

【 ISIM2011 】

Toward a  
Promising  
Future 

***“Total Solution for MEMS Application”  
~ Relations with Worldwide Nanotech Centers ~***



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Chairman  
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10th February, 2011

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PR-1050

- **MEMS Process Technology, Device and Systems**
- **SPP Process Technology Systems (SPTS)**
- **Relations with Worldwide Nanotech Centers**

# **MEMS**

## **Process Technology, Device and Systems**

## (Key Technologies for MEMS Development)

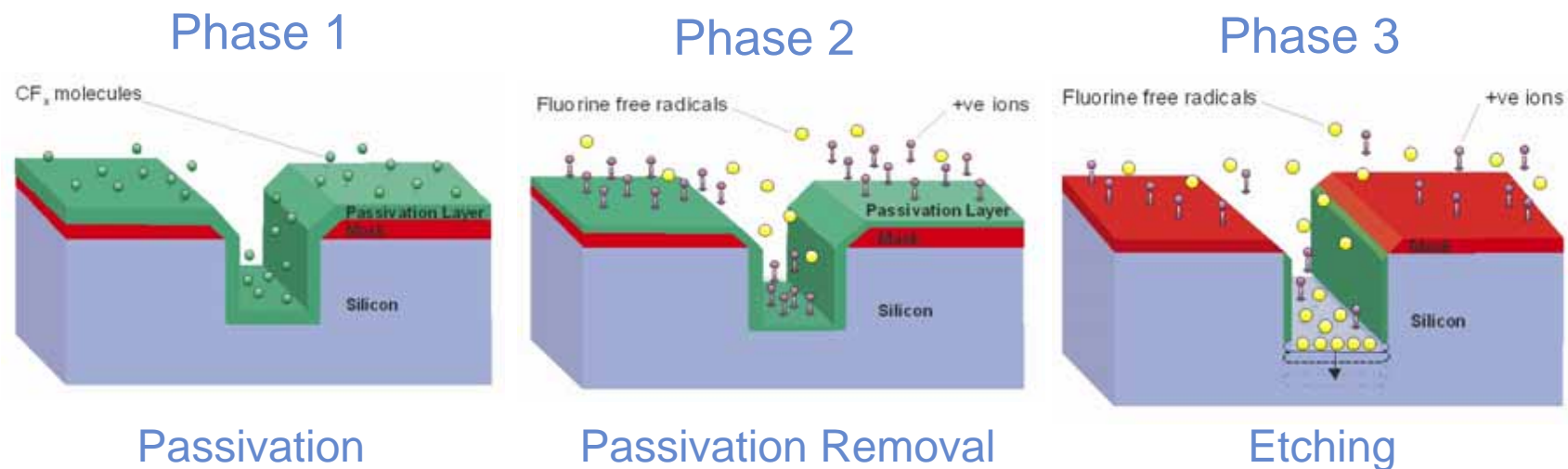
- **Deep Silicon Etching**  
**enabler= DRIE (ICP + Bosch Process)**
- **Sacrificial Layer Etching**  
**Enabler = Si (XeF<sub>2</sub>) / SiO<sub>2</sub> Gas Etcher**

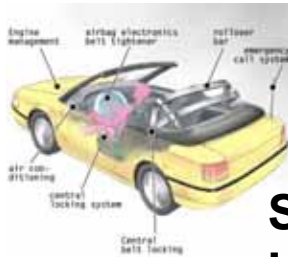
**R&D and Commercialization by SPP/SPTS**

- **Wafer Bonding**  
**Enabler = Anodic Bonding**

# Advanced Silicon Etch (ASE)<sup>®</sup>: A Pioneering Solution

- SPTS is Synonymous with the MEMS industry!
- In 1994, we began working with Robert Bosch to develop a production version of an Etch Process that they had patented.
- This became known as the Advanced Silicon Etch Process (ASE<sup>®</sup>)
- This was an enabling technology in MEMS manufacturing
- Today >95% of MEMS manufacturers use this technique





**Silicon  
Inertial  
sensors**



**Ink Jet heads**



**Optical  
MEMS  
switching**

**RF MEMS  
De-coupling  
capacitors**



**Advanced  
Packaging**



**Micro Fluidics  
'Lab on a chip'**



**MEMS Pressure  
sensors**



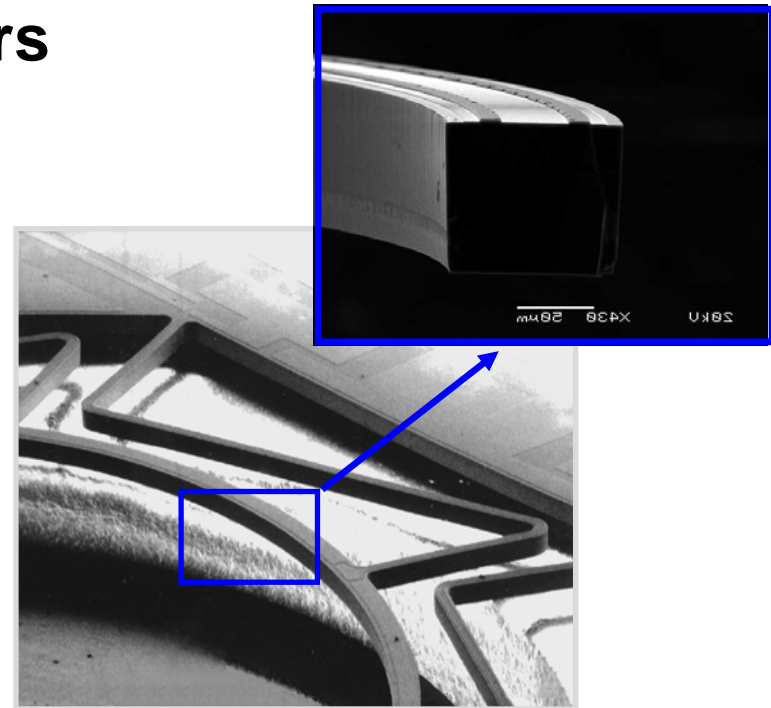
**Power  
Devices**



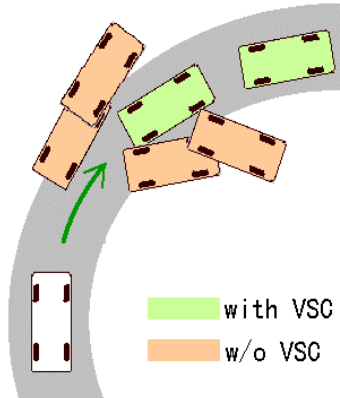
# ***MEMS Commercial Applications***



- **Silicon Sensing Systems Angular Rate Sensor**
  - **Si MEMS Bulk Micromachining with DRIE**
  - **Its Unique Si MEMS Ring Structure**
- **Features**
  - **Accurate up to 50x than others**  
**(automotive condition)**
  - **Robust for shock & vibration**
  - **Long life**
  - **Operating temperature**  
**-40 ~ +85**



## Application for Automotive



**VSC : Vehicle Stability Control**

## Segway HT



**Balanced Sensor Assembly  
(XYZ+2units)**

## Application for Aircraft



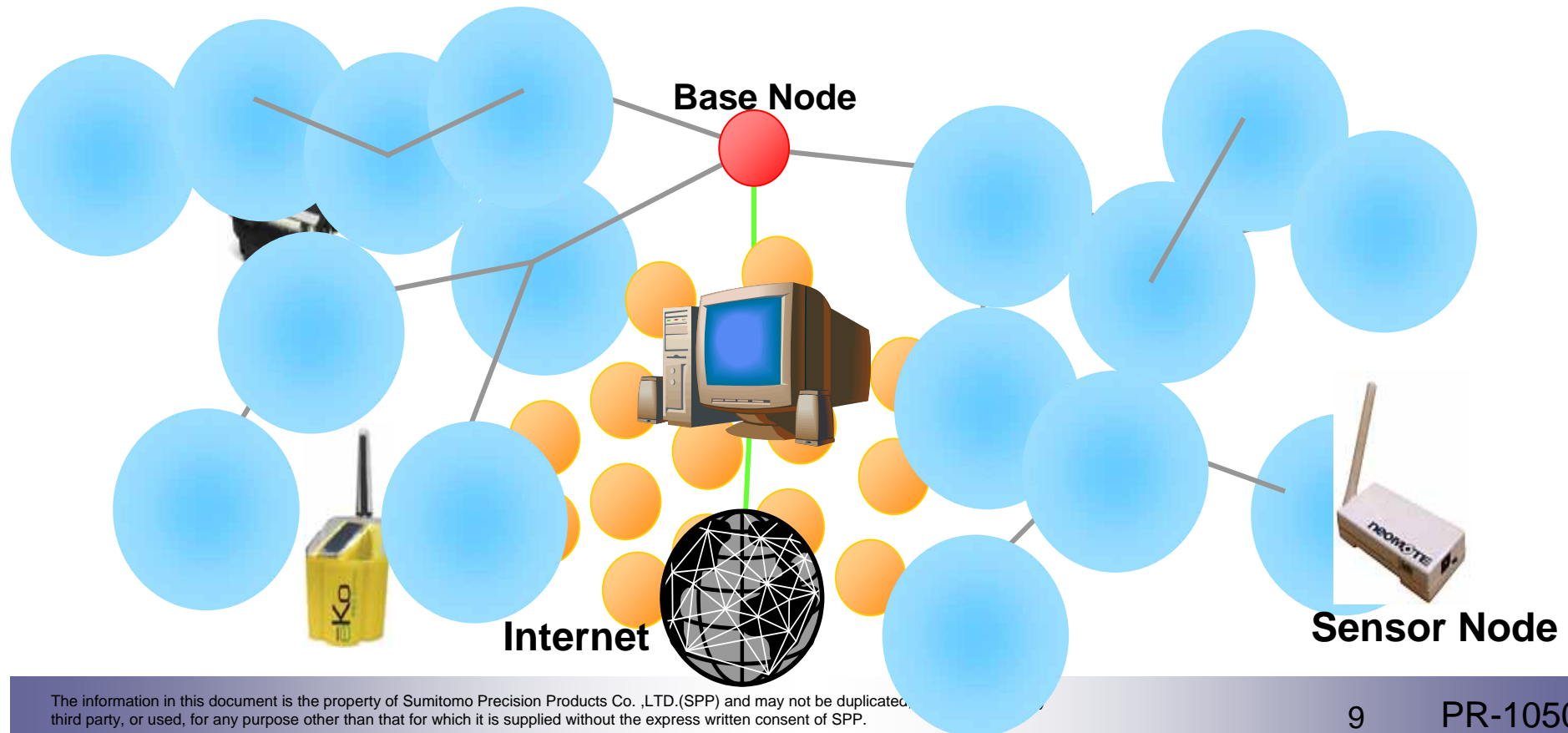
**Flight Navigation Systems**



**Unmanned Helicopter Control**



- Each sensor node forms multi-hop wireless route to the base station;  
AND self-heals.
- Saves wiring costs on industrial metering or energy-saving system.  
Because of wireless, a layout change requires no re-wiring costs.
- SPP/Crossbow's NeoMOTE has numerous deployment cases in various situations: proven immunity in communication robustness.



Wireless monitoring the electric power, temp etc  
--> Control the energy saving (Smart Grid)



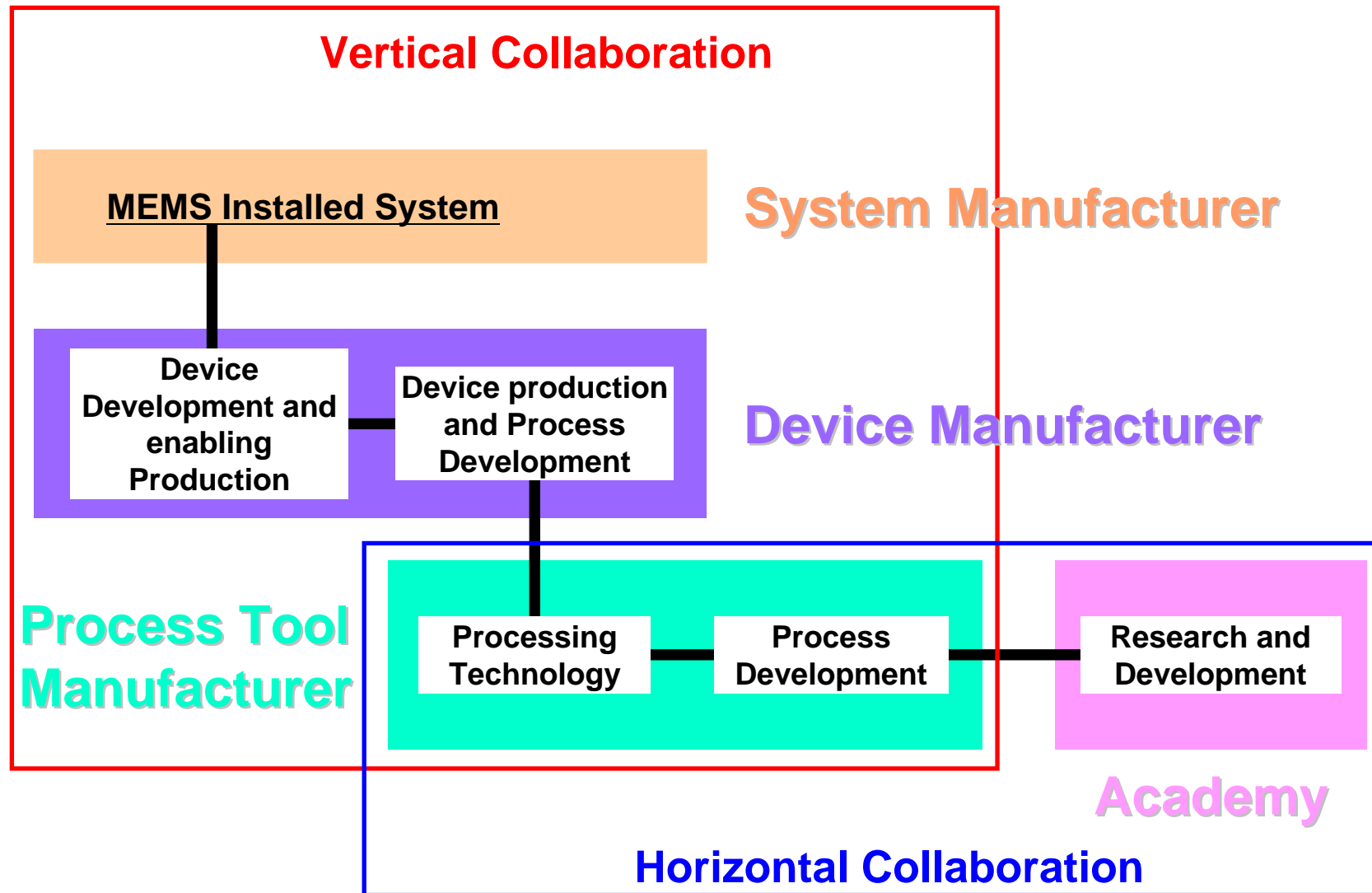
**Information by mail alarm**



Wireless monitoring the temp and vibration without circuter

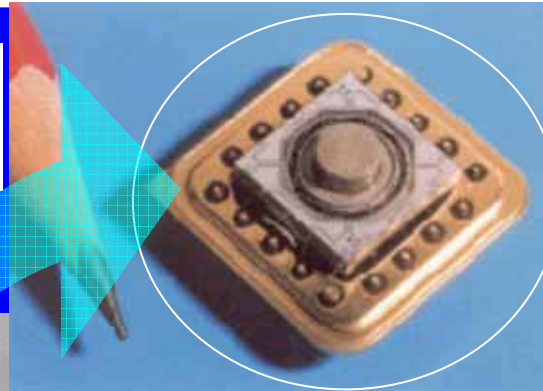
Monitoring the state of conservation



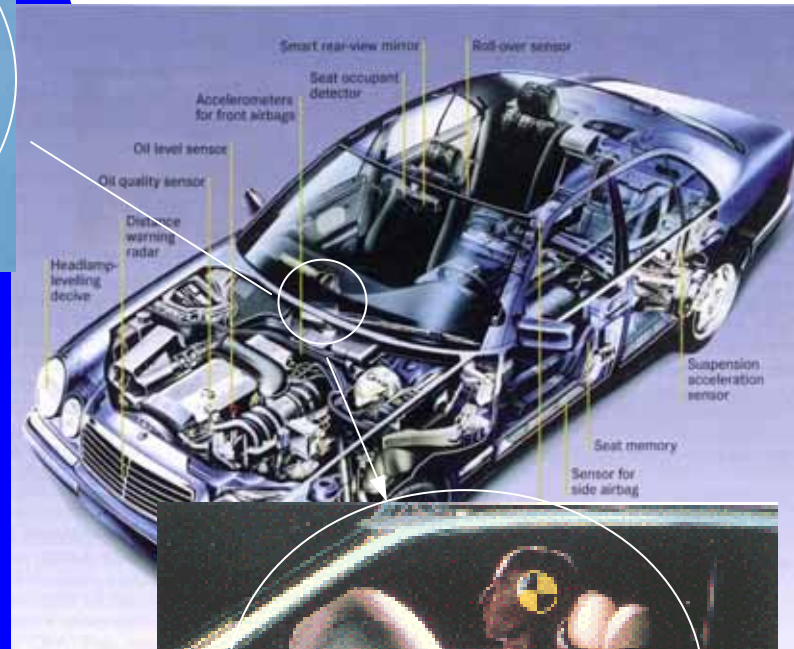




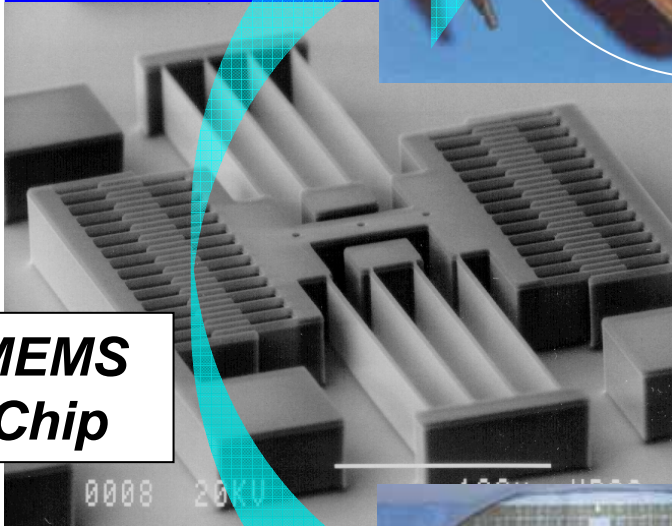
**Packaged device**



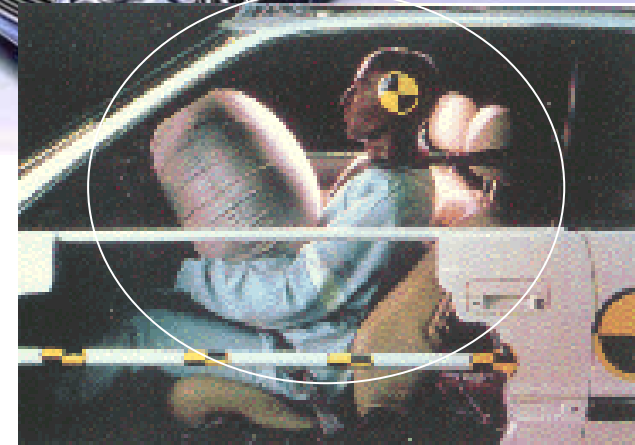
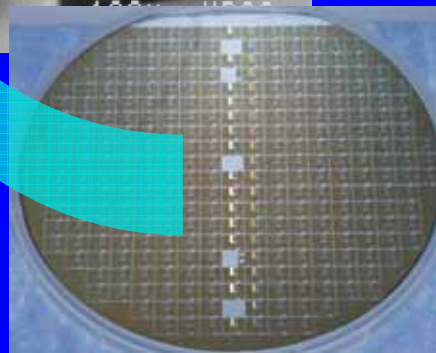
**System integration**



**MEMS Chip**



**Si wafer**



**Application**

- **MEMS Sensors can be enabler to contribute for Society ;**
  - **Environment      (Sensor Network)**
  - **Energy              (Energy Harvest)**
  - **Security             (Sensor Network)**
  - **Life                   (Bio Technology)**

# **SPP Process Technology Systems (SPTS)**



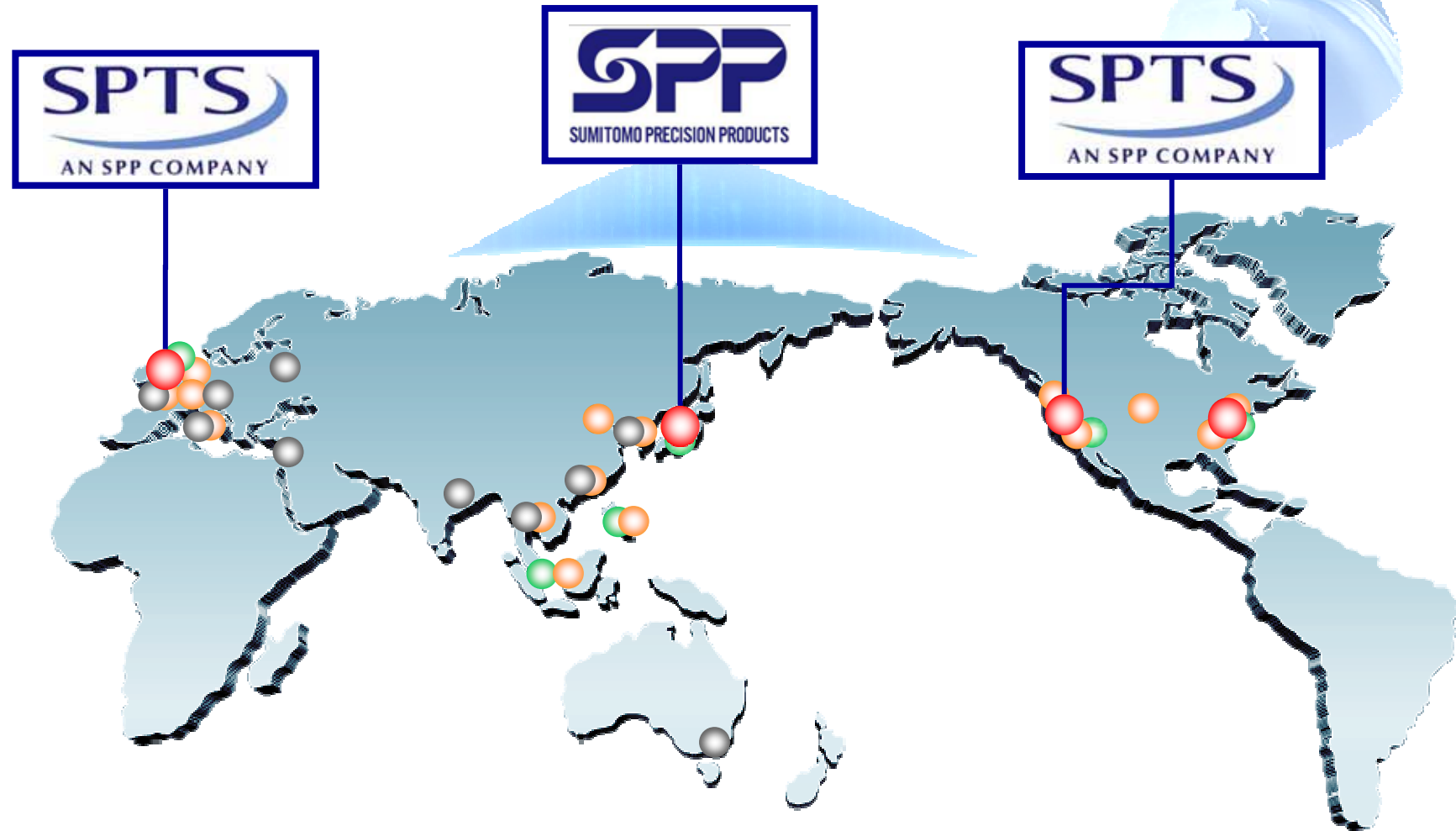
- **Optimized processes as package solution for MEMS/Semiconductor production can be provided through new formation by SPP Group**
  - SPP Process Technology Systems (SPTS) is newly formed in October, 2009
  - Acquired former Aviza business and Surface Technology Systems (STS) are integrated under SPTS formation
  - Primaxx transferred from SPP to SPTS in December, 2010



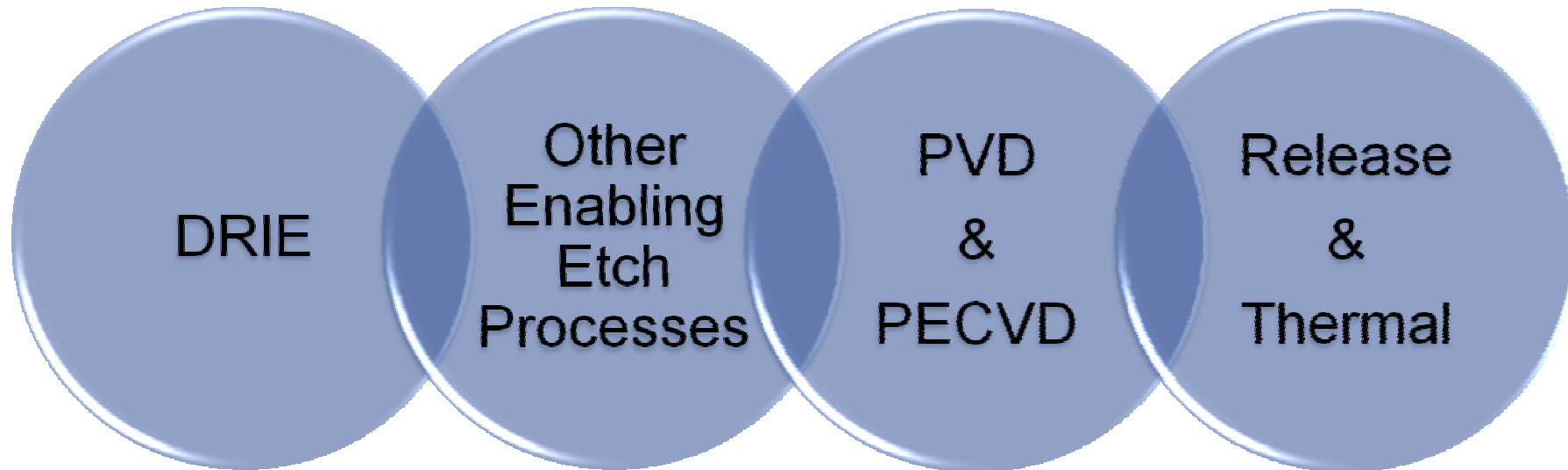
# Much Stronger Global Presence - SPP/SPTS MEMS Related Business

Worldwide Locations **35**

Workforce **~500**



**● Headquarters / Factories**   **● Sales offices**   **● Service Centres**   **● Sales Representatives**

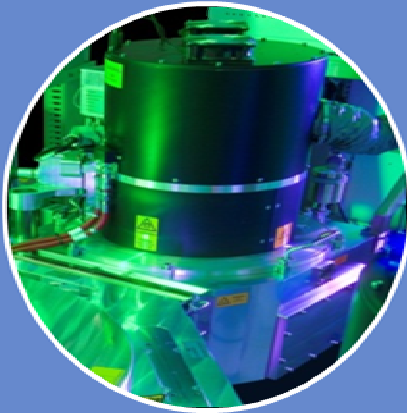


Deep High Rate Etch  
 HAR Feature Etch  
 Smooth Sidewall Etch  
 SOI Applications

Positive Profile Si Etch  
 Non-Bosch Si Trench  
 SiO<sub>2</sub> Etching  
 Polymer Etch  
 SiC Etch

Barrier / Seed PVD  
 Metal PVD  
 Thick Al Deposition  
 Low Temp TEOS  
 Low Stress SiNx  
 MOCVD

HF SiO<sub>2</sub> Release  
 XeF<sub>2</sub> p-Si Release  
 Low Stress Nitride



**ETCH**  
DRIE/ICP/Dielectric  
Etch/HF



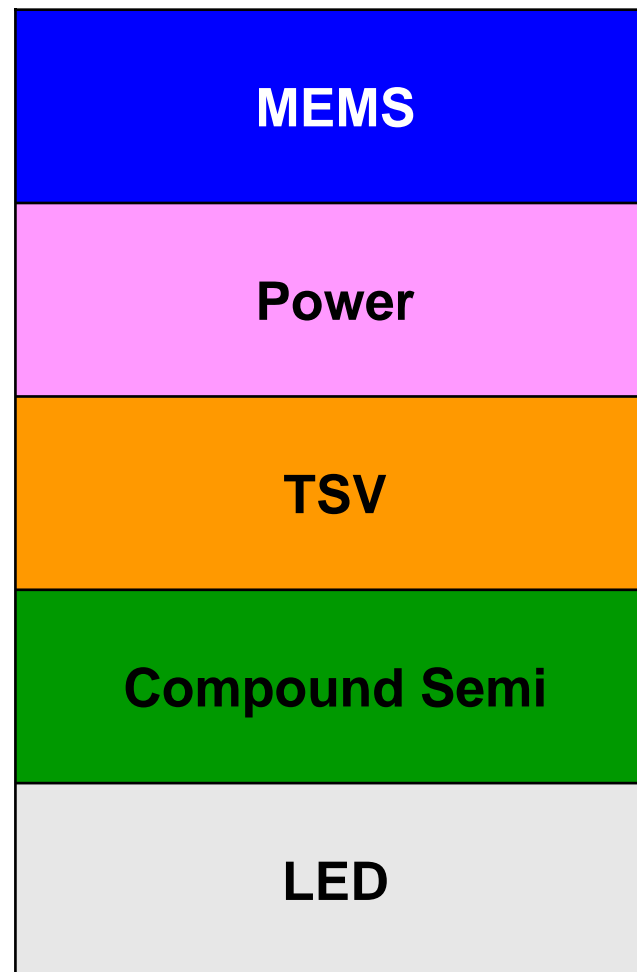
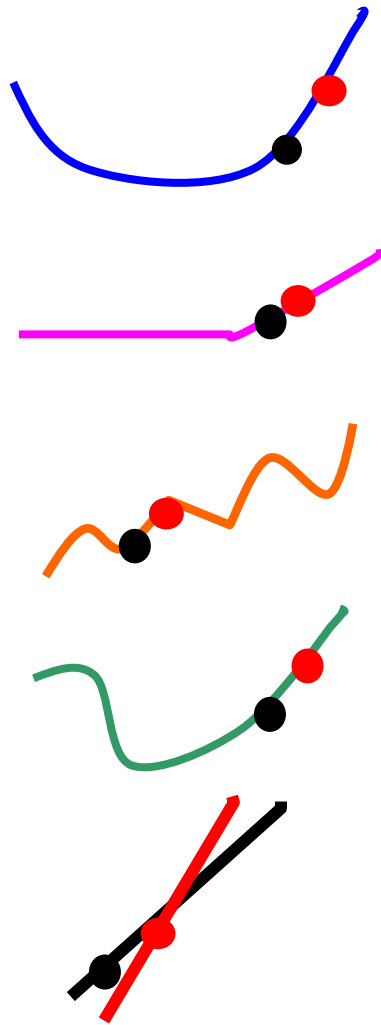
**DEPOSITION**  
PVD/PECVD/IBD/AP  
CVD



**THERMAL**  
150-300 mm Systems

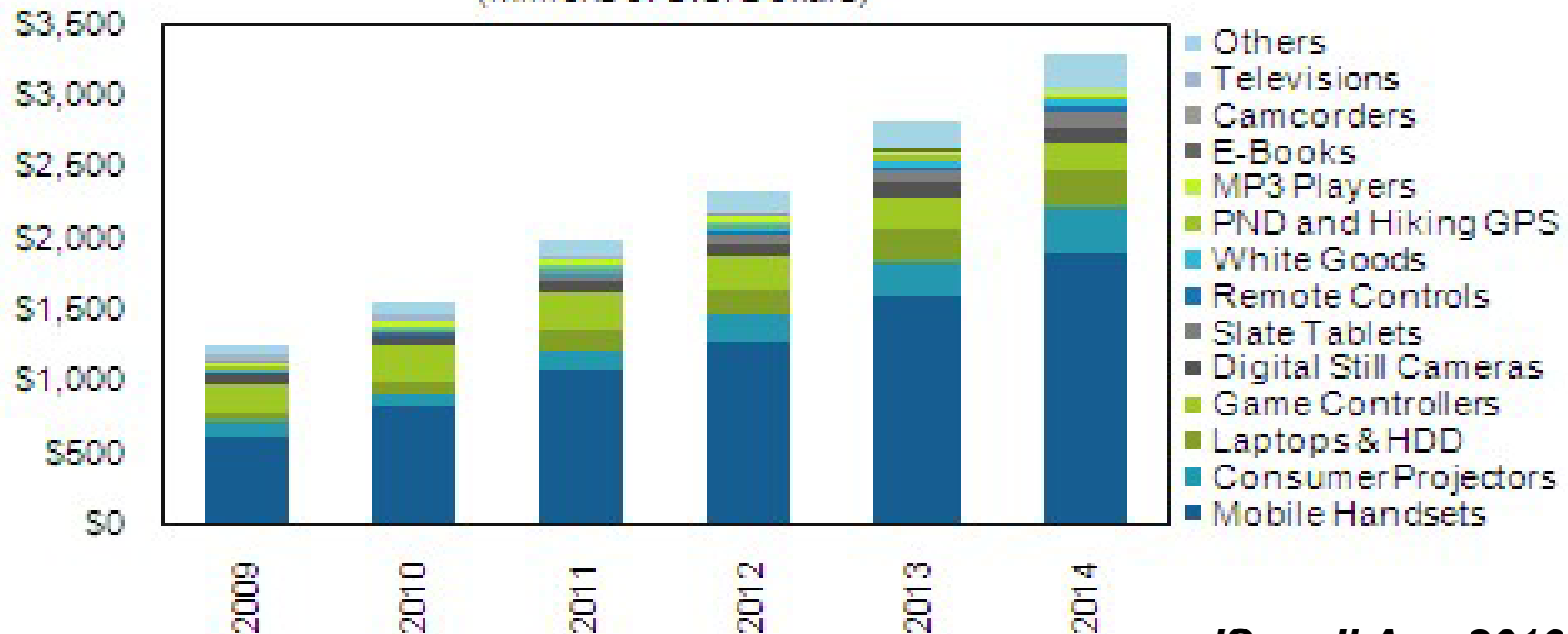
**Served Markets – MEMS/Compound/SEMI/Advanced  
Packaging/Targeted FEOL**







Consumer and Mobile MEMS Revenue by Application  
(Millions of U.S. Dollars)

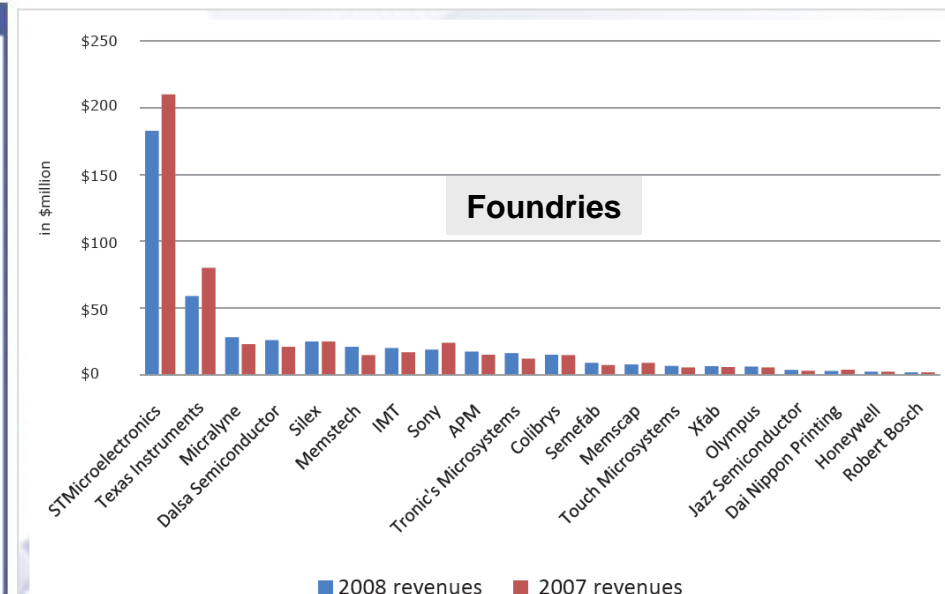
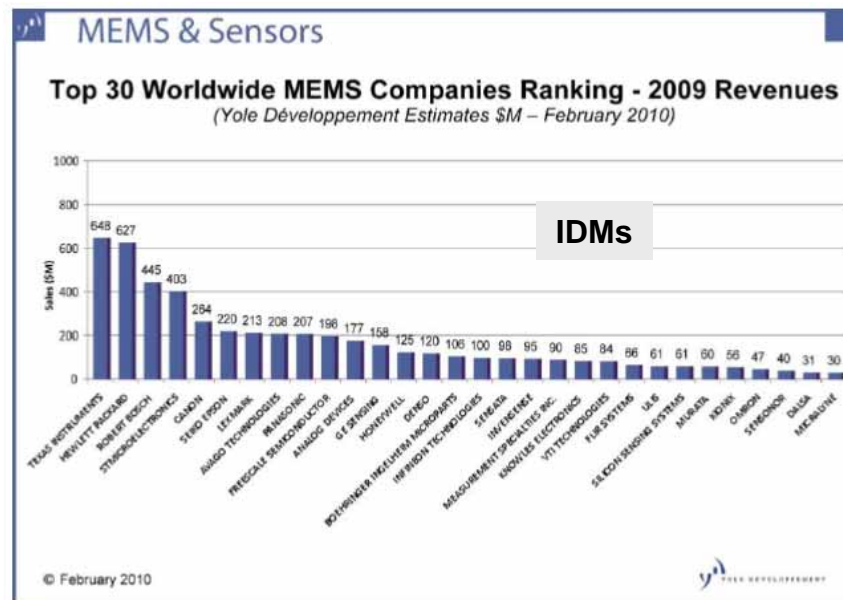


*iSuppli Aug 2010*

## ■ Consumer and Mobile MEMS drive the market

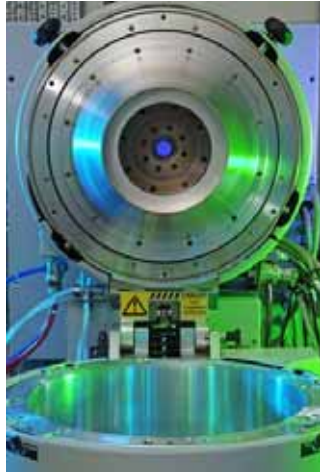
–Super smart phones, tablets, e-books...20% CAGR through 2014

- SPTS/SPP supplies 26 out of the top 30 MEMS companies
- SPTS/SPP supplies 19 out of the top 20 MEMS Foundries
- >75% market share WW



SPTS processed  
chip-sets in ...



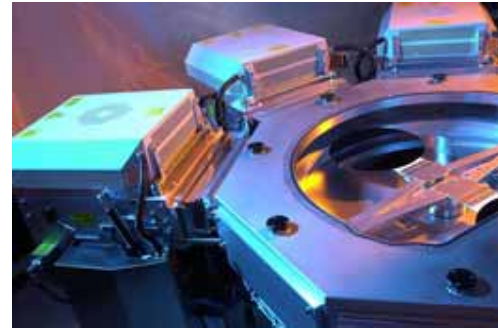


**Si DRIE**



**XeF<sub>2</sub>**

Plasma-less, dry,  
isotropic Si release  
etch (XACTIX)



**PE-CVD**

Plasma Enhanced CVD



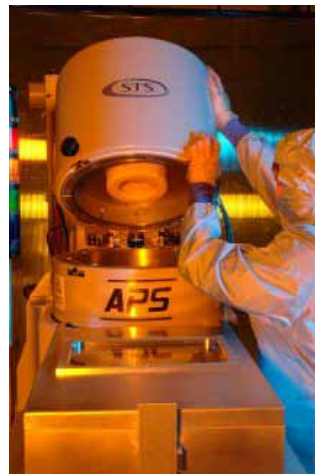
**Furnace**

Thermal Batch



**HF**

Plasma-less, dry,  
isotropic SiO<sub>2</sub>  
release etch



**Dielectric Etch**



**ICP**

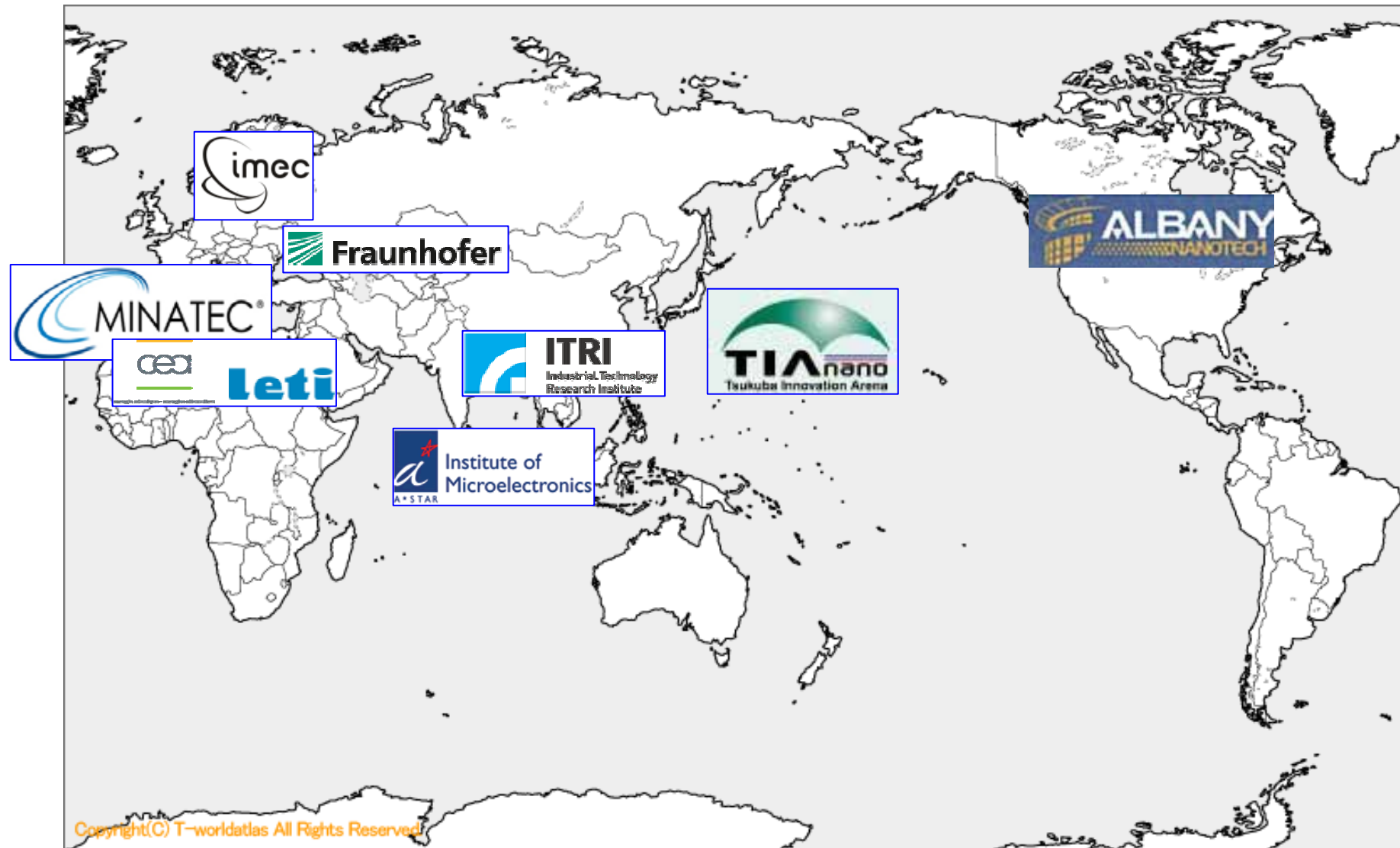
Standard rate  
Inductively  
Coupled Plasma  
Source



**PVD**

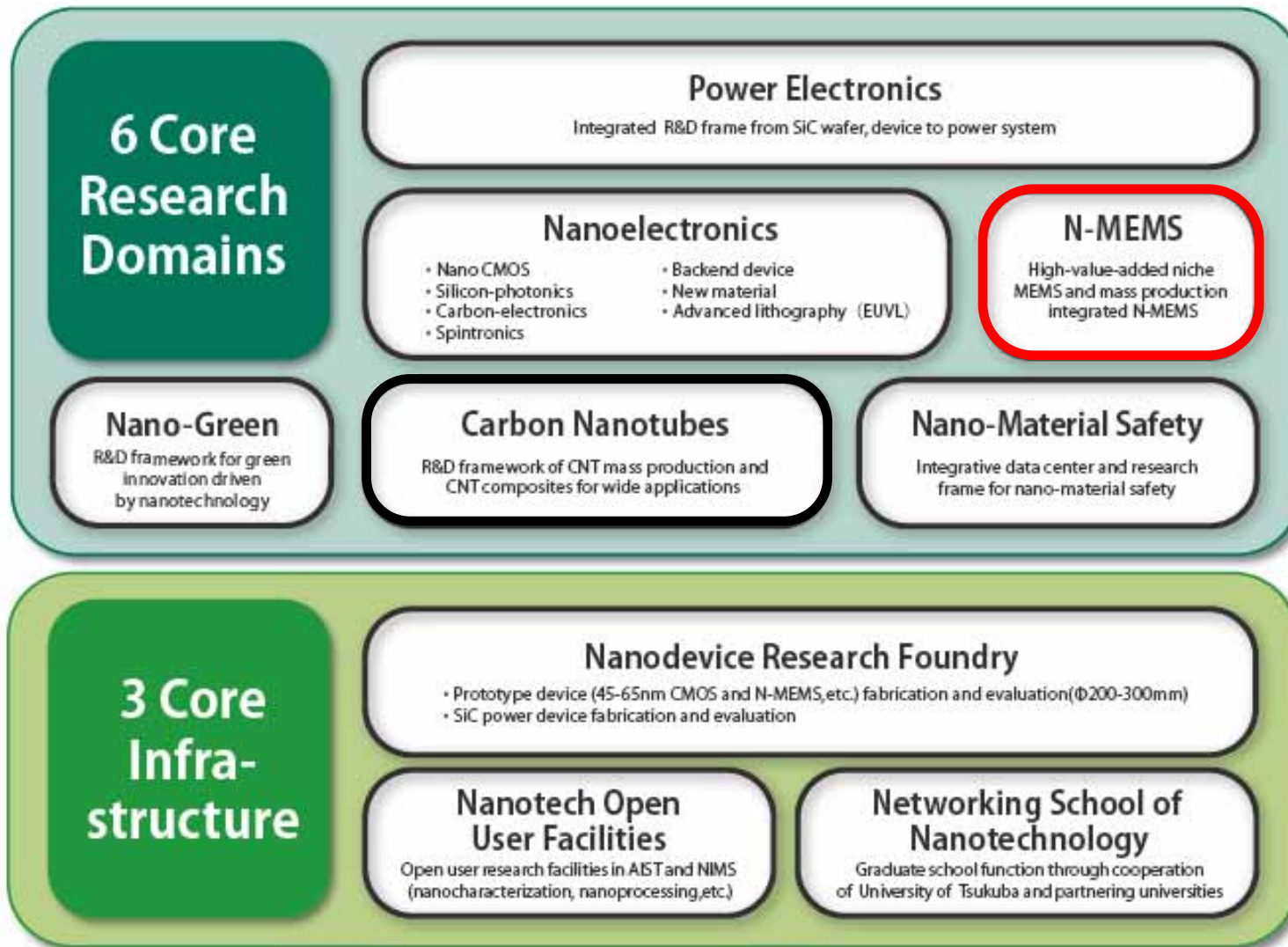
Physical  
Vapour  
Deposition

## **Relations with Worldwide Nanotech Centers**



# **Tsukuba Innovation Arena (TIA)**





[http://tia-nano.jp/brochure/TIA\\_e.pdf](http://tia-nano.jp/brochure/TIA_e.pdf)

## SPP installed 3 systems to TIA N-MEMS for prototyping service for rapid from R&D to production

**Si Deep RIE**  
**「VPX Pegasus300」**



**Si Deep RIE**  
**「MUC-21 Pegasus」**



**Scanning Probe Nano  
Lithography**  
**「MPS-1000」**



# Collaboration between CEA-Leti and SPTS/SPP

**07/10/2010- CEA-Leti and SPTS to collaborate on next-generation TSV development**

*Leading Research Institute and Equipment Maker to Develop New Process Technologies for 3D-ICs*

**TOKYO, Japan, and GRENoble, France – Oct. 6, 2010** – CEA-Leti and SPP Process Technology Systems (SPTS) today announced an agreement to develop advanced 300mm through-silicon via (TSV) 3D-IC processes at CEA-Leti's 300mm facilities in Grenoble, France. The agreement defines their collaboration on a range of 3D TSV processes to optimize etch and deposition technologies used to create next-generation high aspect ratio TSVs.

The partners will research alternative hardware and processes to address the need for new methods of cost-effective via fill. In some via-middle applications, where the via is created between contact and first back end of line (BEOL) metal layer, via aspect ratios may extend beyond 10:1, and these very high aspect ratios require a new approach to current etch and deposition techniques.

- **Strategic alliances between tool vendors and technology developers will accelerate 3D-IC development**



Laurent Malier (CEO CEA-LETI) & Susumu Kaminaga (President SPP & Chairman SPTS) signing the agreement in Oct 2010; receiving the first Leti 300mm wafer in Jan 2011



Toward a Promising Future

**SPP** Group

SPTS

SPP

Primaxx

***Thank you for your attention !***

JP : Sumitomo Precision Products Co., Ltd.

UK : SPP Process Technology Systems Ltd.

US : Primaxx Inc.