GDE Summary

Akira Yamamoto

ILC-GDE PM / KEK

presented, April 19, 2009

Acknowledgements

- **On behalf of ILC-GDE, we would thank:**
  - ***Accelerator Advisory Committee (AAP)*** *for its guidance for us to prepare for the review and for various, very important advices during the first AAP review, during this meeting, specially during the week end.*
  - ***ILC collaborators*** *for their much effort to prepare for the presentation and to respond to the AAP Committee, and also to prepare for the parallel session.*
  - ***TILC-09 local organizing committee*** *supported by KEK for their preparation for this meeting since the preparation started already in last summer, and for the excellent organization during the meeting.*

Outline

- **Introduction**
  - Project management update
  - Overview of TILC09 GDE meeting and the 1st AAP Review
- **Progress Reports from Technical Areas**
  - AAP report,
  - Group leader's reports
- **The New baseline – updating the Reference Design**
  - Minimum Machine Design >> Cost-driven Design and Integration
  - General Plan toward TDP-2
- **Summary**

Technical Organization Update
as of April 2009

- **Technical Area Organization and the Group Leaders to be updated,**
  - SCRF
    - Cavity : Lutz Lilje (DESY) to Rongli Geng (Jlab)
  - CF&S
    - Control: Margaret Votava (Fermilab) resigned
  - AS
    - DR: Andy Wolski (C.I) to Susanna Guiducci (INFN)

- ***We would thank Lutz and Andy for their excellent work with strong leadership to bring the project to the current stage.***

Akira Yamamoto
Project Manager
SCRF Tech.

- Tetsuo Shidara (KEK)
- Jim Kerby (FNAL)
- R. Geng — Cavity Processing
- Hitoshi Hayano (KEK) — Cavity Production & Integration
- Norihito Ohuchi (KEK) Leader, Harry Carter (FNAL) Co-Leader — Cryomodule
- Shigeki Fukuda (KEK) — HLRF
- Tom Peterson (FNAL) — Cryogenics
- Chris Adolphsen (SLAC) — Main Linac Integration

Marc Ross
Project Manager (chair)
CFS & Global

- Wilhelm Bialowons (DESY)
- John Carwardine (ANL)
- John Osborne (CERN) — Civil Engineering
- Vic Kuchler (FNAL) — Conventional Facilities

Project Management Office

-

Nick Walker
Project Manager
Accelerator Systems

- Frank Lehner (DESY)
- Junji Urakawa (KEK)
- Axel Brachmann (SLAC) — Electron Source
- Jim Clarke (STFC) — Positron Source
- Susanna Guiducci (infn) — Damping Ring
- Nikolay Solyak (FNAL) — RTML
- Andre Seryi (SLAC) — BDS
- Kiyoshi Kubo (KEK) — Simulation

Technical Areas and Groups

AAP Review

- **The first GDE Internal Review**
  - Interim review for the TDP-1
  - Main review for TDP-1, in early 2010
  - Interim review for TDP-2, in 2011
  - Main review for TDP-2, in 2012

- **Summary**
  - April 21, 2009
  - By E. Elsen

Summary of AAP Review

E.Elsen
DESY

April 21, 2009
TILC'09

Role AAP

Role of AAP

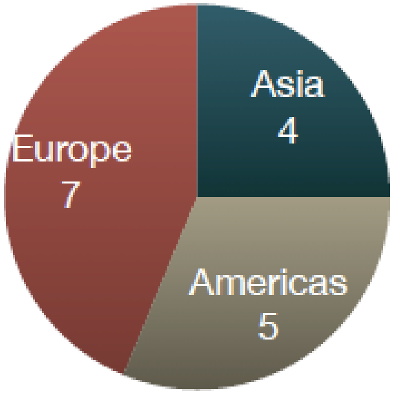
- Internal Review Body
  - of technical matters
  - reporting to director
- Support the project
  - examine the technical progress
  - reflect on management structures

AAP considered this
an experiment;
explore and adapt till
the answer is there

AAP Reviewers

AAP Reviewers

- Regular Members
  - C Damerell
  - J Dorfan
  - E Elsen
  - T Himel
  - M Kuriki
  - O Napoly (*)
  - K Oide
  - H Padamsee
  - T Raubenheimer
  - D Schulte
  - W Willis



- External Members
  - N Holtkamp (*)
  - L Rossi (*)
  - T Tajima
  - M Uesaka
  - F Zimmermann

(*) apologies received

- F Lehner served as the scientific secretary for this meeting

AAP Review

Date	Area	Topics	Conveners
April 17	GDE	Overview, PM Report	Barish, Ross
April 18	CF&S	Overview, Water, RF, Tunnel	Kuchler, Huedem, Hammond, Enomoto, Lackowski, Osborne,
	AS	CesrTA Test Facility / e-cloud	Palmer, Dugan, Rubin
	AS/SCRF	FLASH Test Facility	Carwardine
April 19	SCRF	Cavity, Cavity Integration, Cryomodule, Plug- Compatibility	Yamamoto, Lilje, Hayano, Ohuchi, Kerby, Peterson
	SCRF	HLRF, MLI, Test Facility, Industrial.	Fukuda, Adolphsen
	AS	ATF2 progress	Seryi
April 20	Integration	Design and Integration (M. M.)	Paterson
	AS	E-source, RTML, BDS/MDI, Simulation,	Brachmann, Solyak, seryi, Kubo
	AS	Dumping ring (e-cloud), e+ source	Guiducci, Clarke
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Electron Cloud R & D

- **By mid-2010, CesrTA will have studied:**
  - Coated vacuum chambers → several coatings
  - Electrodes
  - Grooved vacuum chambers
  - (and ‘bare’ chambers’ as control)
- **Cloud density measurements:**
  - Electron analyzers
  - Tune measurements
- **Low emittance tuning**
- **Comprehensive program, includes simulation activities**
  - adequately supported

Progress at CesrTA and collaborating labs

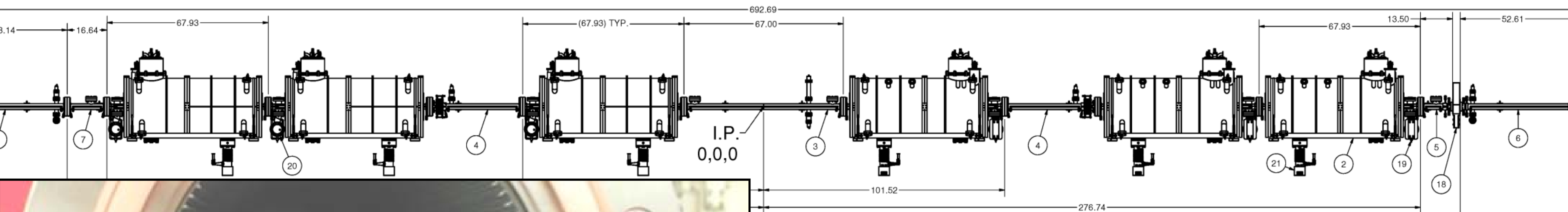
CesrTA Goals

- **Key Elements of the CesrTA R&D Program:**
  - Studies of Electron Cloud Growth and Mitigation
    - Study EC growth and methods to mitigate it, particularly in the wigglers and dipoles which are of greatest concern in the ILC DR design.
    - Use these studies to benchmark and expand existing simulation codes and to validate our projections for the ILC DR design.
  - Studies of EC Induced Instability Thresholds and Emittance Dilution
    - Measure instability thresholds and emittance growth due to the EC in a low emittance regime approaching that of the ILC DR.
    - Validate EC simulations in the low emittance parameter regime.
    - Confirm the projected impact of the EC on ILC DR performance.
  - Low Emittance Operations
    - Support EC studies with beam emittances approaching those specified for the ILC DR (CesrTA vertical emittance target: ε_v<20 pm-rad).
    - Implement beam instrumentation needed to achieve and characterize ultra low emittance beams
      - x-Ray Beam Size Monitor targeting bunch-by-bunch readout capability
      - Beam Position Monitor upgrade
    - Develop tuning tools to achieve and maintain ultra low emittance operation in coordination with the ILC DR LET effort
  - Inputs for the ILC DR Technical Design
    - Support an experimental program to provide key results on the 2010 timescale
    - Provide sufficient running time to commission hardware, carry out planned experiments, and explore surprises ⇨ ~240 running days over a 2+ year period

CesrTA Schedule: Upgrade Milestones

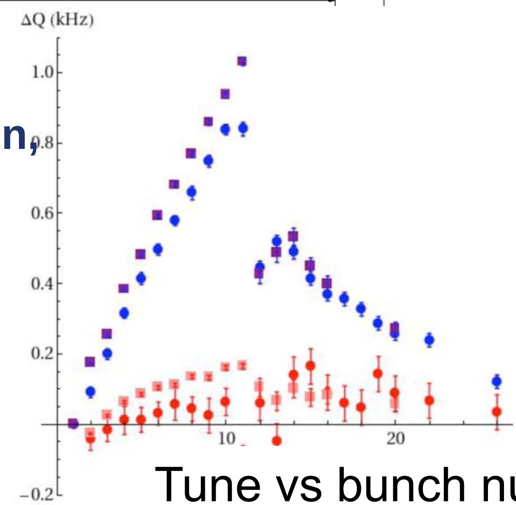
Period	Task	Target	Status	Special Comments
Down #1	1. Installation of 1st CESR dipole with RFA 2. Installation of instrumented drift VCs	FY08 Q3 FY08 Q3	Done Done	
Down #2	1. CESR layout for low emittance operation 1.L0 Wiggler straight (former CLEO IR) 2.Vertical electrostatic separator removal 3.CESR quadrupole alignment mechanism upgrade and improved ring survey	FY09 Q1	Done	**Major Contingencies**: Failed SRF cavity – removed, impacts bunch length • Vertical separators largest single source of impedance in ring
	2. Electron cloud diagnostic upgrades 1.Diagnostic wiggler VCs (with EC mitigation) 2.L3 EC experimental region preparation 3.EC diagnostics in CESR arcs and preparation of isolated test chamber sections	FY09 Q1	Done	• Diagnostic wigglers installed Oct 23-24, 2008
	3. Beam instrumentation upgrades 1.Installation of e+ x-ray beam size monitor beam line (upgrade of existing CHESS line) 2.Phased installation of BPM system hardware	Phased Installation - FY09 Q3	Ongoing	• e+ x-ray line completed – ongoing commissioning and development of new optics and detector hardware • BPM infrastructure upgrade begun
Down #3	1. L3 EC experimental hardware in ring 2. Photon stop for L0 wiggler straight 3. Beam instrumentation upgrades 1.Installation of e- x-ray beam line (upgrade of CHESS C-line) 2. Phased installation of new BPM system hardware 3. New streak camera optics lines in L3 region	FY09 Q2 FY09 Q4 Phased Installation - FY09 Q3	Done Done Ongoing	**Major Contingencies**: SRF cavity - replaced Dipole bus repair • L3 EC ring hardware installed – ⇨ operational in May `09 • Electron x-ray line front end modifications complete

Electron cloud: *Cornell*, SLAC, KEK and INFN

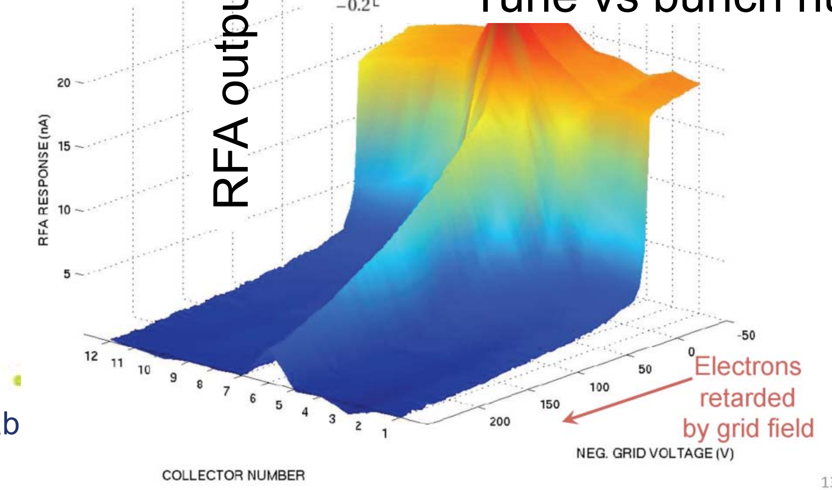


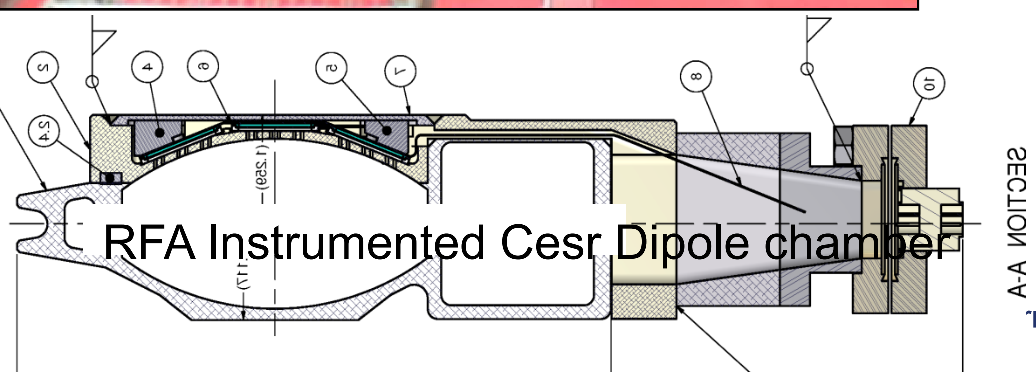

SLAC Vacuum chamber – w/fins

SC Wigglers, mitigation, diagnostics and measurements



Tune vs bunch nu





RFA Instrumented Cesr Dipole chamber

rmilab

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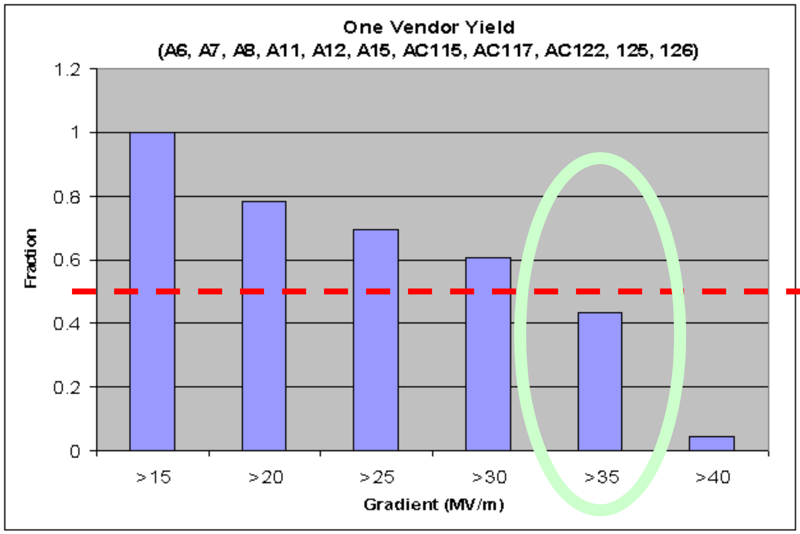
Global Yield of Cavities (November 2008) and Expectation

23 tests, 11 cavities

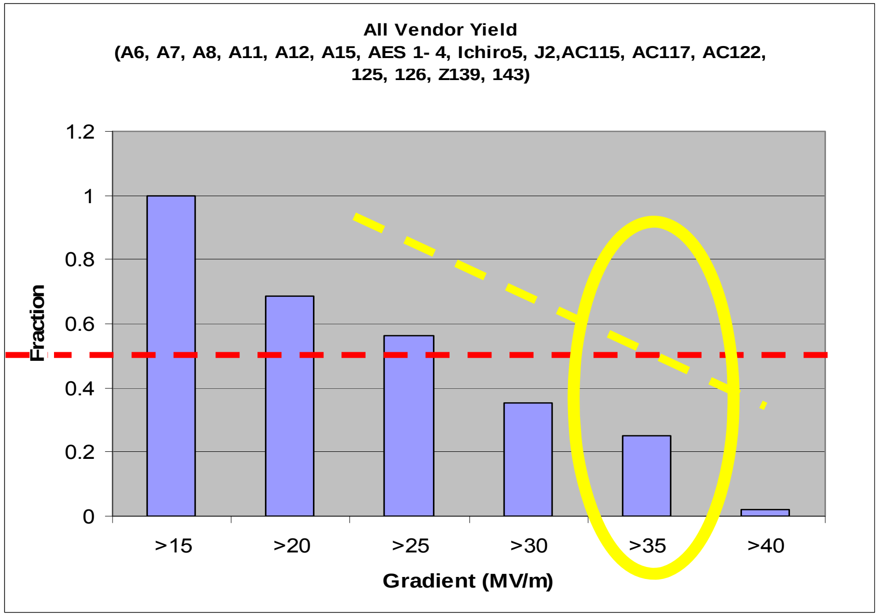
One Vendor

48 Tests, 19 cavities

ACCEL, AES, Zanon, Ichiro, Jlab



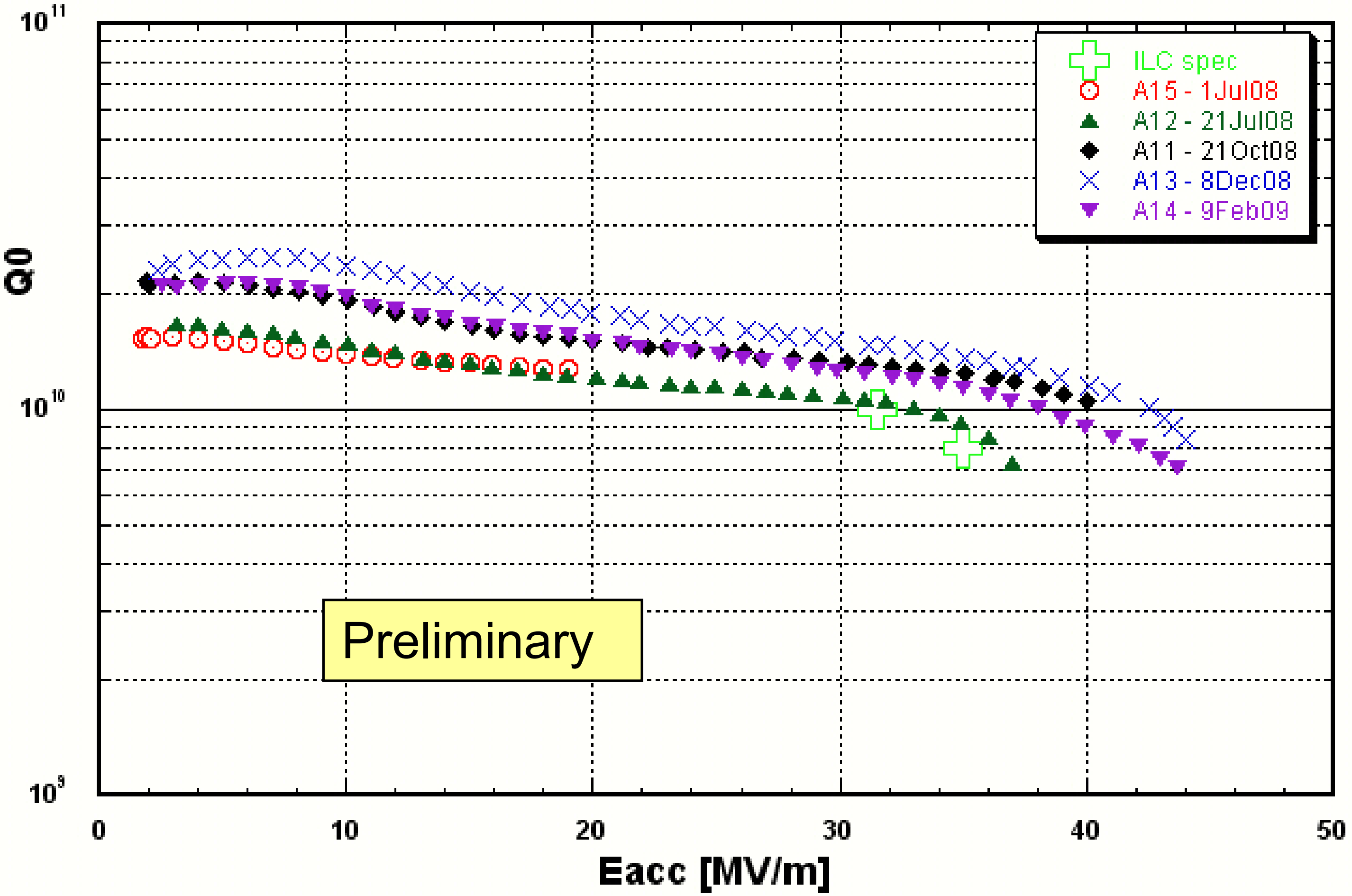
50%



45% yield at 35 MV/m being achieved by cavities with a qualified vendor

H. Padamsee, TTC-08 (IUAC), ILC-08 (Chicago)

America R&D: Recent 9 cell series

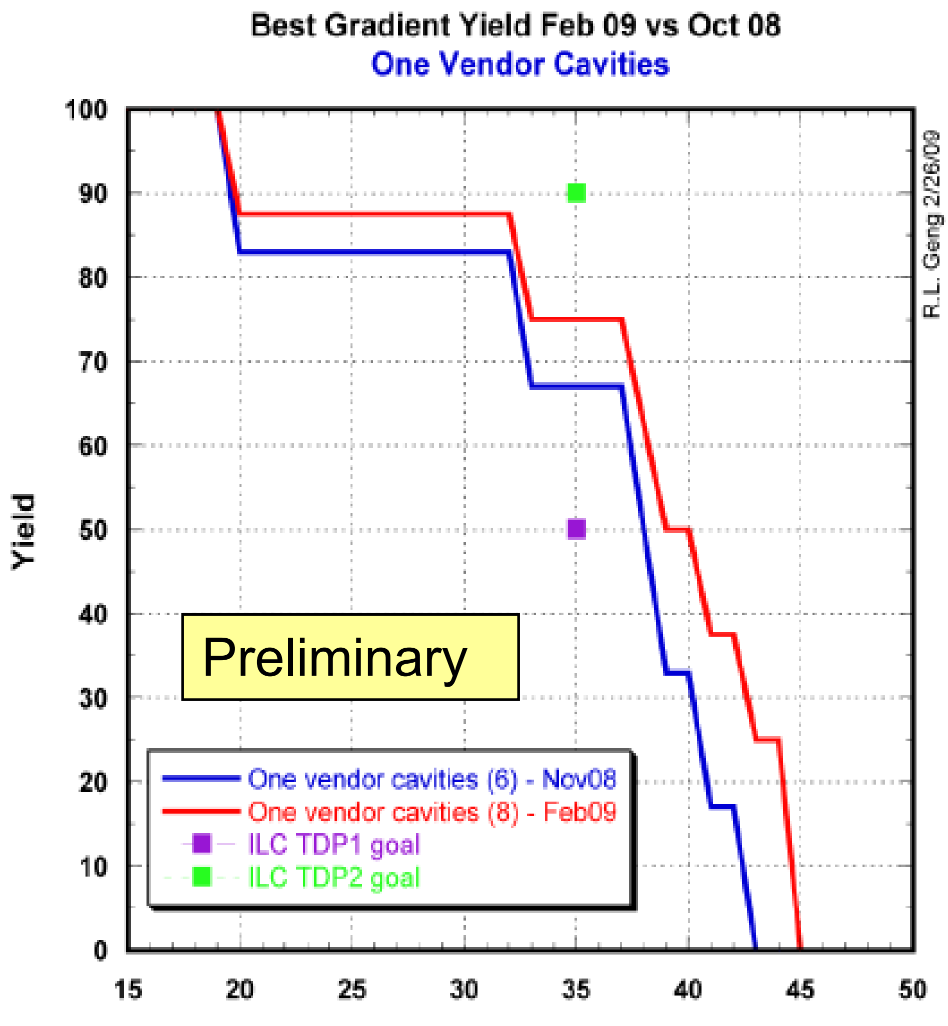


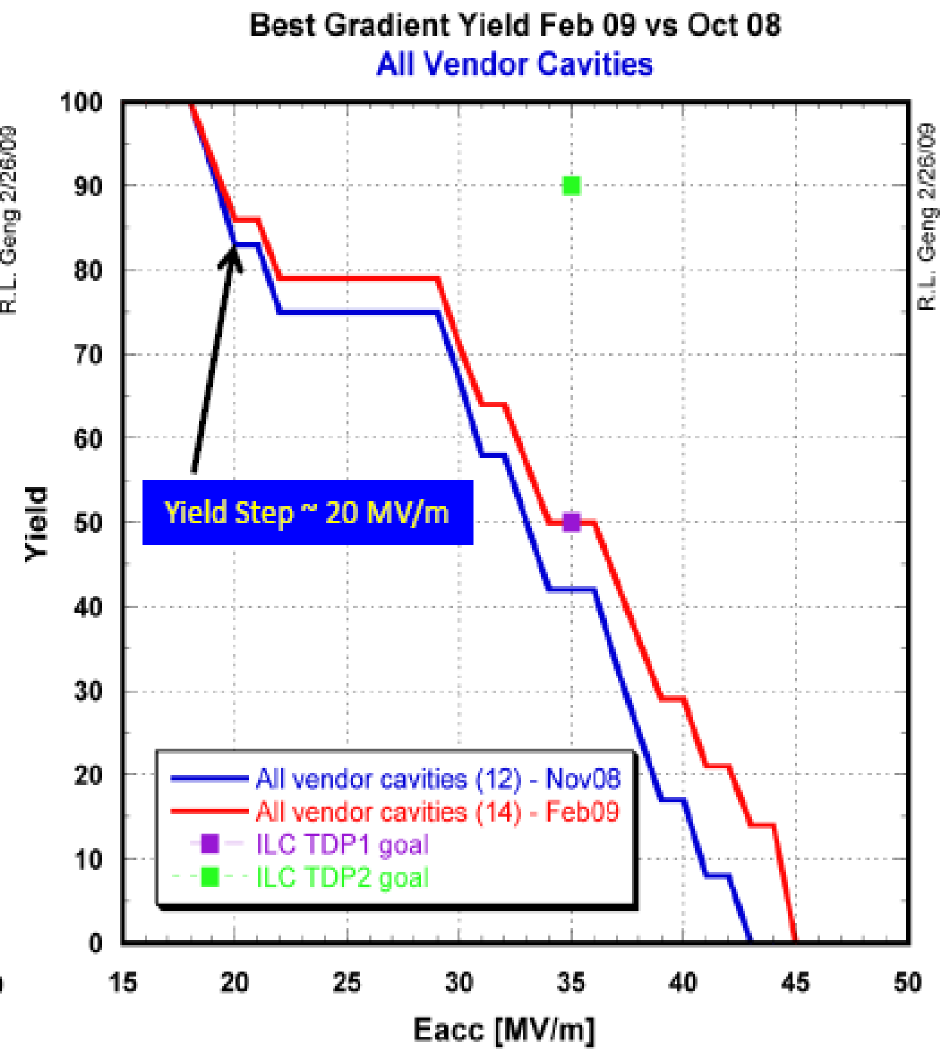
- Five 9-cell cavities: built by ACCEL, and processed/tested at Jlab.
- All processed with one bulk EP followed by one light EP and by ultrasonic pure-water cleaning with detergent (2%).

R. Geng - JLab

Yield Curve – as of Feb 09

14 9-cell Cavities Processed & Tested at JLab

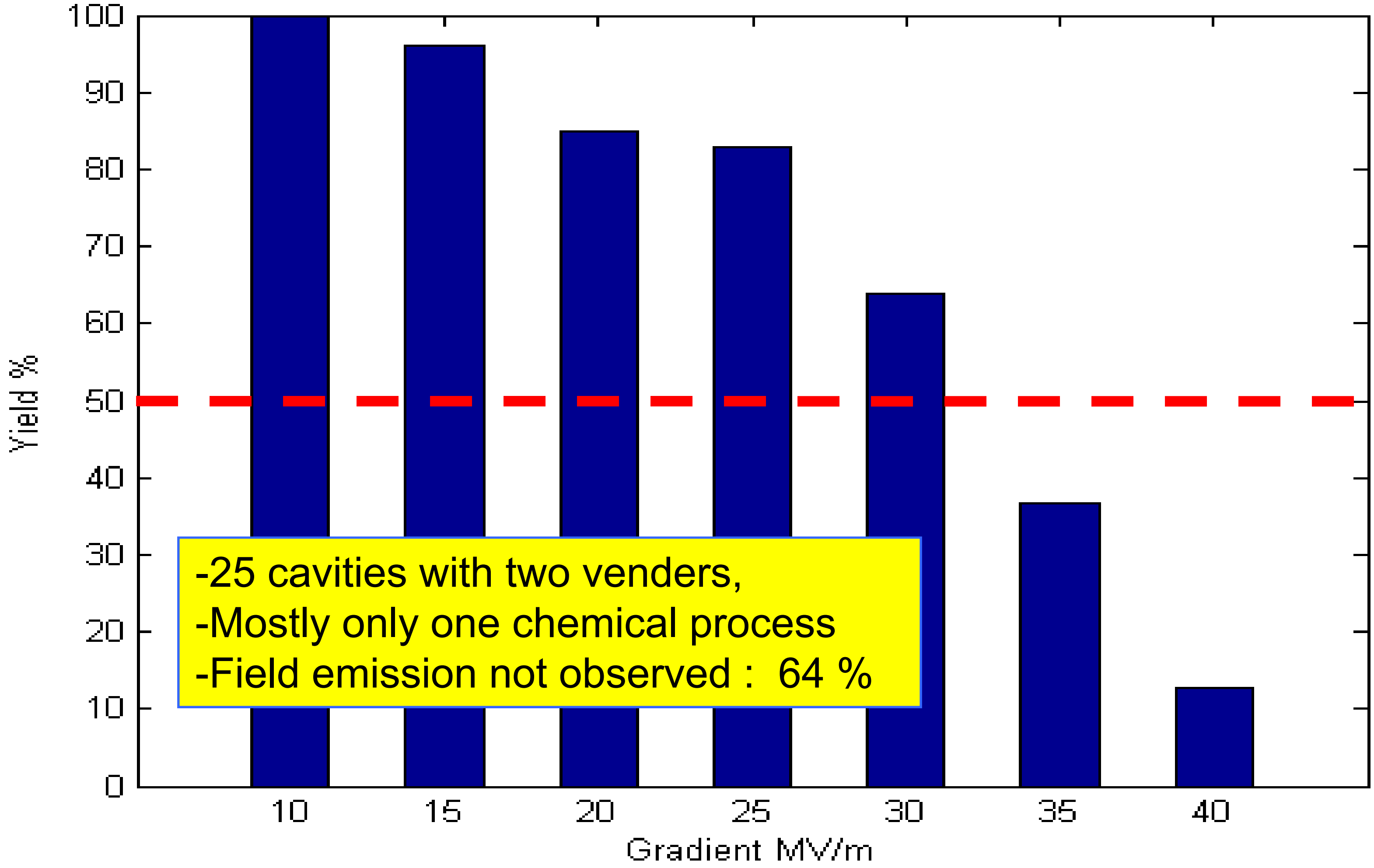




R. Geng - JLab

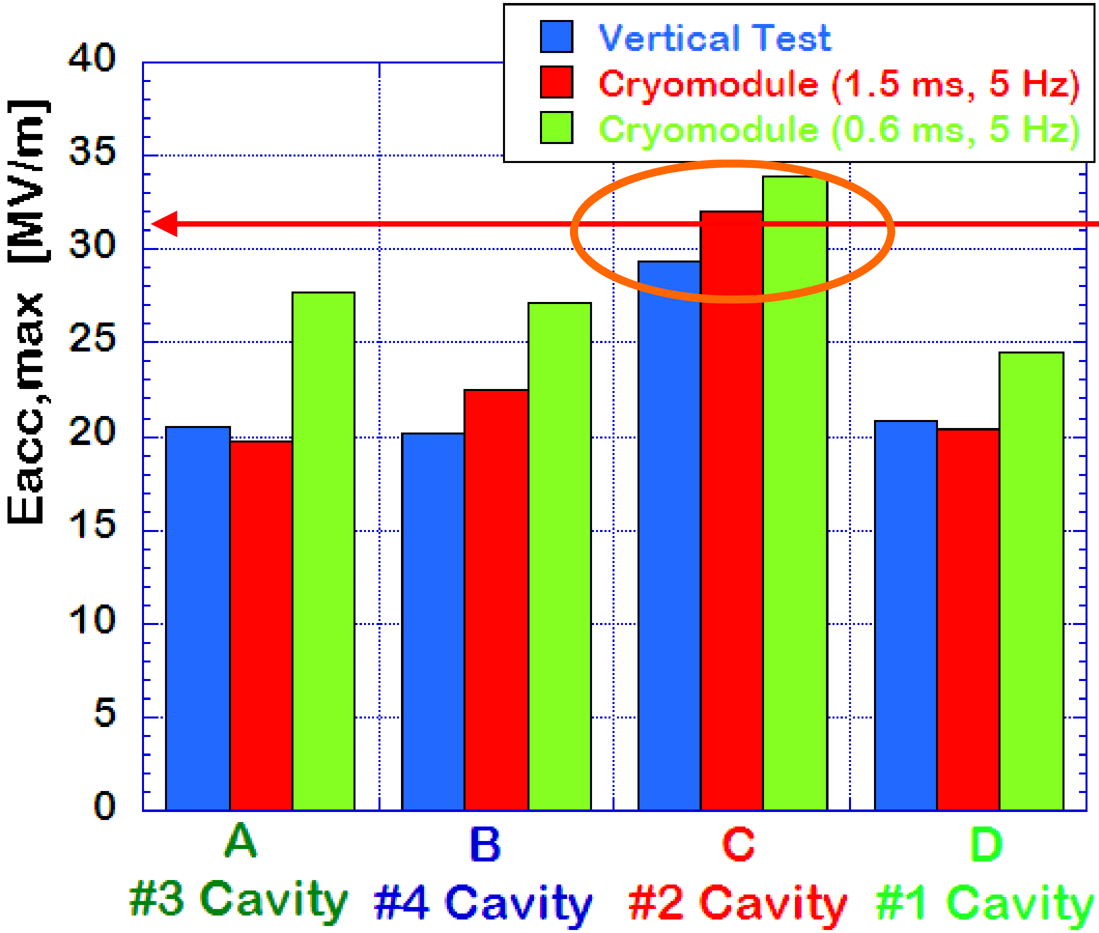
Recent Progress in Yield at DESY

Data provided by D. Reschke, and reassembled by M. Ross



Comparison of achieved Eacc,max between Vertical Tests and Cryomodule Tests

November, 2008



RF Feedback / ON

Operational Gradient at 31.5 MV/m for ILC

Ave. Eacc,max (V.T) = 22.7 MV/m

Ave. Eacc,max (Cryo.) = 23.7 MV/m

No degradation was observed in the cryomodule tests.

S. Noguchi, E. Kako, H. Hayano et al.

Guideline: Standard Procedure and Feedback Loop

	Standard Fabrication/Process	(Optional action)	Acceptance Test/Inspection
Fabrication	Nb-sheet purchasing		Chemical component analysis
	Component (Shape) Fabrication		Optical inspect., Eddy current
	Cavity assembly with EBW	(tumbling	Optical inspection
Process	EP-1 (Bulk: ~150um)		
	Ultrasonic degreasing (detergent) or ethanol rinse		
	High-pressure pure-water rinsing		Optical inspection
	Hydrogen degassing at 600 C (?)	750 C	
	Field flatness tuning		
	EP-2 (~20um)		
	Ultrasonic degreasing or ethanol	(Flash/Fresh EP) (~5um))	
	High-pressure pure-water rinsing		
	General assembly		
	Baking at 120 C		
Cold Test (vertical test)	Performance Test with temperature and mode measurement	Temp. mapping	If cavity not meet specification Optical inspection

Cavity R&D: Actions to be made

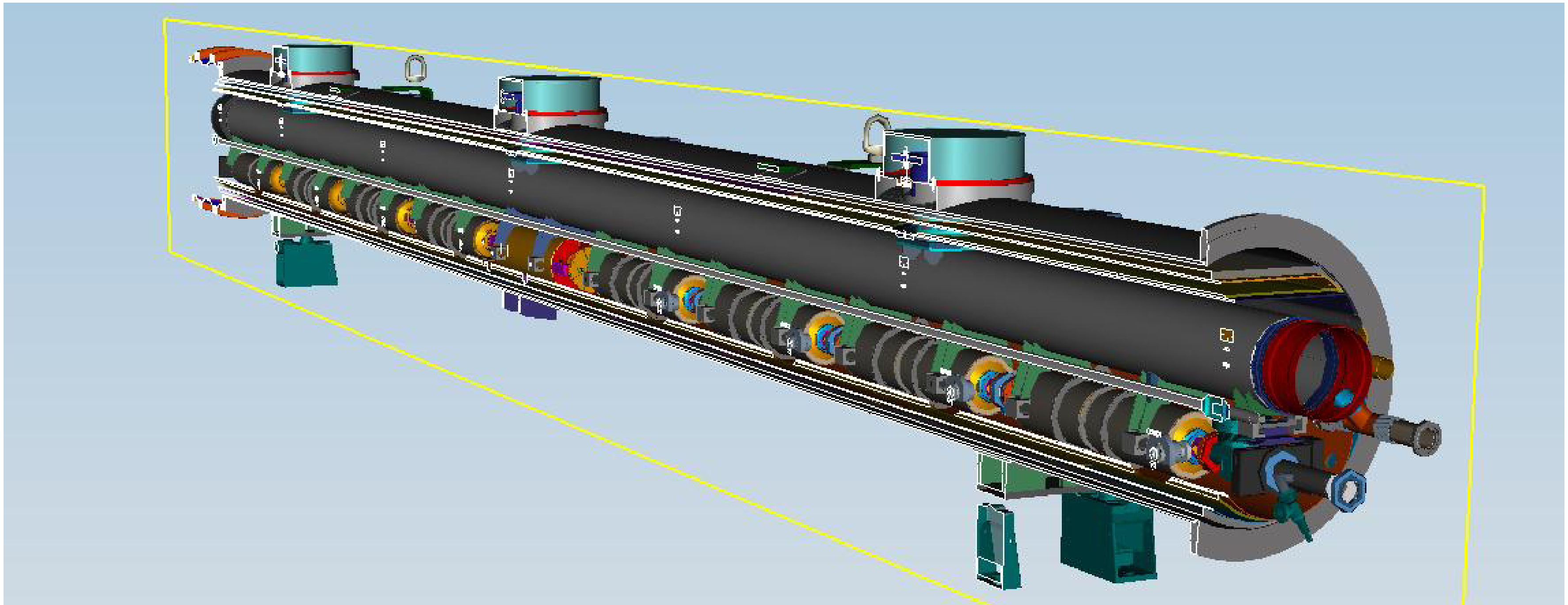
- **Focus on the fabrication process,**
  - specially on EBW and understand the reasons for defect/pit frequently observed near the heat affected zone,
- **Widely facilitate high-resolution optical inspection system**
  - Directly to cavity fabricators/manufacturers, and
  - Accumulate more inspection data and which can be shared by the cavity communities for better and quick feed-back to fabrication process,
- **Boost laboratory-industry cooperation**
  - fair contribution and fair benefit/return, between laboratories and industries,
  - It may lead best qualified technology transfer, indirectly through laboratories contribution and effort.

Cavity R&D : Summary

- **Status of Cavity Performance**
  - Field gradient : reaching 35 MV/m (at the yield of 50 % with the fabrication by the best qualified vender and with surface process with two leading laboratories,
- **Progress being made pushing the yield curve**
  - We expect more statistics (> 60) in 2009-2010
- **Re-baseline is to be made in 2010**
  - Need to have a practical scope in re-optimization of
    - Field Gradient : 35 MV/m (TBD) with the success yield of 90 % (TBD) at vertical test, and 31.5 MV/m for the ILC operation,

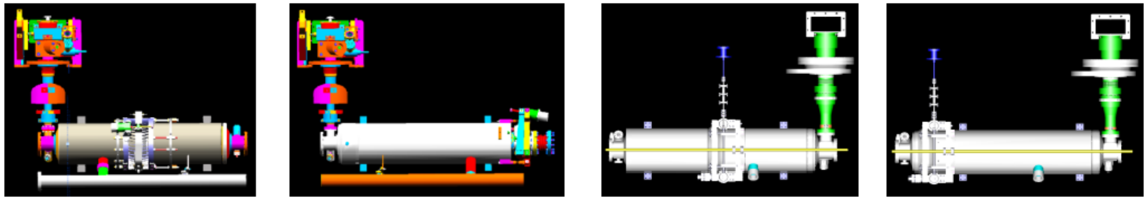
Level of Plug-compatibility

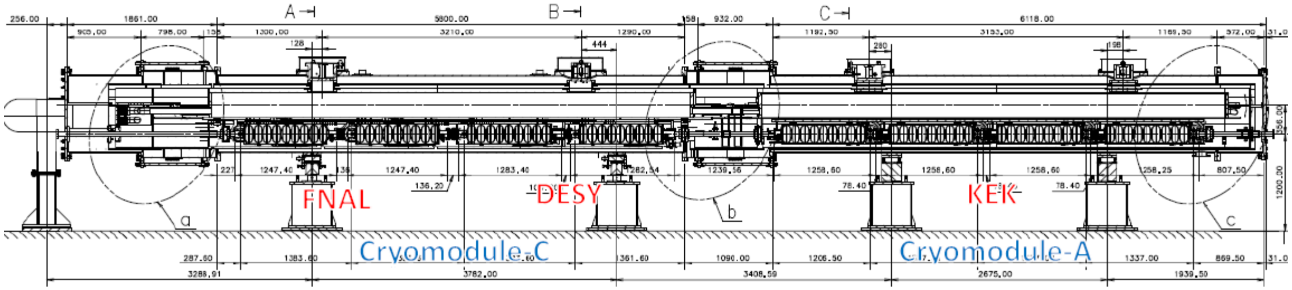
- **Plug Compatibility could be applied from a level of the whole cryomodule, to the smallest component. During R&D, it is appropriate to set boundaries such that technical components can be most efficiently addressed.**
  - setting of minimum number of boundaries required for compatibility, such a part can be accepted into whole while allowing for as much innovation as possible



S1 Global Cryomodule Design

Status of design works of S1-G cryomodules-1





1. Design of the Module-C and -A for S1-G started at May 2008.
2. Module-C has two FNAL cavities and two DESY cavities, and Module-A has four KEK cavities.
3. Two vacuum vessels are connected with a vacuum bellows.
4. The total length of the S1-G modules including end cans is designed to be 14900 mm.

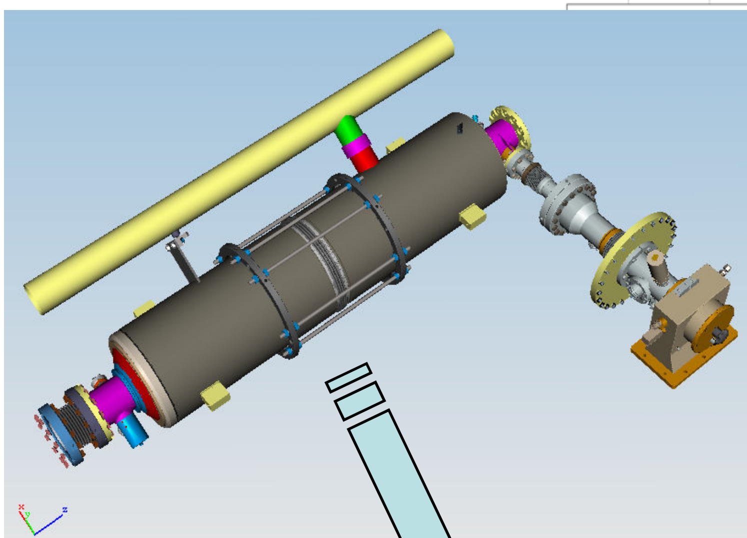
Goals and status described in detail in talk of N. Ohuchi

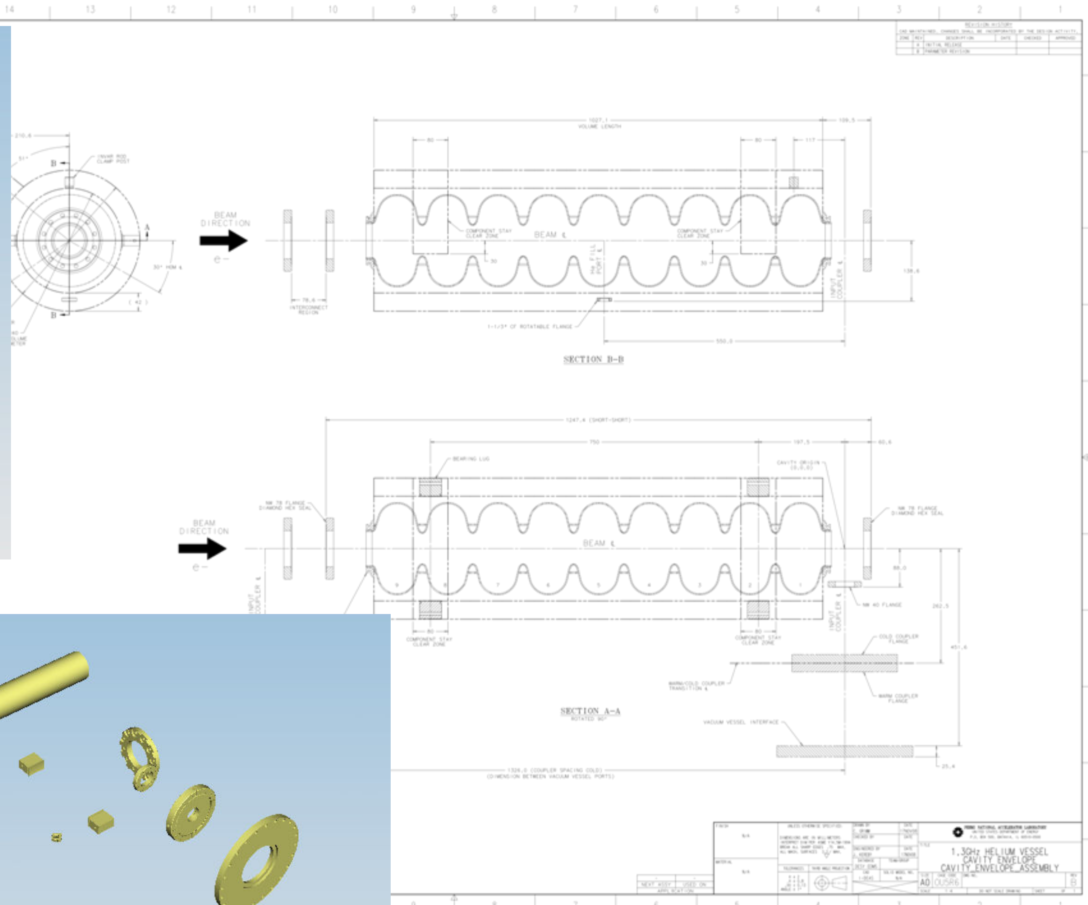
Credit: N. Ohuchi

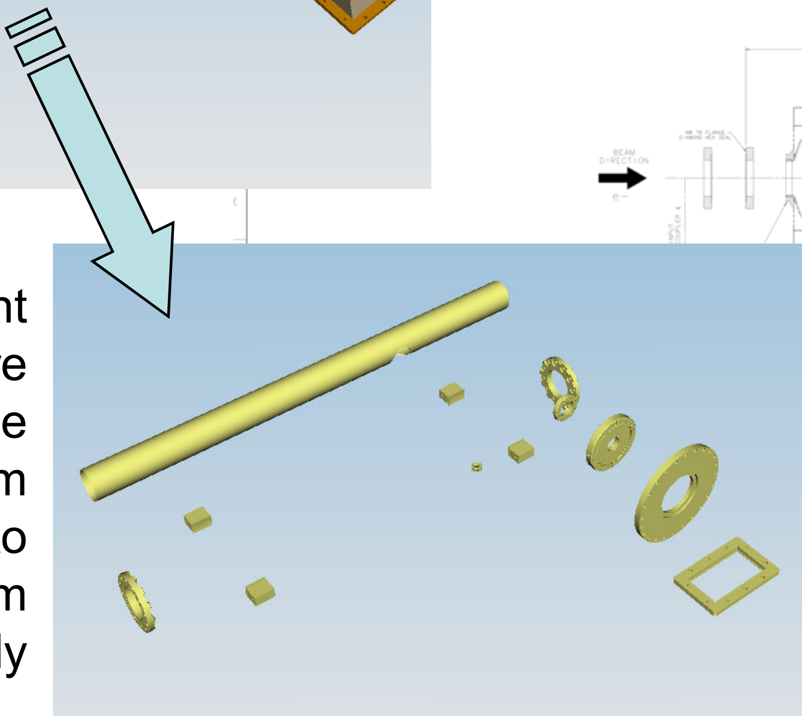
2009/4/17-20 TILC09 at Tsukuba 8

S1 Global effort also shows value of plug compatibility, allowing limited resources to work on technical goals as compared to singular interface efforts

Cavity: Plug-compatible Interface





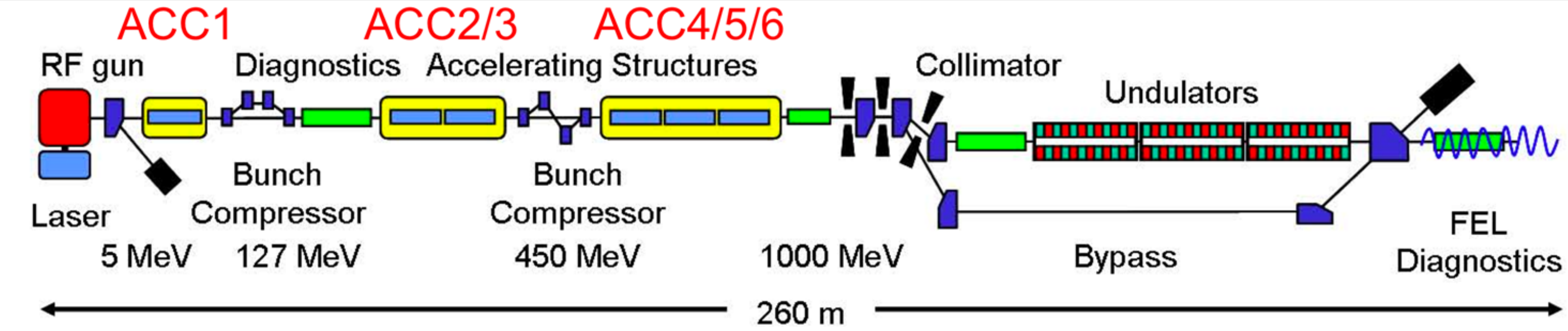


Component interfaces are reduced to the minimum necessary to allow for system assembly

Global Plan for SCRF R&D

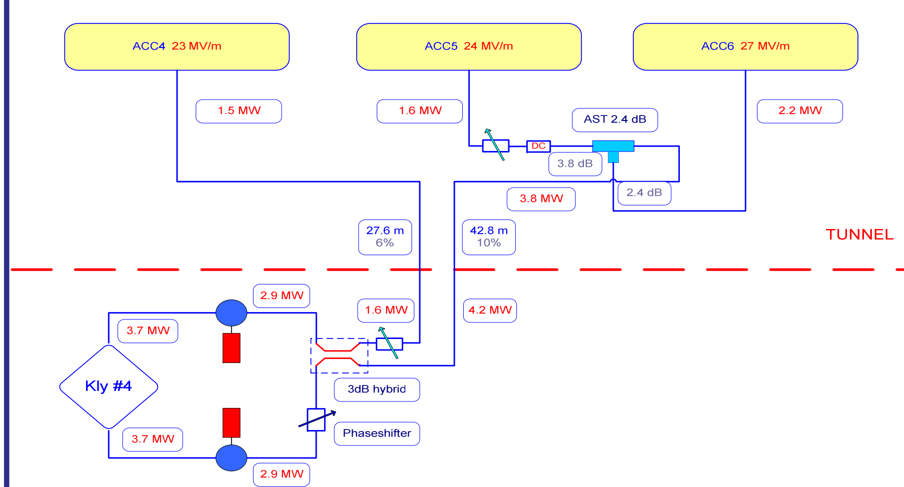
Calender Year	2007	2008	2009	2010	2011	2012
Technical Design Phase	TDP-1				TDP-2	
Cavity Gradient R&D to reach 35 MV/m		Process Yield > 50%			Production Yield >90%	
Cavity-string test: with 1 cryomodule			**Global collab. For <31.5 MV/m>**			
System Test with beam 1 RF-unit (3-modulce)		FLASH (DESY)			STF2 (KEK) NML (FNAL)	

FLASH accelerator layout



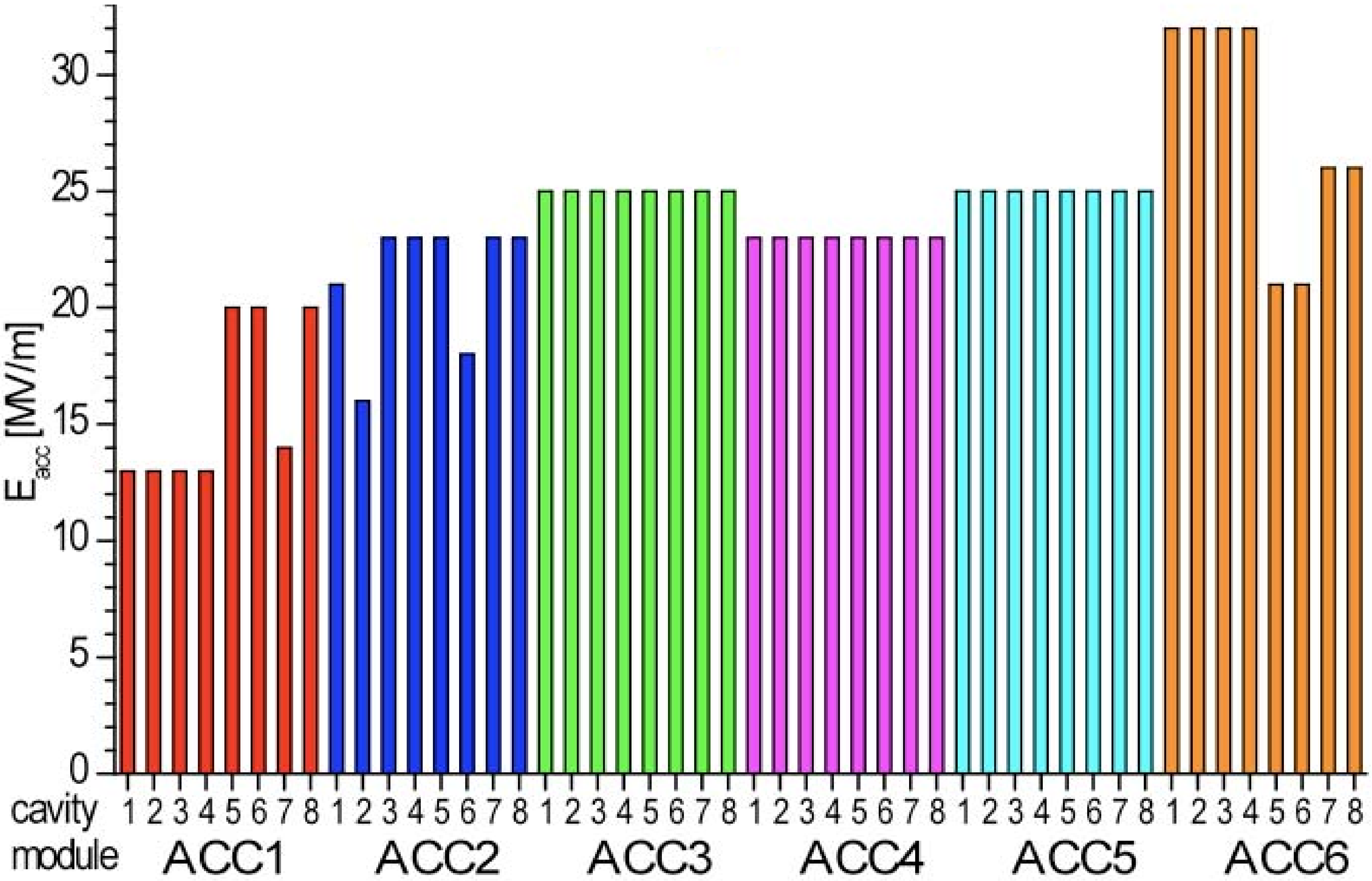
Comparison of machine parameters

		XFEL	ILC	FLASH design	9mA studies
Bunch charge	nC	1	3.2	1	3
# bunches		3250	2625	7200*	2400
Pulse length	μs	650	970	800	800
Current	mA	5	9	9	9



ACC456 is main focus of 9mA RF studies

FLASH Gradient limits



The 9mA experiment in context

- **Experiment addresses needs of ILC, XFEL and FLASH**
  - ILC: International GDE stated milestone
    - Driver: important and visible deliverable for international effort
  - XFEL: Close collaboration with world-wide LLRF groups
    - Focus (potentially accelerate) development and planning for XFEL
    - “Operation at limits” experience provides important input for future XFEL development
    - Important demonstration also for XFEL
  - FLASH: Addresses many operational issues
    - Automated exception handling and recovery
    - Better characterisation of machine
    - Towards routine high-power long-pulse operation for users.
- **Growing International Collaboration (ILC-driven)**
  - SLAC, FNAL, KEK, SACLAY, ANL,DESY…
- **TTF2/FLASH remains a unique facility world-wide**

9mA experiment chronology

- **First run (May 08)**
  - Hardware failures (power-out) effectively made shifts unusable
  - Resulting poor set-up of injector / accelerator made by-pass optics/steering virtually impossible.
- **Second run (September 08)**
  - Significant progress on all fronts
  - Careful set-up of injector (3nC, 1MHz) resulted in ‘loss-free’ transmission to dump (via by-pass)
  - Vacuum incident resulted in aborted programme
- **Third run (January 09)**
  - Beam loss studies
  - LLRF regulation, beam loading compensation algorithms
  - Run cavities at higher gradients

Results to date compared with the 9mA goals

	Achieved in Sept 08	Goal for Sept 09
Bunch charge to dump	2.5nC @ 1MHz	3nC @ 3MHz
Bunches/pulse	550 @ 1MHz	2400 @ 3MHz
Beam pulse length	550uS	800uS
Beam power	6kW (550x3nC/200mS @ 890MeV)	36kW (2400x3nC/200mS @ 1GeV)
Gradient in ACC4-6	Ensemble avg: ~19MV/m	Ensemble avg: to ~27MV/m Single cavities: to ~32MV/m

Plus…

- All RF systems operating routinely with 800us flat tops.
- Improved characterization of the bypass and dump line optics
- Characterization of LLRF feed-forward and feedback performance.
- Collected and analyzed cavity data for RF power overhead study

Toward Industrialization

- **Global status of Industries**
  - ACCEL and Zanon in Europe
  - AES and Niowave (and PAVAK in plan) in Americas
  - MHI in Asia
- **Project Scope**
  - XFEL: 1/20 scale of ILC
    - 800 cavities / 2 yrs = ~ 400 cavity / yr = 2 cavity/day
    - Including setup, 800 cavities / 3~4 year,
  - Project-X:
    - ~ 400 cavities / 3 yrs = 130 cavity /yr = < 1 cavity /day
  - ILC:
    - 15,500 cavities/4 yrs = ~ 4000 /yr = 15~20 cavities/day
    - If shared by three regions: 5 ~6 cavities / day /region
- **Industrial Capacity: status and scope**
  - No companies yet to be ready in 2012, to meet this requirement/plan,

How we may prepare for Industrialization and cost reduction?

- **Re-visit previous effort, and update the cost-estimate for production**
  - Understand the cost estimate in RDR
    - mainly based on TESLA design work at ~ 10 years ago and the subsequent experience,
  - Reflect recent R&D experience with laboratories and industries,
- **Encourage R&D Facilities for industrialization**
  - To Learn cost-effective manufacturing, quality control and cost-reduction in cooperation with industries,
    - It is important to facilitate them at major SCRF laboratories and extend the experiences at various laboratories (DESY, Jlab, Cornell and others),
- **Reflect the R&D progress for cost-reduction**
    - Main effort for Baseline >> Forming, EBW, assembly work …
    - Alternate effort with limited scale>> large-grain, seamless, or …

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	GDE	PM Summary	Walker

First Impression by AAP

First impressions

- positive interaction with the experts
  - openly shared their concerns and challenges
  - recurring topic
    - generic accelerator R&D
    - ILC directed engineering and development (baseline and design integration)
- Closeout with B Barish yesterday

Reports from TAGLs and (AAP)

- **Electron Source:** **Jim Clarke (STFC)**
- **Damping Ring:** **Susanna Guiducci (INFN)**
- **ML/SCRF:** **Hitoshi Hayano (KEK)**
- **BDS:** **Andrei Seryi (SLAC)**
- **Beam Dynamics:** **Nikolay Solyak (FNAL)**
- **CFS:** **Atsushi Enomoto (KEK)**
- **CLIC/ILC:** **P. Gabincius (FNAL)**
- **Design and Integr.:** **Ewan Paterson (SLAC)**
- **AAP** **Eckhard Elsen (DESY)**

Sources
Parallel Session Summary

Jim Clarke

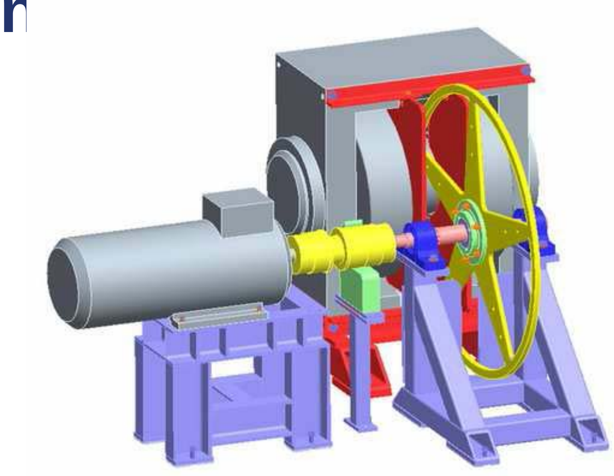
STFC Daresbury Laboratory

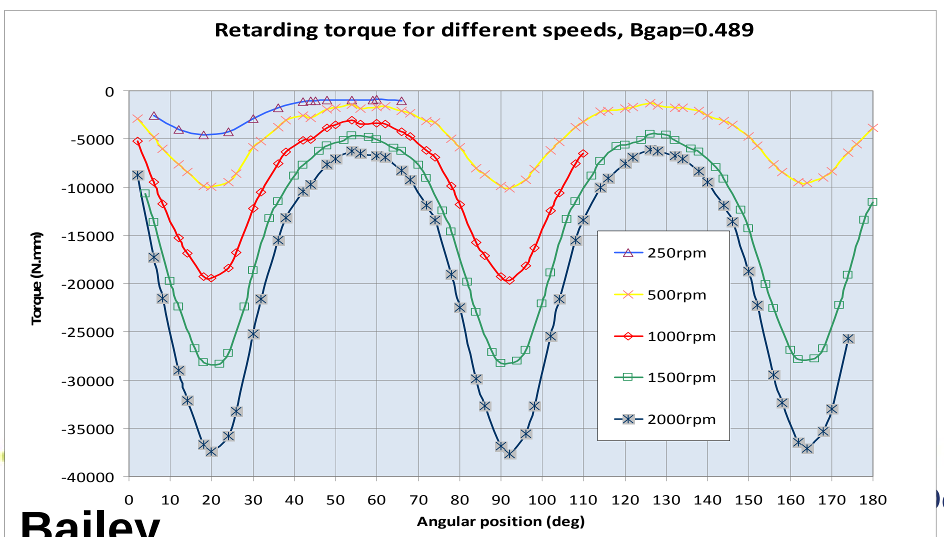
Electron Source Update Summary

- **DC-Gun development at Jlab with CEBAF synergy**
  - ‘Joint’ project with ILC to develop a higher voltage DC gun
  - Inverted gun
  - Development of materials and techniques to supress field emission
- **Laser development**
  - Progress, but slowed by amplifier pump laser problems
- **Photocathode R&D**
  - Studies of surface charge limit QE and polarization optimization are ongoing
  - Needs laser system to demonstrate performance of ILC beam

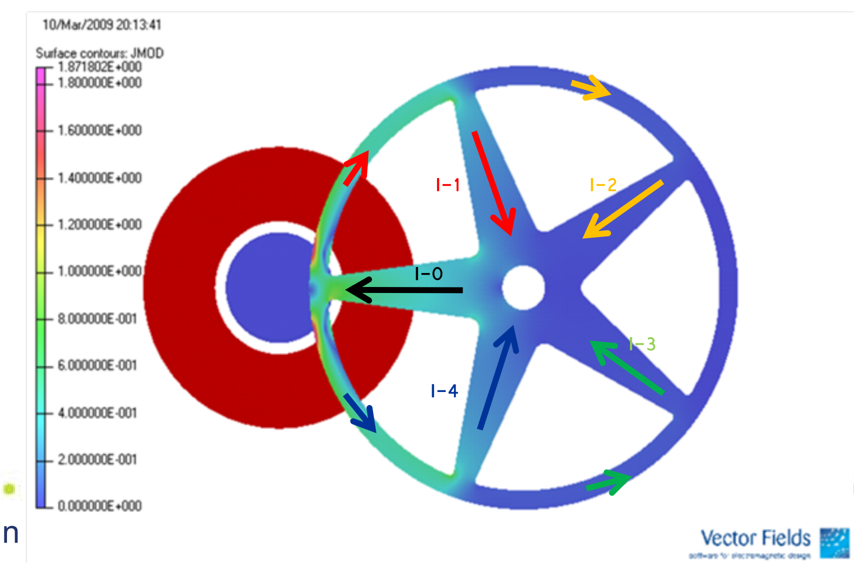
Baseline Target

- **Eddy current test at Cockcroft In**
  underway
- **More sophisticated model suggests spokes have big effect – so far data does not see this!**



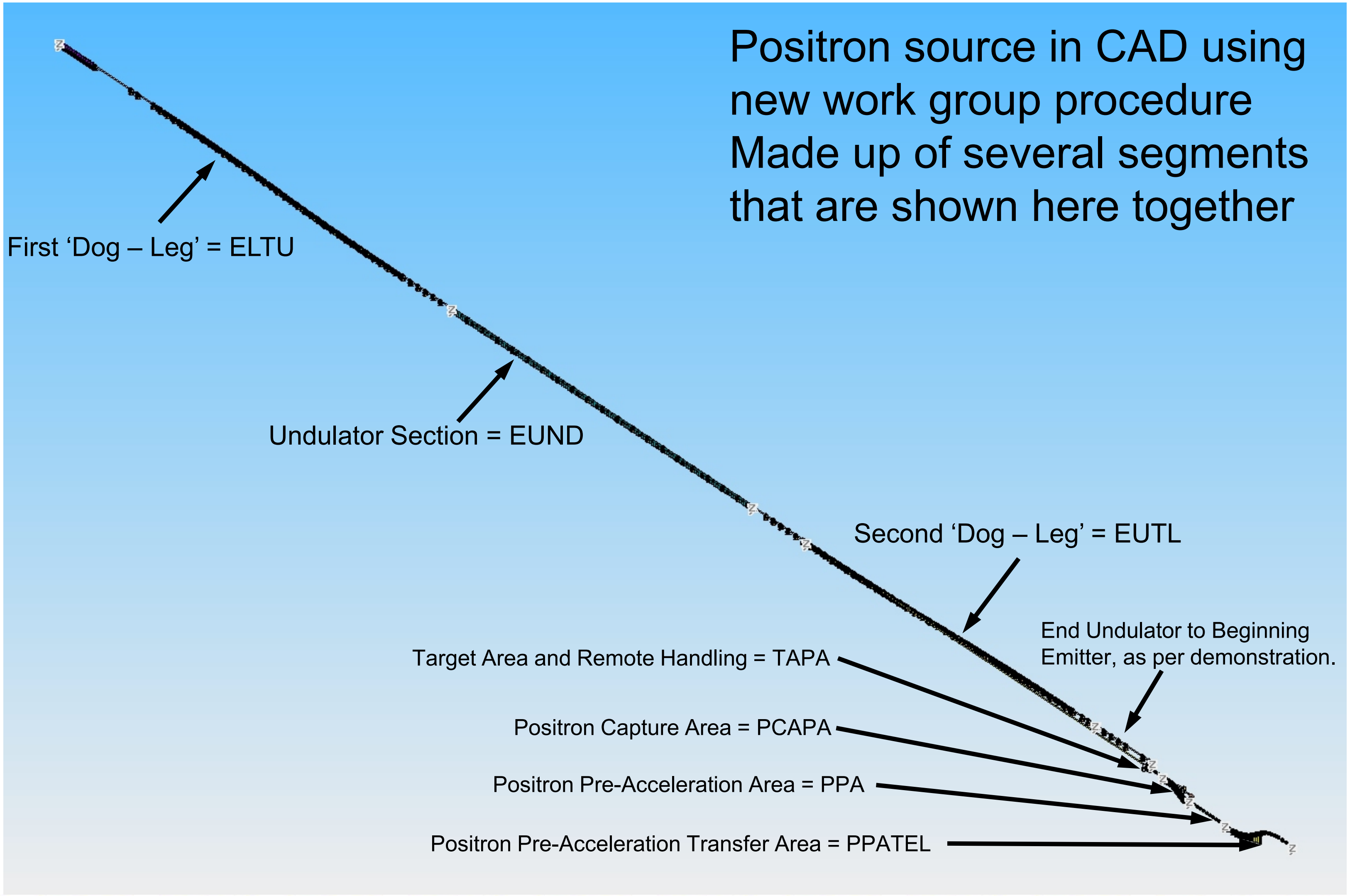


Bailey



esign

Integration



Conventional Source

Two Proposals

- **LowE e- driven: e+ generation in 1 ms**
  - Liquid Pb target + Li lens
  - Drive e- beam: 2.2 GeV, 4.5 nC, 5 Hz, SC Linac
  - e+ booster : 5 Gev, 5 Hz, SC Linac
  - Aiming cheap.
  - Timing structure in source&inj is the same as the baseline.
  - Risks in target & Li lens --> need R/D
- **300 Hz generation: e+ generation in 63 ms**
  - (a) Liquid Pb target + Flux concentrator
    - Drive e- beam: 2.2 GeV, 5.9 nC, (LowE) 300 Hz, NC Linac
    - e+ booster : 5 Gev, 300 Hz, NC Linac
  - (b) Hybrid Target + Flux concentrator
    - Drive e- beam: 10 GeV, 2.1 nC, 300 Hz, NC Linac
    - e+ booster : 5 Gev, 300 Hz, NC Linac
  - Aiming mature and low risk.
  - Need R/D of targets

Conventional Source

Two Proposals

- LowE e- driven: e+ generation in 1 ms
  - Liquid Pb target + Li lens
  - Drive e- beam: 2.2 GeV, 4.5 nC, 5 Hz, SC Linac
  - e+ booster : 5 Gev, 5 Hz, SC Linac
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- 300 Hz generation: e+ generation in 63 ms

  (a) Liquid Pb target + Flux concentrator
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    - e+ booster : 5 Gev, 300 Hz, NC Linac

  (b) Hybrid Target + Flux concentrator
    - Drive e- beam: 10 GeV, 2.1 nC, 300 Hz, NC Linac
    - e+ booster : 5 Gev, 300 Hz, NC Linac

  - Aiming mature and low risk.
  - Need R/D of targets

KEK Beam Test Plans

- **Window tests on KEKB now in doubt**
- **Liquid lead target tests on ATF Linac to go ahead**

Energy density on target
0.006 to 48 x 10^{10} GeV/mm^2
Power deposit on target
0.004 to 300 x 10^{10} GeV/mm^2 s
Acceptable beam rep. rate?

What is meaningful beam experiments for ILC liquid target?
This is under discussion.

- **Hybrid target tests also to go ahead on ATF Linac**

KEK Beam Test Plans

- **Liquid Lithium Lens – Need a design work for ILC positron beam by BINP. Just need the design. Hardware R&D is impossible at present.**
- **4m undulator on ATF Linac now under discussion. Need to check beam quality compatible**

Damping Ring Session Summary

S. Guiducci

TILC09

Tsukuba 21 April 2009

DR session on Crucial R&D items

Saturday 18 April 9:00 - 12:30

	kickers	Convener S. Guiducci		
9:00	Fabio Marcellini (Webex)	Strip line kicker design		
9:30	Craig Burkhart (Webex)	Fast Kicker Pulser Development at SLAC		
10:00	Takashi Naito	Fast kicker test at ATF		
10:30	coffee break			
	LET	Convener Junji Urakawa		
11:00	David Rubin	Low Emittance Tuning at CesrTA		
11:30	Shigeru Kuroda	Low Emittance Tuning at ATF		
12:00	Manfred Wendt	BPM DR Upgrade plan		

Sunday 19 April9:00 - 12:30

	e-cloud and fast ion	Convener Mark Palmer		
9:00	Theo Demma (Webex)	e-cloud studies at LNF		
9:30	Stefano De Santis (WebEx)	electron cloud studies		
10:00	Gerald Dugan	e-cloud measurements and simulations at CesrTA		
10:30	coffee break			
11:00	Yusuke Suetsugu	e-cloud R&D at KEKB		
11:30	Nobuhiro Terunuma	Fast ion study		
12:00	All	Discussion and Plans for "Minimum Machine"		

LET - ATF

- **2 pm is a TDP R&D plan deliverable for ATF**
- **4 pm has been achieved in 2004**
- **LET was based on Orbit Response Matrix analysis correcting iteratively orbit dispersion and coupling**
- **In 2007, after the same tuning procedure, 20-30 pm were measured?**
  - During 2008 DR magnets were realigned
  - A BPM upgrade program is in progress
- **This week:**
  - ε_y ~ 10 pm measured by X-SR
  - ε_y ~ 5 pm measured by Laser Wire
- **The resolution of the measurement systems needs further check/improvement but progress is in the good direction**

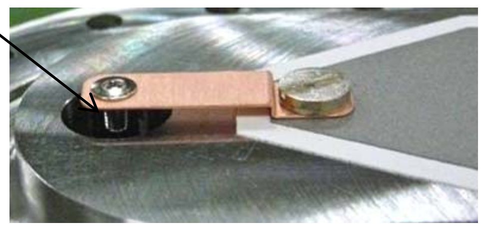
CesrTA e-cloud

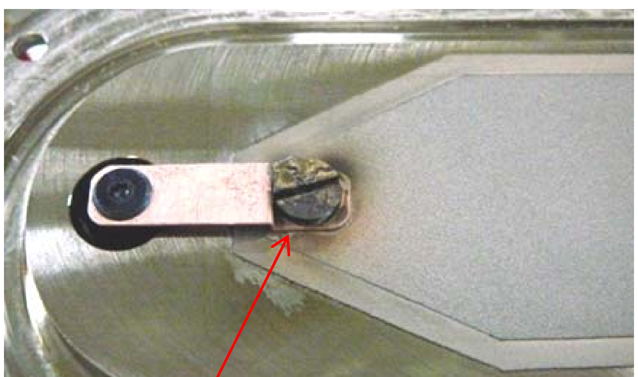
- **A large experimental program including**
- **Mitigation techniques**
  - effects of vacuum chamber coatings (TiN, alpha carbon)
  - clearing electrodes
  - grooved chambers
- **Tests of these techniques in dipoles and wigglers**
- **Monitoring with retarding field analyzers**
- **Measurements of coherent tune shifts produced by the ring-averaged cloud density near the beam**
- **X-ray beam size monitor for bunch by bunch measurement**
- **TE Wave Measurements**

Clearing electrode in KEKB wiggler

- **A key issue: development of a reliable connection to feed through**
  - We had a trouble in the previous version
  - A revised electrode is under test now (2009).

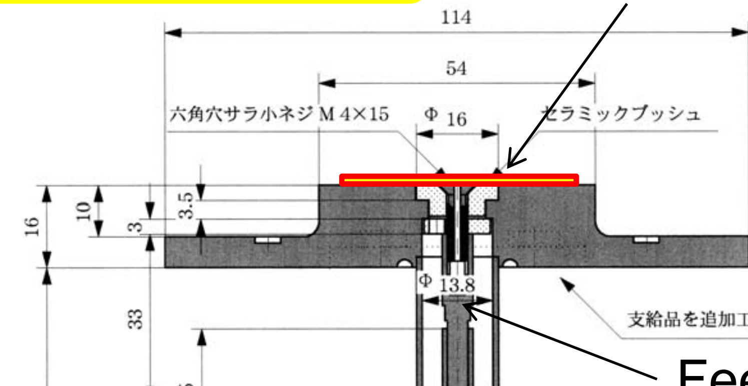
Feed through



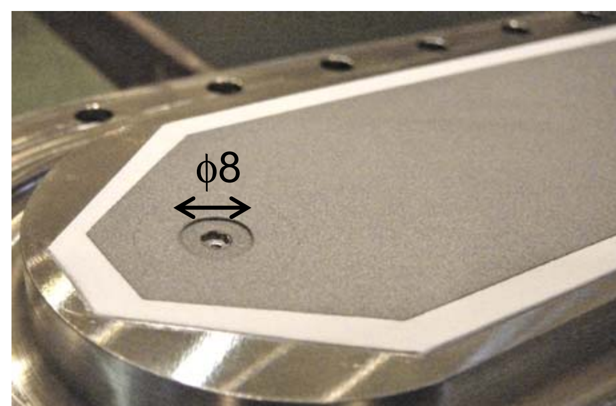


Discharging !

Electrode



Feed through



Conclusion

Progress in crucial R&D is very significative.

Parallel session summary ML/SCRF

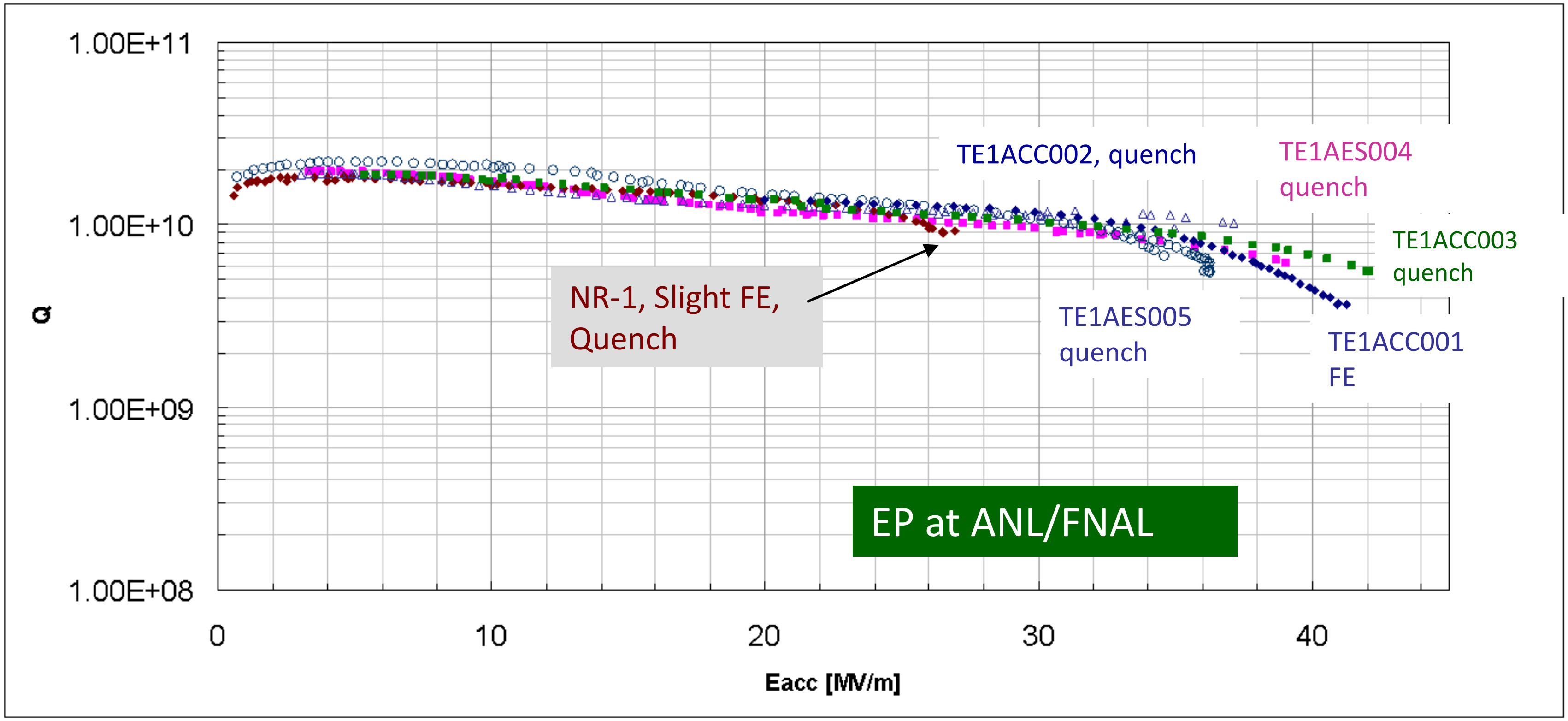
L. Lilje, H. Hayano, N. Ohuchi, S. Fukuda, C. Adolphsen
(with help of Chris Nantista)

Overview S0 Session

- **Vendor qualification using temperature mapping and high-resolution optical inspection**
  - Example on optical inspection from Asia
  - Example of single cells in new preparation facility from the US
- **Very good series with good results on initial test**
  - At JLab
- **Sample tests of rinsing methods**
  - Choices of either ethanol or ultrasonic degrease are validated
- **Industrialization in Europe for XFEL**
  - Preparation for call for tender
  - Streamlining procedures
  - Improving quality control
  - International process:
    - CEA, INFN, DESY
    - ILC participation via M. Champion and H. Hayano

EP single cell cavity performance

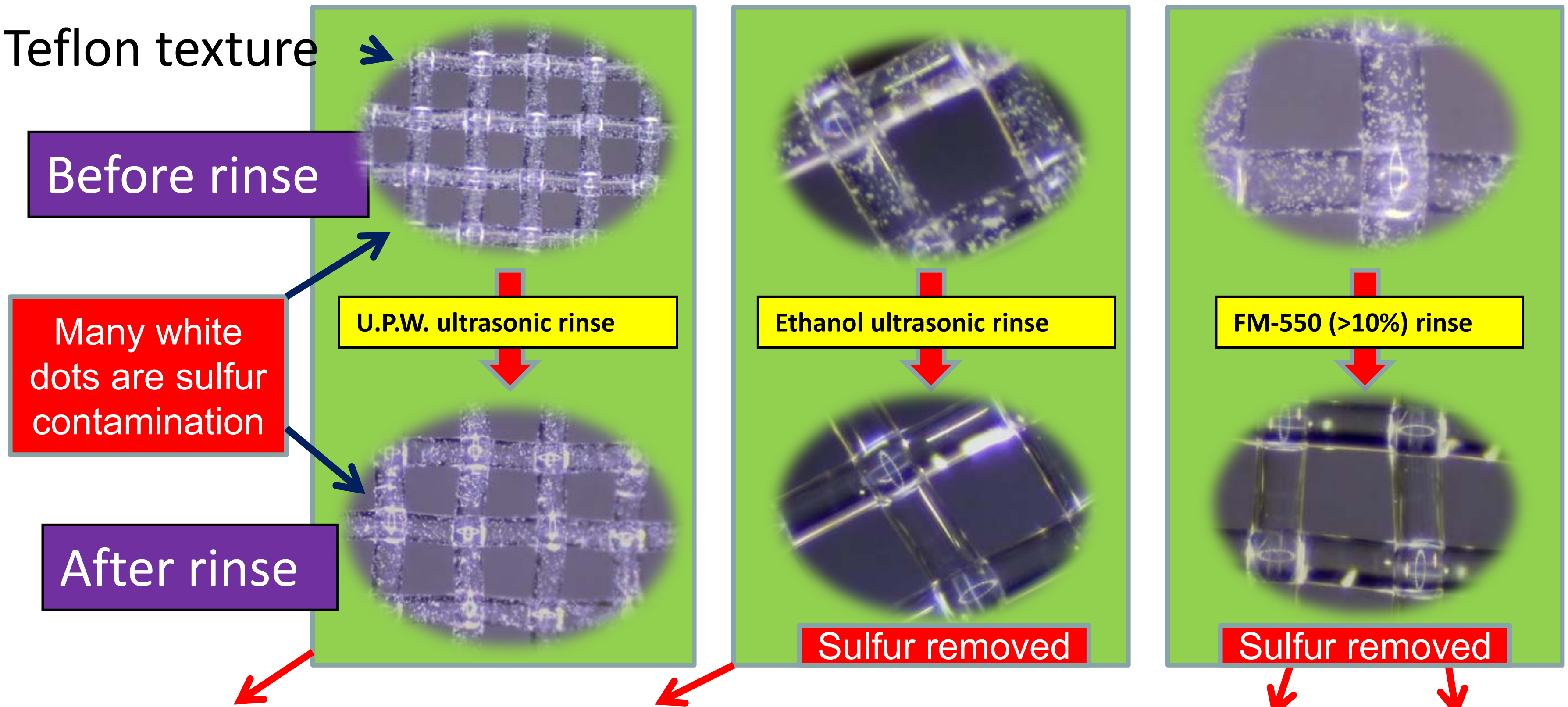
FNAL,ANL



	BCP	EP	Ethanol	Eacc [MV/m]	Notes
NR-1	150	93		26.5	Oxidation by acid residual
TE1AES004	107	65		39.2	Equator large pit present
TE1AES005	104	100	Yes	36.3	Oxidation by HPR water
TE1ACC002		112	Yes on second	37.1	
TE1ACC001		99		41.3	FE appeared after 120°C baking
TE1ACC003		119		42.1	Pit present
TE1ACC004					

T. Saeki
KEK

Rinse Effect to Remove Sulfur precipitation/contamination

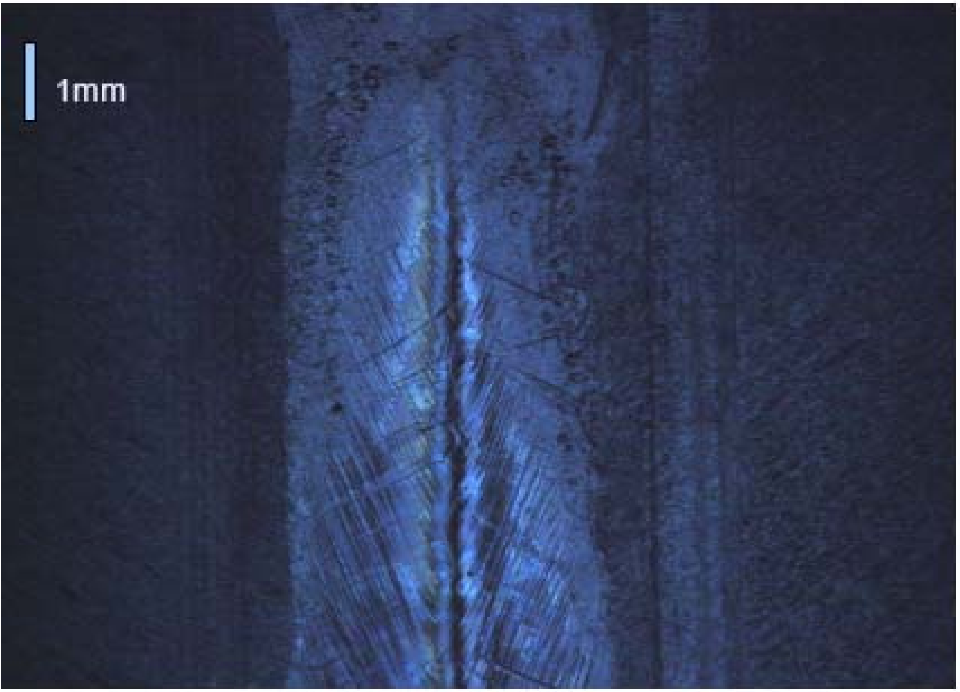


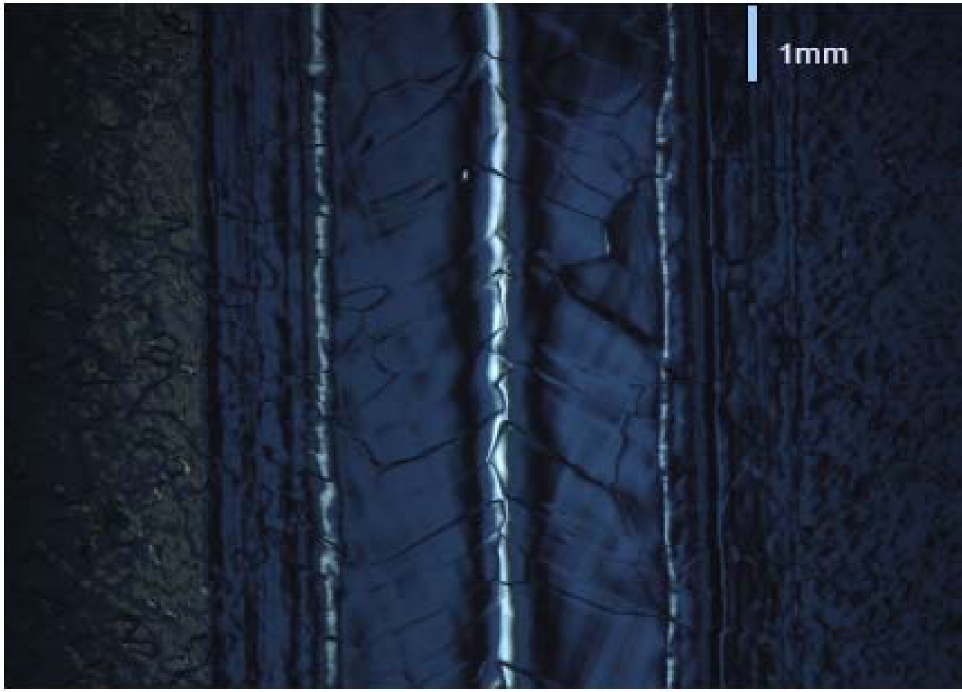
	U.P.W. ultrasonic rinse	Ethanol rinse (vibration)	Ethanol ultrasonic rinse	Detergent FM-550 2 %	Detergent FM-550 5 %	Detergent FM-550 10 %	Detergent FM-550 20 %
Cleaning Result Date	× Event	△	○	△	△	○	○ 66

Evolution of defects:

Systematic inspection through full preparation process

Equator #7 at 44 deg.





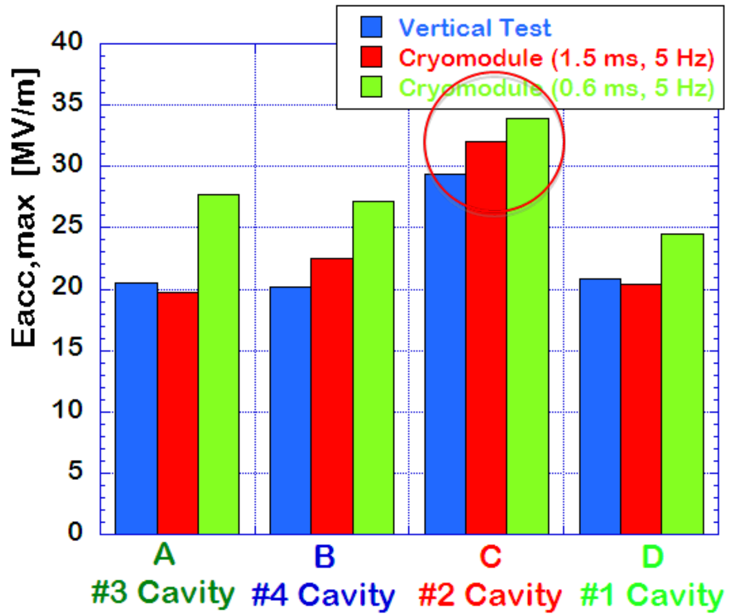
Before treatment

After 108 μm main EP

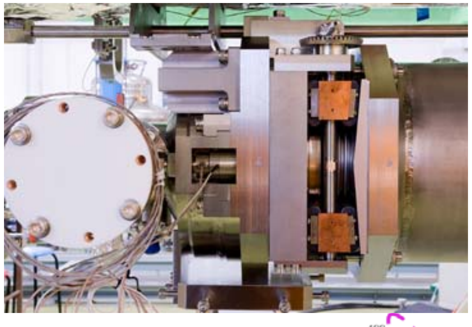
- Pits at weld interface removed by main EP

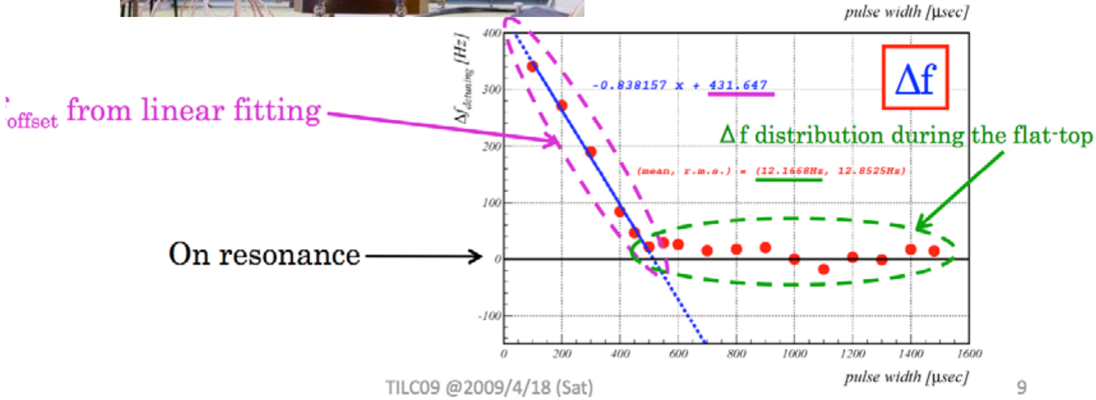
S. Aderhold
DESY

STF module test

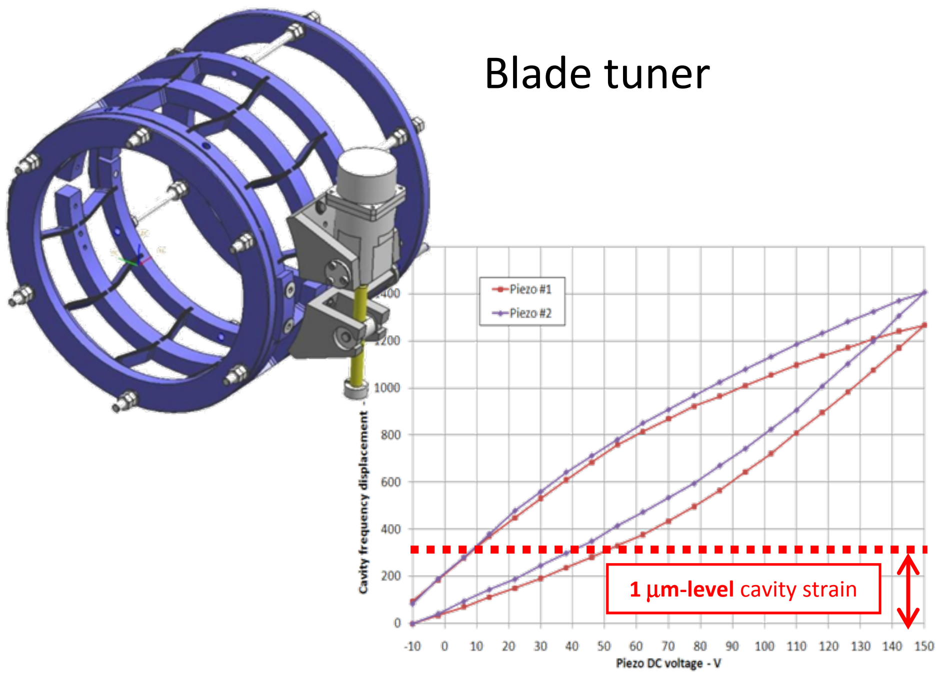


Slide-jack tuner

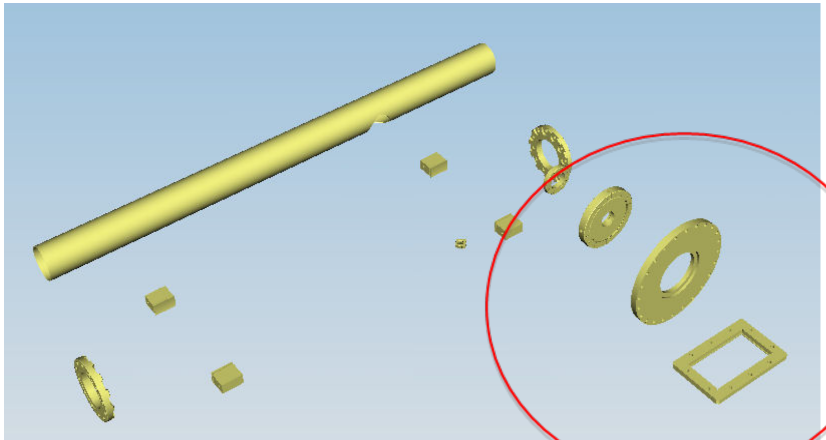




Blade tuner



Input coupler boundary



For non-BCD input port diameter:
think it as cavity package :cavity + input coupler,
keep boundary as a cavity package

Cryomodule Design Optimization

Plug-compatible and Cost reduction

Thermal design (based on TTF-type III)

- Thermal performance of the components
  - Thermal intercepts
  - RF cables
  - Input couplers (Tesla type, KEK type)
  - Quadrupole package and BPM
- Evaluation of heat loads at 31.5 MV/m
- Temperature profile in the module
  - Module design with or without 5K shield
  - Cooling scheme in the cryomodule

Mechanical design

- Assembly process and tooling
- Alignment method

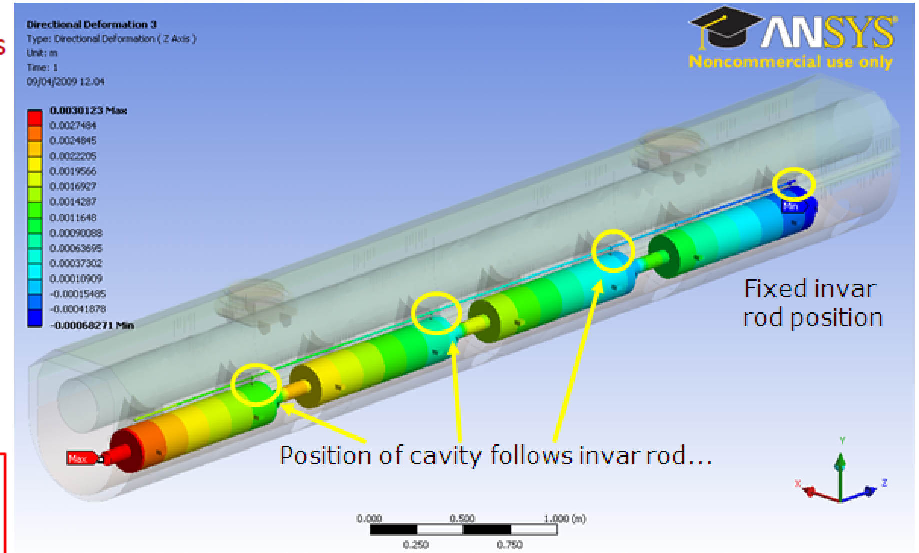
Tests and measurements

- Cold test of cryomodule with or without 5K shield at KEK-STF
- CM1 at FNAL-NML
  S1-Global at KEK-STF
- Dynamic heat load measurements at FLASH

Design of ILC proto-type
Type IV or V at FNAL
STF2 module at KEK

2009/4/17-20 TILC09 at Tsukuba 3

Longitudinal behavior

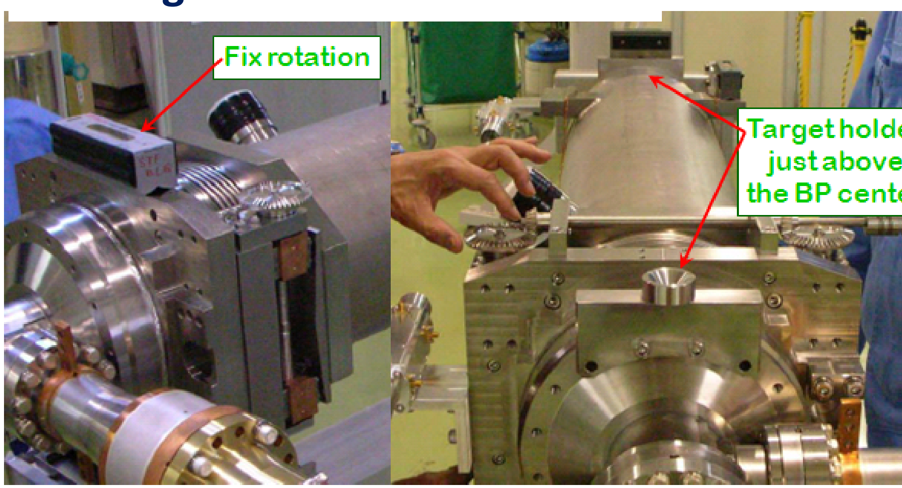


S1_

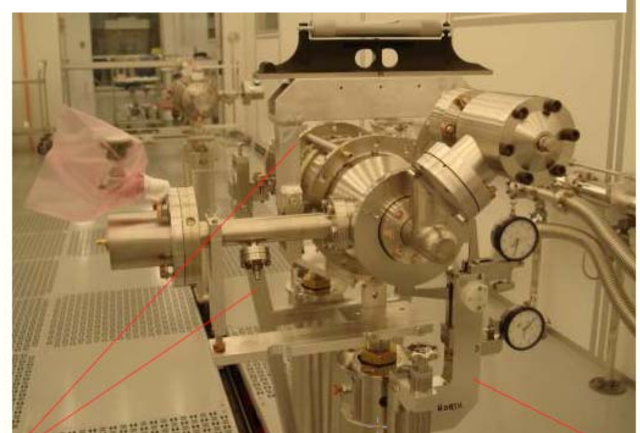
Thermal analysis of S1-G cryomodule (Module-C) by the INFN group.

Assembly study for FNAL/DESY/KEK cavities

KEK alignment tools of cavities



FNAL alignment tools of cavities

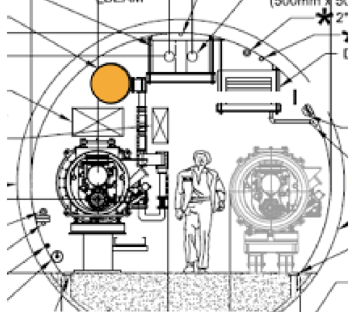


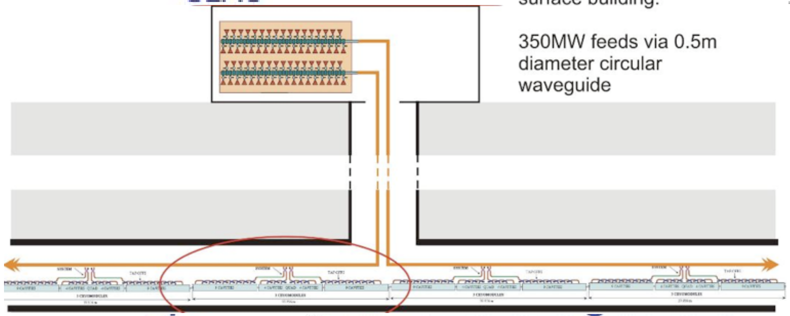
Rotational Alignment fixture

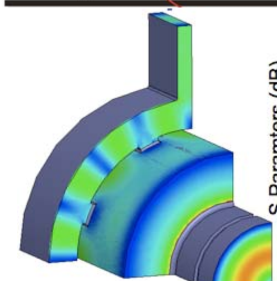
X-Y Alignment fixture

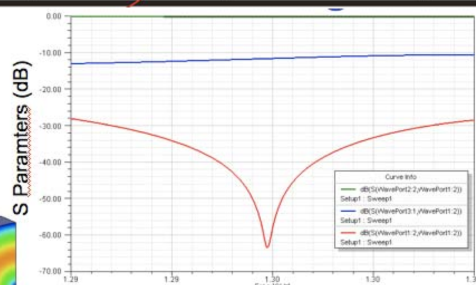
Klystron Cluster Concept for ILC High-Power RF Power Distribution

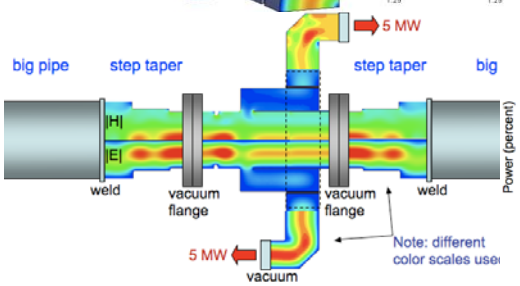
Christopher Nantista
Chris Adolphsen
SLAC

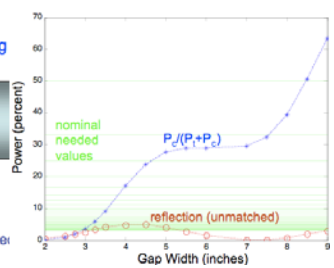










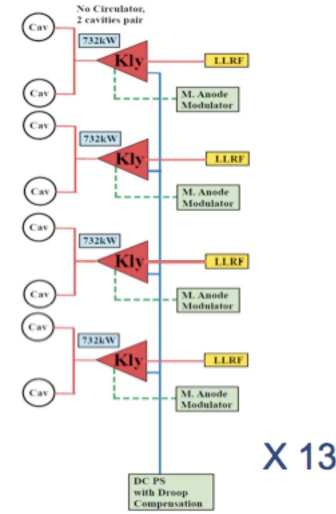


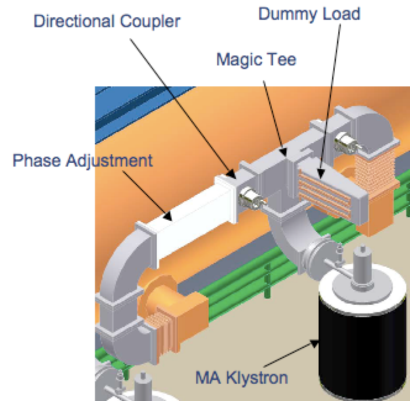
Surface klystron clusters can save ~300 M$ (~200 M$ from eliminating service tunnel and ~100 M$ from simpler power and cooling systems).

The proposed CTO tap in/off design is likely to be robust breakdown-wise. Have a plan to demonstrate its performance, although with only 1/5 of the worst case ILC stored energy after shutoff.

Distributed RF-source Scheme (DRFS) First Design

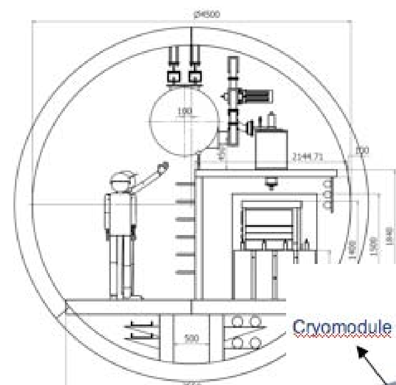
Shigeki Fukuda (KEK)



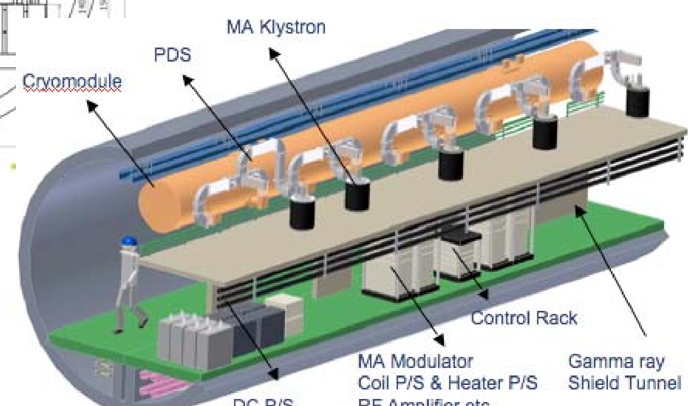


Design Parameters

- Frequency 1300MHz
- Output Power 750kW
- RF pulse width 1.565ms
- Beam pulse width 1.7ms
- Average RF power 6kW
- Peak beam voltage 62kV
- Peak beam current 21A
- Beam Perveance 1.36mP(@62kV)
- Gun Perveance 1.735mP (@Ea-k=53kV)
- DC Gun Voltage(A-B) >64kV
- Tetrode MA-type
- Electromagnetic Focusing
- Water cooling
- Total length 1.1m
- Weight 70kg



Cross Section



BDS Summary

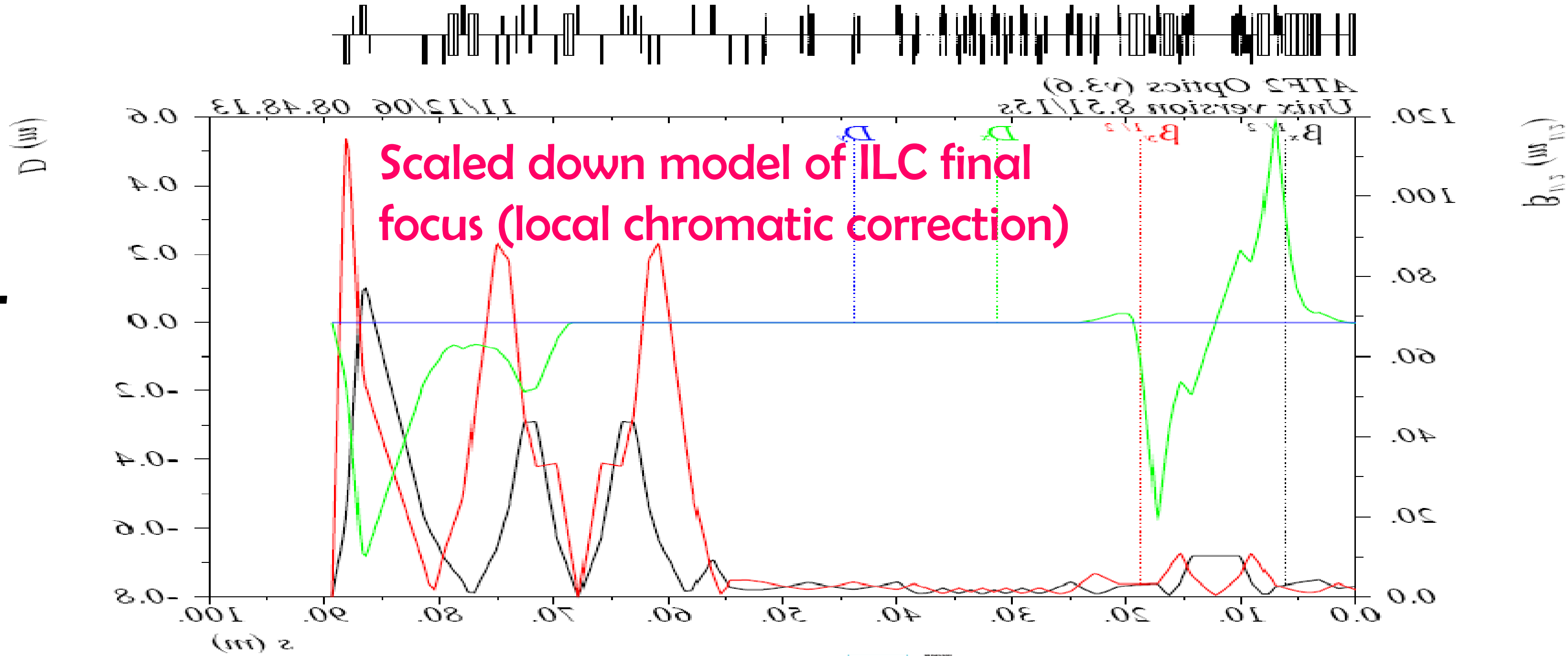
Andrei Seryi, SLAC
for the Beam Delivery team

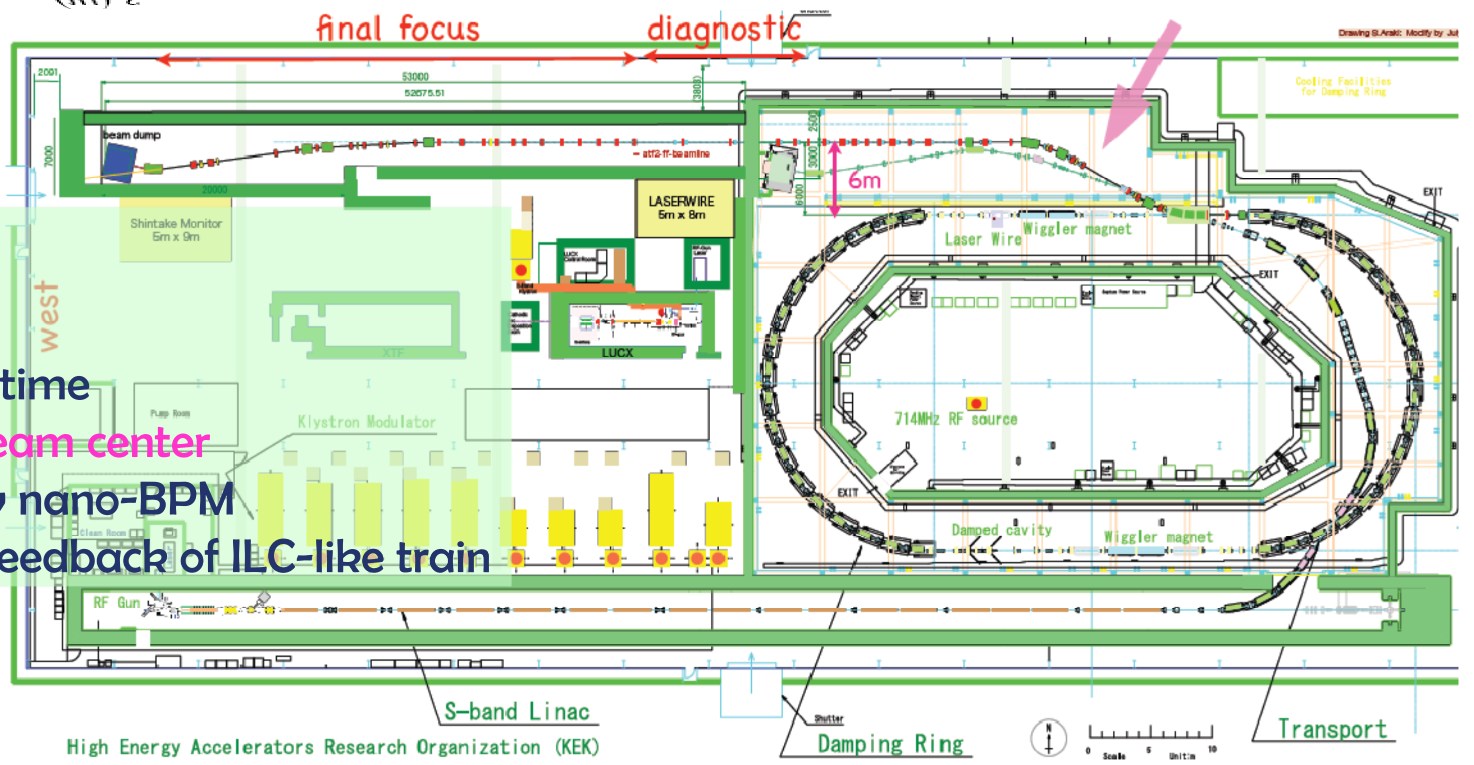
TILC09, April 21, 2009

BDS activities at TILC09

- **ATF2 – review commissioning status, next steps & longer term plans**
- **Discussion of new optics & studies for min machine**
- **Discussion with Detector colleagues on MDI progress and next steps**
- **Presentations to AAP on ATF2 and BDS/MDI**

ATF2 – model of ILC BDS





ATF2 goals

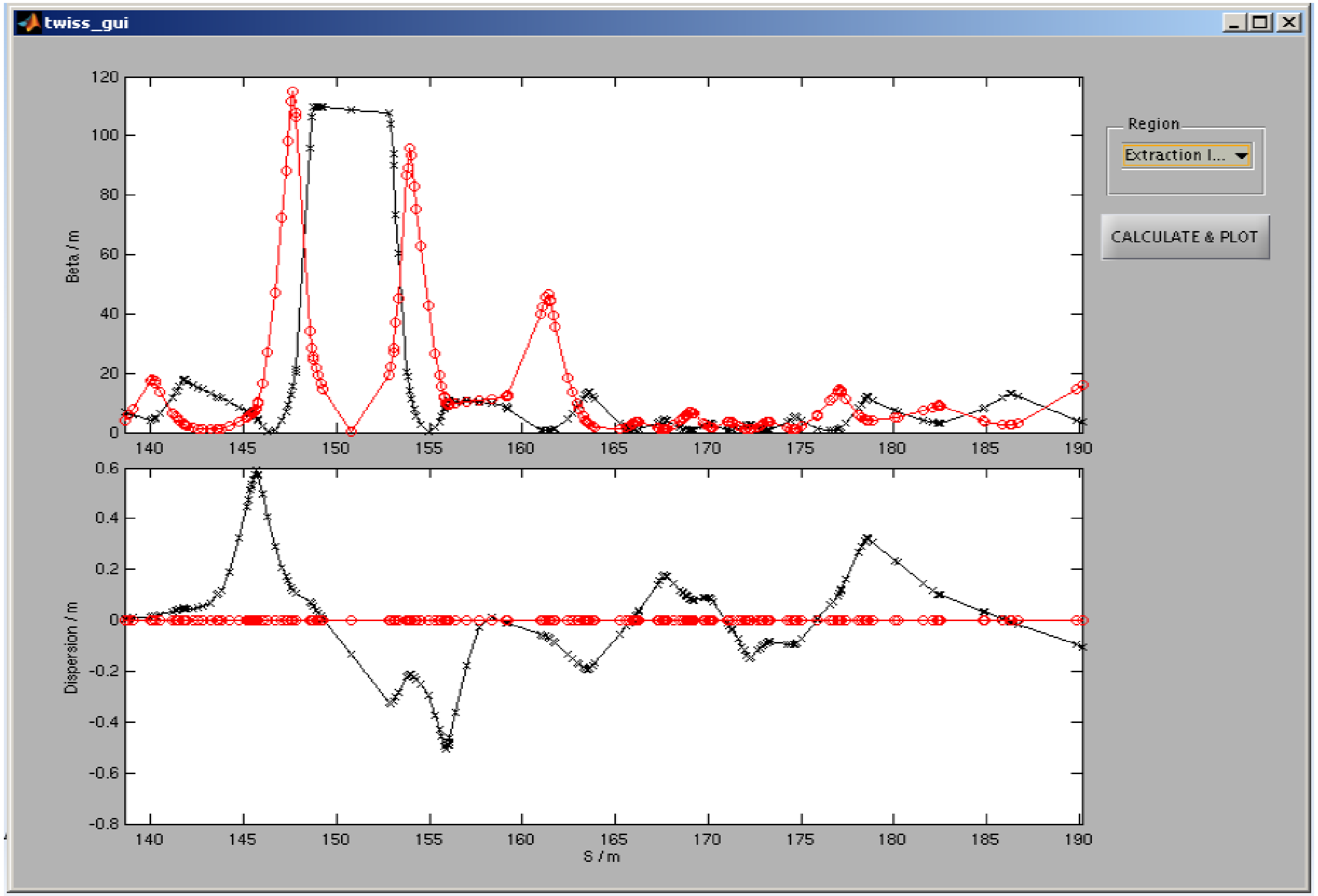
(A) Small beam size
- Obtain σ_y ~ 35nm
- Maintain for long time

(B) Stabilization of beam center
- Down to < 2nm by nano-BPM
- Bunch-to-bunch feedback of ILC-like train

Highlights of recent runs

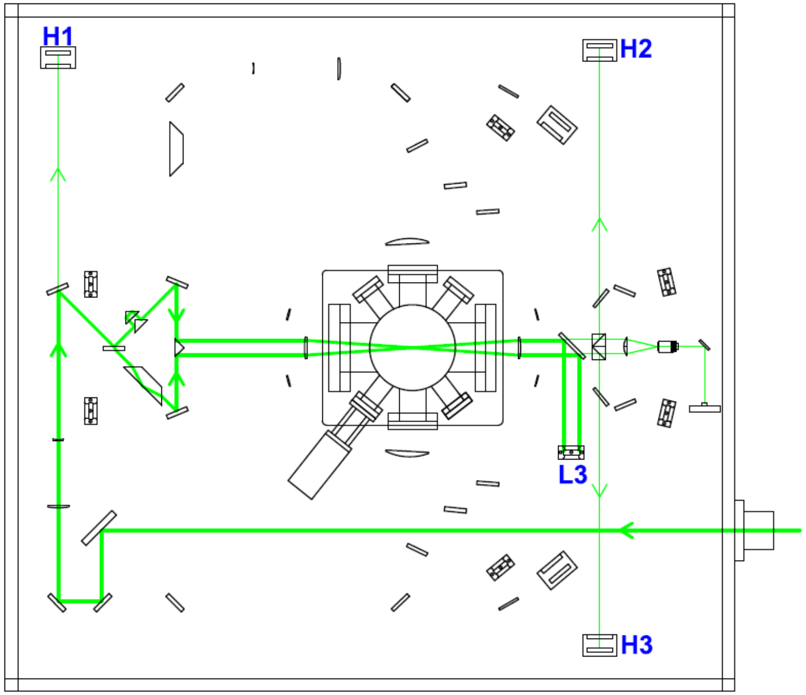
- **December 2008**
  - large IP beta optics, semi-ballistic trajectory
  - Establish beam to beam dump, minimize losses, Radiation inspection
  - First tests of hardware and tuning software (FS)
  - BSM commissioning & background characterization
- **Jan 2009**
  - Continue hardware commissioning & fast kicker study
  - Replace QM7 to one with larger aperture (possible source of EXT ε growth)
- **Feb-Mar 2009**
  - Large (8cm beta*), all magnets ON
  - Continue hardware commissioning
  - Commission laser wire mode of BSM
  - Tuning tools (EXT disp./coupling corr., IP scans, β/η & ε determ, BBA)
- **Current April 2009 run**
  - Optics verification for ~1um beam (large, 1cm β^*) / IP wire scanners
  - Commission interferometer mode of BSM

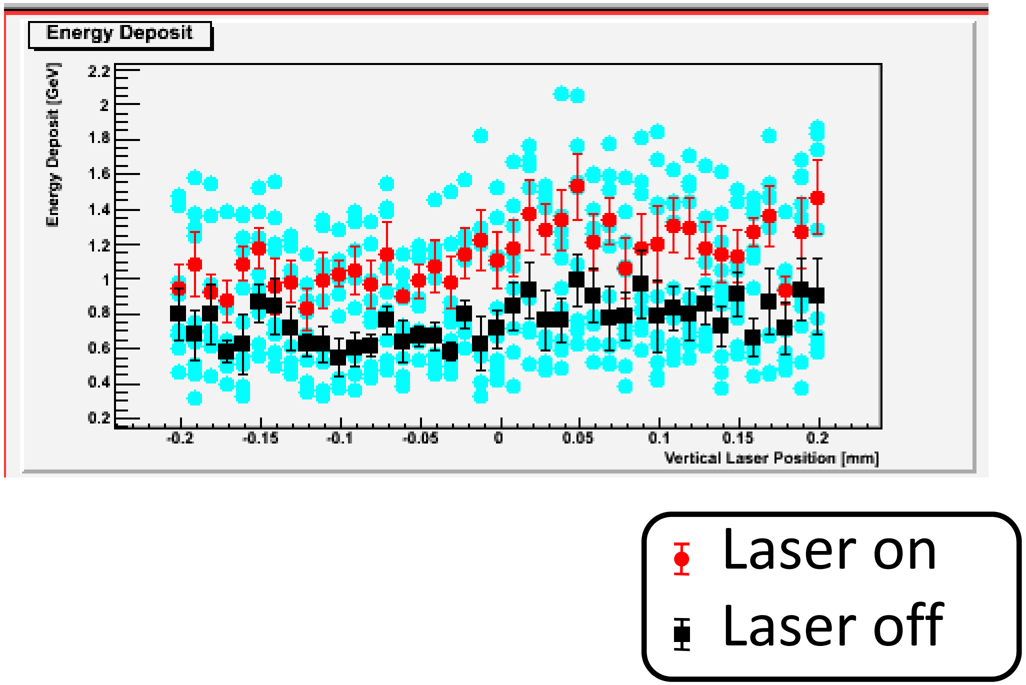
Optics verification tools



- Can verify and correct optics
- DR to EXT well matched, BMAGy~1.04

Highlights of April run





- **BSM: 8 deg mode**
- **Can observe the signal from the start**
- **Continue working on laser and optics, to achieve beam size and see it by BSM**

Summary on ATF2

- **ATF collaboration has completed construction of ATF2 facility and has started its commissioning**
- **ATF collaboration & BDS team is streamlining organization of commissioning to match the challenge and the timescale**
- **Hardware for the second goal of ATF2 is being developed**
- **Looking into the future, planning upgrade of ATF2**
- **Tentative long term plans being developed**

Conclusion

- **The BDS group, in TDP phase, is focused on**
  - ATF2 test facility
  - Machine Detector Interface
  - and several other key systems
- **that may make significant contribution to reduction of cost, risk and increase of machine performance**

GDE Main Linac and RTML Beam Dynamics

Conveners: Nikolay Solyak,
Cris Adolphsen, Kyioshi Kubo

April 20, Room 303, 14:30 – 18:00

Program

- **14:30 ILC Low energy quad --Vladimir Kashikhin (*FNAL*)**
- **14:50 General quad issues -- Chris Adolphsen (*SLAC*)**
- **15:10 Alignment studies -- John Dale (*University of Oxford / JAI*)**
- **15:30 Overview of RTML emittance control -- Nikolay Solyak (*FNAL*)**

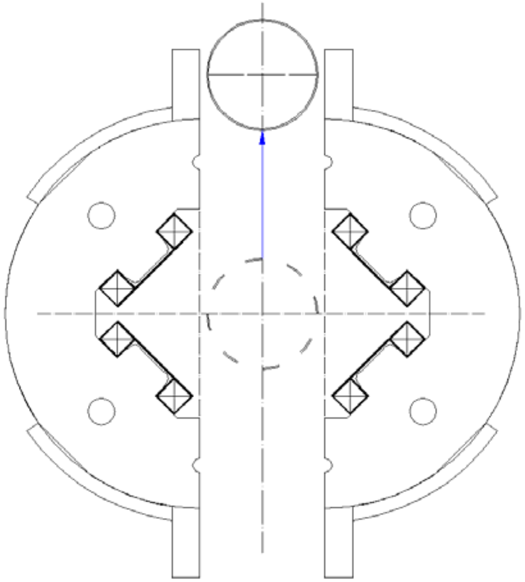
Coffee break

- **16:10 Single stage BC design – Nikolay Solyak, Andrea Latina (*FNAL*)**
- **16:30 Design of extraction line for single stage BC –**

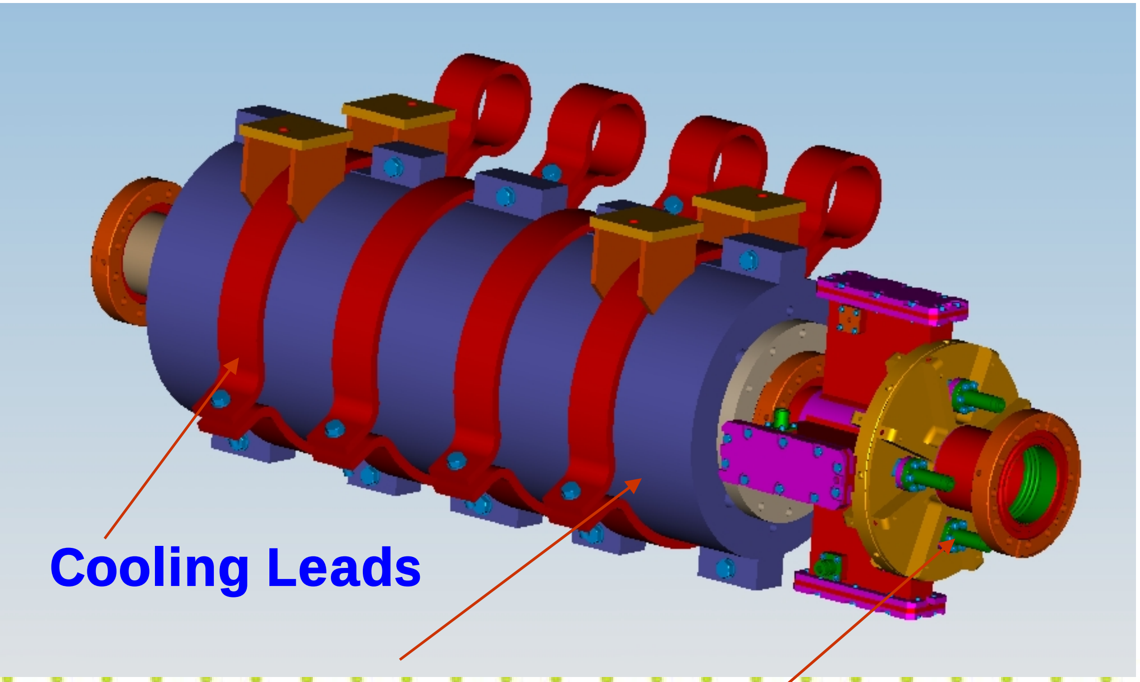
  Sergei Seletskyi (*BNL*)
- **17:00 BC simulations, recent progress at KEK - Kiyoshi Kubo (*KEK*) , Dou WANG (*IHEP*)**
- **17:20 BC alignment requirements and alignment issues –**

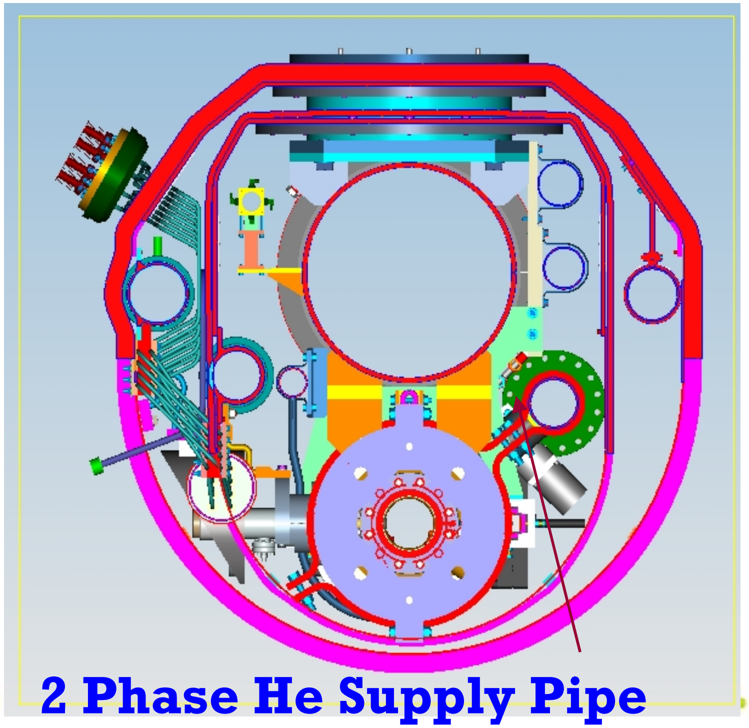
  Andrea Latina (FNAL)
- **17:40 Discussion on beam dynamics studies in RTML and ML**

Splittable ML Quadrupole



Task from ILC Project Management: Look at the Splittable Quadrupole conceptual design to provide the quadrupole package installation and replacement outside of a very clean room.





V.Kashikhin

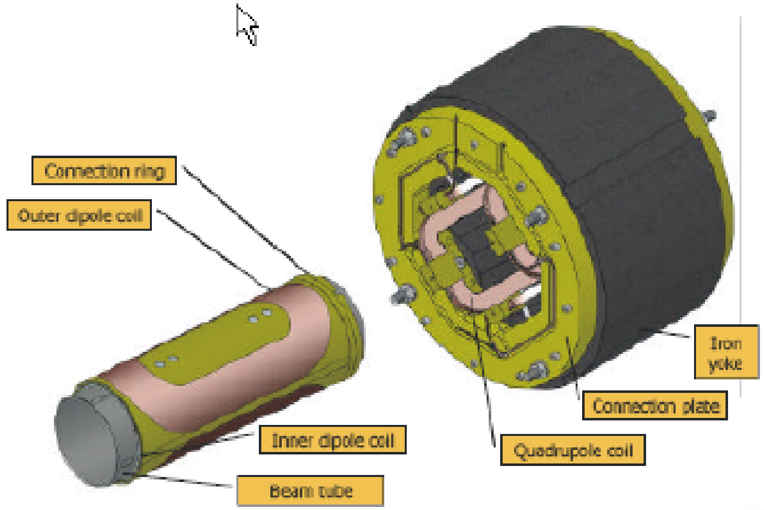
Quadrupole Final Assembly View

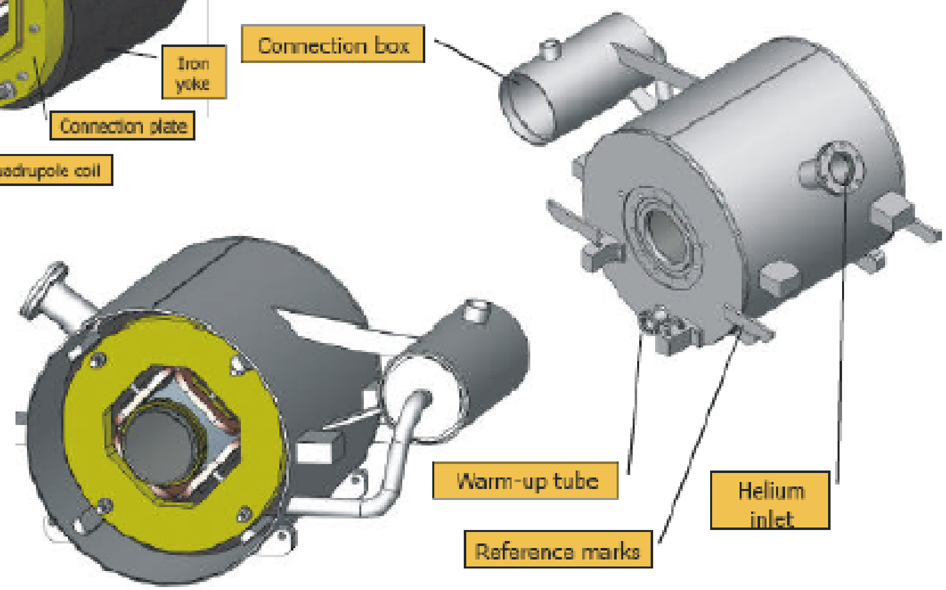
Summary

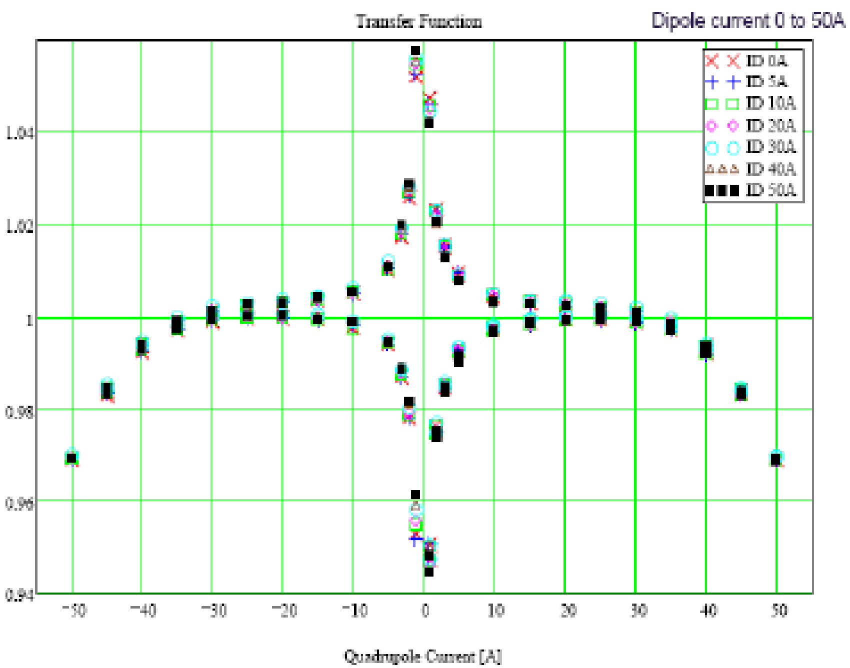
- The first look at the splittable quadrupole showed this approach visibility;
- Proposed the quadrupole concept with vertical split;
- Quadrupole has a conduction cooling from LHe supply pipe;
- Quadrupole mounted around beam pipe outside of the clean room;
- BPM has tight connection with quadrupole;
- Quadrupole bolted to the strong 300 mm diameter He gas return pipe;
- Special attention paid on the magnet assembly and mounting tolerances;
- Current leads also conductively cooled;
- Magnet cooling down time ~ 38 Hours;
- The Quadrupole model with split should be built and tested to verify the design.

XFEL Prototype Superferric 6 T SC Quad

- Design according to TUEV pressure vessel rules
- Copperized beam tube
- Sliding supports on linear bearings
- BPM attached on endplate





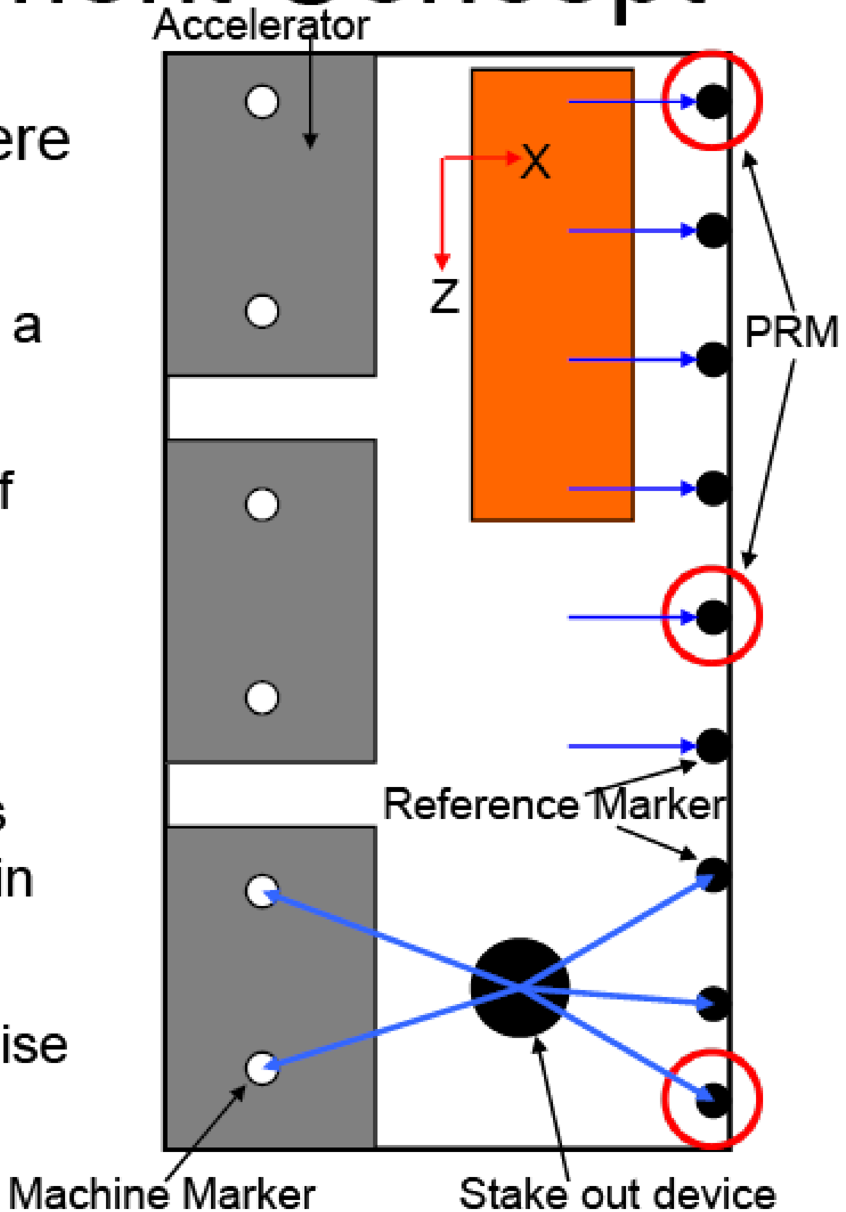


The persistent current effect of the dipole wires is very important at low currents.

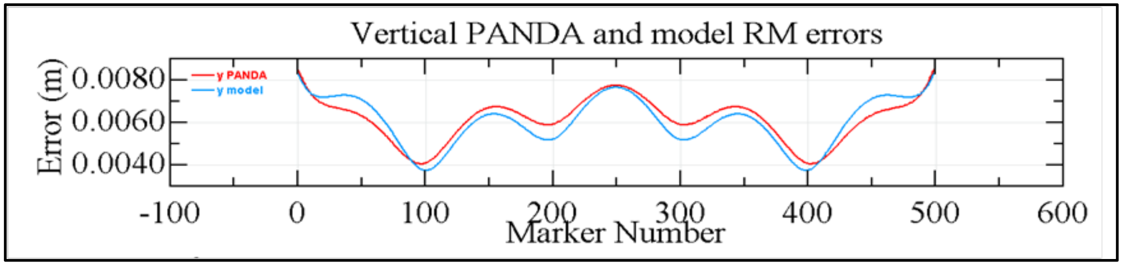
Fernando Toral

Accelerator Alignment Concept

- Many possible ways to Align an Accelerator, the concept used here is:
  - Over lapping measurements of a network of reference markers using a device such as a laser tracker, stretched wires or LiCAS RTRS
  - Measurements of a small number of Primary Reference Markers (PRM) using, for example GPS transferred from the surface.
  - Combining all measurements in a linearised mathematical model to determine network marker positions
  - Using adjusted network to align Main Linac
  - Using Dispersion Matched Steering (DMS) to adjust correctors to minimise emittance



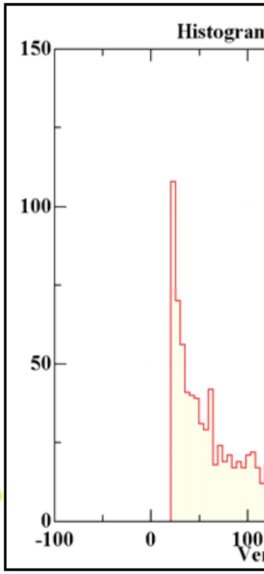
Error Curve Comparison of the simplified model with a commercial code "PANDA" for Laser Tracker Network



DMS Simulations for Laser trackers

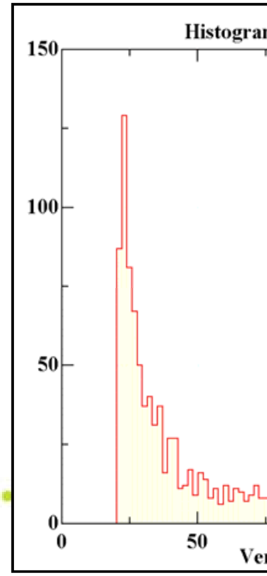
- **100 networks generated with PRMs using PANDA and the model**
- **10 DMS simulations performed on each network using Merlin**

Model



- Mean : 110nm
- 90% : 270nm
- ≤ 30nm : 18%

PANDA



- Mean : 46nm
- 90% : 104nm
- ≤ 30nm : 42%

Simulation Studies on ILC Bunch Compressor with SLEPT

Dou WANG and Kiyoshi KUBO

Summary

1. Coupler wake has been newly introduced to SLEPT. Final vertical

emittance growth in RDR BC RF section **including coupler RF kick and wakes is :**

BC1: **0.21** nm

BC2: **4.41** nm

2. DFS changing RF phase was introduced in SLEPT.
3. This DFS is not very effective to cavity tilt. (Should be checked.)
4. With all other errors except for cavity tilt, the final emittance growth can be controlled to **0.5 nm**. But the final emittance growth will be **6 nm** including 200 urad cavity tilt.
5. SLEPT is being improved to include Z-position change for BC.

Summaries of the working group activities

CONVENTIONAL FACILITIES AND SITING GROUP

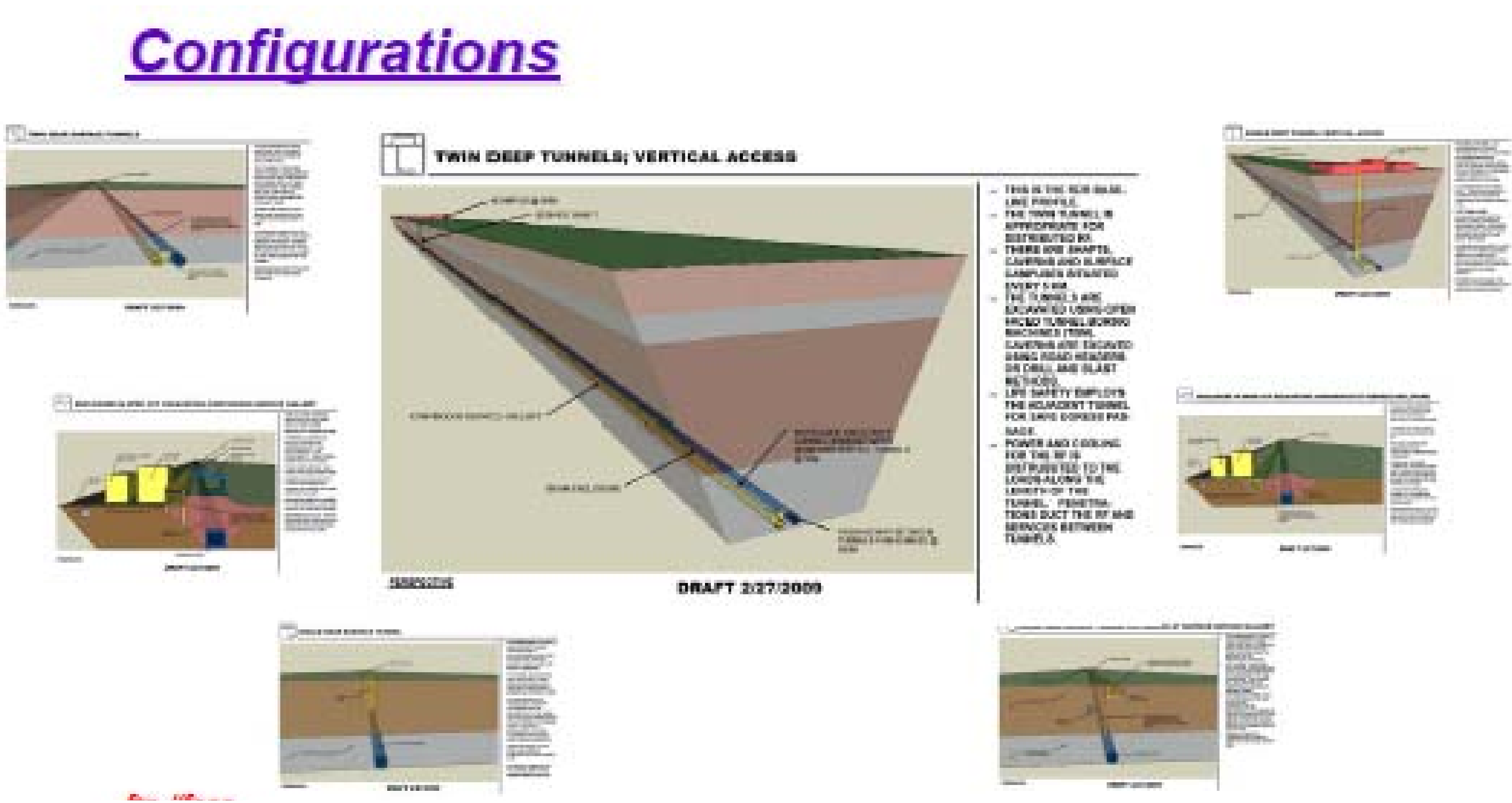
Atsushi Enomoto (KEK)
John Osborne (CERN)
Vic Kuchler (FNAL)

• Outline of CFS Activity in TILC09

– AAP Review and Parallel Session Discussion

- Saturday, (4/18)
  AM) CFS AAP Review (VK LH EH AE/MT JO VK)
  PM) CFS with Minimum Machine Design Study
  3D CAD Collaboration (LH JO)
- Sunday, (4/19)
  AM) CFS Only
  Discussion of 3D Effort with DESY
  CFS Resource Planning
  PM) SCRF AAP Review
  CFS with CLIC/ILC Cost Group
- Monday, (4/20)
  AM) Minimum Machine AAP Review
  CFS with Main Linac Group
  Klystron Cluster Alternative (VK)
  Distributed RF Alternative (AE)
  PM) Discussion of GSPI Report for Dubna Site (GS)
  Damping Ring and Positron Source AAP Review
  Executive Summary AAP Review

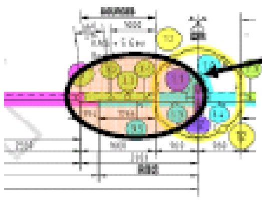
- **FNAL MM Study – Single Tunnel Configurations**



- # 3D CAD Activity at CERN

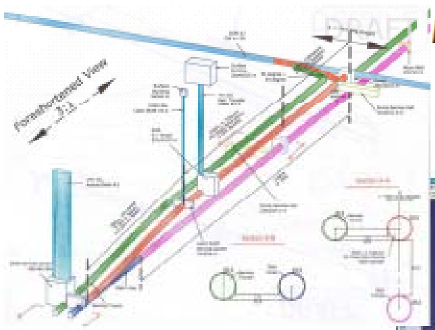
3d models for ILC started in 2009

- *Working group established*
- *Efforts co-ordinated at DESY*
- *CERN team providing civil engineering models using CATIA software (A.Kosmicki)*
- *Main Linac / BDS intersection on e- side selected as study area*
- *Models will be used in decision making process for Minimum Machine*

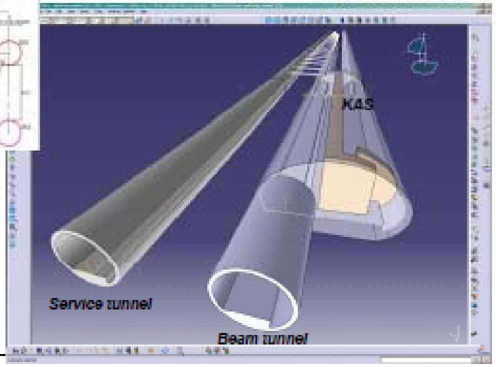


Study area

RDR SLAC Model



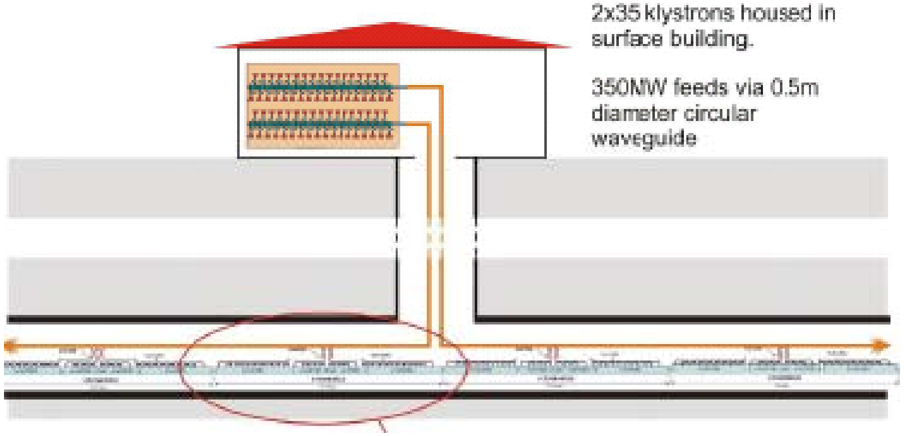
TDP Catia Model



• Preliminary Studies on Klycluster CFS

Americas KlyCluster Cost Analysis Overview

Tom Lackowski
RF & Sum reported by Peter H. Garbincius



Major Civil Changes

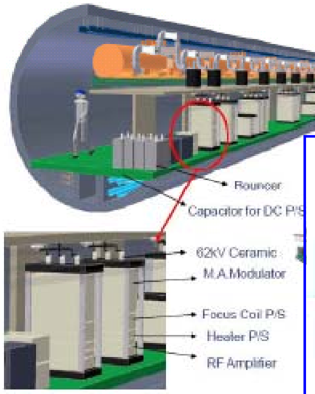
- Civil cost reduced by 28% (relative to Main Linac)
- + Added four; 3 meter diameter shafts
- + Added four (4) sites
- +Added eight (8) full and 2 half buildings for housing KLY Cluster and rack equipment.
- - Eliminated Service Tunnel: Maintained 4.5 meter tunnel Diameter
  - **+ Added 28 Refuge Areas**
- - Reduced caverns volumes by 25% (comparison made using a corrected excavated volume for caverns)

Summary

- Functional Requirements used in the RDR have been maintained.
- Life Safety further study.
- Changes in the costs are a reflection of the KLY Cluster scheme only; potential savings from other value engineering ideas have not be incorporated.
- **corresponds to -4.9% savings wrt ILC RDR est**

- **Comparison betw. KlyCluster and DRFS in a Sample Site**

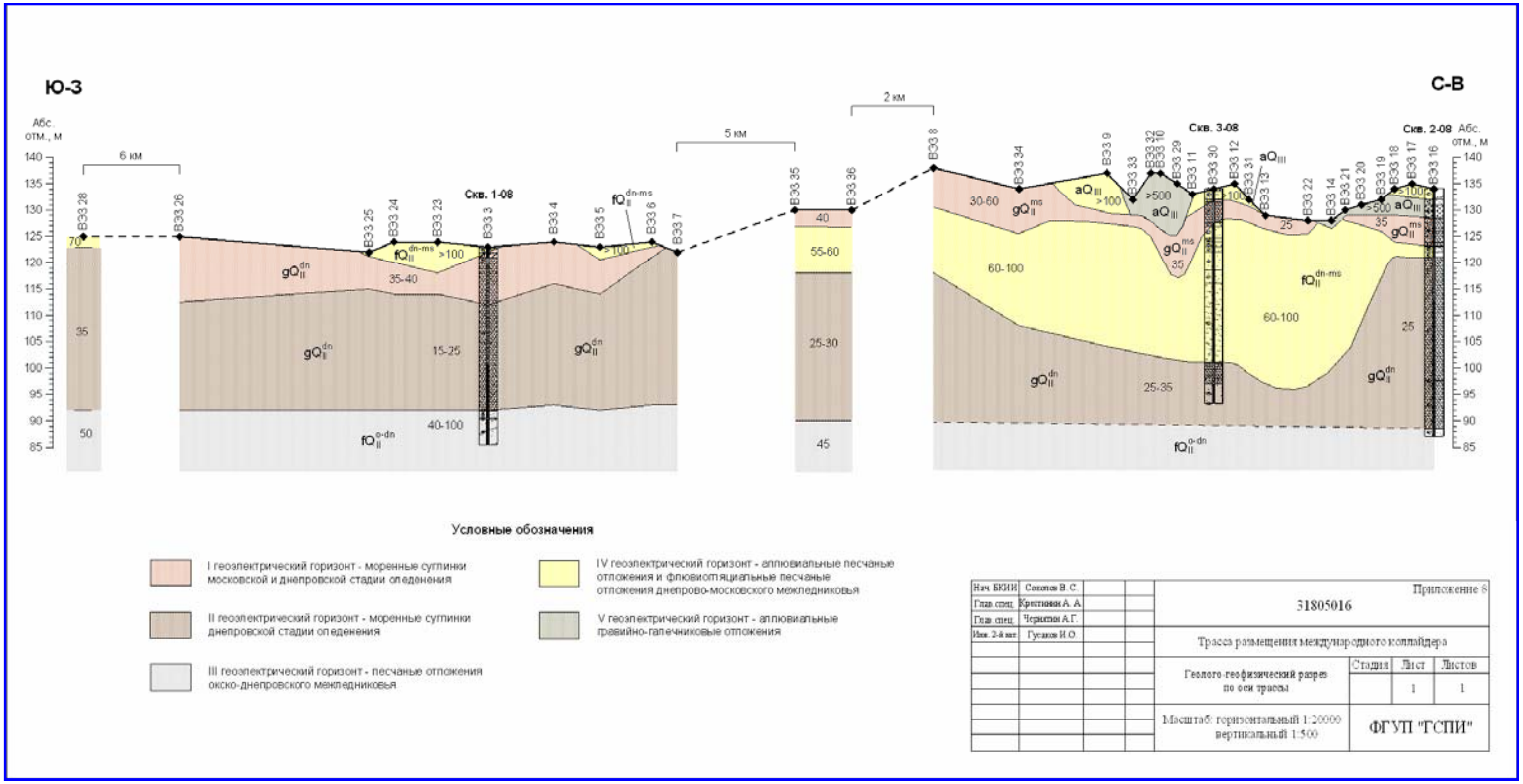
(2) Distributed RF System (Tunnel view)



Impacts on Main Linac civil engineering

Main Linac CF	RDR	RF Cluster	Distributed RF
Tunnel Penetration Safety path Safety area	ϕ4.5m, 22.3 km X2 (double) (ϕ0.43m, ϕ0.3m X2) X10m X560 1.2m X2.2m X20m X48 Opposite tunnel	ϕ4.5m, 22.3 km X1 (single) None None Refuge area	ϕ4.5m, 22.3 km X1 (single) None None Fire/smoke protection
Access shaft/tunnel (Size and quantity)	X6 7m X6.5m X~1,270m X6	X10 7m X6.5m X~1,270m X6 + 3.5m X3.5m X~1,270m X4	X6 7m X6.5m X~1,270m X6
Shaft-base cavern	X6 16m X18m X120m	X6 ~ half	X6 16m X18m X120m
Surface building	X6 4,300m² X6	X10 (4,300m² +1,000m²)X6 ~3,800m² X10	X6 4,300m² X6
Remarks		Tunnel and shaft-base cavern decreased but access-tunnels and surface buildings increased	Tunnel decreased half

- # Discussion of GSPI Report for Dubna Site



(G. Shirkov)

- # From Closing Talk at AAP Review

Summary

- *The CFS Group has Clear Direction and Milestones that are Established in the ILC R&D Plan*
- *Conventional Facilities Continues to be A Substantial Portion of the Overall Project Cost*
- *Current Resource Levels Provided for the CFS Group Support the Workload Outlined in the ILC R&D Plan*
- *This Effort is a Fundamental and Necessary Part of a Process to Generate a Complete Project Proposal*
- *The CFS Role Beyond the TDP is Likely to Depend on Factors that may be in Motion Prior to Release of the TDR and, at Some Level, Beyond the control of the CFS Group*
- *The CFS Group will Welcome the Chance to Participate in the Discussion of Our Role in the Post TDP Period*

CLIC-ILC Cost & Schedule Working Group Meeting

TILC09 – Sunday, April 19, 2009

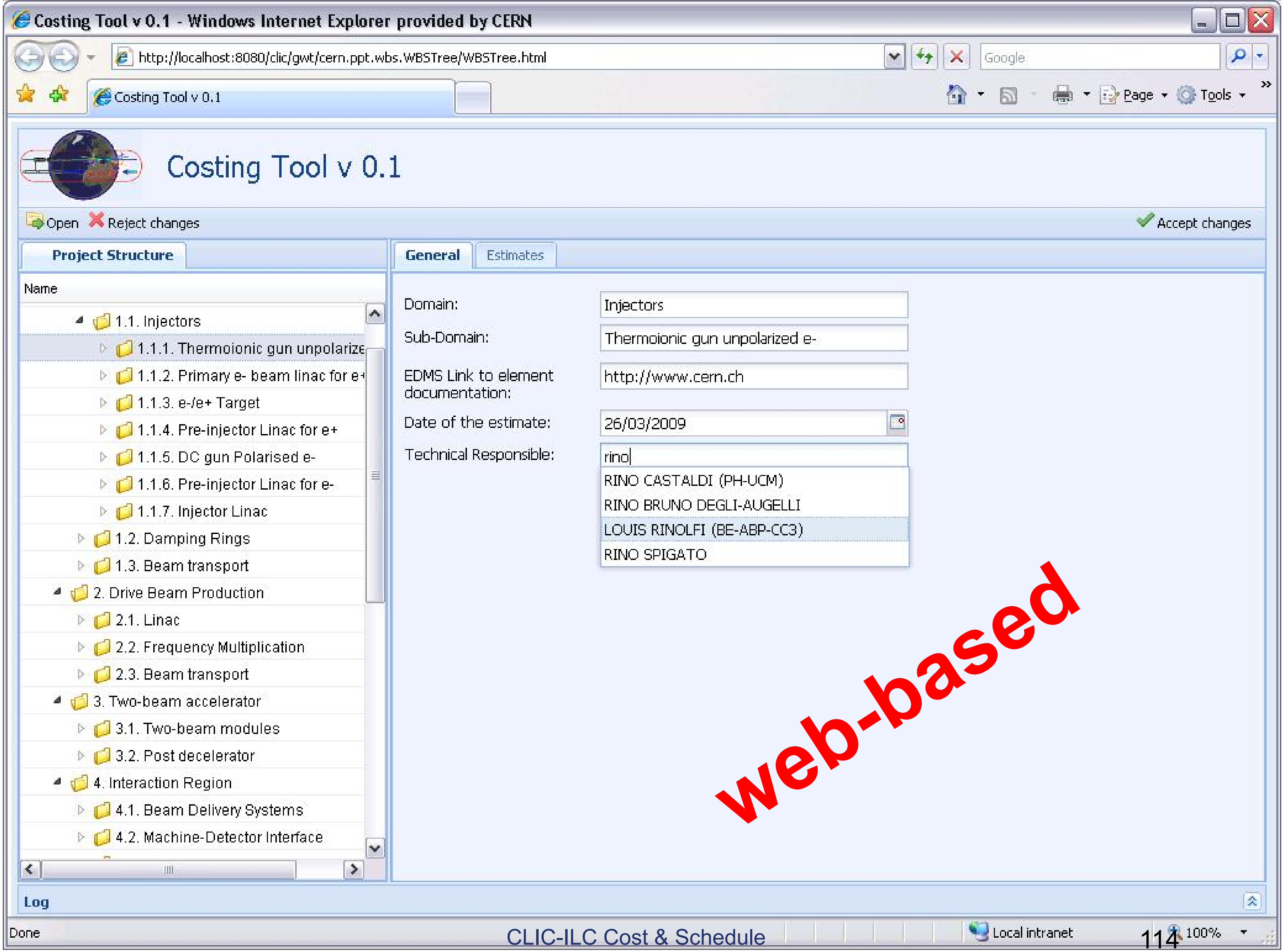
reported by Peter H. Garbincius
21 april, 09

Many thanks for many participants from CERN and CLIC to this meeting and discussions

CLIC Cost &Schedule Mandate

- Establish and optimize the **cost** of the CLIC complex at the nominal colliding beam energy of **3 TeV**, as well as that of an optional first phase with a colliding beam energy of **500 GeV**
- Define and optimize the general **schedule** for the 3 TeV and 500 GeV projects defined above
- Estimate the **electrical power consumption** of the 3 TeV and 500 GeV projects defined above
- Identify possible modifications of parameters and/or equipment leading to substantial capital and/or operational cost savings, in order to define **best compromise between performance and cost**
- Develop **collaboration with ILC** project on cost estimate methodology and cost of common or comparable systems, aiming at mutual transparency
- Document the process and conclusions in the **CDR in 2010**

(see posting for Methodology & Activities)



Costing Tool v 0.1 - Windows Internet Explorer provided by CERN
http://localhost:8080/clic/gwt/cern.ppt.wbs.WBSTree/WBSTree.html
Google
Costing Tool v 0.1
Page
Tools
Costing Tool v 0.1
Open
Reject changes
Accept changes
Project Structure
General
Estimates
Name
1.1. Injectors
1.1.1. Thermoionic gun unpolarize
1.1.2. Primary e- beam linac for e+
1.1.3. e-/e+ Target
1.1.4. Pre-injector Linac for e+
1.1.5. DC gun Polarised e-
1.1.6. Pre-injector Linac for e-
1.1.7. Injector Linac
1.2. Damping Rings
1.3. Beam transport
2. Drive Beam Production
2.1. Linac
2.2. Frequency Multiplication
2.3. Beam transport
3. Two-beam accelerator
3.1. Two-beam modules
3.2. Post decelerator
4. Interaction Region
4.1. Beam Delivery Systems
4.2. Machine-Detector Interface
Domain:
Injectors
Sub-Domain:
Thermoionic gun unpolarized e-
EDMS Link to element documentation:
http://www.cern.ch
Date of the estimate:
26/03/2009
Technical Responsible:
rino
RINO CASTALDI (PH-UCM)
RINO BRUNO DEGLI-AUGELLI
LOUIS RINOLFI (BE-ABP-CC3)
RINO SPIGATO
web-based
Log
Done
Local intranet
100%

Cost variance analysis => Probabilistic approach depends on ***correlations*** between estimated items

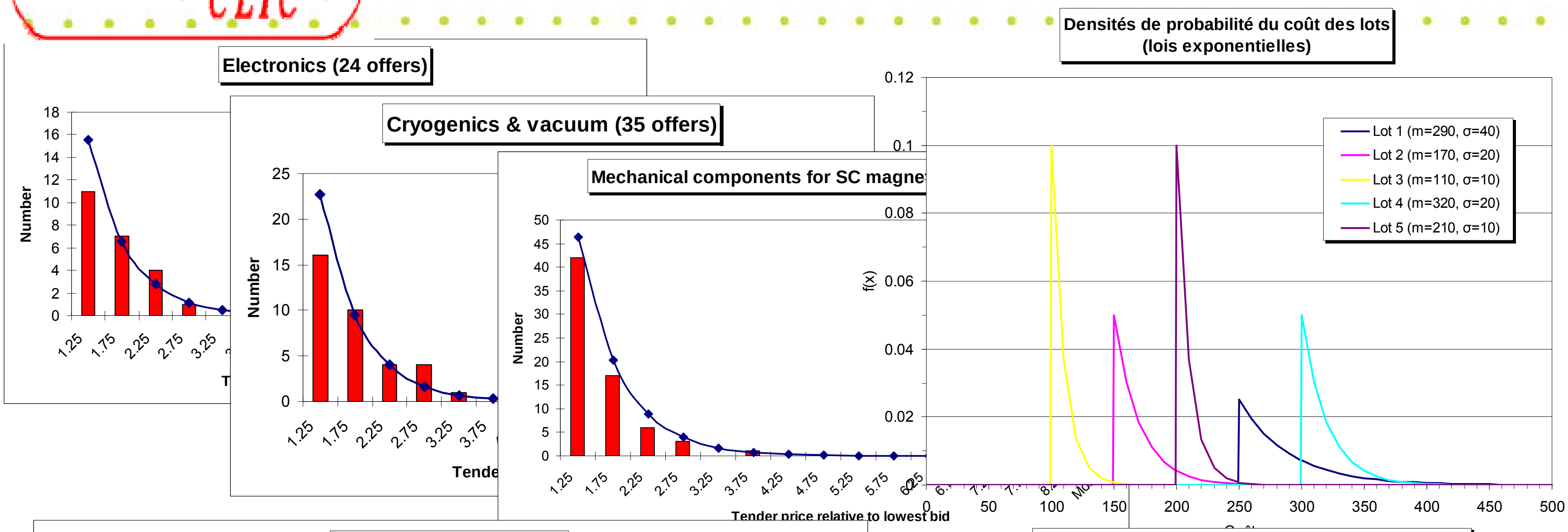
Cost variance factor	Evolution of configuration	Technical risk in execution	Evolution of market	Commercial strategy of vendor	Industrial price index	Exchange rates, taxes, custom duties
Lot 1						
Lot 2						
Lot 3						
…						
Lot N						
Total						

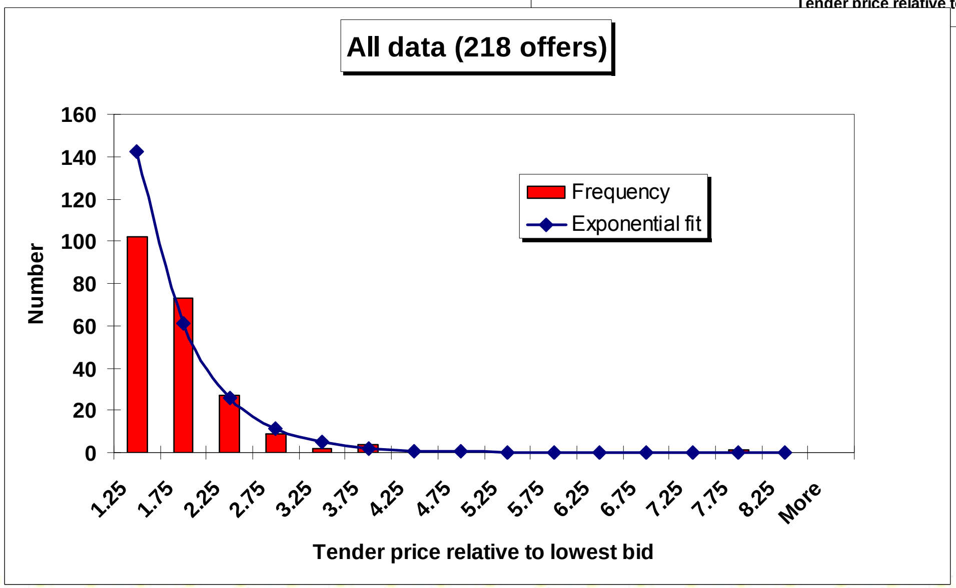
Not addressed here

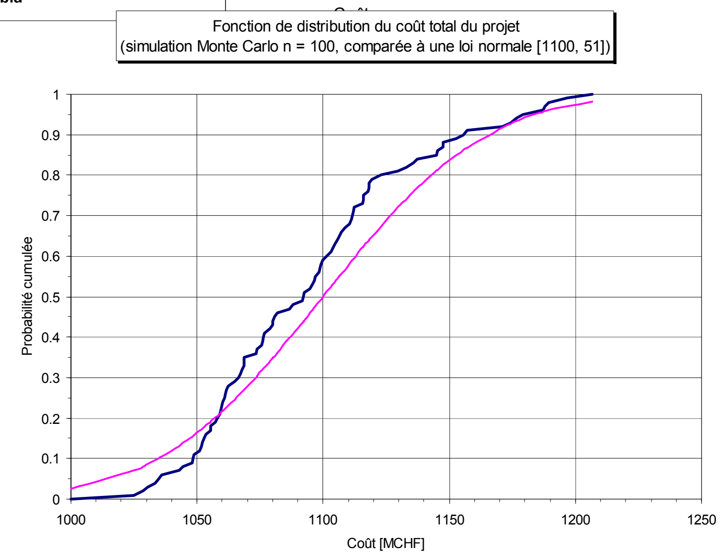
Coped for in tender price variance

Deterministic & compensated, not addressed here

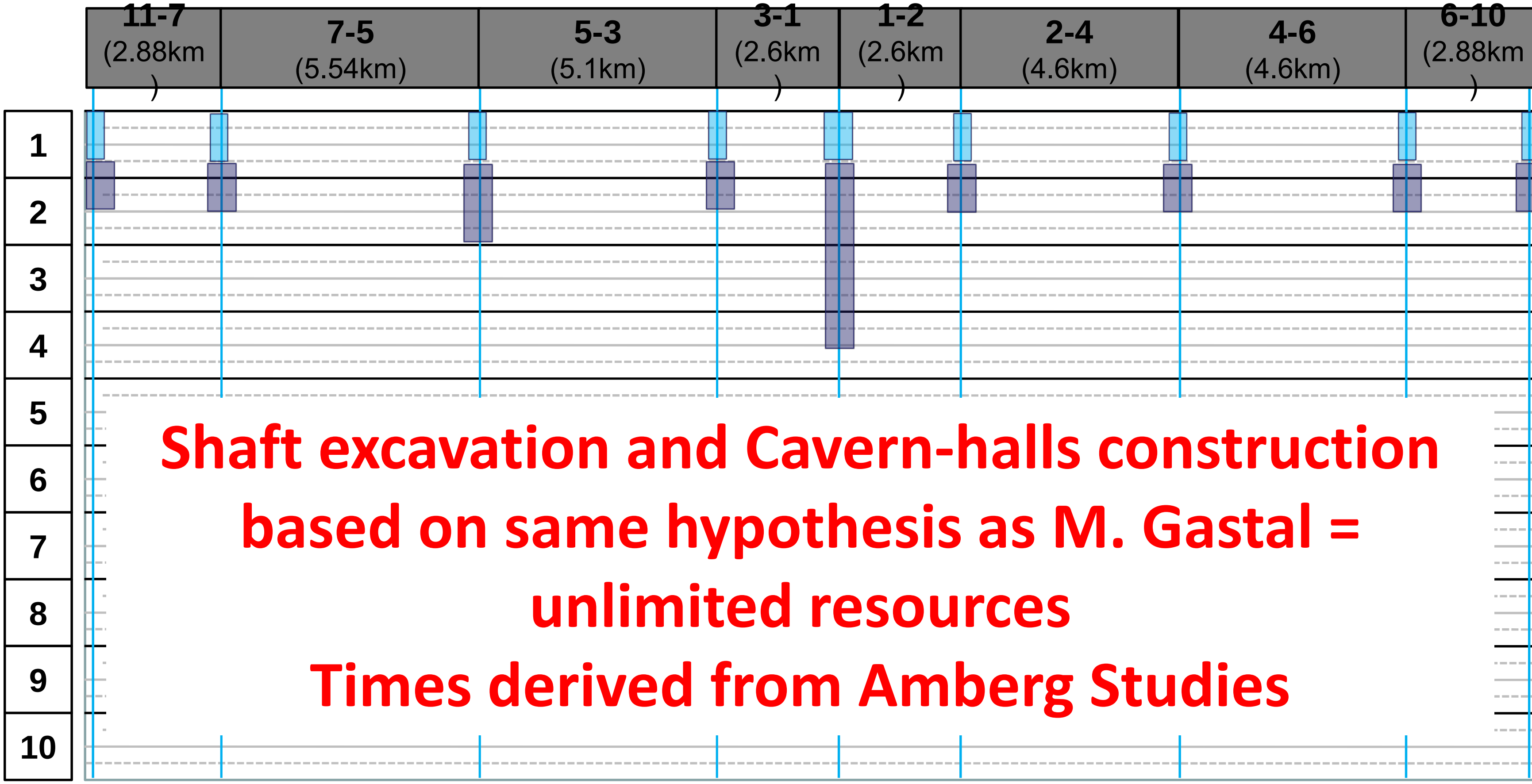
LHC experience on tenders







ILC - Civil engineering works

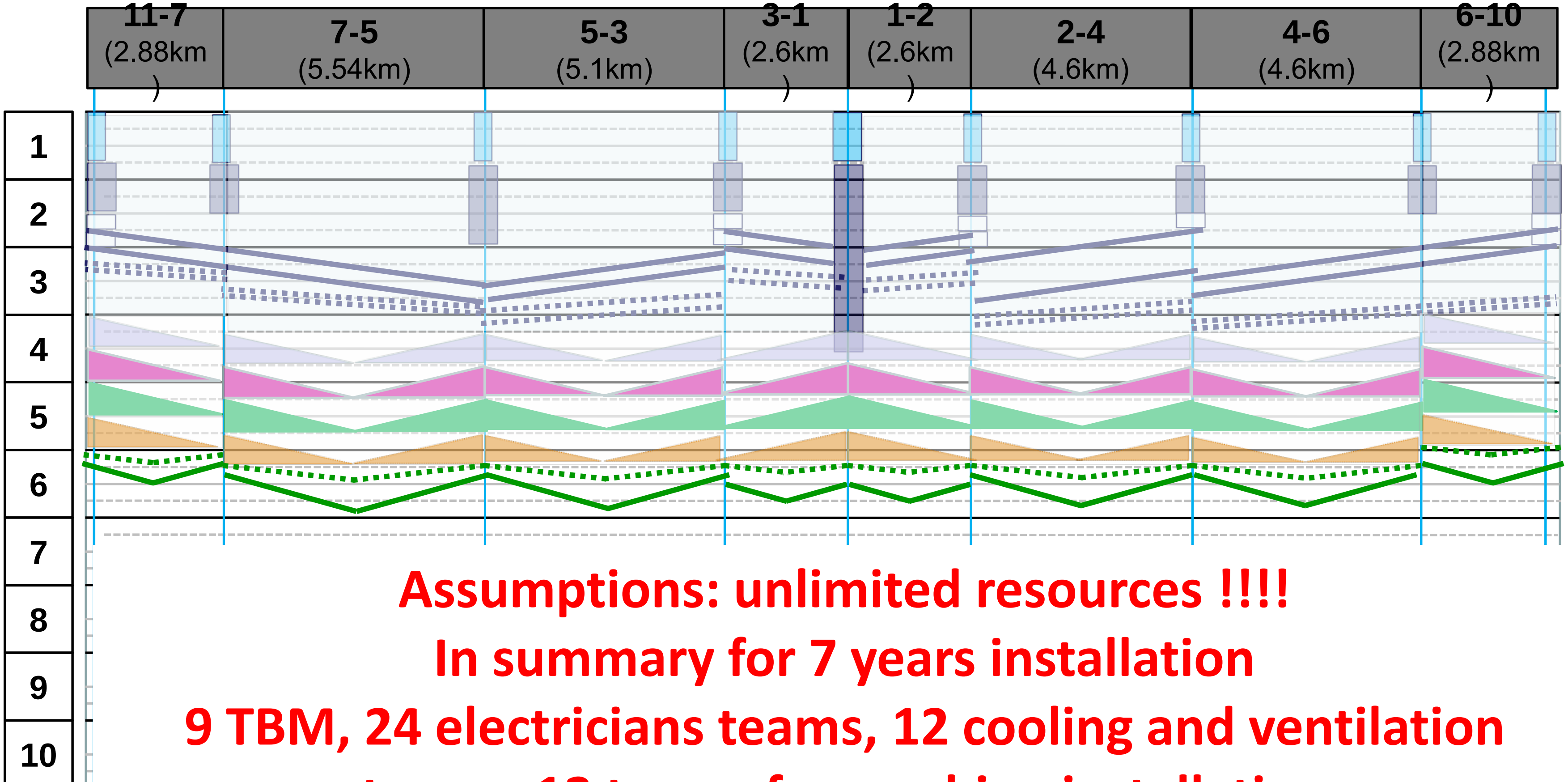


Shaft excavation and Cavern-halls construction based on same hypothesis as M. Gastal = unlimited resources

Times derived from Amberg Studies

- Site installation & shaft excavation
- Cavern and halls
- TBM installation
- Tunnel excavation
- Tunnel concrete and finishes

ILC - Machine installation



Assumptions: unlimited resources !!!!

In summary for 7 years installation

9 TBM, 24 electricians teams, 12 cooling and ventilation teams, 12 teams for machine installation

Support installation and alignment (250m/wk)

Machine inst.: transport and interconnections (progress rate to be confirmed 100m/wk)

more realistic: 4 TBM, 8 elec, 4 hvac, 2 mach inst => 9.5 yrs

our common plans - *11/08*:

- √ CLIC-ILC Cost & Schedule Working Group WEBEX, 2nd Thursday of each month
- √ Keep work towards cost estimate mutually transparent
- √ Profit by synergies
- √ Understand and communicate unavoidable differences in the methodologies used for the two projects
- √ Construction & installation schedules for CLIC & ILC w same methodology – 6/09
- Common ILC/CLIC notes (for mid ’09)
  - Tunnel safety underground compliance
    defer to: Fabio Corsenego - ILC-CFS and CLIC-CES groups
  - Standardization methods to estimate cost of warm magnets including cabling and power supplies – Braun & Garbincius gathering materials, but international magnet fabrication experts ***– are just not available! - defer***
  - Description of cost risk assessment – Lebrun, Riddone, Lehner, Garbincius ***reviewed other applications, started outlining this mgt – outline soon!***

Summary of Accelerator Design & Integration

Saturday April 18

Ewan Paterson

GDE

Purpose of Meeting

- **Face to face meeting of Technical Area Group Leaders and Management to**
  – hear status reports on “Minimum Machine” R&D programs.

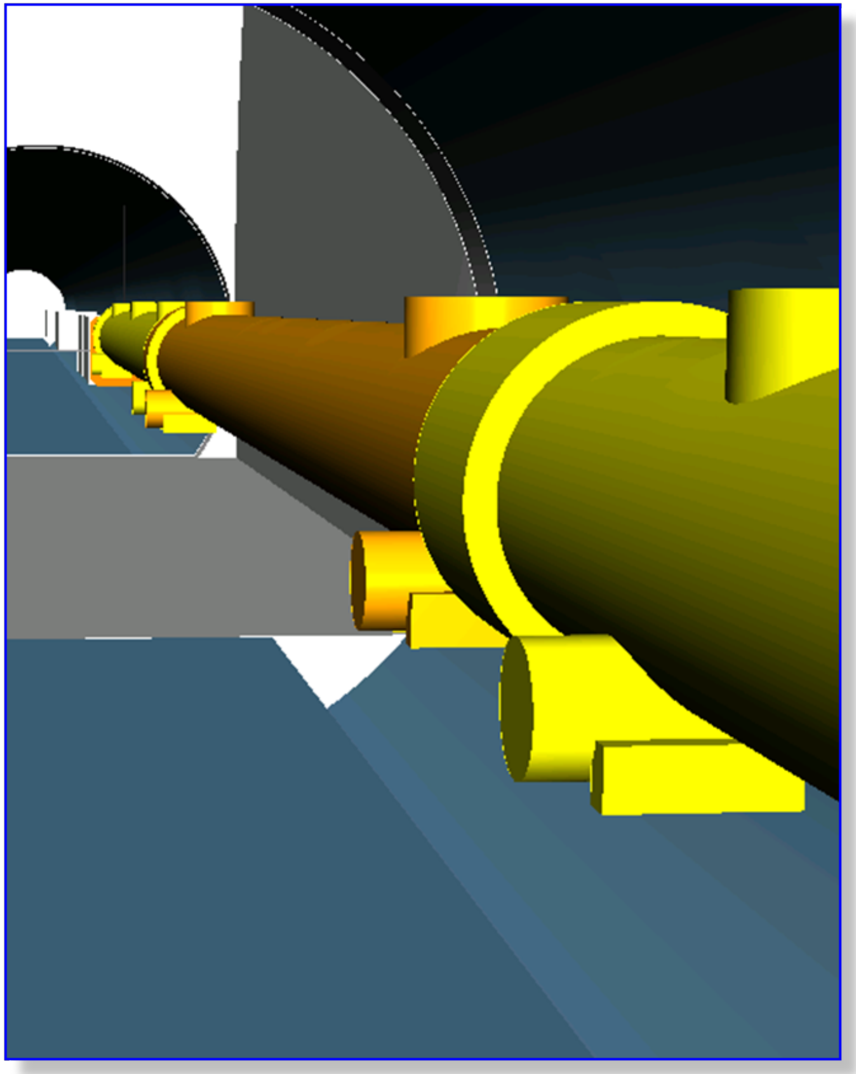
- **Discussion of plans for continuing work towards re-baseline in 2010**

PROGRAM

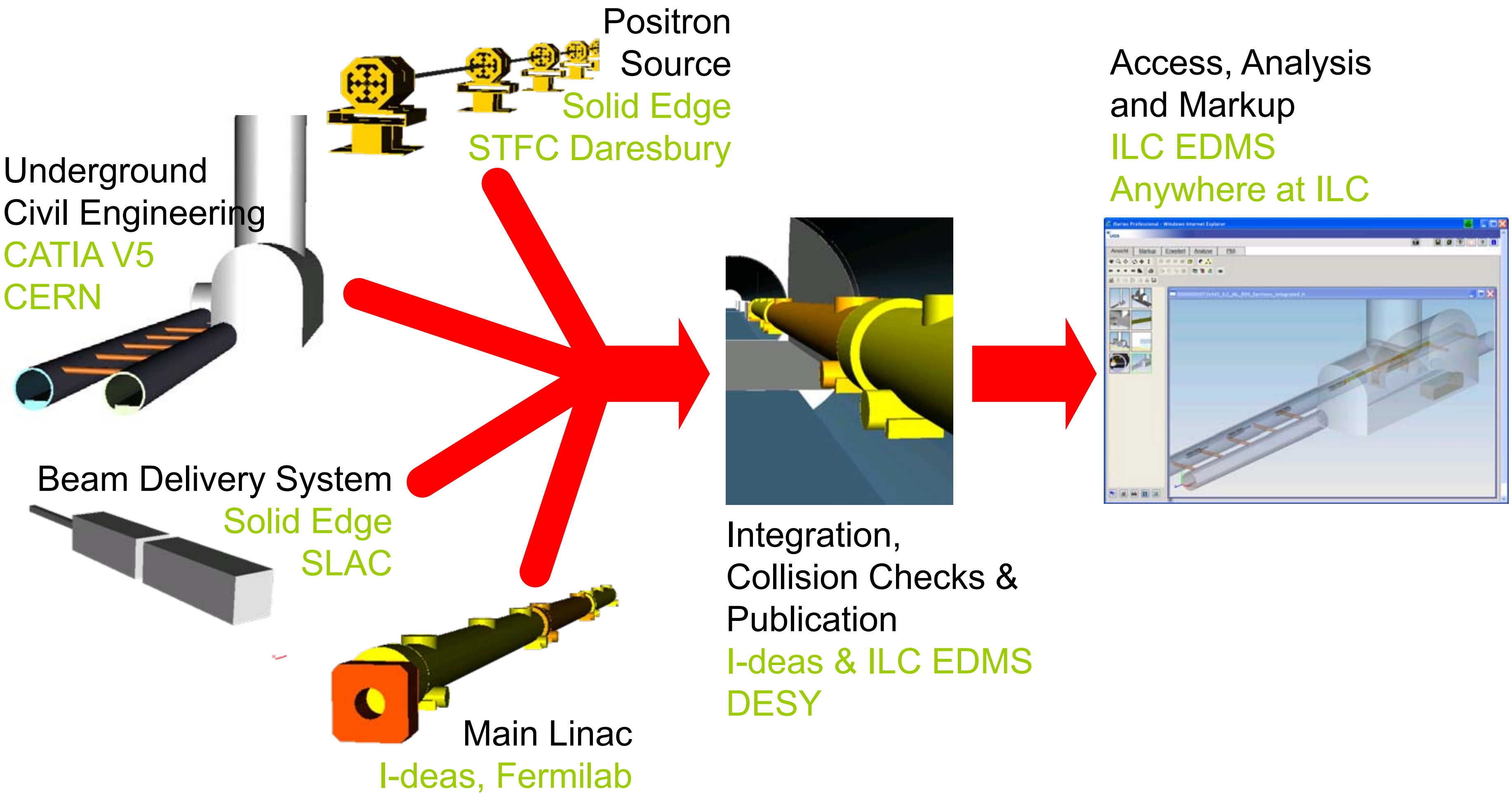
• **Status of 3D CAD development**	**Lars Hagge**
• **Beam Delivery studies**	**Andrei Seryi**
• **E+ Source studies**	**Jim Clarke**
• **Damping Ring studies**	**Susanna Guiducci**
• **Klystron Cluster R&D**	**Chris Adolphsen**
• **Distributed RF**	**Shigeki Fukuda**
• **Near term studies**	**Ewan Paterson**
• **AD&I towards re-baseline**	**Nick Walker**

Objective

- **Provide 3D visualization of conceptual design models enabling e.g.**
  - collision checks – will facilities fit into tunnel?
  - interface compliance checks
  - studies and animation, e.g. safety concept, installation procedures
- **Establish unified design process and platform**
  - integrate contributions from TAG design eng's
  - demonstrate feasibility at TILC09



3D CAD Collaboration Test Scenario



Proposing the Updated Baseline

- **Project Management will drive re-baseline design**

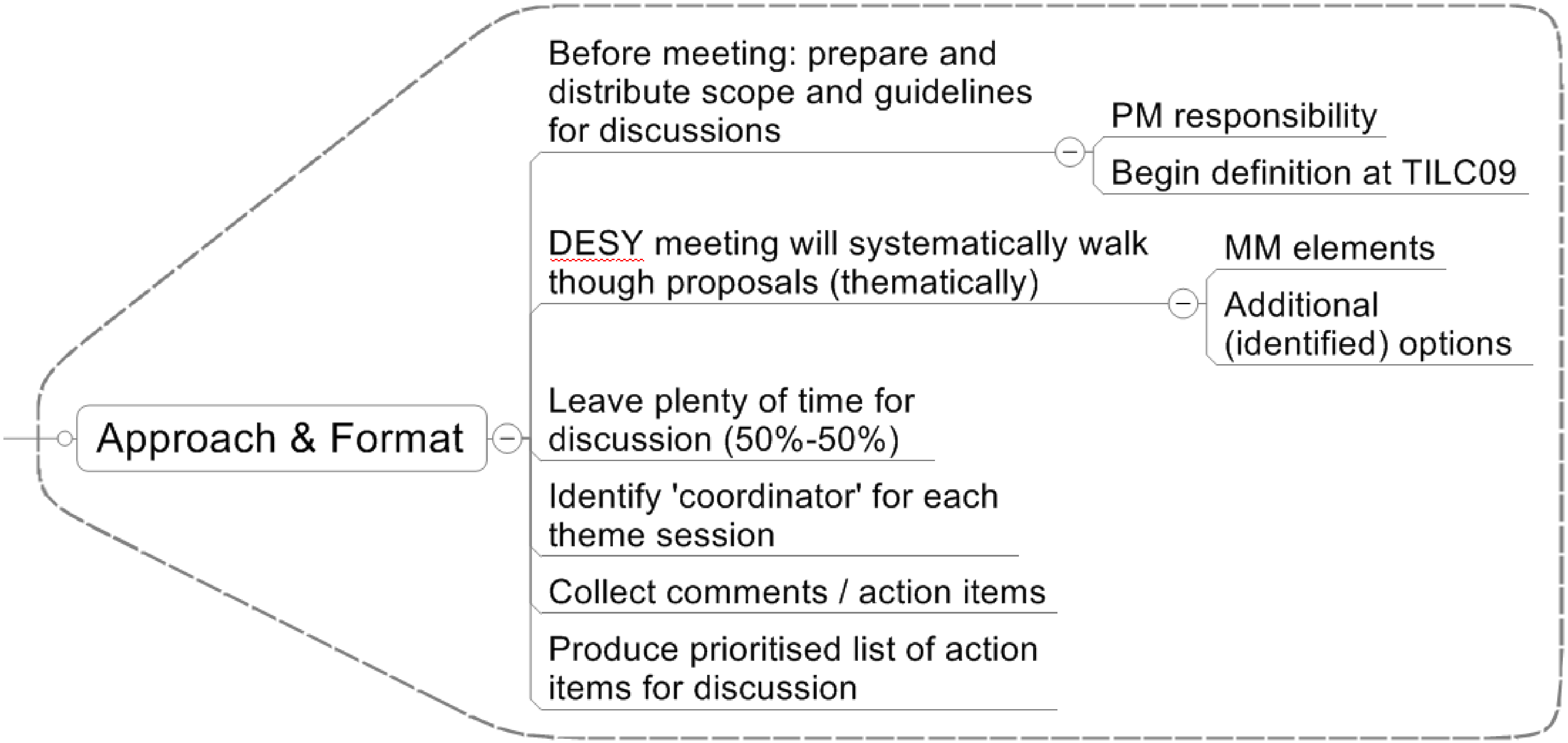
- **Core "design & integration" team** (~30 people)
  - TAG leaders
  - Cost Management Group
  - Few key (specialist) additions

- **Series of face-to-face meetings foreseen**
  - DESY 28-29.05
  - ALCPG GDE meeting (Albuquerque) 29.09-03.10
  - (Possible meeting in early December – tbc)

- **Produce proposed baseline early 2010**
  - Review process → consensus → sign-off

- **Mechanisms for transparency and communication during process needs to be defined**
  - Particularly true for Physics & Detector groups

DESY Meeting

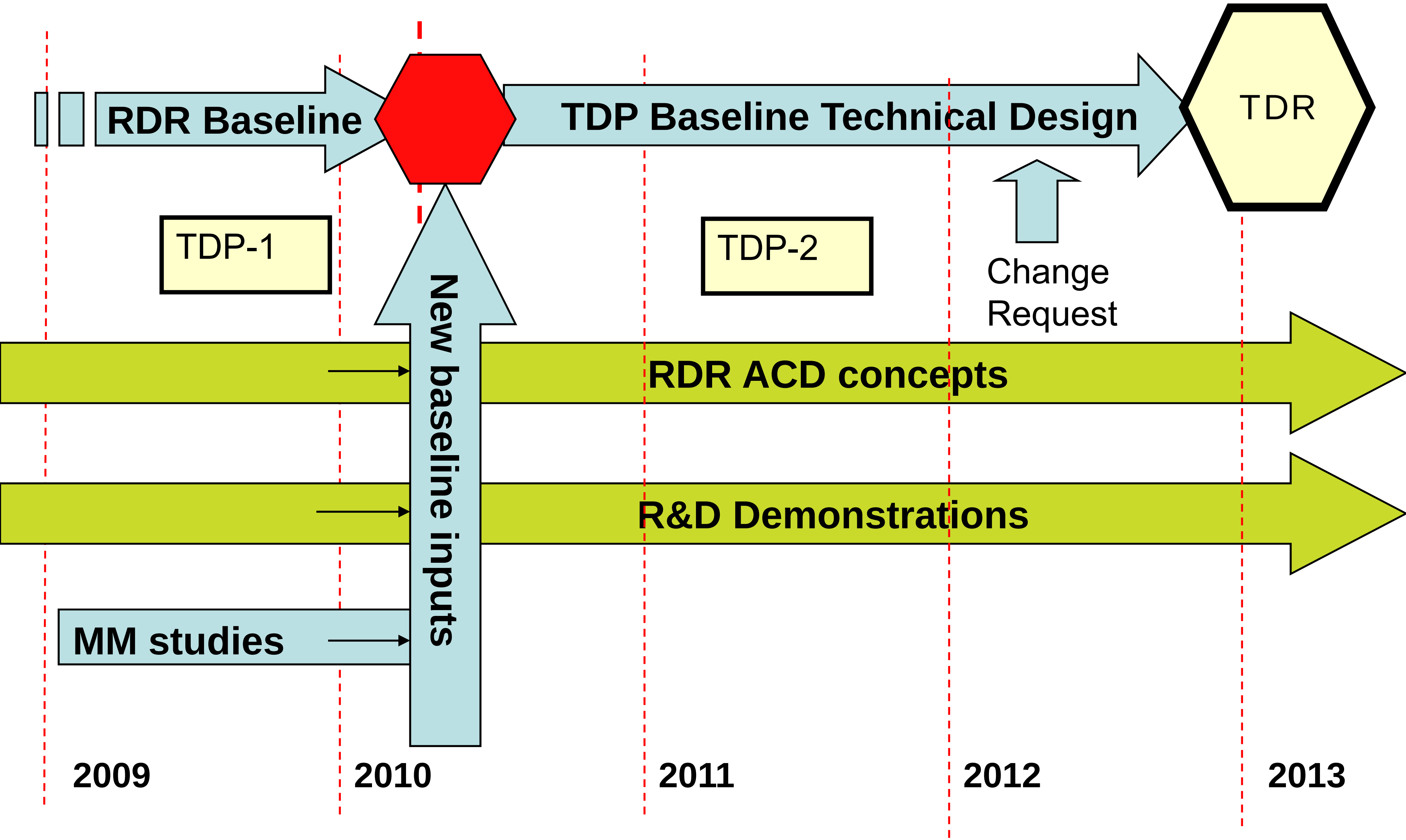


- **Tentative structure on InDiCo**
  - http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3526

What are we aiming for

- **A list of modifications to the RDR**
  - MM document will provide many
  - Others can be proposed (within the guidelines TBD)
- **We may not arrive at a single baseline**
  - We must discuss the implications of regional constraints
  - Possibility of supporting (costing) multiple variants
- **But we must constrain the number of variants to an absolute minimum**
  - CFS global resources are critical!
  - Minimise parallel effort

Technical Design Phase and Beyond



Summary

- **SCRF technology is progressing**
  - Approaching the TDP-1 goal: field gradient of 35 MV/m with the process yield of 50 % with the most qualified vender's fabrication and two leading SCRF laboratory's processes.
- **CF&S engineering study in progress**
  - Various studies on geological site condition in progress
  - A sample site geological survey has been provided,
- **Accelerator System R&D in progress**
  - ATF-2 commissioned to study low emittance beam
  - CESR-TA is playing an essential role to study e-cloud,
  - FLASH 9 mA study progressing to study the ILC accelerator beam condition, using the SCRF linac at DESY.
- **Re-Baseline for Acc. Design and Eng.**
  - Toward cost-driven accelerator design in TDP-2.

Many thanks, again

- ***For your cooperation to bring the TILC-09 meeting being completed successfully, and***

- ***For your further cooperation in advance to bring the ILC to be a real project in our near future.***

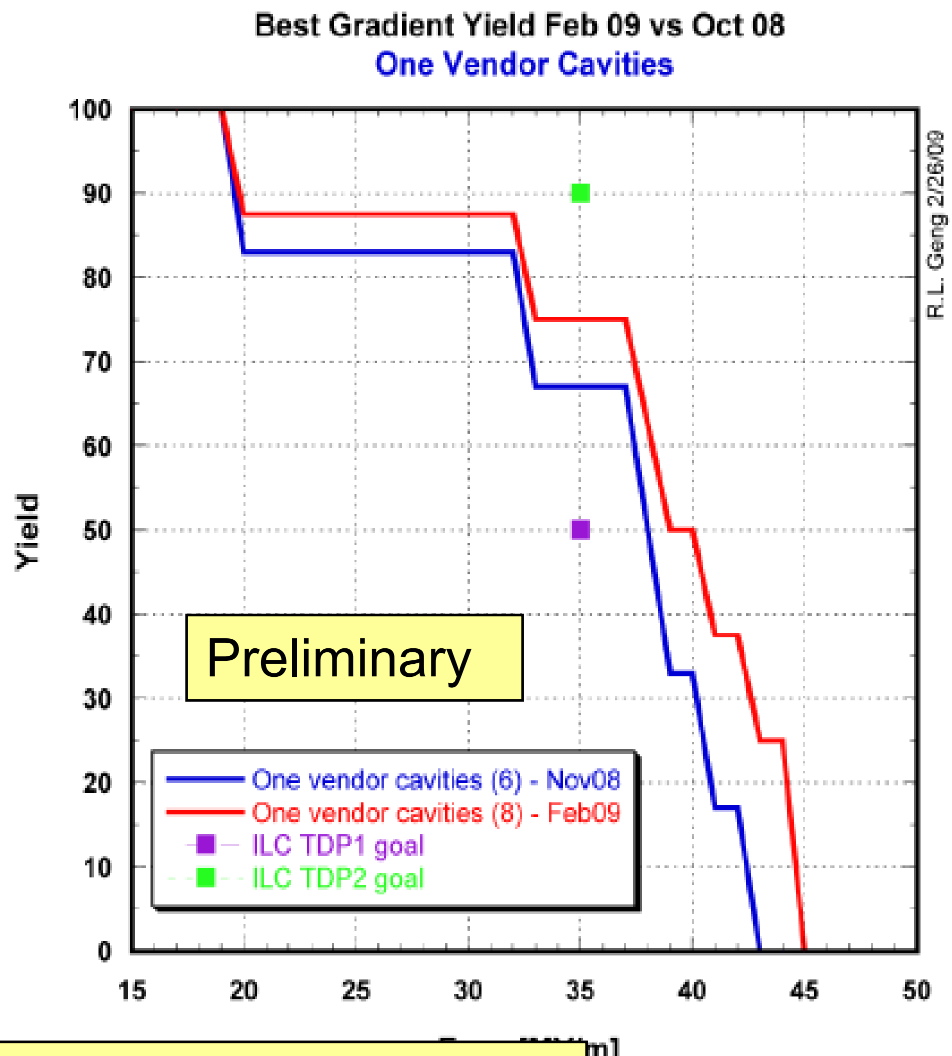
backup

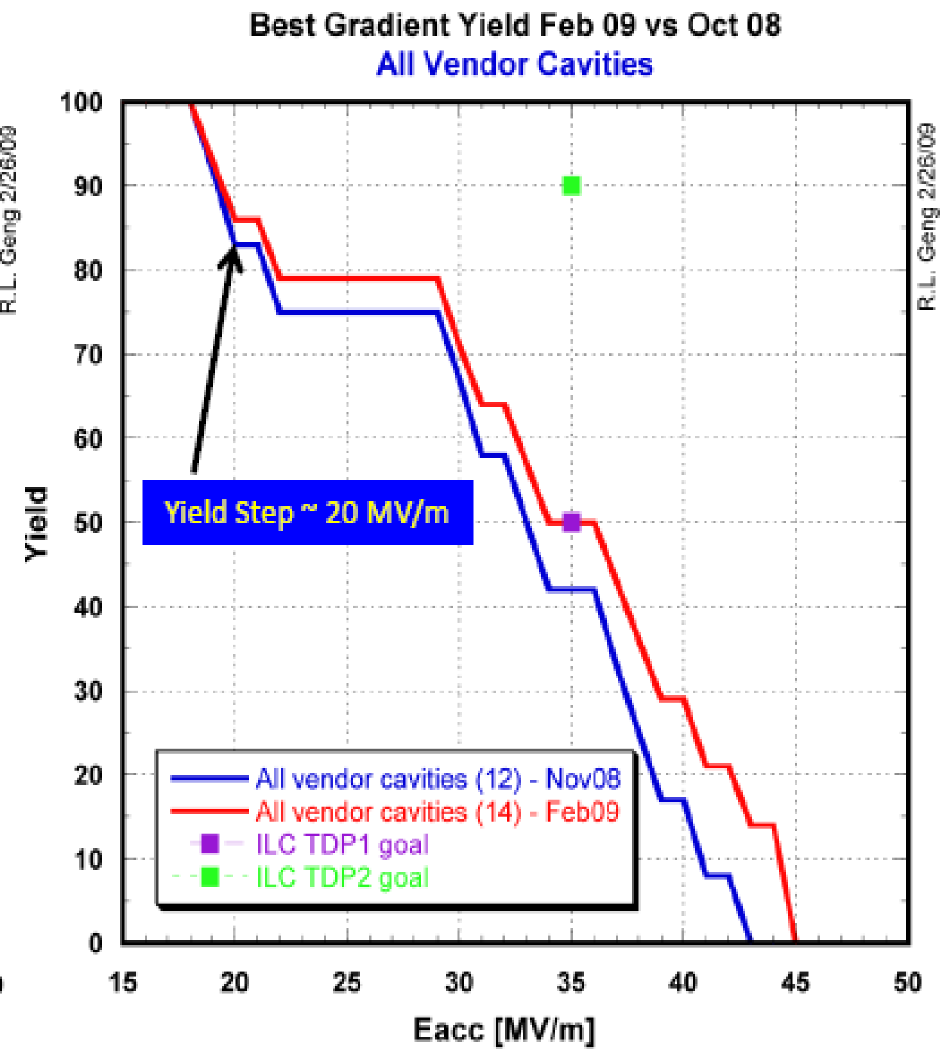
SCRF Session Agenda, April 19

Time	Report	Charged by	Note
09:30	Introduction	A. Yamamoto	
	Path to finalizing cavity field gradient		S0
09:40	- R&Ds to improve the gradient	L. Lilje	
10:15	- **Decision process**	A. Yamamoto	
10:30	-- Coffee Break --		
11:00	Path towards industrialization		S1
11:00	- Cavity Integration	H. Hayano	
11:30	- Cryomodule	N. Ohuchi	
12:00	- **Role of plug-compatibility (cavity/cryo)**	J. Kerby (updated)	
12:20	- Cryogenics	T. Peterson	
12:30	-- Lunch break --		
14:00	- HLRF	S. Fukuda	
14:20	- MLI: beam dynamics and quadrupoles	C. Adolphsen	
14:40	Lesson expected from system tests		S2
14:40	- STF at KEK	H. Hayano	
15:00	- NML at FNAL	M. Champion	
15:20	Summary / Discussions (toward industrialization)	A. Yamamoto	
15:30	Adjourn		

Yield Curve – as of Feb 09

14 9-cell Cavities Processed & Tested at JLab





R. Geng - JLab

Plug-compatibility: Summary

- **Plug Compatibility is**
  - a means to allow continued innovation from existing and new(!) collaborators while acknowledging the work is part of a larger effort.
  - a way to segregate work such that efforts on components and systems can proceed in parallel
  - a means in the longer term to be more efficient in infrastructure usage
- **Plug Compatibility does**
  - have an initial setup cost
  - impose some minimal boundary conditions, though strong efforts are made to keep them as minimal as possible

Response to the AAP

Mark Palmer
Cornell University

Request for Response

The AAP was very much impressed by the experimental program at CesrTA and elsewhere and the many nice results emerging.

In the following discussion, however, we noticed that we would not be in a position to anticipate your strategy of using and applying the results to make a final evaluation of the damping ring design concerning the e-cloud problem.

Overview of DR Technical Plan

A. Wolski
ILC08

	Minimum Machine	Technical Design, and Costing	Critical R&D
2008	Specify tasks.	Specify scope.	Continue critical R&D for cost reduction and risk mitigation: •electron cloud; •fast kickers; •low-emittance tuning.
2009	Perform studies.	Perform technical design and costing work in support of revising the baseline configuration.	
Start 2010	Revise baseline configuration.		
2010 – 2012		Complete work for TDR (end 2012).	Complete critical R&D.

TDP Phase I

TDP Phase II

EC R&D Guided by the R&D Board's S3 Task Force Report

- ***Very High Priority* EC R&D Issues:**
  - Characterize EC Build-up
  - Develop EC Suppression Techniques
  - Develop Modeling Tools for EC Instabilities
  - Determine EC Instability Thresholds
- **Particular issues are to:**
  - Validate our simulation projections for the ILC DR by a detailed comparison of data and simulation in a low emittance machine

    ⇨ CesrTA
  - Continue to improve our understanding of EC instability issues through measurements at various labs (CesrTA, DAΦNE, KEKB and collaboration with hadron machines)
  - Test mitigation methods in vacuum chambers, magnetic environments and with beam parameters closely matched to the ILC DR ⇨ ongoing work at all of the participating laboratories
    - Dedicated experimental areas at CesrTA and KEKB
    - Targeting baseline performance tests (in actual vacuum chambers) of the principal mitigation methods by 2010

Baseline Vacuum System

- **General vacuum design is underway (Cockroft)**
  - Present baseline assumptions are being implemented
    - NEG coating in drifts (pumping and EC mitigation)
    - Antechambers and TiN coatings in dipole and wiggler regions
    - Dipole and wiggler chambers are the most likely elements to see substantial change
  - In 2010, we expect to review these starting point assumptions
    - Make a provisional down select between baseline and alternative mitigation methods
    - Re-evaluate what remaining R&D checks are required in order to fully validate the vacuum system design
    - Determine what level of further prototyping is required based on the mitigation choices

Final DR and Engineering Designs

- **We expect by 2010 to have placed the positron damping ring on a more solid foundation by having confirmed and updated our performance projections**
  - Detailed comparisons of data and simulation in the low emittance regime will lead to significantly more reliable estimates in our DR simulations
  - Results will confirm, or cause us to re-evaluate, our plans to move to a smaller circumference layout
- **Testing of a range of mitigations in operational vacuum chambers will provide the necessary inputs for the technical design**
  - Will allow us to proceed with detailed design work and costing on an updated baseline vacuum system
  - Fully expect that there will be significant ongoing work to validate the design details
    - Prototyping
    - Some tests such as durability checks of newer coatings may still await final results
  - We anticipate that these inputs can largely be incorporated as incremental changes to the designs presently under development