IPS-14-01

The Importance of Pre-Job Shock Modeling as a Risk Mitigation Tool in TCP Operations

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Objective

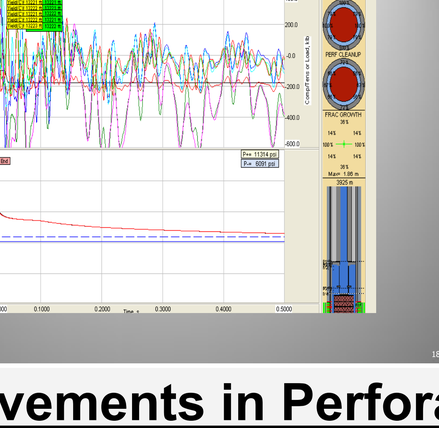
- **Demonstrate importance of Pre-Job Shock Modeling through successful field applications.**
- **Highlight recent physics advances in perforation modeling services**

WEST AFRICA APPLICATION

Compression Failure of Tubing Joint Directly on Top of Guns.

Risk Mitigation

- TCP job modeled with 30ksi system
  - 475klbf Max Rated Load on Packer Body
- General Modeling Template used
- Possible Remedies:
  - More Shock Absorbers
  - Different distance between Packer and Guns
  - Different distance between Sump Packer and Guns
  - Different Grade of Tubing



J-XX Run 1 542 mD Permeability

J-XX Run 2 249 mD Permeability

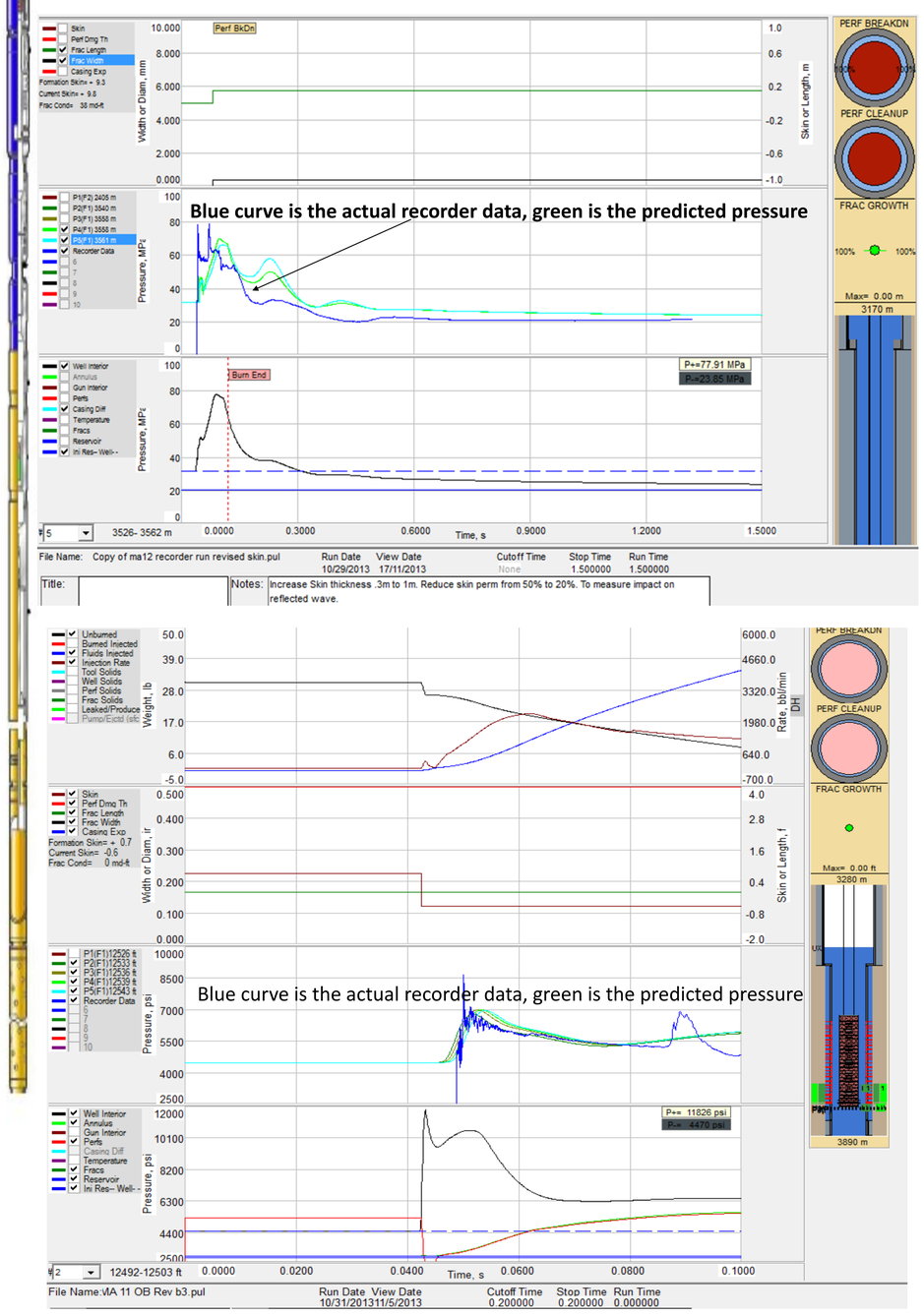
PHILIPPINES STIMGUN JOB

The Job

- **Redundant firing heads, one electronic, one pressure activated de-ployed on intelligent coiled tubing with 200 meter StimGun perforating assembly.**
- **Propellants used to break through suspected cement invasion to connect to the high permeability carbonate**

Key Results

- **All shots fired**
- **No damage to the coil or related equipment.**
- **Wells delivered as expected.**



What causes Shock ?

- Mechanical forces acting on BHA leading to Burst, Collapse, Buckling
- Pressure Surges occurring around tubulars, packers and under balance conditions

Shock Modeling Service

- Transient, coupled, multi-physics approach
- Field scale in-depth modeling of dynamic perforation events and associated downhole equipment

Modeling Applications

- Load analysis on packers, bridge plugs, tubulars
- Pressure surge/spike on Downhole equipment
- Pre-job design tool for Risk Mitigation

Value of Shock Modeling

- Reduce NPT due to mechanical failure of :
  - Perforating BHA
  - Packer/Workstring
  - Liner /casing
- Assurance on life-of-well

Recent Improvements in Perforation Modeling Services

- **Intuitive Data Analysis and Interpretation (Report Generator)**
  - **Critical for faster on-site decision making**
  - **Useful in detailed analysis and comparison of potential completion designs**
- **Faster and Efficient Computational Algorithms**
  - **Significantly improves calculation times for complex well scenarios (long horizontals, HPHT, Deepwater)**
- **Frictional Force Model**
  - **Industry models leveraged to improve downhole equipment force calculations.**