Francesco Zappon

Background:

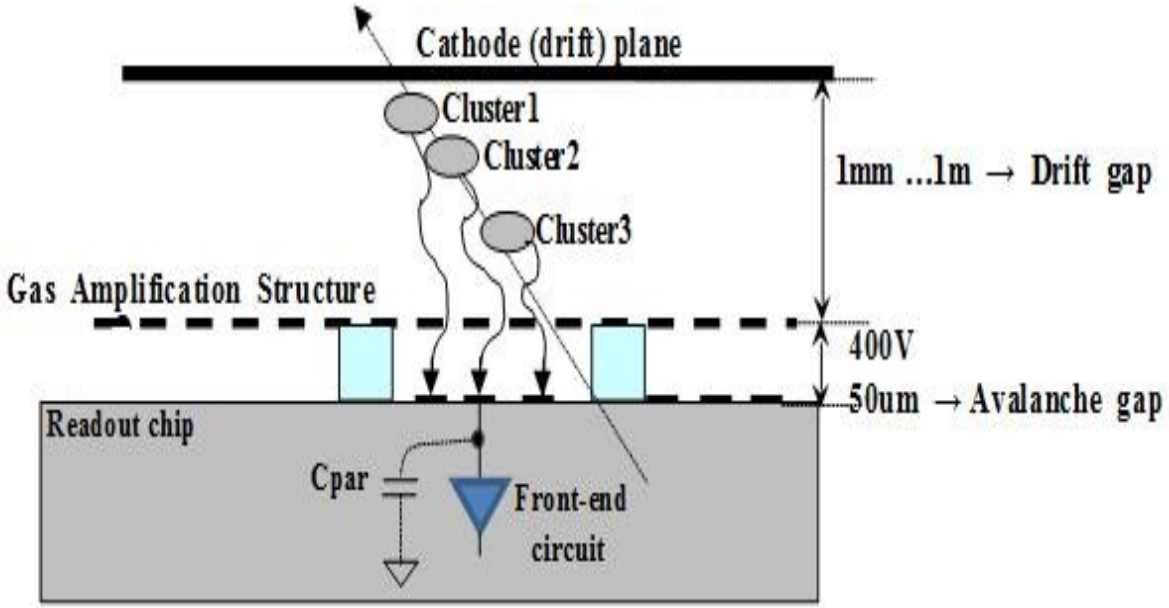
- Home country: Italy
- Physics degree in December 2008, Università di Padova;
- Thesis topic: development of a FPGA board for the ICARUS experiment;

Present status:

- ESR at Nikhef (NL)
- Start date: 1st June 2009;
- MC-PAD project P9;
- Supervisor: Martin van Beuzekom
- Thesis advisor for Universiteit van Amsterdam: Prof. Dr. Els Koffeman

Project description

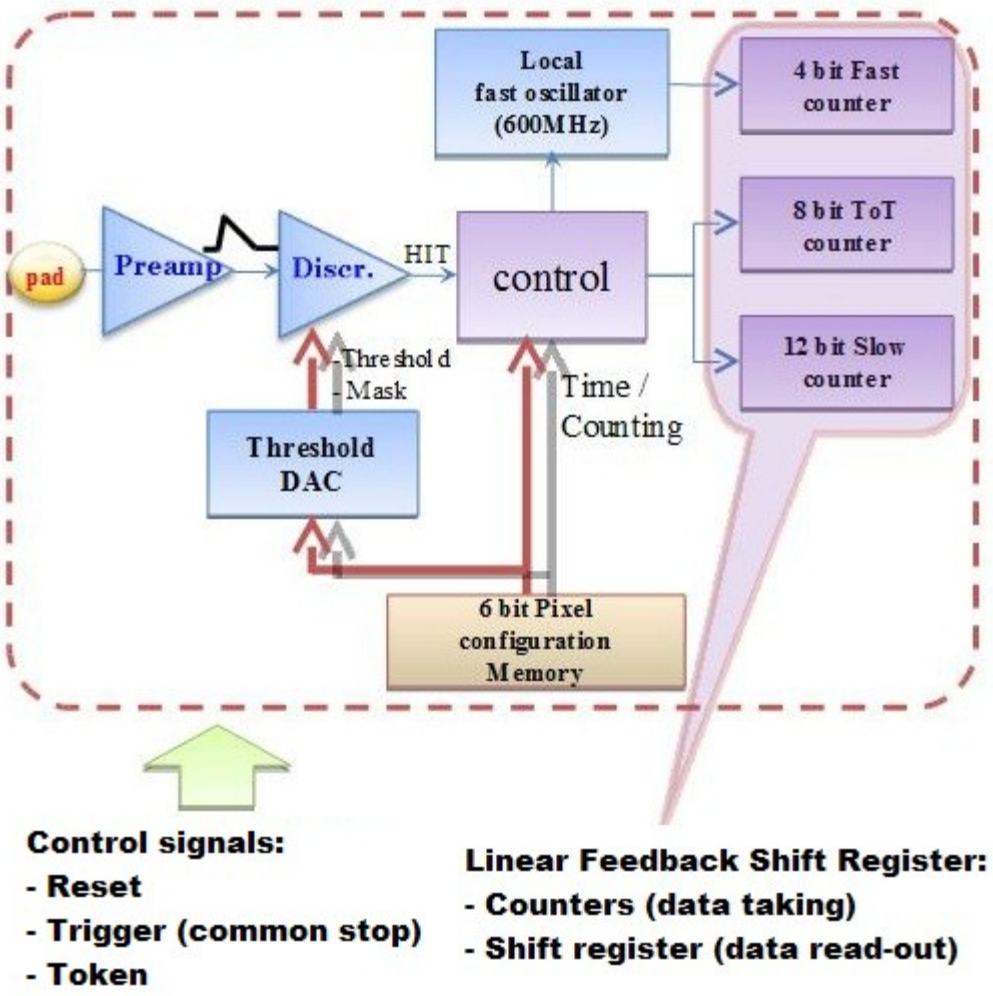
Applications:
Development of readout circuits for gaseous pixel detectors for High Energy Physics



1st part: Gossipo3.
Prototype chip, developed to test analog and digital blocks for a future full-chip design.
Work on:
- Design/Layout;
- Development of the test program;
- Data analysis.

2nd part: Timepix2.
Multi-purpose full chip with a new readout structure.
- Characterization of Timepix2;
- High level simulation of the readout;
- Design and Layout.

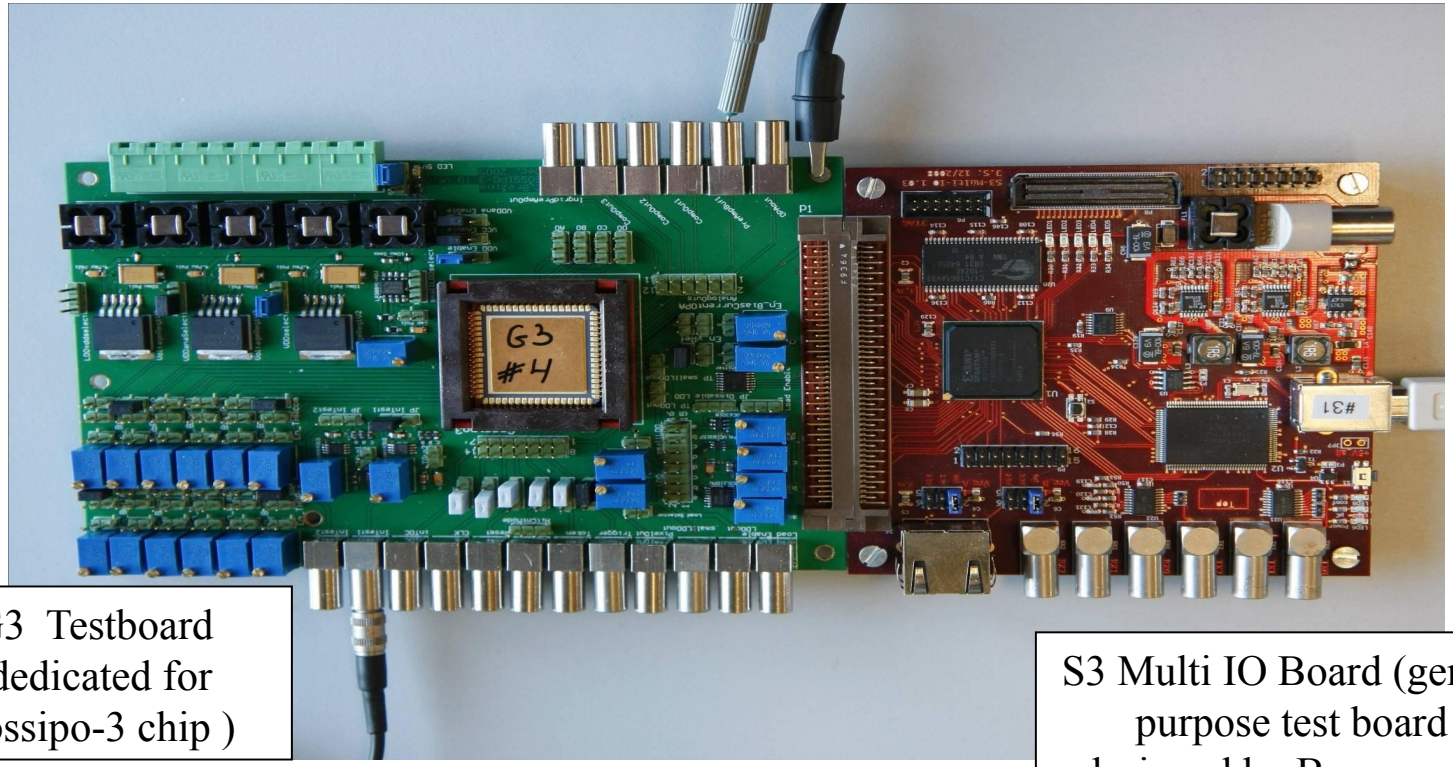
Gossipo3: block diagram



Test setup

Development of the test program:

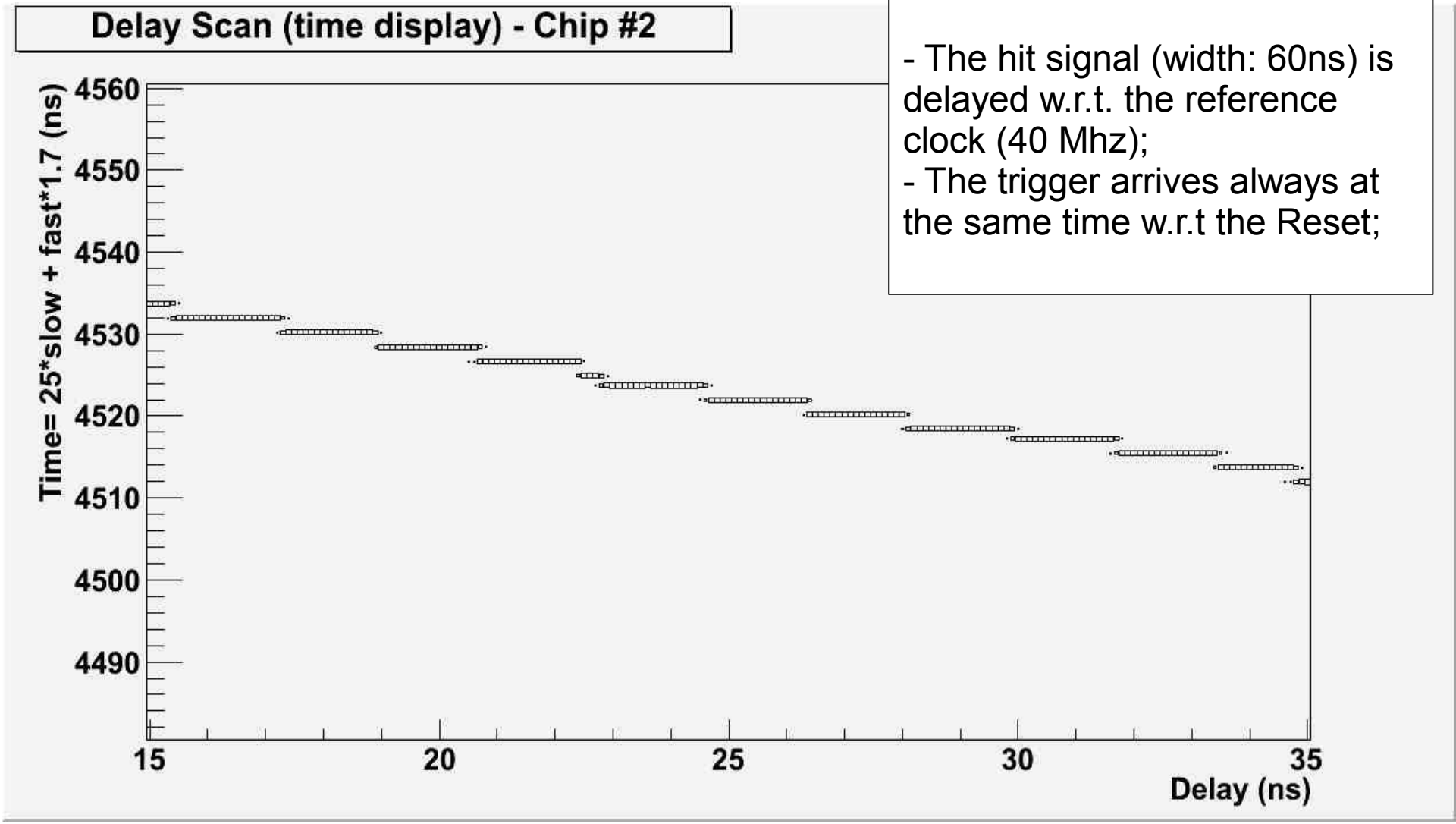
- C++ based
- Qt libraries to develop the GUI
- GPIB protocol to control the pulse generator
- Verilog to write the program to control the FPGA (ModelSim for simulations)



G3 Testboard (dedicated for Gossipo-3 chip)

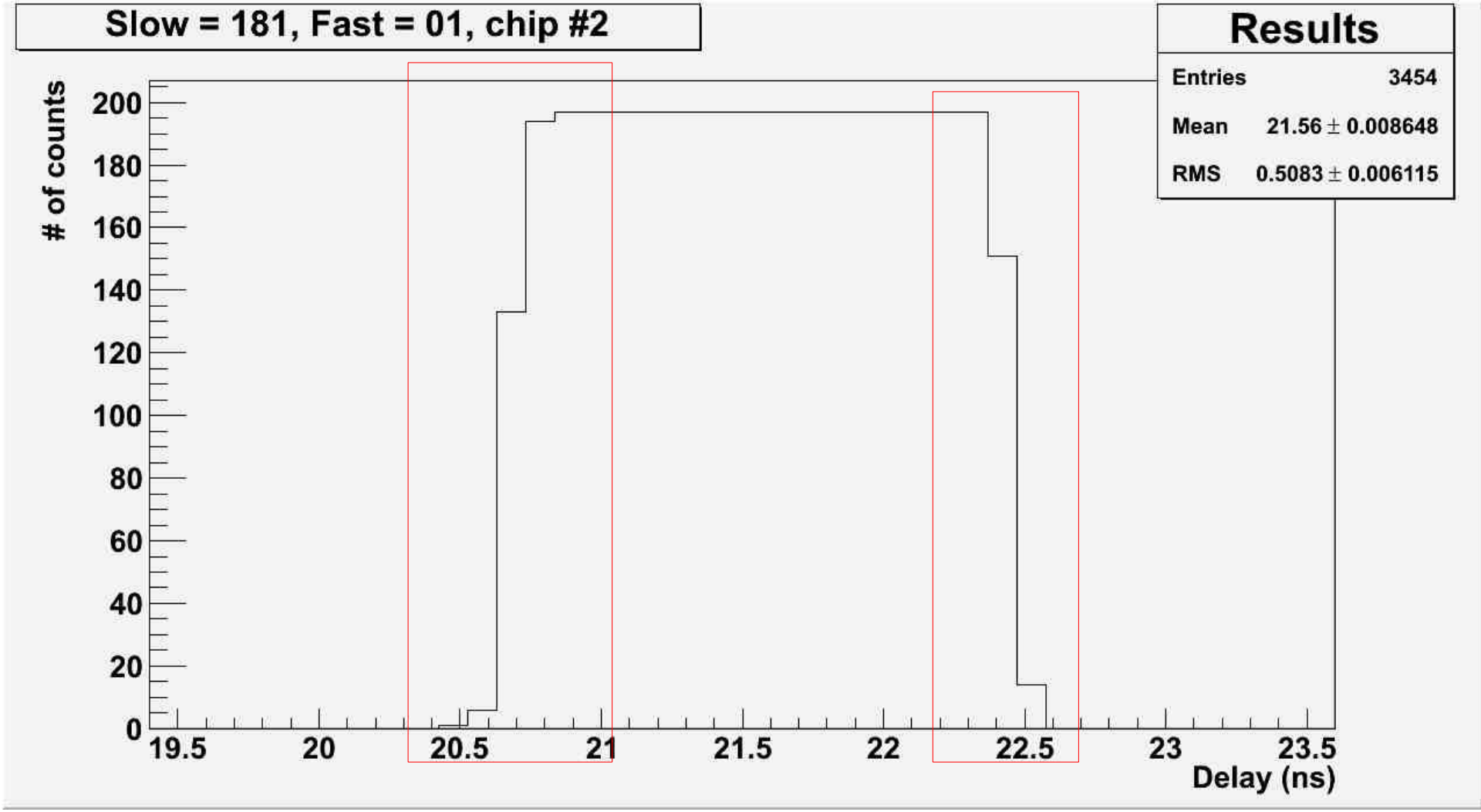
S3 Multi IO Board (general purpose test board designed by Bonn group)

Results (1)

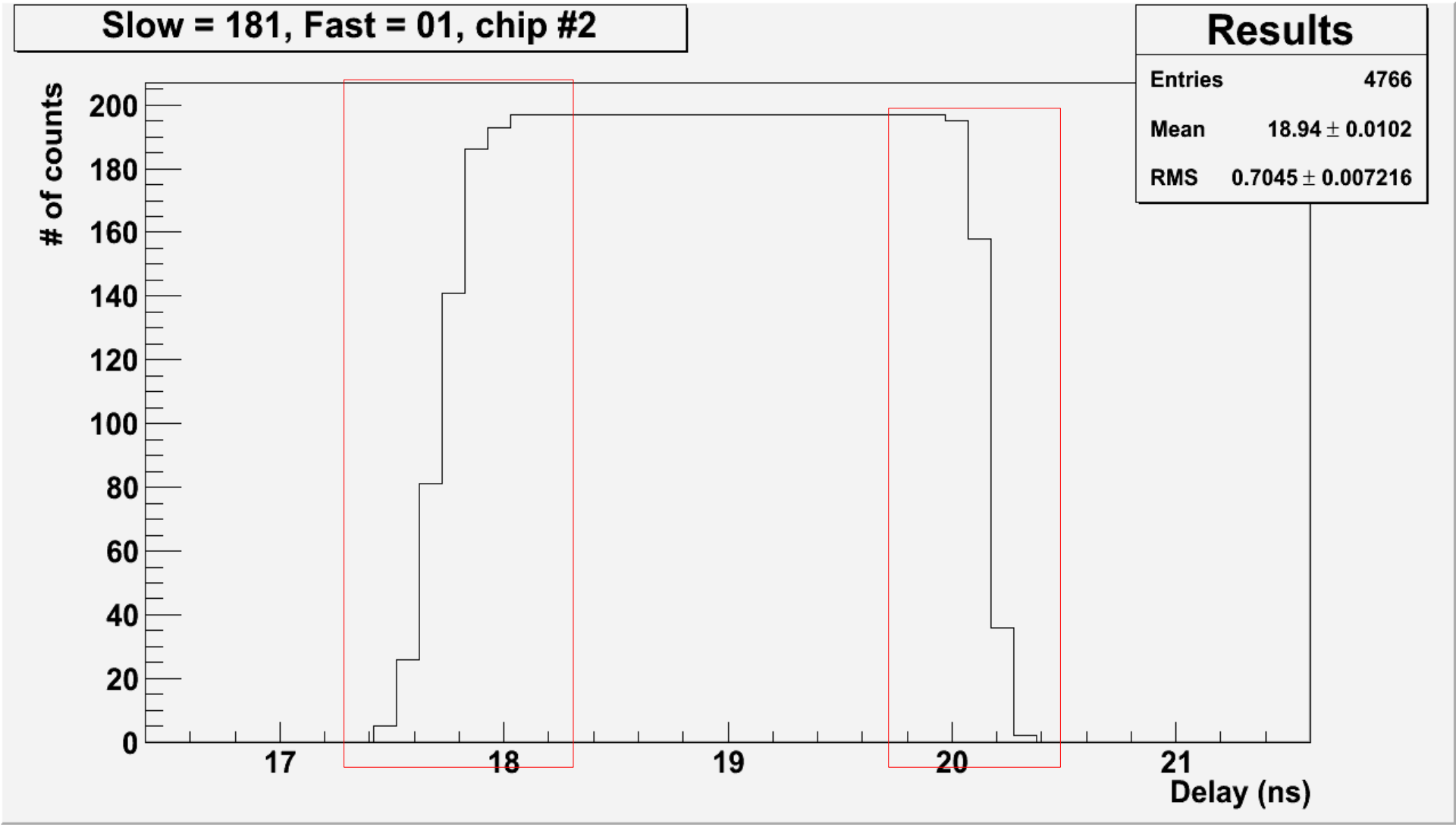


- The hit signal (width: 60ns) is delayed w.r.t. the reference clock (40 Mhz);
- The trigger arrives always at the same time w.r.t the Reset;

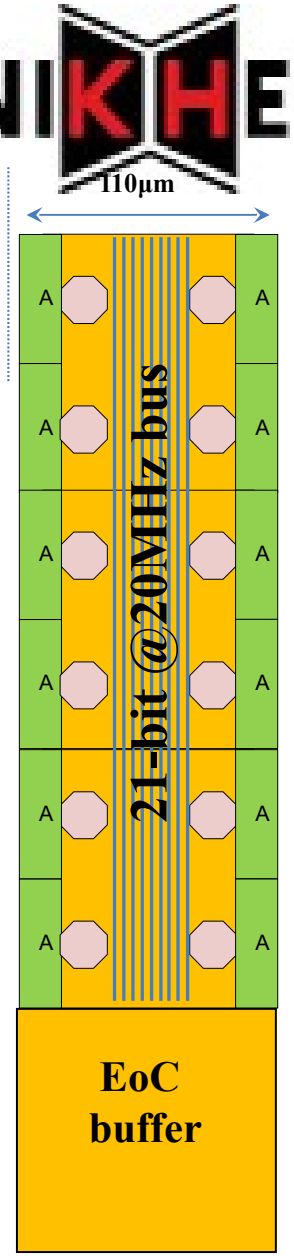
Results (2)


Slow = 181, Fast = 01, chip #2
Results
Entries 3454
Mean 21.56 ± 0.008648
RMS 0.5083 ± 0.006115
# of counts
0
20
40
60
80
100
120
140
160
180
200
19.5
20
20.5
21
21.5
22
22.5
23
23.5
Delay (ns)

Results (3)


Slow = 181, Fast = 01, chip #2
Results
Entries 4766
Mean 18.94 ± 0.0102
RMS 0.7045 ± 0.007216
# of counts
0
20
40
60
80
100
120
140
160
180
200
17
18
19
20
21
Delay (ns)

Timepix2



Why Timepix2:

- General purpose chip
- Next iteration after Timepix with new features required for new experiments
- Use the knowledge gained with G3 for the design

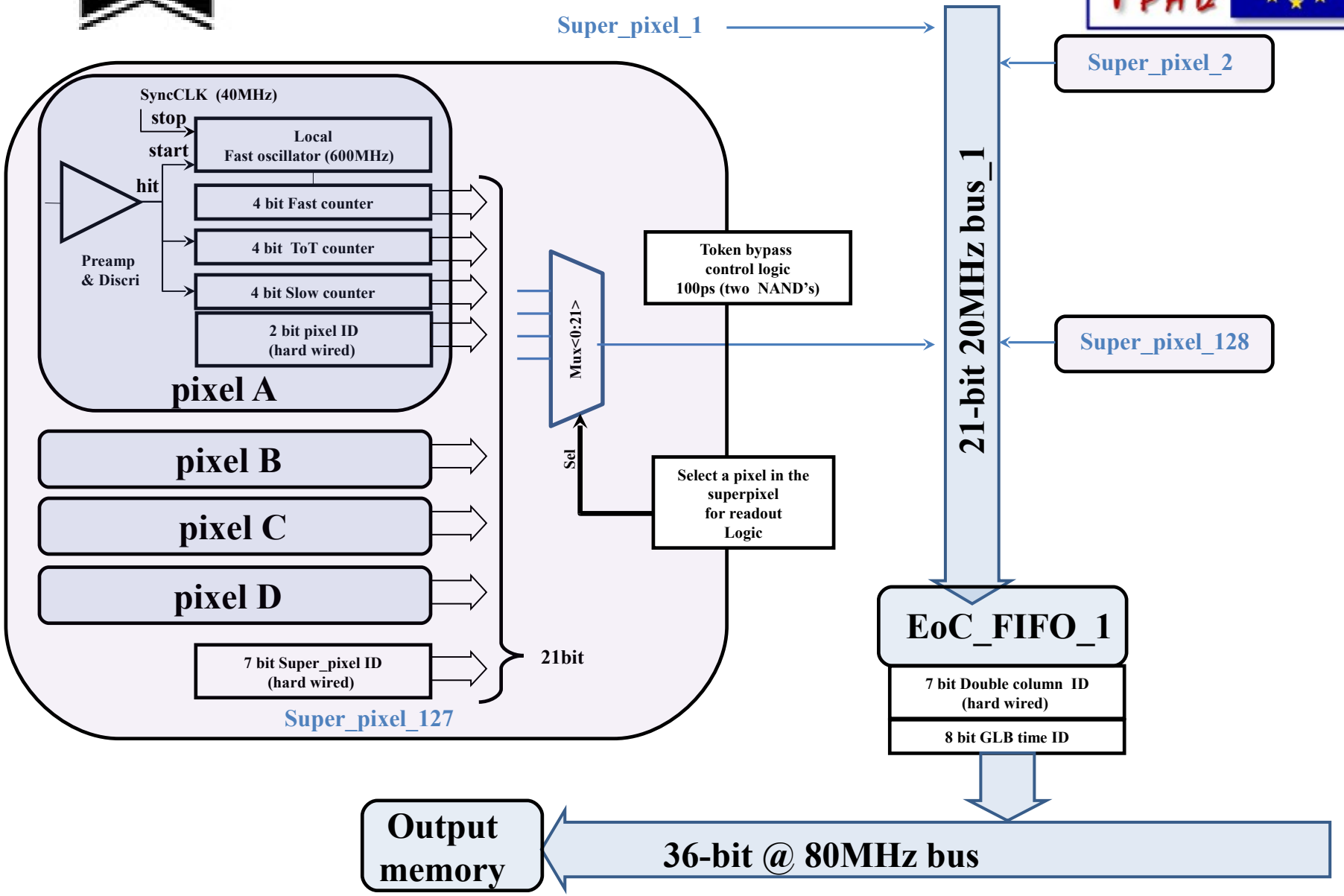
Applications:

- Neutrinoless Double Beta Decay with CdTe sensors (Erlangen - Germany)
- Imaging Mass Spectrometer (Freiburg – Germany)
- Biomolecular Imaging Mass Spectrometry (AMOLF - Netherland)
- Extreme Ultraviolet Physics: Molecular Imaging (AMOLF - Netherland)
- Prototype for the future VELOpix (LHCb)
- HEP gas detector (Nikhef - Netherland and Bonn - Germany)

Features:

- Technology: 130nm CMOS
- Pixel size : 55µm x 55µm
- Measures: ToA & ToT (simultaneously)
- ToA resolution/range: 1.6ns / 102µs (12 bit@40MHz)
- ToT resolution/range: 25ns / 102µs (12 bit@40MHz)

Block diagram



Overview

- **Articles:**

  - "Gossipo-3: a prototype of a Front-end pixel chip for readout of Micro-Pattern Gas Detectors", proceedings of the TWEPP-09 Topical Workshop on Electronics for Particle Physics, Paris, France, 21-25 September 2009;

  - "Gossipo-3: Measurements on the Prototype of a Read-Out Pixel Chip for Micro-Pattern Gas Detectors", proceedings of the TWEPP-10 Topical Workshop on Electronics for Particle Physics, Aachen, Germany, 20-24 September 2010;

- **Presentations:**

  - Poster presentation at the MC-PAD meeting in Krakow, Poland, September 2009;

  - R&D group meeting 16 June 2010;

  - Poster presentation at the MC conference in Turin, Italy, June 2010;

  - Talk at Veldhoven 2011 (January) – Netherland

Overview

Planned milestone and deliverables:

- MPW submission of pixel analog circuit in 130nm (end 2011)
- Translation of the analogue part of the pixel circuit from 0.25 to 0.13 µm (end 2011)
- Simulation and evaluation of different readout architectures (end 2013)

→ Project changed, because I started the PhD later than expected in the original MC-PAD planning.

New milestone and deliverables:

- Design and Layout of the digital block for Gossipo-3 in 130nm (March 2010)
- Test of the functionality of Gossipo-3 (present time)
- Design and Layout of Timepix-2 (not well defined yet: end 2011?)

Other activities

- Training:
  - Advanced digital design in 90nm technology (Lodz, Poland);
  - SystemVerilog course (future)
- Teaching tasks:

  - Course assistant in Numerical Physics (2nd year students)

  - Assistant in the Muon Lab. Course (1st year students)

THANKS FOR YOUR ATTENTION!