LAB
ACCIDENTOLOGIE, BIOMECANIQUE, COMPORTEMENT HUMAIN

Update of the Deq thoracic injury criterion

GRSP FI group
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Paris

eesar
CENTRE EUROPEEN D'ETUDES DE SECURITE ET D'ANALYSE DES RISQUES

Outline – Deq

- List of actions (EuroNCAP FIWG)
- Technical updates
  - Stiffness for belt contribution
  - Stiffness for airbag contribution
  - Age contribution
  - Fn
  - Validation sample
- Schedule

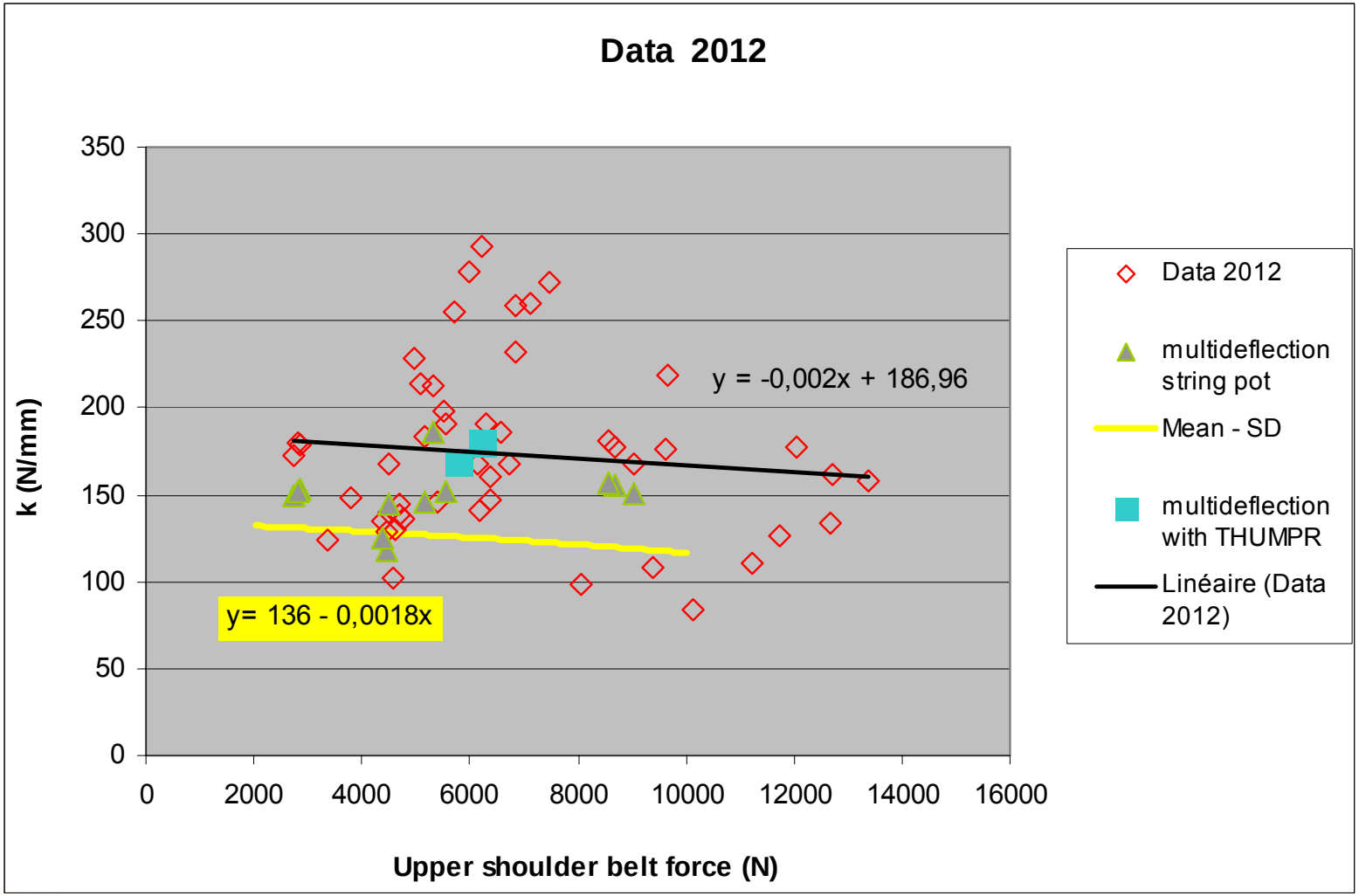
List of actions EuroNCAP FIWG

	PROS	CONS	ACTIONS		WHO
CONCEPT	Initial goal (=take into account belt and AB loads with different thresholds for injury) is relevant	DEQ requires further adjustments and validation: ① Further validation for 2 and 3 point belt plus airbag,	①	- Validate AB and Belt IRC and therefore Fn - Validate the thorax stiffness under the seat belt	LAB/CEESAR
		② Adjustments to consider other types of restraint systems (knee airbag, cushion airbag, double pretensioner)	②	- Compare DEQ with other chest IC with knee airbag, cushion airbag, double pretensioner	Toyota
METHOD	Method currently available, applicable to the regulatory dummy, Hybrid III average male and taking into account the difference of tolerance for a belt or an airbag loading	③ DEQ is based on outside dummy measurement. The discrepancy of belt load measurements (repeatability and reproducibility) should be compared to in dummy measurement one.	③	- Verify belt force measurement calibration procedure (ISO + UTAC) - Compare results between labs (Round Robin tests) - Compare R&R results of belt force to dummy chest pot ones	ISO/UTAC
		④ DEQ is not a direct measurement and needs routines with optimization process which creates some error that should be in the range of rodpot one.	④	- Show the relative errors generated by each method (DEQ and chest pot) - Evaluate the effects of scattering parameters (belt geometry, pelvis excursion, level of forces)	LAB/CEESAR
		⑤ AB IRC based on impactor load	⑤	- AB IRC to be investigated	LAB/CEEAAR

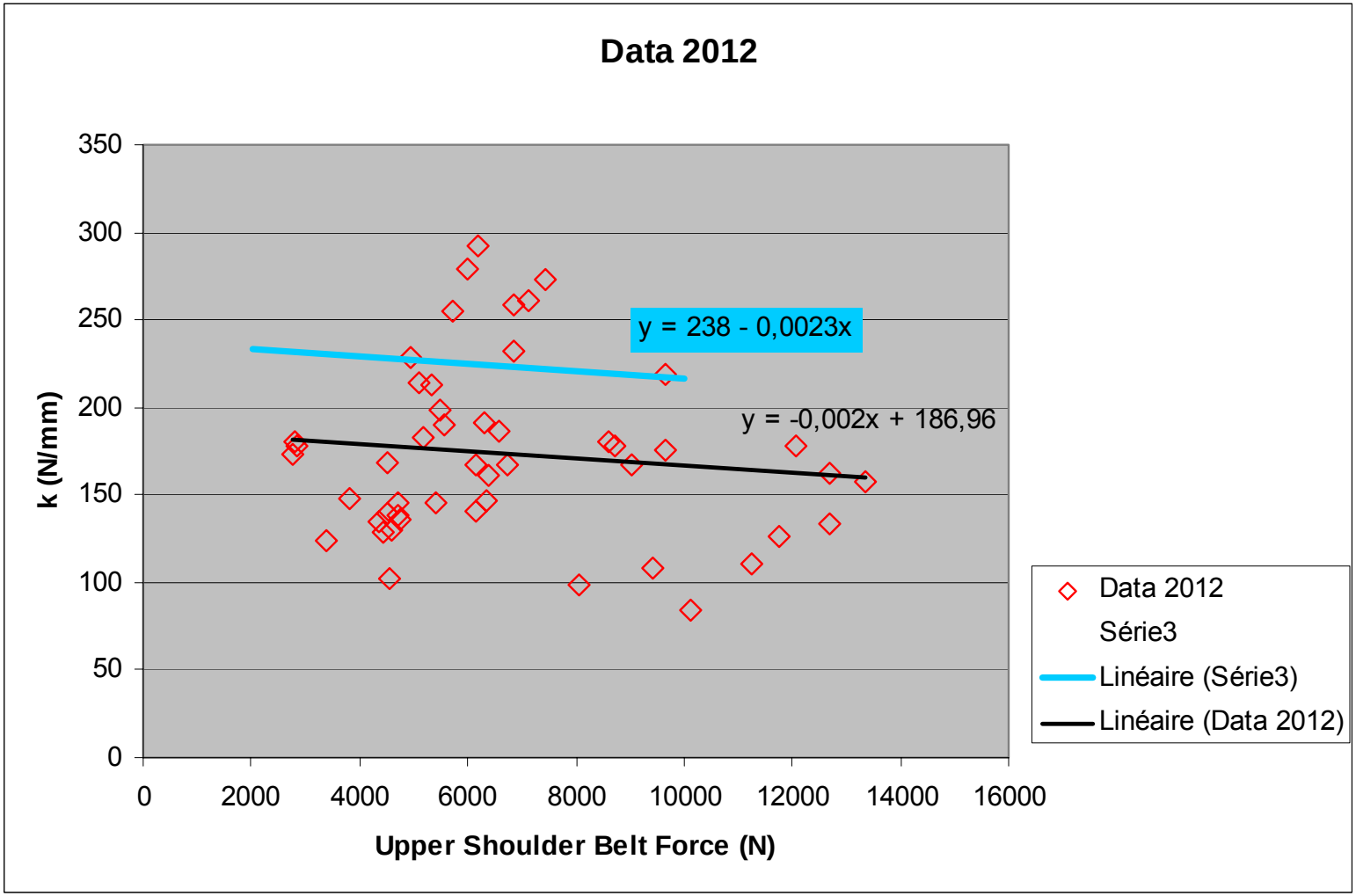
List of actions EuroNCAP FIWG

	PROS	CONS	ACTIONS		WHO
SENSITIVITY	Easy to control the peak value with load limiter	⑥ Small sensitivity to shoulder inner belt load (generally lower with knee airbag, cushion airbag, double pretensioner)	⑥	- Investigate the possibility to include lower shoulder belt force or multi-point measurements in the DEQ calculation - In addition, investigate the effect of KAB or other systems on HBM and compare to the effect on HIII (LAB hypotheses that HIII may increase the effect compared to HBM)	LAB/CEESAR LAB/CEESAR Toyota
		⑦ Small sensitivity to SW load and possible underestimation of airbag bottoming out	⑦	- Compare injury risk given by DEQ and chest pot in case of SW load - Validate the factor Fn and the coupling between belt and airbag deflection	Toyota LAB/CEESAR

DEQ criterion
Belt contribution



DEQ criterion
Airbag contribution



DEQ criterion

Age contribution

Fn

Survival analysis

- ⇨ Foret-Bruno + Kroell
  - ⇨ Age effect = -0.016

    (To be applied to validation sample)
  - ⇨ Fn = 0,84

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DEQ criterion

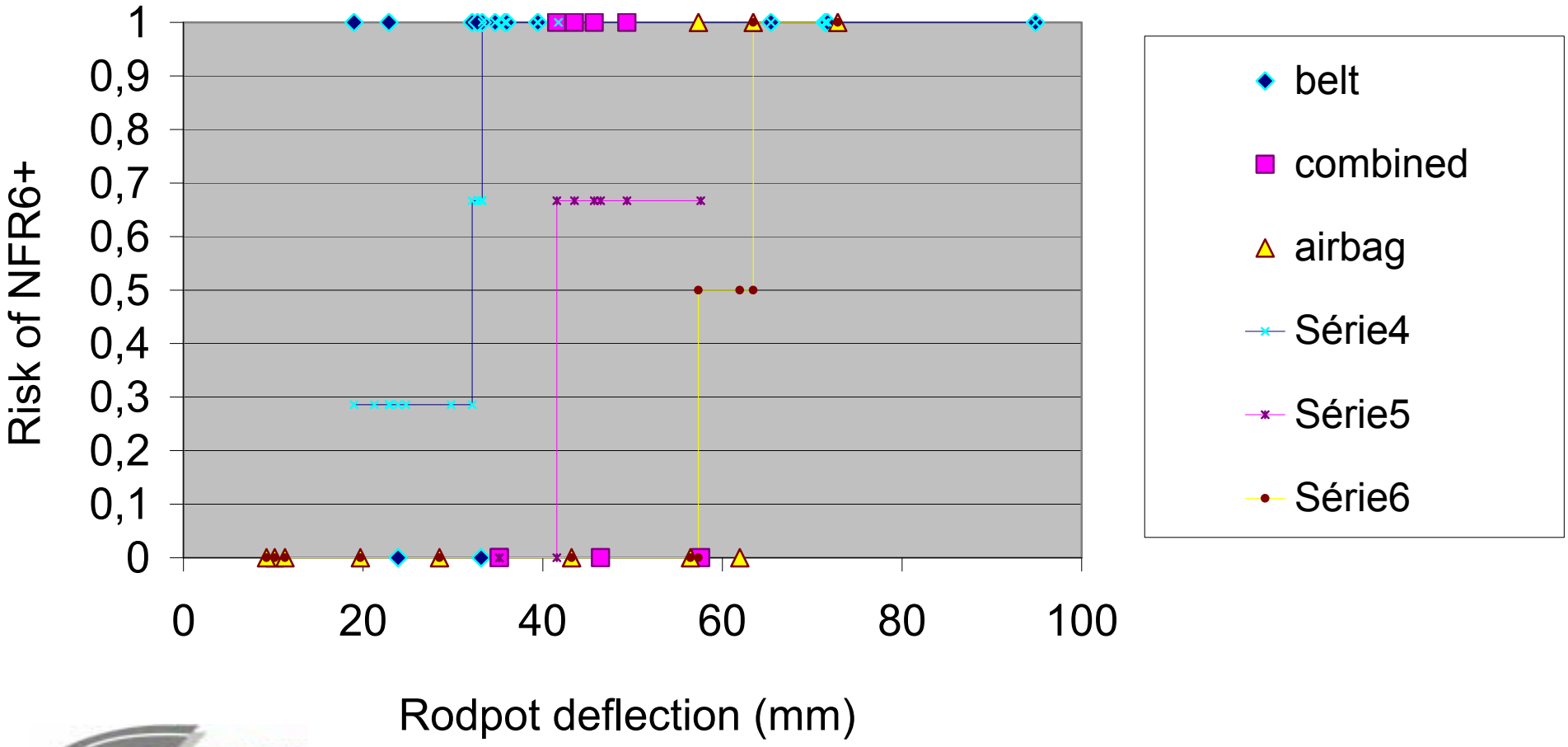
Validation data

Test	labo	Age	Gender	Wt,	Ht,	ΔV	Rest,	HIII tests	Fx
1386		67	M	69	175	48,2	FL 3/4.4 kN dual stage (rear seat)	1316, 1317, 1318	12
1387		69	M	67	171	49,6	FL 3/4.4 kN dual stage (rear seat)	1316, 1317, 1318	2
1389		72	M	72	183	49,4	FL 3/4.4 kN dual stage (rear seat)	1316, 1317, 1318	17
Humos3	INRETS	58		62	172		4 kN	Dummy3, Dummy4	19
Humos4	INRETS	70		76	177		4 kN	Dummy3, Dummy4	9
Humos1	INRETS	76		45	169		6 kN	Dummy1, Dummy2	26
Humos2	INRETS	66		76	180		6 kN	Dummy1, Dummy2	24
C17	LAB	76	M	67	172		6kN	C11, C12, C19, C21	25
C23	LAB	75	M	70	169		6kN	C11, C12, C19, C21	18
1262		51	M	55	175	48,9	L/S (rear seat)	1210, 1211, 1212	13
1263		57	F	109	165	47,1	L/S (rear seat)	1210, 1211, 1212	29
1264		57	M	59	179	48,5	L/S (rear seat)	1210, 1211, 1212	13
102	UVA	60	M	95	176	33,1	2-pt	101	19
9013C	Heibelberg	34	M	71	180	48	L/S	9001D, 9002D	0
114	UVA	60	F	65	164	47	2-pt	112	27
227	UVA	53	M	70	165	53,5	2-pt	226	12
228	UVA	47	M	85	177	54,7	2-pt	226	16
1094		49	M	58,1	178	29,9	L/S (passenger side)	1023, 1024, 1025	0
1095		44	M	77,1	172	29,8	L/S (passenger side)	1023, 1024, 1025	0
1096		39	M	79,4	184	29,4	L/S (passenger side)	1023, 1024, 1025	0
1110		44	M	77,1	172	39,2	L/S (passenger side)	1108, 1109	0
577P	UVA	57	M	70	174	47,4	F/L(4kN) +AB passenger	571P, 572P, 576P	0
580P	UVA	57	F	57	177	47,6	F/L(4kN) +AB passenger	571P, 572P, 576P	0
665P	UVA	55	M	85	176	48	L/S+AB passenger de-powered	663P, 664P	3
666P	UVA	69	M	84	176	48	L/S+AB passenger de-powered	663P, 664P	3
667P	UVA	59	F	79	161	48	L/S+AB passenger de-powered	663P, 664P	13
668P	UVA	54	F	55	162	48	L/S+AB passenger de-powered	663P, 664P	23
C05	LAB	78	F	70	169		4kN+AB	C03, C13, C18, C20	6
C22	LAB	81	M	60	174		4kN+AB	C03, C13, C18, C20	19
651P	UVA	70	M	57	176	48,6	lap-belt+ AB passenger full-powered	648P, 649P	0
652P	UVA	46	M	74	175	49,7	lap-belt+ AB passenger full-powered	648P, 649P	0
9014C	Heibelberg	31	M	70	170	47	AB	9003D	0
9207C	Heibelberg	25	M	74	184	49	AB	9003D	0
9212C	Heibelberg	38	M	79	174	47	AB	9003D	0
554-M13-PCH1597	LAB	76	M	77	170		AB	PCH1640, PCH1641	15
555-M13-PCH1598	LAB	67	M	65	175		AB	PCH1640, PCH1641	15
559-M78-PCH1624	LAB	73	M	67	174,5		AB	PCH1628, PCH1629	11
561-M78-PCH1658	LAB	72	M	83	173		AB	PCH1628, PCH1629	0
594-M78-SEB144	LAB	78	M	65	170		AB	PCH1628, PCH1629	3
560-M128-PCH1625	LAB	74	F	73	160		AB	PCH1627, PCH1643	0

DEQ criterion

Validation data

45 yo



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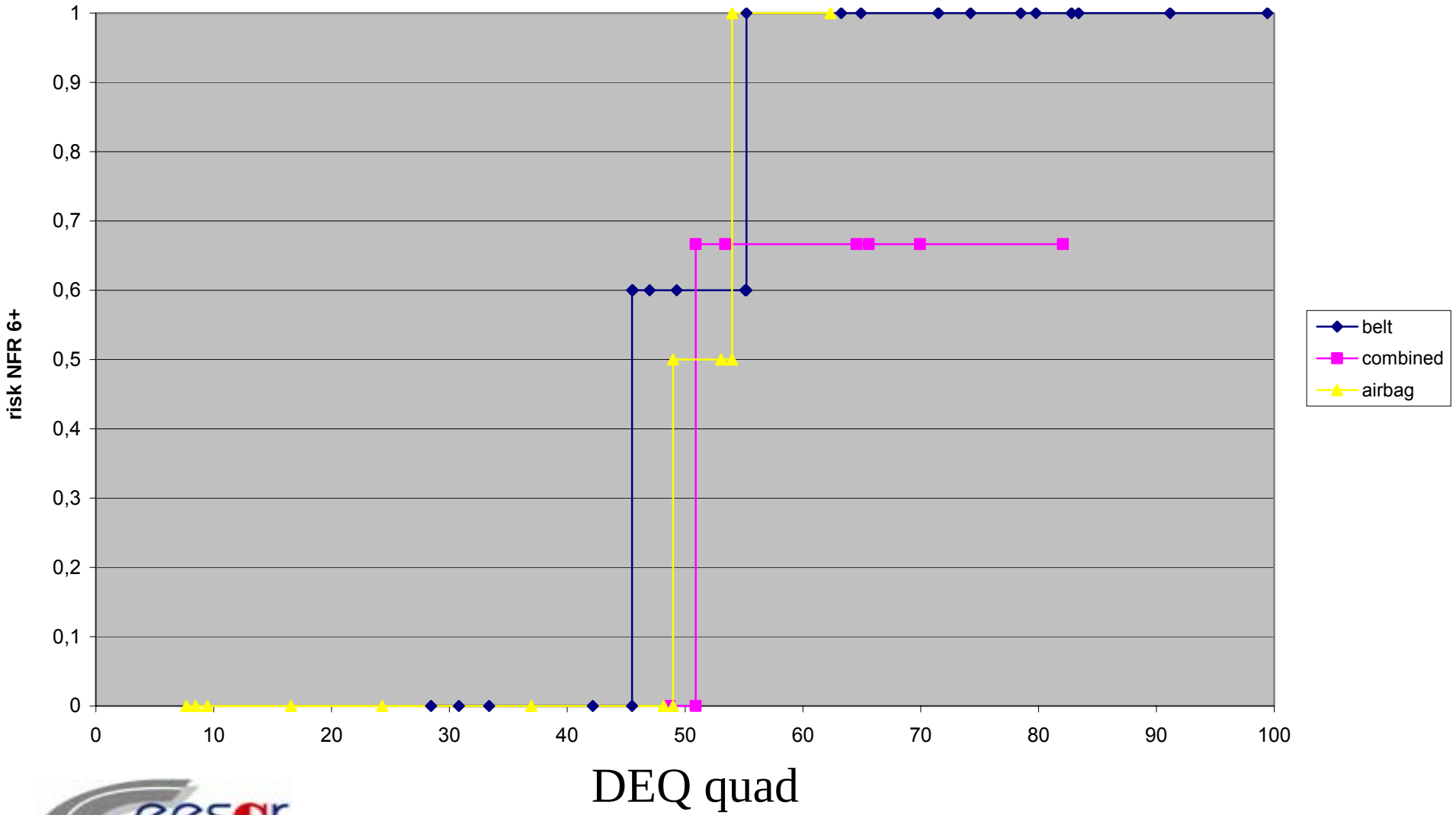

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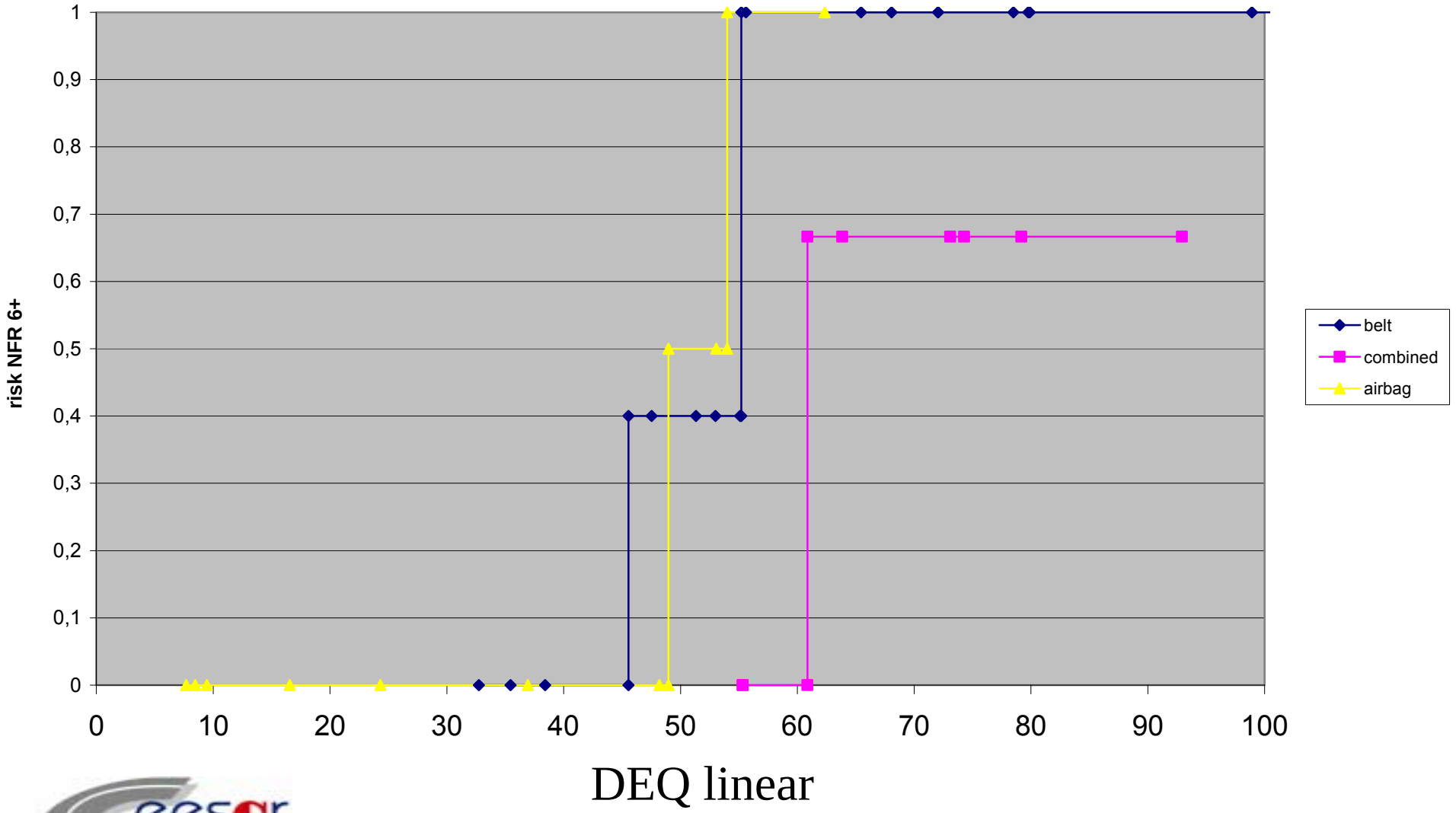

DEQ criterion

Validation data

AIC	Rodpot	DEQ Upper Quad	DEQ Upper Lin
	50	39	41
		DEQ Lower Quad	DEQ Lower Lin
		31	35

DEQ Schedule

- EuroNCAP biomechanical workshop
  - 19th of June 2012
- Expert group to validate the use of thorax injury prediction tools: DEQ, THMPR , Rib Eye for the H3
  - Beginning Sept 2012