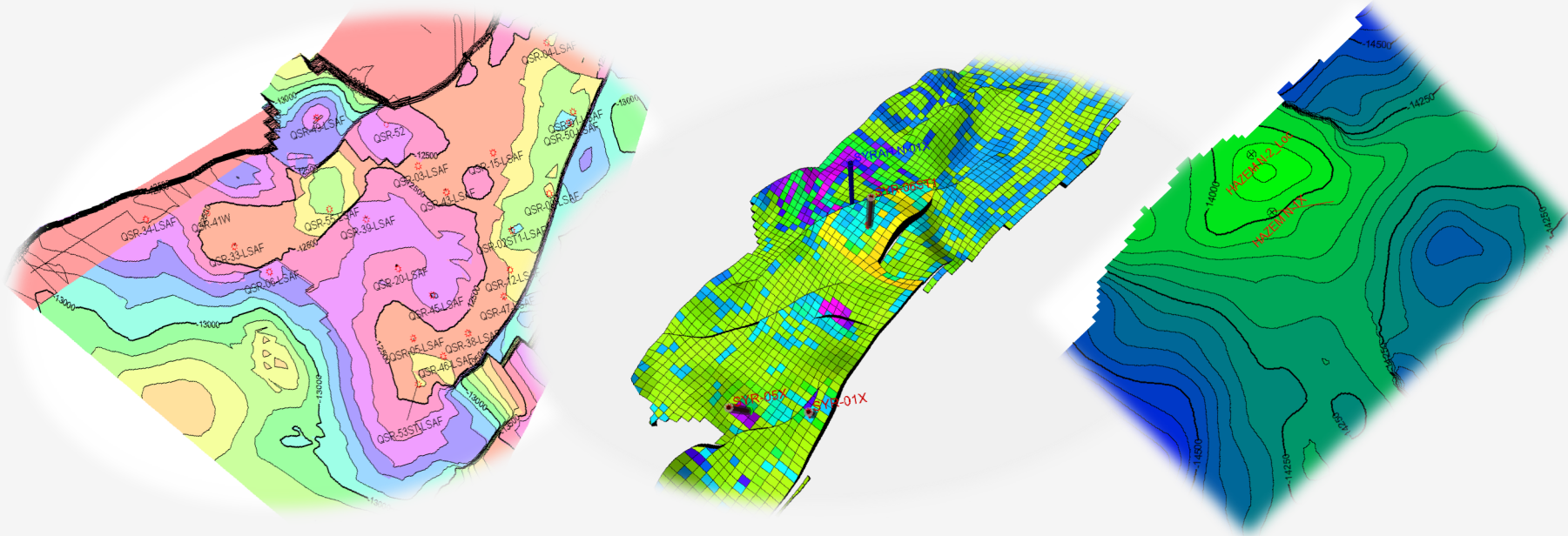




Integrated Asset Modeling

“Network, Compressors and Coupling Modeling of the Huge QASR field using Petrel User Defined Keywords”



SIS Global Forum 2019

Ahmed Adel

Reservoir Simulation Team Leader

Outlines

- Introduction
- Study Objectives
- Challenges
- Workflow
- Conclusions
- Way Forward

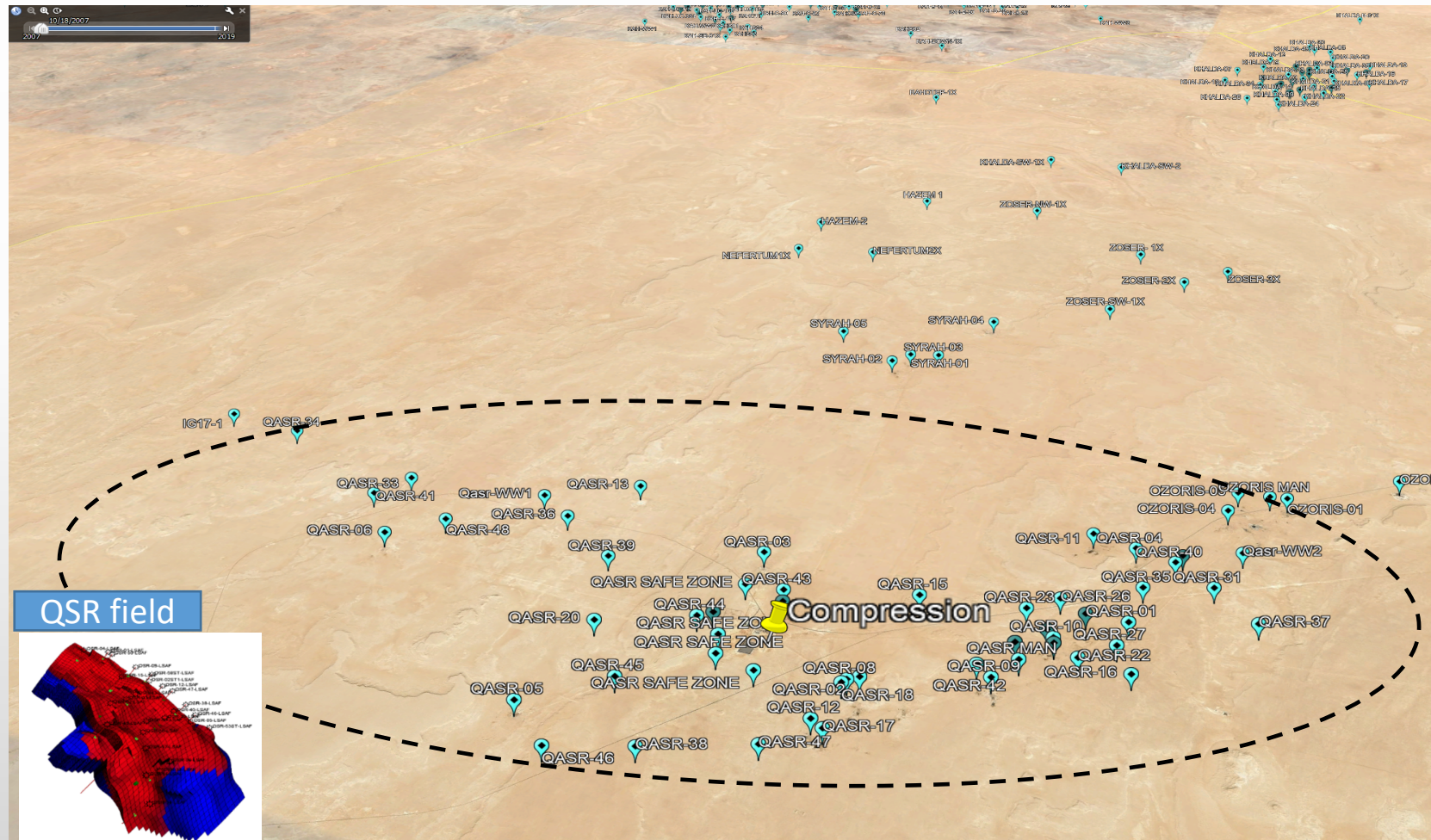
Khalda Petroleum Company

- First Production in 1983 from Egypt western desert
- J.V. (Apache and EGPC)
- 14 concessions
- 350 fields
- 2800 wells
- Current production: 150 MSTB/day and 700 MMSCFD



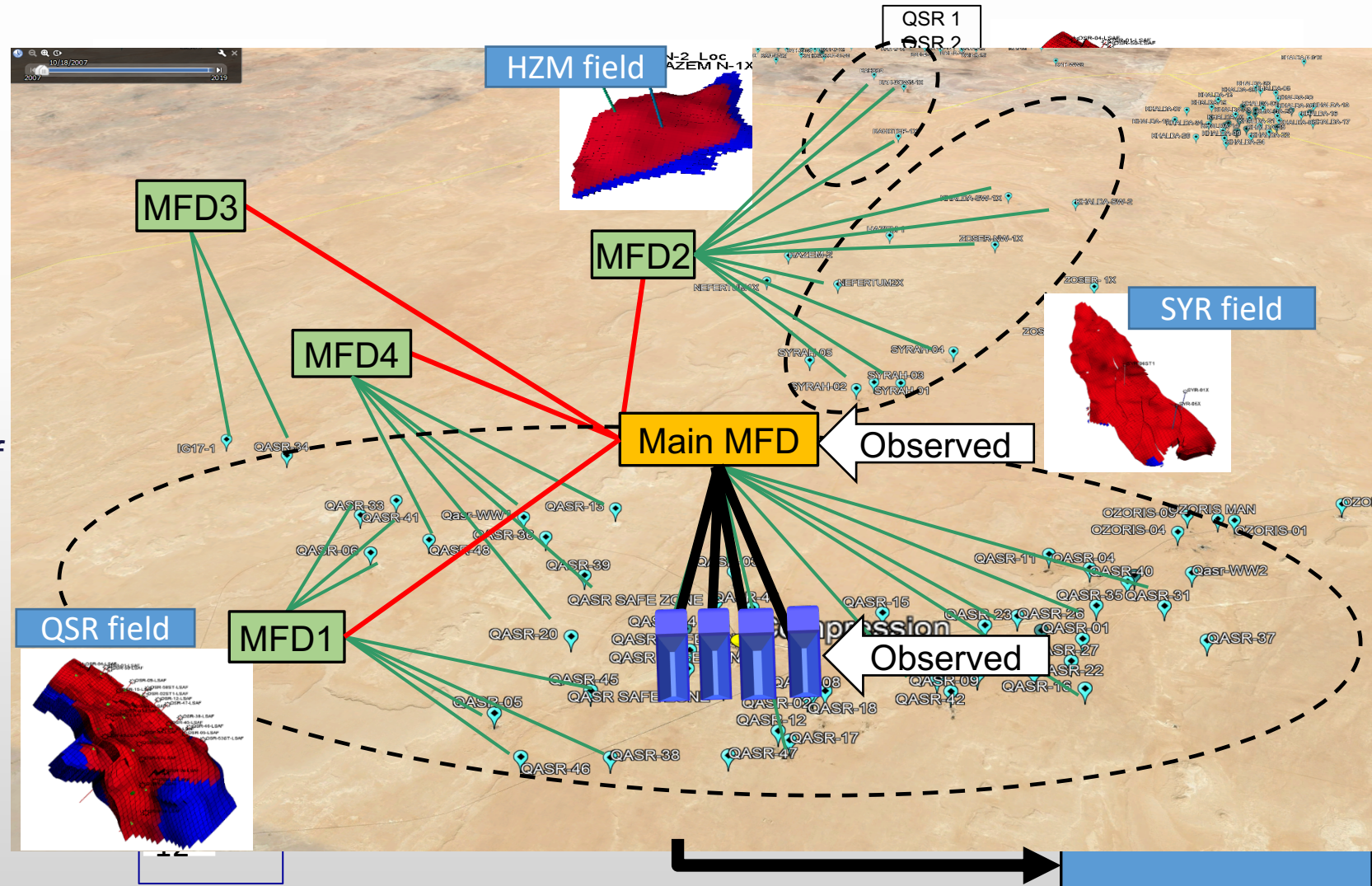
QASR Field

- Started in 2003 with 800 MMSCFD and about 35000 STBC/day
- Safa reservoir, Jurassic age
- Current production 400 MMSCFD
- Contain 27 wells



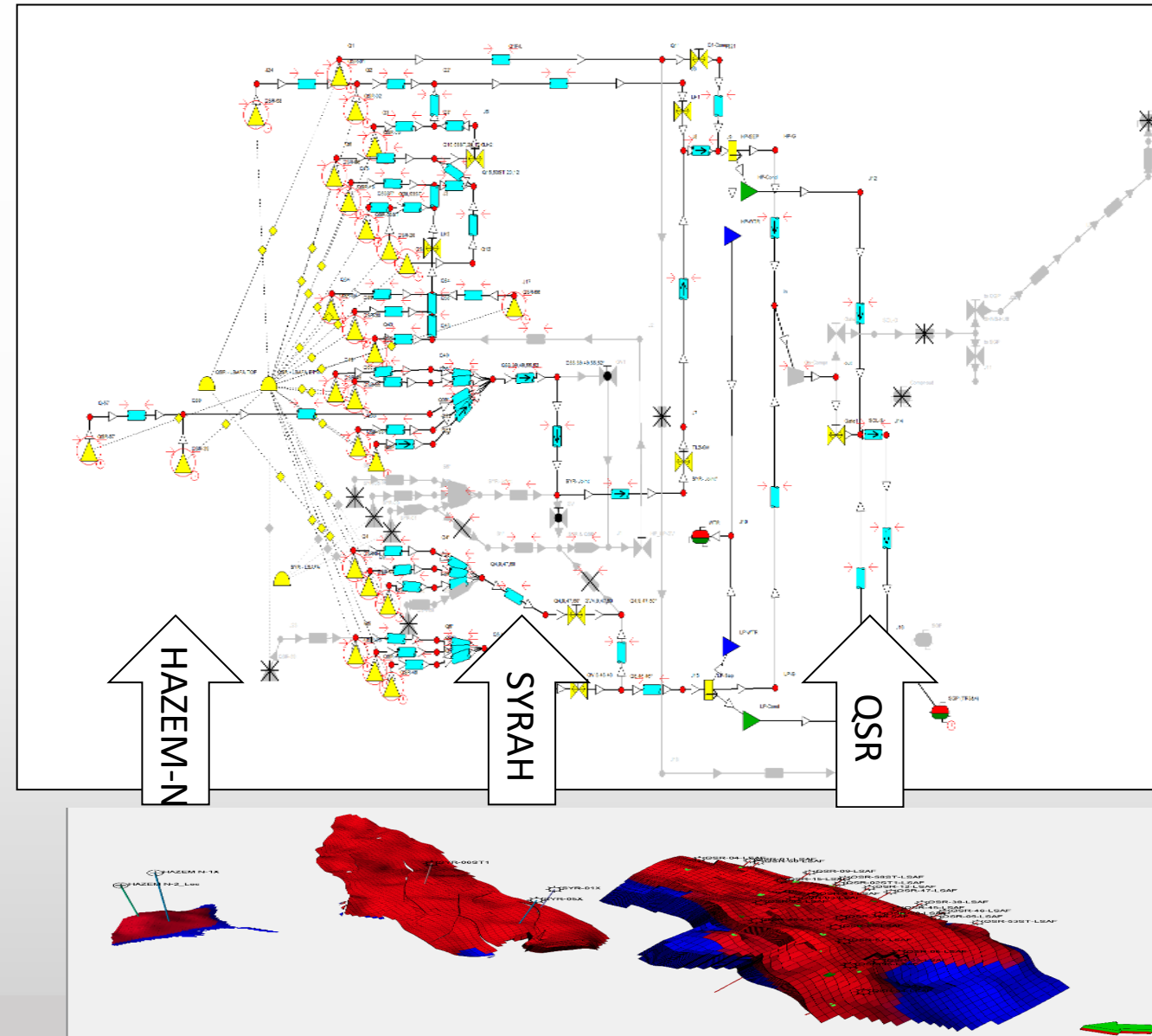
Study Objectives

- Model the surface communication between the three fields
- Model the compression system
- Predict the production performance of the Huge Qasr field to do economical analysis



Challenges

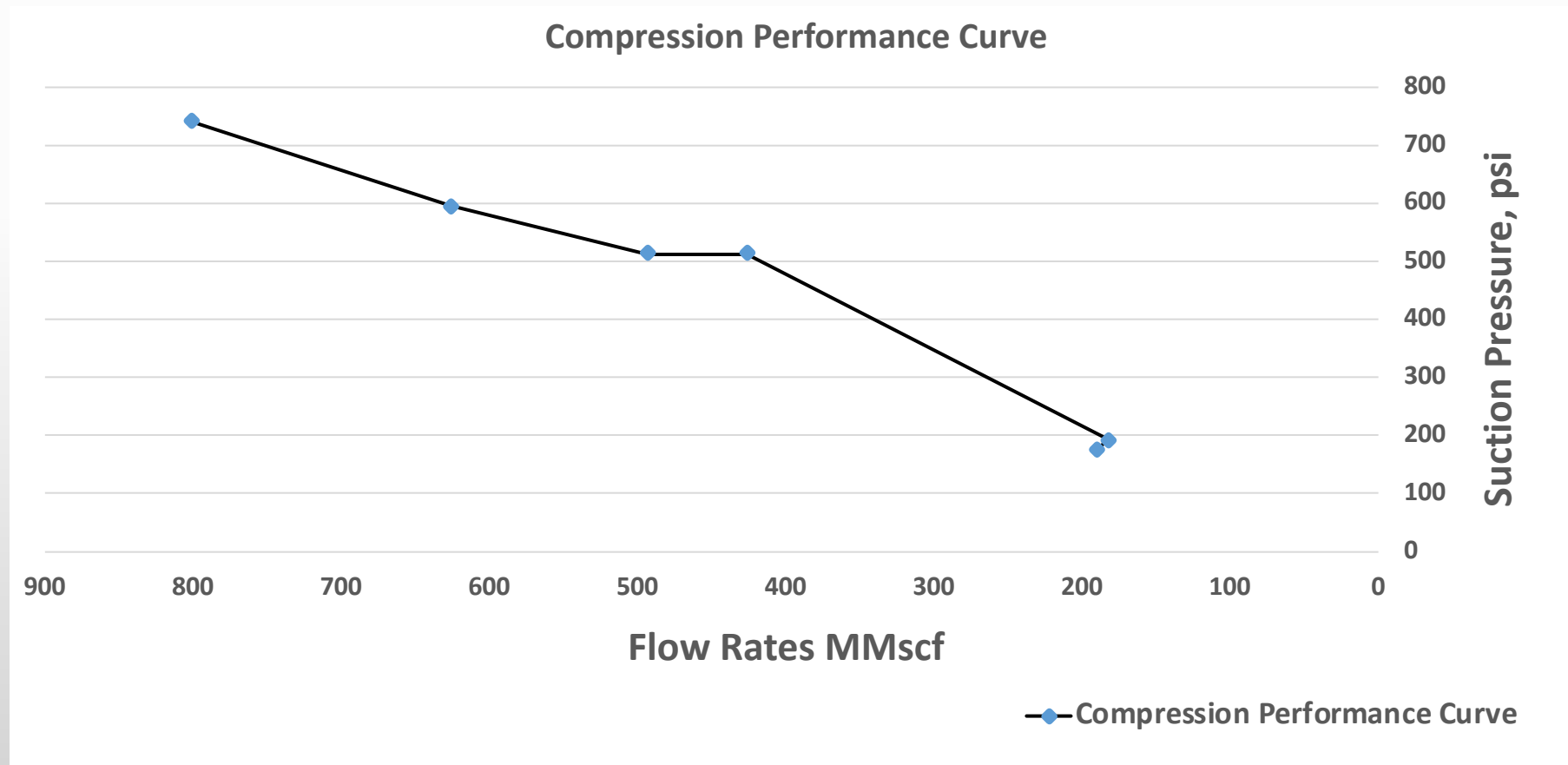
- The three fields have three separate simulation models.
- The network is very complex, as it has many branches.
- There are no existing modules in Petrel to model the coupling, network nor compressors



Workflow

1- Modeling the compression system

➤ Compression Performance Curve

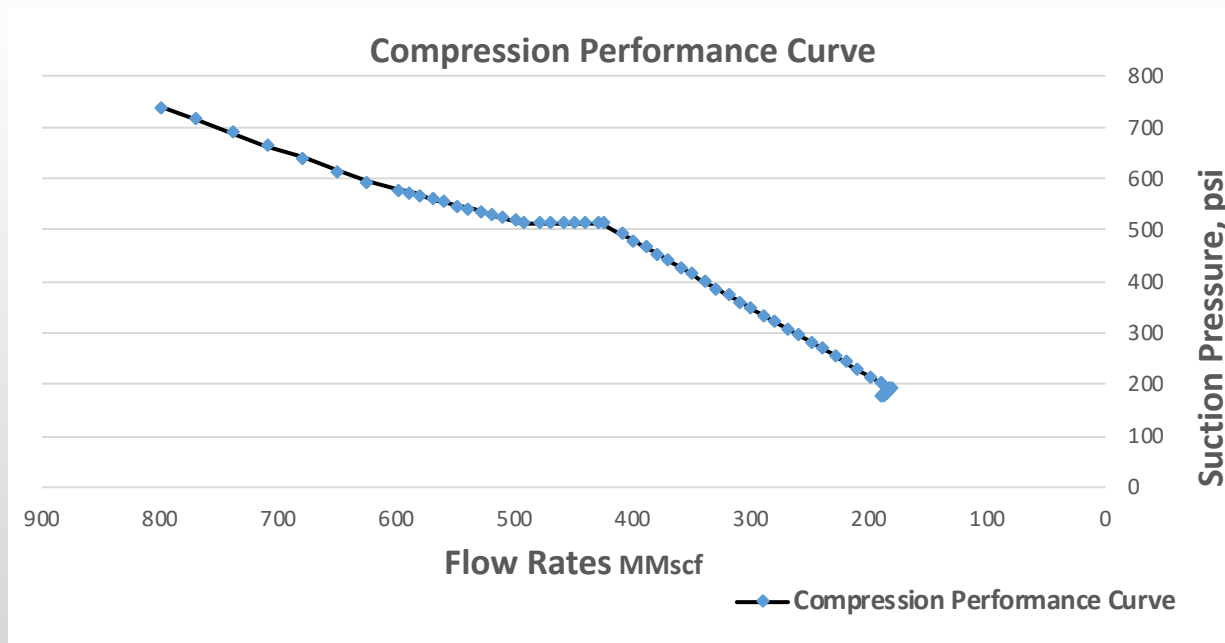


Workflow

1- Modeling the compression system

➤ Implementation

Performance curve interpolation resulted in 58 steps



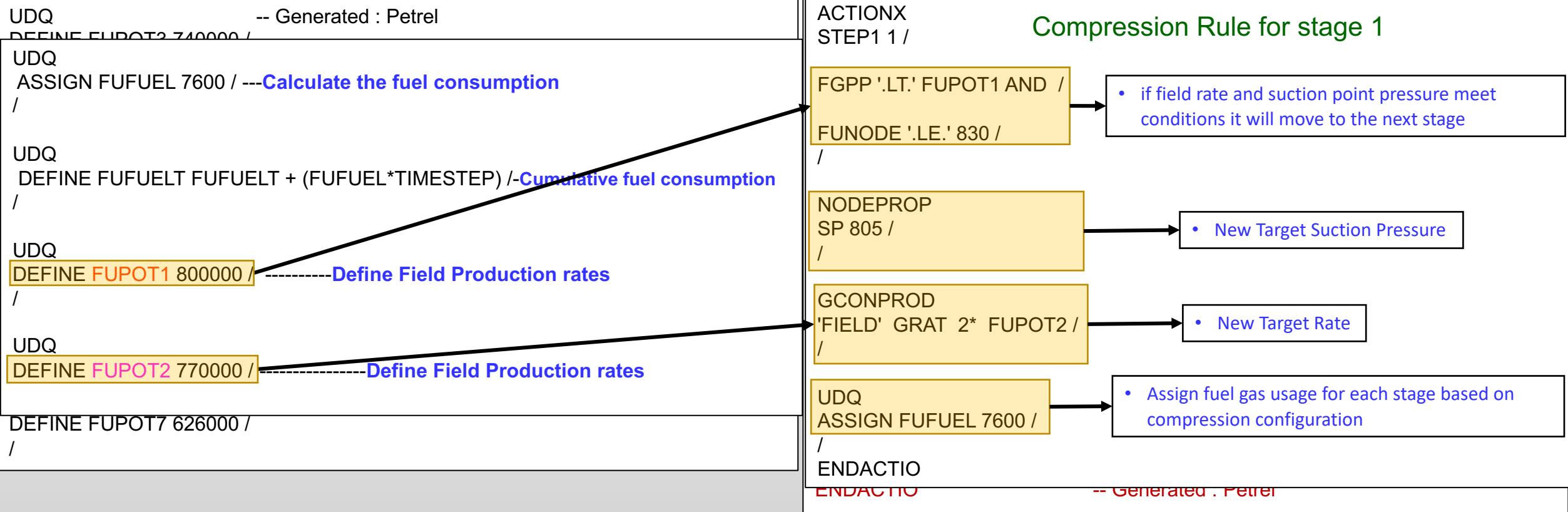
Stage NO.	Configuration	Compressor Suction Pressure (barg)	Average Flowline Inlet Pressure (barg)	Flow (MMscfd)	Compressor Suction Pressure (psia)
1	Parallel	50	50	800	740
2		48		770	715
3		47		740	690
4		45		710	665
5		43		680	640
6		41		650	615
7	Parallel	40	40	626	595
8		39		600	579
9		38		590	573
15		36		530	536
16		36		520	530
17		35		510	524
18		35		500	518
19	Parallel	34	34	493	514
20		34		480	514
24		34		440	514
25		34		430	514
26	Series	34	34	426	514
27		33		410	493
28		32		400	479
29		31		390	466
49		13		190	203
50		12		182	193
51		12		183	191
52		12		184	189
53		12		185	187
54		12		186	185
55		12		187	183
56		11		188	181
57		11		189	179
58		11		190	177

Workflow

1- Modeling the compression system

➤ Implementation

Apply inside Eclipse use the keywords UDAQ and ACTIONX for 58 stages

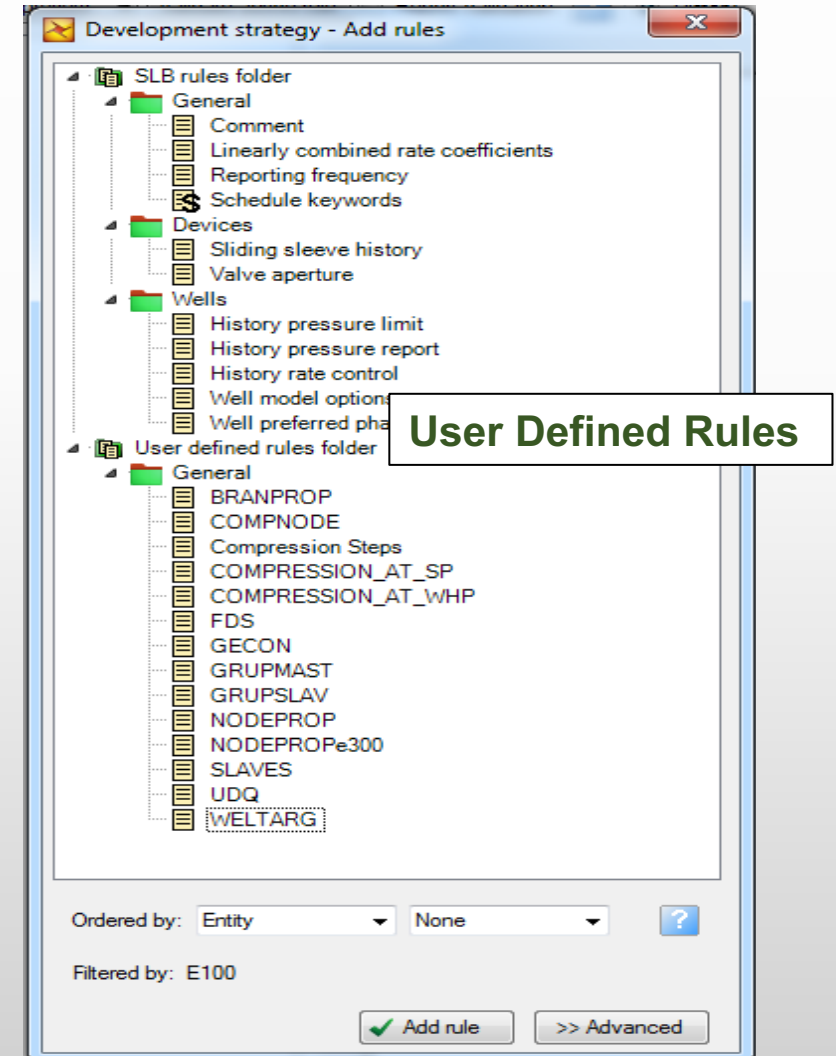


Workflow

2- Use Petrel User defined rules to model Coupling, Network and Compression system

➤ Advantages

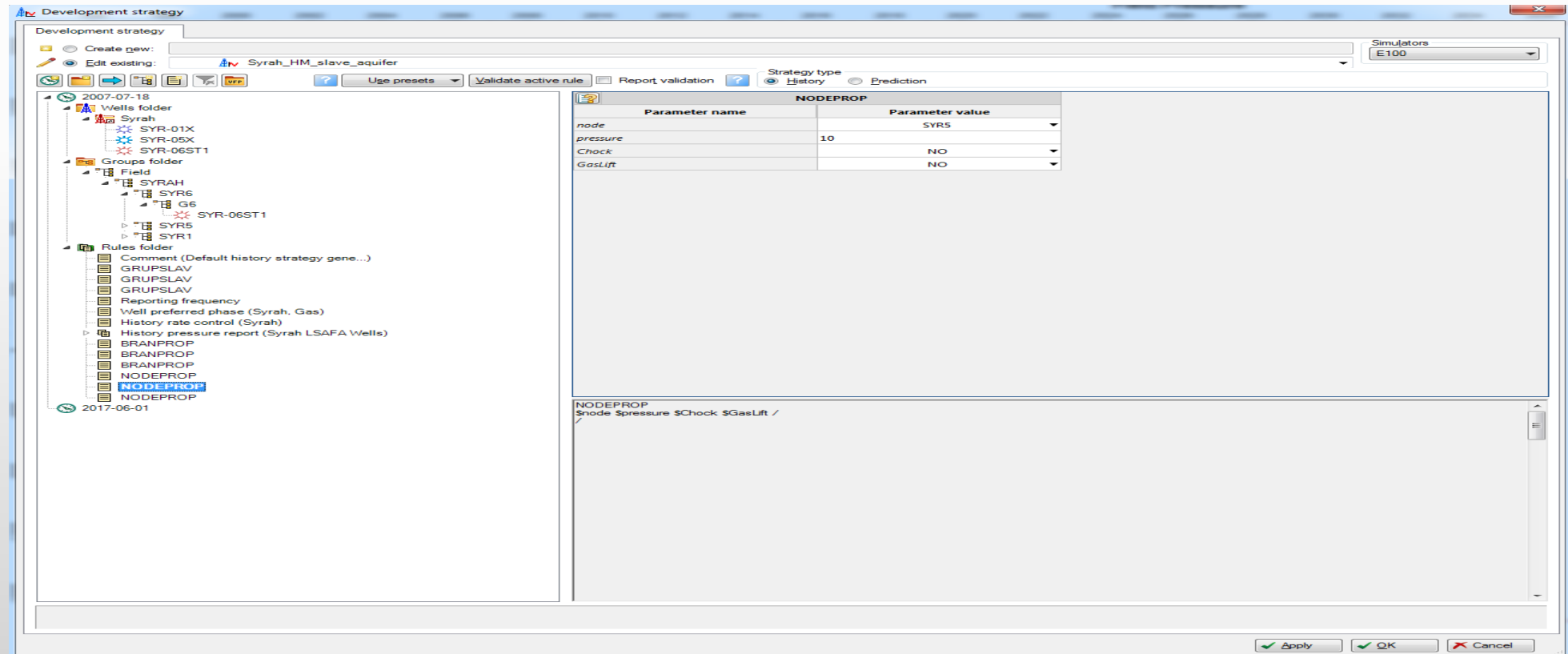
- Saving time by using Petrel interface instead of data file
- Ability to use Uncertainty and Optimization module



Workflow

2- Use Petrel User defined rules to model Coupling, Network and Compression system

➤ Building Extended Network, Branches & Nodes inside Petrel



Workflow

2- Use Petrel User defined rules to model Coupling, Network and Compression system

➤ Building Compression inside Petrel

ACTIONX
STEP3 1 /
FGPP '.LT.' FUPOT3 AND /
FUNODE '.LE.' 780 /
/

-- Generated : Petrel

NODEPROP
SP 755 /
/

-- Generated : Petrel

GCONPROD
'FIELD' GRAT 2* FUPOT4 /
/

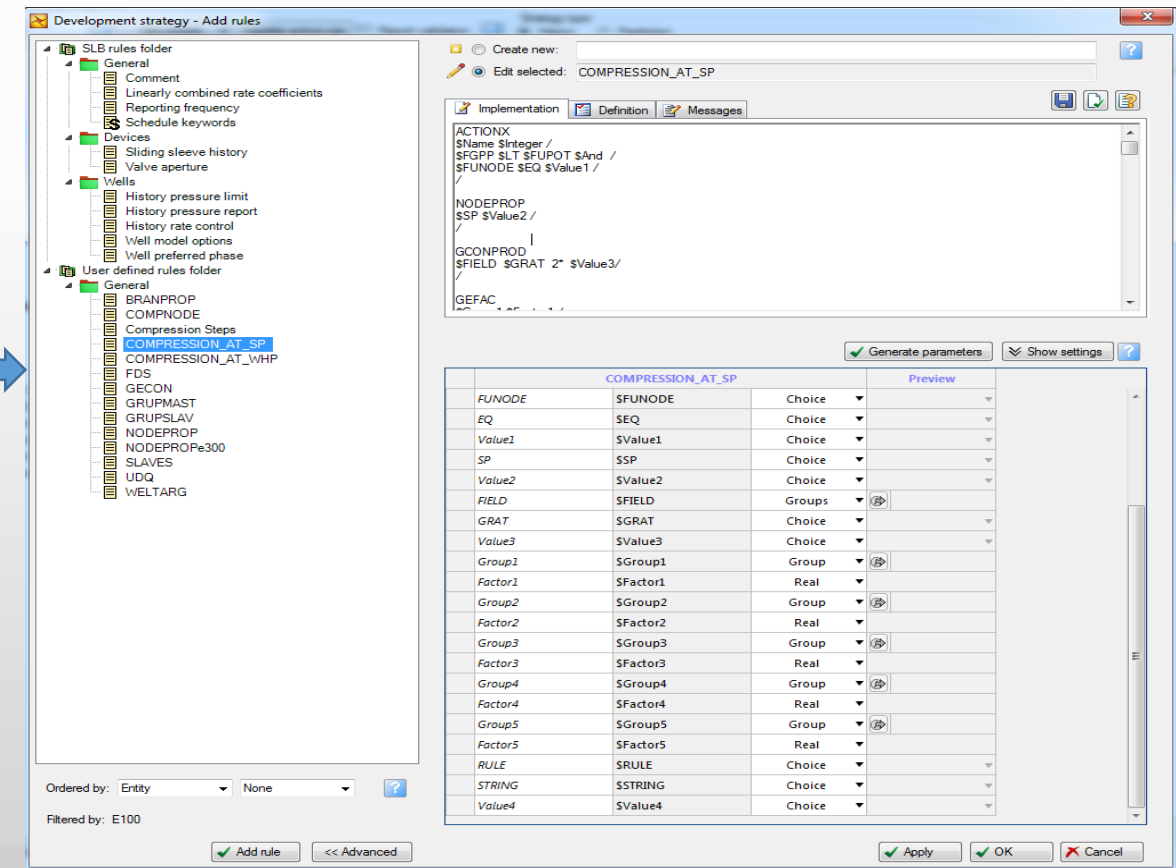
-- Generated : Petrel

UDQ
ASSIGN FUFUEL 7600 /
/

-- Generated : Petrel

ENDACTIO

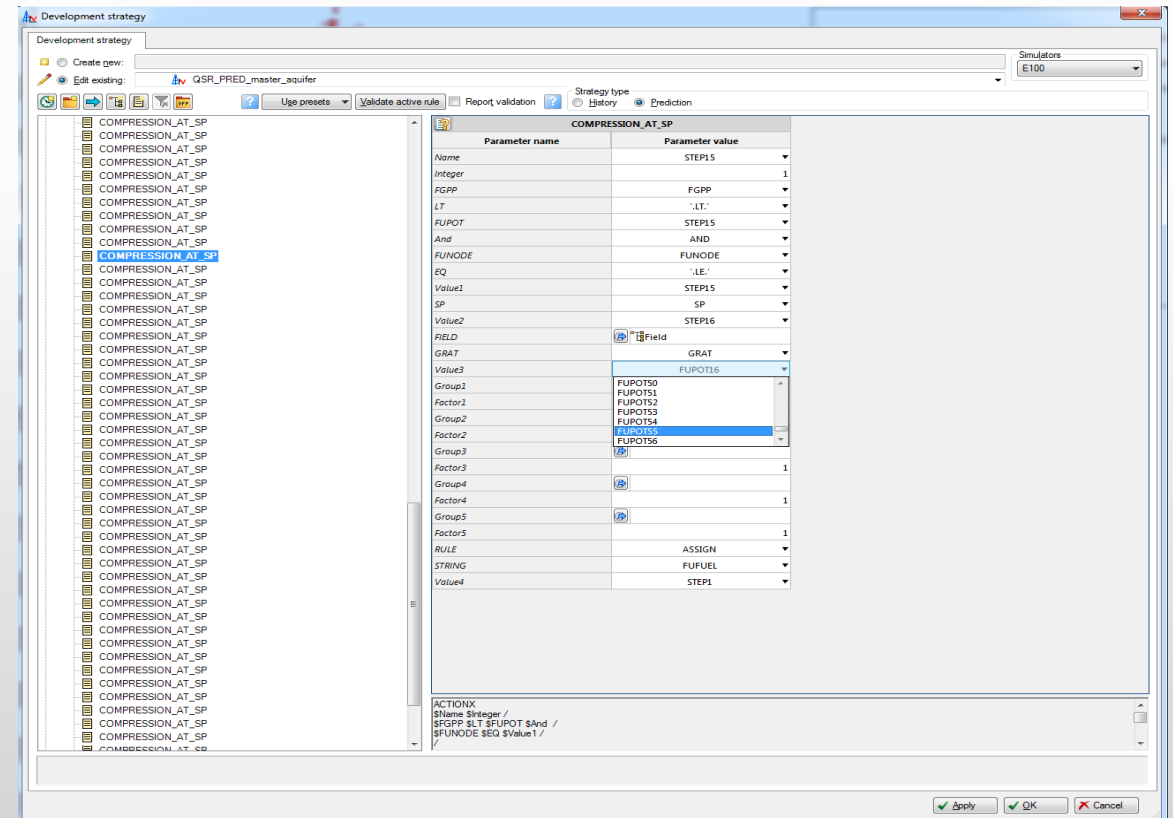
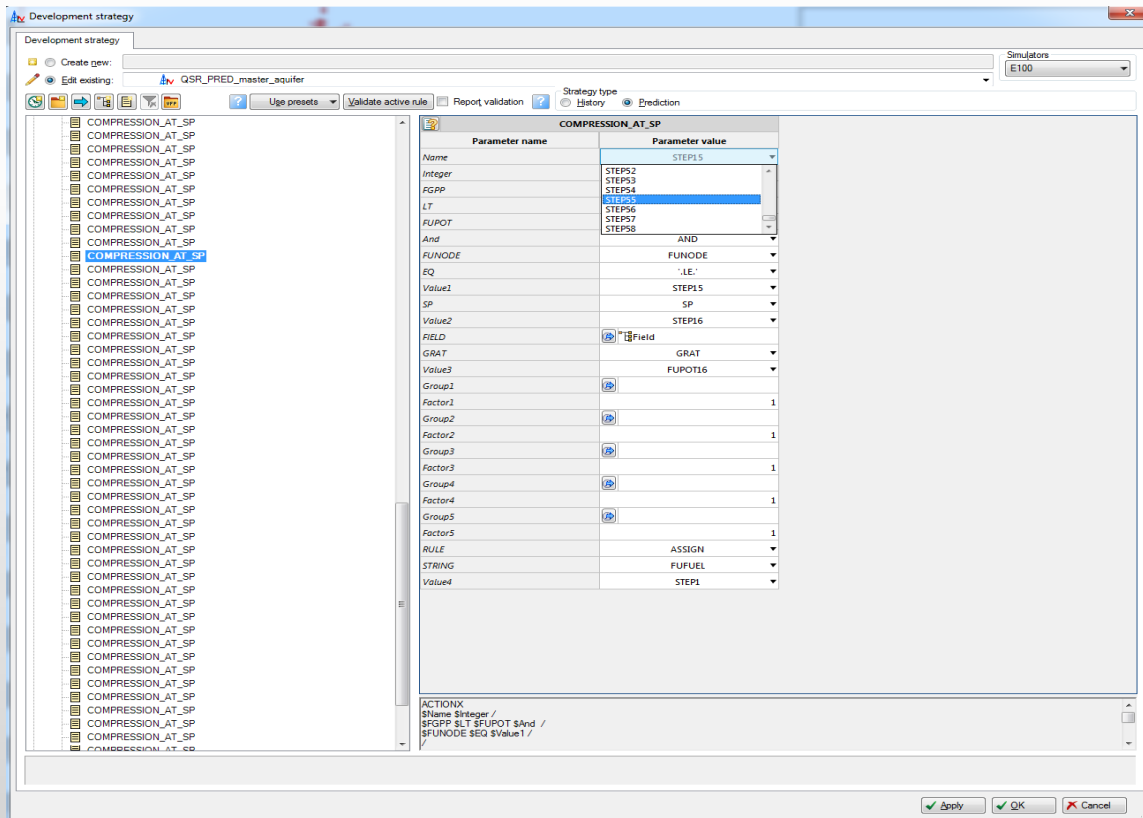
-- Generated : Petrel



Workflow

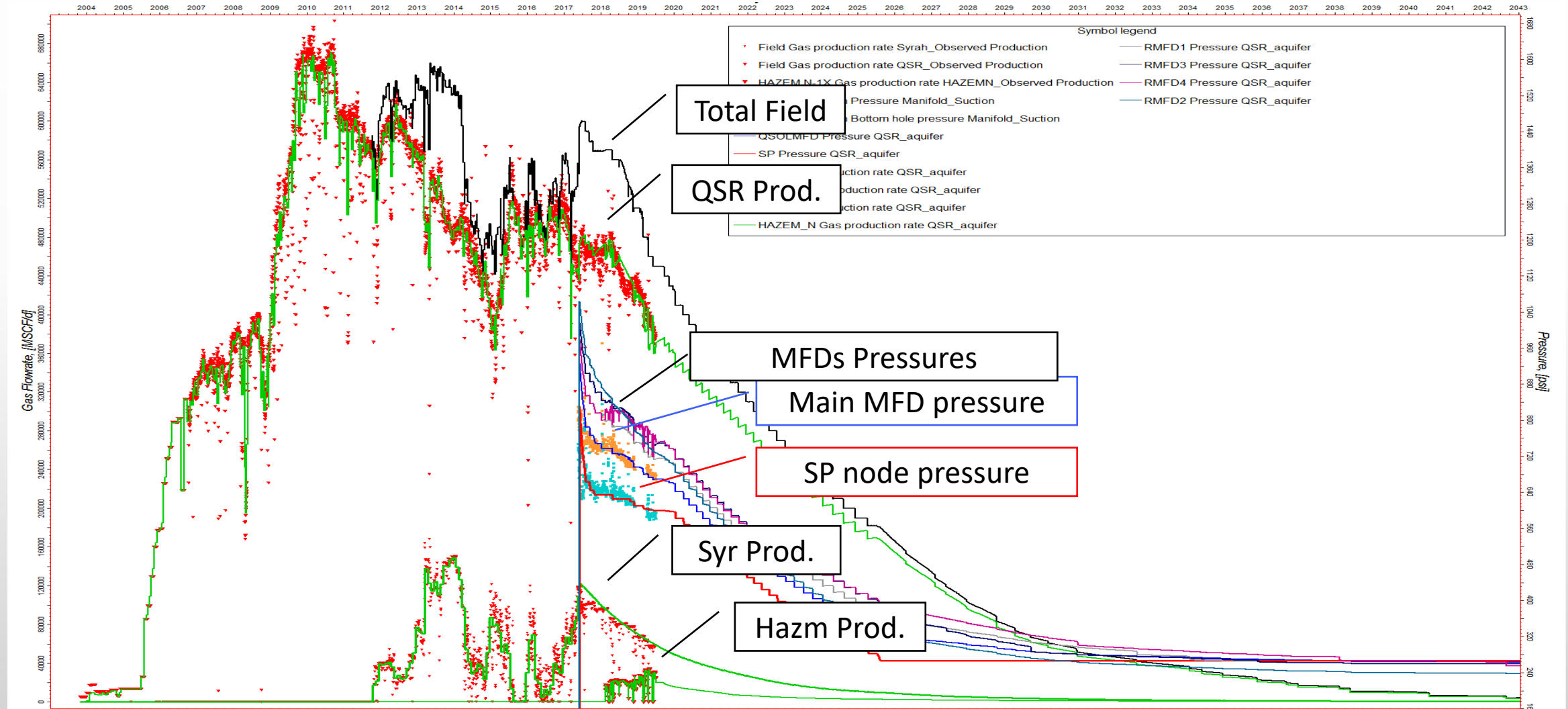
2- Use Petrel User defined rules to model Coupling, Network and Compression system

➤ Building Compression inside Petrel



Conclusions

“History Match”

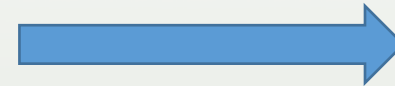


Way Forward Plan

Reservoir Coupling workflows



ECLIPSE Built in
NETWORK





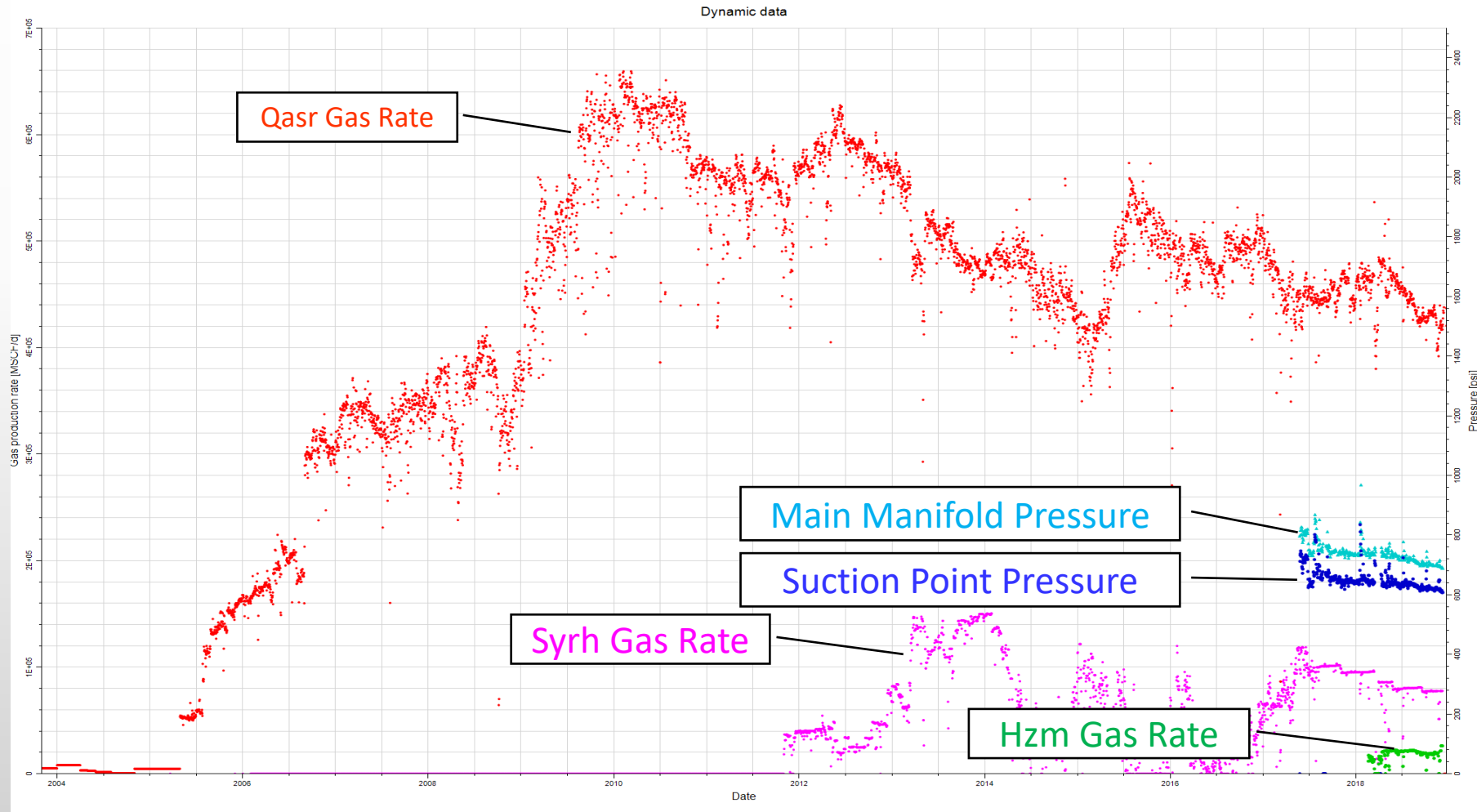
Thanks

Ahmed Adel

KPC Reservoir Simulation Team Leader

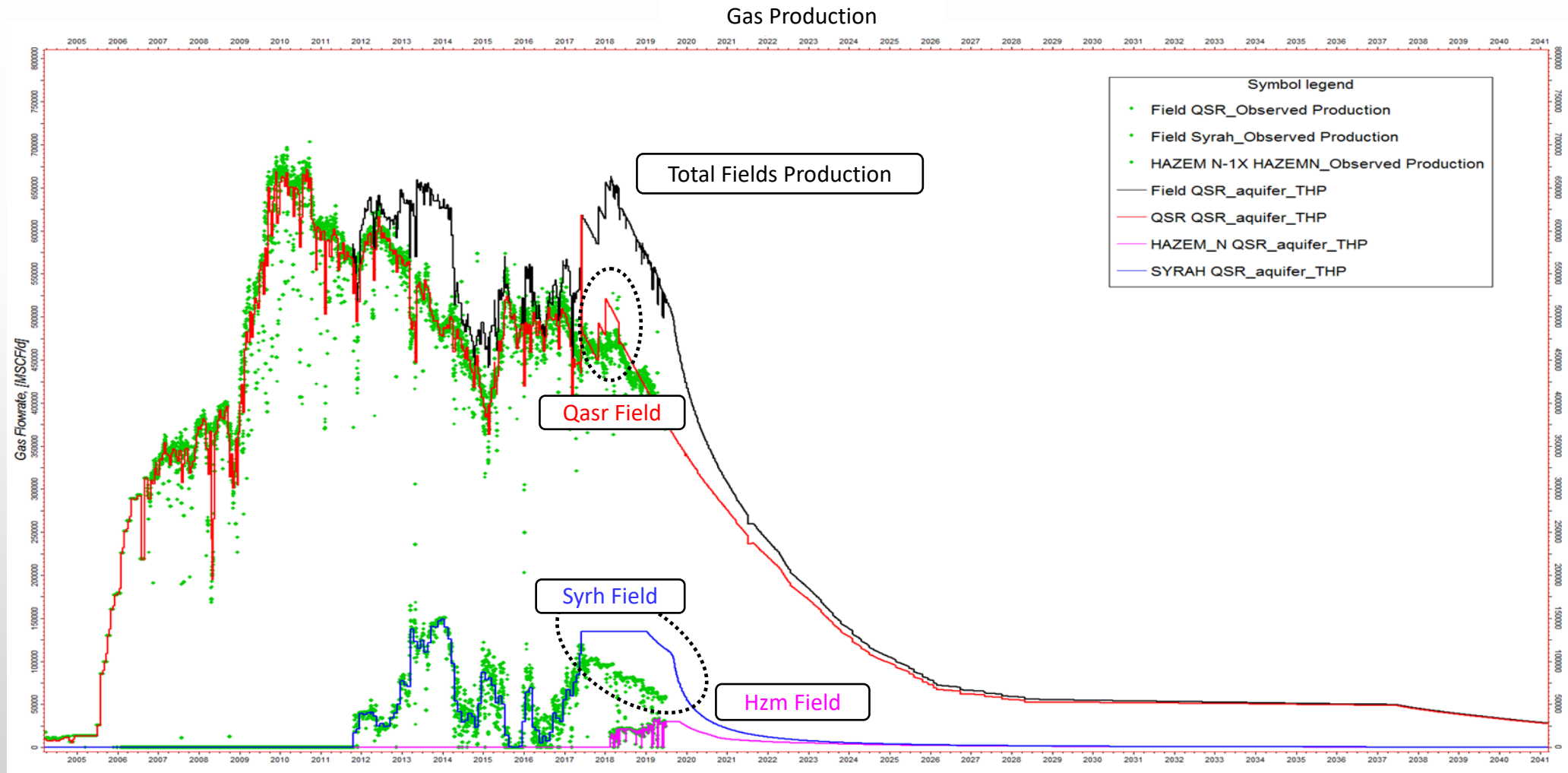
Reservoir Coupling Workflows

➤ Observed Gas Profile & Nodes' Pressures



Reservoir Coupling & Compression at Well Heads

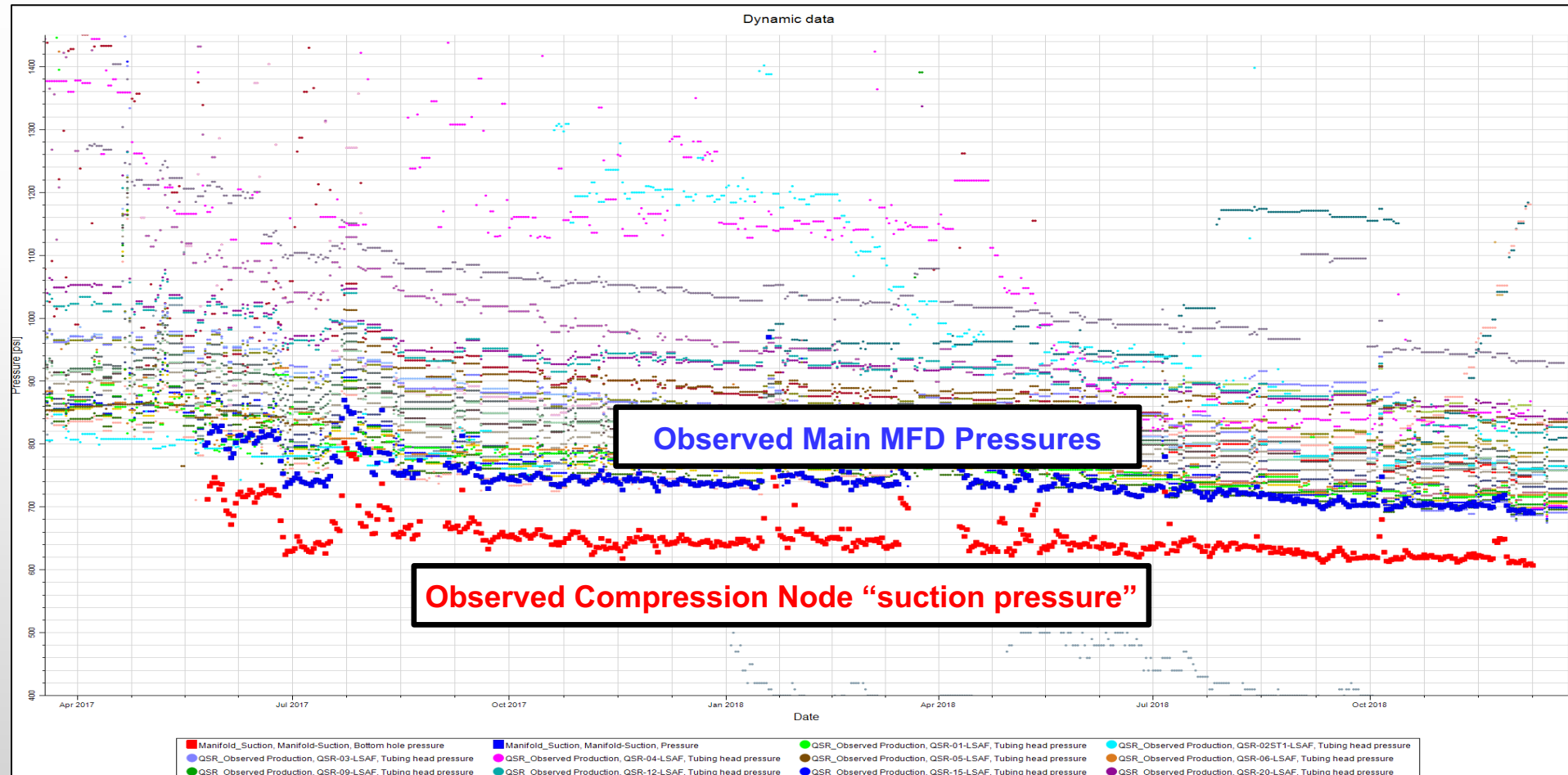
➤ Reservoir Coupling Results under compression (no surface lines)



Reservoir Coupling & Compression at Well Heads

“Mismatch issue”

➤ Observed THPs & Nodes' Pressures



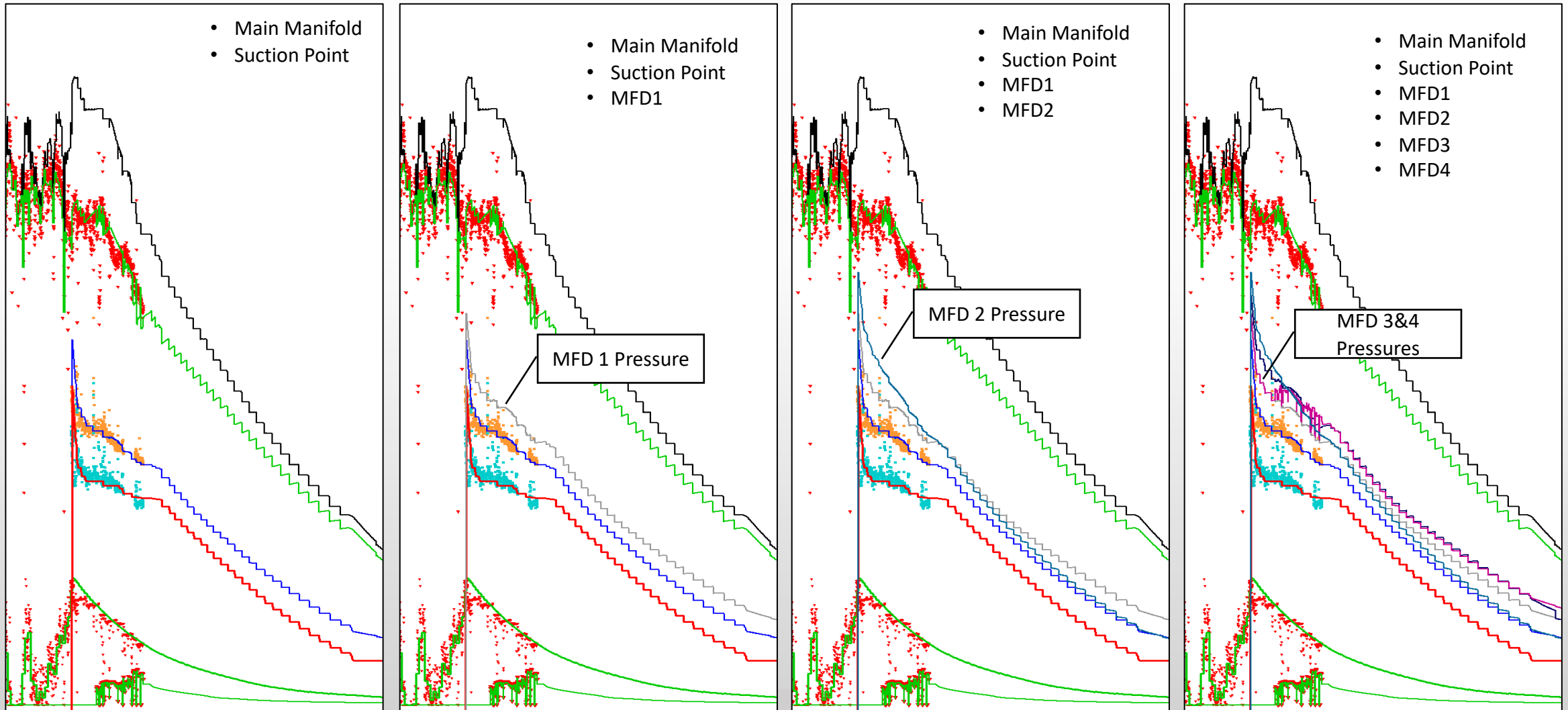
Compression at the suction node "including the full network"

➤ Considerations

- Using VFPs which representing each pipe line in the Surface Network
- Changing the design to include all pipe lines is very important to account
 - ✓ Back pressures from the surface flow lines
 - ✓ Realistic production forecast

Compression at the suction node "including the full network"

➤ History Match Results



Compression at the suction node "including the full network"

➤ Reservoir Coupling Workflow

