EFILive Virtual VE Tutorial

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(V8 edition)

First published
11 November 2020

Revised
16 November 2020

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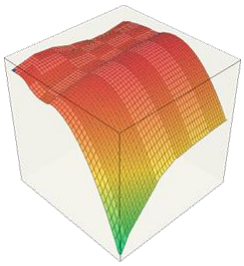


Prerequisites

Intended Audience

EFILive tuners.

Computer Knowledge

It is expected that readers have a basic understanding of:

- The Windows operating system;
- Starting and using Windows applications.

Introduction

With the release of the E38 controller, GM removed the static VE table that has been the mainstay of speed density tuning for many years. The trusty VE table was replaced with an equation and a set of 450 coefficients that generate VE values ***on the fly***.

Mathematically, the equation is known as 2nd order, non-linear, multivariate polynomial, and the 450 coefficients must be altered in a mathematically precise manner to generate desired VE values. Until recently, the computational demands of calculating VE-values on the fly had been prohibitive. Now that GM is using the Power PC processor with its high speed, floating point capabilities, computing the VE values on the fly is possible. EFILive has named these computed VE values, ***Virtual VE*** values.

The good news is, virtual VE tables have no built-in upper limit for the Manifold Absolute Pressure (MAP) axis.

By comparison, Static VE tables with their one bar MAP limit, caused problems for tuners who were tuning two and three bar MAP pressures for super and turbo charged applications. With Static VE tables, EFILive cleverly got around the 1-bar limitation by developing and releasing (free) custom operating systems that extended the Static VE tables up to 285kPa, almost 3 bar.

Initially most tuners were optimistic that, with no VE table, the stock operating system could be easily calibrated for 2 and 3 bar applications. That optimism soon turned to confusion and disappointment because, without a PhD in Mathematics, it was next to impossible to know exactly how to modify the 450 coefficients to generate the required Virtual VE values.

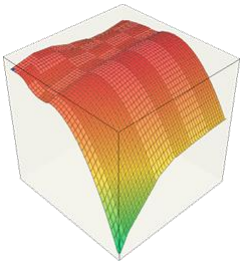
EFILive and Matt Rouse (in association with Thunder Racing) have designed and implemented the ***EFILive Virtual VE Table,*** which puts speed density tuning back into the hands of the tuners.

EFILive's Virtual VE Table technology means you never have to calculate, nor modify the coefficients again. EFILive converts the coefficients into three Virtual VE Tables (1-bar, 2-bar and 3-bar). You can modify the Virtual VE table that best suits your application. Then EFILive converts the modified Virtual VE table back into the appropriate coefficient values. You can even watch the coefficients being updated as the VE table is changed. The coefficients->Virtual VE Table->coefficients conversion cycle can be repeated as many times as required.

This tutorial does not attempt to explain the mathematical computations that are required to convert between the coefficients and the Virtual VE Table. Although it

may be “bread and butter” to a mathematician, for us mere mortals, it might as well be black magic.

The EFILive Virtual VE Table is available free to all EFILive customers as part of EFILive’s commitment to providing free software upgrades.

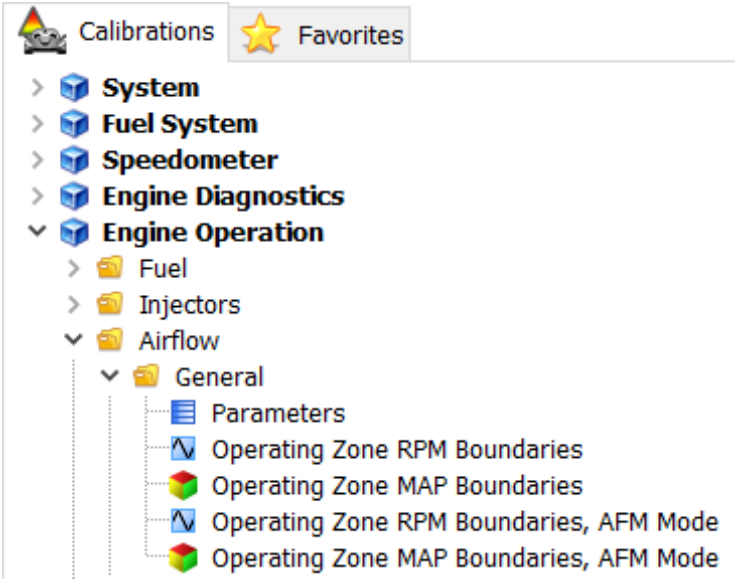


The Virtual VE Table

Background

A Virtual VE Table behaves almost identically to the static VE Tables in the LS1 and E40 style controllers. You can apply all the normal operations to a Virtual VE Table including but not limited to; manual editing, smoothing and undo/redo operations. See the *Undo/Redo Considerations* section for differences in the undo/redo procedures.

The underlying data that is used to build the Virtual VE Table is taken from the appropriate coefficients table and the Operating Zone Boundary tables.



There are four boundary tables, one for each of the following combinations:

1. RPM boundaries, non-AFM mode
2. MAP boundaries, non-AFM mode
3. RPM boundaries, AFM mode
4. MAP boundaries, AFM mode

If you need to modify the boundary tables, we recommend doing so BEFORE editing the Virtual VE Tables. Modifying the boundary tables mid-way through an editing cycle will produce confusing results.

There are four coefficients tables, one for each of the following operational combinations:

1. Intake Manifold Tuning Valve Open, non-AFM mode

2. Intake Manifold Tuning Valve Closed, non-AFM mode
3. Intake Manifold Tuning Valve Open, AFM mode
4. Intake Manifold Tuning Valve Closed, AFM mode

Each of the four coefficients tables has three Virtual VE Tables:

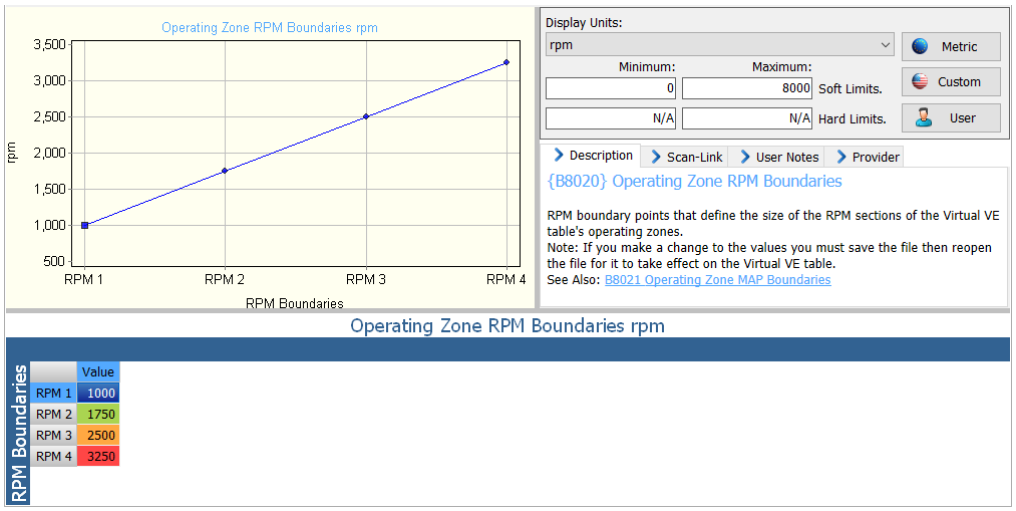
1. Naturally Aspirated (or 1-Bar)
2. 2-Bar Forced Induction
3. 3-Bar Forced induction

You MUST use the appropriate Virtual VE Table for your intended application. No check is made in the software to ensure that you do, it is up to you to choose the correct table.

If you do use a smaller table than appropriate, the coefficients will only be calculated for the maximum MAP of the Virtual VE Table that you are using. All virtual VE Table values for higher MAP values will be discarded.

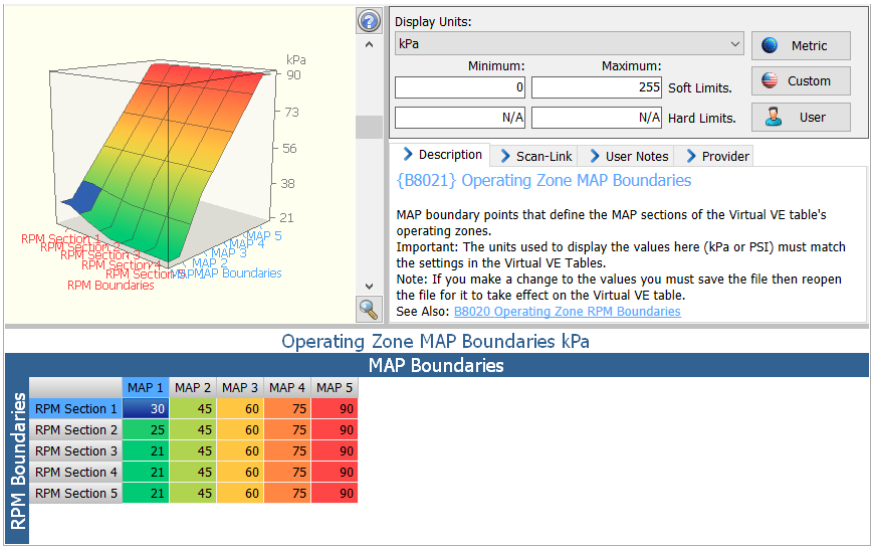
Zones and Boundaries

Each Virtual VE Table is divided into 30 zones, defined by MAP and RPM breakpoints. The breakpoints are defined in the Zone Boundary Tables.



There are 5 RPM sections, defined by 4 RPM boundary points. In the example above:

- Section 1 is 0 to 999rpm
- Section 2 is 1000 to 1749rpm
- Section 3 is 1750 to 2499rpm
- Section 4 is 2500 to 3249rpm
- Section 5 is 3250 and above



There are 6 MAP sections defined for each of the 5 RPM sections, giving a total of 5x6=30 zones. In the example above for the first RPM section:

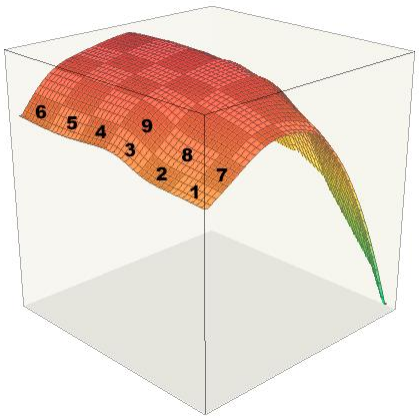
- Section 1 is 0 to 29 kPa
- Section 2 is 30 to 44 kPa
- Section 3 is 45 to 59 kPa
- Section 4 is 60 to 74 kPa

- Section 5 is 75 to 90 kPa
- Section 6 is 90 and above

You may specify different MAP boundaries for each of the 5 RPM sections.

To function correctly with EFILive's Virtual VE technology all zones must contain at least three rows and at least three columns of cells

The EFILive software highlights the zones using a subtle shading of the table and 3D colour schemes. The shading produces a checkerboard pattern that highlights the zone boundaries.



Zones are numbered from 1 to 30 from right to left and from top to bottom of the Virtual VE Table data.

Virtual VE Table, Naturally Aspirated

kPa

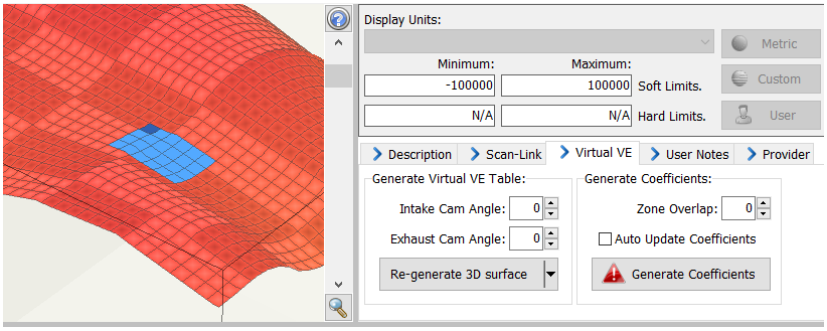
rpm	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
400	2007	2038	2069	2100	2131	2162	2193	2224	2260	2250	2240	2230	2219	2209	2199	2196	2156	2115	2075	2035	1995	1954	1914	1927	1904	1881
600	2008	2038	2067	2097	2126	2156	2186	2215	2254	2243	2232	2222	2211	2201	2190	2171	2132	2094	2055	2017	1979	1940	1902	1909	1894	1879
800	2017	2045	2074	2102	2130	2158	2186	2214	2251	2240	2229	2218	2207	2197	2186	2158	2121	2085	2048	2012	1975	1938	1902	1906	1899	1892
1000	2020	2052	2085	2117	2149	2194	2198	2201	2204	2207	2210	2213	2216	2219	2222	2168	2136	2105	2074	2042	2011	1980	1948	1953	1949	1946
1200	1996	2030	[illegible]	2099	2133	2164	2171	2177	2183	2189	2195	2202	2208	2214	2220	2148	2123	2097	2071	2046	2021	1995	1970	1974	1972	[illegible]
1400	1936	1972	2008	2044	2081	2107	2116	2125	2134	2143	2153	2162	2171	2181	2190	2125	2106	2086	2066	2047	2027	2007	1988	1994	1991	[illegible]
1600	1840	1878	1917	1955	1993	2021	2033	2045	2058	2070	2082	2095	2107	2119	2132	2098	2084	2071	2057	2043	2029	2015	2001	2011	2018	2025
1800	1697	1739	1781	1853	1872	1891	1910	1929	1948	1967	1986	2005	2024	2043	2062	2075	2063	2051	2038	2026	2014	2002	1990	2036	2044	2053
2000	161[illegible]	16[illegible]	1700	1761	1783	1804	1826	1848	[illegible]	[illegible]	1912	1934	1956	1977	1999	2045	2038	2030	[illegible]	[illegible]	2008	2001	1994	2043	2052	[illegible]
2200	1544	[illegible]	1641	1700	1724	1749	1773	1797	[illegible]	[illegible]	1870	1894	1918	1942	1966	2018	2016	2013	[illegible]	[illegible]	2005	2003	2000	2044	2054	2064
2400	1499	1551	1603	1670	1697	1723	1750	1777	1804	1831	1857	1884	1911	1938	1965	1994	1996	1999	2001	2003	2005	2007	2009	2037	2048	2059
2600	1477	1544	1612	1664	1691	1719	1747	1774	1802	1830	1858	1885	1913	1941	1968	1954	1960	1967	1973	1979	1986	1992	1999	2005	2016	2027
2800	148[illegible]	[illegible]	1618	1673	1701	1729	1756	1784	[illegible]	[illegible]	1867	1895	1923	1951	1978	1954	1962	1970	[illegible]	[illegible]	1995	2003	2011	2015	2022	2029
3000	1497	1562	1627	1691	1719	1747	1774	1802	[illegible]	[illegible]	1886	1913	1941	1969	1997	1967	1977	1987	1997	2007	2017	2027	2037	2040	2052	2063
3200	1508	1572	1636	1717	1745	1773	1801	1829	1857	1884	1912	1940	1968	1996	2024	1993	2005	2016	2028	2040	2052	2064	2076	2081	2093	2105
3400	1604	1651	1698	1796	1820	1844	1869	1893	1917	1941	1966	1990	2014	2039	2063	2109	2118	2126	2135	2143	2152	2161	2169	2186	2198	2209
3600	159[illegible]	[illegible]	1707	1795	1825	1855	1885	1915	[illegible]	[illegible]	2004	2034	2064	2093	2123	2154	2165	2176	[illegible]	[illegible]	2210	2221	2232	2241	225[illegible]	[illegible]
3800	156[illegible]	[illegible]	1696	1778	1813	1848	1883	1919	[illegible]	[illegible]	2025	2060	2095	2131	2166	2183	2197	2210	[illegible]	2238	2252	2266	2279	2281	229[illegible]	[illegible]
4000	1514	1590	1666	1742	1783	1824	1865	1905	1946	1987	2028	2069	2110	2150	2191	2196	2213	2229	2246	2262	2278	2295	2311	2306	2318	2331
4200	1445	1531	1617	1689	1735	1782	1828	1874	1921	1967	2014	2060	2106	2153	2199	2194	2213	2232	2251	2270	2289	2308	2327	2316	2328	2341

Not all VE values can be represented within a single zone. Sharp peaks and valleys (other than at zone boundaries) cannot be mathematically modelled by the coefficients and polynomial. They will be reduced to smooth lumps and/or hollows during the Virtual VE Table to coefficients conversion.

Editing the Virtual VE Table

This (contrived) example shows you how to edit the Virtual VE Table, update the coefficients and refresh the Virtual VE Table using the newly updated coefficients. It will also show the importance of boundary edge alignment.

The example shows a trivial adjustment to a rectangular section of cells in the Virtual VE table. The 3D surface plot has been zoomed and panned to display greater detail.



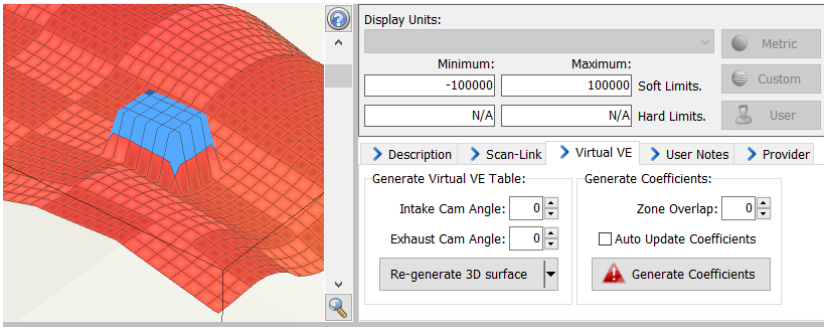
Virtual VE Table, Natural

kPa

	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47
400	2007	2038	2069	2100	2131	2162	2193	2224	2260	2250	2240	2230	2219	2209	2199	2196	2156
600	2008	2038	2067	2097	2126	2156	2186	2215	2254	2243	2232	2222	2211	2201	2190	2171	2132
800	2017	2045	2074	2102	2130	2158	2186	2214	2251	2240	2229	2218	2207	2197	2186	2158	2121
1000	2020	2052	2085	2117	2149	2194	2198	2201	2204	2207	2210	2213	2216	2219	2222	2168	2136
1200	1996	2030	2064	2099	2133	2164	2171	2177	2183	2189	2195	2202	2208	2214	2220	2148	2123
1400	1936	1972	2008	2044	2081	2107	2116	2125	2134	2144	2153	2162	2171	2181	2190	2125	2106
1600	1840	1878	1917	1955	1993	2021	2033	2045	2058	2070	2082	2095	2107	2119	2132	2098	2084
1800	1697	1739	1781	1853	1872	1891	1910	1929	1948	1967	1986	2005	2024	2043	2062	2075	2063
2000	1610	1655	1700	1761	1783	1804	1826	1848	1869	1891	1912	1934	1956	1977	1999	2045	2038
2200	1544	1592	1641	1700	1724	1749	1773	1797	1821	1845	1870	1894	1918	1942	1966	2018	2016
2400	1499	1551	1603	1670	1697	1723	1750	1777	1804	1831	1857	1884	1911	1938	1965	1994	1996
2600	1477	1544	1612	1664	1691	1719	1747	1774	1802	1830	1858	1885	1913	1941	1968	1954	1960

Select the cells shown in the image. The selection includes RPM 2000 to 2600 inclusive and MAP 37 to 47 inclusive. The Zone of the top left corner of the selected cells is 14.

Enter 2500 into the adjustment text box on the tool bar and click the # icon.



Virtual VE Table, Natural

kPa

	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47
400	2007	2038	2069	2100	2131	2162	2193	2224	2260	2250	2240	2230	2219	2209	2199	2196	2156
600	2008	2038	2067	2097	2126	2156	2186	2215	2254	2243	2232	2222	2211	2201	2190	2171	2132
800	2017	2045	2074	2102	2130	2158	2186	2214	2251	2240	2229	2218	2207	2197	2186	2158	2121
1000	2020	2052	2085	2117	2149	2194	2198	2201	2204	2207	2210	2213	2216	2219	2222	2168	2136
1200	1996	2030	2064	2099	2133	2164	2171	2177	2183	2189	2195	2202	2208	2214	2220	2148	2123
1400	1936	1972	2008	2044	2081	2107	2116	2125	2134	2144	2153	2162	2171	2181	2190	2125	2106
1600	1840	1878	1917	1955	1993	2021	2033	2045	2058	2070	2082	2095	2107	2119	2132	2098	2084
1800	1697	1739	1781	1853	1872	1891	1910	1929	1948	1967	1986	2005	2024	2043	2062	2075	2063
2000	1610	1655	1700	1761	1783	1804	1826	1848	1869	1891	1912	2500	2500	2500	2500	2500	2500
2200	1544	1592	1641	1700	1724	1749	1773	1797	1821	1845	1870	2500	2500	2500	2500	2500	2500
2400	1499	1551	1603	1670	1697	1723	1750	1777	1804	1831	1857	2500	2500	2500	2500	2500	2500
2600	1477	1544	1612	1664	1691	1719	1747	1774	1802	1830	1858	2500	2500	2500	2500	2500	2500

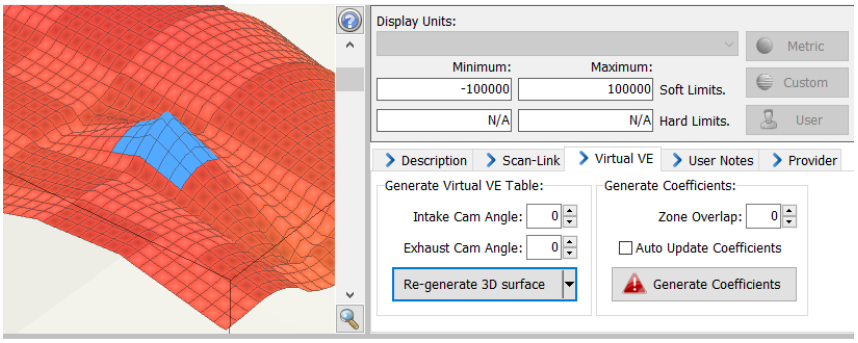
A red exclamation mark appears next to the ***[Generate Coefficients]*** button. That means the Virtual VE Table has been modified but the coefficients have not yet been updated. You may select the ***Auto Update Coefficients*** checkbox and EFILive will automatically update the coefficients each time a change is made to the Virtual VE Table.

Make sure the ***Zone Overlap*** value is set to 0, then click on the ***[Generate Coefficients]*** button. The red exclamation mark will disappear and the corresponding zones that have been modified in the Virtual VE Table will be updated in the coefficients table. In this case, zones 14, 15, 20 and 21. The modified cells are shown with blue flashes in their corners.

Normal VE Coefficients

Operating Zone #	[MAP Base]	[MAP_RPM]	[MAP Intake]	[MAP Exhst]	[RPM Sq]	[RPM Intake]	[RPM Exhst]	[RPM Base]	[Intake Sq]	[Intake/Exhst]	[Intake Base]	[Exhaust Sq]	[Exhaust Base]	[VE Sum]	[MAP Sq]
1	16.960022	-0.003607	0.252230	0.000000	0.000101	0.007792	0.000000	-0.041418	-0.385764	0.000000	-20.268269	0.000000	0.000000	1774.517700	0.000000
2	-4.843760	-0.000716	0.288049	0.000000	0.000050	-0.020924	0.000000	-0.061260	-0.352918	0.000000	8.157284	0.000000	0.000000	2435.959229	0.000000
3	-21.948589	0.004539	-0.011787	0.000000	0.000157	-0.035126	0.000000	-0.486873	-0.242004	0.000000	31.455978	0.000000	0.000000	3271.680420	0.000000
4	-19.456593	0.019901	-0.013637	0.000000	0.000179	-0.014676	0.000000	-1.481332	-0.182682	0.000000	6.689052	0.000000	0.000000	3192.069336	0.000000
5	-1.146412	0.002565	-0.002170	0.000000	-0.000348	0.005643	0.000000	0.749448	-0.176437	0.000000	-16.549448	0.000000	0.000000	1480.766602	0.000000
6	16.332575	-0.015845	-0.095693	0.000000	-0.000415	0.003399	0.000000	2.508002	-0.183517	0.000000	-5.254735	0.000000	0.000000	-112.850067	0.000000
7	11.380553	0.004819	0.116811	0.000000	-0.000446	0.006625	0.000000	0.788912	-0.400280	0.000000	-17.222486	0.000000	0.000000	1434.149048	0.000000
8	-6.199858	0.007740	0.163481	0.000000	-0.000350	0.002433	0.000000	0.426859	-0.271775	0.000000	-17.722757	0.000000	0.000000	2079.219971	0.000000
9	-30.240898	0.014575	0.062600	0.000000	-0.000048	0.001337	0.000000	-0.647801	-0.195090	0.000000	-15.429175	0.000000	0.000000	3568.182129	0.000000
10	-10.569787	0.008779	0.038150	0.000000	-0.000025	0.001763	0.000000	-0.372081	-0.168240	0.000000	-15.999197	0.000000	0.000000	2459.465576	0.000000
11	-0.467906	0.001614	0.004686	0.000000	-0.000140	0.001438	0.000000	0.451529	-0.155278	0.000000	-13.684005	0.000000	0.000000	1568.355469	0.000000
12	8.030450	-0.005740	-0.145407	0.000000	-0.000087	0.001251	0.000000	0.964134	-0.159218	0.000000	0.273328	0.000000	0.000000	895.081116	0.000000
13	7.187981	0.007744	-0.022745	0.000000	0.000266	0.006064	0.000000	-1.560491	-0.427399	0.000000	-13.463055	0.000000	0.000000	3328.063721	0.000000
14	-81.124229	0.055113	0.119782	0.000000	-0.000718	0.003869	0.000000	1.311270	-0.278462	0.000000	-19.008610	0.000000	0.000000	1351.706177	0.000000
15	62.097687	-0.043052	0.058763	0.000000	-0.000648	0.002603	0.000000	5.101040	-0.203248	0.000000	-17.378283	0.000000	0.000000	-4244.712402	0.000000
16	1.047001	0.001781	0.014087	0.000000	-0.000087	0.001181	0.000000	0.259658	-0.189845	0.000000	-12.427613	0.000000	0.000000	1590.649414	0.000000
17	-0.714490	0.001471	0.002982	0.000000	-0.000095	0.000722	0.000000	0.311085	-0.179877	0.000000	-11.198920	0.000000	0.000000	1702.861206	0.000000
18	-6.750374	0.002565	-0.054663	0.000000	-0.000109	0.001349	0.000000	0.268357	-0.181701	0.000000	-7.255093	0.000000	0.000000	2197.045166	0.000000
19	40.684105	-0.002708	-0.144758	0.000000	0.000017	0.007612	0.000000	-0.007919	-0.534408	0.000000	-10.741093	0.000000	0.000000	875.273865	0.000000
20	158.809479	-0.047249	0.108953	0.000000	0.001298	0.006000	0.000000	-6.213382	-0.326191	0.000000	-22.060875	0.000000	0.000000	8225.694336	0.000000
21	-187.163101	0.062765	-0.001148	0.000000	0.001009	0.003819	0.000000	-9.221511	-0.225108	0.000000	-16.259720	0.000000	0.000000	20508.537109	0.000000
22	3.738750	0.000720	-0.025204	0.000000	0.000196	0.003843	0.000000	-1.054577	-0.199621	0.000000	-16.197487	0.000000	0.000000	3079.471924	0.000000
23	4.852372	-0.000765	0.005507	0.000000	0.000188	0.003918	0.000000	-0.900268	-0.194306	0.000000	-18.968954	0.000000	0.000000	2935.717773	0.000000
24	2.913789	-0.001330	-0.006196	0.000000	0.000171	0.003550	0.000000	-0.753853	-0.192631	0.000000	-16.992222	0.000000	0.000000	2978.089600	0.000000
25	-59.094757	0.024293	-0.531074	0.000000	-0.000239	0.022724	0.000000	1.251062	-0.754927	0.000000	-45.702038	0.000000	0.000000	-242.332184	0.000000
26	-34.809891	0.013807	0.005892	0.000000	-0.000219	0.015375	0.000000	1.243987	-0.401700	0.000000	-47.547745	0.000000	0.000000	-152.185608	0.000000
27	-17.758745	0.006488	-0.018107	0.000000	-0.000195	0.012517	0.000000	1.293894	-0.282247	0.000000	-42.044136	0.000000	0.000000	-233.641220	0.000000
28	3.204474	0.000744	0.034504	0.000000	-0.000189	0.012188	0.000000	1.551270	-0.241356	0.000000	-45.812000	0.000000	0.000000	-1255.012329	0.000000
29	-0.728021	0.000716	0.007302	0.000000	-0.000186	0.011986	0.000000	1.514806	-0.213960	0.000000	-44.251926	0.000000	0.000000	-864.471619	0.000000
30	-5.185100	0.000860	-0.005061	0.000000	-0.000181	0.011490	0.000000	1.451816	-0.198756	0.000000	-42.090981	0.000000	0.000000	-338.044464	0.000000

Next, to see how closely the newly calculated coefficients model the requested change, click on the Virtual VE Table's ***[Re-generate 3D Surface]*** button.



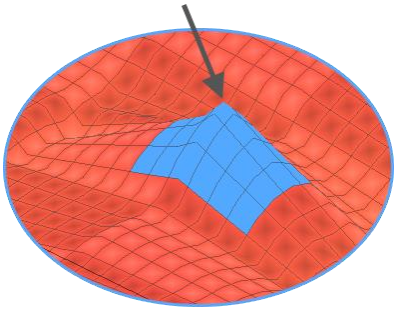
Virtual VE Table, Natural

kPa

	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47
400	2007	2038	2069	2100	2131	2162	2193	2224	2260	2250	2240	2230	2219	2209	2199	2196	2156
600	2008	2038	2067	2097	2126	2156	2186	2215	2254	2243	2232	2222	2211	2201	2190	2171	2132
800	2017	2045	2074	2102	2130	2158	2186	2214	2251	2240	2229	2218	2207	2197	2186	2158	2121
1000	2020	2052	2085	2117	2149	2194	2198	2201	2204	2207	2210	2213	2216	2219	2222	2168	2136
1200	1996	2030	2064	2099	2133	2164	2171	2177	2183	2189	2195	2202	2208	2214	2220	2148	2123
1400	1936	1972	2008	2044	2081	2107	2116	2125	2134	2144	2153	2162	2171	2181	2190	2125	2106
1600	1840	1878	1917	1955	1993	2021	2033	2045	2058	2070	2082	2095	2107	2119	2132	2098	2084
1800	1697	1739	1781	1766	1802	1838	1875	1911	1947	1983	2019	2055	2092	2128	2164	2145	2115
2000	1610	1655	1700	1714	1773	1831	1889	1947	2005	2064	2122	2180	2238	2296	2355	2286	2238
2200	1544	1592	1641	1605	1686	1766	1846	1926	2006	2087	2167	2247	2327	2408	2488	2374	2309
2400	1499	1551	1603	1439	1541	1643	1746	1848	1950	2052	2155	2257	2359	2462	2564	2411	2329
2600	1477	1544	1612	1602	1674	1746	1818	1890	1962	2033	2105	2177	2249	2321	2393	2273	2225

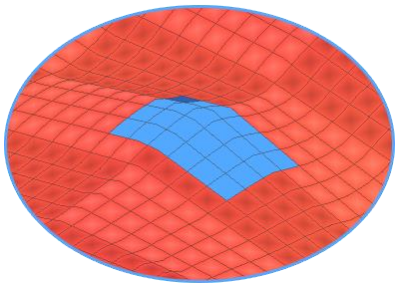
The first thing you'll notice is that the square shape that was requested has been replaced by a rounded bump. The bump is the closest approximation to the square shape that the polynomial and coefficients can mathematically produce.

Notice the edge boundary between zone 14 and 15. It contains a peak that we don't want.



Now, try generating the coefficients again with ***Zone overlap*** set to 2. Click the ***Undo*** toolbar button and enter 2 into the ***Zone overlap***, then click the ***[Generate Coefficients]*** button again.

To see how closely the newly calculated coefficients model the requested change, click on the Virtual VE Table's ***[Re-generate 3D Surface]*** button.



This time the spikes have been replaced with a smoother zone boundary transition.

Editing the Coefficients Table

It is not advisable to edit the coefficients table directly unless you have a thorough understanding of how the coefficients are used to generate the Virtual VE Table.

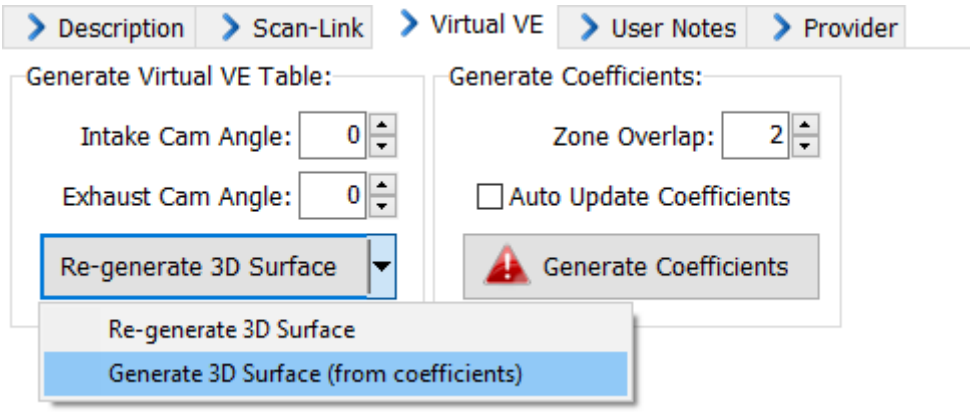
Any changes that you make to the coefficients table will be overwritten when you click on the ***[Generate Coefficients]*** button.

If you change any coefficient in a zone (i.e. in a single row of the table) then those zones will be modified in the Virtual VE Table when you click on the Virtual VE Table's [***Re-generate 3D Surface]*** button.

Preventing the Coefficients Table from Changing

Each time you click the ***[Re-generate 3D Surface]*** button, the 3D model is internally converted to coefficients and the coefficients table is updated, then the 3D model is re-created from the new coefficients. That will cause the 3D model to change slightly each time you click that button.

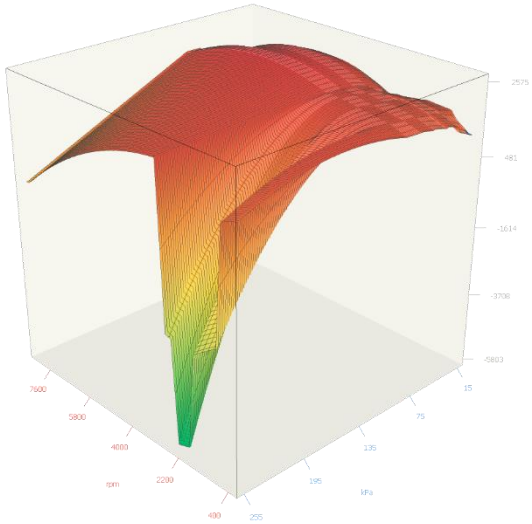
There is a second option on the drop-down menu of the ***[Re-generate 3D Surface]*** button called ***"Generate 3D Surface (from coefficients)***" which does not re-compute the coefficients, it merely re-computes the 3D model from the existing coefficients. That option is useful when you are copy/pasting coefficients from one tune to another. After pasting new coefficients use this option to generate the 3D surface without altering the newly pasted coefficients.



Forced Induction Applications

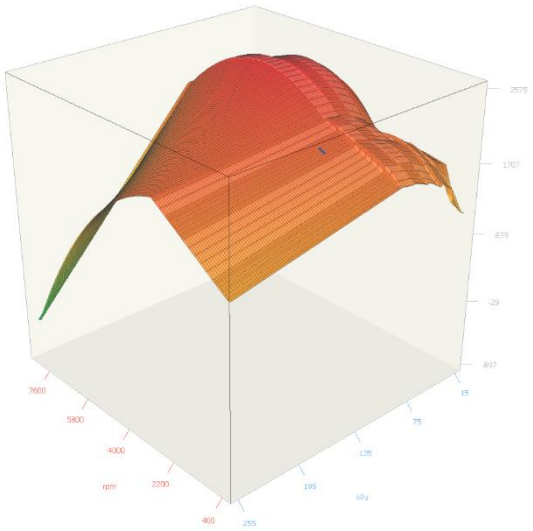
Most stock calibrations are only tuned up to 105 kPa, which is perfectly acceptable for naturally aspirated engines. However, if you look at the 2 or 3-bar Virtual VE Tables for most stock tunes you will find some interesting and potentially dangerous values.

For example, the Virtual VE table shown below is from a stock, naturally aspirated vehicle. If we request the 2-bar Virtual VE Table, it is plain to see that between 800 and 3200 rpm, and from 90 kPa and above the Virtual VE Table values would drop away causing a dangerously lean condition if the engine was operated under boost.



If you want to operate the engine under boost, then you MUST correct these types of anomalies by reshaping the Virtual VE Table and generating the coefficients again.

To do that, select the problem area and click on the two-way linear-fill icon.



Then click the ***[Generate Coefficients]*** button.

To see how closely the newly calculated coefficients model the requested change, click on the Virtual VE Table's ***[Re-generate 3D Surface]*** button.

VVE tables may be edited using three different 3D surfaces:

- Naturally aspirated
- 2bar Forced Induction
- 3bar Forced Induction

Changing any one of those three 3D surfaces will update the coefficients that control the shape of all three surfaces. However, the other two surfaces are not automatically updated until/unless you click the the ***[Generate Coefficients]*** button or the ***"Generate 3D Surface (from coefficients)"*** drop-down option for those other tables.

Use the ***"Generate 3D Surface (from coefficients)"*** drop-down option to update other 3D surfaces without recomputing and potentially changing the coefficients.

Undo and Redo considerations

Unlike other tables, the Virtual VE and coefficient tables have an extra source of data. The Virtual VE Table can be generated from the coefficients table and the coefficients table can be generated from the Virtual VE Table.

Each of the generated data cycles is also stored in the undo buffer so that you can undo the results of a generate cycle.

Each of the user modifications is stored in an undo buffer so that you can click the undo/redo icon in the tool bar to undo and redo any changes that you make manually.

The undo/redo actions are not synchronized between the two tables. If you click on either ***Generate*** button and then click undo, only the visible table's data is undone. To undo the generated data in the other table, you must make that other table visible and then click on the undo toolbar icon to undo any changes in that table.

Limitations

Virtual VE Table Shape Limitations

Each Virtual VE Table zone can only support one continuous curve in the RPM direction and one continuous curve in the MAP direction.

A curve cannot change from convex to concave within a single zone.

Large peaks or valleys at the corners of a zone will usually adversely affect the other corners of the same zone.

Outlying or spiked data will be smoothed when generating coefficients.

Variable Position Cam Shaft Not Supported

The software does not yet have the ability to factor in cam phasing (if the engine has it fitted). Cam phasing is always assumed to be 0 deg. The majority of Gen-IV engines do not use cam phasing. However, you can change the cam phasing to see what the VVE table looks like at various cam phases – you just can't generate coefficients for non-zero cam phases.

Generating 1-Bar Coefficients will Overwrite 2 and 3-Bar Data

If you are working on a 2-bar Virtual VE Table and you open the 1-bar Virtual VE Table and update the coefficients then you will lose all the Virtual VE Table data for MAP values above the limit of the 1-bar table. The same thing occurs if you are working on a 3-bar table and you open a 1-bar or 2-bar table and generate coefficients.

If you do accidentally do that, close all the Virtual VE Tables, open the coefficients table and select Undo. Then re-open the correct 2 or 3 bar Virtual VE table and it should be restored.

Large 2 and 3 bar Virtual VE Tables

Large 2 and 3 bar Virtual VE Tables require additional memory. With multiple 3-bar tables open, the memory requirements of EFILive can exceed 80Mb. We recommend using a computer with 512Mb or more of memory.