



Report on the 4th Open Meeting of the Belle II Collaboration (B2GM)

- Status of SuperKEKB Funding
- Interaction Region Report
- Issues in the PXD Area
- SVD Report
- Some Open Issues

Shuji Tanaka
Liaison of PXD to KEK





Schedule of B2GM



Wednesday 18 November 2009

chair: Bostjan Golob - 3-go-kan, seminar hall (09:00-09:40)

time	[id] title	presenter
09:00	[3] Opening address	P. KRIZAN (SPOKESPERSON)
09:10	[4] News from KEK management	A. SUZUKI (KEK GENERAL DIRECTOR)
09:25	[5] Self-introduction	BONN

chair: Bostjan Golob - 3-go-kan, seminar hall (10:00-12:00)

time	[id] title	presenter
10:00	[6] machine	TAWADA, M.
10:40	[53] BSM searches at Belle II	DRUTSKOY, A.
11:00	[8] IB [1]	IB MEMBERS

chair: Tom Browder - 3-go-kan, seminar hall (13:30-14:30)

time	[id] title	presenter
13:30	[9] SuperB project overview	LEITH, David
14:00	[10] SuperB and DAFNE: Crab Waist Approach	MIKHAIL ZOBOV (LNF-INFN)

after that: 1.5 days parallel sessions (PXD after dinner (19:00-23:30))

Friday 20 November 2009

chair: Takeo Higuchi - 3-go-kan, seminar hall (09:00-10:15)

time	[id] title	presenter
09:00	[29] IR status report	IWASAKI, M.
09:25	[30] PXD status report	MOSER, H.-G.
09:50	[31] SVD status report	FRIEDL, M.

chair: Takeo Higuchi - 3-go-kan, seminar hall (10:35-12:10)

time	[id] title	presenter
10:35	[32] CDC status report	UNO, S.
11:00	[33] PID status report	INAMI, K.
11:45	[34] ECL status report	KUZMIN, A.

chair: Yuji Unno - 3-go-kan, seminar hall (13:30-15:10)

time	[id] title	presenter
13:30	[35] KLM status report	PAKHLOV, P.
13:55	[36] TRG status report	IWASAKI, Y.
14:20	[37] DAQ status report	ITOH, R.
14:45	[38] STR status report	HABA, J.



Status of SuperKEKB Funding



M. Yamauchi

- New Japanese government in process of scrutinizing all science projects
- 4 Categories: 1=Goahead, 2=OKwith Cuts
3=Freeze, 4=„Kill“
- Some „big science“ projects already killed (e.g. new rocket propulsion system, frozen: SuperComputer Project, Spring8)
- However, KEK management optimistic
- This Thursday: Meeting of the ministers



Status of SuperKEKB Funding (cont.)



M. Yamauchi

- Not clear whether we will know the outcome this Friday

- Three possibilities:

Cat 1: everything OK

Cat 2: cut (how much?) means possible delay

Cat 3,4:

„fire back“: collect support letters etc.
to revert the decision



IR status report

2009/11/20 M. Iwasaki (Tokyo)

*For Belle-II IR Group
Tokyo / Tohoku / KEK*

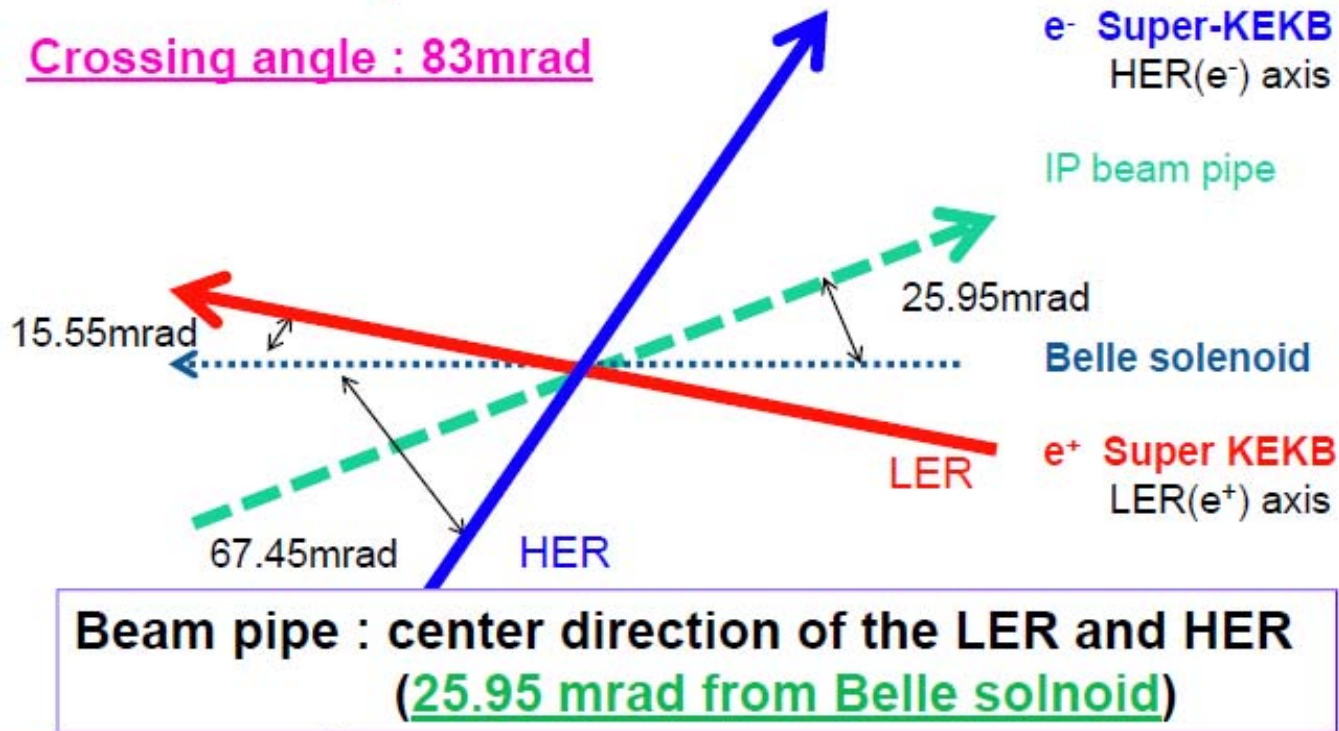


Accelerator design

- The base design is Nano-beam option
 - There are two final-Q magnets in both L / R sides
- 7x4GeV beam energies
(To solve the problem on dynamic aperture.)
- Crossing angle becomes 83 mrad
to put the final-Q magnets closer to the IP
- The QCS chamber radius is 1cm
 - to avoid the resonant cavity structure,
our IP beam-pipe radius should be 1cm

Interaction Region (cont.)

Relationship btw Belle-II and Super-KEKB

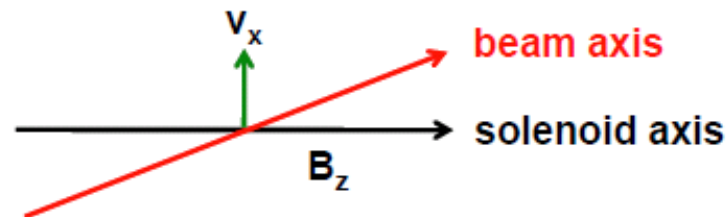


Parameters are not fixed yet

We'll have the new optics with the detector solenoid soon
 .. need to check the SR direct hit
 → Beam-pipe direction may change

Synchrotron Radiation

- **Beam trajectory is 3D twist due to solenoid field.**
- **Beam is kicked in solenoid region vertically and a vertical dispersion is generated.**



- **Synchrotron radiation effect will be different from the optics without the solenoid field. Need BG simulation.**



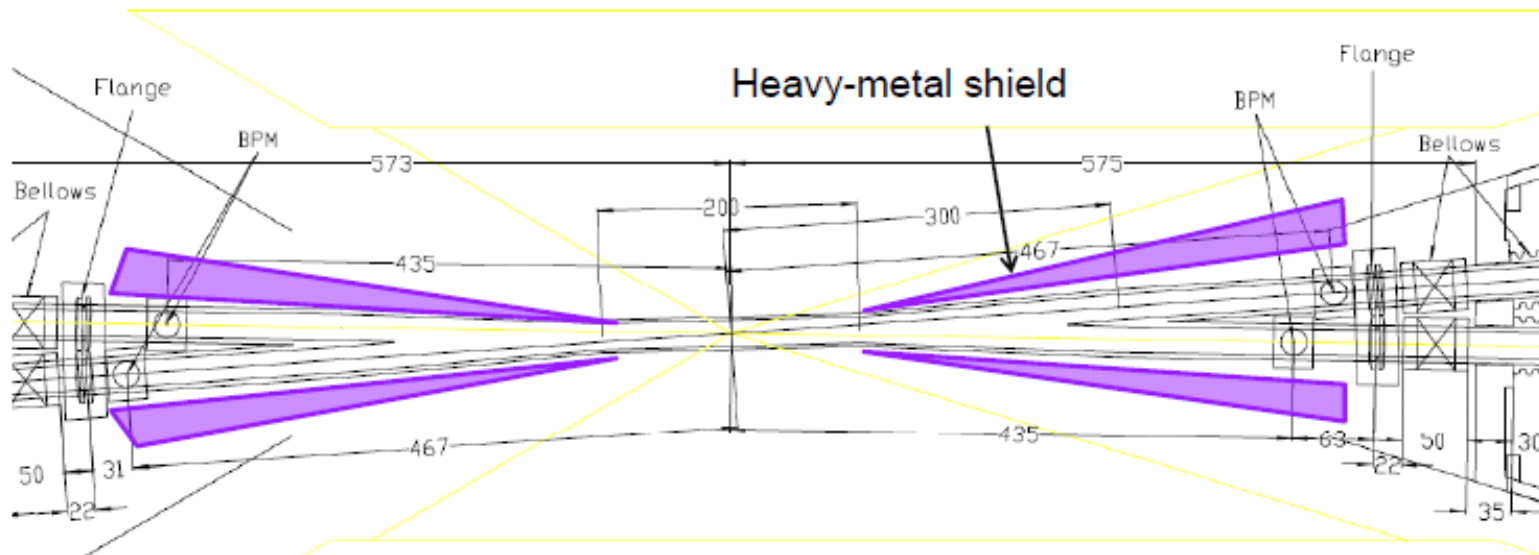
Y. Ohnishi

Summary

- Machine parameters are almost fixed to study the machine performance.
- Large X-angle 83 mrad is necessary to separate two beam lines and the isolated final quads can be located near IP as closer as possible.
- Optics design with solenoid field is still under going. We have the first version to study the performance. Dynamic aperture, Touschek lifetime will be improved by further optimization.
- Belle rotation is still open question concerning the optics performance. It can make the smaller radius of the compensation solenoids. This leads weaker electromagnetic force and gives mechanical advantages (The current configuration is possible).

2009/08 Kanazawa

Belle-II IP chamber



- Size/ shape / materials are not fixed, but based on the same structure as current (Be straight part + heavy metal shields)
- Taper part (in Belle) will be crotch structure
- Assume 1cm radius to the Be straight part
- Beam position monitors are on (or near) the IP-beam pipe

Belle-II IP chamber : To do

1. Design of the shield

This time, we assume 1cm radius to Be straight part

- 1cm radius Be pipe part will be broken with the current support method (heavy shield edges are supported by CDC)

We need to think about the heavy metal shields (20kg in one side)

- As light as possible
- Separate design for beam-pipe and shields
(Currently taper part and shield are integrated)
- New supporting design

The heavy shields should be supported by SVD and CDC

To design the heavy metal shields,

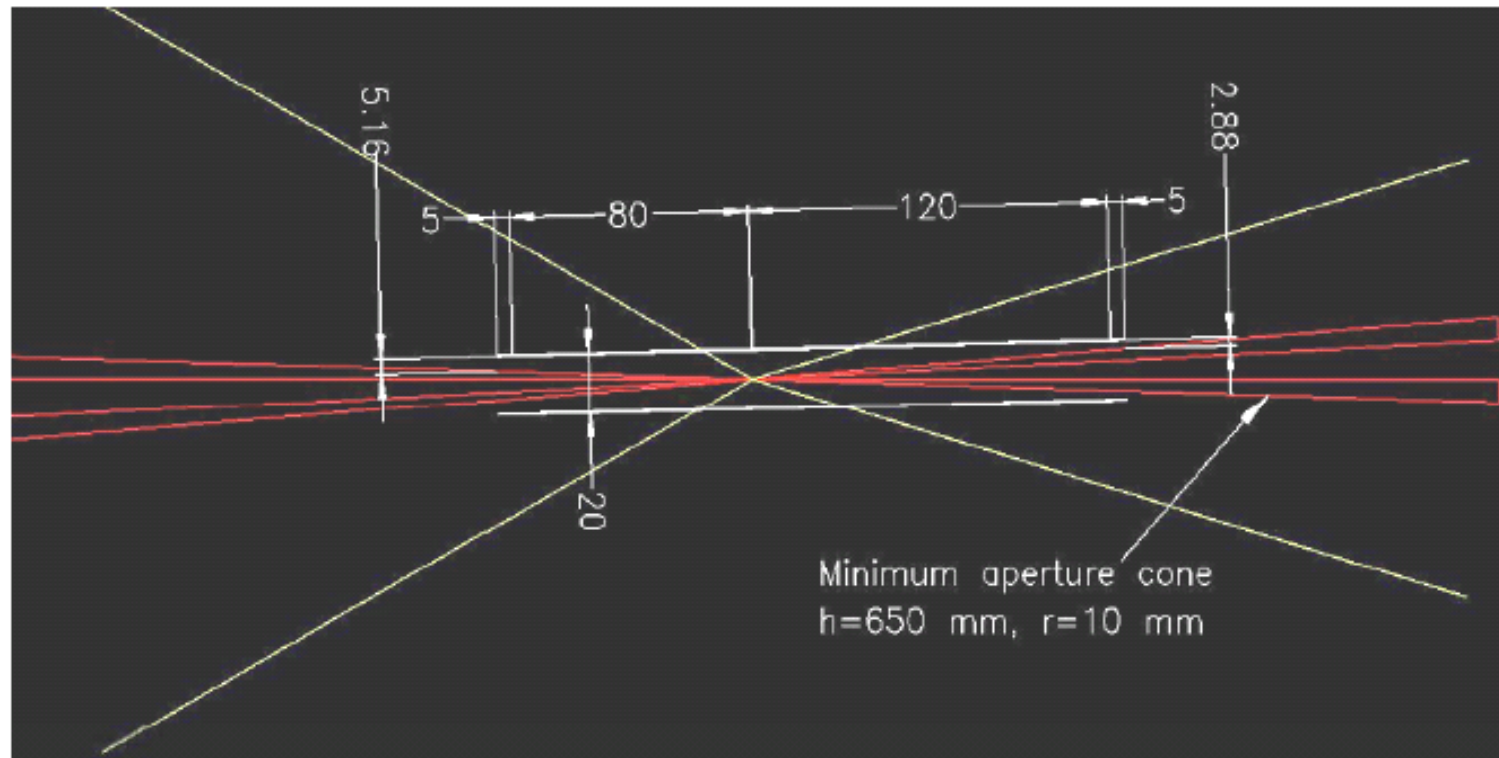
particle BG simulations (Beam-gas and Touschek) are important

2. Design of the straight part

PXD wants longer straight part → See K.Kanawaza-san's talk

K.Kanazawa

Clearance of Be pipe



Forward 120mm + backward 80mm Be pipe with +5mm for connection looks possible.

Forward 120mm + backward 100mm with +5mm for connection also looks possible.
(2009/11/19 By Kanazawa-san)

K.Kanazawa

Pressure around IP-Summary

- Pressure within 2m from the IP is of the order of 10^{-5} Pa after 12 days of full current run.
- The final pressure will be around 10^{-6} Pa.
- The thermal desorption rate and the photo-desorption coefficient of a gold plated surface is not reported. (This perhaps means the gold surface has no superior vacuum property than other metals).

x10-100 higher vacuum pressure than current KEKB

← not x100-1000 :

There was a mistake in the calculation (2009/11/19)



Detector BG status

1. Touschek

- Rough estimation based on life-time (LER)
x20 - 30 higher than the current Belle
- Simulation by Tohoku

2. Beam-gas

- Vacuum around IP (+- 2m) will be worse (~~x100-1000~~) (x10-100)
- Simulation by Tokyo

in progress

only photon processes

3. We'll propose the BG estimation run during this fall Belle run to estimate the Touschek and beam-gas with single beam.

4. We did rough BG estimations based on the optics parameters

- Radiative Bha-Bha 1/40
- Backscattering SR 1/800 of the current Belle

→ These estimations may change (with new optics)

T. Tsuboyama

Number of cables and tubes

Tubes and cables from each side. For the most narrow part, heat shield will not be minimized.

	Cables (cm ²)	Tubes (cm ²)
IP chamber	4 (8 BPM cables)	2 (3 tubes)
PXD	30(power) 5 (signal)	2 (minimum heat shield)
SVD	94 (hybrid)	2 (4 tubes)
Total	133 cm ²	6 cm ²

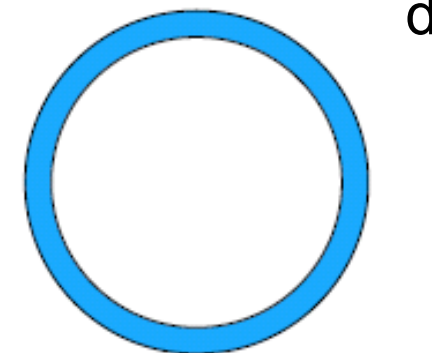
only 1/2 of
DHH's
considered

The outer radius of the SVD support will be 14 cm. If we use 1/3 of the circumference for mechanical support, 2/3 can be used for cables and tubes.

The thickness, T , of cables and tubes is, then,

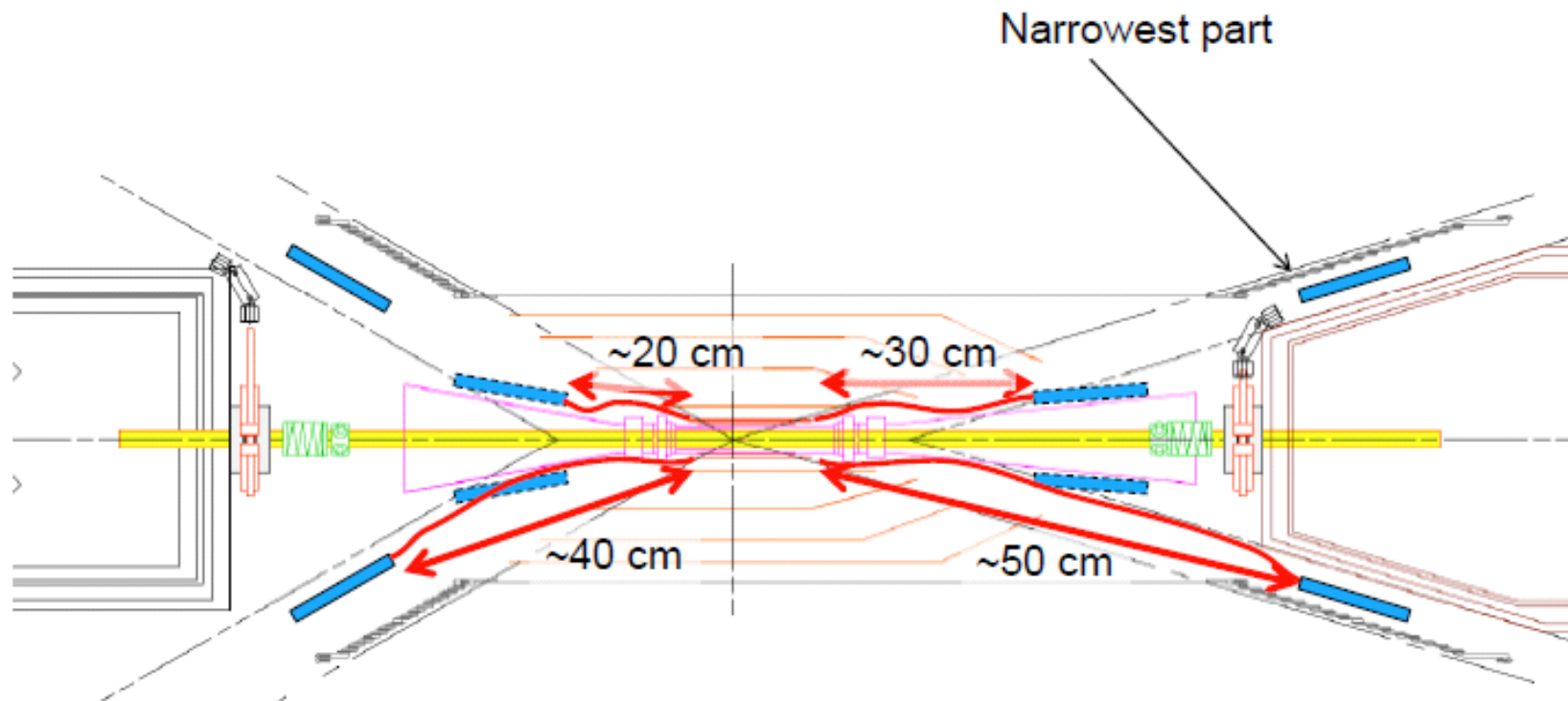
$$T = 133 / (14 * 3.14 * 2 * (2/3)) = 2.2 \text{ cm}$$

This is not impossible to design.



T. Tsuboyama

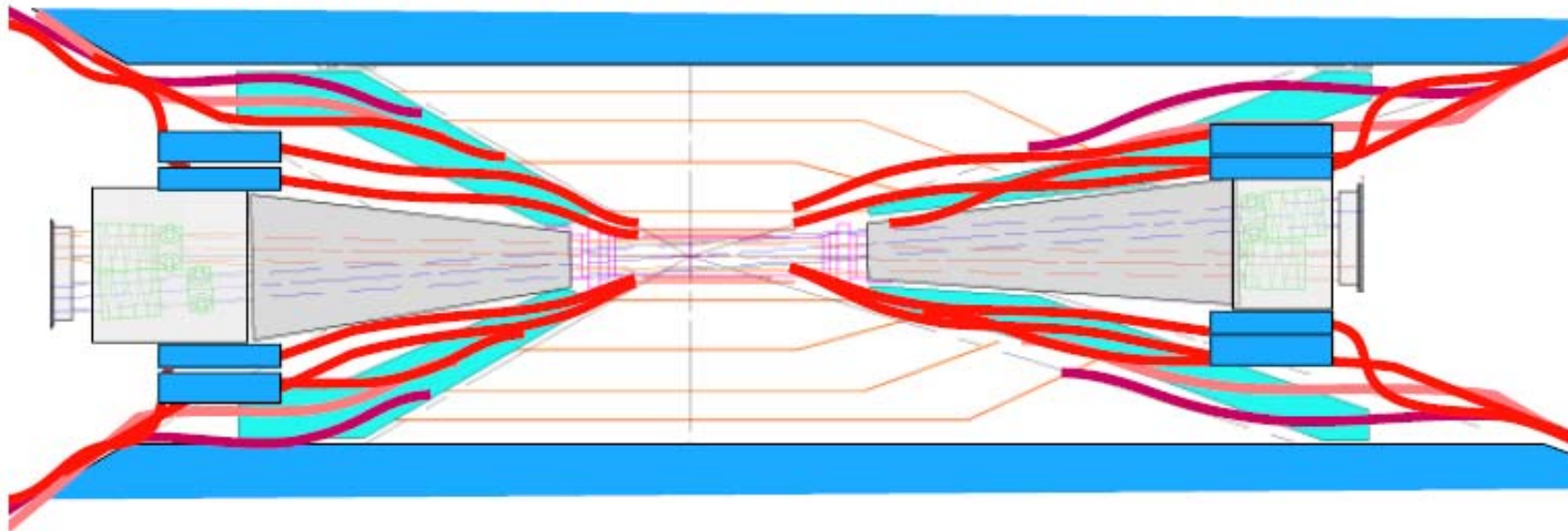
Places for DHH



T. Tsuboyama

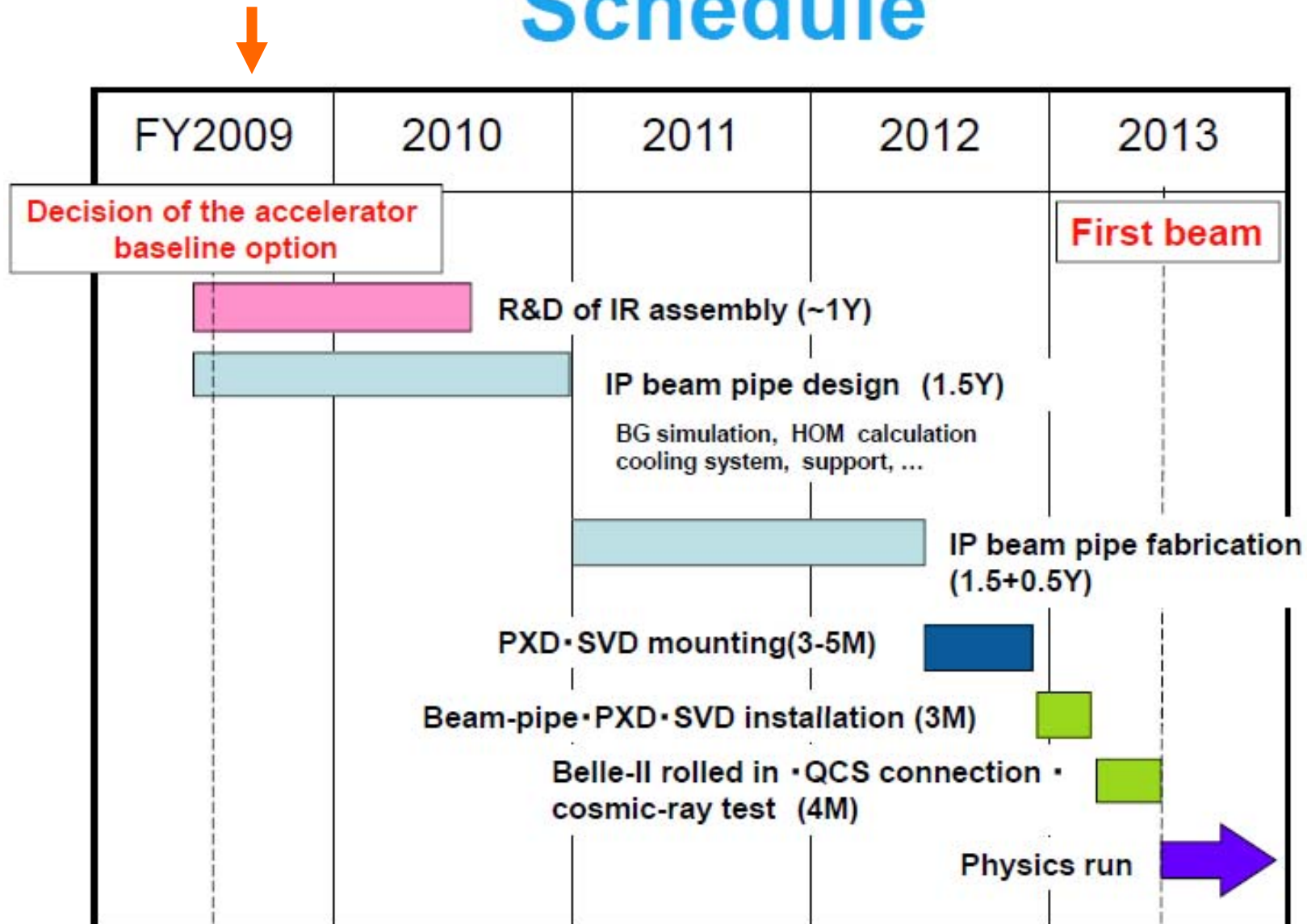
IR detector assembly procedure

- 7. DEPFET DHH (repeater cards) are installed around the added masks. We invade the accelerator realm. We need

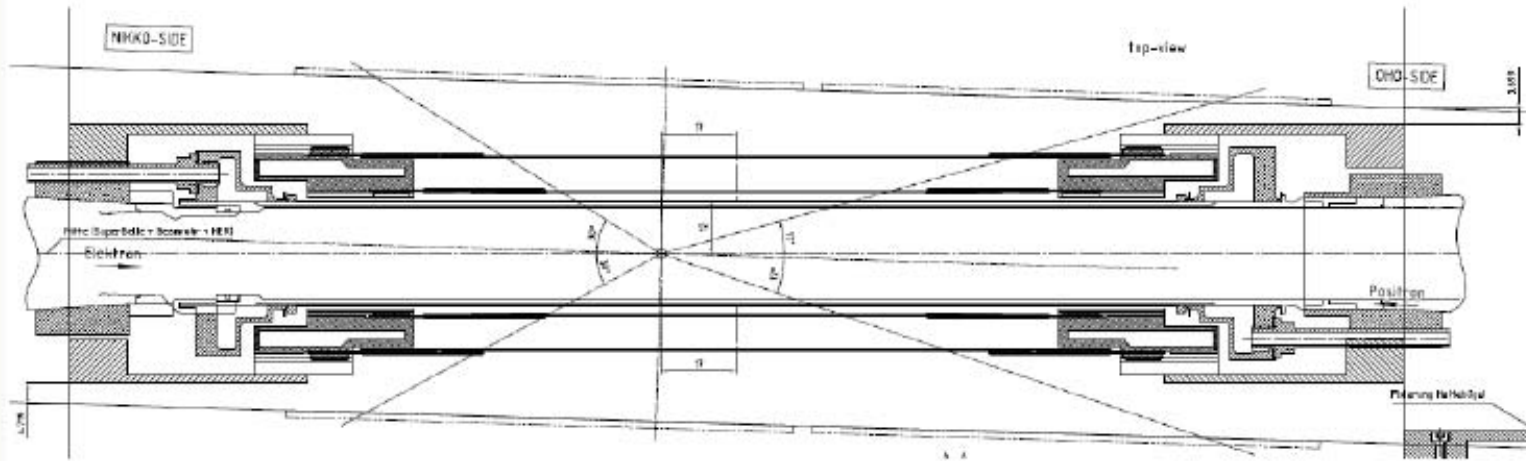


- 8. PXD Cablings are done.

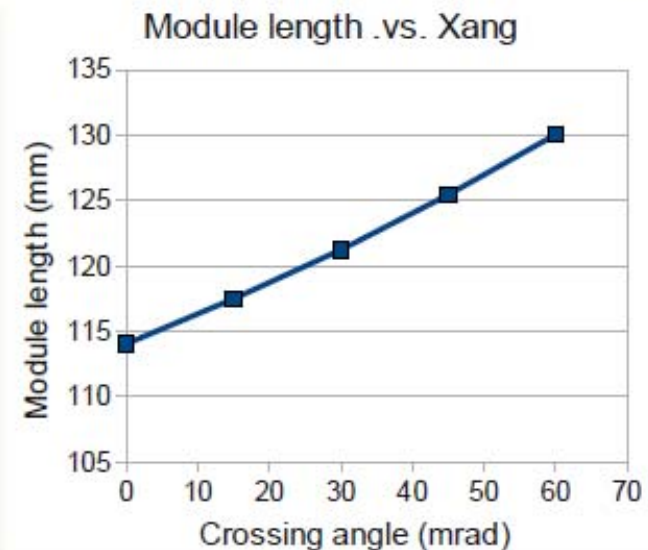
Schedule



Belle rotation (maybe required by machine)



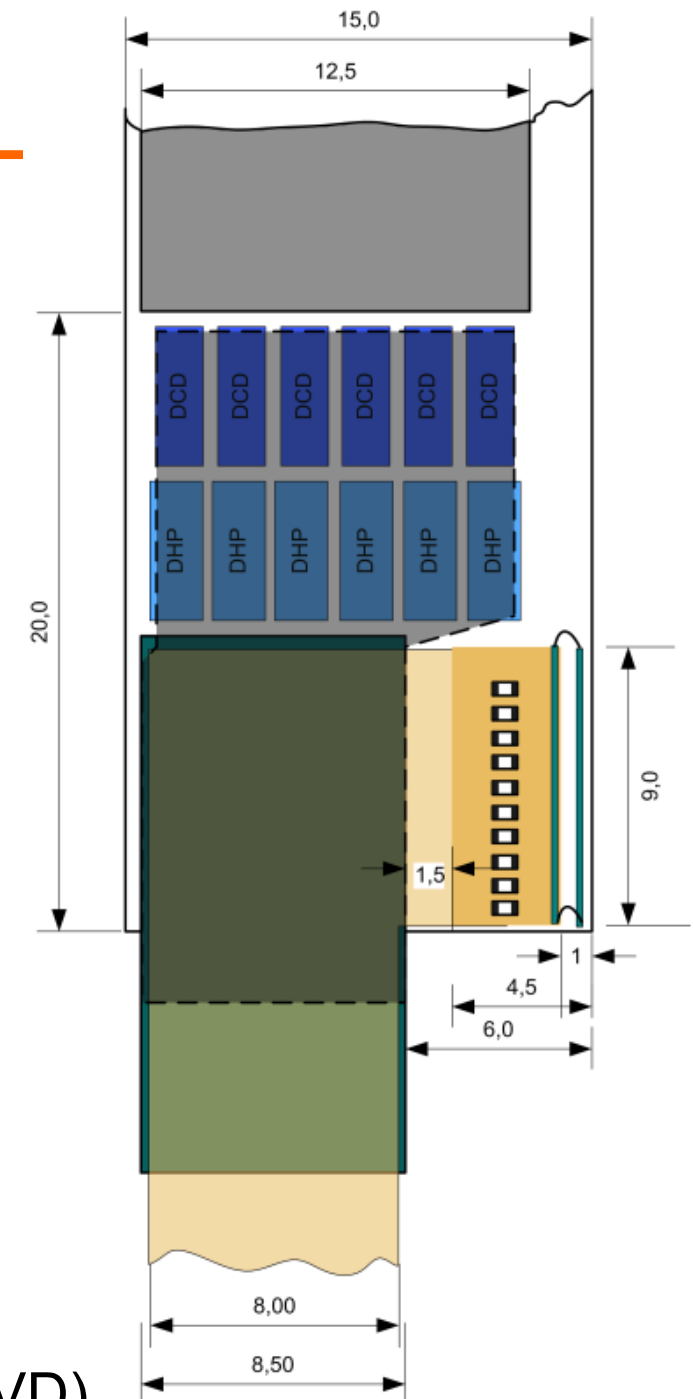
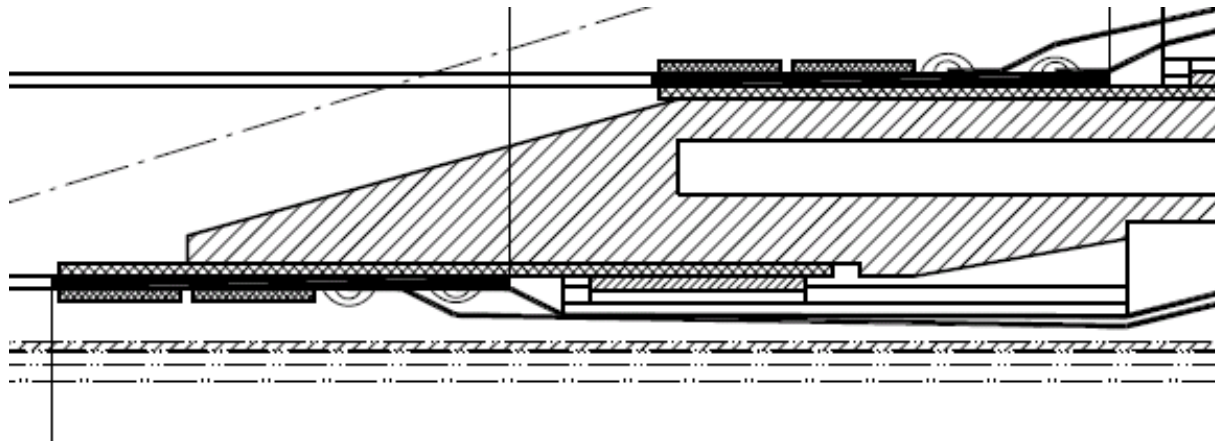
- ✓ Two “nasty” effects of rotation
 - ➔ We get dangerously close to SVD envelope
 - ➔ We have to increase the module length to
 - ✧ Cover acceptance
 - ✧ Extra increase to avoid the chips being on active region
 - Max. module length is 120 mm
 - Max. angle ~ 25 mrad
- ✓ Current angle is at the limit. We may need to split it in 2 halves (with 500 μ m gap in the joint). To be avoided
- ✓ We hope beam pipe can still be parallel to detector axis



New Ideas on End of Stave

Conceptual breakthrough after Barcelona meeting

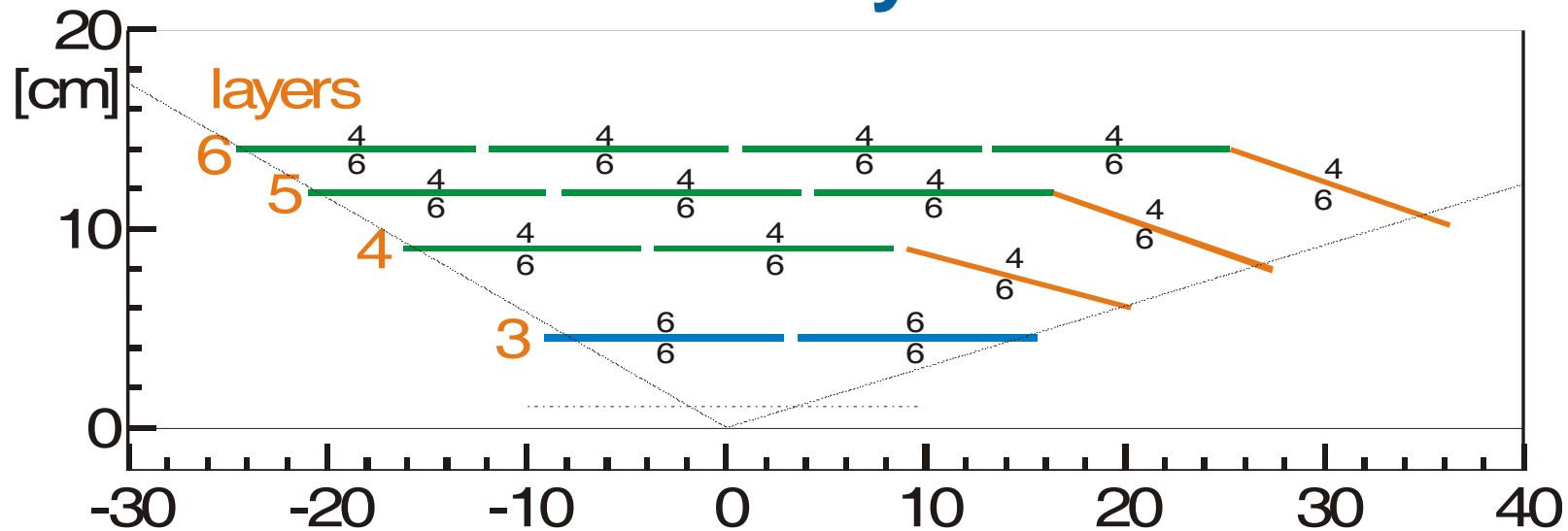
- Sandwich sensor between CVD and Kapton cable („CVD below“)
- Kapton cable leaves through the end
- Mount inner layer „upside down“



Think about direct coupling of ladder to Cu (no CVD)

SVD Layout

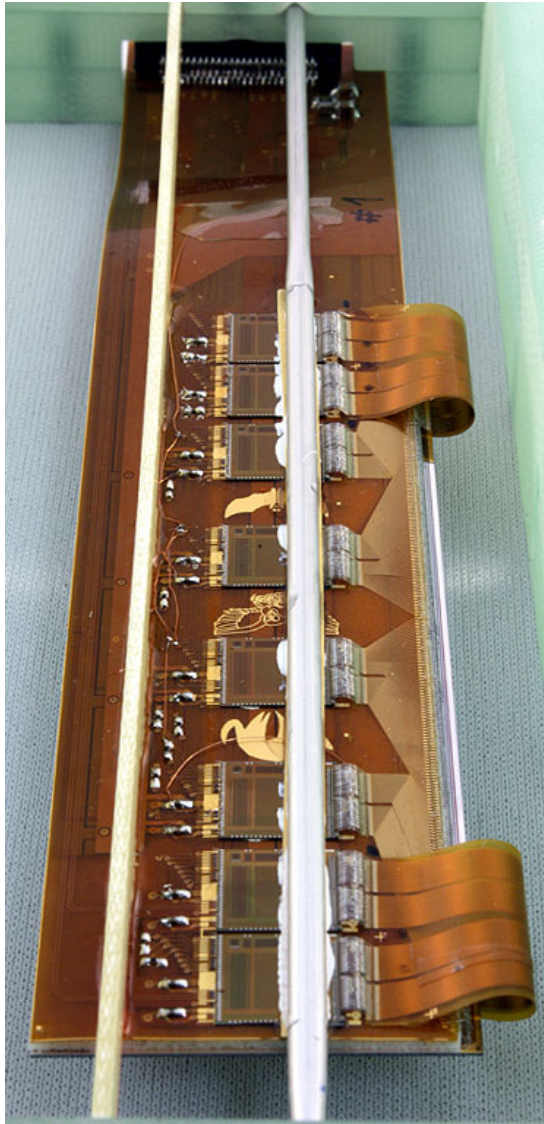
M. Friedl



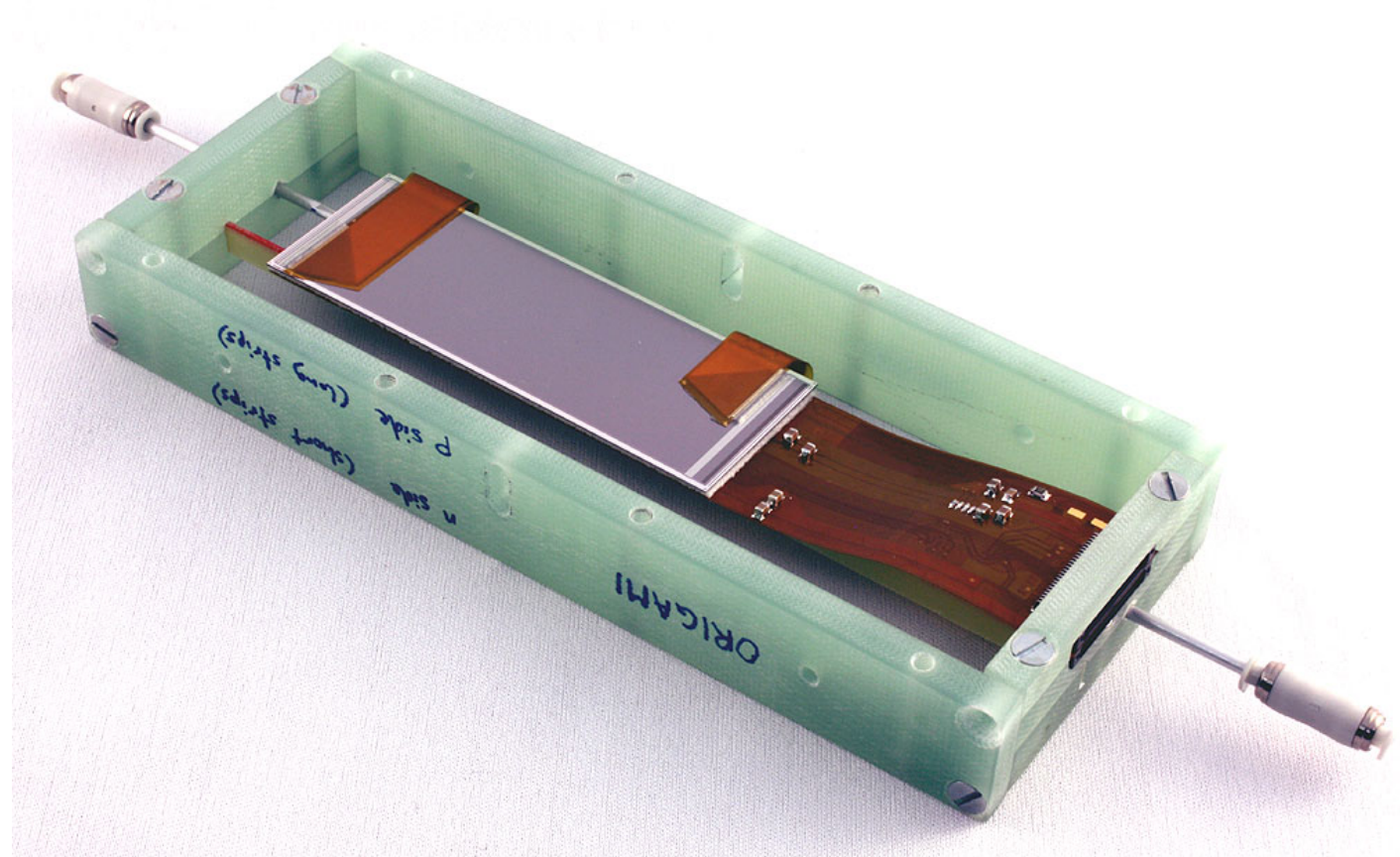
Layer	# Ladders	Rect. Sensors [50 μ m]	Rect. Sensors [75 μ m]	Wedge Sensors	APVs
6	17	0	68	17	850
5	14	0	42	14	560
4	10	0	20	10	300
3	8	16	0	0	192
Sum:	49	16	130	41	1902

Final Origami Module

M. Friedl



- Top and bottom side Origami concept
- Prototype completed beginning of August 2009



Origami Cooling – Results

M. Friedl

- As expected significantly better SNR with cooling
- **Relative improvement: ~ 20% @ -8.5°C**
- Corresponds to CMS studies
- Some APV settings have to be adapted for low temperature operation to avoid increase of power consumption
(*not yet done, but recommended by Mark Raymond*)

Temperature at first thermal sensor	Cluster SNR		improvement referred to warm	
	p-side	n-side	p-side	n-side
[°C]				
67,70	11,03	14,61		
8,70	12,15	17,20	18%	10%
-8,50	13,25	17,73	21%	20%



Cooling



Will need cold spot (heat sink) $< 15\text{ }^{\circ}\text{C}$ (below dew point!)

3 options under study:

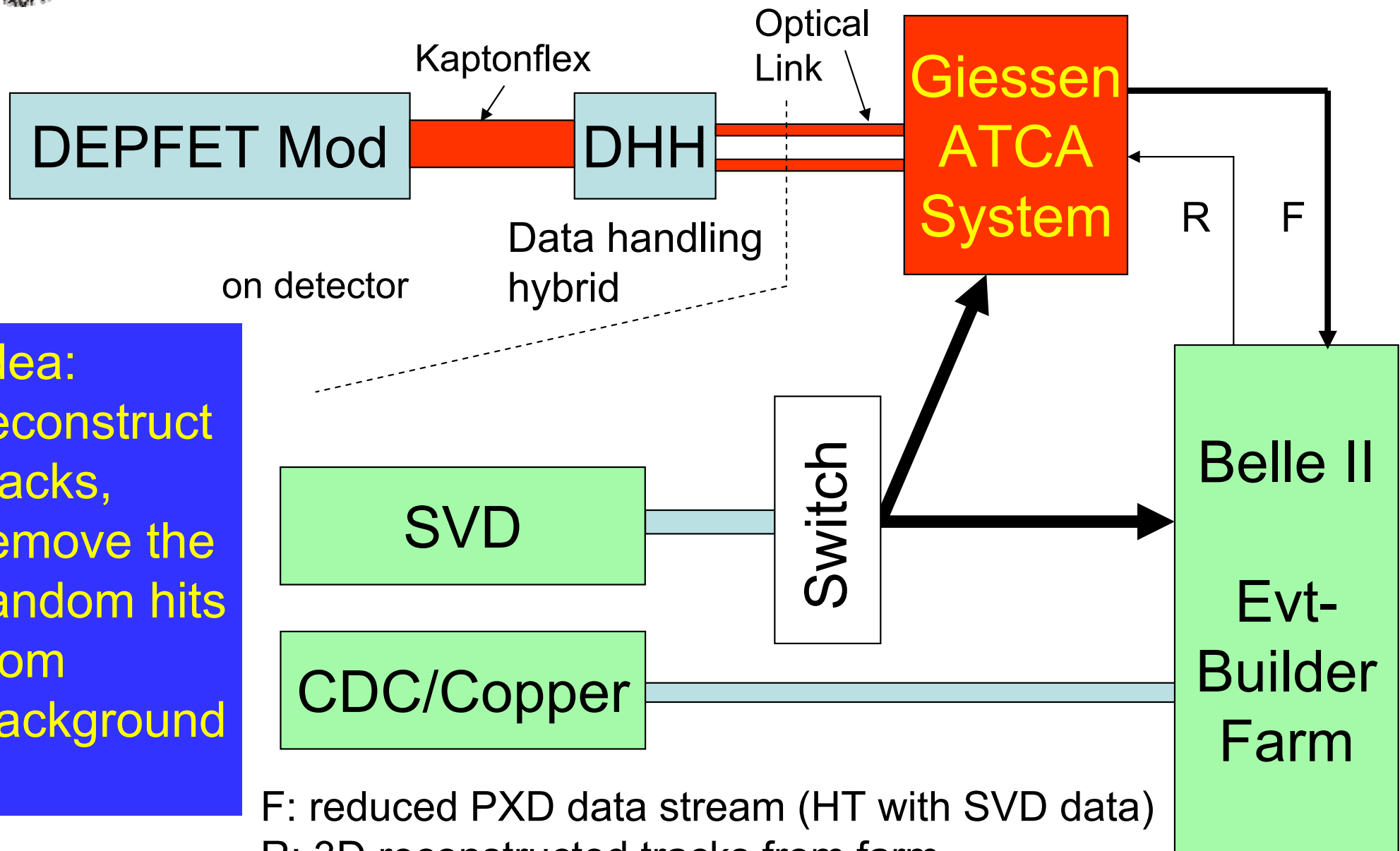
low pressure systems:	water cooling
Evaporative Cooling (high pressure):	C3F8 , CO2

In addition need (cold) dry air (N2?) for flushing

Can we encapsulate the inner volume of the CDC
so that PXD + SVD will be serviced with dry air (N2)?

Cooling / IR Taskforce created:

Y Ushiroda, T. Tsuboyama, M. Friedl, HG. Moser + machine

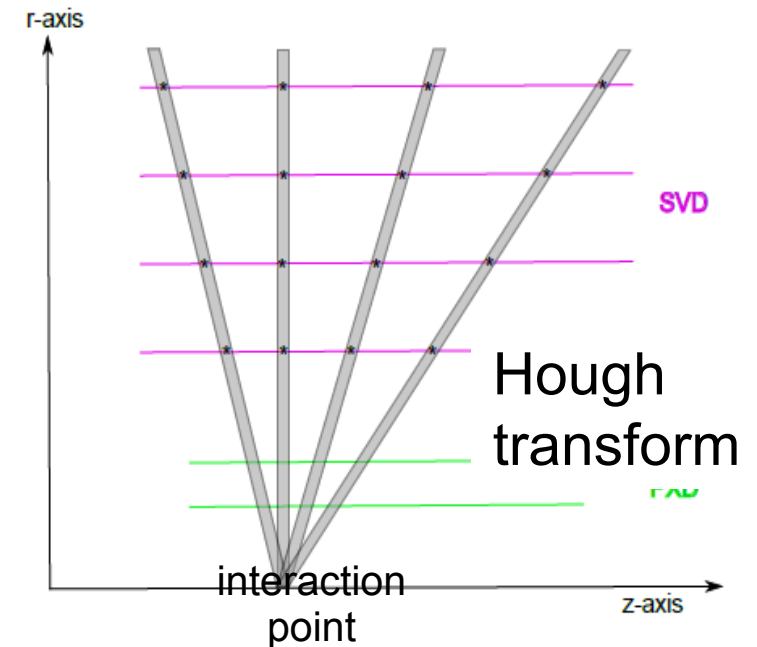


- debugging ongoing
incl. development and testing
of FPGA-to-FPGA communication
 - a.) onboard
 - b.) board-to-board
(via backplane)
- preparation for beamtime
(readout with 1 ATCA shelf)
at HADES test experiment at GSI
in 2010
- **main priority right now:
trigger and event builder
algorithms for HADES**

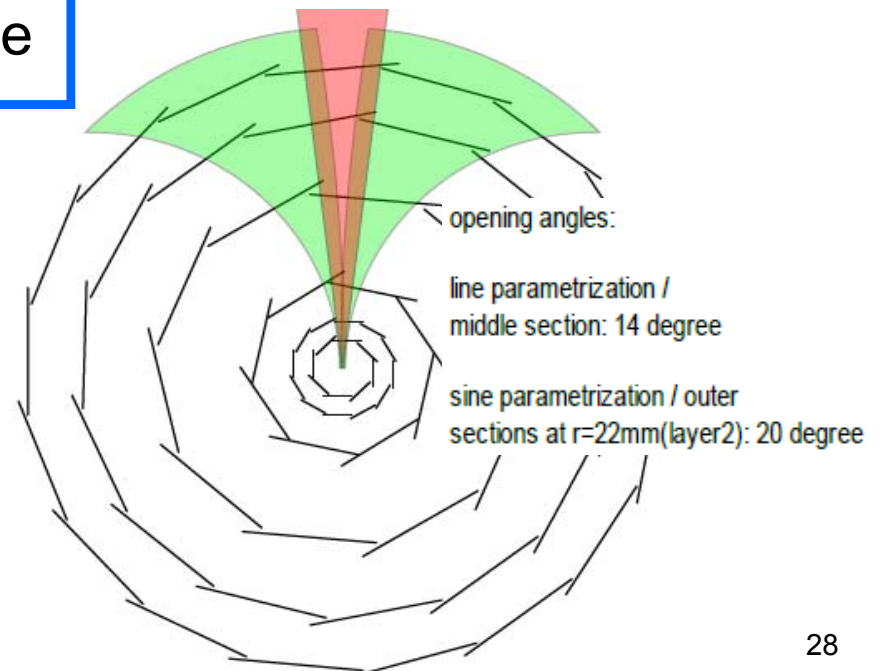
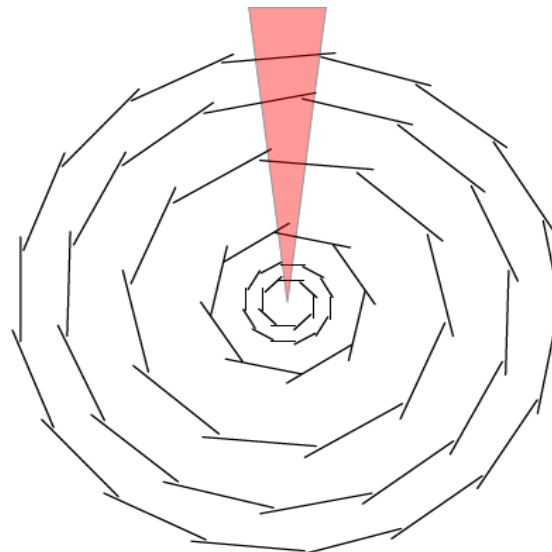
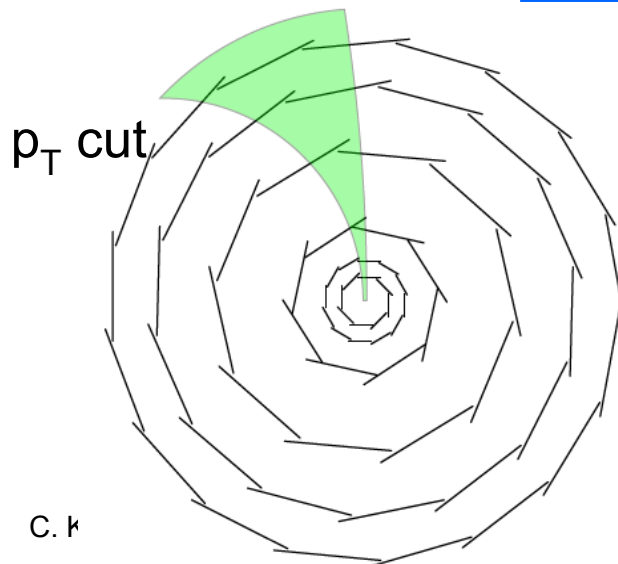


work by Claudio Heller (MPI)

- 2D pattern recognition in z-r-plane using SVD data: Hough-transform with fast peak finding algorithm
- SVD hits are divided into 3×40 overlapping sectors in r-phi rotated with $\Delta\Phi=9^\circ$
- different shaped sectors for low momentum particles and nearly straight tracks in r-phi-plane



factor >10 seems possible

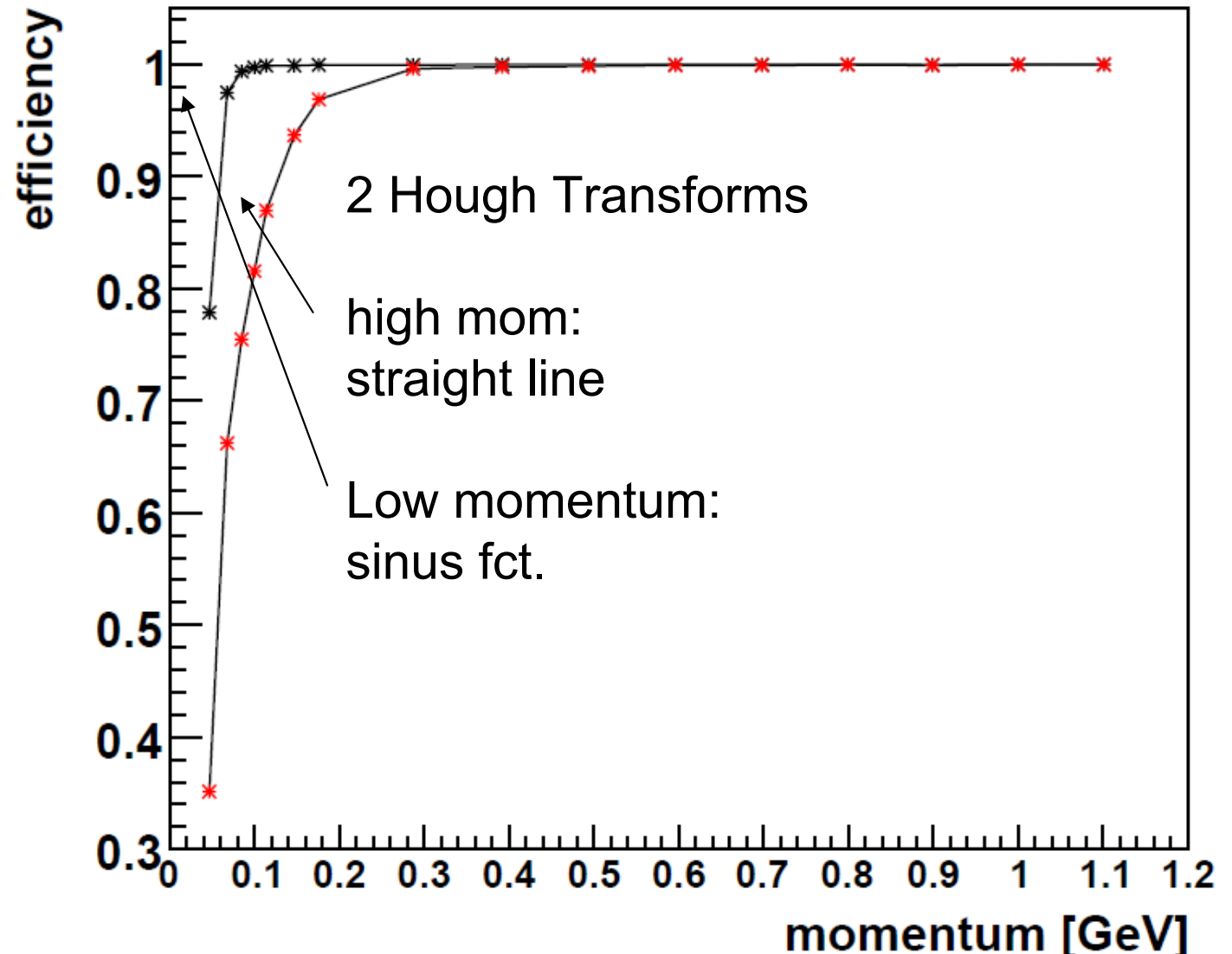


high efficiency
important to find
all tracks and
NOT to throw
away good
PXD hits



very good eff.
down to very
low momenta

efficiency for finding a single muon



Claudio Heller (MPI)

- mechanical support of the ladders (end of stave)
 - we have some new ideas („no“ diamond),
 - but need now to go into concrete design and
 - mock-ups to test for feasibility
 - support on the beampipe
- cooling issues
 - there are now 3 different schemes for cooling
 - Which one does the job? Need mockups for realistic tests,
 - Have to prepare a decision procedure
- interface of ladders to the outside services (DHH)
 - some ideas exist, need to interact with IP group etc
- need final machine parameters, rotation of Belle ? .



- Report at B2GM by Z. Dolezal (editor together with Y. Ushiroda)
- Each part about 30-40 pages -> PXD
- Structure of PXD part defined (see Twiki)
- We have 12 sections in our PXD part
-> 3 pages per section (including figures)
- Style file will be prepared this week (-> Zdenek)
- First version should be ready by Jan 6, 2010
Convenors are defined (see last EVO meeting)
- Editorial Board: C Lacasta, Z Dolezal, HG Moser, C Kiesling