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# European Initiative towards a Pixel SVD for SuperBelle

C. Kiesling, MPI for Physics, Munich, Germany

- Motivation
- Results from the Munich kick-off meeting
- Next steps

# Why SuperBelle? A Bit of History ...

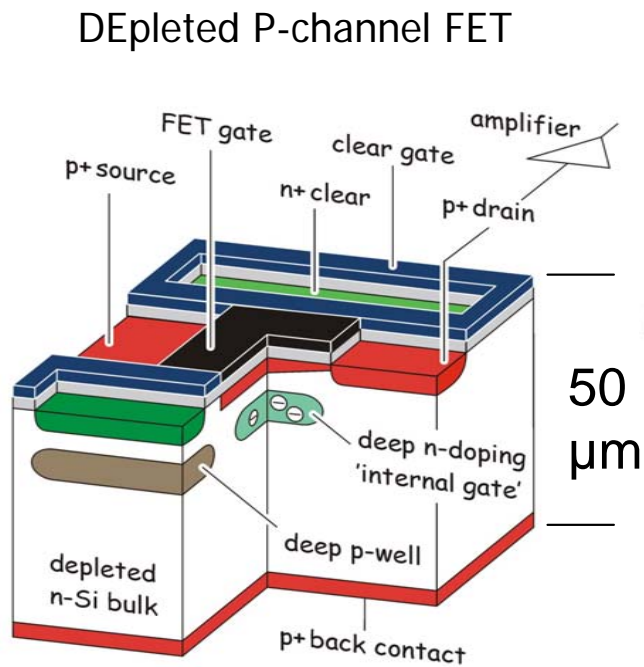
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- Strong international interest in a future Linear Collider (e.g. ILC),
  - ➔ physics complementary to the LHC program
- Planning for the machine is ongoing
- R&D programs ongoing for several detector concepts (ILD; SID, 4th)
- Common element to all such detectors:
  - Si vertex detector (SVD), pixels required for the innermost layers
- One possible technology: the DEPFET pixel detector (MPI invention)
  - ➔ DEPFET Collaboration, since ~2004
  - ➔ Elaborate R&D program for ILC SVD ongoing
- BUT: ILC timeline ever slipping ...  $\geq 2020$  ?
- ➔ Competitive Physics program offered by Belle/SuperBelle (now and  $\geq 2013$ ) sensitive to large mass scales, even beyond LHC (!)
- ➔ A pixel vertex detector will be needed for SuperBelle

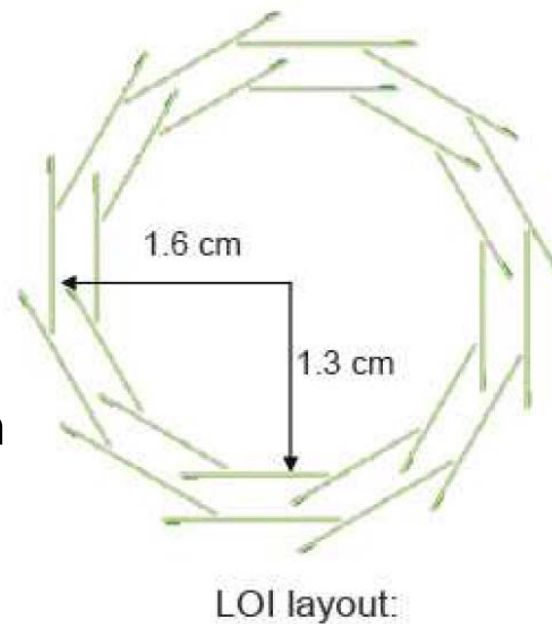
# Contribution of the DEPFET Community to SuperBelle

- Deliver a 2-layer pixel vertex detector, close to the beam pipe ( $>1.3$  cm), based on the DEPFET technology

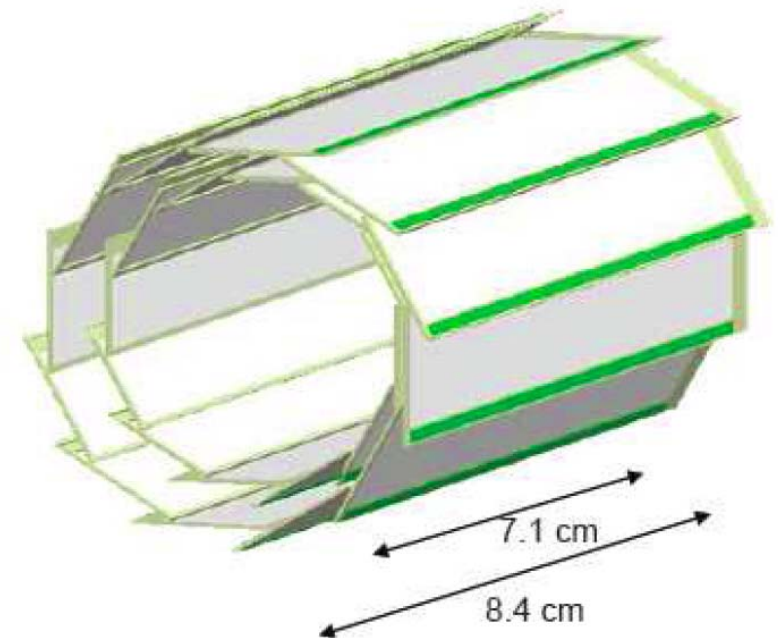
background-tolerant, minimal multiple scattering, radiation-hard



variable pixel size



(for details see Laci Andricek's talk)



# Munich Meeting on June 25/26

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Mission: Prepare a scenario for a complete pixel SVD system for SuperBelle, based on the DEPFET technology

Participants:

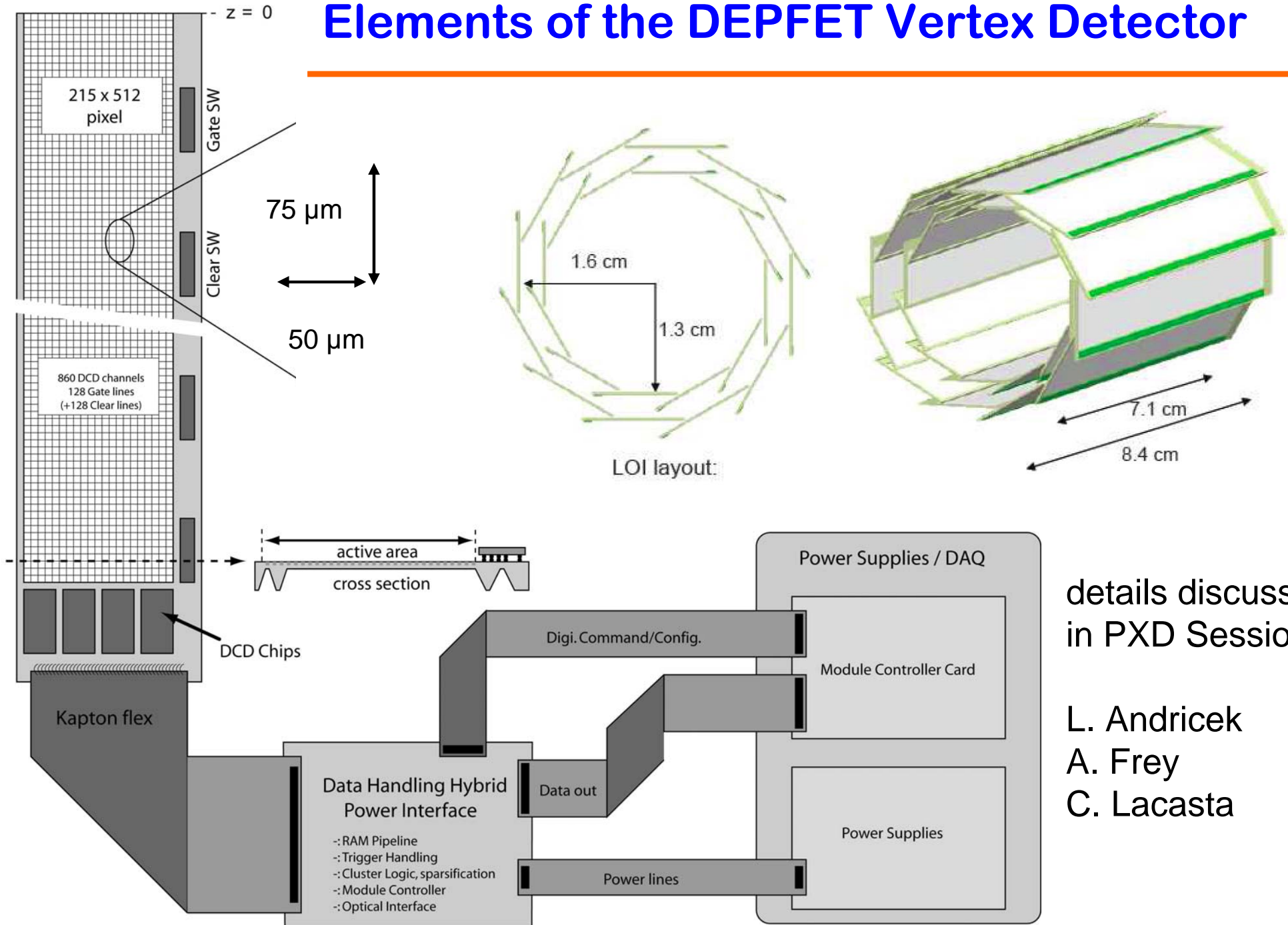
L. Andricek (MPI)  
A. Frey (MPI, Göttingen)  
C. Kiesling (MPI)  
A. Moll (MPI)  
H.-G. Moser (MPI)  
R. Richter (MPI)  
S. Rummel (MPI)  
A. Wassatsch (MPI)  
H. Krüger (Bonn)  
N. Wermes (Bonn)  
P. Fischer (Heidelberg)  
I. Peric (Heidelberg)

T. Müller (Karlsruhe)  
H.-J. Simonis (Karlsruhe)  
C. Lacasta (Valencia)  
I. Vila (Santander)  
E. Cortina (Louvain)  
H. Palka (Krakow)  
Z. Dolezal (Prague)  
P. Kodys (Prague)  
M. Friedl (Vienna)  
T. Tsuboyama (KEK)

## 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
	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

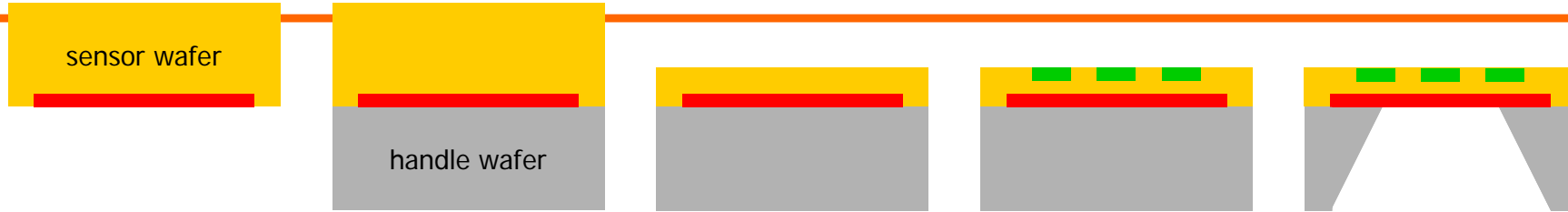
# Elements of the DEPFET Vertex Detector



details discussed  
in PXD Session

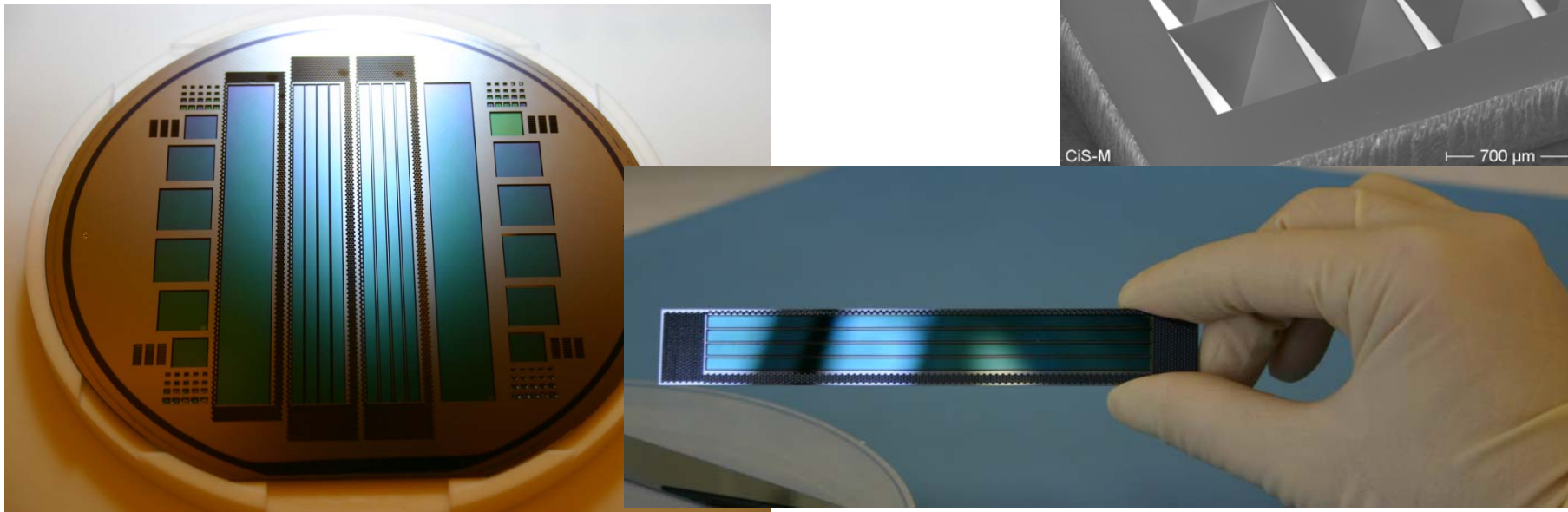
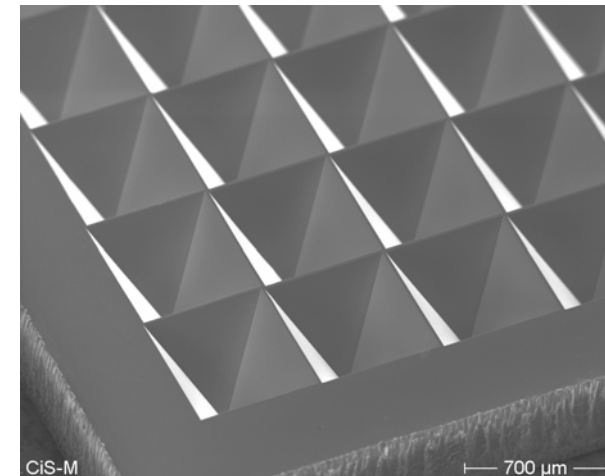
L. Andricsek  
A. Frey  
C. Lacasta

# Thinning Technology



1. implant backside on sensor wafer
2. bond sensor wafer to handle wafer
3. thin sensor side to desired thickness
4. process DEPFETs on top side
5. structure resist, etch backside up to oxide/implant

- Sensor wafer: high resistivity  $d=150\text{mm}$  FZ wafer.
- Bonded on low resistivity “handle” wafer”.
- Rigid frame for handling and mechanical stiffness
- $50\ \mu\text{m}$  thickness produced
- Samples of  $10 \times 1.3\ \text{cm}^2$  & frame of 1 & 3 mm width
- Electrical properties ok (diodes)



# Work Packages and Assignments

Results of the Munich meeting

Nr.	Work Package	Lead Institution	Collab. Institutions
<b>1.0</b>	<b>DEPFET Modules</b>		
1.1	Parameter Definitions	MPI	KRA PRA ( help from Osaka)
1.2	Sensor Development	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	BON	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)		



## Work Packages and Assignments (cont.)

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

## Work Packages and Assignments (cont.)

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, UBA, CNM, IFB, USC
2.2	Setups for thermal tests	KAR	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>		

Conclusion:

- great enthusiasm for building DEPFET@SuperBelle
- all workpackages (up to „integration“, 3.0) are covered
- responsible groups are defined,
- schedule is tight (2012), but no show stopper visible

Project Cost: rough estimate ~ 2.5 M€ over 4 years

# Next Steps

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- R&D: work continues, (new) WP groups are getting organized
  - ➔ need now very close collaboration with our Japanese colleagues (physics, machine), and the other institutions already engaged in SuperBelle
- Meetings: Follow-ups of Munich meeting already planned (Heidelberg, Karlsruhe, Ringberg)
- Funding: German group's money (as well as Spain's) earmarked as „ILC“, need to sort out funding beyond 2009
- Competitor: Discussions about SuperKEKB / SuperB ongoing in Europe
  - ➔ workshop on physics cases in November 2008 (Munich?)
- meanwhile: looking forward very much to the exciting physics prospects at SuperKEKB, and giving strong support in upcoming discussions