

Status report of the TOP mechanics

K. Suzuki (Nagoya)

Outline

- *(FEM analysis)*
- *Quartz window design*
- *The latest QBB designs*
- *QBB prototype production*
- *(Review of the mechanical issues)*
 - *CRT mechanics*
 - *QBB design*
 - *Module assembly scheme*
- *Nagoya engineering group & installation jigs*
- *Proposed plan for the TOP mechanics*

Quartz window design (1)

- Quartz window

- As an environment separator.

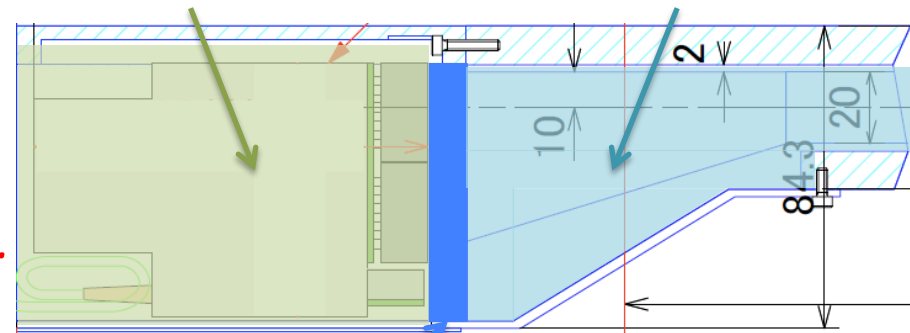
- Between the quartz components and PMTs/front-end modules.
- Keeps a clean, low out-gassing environment for the quartz components.

- As a fixed structure in a QBB.

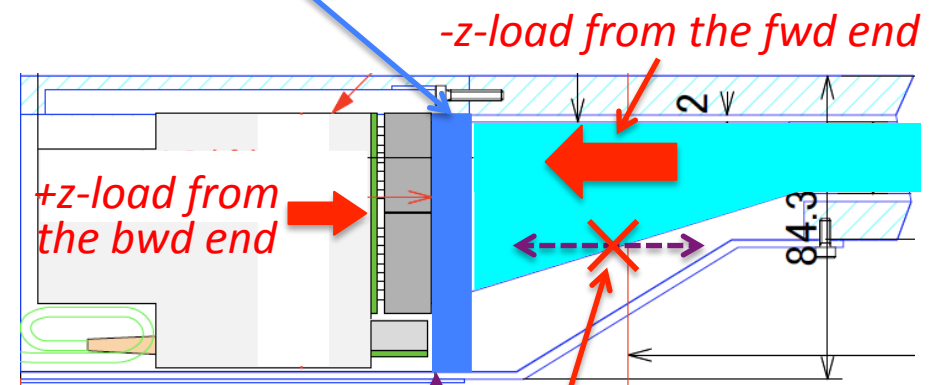
- To apply a “-z”-load from the fwd end.
 - ✓ Suppresses possible z-motions of the quartz components inside a QBB, improving the earthquake resistance.
 - ✓ Gives tensions to the quartz joints, keeping good optical contacts between them against possible vertical motions.
- To apply a “+z”-load from the bwd end.
 - ✓ Pushes PMTs toward the window/wedge, keeping good optical contacts between them.
- To protect the wedge-radiator joint from a vertical moment.
 - ✓ Concerning the mismatched vertical gravity-centers of the fwd and bwd z-loads.
- Can be used as the z-position reference.

Possible out-gases in long term operation

Clean environment for quartz components



Quartz window

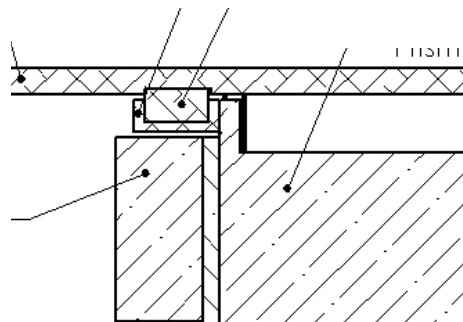
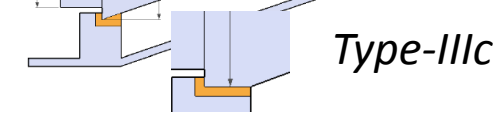
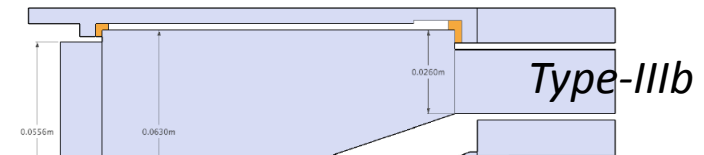
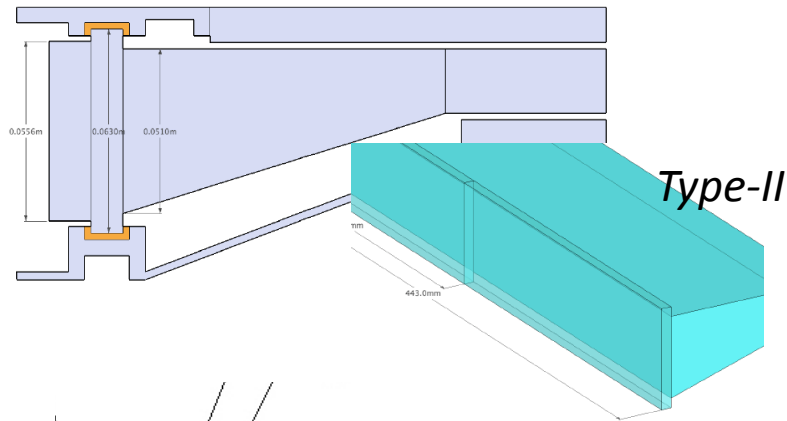


z-position reference

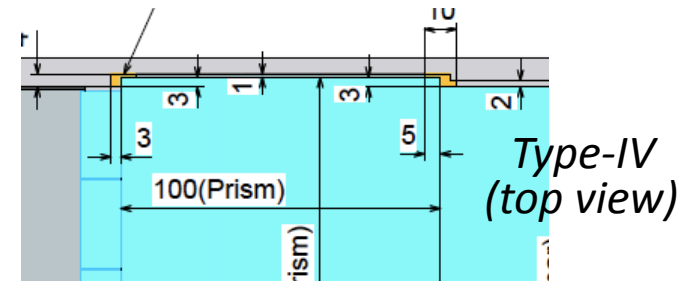
Quartz window design (2)

- *Designs considered*
 - *Jim Fast, Inami-san and K.S. proposed several designs.*

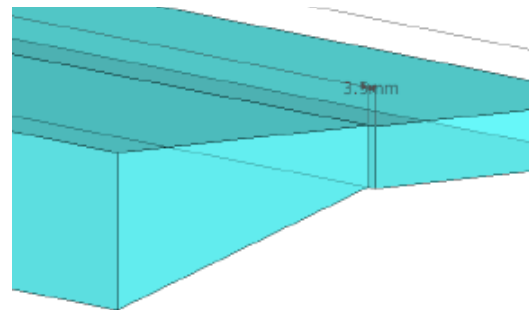
Type-I



Type-V
(top view)



Type-IV
(top view)



Type-VI

Quartz window design (3)

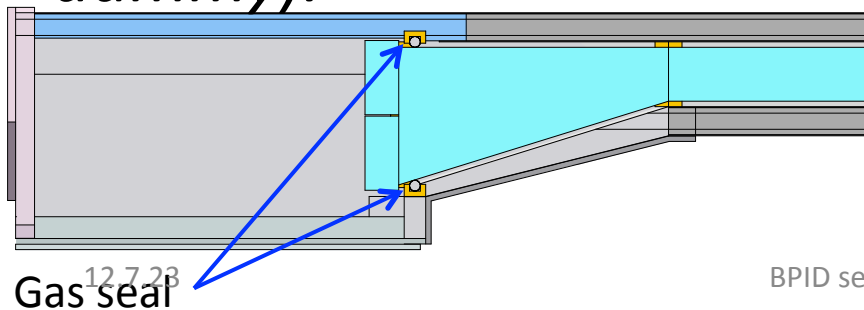
- Marko Staric and Inami-san checked the performance difference among the designs.

Summary

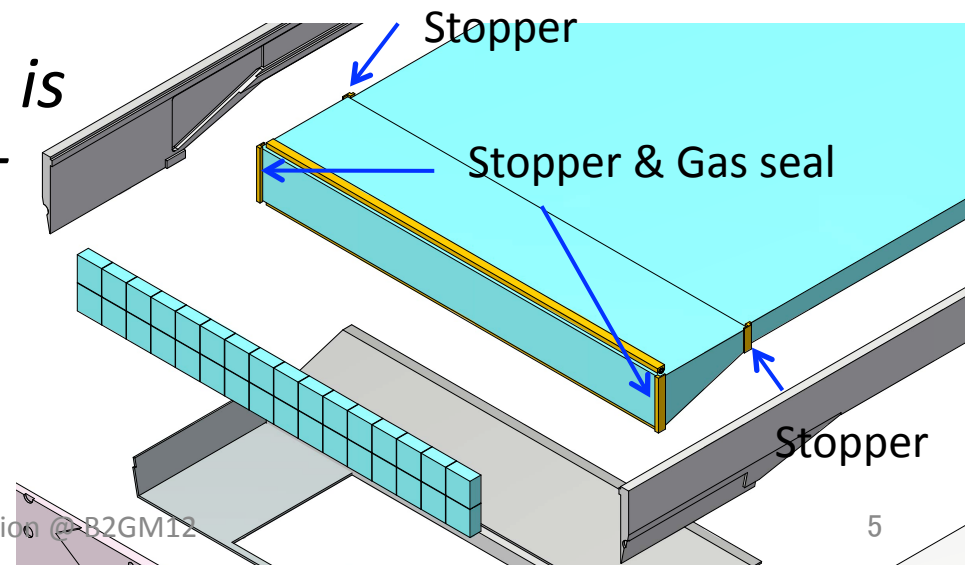
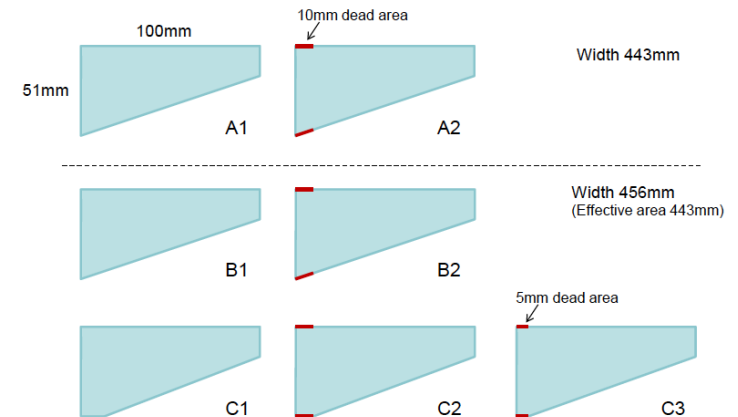
	$\pi\pi$ eff.	fake	$\rho\gamma$ eff.	fake	N_{hit} ratio
A1	98.5%	2.5	99.3	1.7	100%
A2	98.4	2.6	99.2	1.7	96.0
B1	98.5	2.5	99.2	1.7	98.7
B2	98.4	2.6	99.2	1.8	94.7
C1	98.5	2.5	99.2	1.7	99.4
C2	98.3	2.7	99.1	1.8	91.4
C3	98.4	2.6	99.2	1.7	95.5

- No significant difference in performance
- Actual dead space should be small, if we use O-ring.
- I propose B2(+smaller dead space) or C3 type.

- Now the wider prism design is adopted for prototyping (Al-dummy).

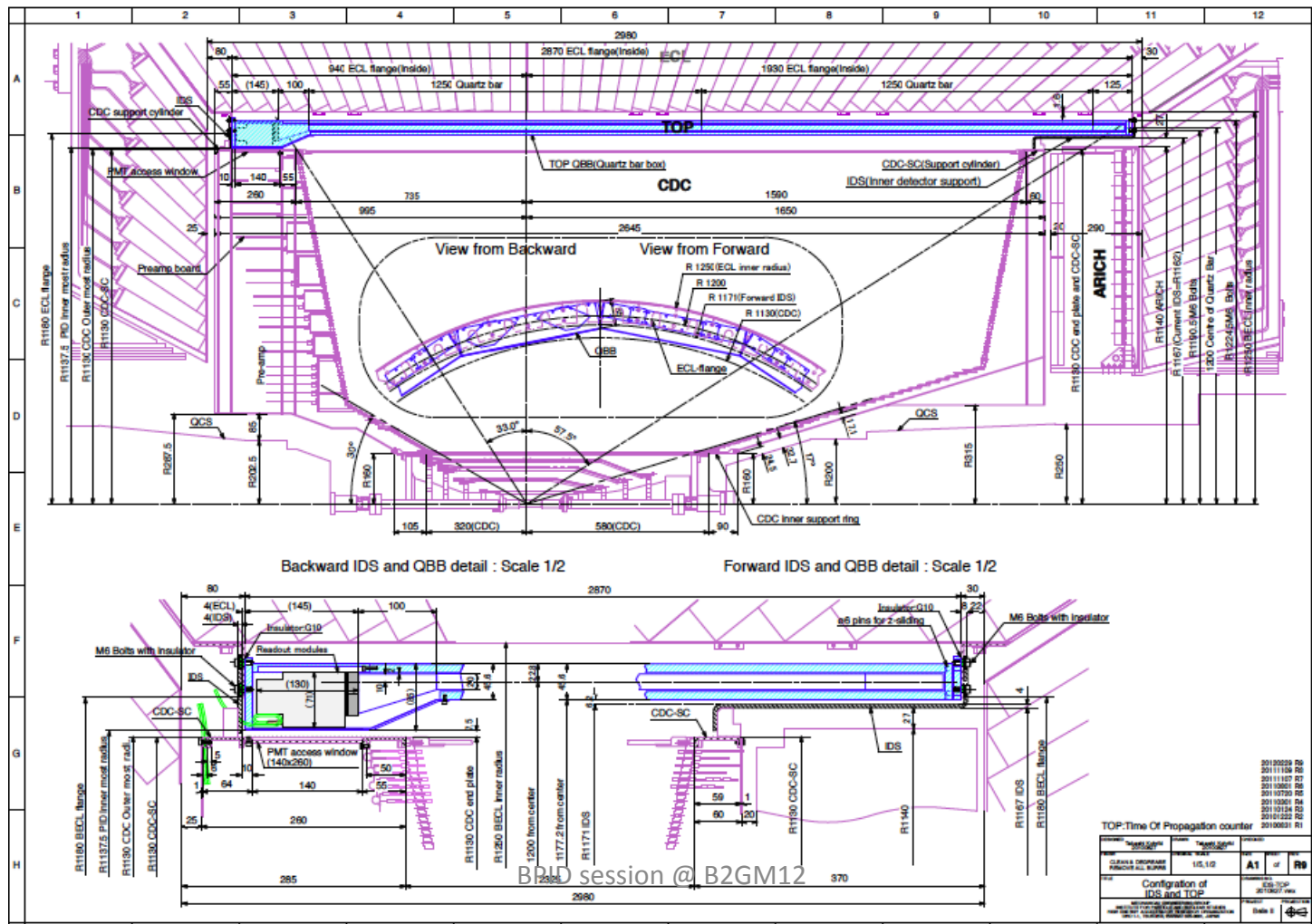


Checked wedge design



Mechanical configuration around TOP

- Drawn in “IDS-TOP20100827R9”.
 - Drawn by T. Kohrki (KEK), released on 02/29/2012.
 - Available in the INDICO page of our mechanical meeting.

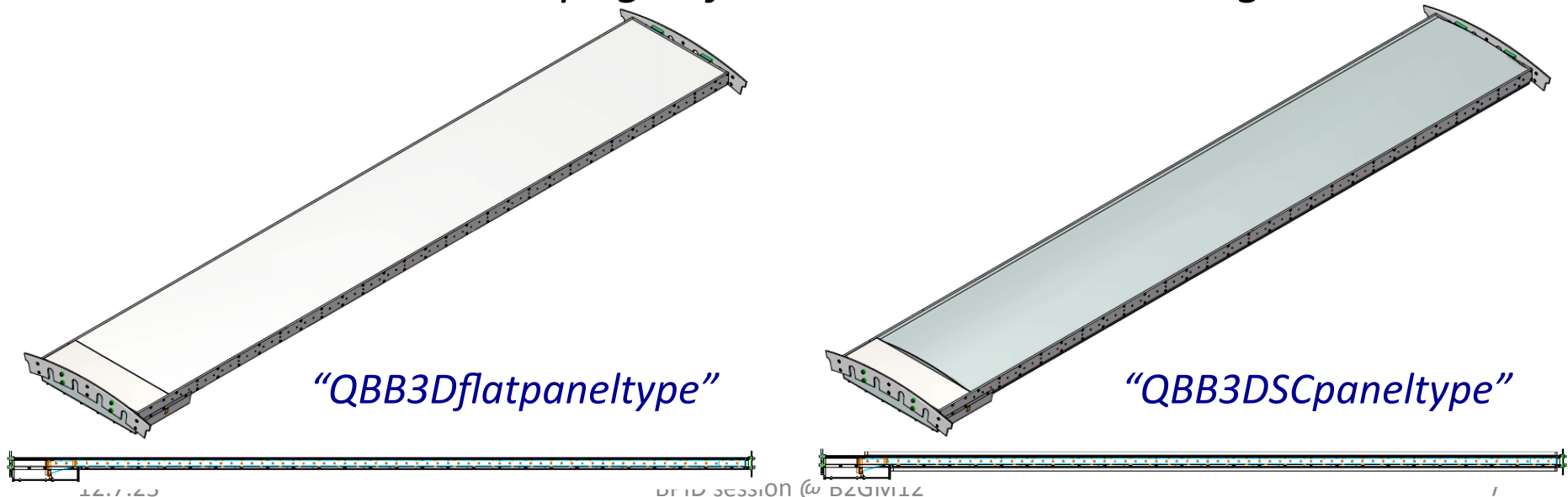


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B2GM12

The latest QBB designs

- The latest designs have two Honeycomb panel types.
 - With flat panels: “QBB3Dflatpaneltype”
 - With semi-cylindrical panels: “QBB3DSCpaneltype”.
 - Some details are still missing, e.g. the fwd compression springs, dry-air inlets/outlets, laser-fiber inlets, etc.
 - Will choose either one or merge them for the final design after having various mechanical tests on the prototypes.
- Both types are available in various 3D-CAD formats.
 - From the INDICO page of our mechanical meeting.

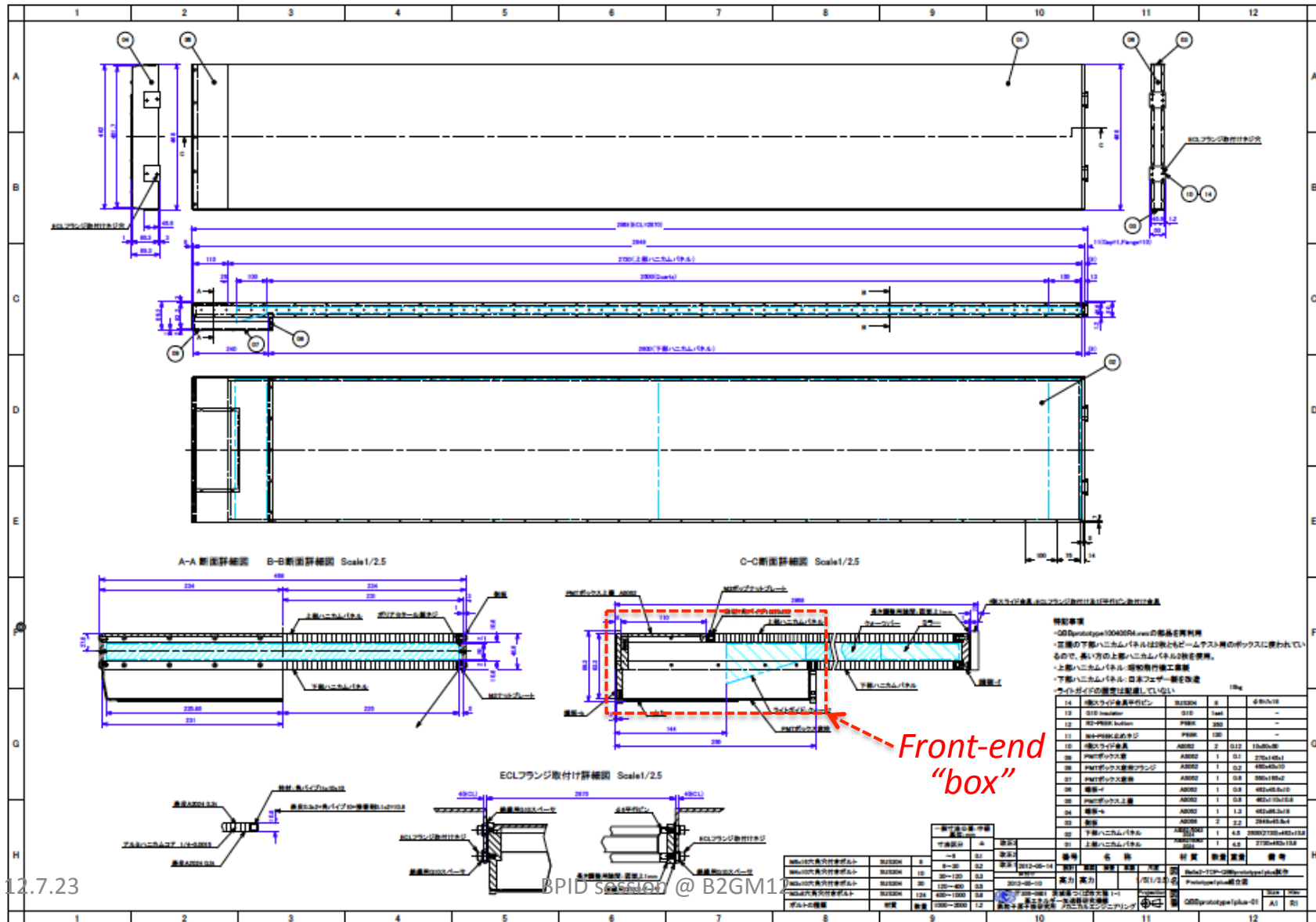


Designs of the QBB prototypes 2012 (1)

- *Based on the latest QBB designs.*
 - *With flat panels: “QBBprototype1plus”*
 - *The inner (shorter) Honeycomb panel will be made by cutting one of the existing two outer (longer) panel.*
 - *The side plate thickness is thinner than the latest design since the width of the existing panel is wider than the latest one.*
 - *Mounting scheme, e.g. gas-sealing materials, of the wedge is not implemented.*
 - *To be tested using an Al dummy weight only, not using a quartz bar.*
 - *With semi-cylindrical panels: “QBBprototype2”.*
 - *Since the length of the produced Honeycomb panels is shorter than the latest design, 25-mm-plates are added at the forward end of the panels.*
 - *To be tested using an Al dummy weight and a quartz bar.*
 - *Both types have a front-end “box” w/o a tilted bottom.*
 - *Just for the ease of manufacturing.*
 - *After prototyping, Kohriki-san got an impression that the tilted bottom would be feasible.*
- *Both types are available in a 2D-CAD format (.dwg).*
 - *From the INDICO page of our mechanical meeting.*

Designs of the QBB prototypes 2012 (2)

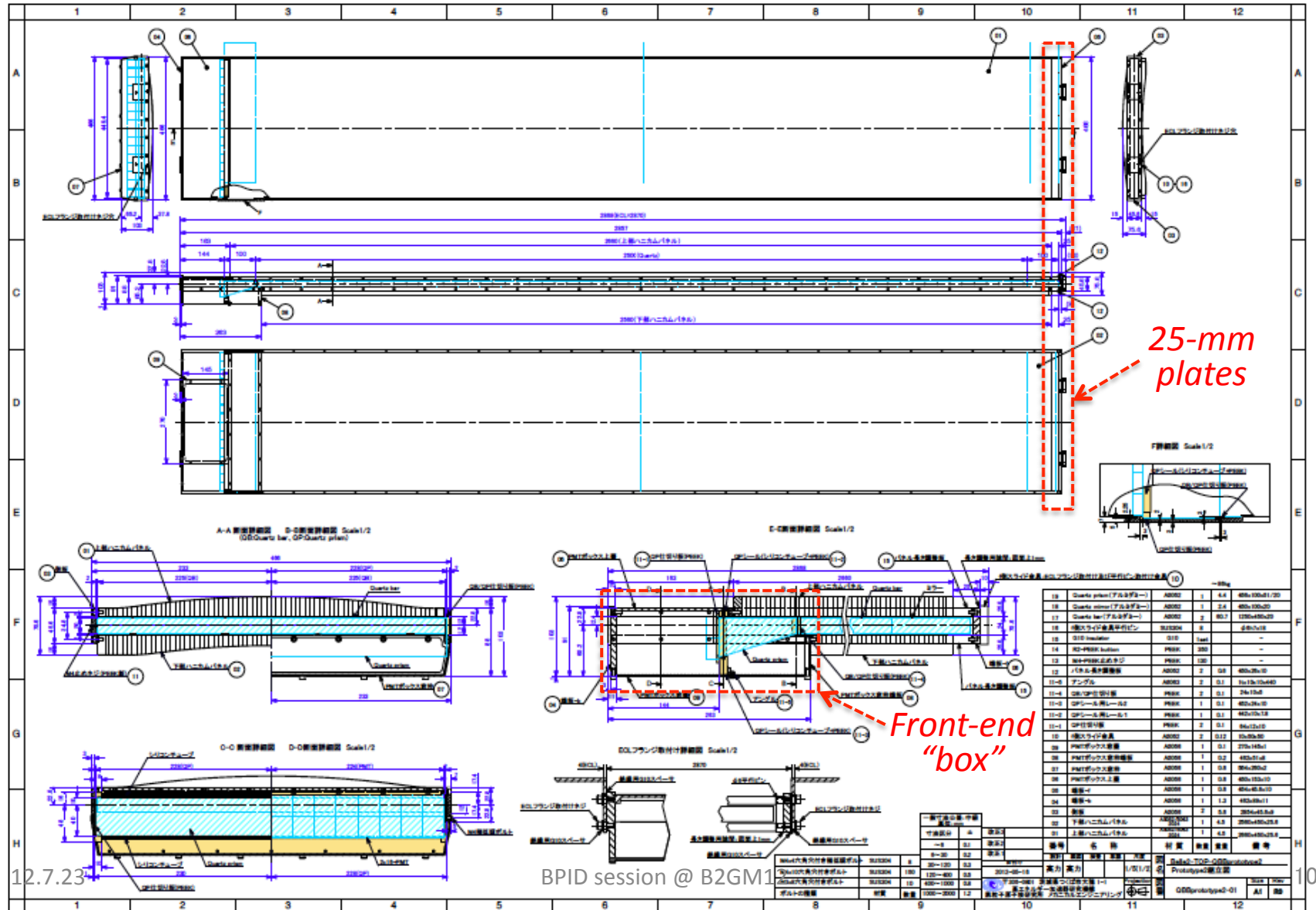
- “QBBprototype1plus”



Front-end "box"

Designs of the QBB prototypes 2012 (3)

- “QBBprototype2”

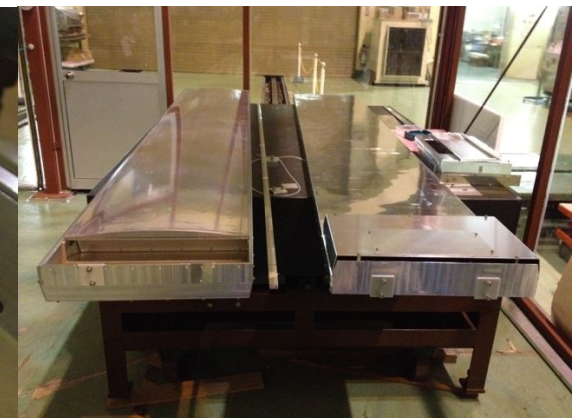
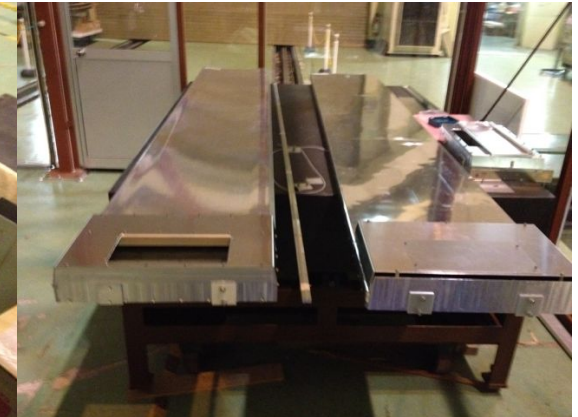
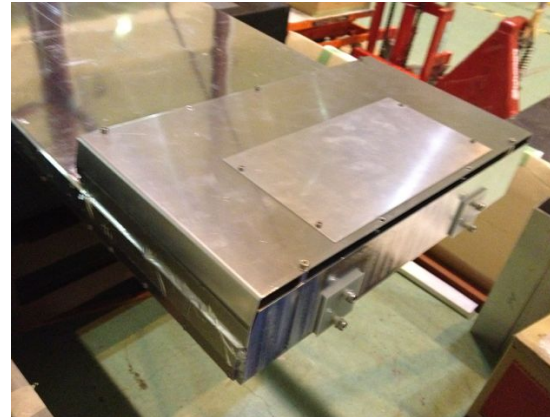
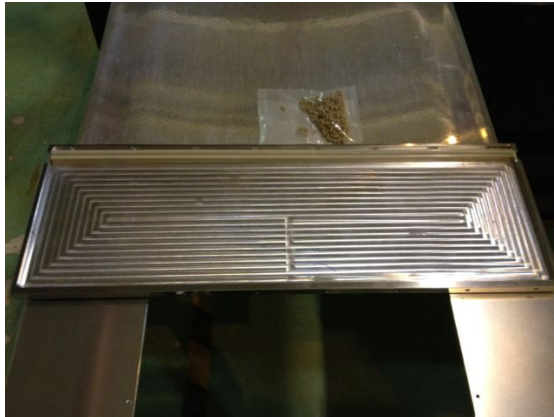
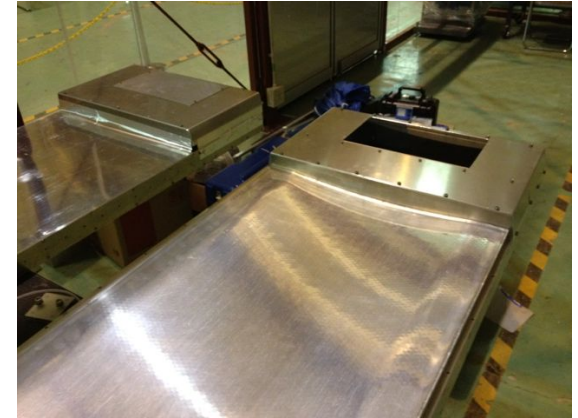


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BPID session @ B2GM1

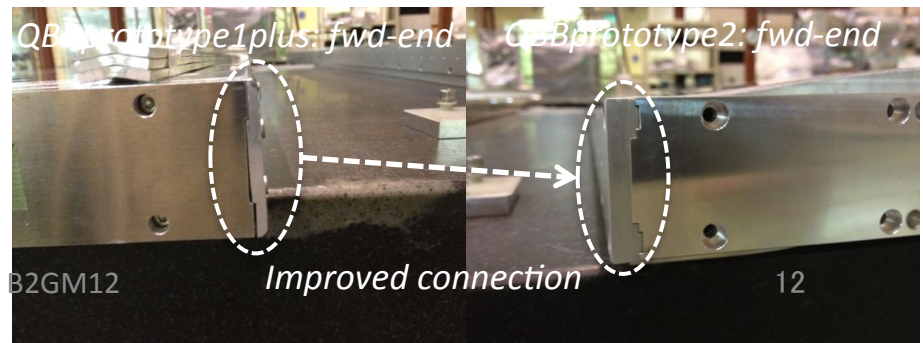
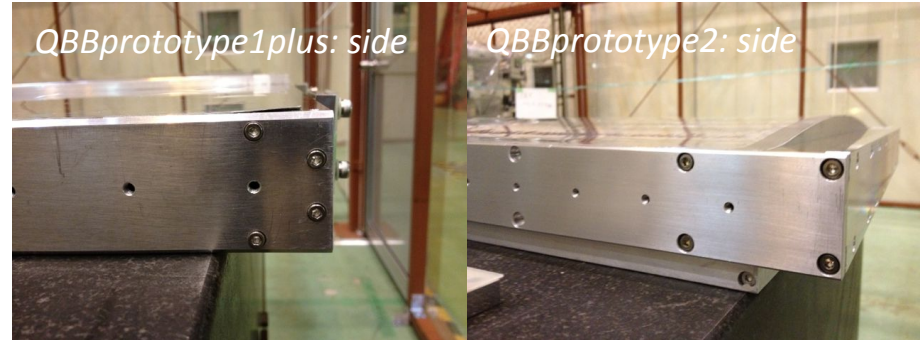
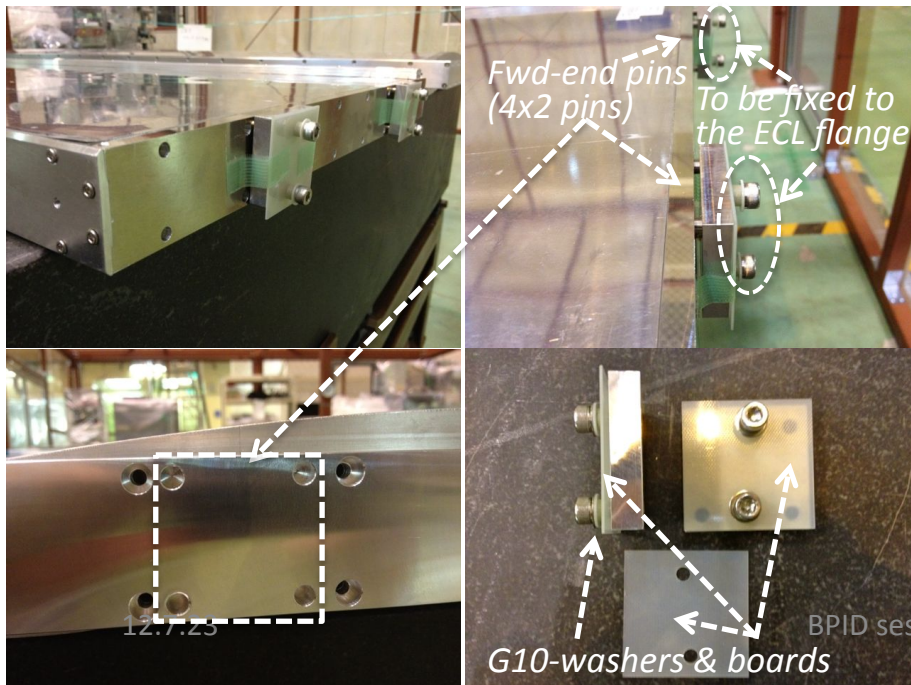
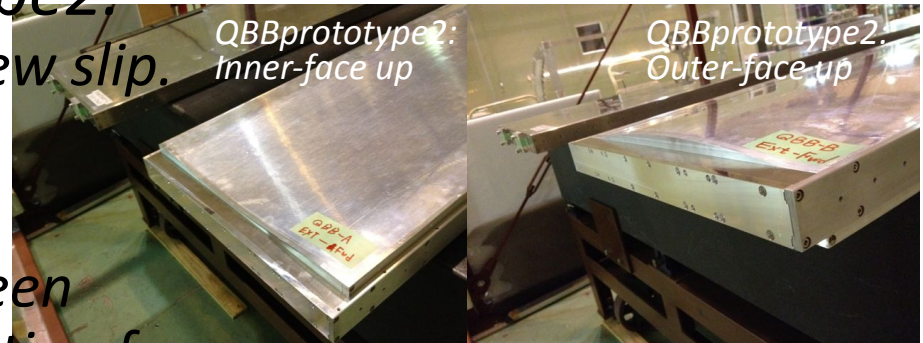
QBB prototype production (1)

- *Prototyping is in progress.*
 - *All done by T. Kohriki (KEK).*
 - *Looks mostly done.*
 - *One of the flat panels is being cut now.*
 - *To be used for various mechanical tests.*



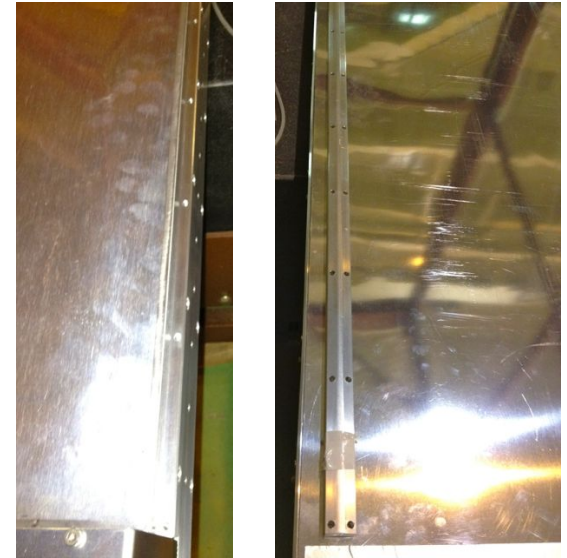
QBB prototype production (2)

- *At the sides, the connection shape has been improved in QBBprototype2.*
 - *Not to bend a box due to the screw slip.*
- *At the fwd end-plate,*
 - *4x2 pins can be seen.*
 - *G10 washers and boards have been implemented for electrical insulation from the Belle spectrometer.*



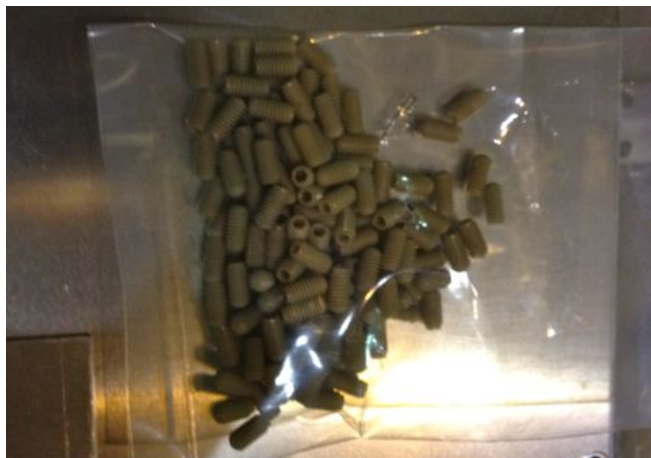
QBB prototype production (3)

- *Z-beams (3mmt-Al) have been produced.*
 - *To be used to connect adjacent modules at the inner-face of the side rails.*
- *PEEK screws and buttons have been produced.*
 - *To be used to support the quartz optics at the side rails (screws) and at the Honeycomb panels (buttons).*



Z-beams

PEEK screws



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PEEK buttons



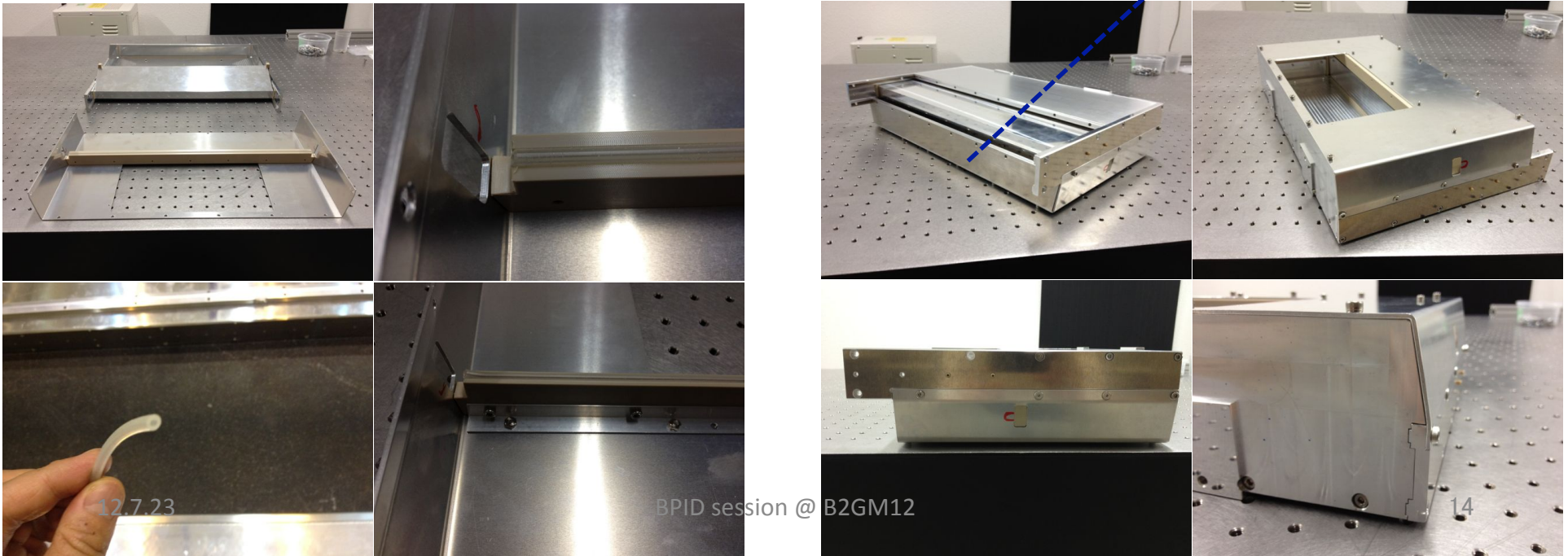
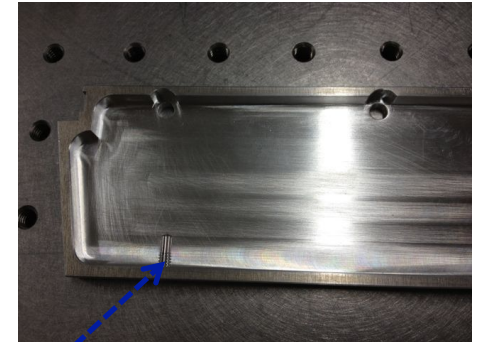
BPID session @ B2GM12



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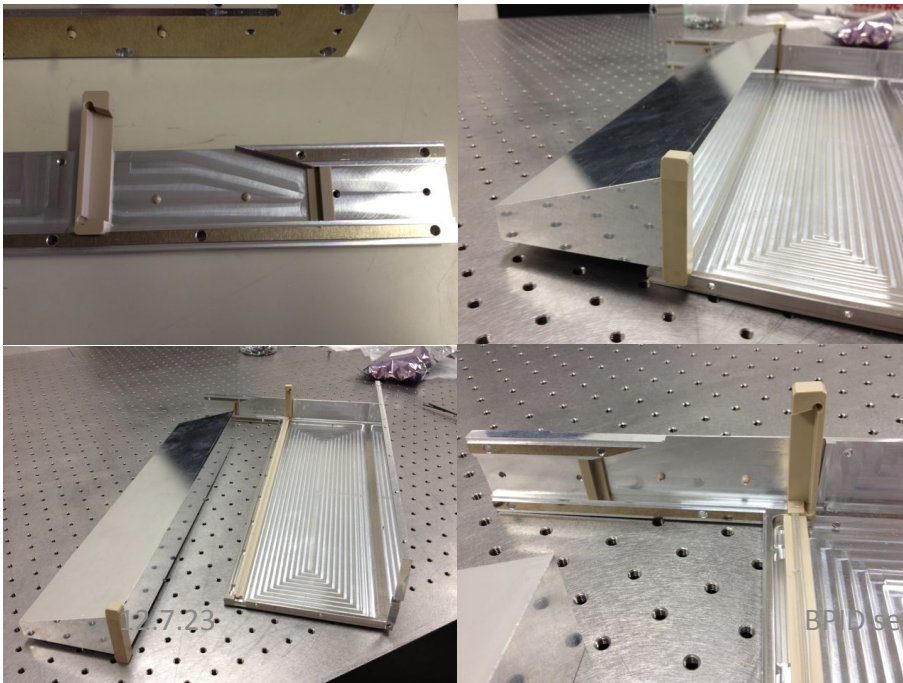
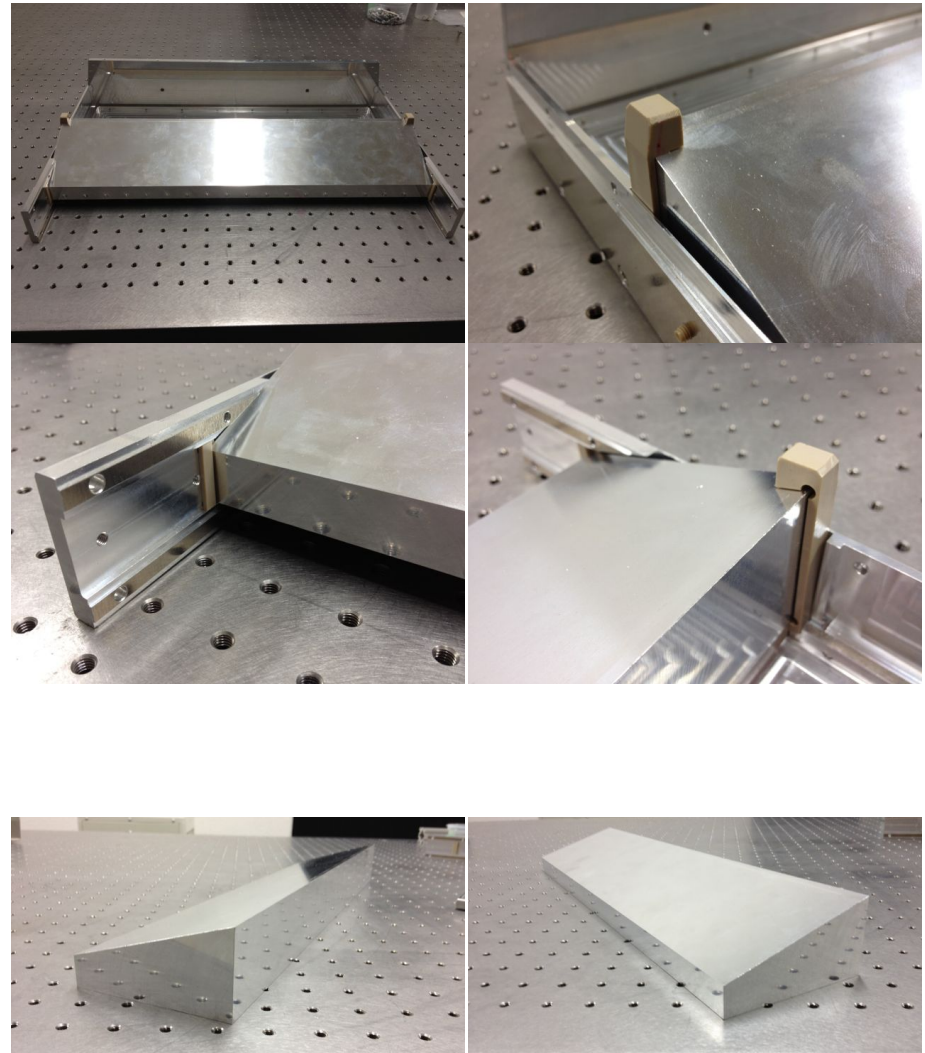
QBB prototype production (4)

- A mock-up of the front-end box has been produced.
 - Can be used for the Quartz Window study.
 - Gas-sealing scheme, z-load stopper scheme, etc.
 - Can be used for the Access Window study.
 - Front-end (dis)mount scheme, cabling, etc.



QBB prototype production (5)

- *You can have a closer look of the sealing scheme.*
 - *It can be applied even without flat face.*
- *An Al-dummy prism has also been produced.*



Nagoya engineering group

- *Nagoya Univ. engineering group has joined to the TOP mechanics team.*
 - *Key players: Toshi Kawai, Kenji Tachibana*
 - *~5 other engineers are expected to help occasionally.*
 - *Their main task is to design and manufacture the installation scheme and machinery.*
 - *They are also expected to give useful comments/suggestions to other mechanical topics.*
- *They have visited KEK on July 11th-12th.*
 - *To look at the QBB prototypes, ECL mock-up and the Belle spectrometer.*
 - *To discuss with Kohriki-san about the installation scheme and machinery.*



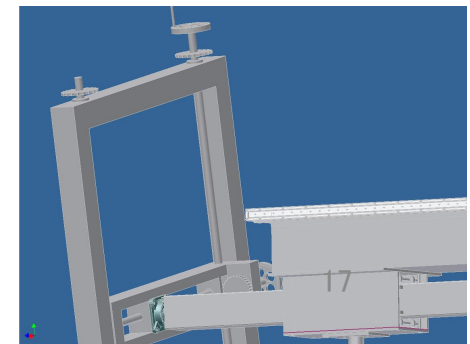
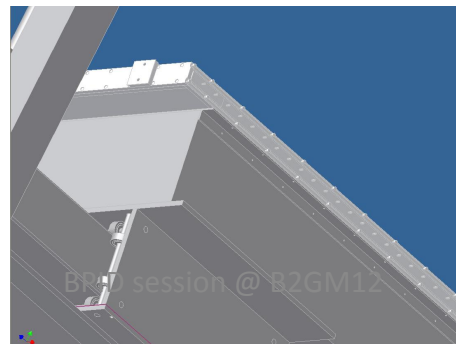
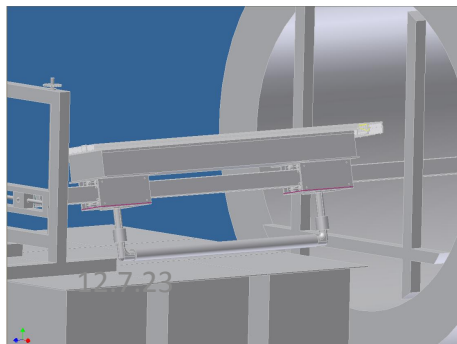
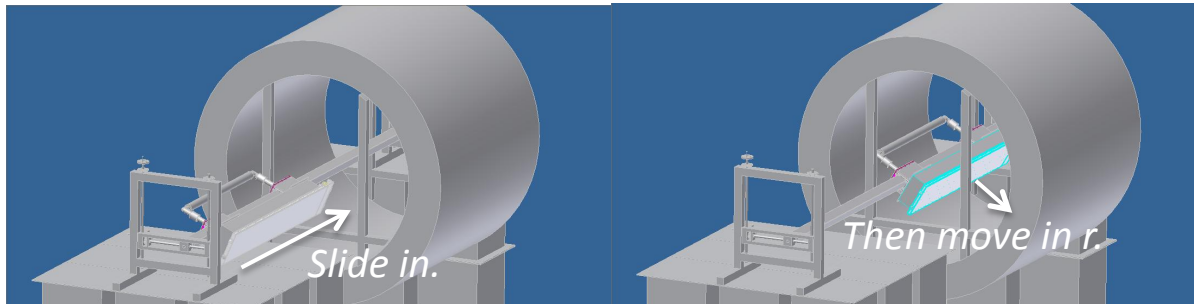
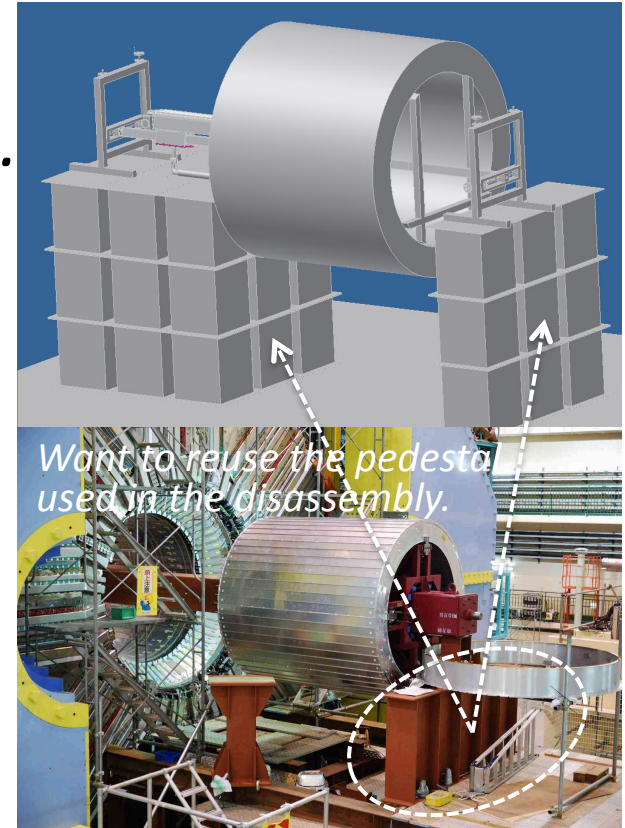
T. Kawai

K. Tachibana

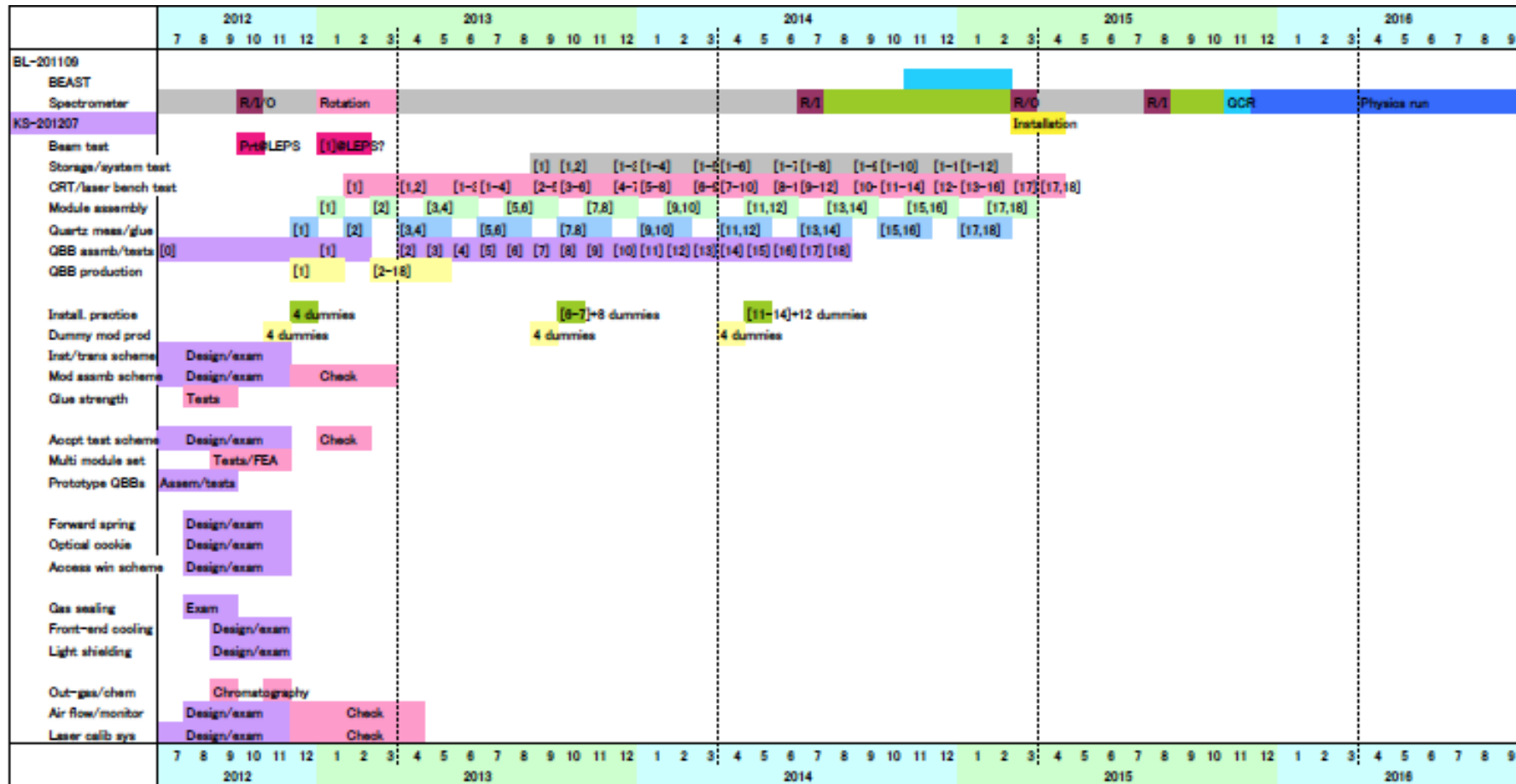


Conceptual design of the installation jigs

- Kenji and Toshi have already drawn a conceptual design of the installation jigs.
 - Very much appreciated for their quick response and hard work.
 - We have to finalize the design by the end Nov. so that the QBB design can be finalized incorporating the installation scheme.



Proposed plan for the TOP mechanics



Summary

- *Significant progresses can be seen since B2GM11.*
 - *Updates on the QBB designs and QBB prototyping.*
 - *New personnel from Nagoya Univ.'s engineering group.*
 - *Resulting in prompt actions to design the installation scheme and machinery.*
- *PID-internal reviews on mechanics are on-going.*
 - *Quite useful to share understandings and interesting ideas to improve designs or to overcome issues.*
 - *Involvement of various people is very important, especially to consider the assembly/installation schemes.*
- *A long/near-term plans have been proposed.*
 - *It is realistic but very tight.*
 - *Various designing work, examinations and tests/checks have to be completed by Nov. this year.*
 - *Need more careful considerations on financial issues, too.*