On-chip Bio-sensing System using Silicon Nanophotonic Devices

Presented

by

Ray T. Chen

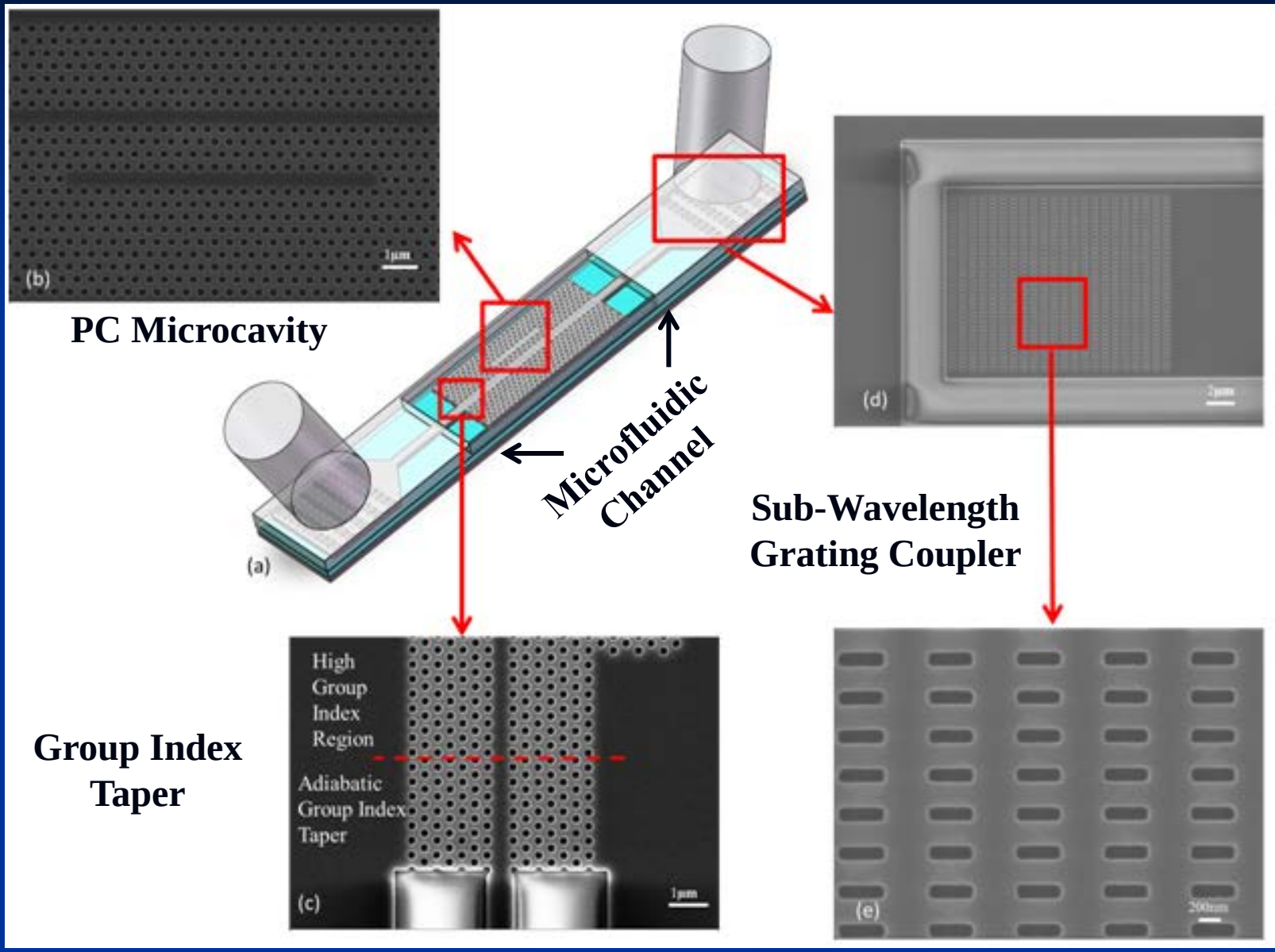
Omega Optics

9/11/2014

Brief History

- Founded in September 2001
- Omega Optics (OO) has been actively involved in optical communications/interconnects research/development work where arrays of products have been developed from internal R&D and SBIR/STTR efforts. Polymer based planar lightwave circuit (PLC), dense wavelength division multiplexers (DWDM)
- Raised 18 million dollars to commercialize photonic devices
- Within the last five years, we have focused on biosensing and environmental sensing using silicon photonic devices

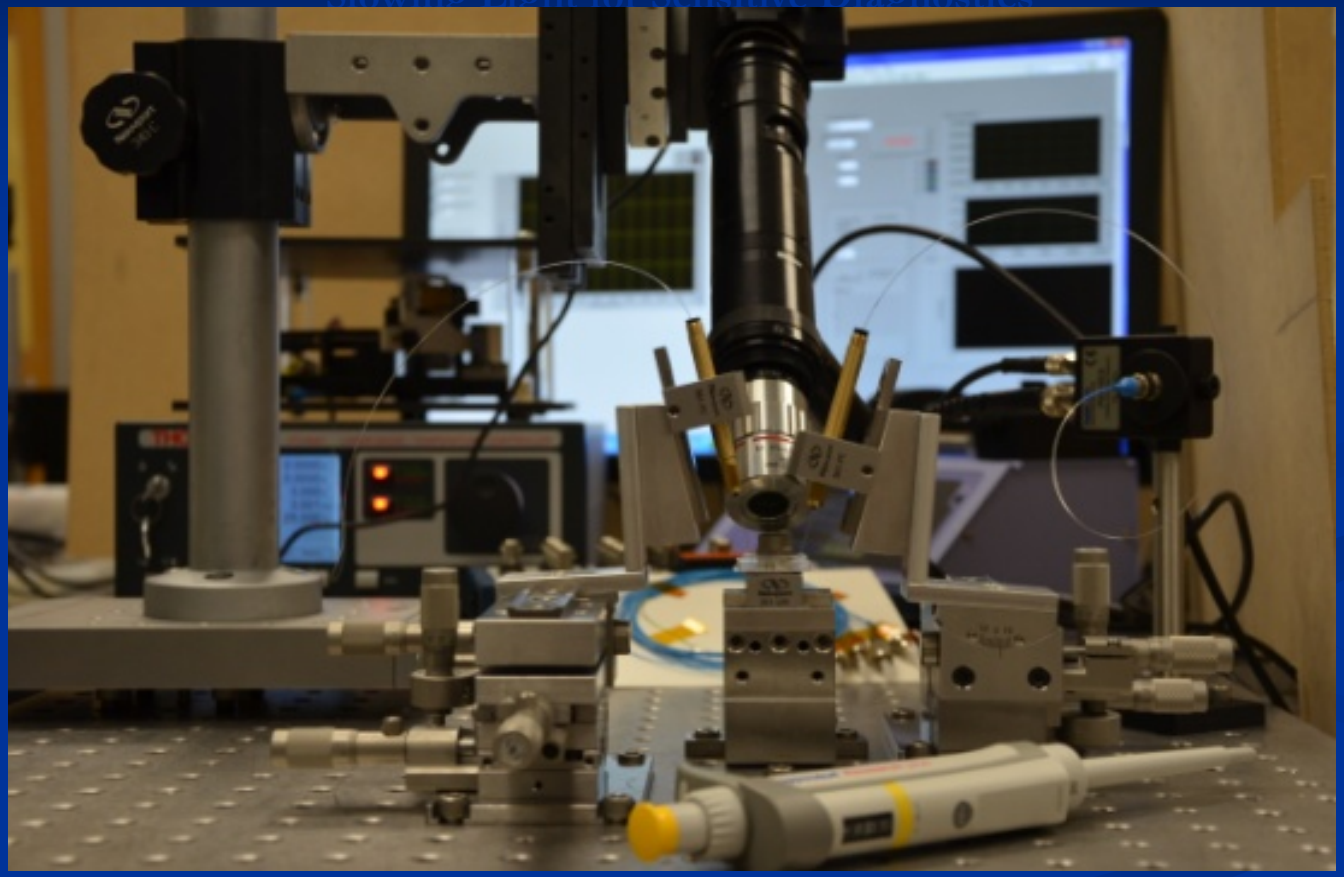
The Sensor on a System Level



Low Cost of Ownership Chip-Integrated Microarray for High Throughput Highly Sensitive Highly Specific Cancer Detection

Omega Optics Inc., Austin, TX

Slowing Light for Sensitive Diagnostics

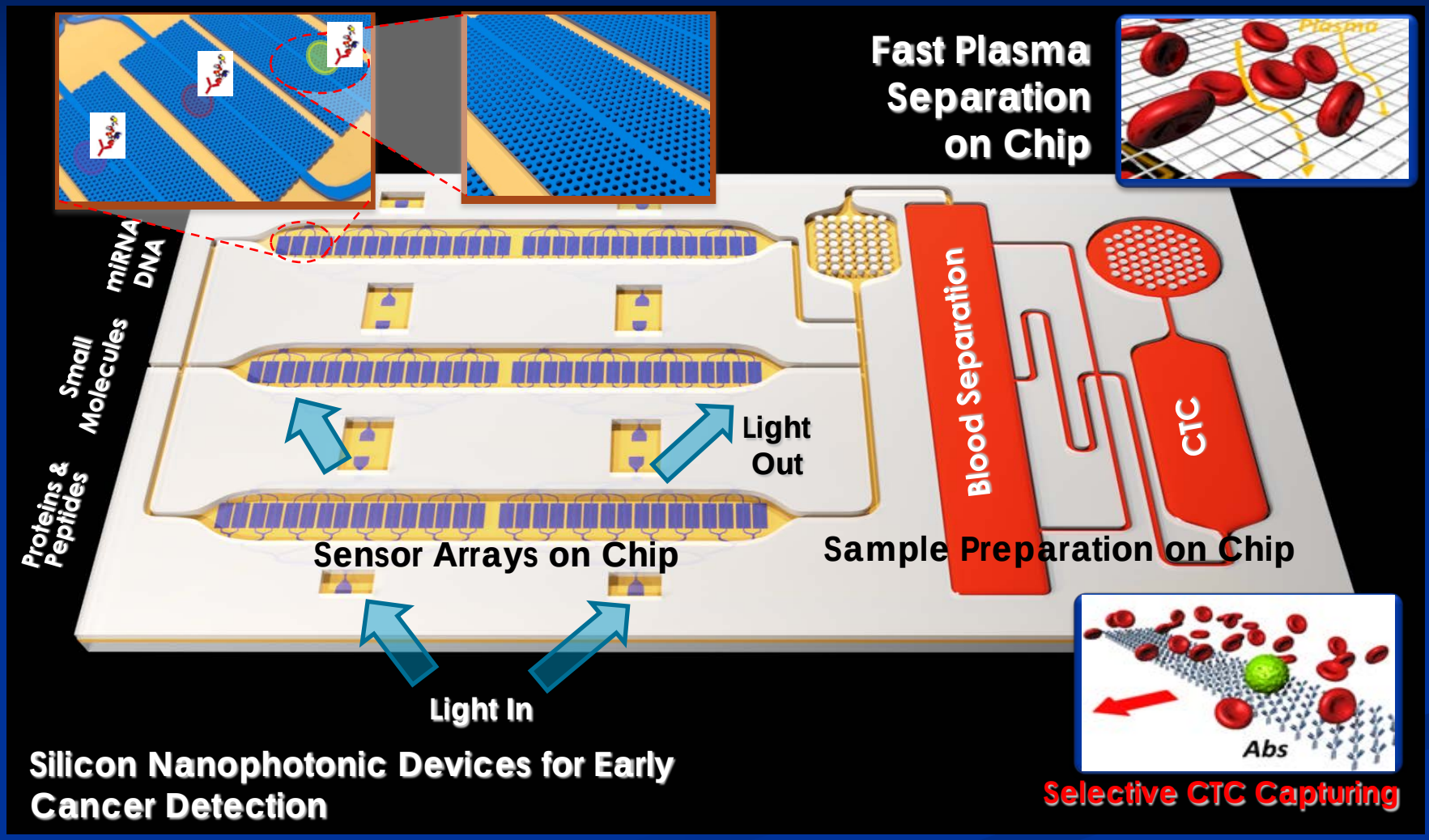


Prototype system demonstrated at a Symposium of Chinese American Biologists at Baylor College of Medicine in May 2013

Translation to portable platforms possible

Contact: Dr. Ray Chen, CTO, ray.chen@omegaoptics.com, 512-825-4480

Integrated Sample Preparation and Sensors on a Chip with User-Friendly Machine-Human Interface



Issued Patents

1. “Photonic Crystal Microarray Device for Label-free Multiple Analyte Sensing, Biosensing and Diagnostic Assay Chips,” Patent 8293177 (Issued: 10/23/2012) US Patent and Trademark Office (2009). (Omega Optics Inc.)
2. “Photonic Crystal Slot Waveguide Miniature On-Chip Absorption Spectrometer,” Patent 8282882 (Issued: 10/09/2012) US Patent and Trademark Office (2010). (Omega Optics Inc.)
3. “Method for Label-Free Multiple Analyte Sensing, Biosensing and Diagnostic Assay,” Patent Application # 13607791, US Patent and Trademark Office (2012). (Omega Optics Inc.)
4. “Method for the Chip-Integrated Spectroscopic Identification of Solids, Liquids, and Gases,” Patent Application # 13607792, US Patent and Trademark Office (2012). (Omega Optics Inc.)
5. “Packaged chip for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity,” Patent Application # 13607801, US Patent and Trademark Office (2012). (Omega Optics Inc.)
6. “Photonic Crystal MicroArray Layouts for Enhanced Sensitivity and Specificity of Label-Free Multiple Analyte Sensing, Biosensing and Diagnostic Assay,” Patent Application # 13607793, US Patent and Trademark Office (2012).
7. “Fabrication Tolerant Design for the Chip-Integrated Spectroscopic Identification of Solids, Liquids, and Gases,” Patent Application # 13607794, US Patent and Trademark Office (2012).
8. “Multimode Interface Coupler for Use with Slot Photonic Crystal Waveguides,” Provisional Application 61/092,672 (2008).
9. “Broadband, group index independent, and ultra-low loss coupling into slow light slotted photonic crystal waveguides”, PCT Conversion, WO 2013/048596 A2 (2012)
10. “Subwavelength grating coupler”, Provisional Application 61/770,694 (2013).

What we need from outside Collaborators

1. Microfluidic and Automation system Engineering
2. Pilot System Manufacturing
3. Future Clinical Trial
4. Joint Venture and Potential Investors to speed up commercialization
5. Further application partners

Further Applications

APPLICATION	BIOMARKER	TARGET TYPE
Lung Cancer	IL-10 Antibody	Protein
Breast Cancer	Annexin 11 Protein	Protein
Mesothelioma	Osteopontin Antibody	Protein
Melanoma	GM3 Antibody	Lipid
AIDS	HIV Gene	DNA/RNA/mRNA
Bacteria/Virus Infection	Anti-HCV Antibody	Protein
Therapeutic Drug	Anti-Amphotericin B Ab	Protein
Signal Transduction Pathway	P53 Antibody	Protein
Cancer Stem Cell Pathway	Wnt Antibody	Protein

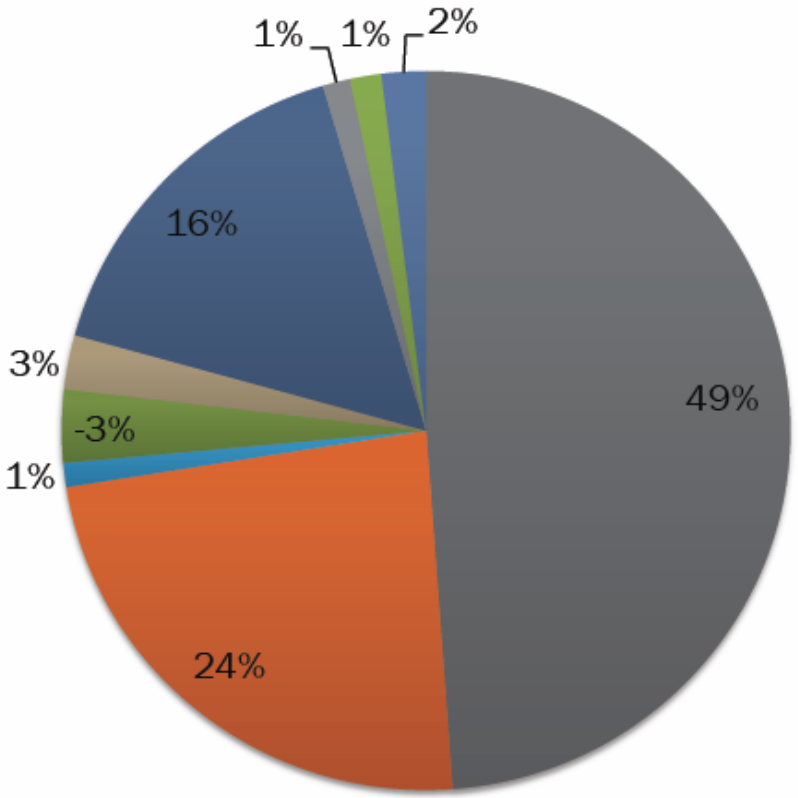
How did the company plan to traverse the “valley of death”?

Traverse Valley of Death

- Sustain the funding through non-SBIR sources to pave a longer run way
- Build the core strength through multiple grants from different agencies who need different applications
- Strengthen the patent portfolio
- Build prototypes and by products to generate early revenue through sales
- Open all possible scenarios for success

Where VC's money goes

TECHNOLOGY FORECAST: 2015

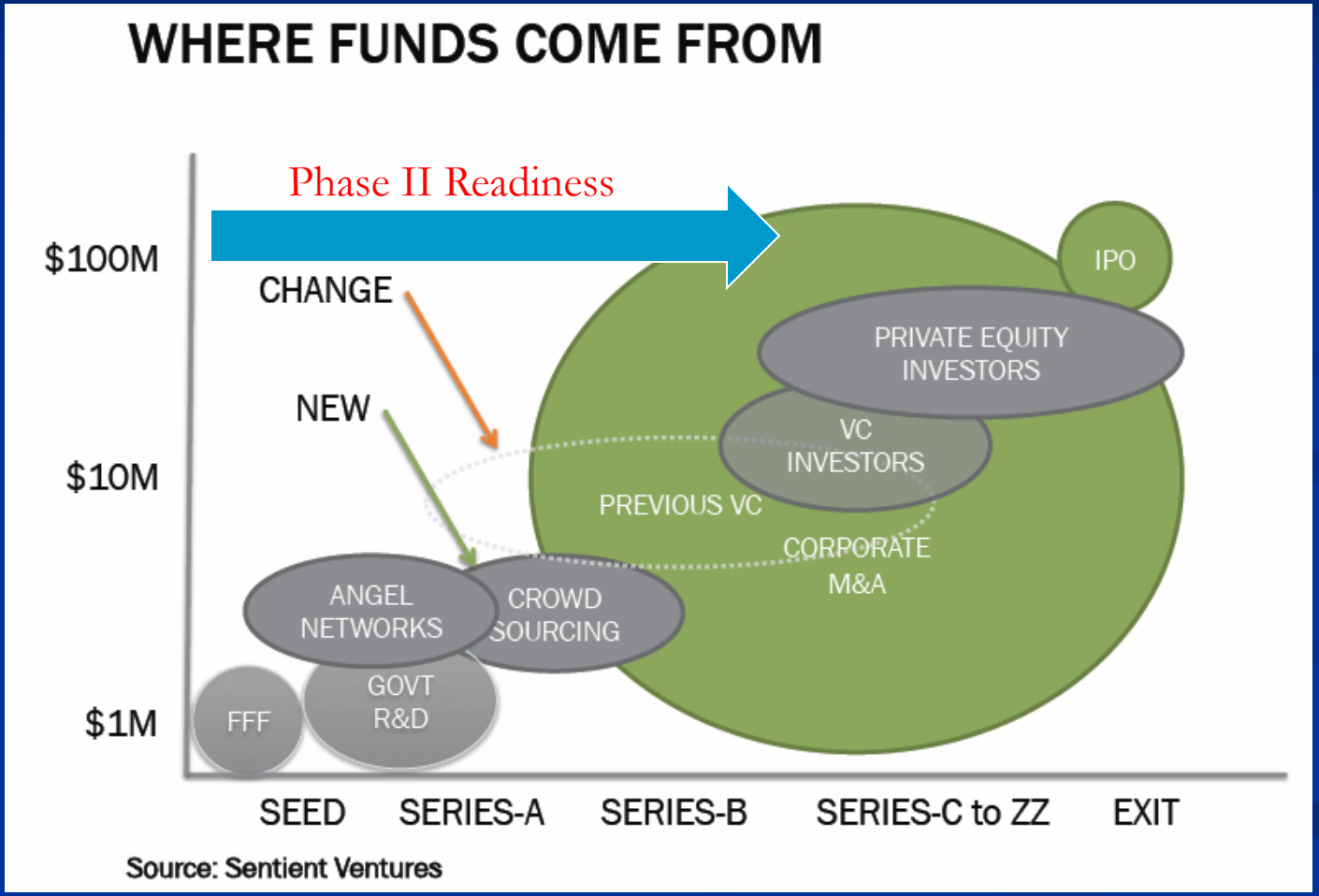


Three dominant sectors based on 3-year trend by deal count

- Internet ← 130%
- Mobile & Telecom ← 200%
- Software
- Energy & Utilities
- Computer HW & Services
- Healthcare ← 60%
- Industrial
- Automotive & Transportation
- Business Products & Services
- Electronics
- Environmental (svc & equip)
- Consumer Products & Services

Source: JFS analysis of HALO reports (2011-2013)

The gap between phase II and VC and private funding



What we need from the government

- Connect with the users and potential customers
- Provide cost effective access to nano-fabrication facility such as NNIN, OPSIS and others….
- Provide prototype manufacturing network
- System automation to make a user friendly system
- An inter-agency hot line that can help phase II company find right answers even phase II ends (traverse valley of death)

- A few questions were suggested to keep the theme of the small business presentations in-line with the scope of the meeting. These questions (below) will be discussed during tomorrow's call.

- · How was the company started? [Was it a market-based decision?]

- · How did the company traverse (or plan to traverse) the "valley of death"?

- · How did the company meet (or plan to meet) any regulatory challenges?

- · How did the company achieve (or plan to achieve) full-scale manufacturing / integration, commercialization, and utilization?

- · What lessons did the company learn that might be helpful to other nanotechnology entrepreneurs?