ILC main linac splitable quadrupole magnet and cold cavity BPM R&D

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On behalf of the IFIC and CIEMAT teams

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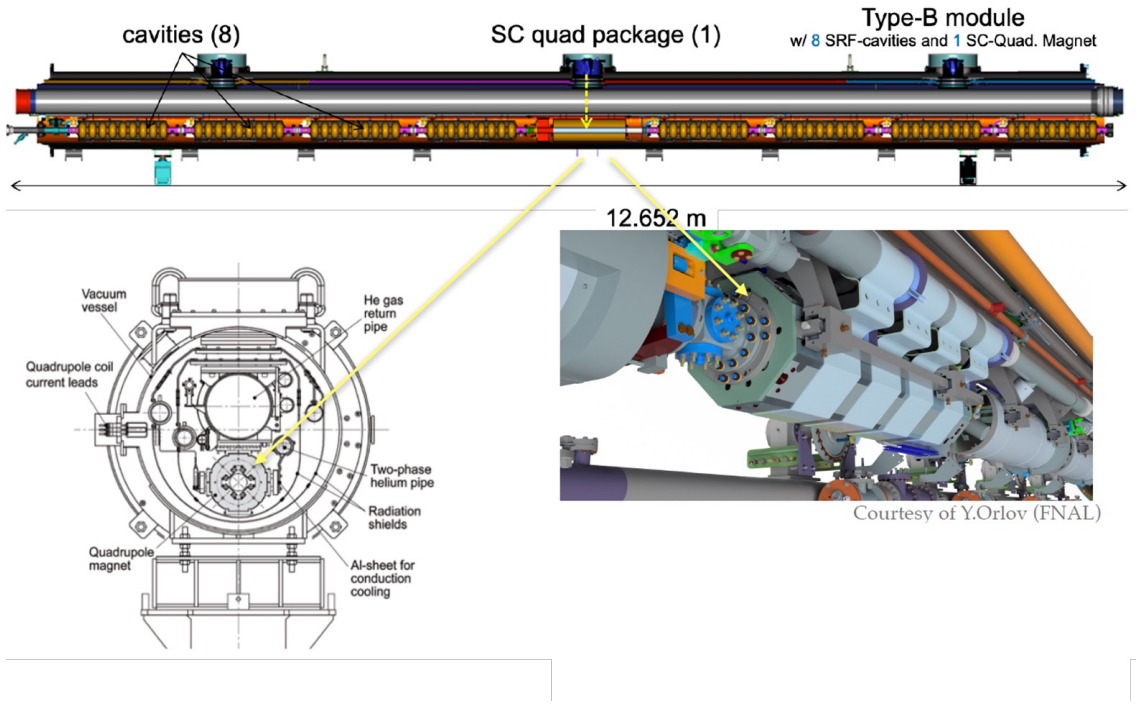
ILC cryomodule

Thanks to Ó. Durán, L. García-Tabarés, F. Toral (CIEMAT)

- SRF string for beam acceleration.
- A SC quadrupole (SCQ) package is placed at the center of the cryomodule, type B.
- The SCQ package consists of a main quadrupole magnet combined with dipole corrector and beam-position monitor.
- Two types of magnets located at low energy and high energy sections.
- Dark-Current energy absorption in the SC-coils compromises the operational margin of the superconductor.



ARIMOTO *et al.*: Design Study of a Superconducting Quadrupole Magnet System Sustainable Under Dark Current Heating in ILC Main Linac

Parameters	Unit	Low Energy (5-25 GeV)	High Energy (25-250 GeV)
Dimensions:			
Physical length	m	0.25	1
Magnetic length	m	0.20	0.95
Iron-pole radius	m	0.045	
Quadrupole field:			
Field gradient (G)	T/m	19	40
G-Integral (required)	T	3.8	38
B_G at pole	T	0.86	1.8
Dipole field:			
B0	T	0.05	0.11
B-integral (required)	T · m	0.01	0.10
B max:			
in coil	T	~1.5	~3

CIEMAT contribution

Present CIEMAT commitment

Thanks to Ó. Durán, L. García-Tabarés, F. Toral (CIEMAT)

- Study Nb_3Sn alternative for increasing the temperature margin.
  - Tc @3T: NbTi = 7 K ; Nb3Sn = 13 K ; MgB_2 = 15 K
- Design and manufacture of a Nb_3Sn test coil. (MgB_2 option has been discarded).
- Preparation of a cryogenic station for conduction cooling tests using a cryocooler.
- Study of the Nb_3Sn test coil on conduction cooling.
  - Coil performance
  - Thermal margin
  - Dark currents heat management

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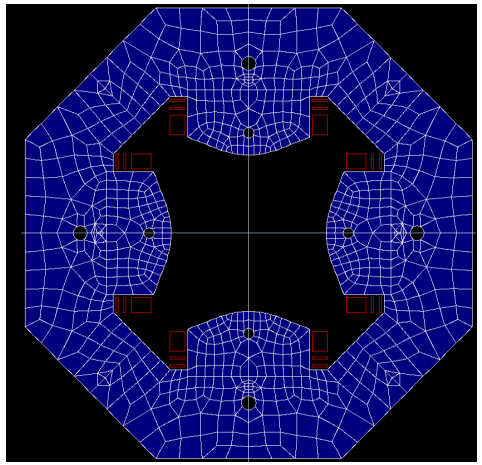
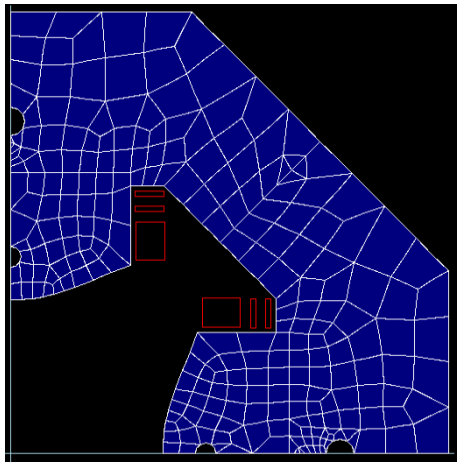




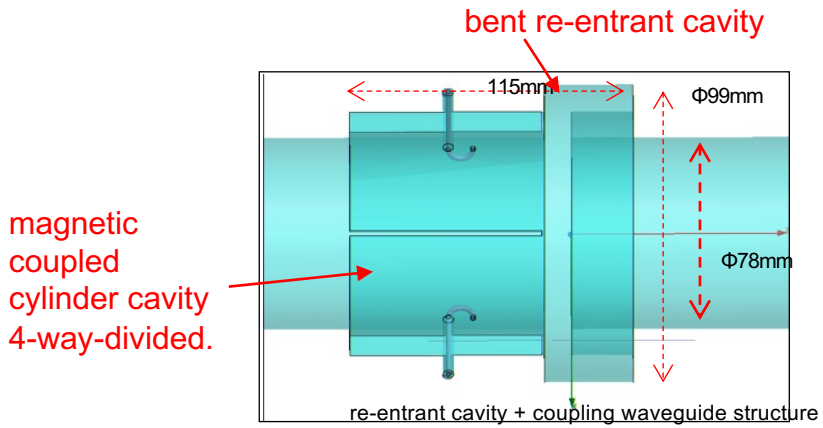
Commitment extension under study

- Design and fabrication of a model magnet for ILC low energy type SQC magnet, based on test coil results.

IFIC contribution

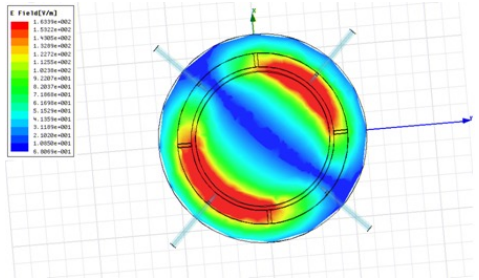
Cold-cavity BPM R&D

- Improve the last KEK+KNU prototype tested at KEK.

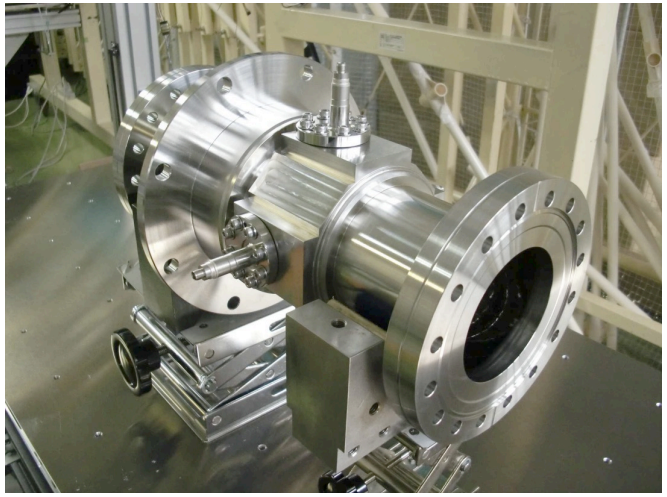


design: S.-Y. RYU

Thanks to H. Hayano



dipole mode: 2.04GHz



Design based on the re-entrant cavity BPM constructed and tested by the KEK (H. Hayano) and the Korean groups (Si-won Jan et al.).

General requirements:

- High precision BPM with a time nanometer resolution (< 369 ns) and a spatial resolution < 1 µm.
- ILC beam bunch by bunch measurements (fast readout electronics).
- Low beam dynamics impact (wakefields studies).
- Ultra high-vacuum and cryogenic temperatures performance.
- Special mechanical design for ease cleaning.

IFIC contribution

WP1: Design and optimization studies.

- EM, common mode rejection methods study and beam dynamics.
- Mechanical studies to ease cleaning and ultra-high vacuum performance.
- Cost design studies -> in synergy AVS (Spanish company).

WP2: Integration/alignment with the quadrupole magnet and cryomodule considerations.

- Precise CM-1 BPM attachment method into quadrupole study.

WP3: Development of the readout electronics and data acquisition system.

- Including the position sign data without reference cavity.

WP4: Manufacturing of the prototype (AVS Spanish company).

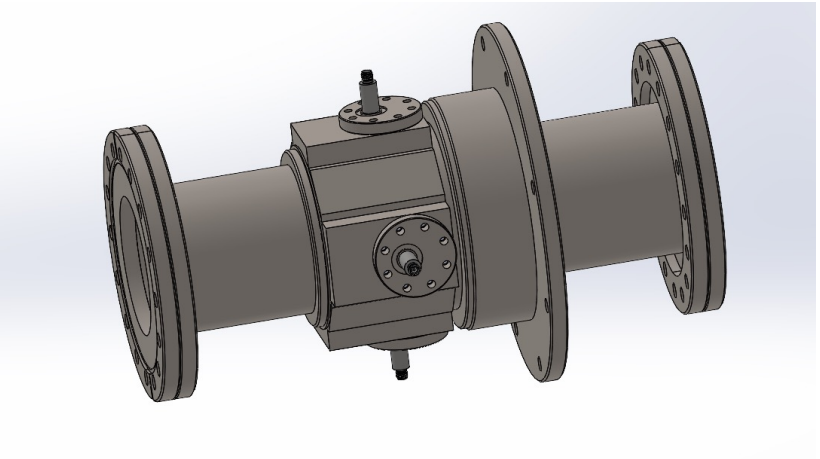
WP5: Commissioning/tests without beam at IFIC and KEK.

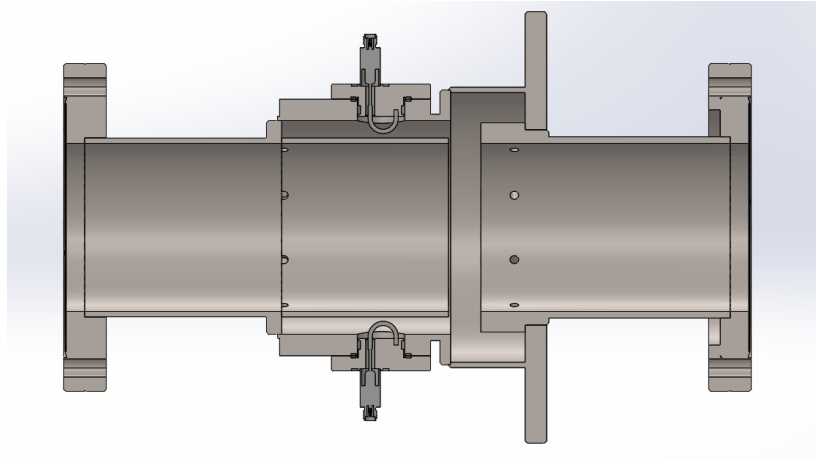
- Calibration, vacuum and cryogenic temperatures tests.
- Installation in a cryomodule within the ILC program.

WP6: Commissioning/tests with beam at ATF/STF.

- Resolution measurements.

3D model by C. Blanch





Thank you very much for your attention