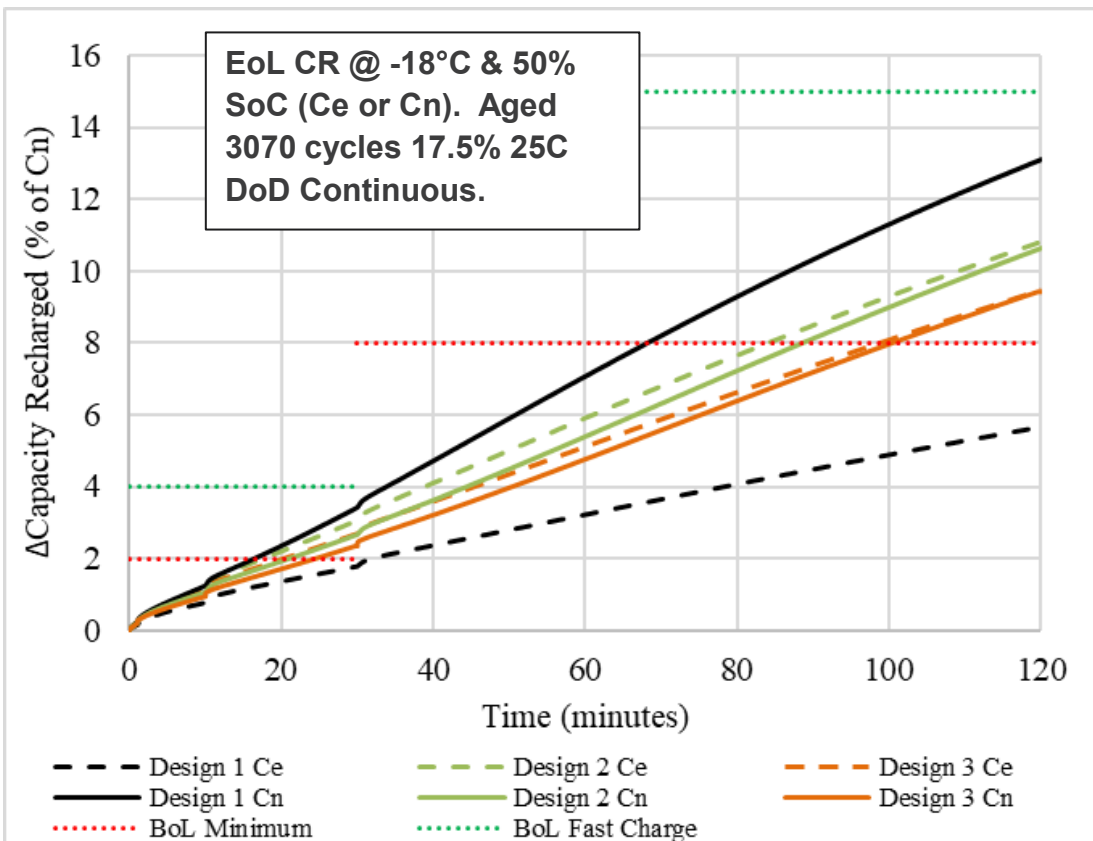




End of Life Charge Recovery & Pulse Power Characteristics – Ian Wolfe

End of Life CR & PPC Characteristics

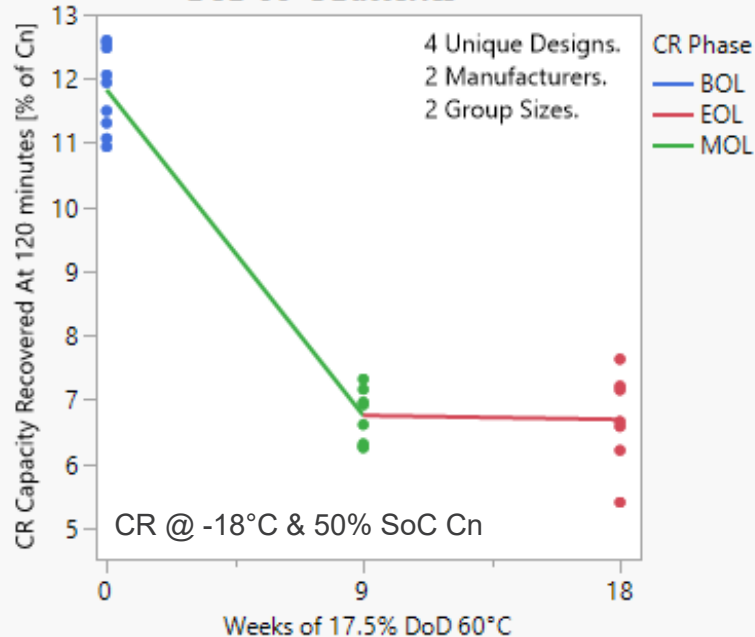


Parameter	Units	Design1	Design2	Design3
Cn	Ah	50	50	50
EoL Ce (C20)	Ah	36.4	51.2	47.9
% Change	%	-27%	2%	-4%

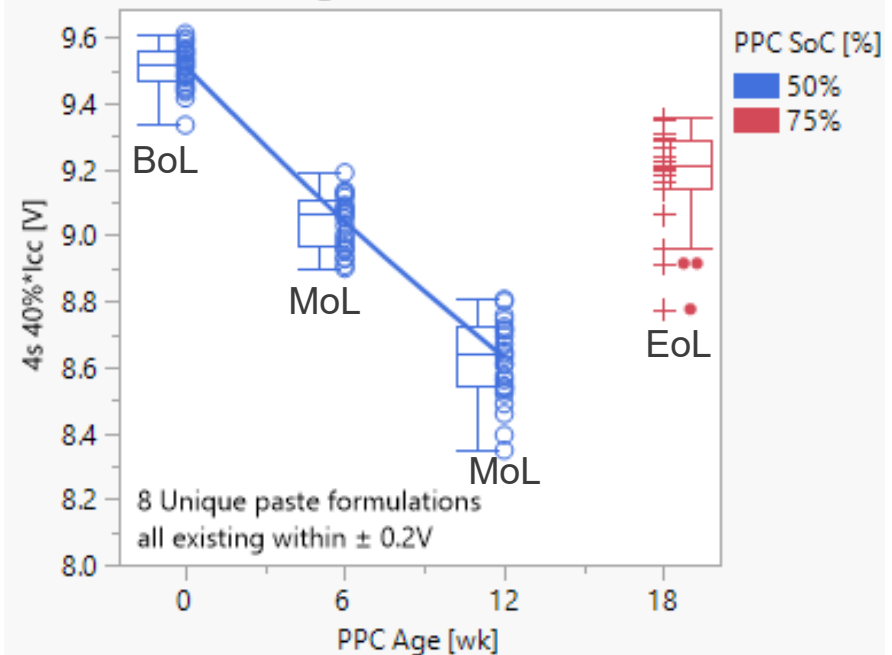
- Setting SoC by Cn or Ce will have a significant impact on EoL Charge Recovery.
- How do different aging tests affect this?
- Can EoL C20 be a proxy for EoL CR?

End of Life CR & PPC Characteristics

Charge Recovery Checkup on Aged 17.5%
DoD 60°C Batteries

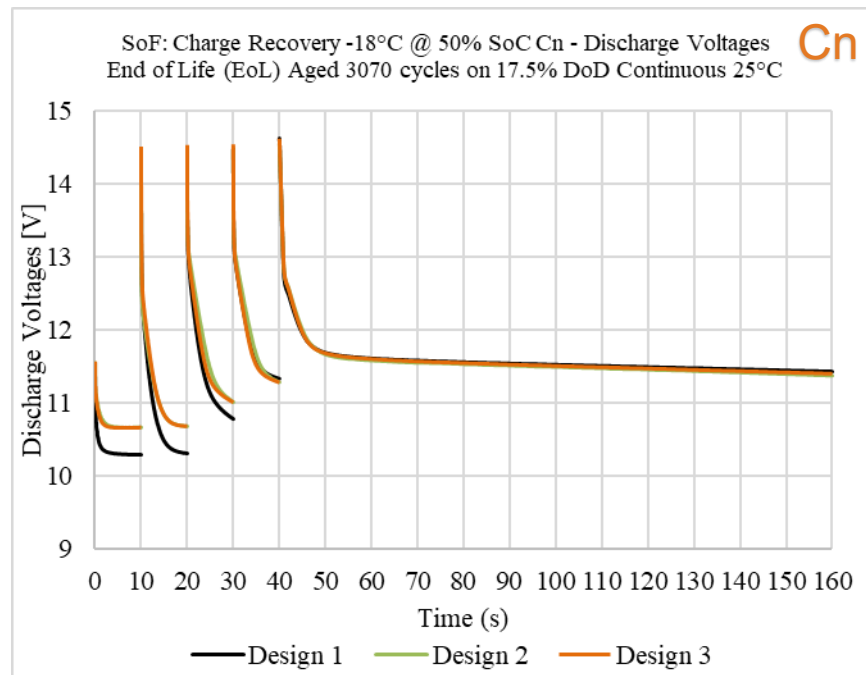
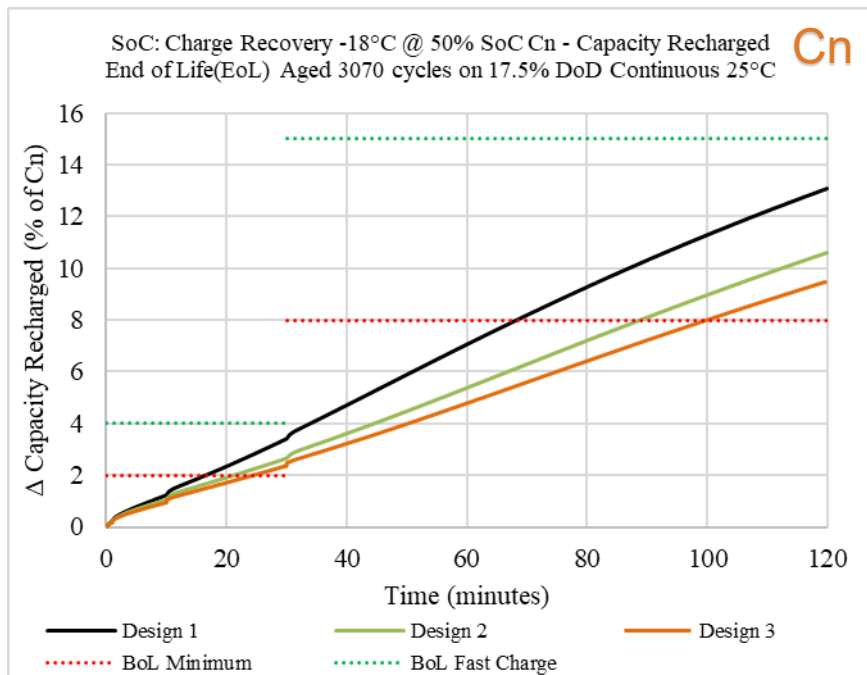


17.5% DoD 60°C Aged PPC Results @ -18°C



- Design differences appear to have no impact on PPC or CR when aged by 17.5% DoD 60°C. Is this unique to high temperature tests? Does CR plateau at ~6%?

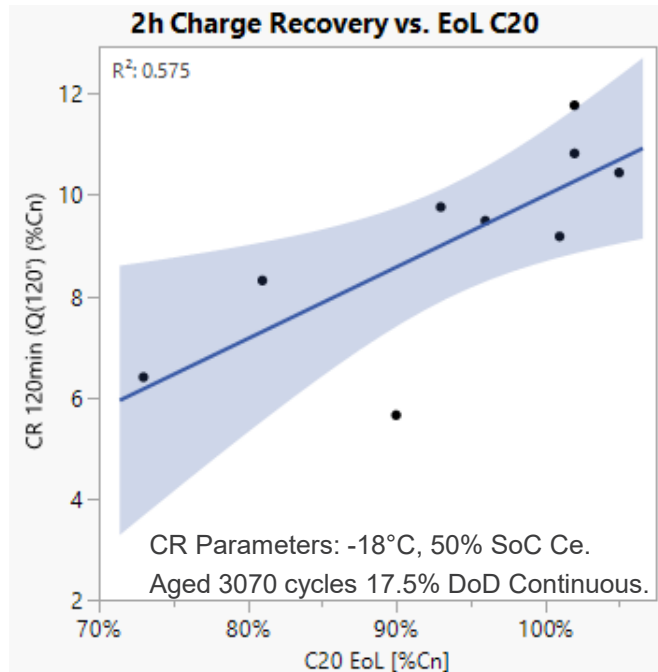
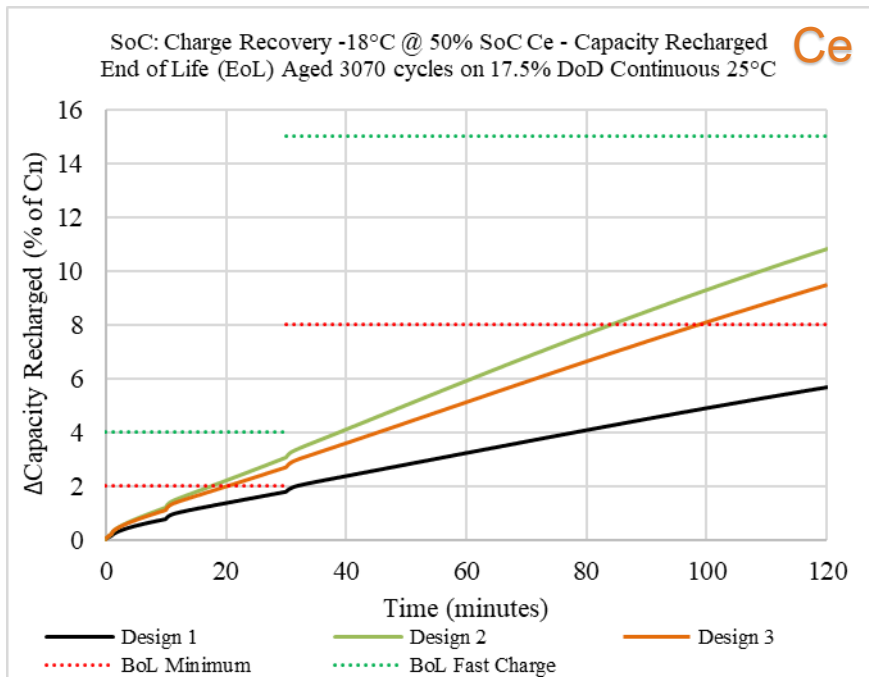
End of Life CR & PPC Characteristics



- Using Cn on EoL data produced unexpected results, “Design 1” recovering fastest.
- Low initial SoF suggests starting SoC is lower than the other samples.

What about Ce then?

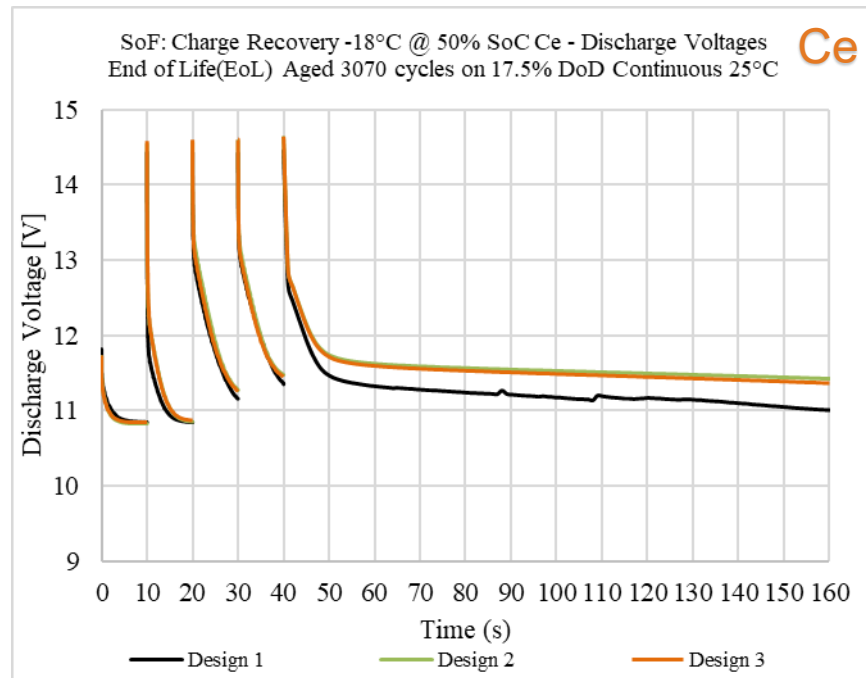
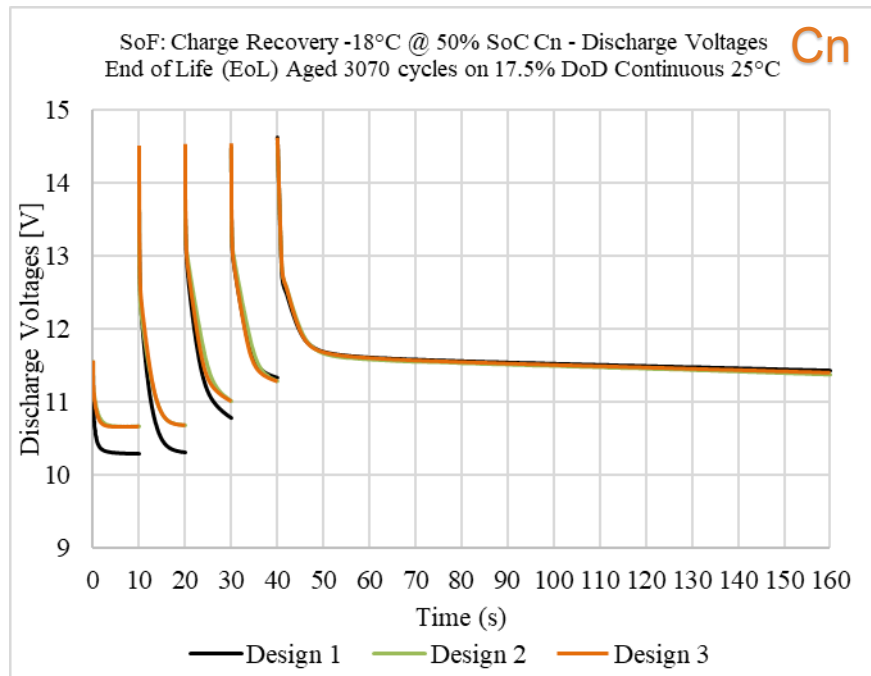
End of Life CR & PPC Characteristics



- Only batteries that lost significant C20 from aging had lower EoL CR.
- Can EoL C20 be a proxy for EoL CR?

Parameter	Unit	#1	#2	#3
EoL Ce	Ah	36.4	51.2	47.9
% from Cn*	%	-27%	2%	-4%

End of Life CR & PPC Characteristics



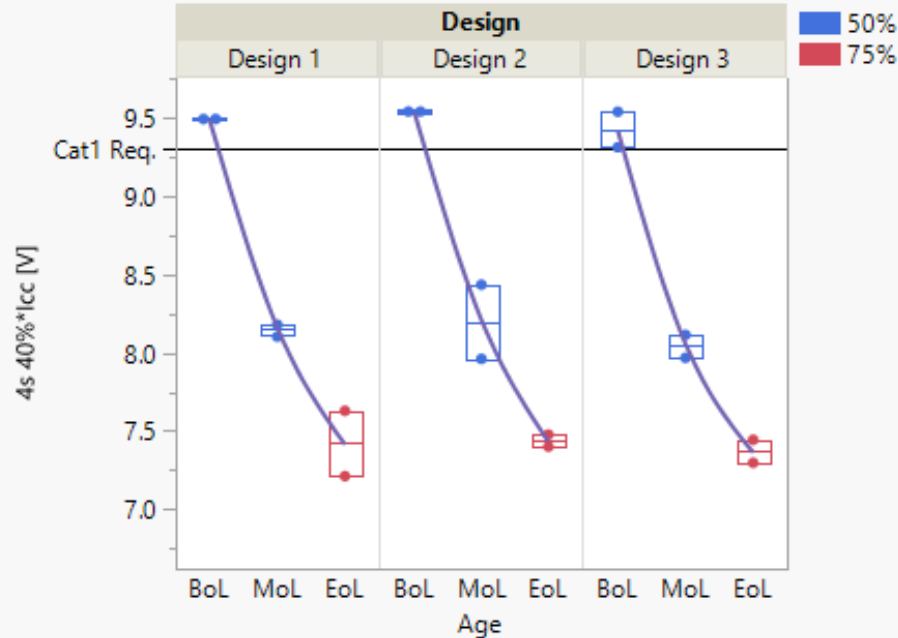
- SoF lower when test is performed with setting SoC via Cn.
- SoF similar when using Ce, except for plateau. Pseudocapacitance helps low-capacity aged battery in short discharges, if Voltage/SoC is controlled.

Parameter	Unit	#1	#2	#3
EoL Ce	Ah	36.4	51.2	47.9
% from Cn*	%	-27%	2%	-4%

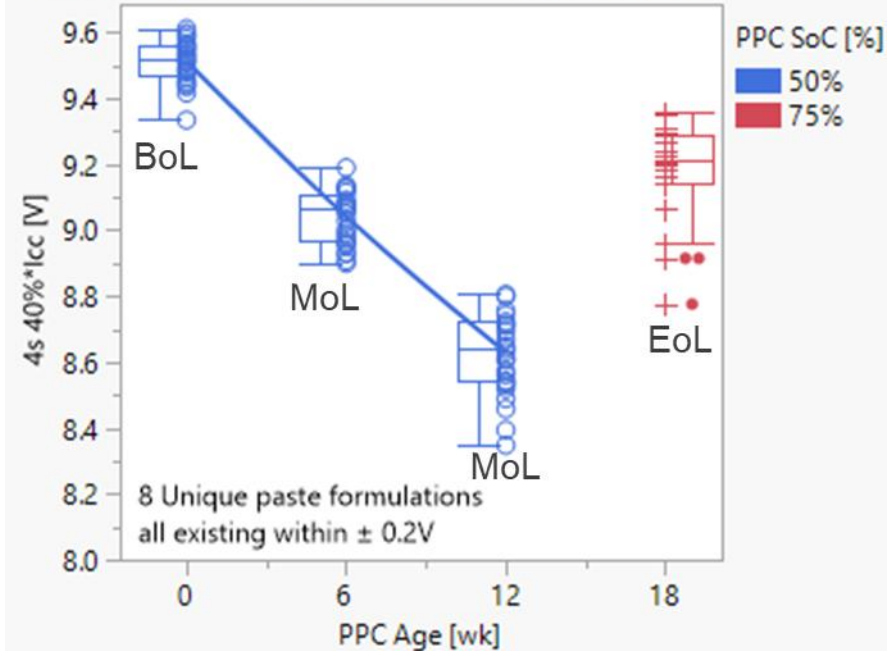
End of Life CR & PPC Characteristics

J2801 75°C Aged PPC Data

PPC @ -18°C

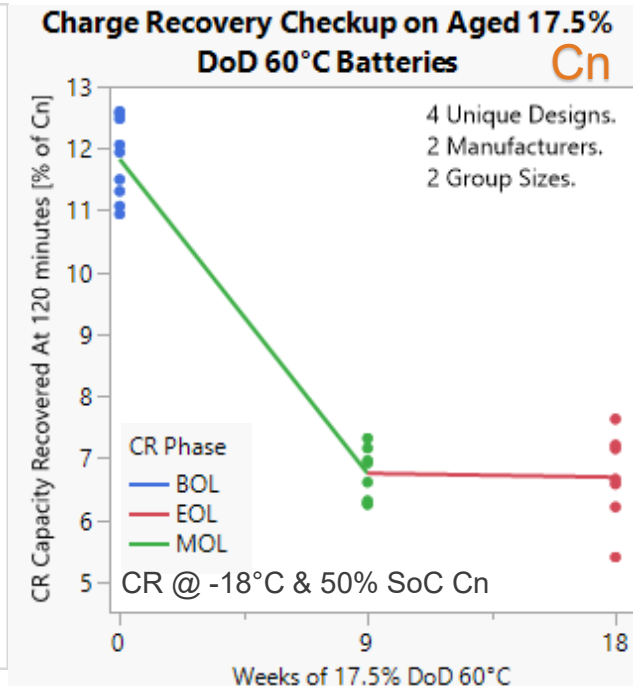
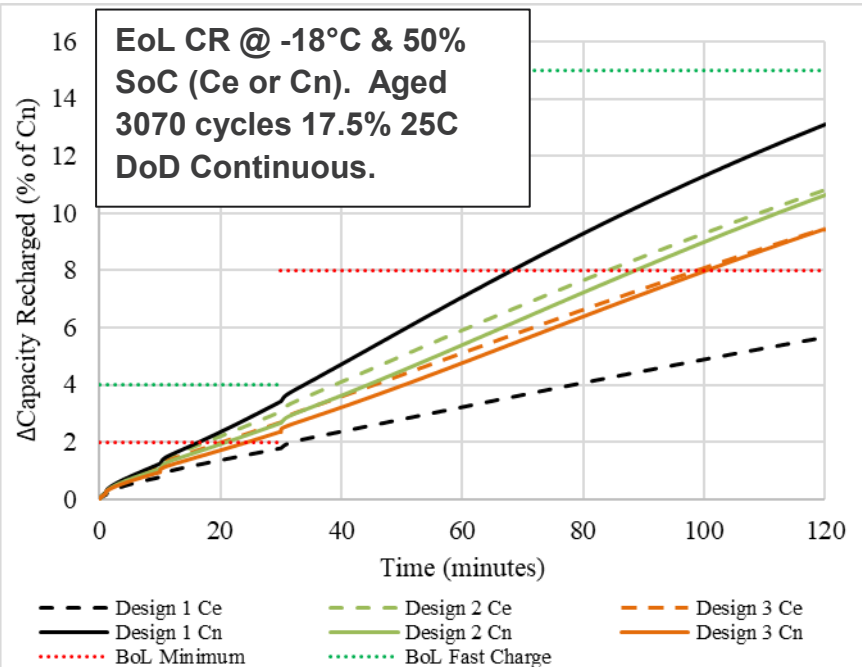


17.5% DoD 60°C Aged PPC Results @ -18°C



- High temperature aging is more impactful than design differences on PPC.
- Do deep cycle or PSoC life tests create different results? What is best?

End of Life CR & PPC Characteristics



- Clearly we can get design differences to appear (left), this is true for Cn or Ce.
- Do high temperature life tests diminish our ability to observe design differences? Or does charge recovery plateau at ~6% and is inherent for LABs and high temp tests just speed this up?

- Which life test is best to evaluate CR (or PPC) over life? Is Ce required?
- We need more data! Please see Villanova University's ALBA+ Project.**