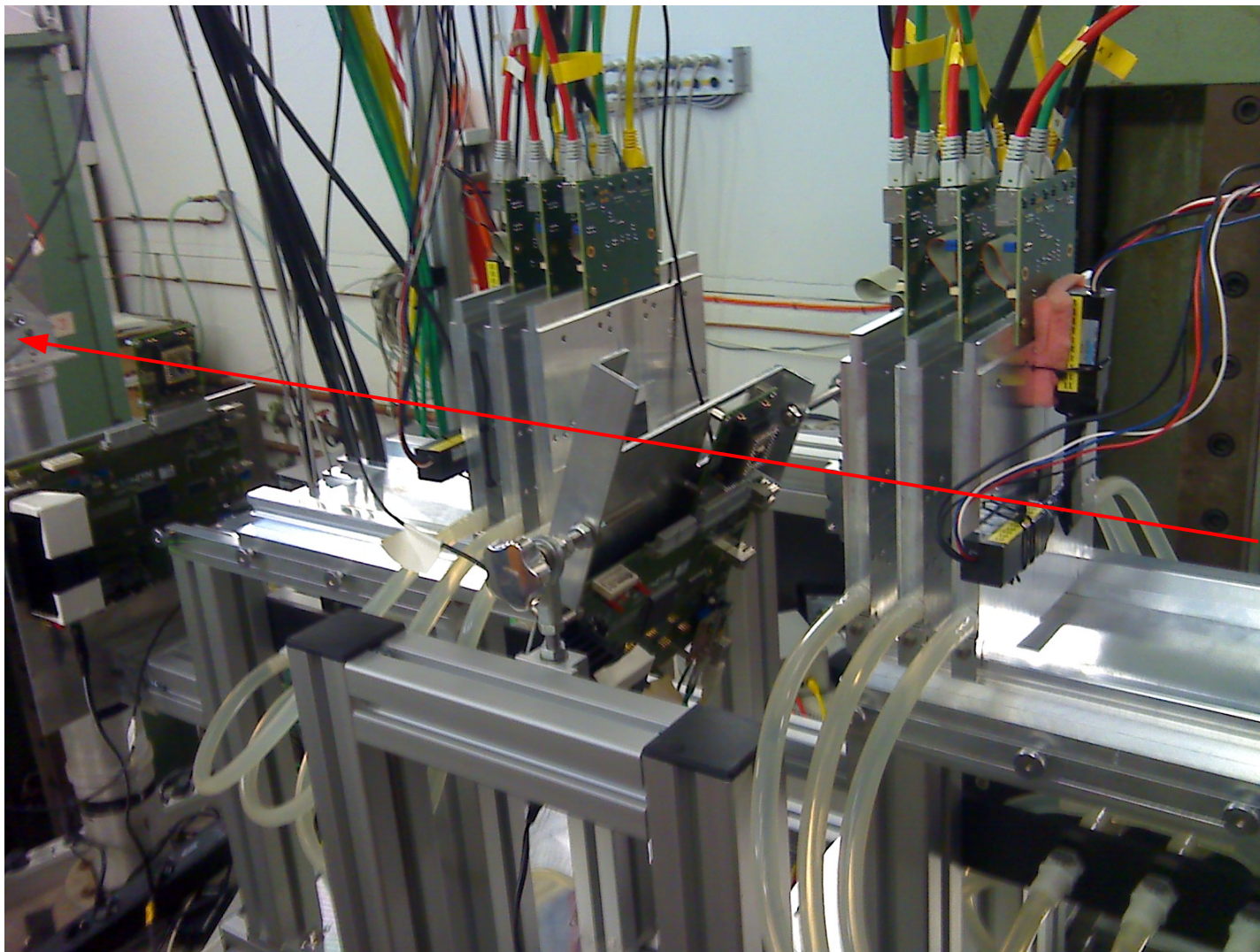


Pixel test plans 1st half of 2012

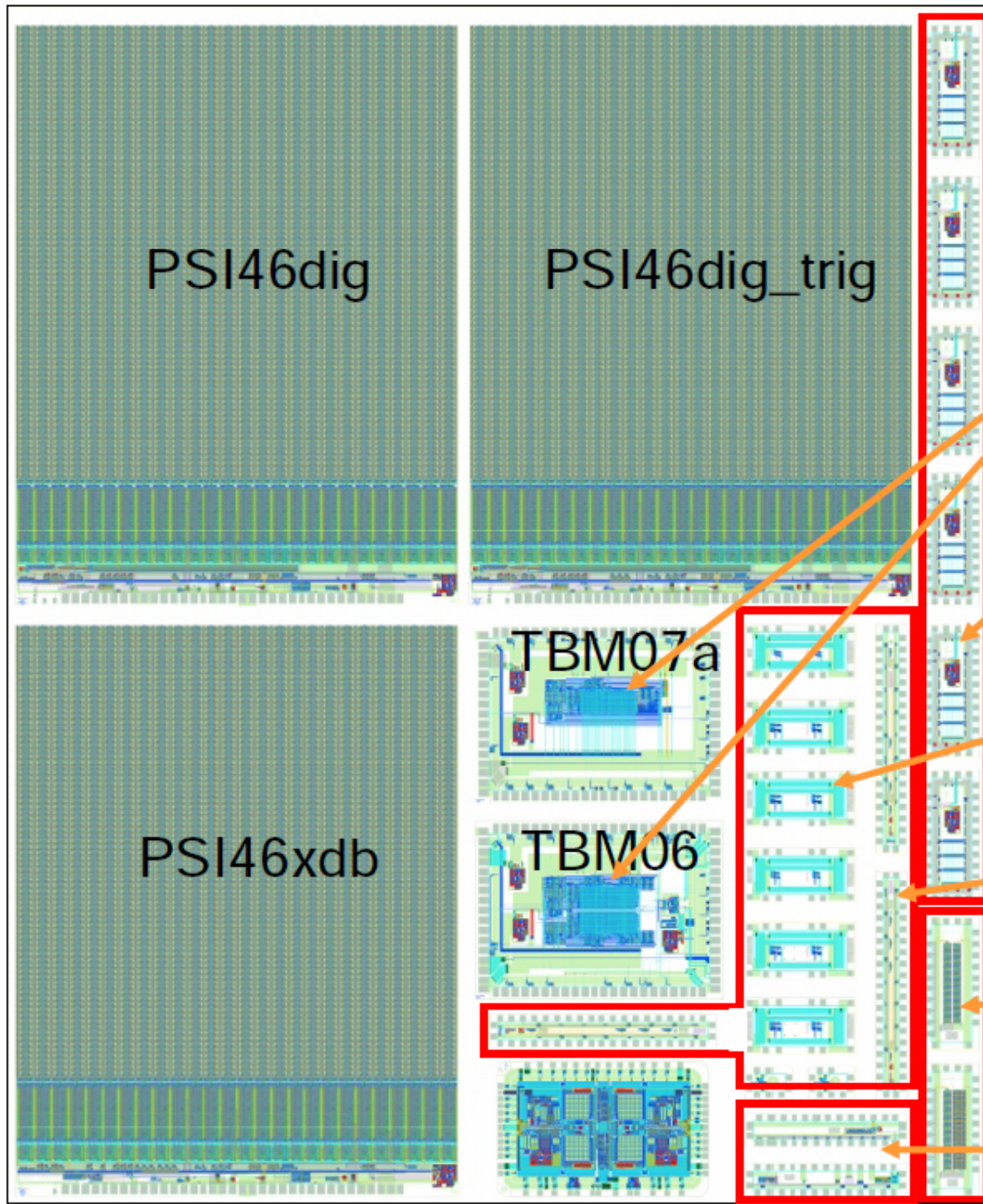
Daniel Pitzl, DESY

DESY CMS Tracker Upgrade, 10.2.2012



- new ROC design
- beam tests

ROC submission 2012a



Size: 17.4 mm x 21.2 mm

60 recticles/wafer, 6 wafers

3 new ROC versions (PSI)

2 new TBM versions

Ed Bartz, Rudgers

LCDs cable drivers with bug fixed in read back (PSI)

Digital Level Translator DTL to replace the ALT chip (PSI)

Christoph Nægeli

LCDs/LVDS converter for test setups (PSI)

SEU resistant register test structures (PSI)

ADC, PLL and oscillator test structures (PSI)

Beat Meier (PSI): Pixel Upgrade plenary at CERN, 1.2.2012

D. Pitzl (DESY): Pixel test plans

ROC submission 2012a

- PSI46xdb: Enlarged data buffers, reduced crosstalk and better level distribution; - 3 DACs
- PSI46dig_trig: Digital readout added; - 4 DACs
- PSI46dig: Trigger mechanism removed; read back; - 7 DACs
- 2 TBM versions
- DLT Digital Level Translator for POH, replacing the ALT
- LCDS/LVDS level translator for test boards (LCDS not a standard)
- Other test structures (ADC, PLL)
- Tape out: January 2012 to IBM
- 6 wafers in May 2012 (not yet confirmed from IBM)

Beat Meier (PSI): Pixel Upgrade plenary at CERN, 1.2.2012

<https://indico.cern.ch/conferenceDisplay.py?confId=172930>

ROC submission 2012a

Data Rate, Efficiency:

- Extended data buffer 32 → 80 cells
- Extended time stamp buffer 16 → 24

Crosstalk, threshold uniformity:

- 6 metal layer (process option)
- Thick top metal (LM instead of MZ process option, +37%)
 - better power and ground distribution (lower resistance)
 - better threshold uniformity
- New routing for calibrate signal → less crosstalk of calibrate signal
- Better decoupling of comparator and digital voltage → less crosstalk
- Different other minor layout changes to reduce crosstalk

ROC submission 2012a

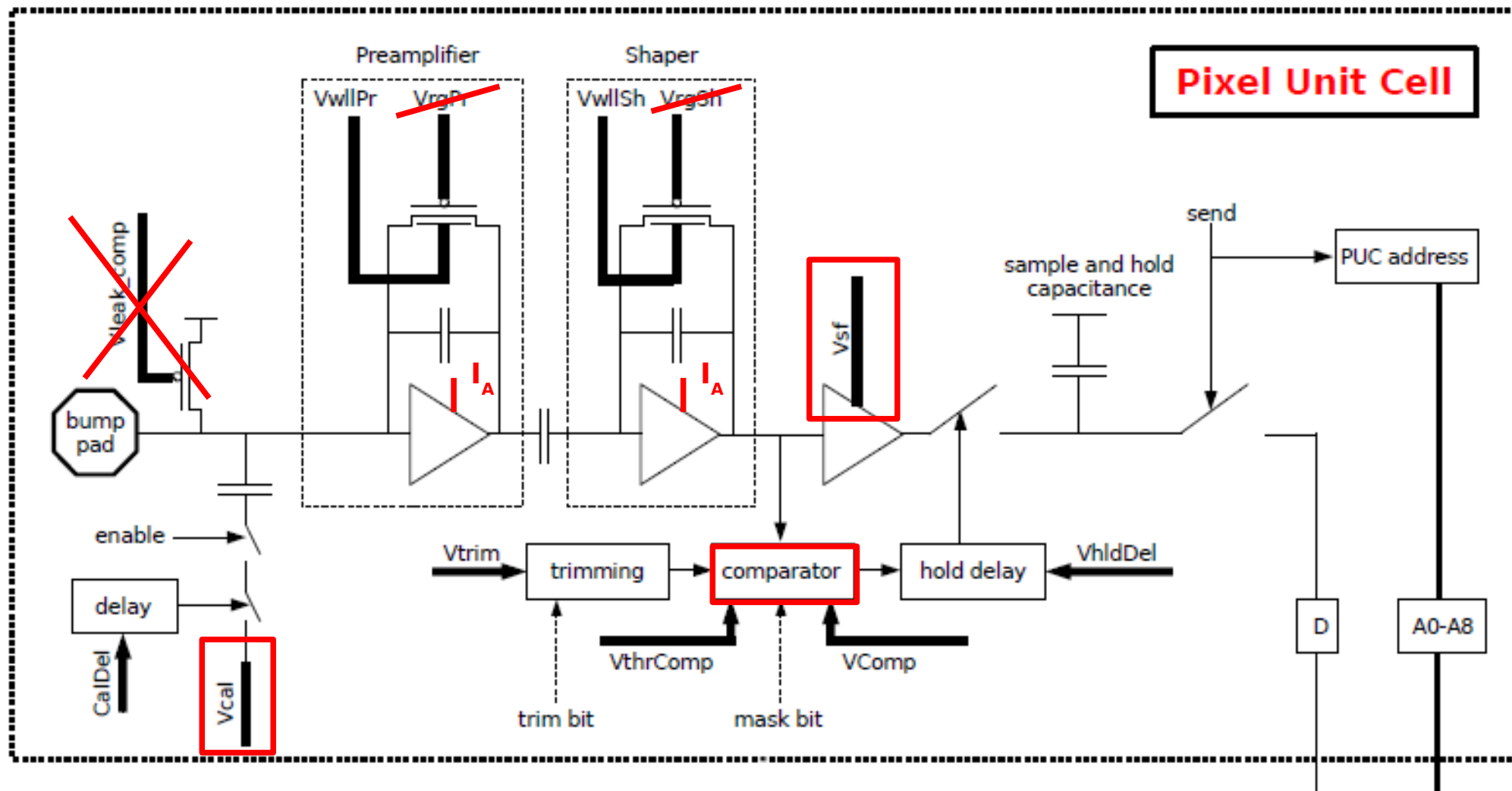
DAC:

- 3 DACs removed: VRGPR, VRGSH and Vleakage
- All DAC's with power on reset for low power ROC configuration
- **Current control** instead of voltage control for **S&H and analog power supply** → easier and independent setup

Timing:

- Small performance optimization in column drain mechanism (timing)
- Modified comparator with **reduced timewalk**
- Same analog read out as PSI46 → **same test board**
- **Comparison possible between PSI46 and PSI46xdb**

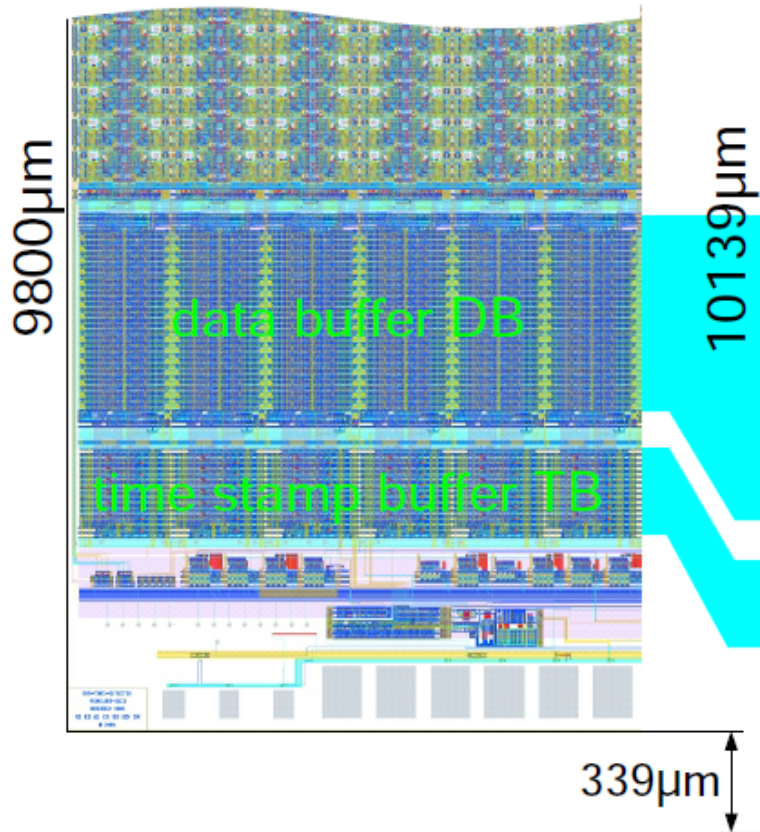
PSI46xdb pixel unit cell



 modified in PSI46xdb

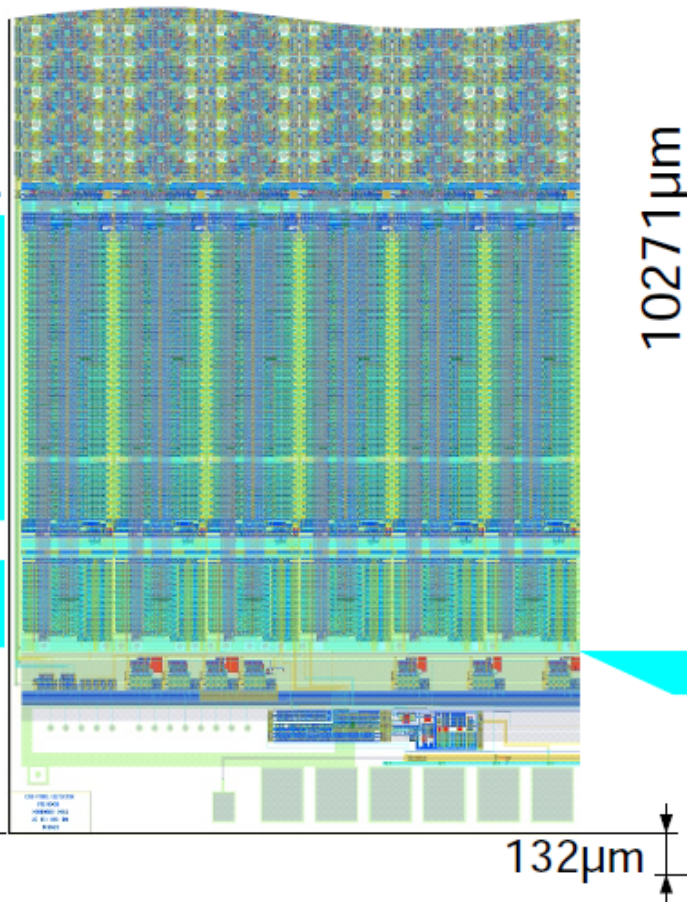
ROC submission 2012a

PSI46



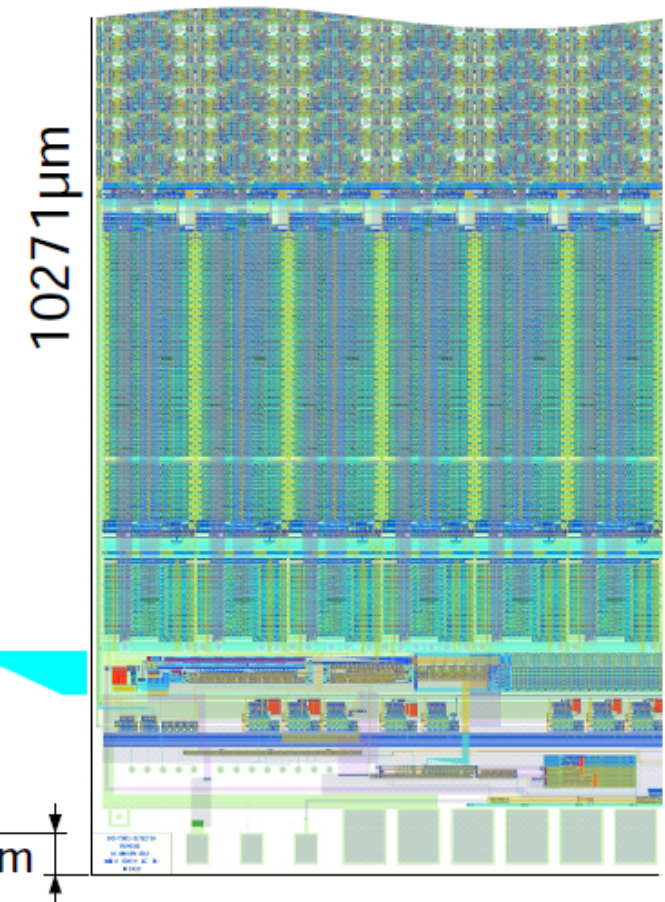
- DB 32
- TB 16

PSI46xdb



- DB 80
- TB 25

PSI46dig(_trig)



- DB 80 RB 64
- TB 32 8-bit ADC

Pixel plans for 1st half of 2012

- Visit to PSI end Jan
 - brought back 5 single chip modules, one full module
- Prepare ROC efficiency measurement:
 - use 2nd CMS pixel plane as timing reference TB 21, Feb
 - take reference data with present ROC TB 21, end April
- New ROCs: PSI46xdb, PSI46dig
 - in production at IBM expected at PSI in May
 - lab tests with PSI46xdb early June
 - test beam with PSI46xdb TB 21, end June-July

2 pixel chips in the EU Telescope

**CMS
pixel
as
timing
plane**

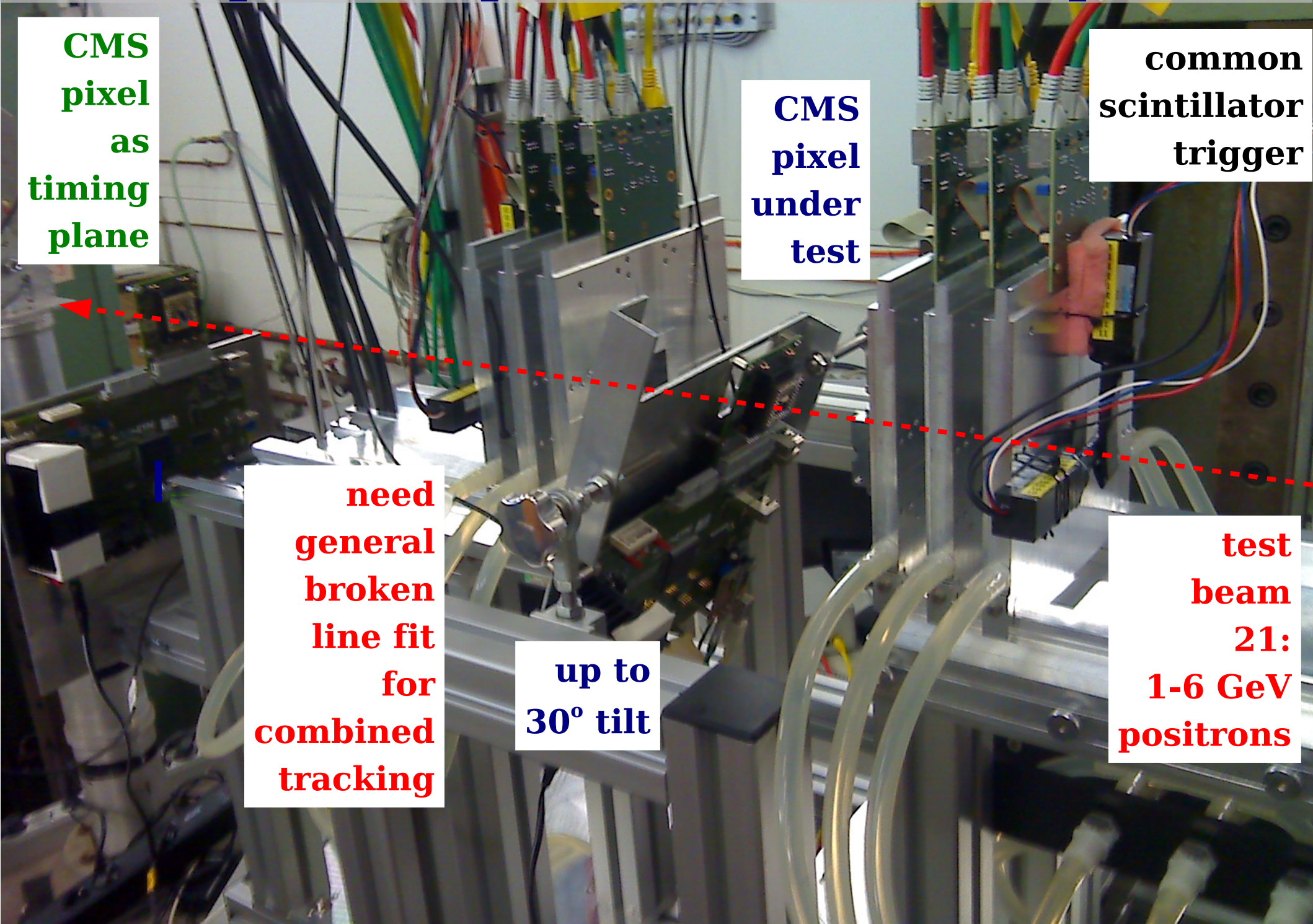
**CMS
pixel
under
test**

**common
scintillator
trigger**

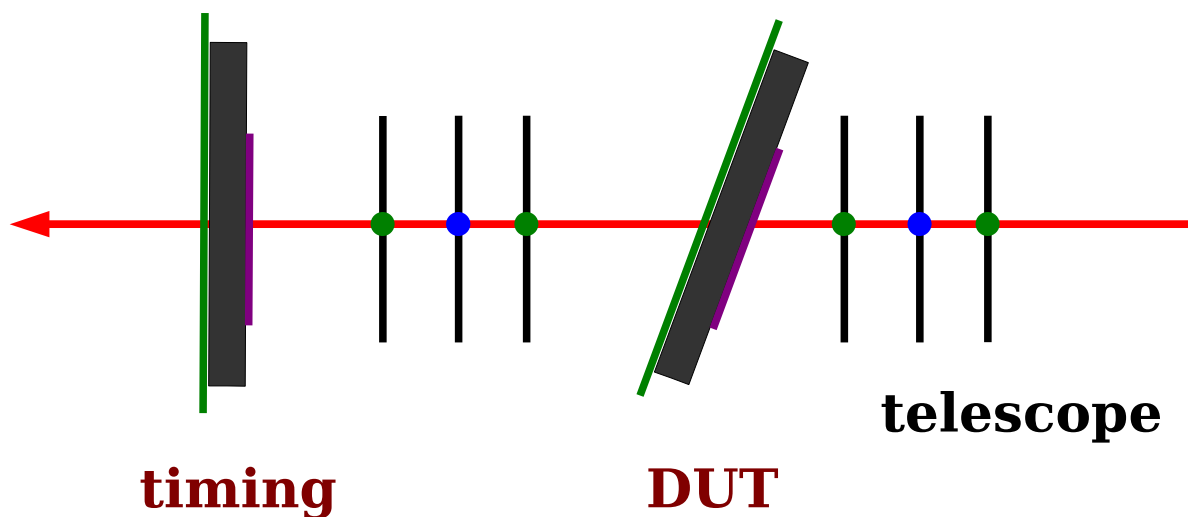
**need
general
broken
line fit
for
combined
tracking**

**up to
30° tilt**

**test
beam
21:
1-6 GeV
positrons**



efficiency measurement

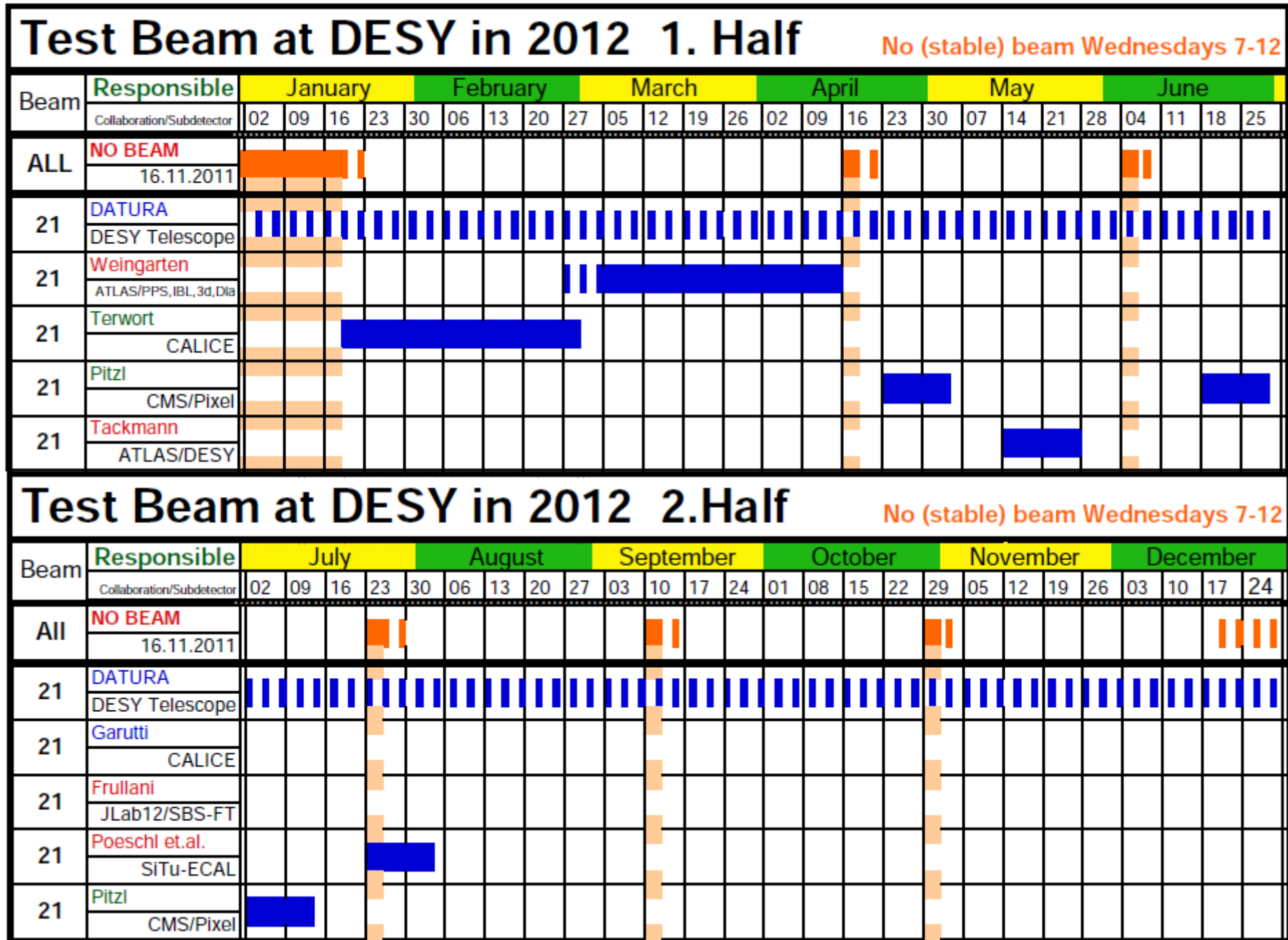


- Trigger and DAQ for 2 test boards and telescope established
- Software to be written:
 - link telescope track to hit in timing plane.
 - need General Broken Line fit, taking material into account,
 - with interface to MillePede II for common alignment.
- $\text{efficiency} = \text{DUT} / (\text{Telescope track} \&\& \text{timing hit})$
 - as function of position, angle, bias voltage, threshold, timing, ...

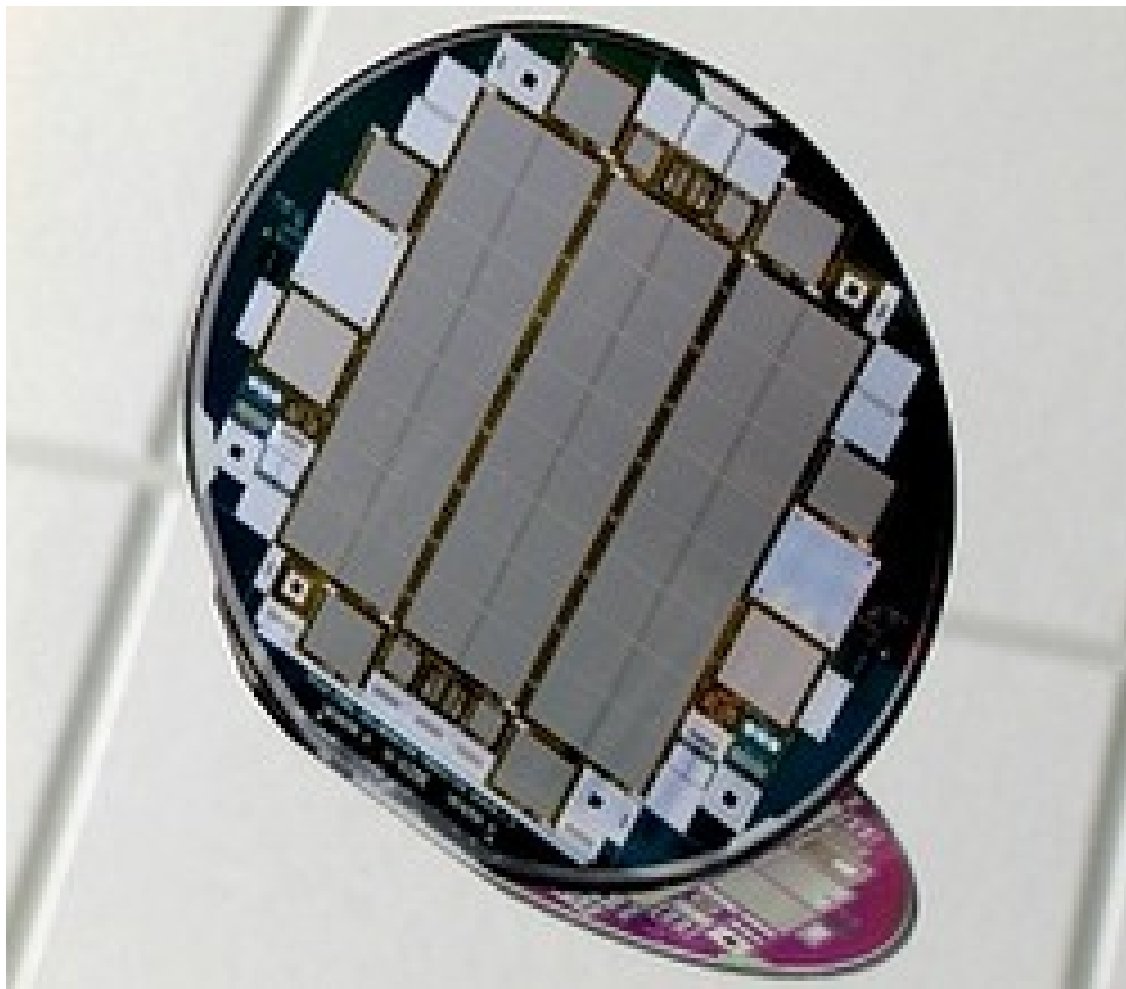
CMS Pixel in the DESY test beam

<http://adweb.desy.de/~testbeam/>

20.01.2012



CMS Pixel Sensors



design: Tilman Rohe, PSI

- 60 wafers under production at CIS (Erfurt)
 - standard CMS pixel sensor design (double sided, n-in-n, p-spray insulation).
 - for Karlsruhe, INFN, CERN/Taiwan, MRI, Purdue, DESY.
 - 5 wafers with increased bump pad passivation opening: 30 μm , for DESY.
 - Delivery in Mar 2012.
- Full sensors for first bump bondings.
- Single chip sensors for tests with new ROCs.