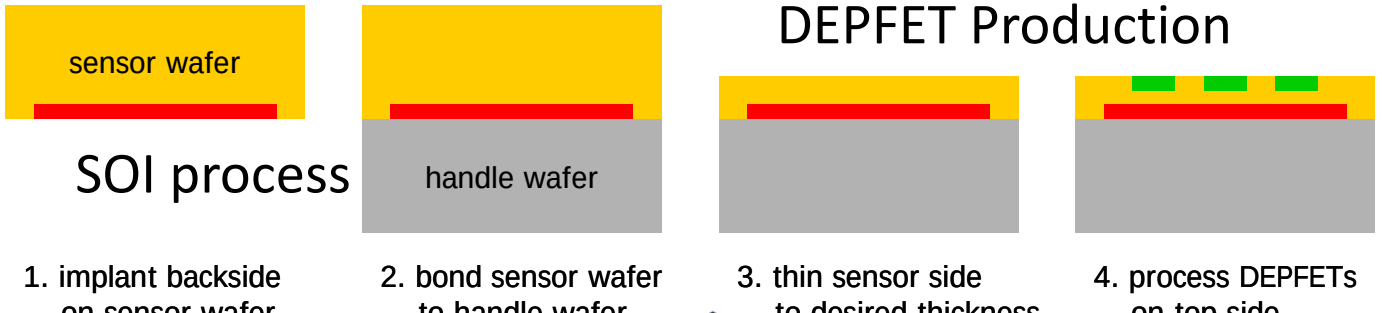
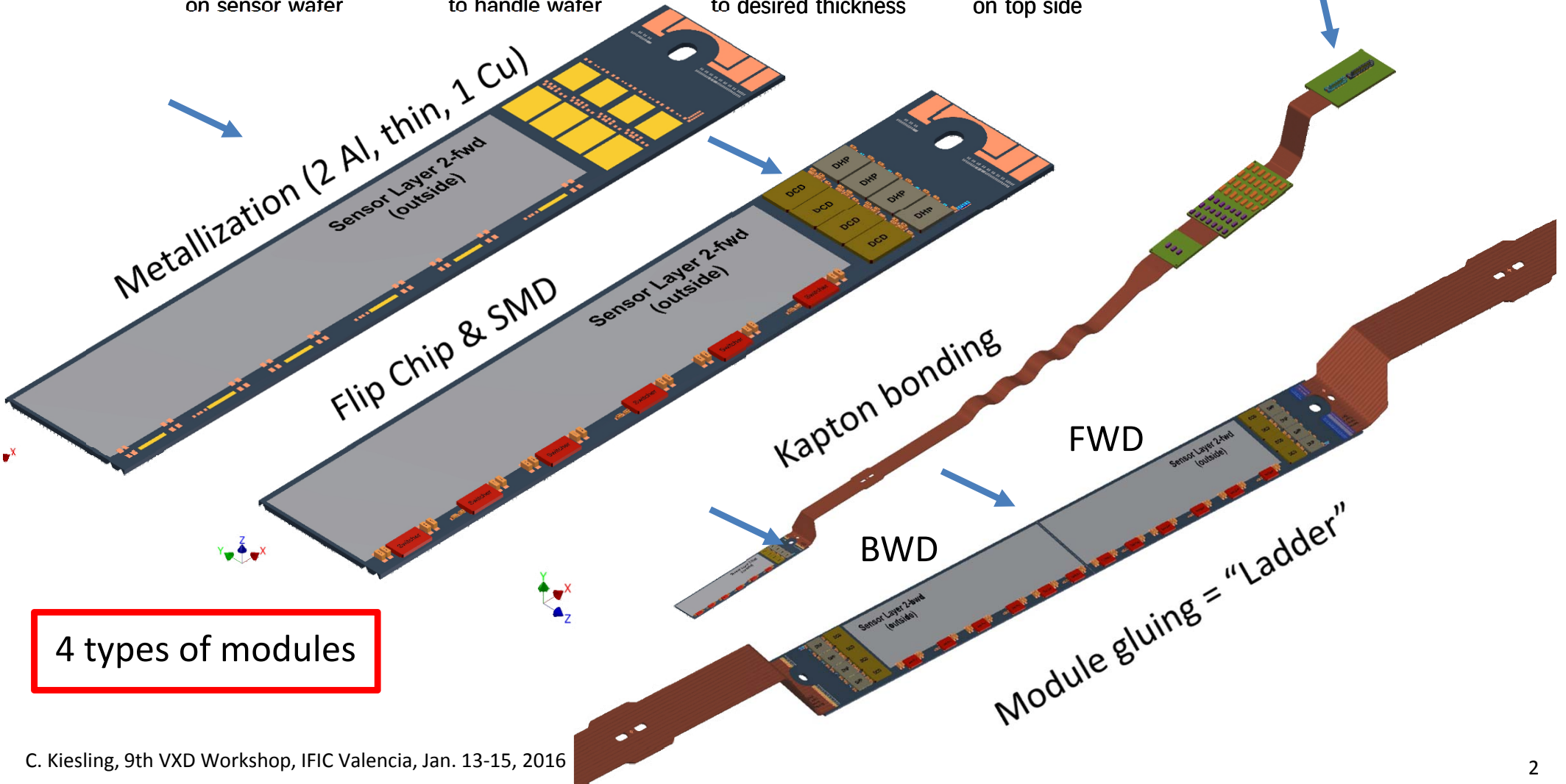
9th VXD Workshop
- Introduction and Issues -

- Short overview of PXD production status
- Matters to be discussed/decided during this workshop. (to be presented at B2GM / BPAC)
- Discussion on update for the production schedule of the PXD

Production Steps of PXD Ladders

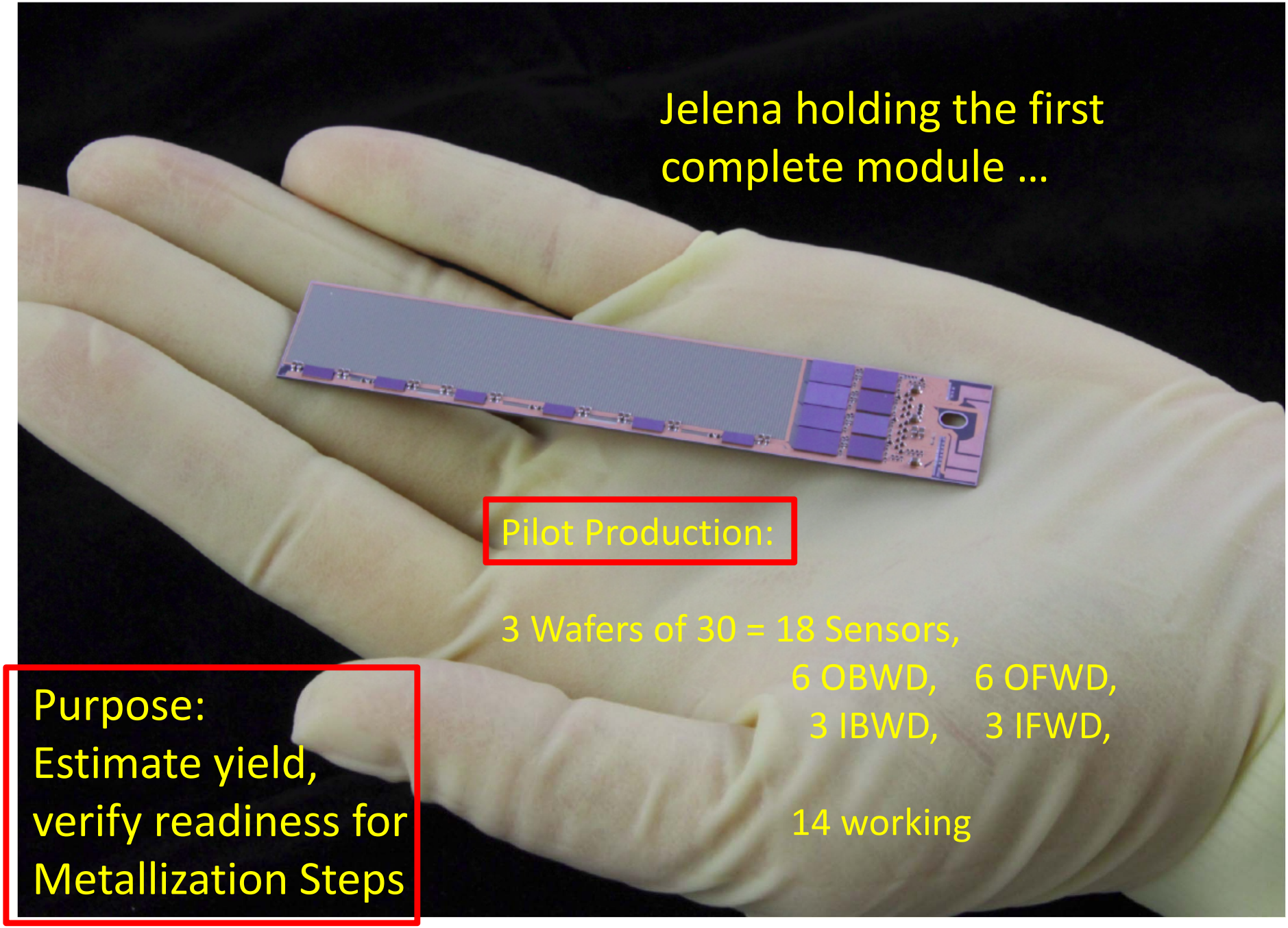


Kapton cable with SamTec connector(s)



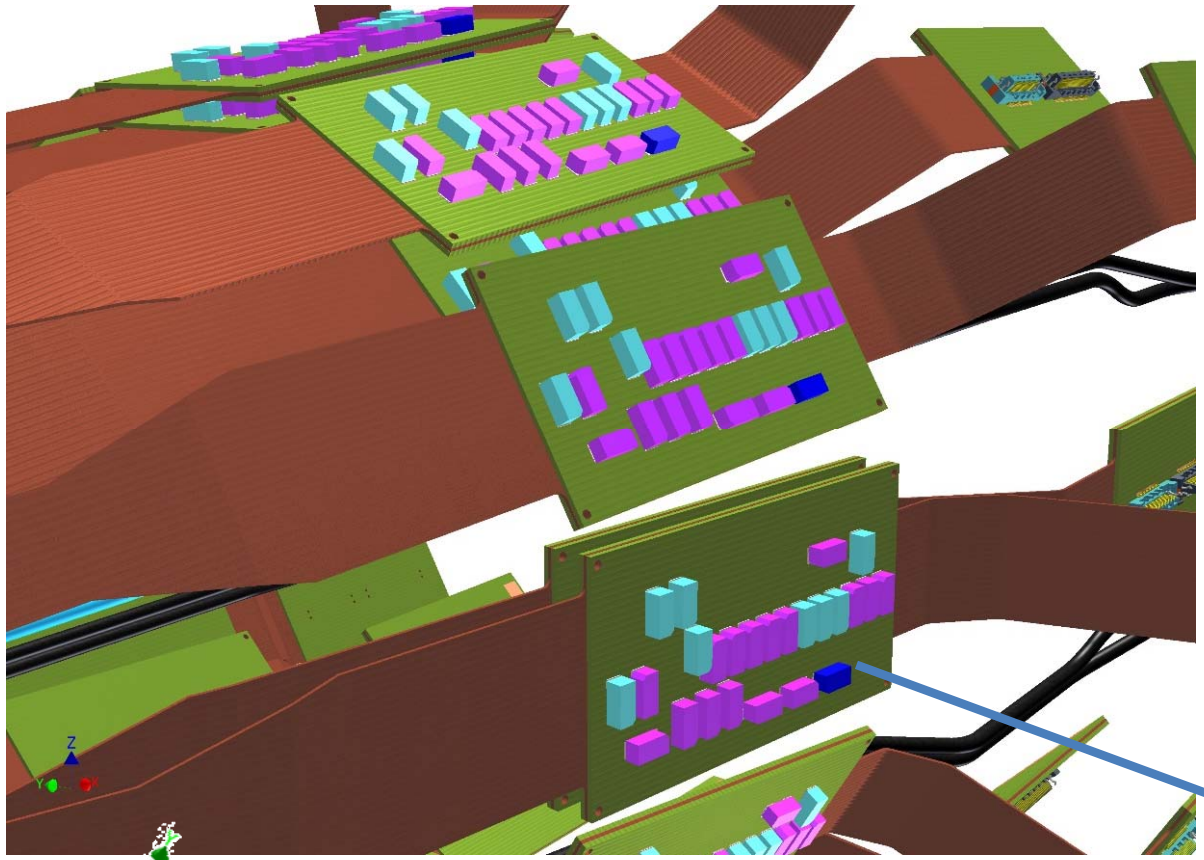
4 types of modules

The First PXD9 (Belle II) Module



Status of Kapton Cables

4 types: layer 1 (I_Fwd, I_Bwd), layer 2 (O_Fwd, O_Bwd)



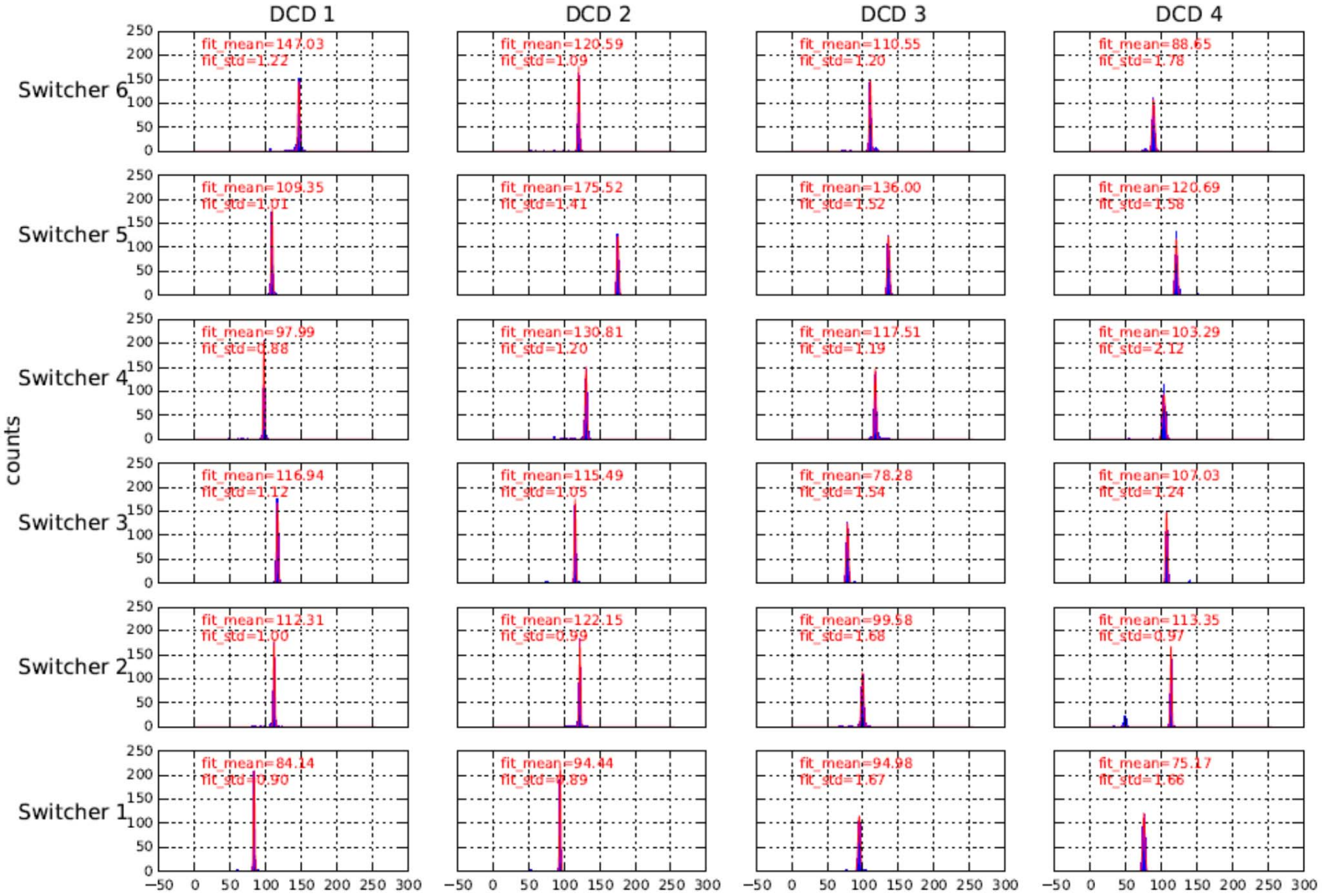
First samples (15) "O_Bwd" delivered & tested OK in Bonn/HLL

Other 3 designs finished, submitted to Taiyo. Samples of all cable variants to be delivered by Feb. 2016

Backup test production by other company?

The First PXD (Belle II) Module ("OB")

PXD Sensors: Ready for Mass Production ?



OB with Kapton

Laser on single pixel, fuill speed, CLEAR OK

PXD Sensors: Ready for Mass Production ?

OB with Kapton is working at full speed and complete CLEAR

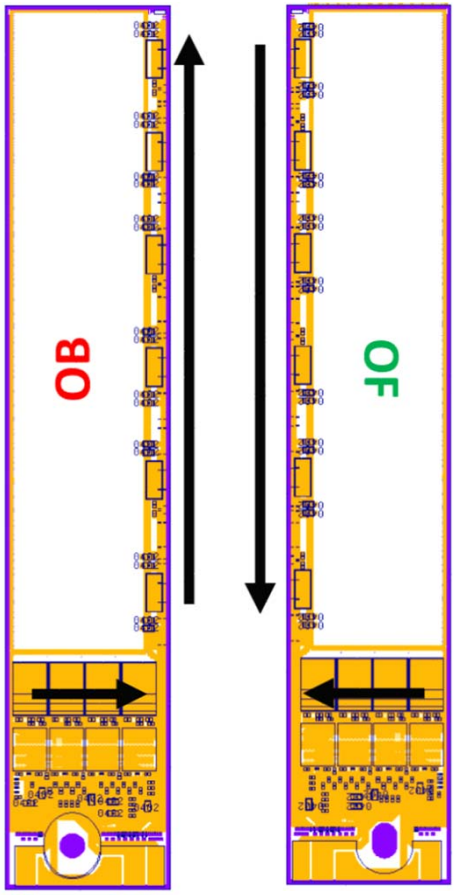
Should we insist on OF measurements (mounted on hybrid)?

-> There ARE some differences in the metal1 layout.

To be sure, we should continue producing the same plots with (hybrid) OF as for (Kapton) OB [remark: Kapton cable does not introduce any strange effects, seems to work as specified]

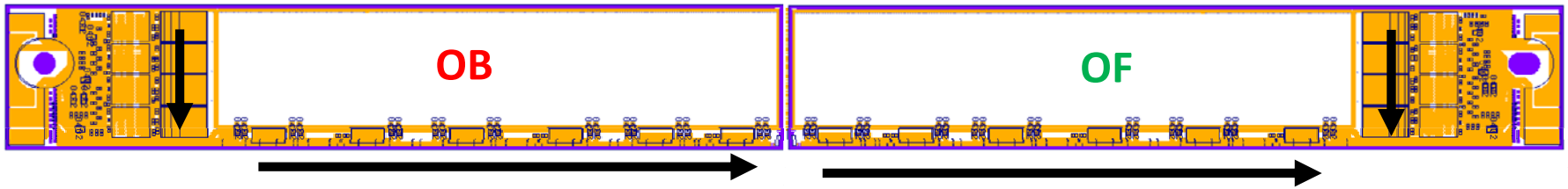
With some risk, we could decide to go ahead without full analysis of OF

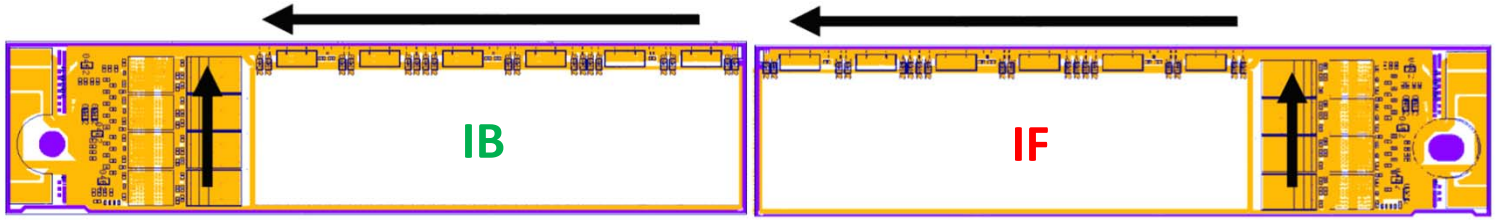
Crucial: Time involved to get software / tuning fully working to repeat OB test



PXD Modules: Yield from Pilot

View from “outside”





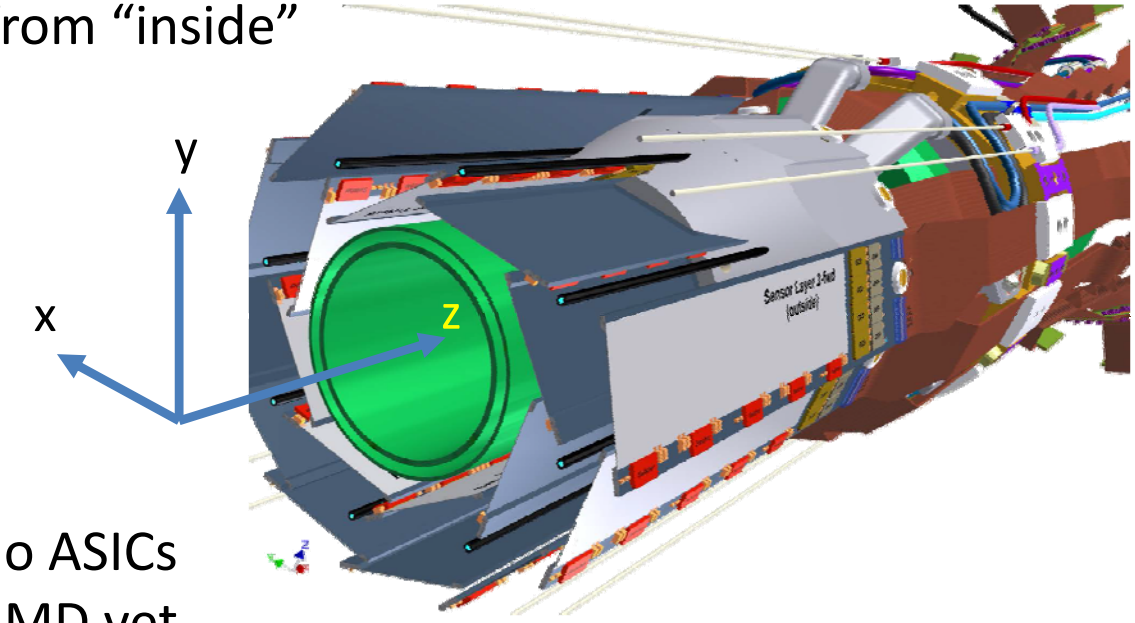
View from “inside”

Pilot run yield: 14 of 18

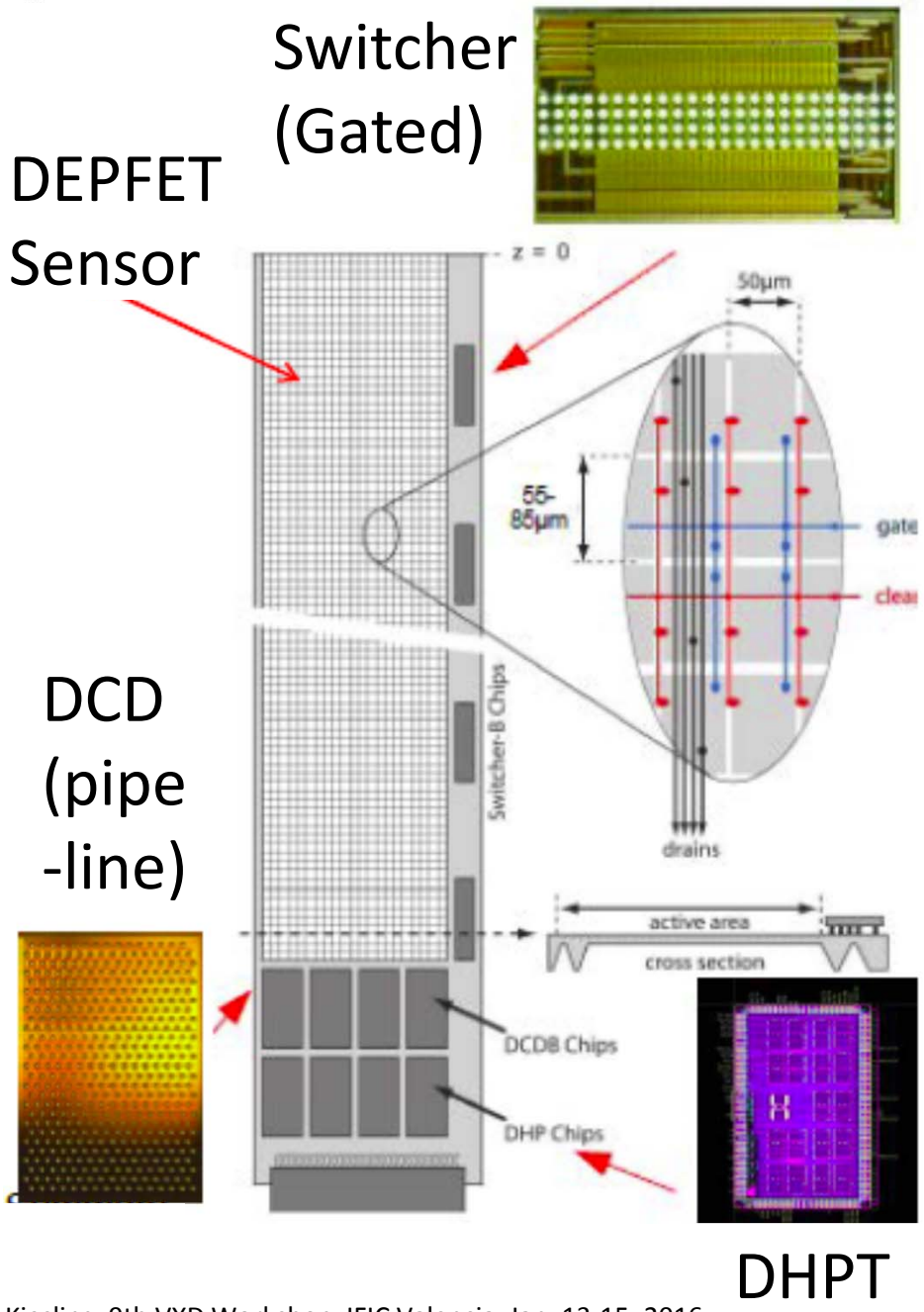
2 IF	(2)	2 IB	(2)
6 OF	(5)	4 OB	(2)

2 OB with Kapton
1 OF as Hybrid

(?): no ASICs / SMD yet



Final ASIC Production



DHPT 1.1 delivered, under test

Switcher delivered, back from bumping end of January

DCDBs (5 versions) submitted, expected back early February

Ongoing at KIT:

- Probe cards for new SWB and DCD under development
- Qualify present DCDs (for DESY test)

Discussions really needed !

Ladder Production (I)

Further steps towards ladder production:

- SMD process established at HLL
- Kapton attachment established at MPI
  (some issues with Kapton soldering identified, changes for production at Taiyo agreed, new samples to be delivered in January
- All jigging / hardware / software established for final module test

- Last step: end-to-end gluing of two modules in development
  - glue dispensing machine already at MPI, assembly and commissioning after Valencia (second half of January)
  - complete tooling designed and in the workshop
  - samples for process development in hand

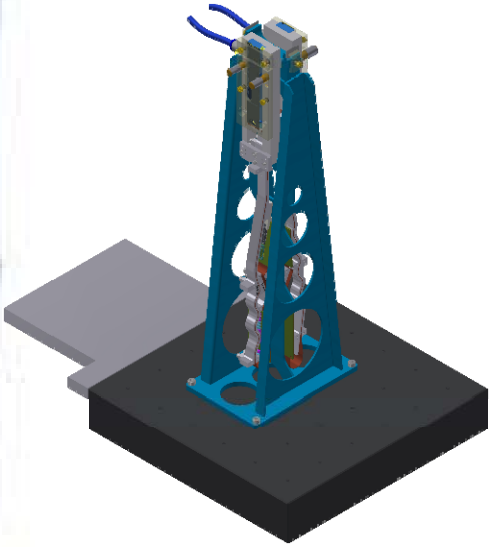
- Jigs for testing the finished ladder (including water cooling) going to the MPI workshop

Ladder Production (II)

Concept for final production step: gluing of modules to sensors

Glue dispenser
(not to scale)

Tower holding 2 modules vertically under dispenser



Precise alignment of modules for dry-out phase

End-to-end gluing plus ceramic pieces under thick rim of sensor

Subjects to Address

- Next step (after Green Light for Production):
  equip one / two modules (OF) with new DHPT + old SWB / DCD

- Preparation of DESY Test: old DCD, old Switcher, new DHPT for one / half ladder
  - other ladder: new SWB, old DCD
  - Gluing technology needs attention

- Have more groups involved in testing (-> training sessions at HLL)
  - MPI, Bonn, ?? Can provide 3 OF modules (with Kapton)

- After DESY Test: need to prepare for BEAST 2 -> schedule, manpower

- Certification of IBBelle and MARCO (designed for 110 Bar maximum pressure, KEK can certify only up to 80 Bar)

- German TÜV may (again) be a solution

DESY Test

Near-term project (after start of metal1 structuring):

- Equip (1-2) sensors from pilot production with new DHPT, but “old” DCD and Switcher
- Continue testing entire matrix (all DHPT/DCD pairs working)

- Modules can be used for DESY test (gain time in ladder preparation for the DESY test, no performance loss due to fixed communication)

ASIC arrangement for the other DESY modules:

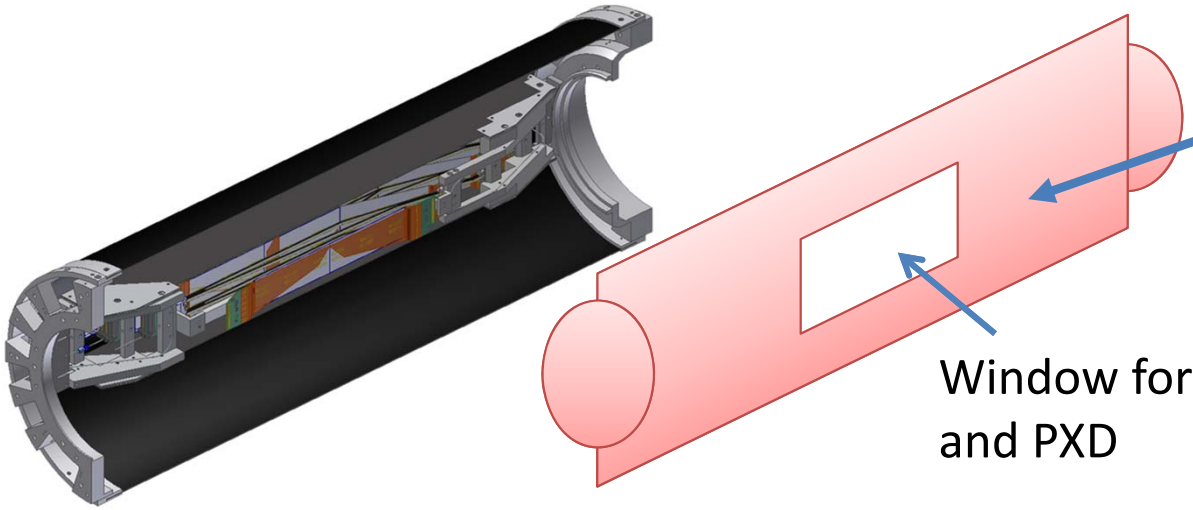
- new DHPT 1.1
- if new DCD not ready, take present DCD (works adequately)
- New Switcher needed, test setup being developed at KIT (this is critical, since too few “old” Switchers available)

Mechanical support / cooling being designed:

- SCBs mounted on metal ground plate
- Plate also holds the SVD cartridge

DESY Test: VXD Mechanics

Original idea (Katsuro Nakamura in Trieste)



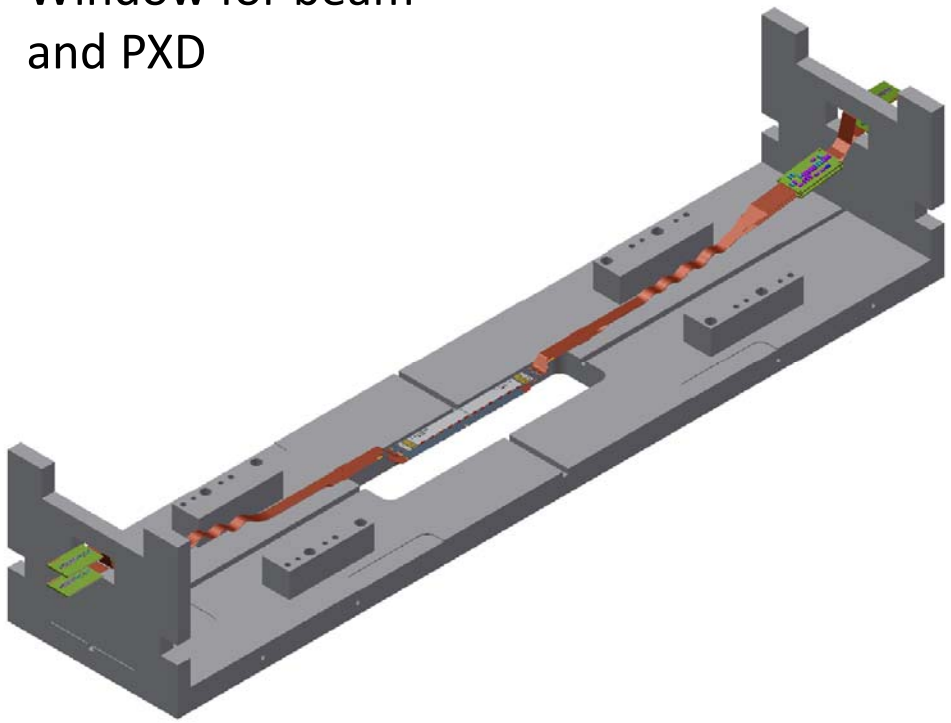
Mount SCB on ground plate

Window for beam
and PXD

New (favored) idea:

make a “box” and provide
fixtures for the SVD cartridge

[Box is closed by cover, cables holes
by EPDM]



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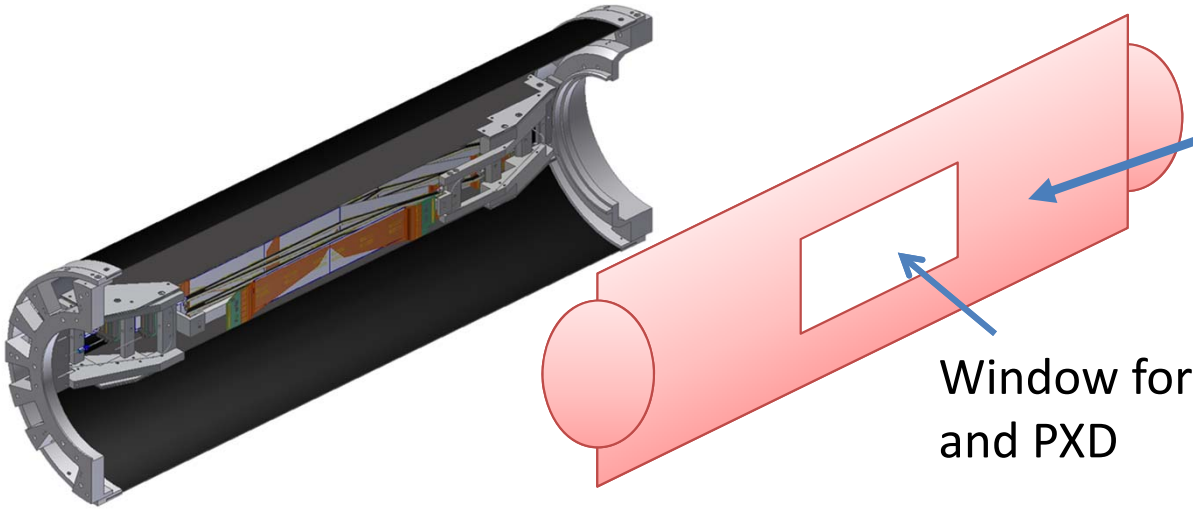

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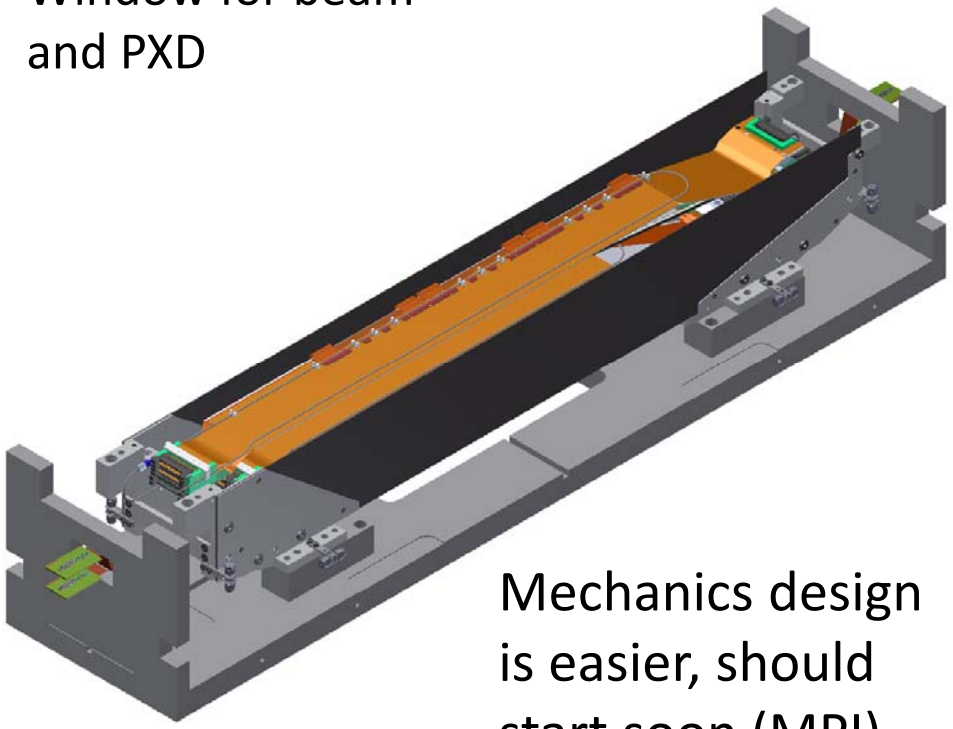


Mechanics design
is easier, should
start soon (MPI)

BEAST 2

Preparation for BEAST 2 Hardware:

DESY
- PXD / SVD setup as for DESY Test
- FANGS test and integration
- CLAWS test and integration
- environmental sensors (FOS, already active for the DESY test)
- Plume integration
- Test of complete sensor system (with CO2 and N2 flow)

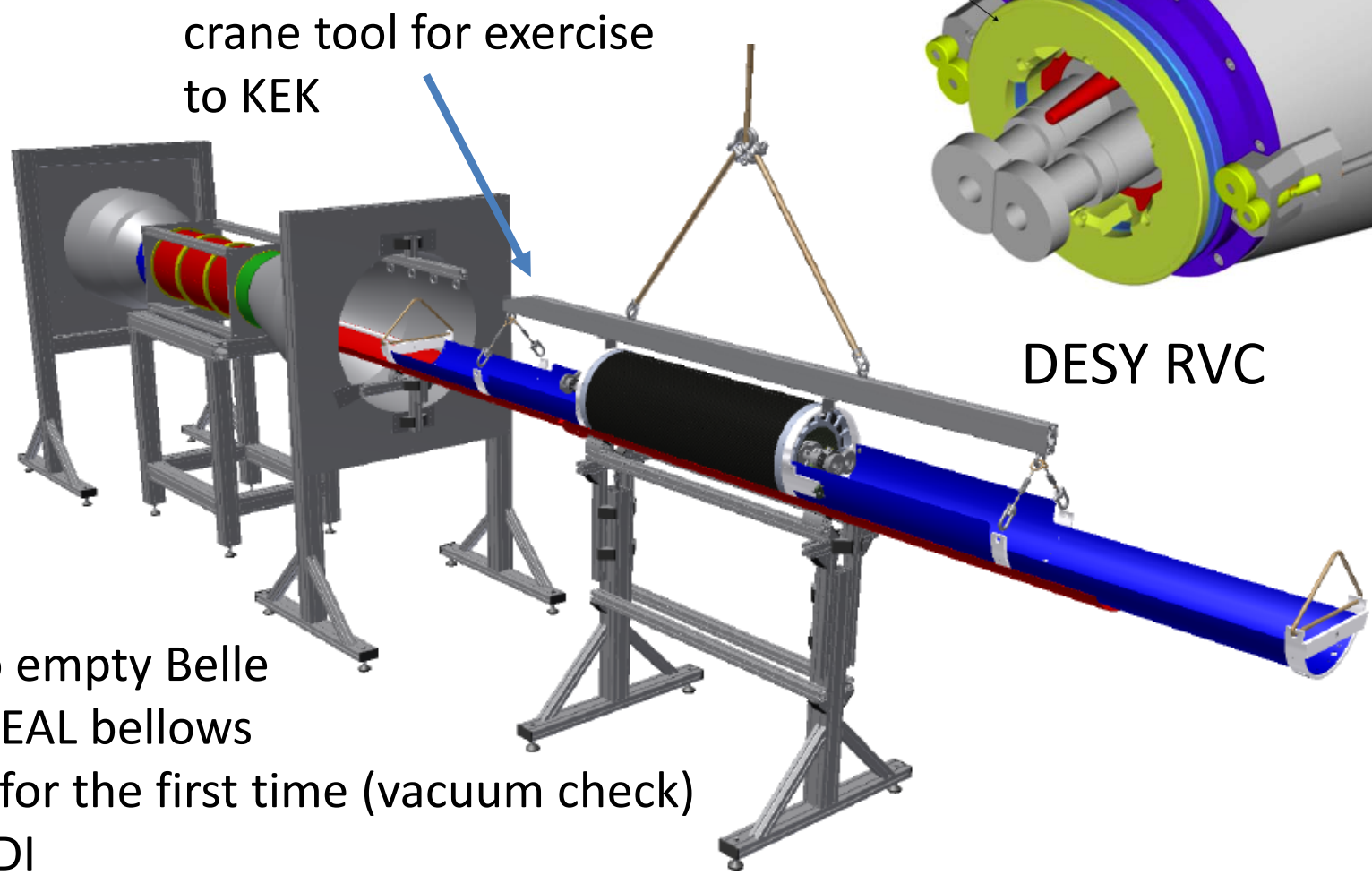
transport to KEK (after disassembly)

KEK (B1)
- Diamond sensor installation on BEAST 2 beam-pipe
- re-assembly of BEAST 2 sensors on beam pipe (PXD, FANGS, CLAWS, Plume)
- SVD mounting on end flanges, integration onto beam pipe
- environmental monitors, system test

DAQ and Slow Control for complete system (DESY Setup as test bench)

VXD Installation: RVC & AIM

"Mockup" on the way to a fully engineered procedure (D. Kittlinger)



DESY RVC

Three phases:

- Move QCS into empty Belle
- Dummy with REAL bellows
  - ✓ close RVC for the first time (vacuum check)
  - ✓ Exercise EDI
- Install BEAST 2 (first full test with vacuum chamber)
- Install VXD

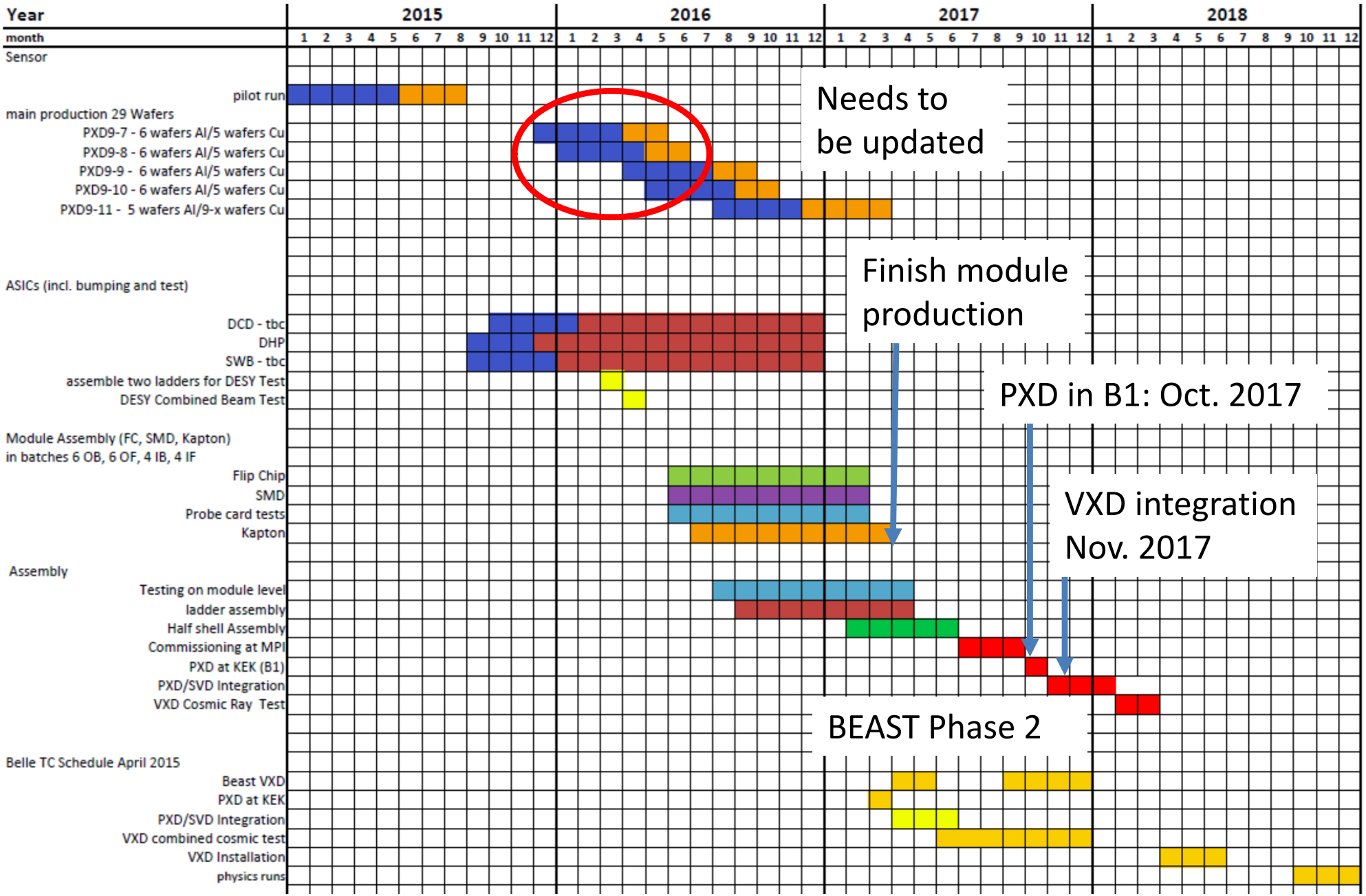
Infrastructure at KEK

- MARCO (provides cooling for VXD) cannot be on presently foreseen platform -> new location needed
- Where will be the assembly be? B1 or B4 (CDC area)?
- Where do we store (smaller) tools and equipment (e.g. crane tool etc.)
  -> offer by Yutaka: Fuji hall (now occupied by ITOP)
- Organization of access to the KEK workshop (machining of parts)
- European standard electrical power supply in B1 and B4
- Concentric CO2 transfer lines from IBBelle to park and beam positions
- N2 and vacuum

Further Subjects to Address

- Schedule for IBBelle commissioning, certification (at MPI) and transport to KEK, Installation at KEK, commissioning with dummy load
- Installation of all CO2 pipes (up to the docks)
- Decision on length of flex lines (parts already built at MPI, assembly at DESY)
- Software (mainly Slow Control):
  at Hardware level, standalone VXD DAQ, Express Reco
  (need some “pocket DAQ” system at DESY to continue development)
  Definition of PVs to look at, histogramming, rate measurements
- PXD Commissioning at MPI:
  Planned in principle up to the ladder test (water cooling, full PXD: CO2)
- + certainly many more items to consider

PXD Production Schedule: Needs Update



Accelerating the Production Schedule

Start of structuring the first metal layer delayed by about 4-6 weeks

Recovery of lost time possible by accelerating module assembly:
- send larger batches of sensors for ASIC flip-chipping
- 5 consecutive batches planned,
- could be reduced to 4 or even 3

Reason for present conservative planning:
- check (small) batches after return from FC to spot errors
- get some contingency in case of delays

Fewer batches (with larger number of sensors):
- no clearly visible disadvantages,
- IZM so far demonstrated excellent control of FC process

Finally …

Many thanks to Juan, Carlos, Marcel
and the whole IFIC Team
for hosting (again)
a PXD Meeting
in this wonderful and
enjoyable place!

Backup

Test Program during Module Production

"Short List"

1 ASIC sanity check: voltages and currents, high speed link, DHPT temperature
2 Digital test pattern, delay scan
3 Probe Switcher Control Signals
4 Raw data read-out
5 check: pedestal distribution, noise
6 check: response on light (laser)
7 Source measurement (Cd 109 on the movable stage)
8 Gated Mode Test with Laser (cross matrix -> all switchers)

Test Program (full version)

1	Power up ASICs
2	sanity check: voltages and currents
3	configure JTAG
4	sanity check: voltages and currents; high speed links; DHPT temperature
5	check boundary scan (incl. DHPT-DCD links)
6	scan DHPT link parameters (amplitude, boost, delay)
7	digital test pattern, delay scan
8	program SWB sequences (192 channels) - DHPT output still off
9	increase DCD current limit
10	enable DCD analog part: analog CMC off, no pedestal correction
11	sanity check: voltages and currents
12	enable DHPT to SWB control signals
13	Probe Switcher Control Signals
14	power up DEPFET voltages
15	sanity check: voltages and currents;
16	raw data read-out

Test Program (full version)

17	check: pedestal distribution, noise
18	check: response on light (laser)
19	sampling point scan
20	optimization of DEPFET voltages,
21	store pedestal values for 2-bit DAC offset correction
22	upload pedestals for zero suppressed readout
23	trigger zero suppressed frames (no data should arrive)
24	Laser spot (move laser across the matrix via movable stage)
25	Source measurement (Cd 109 on the movable stage)
26	Gated Mode Test with Laser (cross matrix -> all switchers)
27	Scan CLEAR voltage for complete charge removal (with laser)
28	power down DEPFET voltages
29	disable DHPT to SWB control signals
30	disable DCD analog part
31	decrease current limits
32	power down ASIC voltages

PXD/VXD Installation Procedure in B1 (I)

PXD will be assembled and tested in Munich
Here are the steps to be executed for the acceptance

(Assumption: Closed CO2 cooling system available in B1)

Upon arrival of transport box in B1:

1. Check transport case for damages (optical inspection)
2. Analyze acceleration sensor data (stored on devices)
3. Unpack PXD halves, inspect visually for damages
4. Check tightening torque on all screws
5. Check geometrical positions of mounting holes on SCBs with dummy beampipe (tooling already prepared at MPI)
6. Check collision-free assembly of sensors on SCBs after lowering half-shell on dummy beampipe (tooling prepared)
7. Electrical tests on individual sensors (FWD / BWd separately)
   For this: dismount patch panels one by one (replace after test)

PXD/VXD Installation Procedure in B1 (II)

PXD assembly on beampipe:

8. Installation of PXD mounting on KEK granite table
   (real beampipe with heavy metal, diamonds and beampipe services is already prepared and aligned on rotational holding structure)
9. Check pins on PXD mount blocks with dummy SCB assembly
10. Grab first PXD half-shell with tool and lower from above, tighten screws on SCBs with nominal torque
11. Arrange Kaptons on the Heavy Metal structure and fit through end flange
12. Turn mounting table by 180°
13. Check pins on PXD mount blocks with dummy SCB assembly
14. Grab second PXD half-shell with tool and lower from above, tighten screws on SCBs with nominal torque
15. Arrange Kaptons on the Heavy Metal structure and fit through end flange.

PXD/VXD Installation Procedure in B1 (III)

PXD (both halves) fixed on beampipe: Cable attachment

16. Attach Patch Panel support on BWD and FWD sides
17. Attach Patch Panels (with cables) on both sides
18. Guide cables radially and keep in position with temporary support
19. Mount cable support on both BWD and FWD sides
20. Bring cable one by one in position and fix them at a distance of about 300 mm from the end flange at their default positions. Cables are now in their default position
21. Final positioning check using precision arm (register positions on data base)
22. Electrical test cable by cable, one module after the other (no CO2 cooling yet)
23. Remove PXD mounting too from KEK granite table

PXD/VXD Installation Procedure in B1 (IV)

PXD complete with cables on beampipe: Add SVD

24. Assemble SVD mounting tool on KEK granite table.
25. Bring first SVD half-shell vom the +x side
26. Fix SVD cable on the VXD cable support
27. Bring second SVD half-shell vom the -x side
28. Fix SVD cable on the VXD cable support
29. Mount cover plate of cable support to keep cables away from RVC.
30. Connect CO2 pipes on each side to the CO2 cooling unit
31. Connect all cables to their services with proper cable strain relieves
32. Power CO2 unit
33. Do electrical tests for PXD
34. Do electrical tests for SVD
35. Removal of SVD mounting tool from the KEK granite table.
36. Install comsic ray trigger counter
37. Do cosmic ray test

PXD/VXD Installation Procedure in B1 (V)

VXD after Cosmic Ray Test: Preparations for the transport to Belle

38. Mounting of the first AIM components
39. Support of PXD now switched from support on beampipe to support by the end rings so that a further installation is possible.
40. Mounting of additional AIM components such as cable trays etc.
41. Repositioning of the VXD with cable trays attached from the KEK granite table onto the movable transport cart (using small crane and a steel traverse prepared at MPI)
42. Protective foil cover of entire VXD for transport (protect against dirt and dust on the way down to the beam line
43. Install support on the gallery outside B1 to receive the VXD

PXD/VXD Installation Procedure in B1 (VI)

VXD after Cosmic Ray Test: Preparations for the transport to Belle

44. Move VXD out of B1 and position before the support structure
45. Reposition VXD from the transport cart onto the support structure (using the steel traverse and the small crane).
46. Move the VXD on support structure out and connect the hall crane to the steel traverse
47. Transport the VXD via the hall crane to the beam line
48. Position the VXD onto the mounting tube and the monting tube extensn of AIM (which has been prepared beforehand)
49. Install VXD using the AIM procedure