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CiS - Sensing Solutions and Sensor Integration

1993 **Spin-off**

1996 **DIN EN ISO 9001**

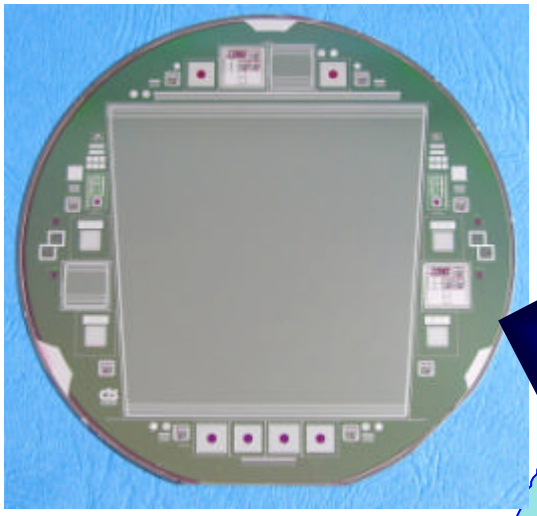
1998 **CiS Institut für Mikrosensorik gGmbH**

2000 **Staff: 52 January 2001**
Turnover (2000): ca. 4 Mio DEM
(incom about 10 Mio DEM)

2001/ Move to Technology Center AZM
2002 (Bussiness Centre for Application of Microtechniques)

Silicon Radiation Sensors

Main Products



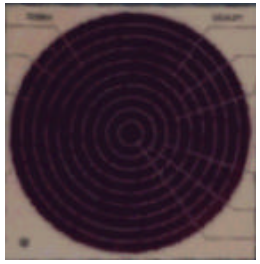
PIN-Diode Arrays

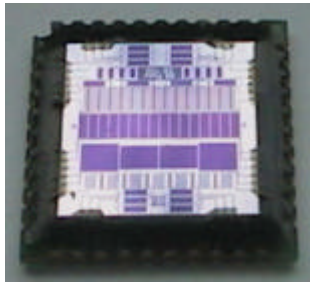
Emitter-Receiver-Modules

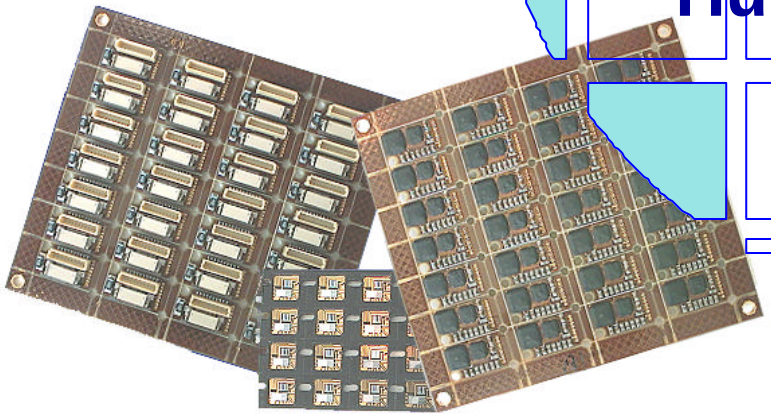
Silicon Radiation Detectors

Humidity Sensors

MEMS



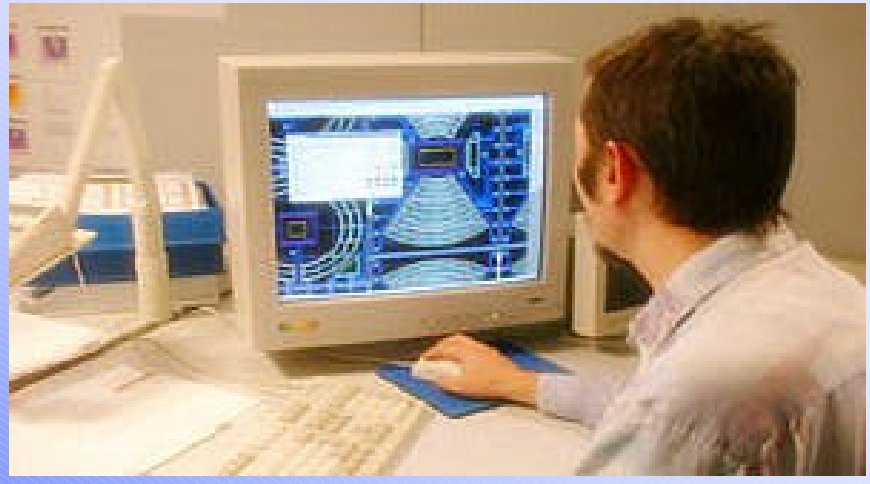


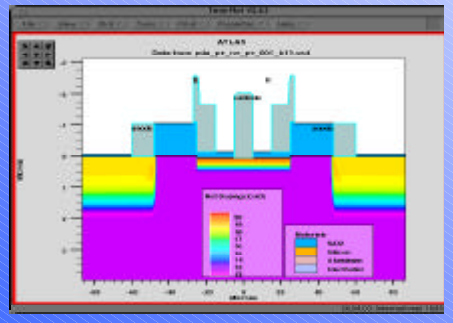


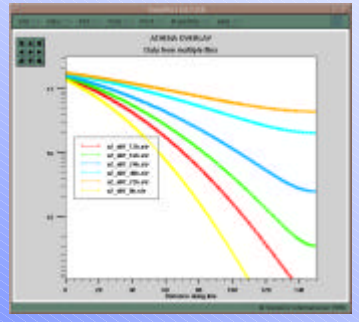
CiS - Partner for Sensing Solutions and Sensor Integration

Application Specific Solutions

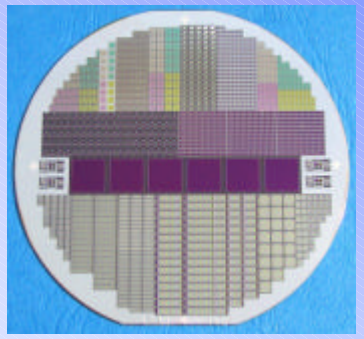
- **Design & Simulation**



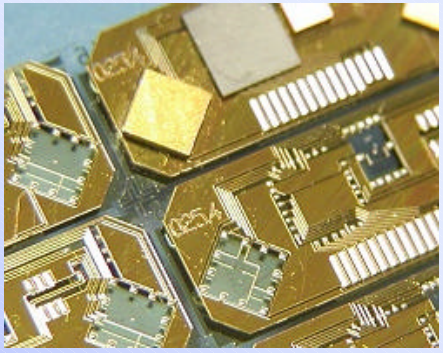


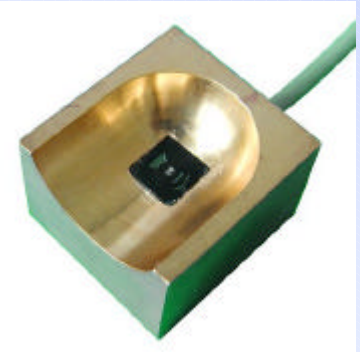


- **Wafer Technology**



- **Assembly & Housing**





CiS - Design & Simulation

- ***Application Specific Solutions***

- ***Technology Simulation***
- ***Device Design and Simulation***

- ***Chip Design***
- ***Layout Services***
    - ***we accept foreign layouts correspondenting to our design rules***
    - ***gds2-files***
    - ***we finish mask layout***

- ***Masks***
    - ***we get from our partner ML&C (Erfurt/Jena)***
    - ***mask making of original masks by e-beam***

CiS - Wafer Foundry

Clean room: ~~100 m²~~ air cleanliness classes 100, 20 m² from it acc10

2002

250 m² air cleanliness classes 100, 70 m² from it acc10 + 200 m² acc 10,000

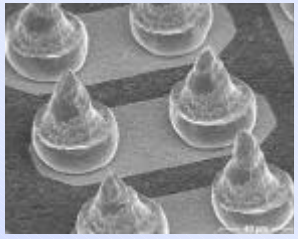
Staff: 8 engineers and 4 skilled worker

- **Wafer processing:** 2, 3, 4 inch
  - Prototyping
  - Series production up to max. 20.000 wafer p.a.
  - also test wafer prototyping for R&D projects
  - Foundry services
- **R&D services**
  - Double-sided processing
  - Silicon bulk micromachining (CMOS compatible)
  - Electrochemical isotropic etching of silicon
  - Chip compatible depth structuring of silicon
  - Anodic and wafer direct bonding
  - Functional passivation
  - Sandwich passivation structures
- **Multi-Project-Wafer service**

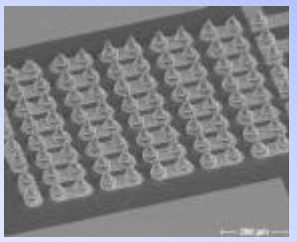
- **Special equipment**
  - Automatic coating and developing cluster for double-side processing
  - Doubleside alignment and exposure facilities
  - Projection photolithography: Projection mask aligner (up to 4 inch)
  - LP- and PE-CVD oxid, SION, Si_3N_4, poly-silicon
  - High temperature equipment
  - Spray coating equipment
  - Megasonic fine cleaning
  - WET bench
  - RIE- and plasma etching equipment
  - Magnetron sputter facility

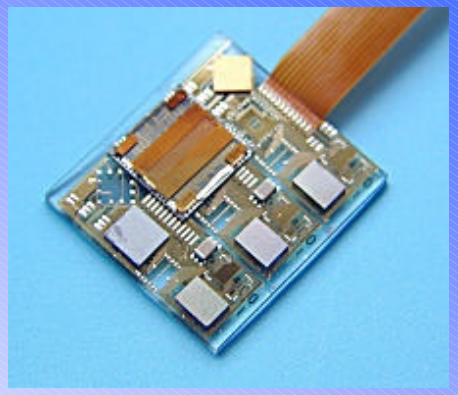
CiS - Assembly

- **Slicing: glass, ceramic, silicon**
  - up to 6 inch substrates
- **Chip & Wire**
  - Ultrasonic and thermosonic bonding
  - Bonding by thick wire
  - Stud bumping
  - Microbumping

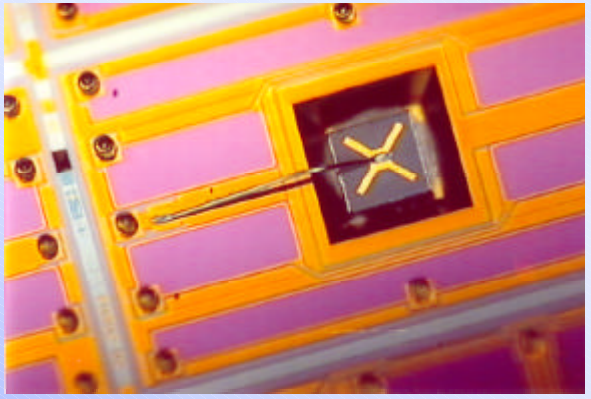


- **Micro Modules**
  - SMD
  - COB / Flip-Chip-Packaging
  - Chip-size-Packaging: Chip-in-Chip and Chip-on-Chip
  - Low-cost Au-ball-bumping
  - Flux-free Flip-Chip-Reflow-Soldering
  - Frame soldering of PI-Flex tapes on to sensitive glass substrats
  - Multi-Chip-Modules
  - Micro-Hybride-Modules





- **Carrier**
  - Silicon-, PCB-, glass- and ceramic
- **Housing**
  - Underfilling and glob topping
  - Adhesive caps



Material for Radiation Detectors

- **4 inch** ultrapure **n/P - typ silicon** wafer, double-sided polished

- **FZ <111>** prefered; FZ <100> , CZ <100> available

- **High resistivity:** FZ <111> 2 ...**3**... 5 kOcm,
  FZ <100> 1 - 6 kOcm ,
  CZ <100> > 600 [**800**] Ocm

- **Thickness:** (200 µm) ... **250 µm ... 285µm** ... 500 µm ... (800 µm)

- available also: high ohmic epitaxial layer on low ohmic CZ <100>
  (> 500 Ocm ... **2 kOcm**) (thickness 30 µm, 50 µm, ...) (0,1 Ocm, **20 Ocm**)
  and others

Technology & Design

- CMOS like **process steps allows 2 µm structures**
- **single and double-sided processing**
- **high temperature steps** (without organics: oxydation using HCL, ...)
- **Implantation** (Phosphorus, Boron, ... dose and energy on demand)
- **Detector device pitch:** ... 40 - 200 ... µm

Options

- **Biasing:** ‘**punch-through’, boron-implantation, poly-silicon**
- **Metal: Al, AlSi, Ti; one or two layer metalization, coating system for UBM**
- **Passiviation:** SiO_2, $Si_xO_yN_z$, Si_3N_4
- **Radiation hardening: by oxygen enrichment (24 ...** 72 **hours)** DOFZ CERN/ROSE
- **(moderated) p-spray or p-stop implantation** MPI Munich

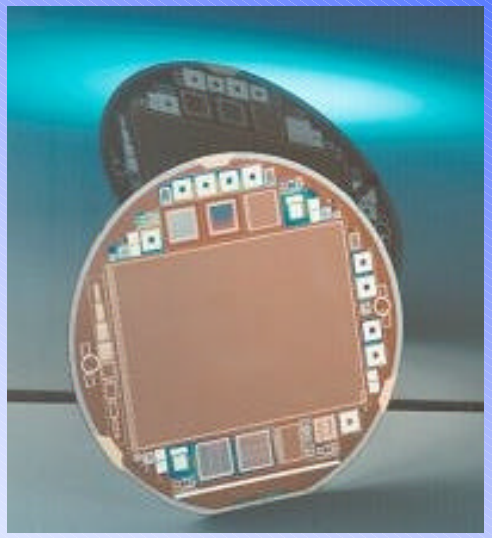
Test of Radiation Detectors

- **Wafer prober:** up to 6 inch wafer
- **Kit for testing of double-sided processed wafers** (special wafer chucks)
- Wafer cryostat
- Measurement kit for device parameters (HF/NF-CV, TVS, U_{BR} , pinhole)
- Spectral photometer
- Laser Scanning Microscop with OBIC-Option

- **yield** (series production): single-sided strip detectors 65 ... 70 ... 80 per cent
  double-sided strip detectors 65 ... 70 ... 80 per cent
  double-sided pixel detectors 50 ... 65 ... 70 per cent

References

Radiation detector projects since 1997



- **Detectors from CiS are used by following experiments:**

♦ HERA-B	DESY, Hamburg
♦ H1	DESY, Hamburg
♦ ATLAS	CERN, CH
♦ MEGA	CERN, CH
♦ D 0	Fermilab, USA
♦ STAR	Relativistic Heavy Ion Collider at Brookhaven National Laboratory

- **in 2000:** **ca. 500 detectors delivered,** ca. 1,000 wafer processed

- **in 2001:** **Atlas-Wedge-Serie: 2080 detectors to be deliver**
  Atlas-Pixel-Pre-Serie: 30 detectors delivered