

XFEL Diagnostic Sections BC1 & BC2 - Revised Layout -

Christopher Gerth, MPY

New Design Criteria as a result of XFEL Bunch Compressor Review Meeting (18/12/2006):

1. Too complex, too long (K Floettmann, W Decking, ...)
2. Budget (R Brinkmann): 1 TDS per diagnostic section
3. LSC (M Dohlus): Significant contribution from warm sections – keep them short
4. Girder/module length: ca. 6m (N Mildner, T Wohlenberg)
Common girder/module concept

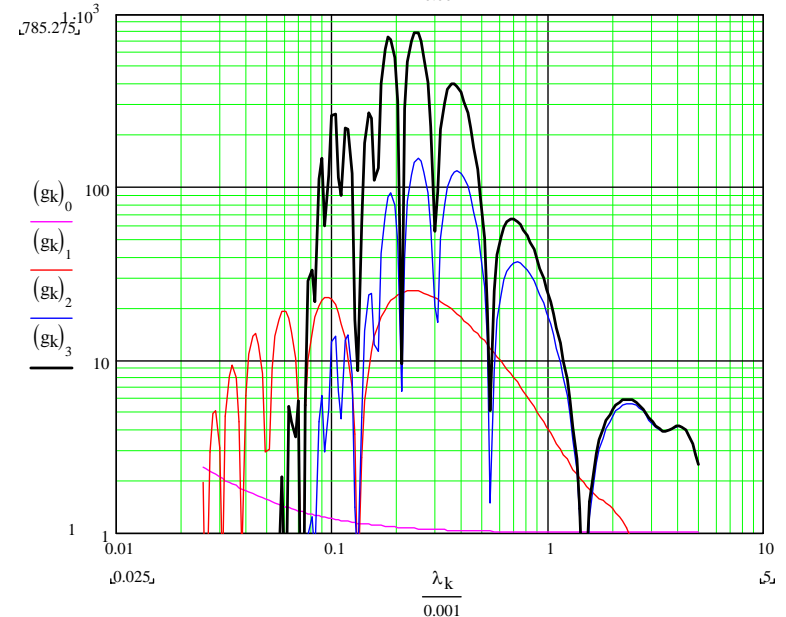
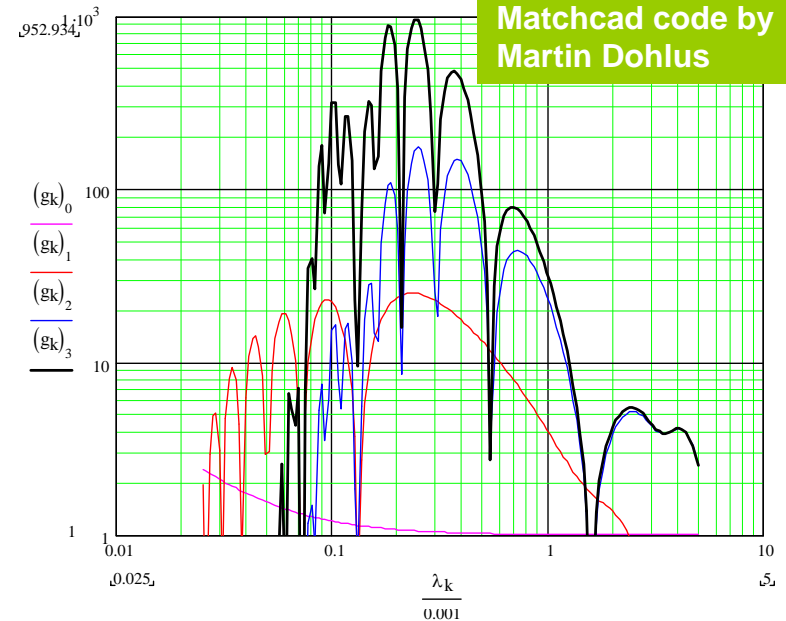
Current Fluctuations (rms) for a laser heater, R_{56} of 0.85 mm in Collimator and 5 kA electron beam

Old Layout

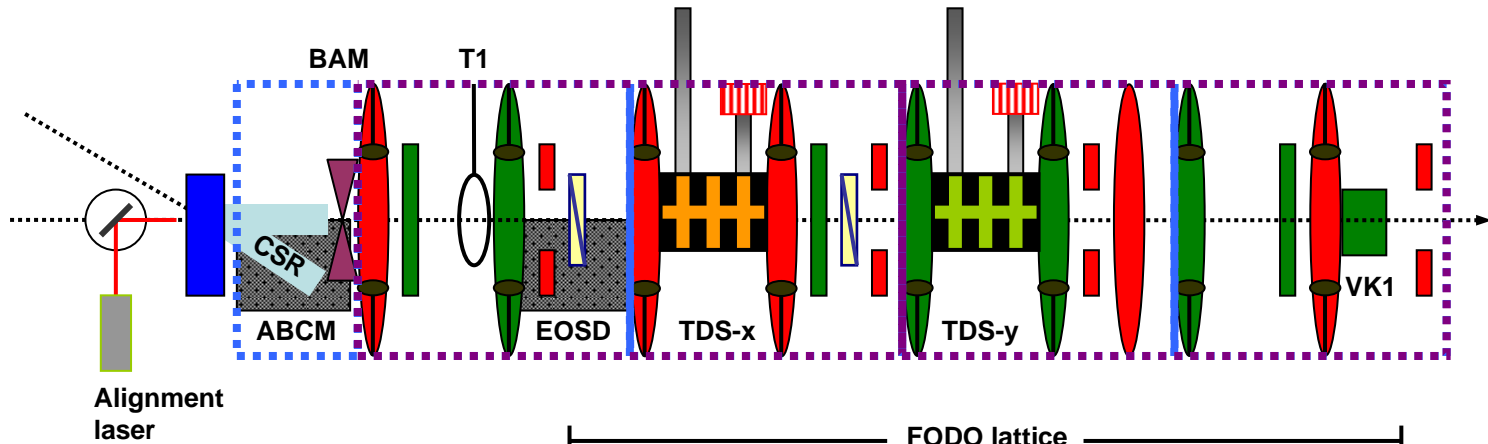
Total Irms : 269 A
 Diagnostic Sections : 269 - 79 = 190 A (70%)
 Diagnostic Section Inj : 110 - 79 = 31 A (16%)
 Diagnostic Section BC1: 213-110 = **103 A (55%)**
 Diagnostic Section BC2: 269-213 = 56 A (29%)

New layout (-34% in BC1, -7% in BC2)

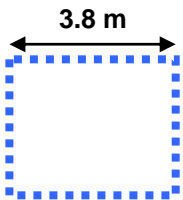
Total Irms : 221 A (-18%)
 Diagnostic Sections : 221 - 79 = 142 A (-25%)
 Diagnostic Section Inj : 110-79 = 31 A (-0%)
 Diagnostic Section BC1: 178-110 = 68 A (-34%)
 Diagnostic Section BC2: 221-178 = 43 A (-23%)



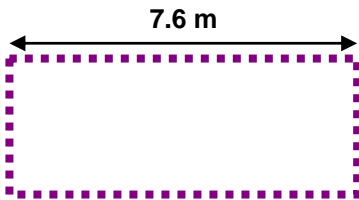
Old!



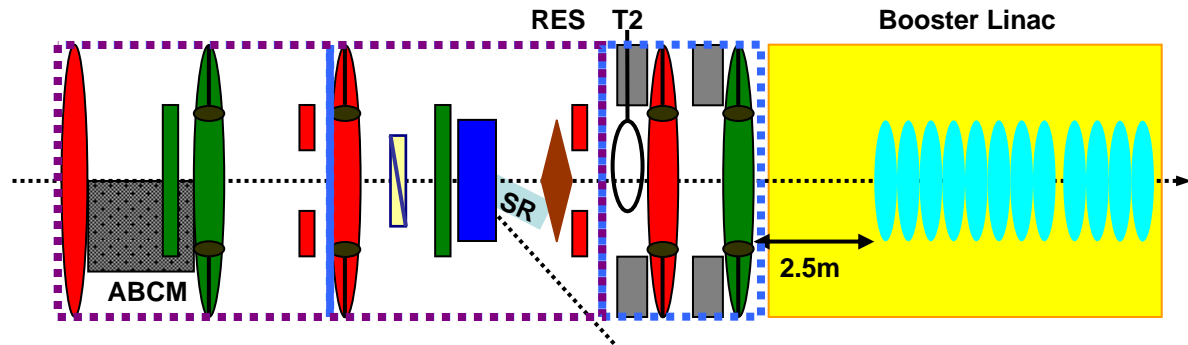
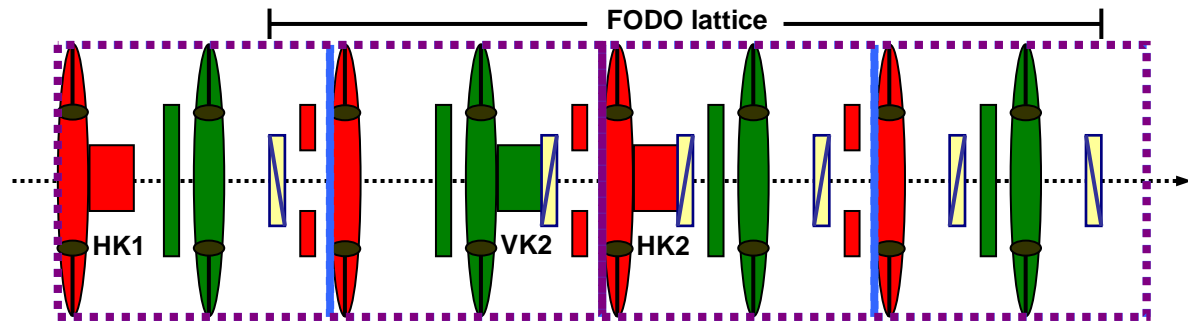
Lattice can be divided into modules:



10 modules

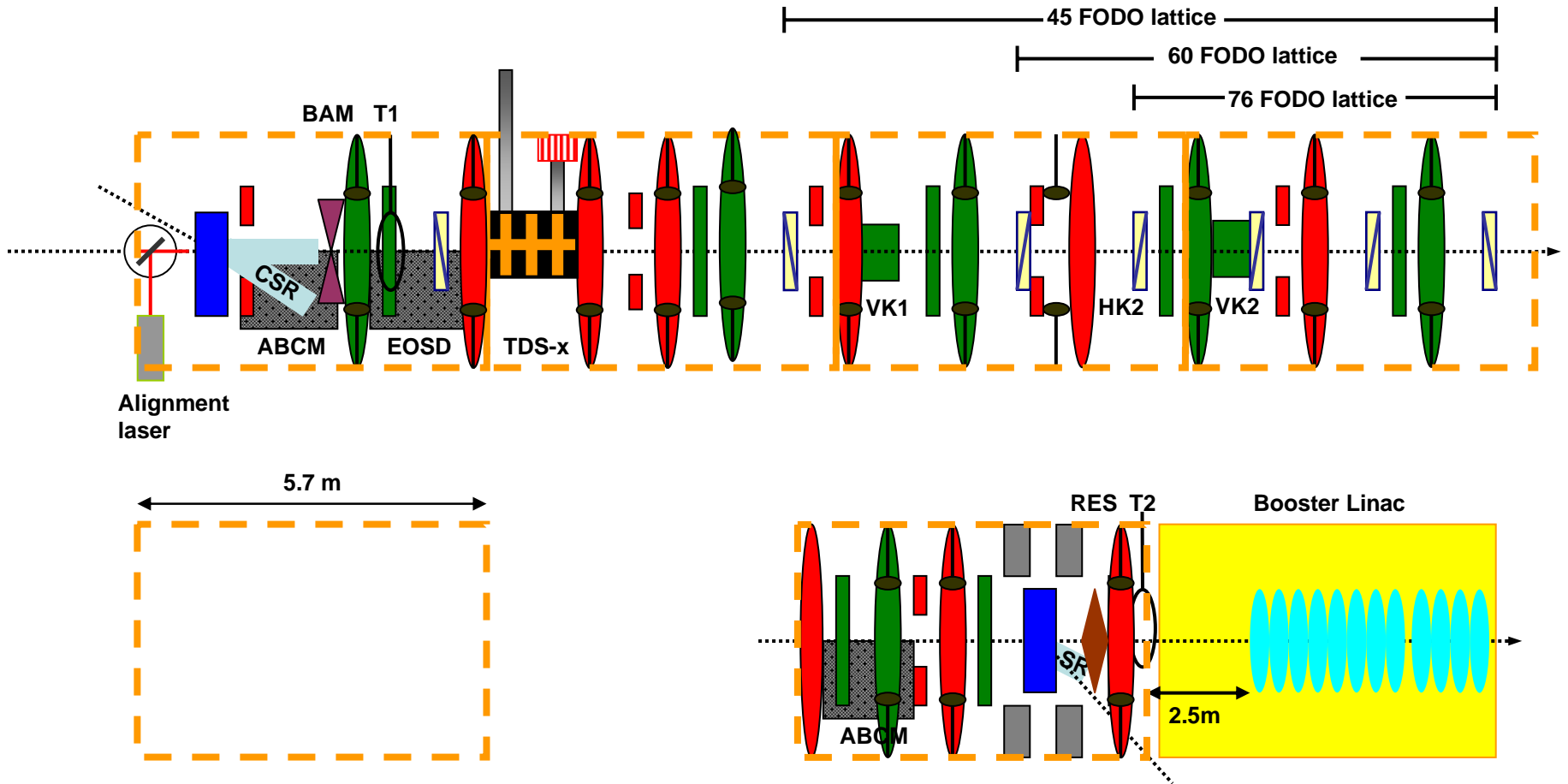


5 modules



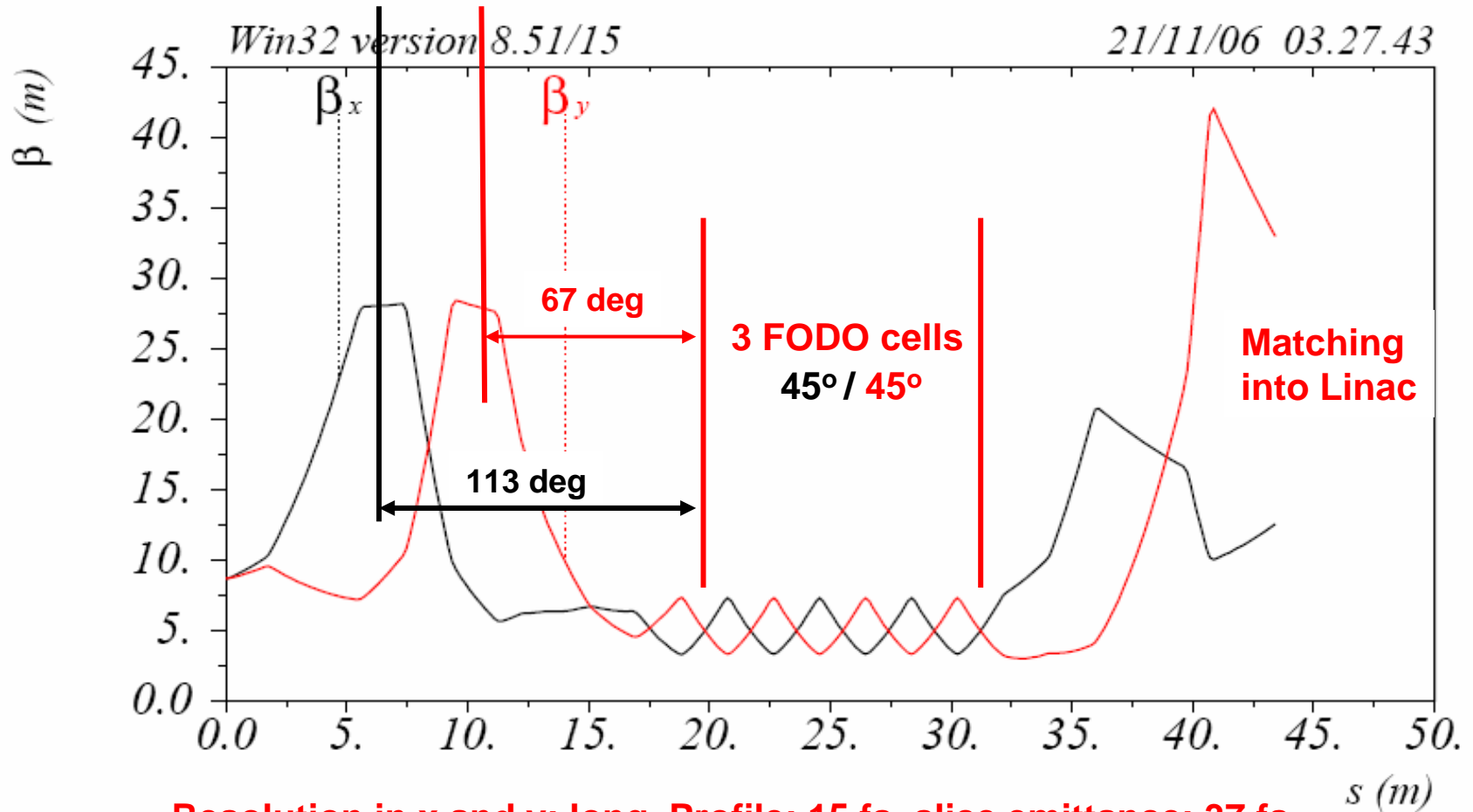
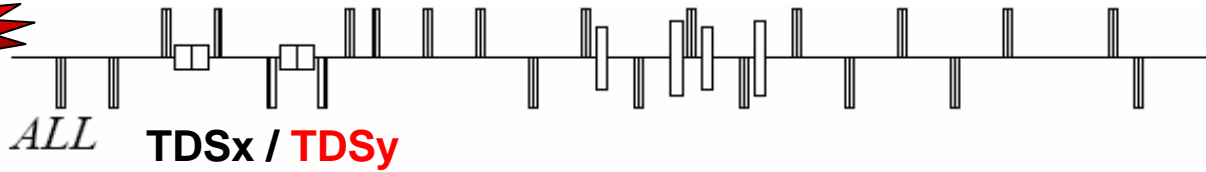
New!

Total length: 29.5m (44.5m)
 Quads (QC): 15 (22)



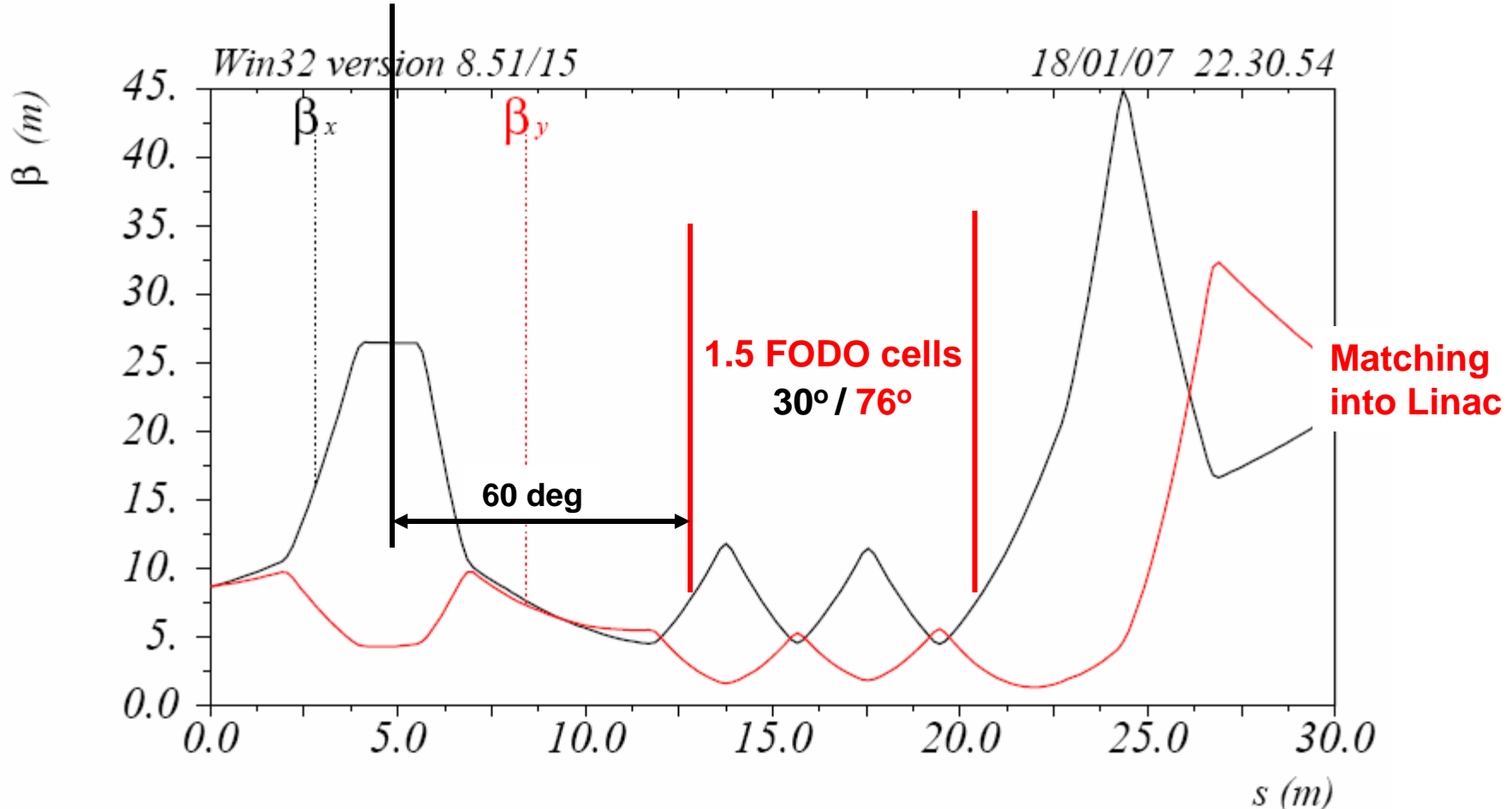
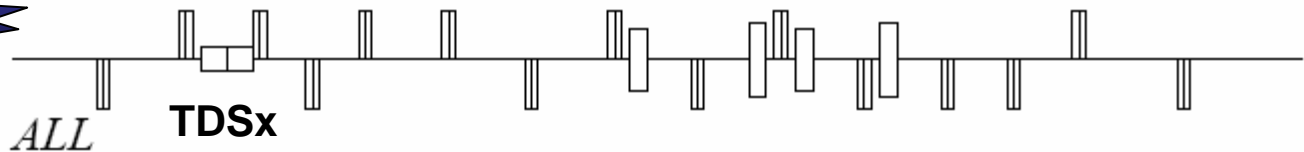
**5 modules!
 + 1 upstream BC**

Old!



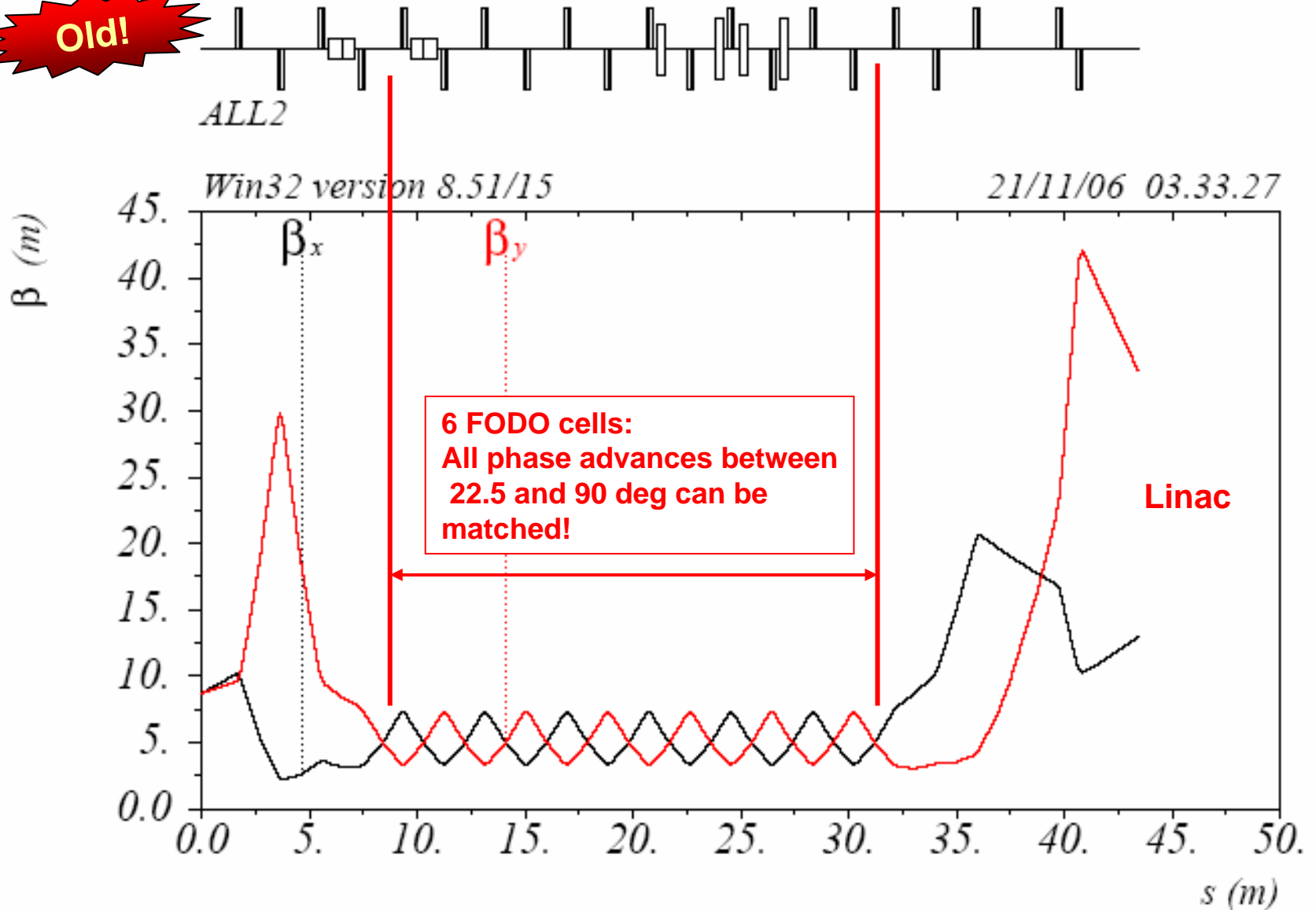
Resolution in x and y: long. Profile: 15 fs, slice emittance: 37 fs

New!

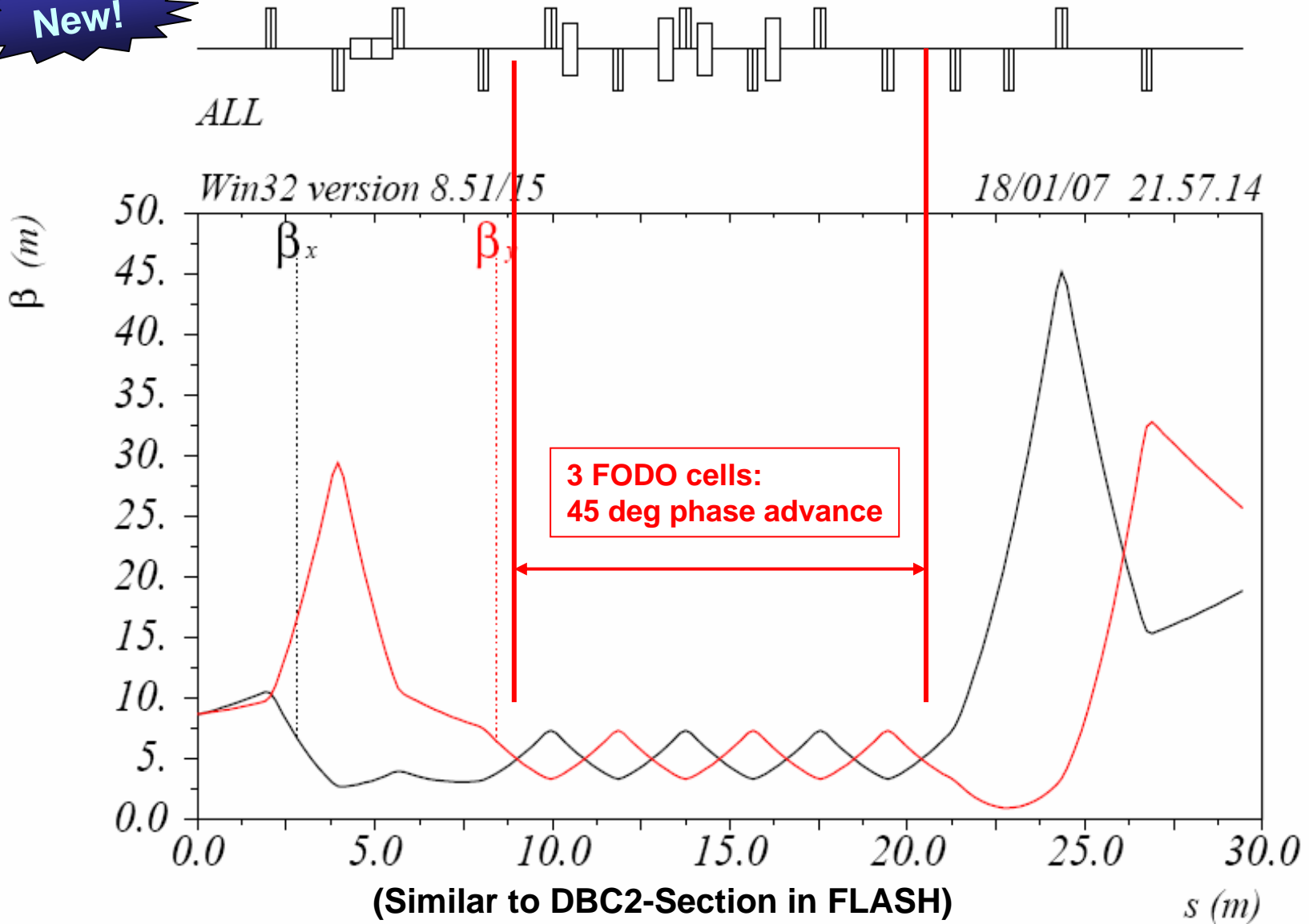


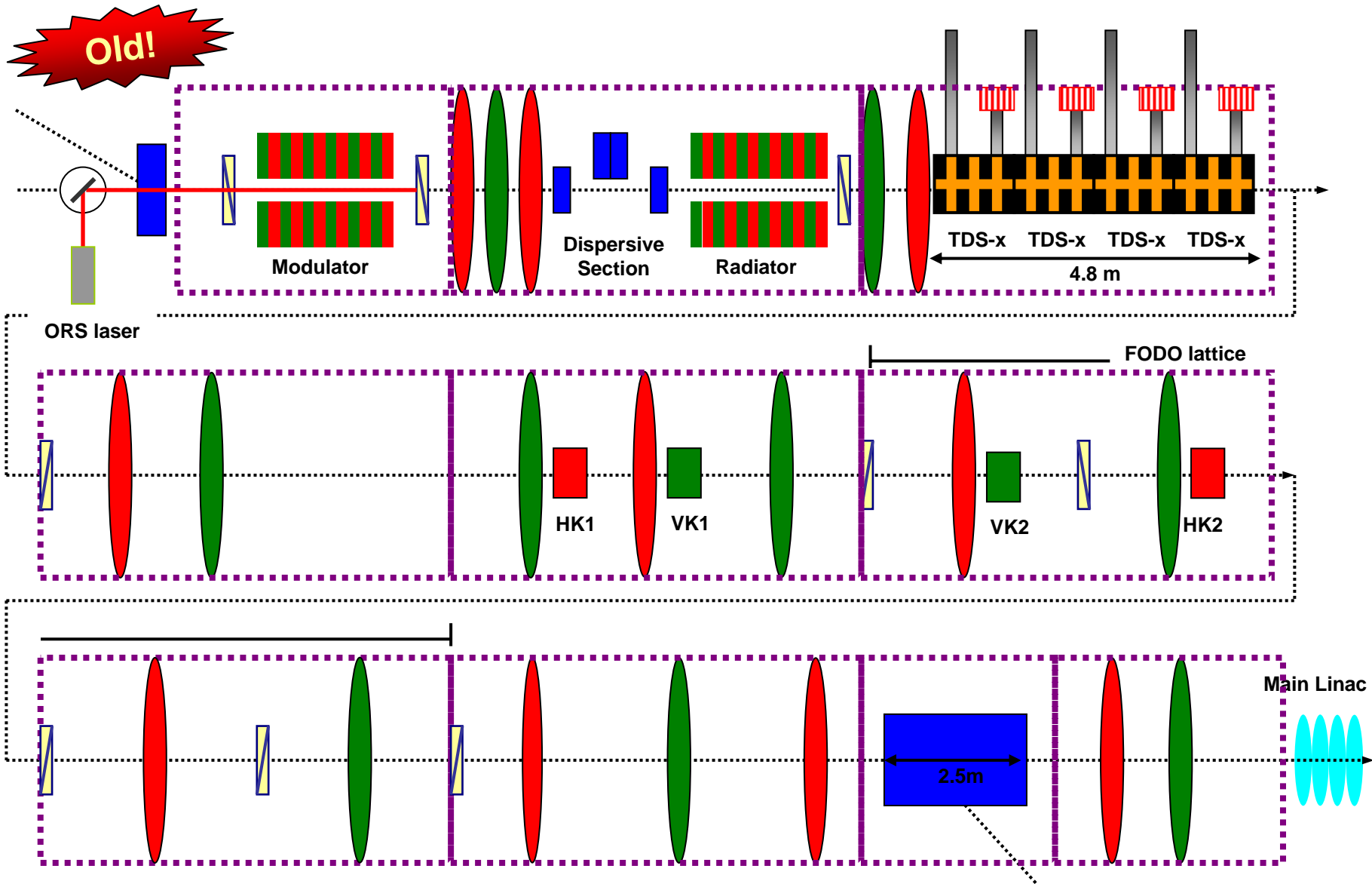
Resolution only in x: long. Profile: 11 fs, slice emittance: 13 fs

Old!



New!

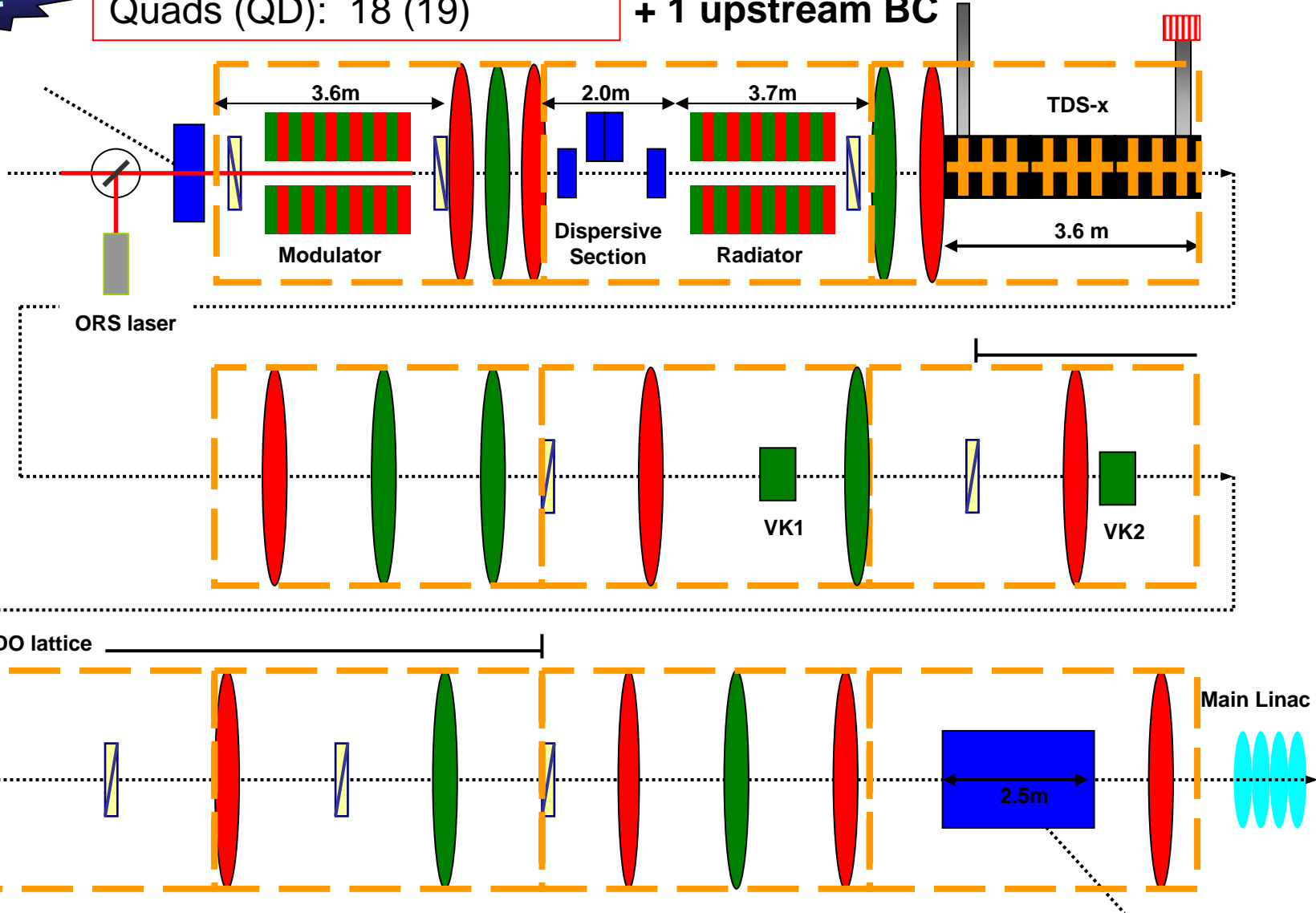




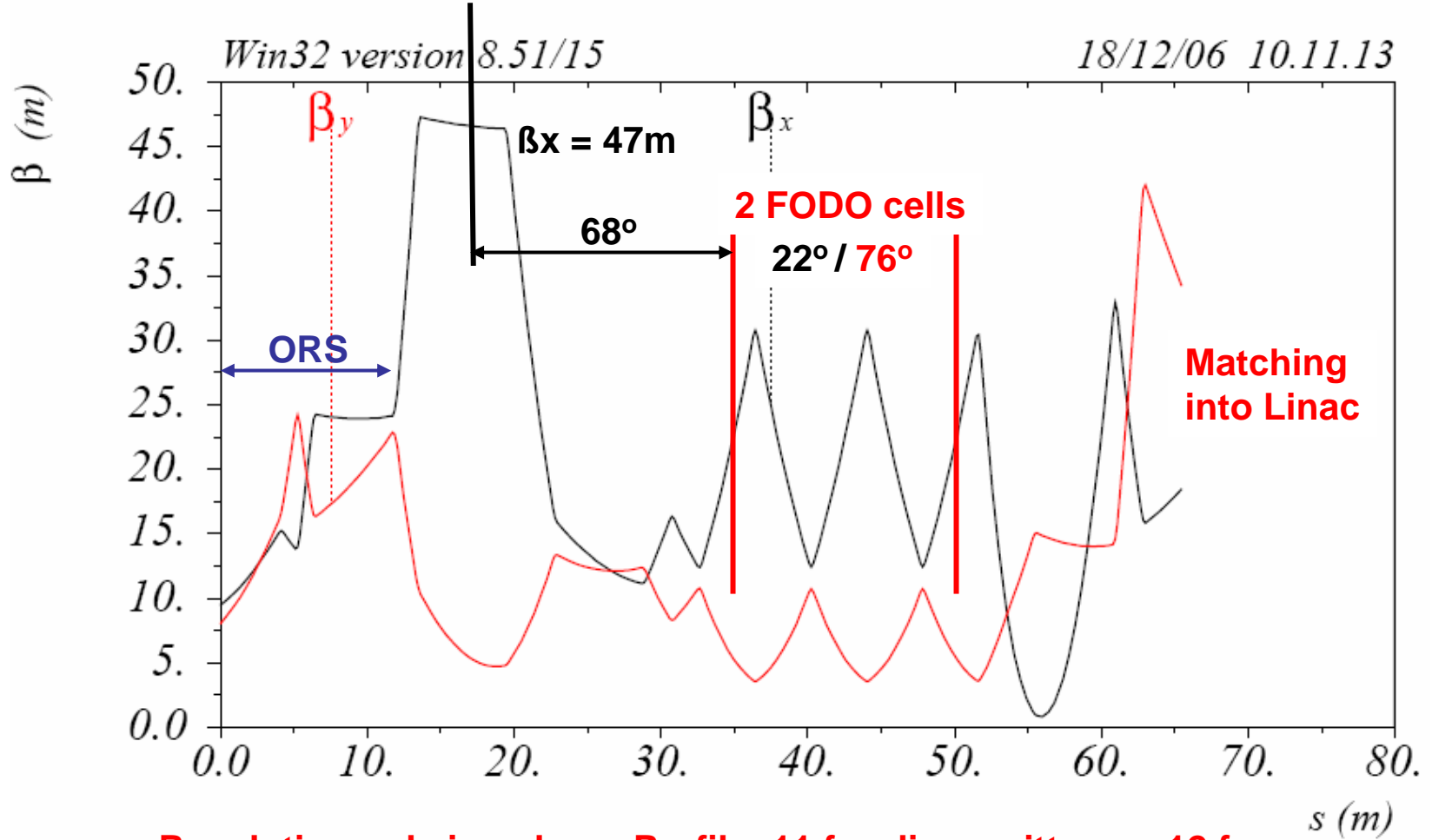
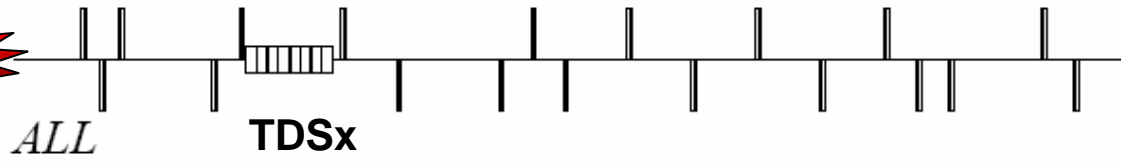
New!

Total length: 60.1m (64.0m)
 Quads (QD): 18 (19)

10 modules
+ 1 upstream BC

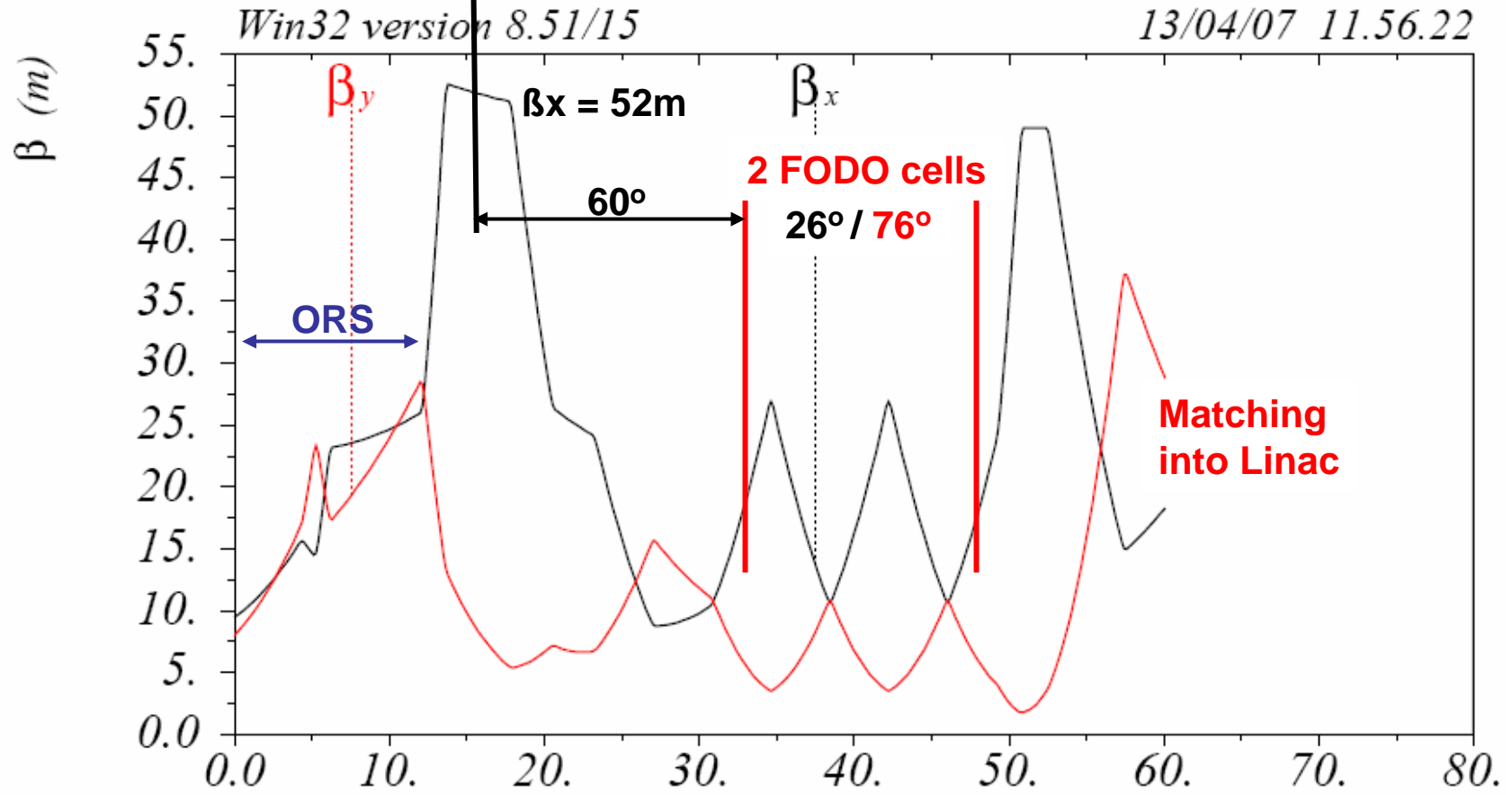
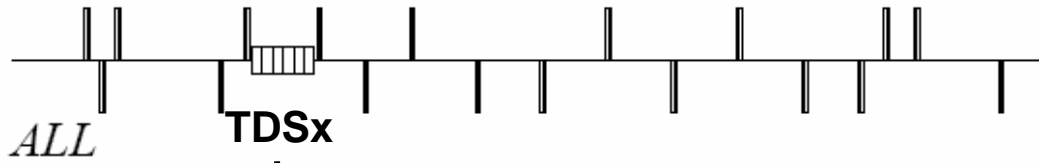


Old!



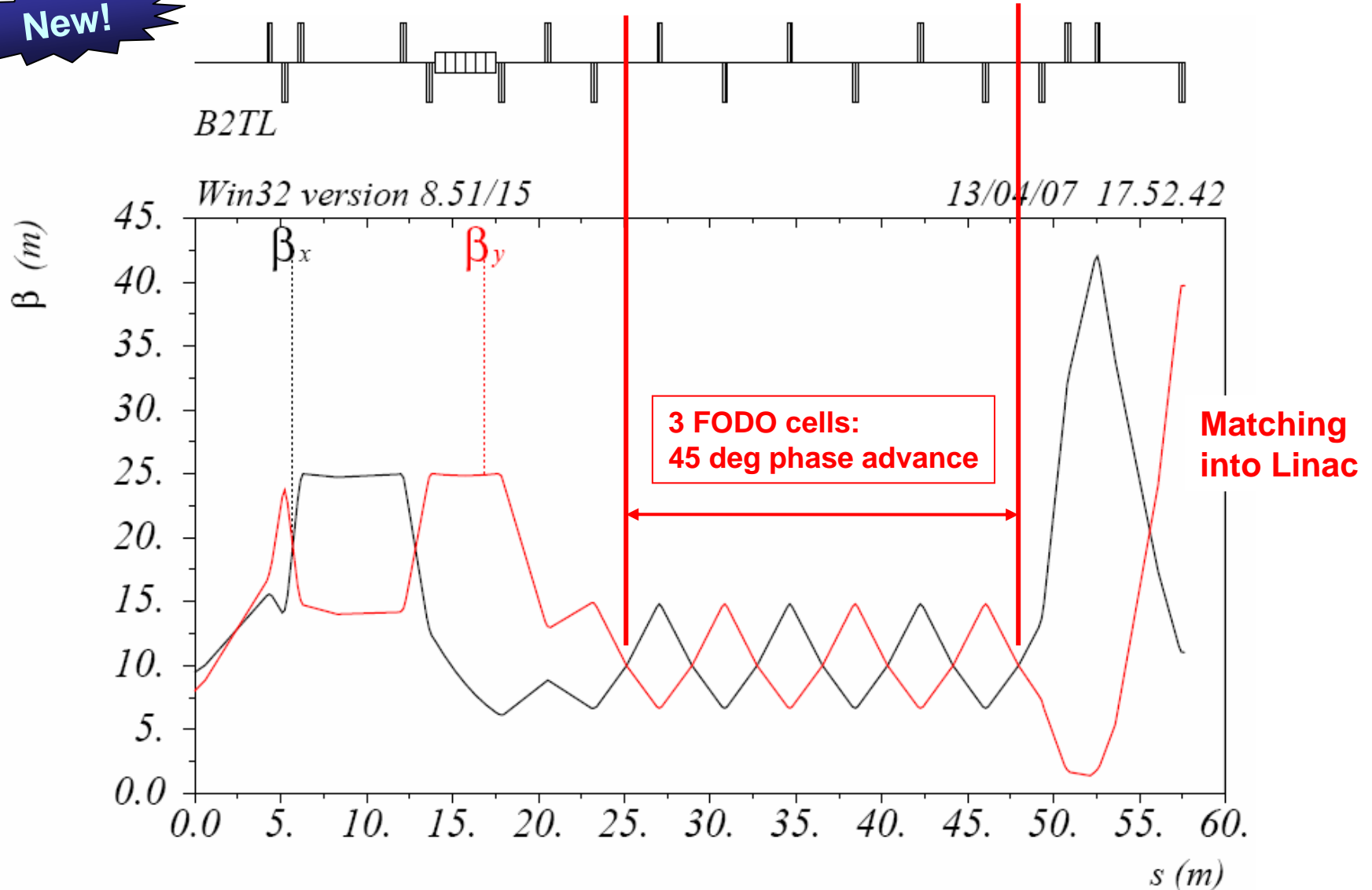
Resolution only in x: long. Profile: 11 fs, slice emittance: 12 fs

New!



Resolution only in x: long. Profile: 11 fs, slice emittance: 13 fs s (m)

New!



Conclusions (1):

Diagnostics Sections BC1 and BC2 have been optimised for compactness and simplicity. The length has been reduced:
BC1: +1.0 m in BC and -15 m in diag section = -14 m
BC2: +1.0 m in BC and -3.9 m in diag section = -2.9 m
LSC reduced by 18%

Both sections have similar generic layout, i.e. similar operation modes, controls, analysis tools, ...

Asymmetric FODO lattice is optimised for slice emittance measurement in y-plane. Different optics need to be loaded for projected emittance measurement.

Number of quads in revised Diagnostic Section layout
BC1 was 22 now 15 (magnet list B. Krause 27 QCs)
BC2 was 19 now 18 (magnet list B. Krause 17 QDs)

Conclusions (2):

Layout of the Diagnostic Sections can be arranged in 5.7 m long girders/modules.

Components can be pre-aligned and tested.

This saves time during installation and commissioning.

BC1: 5 + 1 girders/modules

BC2: 10 + 1 girders/modules

Meeting on the engineering layout of the girders:

Wednesday 18/4/07 13:00h, Bldg. 55a – Room 110