# 1986 LINEAR ACCELERATOR CONFERENCE
## at SLAC 2. ELECTRON LINAC TOPICS

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ABSTRACT

The 1986 Linear Accelerator Conference was held at SLAC on June 2-6. 31 Review Talks and 143 Poster Presentations were given at the conference. This report describes mainly Electron Linac Topics. The most impressive topics were the progress of SLC, many future $e^+e^-$ linear collider developments and CEBAF superconducting linac project.

リニアック国際会議が6月初旬ＳＬＡＣで開催された。講演は全て総合報告であり、オリジナル報告はポスターセッションで展示された。ここでは総合報告の中の電子リニアック関連のトピックスについて、筆者のメモにより報告する。

講演番号　講 演 題 名
講演者、所属機関

M01-2　INDUCTION LINACS
Briggs, LLNL

大電流、パルス →応用面での開発

$e^-$ I.L.: 熱核融合反応研究用(Astron)
collective acceleration of ions. (ERA)
pulsed radiography. (FXR)
beam propagation in air. (ATA, RADLAC)
FEL (ATA)

H.I.I.L.: inertial fusion.

TOPICS:
- beam transport & beam instabilities.
- major limitations for higher voltages & higher currents.
- high brightness for FEL applications.
- recent progress in high repetition rate

M02-1　CONTROL OF BEAM DYNAMICS IN HIGH ENERGY INDUCTION LINACS
Caporaso, LLNL

LASER-ION GUIDING in the Advanced Test Accelerator.
The control of the beam breakup and other instabilities by LASER GUIDING and by various magnetic focusing.

M02-2　LINACS FOR ESOTERIC APPLICATIONS
Jameson, LANL

APPLICATION TO NATIONAL DEFENSE (STRATEGIC DEFENSE INITIATIVE)
かなりの開発の後に、加速器は国防の中で重要な役割を果たすであろう。
Ｒ＆Ｄプログラムが長期的に加速器技術に与える影響は大きい。

M02-3　RF POWER SOURCES FOR 1990 AND BEYOND

Reid, LANL

宇宙空間での中性粒子加速器またはＦＥＬ→ compact, light weight, efficient, solid state, klystrode, lasertron, gyroklystron, gyrocon.

M02-4　LINACS FOR MEDICAL AND INDUSTRIAL APPLICATIONS

Hamm, AccSys Technology, Inc.

RADIATION THERAPY　2500台

増加率　～500台／年

特徴：portability, multi-energy operation.

RFQ LINAC : RI production........

TU2-2　RECENT DEVELOPMENTS IN RF SUPERCONDUCTIVITY FOR LINAC STRUCTURE

Lengeler, CERN

○ Low $\beta$

| | | |
|---|---|---|
| Argonne | Nb | split ring |
| Stonny Brook | Pb | split ring |
| Saclay | Nb | helix |

mechanical stability が重要。

○ electron 用

| | freq. | | $E_{max}$ | |
|---|---|---|---|---|
| CEBAF | 1500 MHz | 5 cell | 6-8 MV/m | industry |
| KEK | 500 〃 | 1 〃 | 7.6 | 〃 |
| Wuppental | 3 GHz | 20 〃 | 7.5 | 〃 |
| CERN | 350 MHz | 4 〃 | 7.5 | CERN |

○ Single Cavity

| | | |
|---|---|---|
| Cornell | 1500 MHz | 22 MV/m |
| Wuppental | 3 GHz | 23 〃 |

TU2-3 THE CEBAF SUPERCONDUCTING ACCELERATOR —— AN OVERVIEW

Leemann, CEBAF

\$236M/5Y　ACC. \$86M EXP. \$39M 1992年完成予定

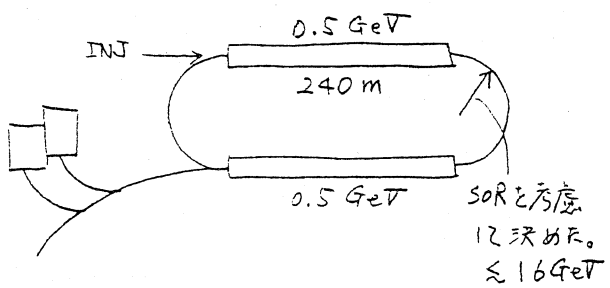
DOE 独自に COST ESTIMATE

RF 5kW/cavity, Amplitude $<10^{-4}$, Phase $<1°$

Multipass BBU : worst case $I_{th}$ ～ 2mA

high quality beam ($\Delta E/E \leqq 10^{-4}$, $\varepsilon \sim 10^{-9}$m)

200$\mu$A, 100% duty factor, 0.5GeV≦E≦4.0GeV




TU2-4　COMPARISON OF STANDING-WAVE AND TRAVELING-WAVE LINACS

Miller, SLAC

Stanford Myths:Half the power waste in S.W. Structures. Reflected power.......

Comparison Study: PRE-Superconducting CEBAF

結論

SW:1.CW に適している

2.pulse でも pulse 幅が $t_b \geqq 2Q/\omega$ なら適

但し 2. については議論が分かれる

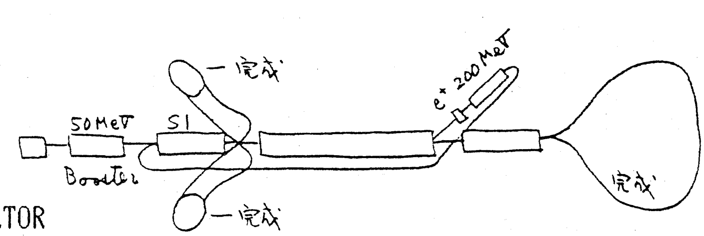
TW:1.nano sec pulse

2.linear collider

3.storage ring injector

WE1-1　SLC PROGRESS REPORT

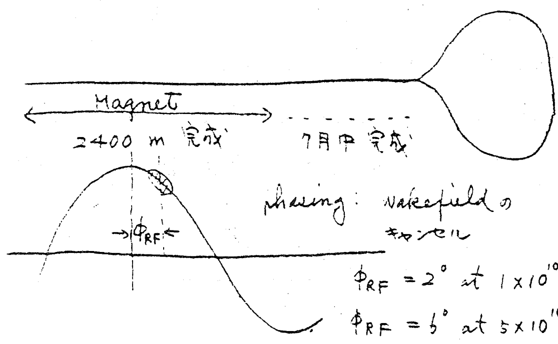
Rees, SLAC




Klystron 50MW(60～70)150本完成12月全数完成

WE1-2 SPECIAL SLC LINAC DEVELOPMENTS

Seeman, SLAC




WE1-3 ADVANCED TECHNOLOGY RECENTLY DEVELOPED AT KEK FOR FUTURE LINEAR COLLIDERS

Tanaka, KEK

High Field in Vac.

Breakdown limit : material (inpurity, gas)

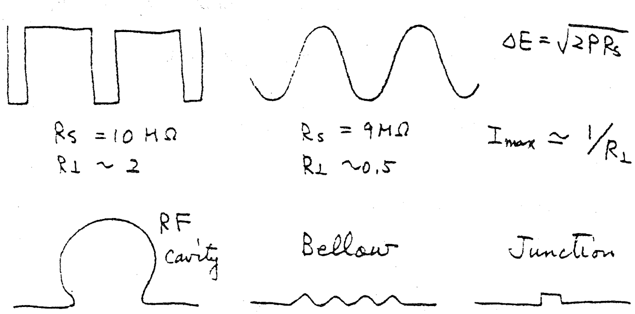
Materials for ACC structures & High power rf source : Ceramics （顕微鏡写真多数）。

High Power Klystron

OFC Vac(cavity) でのガス放出について

WE2-4 RF CAVITY DESIGN AND CODE

Weiland, DESY




freq. domain — time domain

2D CODES — 3D CODES

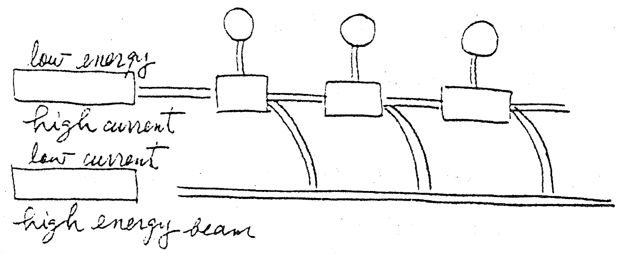
3D MAFIA (direct access file base)

jungle jim, coupler, bellow, beam pipeの設計に使う。

TH1-1 THE TWO-BEAM ACCELERATOR

Sessler, LBL

目的： collider 1TeV × 1TeV




Test Facility I=850A $\gamma$=6.8(3MeV)

(ELF) 80MW test 7 cavities.

TH1-2 PROGRESS ON PLASMA ACCELERATORS

Chen, UCLA

Plasma Beat Wave Accelerator

Plasma Wake Field Accelerator

Conventional Linac 20MeV/m → 1TeV → 50km

Plasma Accelerator 1GeV/cm → 1TeV → 10m

TH1-3 WAKEFIELD ACCELERATORS

Weiland, DESY

1 $\mu$C 1 GeV → 0.1 $\mu$C 2 GeV

1 $\mu$C 1 GeV → 0.01 $\mu$C 10 GeV

DESY driving beam 0.5～1 $\mu$C 8 MeV

driven beam 60 MeV

1985年 100 A laser driven gun 完成

TH2-1 MAGNET INOVATIONS FOR LINACS

Halbach, LBL

variable strength permanent magnet quadrupoles for linacs.

TH2-3 LINACS FOR MICROTRONS AND PULSE STRETCHERS

Penner, NBS

1.WHY CW?

true rate ∝ $I_p$, chance rate ∝ $I_p^2$

∴ chance/true ∝ $I_p$

2.Pulse stretcher vs CW "From the Bigining"

transverse emittance

space charge forces ∝ $I_p$

Gun emittance ∝ $\sqrt{I_p}$

RF stability:lower peak power, no transient

3.Recyclotrons vs Microtrons

| Recyclotrons | | Microtrons |
|---|---|---|
| few | passes | many |
| complex | bends | simple |
| | BBU | sirious |
| high | Energy limit | ~ 1 GeV |
| longer | length | shorter |

4.Superconducting vs Normal

| Superconducting | Normal |
|---|---|
| power efficient Q~5x10$^9$ | No cryogenics |
| high gradient 6~8MeV/m | compact |
| HOMs can be suppressed | cost/length |

結論：１ＧｅＶ以上では超電導が有利

TH2-1 PRODUCTION OF INTENSE LOW EMITTANCE BEAMS FOR FREE ELECTRON LASERS USING ELECTRON LINEAR ACCELERATORS

Smith, SLAC

2000 A FEL using 150 MeV electron linac

$I_{peak}$ = 200 Amp

LANL, Boeing, UK FEL, MkⅢIK FEL,....JAPAN?

TH2-2 ELECTRON LINAC INJECTOR DEVELOPMENT

Fraser, LANL

high brightness : Laser illuminated photo emissive source.

Advantage : High current density......

Disadvantage : Ultra high vacuum, Fragility

Los Alamos Injector Development Program.

FR1-1 FUTURE $e^+e^-$ LINEAR COLLIDERS AND BEAM -BEAM EFFECTS

Wilson, SLAC

What Do Particle Physisists Want?

High Energy $e^+e^-$ collisions with $\mathcal{L} \propto E^2$ each

| | | |
|---|---|---|
| 50 GeV | $6\times10^{29}$ ~ $6\times10^{30}$ |
| 5 TeV | $10^{34}$ |

- pintch enhancement of luminocity.
- Radiation by a single particle in Magnet Field.
- Beam-strahlung by Colliding Gaussian Bunches

FR1-2 FACTORS LIMITING THE OPERATION OF STRUCTURES UNDER HIGH GRADIENT

Schriber, LANL

Kilpatrick criterion に比べて

ｃｗでは２倍程度、パルスでは５倍程度まで可能

FR2-1 COLLIDER CONSTRAINTS IN THE CHOICES FOR WAVELENGTH AND GRADIENT SCALING

Lawson, RUTHERFORD

FR2-2 HIGH ENERGY PHYSICS AND FUTURE VERY HIGH ENERGY ACCELERATORS

Richter, SLAC

高エネルギーコライダーではクォーク模型から考えて電子リニアックが有利。

FR2-3 SUMMARY OF THE CONFERENCE

Angert, GSI

流れは proton Linac → electron Linac

超電導加速管は前回会議のハイライトであったが今回はメーカーにその技術は移転した。