How much, and how sure?

A prospect's oil in place as a range, P90 to P10: where the range comes from, which inputs drive it, and which data could change the decision.

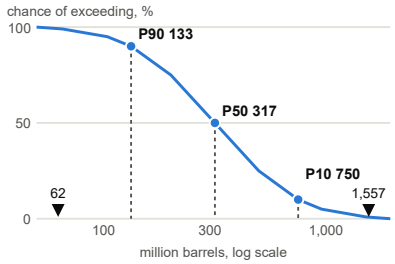
THE EXAMPLE IN THREE NUMBERS

133 P90, the low case
317 P50
750 P10, the high case

Million barrels of oil in place. Before a well is drilled, a volume is a product of things nobody has measured yet: the area of the closure, the pay, the rock and the fluid. In my own work as a petroleum geologist I ran probabilistic volumetrics (P90/P50/P10) using a Monte Carlo spreadsheet; this tool shows the reasoning on a made-up prospect, as a page and as a spreadsheet. P90 is the low case: the volume exceeded with a 90 % chance.

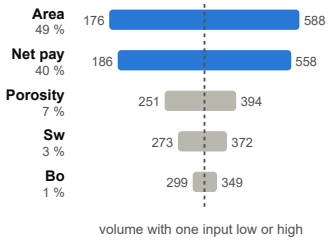
THREE FINDINGS, ON A MADE-UP EXAMPLE

A The low case is not every input at its low end



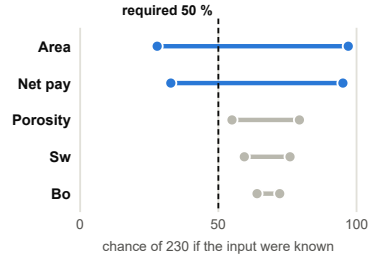
With every input at its unfavourable end the product is 62, less than half of the P90: a volume that low turns up about once in 116 draws. With every input at its favourable end it is 1,557, twice the P10. The mean, 396, sits above the P50.

B A few inputs drive the range



Area and net pay account for 89 % of the variance. Varied alone from low to high, area moves the volume from 176 to 588; the volume factor only from 299 to 349. With area pinned at its P50, P10 would be 3.5 times P90 instead of 5.6.

C Which data could change the decision



The prospect needs 230 million barrels; if it works, the chance of that is 68 % against the 50 % required. Area below 15.9 km² (a 25 % chance) or net pay below 18.9 m (23 %) would turn the answer to no. Porosity, Sw and Bo are unlikely to.

WHAT IT DOES NOT SAY, AND WHERE IT FITS

- **The range is only as good as the input ranges.** The tool multiplies the ranges it is given; it cannot tell a careful range from a hopeful one. Tool 01 of this set, a look-back on past predictions, can.
- **This is the volume if the prospect works.** The chance that there is a trap, a reservoir, a seal and a charge at all is a separate number.
- **Before the well, area is what seismic and depth conversion can sharpen.** Tools 02 and 03 ask the same question of a survey and of a drilling campaign: what must the data resolve to be worth getting.

CHECKED

The page carries 74 checks and all pass: 25 against answers worked out by hand, 49 against an independent calculation of four million random draws. The spreadsheet has its own Test sheet, 38 checks. They test the arithmetic, not the geology.

LINKS

The page: maxim-balaguroff.github.io/how-sure
The spreadsheet: volume-range.xlsx
Code and DOI: github.com/maxim-balaguroff/how-sure, doi:10.5281/zenodo.24242389

Built with AI assistance; the geology and the checks are mine. The example is made up; no survey, well or company data. CC BY 4.0

Maxim Balagurov, petroleum geologist