Kanton Zürich
Baudirektion
AWEL

Survey about functional efficiency of DPF during PTI in Zürich – 22. ETH-NPC 2018

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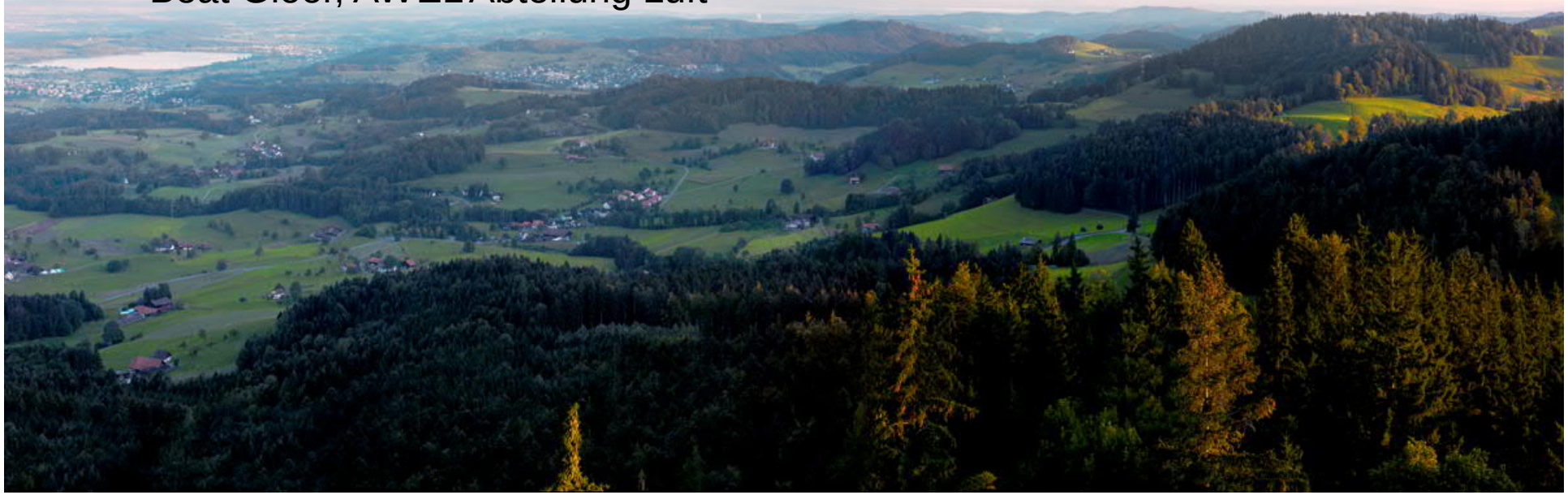


Contents

- definition of the project
- approach – basic points
- measuring equipment
- results
- conclusion

The project

- cars comes for the PTI
- only diesel cars
- if possible only Euro 5b → Euro 6….
- use and test different PN-measuring equipments
- communicate the measuring technique, feasibility, time required

requirements

- no disturbance during PTI
- no consequences for DPF malfunction → wording

Method

- data sheet for one week,
- 7 lanes to monitor at the same time
- to pick the relevant cars
- PN-measuring (2 instruments) during the PTI (drive to or from the control basement)
- notice the value, complete data set if necessary, identify DPF under the car

Quelle: Blick/Keystone

PN-measuring equipment

- P-Trak (TSI) → CPC
- Disc-mini (testo) → diffusion charging
- Partector with heating (naneos) → diffusion charging
- NPET (TSI) → metas-approved PN-measuring equipement for diesel engines with dilution, dilution rate 1:10 and heating to 350°C (CPC) power: 240V AC

Equipment

P-Trak

Disc-mini

Partector

NPET

Method by evaluation the results

List of examined cars and the measured values

→ Euro 5b or younger → always DPF present

→ Euro 5a oder older

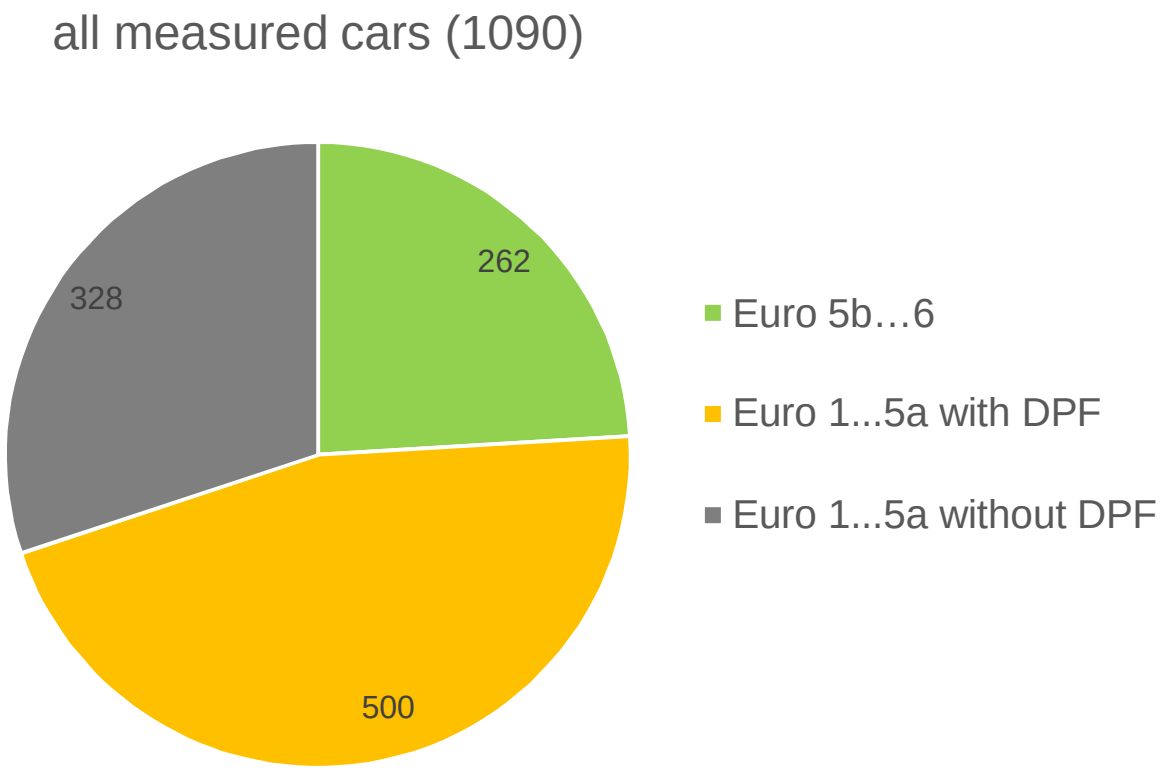
measured value ≤ 300’000 → DPF present

measured value > 300’000 → database of registration by Road Traffic Licensing Department:

a) with COC Nr. → DPF yes/no

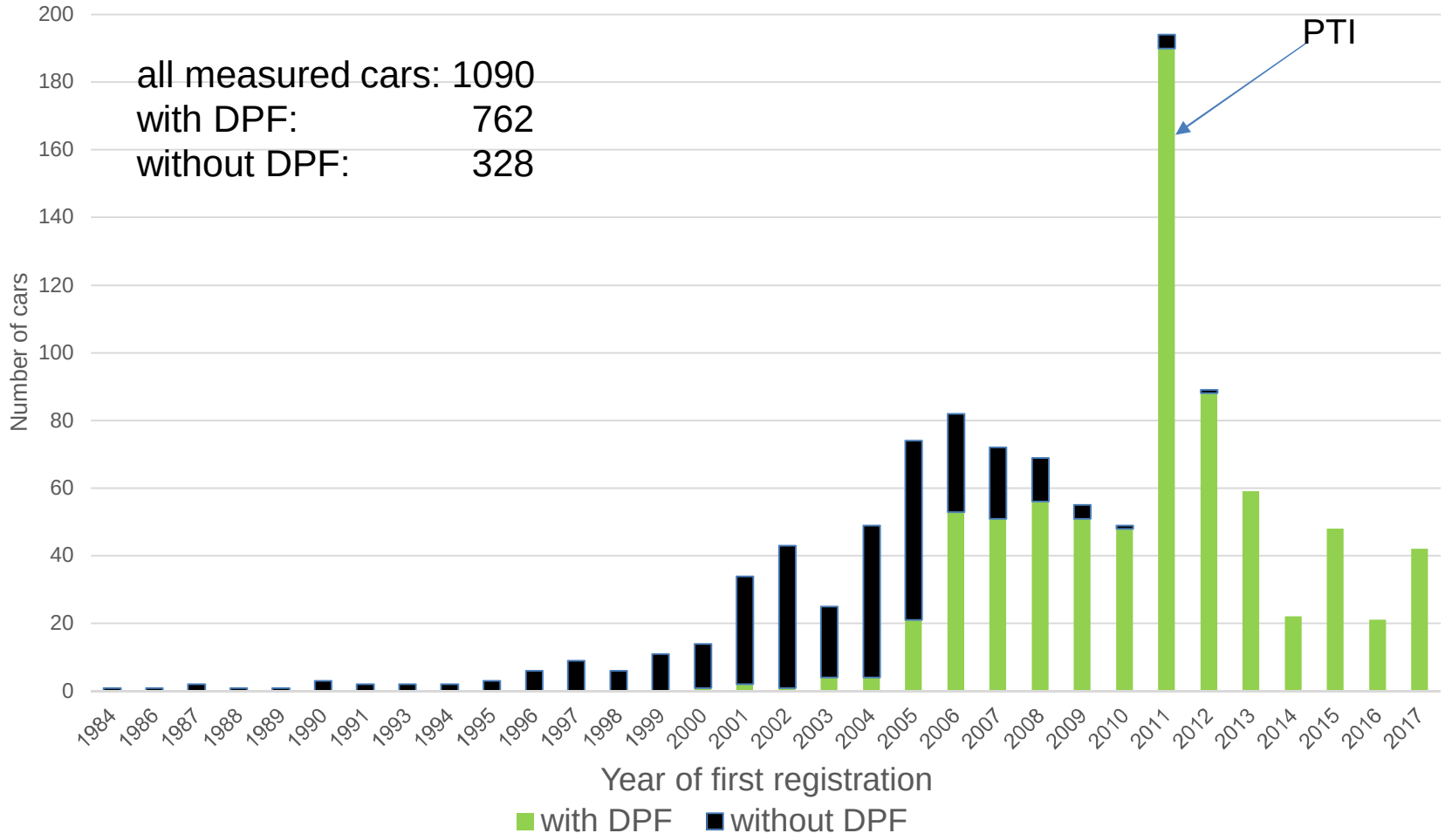
b) without COC Nr. → comparison with the same cars with COC and the same year of first registration → DPF yes/no

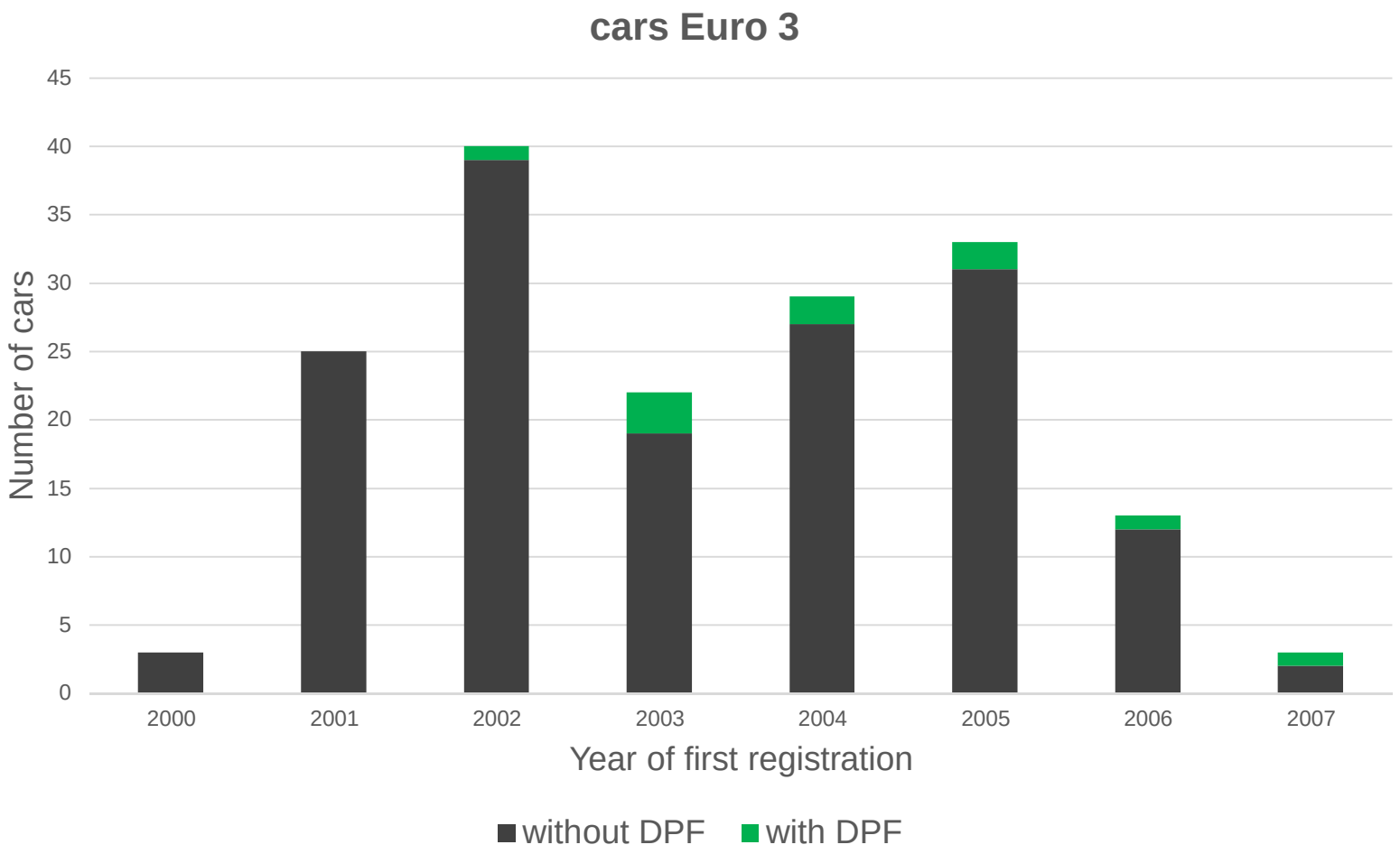
All cars - with and without DPF

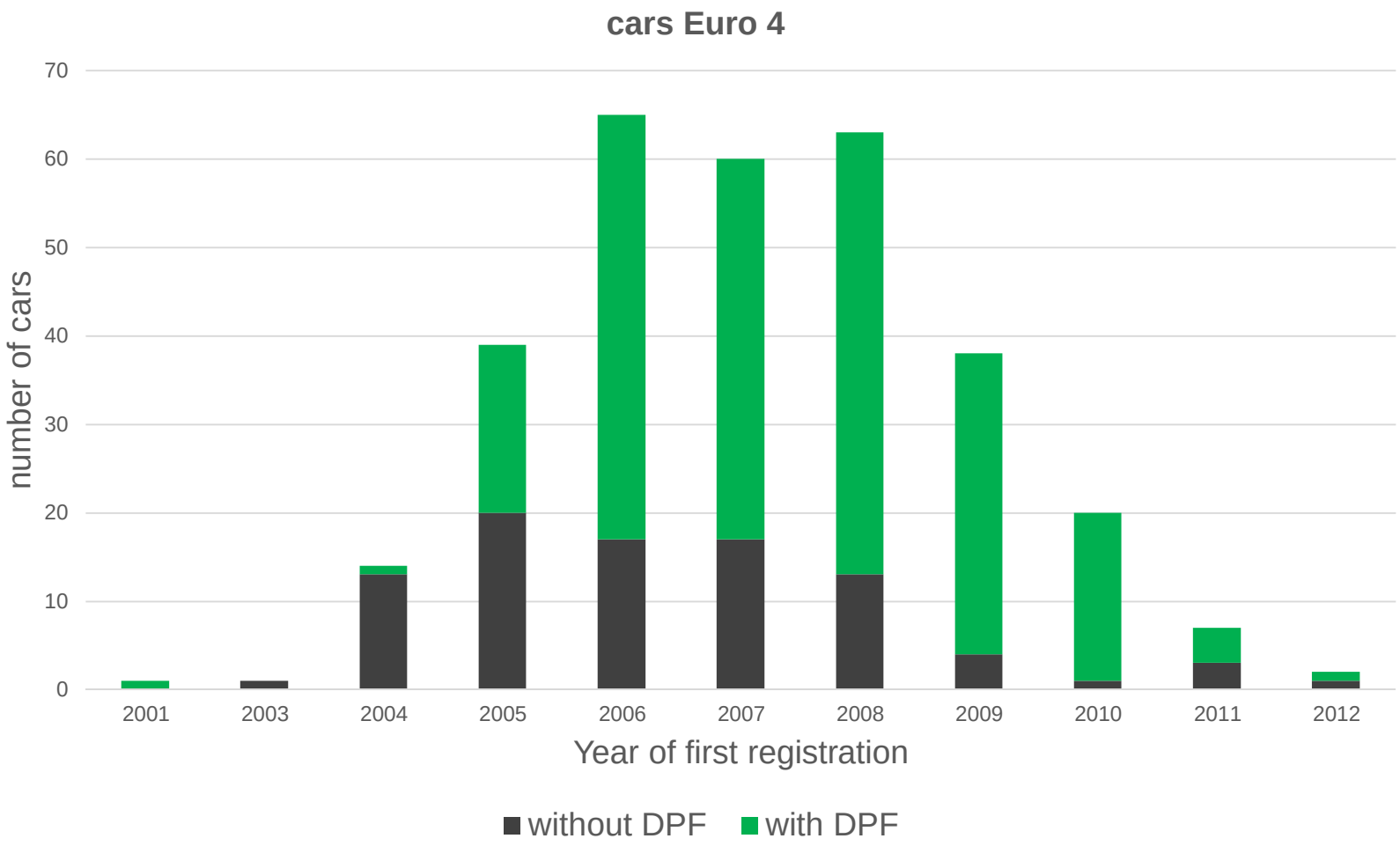


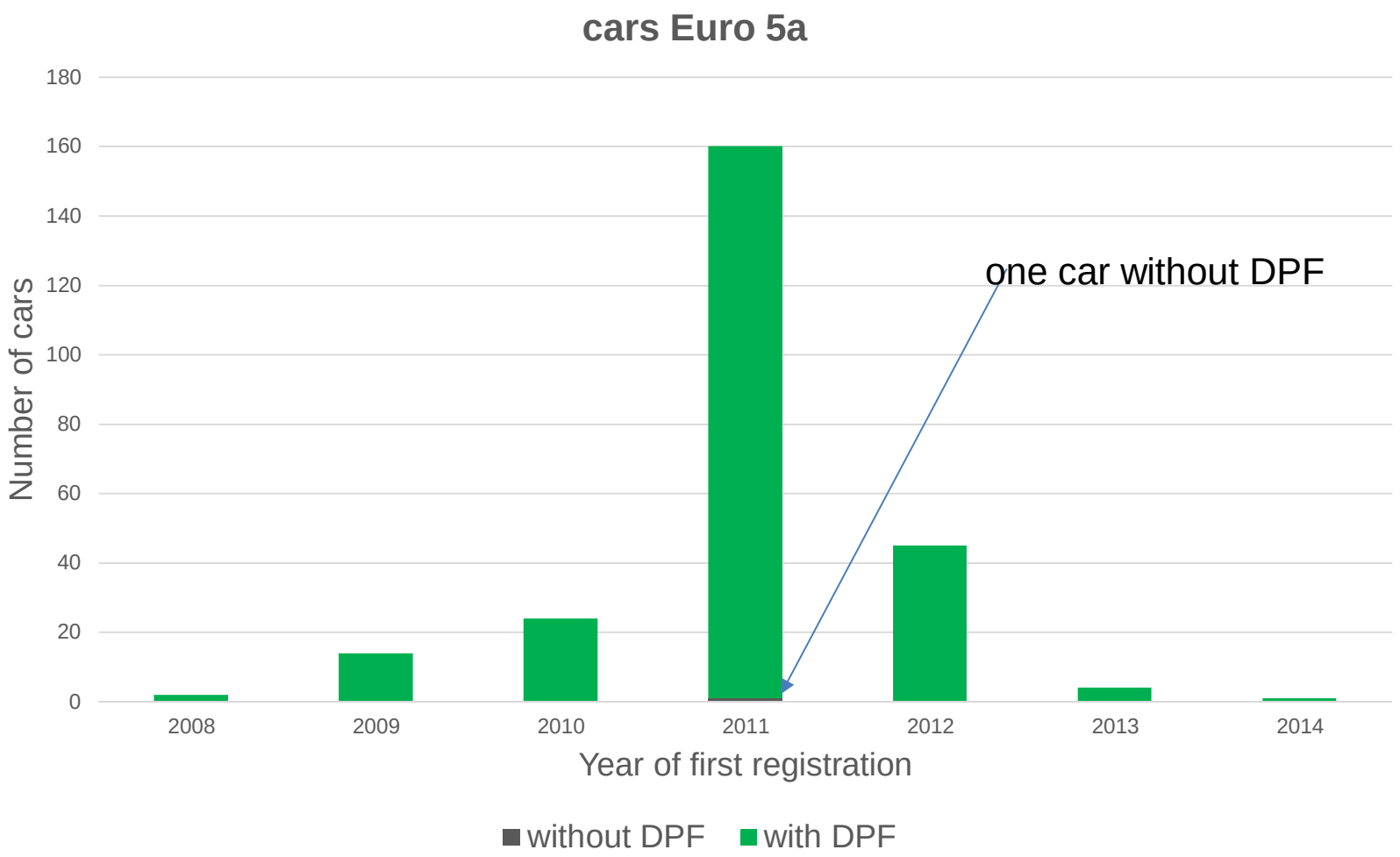
Results

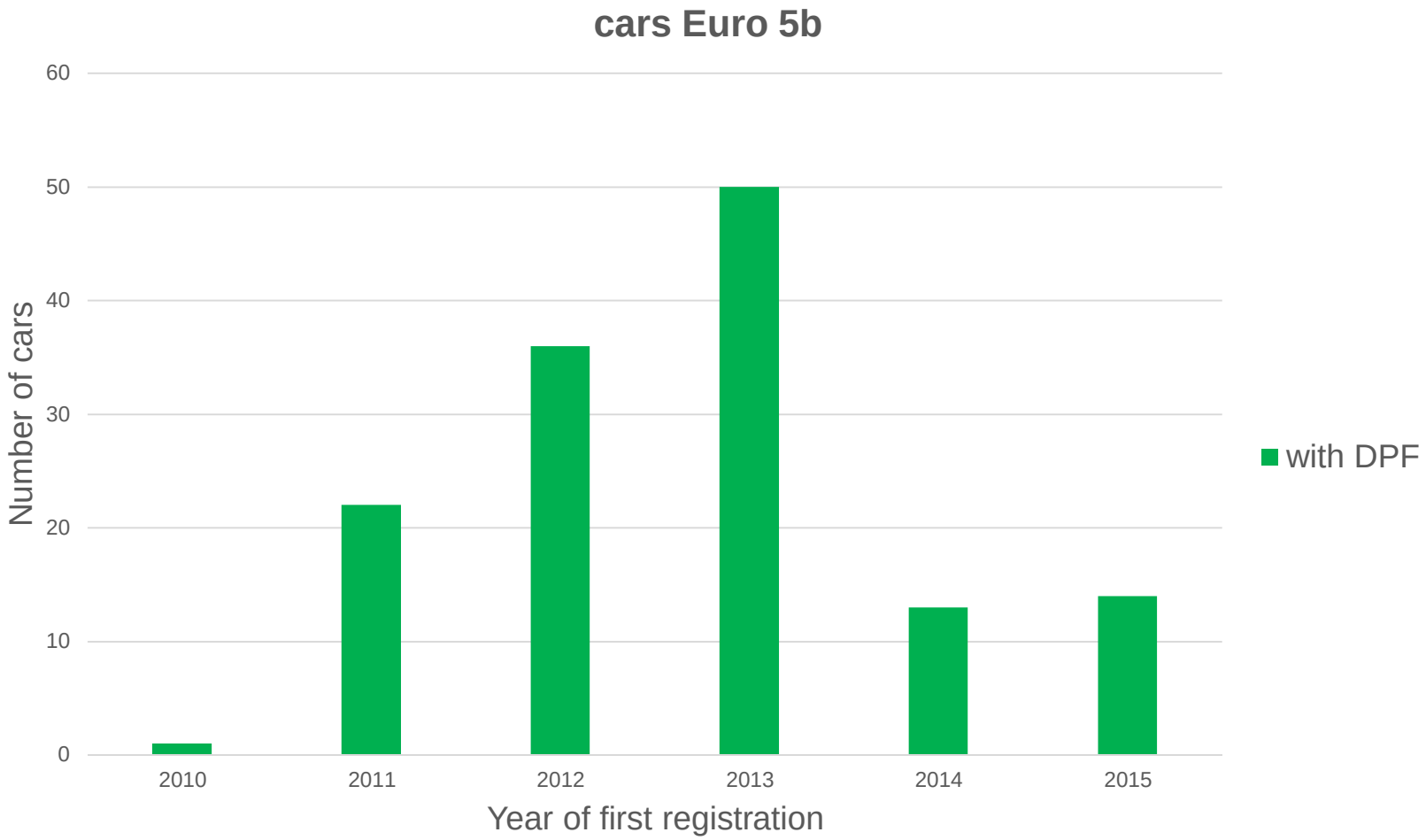
number of measured cars with/without DPF after year of first registration



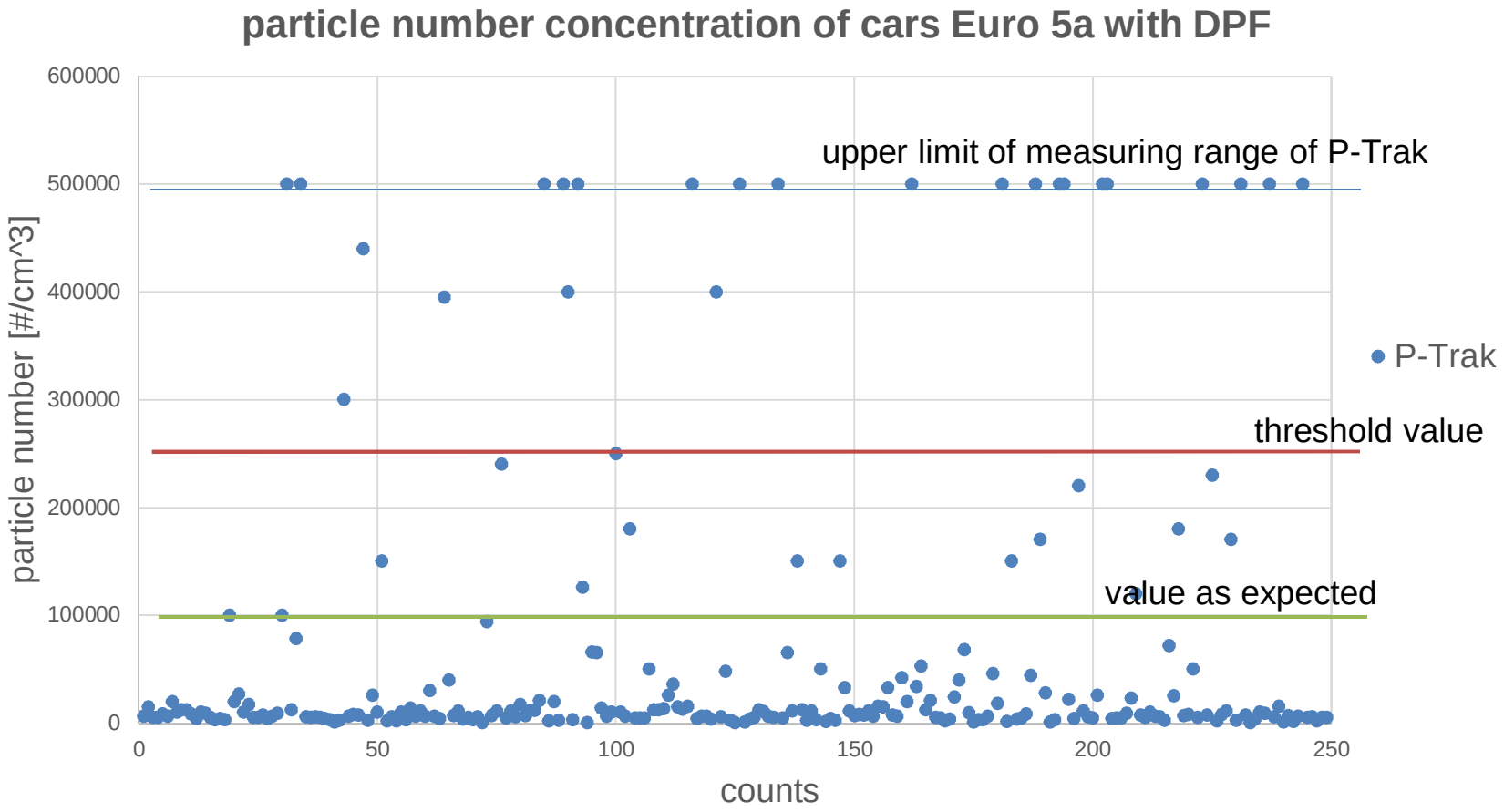

cars Euro 3
Number of cars
45
40
35
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
Year of first registration
without DPF
with DPF


cars Euro 4
number of cars
70
60
50
40
30
20
10
0
2001
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year of first registration
without DPF
with DPF

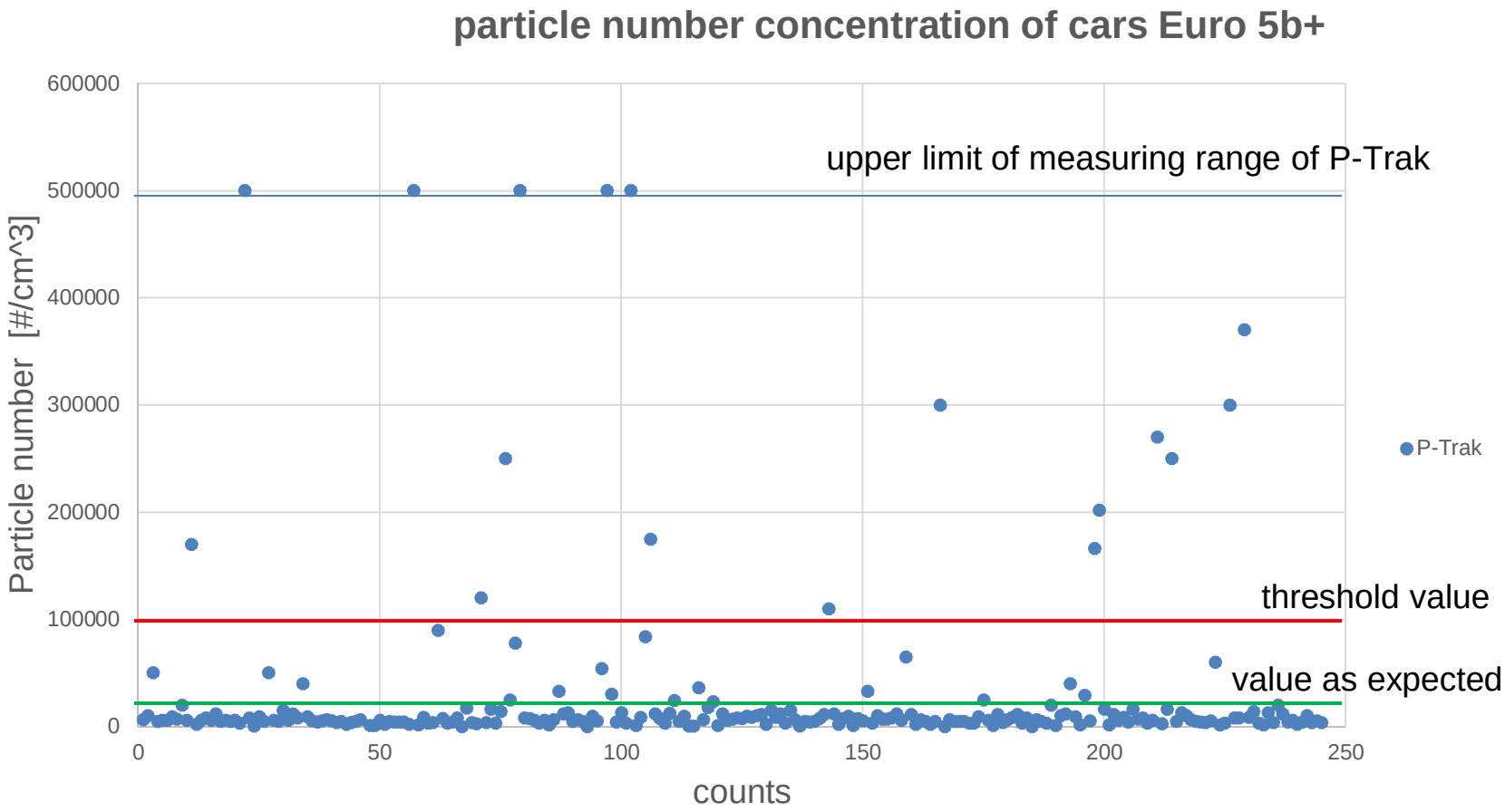

cars Euro 5a
180
160
140
120
100
80
60
40
20
0
Number of cars
one car without DPF
2008
2009
2010
2011
2012
2013
2014
Year of first registration
without DPF
with DPF


cars Euro 5b
60
50
40
30
20
10
0
Number of cars
2010
2011
2012
2013
2014
2015
Year of first registration
with DPF

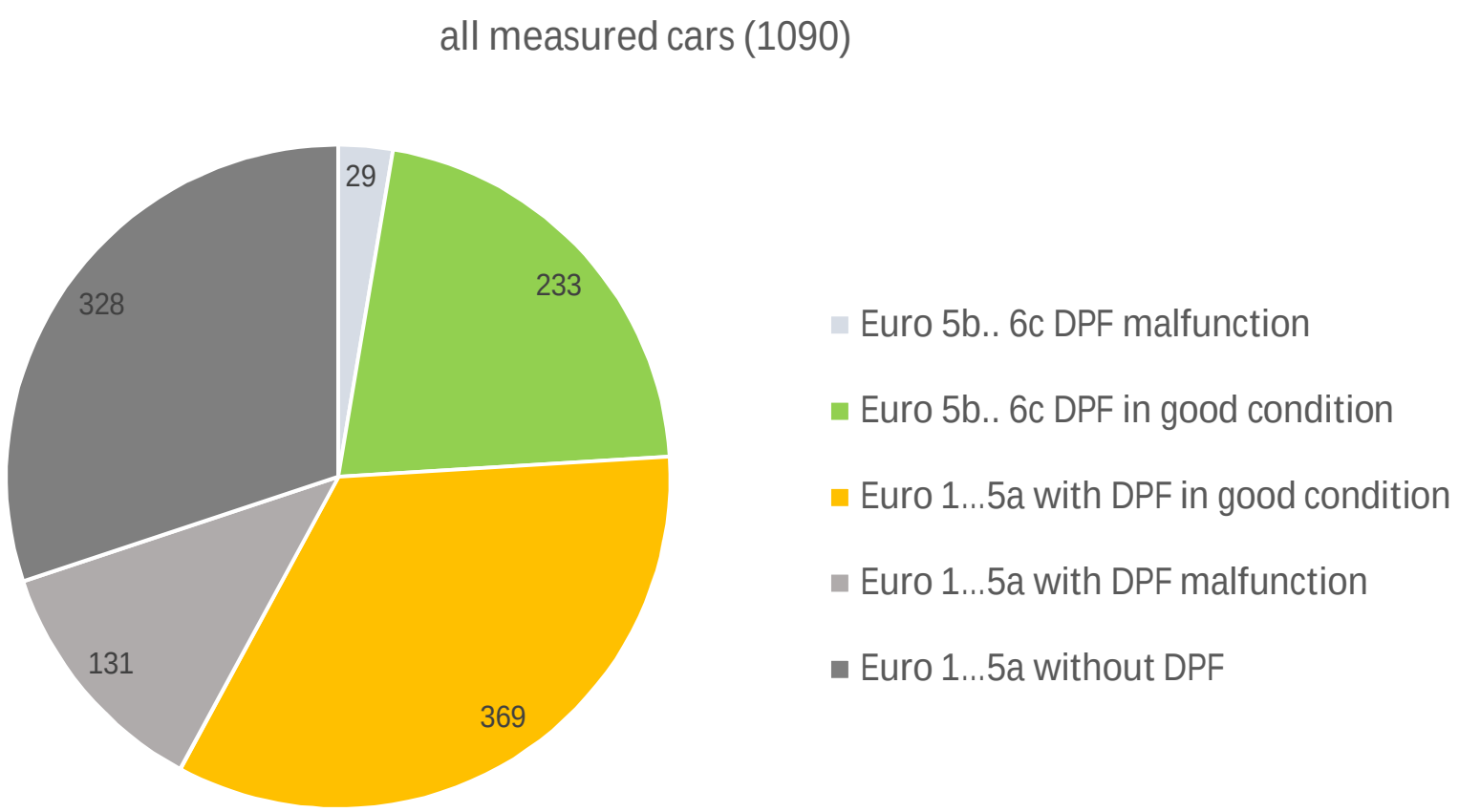
Results


particle number concentration of cars Euro 5a with DPF
particle number [#/cm^3]
600000
500000
400000
300000
200000
100000
0
0
50
100
150
200
250
counts
upper limit of measuring range of P-Trak
threshold value
value as expected
P-Trak

Results


particle number concentration of cars Euro 5b+
Particle number [#/cm^3]
600000
500000
400000
300000
200000
100000
0
0
50
100
150
200
250
counts
upper limit of measuring range of P-Trak
threshold value
value as expected
P-Trak

Evaluation of all measured cars



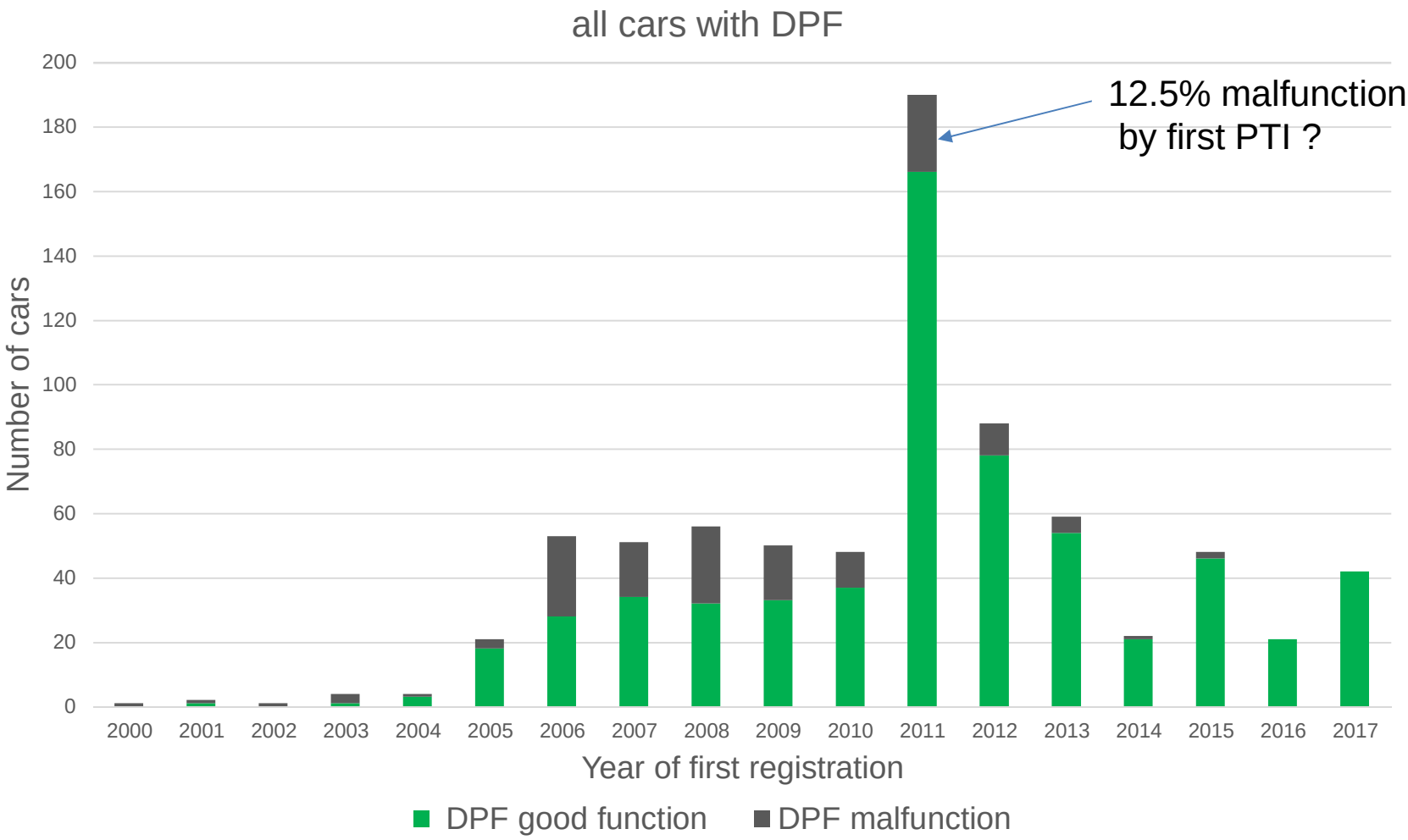
Results of the investigations relating to emission-standard and DPF-obligation

DPF-obligation

no DPF-obligation

B5b->B6...	>100'000	>30'000	<30'000	B00 <- B5a	B00 <- B5a	B00 <- B5a	>250'000	>100'000	<100'000
Total	failure	increased	good	Total	no PFS	with DPF	failure	increased	good
262	29	14	219	828	328	500	131	28	341
100%	11.1%	5.3%	83.6%			100%	26.2%	5.6%	68.2%
				100%	39.6%	60.4%			

A closer look



Controlled cars with first registration 2011

190 cars with DPF

→ **159 cars Euro 5a**
→ 4 cars Euro 4
→ 22 cars Euro 5b
→ 5 buses Euro 5 (public transport)

Cars Euro 5a with first registration 2011

190 cars w. DPF → **159** cars Euro 5a

		total	def	%
reason:	**t**ec.	2	0	0
	free	8	3	38
	perio.	132	11	8
	empty	17	2	12
	total	**159**	**16**	**10%**

statistically verified results, no bias

Conclusions I

- the technology for PN-mesurement is functional although with easier instruments
- with this equipment I can measure 95% of that cars without any doubt and I have a clearly result
- for the 5% «doubt-results», I can use the metas-aprooved equipment(s) or I inform the driver, that the DPF has to be replaced at least before next PTI or the MIL indicate an error.
- time required for mesurement (~ 30 sec.)

Conclusions II

- we need a reliable battery powered PN-measuring equipment, of handy-size with a sufficient measuring range
- handy-size = like P-Trak or Partector
  battery capacity = 5 hours
  measuring ranged = 1000 – 10 million P/cm^3
- we need threshold value(s) for PN, as low as possible, as high as necessary
- we need a mandatory inspection instruction, for a fast and reliable measuring

Special thanks :

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- Dr. M. Fierz UASNWS
- Vera Weichlinger, assistent

Thank you for your attention!

Are there any questions?

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ACHTUNG!
PRÜFGRUBE