



Creating a Cleaner World™

ALBA 2026 TM 27

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John Wertz

12V mild hybrid - DCA run-in test,

AGM results from 2V cells



Evaluate LAB options for 12V mild hybrids Preliminary results 2V 30Ah AGM cells



GEM: -2% to -3%

Ctrl: <-3%, may not come back in run-in test

2V 30 Ah cells

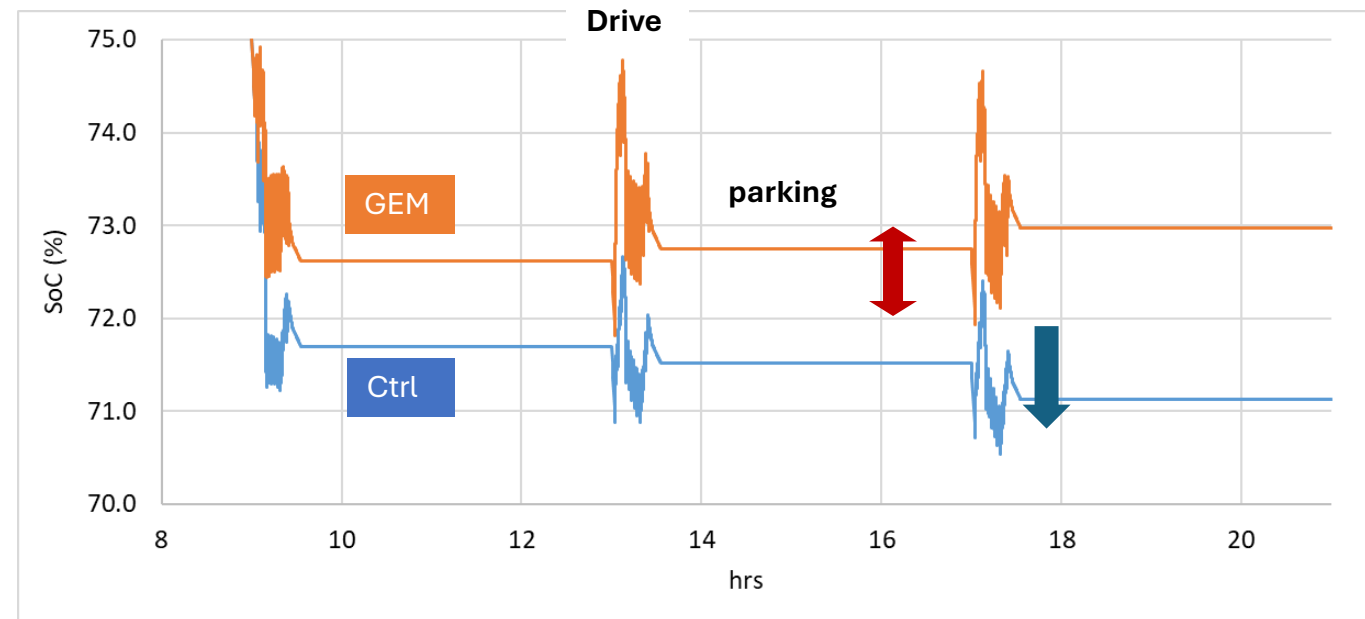
- **One day 3 trips**
- Run-in validation

We are here →

2V 60 Ah cells

- Run-in long

After DCH I20_{true} by 5 hrs
Started at true SoC 75%

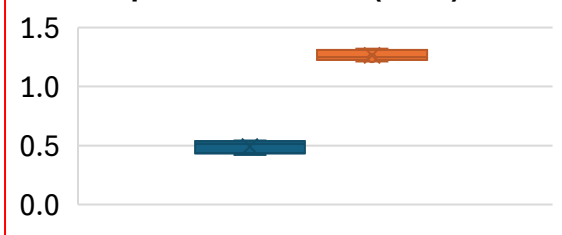


Evaluate LAB options for 12V mild hybrids Preliminary results 2V 30Ah AGM cells

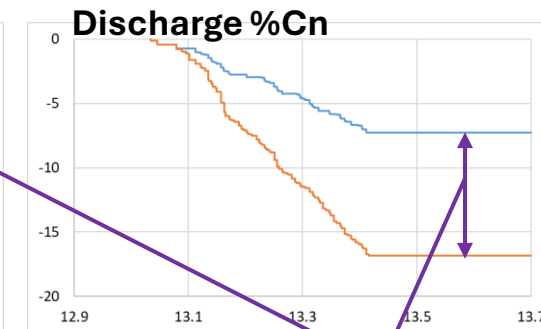
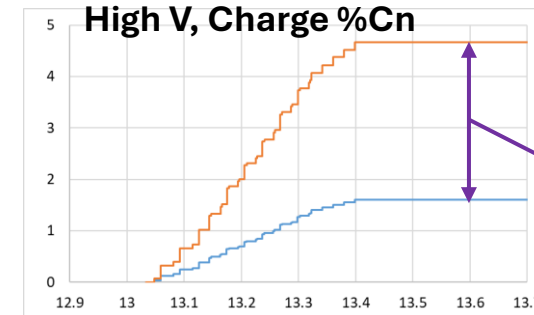
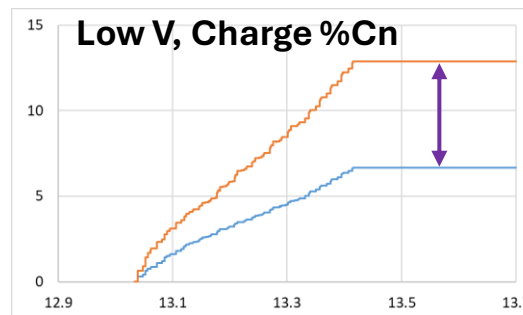
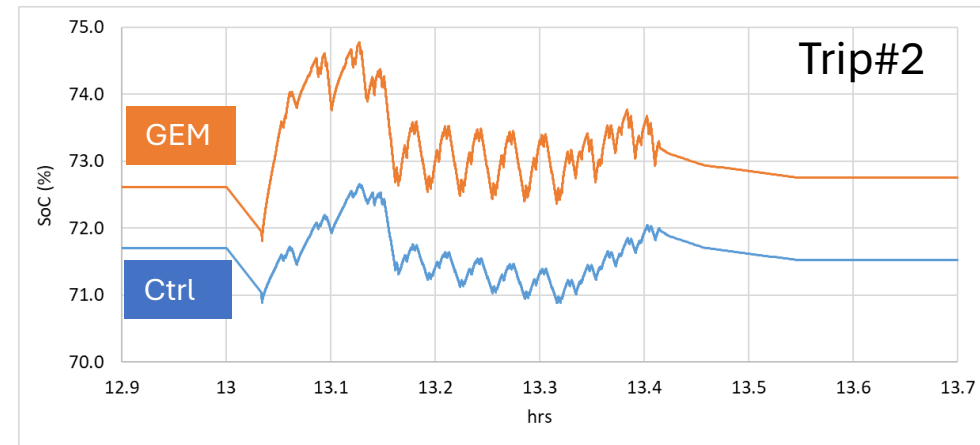
ΔSoC = Cumulative difference in
short-period charging current

WLT8 as a quick ref

Recuperation current (A/Ah)



SoC tracking in a trip



GEM provided
>2X more

1. 2V 30 Ah cells

- **One day 3 trips** → **We are here**
- Run-in validation

2. 2V 60 Ah cells

- Run-in long

	Program Ver.	Test performed
2V 30 Ah	V7	3 trips (one day)
2V 30 Ah	V8 (S/S)	3 trips (one day)

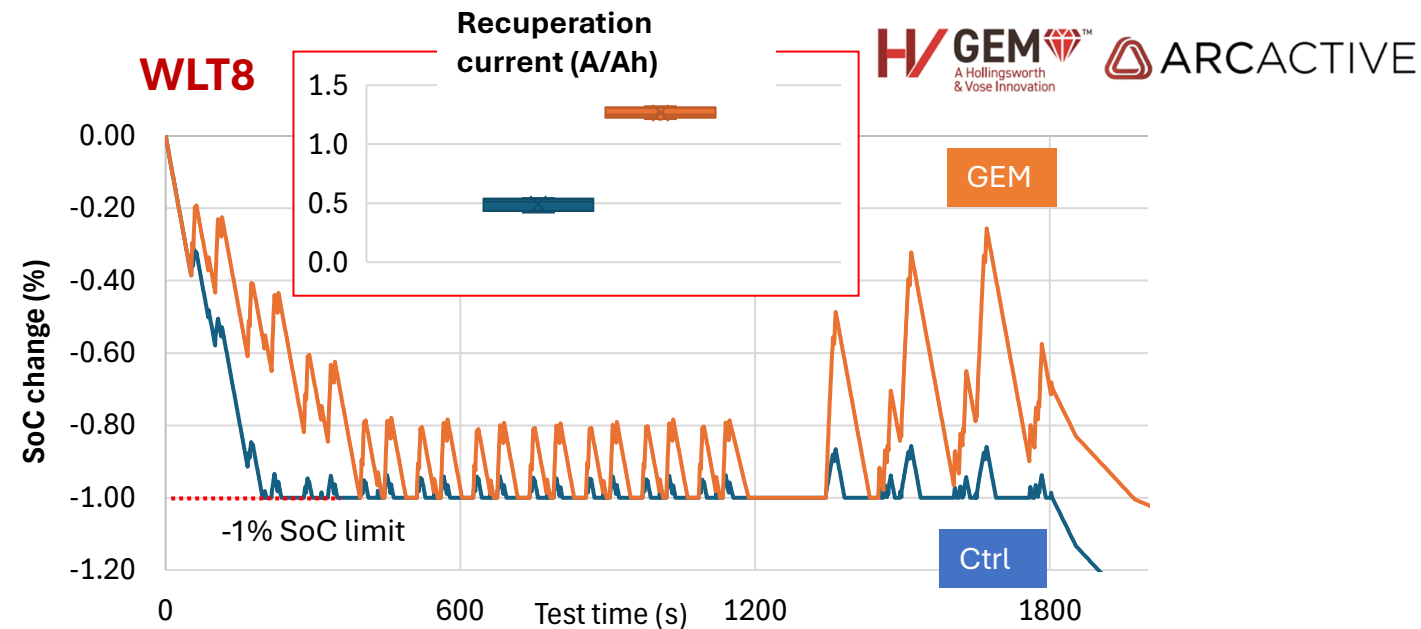
Cell selection:

1. **Ctrl cell**, conventional negative plates
2. **GEM cell**, GEM negative plates

new “hybrid state” / “charge mode” variable

- RECUP (hiCHA, +2) : $U_{BSG} \geq 14.8$ V
- NORMAL (loCHA, +1) : $I_{LIB} > -10$ A and $U_{BSG} < 14.8$ V
- BOOST (DCH, -1) : discharge at $I_{LIB} < -10$ A

(current and voltage thresholds were adjusted per measurement trace to minimize artificial “toggle” flips)



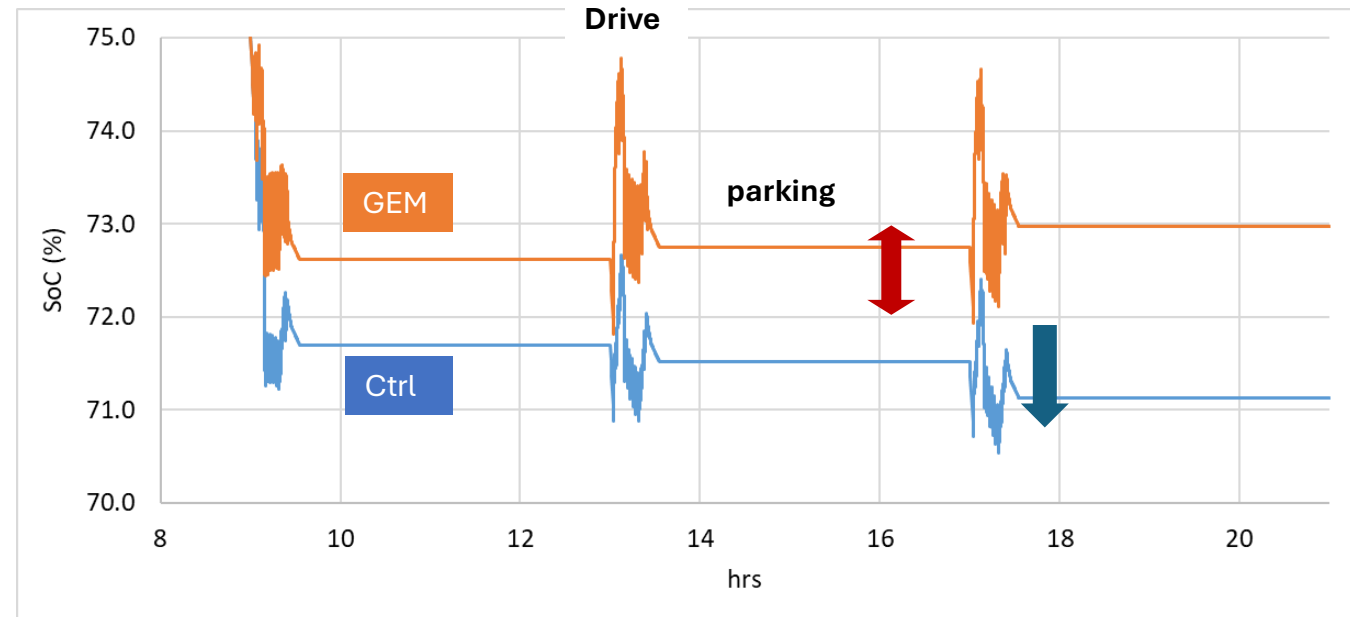
MHEV program V7

	12 V			2 V		
SoC cutoff %Cn	U_lo [V]	U_eps [V]	I_dch [A/Ah]	U_lo [V]	U_eps [V]	I_dch [A/Ah]
< -3%	14.40	14.35	0.5	2.400	2.392	0.5
< -2%	13.90	13.85	1.0	2.317	2.308	1.0
< -1%	13.50	13.45	1.5	2.250	2.242	1.5
0	13.10	13.05	2.0	2.183	2.175	2.0

↑ Normal CHA ↑ Boost DCH

- **RECUP CHA:** U_hi = 2.5 Vpc, 15 V/battery
- Current: I_hi = 5 A/Ah, I_lo = 2.67 A/Ah, I_load = 0.5 A/Ah
- If SoC is high, recharge voltage is lowered

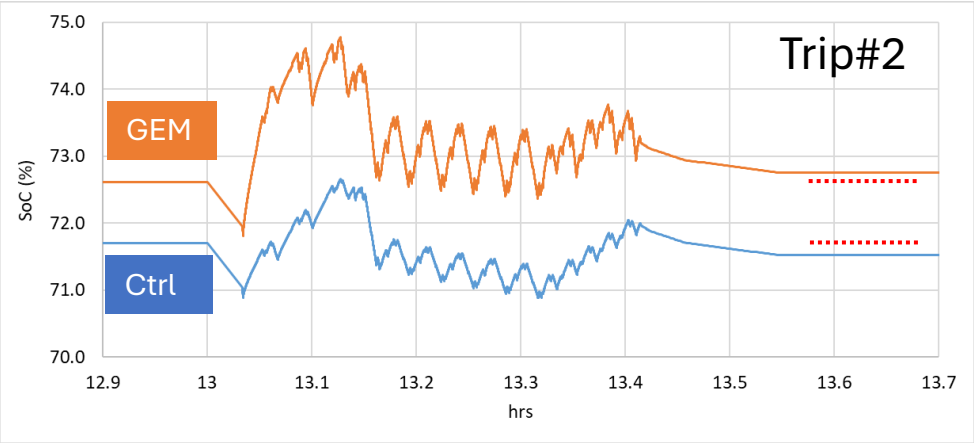
After DCH I20_{true} by 5 hrs
Started at true SoC 75%



GEM: -2% to -3%

Ctrl: <-3%, may not come back in run-in test

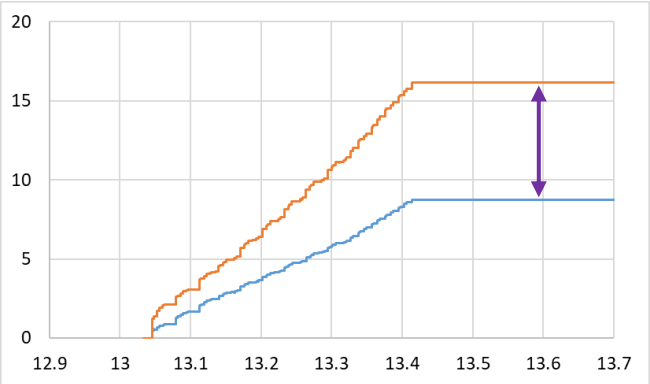
MHEV program V7



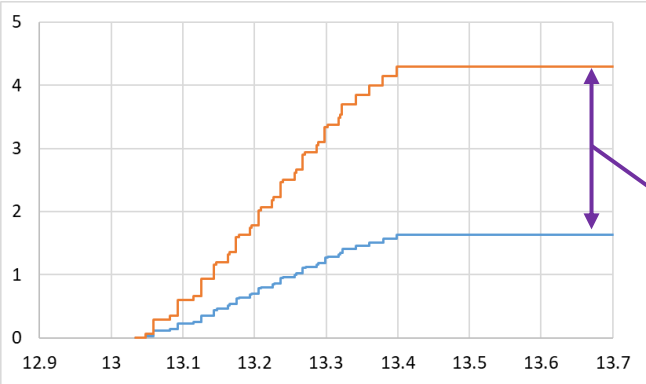
Overall, cell with high DCA is more active
More CHA, more DCH, and high SoC

- Ctrl cell lost SoC in each trip
- GEM can maintain keep SoC stable within a range

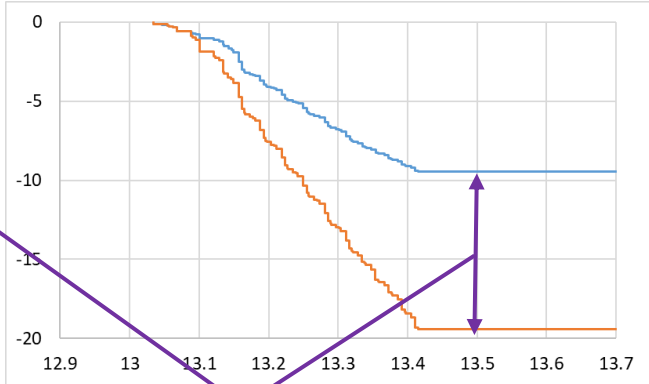
Low V, Charge %Cn



High V, Charge %Cn



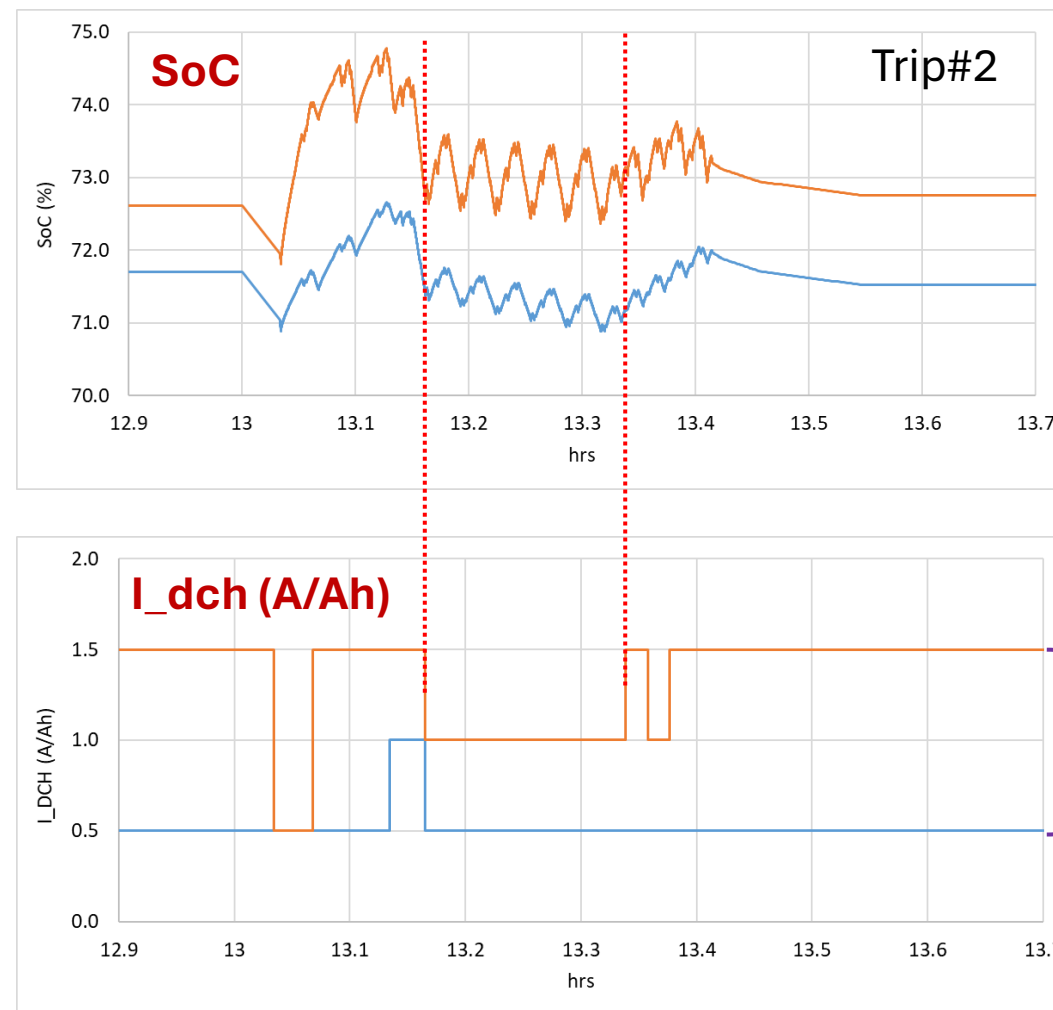
Discharge %Cn



MHEV program V7

Overall, **cell with high DCA is more active**

- Ctrl cell stays at low dch setting (0.5C rate)
- GEM mostly stayed between 1C and 1.5C rate



MHEV program V8 with S/S

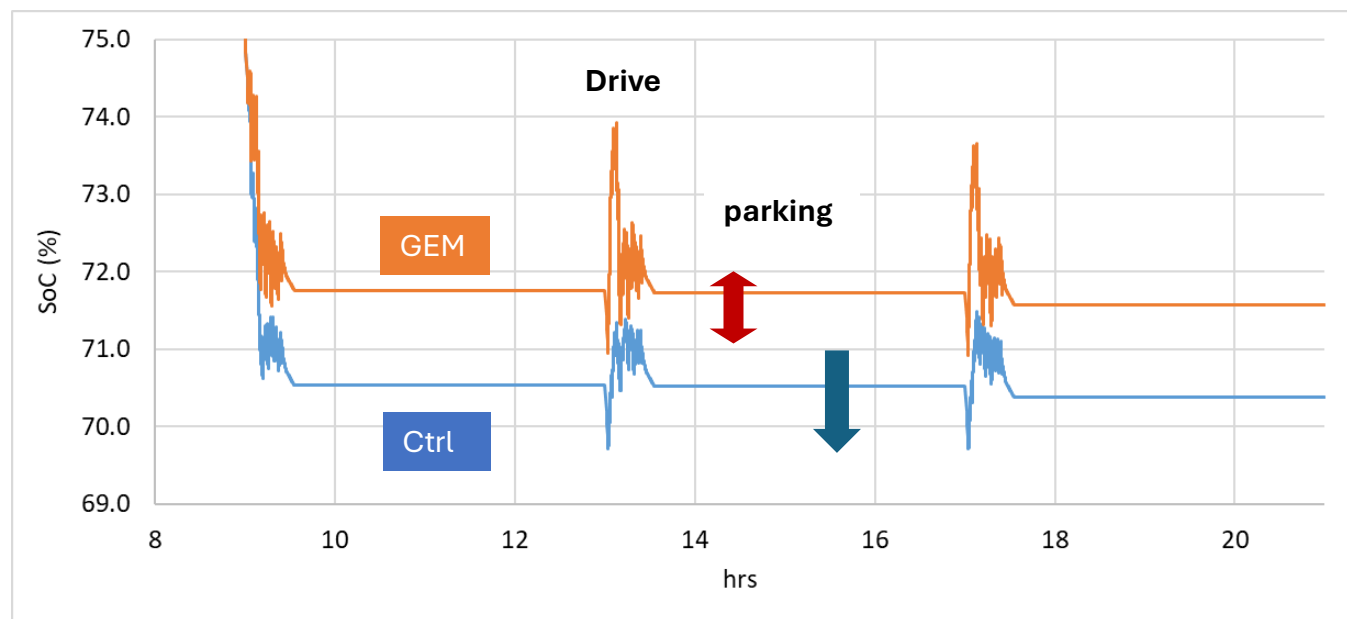
	12 V			2 V		
SoC cutoff %Cn	U_lo [V]	U_eps [V]	I_dch [A/Ah]	U_lo [V]	U_eps [V]	I_dch [A/Ah]
< -4%	15.00	14.92	1.7E-3	2.500	2.492	1.7E-3
< -3%	14.40	14.35	0.5	2.400	2.392	0.5
< -2%	13.90	13.85	1.0	2.317	2.308	1.0
< -1%	13.50	13.45	1.5	2.250	2.242	1.5
0	13.10	13.05	2.0	2.183	2.175	2.0

↑
Normal CHA

↑
Boost DCH

- **RECUP CHA:** U_hi = 2.5 Vpc, 15 V/battery
- I_hi = 4 A/Ah, I_lo = 1.35 A/Ah, I_ext = 0.3 A/Ah
- S/S steps inserted (taking normal CHA time)

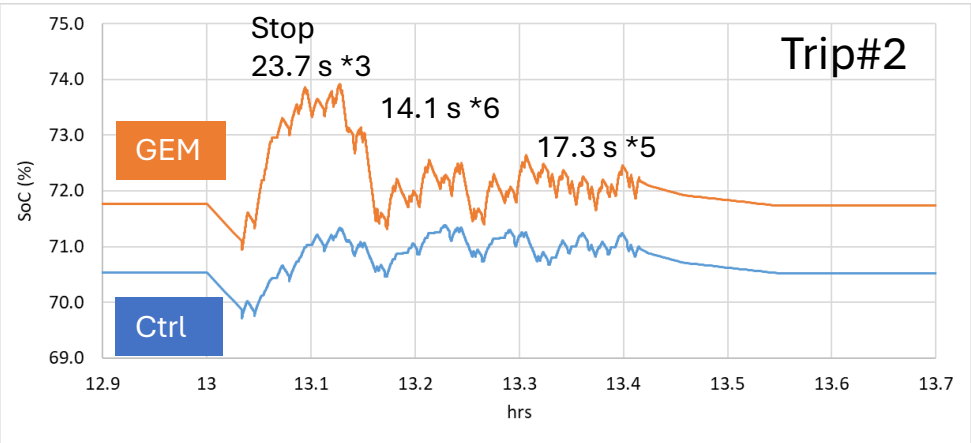
After DCH I20_{true} by 5 hrs
Started at true SoC 75%



GEM: -3% to -4%

Ctrl: <-4%, may come back in run-in test

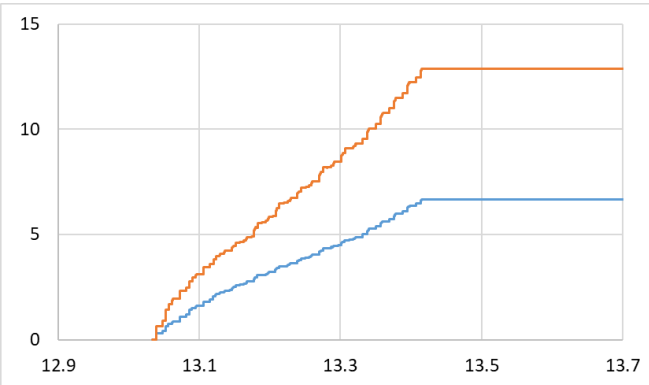
MHEV program V8 with S/S



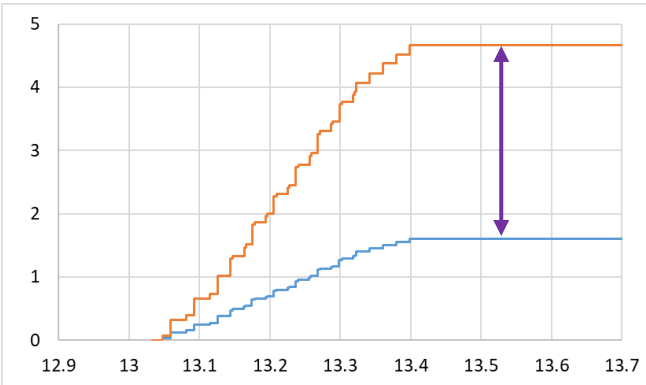
S/S took **lo_V charge time**, a stress on SoC return

- Both cells can keep SoC stable
- Ctrl benefited from **elevated charge V (15 V, 2.5 Vpc)** and **lowered discharge current (0.1 A)** at **< -4%**

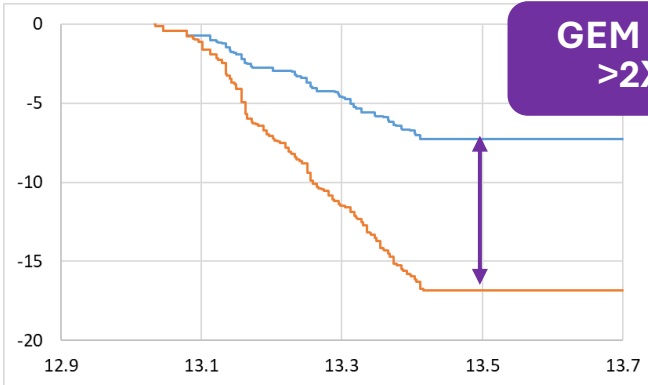
Low V, Charge %Cn



High V, Charge %Cn



Discharge %Cn



GEM provided
>2X more

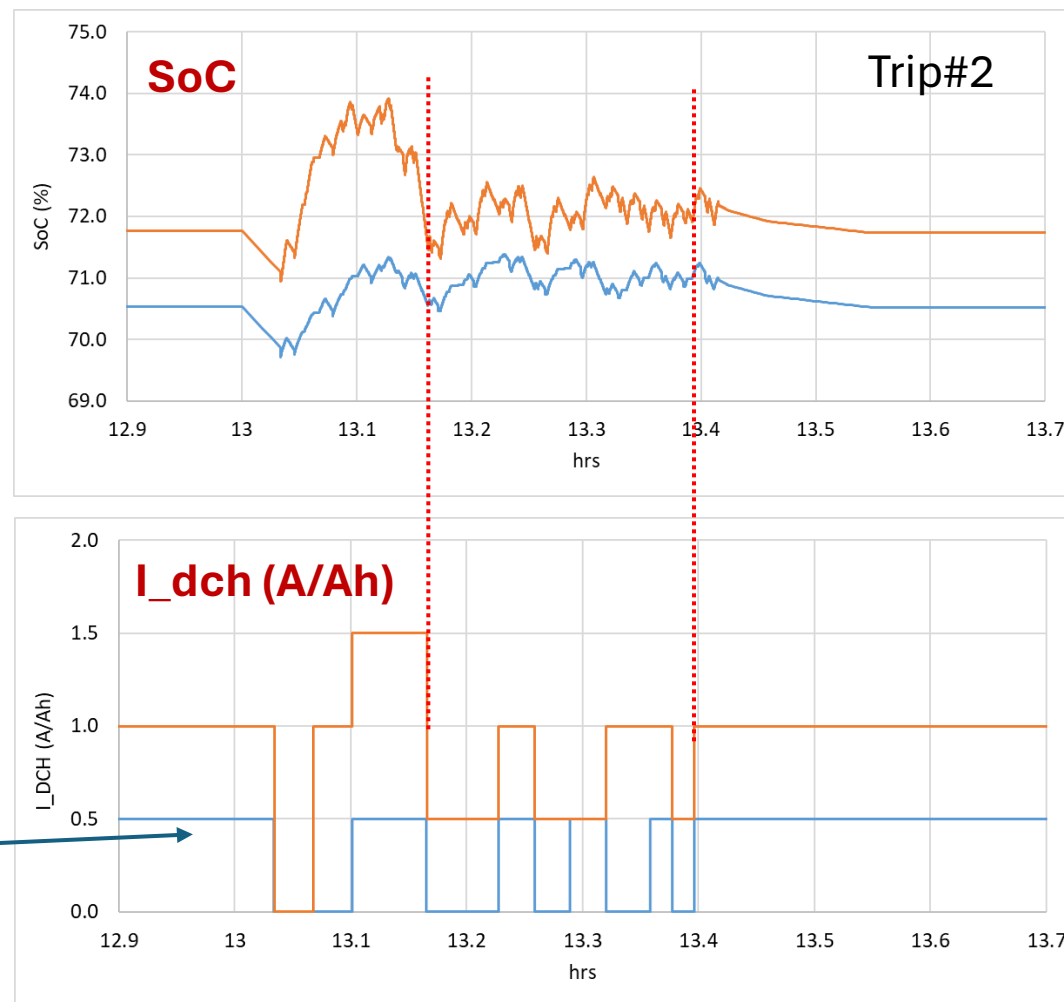


MHEV program V8 with S/S

Overall, **cell with high DCA is more active**

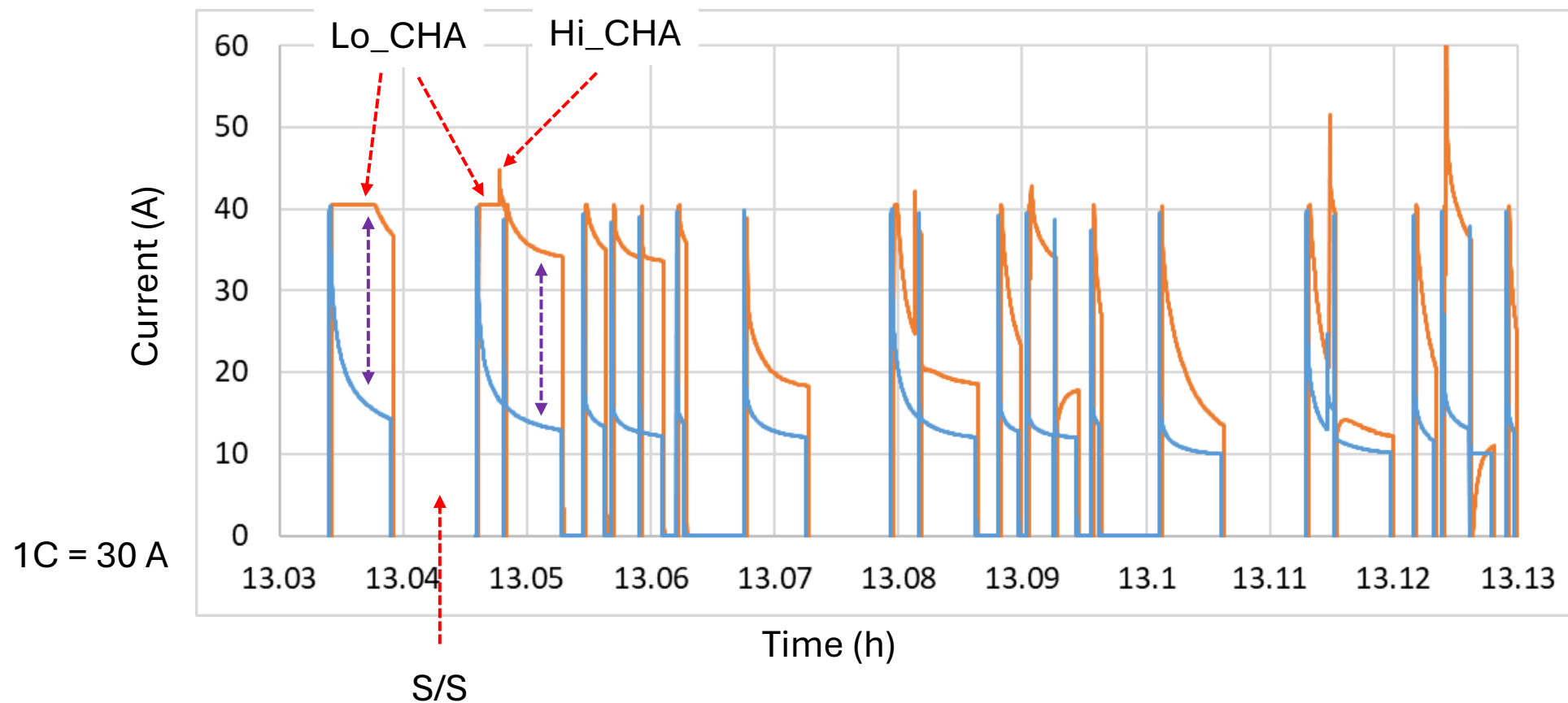
- Ctrl cell stays at very low dch setting (0.05 A)
- GEM mostly stayed between 0.5C and 1C rate
- Run-in test (+KOL) should be fine for both

**Cell with low DCA appears to be “lazy”
Little contribution to "Boost" step**



ΔSoC = Cumulative difference in short-period charging current

GEM cell accepted more current in the short pulses



The Findings:

Charge acceptance strongly affected the SoC and Ah turnover

- Cell with high DCA is more “active”
- Normal charge accounts for >70% total capacity return
- High charge acceptance (with low cell V) can help battery maintain high SoC
- Ah-V-time relationship for short charge pulses (<20 s) ?

new “hybrid state” / “charge mode” variable

- RECUP (hiCHA, +2) : $U_{BSG} \geq 14.8$ V
- NORMAL (loCHA, +1): $I_{LIB} > -10$ A and $U_{BSG} < 14.8$ V
- BOOST (DCH, -1): discharge at $I_{LIB} < -10$ A

(current and voltage thresholds were adjusted per measurement trace to minimize artificial “toggle” flips)

Continuing Work:

- Run-in test validation: can low DCA cell compensate KOL (resistor)?
- 2V 60 Ah cell with run-in test
 - KOL correction
 - Activation / After run steps