

### Oil Pipeline

Oil & Gas Industry



## Beta Machinery Analysis Calgary, Alberta, Canada Platinum Pipe Award Winner - Software Features and Model Creativity

Beta Machinery Analysis (BETA) was asked to investigate a waterhammer and valve slamming problem after pump shutdown in a Canadian crude oil booster pump station that sends product from tanks to a transportation pipeline (see Figure 1).

Jordan Grose, pump systems manager, modeled the system with AFT Impulse and gathered field measurements for model calibration. The initial model results did not match well with the field data since several unknowns existed on the downstream piping past the Pipeline Company meter banks and details of this part of the system were not available. This led to

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investigations of the model boundary conditions (see Figure 2).

A new approach involved making educated trial and error guesses at what was likely happening at the meter banks during the shutdown sequence. Grose decided that it would be easier to estimate flow rates rather than pressures, therefore the constant flow element within AFT Impulse was used as the system boundary condition.

Grose creatively manipulated the AFT Impulse assigned flow junction feature to make the pressures match at the pump discharge check valves.

Tweaking of the transient flow profiles and transient trigger settings allowed an iterative approach analysis

to occur which eventually led to a very good match of the model predictions with measured field data (see Figure 3).

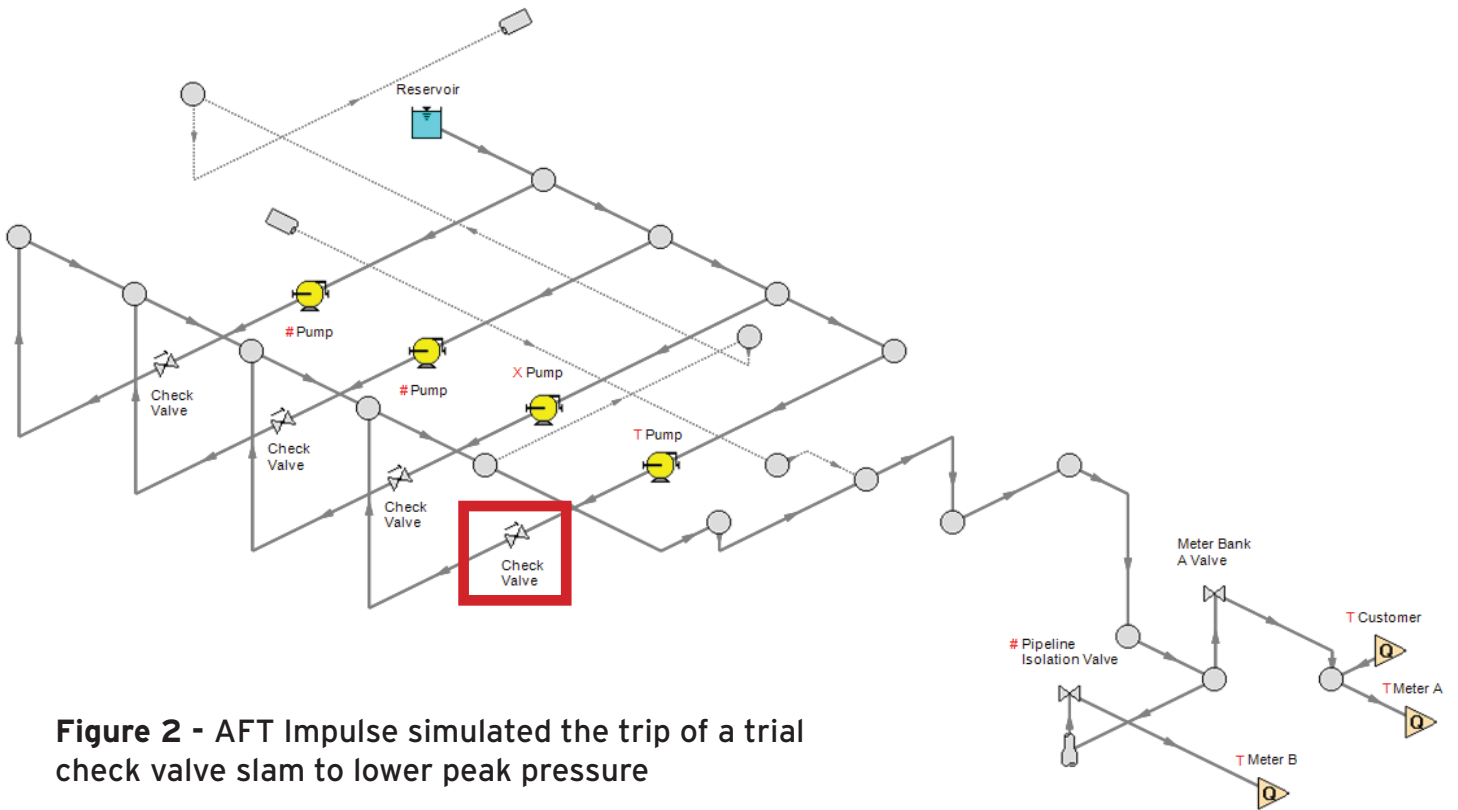
In commenting on the benefits of modeling this system with AFT Impulse, Grose said, “AFT software allowed the significant flexibility needed to tweak, by trial and error, boundary condition transients to find and match the field conditions in this complicated system. The software flexibility led to not only a greater understanding of the system, but to a field validated model that was used to solve the client’s significant waterhammer problem.”

Grose continued, “AFT Impulse provided the flexibility to vary the induced transient flow profiles with many transient activation options. Without this functionality, modeling a system with as many important unknowns as this would not have been possible.”

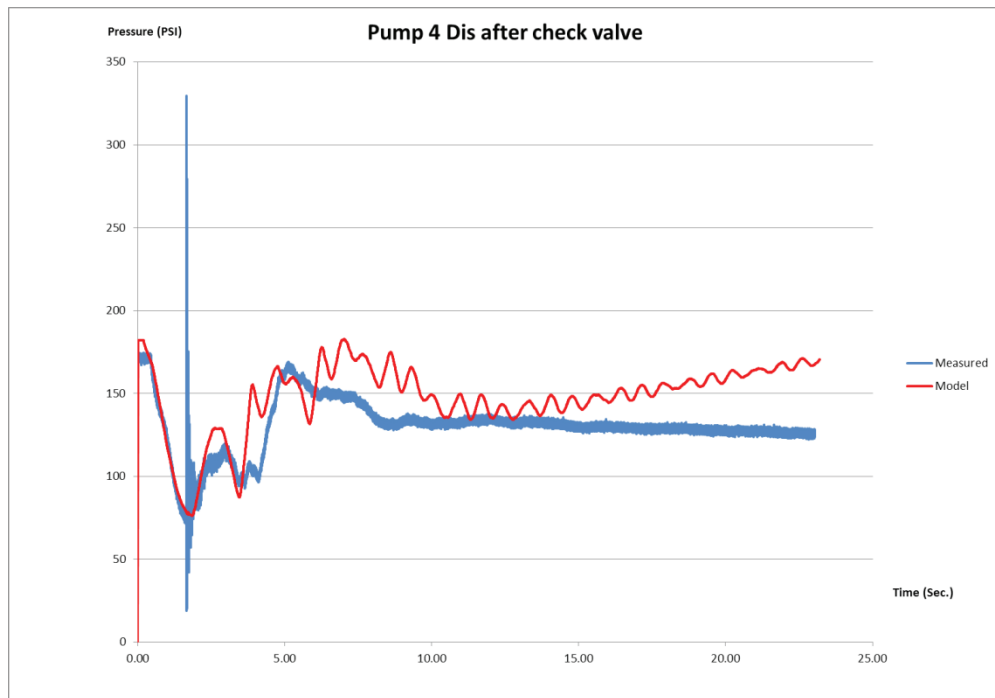


Figure 1 - Crude oil booster pump system

Beta Machinery Analysis is a premier machinery consultant specializing in rotating and reciprocating machines with offices in Houston, Calgary, Kuala Lumpur, and sales support in Beijing and Abu Dhabi.



**Figure 2 - AFT Impulse simulated the trip of a trial check valve slam to lower peak pressure**



**Figure 3 - Comparison of field data pressure measurements over time and AFT Impulse predictions at pump discharge**