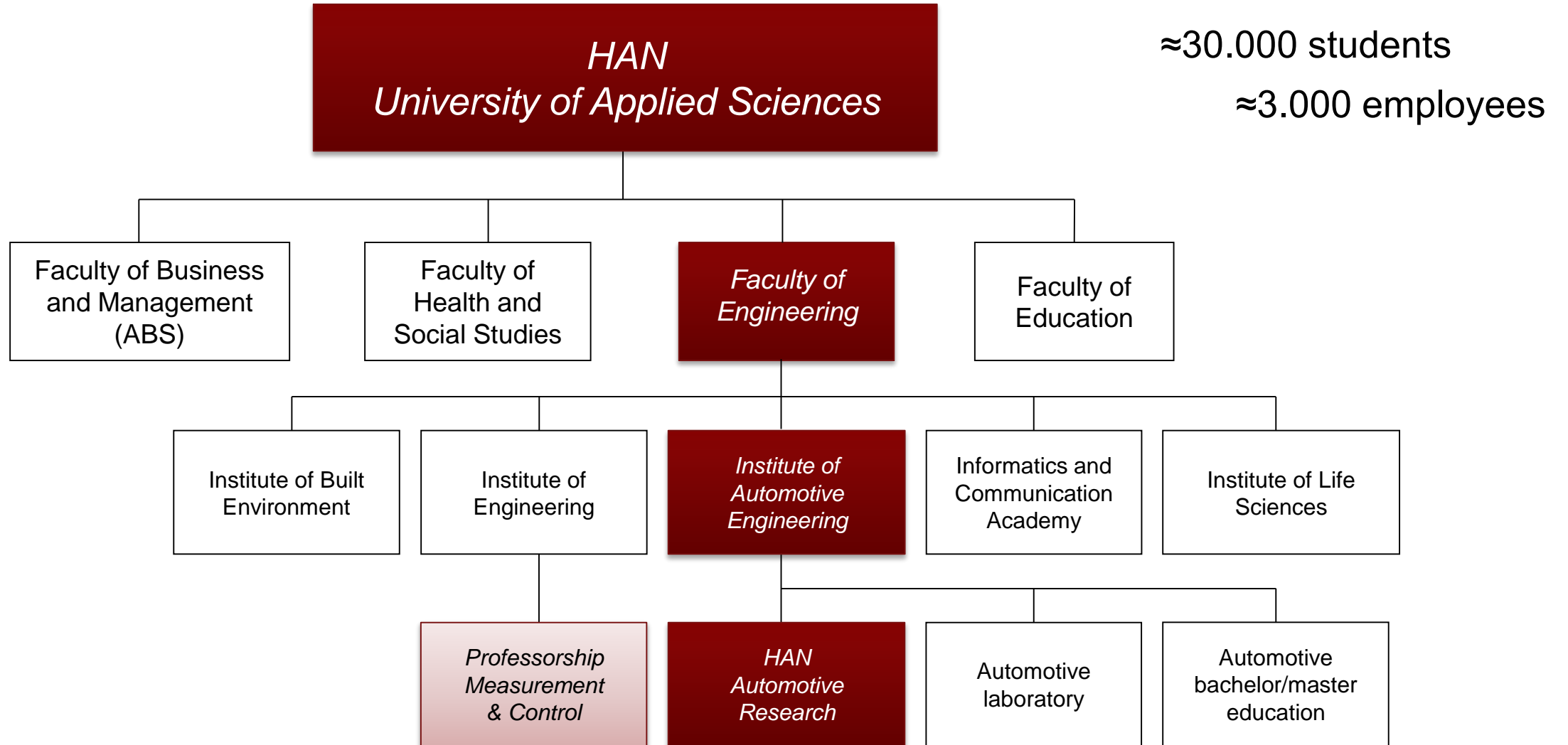# A community for model based development

Jan Benders
Project manager model based development
HAN Automotive Research
HAN University of Applied Sciences
June 11, 2015

Key Takeaways

1. A fruitful format: Community driven tool application & development

2. Model based development can be valuable for smaller companies
   - …and pre-competitive cooperation in a community helps

3. Education, research and companies can strengthen each other when working on a common platform

HAN Organization

≈30.000 students

≈3.000 employees

```
                    HAN
         University of Applied Sciences
    ┌───────────────┬────────────┬───────────────┐
Faculty of      Faculty of   Faculty of      Faculty of
Business and    Health and   Engineering     Education
Management      Social
(ABS)           Studies
```

- HAN University of Applied Sciences
  - Faculty of Business and Management (ABS)
  - Faculty of Health and Social Studies
  - **Faculty of Engineering**
    - Institute of Built Environment
    - Institute of Engineering
      - *Professorship Measurement & Control*
    - *Institute of Automotive Engineering*
      - HAN Automotive Research
      - Automotive laboratory
      - Automotive bachelor/master education
    - Informatics and Communication Academy
    - Institute of Life Sciences
  - Faculty of Education

How to introduce MBD to education and SME's?

	Education	SME's

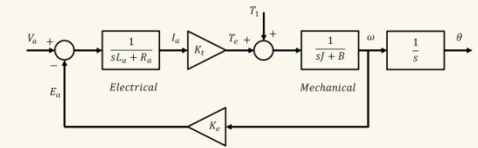**Challenges**

How to reach the required knowledge/experience level in limited time?

Obtaining the necessary modeling/control knowledge

Investment in tools

€

Opportunities

Students get 'market-conform' education

Thinking in systems/applications
No SW engineering skills required

(Algorithm-) Models can serve as:
Specification   –   less misinterpretations
Documentation   –   less documentation work
Implementation   –   re-use for production

http://aptaujucentrs.com/uploads/images/focus-group.jpg

Using *cost effective tools* in a *lightweight MBD process* fits both worlds

Cost effective tools

Target hardware

HAN ◆ coder
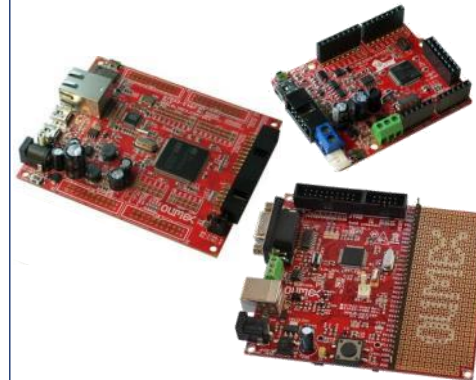
HAN ◆ tune

HANcoder: library of embedded targets

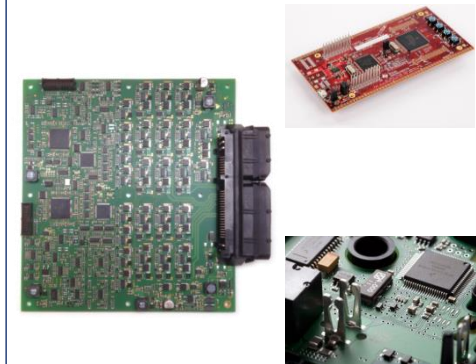| RC30 Target	Prodrive GCU Target	STM32 Target	Coming…

Supported hardware	Supported hardware	Supported hardware	New hardware
RC36-20/30	Prodrive GCU2420	Olimexino-STM32	TMS570
RC28-14/30		STM32-E407	HCS12
RC12-10/30		STM32-P405	AUTOSAR

Workflow

Simulink® control algorithm
Embedded Coder®
HAN coder RC30 Target

HEX file

Flash tool

ECU

XCP Protocol (CAN)

ASAP2 file

HAN tune

Workflow

Simulink® control algorithm

Embedded Coder®

HAN coder RC30 Target
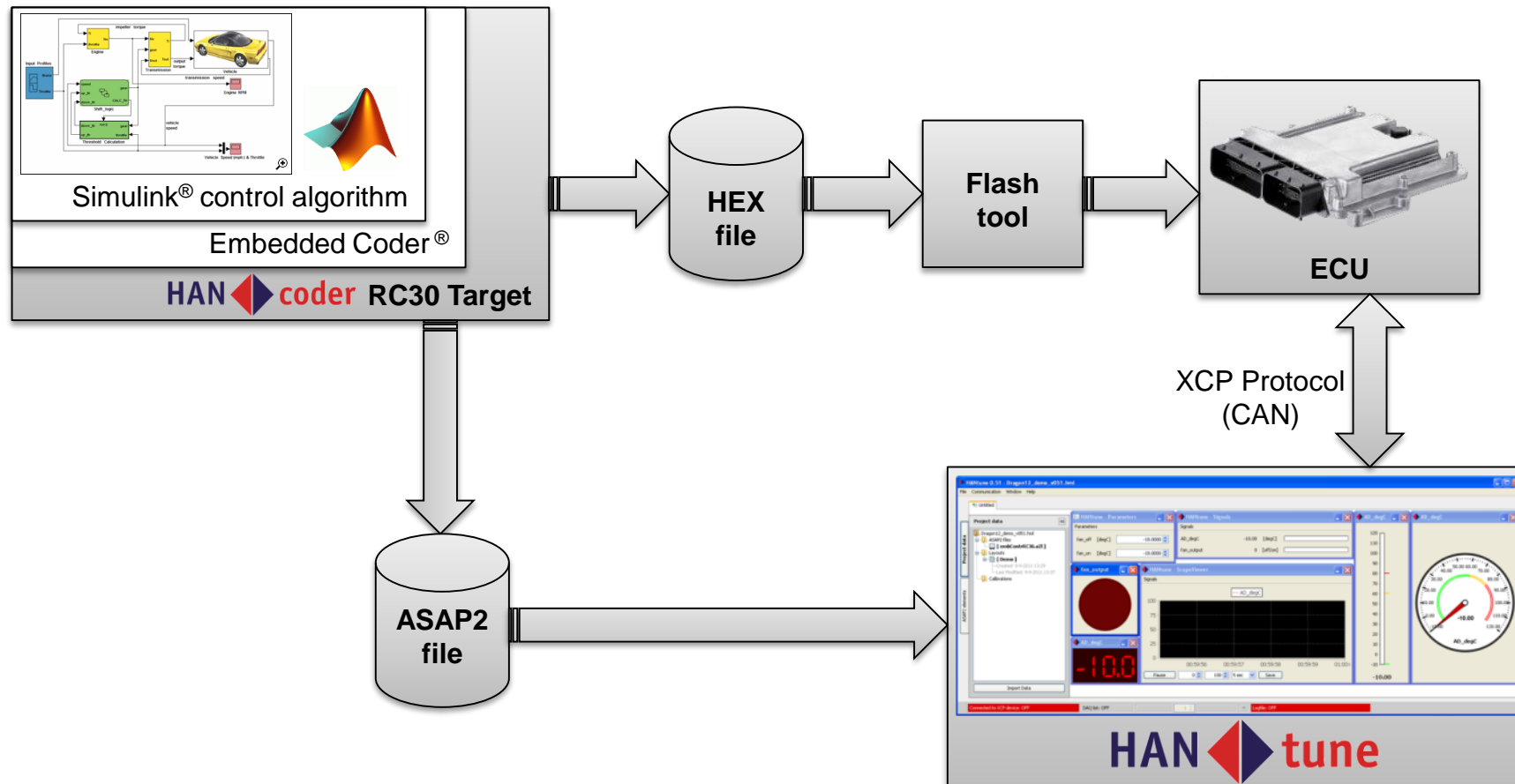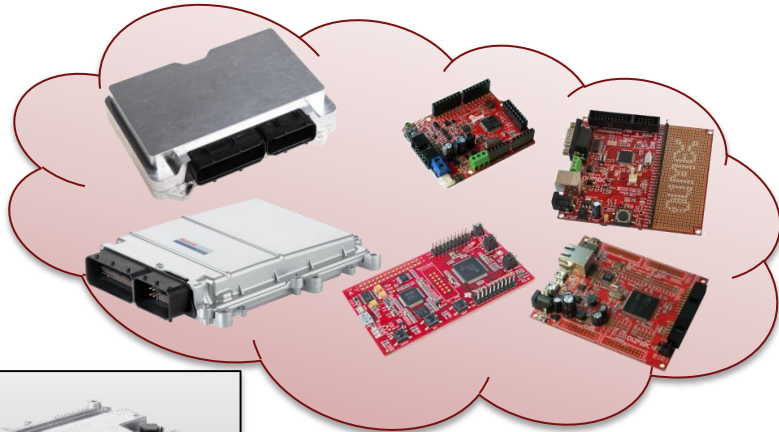
HAN coder STM32 Target
HAN coder Prodrive Target
HAN coder ... Target

HEX file

Flash tool

ECU

ASAP2 file

CANdb file

XCP Protocol (CAN)

Ethernet

USB

HAN tune
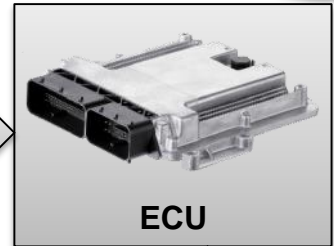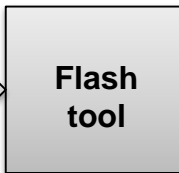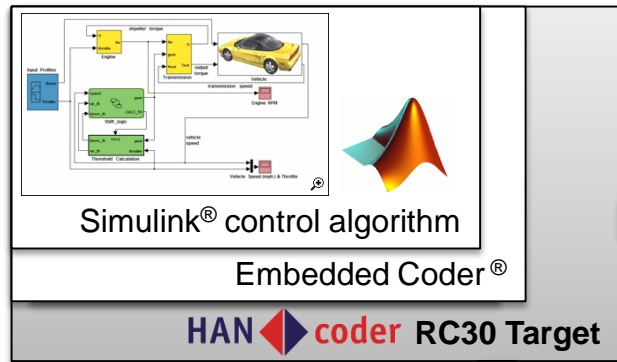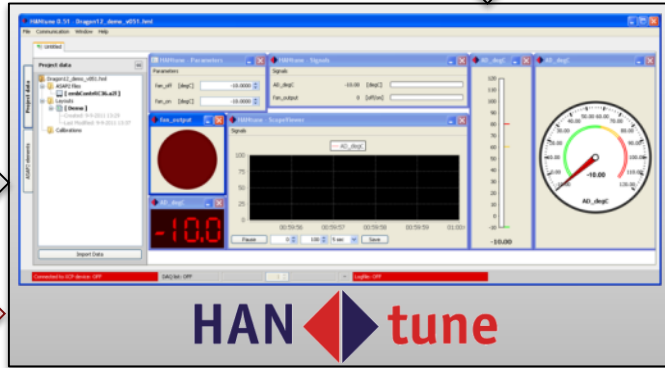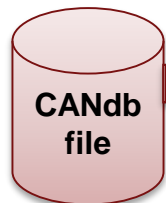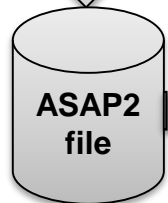
Example applications

HyDoblo

- Fiat Doblo, powered by Hydrogen and electricity
- Powertrain control + fuel cell system control by HANcoder

Arval Inspire 1

- Hydrogen fuelled vehicle for 2012 Shell Eco Marathon
- Road allowed vehicle, fuel cell system control by HANcoder
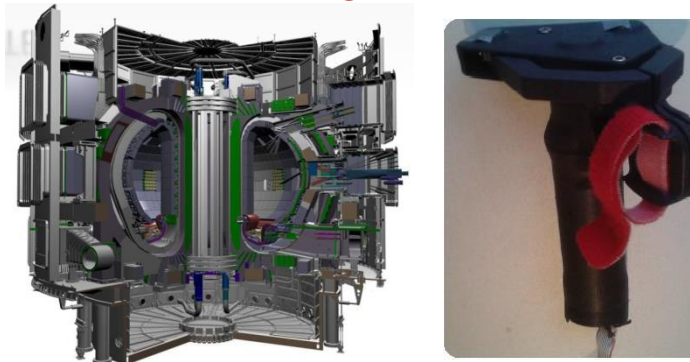- Only vehicle in it's class with student developed FC system control

The New Cool

- Refrigeration without diesel (clean/silent)
- Energy from generator in axle / optional solar panels
- Energy axle system control by HANcoder
- Partners: THT, TMC, TRTA, TPTS, VALX, TRS, Bosch Rexroth, HAN

Plugin hybrid testbed
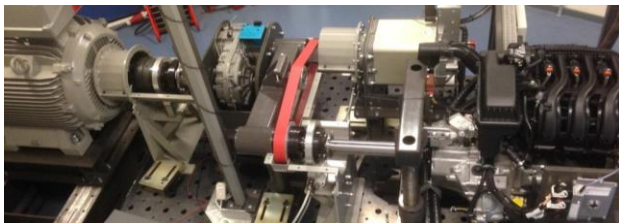
- Development of plug-in hybrid powertrain testbed
- Powertrain / transmission / DC-bus control by HANcoder
- Partners: Punch Powertrain, Gomecsys, Spijkstaal, LMS, P2C, KdG, SuperB

ITER servicing: Master Gripper
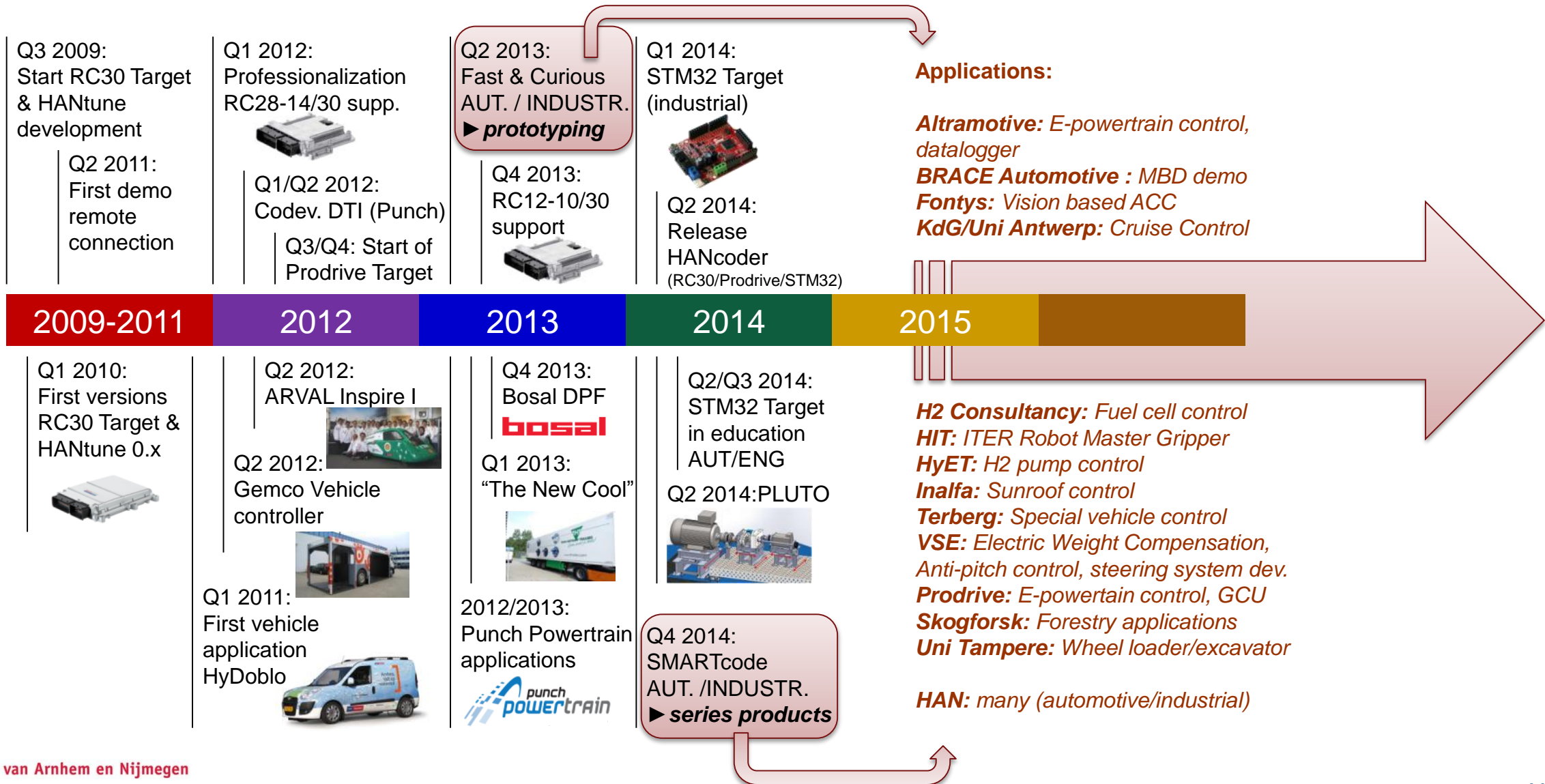

- Haptic feedback control by HANcoder
- See also:
  http://www.mechatronicamachinebouw.nl/artikel/modelgebaseerd-ontwikkelen-in-het-mkb.html

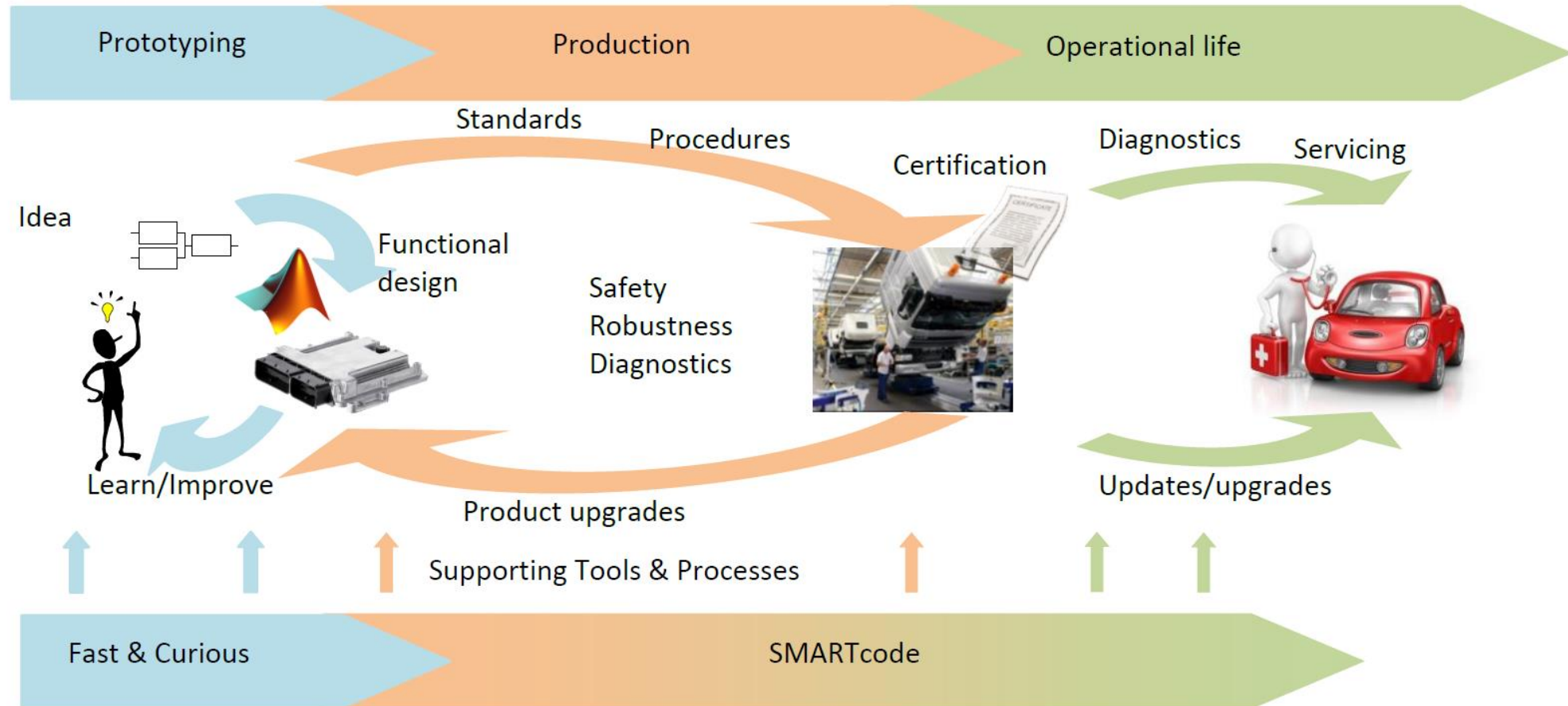## Active Roll Stabilization

- Roll stabilization control by HANcoder
- See also:
  http://www.mechatronicamachinebouw.nl/artikel/modelgebaseerd-ontwikkelen-in-het-mkb.html

Hogeschool van Arnhem en Nijmegen
HAN University of Applied Sciences

10

Evolution

Q3 2009:
Start RC30 Target & HANtune development

Q2 2011:
First demo remote connection

Q1 2012:
Professionalization RC28-14/30 supp.

Q1/Q2 2012:
Codev. DTI (Punch)

Q3/Q4: Start of Prodrive Target

Q2 2013:
Fast & Curious AUT. / INDUSTR.
▶ *prototyping*

Q4 2013:
RC12-10/30 support

Q1 2014:
STM32 Target (industrial)

Q2 2014:
Release HANcoder
(RC30/Prodrive/STM32)

Applications:

Altramotive: *E-powertrain control, datalogger*
BRACE Automotive : *MBD demo*
Fontys: *Vision based ACC*
KdG/Uni Antwerp: *Cruise Control*

| 2009-2011 | 2012 | 2013 | 2014 | 2015 | |

Q1 2010:
First versions RC30 Target & HANtune 0.x

Q2 2012:
ARVAL Inspire I

Q2 2012:
Gemco Vehicle controller

Q1 2011:
First vehicle application HyDoblo

Q4 2013:
Bosal DPF
bosal

Q1 2013:
"The New Cool"

2012/2013:
Punch Powertrain applications
punch powertrain

Q2/Q3 2014:
STM32 Target in education AUT/ENG

Q2 2014:PLUTO

Q4 2014:
SMARTcode AUT. /INDUSTR.
▶ *series products*

H2 Consultancy: *Fuel cell control*
HIT: *ITER Robot Master Gripper*
HyET: *H2 pump control*
Inalfa: *Sunroof control*
Terberg: *Special vehicle control*
VSE: *Electric Weight Compensation, Anti-pitch control, steering system dev.*
Prodrive: *E-powertain control, GCU*
Skogforsk: *Forestry applications*
Uni Tampere: *Wheel loader/excavator*

HAN: *many (automotive/industrial)*

Current project: SMARTcode

Series production oriented Model-based Approach for Real Time code

SMARTcode deliverables

INTERNATIONAL
STANDARD

ISO
26262-1

Road vehicles — Functional safety —

First edition
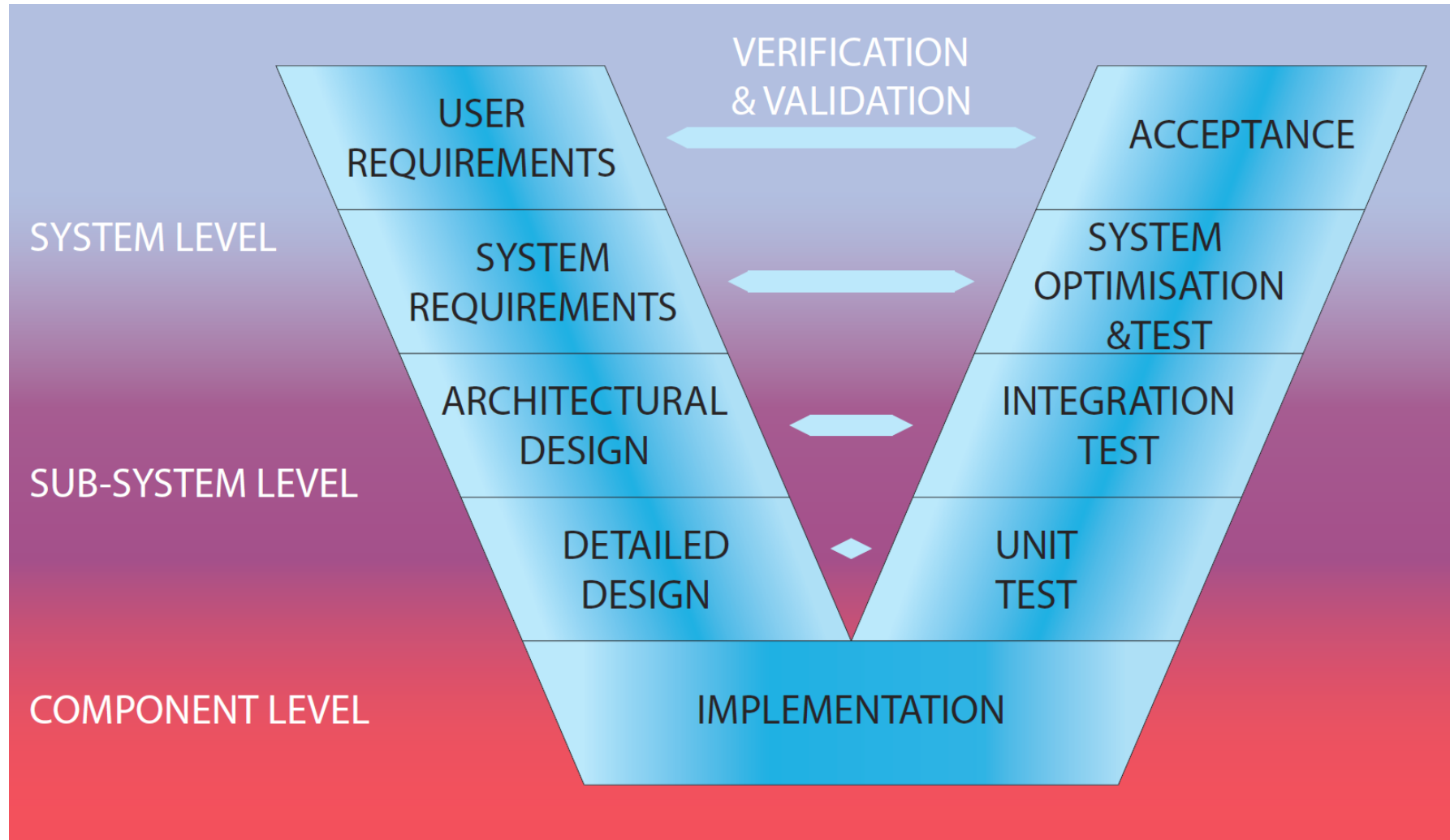2011-11-15

Tools

Recommended practice

Example MBD aspects:

- Usage of Model Advisor to
  enforce MAAB/MISRA rules
- Usage of V&V toolbox for
  requirements management
- Possibilities of Simulink Design
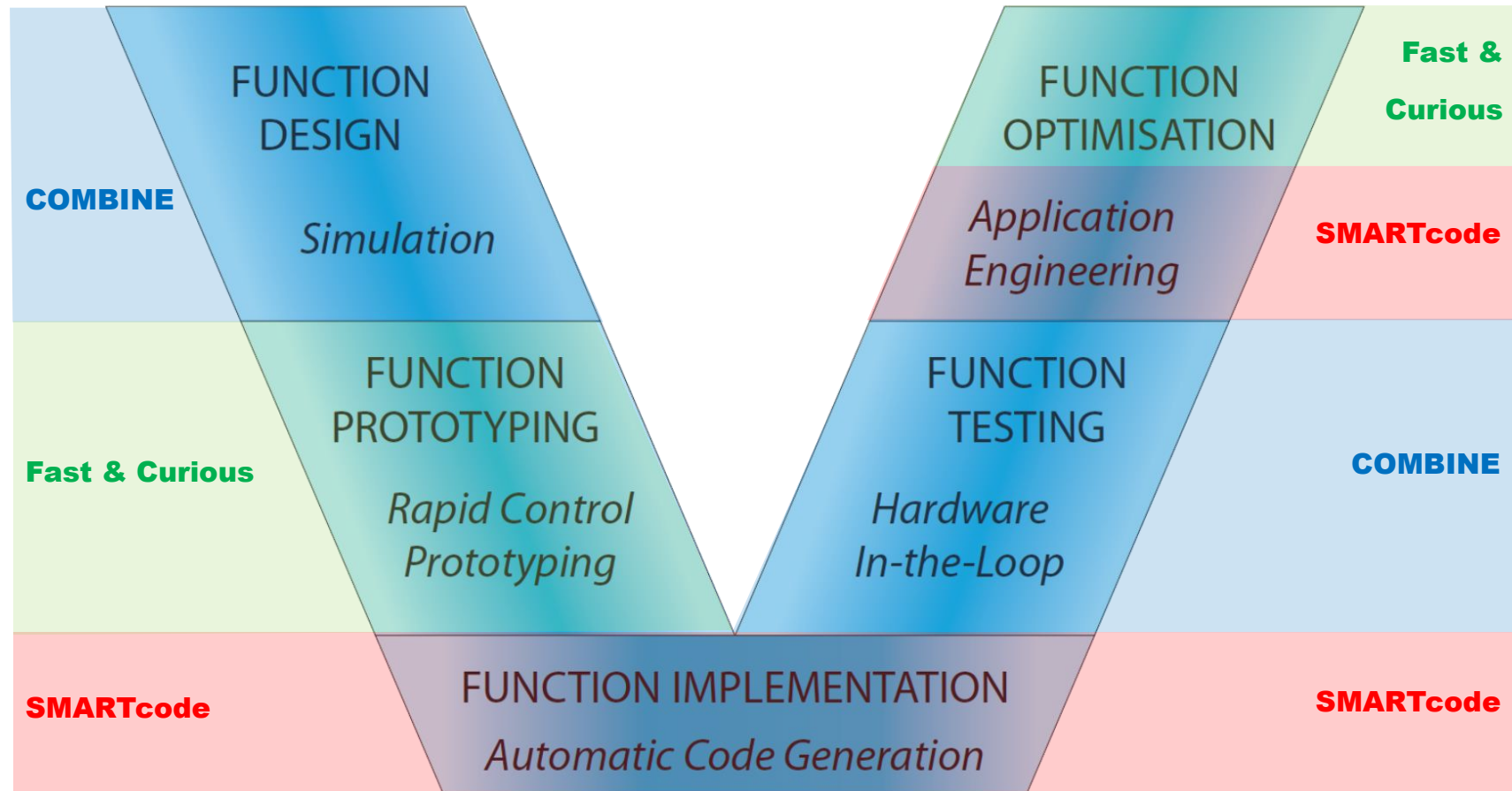 Verifier and Polyspace tools

Hogeschool van Arnhem en Nijmegen
HAN University of Applied Sciences

Lightweight process

V-cycle for software development

'MBD' V-cycle

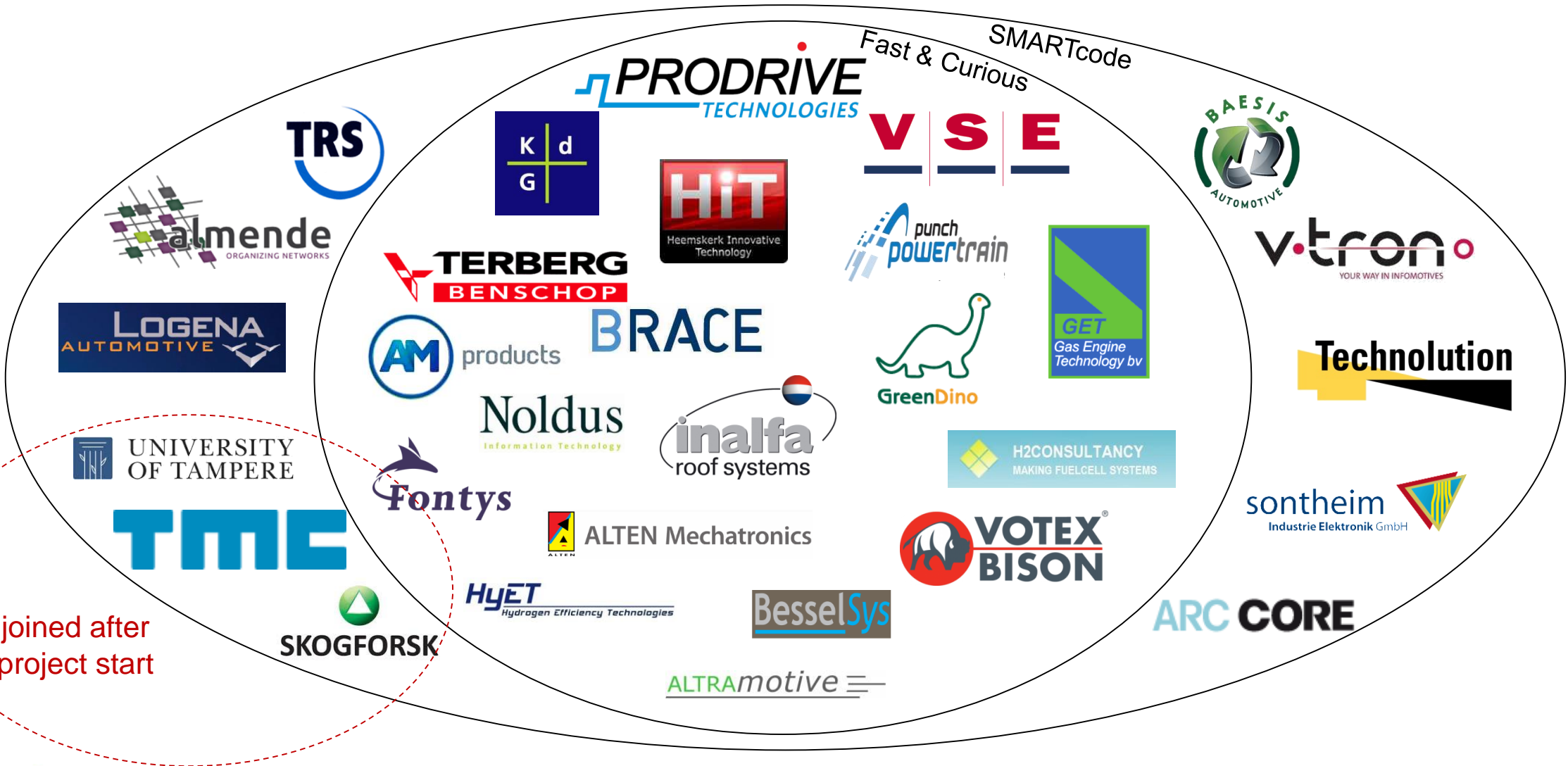Future project COMBINE: COmmunity driven Model Based Intelligent systems Engineering

Introducing these techniques at SME's and in education proves to be effective

More info: Bits&Chips edition 4, May 2015 pages 34-37
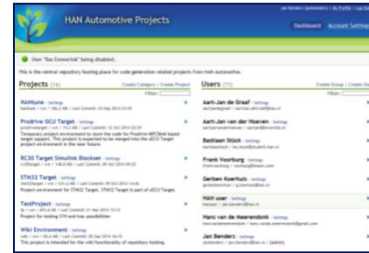
Community

Community partners

joined after project start

Community in practice

Workshops

Community meetings (@partners)
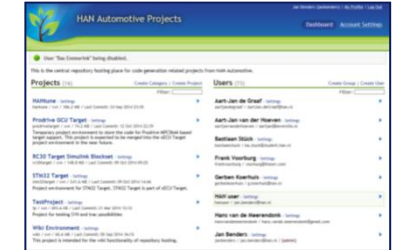

Co-development
by partners
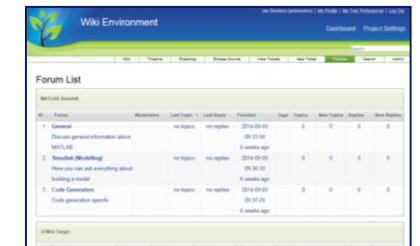

Articles

Newsletters

Youtube channel/
LinkedIn group

Online source code&
project management

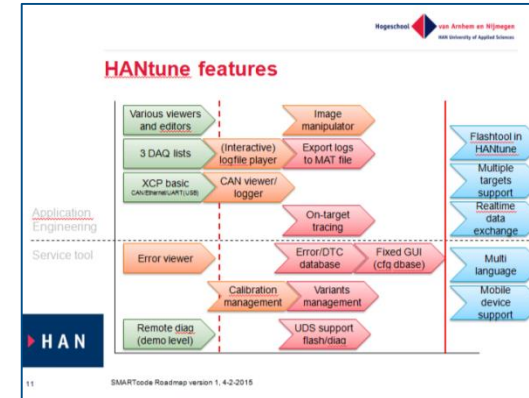Wiki

Discussion forum

Development focus: community driven

http://www.vemployee.com/img/article_image/change_cont_board.jpg

Change Control Board

- Enforcing short term priorities
- Advising on long term vision

Roadmap

- Defined by community
- Confirmed by CCB

Future community goals

- Open up to the external world
  - Publication of STM32 Target for non-commercial use
  - Open-source?

- Community website
  - Public, only partly restricted
  - Source for tools and recommended practices
  - Lively environment for sharing knowledge and experience
    - Examples / online workshops / discussion forums / etc.

- Role of HAN
  - Facilitator/moderator
  - Service provider for MBD applications
  - Support w.r.t. tools & workflow

Interaction education – research – business

Companies

HAN Automotive Research

| | Various projects | Fast&Curious + other projects | SMARTcode + other projects | Tool support Application services |

Tools

RC30 Target HANtune → HANcoder family HANtune → HANcoder family HANtune Recommended practice → Tools / Practices Systems Engineering

Students (intern/thesis)

Education

Minor Autotronica
Automotive engineering

Various courses+minors
Automotive engineering
Electrical engineering

All students / many courses
Automotive engineering
Electrical engineering

autonomous community

| Past | Present | Future |

Mathworks campus license supports educational rollout

Concluding Remarks

- Using *cost effective tools* in a *lightweight MBD process* can be a good fit for education and SME's

- Pre-competitive cooperation in a *community* makes sense

- Next steps:
  - Model based systems engineering project
  - Open up to the world

- Join us!

Thank you for your attention