第８回リニアコライダー計画推進委員会　議事次第

日　時　　平成１８年４月２５日（火）　１０：００～

場　所　　４号館セミナーホール

議　題

１．　機構長挨拶
２．　ＦＡＬＣ報告
３．　ＩＬＣＳＣ報告
４．　ＩＬＣ－ＫＥＫレビュー委員会報告
５．　最近のＧＤＥの活動・計画
６．　平成１８年度ＩＬＣグループ活動計画
７．　その他

配布資料

１．　第７回リニアコライダー計画推進委員会議事要録（案）
２．　ＦＡＬＣ関連報告
３－１．ILCSC 報告
３－２．ILCSC MEETING (CERN 9 February 2006)
３－３．Report of the 1st Meeting of the ILC Machine Advisory Committee
３－４．ILC-MAC member list
４．　第３回ＬＣレビュー答申
５．　Recent GDE Activities and Plans
６．　平成１８年度ＩＬＣグループ活動計画

資料1

第７回リニアコライダー計画推進委員会議事要録（案）

日時：平成１７年１１月１５日(火曜日)　１０：００～１２：００

場所：４号館１階セミナーホール

出席者：小林、小間、神谷、近藤、高崎、黒川、山内、田内、生出、榎本、横谷、竹内、駒宮、野崎、浦川、久保、早野、斉藤、峠、栗木、佐藤、山本、上野、山下、尾崎　各委員、戸塚機構長
（欠席者：岡田、木村、佐貫　各委員）
オブザーバー　29 名

配付資料
１．第６回ＬＣ計画推進委員会議事要録（案）
２．機構長報告
３．FALC/RG 報告
４－１．ILCSC 報告
４－２．ILCSC in SNOWMASS Minutes
４－３．ILCSC in Daegu Minutes
４－４．ILC GDE MOU Annex
５．ILC 設計現状とアジアの計画
６．ATF の現状と計画
７．STF の現状と計画
８．High-gradient cavity

議事

議事に先立ち高崎委員長から、以下のコメントがあった。

今回の委員会開催が前回から６ヶ月たっていることをお詫びします。 LC 推進室に秘書の白形さんが赴任されました。部屋は３号館６階 622A 室の部屋です。

1. 機構長報告

戸塚機構長から、以下の報告があった。

LC 推進室の活動が本格化し機構長としてのイニシアティブは不要となった。したがって、機構長としての報告は最後になるだろう。9 月 26 日に開催された ICFA で、自身の性格の変更を行い、『ICFA は素粒子物理に集中する』こととなっている。その位置づけの中にある『high energy accelerators』を『accelerators』に変更することや人工衛星を使用する大型計画も cosmology 分野との関連も考慮し推進することなども議論された。現在は draft の段階である。また、世界の主な研究所の将来も以下のように紹介された。DESY は HERA の運転を 2007 年に終了し XFEL などの放射光源の研究所となるが、高エネルギー関連の活動はよくわからない。SLAC は PEPII の運転を 2008 年に終了し、放射光源と宇宙物理学（GLAST 計画）の研究所となる。CERN は今まで通り LHC と CLIC の開発研究を行う。FNAL は TEVATRON の運転を 2009 年に終了し、ニュートリノファクトリーのための proton driver や ILC の開発研究を行うが、非加速器の将来計画は持っていない。

ILC の日本への誘致を念頭に、機構長の私的懇談会の「リニアーコライダー計画の推進に関する（LC）懇談会」をこれまで６回開催した。その委員長は前機構長の菅原寛孝氏である。この他に、KEK とは独立に、政治的環境づくりのため、菅原氏のリーダーシップの下、国会

議員による LC 勉強会（与謝野馨会長）が 10 月 27 日開催された。今後、議員連盟のように進展して行くのかもしれない。

（Q：竹内）KEK の活動としての LC 推進室と GDE との関係を明確する時期ではないか。

（A）GDE のもとに design work が行われるが、LC 推進室は GDE の一部ではない。KEK は R&D で貢献、R&D を propose していく。

（Q：野崎高エネルギー委員会委員長）高エネルギー委員会は、LC 推進を学術会議に働きかけ中、KEK も積極的に取り組んでほしい（要望）。

2. FALC 報告

吉岡委員から、以下の報告があった。

11 月 3-4 日に FNAL で第６回 FALC が開催された。今回、山内委員の代理として出席した。FNAL 所長の P. Oddone より、ILC 建設費の国際分担に対する米国の案が紹介された。それは、総額 8 千億円の ILC を 10 年で建設し、米国は 50%、日本とヨーロッパで 25%づつ分担するというものである。R. Wade (FLAC/RG 議長)は、ILCSC との関係の明確化の必要性を述べた。また、彼は GDE の財政援助としての common fund は３地域で等分することを提案した。日本としては参加機関が等分することを提案したが、その後の FALC/RG 会議で３地域等分が決定された。B. Barish から、GDE の上部組織として、ILCSC, FALC や WWS など有ると思われるが、複数からの指導を受けるのは混乱するとの指摘があった。その中で、ILCSC の役割、GDE の任務、FALC の今後の進展などが議論された。３地域より一人づつ委員を出し FALC の将来像検討のための小委員会の結成が提案された。これと平行してアジア地域でどのように LC 推進を行うかの検討が必要であろう。FALC の次回は 2006 年 5 月 22 日となった。

（C：黒川）上記の小委員会は未定である。今後、ICFA, ILCSC 議長は FALC に出席し、ILCSC 議長は FALC/RG に出席することになった。また、FALC の代表者は ILCSC, ICFA へ出席することとなった。

（Q：山内）FALC 内での日本の態度？

（A）文科省：斉藤室長によると JPARC 建設終了の 2010 まで日本は動きがとれない。

（Q：駒宮） GDE の central lab. は FNAL か。

（A ）GDE のホームページ作成など FNAL に秘書室を設けで行われる。年間経費は 4000 万円程度必要である。

（Q：野崎）米国では ILC 建設総額の金額 8000 億円と言われているが、日本での説明ではいくらか？

（A：高崎） TESLA (2001) 3.8 billion euro (7000 人″年)が public になっている唯一のものである。

（A：戸塚）Barry の presentation では TESLA のものを示している。

3. FALC/RG 報告

竹内委員から、以下の報告があった。

R&D 段階の資金のアレンジ等について検討するワーキンググループ的な組織として、17 年２月に第１回 FALC/RG (Resource Group) の会議が開催された。『GDE 段階での R&D 資金』を検討することとされたので、その供給元である KEK の竹内が日本の委員として出席している。第３回目は上記 FALC と同期間に開催された。GDE の進め方について次のような意見を述べた。SNOWMASS で示された GDE の年間予定は 2005-2010 に及んでいる。これは 2004 年 3 月 31 日の ILCSC レポート (Report of the ILCSC Task Force for Establishment of the International Linear Collider Global Design Initiative) のものより長期間で、GDE はこの ILCSC 指針に従うべきである。また、LC 推進室は長期的プランを持つべきである。また、GDE-phase1 (BCD-RDR) でのサンプルサイトの検討は、上記 report の 6 ページの″Establish and disseminate a cost-estimating methodology for the ILC construction″の任務として行うべきである。ILCSC 議長より、これらの問題は ILCSC が GDE の上位機関として役割を果たす

ことで解決されるであろうとの報告があった。

GDE 活動資金（common fund）としては上述のように秘書人件費、ホームページ作成費等 400 千ドル必要である。３地域で分担するため、MOU を締結することとなった（KEK は先の GDE 設立時の MOU アネックスを提案した)。次回は 2006 年 2 月 8 日に CERN で行うこととなった。

4. ILCSC 報告

黒川委員から、以下の報告があった。

今年 7 月に黒川が ILCSC 議長に就任後、SNOWMASS 期間中の 8 月 23 日そして ICFA seminar 前日の 9 月 27 日の２回開催された。ILCSC、GDE、WWS、FALC の役割についての自由討議が行われ、Machine Advisory Committee (MAC)を立ち上げることを決めた。MAC の委員数は 10-12 名で、できれば今年中に結成したい。次回は 2006 年 2 月 9 日に CERN で行うこととなった。

（Q：峠）regional GDEs の意味は何か。 regional GDE director の役割は何か。

（A：横谷）GDE は一つのみである。 regional GDE director は regional contact としての役割を持つが、アジア独自の役割もある。ヨーロッパには European GDE はないが、アジアと米国にはある。

（Q：峠）それぞれの定義を明確にすべきではないか。

（A：戸塚）GDE そして regional GDE の役割などはどんどん進化していくものである。しっかりしているところがリーダシップを取るであろう。したがって、方針を持ってどんどん推進してほしい。

（Q：戸塚）MAC の初回会合はいつか。

（A：黒川）現在調整中で、1 月 16,17,17 日の内のどれか。

（Q：榎本）日本での site study が進みすぎれているといわれているが？

（A：黒川）そのような議論はまだない。

5. ILC-KEK レビュー委員会の報告

佐藤委員から、以下の報告があった。

これまで、2004 年 12 月 16 日に第１回（答申）と今年 7 月 28 日に第２回（答申, 添付資料）を行った。その詳細はそれぞれの答申を見てほしい。第１回目の答申として主要なものの一つは『KEK での短期計画としての組織が明確でない』というものであった。また、第２回目では、『SNOWMASS で何を主張するのか？』そして、『１回目の答申に従って、組織ができたか。』がレビューの観点であった。組織体制については８月１日に横谷氏が追加説明を行い、10 月 7 日に答申を提出した。

（Q： 高崎）答申内容を簡単に説明してほしい。

（A） 45MeV/m R&D の スケジュールがきついため、単セル開発に集中すべきである。 STF の phase-2 は phase-1 の成果をフィードバックすべきである。super-cavity R&D は日本がリードし続けるべきであり、EP 設備を KEK 内に作るべきである。ATF2 現状では予算、マンパワーが不足しているが、国際協力拡大に KEK 執行部のリーダーシップが必要である。超伝導空洞 R&D を優先すべきであり、STF スケジュールを十分な R&D のできるように１年送らせたことは歓迎する。ATF2 での国際協力で外国資金の工面を KEK がすべきである。LC-R&D では、若手がグループリーダーとなっていることは評価できるが、推進体制のリーダー（推進室長）に具体的勢いが感じられない。

（Q：山本）high gradient cavity R&D は、 GED schedule に match しないのでは？

（A）日本が super-cavity を lead しているので、GDE とは独立に R&D をやるべきとの答申は重要であった。

（A：高崎）「私はしろうとである」....。

（A（佐藤）「私はしろうとである」との発言は dis-courage である。『しろうとであろうと』加速器の R&D の状況を理解すればよい。

6. 最近の GDE の活動・計画および ILC の R&D 計画の見直しについて

横谷委員から、以下の報告があった。

GDE は今年度中の BCD (Baseline Configuration Document)を完成し、ILC 加速器の設計の骨子を決定する。 KEK では、High gradient super cavity の single cell R&D に集中している、12 月から 9 cell の試験研究を行う予定である。positron 生成では、undulator の場所として end of linac が有力となっている。DR 設計骨子は、CERN での mini-workshop で決定されるが､周長 6km のリングが有力であり、,e+のものは 6km の２リングとなるであろう。この DR 設計では KEK-ATF で R&D が行われている取り出し用の fast kicker が最重要要素である。今後の予定は、11 月 18 日に BCD 草案作成し、12 月 7－9 日 Frascati 開催の GDE 会議（約 100 名出席）で議論される。2006 年 1 月には、BCD 完成後の設計変更の是非を決定する CCB（Change Control Board）が結成さる。2006 年末には、コスト評価のついた RDR （Reference Design Report）を完成する。ここには、３地域からのサンプルサイトに基づくサイト依存性のあるコスト評価も行われるであろう。2008 - 2009 年には建設のための TDR（Technical Design Report）を完成し、サイト選択が始まるものと思われる。

超電動加速空洞 R&D facilities として TTF(DESY), SMTF(FNAL), STF(KEK)の３つがある。TTF では 5 台の modules で 400MeV の加速試験が行われ、来夏に 35MeV/m の６台目の module が設置される。STF phase-2 は第１回 LC レビュー委員会の答申を受け１年遅らせた。TDR には各 region での super cavity 技術の確立が必須であり、製作段階での knowhow を TDR へ反映させる。KEK に EP 設備を作り、2006 年末には STF phase-2 用の cavity の EP 可能となる。また、ILC 以外の cavity にも対応する予定である。

ATF の国際協力を推進するため、浦川氏が MOU への署名を集めている。現時点で 20 署名を集め、残りは３つとなっている。ATF collaboration の ICB (International Collaboration Board)の議長は E. Paterson (SLAC)であり、その spokesperson は浦川氏である。浦川氏は technical board の議長も務める。ATF collaboration の中の ATF2 グループは磁石架台製作は KEK が分担し、電源一式は SLAC が分担することで検討中である（田内コメント)。

7. ＷＧ・ＧＧ報告

各グループから報告が行われた。

(ATF/ATF2 の現状と計画について、照沼)

ILC-DR の 6km リング用の立ち上がり 3ns の fast kicker の R&D を行っている。空洞型 BPM の Nano-BPM R&D として KEK と SLAC/LLNL の２つのチームが有り､これまでの所それぞれ 72nm そして 17nm の位置分解能を達成している。レーザーワイヤーの commissioning は 12 月に行われる。デジタル回路による fast feedback system の FONT4 実験、そして、DR から取り出しラインへの feedforward system の検討も行われる。ビーム取り出し用のパルス幅の SLAC 製 kicker により､154ns づつ離れた 3 バンチや 336ns 離れた 2 バンチビームの取り出しに成功した。ATF2 計画では、KEK と PAL（韓国）との共同で 100nm 分解能の Q-BPM のプロトタイプを製作している。また、分解能 2nm の IP-BPM のプロトタイプ設計も開始した。ATF2 の commissioning は 2008 年 2 月に予定している。

(STF の現状と計画について、大内)

STF は、control, klystron, EP, cryomodule assemble, cryogenic system などより構成されている。地下トンネル内は clean-up された。phase-1 では、異なる空洞タイプの２つのモジュールが製作される。それらはともに 4 つの空洞よりなる。ビームテストも行われ予定である。Low Level (LL)RF 制御は J-Parc のものを改良して使用する。Klystron は手持ちの TH2104A (Thales 製）と新品の TH2104C の２台を使用する。LL-RF の R&D に、中国からの研究者 2 名が参加する。cryostat の製作が日立製作所で行われている。cryostat 内空洞の支持はローラﾍﾞｱﾘﾝｸﾞを用いたスライﾄﾞ機構(基本的には INFN と同じﾞ構造)である。その R&D(異材継ぎﾞ手)として HIP 法（拡散接合)、圧縮接合のテストが行われている。35MV/m 空洞は三菱重工、そして、入力カップラーは東芝で製作されている（年内に納入)。STF-phase 1

での 2K 冷却システムではトランスファーチューブなどの開発が行われる。clean room（ISO class-4, 空洞用、ISO class-6 真空作業用）と EP 設備の配置は確定した。クリーンルームは 2006 年 6 月末に完成予定である。

(HG-Cavity 開発の現状と計画について、佐伯)

BCD では 35MV/m の TESLA タイプの空洞が選択されたが、40MV/m の ILC 運転を目指して R&D を行っている。最初の 9 セル空洞テストは MP (Multipacting) による break-down により『失敗』した。LL タイプ単セル空洞では５回の表面処理を経て、45.9MV/m を達成した。9 cell 空洞の達成加速勾配は MP により 21MV/m であった。新たに 4 つの単セル空洞作成し 12 月末まで試験する予定である。この他、input coupler の R&D では各部をモジュール化し、tuner では、piezo actuators による co-axial ball screw tuner の開発を行っている。空洞製作のコストダウン化のため、Nb/Cu の seamless 空洞を開発している。3 セルまでのネッキングに成功し、次に 9 セルの製作をする。高勾配の HG 空洞開発研究は国際協力が行われ、韓国、中国、カナダからそれぞれ、2 名、1 名、 1 名が KEK に滞在している。

(その他)

高崎委員長から、以下の補足があった。

GDE の communication group には森田氏が参加している。また、サイト、CF(Conventional Facility)には榎本氏が参加している。各地域のサンプルサイトは、米国が FNAL、ヨーロッパが DESY と CERN のサイトである。アジアから一つサンプルサイトとして、日本サイト候補の中から選ぶ予定である。

（Q：野崎）今回のスライド、presentation は公開してよいか。

（A：横谷）R&D 以降のものは OK である。

（Q）STF と ATF2 のコストはいくらか。

（A：横谷）STF-pahse-1 は検討中であり、ATF2 は約４億円である。

（A：高崎）今年度は全体で 10 億円程度である。

資料2

LC 推進委員会、FALC 関連報告（吉岡正和、2006 年 4 月 25 日）

<u>第 7 回 FALC 会合概要</u>

日　時　平成 17 年 11 月 4 日(金)　9:00～16:00
場　所　Fermilab　Room　1－East
出席者　　委員　13 名

〔イタリア〕	Roberto Petronzio　(INFN 理事長)－議長
〔イタリア、CERN〕	Enzo Iarocci　（INFN，CERN 評議会議長）
〔英国〕	Richard Wade　(FALCRG 議長、PPARC 議長代理)、
	Janet Seed(秘書、PPARC)
〔日本〕	斎藤尚樹　（MEXT）
〔米国〕	Ray Orbach　(DOE 科学局長)、
	Robin Staffin(DOE-HE オフィス副所長)、Jeffery Salmon(DOE)
〔フランス〕	Michel.Spiro (CNRS・原子核・素粒子物理部長)
〔ドイツ〕	Beatrix Vierkorn Rudolph（基礎研局次長）
〔韓国〕	Dongchul Son (CHEP)
〔カナダ〕	Walter Davidson
〔CERN〕	Robert Aymar(所長、電話のみの参加)
招待、オブザーバー	4 名
〔ILCSC〕	黒川眞一　（ILCSC 議長、日本 KEK）
〔GDE〕	Barry Barish (GDE 所長、米国 CALTECH)
〔米国〕	P. Oddone (Fermilab 所長、米国、Fermilab 報告のみ)
〔日本〕	吉岡正和（KEK、山内氏代理）

主な議事;
・議事メモ確認、
・Fermilab 所長報告、
・各人意見表明、
・GDE 所長報告、
・FALCRG 報告、
・CERN 所長との電話、
・ILCSC 議長報告および議論

1．細かなことはさておき、(1)GDE コモンファンドの分担の仕方を決めたこと、(2)FALC 小委員会設置の二つが重要事項である。また ILCSC 議長報告では ILCSC と GDE の関係が整理されたことも注目に値する。

2．GDE 報告で年表が提示されたが、Reference Design の次のステップへの相転移の仕方と、GDE の役割外である Hosting や International Management の動き、ILCSC や FALC の役割など最後にかなり意見交換した。結果、上記1(2)にあるとおり、議長から各地域から 1 名の代表(*)を出して議長とともに FALC の役割拡大（Evolution）の議論を進めるため、FALC に小委員会を設置することが提案され、承認された。この小委員会は、ILC が関係各国の政府の関与する次の段階に進む際に、FALC をどのように改編するのかを議論することになるが、ただし各国代表からは時期尚早との声もある。また ILCSC においてもこの件について議論することが表明された。

(*)米国からは R.Staffin(DOE)、欧州からは M.Spiro(IN2P3)が登録されている。アジアについては山内正則氏(MEXT 科学官)を通じて野崎光昭(KEK 素核研副所長)を登録した。なお、野崎光昭氏の登録にあたっては、アジアの関係各国との調整が困難であることから、野崎氏についてはアジアを代表する立場で参加することが出来ない旨を付帯意見として伝達した。

3．FALCRG からは GDE コモンファンド分担方法につき報告があり、3 種類の方法が示され、FALCRG では合意に至らなかったが、上記1（1）のとおり結局アジア、北米、欧州の 3 地域等分とすることが決まった。

◆以上

FALCRG 会合概要

1．日時 8 February 2006、2:20~16:30 pm

2．場所 CERN in the 6th floor conference centre

3．出席 13 名：

Richard Wade (PPARC, Chair), Janet Seed (PPARC, Secretary), Domenec Espriu (Univ. Barcelona), Jonathan Kotcher (NSF), Paul Grannis (DOE), Olivier Napoly (CEA, France), Dongchul Son (KNU, Korea), Masakazu Yoshioka (KEK), 竹内大二 (KEK), 黒川眞一 (ILCSC Chair), Umberto Dosselli (INFN, Italy),
Barry Barish (GDE Director, by telephone)

欠席 5 名：

Jean-Pierre Delahaye (CERN), Atul Gurutu (India), Jean Pieere Ruder (SBF, Switzerland), Albrecht Wagner (DESY), Michel Spiro (IN2P3, France)

4．議事概要（本当に要点のみ）

（1） 議題1（Minutes of the meeting held on 1 October 2005）及び2（Matters arising）について Common Fund から Fermilab のオーヴァーヘッド分は差し引く。Fund のシェア方式は 3 地域等分となったが RG の多数意見としてでなく 11 月 4 日の FALC にて決まったもので、その旨関係部分の議事録を修正する。

（2）議題3（ Report from the FALC meeting held on 4 November 2005）について（省略）

（3）議題4（ Draft MOU for the GDE Common Fund）について

- ○ ANNEX 関係（各国負担分）：アジア → 日本が半分、あとの半分は韓・中・印負担、当面、中・印の拠出を韓国が負担（事前に DS、DT, MY で打合せ済み）。
- ○ ILC の研究開発参加機関以外の機関からの MAC メンバーの出席旅費については common fund から支弁することになった。
- ○ Common fund の今後の執行計画について次回 RG 会合で BB が報告することになった。

（4）議題 5（ Progress from the GDE (Barry 電話、資料は後ほど配布される)）及び議論

●BB 報告組織表の FALC、FALCRG の役割は現実との乖離が大。RG の任務を変えるのなら議を経るべき。FALC 小委員会で議論せよ。

●FALC より ILCSC で議論すべき。

（5）その他、次回会合予定

5．所感（竹内、吉岡）

●GDE 所長、米国：FALC、FALCRG は財政当局を巻き込みつつ「発展」させたい、ILCSC との役割分担を明確にして（ILCSC の守備範囲を科学的部分と明確にして）いきたいとの考えが明確。

●欧州勢：慎重な意見。

●日本：J-PARC 建設最盛期、ILC は踏み出すのに時期尚早が基本的立場。

●今後の課題：

①FALC・Mandate の見直しに RG も連動せよ。ILCSC との役割分担、協力関係が鍵。

②common fund も GDE 活動が増えるに従い、増加傾向であろう。その検討が必要。

③RG 日本メンバーとして KEK 管理局長が出ているが、今後ともそれで良いのか、本省が出るべきか。（上記②の検討の推移とも関係）

以上

資料3－1

2006 年 4 月 25 日　LC 推進委員会　　黒川　眞一

ILCSC 報告

１．ILCSC meeting at CERN

黒川が昨年の 7 月に ILCSC 議長に就任した後に、これまで 3 回の ILCSC meeting が開催された。最初の会合は、8 月 23 日に Snowmass Workshop 期間中に、第 2 回目の会合は 9 月 27 日に韓国の Daegu にて ICFA Seminar の前日に、また第 3 回は、2 月 9 日に CERN にて 2 月 9 日の夕方から 2 月 10 日の午後にかけて開かれた ICFA meeting の直前に行われた。Snowmass および Daegu の ILCSC meeting については、前回の LC 推進委員会にて報告済みであるので、ここでは、CERN の ILCSC について報告する。要点は以下の通り。この ILCSC の議事録を資料 1 として添付する。

① 今回から ILCSC Meeting に、FALC-RG の Chair(PPARC の Richard Wade 氏)が出席する。

② Barish GDE　Director による BCD の説明。特記すべきことは、
1) Barish は、BCD では 1 TeV の場合のトンネルについてふれていないが、RDR では、1 TeV トンネルのコストにも言及すると明言。
2) Barish は、GDE は resource については、FALC にも報告をする必要があると考えている。
3)WWS の 3 人の Chair が Detector との interface として、GDE の中に加わった。

③ MAC の Chair として DESY の Ferdi Willeke 氏を選出した。今後、直ちにメンバー(10-12)の選考を行いできるだけ早く初回の MAC を立ち上げることとする。ILCSC の Chair は ex-officio として MAC に出席する。また、ILCSC の secretary である FNAL の Roy Rubinstein 氏が MAC の secretary を務める。

④ ILCSC の迅速な応答を担保するために、executive committee の立ち上げを検討する。黒川、Rubinstein、Tigner の 3 名が原案をつくり、次回の ILCSC にて議論する。

⑤ GDE の MoU のメンバーの増やし方については、各 region の steering committee が次回までに candidates を考え、次回の ILCSC にてガイドラインを議論する。

⑥ WWS からの報告と議論が行われた。特記すべきことは、
1)MDI について山本均氏を Chair とする panel を立ち上げた。この panel は、ILCSC と GDE の双方に報告する。
2)WWS は 4 つの detector concept をすべて含み、γγオプションも含んだ report をまとめる予定。
3)WWS は GDE の一部ではなく独立した存在であり、ILCSC に報告する義務を持つ。

4)WWS は 2IP が必須と考える。

⑦ 次回の ILCSC meeting は 5 月 8 日 DESY Zeuten にて、また、次次会は ICHEP 期間中 Moscow にて開催される。

2. MAC at FNAL (06/04/06-07)

第 1 回も MAC が 4 月 6-7 日に FNAL にて開催された。5 月 8 日の ILCSC meeting で Chair の Willeke 氏から正式な報告がなされる予定である。Report を資料 2 とし、またメンバー表を資料 3 として添付してある。この MAC においては、1) Design および Cost 評価の進め方、2)Physics society との communication と consensus の取り方、3)Cavity gradient の妥当性、4)Bid-to-host にたいする考え方、などについて活発な議論が行われた。

次回の MAC は、9 月 20-22 日にヨーロッパで、第 3 回は 12 月末または 1 月始めに多分アジアで、第 4 回は来年春に開催される予定である。

以上

ILCSC MEETING

CERN
9 February 2006

Present: Torsten Akesson, Robert Aymar, Barry Barish (via telephone), Hesheng Chen, Jonathan Dorfan (via telephone), Sachio Komamiya, Shin-ichi Kurokawa (Chair), Won Namkung, Satoshi Ozaki, Francois Richard, Roy Rubinstein (Secretary), Richard Wade, Albrecht Wagner, Ferdinand Willeke

1. Shin-ichi Kurokawa introduced Richard Wade, the Chair of the FALC Resource Group, who will be invited to all future ILCSC meetings. Also introduced was Ferdinand Willeke, the nominee for Chair of the ILC Machine Advisory Committee (MAC).

2. GDE Report

Barry Barish presented the GDE report. He first described the Baseline Configuration Highlights (Attachment I), noting that contentious issues included the positron source (helical undulator with a keep-alive source is in the BCD), the cavity (BCD uses 35 MV/m gradient) and the path to 1 TeV (beam delivery system will go to 1 TeV; all dumps are 1 TeV; initial tunnel for 500 GeV, but site long enough for 1 TeV). The BCD includes attractive alternatives, which are guidance for further R&D.

In response to ILCSC questions, Barry gave examples of how the BCD change control system will work. The BCD does not give details of a 1 TeV tunnel, but the Reference Design Report (RDR) will give 1 TeV tunnel costs. He described the process for costing; 3 cost engineers have been appointed, and costing will be on value, not specific currencies. For the RDR, costing will be based on whatever sources are available, with as much checking as possible. Barry felt that he still needed advice on the strategy for cost presentation. He noted that the additional tunnel to go to 1 TeV from 500 GeV will increase the cost by ~20%.

Barry then presented a GDE Progress Report (Attachment II). He felt that GDE is on track, and described the process undertaken to produce the RDR. The current GDE Executive Committee consists of Barry, the three regional directors (Dugan, Foster, Takasaki) and the three accelerator leaders (Raubenheimer, Walker, Yokoya); it meets weekly. The GDE has been reorganized towards the design/cost effort. The RDR is scheduled for release in December 2006.

Barry presented a GDE organization diagram. In addition to GDE reporting to ILCSC (and ICFA), it also reports to the FALC Resource Group (and FALC) on resources. Currently, GDE has 61 members, equivalent to ~30 FTEs. Barry has sent a request to the Regional Directors for sample site information; he is still concerned about the sensitivities associated with site issues.

The International Accelerator School for Linear Colliders looks very promising, with over 400 student applications for the 80 positions.

In the following question period, Barry said that the 3 WWS co-chairs are in the GDE, as GDE needs very good communication with the detector collaborations. For example, shielding the detectors from muon background is expensive and interacts strongly with the accelerator. He is aware that WWS reports to ILCSC, and does not wish to run the detector programs. Barry has avoided commenting on whether the correct balance has been achieved between accelerator and detector R&D, although he understands that detector R&D is an important issue at present, with no global prioritization mechanism in place.

Barry noted that in the RDR, costing information will be used from the TESLA design, XFEL, and GDE internal costing; some will come from industry. The Willis Panel will list R&D needs. Barry said, in reply to a question about why the RDR will include costs, that governments want a cost number; it is important to be able to say that the machine is affordable.

Barry agreed that a bottom-up baseline is unusual, but should not be a fatal flaw. He said that the current GDE matrix organization, which may be confusing to some people, is necessary because many questions cross several system boundaries.

The GDE input to the Orsay meeting of the CERN Council Strategy Group is given in Attachment III.

3. FALC

Shin-ichi Kurokawa described the November 2005 FALC meeting held at Fermilab. FALC agreed to a common fund for the GDE, to be provided equally by the three regions. In order to minimize GDE reporting and increase communication, the Chair of FALC will be invited to ICFA meetings, and the ICFA and ILCSC Chairs will be invited to FALC meetings. The Chairs of ILCSC and FALC-RG will be invited to each other's meetings.

FALC felt that it was not appropriate that ILCSC be the sole oversight body of GDE, and FALC should also be involved in this. A subgroup of FALC will discuss a model of how FALC will evolve.

Shin-ichi's remarks are in Attachment IV.

Richard Wade commented that there had been much discussion of overlapping ILCSC and FALC roles, and the cross-membership should allow good communication. ILCSC is responsible for the project and its technical aspects; FALC monitors the project so that the funding agencies are well informed.

4. FALC-RG

FALC-RG met on 8 February 2006, reported Richard Wade; it heard a report from Barry Barish. The main discussion item was the GDE common fund; an MOU for funding agencies is close to being signed, and provides for equal contributions from the three regions (although this is not to be considered a precedent). The MOU will have annexes on how each region will collect the funds and deliver them to a GDE account at Fermilab. The fund will initially be small, but will grow; among items to be supported by it are software support, costing activity, and support for those MAC members who are not from major labs.

Richard said that FALC-RG feels that there is much work to be done between FALC meetings, and that some should be delegated.

In response to a question on uses for the common fund, Richard said that GDE should propose a budget, and ILCSC and FALC review it. Representation on FALC is complicated, since each country and region has different funding agency systems, and it is difficult to define a common representation. FALC may not be perfect, but it is doing well in pushing the ILC project forward.

5. MAC

Shin-ichi said that at the last ILCSC meeting, a MAC nominating committee was set up, consisting of Jonathan Dorfan, Won Namkung, Albrecht Wagner and Shin-ichi. The committee's recommendation for Chair of MAC is Ferdinand Willeke (DESY); ILCSC unanimously agreed to this recommendation. The nominating committee and Ferdinand will propose 10-12 MAC member names to ILCSC for approval. Shin-ichi would like the first MAC meeting to be within two months if possible. He will attend MAC meetings ex-officio, and Roy Rubinstein will be MAC Secretary.

6. ILCSC Executive Committee

Torsten Akesson commented that ELCSG had discussed this topic recently. It would be good to create an ILCSC subcommittee to prepare the agenda, etc., for ILCSC meetings, but it should not have executive functions.

ILCSC agreed to the idea of such a subcommittee. Shin-ichi, Roy and Maury Tigner will propose a name, mandate and membership for the subcommittee, and will circulate this to ILCSC members for comment.

7. GDE MOU Membership

Two comments on inconsistencies in the MOU were pointed out, and will be rectified.

Some suggestions were made for additions to the MOU signatories, including IN2P3, INFN and NIKHEF from Europe; Kyungpook, RRCAT, BARC and IUAC from Asia. The MOU says that new signers are subject to agreement of the existing parties. The regional steering groups should write to ILCSC with their suggestions, which will be considered at the next ILCSC meeting.

8. Report from Europe Region

Torsten described the CERN Council Strategy Group activities. The open symposium at Orsay had close to 400 attendees, and 70-80 attending by web at any one time. Discussions took up more than 50% of the time, and were lively. Information from this symposium will be input to the May 2006 retreat at DESY Zeuthen. The final recommendations will be presented to the CERN Council in Lisbon in July.

9. Report from Americas Region

Satoshi commented that the Steering Group meets every two months. There have been some recent membership changes. Maury Tigner is now Chair, and Satoshi is Deputy Chair. The group's name has been changed to Linear Collider Steering Group of the Americas (LCSGA). LCSGA feels that outreach is

very important, and an earlier US outreach group, set up by Michael Witherell, is now an LCSGA subcommittee which will specialize in communications in the US.

An ILC industrial forum was formed in 2005, and had a very successful first meeting. The ILC contact in DOE is Paul Grannis, and it is Randy Ruchti in NSF. ILC R&D funding is up by a factor of 2 in the 2007 President's Budget, and includes an increase for detector R&D.

10. Report from Asia Region

The ALCSC mandate was renewed, Won said, and he was reappointed as Chair. Two meetings were held earlier in 2006, with a third scheduled following the Bangalore meeting. A presentation on ILC was made by Masatoshi Koshiba to the Committee of Science and Technology of the Japanese governing party.

11. Worldwide Study

Francois reported that WWS detector R&D and machine/detector interface panels have been formed, the latter in conjunction with GDE. Preparations are underway for a Detector Conceptual Report, part of which will be in the GDE RDR.

The detector R&D panel (under Chris Damerell) has produced a 70 page status report, describing 53 projects (Europe 19, Americas 28, Asia 6). So far there is only regional/national reviewing of projects. The report commented:

(i) There is currently insufficient overall support, and early R&D is needed on challenging concepts

(ii) Europe had an early R&D start with TESLA

(iii) Korea is in good shape

(iv) A first attempt has been made to identify missing R&D

The detector R&D panel presented preliminary urgent and important items, but did not prioritize. Histograms were given of costs and man years of R&D needed. In the next four years, investment should increase by a factor of two; US $31M per year is needed. The question now is how to go from the R&D panel report to a strategy. The current panel is not appropriate to review proposals.

Regarding the machine/detector interface panel, Francois said that the particle physics community wants to be involved in ILCSC and GDE discussion on this topic. Hitoshi Yamamoto is Chair of this panel, which interfaces with WWS and GDE, and reports to both.

WWS will write a ~200 page detector conceptual report, based on ~100 page reports from each of the 4 detector concepts. Only one cost will be made public, by averaging the concepts. Options ($\gamma\gamma$, etc.) will be included.

Francois gave the following WWS summary:

There has been progress by the Detector R&D Panel—what comes next?

The MDI Panel has begun work.

An organization has been set up for the Detector Conceptual Report.

Links have been tightened between detector and machine activities.

Francois' report is given in Attachment V.

In the following discussion, it was noted that detector R&D funds in Americas and Asia should be increased. There is a need for a correct balance in detector/accelerator R&D funds. Detector performance gains are equivalent to luminosity gains.

The WWS is independent of GDE, not inside it, and reports to ILCSC. The particle physics community wants two interaction regions.

12. Future ILCSC Meetings

The next ILCSC meeting will be held at DESY Zeuthen on Monday 8 May 2006. The following one will be during ICHEP06 in Moscow, on Sunday 30 July 2006.

Report of the 1st Meeting of the ILC Machine Advisory Committee

FNAL, Apr 6-7/06

Committee: Takaaki Furuya, KEK; Günther Geschonke, CERN; Mike Harrison, BNL; In-Soo Ko, PAL; Philippe Lebrun, CERN; Bernd Loehr, DESY; Shin-ichi Kurokawa, KEK (ex-officio); Dave McGinnis, FNAL; Katsunobu Oide, KEK; Burt Richter, SLAC; Lenny Rivkin, PSI; Claus Rode, TJL; Roy Rubinstein, FNAL (Secretary); John Seeman, SLAC; Ferdinand Willeke, DESY (Chair).

Apologies: Y. Shatunov; BINP, N. Holtkamp, ORNL.

Introduction

A first meeting of the Machine Advisory Committee (MAC) for the design of the International Linear Collider (ILC) was held on April 6-7, 2006 at Fermi National Accelerator Laboratory. The committee was charged to review the baseline configuration (BC) and the corresponding reference design (RD) of the ILC with respect to consistency and soundness of the design, its capability to achieve the performance goals as defined by the requirements of the physics program, and the possibility to upgrade it to higher beam energy. The committee was further asked to review the process of producing the design and to comment on the credibility of the cost estimate. The committee's mandate is appended to this report.

The meeting consisted of two half-days of plenary presentations by Global Design Effort (GDE) members on the status of the design and the design process and concluded with a half-day of executive session. The meeting agenda is appended to this report.

The committee would like to express its regrets that due to the limited time available for this first ILC-MAC meeting, it did not succeed in meeting the entire scope of the demanding charge defined by the International Linear Collider Steering Committee (ILCSC). The committee points out that more time should be allocated for future MAC meetings.

The committee organized its findings, comments and recommendations around the following topics:

- General comments
- Baseline configuration of the ILC
- Choice of the accelerating gradient
- Strategy for upgrading to higher energy
- RF systems
- Change control
- Cost and cost estimation
- Availability aspects
- Civil construction and conventional facilities
- R&D program
- Communication

General Comments

An overview of the ILC baseline configuration and the management structure implemented to transform this configuration into the reference design report (RDR), the corresponding preliminary plans for research and development (R&D) of the required hardware components, as well as the cost estimate procedure to be applied to this design and to be integrated into the RDR, were presented to the committee.

- The committee was very impressed by the detailed and systematic design work already accomplished in a very short amount of time. The committee recognizes that the design work is performed under unusual and difficult circumstances in that the central design team, the GDE, has no authority over the funds and personnel resources needed to carry out the design work and the R&D efforts in the three world regions, and that the design and R&D work is carried out by many groups scattered around the world.

Within the very short period of about one year, the GDE has organized itself to overcome some of the difficulties associated with this configuration by creating several overseeing boards to provide global guidance for the individual regional design teams. The committee observes that a fairly detailed and comprehensive, in most areas quite reasonable, design is being produced as the result of this effort. The baseline configuration uses, in general, technology which can be considered available or within reach. Options for more advanced technologies which might provide advantages in performance or cost savings are kept open whenever they appear to be a not stretched-too-far alternative. The GDE has demonstrated a reasonable balance between forward-looking and pragmatism, driven by the need to provide a first credible cost estimate in the near future, and a moderate optimism by leaving room for innovative solutions.

- The committee endorses this approach and would like to congratulate the GDE for the impressive achievements along the way towards an RDR.

- The committee observes that the ILC design is so far the result of a collection of bottom-up subsystem designs which are at the present stage primarily driven by performance considerations and to a much lesser degree by cost considerations. The committee is concerned about the fact that the design has evolved in a bottom-up fashion and recognizes that complementing this approach by a top-down revision may be a difficult task.

A number of boards have been created to execute guidance and coordination of the design and R&D efforts. These include an executive board, an RDR management board, a change control board, an R&D board and a cost control board.

- The committee notes that these boards are in the process of organizing their work and defining their interactions and competences. The committee acknowledges that attention is also given to the necessity to avoid conflicts and to provide effective interfacing between the subsystems. The committee is looking forward to see these boards evolving quickly into the effective management organization needed to successfully carry out the GDE tasks.

- The committee believes that the overall human resources provided for the GDE of about thirty full-time equivalents (FTE) appears to be marginal for coordination of the present stage of the design and R&D effort. Members of the GDE have been chosen based on their technical competence and to a lesser degree for regional balance. The committee would like to endorse this choice.

- The committee discussed the overall organizational structure in which the GDE is embedded and concluded that it constitutes a functioning framework for the GDE to carry out its mission successfully.

Baseline Configuration of the ILC

The baseline configuration and the associated performance goals are driven by the requirements of the physics program, based on a document previously provided by a subcommittee of ILCSC.

- The committee did not see a clear path of how the results of the design effort and the difficulties to achieve the performance goals are fed back to the physics community. This is considered necessary in order to arrive at an optimum design which pushes the correct set of parameters. The committee would like to see a formal procedure which will provide this function and assure that the needs of the physics community are taken into consideration. Such a procedure would also help to avoid ambiguities about the interface of detector and accelerator and it would allow making sure that the evolving physics case is taken into account appropriately in the design specifications and considerations. The committee wishes to point out that the evolution of the physics case will likely be influenced by the physics results of the upcoming Large Hadron Collider (LHC) at CERN.

- The committee did not see clearly where the responsibility for determining the number and configuration of the interaction region(s) lies. While this is not part of the responsibilities of the committee, these decisions affect the beam delivery system and need to be made relatively soon for both the machine and detector designs.

- A well established procedure, as proposed above, would also considerably ease detector performance and cost optimization. An example of a problem to be avoided is a possible miscommunication between accelerator and detector physicists about the specification of beam energy spread during collisions which the committee felt appeared in some of the meeting presentations and discussions.

The basic beam and performance parameters used in the base line configuration occupy a finite volume in parameters space.

- The committee would like to understand in greater detail what the impact on cost and/or possible peak performance are and how much margin and safety is obtained by this expansion of parameter space. The committee deems it important that the GDE understands these trade-offs well.

The committee would like to comment on some specific design features:

- The committee notes that while the electron source of the ILC consists of two parallel RF guns to provide redundancy and enhance availability, they are both driven by a common klystron, which seems inconsistent.

- The committee discussed the change of the RF frequency to 650 MHz in the damping rings. While the committee appreciates that timing considerations may be very important, the committee would like to comment that neither klystrons nor cavities are available for this operating frequency. While the committee, however, believes that it might be possible to scale existing designs (at 500 MHz or 714 MHz) for this operating frequency with a moderate effort, the committee remains concerned about the impact on the cost.

- The committee takes further note that for timing purposes, a 1.3 km insert is anticipated in the positron linac which might be used for enhanced diagnostics. The committee is uneasy about the balance between benefit and costs. The committee encourages the design teams to keep looking for more elegant and cost effective alternatives.

- The committee wonders whether the timing scheme is compatible with the upgrade to 1 TeV.

Choice of the Accelerating Gradient

The choice of the accelerating gradient of the accelerating structures of the ILC main linac is one of the key parameters of the facility which has a large impact on most aspects of the overall design such as the overall length of the main linac.

The committee was presented with a rationale that the impact of the accelerating gradient on the project cost is relatively small (smaller than 10%) over a wide range between approximately 25 MV/m and 45 MV/m.

- The committee notes that the corresponding cost model does not take into account that higher gradients are more difficult to achieve. This is expected to have a considerable impact on cost due to more elaborate preparation procedures for the accelerating structures including iterations and repetitive applications to narrow the distribution of the achieved gradients to a tolerable level.

- The committee believes that the present choice of a peak accelerating gradient of 35 MV/m and an average accelerating gradient of 31.5 MV/m does not appear at this point as an unreasonable long-term goal. This belief is based on the rather encouraging results on peak performance of TESLA-type superconducting cavities, and the prospects of even higher gradients by using different cavity shapes as evidenced by recent results on single cell superconducting cavities at KEK and Cornell, or the promising results achieved with cavities made of large-grain or single-grain niobium.

- The committee however wishes to point out that this performance is by no means in hand at present. If the gradient value taken for the RD was to be chosen more in line with the general design principles (as observed above), the design accelerating gradient would be significantly lower.

- The committee encourages the design team to be prepared to take a fresh look at what the optimum design accelerating gradient should be as soon as more information from the R&D program becomes available.

- The committee believes that a very aggressive, world-wide, well-coordinated, R&D program is necessary to defend the case of an accelerating gradient as large as 35 MV/m. The committee recommends that this R&D effort have a very high priority in the overall ILC R&D plan. The committee would like to learn about the plan at its next meeting.

The committee notes that some spread in the anticipated cavity performance has already been taken into account in the choice of the average accelerating gradient value.

- Sorting of accelerating structures or phasing offset may be considered as methods to cope with a larger spread in accelerating gradient, thereby avoiding the effort of reprocessing weak accelerating structures and loosening the specification on the required minimum performance of individual resonators. This naturally would require a correction of the anticipated ratio of peak to average performance.

- The committee endorses the effort to achieve a higher accelerating gradient by optimization of the cavity shape and the effort to reduce the cavity preparation effort by the use of new materials such as large grain niobium, given that these efforts are appropriately prioritized in view of the more important issue of providing reliably high gradient cavities based on the TESLA type cavities and the well established processing methods. A worldwide coordination of the cavity innovation program is strongly encouraged.

Strategy for upgrading to higher energy

The ILC baseline design for a center of mass energy E_{cm} of 500 GeV includes the capability and a roadmap for upgrading the facility to E_{cm} = 1 TeV. The main element of the upgrade plan is that the geometry of the beam delivery system (BDS) allows an upgrade to 1 TeV (by replacing and adding beam transport elements in the BDS) and by extending at some future time both the electron and the positron tunnels at their low energy ends to provide the space for additional accelerating structures and RF systems.

- The committee can see why the GDE considers the provision of additional tunnel in the first stage of the project for the purpose of upgrading to higher energy at a later time as unattractive, despite the fact that the overall cost for the 1TeV machine is expected to be lower if one would proceed that way.

- The committee remarks that the GDE is aware that this upgrade strategy implies that the industrialization program and the learning curve in industrial production of cryostats, cavities and modulators will have to be repeated, that the cost impact of this way of performing the upgrade has not yet been estimated.

- The committee did not converge to a clear recommendation concerning alternative upgrade strategies. It wants to point out however, that a possible strategy exists which consists in starting with a longer tunnel and a lower gradient for the 500 GeV machine. According to the cost versus gradient curve shown to the committee, this is expected to have only relatively little impact on the cost for gradients as low as 25 MV/m, especially if one takes into account that this curve may be too optimistic for the high gradient range. The 1 TeV option could then be implemented by upgrading the RF power and would rely on further progress in reliably producing cavities with larger gradients at no additional cost before cavity mass production starts. Proceeding this way does not exclude the option to pursue the present upgrade plan with no extra penalty if high gradients cannot be achieved. The advantage of this procedure would be (provided that all these assumptions can be verified) to combine a reduced risk of missing the desired performance of the 500 GeV main linacs with the option for a presumably significantly less costly upgrade to 1 TeV. The committee thus wants to make sure that this option is discussed and well understood by the GDE.

RF Systems

The status of the design of the main linac RF systems was presented to the committee. The baseline design consists of TESLA type cavities and cryostat with minor modifications and adaptations. The option for alternative cavity shape and alternative cavity material is kept open and will be developed in the R&D program. Modifications and improvements with respect to the TESLA design are also anticipated in the coupler and tuner systems.

The baseline for the pulsed RF high voltage supply consists of a bouncer-circuit modulator, which is an established technology.

An R&D program is underway to develop a modulator with a modular architecture consisting of Marx generator cards which allow a parallel charging and a serial discharging of the electrical power into the klystron. This design promises a considerable cost reduction due to mass-producibility and enhanced availability due to the ease of providing margin by just adding cards. The system is also quite compact which should help to economize space in the tunnel.

- The committee believes that this is a worthwhile development and wants to encourage further R&D effort.

The committee notes that a satisfactory solution for the10 MW klystron is not yet at hand.

- The committee notes that an appropriate R&D program which follows several paths at this point is underway to arrive at an improved version of an L-band klystron. The committee endorses and encourages these R&D activities.

The committee notes that the RF control is very challenging.

- It is unclear to the committee why amplitude variation at flat-top needs to be limited to 0.1%.

While there is a baseline RF distribution scheme with circulators to handle the reflected RF power, alternative RF distribution schemes without circulators with presumably lower costs are being considered.

- The committee would like to encourage this effort.

Change Control

The mission, the working model, and the first actions of the change control board were presented to the committee as one of the important management tools to maintain consistent baseline design while the elements of the design are evolving as the result of the ongoing effort to improve on performance, consistency and cost.

- The committee is pleased to see that this important design instrument has already started its activities. However, the committee is concerned with the implementation of present change control and believes that significant difficulties could arise once a large number of design changes is requested along the way to the RDR, including those resulting from R&D programs.

- The committee would like to recommend establishing clear rules of authorization of change requests. This way, some filtering of the change requests is already achieved before the board has to deal with them.

- The committee takes note that no impact criteria have been defined. Once impact criteria have been established, clear rules for escalation and communication of change requests are encouraged as well. The interface between the RDR management board and the change control board must be defined clearly.

- The committee would like to emphasize that CCB decisions must be prepared and communicated with all the technical groups. Each group must be informed of a change request and asked for its impact on their system.

- The committee proposes further the consideration of differentiating between the acceptance procedure for requested changes and the execution and implementation of changes while maintaining a consistent design. The latter task cannot be provided by a committee but requires considerable technical and engineering support.

- The committee is concerned with the present level of version control. In order to maintain a series of reference designs to be able to perform consistent calculations, simulations and comparisons, a higher level of formality and the use of more sophisticated tools is probably necessary.

- The committee encourages the GDE to make cost considerations an important element in the change control procedure. The committee is not sure that some recent change requests would have been accepted by CCB if cost considerations had been included in the acceptance criteria. (Possible examples are the change to 650 MHz in damping ring RF frequency and the 1.3 km insert in the positron main linac tunnel for timing purposes).

Cost and Cost Estimation

A detailed description of the cost models and methodology for the RDR cost estimate was presented to the committee.

- The committee endorses plans to provide a region-independent cost estimate and the rules for translating the cost, or part of the cost, into cost estimates according to the rules in each region.

The committee did not see any plans on how to execute cost control on the evolving design.

- Since the design effort so far has been primarily driven by performance considerations, the committee is concerned that the resulting design will resist attempts of cost reduction. The committee feels that the GDE should be prepared for larger design changes to arrive at a concept which is robust with respect to cost reduction.

- The committee heard little about the methods to encourage or enforce cost consciousness in the design process. The committee is moreover somewhat concerned about the concept of producing first a performance driven design and then introducing cost consideration in a second stage. In order to arrive at a substantial cost reduction in the second stage, very painful design changes might be necessary which may be unfeasible to implement at this later time. The committee encourages the GDE to introduce cost consciousness immediately as an integral part of the design

- The committee finds it difficult to offer direct advice on how to encourage and assure cost consciousness throughout the design team. The committee, however, feels that this task can not primarily rest on the shoulders of the area and system managers but has the opinion that it is a primary responsibility of the GDE. Cost reviews have been mentioned as a possible

instrument of cost control in the design phase. The committee suggests charging the RDR Management Board explicitly with the task of providing guidance for cost conscious design, the encouragement of cost-saving design decisions and the rejection of costly design approaches. The committee notes that this task naturally has to overcome the resistance of the area and system providers which feel primarily responsible to deliver a working design which will meet the performance goals. It will be vitally important to strengthen the authority of the Board (if this is the body which will be assigned to make cost-based decisions) to assure a successful outcome of this task.

- The committee also would like to suggest including cost consideration at an early stage in the industrialization process. The industrialization process for any technical system or major component should not be started up without a clear view of how much responsibility for achieving the performance goals is deferred to industry (the decision of build-to-print or build-to-performance).

- The committee understands that it is very important to make use of the large momentum which has been developed since the ILC design effort has started, and the committee would not like to see this effort slowing down. Given the large amount of work to be done and given the anticipated accuracy of the cost estimate of 20%, however, the committee is concerned that it might be difficult to succeed with this task by the current goal of the end of 2006.

Availability Aspects

The committee takes note that the decision for a double tunnel is based primarily on availability considerations.

- The committee would like to make sure that other considerations such as safety have been taken into account in the layout of the tunnels.

- The committee is concerned that some of the assumed improvements in component reliability might be unrealistic. The committee would like to hear more details in the future.

Civil Construction and Conventional Facilities

A review of technical site considerations and planning for conventional facilities based on evaluations of three site examples was presented to the committee. One of the important conclusions from the assessment is that a deep tunnel will have a number of advantages.

- The committee considers these activities well underway, and recommends that sufficient attention is paid to, and a considerable effort is devoted to, the issues associated with conventional facilities.

The committee was informed about a bid-to-host activity within the US in order to provide the technical preparation of the US site proposal.

- The committee is unsure whether now is the optimum time to proceed with these activities. The committee is aware that these activities are not within the responsibility of the GDE or the Americas Regional Team (ART) R&D program.

R&D Program

The activities of the R&D board of the GDE were presented to the committee. The difficult task of the R&D board is to coordinate the worldwide R&D activities for the ILC without any direct

authority over R&D funds. The first activities of the board are to work out a prioritization of the ongoing and planned R&D activities, and avoid unnecessary duplication.

- The committee did not see an overall R&D plan with milestones. The committee would like to encourage the GDE to aggressively pursue its plans to develop an explicit R&D plan including milestones.

- The committee wants to point out that the communication between the R&D activities in the regions and the GDE must be improved. The regional directors bear the primary responsibility for this.

- Formal relations between the ILC R&D program in the US and the GDE R&D board are being established, which is expected to provide considerable progress towards a well coordinated R&D program. The committee welcomes this as an important step towards better overall coordination. The possibilities for the GDE to influence the ongoing and planned R&D activities in Europe and Asia, however, are quite limited and so far not very successful. The committee believes that the regional directors must take action in order to ensure better overall coordination.

- At this point, the committee rates the overall coordination and the overall focus of the R&D program as unsatisfactory. The committee did not see effective instruments being developed to provide the overall coordination and the focus. The regional directors should work with the regional ILC sub-system technical coordinators as a group to develop a focused program in each technical area.

- The committee is thus very concerned about the present status of the worldwide R&D program. Given the large amount of work to be performed in order to prepare for construction of the ILC, the present lack of sufficient R&D funds, and the current regional imbalance in those available will, if they persist, create a serious problem for the ILC.

Communication

Communications among the GDE members and between GDE and the design and R&D teams was raised as one area of concern by the director of GDE to the ILCMAC. The committee noticed that some progress has been made recently to overcome the difficulties with world-wide distributed design and R&D efforts. Besides the use of email, telephone and video conferences, there is a centralized agenda server located at CERN, there are new communications tools in use such as WEBEX, and a central database for the ILC provided by DESY is in preparation.

- The committee feels that perhaps some of the communication problems are related to the regional control of the funds to carry out R&D and design work, to different regional interests, and to different views on the relationship of ILC activities to other activities in a region.

- The committee recognizes the special responsibility of the regional directors to avoid misunderstanding and misinterpretation between GDE and regional activities. It is important that relevant information on ILC related activities in the regions is brought to the attention of the GDE and be coordinated with initiatives of the GDE. The committee would like to point out that it should also be the responsibility of the ILCSC to make use of its influence in the regions on these matters.

- As noted earlier, the committee further suggests that the communications with the detector and the physics community of the ILC should be strengthened by more formal relationships and regular communications. Well-organized communication between GDE and the ILC physics community is important especially to reach consensus on the design issues that have

significant impact on physics capabilities. The committee believes that well established communication between GDE and the ILC physics community should be institutionalized, and that ILCSC should give some guidance in this area.

- The committee would like to mention that communication is a serious issue as such and needs attention and resources. The committee suggests that the ILC communication group should also look into possible problems of communications within GDE and the ILC design and R&D teams. Replacements for the unscheduled exchange of information that takes place within a laboratory must be provided. The committee wants to point out that these problems are taken rather seriously by private industry, and professional support in these matters is available and can be made use of.

Topics to be addressed at the next MAC meeting

The committee would like to GDE to provide more technical and detailed information at the next ILCMAC meeting. In particular, the committee would like to learn in more detail about

- Availability, safety and machine protection aspects.
- Detailed information on the progress of the configuration and the cost estimate.
- The damping rings are three rings of Tevatron (or HERA) size. MAC would like more information on their design at the next meeting.
- R&D program on superconducting RF cavity development.
- Low Level RF Control

Next MAC Meeting

The next ILC-MAC meeting is foreseen on Sept 20/21/22 2006 (2 ½ days).
The location is yet to be decided.

22 March 06

ILC Machine Advisory Committee (MAC) Mandate

1. The oversight of Global Design Effort (GDE) activities is by the International Linear Collider Steering Committee (ILCSC); MAC will assist ILCSC in one of ILCSC's oversight functions.
2. MAC will meet two or three times per year until ILCSC and the International Committee for Future Accelerators (ICFA) approve the Reference Design Report (RDR).
3. MAC will review GDE accelerator activities; it will report to ILCSC.
4. MAC will review the following aspects of the Baseline Configuration Document (BCD):

a) Is the conclusion of BCD reasonable and consistent with the overall ILC system? Is the BCD design consistent? Is it optimized to produce maximum physics output? Is the plan to upgrade the machine to 1 TeV appropriate?
b) Are there any BCD items that MAC feels should be reconsidered?
c) Are there any issues that MAC thinks should be discussed in a broader context by ILCSC?

5. MAC will review the process that will lead to the RDR:

a) Is the organization of GDE appropriate for this activity?
b) Is the accelerator design process appropriate?
c) Is the cost estimate process appropriate?
d) Are the milestones envisioned in the RDR appropriate and realistic?

6. In addition, MAC will review the RDR for the following:

a) Is the RDR design reasonable and consistent with the overall ILC system? Is the RDR design consistent? Is it optimized to produce maximum physics output? Is the plan to upgrade the machine to 1 TeV appropriate?
b) Is the estimated cost reasonable?
c) Is the envisioned project schedule reasonable?

AGENDA

Thursday 06 April 2006

Review of the BCD (13:30->17:30)

13:50	**Overview** (30') (Slides) `Process and Highlights`	Barry Barish (*Caltech*)
14:20	**Technical Features of the BCD** (1h00') (Slides)	Tor Raubenheimer (*SLAC*)
15:20	break	
15:50	**The Main Linac** (45') (Slides)	Chris Adolphsen (*SLAC*)
16:35	**Conventional Facilities** (45') (Slides)	Victor Kuchler (*Fermilab*)
17:20	**Change Control Board (CCB) Report** (30') (Slides)	Nobu Toge (*KEK*)

Friday 07 April 2006

Efforts on the Reference Design Report and R&D Program towards the TDR (08:50->12:20)

08:50	**Overview** (30') (Slides) `Organization, Schedule, Approach and Goals`	Barry Barish (*Caltech*)
09:20	**Design Cost Board (DCB) Report** (30') (Slides)	Peter Garbincius (*FNAL*)
09:50	**RDR Management Accelerator Design Towards the RDR** (30') (Slides)	Nicholas Walker (*DESY*)
10:20	break	
10:50	**Global R&D Board** (30') (Slides)	William J. Willis (*Columbia*)
11:20	**European Regional Program** (20') (Slides)	Brian Foster (*University of Oxford*)
11:40	**Asian Regional Program** (20') (Slides)	Kaoru Yokoya (*KEK*)
12:00	**Americas Regional Program** (20') (Slides)	Gerald Dugan (*Cornell University*)

資料3－4

ILC-MAC member list

Name	Affiliation	Expertise, etc
Ferdinad Willeke	DESY	Chair
Norbert Holtkamp	ORNL	linac, RF, LC, Project
Katsunobu Oide	KEK	e-ring, Accelerator Physics, Project
John Seeman	SLAC	e-ring, Accelerator Physics, Project, MDI
Pillipe Lebrun	CERN	LHC, project management, cryogenics
Mike Harrison	BNL	superconducting magnets, project
Dave McGinnis	FNAL	RF, accelerator physics, project
Claus Rhode	TJL	cryogenics
Lenny Rivkin	PSI	low emittance ring, accelerator physics
Takaaki Furuya	KEK	SCRF
In-Soo Ko	PAL	linac, accelerator physics, project
Bernd Loehr	DESY	long term technical coordinator of ZEUS
Burt Richter	SLAC	project, Accelerator physics
Gunter Geschonke	CERN	RF, SCRF
Yuri Shatunov **or other person from Russia**	BINP	accelerator physics, project
Shin-ichi Kurokawa	KEK	Chair of ILCSC, ex-officio
Roy Rubinstein	FNAL	Secretary

資料4

第３回LC レビュー委員会答申

これまでの第１，２回のレビューの答申が ILC 推進室によって受け止められ，努力され成果が出されていることを，第３回のレビューにおいて委員会のメンバーは認識できた．上記の経過を見ると、室長をはじめとする指導部の「指導性」が適切に発揮されているが、更なる一層の努力を期待したい．

委員会は、発表された内容から、重要と判断した以下のいくつかのテーマに関し答申を行うものとする．

45MeV/m 空洞開発

成功率はまだ半分程度であるが、単セル空洞で目標が達成されつつあると判断される．このことは空洞処理装置や計測装置などの周辺設備の準備ができたということを意味している。予定より遅れたとはいえ、期待に応えた担当グループの開発能力を高く評価するものである．

最終的に必要とされる多連空洞の開発には、単セル空洞にはない多連空洞に特有のさらに困難な課題も必ずあるであろう．単セル空洞の開発が完了したわけではないが、多連空洞に関しては課題さえ十分に把握されていないのではないか．そこで、開発の主眼を単セルから９セル空洞に変えて、多連空洞製作の問題点解明と量産方法の確立に向かうべきである．もちろん、両タイプに共通な課題の解決には、単セル空洞に戻ることもあろう．熱望される情報は45MV/mの多連空洞が容易に製作できるか否かということであるので、完備したモジュールとしてではなく、先ずは構成要素開発として９連空洞単体の歩留まりを２、３年かけてしっかりと調査することが有効であろう．クライオモジュールへの組み込みを拙速に進めるのではなく、課題をしっかりと追求して高加速勾配の空洞技術を確立して欲しい。ここでの結果はそのままTESLA型空洞開発にもきわめて重要な貢献となるであろう．

STF 建設

STFを建設することによってKEKがどういう貢献をしようとするのかについて、共通の理解がない、独自目標がない印象がある．日本でもシステムを構築してみて問題点を学習する、としか見えない．それとも、要素開発に徹するのか．また、モジュール開発をすべてKEKでやろうとしているのか、それともFermiやDESYとの共同開発、開発分担で進める方針なのかわからない．

ベースラインの雛形として製作が進められている35MeV/m空洞、入力カプラー、周波数チューナー、HOMカプラーなどの構成要素、alternativeとして開発が進められている45MeV/m空洞、それらを同時に試験ができるSTF-Iは要素開発の場としての魅力がある．しかしながら、これまでのところ完成したSTF-Iの利用に関しての議論が乏しい．具体的な実験計画を作成し、各コンポーネントの達成目標と手順を全員で議論することで、STFがILCへどのような貢献ができるかについて理解を共有できるであろう．

STF-Iにおいてビーム加速が予定されていて、空洞性能の確認ができるとともに電子銃やビームモニター系の開発ができ、多くの人を育てることもできるということであった．

しかしながら、現在想定している“手続”で建設されるクライオモジュールを設置したSTF-Iにおいて、十分なビーム運転時間を確保することは容易ではない、と一部の委員が危惧している．また、ビーム加速まで必要かどうかについても、一部の委員は疑問を持っている．再検討し説得力ある実験計画を作成すべきである．

35 MV/mと45 MV/mの開発では、互いに独立にカプラーやチューナーが開発されている．今のところ本命と見なされるこれらのモデルが存在しないので、独自のアイデアのもとに平行に開発を進めることは、委員会として評価するものである．しかしながら、一方では各物的・人的資源を出来るだけ共有するよう、執行部は強力な指導をすべきである．

Phase II では、前回のレビューの答申にそってスケジュールが変更され、Phase Iの結果が建設に生かされることになった．ただし、今後の内外的な条件により更なる変更があり得ると理解している．

R&Dの連携

DESY XFELはスペックの違いはあるにせよ、ILC型の大規模超伝導リニアックの開発・実証の場であることは疑いない．XFELとの一層の連携を目指すべきである．

4月以降、KEK 内に「ERL推進室」が新設され、ERLのR&Dが始まる．超伝導空洞の技術など共通のR&D項目が多いので、連携をとってリソースの有効利用を図るべきである．小規模ではあるが実働する実証機を建設するということで、特に加速器建設に未経験の若い研究者に経験を積ませて育成することに寄与するであろう．

EP設備の整備

超伝導空洞の開発を確立し歩留まりよく製作するうえで、必須であり最優先の課題である．設備はILCのためだけではなく、他のプロジェクトにおいても使用される．このため設計には他プロジェクトからの要求も考慮されており、新設される設備の整備計画と予算措置は機構全体で担うべきである．

ATF/ATF2

国内外の多数機関との共同プロジェクトを標榜しているが、資金面については KEK の持ち出しが目に付く．人的貢献だけではなく各参加機関からの応分の負担を求めるべきである．また、共同研究者を代表にして競争的資金を獲得するなどの努力があってしかるべきだろう．

キッカー開発は、ダンピングリングの形状を決定する上で重要な貢献をすることから、積極的な推進を支持する．当然ながらリングへの入出射の過程を考慮し、実証に説得力のあるキッカー波形を目指すべきである．

経費が十分に得られない場合にはATF2計画の見直しをおこない、ILC設計スケジュールから判断して、緊急度の低いものは遅らせるべきである．

コストを意識したR&D

プロジェクトを立ち上げるためには、徹底したコストの削減が不可欠である．一方では、コスト評価が早急に求められており、加速器全体で主要なコストとなる超伝導空洞、

クライストロン、モジュレーター電源等、各コンポーネントのコストの現状を示し、削減目標を明らかにする必要がある. R&Dをしなければ、合理的な削減目標を設定できないであろう.

このためコスト削減を目的としたR&Dも推進すべきである. 例えば、超伝導空洞の入力カプラーやhigh-power RF系がある. しかしながら、現在の予算・人員の規模では、ILCに必要なコストダウンなどのR&Dができるとは思えない. このためにも、XFEL等の欧米との開発の協力や分担を積極的にすべきである.

今回のレビュー

レビューの性格・目的、委員の専門性等を考慮し、全分野を均等に配分することなく重点を絞った報告としていただきたい. 前回も指摘したが、各報告を見ると重複が多く、また何について答申を求めているのか、一部の報告者の自覚不足を感じることがあった. 今後は、レビュー後の委員の議論時間が十分確保できるよう、重点を絞った短時間の報告としていただきたい.

レビュー委員：

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2006 年 4 月 19 日

資料5

Recent GDE Activities and Plans

Nobu Toge (KEK)

LC Project Meeting of KEK

April 25, 2006

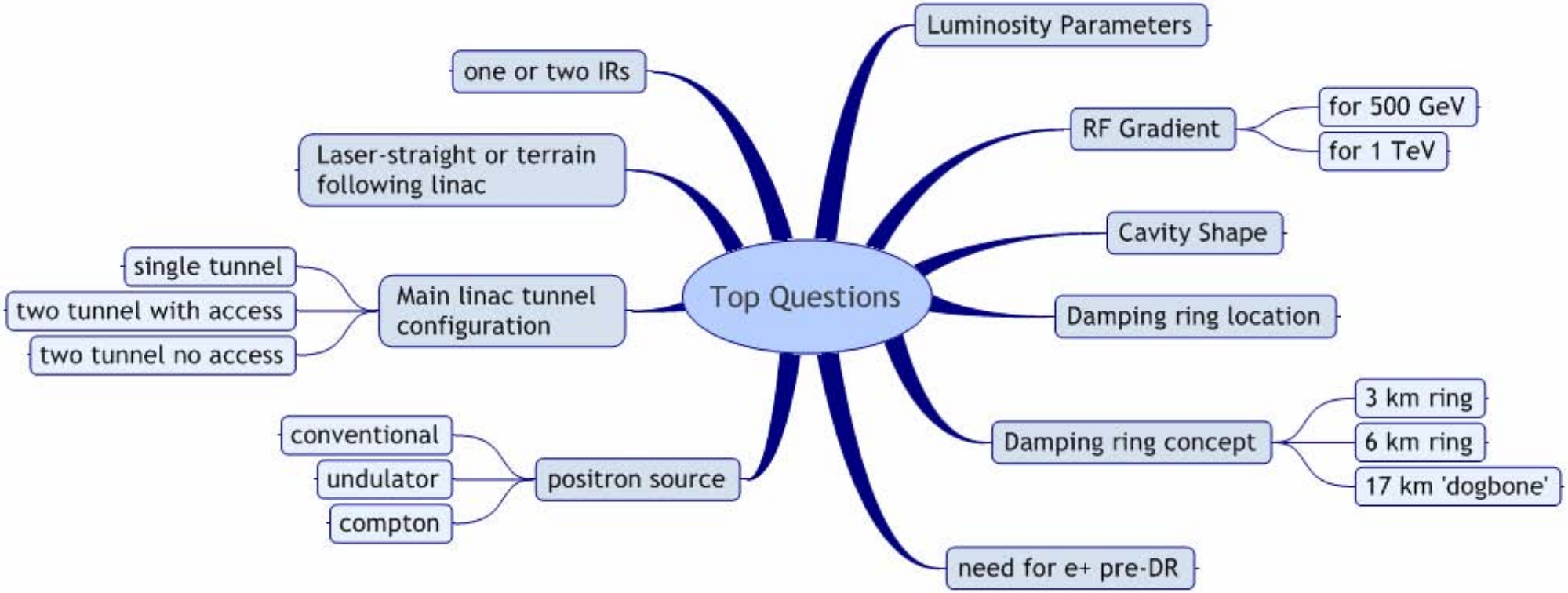
Major Meetings

- Frascati GDE Meeting (Dec. 7-9, 2005)
  - http://www.linearcollider.org/cms/?pid=1000185
- Bangalore GDE Meeting (Mar. 9-11, 2006)
  - http://www.linearcollider.org/cms/?pid=1000203
- Vancouver LCWS (July 19-22, 2006)
  - http://vlcw06.triumf.ca/index.htm
- Valencia GDE Meeting (Nov. 6-10, 2006)

Between Snowmass and Frascati (1)

- BB, at Snowmass 2005, said –
  - Schedule
    - Begin – define configuration (Snowmass 2005)
    - Baseline Configuration Document (end of 2005)
    - ----------
    - Baseline under configuration control (Jan 06)
    - Develop Reference Design (end of 2006)
    - Coordinate the supporting R&D program
  - Three volumes – 1) Reference Design Report; 2) Shorter glossy version for non-experts and policy makers; 3) Detector Concept Report
- Authoring instructions given by EC at http://www.linearcollider.org/cms/?pid=1000104

Between Snowmass and Frascati (2) Design Choices to Make



Between Snowmass and Frascati (3)

- BC – A forward-looking configuration which we are reasonably confident can achieve the required performance and can be used to give a reasonably accurate cost estimate by mid/end-2006 (→ RDR).

- AC – A technology or concept which may provide a significant cost reduction, increase in performance (or both), but which will not be mature enough to be considered baseline by mid-end 2006.

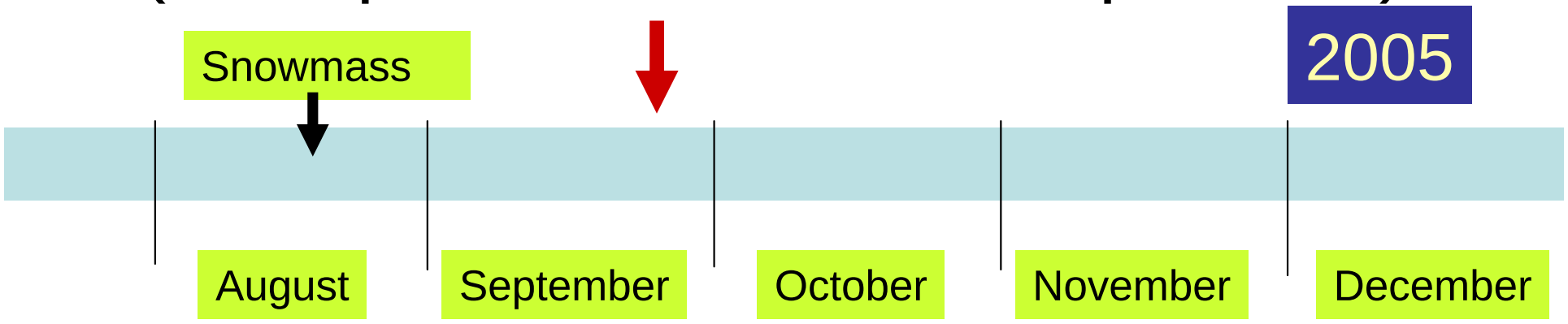
  - BCD outlines the ILC complex.
  - Not a design report, but it describes the essential choices, including the gradient, DR shape, e+ production scheme, # of tunnels, # of IPs, together with the reasons for the choice.

Between Snowmass and Frascati (4)

- Task forces formed (October, 2005)
- Draft writing started at http://www.linearcollider.org/wiki/doku.php?id=bcd:bcd_home
- In Nov. 2005, EC requests 5 groups to draft “white papers” on
  - Energy upgrade → … → Tunnels for 500GeV-only first
  - IP configuration → 2
  - # of tunnels → 2
  - E+ source → undulator
  - Tunnel alignment → ~ Follow gravity
- DR meeting (CERN, Nov.9-11, 2005) → 1 e-, 2 e+ ~6km
- → “Strawman BCD” publicized on Nov.11-18, 2006.

- EC solicited comments from Richter, Oide, Rivkin, Moortgat-Pick
- All put together at http://www.linearcollider.org/wiki/doku.php?id=bcd:dec2005version

From Snowmass to a Baseline (BB report at MAC review, Apr. 2006)



WW/GG summaries

Response to list of 40+ decisions

All documented 'recommendations available on ILC Website (request community feedback)

Review by BCD EC

BCD Executive Committee:
Barish
Dugan, Foster, Takasaki
Raubenheimer, Yokoya, Walker

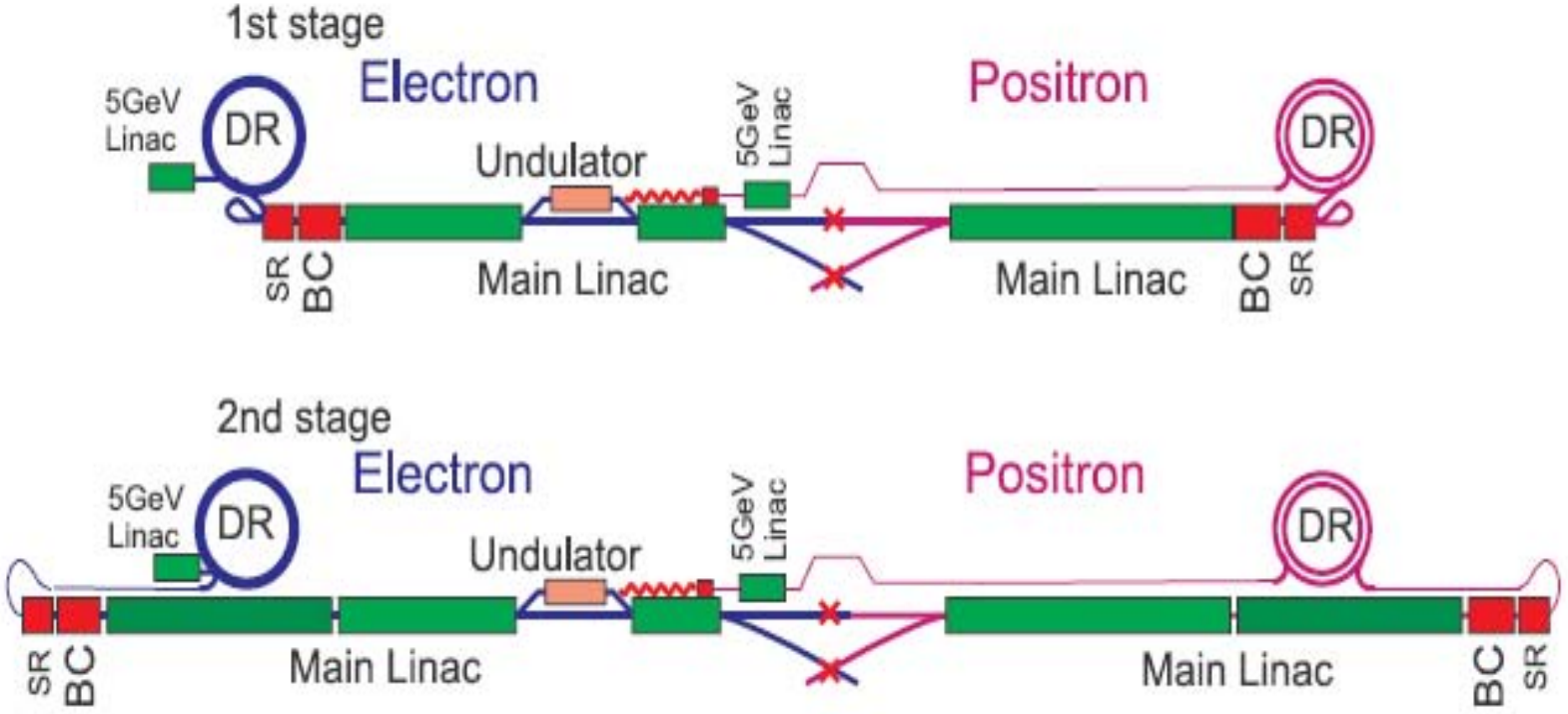
BCD EC publishes 'strawman' BCD

Public Review

Frascati GDE meeting

Frascati Meeting (1)

- “Approval” of Frascati BCD.
  - In the plenary session
    - Overview of “expert comments”.
    - Some discussion on the spot.
  - Check Frascati BCD web page for record.



Frascati Meeting (2) - CCB

- CCB (Change Configuration Board)
  - BCD now under change control, upon approval at Frascati.
  - CCB converted essential contents of Frascati BCD into MSWord files.
  - An hierarchical system of requesting, evaluating and approving changes has been instituted and has started working
  - BCD will evolve, and principal backbones of RDR, when produced, shall be consistent with BCD.
  - For details, see http://www.linearcollider.org/wiki/doku.php?id=bcd:bcd_home
  - CCB will also evaluate R&D defined by the ACs and develop views on what needs to be demonstrated in order to be considered for a CCB action to replace the baseline.

Change Control Board (CCB)

Nobu Toge (chair)	***Asia***
Markiewicz	**US**
Mishra	**US**
Funk	**US**
Kubo	**Asia**
Kuriki	**Asia**
Pagani	**EU**
Blair	**EU**
Schulte	**EU**

Frascati Meeting (3) - DCB

- The Design / Cost Board will be responsible for assessing and providing guidance for the overall RDR design effort program. The DCB initial goals will be to propose the overall structure and content for the RDR document to be developed by the end of 2006. It also will provide early guidance required to enable the design / cost effort to get fully underway by the time of the Bangalore GDE meeting.

- The DCB will set goals and milestones for producing the RDR, conduct design reviews and provide guidance and assessments of the RDR effort. The DCB will report to the Director and EC regularly as the design / cost effort progresses, reporting on early evaluations of costs, problems and changes needed in the BCD, etc.

Design Cost Board (DCB)

Peter Garbincius (chair)	***US***
Phinney	**US**
Paterson	**US**
Kephart	**US**
Enomoto	**Asia**
Shidara	**Asia**
Terunuma	**Asia**
Bialowons	**EU**
Delahaye	**EU**
Mueller	**EU**

Frascati Meeting (4) - RDB

- The Global R&D Board will be responsible for assessing and providing guidance for the overall R&D program. The RDB will suggest priorities for the research facilities and R&D supporting the baseline, the R&D on alternatives to the baseline and selective R&D that could further the field in the longer term. The mission will also include global assessments and recommended priorities for the detector R&D program and evaluate the balance between accelerator and detector R&D.

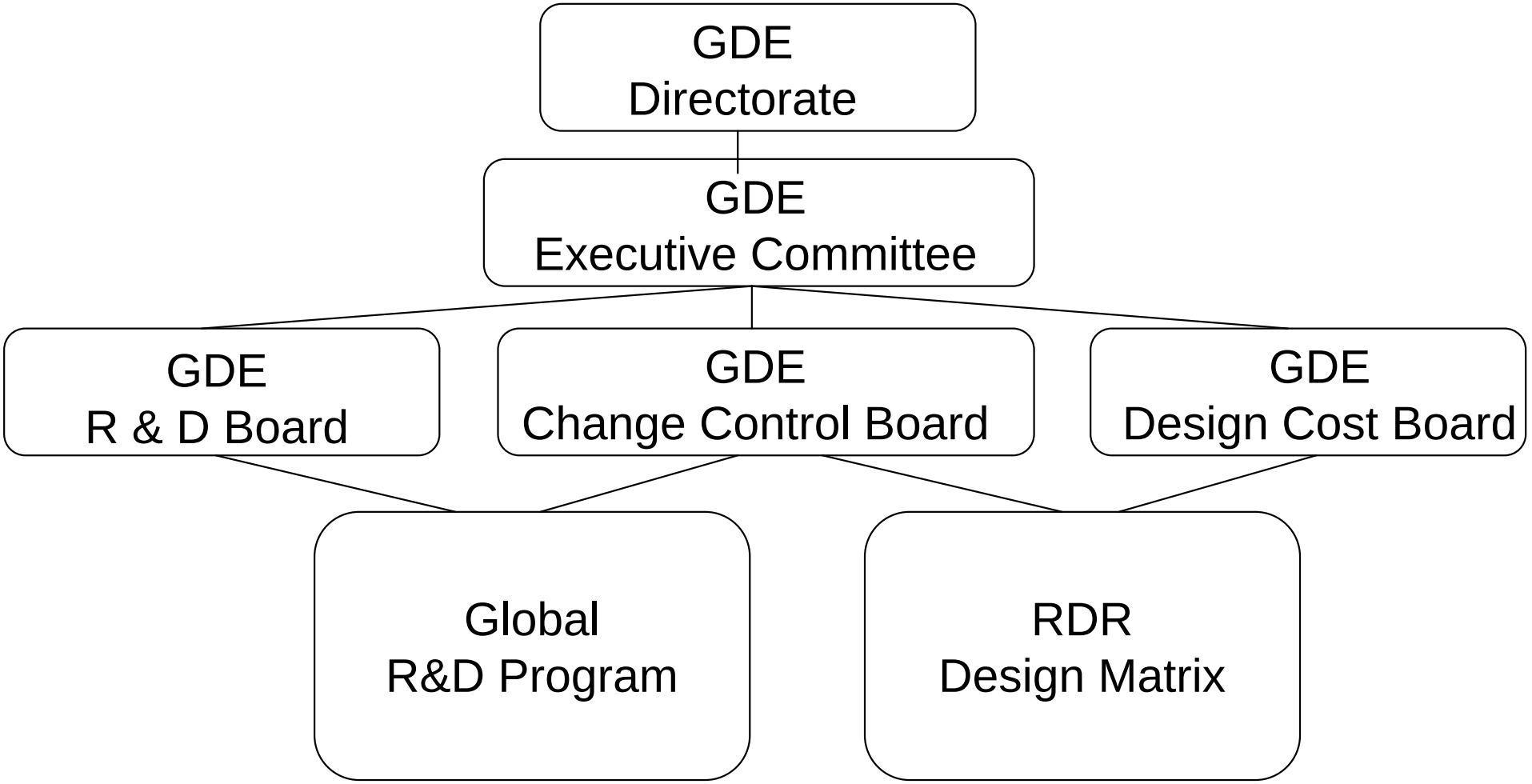
- The RDB will develop a proposal driven program, structured in the sense of defined goals, and milestones, and resources evaluated on a common basis to allow comparison across different regions and national funding systems. It will conduct reviews and identify gaps in coverage of topics, resource or technical issues, duplications, and other concerns..

Global R&D Board (RDB)

Bill Willis (chair) US

Padamsee	**US**
Himel	**US**
Wolski	**US**
Hayano	**Asia**
Higo	**Asia**
Elsen	**EU**
Lilje	**EU**
Garvey	**EU**
Damerell	**EU**

Frascati Meeting (5) – GDE Organization



At Frascati, first descriptions were given on the proposed organization structure above, and discussions began as to what this means, and who should do what in which areas.

Between Frascati and Bangalore (1) Interim Meetings

- Jan 19-20, 2006 at KEK
  - http://lcdev.kek.jp/GDE/ASL2006KEK/
- Feb 13-14, 2006 at FNAL
  - http://ilcagenda.cern.ch/conferenceDisplay.py?confId=14
- Discussions on
  - Identify “First ILC Costing Towards 2006 End” as the TOP PRIORITY
  - Specifically,
    - Remaining baseline choice issues (DR RF, timing, layout, and many other details)
    - Tasks of Area System Leaders and Technical System Groups
    - Need for organizing the whole team according to “RDR Matrix”.
  - Rough schedule

Between Frascati and Bangalore (2)
RDR Matrix

	Area Systems					
Technical Systems	**e- source**	**e+ source**	**Damping Rings**	**RTML**	**Main Linac**	**BDS**
Vacuum systems						
Magnet systems						
Cryomodule						
Cavity Package						
RF Power						
Instrumentation						
Dumps and Collimators						
Accelerator Physics						
Global Systems						
Commissioning, Operations & Reliability						
Control System						
Cryogenics						
CF&S						
Installation						

Between Frascati and Bangalore (3) RDR Matrix (cont)

- Identification of point of contacts.
- Web areas created for
  - Area Systems: http://www.linearcollider.org/wiki/doku.php?id=rdr:rdr_as:rdr_as_home
  - Technical systems: http://www.linearcollider.org/wiki/doku.php?id=rdr:rdr_ts:rdr_ts_home
  - RDR Notes, Proc and Docs from DCB, including RDR outlines, proposed WBS, costing guidelines: http://www.linearcollider.org/wiki/doku.php?id=dcb:dcb_home
- Regular Area/Tech video/phone meetings started
  - http://ilcagenda.cern.ch/categoryDisplay.py?categId=42

Between Frascati and Bangalore (4)

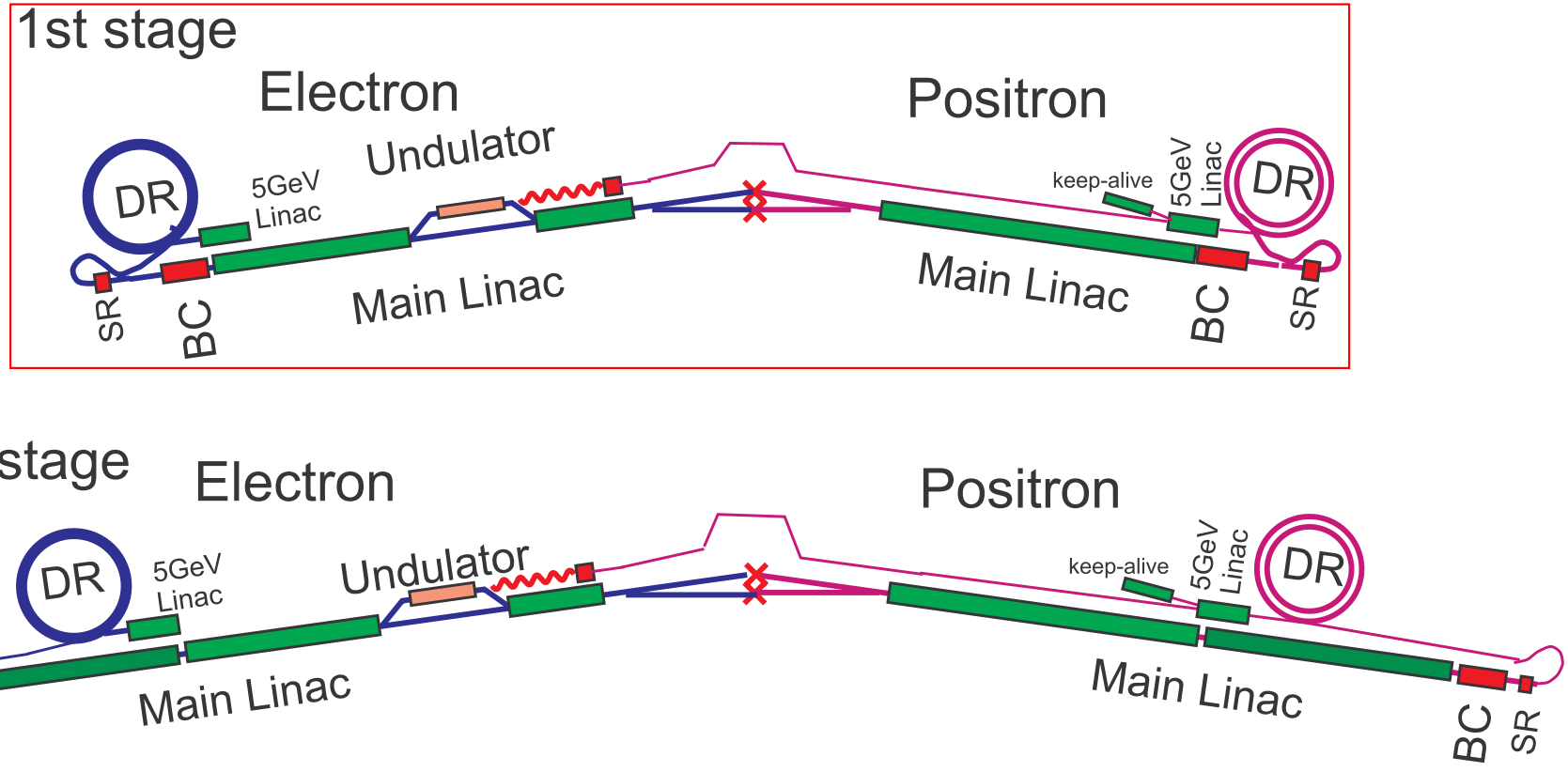
- CCB: Follow-up on the BC document
  - CC procedures
  - Identification of additional burning Baseline issues
    - Beam timing
    - DR RF frequency
    - RTML layout
    - E+ system layout
  - Initial CC “runs”
- RDB:
  - Compilation of ongoing R&D programs
  - Essential R&D issues
  - http://www.linearcollider.org/wiki/doku.php?id=rdb:rdb_home

Bangalore GDE Meeting (1)

- Standard regional overview and board status talks.
- Area Systems status review reports
  - Reconfirm RDR matrix
  - Reconfirm BC
  - Identify missing parts
  - Assigned (cost driven) priority to delivering them.
- Parallel “discussions” in various combinations among EC, DCB, RDB, AGs towards RDR.
  - Review WBS
  - Produce a milestone driven schedule towards Vancouver.

Bangalore GDE Meeting (2)

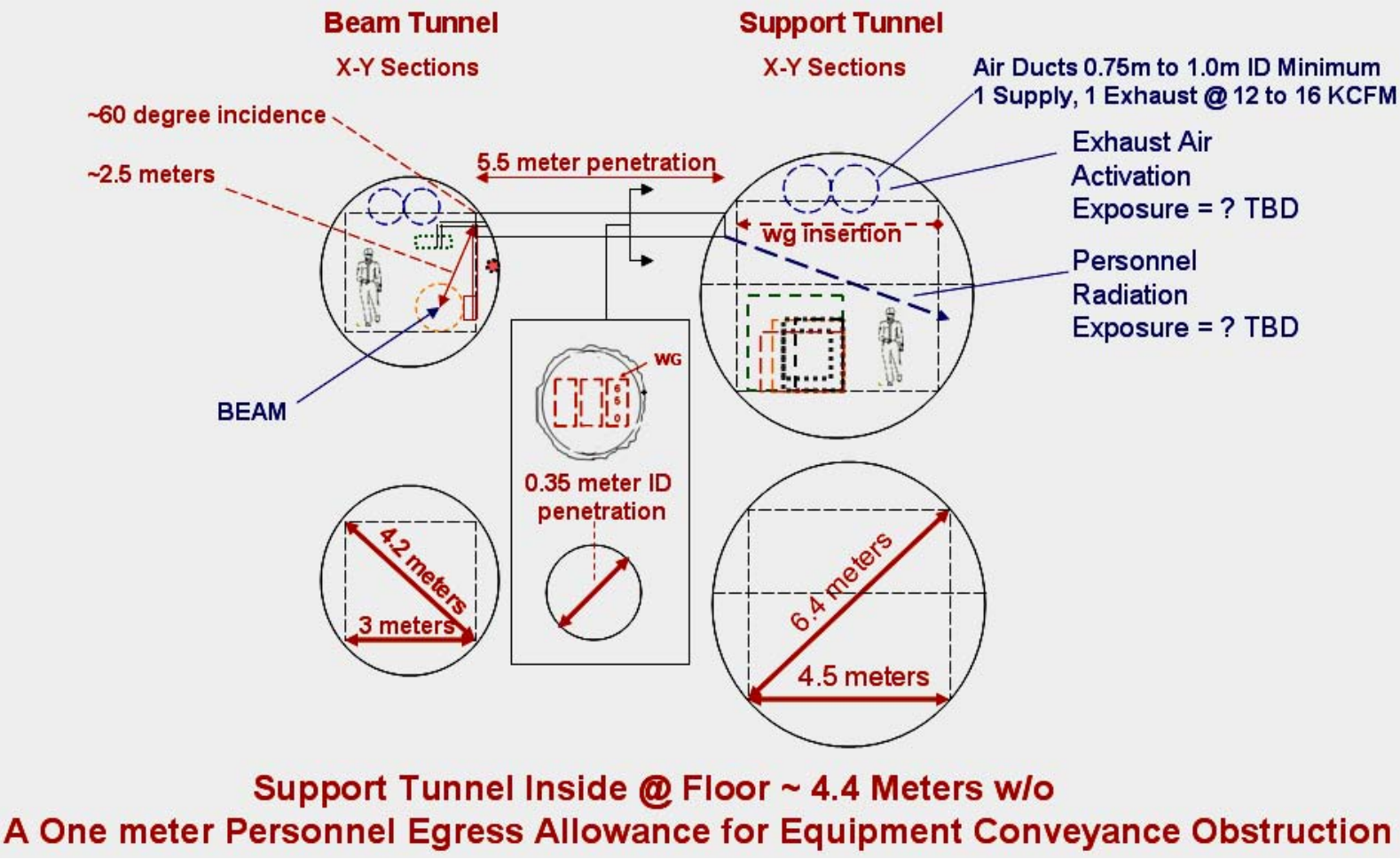
----- Target of costing -----



Bangalore GDE Meeting (3)

----- Target of costing -----

Refined discussion on Tunnel Crosssection.



Bangalore GDE Meeting (4) Example of WBS by DCB

14	Main Linac	1	each	11	36	@ A
141	Electron Linac 15 GeV to 150 GeV	1	each	11	0	
1411	CryoModule (1.3 GHz) - PHG	552	each	11	0	
14111	Module	1	each	0	0	@ C
14112	SC Cavity Fabrication	8	each	0	0	
141121	Material	1	each	0	0	
1411211	Niobium RRR300	1	each	0	0	
1411212	Niobium RRR30	1	each	0	0	
1411213	Niobium Titanium	1	each	0	0	
1411214	Cryoperm	0	each	0	0	
141122	Resonator Production	1	each	0	0	
1411221	SC Resonator Machining	1	each	0	0	
1411222	SC Resonator Electron Beam Welding	1	each	0	0	
1411223	SC Resonator Assembly	1	each	0	0	
141123	Tuner	1	each	0	0	
1411231	Tuner Mechanics	0	each	0	0	
1411232	Tuner Electronics	0	each	0	0	
1411233	Piezo Tuner	0	each	0	0	
141124	Helium Vessel	1	each	0	0	
1411241	Titanium Vessel	0	each	0	0	
14113	SC Cavity Assembly	8	each	0	0	
141131	SC Cavity Assembly	0	each	0	0	
14114	SC Cavity	8	each	0	0	
14115	Cryostat	1	each	0	0	
141151	Material	1	each	0	0	
1411511	Black (Fenromagnetic) Steel	0	each	0	0	
141152	Vacuum Vessel	0	each	0	0	
14116	Cryostat	1	each	0	0	
14117	Power Coupler	8	each	0	0	
14118	HOM Coupler	1	each	0	0	
1412	SC Quadrupole, Corrector, Instrumentation Pkg. - PHG	138	each	0	0	
14121	SC Quadrupole	1	each	0	0	
14122	Correction Magnet	1	each	0	0	

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Accelerator Laboratory, KEK

Bangalore GDE Meeting (5)
First Draft Proposal of RF WBS

1.5.1.1 RF System - Main Linacs

- 1.5.1.1.1 Klystron
  - 1.5.1.1.1.1 Solenoid
  - 1.5.1.1.1.2 Socket, wiring
  - 1.5.1.1.1.3 Vacuum pumps, instrumentaion
  - 1.5.1.1.1.4 Power supplies Solenoid, Filament
  - 1.5.1.1.1.5 RF Pre-driver
  - 1.5.1.1.1.6 Local Diagnostics-Controls-Protection
- 1.5.1.1.2 Modulator
  - 1.5.1.1.2.1 Pulser Forming Unit
  - 1.5.1.1.2.2 Charging Supply
  - 1.5.1.1.2.3 HV Cable Plant
  - 1.5.1.1.2.4 Pulse Transformer
  - 1.5.1.1.2.5 Local Diagnostics-Controls-Protection
- 1.5.1.1.3 RF Distribution
  - 1.5.1.1.3.1 Waveguide distribution
  - 1.5.1.1.3.2 Cavity Coupler Matching tuners
  - 1.5.1.1.3.3 Hybrids and Loads
  - 1.5.1.1.2.4 Motor drivers
  - 1.5.1.1.2.5 Gas & Vacuum Systems
  - 1.5.1.1.2.6 Local Diagnostics-Controls-Protection
- 1.5.1.1.4 Integrated Controls-Diagnostics- Interlocks-Protection-PPS
  - 1.5.1.1.4.1 Klystron
  - 1.5.1.1.4.2 Modulator
  - 1.5.1.1.4.3 RF Distribution
  - 1.5.1.1.4.4 LLRF, Feedback & Tuning
- 1.5.1.1.5 Infrastructure
  - 1.5.1.1.5.1 Instrument Racks & Cabling
  - 1.5.1.1.5.2 Cable Trays
  - 1.5.1.1.5.3 Electrical Distribution - Primary, secondary
  - 1.5.1.1.5.4 Cooling water system
- 1.5.1.1.6 RF Integrated Safety Systems

1.5.1.2 RF Systems - Sources

1.5.1.2.1 Electron Sources

- 1.5.1.2.1.1 10MW RF Stations Warm Structures(Rollup)
- 1.5.1.2.1.2 10 MW RF Stations - 5 GeV Linac (Rollup)
- 1.5.1.2.1.3 Bunch Compressor RF Systems
  - 1.5.1.2.1.2.1 Solid State Amplifier System
  - 1.5.1.2.1.2.2 LLRF System
  - 1.5.1.2.1.2.3 Infrastructure
- 1.5.1.2.1.4 RF Integrated Safety Systems

1.5.1.2.2 Positron Source

- 1.5.1.2.2.1 10MW RF Stations Warm Structures(Rollup)
- 1.5.1.2.2.2 10 MW RF Stations - 5 GeV Linac (Rollup)
- 1.5.1.2.2.3 Bunch Compressor RF Systems
  - 1.5.1.2.2.2.1 Solid State Amplifier System
  - 1.5.1.2.2.2.2 LLRF System
  - 1.5.1.2.2.2.3 Infrastructure
- 1.5.1.2.2.3 RF Integrated Safety Systems

1.5.1.3 RF Systems - Damping Rings

1.5.1.3.1 Electron Damping Rings

- 1.5.1.3.1.1 CW RF Stations
  - 1.5.1.3.1.1 Klystrons
  - 1.5.1.3.1.1 Waveguide
  - 1.5.1.3.1.1 Cavities
  - 1.5.1.3.1.1 Tuners
  - 1.5.1.3.1.1 LLRF
  - 1.5.1.3.1.1 Infrastructure
  - 1.5.1.3.1.1 RF Integrated Safety Systems

1.5.1.3.2 Positron Damping Rings

- 1.5.1.3.2.1 CW RF Stations
  - 1.5.1.3.2.1 Klystrons
  - 1.5.1.3.2.1 Waveguide
  - 1.5.1.3.2.1 Cavities
  - 1.5.1.3.2.1 Tuners
  - 1.5.1.3.2.1 LLRF
  - 1.5.1.3.2.1 Infrastructure
  - 1.5.1.3.2.1 RF Integrated Safety Systems

1.5.1.4 Ring to Main Linac (RTML)

1.5.1.4.1 Electron RTML Systems

- 1.5.1.4.1.1 10MW RF Stations
- 1.5.1.4.1.2 High Performance LLRF
- 1.5.1.4.1.3 Infrastructure
- 1.5.1.4.1.4 RF Integrated Safety Systems

1.5.1.4.2 Positron RTMLSystems

- 1.5.1.4.2.1 10MW RF Stations
- 1.5.1.4.2.2 High Performance LLRF
- 1.5.1.4.2.3 Infrastructure
- 1.5.1.4.2.4 RF Integrated Safety Systems

HLRF WBS Organization - RSL030806

Bangalore GDE Meeting (6) Costing Process

- Yokoya' summary said:
  - Estimate `Value' rather than `Cost'
  - 500GeV. Essential components for 1TeV can be included.
  - Aim at 20% accuracy

Bangalore GDE Meeting (7)
Definition of the `Value'

Selection from 23 rules

2. Cost estimate on the basis of a world wide call for tender
8. No contingency is calculated. The risk will be analyzed and assessed separately.
10. Fixed raw material prices, i.e. for copper, steel and niobium, and fixed prices for power are used.
12. The external labor is included in the value.
13. Internal (institute) labor will be estimated in person hours.
15. Site dependent cost due to real reasons is taken into account, i.e. different geology and landscape, availability of electrical power and cooling water different cycling rate of electrical power etc.
16. Site depending cost due to formal reasons are not taken into account. An International treaty above national laws will equalize the differences of the different regions.
19. One common design including the footprint is used, unavoidable differences due to physical reasons are allowed.
22. Additional regional options are allowed, i.e. use of existing machines or substantial cost savings.

Check the following URI for the latest guidelines:
http://www.linearcollider.org/wiki/doku.php?id=dcb:rdr_notes_procedures_and_documents

Bangalore GDE Meeting (8)

Construction/Installation Schedule

Need to specify roughly for cost estimation,

This is NOT the proposed ILC construction schedule.

- 7 years – after funding authorization => t0
  through installation of all components
- need to start installation of components
- while civil construction continues:
- t0+30 months: e- SRC, e+ Keep-Alive, RTML arcs
- t0+33 months: DR t0+47 months.: start ML
- t0+65 months: last sec ML & BDS
- t0+78 mo.: t0+6.5 yrs.: last components delivered
- t0+84 mo.: t0+7 yrs.: last component installed

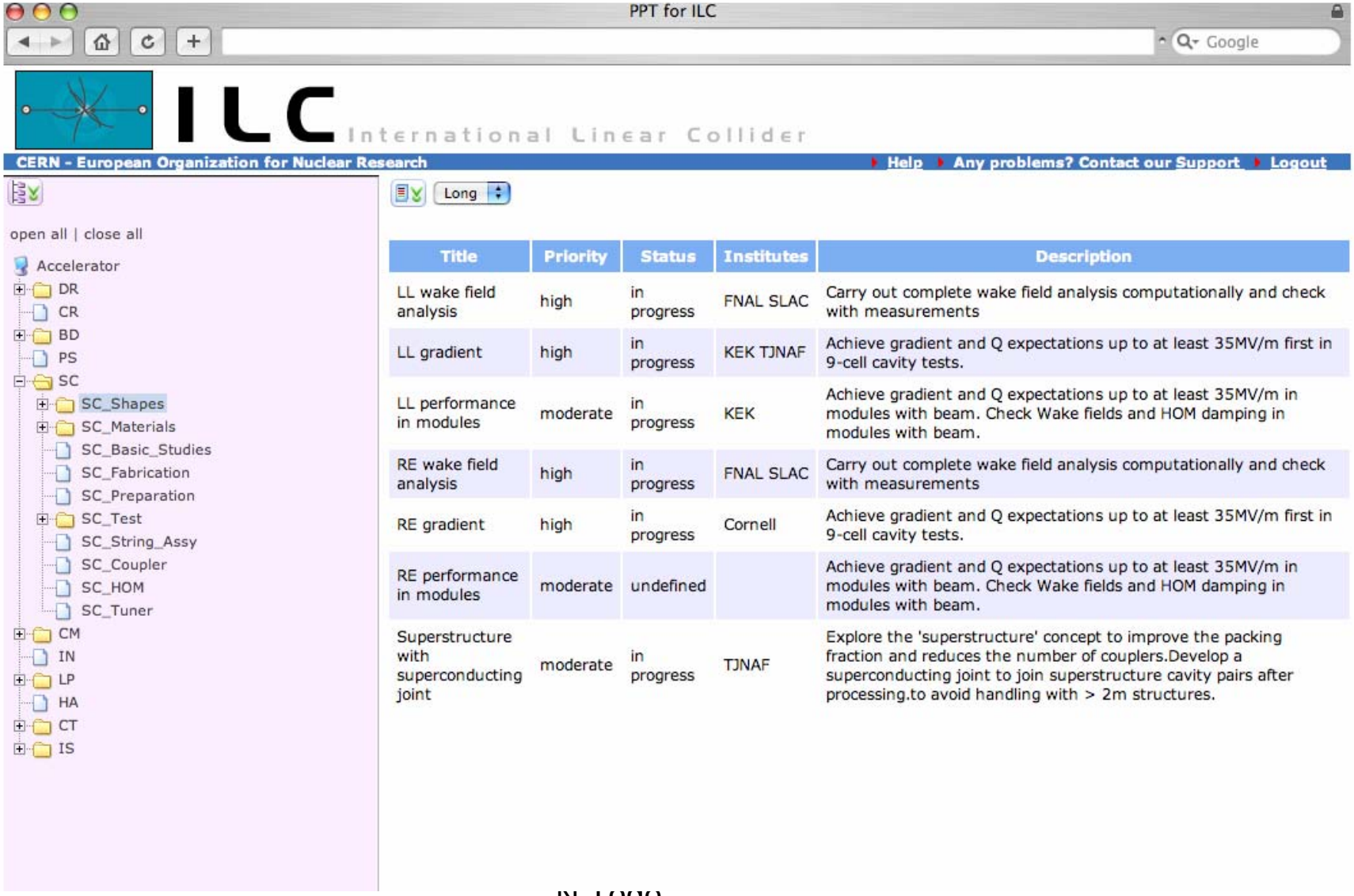
- Start Commissioning each sub-systems as soon as its components are installed

Bangalore GDE Meeting (9)
R&D Board

- R&D is not the main focus of this meeting but will be an essential issue in the near future
- RDB
  - Has created a list of required R&D items
  - Is going to collect information on R&D status and plans from over the world
- `Ideal R&D Program'
  - Prioritized list of R&D items presented
  - This will be evolved to include schedules and resources.

Bangalore GDE Meeting (10)
Segment of a priority list

The whole collection has several hundred entries.

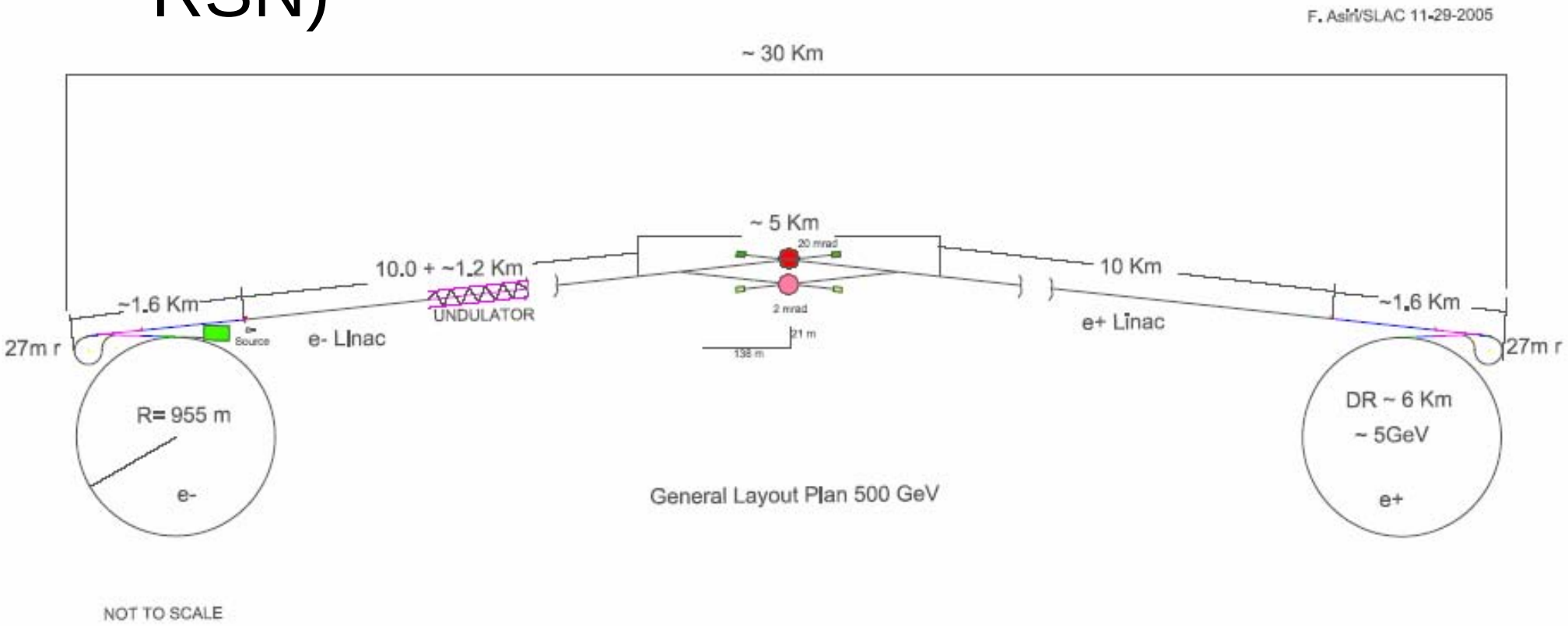


Title	Priority	Status	Institutes	Description
LL wake field analysis	high	in progress	FNAL SLAC	Carry out complete wake field analysis computationally and check with measurements
LL gradient	high	in progress	KEK TJNAF	Achieve gradient and Q expectations up to at least 35MV/m first in 9-cell cavity tests.
LL performance in modules	moderate	in progress	KEK	Achieve gradient and Q expectations up to at least 35MV/m in modules with beam. Check Wake fields and HOM damping in modules with beam.
RE wake field analysis	high	in progress	FNAL SLAC	Carry out complete wake field analysis computationally and check with measurements
RE gradient	high	in progress	Cornell	Achieve gradient and Q expectations up to at least 35MV/m first in 9-cell cavity tests.
RE performance in modules	moderate	undefined		Achieve gradient and Q expectations up to at least 35MV/m in modules with beam. Check Wake fields and HOM damping in modules with beam.
Superstructure with superconducting joint	moderate	in progress	TJNAF	Explore the 'superstructure' concept to improve the packing fraction and reduces the number of couplers.Develop a superconducting joint to join superstructure cavity pairs after processing.to avoid handling with > 2m structures.

Snapshot of DB using CERN's tools

Post-Bangalore Activities (1)
ILC Layout

- Latest update (Change Config Request RSN)



Post-Bangalore Activities (2)
Future Meetings

- May.11-13 DESY (small meeting)
  - Focus on linac
- Jul.19-22 Vancouver (GDE Meeting)
  - Preliminary cost
  - Possibly some draft texts
- Nov.6-10 Valencia (ILCWS+ECFA)
  - Near final form of RDR
  - To be released ~Dec.2006

Post-Bangalore Activities (3)
Plan from Now to Vancouver

- Further organizational refinement
  - J.M.Paterson as “Integration Scientist” for RDR efforts.
- More frequent communication
  - Weekly video (2 hour) meeting coordinated by Go3+DCB rotated through Area and other Systems (in addition to possible group-wise mtg, DCB video, EC tele. etc)

Post-Bangalore Activities (4)

Weekly RDR Video Conf

http://ilcagenda.cern.ch/categoryDisplay.py?categId=58

March 21	Main Linac
March 28	BDS
April 4	DR (during DOE meeting at FNAL)
April 11	Electron and Positron Sources
April 18	Main Linac (prep for DESY)
April 25	RTML
May 2	CF/S
May 9	DESY meeting (May 11 – 13)

Post-Bangalore Activities (5)

Weekly RDR Video Conf (cont)

May 16	RF
May 23	Cryomodules
May 30	Cavities
June 6	Magnet and Vac
June 13	Cryogenics
June 15	Installation, dumps, collim
June 20	CF/S

Conclusions (1)

- A very large amount of progress since Snowmass, through Frascati and Bangalore on
  - Baseline Configuration
  - GDE organization consisting of EC, Boards, AG, GG, TS, “Matrix”
  - Work guidelines (some still as draft)
  - Meeting forums, web information repository, agenda records
  - Activity schedule and goals
- So we are still “on BB’s ILC Timeline”.

BB's ILC Timeline

2005 2006 2007 2008 2009 2010

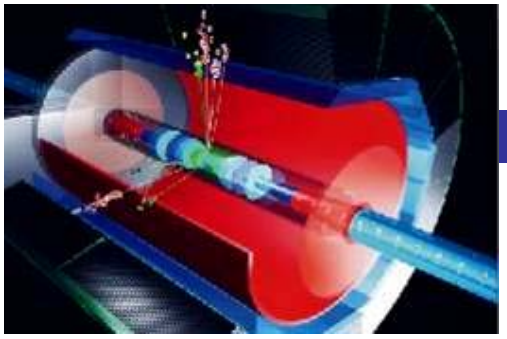
Global Design Effort

Project

Baseline configuration

Reference Design

Technical Design



ILC R&D Program

Expression of Interest to Host

International Mgmt

Conclusions (2)

- Some critical re-evaluations (re-sharpening) would be still worth on
  - "Target end product(s)" of this costing exercise.
  - Guidelines on sharing (or non-sharing) of some sensitive information.
- Future challenges to come
  - Integration of R&D efforts (world-wide collaboration; redirection? of resources depending on BC/AC progress.)

Additional Resources

- GDE: http://www.linearcollider.org
- GDE-related meetings: http://ilcagenda.cern.ch
- ILCSC MAC: http://ilcagenda.cern.ch/conferenceDisplay.py?confId=290
- LCPAC at KEK: http://lcdev.kek.jp/review.php

資料6

平成18年度ILCグループ活動計画

LC計画推進室長　横谷馨

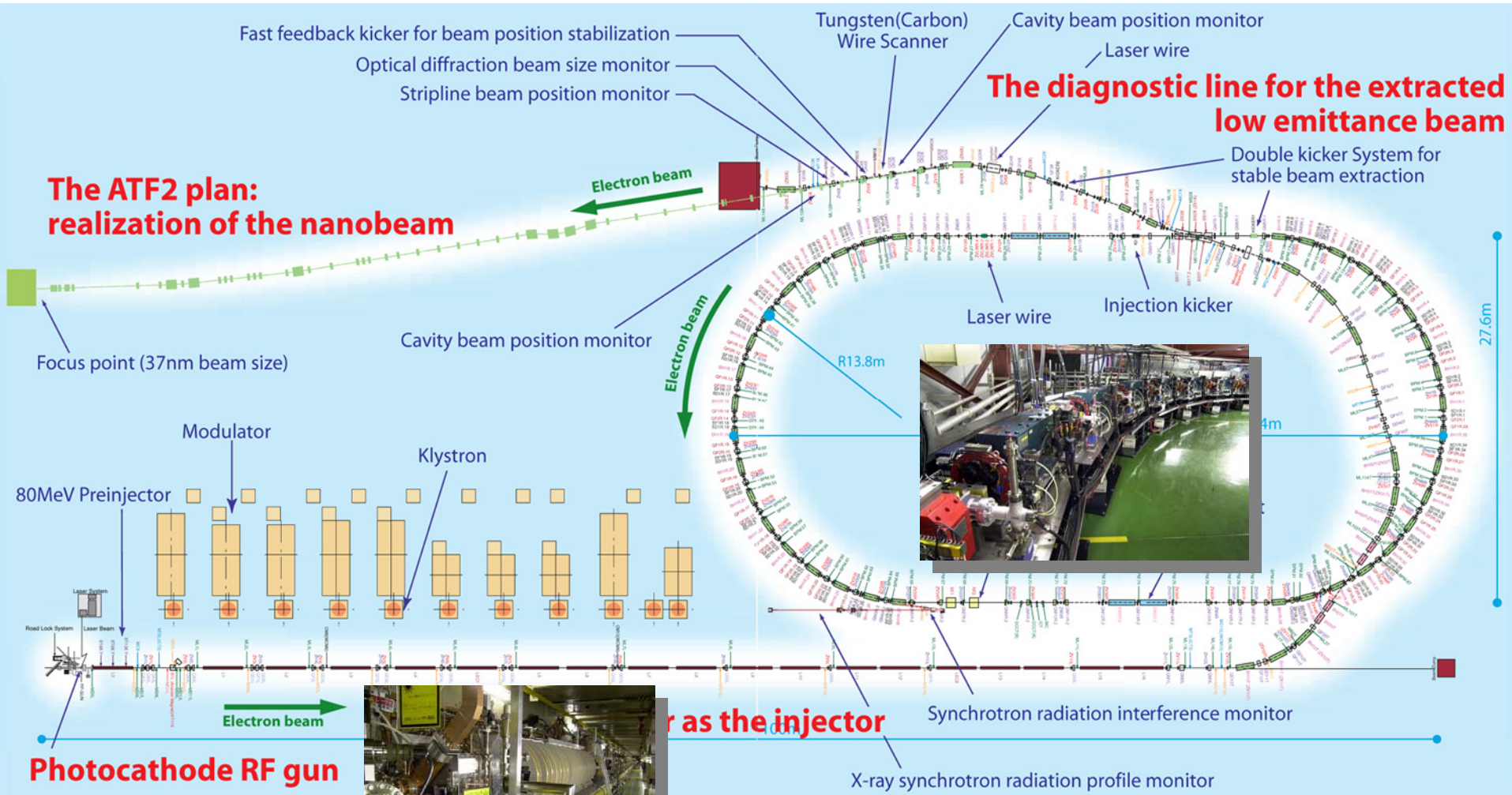
LCグループ組織

- GDE Asian Director　野崎
- LC推進室
  　　室長　横谷、副:峠、野崎、浦川、早野、山下(東大)
- ATF関係　　FTE　(合計 41...含国内)
  - ATF総合管理 （浦川）
  - 運転 （照沼）　8.6
  - ATF Study （栗木）　2.3
  - ATF2 （田内）　4.4
- STF関係
  - Beam & Facility、 総合管理(早野)　2.4
  - Cryogenics （細山）　0.7
  - RF Power Source （福田）　3.7
  - Baseline Cavity （野口）　3.0
  - High Gradient Cavity （斎藤）　8.2
  - Cavity Processing Facility （上野）　0.9
- その他
  - Conventional Facility & Site （榎本）　1.1
  - Cost Estimation （設楽）　0.6
  - その他雑務　3.0

R&D Program

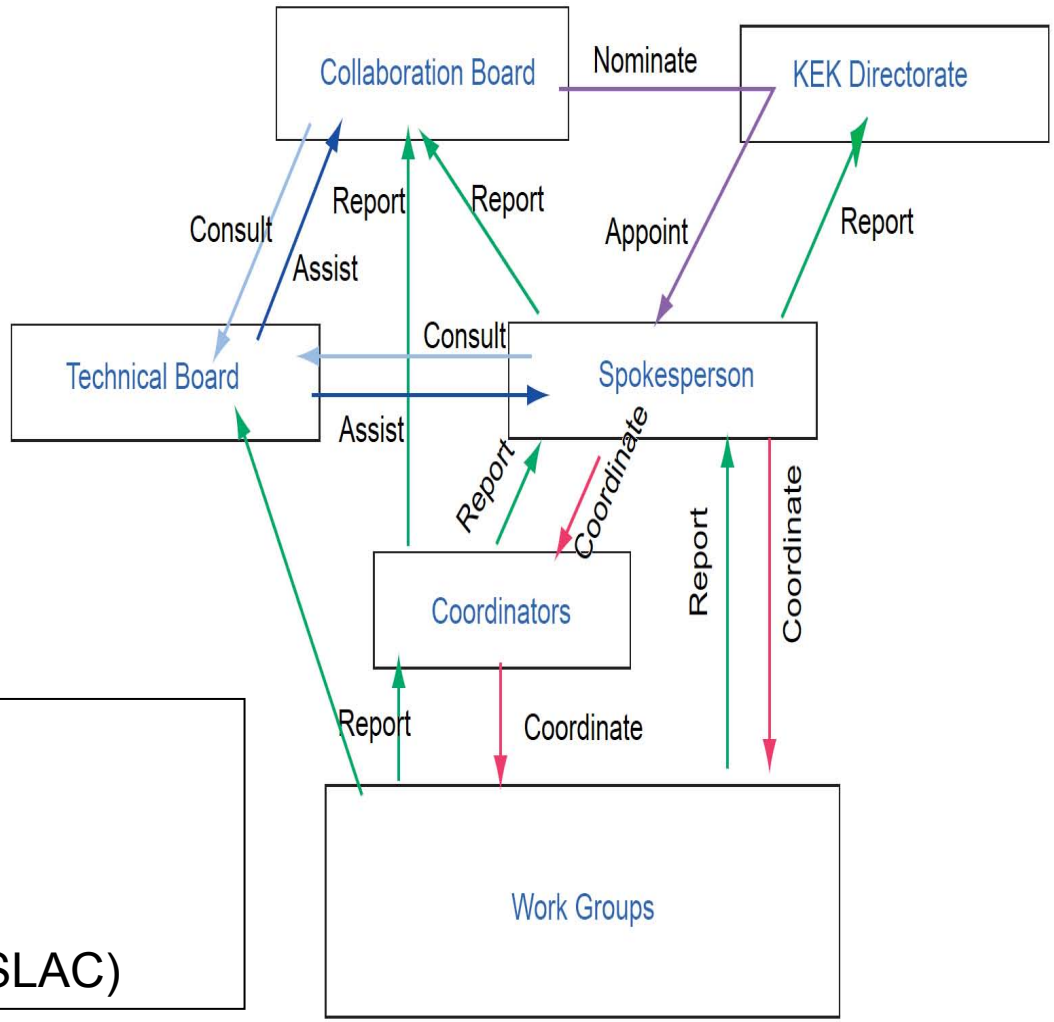
- 加速技術
  - High-gradient Cavities
  - Linac System → STF
  - Infrastructure
- ビーム技術
  - ATF
  - ATF2
- その他
  - Conventional facility study
  - Site study

ATF
Accelerator Test Facility



ATF Collaboration

- 1993年建設開始
- 世界最小emittance達成
- GLC→ILCに伴う国際化
- ATF MoUを締結
  約20研究所の署名
- 毎年5月・12月に TB (Technical Board) 会合により実験開発項目を選択



CB (Collaboration Board) chair:
Ewan Paterson (SLAC)

Spokesperson : 浦川

Deputy: 黒田、照沼、A.Seryi (SLAC)

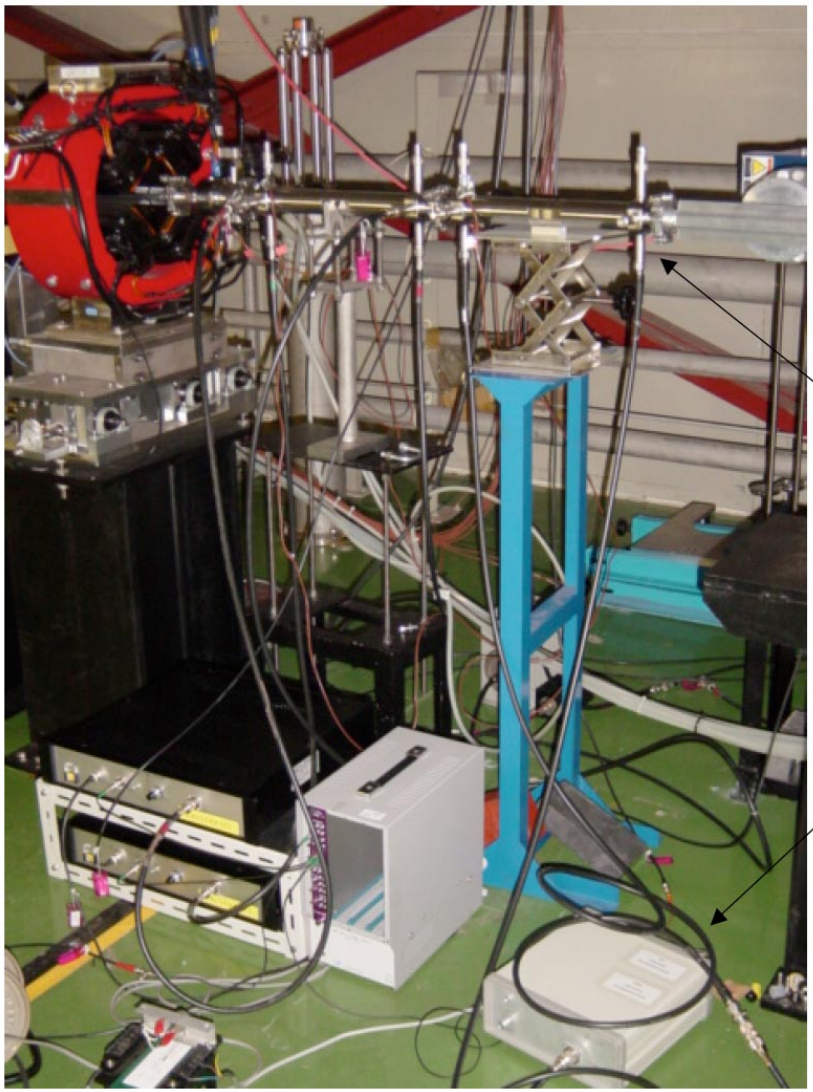
Schedule of ATF operation, TB meeting and Long shutdown

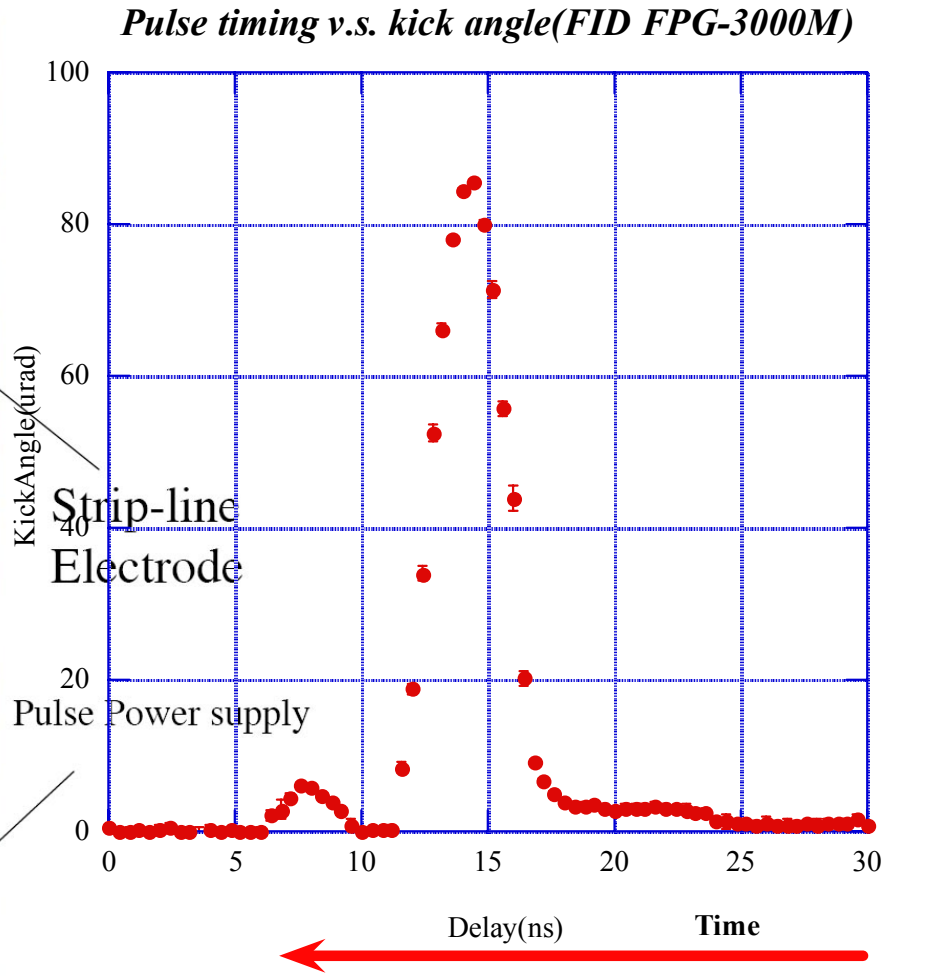
Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun
JFY							NEXT JFY	
ATF		Summer shutdown			22 beam weeks / 32 weeks			Summer
Beam		(KEK power contract)						Shutdown
Schedule								
		Upgrade / Maintenance						
		Installation						
	May				Dec.		May	
	TB meeting				TB meeting		TB meeting	

ATF R&D 項目

- ビーム力学研究 (fast-ion, etc)
- 低エミッタンスのためのbeam tuning
- ILC減衰リング用速いキッカーの開発
- 高解像度 リング BPM
- 空胴 BPM (ATF2, IP-BPM)
- Laser wire
- その他のビーム診断器械 (XSR, ODR, etc)
- S-band RF gun
- CSR (coherent synch. rad.)
- etc.

速いキッカーの開発 (2005)





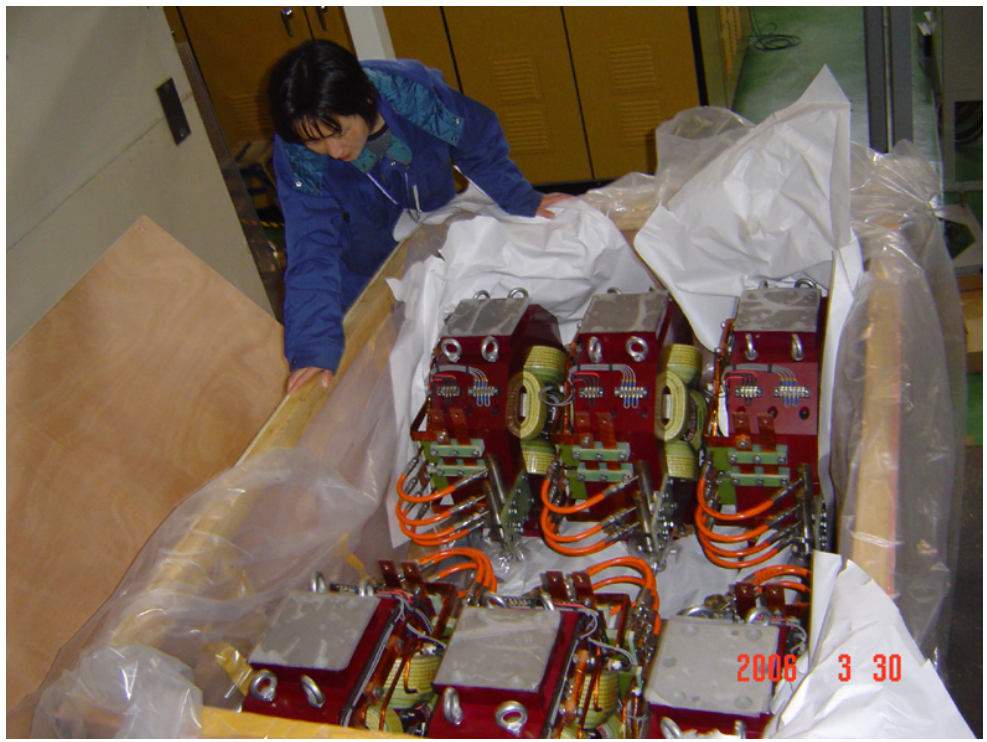
今年度は、リングからの取出しを目標

ATF2

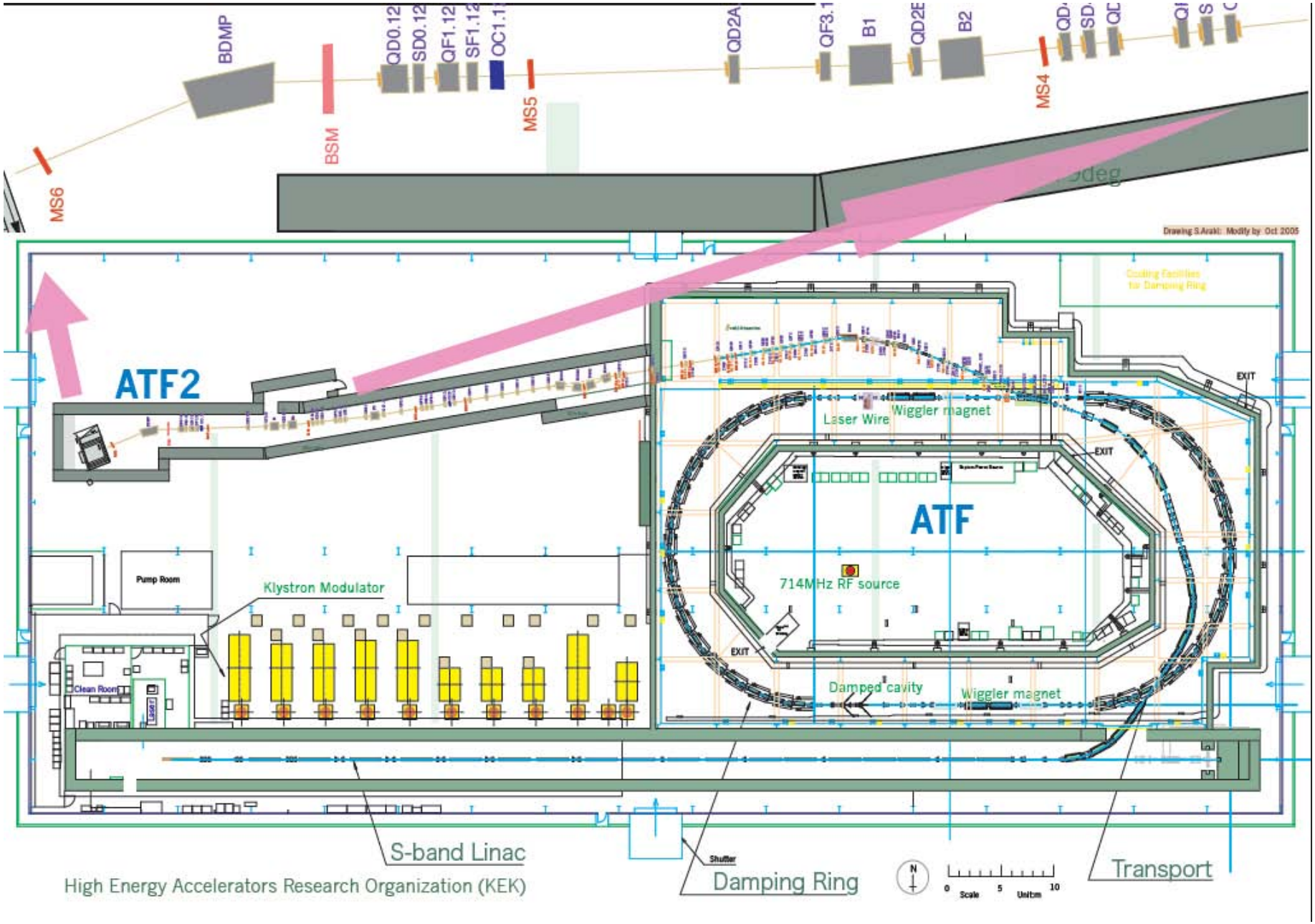
- ATF 取出しライン延長: Final Focus 付加
  - 小さなビームサイズ（～35nm）
    - ATF 取出しビームを ~35nm に絞る
    - 長期間の保持
  - ビーム中心
    - ビーム中心位置の安定か ~2nm
    - ILC型ビームによるBunch-to-bunch feedback systemの開発
- 今年は建設2年目。 運転開始 Jan.2008
- 国際協力による建設
  - Asia: 4極磁石製作, BPM 製作, etc
  - Americas: 設計, BPM 回路, 磁石ムーバー, 電源、etc
  - Europe: フィードバック, laser wire, 最終4極磁石支持, etc

Q-BPM（韓国）

4極磁石（中国）

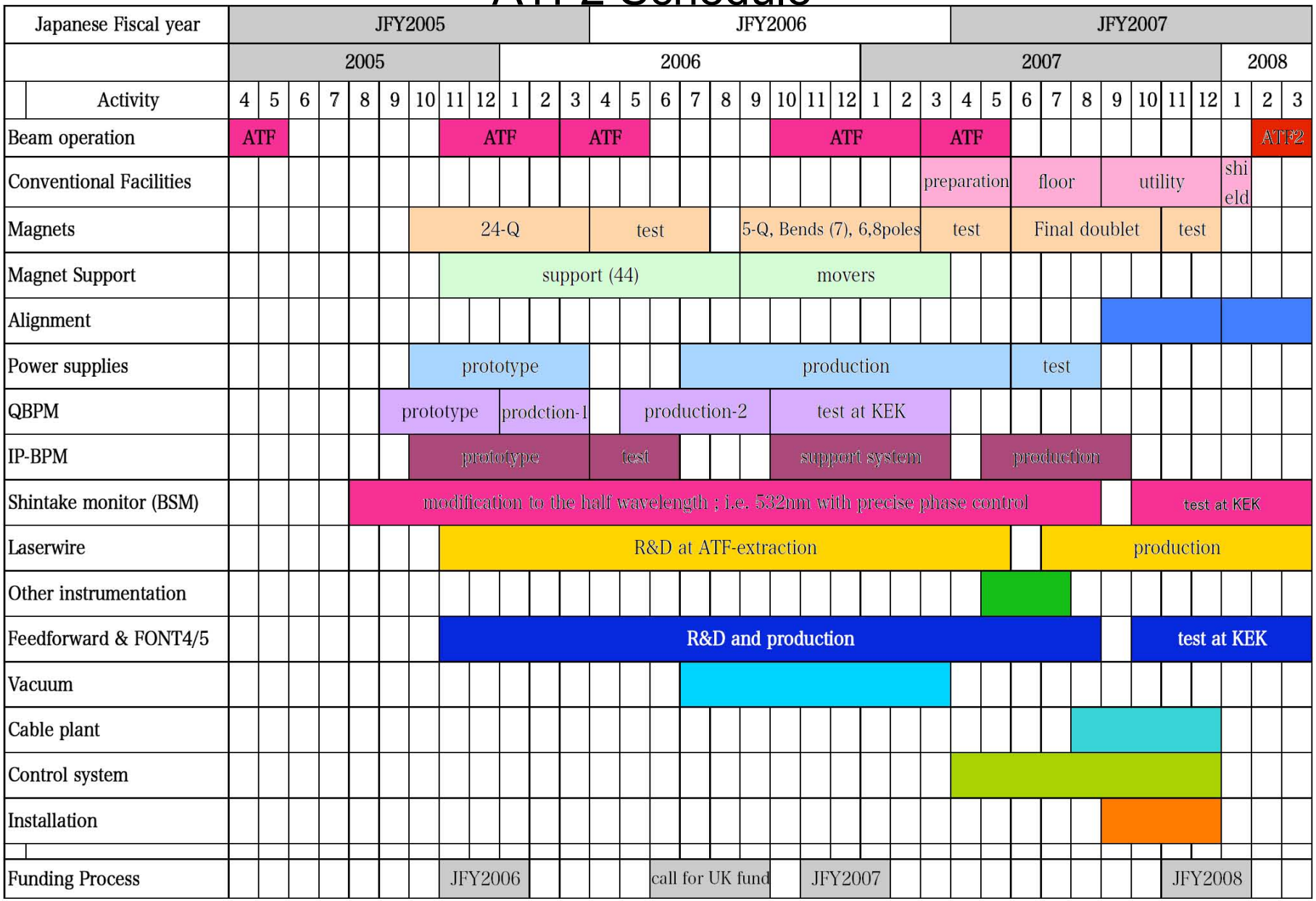


いずれも2005 3月完成


BDMP
BSM
MS6
MS5
MS4
QD0.12
SD0.12
QF1.12
SF1.12
QC1.1
QD2A
QF3.1
B1
QD2E
B2
ATF2
ATF
Laser Wire
Wiggler magnet
EXIT
714MHz RF source
Damped cavity
Wiggler magnet
Pump Room
Klystron Modulator
Clean Room
Laser
Cooling Facilities for Damping Ring
S-band Linac
Damping Ring
Transport
Shutter
High Energy Accelerators Research Organization (KEK)

T.Tauchi

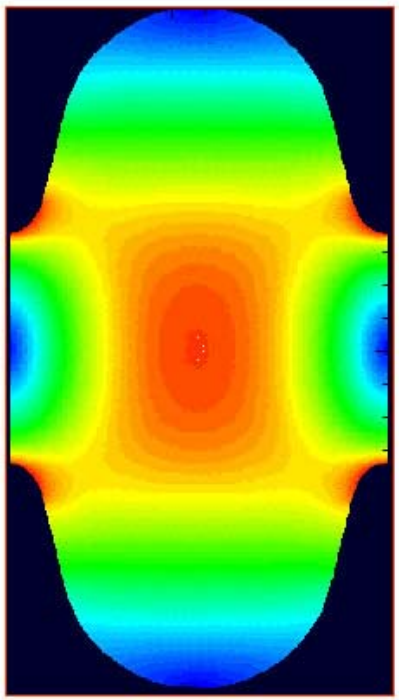
ATF2 Schedule



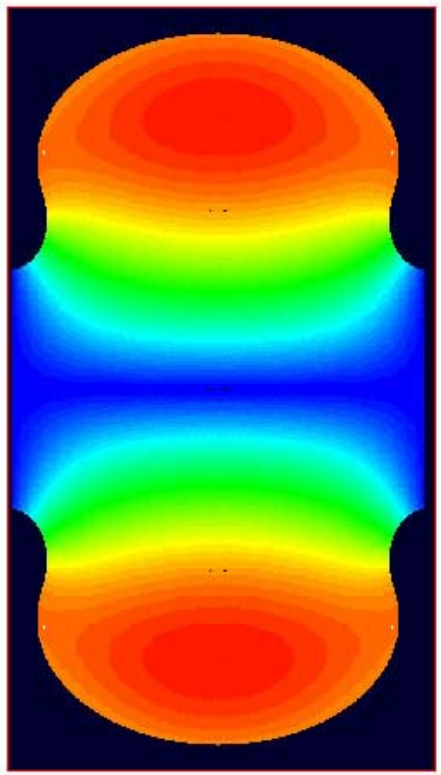
高加速勾配空胴の開発

2つの空胴形状を開発

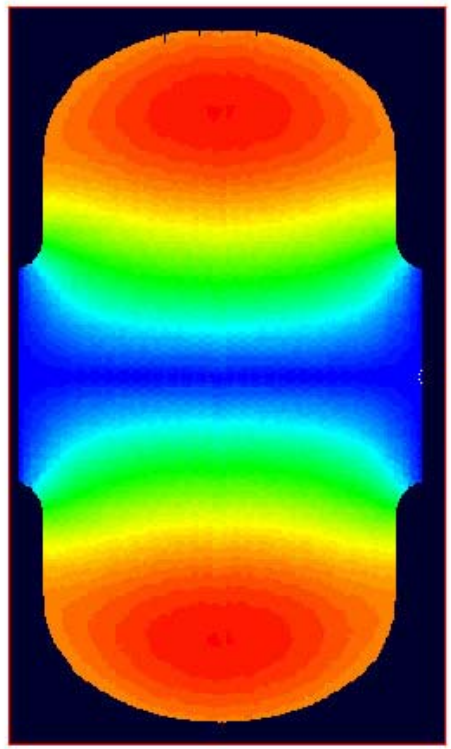
Baseline
TESLA shape



Re-entrant
RE shape

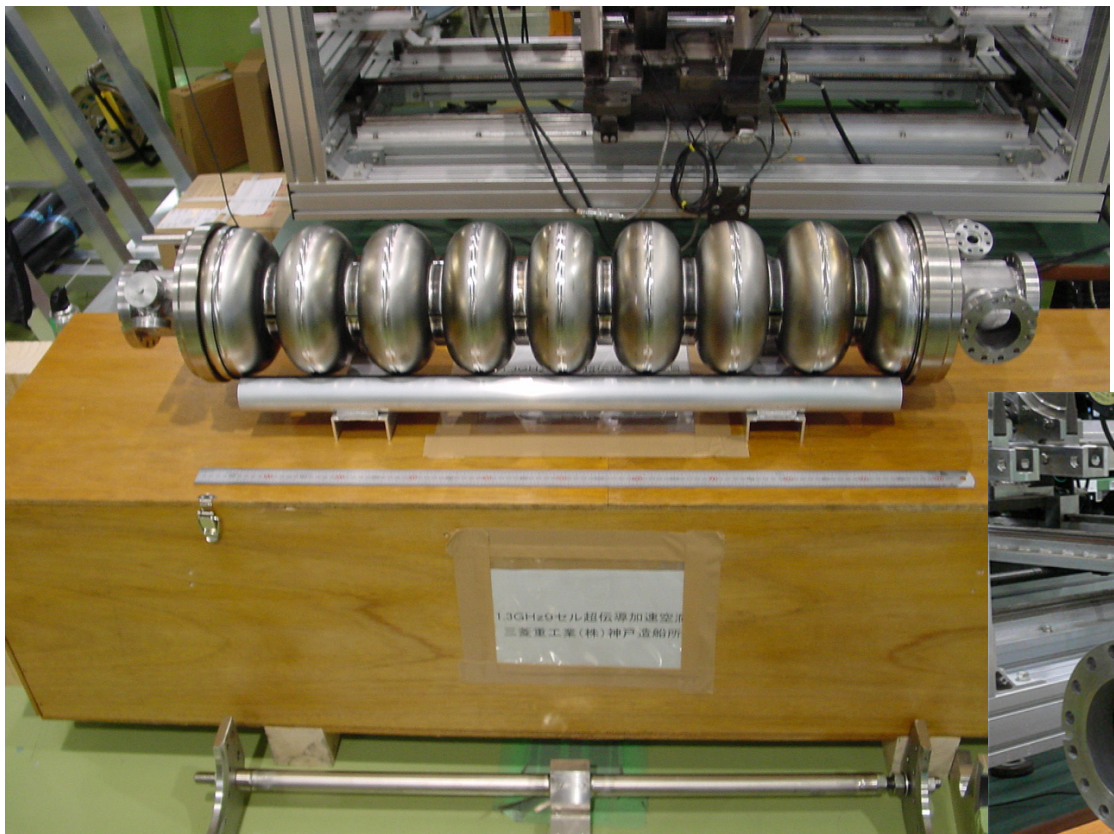


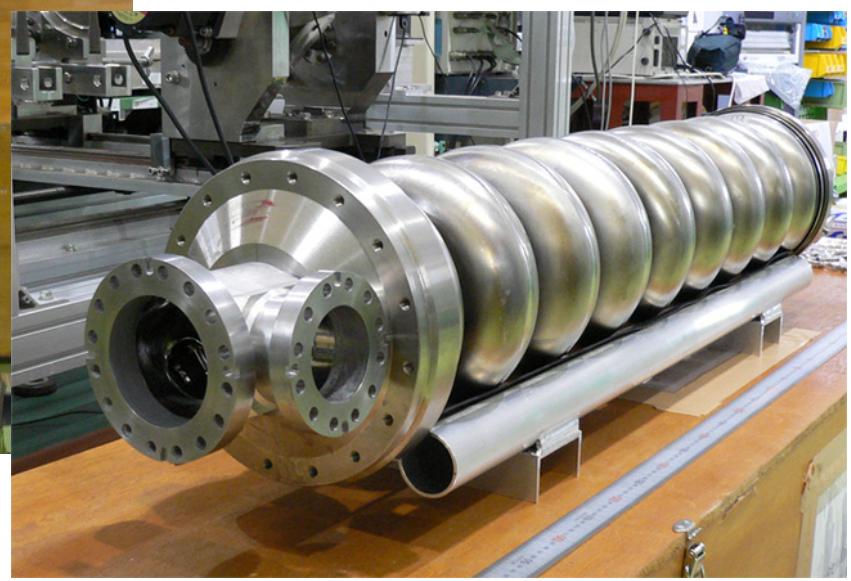
Low Loss Shape
LL



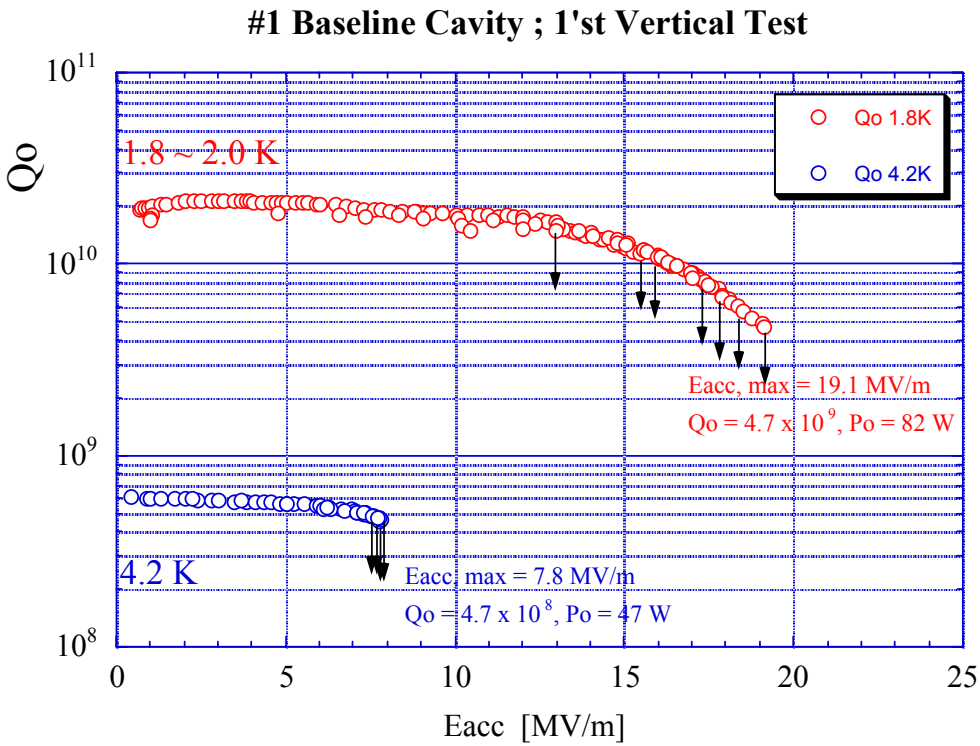
今年の目標： 9セル空胴の実証、クライオモジュールへの組み込み

STF Baseline Cavity

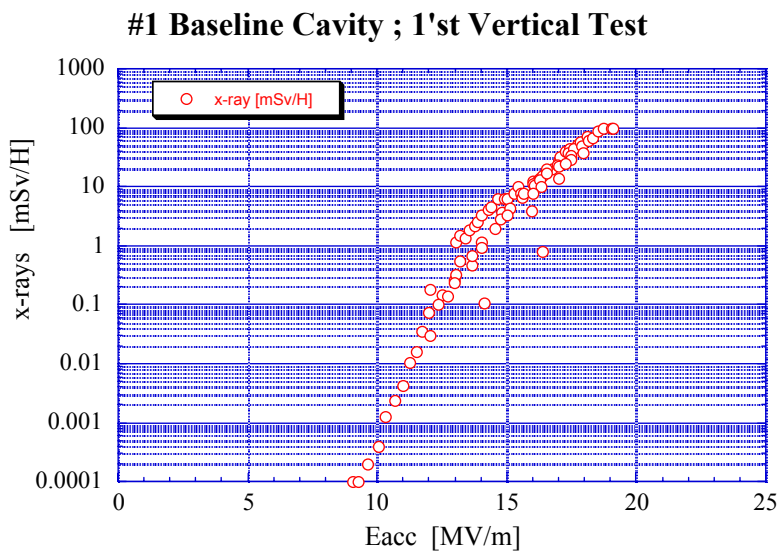




Results of 1st Vertical Test



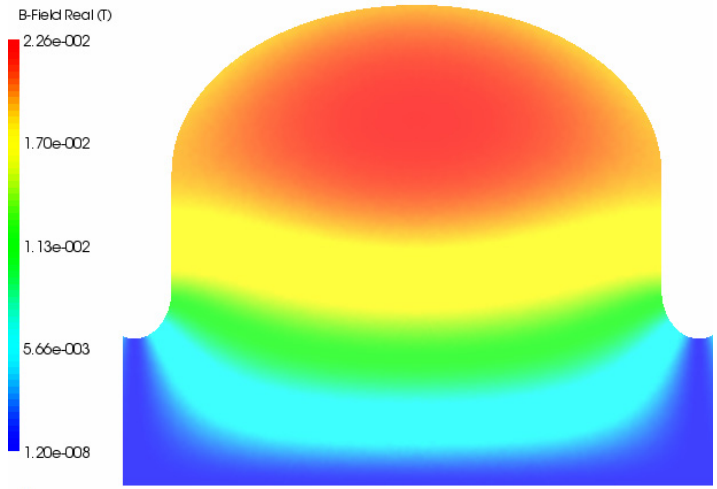
X-rays Radiation Level

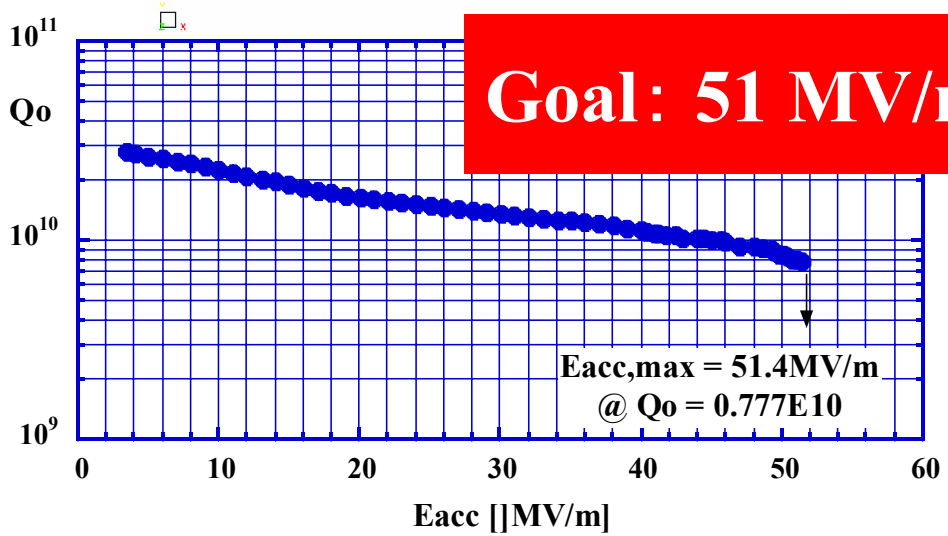


Eacc,max = 19.1 MV/m, Limited by Field Emission

The 2nd vertical test will be carried out after additional surface removal by EP.

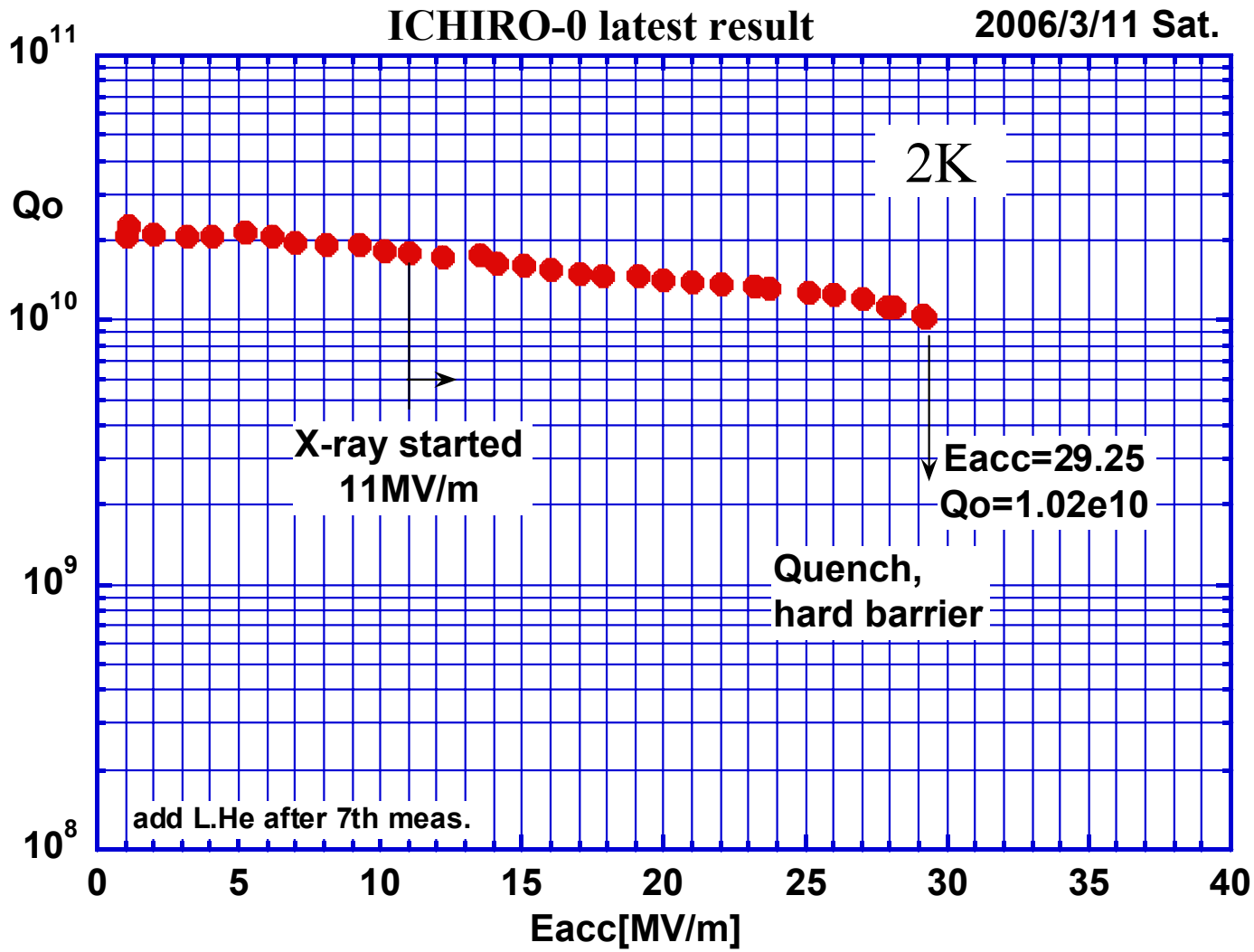
ICHIRO Cavity





Goal: 51 MV/m!

Latest result of the ICHIRO#0



STF Building plane view

Control room

Cryogenic System (from AR-East)

10m x 10m

5m x 15m

Cryogenic Compressor (from AR-East)

Kly Assemble Area

Kly + Mod. (coupler test, RF Gun)

Kly + Mod. (phase1 Cavity)

New 10MW Kly + Mod. (3 cryomodule)

10t crane

Laser room

Klystron Gallery

vertical natch

cryomodule bessel

15t crane

Vertical Test Area

Cold mass assembly

pure water system

Aneal P.S.

Baking

EP

vacuum system

Clean Room for cold mass assembly

7m x 25m Clean room

Cavity Process (EP) & assemble Area (clean rooms)

Cryomodule Assemble Area

Trans

Trans

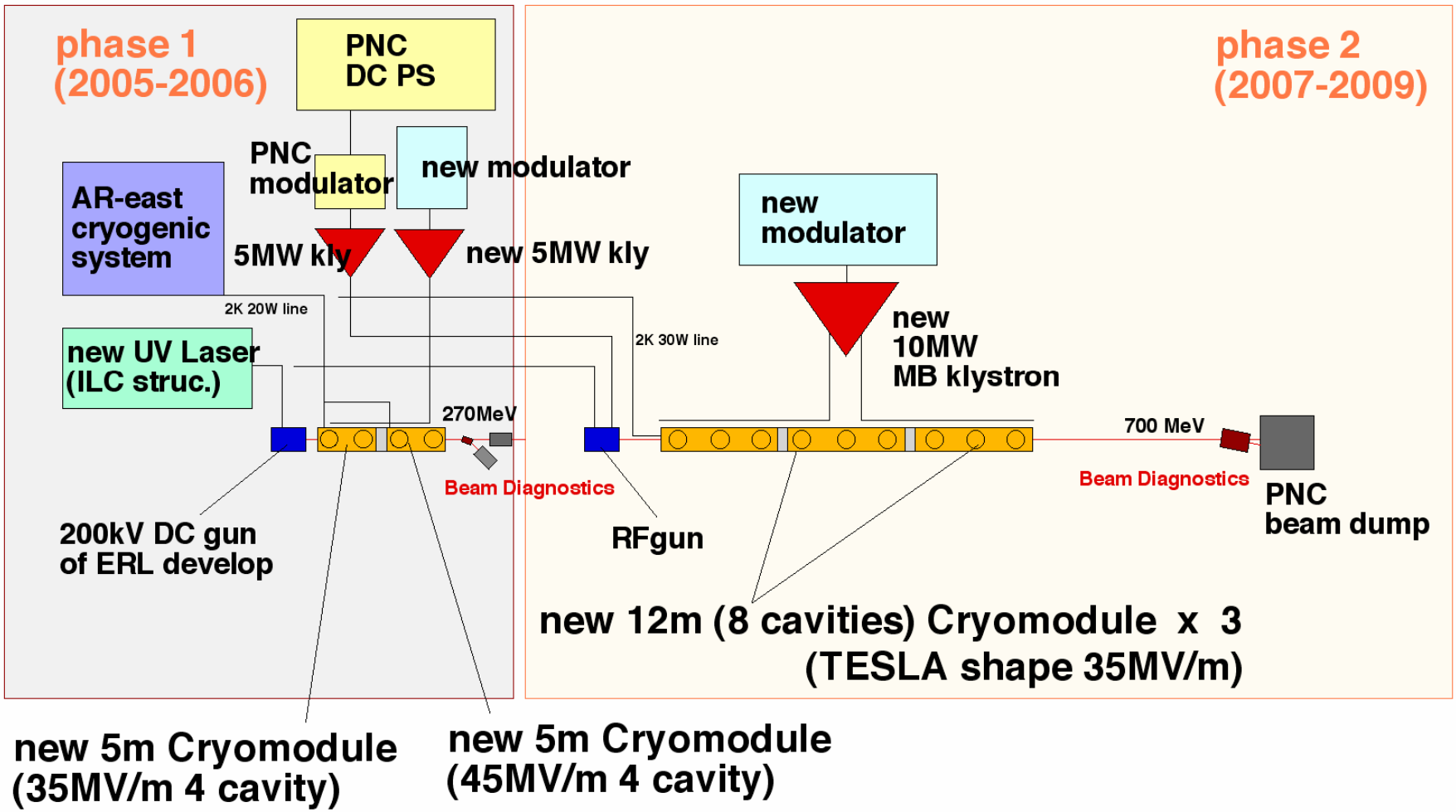
Trans

Filter & Condenser&Crowbar

V6.0 H. Hayano, 12/02/2005

Infra-structure for SC-RF production

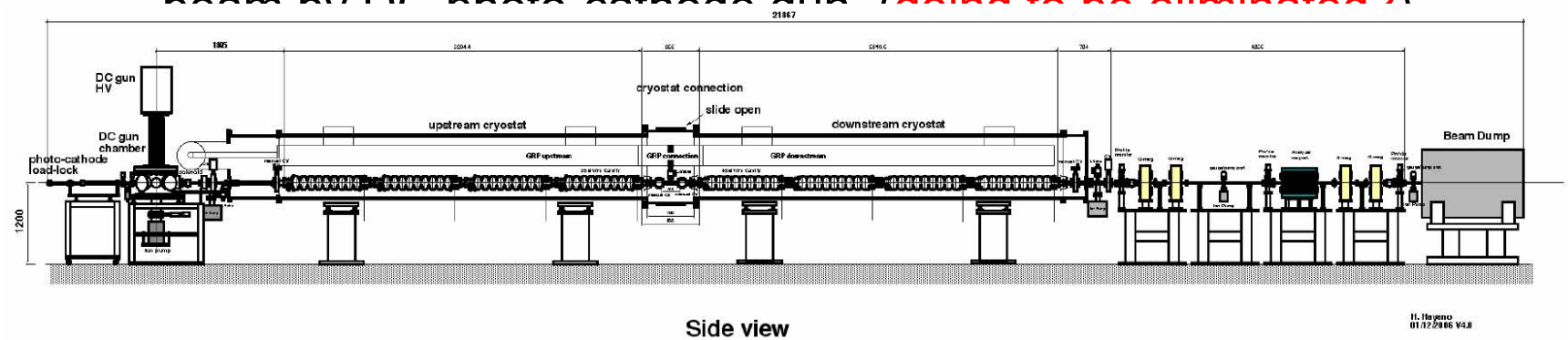
Plan of Superconducting RF Test Facility (STF)



V3.0 Hitoshi Hayano, 12/02/2005

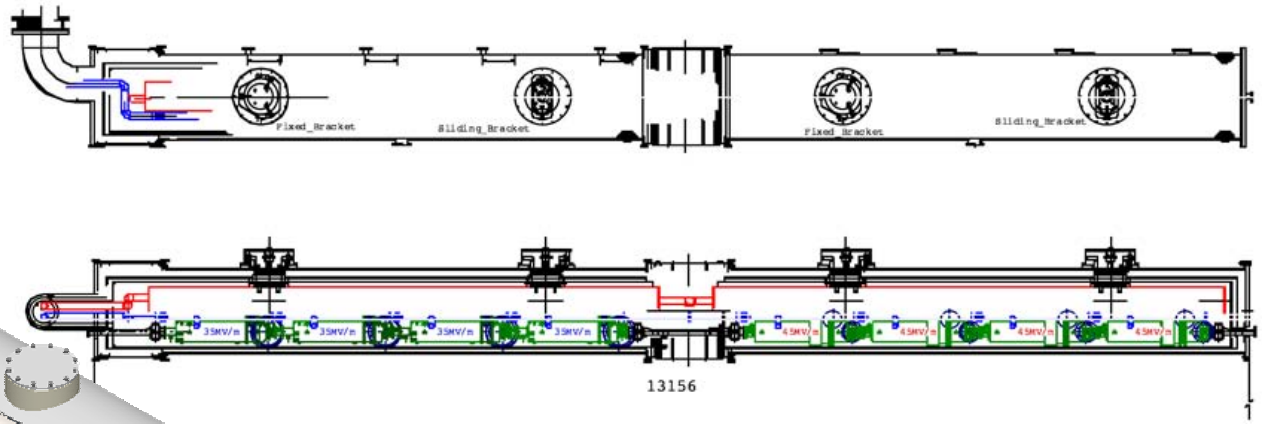
STF Phase 1 (2005-6)

- 2 cryomodules each containing 4 cavities of the type
  - TESLA-type (nominal target 35MV/m)
  - LL (Low Loss) type (nominal target 45MV/m)
- with
  - 5MW klystron
  - second hand modulator
  - beam by DC photo-cathode gun (going to be eliminated?)



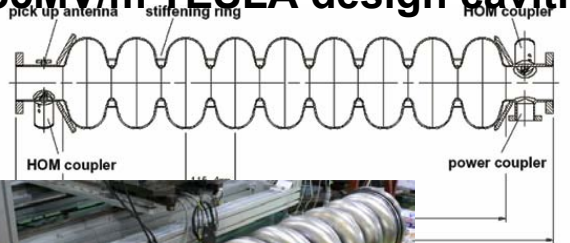
Conceptual design of cryomodule

Valve Box



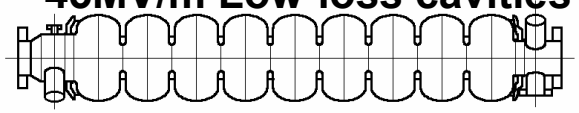
Weld connection

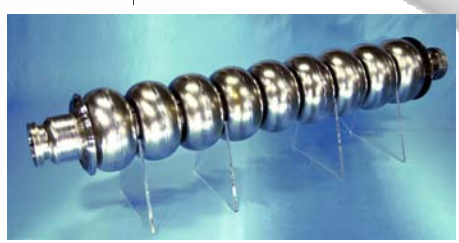
35MV/m TESLA design cavities



STF Phase 1

45MV/m Low-loss cavities

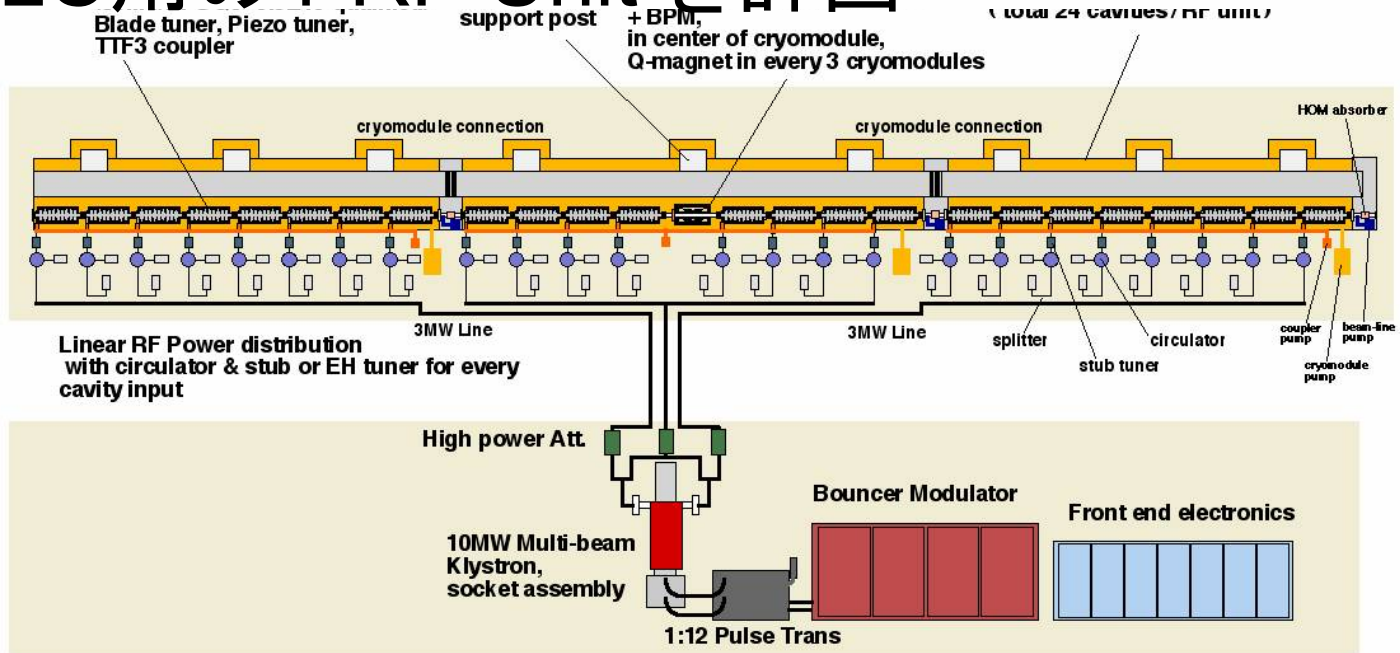




Become to 8 cavities in one cryostat
Like TTF cryomodule

STF Phase 2 (2007-9)

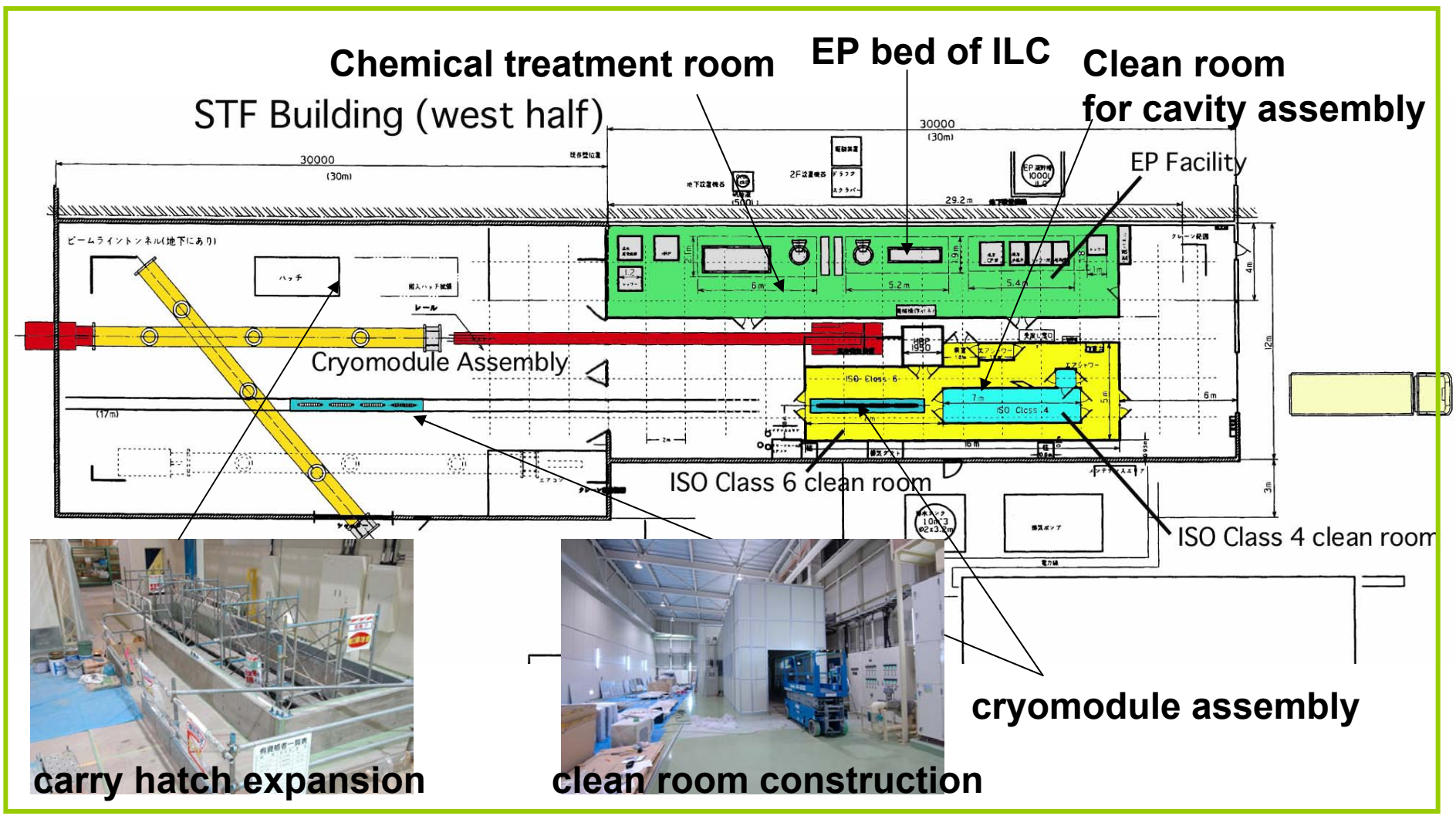
- ILC用の1 RF Unit を計画



- LL空胴採用の可能性もあり（～1年後に判断）
- 2007年度設計 (phase 1 運転中)
- 建設 2008-9年度

STF　Infra-structure

EP: 新 EP(Electro Polishing) 設備 詳細設計中、今年度建設着手
Clean room: 新クリーンルーム完成 （2006．3）



STF phase 1 今年の計画

2006.02 8空胴表面処理・縦測定開始

2006.03 Clean room 完成

2006.03 5MW RF power source 準備完了

2006.04 Coupler 大電力試験開始

2006.07 8空胴縦測定終了

2006.07 Coupler 大電力試験完了

2006.07 Cryostat へのインストール開始

2006.09 Cryomodule 完成

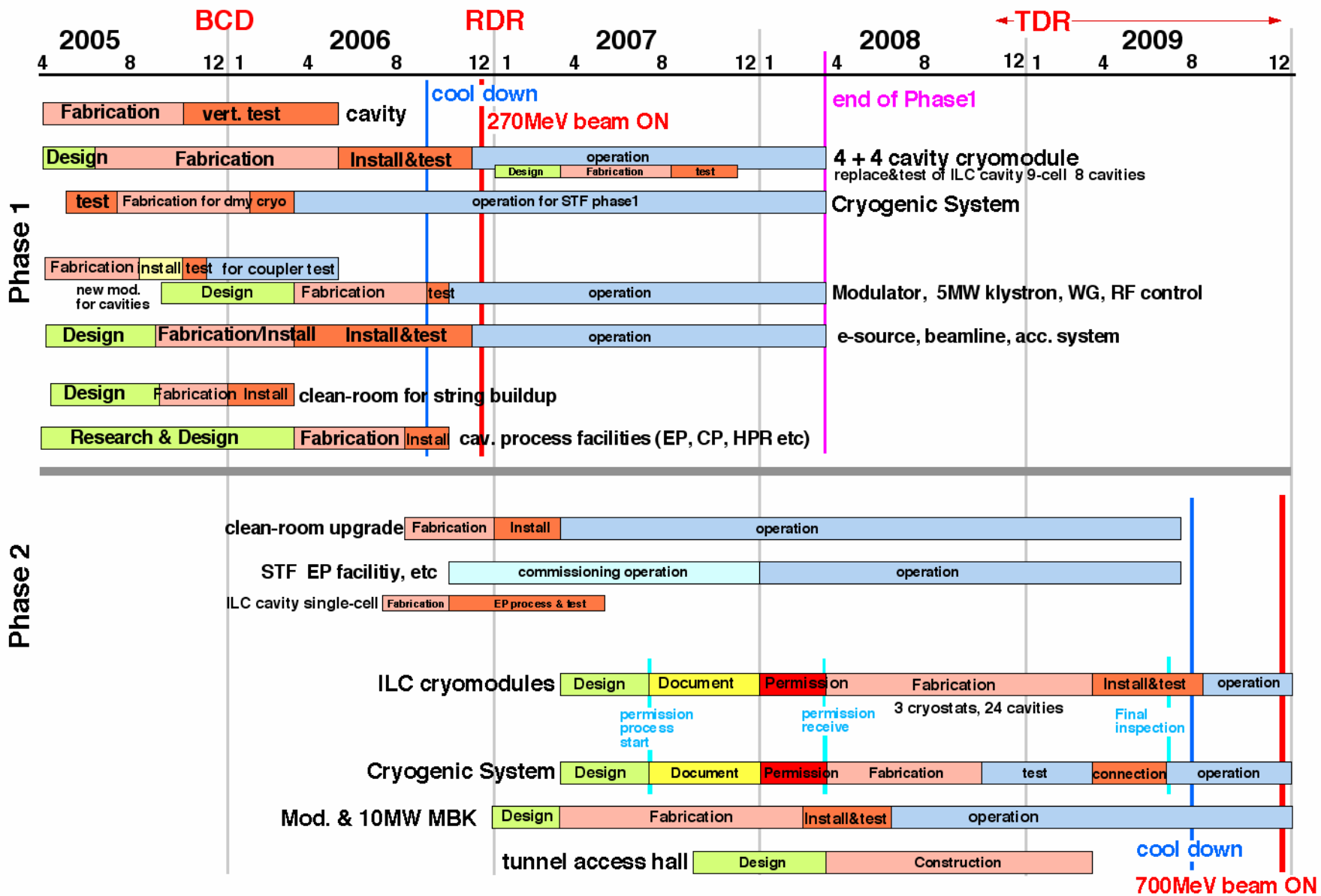
2006.10 Cryomodule トンネルに設置

2006.11 Cryomodule 冷却開始

2006.12 運転開始（ビーム？）

STF long-term Plan

H. Hayano 12022005



*** Phase 2 Schedule was changed(1 year delay).**

予算

- 2005年度約11億円　（含、機構内、日米、科研費、拠点事業など）
- 2006年度ほぼ同額