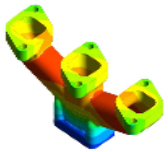
Faculty of Engineering

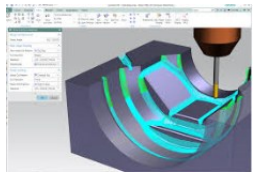
School of Mechanical Engineering













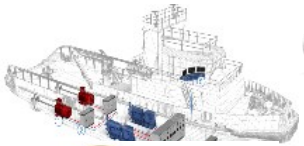
























- **800** Students
- **165** Degrees
- **1 400 000€** RDI
- **40** Employees

Research groups:

- Engine and Powertrain
- Manufacturing Engineering

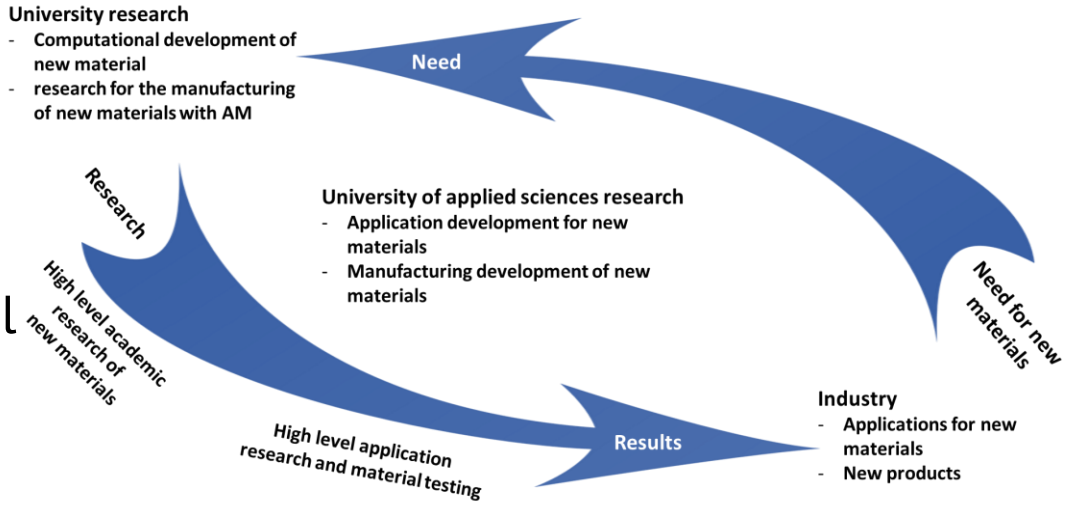
TURKU AMK

Manufacturing Engineering Research Group - MERG

TURKU AMK

- Established 2022
  - Currently employs 7 fulltime and 7 part-time researchers
  - Goal is to grow 10 plus 10 people research group
  - Yearly project bugged is around 1,1 M€

- Research focus on applied and interdisciplinary research topics where manufacturing technology is a central part of the research problem
  - Utilizing the results of basic research in solving practical problems
  - Collaboration between universities and industry is key part of our research activities



Research environment

TURKU AMK

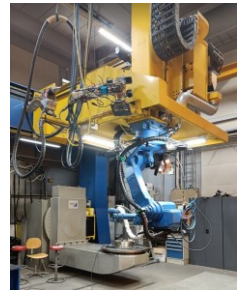
- QandTech Turku is teaching, training and research facility for manufacturing engineering
  - Fully equipped factory

- Joint research and teaching facilities of TUAS & UTU
  - Welding
  - Additive manufacturing
  - Material science
  - Automation
  - Metrology

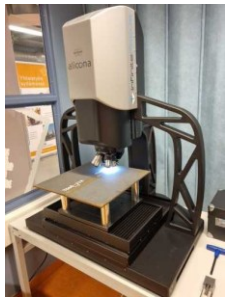
- In Machine technology center Turku there is also vocational students working and training

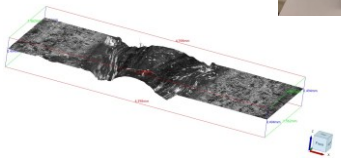
Manufacturing / prototyypin






Material testing / measurements







PBF-LB/M machines

TURKU AMK

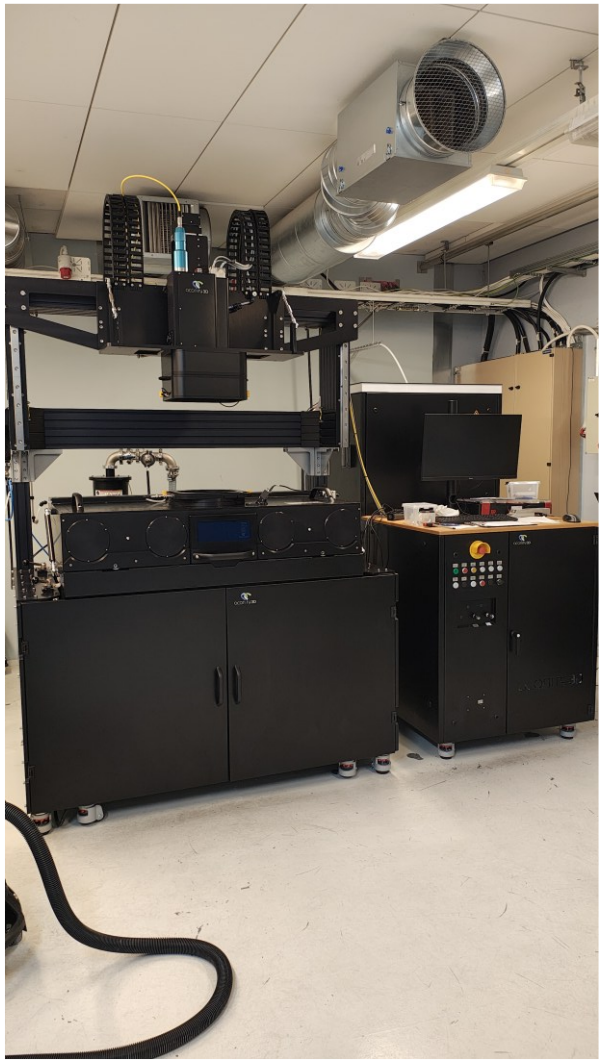
EOS M100

Agonity

SLM280 (Al)

SLM280 (Steel)









Manufacturing engineering research topics

TURKU AMK

- Manufacturing engineering topics
  - Additive manufacturing (SLM & DED)
  - Welding engineering
  - Laser processing
  - Battery manufacturing



- Cross-disciplinary research topics
  - Circular economy in manufacturing industry
    - Vehicle batteries in circular economy
    - Dismantling cars for reuse and recycling of parts
  - Metaverse use in manufacturing industry
    - Teaching of robot programing and use in metaverse
    - Remote operation in factory via metaverse





What we can offer to industry

TURKU AMK

- Research and development
  - Testing services
    - Weldability & material testing
    - Power train testing
  - Prototyping
    - 3D printing of parts or components
    - Welding of metal structures and batteries
  - Modeling and simulations
    - Flow modeling
    - Battery aging

- Publicly funded projects
  - e.g. Business Finland, Horizon
- Direct assignment

- Training and education services
  - IWE/IWT – International welding engineer/technician
  - Tailored training
  - Degree education

Manufacturing engineering education in TUAS

TURKU AMK

- Bachelor degree in mechanical engineering
  - Manufacturing engineering is one of five study fields
    - Other product development, marine engineering, automation engineering, engine and power engineering

- International Welding Engineer / Technician certification IWE / IWT
  - Right to issue the certificate to TUAS in 2023
  - First IWE/IWT course started in September 2023

- Tailored training / education to industry
  - Laser welding
  - Material science
  - Welding engineer

BF funded - New Battery Module

- Project duration 1.1.2021 – 31.12.2023

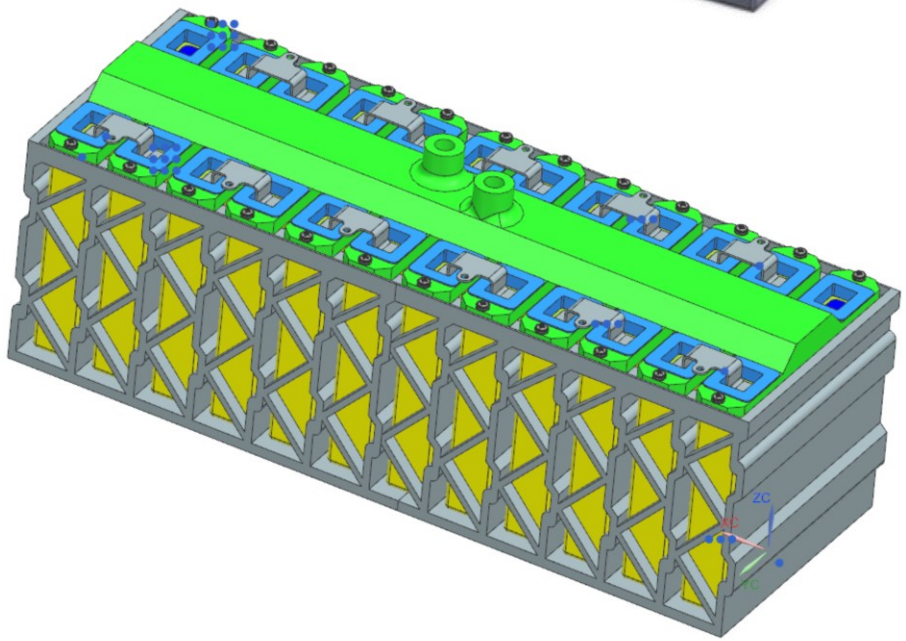
- Project focused on developing new optimized battery cell cooling system that can be integrated directly to battery cell
  - Utilizing 3D printing and flow optimized design
  - Increased thermal management both in cooling and heating

- During the project 3 patents were applied for the innovation

- Initial test show that battery pack can be charge with a higher current and still maintain heat control in acceptable level







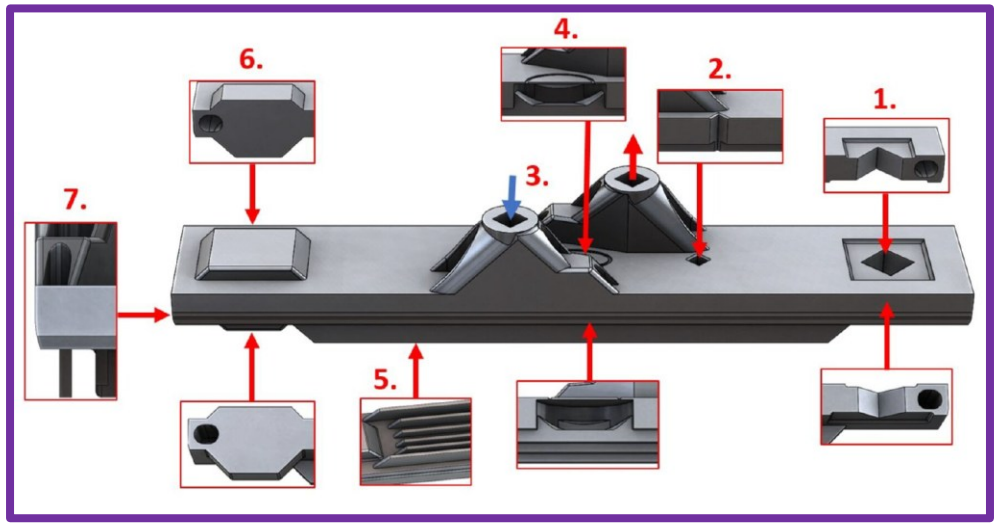
D.Sc. (Tech.) Heikki Saariluoma et al.

RESULTS – Case study

6. Integrated negative terminal

4. Integrated safety port

2. Fill port hole for simple screw sealing



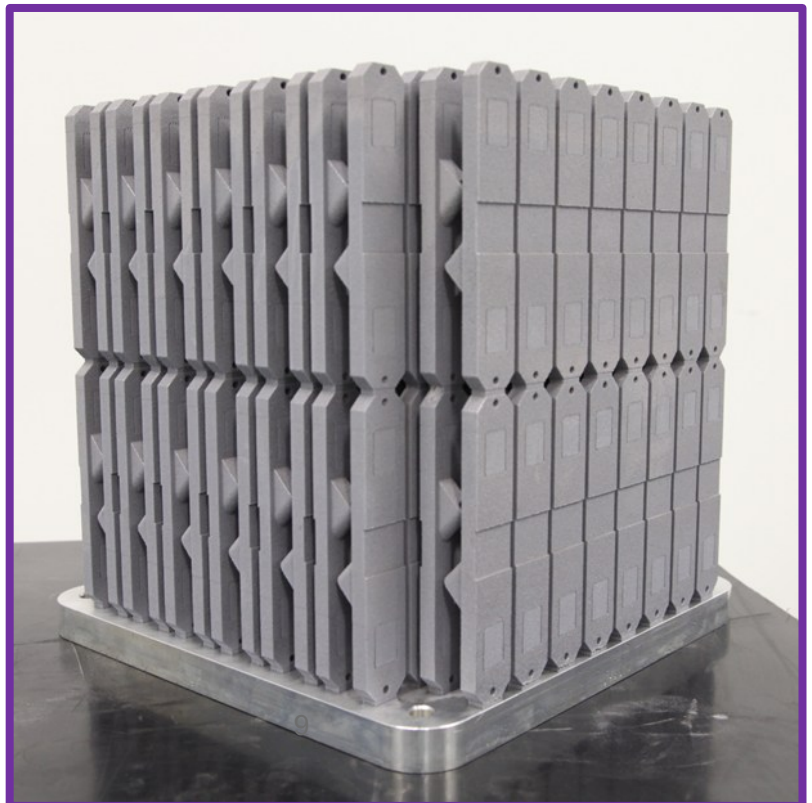
7. Bevel to make assembly easier.

1. Positive terminal pin square feed through hole

5. Fins to expand thermal conductivity surface area

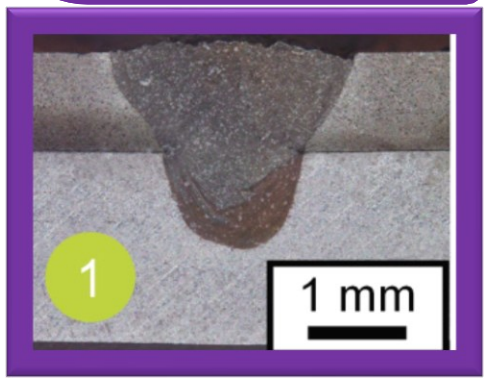
3. Fluid inlet and outlet for thermal management



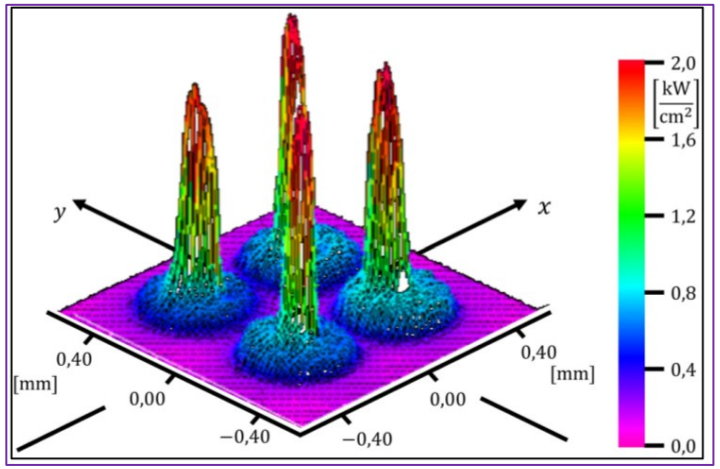


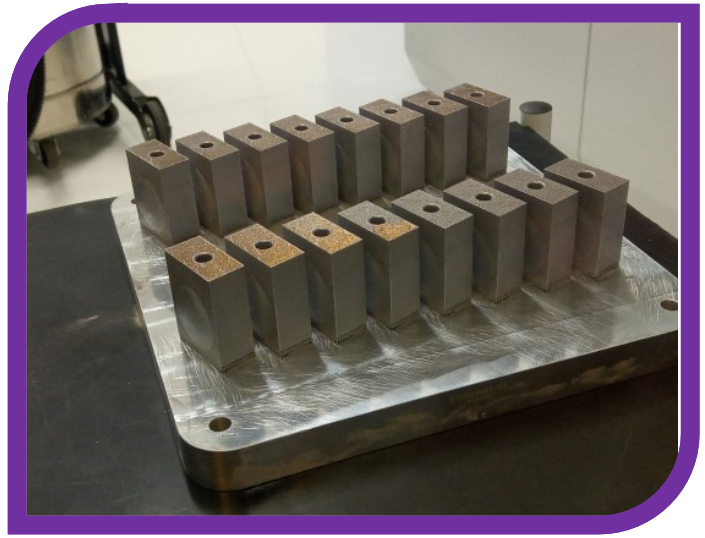
RESULTS – Proof of concept





- Gastight welds between lid part and frame case
- 3D printed thin membrane for the safety vent to rupture







M. Möller, P. Haug, P. Scheible, C. Buse, C. Frischkorn, and N. Speker, doi: 10.2351/7.0000735.

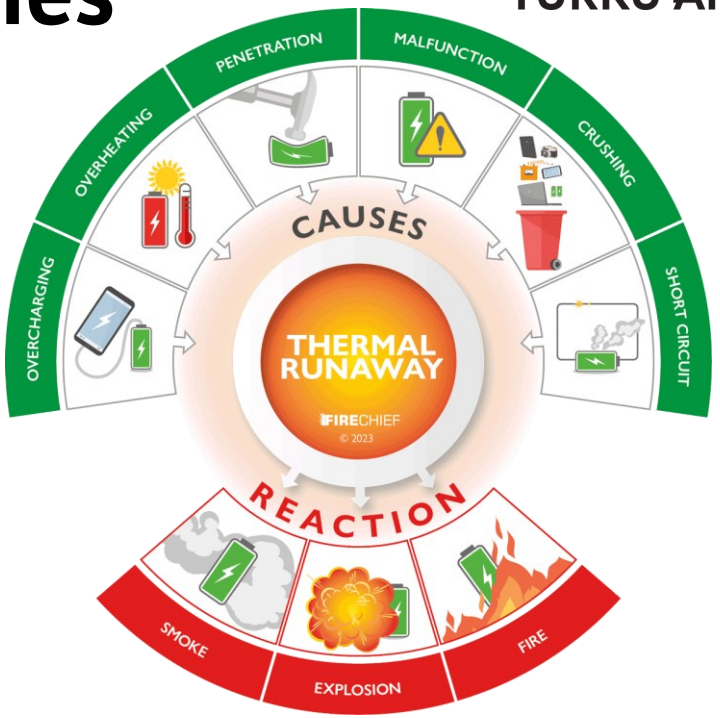
Rikkova - Destructive testing of batteries

TURKU AMK

- Project duration 1.1.2025 – 30.6.2027

- The aim of the project is to design and build a modular testing platform for safe testing of batteries in
  - Extreme conditions (hot / cold)
  - Mechanical stress
  - Electrical loading

- Get new measurement data in different battery conditions, stages of their life cycle, under extreme conditions or malfunction situations
  - Developing new simulation models for batteries
  - Understanding failure mechanisms in battery systems



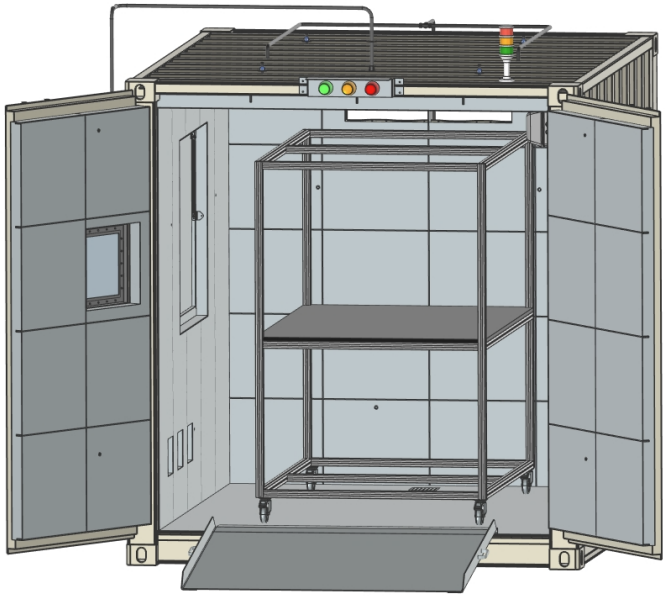


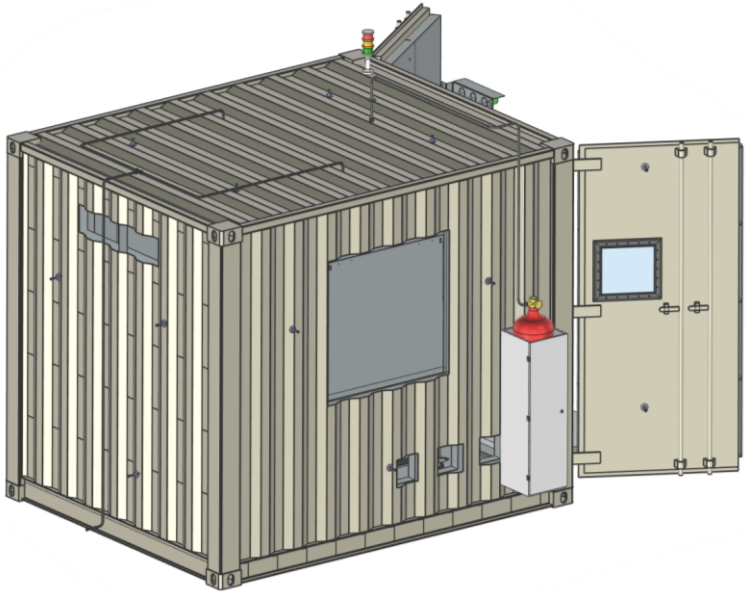
Rikkova - Akkujen rikkova testaus -

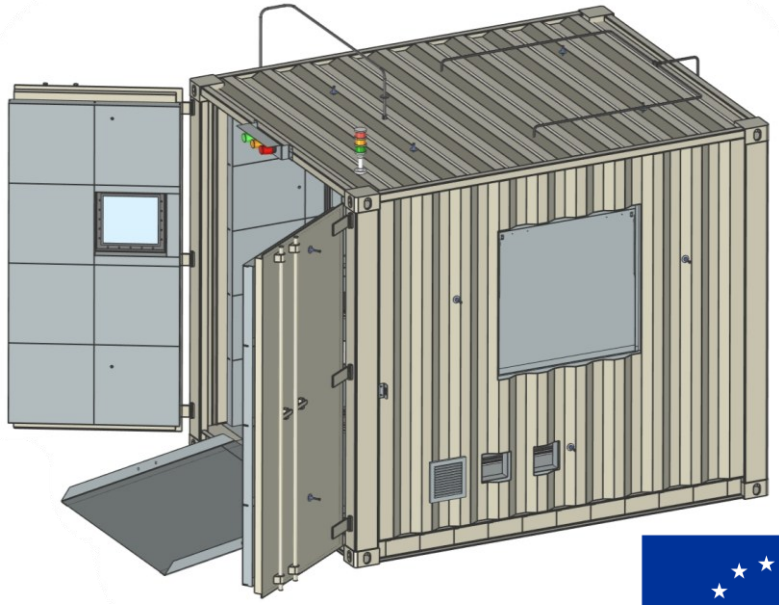
1.1.2025 – 30.6.2027 Euroopan aluekehitysrahasto

TURKU AMK

- Akkujen sähkö ja paloturvallisuuden, sekä ympäristöturvallisuuden huomioiminen järjestelmässä on keskeinen haaste







Euroopan unionin osarahoittama

3D vetymoottori

1.1.2025 – 30.6.2027 Euroopan aluekehitysrahasto

- Hanke lähti halusta ymmärtää miten vetyä voidaan käyttää polttoaineena polttomoottorissa
  - Polttomoottori tunnettu tekniikka johon on olemassa ja useampi yritys esitellyt prototyyppejä aiheesta
  - Miten vety soveltuu polttoaineeksi ei julkista tietoa saatavilla?

- Kokeillaan miten vetyä käyttävä polttomoottori voidaan tehdä käyttämällä 3D tulostettuja osia



Toyota





GenH2



JCB

Euroopan unionin osarahoittama

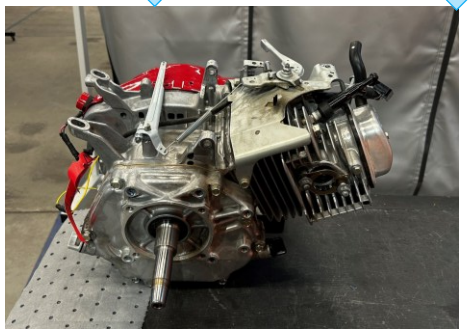
3D vetymoottori

1.4.2025 – 30.09.2027 Euroopan aluekehitysrahasto

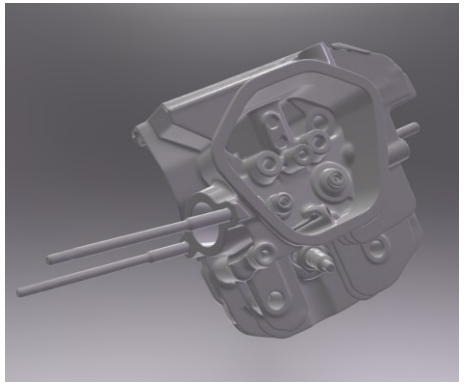
TURKU AMK



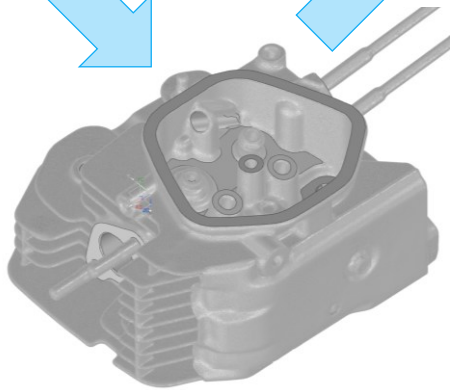
Moottorin purkaminen



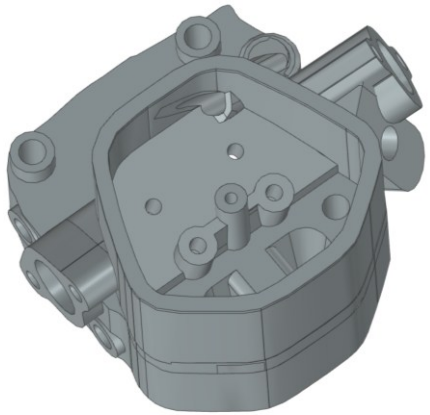
3D skannaaminen



Reverse engineering



Moottorin osan suunnittelu



Osan 3D tulostus

Nykytila



Tulevat toimet

- Uusien moottori konseptien testaaminen
- Moottorin suorituskyvyn testaus
- Vaurioanalyysi (kun moottori hajoaa)
- Monipolttoaineen mahdollistaminen

Euroopan unionin osarahoittama

Innovaatioseteli tukea tuotekehitykseen

- HypInno Oy kehittää ja valmistaa palonsuojausaltaita sähköajoneuvojen turvalliseen sammuttamiseen
- AMK:n rooli hankkeessa oli kehittää tuotteen valmistettavuutta nopeiden kokeilujen avulla sekä testata ohutlevytuotteen hitsausta kokeellisesti
- Prototyyppi toteutettiin pienoiskoossa, mikä mahdollisti kustannustehokkaan palotestien toteutuksen todellisissa olosuhteissa käyttäen todellista rakennetta ja materiaaleilla
- Tämä lähestymistapa mahdollisti suorituskyvyn tehokkaan validoinnin.

TURKU AMK

TURKU ÅBO

BUSINESS TURKU



Miksi tutkimushankkeeseen osallistuminen kannatta

TURKU AMK

- Menestyvä tuote vaatii jatkuvaa parantamista koko elinkaaren ajan

- Tutkimushankkeessa ei uusi tuote valmistu markkinoille, mutta menetelmä tai teknologia voidaan testata sitä varten
  - Tulokset eivät useinkaan ole täydellisiä, enemmänkin riittäviä, joiden suuntaamana tuote voidaan kehittää tehokkaasti valmiiksi

- Tarvitseeko tutkimuksen olla juuri nyt ajankohtaista yritykselle?
  - Hankkeet ovat tulevaisuuden liiketoimintaa varten, ne ovat myös tehokas tapa verkottua
  - Usein hankkeet avaavat silmät yrityksessä – ”näinkin asiat voidaan toteuttaa”

- Yritys voi hakea julkista tukea omalle kehityshankkeelleen osana korkeakoulun tutkimushanketta
  - Korkeakoulu voi tarjota tukea hakuprosessissa
  - Korkeakouluilla on hyvä käsitys eri rahoitusmahdollisuuksista

Manufacturing engineering research group - Turku UAS



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Thank you