

WP 1.1 HYBRID SILICON DETECTORS
REVISED WORK PLAN

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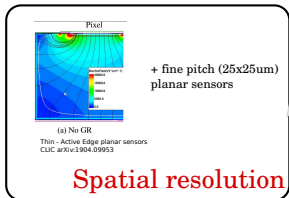
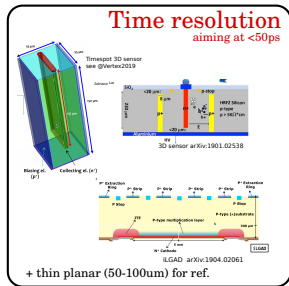
CERN

October 24, 2019

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for inputs and discussions

HYBRID SILICON SENSORS

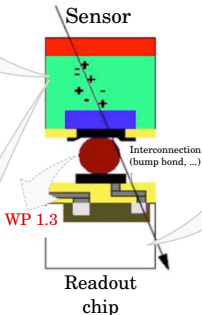
DRIVE HYBRID SILICON PIXEL R&D TOWARDS PROOF-OF-CONCEPT PROTOTYPES.



Available ROC

R/O Chip	TFS (nm)	Pitch (µm)	Size (cm ²)	time bin (ns)	Data rate (Gbit/s)
Timepix3	130	55	2	1.56	5
Velopix	130	55	2	25	19
CLICpix2	65	25	0.1	10	0.1
RD53-A/B	65	50	2/4	25	5
Timepix4	65	55	7	0.2	82

from D. Dannheim



IC block development

Specific ASIC development for

- fine time bin (~20ps)
- fine pitch (25um).

Targeting <65nm technology

Close links with IC and High Speed links work package

Target radiation hardness $\mathcal{O}(10^{16} \text{ n}_{\text{eq}}/\text{cm}^2/\text{y})$, hit rate $\mathcal{O}(10 \text{ Ghit}/\text{s}/\text{cm}^2)$ and output bandwidth up to several 100 Gb/s.

WORKPLAN

Experiment specific resources (LHCb, Exp @ SPS, other R&D projects)

2020

2021

2022

2023

2024

EP R&D resources

Submission
thin planar

1-2 Sensor submission participation per year: 3D sensor - (i)LGAD, reoptimised sensors...

55x55um TPX4 25x25um CLICpix

Characterisation

Irrad.

Post-irradiation
Characterisation

Characterisation
with telescope

Simulation (TCAD + signal simulation): input for reoptimisation, IC block design, etc...

Fine timing telescope construction

phase1

Optimisation of system level timing
+sensor upgrade

phase2

Design bloc for pixel fine TDC

Submit
MPW

Test

Design bloc fine-pitch pixel

Submit
MPW

Test

Fellow 1

Fellow 2

Fellow 3 (shared)

PhD 1

PhD2 (shared)

RESOURCES AND COLLABORATIONS

▶ **Activities down-scaled wrt. previous plan:**

- ▶ ROC development ($\div 5$):
End-to-end fast timing demonstrator in 28nm → specific bloc studies.
- ▶ Flat budget for sensor submission / hybridisation (-30%):
→ compensate with collaboration.
- ▶ FTE (-1 fellow, -1 student):
→ compensate with collaboration / shared students with external institutes.

▶ **Collaborations with external groups:**

- ▶ On iLGAD, including AIDA EoI (Hybrid WP Task 1.4).
- ▶ On fast-timing telescope, including AIDA EoI (Testbeam WP, Task 3.3).
- ▶ Collaboration with several institutes being developed (fast-timing sensor).
- ▶ Possible collaboration on ASIC design.

▶ **Collaborations with other WP:**

- ▶ WP 1.4 for simulation and characterisation + LGADs.
- ▶ WP 1.3 for hybridisation.
- ▶ WP 5 for ASIC development and testing.

LAST WORDS

- ▶ More details on the WP activities in the EP R&D [document](#)
(minus down-scaled activities discussed here)
- ▶ Kick-off meeting in January 2020.
- ▶ Contact us if you are interested in Hybrid silicon pixel sensor R&D!