



The Effect Of Distribution Choice On Mean Resource Estimates

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Outline

- The persistent issue of exploration resource overestimation
- Analytic method
- Net Rock Volume Variability by Distribution Type
 - P99 to P01 cutoffs
 - P99.5 to P00.5 cutoffs
- Effect of selecting a statistical Mode (aka the Most Likely Value) greater than the analytic Mode
- Resource Summaries
- Recommendations

Exploration Resource Overestimation

- Rose conducts bi-annual surveys of the 30+ companies who are members of the Risk Coordinators Network
 - #2 Area for Improvement in the 2025 Survey was:-
 - **“Improving volumetric predictive accuracy and consistency”**
- Citron, Haryott et al. (2026)* listed three major drivers of over prediction in their study of UK North Sea exploration wells, 2018 – 2023
 - Low-end EUR values are too high
 - Often, P10 / P90 ratios are too large
 - Input parameter distribution selection
- Focus here is on parameter distribution selection

*Citron, G. P., et al. (2026). "The predictive performance of United Kingdom North Sea exploration wells, 2018–2023." *AAPG Bulletin* **110**(8): 755–773.

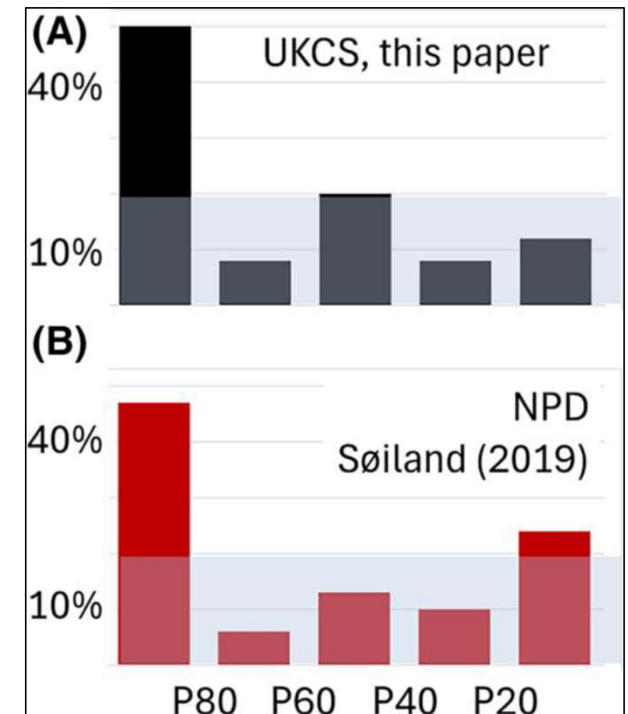
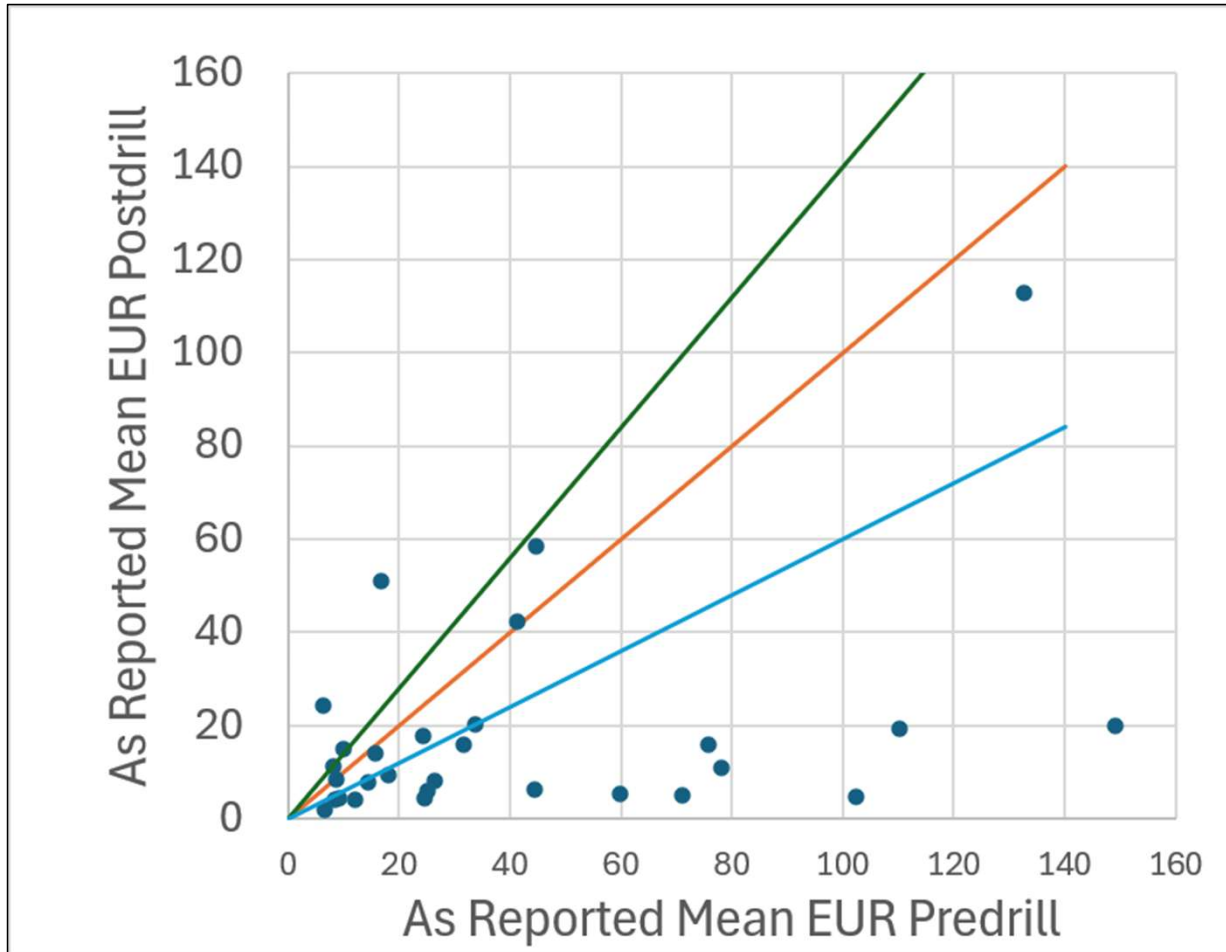


Figure 8 of (Citron, Haryott et al. 2026) showing >40% of post-drill discovery EURs fall in the <P80 Quintile

29 UK North Sea Discoveries 2018 - 2023 Predrill Vs Post Drill EUR

Source - (Citron, Haryott et al. 2026)



Chance Weighted Sum of 52 Prospects PreDrill Mean EUR (MMBOE)	Sum of 29 Discoveries PostDrill Mean EUR (MMBOE)
1,227	528

Sum of 29 Discoveries PreDrill Mean EUR (MMBOE)	Sum of 29 Discoveries PostDrill Mean EUR (MMBOE)
1,209	528

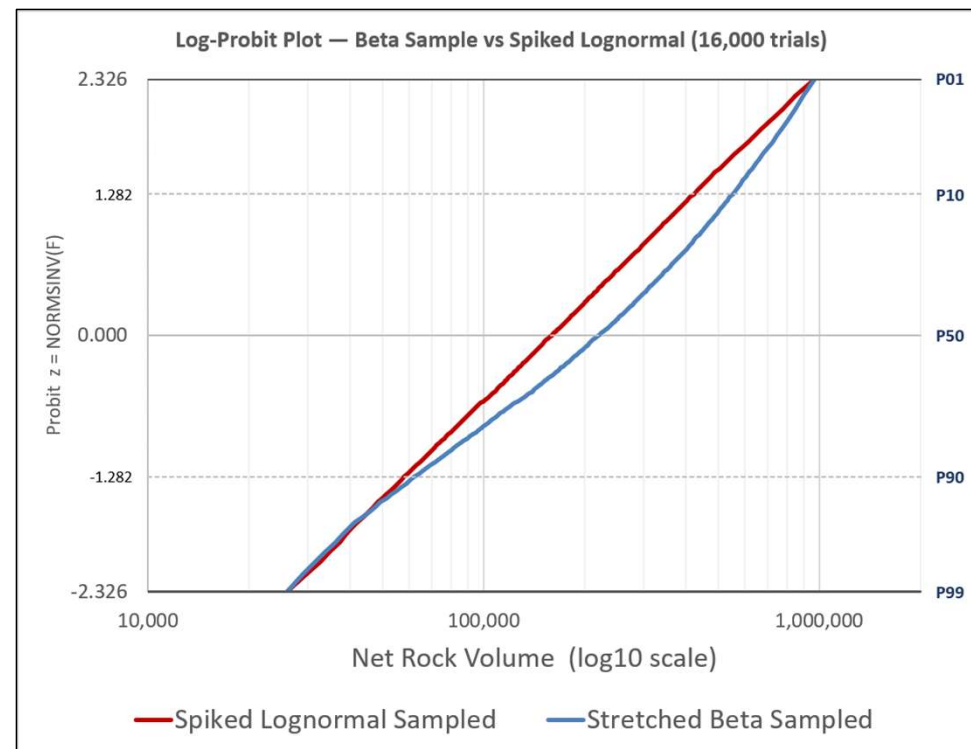
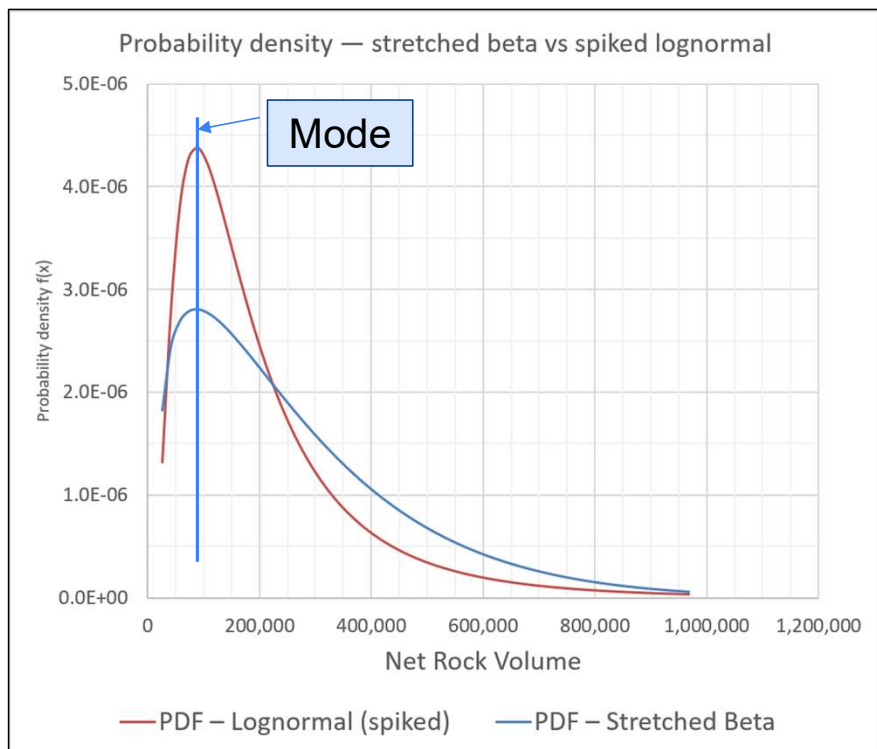
Orange	1:1
Green	+40%
Blue	-40%

Analytic Method

- Fixed Low and High values for Net Rock Volume (acre-ft)
- Consistent Lognormal Yield P90 – P10 of 220 – 389 bbls / acre-ft, Mean 299 bbls / acre-ft
- Compare Mean NRV values of LogNormal (LN) and Stretched Beta (SB) distributions.
 - With Low High Values at P99 / P01 (RoseRA default)
 - Low 25,933, High 967,172
 - P10 / P90s of 7.3 (LN) and 8.9 (SB)
 - With Low High Values at P99.5 / P00.5 (GeoX default)
 - Low 26,907, High 955,055
 - P10 / P90s of 5.9 (LN) and 7.6 (SB)
- Eight cases, in pairs of two follow, including two cases that increase the mode (most likely) value
- Summarize EUR Variance

Net Rock Volume Distribution Low-High P99 to P01

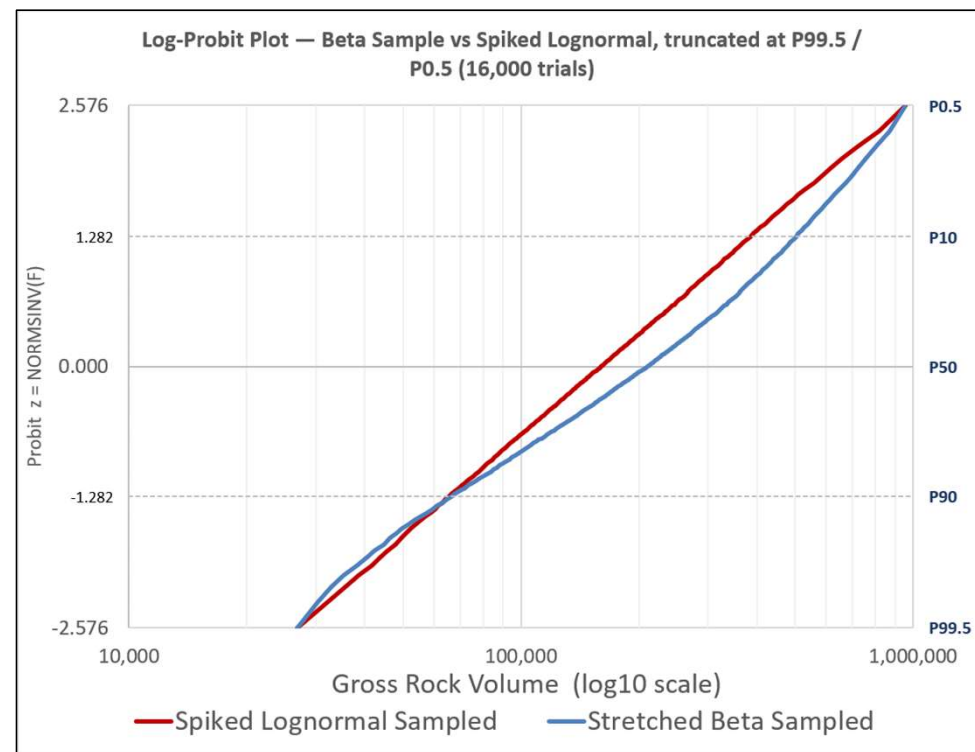
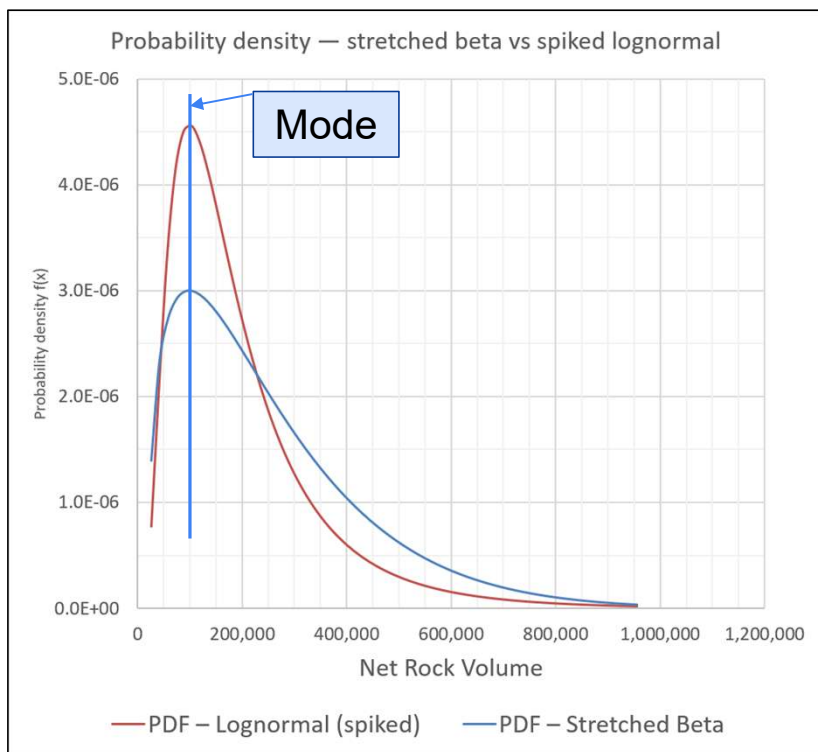
Identical P99, Mode and P01 values



Index	Case	Mode	Curve	P99	P90	Mode	P50	Mean	P10	P01
1	P99-P01	Fixed	Stretched Beta	25,933	62,807	86,486	218,975	273,266	558,654	967,172
2	P99-P01	Fixed	Lognormal	25,933	58,450	86,486	158,373	211,021	429,121	967,172
			(SB-LN)/LN					29%		

Net Rock Volume Distribution Low-High P99.5 to P00.5

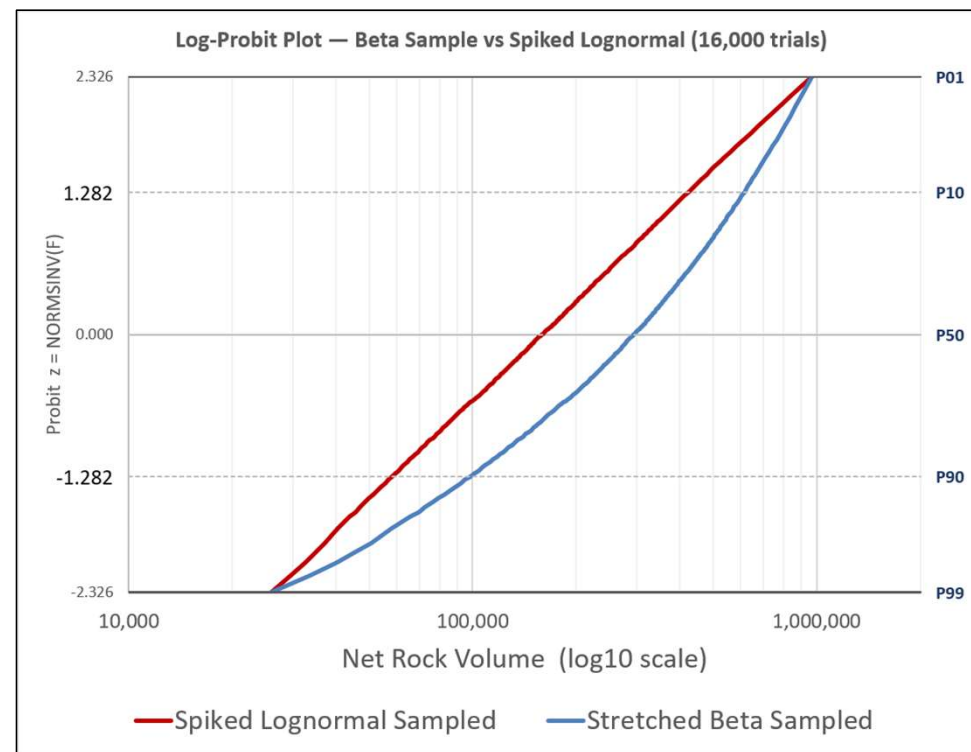
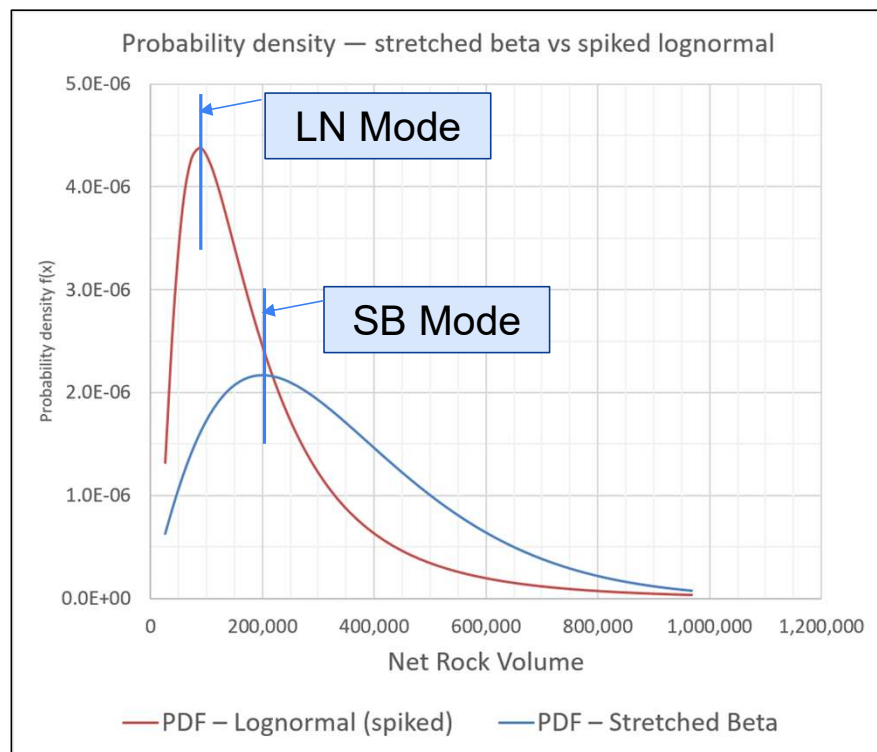
Identical P99.5, Mode and P00.5 values



Index	Case	Mode	Curve	P99.5	P90	MODE	P50	Mean	P10	P0.5
3	P99.5-P0.5	Fixed	Stretched Beta	26,907	66,993	99,190	210,295	256,166	508,557	955,055
4	P99.5-P0.5	Fixed	Lognormal	26,907	65,967	99,190	160,306	202,511	389,561	955,055
			(SB-LN)/LN					26%		

Net Rock Volume Distribution Low-High P99 to P01

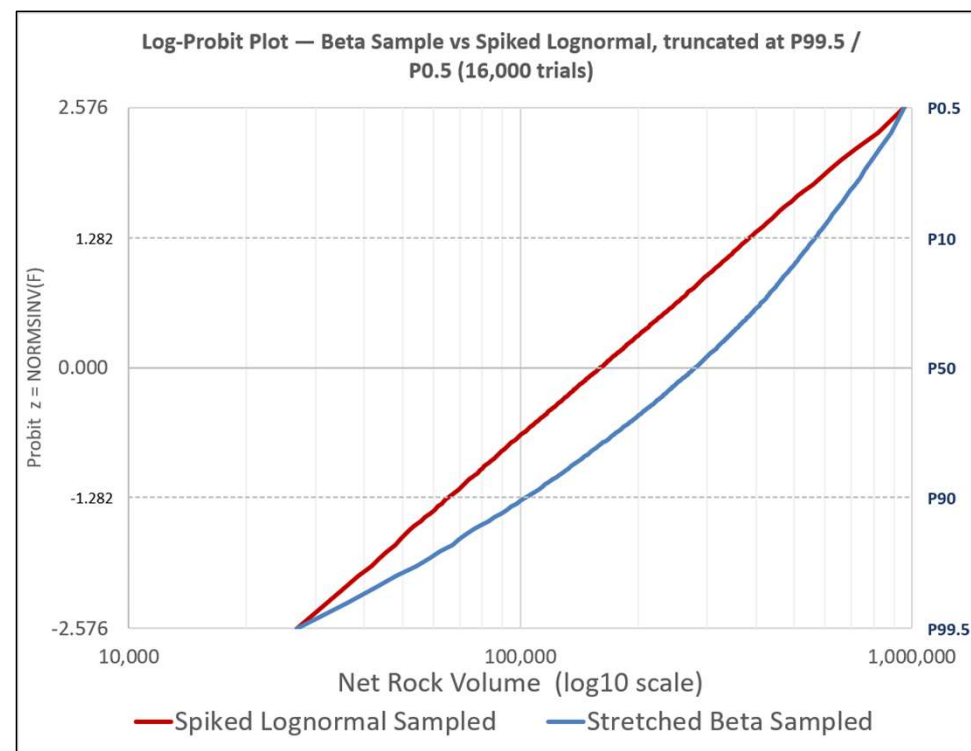
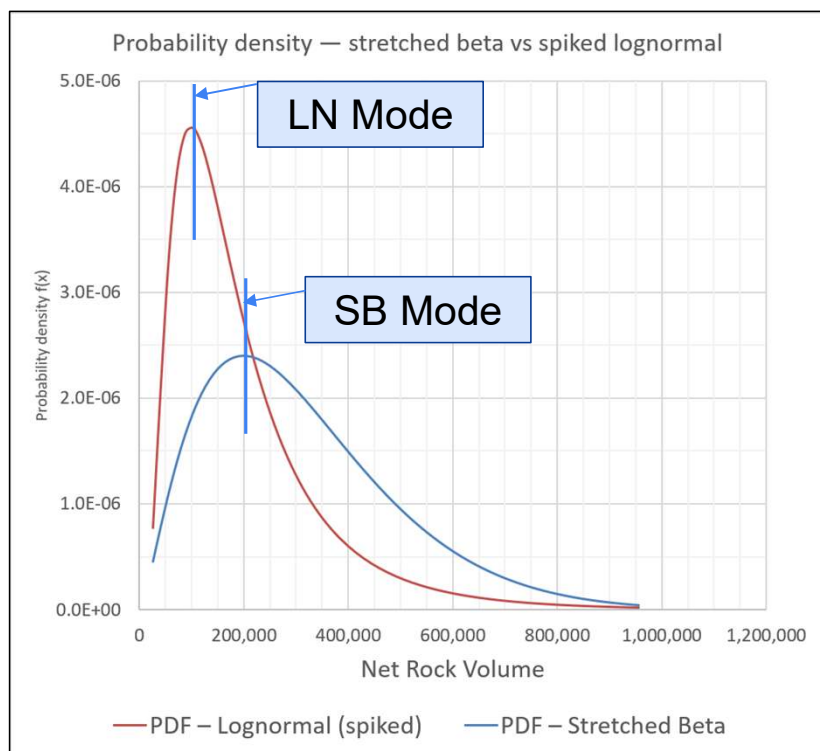
Identical P99 and P01 values with Higher Mode selected in SB



Index	Case	Mode	Curve	P99	P90	Mode	P50	Mean	P10	P01
5	P99-P01	High	Stretched Beta	25,933	98,743	200,000	292,747	332,254	619,796	967,172
6	P99-P01	Fixed	Lognormal	25,933	58,450	86,486	158,373	211,021	429,121	967,172
			(SB-LN)/LN					57%		

Net Rock Volume Distribution Low-High P99.5 to P00.5

Identical P99.5 and P00.5 values with Higher Mode selected in SB



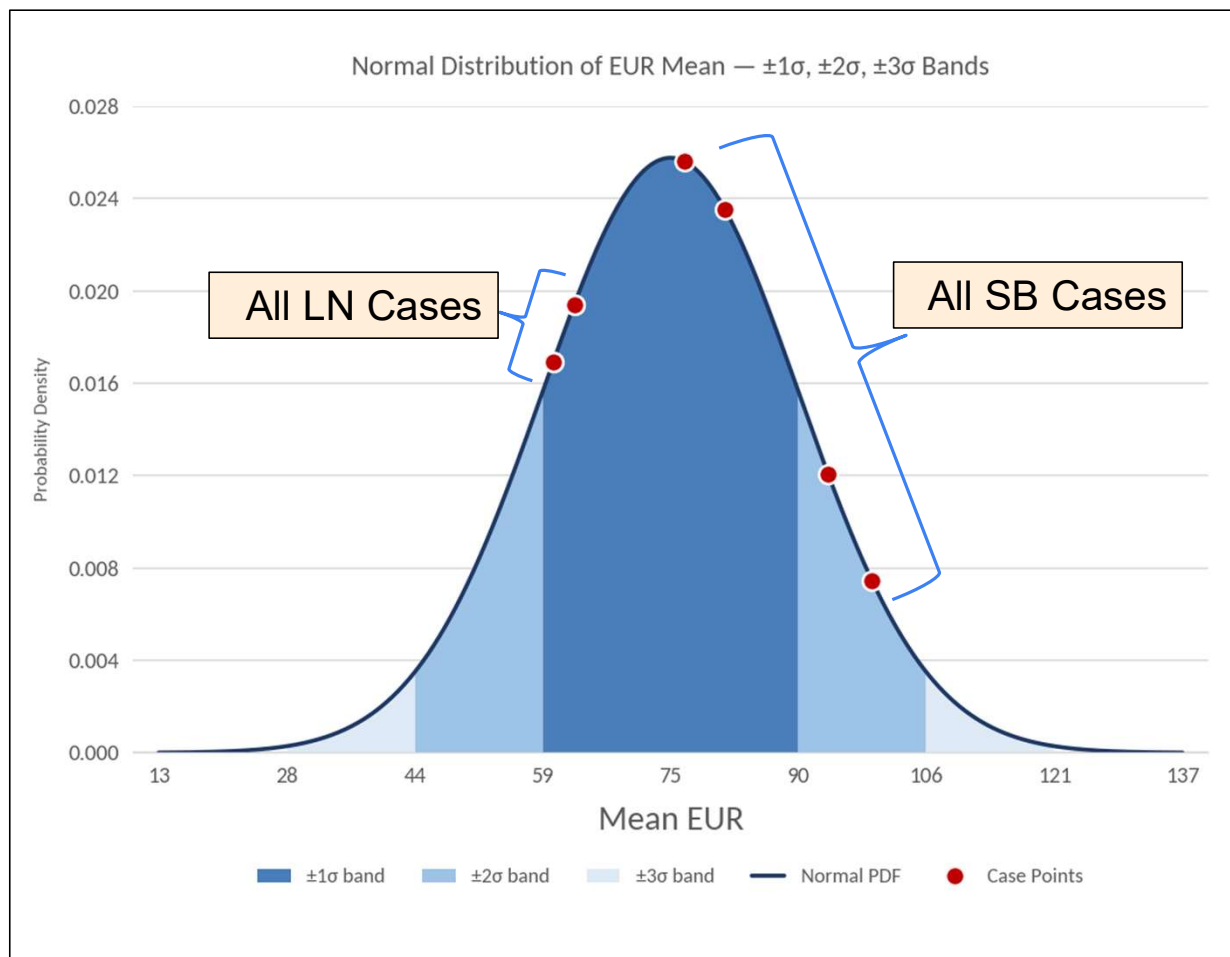
Index	Case	Mode	Curve	P99.5	P90	Mode	P50	Mean	P10	P0.5
7	P99.5-P0.5	High	Stretched Beta	26,907	104,027	200,000	279,911	314,033	570,671	955,055
8	P99.5-P0.5	Fixed	Lognormal	26,907	65,967	99,190	160,306	202,511	389,561	955,055
			(SB-LN)/LN					55%		

Case Description and EUR range

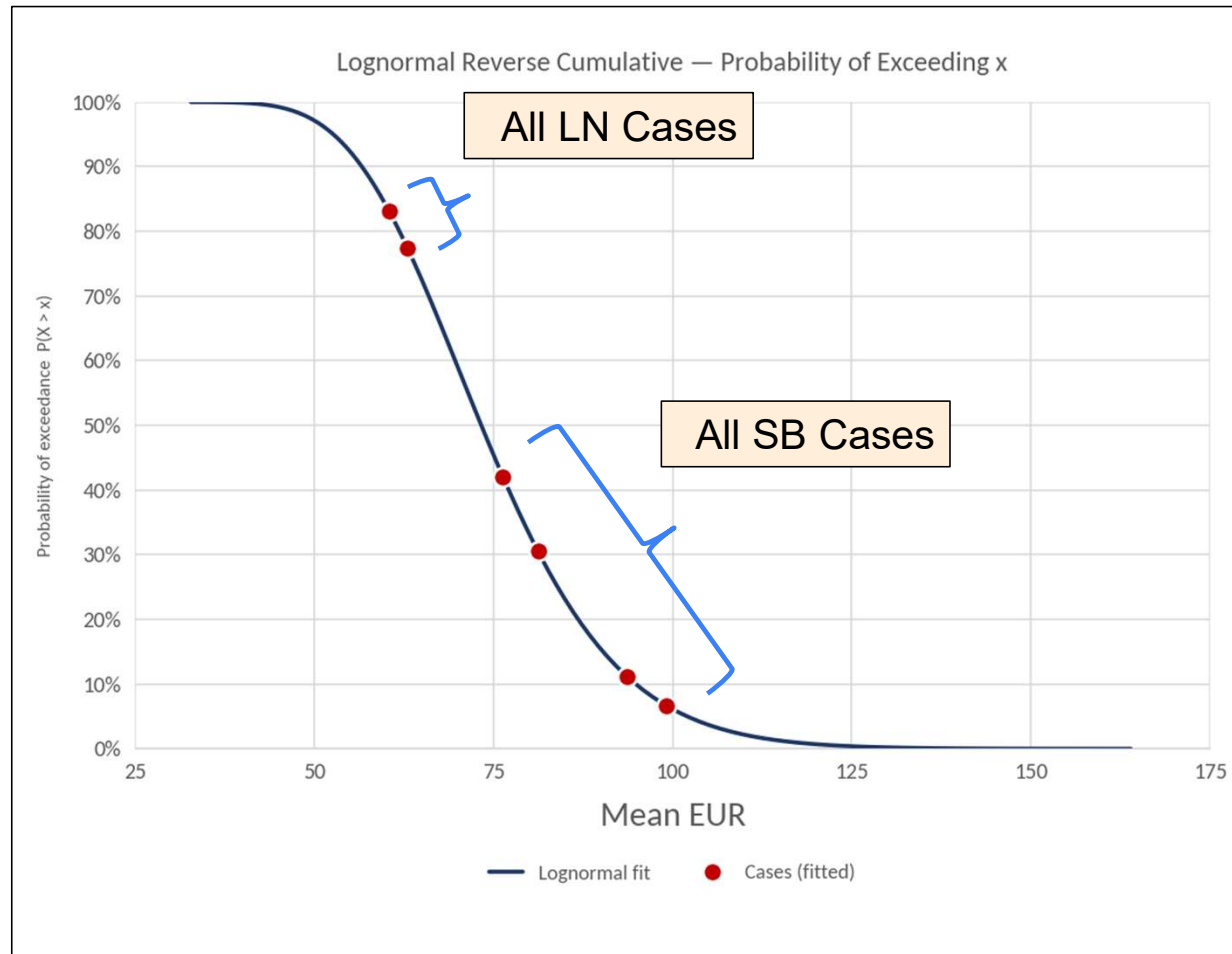
- The 8 NRV cases described above are each converted to EURs using a Yield distribution with P90 – Mean – P10 values of 220 – 299 – 389 bbls/acre ft.
- Boxes illustrate the pairwise EUR comparison of the four sets illustrated here

Index	Case	Mode	Curve	EUR							% Increase in Mean
				P99	P90	P50	Mean	P10	P01	P10/P90	
1	P99-P01	Fixed	Stretched Beta	7	18	64	81	167	301	9	
2	P99-P01	Fixed	Lognormal	8	16	47	63	128	282	8	29%
3	P99.5-P0.5	Fixed	Stretched Beta	8	19	61	76	155	271	8	
4	P99.5-P0.5	Fixed	Lognormal	9	18	47	60	118	245	6	26%
5	P99-P01	High	Stretched Beta	8	28	85	99	188	309	7	
6	P99-P01	Fixed	Lognormal	8	16	47	63	128	282	8	57%
7	P99.5-P0.5	High	Stretched Beta	10	29	81	94	176	285	6	
8	P99.5-P0.5	Fixed	Lognormal	9	18	47	60	118	245	6	55%

Mean EUR Fitted to a Normal Curve



Mean EUR Fitted to a Lognormal Curve



Recommendations

- Be aware of the effects of distributions on Mean EUR estimates
 - Look out for curvature on log-probit plots
- Be especially aware of the tendency to increase the “most likely” value in a range
 - Check for the Overconfidence and Illusion of Knowledge biases
- Predrill: -
 - Document reasoning for distribution shapes and parameter selections
- Postdrill:-
 - Apply rigorous post appraisal techniques
 - Determine the role, if any, of distribution selection in the result
 - Share lessons learned widely



Acknowledgments

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