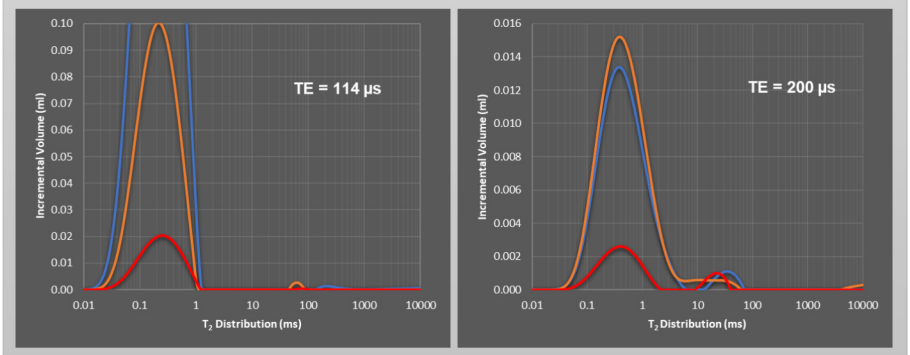
DAEDALUS INNOVATIONS

Overburden Cell Performance Comparison

The Daedalus overburden cell was compared by an independent laboratory to units offered by two major vendors of overburden cells. The data was collected on an Oxford GeoSpec2 at 2 MHz or 12 MHz employing CPMG experiments used for porosity measurements. The Daedalus unit tested was a standard 49 mm OD cell for 1" diameter cores rated to 10,000 psi.

At 2 MHz: It is clear the Daedalus cell trace (red) has a much lower background signal than either vendor 1 (orange) or vendor 2 (blue). Only the Daedalus cell would permit measurements of shale at short TE values; the other cell signals would swamp the sample signal leading to large errors in measurements.

Empty core holder background signals collected at 2 MHz

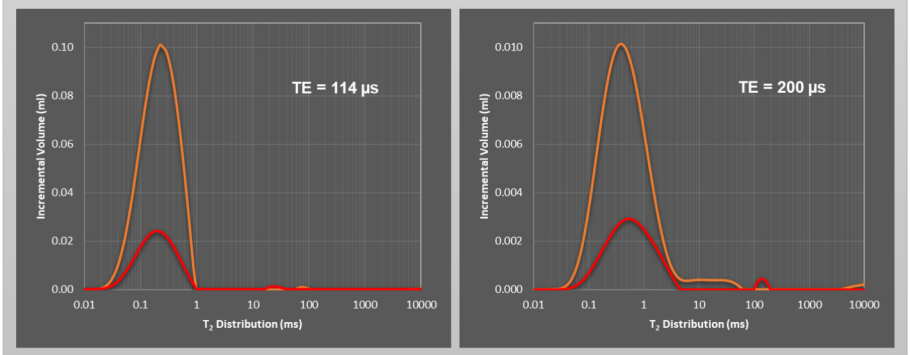


CPMG measurements were collected on empty core holders in a GeoSpec 2 at 2 MHz. The red trace is the Daedalus cell, the orange trace is vendor 1, and the blue trace is vendor 2. The T_2 distributions were obtained from composite NMR signals by inversion using Green Imaging software with 128 individual T_2 components. The time-to-echo (TE) value was 114 µs for the left panel at 200 µs for the right panel. The incremental volume from background signal is reported as a function of T_2 values. The cumulative volumes from the background signal at TE = 114 µs are as follows: Daedalus cell – 0.38 ml, vendor 1 – 1.80 ml, vendor 2 – 4.48 ml. The vertical axis for TE = 114 µs was intentionally narrowed to allow visualization of fine details at higher T_2 values. The cumulative volumes from the background signal at TE = 200 µs are as follows: Daedalus cell – 0.055 ml, vendor 1 – 0.325 ml, vendor 2 – 0.284 ml.

At 12 MHz: Again, it is readily apparent that the background signal from the Daedalus cell (red) is much lower than the vendor 1 cell (orange).

The cell from vendor 2 could not be tested because it was not designed to work at that field with the instruments available for this testing.

Empty core holder background signals collected at 12 MHz



CPMG measurements were collected on empty core holders in a GeoSpec 2 at 12 MHz. The red trace is the Daedalus cell and the orange trace is from vendor 1. The T_2 distributions were obtained from composite NMR signals by inversion using Green Imaging software with 128 individual T_2 components. The time-to-echo (TE) value was 114 µs for the left panel at 200 µs for the right panel. The incremental volume from background signal is reported as a function of T_2 values. The cumulative volumes from the background signal at TE = 114 µs are as follows: Daedalus – 0.42 ml, vendor 1 – 1.71 ml. The cumulative volumes from the background signal at TE = 200 µs are as follows: Daedalus – 0.065 ml, vendor 1 – 0.22 ml.

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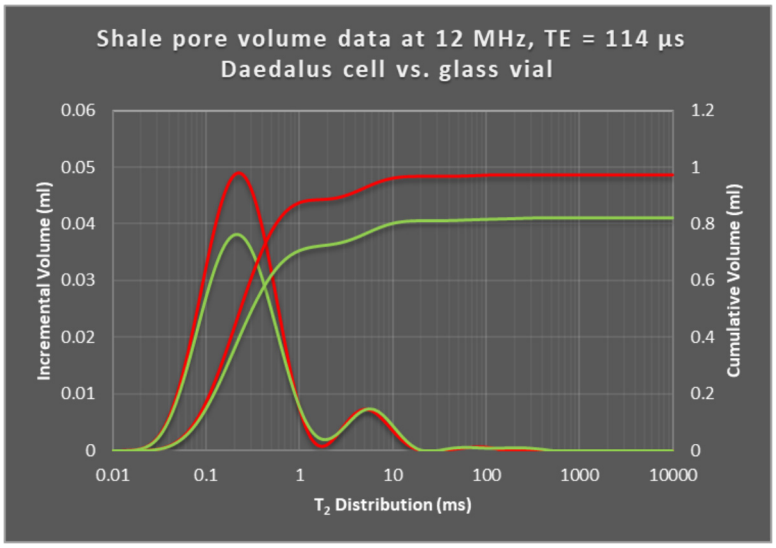
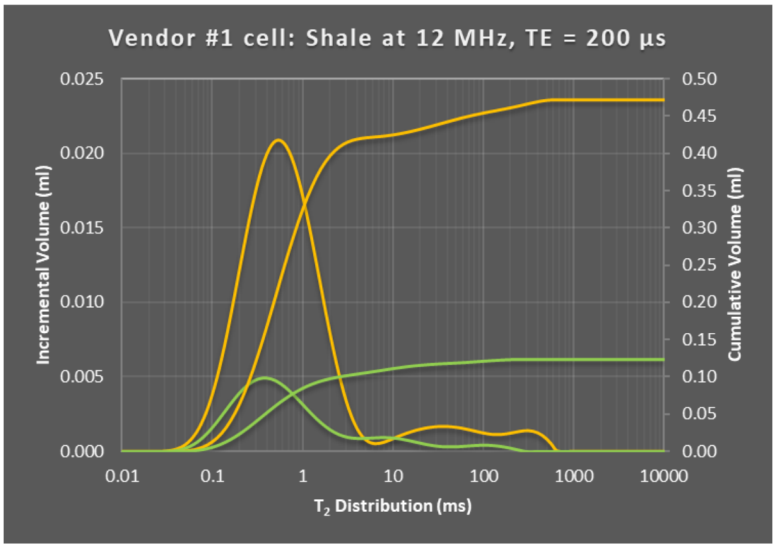
The Daedalus cell delivers:

- **The lowest background signal**
- **Short time-to-echo spacings are now possible**
- **Accurate measurements of tight rock samples**
- **Higher pressures and temperatures**

Shale measurements: Porosity data was collected on shale samples in both the Daedalus cell and the cell from vendor 1 at 12 MHz. For comparison purposes the sample was also measured in a glass vial to assess the accuracy of the data collected. The method of data collection was the same as that used for measurement of the background signal from the empty cells.



The low background signal from the Daedalus cell allows data to be collected with TE = 114 µs. The green traces are the data of the sample in a glass vial with the red traces the data from the Daedalus cell. Though the Daedalus cell data does show an overestimate of the pore volume the overall agreement is remarkably good. No effort was made to subtract the empty cell spectrum from the sample spectrum in this analysis.



The data from the vendor 1 cell could not be collected with TE = 114 µs due to the background signal overwhelming the sample data signal. The data collected at TE = 200 µs (orange) shows considerable overestimation of the total pore volume. Further, due to the high background signal at low T_2 values the overall fitted trajectory of the trace is influenced such that the overall profile only marginally resembles the glass vial data (green).

The background signal from a core holders was either too large to permit measurements of shale samples, or risked throwing away valuable data at low T_2 values. With the Daedalus cell such measurements can be performed with a high accuracy at short TE values. The background signal is sufficiently low that it does not overwhelm the sample signal such that it makes sense to attempt to subtract the background spectrum from the sample spectrum for improved results. Such methods are currently being explored.

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