European ILC community meeting

Wednesday 24 Aug 2022, 10:00 → 12:00 Europe/Zurich

Description https://desy.zoom.us/j/99341718959
Meeting ID: 993 4171 8959
Passcode: 190525

10:00 → 10:20 **Welcome** 20m

- Including impressions from Snowmass

Speaker: Steinar Stapnes (CERN)

10:25 → 10:45 **International discussions and IDT news** 20m

Speaker: Tatsuya Nakada (EPFL - Ecole Polytechnique Federale Lausanne (CH))

10:50 → 11:20 **European planning for priority WPs** 30m

Speaker: Steinar Stapnes (CERN)

11:20 → 11:40 **WG3, ECFA panels** 20m

WG2, WG3, Snowmass, ECFA panels and conference, Conferences

Speakers: Aidan Robson (University of Glasgow (GB)), Jenny List (Deutsches Elektronen-Synchrotron (DE))

11:40 → 11:50 **AOB and next meeting** 10m

European planning

News/updates:

- Still optimimism for MEXT funding request to the ILC Technology Network (aka Priority WPs)
- Meet with Fabiola and Mike Lamont Friday this week
- In the process of extending the CERN-KEK IDT agreement
- LDG meeting 5.9

- More refined planning on the IDT WG2 side (see examples at link): https://agenda.linearcollider.org/event/9724/ (and some examples on next slides) – expected European efforts not always clear

IDT-WG2

IDT EB

IDT WG2
Shin Michizono (Chair)
Benno List (Deputy)

ML&SRF group

Yasuchika Yamamoto	***KEK***
Sergey Belomestnykh	FNAL
Nuria Catalan	CERN
Enrico Cenni	CEA
Dimitri Delikaris	CERN
Luis Garcia Tabares	CIEMAT
Rongli Geng	ORNL
Hitoshi Hayano	KEK
Bob Laxdal	Triumf
Matthias Liepe	Cornell
Peter McIntosh	STFC
Laura Monaco	INFN Milano
Olivier Napoly	CEA
Sam Posen	FNAL
Robert Rimmer	JLAB
Marc C. Ross	SLAC
Kensei Umemori	KEK
Hans Weise	DESY
Akira Yamamoto	KEK

DR/BDS/Dump group

Toshiyuki Okugi	***KEK***
Karsten Buesser	DESY
Philip Burrows	U. Oxford
Angeles Faus-Golfe	LAL
Andrea Latina	CERN
Kiyoshi Kubo	KEK
Jenny List	DESY
Thomas Markiewicz	SLAC
Brett Parker	BNL
Ivan Podadera	CIEMAT
David L. Rubin	Cornell
Nikolay Solyak	FNAL
Nobuhiro Terunuma	KEK
Glen White	SLAC
Kaoru Yokoya	KEK
Mikhail Zobov	INFN LNF

Dump sub-group

Nobuhiro Terunuma	***KEK***
Toshiyuki Okugi	KEK

Crab sub-group

Peter McIntosh	***STFC***
Yasuchika Yamamoto	KEK

Sources group

Kaoru Yokoya	***KEK***
Jim Clarke	STFC
Steffen Doebert	CERN
Joe Grames	JLAB
Hitoshi Hayano	KEK
Masao Kuriki	U. Hiroshima
Benno List	DESY
Jenny List	DESY
Gudrid Moortgat-Pick	U. Hamburg
Tsunehiko Omori	KEK
Sabine Riemann	DESY
Peter Sievers	CERN -retired
Tohru Takahashi	U. Hiroshima

Civil engineering group

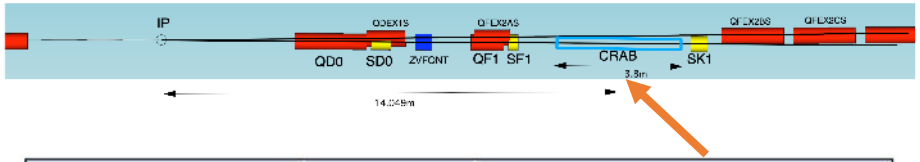
Nobuhiro Terunuma	***KEK***
John Andrew Osborne	CERN
Tomoyuki Sanuki	U. Tohoku

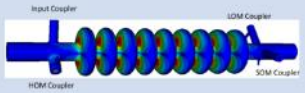
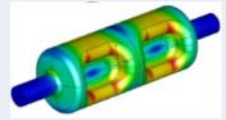
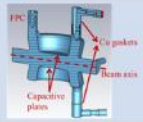
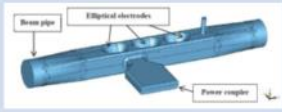
WP-prime 3: Crab Cavity Development with down-selection

- RF property simulation to optimize cavity design
- Pre-down-selection to choose two primary candidates
- Development and evaluation of two prototype cavities
- Demonstration of synchronized operation with two prototypes
- Down-selection to choose final cavity design
- Cryomodule design based on final cavity design

Item	Recent specification (after TDR)
Beam energy	125 GeV (e^-)
Crossing angle	**14 mrad**
Installation site	14 m from IP
RF repetition rate	5 Hz
Bunch train length	727 μsec
Bunch spacing	554 nsec
Operational temperature	2.0 K (?)
Cavity frequency	1.3/3.9 GHz
Total kick voltage	1.845/0.615 MV
Relative RF phase jitter	0.023/0.069 deg rms (49 fs rms)

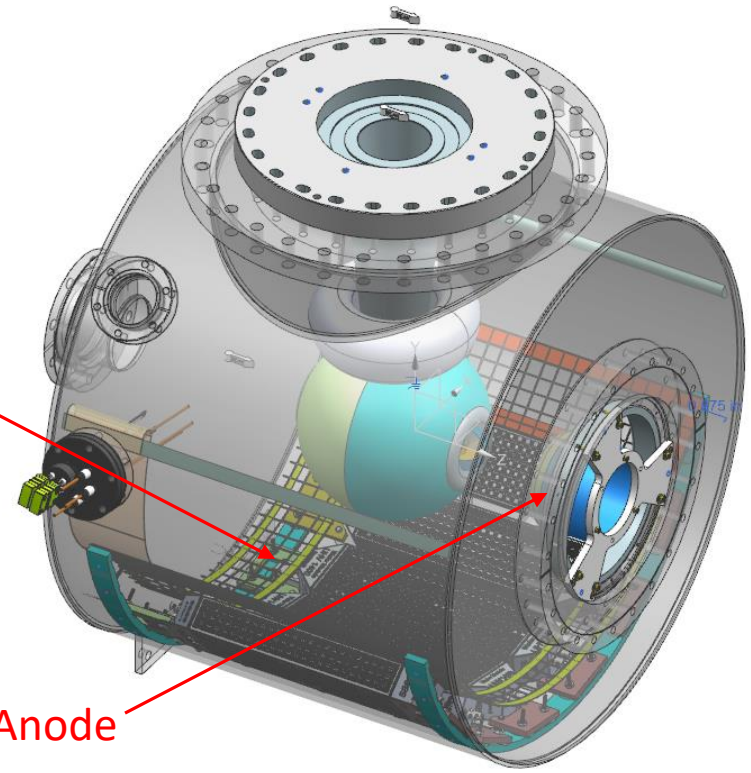
two beamline distance
14.049m x 0.014rad = **197mm**



Elliptical/Racetrack (3.9 GHz)	Lanc. Univ.	
RF Dipole (RFD)	ODU	
Double Quarter Wave (DQW)	CERN	
Wide Open Waveguide (WOW)	BNL	
Quasi-waveguide MultIcell Resonator (QMIR)	FNAL	

WP-prime 4: Electron Gun

- The electron gun consists of
  - High-voltage photo gun
  - Drive laser system
  - GaAs/GaAsP Photocathode
- High-voltage gun is the most urgent item
  - The gun voltage in TDR is 200 kV. A higher voltage desirable.
  - Meaningful technical progresses since TDR would be reflected in a new design
  - New GaAs gun based on lessons learned from 350 kV CsKSb magnetized dc photogun



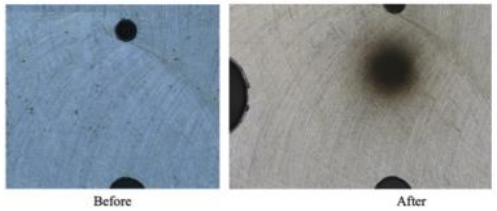
WP-prime 6: Rotating Target for Undulator Scheme

◆Target specification
- ➢ Titanium alloy, 7mm thick (0.2 X_0), diameter 1m
- ➢ Rotating at 2000 rpm (100 m/s) in vacuum
- ➢ Photon power ~60 kW, deposited power ~2 kW
- ➢ Radiation cooling
- ➢ Magnetic bearings

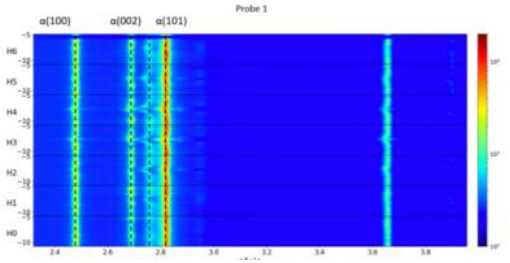
◆ R&D to be done as WP-prime
- ➢ Design finalization, partial laboratory test, mock-up design (in the first 2 years)
- ➢ Magnetic bearings: performance, specification, test (in the remaining years)

Target material test

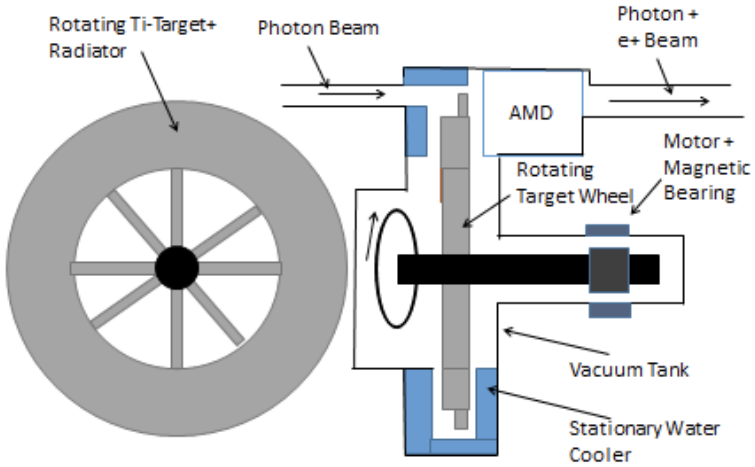
Target before and after radiation:



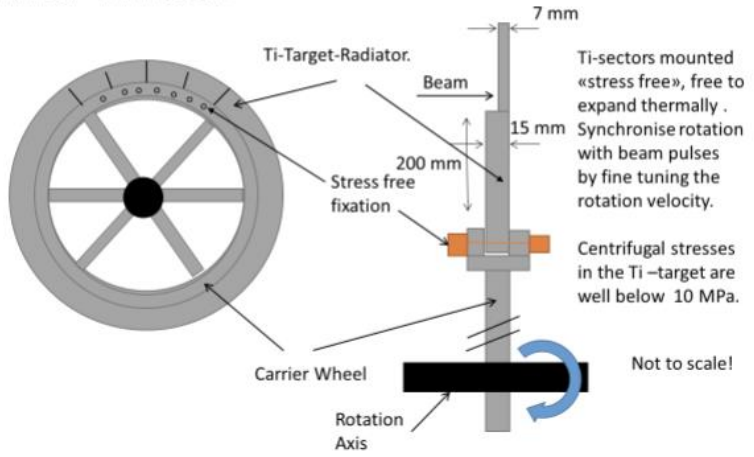
α/β phase transitions in Ti-6Al-4V:



Principal Layout: Ti-Wheel with a Diameter of 1.0 m, rotating at 100 m/s, 2000 rpm.

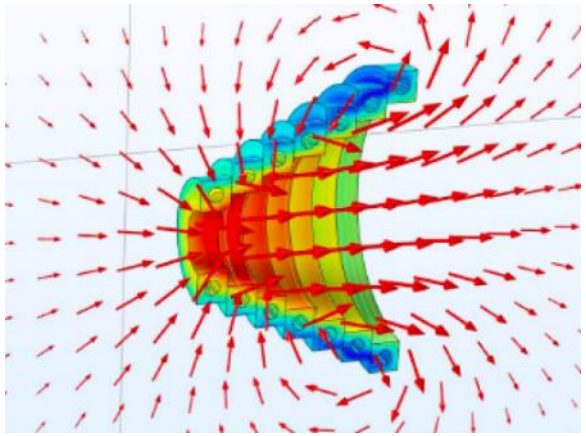


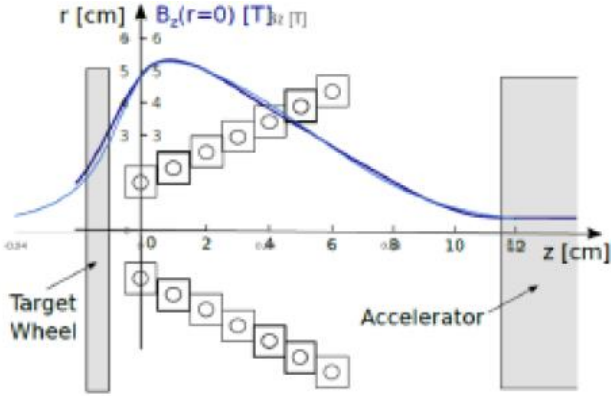
Ti-Target Sector Modules, mounted onto a «Carrier Wheel»



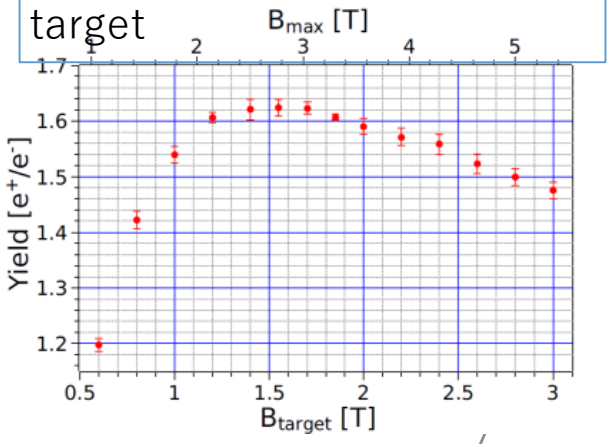
WP-prime 7: Focusing System for Undulator Scheme

- The critical item for the undulator scheme is the magnetic focusing system right after the target
- Possible candidates are: (a) Pulsed solenoid, (b) Plasma lens
- The strongest candidate is (a) pulsed solenoid.
- R&D items to be done as WP-prime
  - ➢ Detailed simulations for (a) (already on-going)
  - ➢ Principal design for a prototype pulsed solenoid
  - ➢ Field measurements with 1kA (pulsed and DC) and with 50kA both in a single pulse mode and finally in a 5ms pulsed mode
  - ➢ Prototype of (b) plasma lens (funded study on-going)





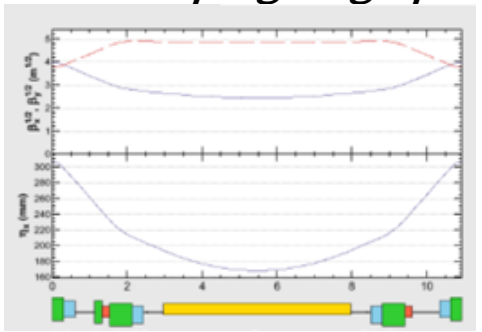
Yield versus field on the target



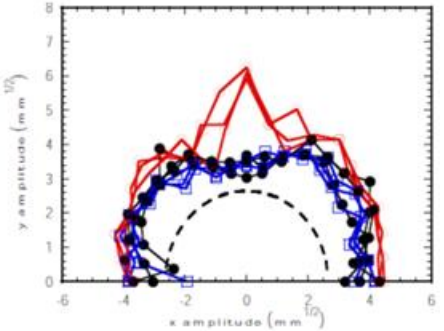
WP-prime 12: System design of ILC DR

- The ILC damping ring (DR) is required to satisfy the low emittance and the large dynamic aperture simultaneously.
- The ILC DR will be further improved by incorporating the findings of the latest light source design. Increasing the dynamic aperture is also important in the design of DR.
- By quantitatively evaluating the effect of fringe field to the dynamic aperture of magnets in ILC DR, the method for evaluating fringe field to the dynamic aperture in accelerator design will be established and the design of ILC DR will be optimized.

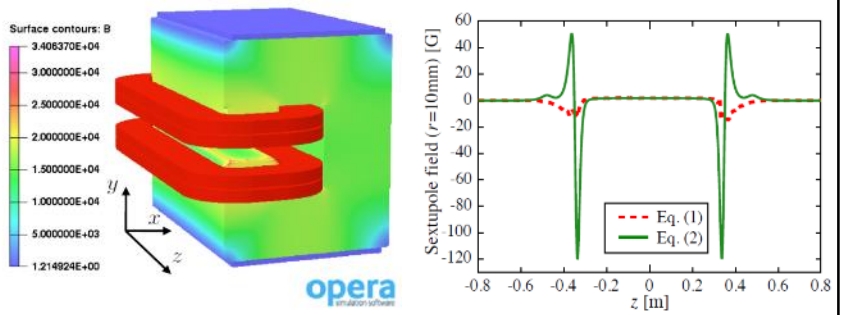
ILC damping ring optics



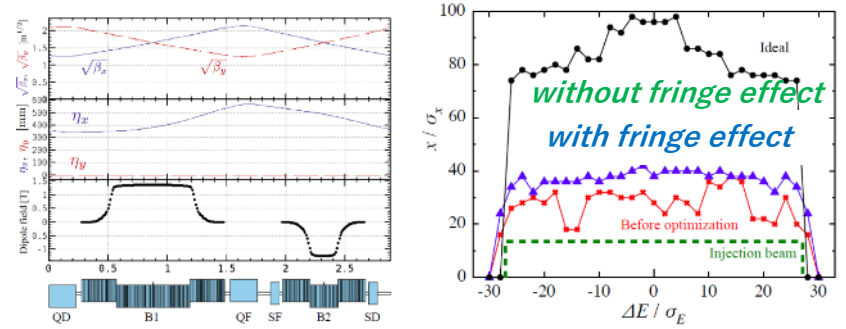
Dynamic aperture for ILC DR (hard edge)



Modeling of the fringe field for SuperKEKB DR



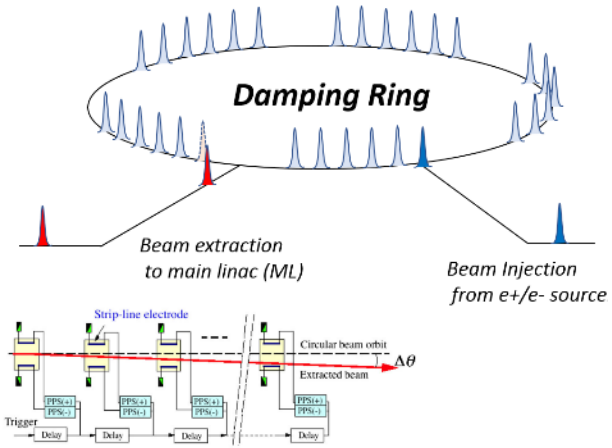
Dynamic aperture evaluation with fringe effect (SuperKEKB DR)



WP-prime 14: System design of ILC DR injection/extraction kickers

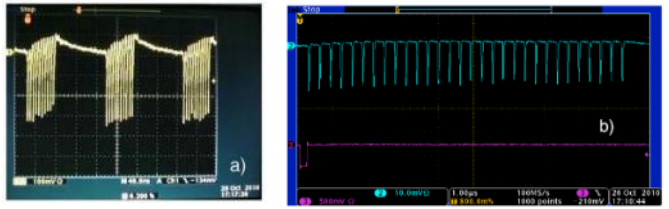
- ◆A fast kicker system using a semiconductor pulse power supply with nanosecond response was confirmed as proof of principle at KEK's ATF about 10 years ago.
- ◆Semiconductor technology has been evolving, and it is now possible to advance nanosecond response beam injection/excitation systems using the recent semiconductor technology.
- ◆The technical evaluation of the fast kicker power supply using the recent semiconductor technologies.
- ◆The evaluation of fast pulsed power supply technology will contribute not only to the fast kicker system but also to the performance and reliability of nanosecond-scale beam control technology and its application to a wide range of accelerator systems.

ILC fast injection/extraction system

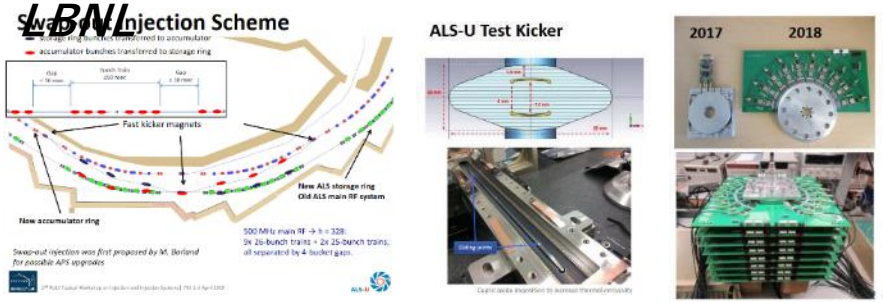


Beam extraction test at KEK ATF

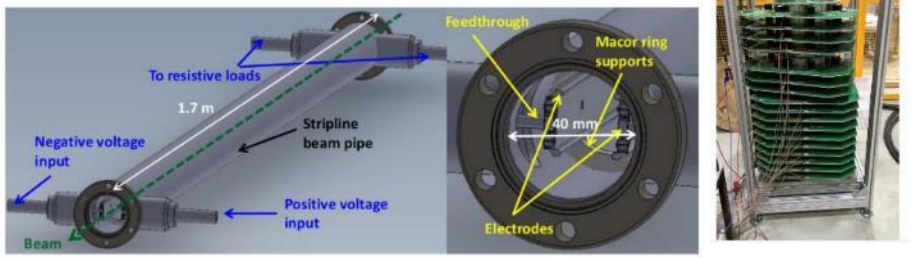
Stored beam in DR Extracted beam from DR



Swap-out injection system planned at LBNL



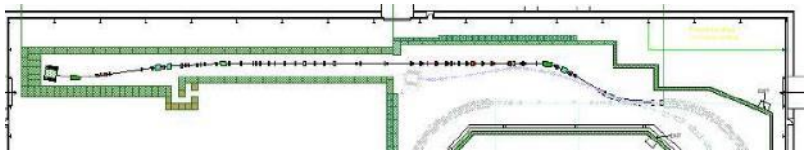
Beam injection/extraction system for CLIC damping ring



WP-prime 15: System design of ILC FFS

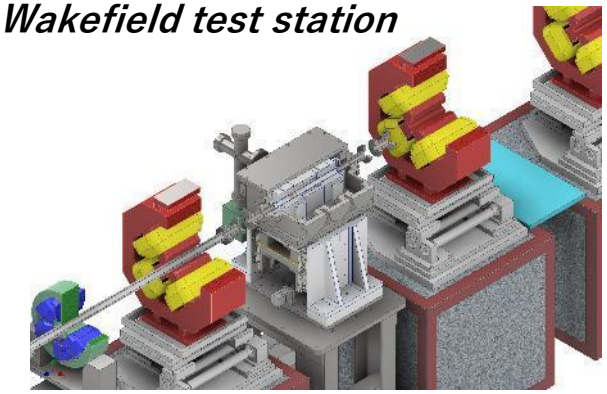
- ATF2 beamline is the only existing test accelerator in the world to test the final focus system (FFS) of linear colliders.
- The following 3 research topics are important topics to be pursued at the ATF.
  - wakefield mitigation
  - correction of higher-order aberration
  - training for ILC beam tuning
- The technical research at ATF2 beamline has proceeded, and should continue to be based on the ATF international collaboration, or its extension (welcome to new collaborators).

ATF2 beamline

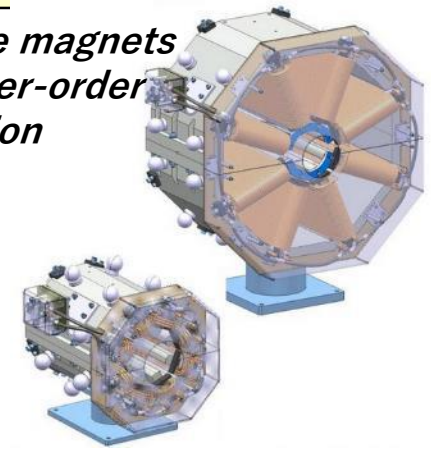


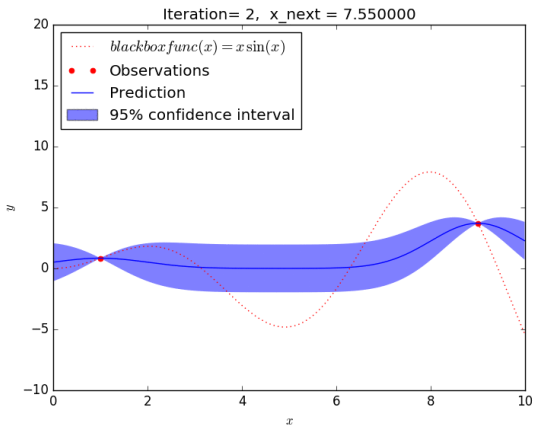
Maximum search algorithms to be applied to beam tuning (Machine Learning)

Wakefield test station



Octupole magnets for higher-order aberration





WP-prime 16: Final doublet design optimization

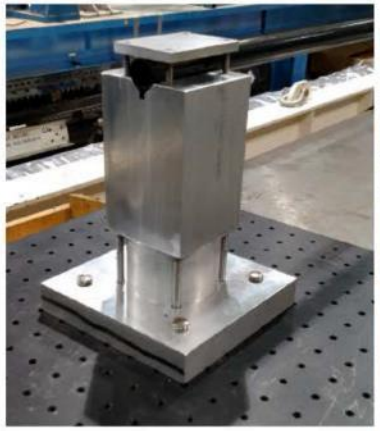
◆Cooling of the superconducting ILC final focus magnets will be performed using 2K superfluid helium to realize superconducting magnets with high oscillation stability.

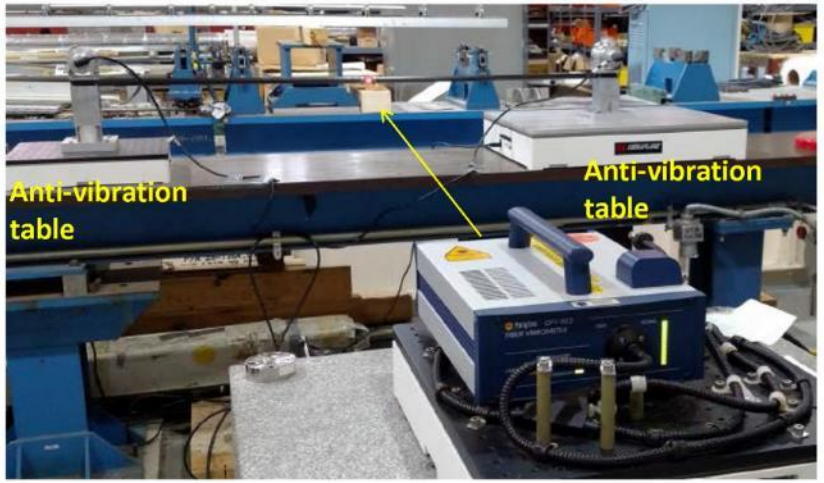
◆Quantitative evaluation of the vibration generated by the 2K cooling system located on the side of the final focus magnets has not been completed.

◆We will measure and evaluate the vibration generated by the 2K cooling system by using the prototype.

Prototype of ILC service cryostat
(2K cooling system ; BNL)

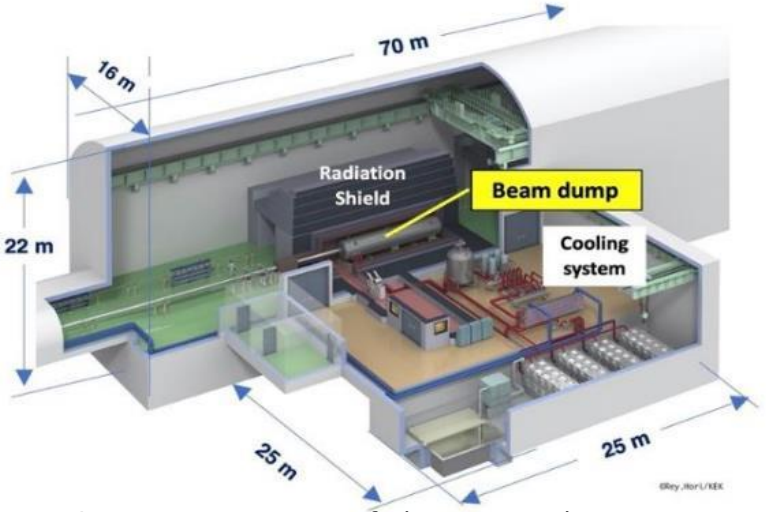
Vibration measurement system
for SuperKEKB final focus magnet (KEK)



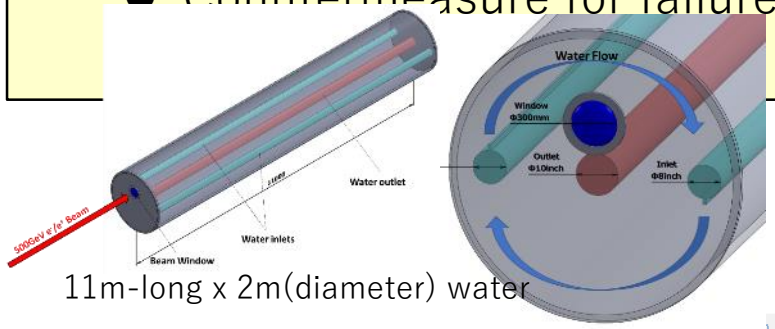


WP-prime 17: Beam Dump

- Finalize the engineering design of the main beam dump system
  - Vortex water flow in the dump vessel
  - Cooling water circulation and heat exchange
  - Remote exchange of the beam window
  - Countermeasure for failures / safety



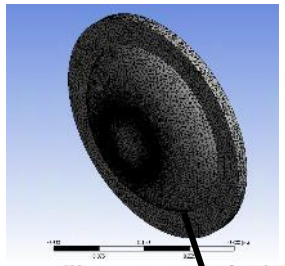
Imaginary view of the main dump section



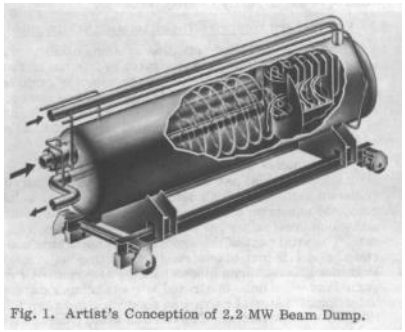
11m-long x 2m(diameter) water

Vortex water flow

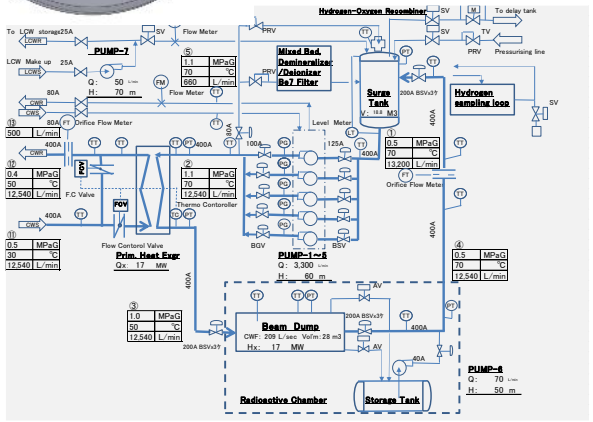
- **17 MW** at 500 GeV beam
- 1 MPa to prevent boiling



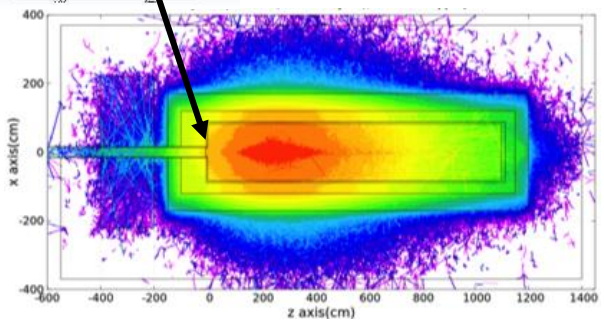
Beam window
- Ti-alloy
- 30 cm diameter
- Exchange every a few years



SLAC 2.2MW water dump (precedent)



Primary design of the beam dump water circulation and heat exchange



Remote exchange of the beam window under high radiation dose

Additionally work on (personnel primarily):

- Sustainability and site (link to EAJADE)
- Cryo
- Beamdynamics and EDR documentation (also EAJADE)
- MDI and other WG3 related activities (use EAJADE)
- More .. ?
- ?