1. Project Plan Factsheet

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Revisions/comments:
Authors: Fred Hartjes
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Project Name	Building Block
Project leader	Harry van der Graaf
Deputy	Fred Hartjes
Program Leader	Niels van Bakel and Peter Kluit
Task leaders	

2. What is the goal of the project?

Give a clear description on how the project is defined.

2.1. 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 extreme 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 relatively small 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_out lines to a multiplexer. Each building block will be designed such that it can easily be repeated in X and Y direction to form a large anode plane while minimizing the dead area. A pilot study shows that the active area of such an anode plane can be increased to 60 – 65% of the total anode surface. The building block will have a surface of approximately 3-6 x 4 cm^2.

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

2.2. What is final delivery/goal of the project. What is ready when the project is completed.
   The development of a GridPix building block of 4 to 8 TimePix-3 chips. The validity of the design is proven by at least one prototype that is functioning for cosmics and a source.
2.3. Specify Project funding and investment.
The project is funded by the regular DR&D budget in 2016 and 2017.
2.4. 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.

3. Work plan

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

task	person	start	ET (wk)	MT (wk)	Var. (wk)
(applying protection layer)	Violeta Prodanovic	jun-16			1.0
requirements PCB/string	Bas van der Heijden	jun-16	pm		
layout PCB/string	Charles Ietswaard	aug-16	5.0		
production PCB	industry	sep-16			3.0
3D FEM drift field calculations	Eric Hennes	sep-16		2.0	
design carrier mechanics, cooling	Auke Korporaal	aug-16		4.0	
manufacturing carrier mechanics	Oscar van Petten	sep-16		4.0	
design gas testbox	DR&D	sep-16			2.0
manufacturing testbox	Oscar van Petten	okt-16		3.0	
schematics of the carrier PCB	Bas van der Heijden	okt-16	9.0		
wire bonding	Joop Rovekamp/ Dimitri	okt-16		2.0	
programming SPIDR FPGA	Bas van der Heijden	dec-16	8.0		
functionning test	DR&D	feb-17			4.0
debugging carrier PCB	Charles Ietswaard	mrt-17	0.5		
production PCB	industry	mrt-17			3.0
functionning test	DR&D	apr-17			4.0
total			22.5	15.0	

3.2. Which expertise is required ?
   Advanced PCB layout, good knowledge of SIPDR DAQ, advanced wire bonding, testing gaseous detectors

3.3. 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
3.4. 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: complete mechanical assembly of the GridPix building block
3.5. 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

4. Infrastructure

Specify what you expect to use in terms of special infrastructure.
4.1. General Labspace
The infrastructure of DR&D labs H039 and H040 will be used for testing
4.2. Specific Labspace Cleanroom, Laserlab, Special storage….
The assembly of the building blocks will be mostly done in Silicon Alley (bonding room and H023)
4.3. Gas systems / compressed air.
The available infrastructure of the DR&D group will be used to provide and verify the gas environment.
4.4. Equipment that may need large investment.

5. 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.

6. 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

6.1. Local project website or reports.

6.2. Data storage.

6.3. Experiment website.

6.4. TDR/LOI or other relevant docs.