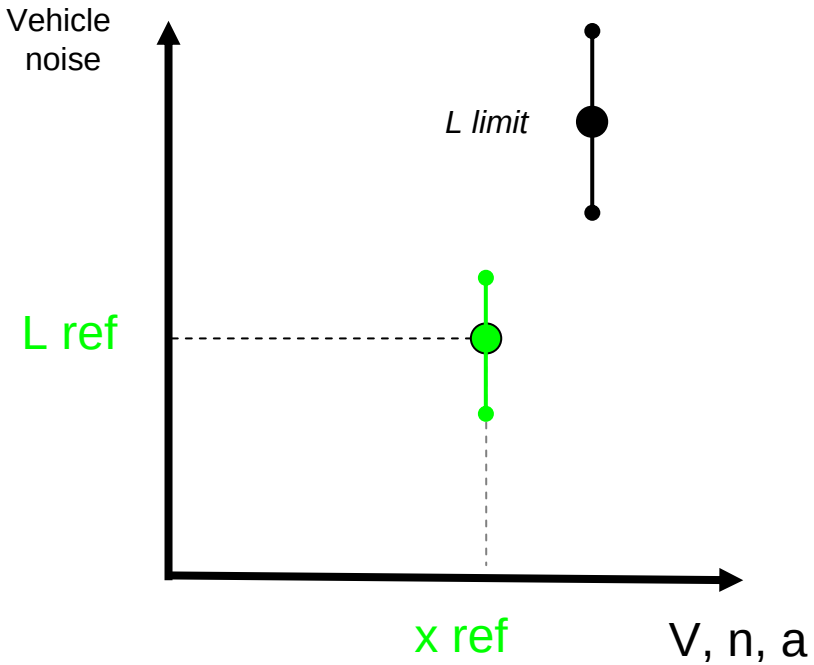
Uncertainties on ASEP Limit for each proposals

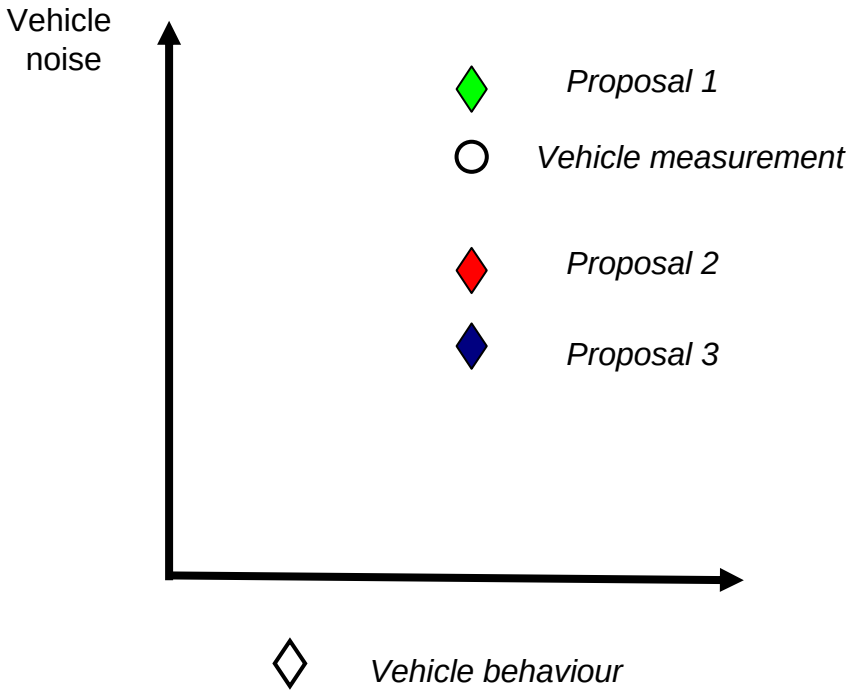
Issue by France

To choose the method, we need to study 2 following points (GRBIG-ASEP-08-07)

The uncertainties to determine
the reference point and vehicle noise limit
(develop in this presentation)



Spread of "normal" vehicles compared to the model



As Limit depends on measurements, Limit has uncertainties

Uncertainties determination by using Gum approach apply on basis variables

Formula with non correlated variables x_1, x_2, … , x_N :

$$y = f\left(x_1; x_2; ...; x_N\right)$$

Standard deviation :

$$u_c^2(y) = \sum_{i=1}^{N} \left[\frac{\partial f}{\partial x_i}\right]^2 \times u^2\left(x_i\right)$$

Exemple on L wot i = Σ L wot :

$$y = \frac{x_1 + x_2 + ... + x_N}{N} \quad \rightarrow \quad u_c(y) = \frac{1}{\sqrt{N}} u(x_i)$$

with $u(x_1) = u(x_2) = ... = u(x_N)$

Basis variables and standard deviation

	standard deviation		
	run to run	Mean of 4 measures	by regression
L wot	0,5	0,25	-
L crs	0,35	0,175	-
L urban	-	0,17	-
N	50	25	-
V	0,7	0,35	-
a	0,05	0,025	-
L tyre	-	-	0,4
OICA slope	-	-	0,0003

Reference point		Tyre noise
F/D Original	$L_{ref} = L_{wot\_i}$	$L_{tyre} = L_{tyre\_ref} + B \times \log(V/50)$
New F/D opt°2	$L_{ref} = L_{wot\_i} + \left(L_{urban\_limit} - L_{urban}\right)$	$L_{tyre} = L_{crs\_50} + 34 \times \log(V/50)$
New F/D opt°1	$L_{ref} = (L_{urban\_limit} - k_p \times L_{crs\_50})/(1-k_p)$	$L_{tyre} = L_{crs\_50} + 34 \times \log(V/50)$
Formula to L limit		
$L_{engine\_ref} = 10 \times \log\left[10^{0.1 \times L_{ref}} - 10^{0.1 \times L_{tyre-ref}}\right]$		
$L_{engine}(N) = L_{engine\_ref} + 0.005 \times (N - N_{ref})$		
$L_{limit}(N,V) = 10 \times \log\left[10^{0.1 \times L_{engine}} + 10^{0.1 \times L_{tyre}}\right]$		

Reference point	
NL	$L_{ref} = L_{urban\,\lim it}$
OICA	$L_{ref} = L_{wot\_i}$
Formula to L limit	
NL	$L_{\lim it}(a,V) = L_{ref} + 0{,}3 \times (V - V_{ref}) + 4 \times (a - a_{urban})$
OICA	$L_{\lim it}(N) = L_{ref} + OICA\_Slope \times (N - N_{ref})$

uncertainties on all methods

$$U(L_{\lim it}) = k \times u_c(L_{\lim it})$$ with k = 2 for 95 % of coverage

$$L_{true\_\lim it} = L_{\lim it\_cal} \pm U$$

For the same vehicle and the same conditions, the “true” limit can be (for 95% of cases) between $L_{limit\_cal} + U$ and $L_{limit\_cal} - U$

UNCERTAINTIES U (dBA)	
F/D original	**1,8**
New F/D option 2	**1,6**
OICA	**1,4**
New F/D option 1	**0,8**
NL	**0,6**

Whatever the proposal, additional tolerance is needed to take into account uncertainties

Uncertainties are not sufficient to compare proposals