

WG5: MPGD related Electronics

Tue. Oct. 14th 9:00 to 12:00

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2nd RD51 Collaboration Meeting

Paris, Mon. Oct 13th to Wed. Oct. 15th

Agenda

09:00	Introduction	Werner Riegler
09:20	Experience with the design and submission of the Medipix3 pixel readout chip in 0.13 um CMOS	Xavier Llopart
09:40	TimePix-2: general purpose applications and requirements	NIKHEF
10:00	GEM Amplifier Shaper Tracking ON Events	Antonio Ranieri
10:30	Coffee	All
10:50	Electronics developments for a Micromegas-based digital Hadron Calorimeter	Renaud Gaglione
11:10	The SLAC KPiX Chip for ILC Digital Hadron Calorimetry	Andy White
11:30	The MIMAC Asic	Jean Pierre Richter, Germain Bosson
11:50	Contribution to the development of portable multichannel systems for detector studies	Jose Toledo

Working Group 5, Tasks

TASK 1

Definition of front-end electronics requirements for MPGDs

TASK 2

Development of general-purpose pixel chip for active anode readout

TASK 3

Development of large-area detectors with pixel readout

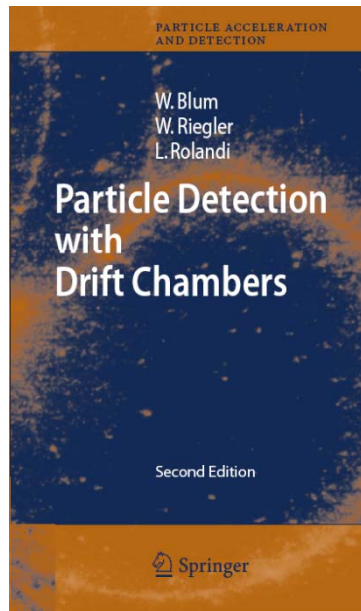
TASK 4

Development of portable multichannel systems for detector studies

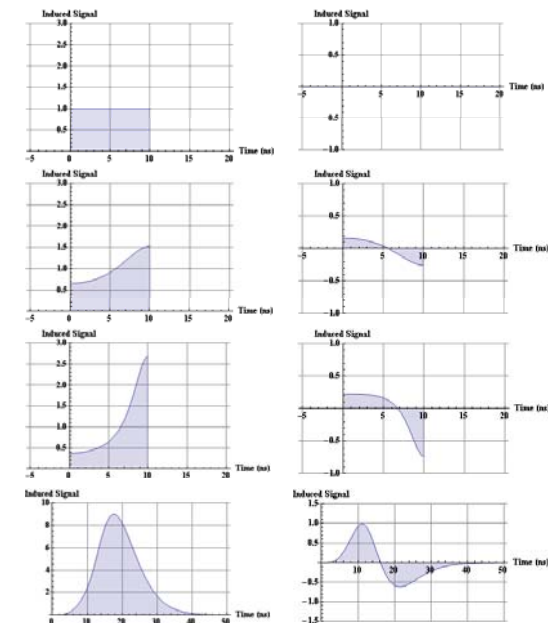
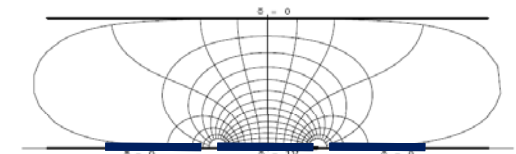
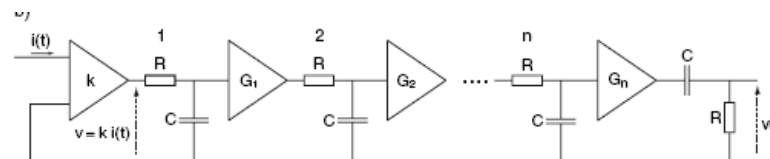
Task1: Definition of front-end electronics requirements for MPGDs

The idea of this task is the development of common front-end requirements for MPGDs.

The necessary prerequisite for this task is a detailed understanding of MPGD signals as well as a common language for electronics parameters (e.g. ENC, Shaping time, Peaking Time etc.)



2nd edition of
“Particle Detection with
Drift Chambers”
contains now 100 pages on
Signal Theorems and
Frontend Electronics
Discussion.



Task1: Definition of front-end electronics requirements for MPGDs

A survey of existing frontends and its specifications and applicability should be carried out.

Questions of the following Nature should be discussed:

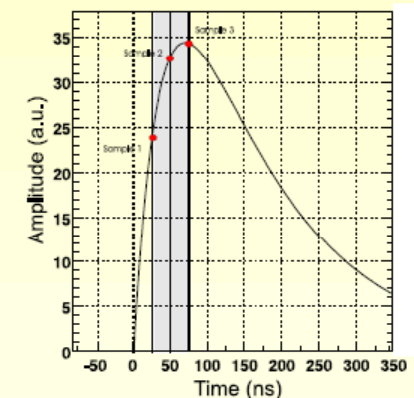
E.g. The ATLAS Muon System Cathode Strip Chambers (Multi Wire Proportional Chambers) use an analog pipeline (SCA) for storing the charge before digitization is necessary, because an ADC sampling at 40MHz is excluded due to Power Consumption Constraints.

Do present ADCs have a power consumption that allows continuous digitization ?

Using a Micro Pattern Gas Detector for this application, would a simple Time Over Threshold Measurement be sufficient to do the Job ?

More General: Are time over threshold measurements for charge measurement sufficient for MPGD tracking applications.

Many of the MPGD specification questions can be carried out by Si



Task1: Definition of front-end electronics requirements for MPGDs

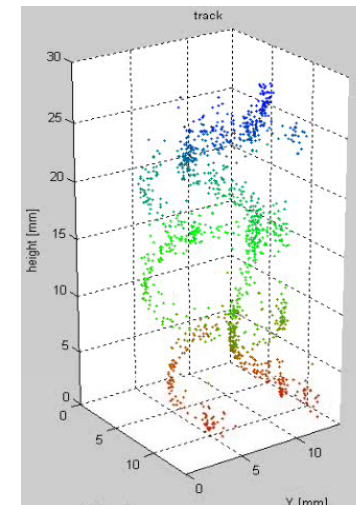
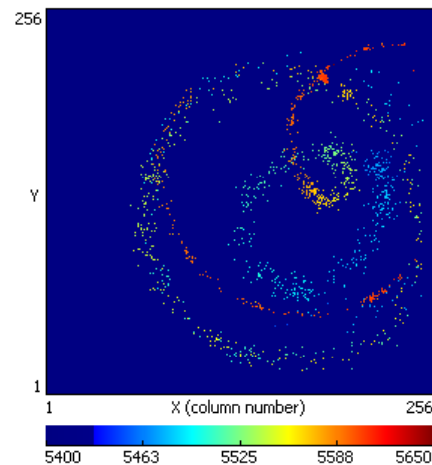
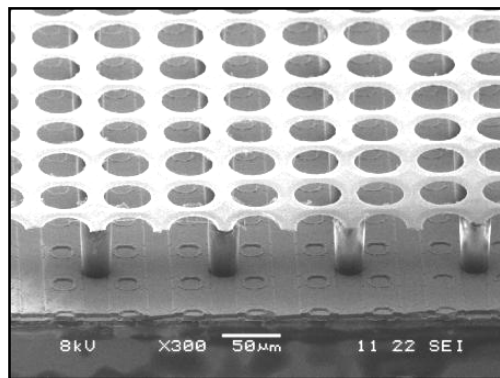
Our goal is a report with these issues within a few months time.

We have to get organized and work on it ...

An outline of the report will be circulated soon among the Persons/Institutes that indicated interest in this task (WG5: Task1) such that we can define who does what.

Task2: Development of general-purpose pixel chip for active anode readout

Pixel Chips like Medipix in conjunction with MPGDs have opened a completely new window of applications. Further development of this technique is essential ...



Task2: Development of general-purpose pixel chip for active anode readout

Limitations of Timepix:

Chip architecture originally designed for imaging is used for single (or sparse multiple) event readout

Non triggerable

Full frame readout only

Either arrival time OR amplitude information

Biggish pixels cf CCD's etc

Task2: Development of general-purpose pixel chip for active anode readout

Successor of Timepix e.g. “Timing and Tracking Pixel (TTPix)”:

Front end

Simple preamp - no charge summing	(≠ MEDIPIX3)
Noise <100e- rms	(~MEDIPIX3)
Positive and negative input charges	(=MEDIPIX3)
Up to 5-10nA per pixel leakage current compensation	(=MEDIPIX3)

Discriminator

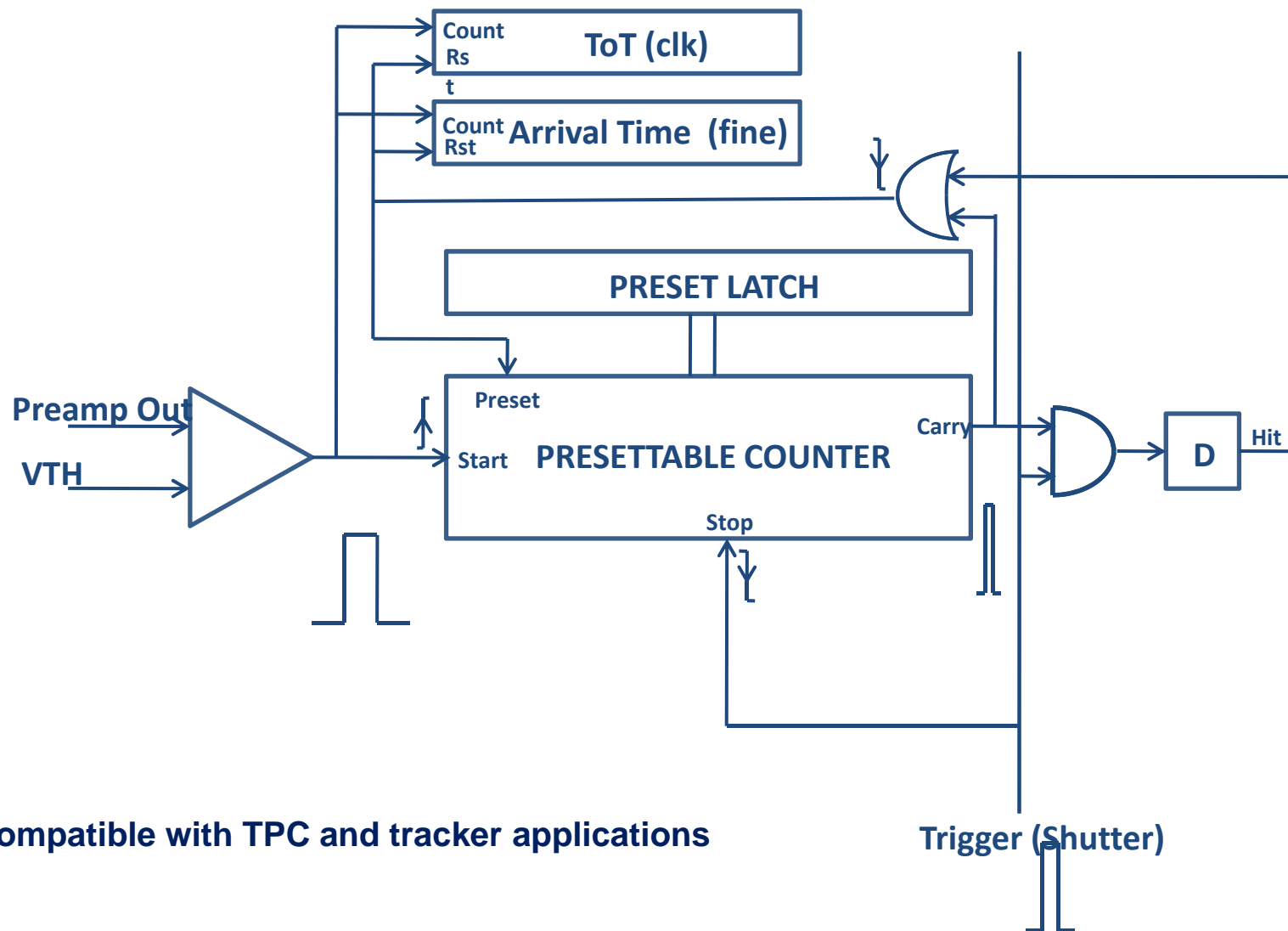
Single threshold with ?X?-bit tuning	(=MEDIPIX3)
Threshold variation < noise	(=MEDIPIX3)

Power consumption

In the region of uW/pixel	(<MEDIPIX3, no charge sum)
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Task2: Development of general-purpose pixel chip for active anode readout

Possible Pixel Architecture



Task2: Development of general-purpose pixel chip for active anode readout

Readout:

Externally Triggerable

Fast OR Signal

Sparse data only (address sent, =zero suppression)

Continuous R/W i.e. continuous sensitivity

No event counting mode

Task2: Development of general-purpose pixel chip for active anode readout

Summary:

Technical specs are converging

Significant detailed design effort still needed

Some questions remain

Behaviour of fine timestamp measurement circuit over large matrix

Is ToT useful for timewalk correction?

Task2: Development of general-purpose pixel chip for active anode readout

Organizational Matters:

0.13um CMOS runs are expensive, 0.5MSfr/run. Assuming two runs we have a cost of 1MSfr 'just' for production, no manpower etc. counted yet.

With 50kSfr from "here and there" this will not be possible within RD51.

Good news:

- 1) Common spec for silicon application and gas detector application seems possible.
- 2) Medipix consortium is interested to contribute with experienced manpower and money, but timescale may be an issue (not immediately ... MPIX3 ...)

Important Questions:

How to organise efficiently a coherent design team across different countries ?

Intellectual Property needs to be clearly defined in ase of commercial interest.

Medipix3 readout hardware and software system may be inappropriate.

Project Management – Consortium agreement is needed (MPix3 or other).

Task2: Development of general-purpose pixel chip for active anode readout

How to proceed:

Collaboration with MPIX3 consortium is essential and we have to make an effort to convince them that this is of interest to them.

Final definition of Specifications and technical design work can go ahead.

All interested parties should meet, possible around MPIX3 workshop end of Nov. 2008 at CERN, in order to define financial and organizational aspects – to be organized.

Task3: Development of large-area detectors with pixel readout

Task4: Development of portable multichannel systems for detector studies

Development on such a system based on the VFAT chip (TOTEM) is ongoing (see presentation)