

Brief summary of DR/BDS/DUMP group meeting (12/22)

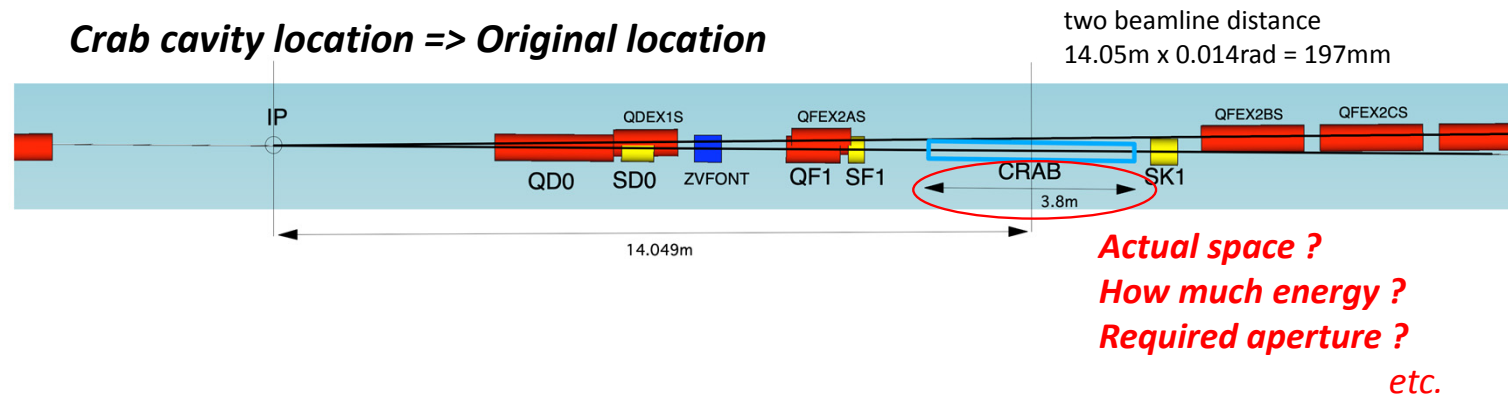
Attendees : Phil Burrows, Angeles Faus-Golfe, Jenny List, Thomas Markiewicz, Peter McIntosh, Toshiyuki Okugi, Brett Parker, Ivan Podadera, David Rubin, Robert Ryne, Nobuhiro Terunuma, Akira Yamamoto, Yasuchika Yamamoto, Kaoru Yokoya, Mikhail Zobov

2022/01/11
Toshiyuki OKUGI, KEK
IDT WG2 meeting

Explanation of the status of the ILC crab cavity and discussion within the BDS group.

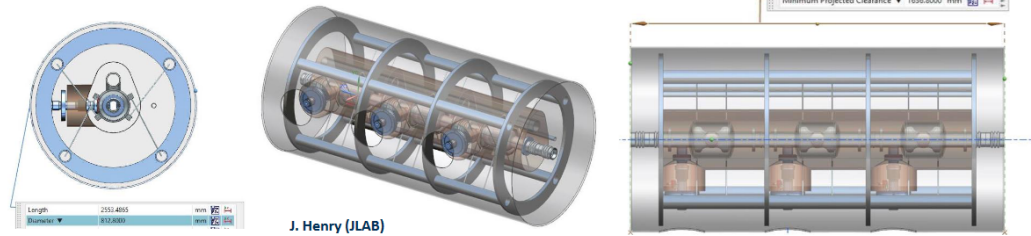
First CC down-selection on 17th Sept. 2022.
(technology selection for 2 prototypes)

CC group request to show the requirement for crab cavity from BDS side by March 2022
as inputs for the technology selection.



RF Dipole (RFD)

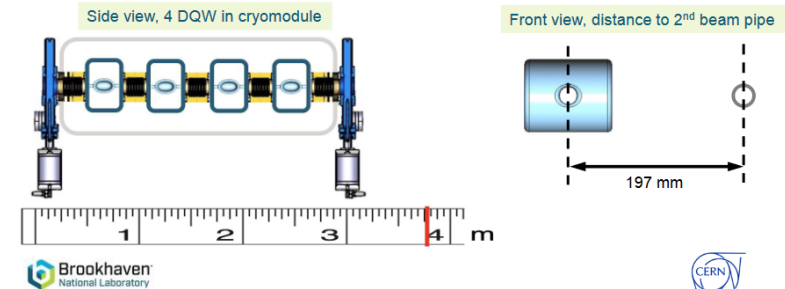
- 1 cryomodule for 1.845 MV at 250 GeV
 - 3 cavities in a single cryomodule allow operation with a cavity failure
- 3 cryomodules for 7.4 MV at 1 TeV
- Cryomodule size: length ~ 1.64 m and diameter ~ 0.82 m
- Design concept follows JLab C100 cryomodule



Frequency : 1.3GHz
 Aperture : 30mm
 Length (1TeV) : **4.9m (3 cryomodule)**

Double Quarter Wave (DQW)

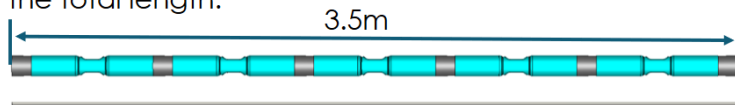
- For 1 TeV CoM beam scenario, **4 or 5 DQW cavities** are sufficient to **provide a 7.4 MV crabbing kick at 1.3 GHz**. Adding a 5th cavity could reduce the V_r /cavity to 1.5 MV.
- Length available of **3.8 m enough for crab cavities and other necessary components** (cold-warm transitions, gate valves, etc.).
- Sufficient **clearance to 2nd beam pipe for coupler integration**.



S. Verdú-Andrés (BNL) | ILC Workshop 2021 | Slide 14

Wide open waveguides (WOW)

- Simple design with single cell cavities and BLAs between cavities.
- Total length 3.5m.
- Use 2 cavities for 125GeV first, depending on the operational experience, choose either 4 or 5 cavities for 500GeV.
- Reducing the beampipe diameter can further reduce the total length.



Gate valves, bellows and cryomodules not shown here, they will not occupy extra length though.

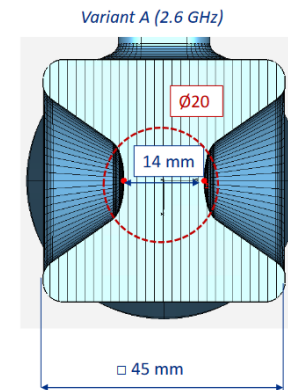
Frequency : 1.3GHz
 Aperture : 20mm
 Length (1TeV) : 3.5m (5 cryomodule)

QMIR cavity

ILC CC Aperture Limit is $\lt; \varnothing 20 \text{ mm}$ (?)

Frequency : 1.3GHz
 Aperture : 20mm
 Length (1TeV) : 3.3m (4 DQW)

Frequency : 2.6GHz
 Aperture : **14mm? ($\lt; 20\text{mm}$)**
 Length (1TeV) : 1.0m (2 cavity)



- QMIR Deflecting Cavity has two opposite electrodes
- Smaller distance between electrodes provides a larger transverse kick
- The SR halo causes the heating of the electrodes
- The total area of SR interception is $\lt; 20\%$ of the "effective" aperture
- Can we tolerate a smaller than 20mm distance?
 - ILC BDS group input is needed
- What is a safe maximal SR power dissipation?
 - For a front pair of electrodes with $dT < 0.5K$:

$$P_{max} \approx 2K_{th}S_e dT / (DF \cdot h_e) \approx 100W$$

$$K_{th} = 10 \text{ W/m/K} - \text{thermal conductivity}$$

$$S_e, h_e - \text{electrode cross-section and height}$$

$$DF = 3.6 \cdot 10^{-3} - \text{duty factor}$$
- We can easily redesign QMIR to a larger aperture
 - in progress ...

During the meeting, we decided to have **a joint meeting of the crab cavity group and the BDS group to finalize the BDS request for the crab cavity.**

- *It was discussed that 2/2(WED) or 2/16(WED) would be good dates during the meeting.*
- *I consider to have the joint meeting **at 2/16 22:00-24:00 (JST).***
- *I'll send out an announcement later, please let me know if you are inconvenient.*

Discussion items

- **What is the actual length (flange to flange) that the crab cavity can be used?**
 - ✓ *We will consider a more precise estimate than we have now.*
- **What is the aperture of the crab cavity?**
 - ✓ *I will prepare the input for the collimation depth at ECM=500 GeV, taking into account the reduction of horizontal emittance (parameters have not been formally discussed yet).*
- **Up to what energy should we place a usable crab cavity at the start of ILC operation?**
 - ✓ *In the previous meeting, it was suggested that ECM=250 GeV is sufficient, but we would like to hear from anyone who disagrees, because it is related to the energy upgrade scenario.*
- **Contingency ?**