

discussion for phase-2 (BEAST II)

Jan. 21, 2015

7th Belle II VXD workshop

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 (Belle group: **BCG**)
 - BG studies of each compartment to check consistency with simulation
 - Studies of relation between VXD hits and monitor hits
 - Beam collimators control study
 - Neutron measurement (fast and slow)
 - **And investigation and confirmation to install the full VXD**
- Belle II DAQ 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
- Optimization of interlock system
 - Slow info. Some alarms or abort by environmental or rad. monitors
 - **First info.: beam abort by hard wired signals**

Targets of phase-2 operation (2)

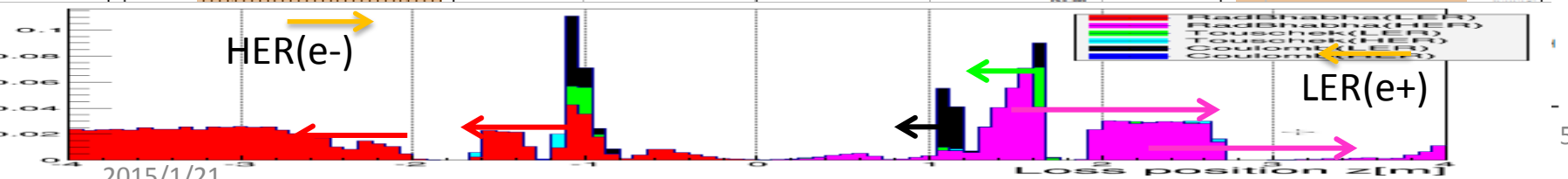
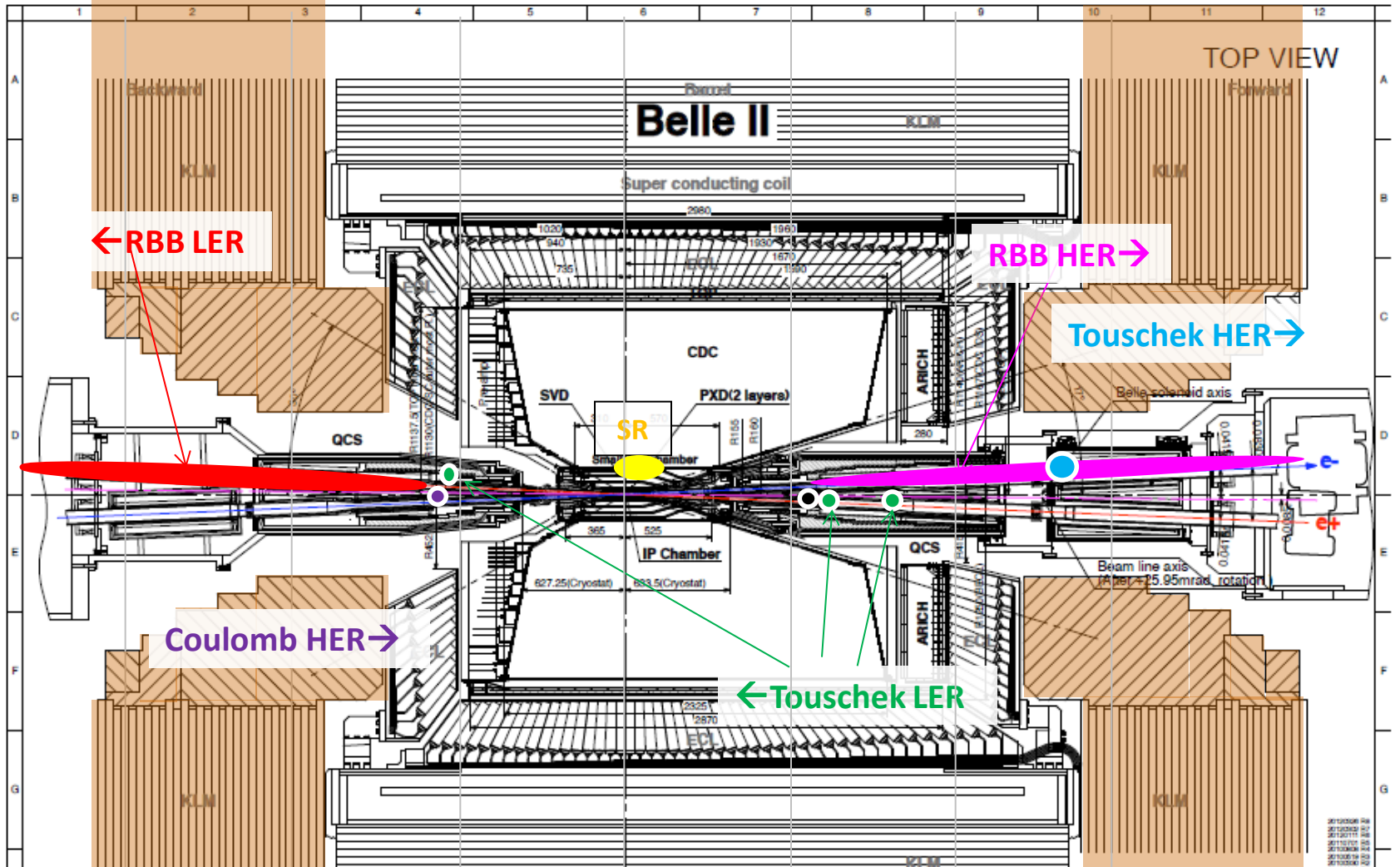
- Beam injection BG study
 - BG damping time measurement for Trigger veto gate
 - requiring storing veto gate width to condition database
 - With moderate update timing
- First try of CO2 cooling system for VXD sensors
 - Checking water vapor level by sucking air
 - cold and warm dry volume
- Others?
- Target luminosity at phase-2 is $L \sim 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$, and BG structure is not exactly same as phase-3. We need somehow extrapolation to expect phase-3 beam BG.

BG sources and Radiation tolerance

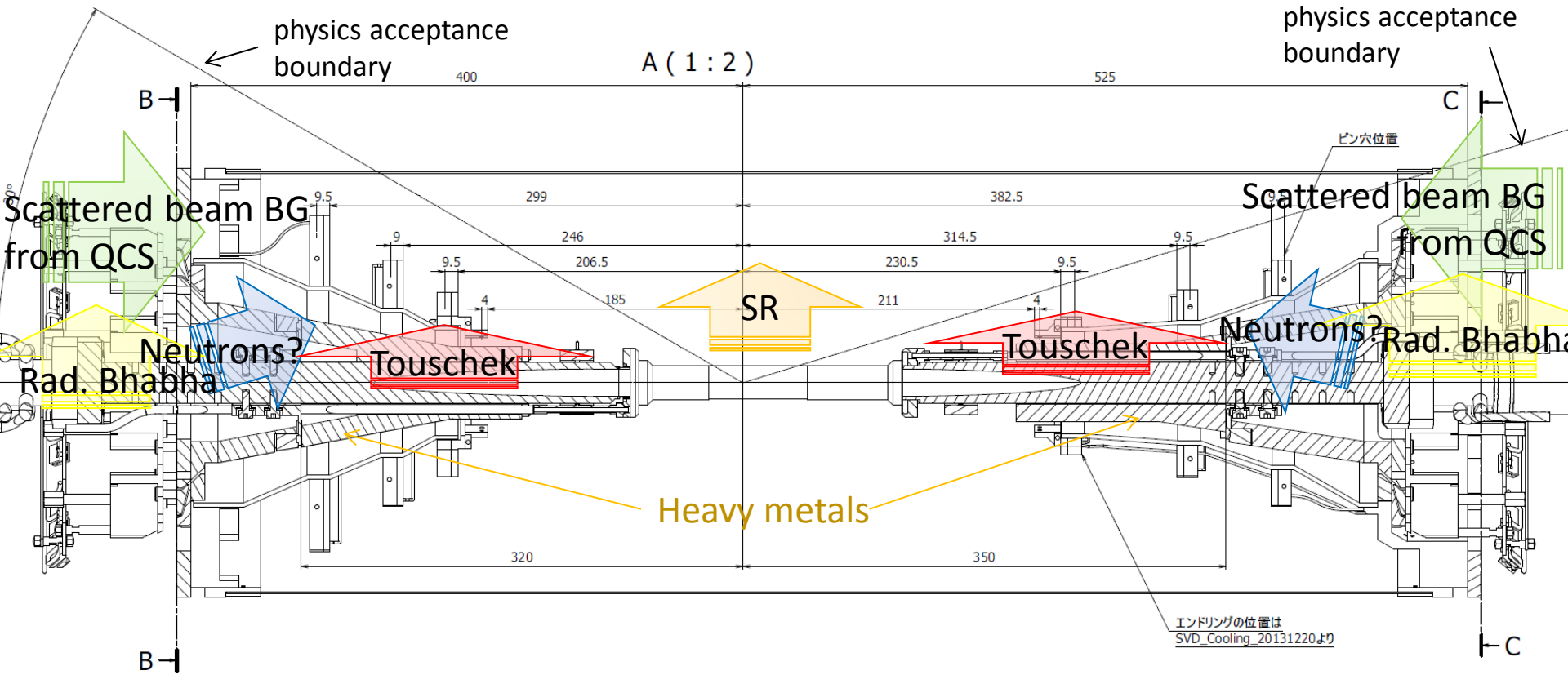
- BG source
 - 4-fermion final state QED process (Lum.)
 - Touschek effect (Beam size and energy)
 - Beam-gas interactions (current, pressure)
 - Synchrotron radiation
 - Radiative Bhabha scattering (Lum.)
 - Injection BG
 - Unexpected noise BG?

Background picture

Ver. 2014.6.18



Expected beam BG in VXD volume



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 or -X?)	Belle II DAQ	
diamond w/ PIN diode (beam BG, abort)	L. Vitale	4 diamonds 64 PIN diodes	not decided	Belle II monitor DB (EPICS) ?	
SDD (Synchrotron rad.)	C. Marinas	?	not decided ?	?	
FE-I4 pixels (Synchrotron rad.)	C. Marinas	3 arms	decided	?	arm design has to be fixed
Scintillator, PIN diode (beam BG)	C. Marinas H. Nakayama K. Nakamura	?	not decided		
BGO (Bhabha events)	NTU	8 (if space allows)	under discussion	BEAST DAQ ?	fixation method has to be decided
temperature (NTC), humidity (DMT242B) (check for FOS)	L. Vitale	?	not decided ?	Belle II monitor DB (EPICS) ?	
L-shape	?	?	?	?	

And PLUME ?

Service space (1)

- As we saw in previous slide, we have a lot of sensors.
- We should discuss service space beforehand.
 - Sensors – cables – dock-boxes – cables – readout
 - How large dock-boxes do we need ?
 - Where readout electronics is located ?
- Of course, we need to know the number and location of sensors for this discussion.
 - Let's fill the table for our start point.
 - I'd like to fix a rough idea by B2GM.
 - Do we need some BG MC inputs to decide locations?

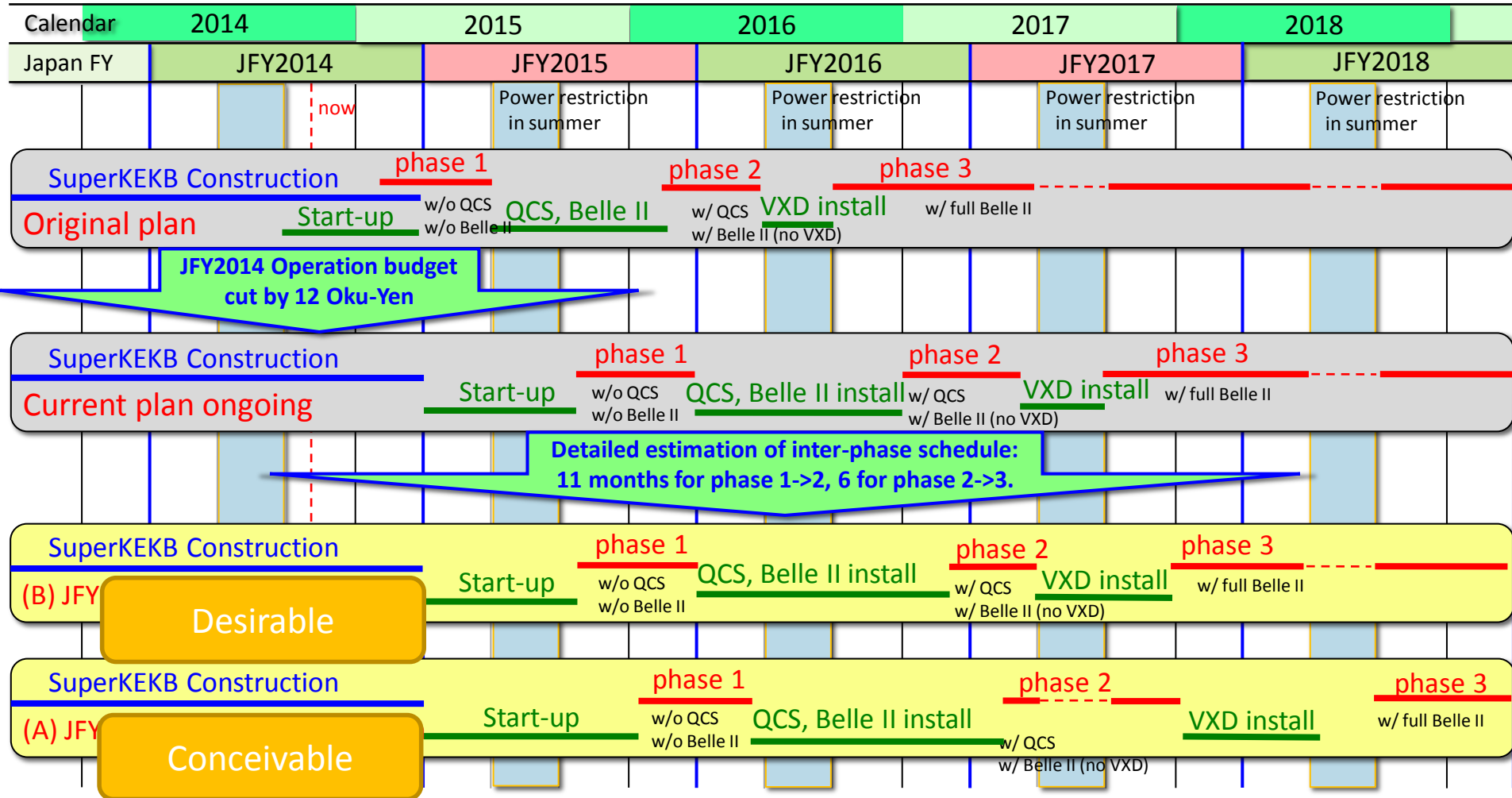
Service space (2)

- And, in order to share the space allocation among us, we should share 3D design in VXD space with a common version managing system, e.g. Belle II SVN.
- However, data sizes of some Inventor files (the biggest one, ~4MB, is full VXD assembly file) are too large to put it into Belle II SVN.
 - Recently, a file size limitation was applied on the SVN.
- From my opinion, we should ask to relax the limitation somehow to SVN manager, otherwise we should prepare our own SVN.
 - Any other idea how to share the designs?

CFRP cone

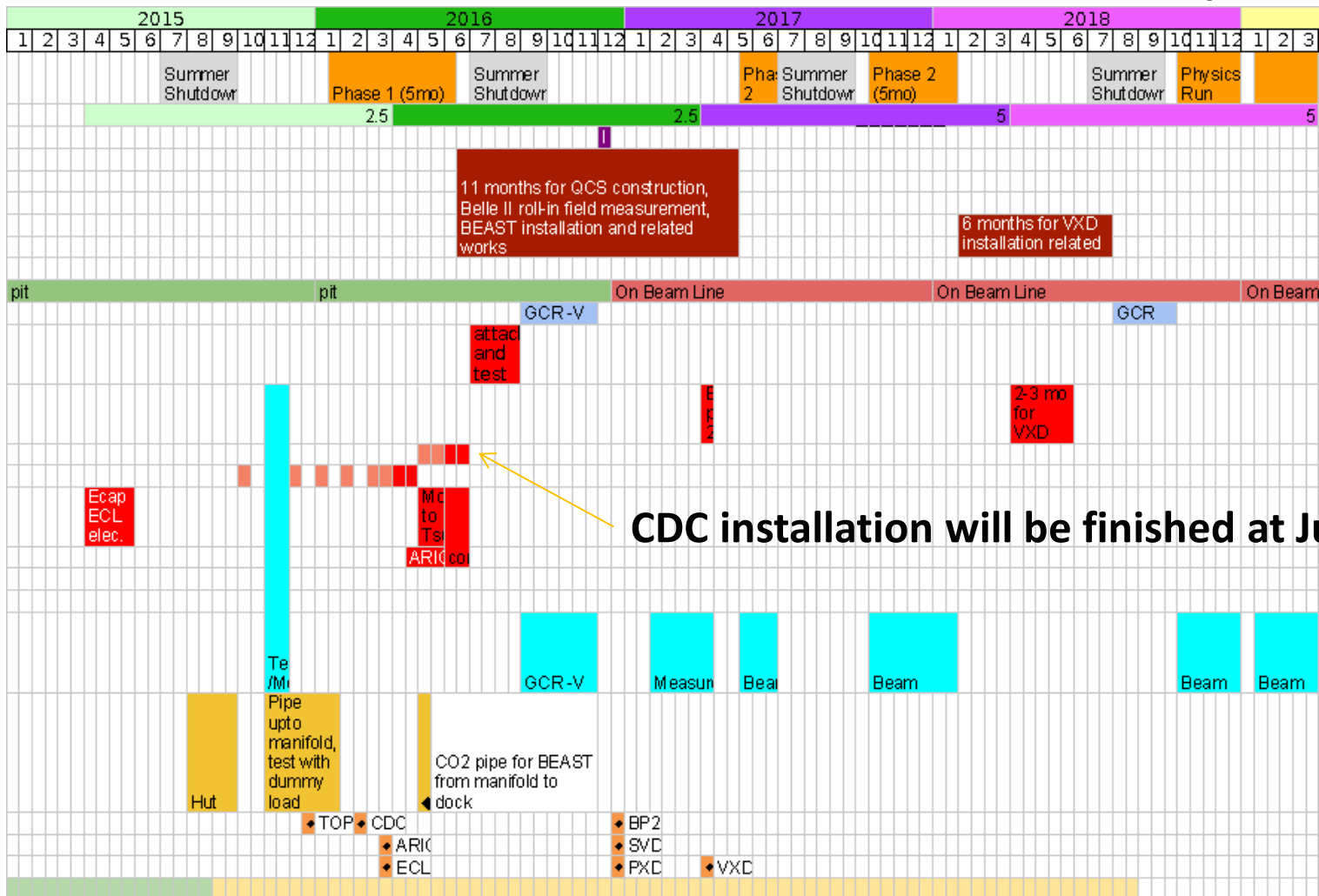
- For phase-3, CFRP cone is necessary to hold SVD ladders.
- However, the phase-2 SVD doesn't use the CFRP cone at all.
 - SVD cartridge is fixed only by endflange.
 - Can we remove CFRP cone?
- Do any groups need the CFRP cone?
 - Diamond detectors or other monitors ?
 - This question should be asked also to the BGO group.

Belle II Schedule



Phase-2 will start at the begin of 2017 in desirable plan.

Detector Construction Schedule (tbc)



Difficult to interpret what Yamauchi-san's brief notice means, but assume phase 1 starts as "early" as Jan. 2016 (=conceivable budget scenario)

Schedule and milestones for phase-2 preparation

- Detailed assembly, test and installation procedure have to be confirmed.
- Draft proposal (very roughly I put dates.)
 - By the end of 2015: phase-2 SVD ladders (B-class) get available
 - Jan. 2016: SVD cartridge assembly and readout test w/ cosmic
 - ???: phase-2 PXD modules and readout system arrive at KEK
 - ???: monitor sensors and readout system arrive at KEK
 - Jun. 2016: phase-2 VXD assembly
 - including monitor sensors
 - BGO will be not available until the end of phase-1.
 - Aug. 2016: Readout test before installation
 - Oct. 2016: phase-2 VXD installation
 - The first trial of our installation method.
 - Will the tools for the final installation method be used at this time?
 - Feb. 2016: VXD test operation
 - May. 2017: Phase-2 operation
- **All of individual studies have to be finished by the begin of 2016!**

- Data acquisition system and trigger distribution. Event building. Timing (800 ps – 115 μ s)
- Level of integration with Belle II other subdetector systems
- How to disentangle the different types of backgrounds?
- How to determine the VETO width in the PXD?
- How to determine the thresholds (radiation, temperature, humidity)?
- How to ensure a tight VXD volume?
- Additional humidity sensors filling the chamber? How to define cold/warm dry volumes?
- Alignment constants update rate? Stability of the primary vertex?
- Do we need a L-shape profile with a FOS to measure BP vibrations?
- ...

Goals and strategies for VXD phase-2 commissioning

- Carlos has already prepared comprehensive document.
- I would propose to every related person to go through the document offline and give any feedback to Carlos to share concerns and make a VXD-group document.

gemba discussion @ Feb. B2GM

- phase-2 VXD assembly procedure
 - 0th version of SVD cartridge was 3D-printed
- Location and service of monitor sensors
 - diamond sensors
 - FE-I4
 - scintillators
 - NTC, humidity sensors
 - BGO

backup

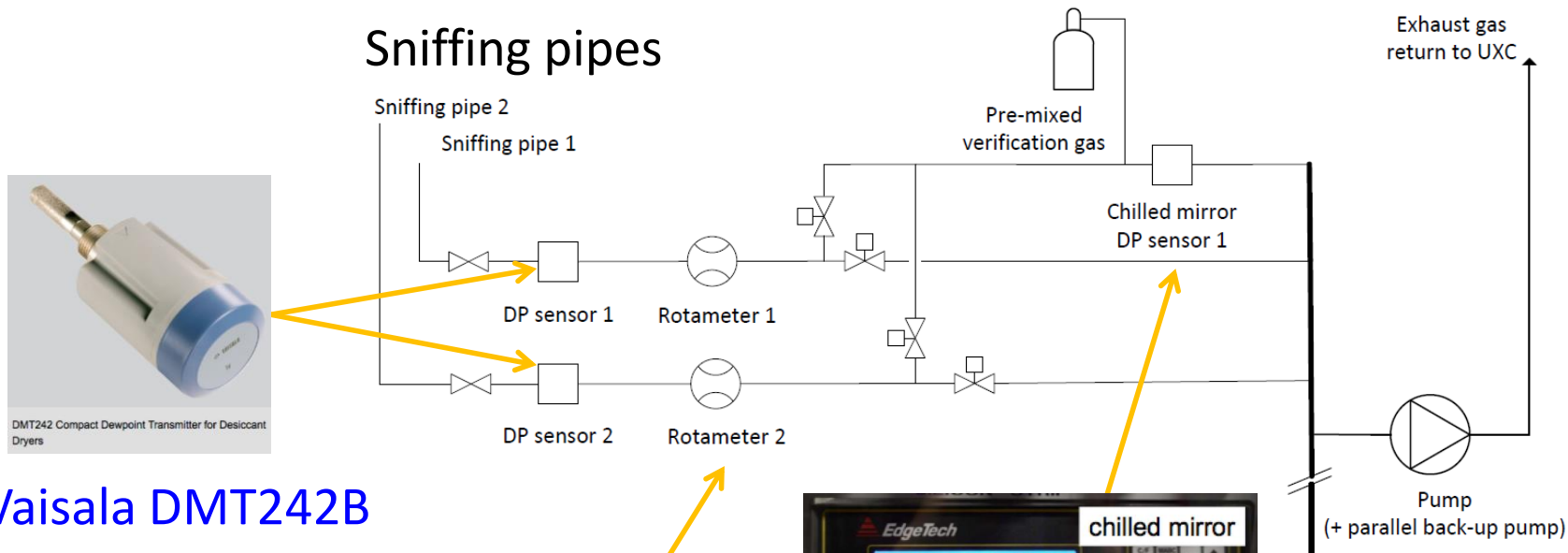
Diamonds for BEAST (location and cabling)

We plan to have 4 diamonds (more only if we have spares)

- With a prototype of final readout system already in phase 1
- Possibly with pin diodes very close (they have foreseen 64, see next slide).
- Where to locate them?
- Can we use the final cabling already in BEAST?
- Pin diodes can be useful also for physics run

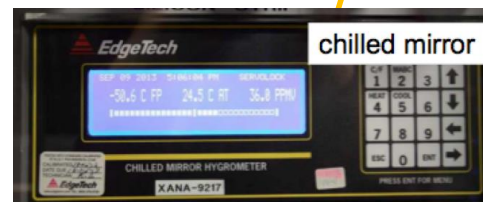
Humidity 2: inputs from Dew Point Sensors

(very preliminary! Needs mechanical design etc)



Vaisala DMT242B
Dew Point Transmitters
[-60, +60]^oC dew point range

Rotameter
flux meters



Edgetech Dewmaster
Chilled Mirror Hygrometer
(for calibrations)

Pump

