Using PipelineStudio® to Simulate Pigging Operations on an Indonesian Pipeline
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Abstract
PT Perusahaan Gas Negara (Persero), Tbk (PGN) is the Indonesia state-owned company in gas transportation and distribution. SBU Transmisi Sumatera Java is Gas Transportation Business Unit that operates and maintains the transmission pipeline in delivering Natural Gas from gas field in Sumatera Island to the Industrial Customers in Java Island. This paper addresses the experiences of comparing between actual and simulation prognosis for pigging that shall be close each other to ensure the pig shall be arrived pursuant to ETA using TG-Net.

About PGN
PGN started life in 1859 as a privately owned Dutch company called Firma L.I. Enthoven, later coming under Government control and eventually emerging as a state company, named Perusahaan Negara Gas, in 1965. Further transformation saw its status change to a limited liability company owned by the state, and then to a public company with its shares listed on the Indonesia Stock Exchanges.

Today PGN is part state-owned, financially strong and professionally managed, with good corporate governance. Focusing on transportation and distribution of natural gas, PGN connects Indonesia’s natural gas sources with users, bringing previously underutilized energy to major markets, as well as having the expertise, the ability and the motivation to look beyond transportation and distribution to integrate up or down the supply chain, securing new sources of energy to meet customers’ long-term needs.
Introduction
South Sumatera - West Java Gas Transmission Pipeline System ("SSWJ") is an open access pipeline that is ruled by Access Arrangement (AA) to ensure that SSWJ is operated in a manner which is fair, proper and transparent. Thus, it is needed a tool to get the several useful information in operating or maintaining the gas flow through the pipe. PipelineStudio (TG-Net) is one of the tools that used in PGN as the stand-alone software, and user can perform an offline simulation using various scenarios, such as calculating the ETA for pigging, analyzing the optional equipment for maximum delivery the gas, calculating linepack in the pipeline, calculating the maximum capacity, calculating the nomination, predicting the survival time on emergency case, etc. This paper will focus the subject on the ETA for pigging and analyzes the optional equipment on the pipeline for maximum gas flow on the delivery, and the rest have been presented at the 2011 APAC User Group Meeting in Singapore.

SSWJ
Before we go further talking about the advantages of using of TG-Net, it would be helpful to review SSWJ pipeline system first.

Figure 1. is SSWJ which has three supply points and three demand points. All gas from supply 1, 2, and 3 are mixed and will be separated to the parallel pipeline along Palembang to Lampung and again be mixed in the Lampung. From Lampung the pipeline is separated into two pipelines through the offshore until reach each delivery point.
Design of the Network Using Tg-Net

Having reviewed the SSWJ network, it is needed to design the network using Tg-Net, and insert the required parameters of pipeline in the simulation. Below is the design that was created by Tg-net represent the real networking.

Estimated Time Arrivals (ETA) for Pigging

As a prudent operator and to maintain the pipeline performance, pigging needs to be conducted to clean and inspect the inside of the pipeline.

As a feature in the Tg-net by running the steady state and transient simulation we can calculate the Estimated Time Arrival (ETA) of pig when we perform pigging by using velocity of gas.

What we need to do to get the value of the ETA? First, we need to define the supply, demand and pipe to run the simulation, and then create the scenario using scenario editor. Just click transient simulation and we shall obtain the velocity of gas from starting time until the end of scenario by opening the trend plot feature.
Pigging Section 1

Below are the network and the result obtained using the Tg-net to calculate the ETA for CDG (Corrosion Detection Gyro) pig Section 1 of the network. CDG pig was launched on 20 October 2012 14:52 PM; the result velocity on section 1 is around 2.3 m/s, Pipe Length 193,500 meters, and total Supply/Delivery shall be 486 MMscfd. It means for next day the nomination at the delivery total shall be around 486 MMscfd. By running the transient simulation, the result for Time Travel about 23.14 hours, ETA CDG to be arrived at Point B of Section 1 is on 23 October 2012 14:06 PM.

**Figure 3. Pigging Section 1**
Comparing the result from Tg-net with actual ETA, giving the 19 minutes in difference.

Figure 4. Pigging Report Section 1

<table>
<thead>
<tr>
<th>Pig Type</th>
<th>Launching</th>
<th>Receiving</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>36” Corrosion Detection Gyro (CDG)</td>
<td>October 20, 2012</td>
<td>October 21, 2012</td>
<td>Recovery: Estimated 10 liters of wet dust and number of welding rods was brought out</td>
</tr>
</tbody>
</table>
Pigging Section 2

Below are the network and the result obtained using the Tg-net to calculate the ETA for CDG (Corrosion Detection Gyro) pig Section 2 of the network. CDG pig was launched on 2 November 2012 09:25 AM; the result velocity on section 2 is around 1.9 m/s, Pipe Length 171,000 meters, and total Supply/Delivery shall be 396 MMscfd. It means for next day the nomination at the delivery total shall be around 396 MMscfd. By running the transient simulation, the result for Time Travel about 23.30 hours, ETA CDG to be arrived at Point C of Section 2 is on 3 November 2012 08:55 AM.

**SSWJ NETWORKING**

- **Deliveries**:
  - DELIVERY 1: 190-366 MMSCF
    - Head Vel: 2.012541 m/s
    - Tail Vel: 1.95995 m/s
    - Head Pres: 810.593 psig
    - Tail Pres: 878.983 psig
    - Temp: 48.9407 Degree F

- **Supplies**:
  - SUPPLY A:
    - Pres: 925.450 psig
    - Flow: 189 MMSCF
    - Temp: 96.19 Degree F
  - SUPPLY B:
    - Pres: 825.960 psig
    - Flow: 144 MMSCF
    - Temp: 86.02 Degree F
  - SUPPLY C:
    - Pres: 905.928 psig
    - Flow: 44 MMSCF
    - Temp: 68.00 Degree F

**Table: Section 2 Velocities**

<table>
<thead>
<tr>
<th>Section 2</th>
<th>Upstream Velocity</th>
<th>Downstream Velocity</th>
<th>Average Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Vel</td>
<td>1.95703</td>
<td>1.95703</td>
<td>1.95703</td>
</tr>
<tr>
<td>Tail Vel</td>
<td>1.95703</td>
<td>1.95703</td>
<td>1.95703</td>
</tr>
<tr>
<td>Head Pres</td>
<td>895.954</td>
<td>895.954</td>
<td>895.954</td>
</tr>
<tr>
<td>Tail Pres</td>
<td>878.983</td>
<td>878.983</td>
<td>878.983</td>
</tr>
<tr>
<td>Temp</td>
<td>48.9404</td>
<td>48.9404</td>
<td>48.9404</td>
</tr>
<tr>
<td>Duration</td>
<td>23.30 hours</td>
<td>23.30 hours</td>
<td>23.30 hours</td>
</tr>
<tr>
<td>ETA</td>
<td>08:55 AM</td>
<td>08:55 AM</td>
<td>08:55 AM</td>
</tr>
</tbody>
</table>

**Graph:** Velocity up and Down Section 2

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Figure 5. Pigging Section 2
Comparing the result from Tg-net with actual ETA, giving the 12 minutes in difference.

### PIGGING REPORT

#### 32” EGP Program Summary

<table>
<thead>
<tr>
<th>Pig Type</th>
<th>Launching</th>
<th>Receiving</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td>Time</td>
<td>Date</td>
</tr>
<tr>
<td>32” Electronic Geometry Pig (EGP)</td>
<td>November 01, 2012</td>
<td>09.25</td>
<td>November 02, 2012</td>
</tr>
</tbody>
</table>

Recovery:
No debris in front of pig

*Figure 6. Pigging Report Section 2*
Pigging Section 3
Below are the network and the result obtained using the Tg-net to calculate the ETA for CDG (Corrosion Detection Gyro) pig Section 3 of the network. CDG pig was launched on 9 November 2012 19:03 PM; the result velocity on section 3 is around 1.7 – 1.8 m/s, Pipe Length 100,000 meters, and total Supply/Delivery shall be 366 MMscfd. It means for next day the nomination at the delivery total shall be around 366 MMscfd. By running the transient simulation, the result for Time Travel about 15.56 hours, ETA CDG to be arrived at Point D of Section 3 is on 9 November 2012 10:59 AM.

![Figure 7. Pigging Section 3](image)

Comparing the result from Tg-net with actual ETA, giving the 2 minutes in difference.

![Figure 8. Pigging Report Section 3](image)

**PIGGING REPORT**
32”CDG Program Summary

<table>
<thead>
<tr>
<th>Pig Type</th>
<th>Launching</th>
<th>Receiving</th>
<th>Observations</th>
</tr>
</thead>
</table>

By running the transient simulation, the result for Time Travel about 15.56 hours, ETA CDG to be arrived at Point D of Section 3 is on 9 November 2012 10:59 AM.

Comparing the result from Tg-net with actual ETA, giving the 2 minutes in difference.
Conclusions
PipelineStudio – (TG-Net) really useful and helpful to handle any case that needs calculating during the operation of the transmission pipeline. The result from the TG-Net is accurate to the real operation condition, and helps the management to make some planning or decision.

About the Authors
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Herlenika currently works as Gas Planning Engineer for PT. Perusahaan Gas Negara (Persero) Tbk. She has six years’ experience in the gas industry, especially in gas planning and pipeline hydraulics.

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Hari has been involved in the gas industry for six years. He specializes in SCADA and Data Management and currently works as Data Management Manager for PT. Perusahaan Gas Negara (Persero) Tbk.