IR Vacuum Chamber and Assembly (for KEKB Upgrade)

corrected version

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15th KEKB Accelerator Committee

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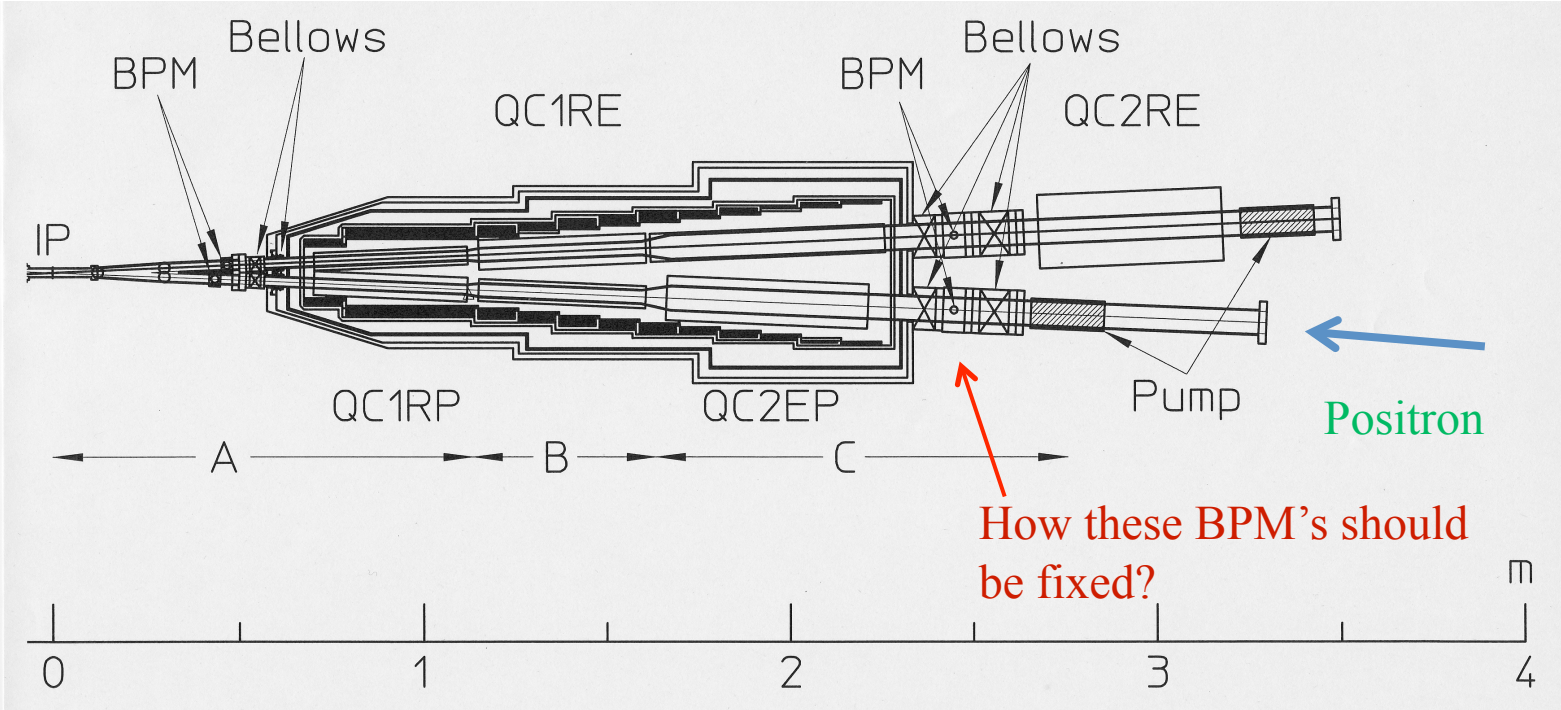
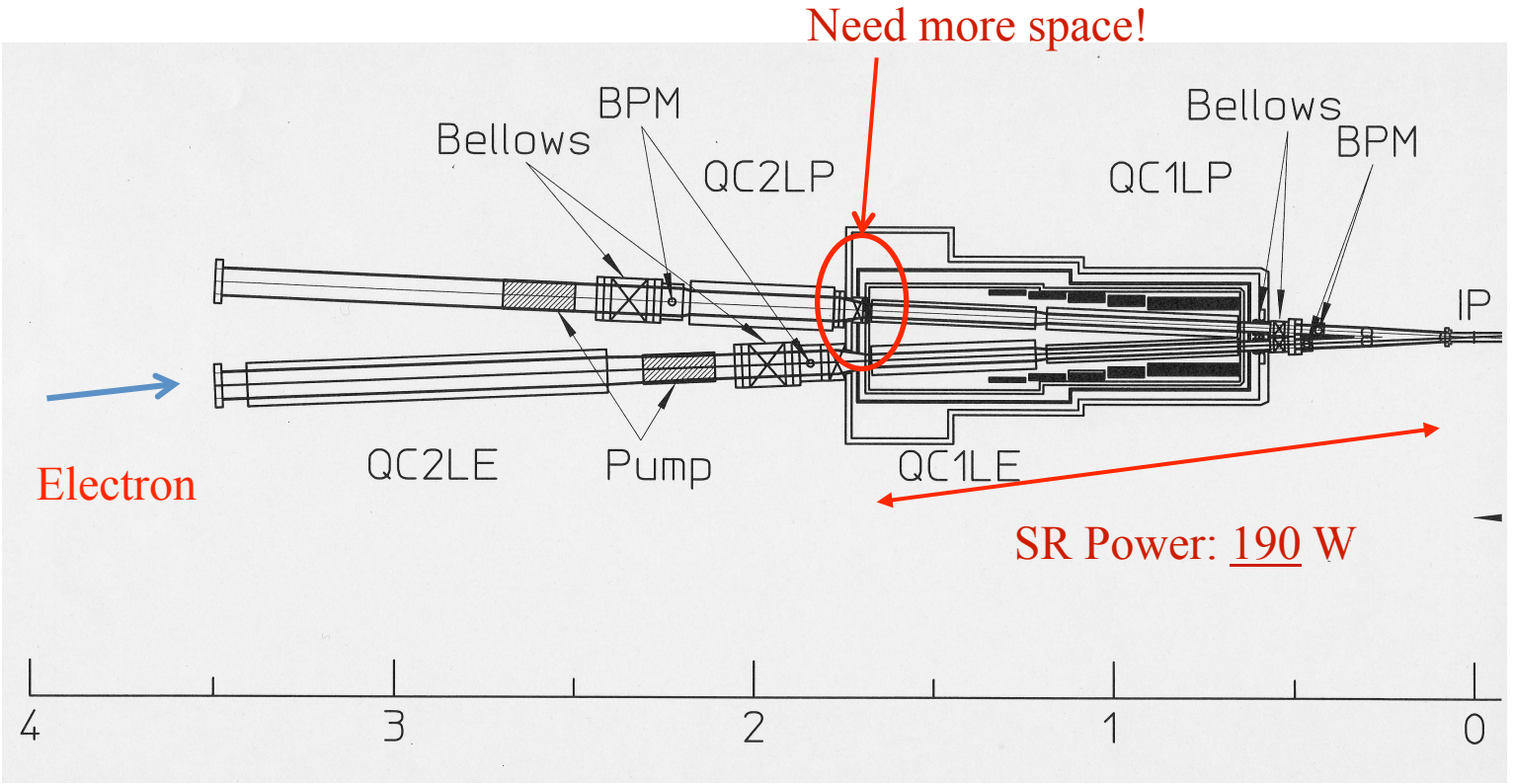
Layout (Right hand Side)



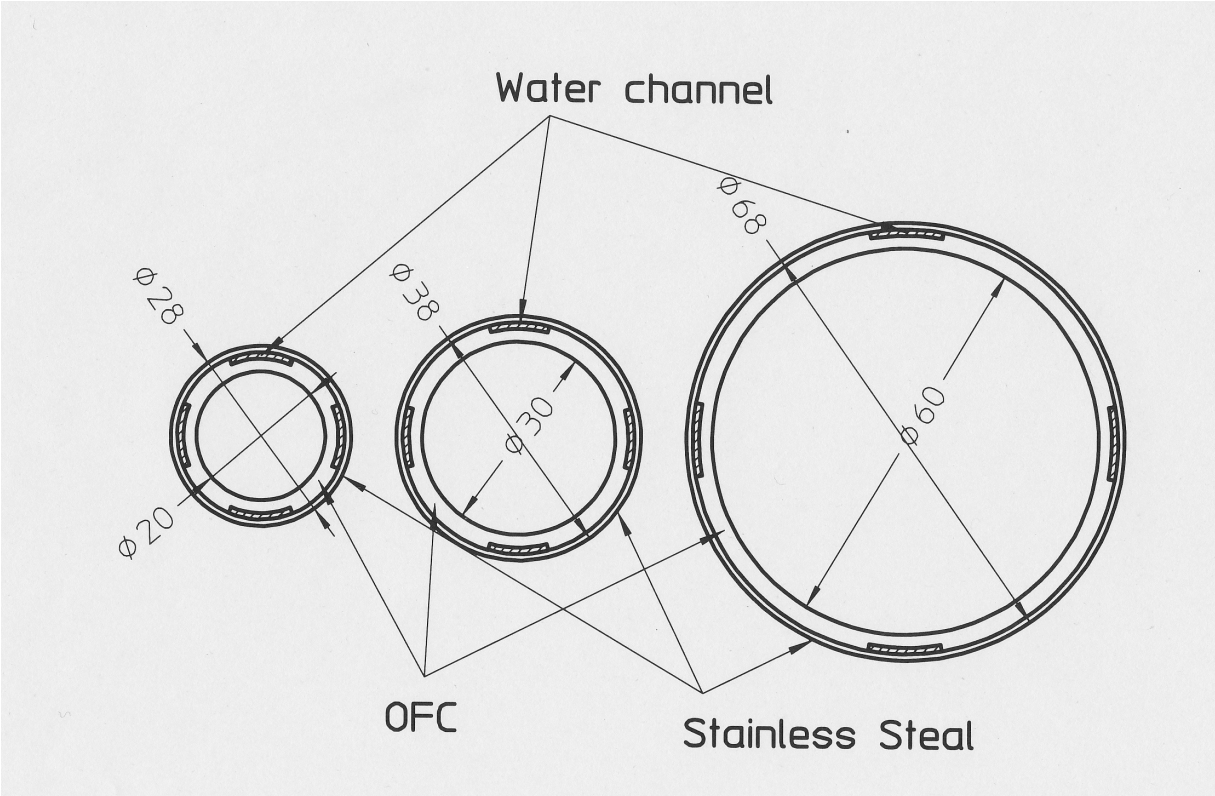
	A	B	C	
Length	1.14	0.5	1.12	m
ID	2	3	6	cm
SR power	240	340	395	W
Ohmic loss (Au)	250	72	81	W

Beam ducts in the cryostat are connected to the cryostat via bellows (not fixed to the cryostat).

Layout (Left hand Side)



Duct Cross Section



Beam ducts in the cryostat are water cooled. A present idea is to use a clad structure. The inner surface of a duct will be gold plated.

Pressure Estimation

	A	B	C	
Length	1.14	0.5	1.12	m
Radius	0.01	0.015	0.03	m
Conductance (C_X)	1.08×10^{-3}	8.29×10^{-3}	2.96×10^{-2}	m^3s^{-1}
Photon load	1.84×10^{18}	2.60×10^{18}	3.03×10^{18}	Photons s^{-1}
Gas load (Q_X)	$7.45\times10^{-3}\eta$	$1.05\times10^{-2}\eta$	$1.23\times10^{-2}\eta$	Pa m^3 s^{-1}

Simplified model for the incoming positron line

P_0 : Pressure at the pump (pumping speed = S)

$$P_0 = \frac{\sum_{X=A,B,C} Q_X}{S} = 1.01\eta \quad [\text{Pa}] \quad (S = 0.03\ \text{m}^3 s^{-1})$$

$$P_{IP} = P_0 + \frac{1}{2}\sum_{X=A,B,C}\frac{Q_X}{C_X} + \frac{Q_A + Q_B}{C_C} + \frac{Q_A}{C_B} = P_0 + 5.8\eta \quad [\text{Pa}]$$

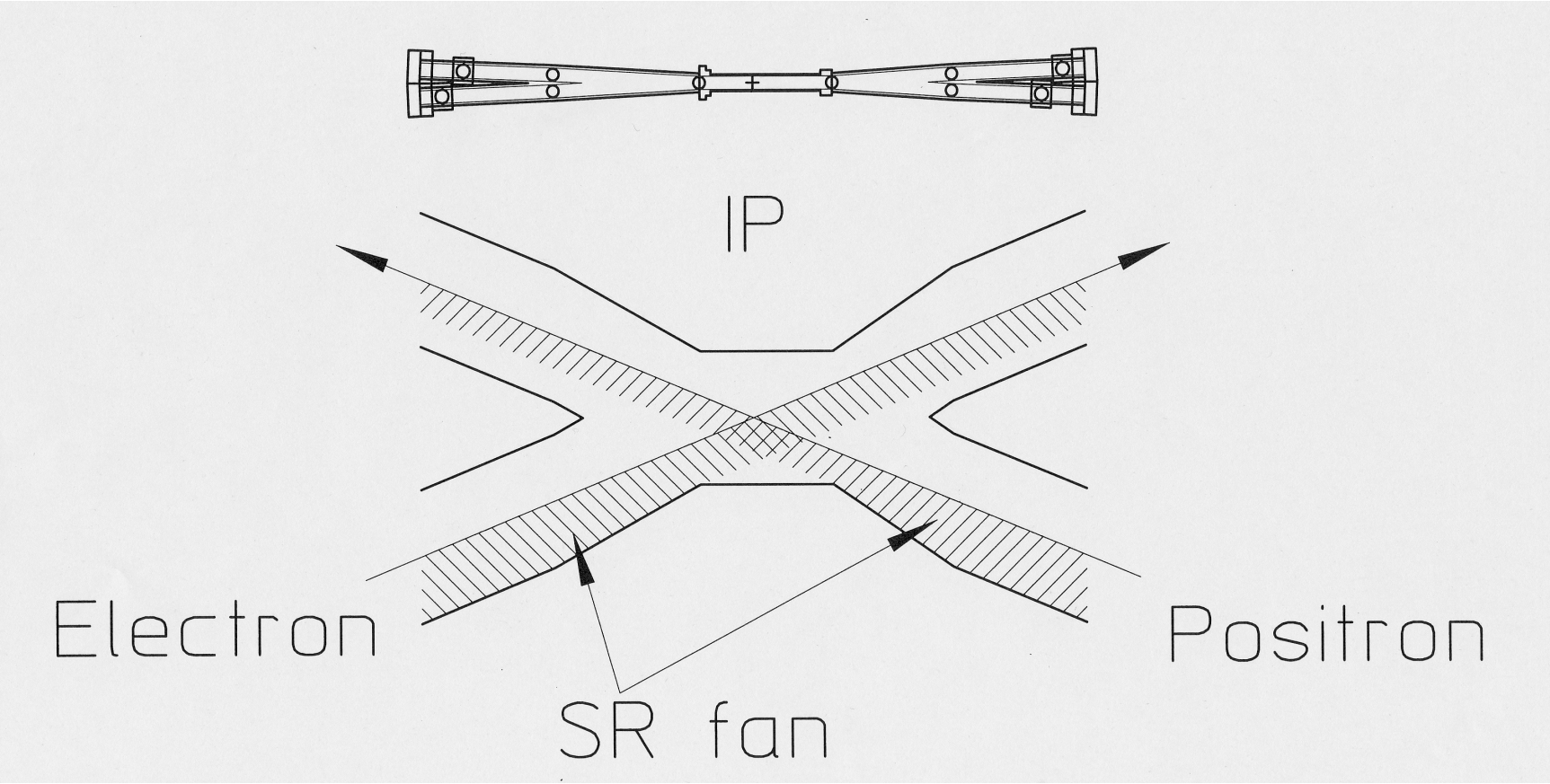
$\eta = 10^{-5}$ (after $\sim 10^{24}$ photons m^{-1})

$\rightarrow P_0 = 1.0\times10^{-5}$ [Pa], $P_{IP} = 6.8\times10^{-5}$ [Pa]

η: Photo-desorption Coefficient

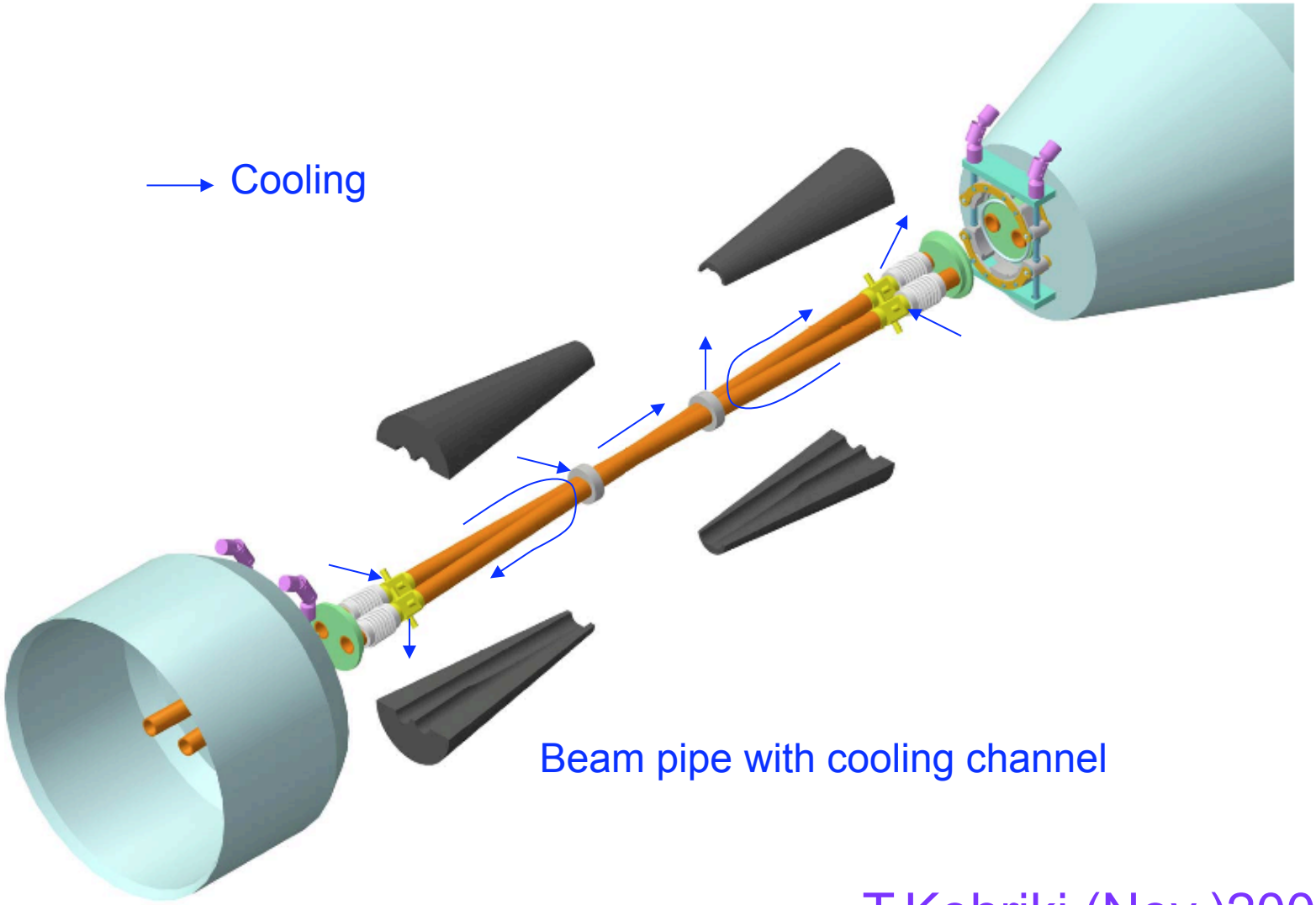
Small conductance and limited space for pumping result in a high pressure around IP. However according to the background study using a pressure bump in the present KEKB, these pressures seem to be acceptable.

IP Chamber



The polarity of the last bend is designed so that SR fan from the bend may not directly hit the central part of the IP chamber (in the 0^{th} approximation).

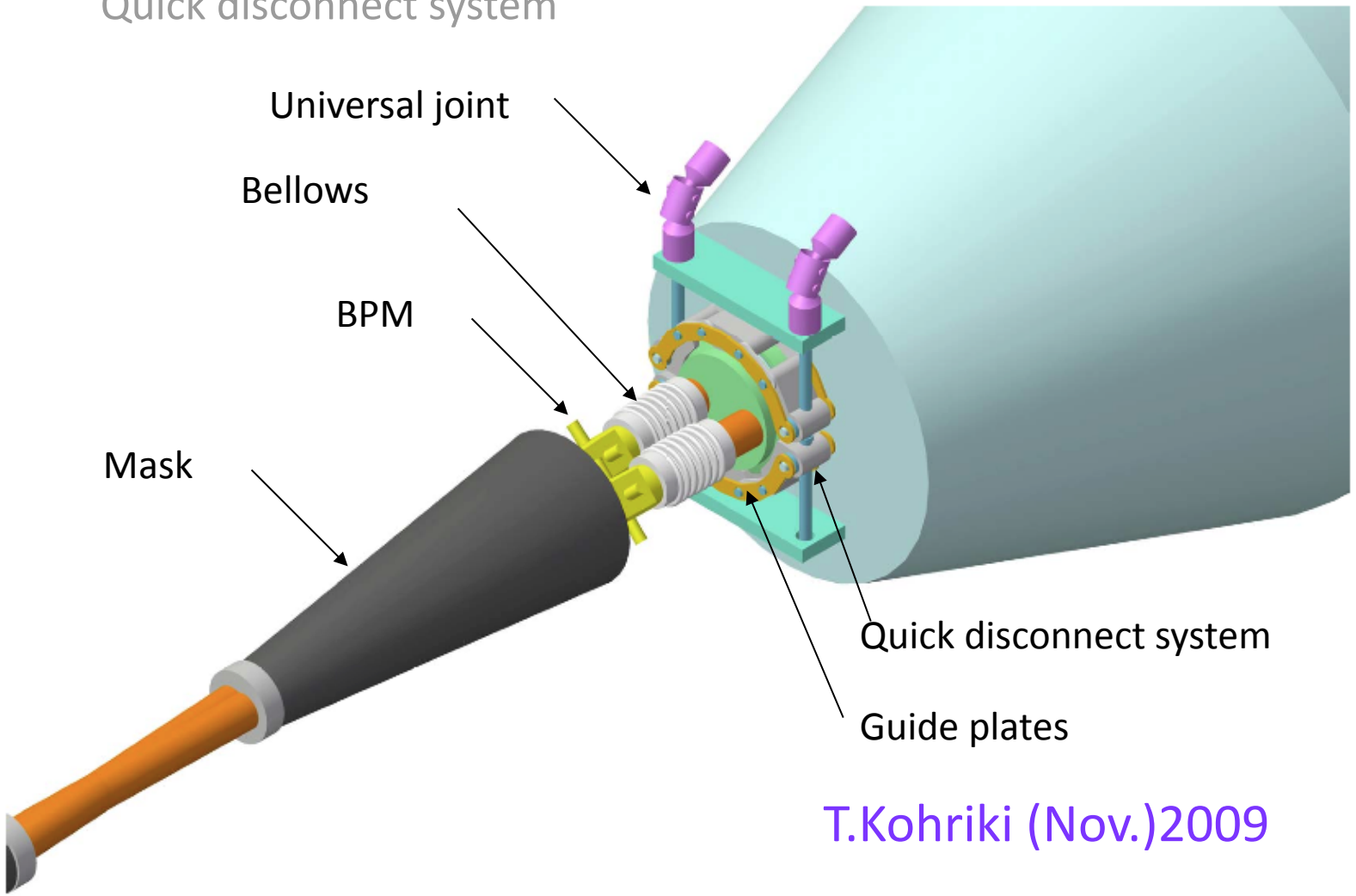
IP Chamber



T.Kohriki (Nov.)2009

IR Assembly - Idea 1

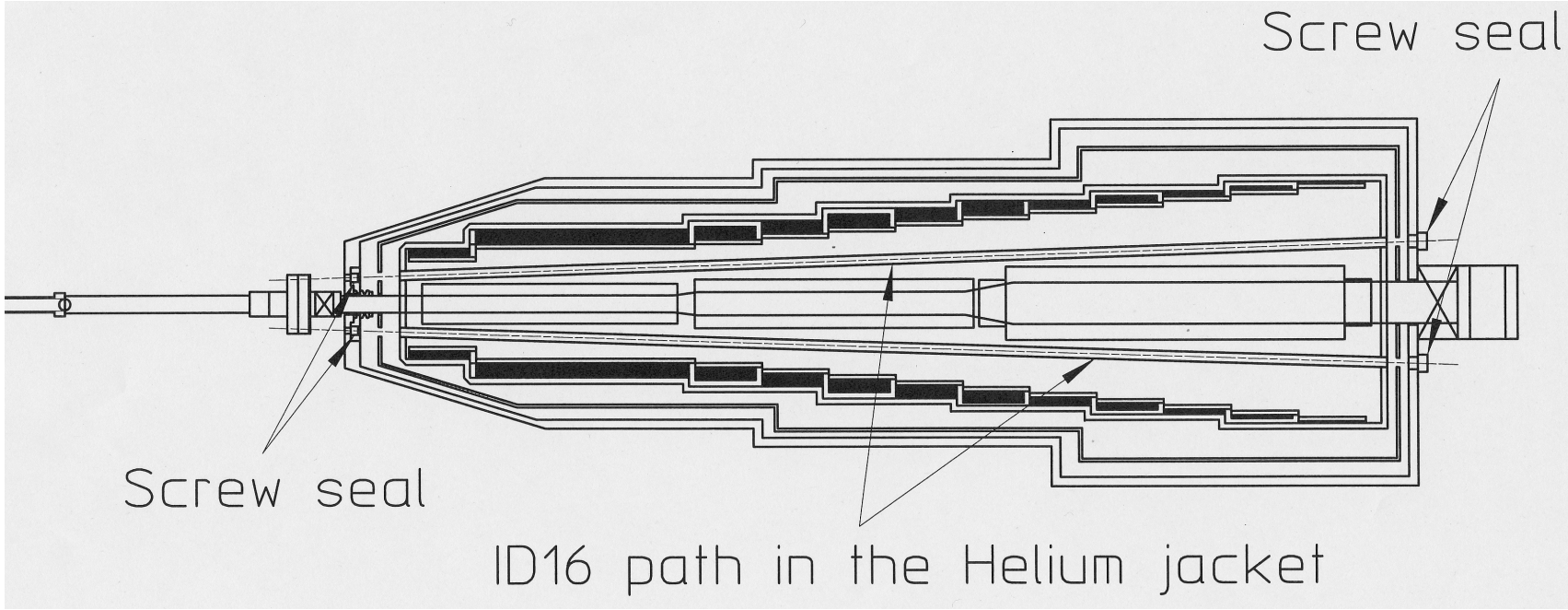
Quick disconnect system



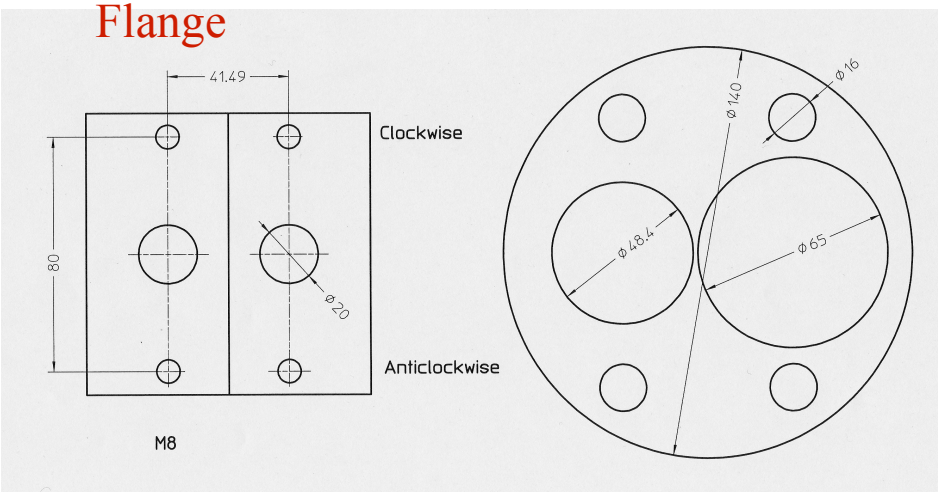
T.Kohriki (Nov.)2009

How to connect the IP chamber to beam ducts in the cryostat is the key issue in the IR design. This picture shows one of ideas for connection.

IR Assembly - Idea 2

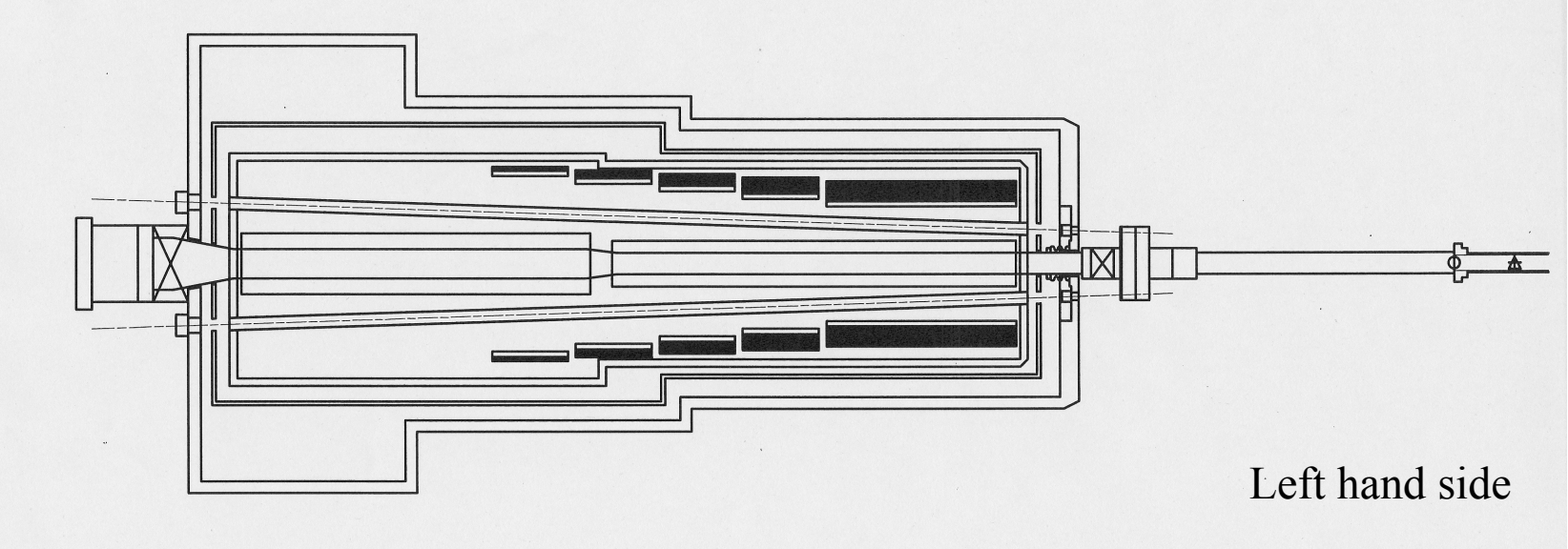


Flange



The second idea is to introduce pipes in a helium jacket for a rod to tighten screws for connecting flanges.

IR Assembly – Idea 2



Summary

- Conceptual design for IR chambers is shown.
  - Beam ducts in the cryostat are water cooled. The clad structure with OFC and stainless steal is proposed. The surface of OFC will be gold plated.
  - Beam ducts are not fixed to the cryostat but connected with bellows.
  - Some space for duct connection should be negotiated.
  - Some BPM's need a reference to fix their position.
- The pressure around IP will be 10^{-4} to 10^{-5} Pa. However no serious effect on the detector background is anticipated.
- The central part of the present IP chamber is free from direct synchrotron radiation from the last bend.
- The connection between the IP chamber and cryostat beam ducts is a key issue. Comments are welcome.