Introduction

The Compact Linear Collider (CLIC) will provide high energy e^+e^--collisions

main focus is on $E_{cm} = 3\,\mathrm{TeV}$, with $\mathcal{L} = 10^{35}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$

beam parameters at IP

$f_r = 100\,\mathrm{Hz}$	$\sigma_z = 30\,\mu\mathrm{m}$	$N = 4 \cdot 10^9$
$N_b = 154$	$\sigma_x^* = 43\,\mathrm{nm}$	$\epsilon_x^* = 680\,\mathrm{nm}$
$\Delta_b = 0.67\,\mathrm{ns}$	$\sigma_y^* = 1\,\mathrm{nm}$	$\epsilon_y^* = 20\,\mathrm{nm}$

cost effective technology

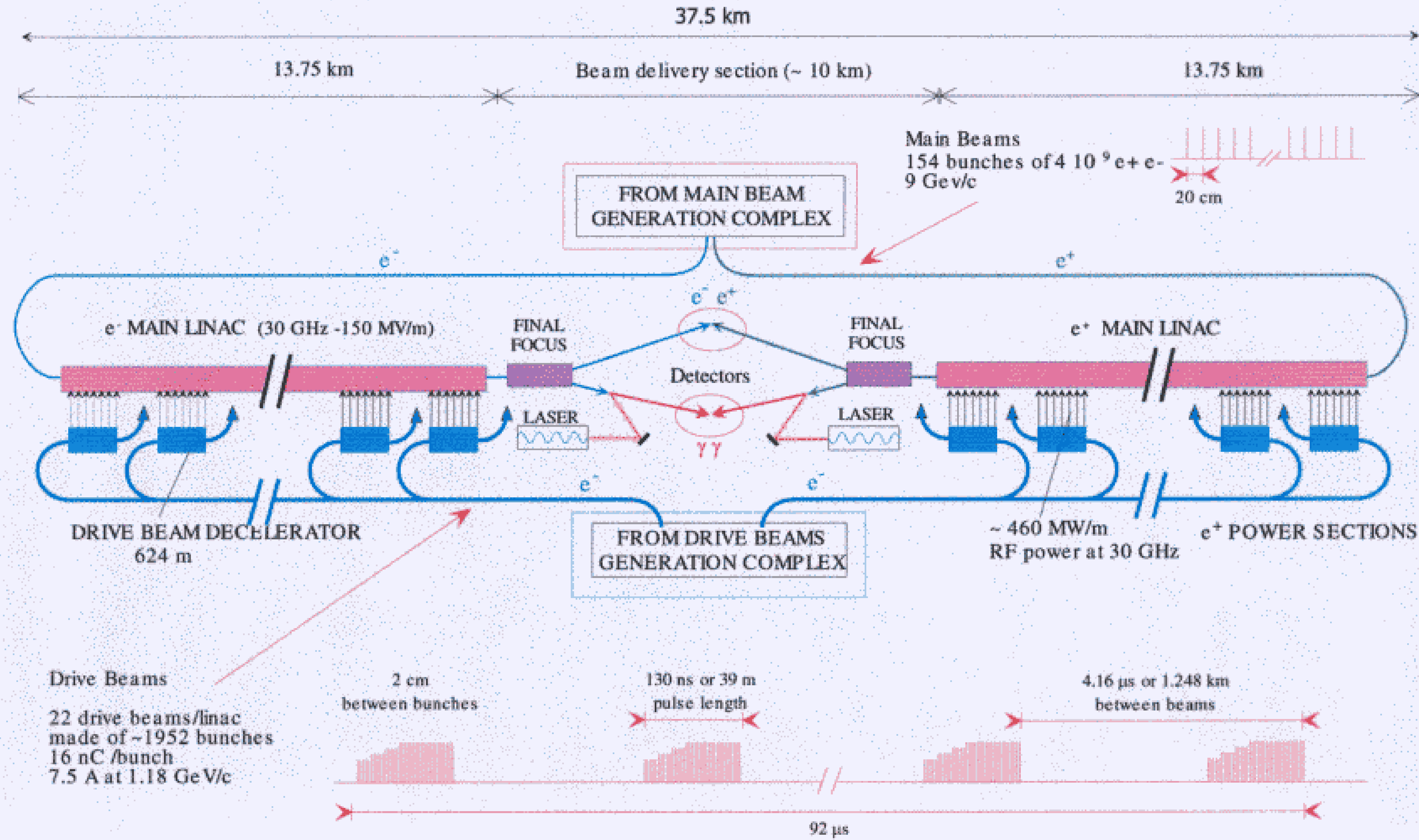
$\Rightarrow$ high gradient (short machine)

$\Rightarrow$ simple power source

the beams are accelerated at high frequency $(30\,\mathrm{GHz})$ to achieve high gradient

the RF-power is produced with a drive beam

Overall Layout of the CLIC complex at 3 TeV c.m.



Main Beam

Main problems

generation of the RF-power

achievable gradient

production of low emittance beam

emittance preservation

RF-power

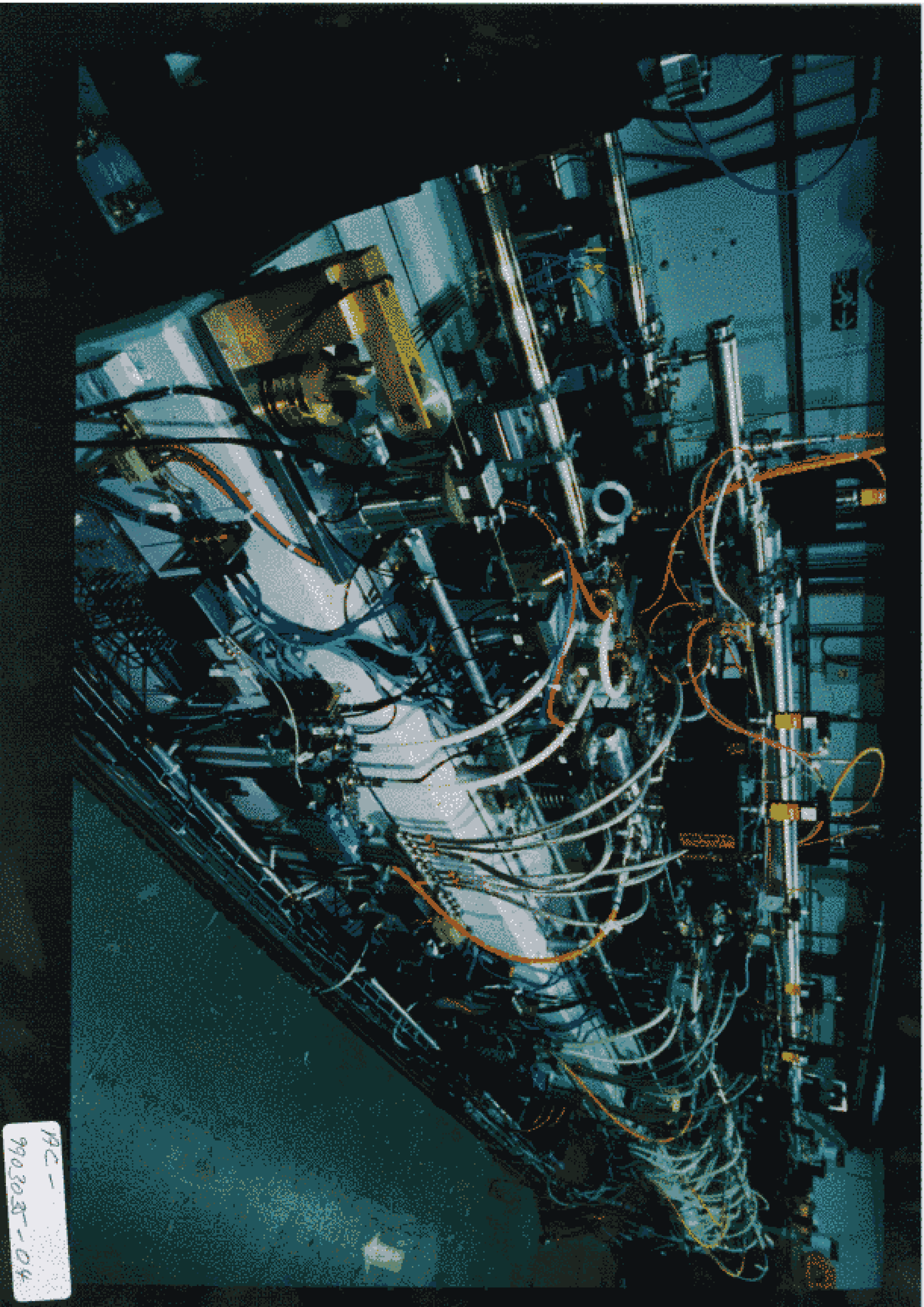
the feasibility of the two-beam acceleration has been demonstrated (CTF II)

$$Q_{\text{train}} = 375\,\text{nC}$$
$$P = 27\,\text{MW}$$
$$G = 57\,\text{MV/m}$$

limited by drive beam current

Gradient

$\Rightarrow$ need a 30 GHz power source with a long pulse and high power


PC-

Production of low emittance beam

- first injector design exists
- work on the damping rings started

Emittance preservation

- static case
  - simulations are advanced
  - ⇒ look very promising
- dynamic case (jitter, ground motion,...)
  - simulations started
  - measurements of element movements necessary
  - different stabilisation options will be investigated
  - ⇒ more work to be done

Beam Delivery and Machine-Detector Interface

A CLIC Physics Working Group has been created at CERN

⇒ see Alberts talk

work on luminosity spectrum and background started

an almost
a satisfactory final focus system has been designed (much shorter option is investigated)

collimation system has to be designed

discussion on best realisation of two IPs has started

development of diagnostics, tuning precedures, feedbacks, final quadrupoles, ... is necessary and is starting

⇒ field of growing activity

Drive Beam

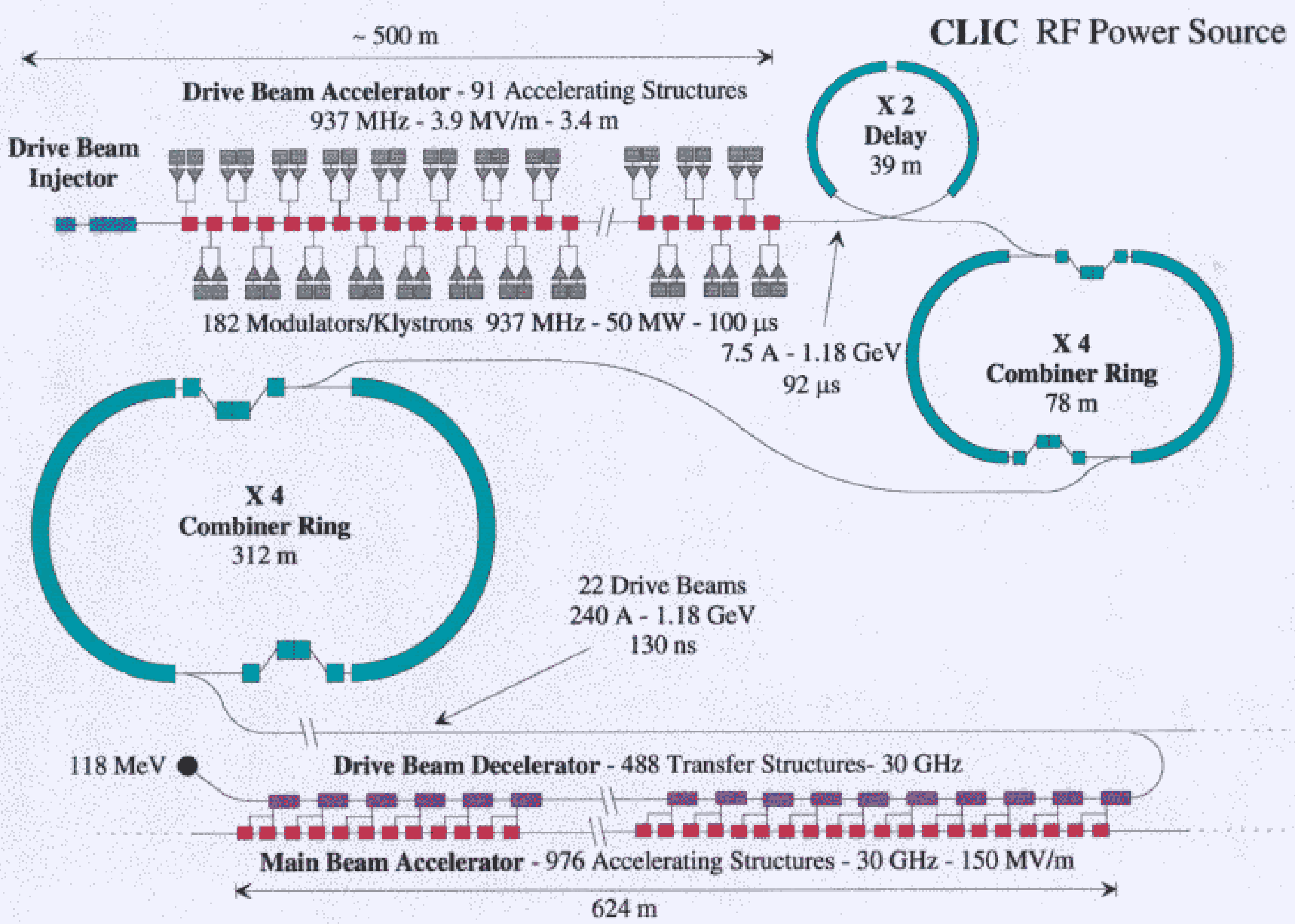
Consistent and efficient scheme to generate the drive beam has been designed

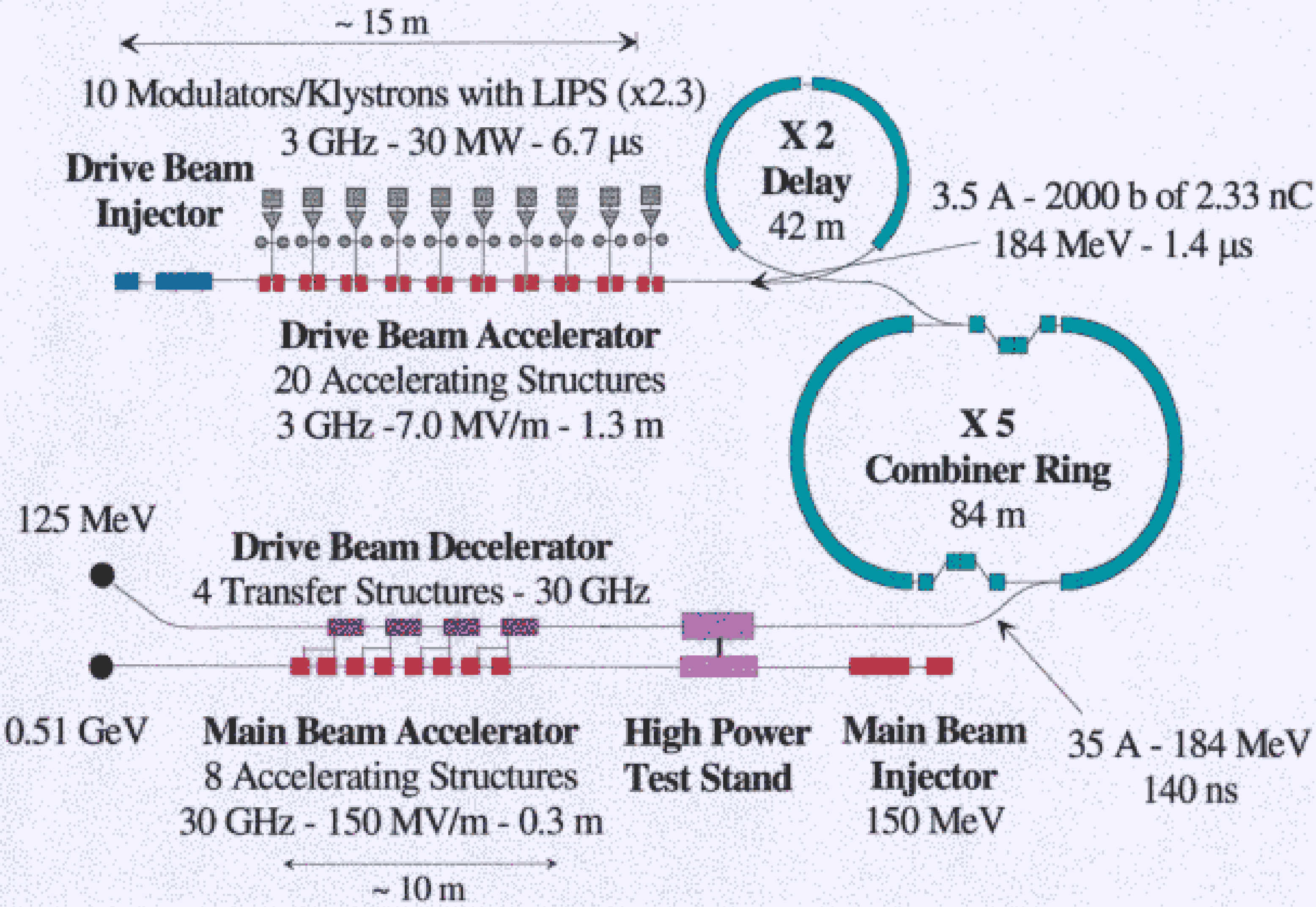
CTF3, a new test facility, will be constructed

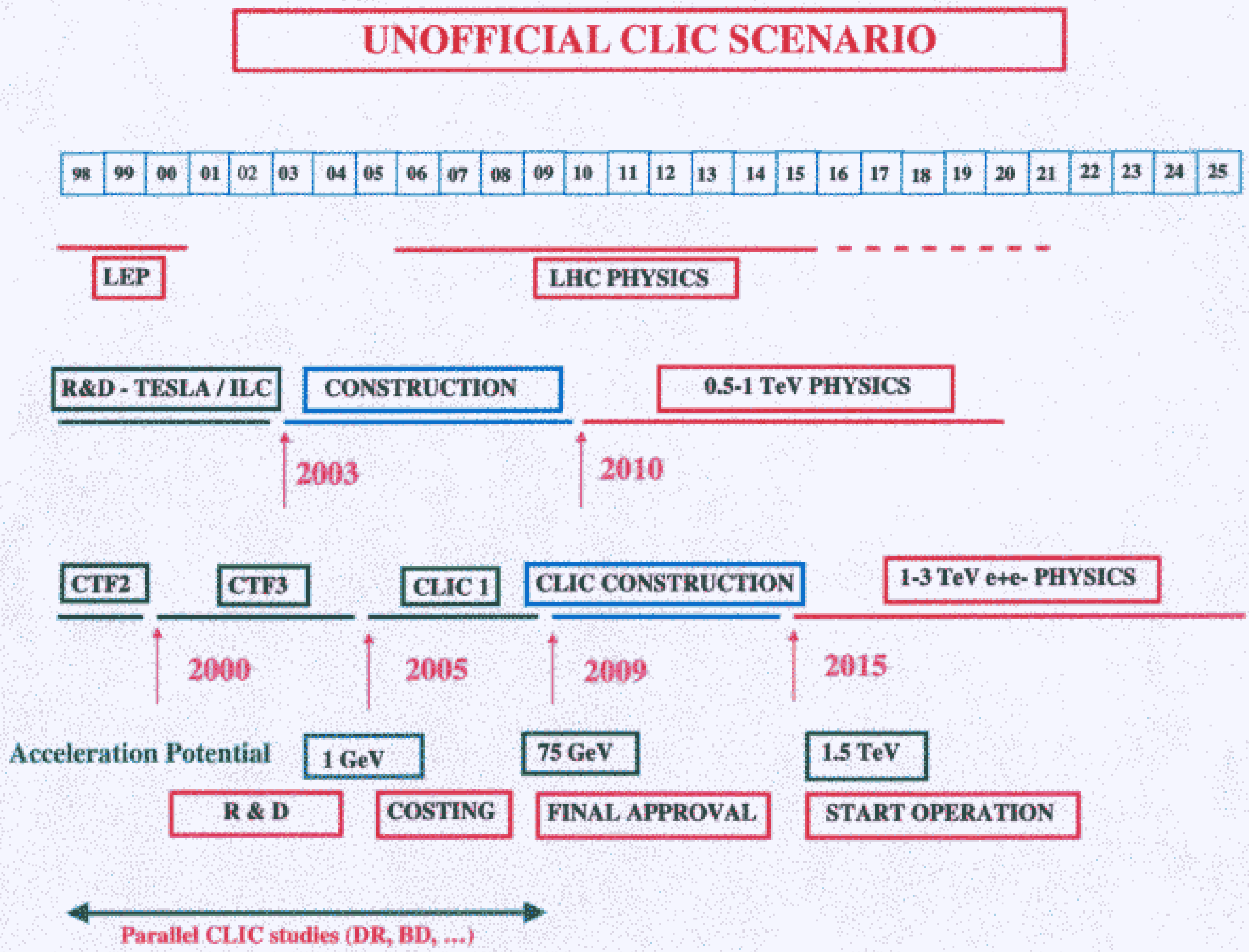
it will test

- production of the drive beam (injector)
- efficient acceleration of the drive beam
- the delay loop
- one combiner ring
- many other things

it will also provide an excellent facility to test accelerating structures


CLIC RF Power Source
~ 500 m
Drive Beam Accelerator - 91 Accelerating Structures
937 MHz - 3.9 MV/m - 3.4 m
Drive Beam
Injector
X 2
Delay
39 m
182 Modulators/Klystrons 937 MHz - 50 MW - 100 μs
7.5 A - 1.18 GeV
92 μs
X 4
Combiner Ring
78 m
X 4
Combiner Ring
312 m
22 Drive Beams
240 A - 1.18 GeV
130 ns
118 MeV
Drive Beam Decelerator - 488 Transfer Structures- 30 GHz
Main Beam Accelerator - 976 Accelerating Structures - 30 GHz - 150 MV/m
624 m


~ 15 m
10 Modulators/Klystrons with LIPS (x2.3)
3 GHz - 30 MW - 6.7 µs
Drive Beam Injector
X 2
Delay
42 m
3.5 A - 2000 b of 2.33 nC
184 MeV - 1.4 µs
Drive Beam Accelerator
20 Accelerating Structures
3 GHz -7.0 MV/m - 1.3 m
X 5
Combiner Ring
84 m
125 MeV
Drive Beam Decelerator
4 Transfer Structures - 30 GHz
0.51 GeV
Main Beam Accelerator
8 Accelerating Structures
30 GHz - 150 MV/m - 0.3 m
~ 10 m
High Power Test Stand
Main Beam Injector
150 MeV
35 A - 184 MeV
140 ns



UNOFFICIAL CLIC SCENARIO
98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
LEP
LHC PHYSICS
R&D - TESLA / ILC
CONSTRUCTION
0.5-1 TeV PHYSICS
2003
2010
CTF2
CTF3
CLIC 1
CLIC CONSTRUCTION
1-3 TeV e+e- PHYSICS
2000
2005
2009
2015
Acceleration Potential
1 GeV
75 GeV
1.5 TeV
R & D
COSTING
FINAL APPROVAL
START OPERATION
Parallel CLIC studies (DR, BD, ...)

I. WILSON

RF Breakdown in room temperature TW accelerating structures.

RF breakdown has been observed in both the NLC/JLC and CLIC prototype accelerating structures at gradients below the nominal values.

A special workshop was organised at SLAC in September to discuss the problem.

The situation for CLIC is given as follows.

The high operating frequency of 30 GHz was chosen for CLIC to be able to attain high accelerating gradients and in consequence shorten the linacs.

CLIC nominal average gradient and pulse length are 150 MV/m and 130 ns.

So how are we doing ?

In 1994 before we had a 30 GHz power source we built and tested a 26-cell 11.4 GHz structure up to peak gradient of 154 MV/m (125 MV/m average) with a pulse length of 150 ns. The structure took about 50 hours to condition and has not been damaged (to the extent we can verify it) but has not been lifetime tested.

This is a proof of existence of high gradients of 320 MV/m on copper surfaces.
Such accelerating gradients have never been achieved in lower frequency TW structures.
So we believe higher frequencies go together with higher gradients.
How this scales we do not know – experiments are in preparation to provide more data.

The ultimate limiting mechanism for gradient (electrical breakdown or pulse surface heating) is not known - experiments are in preparation to provide more data.

Damage of the copper surfaces of 30 GHz prototype structures tested in CTF2 have been observed at relatively low gradients (60 MV/m) but we do not consider these results to be representative of what we can finally achieve. Why ?

- (i) The damage is confined to the input coupler which has a 40% over-voltage enhancement which can be taken out by modifying the design – this is foreseen.
- (ii) The structures have been exposed to air (and dust) for about six to seven years and were operated under unusually poor vacuum (perhaps as bad as 10^{-3} torr).
- (iii) The structures were conditioned using aggressive conditioning procedures.

More importance has clearly to be given to the design which obviously plays a major role in determining final gradients.

We do not know at the moment what the major limiting factors to gradient are – possible candidates include : geometry, cleanliness, conditioning and cleaning procedures, material and frequency, ...