



CHALMERS

TRACKS – AN INITIATIVE FOR CHANGE, FLEXIBILITY, INTERDISCIPLINARITY AND CREATIVITY IN ENGINEERING EDUCATION

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BACKGROUND

- Trend analysis
- Workshops with teachers, students, deans, support functions etc.
- Three trends influence our role in the society
 - complex societal challenges require improved competences to work interdisciplinary
 - changed expectations from, and on, the students including life long learning
 - shorter development times for (digital) technology development



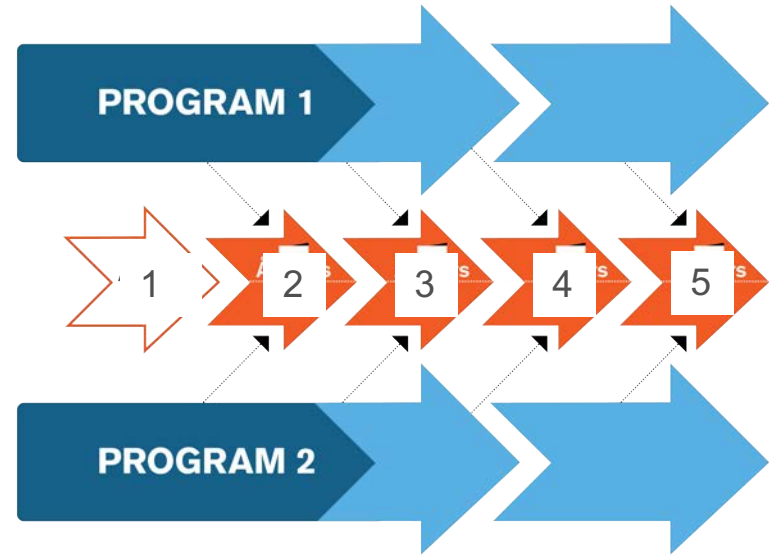
TRACKS: MAJOR FOUNDATION VENTURE

With Tracks, Chalmers will test a new educational model, where education is structured to:

- 1) Give students the opportunity to develop their interdisciplinary competences
 - 1) Courses/projects to understand/solve contemporary societal challenges as well as profound research driven challenges
 - 2) Students are trained to develop, build, test, and implement
- 2) Meet students' needs and expectations for a more individualised study path
- 3) Reduce the time required to offer new educational content including new technology and materials

EDUCATIONAL IDEA

- Within a challenge-driven theme, there will be several Tracks courses and projects.
- A student who chooses one or more Tracks courses within the same theme during the education, will get an opportunity to get deep knowledge within that theme and also relationships with other students from different backgrounds
- Each theme creates a Track with at least one course per semester
- Tracks courses will start in year 2 at BSc level and run through year 5 (2nd year at MSc level)
- Tracks courses are introduced 19/20 with pilots



INTERDISCIPLINARY COMPETENCES

- Courses/projects to understand/solve contemporary societal s and/or recent research related challenges
- Students are trained to discover, develop, build, test, and implement
- Processes, products, systems (physical and digital)



INDIVIDUAL STUDY PATH

- Individual profile with one or many Tracks courses
- Student will identify and reflect on which prerequisite competences they need
- Supportive infrastructure will help the students to attain the required knowledge



DECREASED DEVELOPMENT TIME

- To meet the required competences from the society
- Overall general learning outcomes will be specified for “umbrella” tracks courses while specific contents and outcomes are defined in connection with the course start – “sand box model”



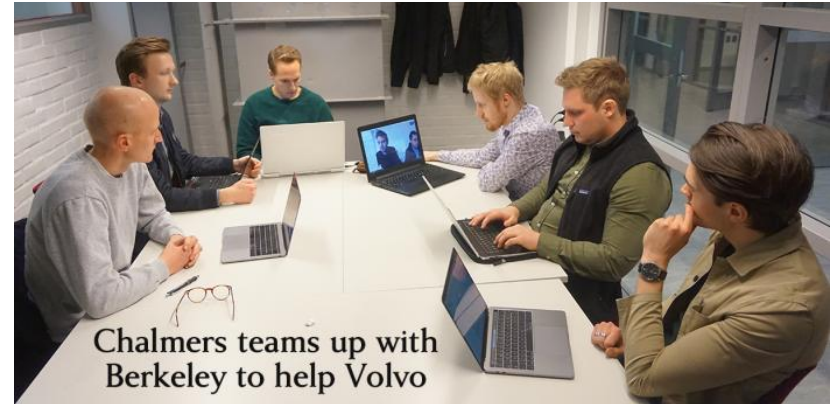
CORNERSTONES

- Agile curricula and flexible delivery, responsive to changes
- Inter- and multidisciplinary
- Project centric learning - projects are instruments for learning about creating and discovering as well as platforms for deepen science, math and technology knowledge and general skills
- Complete problem solving (design) chain
- Supportive modules and on-demand teaching
- Students will get their degree from the educational that they are admitted to but include Tracks courses as electives or as extra curricula

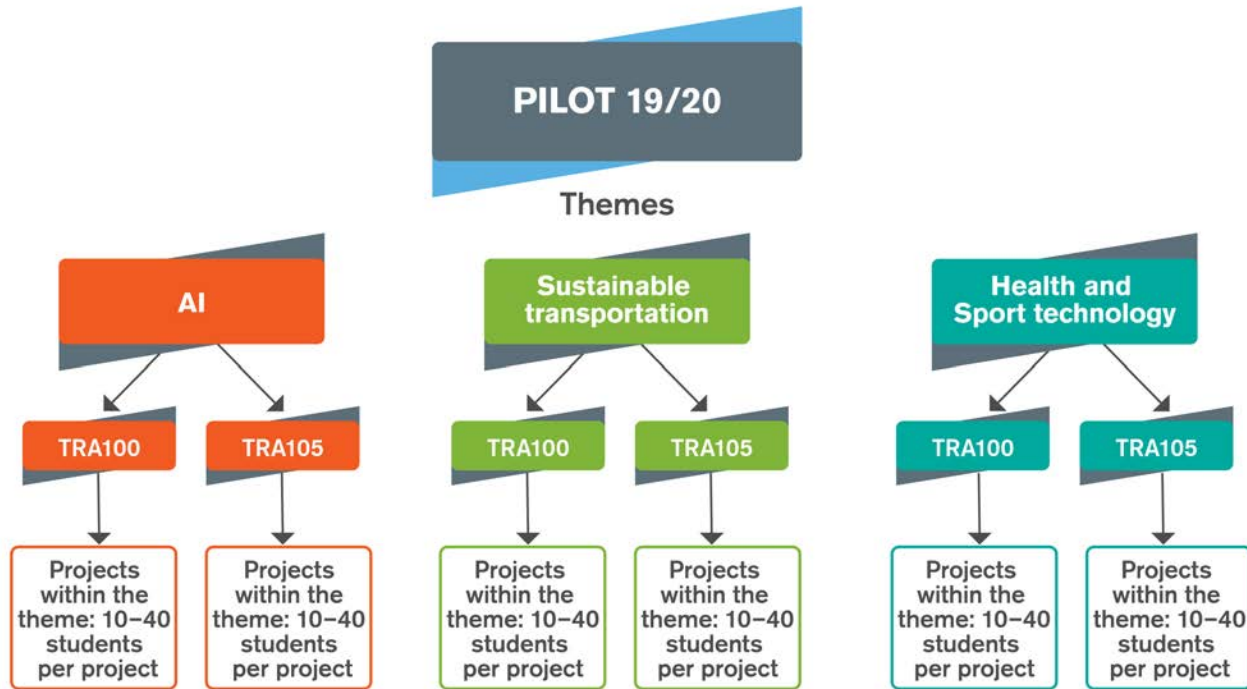


CORNERSTONES

- Supportive learning environment conducive to active and experiential learning
- Readily available and low thresholds for admission
- Individual choices as well as responsibilities
- Students are expected to develop their ability to learn by themselves
- International cooperation – joint distributed student teams
- Cooperation with strategical partners



Chalmers teams up with Berkeley to help Volvo



"On demand"

Tracks modules aimed at the specific knowledge that are needed in a Theme,
Face-to-face teaching and learning

UMBRELLA COURSES TRA100 & TRA105

- Used to teach Tracks projects without having to create a whole new course in the course administrative system
- Included in the regular course offer
- May be updated and extended in the annual course offer process
- Have fixed number of credits (7,5 ECTS for pilots)
- Have general course descriptions, aims and general professional learning outcomes
 - Topic oriented learning outcomes are be added for the specific project

GENERAL LEARNING OUTCOMES – ADV LEVEL

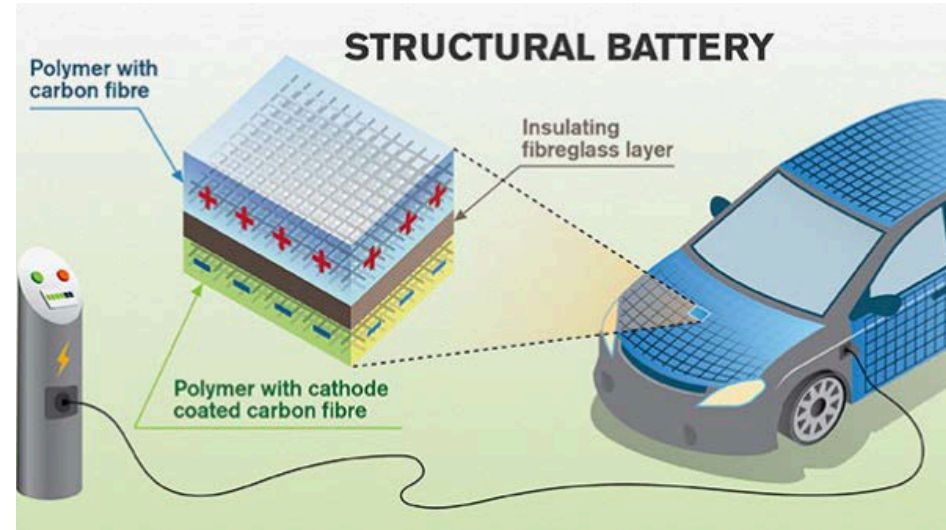
After completion of the course the student should be able to

- **critically and creatively** identify and formulate architectural or engineering problems
- **master problems with open solutions spaces** which includes to be able to handle uncertainties and limited information.
- **lead and participate in the development of new products, processes and systems** using a holistic approach by following a design process and/or a systematic development process.
- **work in multidisciplinary teams** and collaborate in teams with different compositions
- show insights about **cultural/ethnic differences** and to be able to **work sensitively with them**
- **identify ethical aspects** and discuss and judge their consequences in relation to the specific problem

PILOT PROJECTS 2019/20

Theme: Sustainable transportation

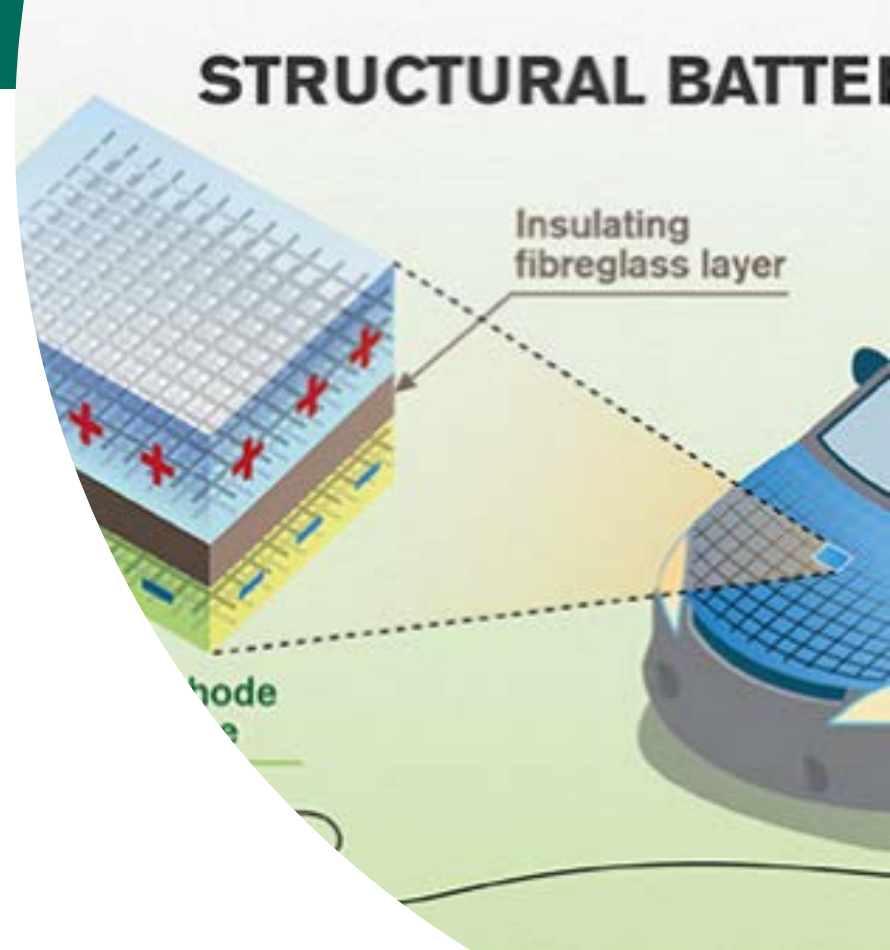
- Structural battery composites:
Realization and multifunctional performance
- Optimize subsystems for electric vehicles
- Sensor systems for sustainable mobility
- Urban Infrastructures in transition:
Transport- Mobility – Space



Structural battery composites: Realization and multifunctional performance

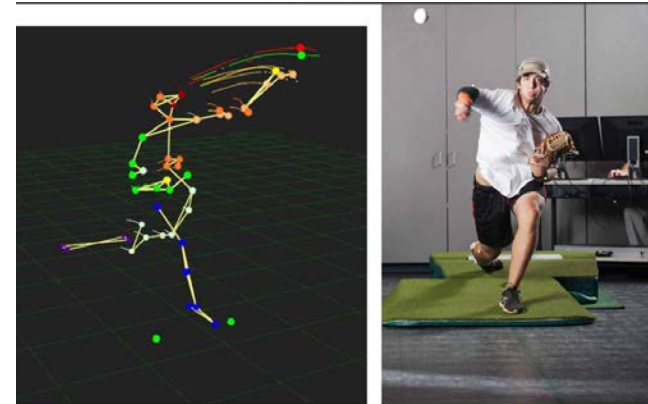
“In an interdisciplinary team you get the opportunity to study the multifunctional performance of carbon fibres, make and characterise polymer electrolytes, design and manufacture structural battery composites and optimise the performance of structural battery composite devices for, e.g., aircraft interior applications”

“We need students with deep knowledge in: Physics; Chemistry; Applied Mechanics; Materials; Mechatronics; Electronics; and Energy Systems.”



Themes: Life science & sport's technology and AI

- Equestrian sports project
- New foiling concept for Formula Sailing
- Transformation from “patient and hospital” to “health at home”
- Projects in Music engineering:
Awareness of sound
- Mechanics in Sports
- Digitalization in Sports and Health
- AI Ethics through Fiction



LEARNING ENVIRONMENTS

- Increased number of large flexible class rooms and project spaces
- Expansion of the digital learning environments, including capacity for large computer simulations, capacity to manage massive amounts of data, machine learning and AI
- Labs to create, test and evaluate prototypes.
- Space for group work and open creative learning environments



LEARNING ENVIRONMENT INCLUDES

Formal environment - approx 1000 m²

- Large flexible area for exhibitions, presentations, lectures and teamwork
- Project and meeting rooms
- Workshops – metal, wood, fabric, paint and surfaces, electronics
- Rapid prototyping - 3D-printing, laser cut etc.
- Physiology ergonomics and sports lab
- Computer lab, virtual lab and film studio
- 2-3 instructors/technicians
- Students involved in development, teaching and running the environment
- Generous opening hours. Students run the facility outside office hours

Informal environment

- Outdoor environment
- Study places that optimize learning
- Encouraging movement
- Flexible– students have a broad range of needs
- App for bookings of rooms etc.
- Café and social areas

PROJECT MANAGEMENT

- Project started Feb 2019. Initiative from Chalmers foundation
- Substantial financial support, 20 M€ during 10 yrs
- Team leadership (leader is an educational leader developer and vice-lead is a skilled and well-thought-of project manager)
- Management group, steering committee and an advisory board
- Vision and initial overview goals. Evolving detailed outcomes and specific requirements
- Continuous development, evaluation and improvement
- Identifying and build the developments around motivated teachers. Give them support and trust. Let developments emerge from self-organized teams

FACULTY AND STUDENT INVOLVEMENT

- Open workshop for all
- Face-to-face meetings
 - all levels of university leadership, from rectors office to research group leaders,
 - faculty, students, admin
 - areas of advanced
 - strategical partnership programs
- Building trust
- Clear milestones and deliverables
- Early development of themes, courses and modules, pilots launched June 2019 and during the academic year 2019/20

RESPONSE

- Successful approach based on simultaneous execution, implementation and development
- Early adopters in faculty
- Students positive
- Confirming response from industry
- Administrative barriers
- Learning environment may be a challenge due to lack of space



NEXT STEPS

- Begin building physical and digital environments
- Develop/implement umbrella courses of different size (credits)
- Additional themes and courses including processes for calls and approval
- Develop a sustainable financial model
- Develop sustainable administrative models for recruitment of students, registration and reporting of grades including accreditation and diploma supplements
- Develop supporting general skills modules
- Develop pedagogical diploma courses for teachers
- Include challenges and issues from industry and society
- International collaborations through globally distributed project teams
- Employment of 3 people including 1 PhD student, 1 secretary of studies (admin support) and 1 blended learning expert
- Thesis work on effects on students' learning, development of general skills and understanding of fundamentals



IN SUMMARY: AIM WITH THE INITIATIVE

Create

Create at least five flexible and individual tracks with different themes and about 50 courses

Establish

Establish physical and digital learning environments

Develop

Develop the support to teachers who teaches interdisciplinary courses where the new learning environments are fully utilized

Prepare

In the long run, prepare students for successful careers and to use/develop technology to solve the societal challenges

DISCUSSION

Based on your experiences

- What would you also include in our work forward?
- How can we make this even more beneficial for the students, academia and the industry?



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