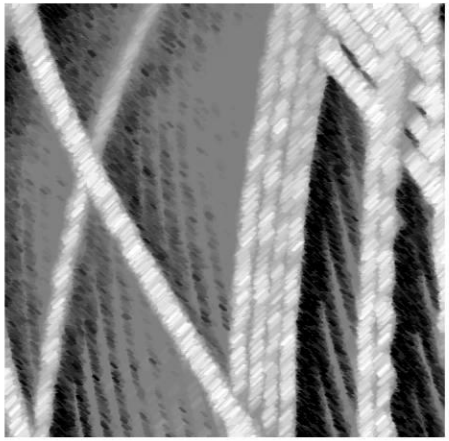
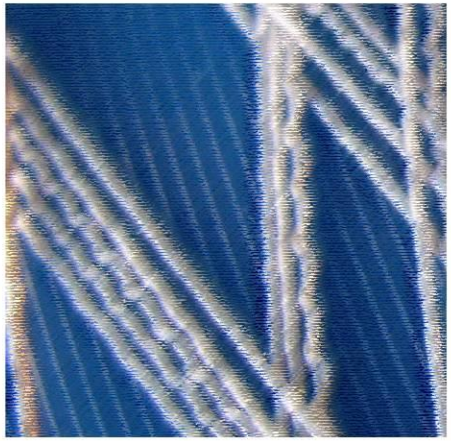
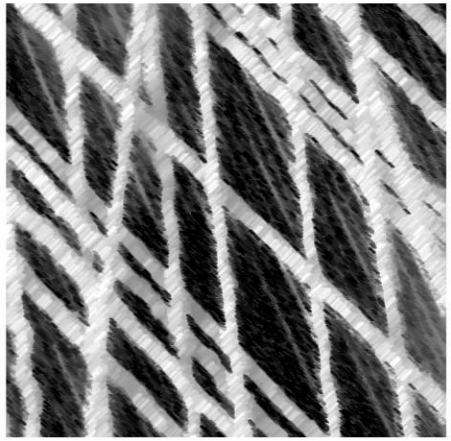
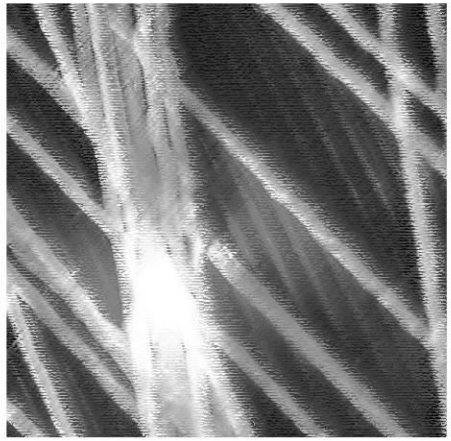
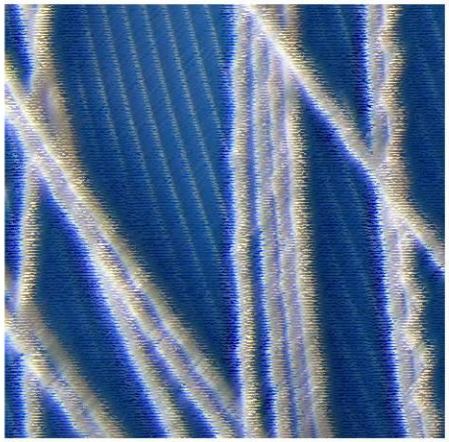
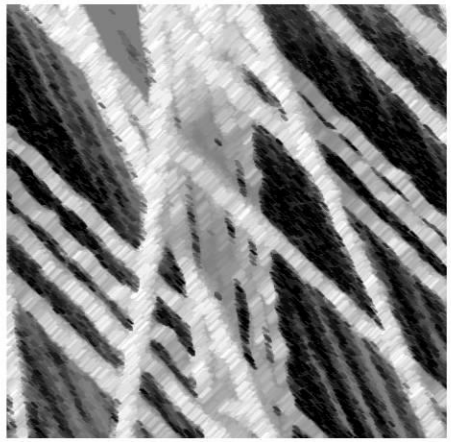
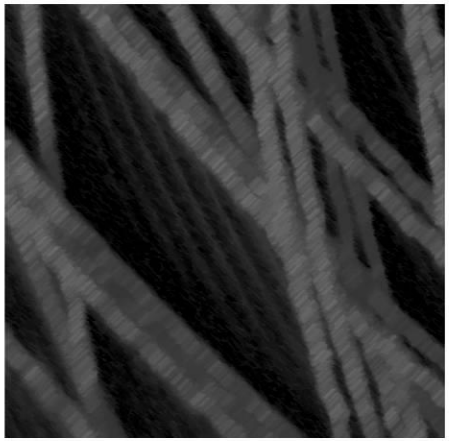
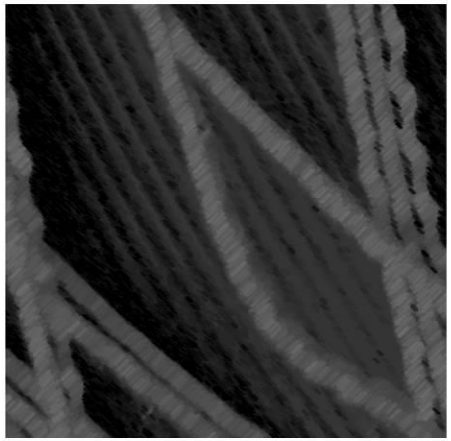
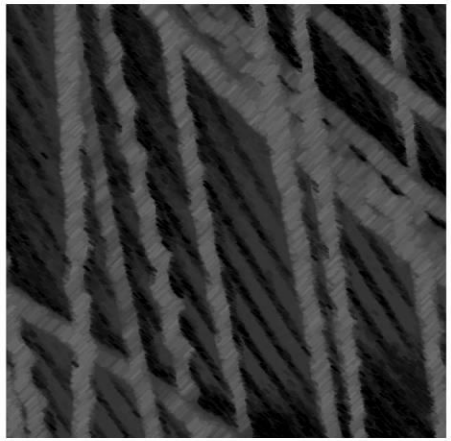






Primo1D

The E-Thread ® Company

From E-Textile to E-Thread®

Dominique Vicard
CTO Primo1D

SMART TEXTILES SALON Vol.4 25 June 2015, Ghent, Belgium

Agenda

- A « Smart Textile » perspective
- The E-Thread® technology
- The Primo1D Company

A “Smart” Textile ? – We have a standard…

- «Smart textiles are textiles or textile material systems having additional intrinsic and functional properties not normally associated with traditional textiles ».

FD CEN/TR 16298 Norme Européenne

Another “Smart” Textile Definition?

- “Smart textiles are those materials that can sense and react to external stimuli or trigger which may be mechanical, chemical, thermal, electrical or magnetic ”

Several Sources, including : Smart Textiles--Assessment of Technology and Market Potential 2010 Frost & Sullivan

A Closer Look at the Definition…

- “Sense”
  - Temperature, Humidity, pH, Ions, Strain, Bio, Attitude, Movement, EM, Electricity, etc…
- “React”
  - Shape, Force, Visual, Audio, Temperature, Energy, etc…
    - The Passive way : Phase change materials, Shape memory materials, Chromic materials, Piezoelectric materials, Nanostructured materials, etc…
    - The Active way : Communication, Computers, Programs, Protocols, RF, etc…

Phase Change Materials

- Materials existing under 2 phases (liquid, vapor, solid)
- Transition between 2 phases consumes/produces energy
- Thermoregulation

Thermoregulated clothing and textile - Outlast – Certified Space Technology

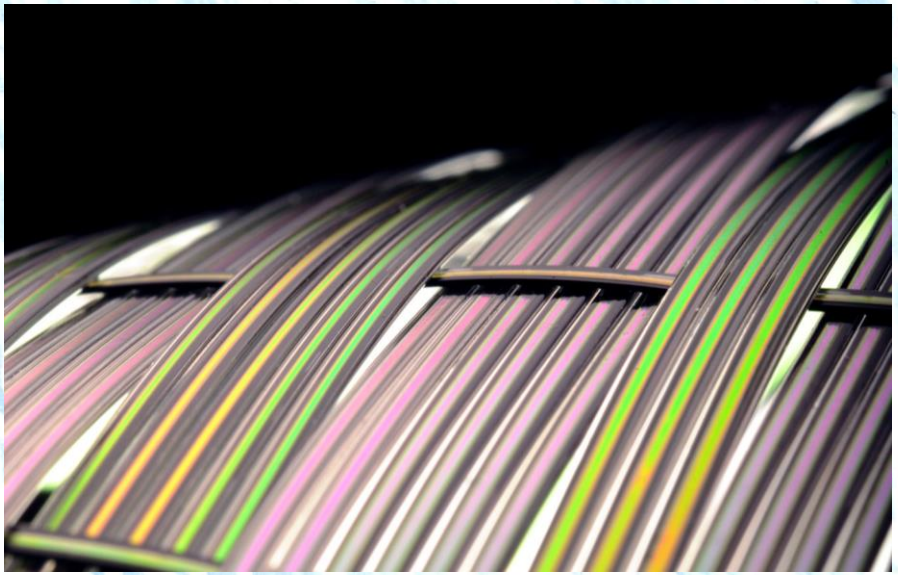
Shape Memory Alloys

- Alloys having the property of memorizing their shape and being able to retrieve this shape under a thermal stress.
- Capability to switch between shapes
- Memorization of shapes, folds, etc…

Folds created by shape Memory alloys - Aniela Hoitink and Isabel Cabral

Piezoelectricity

- Capability of getting polarized under a mechanical constraint, or vice-versa
- Capability to produce a current while moving
- Energy harvesting, Actuation



Piezoelectric yarns able to act as microphones or loudspeakers- MIT

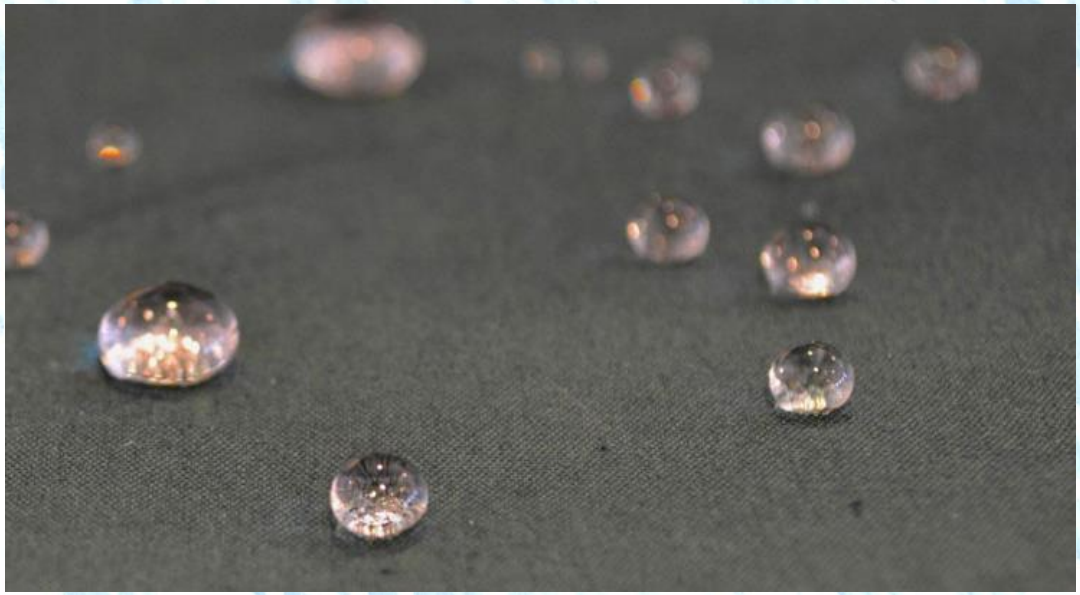
Electro Chromic

- An Electro Chromic material is able to change color under an electrical stimulation (reversible)
- Information display, lighting effects

Ludivine Meunier - GEMTEX - « INTELLITEX » project – textiles electro chromic displays

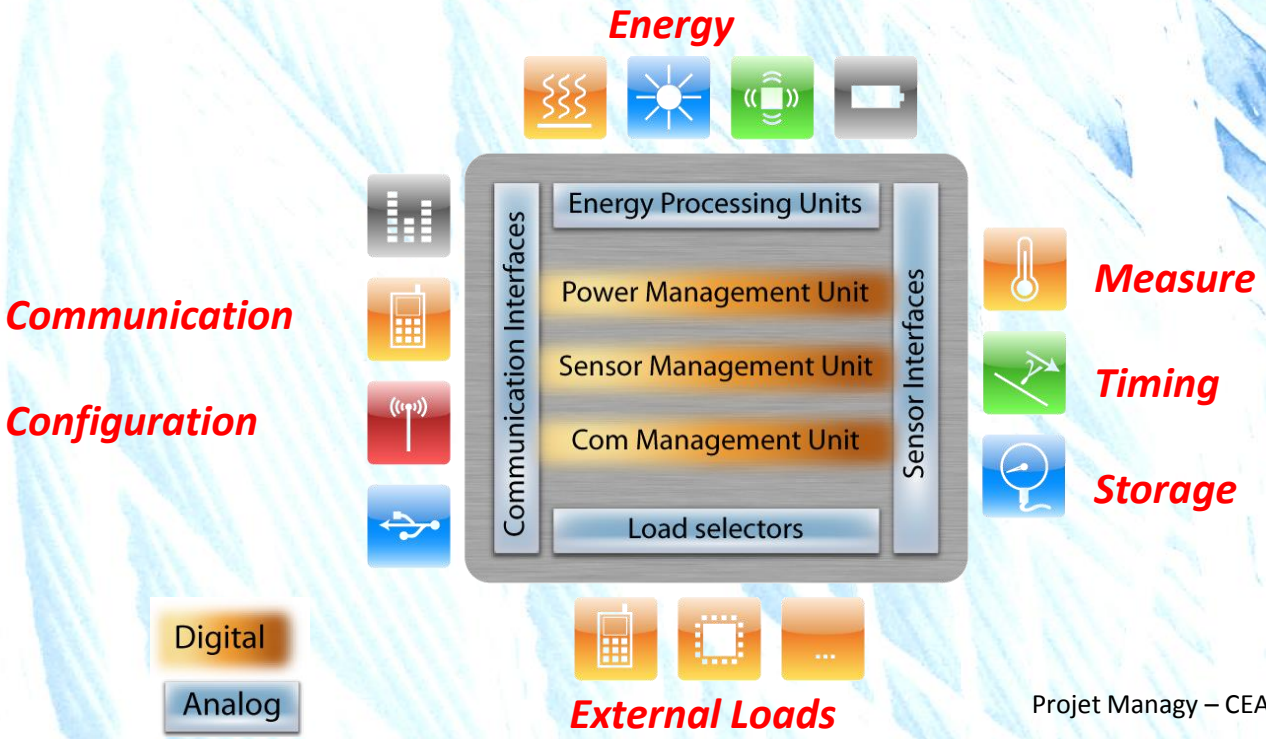
Nanostructure

- Atomic or molecular assembly in which at least one dimension is bounded between 0,1 et 100 nanometer.
- Lotus, Butterfly Wings effects



Lotus effect on a textile - Advanced Textiles Sources. © Industrial Fabrics Association International

The Active Way : Microsystem



Projet Managy – CEA-LETI

What for (in the wearable space)?

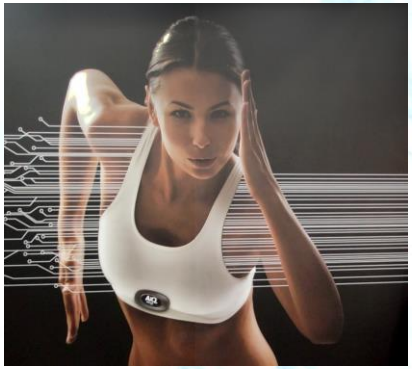
- Safety
  - Protection Equipment
- Healthcare and Wellness
  - Monitoring, Curing
- Fashion
  - Visual Effects
- Sports
  - Performance, training

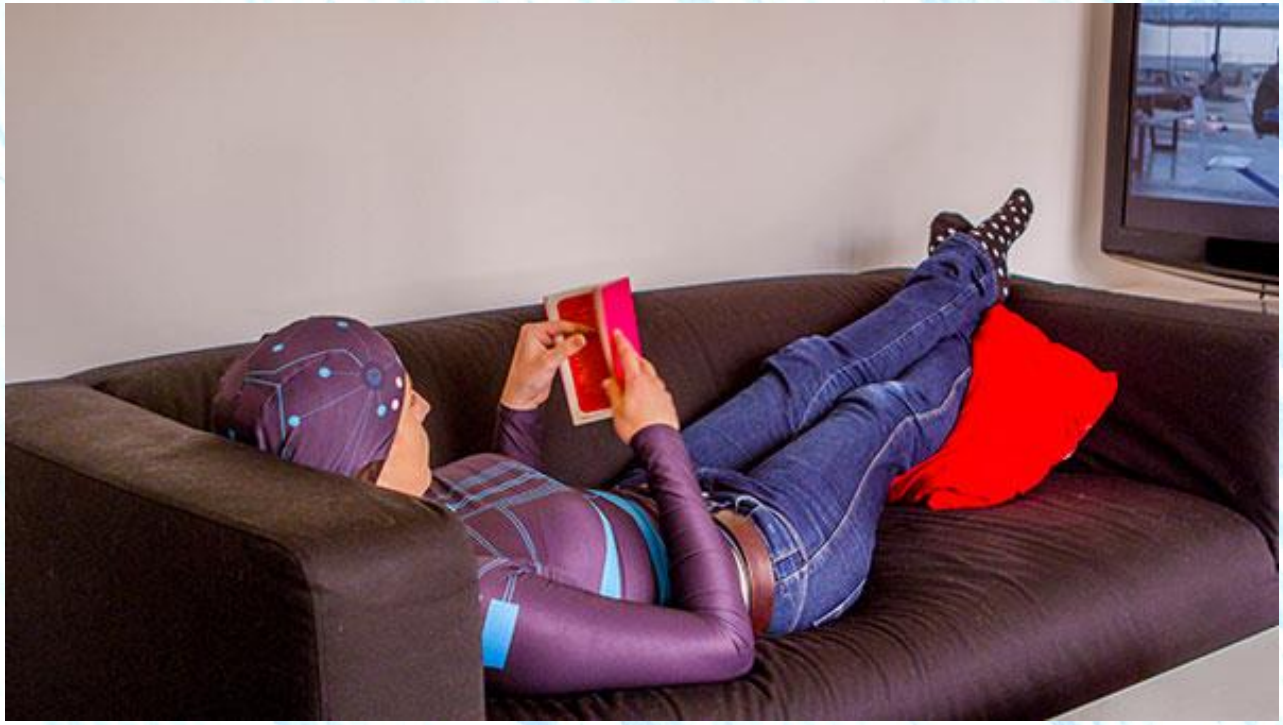
And numerous other applications in non-clothing textiles

Safety

Proetex Project– Sofileta – Brunet-Lion – Continuous monitoring of life signals : heart beats, breathing, etc… - Bio-signals monitoring : sweat, dehydration, electrolytes, O2, carbon monoxide – danger monitoring : under clothing temperature – Image LHD Lion

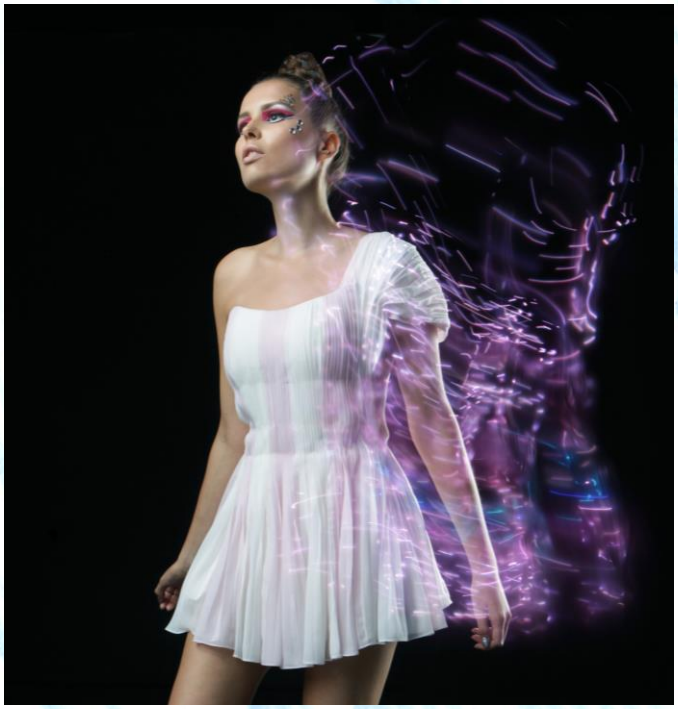
Health and Well Being





AiQ : sports monitoring / Phillips : Blue Touch / Bioserenity – spin-off from ICM (Institut du cerveau et de la Moelle Epinière) – A Smart Cloth with biometric sensors recording body parameters, for epilepsy monitoring.

Mode



CuteCircuit – Robes lumineuses – cutecircuit.com / Moon Berlin – Ligne de sac à main illuminés – www.moonberlin.com

Shows

Luminous Tex at the World Mobile Center / Luminous necklaces for the Olympic Games - Moritz Waldemeyer

And outside Clothing and Decoration?

- Geotextiles
- Composites
- Buildings
- Protections

All those application gain from an Active Monitoring « Smartification »

Geotextiles

- Ground reinforcement - Soil Stabilization
- Sealing - waterproof pockets creation
- Filtering
- Erosion Control

Geotexan – Road Textile Reinforcement

Composites

- Reinforced plastics such as fiber-reinforced polymer
- Lighter, as resistant, with no corrosion
- Aeronautics, car industry, street furniture

Airbus – A350-900 – Computer Graphics - Fixion

Public Works, Buildings

- Tents, roofs
- Frontages
- Isolation
- Road Works

Saint-Eloi - Cugnaux, la Saudrune : Sewage processing center covered with a textile roof

Protection

- Dyneema® : laminated polyethylene fiber UHMwPE (Ultra-High Molecular Weight Polyethylene) : currently the most performant material for ballistic protection. Initially designed for aerospace.

Doursoux – Tactical Vest – Made in France - 67% cotton 33% polyester Téflon coated . Dyneema ® BulletProof
10 ans de vie

Then, What is E-Textile?

- The step before « Smart-Textile »
  - A textile containing electronics (may be dull)
- The result of a long migration of electronics toward textile
  - Step 1 : Side by Side
    - Electronics is attached to textile through external elements (pockets, pouches) and remains stiff
  - Step 2 : Hybrid
    - Electronics is attached to textile through closer coupling and becomes flexible and washable
  - Step 3 : Integrated
    - Electronics is integrated in textile or even in yarns
  - Step 4 : Intrinsic
    - Electronics is made of textile

A couple of examples

- Sensitex (Smart Phone Control)

Step 3 : Integrated

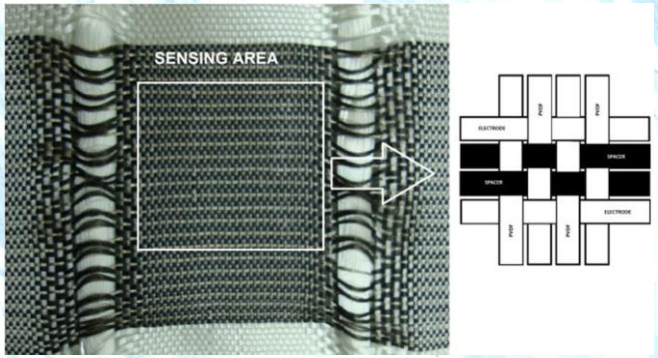
Step 1 : Side by Side

- Hunting Dog Equipment (Kevlar GPS pouch)

A couple of examples

- Biometric T-Shirt OMSignal with its « little USB black box»

Step 2 : Hybrid



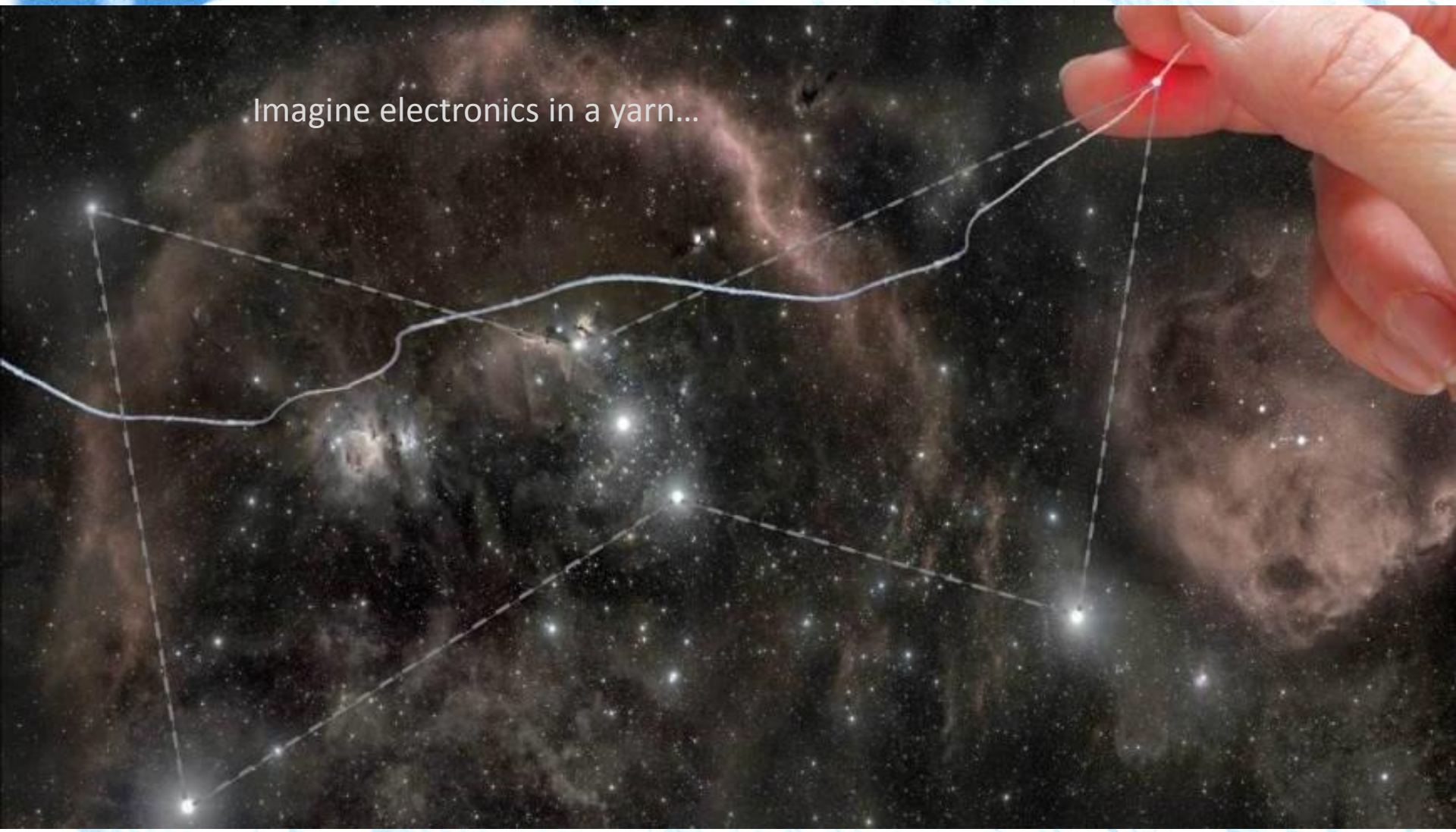
Step 4 : Intrinsic

- Force Sensor made of woven PVDF - Kevin Magniez - Deakin University CSIRO and RWTH Aachen

E-Textile : where are we now?

- In the Labs : Integrated or even Intrinsic
- On the market : Side by Side and Hybrid

But…

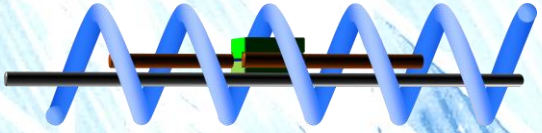

Imagine electronics in a yarn…

The E-Thread® of Primo1D

A disruptive innovation from the CEA, strongly protected by patents

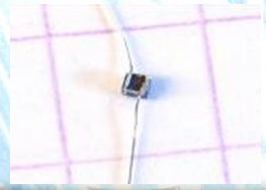
Electronics embedded into a textile yarn, in a unique form factor

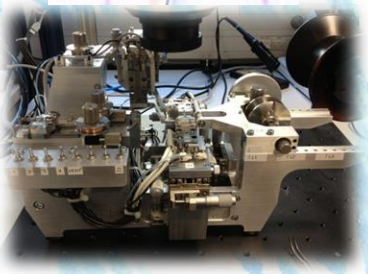
Invisible, inseparable, durable, easy to integrate into textiles and plastics



The E-Thread® technology

From semiconductor…to textile
… through micromechanics

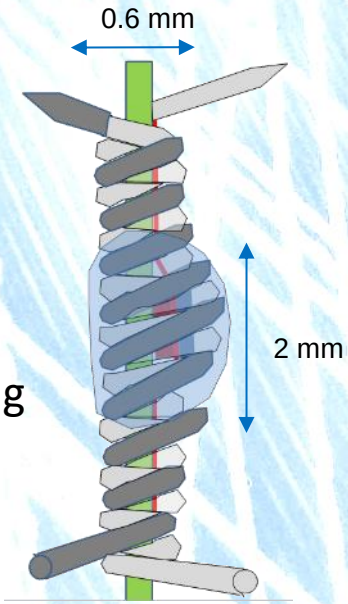




A competitive technology for high volume manufacturing.

E-Thread® RFID Product

- Carrier Wire (Core)
- S Covering Yarn
- Z Covering Yarn
- Polymer Protective Coating



E-Thread® Yarn

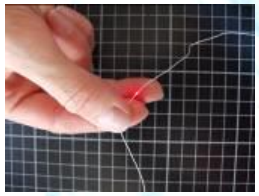
RFID UHF Tags : How to compare?

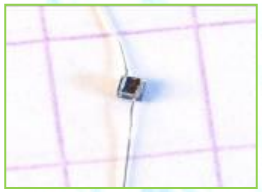
95mm x 8.2mm x 0, 2mm

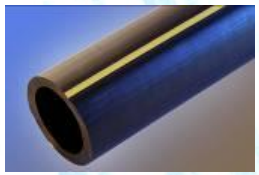
190mm x 0, 1mm x 0, 1mm

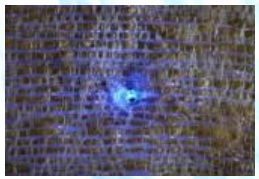
- E-Thread® versus prior art :
  - **Inalterable** : being buried inside the material, the tag remains strongly protected
  - **Inseparable** : cannot be untied from the material/object it belongs to.
  - **Imperceptible** : cannot be easily detected – so tiny it will not alter the material

Application Fields

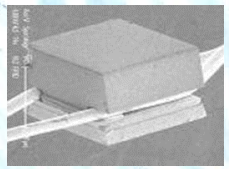








- Function is defined by the chip



  - Today : RFID
    - RFID applications (traceability, inventory, anti-counterfeit/anti-theft, process automation, IoT, web-link)
  - Tomorrow : Sensors Chip:
    - Unlimited applications (sensing, actuating, monitoring)

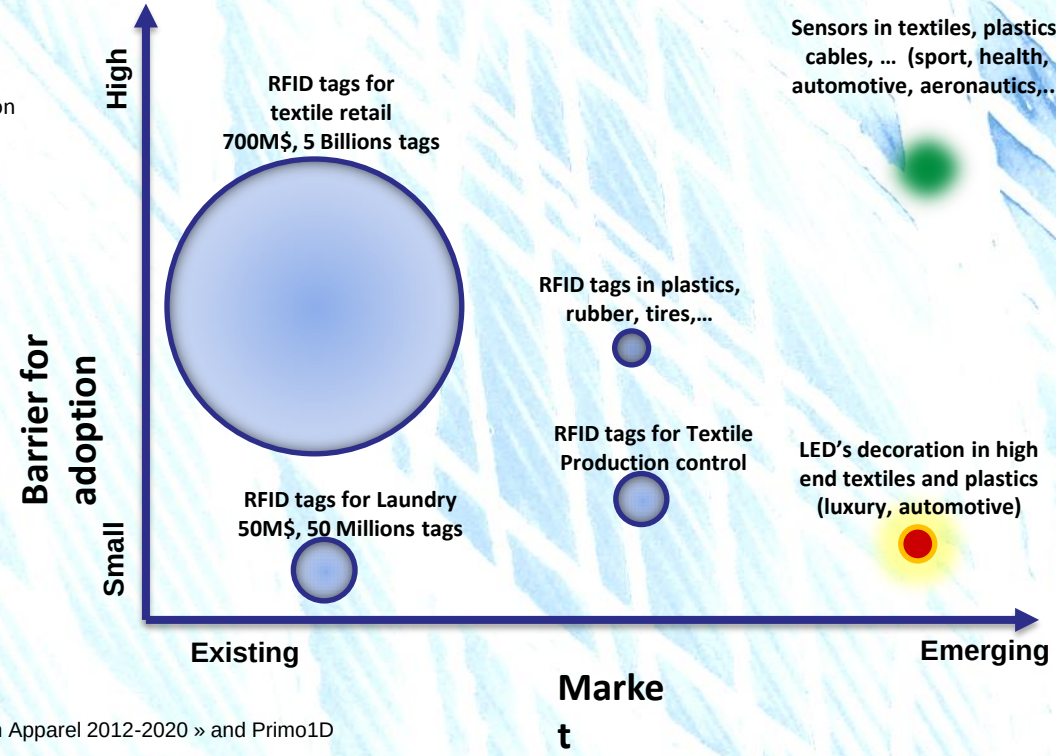
    like : SHM, Sensing Materials, In-Situ process monitoring

A world of applications

Traceability
Supply Chain optimization
Inventory management
Anti-theft
Anti-counterfeiting
Production control
Customer shopping experience

Decoration
LED's lighting effects

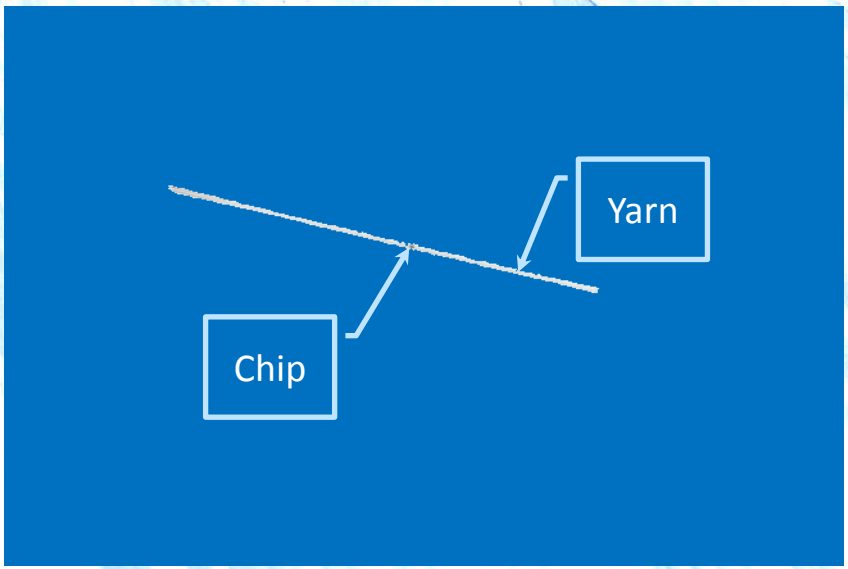
In Situ Monitoring
Health and Sport monitoring
Preventive maintenance



Source: IdTechEx « RFID in Apparel 2012-2020 » and Primo1D

How does the product look like?

- Our first application is clearly traceability, with RFID as E-Thread® Chip in a yarn, dedicated for the industrial laundry market.
- This product is conditioned under the form of a yarn as shown beside.
- The chip is so small and so well integrated that it's difficult to show a nice picture of it.



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- This product is conditioned under the form of a yarn as shown beside
- The chip is so small and so well integrated that it’s difficult to show a nice picture of it
- But we try.

avantex innovationprize.2013 new materials

Company profile

- Created in August 2013, a spin-off from CEA-Leti,
- We turn material smart by embedding electronics in a unique form factor,
- A world of applications for RFID traceability, LED decoration and Smart sensors,
- A unique technology at the crossroads of microelectronics, micromechanics and smart packaging domains,
- A senior management team from the industry,
- An industrial model with strong partnerships and ecosystem.
- First production : Q4-2015

Our Mission & Vision

A unique solution for traceability, anti-theft, anti-counterfeiting, in situ measurement and decoration…

…thru a sparkle of intelligence at the heart of *materials and objects, from creation to recycling…*

… to become leader in the domain of embedded electronics into textile and plastic materials.

Primo1D

The E-Thread® Company

Thank you for your attention!

Winner 2012 « Emergence »

Winner 2013 « Créa/Dév »

Rhône-Alpes Terre d'Innovation
Les Trophées Bref Rhône-Alpes 2014

avantex innovationprize.2013
new materials

HEC PARIS
Best Business Plan Challenge + 2012-2

14e TREMPLIN ENTREPRISES
Laureate 2013