



Competence Center for Gas Exchange



”Charging for the future”



VOLVO



BorgWarner



CCGEx Research Day 2016

28th of October, KTH, Machine Design

Purpose of today

- ✓ Present CCGEx research and activities
- ✓ Opportunity to meet industry and academic partners
- ✓ Discuss science and technology
- ✓ Prepare the center for the future - Feedback



Agenda – Morning session

08:45 - 09:00

Registration & Coffee

09:00 - 09:15

Opening by CCGEx Director – Anders Christiansen Erlandsson

Part 1

09:15 - 10:15

Research Area: Compressor off design Operation (CoD)

- Mihai Mihaescu: intro + overview (10+5 minutes)
- Three PhD project presentations (10+5 min each)
 - Bertrand Kerres (Exp), KTH - ICE
 - Elias Sundström (CFD), KTH - Mek
 - Raimo Kabral (Exp), KTH - MWL

10:15 - 10:30

Coffee break

10:30 - 11:45

Research Area: HOTSIDE

- Mihai Mihaescu: intro + overview (10+5 minutes)
- Four project presentations (10+5 min each)
 - Marcus Winroth (Exp), KTH - Mek
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 - Nicholas Anton (Aero-design), KTH - ICE/SCANIA

11:45 - 12:45

LUNCH & Poster Session



Agenda – Afternoon session

13:00 - 14:15

Research Area: Engine After Treatment (EAT)

- Mikael Karlsson: intro + overview (10+5 minutes)

- Four project presentations (10+5 min each)

Zhe Zhang (Simulations), KTH - MWL

Ghulam Majal (Simulations), KTH - MWL

Arun Prasath (Exp), KTH - ICE

Mireia Altimira (Exp & CFD), KTH – Mek

14:15 - 14:35

Research Area: Power Train System Integration (SYSINT)

- Anders Christiansen Erlandsson, overview (10+5 minutes)

-Two project presentations

Senthil Mahendar, HD DISI gas exchange, KTH-ICE

Sandhya Thantla, WHR, KTH-ICE

14:35 - 14:45

Coffee & Environment set-up for the afternoon discussions

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Anders Christiansen Erlandsson

Part 2: Interviews (two parallel sessions)

14:45 - 15:30

IAB Interviews with the PhD students (room B242)

14:45 - 15:30

Interaction between senior researchers / faculty at CCGEx & Industrial partners

15:30 - 16:00

IAB Interviews with senior researchers and faculty at CCGEx (room B242)

15.30 - 16:00

Interaction between industry partners

16:00 - 16:15

Coffee break – industry and students excused!

Part 3: IAB Summary

16:15 - 16:45

IAB meets CCGEx head, senior researchers and faculty at CCGEx, board members + SICEC chairman to summarize their impressions and their recommendations. (Room Gladan)



Competence Center for Gas Exchange CCGEx at KTH

Vision:

*Enable the move from extensive physical testing to innovative virtual development using **predictive simulation** tools developed on physics-based understanding of phenomena*

Goal:

Enable knowledge-based and efficient design of next generation clean and efficient propulsion systems with focus on advanced Gas Exchange Technologies

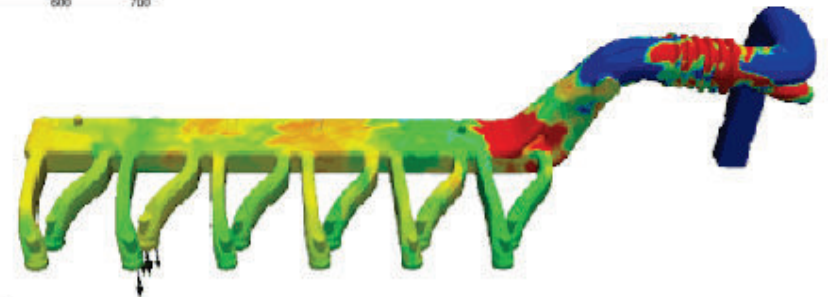
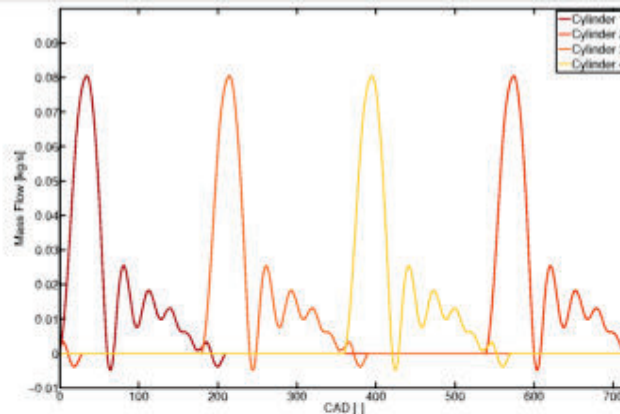
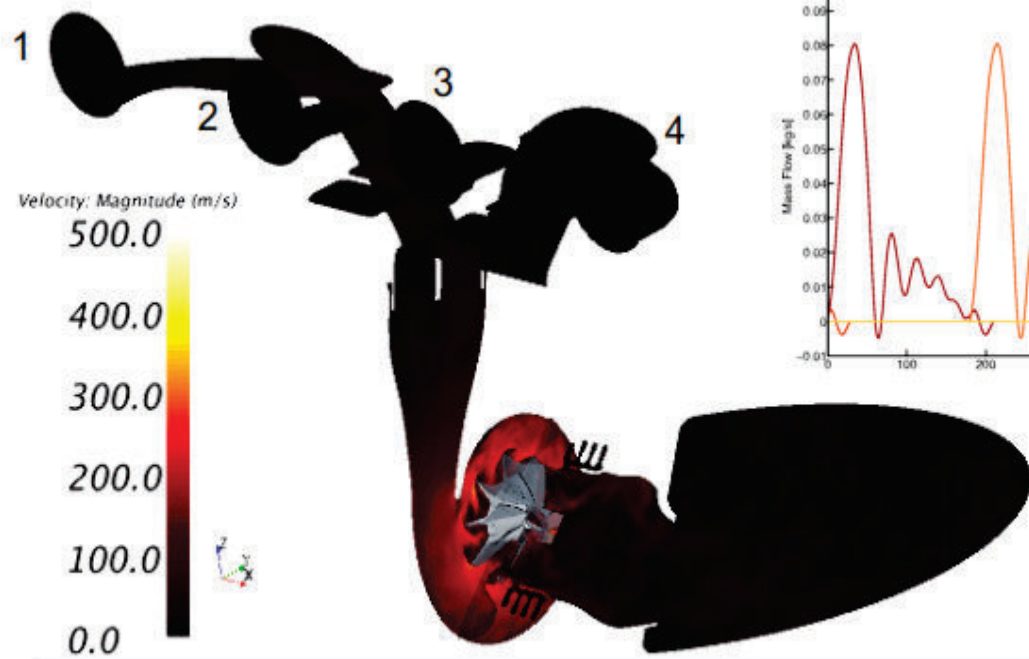
Resources:

Multidisciplinary & integrated research program combining dedicated competences, expertise and facilities in gas dynamics, acoustics, and engine technology

What is CCGEx doing?

Challenges with gas exchange system:

- *Physical Level: Unsteady & chaotic turbulent flows, heat transfer, flow-acoustic interactions*
- *System Level: complex geometries, multi-component attributes, multi-parameter integration for optimal design*
- *Operation Level: Pulsating unsteady heat and mass flows -> significant impact on engine efficiency & emissions, requires non-linear control*



Pulsating flow in an exhaust manifold (VOLVO Cars) integrated with turbine for accurate turbo performance assessment

EGR distribution for a SCANIA intake manifold (intensive red: 100%EGR)



CCGEx relevance to industry

Charging

- Increased efficiency, Higher Pressure Ratio, Wider operating range (reduced surge margins), Intercooling integration
- Aero design
- Noise, vibration & harshness

EGR & Charge air / Exhaust manifold

- Pressure drop; Control /operation
- Efficient / controlled mixing
- Energy recovery – waste heat recovery / Heat transfer

Exhaust aftertreatment

- PMEP influence, Particles, Chemical pollutants, Noise, Thermal management

Engine system

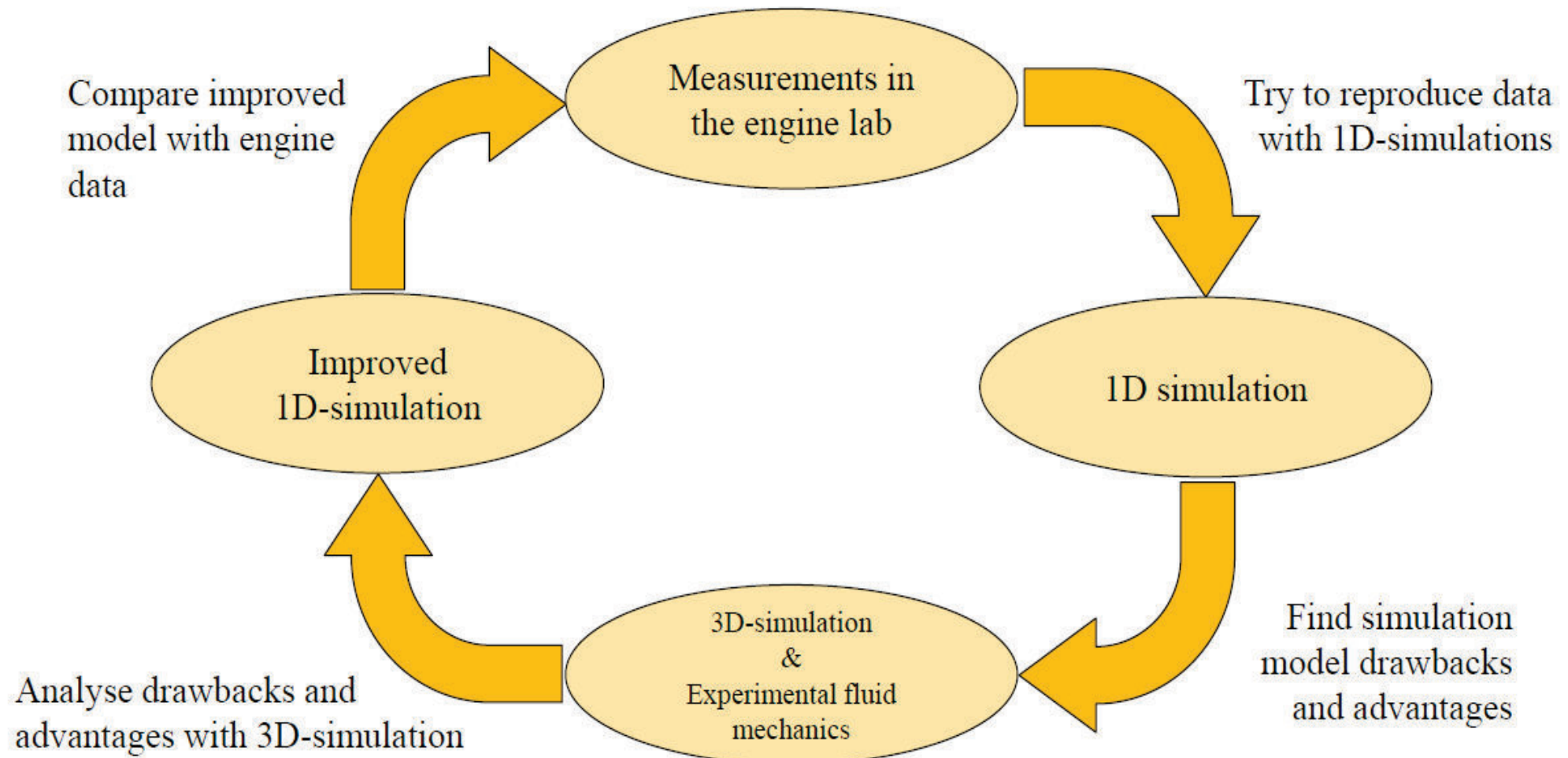
- Thermodynamic cycle, Valve strategy, Miller cycle, Thermal management, Interaction between components
- Electrification



CCGEx

CCGEx Strategy

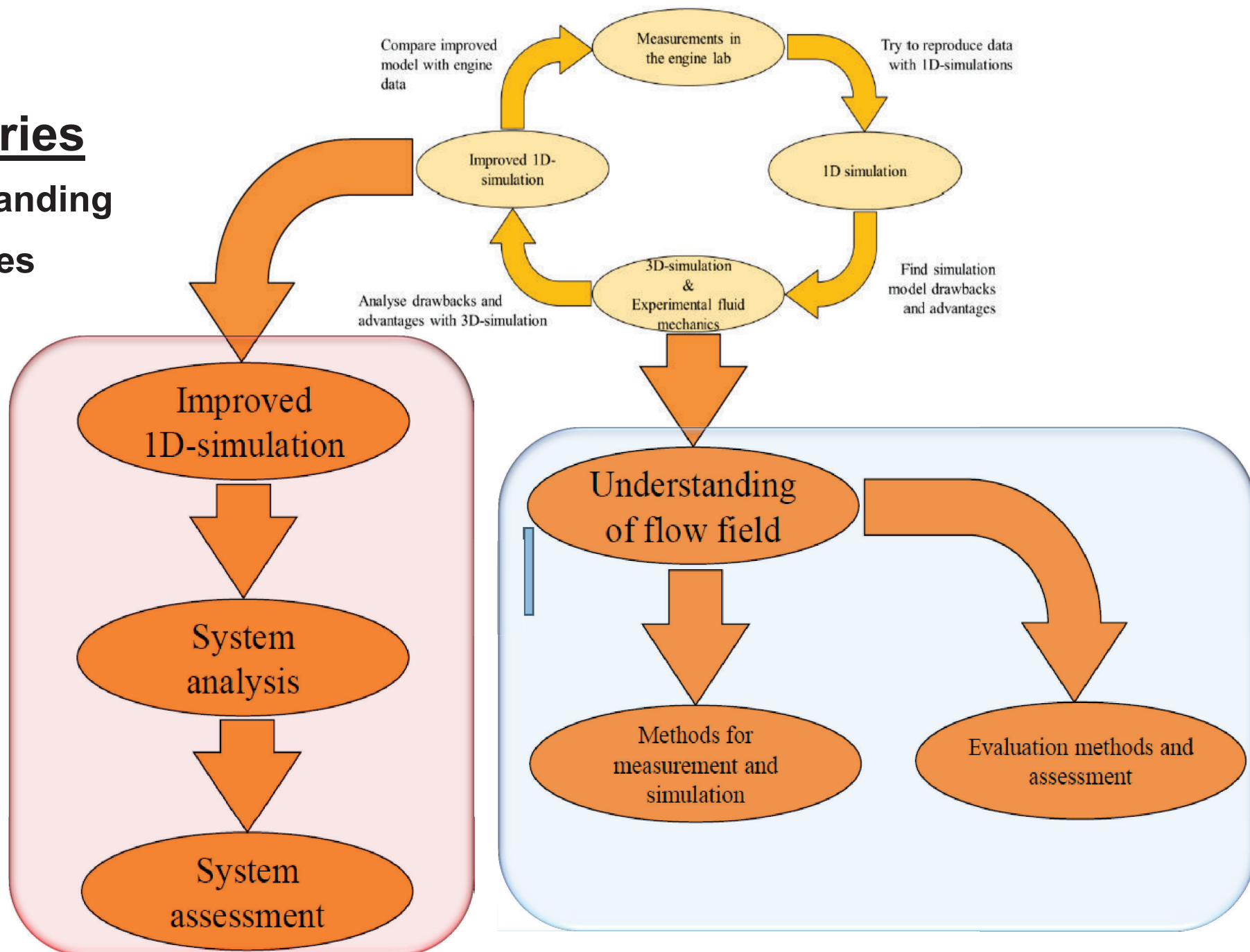
Close the loop between engine system/components and detailed flow and acoustics

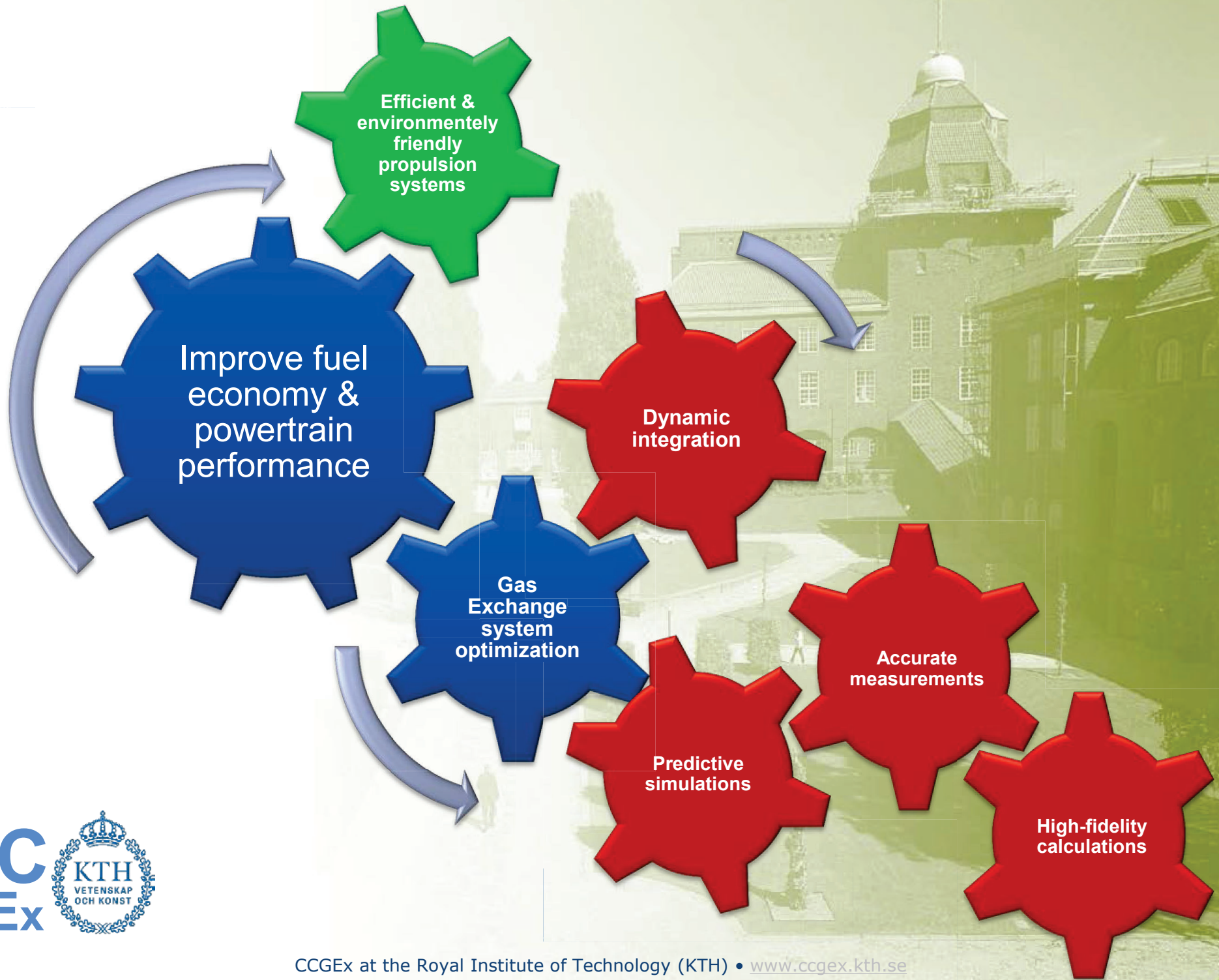


Deliveries

Understanding

Graduates







CCGEx Expertise

Physics

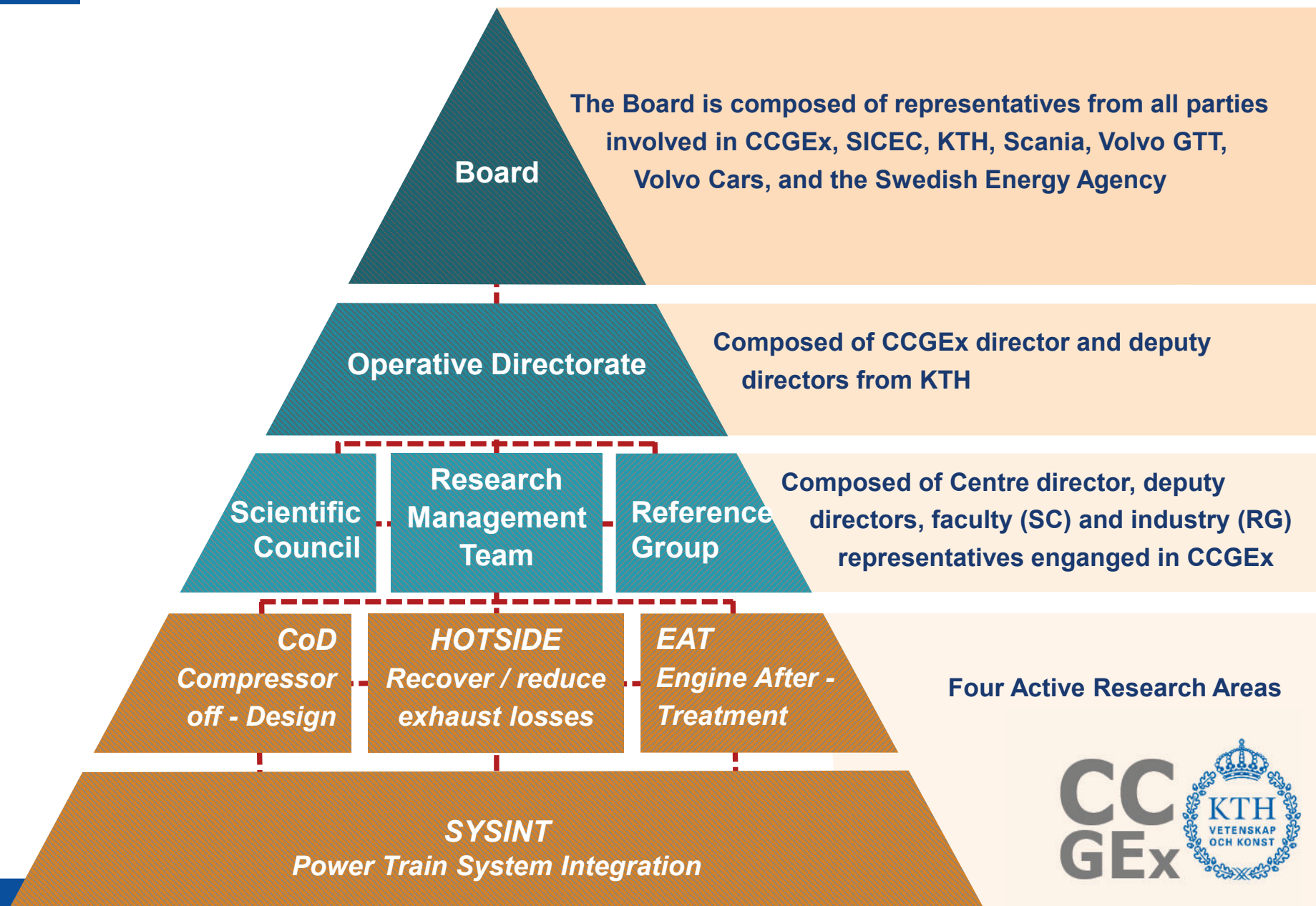
- Turbulent flows
- Heat-transfer, thermodynamics & compressible flows
- Multiphase flows incl. particles
- Acoustic, noise, vibration & harshness
- Combustion

Methods

- High-fidelity Simulations
- Dynamic System Simulations
- Gas-dynamics & gas-stand experiments
- High resolution flow measurements and laser/optical diagnostics
- Predictive simulations & optimization for virtual design
- Engine testing, rig testing & instrumentation



CCGEx Set-up





CCGEx Research Areas & Projects

Research Area	2015				2016				2017				2018				2019				Q1
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
COD : Mihai Mihaiescu																					
Bertrand Kerres, PhD student, ICE, Exp/1D										PhD											
Elias Sundström, PhD student, Mek, CFD					Lic							PhD									
Raimo Kabral, PhD student, MWL, Exp									PhD												
Asuka Pietroniro, Ind. PhD stud Volvo Cars, MWL/Mek, CAA																Lic					
Valeriu Dragan, Post-doc BW, Mek, CFD on non-axisymmetric diffusers																					
HOTSIDE Mihai Mihaiescu																					
Ted Holmberg, PhD student, ICE, 1D/Exp									Lic										PhD		
Marcus Winroth, PhD student, Mek-CICERO, Exp									Lic						PhD						
Shyang Maw Lim, PhD student, Mek, CFD									Lic						PhD						
Nicholas Anton, Ind. PhD stud Scania, ICE, 2D AeroDesign													Lic							PhD	
EAT : Mikael Karlsson																					
Ghulam Majal, PhD student, MWL/Mek, Numerics												Lic								PhD	
Arun Prasath, PhD student, ICE, Exp														Lic							PhD
Mireia Altimira, Researcher, Mek, SCR																					
SYSINT: Anders Christiansen Erlandsson																					
Senthil Mahendar, PhD student (Volvo GTT), ICE, 1D Intr Turbo															Lic						
Sandhya Thantla, PhD student, ICE, 1Dsim															Lic						



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