The Global R&D Board

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Mission of the Global R&D Board

- From the Director at the Frascati meeting:
- Coordinate worldwide, prioritized, proposal- driven, R & D efforts

- The goal is clear, the detailed means required resolution by the RDB of issues, for example:
  - **Level of coordination**
  - **Parallel efforts coordination, Regional needs**
  - **“Reviewing” role: Ideal vs specific R&D Program**
  - **Balance ILC/ILC Detectors issues**
  - **Goals, Timelines**
  - **Interfaces, RDB/DCB, RDB/Industrialization…**

Board Members and Areas

- Chris Damerell
- Eckhard Elsen
- Terry Garvey
- Hitoshi Hayano
- Toshiyasu Higo
- Tom Himel
- Lutz Lilje
- Hasan Padamsee
- Marc Ross
- Andy Wolski
- Bill Willis

AREAS

SC CAVITIES, CRYOGENICS, BEAM DELIVERY, INJECTOR, LINAC PERFORMANCE, INSTRUMENTATION,

CRYOMODULES, DAMPING RINGS, POWER SOURCE, CONTROLS, HIGH AVAILABILTY,

DETECTORS

Plan for Achieving our Mission

- First tackle work that leads to immediate benefits
  - **Project Tools to allow a Work Breakdown structure to put all Global R&D on a common basis, needs:**
    - A Data Entry Tool
    - A Data Base with flexible features
    - A facility for generating needed Reports
  - **CERN has kindly agreed to help us with the Data Base and Reports, and our Board member Eckhard Elsen agreed to be Data Integrator to make the system work**
- Generate an Ideal ILC Research Program

Ideal ILC R&D Program

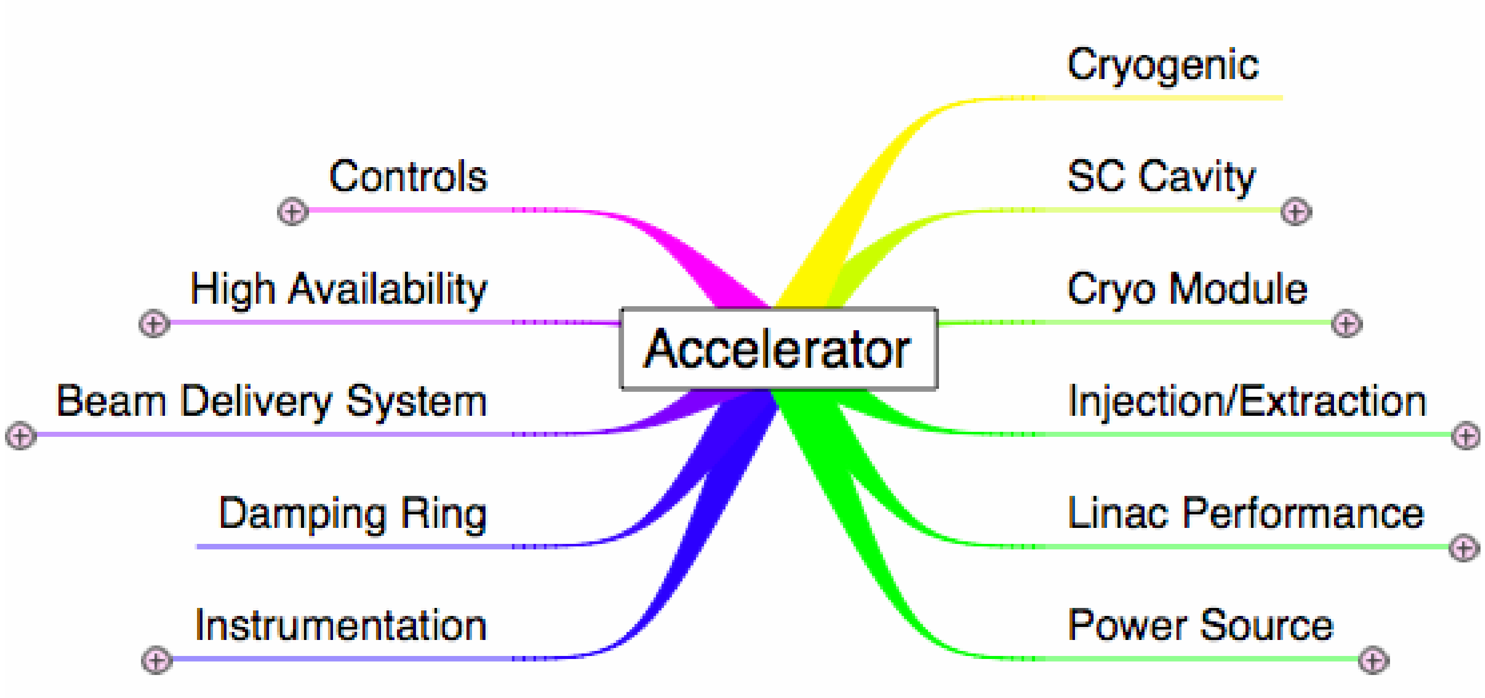
- Generate WBS for ten ILC Areas (no Cryogenics R&D identified for the Baseline), with about 400 items
- The structure will allow us to note links items in different Regions
- Assign Priorities 1 (very high), 2 (high), 3 (moderate), 4 (low)
  - **by team of two Board members per area, with justification**
  - **Reviewed anonymously by all members, with comments**
  - **Discussion of board to reach conclusion**
  - **Face to face meeting to consider uniformities among areas 8 March**
  - **“Last” iteration took place this week**
- Publication (RDB Public Wiki) took place this week

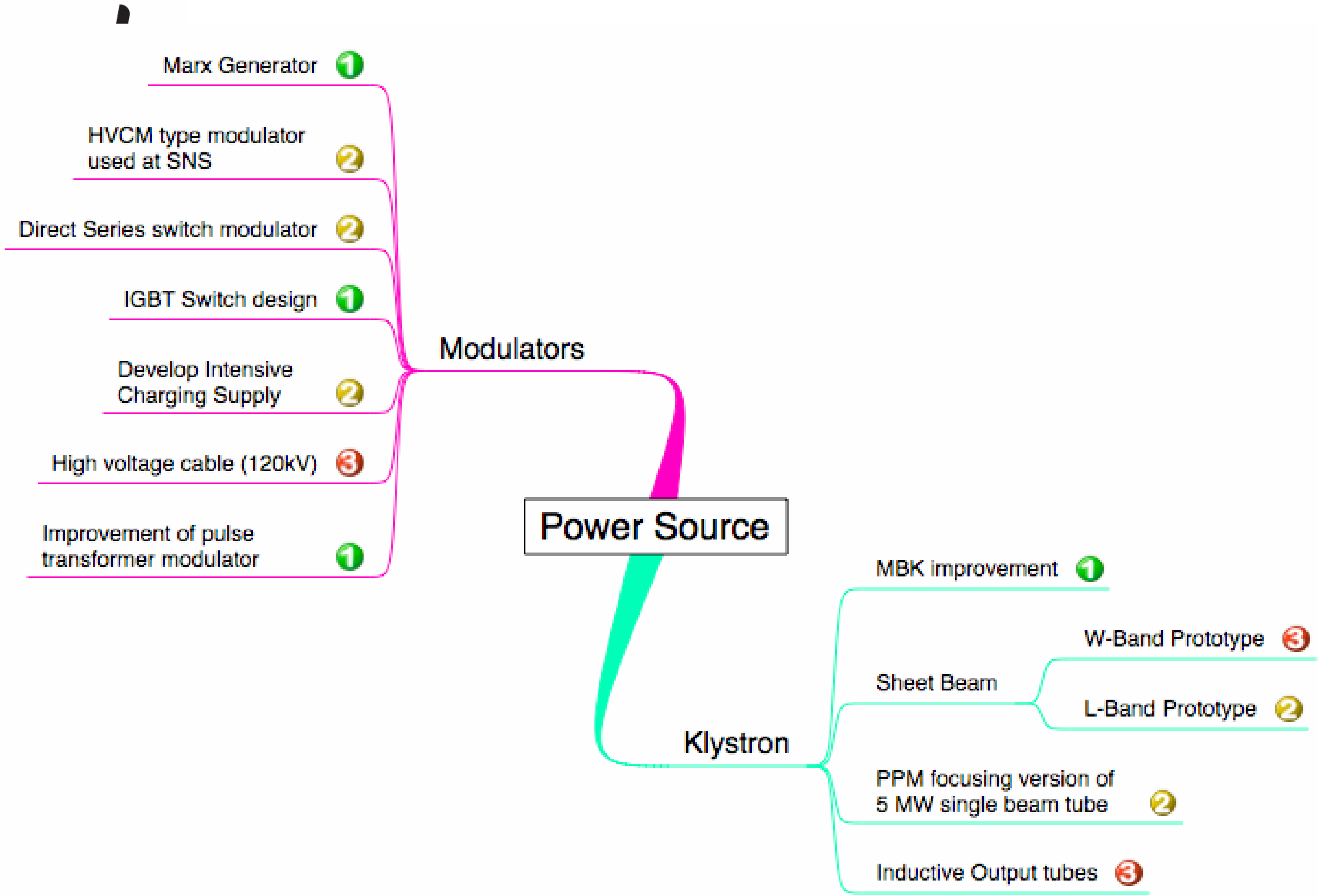
  http://www.linearcollider.org/wiki/doku.php
- Convenient Reports will be created from the data base at CERN soon, useful for example for Dugan 2007 meeting in May

Small sample of Data Entry

SC_HOM_2K_Cryoload	SC_HOM	HOM induced cryoload at 2K	high	DESY		undefined	Measure cryogenic HOMs at 2K to be s as required to keep
SC_HOM_Improve_Existing	SC_HOM	Improve existing design	high	DESY	KEK	in progress	Slight modifications design for ease of f rejection, and therr
SC_HOM_Absorber_Material	SC_HOM	HOM absorber material	high	DESY	Cornell	in progress	Work on reproducib material.
SC_HOM_Feedthroughs	SC_HOM	Higher heat conductivity feedthroughs	moderate	TJNAF	DESY	in progress	Explore higher hea output lines
SC_HOM_Alternate	SC_HOM	Alternate HOM couplers	moderate	TJNAF	KEK	undefined	Explore alternate H
SC_HOM_Output_Parallel	SC_HOM	HOM output in F-piece plane	moderate	TJNAF	KEK	undefined	Radial positioning o plane of so called F
SC_HOM_Hidden_Capacity	SC_HOM	HOM: Hidden capacitor	moderate	TJNAF	KEK	undefined	Version of HOM cou
SC_HOM_No_Capacity	SC_HOM	HOM: No capacitor	moderate	TJNAF	KEK	undefined	Version of HOM cou
SC_Tuner	SC	Tuner					
SC_Tuner_Fast_Range	SC_Tuner	Increase fast tuning range	very high	Saclay	KEK	in progress	Design with increas
SC_Tuner_Fast_Actuator	SC_Tuner	Fast actuator R&D	very high	Orsay		in progress	Fast actuator R&D
SC_Tuner_35	SC_Tuner	Prototype tests at 35 MV/m	high				Prototype tests witl MV/m
SC_Tuner_MTBF	SC_Tuner	MTBF for cold motor	high			undefined	Verification of suffic
SC_Tuner_TJNAF	SC_Tuner	Renascence tuner	moderate	TJNAF		undefined	TJNAF Renascence
SC_Tuner_KEK	SC_Tuner	KEK screwball tuner	high	KEK		in progress	KEK coaxial ball scr for balls, Weight re
SC_Tuner_Redundancy	SC_Tuner	Tuner redundancy	high			undefined	Develop Redundant vessel
SC_Tuner_Warm_Motor	SC_Tuner	Warm tuner motor	low			undefined	Explore Warm motc
SC_Tuner_Magnetostrictive	SC_Tuner	Magnetostrictive tuner	moderate			in progress	Explore larger strok detailed characteriz
SC_Tuner_Reliability	SC_Tuner	Tuner reliability	high			undefined	Conduct Reliability piezo / magnetostri mechanisms and im
CM	Accelerator	Cryo Module					
CM_4th_gen	CM	Development of a 4th generation cryomodule	high	FNAL	KEK	in progress	Type IV cryomodule from Type III+ : S cavity centerline loc cavity support deta rods) Same input c

WBS top level structure




Marx Generator
HVCM type modulator
used at SNS
Direct Series switch modulator
IGBT Switch design
Modulators
Develop Intensive
Charging Supply
High voltage cable (120kV)
Improvement of pulse
transformer modulator
Power Source
MBK improvement
W-Band Prototype
Sheet Beam
L-Band Prototype
Klystron
PPM focusing version of
5 MW single beam tube
Inductive Output tubes

Next Steps: Extend Data

- Identify Institutions planning to work on a given R&D item, with a contact person.
  - **Knowing who is collaborating in the ILC R&D would seem to be a minimal demand.**
  - **It seems necessary for some responsible person to overseen these attributions, and we concluded that it would be best and simplest to ask the Regional Directors to do this, and the GDE EC has agreed.**
- We next intend to discover the plans for the time-lines for the R&D items.
  - **This information will be low-key and informal, reflecting just the estimates of the institutions. It will be needed to evaluate the impact of the linkages and the flag the areas where collaboration is most profitable.**

Urgent Actions Arising

- The RDB has been considering what could be done to accelerate the progress toward the crucial linac R&D goals, to pass the R1 and R2 demonstrations. We find the rate of progress insufficient. We have developed ideas concerning collaboration among the strong institutions involved in the SC cavities and modules. We have found that the hardware facilities of the most developed program, in DESY, are not saturated. We believe that collaboration with the several programs proceeding apace toward new facilities would benefit all parties and the ILC effort.
- There needs to be a coherent collaborative program achieving faster progress toward our short term goals, while providing valuable training experience for new members of the global team.

Urgent….continued

- A small group of RDB members from the three regions is preparing a proposal suggesting how this might best be coordinated.
- There are also opportunities for important studies with beams at the ATF at KEK and the TTF at DESY. Both of these are international and the ILC is only a part of their mission, but these facilities are not yet saturated. The global ILC part of these programs will also benefit from a coherent approach. The RDB intends to propose a body to facilitate the high priority ILC experiments.
- The same body might serve both beam experiments and SC collaboration and collaboration needs.

R&D Completion and the Next Phase

- We need information on the required goals for the R&D tasks. We must know when we have what we need, and can declare a task completed.
- We need to know when the tasks must be complete. Note that there are often serial tasks, and we must study the linkages.
- Pre-construction, in DOE language, includes a host of activities besides Industrialization. They are not included in the Construction part of the RDR cost estimate, but will be,withR&D, in the total cost (TEC in DOE). The RDB is certainly interested in the scope of much of the Preconstruction, and to that extent at least, contributes to the work of the cost estimate.

Summary

- We have evolved a gradualist approach to coordinating the R&D globally.
- We have established powerful project tools for our needs.
- We have now a developed, prioritized, Ideal R&D Program that maps onto the actual programs underway.
- We are responding to the request by Gerry Dugan to help with the needed prioritization of the Americas program.
- We have an Urgent Action plan to present to the labs in order to accelerate the critical R&D line, R1,R2.
- We have several next steps on data gathering.

R1 and R2 definitions ILCTRC Review

- Ranking 1: R&D needed for feasibility demonstration of the machine The objective of these R&D items is to show that the key machine parameters are not unrealistic. In particular, a proof of existence of the basic critical constituents of the m☐achines should be available upon completion of the Ranking 1 R&D items.
- Ranking 2: R&D needed to finalize design choices and ensure reliability of the machine These R☐&D items should validate the design of the machine, in a broad sense. They address the anticipated difficulties in areas such as the architecture of the subsystems, beam physics and instabilities, and tolerances. A very important objective is also to examine the reliability and operability of the machine, given the very large number of components and their complexity.

Ranking 1 TESLA Upgrade to 800 GeV c.m. Energy The Energy Working Group considers that a feasibility demonstration of the machine requires the proof of existence of the basic building blocks of the linacs. In the case of TESLA at 500 GeV, such demonstration requires in particular that s.c. cavities installed in a cryomodule be running at the design gradient of 23.8 MV/m. This has been practically demonstrated at TTF1 with cavities treated by chemical processing1 . The other critical elements of a linac unit (multibeam klystron, modulator and power distribution) already exist. · The feasibility demonstration of the TESLA energy upgrade

to about 800 GeV requires that a cryomodule be assembled and tested at the design gradient of 35 MV/m.

The test should prove that quench rates and breakdowns, including couplers, are commensurate with the operational expectations. It should also show that dark currents at the design gradient are manageable, which means that several cavities should be assembled together in the cryomodule. Tests with electropolished cavities assembled in a cryomodule are foreseen in 2003.

Ranking 2 TESLA Energy · To finalize the design choices and evaluate reliability issues it is important to fully test the basic building block of the linac. For TESLA, this means several cryomodules installed in their future machine environment, with all auxiliaries running, like pumps, controls, etc. The test should as much as possible simulate realistic machine operating conditions, with the proposed klystron, power distribution system and with beam. The cavities must be equipped with their final HOM couplers, and their relative alignment must be shown to be within requirements. The cryomodules must be run at or above their nominal field for long enough periods to realistically evaluate their quench and breakdown rates. This Ranking 2 R&D requirement also applies to the upgrade. Here, the ob jectives and time scale are obviously much more

difficult. · The development of a damping ring kicker with very fast rise and fall times is needed.

Task force Proposal

Context: Some of the largest R&D projects involve the building and testing of cavities and cryomodules. At times in the past it has been suggested that a test linac of a few percent of the ILC energy be built. This study will attempt to determine how many cryomodules are needed and whether a test linac is needed before the ILC is built. As some of this construction may be needed for R&D, and others for industrialization (perhaps in each region), and others for integration tests with other systems, it seems appropriate to study the problem from a wider perspective than the R&D board. For that reason we suggest the formation of a small task force to study the issues and make recommendations.

This task force would address key questions related to the long-term needs for:

- a large number of ILC cryomodules,
- industrial production of cryomodules
- assembly and test facilities
- assembly of the modules into RF units
- assembly of RF units into a test linac.

Some questions the study should address are:

-How many cryomodules world-wide do we need for the ILC-TDR and then through the pre-construction period and for what reasons are they needed?How many RF Units do we need to demonstrate the building blocks? (An RF unit is one Klystron feeding three cryomodules)
What is the time scale and how does it match to the proposed schedule for ILC events?
-Do we need a test linac; if so, why? What beam energy and emittance would be needed to accomplish the goals of the test linac? What can the test linac show which the XFEL won't show
Some of the issues our board should discuss about this study
Who should be involved in this study besides the R&D board members? (Suggest 2 from DCB, 2 from RDB, and 2 from EC.)
How should we deal with the region-dependent issues related to the above questions?
- Do we want to start now-ish, so that preliminary results are available by the Vancouver meeting in July? (Suggest – Yes)