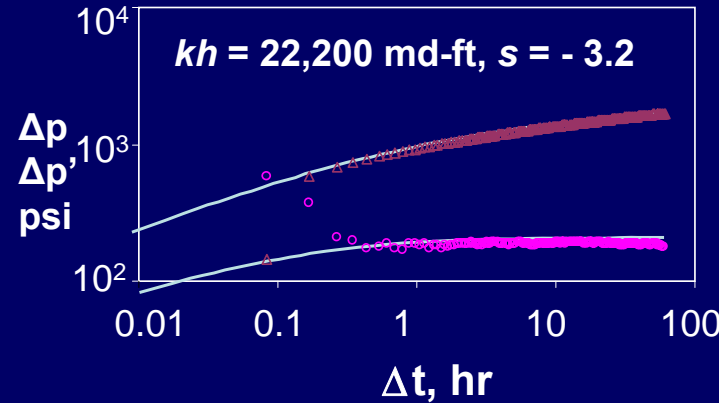
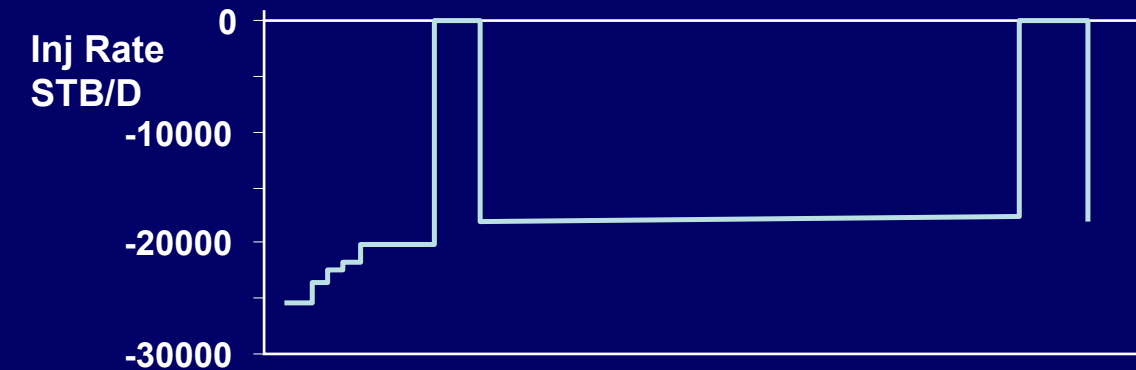
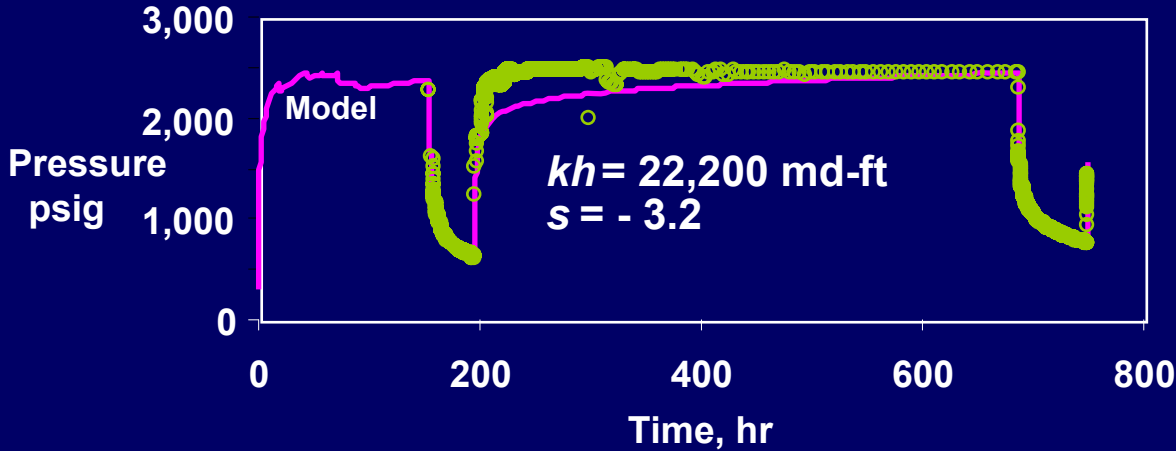
$$\frac{kh}{141.2 \mu B} \frac{(p_i - p_{wf})}{q}$$



$$2.64 \times 10^{-4} k t / \Phi \mu c_f A$$

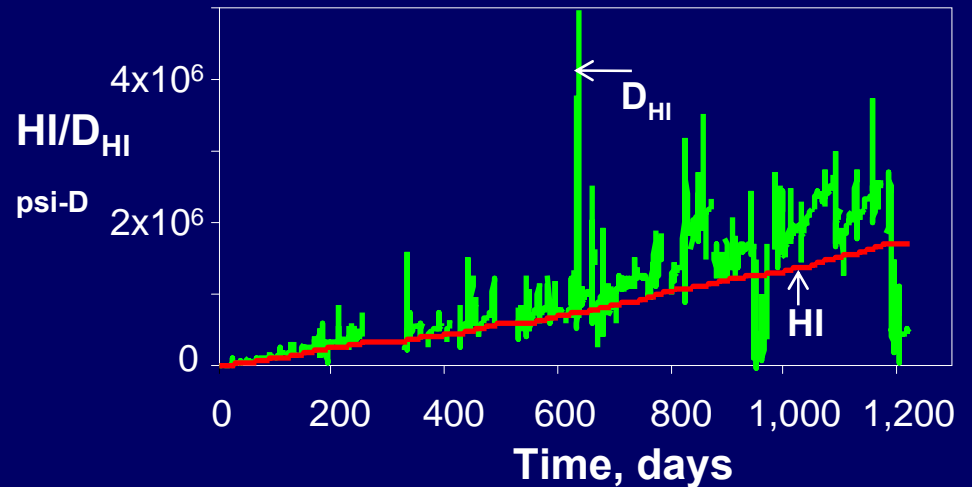
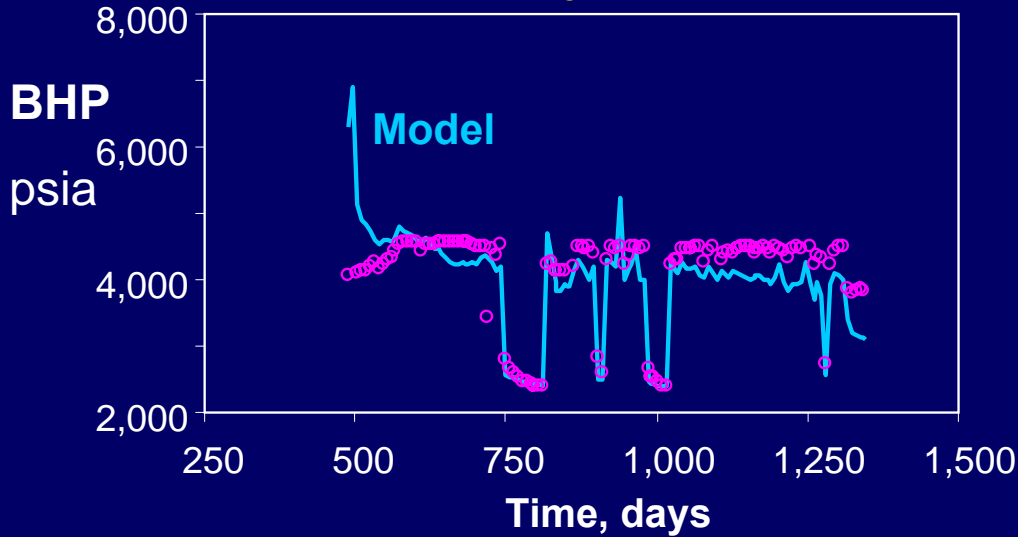
Use of Proxy Model for Overall History Matching

I1 Injector

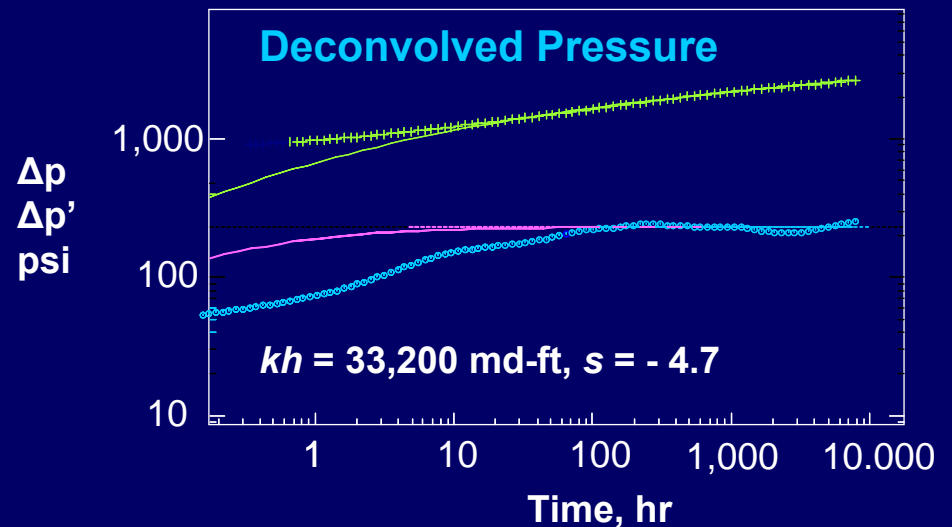
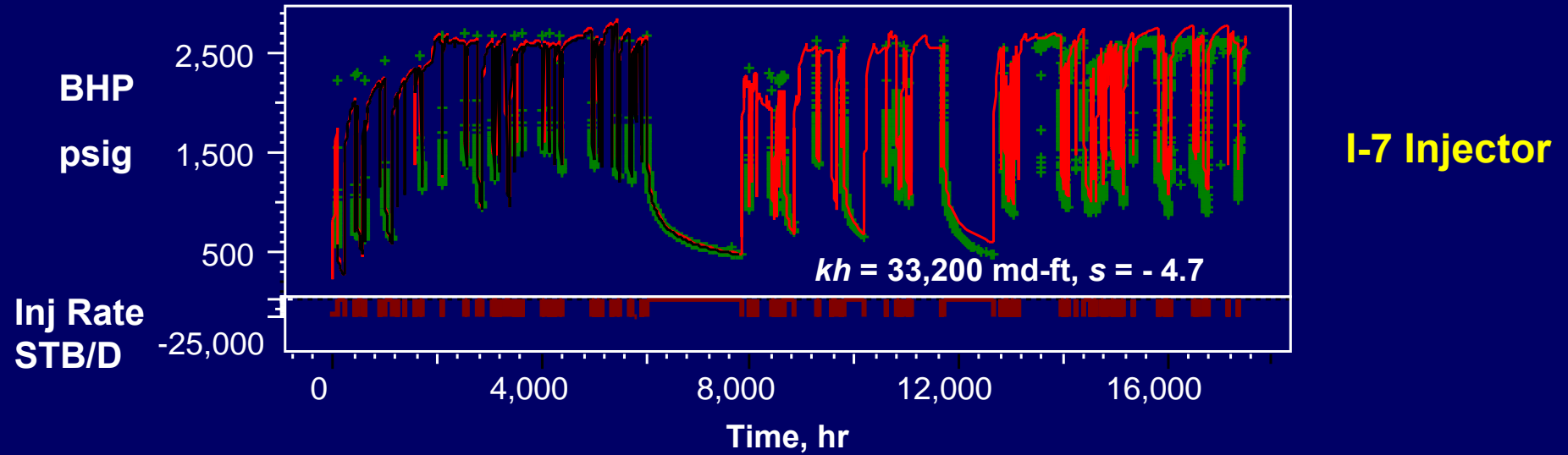


Progressive Plugging Causes HM Divergence

I-7 Injector

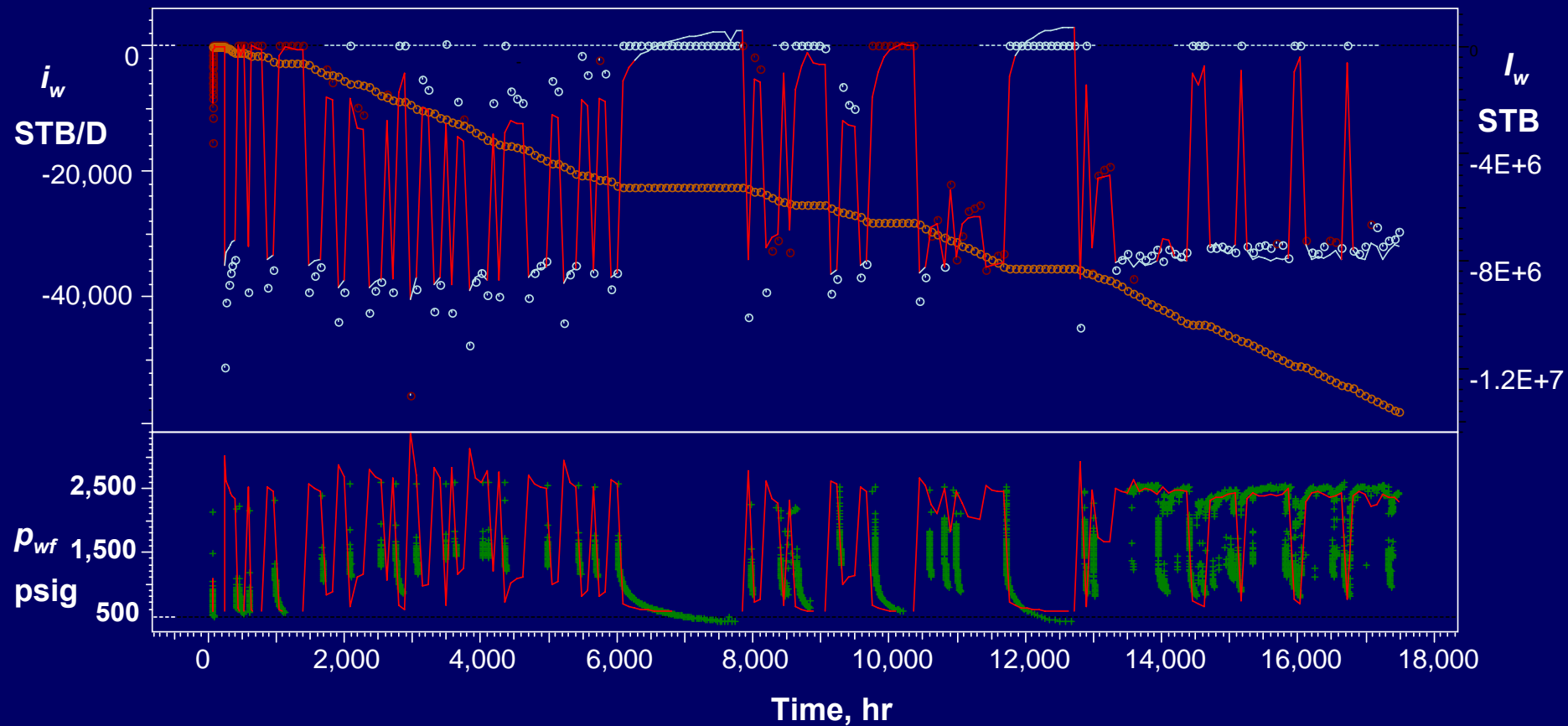


Overall Matching w/Proxy Model

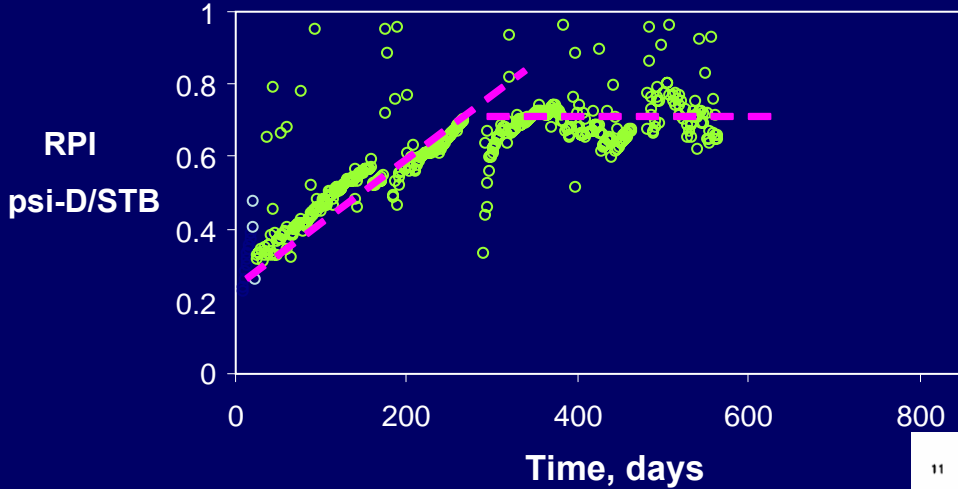


VFM Captures Overall Response

I-7 Injector



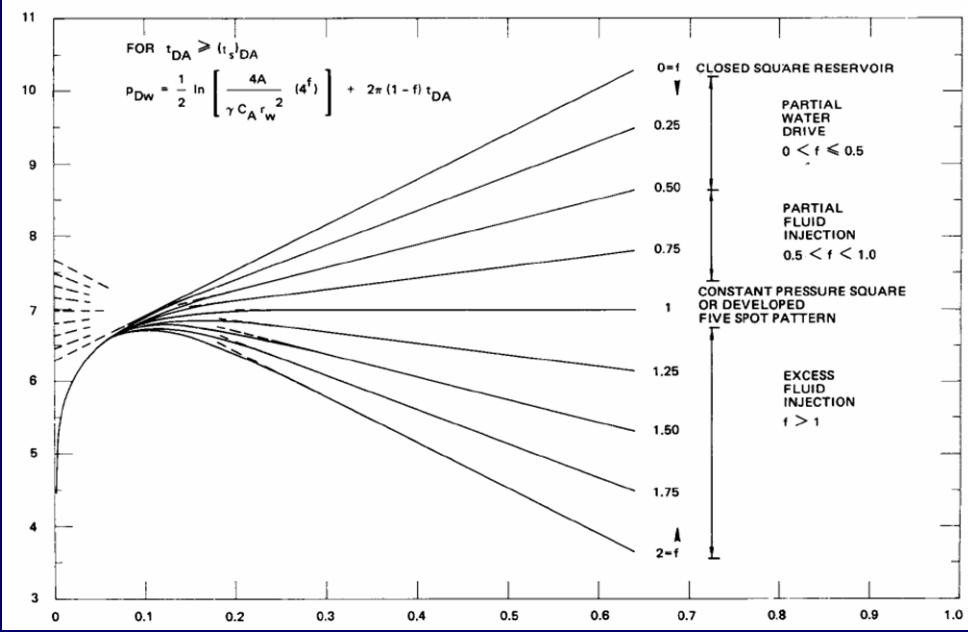
RPI Suggests Lack of Early-Time Pressure Support



P-6 Producer

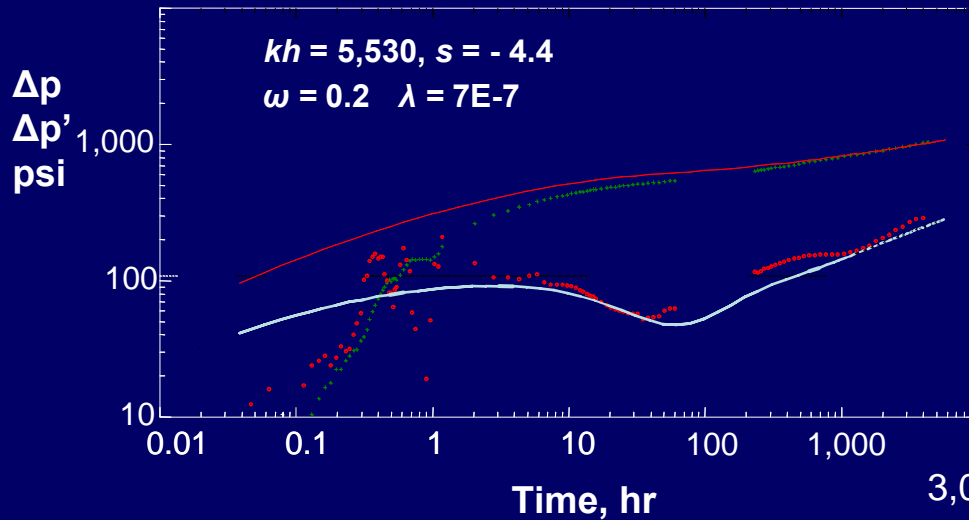
(after Kumar, *JPT*, Nov. 1977)

$$\frac{kh}{141.2 \mu B} \frac{(p_i - p_{wf})}{q}$$

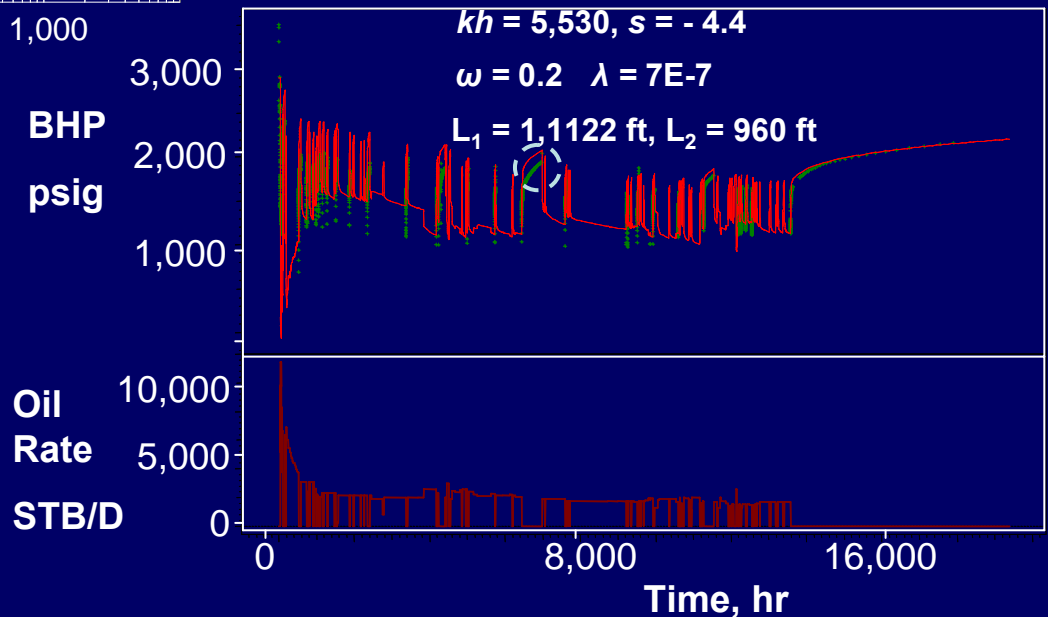


$$2.64 \times 10^{-4} k t / \Phi \mu c_f A$$

Match Quality Suggests Changing BC

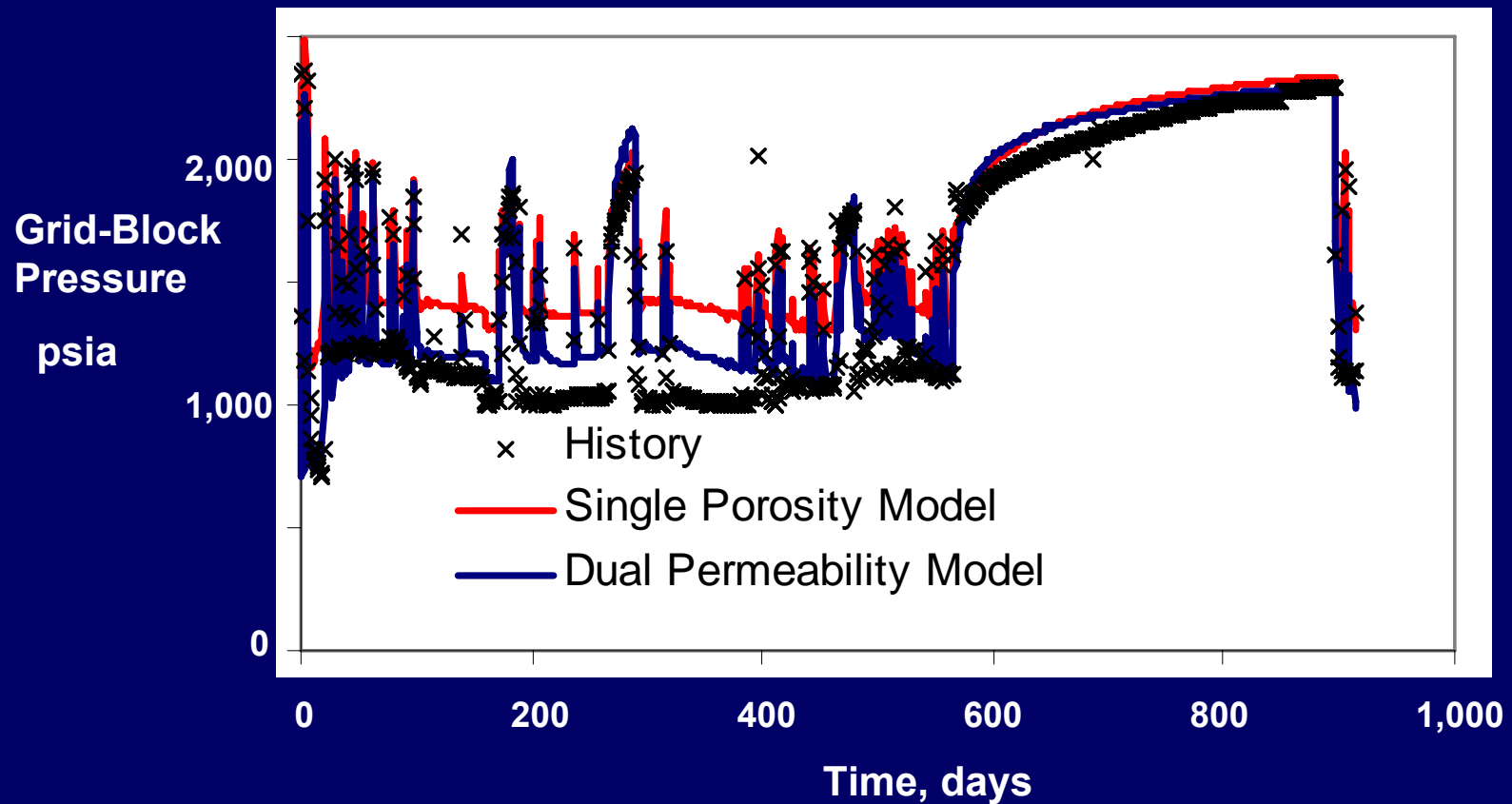


P-6 Producer

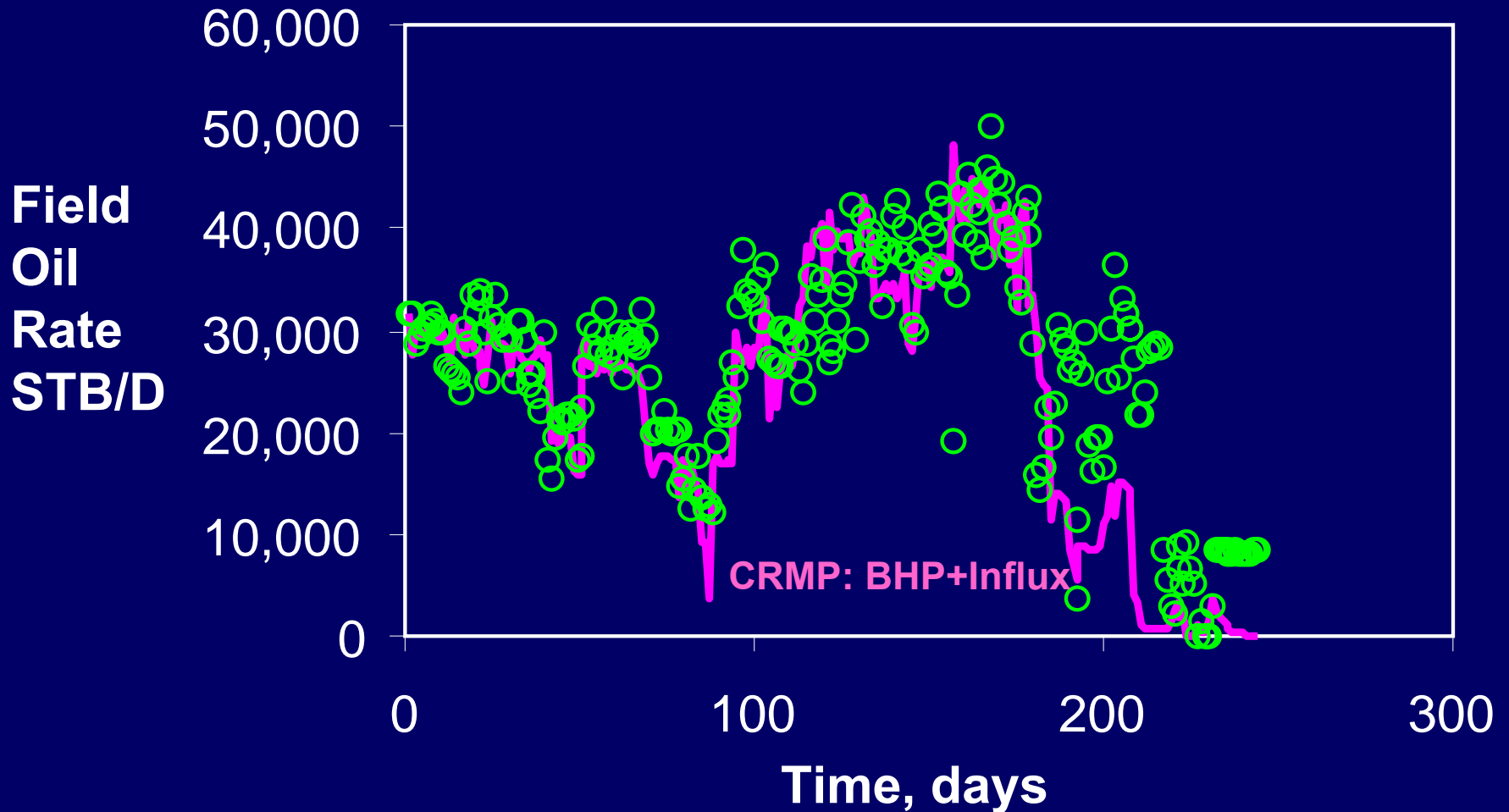


History Match Improved w/PTA-Derived Parameters

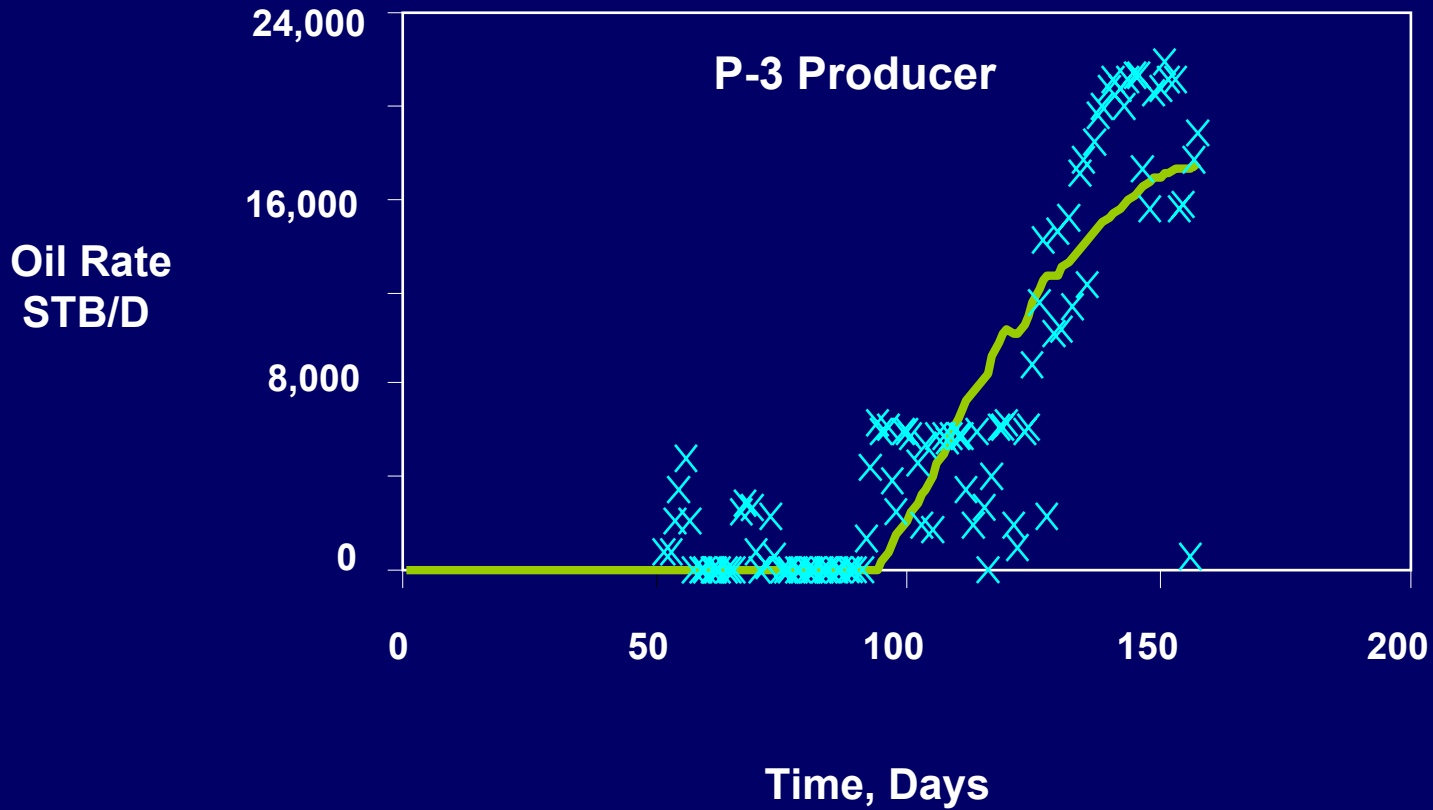
P-6 Producer



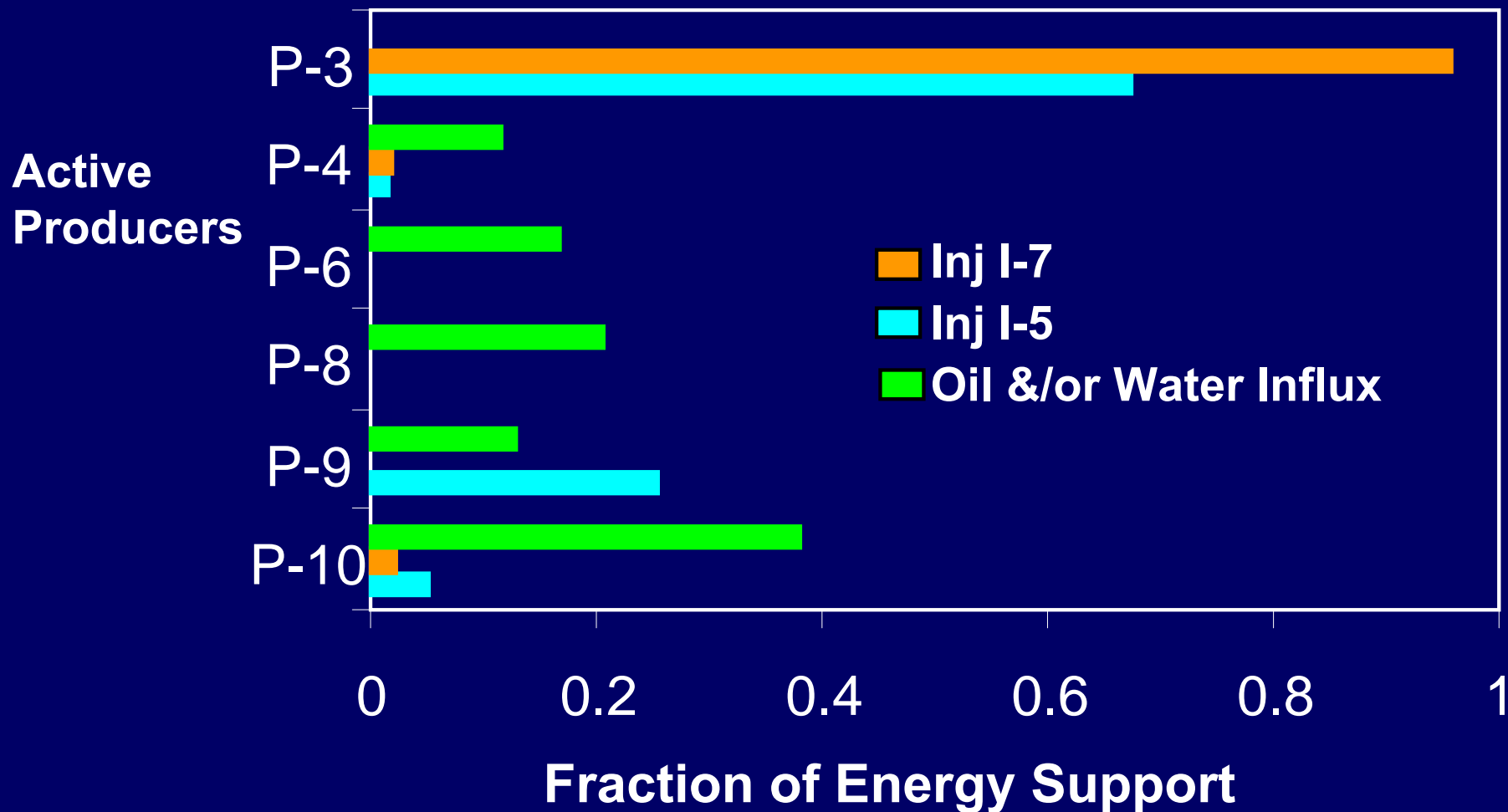
Analysis of Full-Field Data w/CRMP



Analysis of P-3 Well w/CRMP

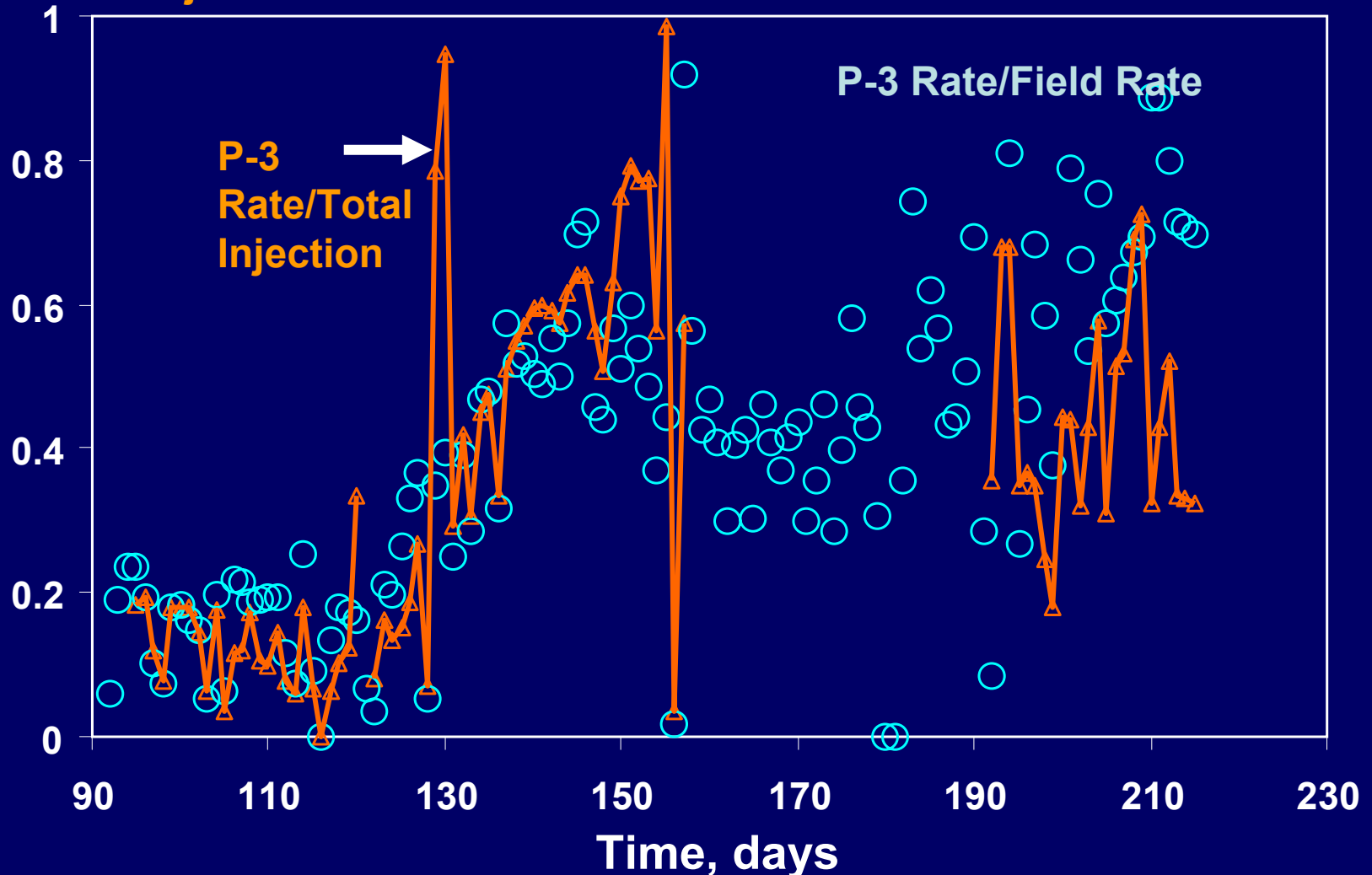


Discerning Producer/Injector Connectivity

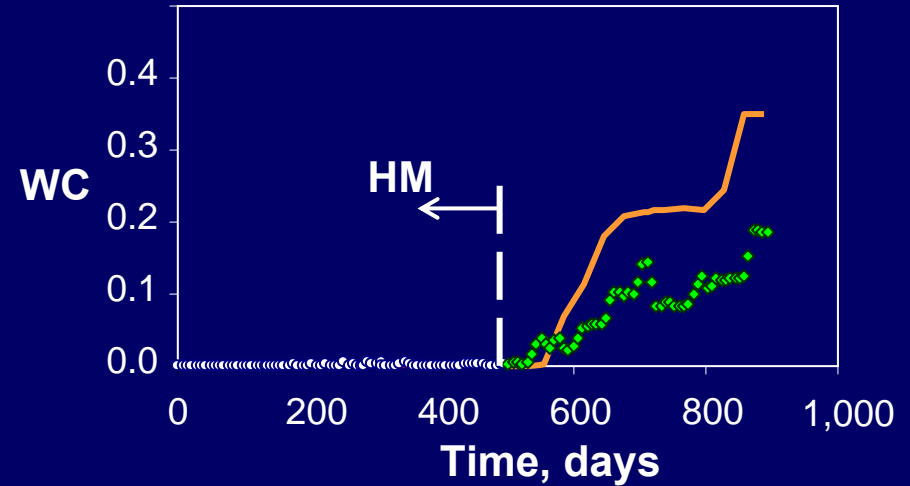
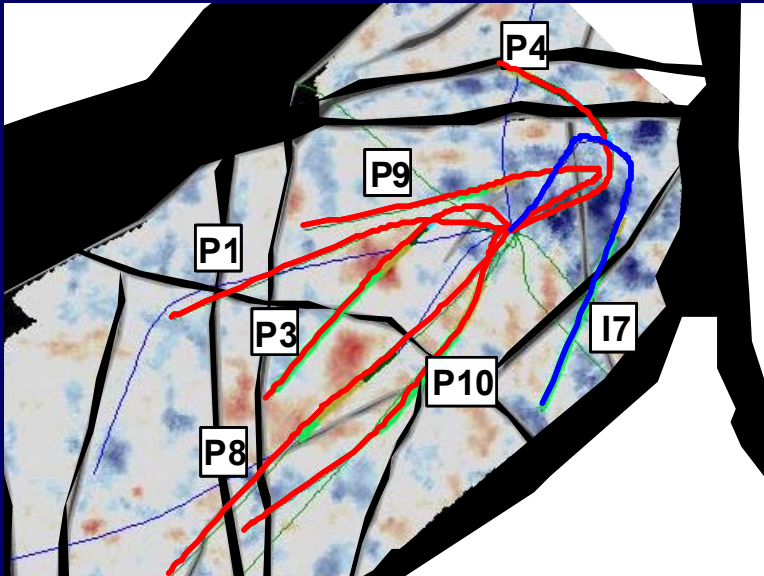


Dominance of P-3 Production Apparent

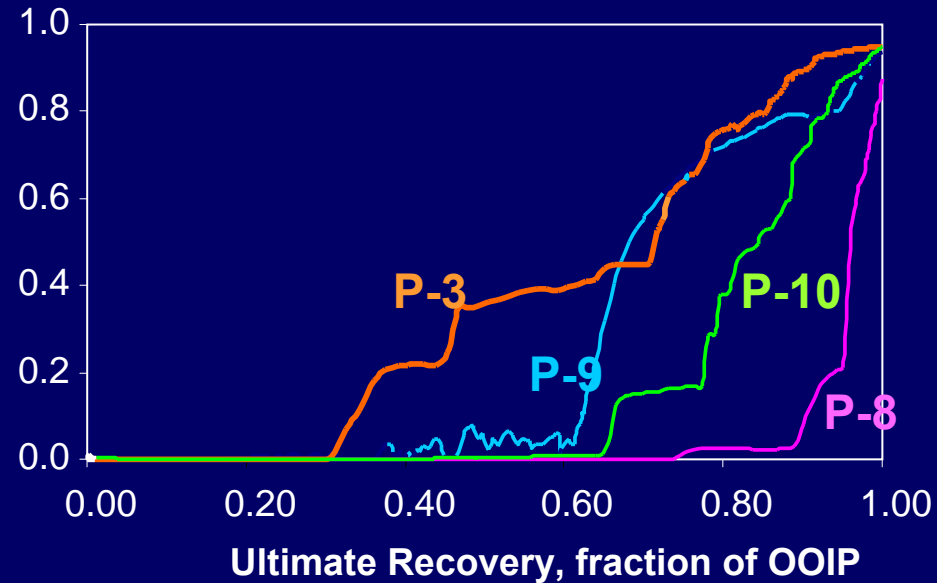
P-3 Oil Rate/Field Oil Rate
P-3 Oil Rate/Total Injection Rate



P-3 Producer Exhibits Early BT in Model



Watercut fraction



Conclusions

- **In NF Reservoirs, Full-Field Simulation Model May be Too Coarse to Diagnose Performance Issues at Well Level**
- **Information Derived From Analytical Tools w/Real-Time Data Complement History-Matching Effort**
- **PTA Suggests That Vertical-Well Proxy Model Appears to Work Well in This NF Reservoir w/Complex Well Architecture**
- **CRM Allowed Understanding of Preferred Flow Path Between Injector/Producer Pair Even Before Breakthrough**

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Q & A