Geotab Calgary review

uSTART GEOTAB DATA

Highlights

- **~85% Faster engine start with uSTART on the 9L Front Load GNG – even with much colder engine temps & fewer starts vs the control truck without uSTART**
- **uSTART improved cranking voltage to >12V up to 50% of time, even with much colder engine temps & fewer starts vs the control truck without uSTART**
- **~75% (combined) of all starts @ 1 second or less with uSTART**
- **Median starting time cut by >50%**

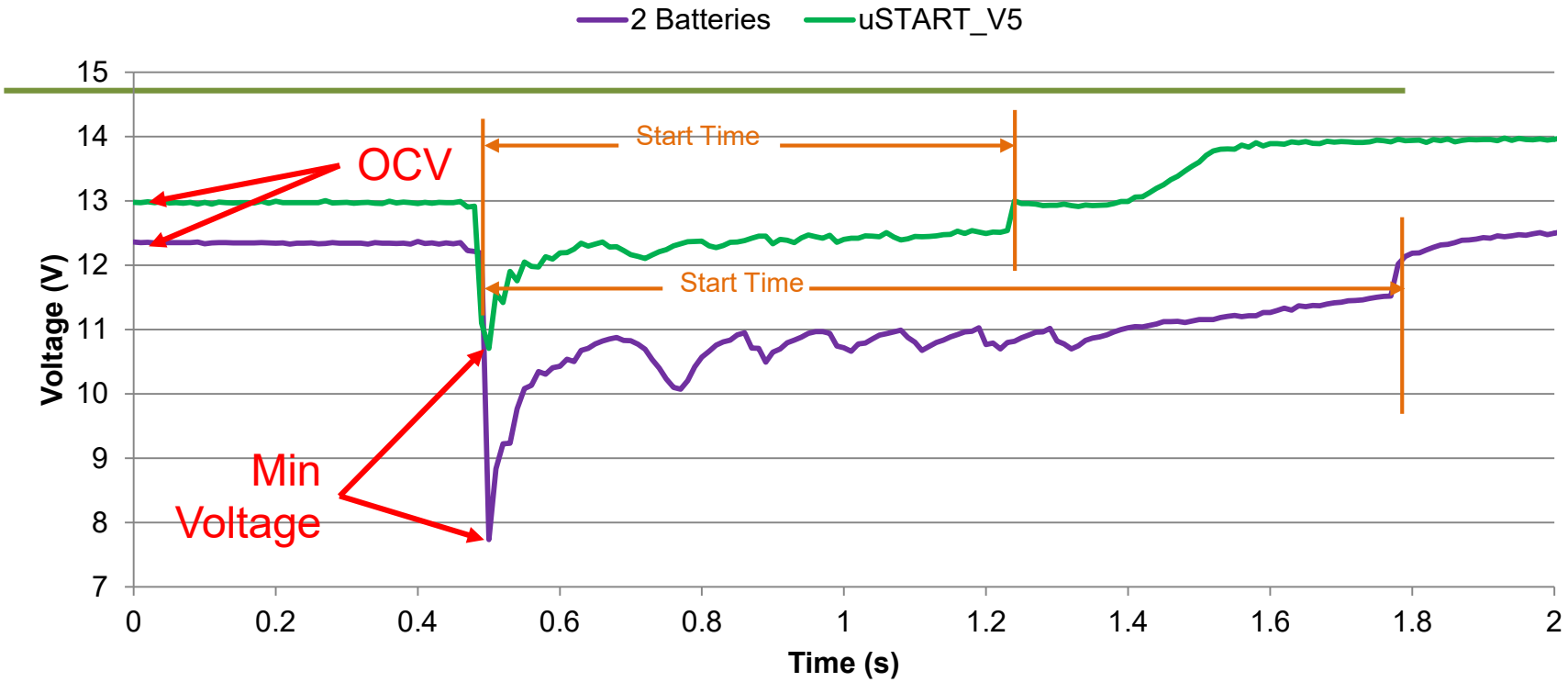
Observations

- **Trucks with uSTARTS were started much less often than the control trucks without uSTARTS – This means that the uSTART data is more concentrated in more difficult starts (cold) or after longer off times (LOWER SOC).**

- **Trucks with uSTART experiencing much colder engine temps vs the control trucks without uSTARTs – We theorize that the block heaters on the uSTART trucks are consistently not working as well Or Drivers are not plugging in**

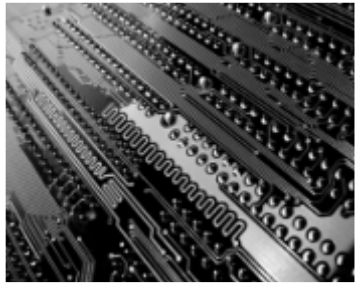
- **uSTART Still Starting reliably and showing strong improvements in V and start times even given tougher environment.**

Analysis Method



Note: this data is only an example set, not specific to these trucks or applications



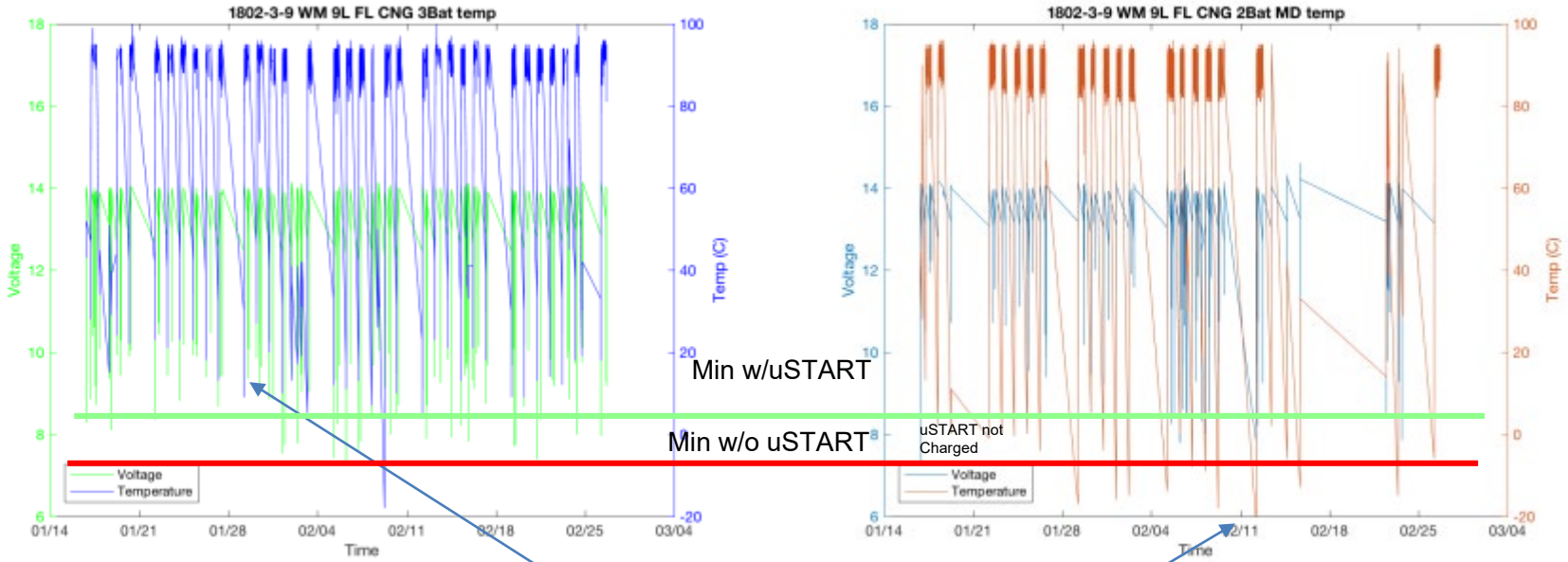
9L Front Loads CNG

9L Front Loads CNG - 1 Shift Jan-Feb 2018

uSTART truck had significantly colder temps vs non uSTART truck

W/O uSTART

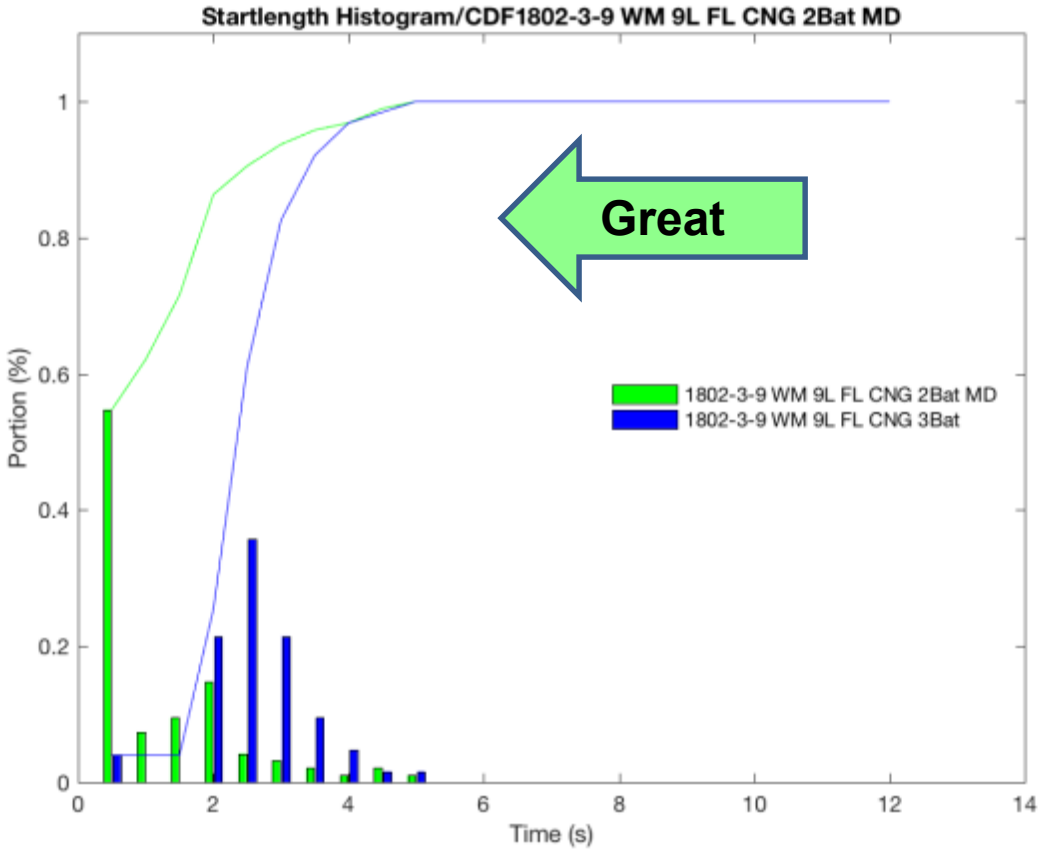
W/ uSTART



9L Front Loads CNG - Start Time Length

Histogram/CDF

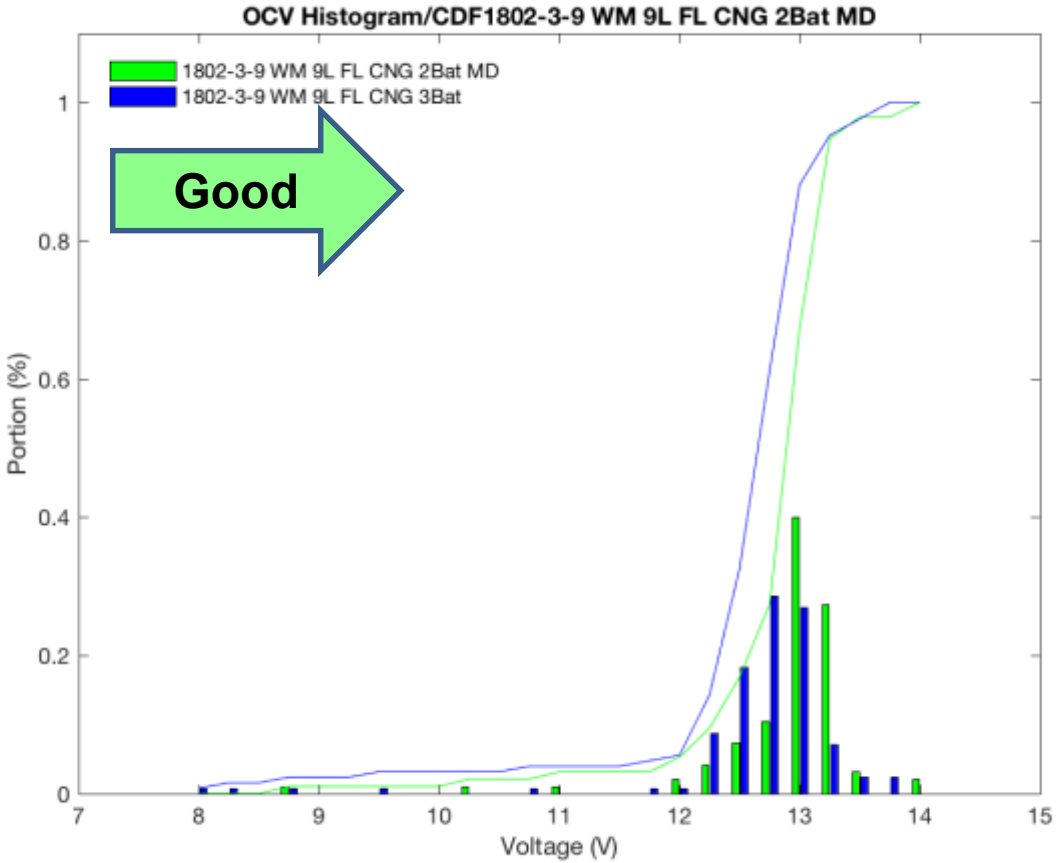
- **~85% Faster engine start with uSTART**
- Even with colder engine temps and fewer starts… Impressive



9L Front Loads CNG - OCV

Histogram/CDF

- Colder uSTART truck (relative) temp skews data
- Would expect these to be similar (and they are)

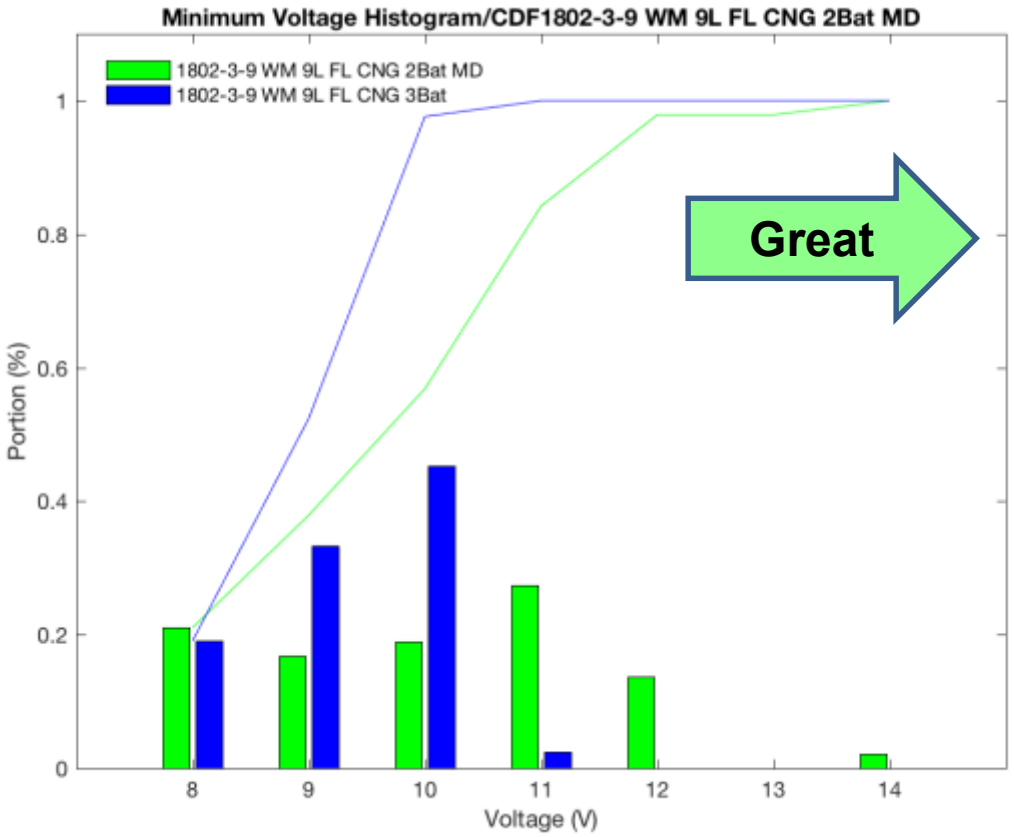


9L Front Loads CNG - Minimum Voltage

Histogram/CDF

- Relative colder temps skews data, but still looks great

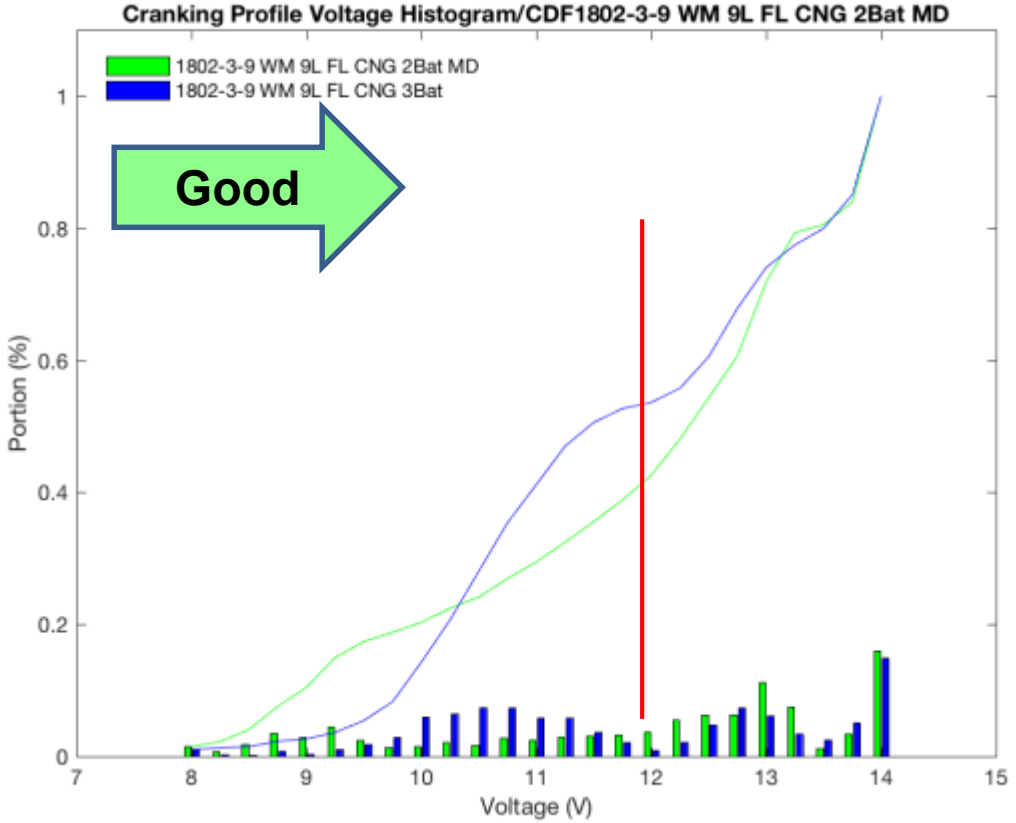
- uSTART Truck still has better improved minimum voltage



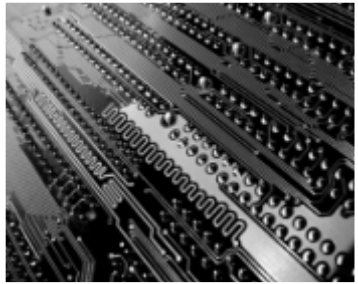
9L Front Loads Cranking Voltage

Histogram/CDF

- 60% of all cranking voltage >12V w/uSTART
- 55% of all Cranking voltage below 12V without uSTART
- Note colder temps





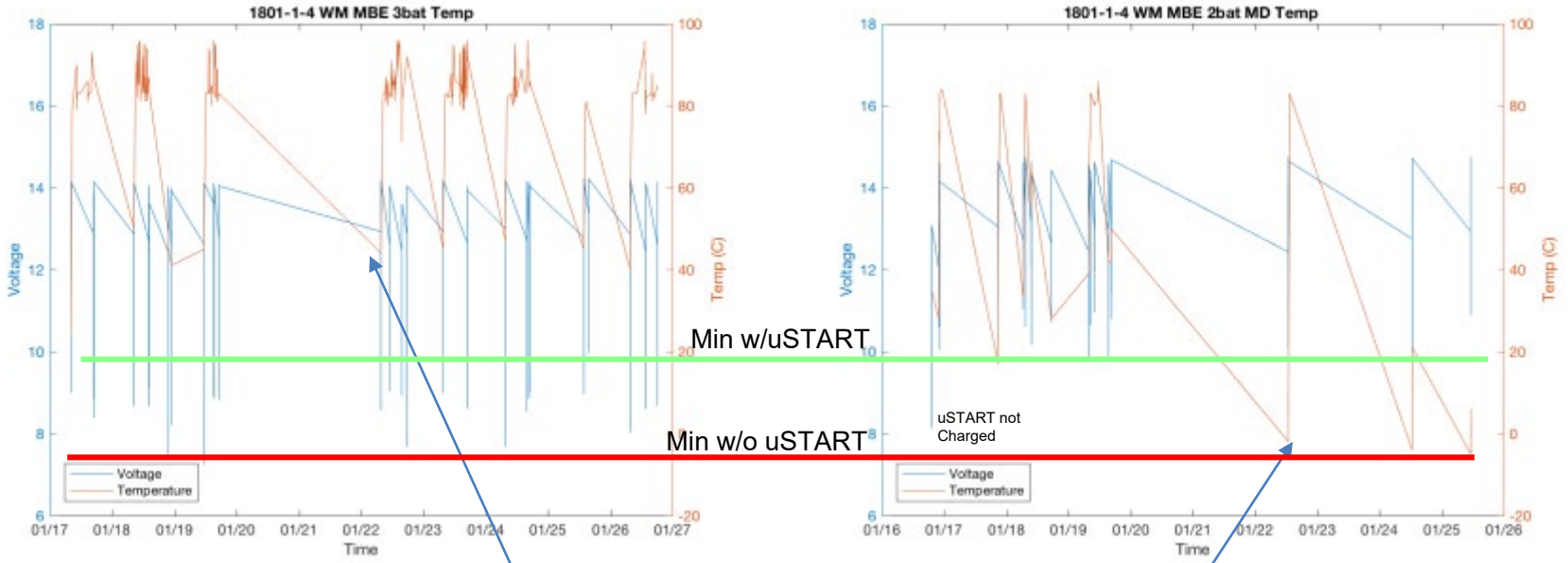
12.8L MBE DT Roll off CNG

(12.8L MBE4000 Roll Off 1 Shift) Jan 2018

Significantly fewer starts, significantly colder temps

W/O uSTART

W/ uSTART

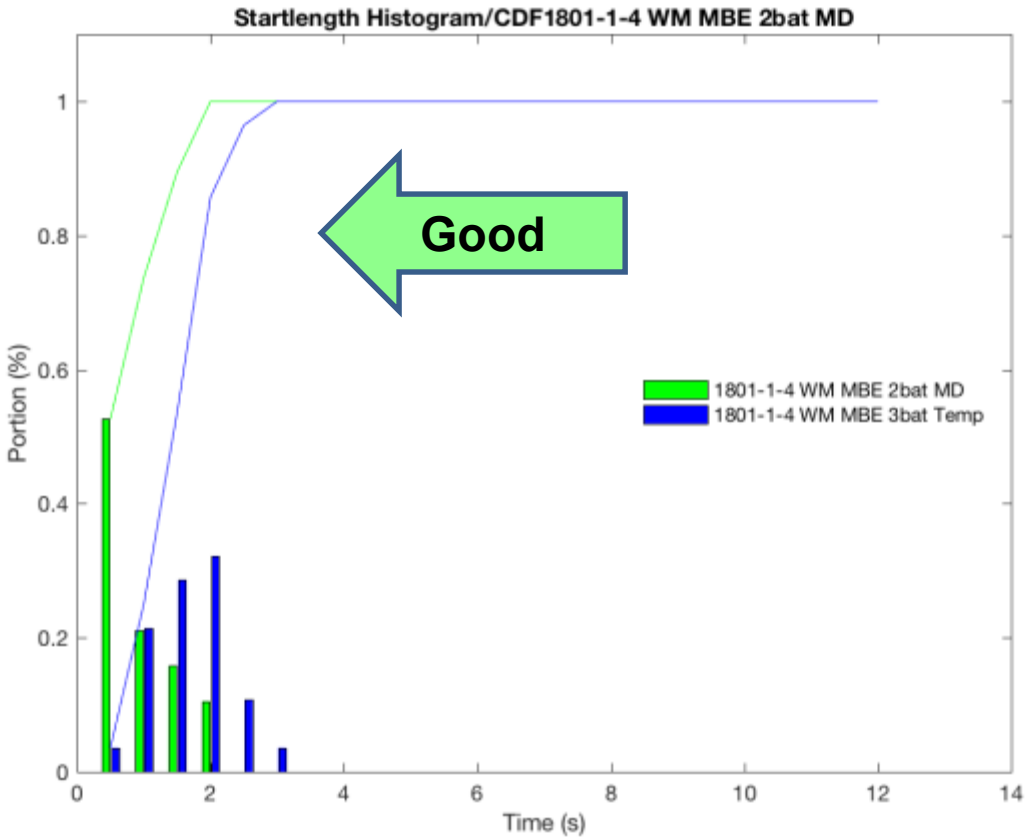


uSTART truck much colder, fewer starts

MBE 4000 Start Length

Histogram/CDF

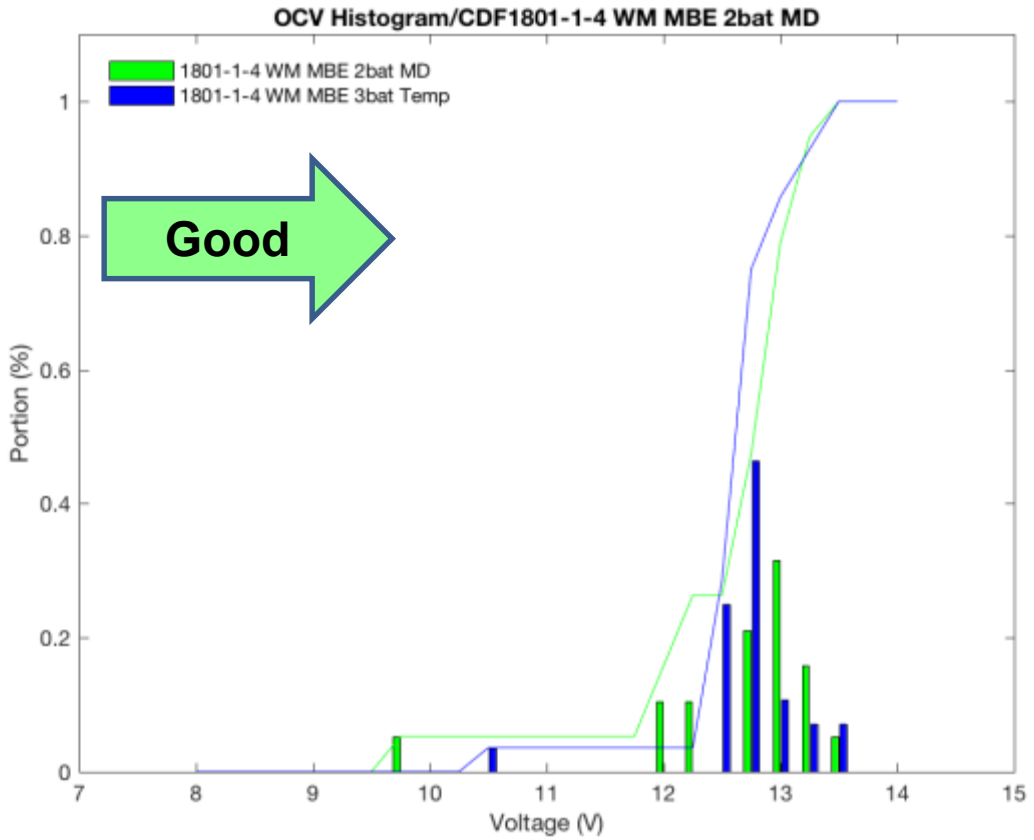
- ~50% Faster engine start
- Even with colder engine temps and fewer starts… Impressive



MBE 4000 OCV

Histogram/CDF

- Significantly fewer starts and colder temp skews data a bit
- Would expect these to be similar (and they are)

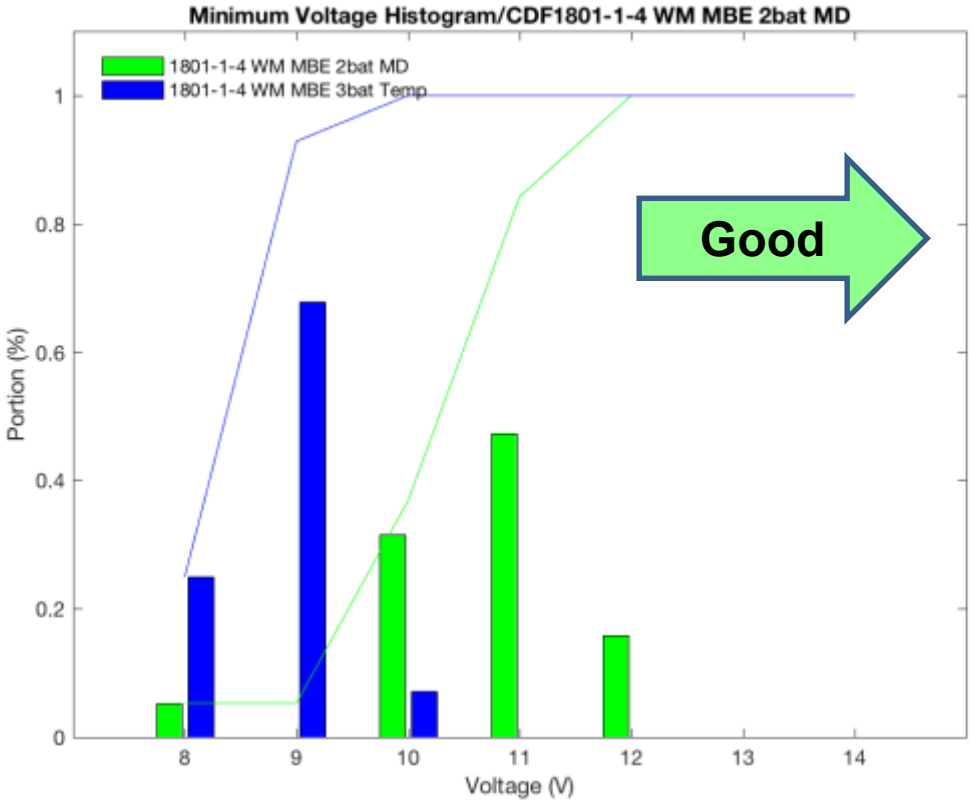


Good

MBE 4000 Minimum Voltage

Histogram/CDF

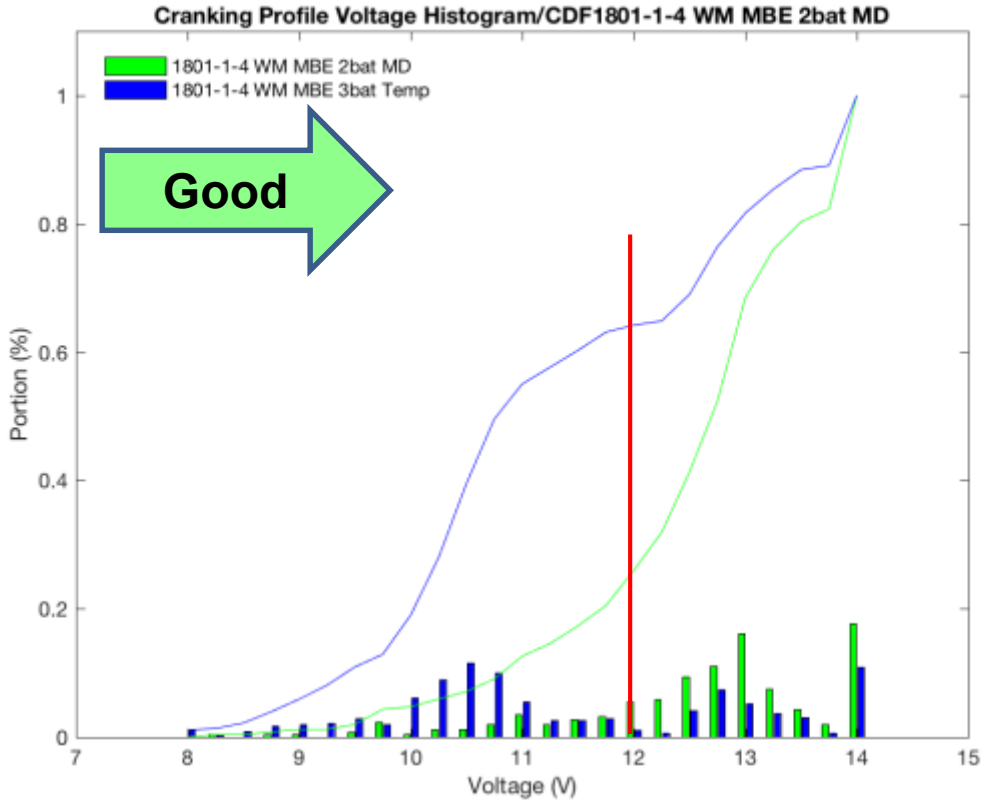
- Dramatically improved minimum voltage -v90% Minimum Voltage during cranking is higher with uSTART
- Note, fewer starts and much colder engine temps



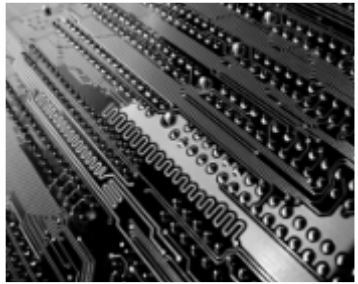
MBE 4000 Cranking Voltage

Histogram/CDF

- 75% of all cranking voltage >12V w/uSTART
- 65% of all Cranking voltage below 12V without uSTART





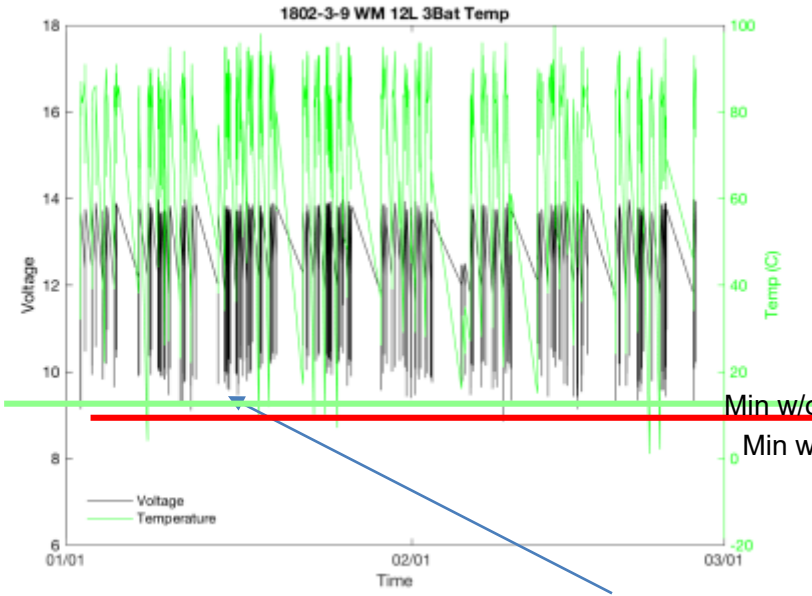



12L Roll Off CNG

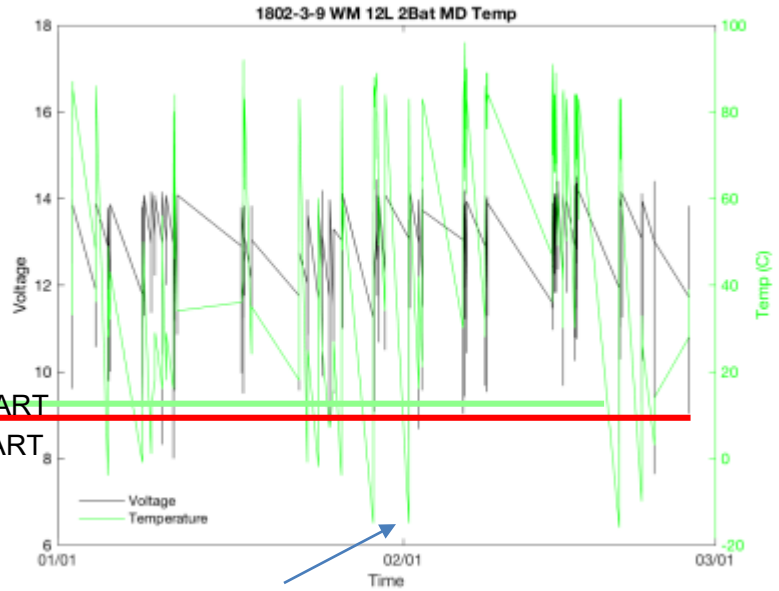
12L Roll Off 1 Shift Jan-Feb 2018

Significantly fewer starts, significantly colder temps

W/O uSTART



W/ uSTART



Min w/o uSTART

Min w/uSTART

Cranking Voltage

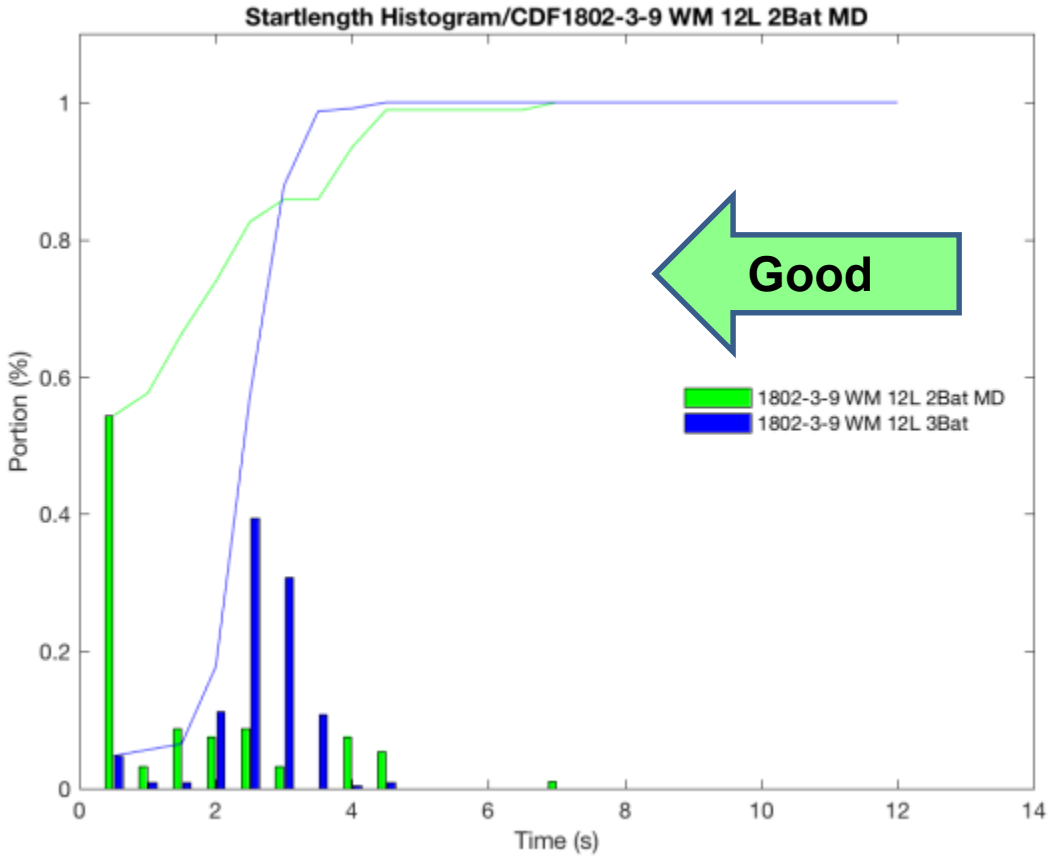
Coolant Temperature

uSTART truck much colder, fewer starts

12L Roll Off Start Length

Histogram/CDF

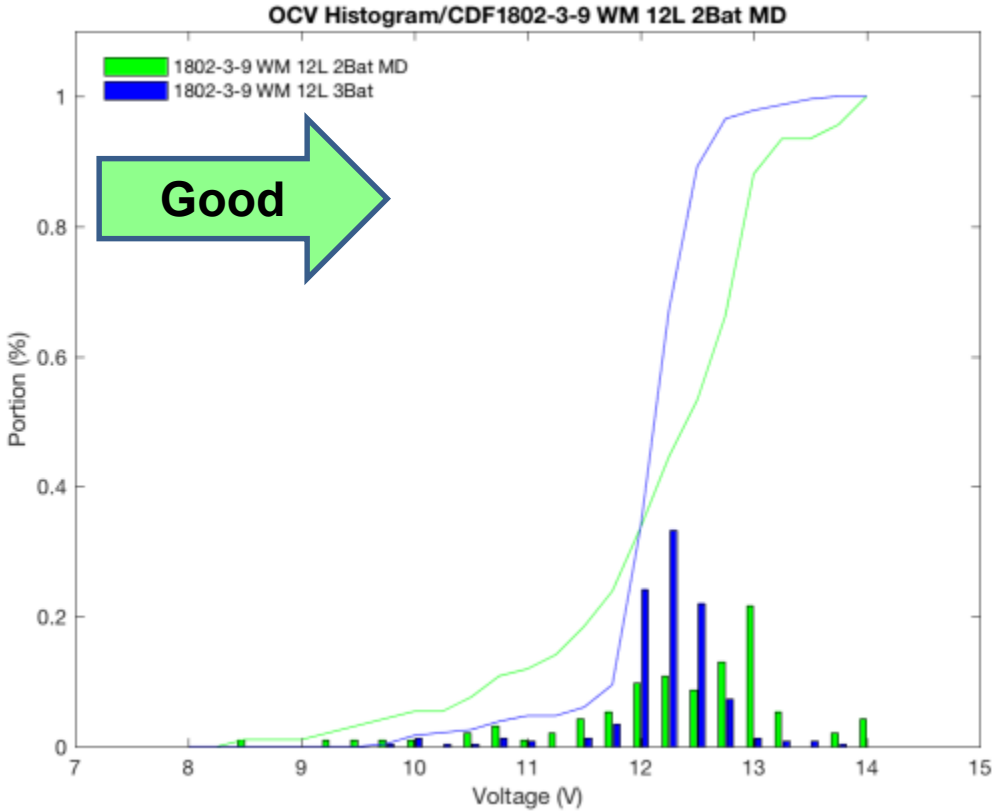
- ~85% Faster engine start with uSTART
- Even with colder engine temps and fewer starts… Impressive



12L Roll Off Loads OCV

Histogram/CDF

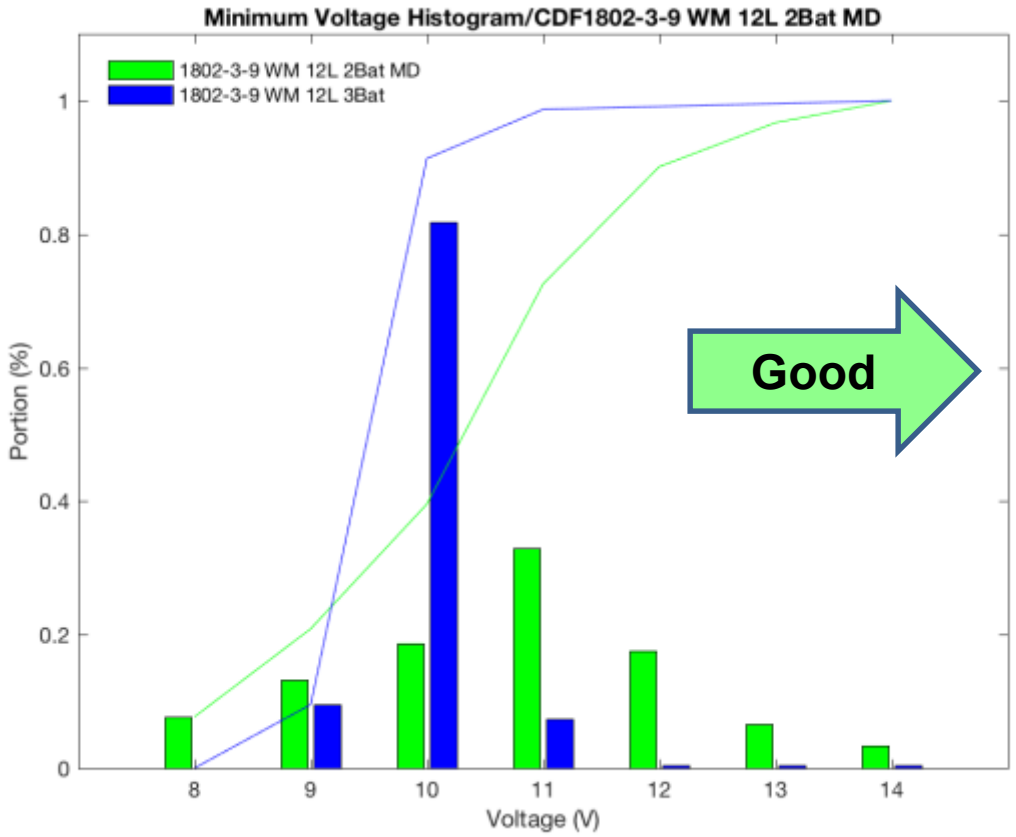
- Colder starts and fewer of them (relative) skews data a bit
- Would expect these to be similar (and they are)



12L Roll Off Minimum Voltage

Histogram/CDF

- Relative colder temps skews data
- uSTART Truck still has generally improved minimum voltage
- >50% ≧ 11V w/uSTART
- 95%≦11V without



12L Roll Off Cranking Voltage

Histogram/CDF

- 50% of all cranking voltage >12V w/uSTART
- 40% of all Cranking voltage below 12V without uSTART
- Note colder temps and fewer starts skew data