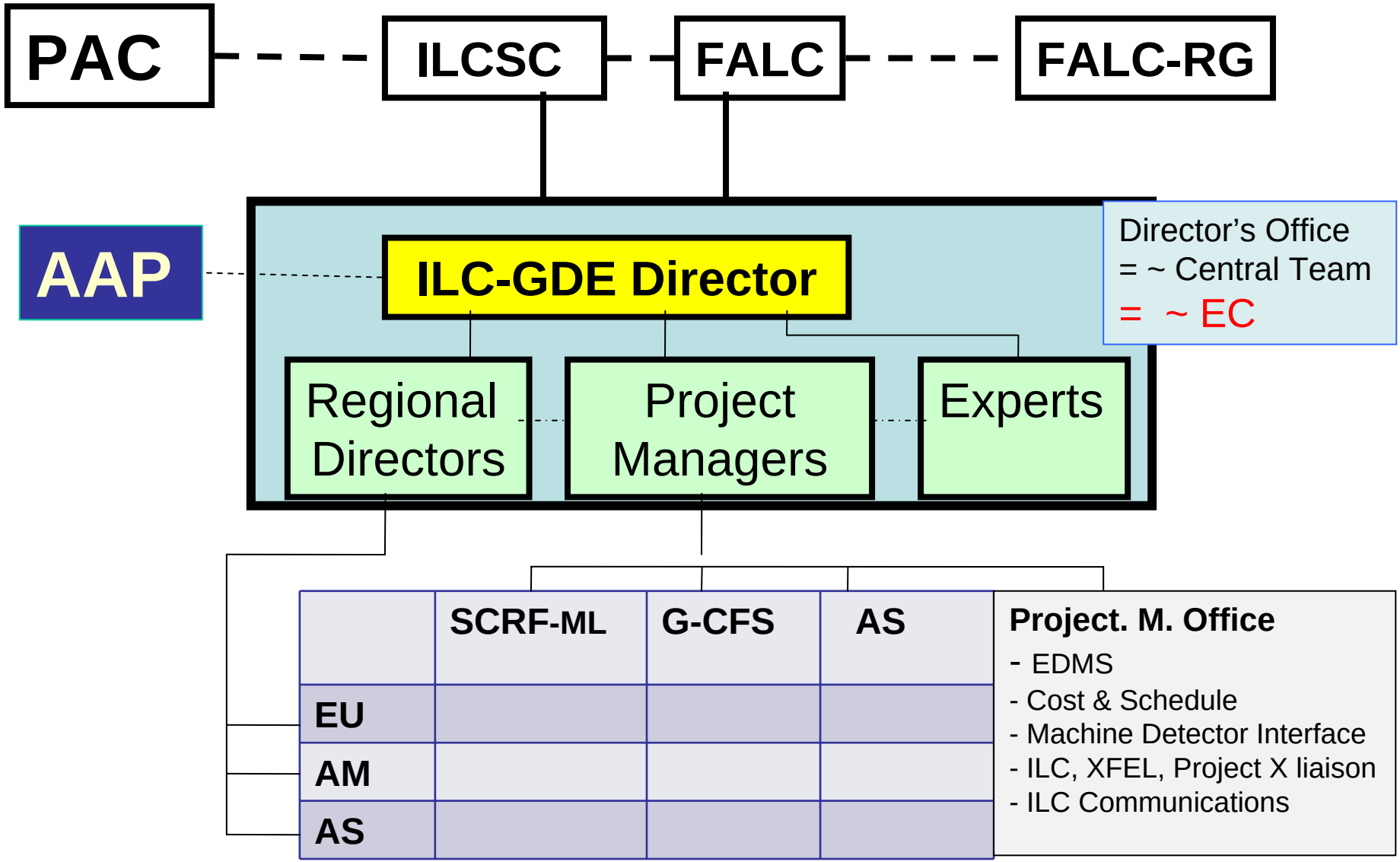
GDE報告

Asian Regional Director

横谷　馨

LC推進委員会 2010.7/13

ILC組織


PAC
ILCSC
FALC
FALC-RG
AAP
ILC-GDE Director
Director's Office
= ~ Central Team
= ~ EC
Regional Directors
Project Managers
Experts
SCRF-ML
G-CFS
AS
EU
AM
AS
Project. M. Office
- EDMS
- Cost & Schedule
- Machine Detector Interface
- ILC, XFEL, Project X liaison
- ILC Communications

現在のGDE組織

Executive Committee
Barish, 3PMs,
Harrison, Foster,横谷,
Paterson, Garbincius,
Delahaye, 田内

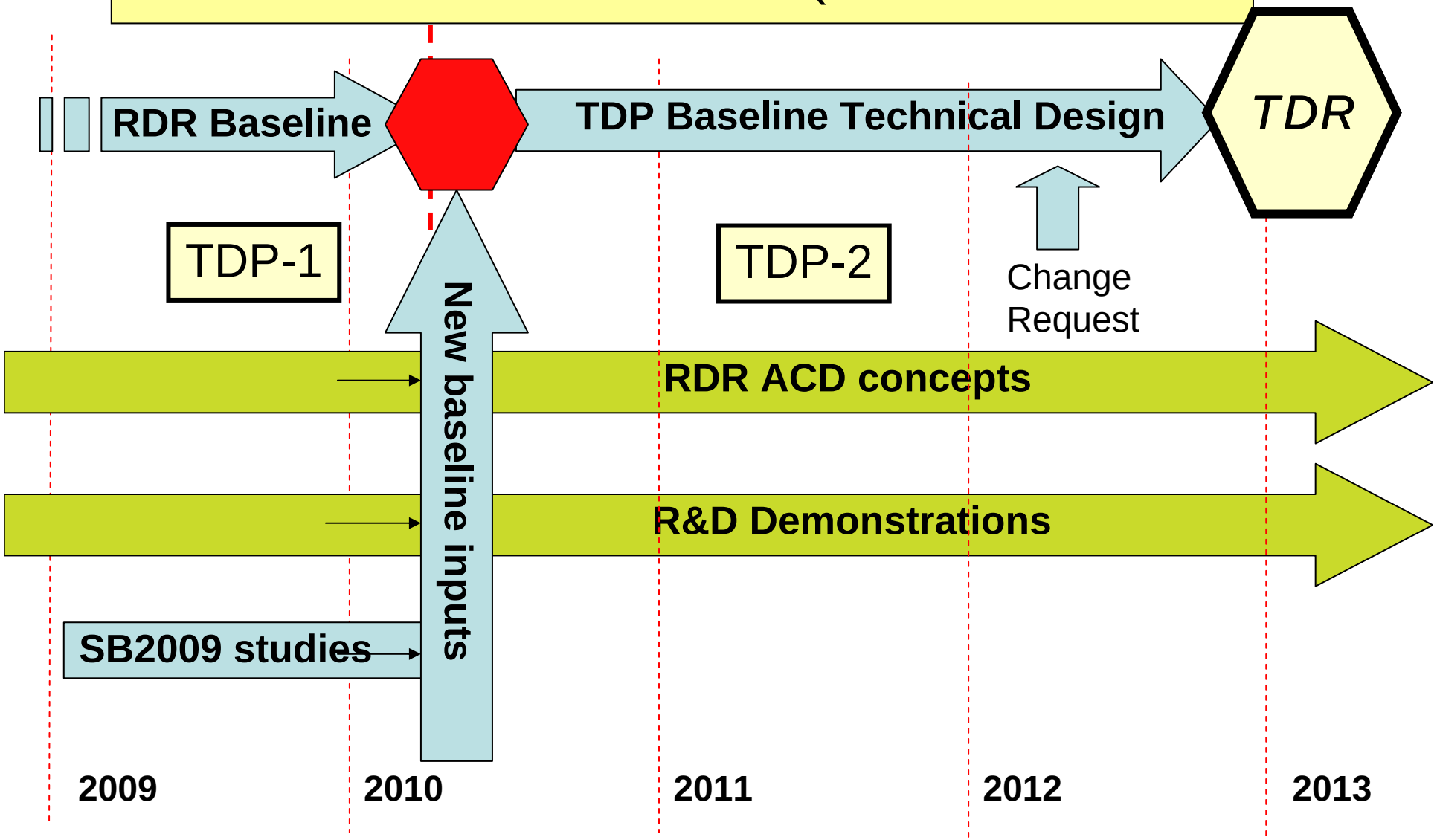
Director's Office
- Director (B. Barish)
- **Project Managers**
  (Ross, Walker, 山本)

主リナック技術
(山本, 設楽, Kerby)
-空洞処理 (Geng)
-空洞総合 (早野)
-Cryomodule(大内)
-冷凍システム (Peterson)
-高周波(福田)
-主リナック総合 (Adolphsen)

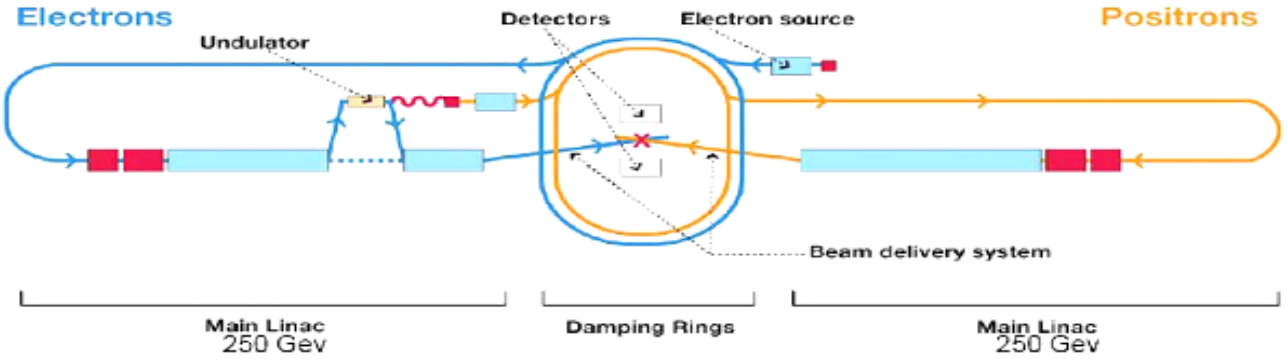
Global Systems
(**Ross**, Carwardine,)
-土木 (Kuchler, 榎本,)
-制御
-建物

加速器システム
(**Walker**, 浦川)
- 電子源 (Brachmann)
- 陽電子源 (Clarke)
- 減衰リング (Guiducci)
- RTML (Solyak)
- BDS (Seryi)
- シミュレーション (久保)

ILC/GDE Timeline (3月以前の計画)



TDRへ向けての設計改良



- Re-baseline
  - コストの最適化
  - コストとリスクのバランス
- Cost Containment
  - Big projectにかんしてコストは重要な問題
  - RDRに提示したコストを上回るべきでない
  - 将来にありうるコスト増加に備えるべき
    - クライオモジュールの価格
    - 空洞の加速勾配

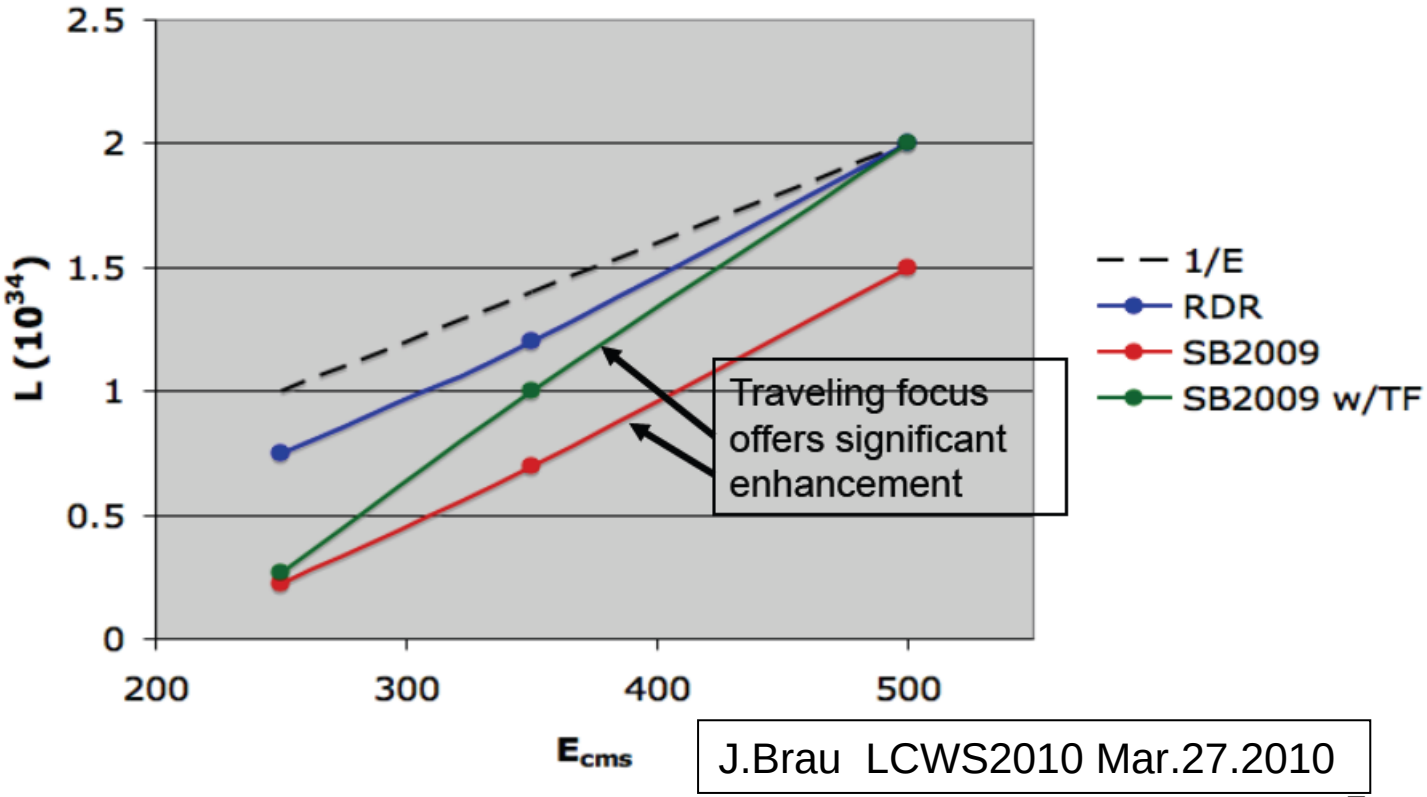
SB2009（昨年末までにまとめた変更案）

- 単一トンネル（新RF systemが必要）
  - KCS (Klystron Cluster System)
  - DRFS (Distributed RF System)
- バンチ数半減（2600→1300) パルス長不変
- 減衰リング周長半分（6km→3km）
- 単段bunch compressor
- 陽電子
  - Undulatorをリナック末尾に置く
  - 補足系としてQWTを採用
- Tighter focusing (traveling focusを含む）
- 施設中央部分の再配置

コスト削減概算値　~13%

Luminosity with SB2009

- バンチ数半減 → luminosity半減
- 高エネルギー領域では `Travelling Focus' で回復できるが、低エネルギー領域ではgeometric emittanceが大きいため十分に回復できない。
- 低エネルギーでは、undulatorの位置のために生成される陽電子数が減り、luminosityがさらに下がる



J.Brau LCWS2010 Mar.27.2010

Review by AAP (Accelerator Advisory Panel)

- 1/6-8にOxfordでAAPのreviewあり
- 主な意見は
  - SB2009の各項目は個々に検討すべき
  - R&Dの必要な項目が多くあり、すぐにbaselineを変更するのは妥当でない
    - KCS, DRFS（これらは採用条件を明確に）
    - Traveling focus
    - Electron cloud
  - Parameter documentと整合していない（luminosity不足）
  - コスト最適化には運転経費も含めよ
  - 設計変更プロセス（Change Control）は厳格にせよ

Low Energy Luminosityの回復

- 3月の北京でのLCWS以来、低エネルギーでのluminosityを回復する可能性を検討中
- 繰返し(5Hz)を上げる可能性
  - 低エネルギーでは総電力に余裕がある
  - Damping Ringはwigglerの強化により繰返しを10Hzに出来そう
  - 低出力ではklystronの効率が下がるので10Hzは無理かもしれない。250GeV(CM)では8Hz程度か？
  - 陽電子数が少ない領域ではAlternating Pulse Modeが使える
- Tight focus
  - 低エネルギーではgeometric emittanceが大きいためfinal quadでのbackgroundが問題
  - 低エネルギーではfinal quadの設計を変えられる可能性がある
  - 高・低どのエネルギーでも使えるfinal quadも検討中

Review by PAC (Project Advisory Committee)

- 5/14-15 ValenciaにおいてPAC Review
- 主な内容
  - Cost Containmentをサポートする
  - バンチ数半減は支持するが、将来の倍増の可能性を残すべし
  - Damping Ringに関してはe-cloud studyの結果を見極めよ
  - Physics/Detector groupとのcommunicationに問題あり

TLCC Process

Top-Level Change Control

keywords: open, transparent

Re-baselineに向けて

- TDRの予定を考慮すれば、新baseline は2011年初めまでに決めるべし
- Four major issues
  - A) 加速勾配
  - B) 単一トンネル (with new RF distribution)
  - C) バンチ数
  - D) Undulator system
- BAW (Baseline Assessment Workshop)
  - BAW1 Sep7/10.2010 @KEK A&B
  - BWA2 Jan17-20???.2011 @SLAC C&D

BAW Team

- 構成
  - PM (chair)
  - ADI team / TAG leaders
  - Agenda organised by relevant TAG leaders
  - Physics & Detector Representatives
    - Jim Brau (SiD, US representative of the WWS)
    - Mark Thomson (ILD software, PFA expert)
    - Tom Markiewicz (SiD, IR)
    - Karsten Buesser (ILD, MID)
    - Keisuke Fujii (ILD, physics)
  - External experts
- 会合（上記のメンバーに限らない）
  - KEK/SLACでの会合に向けてwebex meeting
  - 6/23に第1回（10Hz）
  - 7/23に第2回

Collaboration with CLIC

- Collaboration of the two linear colliders groups, ILC and CLIC, is desirable with respect to synergies and saving resources
- Collaboration is going on in several fields
  - General Issues
  - CFS (Conventional Facility & Siting)
  - Positron Source
  - Damping Ring
  - BDS (Beam Delivery System)
  - Cost Estimation
  - Detectors

Governance

- Discussion launched among the management levels of ICFA, ILCSC, and GDE.
- What sort of organization needed for ILC Lab
  - Models (CERN, ITER, XFEL,…..)
  - Budget model
    - In-kind contribution
    - Common fund
- Site selection procedure

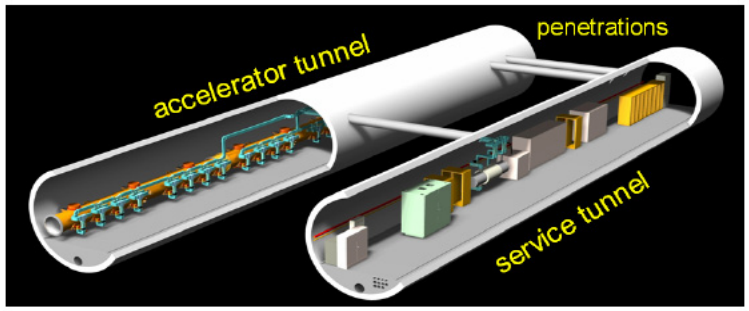
Beyond TDR

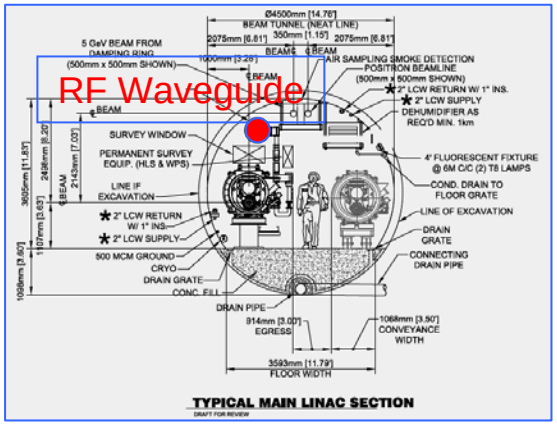
- Technical issues
  - Possible remaining R&D issues
    - RF distribution, positron
  - System tests (most important: S2)
  - Industrialization
    - Cost reduction
    - Mass-production
  - Engineering design
- Project implementation plan
  - Governance
  - Siting

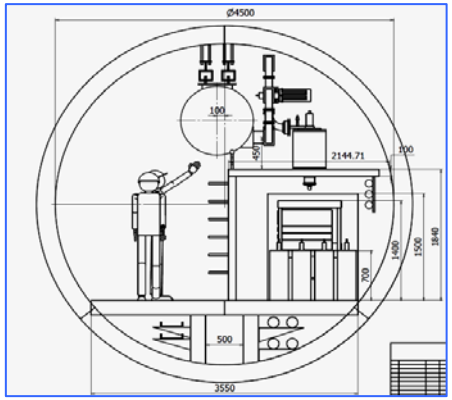
Back Up Slides

Single Tunnel

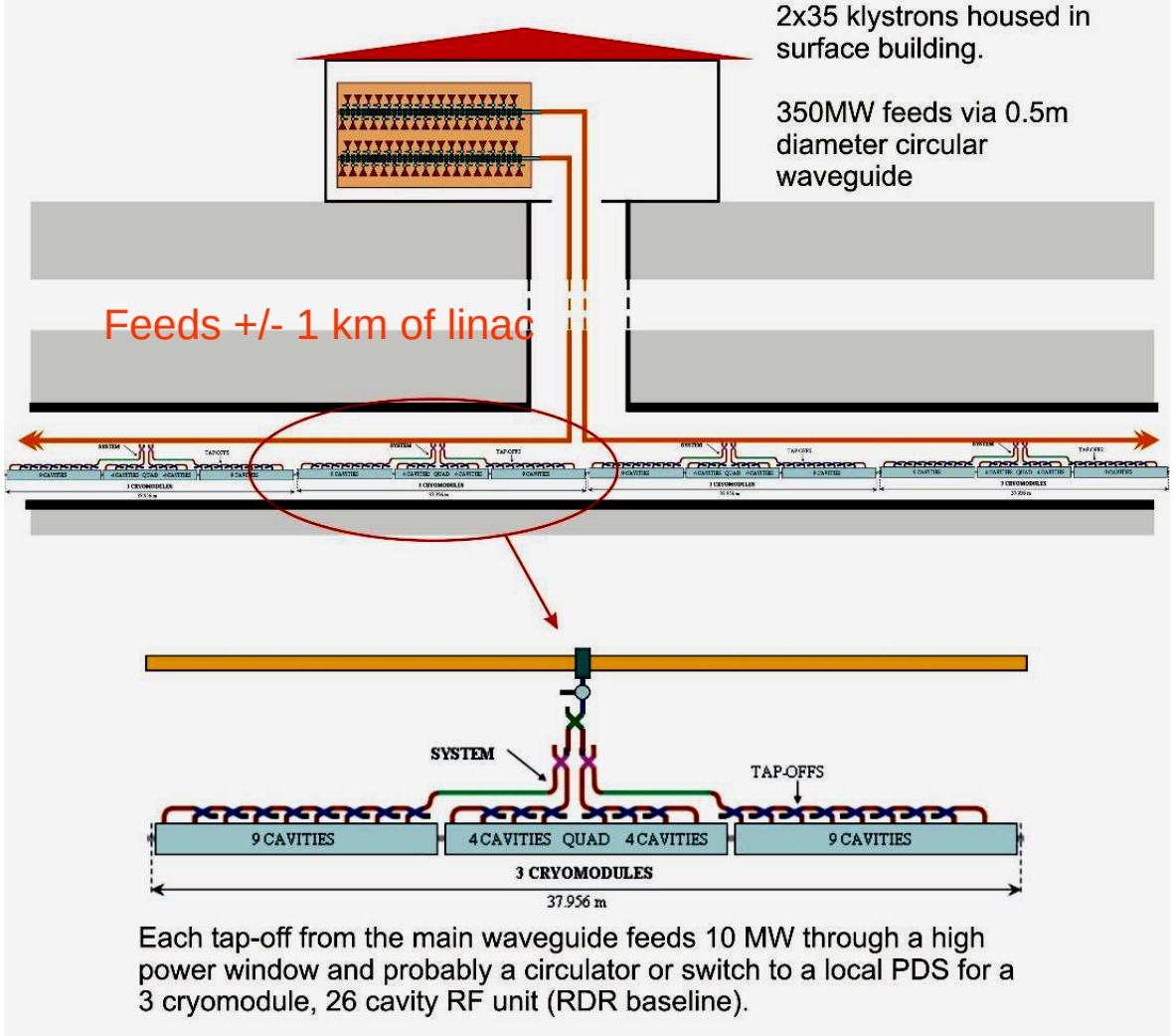
- Packing all component in RDR in single tunnel will cause significant increase of machine down time (XFEL adopts single tunnel but modulators are on the surface)
- Revision of RF distribution system is needed
  - KCS (Klystron Cluster System)
  - DRFS (Distributed RF system)







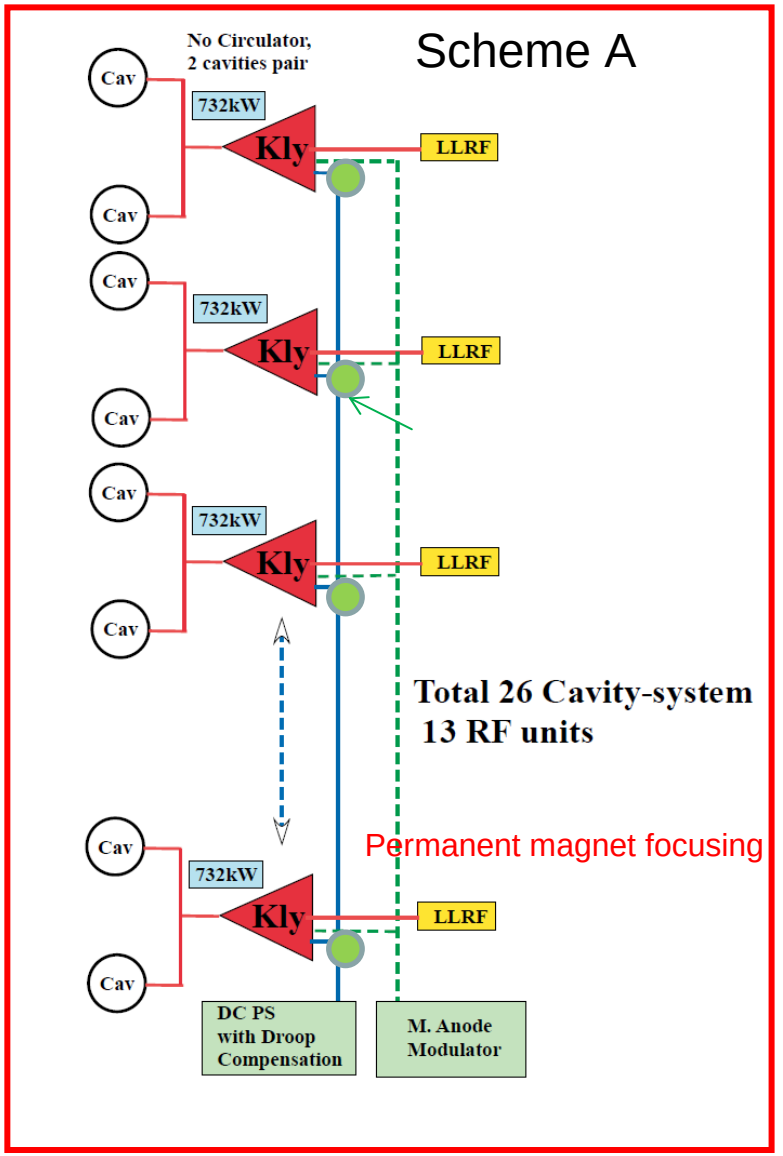
Klystron Cluster System



- Power station on surface every 2km
- ~30 klystrons (10MW MBK) in a station
- Output microwave combined (~300MW) and sent to underground by overmoded wave guide (~48cm)
- Distributed to modules by coaxial tap-offs.
- Need R&D of high power system
- Developed at SLAC

DRFS

- Feed 2 (or 4) cavities by a klystron (~750kW)
- Present scenario
  - 1 klystron for 4 cavities (SB2009)
  - 1 modulator for 26 cavities with back up
- Flexible distribution
- Issues are maintenance and cost
- Being developed at KEK
  - First test planned at the end of S1-Global
  - Capture cavities for STF2
  - STF2 will be driven by DRFS

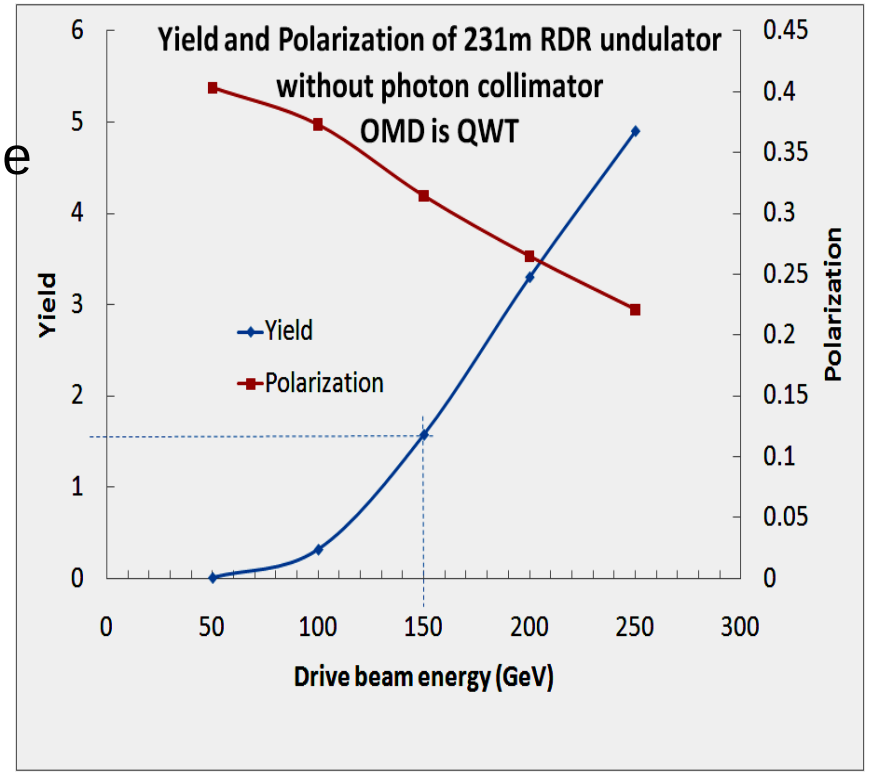


Reduced Number of Bunches

- Number of bunches 2600→1300 with same pulse length (~1ms)
  → half current in linac
  → RF system half
- Allows half size damping rings (same bunch interval in the ring)
  → ~6km → ~3km
  - Electron-cloud : almost the same
  - Update to ~2600 bunches is harder
    - Experience of e-cloud needed
    - Fast kicker
- Need to squeeze more the beam at IP for the same luminosity

New Design of Positron Source

- Replace flux concentrator with Quarter Wave Transformer (less efficient but safer)
  → longer undulator (=230m), higher target load → target R&D
  - Continue R&D of flux concentrator
- Place undulator at linac end (250GeV point)
  - Simpler machine protection system
  - Complex systems concentrated in the central region
  - Allows low acceleration gradient of linac at low energies
  - No deceleration
  - Higher positron yield at high energy (>300GeV CM)
  - **But poor yield below 300GeV CM** (~half at 250GeV)



Luminosity

- Bunch number reduction would cause factor 2 reduction of luminosity → squeeze more tightly
- Further reduction at low energies due to the new location of undulator (factor 2 at 250GeV CM)
- Can be cured in principle by `traveling focus' (at the expense of higher sensitivity on collision offset), but it does not work at low energies due to larger geometric emittance
- → factor of 3-4 reduction from RDR value at 250GeV CM.