



Introduzione

G. Darbo – INFN / Genova

Indico agenda:

<https://indico.cern.ch/conferenceDisplay.py?confId=261734>

- *Discussione tra coordinatori Anna/Nadia e Bedeschi/Carpinelli*

- *Presentazione ai Referee di ATLAS Martedì prossimo*
 - Ho bisogno di aiuto per preparare la presentazione
 - Si spera un qualche feedback utile a continuare

• *Main Activities (WP):*

- **Pixel 3D:** $2 \times 10^{16} \text{ n}_{\text{eq}} \text{ cm}^{-2} \text{ s}^{-1}$, small (1/3 of FE-I4 pixel size) needs thin (100-150 μm , epitaxial or with support wafer), active edge, charge multiplication. – FBK as main silicon foundry
- **Bump-bonding:** develop (and QC) BB for 100'000 bumps/chip, thin (100 μm) FE-I4 (size), Indium bumps – use BB as part of the sensor test – main foundry Selex (interest in a framework contract). Bump-bonding development is critical technology after IBL experience with IZM.
- **Micro-channel cooling:** technology developed in Italy by SuperB and NA62. It is potentially very interesting for low material budget applications (B-layer). Silicon with DRIE processing (FBK) or composite material micro-channels. Study (long) μ -channel with evaporative CO_2 . Look for implementation technologies towards the application in the Pixel systems of future upgrades.

• *Project target goal*

- Develop core technologies for Pixel (Innermost Pixel Layer) upgrades at HL-LHC:
 - Smaller pixel, thinner detectors for very high total dose and low material budget



Call Organization

- SharePoint:
cern.ch/INFN-PixelRD



Restricted site for Call Preparation" need authentication

Authentication by request or subscribing mailing list

- active-gen@cern.ch

Kick-off meeting 28.06.2013

Call Preparation - Home

https://espace.cern.ch/hep-project-INFN-PixelRD/CallSite/SitePages/Home.aspx

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Site Actions Browse Page Nanni Darbo

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Collaborative Space for GR5 INFN Call Preparation on Pixel RD!

Questo sito è stato preparato con lo scopo di aiutare lo scambio di documenti nella preparazione della Call di Gruppo 5 INFN su R&D per i Pixel.

Attività di RD individuate per la Call sono:

1. Sensori 3D sottili resistenti a $2 \times 10^{16} \text{ n}_{\text{eq}}/\text{cm}^2/\text{s}$
2. Bump-bonding per sensori e FE sottili con $>100'000$ bumps per flip-chip
3. Cooling con micro-channels e sistema evaporativo (CO_2) - Studio di sistema applicabile ai futuri rivelatori a Pixel di ATLAS/CMS.

Il sub-sito "Call Preparation" è protetto in scrittura e lettura ai soli membri. Il "parent site" ha accesso anonymous.

Inserire il materiale organizzandolo in folder.

Announcements

Title	Body	Modified
Draft Minutes of the ACTIVE kick-off meeting	Minutes (corrette) of the kick-off meeting have been posted. 2013.06.28_Minute del Kick-off.pdf	01/07/2013 10:55 PM
Apertura sigla in GR.5	La sigla ACTIVE è stata aperta in Gr.5. Le Sezioni partecipanti debbono aprire la sigla nelle loro sezioni: http://www.ac.infn.it/preventivi/2014/	01/07/2013 01:45 PM
New active-gen@cern.ch mailing list	Created a new mailing list for all the participant to the call. Subscription is possible through e-groups .	30/06/2013 10:32 PM
ACTIVE kick-off meeting	indico: https://indico.cern.ch/conferenceDisplay.py?confid=260228 Password: ACTIVE13	30/06/2013 10:30 PM

[Add new announcement](#)

Shared Documents

Type	Name	Modified	Modified By
Folder	General Information	23/06/2013 10:32 AM	Nanni Darbo
Folder	Participant CV	23/06/2013 10:32 AM	Nanni Darbo
Folder	Sezioni_info_material	03/07/2013 01:07 PM	Nanni Darbo
Folder	Tables	23/06/2013 02:27 PM	Nanni Darbo

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Quick Links

- URL
- [CSN1 Home](#)
- [CSNS Home](#)
- [Proposal on 65nm R&D \(RD53\)](#)
- [Proposal on 3D micro-systems RD](#)

Sezioni & Responsible

Two calls in preparation for 2014-16 on Pixel core R&D.

- ATLAS/CMS involved (but not only):
- Call: **ACTIVE: Atlas and Cms Towards Innovative pixelS** – Coord: G. Darbo
 - Aslo (hope!): **Atlas and Cms Together for Innovative pixelS**
 - Main industrial partners FBK, Selex
 - International framework: will look for connections (endorsements) to ATLAS, CMS, CERN RD's,...

Call ACTIVE: Institutes/FTE

	BA	CS	FI	GE	MI	MIB	PI	TN	TO	UD	Total
RIC/TEC	4	7	4	4	2	5	8	7	4	3	48
FTE	1.1	1.3	1.0	0.9	0.7	1.0	1.7	2.7	0.9	0.9	12.2

- **Comment:** too many groups? A bit low average FTE in some Sezione

Sezione	Responsabile
BA	Donato Creanza
CS	Anna Mastroberardino
FI	Marco Meschini
GE	Giovanni Darbo (Resp. Naz.)
MI	Gianluca Alimonti
MIB	Mauro Dinardo
PI	Alberto Messineo
TN	Gian-Franco Dalla Betta
TO	Ada Solano
UD	Mario Paolo Giordani

ACTIVE: Work Packages (WP)

• *Small number of WP:*

- WP1, 2 and 3: basic deliverables
- WP4: put together WP1 & 2 – Sensors and electronics linked by bump-bonding
- WP5: Validation of deliverables in WP1, WP2 and WP3 need irradiation and test-beam
- WP6: coordination glue between WP1-5 and external collaborations

	Name	Coordinator(s)	Institutes
WP1	Sensor design, production and test		
WP2	Bump-bonding - process qualification		
WP3	Micro-cooling		
WP4	Module assembly & Test		
WP5	Irradiation & Test beam		
WP6	Project & Resource Coordination	Project Coordinator	

- Proposta coordinatori dei 5 WP's

↑
Decide now

↑
From WBS

DRAFT

WP's Cost Envelopes

	Name	Cost	Note
WP1	Sensor design and production	€ 195 800	2 batches of 3D, 1 batch of planar, additional wafer processing, raw wafers.
WP2	Bump-bonding - process qualification	€ 182 400	Develop of technology 100'000 bumps + access to BB for sensor testing + electronic wafers + thinning + dummy wafer production
WP3	Micro-cooling	€ 164 000	samples, processing, CO2 chiller
WP4	Module assembly & Test	€ 200 000	PCB, tooling, irradiation, test beam support, lab tests (non inventariabile)
WP5	Irradiation & Test beam		
	Travel money	€ 60 000	Contact to the firms, internal meetings, test beam & irradiation
		€ 802 200	

Comment:

- Bump-bonding costs underestimated?!
- To be credible: we must drive funds where workpackage and expertise exist

WP's Cost Breakdown

WP1 - Sensor design and production: Detailed costs

WBS	FY	Cost	Description
	2014	€ 25 000	6" Wafer procurement (SOI, wafer bonding, epitaxial)
	2014	€ 15 400	Initial technological tests at FBK (etching, thinning, ...)
	2014	€ 30 000	First batch of 3D sensors (in convenzione)
	2015	€ 15 400	Batch of planar active-edge sensors (in convenzione)
	2015	€ 60 000	Second batch of 3D sensors (fuori convenzione)
	2015-2016	€ 50 000	Post-processing (support wafer / epi removal, back-side metallization, ...)

Total € 195 800

WP2 - Bump-bonding - process qualification: Detailed costs

WBS	FY	Cost	Description
	2014	€ 6 000	Production of 6" dummy sensor/FE wafers for qualification of high density bumps (100'000/die) - 1 batch
	2014	€ 11 400	FE-I4 wafers (1900€/wafer x 6 wafers)
	2014	€ 25 000	Upgrade at Selex for 6" wafers Indium deposition
	2014-16	€ 10 000	Bump-deposition masks (FE, Sensori, Dummy): 10 mask (4", 6", 8")
	2014-16	€ 15 000	Thinning of electronic/dummy wafers (20 wafers): 6"-8"
	2014-16	€ 100 000	Bump deposition: 4000€/Wafer 8" (10 W), 3000€/Wafer 6" (20 W)
	2014-16	€ 10 000	Flip chip (~200 assemblies)
	2014-15	€ 5 000	Material cost for qualification

Total € 182 400

WP3

WBS	FY	Cost	Description
	2014	€ 10 000	CO2 bottle chiller x 2 sites
	2014	€ 6 000	CO2 safety sensor system x 2 sites
	2014	€ 5 000	Single μ -channel prototypes
	2014	€ 15 000	Fast video recorder for evaporative bubble recording
	2014	€ 8 000	Differential pressure sensors, heaters, T-sen, cold-box material, etc
	2015	€ 40 000	CO2 chiller (100W, -40°C) with recycling (TRACI developed for IBL)
	2015	€ 20 000	Multi μ -channel industry prototypes
	2015	€ 10 000	Test components: sensors, pipes, welding,
	2016	€ 30 000	System demonstrator
	2016	€ 20 000	CO2 chiller (cost reduced by sharing cost or setting up with only component cost included)

Total € 164 000

- Workpackages divided into a **Breakdown Structure (WBS)** – Institutes' deliverables and responsibility assigned through WBS

WORKPACKAGES BREAKDOWN STRUCTURE (WBS) - INSTITUTES/EQUIPMENT/COSTS

WBS	Description	Responsible	Institutes											Overbook	Material/process cost	Available equipments	
			BA	CS	FI	GE	MI	MIB	PI	TN	TO	UD					
1	Sensor design, production and test	G.F. dalla Betta															
1.1	Requirements definition					A			A	A						OK	
1.2	Process setting up									B							
1.3	Layout																
1.3.1	Wafer floorplan					B			A/B	A					OK (3D)		
1.3.2	ATLAS - Layout sign-off					A									OK		
1.3.3	CMS - Layout sign-off								A	B/A		C			OK		
1.3.4	XXX - Layout sign-off																
1.3.5	Mask production										A						
1.4	TCAD simulation			C					A/B	A							
1.5	Raw wafer procurement									B/C							
1.5.1	Substrate, Epi/Wafer bonding									B/A							
1.6	3D wafer processing																
1.6.1	Process monitor														OK		
1.6.2	Wafer test									B					OK		
1.6.3	Test structure measurement				A	B	B			A/B	A				OK		
2	Bump-bonding - process qualification																
2.1	FE wafers procurement																
2.1.1	ATLAS FE Wafers (8")						A/B	A/B							OK		
2.1.2	CMS FE Wafers (8")									A					UNDER		
2.1.3	XXX FE Wafers																
2.1.4	Dummy (6")					C				A/B							
2.2	Sensor wafer procurement																
2.2.1	3D (4" - 6")						B			B	B				OK		

Work in Progress

• • •

- Under covered WP5
- Questions? Keep updating...

- Update the WBS**
 - See Share Point and get institutes covering

- Prepare needed documents**
 - Use English for all documents.

- Deadline for submission**
 - July 17th

FINANZIAMENTO E ORGANIZZAZIONE	
NOME PROGETTO	
AREA RICERCA	(rivelatori, elettronica)
Responsabile scientifico	
UNITA'/ENTI partecipanti	RUOLO
ANAGRAFICA	mesi/persona
CV responsabile progetto	
CV responsabili WP	
ABSTRACT	(max 1 pagina)
BIPR	Background Intellectual Property Rights
WP1	Responsabile Descrizione puntuale delle attività previste Milestone/Deliverables
..... WPn	
CRONOPROGRAMMA	Milestone/Deliverables principali TABELLA RICHIESTA FINANZIARIA Enti esterni (descrizione) se presenti FONDI ESTERNI - descrizione
PROPOSTA TECNICO-SCIENTIFICA	<p style="text-align: center;">PROPOSTA SCIENTIFICA</p> A) concetti - obiettivi - originalità - innovazione - relazione con stato arte a livello internazionale B) rilevanza - attualità vs INFN e CSN5 C) unità partecipanti - rispettivi ruoli e compiti D) eventuale coinvolgimento di: - altre CSN INFN, istituzioni/lab estere naz/inter, industrie, cofin E) implementazione: - expertise, infrastrutture, collaborazioni, fattibilità e sostenibilità, risorse umane e strumentali disponibili, cronoprogramma, piano di spese F) risk assessment (piani alternativi per garantire il successo della proposta) G) impatto della ricerca, anche alla luce di Horizon 2020.
ALTRA DOCUMENTAZIONE	
Dichiarazioni di Endorsement da parte di (eventuali) Enti esterni	
Parere positivo del Direttore della Struttura INFN	

FINANZIAMENTO E ORGANIZZAZIONE		
NOME PROGETTO		
AREA RICERCA	(rivelatori, elettronica)	
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UNITA'/ENTI partecipanti	RUOLO	COMPITI
ANAGRAFICA	mesi/persona	
CV responsabile progetto		
CV responsabili WP		

 *Semplici da compilare:*

- Preparare I CV dei responsabili locali e dei coordinatori di WP

• *Chi li prepara:*

- Coordinatori dei WP + Nanni e Marco

ABSTRACT

(max 1 pagina)

BIPR

Background Intellectual Property Rights

WP1

Responsabile

Descrizione puntuale delle attività previste

Milestone/Deliverables

..... **WPn**

CRONOPROGRAMMA

Milestone/Deliverables principali

TABELLA RICHIESTA FINANZIARIA

Enti esterni (descrizione) se presenti

FONDI ESTERNI - descrizione

• *Editor team:*

- Discussione

PROPOSTA SCIENTIFICA

PROPOSTA TECNICO-SCIENTIFICA

- A) concetti - obiettivi - originalità - innovazione - relazione con stato arte a livello internazionale
- B) rilevanza - attualità vs INFN e CSN5
- C) unità partecipanti - rispettivi ruoli e compiti
- D) eventuale coinvolgimento di: - altre CSN INFN, istituzioni/lab estere naz/inter, industrie, cofin
- E) implementazione: - expertise, infrastrutture, collaborazioni, fattibilità e sostenibilità, risorse umane e strumentali disponibili, cronoprogramma, piano di spese
- F) risk assessment (piani alternativi per garantire il successo della proposta)
- G) impatto della ricerca, anche alla luce di Horizon 2020.