

Visit to NewFlex technology

WHEN: September 5th, 2011 (“detour return trip” after Kobe’s RD51 meeting)

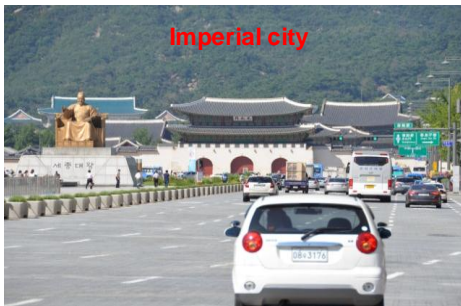
WHO:

From CERN : R. de Oliveira, F. Formenti, H. Hillemanns, H. Taureg (for RD51 collaboration)

From Korea Uni.: Prof. Sung Keun Park (Director detector laboratory and CMS muon system)

From NewFlex: Mr. Woo Hyun Lim (CEO), Mr. Ki Young Jung (new tech. devel. Team Manager)

WHY: Feedback on first small prototype GEM
Get agreement on GEM licensing procedure
Propose plan for technology transfer



NewFlex technology company

Location:

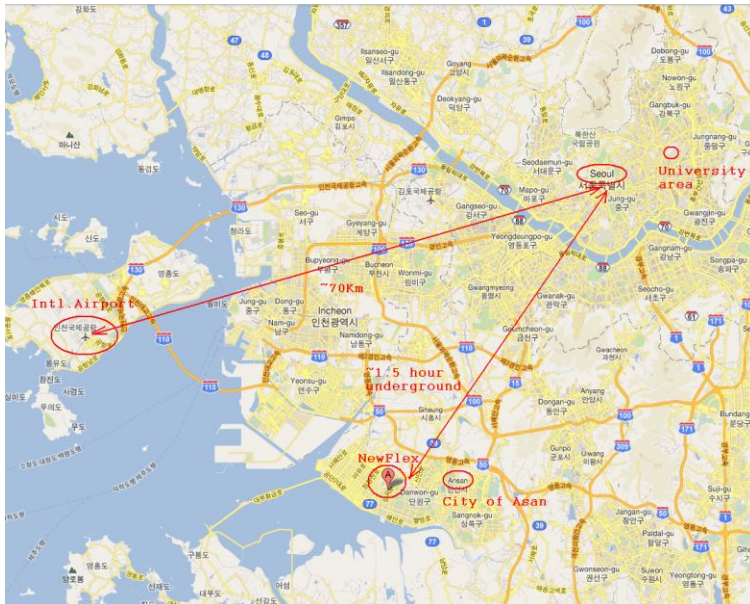
Asan, south west of Seoul, South Korea – about 1.5 hour by underground from Seoul center

Size:

400 employees, 12500 m² plant surface

Production capacity:

~40000 m² /month of Flexible PCB, ~ 30000 m² /month of Metal PCB



Also part of NewFlex group

(note: both of these companies not visited)

NewCRETEC

Location:

Asan, next to NewFlex company

Size:

1250 m² plant surface

Production capacity:

~6000 m² /month of Flexible PCB
Specialized in fine pitch, chip on board



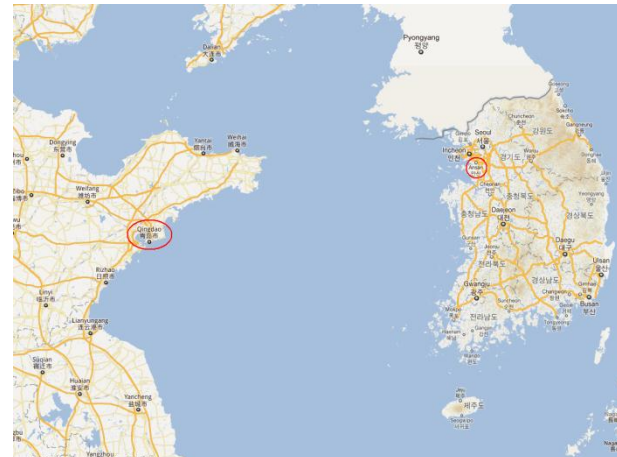
NewFlex subsidiary in China

Location:

Qingdao, Shandong province

Production capacity:

~12000 m² /month of Flexible PCB
Being acquiring full process capability



NewFlex profile

- Established in 1992 (started as rigid PCB manufacturer)
- Began Flexible PCB manufacturing in 1996 (15yrs experience)
- NewCRETEC joined in 2009

Target market application fields:

- LCD displays
- Touch screens
- Cameras and portable camcorders
- Laptops and PC peripherals
- Automotive
- Cellular phones

Flexible PCB commercial product ranges:

- Single side (70-120 μm thickness, 40 μm tracks)
- Double side (110-220 μm thickness, 50 μm tracks)
- Multi layer (3-8 layers, ≥ 250 μm thickness, 70 μm tracks)
- Rigid-Flex (4-8 layers)
- Sequential build up & inner via holes (4-8 layers)

Metal PCBs:

- Semi rigid PCB with thick Cu tracks,
- Used for power distribution, LED light sources



NewFlex production and R&D

Example of standard production schedule:

- Samples in less than 1 week
- Production setup from 2 to 3 weeks
- Production minimal order claimed not a problem (typically from industry 200 m²)



R&D on processes:

- Embedded resistors (NiCr, low resistance $\sim 10\Omega/[]$, finite values range of units of k Ω s)
- Embedded capacitors (polyamide dielectric, low values, area limited)
- Embedded optical waveguides (typ length 12 cm, attenuation 0.18dB/cm)
- Silver ink jet flex PCB (future challenge of flex manufacturing)

Future needs for CERN application:

- Future investments on larger size machines ($>0.6\text{m}$) to be discussed with them

NewFlex facilities: lamination stations



Rough estimation: $\sim 250\text{m}^2$ area for lamination



Laminators for panels

Several lines of reel to reel laminators for line production with fully automated chargers

NewFlex facilities: image transfer



Production line Laser Direct Imaging (LDI) with automated charger
(CERN has the same but manual)



Production line traditional manual exposure units

NewFlex facilities: wet etching process



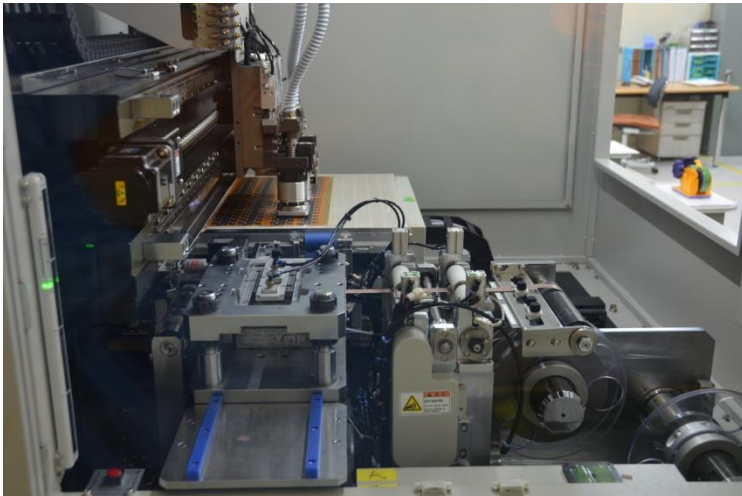
This area is larger than the lamination one
A few (perhaps 4 or 5) process lines operated in parallel

NewFlex facilities: copper plating station



This whole process is controlled by a single operator

NewFlex facilities: flex stiffening and punching stations



Two examples of client-customized flex stiffening machines

NewFlex facilities: laser drilling (micro vias) and optical inspection



Laser drilling



Optical inspection
(CERN has one similar machine)

NewFlex facilities: test area



Climatic chamber



Microscope



Mechanical flexibility tester



Electrical tests

GEM roadmap at NewFlex

First visit November 2008 (organized by Changwon University)

--- Explore company technology and know how

Second visit June 2011 (organized by RD51 in collaboration with Korea University)

--- Starting technology transfer

--- New Flex has successfully produced first 8 cm x 8 cm GEM

--- Satisfactory performance of 8 cm x 8 cm GEM;

Third visit September 2011 (organized by RD51 in collaboration with by Korea University)

--- Agreement on CERN license contract for GEM production

--- Plan for production of 20 GEMs of 10 cm x 10 cm

 Goal to verify process stability

 Work started with the local support of Prof. Sung

--- If OK, mass production of ~100 GEMs 10 cm x 10 cm to sell at CERN stores

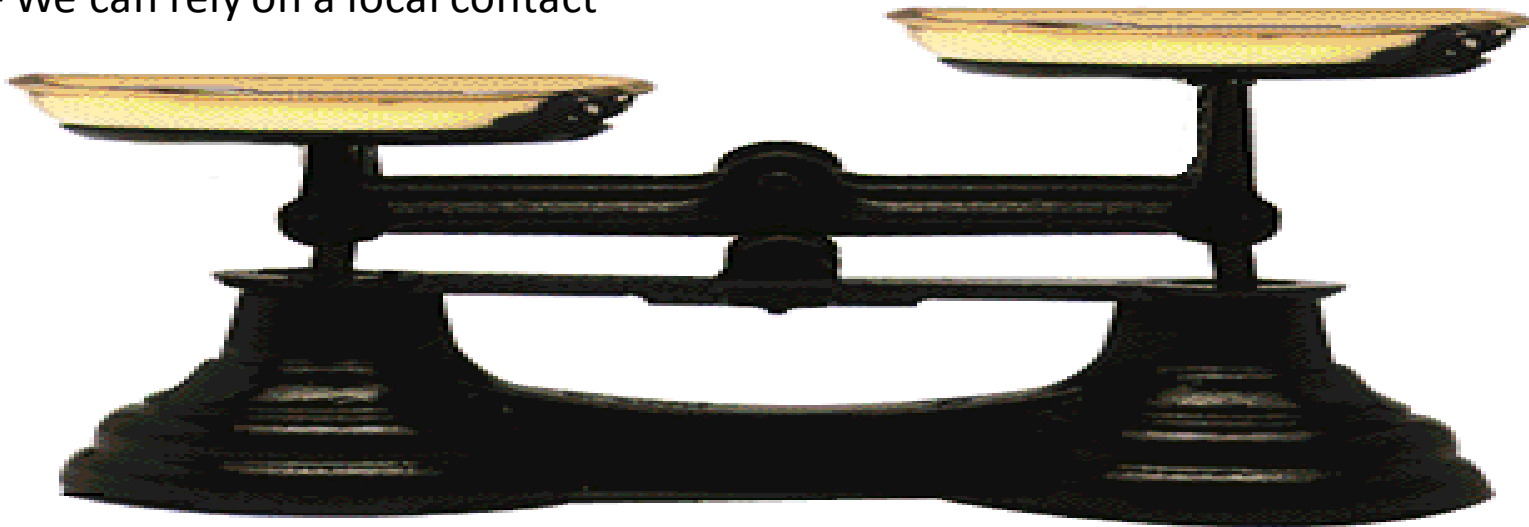
 and also start prototype 30 cm x 30 cm

--- If OK 30 cm x 30 cm, prepare large size CMS-like prototype (0.6 m x 1 m)

 To perform in 2012

Conclusions on NewFlex visit

- They master whole flex process
- They have facilities for large area flexible circuits
- They have large production capacity
- They demonstrate interest to our application field
- They share our plans
- We can rely on a local contact
- They need to fine-tune the technology
- They must prove process stability conform to our specifications
- They need to invest for machines >0.6m (long term issue to discuss)



CERN should continue the GEM industrialization program with NewFlex