GridPix chip production in Bonn and NIKHEF 2012 test beam plans

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Jurriaan Schmitz: MESA+/Univ. Twente, Enschede

Yevgen Bilevych, Klaus Desch, Jochen Kaminski, Thorsten Krautscheid: Univ. Bonn

Paul Colas: CEA-Saclay

RD51 miniWeek, 21 Nov 2011

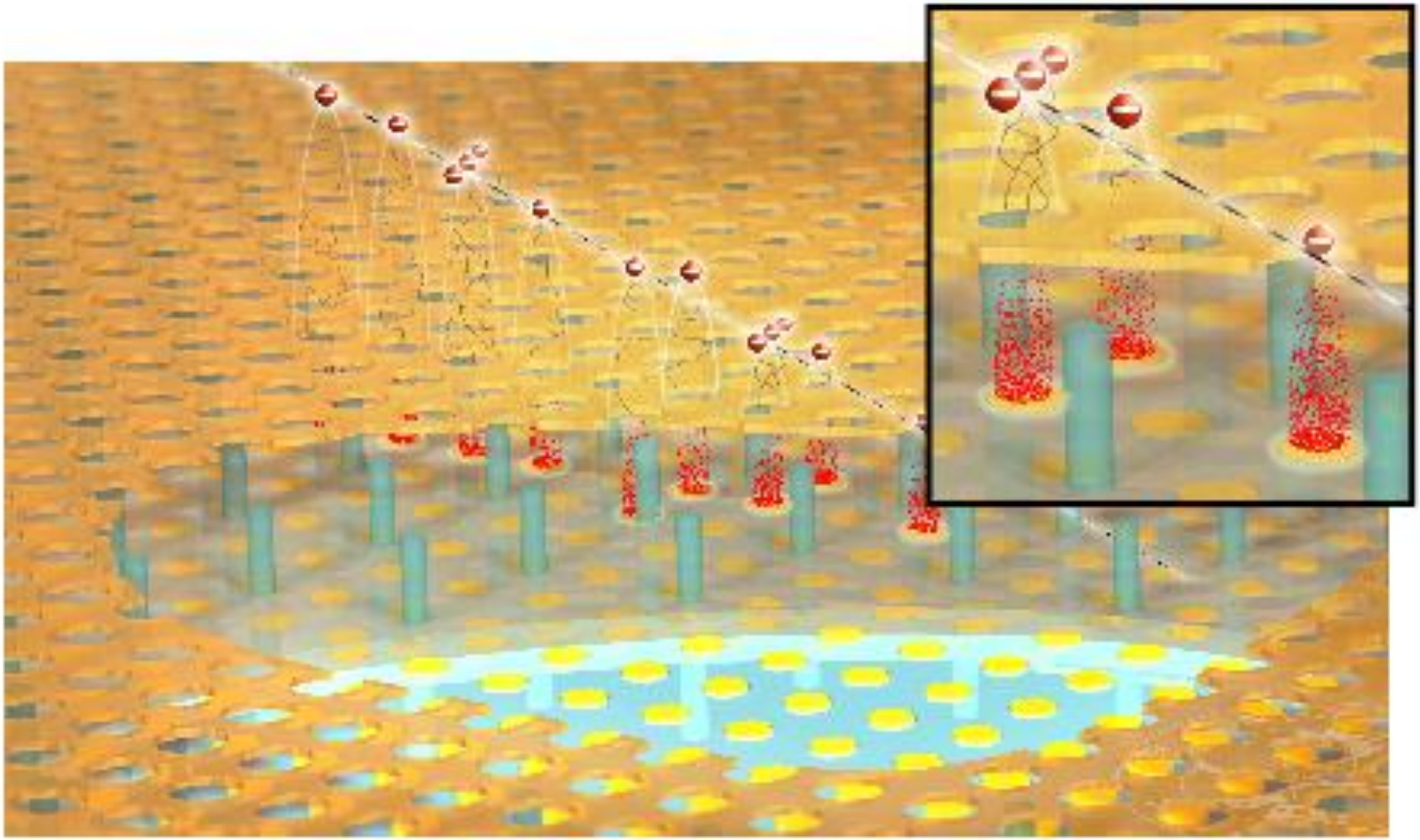


Fig.3: The GridPix detector: a passing fast charge leaves a track of ion-electron pairs in the gas volume above the readout chip. The liberated electrons drift towards the chip and cause an avalanche in the high-field region between the perforated electrode (green dashed line) and the microchip. The inset highlights the gas avalanche part of the detector.

The MediPix2 pixel CMOS chip

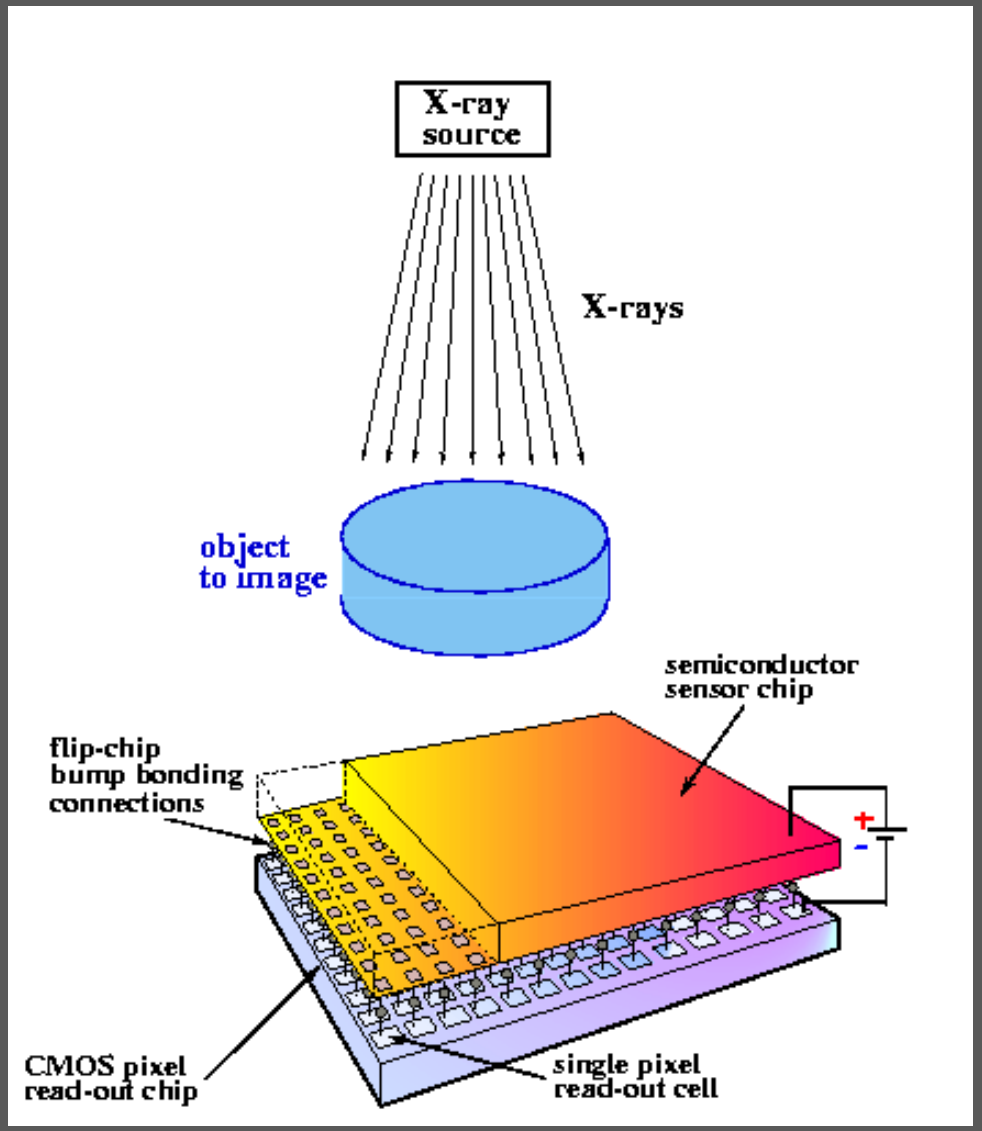
256 x 256 pixels
pixel: 55 x 55 μm^2
per pixel:
- preamp
- shaper
- 2 discr.
- Thresh. DAQ
- 14 bit counter

- enable counting
- stop counting
- readout image frame
- reset

We apply the 'naked' MediPix2 chip without X-ray convertor!

Applied chips:

Medipix-2
TimePix
PSI-46
FE-I4
TimePix-3: underway: submission Dec 2011



Summary of Performance of Gossip

- track position resolution:15 μm: simulation 15 μm;
- single electron efficiency: > 90 %
- track detection efficiency: 99.6 %; simulation 99.4 %

Gas versus Si (or Gossip versus Si detectors)

Pro:

- no radiation damage in sensor: gas is exchanged
- modest pixel (analog) input circuitry: low power, little space
- no bias current: simple input circuit
- low detector material budget: 0.06 % radiation length/layer
  typical: Si foil. New mechanical concepts
- low power dissipation : little FE power (2 μW/pixel); no bias dissipation
- operates at room temperature (but other temperatures are OK)
- less sensitive for neutron and X-ray background
- 3D track info *per layer* if drift time is measured
- gas is cheap (and *very* cheap wrt. Si sensors!), and light
- single (free drifting) electron sensitive

Con:

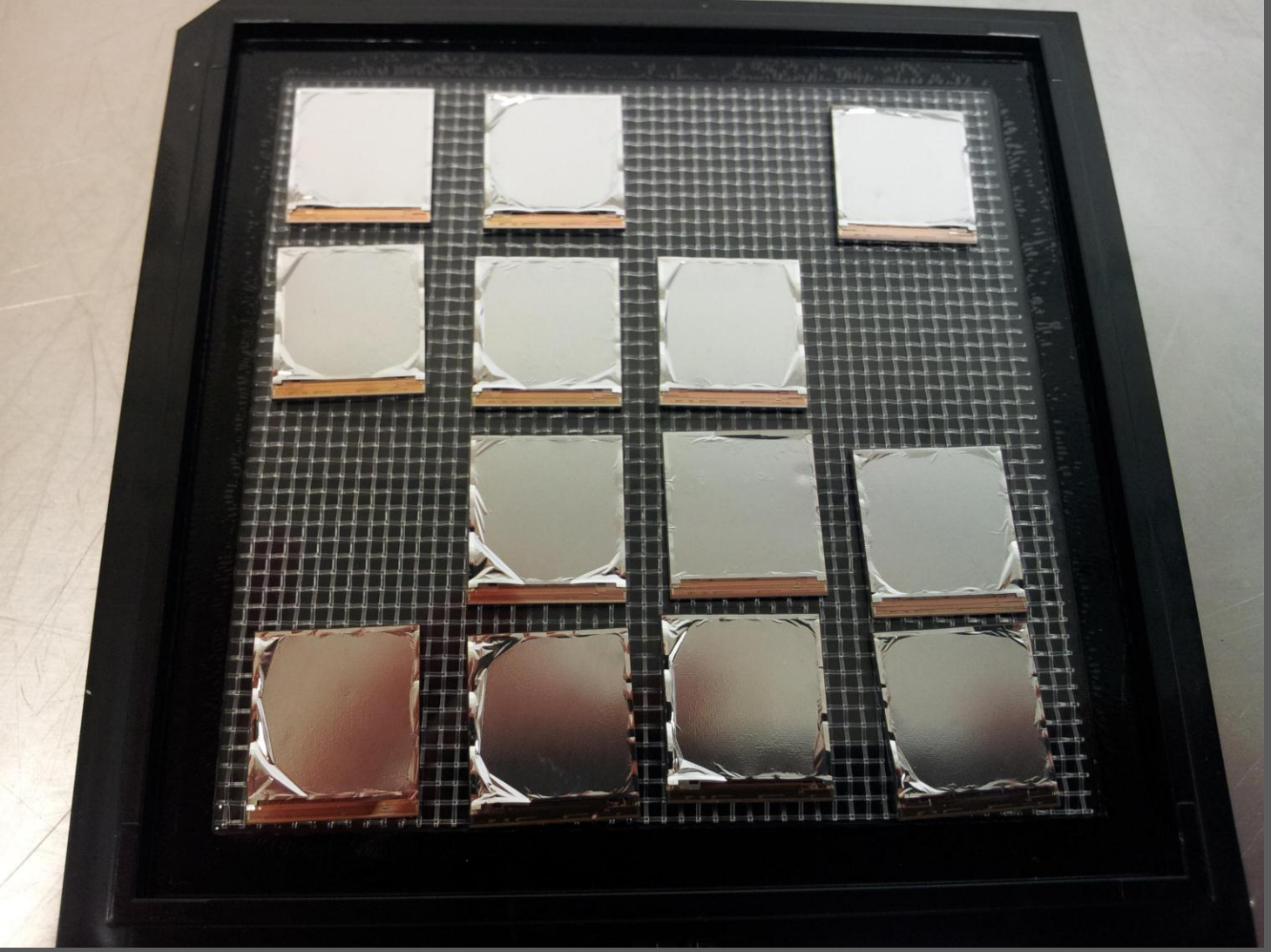
- Gaseous chamber: discharges (sparks): destroy CMOS chip
- gas-filled proportional chamber: 'chamber ageing'
- limit in spatial resolution due to low primary gas-particle interaction statistics
- Needs gas flow
- Parallax error: 1 ns drift time measurement may be required
- diffusion of (drifting) electrons in gas limits spatial resolution

There is a broad interest in GridPix chips

Commercial production is under development at IZM-Fraunhofer, Berlin.

Goal:
to make robust InGrids on 8” wafers,
for a low price, in large numbers

IZM-Berlin
MESA+/Univ of Twente
Nikhef
Univ. of Bonn
Saclay



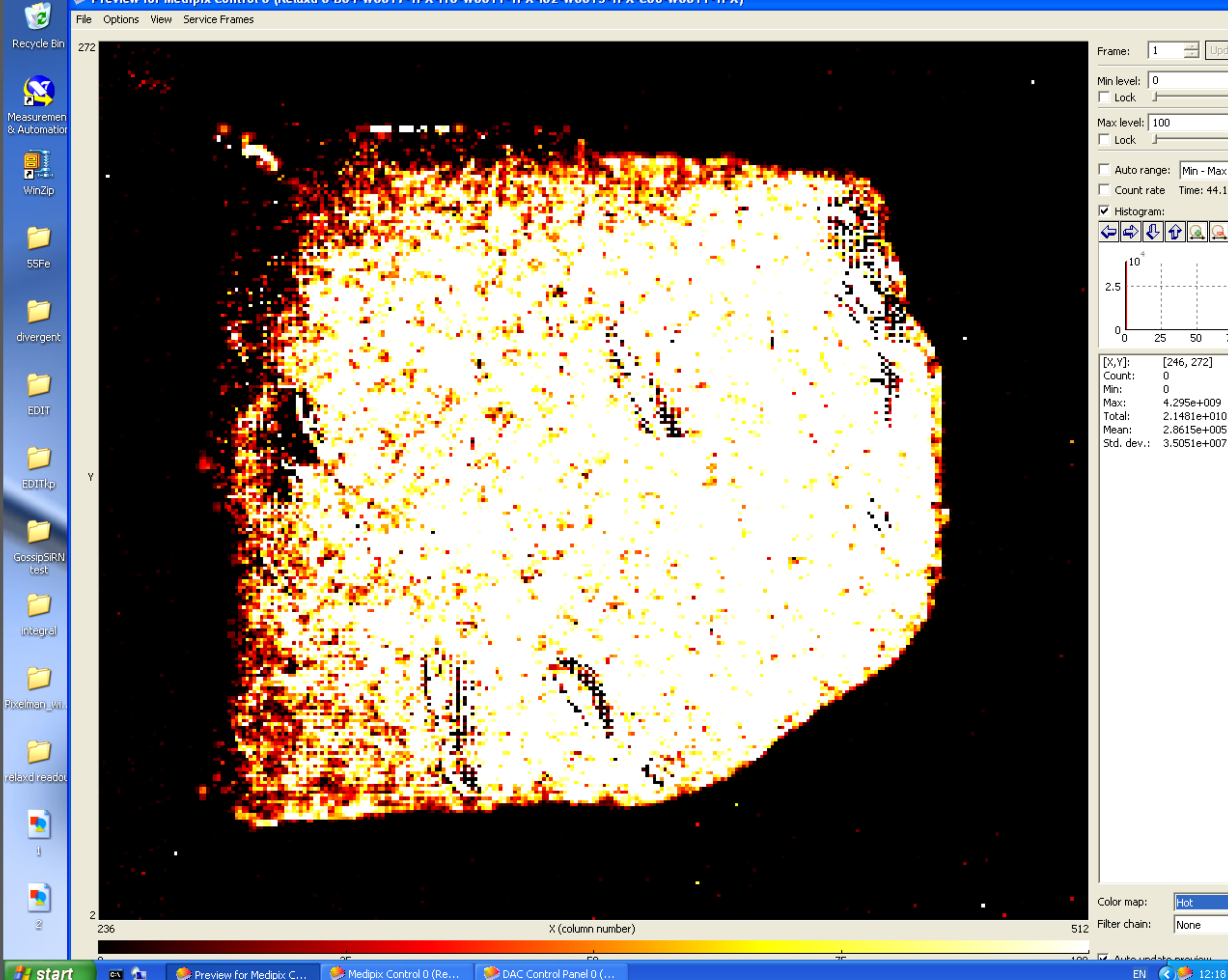
August 2011:

First
IZM GridPixs!

- wire bonding pads covered with SiNitride film

- InGrid peel-off at edges (due to unfortunate last correction treatment…..!)

- Good outlook to have low-cost mass production in October 2011



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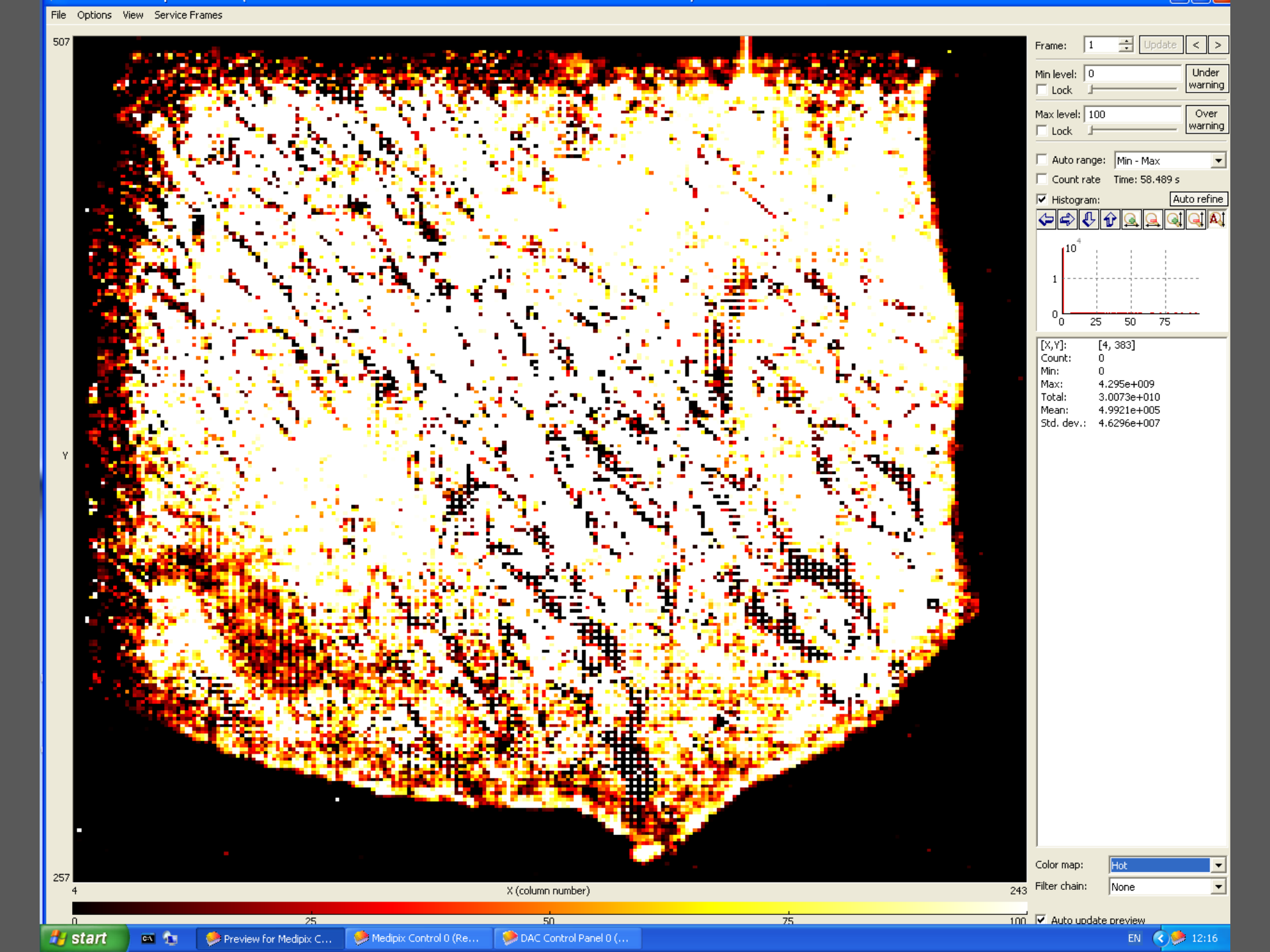
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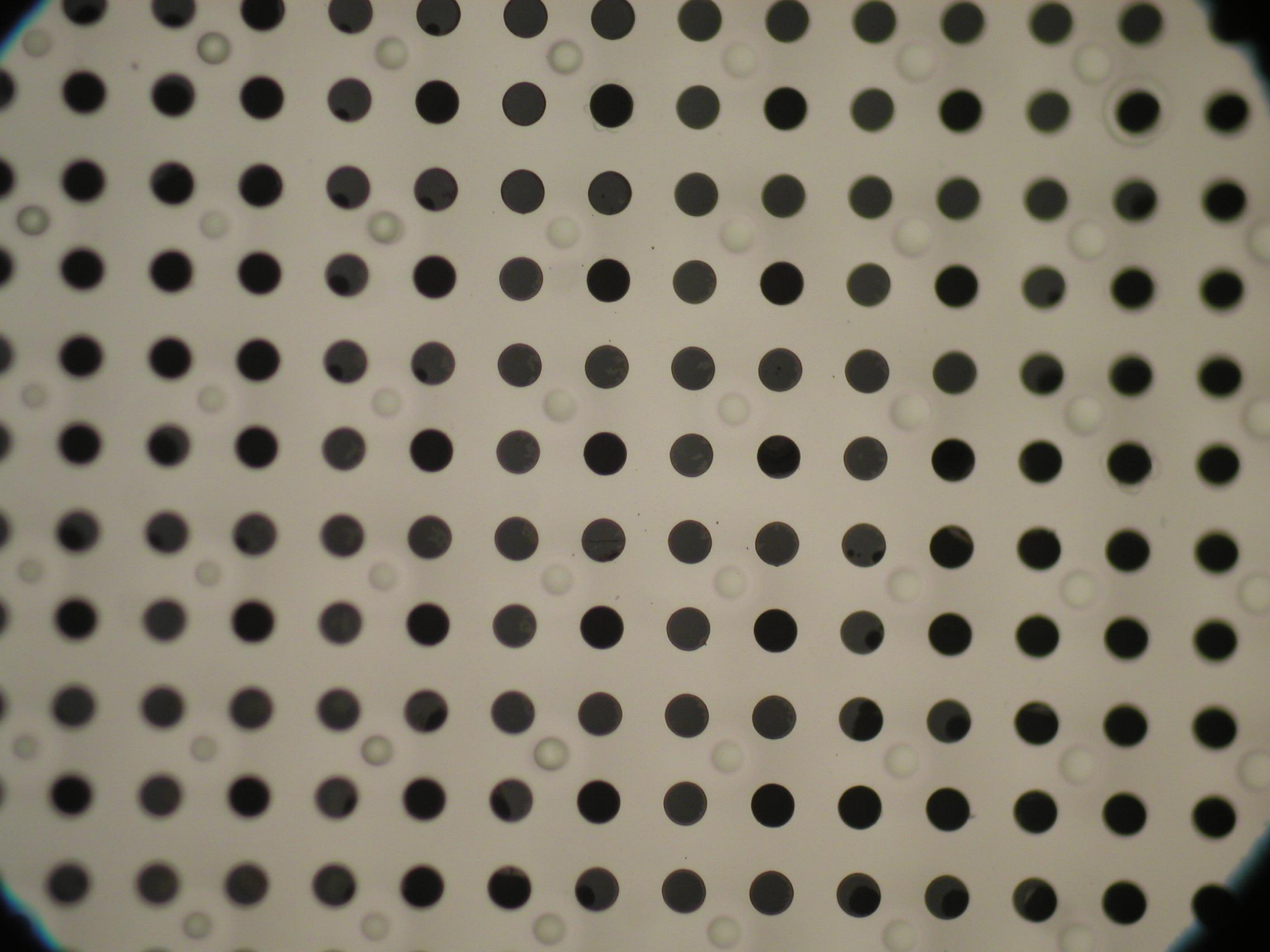

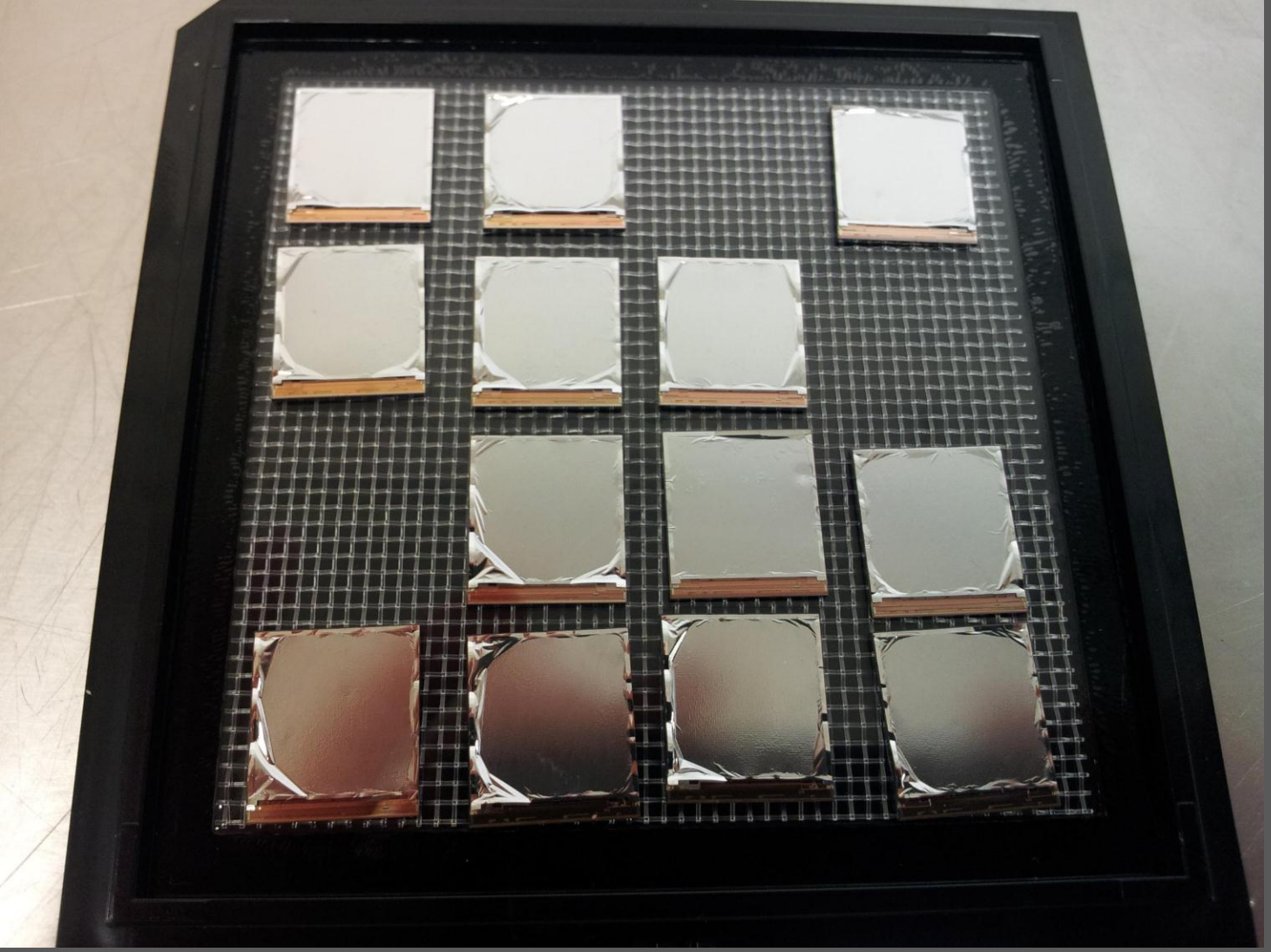

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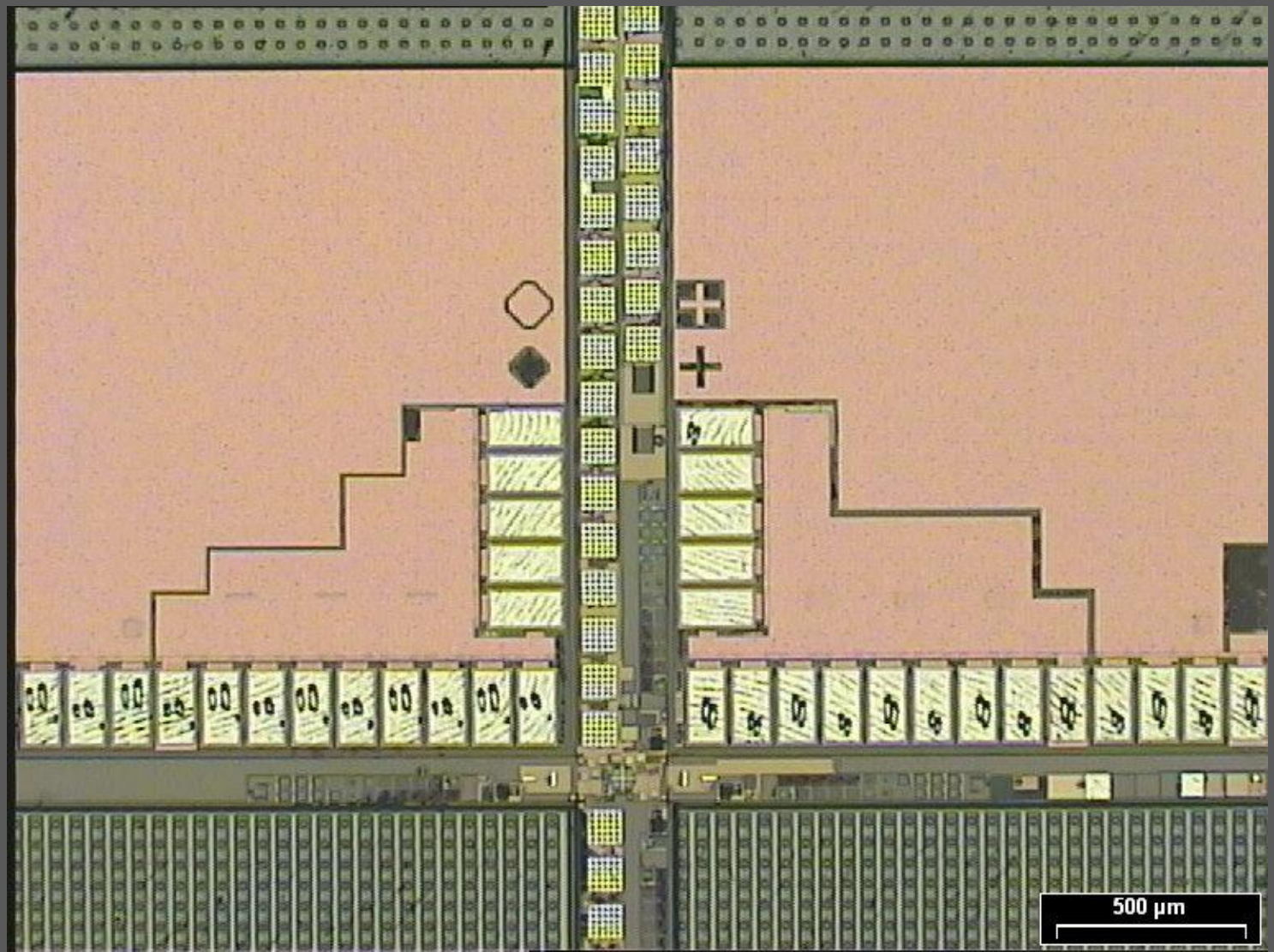
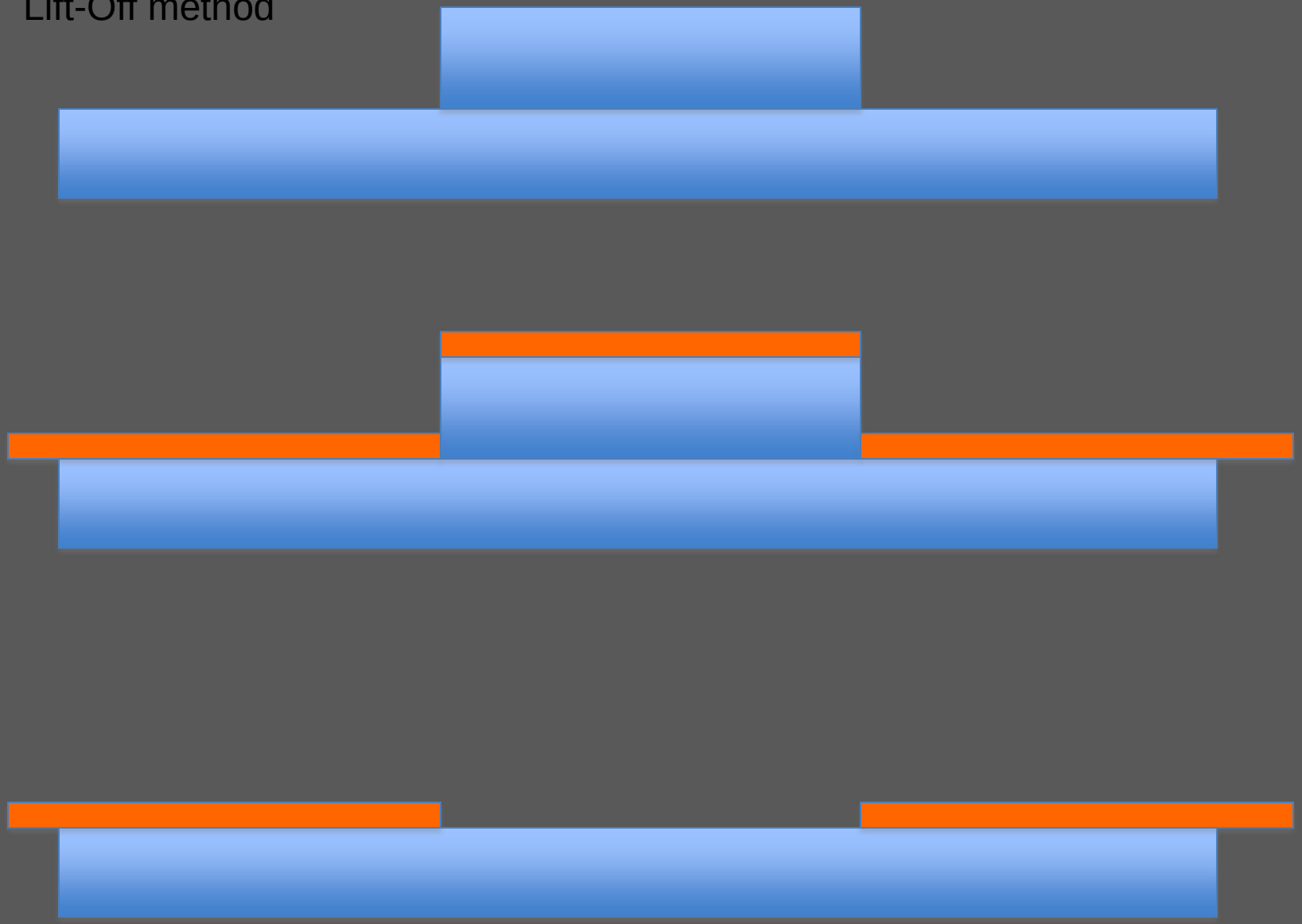
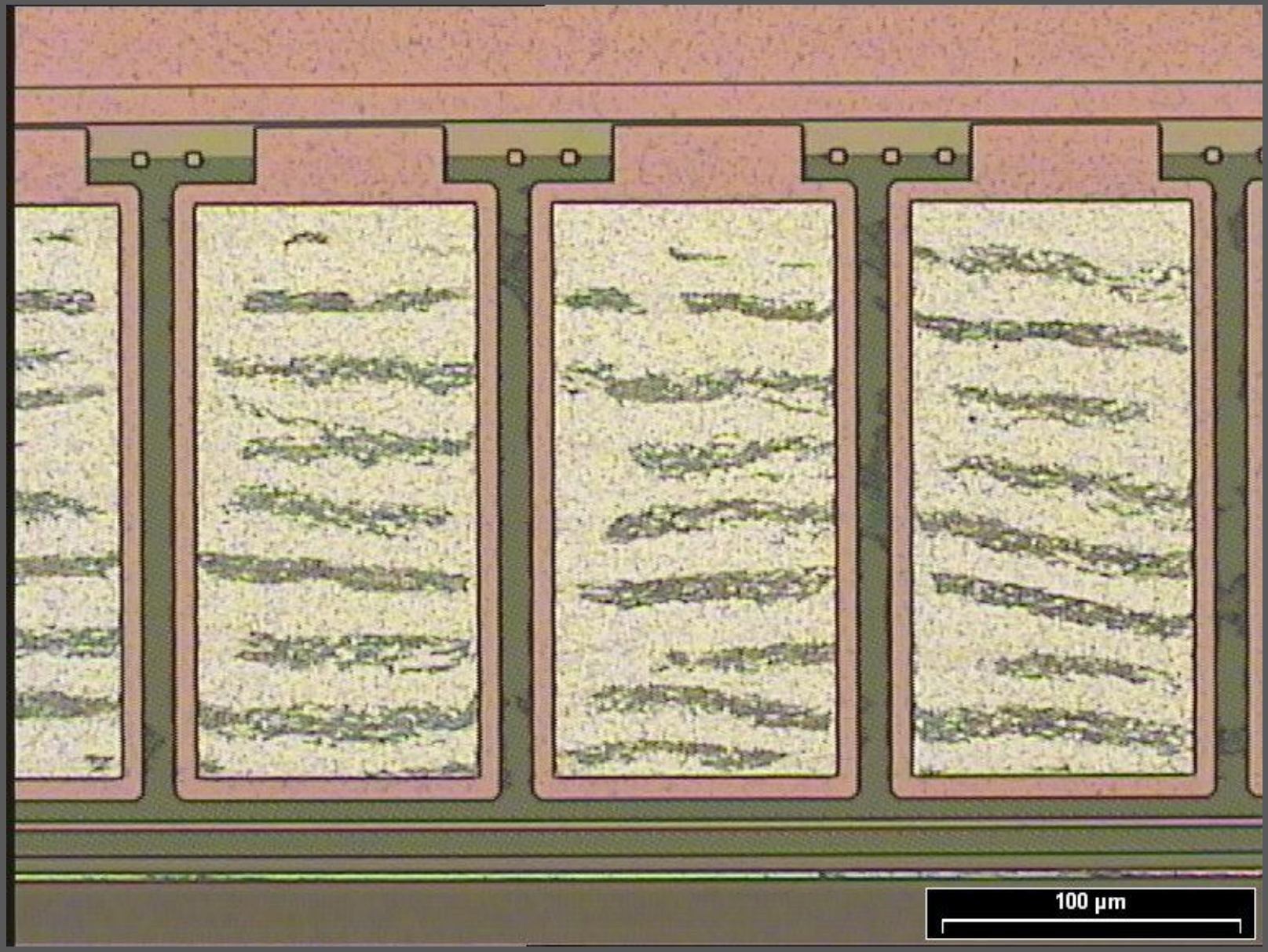
Another try: Yevgen @ MESA+ with lift-off method



Lift-Off method




100 µm

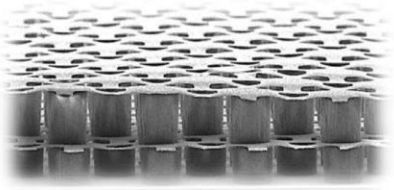
intentions to make available:

- GridPix chips
- chip carrier boards (ReNext)
- ReLaXd readout system (Ethernet out)
- DAQ & Control software

+

- NewGas system: pre-mix bottles
- miniHV High Voltage (low current) supplies

group	experiment	representative
Nikhef/Vertex-Pixel	ATLAS	Harry
Nikhef/ILC	ILC	Jan Timmermans
Nikhef/LVL1	ATLAS	Nigel Hessey
Nikhef/TRT	ATLAS	Anatoli Romaniouk
Nikhef/XenonDarwin	XENON	Patrick D., Matteo Al.
Saclay	ILC	Paul Colas
Univ. Bonn	ATLAS	Norbert Wermes
Univ. Bonn	ILC	Klaus Desch
Univ. Bonn	TPC	Klaus Desch
Univ. Bonn	ATLAS	Klaus Desch
ZEPLIN	ZEPLIN	Vitaly Chepel
PSI	Mueee	Malte Hildebrandt
NA61	NA61	Marek Gazdzicki, Tome ….
CERN	LHeC	Alessandro Polini, Peter Kostka
Saclay	CAST	Ionnis Giomataris
ECAP/UniErlangen	PolaPix	Thilo Mechil
MIT/LNS	DarkForces	Peter Fisher
HIP Helsinki		Francisco Garcia
	CALICE	Max Chefdeville



GridPix workshop

December 14, 2011

University of Twente

The University of Twente will host the 2nd international workshop on GridPix detectors, following the successful event in Bonn on 13 December 2010. Topic of the workshop is the miniaturized gaseous radiation imaging detector, ranging from fabrication and readout to functionality and application. The workshop is open to anyone working in this domain. It is free of charge, thanks to our sponsor, the MESA+ Institute for Nanotechnology.

Organizing Committee

Prof. Dr. Jurriaan Schmitz
University of Twente
Dr. Ir. Cora Salm
University of Twente
Dr. Ir. Harry van der Graaf
Nikhef
Dr. Niels van Bakel
Nikhef

Contact

j.schmitz@utwente.nl
Tel. +31 53 489 5767

Registration

Mail name, affiliation and dietary wishes to Mrs. Annemiek Janssen
a.m.r.j.janssen@utwente.nl

Tentative program

09:30 Welcome coffee
10:00 Opening – Jurriaan Schmitz
10:10 Recent progress at Nikhef
10:50 Recent progress at Bonn
11:40 Recent progress at IZM
Lunch
14:00 Tour around the Nanolab
14:30 The Medipix family
15:10 GridPix application perspectives
15:40 tea break
16:00 Funding opportunities
16:45 Adjourn

Venue

University of Twente
Drienerlolaan 5
7522 NB Enschede
The Netherlands

Meeting room

Demoruimte, Carré 1333
(Entry: building nr. 13)

Directions

http://www.utwente.nl/contact/routeeng

Hotel suggestions

Eden Hotel De Broeierd
www.edenhoteldebroeierd.com
Drienerburght
www.drienerburght.nl
(both within walking distance of the venue)

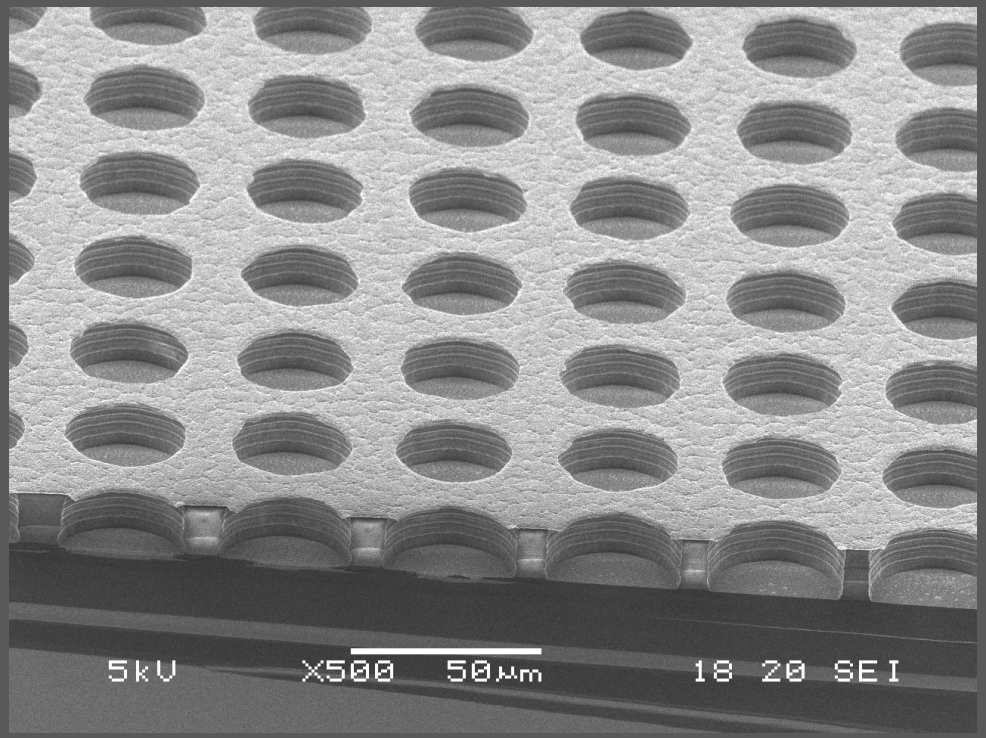
MESA+
INSTITUTE FOR NANOTECHNOLOGY

UNIVERSITY OF TWENTE.

New R&D: the all-ceramic GridPix:

- Si TimePix chip
- SiNitride protection layer
- SiO_2 pillars or spacers
- SiNitride InGrid: double protection (like RPC!)

➔common thermal expansion coefficient: 6 x 10^{-6} K^{-1}



First GEMGrid with SiO2 as insulating spacer between grid and substrate
Victor Blanco Carballo, MESA+/Nikhef

Testbeam plans 2012

- GridPix TPC test for ATLAS LVL1 / TRT (Anatoli Romaniouk, Nigel Hessey)
  In strong magnetic field: B // E, and B perp to E. Gas properties (Xe mix), E x B effects, diffusion, Lorentz Angle, systematics.

- Gossip ‘telescope’ test: basic performance of GridPix/Gossip: spatial resolution, track efficiency, straightness of tracks, single electron efficiency

- Quad, Octopuce tests. Possibly at DESY.

- Tests with (polarized) photons (Desy, ESRF)