



# Upstream Technology Trend For the Future

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**Nov 15, 2017**

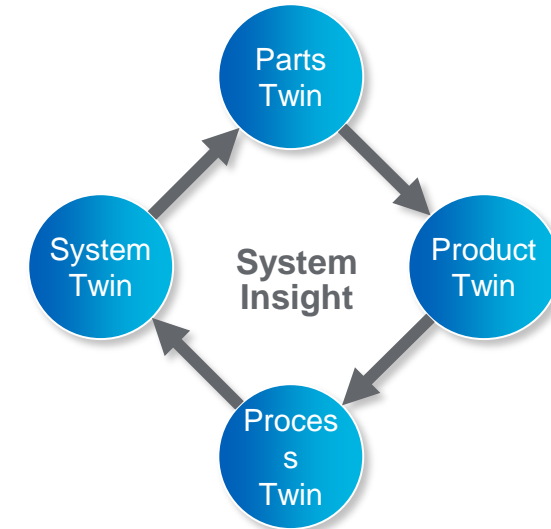
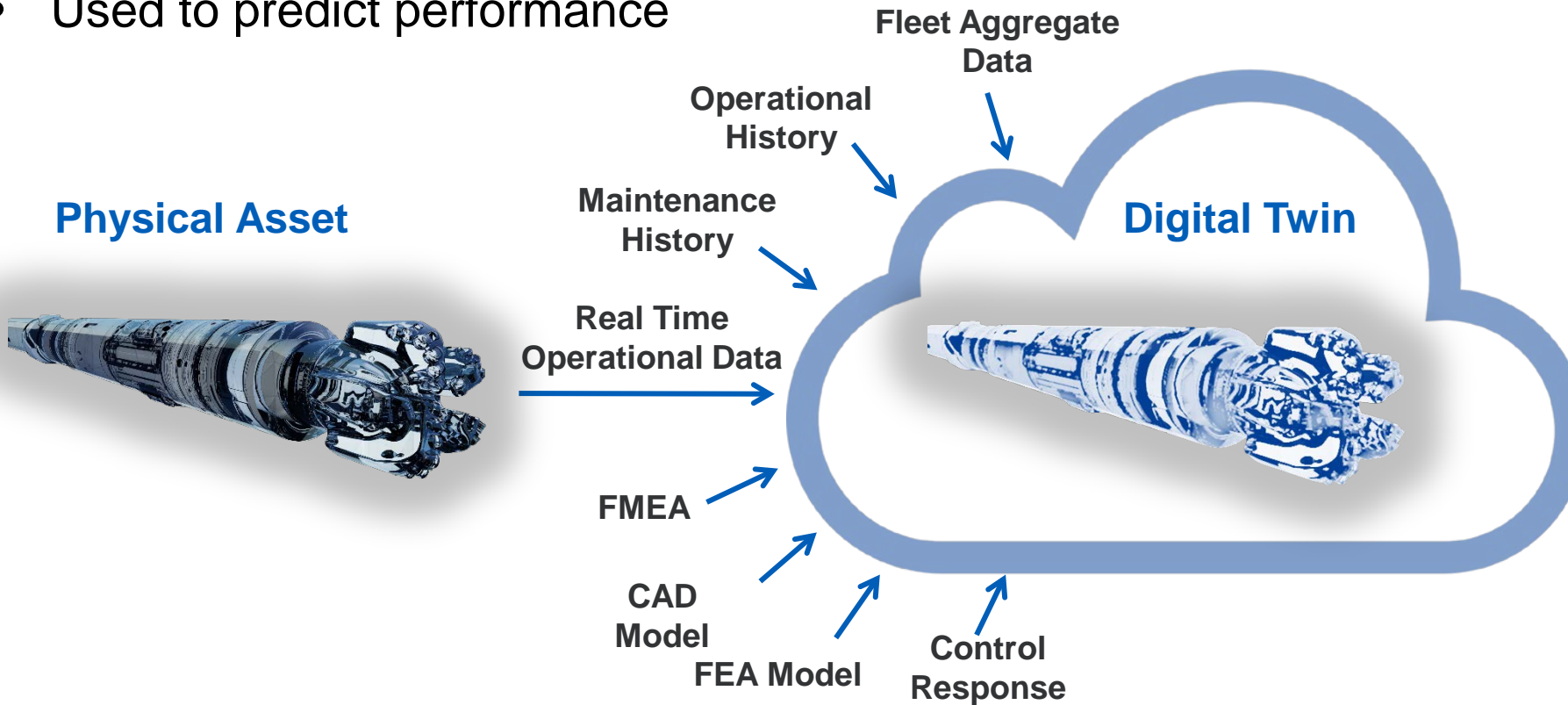
**December 5, 2017**

# Digital Twin...Video



# Digital Twins

- A live up-to date digital representation of an asset, system or process
- Used to predict performance



# Industrial IoT Powered by PREDIX ...Minds & Machine

Machine  
Connectivity

Deep insight  
of Industry



Data  
computing

Industry  
Security

Data  
Protection

Stack  
Safety

Machine  
learning

Process  
Monitoring

Hybrid  
Cloud

Client and  
Partnership



Developed  
for  
Industry

+

100+ years  
domain expertise

+

550,000 digital twins

=

GE Advantage

# IntelliStream™ Onshore...Oilfield upstream digital solution

PREDIX

↓ 10% - 20%  
Reduce Downtime

↓ 10% - 40%  
Reduce Operating and Maintenance Cost

↑ 5% - 10%  
Improve Output

Application	Monitoring	Reliability	Maintenance	Optimization
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- Data Integration
- Visualization
- KPI
- Central Monitoring
- Alarm Event
- Asset Performance Management

- Data management
- Case sharing
- Failure Diagnose

- Failure mode analysis
- Maintenance based on reliability
- Device maintenance strategy

- Artificial Lifting
- Scenario analysis
- Optimize constraints
- Modeling Calibration

KPI Index



More modules to be released...



# Improve Upstream Recovery Efficiency Through Technology Innovation

**Increase  
Efficiency**

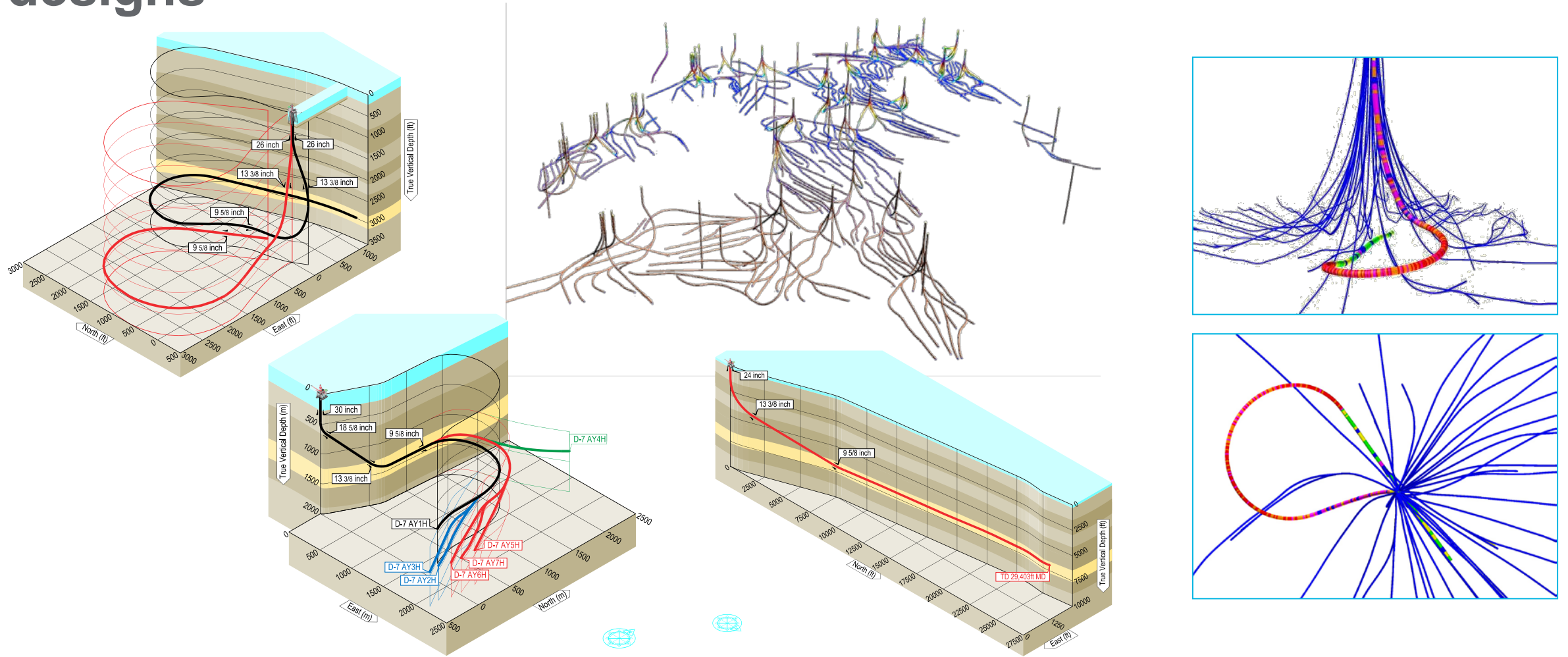
**Boost  
Production**

**Reduce Cost**

**Maximize ROI**

**Minimize Risk**

# Drilling - AutoTrak™ enables the most advanced well designs

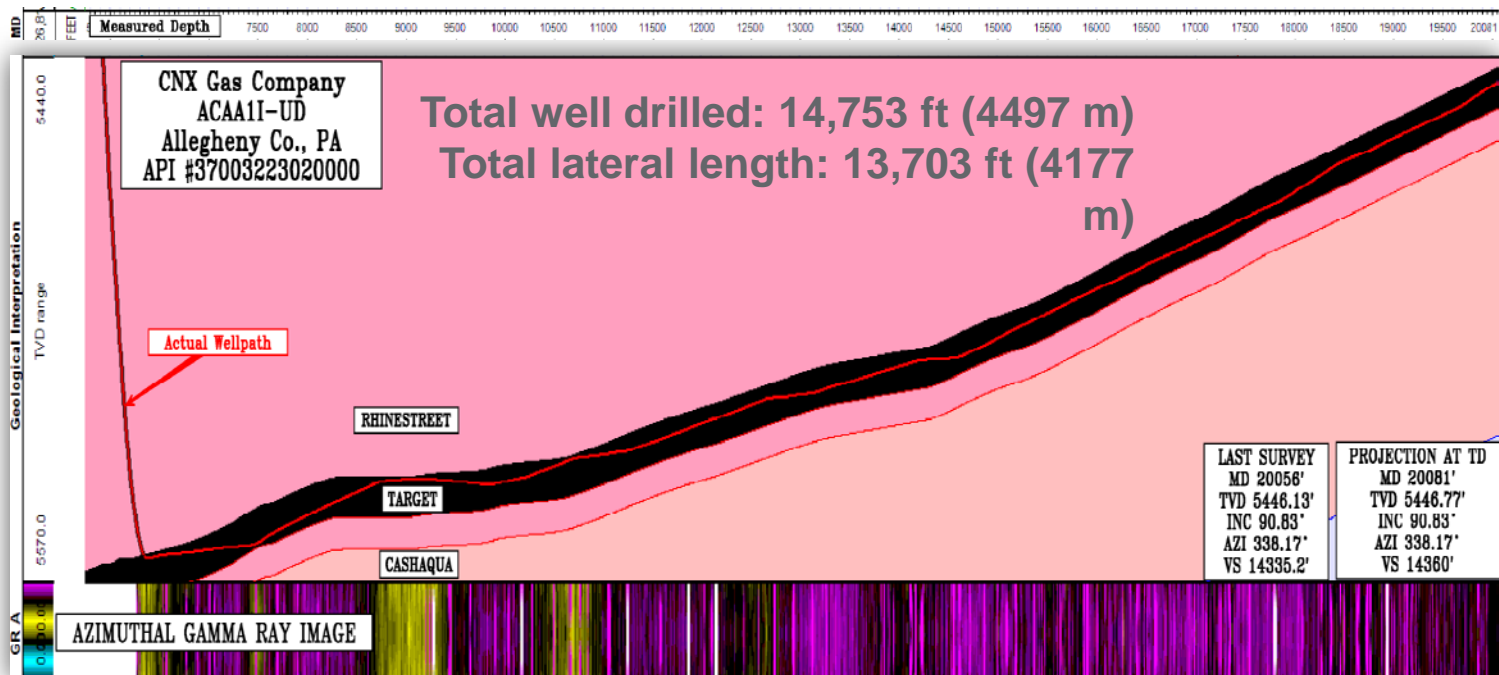




# Reservoir navigation service with AutoTrak curve system

**Record mile-a-day (5293 ft/day, 1613 m/day) with 100% in target zone, drilling up-dip**

**80+ MAD wells with 9 operators in 10 different counties in Marcellus and Utica**



- **Longest footage in one run: 18,024 ft (5494 m)** (DJ Basin, Colorado, VCL)
- **Longest lateral in one run: 13,703 ft (4177 m)** (Marcellus)
- **Deepest KOP TVD: 15,296 ft (4,662 m)** (Woodford)
- **Deepest Well TVD: 16,219 ft (4943 m)** (Woodford)
- **Highest 24 Hour Footage: 8,197 ft (2498 m) = 1.6 mile** (Woodford)
- **Fastest: 476 ft/hr (145 m/hr)** (Woodford, 9,523 ft (2902 m) drilled, 1 run, L)



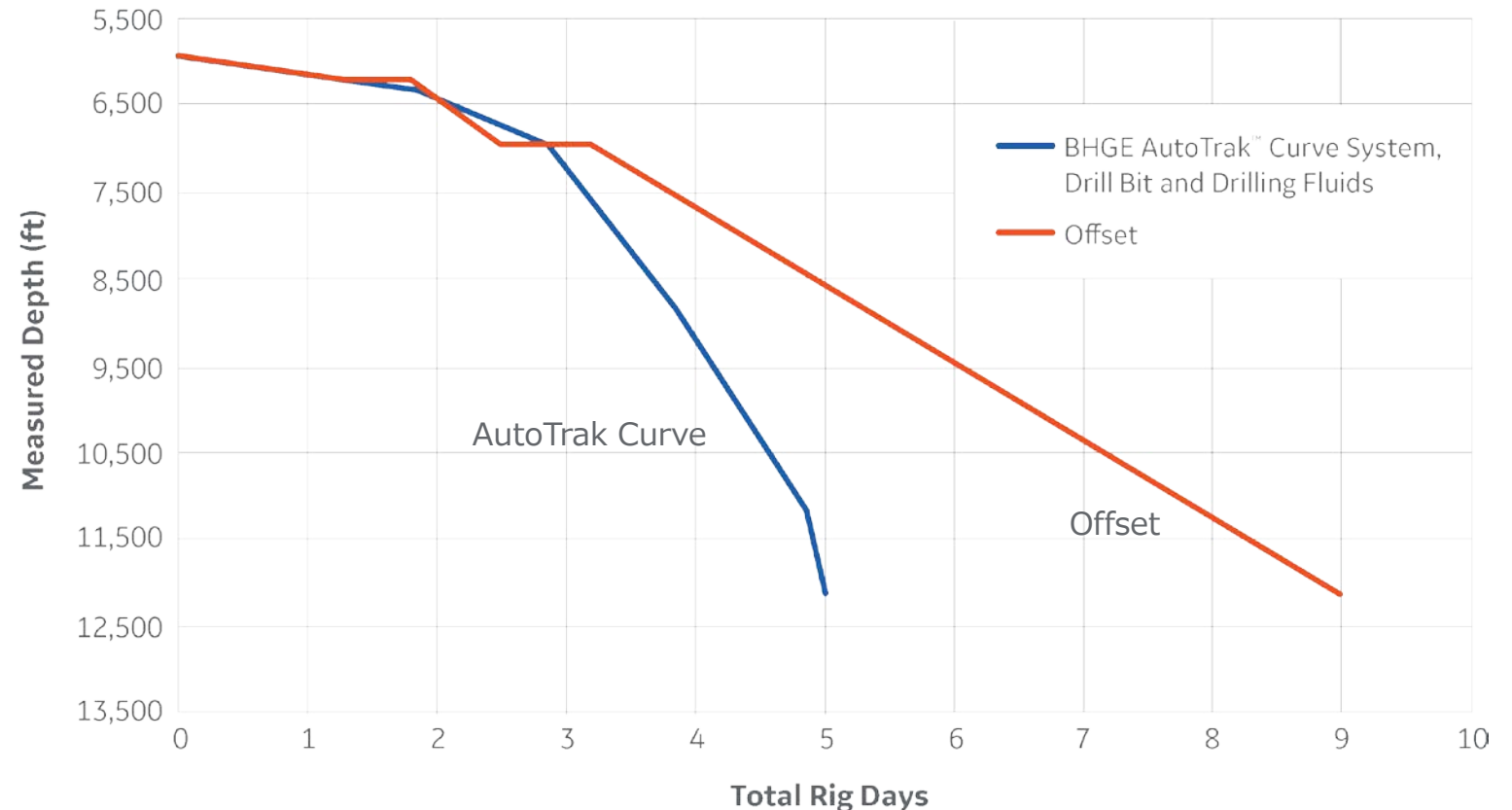
# Integrated services (drill bits and drilling fluids)

**Matching drill bit, BHA and drilling parameters**

**Mud program, solids control, monitoring drilling fluids properties during execution are key for:**

- Wellbore stability
- Hole cleaning
- Avoid balling
- Allow good lubricity for longer extended laterals

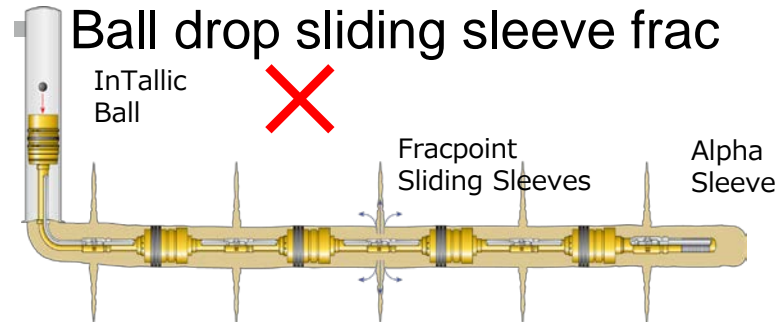
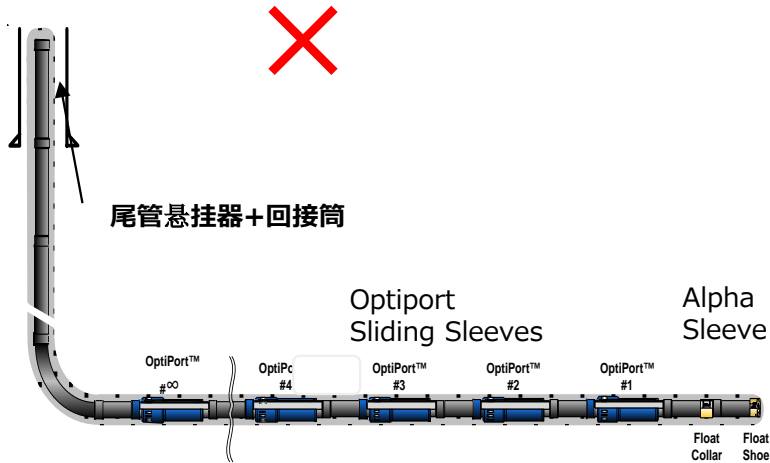
**Days vs. Depth Comparison to Drill Curve and Lateral Sections in the Marcellus**



# Completion Technologies for Unconventionals

## Optimized Solutions for Long Laterals

- CT annular frac



### Improve efficiency

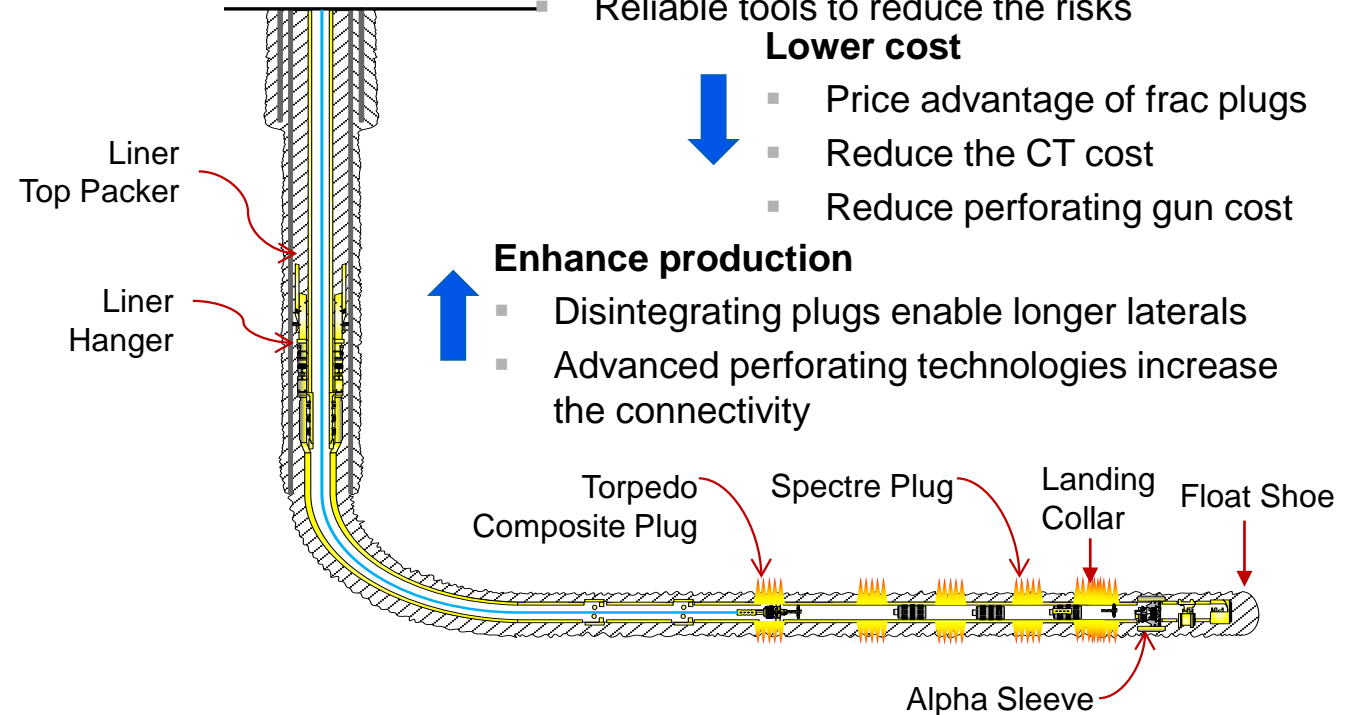
- Using **disintegrating plugs**, no milling is required
- Advanced **composite plugs** and milling tools to reduce the operational time
- Reliable tools to reduce the risks

### Lower cost

- Price advantage of frac plugs
- Reduce the CT cost
- Reduce perforating gun cost

### Enhance production

- Disintegrating plugs enable longer laterals
- Advanced perforating technologies increase the connectivity

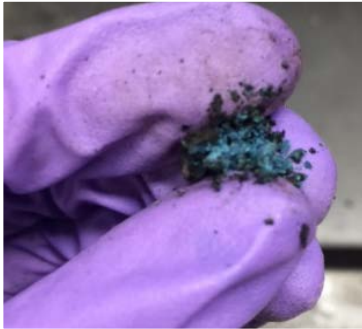


# SPECTRE™ Disintegrating Plug



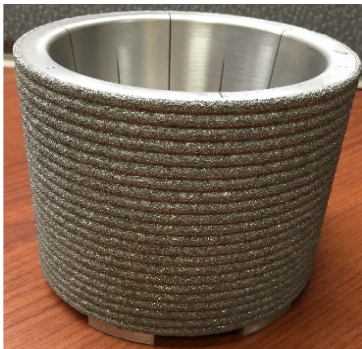
## Body

- The same material of In-Tallic disintegrating ball, which has been used in more than 100,000 stages globally
- Dissolving rate is affected by salinity and temperature, can be controlled



## Element

- Made of patented BHGE polyurethane material
- Break down into fine debris and flow back
- Dissolving rate is effected by temperature, can be controlled



## Slips

- Advanced Nickle alloy coating technology (0.25mm - 0.38mm)
- Break down into fine debris when flow back

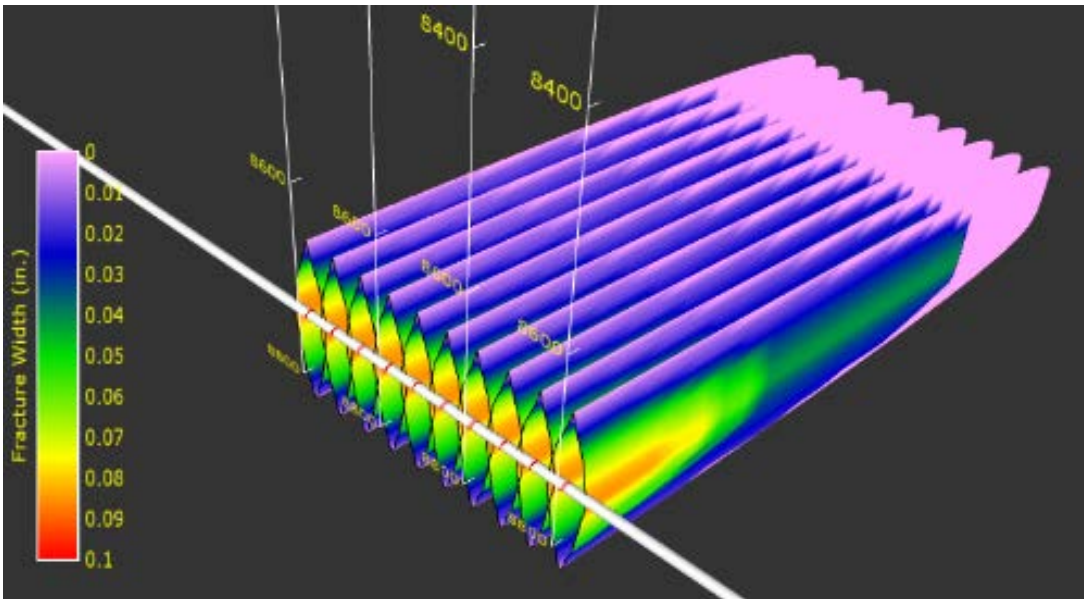
# Completions with FracFit™ ...Reduce risk and maximize ROI

Generate optimum **reservoir coverage** with the **right fracture conductivity** along the lateral **in the right intervals**

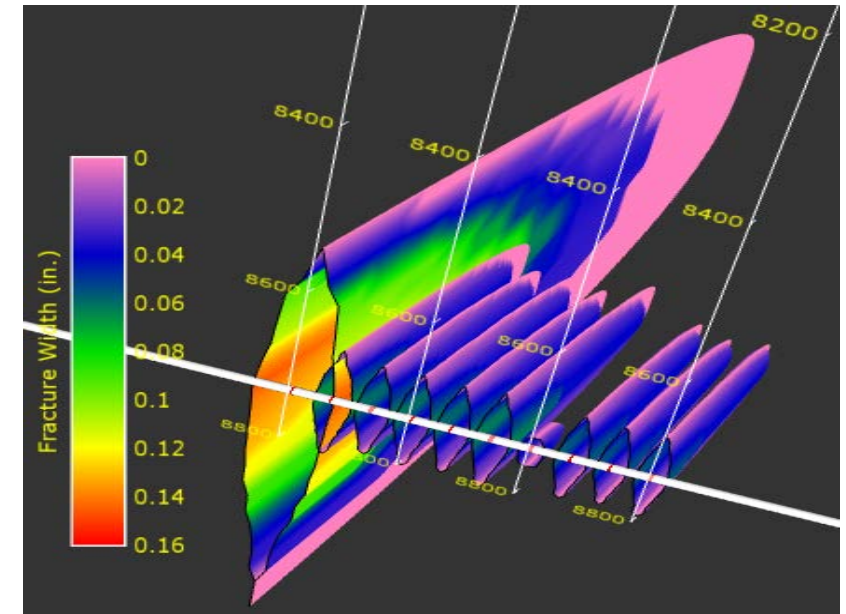
- Ensure maximum reservoir contact
- Avoid geohazards

GET THE RIGHT DATA - **reduce geological uncertainty** and **optimize completion** to maximize ROI

- Producibility
- Fracability
- Geohazards



V  
S



# FracFit... Reducing subsurface uncertainties

## Fracability

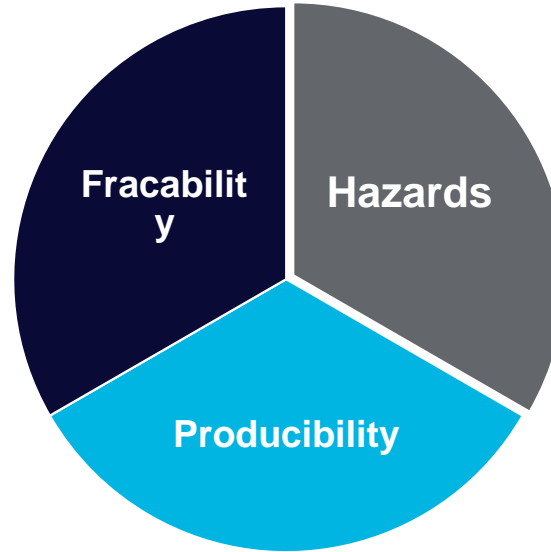
Mud Gas Hydrocarbons Analysis

### Advanced Cuttings Evaluation:

- XRD Mineralogy & XRF ED Elements
- Pyrolysis: Kerogens, bitumens
- HC phase, Asphaltenes
- FIB-SEM, nano-scale porosity

### Wireline Logging:

- Geomechanical Analysis
- Cross Dipole - Deep shear Wave Imaging
- Pulse Neutron – Mineralogy



## Hazard Avoidance

Mud Gas Hydrocarbons Analysis

### Advanced Cuttings Evaluation:

XRD Mineralogy & XRF ED Elements

### LWD and Wireline Logging:

Cross Dipole - Deep shear Wave Imaging

## Producibility

Mud Gas Hydrocarbons Analysis

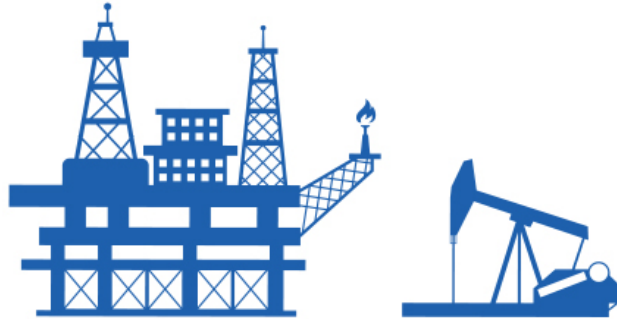
### Advanced Cuttings Evaluation and Wireline:

- XRD Mineralogy & XRF ED Elements
- Pulse Neutron – TOC
- Pyrolysis: Kerogens, bitumens
- HC phase, Asphaltenes, FIB-SEM, nano-scale porosity



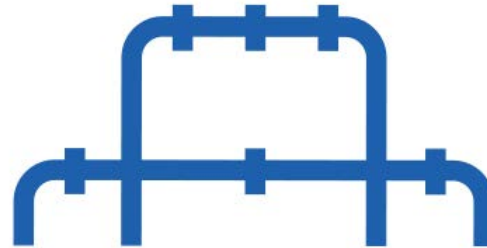
# BHGE ... The world's first fullstream company for O&G industry

\$23Billion Revenue+ ~70,000 employees+ 120 countries+ 125 year history



## UPSTREAM

Evaluation, Drilling, Completion & Production



## MIDSTREAM

LNG, Pipeline & Storage



## DOWNSTREAM

Refinery & Petrochemical Solutions

**Total solution provider across Oil and Gas value chain**

An ecosystem open to modules and digital twin

## Fullstream digital insights on Predix, GE's industrial platform

Digital+ Service+ Equipment+ GE Store = Fullstream Productivity leader

# Summary and Outlook

## We invent smarter ways to bring energy to the world

### Efficiency, cost and Capital ROI

When \$50~\$60 oil price becomes new normal, O&G industry needs higher efficiency, lower cost and higher capital ROI



### Digital + Innovation

We are driving higher productivity and unique competence for oil and gas industry through digital and technology innovation



### Baker Hughes, a GE Company

- Fullstream
- Digital + Innovation
- Global + local
- Customer orientation

**BAKER**  
**HUGHES**  
a GE company

