BAKER HUGHES
a GE company

CIRCA Real Time

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Discussion Overview:

How Circa Real Time works

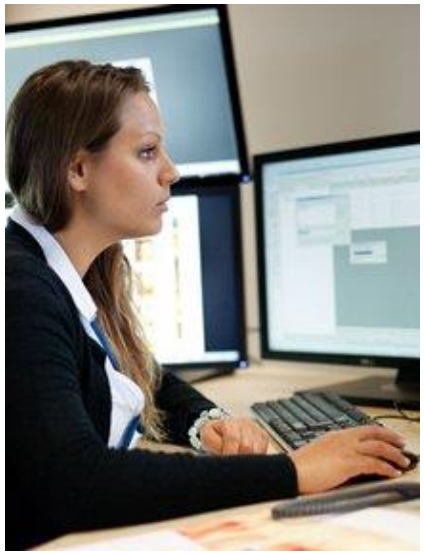
Traffic Lights

Avoid parted pipe

Injector Control

Avoid Stuck Pipe

Circa Real-Time: The Opportunity for Automation



Circa

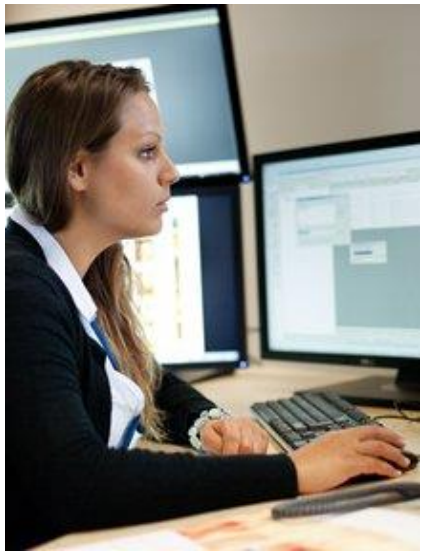
Work over Program

DAS/Recording

But changing well conditions can leave you facing NPT, unnecessary safety risks, and costly rework

You can't plan for what you don't know

Circa Real-Time: The Opportunity for Automation



Circa

Work over Program

Circa File

DAS/Recording

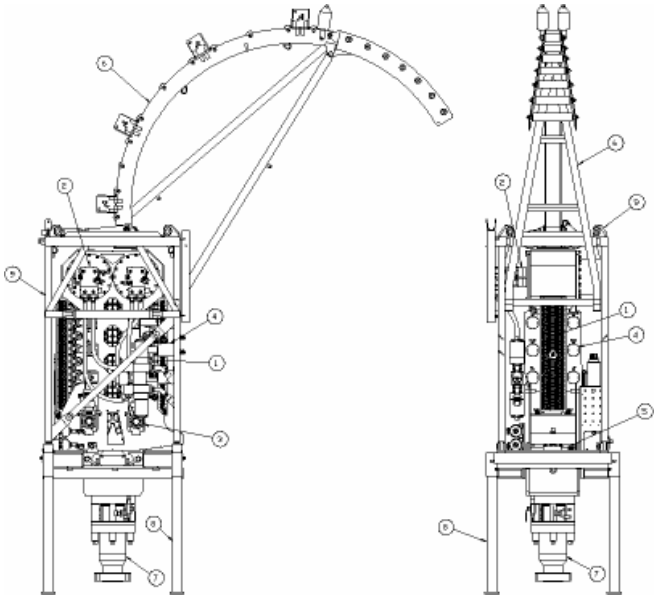
Circa Real-Time

Injector PLC

But changing well conditions can leave you facing NPT, unnecessary safety risks, and costly rework

Circa Real-Time: The Opportunity for Automation

Data Exchange



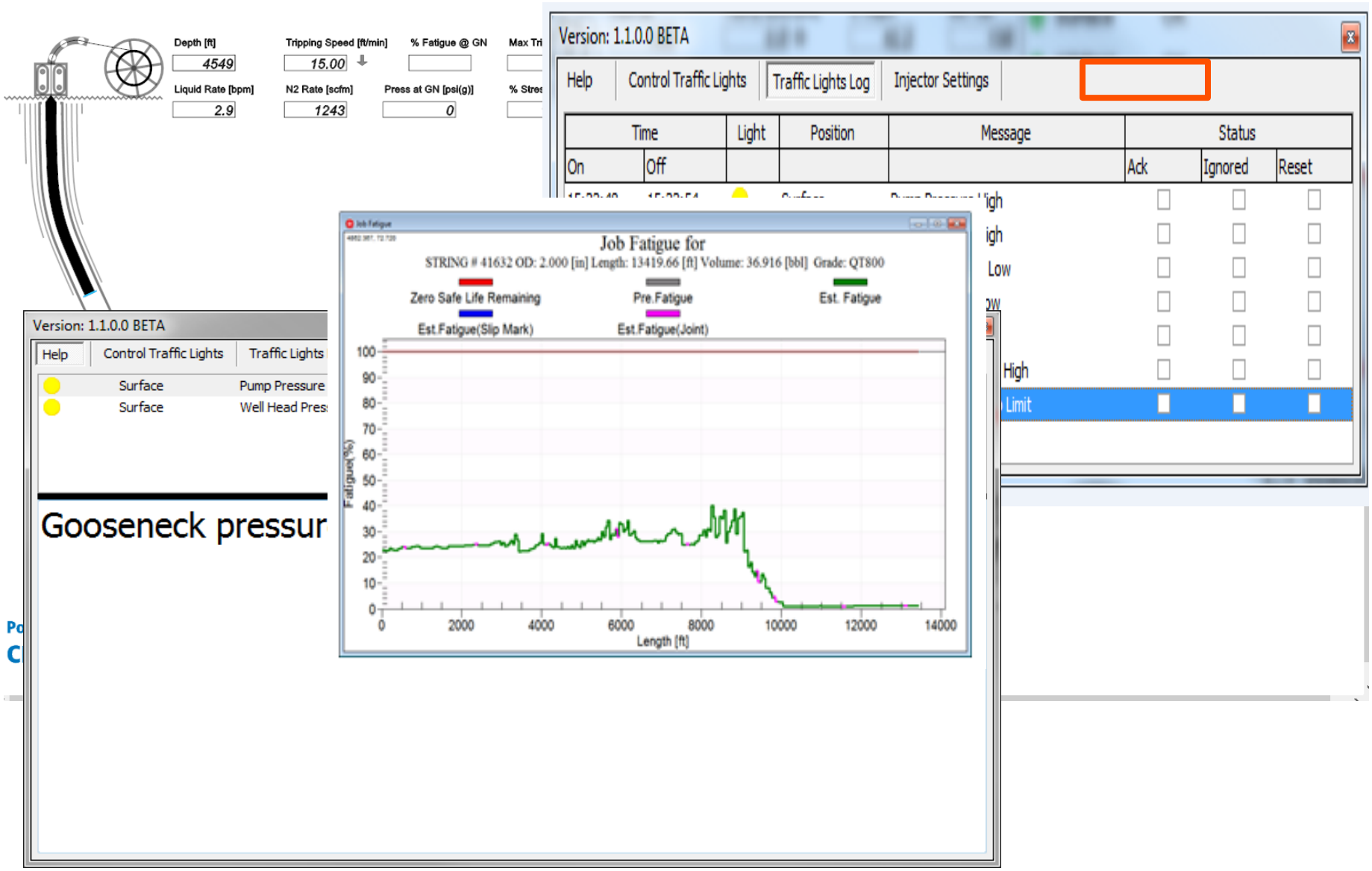
Field Input

- Weight Gauge
- Depth
- Pump Pressure
- Pump rates
- Well Head Pressure
- Injector Mid Skate Traction Pressure
- Injector Tension Pressure

Field Output

- Maximum Motor Injector Pressure
- Minimum Traction Pressure
- Weight Gauge/Pressure Limits
- CT Fatigue
- Traffic Lights [Warnings]
- CT Position; MD, TVD and well deviation at the BHA
- Time/Distance to next well feature

CIRCA Real Time Field Display



CIRCA Real-Time:Traffic Lights

Version: 1.1.0.0

Help | Control Traffic Lights | Traffic Lights Log | Injector Settings

Time		Light	Position	Message	Status		
On	Off				Ack	Ignored	Reset
17:31:25			Surface	Injector Traction Low	☑	☐	☐
17:28:47			Surface	Injector Tension High	☑	☐	☐
16:33:09	17:13:17		Well	Downhole Restriction	☐	☐	☐

Version: 1.1.0.0

Help | Control Traffic Lights | Traffic Lights Log | Injector Settings

Surface Injector Traction Low
Surface Injector Tension High

Injection traction pressure is 123 psig, recommended pressure is 500 psig. Increase pressure to avoid a risk of a runaway.

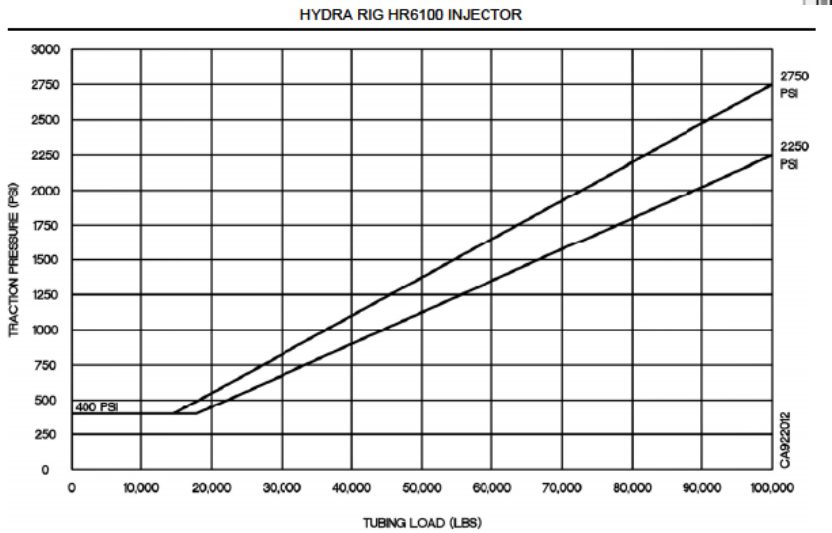


Fig. 3-4, Traction Pressure vs. Tubing Load

CIRCA Real-Time:Traffic Lights

Version: 1.1.0.0

Help | Control Traffic Lights | Traffic Lights Log | Injector Settings

Time		Light	Position	Message	Status		
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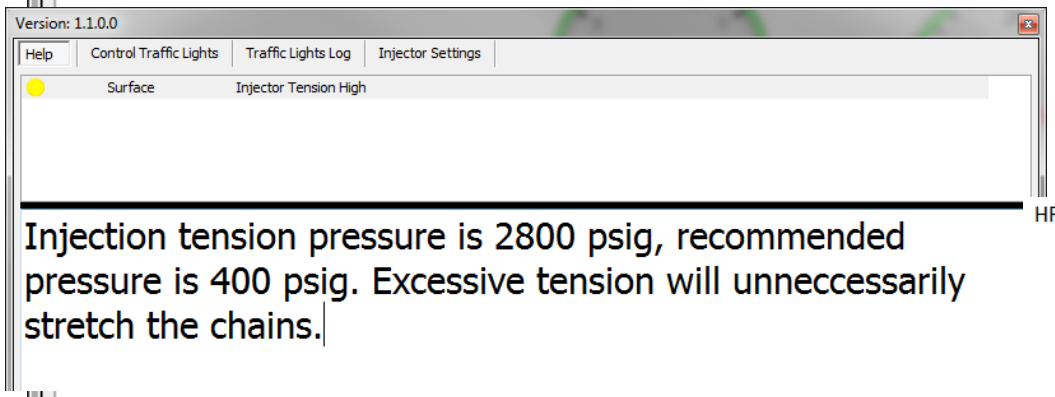
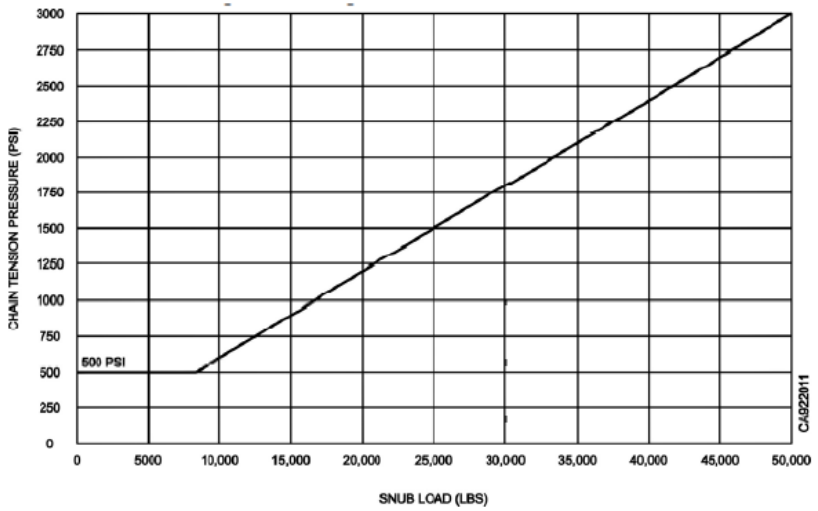


Injection tension pressure is 2800 psig, recommended pressure is 400 psig. Excessive tension will unneccessarily stretch the chains.

HR6100 TENSION/SNUB CHART

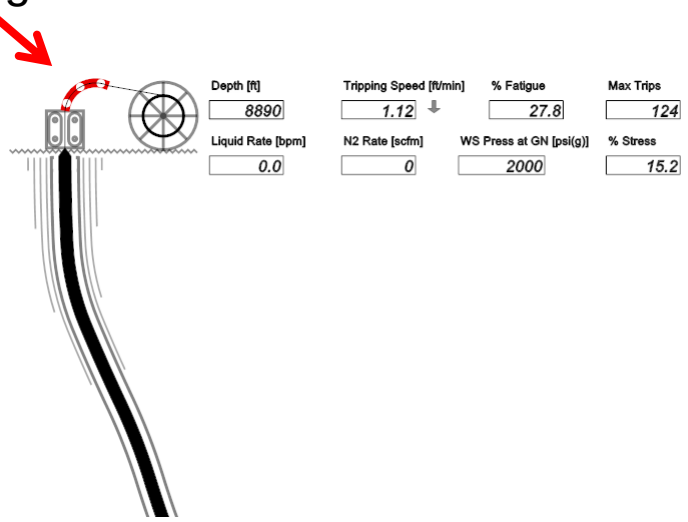


CIRCA Real-Time:Traffic Lights

Weld/Slips on Gooseneck

Weld/Slip 30 meters away

Weld/Slip on gooseneck

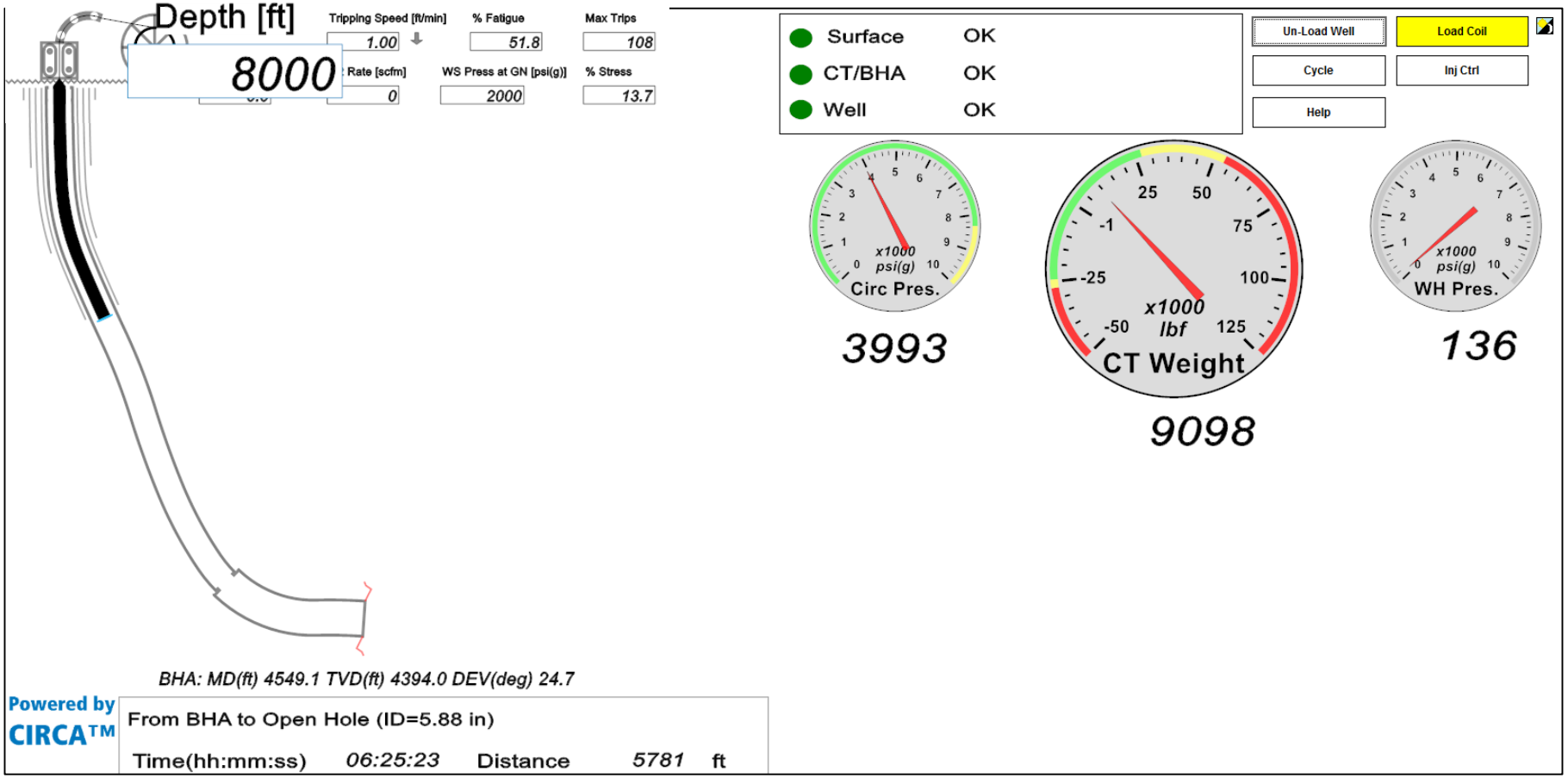


Traffic lights also flag within 30 m

1) High Fatigue section [>90%]
2) Minimal trips remaining [<5]

CIRCA Real Time Field Display

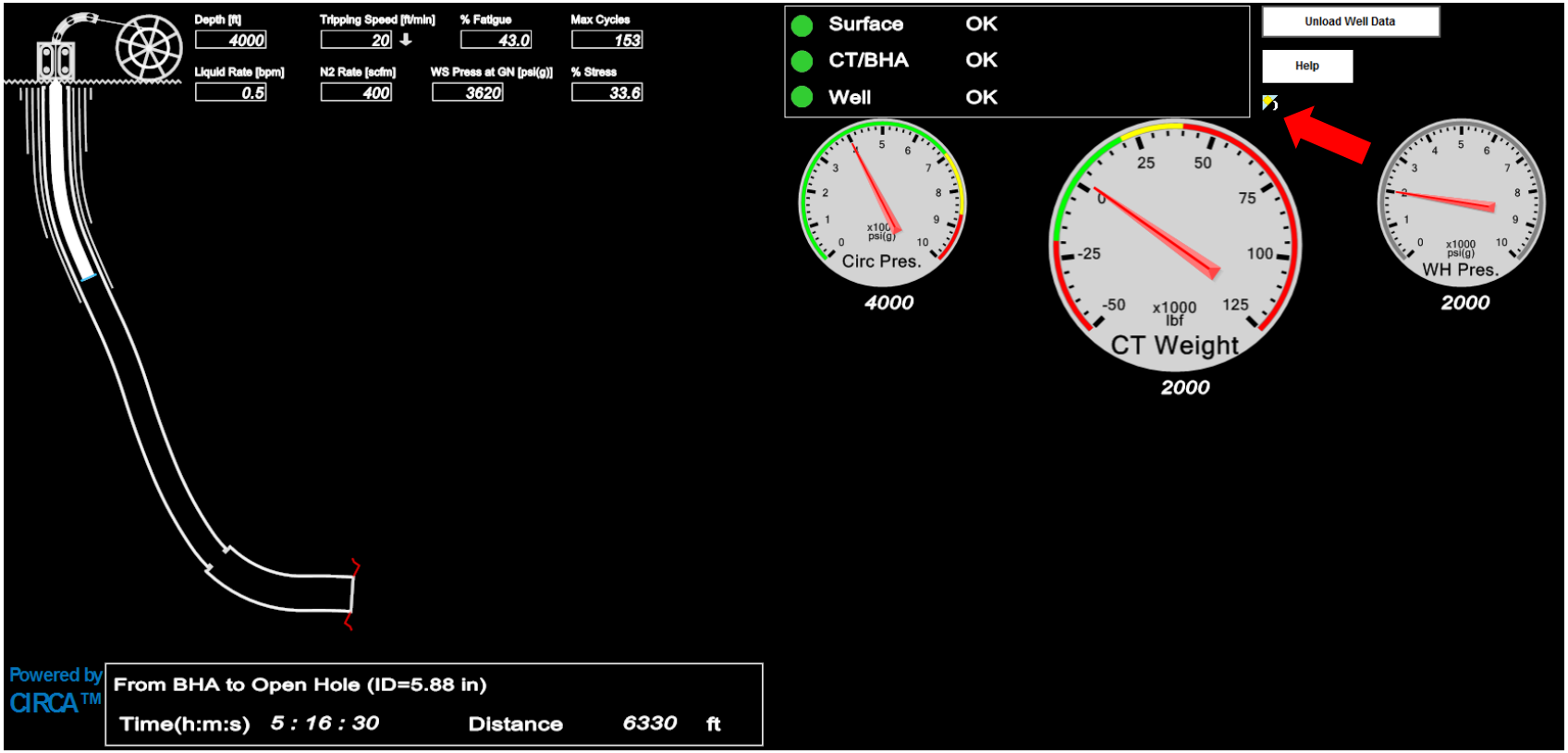
Hover over digital displays to magnify



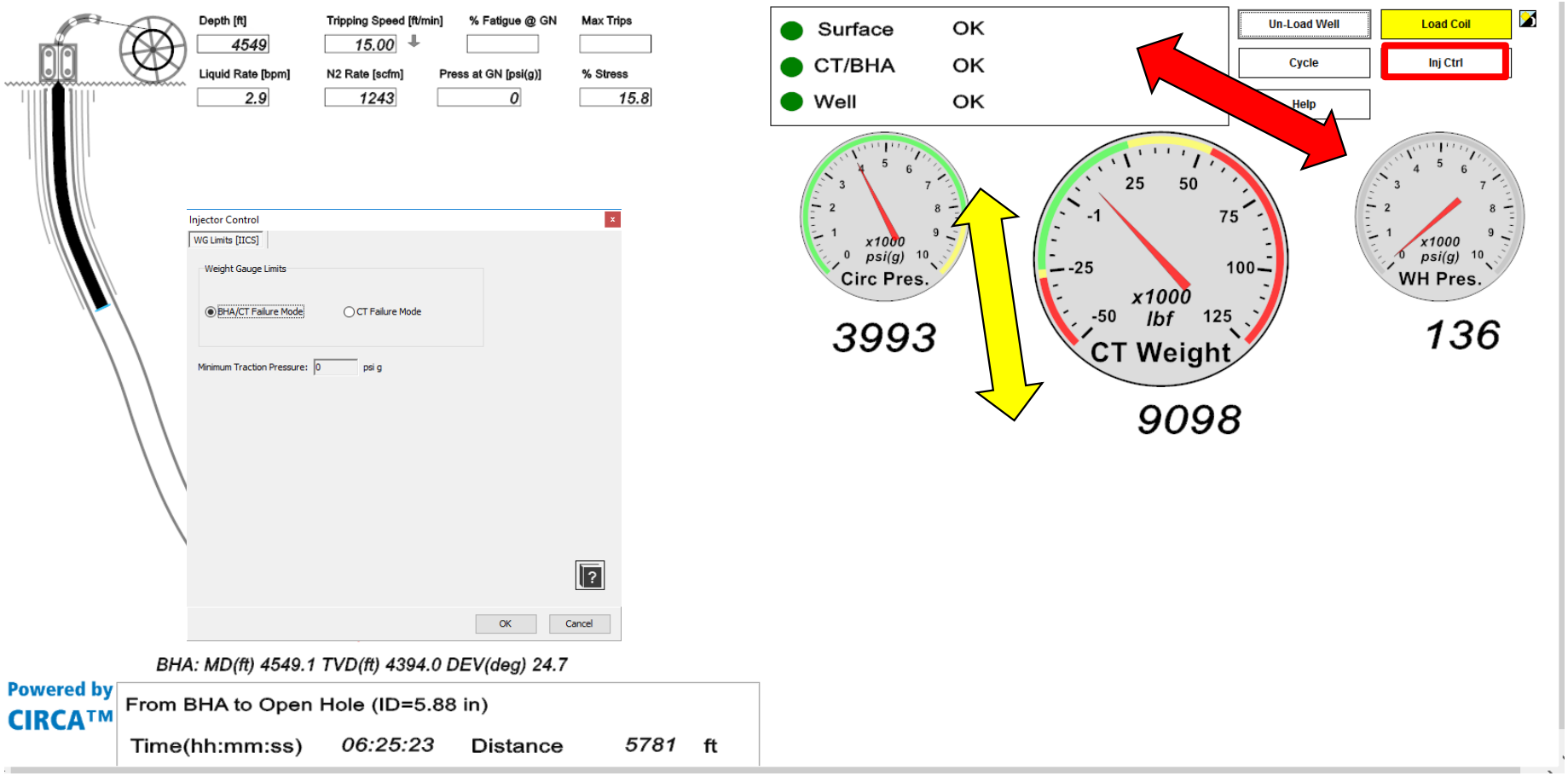
CIRCA Real Time Field Display

Day/Night switch

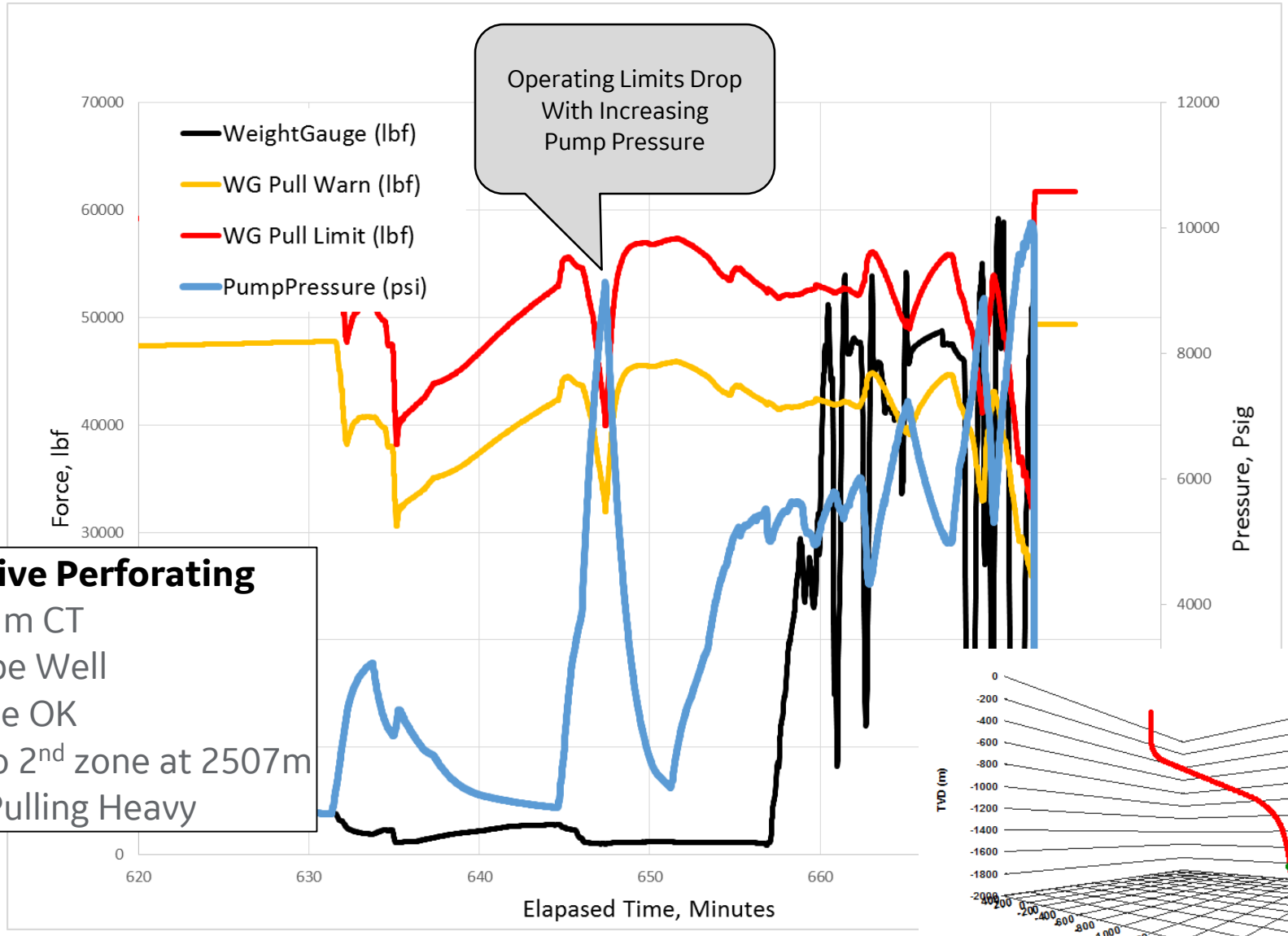
- Click on the day/night button to toggle foreground and background colors.



CIRCA Real Time: Parting Pipe



Circa Real-Time Software – Part Pipe With Overpull



Abrasive Perforating

50.8 mm CT

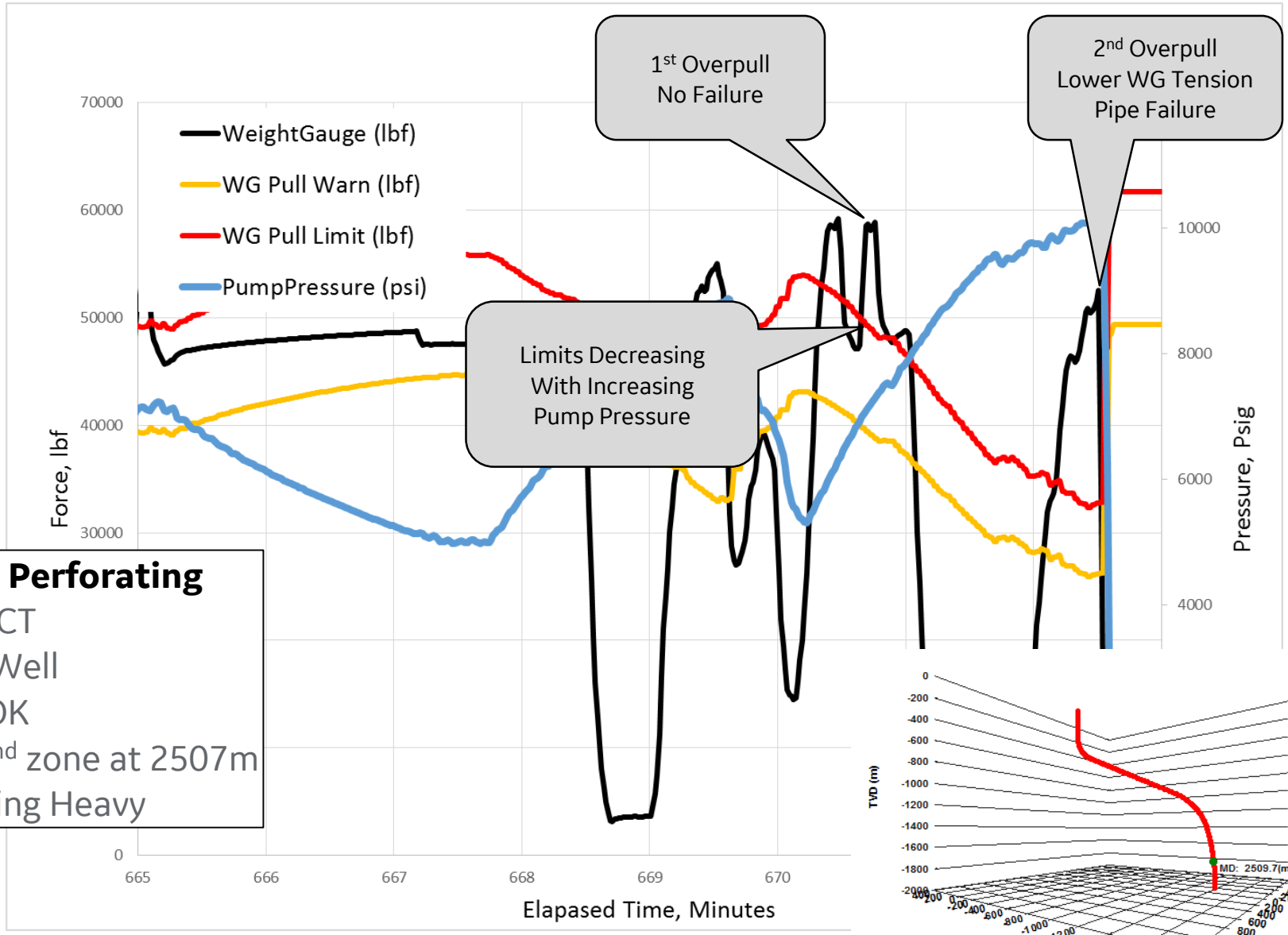
S-Shape Well

1st zone OK

POH to 2nd zone at 2507m

Start Pulling Heavy

Circa Real-Time Software – Part Pipe With Overpull



Abrasive Perforating

50.8 mm CT

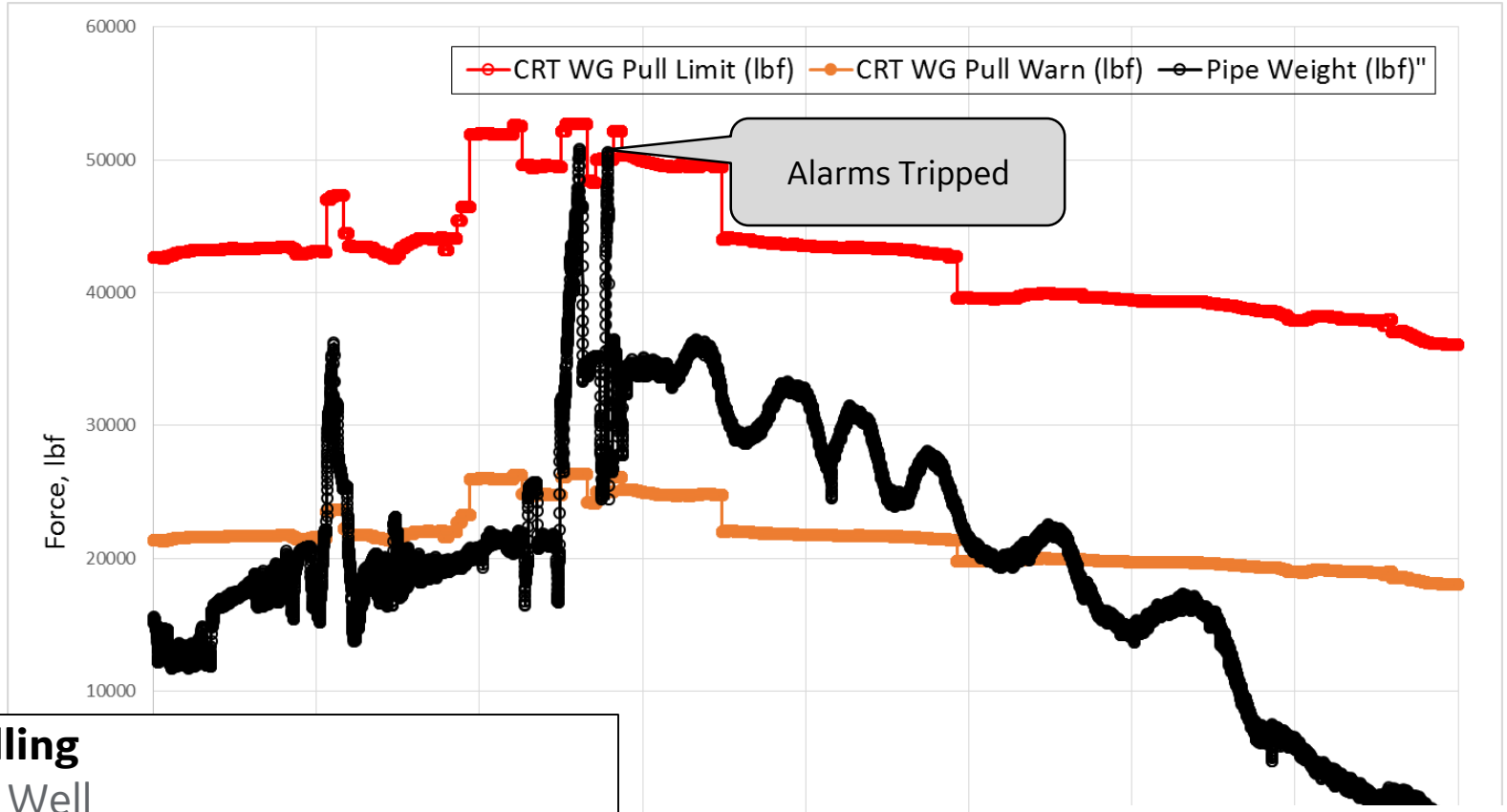
S-Shape Well

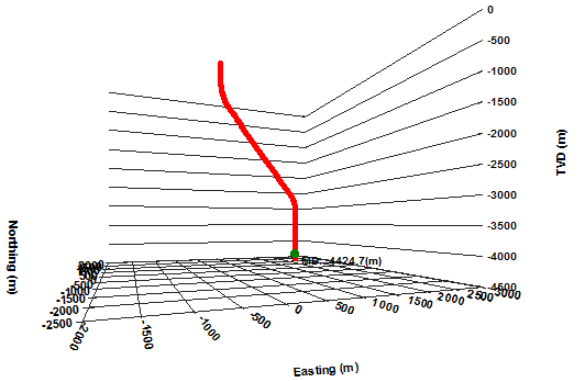
1st zone OK

POH to 2nd zone at 2507m

Start Pulling Heavy

Circa Real-Time Software – Overpull Part Avoided





Plug Milling

S-Shape Well

50.8 mm CT

Plug at 4420 m OK

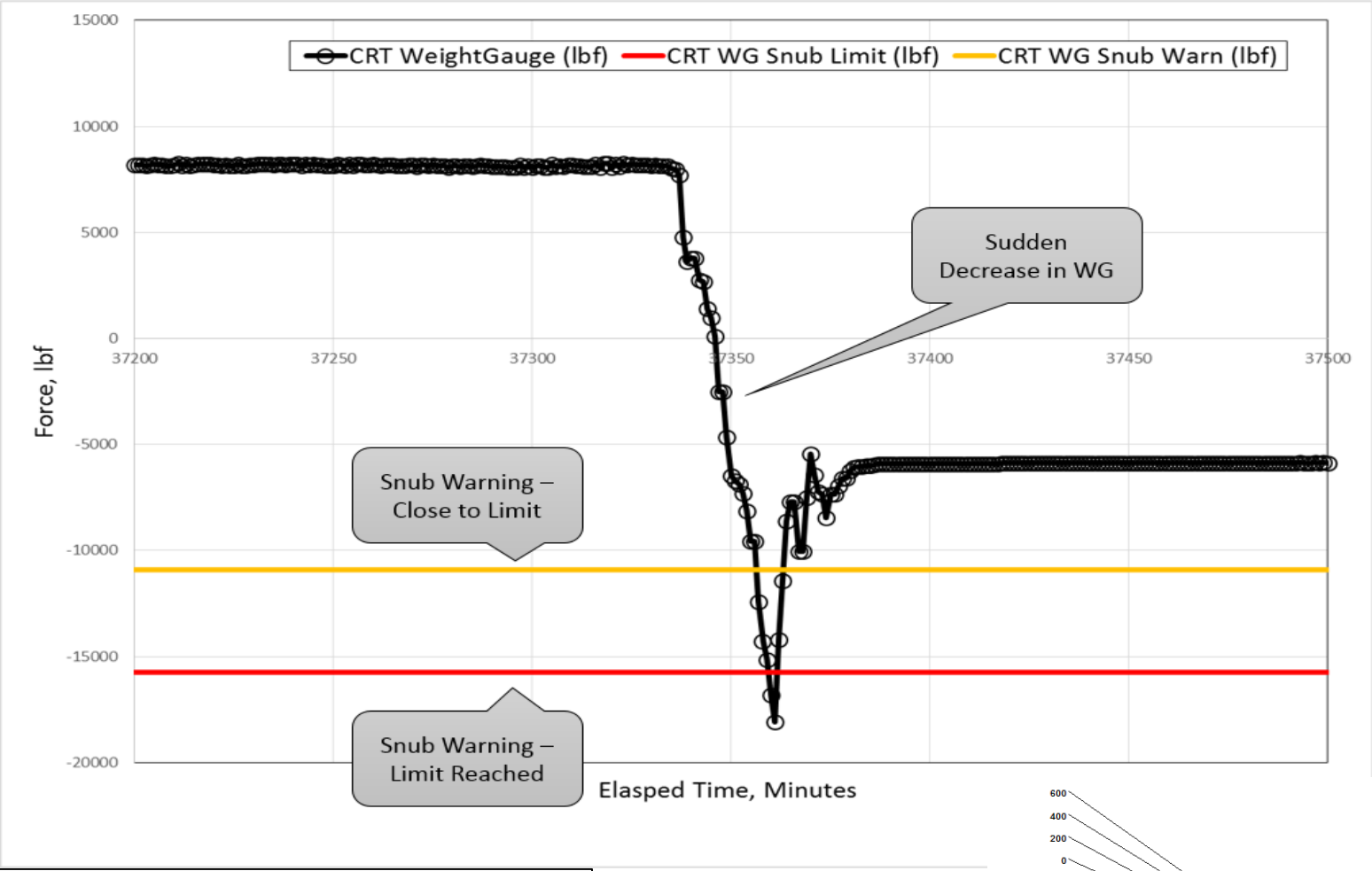
RIH 60 m to TD cleaning

POH Start Pulling Heavy; Alarm Tripped

RIH to free plug slips around mill

POH OK

Circa Real-Time Software – Pipe Parted during Snub

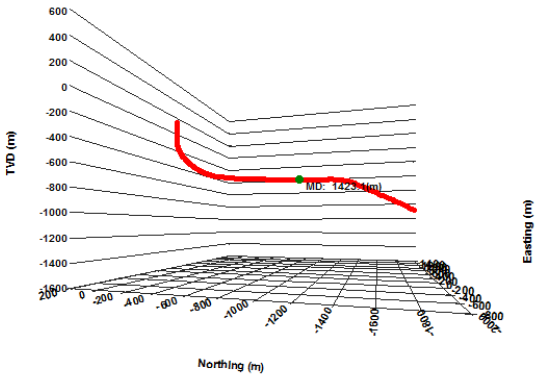


Run a blanking plug for ESP bypass

S-Shape Well

44.45 mm CT

CT at 1411 m when WG fell off



Circa Real-Time Software – Injector Head Control

- HW control box inside CT control cabin
- Includes PLC's, pressure transducers, control valves, cabling for communications and power.
- No external HW outside the CT control cabin

- **Anticipates failure by limiting motor pressure**
- **Prevents run-aways by limiting traction pressure**

Stuck Pipe during scale removal

Scale Removal

4300 m Vertical Well

88.9 mm tubing

44.45 mm CT

54 mm RotoJet

Pump KCl Brine at 50 lpm

Circa Real Time Software: Stuck Pipe during scale removal

Pump Pressure Dropping

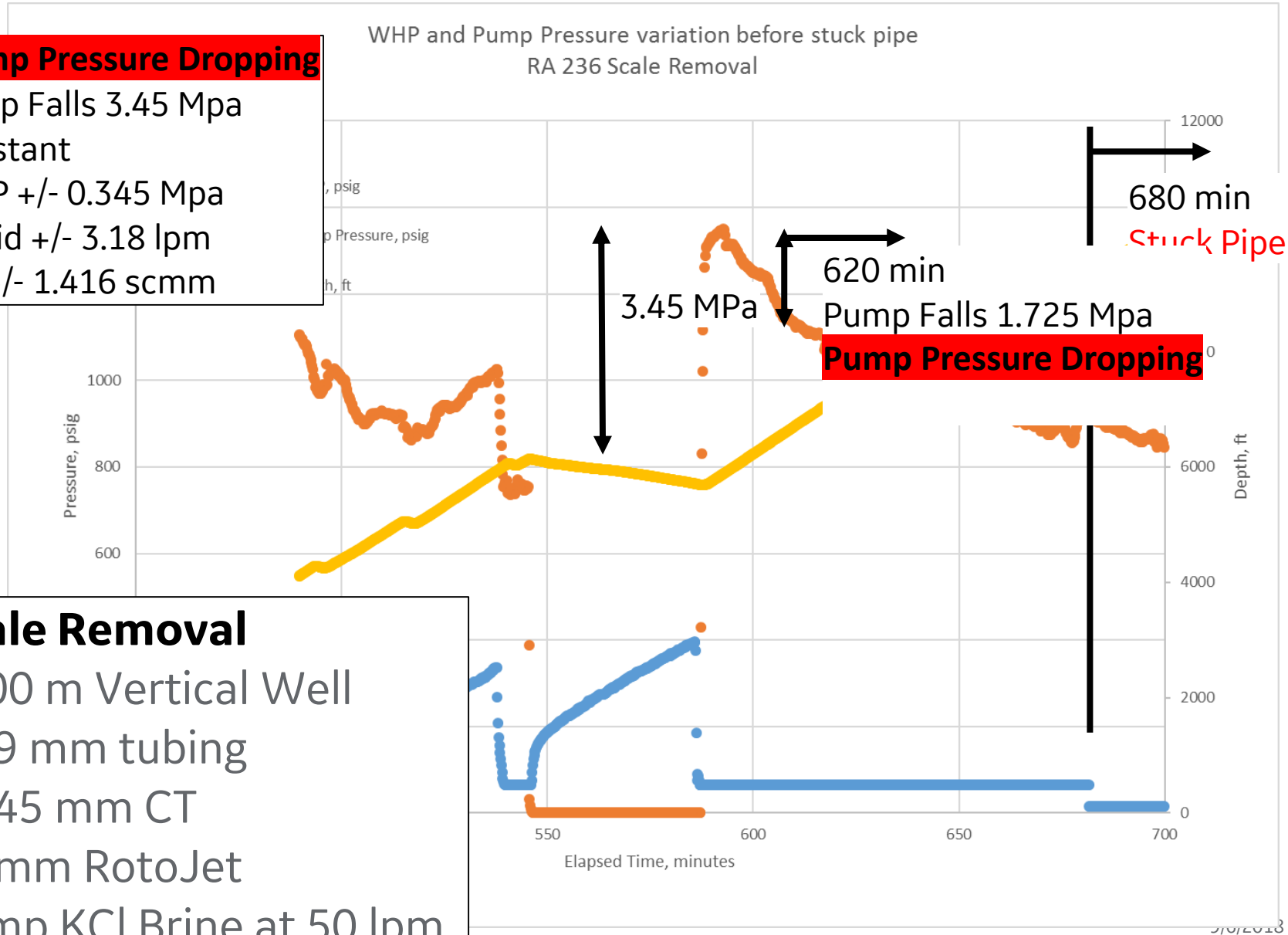
Pump Falls 3.45 Mpa

Constant

WHP +/- 0.345 Mpa

Liquid +/- 3.18 lpm

N2 +/- 1.416 scmm



Scale Removal

4300 m Vertical Well

88.9 mm tubing

44.45 mm CT

54 mm RotoJet

Pump KCl Brine at 50 lpm

Circa Real Time Software: Updated Stuck Pipe warning

Pump Pressure Falling

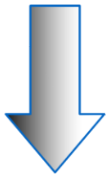
Pump Pressure Falls 3.45 MPa

Constant

WHP +/- 0.345 MPa

Liquid +/- 3.18 lpm and > 0.0

N2 +/- 1.416 scmm and > 0.0



Pump Pressure Falling

Pump Pressure Falls 1.725 MPa

Constant

WHP +/- 0.345 MPa

Liquid +/- 3.18 lpm and > 0.0

N2 +/- 1.416 scmm and > 0.0

Circa Real Time Software: New Stuck Pipe warnings

WH Pressure Dropping [WHP > 3.45 MPa]
WH Pressure Dropping [WHP <= 3.45 MPa]
WHP Falls 0.7 Mpa
Constant
Liquid +/- 3.18 lpm and > 0.0
N2 +/- 1.416 scmm and > 0.0

WH Pressure Dropping [WHP > 3.45 MPa]
WH Pressure Dropping [WHP <= 3.45 MPa]
WHP Falls 0.7 Mpa
Constant
Pump Press +/- 0.35 Mpa
Rates Increasing
Liquid Rate increased 8 lpm
or
N2 increased 2.8 scmm

Circa Real Time Software: New Stuck Pipe warnings

WH Pressure Dropping Cleanout Job
WHP Falls 0.35 Mpa
Constant
Liquid +/- 3.18 lpm and > 0.0
N2 +/- 1.416 scmm and > 0.0

Pump Pressure Increasing
Pump Pressure Increases 1.7 MPa
WHP Falls 0.35 Mpa
Constant
Liquid +/- 3.18 lpm and > 0.0
N2 +/- 1.416 scmm and > 0.0

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Questions/Comments

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