



Introduction to 'DRDT 7.6' : Monolithic Sensor ASICs

Implementing DRD7 : R&D Collaboration on Electronics and On-detector Processing

CERN – Wednesday March 15th, 2023 Marlon Barbero / Iain Sedgwick / Walter Snoeys



'DRDT 7.6' introduction

- DRD7 in original ECFA document: 5 tasks.
- 2 additional areas proposed:

to address challenges of ASIC developments

- 7.6: Common R&D issues related to monolithic sensors
- 7.7: Access to new technologies and tools for ASIC design

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Data density	High data rate ASICs and systems	7.1	• • •		*		•	•
	New link technologies (fibre, wireless, wireline)	7.1) 🥚 🍯		• • •	• • •	
	Power and readout efficiency	7.1	i i i i i i i i i i i i i i i i i i i		*••	• • •		
Intelligence on the detector	Front-end programmability, modularity and configurability	7.2						
	Intelligent power management	7.2			*		$\bullet \bullet \bullet$	
	Advanced data reduction techniques (ML/AI)	7.2						
4D- techniques	High-performance sampling (TDCs, ADCs)	7.3	• •					•
	High precision timing distribution	7.3	• •	- Č	i i i i i		ě ě ě	ŏ • i
	Novel on-chip architectures	7.3	i i	- ě			ŎŎŎ	Ŏ
Extreme environments and longevity	Radiation hardness	7.4						ŏ i
	Cryogenic temperatures	7.4		•				i i
	Reliability, fault tolerance, detector control	7.4					• • •	ŏ i
	Cooling	7.4			*			ŏ • ċ
Emerging technologies	Novel microelectronic technologies, devices, materials	7.5	• • •					
	Silicon photonics	7.5				ŏ ŏ	ă ă ă	ŏ
	3D-integration and high-density interconnects	7.5			*			ě č
	Keeping pace with, adapting and interfacing to COTS	7.5						

• Coordination 7.6: Marlon Barbero (CPPM), Iain Sedgwick (STFC), Walter Snoeys (CERN)



Goals of 'DRDT 7.6'

- Build on expertise available in the community
- Strong relations with DRDT 3.1 to facilitate and coordinate exploration of new technologies (lowering costs and risks to DRDT 3.1 R&D when transitioning to larger scale developments or advanced technologies)
- Develop common standards, methodologies, identify resources to address large and complex monolithic ASIC design
- Ease relations to facilities and tools for R&D
- Potentially act as reviewing and coordination body



Goals of this 1st kickoff session today

- Start to draw how our organization should function !
- Schematically:
 - 1st area: Smaller-scale prototyping, exploring novel concepts, delivering proof-of-principle demonstrators ... these activities do not necessarily lead to large scale production, can be exploratory (→ not in 'DRDT 7.6').
 - 2nd area: Common generic developments, complex design flow, negotiated access to technologies with industrials, ... common community effort, not exploratory (→ in 'DRDT 7.6').
 - Joint body to avoid parallel or conflicting proposals, to enhance readability of our work (no overlap, no duplication of efforts ...)? Yet efficiently organize work in our community.
- In today's meeting, discuss topics related to 'DRDT 7.6' "added-value":
 - How to choose technological focus?
 - How to avoid single techno. source for "larger" projects?
 - Should we go to deeper sub-micron than current?
 - What model to manage relations to foundries?

- How to access sensitive foundry information (NDAs, profiles for TCAD etc..)?
- Management of support?
- Design methodology? Digital tools and verification?



'DRDT 7.6' agenda today

- 4 short 10-minute talks oriented to specific relatively advanced developments as examples of questions, issues encountered in such developments, methodologies developed.
- 5 minutes for discussion at end of each talk
- Leading to a 20-25 minutes general discussion on 'DRDT 7.6' organization and model for collaboration:
 - How to choose technological focus?
 - How to avoid single techno. source for "larger" projects?
 - Should we go to deeper sub-micron than current?
 - What model to manage relations to foundries?

Speakers, please respect the time allowed

Introduction	Marlon B. Barbero
40/S2-C01 - Salle Curie, CERN	13:30 - 13:40
Monolithic Sensors in ALICE	Magnus Mager
40/S2-C01 - Salle Curie, CERN	13:40 - 13:55
ALICE ITS3 - The unfashionable but important bits	Frederic Morel
40/S2-C01 - Salle Curie, CERN	13:55 - 14:10
Belle II VXD Upgrade	Jerome Baudot
40/S2-C01 - Salle Curie, CERN	14:10 - 14:25
MightyPix	Ivan Peric
40/S2-C01 - Salle Curie, CERN	14:25 - 14:40
Longer Term R&D and Discussion	Walter Snoeys
40/S2-C01 - Salle Curie, CERN	14:40 - 15:00

- How to access sensitive foundry information (NDAs, profiles for TCAD etc..)?
- Management of support?
- Design methodology? Digital tools and verification?