

Boundary of BDS group and Crab cavity group

2022/08/31

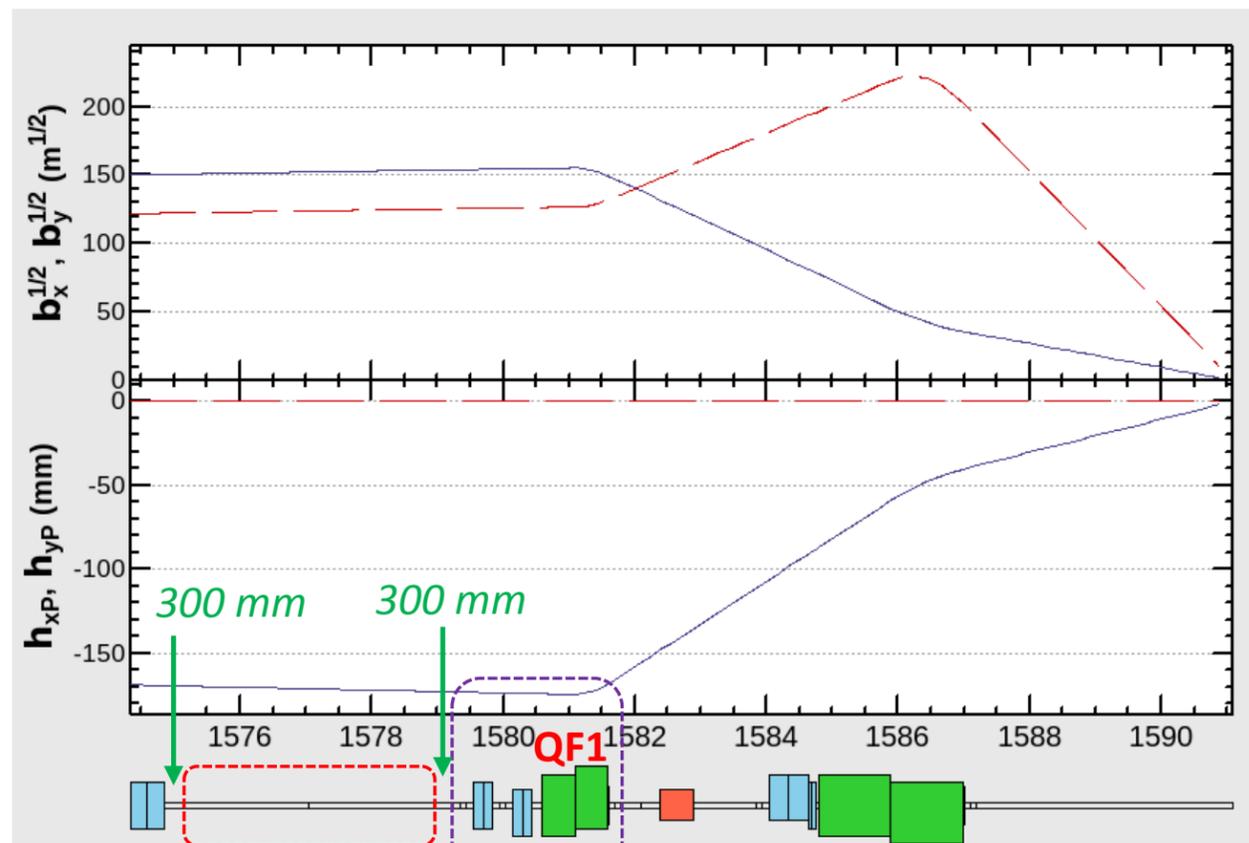
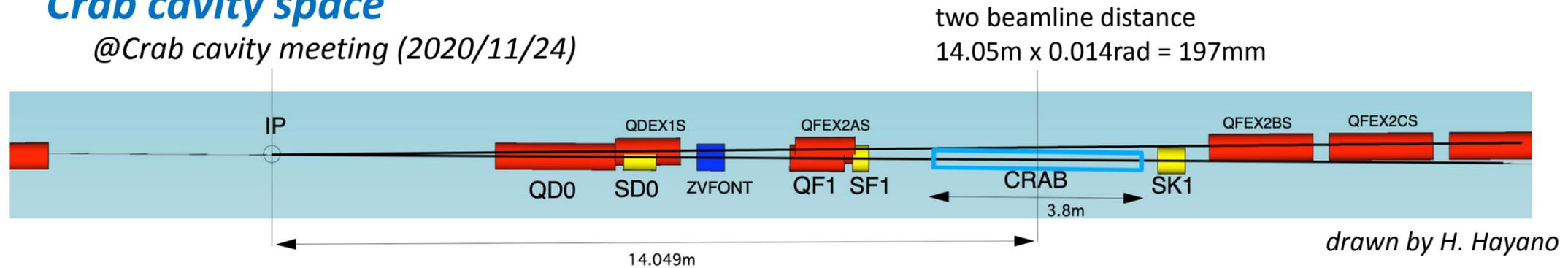
Toshiyuki OKUGI, KEK

IDT WG2 DR/BDS/Dump group meeting

Exact length of the crab cavity space

Crab cavity space

@Crab cavity meeting (2020/11/24)



Space for C.C.
3800 mm

SF1
OC1

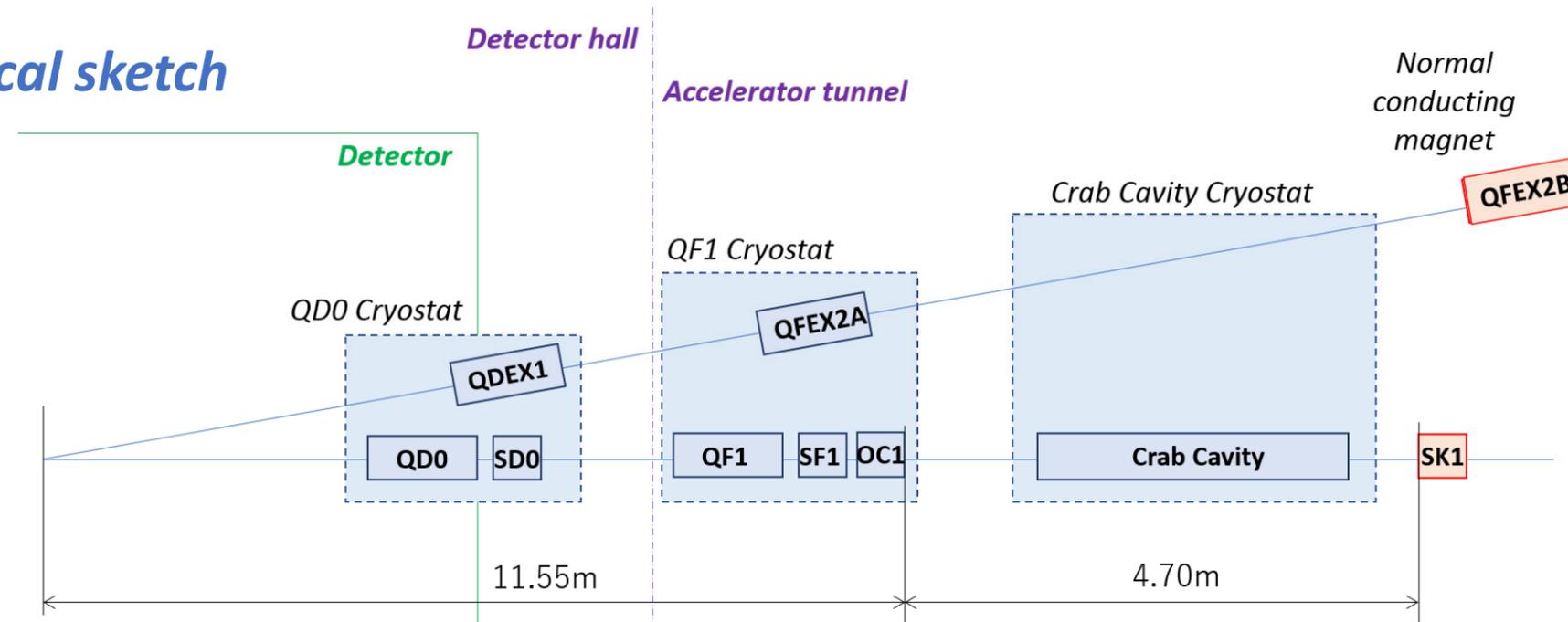
Space for QF1 cryomodule package

Length between OC1 end to QF1 cryomostat end plate : 300 mm

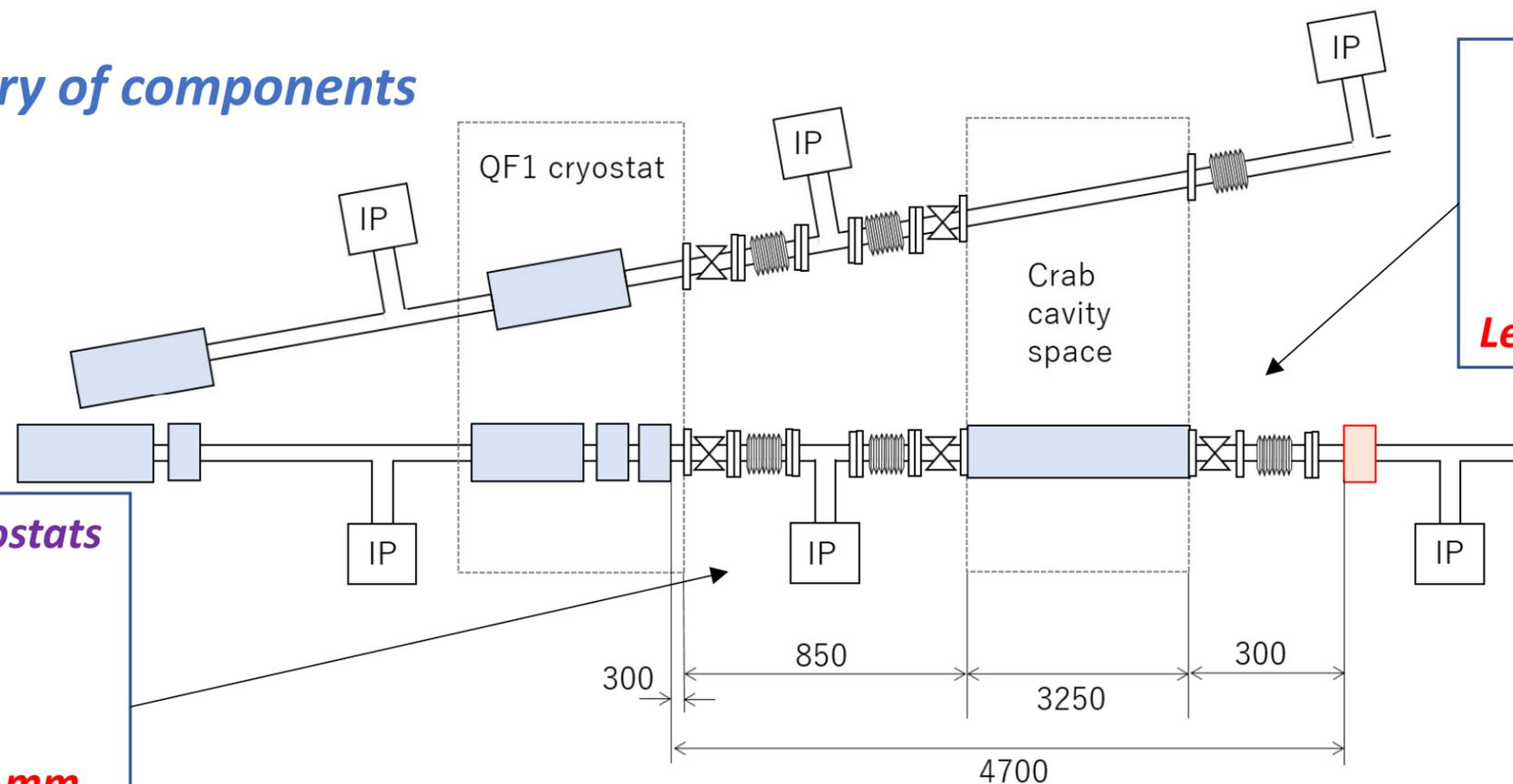
- Although it is not included in the figure above, there is actually an octupole called OC1 between SF1 and the crab cavity. The magnet including OC1 is included in the QF1 cryostat package.
- In the present optics deck, **the distance from the end of OC1 to the end plate of the QF1 cryostat is 300mm**, and the space from there to the space of the crab cavity is also assumed to be **300mm**.
- The distance from the space of the crab cavity to SK1 is also **300mm**.
- Some ideas have been proposed, such as winding OC1 on top of SF1, but all present optics designs are based on the assumption of independent coils. The QF1 cryostat has possibility to be shortened in future, but we would like to consider it based on this drawing for now.

Discussion at the BDS/Crab cavity joint meeting (2022/02/16)

Geometrical sketch



Boundary of components



Length between C.C. cryostat end plate to SK1

- 1 vacuum valve
- 1 bellows

Length of warm section : 300 mm

Warm section in between cryostats

- 4 vacuum valves
- 2 bellows
- 2 vacuum pumps

Length of warm section : 850 mm

After the joint meeting

Comments from crab cavity group

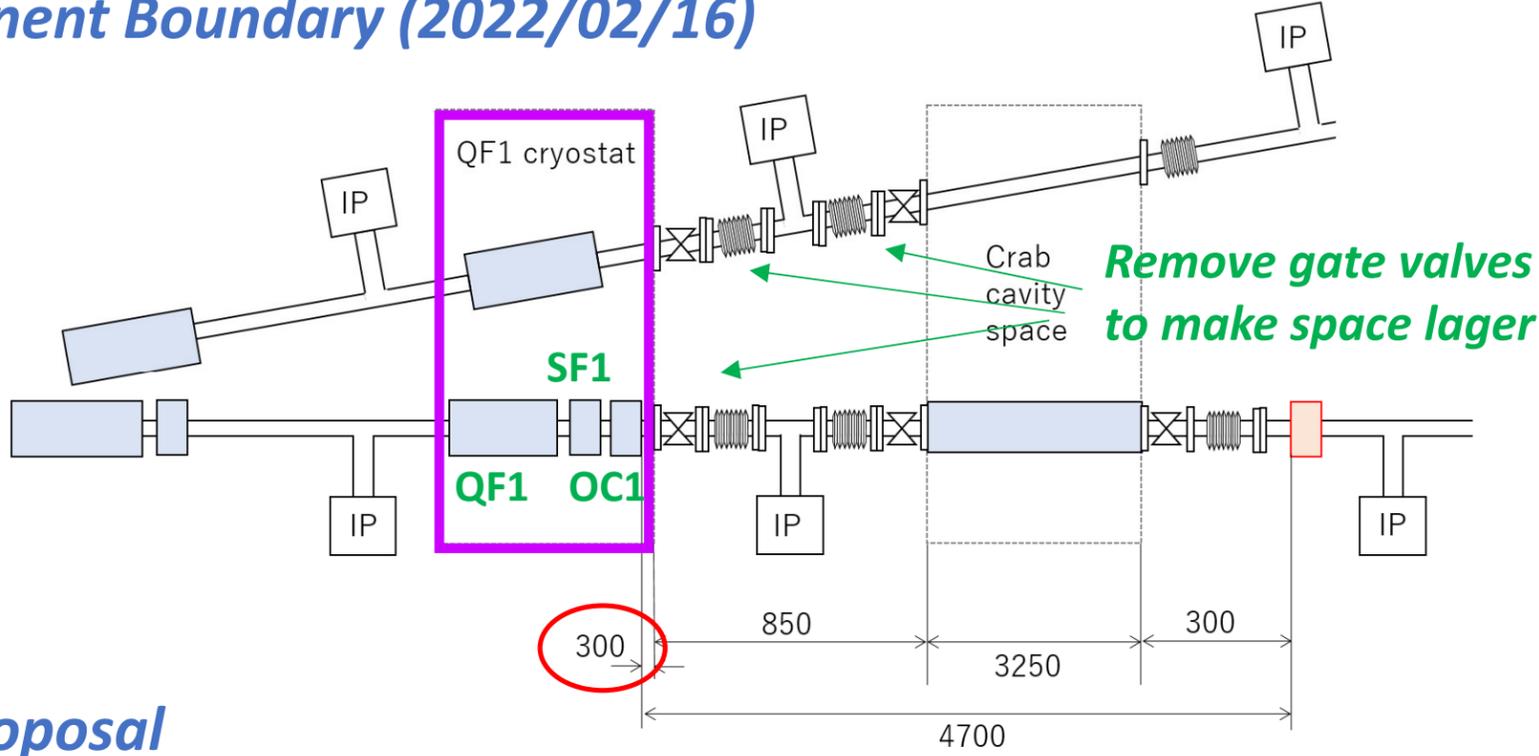
- *More detailed delineation of boundaries is needed.*
- *What kind of devices will fit in either side? For example, vacuum valves on both sides of the cavity should be included in the crab cavity device in order to protect the crab cavity.*
- *They would like to have as long a space as possible for the crab cavity.*

Private communication with Ohuchi-san (superKEKB SC final focus magnet group)

- *SC final focus magnet should not be connected to Crab cavity by cryogenic shield from point of view for alignment and thermal shrink (A warm section should be placed in between).*
- *In SuperKEKB's QCS, the pipe itself is at room temperature, and the vacuum valves are not located on both sides of magnet.*
- *Even if you put in a low-temperature pipe, the boundary should be set to room temperature.*
- *In their experience with the QCS magnets in SuperKEKB, 30 cm is a sufficient space. The crab cavity side also has a space of about 30 cm to accommodate the thermal shield with gate valve as a base design (explain later).*
- *If a space of 30 cm is secured, we do not think that there will be any restriction on the QF1 cryostat (Would like to hear Brett's opinion).*

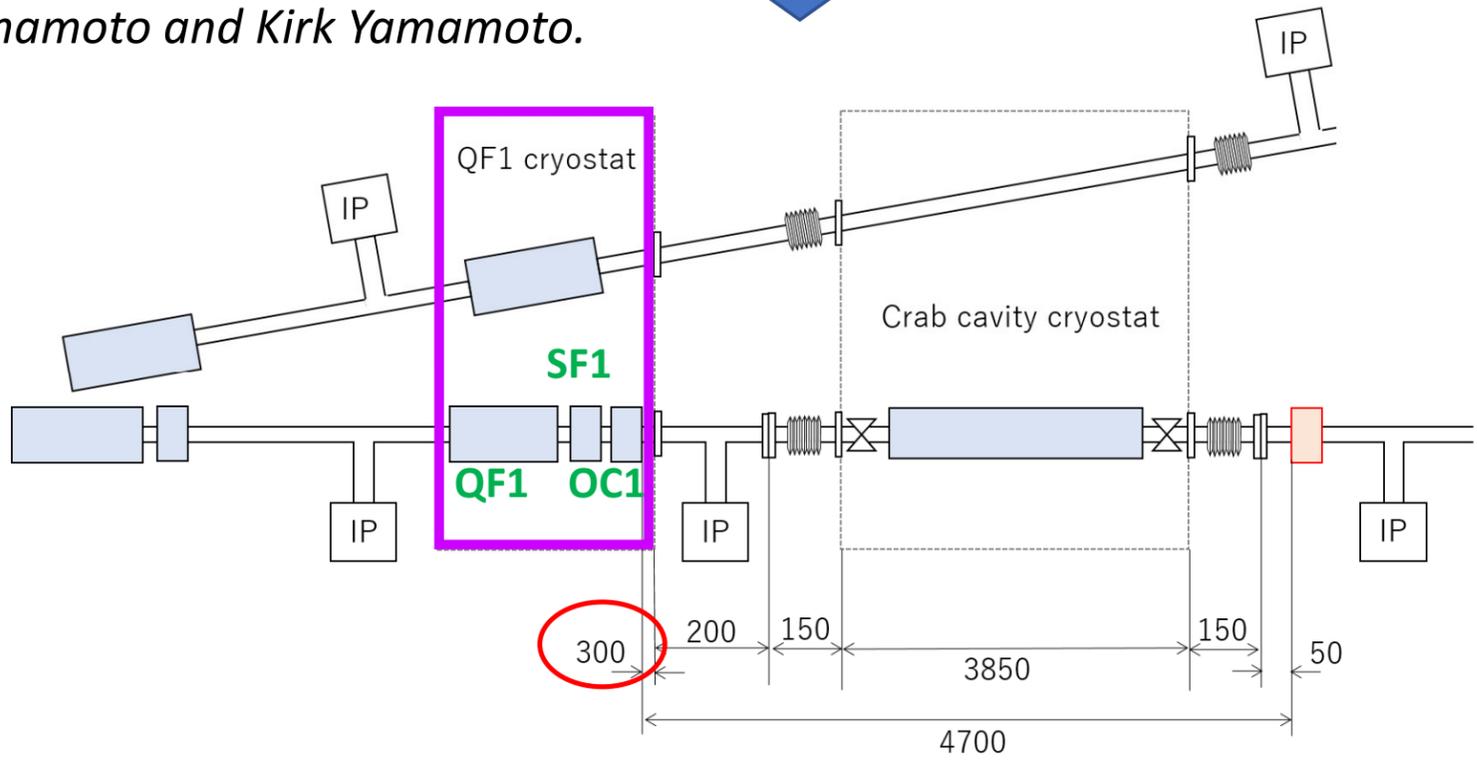
QF1 cryostat arrangement (basically no change)

Component Boundary (2022/02/16)



New proposal

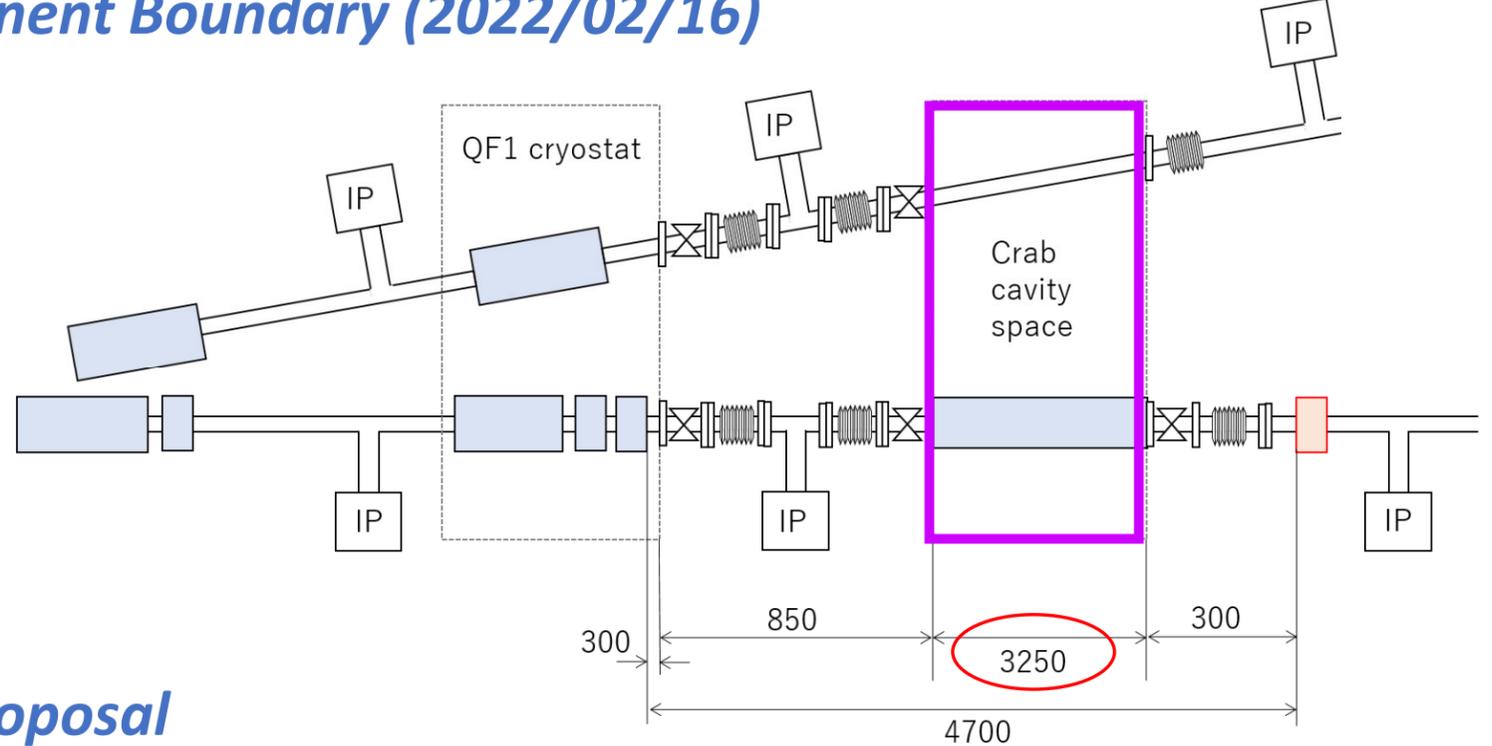
The boundary was fixed by discussing with Akira Yamamoto and Kirk Yamamoto.



- The boundary of the QF1 and crab cavity cryostat will not connect with thermal shield, but will have the **“warm section”** as original design.
- The incoming beamline of the QF1 cryostat has three independent magnet arrangements, QF1, SF1, and OC1.
- A space of 30 cm is provided in the optics deck from the pole face of OC1 to the cryostat boundary. The space will **not change for the proposal to the cryostat arrangement for the crab cavity group.**
- Even if you put in a low-temperature pipe, the boundary should be set to room temperature with the 30 cm space. We should design the QF1 cryostat by taking account of the thermal shield of the pipe.
- If SF1 and OC1 are combined, the space for the thermal shield can be even longer (leaving flexibility in the design).

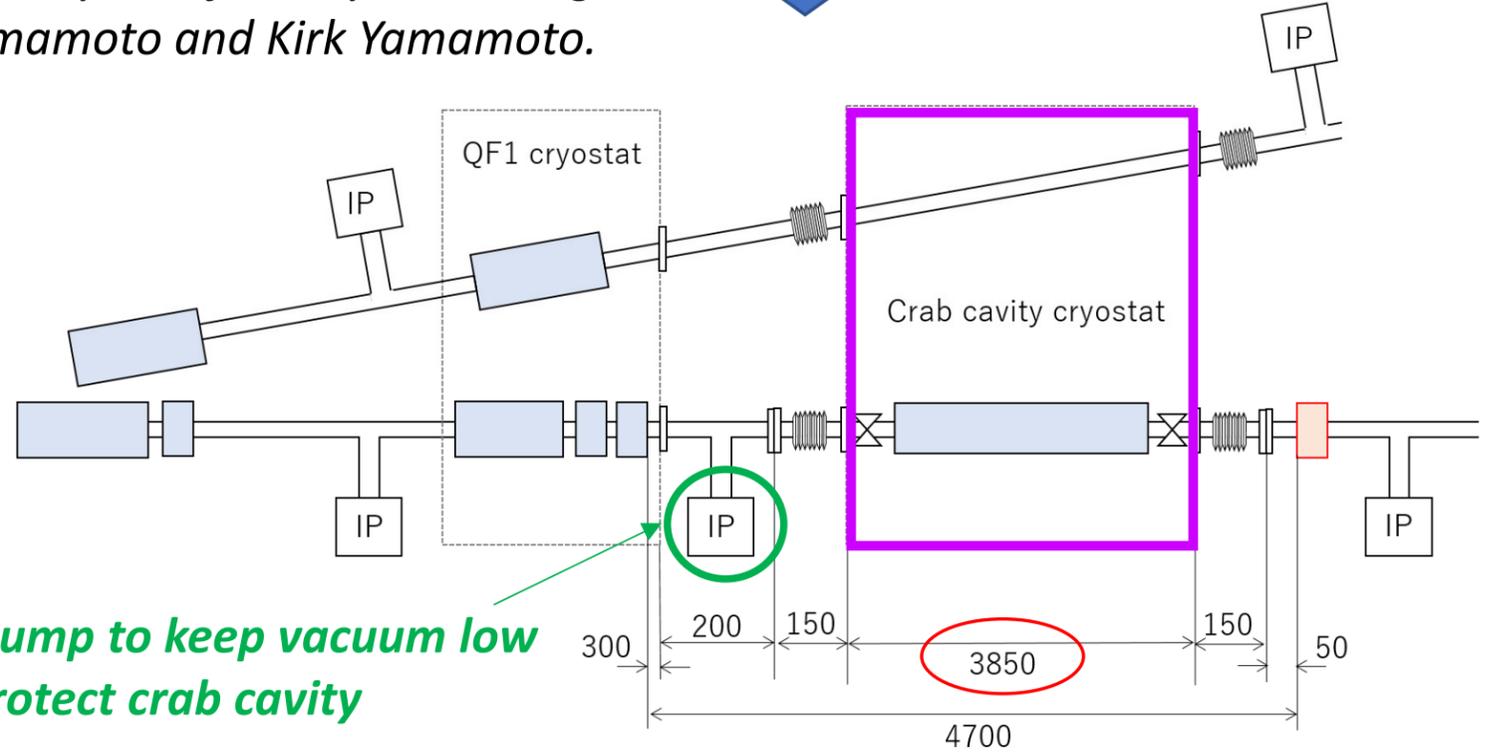
Crab cavity arrangement (new proposal)

Component Boundary (2022/02/16)



New proposal

The boundary was fixed by discussing with Akira Yamamoto and Kirk Yamamoto.



ion pump to keep vacuum low to protect crab cavity

- To avoid contamination of the crab cavity, the vacuum in the warm section must be kept lower than that of the crab cavity when opening the gate valve of the crab cavity.
- Only the warm section on the side of the crab cavity should have an ion pump.
- The space available for the crab cavity has increased from 3250mm to **3850mm**, a 600mm increase.
- However, **the crab cavity cryostat must be designed to include gate valves and thermal shields on both sides.**
- If such a shield can be designed shorter than **300 mm per side**, the space available for the crab cavity itself will become longer than previous design, and if it becomes longer than 300 mm, it will become shorter.