

# International Development Team

**IDT WG2 Activities**

Benno List, DESY and CERN

ILC Europe Meeting

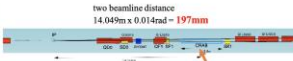
9.12.2022

# Crab Cavity: Design Downselect

- 30.11./1.12: crab cavity down-selection preparation meeting  
<https://agenda.linearcollider.org/event/9891/>
- Active effort with wide international participation, strong European role

### 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 <sup>-</sup> )
Crossing angle	14 mrad
Installation site	14 m from IP
RF repetition rate	5 Hz
Beam train length	727 μsec
Beam spacing	554 nsec
Operational temperature	2.0 K (T)
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)

✓ Strategy for prototype cavity production to be in series:

- The first prototype experience should be efficiently reflected to the second prototype, even if two crab cavities are necessary for synchronized operation, hopefully within the ITN period expected to be ~ 4 years.

✓ Possibility to purchase Nb material for prototypes, in next FY:

- KEK is seriously considering to purchase Nb material for the 1<sup>st</sup> (+)

-> Down-selection is the important milestone to start ILC technology network

S. Michizono

### Introduction and Remit for Discussion

- Assess and compare CC EM designs, finally optimised:
  - Cavity,
  - HOMs,
  - Couplers (input and HOM),
  - Multipacting,
  - Pressure stability and tuning,
  - Fabrication - Sheet/Ingot/Mixed, Nb material required,
  - Cryomodule integration compliance with specification,
  - Anything else – level of design detail - bare/dressed?
- WP3 meeting to review and agree criteria in Nov/Dec (today).

P. McIntosh

Identified from WP3 Design Review Meeting #3

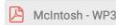
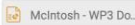
## WP3 Down-selection Preparation Meeting


Nov 30, 2022, 11:30 PM → Dec 1, 2022, 1:00 AM Asia/Tokyo

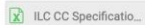
Description <https://ukri.zoom.us/j/98814955429>

### WEDNESDAY, NOVEMBER 30

- 11:30 PM

 → 11:35 PM **Welcome and remit for the discussion**  
 Convener: Peter McIntosh (STFC)  


- 11:35 PM

 → 11:40 PM **IDT Perspective for CC developments**  
 Conveners: Akira Yamamoto (KEK), Shinichiro Michizono (KEK)  

- 11:40 PM

 → 11:45 PM **Assessment of cavity parameters (review collated table)**  
 Convener: Peter McIntosh (STFC)  

- 11:45 PM

 → 12:00 AM **The down-selection process and criteria to be clarified: Open Discussion**

### THURSDAY, DECEMBER 1

- 12:00 AM

 → 12:35 AM **The down-selection process and criteria to be clarified: Open Discussion**
- 12:35 AM

 → 12:50 AM **Format for the review, i.e. duration, location, reviewers, expectation**  
 Conveners: Akira Yamamoto (KEK), Peter McIntosh (STFC), Yasuchika Yamamoto (KEK)
- 12:50 AM

 → 12:55 AM **Conclusions**  
 Convener: Peter McIntosh (STFC)

# SRF Subgroup

- KEK/Japan preparing for cryomodule production project starting next year
- Investigating "Medium Grain" material (sliced from ingots) -> offer to supply material to EU and US
- New ILC cryomodule design by FNAL based on LCLS-II experience: US very active

## Preparation for SRF Five-year plan at KEK

Michizono-san, Akira Yamamoto-san and Kirk have discussed internally the SRF five-year plan at KEK. This plan follows the time-critical WPs discussed with the WG2/SRF group. In WP-prime 2, we will produce **first** CM for ILC. Also, we will construct the infrastructure related to helium refrigerator, CM assembly/test area, etc.

### SRF Five-year plan at KEK (currently prospect)

	F.Y.2023	F.Y.2024	F.Y.2025	F.Y.2026	F.Y.2027
Infrastructure @COI					
Infrastructure @CFF					
Cavity production					
Cavity test	R&D	R&D			
CM production/assembly					
CM test					

Y. Yamamoto WG2 meeting 8.11.22

## Possibility of supply of Nb material

At KEK, we are thinking of a possibility to supply Nb material to EU and US. On early next year, we will start to make a document to purchase them.

If you have an interest in use of MG, we can provide more information.

	# of cavities to be produced in each region				Crab cavity
	1-cell cavity		9-cell cavity		
	FG	MG	FG	MG	
Japan	3	3	10	10	0
Europe	?	?	?	?	2 (x 2)
Americas	?	?	?	?	

Y. Yamamoto WG2 SRF meeting 6.12.22

## Change requests related to SRF

If KEK has enough budget from next FY, we'd like to start cavity/CM production as soon as possible. Then, we have to decide the design of cavity/CM including tuner/coupler/magnet. Currently, we have two change requests related to tuner/helium tank and position of current lead box for Q-mag.

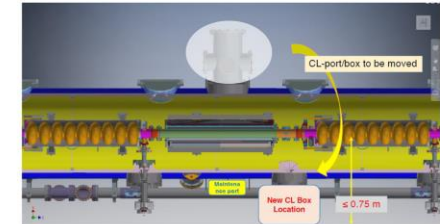
LCLS-II tuner has worked with high reliability, but there is no experience in pulsed mode operation. We need to check this with **first** CM.



LCLS II (HE)/FNAL's  
N=320 units+ 180units

CM design is already completed, but we have to design outside components, that is, waveguide system, pumping system for power coupler, current lead box, etc. We need more detailed drawing.

### Proposal for the CL box to be moved to the Coupler Port Side




Y. Yamamoto WG2 meeting 8.11.22

# FNAL Cryomodule Design

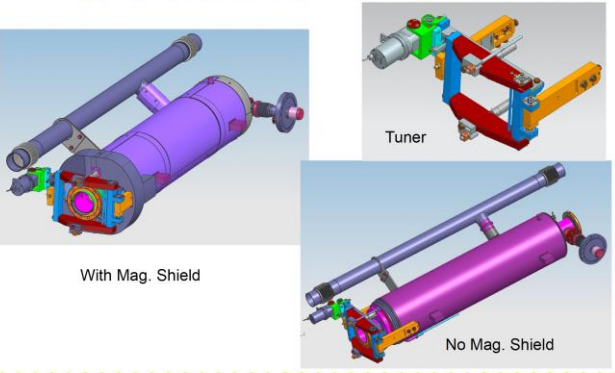


## ILC 1.3 GHz CM, 2022

Design status on 11/16/22,  
by Y. Orlov, behalf FNAL and KEK  
teams



## 1.3GHz Dressed Cavity with Tuner




With Mag. Shield

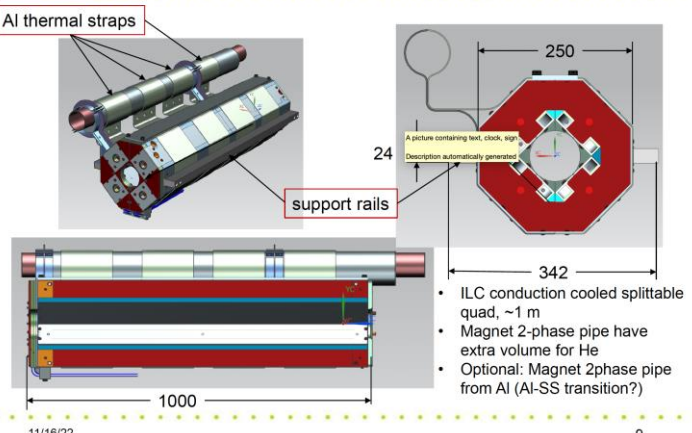
Tuner

No Mag. Shield

11/19/22 6



## 1.3 GHz ILC magnet



Al thermal straps

support rails


250

342

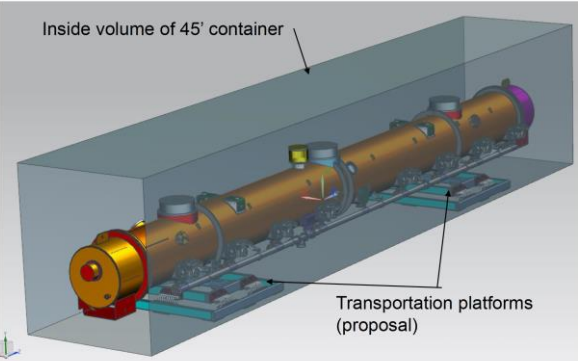
1000

- ILC conduction cooled splittable quad, ~1 m
- Magnet 2-phase pipe have extra volume for He
- Optional: Magnet 2phase pipe from Al (Al-SS transition?)

11/16/22 9



## Transportation of 1.3 GHz CM



Inside volume of 45' container

Transportation platforms (proposal)

11/16/22 27

# BDS/DR/Dumps Subgroup

- Presentation by A. Grudiev on CLIC power optimisation
- High efficiency klystrons developed for CLIC now prototyped  
-> highly interesting for ILC (klystron efficiency 65% -> 85%)
- Europe leading here

## Update of the 380 GeV CLIC power consumption and Damping Rings

Alexej Grudiev

28th IDT WG2 DR/BDS/DUMP group meeting

16/11/2022

[A. Grudiev BDS/DR/Dump subgroup meeting 16.11.22](#)

## New ideas for CLIC 1GHz klystron for DB linac

### High Efficiency 24 MW, 1 GHz, CLIC TS MBK performance summary (PIC CTS/3D)

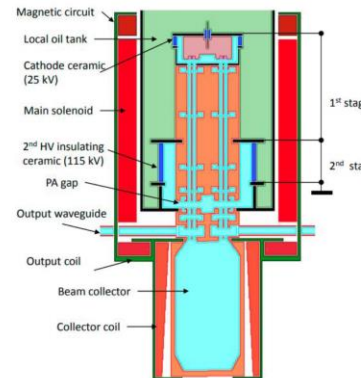
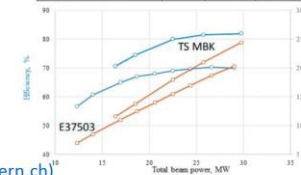


TABLE I. DESIGN AND SIMULATED PARAMETERS (CTS/3D) OF THE CLIC TS MBK AND CANON MBK E3750 CATALOGUE DATA

Parameter	TS MBK	E37503	Unit
Operating frequency	1000	1000	MHz
Voltage at the 1 <sup>st</sup> stage	25	160	kV
Voltage at the 2 <sup>nd</sup> stage	140		
Total beam current	212	180	A
Number of beamlets	30	6	
Number of cavities	6	6	
Pervance at the 1 <sup>st</sup> stage	1.77	0.47	$\mu\text{A/V}^{1/2}$
Pervance at the 2 <sup>nd</sup> stage	0.133		
Output RF power	24.1	20	MW
Saturated power gain	53	54	dB
Saturated efficiency	82	70	%
Length of RF circuit	900	1500	mm



Novel design Two-Stage (TS) Multi-Beam Klystron (MBK)

It has more power per klystron compared to PIP baseline: **20 MW -> 24 MW**  
Significant **cost** impact

It has higher Efficiency compared to PIP baseline: **70 % -> 82 %**  
Significant impact on **power consumption**

CLIC project meeting 15 June 2021 [Igor Syratcev \(cern.ch\)](#)

# IDT-WG2 report

## *Shin MICHIZONO (KEK/IDT-WG2)*

### *(Nov.29, 2022)*

- Federation of Diet Members visited the Minister of MEXT and the Minister of Finance. The Federation of Diet Members requested on Nov. 2 that MEXT Minister Keiko Nagaoka further deepen international collaboration to promote the project. They visited Minister of Finance on Nov.4.
- European Lab Directors Group meeting was held on Nov.10. Steinar explained ILC status and ILC technology network.
- KEK/ILC-Japan/IDT delegation will visit JLAB on Dec.8.

2022.11.03

シェアする
 ツイート
 LINEで送る

#### ILC推進へ国際連携深化を要望 超党派議連、文科相に決議文提出



永岡桂子文科相に決議文を手渡す塩谷立会長（左）

【東京支社】国際リニアコライダー（ILC）の誘致に取り組む超党派のリニアコライダー国際研究所建設推進議員連盟（会長・塩谷立衆院議員）は2日、永岡桂子文部科学相に対し、計画推進に向けて国際連携をさらに深めるよう要望した。

塩谷会長らが文科省を訪れ、10月13日の総会で採択した決議文を手渡した。決議は▽ILC計画は国際協力が不可欠であり政府は活動を推進する研究者と緊密に連携を図る▽計画推進につながる次世代加速器の技術開発を適切な国際協力の下で着実に推進▽技術開発に関する2023年度予算を確実に確保などを求めている。

懇談後、塩谷会長は「永岡氏は文部科学副大臣時代にILCの陳情を受けていたので内容は承知していた。今後は研究者の連携を深めて各国が動けるような状況をつくるのが大事。永岡氏にリーダーシップを取ってもらいたい」と述べた。

同議連は4日、鈴木俊一財務相（衆院岩手2区）に決議文を提出する。

IDT-WG2 meeting on Nov.29, 2022

<https://www.iwate-np.co.jp/article/2022/11/3/128422>