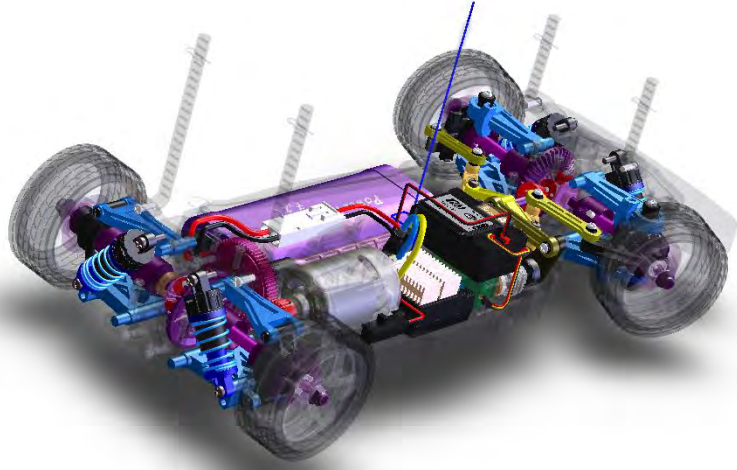


FCAT – 30

H2Hybrid Fuel Cell Automotive Trainer

Product Presentation



0 – PRODUCT OVERVIEW



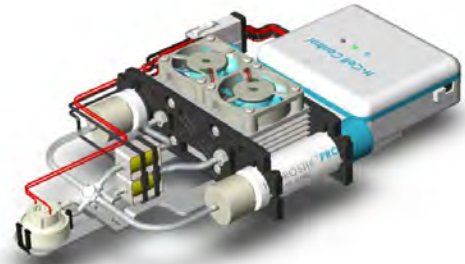
1 – BASIC SPECIFICATIONS

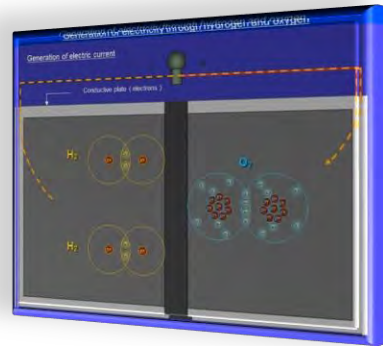
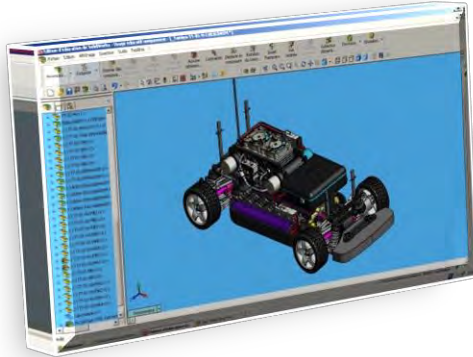


2 – START THE CAR, MEASURES



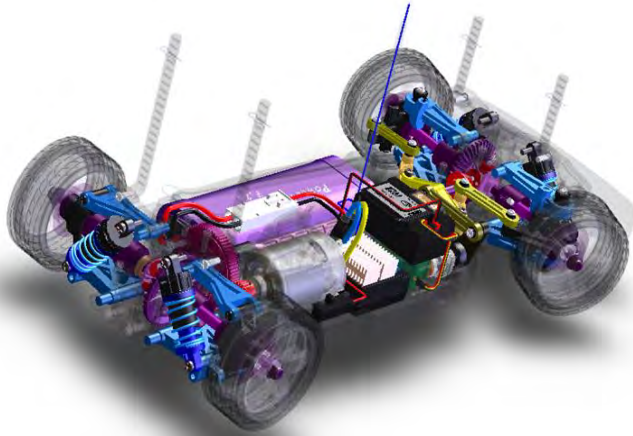
3 – AFTER SALES SERVICE

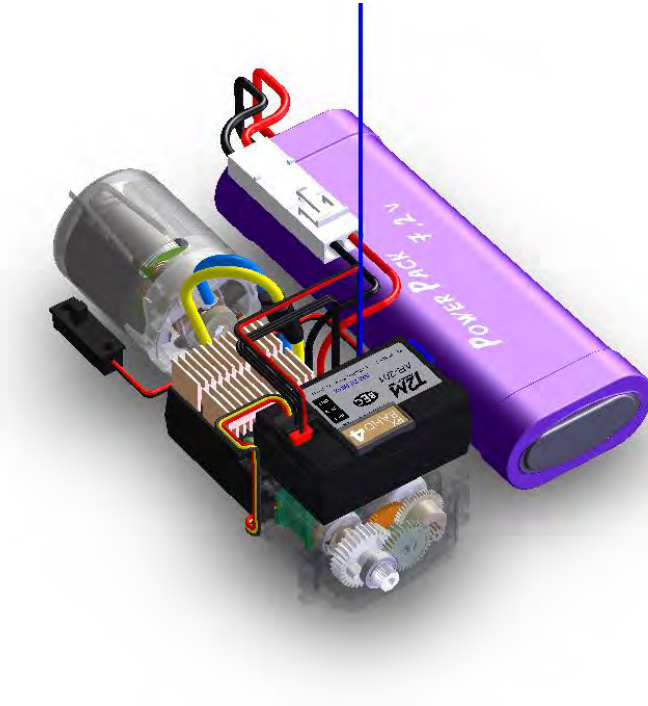




- Mechanical studies
- Electronic structure
- Hcell studies
- Battery
- Electronic measures
- Energy MIX, hybrid Energy sources
- Chemical & physical applications
- Real cars and tamiya comparison

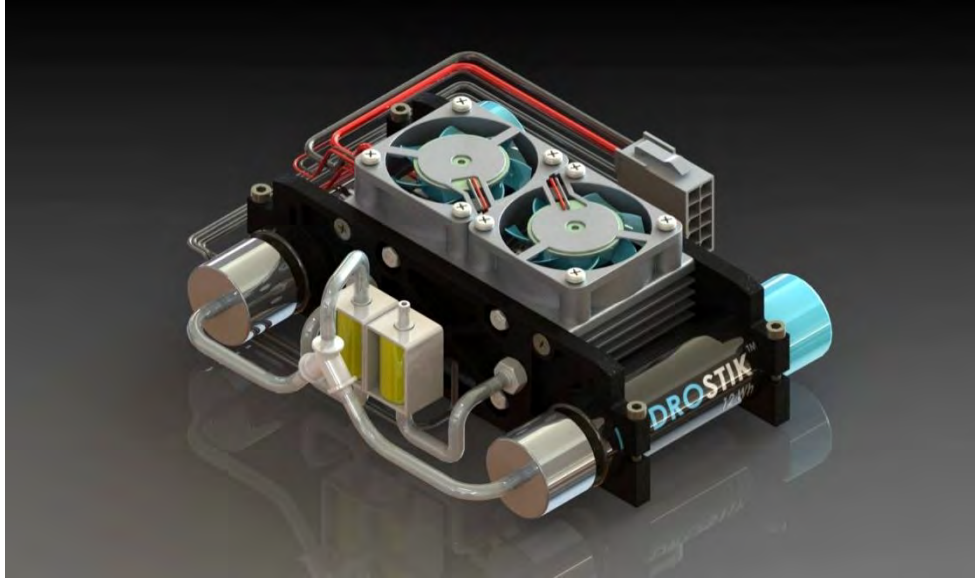
- Mechanical Systems





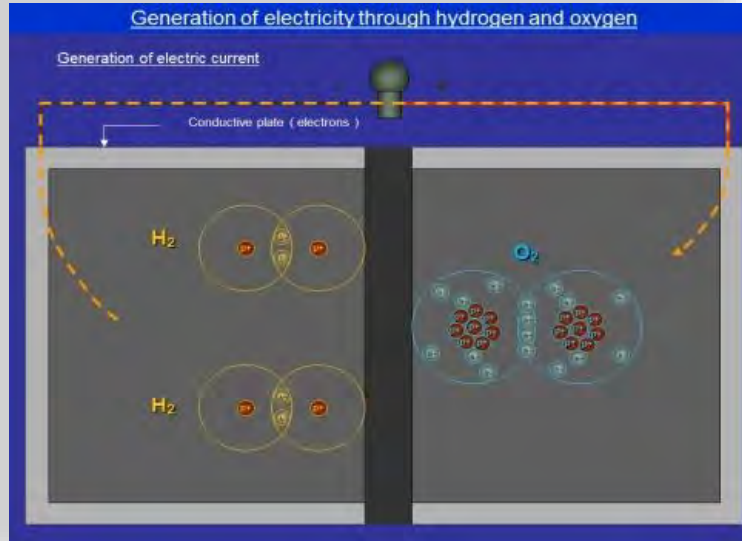
Electronic Systems





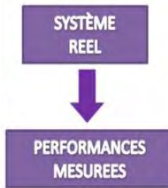
- H-cell System





- Chemical & physical applications





- Dimensions, weight
- Energy, power,
- Performances
- In-board energy and autonomy



- Real cars and tamiya comparison



VERSION 2 IMPROVED

On FCAT-30:

- New car 4 wheels drive in the market, spare parts available for a long time
- Arduino Yun microcontroller board with built-in web server
- shield board compatible Arduino without display, no risk to brake display during the trial
- Plexiglass part to protect the board
- Inhibited reverse gear to avoid a measuring board broken during the track tests
- Communication via wifi for PC, tablets and smartphones
- On track, communication http using internet browser (php5)
- Data storage directly in the car
- data saved on PC, tab, smartphone on .csv format compatible with spreadsheet
- socket key on measuring board to avoid connections error
- External power supply to avoid power consumption in measuring curves data

VERSION 2 IMPROVED

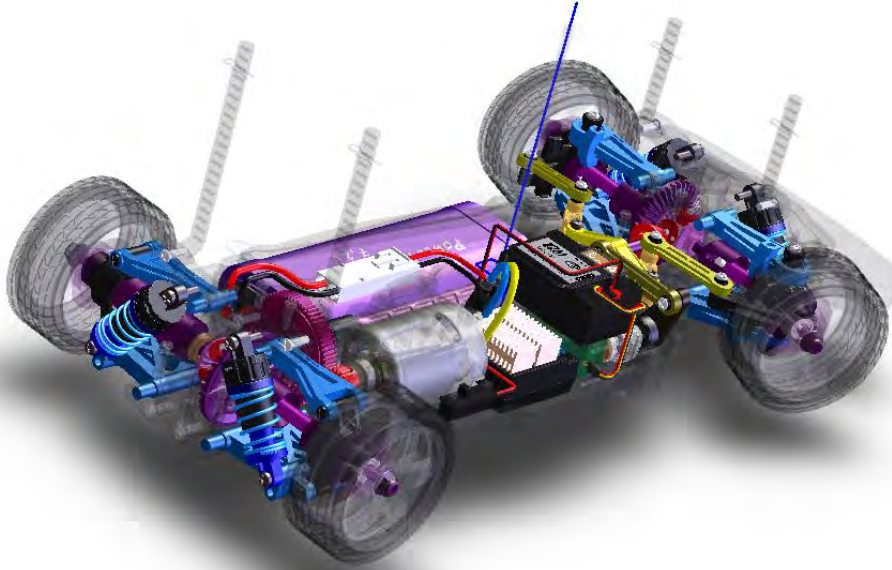
On the bench :

Aluminum bearing housing, no risk to brake during transportation

New brake sensor, stronger and reliable than previous one

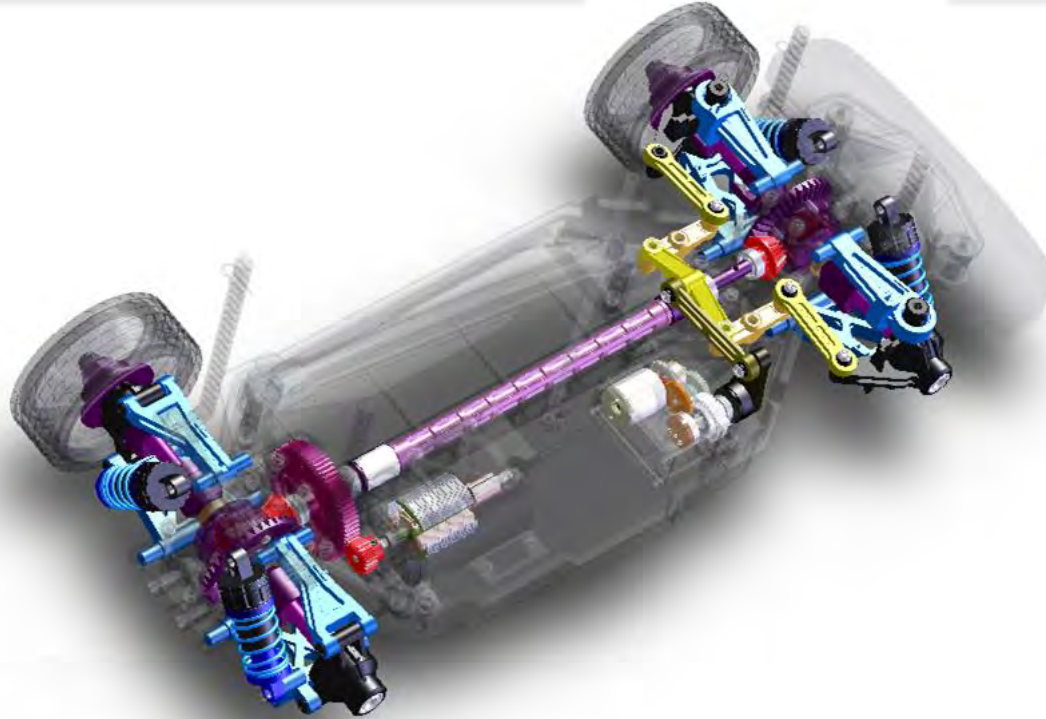
New brake system, reliable and better appearance than V1 version

Improved wires trunk to connect the car



1A - TT-02 basic model

1A - TT-02 basic model



- New model TT02
- Long life time system
- Strong build
- Reliable parts
- Easy to find worldwide

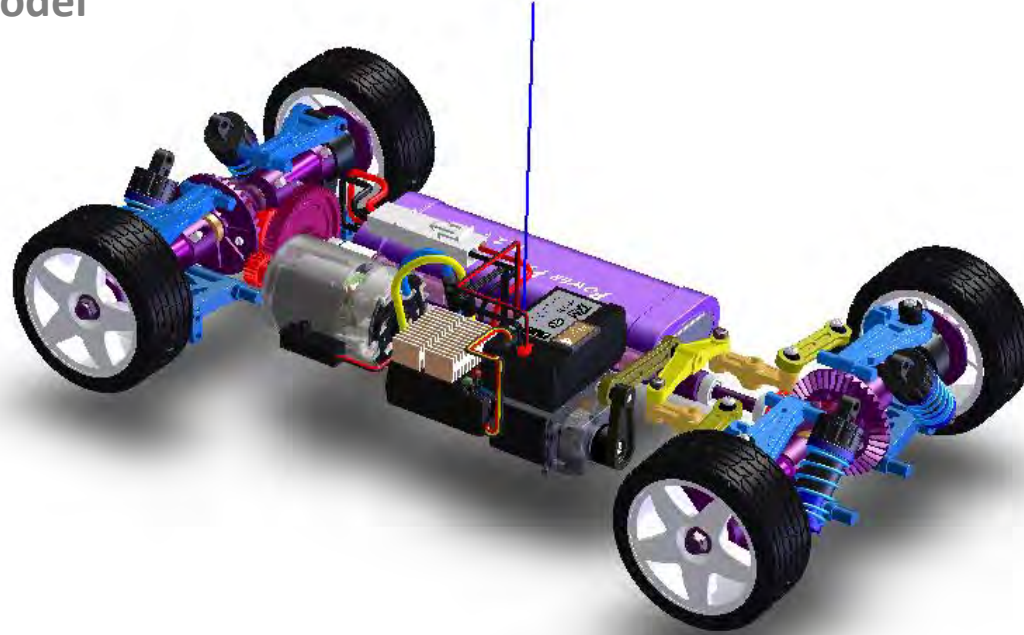
1A - TT-02 basic model

- 1/10 scale
- 4 wheels drive car
- Current drive motor - mabuchi 540
- Remote control - 2.4Ghz
- Battery - Ni-Mh 7.2V – 4200mAh
- Standard connections - Deans

And the bench ?

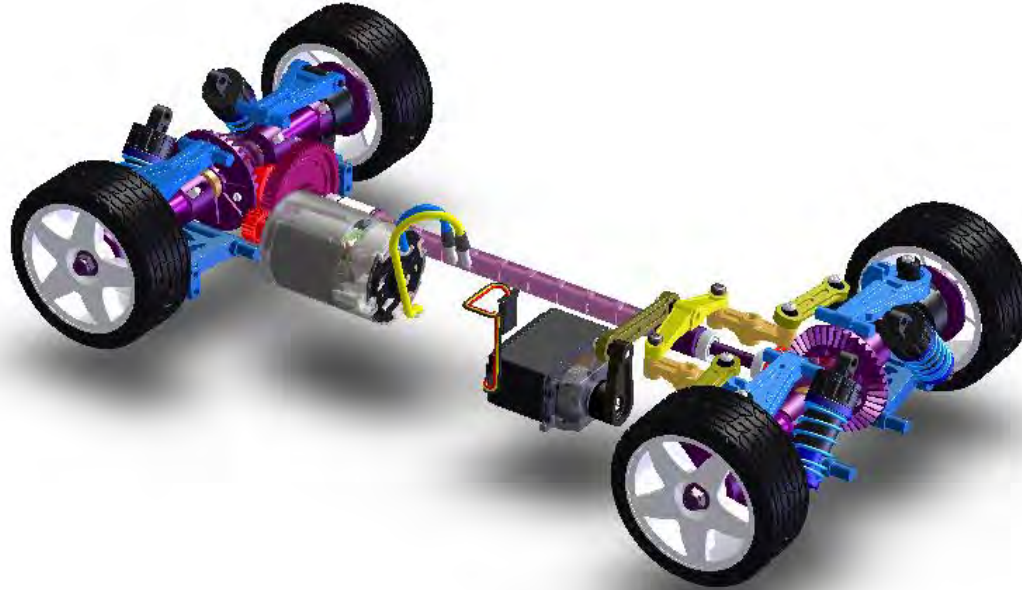


1A - TT-02 basic model



HOMOTHETIC
WITH REAL
CARS

1A - TT-02 basic model



MECHANICAL
RESSOURCES
AVAILABLE

1A - TT-02 basic model



Suspension

Animation



1A - TT-02 basic model

Suspension

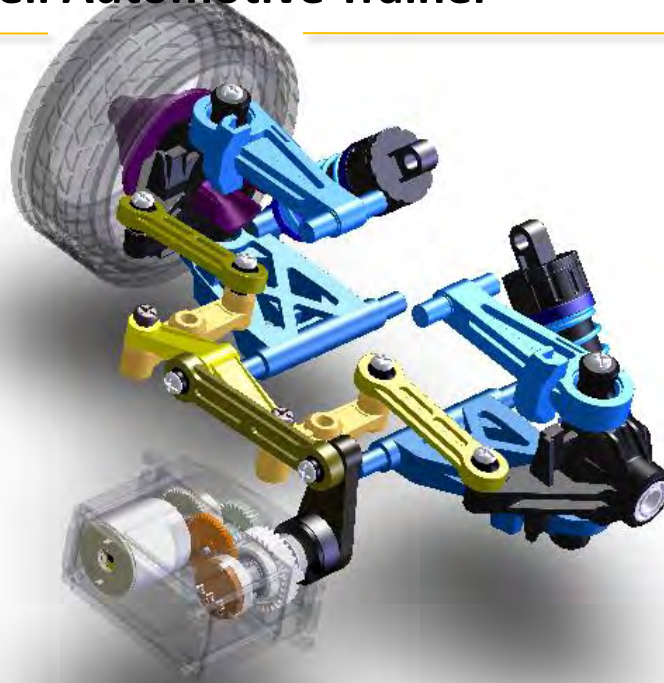
Animation



1A - TT-02 basic model

Steering system

Animation



1A - TT-02 basic model

Steering system

Animation



1A - TT-02 basic model

Steering system

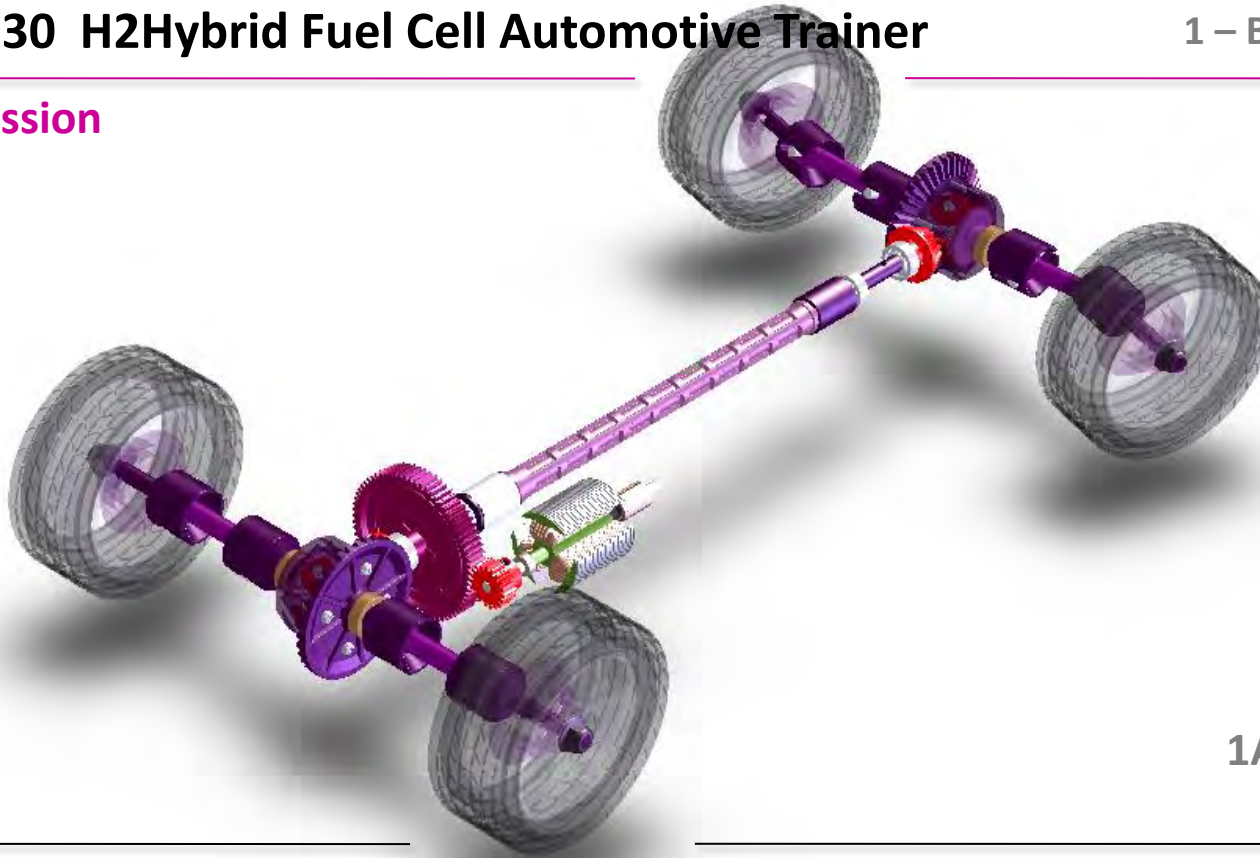
Animation



1A - TT-02 basic model

Transmission

Overview

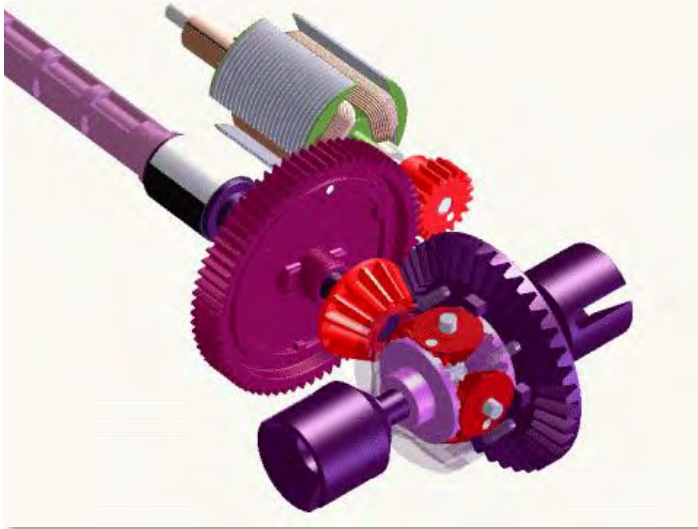


1A - TT-02 basic model

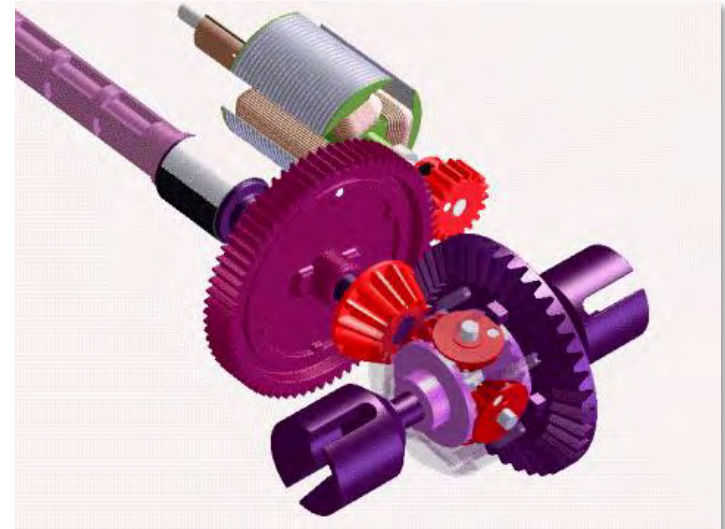
Transmission

Differential gear animations

1A - TT-02 basic model



Driving in right curve

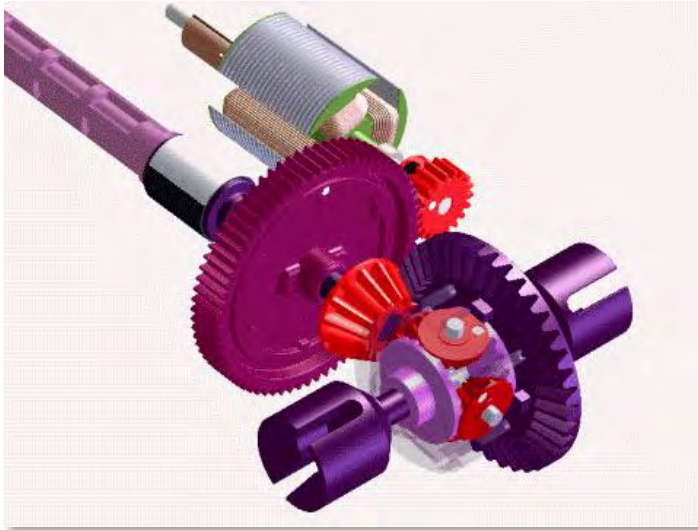


Driving in straight line

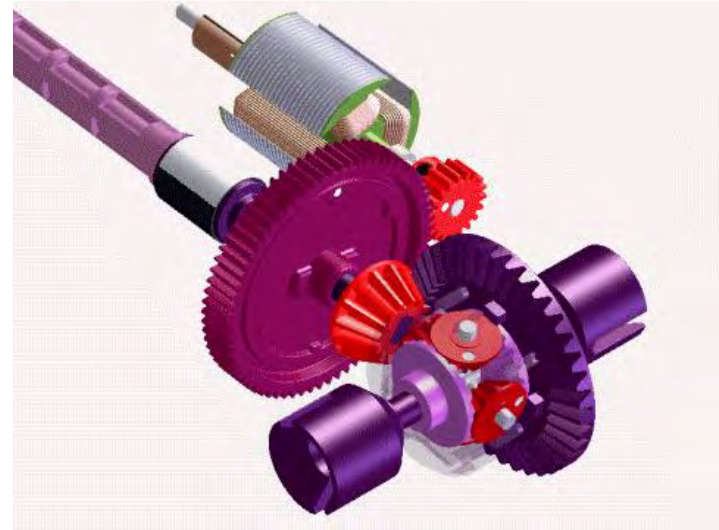
Transmission

Differential gear animations

1A - TT-02 basic model



Right wheel stopped

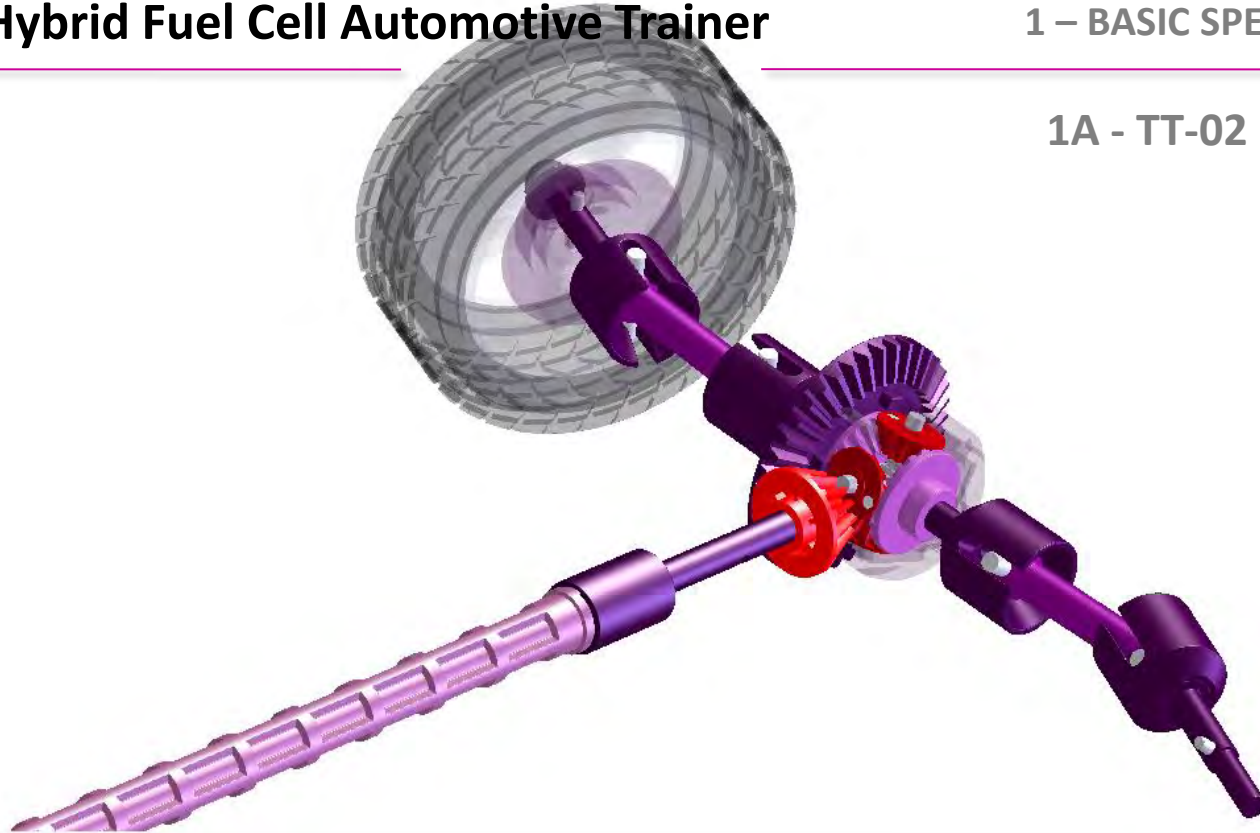


Motor stopped

Transmission

Gear details

1A - TT-02 basic model



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

Transmission

Gear details

1A - TT-02 basic model

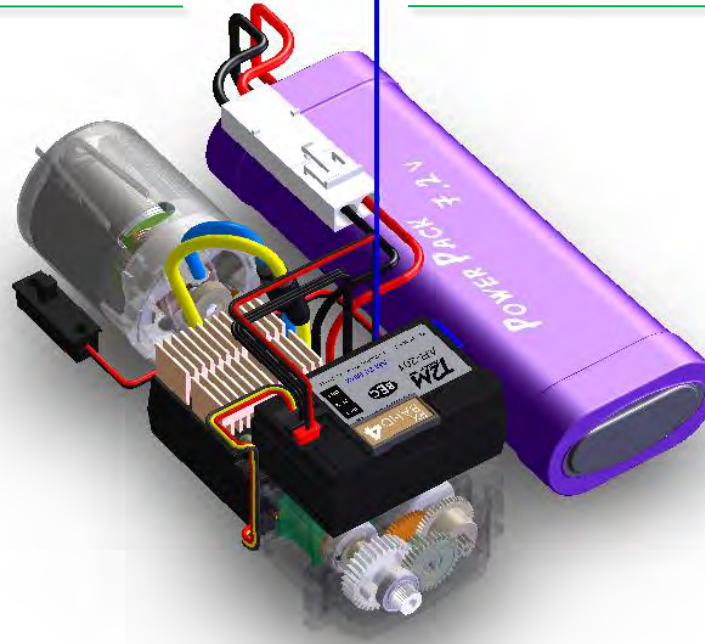


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

Basic connections

1A - TT-02 basic model



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

Basic connections

1A - TT-02 basic model



Radio receiver

1 – BASIC SPECIFICATIONS

1A - TT-02 basic model

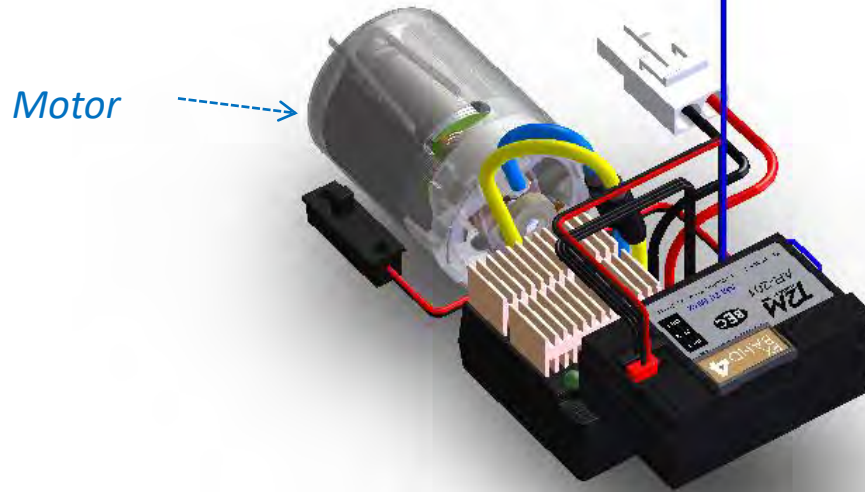


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

Basic connections

1A - TT-02 basic model

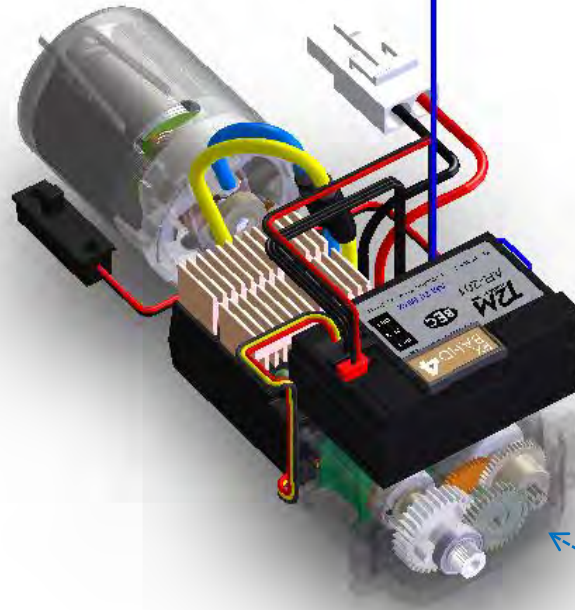


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

Basic connections

1A - TT-02 basic model



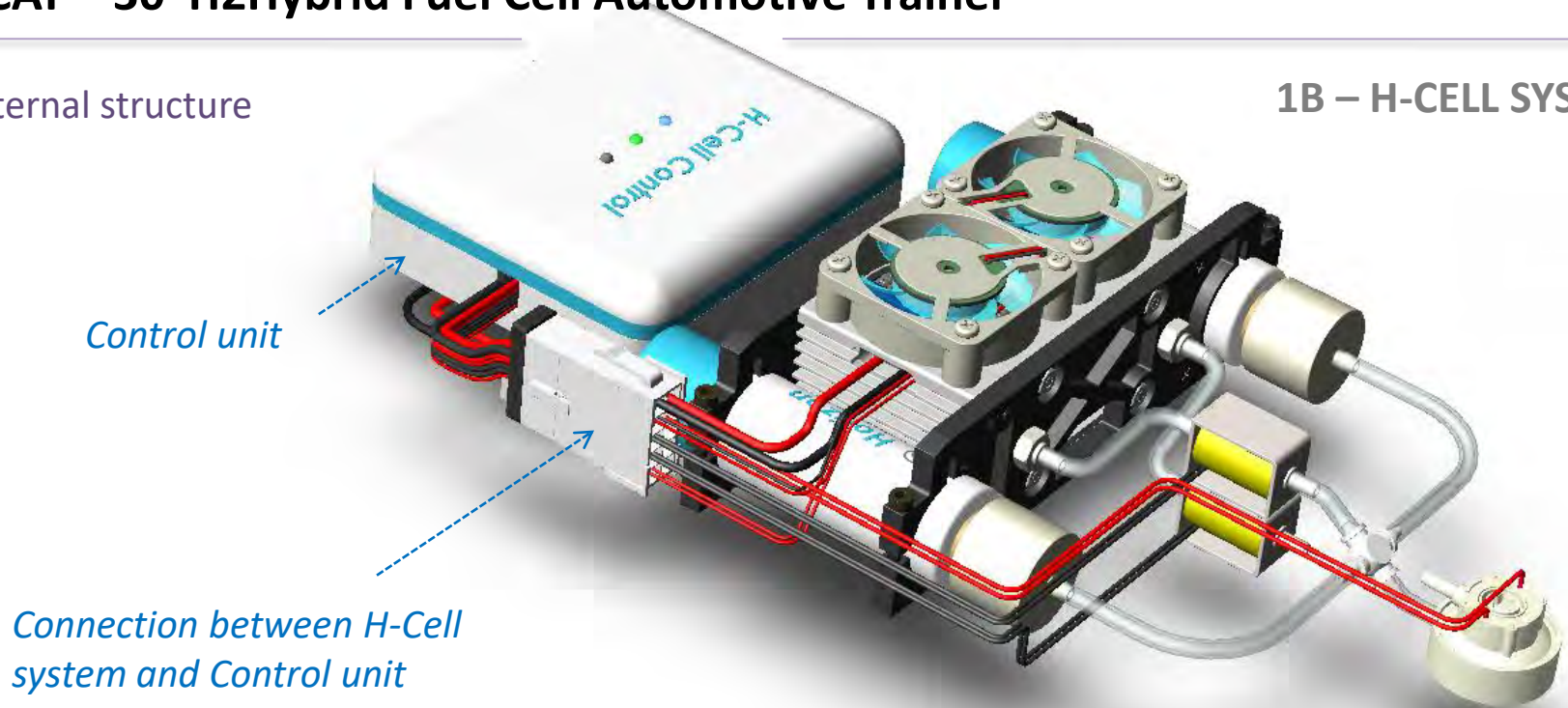
Servo motor



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

External structure

1B – H-CELL SYSTEM

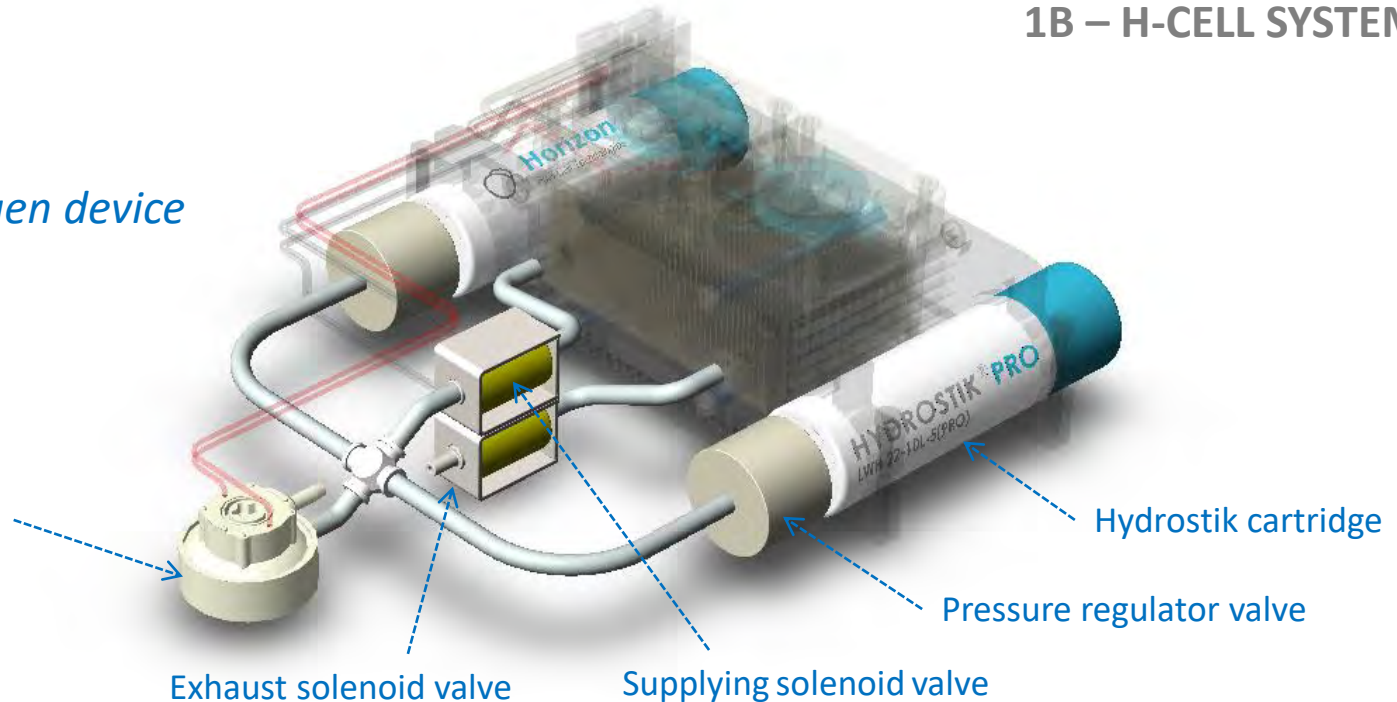


External structure

1B – H-CELL SYSTEM

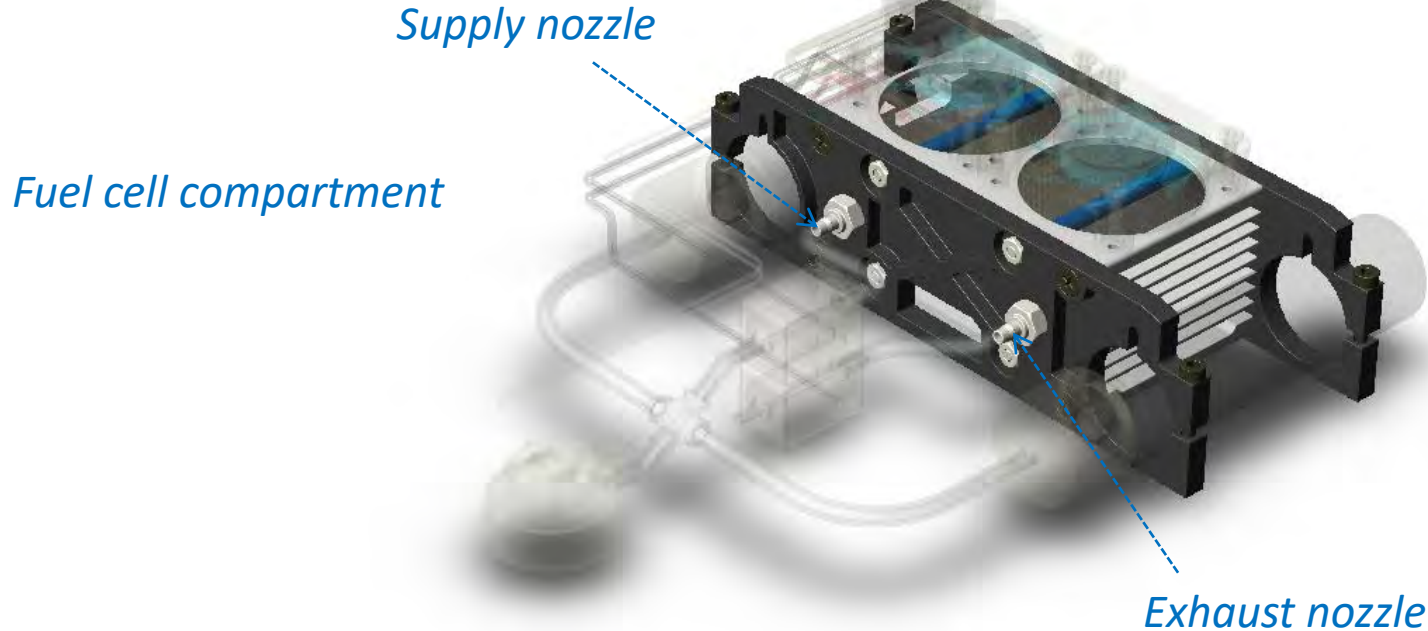
Supplying hydrogen device

Detection of low
Hydrogene pressure



External structure

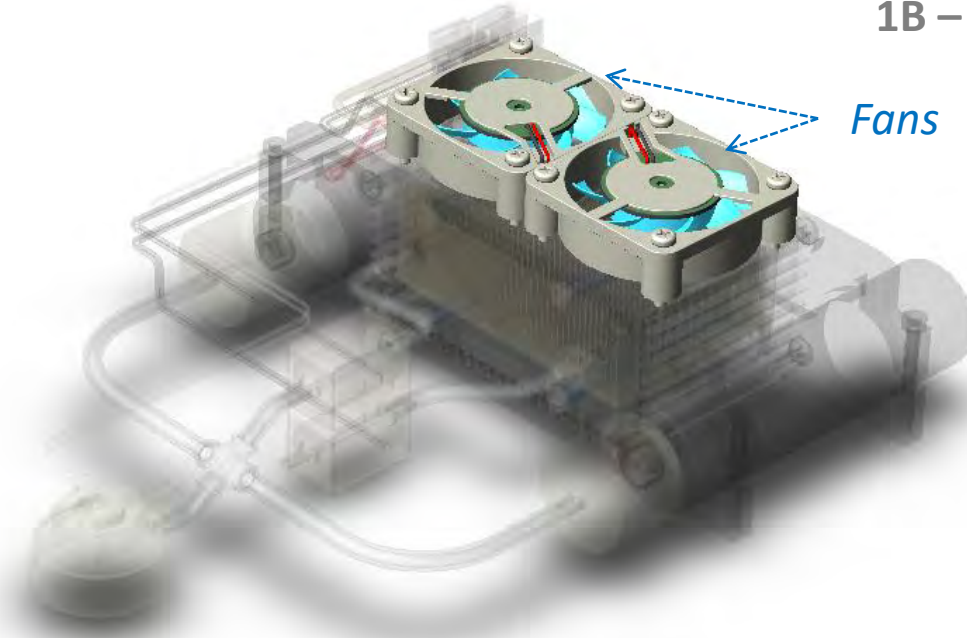
1B – H-CELL SYSTEM



External structure

*Oxygen supply from
external fans*

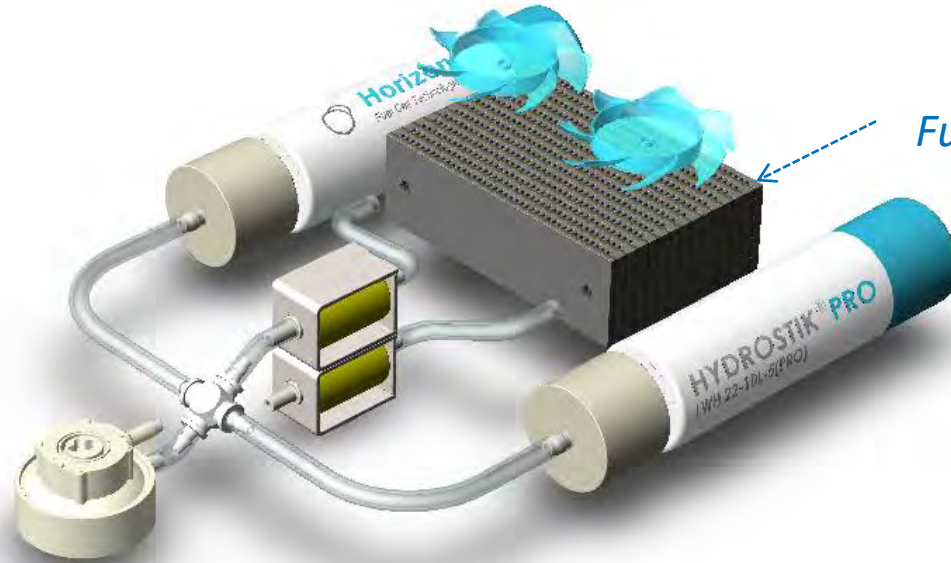
1B – H-CELL SYSTEM



External structure

1B – H-CELL SYSTEM

Fuel cell implant

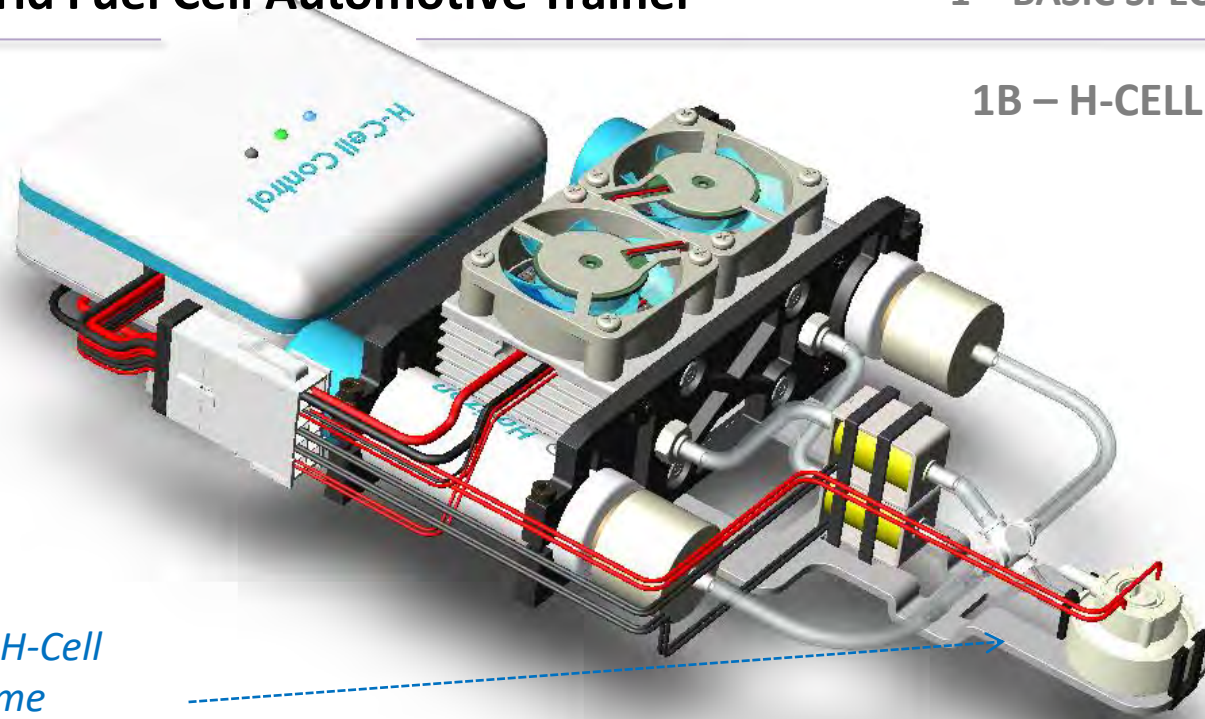


*Fuel Cell « p.e.m.f.c. »
technology*

(pemfc : Proton Exchange Membrane Fuel Cell)

External structure

1B – H-CELL SYSTEM



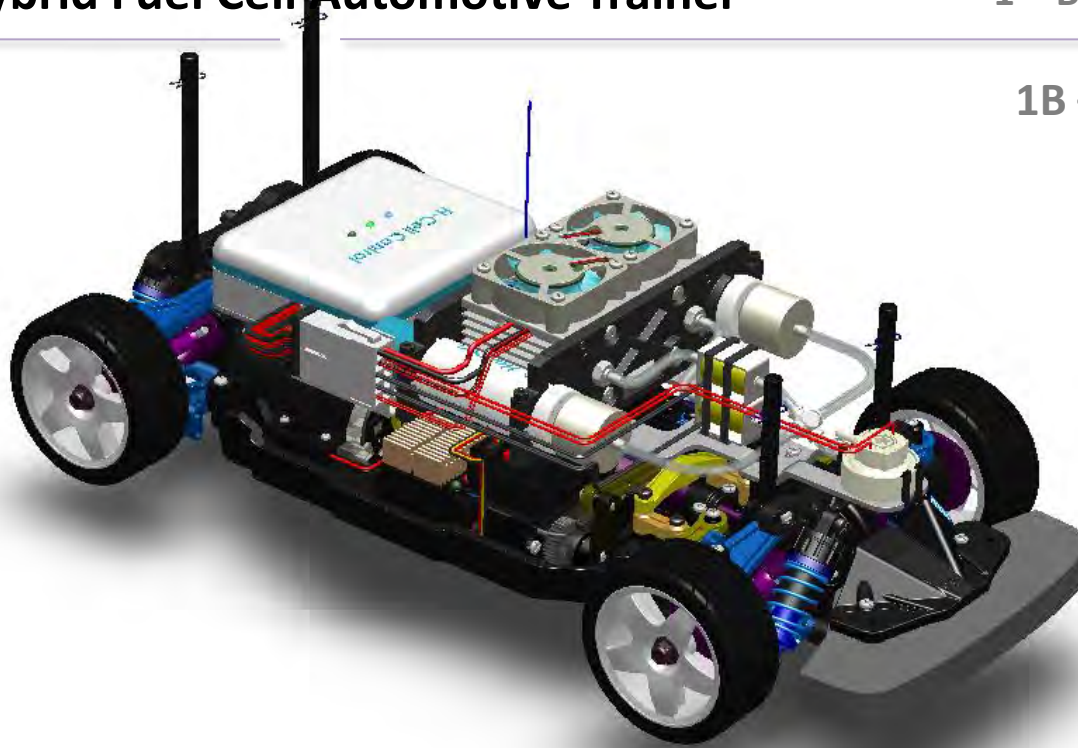
*Mounting plate of H-Cell
group on TT-02 frame*

FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

External structure

1B – H-CELL SYSTEM



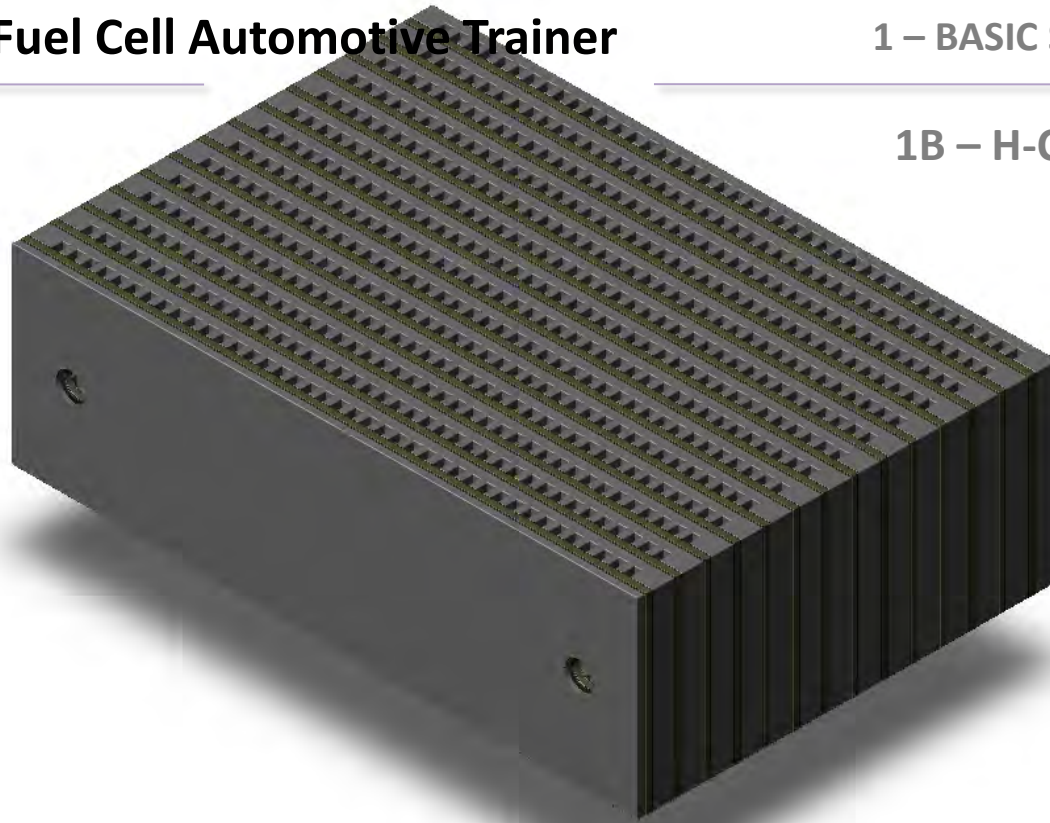
*Implant on
TT-02 Frame*

FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

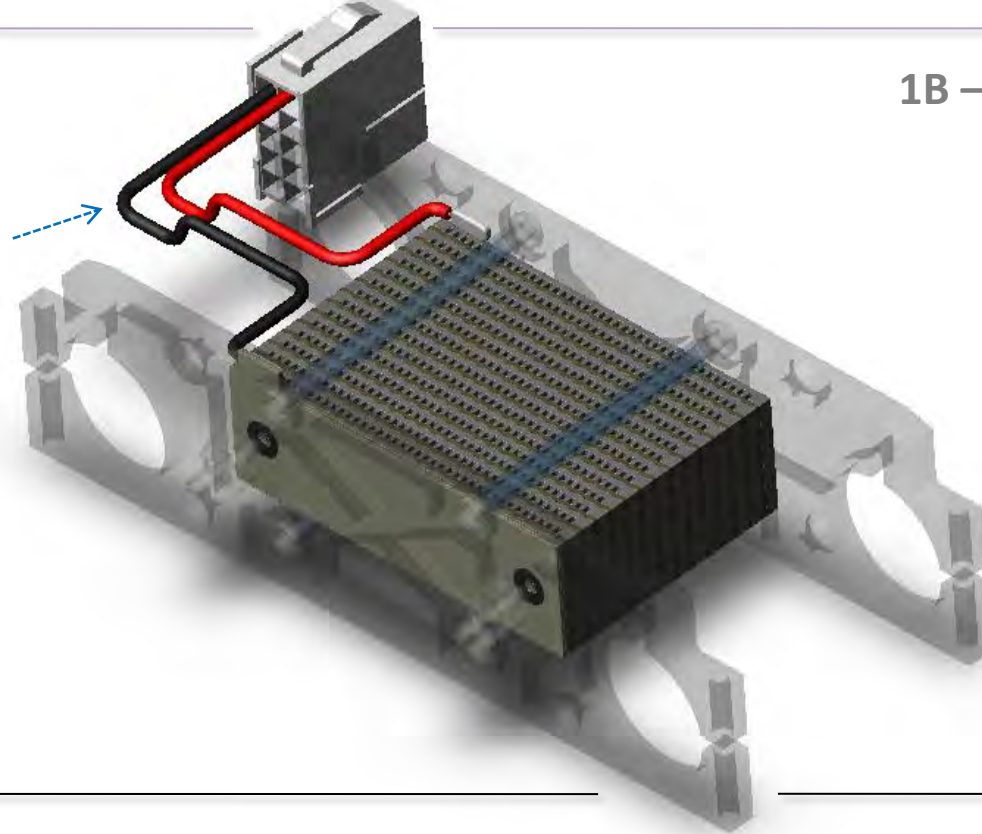
Internal structure

1B – H-CELL SYSTEM



Internal structure

Recovery circuit for electric energy,
from the chemical reaction within
the fuel cell.



1B – H-CELL SYSTEM

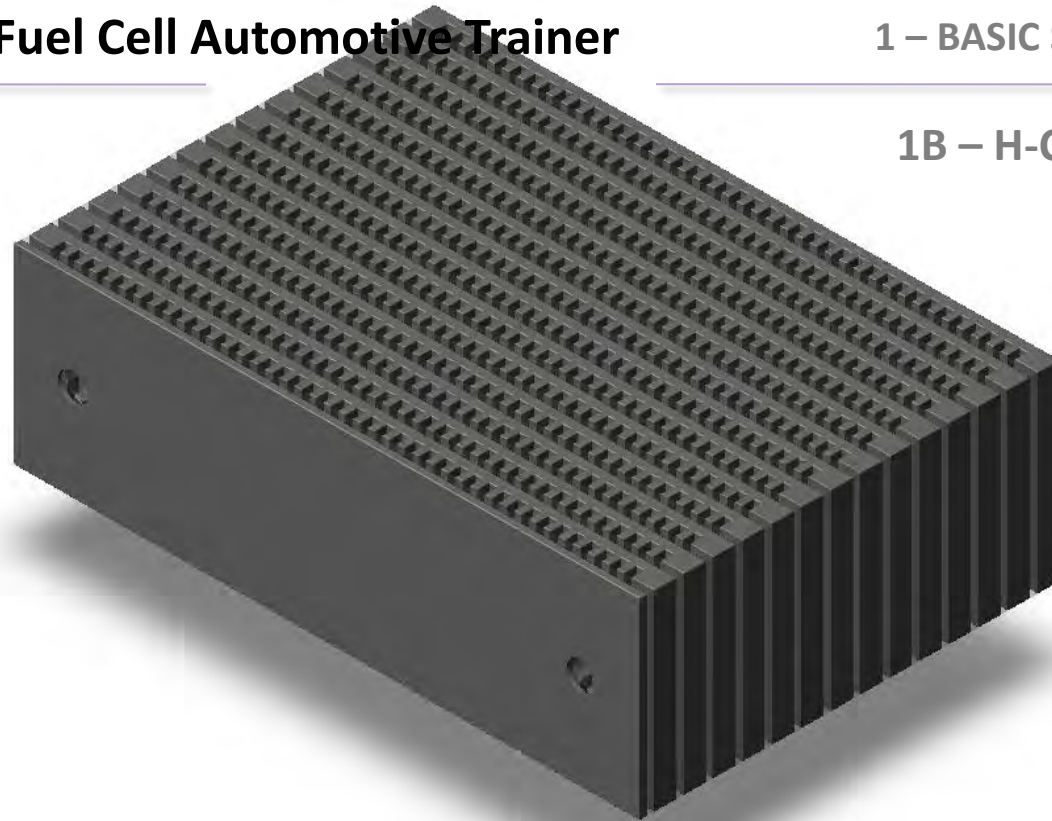


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Grounding plates

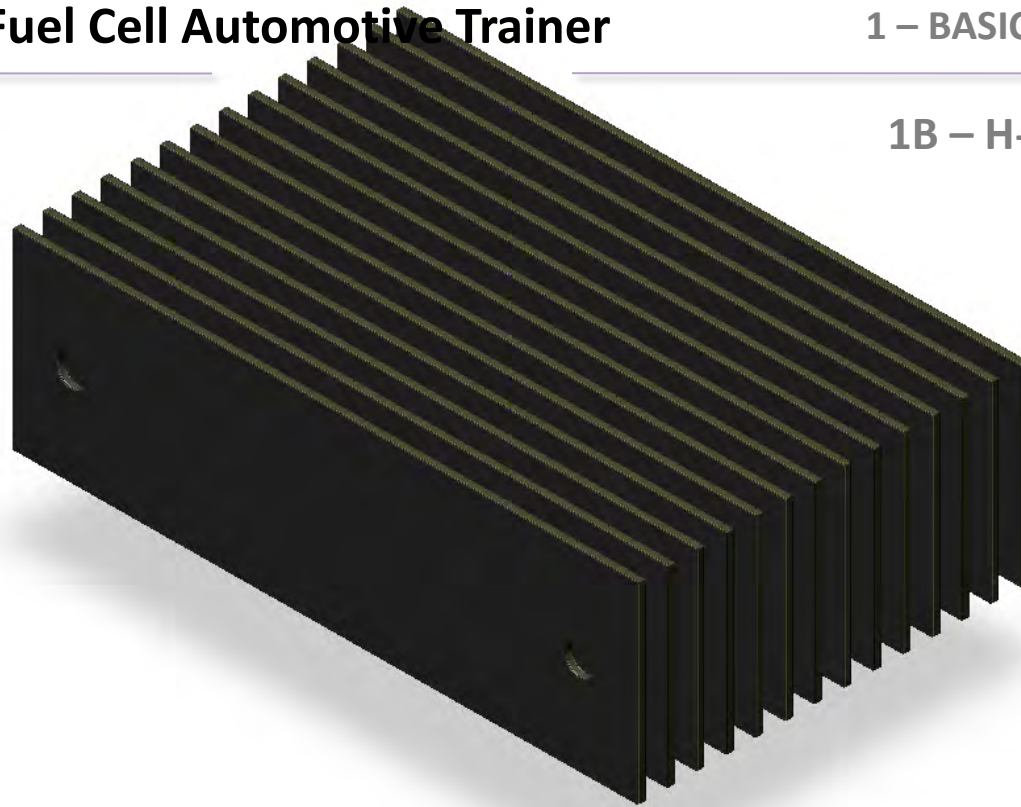


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

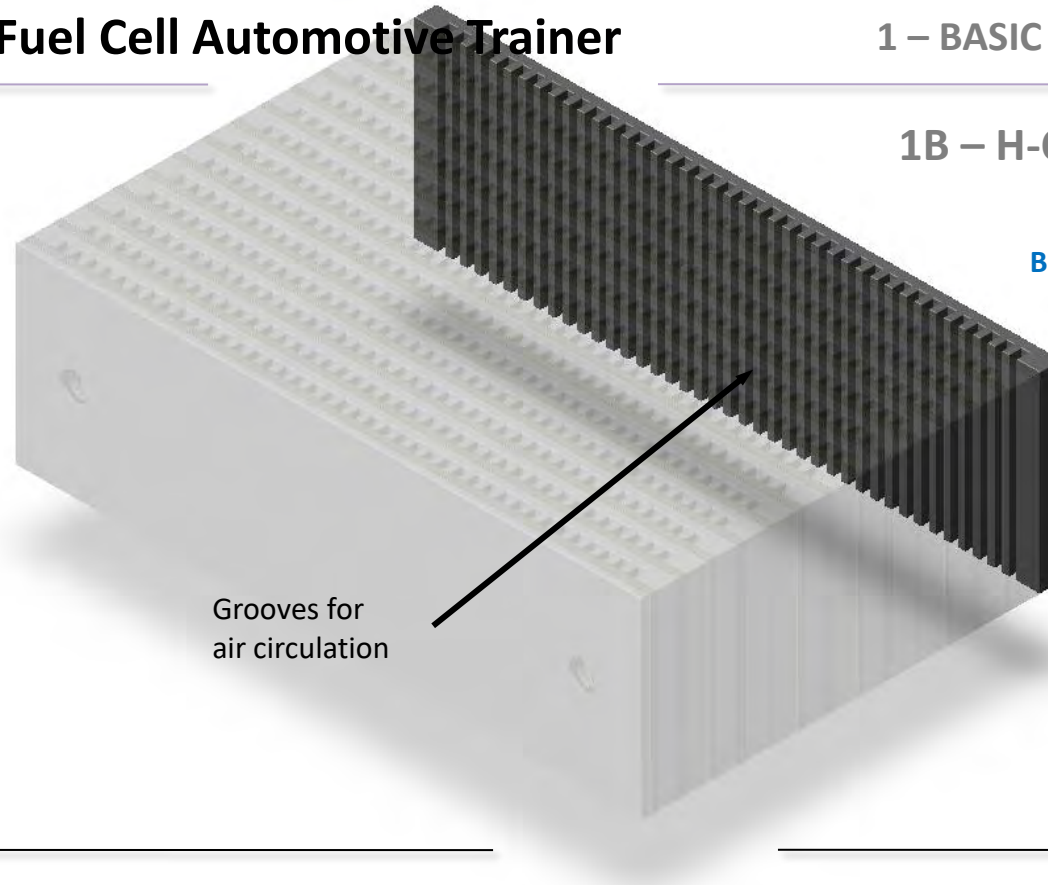
*Proton exchange
membranes inserted
between plates*



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM



Grooves for
air circulation

Back unipolar plate



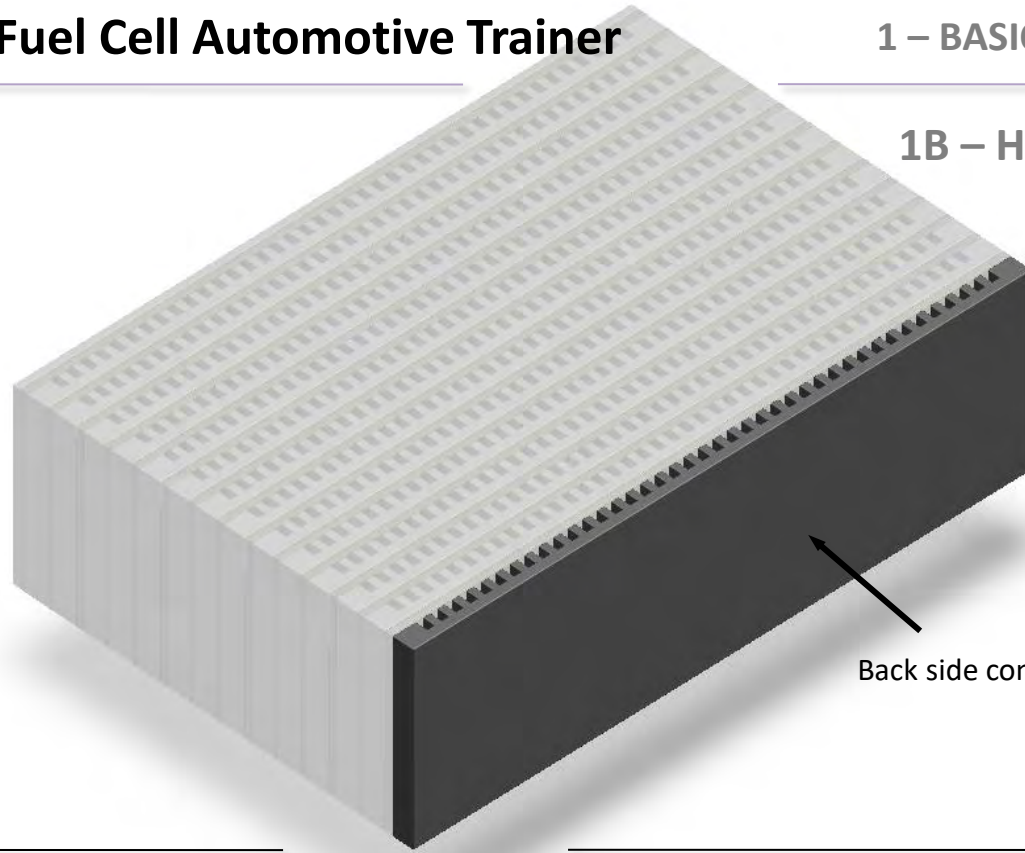
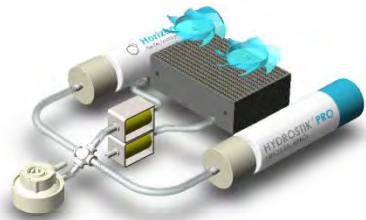
FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Back unipolar plate

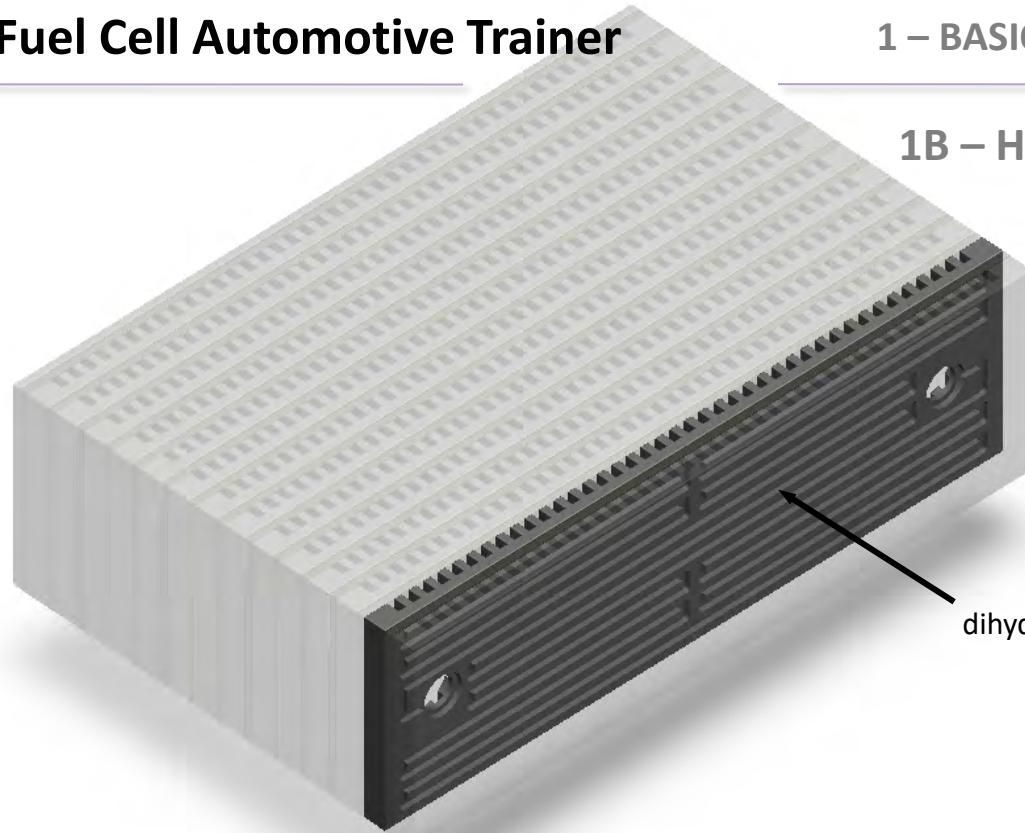
Back side connected with line + (red)



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM



Bipolar plates

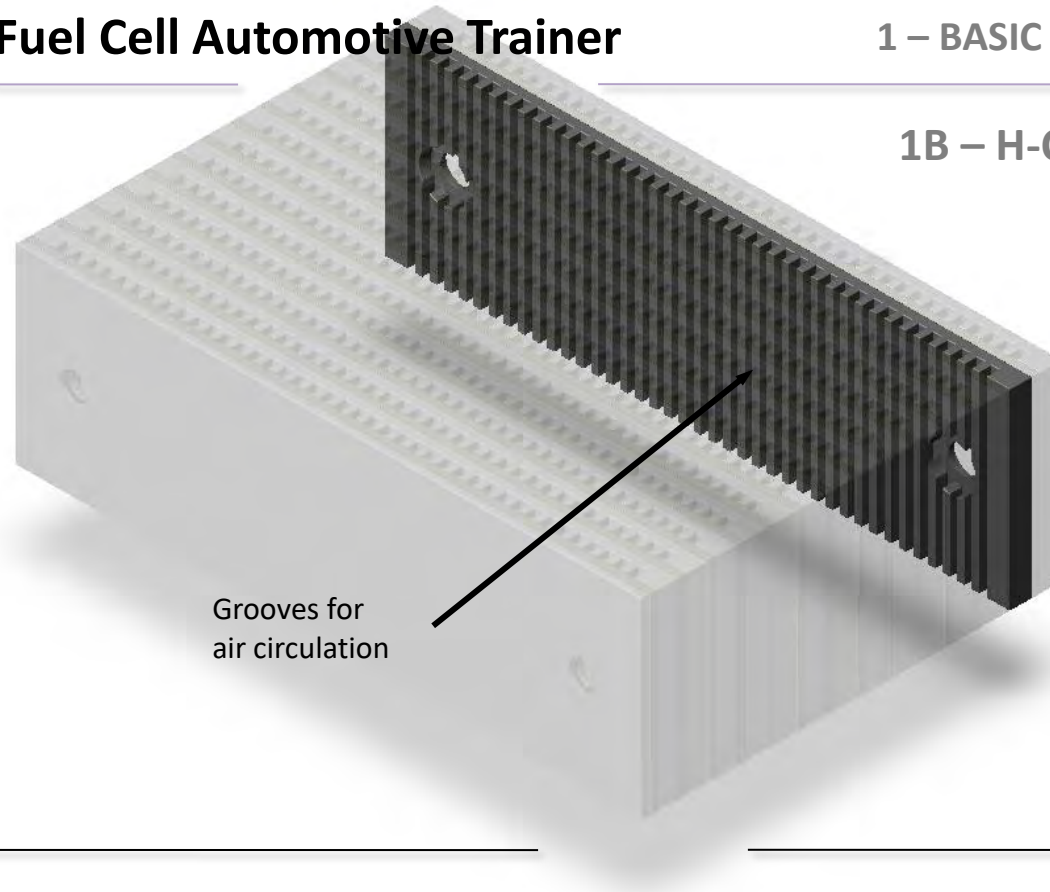
dihydrogen circuit



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

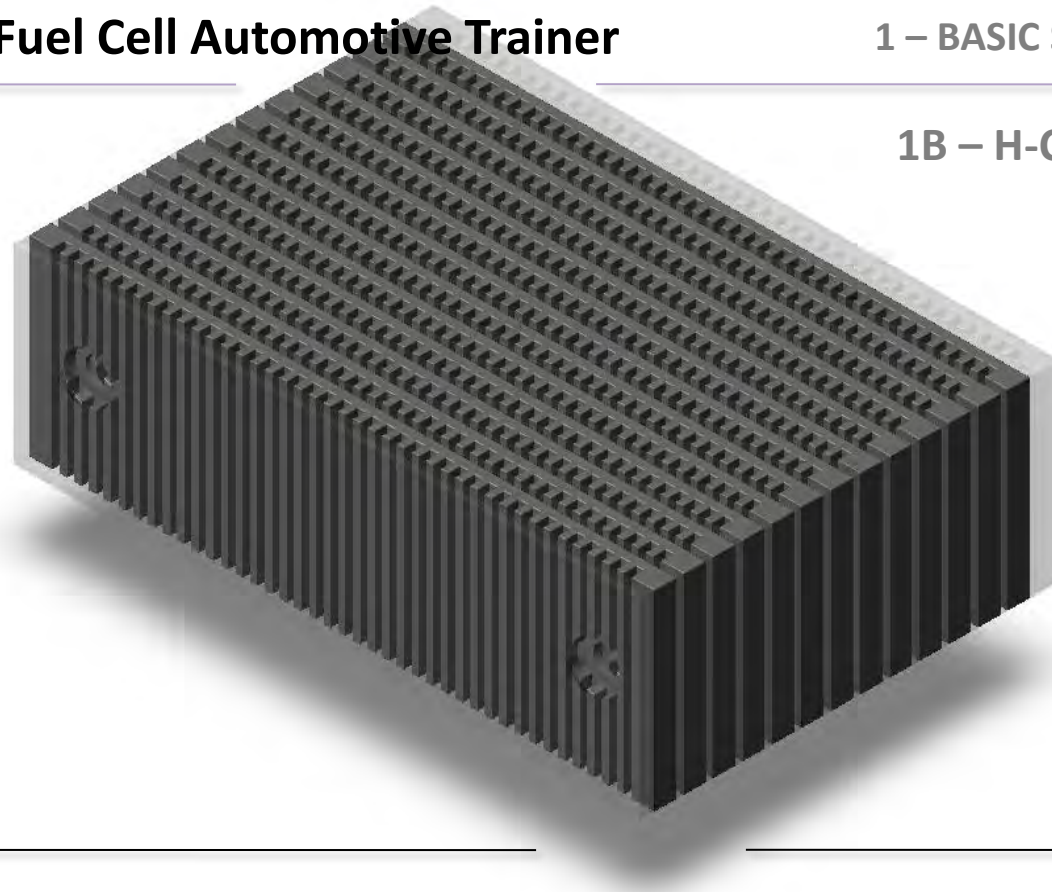


Bipolar plates

Grooves for
air circulation



1B – H-CELL SYSTEM

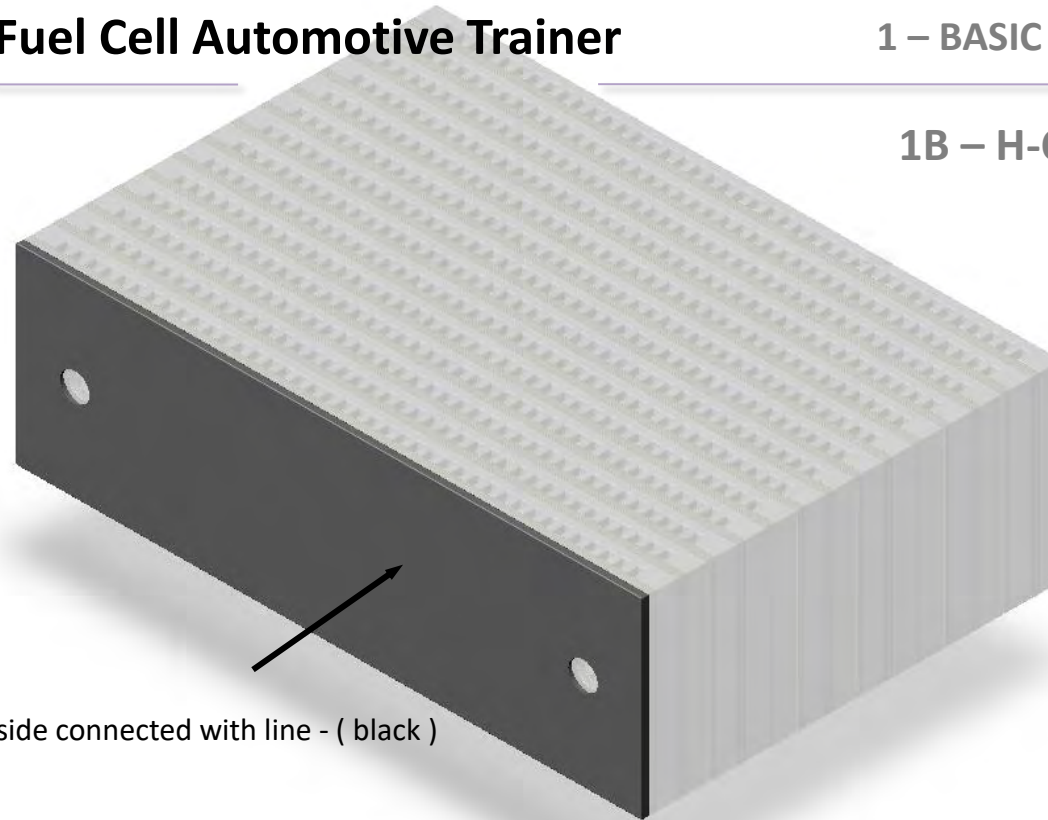


Bipolar plates



1B – H-CELL SYSTEM

Front unipolar plate



Back side connected with line - (black)



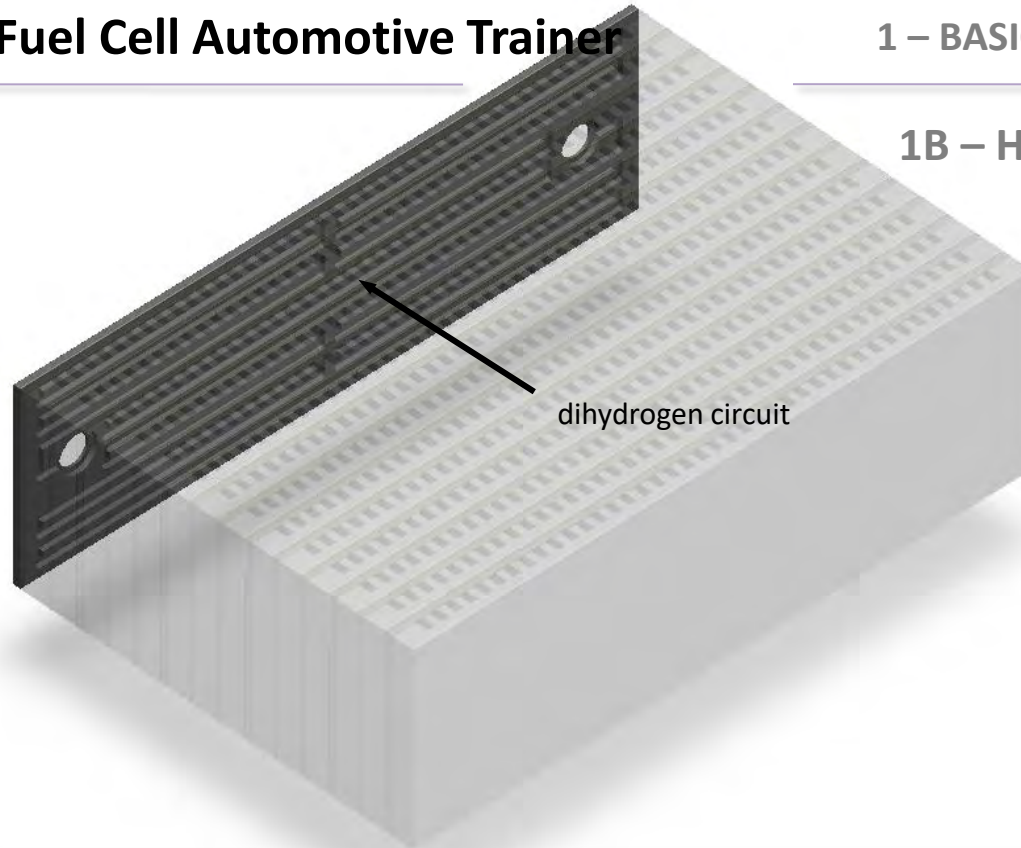
FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Front unipolar plate

dihydrogen circuit



FCAT – 30 H₂Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Output

Input

Dihydrogen supply



FCAT – 30 H₂Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Output

Input

Dihydrogen supply

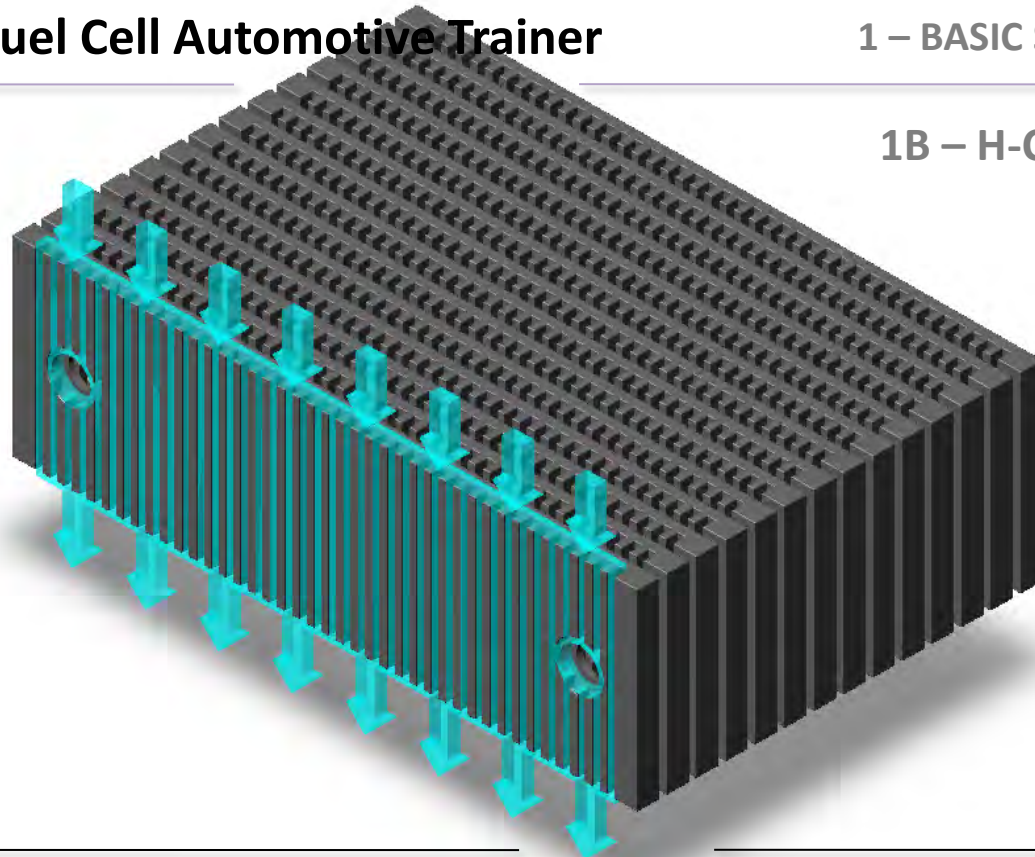


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Dioxygen from
ambient air supply

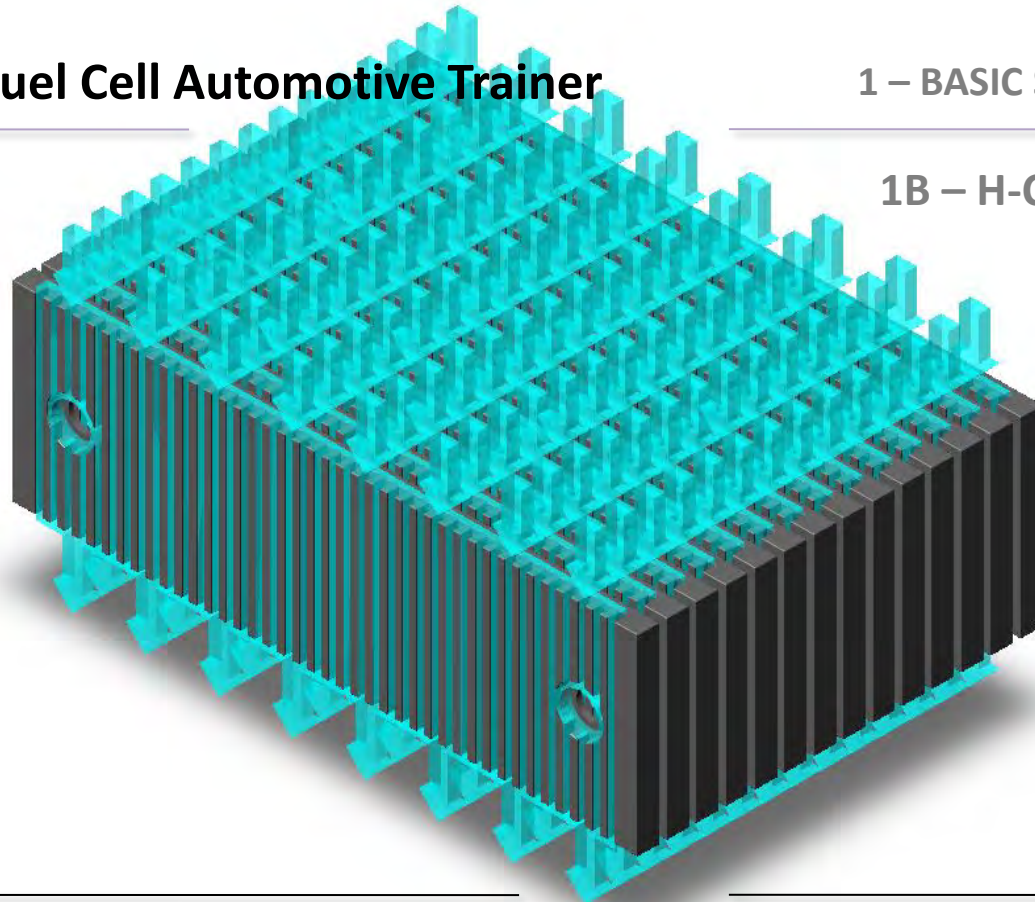


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Dioxygen from
ambient air supply

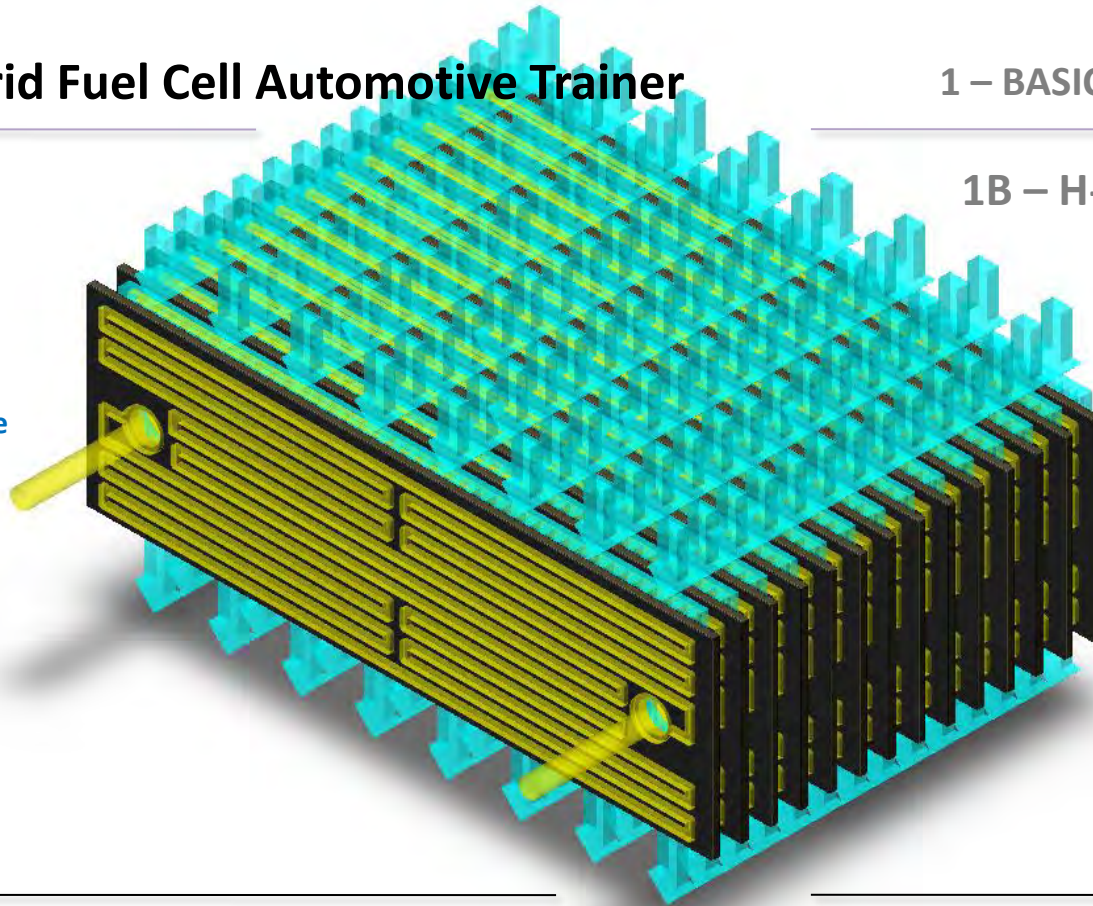


FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

1 – BASIC SPECIFICATIONS

1B – H-CELL SYSTEM

Dihydrogen and dioxygen separated by proton exchange membranes before the chemical reaction



Principle of PEMFC

Basic chemical reaction

Different types of particles :



Proton(s) : positively charged particles



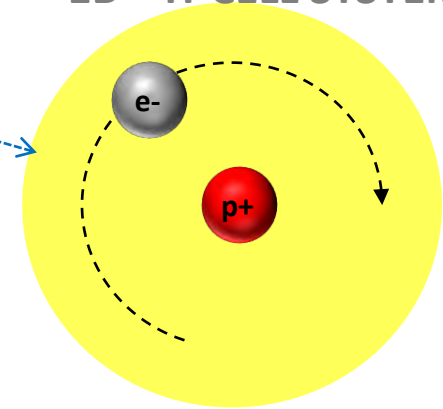
électron(s) : negatively charged particles



neutrons : uncharged particle, unshawed on drawing

Hydrogen atom :
1 proton, 1 electron

1B – H-CELL SYSTEM



The Atom: constituted by at least one proton and one rotating electron, and possibly several other neutrons. The atom is neutral, that is balanced in number of protons and electrons.

The Ion: constituted by at least one proton and possibly by several rotating electron (s) and by neutron (s). He is not neutral, thus not charged positively or negatively (more electrons than protons)

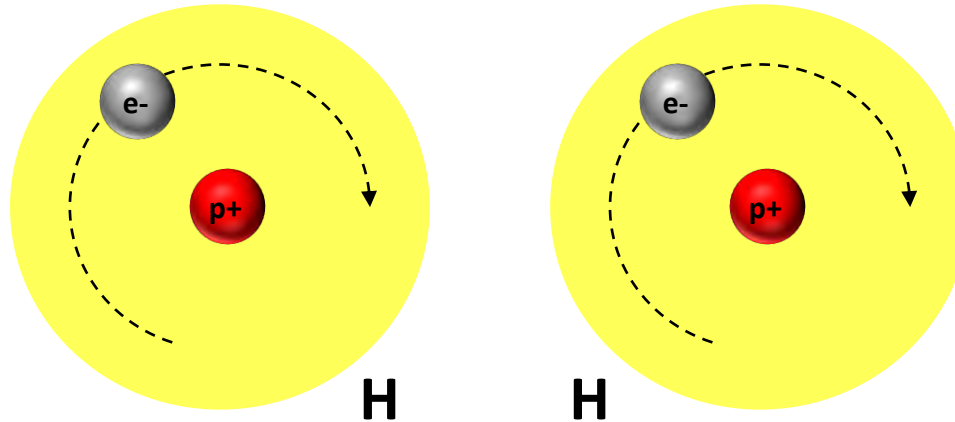
The Molecule: element constituted by several atoms and/or ions bound between them by connections constituted by motionless electrons.

Principle of PEMFC

Basic chemical reaction

1B – H-CELL SYSTEM

Two hydrogen atoms...

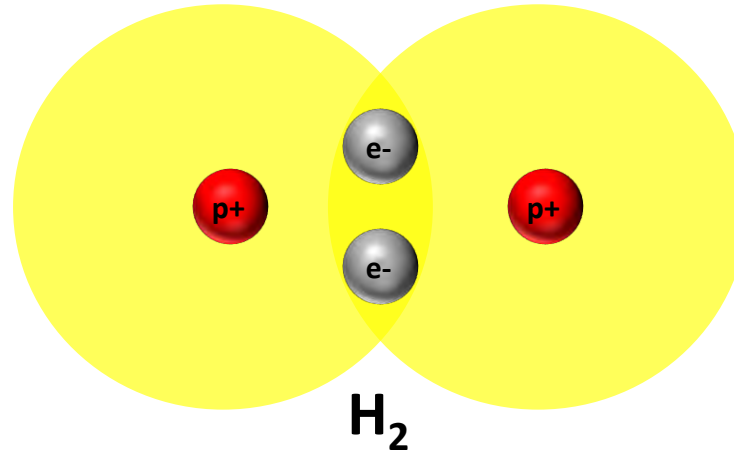


Principle of PEMFC

Basic chemical reaction

1B – H-CELL SYSTEM

Create a dihydrogen molecule

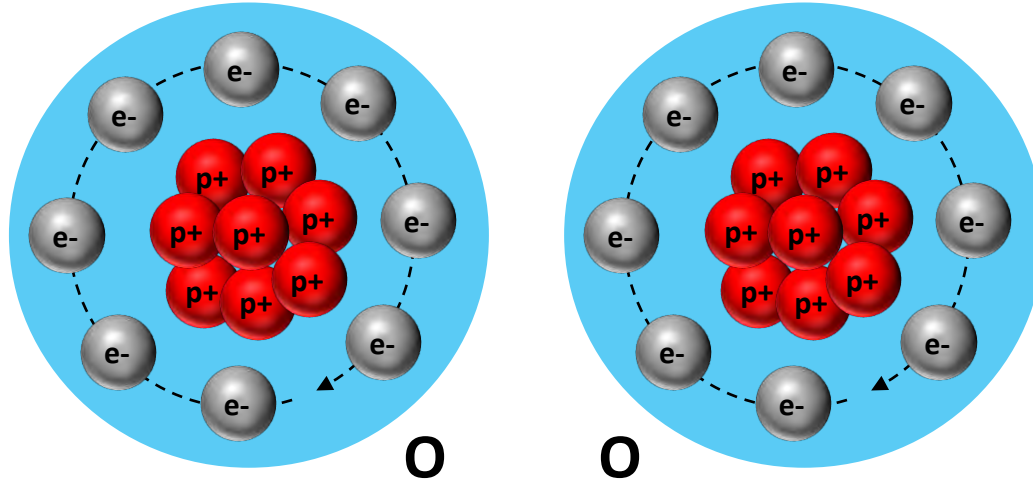


Principle of PEMFC

Basic chemical reaction

1B – H-CELL SYSTEM

Two oxygen atoms...

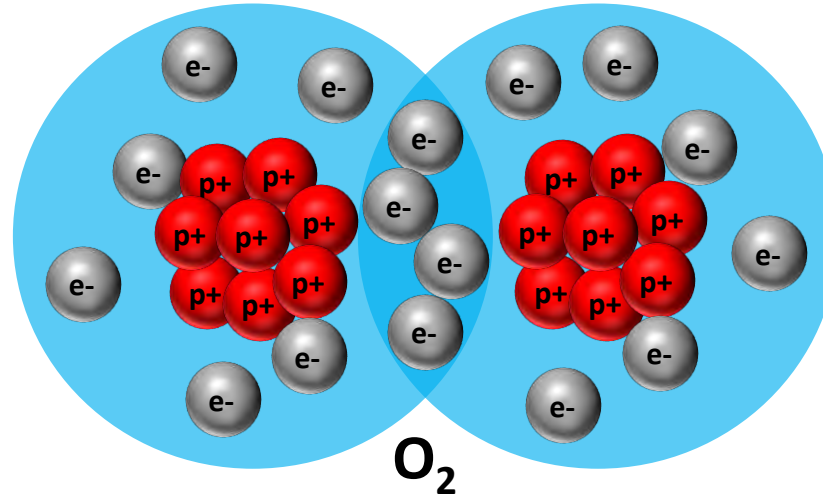


Principle of PEMFC

Basic chemical reaction

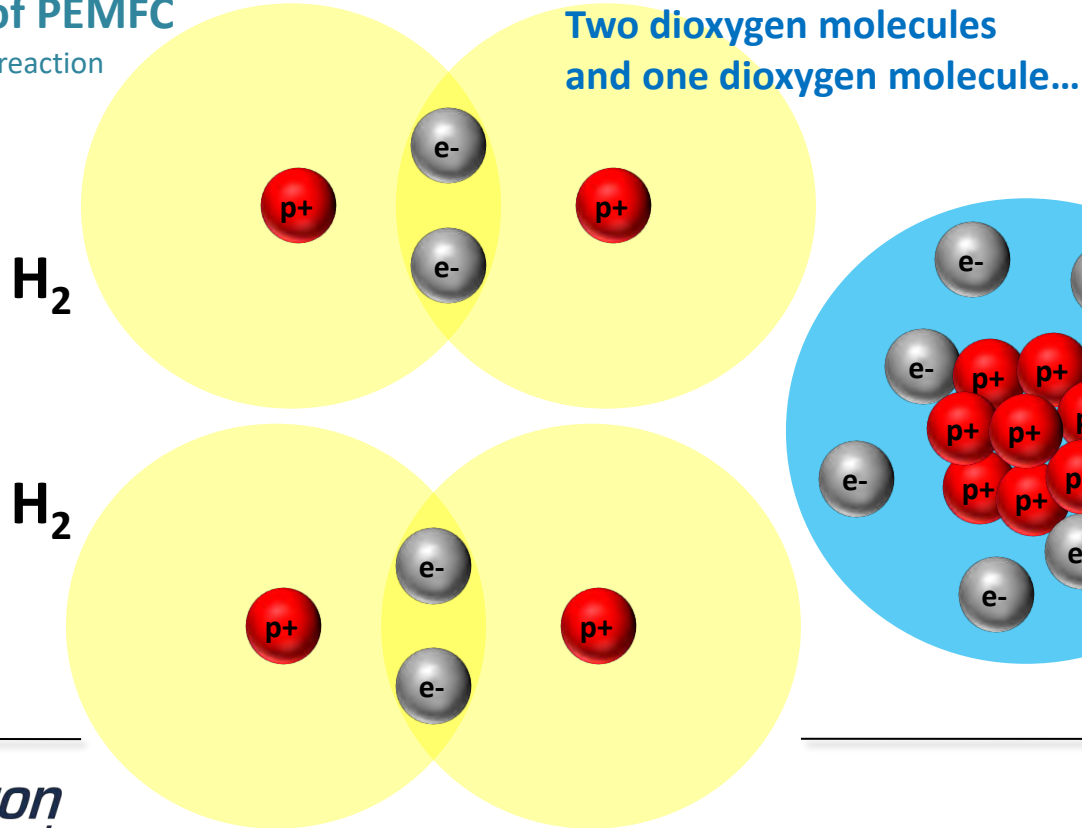
1B – H-CELL SYSTEM

Create a dioxygen molecule

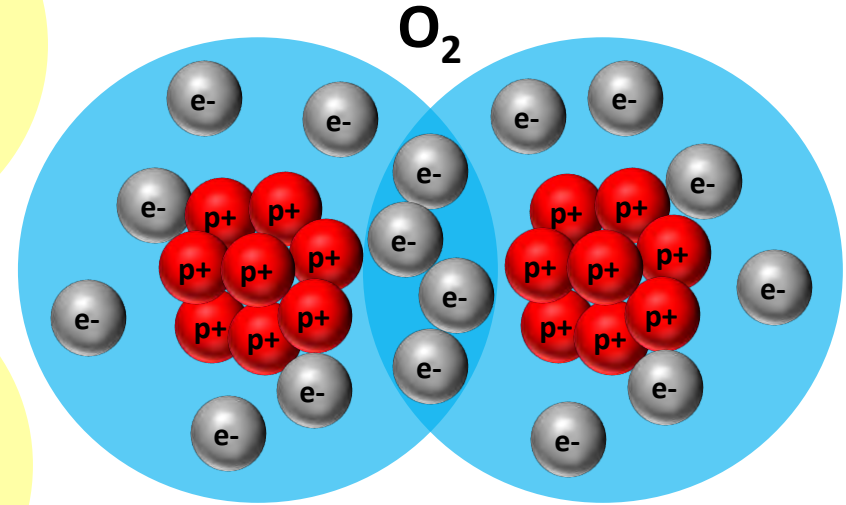


Principle of PEMFC

Basic chemical reaction



1B – H-CELL SYSTEM

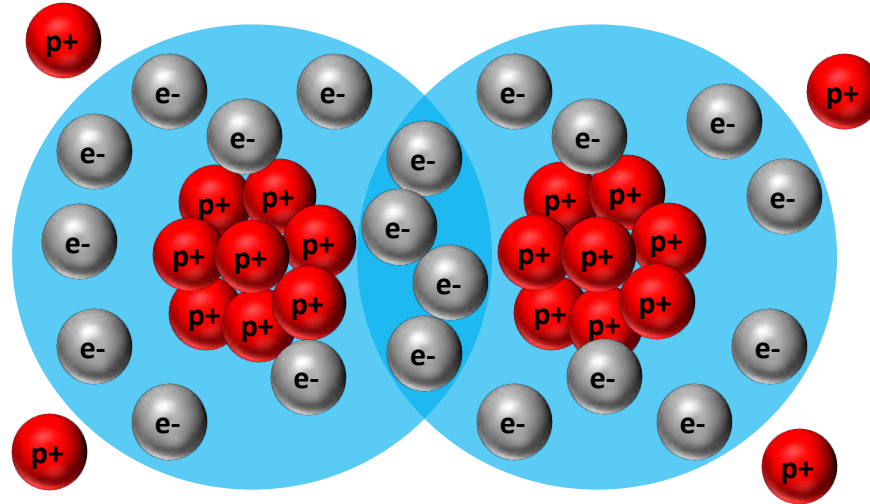


Principle of PEMFC

Basic chemical reaction

Two dioxygen molecules
and one dioxygen molecule...

1B – H-CELL SYSTEM

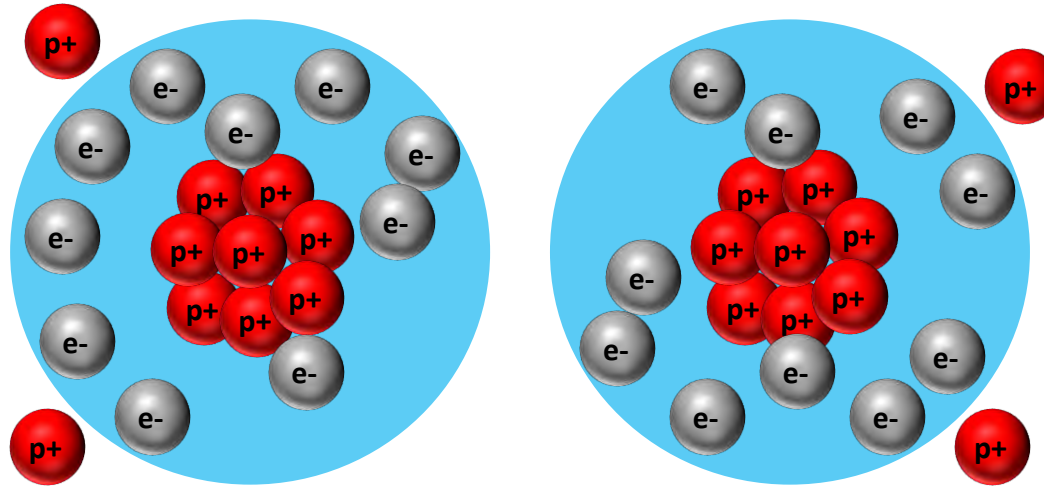


Principle of PEMFC

Basic chemical reaction

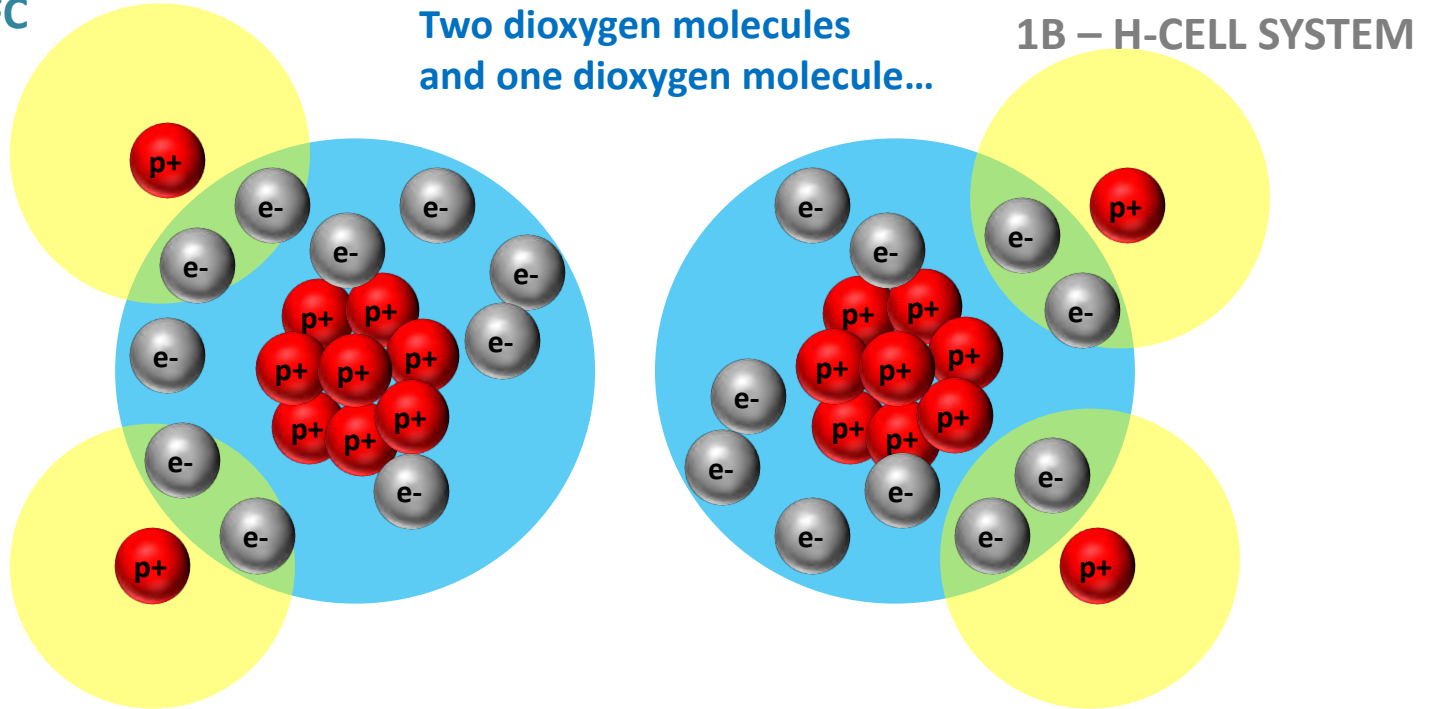
Two dioxygen molecules
and one dioxygen molecule...

1B – H-CELL SYSTEM



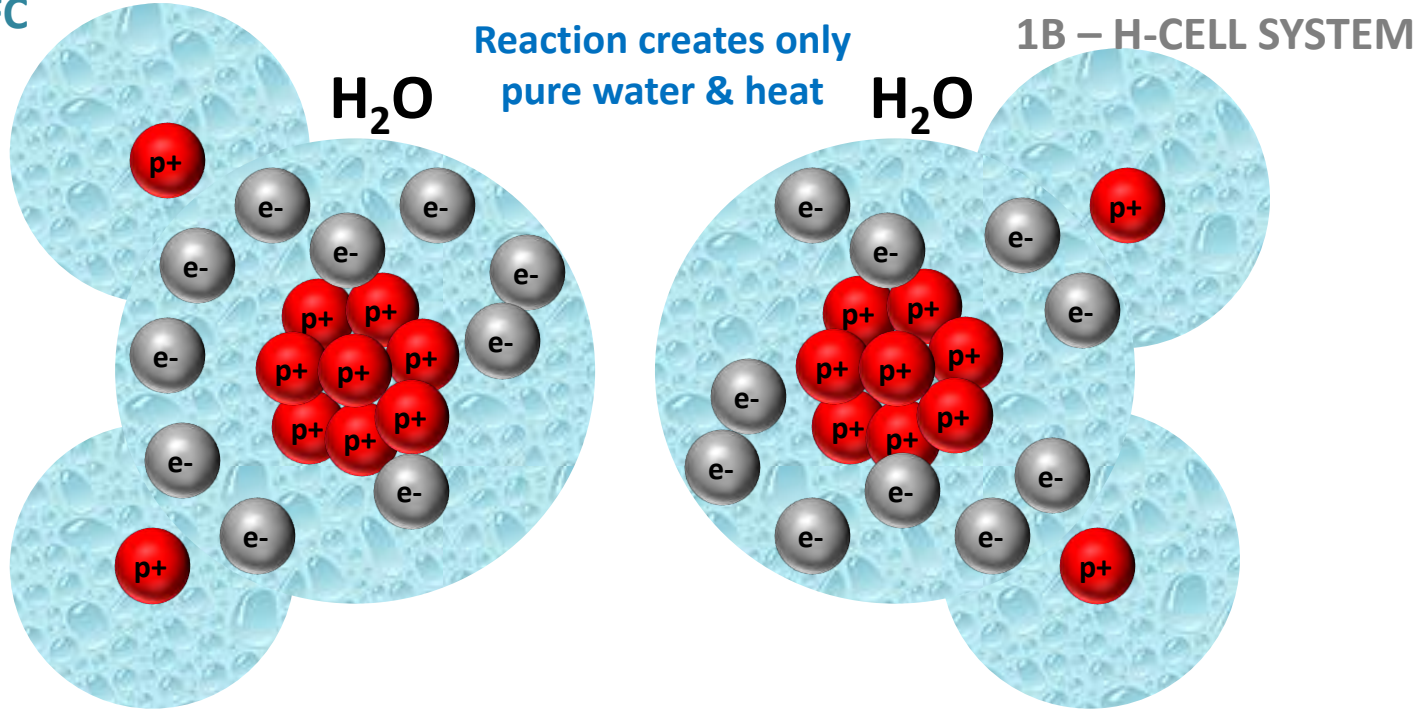
Principle of PEMFC

Basic chemical reaction



Principle of PEMFC

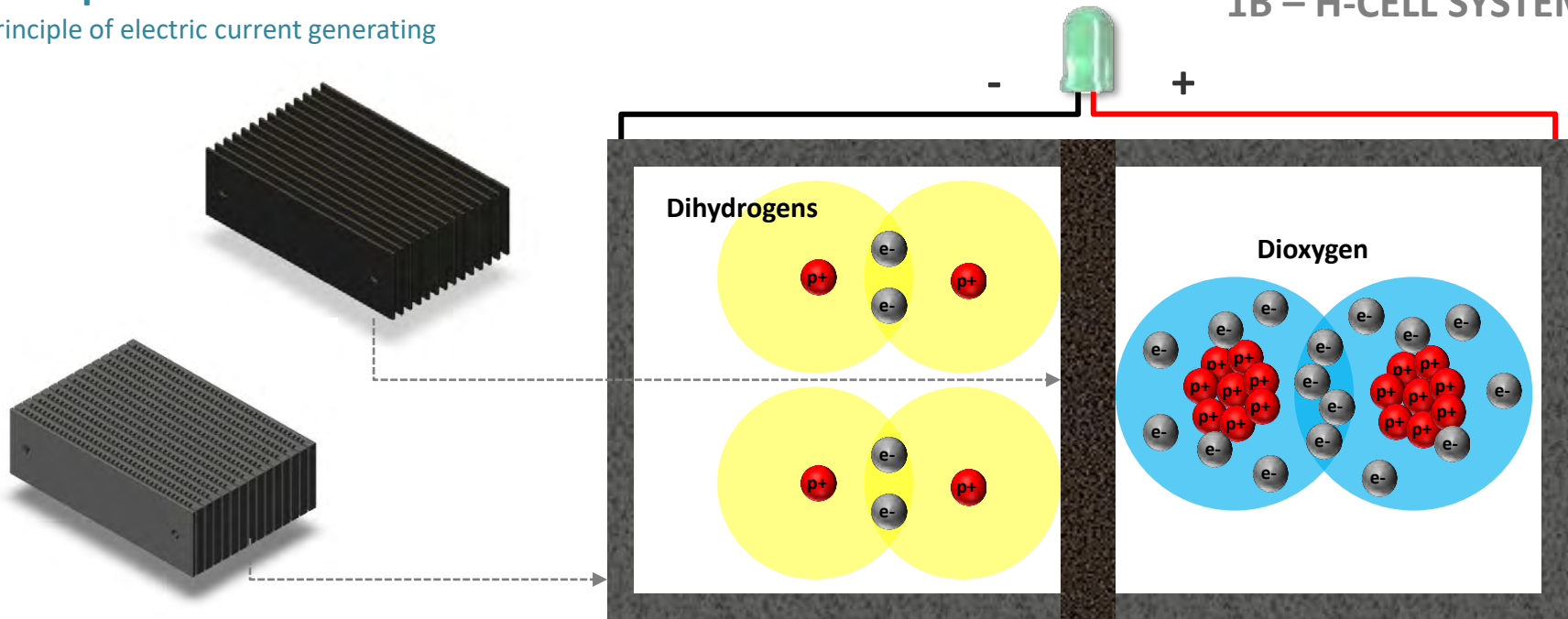
Basic chemical reaction



Principle of PEMFC

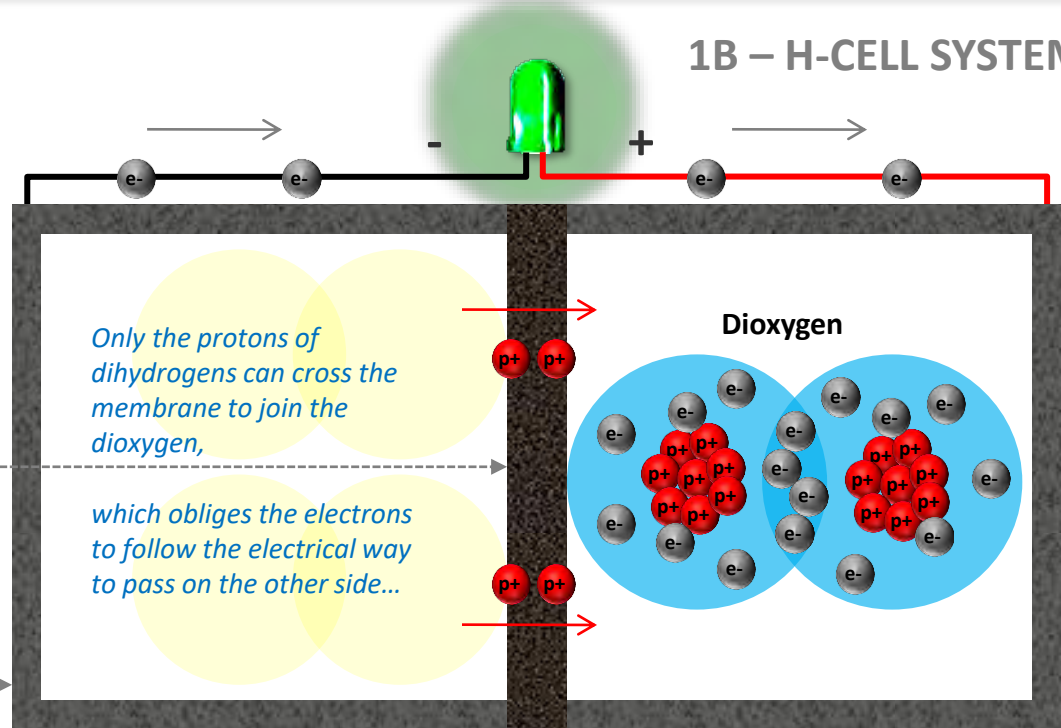
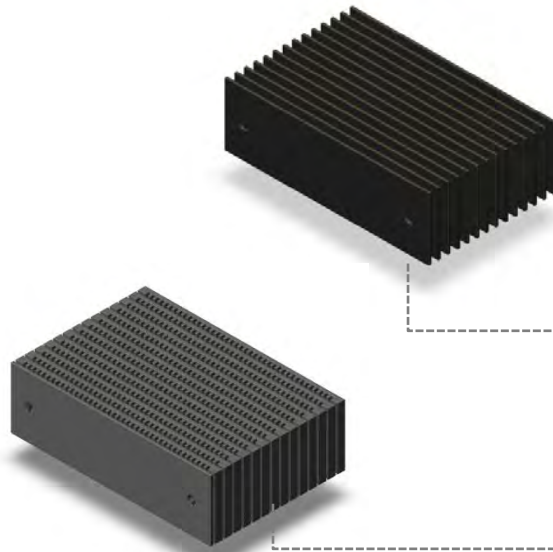
Principle of electric current generating

1B – H-CELL SYSTEM



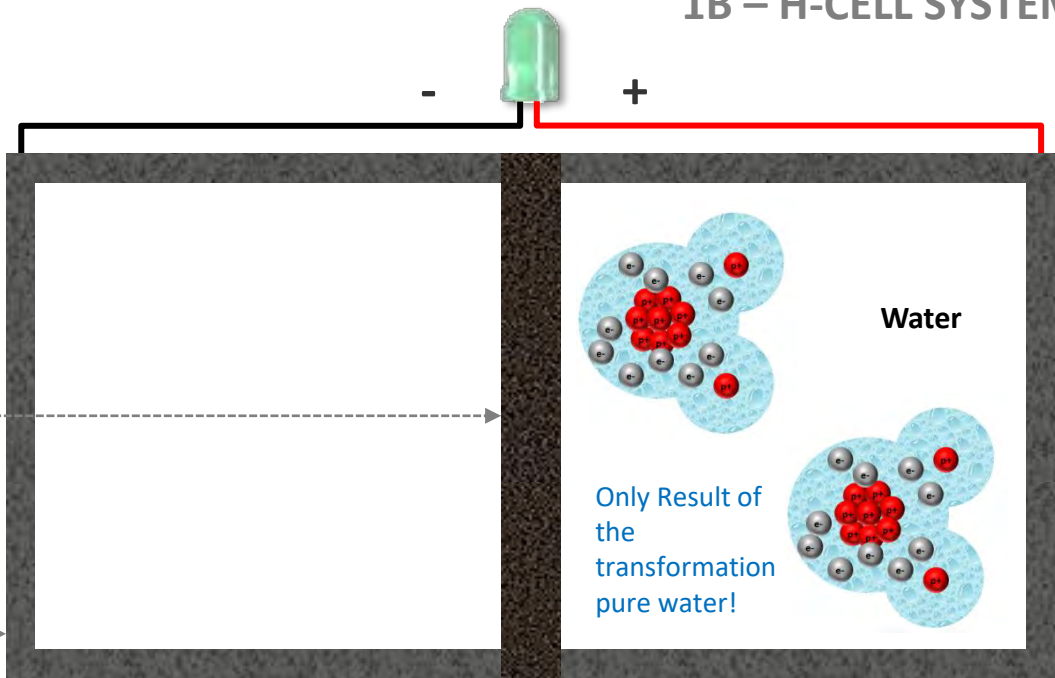
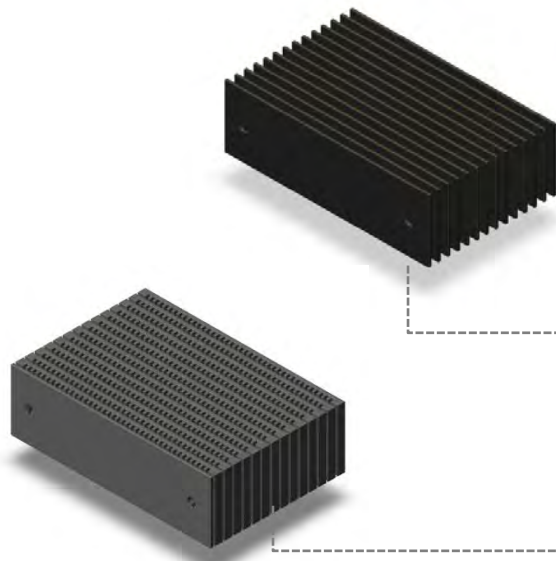
Principle of PEMFC

Principle of electric current generating



Principle of PEMFC

Principle of electric current generating



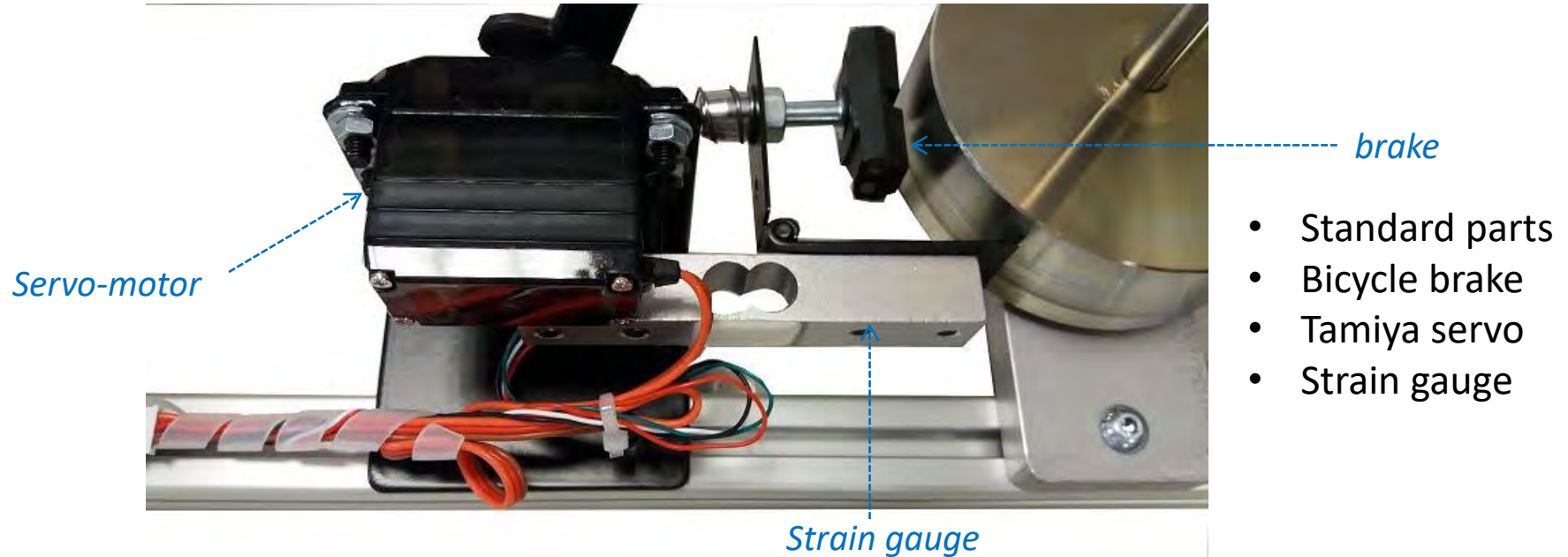
1B – H-CELL SYSTEM

1C – MEASURING BENCH

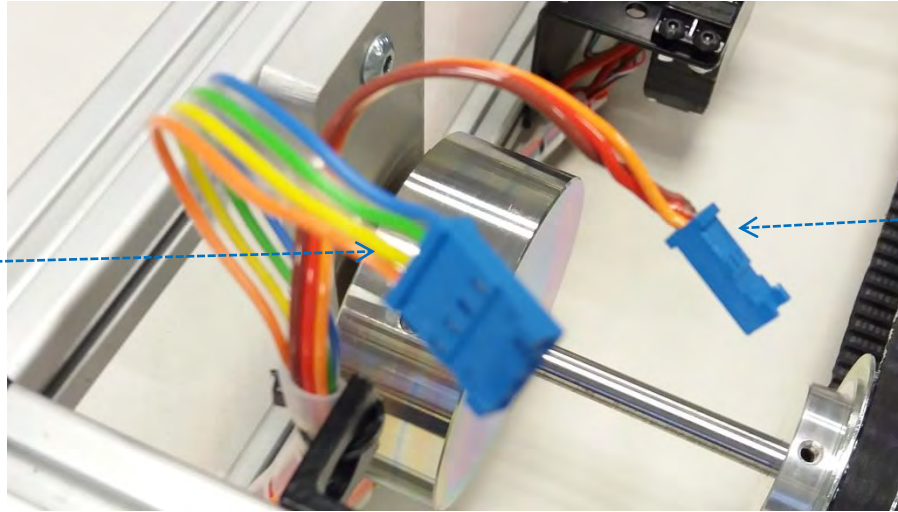


- 4 inertial wheels
- Stub axes
- Aluminium bearing housing
- Strong and reliable

1C – MEASURING BENCH



1C – MEASURING BENCH



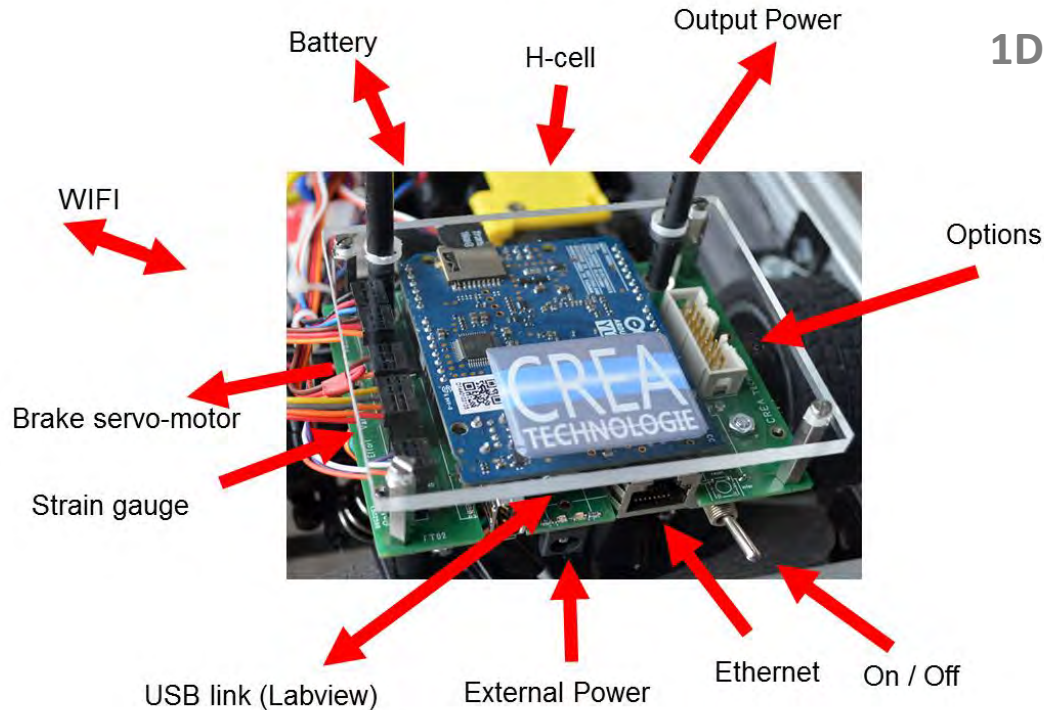
*Strain gauge
connector*

*Brake Servo-motor
connector*

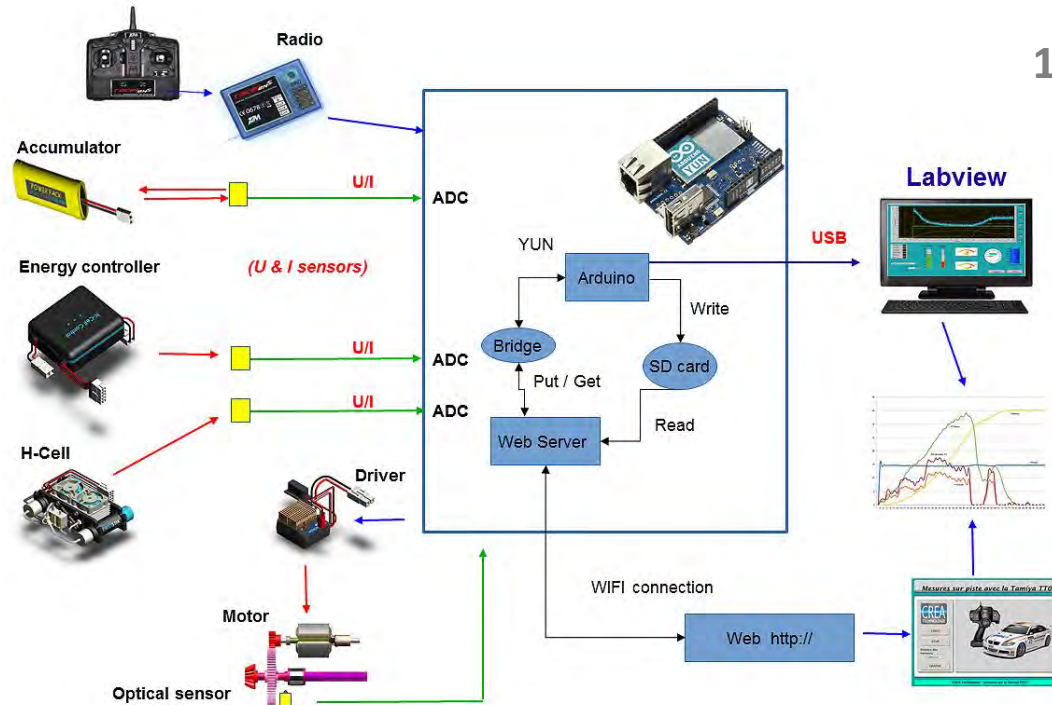
And measuring board ?



1D – MEASURING BOARD



1D – MEASURING BOARD



FCAT – 30 H2Hybrid Fuel Cell Automotive Trainer

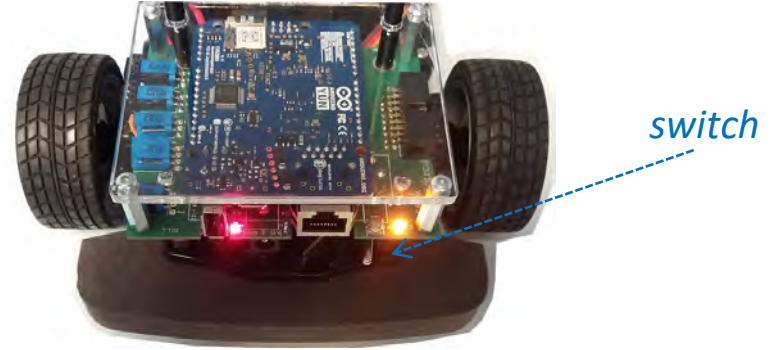
START THE CAR, MEASURES



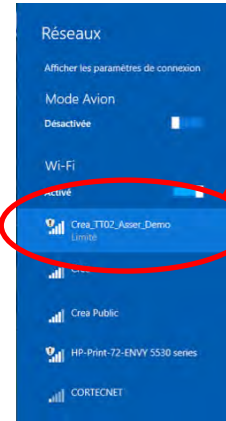
- Turn remote controler on

2A – ON TRACK

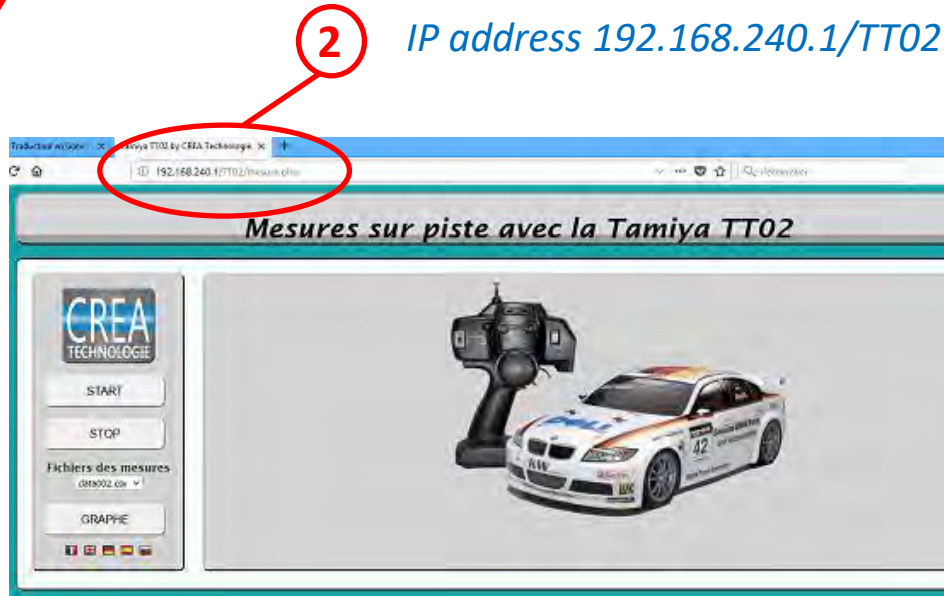
- Turn Hcell on
- Wait for green fixed hcell LED light



- Turn Hcell on
- Turn car on
- Wait for yellow fixed light



1 *Wifi connection*



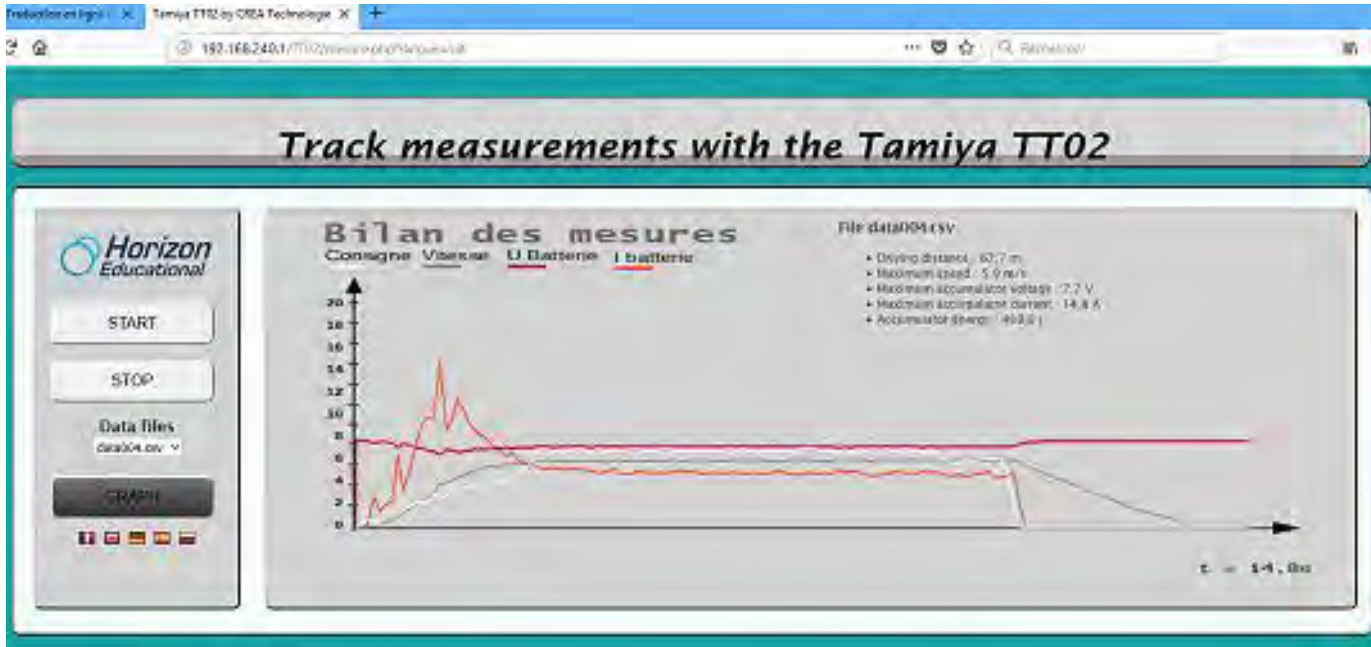
2 *IP address 192.168.240.1/TT02*

2B – WEB INTERFACE

- Easy to use
- Multi-language
- No software required
- Smartphone, tabs and PC compatible
- On board HMI
- Remote measurement
- Ideal on track

2B – WEB INTERFACE

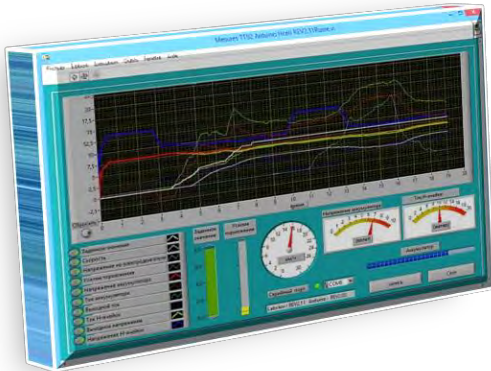
- Easy to use
- Multi-language
- No software required
- Smartphone, tabs and PC compatible
- On board HMI
- Remote measurement
- Ideal on track





1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply
 - D. USB communication with PC

2. Labview dashboard
 - A. Installation on PC
 - B. Using labview with the car
 - C. Data records and data treatment



2C - LABVIEW INTERFACE - TT02 ON THE BENCH

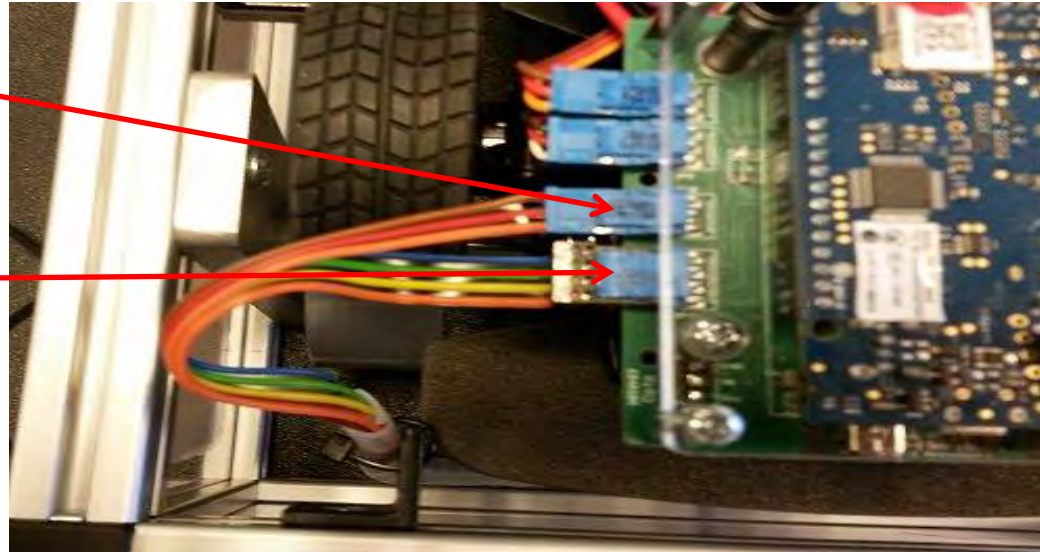
1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply
 - D. USB communication with PC



1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply
 - D. USB communication with PC

Brake
servomotor

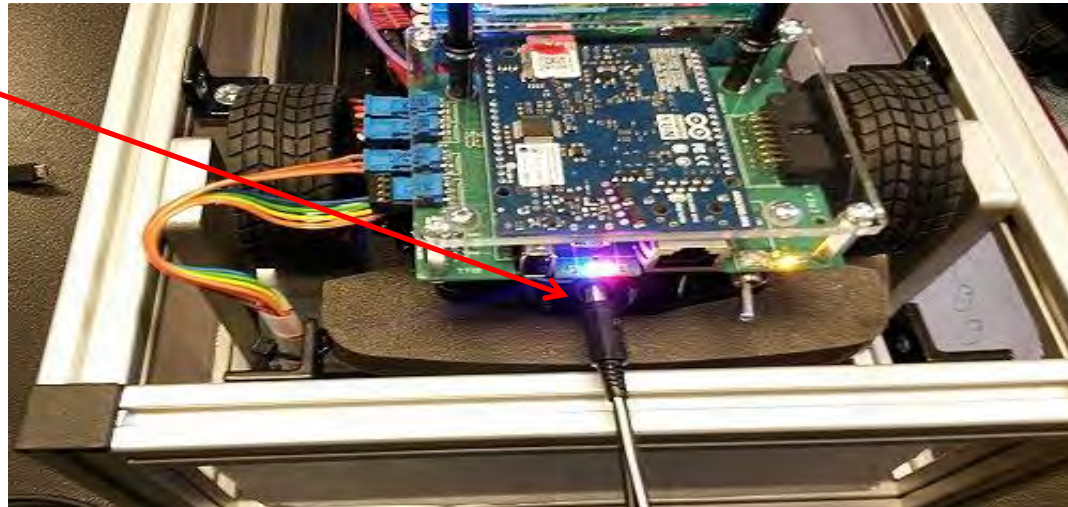
Strain
Gauge



1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply
 - D. USB communication with PC

Power supply
servomotor

VERY IMPORTANT !
IT SHOULD BE
CONNECTED
BEFORE TURNING
THE CAR ON

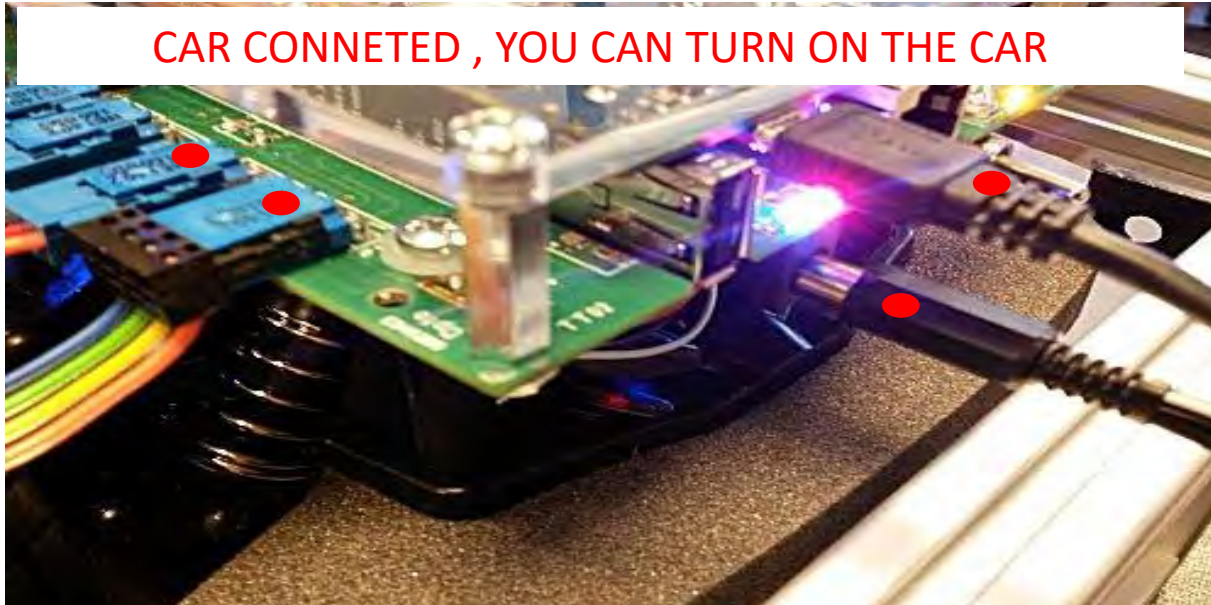


1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply
 - D. USB communication with PC

Micro USB to
USB PC

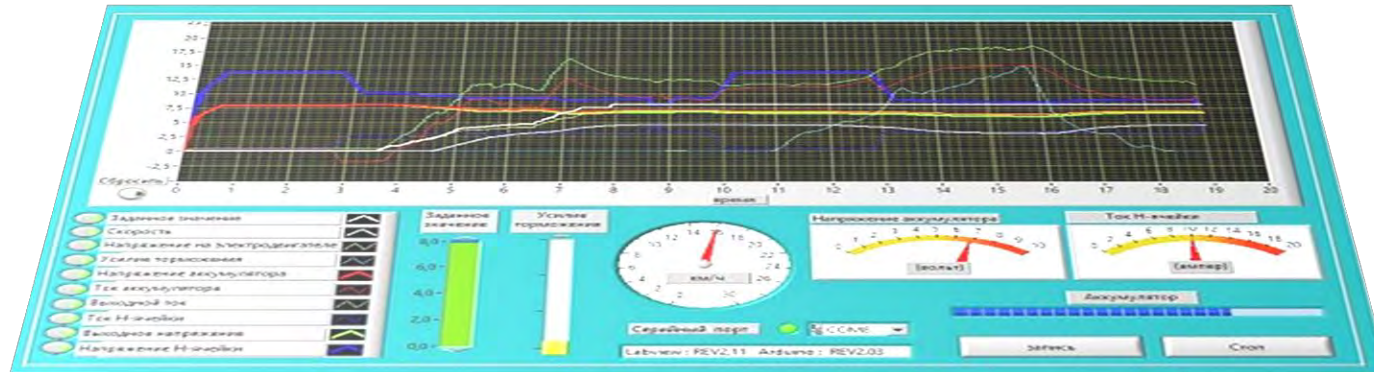


1. How to connect the car with the Bench
 - A. Brake sensor connection
 - B. Brake servomotor connection
 - C. Brake servomotor power supply



2. Labview dashboard

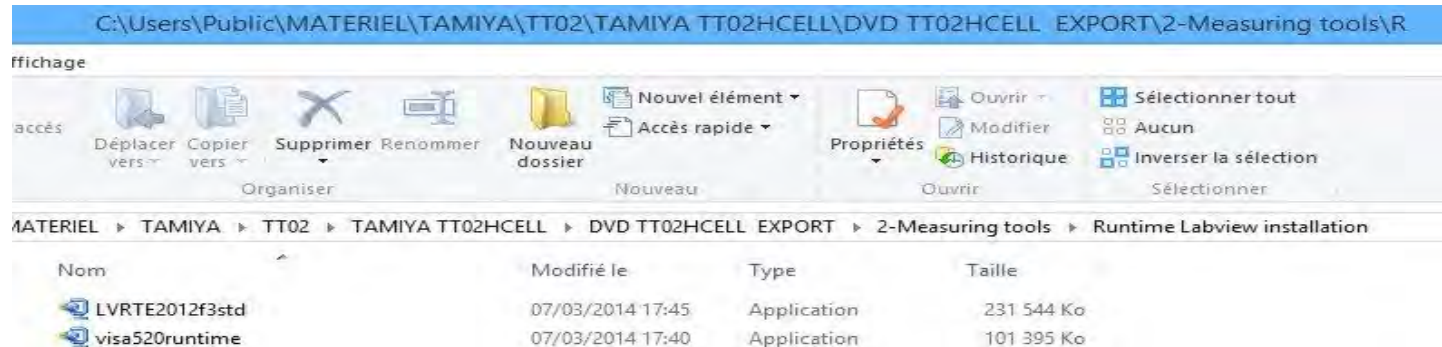
- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment



2. Labview dashboard

- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment

The dashboard has been developped with labview software (National Instruments). The full software is not needed on your computer. You just need to install the following free applications :



2. Labview dashboard

- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment

The measuring board of the car is using a microcontroller board model YUN of Arduino. This board should be recognized by the PC. You need to instal Arduino Freeware :

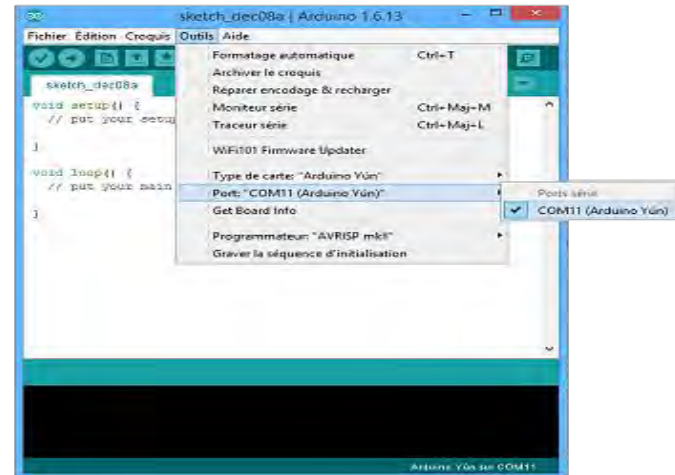
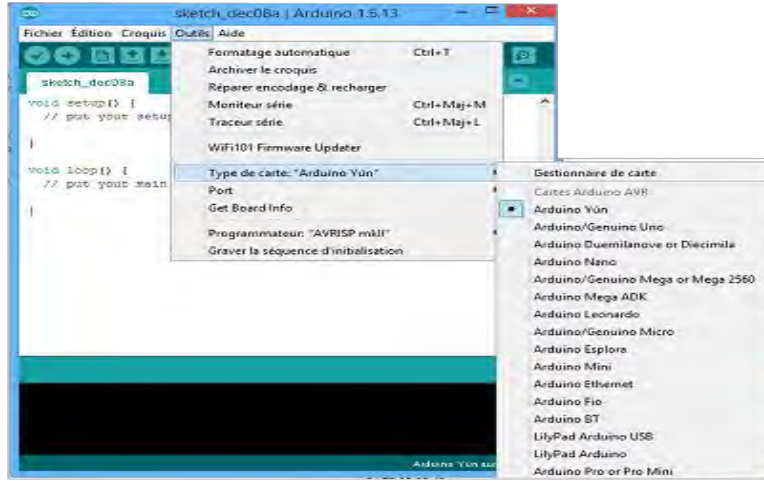
<https://www.arduino.cc/en/Main/Software>



2. Labview dashboard

- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment

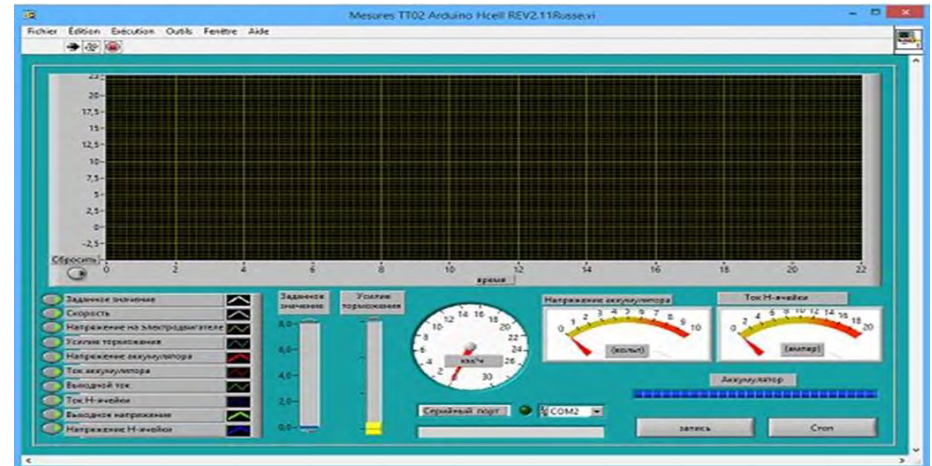
After Arduino installation software, and with USB cable connected , the COM port used by the PC can be shown as follow :



2. Labview dashboard

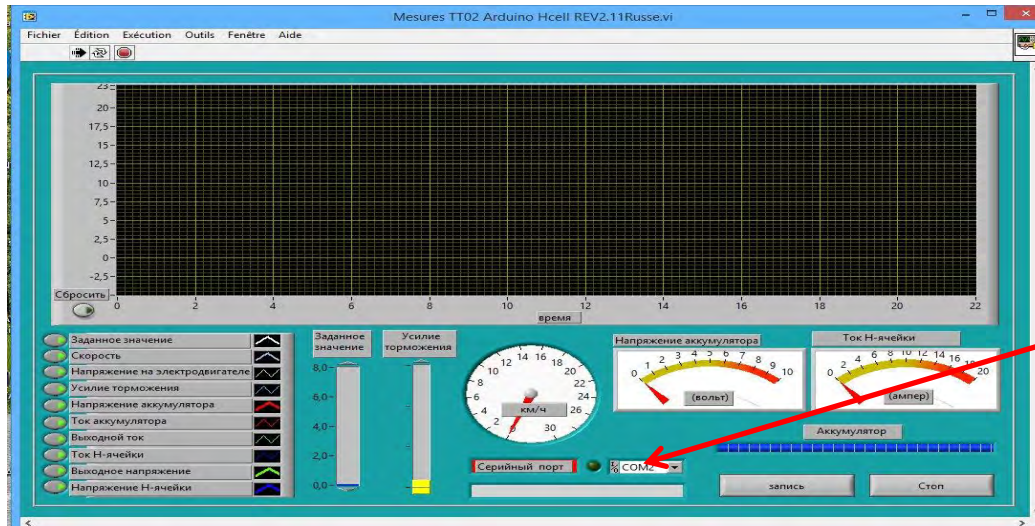
- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment

The car is connected to PC and recognized on COM port 11 (exemple). The dashboard can be opened in doubleclicking on "measures TT02". You should obtain the following screen :



2. Labview dashboard

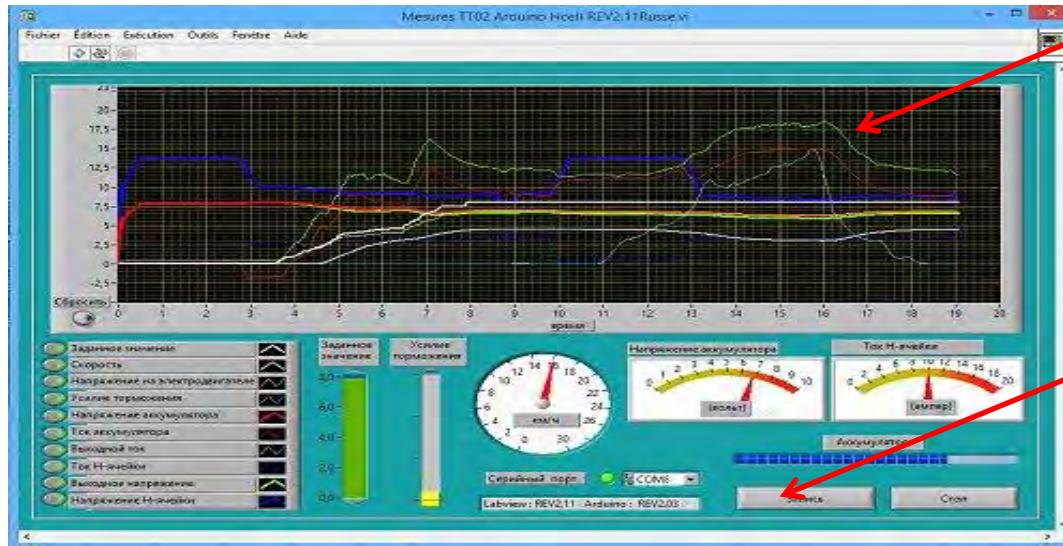
- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment



Select Com port,
the measurement
can start after
few seconds

2. Labview dashboard

- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment



Real time Curves are displayed

Pressing this button stop the measures and record the data as .csv format

2. Labview dashboard

- A. Labview files installation on PC
- B. Arduino installation on PC
- C. Using labview with the car
- D. Data records and data treatment

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	время	Период	Заданное значение	Ускорение	Ускорение	Напряжение аккумулятора	Ток аккумулятора	Напряжение Н-ячейки	Выходное напряжение	Ток Н-ячейки	Выходной ток		время	Протяженность следования	Скорость	Скорость (km/h)	Напряжение аккумулятора	Ток аккумулятора
2	Cpt	Période	Consigne	ACC	ACC	Tension	Courant	Tension	Tension	Courant	Courant		seconde	mètre	Vitesse	Vitesse	Volt	Amp
3	Imp	Imp us	radio	X	Y	Batterie	Batterie	Pile	Utilité	Pile	Utilité		Temps	Distance			tension	cour batt
4	0	310500	25	0	0	582	0	738	585	36	2		0,1	#VALEURI	0,3	0,9	7,8	#VALI
5	0	310500	58	0	0	426	353	612	413	70	360		0,2	#VALEURI	0,3	0,9	5,7	17
6	1	310500	85	0	0	401	442	586	366	74	455		0,3	0,1	0,3	0,9	5,4	21
7	3	48412	90	0	0	419	412	601	391	70	449		0,4	0,2	1,6	5,8	5,6	20
8	7	3117	90	0	0	436	379	618	415	67	415		0,5	0,5	2,5	9,1	5,8	18
9	10	26588	90	0	0	452	333	630	432	64	389		0,6	0,8	3,0	10,6	6,1	16
10	14	23496	90	0	0	466	295	643	448	61	349		0,7	1,1	3,3	12,0	6,2	14
11	18	21420	90	0	0	477	264	652	459	59	325		0,8	1,4	3,7	13,2	6,4	12
12	24	19536	90	0	0	486	238	659	471	58	302		0,9	1,9	4,0	14,5	6,5	11
13	29	18468	90	0	0	493	218	669	479	56	280		1,0	2,3	4,3	15,3	6,6	10
14	34	17688	90	0	0	498	202	671	487	54	257		1,1	2,7	4,4	16,0	6,7	9
15	40	17024	90	0	0	504	187	675	492	55	242		1,2	3,1	4,6	16,6	6,8	8
16	47	16388	90	0	0	510	170	678	498	52	223		1,3	3,7	4,8	17,2	6,8	8
17	53	16076	90	0	0	516	167	679	501	51	219			4,2	4,9	17,6	6,8	8
18	59	15744	90	0	0	522	167	680	501	51	219				5,0	17,9	6,9	8
19	65	15456	90	0	0	528	167	683	507	51	219				5,1	18,3	6,9	7
20	71	15244	90	0	0	534	167	685	510	51	219					18,5	7,0	7
21	79	15112	90	0	0	540	167	685	510	51	219					18,7	7,0	7
22	85	15008	90	0	0	546	167	686	513	51	219					18,8	7,0	6

Open your data file with raw values, copy and past here

Values are calculated. Curves can be dertermined



- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software



► Der neue TAMIYA RC-Katalog 2018 ist da!



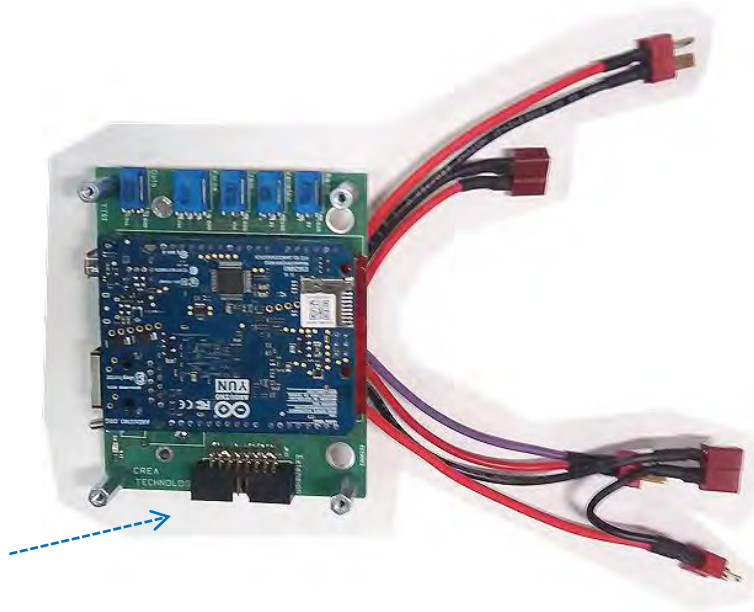
Ab sofort ist der brandneue RC-Katalog von TAMIYA erhältlich. Die 228 Seiten beinhalten alles was das RC-Modellbau-Herz höher schlagen lässt. Hochwertige RC-Modelle von TAMIYA, dem japanischen Marktführer für ferngesteuerte Elektrofahrzeuge, haben sich im Laufe der Jahre einen guten Ruf geschaffen und werden zu Recht mit dem Slogan „First in Quality Around the World“ beworben.



- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software



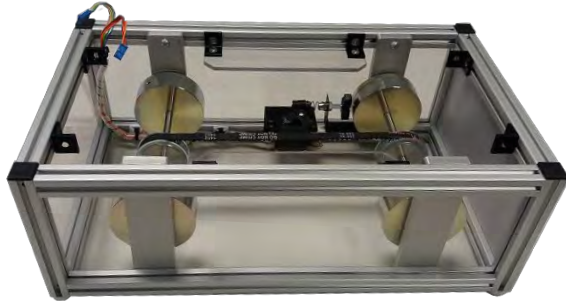
*Circuit board ready to use
with terminal connections*



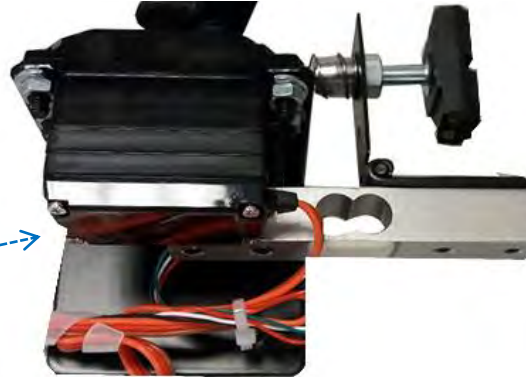
- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software



- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software



*Complete brake system
with terminal connections*



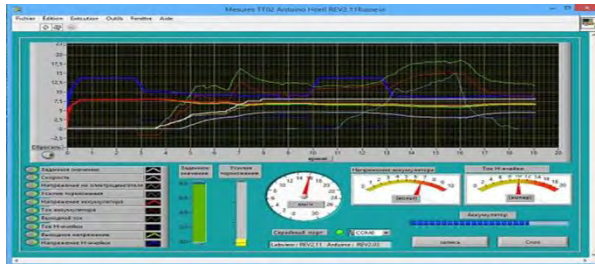
- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software

Arduino YUN

Microcontroller program
On measuring board



HTML WEB server program
On measuring board



Labview Interface
On DVD, can be updated

- The TT02 car
- The measuring board
- The H-cell
- The hydrofill
- The hydrosticks
- The bench
- The software