TAM Software Features for Dynamometer Analysis

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Download the Session 17 PDF Bundle and TAM Example Data from
https://echometer.com/Support/AskEchometer

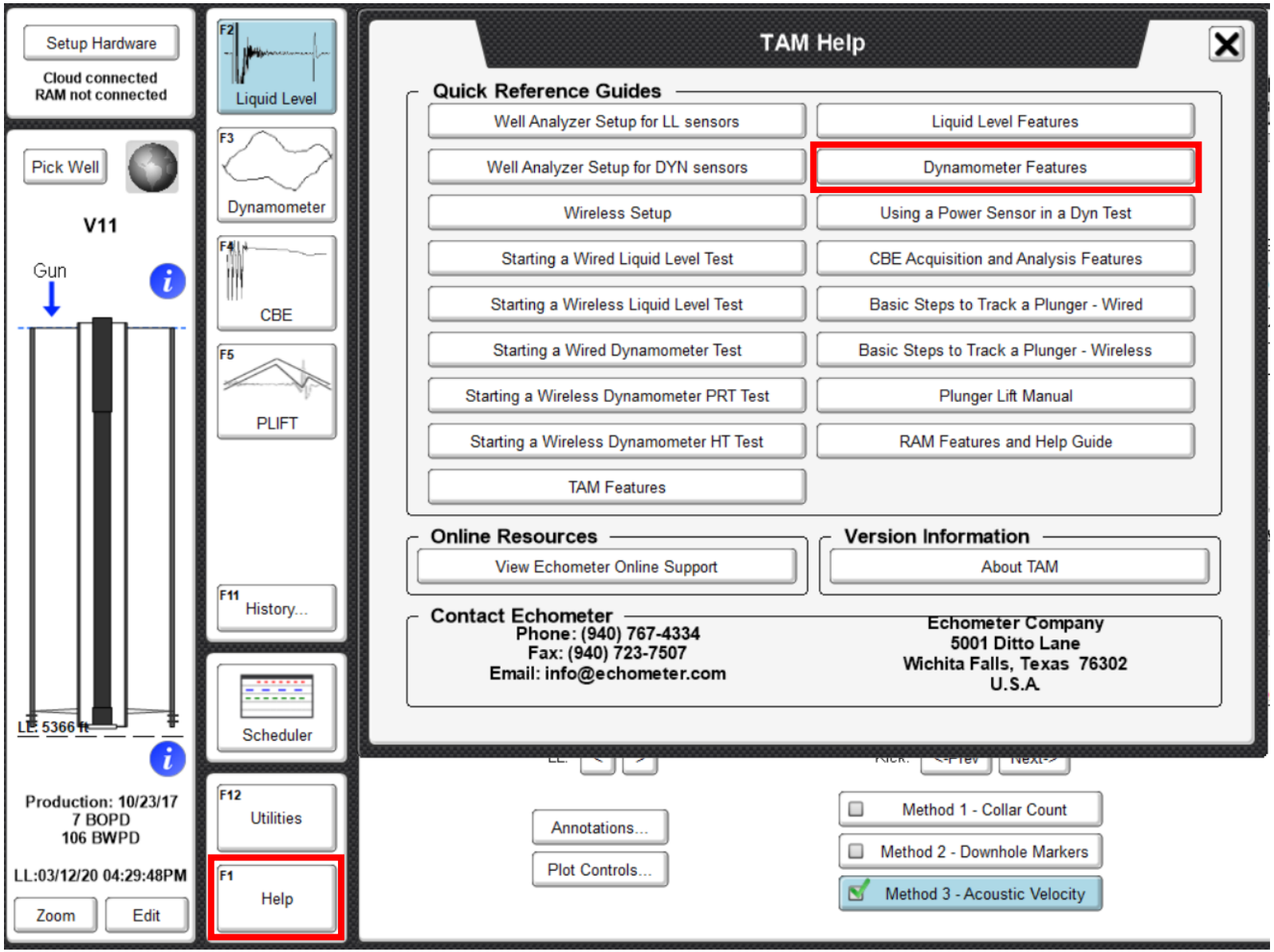
Objective

- To show users the several features/tools available in TAM software to perform a Dynamometer Analysis.

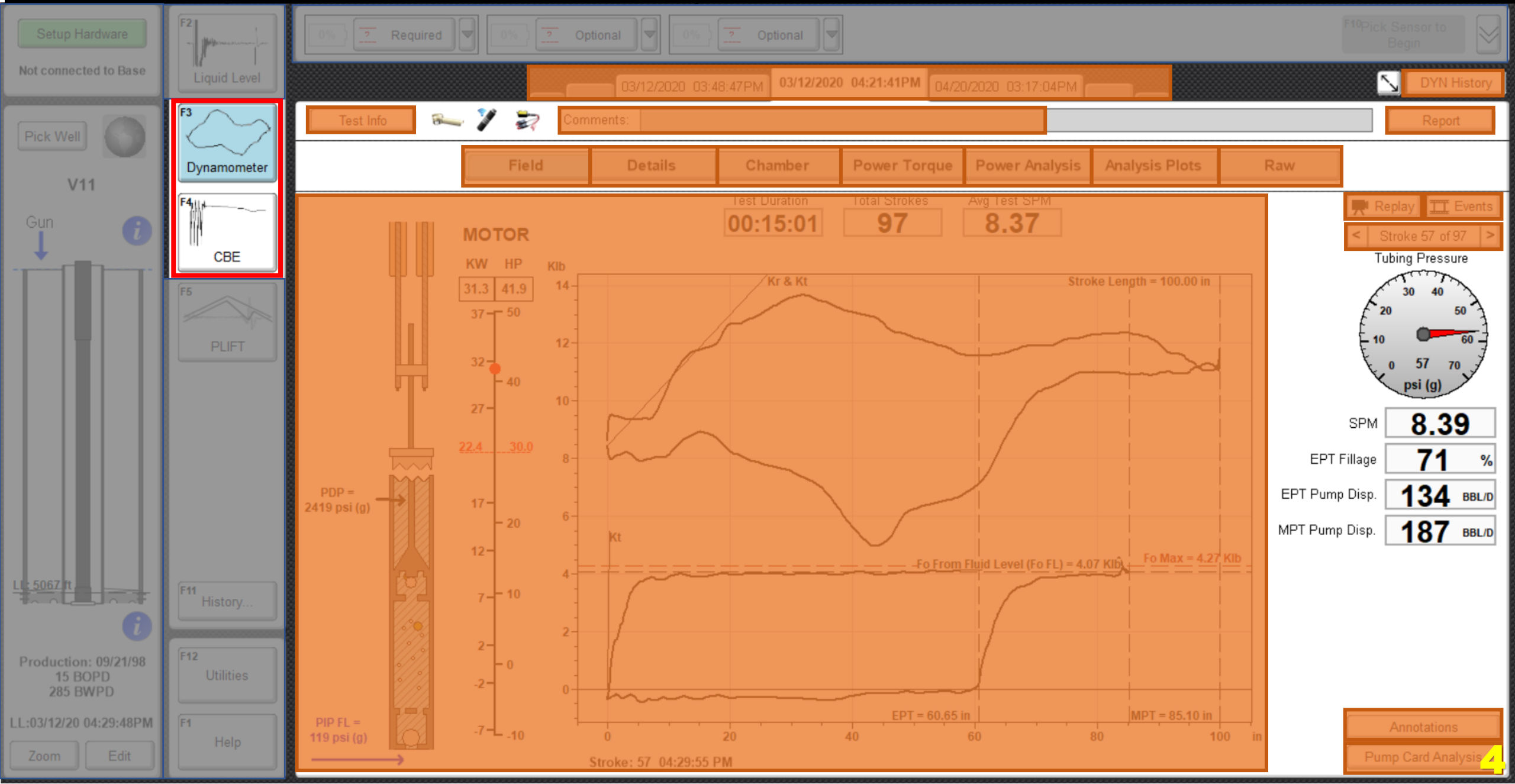
TAM Software version

- TAM 1.7.41 Release
- TAM 1.8 Development to include RAM support. Available soon.

Dynamometer Features document available in TAM Help



Main Dynamometer Analysis Window



Main Dynamometer Analysis Window

The primary ***Dynamometer*** analysis screen shows:

1. Top of the screen:

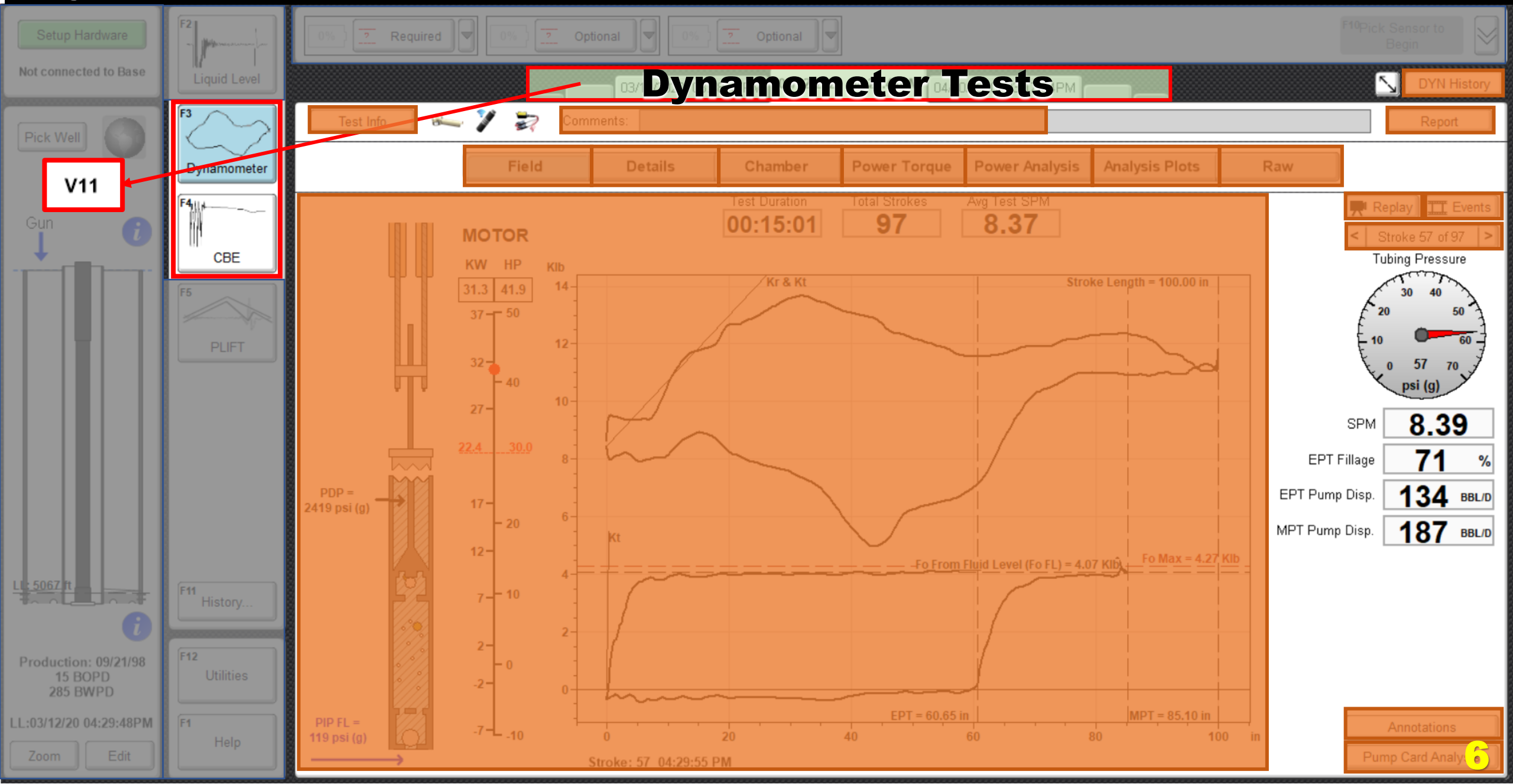
- History options, test information, and Dynamometer report
- Dynamometer Analysis Windows
  - Field View
  - Detailed View
  - Chamber View
  - Power Torque
  - Power Analysis
  - Analysis Plots
  - Raw Data/Valve Tests

2. Left of the screen: Surface and Pump sections animation.

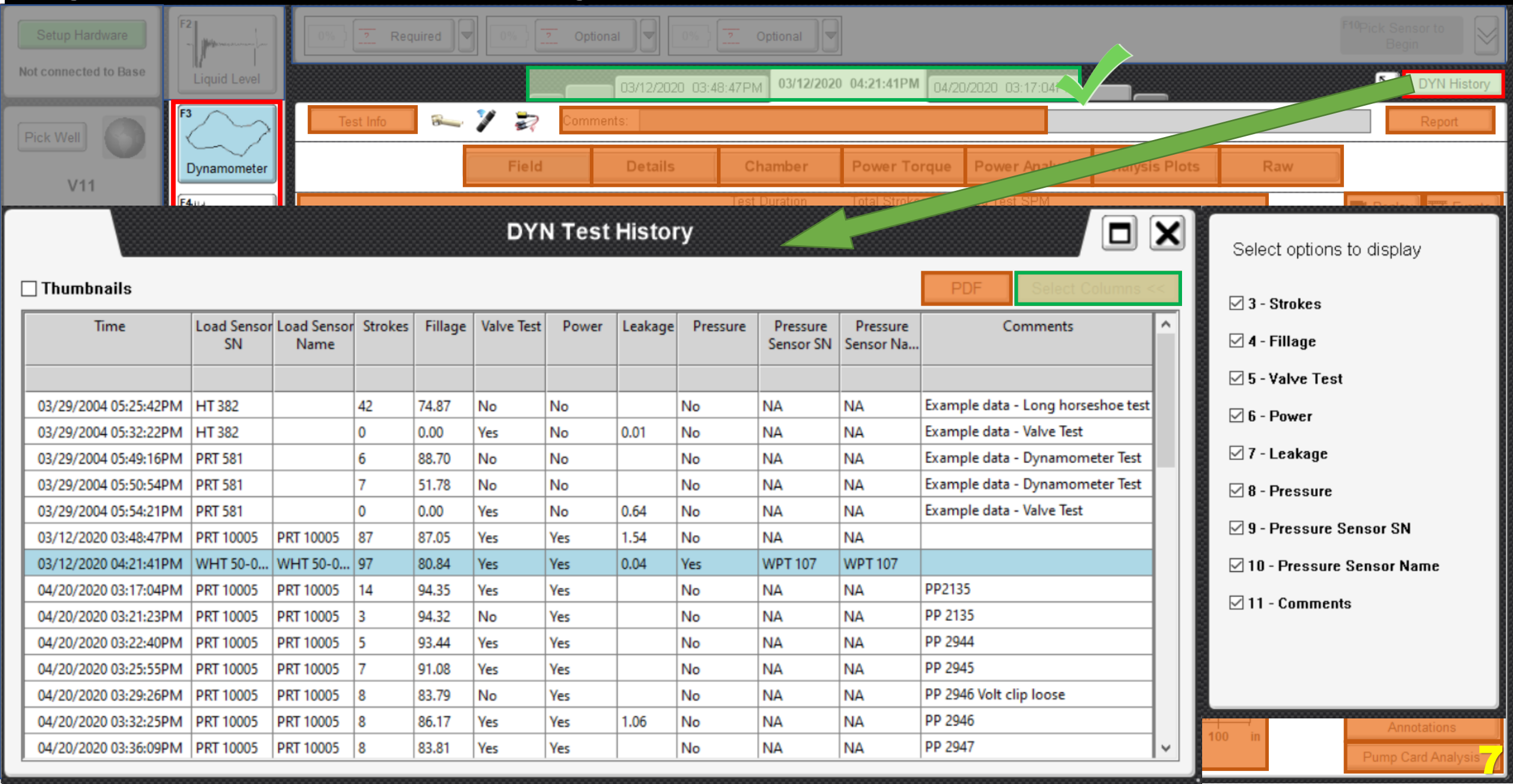
3. Center of the screen: Surface and Pump dynamometer plots

3. Bottom right-hand corner of the screen: *Annotations* and *Pump Card Analysis buttons.*

Dynamometer Test Tabs

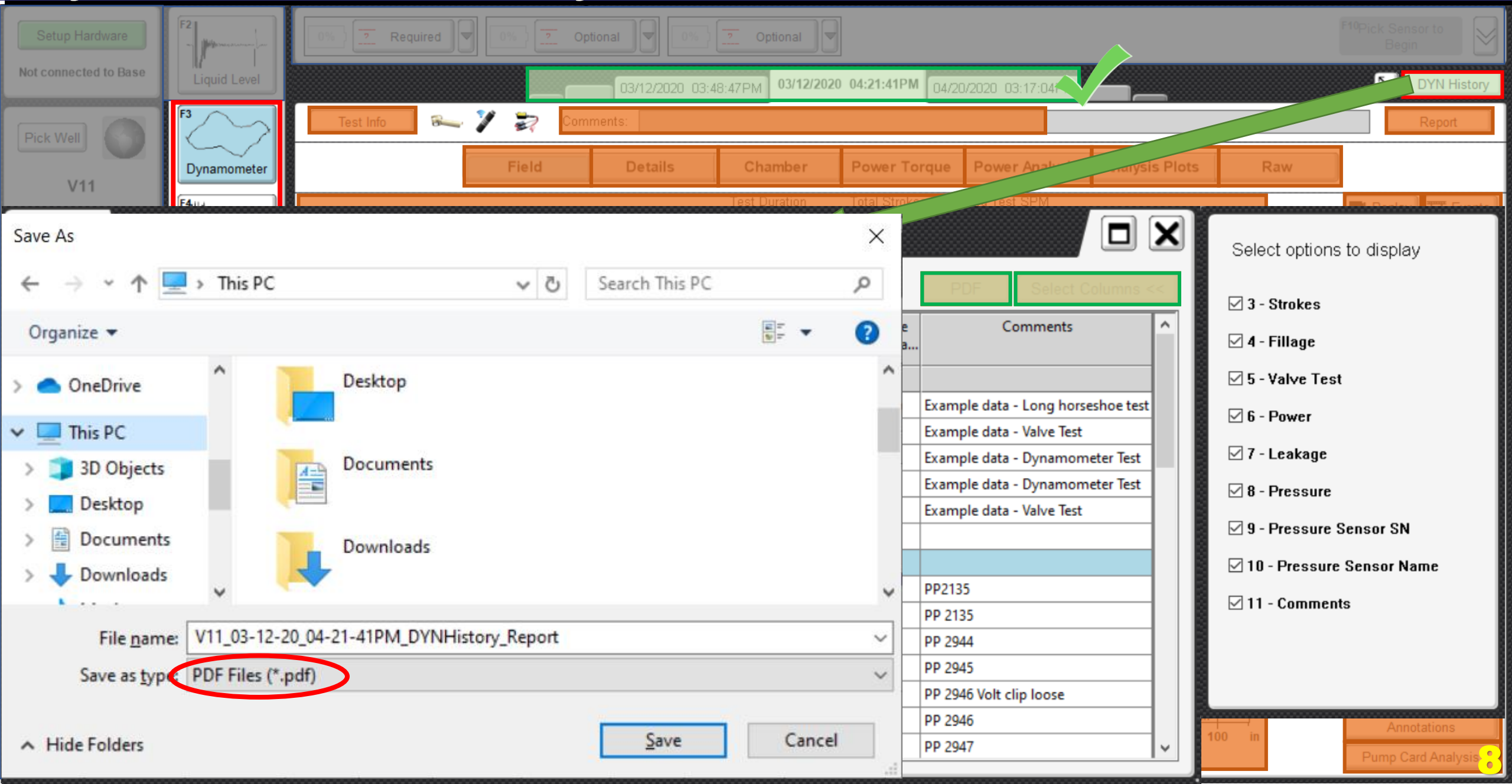


Dynamometer History



Time	Load Sensor SN	Load Sensor Name	Strokes	Fillage	Valve Test	Power	Leakage	Pressure	Pressure Sensor SN	Pressure Sensor Na...	Comments
03/29/2004 05:25:42PM	HT 382		42	74.87	No	No		No	NA	NA	Example data - Long horseshoe test
03/29/2004 05:32:22PM	HT 382		0	0.00	Yes	No	0.01	No	NA	NA	Example data - Valve Test
03/29/2004 05:49:16PM	PRT 581		6	88.70	No	No		No	NA	NA	Example data - Dynamometer Test
03/29/2004 05:50:54PM	PRT 581		7	51.78	No	No		No	NA	NA	Example data - Dynamometer Test
03/29/2004 05:54:21PM	PRT 581		0	0.00	Yes	No	0.64	No	NA	NA	Example data - Valve Test
03/12/2020 03:48:47PM	PRT 10005	PRT 10005	87	87.05	Yes	Yes	1.54	No	NA	NA	
03/12/2020 04:21:41PM	WHT 50-0...	WHT 50-0...	97	80.84	Yes	Yes	0.04	Yes	WPT 107	WPT 107	
04/20/2020 03:17:04PM	PRT 10005	PRT 10005	14	94.35	Yes	Yes		No	NA	NA	PP2135
04/20/2020 03:21:23PM	PRT 10005	PRT 10005	3	94.32	No	Yes		No	NA	NA	PP 2135
04/20/2020 03:22:40PM	PRT 10005	PRT 10005	5	93.44	Yes	Yes		No	NA	NA	PP 2944
04/20/2020 03:25:55PM	PRT 10005	PRT 10005	7	91.08	Yes	Yes		No	NA	NA	PP 2945
04/20/2020 03:29:26PM	PRT 10005	PRT 10005	8	83.79	No	Yes		No	NA	NA	PP 2946 Volt clip loose
04/20/2020 03:32:25PM	PRT 10005	PRT 10005	8	86.17	Yes	Yes	1.06	No	NA	NA	PP 2946
04/20/2020 03:36:09PM	PRT 10005	PRT 10005	8	83.81	Yes	Yes		No	NA	NA	PP 2947

Dynamometer History



Test Info / Comments

Sensors information can also be viewed when placing the mouse pointer on the sensor icon.

Test Info

Acquired with version:

1.7.41 Release, May 10 2018 11:39:21

Acquired with base firmware version:

10-24-17

Sensors:

Details WHT 50-001

Details WPT 107

Details WPP 170

Comments:

Relevant test comments

Sensor Information

Serial Number: WHT 50-001
System Type: Wireless
Acquisition Rate: 60 Hz
Sensor Firmware Version: 6-5-17
Coefficients:
C1: -2.6400 C4: 0.0000
C2: 23.5400 C5: 0.0000
C3: 0.0000 C6: 65.4100
Zero Offset: -0.71 Klb
Zero Date: 03/12/2020 04:13:41PM

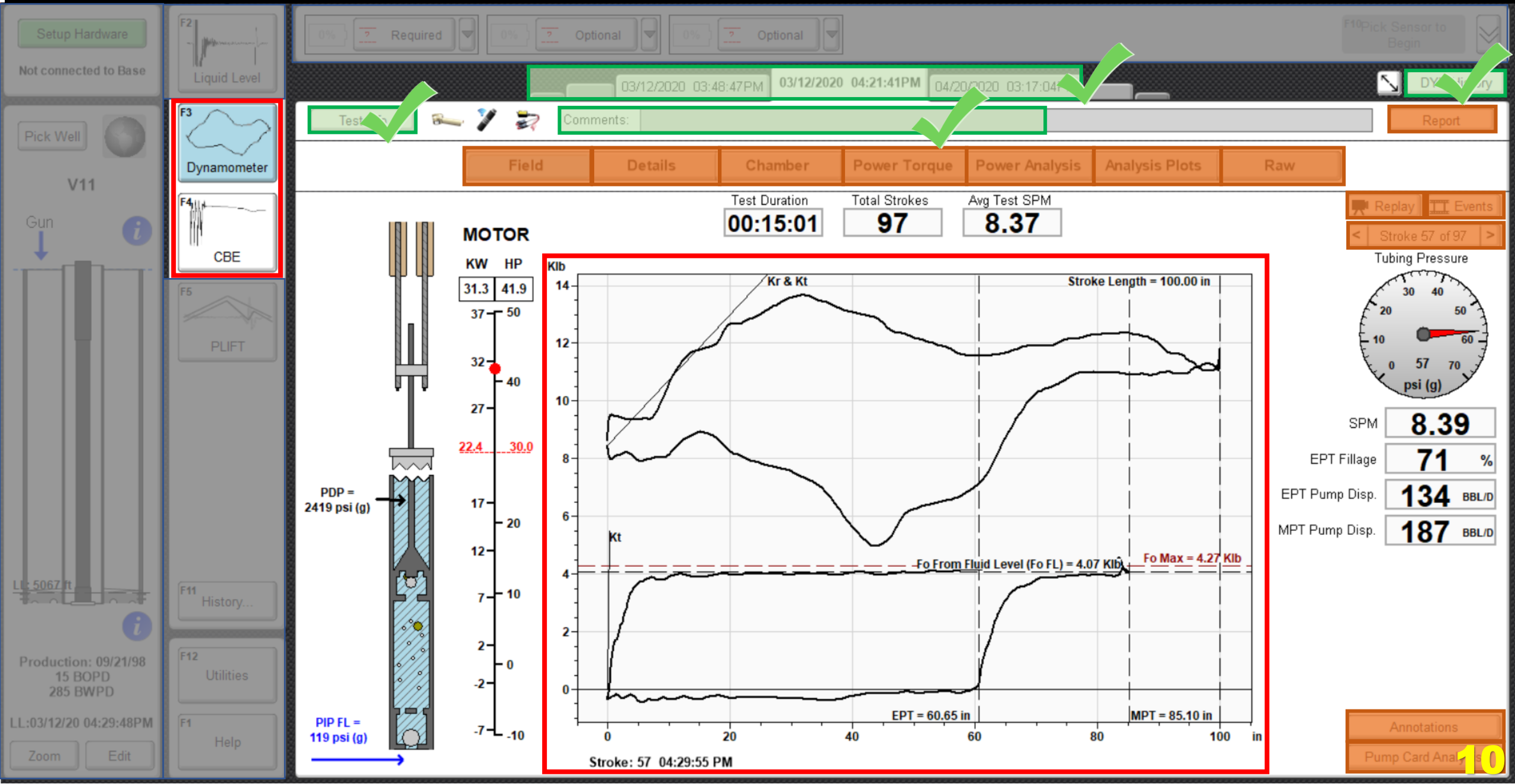
Sensor Information

Serial Number: WPT 107
System Type: Wireless
Acquisition Rate: 60 Hz
Sensor Firmware Version: 6-5-17
Coefficients:
C1: 0.0000 C4: 0.0000
C2: 641.1600 C5: 0.0000
C3: 0.0000 C6: 0.0000
Zero Offset: +6.6 psi (g)
Zero Date: 03/12/2020 04:16:56PM
Temperature: 92 deg F

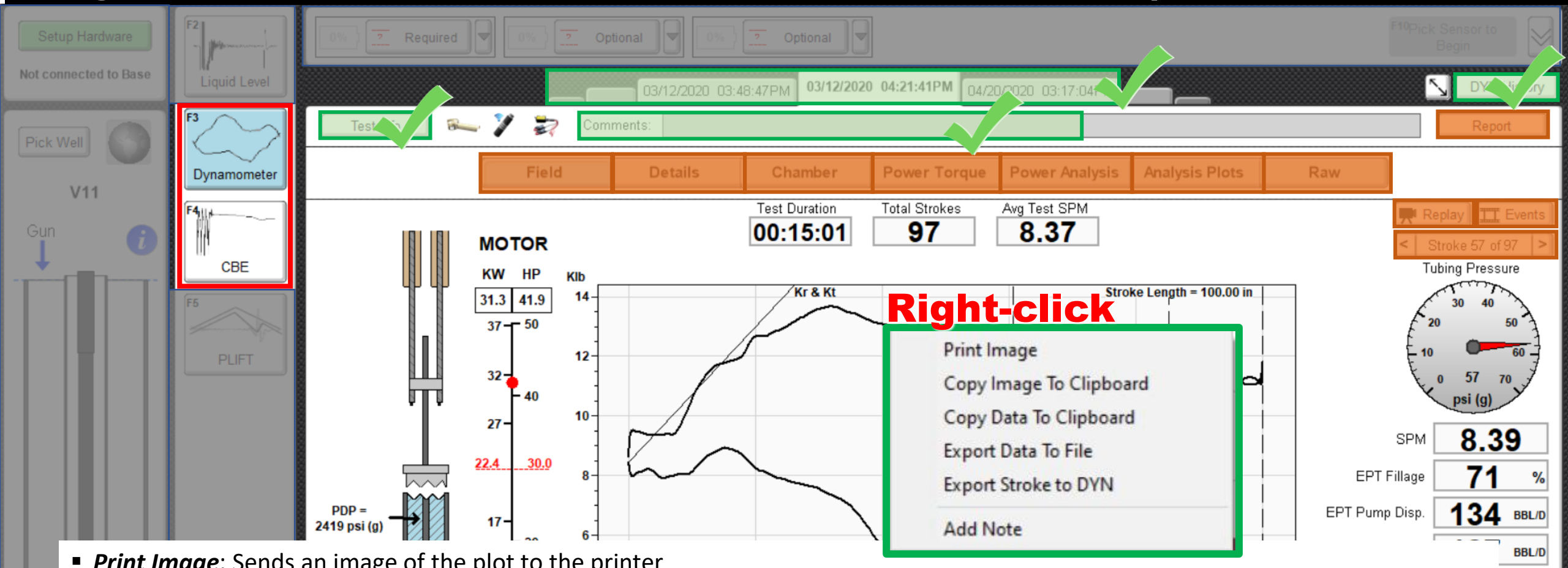
Sensor Information

Serial Number: WPP 170
System Type: Wireless
Acquisition Rate: 60 Hz
Sensor Firmware Version: 6-5-17
Coefficients:
C1: 0.068706 C4: 0.628924
C2: 0.202554 C5: -0.054475
C3: -0.456222 C6: 0.172771

Main Dynamometer plot

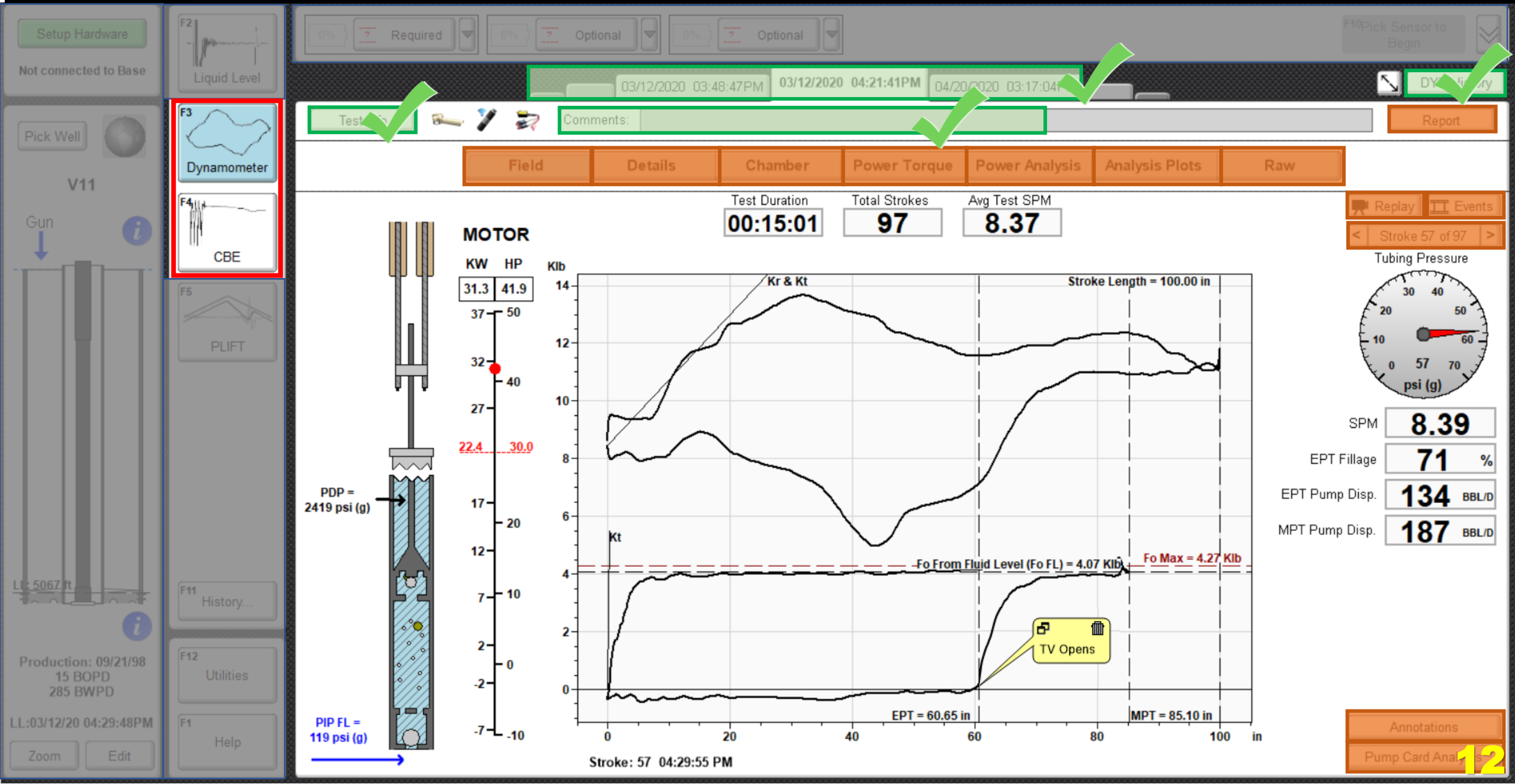


Right Click Menu - Additional DYN Plot options

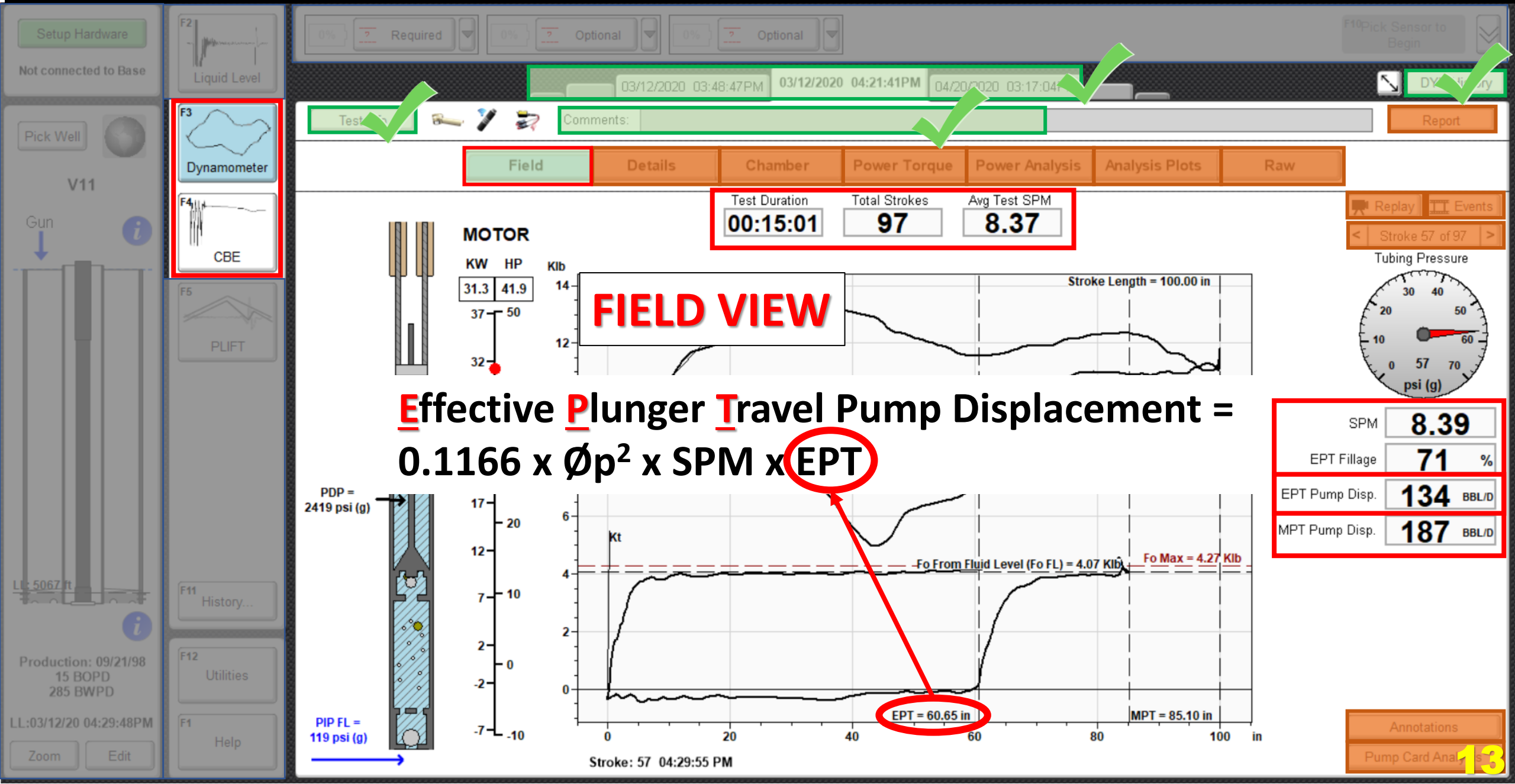


- ***Print Image***: Sends an image of the plot to the printer
- ***Copy Image to Clipboard***: copies the plot image to the system clipboard
- ***Copy Data to Clipboard***: copies the position, load, and pressure (if acquired) values of the selected strokes to the system clipboard
- ***Export Data to File***: saves the position, load, and pressure values of the selected strokes to a text file (which can be loaded into spreadsheet programs like Excel)
- ***Export Stroke to DYN:*** saves the stroke load data, CBE information, valve loads, calculated stroke information, and information about the well and sensors used to record the data to an industry standard .DYN file.
- ***Add Note***: add a note/annotation to the plot (see **"Plot Notes"** section in **"TAM Features"** document)

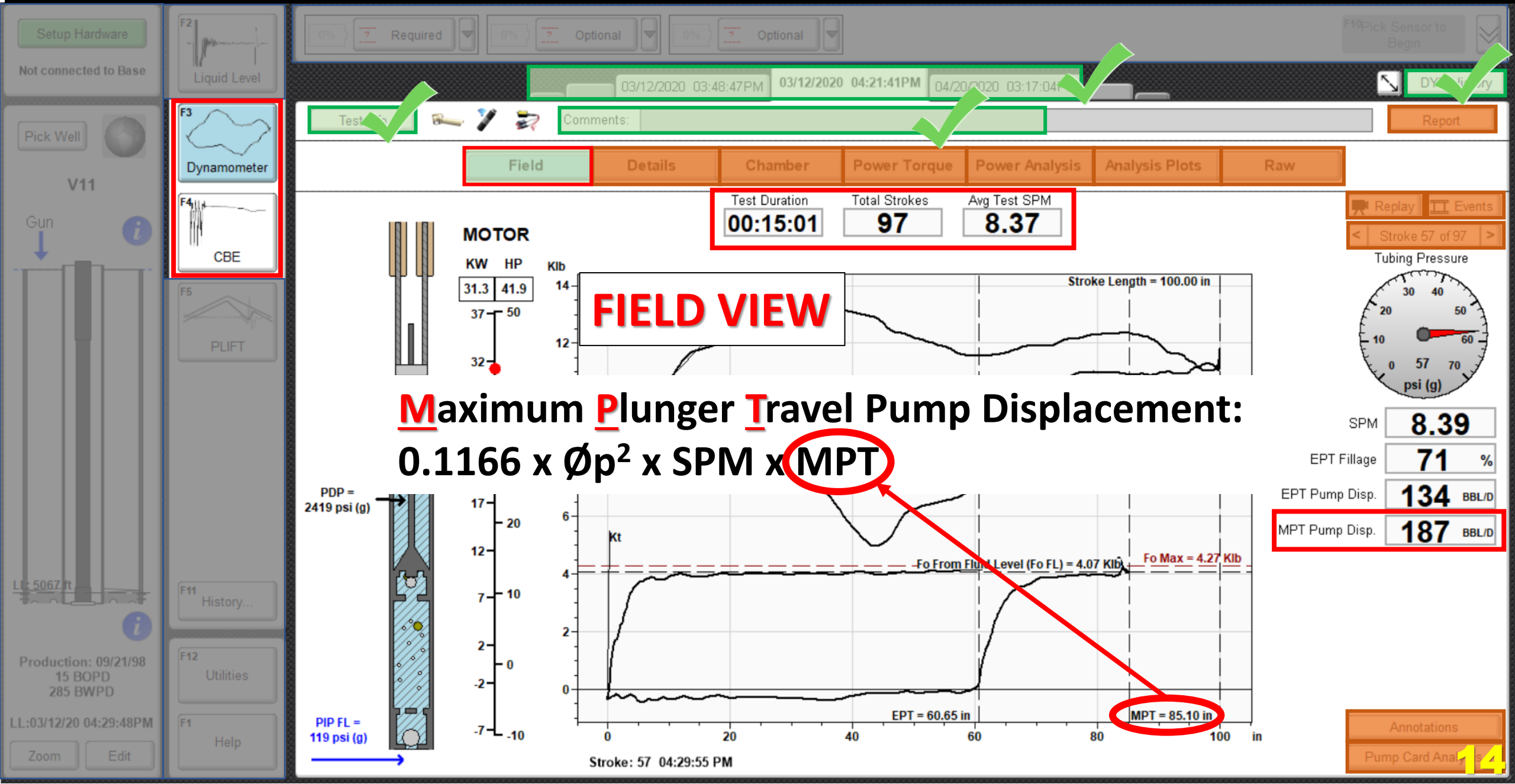
Right Click Menu - Add Note



Analysis Windows / Field View



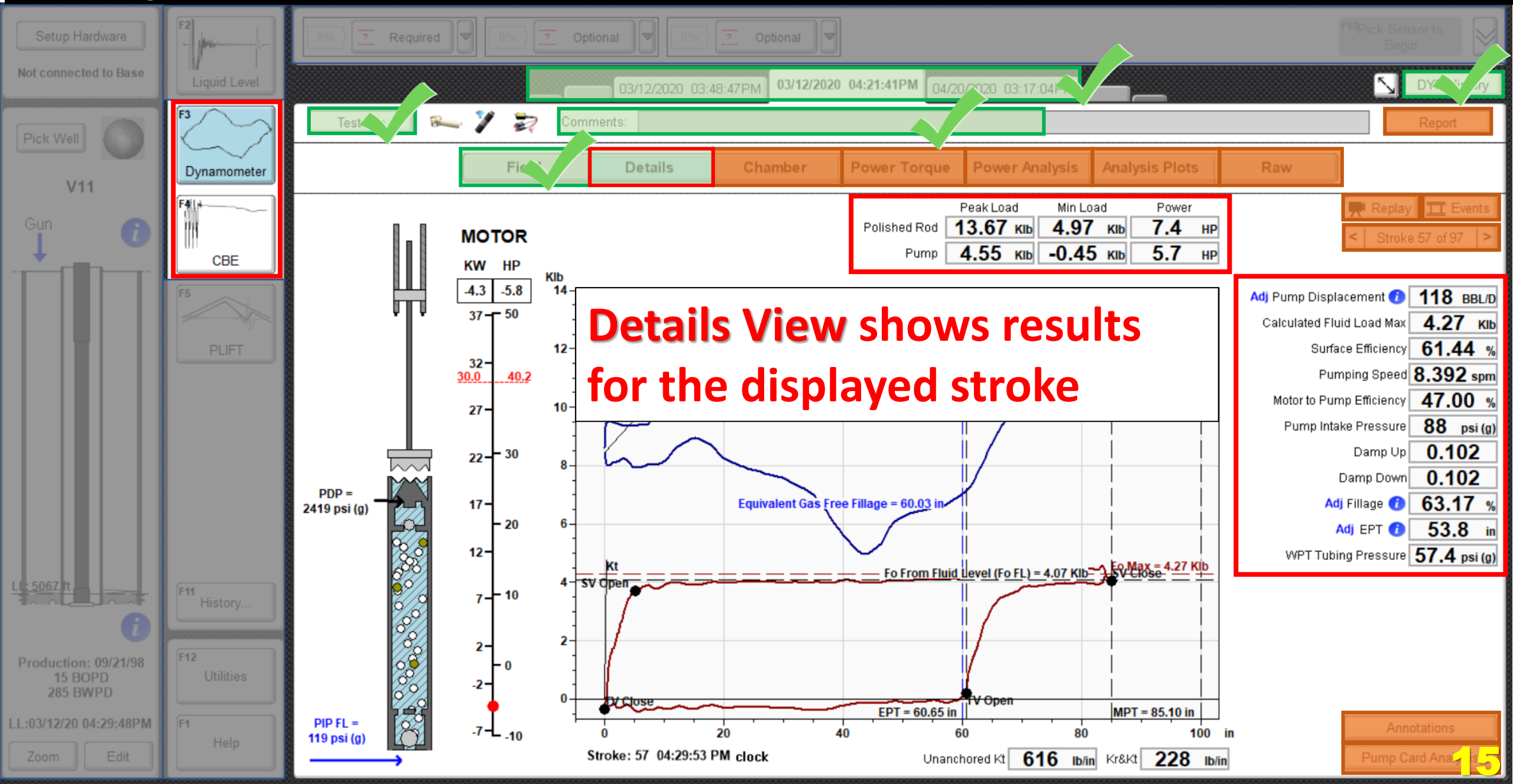
Analysis Windows / Field View



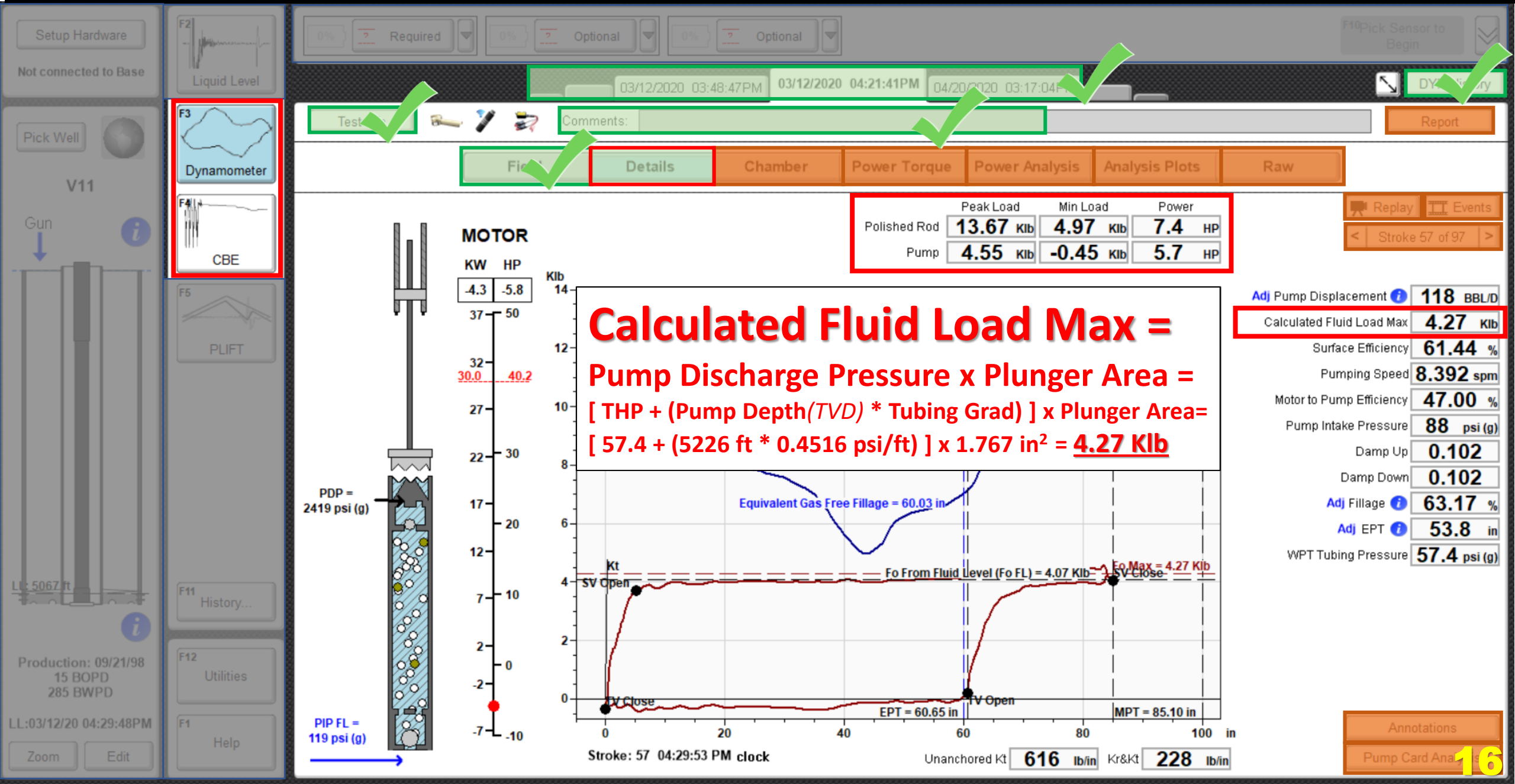
Maximum Plunger Travel Pump Displacement:

$0.1166 \times Øp^2 \times SPM \times MPT$

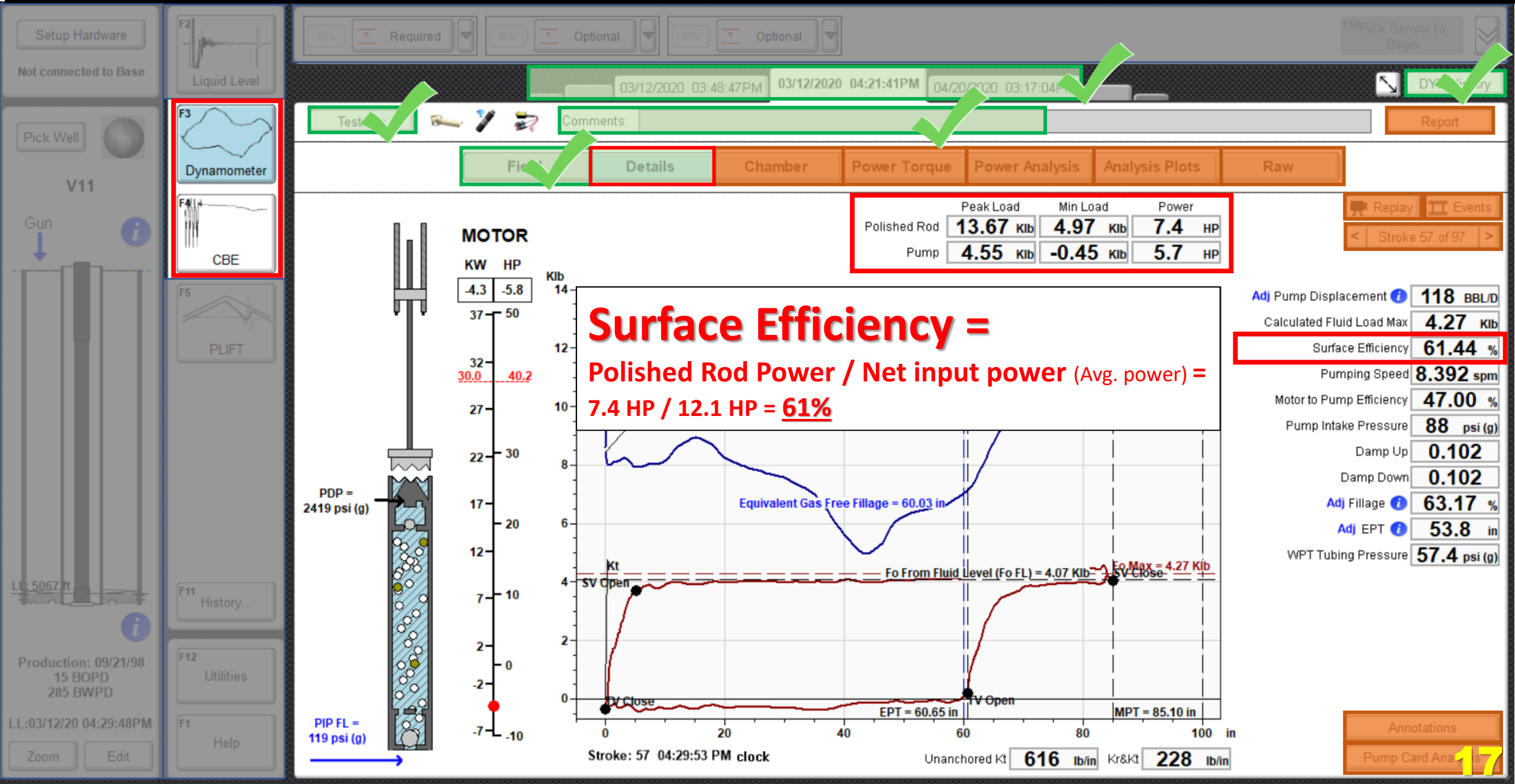
Analysis Windows / Details View



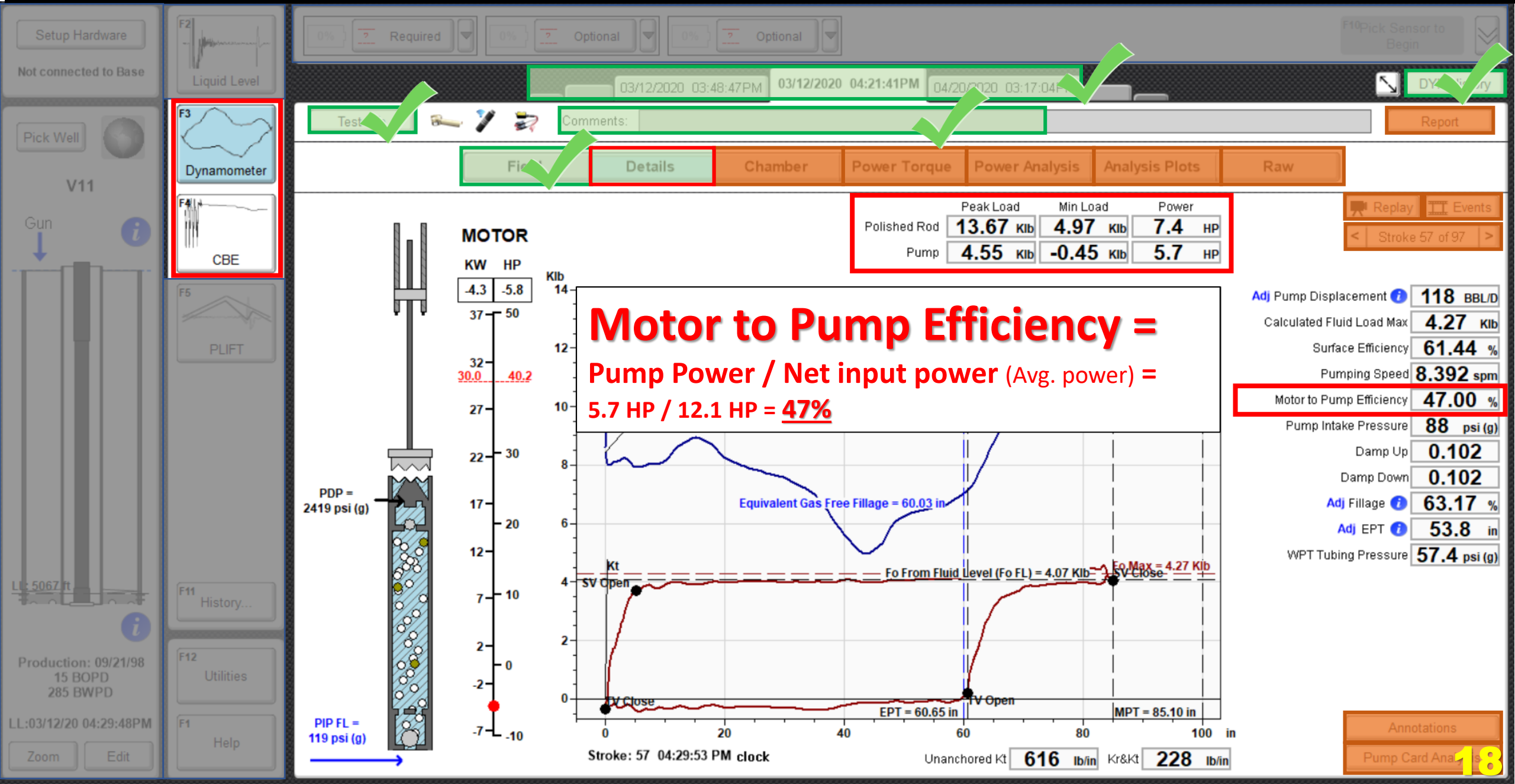
Analysis Windows / Details View



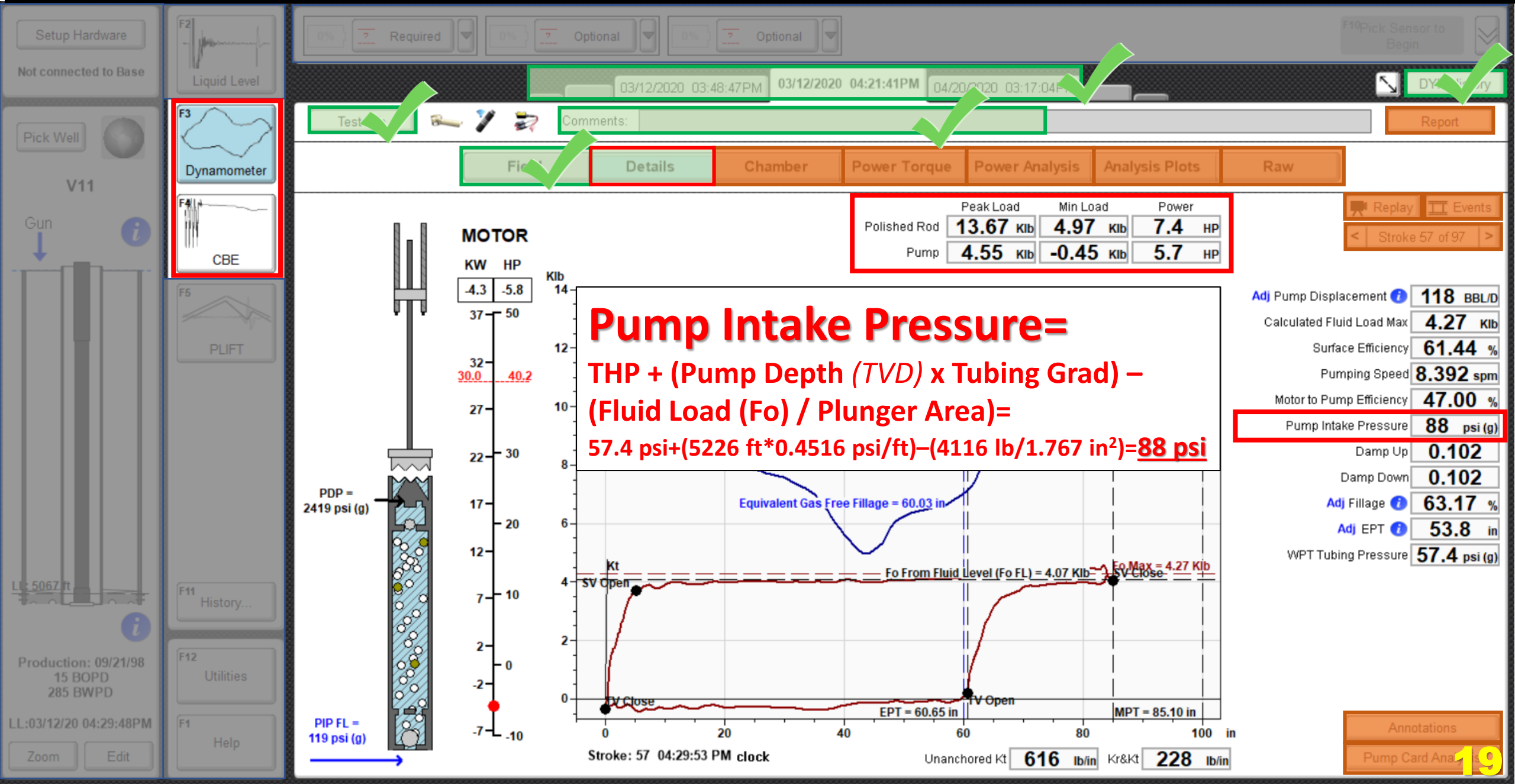
Analysis Windows / Details View



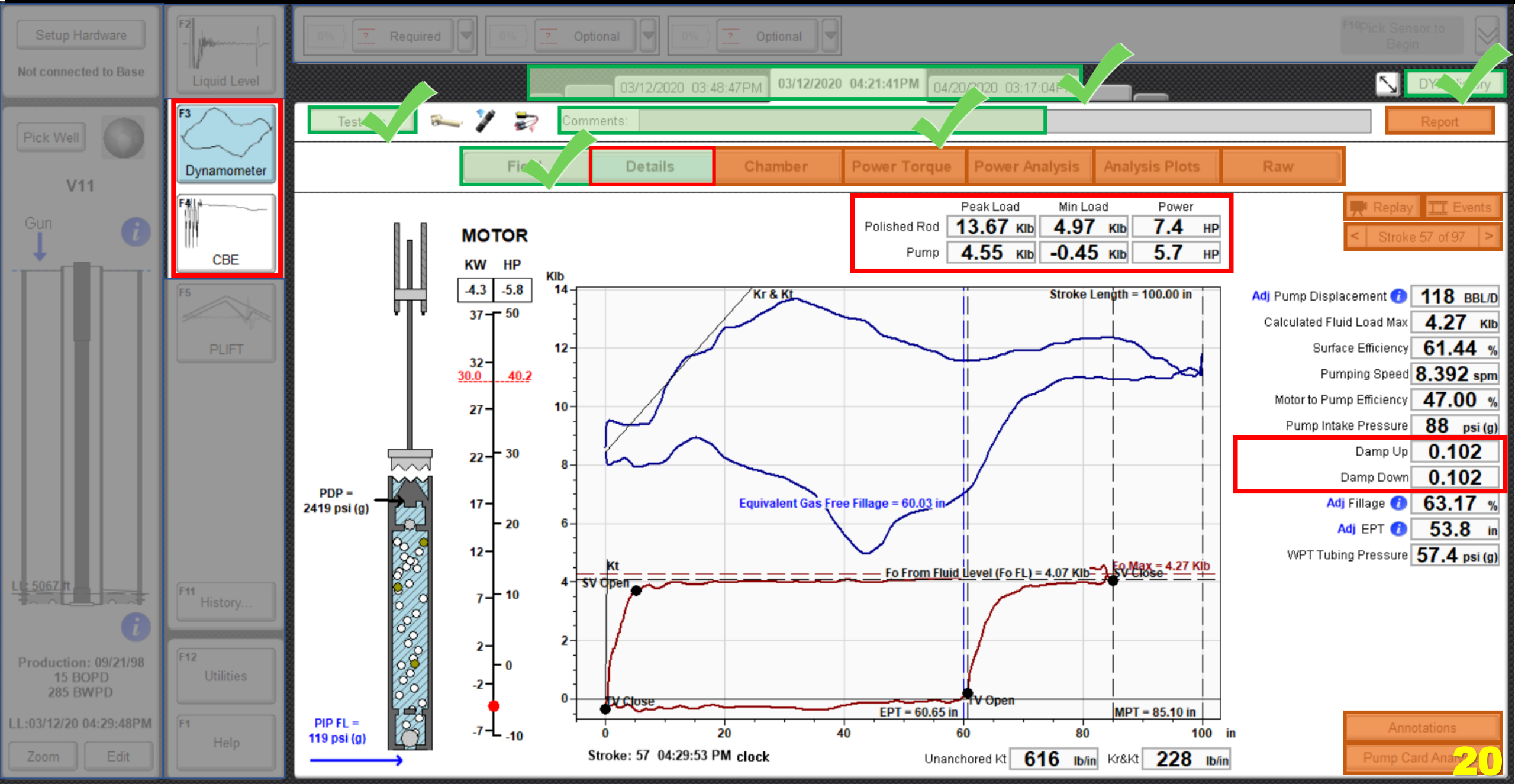
Analysis Windows / Details View



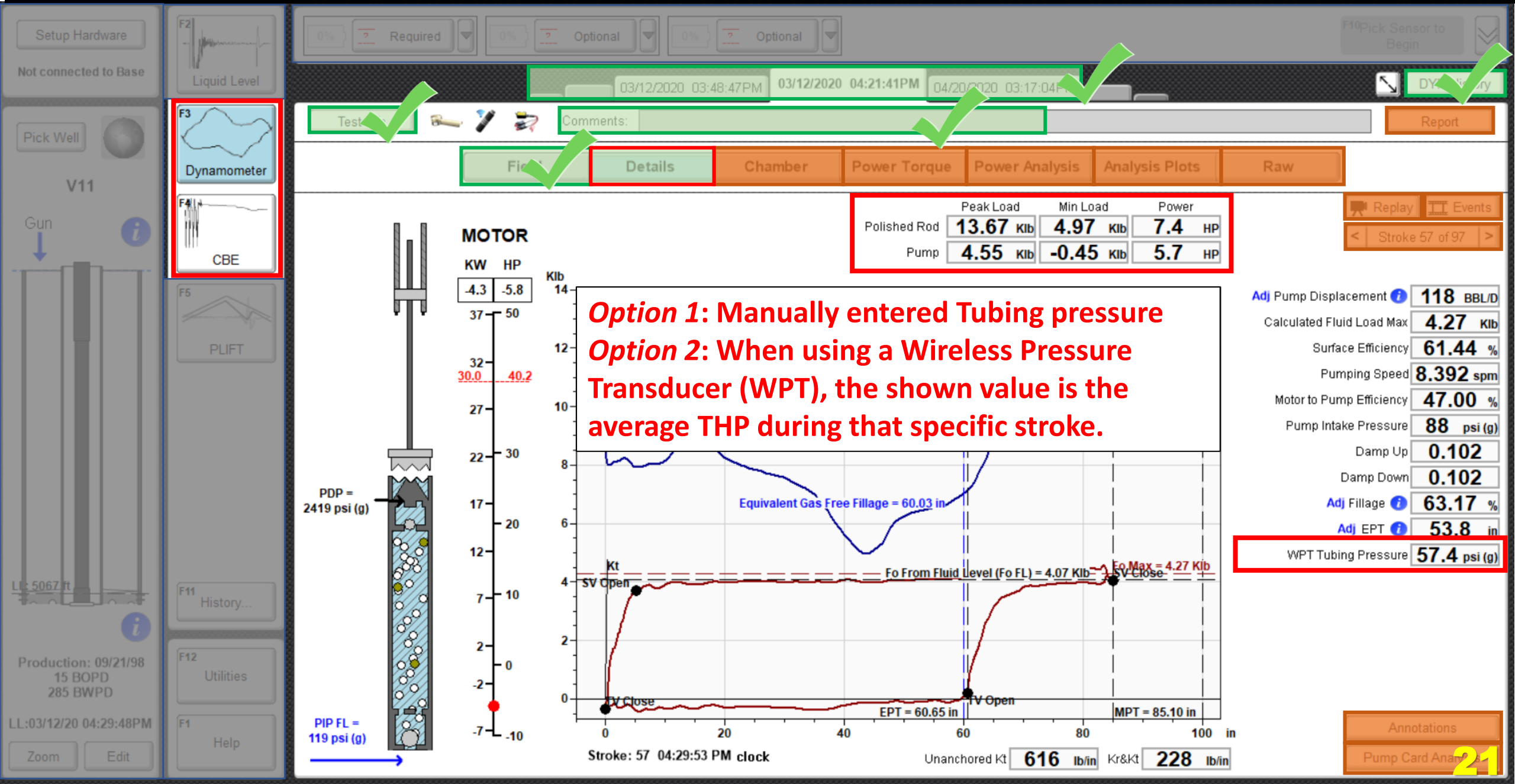
Analysis Windows / Details View



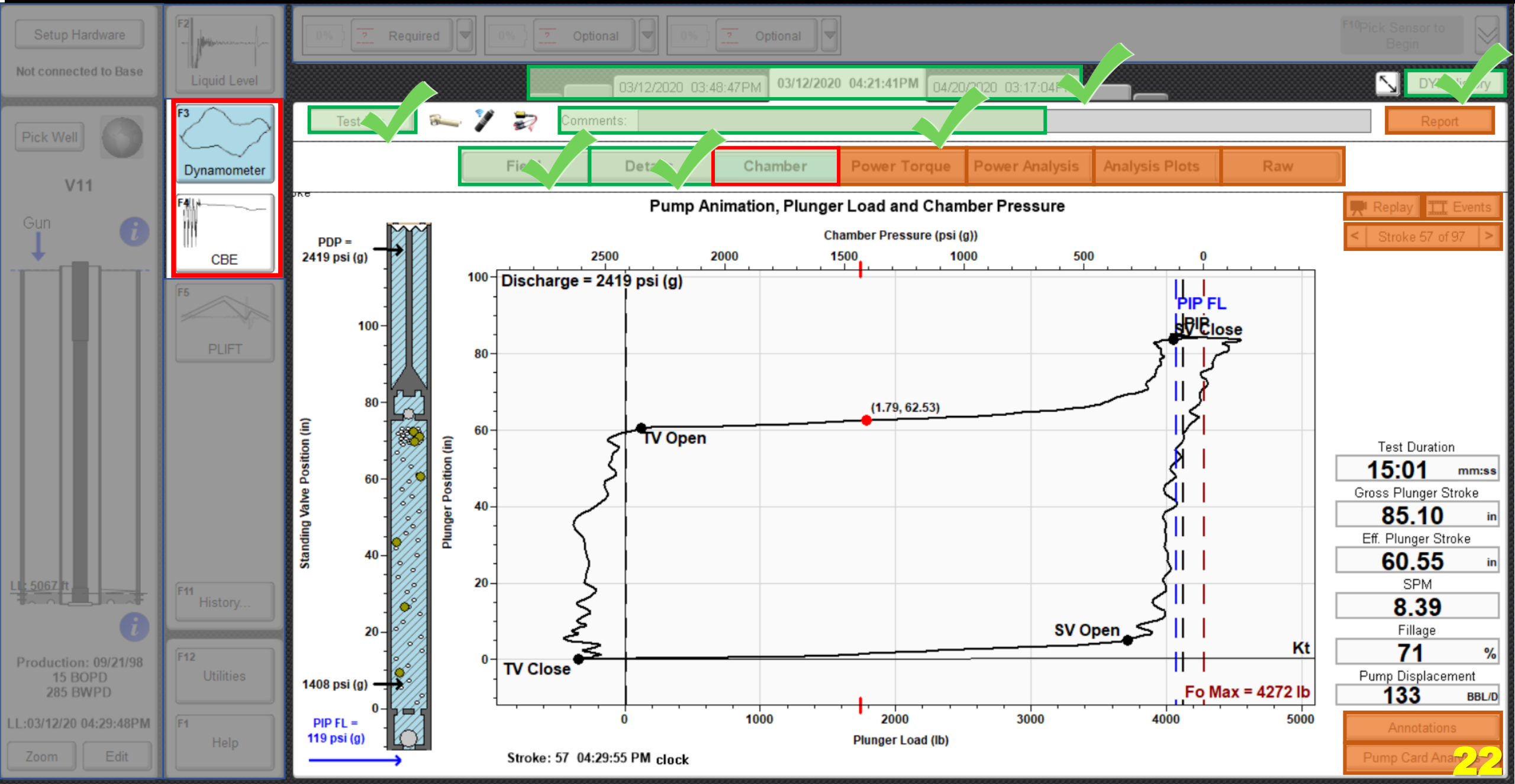
Analysis Windows / Details View



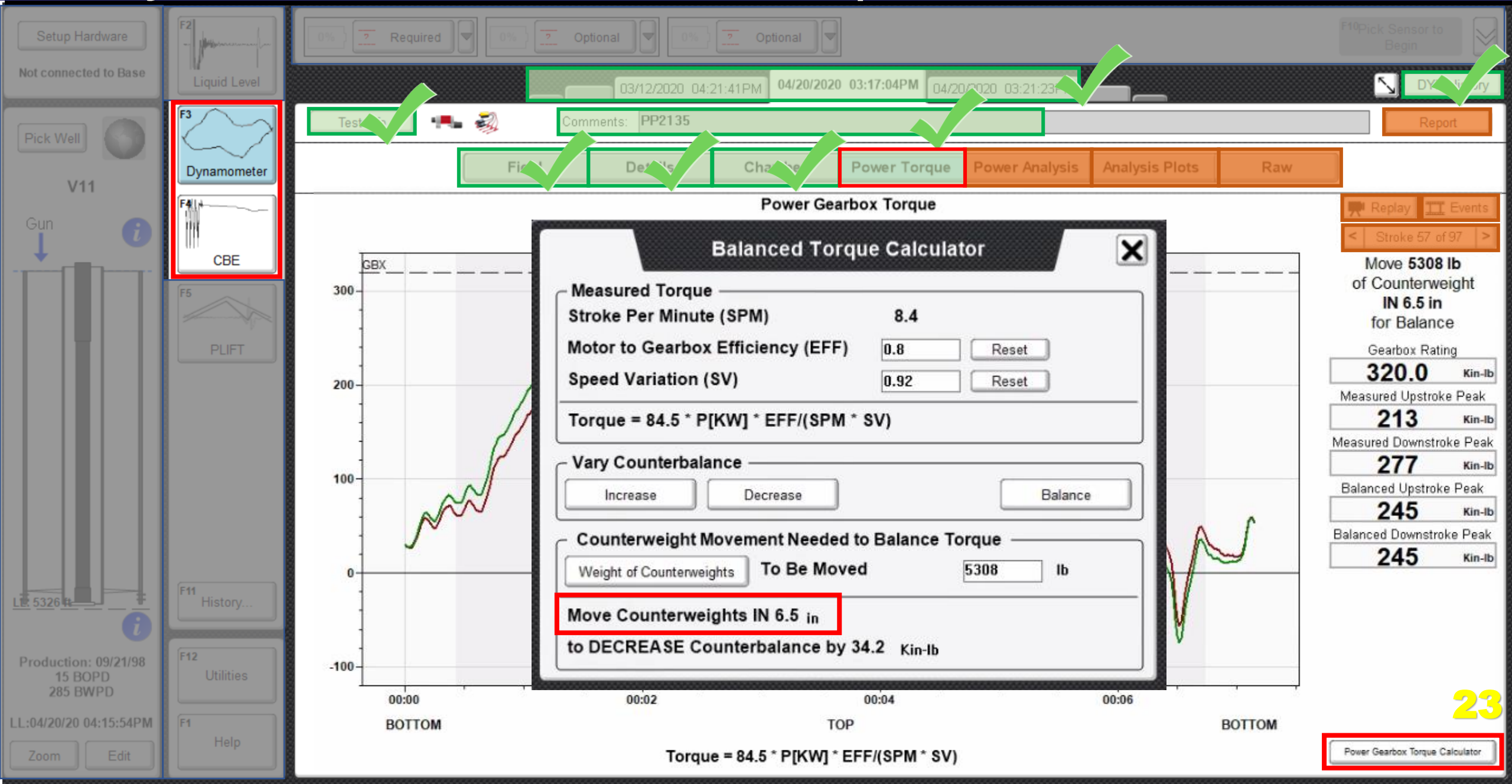
Analysis Windows / Details View



Analysis Windows / Chamber

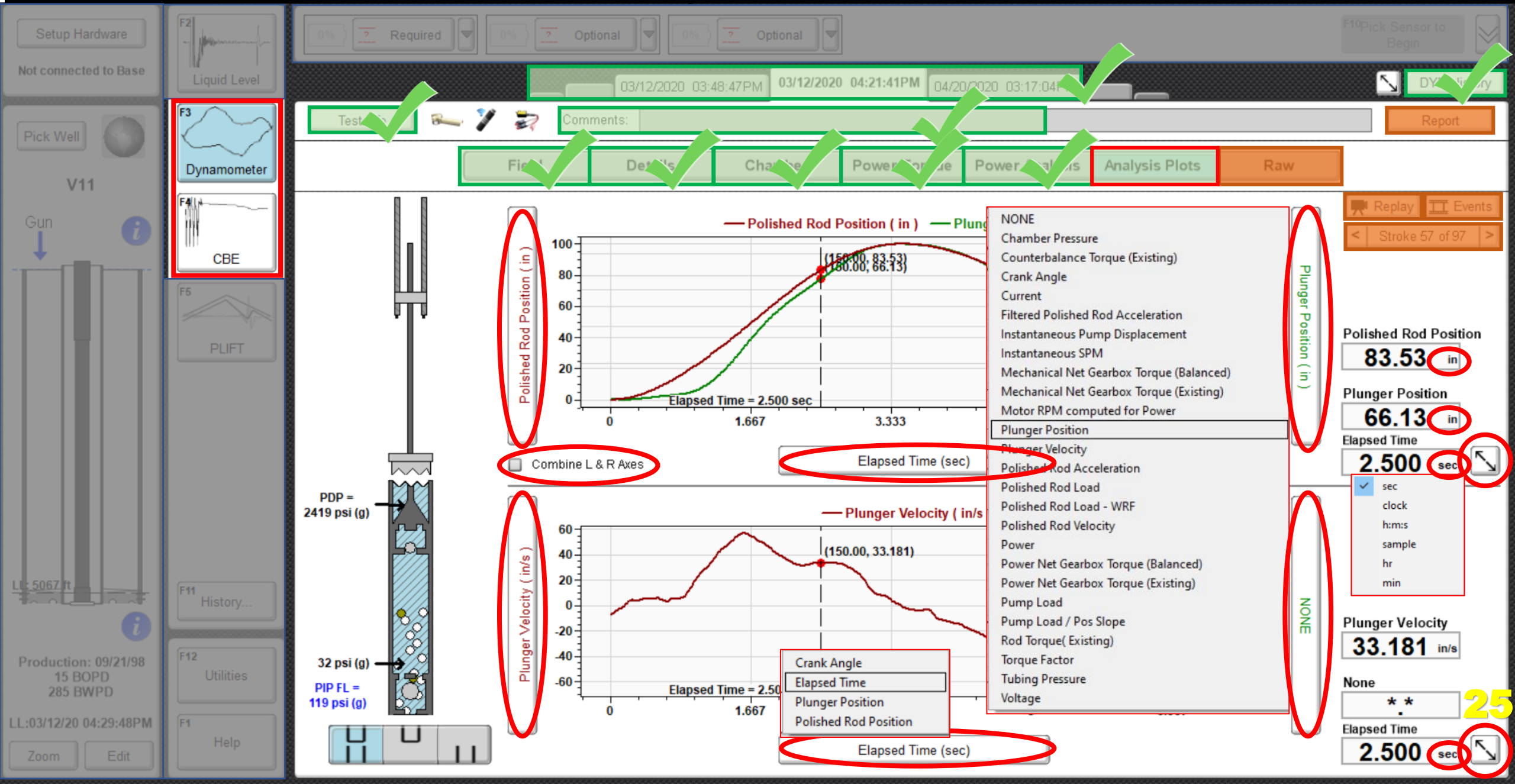


Analysis Windows / Power Torque

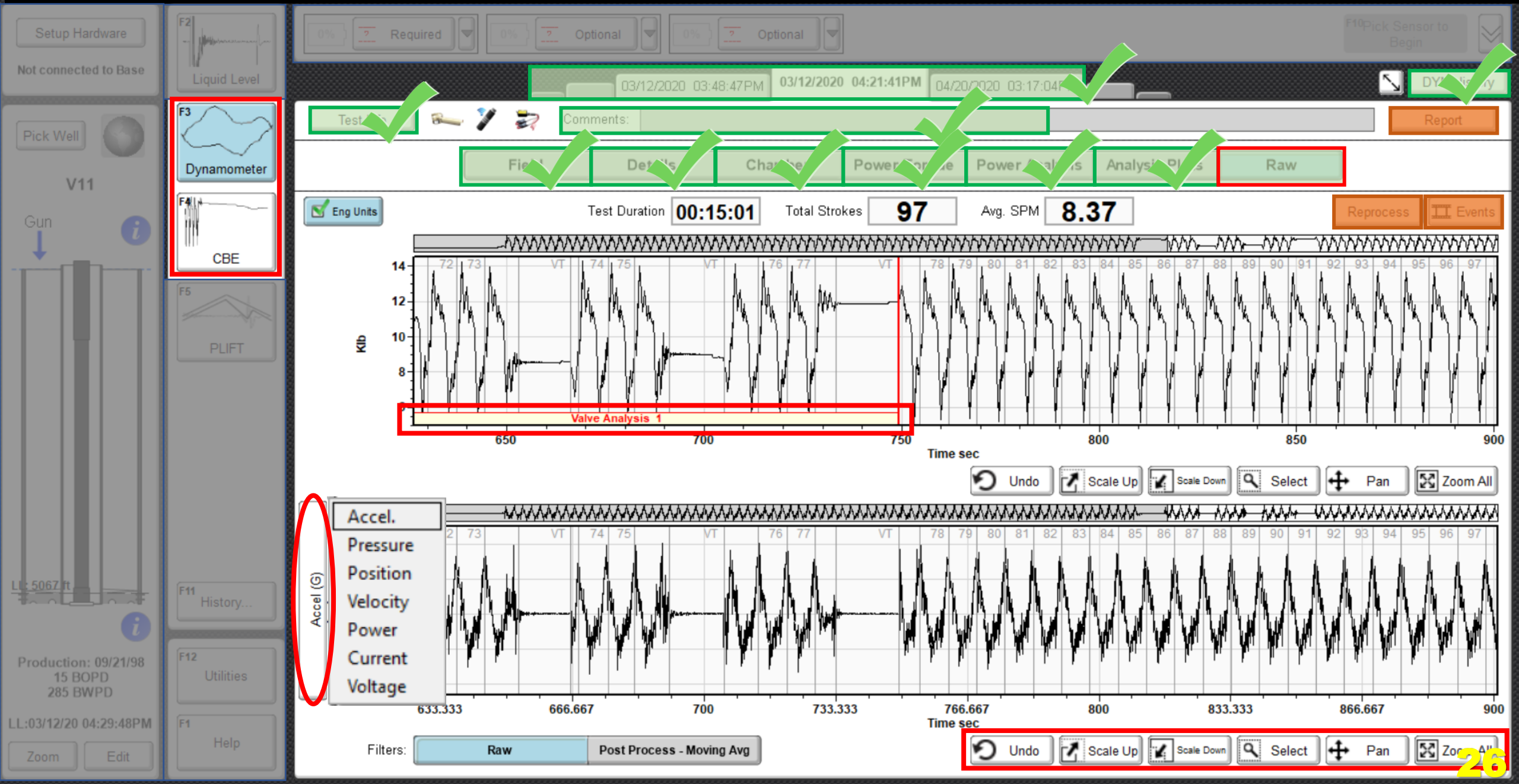


Analysis Windows / Power Analysis

Analysis Windows / Analysis Plots



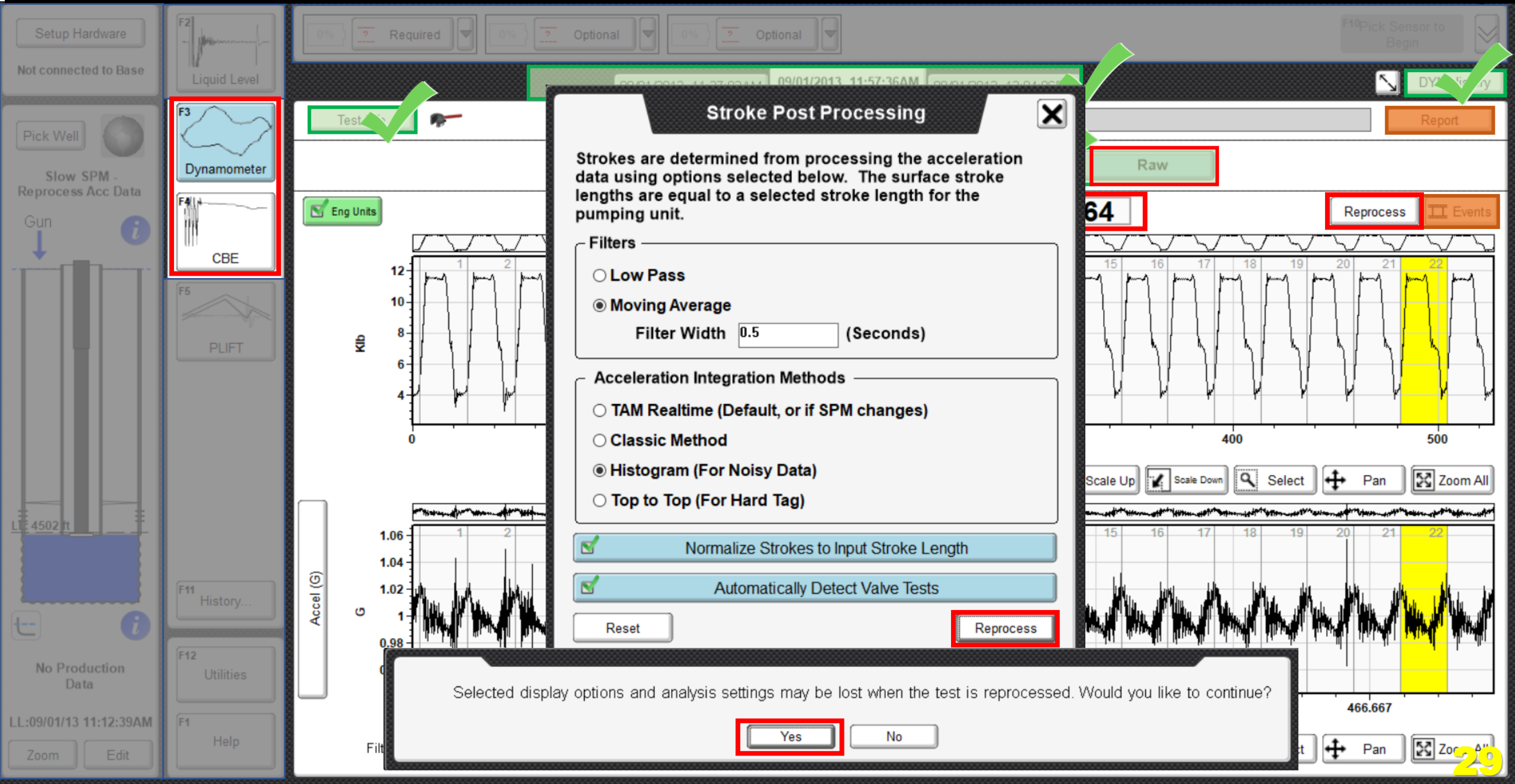
Analysis Windows / Raw Data



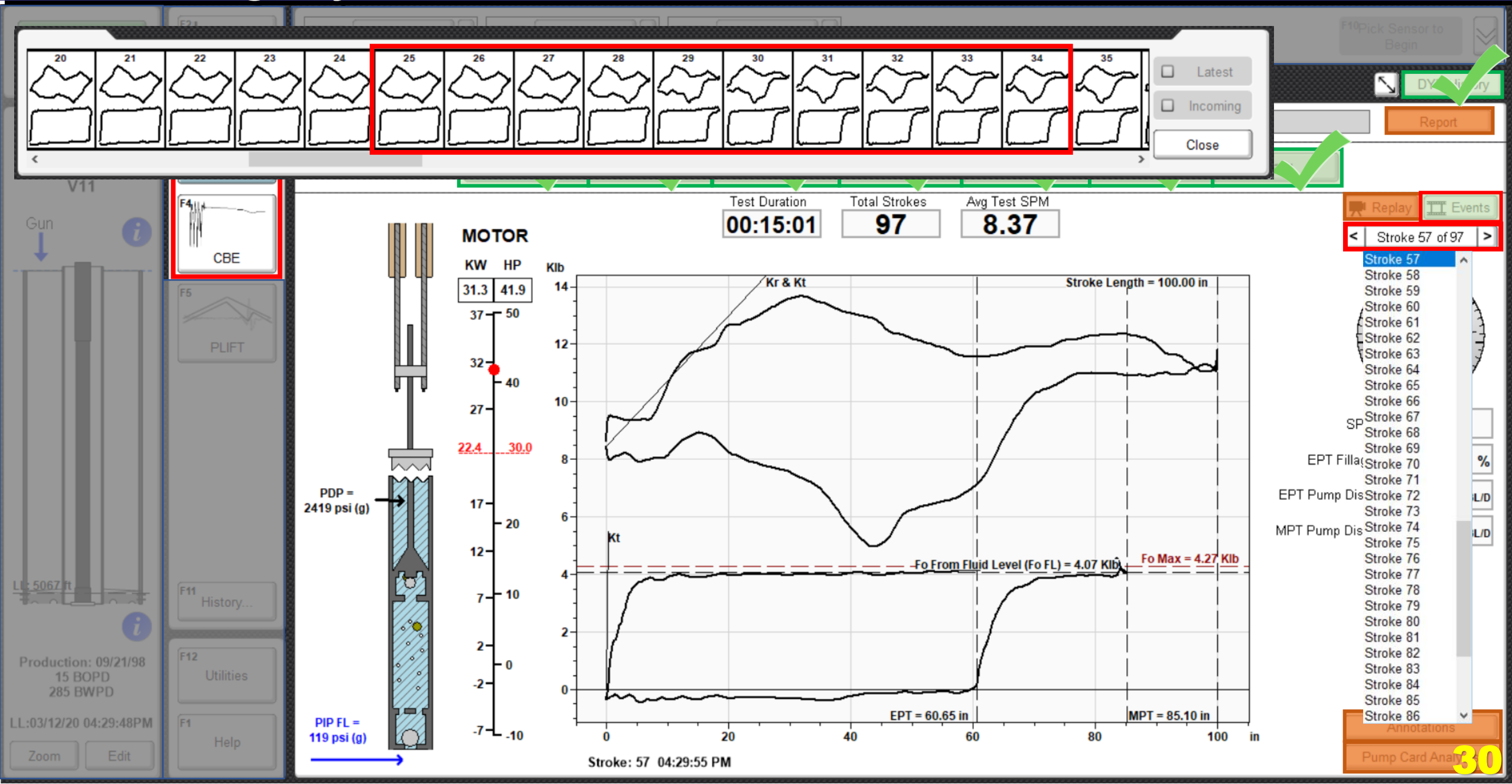
Analysis Windows / Raw Data / Valve Tests

Analysis Windows / Raw Data / Valve Tests

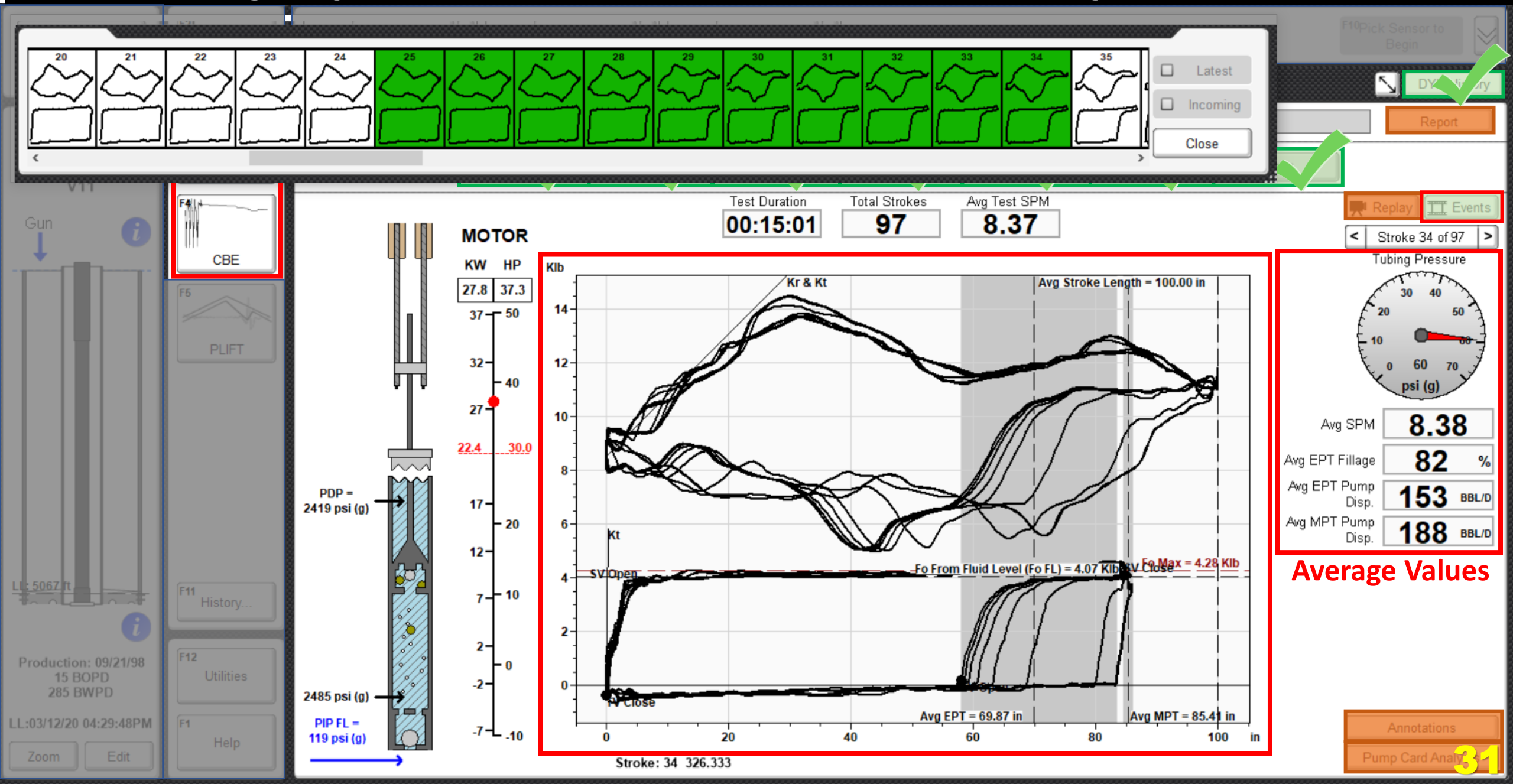
Analysis Windows / Raw Data / Stroke Post Processing



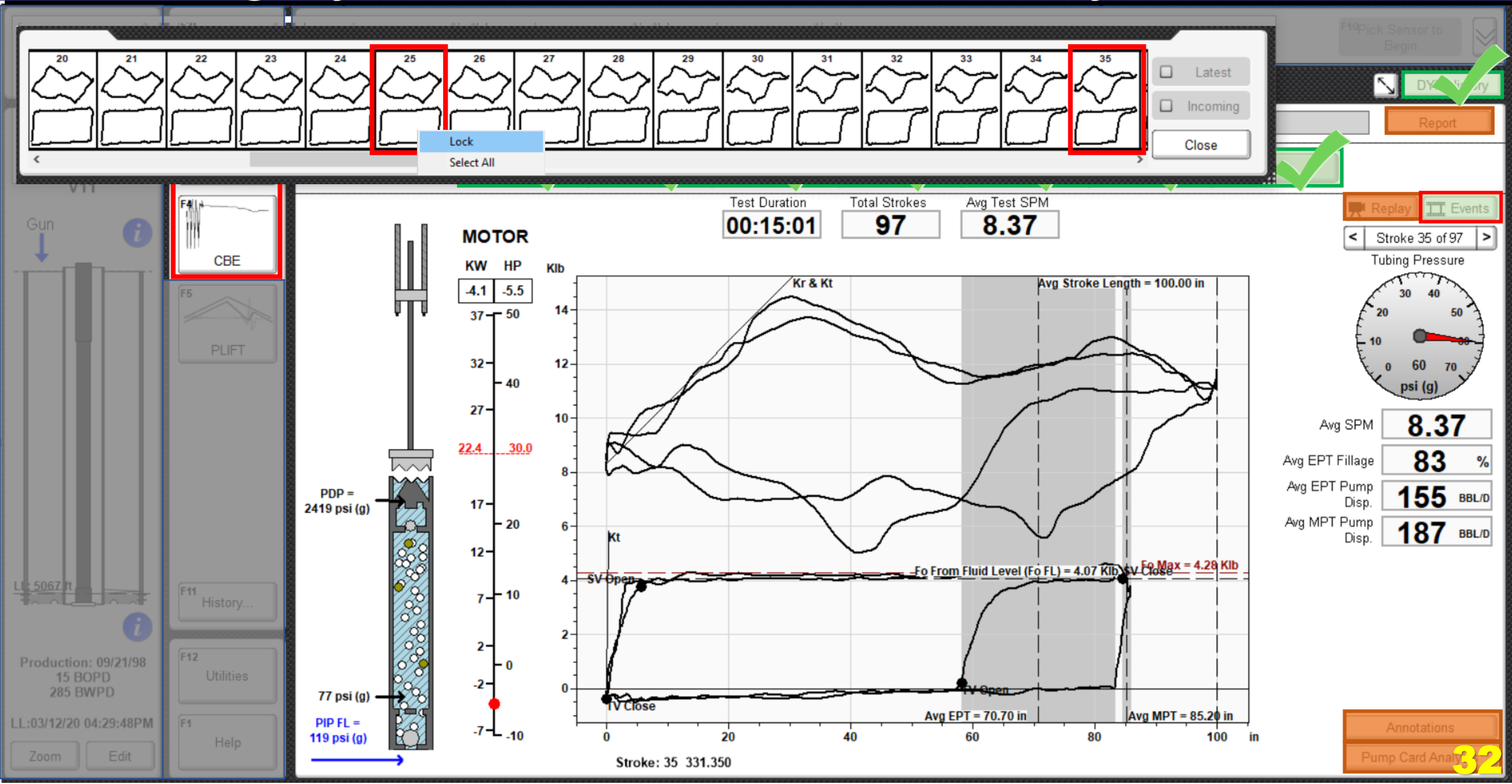
Selecting Dynamometer Events



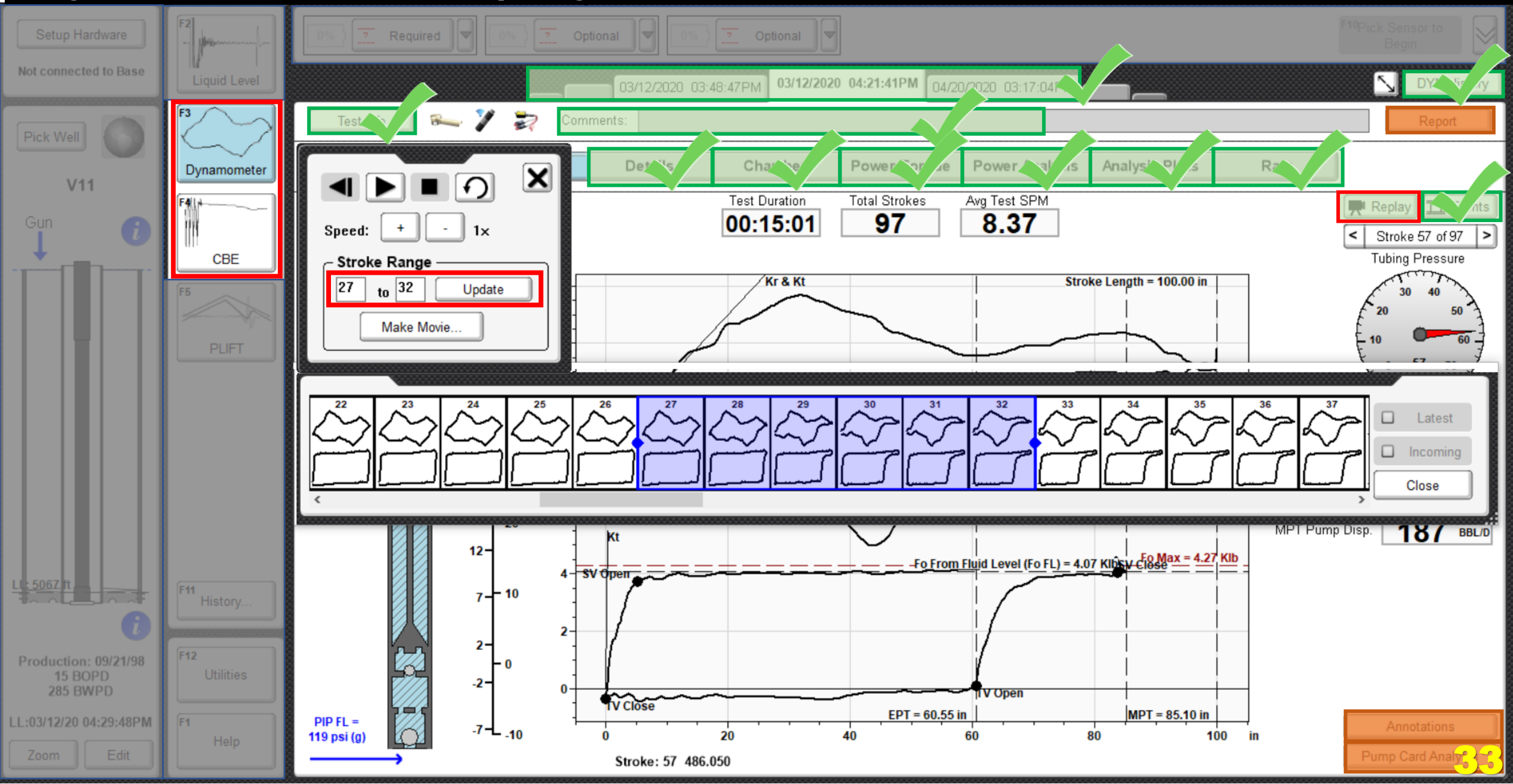
Selecting Dynamometer Events / Overlay cards



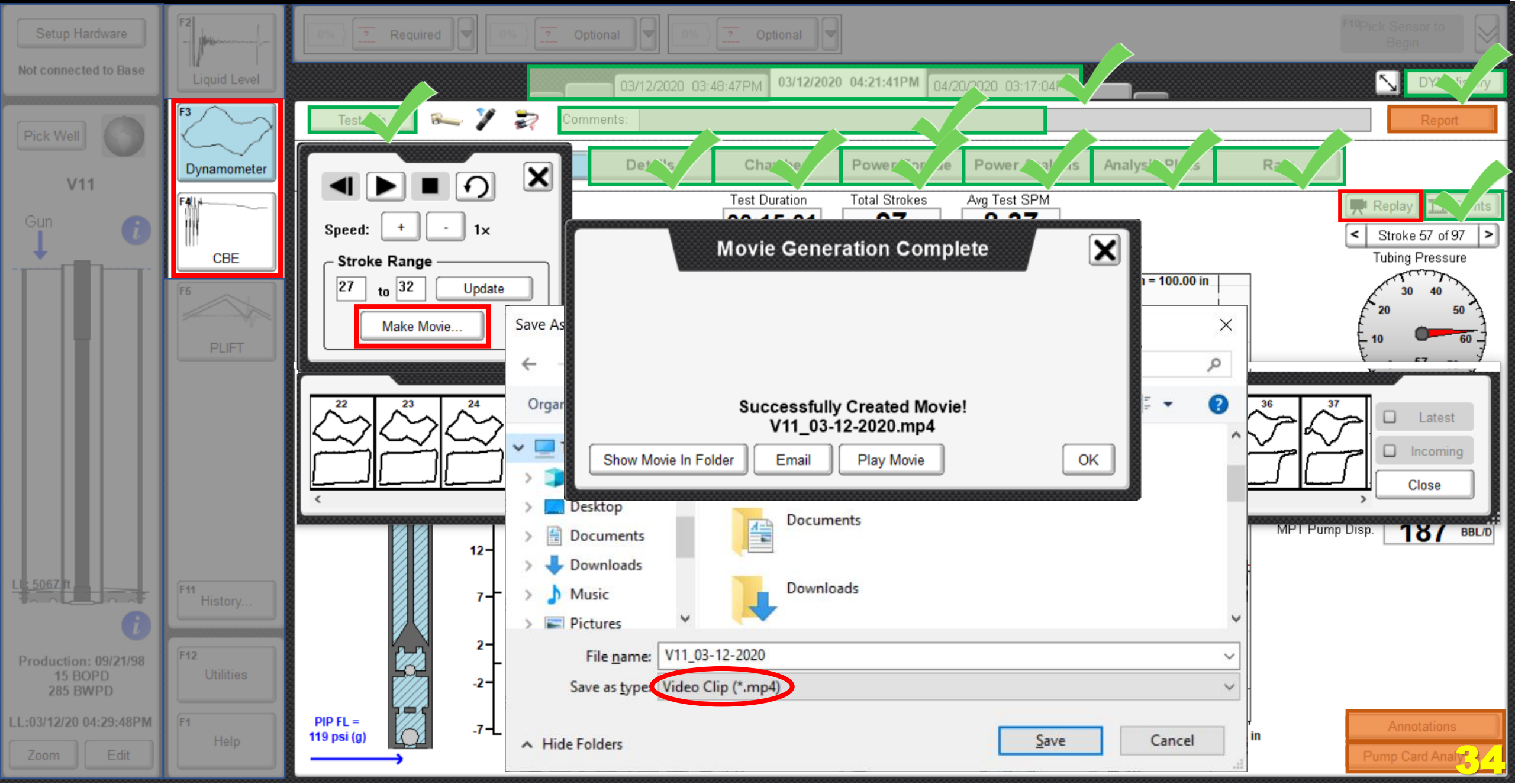
Selecting Dynamometer Events / Overlay cards



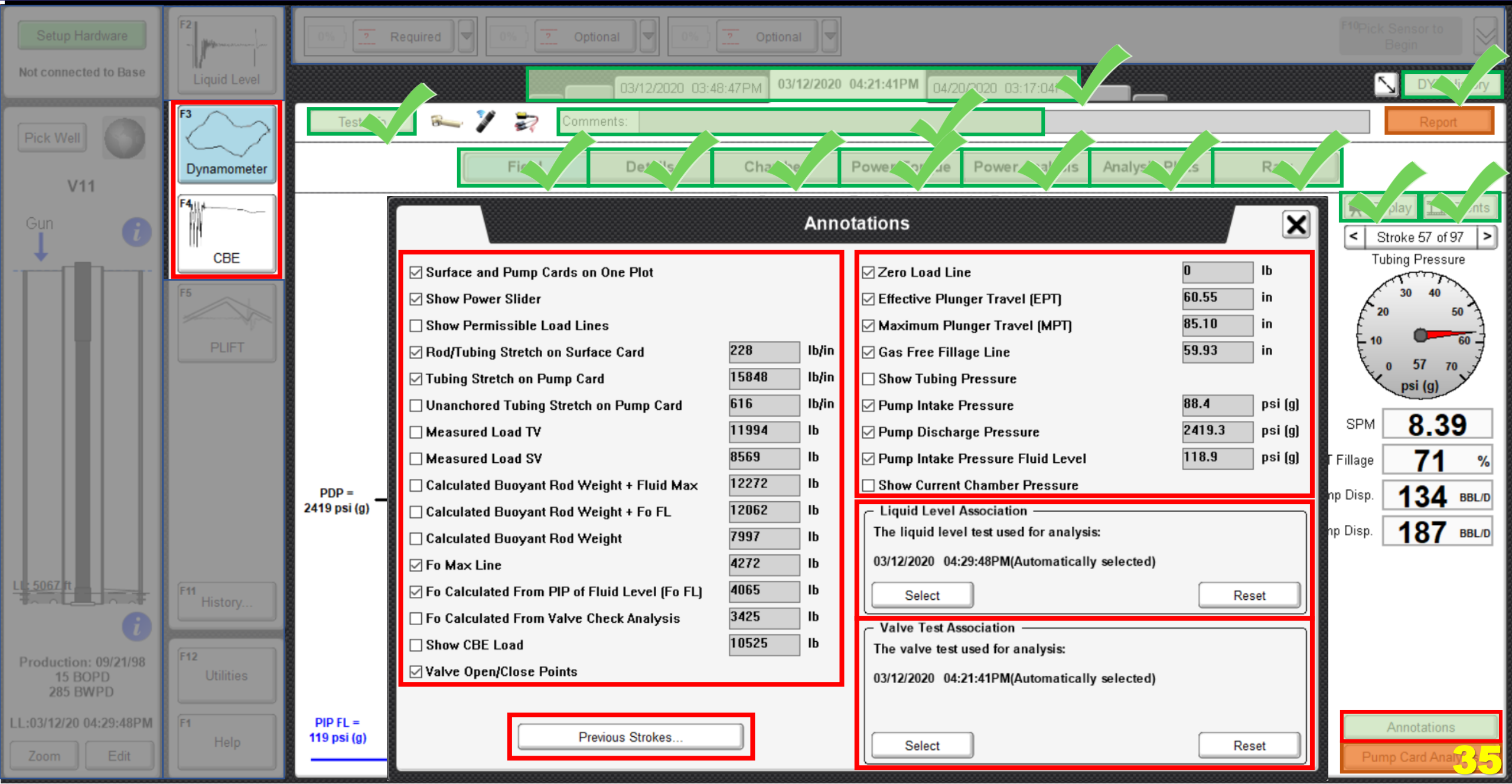
Dynamometer Replay



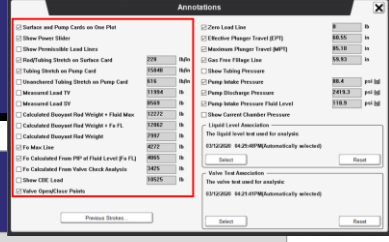
Make a Movie


Setup Hardware
Not connected to Base
Pick Well
V11
Gun
Production: 09/21/98
15 BOPD
285 BWPD
LL:03/12/20 04:29:48PM
Zoom
Edit
Liquid Level
Dynamometer
CBE
PLIFT
History...
Utilities
Help
Required
Optional
Optional
Pick Sensor to Begin
03/12/2020 03:48:47PM
03/12/2020 04:21:41PM
Comments:
Report
Test Duration
Total Strokes
Avg Test SPM
Replay
Stroke 57 of 97
Tubing Pressure
Speed:
1x
Stroke Range
27
to
32
Update
Make Movie...
Movie Generation Complete
Successfully Created Movie!
V11_03-12-2020.mp4
Show Movie In Folder
Email
Play Movie
OK
Save As
Desktop
Documents
Downloads
Music
Pictures
File name:
V11_03-12-2020
Save as type:
Video Clip (*.mp4)
Hide Folders
Save
Cancel
Latest
Incoming
Close
MPT Pump Disp.
187
BBL/D
PIP FL =
119 psi (g)
Annotations
Pump Card Analy

Annotations

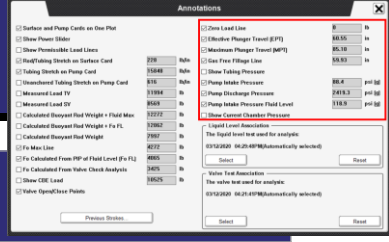


Annotations



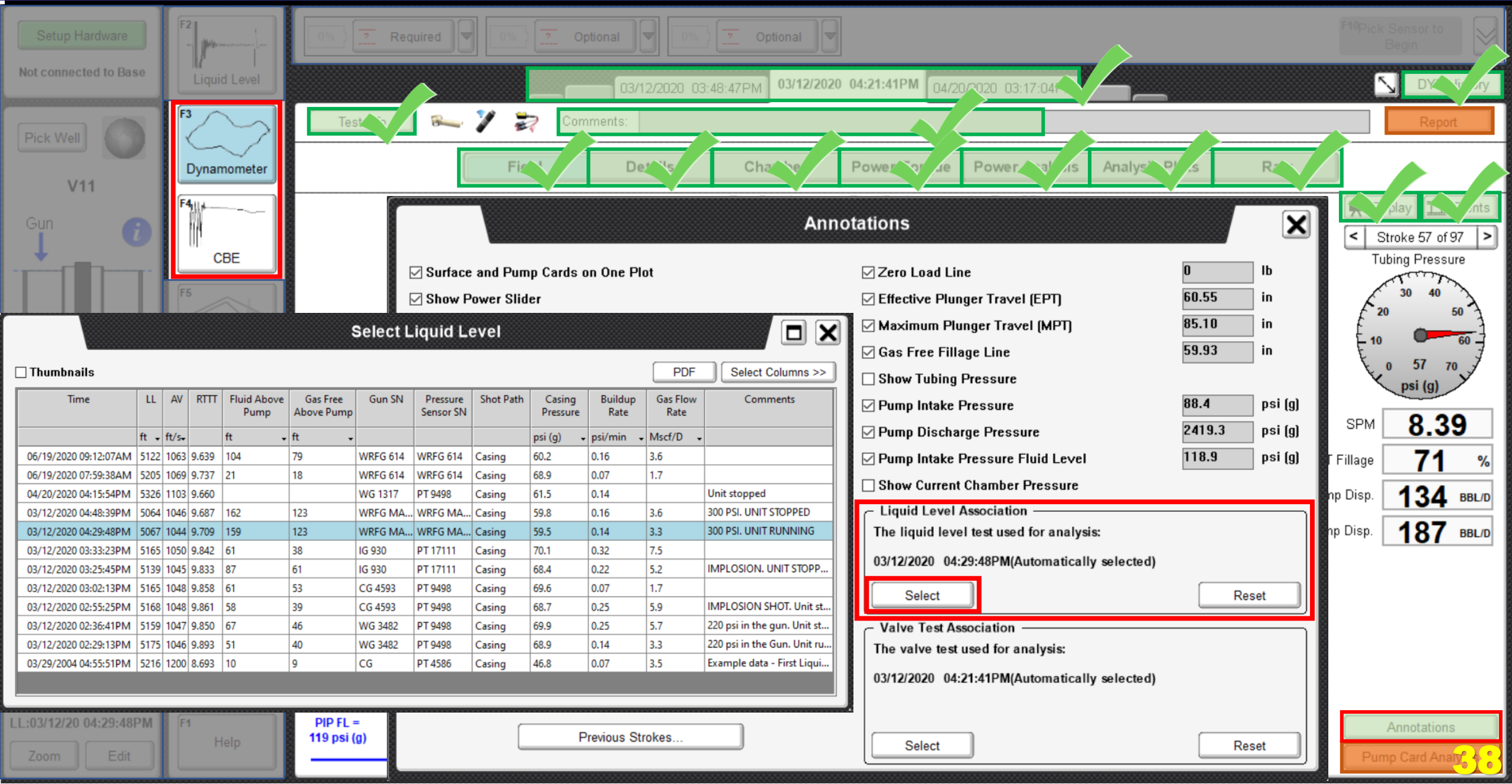
Label	View(s) Affected	Description
Surface and Pump Cards on One Plot	Card	Displays card on a single, continuous plot instead of two
Show Power Slider	Pump Analysis	Displays the Power in KW and HP.
Show Permissible Load Lines	Card	Displays the Permissible Load Lines if they were able to be calculated.
Rod/Tubing Stretch on Surface Card	Card	Displays the Kr line on the surface card plot
Tubing Stretch on Pump Card	Card, Pump	Displays the Kt line on the pump card plot
Unanchored Tubing Stretch on Pump Card	Card, Pump	Displays the Unanchored Kt line on the pump card plot
Measured Load TV	Card	Displays the measured TV load on the surface card plot (if valve test performed)
Measured Load SV	Card	Displays the measured SV load on the surface card plot (if valve test performed)
Calculated Buoyant Rod Weight + Fluid Max	Card	Displays the Wrf + FoMax load value on the surface card plot
Calculated Buoyant Rod Weight + Fo FL	Card	Displays the Wrf + Fo FL load value on the surface card plot
Calculated Buoyant Rod Weight	Card	Displays the Wrf load value on the surface card plot
Fo Max Line	Card	Displays the FoMax load value on the pump card
Fo Calculated From PIP of Fluid Level (Fo FL)	Card	Fo computed from pump intake pressure found during a recent fluid level test
Fo Calculated From Valve Check Analysis	Card	Fo computed from the difference in measured TV and SV loads (if valve test performed)
Show CBE Load	Card	Displays the measured CBE load on the surface card plot (if CBE test performed)
Valve Open/Close Points	Card, Pump Analysis	Displays the TV and SV opening and closing points used for the pump animation

Annotations

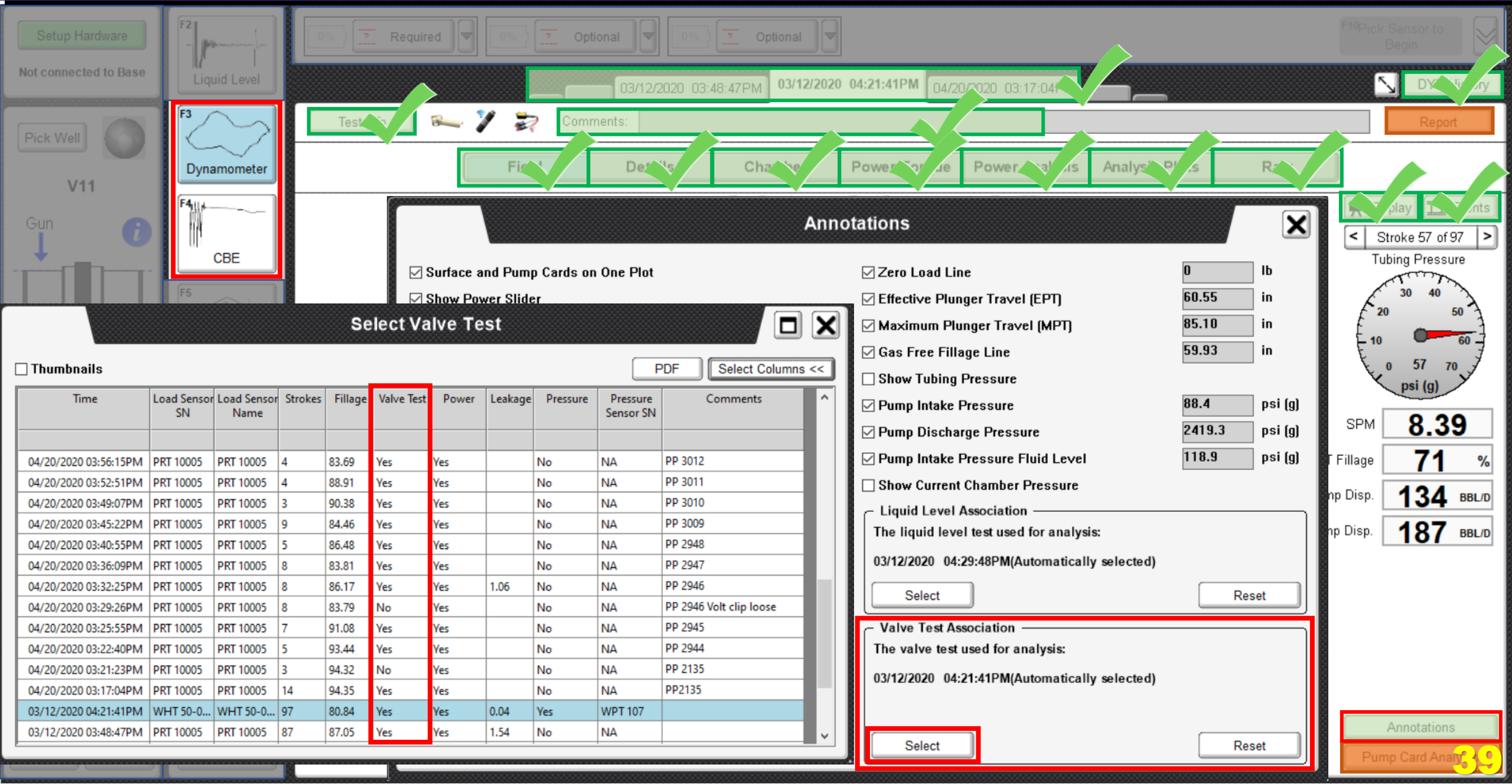


Label	View(s) Affected	Description
Zero Load Line	Card	Displays a solid line at zero load of the pump card
Effective Plunger Travel (EPT) (Pump Fillage)	Card	Displays the EPT cursor at fillage position on the pump card
Maximum Plunger Travel (MPT)	Card	Displays the MPT cursor at the max position of the pump card
Gas Free Fillage Line	Card	Displays the Equivalent Gas Free Fillage cursor at the gas free fillage position on the pump card
Show Tubing Pressure	Card	Displays acquired pressure vs. position overlay on the surface card
Pump Intake Pressure	Pump Analysis	Displays the PIP cursor on the pump card plot and PIP value shown at the bottom of the pump animation
Pump Discharge Pressure	Pump Analysis	Displays the discharge pressure cursor on the pump card and DP value shown at the top of the pump animation
Pump Intake Pressure Fluid Level	Pump Analysis	Displays the PIP FL cursor on the pump card plot and PIP FL value shown at the bottom of the pump animation
Show Current Chamber Pressure	Card, Pump Analysis	Displays the chamber pressure value next to the pump animation at a given point on the pump card

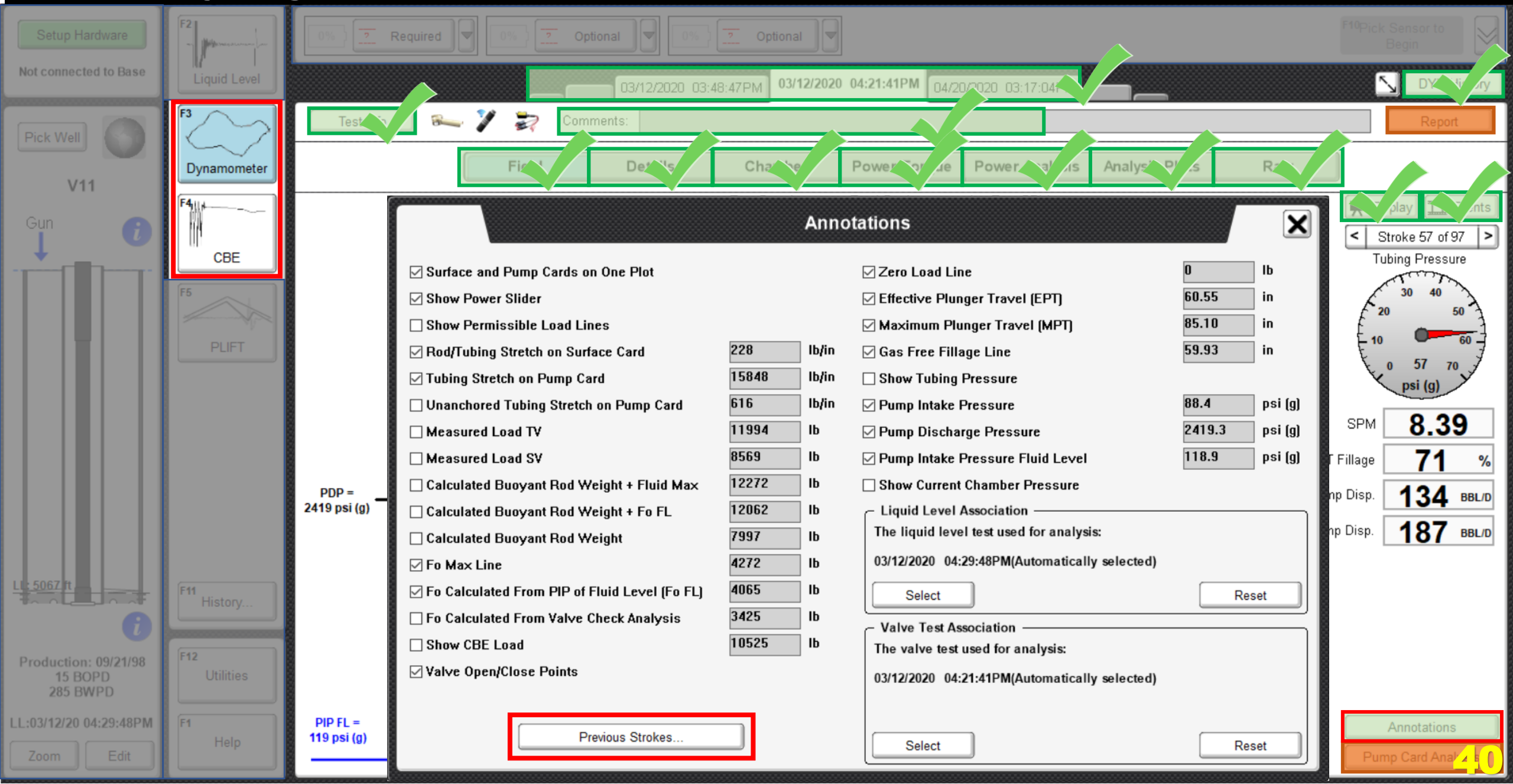
Annotations



Annotations



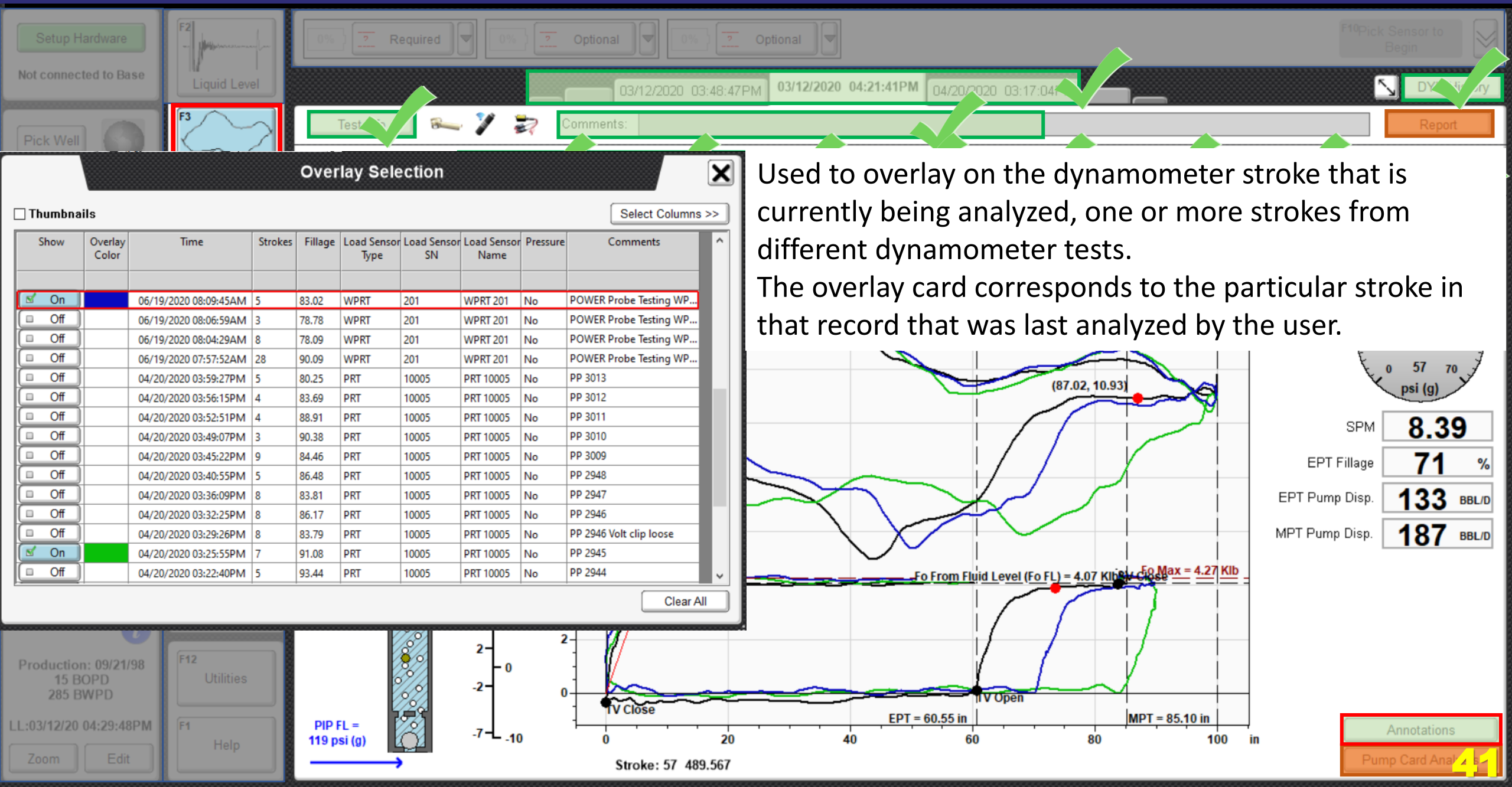
Overlaying Previous Strokes



Annotations

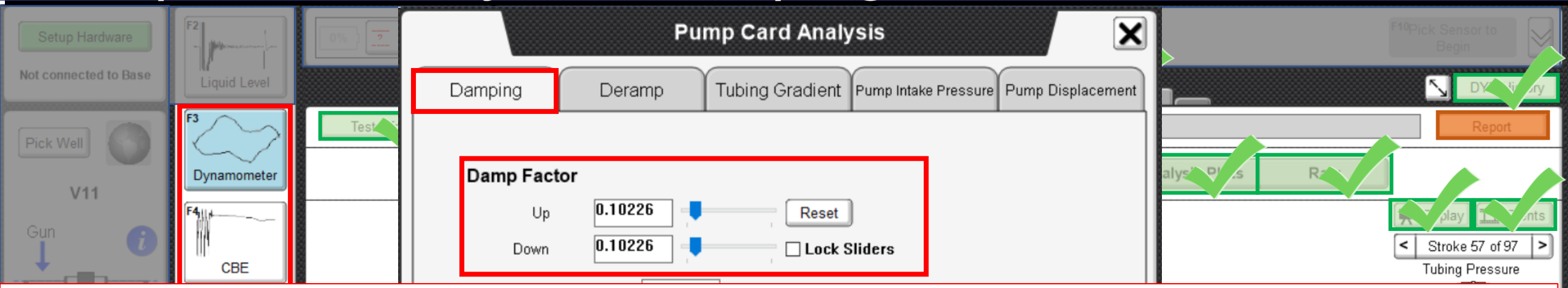
Used to overlay on the dynamometer stroke that is currently being analyzed, one or more strokes from different dynamometer tests.

The overlay card corresponds to the particular stroke in that record that was last analyzed by the user.

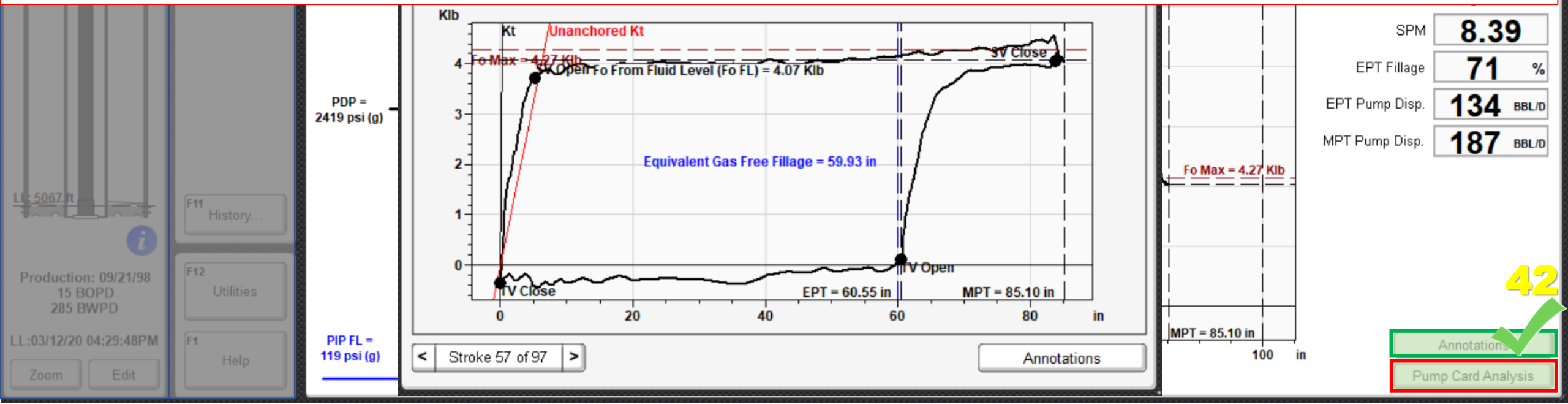


Show	Overlay Color	Time	Strokes	Fillage	Load Sensor Type	Load Sensor SN	Load Sensor Name	Pressure	Comments
On		06/19/2020 08:09:45AM	5	83.02	WPRT	201	WPRT 201	No	POWER Probe Testing WP...
Off		06/19/2020 08:06:59AM	3	78.78	WPRT	201	WPRT 201	No	POWER Probe Testing WP...
Off		06/19/2020 08:04:29AM	8	78.09	WPRT	201	WPRT 201	No	POWER Probe Testing WP...
Off		06/19/2020 07:57:52AM	28	90.09	WPRT	201	WPRT 201	No	POWER Probe Testing WP...
Off		04/20/2020 03:59:27PM	5	80.25	PRT	10005	PRT 10005	No	PP 3013
Off		04/20/2020 03:56:15PM	4	83.69	PRT	10005	PRT 10005	No	PP 3012
Off		04/20/2020 03:52:51PM	4	88.91	PRT	10005	PRT 10005	No	PP 3011
Off		04/20/2020 03:49:07PM	3	90.38	PRT	10005	PRT 10005	No	PP 3010
Off		04/20/2020 03:45:22PM	9	84.46	PRT	10005	PRT 10005	No	PP 3009
Off		04/20/2020 03:40:55PM	5	86.48	PRT	10005	PRT 10005	No	PP 2948
Off		04/20/2020 03:36:09PM	8	83.81	PRT	10005	PRT 10005	No	PP 2947
Off		04/20/2020 03:32:25PM	8	86.17	PRT	10005	PRT 10005	No	PP 2946
Off		04/20/2020 03:29:26PM	8	83.79	PRT	10005	PRT 10005	No	PP 2946 Volt clip loose
On		04/20/2020 03:25:55PM	7	91.08	PRT	10005	PRT 10005	No	PP 2945
Off		04/20/2020 03:22:40PM	5	93.44	PRT	10005	PRT 10005	No	PP 2944

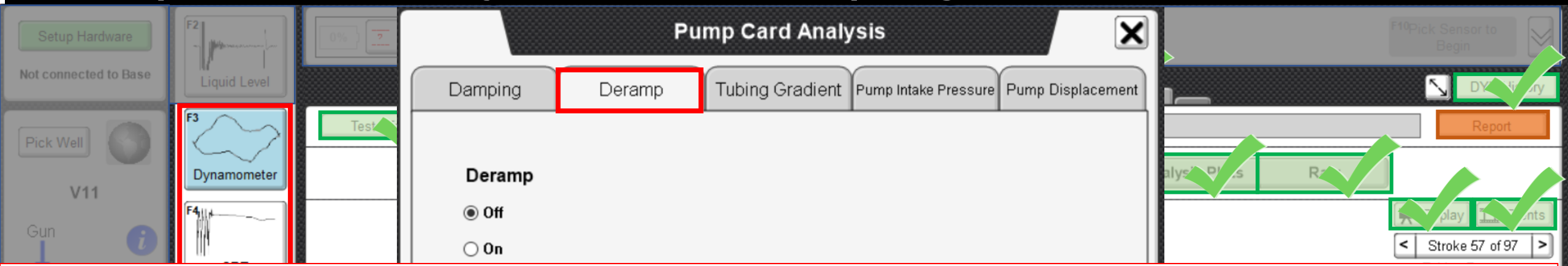
Pump Card Analysis / Damping Factor



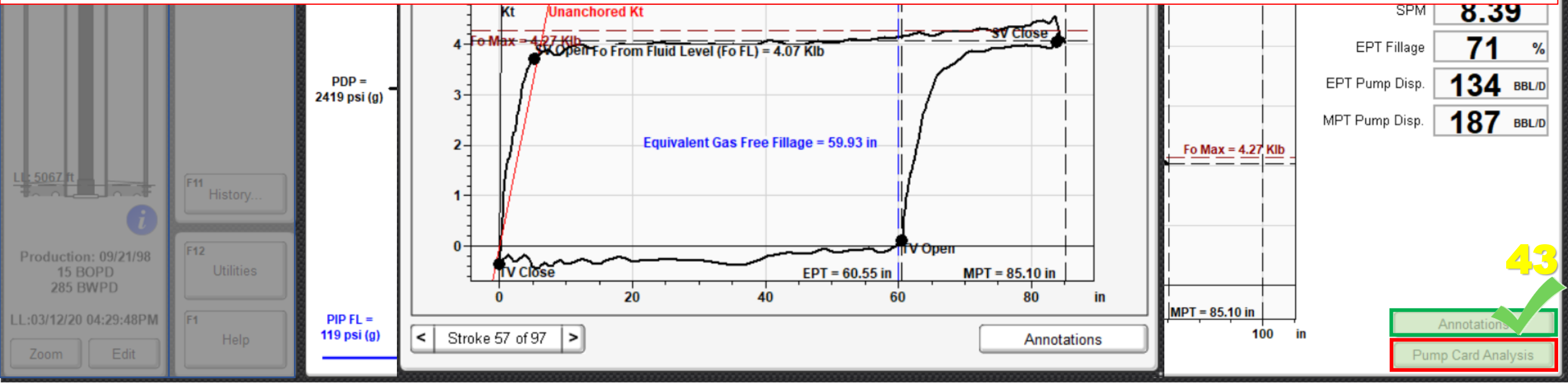
The user can change the damping factor used in modeling the rod string dynamics in the wave equation calculation. Doing so updates the calculation of the pump card. A new value can be entered or the slider control can be used to quickly view the change in the pump card characteristics as the damping factor is adjusted.



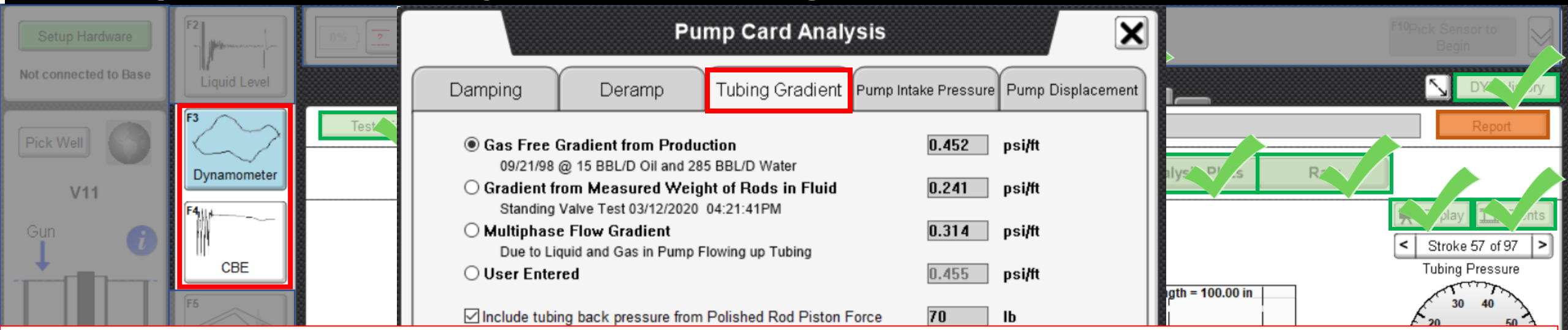
Pump Card Analysis / De-ramping



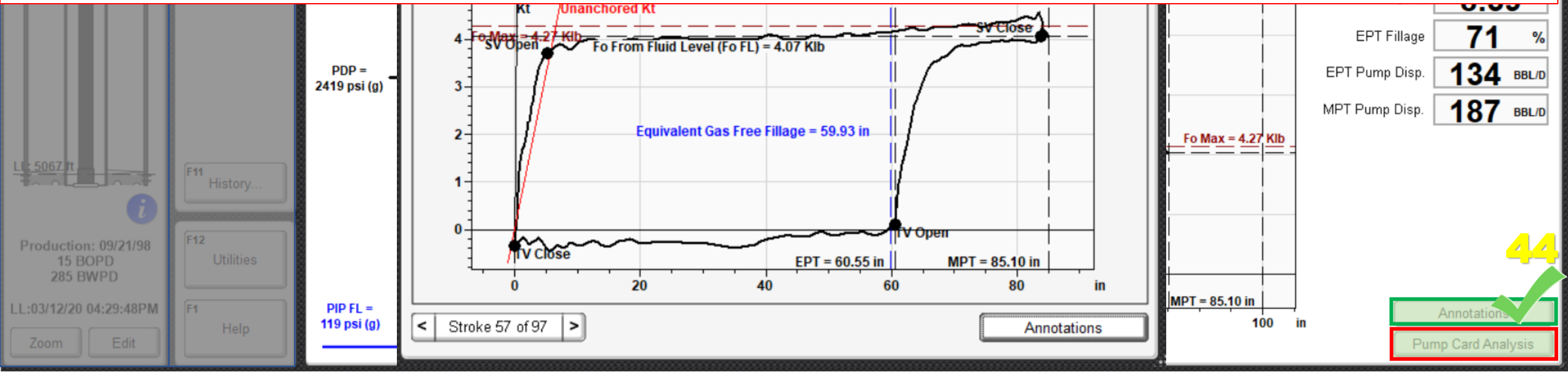
This tool is used to adjust the tilt of a pump dynamometer card acquired with a PRT on a well where the polished rod is bending due to misalignment of the pumping unit and the wellhead. The user can choose to de-ramp the pump card by clicking on the ***"On"*** button from the ***Deramp*** tab. The software eliminates the tilt and redraws the card so that the load on the upstroke is mostly horizontal.



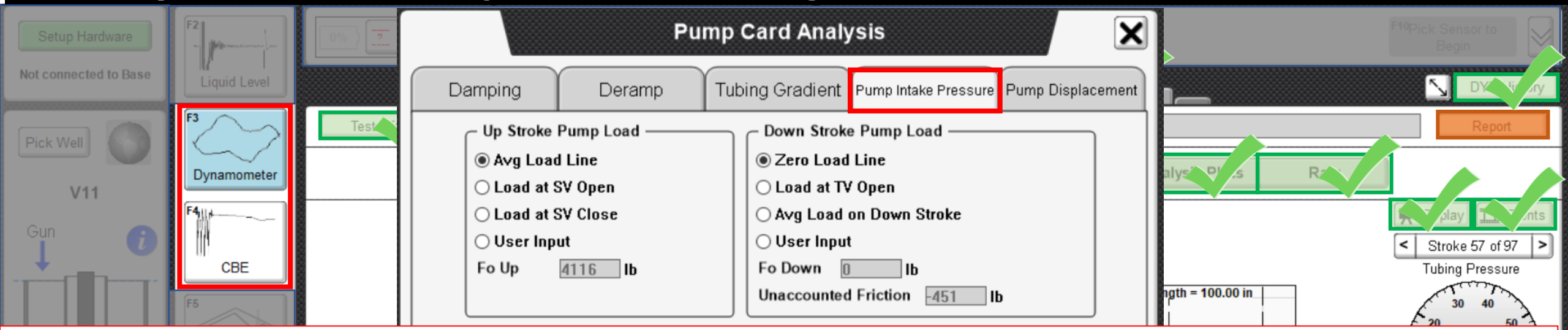
Pump Card Analysis / Tubing Gradient



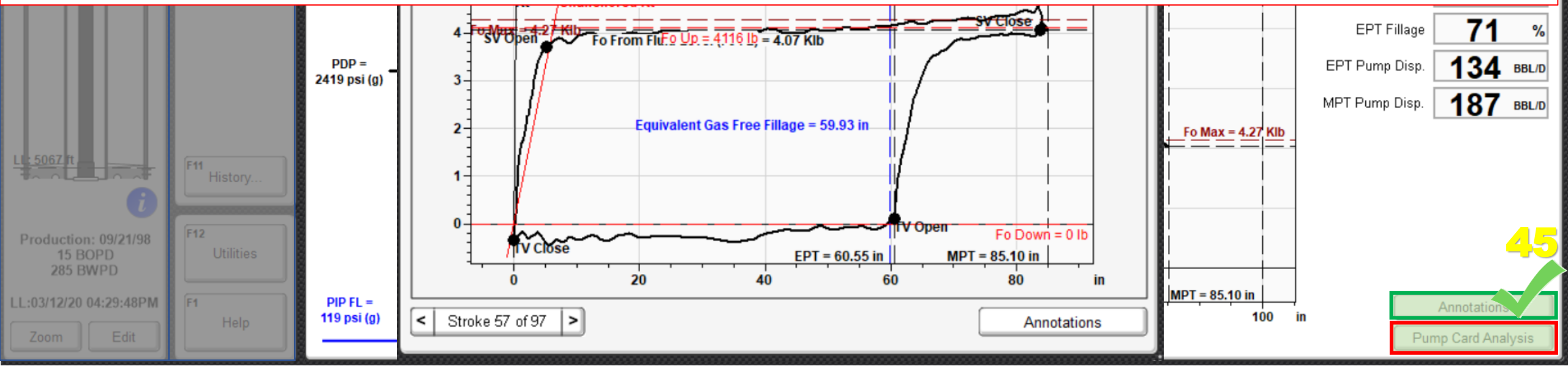
From the tubing gradient tab the user can select to use the gas free gradient computed from production Water/Oil Ratio history, the gradient computed from measured weight of rods in fluid from a SV test, or estimated from multiphase flow correlations or a user entered gradient. The user can also choose to include tubing back pressure from Polish Rod Piston Force.



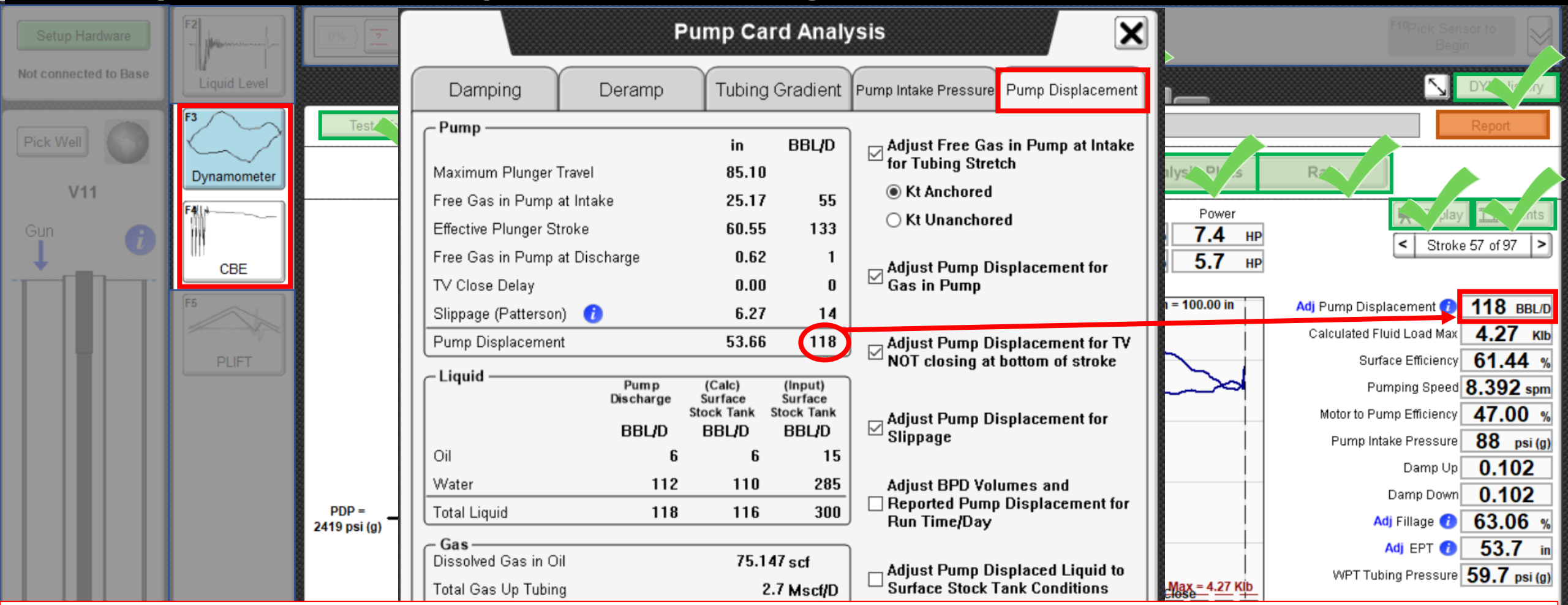
Pump Card Analysis / Tubing Gradient



The user can select the up and down stroke pump loads that will be used for the PIP calculations or enter a custom value. By default, ***Average Load Line*** option is selected for Up stroke ***Pump Load and Zero*** Load Line is selected for Down stroke Pump Load. For ***User Input***, the Up and Down Stroke lines can be dragged and positioned using the mouse.

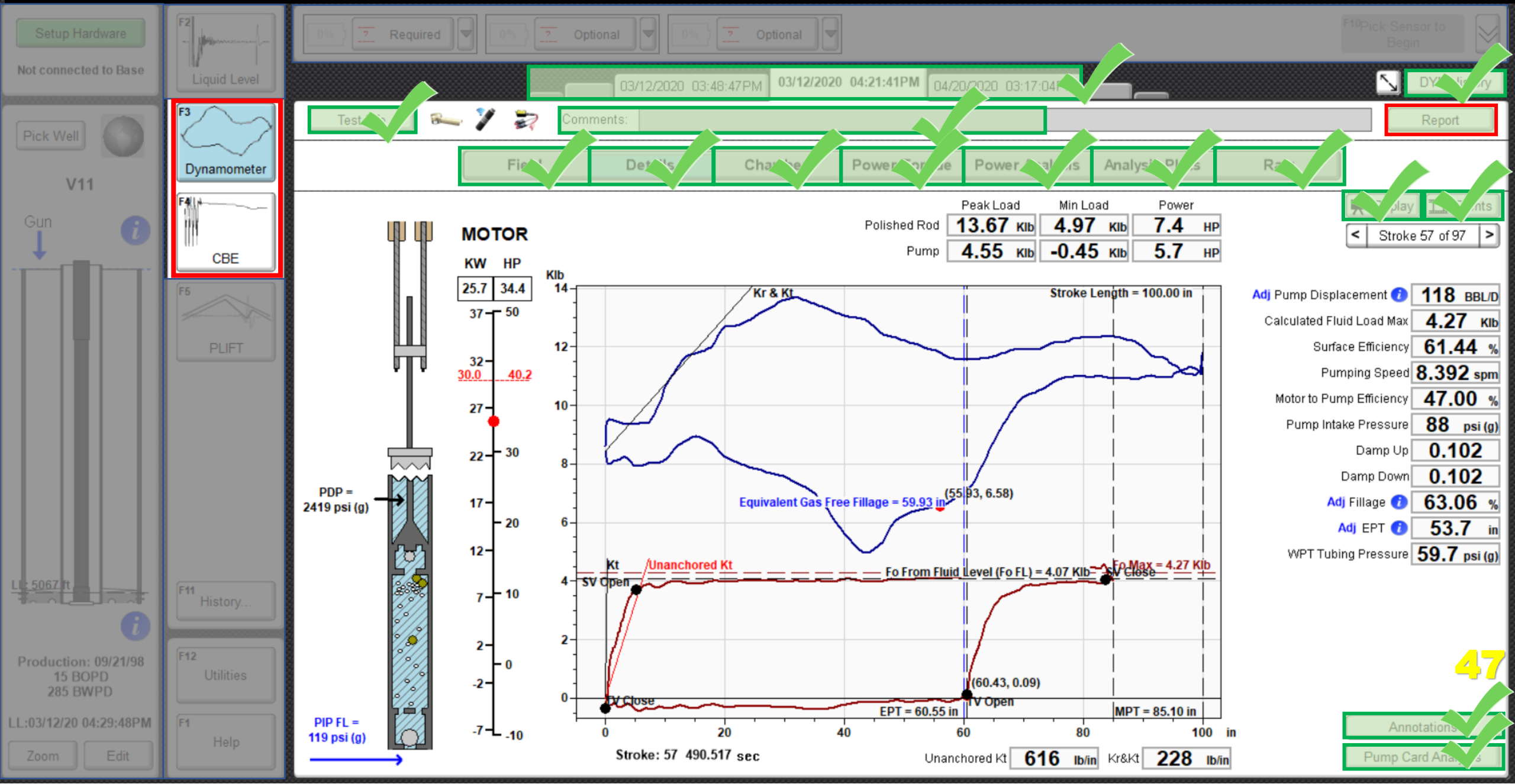


Pump Card Analysis / Tubing Gradient



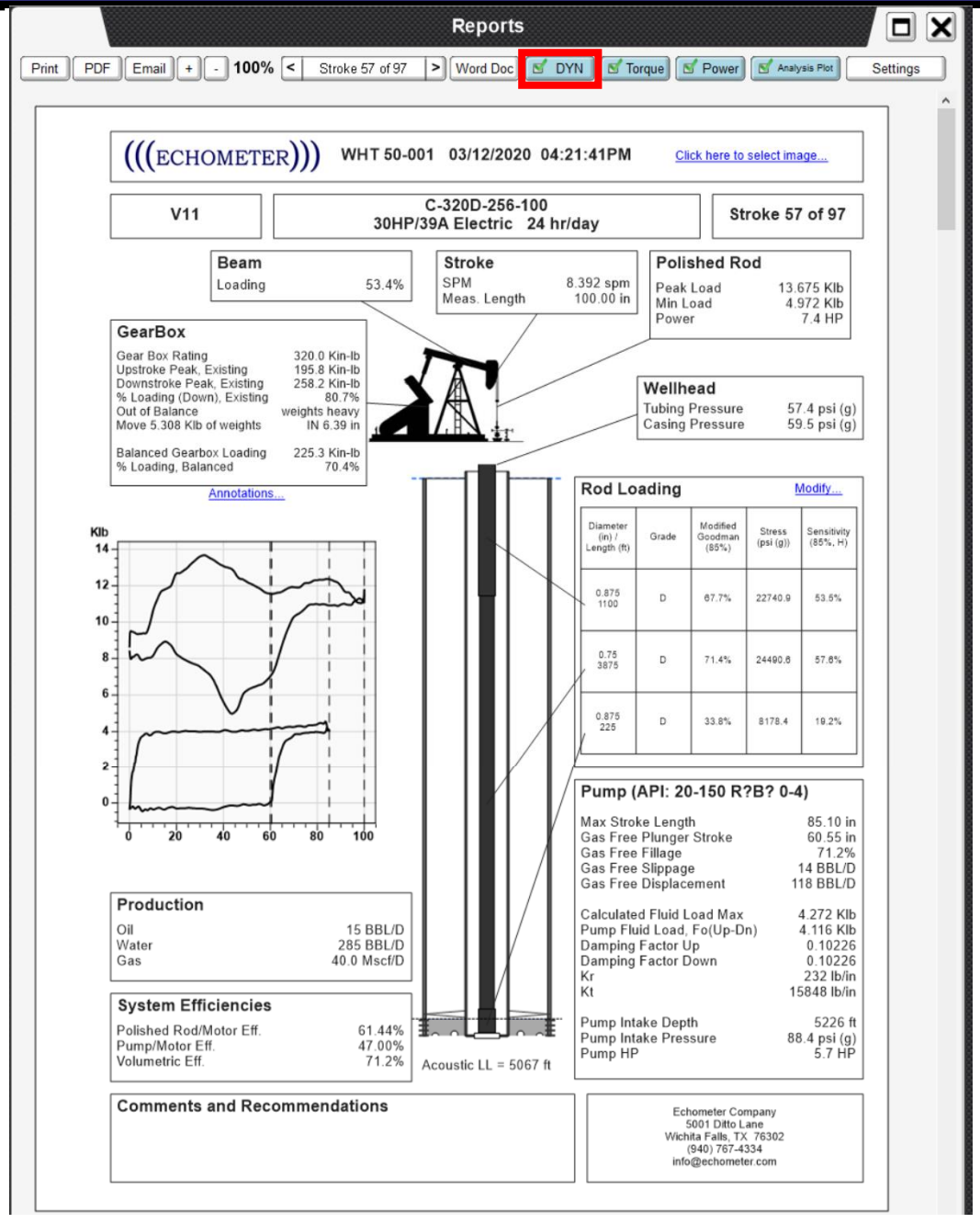
The user can select which factors are taken into consideration when computing pump displacement.
When a factor is selected, with a checkmark in the list at right, it will appear black in the table on the left. When a factor is not selected it will appear grayed out.

Dynamometer Report



Dynamometer Report

Dynamometer Report



Dynamometer Report

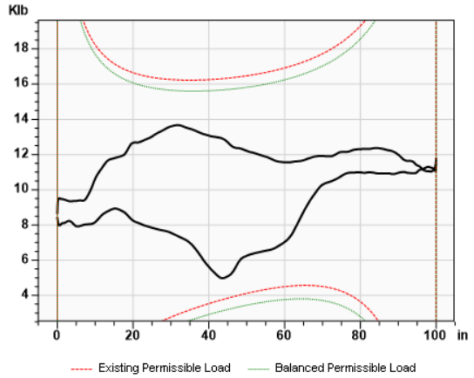
Torque Report

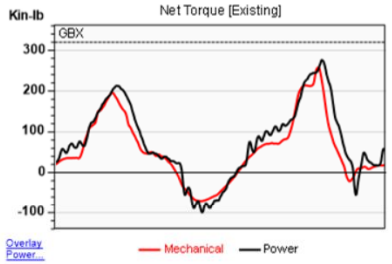
Reports

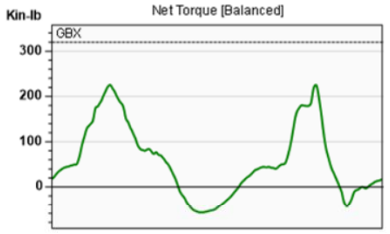
Print | PDF | Email | + | - | 100% | < Stroke 57 of 97 > | Word Doc | DYN | Torque | Power | Analysis Plot | Settings

(((ECHOMETER))) WHT 50-001 03/12/2020 04:21:41PM Click here to select image...

Manufacturer	LUFKIN
API Description	C-320D-256-100
Rotation	Counter ClockWise
Gearbox Rating	320.0 Kin-lb
Pumping Speed	8.392 SPM
Polished Rod Stroke	100.00 in
Net Torque Calculations use:	
CBM From counterweights database	
CBM: 503.2 Kin-lb	CBE: 10.525 Klb
Top of Stroke Crank Angle	173.5Â°
Bottom of Stroke Crank Angle	357.8Â°
Theoretical Stroke Length	100.00 in
API Dimensions:	
A = 129.00 P = 132.00	C = 111.07
I = 111.00 K = 175.55	R = 42.00
Phase Angle	0 degree
Structural Unbalance	550 lb







	Existing	In Balance
Min Gearbox Torque, Upstroke	-69.9 Kin-lb	-57.9 Kin-lb
Max Gearbox Torque, Upstroke	195.8 Kin-lb	225.3 Kin-lb
Min Gearbox Torque, Downstroke	-56.9 Kin-lb	-53.0 Kin-lb
Max Gearbox Torque, Downstroke	258.2 Kin-lb	225.3 Kin-lb
RMS Gearbox Torque	98.6 Kin-lb	98.0 Kin-lb
AVG Gearbox Torque	57.9 Kin-lb	57.7 Kin-lb
Cyclic Load Factor	1.704	1.699

Out of Balance	weights heavy
Maximum Counterbalance	713.2 Kin-lb
Existing Counterbalance	503.2 Kin-lb
Required Counterbalance Decrease	33.9 Kin-lb
To Balance Move 5.308 Klb weights IN	6.39 in

Echometer Company
5001 Ditto Lane
Wichita Falls, TX 76302
(940) 767-4334
info@echometer.com

Dynamometer Report

Power Report

Reports

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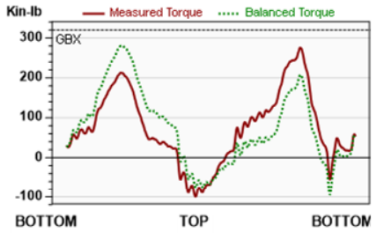
(((ECHOMETER))) WHT 50-001 03/12/2020 04:21:41PM Click here to select image...

V11	C-320D-256-100 30HP/39A Electric 24 hr/day	Stroke 57 of 97

Power Torque

Measured Upstroke Peak	212.9 Kin-lb	Move Counter Weights In	2.80	in
Measured Downstroke Peak	276.7 Kin-lb	Weight of Counterweight To Be Moved	5.308	Klb
Balanced Upstroke Peak	280.7 Kin-lb	Counter Balance Change for Balance	-14.9	Kin-lb
Balanced Downstroke Peak	208.2 Kin-lb			



Torque = 84.5*P[KW]*EFF/(SPM *SV)

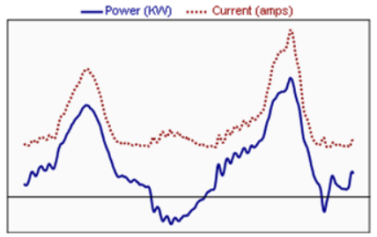
Strokes Per Minute	8.392	
Motor/Belts Efficiency (EFF)	0.8	fraction
Speed Variation (SV)	0.9	fraction
Gearbox Rating	320.0	Kin-lb

Power Analysis

Monthly Operation Costs (30 Days/Month)

Run Time	24.0	hr/day
Cost With Gen. Credit	453.53	$
Cost No Gen. Credit	490.57	$
Demand Cost	83.75	$
Oil Production Cost	127.6	¢/bbl
Liquid Production Cost	6.4	¢/bbl
Oil Production	15	BBL/D
Water Production	285	BBL/D

Recommended Min NEMA D Motor	17.9	HP
Rated HP	30.0	HP
Rated Full Load AMPS	39	
Thermal AMPS	21.5	
Gross Input	13.0	HP
Net Input	12.1	HP
Demand	10.5	KW
Average	9.6	KVA
Average Power		
With Generation Credit	9.0	KW
No Generation Credit	9.7	KW
Average Power Factor	76.6	%
System Efficiency	95.9	%



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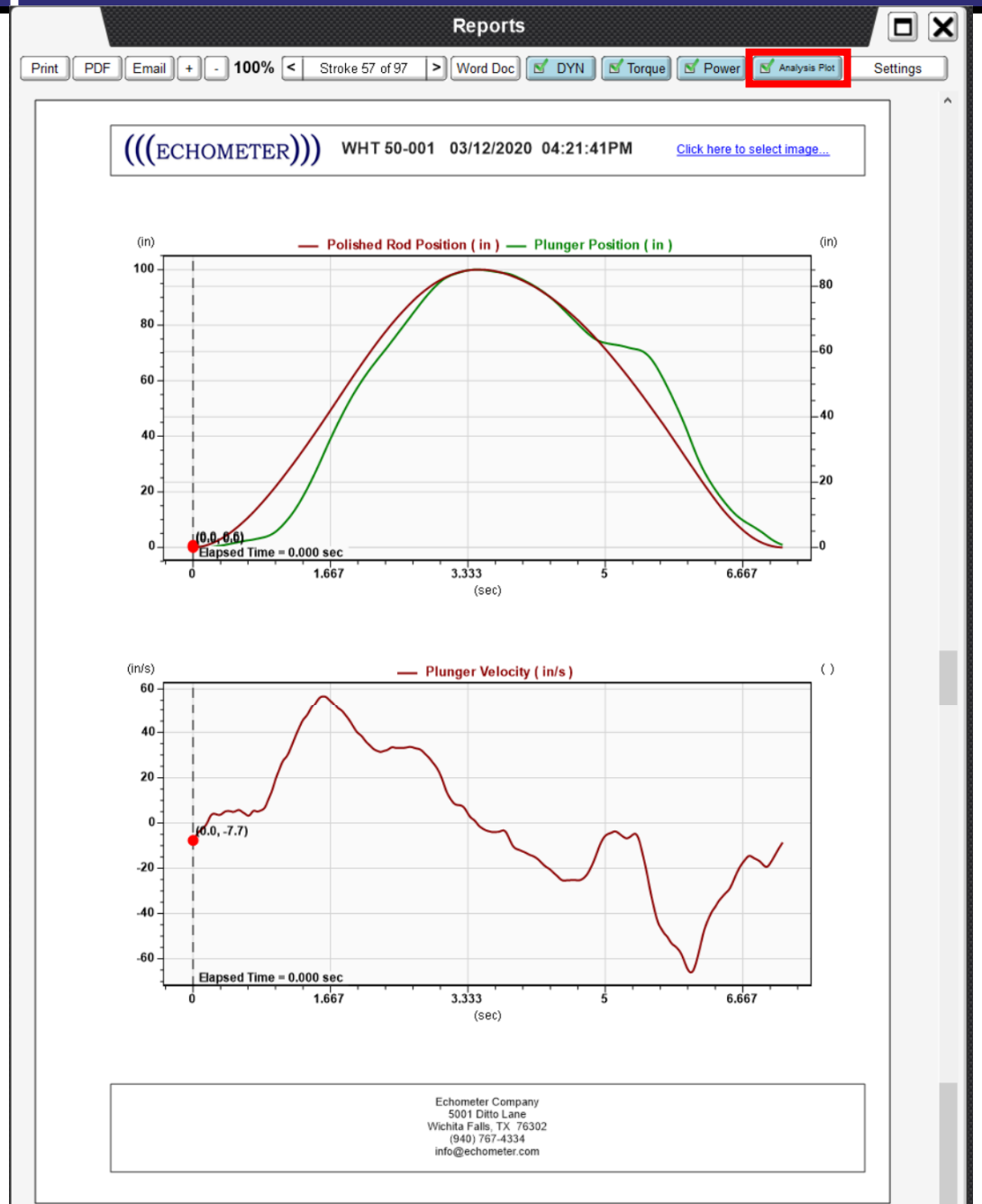
info@echometer.com

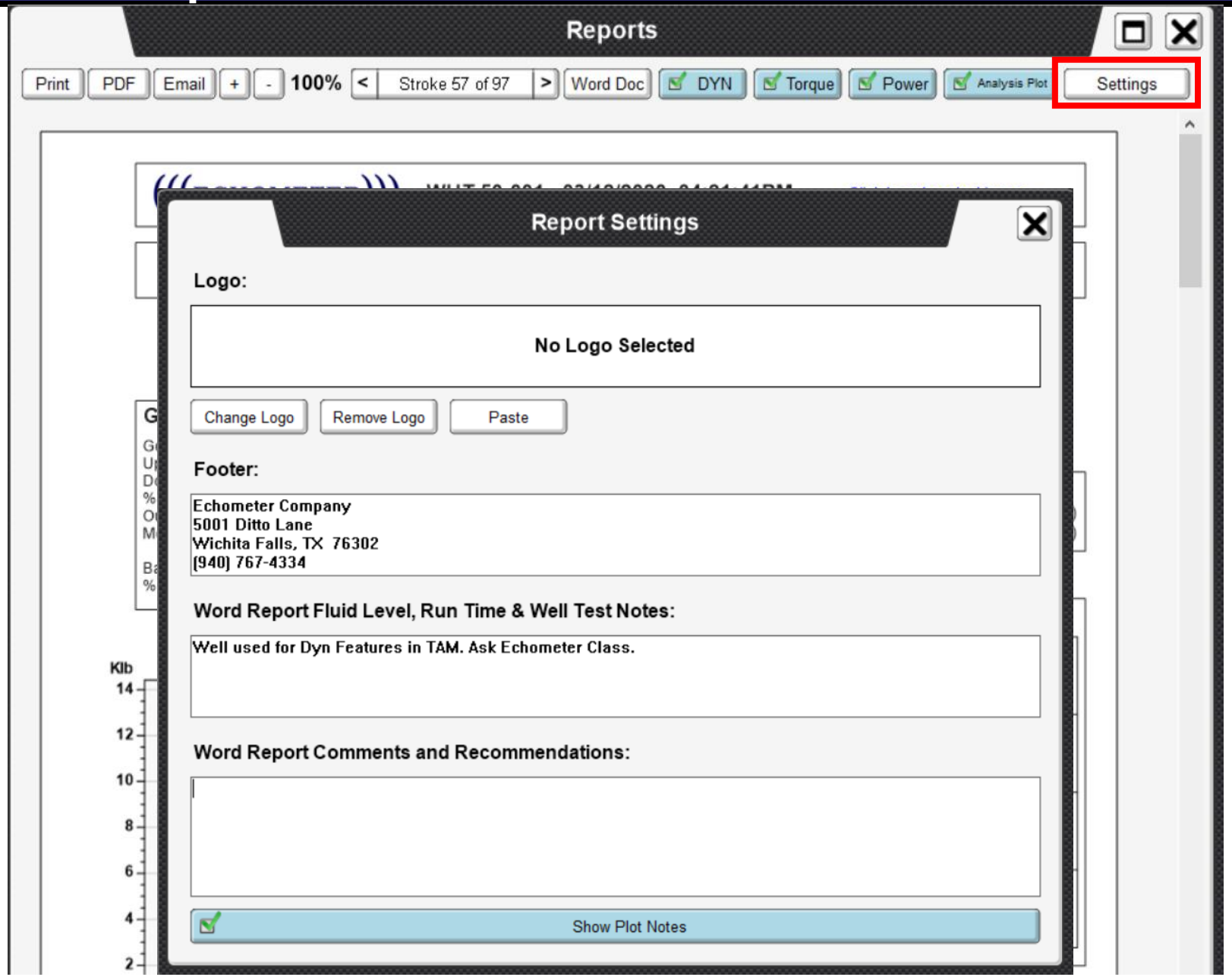
Dynamometer Report

Analysis Plots Report



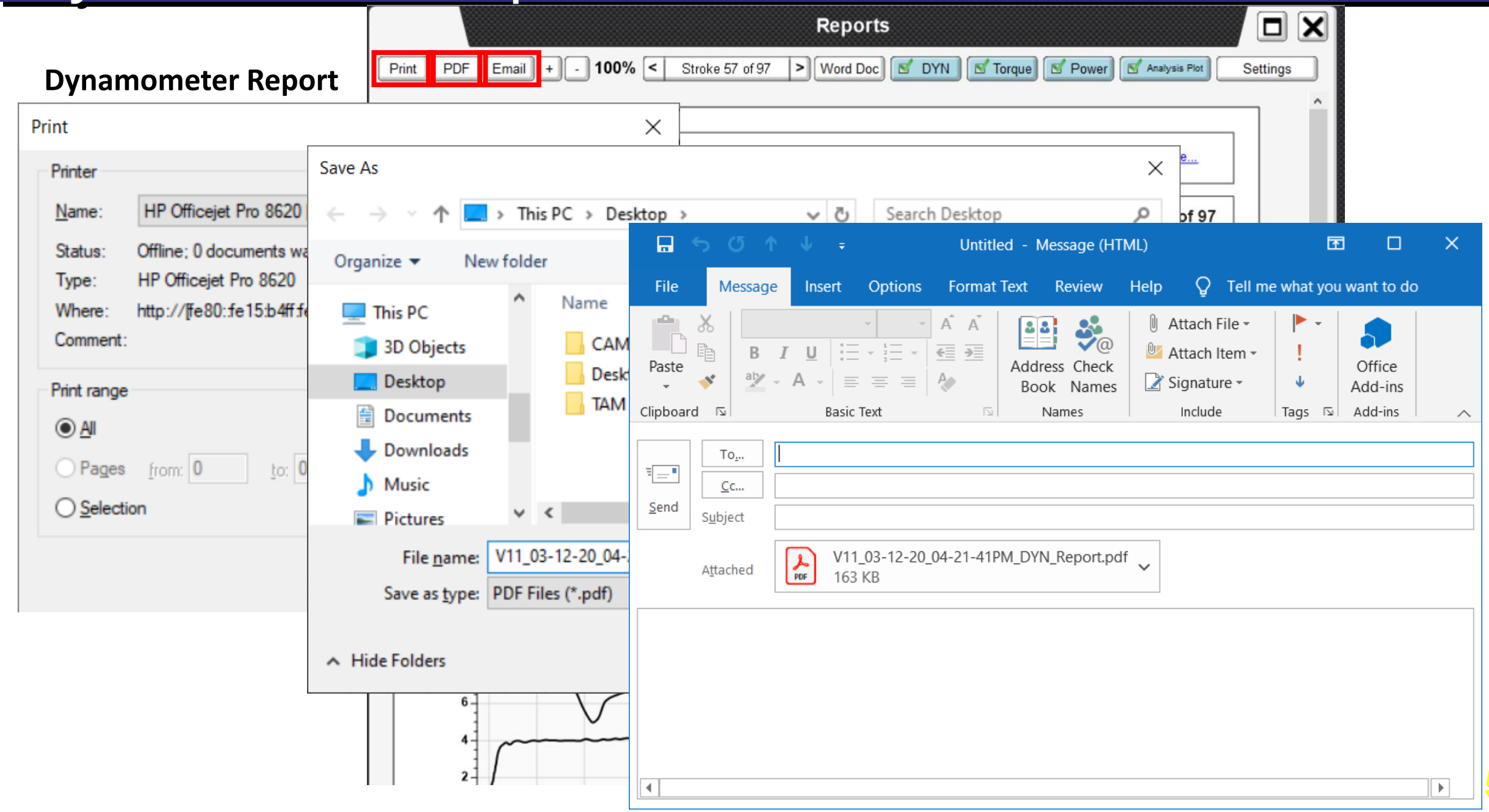
Dynamometer Report

Dynamometer Report



Dynamometer Report

Dynamometer Report



Questions…