# SCRF Monthly WebEx Meeting June, 29, 2011

1. Report from PMs (15 min.)
   1. GDE SCRF related meeting plan in 2011~2012 (PMs)
   2. SCRF webex meeting plan for a Series of topical discussions on each subject (A.Y.)
   3. SCRF Cavity Industrialization workshop, Chicago, July 24
   4. LCWS Gradana meeting plan (to be discussed later),
   5. S1-Global Progress Report in cooperation with KEK and ILC-GDE (A.Y.)
   6. ILC Cryomodule design to be unified with a 8-cavity-string and independent Q (A.Y.)
   7. Update of SCRF Industrialization Model and Diagram

2. Report from TA Group Leaders
   1. Cavity Gradient R&D: R. Geng
   2. Cavity Integration: H. Hayano
   3. Cryomodule: P. Pierini
   4. Cryogenics: T. Peterson
   5. HLRF: S. Fukuda & C. Nantista
   6. ML Integration: C. Adolphsen

3. Special Discussions (30 min.)
   1. HLRF-KCS R&D progress and Preparation for Technical Design Report (C. Nantista)
   2. Granada, LCWS, meeting and SCRF agenda (J. Kerby, H. Hayano, C. Nantista, P. Pierini

# Meeting Schedule related to SCRF (2011~)

| Month | Day | Place | Meeting |
|---|---|---|---|
| 2011<br>May | 4 →6<br>19-20 | Web<br>Taipei | Monthly meeting<br>ILC-PAC (SCRF: R&D report by R. G. and H.H.; Industrialization by A.Y.) |
| June | 1<br>6-8<br>29 | Web<br>DESY<br>Web | Monthly meeting<br>FLASH-9mA workshop<br>Monthly meeting (HLRF-KCS discussion) |
| July | 24<br>27 | Chicago<br>Web | Cavity industrialization WS, SRF2011 (25~29)<br>Monthly meeting (Cavity-Integration/Cryomodule-Assembly) |
| August | 24 | Web | Monthly meeting (Cryogenics) |
| Sept. | 5-9<br>21<br>26-30 | San Sebastian<br>Web<br>Gradana | IPAC-2011<br>Monthly meeting (ML Integration and LCWS preparation)<br>LCWS-GDE (ILC-CLIC collab.) meeting |
| Oct. | 19 | Web | Monthly meeting |
| Nov. | 14-15<br>16 | Prague<br>Web | UKC-PAC<br>Monthly meeting |
| Dec. | 5-8,(8-9)<br>14 | Beijing<br>Web | TTC meeting ( ILC-SCRF meeting)<br>Monthly meeting |
| 2012,<br>Jan. | 11<br>19-20 | Web<br>KEK | Monthly meeting<br>SCRF TDR Preparation Review & WS |
| Feb. | 8 | Web | Monthly meeting |

# The 2nd workshop on SCRF
## Technology and Industrialization for the ILC


as a satellite meeting of SRF 2011

- Date: July 24, 2011, (8:30 ~ 16:00)
- Place: Chicago
- Agenda:
  - Introduction
  - Reports from SCRF cavity/cryomodule industry
  - Reports from SC material vendor
  - Comments from Regional Hub-laboratory
  - Discussions on the ILC SCRF industrialization model
- Note:
  - Open for everybody,
  - Industrial participation anticipated

# Agenda Proposed

- 8:30 , Opening with Chair person -- Mark / Camille
- 08h30-09h15. Welcome, Introduction, Purpose. --Akira. 45 minutes
  09h15-10h10 and 10h25-12h15 165 minutes total. Cavity Industrial Partners
  J. Sredniawski AES, ILC SCRF Dressed Cavity, An Industrial Cost Estimate Update"
  T.L. Grimm, C.H. Boulware, J.L. Hollister, A.A. Kolka Niowave, "Niowave's Industrialization Plan"
- 10h10-10h25 Coffee Break
  R. Edinger Pavac , "Utilization of Industrial Electron Beam Processing in Order to Optimize Fabrication of SRF Cavities in Larger Quantities".
  M. Pekeler RI "Preparing RI for the Mechanical Manufacturing and Surface Preparation of 300 XFEL Cavities"
  S. Ishii MHI "Study of industrialization and factory layout for SCRF cavity production"
  T. Semba Hitachi "Study of industrialization and factory layout for Cryomodule assembly"
  Lunch 12h15-13h15
  13h15-14h35 80 minutes Material Industry Partners
  H. Zhao OTIC, Ningxia, "Progress and Future Capability in Production of Material for SCRF Cavities"
  H. Umezawa Tokyo Denkai . "Nb-sheet production status and future prospect"
  T. Nelson ATI / Wah Chang , "Status and future prospect for superconducting material (TBC)"
  Bernd Spaniol Heraeus/Plansee, "Progress and capability of Nb Seamless Pipe and Sheet Production"
- Coffee Break
- 14h50-15h30 40 minutes Laboratories
  B. Kephart FNAL "Progress and Plan for SCRF cavity industrialization (TBC)"
  H. Hayano KEK, "Industrialization Studies in the KEK Cavity Fabircation Facility (CFF)"
  15h30-16h00 30 minutes Summary and Discussion
  Camille/Mark

# An Invited Talk in SRF-2011

## July 25, Monday

- Title:
  - **"Advances in ILC SRF Development for ILC "**
- Presenter:
  - Akira Yamamoto
- Outline (proposed)
  - Cavity Gradient R&D and Fundamental research
  - Cavity-string test: Flash, S1-Global, NML, progress
  - Preparation for SCR industrialization
  - Design updates in Technical Design Phase

- *I would thank, in advance, all collaborator for their kind cooperation to prepare for the talk*

# LCWS 2011: Granada, Spain
# September 26-30, 2011

The 2011 International Workshop on Future Linear Colliders (LCWS11) will be hosted by the Universidad de Granada and will be held at the "Palacio de Congresos" (Congress Hall) downtown Granada (Spain).

The workshop will be devoted to the study of the Physics case for a high energy linear electron-positron collider, taking into account the recent results from LHC, and to review the progress in the detector and accelerator designs for both ILC and CLIC projects.

Since Granada is a very touristic city receiving constantly a large number of visitors, we encourage to register and make your travel arrangements as early as possible.

# Subjects to be discussed on SCRF

## at Joint ILC-CLIC Meeting

### Gradana, Sept. 25^29, 2011

- TDR preparation
  - Progress reports, and further discussions
    - Sub-section writers/editors' participation anticipated
    - Contents to be discussed, today
    - Interim process to prepare for the SCRF TDR preparation review to be held at KEK on Jan. 19 – 20.
- SCRF R&D
  - Progress of TDP R&D
  - R&D Plan for 1 TeV upgrade

# Agenda for WWS-GDE Meeting, Granada, September, 26- 30, 2011

- Day 1:
  - Plenaries--PMs baseline design after BAWs
  - Task leader summaries of current status, description of chapters of TDR, parameters as they know them, needs. up to 1 hour each.
  - They could start by reading the RDR and associated cost estimate and talking about what has been changed, improved, etc.
- Day 2; 3; 4 (half-day)
  - Small working groups on text, discussions on interfaces, discussion of machine design parameters that are falling through the cracks or things that need to be drawn up in following 6 months.
  - Preliminary inputs to cost chapter. Agreement on models to be used for production. Maybe a couple of talks on system tests as they educate the technical portions of the text.
  - These could be done in a small group settings, or via webex. Creation of decent outline for TDR. Placeholders for figures, etc.
- Day 5:
  - summary; plenaries as required.

# SCRF Parallel Session and Subjects to be discussed

1. TD report preparation

- Part-1:
- 1) 9-cell cavity Gradient R&D progress to meet requirement for TDR
- 2) Cavity-string R&D progress
- 3) SCRF accelerator test facility progress with FLASH
- 4) SCRF cavity and cryomodule industrialization technology and industrialization models.
- Part-2:
- 1) ML Accelerator design
  including beam dynamics, alignment tolerance, tracking tune-ability with steering,
- Part 3:
- 1) Future prospect toward 1 TeV with cost-effective ways
  including cavity gradient and Q0 improvement, and cost-effective fabrication technology

2. Special technical topics (preparation for TTC WG)

- 1) S1-Global results and analysis
- 2) NML status and plan
- 3) PXFEL progress and analysis
- 4) Cavity-string gradient degradation issues,

# Proposal for S1-Global Progress Report and Discussions in TTC meeting

- to organize a one-day full working group dedicated to cryomodule and cavity-string assembly test

- including S1-Global, NML, and PXFEL cavity-string test specially focuding on cavity gradient degradation, tuner, and coupler issues, in a part of TTC, and

- to organize a separate one day meeting (may be one afternoon (12/8) and one morning (12/9) in the folloiwing day
- to discuss specific ILC-GDE oriented issues, (such as what should be our baseline in TDR).

- As a further possibility, we may include HLRF and LLRF issues related to S1-Global in the separate meeting

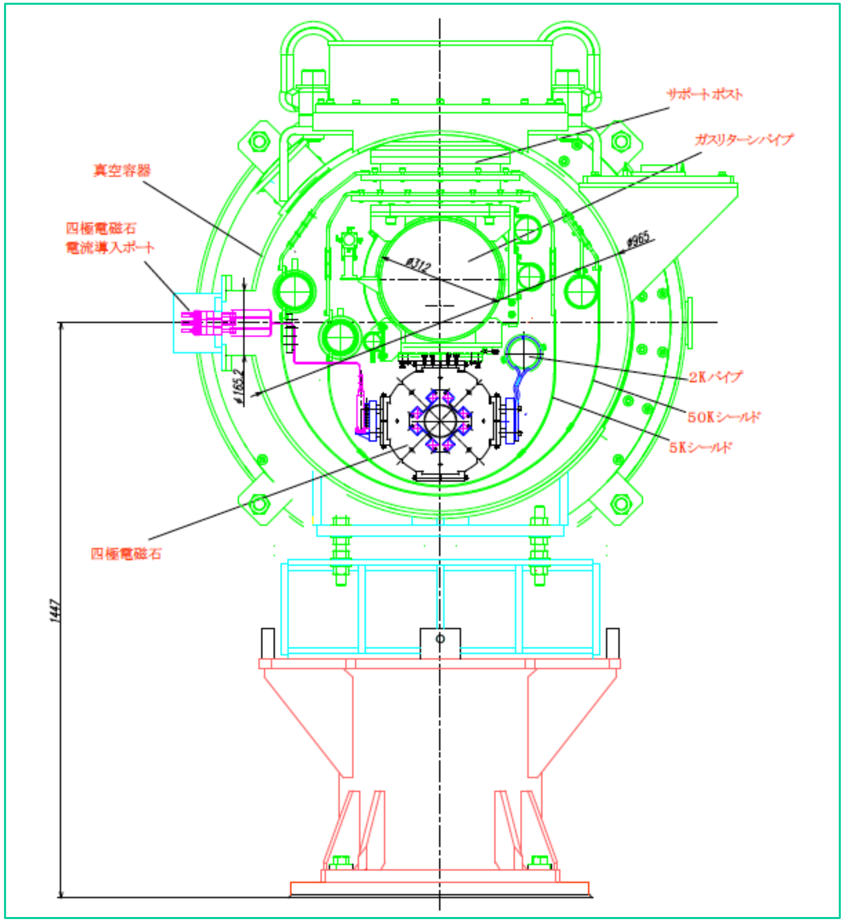
  (because of the limited time in the TTC meeting).

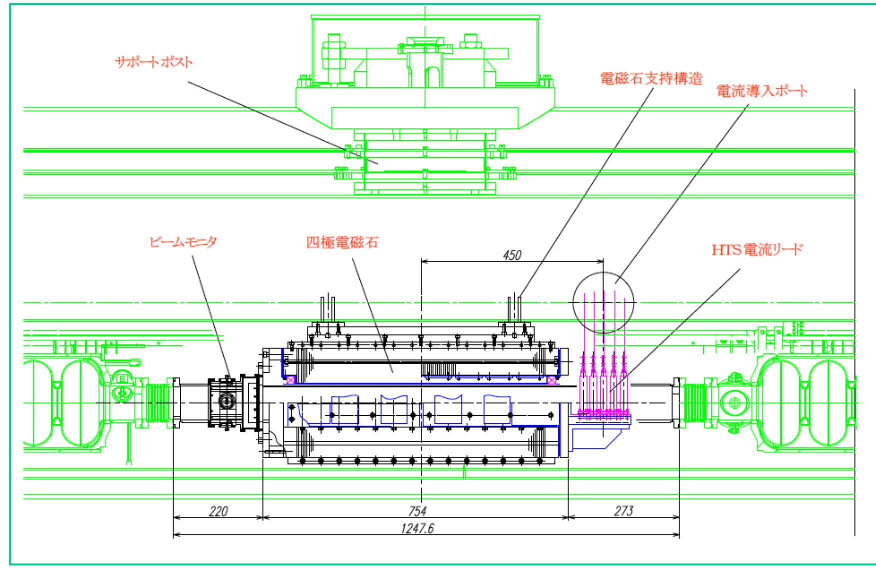
# Study of SC Quadrople in Cryomodule

Reported by
Akira Yamamoto

Cryomodule Webex Meeting, June 20, 2011

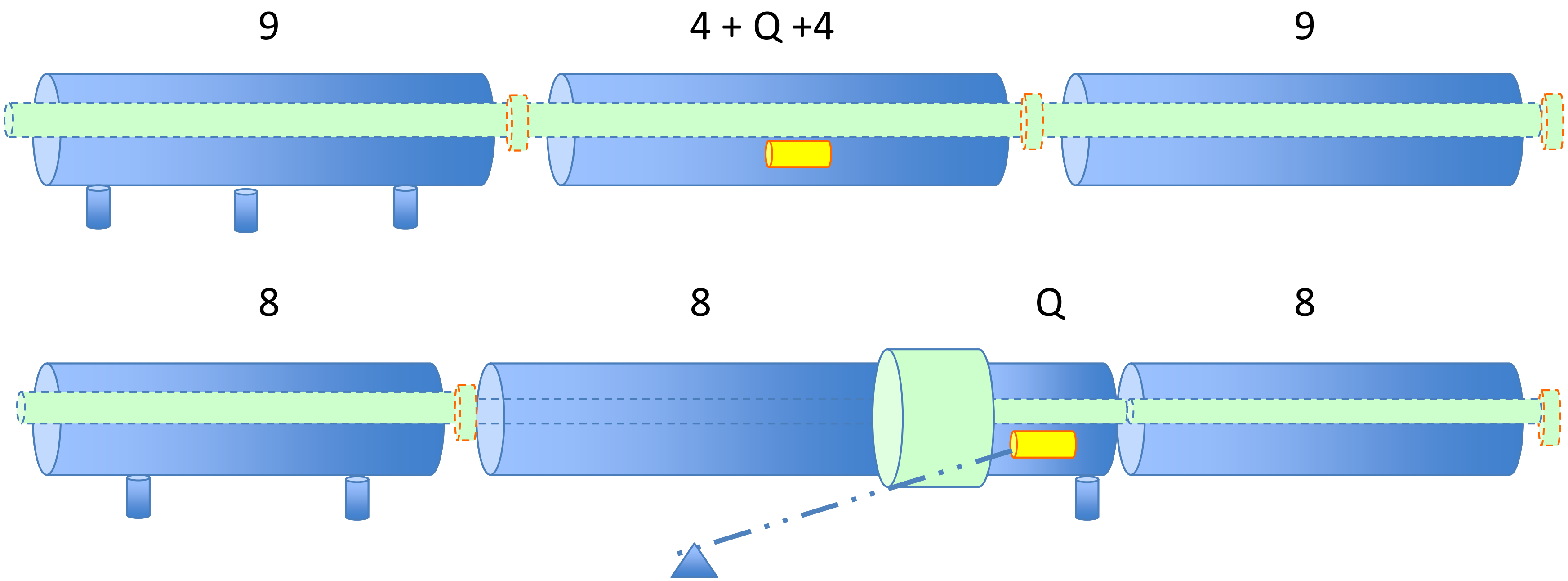
# SC Quadrupole in Cryomodule



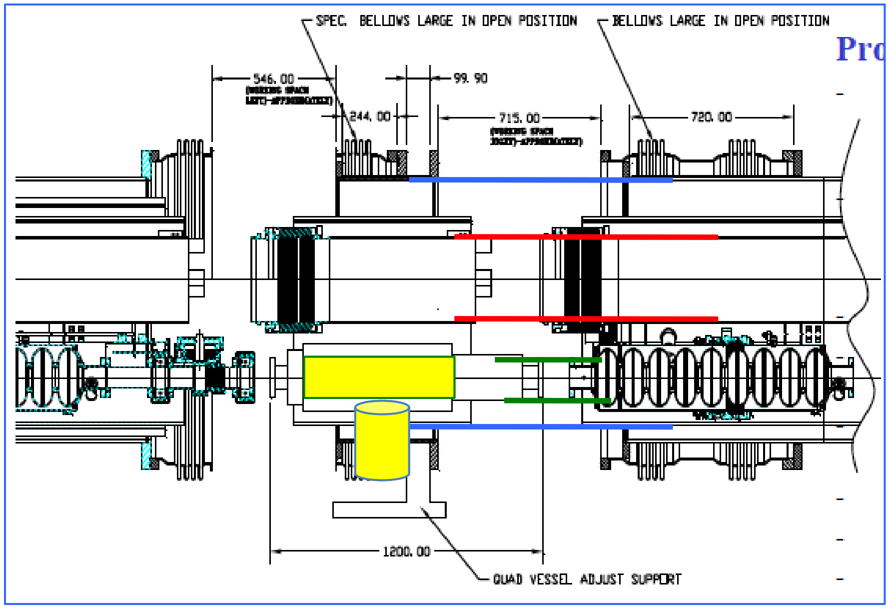

- Suspended by GRP

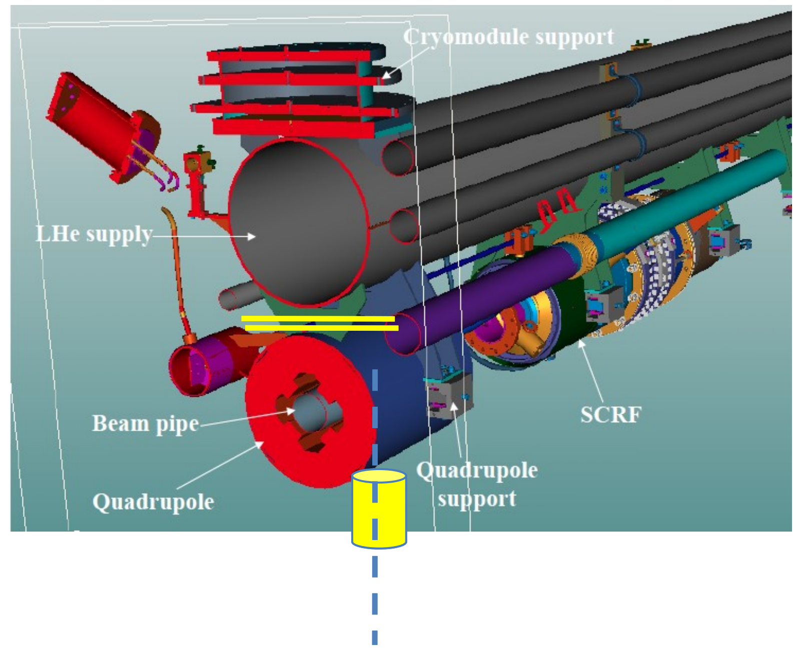
# A Proposal / Revival




- Independent stand-off at bottom, mechanically free from GRP,
- Solid pipe work (without bellows) at down stream end
- Minimize additional piping work
  - Not full additional interconnect : not (3 +1 full) but (3 + alpha) interconnect,

# Thinking about a cost-effective connection



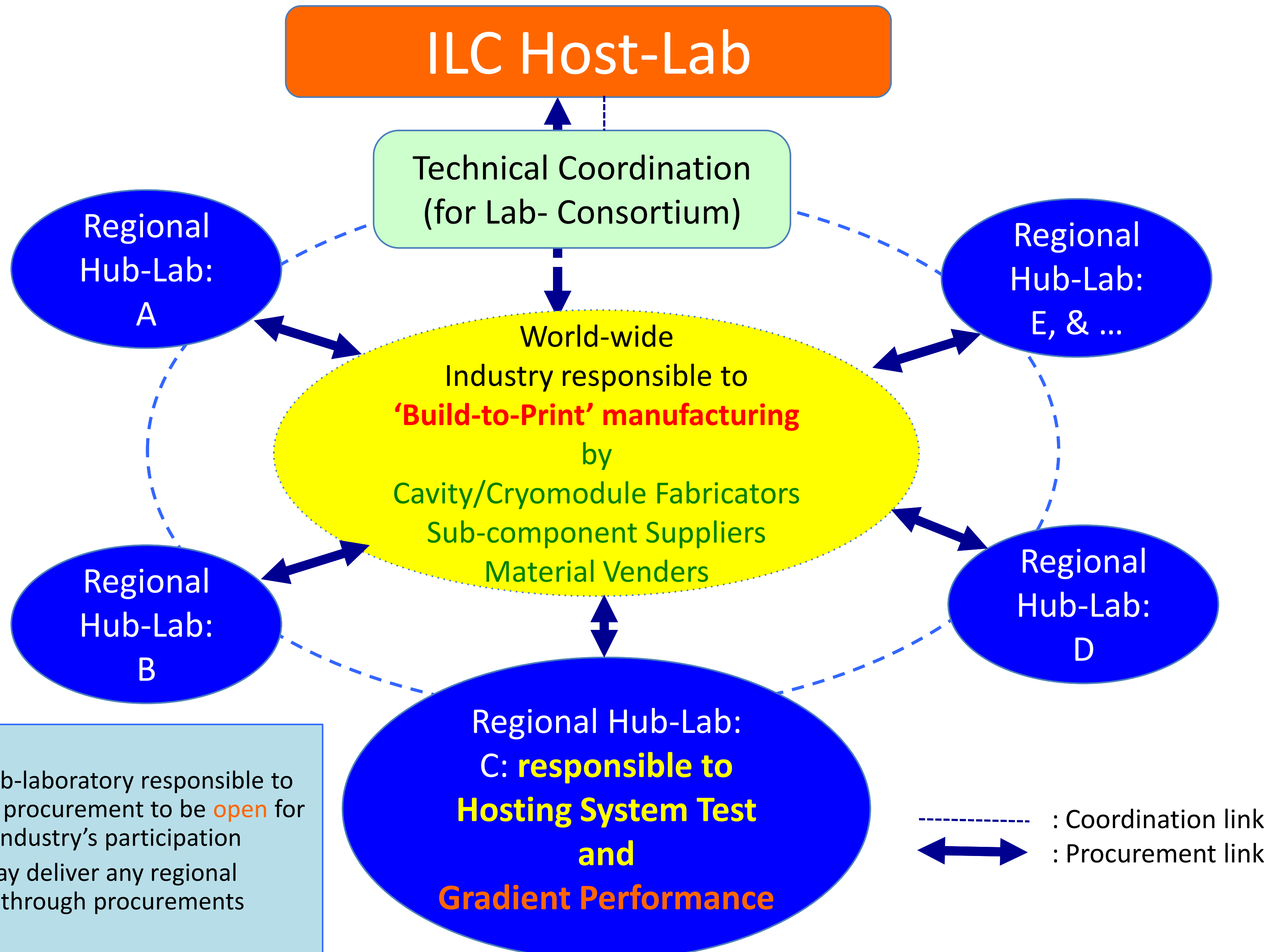

- We could eliminate flexible/bellows connection one-side, with simple extension of solid pipes
- We would like to seek for a smart/sophisticated solution with expert's contribution.

- Another possibility is to place Q in every 4 cryomodules (instead of every 3 cryomodule)

# Advantage/Disadvantage and Necessary Study/Work

- Advantage:
  - Single cryomodule design and manufacturing
  - Independent work between RF and Magnet
  - Easier and direct alignment including BPM, in installation in case of keeping conductive cooling magnet,
- Disadvantage:
  - Additional interconnect work
- Necessary study/work/communication
  - Smart and sophisticated interconnect design and work including connection of beam-pipe,
  - Discussions and consensus in ILC-GDE SCRF group
  - Visit and discussion with key persons
    - 7/5: INFN (Milano), 7/22: Fermilab, 7/24, Workshop, 7/25 ~ SRF,

# A Possible ILC-SCRF Industrialization Model




Note 1:

-Regional hub-laboratory responsible to any regional procurement to be open for world-wide industry's participation

- Industry may deliver any regional laboratories through procurements above

# backup

# Sharing Responsibility

- Regional hub-laboratories to
  - Primarily support the ILC host-laboratory in cooperation with other laboratories,
  - be responsible with cryomodule performance
  - host cold, RF performance test facility,
  - may host cavity-string/cryomodule assembly facility and work on it through contract.
  - handle prrocurements of sub-components and cavity and cryomodule hardware assembly

- - Industry
  - be responsible to fabricate the sub-components, cavity assembly,  according to ‘built-to-print’ specification, with minimum acceptance criteria

# Procurement Policy/Guideline

- Bid is open for international bidding, and

- Any company around the world may participate the procurement to be organized by any hub-laboratories,
  - if the company pass a qualification process authorized by consortium of regional hub-laboratories.

# Build-to-Print Manufacturing

- To be contracted with minimum acceptance criteria such as,
  - dimension
  - RF performance at room temperature,
  - high-pressure code inspection test and report,

# Flexible Industrialization Models Required

- Subcomponents and material
  - may be procured more flexibly according to industrial availability and market/competition
  - Do not need to concern regional balance in manufacturing.
- Assembly and integration
  - Cryomodule assembly may be an important issue to seek for best efficient work.
    - Need more communication with industry and laboratories
    - A technically corresponding person  from CERN anticipated

# An European Industry Response

- RI has responded to our ‘Request for Information’

- Major response (with no study-contract):
  - Cost saving for 20 % fraction of production within 6 years, as a simple extension of the EXFEL experience
  - Full responsibility in manufacturing with no-consortium considered. If necessary,  industrial purchasing shall work well to get specific sub-component, such as tuner, coupler and others

- Specific contract to be required for further industrial study for larger and deeper industrial study.

# Possible Actions suggested

- Industrial study to be contracted with EU companies
  - R.I. , Zanon, and/or B. Noel
- Communication with specific companeis
  - Such as EBW machine, as SST in Germany which recently delivered a machine to KEK,
- Comunication with laboratories
  - CERN (?), CEA/Saclay (7/1) , and INFN (7/4~5),

# Visiting Companies in Progress

| | Date | Company | Place | Technical sbject |
|---|---|---|---|---|
| 1 | 2/8 | **Hitachi** | Tokyo (JP) | Cavity/Cryomodule |
| 2 | 2/8 | **Toshiba** | Yokohana (JP) | Cavity/Cryomodule, SCM |
| 3 | 2/9 | **MHI** | Kobe (JP) | Cavity / Cryomodule |
| 4 | 2/9 | **Tokyo Denkai** | Tokyo (JP) | Material (Nb) |
| 5 | 2/18 | **OTIC** | NingXia (CN) | Material (Nb, NbTi, Ti) |
| 6 | 3/3 | **Zanon** | Via Vicenza (IT) | Cavity/Cryomodule |
| 7 | 3/4 | **RI** | Koeln (DE) | Cavity |
| 8 | 3/14, (4/8) | **AES** | Medford, NY (US) | Cavity |
| 9 | 3/15, (4/7) | **Niowave** | Lansing, MI (US) | Cavity/Cryomodule |
| 10 | 4/6 | **PAVAC** | Vancouver (CA) | Cavity |
| 11 | 4/25 | **ATI Wah-Chang** | Albany, OR (US) | Material (Nb, Nb-Ti, Ti) |
| 12 | 4/27 | **Plansee** | Ruette (AS) | Material (Nb, Nb-Ti, Ti) |
| 13 | 5/24 | **SDMS** | Sr. Romans (FR) | Cavity |
| 14 | 7/6 | **Heraeus** | Hanau (DE) | Material (Nb, Nb-Ti, Ti) |

# RDR to TDR

- Re-visit of SCRF in RDR
  - Outline and contents
- Plan proposed for SCRF in TDR
  - Chapter 1: TD Phase R&D
  - Chapter 2: RDP Reference Accelerator Design

# Technical Update in ML and SCRF RDR to TDR

| Sybhect | RDR | TDR |
|---|---|---|
| ML Integration | Twin tunnel<br>5 Hz operation<br>31.5 MV/m (fixed) | Single tunnel<br>10 Hz –alternate operation<br>31.5 MV/m +/-20% |
| Cavity | 35 MV/m with yield 80 % | Yield plot evaluation<br>R&D goal: 35 MV/m at 90%<br>Production :35 +/-20% spread |
| Cavity Integration | | Plug compatible design<br>Mag. shield inside (proposed)<br>Industrialization |
| Cryomodule | w/ 5 K shield<br>Quadrupole w/ LHe cooling | w/o 5 K bottom-shield (proposed)<br>Conduction-cooled magnet |
| Cryogenics | | |
| HLRF / LLRF | RDR/RF-unit configuration | KCS or DRFS configuration<br>RDR RF Backup option |
| 1 TeV path | | Alternate shape (LL)<br>Hydro-forming, Large-grain |

# Main Linac and SCRF in RDR

| Chapter | Contents |
|---|---|
| 1. Overview | 1,1 Introduction<br>1.2 Superconducting RF (3 pages)<br>1.3 The ILC baseline design<br>1.3.6 Main Linac (3 pages) |
| 2. Acc. Description | 2.6 Main Linac (10 pages)<br>2.6.1 Overview<br>2.6.2 Beam parameters<br>2.6.3 System description<br>2.6.4 Accelerator physics issue<br>2.6.5 Accelerator components |
| 3. Technical Systems | 3.4 Klystrons (4)<br>3.5 RF distribution (4)<br>3.6 Cavities (8)<br>3.7 Cryomodules (5)<br>3.8 Cryogenic systems (7)<br>3.9 Low level RF controls (7)<br>2.10 Instrumentation (9) |
| 4. CF & Siting … | |

# 1. Overviews

| Section | | |
|---|---|---|
| 1.2<br>SCRF | | - Cavity and cryomodule outlook<br>- Cavity gradient (Q vs G) status<br>- Cavity assembly and preparation process |
| 1.3<br>ILC Baseline design | 1.3.6<br>Main Linac | - Functional requirements<br>- System description<br>-Challenges |
| | | |

# 2. Accelerator Descriptions

| | | |
|---|---|---|
| 2.6 Main Linac | 1. Overview | |
| | 2. Beam parameters | -Nominal beam parameters (table) |
| | 3. System description | -RF unit (RF unit figure/table, Cryomodule cross s)<br>-Linac layout |
| | 4. Accelerator physics issue | -Optics<br>-Beam dynamics<br>-Operation |
| | 5. Accelerator components | -Cavities and Cryomodule<br>-Quad package<br>-Vacuum system<br>-Beamline components (table) |
| | | |

# 3. Technical Systems (3.4, 3.5)

| | | |
|---|---|---|
| 3.4 Klystrons | 1. Overview | |
| | 2. Technical description | -L-band klystron<br>-Damping ring klystron |
| | 3. Technical issue | -L-band klystrons |
| | 4. Cost estimation | |
| | 5. Components | (1.3 GHz, 650 MHz klystron table) |
| | | |
| 3.5 RF Distribution | 1. Overview | |
| | 2. Technical description | -RF unit diagram<br>-Wave guide circuit configuration |
| | 3. Technical Issues | -Wave gude<br>-Tap-offs, curculators, and tuners |
| | 4. Cost estimation | |
| | 5. Components | - Components table |

# 3. Technical Systems (3.6, 3.7)

| | | |
|---|---|---|
| 3.6 Cavities | 1. Overview | |
| | 2. Technical description | -Cavity design<br>-Cavity fabrication (design parameters)<br>-Cavity processing<br>-Peripheral components<br>-Cavity performance requirements<br>-Alternative cavity designs |
| | | |
| 3.7 Cryomodules | 1. Overview | |
| | 2. Technical description | - Cross section figure |
| | 3. Technical issues | -The cryomodule<br>-- structual description, heat-load table<br>-Quadrupole/corrector/BPM package<br>-Damping ring and beam delivery CMs<br>-Shipping of cryomodule |
| | 4. Cost estimateion | |
| | 5. Table of CM types | |

# 3. Technical Systems (3.8)

| | | |
|---|---|---|
| 3.8 Cryogenics Systems | 1. Overview | -overall cryogenics layout |
| | 2. Technical Issues | -Cryogenic system definition<br>-Cryogenic cooling scheme for ML<br>-- Cooling scheme of a cryo-string<br>-- Length and ypical arrangement<br>-- Two-phase helium flow w/ slope<br>- LHe management in 1.3 GHz modules<br>-Sources, DR, BDS system<br>-Heat load and cryogenic plan power<br>-- ML heat load and cryo-plant size<br>-- DR cryogenics<br>-- ILC cryogenic plant size<br>- He inventory (relative He-mass chart) |
| | 3. Cost estimation | |
| | | |

# 3. Technical Systems (3.9,  3.10)

| | | |
|---|---|---|
| 3.9 LLRF Control | 1. 0verview | |
| | 2, Technical Description | - Tolerance of phase & amplitude control |
| | 3. Technical Issues | -Harware architecture<br>-Digital technologies<br>-Sofware architecture |
| | 4. Components | |
| 3.10 Instrum. | 1. Overview | |
| | 2. Technical description | -Beam position monitor<br>-Beam profile monitors<br>-Beam current monitors<br>-Beam phase monitors<br>-Beam loss monitors<br>-Beam feedback systems |
| | 3. Technical issues | -Feedback harware<br>-Layout |
| | 4. Cost est. methodology | |
| | 5. Table of components | |

# TDR Part 1: RD Phase R&D

- Focus on TD Phase R&D (progress)
  - An extension/update of Int. Report (IR), but more conclusive
  - The basis of the technical decisions of the design baseline described in Chapter 2
    - Introduction/Overview
    - **SCRF technology**
    - Accelerator systems (CESR-TA, ATF)
    - Concluding (or scummary)
    -
  - **SCRF Technology**
    - Cavity gradient (R. Geng)
    - Cavity integration (H. Hayano)
    - Cavity-String/cryomodule integration
      - >> S1 Global, NML, (H. Hayano/E.Kako, somone(FNAL)
    - SC accelerator system test >> FLASH (J. Carwardine)
    - SCRF Infrastructure/facility development (each lab.)

# TDR Part 2: ILC Accelerator Design

- Focus on Accelerator Reference Design
  - Equivalent (replacement) for the RDR,
    - No significant change from RDR, but be updated
  - Accelerator system oriented description,
    - Relevant technical components be dealt with in each specific section, with better order.

      1. Introduction
      2. Overciw, layout and parameters
      3. Main Linac
      4. Sources
      5. Damping Rings
      6. RTML / bunch compressors
      7. BDS/MDI
      8.CFS
      9. TeV upgrade path

- **Main Linac**
  - Linac acc. Design
    - beam dynamics , alignment, (K. Kubo, C. Adolphsen)
  - SCRF Cavity/Cryomodule
    - Cavity and Cavity Integration (R. Geng, H. Hayano)
    - Cryomodule (P. Pierini)
    - Magnet (TBD)
    - Instrumentation (H. Hayano, P. Perini)
  - Cryognenics (T. Peterson)
  - HLRF and LLRF (S. Fukuda/C. Nantista, S. Michizono)
  - ML Integration (C. Adolphsen)