High-frequency high-power in CTF3

The nominal CLIC RF pulse is 30 GHz, 240 MW, 130 ns, 100 Hz giving an accelerating gradient of 150 MV/m.

The nominal CLIC drive beam is 240 A, 37 kJ.

In order to develop the CLIC RF system we need a such a beam and such a power…

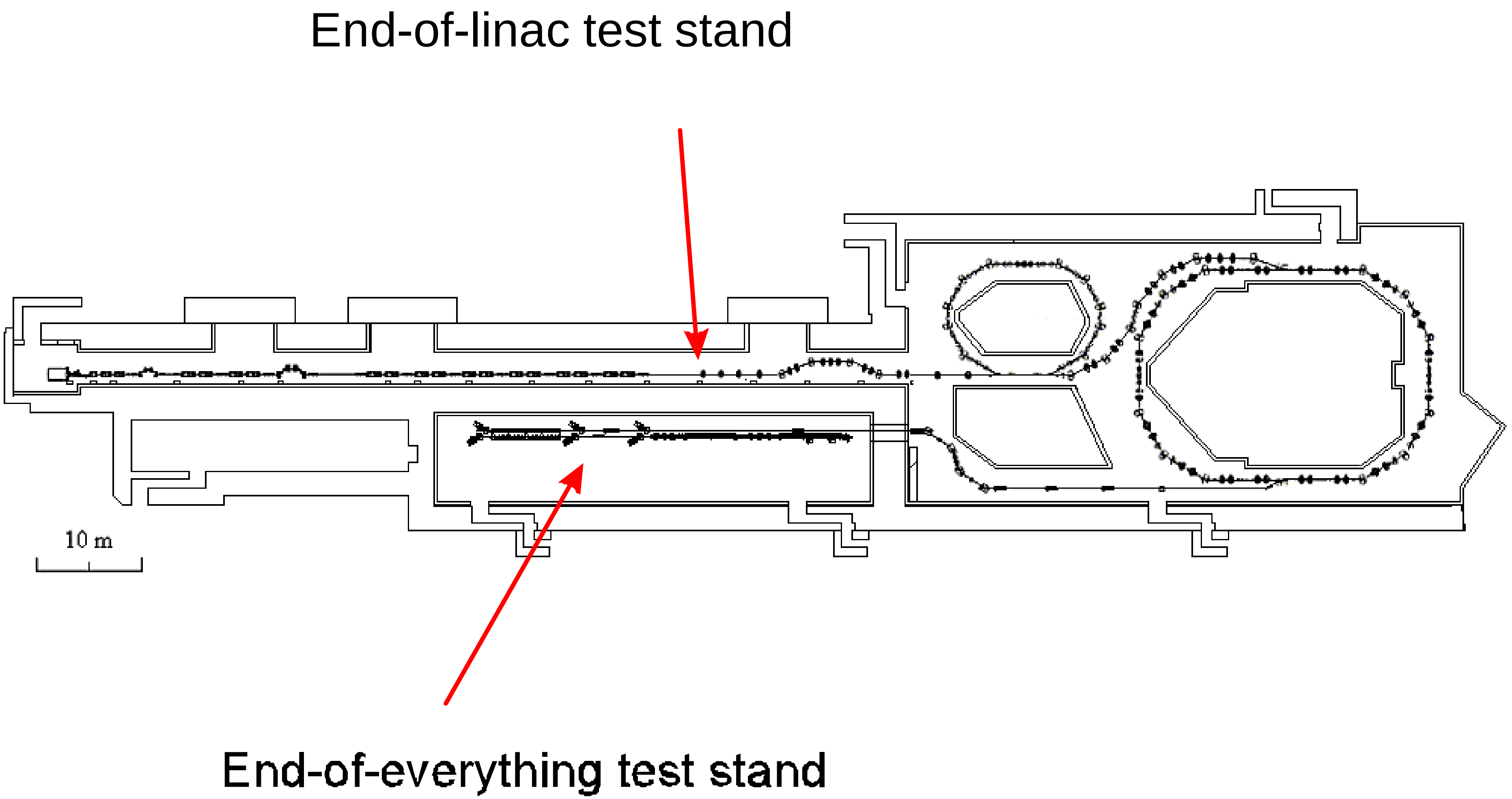
We can probe these parameters with the CTF3 test stands.

The CTF3 test stands are foreseen to be the main experimental facilities for CLIC RF system development.

A test stand is a highly flexible single unit of two beam accelerator driven by the CTF3 beam and instrumented for high power, gradient and current tests.

For high power testing, the CTF3 test stands are direct descendents of CTF1 and CTFII.

We expect to start with the end-of-linac test stand (Roberto's talk) to get going as early as possible. We continue with the end-of-everything test stand for ultimate performance.


End-of-linac test stand
10 m
End-of-everything test stand

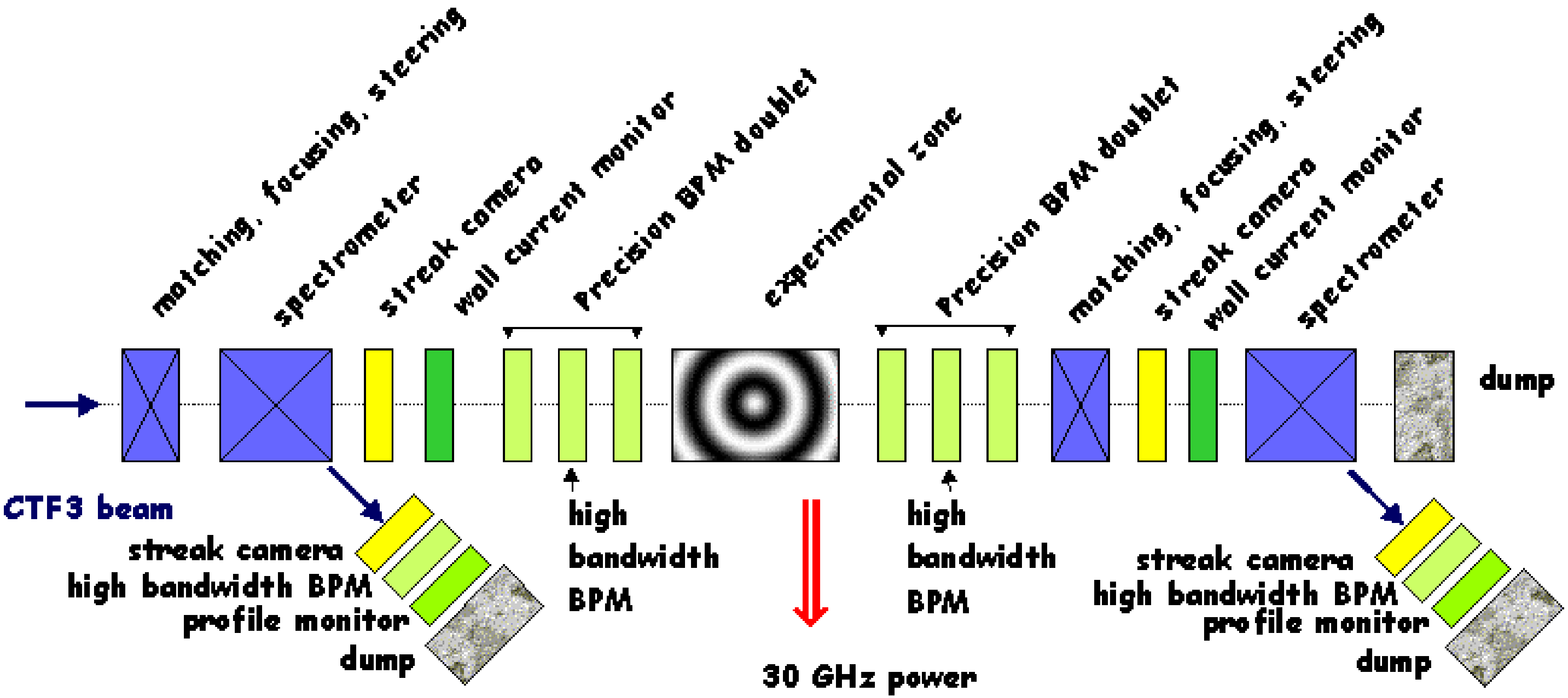
In order to be clear,

I will **NOT** present a detailed design and supporting calculations for the test stand - the work has not yet been done.

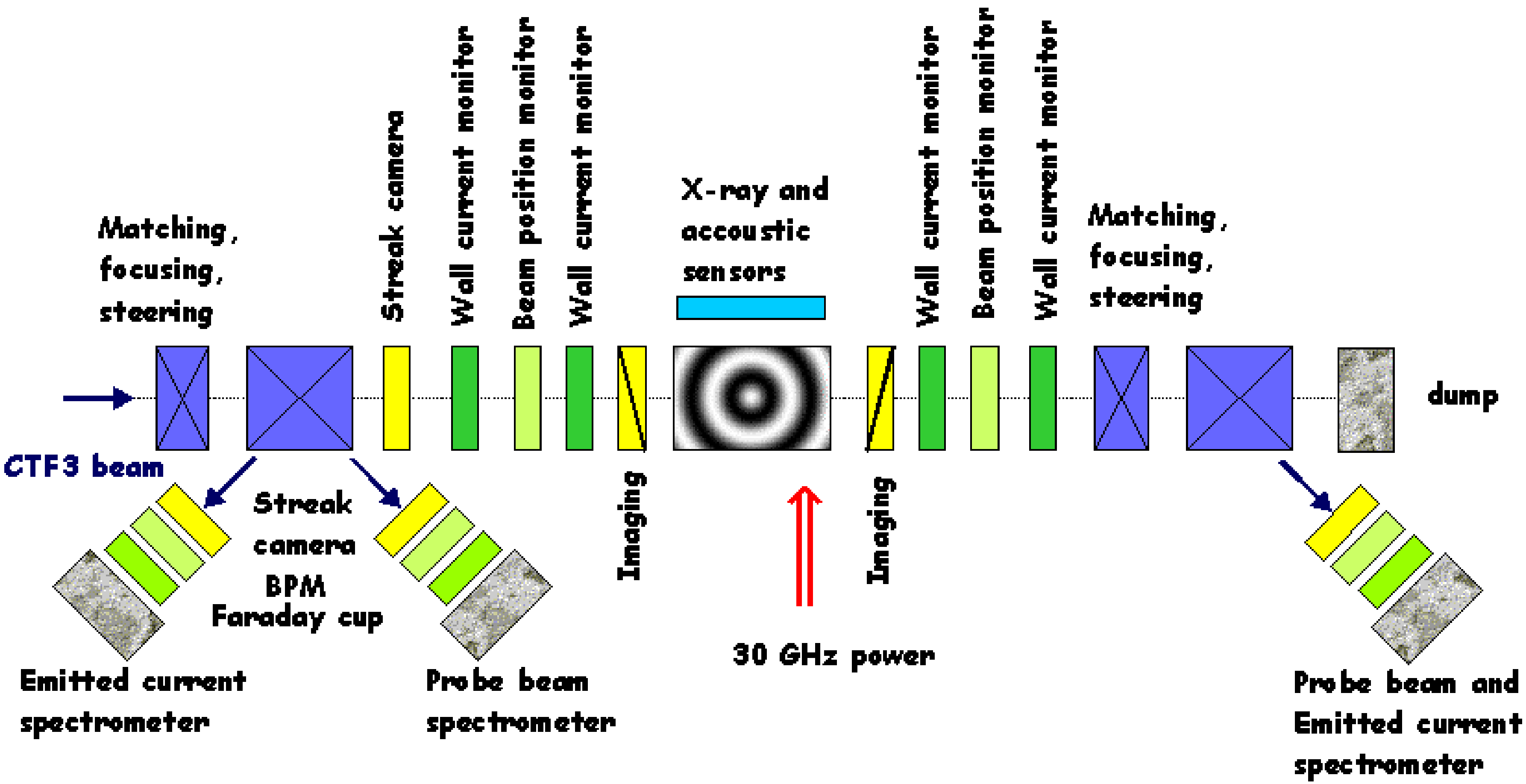
Nonetheless, 10 years of CTF1 and CTFII is direct evidence that the test stand is feasible and the accumulated experience make us very well prepared to design, build and operate it.

I will **NOT** present a detailed experimental program.

High powers and gradients are hot topics for which our understanding and achievements are evolving rapidly. We cannot say where we will be three or more years from now.



Layout of test stand, power generating side



Optic and instrumentation layout of test stand, driven side

Physics and Development

Structures:

Power generating structures

Accelerating structures

Waveguide components

Special test structures

Subjects:

Physics of breakdown: Trigger process, evolution of arc, absorption of RF energy, ultimate gradient, frequency scaling*, pulse length scaling, effect of RF design, effect of beam loss*, instrumentation.

Materials: materials for arc resistance, materials for ultimate gradient.

Preparation and RF Processing: Machining, cleaning, pre-processing (glow discharge, laser melting etc.), 'soft' conditioning.

Pulsed surface heating: Physics, mechanics, materials, machining.

Lifetime testing…………………………...

Beam/structure interaction: Verification of RF parameters, field asymmetry, beam loading compensation, longitudinal and transverse wakefields, beam position signals.

Power generation

CTFI - 24 A, 90 MeV, 8 ns, 80 MW
CTFII - 37 A, 60 MeV, 16 ns, 300 MW

CTF3 - 35 A, 160 MeV, 130 ns
(End-of-linac- 3.5 A)

One of the most central design issues of the test stand is that of the power generating structures which must be matched to the current and energy of the driving beam.

CTF3 current* allows the use of existing CTFII style power generating structures. We may choose to re-optimize because,

Higher beam energy makes transmission through power generating structures easier.

Increased pulse length will be more difficult - but pulse length is an objective!