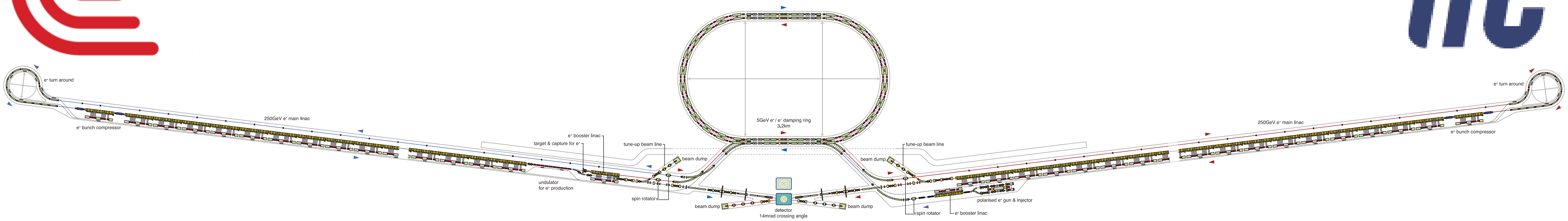
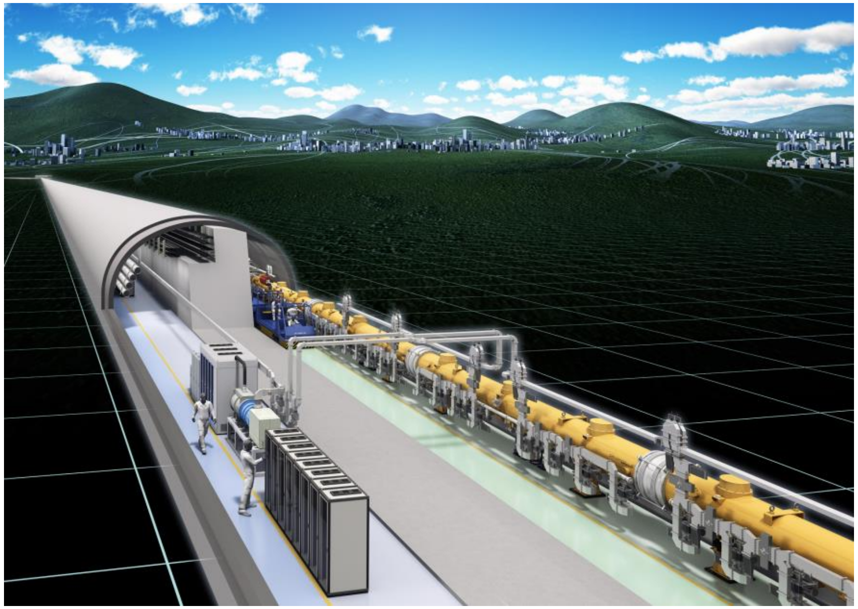
international linear collider



Recent Progress of ILC



H. Hayano, KEK 01312015

Political movement for ILC realization

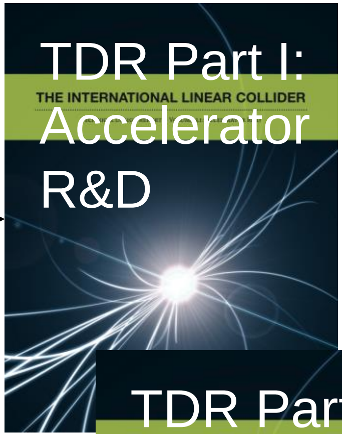
Completion of TDR(Technical Design Report)

https://www.linearcollider.org/ILC/Publications/Technical-Design-Report/

2007 **2011** **2013**

ILC Technical Progress Report (“interim report”)

AD&I



~240 pages

~360 pages

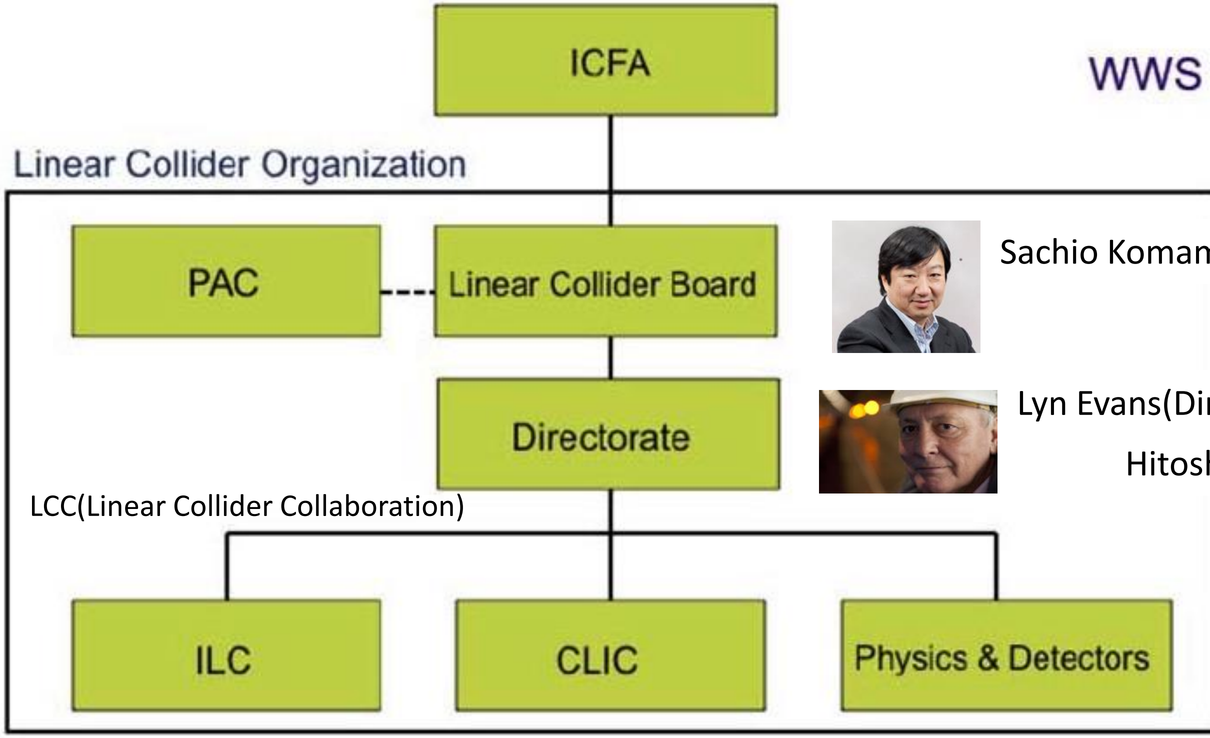
Reference Design Report

Technical Design Report

By GDE (Grobal Design Effort)

New organization: Linear Collider Collaboration (LCC)

since 2013 -



Sachio Komamiya(Director, Tokyo-U)

Member: 5 people each from 3 region

Lyn Evans(Director, CERN)

Hitoshi Murayama(Deputy, IPMU)

Michael Harrison(Director, BNL)

Hitoshi Hayano(Deputy, KEK)

A. Yamamoto (Adviser, KEK)

Steiner Stapnes(Director, CERN)

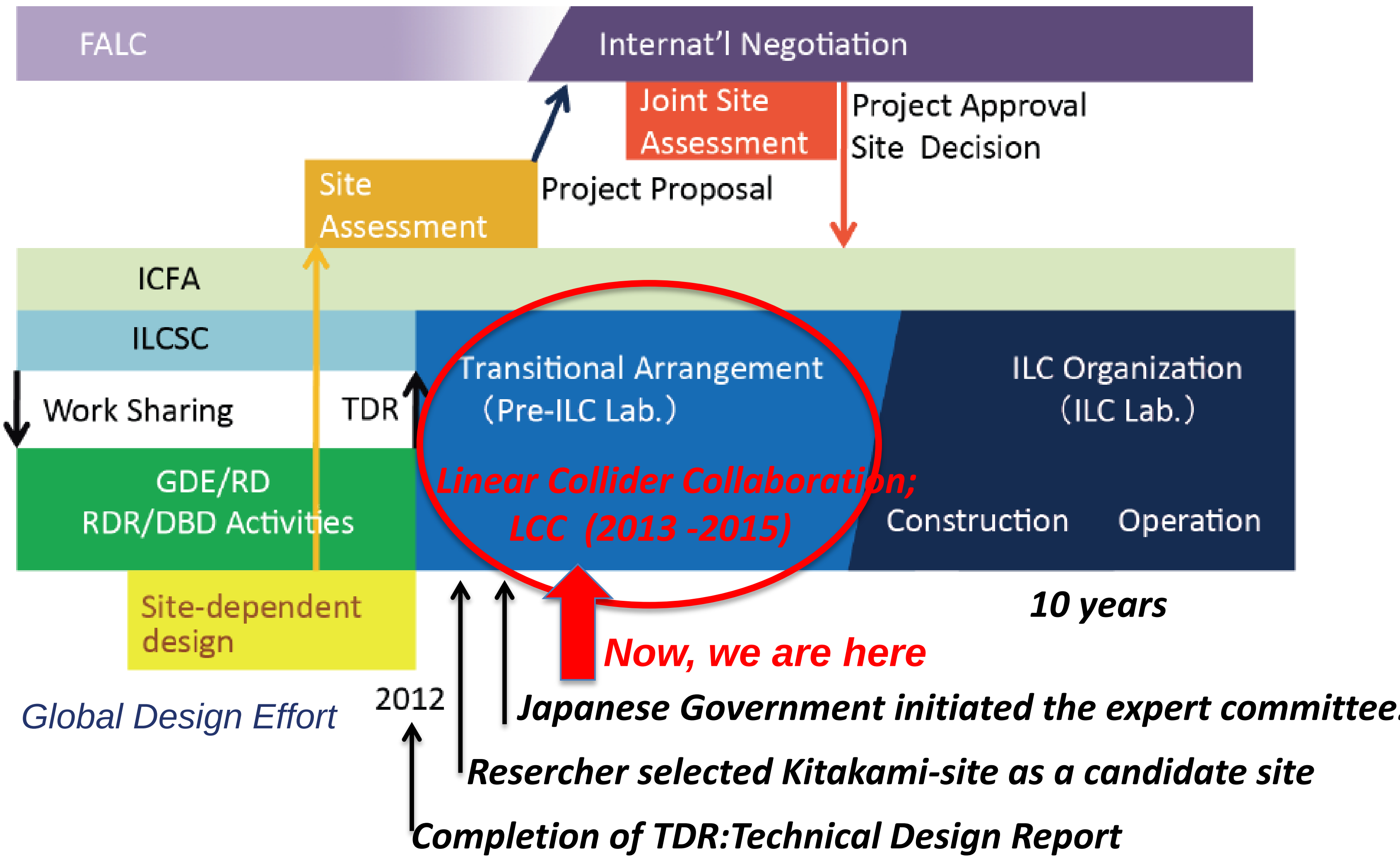
Hitoshi Yamamoto(Director, Tohoku)

Member: 2 people each from 3 region

N. Terunuma (KEK)	N. Walker (DESY)	M. Ross (SLAC)
Y. Yamamoto (KEK)	O. Napoly (Saclay)	N. Solyak (FNAL)

LCC symbol mark

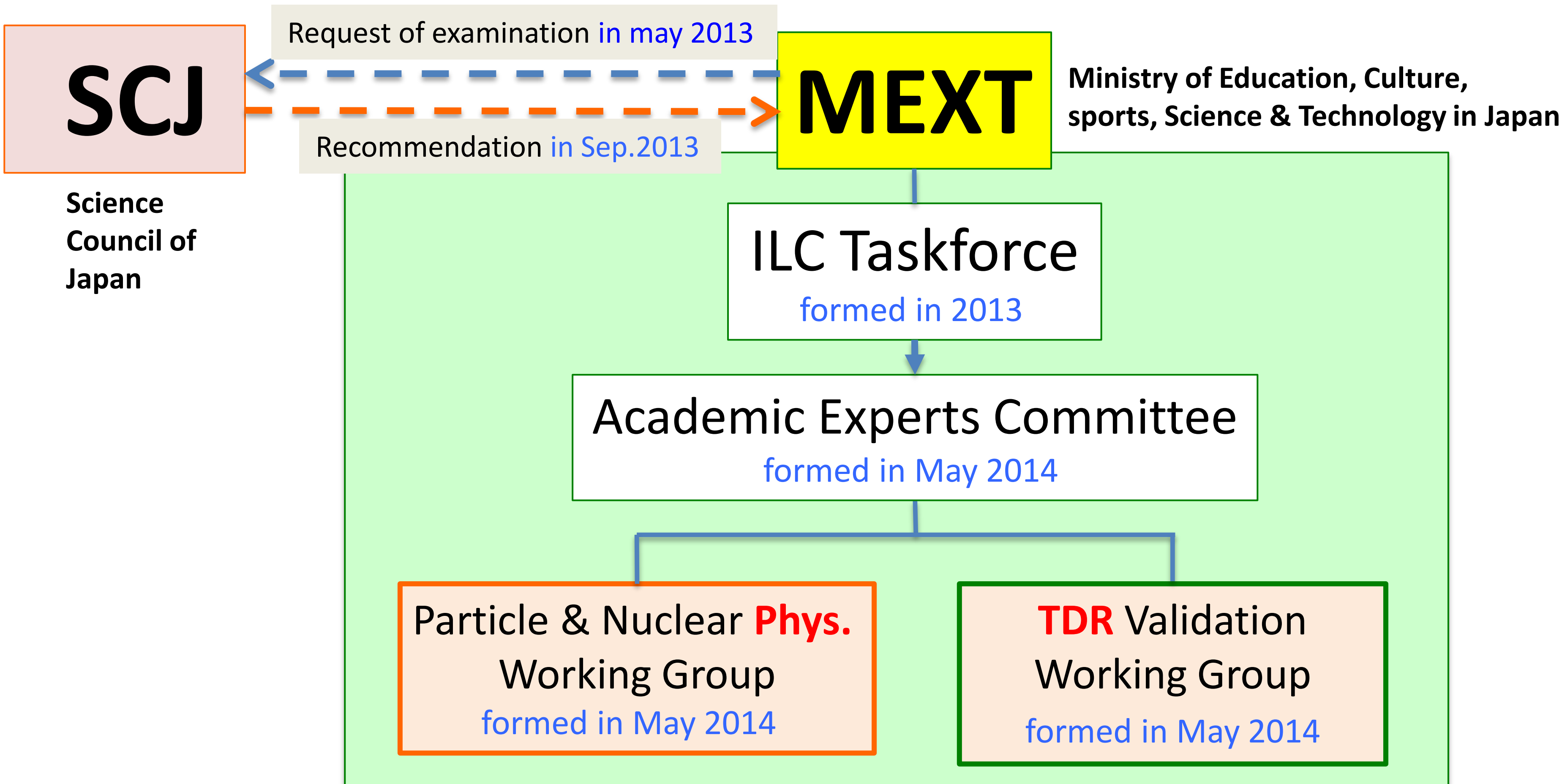
Possible Load Map of ILC realization



A. Yamamoto

MEXT's Organization for Studying ILC

based on SCJ's Recommendation



Mission of Expert committee

The mission is to analyze the followings,
and make them complement to analyze by ILC-Task force in MEXT.

(1)Clear direction of ILC physics, among other research project.
(2)Overall cost and international cost share.
(3)Required manpower during construction and operation.
(4)What domectic organization should be.
(5)What is effect on society.
(6)Other issue on ILC.

Term: from 1 May 2014 to 31 March 2016 .

A. Yamamoto

Schedule for Committee and WGs

Experts committee	
	date
1	5/8
2	11/14
3	4/21

Expert from various region (13people)

Physics expert (15people)

Accelerator expert (10people)

Physics WG		
	date	Subject
1	6/24	Status of Particle Physics and ILC physics overview
2	7/29	Future prospect in the US and in Europe
3	8/27	Cosmic-ray and Astrophysics, and ILC
4	9/22	Flavor and Neutrino physics, and ILC
5	10/21	Interim summary to be input to the Experts Committee
6	1/8	SSC Experience, ILC objectives
7	2/17	TBD

TDR Validation WG		
	date	Subjects
1	6/30	Overview
2*	7/	ML and SRF
3*	9/	SRF Q&A,, CFS
4*	11/	Schedule and Project Management including Cost and Human Resource
5*	1/	Sources, DR, RTML, BDS, MDI Detector Human Resource
6*	3/	TBD

* Closed session, including discussion on cost-estimate

MEXT Tender

- *MEXT has issued a call for tender for a company to investigate technology spin-off and economic ripple effects from ILC.*
- *A report is due 31 March 2015.*

Technical movement for ILC realization

Key Issues of ILC Accelerator

Site-specific CFS design has started;

collision point location, access tunnel, vertical shaft, central concrete wall thickness, He compressor location,etc

MDI detail design, revisit of BDS design; L*, βy*, βx*

Positron target study (undulator base);

Design of back-up positron source(electron drive base);

Over-all timing issue (length adjustment) is under study;

For SCRF

Key Issues of ILC SRF (1)

Cavity gradient & yield performance;

X-FEL High statistics data avialble, but operational gradient ~24MV/m, low from ILC.
How to extrapolate to ILC?

More cost effective Cavity

Mass-production effort and cost-reduction effort by industries, world-wide.
KEK-Industry effort, for endgroup fabrication, for EP process.

More cost effective tuner & He vessel

X-FEL tuner and vessel to ILC cavity package
LCLS-II tuner development

More cost effective coupler

X-FEL coupler production experience, see what happens.
Reduction of process time from 50 hours(warm state), 20hours(cold state) to few hours?

For SCRF

Key Issues of ILC SRF (2)

Demonstration of conduction-cooled SC-quad

Demonstration in FNAL and STF-CM1, see what happens.

Earthquake-resistant-proof cryomodule design

Simuration on one stand-alone cryomodule was done by KEK.
Question arisen from expert-committee, what about connected cryomodule case?
Are amplitude and stress amplified?

and comparison before/after module assembly

European XFEL

Vertical acceptance tests

- Analysis of vertical acceptance tests includes
  - Series Cavities
  - "HiGrade"-Cavities
  - NO infrastructure commissioning tests

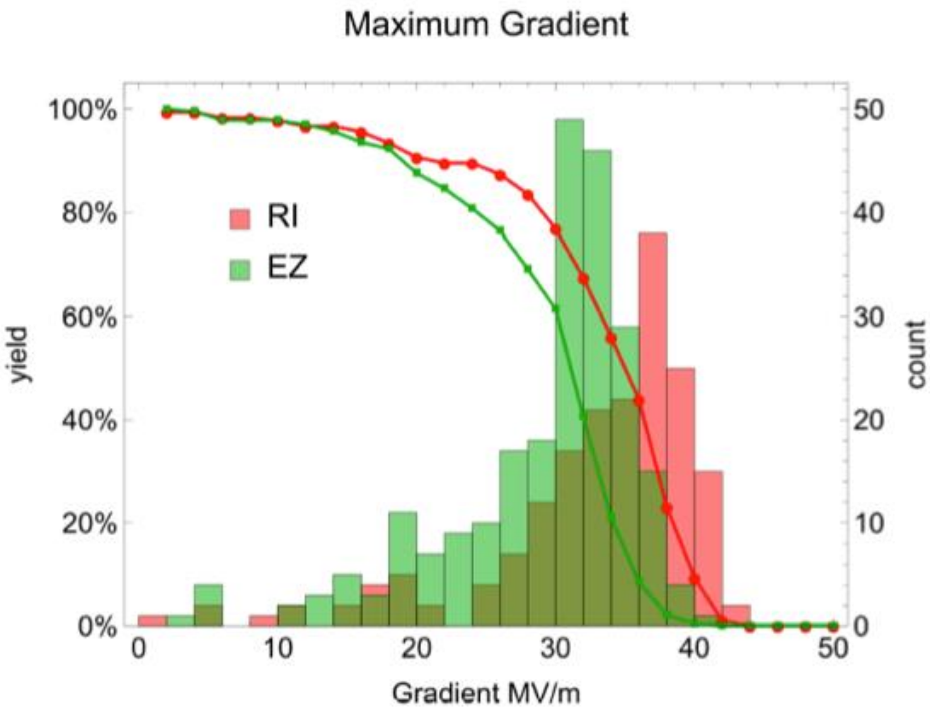
- So far delivered: 512 cavities (Nov 30)
- Total RF tested: ~500 cavities (Nov 30)

- Data analysis group:
  S. Aderhold, L. Monaco, D. Reschke, (D. Sertore), J. Schaffran, L. Steder, N. Walker, K. Yamamoto
  + XFEL cavity data base team: V. Gubarev, D. Gall, S. Yaser
- Analysis fully based on XFEL cavity data base

- Status of vertical tests analysis: **Nov 10, 2014** (~470 cavities)

Results: Maximum Gradient "As received"

- Analysis: No selection done, no cut



	RI	EZ	Total
Tests	182	234	416
G_{AVG} (MV/m)	32.9	29.1	30.8
G_{RMS} (MV/m)	7.6	7.	7.5
yield @ 20MV/m	91%	88%	89%
yield @ 26MV/m	87%	76%	81%
yield @ 28MV/m	84%	69%	75%

- Reminder: RI applies "Final EP" => higher gradients expected

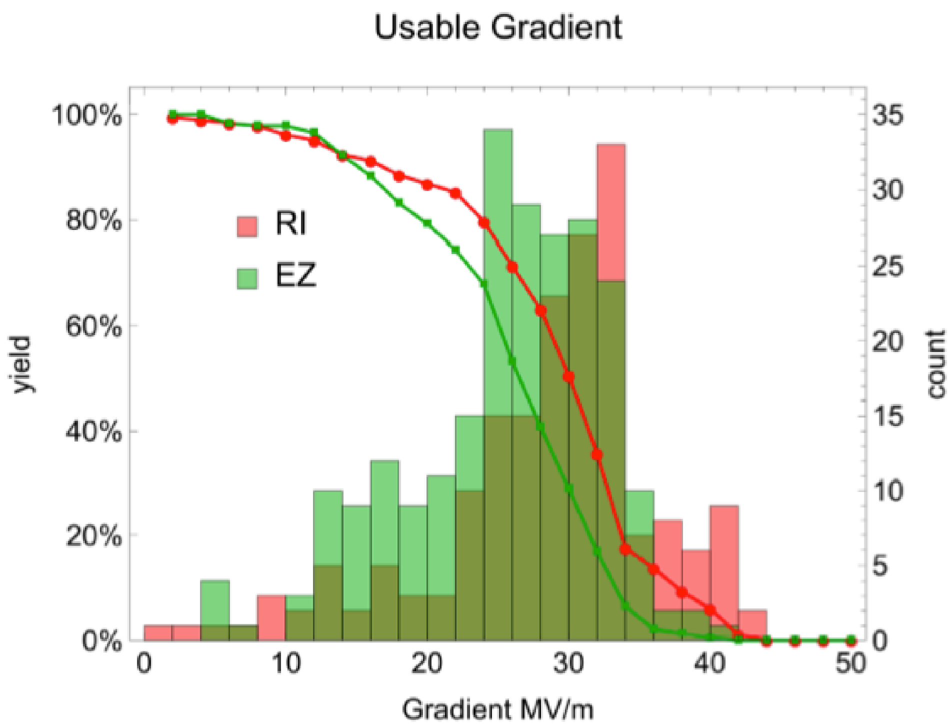
- Comment: "Missing" cavities with status "as received"?
  => About 50 cavities sent back to vendor (new status "retreatment at vendor")

Preliminary data; results are not published

European XFEL

Results: Usable Gradient "As received"

- Usable Gradient:



	RI	EZ	Total
Tests	182	231	413
G_{AVG} (MV/m)	28.6	25.5	26.9
G_{RMS} (MV/m)	7.9	6.9	7.5
yield @ 20MV/m	87%	79%	83%
yield @ 26MV/m	71%	53%	61%
yield @ 28MV/m	63%	41%	51%

- "not passed":
  - re-treatment at DESY; partly still to be done
  - "special" handling e.g. retreatment by vendor accepted

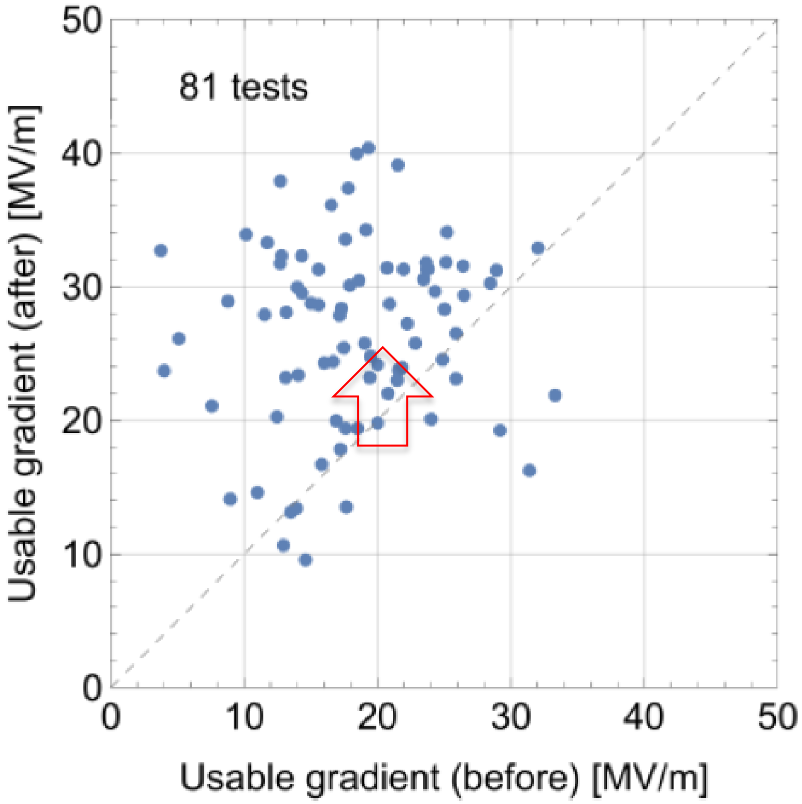
Preliminary data; results are not published

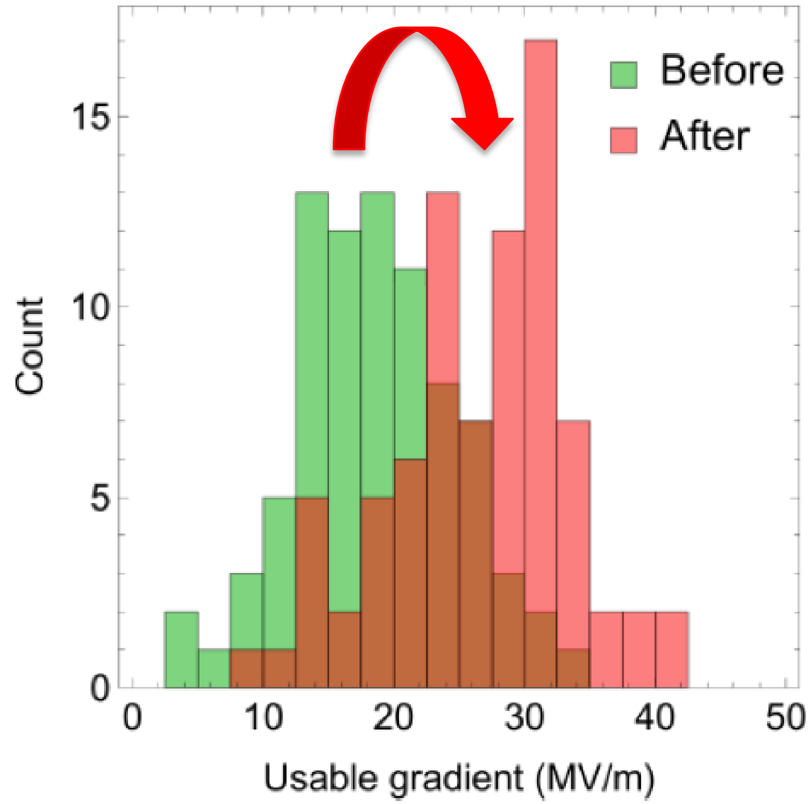
TTC meeting, KEK Dec.2014

and comparison before/after module assembly

European XFEL

Re-Treatment: Gradients



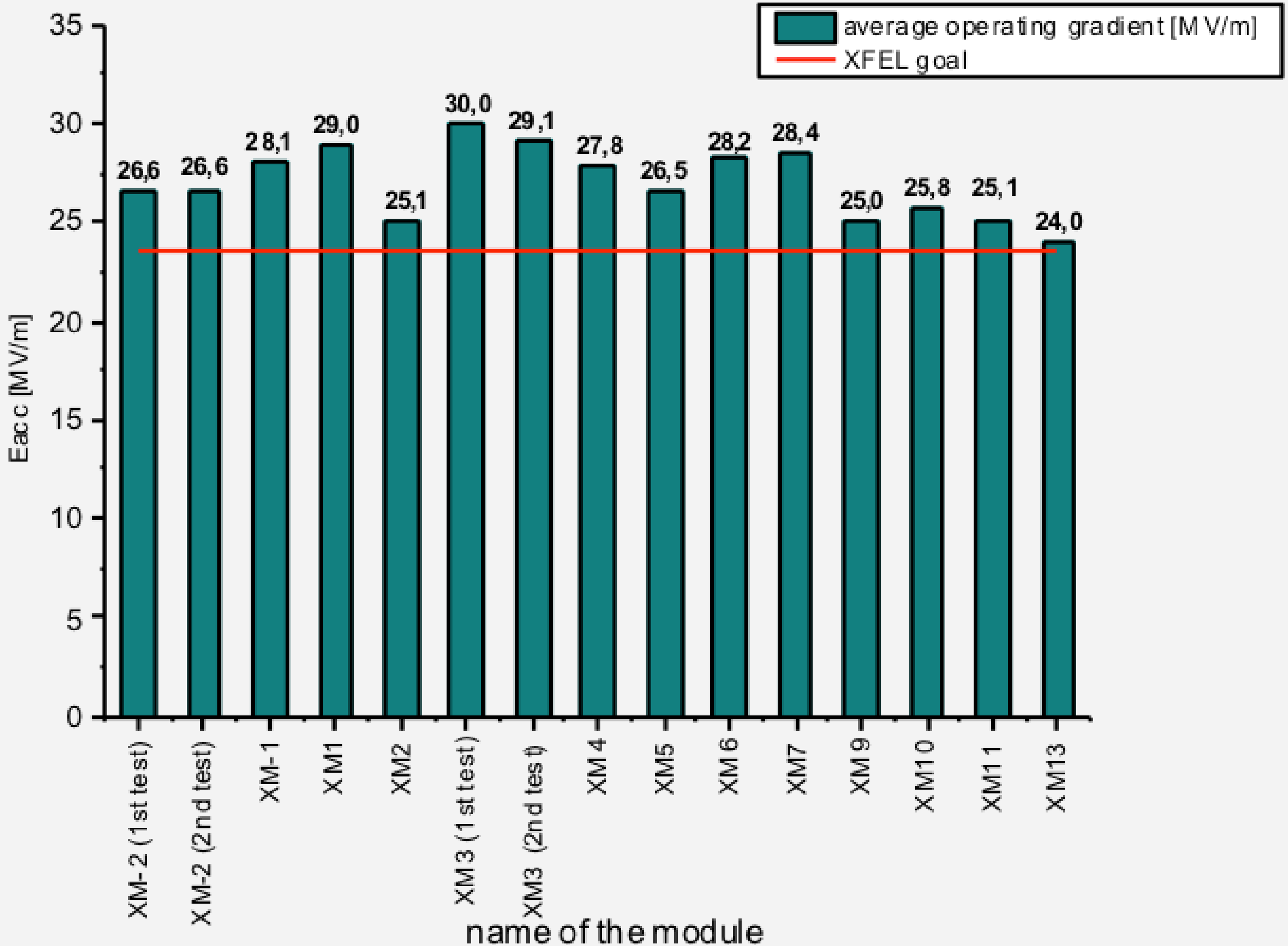


	Before	After
Tests	81	82
G_{AVG} (MV/m)	18.5	26.6
G_{RMS} (MV/m)	6.3	6.8
yield @ 20MV/m	40%	83%
yield @ 26MV/m	10%	56%
yield @ 28MV/m	7%	50%

Preliminary data; results are not published

European XFEL

Module Averaged Gradient Statistics



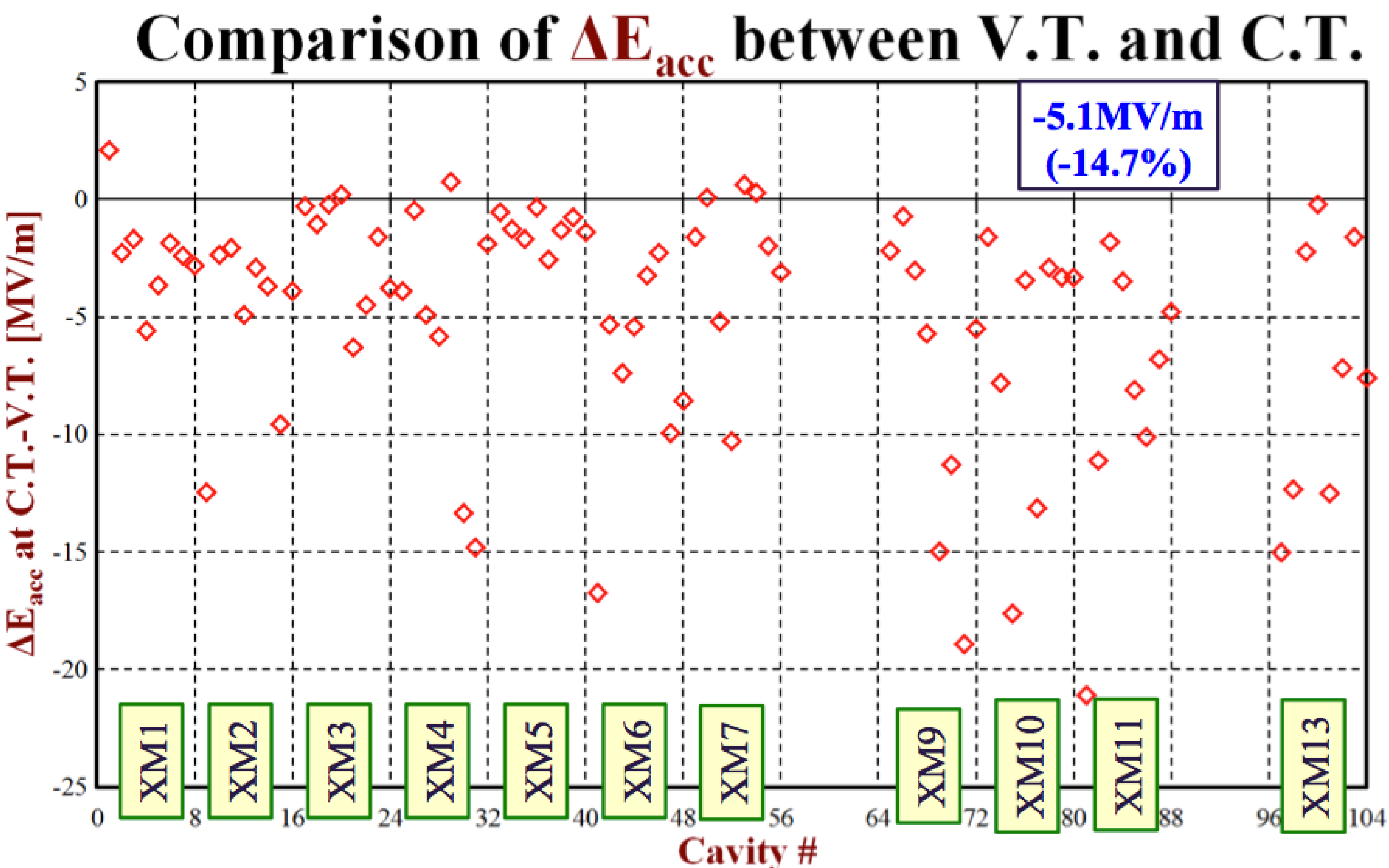
Preliminary data; results are not published

European XFEL

and comparison before/after module assembly

Changes in Cavity Performance from Vertical Test to Module Test

- Hans:
  - "We lose in usable gradient between vertical and module test"
  - "too often we are disappointed by a decreased gradient of single cavities"



Preliminary data; results are not published

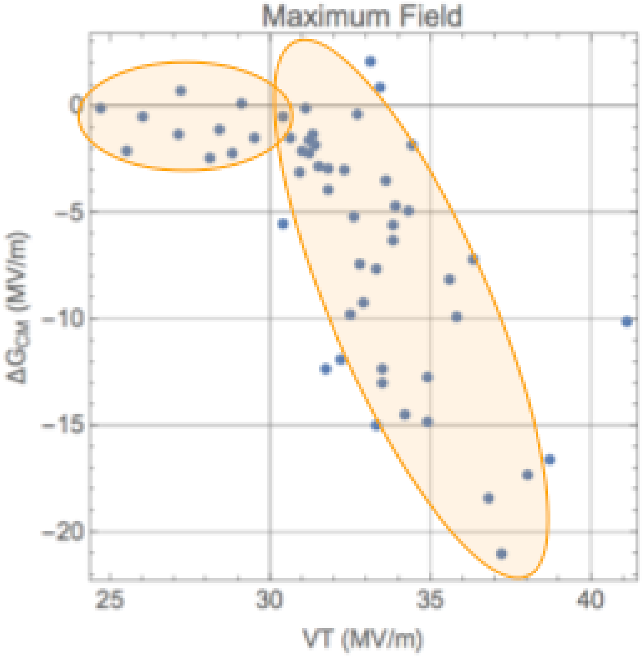
CRISP INFN DESY HELMHOLTZ ASSOCIATION

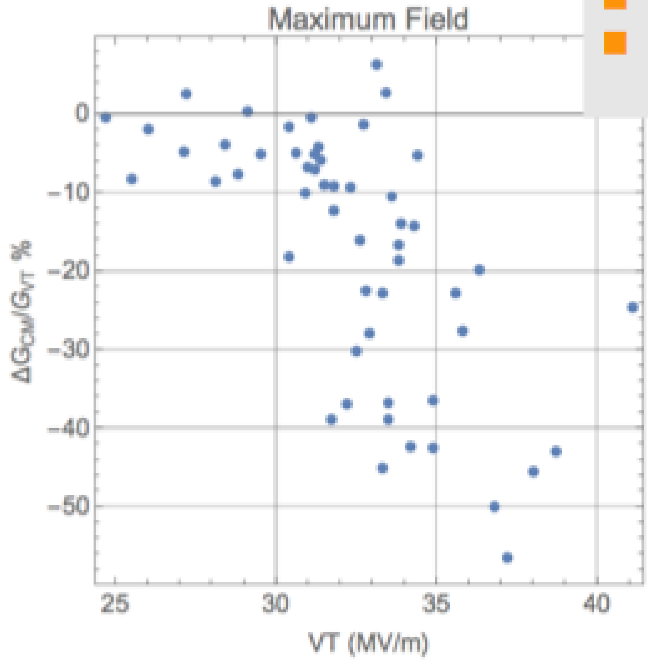
European XFEL

VT-CM comparison: MAX GRADIENT

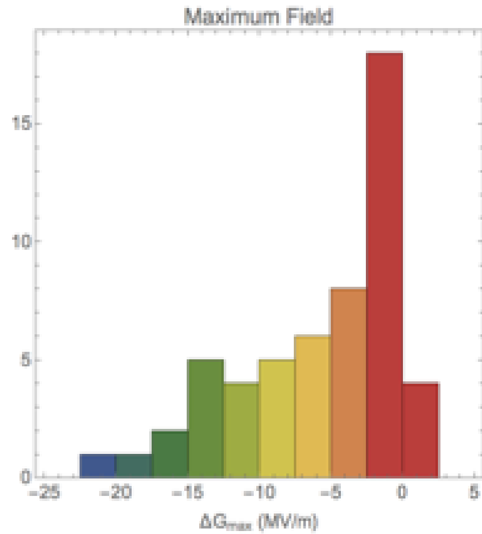
- not including power-limited CM results (quench limit)

Stats (mean ± rms):
- 54/88 cavities
- Average reduction: -6±6 MV/m
  - -17% ±16%



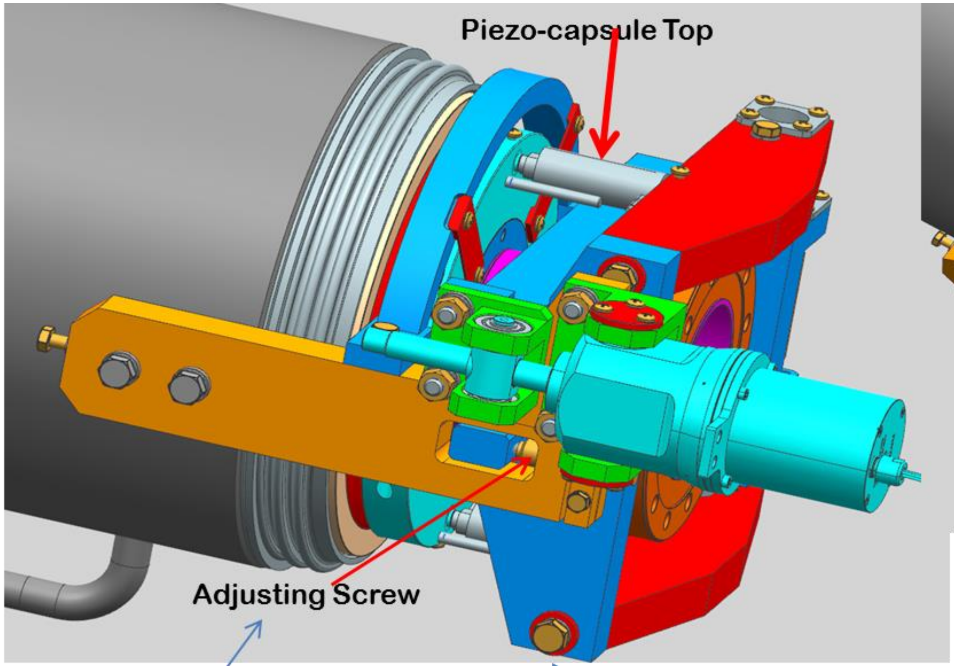


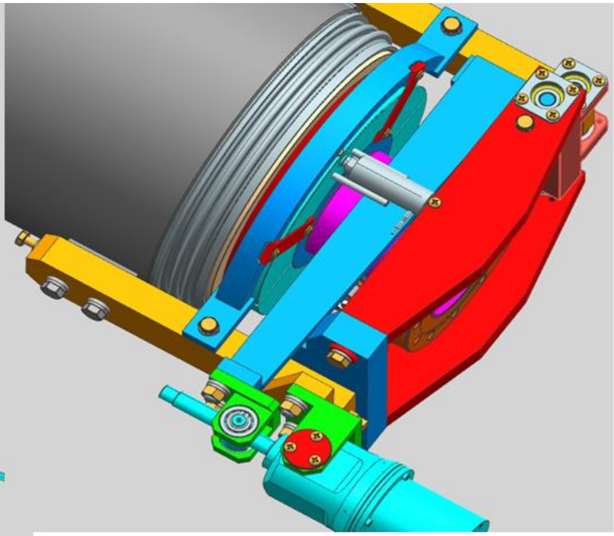
- Below ~30 MV/m, no degradation
- Above ~30 MV/m, correlated to VT performance

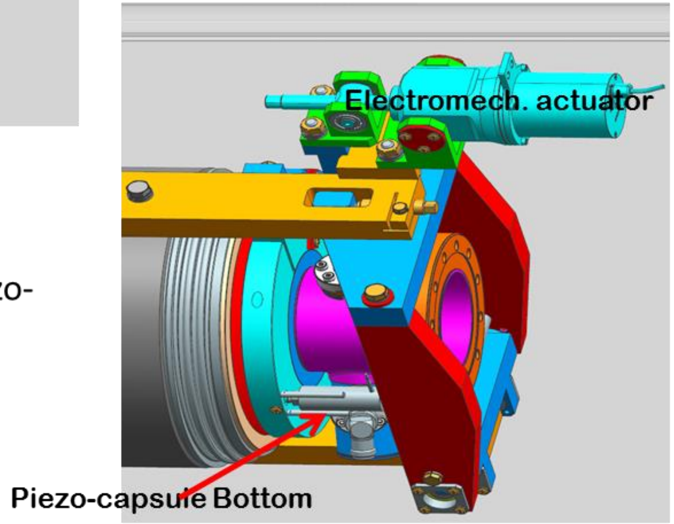


LCLS II Tuner *(designer Evgueniy Borissov)*

Electromechanical actuator & piezo can to be replaced through special port



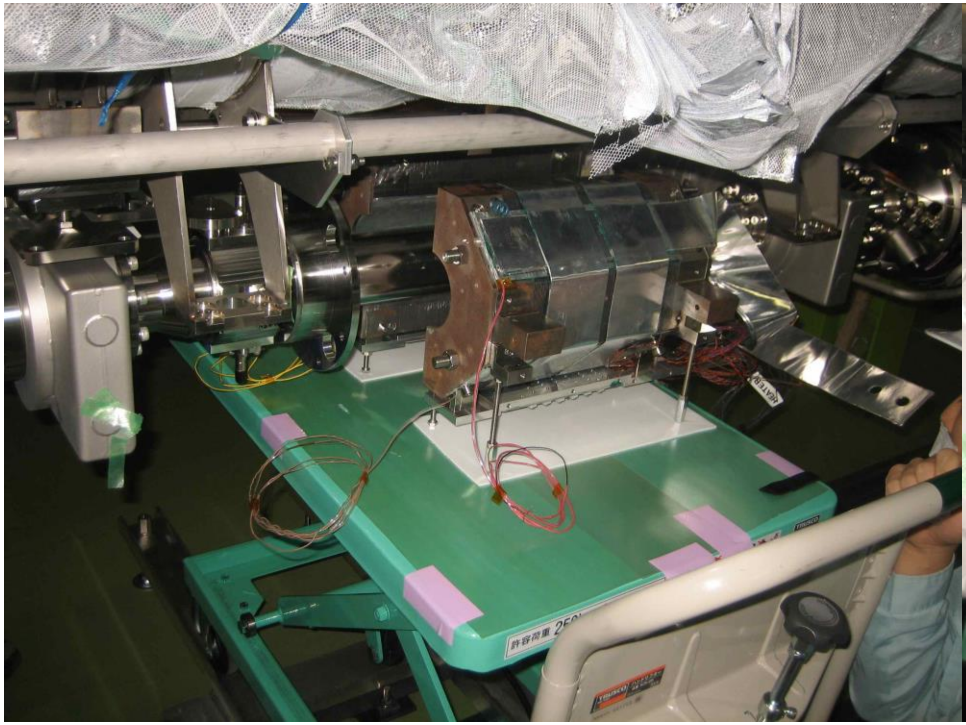




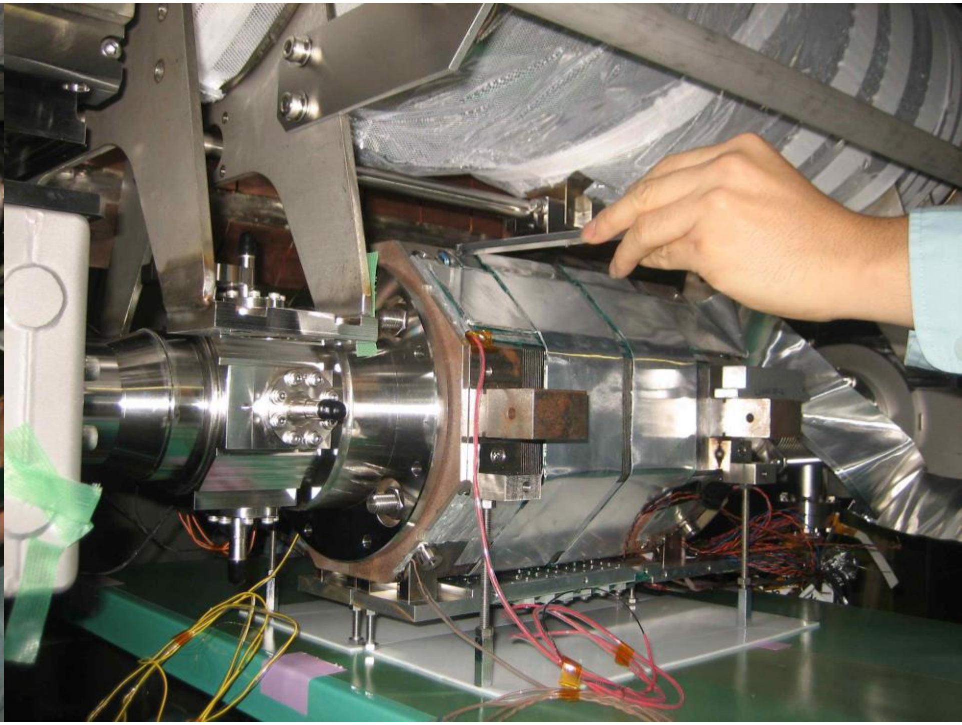
Adjusting Screw to unload piezo-capsule for replacement (in case of failure)… capsule can be replaced through special port

Tuning mechanism to uniformly preload piezo-capsule during initial assembly.

5.



6.



5. Lift up the magnet to right position.
6. Align the yoke, and couple the iron yoke.

Introduction of
participation to ILC accelerator construction

Components of SCRF

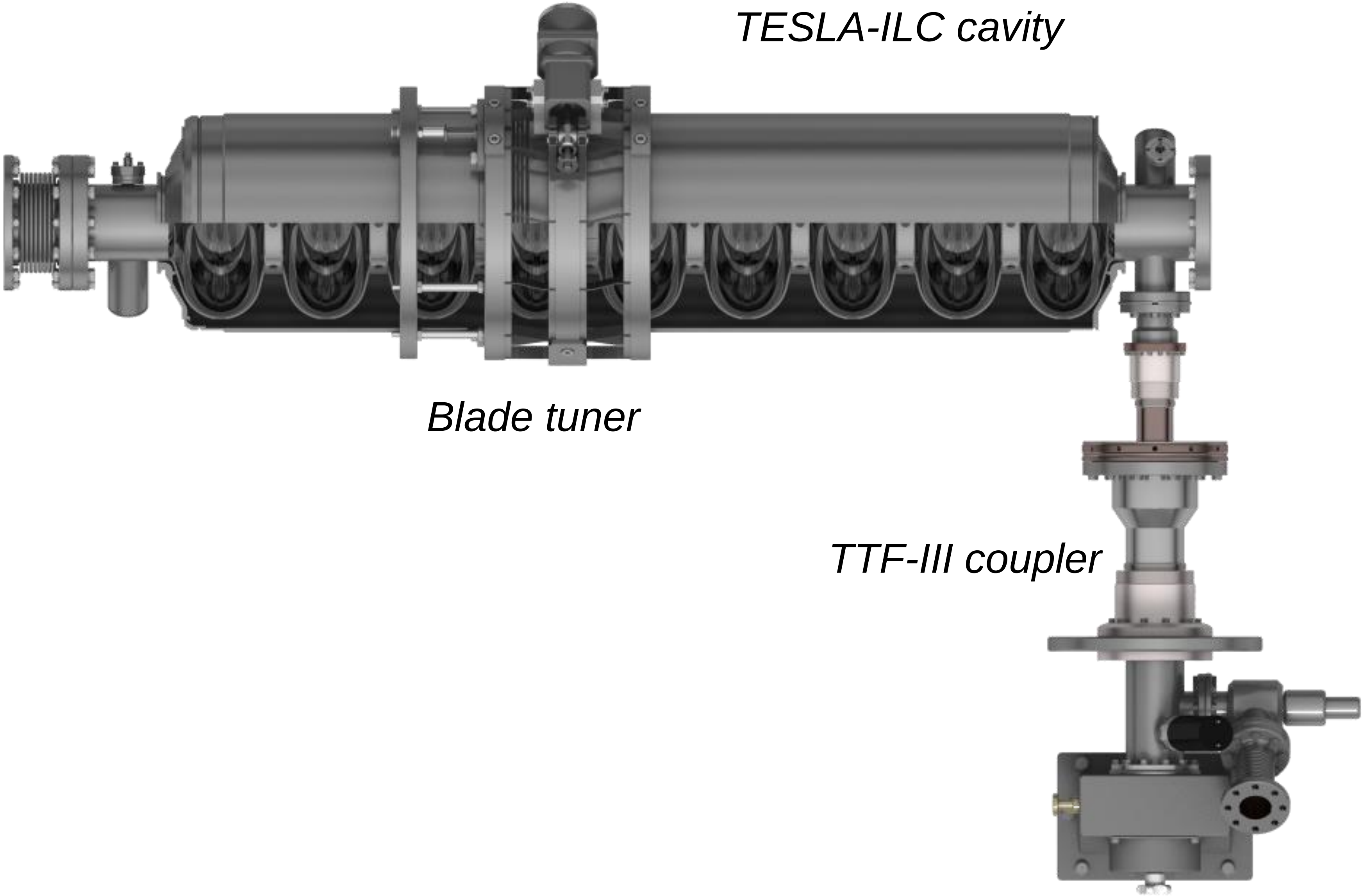
- Cavity (or parts of cavity)
- He Jacket tank
- Magnetic shield
- tuner
- Coupler

- Cryomodule components

- RF power source, waveguids, circulators, RF loads
- Digital RF control
- SC magnet
- Cold BPM

For SCRF

TDR Cavity Package



For SCRF

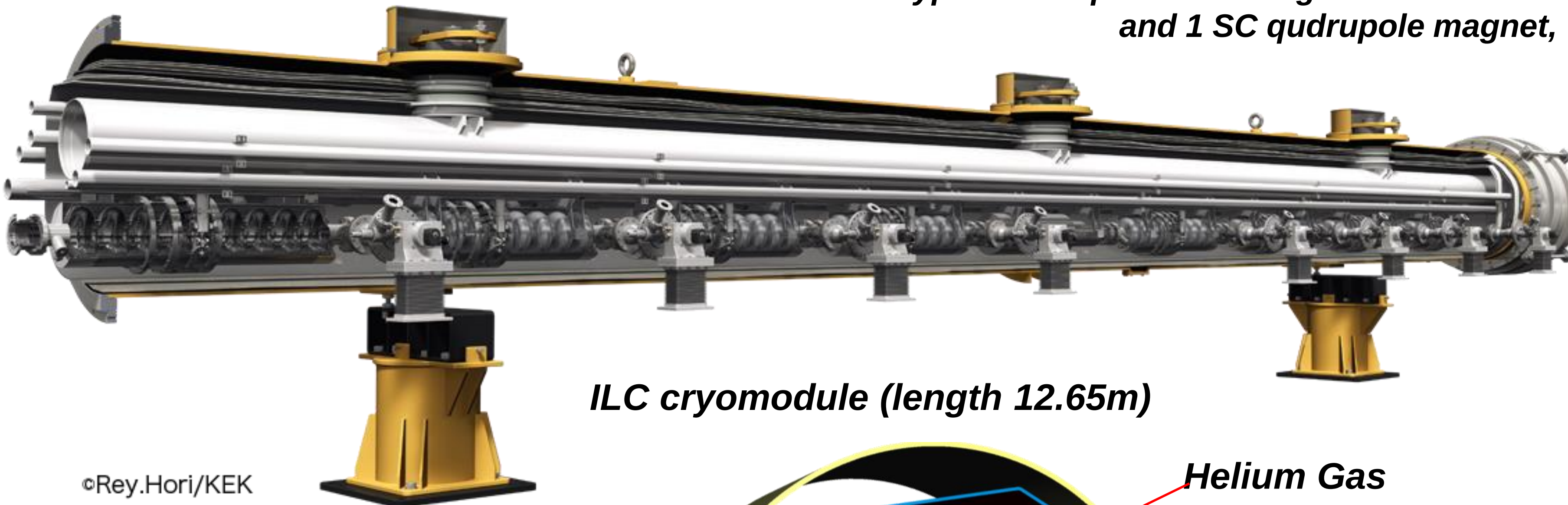
TDR Cryomodule

1701 unit (TDR)

Type-A: 9 Superconducting cavities inside,

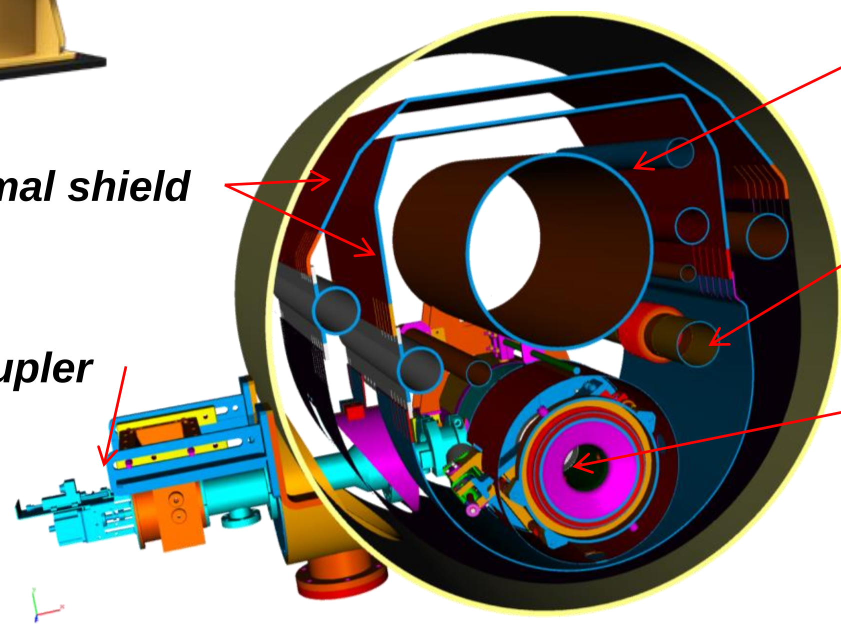
Type-B: 8 Superconducting cavities
and 1 SC qudrupole magnet,

1m diameter cryostat



©Rey.Hori/KEK

ILC cryomodule (length 12.65m)



Components other than SCRF

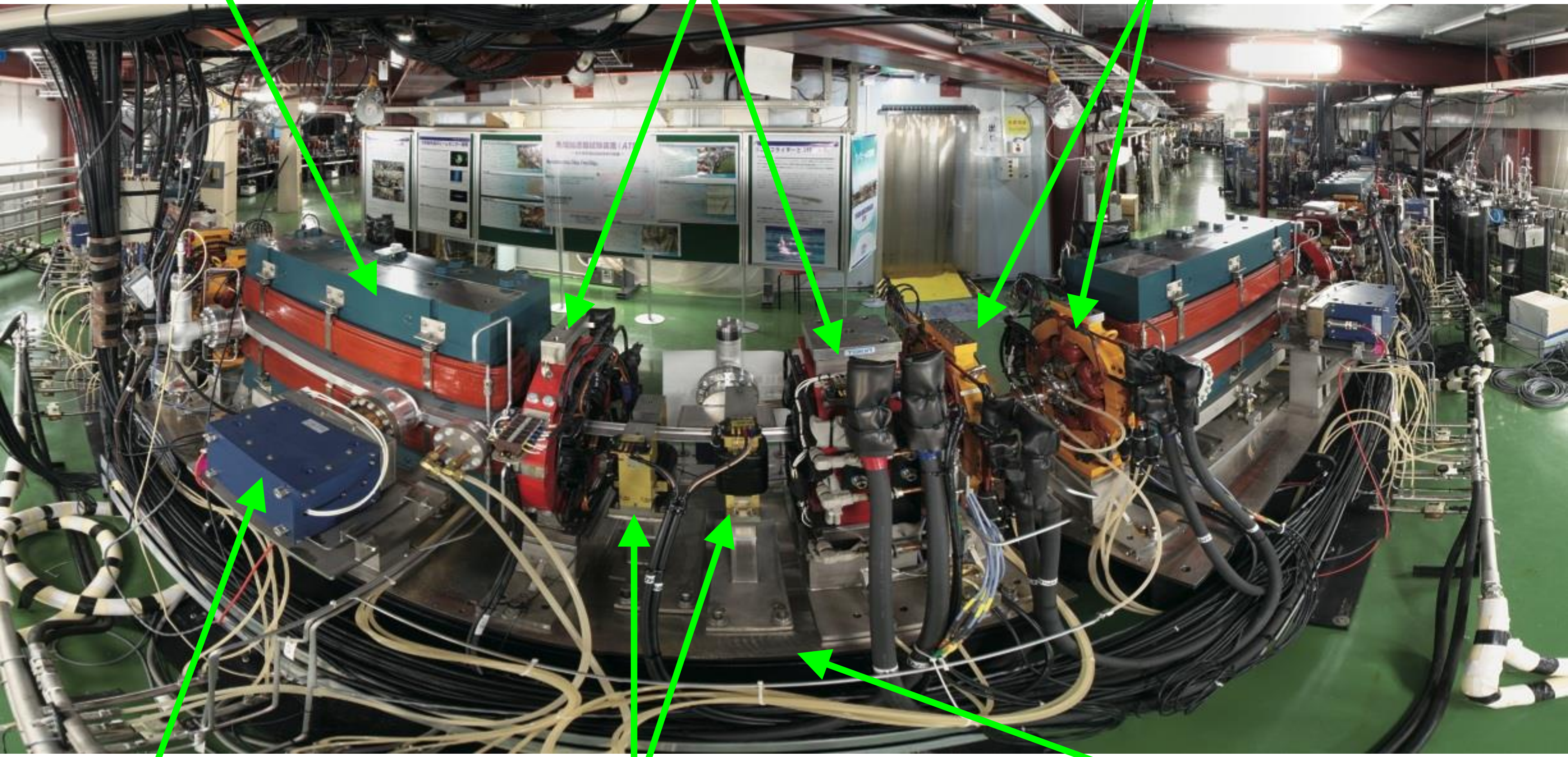
- Magnets
- Magnet Power Supply
- Vacuum chamber
- Vacuum pump, gauge, gate-valvs
- Beam Monitors

- Control computers
- Master Oscillator and RF&timing distribution
- Radiation monitors


View of
ILC damping ring
©Rey.Hor

Example of ATF damping ring

Bend magnet **Q magnet** **Sextupole magnet**



IonPump **Steering magnet** **Mover table**

Example of ATF2 final focus line

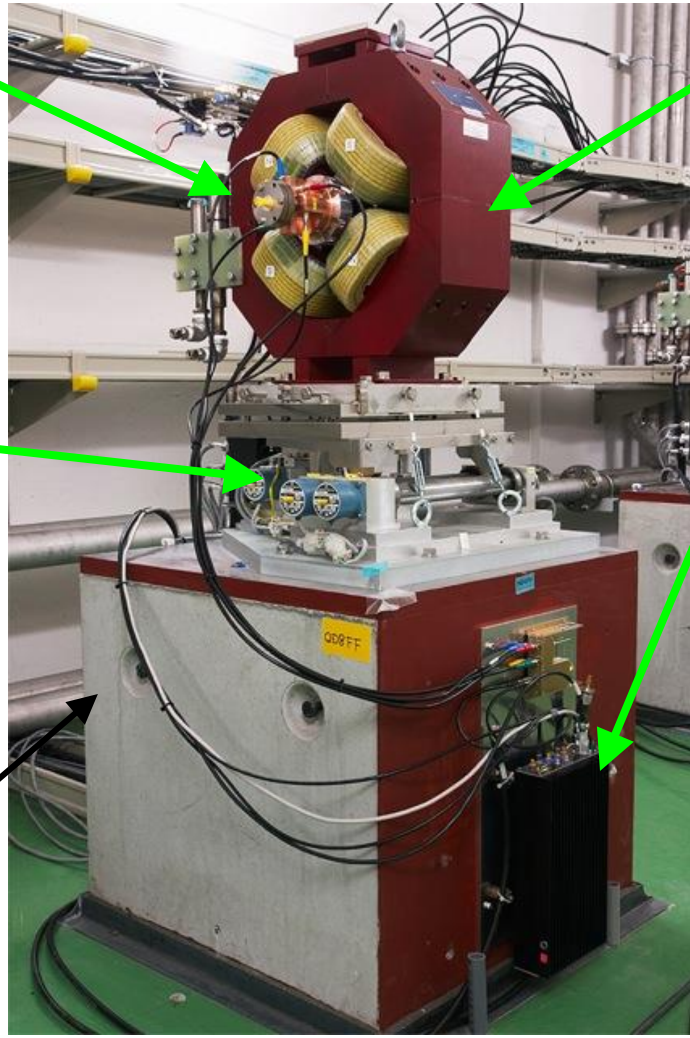
Q-BPM

(KEK,PAL)

Magnet
mover

(SLAC)

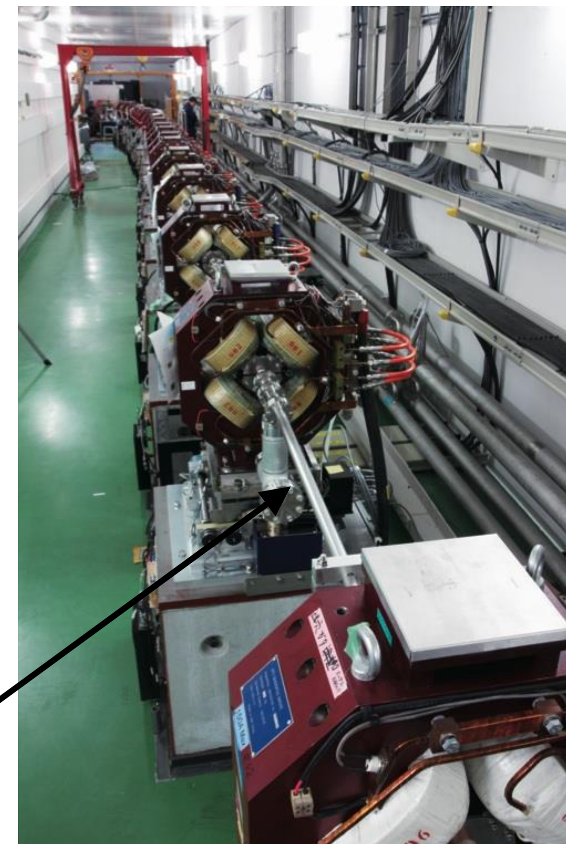
Stage (KEK)



Q magnet

(KEK,SLAC,IHEP)

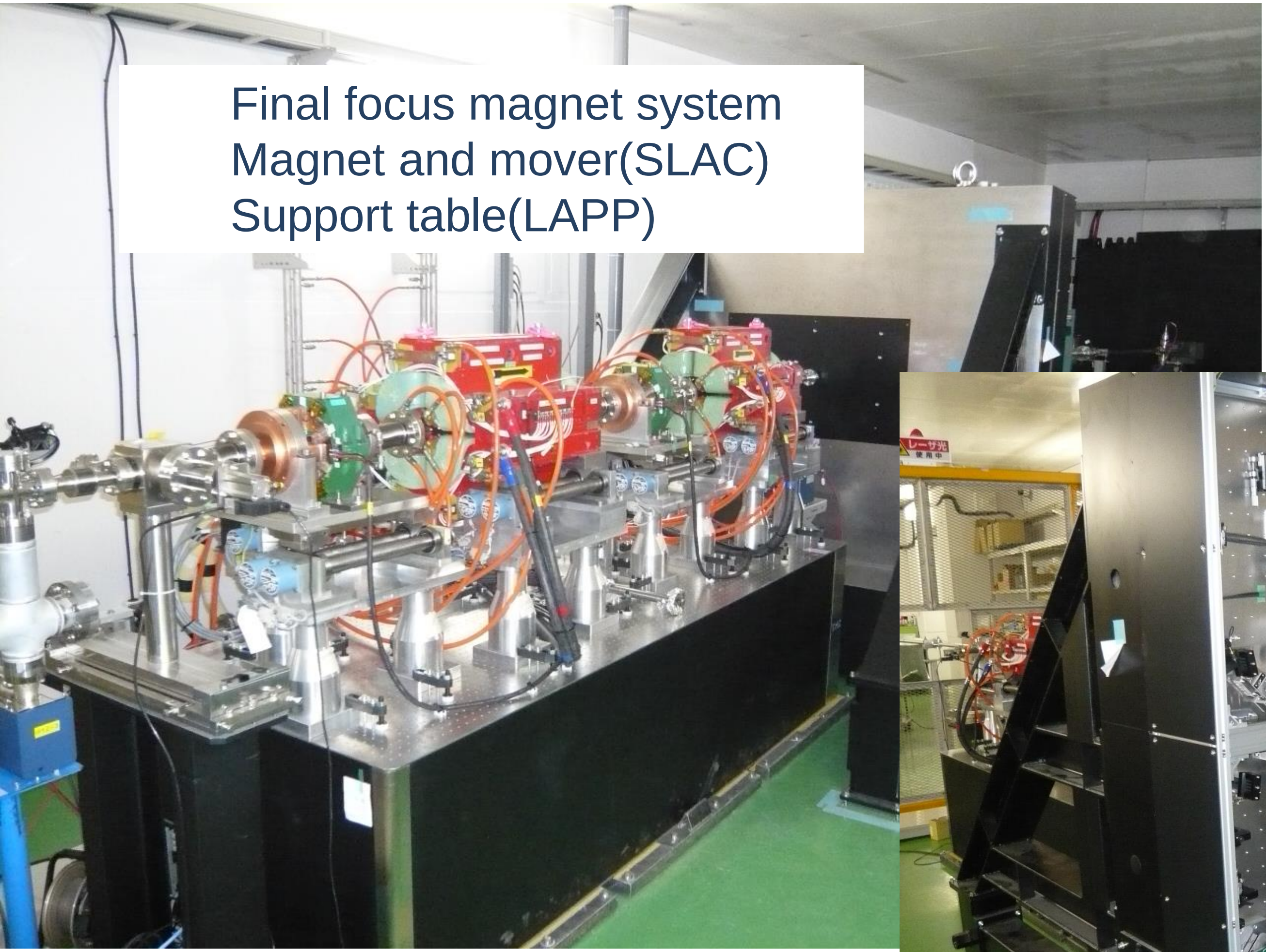
Q-BPM
electronics(SLAC)



Vacuum chamber (KEK)

Example of ATF2 focus part

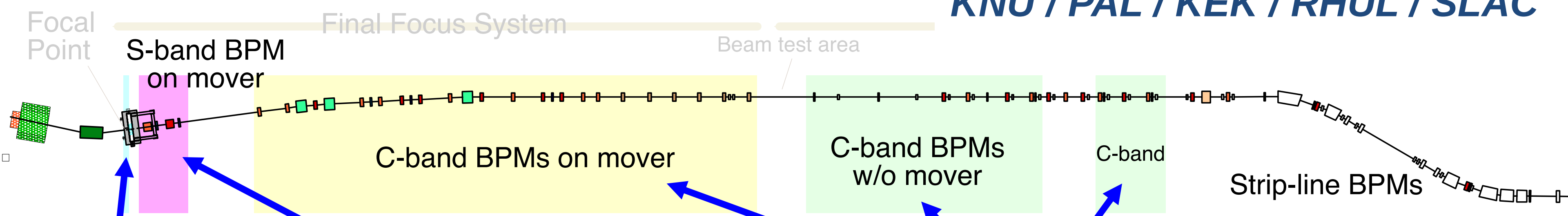
Final focus magnet system
Magnet and mover(SLAC)
Support table(LAPP)



Beam size monitor
(Tokyo Univ., KEK)

ATF2 beam position monitors

KNU / PAL / KEK / RHUL / SLAC

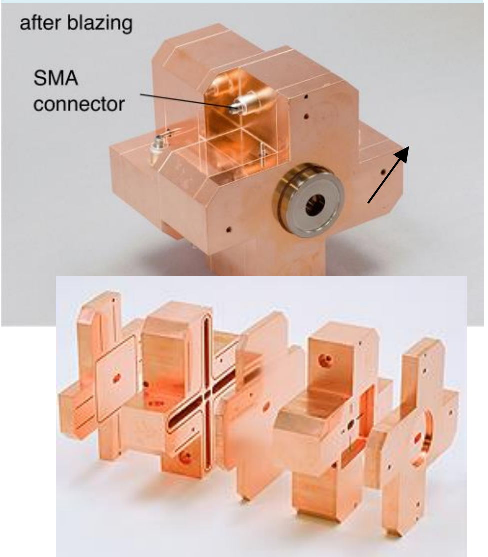


IP BPM system

(BPM + Ref) Cavity **1 unit**

Target : 2 nm

Aperture: 6 mm(V)



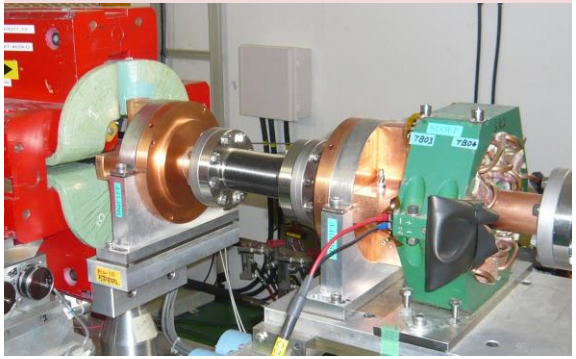
S-band BPM system

BPM cavity: **4 units**

Ref. cavity: **1 unit**

Target : 100 nm

Aperture: ϕ40 mm



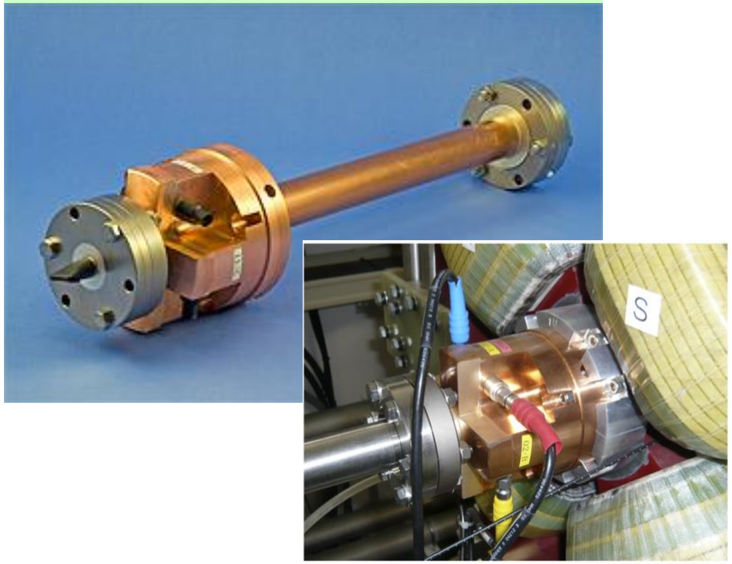
C-band BPM system

BPM cavity: **34 units**

Reference cavity: **4 units**

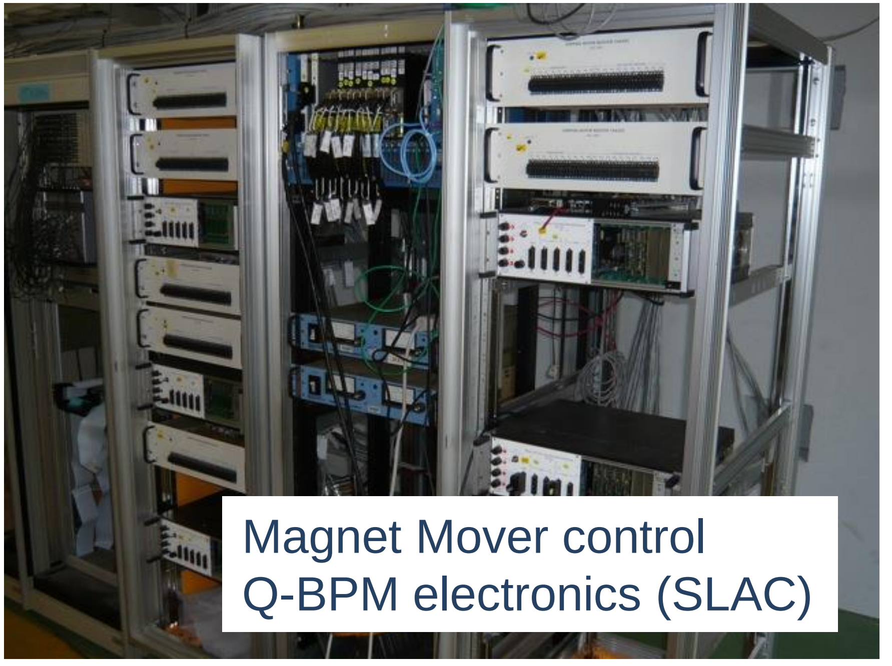
Target resolution: 100 nm

Aperture: ϕ20 mm



Example of ATF2
Magnet power supply and instrumentations

Magnet power supply (SLAC)



Magnet Mover control
Q-BPM electronics (SLAC)

Let's participate to ILC accelerator construction

Thanks

End of slide