



IEKP Karlsruhe



universität**bonn**

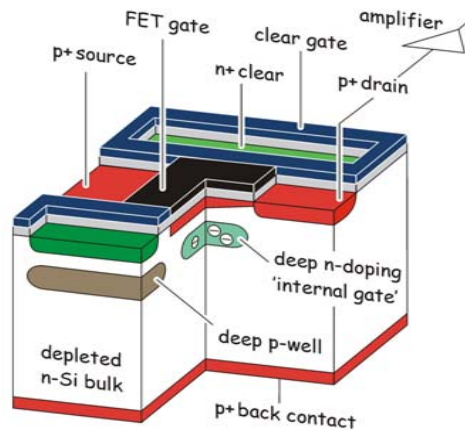


HEPHY

# The DEPFET-Project: European Collaboration for a Pixel SVD @ SuperBelle (PXD)



C. Kiesling, Max-Planck-Institute for Physics, Munich



- Report from the German SFF meeting
- Work Packages Update
- Schedule
- Conclusions & Outlook

# Workshop on Prospects of future Super Flavor Factories

Motivation: German groups should make a decision

- whether to engage in activities in a Super Flavor Factory, and
- if yes, in which one: at KEK „SuperKEKB“ or Frascati („SuperB“)
- Grants from the German government need to be requested for the coming funding period by Dec. 5, 2008

Date: 31. Oct. 2008 and 1. Nov. 2008 (Fri/Sat)

Place: MPI Munich

60 participants from 13 German universities (& outside)

Bochum, Bonn, Dortmund, Göttingen, Gießen, Heidelberg,  
Karlsruhe, Mainz, Munich (MPI, LMU, TUM), Regensburg, Siegen

# Friday 31 October 2008

## **Introduction - Auditorium (11:00-12:00)**

time	[id] title	presenter
11:00	[25] Welcome address	CALDWELL, Allen
11:05	[24] Aim of the Workshop (I)	LENSKE, Horst
11:15	[2] Status and Prospects for B-Physics	UWER, Ulrich

## **The Physics Case for a Super Flavor Factory (I) - Auditorium (13:00-15:30)**

time	[id] title	presenter
13:00	[4] The CKM Parameters	LACKER, Heiko
13:30	[6] Hadronic Two-Body Decays	FLEISCHER, Robert
14:00	[5] CP Violation and Hadronic B-Decays	BUCHALLA, Gerhard
14:30	[7] Physics at the Y(5S) and ISR Perspectives	DENIG, Achim
15:00	[8] Charm and Bottom Spectroscopy	PETERS, Klaus

## **The Physics Case for a Super Flavor Factory (II) - Auditorium (16:00-19:00)**

time	[id] title	presenter
16:00	[1] Aim of the Workshop (II)	MÄTTIG, Peter
16:10	[9] FCNC Processes and Rare Decays	NIERSTE, Ulrich
16:40	[10] Lepton Flavor Violation	PAES, Heinrich
17:10	[11] Weak Interactions of Charm	BIGI, Ikarus
17:40	[12] Flavor Theory Perspective	BURAS, Andrzej

# Saturday 01 November 2008

## **The Super Flavor Factory Projects (I) - Auditorium (08:30-10:00)**

time	[id] title	presenter
08:30	[13] The SuperKEKB Project	YAMAUCHI, Masa
09:15	[14] Machine Aspects of the SuperKEKB	OIDE, Katsunobu

## **The Super Flavor Factory Projects (II) - Auditorium (10:30-12:30)**

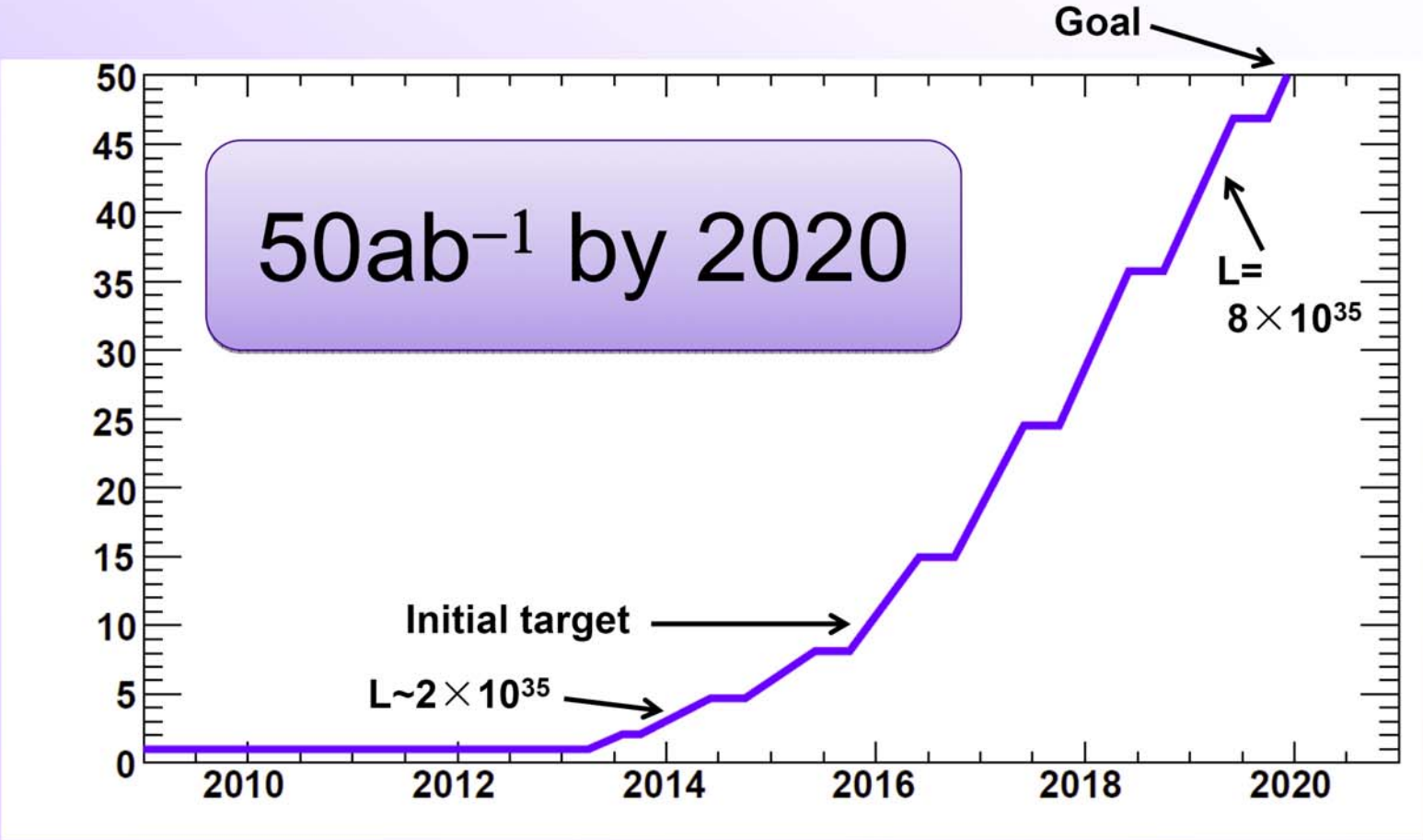
time	[id] title	presenter
10:30	[15] The SuperB Project	HITLIN, David
11:15	[16] Machine Aspects of SuperB	HITLIN, David
12:00	[17] RECFA Recommendations	NAKADA, Tatsuya

## **German Interests in a Super Flavor Factory - Auditorium (13:30-15:00)**

time	[id] title	presenter
13:30	[21] Report of the MPI Group	MOSER, Hans-Günther
13:40	[20] Report of the Karlsruhe Group	FEINDT, Michael
13:50	[22] Report of the Bonn Group	WERMES, Norbert
14:00	[23] Report of the Giessen Group	LANGHE, Soeren
14:10	[26] Report of the Göttingen Group	FREY, Ariane

## **Concluding Discussion - Auditorium (15:00-16:00)**

# Luminosity prospect

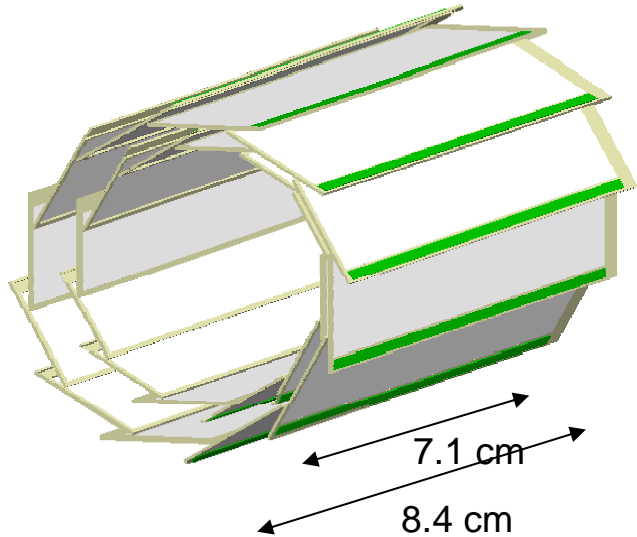


# Concluding Discussions of the Munich Meeting

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- Theoretical colleagues unanimously supporting SFF
  - DEPFET will be baseline for SuperBelle (M. Yamauchi)  
DEPFET can also be installed in SuperB detector (D. Hitlin)
  - 6 German groups expressed interest to participate in the SuperKEKB/SuperBelle project
  - No group expressed interest to participate in SuperB
  - Some German groups are busy with LHCb, but expressed their opinion that a Super-B-Factory ( $> 50 \text{ /ab}$ ) opens a new Era of Flavor Physics and must be pushed
- ➔ **Very positive outcome of the German Meeting for SuperKEKB**

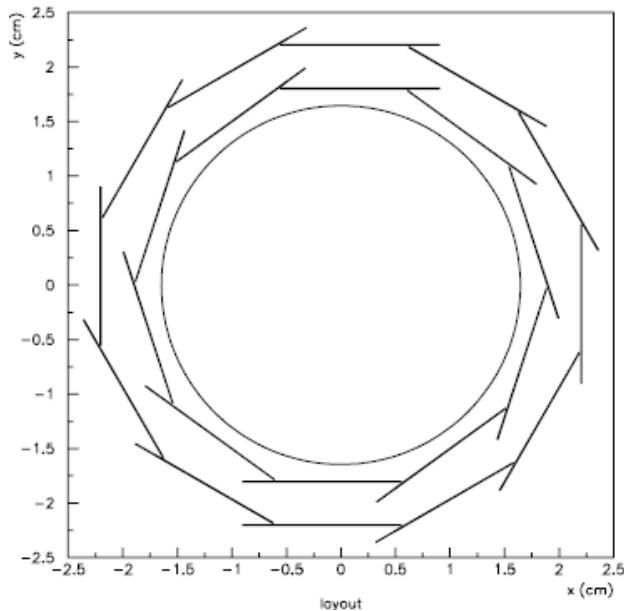
# DEPFET Pixel Detector



Small, thin (50 $\mu$ m) Detector:  
20 – 24 Modules (one sensor each)

Beam pipe radius (presently):  
1.5cm initially with upgrade to 1.0 cm later

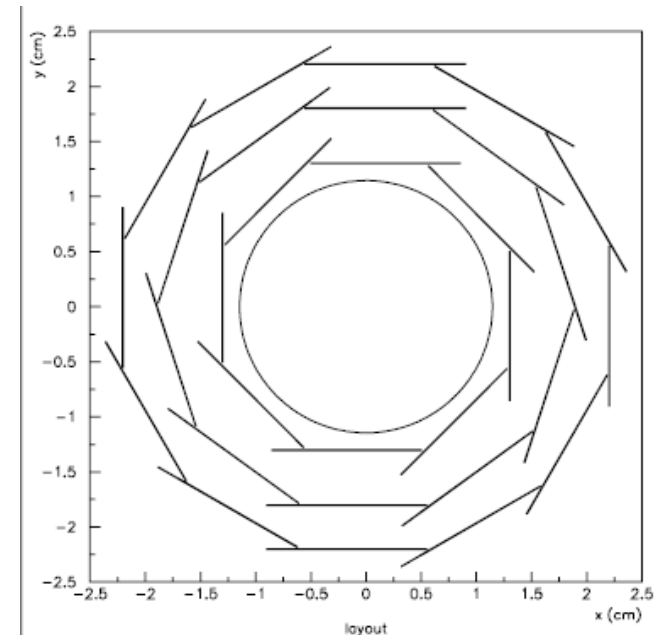
Radii still subject to optimisation:



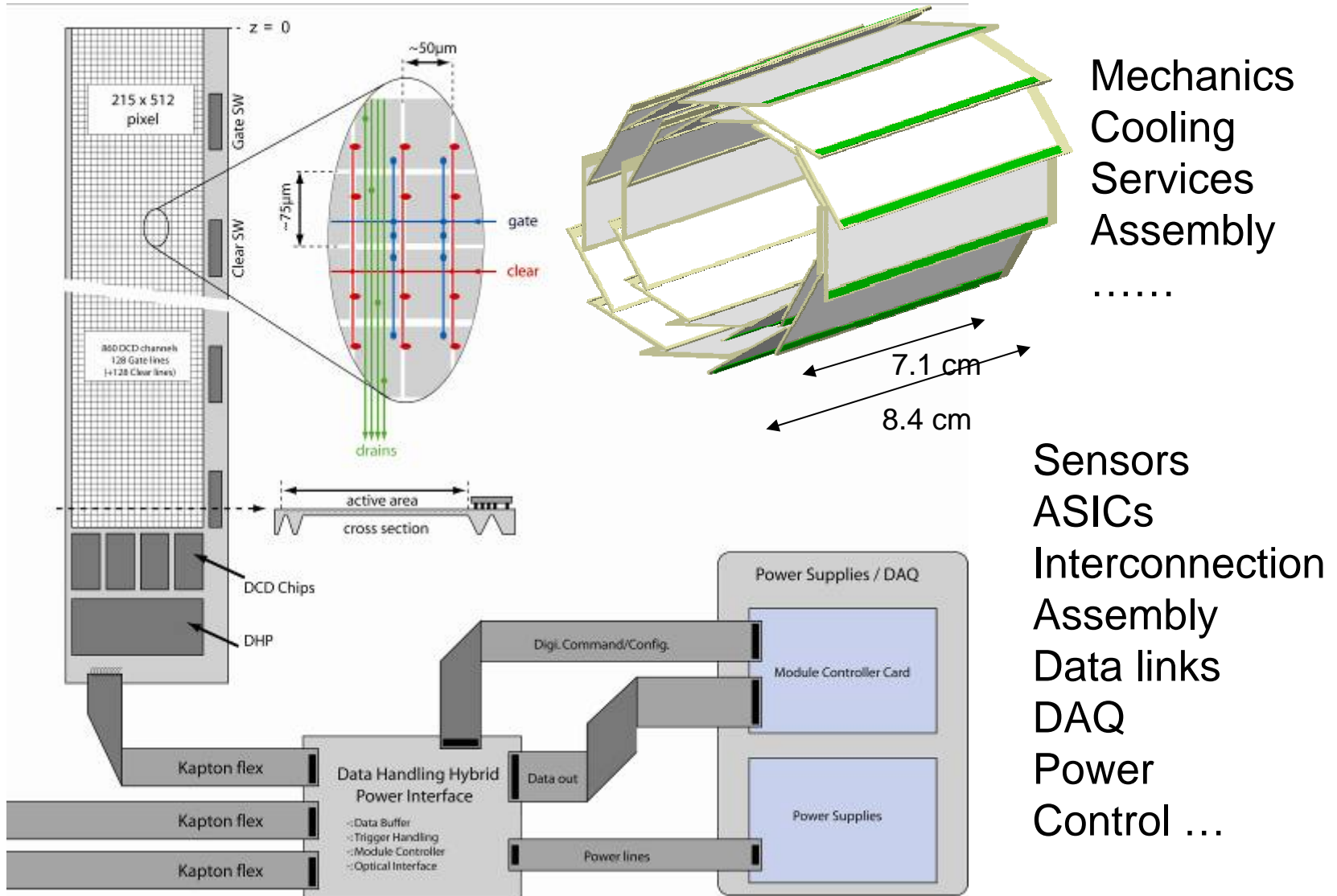
Likely scenario:

Layer 1 at 1.8 cm  
Layer 2 at 2.2 cm

Upgrade option:  
add Layer 0 at 1.3 cm



# DEPFET Pixel Sensors, details



(see talk by L. Andricek)



# Main R&D Issues

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Sensors:	pixel geometry -> parameter studies prototyping, radiation hardness (> 10Mrad), thinning (see Laci's talk)
Read-out ASICs:	<b>Current Digitizer</b> chip (DCD): prototype OK, needs test at full speed (x2) (< O(1%) occupancy) <b>Switcher:</b> rad-hard design, speed OK, redesign for SuperBelle
DHP & Data Link:	Zero-suppr: 400 Gpx/s -> 2 Gpx/s (trigger, occ) -> 1.6 Gb/s per half module
DAQ:	80 Gb/s total -> Gießen R&D for Panda (32 Gb/s)
Test Procedures:	Beam/system tests (see Peter's talk)
Mechanics, Cooling:	Mounting, vibrations, thermal issues, alignment ....,

## List of Institutions contributing to DEPFET @ SuperBelle

			Contact
Germany	MPI	Max-Planck-Institute for Physics, Munich	C. Kiesling, H.-G. Moser
	BON	University of Bonn	N. Wermes
	GIE	University of Giessen	S. Lange
	GOE	University of Göttingen	A. Frey
	HEI	University of Heidelberg	P. Fischer
	KAR	University of Karlsruhe	T. Müller
Austria	VIE	Institute for High Energy Physics (HEPHY), Vienna	M. Friedl
Czech Rep.	PRA	Charles-University Prague	P. Kodys
Poland	KRA	Institute of Nuclear Physics, Krakow	H. Palka
Spain	IFV	Instituto de Fisica Corpuscular (IFIC), Valencia	C. Lacasta
	URL	University Ramon Llull, Barcelona	J. Riera Babures
	UBA	University of Barcelona	L. Garrido
	CNM	Centro Nacional de Microelectronica, Barcelona	E. Cabruja
	IFB	Instituto de Fisica d'Altes Energies (IFAE), Barcelona	M. Chmeissani
	USC	University of Santiago de Compostela	P. Vazquez Regueiro
	IFC	Instituto de Fisica de Cantabria (IFCA), Santander	I. Vila
USA	HAW	University of Hawaii	G. Varner
Japan	KEK	KEK	T. Tsuboyama

# Work Packages and Assignments

Nr.	Work Package	Lead Institution	Collab. Institutions
<b>1.0</b>	<b>DEPFET Modules</b>		
<b>1.1</b>	<b>Parameter Definitions</b>	MPI	KRA, PRA
<b>1.2</b>	<b>Sensor Development</b>	MPI	
<b>1.3</b>	<b>ASIC Development</b>		
1.3.1	Switcher	HEI	
1.3.2	DCD		
1.3.3	Data Handling Processor (DHP)	BON	MPI, UBA
1.3.4	Data link		USC, URL
<b>1.4</b>	<b>Module Design</b>		
1.4.1	Sensor Ladder	MPI	HEI, BON, IFV, CNM, IFB
1.4.2	Kapton Flex	KEK	VIE, BON
1.4.3	Data Handling Hybrid (DHH)	KEK	VIE, BON

## Work Packages and Assignments (cont.)

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Nr.	Work Package	Lead Institution	Collab. Institutions
1.5	<b>Mechanical Design</b>	MPI	KAR, VIE; KRA, IFV, IFB
1.6	<b>Thermal Issues</b>	KAR	MPI, VIE, KRA, IFV, IFB
1.7	<b>System</b>		
1.7.1	Data Acquisition board	GOE	KRA, GIE, MPI, KEK, URL, HAW
1.7.2	Power supplies with slow control	KRA	KEK, USC
1.7.3	Cooling plant (refrigerator, heat exchanger)	KEK	

## Work Packages and Assignments (cont.)

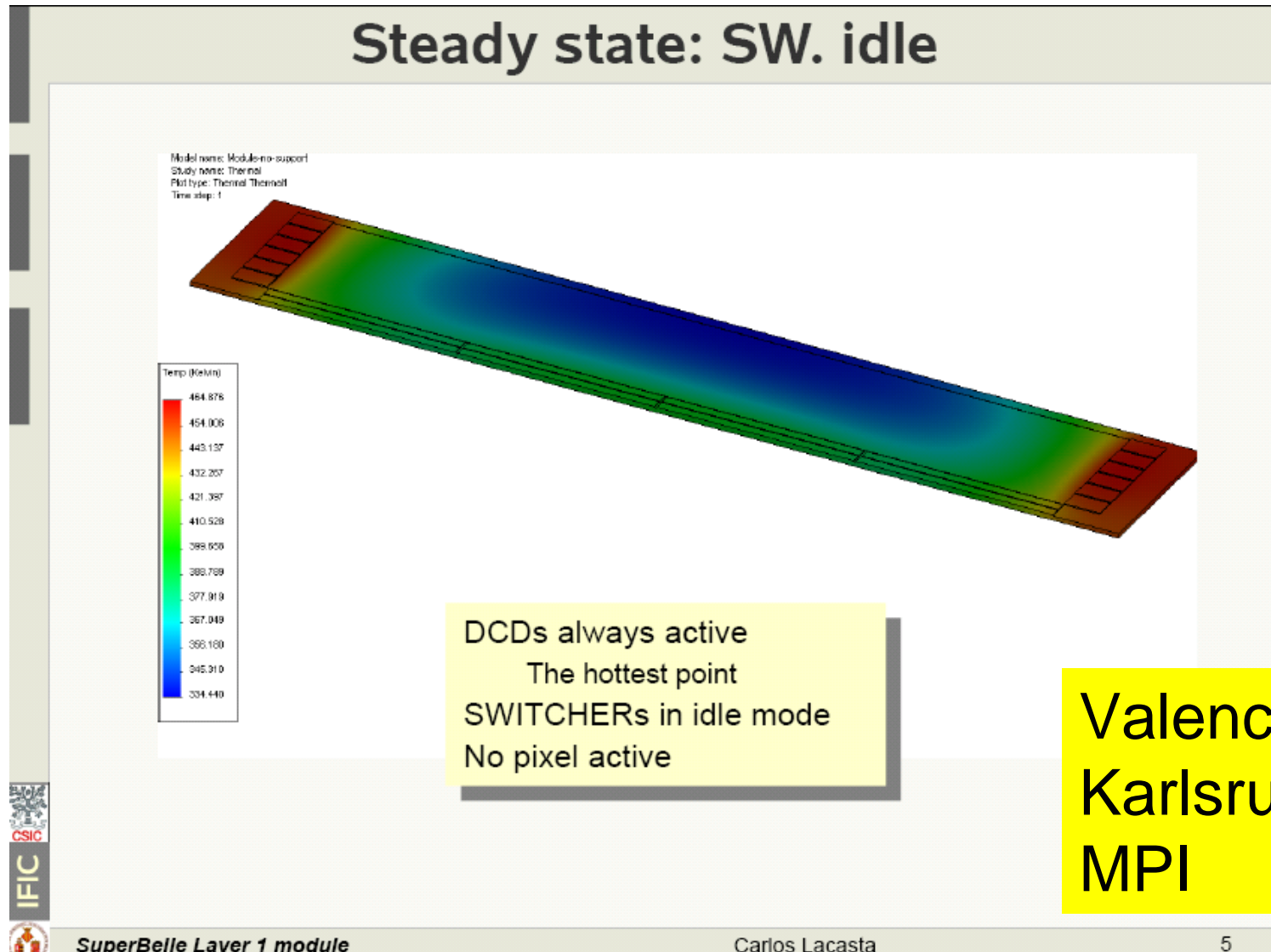
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Nr.	Work Package	Lead Institution	Collab. Institutions
<b>2.0</b>	<b>Test Facilities</b>		
2.1	Test beams	PRA	KAR, BON, VIE, IFV, IFC URL, CNM, IFB, USC
2.2	Setups for thermal tests	KAR	MPI, VIE, IFV, USC, IFC
2.3	Mechanical mockup		
<b>3.0</b>	<b>Integration and running-in scenario</b>		
<b>4.0</b>	<b>Operation Issues</b>		

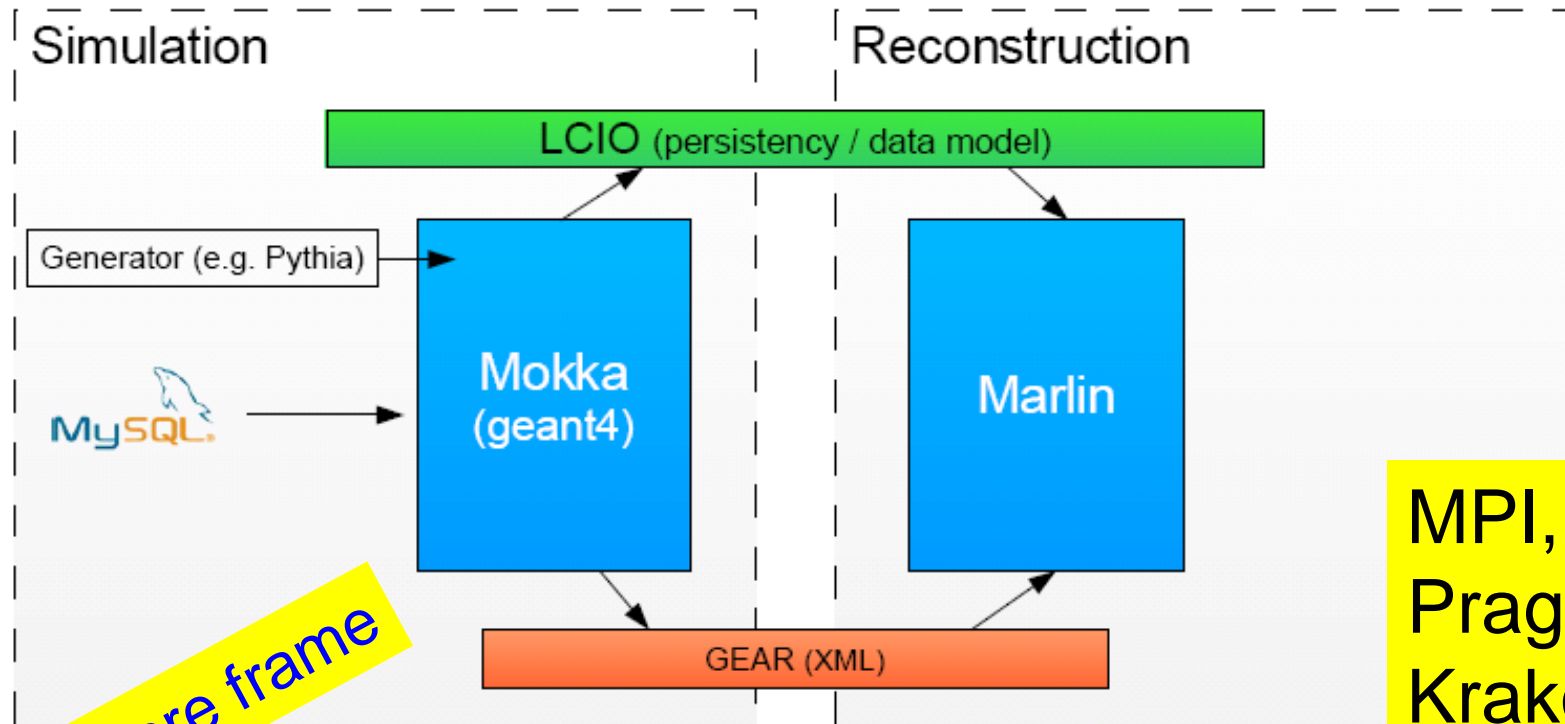
DEPFET-Collaboration:

total of 18 Institutes from 7 Countries

# Example of Work Package „Thermal Issues“



# Example of Work Package „Parameter Definitions“



ILC software frame

MPI,  
Prague,  
Krakow

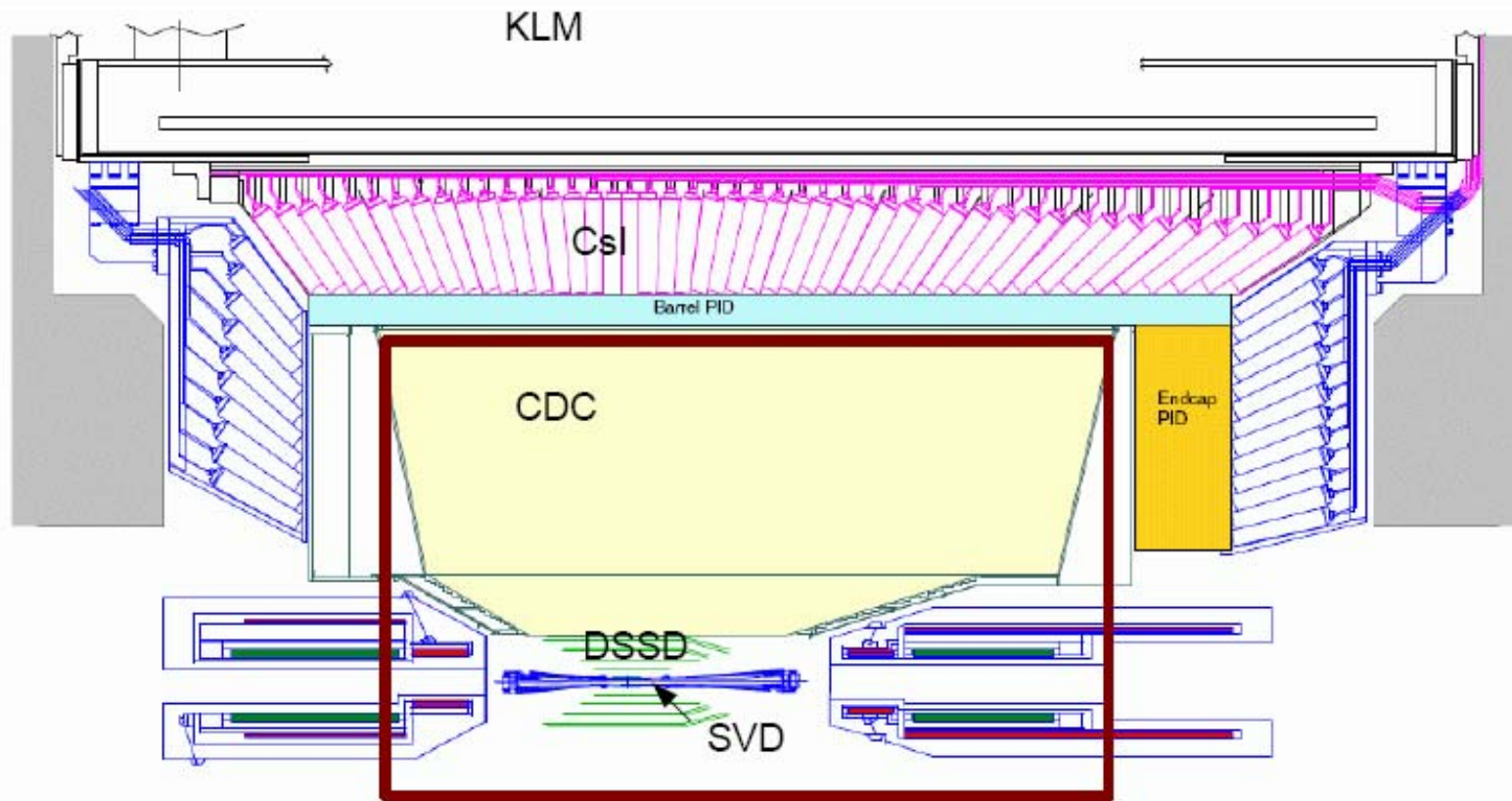
**Mokka** is geant4 based framework for full detector simulation

**LCIO** is a persistency framework that defines a common data model

**Marlin** is modular C++ application framework based on LCIO

**GEAR:** one source of geometry. Mokka creates geometry xml files used in Marlin

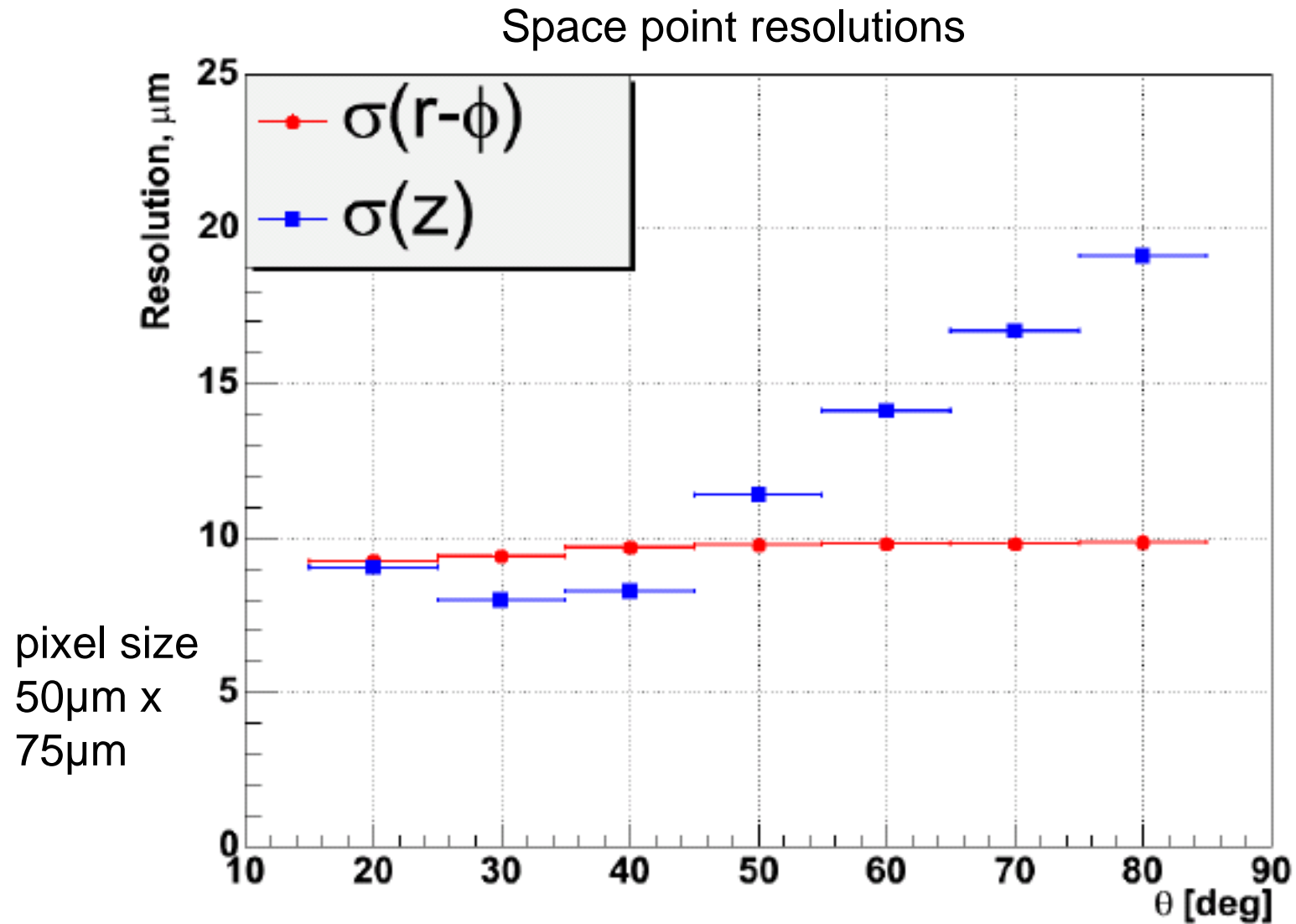
## Example of Work Package „Parameter Definitions“ (cont.)



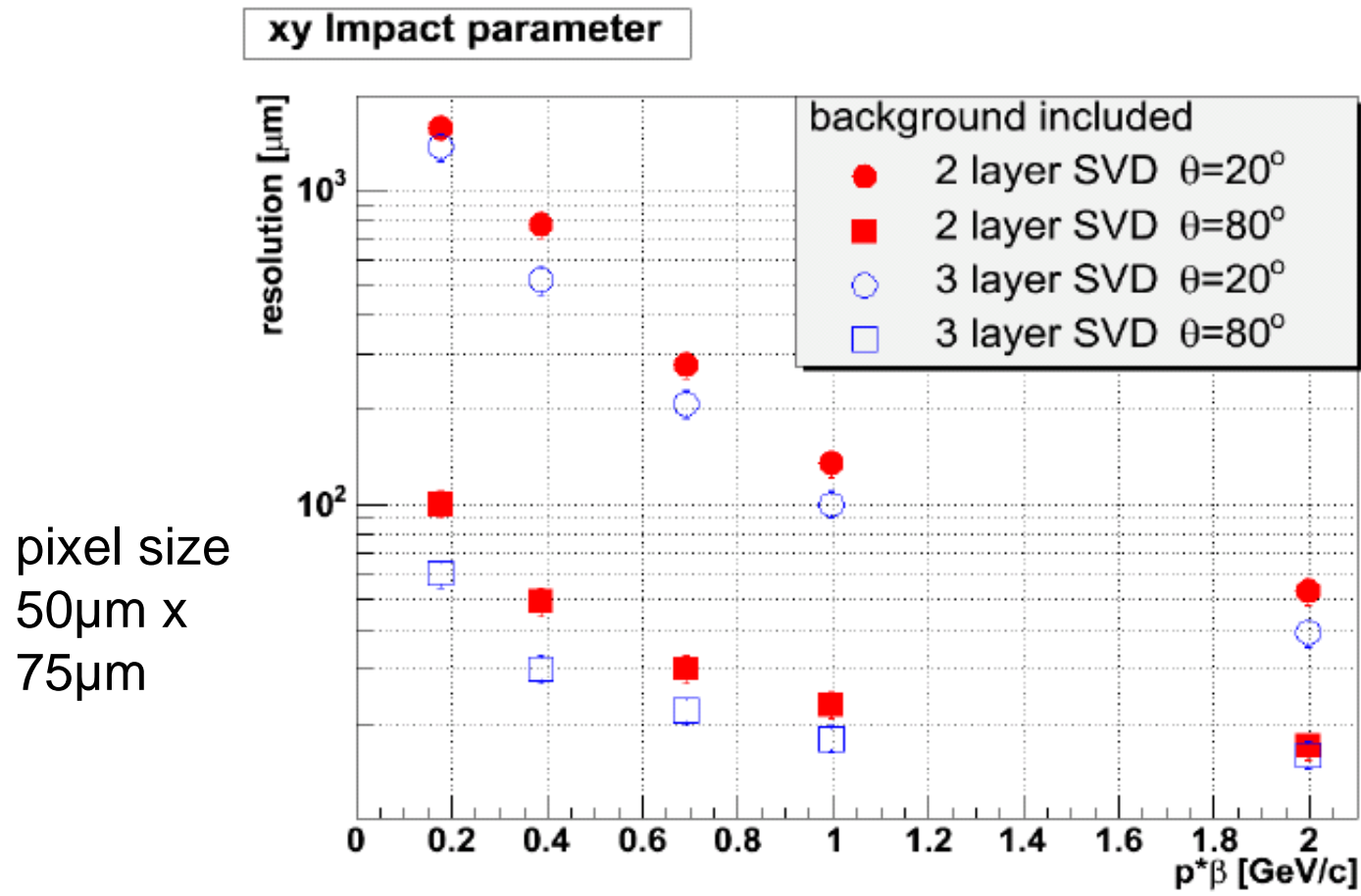
Components implemented in detector simulation  
beampipe, SVD, CDC



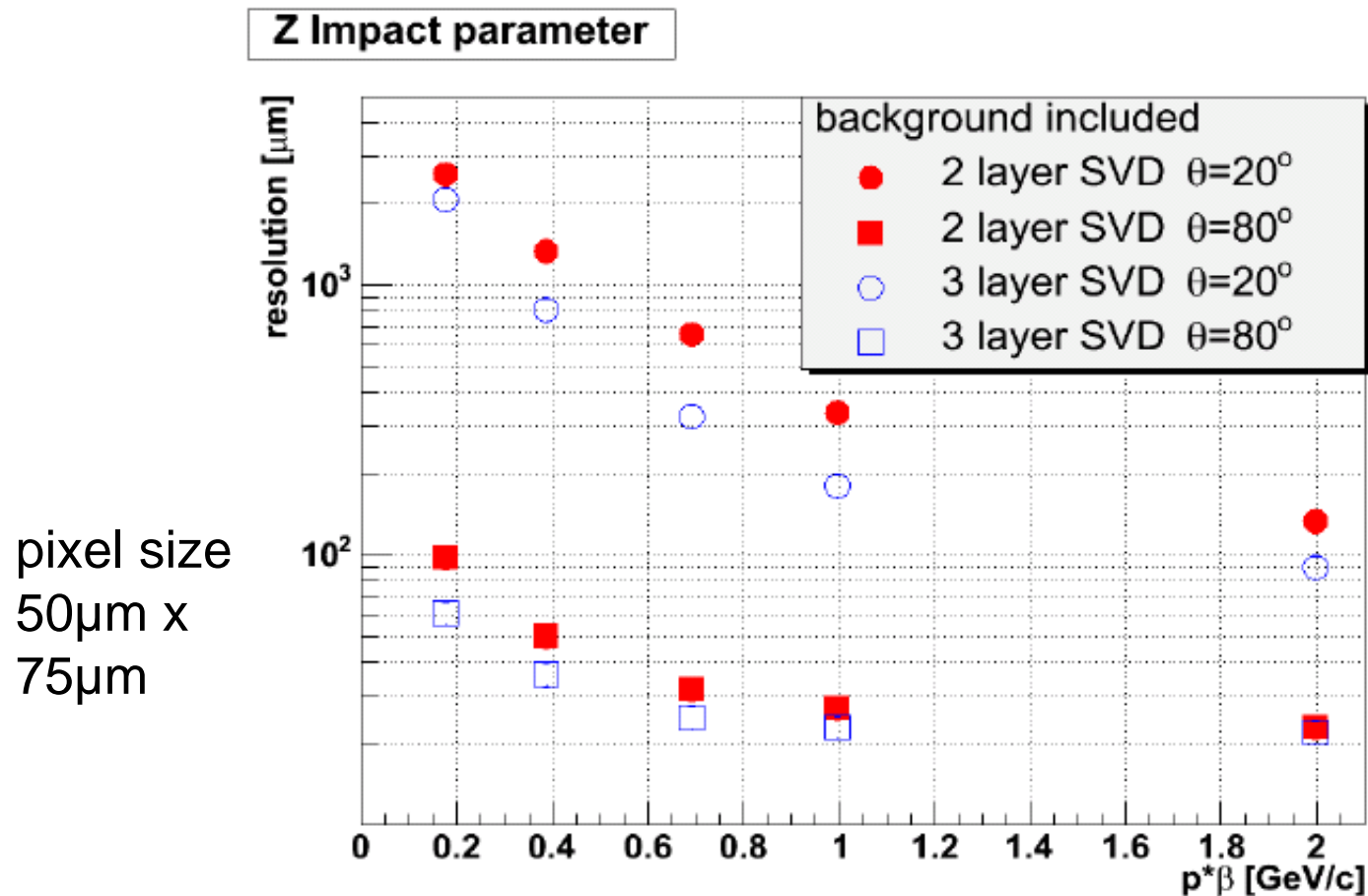
## Example of Work Package „Parameter Definitions“ (cont.)



# Impact Parameter Resolution in Presence of Backgrounds



# Impact Parameter Resolution in Presence of Backgrounds



## Example of Work Package „Power & Slow Control“

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# Low Voltage Power Supplies (LVPS)

### Planning

#### Short term

- agree on design parameters
- find/select a designer

Krakow  
USC (Spain)

#### Long term

- workout a detailed list of components
- elaborate a technical specifications document
- estimate costs
- prototype procurement
- select the manufacturer

informal contact established with Fideltronik, the producer of HVPS for ATLAS

<http://www.fideltronik.com.pl>

# Installation & Operation

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- Module assembly (where, how ?)
- Assembly of modules to a layer (or complete detector)
- Installation in SuperBelle
- Operation issues (calibration, monitoring)
- Online monitoring and logging:
  - Currents
  - Temperatures
  - Occupancy
  - Signal and pedestal distributions (pedestal updating!)
  - Noise
  - Radiation dose

# Schedule

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**2009:** finish checks on radiation hardness up to 10Mrad  
demonstrate fast readout with existing components  
fix geometry & technology  
prepare DEPFET production (SOI wafers)

prototype production (processing: ~ 1.5 years)  
½ SuperBelle module size (one electrical unit)  
some parameter variations

**2010:** test and evaluation of prototypes  
assembly procedure and tooling

**2011:** final detector production

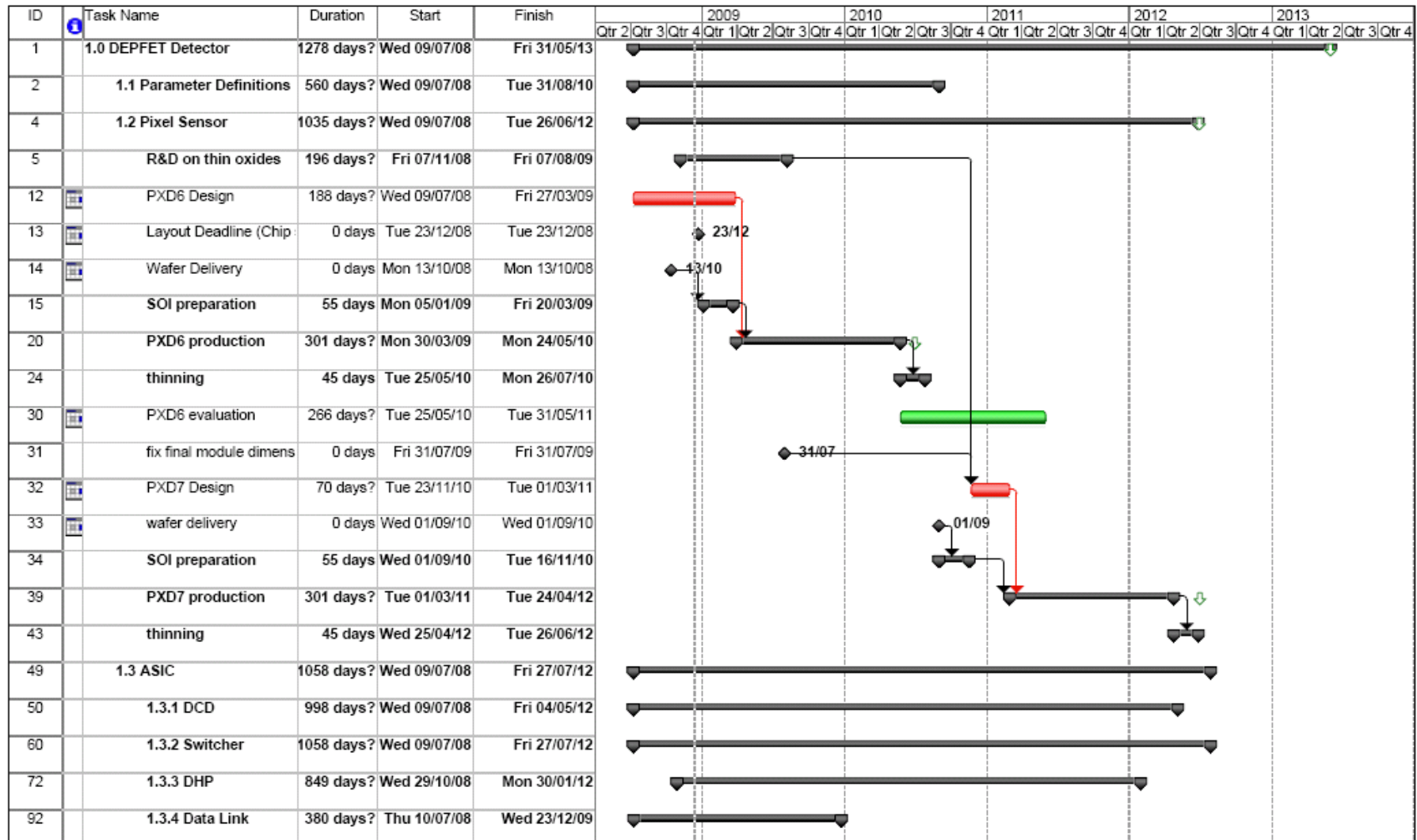
**2012:** assembly + tests

**2013:** installation

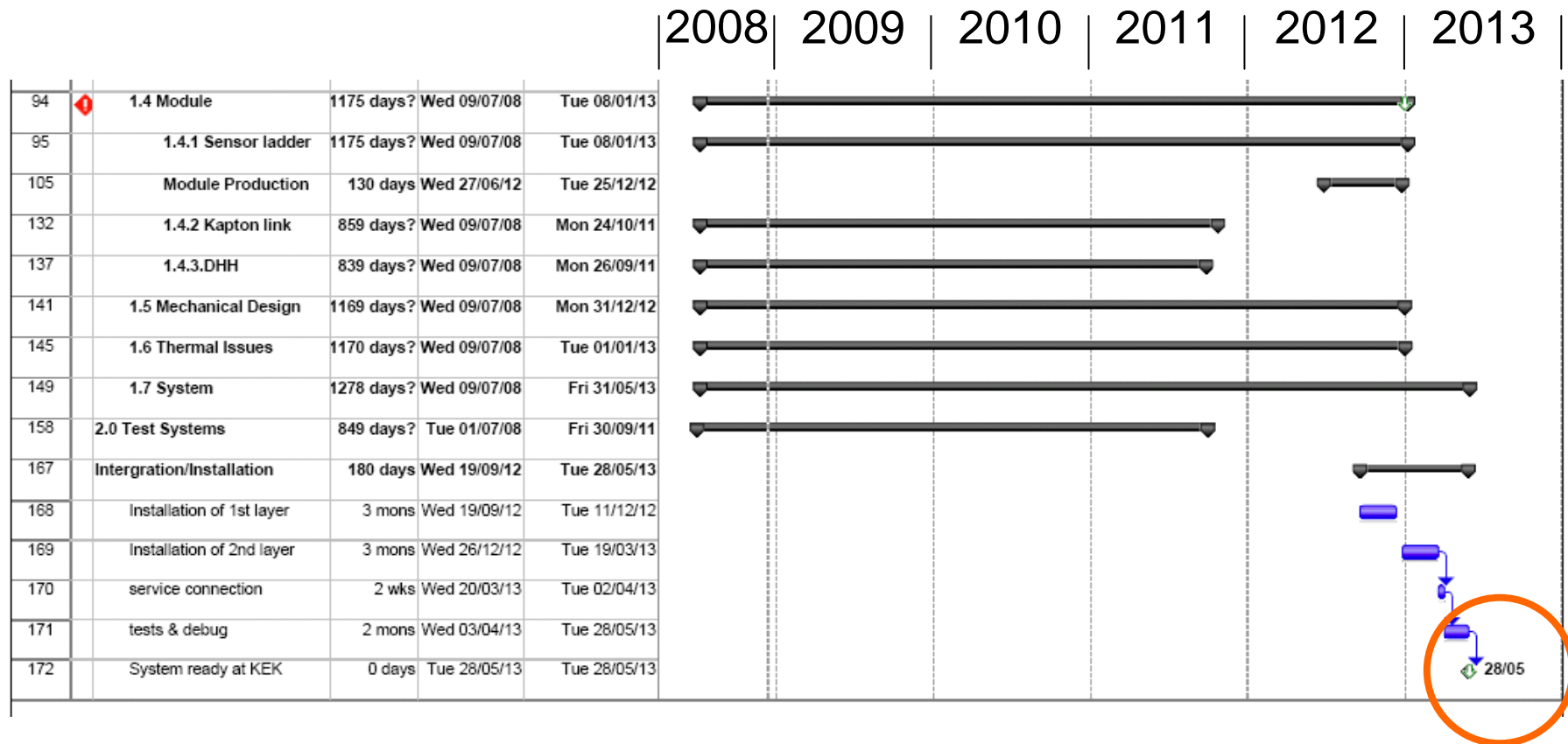
**Very tight schedule, not without risk**

# Schedule (detail)

2008 | 2009 | 2010 | 2011 | 2012 | 2013



# Schedule (detail)





# Conclusions and Outlook

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- DEPFET Collaboration / German groups are now firmly behind the PXD project for SuperBelle,
- Funding agencies have been approached (total of ~2.5 MEuro core cost)
- Work packages are defined, lead institutions (+contacts) are identified
- Working Groups are getting organized, work for SuperBelle intensifying (regular meetings)
- Groups working towards DEPFET PXD baseline option for SuperBelle
- Schedule for the project is established and agreed (but tight!)
- SuperBelle Note for DEPFET PXD is being planned