Design Support

Tractive System

Objectives

The purpose of the tractive system is the propulsion of the vehicle. It is compounded by the motor, the inverter, the PDBox, the cooling system and the battery (choice of battery is justified in another paper).

- Maximum 3.5 kWh in the TSAC
- Keep as much as possible the architecture of the previous thermal vehicle (first electric vehicle) -> Single motor with chain and differential
- TSBox container the same size as the inverter container to facilitate assembly
- The vehicle weight is about 250kg
- Dynamic results :
    - Acceleration: 4.5s
    - Skidpad : 5.3s

Conception steps

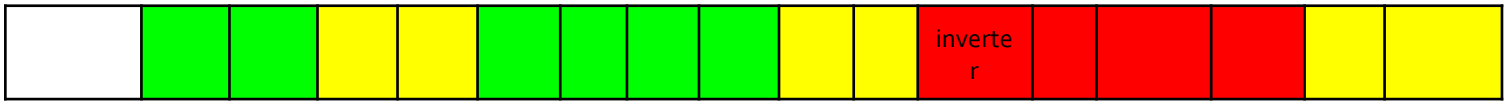
Determination of the power by calculation with our objectives , the selection of a motor and an inverter that can manage that power, the design of a PDBox that can fit the discharge circuit, the datalogger, the current sensor, and the placement of the TSMPs and the TSMS.

Simulations steps overview

- Engine : Simulation of the engine feature required for our objectives :

We conclude we need an engine able to deliver at least 62 kW of power and 306 Nm of torque.

Engine	Nominal Power (kW)		Nominal Torque (Nm)		Maximal Power (kW)		Maximum Torque (Nm)		Weight (kg)		Price (€)		Dimensions (mm)		Choice	
Emrax 228	75	5/5	130	2/5	124	5/5	220	3/5	13.5	3/5	5200	3/5	D = 228 L = 86	3/5	V	3.43/5
Emrax 208	56	0/5	90	1/5	86	5/5	150	2/5	10.1	5/5	4499	4/5	D = 208 L = 85	4/5	X	3/5
AIM 258	120	5/5	190	3/5	170	5/5	390	5/5	12.4	4/5	7200 + 5000	0/5	D = 258 L = 72	1/5	X	3.28/5



- Inverter : After choosing the engine, we have to choose the inverter that corresponds to the engine :

Voltage max = 630 Vdc

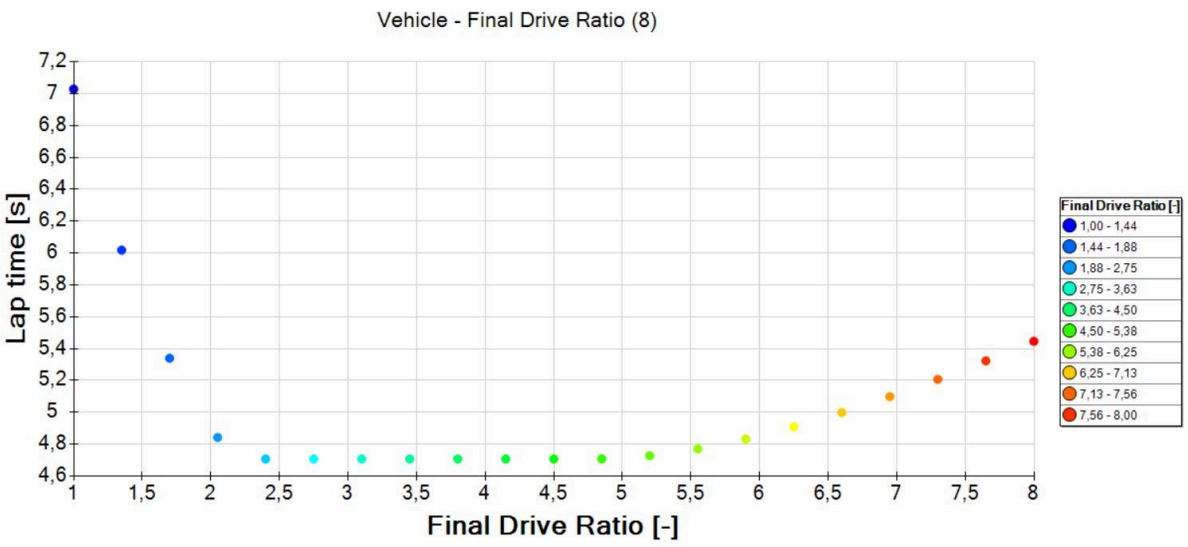
Imax = 197 A

Inverter	Maximum Voltage (V)		Maximum Current (A)		Weight (kg)		Price (€)		Dimensions (mm)		Choice	
BAMOCAR-PG-D3-700-400-RS	700	5/5	300	5/5	8.5	3/5	3400	5/5	355*230*135	4/5	V	4.4/5
HV-850	800	5/5	600	5/5	6.80	5/5	5900	3/5	420*213*77	2/5	X	4/5

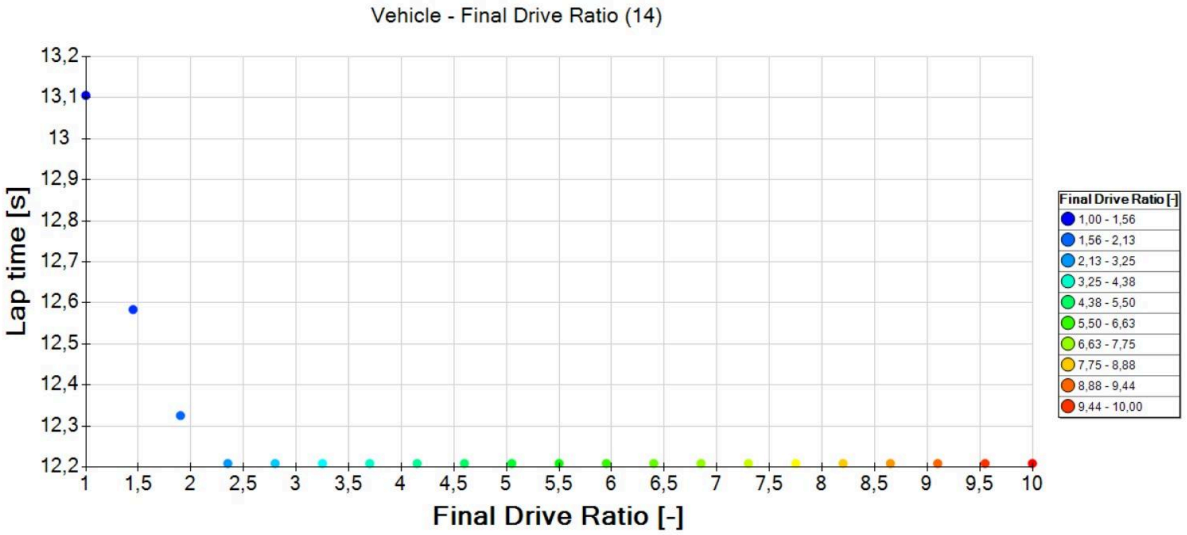
- PDBox : Designed in order to be rule compliant and easy to operate

- Cooling System : Water flow 8L/min at 50°C (engine datasheet) and 12L/min under 65°C (Inverter datasheet) → Pump sized for 12L/min at 50°C taking in consideration pressure loss in the pipes. The radiator is sized to ensure the amount of thermal exchange to maintain the water under 50°C

- Gear Ratio : Autocross (Germany 2010)



Skidpad


Vehicle - Final Drive Ratio (14)
Lap time [s]
13,2
13,1
13
12,9
12,8
12,7
12,6
12,5
12,4
12,3
12,2
1
1,5
2
2,5
3
3,5
4
4,5
5
5,5
6
6,5
7
7,5
8
8,5
9
9,5
10
Final Drive Ratio [-]
Final Drive Ratio [-]
1,00 - 1,56
1,56 - 2,13
2,13 - 3,25
3,25 - 4,38
4,38 - 5,50
5,50 - 6,63
6,63 - 7,75
7,75 - 8,88
8,88 - 9,44
9,44 - 10,00