BDIR2000報告

７月１７日、田内利明

Linear Collider Beam Delivery and Interaction Region Workshop (BDIR200),
７月３日～６日, Daresbury lab.

参加人数は３７名

Daresbury lab.より	１０名
DESYより	９名
SLAC/USより	７名
CERNより	２名
その他のイギリス、フランスより	８名
KEKより	1名。

WG1:Luminosity stabilisation/Diagnostics,
WG2:Collimation Systems,
WG3:Background and Interaction Region Related Issues,
WG4:Novel Concepts for Linear Colliders

参照：http://accelerator.dl.ac.uk/ap/bdir2000/

BDIR2000 Programme

Programme

Sunday	2 July	19:00	Bus from hotels to lab
		19:00-21:30	Reception and Registration Daresbury Laboratory (Science Centre)
		21:30	Bus from lab to hotels
Monday	3 July	09:00	Bus from hotels to lab
		09:00-09:30	Registration
		09:30-11:00	**Introductions - Plenary**
		11:00-11:30	Coffee
		11:30-13:00	**Plenary - Working Groups Preparation**
		13:00-14:00	Lunch (Science Centre)
		14:00-17:30	**Working Groups (Luminosity/Collimation)** *15:30 Coffee*
		17:30	Bus from lab to hotels
Tuesday	4 July	09:00	Bus from hotels to lab
		09:30-10:00	**Summaries from Monday**
		09:30-13:00	**Working Group (Novel Concepts)** *11:00 Coffee*
		13:00-14:00	Lunch (Tower)
		14:00-15:30	**Discussion**
		15:30	Coffee
		16:00-17:30	Tour of SRS
		17:30	Bus from lab to hotels
		18:30	Bus from hotels to Stockton Heath
		22:30	Bus from Stockton Heath to hotels
Wednesday	5 July	09:00	Bus from hotels to lab
		09:30-10:00	**Summaries from Tuesday**
		10:00-13:00	**Working Groups (Luminosity/Backgrounds)** *11:00 Coffee*
		13:00-14:00	Lunch (Tower)
		14:00-17:30	**Working Groups (Backgrounds/Collimation)** **Plenaries Preparation** *15:30 Coffee*
		17:30	Bus from lab to hotels
		19:00	Bus from Travel Inn to Daresbury Park
		19:30	Workshop Dinner - Darebury Park Hotel
		22:00	Bus from Daresbury Park to Travel Inn
Thursday	6 July	09:00	Bus from hotels to lab
		09:30-12:00	**Summaries/Plenary** *10:30 Coffee*
		12:00	Lunch (Science Centre)
			Bus to Manchester Airport

Working Group 1
Monday pm/Wednesday am
Luminosity Stabilisation
Diagnostics

Working Group 2
Monday pm/Wednesday pm
Collimation Systems

Working Group 3
Wednesday am/Wednesday pm
Background and Interaction Region Related Issues

Working Group 4
Tuesday am
Novel Concepts for Linear Colliders

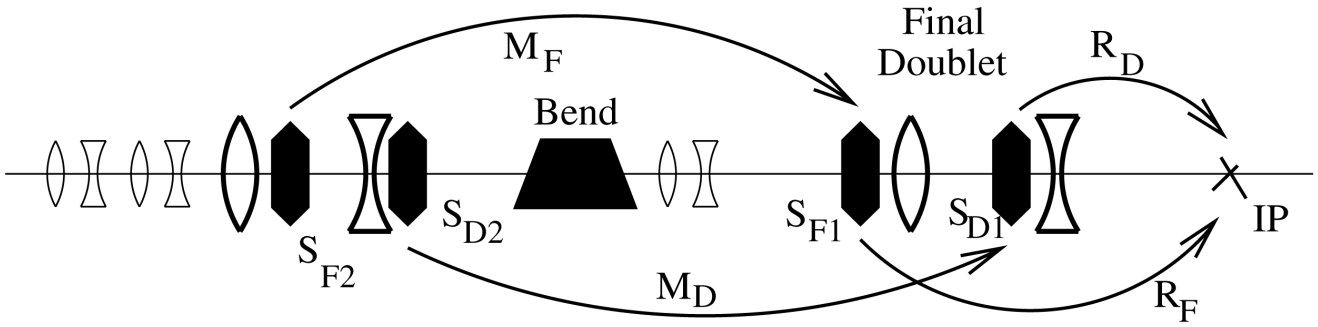
BDIR2000 Proceedings

Opening Plenaries: Beam Delivery Systems Overviews	Tom Markiewicz Daniel Schulte Toshiaki Tauchi Nick Walker	NLC CLIC JLC TESLA
Novel Concepts	Nan Phinney	NLC New Final Focus
Luminosity and Diagnostics	Phil Burrows Joe Frisch Christian Magne Nan Phinney Tor Raubenheimer Ingrid Reyzl Daniel Schulte Daniel Schulte Nick Walker Manfred Wendt	Feedback Proposals Mechanical Stabilisation Non-Resonant Cavity BPM SLC Feedback Ground Motion TESLA Fast Feedback Luminosity Monitors NLC Fast Feedback TESLA Slow Feedback TESLA BDS Instrumentation
Collimation	Reinhard Brinkmann Reinhard Brinkmann Joe Frisch Tor Raubenheimer Mike Seidel Peter Tenenbaum Nick Walker	Effective Acceptance Expander Halo Estimate for TESLA Advanced Spoiler Concepts Wakefield Graphs Spoiler Material Issues NLC Collimation Overview TESLA Energy Spoiler
Backgrounds and Interaction Region	Karsten Buesser Stan Hertzbach Toshiaki Tauchi	Beam Related BG in TESLA SR Fans in NLC FF Lum Monitor and Active Mask

Other Topics and Some Papers	Phil Burrows Fenn et al Jean-Bernard Jeanneret Michael Peskin NLC Design Group	Opportunities for Collaboration Quadrupole Vibration Measurements in FFTB Thermal and Acoustic Effects in CLIC Absorbers NLC Physics Case NLC ZDR Chapter 11
Closing Plenaries	Grahame Blair Ingrid Reyzl Mike Seidel	Backgrounds and IR Luminosity Stabilisation Collimation

18th July 2000
Please report omissions, errors etc. to Andy Wolski at Daresbury Laboratory.

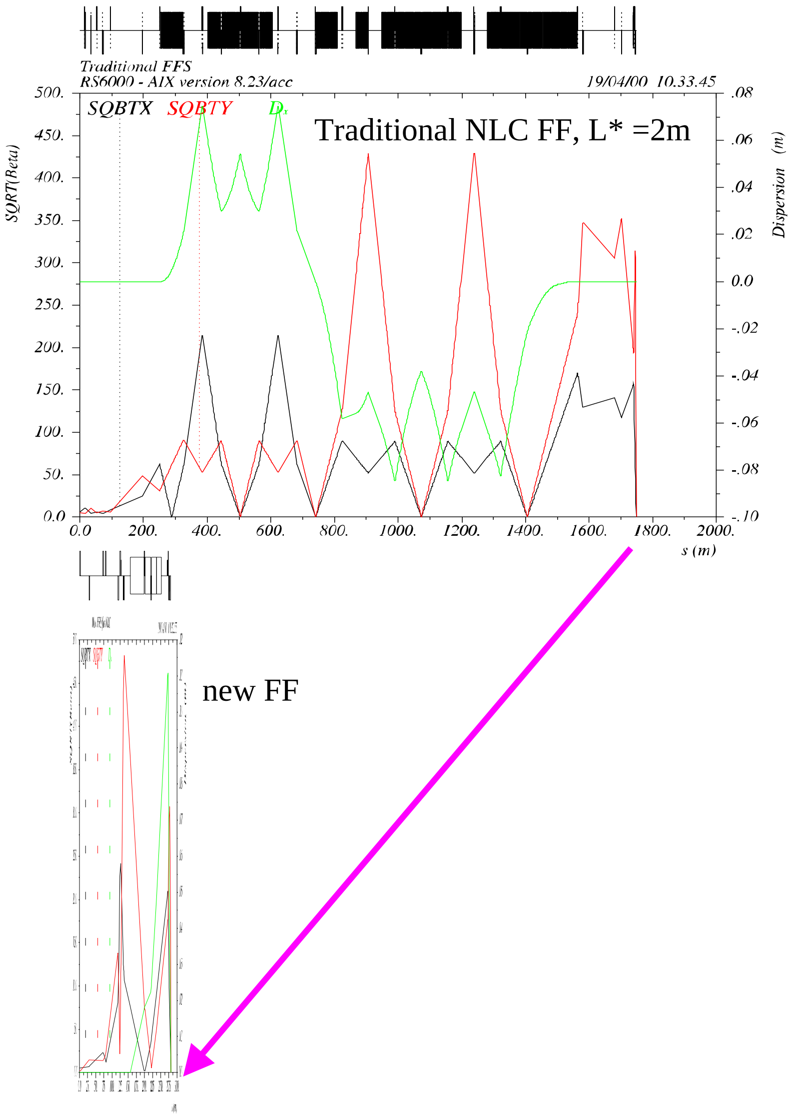
Principles of the “ideal” FF



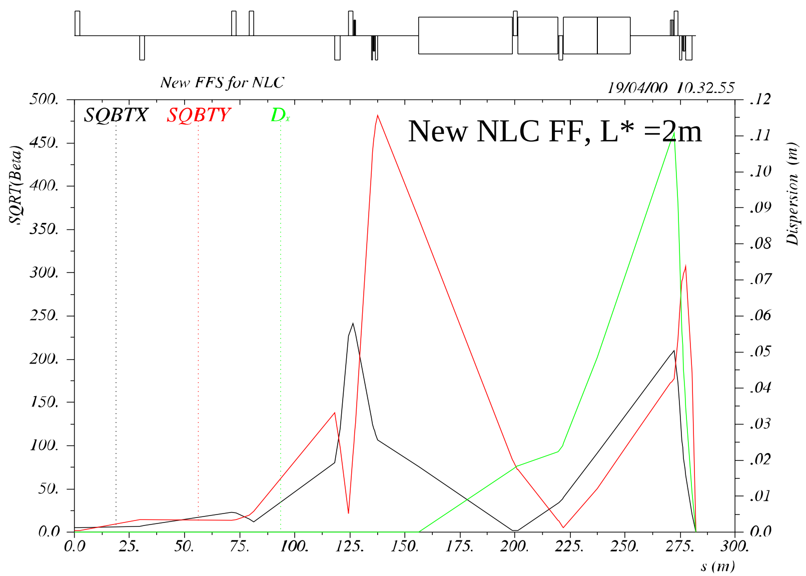
- Final Doublet is required.
- Chromaticity is cancelled locally by two sextupoles placed in FD with a bend upstream to generate dispersion across the FD.
- Geometric aberrations of FD sextupoles are cancelled by two more sextupoles placed in phase with them and upstream of the bend.
- Four more quadrupoles are needed to match the incoming beam.

[SLAC-PUB-8460, LCC-0039]

Traditional and new FF



A new FF with the same performance as NLC FF can be ~300m long, i.e. 6 times shorter

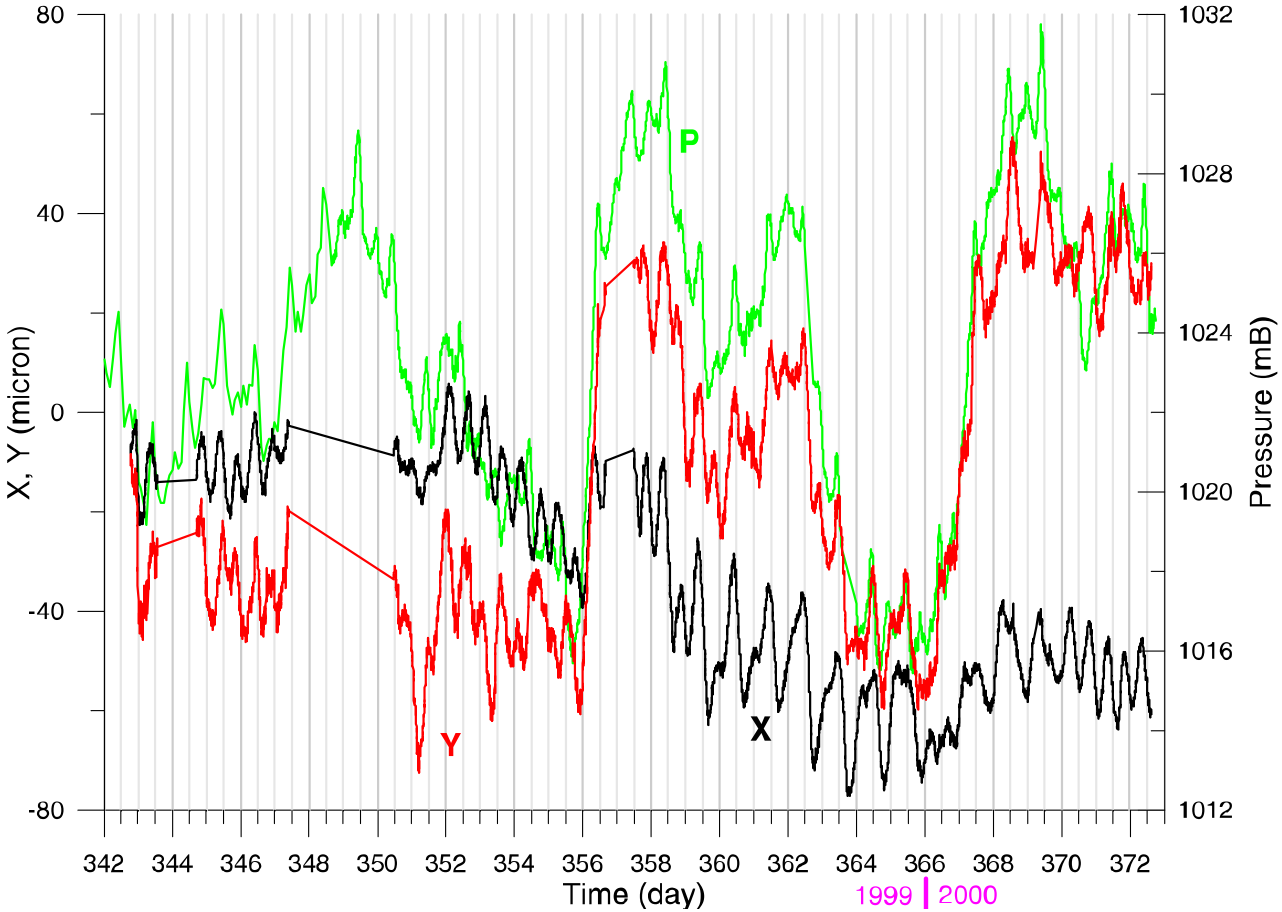


P.Raimondi, A.Seryi

SLAC tunnel drift studies

Unexpected facts:

- The tidal component of motion is surprisingly big ~10 micron.
- Motion has strong correlation with external atmospheric pressure.

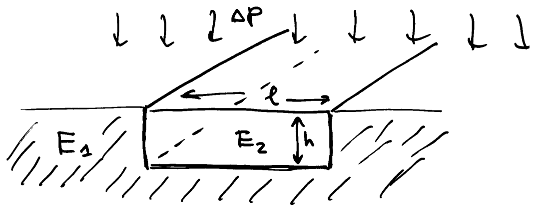


Horizontal and vertical displacement of the SLAC linac tunnel and external atmospheric pressure.

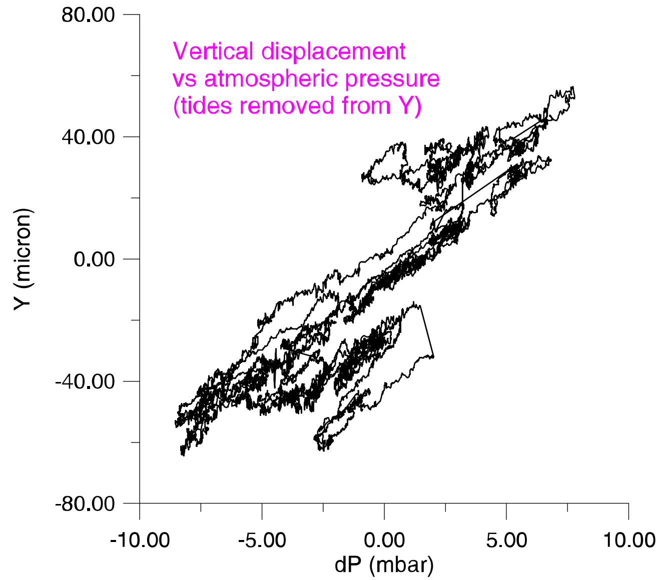
A.Seryi

Influence of atmospheric pressure

Very slow variation of external atmospheric pressure result in tunnel deformation. Explanations: landscape and ground property variations along the linac:



$$\Delta h \approx \frac{\Delta P\, h}{E} \frac{\Delta E}{E}$$

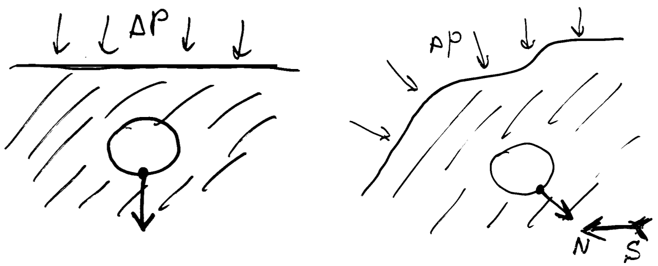


Observed Δh=50µm for ΔP=1000 Pa is consistent with these estimations if $\Delta E/E$~0.5, h~ ℓ~ 100m, α~0.5 and E~10^9 Pa.

Assumption E~10^9 Pa is consistent with SLAC correlation measurements.

$$v \approx \sqrt{\frac{E}{2\rho(1+\nu)}}$$

Taking v=500m/s (at ~5Hz, I.e. λ~100m) and ρ=2*10^3 kg/m^3, we get E= 10^9 Pa



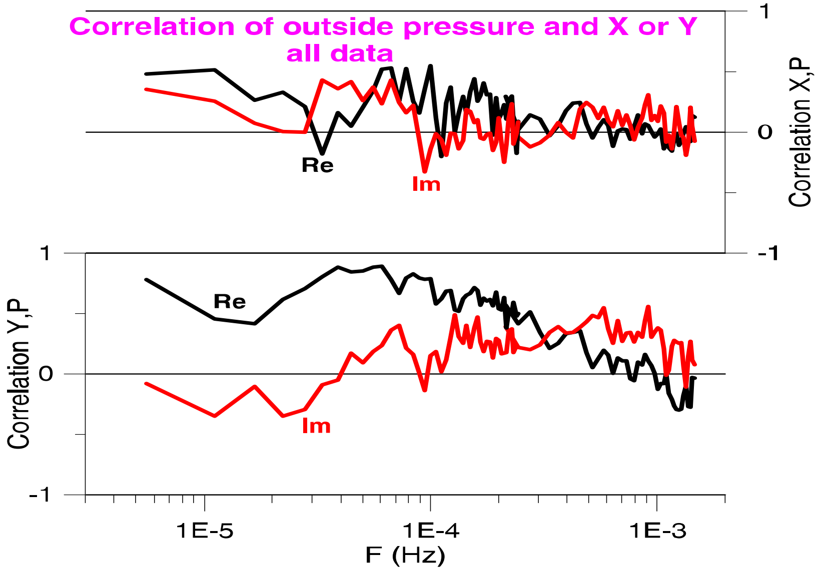
$$\Delta h \approx \frac{\Delta P}{E} \ell \, \alpha$$

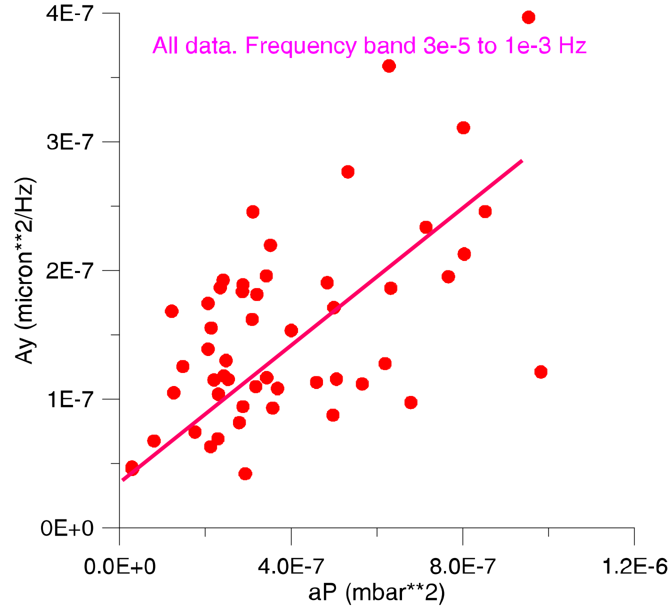
ℓ - length of landscape change,

α - variation of the normal angle to the surface

A.Seryi

Atmospheric pressure again





“A” vs amplitude of atmospheric pressure spectrum aP.

- Correlation **X or Y and atmospheric pressure** is significant from 10^{-6} up to about 0.003 Hz.
- **Spectra of pressure** also behave as $\sim$ **aP/ω^2**
- The amplitude of **“A“ correlates** with amplitude of **pressure spectrum aP**.
- The **ratio (X/P)** almost **does not depend on frequency** in 10^{-6} -0.003 Hz and is about 6μm/mbar in Y and 2μm/mbar in X.

=> **Spatial λ does not depend on f, but given spectra of landscape/ground properties.**

A.Seryi

“A” versus Young’s modulus

Spatial variation of ground and/or landscape + variation of atmospheric pressure is a major cause of diffusive-like motion of the SLAC linac tunnel

The spectra of ground **properties/landscape** vary as $\mathbf{1/k^2}$, the spectra of **pressure** behave as $\mathbf{1/\omega^2}$ and together they give $\mathbf{1/(\omega\, k)^2}$ that is (or mimic) **diffusive motion**

($1/k^2$ justifies extrapolation of 2 mile base measurements to shorter scale)

(Spatial shape of landscape/properties is diffusive in space but stationary in time)
For other mechanisms of diffusive motion this may be different).

For the shallow tunnel, the “A” scales as $1/E^2$ or $1/v^4$!!!

Look for strong media, (higher Young’s modulus E or shear velocity v)!

Systematic motion of SLAC linac tunnel

- Based on year to year motion of the SLAC linac tunnel one may suggest that "A" is ~ 10^{-4}
- However, the year-to-year motion is dominated by systematic component
- Parameter "A" was found to be almost 1000 times smaller for minute-hour time scale.

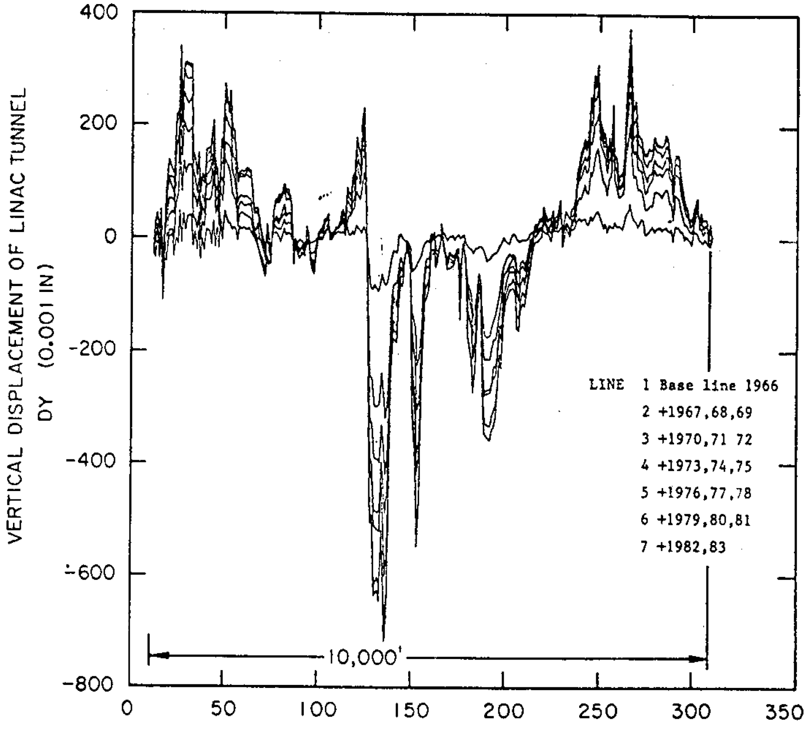


Figure 7: Displacement of the SLAC Linac Tunnel - Vertical.

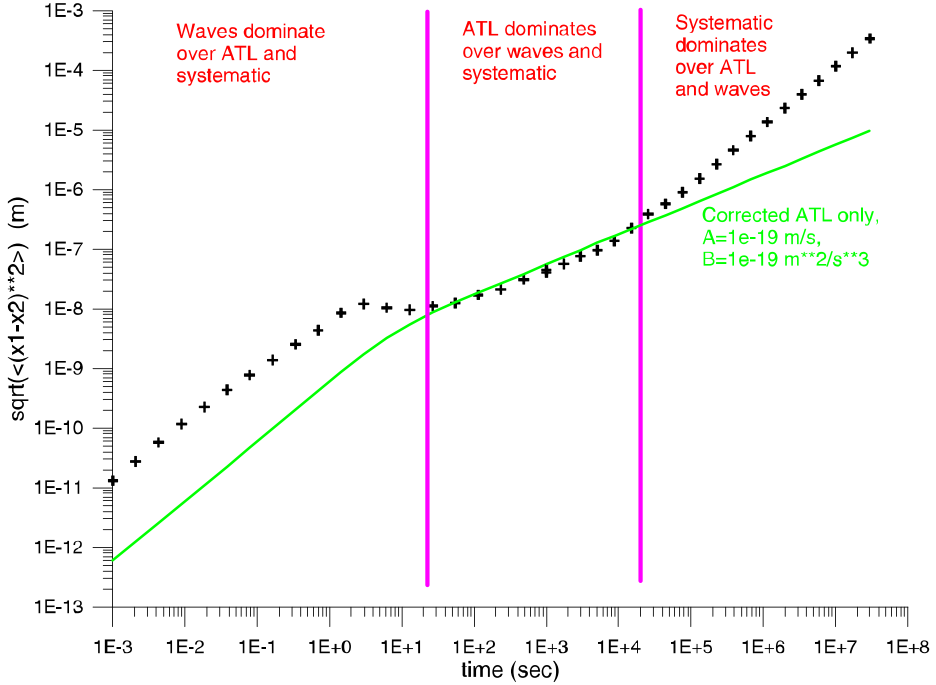
Vertical displacement of SLAC linac for 17 years

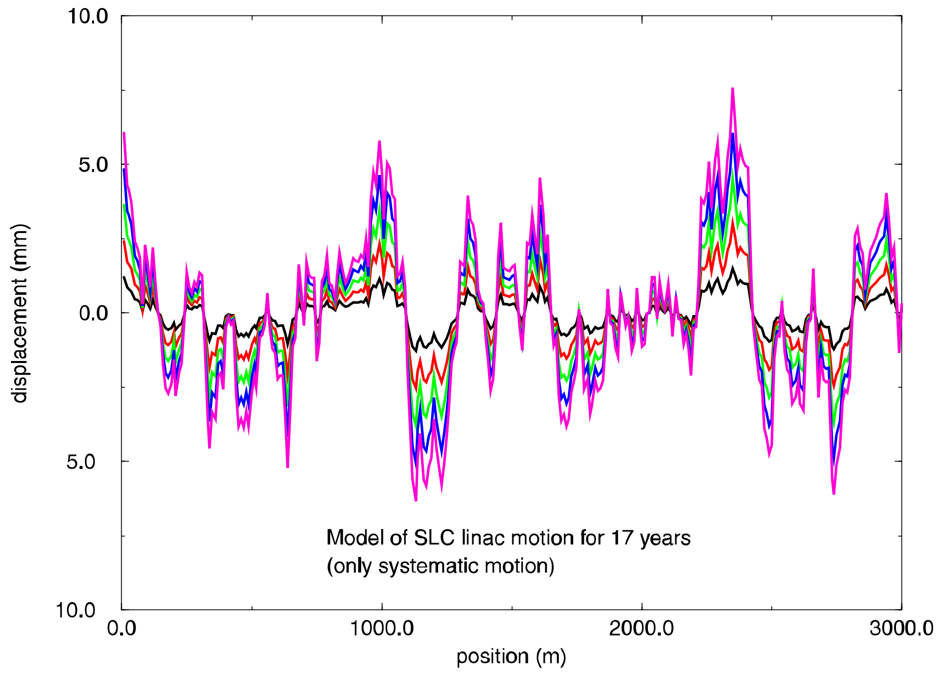
[G.Fischer, M.Mayond 1988]

Modeling systematic motion

Rms ΔY for ΔL=33m.

Typically systematic motion dominates for t > days-weeks time scale.





Model of 17 years of linac motion

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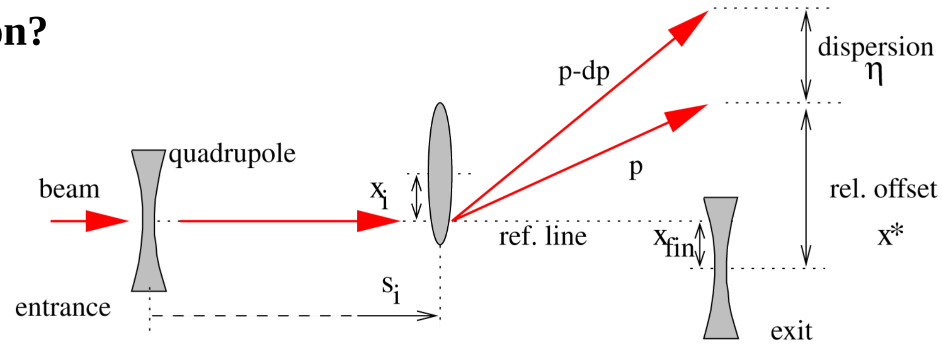
How ground motion influence on the beam

How to find trajectory offset or chromatic dilution?



Relative beam offset at exit and dispersion:

$$x^*(t) = \sum_{i=1}^{N} c_i x_i(t) \; - x_{fin} \qquad \eta(t) = \sum_{i=1}^{N} d_i x_i(t)$$

Linear model: $c_i = \dfrac{dx^*}{dx_i} \approx -K_i r_{12}^i \qquad d_i = \dfrac{d\eta}{dx_i} \approx K_i (r_{12}^i - t_{126}^i)$ Approximate values are for thin lens, linear order

Then, for example, the **rms beam dispersion:**

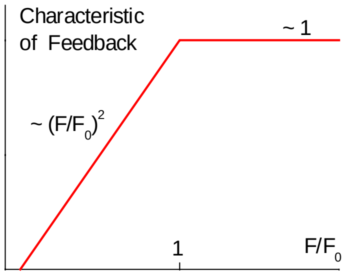
$$< \eta^2(t) > = \int_{-\infty}^{\infty} P(t,k)\, G_\eta(k) \frac{dk}{2\pi} \qquad \text{where} \qquad P(t,k) = \int_{-\infty}^{\infty} P(\omega,k)\, 2[1-\cos(\omega t)] \frac{d\omega}{2\pi}$$

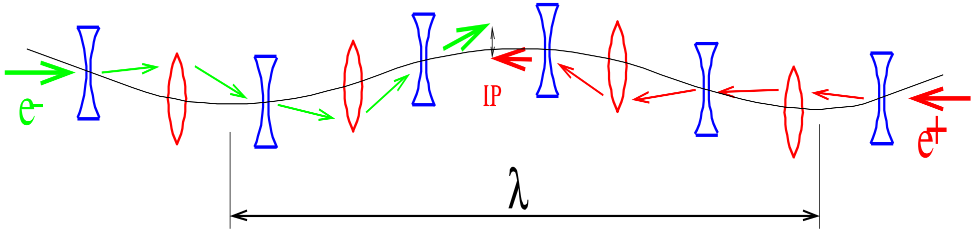
and $G_\eta(k) = \left(\sum_{i=1}^{N} d_i (\cos(k s_i) - 1) \right)^2 + \left(\sum_{i=1}^{N} d_i \sin(k s_i) \right)^2$ **- spectral response function**

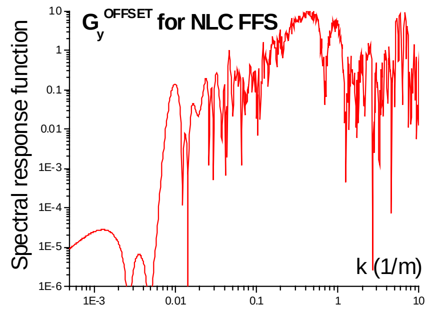
Sum rules. E.g. $\sum d_i s_i = -T_{126}$ at small k then $G_{offset}(k) \approx k^2 R_{12}^2 \qquad G_\eta(k) \approx k^2 T_{126}^2$ unless R_{12} or $T_{126}=0$

A.Seryi

Ground motion induced beam offset at IP







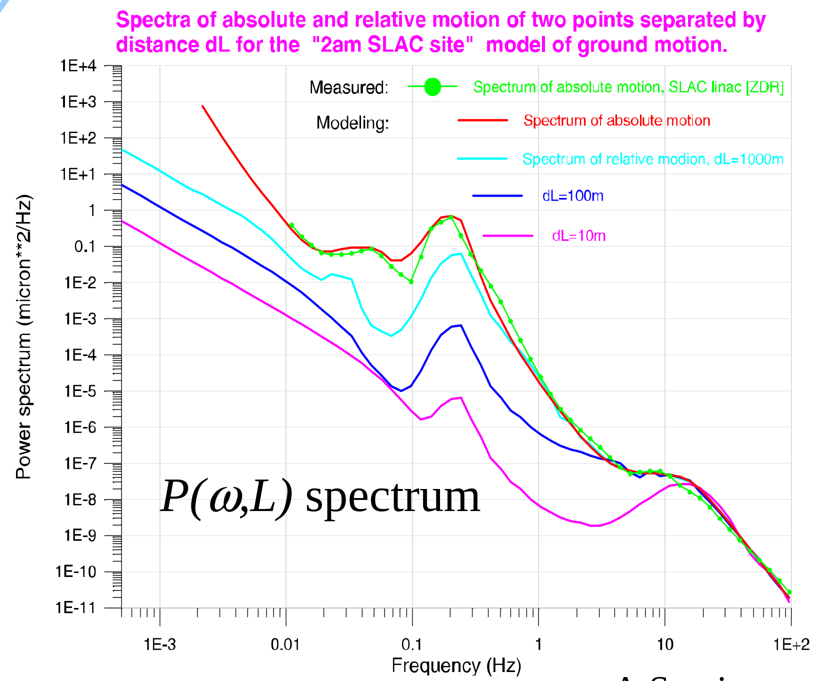
rms beam offset at IP:

$$\propto \iint P(\omega,k)\, G(k) \cdot F(\omega) \cdot dk \cdot d\omega$$

$G(k)$ - spectral response function

$F(\omega)$ - performance of inter-bunch feedback

$P(\omega,k)$ - 2D spectrum of ground motion



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Ground motion and Final Focus

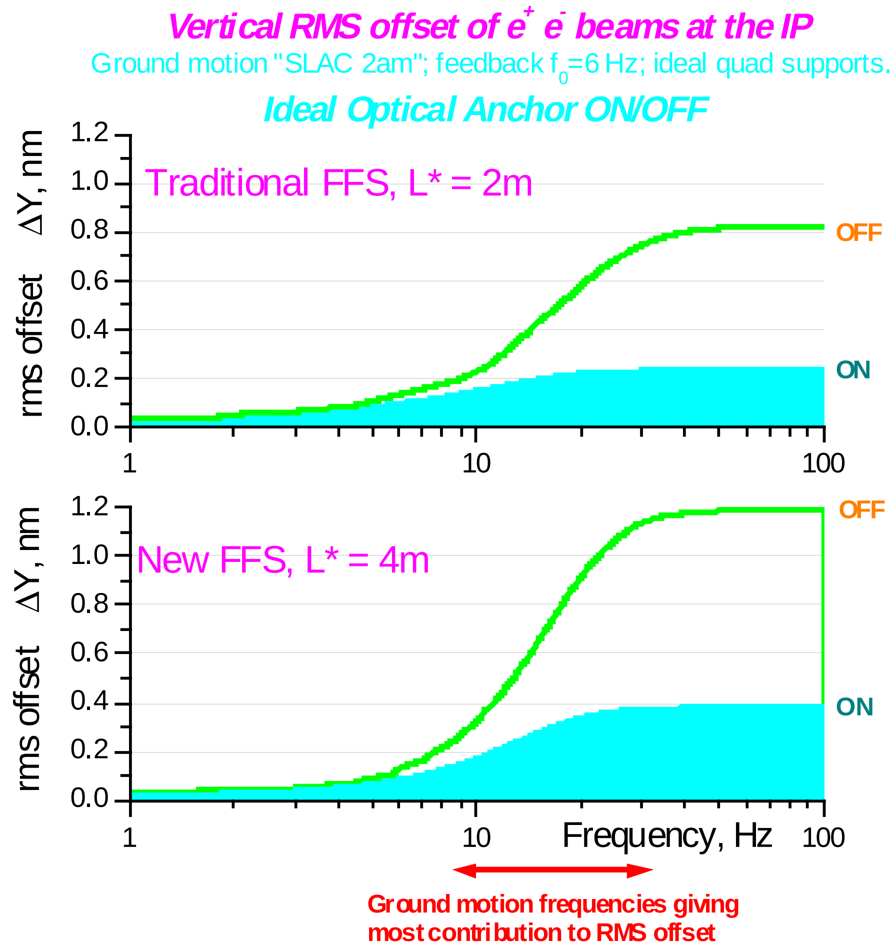
- **Final focus tolerances are most severe.**
- **Fast ground motion** induces vibrations of optical elements resulting in the beam offset at the IP.
  - The inter- bunch-train feedback will keep the rms IP beam offset constant (and hopefully small).
- **Slow ground motion** induces misalignments of optical elements resulting in slow growth of the IP beam size.

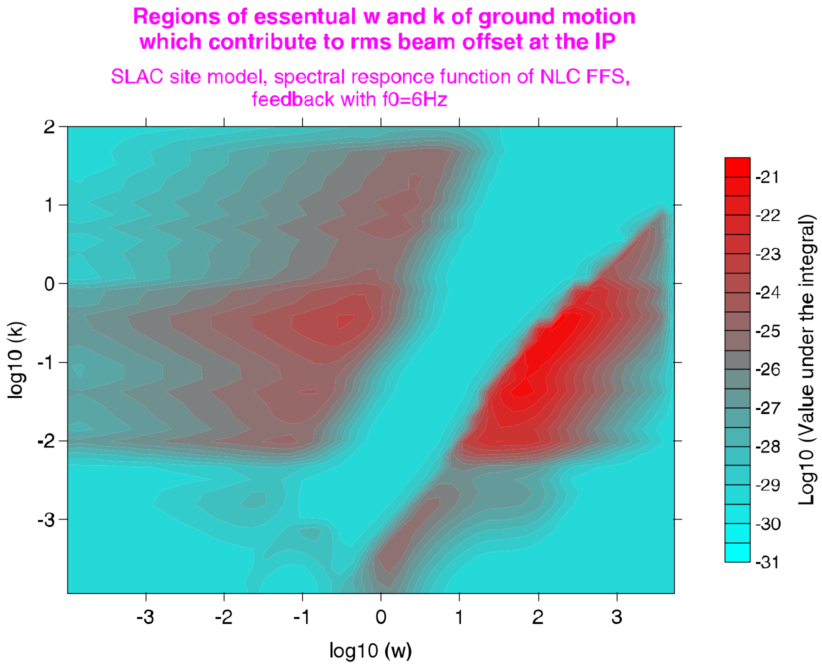
Rms beam offset at IP

Vertical rms offset is ~**1 nm** for “SLAC 2am”

With an **ideal anchor** the position of final quads is locked to the motion of a single ground point under IP.

With an **ideal anchor** the contribution of final quads vanishes, and ΔY decreases ~3 times





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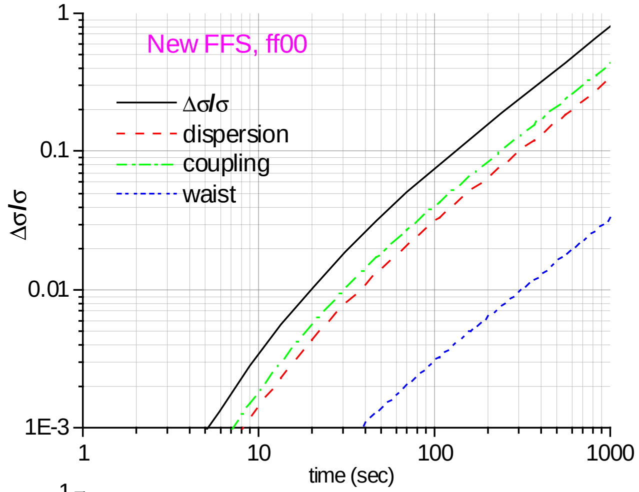
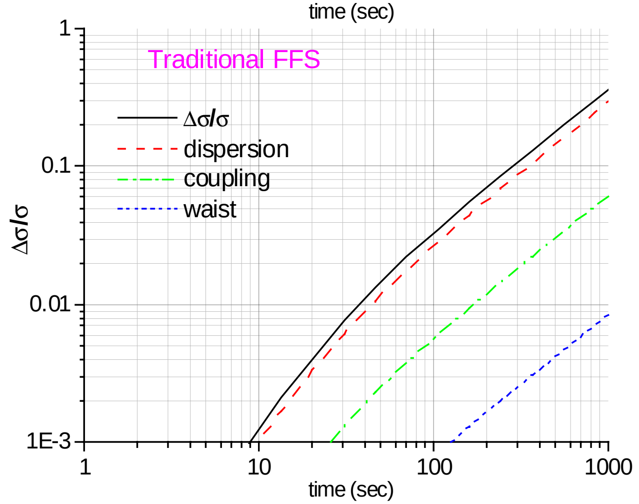
IP beam size growth due to slow misalignments



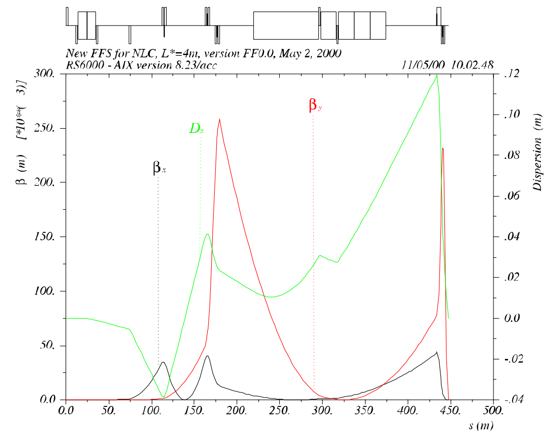


Orbit feedbacks drastically reduce this growth!

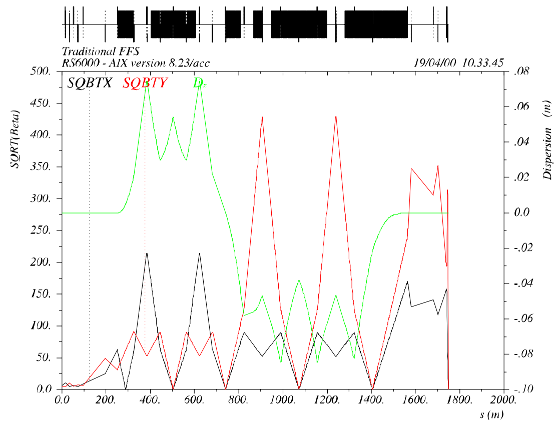
Beam size growth vs time.
Evaluated using FFADA
No beamsize feedback.
Ground motion model with

$$A = 5 \cdot 10^{-7} \frac{\mu m^2}{m \cdot s}$$

L* =4.3m



L* =2m



Beam energy, GeV	500
$\gamma\varepsilon_x$ / $\gamma\varepsilon_x$ $(10^{-8}$ m)	400 / 6
σ_x^* / σ_y^* at IP (nm)	197 / 2.7
Energy spread σ_E (10^{-3})	3

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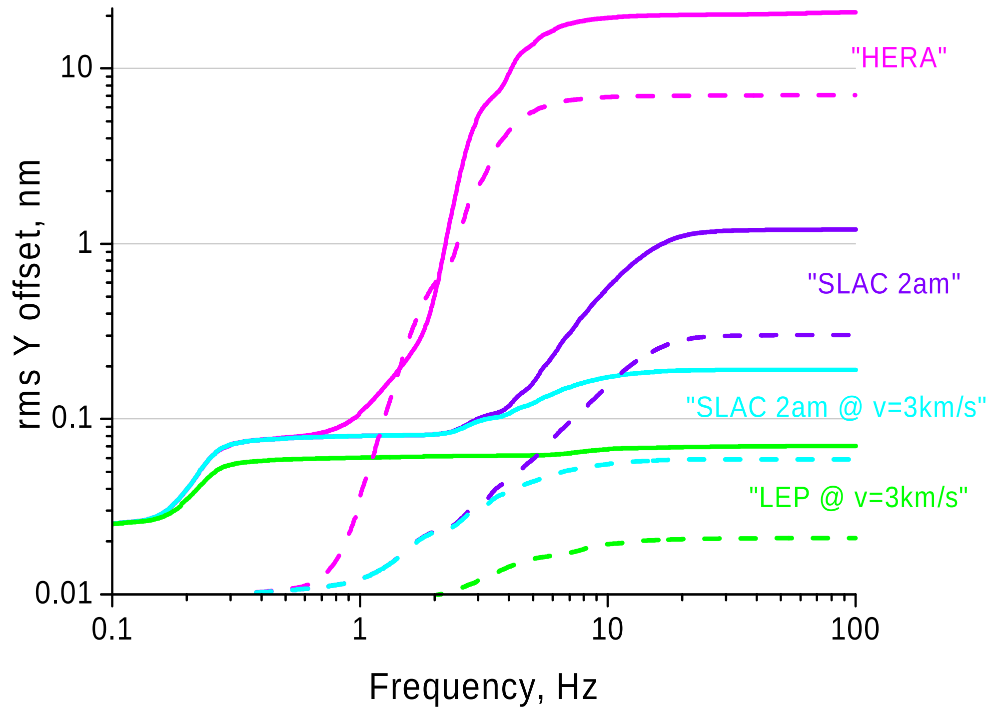
IP beam offset for different GM models

Ground motion models

- **"HERA"** -- noise level as in HERA and SLAC v(f). Extremely noisy, moderate correlation.
- **"SLAC 2am"** -- not too noisy, moderate correlation.
- **"SLAC 2am and v(f)=3km/s"** -- not too noisy, good correlation.
- **"LEP and v(f)=3km/s"** -- extremely quiet, good correlation

Too pessimistic:
"HERA" - noise level did not matter, so nobody care
Too optimistic:
"LEP" - one cannot avoid adding cultural noise in real LC tunnel



IP rms beam offset for different GM models, new FF v.ff01, FD supported 8m from IP.

Need to understand:
what we can do using anti-GM methods,
what will be the noise level in the LC tunnel

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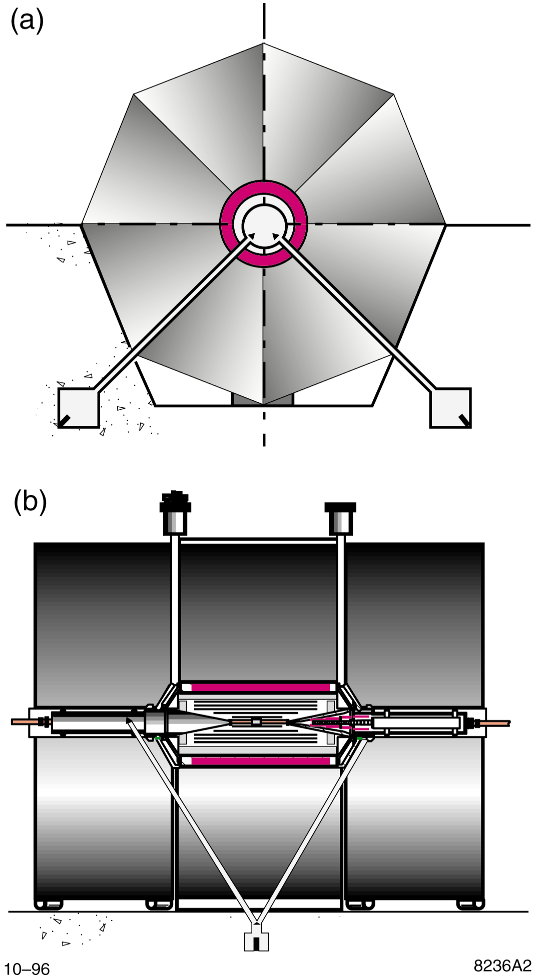
Performance of an Optical Anchor

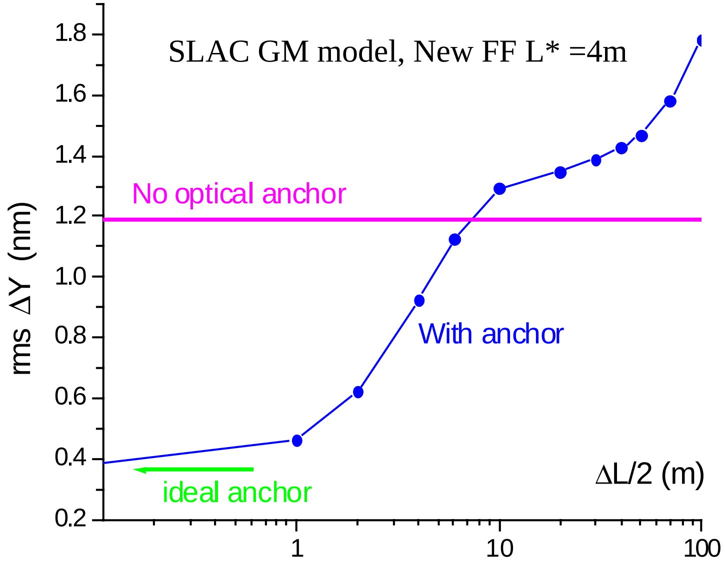


Detector cross-section with an "optical anchor" [G.Bowden, 96]

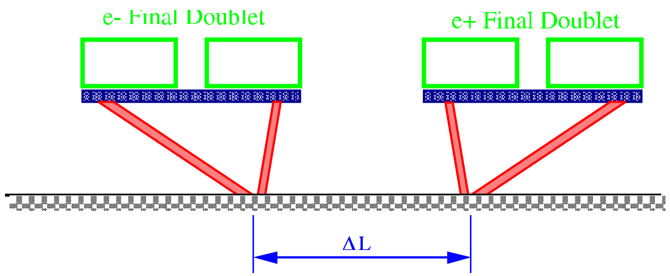
An optical anchor with ΔL>(2-3)L* **does not help to achieve smaller ΔY.**

(It may still be useful to **suppress resonances of supports.)**

An **"ideal" anchor** with ΔL=0m give a factor of 3 in ΔY **but it is not ideal for the detector.**



Optical anchor performance vs ΔL



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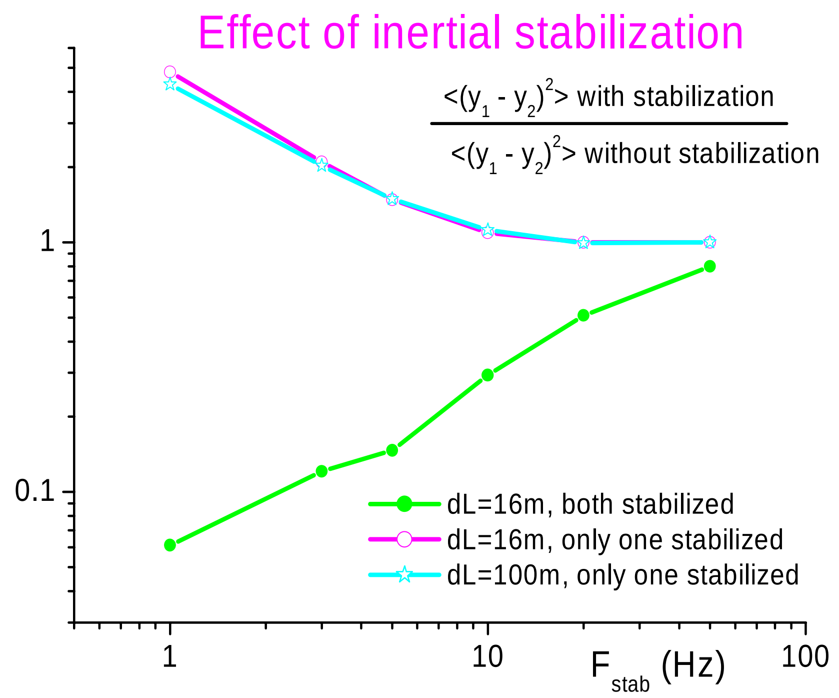
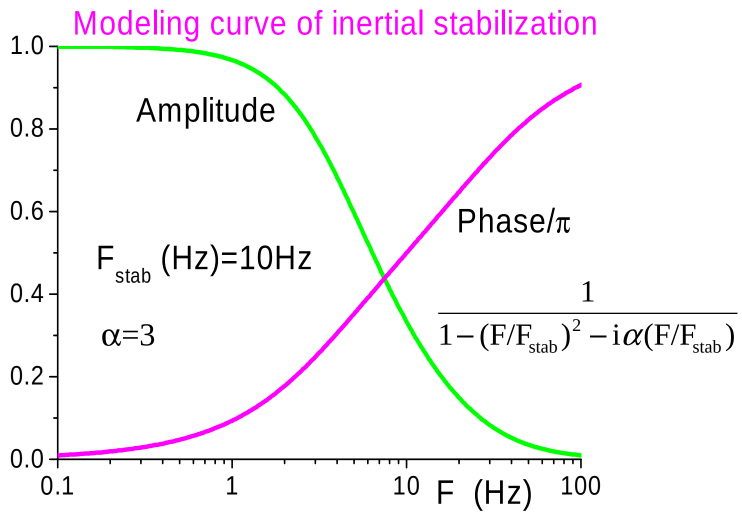
Inertial stabilization with respect to inertial frame very preliminary results! To be tested!

- Stabilization of two quads decrease their relative ΔY
- but ΔY relative to neighboring not stabilized quad increase





- **Inertial Stabilization of the relative motion may be more appropriate**

A.Seryi

Further plans

- **Fast motion:** amplitudes, correlation vs ground/rock properties, noise sources; correlation vs discontinuities
- **Slow motion:** mechanisms of diffusive motion; validity of extrapolations; measurements
- **Cultural noises:** classification of sources; attenuation, damping, trapping in tunnel; measurements
- **Tunneling options:** "A" vs construction technique, understanding of tunnel geology, etc.
- **Anti-GM methods:** inertial/optical anchors, etc.

Ground motion Workshop @ SLAC

~ October 2000 (date to be adjusted)

Luminosity Stabilisation

TESLA:

$\leq 10\%$ $\mathcal{L}$ loss $\Rightarrow$ $\leq 0.1\sigma$ r.m.s. jitter

(Ingrid Reyzl)

NLC:

$\leq 10\%$ $\mathcal{L}$ loss $\Rightarrow$ $\leq 1\sigma$ r.m.s. jitter

(Daniel Schulte)

$\Rightarrow$ slow [O(10s)] and fast [O(10-100)ns] FB systems
required for $< \mathcal{L} > \simeq 70\%$ $\mathcal{L}_0$
for $t > 10$s
(Nick Walker)

Fast IP FB system:

$\Rightarrow$ position correction (near IP)
angle correction (entrance to CCS)

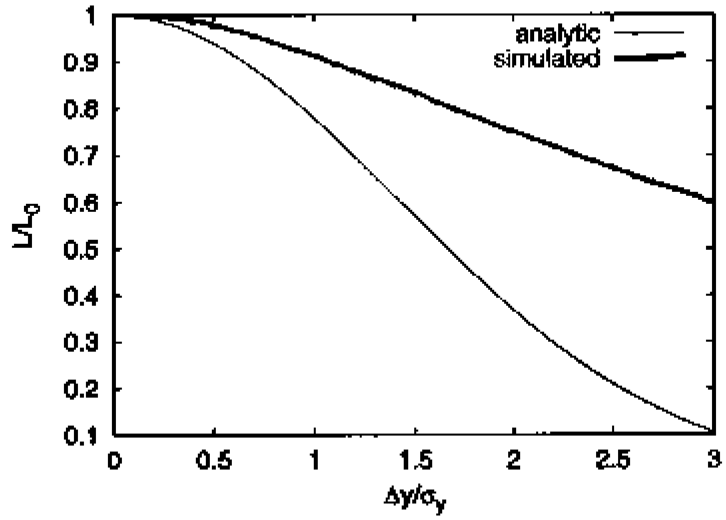


Figure 1: Dependence of the luminosity on the vertical relative offset of the two beams.

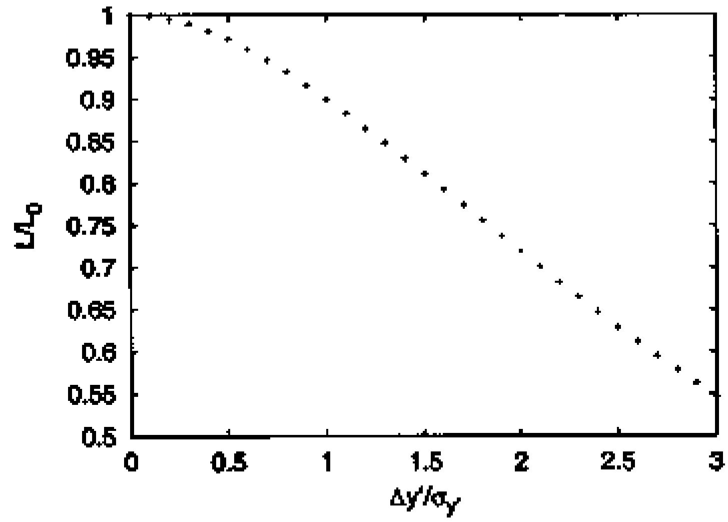


Figure 2: Dependence of the luminosity on the vertical collision angle.

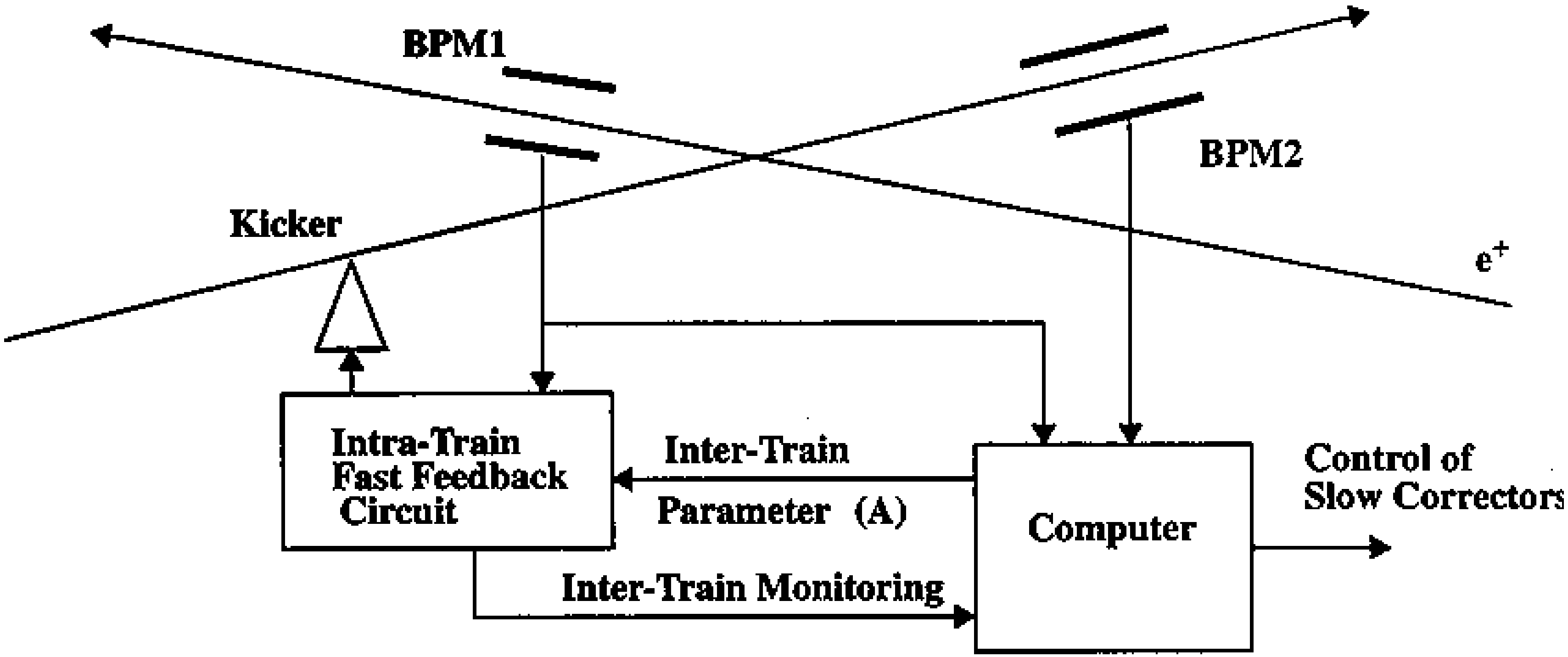
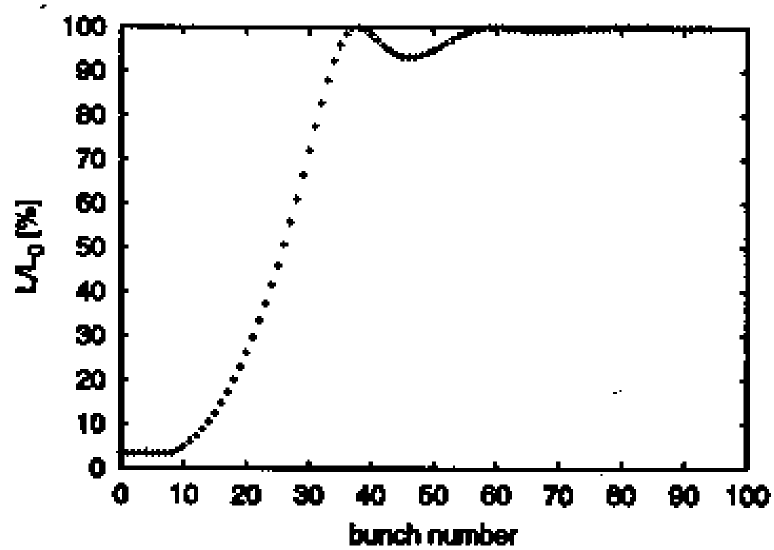


Figure 1: Blockdiagram of feedback system.

Breidenbach + Haller

Very Large Offset



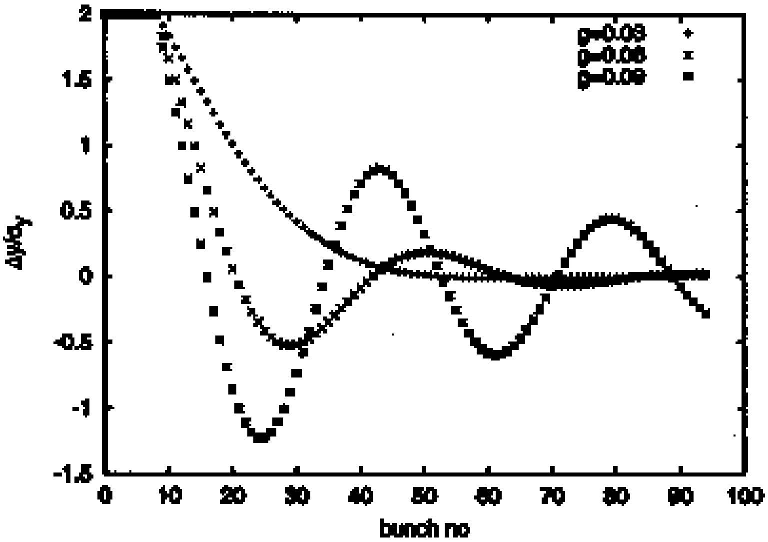
Initial offset $\Delta_y = 12\sigma_y^*$

$I \approx 6\,\mathrm{A}$

⇒ would need tube amplifier

increases luminosity from $\approx 3\,\%\mathcal{L}_f$ to $73\,\%\mathcal{L}_0$

Determining the Gain



Here, gain is

$$\frac{\delta_y}{\sigma_y^*} = g\frac{\theta}{\sigma_{y'}^*}$$

simplest model g is constant for each bunch

$\Rightarrow$ good value is $g = 0.06$

Collimation:

Machine protection(MPS)を想定したfailure modes

energy variation (injection error,klystron down),
focussing mismatch,
transverse feedback, magnet failure,
vacuum burst,
near wall wakefield,
magnet mover,
earth quake

SLACで行われたcollimatorによるwake fieldの測定
測定値は予想されたもの（理論値）の約１／１０
MAFIAによるsimulationが行われ、よい一致。
note: geometrcal effect only, no resitive wall effect

非線形光学

Brinkmannによる Effective Acceptance Expanderと題するtalk：final doubletの上流50mほどの所にoctupoleを置き、ビームテールをより小さく制御しようとするものであった。彼によると、40%程度はテールを小さくできそうだ。ただし、テール粒子が極端にover-focusされないためにcollimationは必要である。このアイデアはぜひJLCでも取り入れてみたい。

Backgrounds and Interaction region:

TESLA,NLCともLC99,ISG4などですでに議論されているものだった。

TESLAの新マスクデザインで、円錐状マスクの開口角がかなり大きくなっていることに関して、TPCでの低エネルギー（<MeV）光子によるバックグランドヒットが多くなるのではないかとの質問があった。これに対して、GEANTでの光子のしきい値エネルギーを10keVとして、比較検討することが合意された。

NLCデザインについては、衝突点間近に置かれるベリリュウムのリング状マスクに対しても同様な議論があった。NLCのsmall detectorでは、central trackerにsilicon strip detectorを使用するので問題ないかもしれないが、最近、US-high energy 実験屋で有力なlarge detectorではTESLAと同様にTPCを使用するため問題となるかもしれない。

TUC (Towards Ultimate Codes) 議論：

現在、LINAC,BDS,IRのビームダイナミックスを扱う多くのシミュレーションプログラムが存在している。例えば、ヨーロッパでは、PLACET (LINAC), MERLINE(BDS), Guinea-PIG(IR)、アメリカでは、LIAR(LINAC), DIMAD(BDS), Guinea-PIG(IR), 日本では、SAD (LINAC, BDS), CAIN(IR)など。

『リニアコライダーのビームを扱う統一的なプログラムを国際協力でできないものか』というものが元々の動機である。この方向の例としては、GEANT4が挙げられるが、これが最も よい方法であるかは、提案者のN.Walker自身も懐疑的であった。

ヨーロッパでは、上記の３つのプログラムの出入力を標準化することがすでにそのauthorsの間で話し合われている。これを国際的にしたいということが今回の議論のまとめであった。特に、先ずLattice descriptionsの標準化を謀りたいということで、KEKのSADにも加わってほしいという要請があった。生出さん、久保さんに連絡を取るべしということであった。追って、N.Walkerからannouncementがあるかもしれないが、JLCグループとしても、リニアコライダーをシステムとしてその安定性を研究する上で重要であるので、積極的に対応した方がよいと思われる。

BDSに特化しているように見えるMERLINE（N.Walkerがauthor）は、C++で書かれており構造が分かりやすく、使用方法がよさようである印象をうけた。

国際協力の議論：

TESLAグループはCDRの完成に向けて熱気に満ちている。

（１）FFTB-2

SLAC辺では、Pantaleoによるnew FF opticsの提案に触発されて、ぜひこのopticsをFFTBで試してみたいという気運が出ている。また、TESLAでは、特にPantaleoのopticsについて強い関心はないが、beam size monitor (Shintake laser inteferometer),collimationなどに関心がある。我々としても、40nmビームの達成（振動問題の理解）、Pantaleo opticsに興味がある。しかしながら、manpower, moneyなどSLAC managementの十分な理解と協力が必要であるため、FFTBと同じような強力な国際協力が必要となるであろう。このような認識の中、DESY, CERN, KEKなどの各研究所でのFFTB-2の必要性（どのような実験、試験をFFTB-2でしたいかなど）についてそれぞれの研究所で見解をまとめることが確認された。このまとめ役として、Oxford universityのPhillip Burrowsがなり、１０月２２－２８日にFermi lab.で開催されるLCWS2000で議論しようということになった。

（２）Ground motion

SLACでは、A.Seryiを中心にGround motionの測定、そのモデル化に大きな進展があったようだ。このような流れの中Andrei SeryiによってGround Motion ワークショップが提案された。このワークショップは、直前のEPAC2000で議論されほぼ合意されたものとして、今年１１月にSLACで開催される予定である。

（３）Instrumentation

DESYのManfred Wendtによって提案された。BPM, beam size monitor (Laser wire/ interference, wire scanner etc.) などのinstrumentationと、fast (intra-bunch) and slow feedback systemによるluminosity安定化が主題となる。JLCグループではATFグループで十分なinstrumentationの開発・研究の実績があるので、この分野での国際協力が期待されている。このワークショップでも、Wendtより直接その旨の話があった。彼によれば、来年の夏ごろにヨーロッパでinstrumentationワークショップをぜひ行ないたいとのことであった。JLCグループとして、参加の旅費等を含めた対応・検討が必要である。

また、ATFでのLaser wire R&DについてUniversity of LondonのGrahame Blairが特に興味を持ち、彼がICHEP(7/27-8/2)に来日のとき京都大グループと接触したいとの申し出があった。彼のグループでは先ずSLACよりLaser wire一式を借り受けR&Dを始めるとのことであった。

（４）その他

〇Collimation/Beam Halo ：

Collimatorの物質と構造、wakefield effect、beam haloの生成機構と測定

〇Sources：

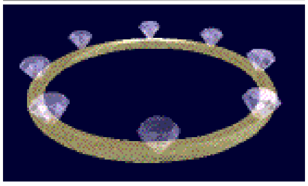
Polarized Positron source (TESLAとJLCでは全く違った方法がR&Dされている。）を含むワークショップ。

〇Bunch compression + Pre-linac collimation

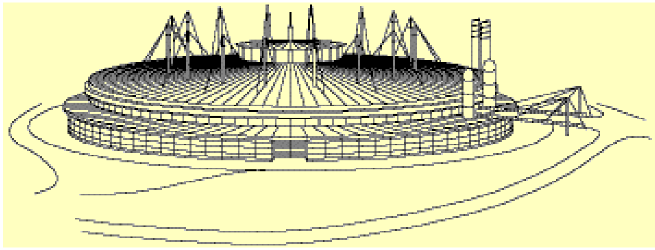
〇Operational aspects

など。

とにかく、これらの個別テーマによる国際協力（mini-workshopsを軸とする）は実際に建設する立場でどうしても必要とするもので、その現実化が近付けば近付く程、その必要の声が大きくなると思われる。特に、R&DのためのMan power/Moneyに制限が各lab.にあるとき必要となる。したがって、これら国際協力に積極的にJLCグループも参加すべきであると思う。



DIAMOND Machine Parameters



User Information for the new Source

The present concept being pursued by the Accelerator Physics Group is to have several operating modes for DIAMOND. The lattice will be commissioned with a conventional third generation light source optic with an emittance of about 5 nm rad and a lifetime of at least 10 hours. Once commissioning is complete efforts will be made to move towards the Very Low Emittance Optic given in the table below. It is recognised that this mode will be difficult to operate at because of the reduced dynamic aperture. The lifetime is likely to suffer, as a result of the dynamic aperture reduction and it may be that top-up injection will be required for successful operation with this mode. The Accelerator Physics Group is currently studying novel techniques for producing low emittance lattices with large dynamic apertures. More details can be obtained from the Accelerator Physics Group or from the poster on display at this User Meeting.
The SRS source sizes vary somewhat depending on the position in the lattice and which wigglers are in operation. Typical sigma values are 1mm horizontally and 0.14mm vertically. To obtain values of the full width at half maximum, multiply the sigma values by 2.35.

Energy	3 GeV
Circumference	407 m
Lattice	20 x DBA, 4 long straights
Max length for IDs	16 x 4.5m ; 4 x 8m
Injection energy	3 GeV
Maximum Beam current	300 mA
Minimum Emittance; h,v	1.7, 0.017 nm-rad
Minimum Source sizes and divergences. H,V (s)	
Short straight source size	178, 5.0 mm
Short straight source divergence	13.8, 3.4 mrad
Long straight source size	171, 5.7 mm
Long straight source divergence	14.8, 3.0 mrad
Bending magnet source size	62.0, 16.1 mm

For more information contact Mike Poole

Last updated : 28th September 1999
Please send any comments or suggestions to A.D.Smith

Subject: interest in FFTB
Date: Thu, 13 Jul 2000 16:47:44 -0700 (PDT)
From: burrows@SLAC.Stanford.EDU
To: NICHOLAS.WALKER@DESY.DE, DANIEL.SCHULTE@CERN.CH, TOSHIAKI.TAUCHI@KEK.JP, TWMARK@SLAC.Stanford.EDU

Dear Nick, Daniel, Tauchi-san and Tom,

Following on from the discussion at BDIR2000, this is a polite reminder to one member of each regional group to think about possible experiments at a revived FFTB:

Test of Raimondi optics

Achievement of 40 nm spots

beam-size monitor tests (eg laser wire?)

collimation system tests

beam halo measurements

+ ??????

We agreed to meet at LCWS2000 and have a discussion about whether/how to take things further. I'll send a reminder ahead of LCWS2000.

best wishes,

Phil

The 22nd Advanced ICFA Beam Dynamics Workshop

on Ground Motion in Future Accelerators

November 6 - 9, 2000 SLAC

Coordinators: Andrei Seryi & Tor Raubenheimer

- **Goals**
- **Review of the problems**
- **Agenda**
- **Registration**
- **Committees**
- **Location, Accommodations and Travel**
- **Presentations**

Workshop on Ground Motion in Future Accelerators

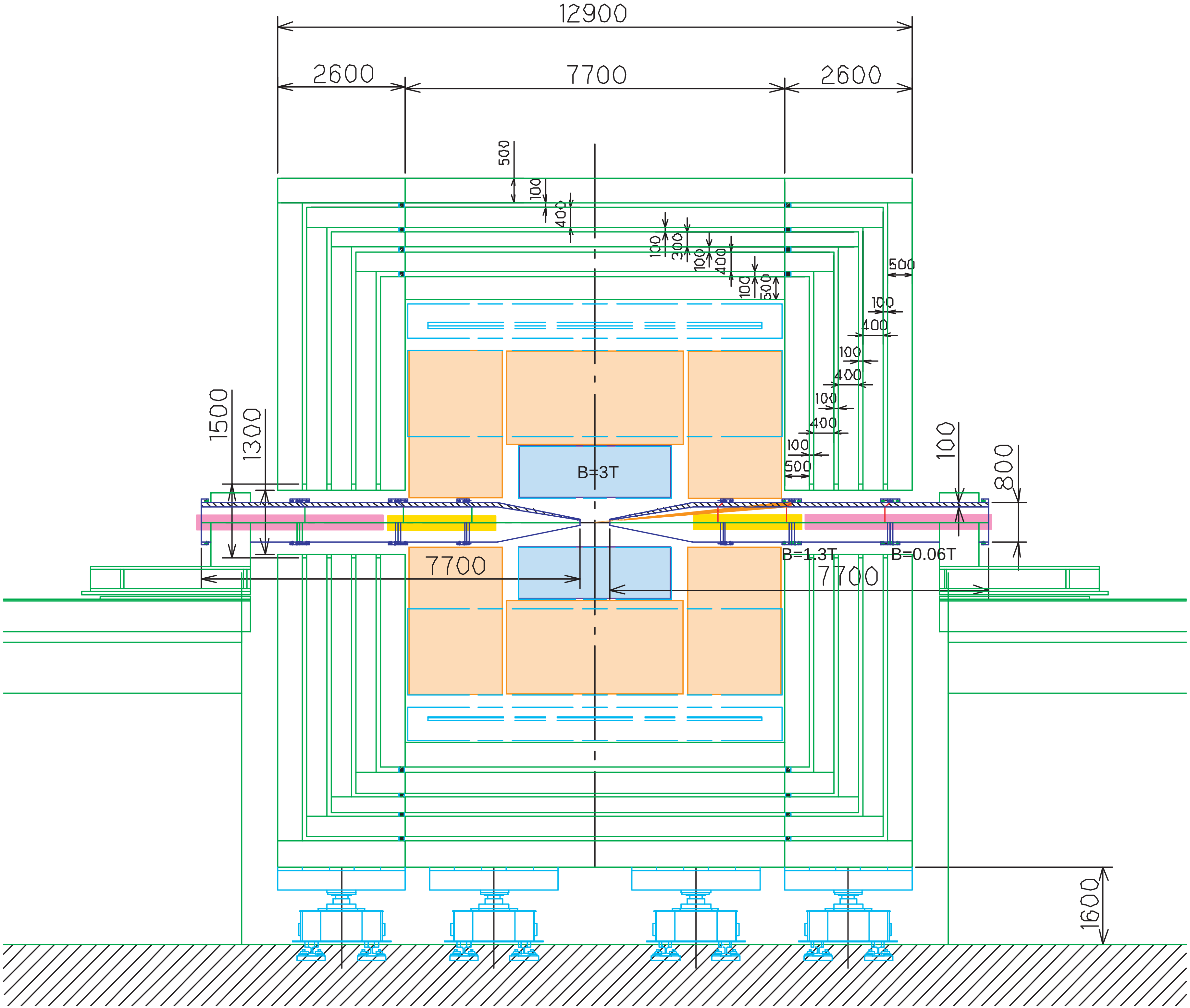
A workshop will be held at SLAC that will be devoted to ground motion and its effects on future accelerators. Ground motion and vibration can be a limiting effect in synchrotron light sources, hadron circular colliders, and electron/positron linear colliders.

Over the last several years, there has been significant progress in the understanding of the ground motion and its effects, however, there are still many problems and questions which need to be resolved including measurement techniques, classification of the motion, and modeling its effect on the accelerator.

A dedicated Workshop will be useful to collect the data, resolve outstanding issues, sharpen the contradictions, and outline further studies.

The Workshop will be primarily focused on the following problems:

- Measurements of ground motion: methods, accuracy, interpretation, ongoing and suggested experiments.
- Interpretation and classification of ground motion: fast/slow, diffusive/systematic, etc.
- Modeling ground motion, methods to evaluate accelerator performance in terms of ground motion.
- Beam independent methods to cure ground motion effects, including passive damping, inertial stabilization, interferometry for stabilization, etc.
- Tunnel construction techniques and their influence on ground motion problems.



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