STATE OF NEW MEXICO
DEPARTMENT OF ENERGY, MINERALS AND NATURAL RESOURCES
OIL CONSERVATION DIVISION

APPLICATION OF NGL WATER SOLUTIONS PERMIAN, LLC FOR APPROVAL OF SALT WATER DISPOSAL WELL IN LEA COUNTY, NEW MEXICO

Case No. 20896
[Original Case No. 16507]

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Exhibit 4

<u>Affidavit of Dr. Steven Taylor</u>

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APPLICATION OF NGL WATER SOLUTIONS PERMIAN, LLC FOR APPROVAL OF SALT WATER DISPOSAL WELL IN LEA COUNTY, NEW MEXICO **Case No. 20896**
[Original Case No. 16507]

AFFIDAVIT OF DR. STEVEN TAYLOR

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

I, Dr. Steven Taylor, make the following affidavit based upon my own personal knowledge.

1. I am over eighteen (18) years of age and am otherwise competent to make the statements contained herein.

2. I have worked at the Los Alamos National Labs from 1991 to 2006. I currently am the secretary of GeoEnergy Monitoring Systems, Inc., a company that builds and conducts seismic monitoring.

3. I have obtained a Bachelor of Science degree in geology at Ohio University (1975) and a Ph.D. in Geophysics at the Massachusetts Institute of Technology (1980).

4. I am familiar with the application that NGL Water Solutions Permian, LLC ("NGL") has filed in this matter and I have conducted a study related to the area which is the subject matter of that application.

5. The applicant, NGL (OGRID No. 372338), seeks an order approving the Moab SWD #1 well. This well is a salt water disposal well.

6. In its application, NGL requests approval to use larger diameter tubing for this well which is 7" by 5 ½".

7. The well will be spaced out and not located closer than approximately 1.5 miles from other disposal wells approved for injection into the Devonian and Silurian formations.

8. The approved injection zone for the well is located below the base of the Woodford Shale formation and above the Ordovician formation, which consists of significant shale deposits.

9. The well will primarily be injecting fluids into the Wristen Group and Fusselman formations, with some fluids potentially being injected into the Upper Montoya Group. Each of these sub-formations or zones are located within what is commonly referred to by operators and the Division as the "Devonian Silurian" formations. These zones consist of a very thick sequence of limestone and dolostone that has significant primary and secondary porosity and permeability that is collectively between 1,400 to 1,500 feet thick.

10. The closest known fault line is located approximately 1.2 miles away from where the subject well is located.

11. I have studied seismic catalogs, unpublished catalogs and USGS catalogs for the time period of 2010 – 2017 selective events within 50 km of the Striker SWD wells. A copy of my study is provided in Attachment A to this affidavit. My study concludes that there is very little seismic activity in the area where the well is located.

12. I have also reviewed information provided by FTI Platt Sparks involving several different fault slip probability analyses conducted using a tool created by Stanford University. These fault slip potential models showed low probability of slip or earthquakes to known

mapped faults located closest to the wells. A copy of the studies are included in Attachment B to this affidavit.

13. I attest that the information provided herein is correct and complete to the best of my knowledge and belief.

14. The granting of this application is in the interests of conservation and the prevention of waste.

[Signature page follows]

Steven Taylor

Dr. Steven Taylor

SUBSCRIBED AND SWORN to before me this 8th day of ~~August,~~ NOVEMBER 2019 by Dr. Steven Taylor.

Mary A. Chavez

Notary Public

My commission expires: 5-18-21

OFFICIAL SEAL
Mary A. Chavez
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 5-18-21

Seismic Catalog Analysis Within 50 km of Moab SWD #1 Well

Prepared for NGL-Permian
by
GeoEnergy Monitoring Systems
October 27, 2019

Analysis is based on NMT seismic catalogs, unpublished catalogs and USGS catalogs for the time period 2010-2017 selecting events within 50 km of the Moab SWD well. Additionally, seismic monitoring through September 28, 2019 from the three NGL seismic stations installed at Striker 2, Striker 3 and Striker 6 SWD wells on September 6, 2018. NGL/GeoEMS installed a seismic monitor at the Salty Dog SWD well (SDOG) in Texas just across New Mexico border on March 28, 2019 that will help constrain locations in southeastern NM.

Striker Two (STR2), Sand Dunes well, Lat/Long: 32.2072820/-103.7557370
Striker Three (STR3), Gossett well, Lat/Long: 32.2551110/-104.0868610
Striker Six (STR6), Madera well, Lat/Long: 32.2091150/-103.5359570
Salty Dog (SDOG), Salty Dog well, Lat/Long: 32.22531/ -103.045212

Figure 1 shows seismic station locations with estimated detection levels for M 1.0 (green circles) and M 1.5 (red circles) along with NGL-Permian stations (yellow pushpins). **Figure 2** shows seismicity listed in Table 1 shown as red circles and additional regional stations from TexNet and NMT (green pushpins). These regional stations are used along with the 3 Striker SWD seismic stations for regional monitoring.

The USGS reports no events in the vicinity since 2010. New Mexico Tech runs a seismic network (SC) north of the wells for the DOE Waste Isolation Plant (only short-period vertical components). There are a total of seven seismic events in this time period ranging in magnitude from 1.0 to 3.1. Since the NGL seismic deployment, there have been event detections listed in Table 2 having preliminary locations using available regional data (**Figure 3**). Due to the small magnitudes, the signal-to-noise levels are low so the locations have large uncertainty and there is little constraint on depth.

Table 1: Seismicity Within 50 km of Striker SWD Wells 2010-2017

Date	Origin Time GMT	Latitude	Longitude	Depth (km)	Magnitude
20111227	23:10:37	32.37	-103.95	NaN	1.6
20120318	10:57:22	32.281	-103.892	5.0	3.1
20170211	14:34:27	32.29	-103.92	NaN	1.5
20170302	11:38:53	32.37	-103.88	NaN	1.7
20170325	22:46:01	32.13	-103.77	NaN	1
20170503	17:47:21	32.082	-103.023	5.0	2.6
20170814	01:09:56	32.39	-103.56	NaN	1.2

Table 2. New Mexico Area Reporting Period Seismicity (km units)

Date	Origin Time (GMT)	Lat	Long	Depth	Loc Error	M	(+/-)
09/10/18	23:35:43.942	32.1793	-103.5283	1	5.58	1.25	0.23
09/14/18	06:57:47.614	32.1540	-103.5030	1	5.58	1.11	0.41
09/15/18	16:48:21.041	32.1630	-103.5211	1	5.37	1.50	0.00
10/13/18	22:07:22.259	32.0998	-103.4560	6	5.64	1.60	0.12
11/18/18	09:04:52.707	32.2526	-103.7853	5	3.77	1.75	0.20
12/09/18	18:51:00.805	32.3634	-103.8510	1	2.09	1.44	0.08
01/03/19	09:15:48.809	32.2761	-103.6732	6	5.64	1.63	0.00
01/03/19	23:05:33.122	32.2599	-103.7654	4	5.51	1.60	0.25
01/04/19	09:45:38.943	32.2346	-103.7798	4	4.34	1.98	0.38
01/09/19	10:18:54.389	32.2255	-103.7166	5	2.80	1.47	0.41
01/27/19	07:33:47.127	32.2219	-103.7220	5	3.53	1.72	0.31
02/19/19	09:35:15.109	32.2443	-103.6898	1	4.17	1.20	0.00
02/19/19	09:35:15.109	32.2443	-103.6898	1	4.17	1.20	0.00
02/19/19	09:35:15.109	32.2443	-103.6898	1	4.17	1.20	0.00
05/23/19	06:33:40.530	32.2617	-103.7581	4	2.28	1.53	0.27
06/08/19	23:11:24.669	32.3102	-103.8510	2	0.55	1.39	0.07
07/09/19	14:43:45.683	32.2263	-103.6260	4	3.02	1.54	0.06
07/17/19	03:24:43.975	32.3326	-103.8093	6	0.91	1.56	0.07
08/10/19	16:06:35.306	32.3091	-103.7533	2	3.60	1.44	0.58
08/16/19	04:46:20.946	32.2704	-103.8383	3	0.03	1.46	0.00
08/22/19	14:39:58.164	32.2671	-103.7654	4	4.31	1.92	0.32
08/27/19	06:54:59.122	32.1473	-103.7345	1	1.35	1.66	0.22
09/03/19	20:16:04.540	32.3138	-103.8528	1	5.64	1.65	0.19
09/10/19	14:15:00.998	32.4211	-103.7478	2	0.76	2.11	0.21
09/10/19	14:15:00.821	32.4176	-103.7401	1	1.78	0.00	0.00
09/13/19	09:41:47.001	32.2173	-103.4072	1	0.67	1.55	0.10
09/24/19	03:20:22.478	32.3247	-103.9613	7	5.64	1.46	0.07

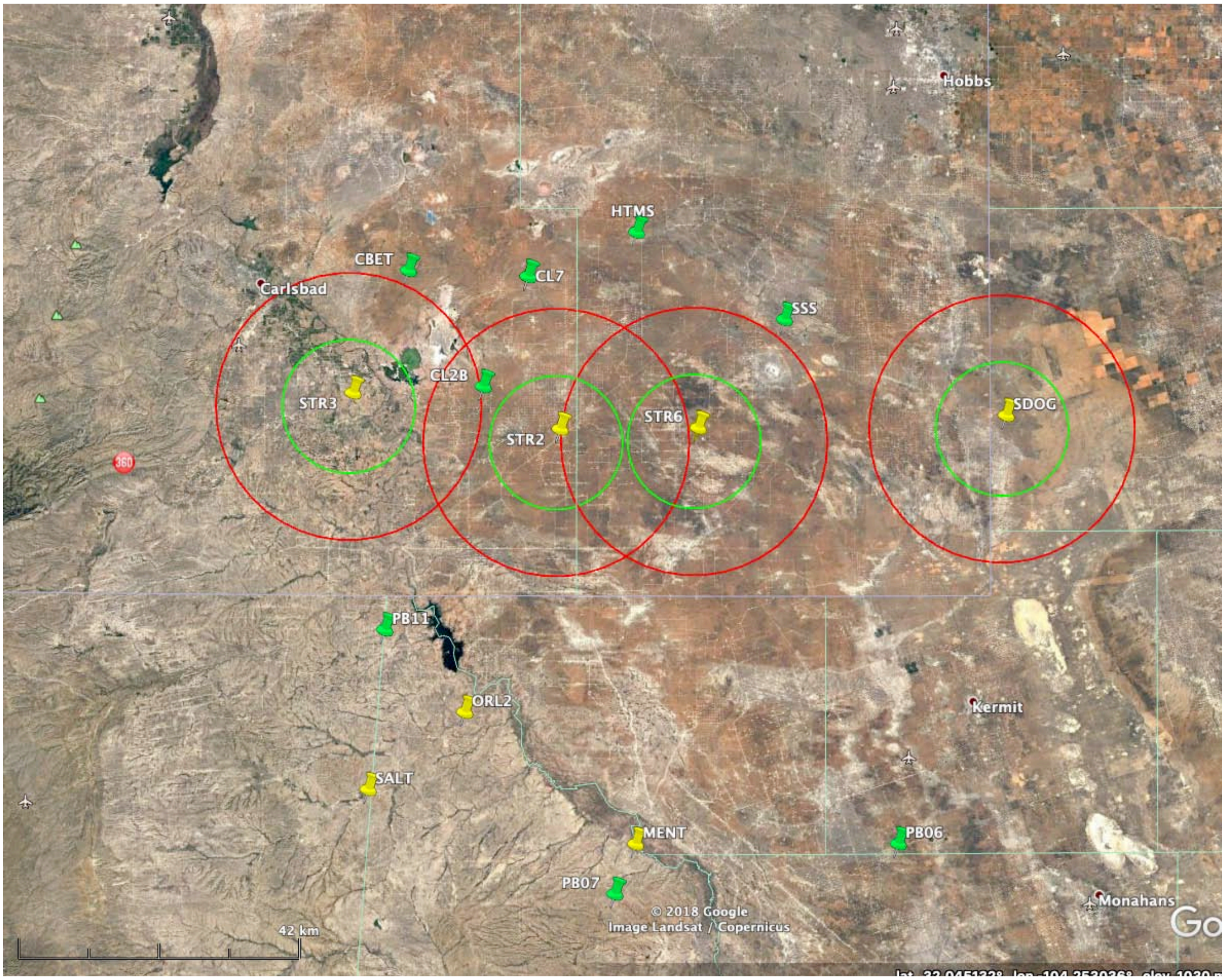


Figure 1. Striker SWD wells seismic station locations and existing NGL-Permian seismic stations (yellow pushpins). Green and red circles around stations show approximate detection levels for ML 1.0 and 1.5, respectively.

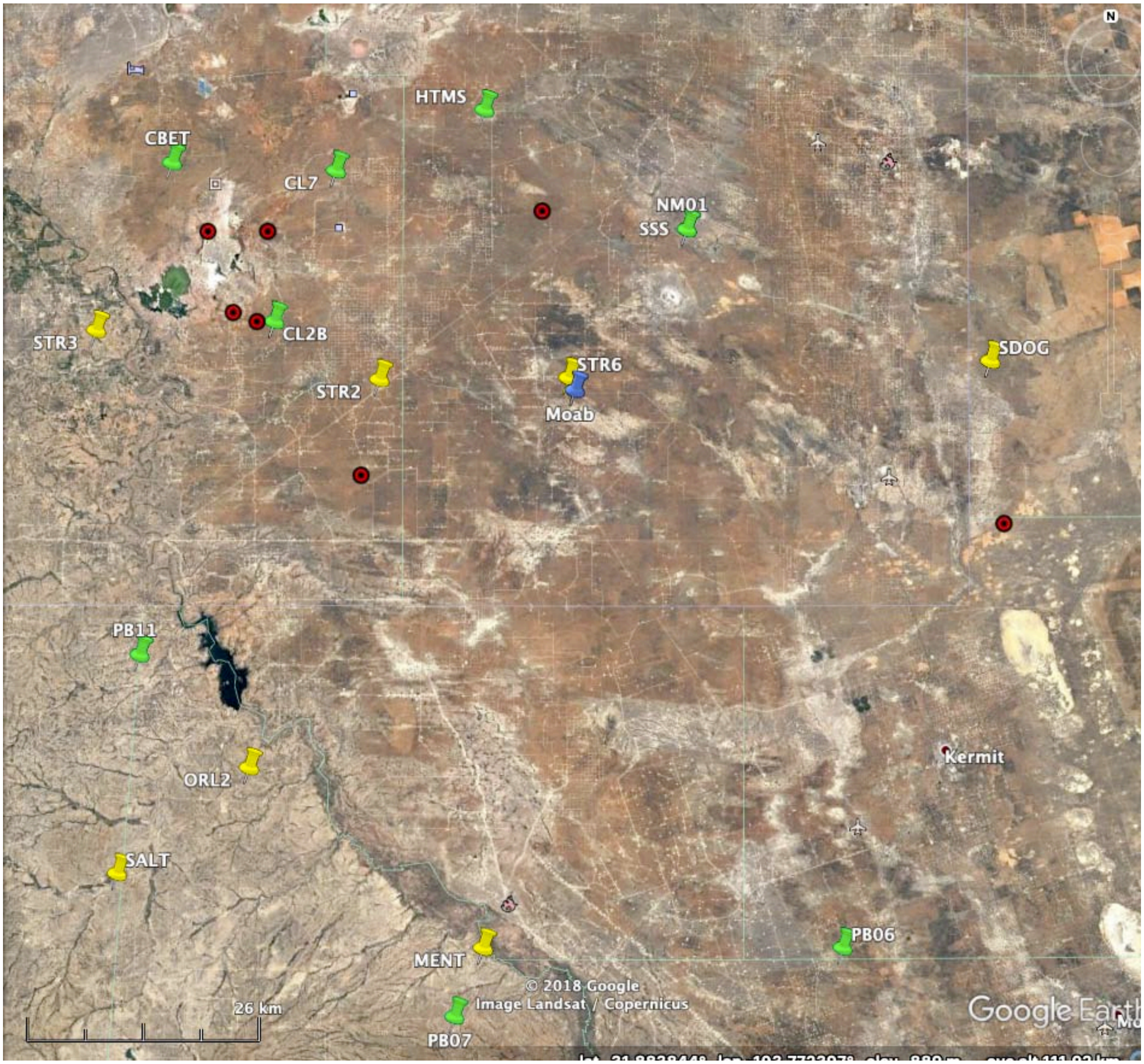


Figure 2. Striker SWD wells seismic station locations (yellow push pins) and existing NGL-Permian seismic stations (yellow pushpins). Other regional seismic stations run by TexNet and New Mexico Tech are shown as green pushpins. Historic seismicity listed in Table 1 shown as red circles. Moab SWD well shown as blue pushpin.

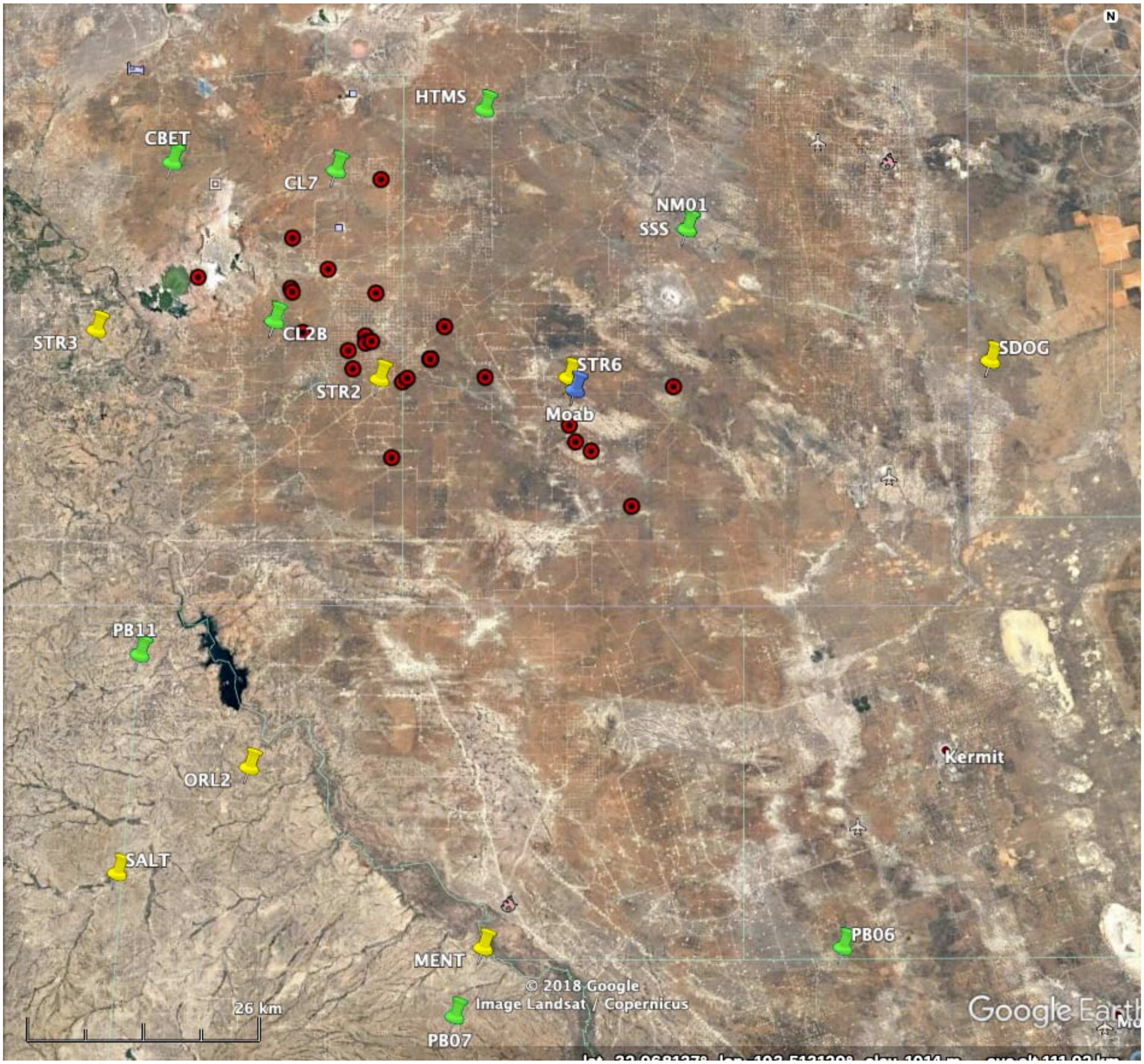


Figure 3. Seismic events in between September 6, 2018 and September 28, 2019 as red circles (Table 2). Seismic stations as yellow (NGL) or green (NMT and TexNet) pushpins. Moab SWD well shown as blue pushpin.

November 12, 2019

RE: FSP Analysis **Moab SWD No. 1**
Lea County, New Mexico

FSP Analysis

The FSP software used for this analysis was jointly developed by Stanford University, Exxon Mobil and XTO Energy as a tool for estimating fault slip potential resulting from fluid injection.

I have reviewed the geology, seismic activity, injection history and future proposed injection in the Subject Area and I would conclude that the **Moab SWD No. 1** well does not pose a risk of increasing seismicity in the area. The primary risk reduction factor is that the faults are not optimally oriented to slip, and significant pressure increases would be necessary to initiate slip on the faults analyzed.

Fault slip potential (FSP) was analyzed in the area of review shown on **Exhibit No. 1.** The analysis integrates all of the proposed well locations as well as any existing injection wells in order to fully assess the pressure implications of injection in the area and the potential for slip along existing faults. Historical USGS earthquake events are denoted by the "blue" bulls-eye symbols and earthquake events recorded on NGL's regional seismic monitoring system is denoted by the "pink" bulls-eye symbols.

Exhibit No. 2 shows the FSP input parameters for the local stress, average reservoir depth, pressure gradients and reservoir characteristics. Depths and reservoir characteristics were derived from nearby well logs and stress values were derived from the Lund Snee and Zoback (2018) paper related to Stress in the Permian Basin.

Exhibit No. 3 shows the location of existing wells and locations of the Proposed SWD wells relative to the faults documented in this area. The faults were independently mapped by FTI Platt Sparks and compared to the faults documented by the Texas Bureau of Economic Geology (BEG) The BEG faults are also the fault traces shown in the referenced Snee/Zoback paper (Figure 3 in the paper) and shown as **Exhibit No. 4** in my report. The Snee/Zoback paper only considers fault orientation relative to the stress orientation in determination of fault slip potential. Based on their limited analysis of the area they concluded the faults have low slip potential based on orientation/azimuth. My analysis further incorporates the injection history and future injection projections and the injection reservoir characteristics to fully assess the potential for slip along these faults. The proposed wells were modelled at 30,000 bbls/day and held constant for the life of the analysis (+25 years).

The proposed wells are denoted in the model as follows: (**Exhibit No. 3)**

6 – Moab SWD
7 – Asroc SWD
8 – Sparrow SWD
9– Trident SWD
10 - Viper SWD
11 – McCloy Central SWD
12 – Minuteman SWD
13 - Tomahawk SWD
15 - Patriot SWD
16 – Javelin SWD
17 – Telluride SWD
18 - Aspen SWD
19 – Harpoon SWD
20 - Maverick SWD

Existing wells were incorporated into the analysis using their injection volume histories and holding them constant into the future at their last reported monthly injection volume.
Also included in the model are existing SWD injection wells as follows: (**Exhibit No. 3)**

1 - 3002523895
2 - 3002542448
3 - 3002544291
4 - 3002544661
5 - 3002545427

Exhibit No. 5 illustrates the geomechanical properties of the fault segments in the area of review. It should be noted that the FSP software only calculates a single pressure change along a fault (at the fault mid-point) so it is critical that faults are broken into multiple segments to get a true evaluation of the pressure increases associated with injection. **Exhibit No. 5 also** shows the **direction** of max hor. stress as denoted by the grey arrows outside the circle on the stereonet in the lower right portion of this exhibit. Faults that align parallel or closer to this orientation will have the highest potential for slip or lowest ΔP to slip. Faults 12-22 have the highest potential for slip and Faults 1-11 have very low potential for slip.

Exhibit No. 6 shows that the input stress and fault values were varied by +/-10% to allow for uncertainty in the input parameters. Even considering the variability of the inputs the model results show low probability for slip on the faults in the area of review. An increase of 1150 psi at Fault 22 still only results in a 10% probability of fault slip.

Exhibit No. 7 takes a closer look at fault 22. The sensitivity analysis is highlighted in the lower right portion of this exhibit and shows that without any variability of inputs the ΔP needed to slip is 1,400 psi along this fault. A 10% decrease in the friction coefficient of the fault could lower ΔP needed to slip to 1000 psi.

Exhibit No. 8 takes a closer look at fault 16. The sensitivity analysis is highlighted in the lower right portion of this exhibit and shows that without any variability of inputs the ΔP needed to slip is 1,900 psi along this fault. A 10% decrease in the fault strike or SHmax azimuth could lower ΔP needed to slip to 1,400 psi.

Exhibit No. 9 takes a closer look at fault 12. The sensitivity analysis is highlighted in the lower right portion of this exhibit and shows that without any variability of inputs the ΔP needed to slip is +2,700 psi along this fault. A 10% change in the fault strike or SHmax azimuth could lower ΔP needed to slip to 1,600 psi.

Exhibit No. 10 takes a closer look at fault 7. The sensitivity analysis is highlighted in the lower right portion of this exhibit and shows that without any variability of inputs the ΔP needed to slip is +5,600 psi along this fault. A 10% change in the fault strike or SHmax azimuth could lower ΔP needed to slip to 3,000 psi. This is the area nearest the proposed Moab SWD.

The following exhibits will track the pressure changes at the faults moving forward in time based upon the anticipated injection in the future from these proposed wells and the existing wells in the Subject Area.

Exhibit No. 11 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2020. This map indicates ΔP pressure increases of 155 psi at F22 and 4 psi at F7.

Exhibit No. 12 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2025. This map indicates ΔP pressure increases of 234 psi at F22 and 405 psi at F7.

Exhibit No. 13 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2030. This map indicates ΔP pressure increases of 361 psi at F22 and 758 psi at F7.

Exhibit No. 14 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2035. This map indicates ΔP pressure increases of 542 psi at F22 and 1,043 psi at F7.

Exhibit No. 15 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2040. This map indicates ΔP pressure increases of 641 psi at F22 and 1,285 psi at F7.

Exhibit No. 16 illustrates the ΔP pressure in a "heat map" and shows ΔP pressure increases at the faults as of 1/1/2045. This map indicates ΔP pressure increases of 775 psi at F22 and 1,495 psi at F7.

The pressure analysis over time shows that pressure is expected to increase along the faults however pressures remain below critical levels. The table below shows the ΔP pressure increases needed to imitate fault slip along each fault segment and the corresponding ΔP pressure increases as of 2045:

Fault Segment	ΔP to slip (fixed inputs)	ΔP to slip (10% varied inputs)	ΔP at 2045
F1	7,282	4,600	1,604
F2	7,261	4,550	1,853
F3	7,261	4,550	1,787
F4	7,229	4,500	1,797
F5	7,229	4,500	1,743
F6	5,638	3,300	1,676
F7	5,469	3,200	1,495
F8	5,125	2,750	1,541
F9	5,125	2,750	1,212
F10	5,678	3,325	1,026
F11	5,678	3,325	732
F12	2,717	1,600	495
F13	2,697	1,600	333
F14	1,893	1,400	485
F15	1,921	1,420	589
F16	1,922	1,420	643
F17	2,311	1,500	683
F18	2,267	1,450	726
F19	2,155	1,430	753
F20	1,601	1,150	759
F21	1,601	1,150	769
F22	1,404	1,000	775
F23	7,815	5,500	875
F24	6,852	4,150	1,100
F25	6,666	4,000	1,295
F26	5,969	3,500	1,419
F27	5,853	3,450	1,208

This analysis demonstrates that there is a low likelihood of injection induced seismicity in the Subject Area. The pressures as of 1/1/2045 remain well below the 10% modified inputs.

Recently recorded Seismicity

NGL has recorded and located 3 events within the 100 sq. mi. area of review on its local seismology network:

9/10/18 – 1.25 mag

9/14/18 – 1.11 mag

9/15/18 – 1.50 mag

All of these events are below the magnitude of "felt" events and are so small that they are not detected on the USGS network.

The seismicity is likely a poroelastic stress response due to the pressure reduction associated with recent production at Wolfcamp depths and also short-term increases in pressure associated with Frac-stimulations at these same depths. TexNet data, in the Texas portion of the Delaware Basin, appears to confirm that the seismicity is primarily focused within the overpressured section with some deeper responses in the basement and there are numerous examples of the recent seismicity being spatially and temporally correlated to Hydraulic Frac-stimulations (HF) in Wolfcamp wells. This is evidenced by a lack of seismicity prior to the HF operations, a cluster of seismicity during the HF operations and no seismicity since the HF operations. This has been the opinion of FTI Platt Sparks for almost 2 years and recently the Bureau of Economic geology, Lomax et al., published a paper that concludes HF activity is more likely than SWD to be causing seismicity in the Delaware Basin study area (See research paper titled; "Improving absolute earthquake location in West Texas using probabilistic, proxy ground-truth station corrections")

Conclusion

The faults and fault trends in this area of review are not optimally oriented to slip. The orientation of the faults requires significant pressure changes (ΔP +1,400 psi) based on the fixed input parameters and the ΔP increase at the most vulnerable fault only reaches 775 psi by 2045. This model assumes constant injection rates over the next +25 years which is not a typical scenario as SWD wells tend to decrease injection volumes over time as the well ages and disposal demand decreases in the area. If injection volumes are lower over time than the model represents, then the risk for fault slip is lowered also.

In the event seismicity should occur in the future, the wells closest to the faults (proposed and existing) should be the wells considered for modification or reduction of injection rates. At this time there is no evidence to support rate reduction for any of the existing or proposed wells.

Should you have any questions, please do not hesitate to call me at (512) 327-6930 or email me at todd.reynolds@ftiplattsparks.com.

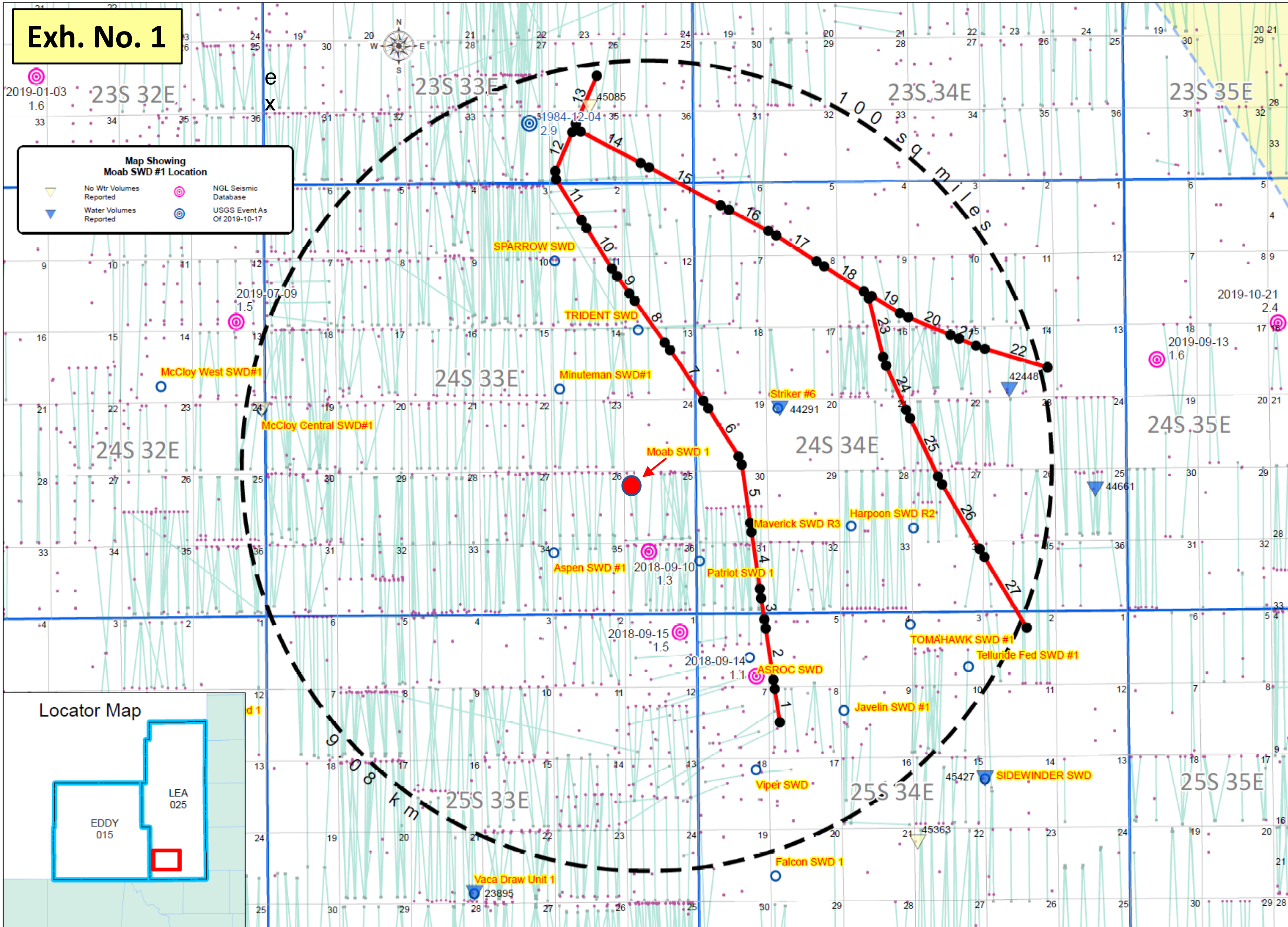
Regards,

Todd W. Reynolds – Geologist/Geophysicist
Managing Director, Economics/FTI Platt Sparks

Todd W. Reynolds

FTI Platt Sparks
512.327.6930 office

Exh. No. 1



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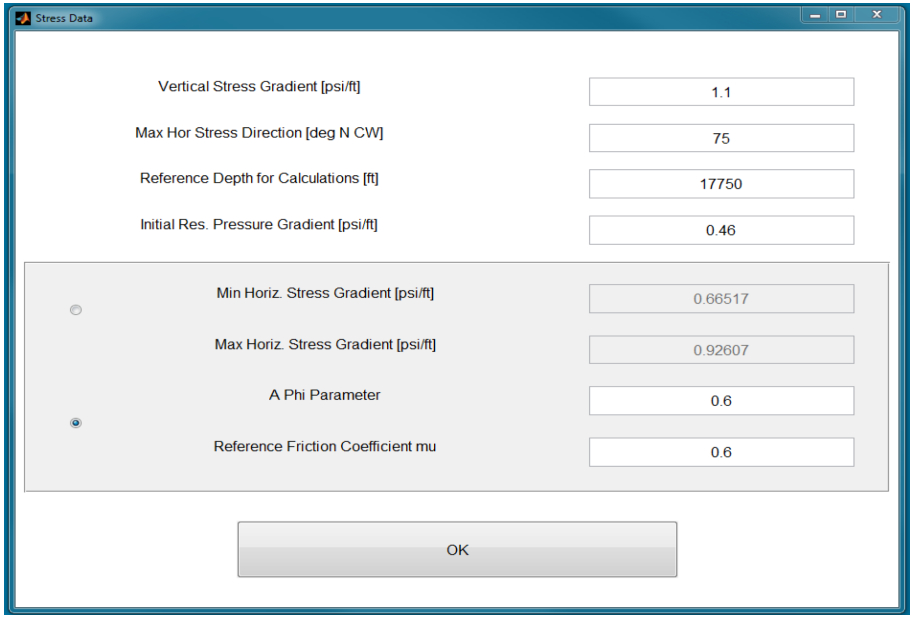
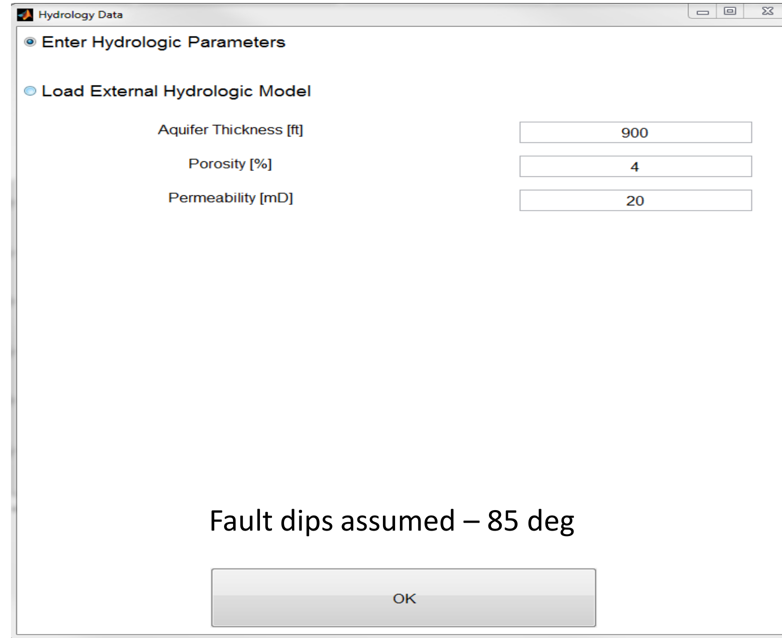
FTI PLATT SPARKS
Texas Registered Engineering Firm No F - 16381

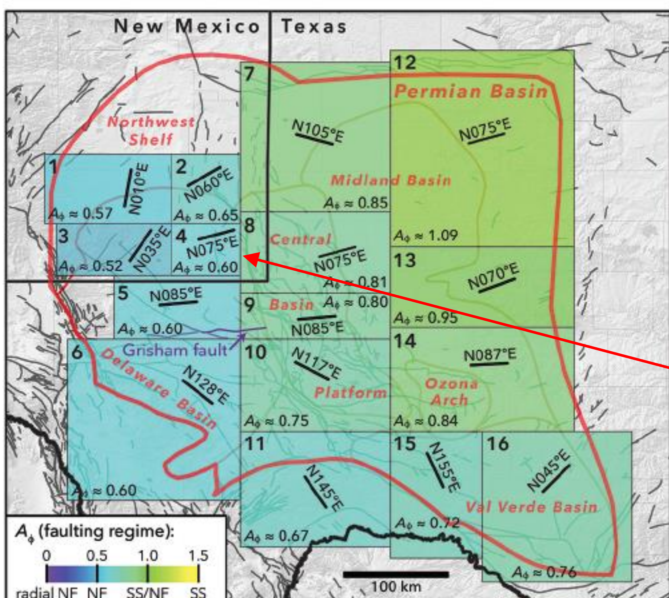
Exh. No. 2

FSP INPUT PARAMETERS





Fault dips assumed – 85 deg



Input Parameter Comments

Hydrologic Parameters – Derived from Striker 6 SWD #2 logs

Stress Gradients – Derived from A Phi parameter from Snee/Zoback paper (.60)

Max Hor. Stress Direction - Derived from Snee/Zoback paper (N75E)

Exh. No. 3

File Zoom

Fault Slip Potential

MODEL INPU... | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

Fault Selector:

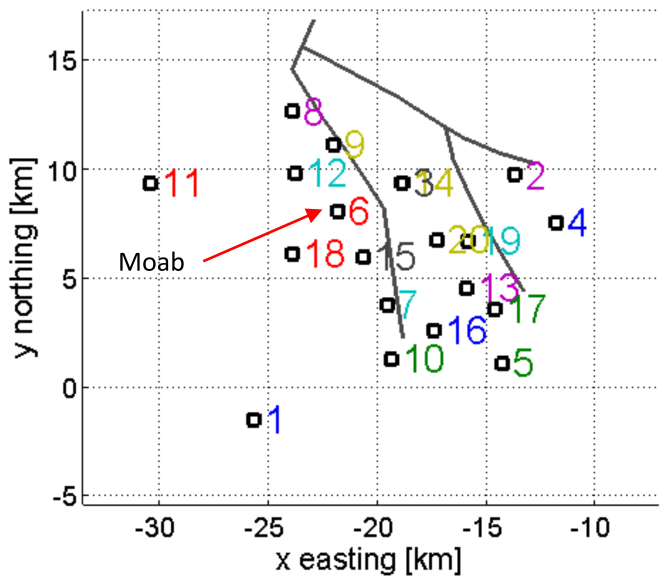
- All Faults
- Fault #1
- Fault #2
- Fault #3
- Fault #4
- Fault #5
- Fault #6
- Fault #7
- Fault #8
- Fault #9
- Fault #10
- Fault #11
- Fault #12
- Fault #13
- Fault #14
- Fault #15
- Fault #16
- Fault #17
- Fault #18
- Fault #19
- Fault #20
- Fault #21
- Fault #22
- Fault #23
- Fault #24
- Fault #25
- Fault #26
- Fault #27

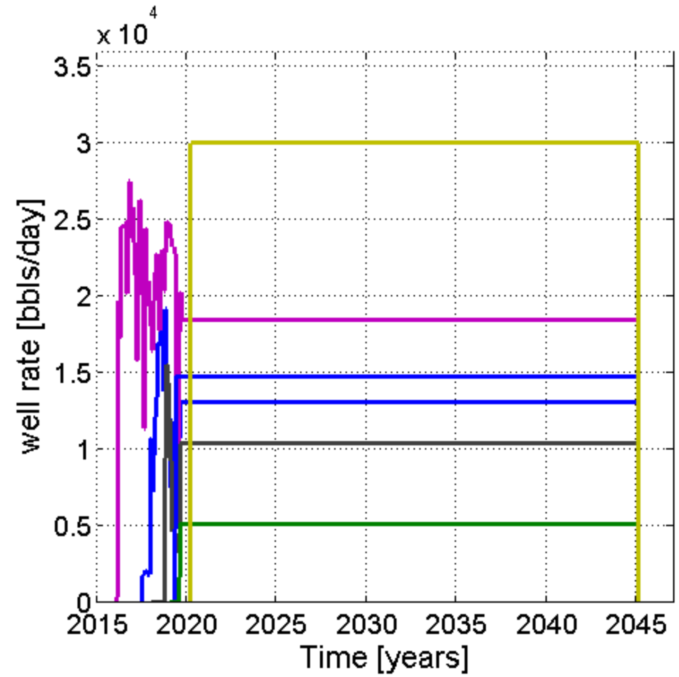
Calculate

Stress Regime: Normal Faulting

Select Well: All

FSP INPUT Fault and well locations





FSP INPUT Injection history and projected future injection

Exh. No. 4

Area of Review

Low slip potential based on fault orientation (green faults)

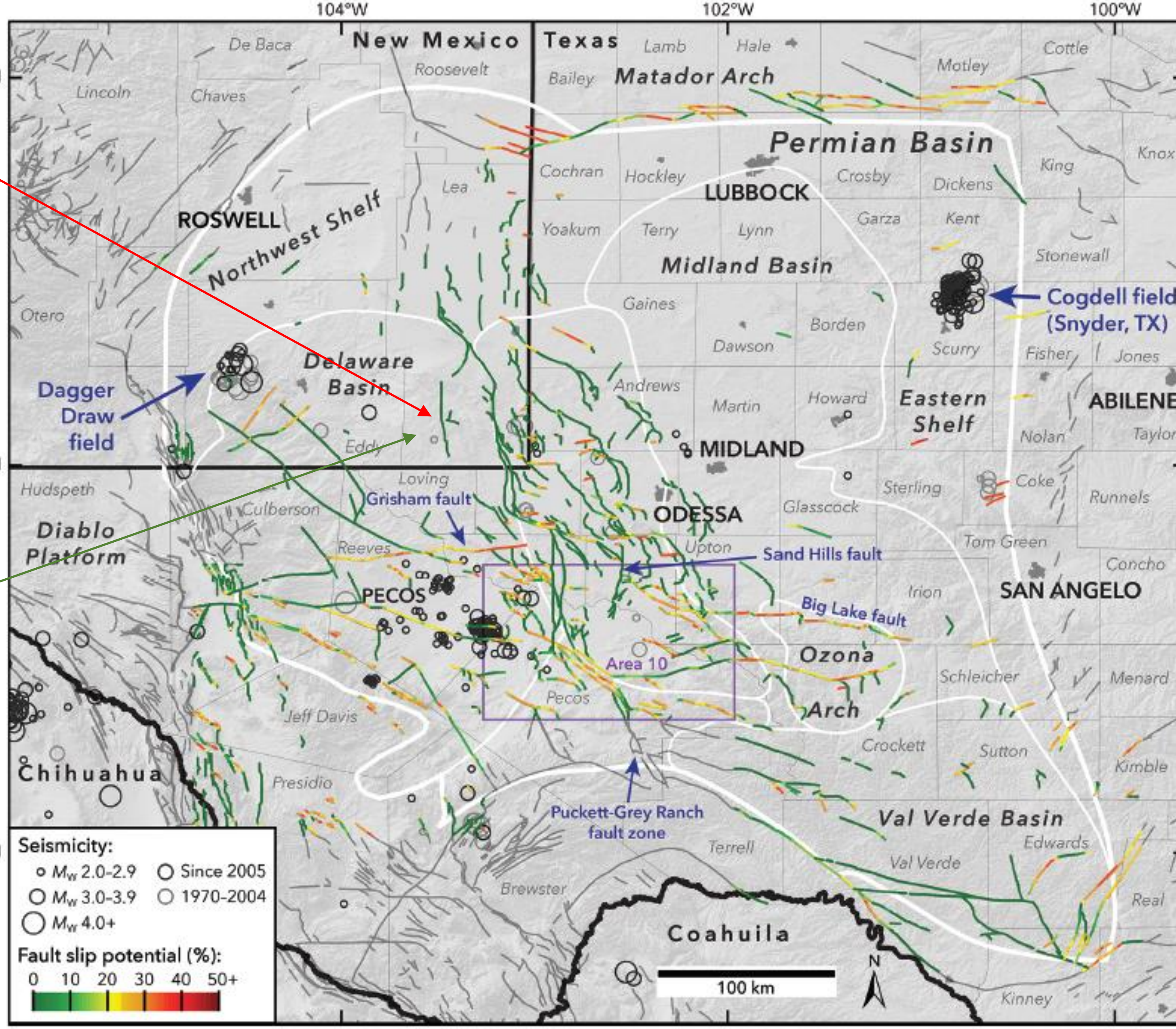
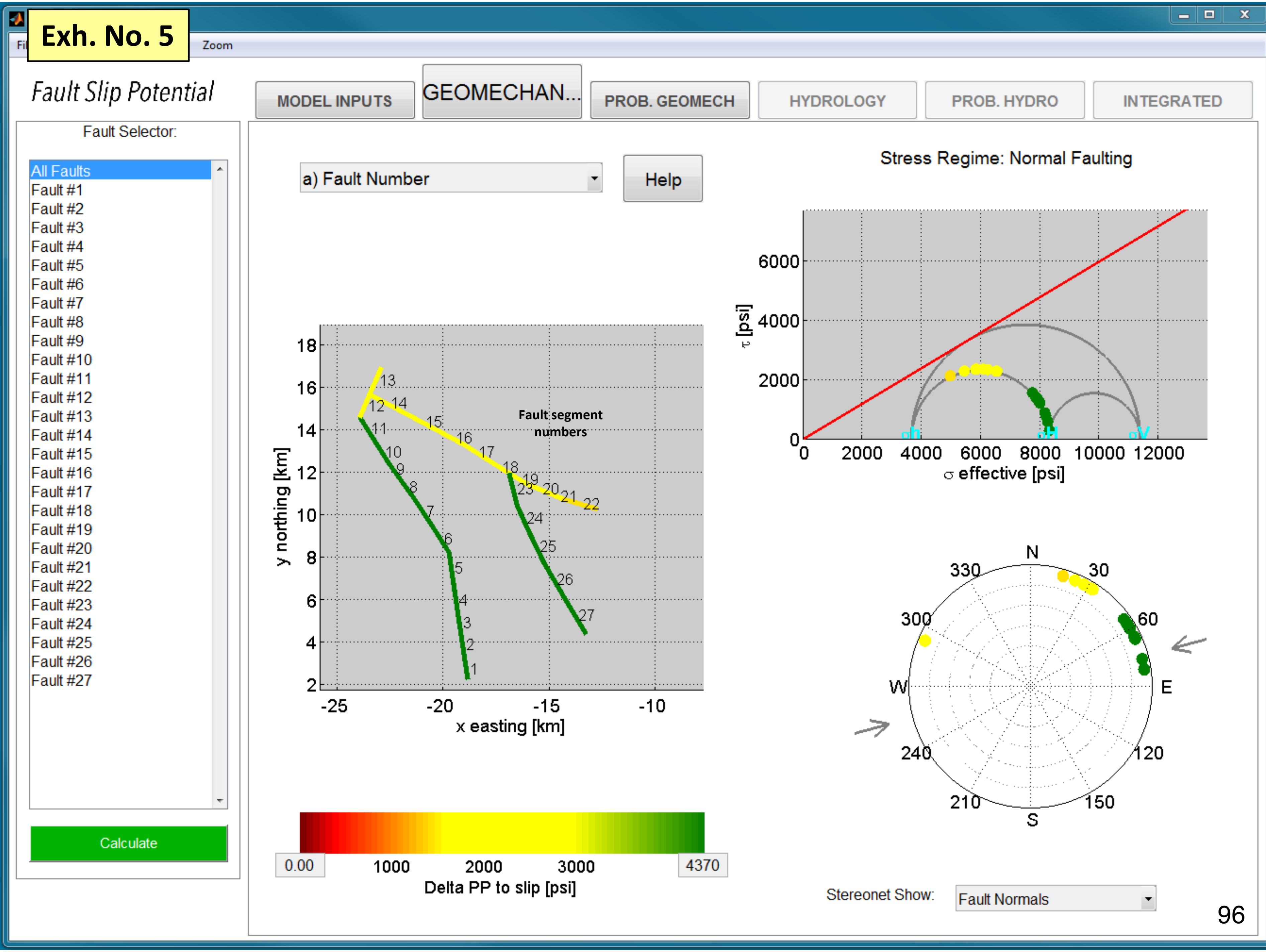


Figure 3. Results of our probabilistic FSP analysis across the Permian Basin. Data sources are as in Figures 1 and 2.

From Lund Snee and Zoback (2018)

Exh. No. 5



Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHAN...
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
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Delta PP to slip [psi]
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σ effective [psi]
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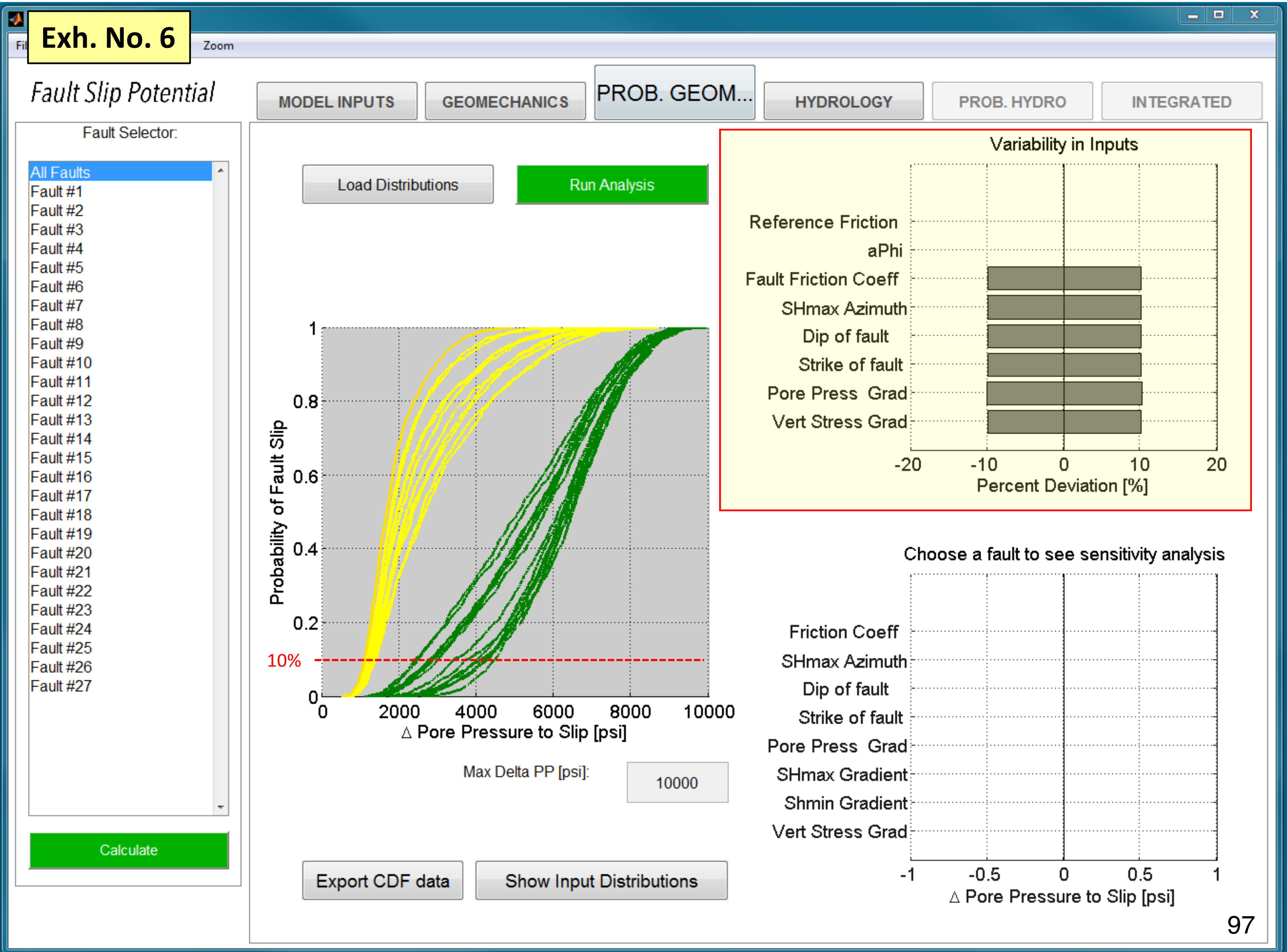
Exh. No. 6



Zoom
Fault Slip Potential
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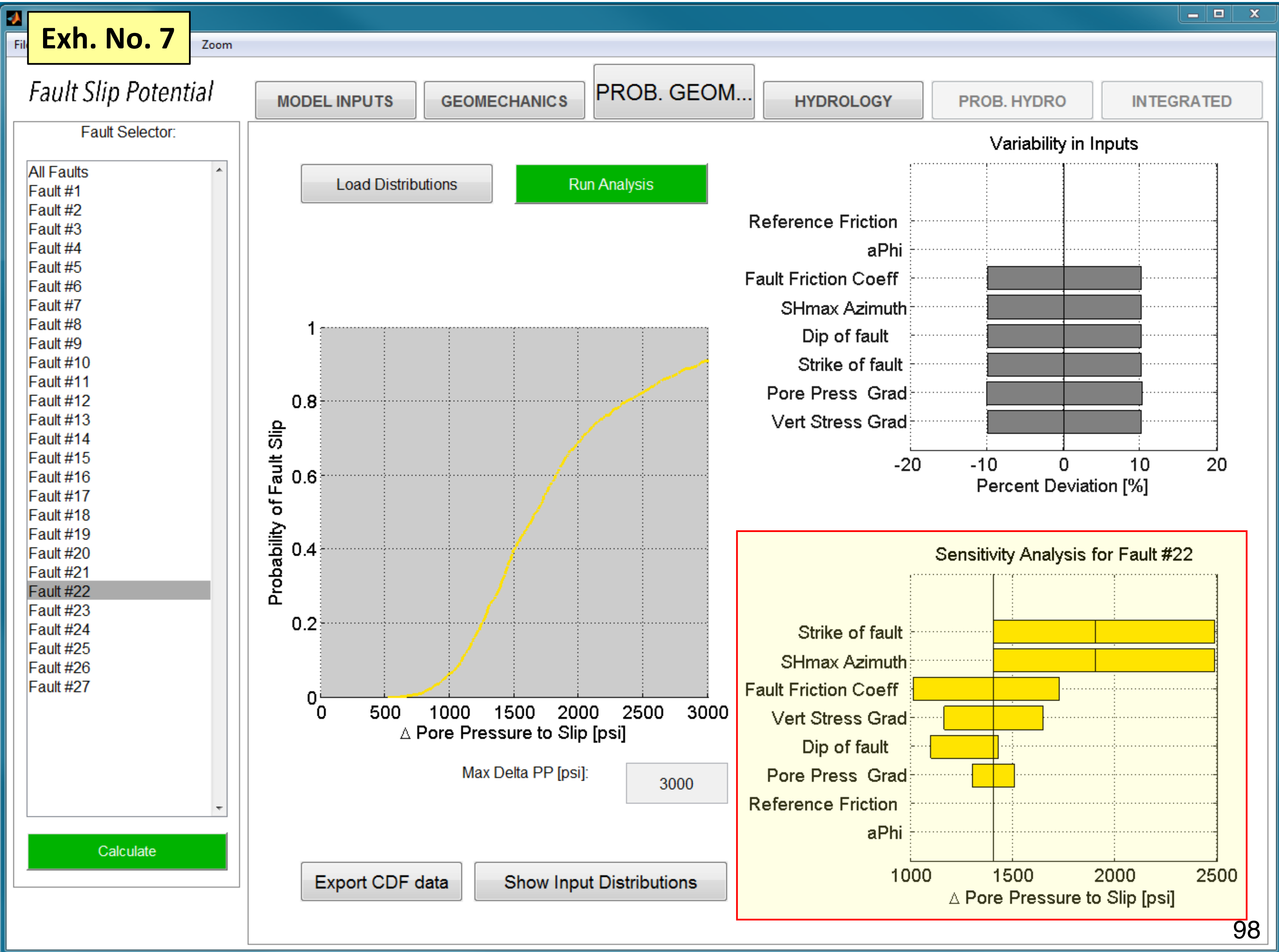
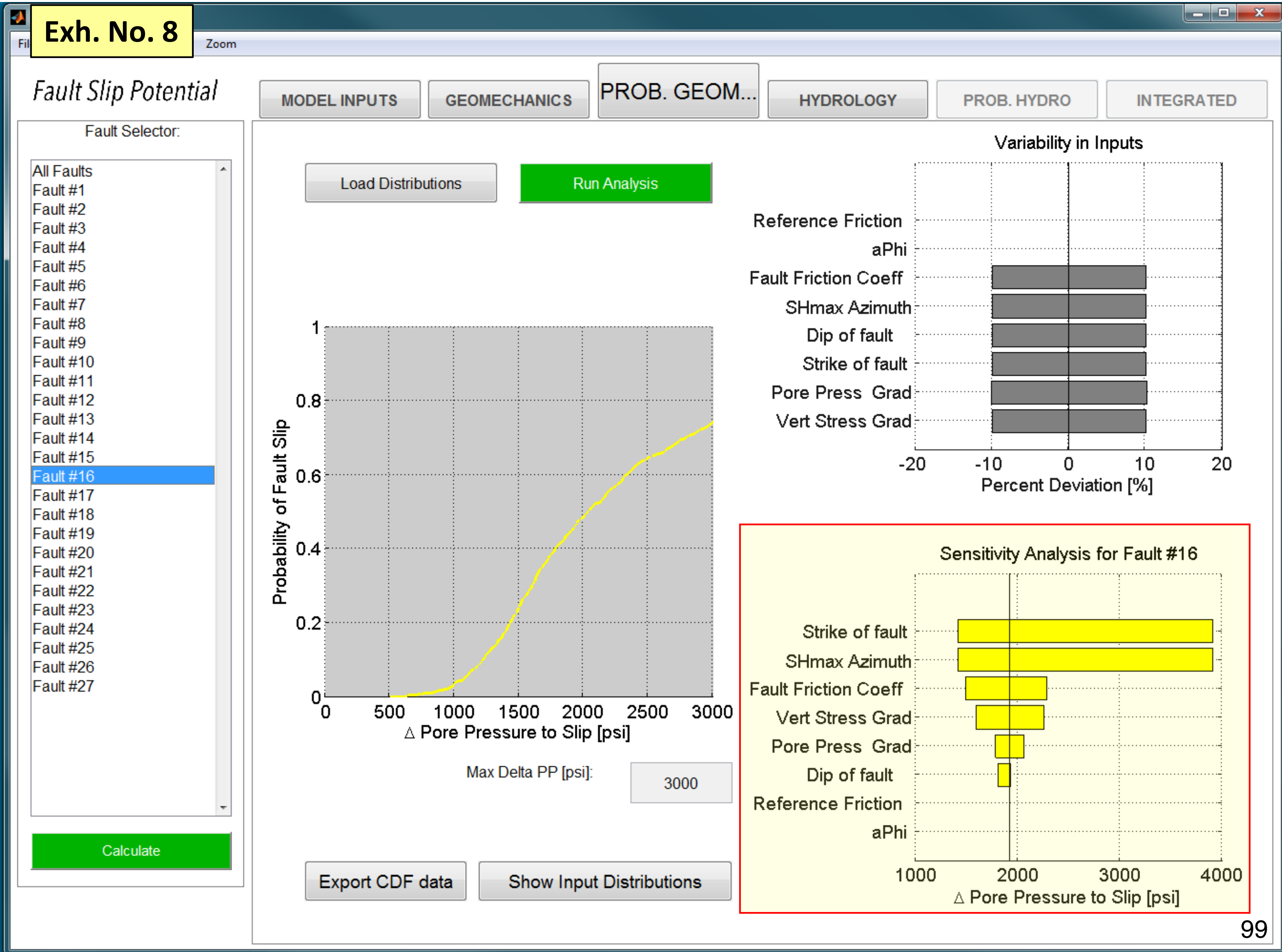
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
Fault #9
Fault #10
Fault #11
Fault #12
Fault #13
Fault #14
Fault #15
Fault #16
Fault #17
Fault #18
Fault #19
Fault #20
Fault #21
Fault #22
Fault #23
Fault #24
Fault #25
Fault #26
Fault #27
Calculate
Load Distributions
Run Analysis
Probability of Fault Slip
10%
Δ Pore Pressure to Slip [psi]
Max Delta PP [psi]:
10000
Export CDF data
Show Input Distributions
Variability in Inputs
Reference Friction
aPhi
Fault Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
Vert Stress Grad
Percent Deviation [%]
Choose a fault to see sensitivity analysis
Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
SHmax Gradient
Shmin Gradient
Vert Stress Grad
Δ Pore Pressure to Slip [psi]

Exh. No. 7

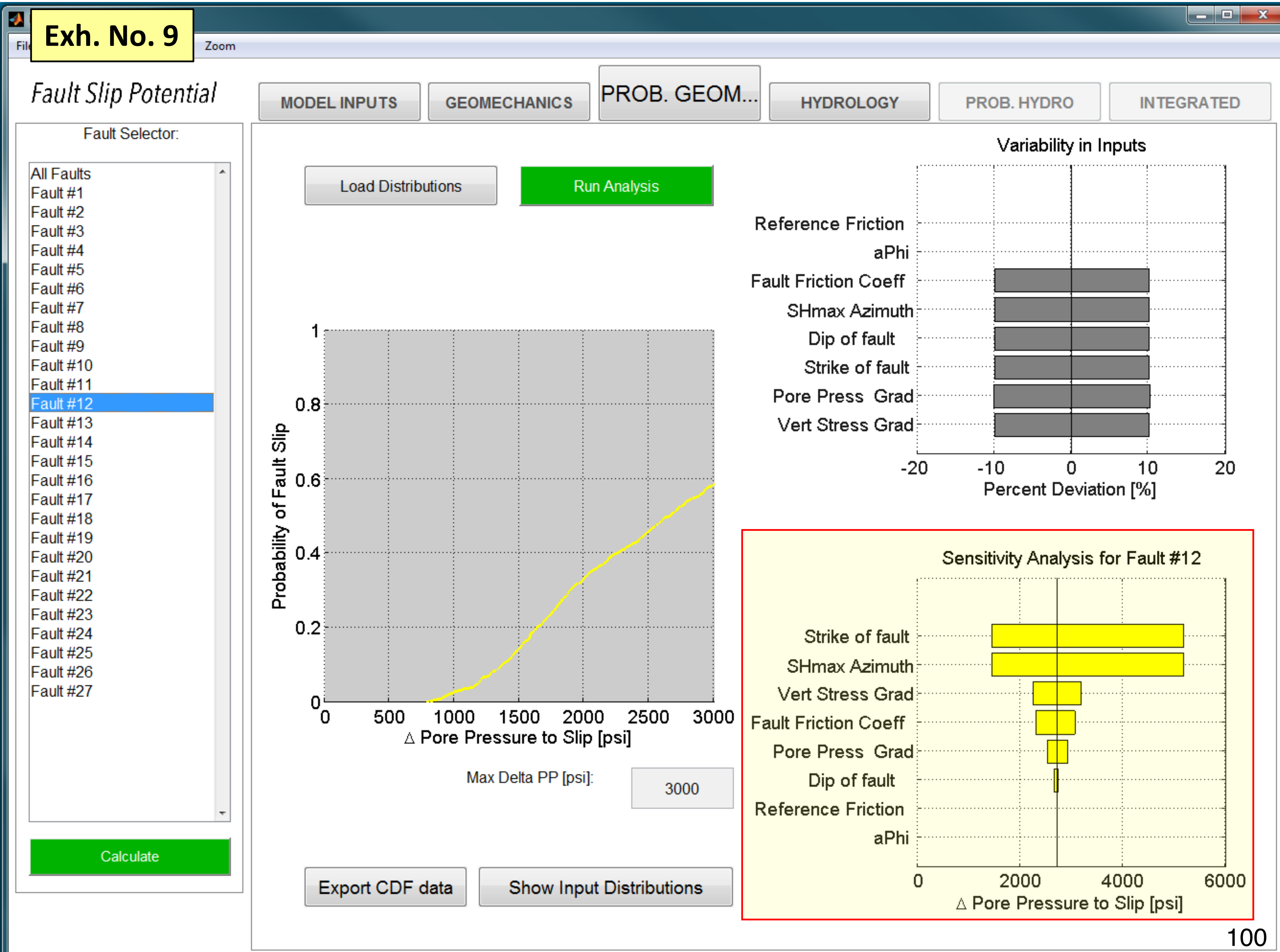

Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOM...
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
Fault #9
Fault #10
Fault #11
Fault #12
Fault #13
Fault #14
Fault #15
Fault #16
Fault #17
Fault #18
Fault #19
Fault #20
Fault #21
Fault #22
Fault #23
Fault #24
Fault #25
Fault #26
Fault #27
Calculate
Load Distributions
Run Analysis
Probability of Fault Slip
1
0.8
0.6
0.4
0.2
0
0 500 1000 1500 2000 2500 3000
Δ Pore Pressure to Slip [psi]
Max Delta PP [psi]:
3000
Export CDF data
Show Input Distributions
Variability in Inputs
Reference Friction
aPhi
Fault Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
Vert Stress Grad
-20 -10 0 10 20
Percent Deviation [%]
Sensitivity Analysis for Fault #22
Strike of fault
SHmax Azimuth
Fault Friction Coeff
Vert Stress Grad
Dip of fault
Pore Press Grad
Reference Friction
aPhi
1000 1500 2000 2500
Δ Pore Pressure to Slip [psi]

Exh. No. 8

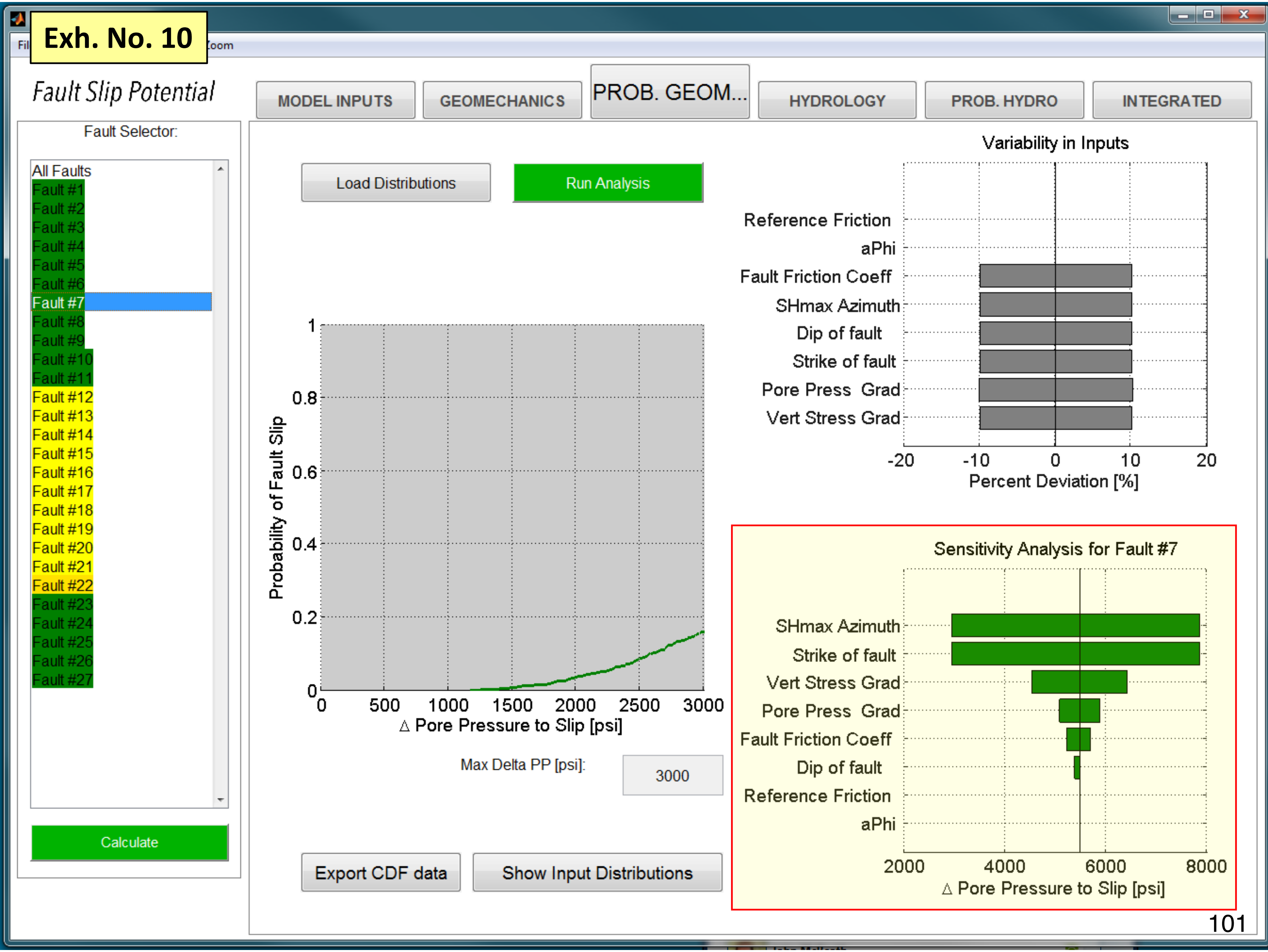


Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOM...
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
Fault #9
Fault #10
Fault #11
Fault #12
Fault #13
Fault #14
Fault #15
Fault #16
Fault #17
Fault #18
Fault #19
Fault #20
Fault #21
Fault #22
Fault #23
Fault #24
Fault #25
Fault #26
Fault #27
Calculate
Load Distributions
Run Analysis
Probability of Fault Slip
1
0.8
0.6
0.4
0.2
0
0
500
1000
1500
2000
2500
3000
Δ Pore Pressure to Slip [psi]
Max Delta PP [psi]:
3000
Export CDF data
Show Input Distributions
Variability in Inputs
Reference Friction
aPhi
Fault Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
Vert Stress Grad
-20
-10
0
10
20
Percent Deviation [%]
Sensitivity Analysis for Fault #16
Strike of fault
SHmax Azimuth
Fault Friction Coeff
Vert Stress Grad
Pore Press Grad
Dip of fault
Reference Friction
aPhi
1000
2000
3000
4000
Δ Pore Pressure to Slip [psi]

Exh. No. 9

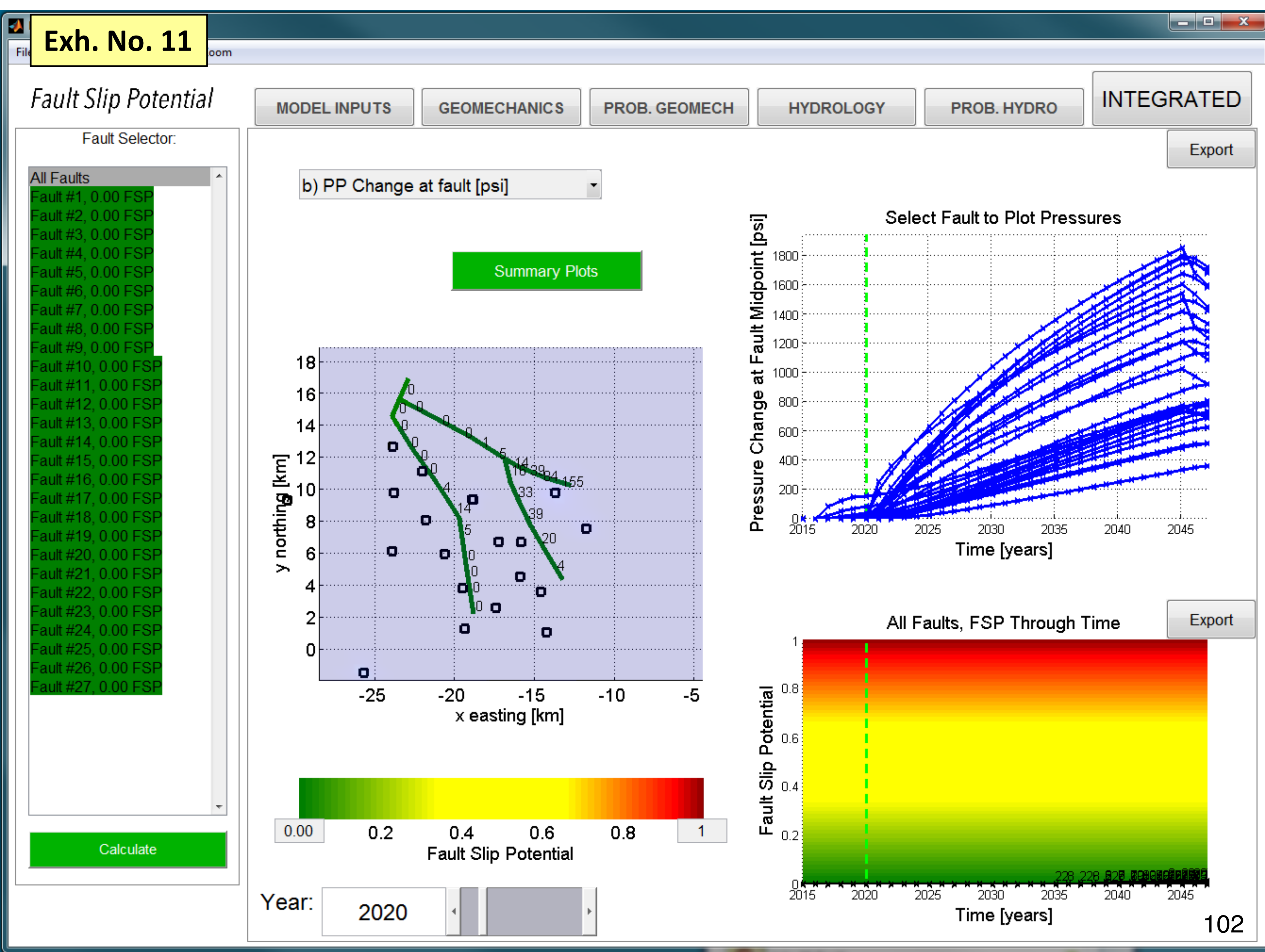

File
Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOM...
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
Fault #9
Fault #10
Fault #11
Fault #12
Fault #13
Fault #14
Fault #15
Fault #16
Fault #17
Fault #18
Fault #19
Fault #20
Fault #21
Fault #22
Fault #23
Fault #24
Fault #25
Fault #26
Fault #27
Calculate
Load Distributions
Run Analysis
Probability of Fault Slip
1
0.8
0.6
0.4
0.2
0
0
500
1000
1500
2000
2500
3000
Δ Pore Pressure to Slip [psi]
Max Delta PP [psi]:
3000
Export CDF data
Show Input Distributions
Variability in Inputs
Reference Friction
aPhi
Fault Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
Vert Stress Grad
-20
-10
0
10
20
Percent Deviation [%]
Sensitivity Analysis for Fault #12
Strike of fault
SHmax Azimuth
Vert Stress Grad
Fault Friction Coeff
Pore Press Grad
Dip of fault
Reference Friction
aPhi
0
2000
4000
6000
Δ Pore Pressure to Slip [psi]

Exh. No. 10



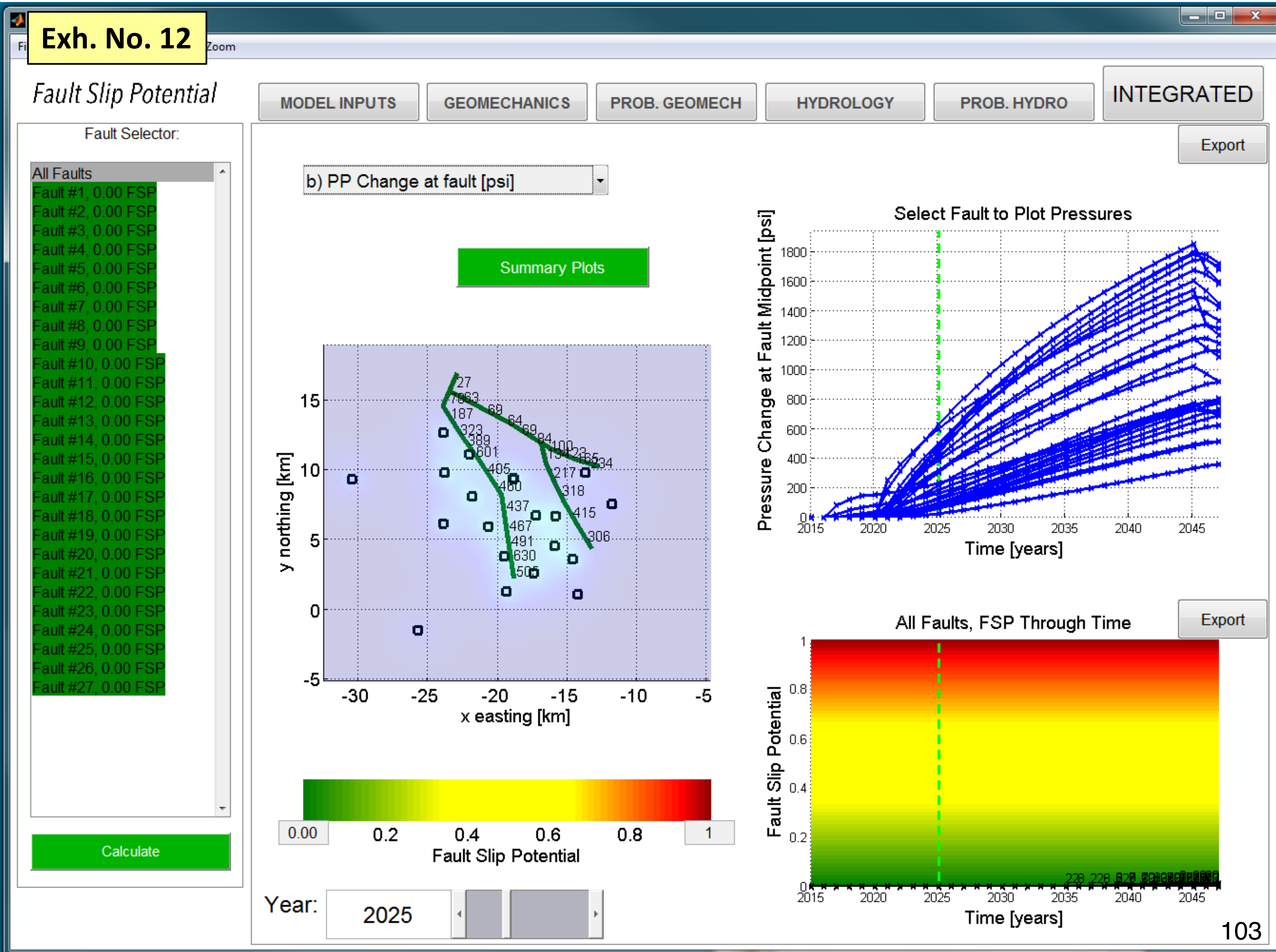
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOM...
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6
Fault #7
Fault #8
Fault #9
Fault #10
Fault #11
Fault #12
Fault #13
Fault #14
Fault #15
Fault #16
Fault #17
Fault #18
Fault #19
Fault #20
Fault #21
Fault #22
Fault #23
Fault #24
Fault #25
Fault #26
Fault #27
Calculate
Load Distributions
Run Analysis
Probability of Fault Slip
1
0.8
0.6
0.4
0.2
0
0
500
1000
1500
2000
2500
3000
△ Pore Pressure to Slip [psi]
Max Delta PP [psi]:
3000
Export CDF data
Show Input Distributions
Variability in Inputs
Reference Friction
aPhi
Fault Friction Coeff
SHmax Azimuth
Dip of fault
Strike of fault
Pore Press Grad
Vert Stress Grad
-20
-10
0
10
20
Percent Deviation [%]
Sensitivity Analysis for Fault #7
SHmax Azimuth
Strike of fault
Vert Stress Grad
Pore Press Grad
Fault Friction Coeff
Dip of fault
Reference Friction
aPhi
2000
4000
6000
8000
△ Pore Pressure to Slip [psi]

Exh. No. 11

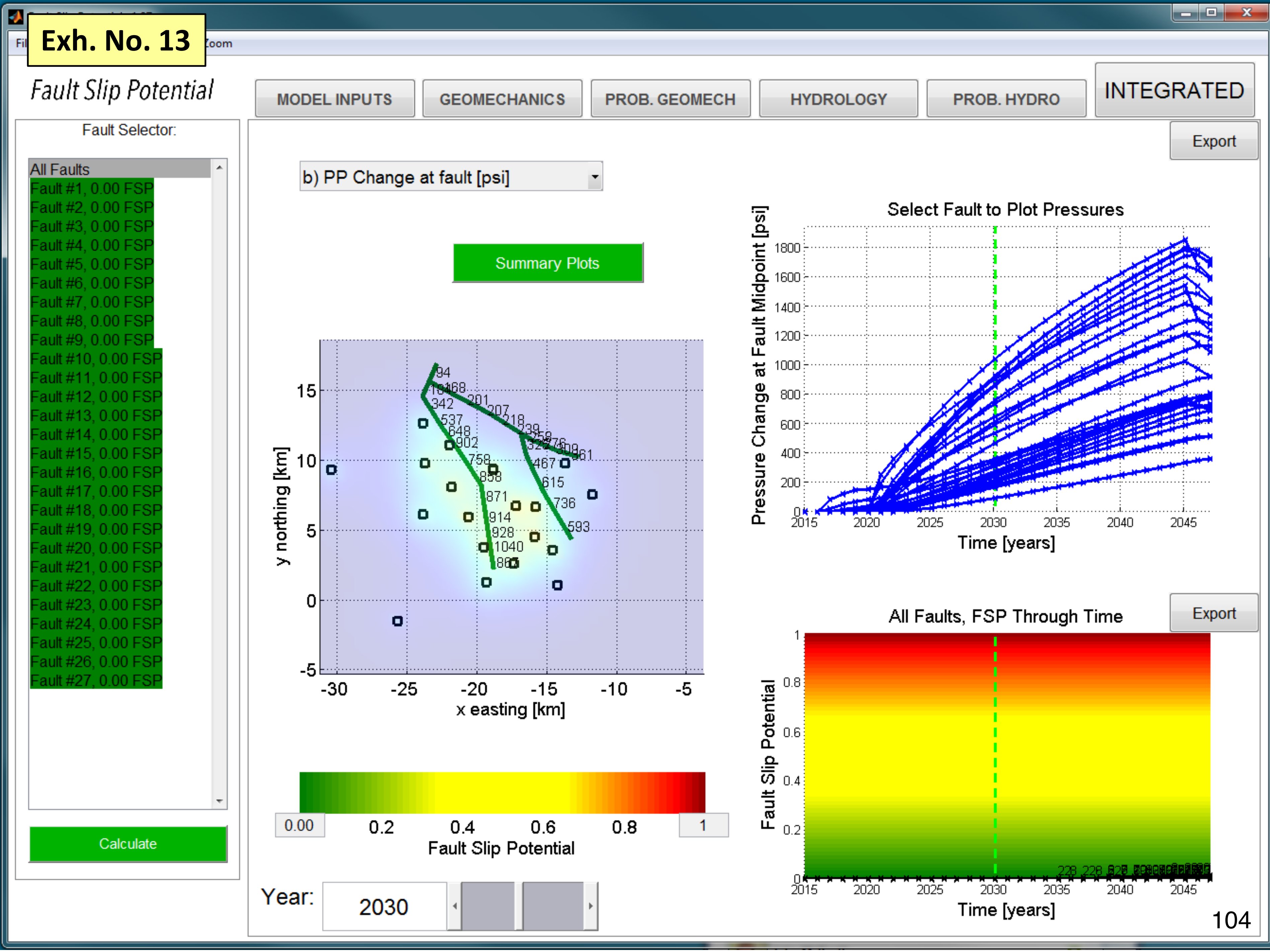


Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Export
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.00 FSP
Fault #7, 0.00 FSP
Fault #8, 0.00 FSP
Fault #9, 0.00 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.00 FSP
Fault #18, 0.00 FSP
Fault #19, 0.00 FSP
Fault #20, 0.00 FSP
Fault #21, 0.00 FSP
Fault #22, 0.00 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
0.00
0.2
0.4
0.6
0.8
1
Fault Slip Potential
Year:
2020
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
All Faults, FSP Through Time
Fault Slip Potential
Time [years]

Exh. No. 12

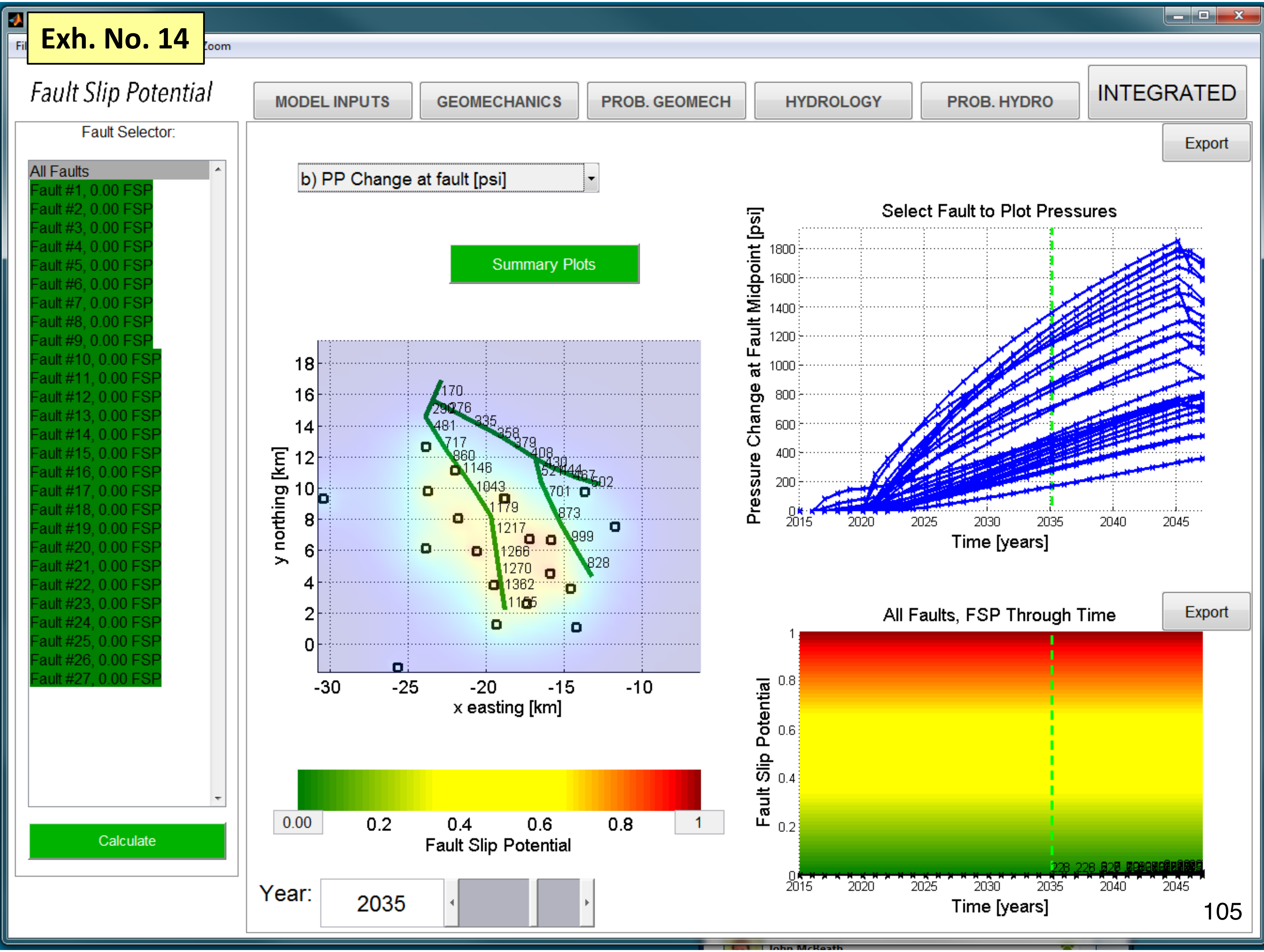

Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Export
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.00 FSP
Fault #7, 0.00 FSP
Fault #8, 0.00 FSP
Fault #9, 0.00 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.00 FSP
Fault #18, 0.00 FSP
Fault #19, 0.00 FSP
Fault #20, 0.00 FSP
Fault #21, 0.00 FSP
Fault #22, 0.00 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
0.00
0.2
0.4
0.6
0.8
1
Fault Slip Potential
Year:
2025
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
All Faults, FSP Through Time
Fault Slip Potential
Time [years]

Exh. No. 13

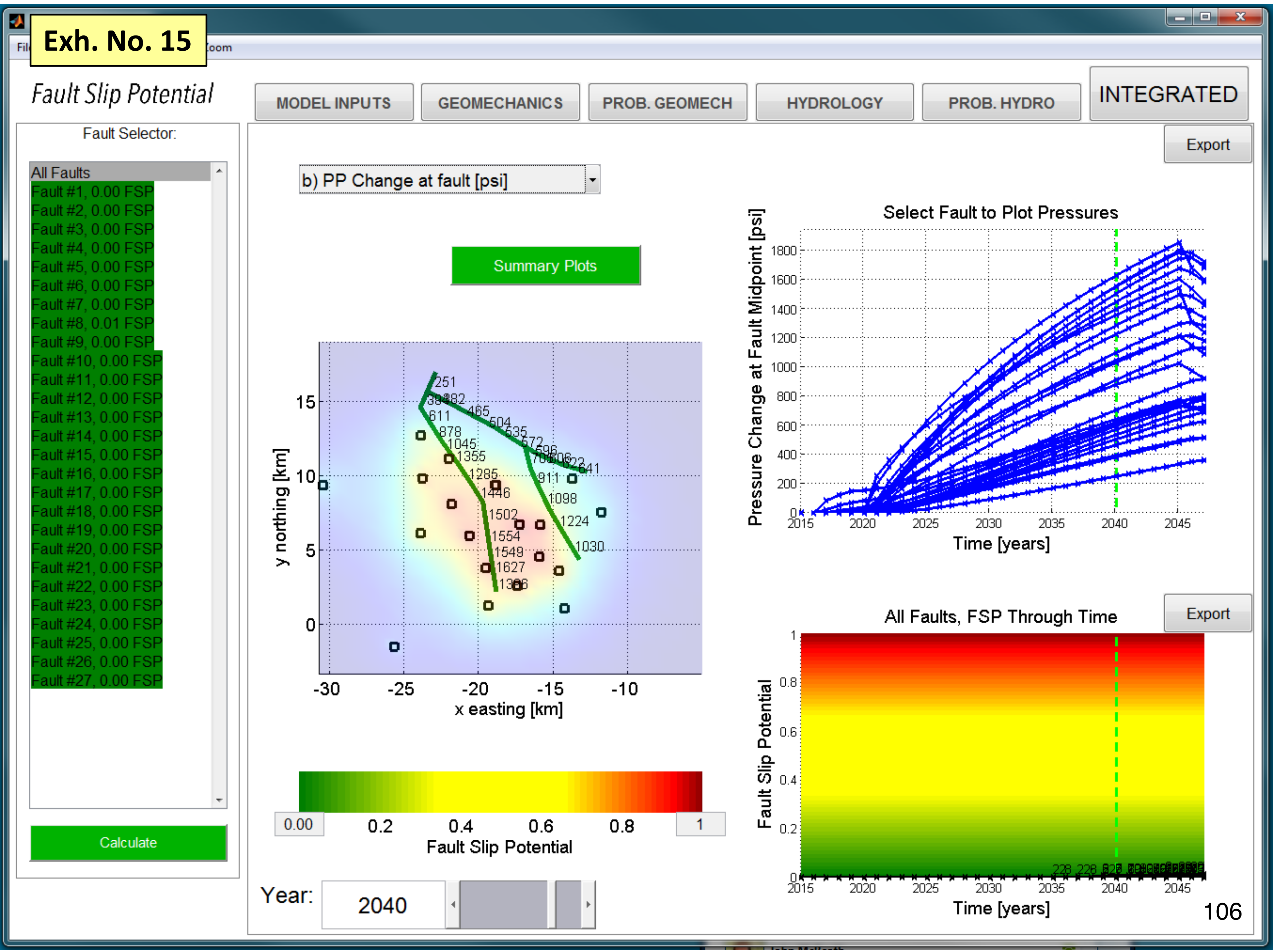


Zoom
Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.00 FSP
Fault #7, 0.00 FSP
Fault #8, 0.00 FSP
Fault #9, 0.00 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.00 FSP
Fault #18, 0.00 FSP
Fault #19, 0.00 FSP
Fault #20, 0.00 FSP
Fault #21, 0.00 FSP
Fault #22, 0.00 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
0.00
0.2
0.4
0.6
0.8
1
Fault Slip Potential
Year:
2030
Export
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
Export
All Faults, FSP Through Time
Fault Slip Potential
Time [years]

Exh. No. 14

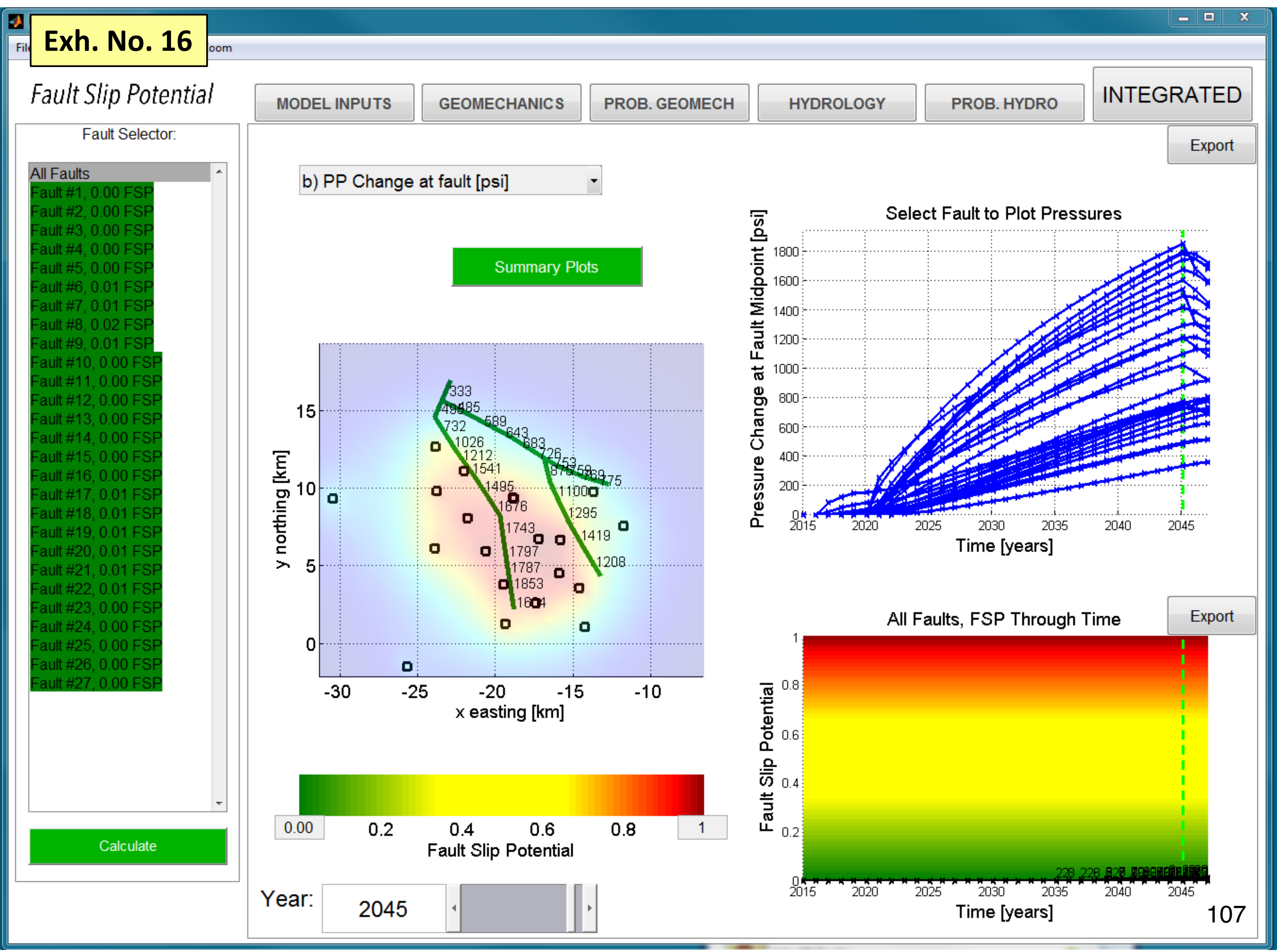

Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Export
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.00 FSP
Fault #7, 0.00 FSP
Fault #8, 0.00 FSP
Fault #9, 0.00 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.00 FSP
Fault #18, 0.00 FSP
Fault #19, 0.00 FSP
Fault #20, 0.00 FSP
Fault #21, 0.00 FSP
Fault #22, 0.00 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
Fault Slip Potential
0.00
1
Year:
2035
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
All Faults, FSP Through Time
Fault Slip Potential
Time [years]

Exh. No. 15



Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Export
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.00 FSP
Fault #7, 0.00 FSP
Fault #8, 0.01 FSP
Fault #9, 0.00 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.00 FSP
Fault #18, 0.00 FSP
Fault #19, 0.00 FSP
Fault #20, 0.00 FSP
Fault #21, 0.00 FSP
Fault #22, 0.00 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
Fault Slip Potential
0.00
1
Year:
2040
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
All Faults, FSP Through Time
Fault Slip Potential
Time [years]

Exh. No. 16



Fault Slip Potential
MODEL INPUTS
GEOMECHANICS
PROB. GEOMECH
HYDROLOGY
PROB. HYDRO
INTEGRATED
Export
Fault Selector:
All Faults
Fault #1, 0.00 FSP
Fault #2, 0.00 FSP
Fault #3, 0.00 FSP
Fault #4, 0.00 FSP
Fault #5, 0.00 FSP
Fault #6, 0.01 FSP
Fault #7, 0.01 FSP
Fault #8, 0.02 FSP
Fault #9, 0.01 FSP
Fault #10, 0.00 FSP
Fault #11, 0.00 FSP
Fault #12, 0.00 FSP
Fault #13, 0.00 FSP
Fault #14, 0.00 FSP
Fault #15, 0.00 FSP
Fault #16, 0.00 FSP
Fault #17, 0.01 FSP
Fault #18, 0.01 FSP
Fault #19, 0.01 FSP
Fault #20, 0.01 FSP
Fault #21, 0.01 FSP
Fault #22, 0.01 FSP
Fault #23, 0.00 FSP
Fault #24, 0.00 FSP
Fault #25, 0.00 FSP
Fault #26, 0.00 FSP
Fault #27, 0.00 FSP
Calculate
b) PP Change at fault [psi]
Summary Plots
y northing [km]
x easting [km]
0.00
0.2
0.4
0.6
0.8
1
Fault Slip Potential
Year:
2045
Select Fault to Plot Pressures
Pressure Change at Fault Midpoint [psi]
Time [years]
Export
All Faults, FSP Through Time
Fault Slip Potential
Time [years]