Project
Workshop

Algebraic Oil

Genova, April 2009

Production Allocation Problem

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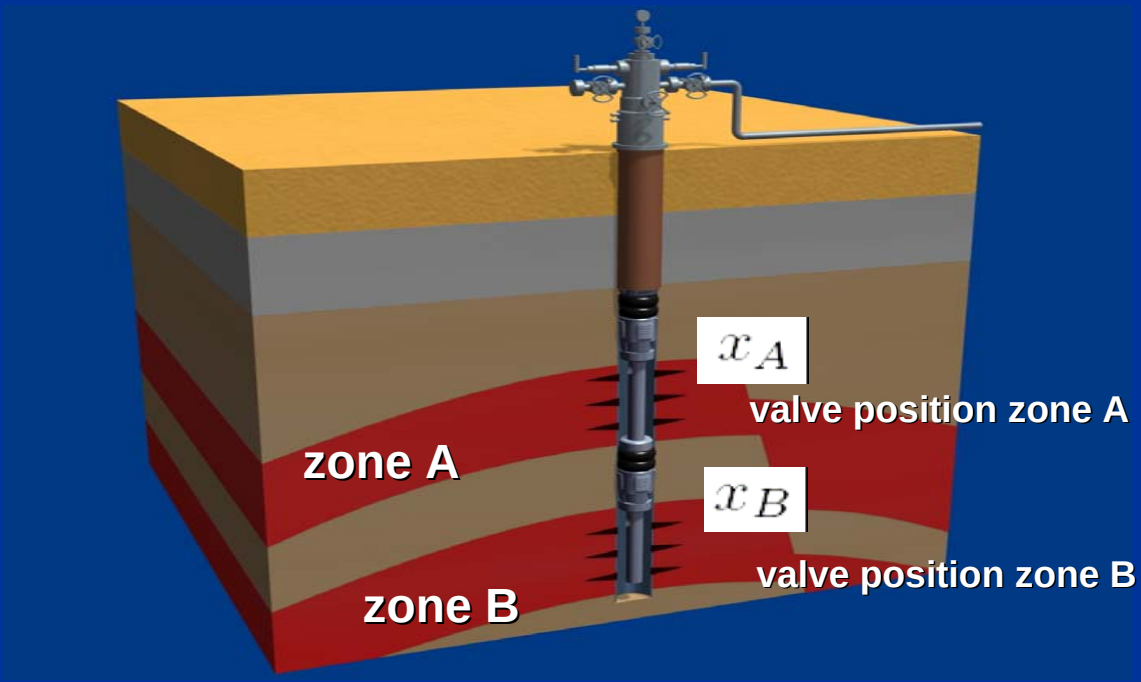
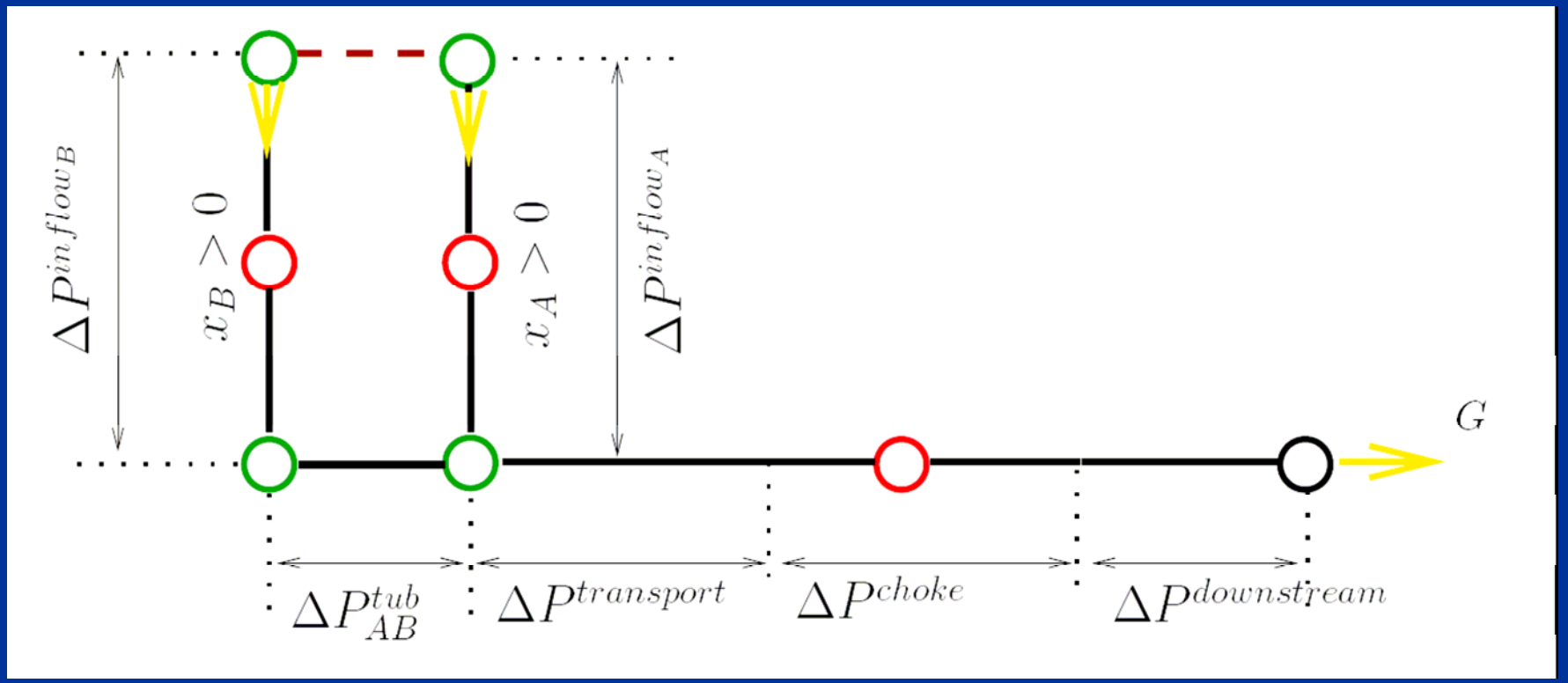

x_A
valve position zone A
zone A
x_B
valve position zone B
zone B


ΔP^{inflow_B}
$x_B > 0$
$x_A > 0$
ΔP^{inflow_A}
G
ΔP^{tub}_{AB}
$\Delta P^{transport}$
ΔP^{choke}
$\Delta P^{downstream}$

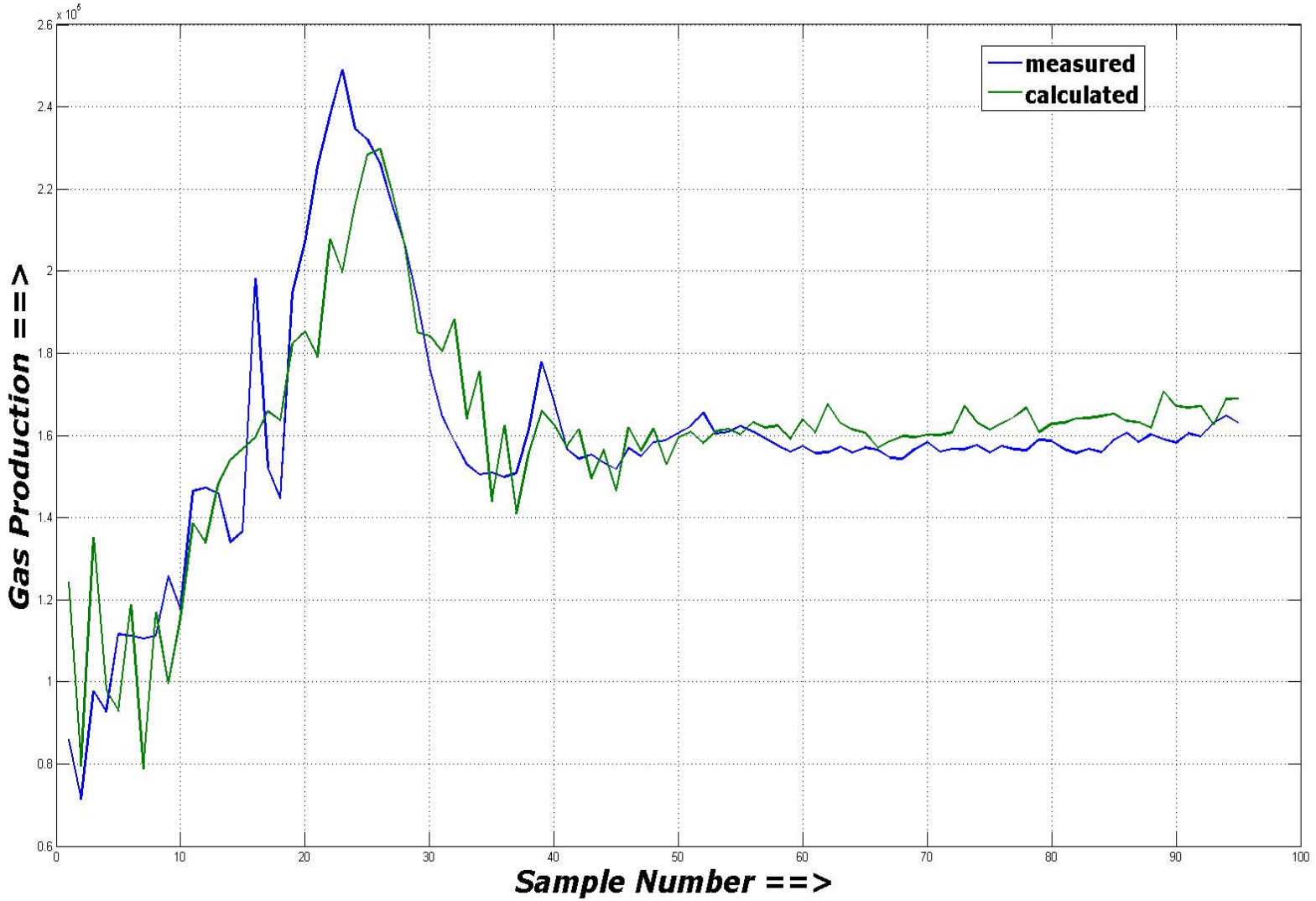
$$G_{AB} = (\,1 + X_B \mathcal{G}^A_{AB}) G_A + (1 + X_A \mathcal{G}^B_{AB}) G_B$$

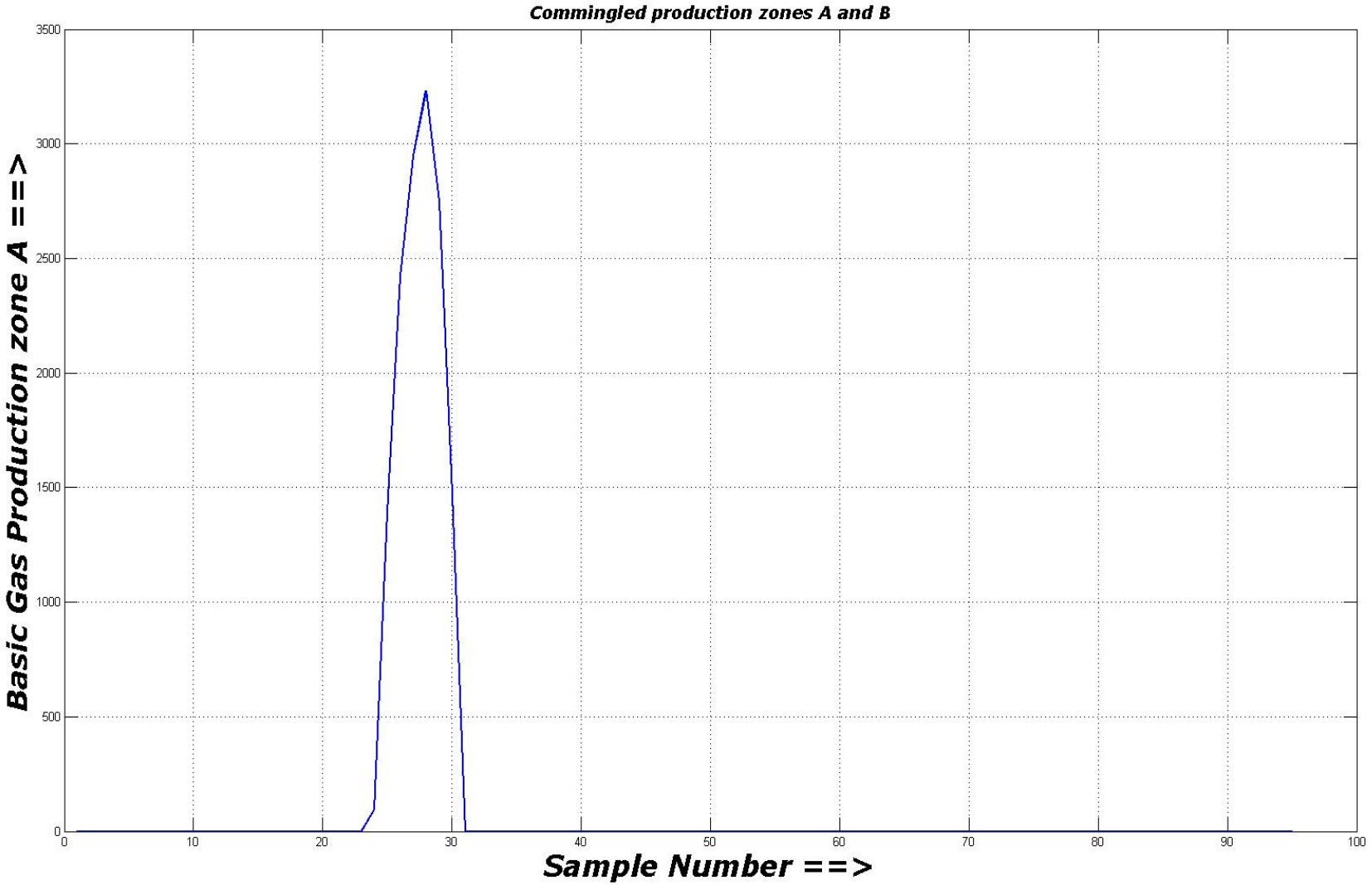
$$\mathcal{G}^A_{AB} = (\,0.00936338 FLP^{upstream}_{choke} - 0.02685802 P^{tubing}_B + 479.81002630)$$

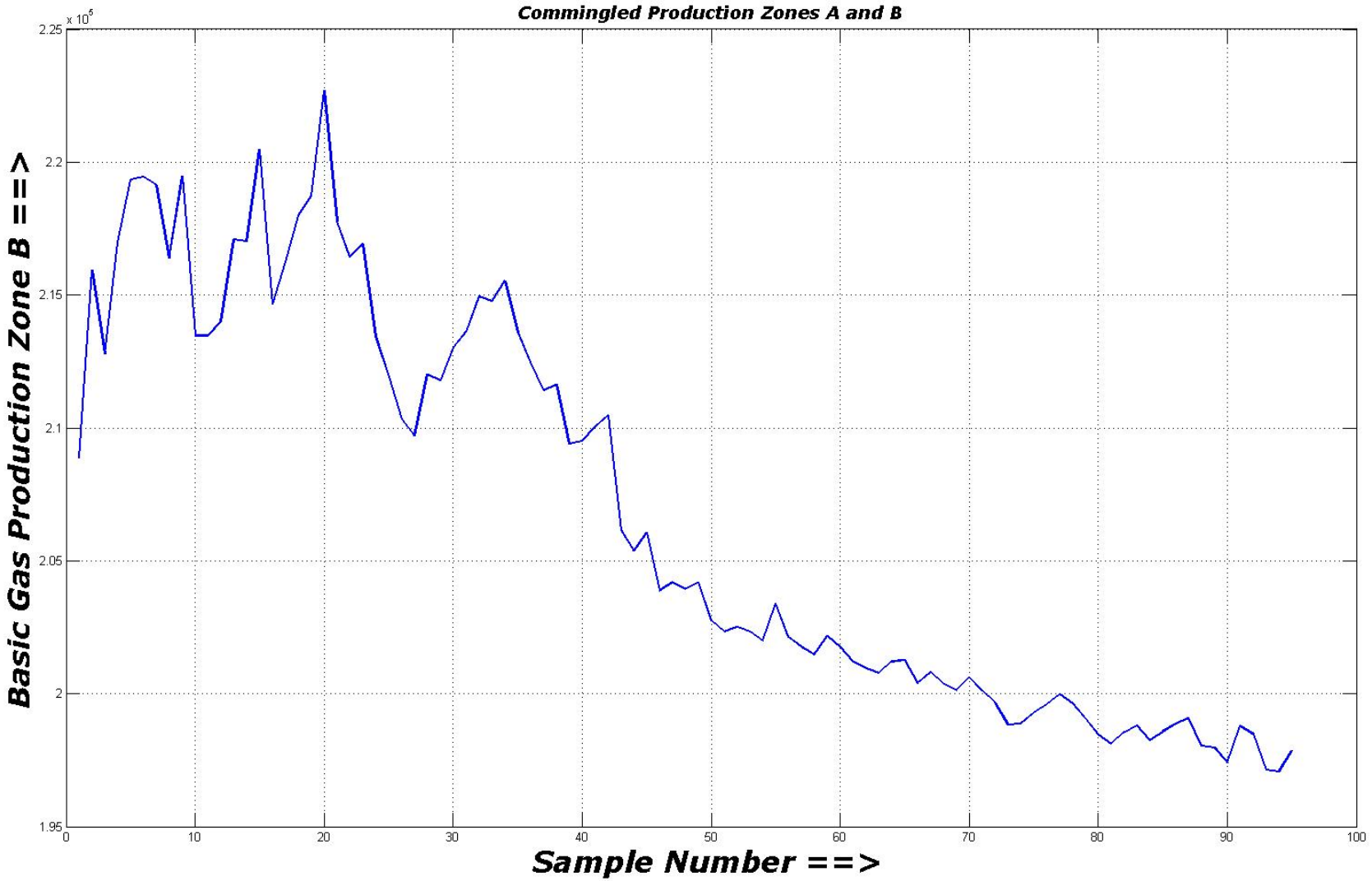
$$\mathcal{G}^B_{AB} = (\,-0.00032810 THP + 0.00027423 P^{annulus}_A + 0.00005697 P^{tubing}_B + 0.00001399 P^{annulus}_B - 0.49189729)$$

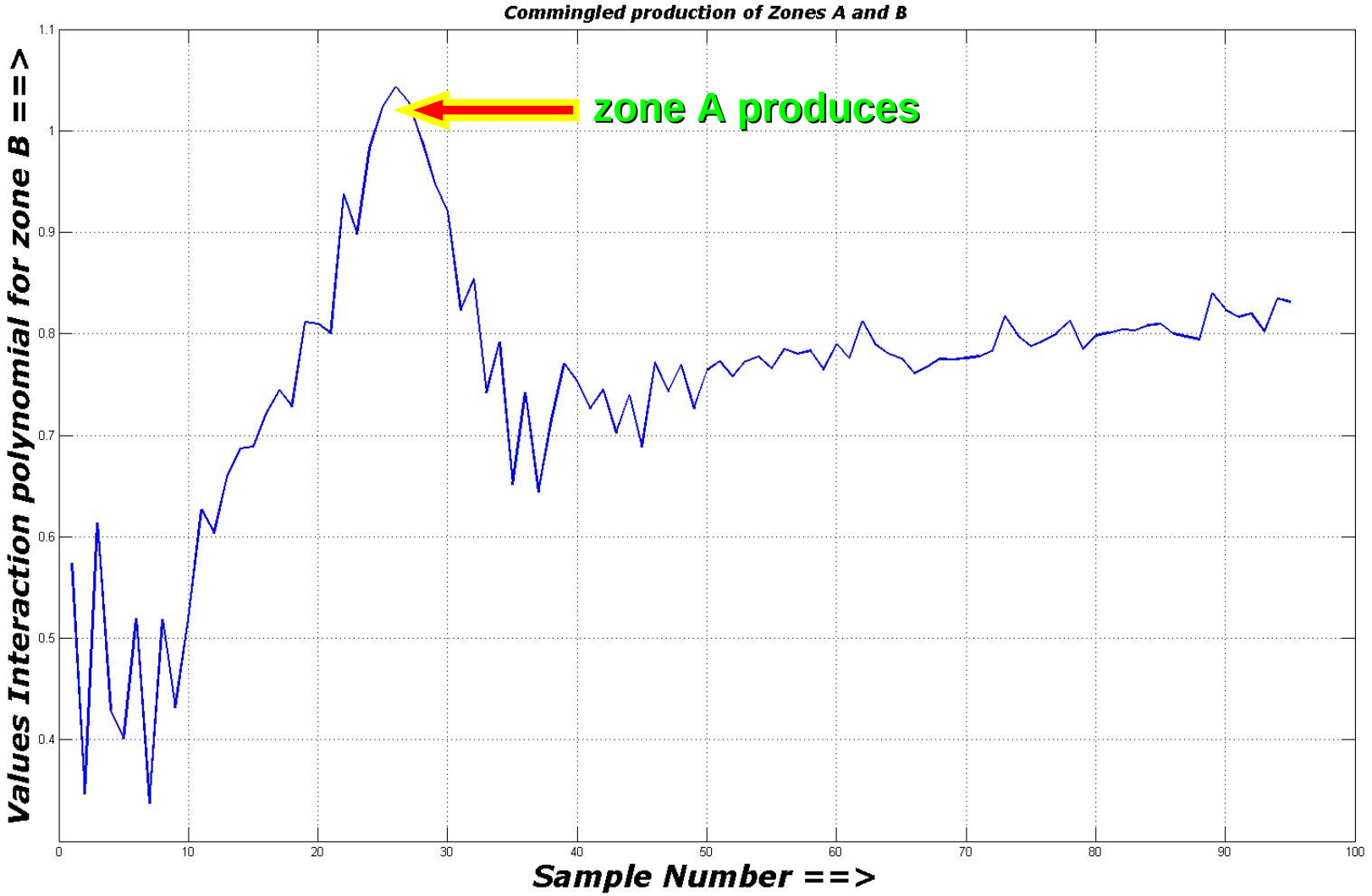
$$\begin{aligned} G_A = (\,& 0.00198656 X_A \Delta P^{inflow}_A - 0.00002134 \Delta P^{choke} \Delta P^{inflow}_A + 0.00003942 \Delta P^{transport} \Delta P^{inflow}_A \\ & + 0.00003417 (\Delta P^{inflow}_A)^2 - 14.86965269 X_A - 0.18256926 \Delta P^{choke} - 0.16504280 \Delta P^{transport} \\ & - 0.86316846 \Delta P^{inflow}_A + 4455.27330792) X_A \end{aligned}$$

$$\begin{aligned} G_B = (\,& -0.00008676 \Delta P^{transport} \Delta P^{inflow}_B - 0.00582431 \Delta P^{tubing}_{AB} \Delta P^{inflow}_B + 0.00001043 (\Delta P^{inflow}_B)^2 \\ & - 143.26658678 X_B + 5.70413606 \Delta P^{downstream} - 0.23547857 \Delta P^{choke} - 0.20924248 \Delta P^{transport} \\ & + 9.97975914 \Delta P^{tub}_{AB} + 4.11146747 \Delta P^{inflow}_B + 13010.64089330) X_B \end{aligned}$$


x 10^5
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0
10
20
30
40
50
60
70
80
90
100
measured
calculated
Gas Production ==>
Sample Number ==>


Commingled production zones A and B
Basic Gas Production zone A ==>
Sample Number ==>
3500
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
90
100


Commingled Production Zones A and B
x 10^6
2.25
2.2
2.15
2.1
2.05
2
1.95
0
10
20
30
40
50
60
70
80
90
100
Basic Gas Production Zone B ==>
Sample Number ==>


Commingled production of Zones A and B
zone A produces
Values Interaction polynomial for zone B ==>
Sample Number ==>
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0
10
20
30
40
50
60
70
80
90
100

Thank you