UDRIVE

European Naturalistic Driving Study

Naturalistic Research on Powered Two-Wheelers

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Two worlds…

… two populations

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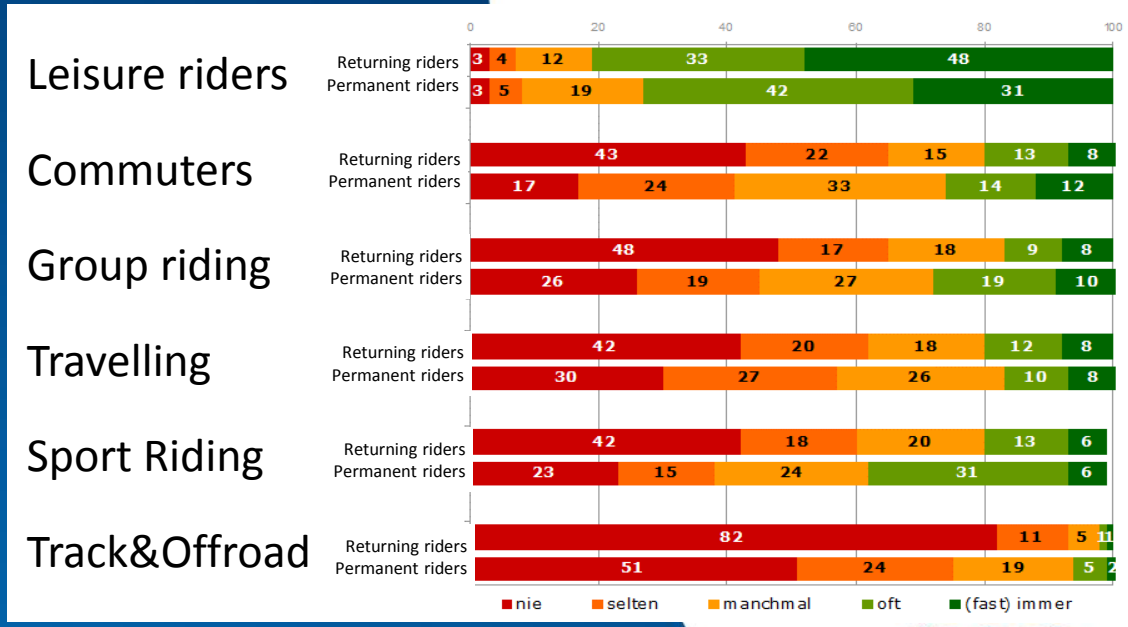
Typical Riding Purposes

- 75% leisure riders
- 25% commuters
- Hardly any overlaps
- (Austria, 2012, n=1038)



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Camera positions

Forward cameras

Feet camera

Face camera

Driver's action camera

Passenger compertment camera

Right blind spot camera

Rear View

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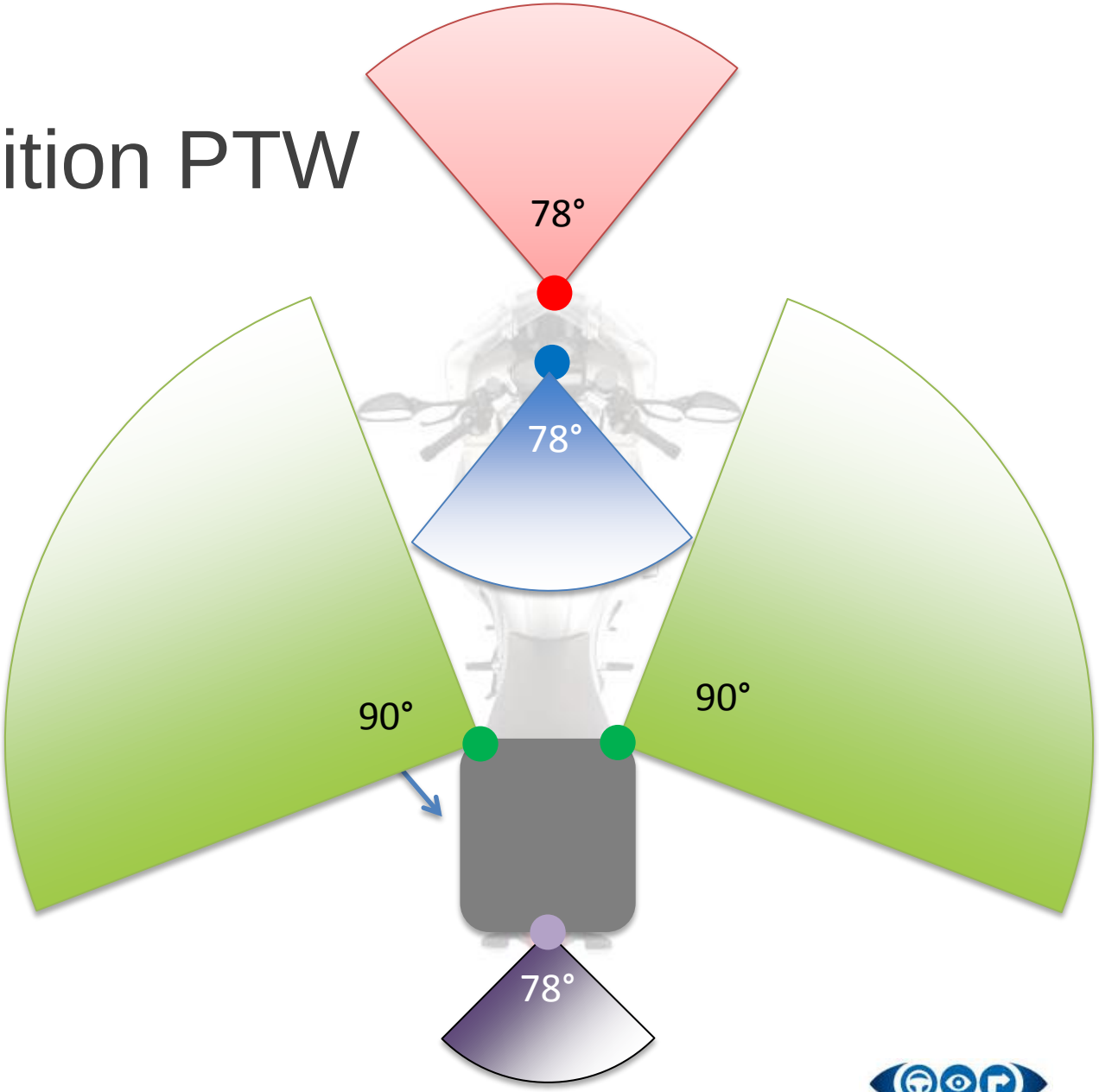
Camera Position PTW

Forward cameras

Face camera

Side cameras



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DAS overview

Cars
Trucks
PTW

GPS/GSM antenna

Cars
Trucks
PTW

Automotive Computer

IR Spot

Cars
Trucks

Cars

Microphone

CAN/3D acc. and connectors adapter

MobileEye

Cars
Trucks

Cars
Trucks
PTW

ON/OFF video recording

Cameras

Cars
Trucks

PTW

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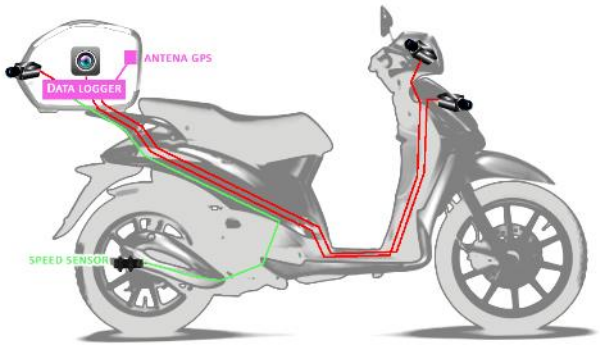
UDRIVE PTW
Piaggio Liberty 125

1 FRONT CAMERA

2 FACE CAMERA

3 4 5 TOP CASE CAMERAS



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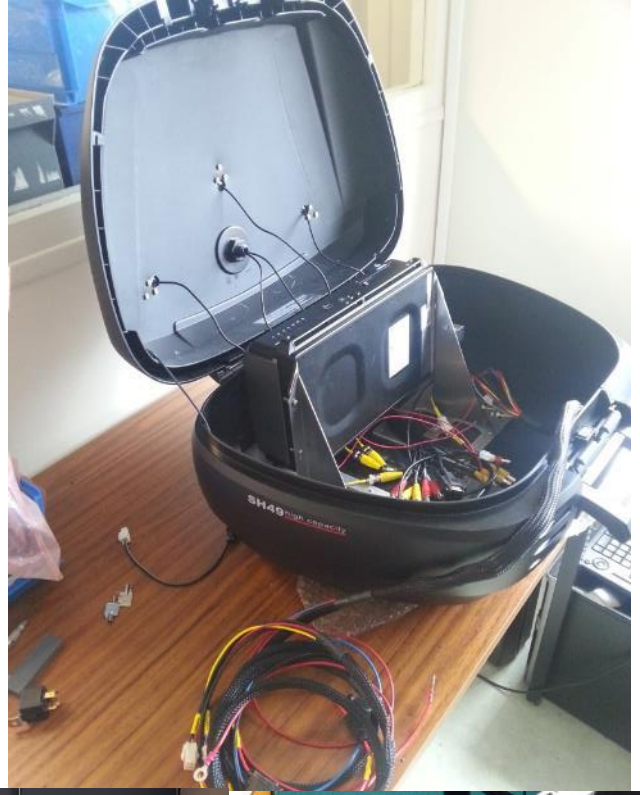

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Research questions particular in PTW

- Everyday riding
  - 50 km/h
  - right turn, left turn
  - Acceleration from stop
  - etc
- Safety Critical Event (SCE) detection
  - Test triggers
  - Validate by video
- Time Headway
  - Read endings, 62% drivers at fault
  - Car data only
  - Use mobileye

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Preliminary results: Time Headway

- 10% PTW crashes rear ending
- 62% car at fault
- research based on car data
- using Mobileye
- queries direction on SGL database
- avoid traffic jam
  - v > 30 km/h
  - v > 0,5 speed limit
- sidewards distance < 3 m
- lead vehicle present > 10 s

- 134 mio records i.e. 1242 h
- 22% behind car
- 1.25% behind truck
- 0.07% behind PTW
- for v > 85 km/h distance detection probably not exact enough (currently too few data)

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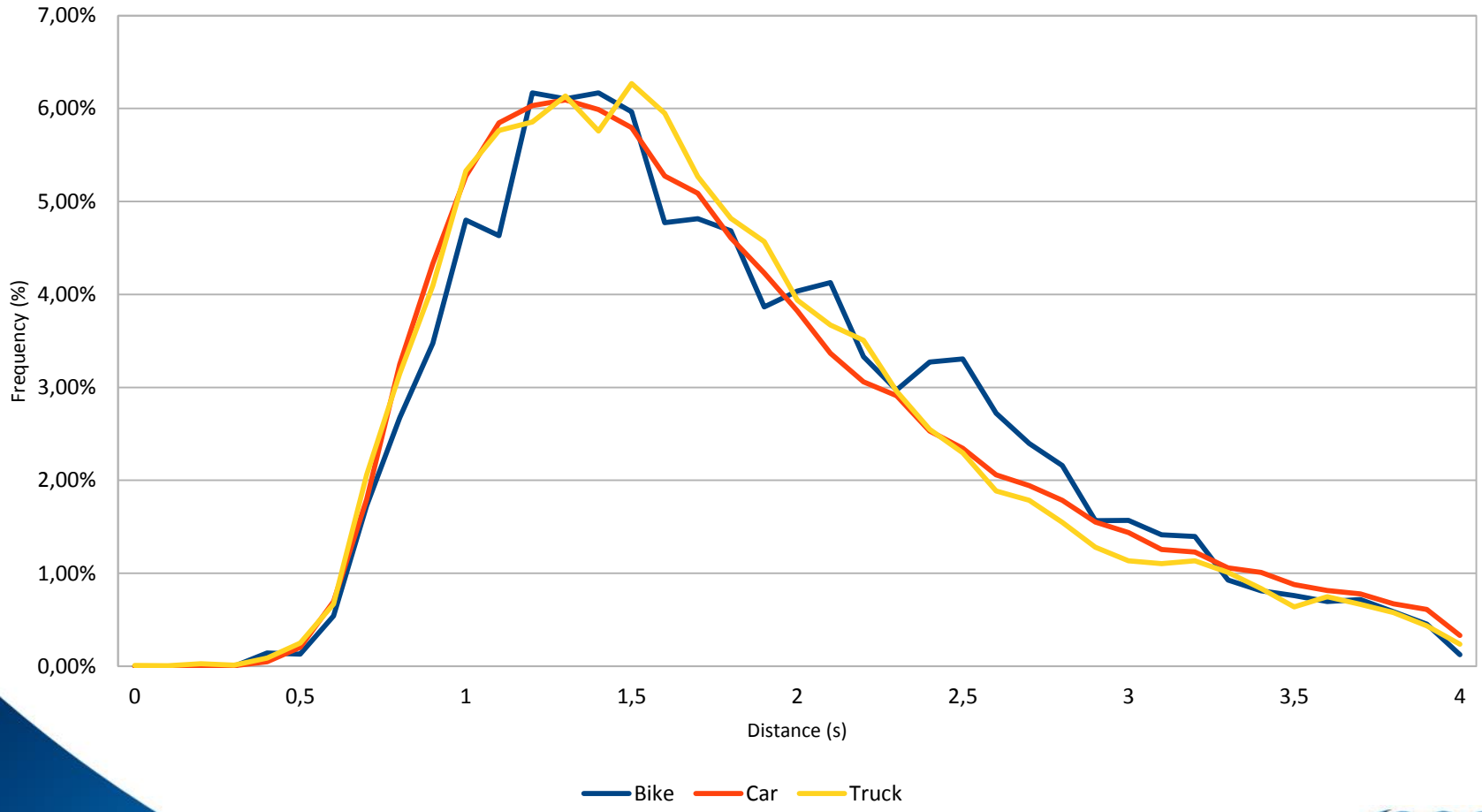
Frequency of distance, v < 55 km/h



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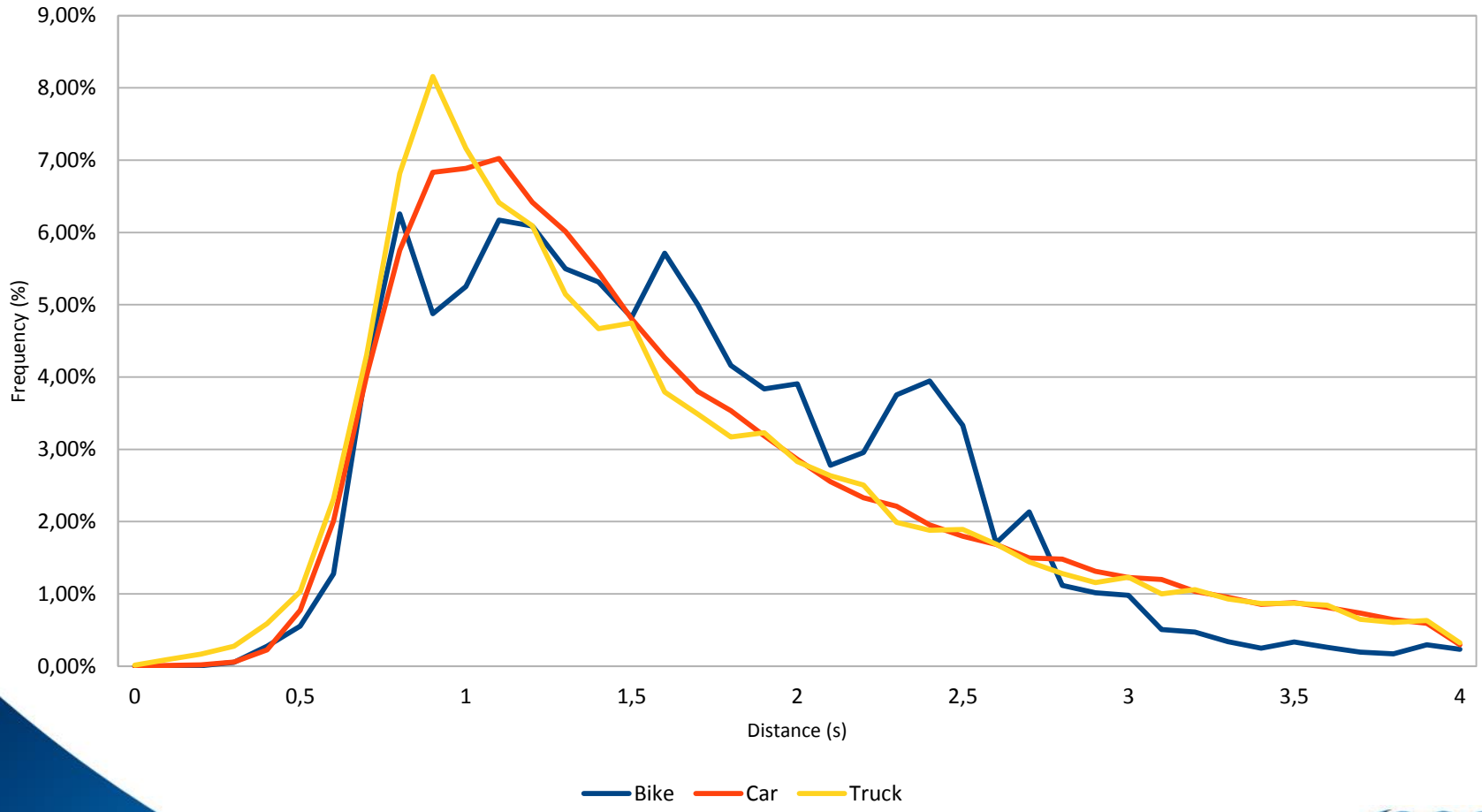
Frequency of distance, 55 < v < 85 km/h



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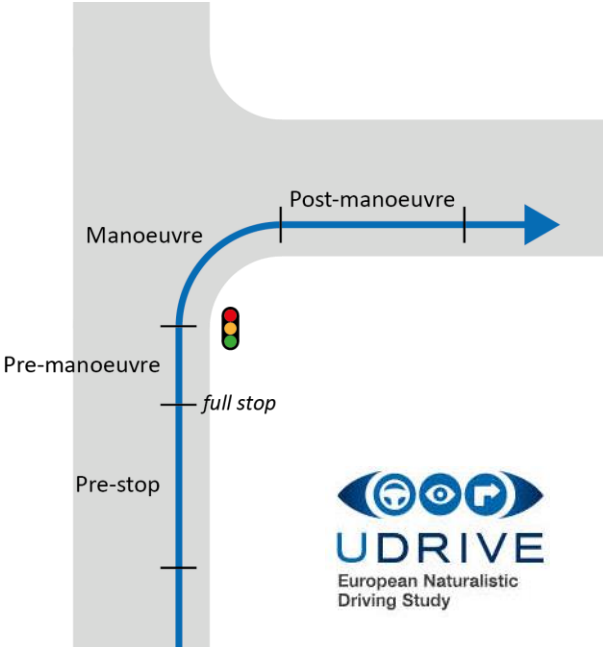
Average of distance

- 1.1 s behind cars
- 1.2 s behind PTWs
- 0.9 s behind trucks
- Explanation for rear endings?
- Back to conspicuity?

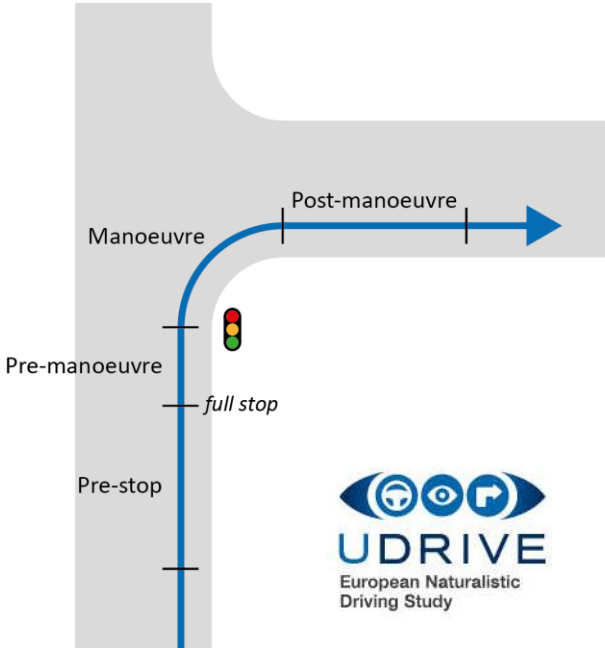
Everyday riding: Setup

- Aim:
  - To detect, understand, and possibly prevent motorscooter crashes
- Approach:
  - Descriptives on everyday riding at urban intersections
- Measures:
  - Speed choice & g-forces
- Depending on:
  - Scenarios: Flow, Full stop
  - Manoeuvres: Left turn, Right turn, Straight ahead
  - Driver personalities based on questionnaires



Everyday riding: Expected results

Scenario		Speed (km/h) – distribution, %above limit				Acceleration (g) – distribution			
		Pre-stop	Pre-man	Man	Post-man	Pre-stop	Pre-man	Man	Post-man
Flow	Left		X	X	X	X	X	X	X
	Right		X	X	X	X	X	X	X
	Straight		X	X	X	X	X	X	X
Full stop	Left	X	X	X	X	X	X	X	X
	Right	X	X	X	X	X	X	X	X
	Straight	X	X	X	X	X	X	X	X



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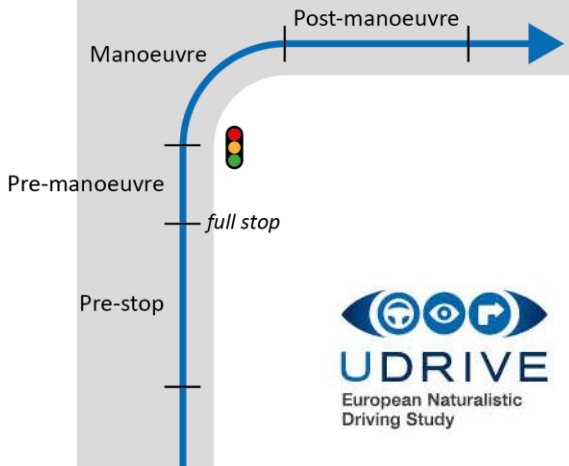
Everyday riding: Expected results

Scenario		Speed (km/h) – mean,min,max, %above limit				Acceleration (g) – mean,min,max			
Full stop		Pre-stop	Pre-man	Man	Post-man	Pre-stop	Pre-man	Man	Post-man
Gender	M	X	X	X	X	X	X	X	X
	F	X	X	X	X	X	X	X	X
Age	Young	X	X	X	X	X	X	X	X
	Old	X	X	X	X	X	X	X	X
Experience	Novice	X	X	X	X	X	X	X	X
	Exp.	X	X	X	X	X	X	X	X
Personality	Cat 1	X	X	X	X	X	X	X	X
	Cat 2	X	X	X	X	X	X	X	X
	Cat 3	X	X	X	X	X	X	X	X
	Cat 4	X	X	X	X	X	X	X	X



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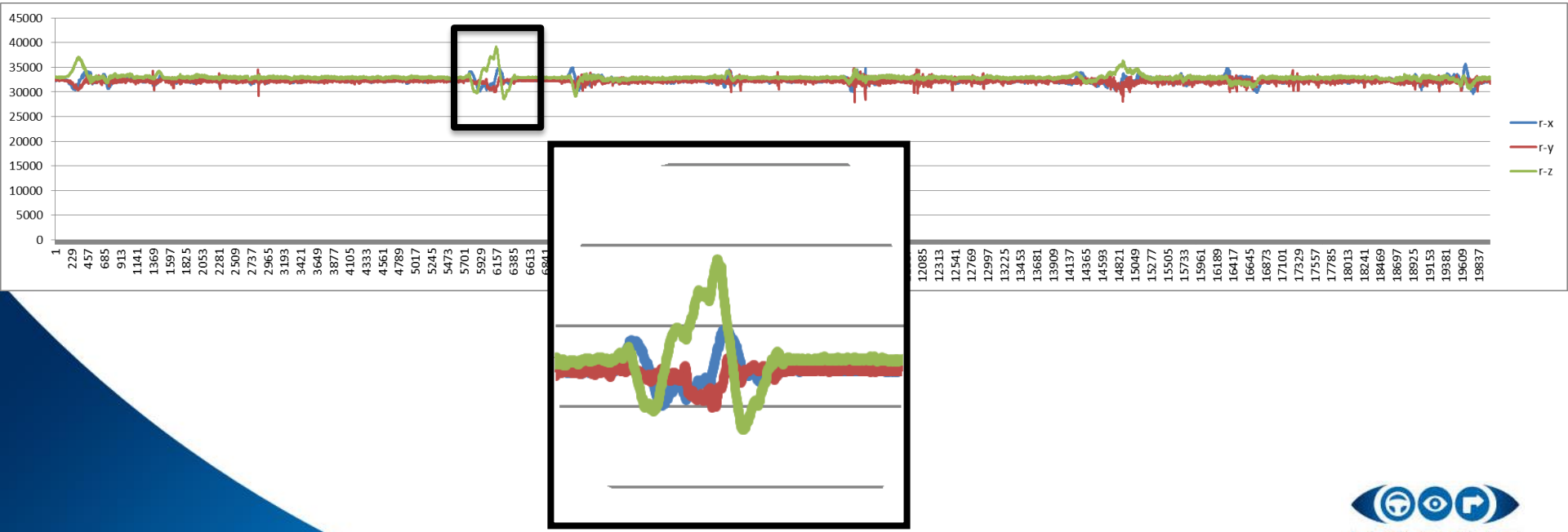
SCEs: What we're looking for ...

- Recording
  - Vehicle manoeuvres: e.g. speed, acceleration/deceleration, direction, high jerk
  - Driver/rider behaviour: e.g. eye, head and hand manoeuvres
  - External conditions: e.g. road, traffic and weather characteristics



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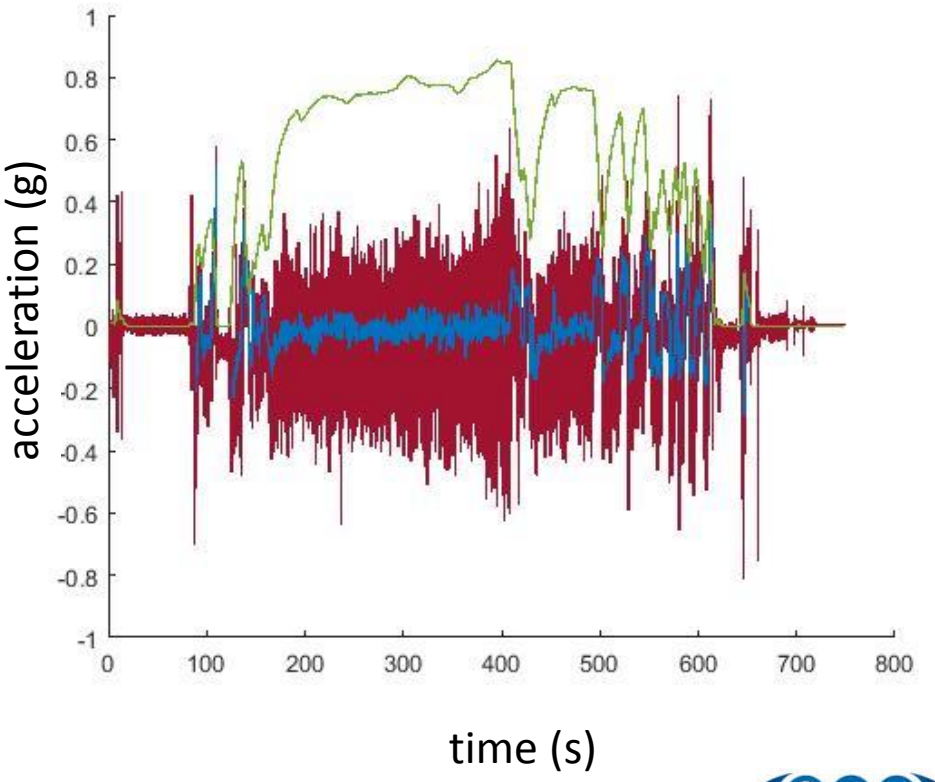
Preliminary results: SCEs

- 19 / 40 scooters
- 500 hours of riding data
- Acceleration x / y / x
- Rotation speed x / y / z
- y … longitudinal
- x … lateral
- z … vertical
- corrected by average
- filtered 30 to 2 Hz
- cut off at 55km/h

map-matched GPS speed
original y acceleration
filtered y acceleration



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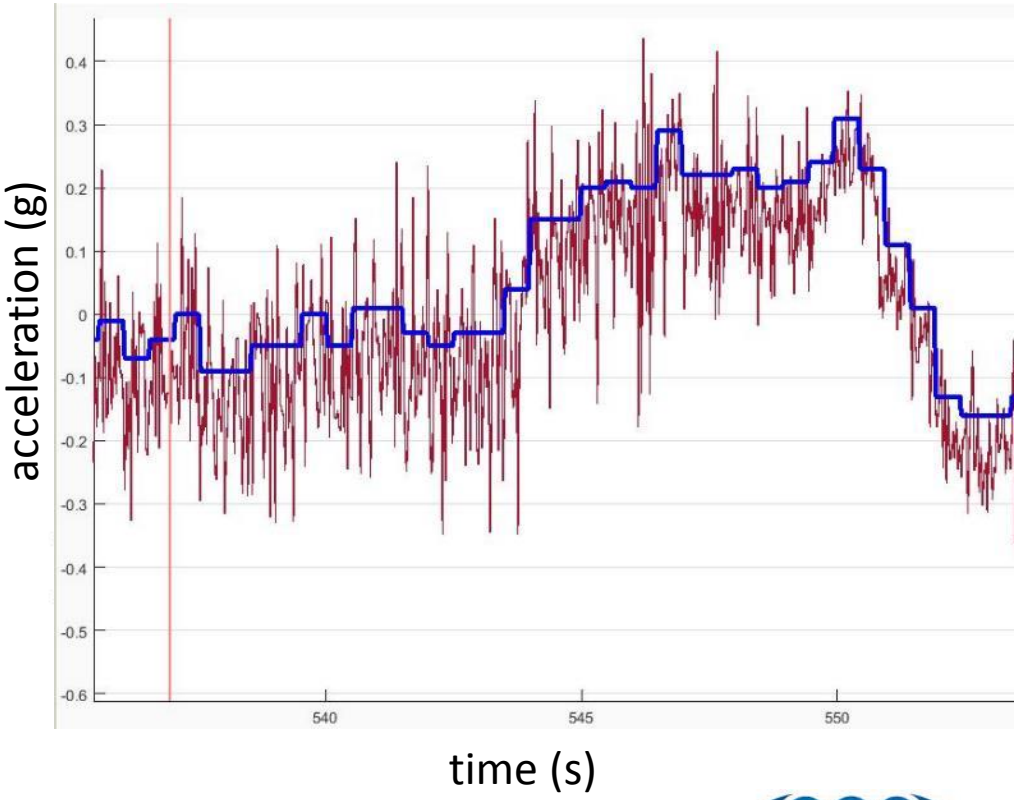

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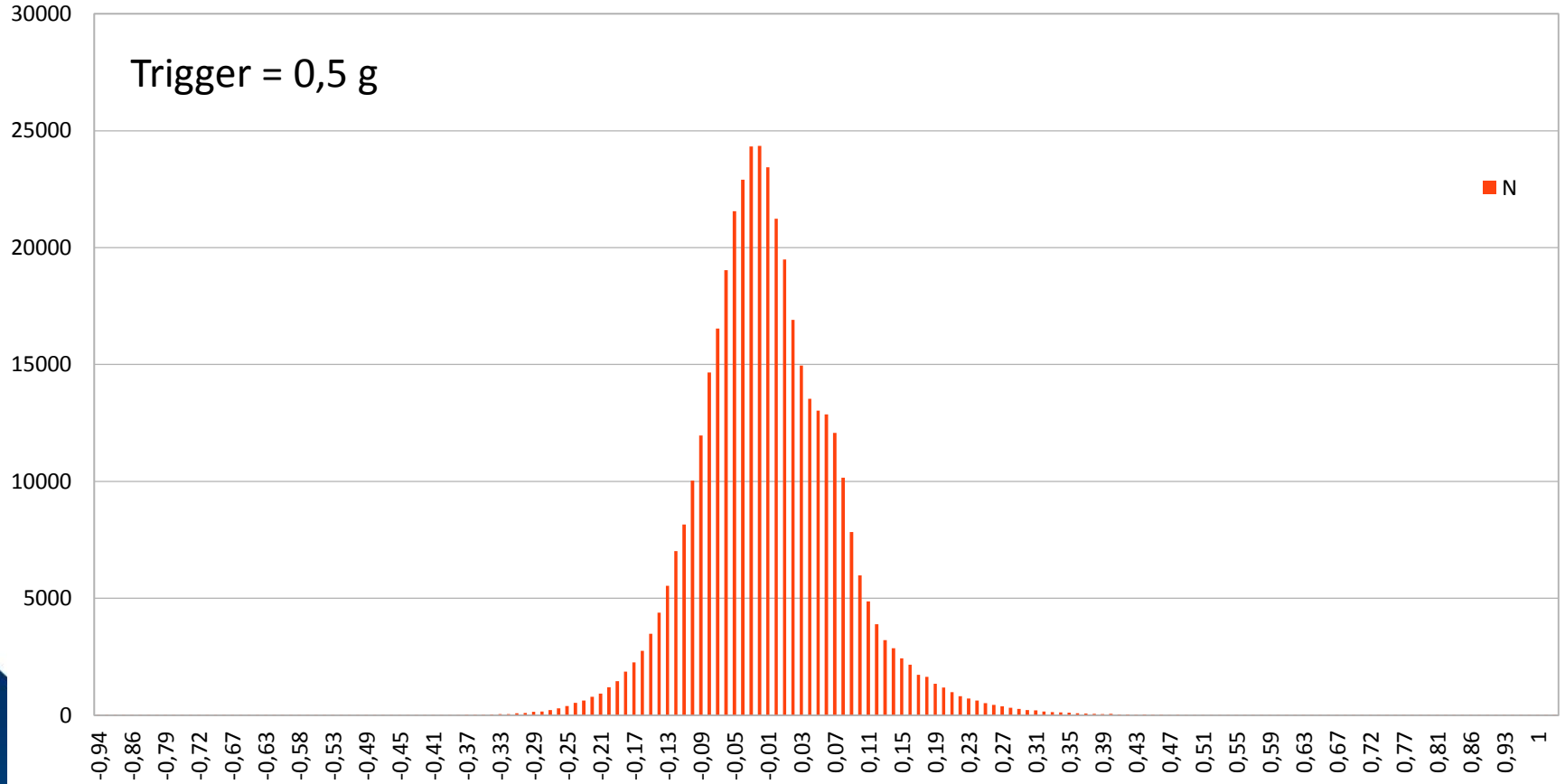
Distribution of longitudinal acceleration



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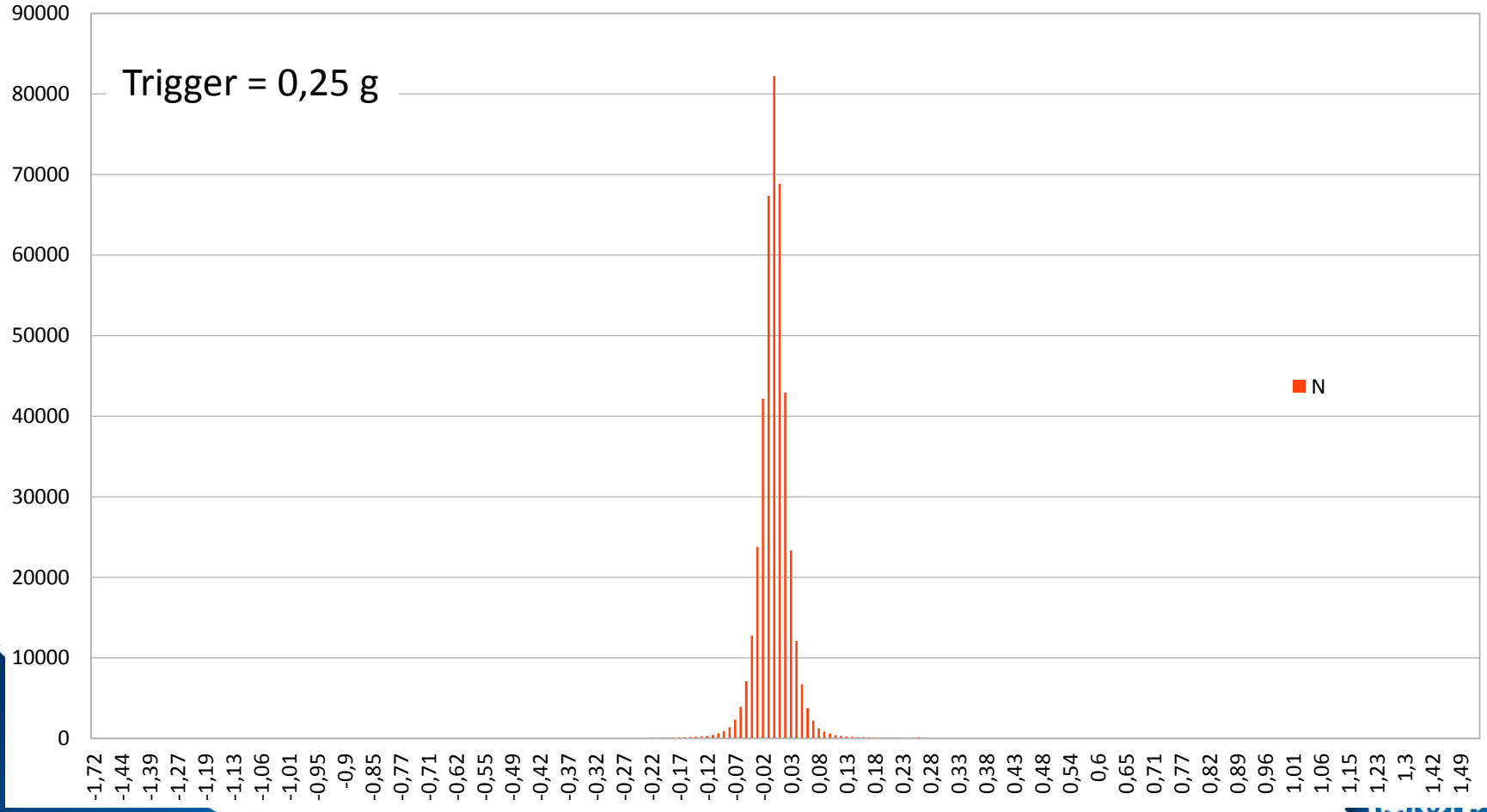
Distribution of lateral acceleration



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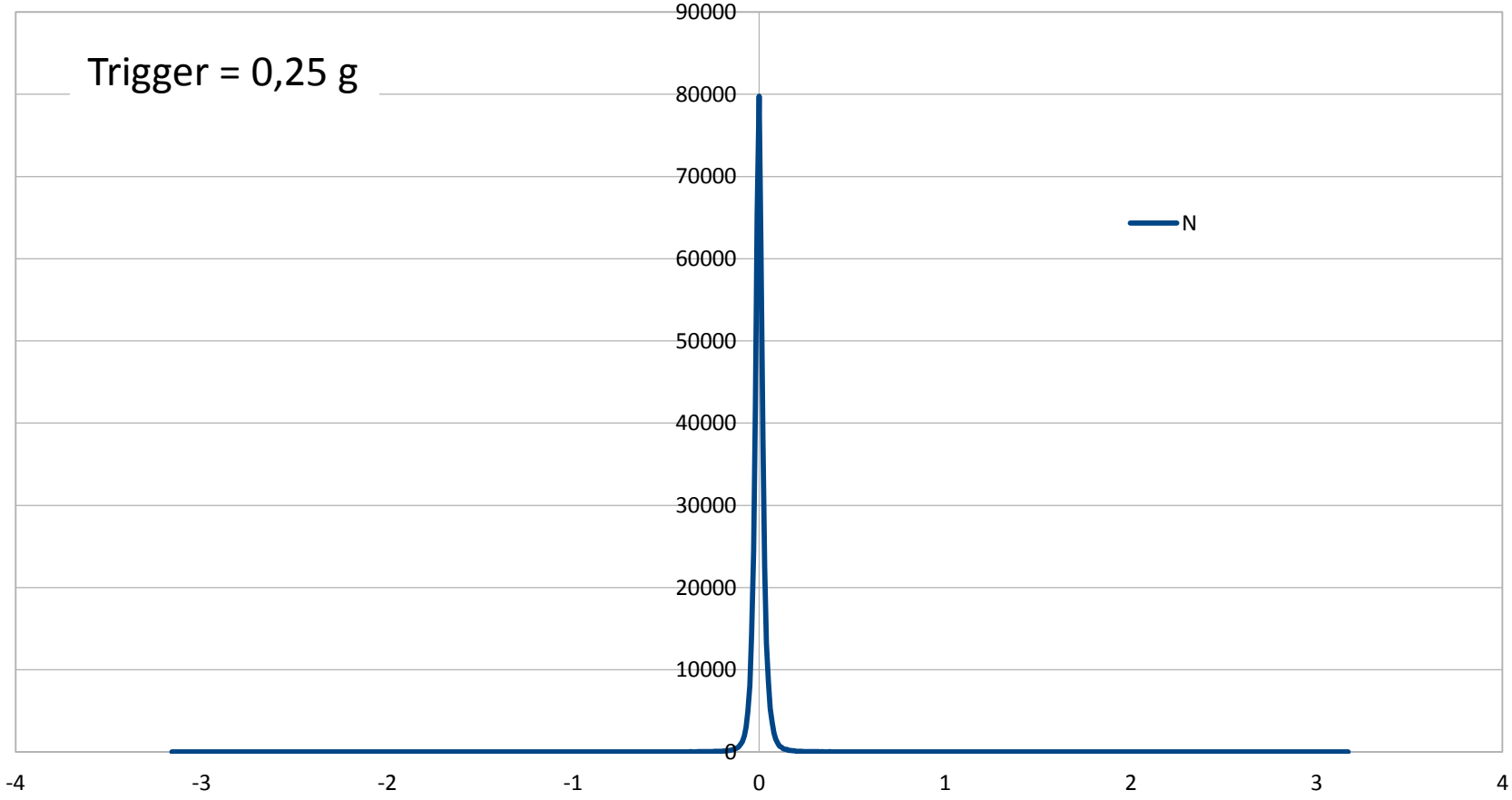
Distribution of vertical acceleration



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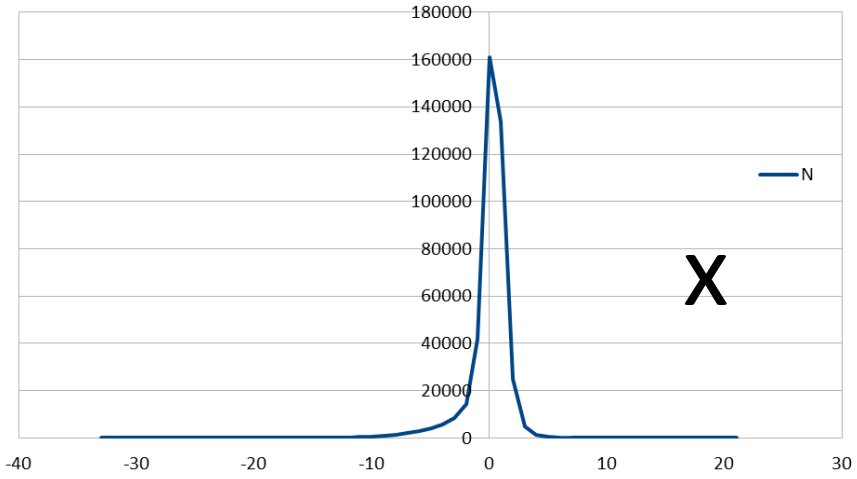
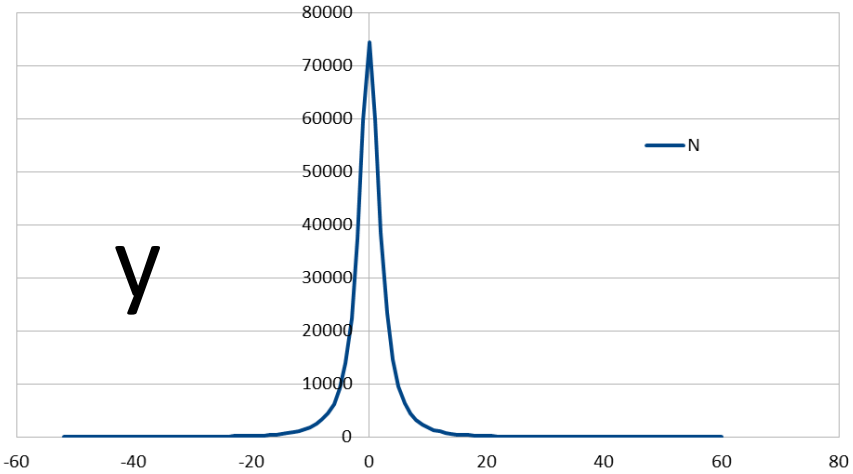
Observations at outliers …

…but nothing dangerous

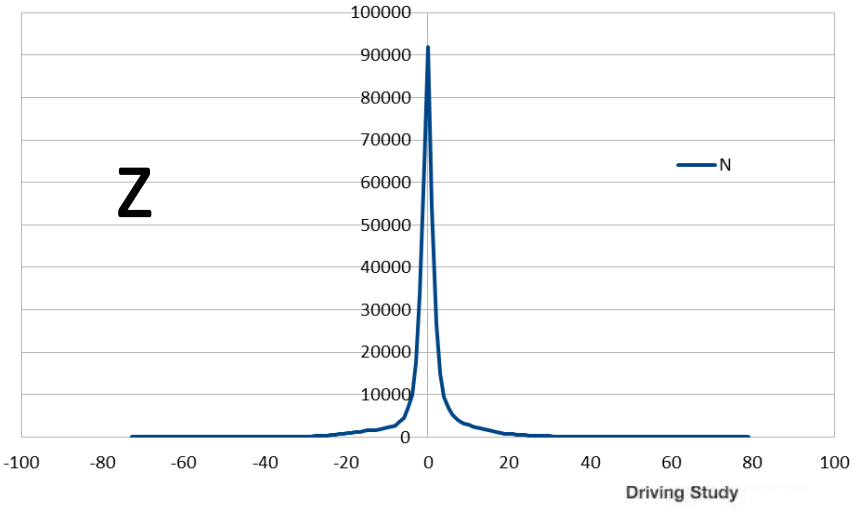
obs	subjective assessment
87	no reason recognisable
47	in garage
32	curve
29	brake
16	start from traffic light
10	strong brake at zebra (no ped.)
6	gravel road
5	lane change
5	brake for pedestrian on zebra
4	speed hump
4	probably curve (unsecure detection)
4	rough road
3	start (other)
3	strong braking at traffic light
2	start from parking
2	swerve
2	turn
1	start from traffic light and change lane
1	enter parking lot
1	accelerate
1	non-critical interaction with pedestrian on zebra
1	strong braking in congestion
1	brakíng, curve
1	strong braking behind other PTW
1	overtaking bicycle
1	strong braking for parking space
1	strong braking
271	Total

Distributions of rotation speed

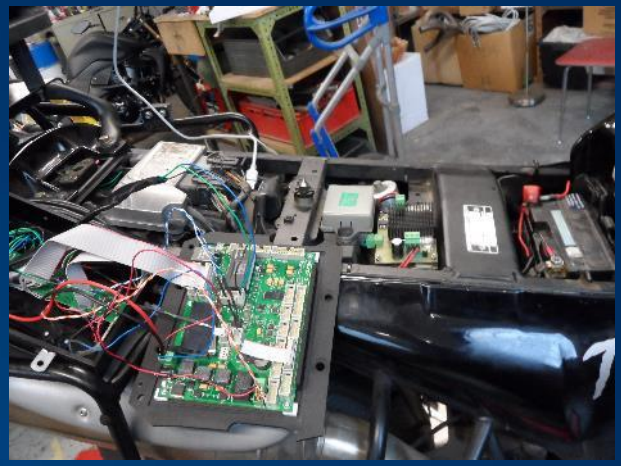




- 109 cases
- as acceleration ….
- and a lot of roundabouts
- and some u-turns








NR is not easy, but worth it

TRA Conference Paris 2014



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