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MALTA 2015

The electronic on road bikes and on circuit : how they help each other in the development of better systems for road use

Conference on Road Safety in Malta
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Dipl.-Ing. Matthias Mörbe

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Main objectives

Race

Fast & Manageable

LAP Time

No general inconsistence

Road

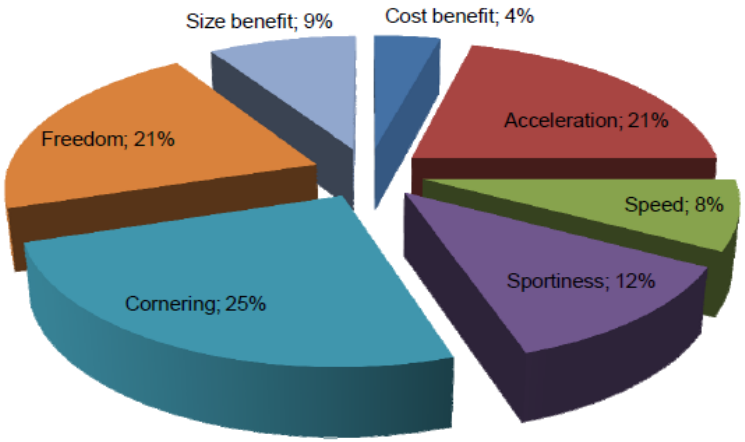
Manageable & Safe

Acceleration

TESTZEITEN MOTOGP / Jerez

Fahrer	Motorrad	Bestzeit (Runden)
1. Jorge Lorenzo (E)	Yamaha YZR -M1	1:38,508 (52)
2. Valentino Rossi (I)	Yamaha YZR -M1	1:38,550 (66)
3. Cal Crutchlow (GB)	Honda RC213V	1:38,814 (64)
4. Aleix Espargaró (E)	Suzuki GSX-RR	1:38,890 (65)
5. Marc Márquez (E)	Honda RC213V	1:38,968 (31)
6. Bradley Smith (GB)	Yamaha YZR -M1	1:39,339 (41)
7. Yonny Hernández (COL)	Ducati D16 GP14.3	1:39,357 (56)
8. Scott Redding (GB)	Honda RC213V	1:39,370 (105)
9. Maverick Viñales	Suzuki GSX-RR	1:39,475 (79)
10. Pol Espargaró (E)	Yamaha YZR -M1	1:39,654 (45)
11. Álvaro Bautista (E)	Aprilia RS-GP	1:39,766 (53)
12. Stefan Bradl (D)	Forward-Yamaha*	1:39,887 (52)
13. Danilo Petrucci (I)	Ducati D16 GP14.3	1:39,892 (60)
14. Nicky Hayden (USA)	Honda RC213V-RS*	1:39,909 (73)
15. Eugene Laverty (GB)	Honda RC213V-RS*	1:40,101 (73)
16. Loris Baz (F)	Forward-Yamaha*	1:40,186 (59)
17. Jack Miller (AUS)	Honda RC213V-RS*	1:40,248 (64)
18. Héctor Barberá (E)	Ducati D16 GP14*	1:40,260 (52)
19. Hiroshi Aoyama (J)	Honda RC213V	1:40,342 (60)
20. Karel Abraham (CZ)	Honda RC213V-RS*	1:40,654 (63)
21. Mike di Meglio (F)	Ducati D16 GP14*	1:41,085 (62)
22. Marco Melandri (I)	Aprilia RS-GP	1:41,825 (19)

* Open-Motorräder



Source: Gesamtverband der Versicherungswirtschaft e.V.

Transfer examples – traction control

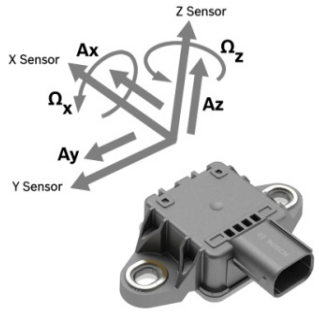
Lean angle – Wheelie control – Launch control

The first introduction of traction control on PTWs was already done in the early 80s but not successful. Later in racing it was the measure to get powerful 500s under control.
With the change to 4-stroke in MotoGP it became vital for good results on circuit.
A transfer to road bikes in more significant numbers started with the introduction of electronic throttle control.

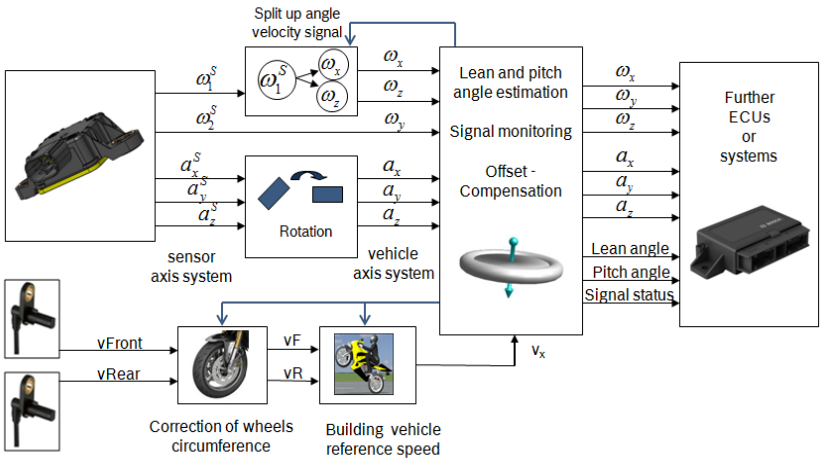
Customer acceptance on road is depending on the predicable functionality under all conditions.

Better algorithms and use of more and precise data will improve performance

Examples of transfer – lean angle sensor



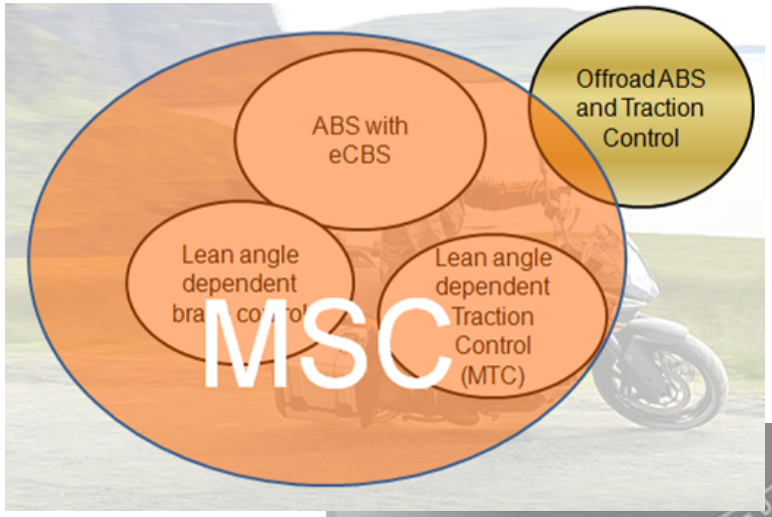
Traction control systems based on wheel speed differences have the fundamental drawback in corners. At high lean angles the wheel speed difference is already at the maximum slip rate on straights. This can be compensated only with an accurate lean angle calculation. The first sensor in series production was based on a 4wheeler but the requirements of PTW in terms of size, function and cost caused a specific design.
A next generation with more features is coming.



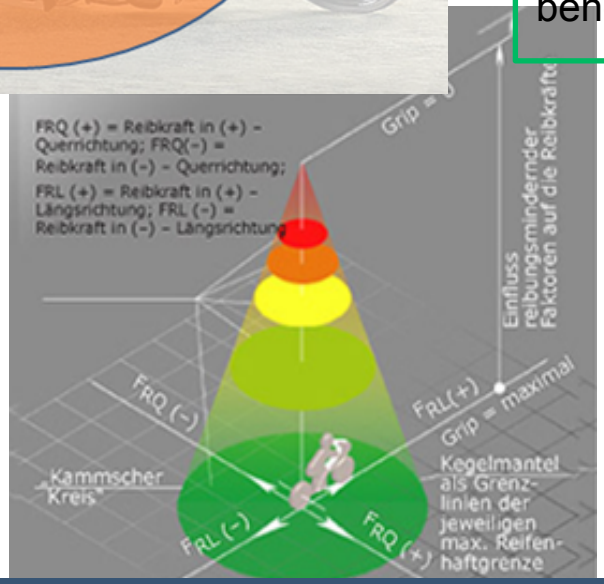
The sensor cluster is used for many purposes like traction control, ABS, head lights, eCall, semi active suspension, connectivity.

Sensor data from a sensor cluster is the corner stone of many new systems

Examples of transfer – ABS & MSC



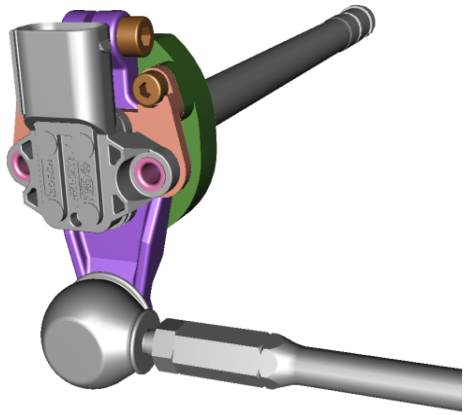
The roots of ABS are not on the race track and many drivers still believe that they can brake better than a system does. But some tests have proven that on wet circuits braking distances are similar but with less risk. If the friction is unexpected and suddenly changing, no rider can react as fast as these systems can do. With special settings for racing, amateur riders can benefit a lot.

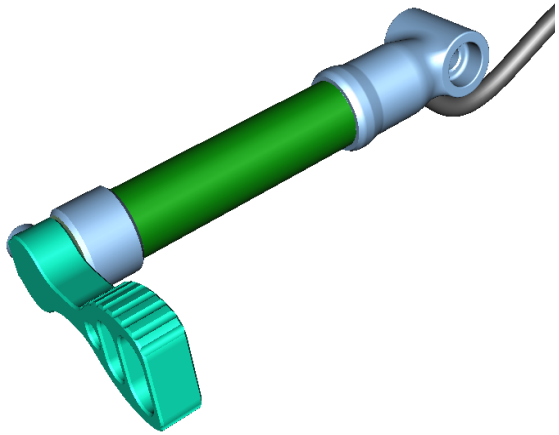


The introduction of motorcycle stability control MSC has brought a high extension of functionality to ABS and traction control.

MSC is the entry point of future driver assistance systems

Examples of transfer – gear shift





Since decades a short ignition interruption is used in racing for gear shift up. On road it was mainly an accessory issue until more copies of superbikes came to the show room having quick shifter on board. The shorter and softer the torque disengagement has to be, the more sophisticated the algorithms for gear shift have to be. Today even down shifting without clutch is realized.

The transfer of gear shifters from race to road bikes has to consider much more design constrains. There is load range, speed, gear ratios, drag down hill, different drive trains etc. increasing the development effort.

Down shifting on road bikes is more complicated but will come into the market.

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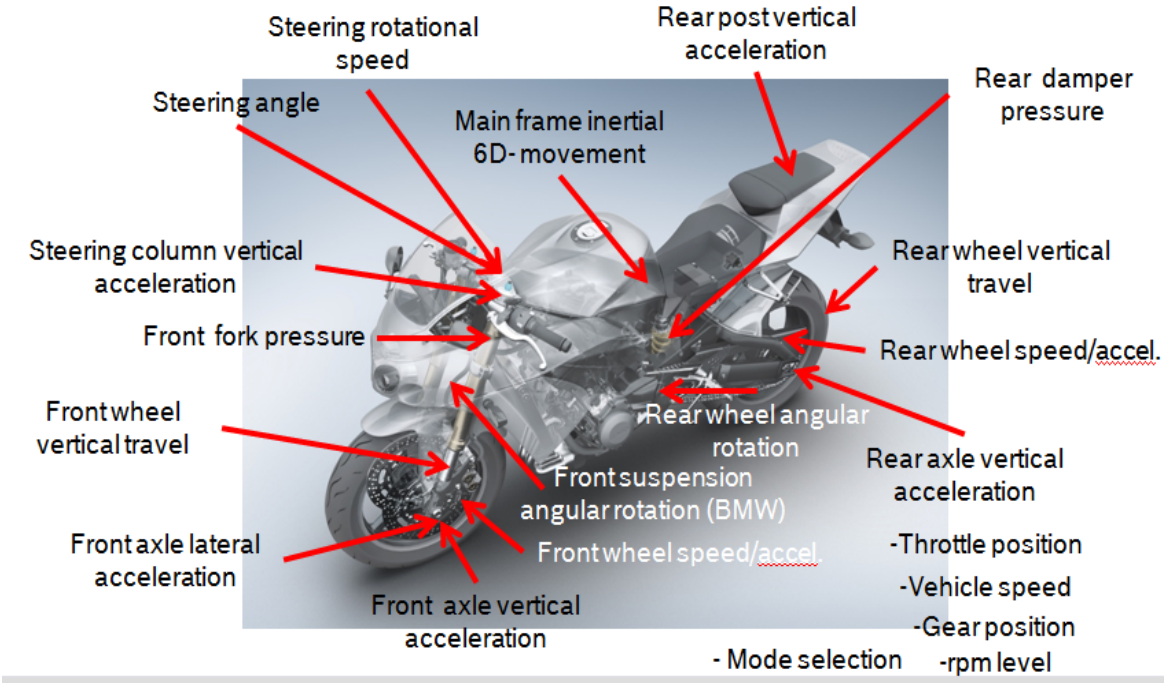
Examples of transfer – Drive by wire

Sophisticated engine management systems controlling the throttle with electrical motors. The driver intention is coming from the throttle grip by sensor signals. This type of control was introduced on cars many year before PTWs. Because in racing carburetors have been used much longer, this development was delayed for years.
With the limitation of fuel consumption and to achieve a maximum of drivability drive by wire is now in racing as well.

The safety requirements on road have influenced the development and design process. Many high power bikes have drive by wire and as a result only manageable for a wide range of drivers by that.

Drive by wire makes traction control with mode selection possible

Examples of transfer – semi active suspension

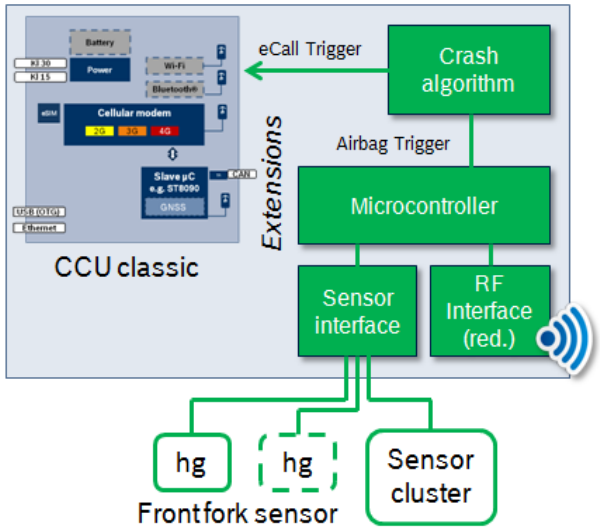


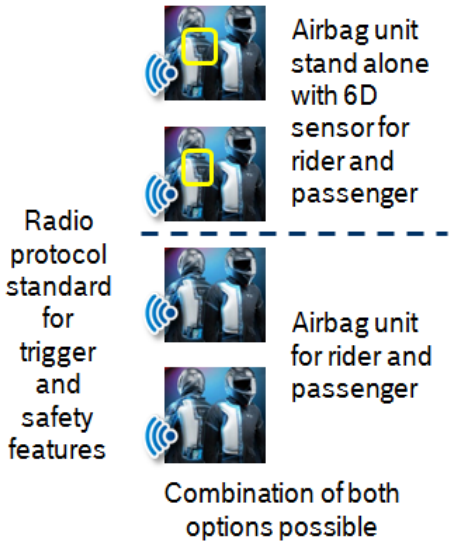
Semi active suspension was banned for racing in 2008. For road bikes it opens the door for optimized suspension performance on a wide range of road conditions and is part of a safety strategy.

With semi active suspension even during riding the set up can be modified to optimize drivability of the bike . Most riders have not the experience for customized suspension adjustment.

Semi active suspension becomes part of overall driver assistance strategy

Examples of transfer - Airbag



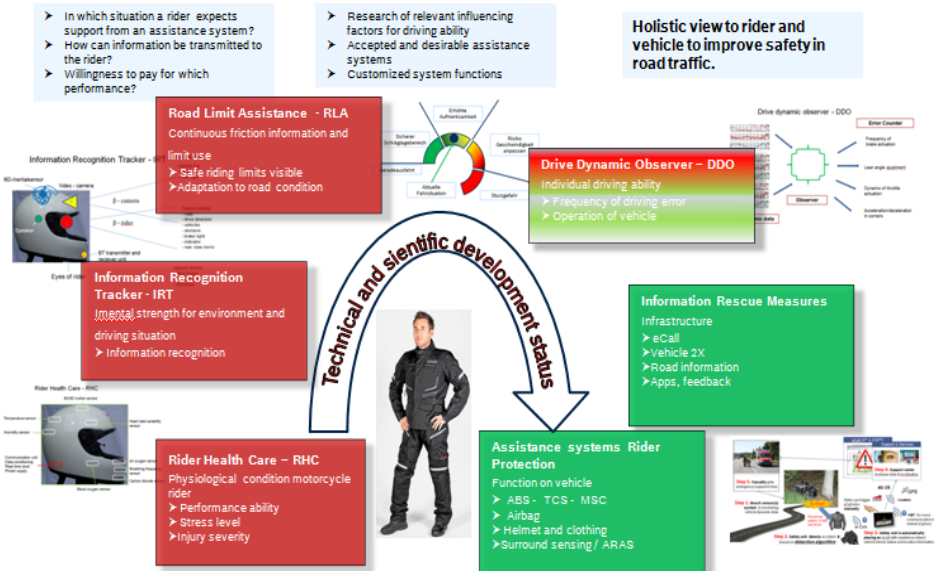


Airbags in motorcycle suits where introduced first on the race track. While these systems are independednt from the bike, first solutions are coming into the market for road use with sensors on the bike. They are designed for crash detection with other road users.

The maximum protection is given if there are sensors on the bike and on the rider and passenger. Standards for testing and the radio interface are necessary. Injury detection is a potential for advanced eCall information.

Airbag has a high potential of life saving for PTW riders in accidents

Examples of transfer – Data recording



Data recording is the key to success on the race track. All information in holistic view define measures for maximum performance.
With the improvements of electronics, sensors, data storage and monitoring algorithms, a move from subjective feeling to objective assessment was possible.

Getting data from the rider and the bike is a big step into the direction of advanced driver assistance systems.
This will improve safety and reduce fatalities.

Enjoyable motorcycle riding on road supports racing as well

Conclusion

Key question : Does the transfer continue in the same speed? Why?

- Decreasing volumes (e.g. superbike sale)
- Customer community (age, high volume markets)
- Drive train change (e-mobility)
- Change of use (commuting)
- Change of motorcycle style (retro)

The continuously increasing interest in motorcycle racing in developing countries shows that impulses from the circuit to the road are ongoing. There is a self-contained path of electronic development for road use with exceeding complexity .

Road bikes and on circuit benefit from the same technology and inspire each other