09 Dragon 800 “reflash” ECU dyno test data

Here’s Casey Mulkins’ stock Dragon 800 one more time, with his ECU reflashed with Polaris’ latest program.

As we all know, the original D8 ECU programming was extremely EPA-lean in the midrange creating for many riders at best lean part throttle stumbling and at worst piston damage/ seizures from A/F ratios as lean as 16/1. Lean mixtures like this can cause pistons to grow and grab and score in the bores even at light throttle openings. Many D8 riders used Boondocker and Power Commander fuel controllers to add gobs of midrange fuel to create good drivability and reliability (and reportedly better mileage) and lean out the top end to make good power. Thousands of no problem miles with our PCIII tuning, and death to many bone stockers with 10 less peak HP. That is reality. But for now we’re greedy devils looking for max HP. And Greedy Casey is back for more, hoping for 160 plus HP and safe midrange HP if tuning is correct.

This turned out to be a 12 hour dyno thrash, with Casey, Wayne Stoutner and Rex and Sean Ray helping out to figure out what the “reflash” was doing for us. Casey monitored the Digital Wrench data and Wayne used his own laptop to monitor/ tweak PCIII mapping. We also had a box of stuff to try, sent to Casey by Erich at Bikeman Performance including a ported cylinder and a billet head with lower compression chambers that Erich thought would be more forgiving for the extra-protective protective deto sensor. We didn’t have a BMP modded stock pipe, nor did we have an Exxtreme modded SLP pipe for comparison or revised PCIII mapping. As indicated in the following text, we neglected to perform some dyno tests that would have provided valuable information.

We’ve also been fortunate that Sean Ray (seanmray@yahoo.com) has been doing parallel dyno testing/ tuning here on his own 600 IQ race sled with Dragon 800 top end (carbureted with injector holes plugged). This is a package Sean has created to sell to others including a custom fitted DynoPort single pipe package. With stock carbs fitted, Sean had to lower the compression ratio of the stock 800 head to achieve 163 HP on pump gas with no clicks of detonation at 12.5/1 and .63 lb/hphr. The stock head had limited power to about 158 HP in his IQ racer with carbs, and dropping the compression about one point had allowed leaner jetting/ more timing to create 163 HP at 120 degree F coolant temp. Because of this positive testing we acquired one of Sean’s cylinder heads to try on Casey’s D8. Remember, in the archives on this website Sean had created more HP on pump gas with his dad’s XC800 by reducing compression ratio. In both cases, Sean left the squish band stock and opened the bowls on CNC milling equipment. And for the Dragon 800, Sean opened up the chambers by squaring them off into a “top hat” shape that made best HP on the Hentges Racing Polaris mod 800 twins that Sean had developed and optimized here a few years ago.

Casey had been riding his Dragon 800 sled with the reflash and reported that it has been good in the midrange—very much like the latest CCW Power Commander map we've been using on the original D8 ECU calibration (the PCIII CCW map added lots of midrange part throttle fuel while leaning out top end). But the factory reflash was still seemingly lazy on top. So here we go.

For this test session we used 93 octane 10% ethanol unleaded fuel. And unlike our previous session with Wayne Stoutner's D8 (where octane was surely lower than posted) we were able to make good power before deto was heard through the copper tube bolted to the cylinder head. Coolant temperature was maintained at 110-120 degrees F. Pipe center section temperature was 1000 degrees F or more at peak revs. Each dyno test was 20 seconds at WOT. Also note that as usual on these sleds the airflowmeter attached to the stock airbox on Casey's sled read low, due to poor airbox sealing at the throttle bodies and at the airbox halves themselves. This gave us lower than actual A/FA-B readings (mechanical dyno airflow vs fuel flow meters). Also, the fact that the dyno measures gross fuel flow from pump to rail, then uses a second meter to measure (and deduct) fuel flow from bypass back to the tank, results in a less than perfectly smooth net fuel flow curve. Those airflow readings are included for comparison. The LAMAF1 A/F ratio readings in the dyno data are obtained by an Innovate LM-1 with an O2 sensor sniffing exhaust via a ¼" tube slipped deep into the muffler from its outlet.

With very good air on the day of this session (mid 30's F air and 29.56 in hg baro), resulting in negative correction factor (observed HP was slightly higher than the corrected HP shown here), Casey's reflashed ECU delivered WOT fuel flow similar to the original flash. But monitoring the Polaris Digital Wrench computer during our baseline dyno runs Casey noted two important changes:

1) several degrees more timing at peak revs compared to the original flash.
2) less sensitivity to knock, allowing good timing/ power until audible clicks from the copper tube [bolted to the thermostat housing and plumbed into the control room] that would result in meaningful ignition retard/ power reduction.

The added timing resulted in some baseline HP increase even with similarly fat top end fuel flow. Here is Casey's engine bone stock with reflashed ECU:

EngSpd	STPTrq	STPPwr	FulA-B	BSFA-B	LAMAF1	A/FA-B	Air 2	FuelP
RPM	Clb-ft	CHp	lb/hr	lb/hph	Ratio	Ratio	scfm	psig
5500	76.0	79.6	62.1	0.77	14.7	11.37	154	58.5
5600	76.5	81.5	62.5	0.76	14.7	11.46	156	58.5
5700	77.7	84.3	60.4	0.71	14.7	12.08	159	58.4
5800	78.4	86.5	68.0	0.78	14.4	10.91	162	58.3
5900	79.0	88.8	70.1	0.78	14.3	10.66	163	58.2
6000	80.6	92.1	70.1	0.75	13.8	10.84	166	58.0
6100	81.5	94.7	68.2	0.71	13.4	11.26	168	58.1
6200	82.1	96.9	70.1	0.72	13.1	11.07	169	58.0
6300	82.5	99.0	75.4	0.75	12.5	10.39	171	57.9
6400	82.9	101.0	77.2	0.76	12.3	10.12	171	57.9
6500	83.9	103.8	78.3	0.75	11.9	10.18	174	57.8

6600	84.5	106.2	80.3	0.75	11.8	10.10	177	57.8
6700	84.7	108.0	82.6	0.76	11.7	10.07	182	57.8
6800	84.5	109.4	84.9	0.77	11.7	9.85	183	57.8
6900	84.9	111.5	86.8	0.77	11.7	9.96	189	57.7
7000	87.8	117.0	91.8	0.78	11.8	9.85	198	57.5
7100	89.9	121.6	97.0	0.79	11.6	9.68	205	57.4
7200	92.7	127.1	98.0	0.76	11.4	9.89	212	57.3
7300	93.0	129.3	99.1	0.76	11.4	9.90	214	57.3
7400	97.1	136.8	105.6	0.77	11.0	9.75	225	57.2
7500	96.3	137.5	108.5	0.78	10.8	9.62	228	57.1
7600	94.1	136.1	114.3	0.83	10.5	9.28	232	56.9
7700	93.3	136.8	113.1	0.82	10.4	9.48	234	57.0
7800	94.4	140.2	111.7	0.79	10.4	9.73	237	57.1
7900	95.5	143.6	111.9	0.77	10.4	9.81	240	57.2
8000	95.9	146.0	107.6	0.73	10.6	10.22	240	57.1
8100	93.4	144.0	109.9	0.76	10.6	10.04	241	57.1
8200	89.3	139.5	105.7	0.75	10.7	10.42	240	56.8

Next we plugged the ethanol wires together, which fooled the ECU into thinking we had non-ethanol fuel on board. This leaned out the fuel flow 5% and added some HP. But this would probably not be wise to do in the field since it may exacerbate the still EPA-lean reflash midrange.

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	76.1	79.7	58.5	0.73	14.8	12.24	156	58.6
5600	76.8	81.8	65.2	0.79	14.7	11.09	158	58.5
5700	78.1	84.8	66.9	0.78	14.6	11.03	161	58.4
5800	78.9	87.2	68.6	0.78	14.4	10.88	163	58.4
5900	81.2	91.2	74.1	0.80	14.1	10.21	165	58.3
6000	81.5	93.1	70.2	0.74	13.7	10.92	167	58.2
6100	81.5	94.7	70.5	0.74	13.6	10.82	167	58.2
6200	82.7	97.6	73.2	0.74	13.2	10.59	169	58.2
6300	83.3	99.9	76.7	0.76	12.7	10.33	173	58.0
6400	83.5	101.7	77.3	0.75	12.5	10.30	174	58.0
6500	84.0	103.9	78.9	0.75	12.3	10.15	175	58.0
6600	85.1	107.0	77.2	0.71	12.1	10.57	178	58.0
6700	85.3	108.8	79.3	0.72	12.0	10.45	181	58.0
6800	84.0	108.8	82.3	0.75	12.1	10.27	185	57.9
6900	83.7	110.0	83.6	0.75	12.1	10.22	187	57.9
7000	84.0	112.0	87.1	0.77	12.2	9.91	188	57.9
7100	90.4	122.2	92.2	0.75	12.0	10.09	203	57.6
7200	91.4	125.2	95.6	0.76	11.9	9.88	206	57.6
7300	97.0	134.8	96.1	0.71	11.5	10.43	219	57.5
7400	98.0	138.0	99.3	0.71	11.5	10.36	225	57.4
7500	97.4	139.1	102.2	0.73	11.3	10.30	230	57.2
7600	95.9	138.7	110.1	0.78	10.9	9.63	231	57.2
7700	96.8	141.9	110.1	0.77	10.7	9.84	237	57.1
7800	96.3	143.0	111.9	0.77	10.7	9.74	238	57.2
7900	97.9	147.2	110.8	0.74	10.8	10.00	242	57.2

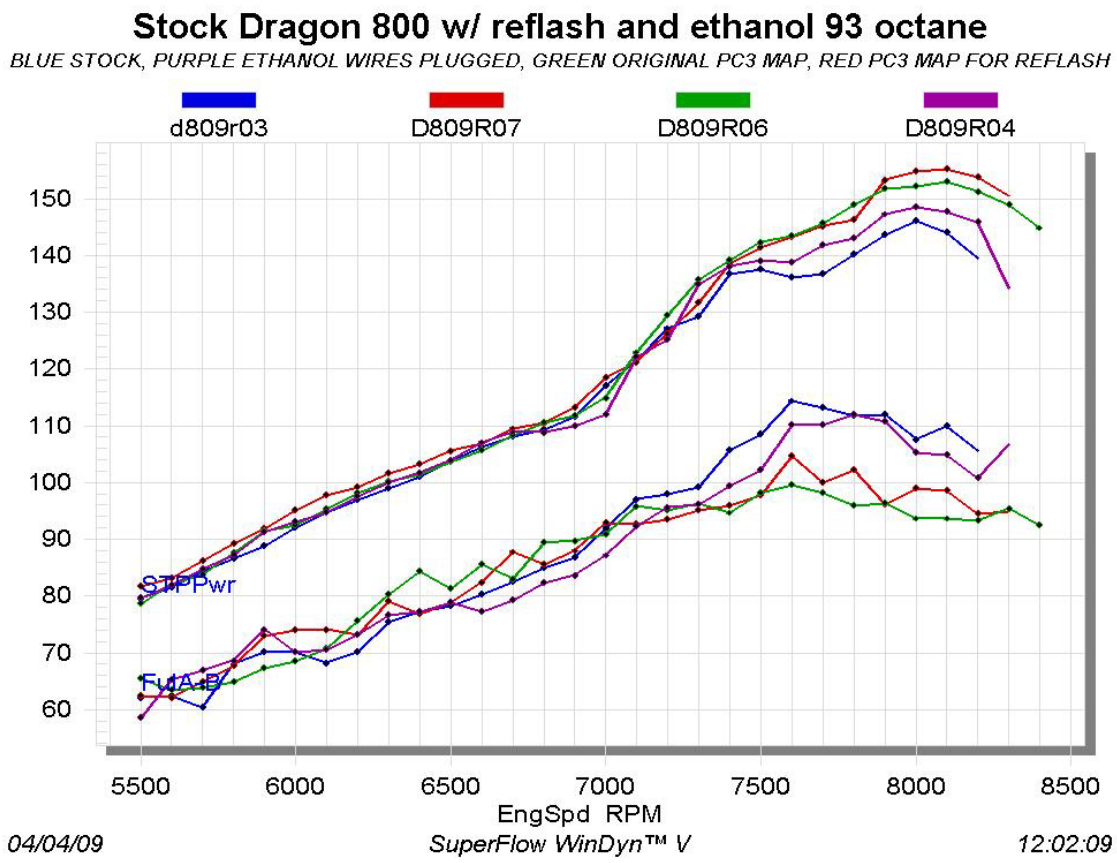
8000	97.5	148.4	105.2	0.70	10.9	10.54	242	57.3
8100	95.8	147.7	104.9	0.70	11.0	10.60	243	57.4
8200	93.4	145.8	100.8	0.68	11.1	10.97	241	57.1
8300	85.0	134.3	106.7	0.79	11.1	10.20	238	57.3

The following test data is with wires once again unplugged, and Casey's PCIII attached to the ECU harness, with our original CCW map loaded. The extra timing of the reflash combined with our CCW map's top end lean mixture created some clicks of deto that caused timing to be pulled during this test:

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	76.9	80.5	56.1	0.69	14.7	12.65	155	58.3
5600	78.1	83.3	60.0	0.71	14.7	12.10	159	58.4
5700	79.2	86.0	63.0	0.72	14.6	11.71	161	58.2
5800	79.6	87.9	64.3	0.72	14.4	11.61	163	58.3
5900	81.4	91.4	65.5	0.71	14.1	11.54	165	58.2
6000	82.0	93.7	69.3	0.73	13.7	10.97	166	58.1
6100	82.9	96.3	72.7	0.75	13.2	10.51	167	58.1
6200	83.8	98.9	73.4	0.73	12.8	10.59	170	57.9
6300	83.5	100.1	76.4	0.75	12.6	10.32	172	57.9
6400	84.0	102.3	78.2	0.75	12.3	10.20	174	57.9
6500	84.2	104.2	82.3	0.78	12.0	9.76	175	57.8
6600	84.0	105.5	83.0	0.78	11.8	9.78	177	57.8
6700	84.9	108.2	86.3	0.79	11.5	9.65	182	57.7
6800	85.1	110.2	87.9	0.79	11.4	9.67	186	57.7
6900	84.8	111.5	88.3	0.78	11.5	9.84	190	57.6
7000	84.9	113.2	89.6	0.78	11.5	9.78	191	57.6
7100	89.7	121.3	92.8	0.76	11.6	10.03	203	57.5
7200	91.3	125.1	91.9	0.73	11.5	10.30	207	57.5
7300	95.0	132.1	92.2	0.69	11.5	10.68	215	57.6
7400	98.0	138.1	97.3	0.70	11.7	10.55	224	57.4
7500	98.3	140.4	99.2	0.70	11.7	10.58	229	57.4
7600	97.9	141.7	99.2	0.69	11.6	10.69	232	57.2
7700	97.2	142.5	97.8	0.68	11.5	10.90	233	57.3
7800	98.2	145.8	99.2	0.67	11.5	10.94	237	57.1
7900	100.5	151.1	95.5	0.62	11.7	11.59	242	57.5
8000	100.6	153.2	94.5	0.61	11.9	11.79	243	57.5
8100	99.5	153.4	94.1	0.61	12.1	11.89	244	57.5
8200	97.3	151.9	95.5	0.62	12.1	11.74	245	57.5
8300	94.0	148.6	94.4	0.63	12.1	11.83	244	57.4
8400	90.6	144.9	95.5	0.65	12.0	11.61	242	57.5

So next Wayne and Casey added some points of fuel to the PCIII stock exhaust map, and ridded the engine of any audible signs of knock. This left the timing advanced as it should be, and rewarded us with even more HP bone stock at 155. This is the CWR (Casey Wayne Reflash) PCIII map for the stock exhaust:

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	78.0	81.6	62.4	0.76	14.8	11.43	156	58.5
5600	78.0	83.2	62.1	0.74	14.9	11.62	158	58.4
5700	79.4	86.1	64.8	0.74	14.9	11.31	160	58.3
5800	80.8	89.3	67.7	0.75	14.5	11.06	164	58.2
5900	81.8	91.9	72.9	0.78	14.2	10.36	165	57.8
6000	83.2	95.1	73.9	0.77	13.6	10.36	167	57.9
6100	84.1	97.7	74.1	0.75	13.0	10.57	171	58.0
6200	84.0	99.1	73.1	0.73	12.8	10.67	170	58.0
6300	84.7	101.6	79.1	0.77	12.5	10.00	173	57.6
6400	84.7	103.2	76.9	0.74	12.4	10.37	174	57.7
6500	85.3	105.5	78.9	0.74	12.1	10.22	176	57.8
6600	85.1	106.9	82.4	0.76	11.8	9.91	178	57.8
6700	85.8	109.4	87.7	0.79	11.6	9.53	182	57.7
6800	85.3	110.4	85.6	0.77	11.5	9.83	184	57.6
6900	86.1	113.1	87.9	0.77	11.4	9.88	190	57.6
7000	88.9	118.5	92.8	0.77	11.6	9.80	199	57.6
7100	89.6	121.2	92.7	0.76	11.6	9.98	202	57.5
7200	92.1	126.3	93.4	0.73	11.6	10.17	207	57.5
7300	94.7	131.6	95.1	0.71	11.7	10.41	216	57.3
7400	98.3	138.5	95.9	0.68	11.8	10.69	224	57.6
7500	99.0	141.4	97.8	0.68	11.8	10.79	231	57.4
7600	99.0	143.3	104.7	0.72	11.5	10.30	235	57.1
7700	99.0	145.2	100.0	0.68	11.3	10.83	237	57.2
7800	98.5	146.3	102.2	0.69	11.3	10.67	238	57.5
7900	101.9	153.3	96.1	0.62	11.5	11.59	243	57.4
8000	101.6	154.8	99.0	0.63	11.7	11.22	243	57.4
8100	100.6	155.1	98.5	0.63	11.9	11.43	246	57.2
8200	98.5	153.8	94.5	0.61	12.0	11.90	246	57.2
8300	95.2	150.5	94.9	0.62	12.1	11.81	245	57.5



THIS NEXT SERIES OF TESTS IS WITH STOCK FUEL FLOW NO PCIII

Here's the latest DynoPort single pipe with no internal stinger and worked well with the stock reflashed ECU. Stock muffler is used here.

09 156hp

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	79.8	83.6	59.0	0.70	15.2	12.26	158	58.4
5600	80.0	85.3	61.0	0.71	15.2	11.93	159	58.3
5700	81.5	88.4	64.8	0.72	15.1	11.46	162	58.2
5800	82.8	91.4	70.0	0.76	14.9	10.77	165	58.1
5900	83.8	94.1	66.7	0.70	14.5	11.42	166	58.1
6000	84.3	96.3	68.4	0.70	14.1	11.21	167	58.0
6100	84.0	97.5	71.9	0.73	13.6	10.76	169	58.0
6200	83.8	98.9	72.2	0.72	13.2	10.71	169	57.9
6300	84.0	100.7	77.0	0.76	12.6	10.05	169	57.9
6400	82.9	101.0	76.6	0.75	12.3	10.11	169	57.8
6500	82.9	102.6	80.0	0.77	11.9	9.83	172	57.9
6600	82.2	103.3	83.9	0.80	11.7	9.53	175	57.7
6700	81.9	104.5	83.8	0.79	11.5	9.59	176	57.7
6800	81.2	105.1	84.1	0.79	11.4	9.64	177	57.7
6900	81.2	106.7	84.0	0.78	11.3	9.70	178	57.7
7000	82.4	109.8	89.0	0.80	11.3	9.30	181	57.6

7100	86.3	116.7	96.6	0.82	11.1	9.08	192	57.4
7200	86.6	118.7	98.1	0.82	11.1	9.03	193	57.3
7300	88.9	123.6	95.5	0.76	10.8	9.65	201	57.3
7400	91.2	128.5	99.1	0.76	10.7	9.55	207	57.2
7500	95.0	135.7	109.7	0.80	10.3	9.39	225	57.0
7600	94.9	137.4	113.8	0.82	10.3	9.20	229	56.9
7700	96.0	140.8	110.1	0.77	10.2	9.70	233	57.0
7800	99.6	147.9	110.0	0.73	10.2	9.91	238	57.1
7900	102.6	154.3	108.3	0.69	10.6	10.27	243	57.5
8000	102.6	156.3	109.4	0.69	10.8	10.25	245	57.1
8100	101.2	156.2	106.3	0.67	10.9	10.63	247	57.1
8200	98.7	154.1	107.3	0.69	11.0	10.56	247	57.1
8300	95.2	150.4	107.1	0.70	11.0	10.61	248	57.1
8400	87.7	140.2	107.5	0.76	11.1	10.45	245	57.2

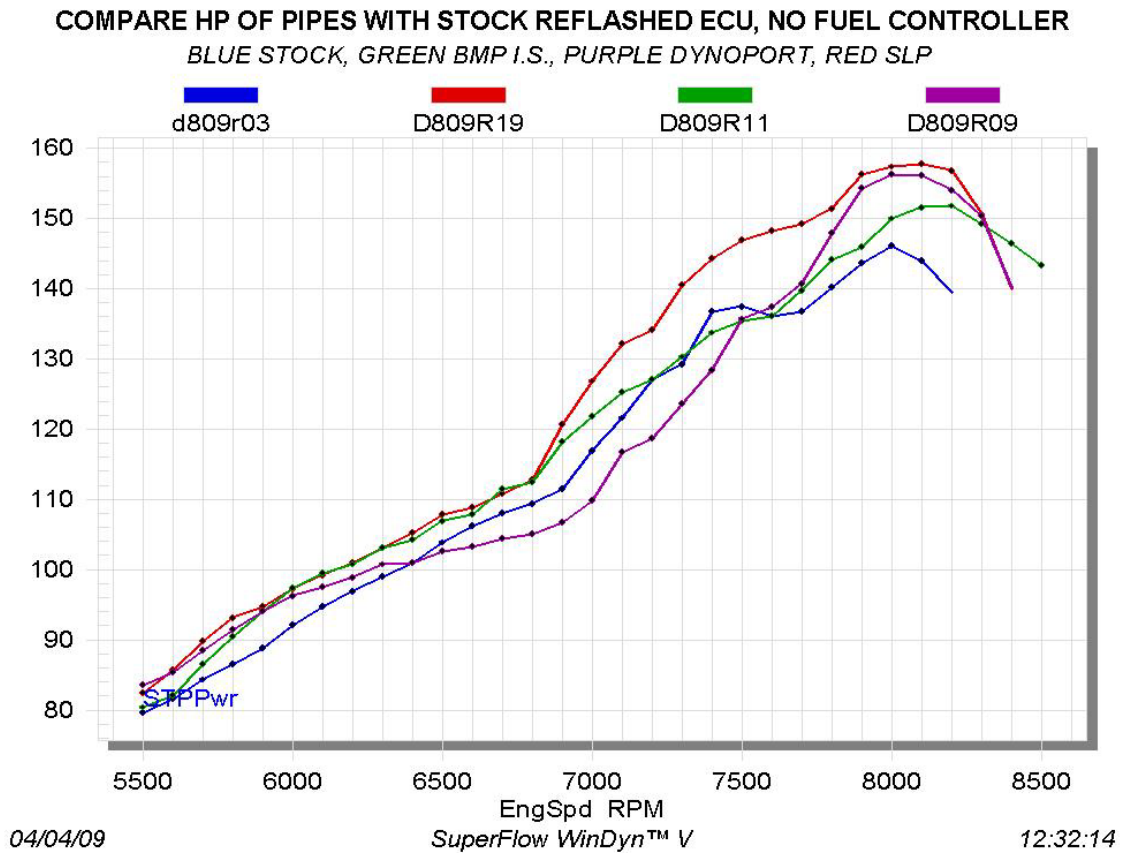
The Bikeman single pipe has an internal stinger which also worked well with the stock ECU and stock muffler (Bikeman's glasspack can muffler approximately matched the stock muffler airflow and HP):

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	76.7	80.4	66.4	0.81	16.7	10.94	159	58.4
5600	77.0	82.1	66.7	0.80	16.6	11.00	160	58.4
5700	79.7	86.5	63.6	0.73	16.4	11.80	164	58.3
5800	81.9	90.4	68.1	0.75	15.9	11.22	167	58.2
5900	83.7	94.1	71.1	0.75	15.4	10.90	169	58.1
6000	85.2	97.4	72.4	0.74	14.7	10.83	171	58.1
6100	85.6	99.4	72.5	0.72	14.2	10.96	173	58.0
6200	85.3	100.7	73.7	0.72	13.9	10.85	175	57.9
6300	85.9	103.1	77.4	0.74	13.1	10.42	176	57.8
6400	85.5	104.2	80.2	0.76	13.0	10.17	178	57.8
6500	86.4	106.9	80.2	0.74	12.4	10.33	181	57.8
6600	85.8	107.8	83.0	0.76	12.3	10.03	182	57.8
6700	87.4	111.5	86.5	0.77	12.2	9.92	187	57.6
6800	86.9	112.5	83.2	0.73	12.2	10.38	189	57.6
6900	90.0	118.2	85.3	0.71	12.2	10.56	197	57.9
7000	91.4	121.8	93.8	0.76	12.4	9.86	202	57.6
7100	92.6	125.2	99.0	0.78	12.2	9.84	213	57.4
7200	92.7	127.1	100.1	0.78	12.0	10.09	221	57.1
7300	93.7	130.3	102.9	0.78	11.9	9.93	223	57.1
7400	94.9	133.7	103.4	0.77	11.8	10.03	227	57.1
7500	94.8	135.4	107.9	0.79	11.3	9.86	232	57.0
7600	94.0	136.0	109.8	0.80	11.2	9.74	234	57.0
7700	95.3	139.8	111.5	0.79	10.9	9.79	238	57.0
7800	97.0	144.1	109.0	0.75	10.9	10.13	241	56.9
7900	97.0	145.9	110.9	0.75	10.9	10.00	242	57.0
8000	98.5	150.0	103.7	0.68	11.2	10.90	247	57.0
8100	98.3	151.6	104.8	0.68	11.2	10.82	248	57.1
8200	97.2	151.8	106.1	0.69	11.3	10.72	248	57.1
8300	94.4	149.2	109.7	0.73	11.4	10.40	249	57.1

8400	91.6	146.4	106.3	0.72	11.4	10.70	248	57.2
8500	88.6	143.4	100.0	0.69	11.8	11.31	247	57.3

SLP sells their exhaust as a complete package including a Y pipe (that made same airflow and HP as the stock Y pipe) and a reasonably quiet muffler, which must be used together since stock components don't fit. The SLP muffler is freer flowing, and results in leaner A/F ratio. *Note that the reflashed stock map doesn't have the fuel flow drop off at high revs as severely as the original flash…*

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	78.7	82.4	66.0	0.79	17.8	11.19	161	58.8
5600	80.4	85.7	62.6	0.72	17.6	12.07	165	58.8
5700	82.8	89.8	65.5	0.72	17.3	11.74	168	59.0
5800	84.3	93.1	65.3	0.69	16.8	11.99	171	58.9
5900	84.3	94.7	68.9	0.72	16.5	11.46	172	58.8
6000	85.1	97.2	72.4	0.74	15.5	11.00	174	58.5
6100	85.4	99.2	73.4	0.73	14.8	10.98	176	58.5
6200	85.5	101.0	74.7	0.73	14.4	10.90	178	58.4
6300	85.9	103.1	75.7	0.73	13.9	10.90	180	58.4
6400	86.3	105.2	76.5	0.72	13.7	10.89	182	58.4
6500	87.1	107.8	83.9	0.77	13.4	10.08	185	58.3
6600	86.6	108.8	82.6	0.75	13.2	10.38	187	58.2
6700	86.9	110.9	90.2	0.80	12.9	9.76	192	58.1
6800	87.1	112.8	90.9	0.80	12.8	9.77	194	58.1
6900	91.8	120.7	91.2	0.75	12.6	10.23	204	58.0
7000	95.2	126.8	96.3	0.75	12.6	10.07	212	58.0
7100	97.7	132.1	96.6	0.72	12.4	10.35	218	61.8
7200	97.8	134.1	96.9	0.72	12.4	10.49	222	59.9
7300	101.1	140.5	103.0	0.73	12.3	10.29	231	58.0
7400	102.4	144.3	101.6	0.70	12.1	10.63	236	57.7
7500	102.9	146.9	106.1	0.72	11.9	10.43	242	57.5
7600	102.5	148.3	114.5	0.76	11.3	9.92	248	57.4
7700	101.8	149.2	115.9	0.77	11.1	9.93	251	57.4
7800	102.0	151.4	115.2	0.75	11.1	10.06	253	57.5
7900	103.9	156.3	109.3	0.69	11.5	10.78	257	57.6
8000	103.3	157.4	106.4	0.67	11.7	11.10	258	57.6
8100	102.3	157.7	107.8	0.68	12.1	11.05	260	57.6
8200	100.5	156.9	106.8	0.67	12.2	11.17	261	57.6
8300	95.3	150.6	106.6	0.70	12.3	11.06	258	57.6
8400	87.5	139.9	103.5	0.73	12.2	11.25	254	57.7



Using Casey's Power Commander III fuel controller we optimized the fuel flow to create best HP with no deto on the BMP and SLP pipes. In the mad thrash of back and forth parts we missed optimizing the fuel flow with the DynoPort pipe (Sorry Rich but we made up for that when we tested later with BMP ported cylinders).

Here is the BMP internal stinger single pipe with stock muffler, tuned for best HP with PCIII mapping:

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	74.8	78.3	64.4	0.81	16.6	11.15	157	58.6
5600	75.7	80.7	66.8	0.82	16.6	10.92	159	58.6
5700	78.9	85.6	65.1	0.75	16.3	11.48	163	58.5
5800	80.7	89.1	63.7	0.71	15.8	11.89	165	58.4
5900	81.5	91.5	70.9	0.77	15.4	10.78	167	58.3
6000	83.5	95.4	68.8	0.71	14.5	11.39	171	58.2
6100	83.7	97.2	76.4	0.78	14.1	10.40	173	58.2
6200	84.2	99.4	75.5	0.75	13.6	10.59	175	58.1
6300	84.5	101.3	78.5	0.76	13.1	10.25	176	58.3
6400	85.3	103.9	83.5	0.79	12.5	9.77	178	58.4
6500	84.3	104.3	83.6	0.79	12.4	9.79	179	58.2
6600	85.0	106.8	84.0	0.78	12.2	9.92	182	57.9
6700	85.4	109.0	90.0	0.81	12.1	9.44	186	57.8

6800	86.2	111.7	87.8	0.78	11.9	9.87	189	57.8
6900	87.3	114.7	90.7	0.78	11.9	9.79	194	58.1
7000	90.2	120.2	94.1	0.77	12.0	9.84	202	58.2
7100	91.5	123.7	97.0	0.77	12.0	9.93	210	57.7
7200	91.3	125.2	95.8	0.76	12.0	10.25	214	57.6
7300	93.9	130.6	93.2	0.71	12.2	10.91	222	57.6
7400	95.3	134.3	100.1	0.74	12.3	10.40	227	57.5
7500	95.7	136.6	99.6	0.72	12.2	10.53	229	57.4
7600	95.5	138.2	102.5	0.73	12.2	10.34	231	57.4
7700	97.0	142.2	106.1	0.74	11.7	10.20	236	57.3
7800	100.1	148.7	101.0	0.67	11.6	10.92	241	57.4
7900	100.9	151.8	98.1	0.64	11.8	11.39	244	57.4
8000	100.8	153.6	99.2	0.64	12.1	11.32	245	57.4
8100	101.4	156.5	100.5	0.63	12.3	11.28	248	57.3
8200	100.7	157.1	99.9	0.63	12.3	11.44	250	57.2
8300	98.8	156.1	101.6	0.64	12.3	11.34	252	57.2
8400	96.9	155.0	96.0	0.61	12.3	11.99	251	56.8
8500	92.1	149.1	96.2	0.64	12.3	11.82	248	56.0

The SLP complete exhaust system is most expensive, but made the best HP especially when fuel flow was optimized with this CWRSLP PCIII map:

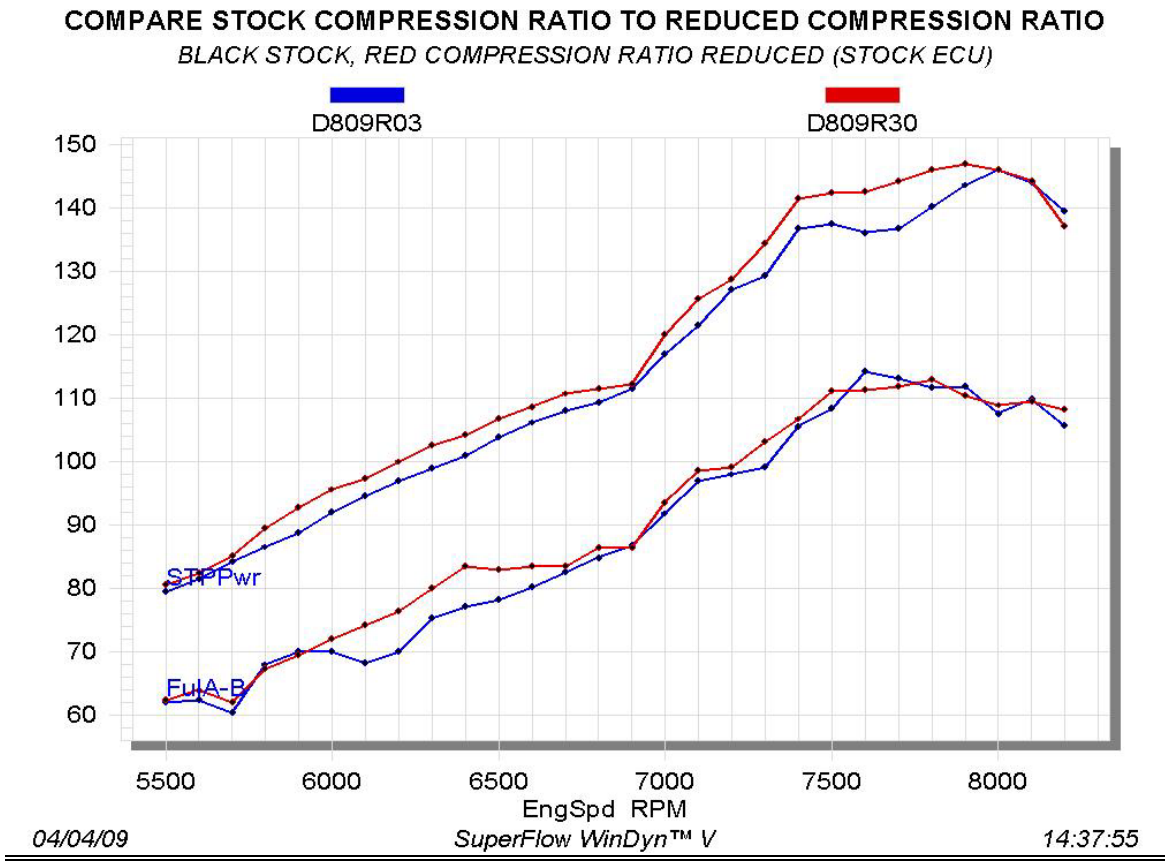
EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	78.0	81.7	60.2	0.74	17.2	11.87	156	59.1
5600	80.3	85.7	62.2	0.73	17.0	11.87	161	59.1
5700	81.8	88.8	65.9	0.75	16.8	11.25	162	59.0
5800	83.7	92.5	67.1	0.73	16.5	11.33	166	58.9
5900	83.6	93.9	68.6	0.73	16.2	11.18	167	58.8
6000	84.6	96.7	70.9	0.74	15.4	10.93	169	58.8
6100	85.2	99.0	71.9	0.73	14.8	10.89	171	58.7
6200	84.7	100.0	74.1	0.74	14.5	10.65	172	58.7
6300	85.7	102.8	77.7	0.76	13.7	10.37	176	58.5
6400	85.3	104.0	80.1	0.77	13.3	10.12	177	58.5
6500	85.3	105.6	84.3	0.80	13.1	9.72	179	58.6
6600	86.9	109.2	87.2	0.80	12.7	9.65	184	58.4
6700	86.1	109.8	90.6	0.83	12.7	9.39	186	58.4
6800	86.7	112.3	94.4	0.84	12.6	9.23	190	58.2
6900	86.7	113.9	93.1	0.82	12.6	9.40	191	58.2
7000	93.9	125.2	93.9	0.75	12.5	9.94	204	58.4
7100	96.0	129.7	98.8	0.77	12.4	9.74	210	58.3
7200	97.9	134.2	103.0	0.77	12.3	9.65	217	58.1
7300	101.4	140.9	107.1	0.76	12.0	9.68	226	57.9
7400	102.2	144.0	106.2	0.74	11.9	9.96	231	57.8
7500	103.0	147.1	110.8	0.76	11.3	9.87	239	57.6
7600	102.5	148.3	114.1	0.77	11.1	9.67	241	57.6
7700	102.5	150.3	112.1	0.75	11.1	9.91	243	57.6
7800	104.1	154.6	106.8	0.69	11.2	10.50	245	57.9
7900	105.2	158.3	104.9	0.67	11.6	10.83	248	57.8

8000	105.4	160.6	99.6	0.62	12.0	11.52	251	58.0
8100	105.7	163.1	97.5	0.60	12.8	11.90	253	58.0
8200	103.0	160.8	98.8	0.62	12.9	11.78	254	58.0
8300	98.9	156.3	99.7	0.64	12.9	11.61	253	58.0
8400	96.2	153.8	96.4	0.63	12.9	12.00	253	58.1

Next Casey removed his stock head and installed the Sean Ray modded stock head, with stock tight squish (Sean's preference) and larger top hat style bowl. Back to the stock pipe, very incredibly the lower compression head made more midrange and peak HP than the stock head with identical fuel flow. Could Sean's top hat design be creating better combustion chamber turbulence, which could cause peak combustion pressure to occur earlier increasing torque? Or is the ECU sensing light inaudible deto with the stock head and pulling some midrange timing that we failed to notice on the Digital Wrench? We compared stock head vs Sean's head with stock fuel flow and with ethanol wires connected. The results are similar. And then with fuel flow reduced even further (we made better power with no knock with leaner PCIII CWLC map).

With stock exhaust in place and stock ECU delivering fat fuel flow at WOT, here is reduced compression:

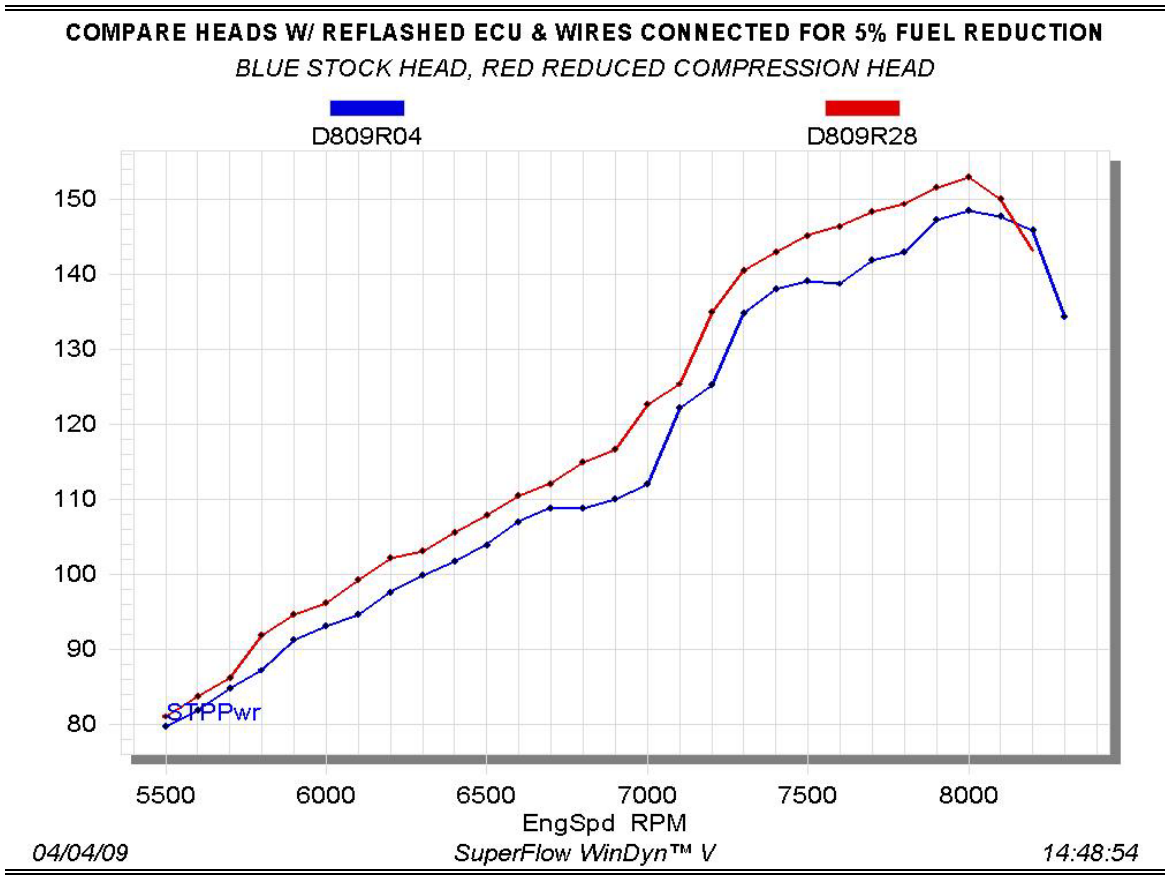
EngSpd	STPTrq	STPPwr	FulA-B	BSFA-B	LAMAF1	A/FA-B	Air 2	FuelP
RPM	Clb-ft	CHp	lb/hr	lb/hph	Ratio	Ratio	scfm	psig
5500	76.9	80.6	62.5	0.77	16.2	11.20	153	58.9
5600	77.3	82.5	64.0	0.77	16.1	11.02	154	58.9
5700	78.4	85.1	62.1	0.73	16.0	11.66	158	58.9
5800	81.1	89.6	67.3	0.75	15.5	10.95	161	58.8
5900	82.6	92.8	69.5	0.75	14.8	10.76	163	58.6
6000	83.7	95.6	72.0	0.75	14.2	10.62	167	58.6
6100	83.8	97.3	74.2	0.76	13.9	10.23	166	58.5
6200	84.7	100.0	76.4	0.76	13.5	10.14	169	58.5
6300	85.5	102.6	80.1	0.78	12.6	9.81	172	58.4
6400	85.6	104.3	83.6	0.80	12.3	9.47	173	58.4
6500	86.3	106.8	83.0	0.77	12.2	9.62	174	58.3
6600	86.5	108.7	83.6	0.77	12.1	9.76	178	58.3
6700	86.8	110.7	83.5	0.75	12.1	9.86	180	58.3
6800	86.1	111.5	86.4	0.77	12.0	9.79	185	58.3
6900	85.4	112.2	86.4	0.77	12.1	9.85	186	58.3
7000	90.1	120.1	93.6	0.78	12.2	9.64	197	58.0
7100	93.0	125.7	98.6	0.78	12.0	9.36	202	57.9
7200	94.0	128.8	99.1	0.77	11.9	9.48	205	57.9
7300	96.7	134.4	103.2	0.77	11.4	9.52	215	57.8
7400	100.4	141.5	106.7	0.75	11.3	9.69	226	57.7
7500	99.8	142.4	111.2	0.78	11.2	9.50	231	57.7
7600	98.6	142.6	111.3	0.78	10.8	9.55	232	57.7
7700	98.4	144.2	111.9	0.77	10.7	9.61	235	57.7
7800	98.4	146.1	113.0	0.77	10.6	9.65	238	57.5
7900	97.7	146.9	110.5	0.75	10.7	9.96	240	57.9
8000	95.9	146.0	108.9	0.74	10.7	10.13	241	57.6
8100	93.6	144.3	109.5	0.76	10.7	10.05	240	57.7
8200	87.9	137.2	108.2	0.79	10.7	10.08	238	57.7



Next, here is Casey's engine with the low compression head and ethanol wires plugged in to reduce fuel flow about 5%.

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	77.4	81.0	63.9	0.78	16.4	11.20	156	59.0
5600	78.5	83.8	63.9	0.76	16.2	11.43	159	58.8
5700	79.3	86.1	64.2	0.74	16.1	11.47	161	58.8
5800	83.2	91.9	67.4	0.73	15.4	11.24	165	58.7
5900	84.2	94.6	69.8	0.73	14.8	10.89	166	58.7
6000	84.2	96.2	74.0	0.76	14.5	10.35	167	58.6
6100	85.5	99.3	67.1	0.67	14.0	11.71	172	58.5
6200	86.6	102.2	76.0	0.74	13.3	10.46	174	58.4
6300	86.0	103.1	78.0	0.75	13.3	10.21	174	58.4
6400	86.7	105.6	78.3	0.74	13.0	10.25	175	58.4
6500	87.2	107.9	81.1	0.75	12.6	10.03	178	58.4
6600	87.9	110.4	84.4	0.76	12.4	9.82	181	58.4
6700	87.9	112.1	82.7	0.73	12.4	10.06	182	58.3
6800	88.8	114.9	83.3	0.72	12.3	10.25	186	58.3
6900	88.7	116.6	86.0	0.73	12.5	10.23	192	58.2
7000	92.0	122.6	88.8	0.72	12.7	10.35	201	58.1
7100	92.7	125.3	89.6	0.71	12.7	10.43	204	58.1
7200	98.5	135.0	100.4	0.74	12.4	9.86	216	57.9
7300	101.1	140.5	98.7	0.70	12.0	10.38	224	57.8

7400	101.4	142.9	99.9	0.69	11.9	10.43	228	57.5
7500	101.6	145.2	107.4	0.73	11.6	10.02	235	57.7
7600	101.2	146.4	104.0	0.71	11.3	10.41	236	57.7
7700	101.2	148.3	108.6	0.73	11.0	10.11	240	57.4
7800	100.5	149.3	107.3	0.71	11.0	10.28	241	57.4
7900	100.7	151.5	108.6	0.71	11.1	10.21	242	58.1
8000	100.4	152.9	104.3	0.68	11.3	10.68	243	57.8
8100	97.3	150.0	108.5	0.72	11.4	10.3	244	57.6
8200	91.7	143.2	107.0	0.74	11.4	10.37	242	57.6



Finally with the stock exhaust and low compression head, we installed the PCIII with the stock exhaust map that made 155 hp max with stock head and now it makes 157 HP and lots more midrange HP.

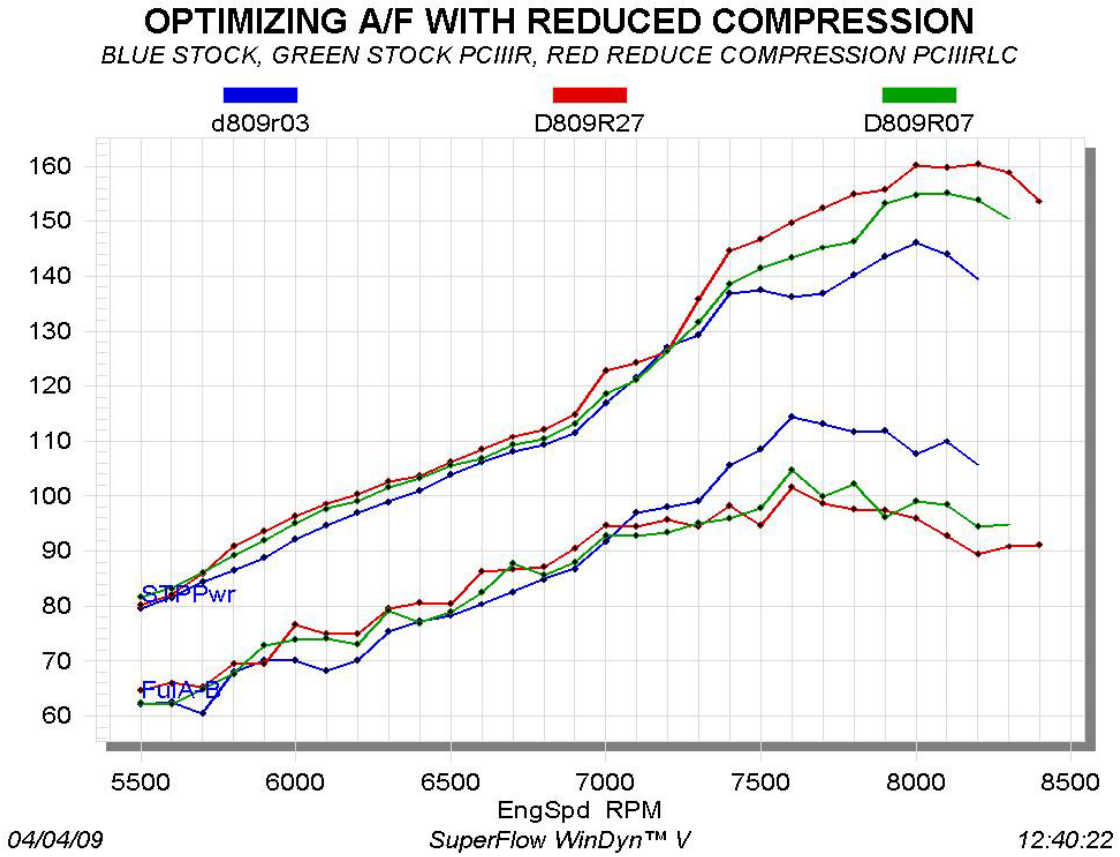
EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	74.8	78.3	64.4	0.81	16.6	11.15	157	58.6
5600	75.7	80.7	66.8	0.82	16.6	10.92	159	58.6
5700	78.9	85.6	65.1	0.75	16.3	11.48	163	58.5
5800	80.7	89.1	63.7	0.71	15.8	11.89	165	58.4
5900	81.5	91.5	70.9	0.77	15.4	10.78	167	58.3
6000	83.5	95.4	68.8	0.71	14.5	11.39	171	58.2
6100	83.7	97.2	76.4	0.78	14.1	10.40	173	58.2
6200	84.2	99.4	75.5	0.75	13.6	10.59	175	58.1

6300	84.5	101.3	78.5	0.76	13.1	10.25	176	58.3
6400	85.3	103.9	83.5	0.79	12.5	9.77	178	58.4
6500	84.3	104.3	83.6	0.79	12.4	9.79	179	58.2
6600	85.0	106.8	84.0	0.78	12.2	9.92	182	57.9
6700	85.4	109.0	90.0	0.81	12.1	9.44	186	57.8
6800	86.2	111.7	87.8	0.78	11.9	9.87	189	57.8
6900	87.3	114.7	90.7	0.78	11.9	9.79	194	58.1
7000	90.2	120.2	94.1	0.77	12.0	9.84	202	58.2
7100	91.5	123.7	97.0	0.77	12.0	9.93	210	57.7
7200	91.3	125.2	95.8	0.76	12.0	10.25	214	57.6
7300	93.9	130.6	93.2	0.71	12.2	10.91	222	57.6
7400	95.3	134.3	100.1	0.74	12.3	10.40	227	57.5
7500	95.7	136.6	99.6	0.72	12.2	10.53	229	57.4
7600	95.5	138.2	102.5	0.73	12.2	10.34	231	57.4
7700	97.0	142.2	106.1	0.74	11.7	10.20	236	57.3
7800	100.1	148.7	101.0	0.67	11.6	10.92	241	57.4
7900	100.9	151.8	98.1	0.64	11.8	11.39	244	57.4
8000	100.8	153.6	99.2	0.64	12.1	11.32	245	57.4
8100	101.4	156.5	100.5	0.63	12.3	11.28	248	57.3
8200	100.7	157.1	99.9	0.63	12.3	11.44	250	57.2
8300	98.8	156.1	101.6	0.64	12.3	11.34	252	57.2
8400	96.9	155.0	96.0	0.61	12.3	11.99	251	56.8
8500	92.1	149.1	96.2	0.64	12.3	11.82	248	56

The lower compression ratio and possibly improved turbulence allowed us to reduce fuel flow via PCIII even more to increase HP to over 160 in a flat plateau, and create CWLC map as follows:

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	FulA-B lb/hr	BSFA-B lb/hph	LAMAF1 Ratio	A/FA-B Ratio	Air 2 scfm	FuelP psig
5500	76.6	80.2	64.6	0.80	16.4	11.05	156	58.9
5600	77.0	82.1	66.0	0.80	16.2	10.92	157	58.9
5700	79.1	85.8	65.2	0.75	15.8	11.24	160	58.8
5800	82.3	90.9	69.4	0.76	15.4	10.89	165	58.7
5900	83.3	93.5	69.5	0.74	14.7	10.99	167	58.6
6000	84.4	96.4	76.7	0.79	14.2	10.05	168	58.5
6100	84.9	98.5	74.9	0.75	13.8	10.29	168	58.4
6200	85.0	100.4	75.0	0.74	13.5	10.41	170	58.4
6300	85.5	102.6	79.5	0.77	13.0	9.94	173	58.3
6400	85.1	103.8	80.6	0.77	12.7	9.92	175	58.3
6500	85.8	106.2	80.4	0.75	12.3	10.12	178	58.3
6600	86.3	108.5	86.2	0.79	12.1	9.60	181	58.2
6700	86.8	110.7	86.7	0.78	11.9	9.74	184	58.1
6800	86.6	112.1	87.1	0.77	11.8	9.80	186	58.1
6900	87.4	114.8	90.4	0.78	11.8	9.67	191	58.1
7000	92.2	122.8	94.6	0.76	12.0	9.77	202	58.0
7100	91.9	124.2	94.5	0.76	12.0	9.84	203	58.0
7200	92.2	126.3	95.7	0.75	12.0	9.75	204	58.0
7300	97.7	135.8	94.5	0.69	12.0	10.51	217	58.0

7400	102.6	144.5	98.2	0.67	12.2	10.58	227	57.9
7500	102.7	146.6	94.7	0.64	12.2	11.12	230	57.9
7600	103.5	149.7	101.6	0.67	12.0	10.66	236	57.8
7700	103.9	152.3	98.6	0.64	11.8	11.08	239	57.8
7800	104.3	154.9	97.6	0.63	12.0	11.34	242	57.9
7900	103.6	155.8	97.4	0.62	12.0	11.39	242	57.9
8000	105.2	160.2	95.9	0.59	12.4	11.72	246	58.0
8100	103.6	159.7	92.7	0.58	12.7	12.08	245	58.1
8200	102.6	160.3	89.4	0.55	12.9	12.47	244	58.1
8300	100.5	158.8	90.8	0.57	12.9	12.26	243	58.1
8400	96.0	153.5	91.0	0.59	13.0	12.16	242	58.1



Next we removed the remachined stock head and installed a beautifully CNC machined BMP billet head with similarly lower compression 41cc domes on the stock cylinder. The difference in heads was the BMP 41 domes have about .010" thicker squish clearance and slightly smaller chambers than Sean's recut stock head. The result was slightly less HP, but for those who like to run added squish clearance to cool piston domes this is appropriate. Plus BMP claims improved cooling of combustion chambers vs. stock due to improved cooling circulation control.

The last part of the dyno session was to install a monoblock cylinder sent to Casey by Bikeman Performance. This cylinder had increased transfer port timing and widened and

slightly raised main exhaust port. We installed the BMP billet head with this cylinder and began to tweak and tune. Starting with the stock pipe we maxed out at just over 160 before deto caused timing to be pulled by the still very protective ECU. We switched to the BMP single with internal stinger and it was similar—flatlining at 160 and timing would be yanked. The BMP can was not freeflowing enough to add airflow and reduce knock with our pump gas and we were still flatlining at 160. We installed the DynoPort single pipe with no internal stinger and with stock muffler 160 again.

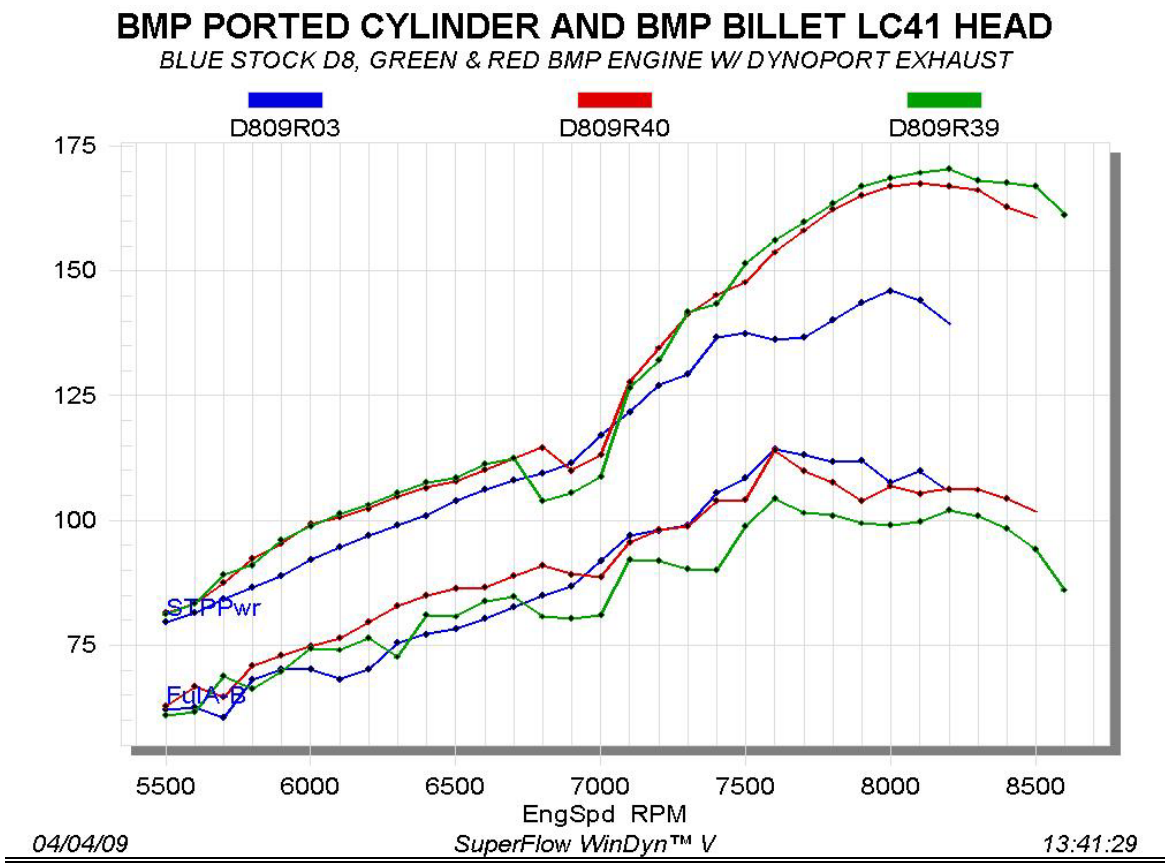
Then Sean's dad Rex suggested that we try the DynoPort muffler and that provided us with a huge bonus of added airflow and HP climbed to the moon. This surely was a combo of added airflow from the reduced backpressure, and the reduction of active radicals trapped in the hot combustion chambers, creating deto that caused the ECU to dump timing/ add fuel to reduce charged temp/ HP.

Here is the BMP ported cylinder, BMP head with knock-free but very lean fuel flow for max HP for 20 seconds at WOT on 93 octane (the Bosch 02 sensor was going bad).

EngSpd	STPTrq	STPPwr	FulA-B	BSFA-B	LAMAF1	A/FA-B	Air 2	FuelP
RPM	Clb-ft	CHp	Lb/hr	lb/hph	Ratio	Ratio	scfm	psig
5500	77.5	81.1	60.9	0.75	19.0	11.82	157	59.0
5600	78.2	83.3	61.6	0.74	19.0	11.88	160	59.3
5700	82.1	89.1	68.7	0.77	19.0	11.00	165	59.0
5800	82.4	91.0	66.3	0.73	18.9	11.40	165	58.9
5900	85.5	96.1	69.7	0.72	18.9	11.12	169	58.7
6000	86.5	98.9	74.3	0.75	19.0	10.51	171	58.8
6100	87.2	101.3	74.0	0.73	19.0	10.71	173	58.7
6200	87.3	103.1	76.5	0.74	19.0	10.44	174	58.6
6300	88.0	105.6	72.6	0.69	19.0	11.05	175	58.4
6400	88.2	107.5	81.1	0.75	19.0	10.03	178	58.4
6500	87.6	108.4	80.7	0.74	19.0	10.09	178	58.4
6600	88.5	111.2	83.8	0.75	19.0	9.89	181	58.4
6700	88.1	112.4	84.8	0.75	19.0	9.89	183	58.3
6800	80.2	103.9	80.7	0.78	19.0	9.98	176	58.4
6900	80.2	105.4	80.4	0.76	19.0	10.07	177	58.4
7000	81.6	108.8	81.0	0.74	19.0	10.22	181	58.4
7100	93.5	126.4	92.1	0.73	19.0	10.27	207	58.4
7200	96.3	132.0	91.9	0.70	19.0	10.71	215	58.1
7300	102.0	141.8	90.3	0.64	19.0	11.52	227	58.3
7400	101.8	143.5	90.1	0.63	19.0	11.60	228	58.2
7500	106.1	151.6	98.9	0.65	19.0	11.02	238	57.8
7600	107.8	156.0	104.3	0.67	19.0	10.78	246	57.8
7700	108.9	159.7	101.5	0.64	19.0	11.28	250	57.9
7800	110.1	163.4	101.0	0.62	19.0	11.43	252	58.0
7900	111.0	166.9	99.4	0.60	19.0	11.84	257	58.0
8000	110.7	168.6	99.1	0.59	19.0	11.91	258	57.9
8100	110.0	169.6	99.8	0.59	19.0	12.00	262	58.0
8200	109.1	170.3	102.0	0.60	18.9	11.84	264	58.0
8300	106.4	168.1	100.8	0.60	18.9	11.99	264	58.0
8400	104.8	167.6	98.3	0.59	19.0	12.24	263	58.0
8500	103.2	167.0	94.2	0.57	19.0	12.74	262	58.1
8600	98.5	161.3	86.0	0.54	19.0	13.90	261	58.3

Finally, Casey and Wayne created this PCIII map that fattened and flattened the fuel curve nicely, and still maintained excellent HP on 93 octane. This is the way I would ride this sled—but knowing Casey he's probably got the 170hp map loaded, with a touch more fuel at 8500 and 8750.

EngSpd	STPTrq	STPPwr	FulA-B	BSFA-B	LAMAF1	A/FA-B	Air 2	FuelP
RPM	Clb-ft	CHp	lb/hr	lb/hph	Ratio	Ratio	scfm	Psig
5500	77.9	81.6	62.7	0.76	16.8	11.58	159	59.1
5600	78.1	83.3	66.6	0.80	16.8	11.01	160	59.3
5700	80.7	87.5	64.7	0.74	16.5	11.51	163	59.2
5800	83.7	92.4	70.9	0.76	15.8	10.93	169	59.0
5900	84.9	95.4	72.9	0.76	15.4	10.74	171	58.9
6000	86.8	99.2	74.7	0.75	14.5	10.58	173	58.8
6100	86.6	100.6	76.5	0.76	14.1	10.35	173	58.8
6200	86.7	102.4	79.6	0.77	13.9	9.96	173	58.7
6300	87.3	104.8	82.9	0.79	13.5	9.66	175	58.7
6400	87.4	106.5	84.9	0.79	13.2	9.54	177	58.6
6500	87.1	107.8	86.4	0.80	12.9	9.46	178	58.5
6600	87.6	110.1	86.5	0.78	12.8	9.61	181	58.5
6700	88.1	112.4	88.9	0.79	12.4	9.65	187	58.4
6800	88.5	114.6	91.0	0.79	12.3	9.54	190	58.4
6900	83.7	110.0	89.2	0.81	12.2	9.61	187	58.5
7000	84.8	113.1	88.7	0.78	12.2	9.80	190	58.5
7100	94.5	127.8	95.6	0.75	12.3	9.97	208	57.9
7200	98.1	134.5	98.1	0.73	12.2	10.13	217	58.1
7300	101.7	141.4	98.8	0.70	12.1	10.51	227	58.2
7400	103.0	145.1	103.8	0.71	12.1	10.21	231	58.0
7500	103.4	147.7	104.2	0.71	12.1	10.33	235	58.0
7600	106.2	153.7	114.0	0.74	11.5	9.98	248	57.8
7700	107.8	158.1	109.9	0.69	11.4	10.46	251	57.9
7800	109.3	162.4	107.6	0.66	11.7	10.81	254	57.9
7900	109.7	165.1	103.8	0.63	11.8	11.33	257	58.0
8000	109.7	167.0	106.8	0.64	12.3	11.17	261	57.9
8100	108.6	167.5	105.4	0.63	12.4	11.44	263	57.9
8200	106.9	167.0	106.3	0.64	12.5	11.34	263	57.9
8300	105.1	166.2	106.1	0.64	12.7	11.37	263	58.0
8400	101.7	162.7	104.4	0.64	12.7	11.50	262	58.1
8500	99.4	160.8	101.8	0.63	12.8	11.71	260	58.2



EPILOGUE

I should note that midrange part throttle testing we did during warmups showed there were no obvious excessively lean areas like the 16/1's that plagued the original stock map. Nor did it have that Stoutner midrange fat burble that required scarily big negatives to clean up. But riders with higher flowing exhaust or porting might opt to add fuel in the midrange map of PCIIIs or Boondockers to be safe. Riders w/ wideband A/F ratio meters haven't brought anything to our attention, but are experimenting. It's likely that as riders begin using their PCIIIs on the reflashed sleds, midrange map changes will be happening.

After I shared the dyno results with Erich at BMP, he shipped several internal stingerless iterations of the stock pipe to test with the BMP can muffler next time we do the ported engine, which will probably be after Polaris finalizes the Dragon 800 situation.

On post dyno teardown Casey discovered some smearing of both pistons at 10 and 2 o'clock right in the vicinity of the exhaust port dividers. These pistons were perfect for 1500 miles on the lakes/ trails with PCIII CCW map, and were perfect when Casey dropped the BMP cylinder in place on the dyno. We made perhaps 20 dyno tests with those cylinders and now the pistons are showing wear in the area of the exhaust port dividers.

Casey reminded me that these pistons were oversize—originally installed in Casey's stock engine after I had goofed and partially squeeked Casey's engine, during an earlier dyno session running too lean with deto protection disconnected. I thought it was ten clicks and abort, but it should have been five clicks and abort. Casey installed these two slightly oversize new pistons (.005" larger diameter than typical) that had come from Polaris R&D. Normal D8 engines typically measure at .012" to .014" piston to wall clearance, but this one was closer to .008" about like my rattling 427 Ford engine in 1967. So those slightly narrower exhaust port bridges must have grown into the bores enough to lightly rub the pistons.

So it was likely the combo of larger prototype piston diameter with ported cylinders that created the elimination of the clearance that allows a hot lubed piston to slide freely up and down. Plus, note that on the 170hp lean run, fuel flow declined to leaner than 14/1 at 8600, which surely didn't help matters. D8 riders who opt for this porting, with factory stock pistons should be fine with safe fueling (we have saved that last 167 HP PCIII map). It's all about cylinder and piston cooling, and Polaris recognizes that they need this large piston to wall clearance to try to be squeek-free on the current D8. I conferred with Kevin Cameron about this exhaust port bridge issue, and he offered this regarding extreme duty roadracing twostrokes:

"Yamaha had to develop a special honing process to relieve the region you speak of [on their racing motorcycle two strokes], and all the successful engines with exhaust devices have had plenty of coolant around those areas. Honda, who always used those MX-style T-ports with center divider, had to lower the surface on the divider by .003" and also chamfer the edges of the ring grooves to remove material that otherwise would be forged onto the ring(s) by hard contact with the divider. Eventually Yamaha, too, adopted the T-port and gave up its main port plus sub-port scheme. As long-dead GP competitor Dave Simmonds once put it, "Those dividers either bow in or bow out. Usually in."