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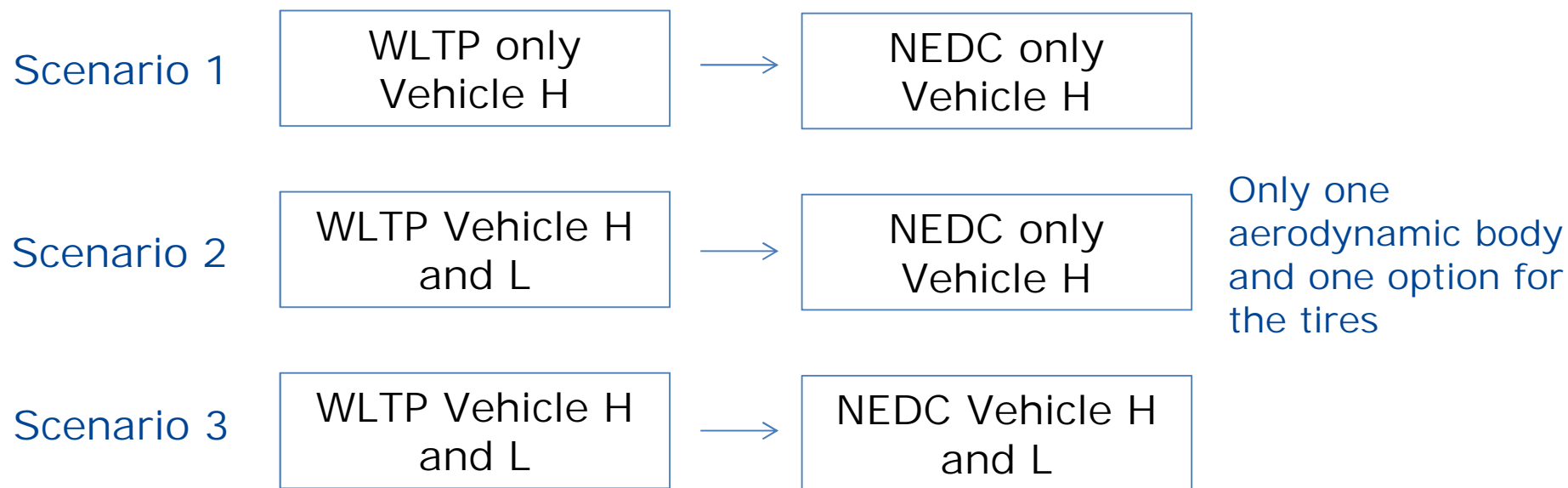
Description of WLTP/NEDC Correlation Procedure

2nd workshop with TA authorities
I spra, November 24, 2016

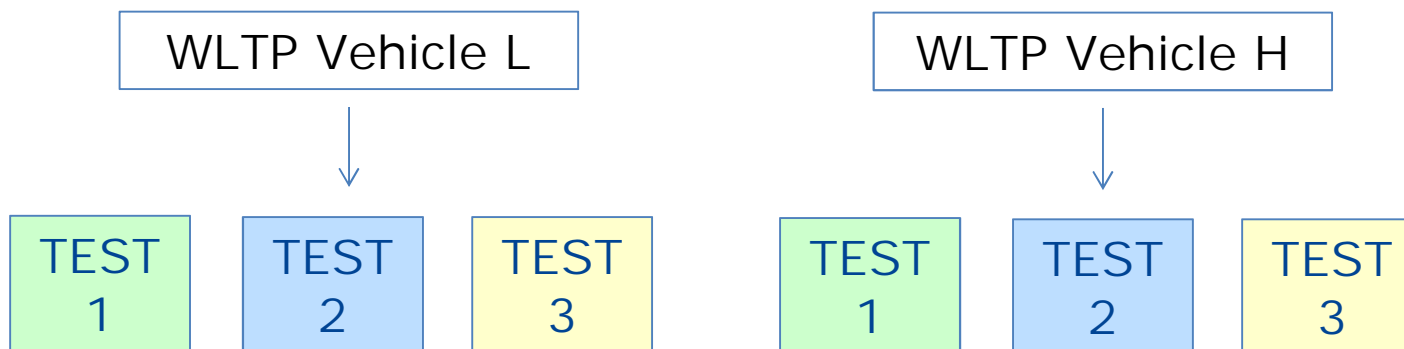
Agenda

- Steps before CO2MPAS
 - NEDC RL calculations
 - WLTP Tests
- Interpretation of CO2MPAS results
- Random number and random tests
- Individual vehicles and interpolation

Before CO2MPAS – NEDC Family



Before CO2MPAS – Number of WLTP tests

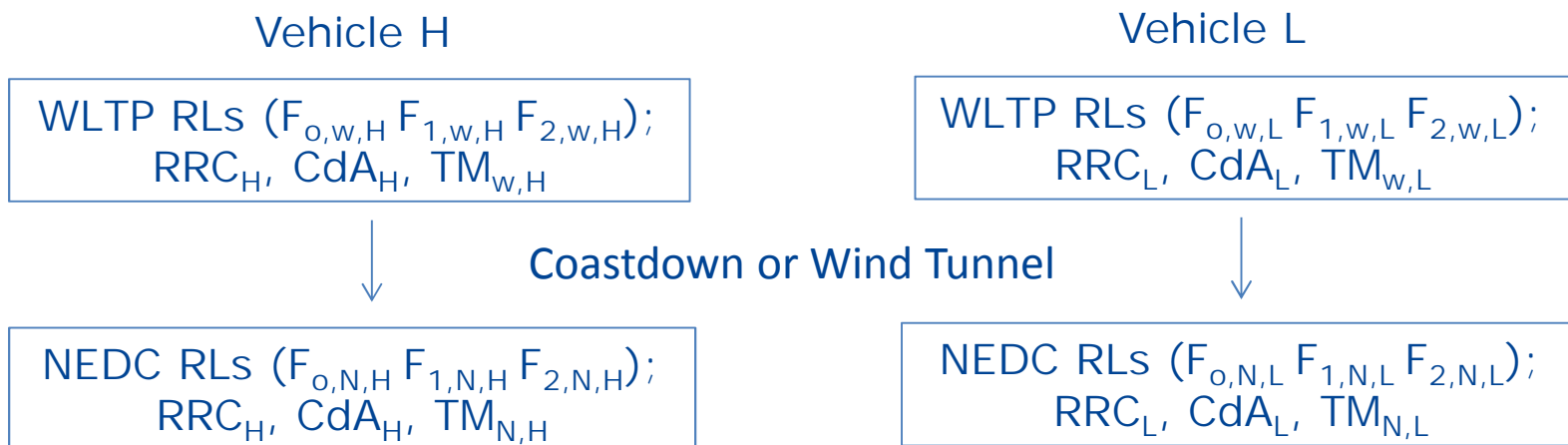


In case of 1 WLTP test: Input to CO2MPAS are the results from that test;

In case of 2 WLTP tests: Input to CO2MPAS are the results from test that has higher CO2 result;

In case of 3 WLTP tests: Input to CO2MPAS are the results from test that has median CO2 result.

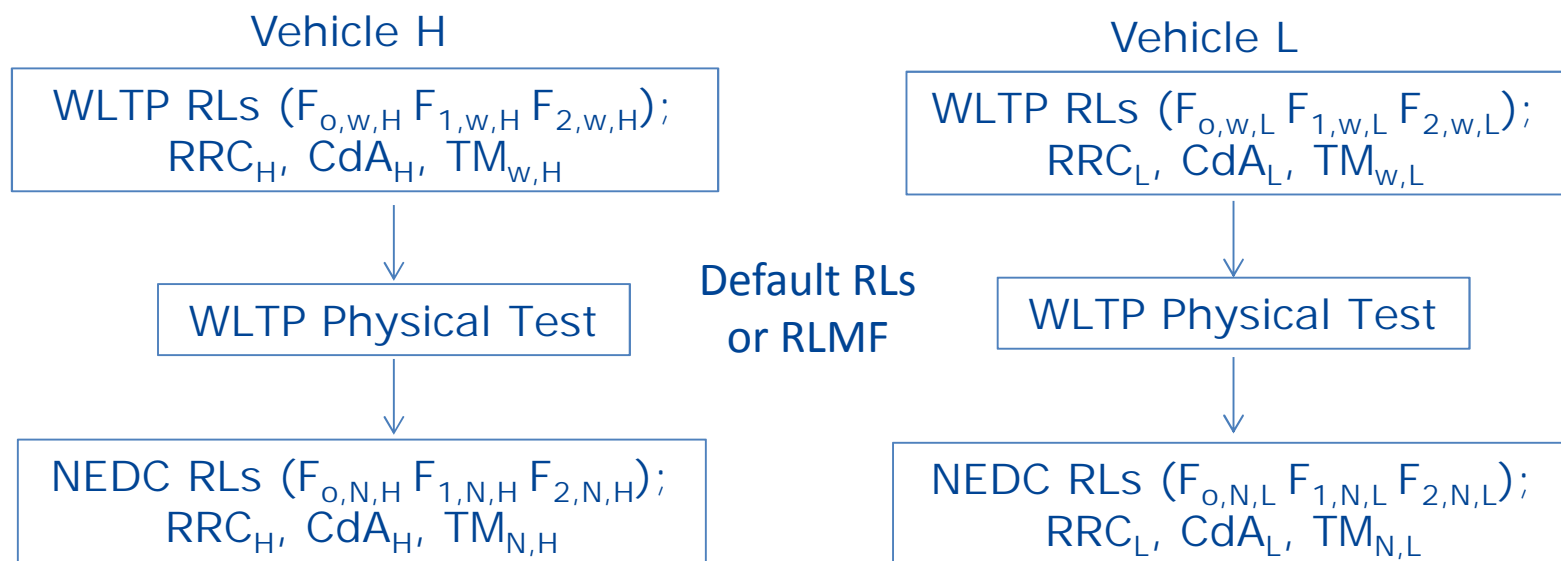
Before CO2MPAS – NEDC RL Calculation



When WLTP RLs are measured with coastdown or wind tunnel method formulas in section 2.3.8.1. apply for NEDC RL calculation. For NEDC inertia section 2.3.1. should be used.

Be aware that there is slightly different calculation of RLs for CO2MPAS and physical tests.

Before CO2MPAS – NEDC RL Calculation



When in WLTP default RLs are used for vehicle H and L formulas in section 2.3.8.2 apply for NEDC RL calculation. For NEDC inertia section 2.3.1. should be used. Be aware that there is different approach for CO2MPAS and physical tests. For physical NEDC tests chassis dyno tabulated values should be used.



After CO2MPAS – Interpretation of results

CO2MPAS detailed report contains all input/output data, charts, summarized results. Two important tabs for TA process are:

1. OUTPUT REPORT

CO2MPAS SUMMARY OUTPUT REPORT

TA Certificate Number	
CO2MPAS version	1.4.1rc0
Date/Time	2016/11/22-14:19:09
Type approval mode	True

NEDC Average Specific CO2 Emissions*	Vehicle H	Vehicle L	units
NEDC CO2 declared value	145.31	143.90	g/km
NEDC CO2MPAS simulated	145.39	142.31	g/km
CO2MPAS deviation	0.05	-1.10	%

*Ki factor - corrected

NEDC CO2MPAS CO2 Emissions	Vehicle H	Vehicle L	
CO2MPAS simulated NEDC	145.39	142.31	g/km
CO2MPAS simulated UDC	161.34	157.63	g/km
CO2MPAS simulated EUDC	136.14	133.43	g/km



After CO2MPAS – Interpretation of results

OUTPUT REPORT

1. If CO2MPAS deviation < 4%
OEM declared NEDC CO2
value is accepted;
2. If CO2MPAS deviation > 4%
OEM has option to accept new
value or to request physical
test.

CO2MPAS SUMMARY OUTPUT REPORT

TA Certificate Number	
CO2MPAS version	1.4.1rc0
Date/Time	2016/11/22-14:19:09
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NEDC Average Specific CO2 Emissions*	Vehicle H	Vehicle L	units
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NEDC CO2MPAS CO2 Emissions	Vehicle H	Vehicle L	
CO2MPAS simulated NEDC	145.39	142.31	g/km
CO2MPAS simulated UDC	161.34	157.63	g/km
CO2MPAS simulated EUDC	136.14	133.43	g/km

*These values are already Ki factor corrected

After CO2MPAS – Interpretation of results

CO2MPAS SUMMARY OUTPUT REPORT

From OUTPUT REPORT phase-specific CO₂ values should be calculated (section 3.3)

TA Certificate Number	
CO2MPAS version	1.4.1rc0
Date/Time	2016/11/22-14:19:09
Type approval mode	True

$$NEDC\ CO_{2,p,H} = NEDC\ CO_{2,p,H,C} \cdot CO_{2,AF,H}$$

CO_{2, AF} is adjustment factor and ratio between final combined NEDC CO₂ (declared, CO2MPAS, or test) and CO2MPAS simulated value.

NEDC Average Specific CO ₂ Emissions*	Vehicle H	Vehicle L	units
NEDC CO ₂ declared value	145.31	143.90	g/km
NEDC CO2MPAS simulated	145.39	142.31	g/km
CO2MPAS deviation	0.05	-1.10	%

*Ki factor - corrected

NEDC CO2MPAS CO ₂ Emissions	Vehicle H	Vehicle L	
CO2MPAS simulated NEDC	145.39	142.31	g/km
CO2MPAS simulated UDC	161.34	157.63	g/km
CO2MPAS simulated EUDC	136.14	133.43	g/km



After CO2MPAS – Interpretation of results

CO2MPAS DICE REPORT

2. DICE REPORT – for each WLTP interpolation family this file should be sent to a functional mailbox – as a result random number will be received (from 1 to 100).

TA Certificate Number	
CO2MPAS version	1.4.1rc0
Date/Time	2016/11/22-14:19:09
Type approval mode	True

	Vehicle H	Vehicle L	units
Fuel Type	<i>diesel</i>	<i>diesel</i>	-
Engine Capacity	2041.00	2041.00	cc
Gearbox type	<i>manual</i>	<i>manual</i>	-
Turbo engine	TRUE	TRUE	-
sub_models_uuid	<i>b'\x80\x03}q\x00(X\x0</i>	<i>b'\x80\x03}q\x00(X\x0</i>	-
alternator_model score	4.44	6.01	A
at_model score			-
clutch_torque_converter_model score	0.35	0.35	RPM
co2_params score	0.00	0.00	CO2g/s
engine_cold_start_speed_model score	0.00	0.05	RPM
engine_coolant_temperature_model score	0.87	0.81	°C
engine_speed_model score	0.00	0.00	RPM
start_stop_model score	-1.00	-1.00	-
CO2MPAS deviation	0.05	-1.10	%

Random number interpretation

Every time CO2MPAS is used for TA (also in the cases when deviation is more than 4% compared to declared NEDC CO2 and physical test is performed afterwards) DICE REPORT should be sent to functional mailbox and random number (from 1 to 100) will be received.

Possible scenarios:

1. For both vehicles H and L the CO2MPAS deviation was <4% and for both vehicles declared value is accepted. If the random number is in the range from 91 to 95 vehicle L, and if the random number is in the range from 96 to 100 vehicle H should be tested.
2. CO2MPAS deviation was >4% for both configurations (H and L) and both configurations are physically tested reply from the time-stamped server in terms of generated random number should be ignored.

Random number interpretation

Possible scenarios:

3. For one vehicle configuration CO2MPAS deviation was $\geq 4\%$ and that vehicle is physically tested. For another configuration CO2MPAS deviation was $\leq 4\%$ and for that vehicle the manufacturer declared value is accepted. If the random number received is in the range from 91 to 100 physical measurement should be performed for the vehicle configuration where declared value is accepted.

Only in cases where CO2MPAS was used to confirm declared value there is 10% of chance for performing one random physical test.

Random test

Physical test shall be performed under NEDC test conditions and with RLs and mass as outlined in section 2.3.

From this test Verification Factor and Relative Deviation should be recorded in TA certificate and CoC.

Verification Factor is used to check accuracy of the input data. In case of non conformity it shall be set to 1.

Relative Deviation is deviation between measured and OEM declared value:

$$De = \frac{RTr - DV}{DV}$$

RTr is random test result and
DV is the declared value



Random test vs NEDC “double” testing

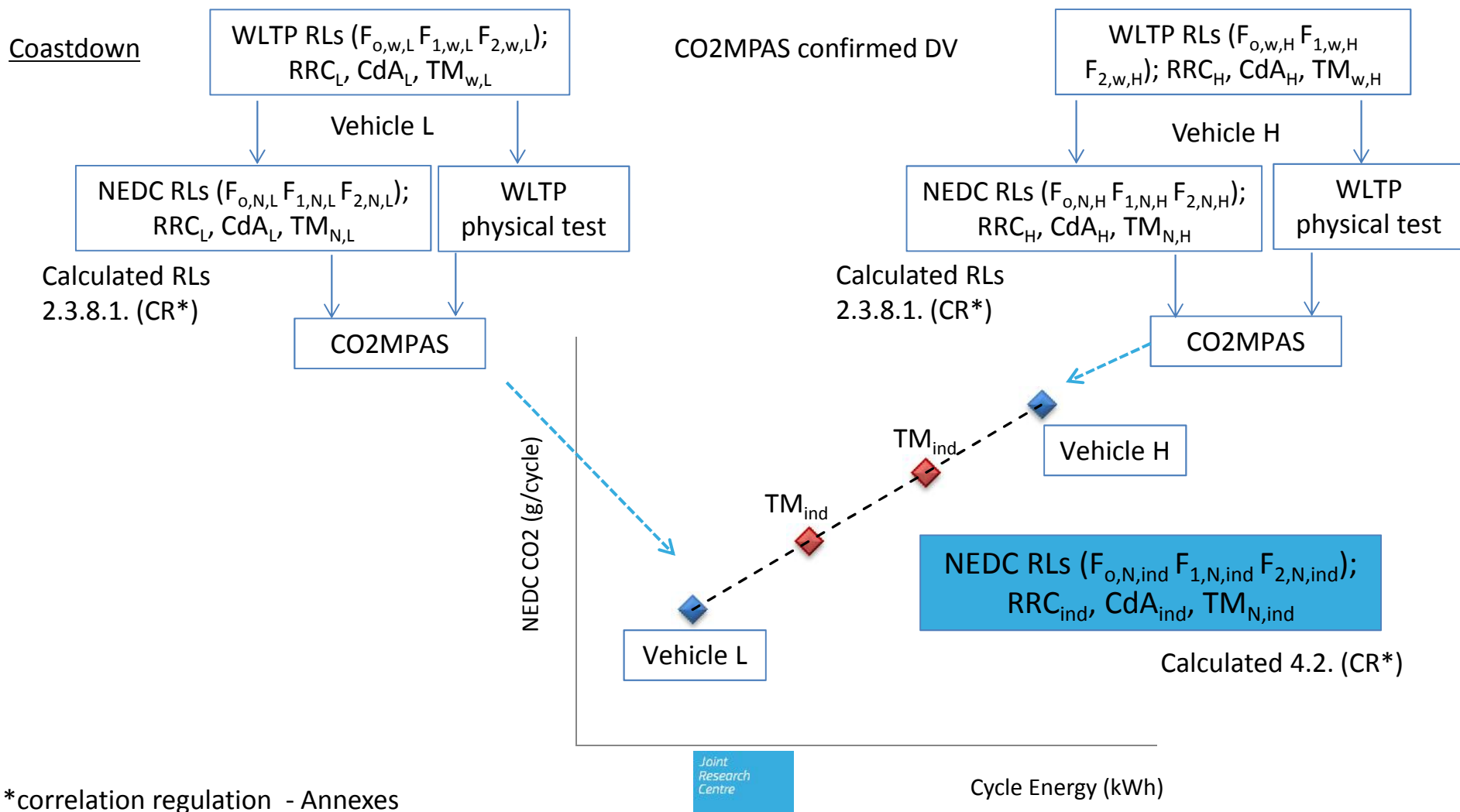
NEDC “Double” testing can be performed in cases when CO₂MPAS deviation is >4% and should not be mixed with Random Test.

Up to 3 physical tests can be performed under NEDC test conditions and with RLs and mass as outlined in section 2.3.

1. If the result of 1st test exceeds DV by more than 4% second NEDC test is performed;
2. If the average of 2 NEDC tests exceeds DV by more than 4% third NEDC test is performed;
3. The average of 3 tests is the new NEDC CO₂ value.

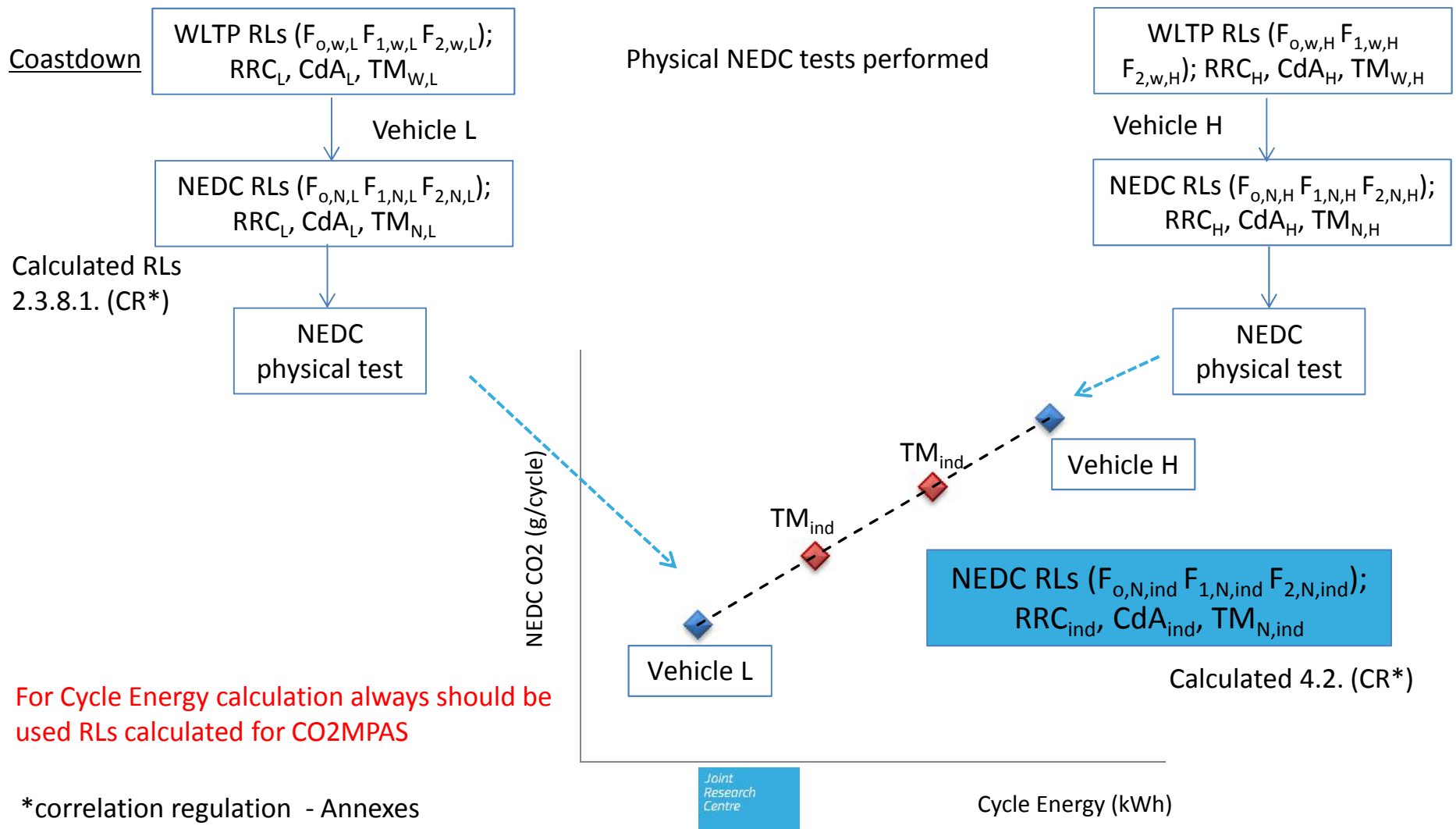
There is no Verification Factor and Relative Deviation in case of “double” testing.

Individual vehicles and interpolation

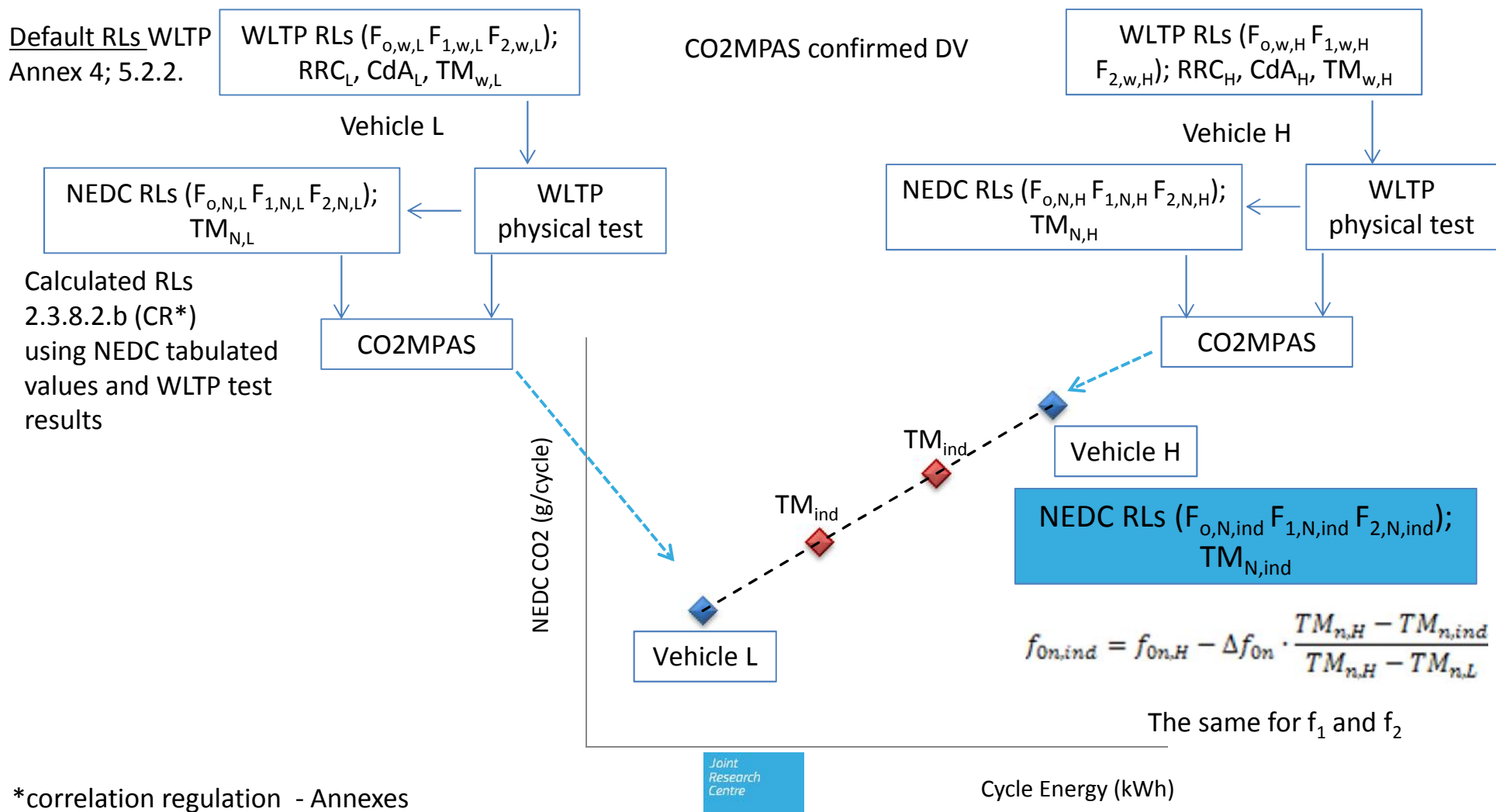


*correlation regulation - Annexes

Individual vehicles and interpolation



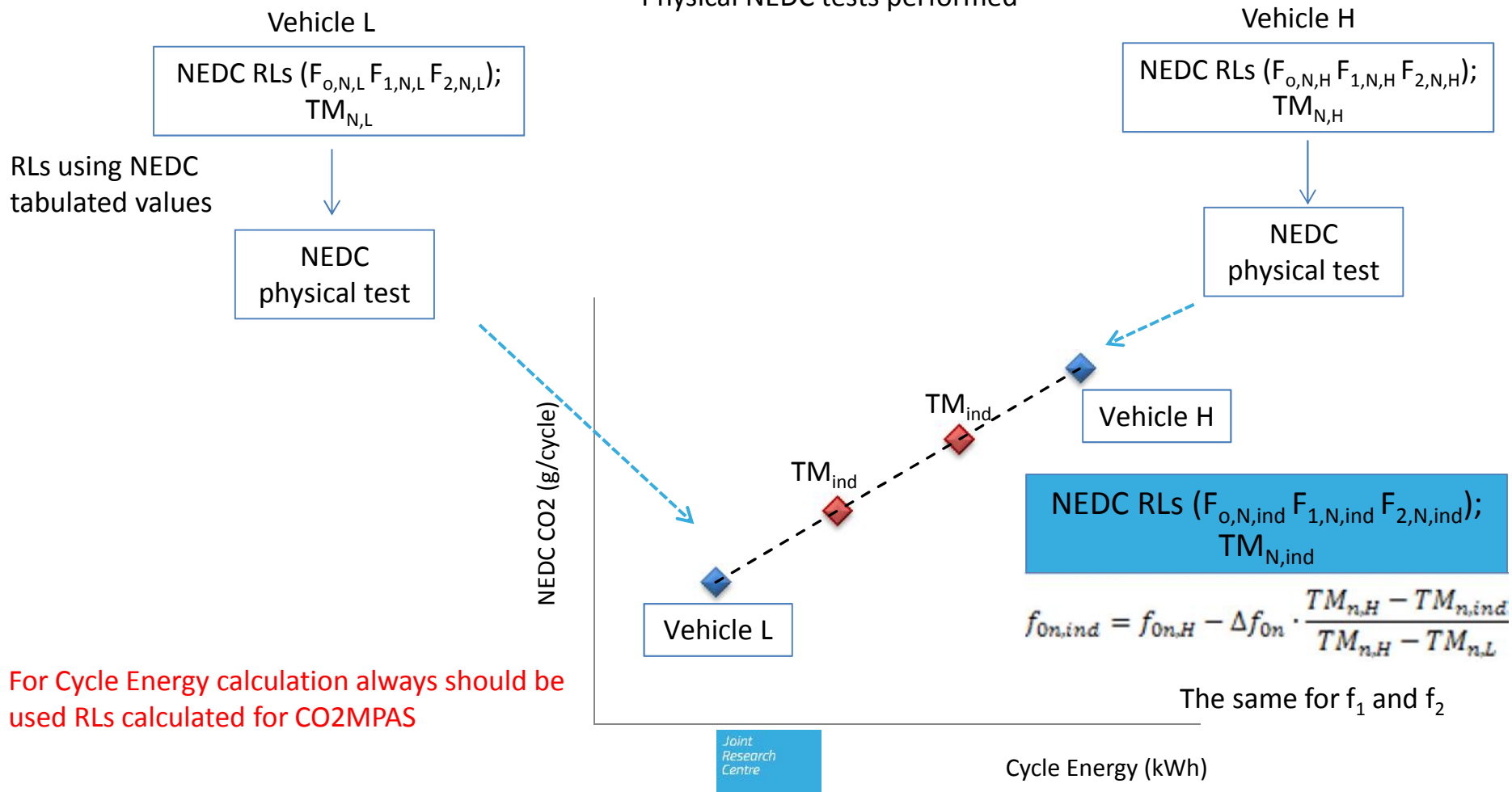
Individual vehicles and interpolation



*correlation regulation - Annexes

Individual vehicles and interpolation

Default RLs



For Cycle Energy calculation always should be used RLs calculated for CO2MPAS



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Questions ?