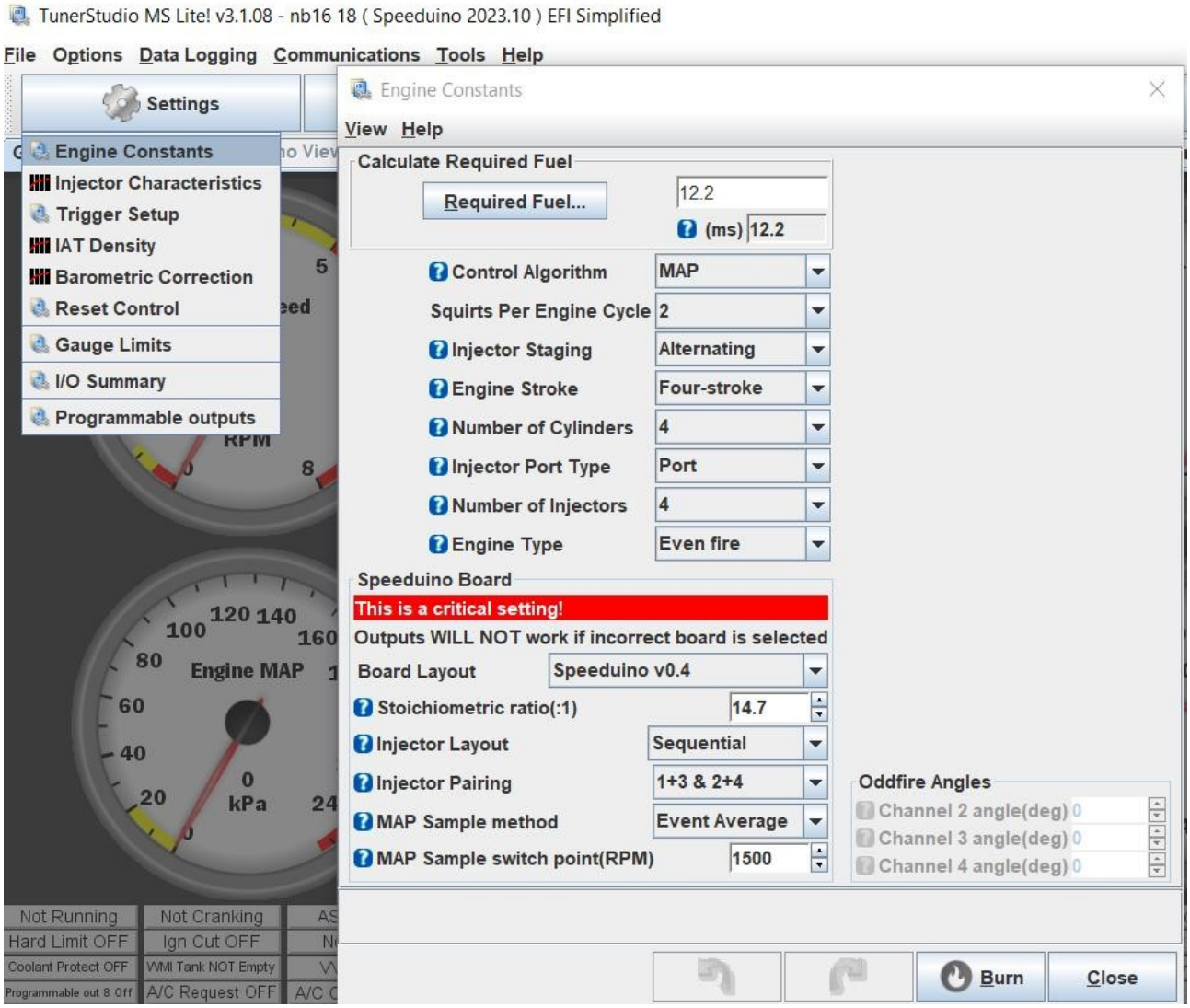
# *Speeduino*

young tuner crash course ;-)

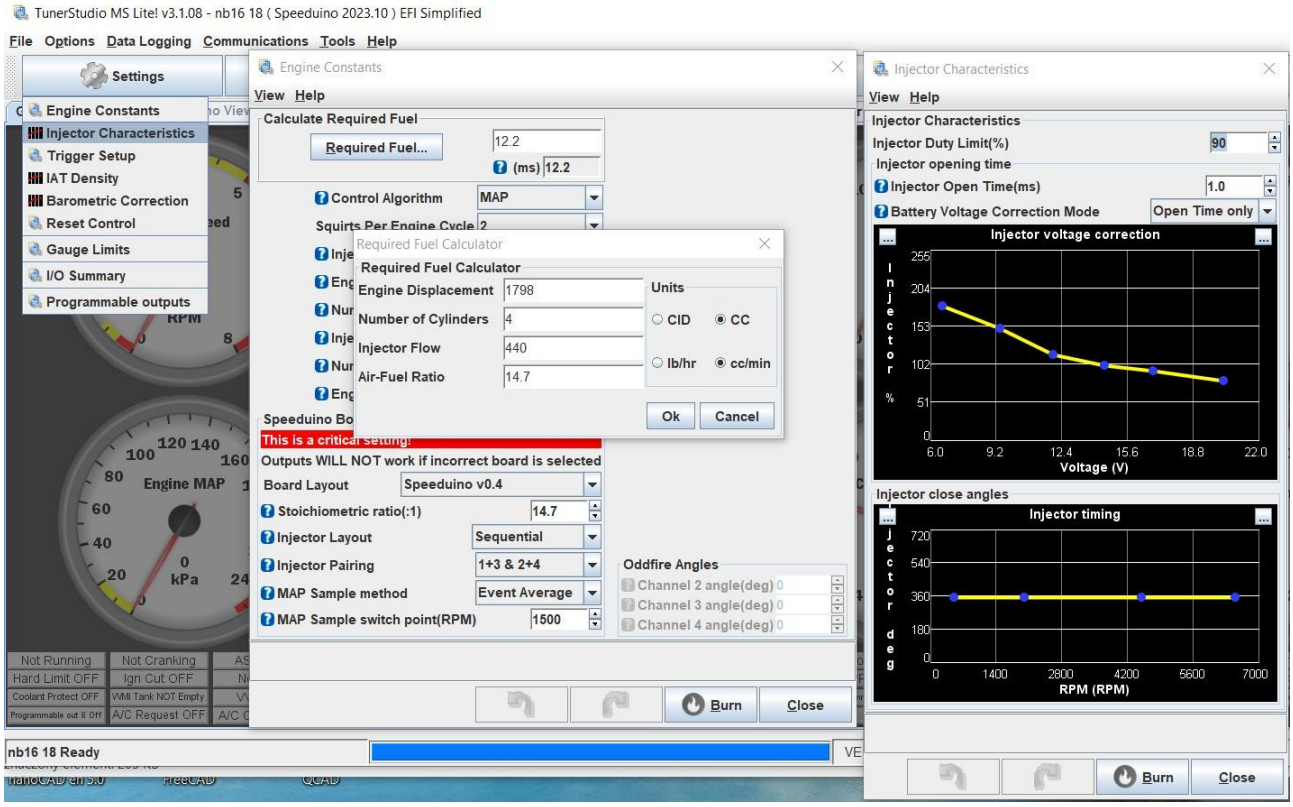
### Basic Speeduino parameters and tables description in TunerStudio

1. Engine Constans – basic engine control parameters, including injector flow rate (Required Fuel).




In stock car (trigger, injectors, ignition) there is no need to change anything from base map

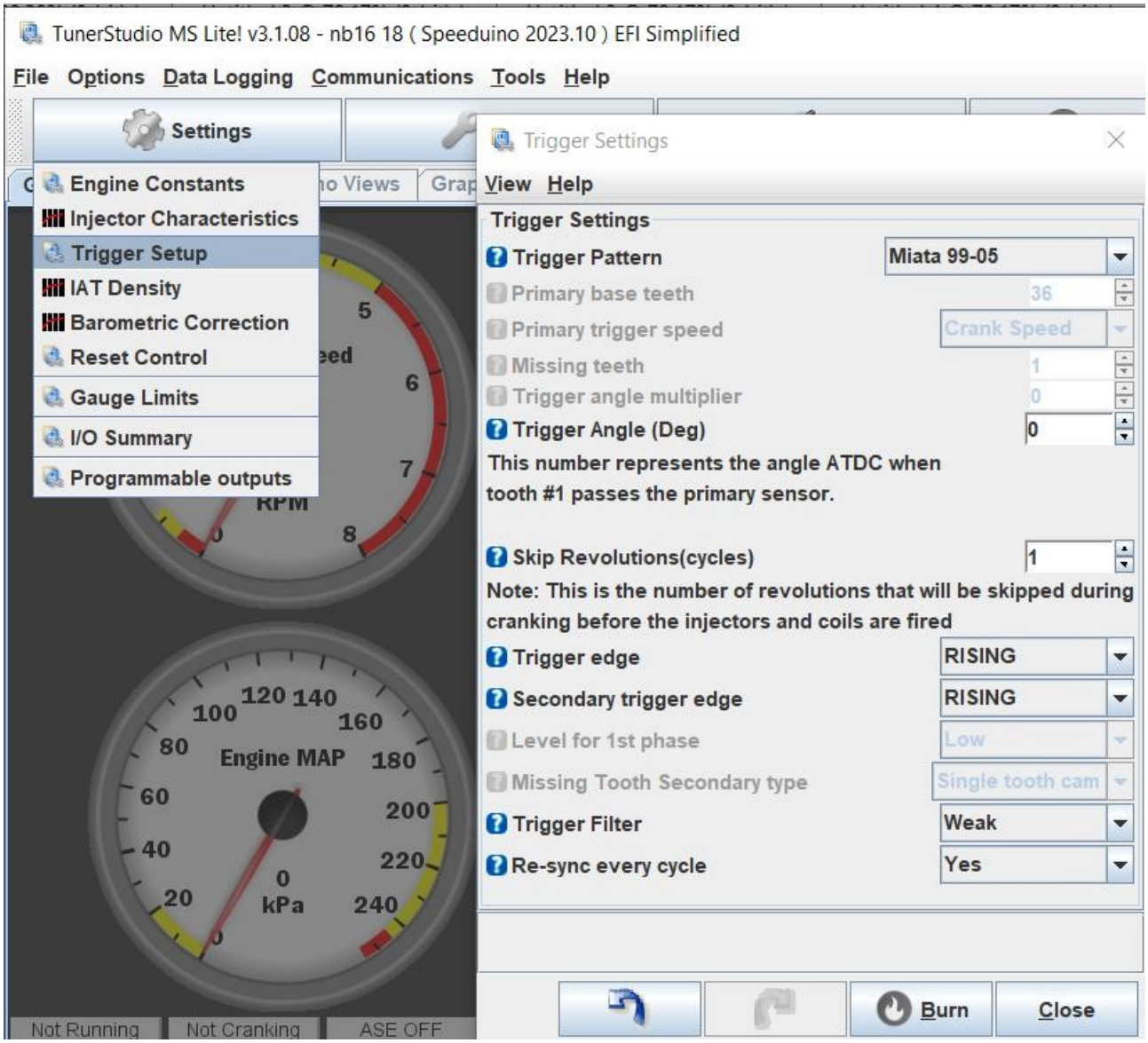
2. **Required Fuel, Injector characteristics**.




Having stock injectors there's no need to change anything there.

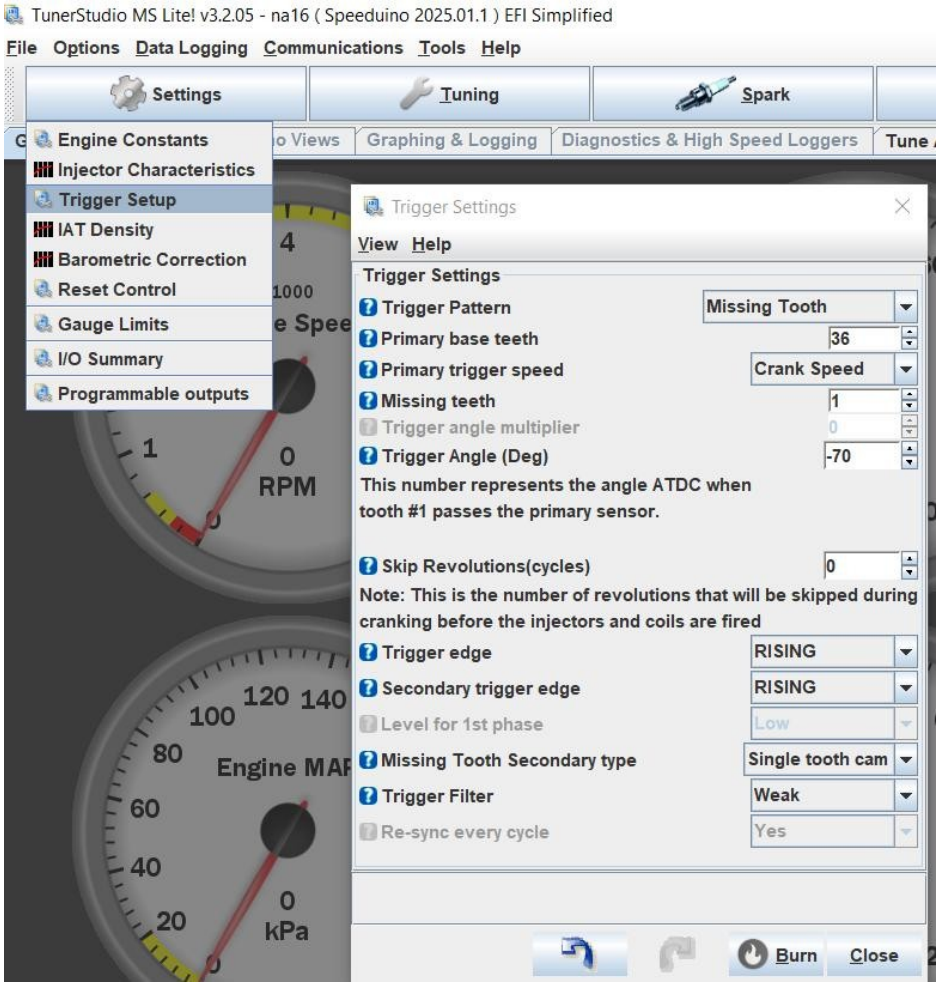
If changing injectors use built-in calculator to find new **RequiredFuel** value. Later it may be necessary to adjust other injectors parameters (voltage correction).

3. **trigger setup** – crankshaft (CKP) and camshaft (CMP) sensors configuration




having stock car the only parameter you should check and adjust is **Trigger Angle** using timing light. Lock spark advance (**Enable Fixed Timing ON** menu **Spark Settings**) and set value to have physical spark advance identical to written in maps

if swapping trigger wheel you have to change parameters here




(example of settings for 36-1 trigger wheel)

according to trigger installed set:

**Primary base teeth** (including missing ones) for instance 36

**Missing Teeth** count for instance 1

real crankshaft angle when 1st tooth comes near sensor **Trigger Angle** for instance **-70.** This value depends on how trigger wheel in physically installed. First rough adjustment can be done using protractor. Then start engine and fine tune this value using timing light identically as with stock trigger (**Enable Fixed Timing ON**)

**Note:**
1. If changing only crankshaft trigger wheel and leaving stock camshaft its necessary to switch from full sequential to semi sequential mode. (**Injector Layout → Semi Sequential** menu **Engine Constans**, otherwise engine wont start.

2. In semi-sequential mode VVT control does not work in **ClosedLoop** mode, only **OpenLoop**. Not optimal, so I dont recommend doing it for 1.8VVT engine

**axes on tables VE, AFR/lambda, spark advance**

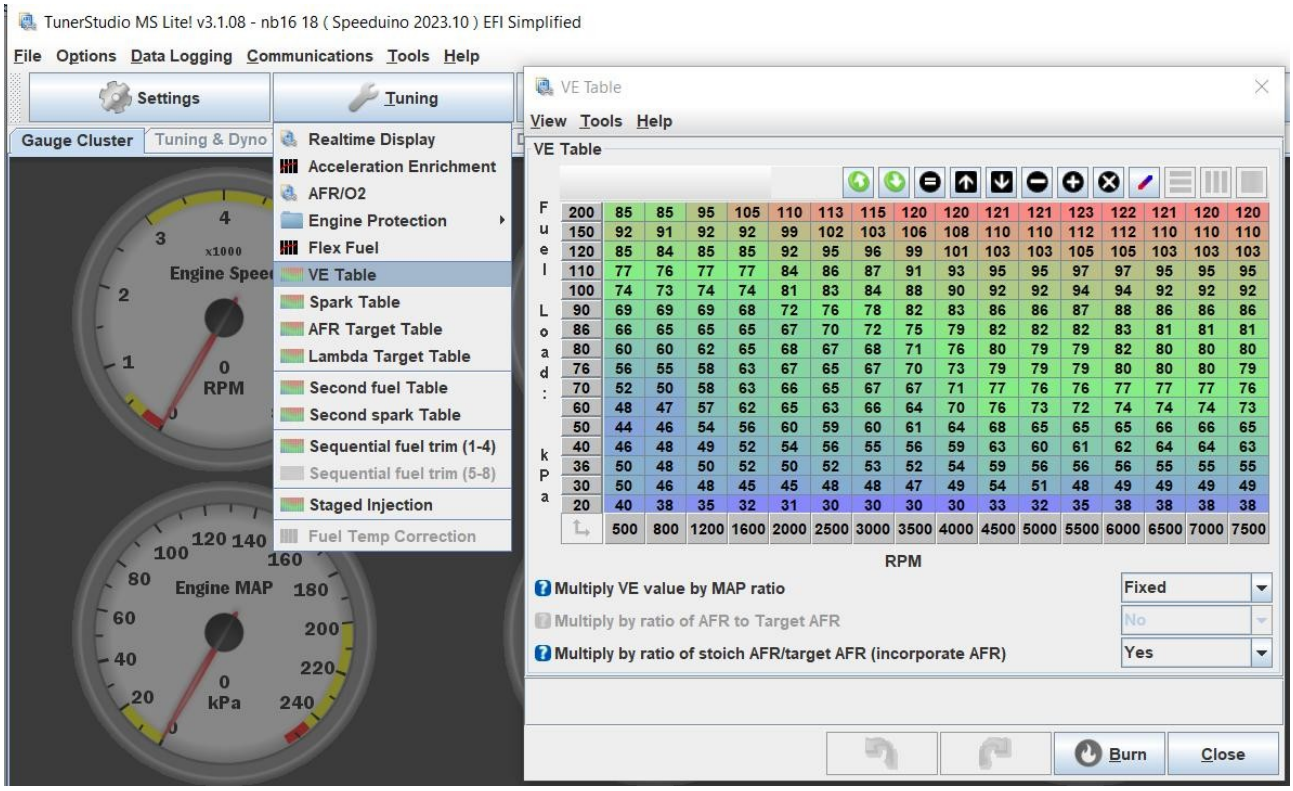
**horizontal** – engine RPM

**vertical** – manifold absolute pressure → engine load
<100kPa vacuum: idle, partial load, cruising
approx 100KPa – atmospheric pressure → maximum for atmo engine
>100kPa boost

particular points on X i Y axes can be changed – click and write desired value. Can be useful if you want to use higher rpms for instance, more boost or need more precision in particular MAP range

Every table (VE, AFR, Spark Advance) can have different X, Y axes point, but I recommend all have the same for clarity

4. **VE table** (Volumetric Efficiency)




this table reflects how engine works in particular RPM/MAP ranges, together with intake and exhaust, reflects how much fuel is delivered.

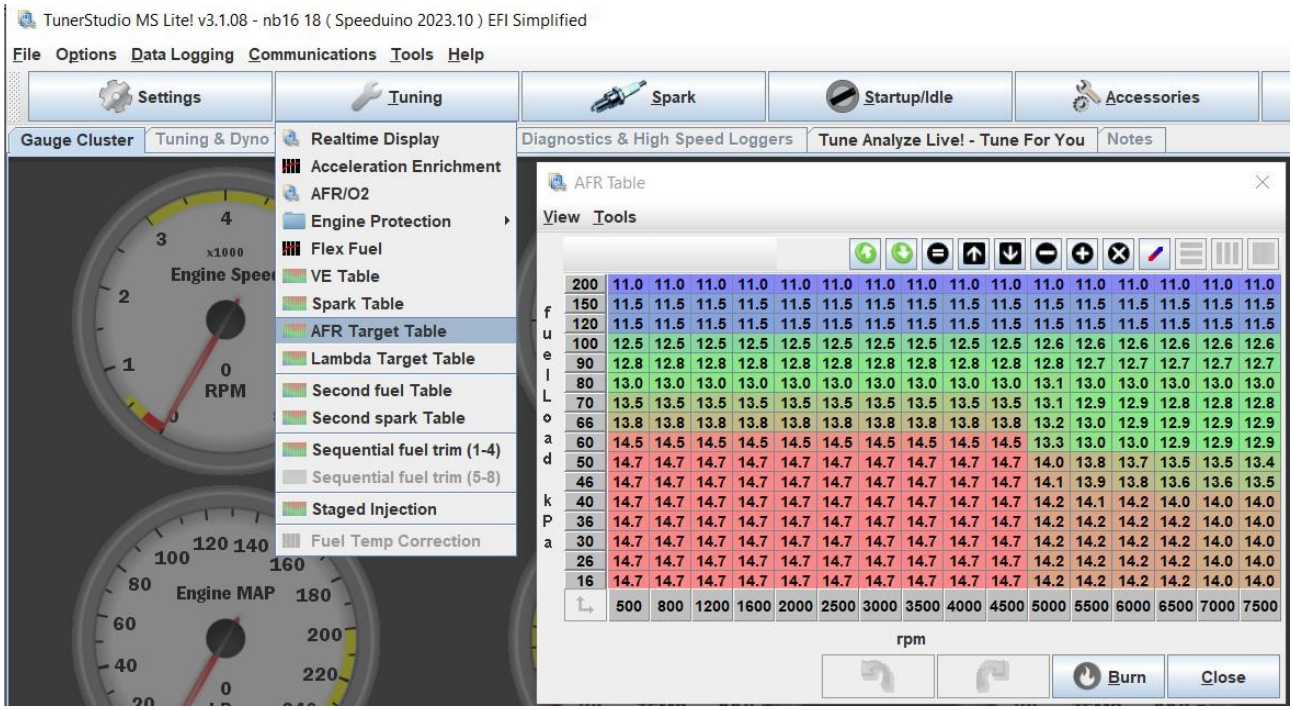
You have to adjust this map to fit your car. Do this to get **measured AFR** matchig **Target AFR** in all areas

Every time if you change:
- intake
- exhaust
- camshaft
- porting

you should change this table

during adjustments of this table usually you should switch OFF o2 sensor correction (**AFR/o2 → no correction)**

5. target **AFR table** (Air To Fuel Ratio)

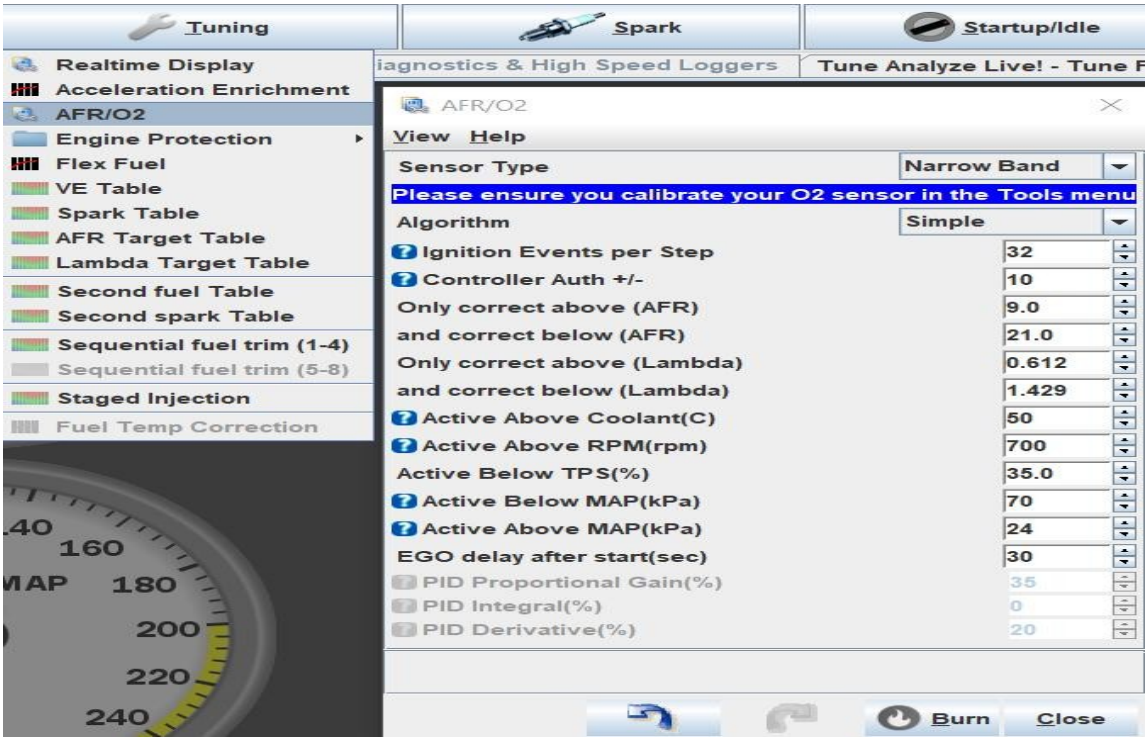



together with VE table affects fueling.

*You can also use Lambda Target table if you like Lambda more than AFR. Change in Target Lambda table changes AFT table accordingly and vice-versa*

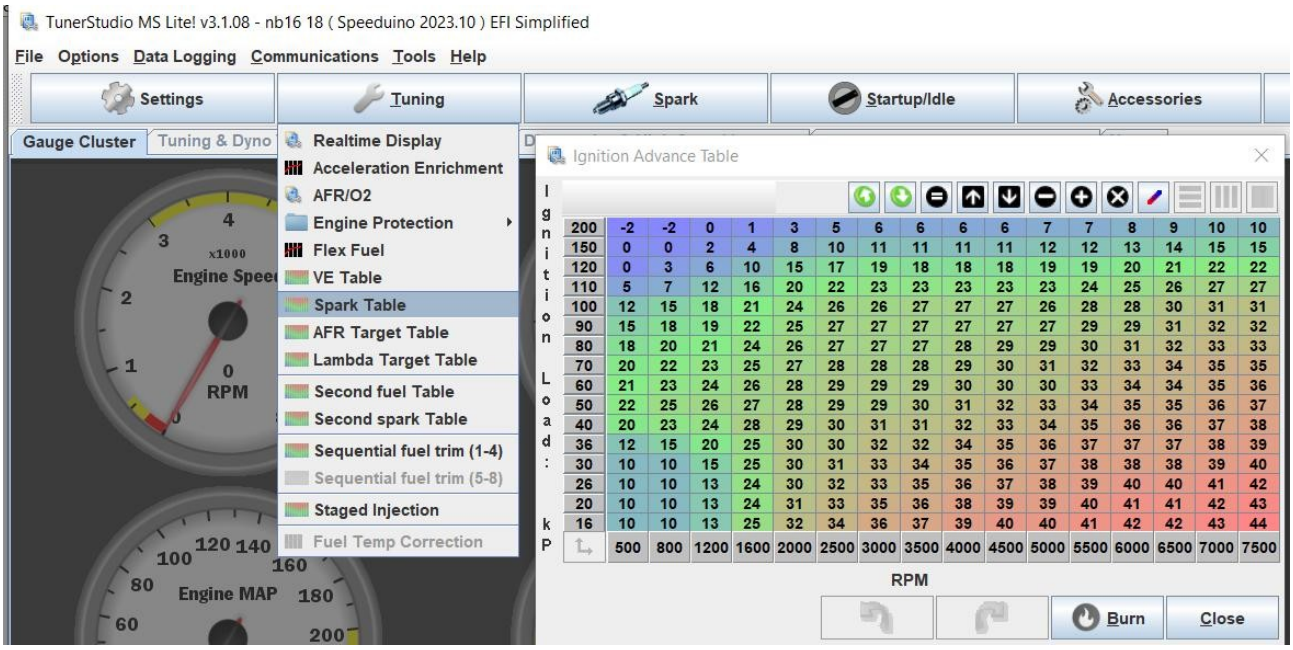
Adjustment of this map can be useful at final stage of tuning to add or remove fuel in some areas. (for instance leaning at cruise, more fuel with more boost or idle). Every time you should adjust **VE** table to track your target AFR. When **VE** table perfectly tracks AFR target but you need more or less fuel somewhere – then change **Target AFR** table

6. o2 sensor fueling correction




Speeduino can control fueling using o2 sensor, you can choose following algorithms:
- simple. Usable on low load and if only stock narrowband is used. This algorithm is used on preloaded maps. Works also with wideband sensor, just switch sensor type
- PID. More advanced algorithm, originally intended to use with wideband sensors. Needs optimization of P I D values to get optimal results
- no correction. Often used during calibration

Spark Advance table

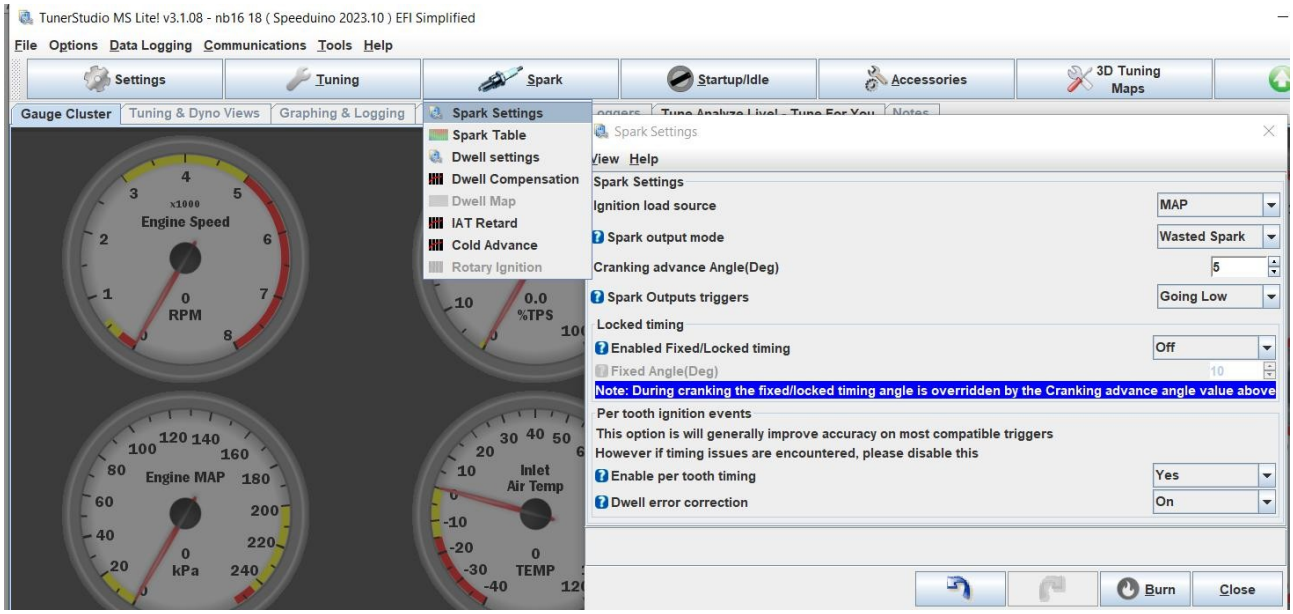



This is spark advance in different engine work areas (RPM/load). This value can be modified by:
- engine coolant temperature ECT (**Cold Advance**)
- intake air temperature (**IAT retard**)
- idle correction (**IdleAdvance**) if used

you should adjust this table to have optimal engine performance and **safety**.

**before modification** remember to adjust base timing →page **3/4**

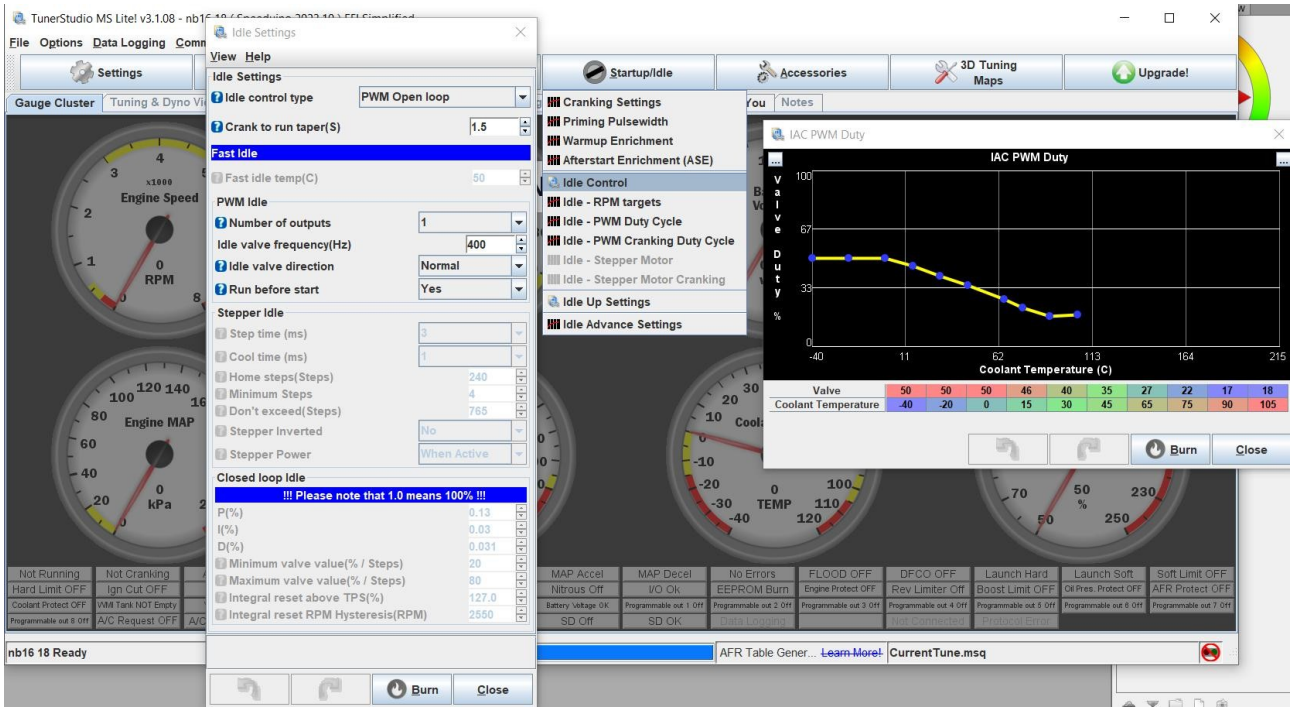
8. spark settings




having stock spark system nothing has to be changed here

You should change Spark Output Mode if using 4 individual coils (COPs) working fully sequential (connected to additional ignition outputs). Remember to set **Dwell Settings, Dwell Map** according to coils you are using

9. idle setting




there are few modes of idle control. On preloaded maps there is **PWM open + closed loop** used, in most cases works pretty good.

**PWM open-loop** mode gives better stability in some cases even with non optimal spark and fueling, at the expense of worse idle stability versus load. Can be useful in heavily modded cars. Adjust **PWM duty cycle** to suit your car.

modes: **none, on/off**, **Stepper** (open loop, closed loop, open+closed loop) are not used in MX5's

## Idle Advance


**Idle Advance is** additional method of idle control working in parallel with idle valve control. Uses changing spark advance has much lower control range but its fast and precise

using this method:
- dont set Spark Advance **around idle** too high. I recommend to be near stock 10 deg
- it may be necessary to fine tune **Idle RPM targets** vs ECT table and **Advance/RPM delta** table to better suit you cars needs

10. RevLimiter


on preloaded map Rev Limiter is set at stock 7000rpm. You can change this value. I recommend raising this carefully. Too high RPMs can destroy your engine immediately or drastically lower its life span.

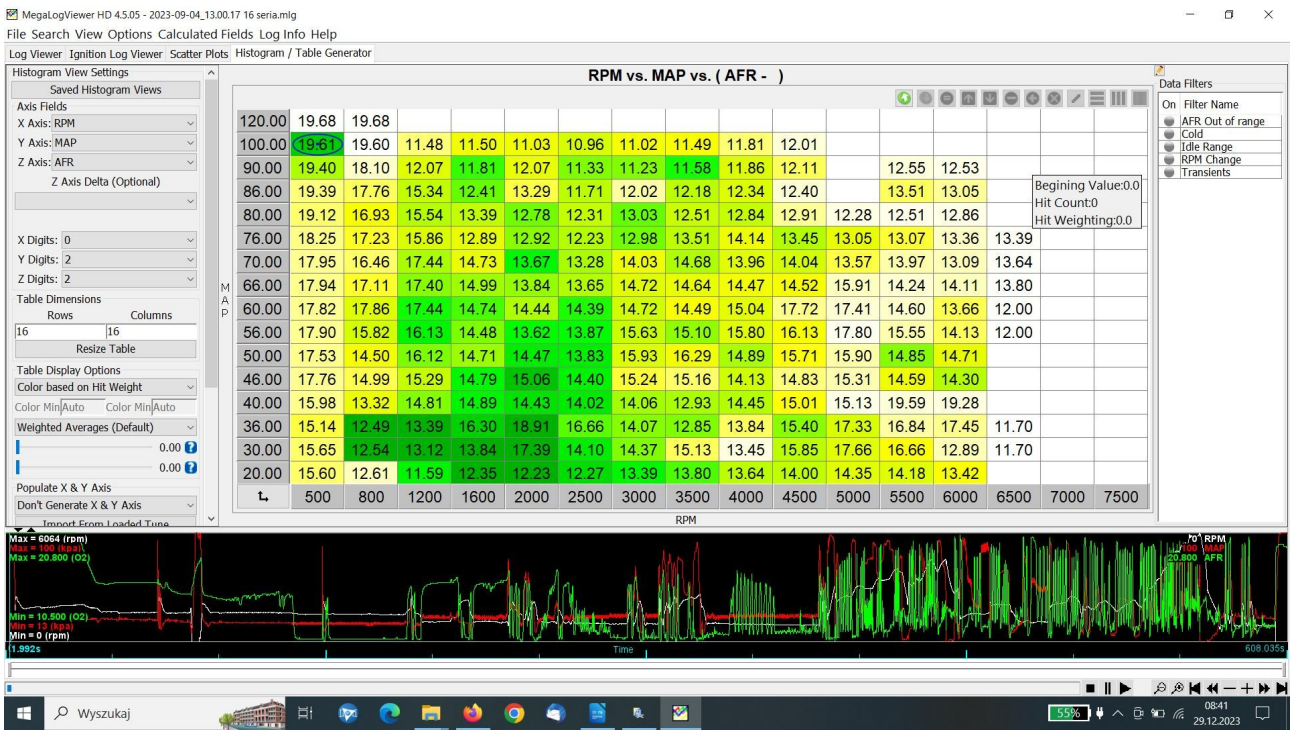
Its possible to chave RPM limiter based on collant value (**Hard Limiter Mode – coolant based**). This gives you additional safety.

## Calibration process basics

1. first verify all sensor IAT, ECT, AFR, TPS, MAP, Baro calibration and Spark Advance.
2. (ony if using idle **PWM open-loop** mode) roughly set Idle rpm
3. calibrate when engine is warm, in as stable conditions as possible. I recommend to find low traffic road, avoid stop and go, and changing load/RPM as smooth as possible to get accurate results.
4. Optimize startup and warming up **after** calibrating fueling and spark advance

Log parameters to file (TunerStudio –> Data Logging → Start Logging → choose filename → Save). To stop Logging (→Data Logging -> Stop)

for log analysis I recommend MegaLogViever HD (registered), especially histogram function




darker fields show more data in this area = more reliable. Dark green are most reliable, light green less reliable, yellow and white not reliable that should not to be taken into account.

General rule: Adjust **VE** to have masured AFR as close as possible to **target AFR/lambda**

AFR table is roughly set on preloaded maps, there is no need to change it at the beginning. Just adjust **VE table**

To have all engine areas properly adjusted you need **Wideband o2 sensor**, like LSU4.9 with controller.

Using stock narrowband o2 sensor you can only set AFR 14.7

general rules:

1. if changing intake, exhaust, camshafts, vvt settings etc -> adjust **VE** table

2. if changing injectors try not to touch **VE** table at first but change required fuel and other injector parameters (if needed) to get AFR/lambda values you had before on stock injectors. Some fine tuning of VE table can be necessary

fueling is also affected by:
- cranking, afterstart **ASE**, warmup **WUE** corrections
- Baro correction
- IAT density correction
- acceleration enrichment / DFCO (fuel cut on deceleration)
- AFR/o2 adjustment , if enabled

thats why you should take logging and adjustment with warm engine, as stable conditions as possible, and usually switching OFF o2 sensor adjustment

**Spark / Ignition Advance** table

adjust this table to get optimal performance. Remember to monitor knock events using **det-cans** or **knock monitor**. I recommend use at least 2-3 degrees margin before knock occurs

I recommend to watch **Throttlebuddies**: Speeduino ECU Tuning Guide | Part 13: Street Ignition Tuning with Det-Cans

https://www.youtube.com/watch?v=wLVPjWp7OPM&t=411s

cranking and warmup optimization

should be done after VE table and Spark Advance calibration

**Spark Advance** during cranking usually uses **Fix Cranking Timing with trigger** option. If disabled you can use different advance but its not recommended for stock MX5 triggers

other parameters affecting cranking:
**settings→trigger settings→skip revolution(cycles)** number of skipped cycles before injectors will be fired during (0 shortest)

**startup/idle→cranking→injectors priming delay**

**startup/idle→PWM cranking duty cycle** idle valve value during cranking and while after

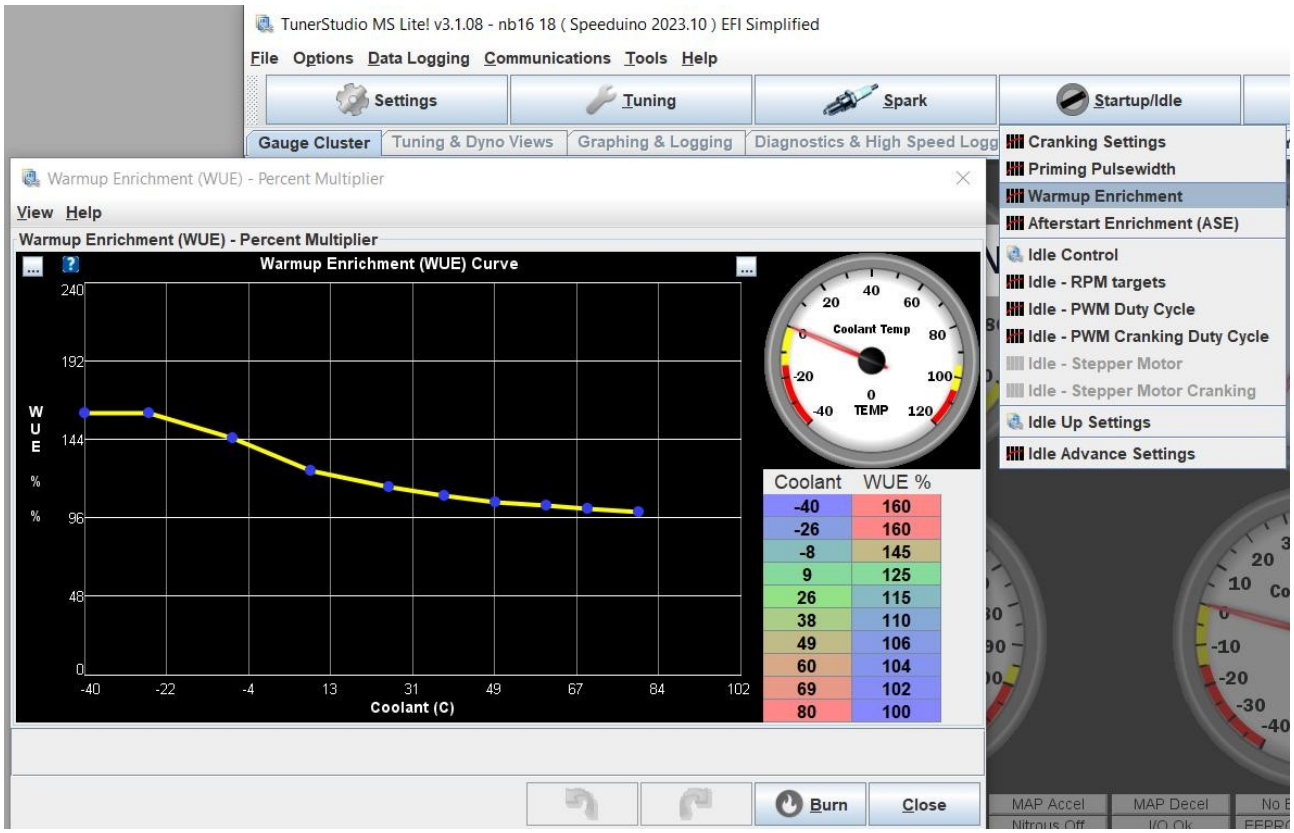
**fueling**:

- takes point MAP =100, RPM min (500) in **VE** table
- during cranking **Cranking Enrichment** (**startup/idle→cranking**) and **Warmup Enrichment** (**startup/idle→warmup WUE**) enrichments are used

- while after startup **Afterstart Enrichment** (**startup/idle→Afterstart ASE**) is also used

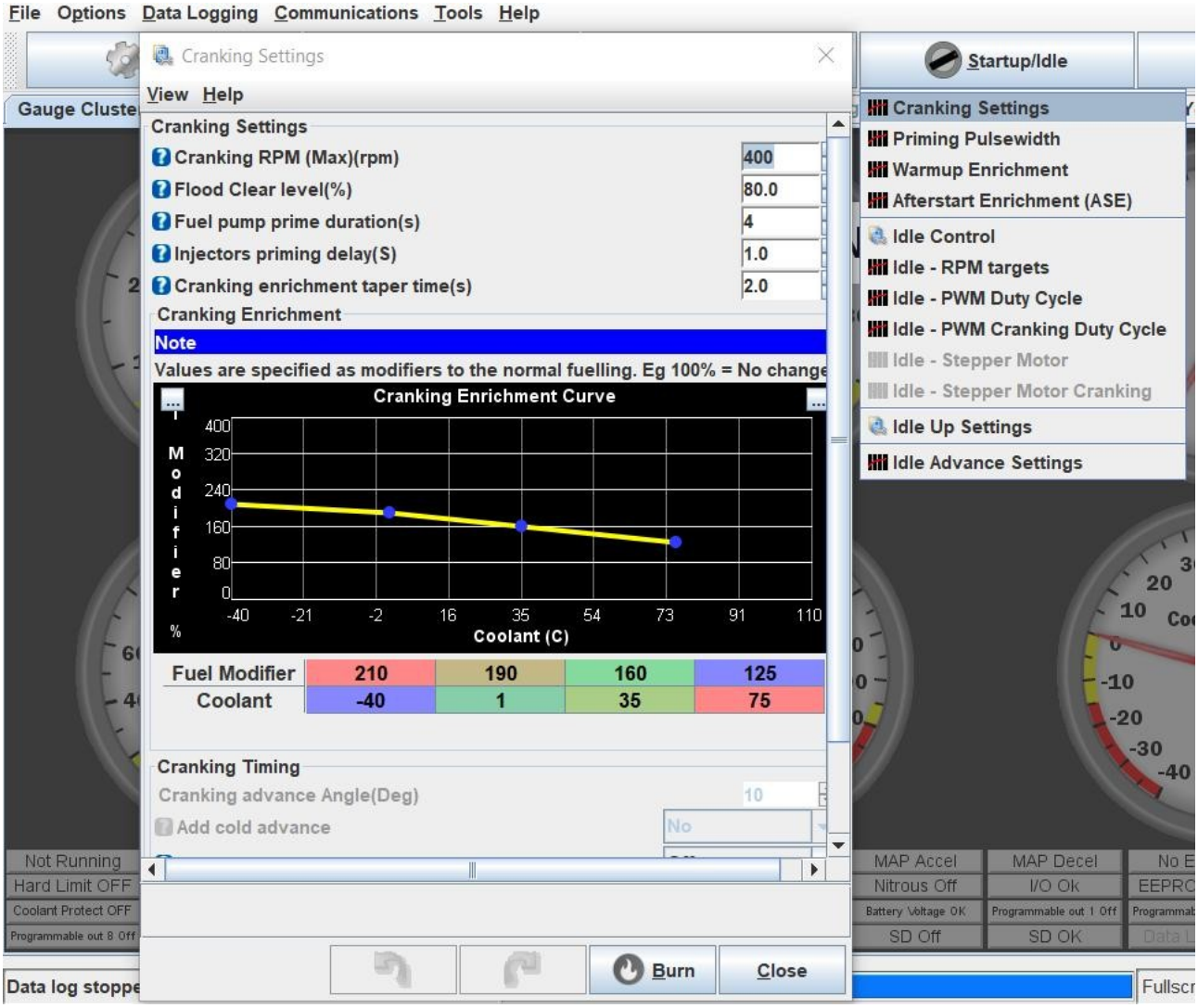
recommended optimization order
VE table → Warmup Enrichment → Cranking Enrichment → Afterstart Enrichment

## Warmup Enrichment




additional enrichment during warmup, switches off when ECT reaches 80 deg C. Its roughly set-up, some fine tune may be needed to have engine running stable during whole warmup

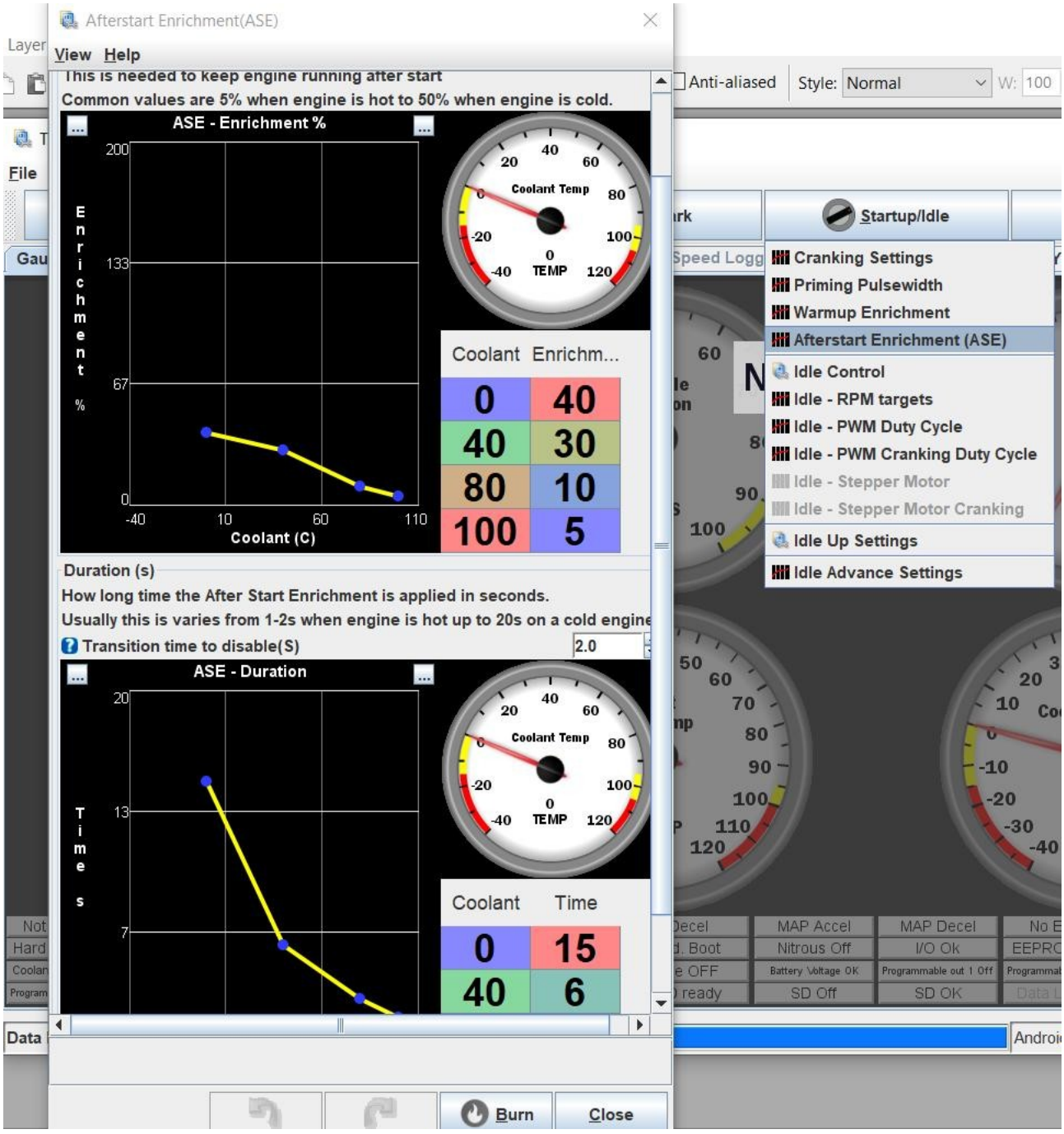
# Cranking Enrichment




fuel enrichment during **during cranking**

while after engine start (**Cranking Enrichment Taper Time**) it gradually switches off and comes to **Afterstart Enrichment**

roughly set, some fine tuning may help




tables or enrichment used after **Cranking Enrichment Taper Time**.

Two tables. First is percentage of enrichment, second time of enrichment. Both ECT related

roughly set. If you have problems with engine hesitation or stall shortly after cranking (2...10 sec) you should change them to have transition as smooth as posiible

7 additional knowledge sources:

High Performance Academy https://www.hpacademy.com/
https://www.youtube.com/@hpa101

Driving4Answers https://www.youtube.com/@d4a → boost school

Throttle Buddies (Youtube) https://www.youtube.com/@throttlebuddies6356 → Speeduino Tuning Guide

Haltech Support Knowledge Base https://support.haltech.com/portal/en/kb/articles/how-ecus-work

https://www.megamanual.com/begintuning.htm#works