SVD phase-2 commissioning preparation

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7th VXD workshop

Base Requirements and SVD Cartridge Concept

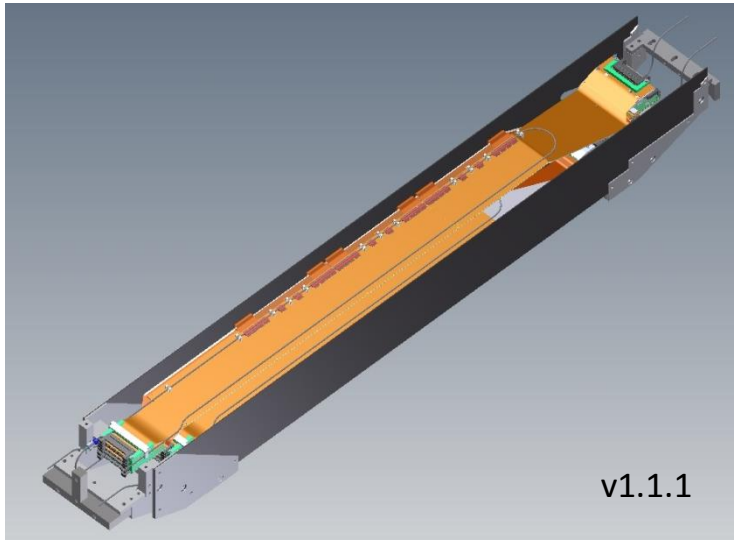
- **1 ladder / 1 layer**
  - 4 ladders in total
- **The installation direction is +X**
- **B-class ladders before mass production will be used.**
  - because of limited number of spare A-class ladders
- **CO2 cooling will be performed as a study and practice for phase-3.**
- **Space has to be shared with PXD and monitor sensors.**

TWiki for SVD phase-2 commissioning

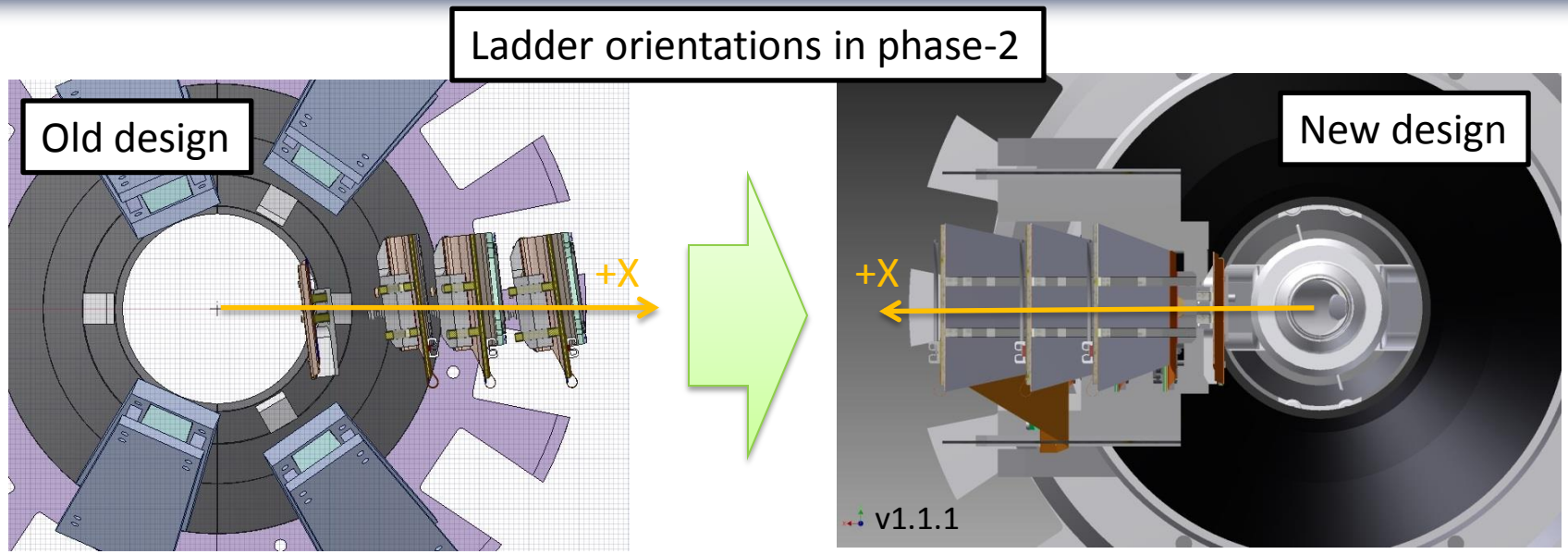
- **Same end-rings cannot be used any more.**
- **Limited cabling service space.**

- **"SVD cartridge" would be a good solution for phase-2.**
- **Merits of the cartridge concept**
  - Just mount on end-flange. No need of new end-rings on the CFRP cone.
  - Routing of cables and pipes can be easily done outside of the VXD volume.
  - The initial sensor alignment can be measured by CMM.
  - The cartridge can be used for other beam test.
  - The location of the ladders can easily be switched between +X and -X.

SVD Cartridge



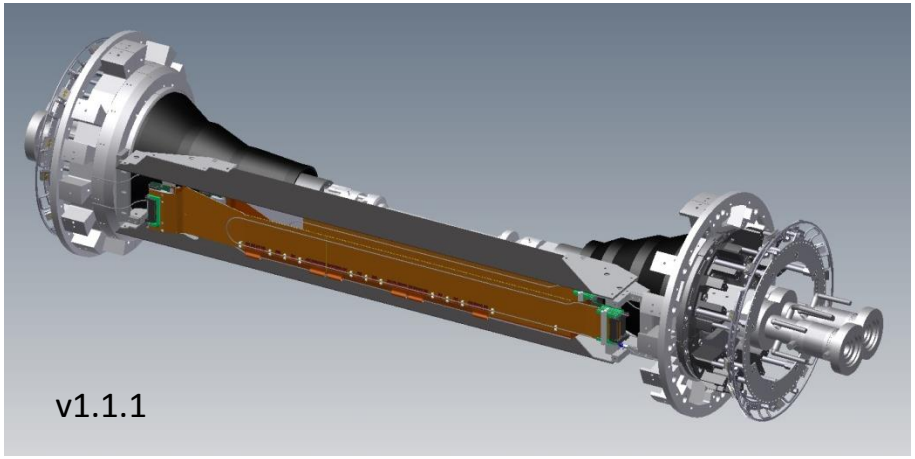
Ladder Orientation in Phase-2



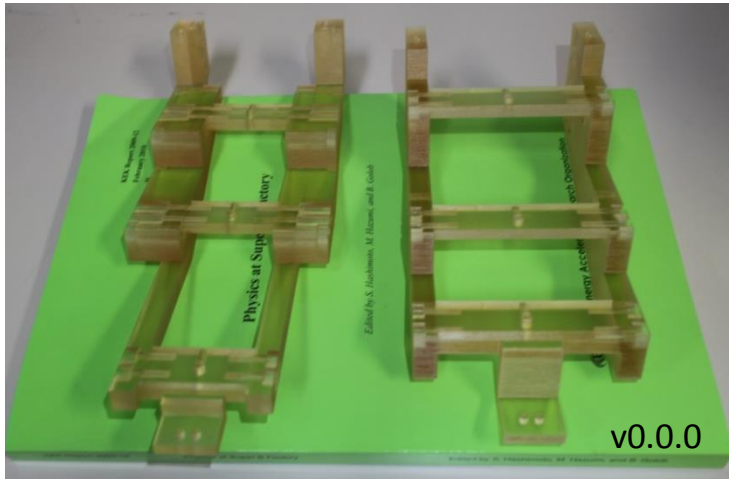
- **Windmill angle in phase-3 is for overlaps with adjacent ladders and cancelation of the Lorentz shift.**
- **However,**
  - No overlap in phase-2
  - The Lorentz shift is about 17um in phi-direction and it would be negligible.
- **→ Put all ladders in perpendicular to the +X direction.**
  - It makes the support structures rather simple.

SVD Cartridge Status

- **The design for 1st production is prepared.**
  - After final checks, I will ask the production to the KEK workshop.
  - CFRP side-plates are already ordered.
- **Assembly jig design is not finalized yet.**
  - will be finished by Feb. 2015
- **Sent the design to Tscharlie to combine it with PXD components**
  - Tscharlie has prepared the combined 3D design.
  - Solved interference with PXD
- **Mockup of support blocks were produced by 3D printer. Also mockup of CFRP plates will be prepared by Feb. B2GM.**
  - Although it is an old design, service area is same.
- **We will discuss installation procedure and space allocation of monitor sensors with the mockup at B2GM.**



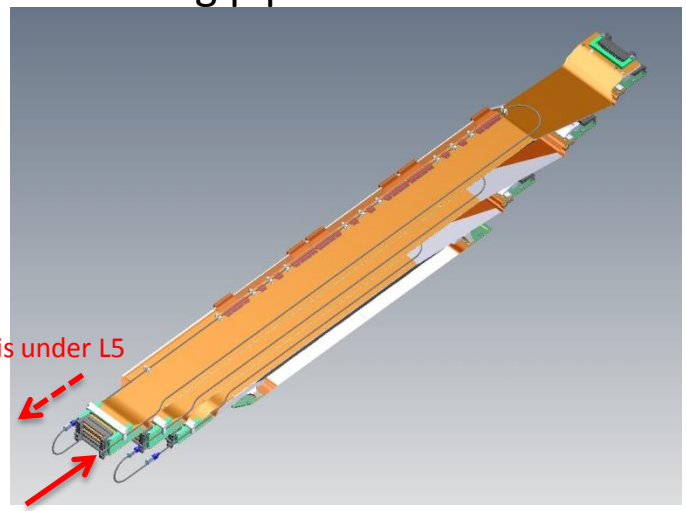
Support blocks of SVD cartridge (made by 3D printer)



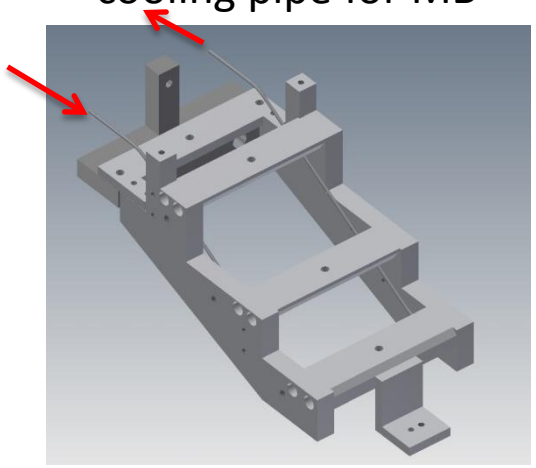
Cooling Pipes on SVD Cartridge

- **Problem is the preparation of cooling pipes.**
- **Cooling pipe for ORIGAMI**
  - Diameter: 1.6mm (outer), 1.4mm (in)
  - All curvatures in each pipe is in a plane.
  - In current design, minimal radius for bending is 15mm.
  - Need a larger bending radius? How much radius can HEPHY or DESY accept to produce them?
- **Cooling pipe for MB**
  - Can we use larder diameter pipe? (e.g. 4mm diameter SUS pipe)
    - We can bend it by ourselves.
  - Is the connection with outside pipe problem?

cooling pipe for ORIGAMI

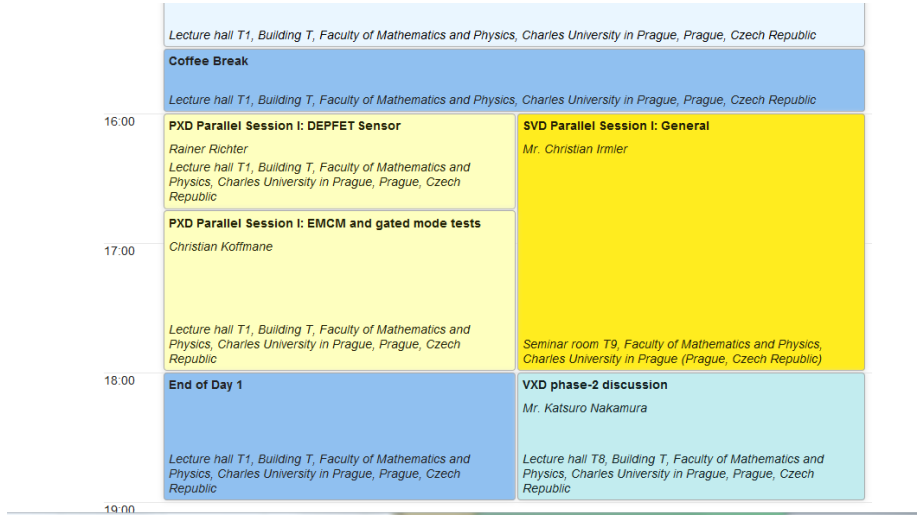


cooling pipe for MB



Face-to-face Discussion for phase-2 VXD Commissioning

- We still have a lot of discussion items to prepare the phase-2 VXD commissioning.
- Then, we had a discussion about the phase-2 VXD commissioning from 18:00 21 Jan (Wed.).



Phase-2 sensors in VXD volume

sensor	contact person	number	location	DAQ	note
PXD + SVD	C. Marinas K. Nakamura	2 PXD modules 4 SVD ladders	decided **+X**	Belle II DAQ	
diamond w/ PIN diode (beam BG, abort)	L. Vitale	4 diamonds 64 PIN diodes	diamond: decided	Belle II monitor DB	PIN diode location: around diamond and beam pipe
FE-I4 pixels (Synchrotron rad. and track multiplicity)	C. Marinas	3 arms	decided (90, 180, 270)	?	arm design has to be fixed
Scintillator (beam BG)	C. Marinas	2 ladders	decided (45 and 135)	?	
Scintillator PIN diode (beam BG)	H. Nakayama K. Nakamura	?	not decided		
BGO (Bhabha events)	Terry (NTU)	8 (if space allows)	under discussion	BEAST DAQ	fixation method has to be decided
temperature (NTC), humidity (DMT242B) (crosscheck for FOS)	L. Vitale	?	not decided	Belle II monitor DB	
FOS + L-shape	I. Vila D. Moya	?	?	?	sensor on outer cover?

Baseline plan of PLUME: behind the FE-I4

Issues on the previous table

- **Blanks should be filled by a deadline.**
  - The deadline will be discussed on the Feb. B2GM in schedule discussion.
  - Location of PIN diodes is not urgent issue, but number should be determined to discuss service and cabling.
- **More detailed information is necessary.**
  - Data path, front-end and back-end system
  - Which quantities to be stored on DAQ
  - Necessary trigger
  - See the next Tanaka-san's slide
- **Table will be updated on the Feb. B2GM**
  - KN will prepare an updated version.
  - Plan to have a meeting on 4th Feb (BEAST mini-meeting).
  - Since SVD BPAC rehearsal is in same day, time should be arranged.

CFRP Cone in Phase-2

- **For phase-3, CFRP cone is necessary to hold SVD ladders.**
- **However, the phase-2 SVD doesn't use the CFRP cone at all.**
  - SVD cartridge is fixed only by endflange.
  - Can we remove CFRP cone?
- **Do any groups need the CFRP cone?**
  - Diamond detectors or other monitors ? →No.
  - This question should be asked also to the BGO group.
- **Baseline: remove the CFRP cone**
  - the ease of assembly
  - larger service space
  - save money for the CFRP cone production

Summary

- **The SVD cartridge design (1st version) including assembly jig will be finalized in Feb. 2015.**
- **However, the problem is cooling pipes.**
  - Cooling pipe for ORIGAMI
    - In current design, minimal radius for bending is 15mm.
    - Need a larger bending radius? How much radius can HEPHY or DESY accept to produce them?
  - Cooling pipe for MB
    - Can we use larder diameter pipe? (e.g. 4mm diameter SUS pipe)
  - Is the connection with outside pipe problem?

backup

Ladder orientations in phase-2

Ladders in the phase-3 setup are tilted by about 7 degrees due to Lorentz shifts.

Table 1
Lorentz angle of electrons and holes. The Lorentz angle is given for a magnetic field of $B = 4$ T (CMS)

Bias/V	Electrons (280 K) Θ (deg)	Δx (μm)	Holes (260 K) Θ (deg)	Δx (μm)
40	34	202	7.2	38
100	31	180	8.0	42
200			6.5	34
300			5.3	28

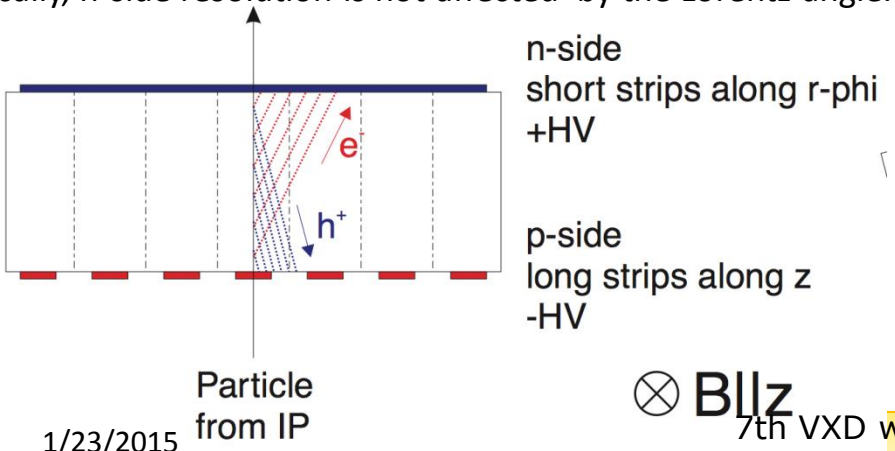
$$\tan(\Theta_L) = \frac{\Delta x}{d} = \mu_H B = r_H \mu B$$

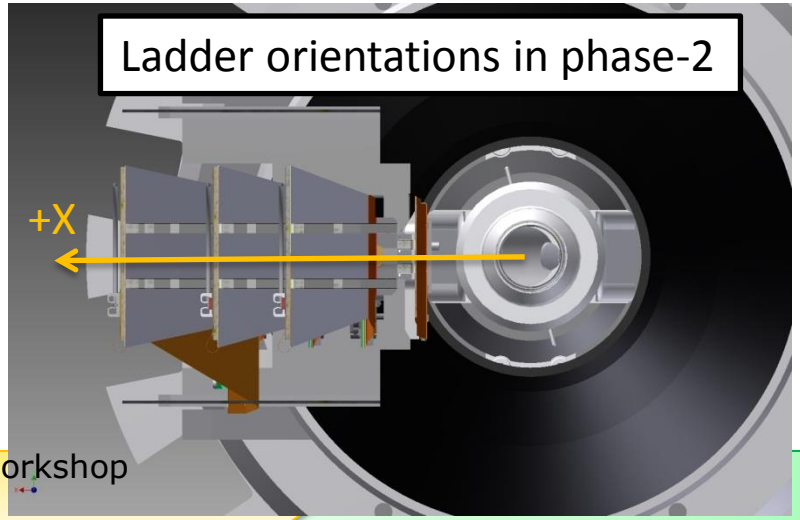
Results are from 290um Si sensor. (NIM A 461 (2001) 200)

In our case, the Lorentz angle is smaller by a factor of about 1.5T/4.0T*320um/290um ~ 41%.

- **Lorentz shift in p-side will be about 17um. It would be negligible.**
- **→ put all ladders in perpendicular to the +X direction.**
  - It makes the support structures rather simple.

Basically, n-side resolution is not affected by the Lorentz angle.





referred from Shuji's slides (IN2P3-KEK, Jan 2015)

Targets of phase-2 operation (1)

We have a lot of targets in the phase-2 operation. We have to keep them in our minds and have proper strategies to achieve them.

- **Beam commissioning to start collision (machine group: KCG)**
  - Forward luminosity monitors(ZDLM) for knob tuning
- **First try of BG control (KEK Belle group: BCG)**
  - BG studies of each comportment to check consistency with simulation
  - Studies of relation between VXD hits and monitor hits
  - Beam collimators control study
  - Neutron measurement (fast and slow)
- **Belle II commissioning with partial VXD sensors (Belle II shift)**
  - Full Belle II DAQ
  - Slow control (also communication with machine)
  - PXD RoI finding with CDC+SVD tracking data
  - Detector noise check
  - **And investigation and confirmation to install the full VXD**
- **Optimization of interlock system**
  - Slow info. Some alarms or abort by environmental or rad. monitors
  - First info.: beam abort by hard wired signals

referred from Shuji's slides (IN2P3-KEK, Jan 2015)

Targets of phase-2 operation (2)

- **Beam injection BG study**
  - BG damping time measurement for Trigger veto gate
    - requiring storing veto gate width to condition database
    - With moderate update timing
- **First try of CO2 cooling system for VXD sensors**
  - Checking water vapor level by sucking air
  - cold and warm dry volume
- **Others?**

- **Target luminosity at phase-2 is L ~ 10^{34} cm^{-2} s^{-1} , and BG structure is not exactly same as phase-3. We need somehow extrapolation to expect phase-3 beam BG.**
  - how to extrapolate it?
    - Effect from each BG component has to be studied separately by BG MC.
    - The MC simulation for BEAST detectors is performed by Igor??? (Hawaii). Can we ask him to perform also MC for our detectors? Otherwise we have to find a person who can work on that.
    - This extrapolation can be done only after the BG is will controlled by collimator studies.