

Update on Gas Detectors

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RD51 talk by H. van der Graaf at FNAL

Optical Readout ?

GEM ideas, etc

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Nov 21, 2008

first

- A few slides from Harry van der Graaf
- Talk on Gas Detectors
- Nikhef, RD51
- (given at at Fermilab, SLAC, BNL, etc)

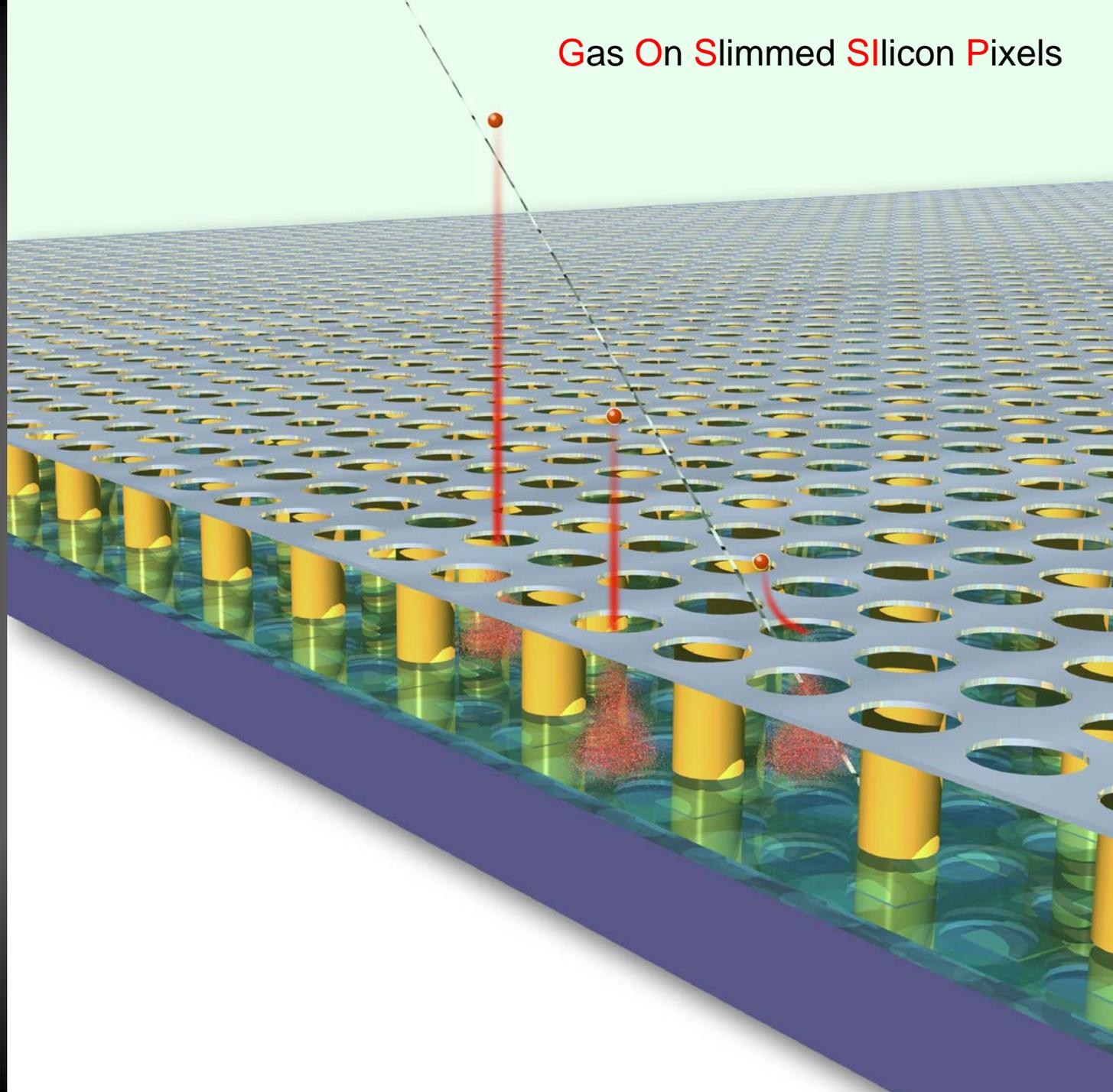
GOSSIP detector

Gas
amplification
between grid
and pixels.

Pixels are on
CMOS chips,

There is a
resistive/
protective
layer over the
pixels.

Gas On Slimmed Silicon Pixels



The MediPix2 pixel CMOS chip

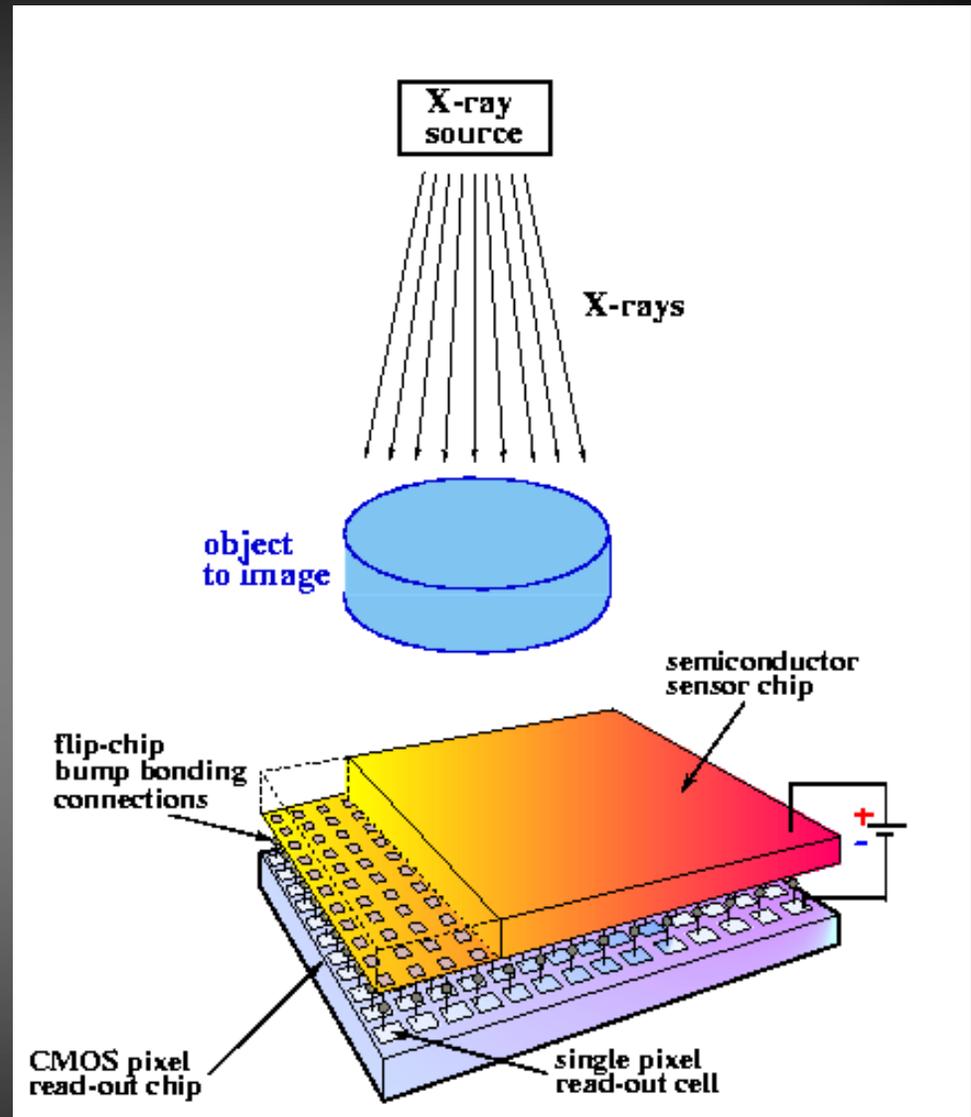
256 x 256 pixels

pixel: $55 \times 55 \mu\text{m}^2$

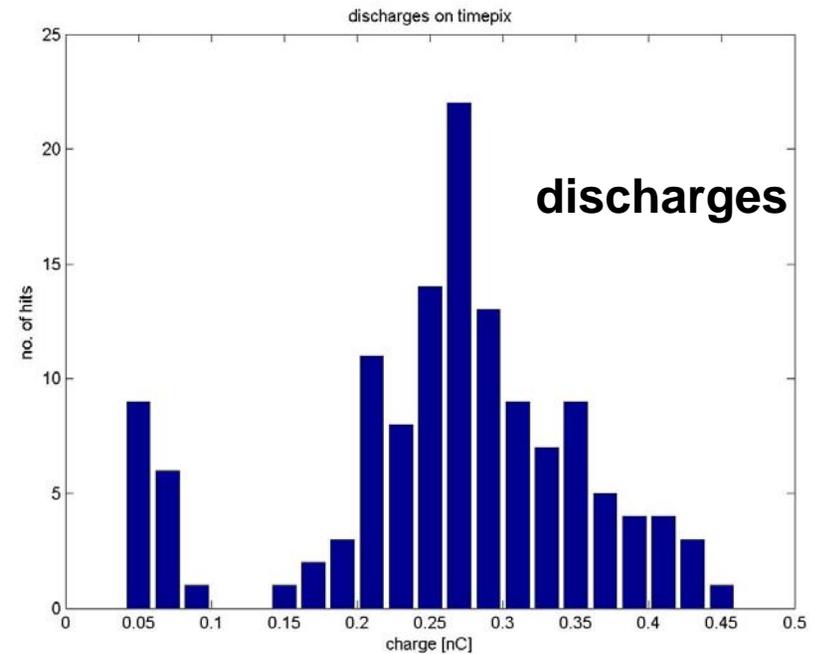
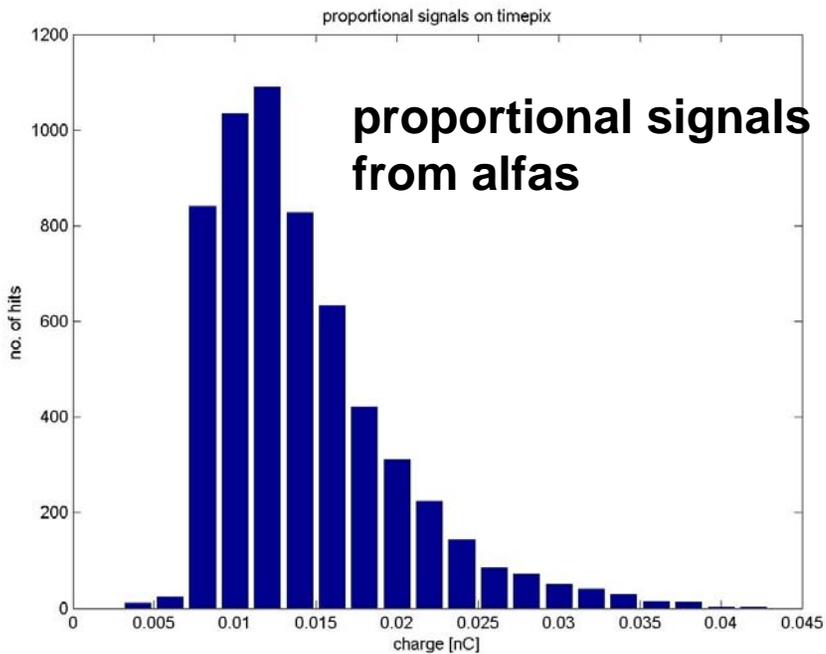
per pixel:

- 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!!



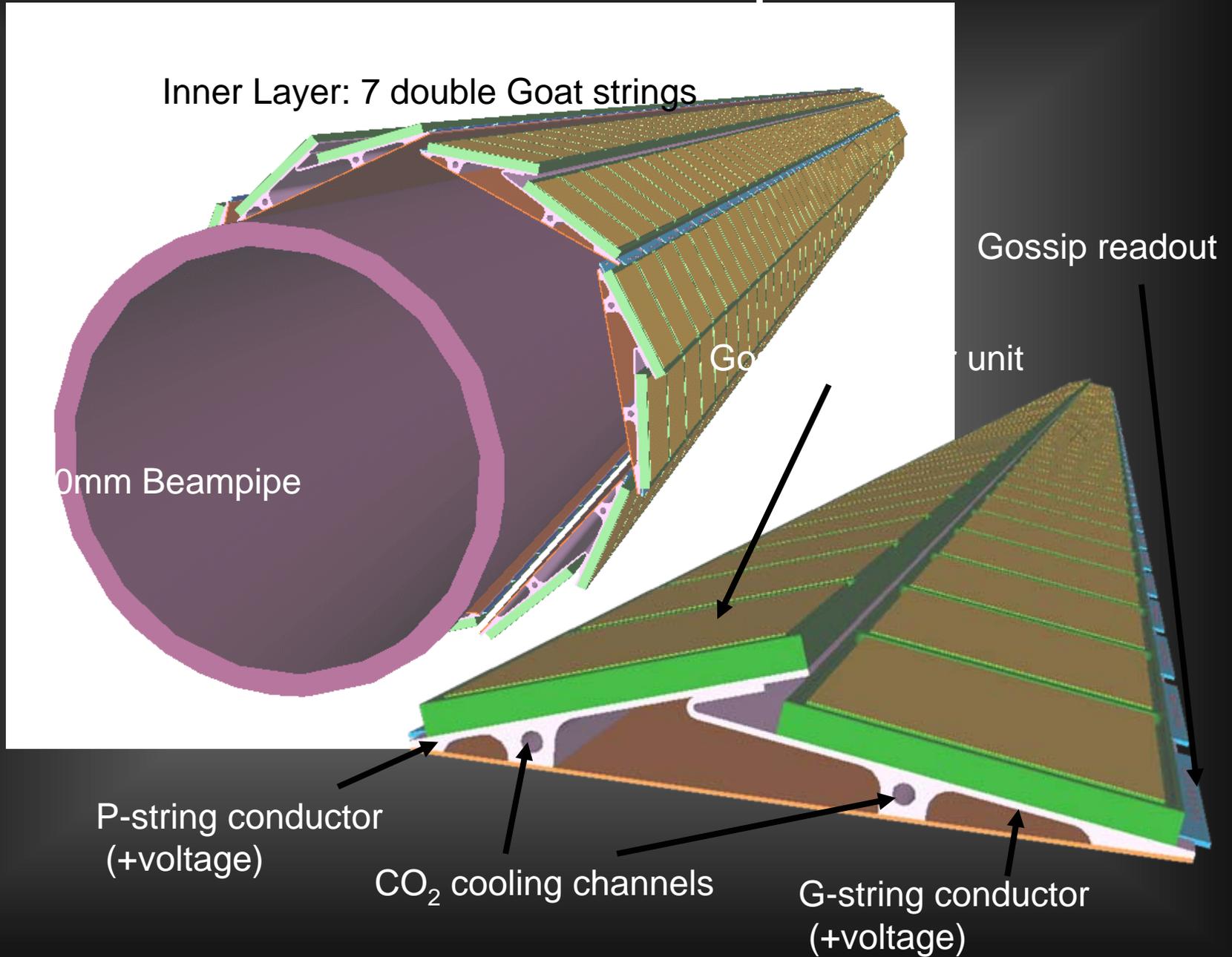
- CMOS chips are no longer destroyed
- discharges in gas proportional chambers are hard to exclude
- SiProt makes chips **spark proof**

Hydrogenated amorphous Silicon

One can vary mix with SiO₂ to control resistivity

Just like my paint mixes for RPC

GOAT: **GO**ssip in **AT**las



Conclusions and plans

- Gossip has shown to work with the PSI-46 CMS Pixel FE chip
- With a 20 μm SiProt layer, CMOS chips are spark proof
- Si_3N_4 is a promising material for protection & InGrid

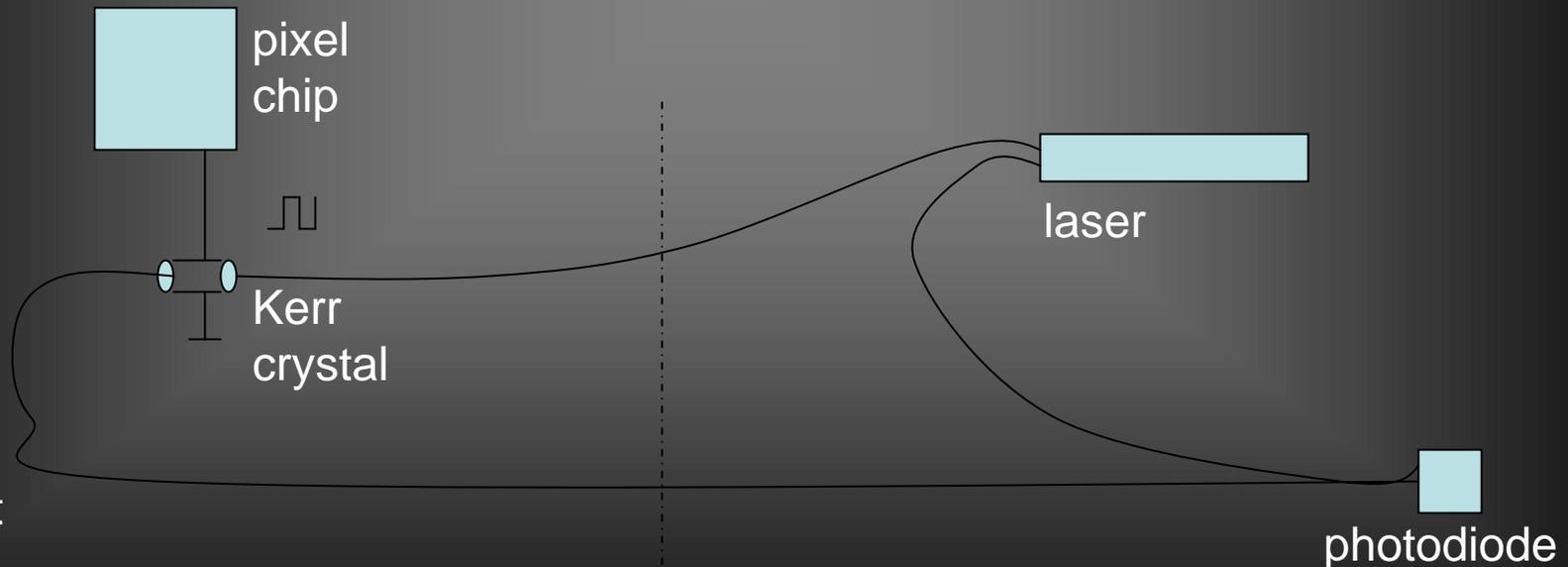
Next steps:

- Mass production (by industry) of (SiNitride) InGrid, SiNProt
- Build from (TimePix, PSI-46) + SiProt + InGrid
 - Many more small chambers
 - Demo 'beam telescope': testbeam work
 - ATLAS Pixel Staves
- Gas ageing studies: testing Si containing compounds (SiO_2 , SiH_4 , SiC_nH_m)
- In framework of CERN R&D project RD51 (kick-off Workshop @ Nikhef April 2008)
 - Simulations
 - Development of general purpose GridPix chip TimePix-2

Data Transport

- to outside world
- inter (pixel) chip communication
- Level 1 trigger

status: kapton/aluminium: dominant material for pixel detectors @ sLHC!
VCels + optical fiber: not rad hard, much material, much power required



Fibers are not Rad-Hard – I (DU) am looking into steering light with diffraction.

Non-Fiber Optical Readout ?

van der Graaf was talking about 1 mm^2 light modulators at a few GHz. I hope these work at low voltage as claimed.

It is possible to split a laser into several small beams using diffraction. (something like Fourier transform of desired pattern at a focal plane)

It is possible to steer beams, take out vibration, etc with MEMS optics ,
Very large number of steerable pixels,
two kinds - either less than a wavelength, or more
(Talk by Roland Ryf of Bell Labs in CMT division a couple of weeks ago)

An issue is whether the modulated beams have to be kept physically separate, or can be allowed to merge, and then separated using interference as in a hologram.

A little at Argonne

- My GEM detector LDRD proposal was not approved.
- Maybe Industry could do what I think is the next advance, a readout plane with short strips.
- Brad DiGiovine in Physics just now got some GEM foils from TechEtch after waiting for months.
- I am still working on DAQ for the STAR GEM tracker.

Physicist – Detector Development (A13)

Within the Helmholtz-Alliance network “Physics at the Terascale” consisting of DESY, FZ-Karlsruhe, 17 German Universities and MPI Munich, Bonn University is a centre for the development of particle physics detectors and ASIC electronics. We aim to enlarge and bring together the existing labs SiLab, specialized on pixel detectors, and TPCLab, specialized on gaseous detectors, into a university based facility for detector instrumentation and associated front end electronics. The facility is intended to serve both research projects from partners within the Helmholtz Alliance and in-house projects.

Conclusions

GOSSIP detector, RD51, looks more promising

Whole project is pretty high-tech

- - Detector, FEE, Power, Cooling, Data Path

Argonne might be able to do something on detector, or data path

GEM technology could be advanced with short-segment readout strips

Probably a commercial lithographic PC place in Pennsylvania could do something, but need justification, money, etc.