Introduction of the “Integrated Microsystems” project

Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST)
http://www.jsps.go.jp/english/e-first/index.html

Masayoshi Esashi　(Core researcher)

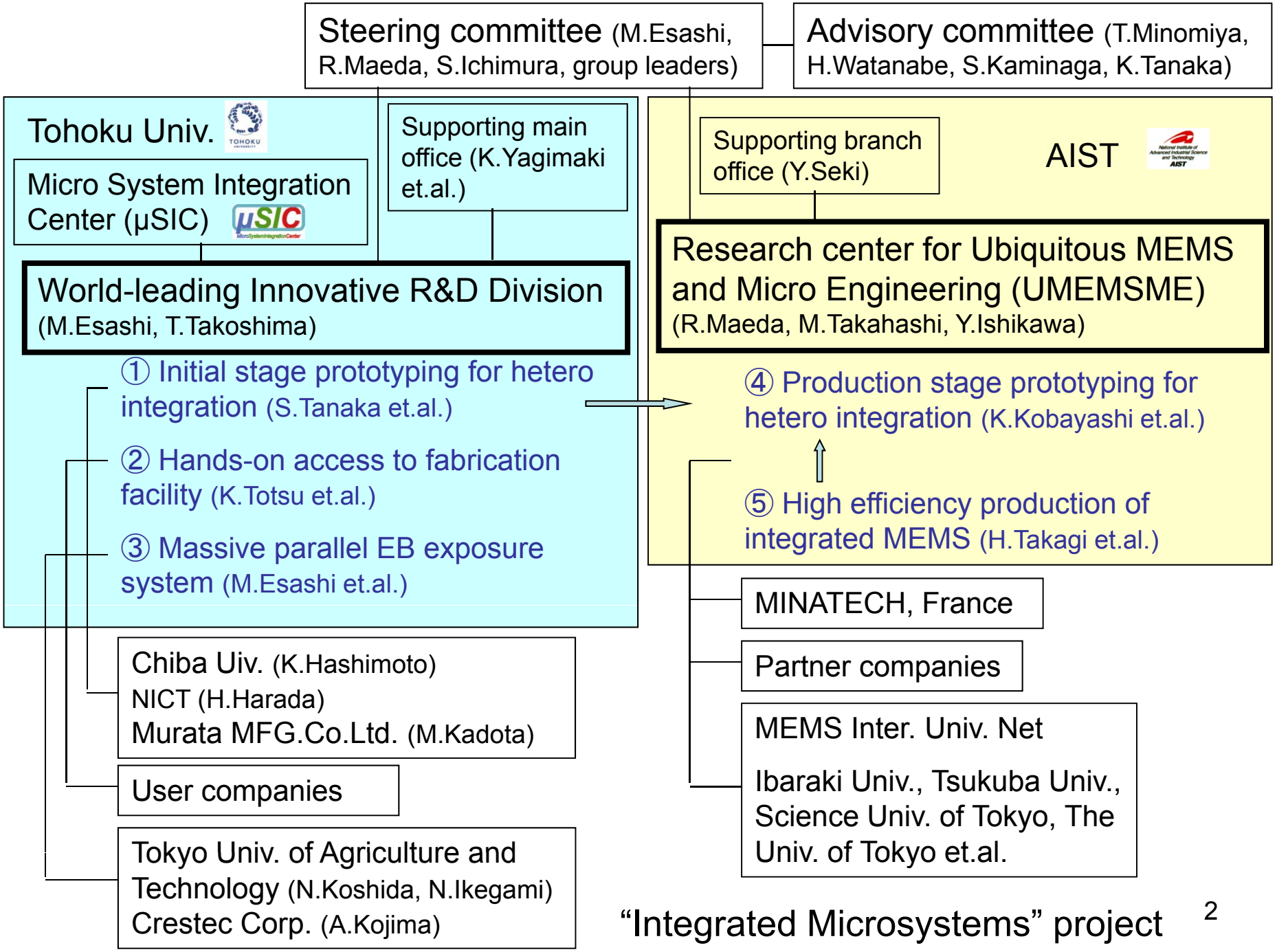
Micro System Integration Center (μSIC), Tohoku University
http://www.mu-sic.tohoku.ac.jp/

Ryutaro Maeda　(Co-core researcher)

Research center for Ubiquitous MEMS and Micro Engineering (UMEMSME),
National Institute of Advanced Industrial Science and Technology (AIST)
http://unit.aist.go.jp/umemsme/ci/

Term :　March, 2010 ~ March, 2014

Feb.10, 2010



"Integrated Microsystems" project

Technologies for health, safety and green environment.

Supporting industry for job making.

Contributions to society

「Hetero Integration」 to integrated heterogeneous components for value added devices.

「Shared facility for industry」 to enable the MEMS prototyping without facilities. Hands-on access to fab.

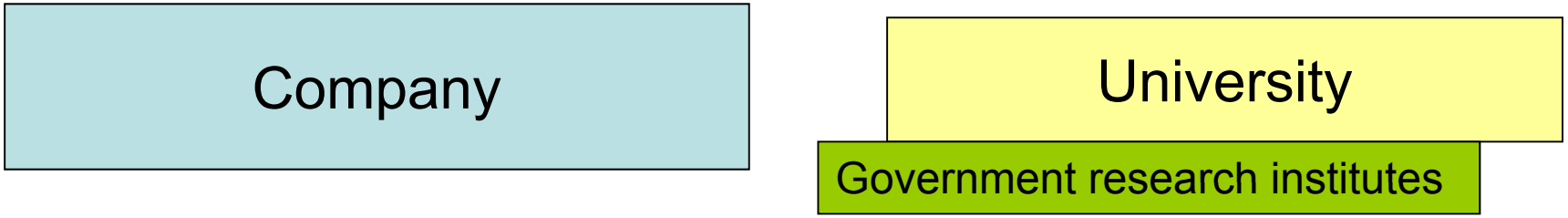
「Massive parallel EB direct writing systems」 to produce small volume LSI cost effectively.

Solutions to the economical crisis of advanced LSI

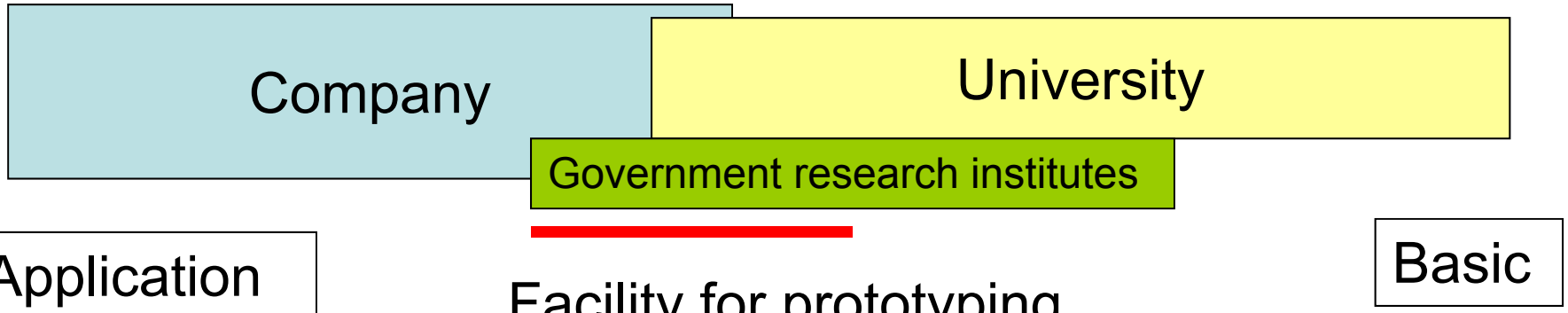
Objectives of our project

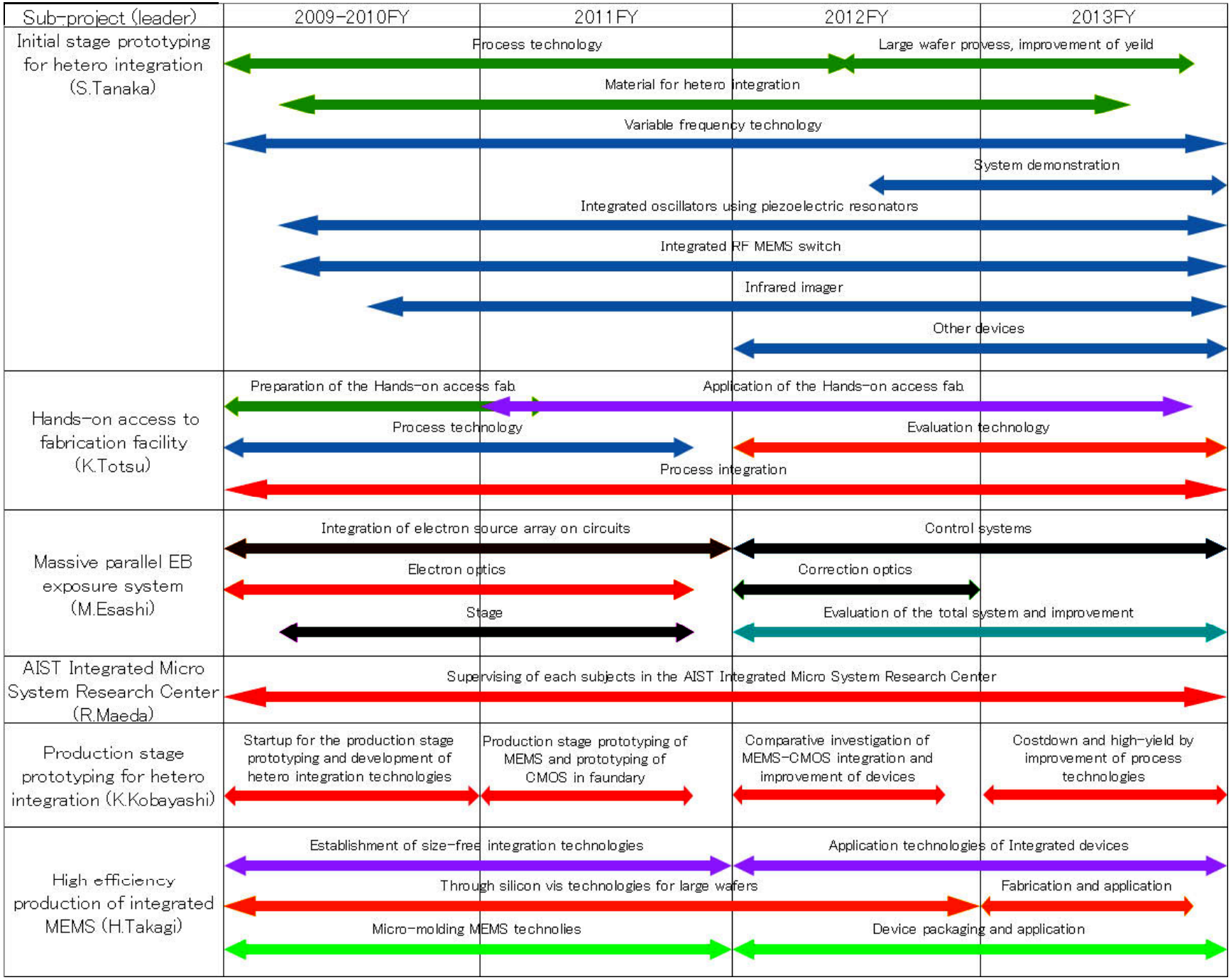
In the past

At present



In future




Sub-project (leader)
2009-2010FY
2011FY
2012FY
2013FY
Initial stage prototyping for hetero integration (S.Tanaka)
Process technology
Large wafer provess, improvement of yeild
Material for hetero integration
Variable frequency technology
System demonstration
Integrated oscillators using piezoelectric resonators
Integrated RF MEMS switch
Infrared imager
Other devices
Hands-on access to fabrication facility (K.Totsu)
Preparation of the Hands-on access fab
Application of the Hands-on access fab
Process technology
Evaluation technology
Process integration
Massive parallel EB exposure system (M.Esashi)
Integration of electron source array on circuits
Control systems
Electron optics
Correction optics
Stage
Evaluation of the total system and improvement
AIST Integrated Micro System Research Center (R.Maeda)
Supervising of each subjects in the AIST Integrated Micro System Research Center
Production stage prototyping for hetero integration (K.Kobayashi)
Startup for the production stage prototyping and development of hetero integration technologies
Production stage prototyping of MEMS and prototyping of CMOS in faundary
Comparative investigation of MEMS-CMOS integration and improvement of devices
Costdown and high-yield by improvement of process technologies
High efficiency production of integrated MEMS (H.Takagi)
Establishment of size-free integration technologies
Application technologies of Integrated devices
Through silicon vis technologies for large wafers
Fabrication and application
Micro-molding MEMS technolies
Device packaging and application

	2009FY-2011FY	2011FY	2012FY	2013FY	Total
Tohoku Univ.	¥387.21M	¥393.44M	¥385.048M	¥377.802M	¥1,543.5M
AIST	¥792.79M	¥367.4M	¥244.952M	¥220.198	¥1,543.5M
Total	¥1,180M	¥679M	¥630M	¥598M	¥3,087M

Basic budget *

* In addition to the basic budget, those for the International Symposium and for boosting (¥190M) are expended in 2010FY.

① Initial stage prototyping for hetero integration 20mm□

(S.Tanaka* (Tohoku Univ.), K.Hashimoto (Chiba Univ.), H.Harada (NICT), M.Kadota (Murata MFG.Co.Ltd.)),

② Hands-on access to fabrication facility 4-6 inch

(K.Totsu* (Tohoku Univ.), T.Ono (Tohoku Univ.), S.Yoshida (Tohoku Univ.))

http://www.mu-sic.tohoku.ac.jp/coin/index.html

③ Massive parallel EB exposure system

(M.Esashi* (Tohoku Univ.), N.Koshida (Tokyo Univ. of Agriculture and Technology), A.Kojima (Crestec Corp.), N.Ikegami (Tokyo Univ. of Agriculture and Technology))

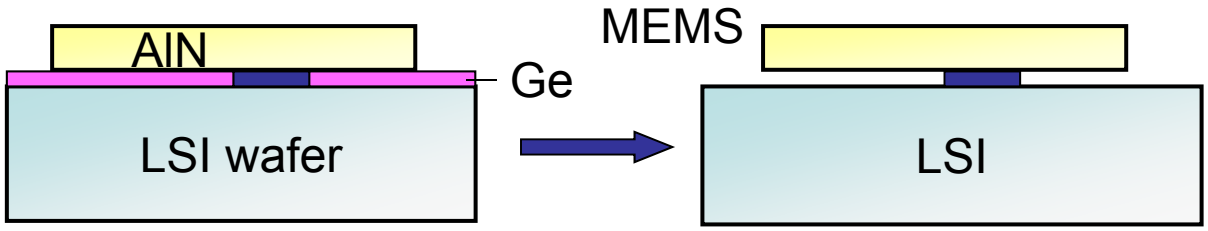
④ Production stage prototyping for hetero integration 8 inch

(T.Kobayashi* (AIST), Y.Zhang (AIST), H.Ohada (AIST), T.Kamei (AIST))

⑤ High efficiency production of integrated MEMS

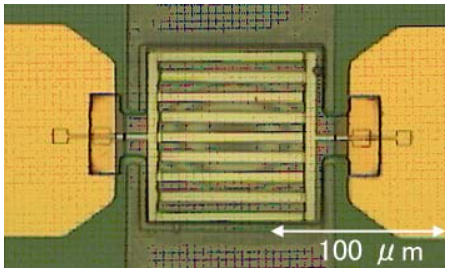
(H.Takagi * (AIST), S.-W.Young (AIST), K.Kurihara (AIST), S.Matsumoto (AIST), M.Takahashi (AIST))

5 sub-projects and members (* sub-project leader)

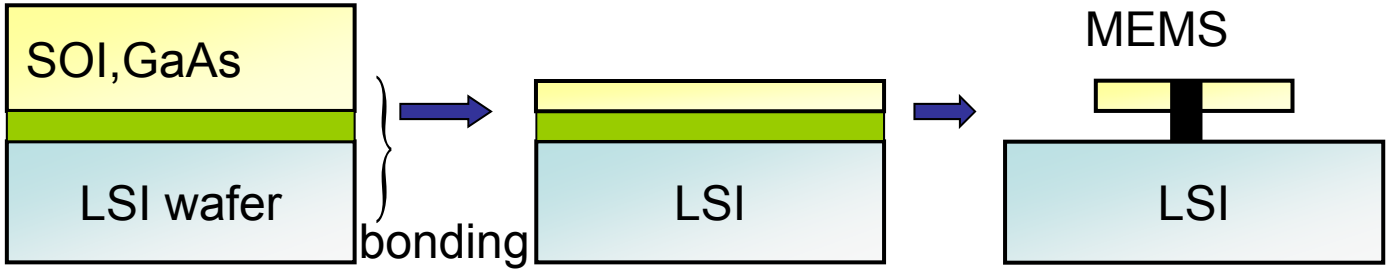


Surface micromaching using deposited Ge/AlN

(MEMS fabrication without damage to LSI)

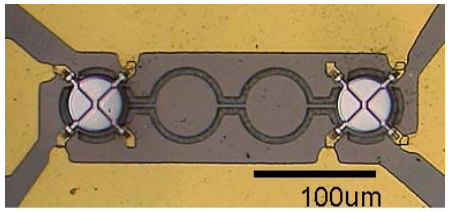


AlN Lamb resonator

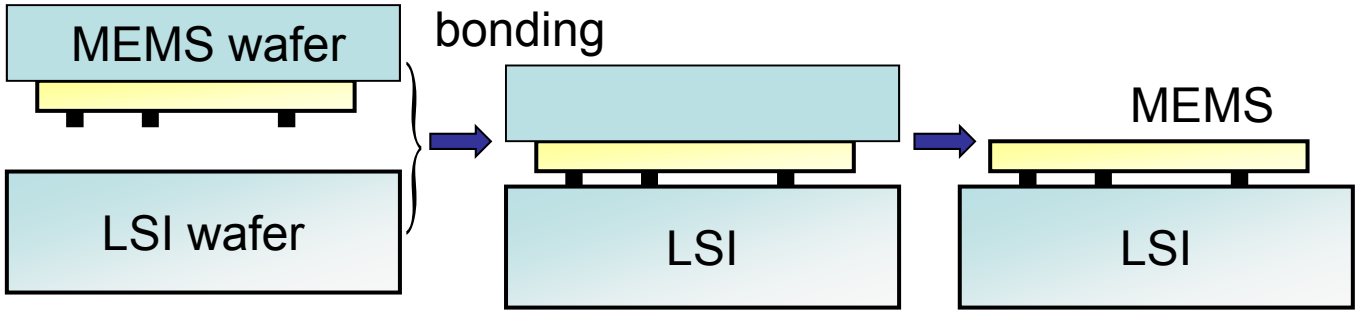


MEMS fabrication after bonding single crystal

(Low temperature bonding without damage to LSI)

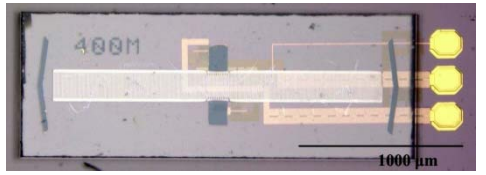


MEMS filters on LSI



Bonding of MEMS wafer to LSI wafer

(Electrical interconnection using metal bonding)



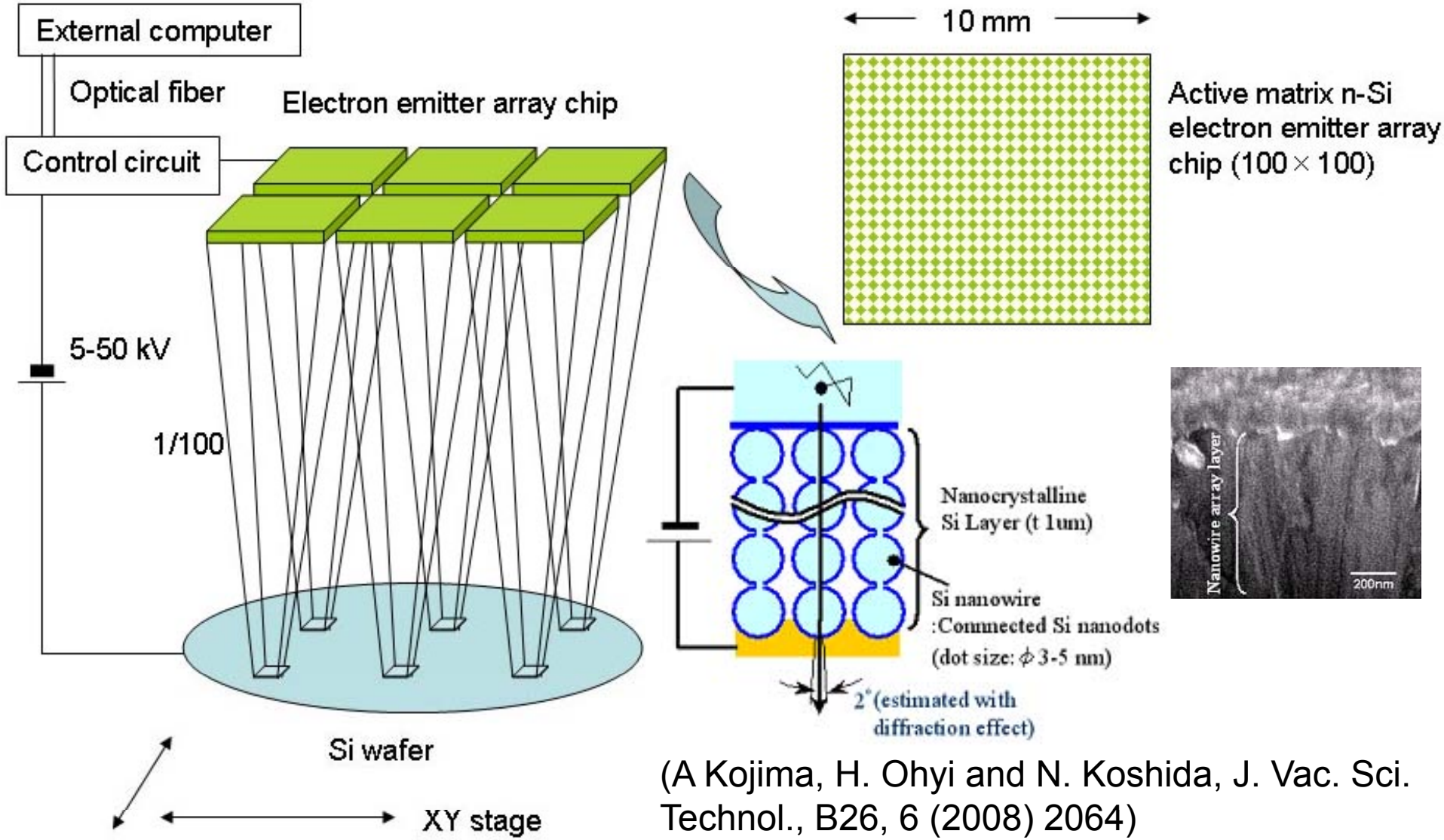
SAW filter on LSI

Three types of integrated MEMS

Shared facility for industry to prototype MEMS devices (4 / 6 inch)

Hands-on access fab. (Nishizawa memorial research center in Tohoku Univ.)

Contact person : Dr.Kentaro Totsu totsu@mems.mech.tohoku.ac.jp



(A Kojima, H. Ohyi and N. Koshida, J. Vac. Sci. Technol., B26, 6 (2008) 2064)

Massive parallel EB exposure system using active matrix nano-crystal silicon electron sources

(collaborators : A Kojima & H. Ohyi (Crestec corp.), Prof. N.Koshida (Tokyo Univ. of Agriculture and Technology))

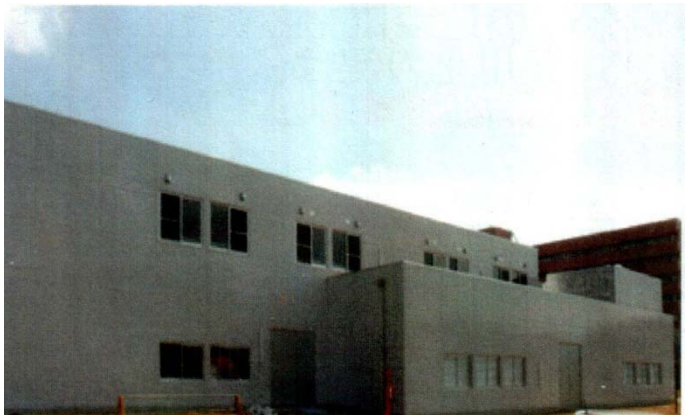
Micro-nanomachining research and education center (2 inch LSI process line)

Tohoku Univ. Aobayama campus

Jun-ichi Nishizawa memorial research center (4/6 inch MEMS process line)
(Hands-on access fab.)

MEMS prototyping room in Tohoku Univ.(20mm)

(Initial stage prototyping)



AIST MEMS business building in Tsukuba (8 inch process line)
(R.Maeda)
(Production stage prototyping)

Prototyping infrastructures

Micro System Integration Center (μSIC) Kick-off Symposium (March 30, 2010)

1st meeting of Micro System Integration (May 14, 2010)

MEMS Seminar in Tsukuba (Aug.5-7,2010)

2nd meeting of Micro System Integration (Sept.10, 2010)

3rd meeting of Micro System Integration (Jan.14, 2011)

Tohoku Univ. Micro System Integration Center (μSIC) Symposium (Dec.6, 2010)

ISIM2011 (International Symposium on Integrated Microsystems) (Feb.10, 2011)

First Science Forum in Kyoto (March 13, 2010) http://first-pg.jp/

MEMS Seminar in Kyoto (Aug.9-11, 2011) planned

Open seminar, meeting and symposium

First “Integrated Microsystems” preparation meeting (Jan.8, 2010) in Tsukuba

1st First “Integrated Microsystems” meeting (May 13, 2010) in Sendai

2nd First “Integrated Microsystems” meeting (July 7, 2010) in Tsukuba

3rd First “Integrated Microsystems” meeting (May 13, 2010) in Sendai

4th First “Integrated Microsystems” meeting (Nov. 11, 2010) in Tsukuba

Closed internal meeting