

MAKING MODERN LIVING POSSIBLE



Danfoss PolyPower A/S



www.polypower.com

Presentation outline

- Introduction
- PolyPower® technology and functionality
- PolyPower applications
- Project: “Under bandage sensor”
- Conclusion

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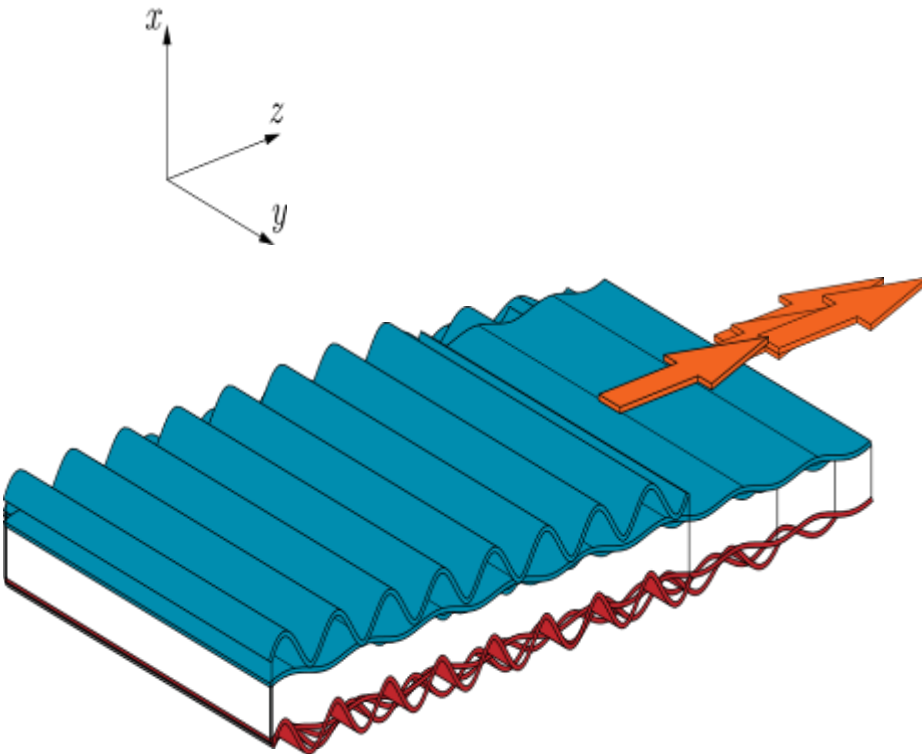


- In 1995 Danfoss President and CEO, Jørgen Mads Clausen had the idea to make a polymer fiber structure that would work like a human muscle
- 1995 – 2005, it continued as “under the radar” projects and “skunk work”
- In 2006, a formal project team was established to make proof of concept and secure IPR
- Danfoss PolyPower A/S was established on July 1st, 2008 with the mandate to commercialize PolyPower DEAP products
- Danfoss PolyPower A/S is 100% owned by Danfoss A/S
- 16 employees - R&D, Manufacturing and Sales
- Within the health care sector we act as a technology provider, working with commercial partners

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Unique PolyPower technology



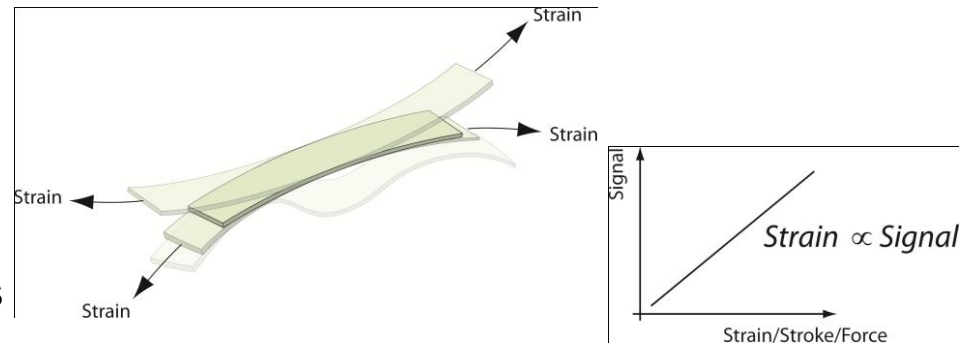
A fundamental platform technology targeting applications across industries with unique features:

- High force density, compact
- Long strains
- Direct acting and compliant
- Unparalleled energy efficiency
- Very fast acting
- Proportional
- Completely silent
- Light weight

Basic functionalities

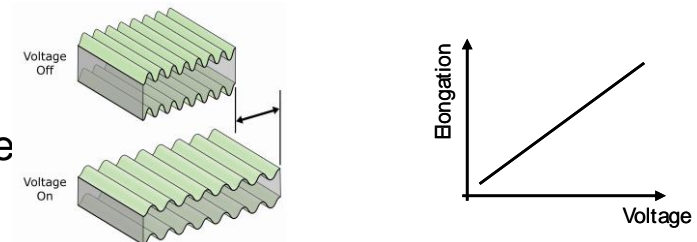
Sensors

- Elastic, capacitive strain sensors
- Strain capability up to 100%
- Linear as well as non-planar surfaces



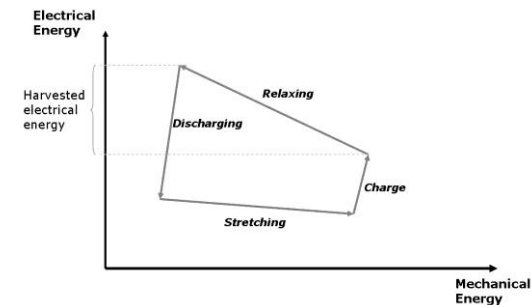
Actuators

- Direct acting capacitive actuators
- Low power consumption, noiseless and flexible
- Linear as well as morphing structures



Generators

- Converts mechanical energy to electrical energy
- Charging and discharging large variable capacitors
- Direct acting, potential very high efficiency

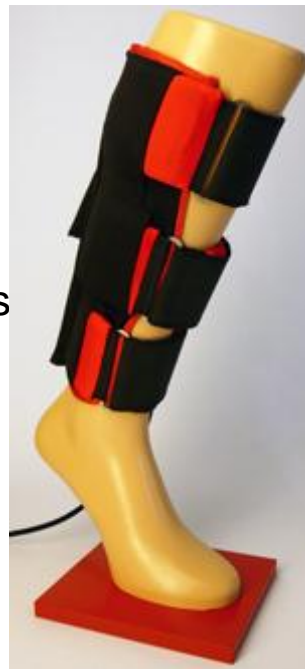


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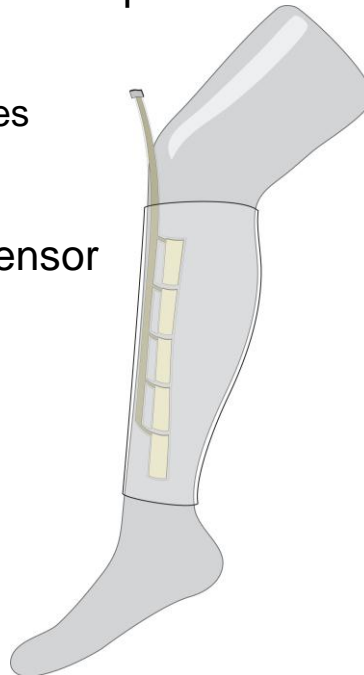
Health care applications – “Artificial Muscle

- Active Compression Bandage
- Micro massage patches/bandage
- “Active” prosthetics and braces
- Robotics with “gentle” touch
- Silent wearable medicine dosing pumps



Health care applications - Sensors

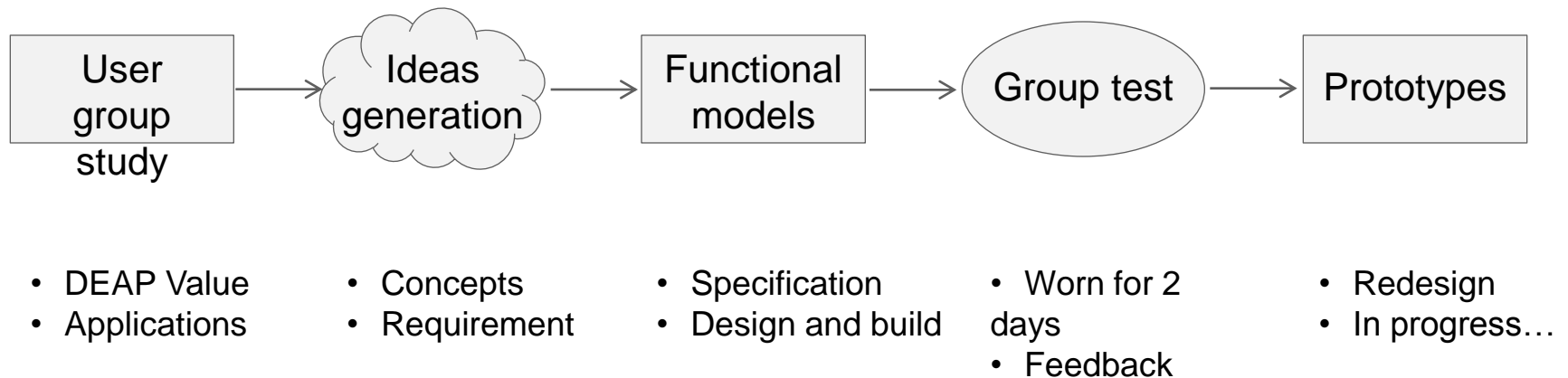
- Decubitus monitoring sensor
 - Early warning by monitoring pressure distribution
 - In cooperation with Decutech Aps
- Breathing monitoring
- Measurements of movements and/or position
 - Direct measurement on skin
 - Embedded in smart cloth/textiles
- Rehabilitation training devices
- Under the bandage pressure sensor



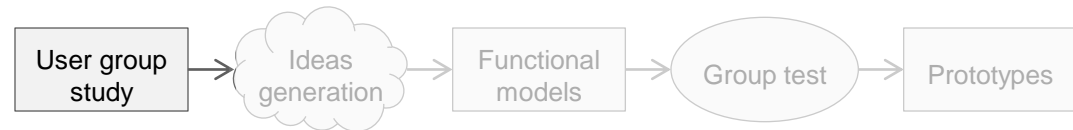
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Under bandage sensor - Development process



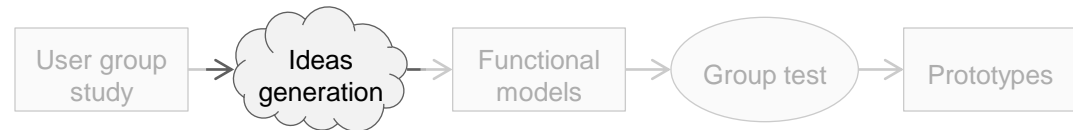
User group study



- Nurses work practice and users life with wounds
- Existing products and pros/cons of their usage
- Input of value propositions of PolyPower DEAP film
 - And where user needs could be met with the technology
- Decided to pursue bandage pressure measurement

- Note: Active compression bandage possibility

Ideas generation

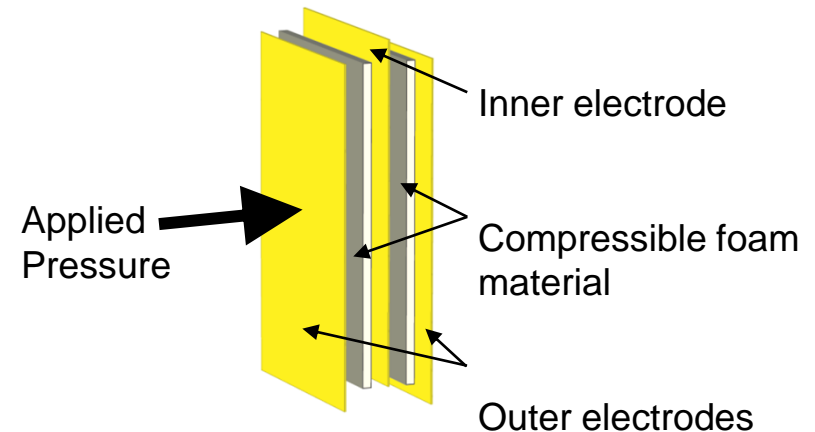


■ Within scope of bandage pressure measurement

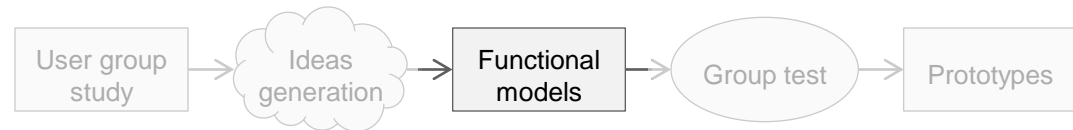
- Size / proportions
- Pressure range
- Usage / fitting /comfort
- Measurement intervals
- DEAP configuration

■ Perceived value of the device:

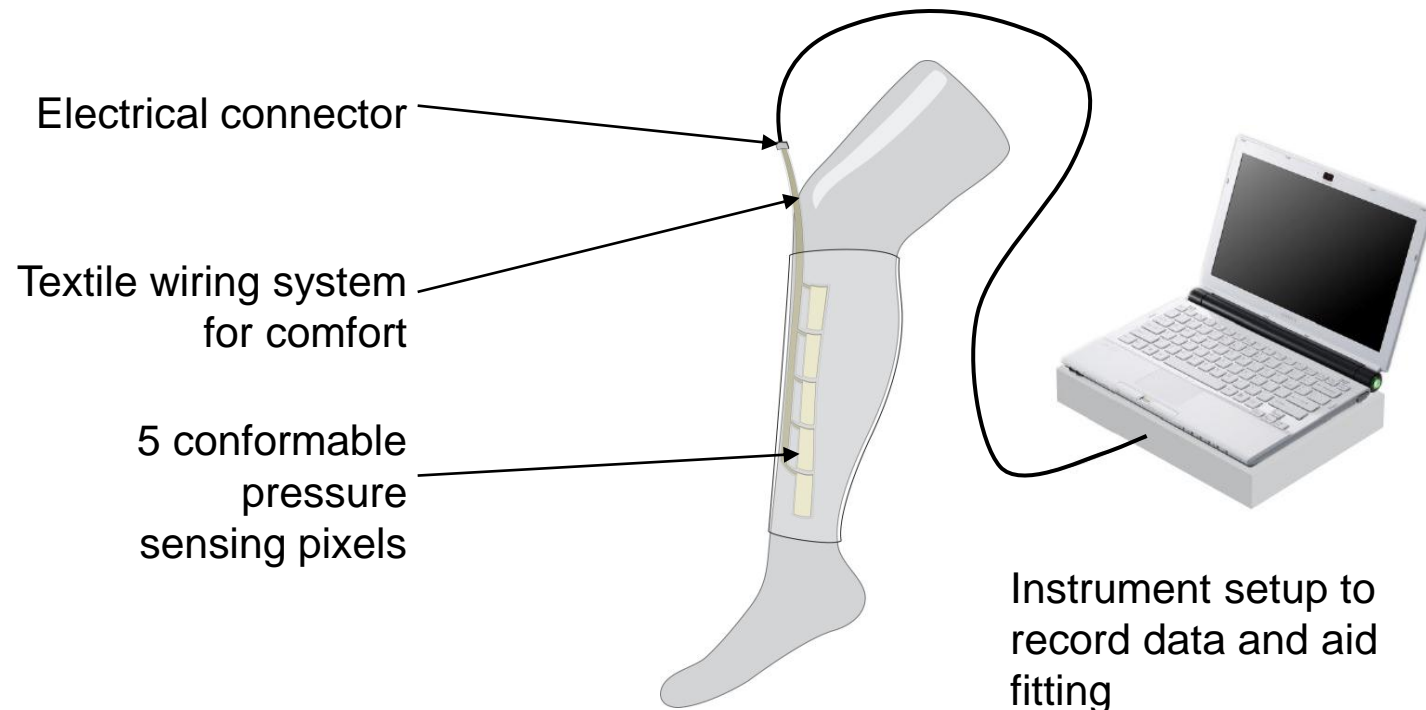
- Fewer bandage changes
- Helps ensure correct bandage pressure
- Avoids high or low pressure spots
- Shorter healing time
- “On demand” or continuous pressure measurements



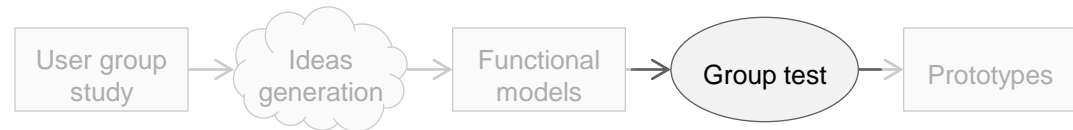
Functional models



- Physical concept (mock up) was presented and specification written
- Production of 5 pieces and 1 instrument setup



Group test

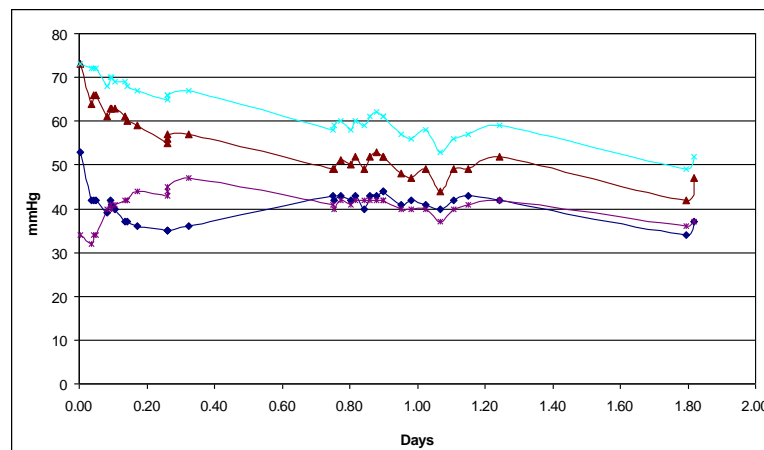


■ User feedback

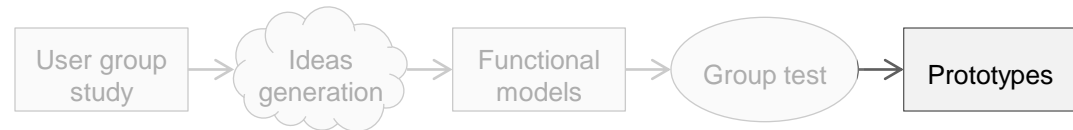
- Breathability between sensor and skin – Large sensor area
- Should be less noticeable to wear
- Connector is uncomfortable

■ Performance

- Offset in pressure reading at installation
 - Probably caused by non-homogenous compressible material and size of pixels



Prototypes



- 20 prototypes will be produced
- More comfortable / flexible
 - Smaller connector
 - Thinner
- Improved accuracy
 - Reduce offset at fitting
 - More pixels
- Easier to produce
 - Simple design
 - Electrical connection assembly outsourced
- First step made on dedicated electronics (3 units will be built,
 - Smaller
 - More simple



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Konklusion

- Det har været et spændende og udfordrende projekt
 - Professionelle med vidt forskellig baggrund, erfaringer og kompetencer
 - "Bruger dreven innovation" konceptet er godt og giver værdifuldt udbytte
- Projektet afsluttes med et antal færdige prototyper klar til "field test"
 - Samarbejde med e-stocking projekt på Aarhus universitet
 - Projektet overvejer alternative måder at "field teste"
- Vi ønsker at finde en kommerciel partner som kan tage ejerskab for idéen og bringe den til markedet
- Har du/I andre idéer til anvendelse af teknologien ????