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# Project Plan Factsheet

Date of report: Sep. 2016

Revisions/comments:

Authors: Fred Hartjes, Gerhard Raven

Begin and end date: Sep. 2016; Sep. 2017

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| Project Name | Building Block |
| Project leader | Gerhard Raven |
| Deputy | Fred Hartjes |
| Program Leader | Niels van Bakel and Peter Kluit |
| Task leaders |  |

# What is the goal of the project?

Give a clear description on how the project is defined.

* 1. Scientific background (short) and what are the opportunities for Nikhef.

For many experiments in HEP high resolution tracking while introducing a minimal amount of material, is highly beneficial. With the GridPix technology we combine the low mass properties of a gas filled detector with the high granularity of a pixel chip. Using the TimePix-1 chip several testbeam experiments have been performed including a test of an assembly of 160 chips. Presently we are applying the TimePix-3 chip that has a greatly improved time resolution.

Given 1. the complexity of the control and RO of the TimePix-3 chip and 2. the fragility of the TimePix-3 chip equipped with an amplification grid (InGrid), a large detector anode using TimePix-3 chips can be realized best as an assembly of units containing 4 – 8 chips. These building blocks provide support and cooling of the chips, provide the supply voltages and control lines, and connect the data output lines to a multiplexer. Each building block will be designed such that it can easily be tiles into a larger plane to form a large anode plane, minimizing the inactive area. A pilot study shows that the active area of such an anode plane can be increased to approximately 70% of the total surface. The building block will have a surface of approximately 3-6 x 4 cm2.

The Building Block project aims to develop such building blocks and to produce a few functioning prototypes. As such it forms the basis for various HEP tracking detectors. About 12 – 25 building blocks would be sufficient to form a prototype sector of a TPC for LepCol.

* 1. What is final delivery/goal of the project. What is ready when the project is completed.

The development of a GridPix building block with a size between 4 to 8 TimePix-3 chips. The validity of the design is proven by at least one prototype that is capable of measuring cosmics and a source. As a next iteration, a few building blocks will be combined together, demonstrating the scalability towards an larger integration between building blocks, including positioning, services, and gas tightness.

* 1. Specify Project funding and investment.

The project is funded by the preliminary LEPCOL program, in combination with the regular DR&D budget.

* 1. Define the external context: international collaboration, who are partners, what are external risks, dependencies and uncertainties in the plan.

The project will be carried out in collaboration with the group of Klaus Desch from Bonn university. The InGrid structure will be manufactured at IZM Berlin by Bonn collaborator Yevgen Bilevych. Given the complexity of the photolithography there is a risk that this takes longer than anticipated.

As an alternative solution Micromegas foils from the CERN photolithography workshop are presently available. The process of mounting them to the TimePix-3 chips proceeds prosperously. TimePix-3 chips equipped with the Micromegas foil have an almost identical grid geometry as with InGrid.

# Work plan

* 1. Breakdown the tasks that are relevant for work at Nikhef. Comment on the type of work and estimate duration.



* 1. Which expertise is required ?

Advanced PCB layout, good knowledge of SIPDR DAQ, advanced wire bonding, advanced mechanical design, testing gaseous detectors

* 1. Make a list of tasks and responsible persons.

SPIDR FPGA programming: Bas van der Heijden

PCB layout: Charles Ietswaard

Mechanics design: Auke Korporaal

Mechanics manufacturing: Oscar van Petten/ Rob Leguyt

Wire bonding: Joop Rövekamp, Dimitri John

* 1. Specify deliverables/milestones with dates. Focus on the current year. Please make a separate excel file (MS project is accepted but not needed).

For 2016: assembly of the first GridPix building block demonstrator

For 2017: assembly and integration of several (improved) building blocks.

* 1. Provide a schedule/manpower request for the running year. Please provide this in a separate XLS file and discuss with TGLs.

Bas van der Heijden: 8 wk

Eric Hennes: 2 wk

Charles Ietswaard: 2 wk

Auke Korporaal: 4 wk

Oscar van Petten/ Rob Leguyt: 7 wk

Joop Rövekamp, Dimitri John: 2 wk

# Infrastructure

Specify what you expect to use in terms of special infrastructure.

* 1. General Labspace

The infrastructure of DR&D labs H039 and H040 will be used for testing

* 1. Specific Labspace Cleanroom, Laserlab, Special storage….

The assembly of the building blocks will be mostly done in Silicon Alley (bonding room and H023)

* 1. Gas systems / compressed air.

The available infrastructure of the DR&D group will be used to provide and verify the gas environment.

* 1. Equipment that may need large investment.

# Project Safety

Do you foresee occupational or health hazards within this project that may need a risk analysis? Provide a list even if you are uncertain on the need of such analysis.

The building blocks will be probably tested with flammable gas mixtures. In the labs H039 and H040 a flammable gas safety system is available.

# Useful documentation

Make a list of abbreviations.

GridPix: an assembly of a pixel chip equipped with an amplification grid

InGrid: a grid deposited on a pixel chip by photolithography

Micromegas: a grid made from a coppered Kapton foil

SPIDR: a DAQ system for the TimePix-3 chip

TimePix: a 256 x 256 pixel chip supplied by the Medipix collaboration at CERN

TPC: Time Projection Chamber, in this report with a gaseous medium

Where possible give links to

* 1. Local project website or reports.
  2. Data storage.
  3. Experiment website.
  4. TDR/LOI or other relevant docs.