

CTF3 probe beam

- **applications**
- **options**

Warning:

Not much has been done so far for the probe beam, therefore all the considerations presented are very preliminary!

Probe beam applications

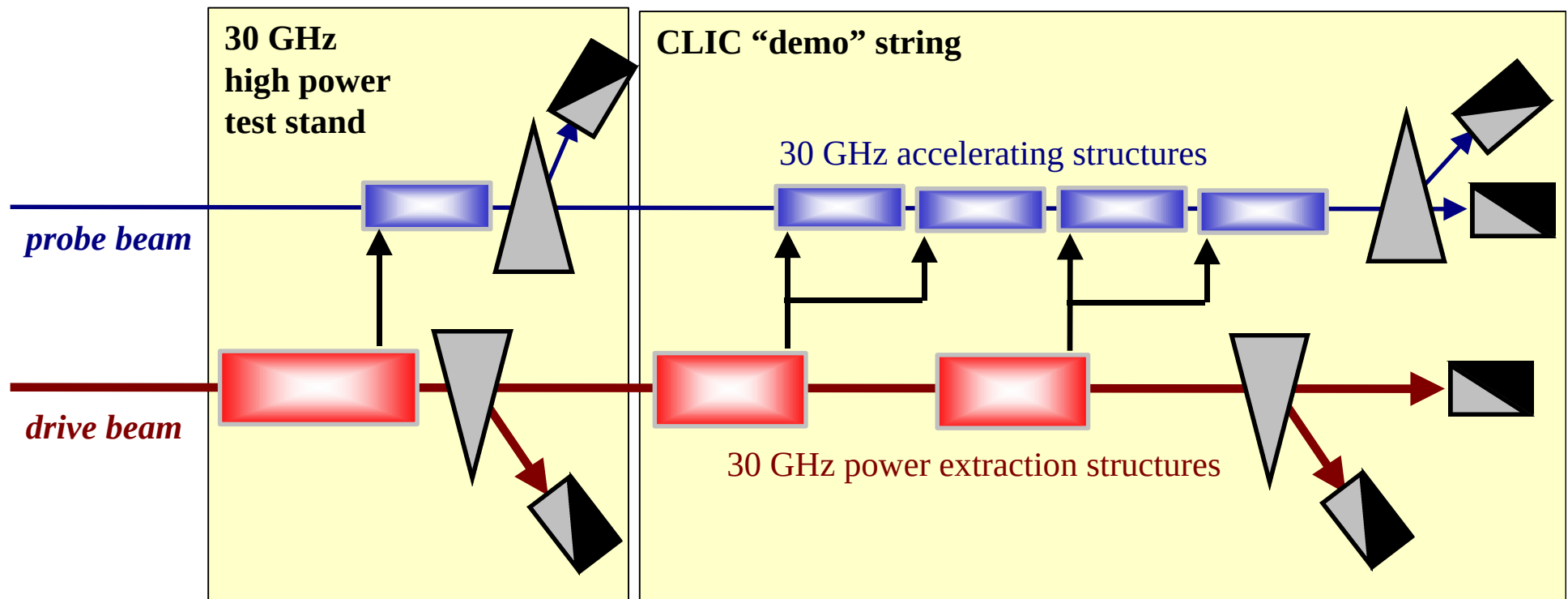
Single bunch probe beam

- test acceleration
- cross check of 30 GHz RF power calibration
- measure synchronous frequency of accelerating structures prototypes
- measure higher order modes frequencies of accelerating structures prototypes
- test-bed for CLIC main beam instrumentation
- engineering test-bed for CLIC accelerator module

Multi bunch probe beam

- test CLIC beam loading compensation scheme
- test damping of HOM's in accelerating structure prototypes
- test-bed for CLIC main beam instrumentation

CLEX - CLIC experimental area



Parameter space for probe beam injector

Injection energy in 30 GHz Module:

Assuming a 30 GHz module length of 1.4m, an aperture of $\varnothing 3.5$ mm, a norm. injector emittance of 50 mm mrad and a 4σ beam clearance with

$$g = \frac{64L}{d^2} e$$

► $E > 186$ MeV

Bunch length:

Energy spread due to bunchlength $\Delta T/T \approx 1 - \cos \omega \sigma_t$

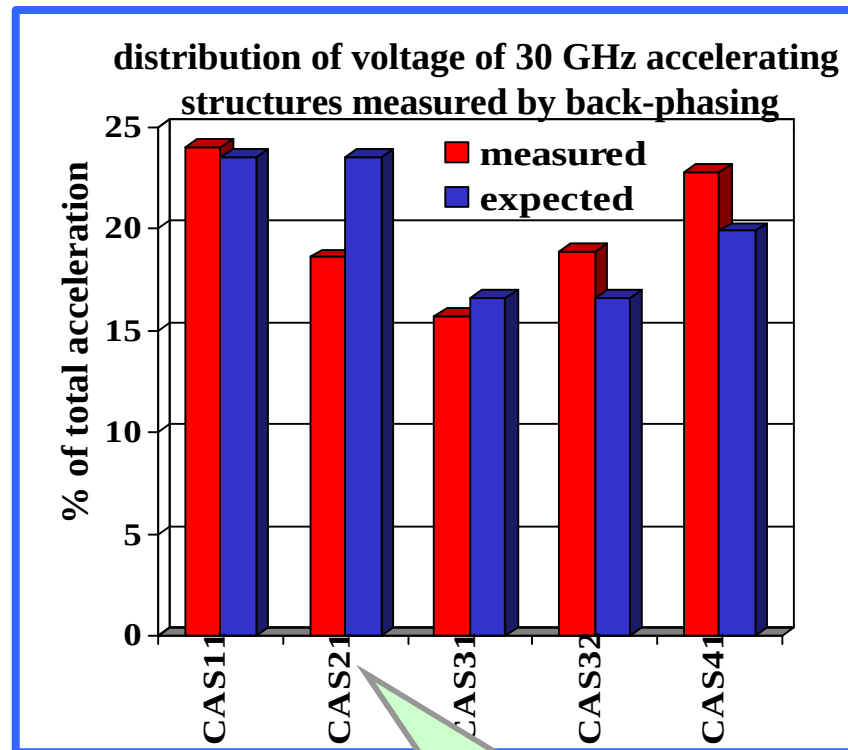
For $\Delta T/T \leq 1\%$ ► $\sigma_t \leq 0.75$ ps

Potential energy gain in a 30 GHz accelerator

Assume 30 GHz structure parameters, $E = 150$ MV/m, $L = 0.286$ m, $\Delta T = 3.51 P^{1/2}$

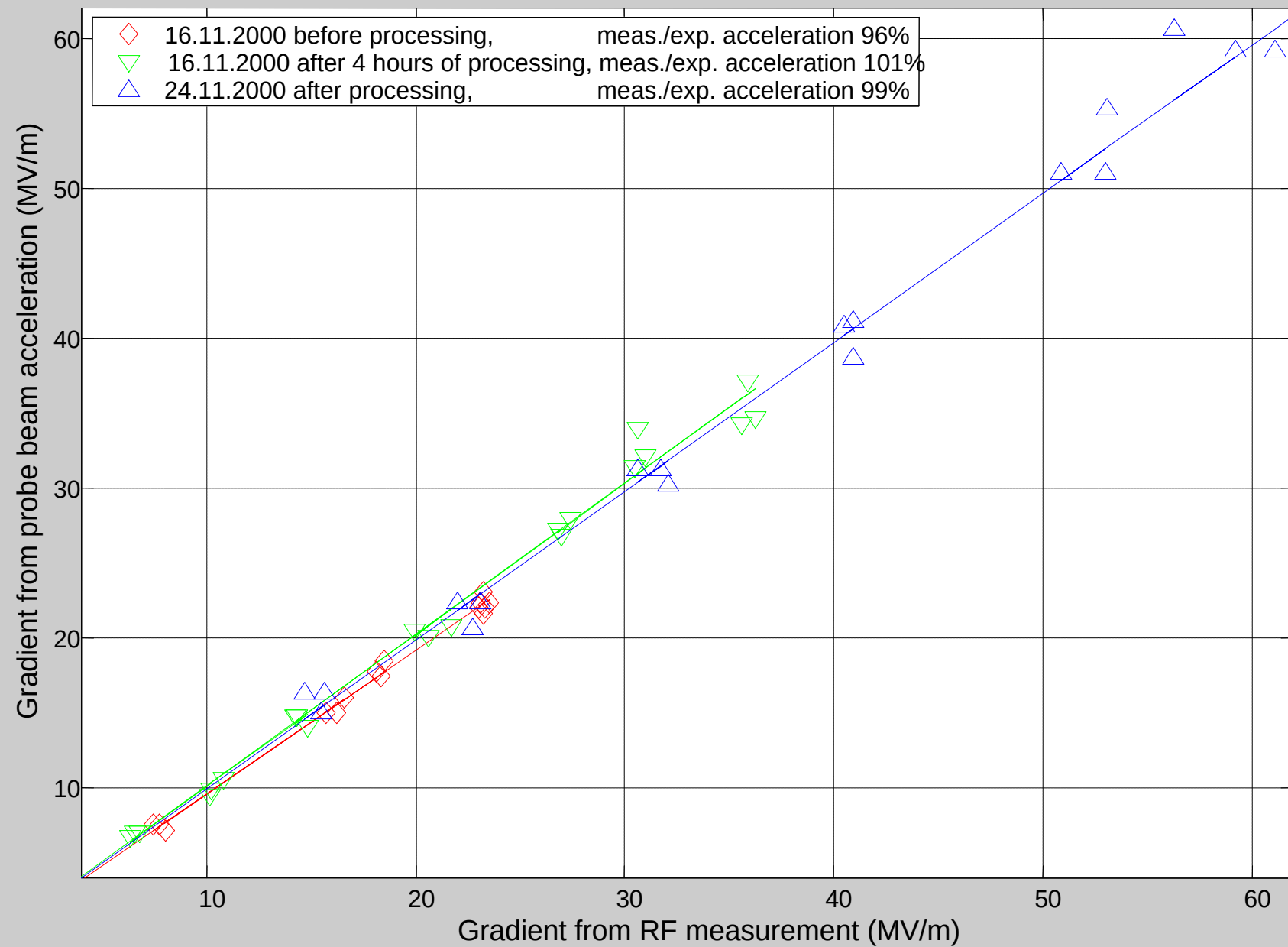
If we decelerate the drive beam by 100 MeV we have 3.5 GW of 30 GHz power available.

This is sufficient to power 24 accelerating structures, giving a total acceleration of 1.03 GeV in an active length of only 6.9 m !



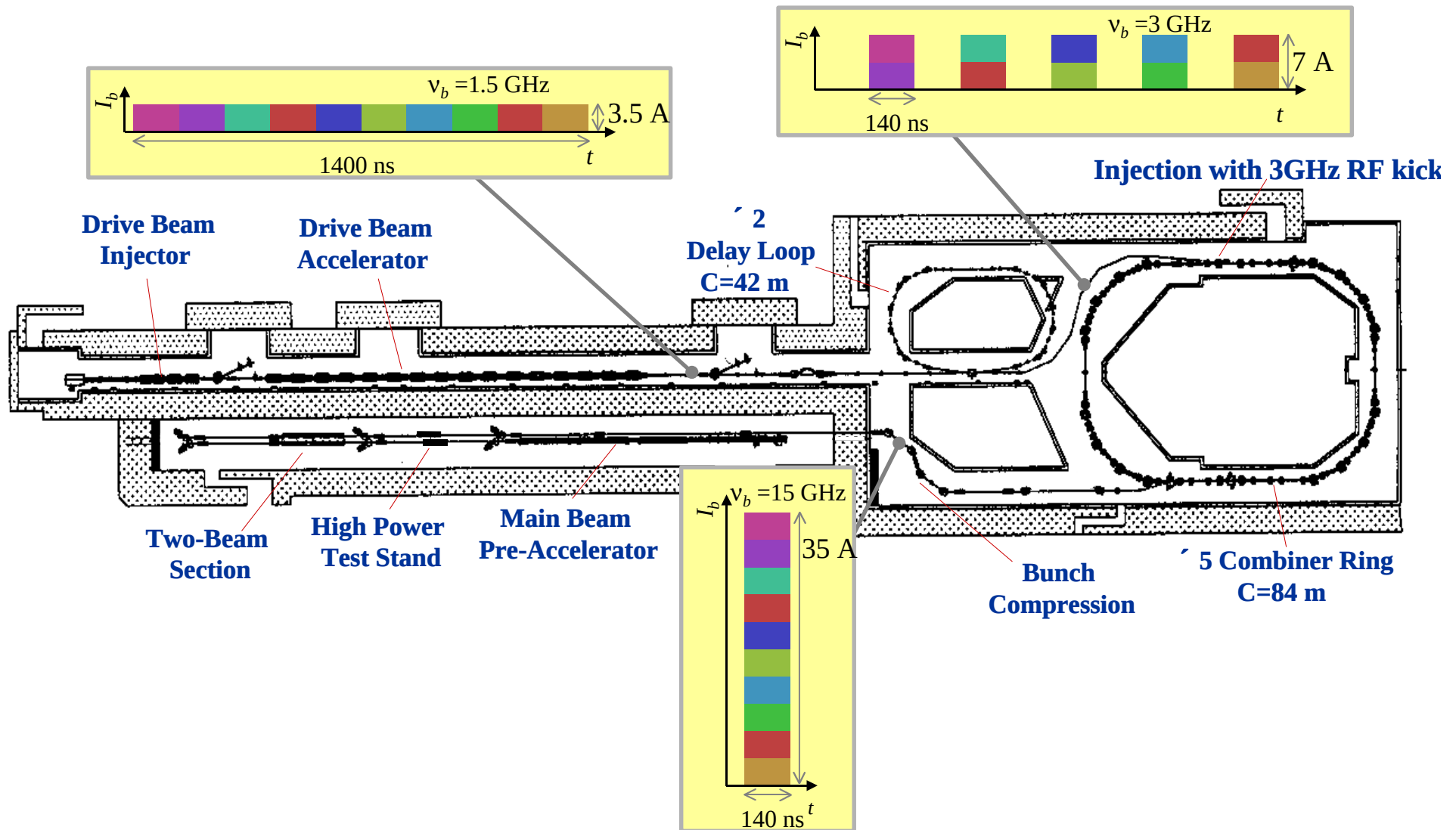
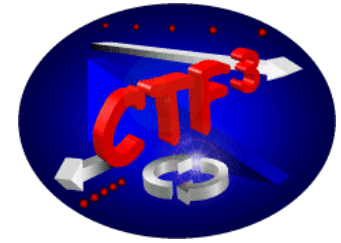
**this structure
was heavily
damaged**

shunt impedance verifications of structure #7 during processing

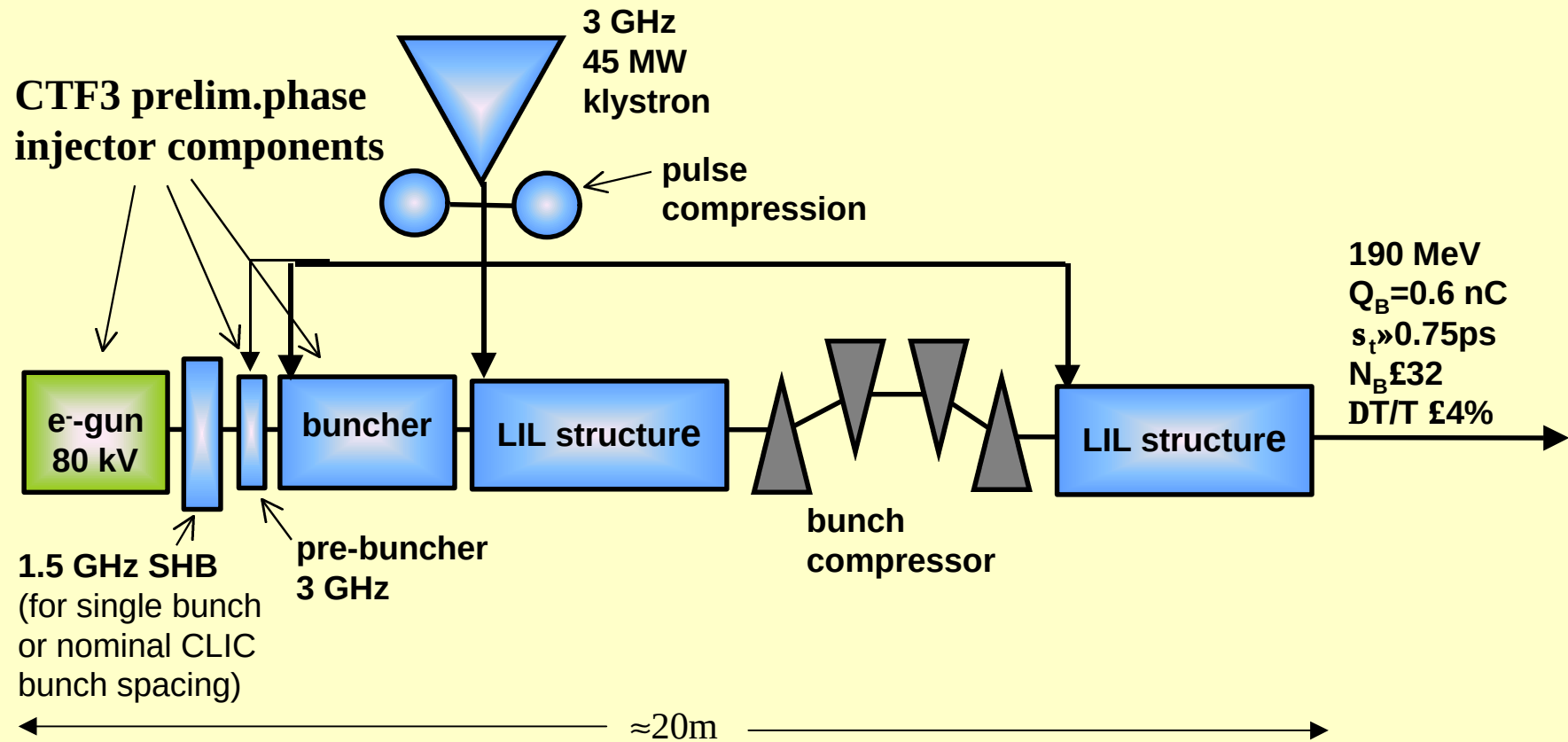


CTF3

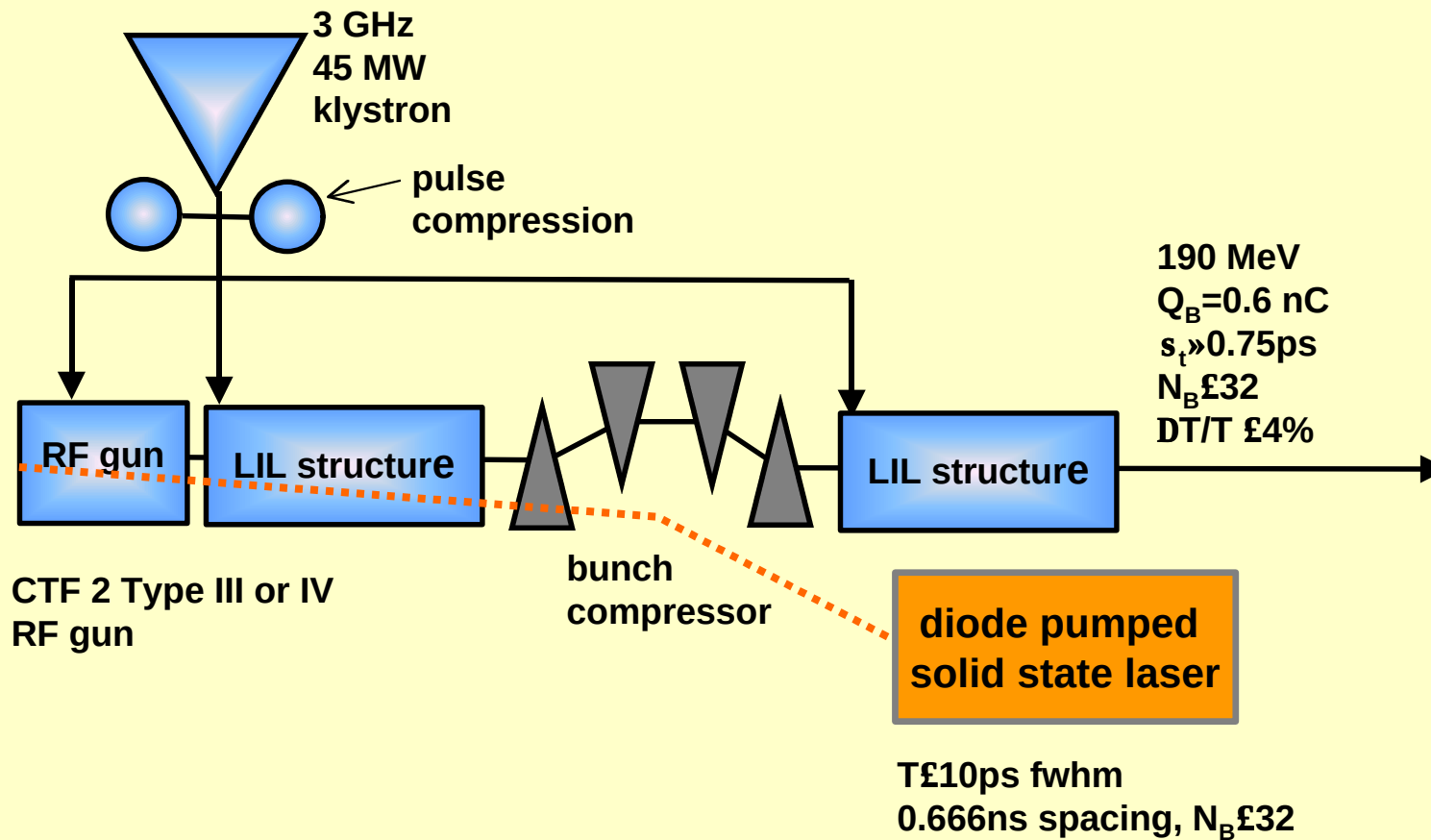
- demonstration of CLIC drive beam scheme
- 30 GHz power source with $P=300$ MW, $T=140$ ns



Probe beam source, thermionic gun scenario



Probe beam source, RF photo injector scenario



Summary

- **The probe beam injector will be needed from 2005 on**
- **As for the drive beam we have two gun options, thermionic and a photo-injector.**
- **The choice will probably follow the choice for the drive beam**
- **Both options will make extensive use of existing equipment**
- **Both options need one 45 MW klystron with pulse compression as 3 GHz power source**
- **Both options will be about 20-25 m long**
- **Both options will need a bunch compressor**
- **No detailed design has been worked out yet**
- **Before making a more detailed design we need discussions and decisions what we want to measure with the probe beam**