



# Automating OLGA with **FLUX**

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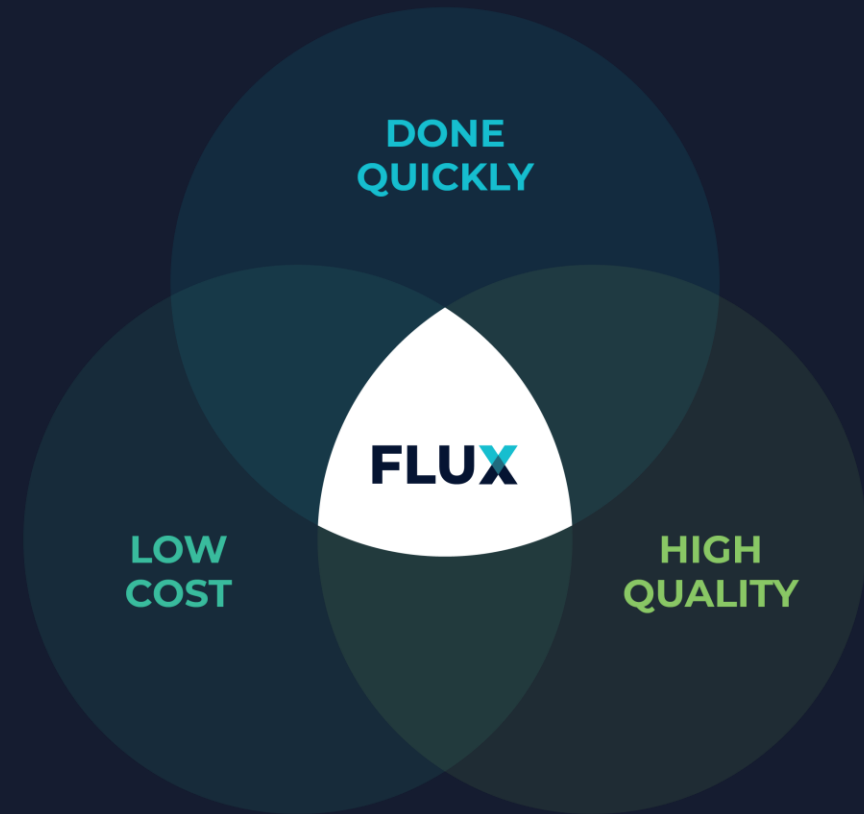
Schlumberger

Digital Forum 2022  
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# Automating OLGA with **FLUX**

- X** Manual Engineering Workflow
- X** Power of Automation for OLGA
- X** FLUX
- X** Value Realisation – CCS Injection
- X** Advanced Visualisation

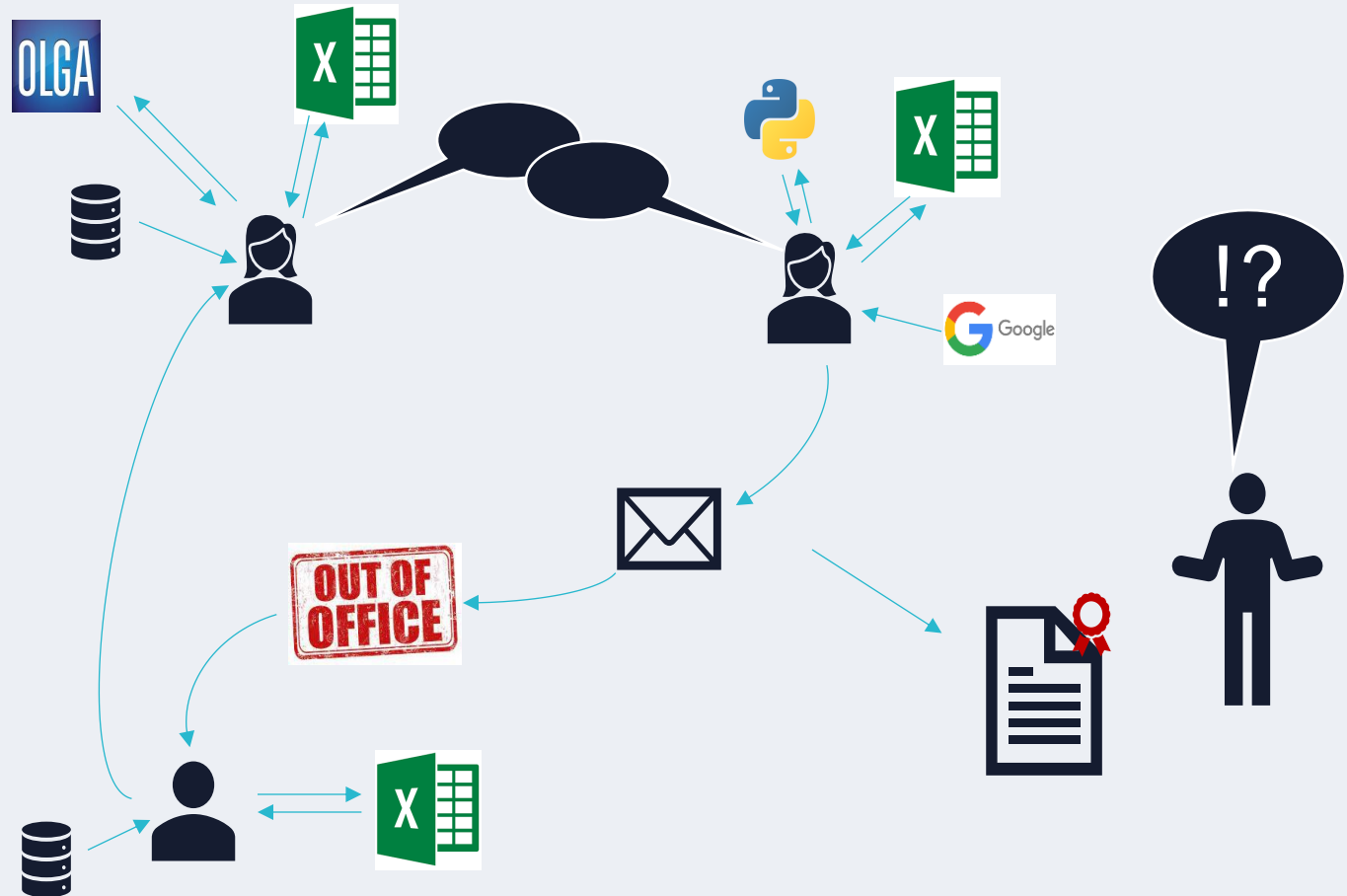




# Complex Engineering Workflows

## RISKS

- Multiple data sources
- Uncontrolled calculations
- Inefficiencies
- Communication
  - Revised Basis
  - Results between disciplines
  - Outcomes to stakeholders





# Manual OLGA Parametric

Manual duration ~ 3 weeks

Traditionally would Analyse 20-50 sensitivity cases



Define basis & assumptions

2 days



Model Build

2 days



Create parametric matrix, run simulations & extract results

5 days



Extend matrix for better definition and re-run

3 days



# Automated OLGA Workflow

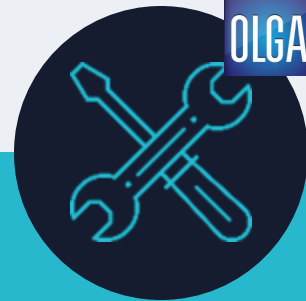
Automated duration ~ 1 week

Can assess thousands of sensitivities in less time



Define basis & assumptions

2 days



Model Build / Generate Simulation File

2 days



Create parametric cases (sensitivities)

2,300 cases  
30 seconds



Run simulations

~ 1 day



Extract Relevant Data

1 hour



Visualise Data

30 seconds



# Introducing **FLUX**

Xodus Inhouse Integrated Engineering Platform



## WEB APPLICATION

- Access Globally
- Controlled QA'd Scripts and Calculations
- Cross working locations
- Client Access

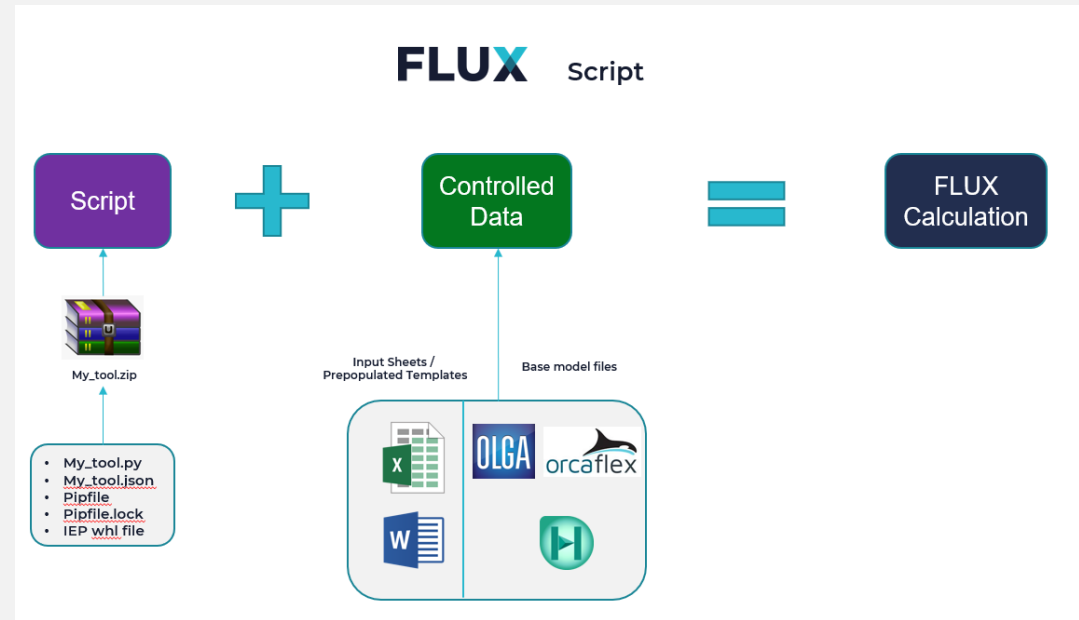
## EXECUTES AUTOMATED TASKS

- Python Scripts
- Controlled Calculations
- Calls up Software – Executes Analysis
- Extracts Results
- Iterates to Solutions
- Graphical Outputs

## STORES DATA

- Digital Design Basis
- Single Data Source for all Disciplines
- Outputs from analysis held as Inputs for other disciplines
- Management of Change Control

- Create a Project
- Create a Workspace
- Upload your FLUX Script**
- Check-in / Check-out
- Create a Calculation
- Construct the Workflow
- Execute a Calculation
- View the Results
- Execution History



**Script:**

Upload the approved script into the workspace

**Controlled Data**

The term **Controlled Data** refers to any data that is uploaded and stored in FLUX

- The version/upload history of the **Controlled Data** will be tracked
- The **Controlled Data** can be passed as inputs to Calculations.



Create a Project

Create a Workspace

Upload Controlled Data

Check-in / Check-out

Create a Calculation

Construct the Workflow

Execute the Calculation

View the Results

Execution History

The **Workflow** is used to:

- Describe the inputs and outputs of the *script(s)* to be executed
- Assign **Controlled Data** to the *script(s)*
- Define the order of *script(s)* to be executed
- Define which outputs to be shown on the Results page on an execution

The screenshot shows the XODUS FLUX interface for configuring a workflow. The main content area is titled 'Calculation' and shows a workflow visualization with three steps: 'User Inputs', 'Script', and 'Results'. The 'Script' step is expanded to show its definition, including inputs like 'Steel Outer Diameter', 'Steel Wall Thickness', 'Liner Thickness', and 'Coating Thicknesses'. The 'Results' step is also expanded to show its output: 'LIB-SSPL-S-002 Pipeline Cross Section Diagram'. The interface also shows a 'Save Workflow Text' button and a 'Manage Profile' section at the bottom left.





# Example Automated Calculation - DNV RP501 Erosion

Calculation Name  
CCS Parametric Study - GLKB 1557
Workflow Designer

<> Script

Alias  
LIB-PA-002 OLGA Batch Generator and Executor

Function Name  
LIB-PA-002 OLGA Batch Generator and Executor (v6)

+

↓ User Inputs

Inputs  
Sample Timestamp  
Branch  
OLGA Variable  
Type  
+ 36 more

+

<> Script

Alias  
LIB-PA-003 OLGA Post Processor

Function Name  
LIB-PA-003 OLGA Post Processor (v26)

+

↓ User Inputs

Inputs  
Plot Name

+

<> Script (Outdated)

Alias  
LIB-PA-004 OLGA Parallel Coordinate Plot Generator

Function Name

### Configure User Inputs

Post Process Variables
Erosion
Surge
Momentum

Particle Density*	<input type="text" value="2420"/>	kg/m <sup>3</sup>	?
Particle Diameter*	<input type="text" value="0.003"/>	metre	?
Pipeline Material*	<input type="text" value="Carbon Steel"/>	string	?
Sand Rate Calculation Method*	<input type="text" value="A - Based on Liquid/Ga..."/>	string	?
Gas Sand Rate*	<input type="text" value="0.1"/>	lb/MMscfd	?
Liquid Sand Rate*	<input type="text" value="1"/>	lb/kstbd	?
Sand Concentration*	<input type="text" value="1"/>	ppmw	?
User Defined Sand Rate (If Using Method C)*	<input type="text" value="0"/>	lb/MMscfd	?
Geometry Correction Factor*	<input type="text" value="4"/>	dimensionless	?
Bend Radius*	<input type="text" value="1.5"/>	metre	?

#### Erosion

```

UserInput: Post Process Variables.Sand Rate Calculation Method : string = A - Based on Liquid/Gas Rates {"group": "Erosion"}
UserInput: Post Process Variables.Gas Sand Rate : lb/MMscfd = 0.1 {"group": "Erosion"}
UserInput: Post Process Variables.Liquid Sand Rate : lb/kstbd = 1 {"group": "Erosion"}
UserInput: Post Process Variables.Sand Concentration : ppmw = 1 {"group": "Erosion"}
UserInput: Post Process Variables.User Defined Sand Rate (If Using Method C) : lb/MMscfd = 0 {"group": "Erosion"}
          
```

Cancel
Save Workflow



# FLUX CO<sub>2</sub> Wells Injection Case Study

## CCS Feasibility Project

- X** Injection into depleted (low pressure) Reservoirs
- X** Multiple Well Options and Injection Targets
- X** Low Pressure Reservoirs
- X** CO<sub>2</sub> Phase change risks

**Upstream Choke** **A** **B** **Downstream Choke**

**A Arrival Conditions**

- 99% CO<sub>2</sub> (dry) + Impurities
- H<sub>2</sub>O 2lb/MMscf – 40ppmv
- Inj Rates = 10 - 90 MMscfd/well
- IWHP ds = 80-130bar
- IWHT ds = 20 C

**B IWHP up, IWHT up, Valve Op, EVR**

**D BHP/BHT, Inj rate**

**E Index Prod /6 Res layers**

**C Well Design**

- Tbg 2-<sup>7</sup>/<sub>8</sub> " 3 ½", 4 ½"
- Well Trajectory
- DH Choke
- Geothermal Gradient

Golak PI Vs Res P

OLGA software (SPT group - a Schlumberger company)



# Value realisation of **FLUX**

- X** A typical 4 week job completed within 1 week
  - X** A total of 1,300 sensitivity cases were assessed and communicated through FLUX
  - X** Early insights dramatically streamline early phase engineering
  - X** Identified that smaller tubing sizes could be discounted early (saved well engineering on non practical scenarios)
- X** Additional focus areas were assessed quickly and efficiently
  - X** Option and benefit of a downhole choke assessed within a day
- X** Data visualisations proved a powerful communication tool



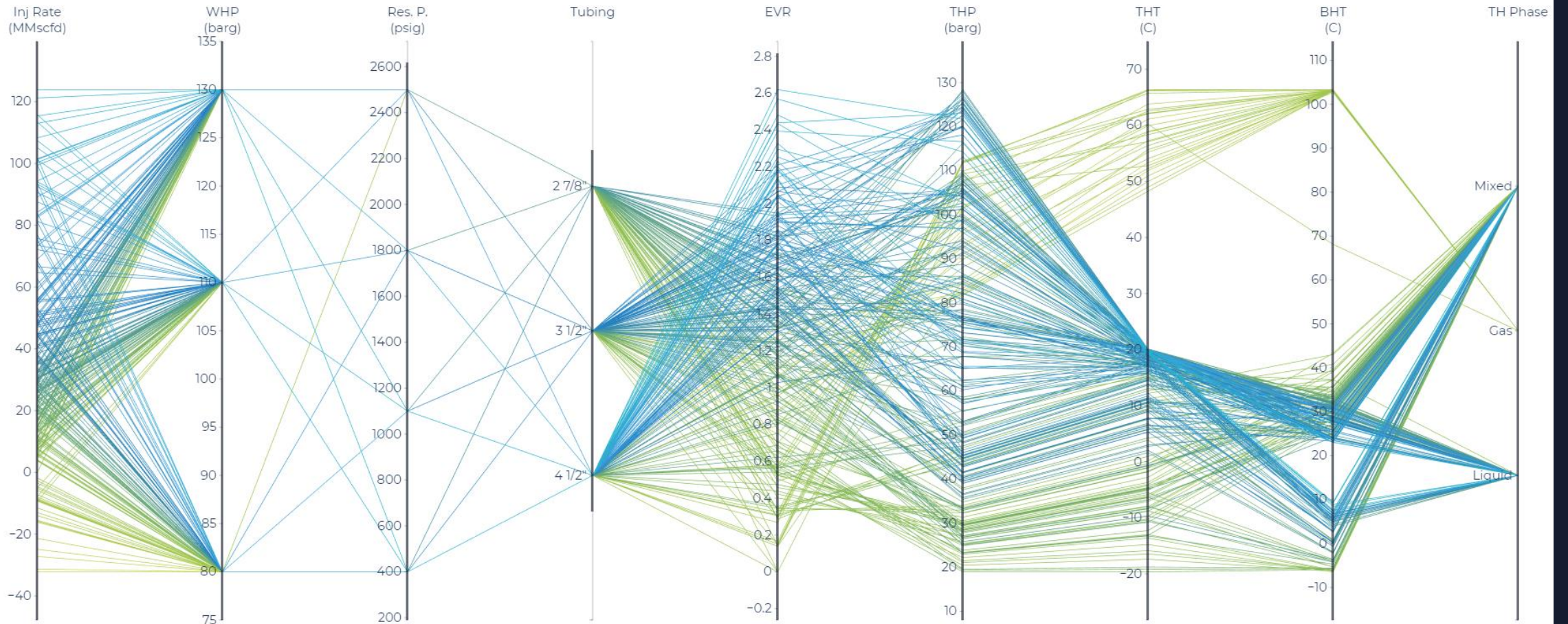
# Example Interactive Multi-Parameter Plot



Injection Well 2.html



## Injection Well 2





**Thank you for your attention**  
**Questions?**