RD_Fase2 Pixel

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CSN1 funds

~~*CSN5 project*~~

EU funds: AIDA-2

Indico agenda:

https://agenda.infn.it/conferenceDisplay.py?confId=8380

2014 – FUNDING AND STATUS

Got Funded (ATLAS + COMMON)

- *3D Sensors*
  - Funded 3 batches at FBK:
    - Mechanical test – approved by MEMS3 committee – order placed (3x2200 €)
    - Simple planar to qualify substrates – approved by MEMS3 – order placed (6x2200 €)
    - 3D batch, single side, on hold waiting batch 2.
  - Substrates
    - Ordered 55 wafers from IceMOS (SiSi wafer bonded) – material arrived at CERN, reshipped to TN
    - Looking for Epi wafers – indirect contact with SHINETSU – offer received (25 wafers – 11.9 kCHF) – doubts on specifications (epi-layer thickness spread: 104÷156 µm!)
- *Bump-bonding*
  - Funded 20 k€ for BB at Selex + 7 k€ for FE-I4B
    - Bump-bond 3D sensors in production at FBK – old design IBL-like
    - Develop Indium-bumps for high density – incomplete funding: cut the dummy wafers (6 k€) and funds for Selex (10 k€).
- *HV-CMOS hybridization*
  - FE-I4B plus consumables to test hybridization
- *CO2 cooling*
  - Funded TRACI CO2 cooler

SUMMARY OF RECEIVED FUNDS IN 2014

Date	Sezione	Category	ATLAS/COMMON	Assigned	Committed	Description
Feb 2014	GE	3D	COMMON	€ 21 000	€ 15 000	Wafer for 3D sensors (common with CMS) -
Apr 2014	GE	3D	COMMON	€ 44 000	€ 19 800	3 processes at FBK - 2 committed
May 2014	GE	HV	ATLAS	€ 13 000		HV-CMOS Hybridization - 3 FE-I4B wafers
May 2014	MI	BB	ATLAS	€ 27 000		BB of 3D (IBL design on 6") + BB high density + 3 FE-I4B wafers
May 2014	MI	CO2/µ-CH	ATLAS	€ 20 000		TRACI - co-funded with LHCb
				€ 125 000		

How to prepare 2015 fund requests – few tables to keep in mind

CSN1 – FUNDS 2015

ATLAS / CMS Pixel R&D – Cost Profile

Richieste CSN1 (17/3/2014) - 2014, 2015, 2016

Attività	Descrizione	2014	2015	2016	Total	Grand T.	ACTIVE	Nota
3D	ATLAS	k€ -	k€ -	k€ -	k€ -			4 batches: (1) mechanical test (3 litho), (2) substrate test with planar (6 litho), 3D batch 1 (11 litho), 3D batch 2 (11 litho - 2016 in MEMS3), SiS DWB / SoI /Epi
3D	CMS	k€ -	k€ -	k€ -	k€ -			
3D	Common	k€ 64.0	k€ 20.0	k€ 24.2	k€ 108.2	k€ 227.2	k€ 195.8	
AE	ATLAS	k€ -	k€ -	k€ -	k€ -			2 batches: 2015 - 2016. Both in MEMS3, substrates, thinning. Partially in ACTIVE (1 batch)
AE	CMS	k€ 32.0	k€ 20.0	k€ 67.0	k€ 119.0			
AE	Common	k€ -	k€ -	k€ -	k€ -			
HV	ATLAS	k€ 62.5	k€ 100.0	k€ 50.0	k€ 212.5			
HV	CMS	k€ -	k€ -	k€ -	k€ -	k€ 212.5	k€ -	
HV	Common	k€ -	k€ -	k€	k€ -			
BB	ATLAS	k€ 37.5	k€ -	k€ -	k€ 37.5			Upgrade for 6" at selex, 3D/Active module bumping, develop hi-density and thin BB.
BB	CMS	k€ 27.0	k€ 24.0	k€ 64.0	k€ 115.0	k€ 324.5	k€ 227.4	
BB	Common	k€ 36.0	k€ 48.0	k€ 88.0	k€ 172.0			
MOD	ATLAS	k€ 11.0	k€ 20.0	k€ -	€ 31.0			-> FE-I4 test upgrade, flex, module assy, contr. to TB
MOD	CMS	k€ 10.0	k€ 42.0	k€ -	€ 52.0	k€ 147.0	k€ 165.0	-> Setup, module assy, TB setups, shipping, sample prep.
MOD	Common	k€ -	k€ -	k€ 64.0	€ 64.0			-> Irradiation
M-R/O	ATLAS	k€ -	k€ 15.0	k€ 20.0	k€ 35.0			Board per R/O fino a 16 FE-I4, test infiniband/GBT/Felix,etc. - 2 prototipi + 5 schede per lab italiani
M-R/O	CMS	k€ -	k€ -	k€ -	k€ -	k€ 35.0	k€ -	
M-R/O	Common	k€ -	k€ -	k€ -	k€ -			
CO2/µCH	ATLAS	k€ 20.0	k€ 20.0	k€ 20.0	k€ 60.0			
CO2/µCH	CMS	k€ 20.5	k€ 14.5	k€ 23.3	€ 58.3	k€ 118.3	k€ 171.0	
CO2/µCH	Common	k€ -	k€ -	k€ -	k€ -			
Tot	ATLAS	k€ 131	k€ 155	k€ 90	k€ 376			
Tot	CMS	k€ 90	k€ 101	k€ 154	k€ 344	***k€ 1 065***	***k€ 759***	
Tot	Common	k€ 100	k€ 68	k€ 176	k€ 344			
		k€ 321	***k€ 324***	***k€ 421***				

Goes to CSN5

Stays in CSN1

Legend:

3D	3D sensor batches and raw wafers
AE	AE sensor batches and raw wafers
HV	HV-CMOS development: contribution to MPW and module integration
BB	Bump-bonding for module and sensor testing, BB development for hi-density and thin modules
MOD	Module dressing with flex/PCB, irradiation, test-beam
M-R/O	Multi module R/O for test beam an test system
CO2	CO2 cooling (µCH or Standard)
µ-CH	µ-channel cooling development

Referee CSN1: Tasca + CSN5

Richieste

		2014-2017			2014			
		ATL	CMS	Com	ATL	CMS	Com	
tracker	3D			108			64	
	AE		119			32		
	HV	212			62			
	BB	37	137	142	37	27	6	
	MOD	31	52	128				
	Mod R0	37						
	cooling	60	60.5		20	20.5		ATL-sinergia LHCB / CMS PI
	Totali	377	368.5	378	119	79.5	70	
		1123.5			268.5			

Proposte

		2014-2017			2014			CALL			
		ATL	CMS	Com	ATL	CMS	Com	ATL	CMS	Com	
tracker	3D			108			65				
	AE		80			32					ipotizziamo che continui mems3
	HV				13			212			
	BB	37	137	142	27	27					
	MOD	31	52	128							
	Mod R0	25									ridurre il numero sedi dove fare test.
	cooling	40	40		20	10					
	Totali	133	309	378	60	69	65	212	0	0	
		820			194			212			

What Anticipated for 2015 to CSN1

- *The table below follows the document provided to referee in March and later updated in May.*
  - In preparing the request for 2015 should be coherent with that

- *Considerations*
  - Should revise the numbers below with better cost estimation, but stay in the envelopes ("tasca") defined by CSN1 in May

Richieste CSN1 - 2015: ATLAS + COMMON ("WHAT CSN1 KNOWS")

Attivtà	Descrizione	Richiesta	ATLAS	50-50	% ATLAS	Sez. Assegn.	Nota
3D.1	6" Wafer procurement (SOI, wafer bonding, epi)	k€ 20.0		k€ 20.0	50%	XX/CMS	Substrates for 2nd 3D batch (batch 5)
BB.1	6" dummy wafers - test deposition on 6" and high-density bumps (150 k-bumps/chip)	k€ 6.0		k€ 6.0	50%	XX/CMS	6k€ for dummy wafer with resistive chains + mask for In deposition.
BB.2	BB for 3D sensor test	k€ 48.0		k€ 48.0	50%	XX/CMS	To be done at Selex or IZM, when FBK 3D sensors (batch 3) are available. In spring 2015 - Mask (1), FE Wafer (4: FE-I4 and PSI46), 3D wafers (8), Flip-chip (60)
	Total requested by ATLAS	**k€ 120.0**	**k€ 46.0**	**k€ 74.0**			

Timeline

- *Funding must follow timeline*

WP	Date	Milestones - V1 (to be agreed with CMS)
3D	30/06/2014	Selection and procurement of the raw wafers
	30/11/2014	Qualifica dei substrati da usare per i sensori 3D
	30/11/2015	3D sensor of batch 1 measured in laboratory and test beam with FE-I4/PSI46 chips
	30/11/2016	3D sensor of batch 2 produced
HV/ MOS	30/09/2014	Design-1 ready to submit
	30/09/2015	Measurements of design 1 in lab and test-beam performed
	30/06/2015	Hybridization process qualiifed
	30/11/2015	Design-2: full scale chip
	30/09/2016	Design-2: qualified at lab and test-beam
Bump-bonding	30/09/2014	Test of single side bumps completed
	30/09/2015	3D of batch 1 bumped to FE-I4/PSI46
	30/06/2015	Results of high density bumps - technology review
CO2/µ-CH	30/09/2014	TRACI: operational
	30/09/2015	Qualification of thermal behaviour of staves with cooling channnel
M-Mod R/O	30/11/2015	Prototype of M-module R/O board available and tested
	30/06/2016	5 M-Module R/O boards produced.

Buy substrates for 2nd batch

Funds needed for BB
Funds needed to develop HD BB

Develop µ-CH cooling

Funds for prototype

EU FUNDS- AIDA-2

Silicon in AIDA2: Beneficiaries

WP3:

Electronics & Interconnections

AIDA 2 - WP Name - Task 3.2: 65 nm chips

Beneficiary short name*	Institute
CERN	CERN
INFN	PAVIA
INFN	TORINO
INFN	MILANO
IN2P3	CPPM
IN2P3	OMEGA/LAL/LPNHE
AGH	AGH-Krakow

AIDA 2 - WP Name - Task 3.3: SiGe chips

Beneficiary short name*	Institute
IN2P3	OMEGA
IN2P3	CPPM
CEA	SACLAY
AGH	AGH-Krakow
UHEIDELBERG	University of Heidelberg

AIDA 2 - WP Name - Task 3.4: Interconnection and TSV

Beneficiary short name*	Institute
INFN	PAVIA
INFN	GENOVA
INFN	PERUGIA
IN2P3	CPPM
IN2P3	LAL
UBONN	University of Bonn
UU	University of Uppsala
UGLAS	University of Glasgow
MPG	MPI Munich

WP5:

Advanced Hybrid Pixel Detectors

AIDA 2 - WP Name - Task 5.2: TCAD SIMULATION

Beneficiary short name*	Institute
INFN	Perugia
INFN	Trento
CERN	LCD

AIDA 2 - WP Name - Task 5.3: Process optimization

Beneficiary short name*	Institute
CSIC	CNM
FBK	

AIDA 2 - WP Name - Task 5.4: Detector validation (3D and planar sensors)

Beneficiary short name*	Institute
CERN	LCD
MPG	MPP
Manchester	
INFN	Milano
INFN	Firenze

WP6:

HV/HR-CMOS

ATLAS – Beneficiary

CMS – Beneficiary

AIDA 2 - HV-CMOS - Task 6.2: Simulation

Beneficiary short name*	Institute
CPPM	Marseille
Bonn	
STFC	RAL

AIDA 2 - HV-CMOS - Task 6.3: Sensor development

Beneficiary short name*	Institute
Bonn	
KIT	Karlsruhe
CEA	Saclay
STFC	RAL
Glasgow	
Liverpool	
CPPM	Marseille

AIDA 2 - HV-CMOS - Task 6.4: Hybridisation

Beneficiary short name*	Institute
IFAE	Barcelona
Liverpool	
INFN	Genova