

# Problem

CO<sub>2</sub> project lasts years thus can drill more wells but:

- ▶ many location options
- ▶ expensive



Operators deciding well locations should be informed by

- ▶ current knowledge of the CO<sub>2</sub> plumes
- ▶ physics simulations of plume forecasts

# Solution: Bayesian experimental design

Chose acquisition design  $\mathbf{W}[\mathbf{w}]$  that allows for **maximal** information gain

$$\mathbf{y} = \mathbf{W}(\mathbf{x})$$

where  $\mathbf{W}$  is a binary sampling mask derived from density  $\mathbf{w}$

Collect data by maximizing the Kullback-Leibler divergence:

$$\max_{\mathbf{W}} D_{KL}(p(\mathbf{x} | \mathbf{y}) || p(\mathbf{x})) .$$

***Maximize Expected information gain (EIG) averages over all possible designs***

$$\max_{\mathbf{W}} \{ EIG(\mathbf{W}) = \mathbb{E}_{p(\mathbf{y}|\mathbf{W})} [D_{KL}(p(\mathbf{x} | \mathbf{y}) || p(\mathbf{x}))] \} .$$