Brookhaven National Laboratory
CAD seminar
2/2/2007

The Q0 scheme in the framework of LHC luminosity upgrade

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Reducing β*

Moving the existing triplet to 13 meters from the IP could be a way to decrease the value of β*

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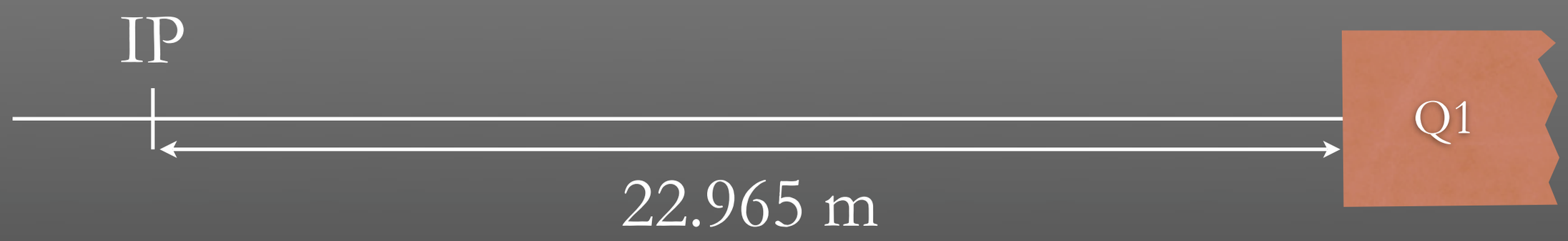
Reducing β*

Moving the existing triplet to 13 meters from the IP could be a way to decrease the value of β*

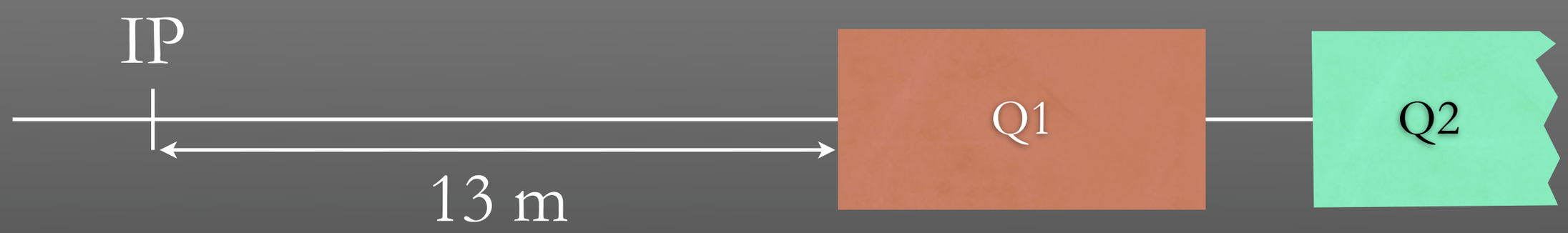
but

a first analisys shows that, if we want to preserve the size of the triplet in order to have a limited impact into experiments integration, an increase in gradient or in aperture is mandatory.

For example



For example



$L^*=13$ m

$\beta^*=0.25$ m

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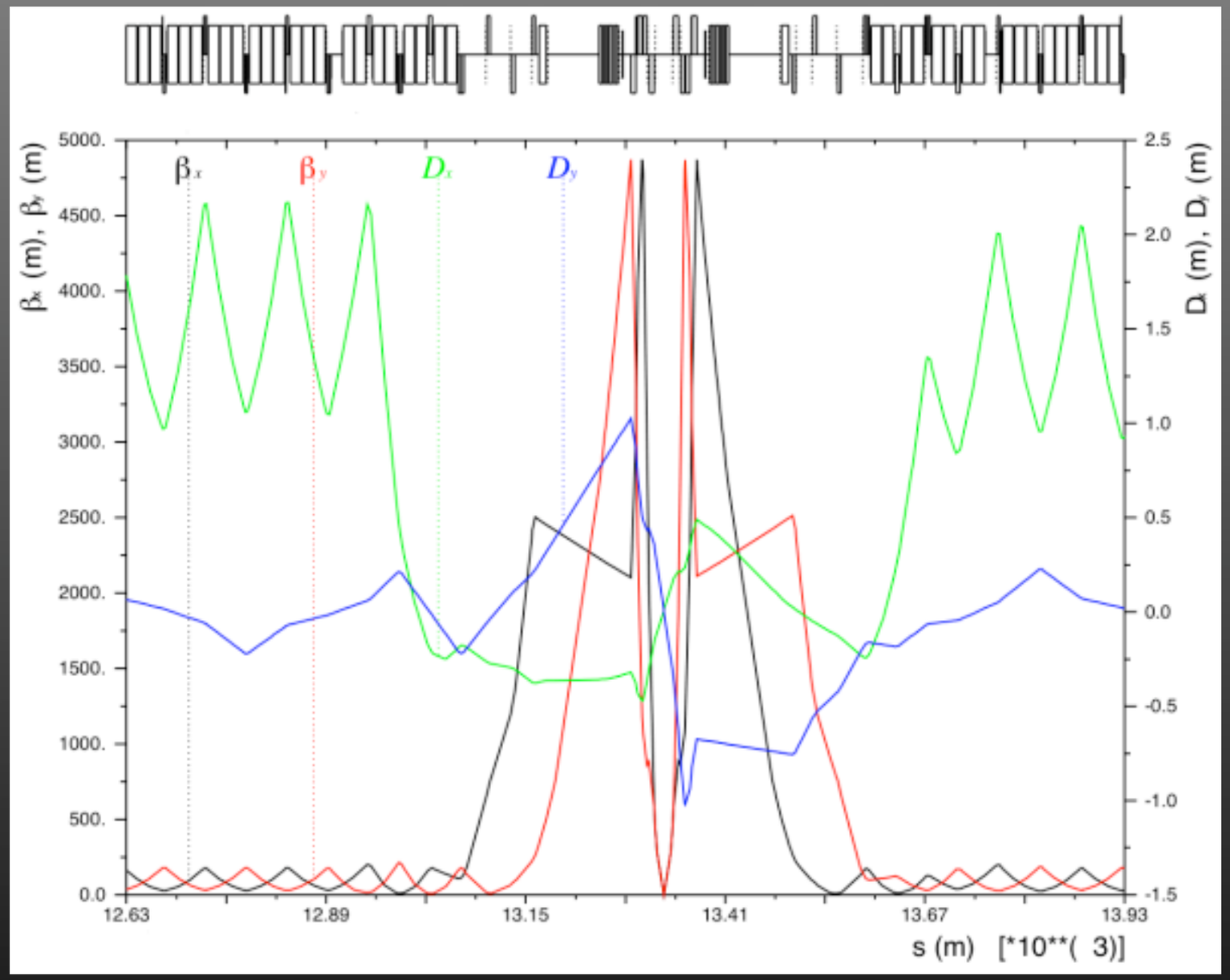
For example



L*=13 m

β*=0.25 m

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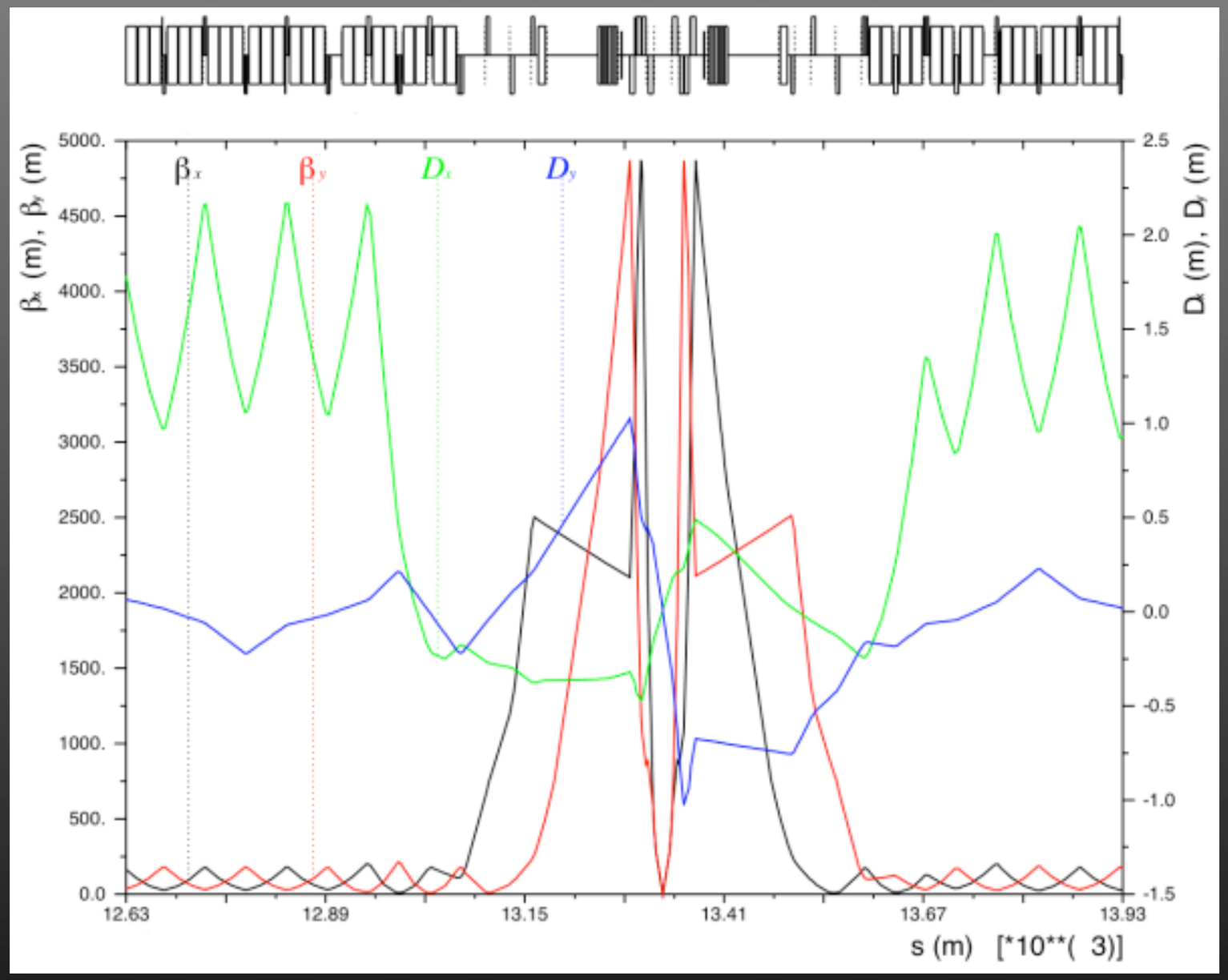
For example



L*=13 m

β*=0.25 m

β Max=4900 m

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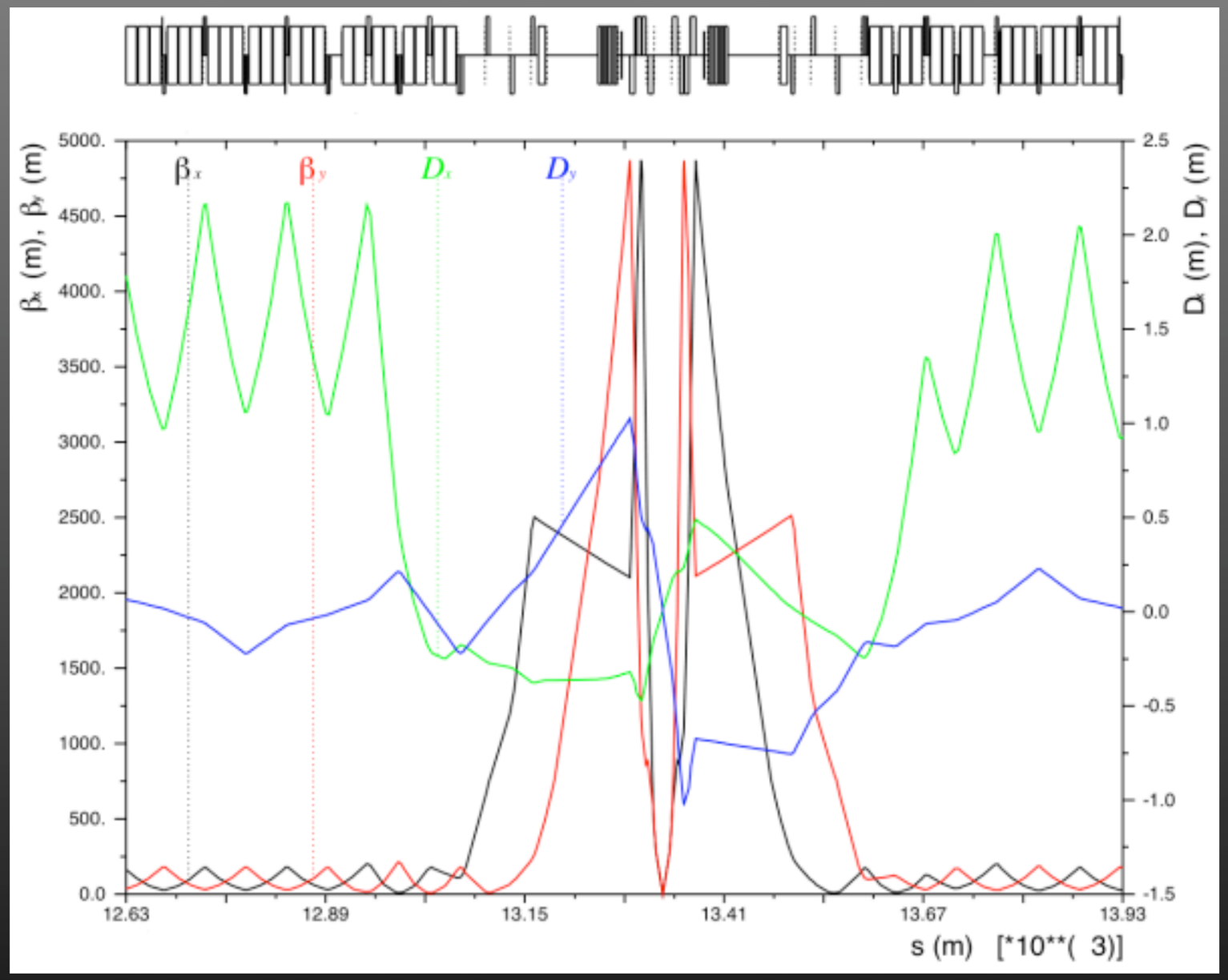
For example



L*=13 m

β*=0.25 m

β Max=4900 m

Ø=75 mm

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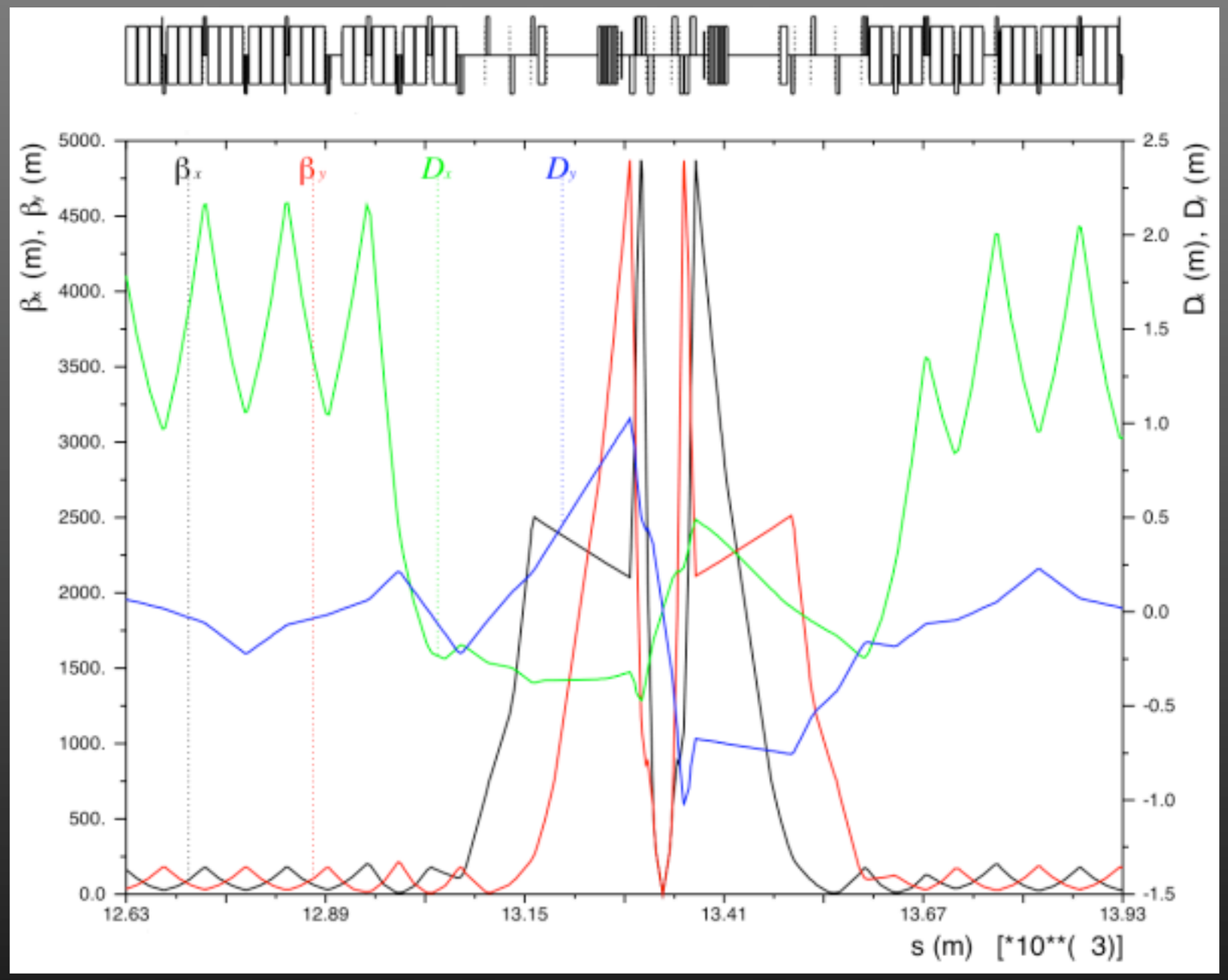
For example



L*=13 m

β*=0.25 m

β Max=4900 m

Ø=75 mm

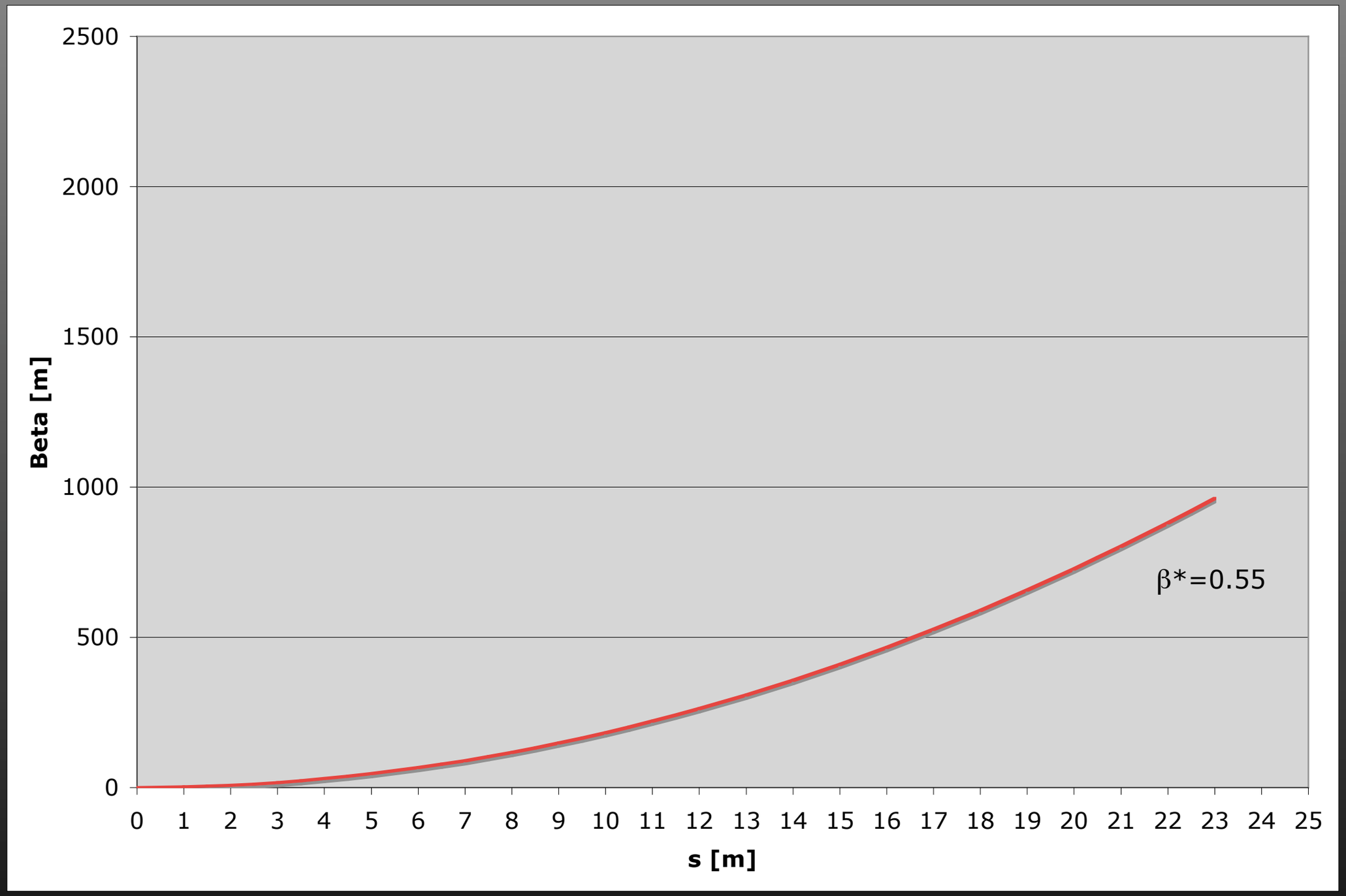
G=275 T/m

A quadrupole with a diameter of 75 mm and a gradient of 275 T/m is far from the limits of nominal LHC IR magnets.

It also seems to be far from the limits of the NbTi technology.

Is there any way to reduce β* without introducting new technology (Nb_3Sn) or a completely new design of the Triplet?

Beta function



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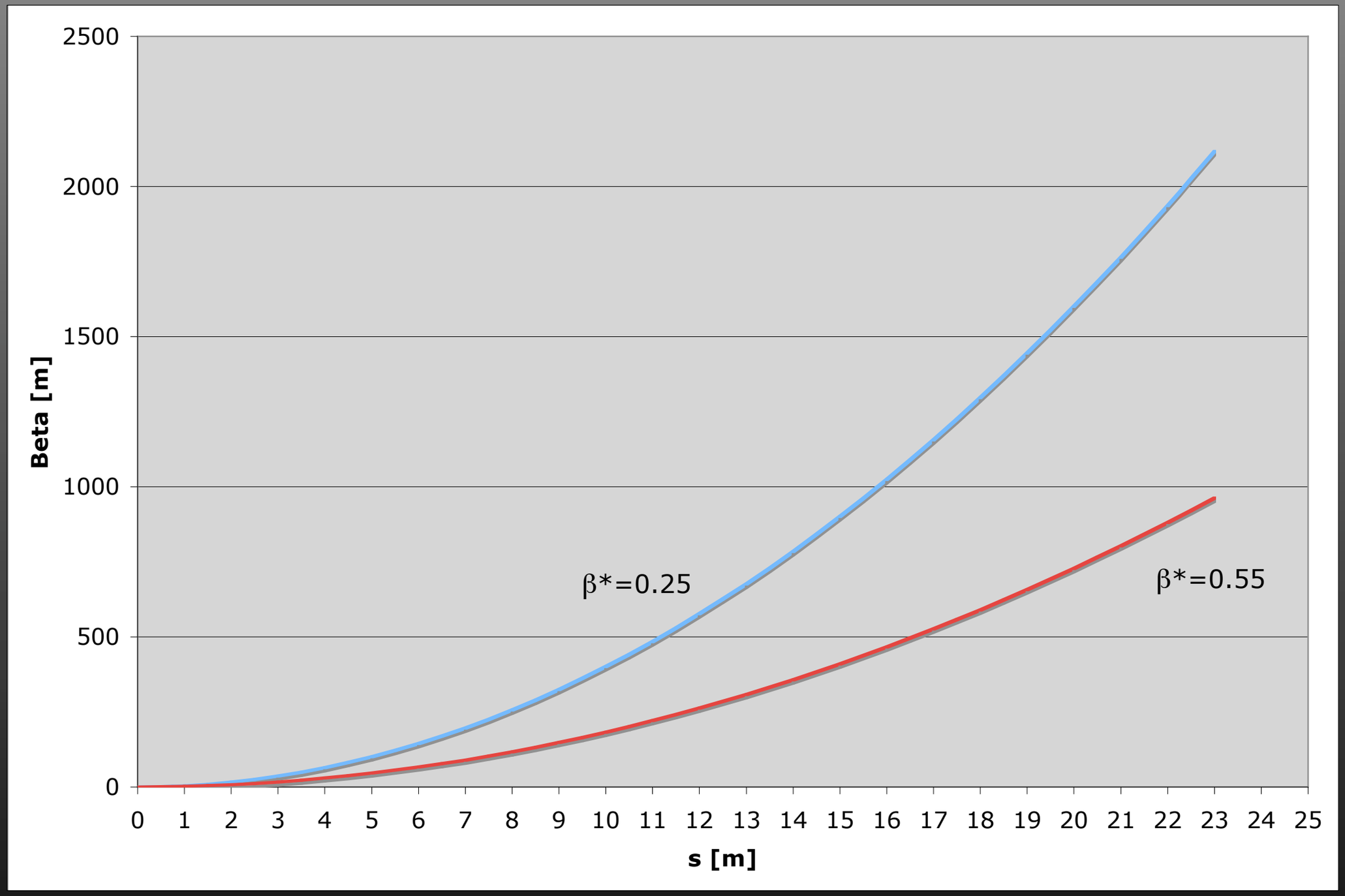
Beta function



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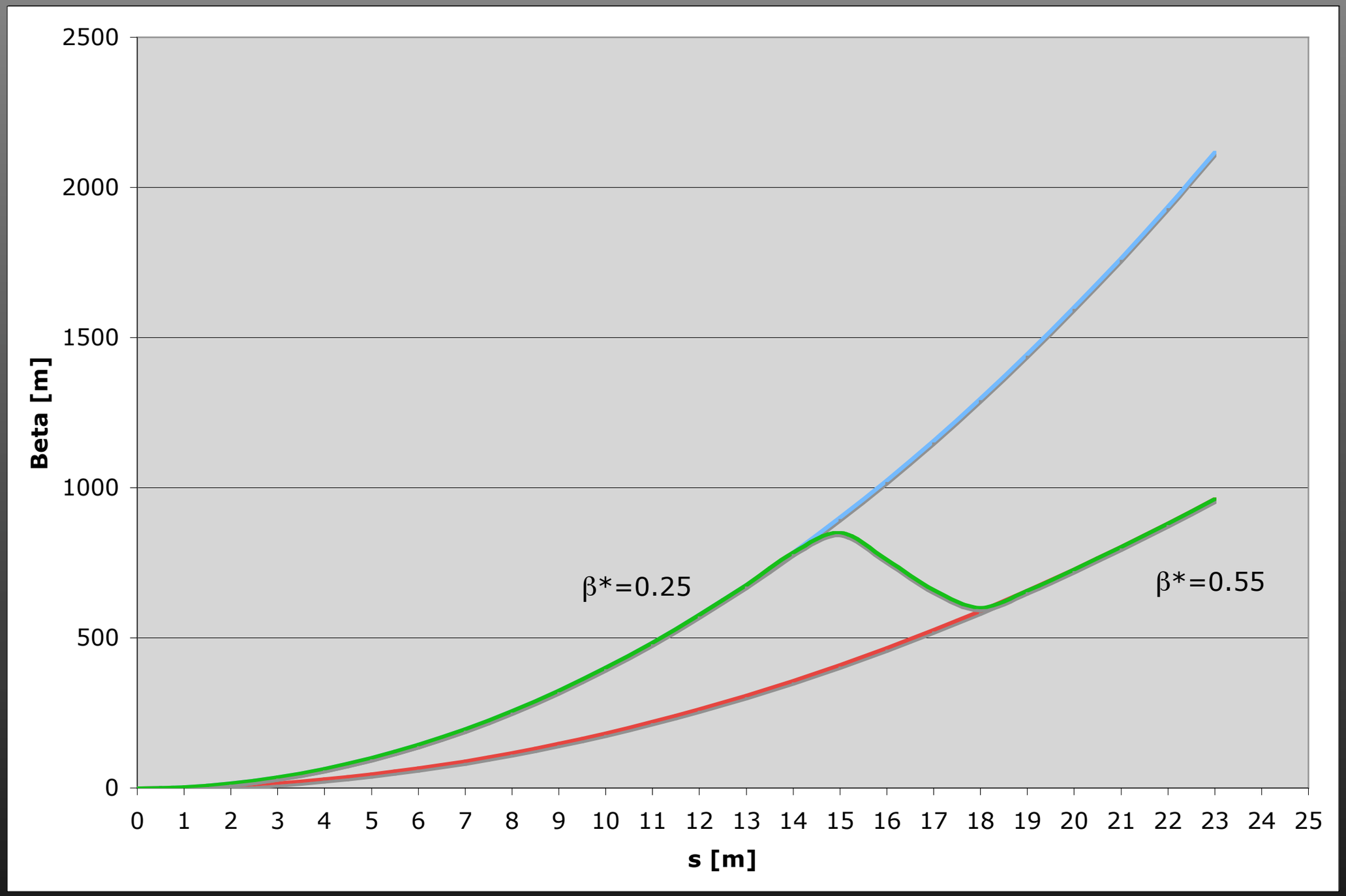
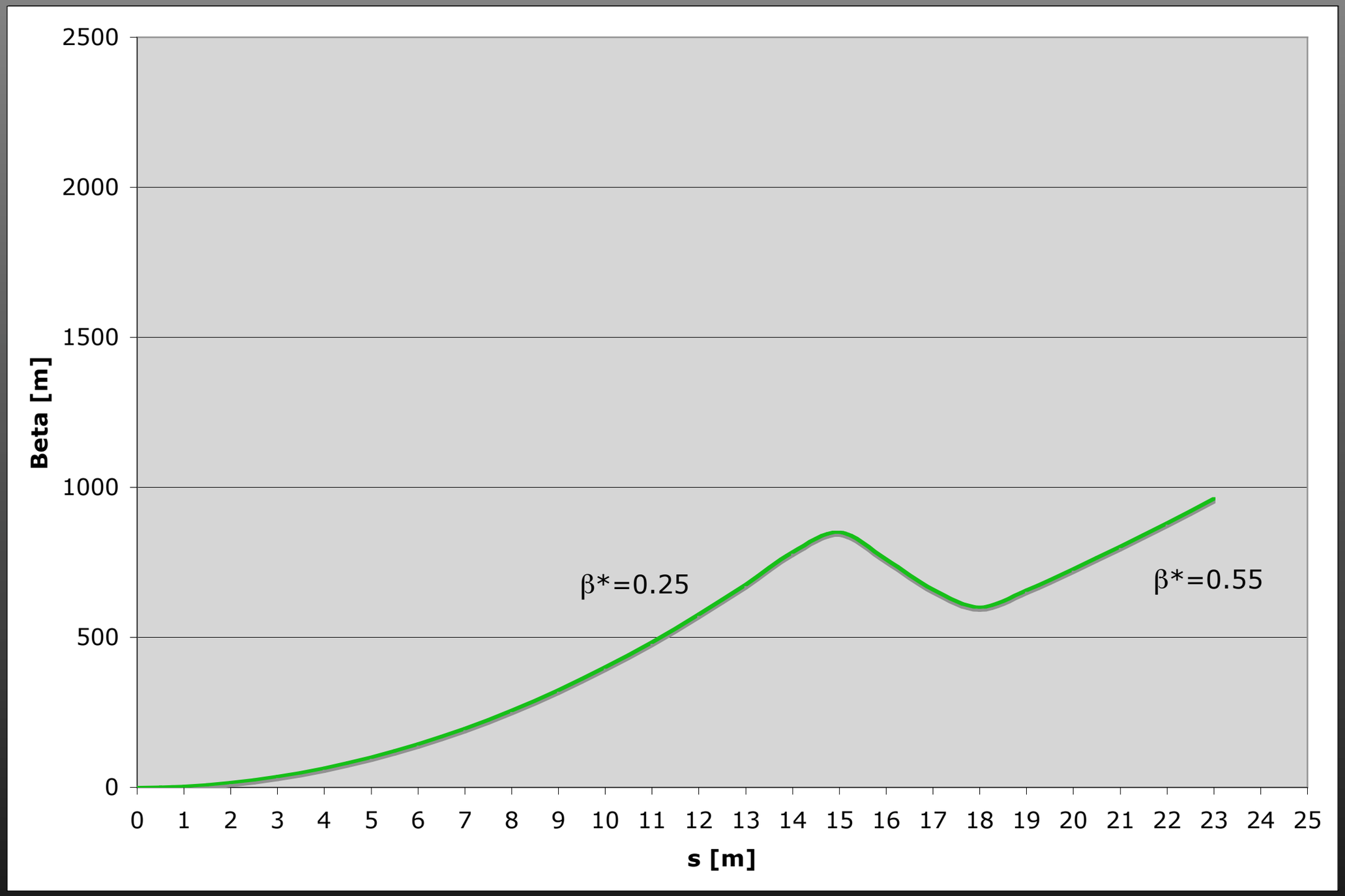
Beta function



Beta function



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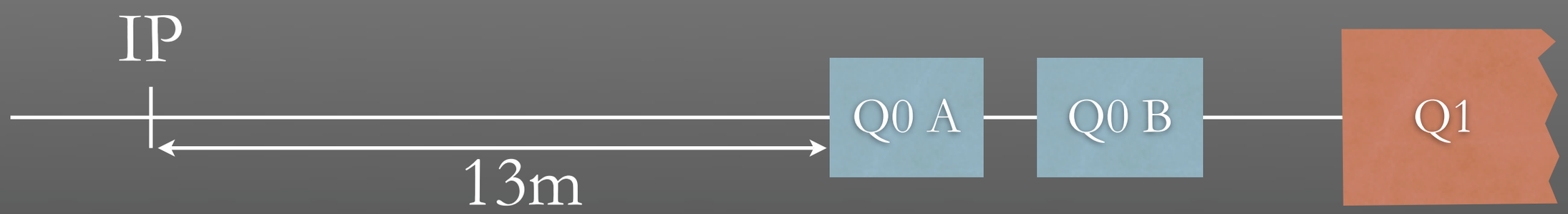
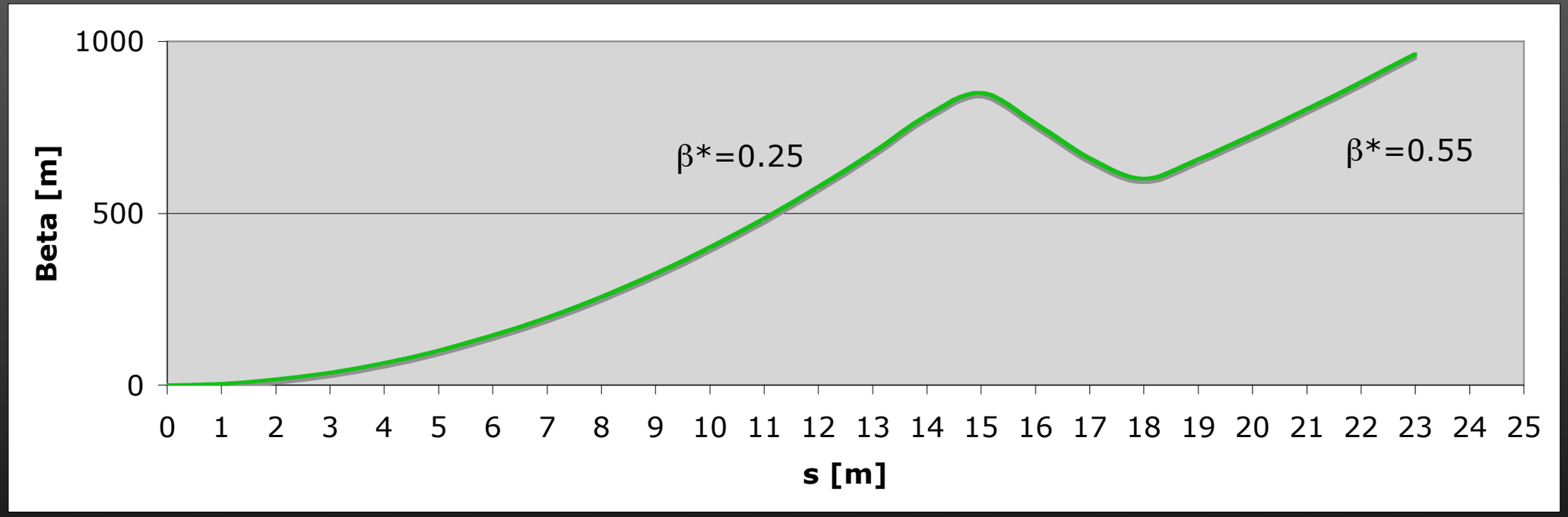
New layout





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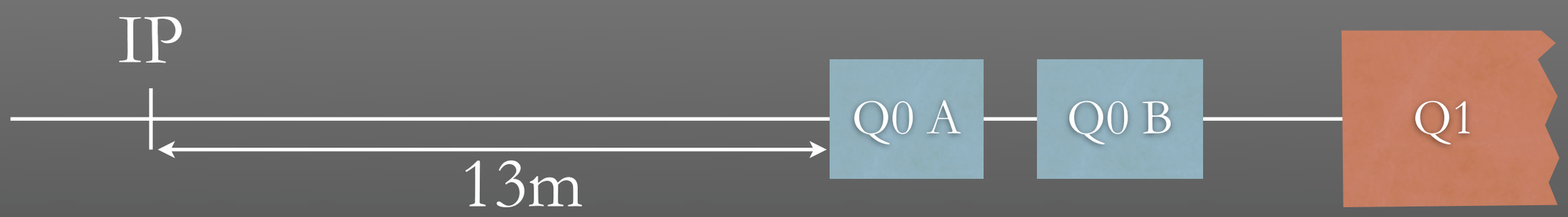
This ideal scheme seems to be difficult to obtain with reasonable values for Q0 or without changes into triplet gradients.

There is some possible working layout?

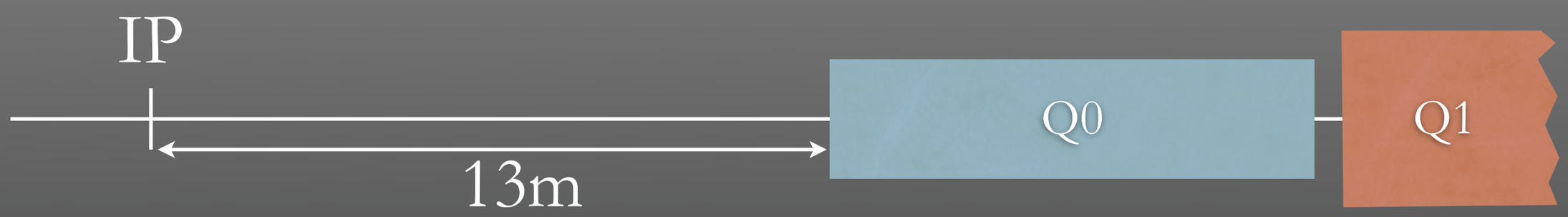
Layout 1

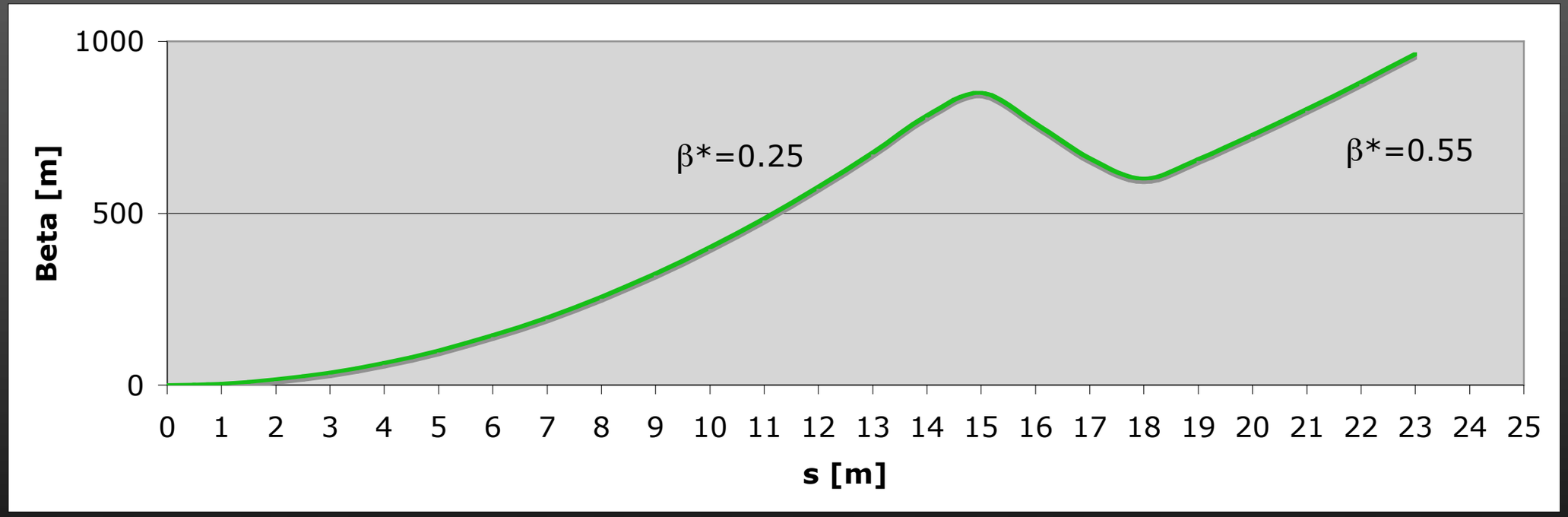


Same scheme but changes in triplet.

Layout 2

Long magnet and some minor Triplet changes





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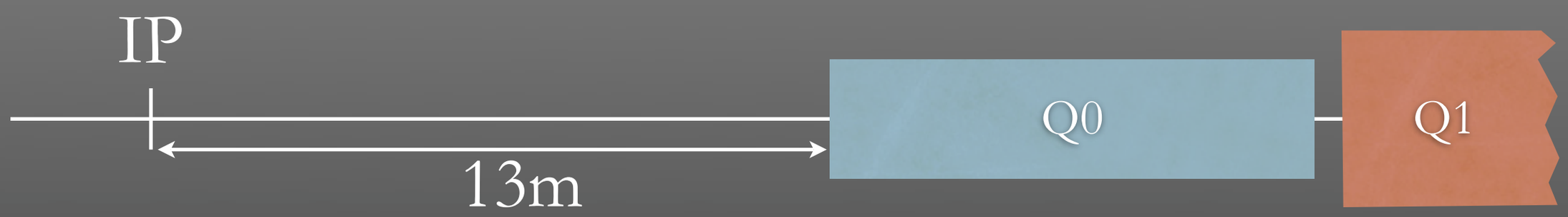
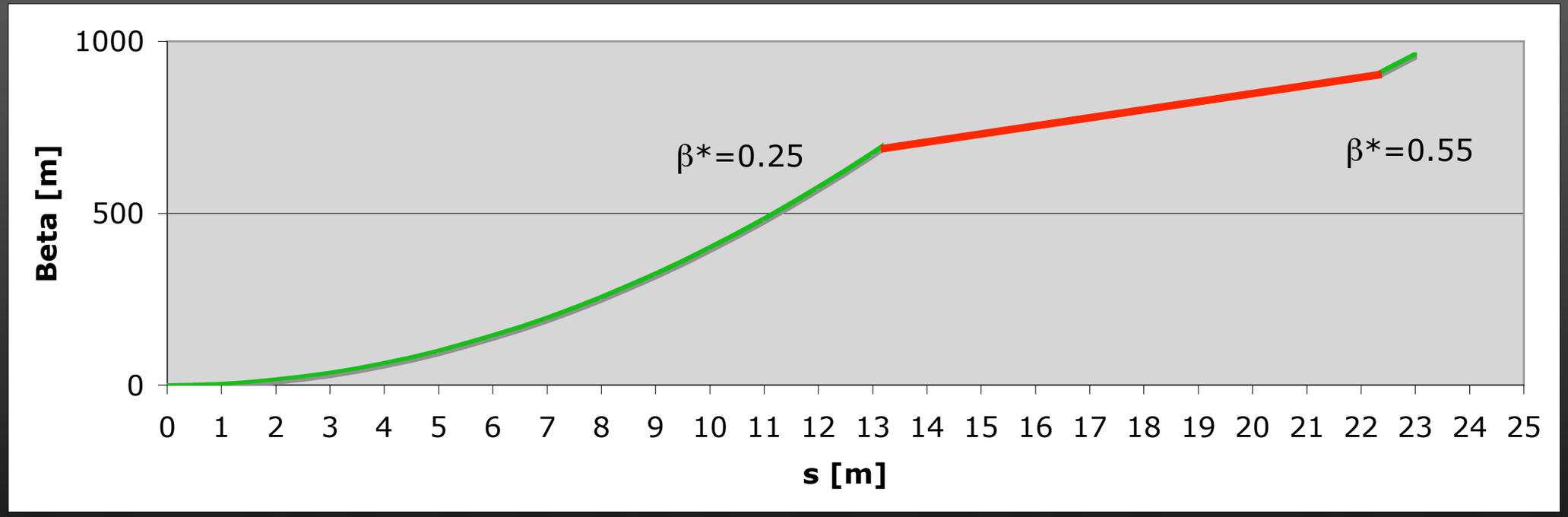
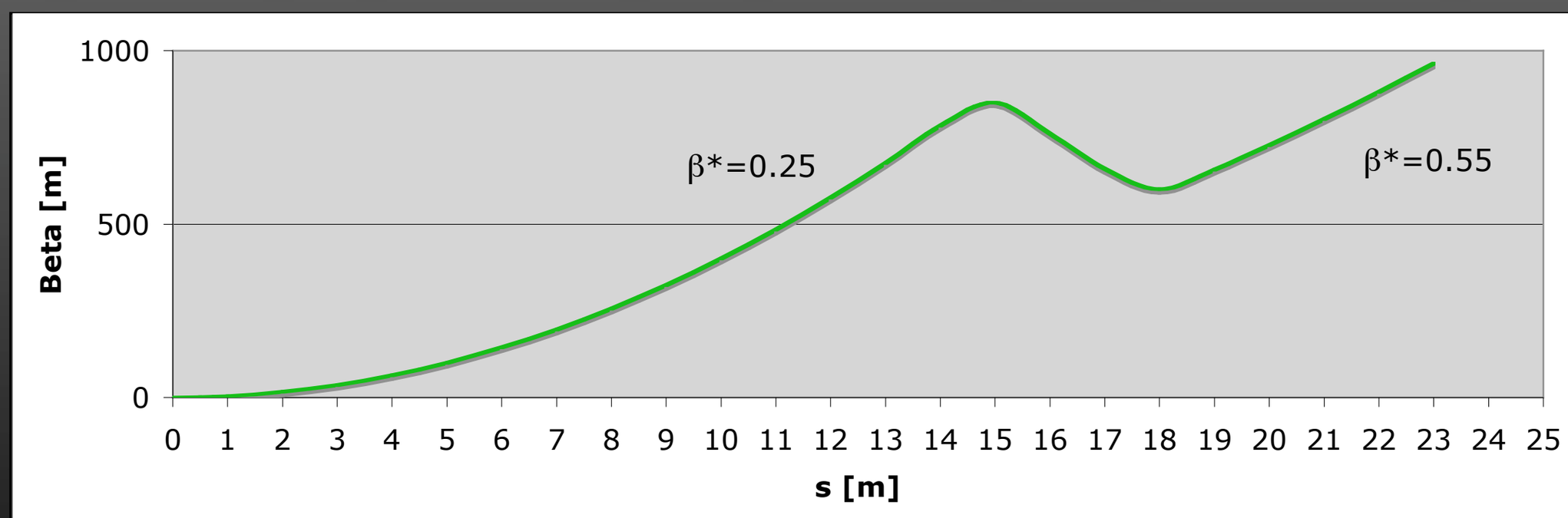
Long magnet and some minor Triplet changes





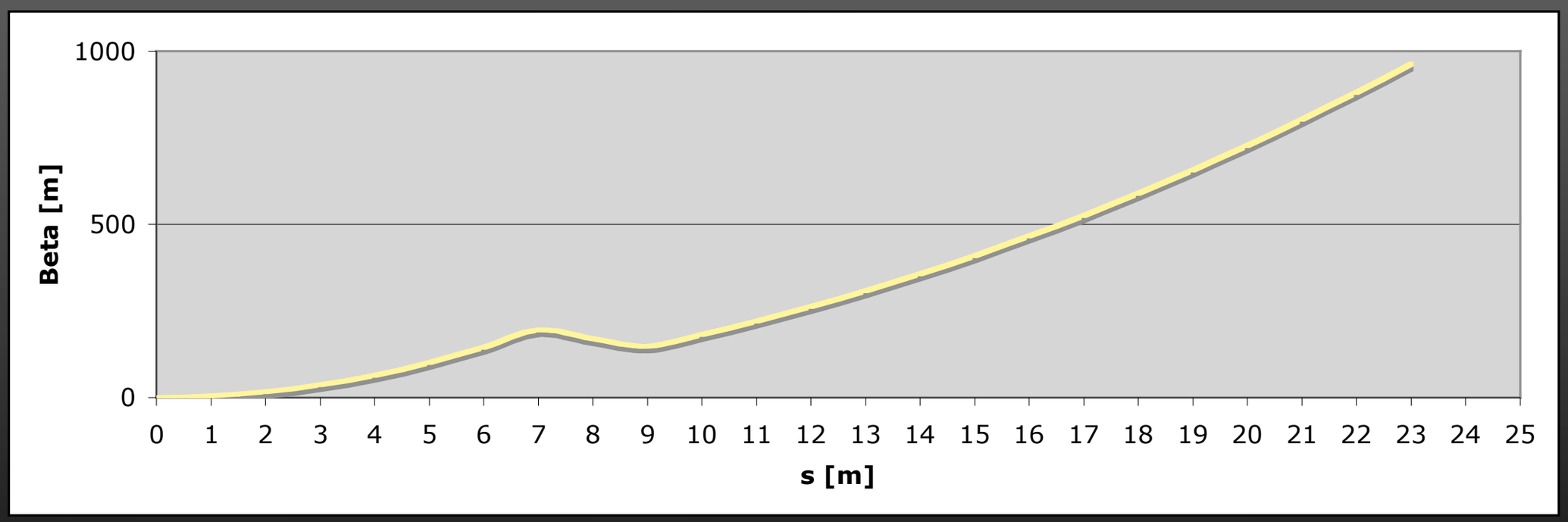
Layout 3

IP
7.5m
D0/
Q0 A
D0/
Q0 B
Q1


1000
500
0
Beta [m]
β*=0.25
β*=0.55
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
s [m]

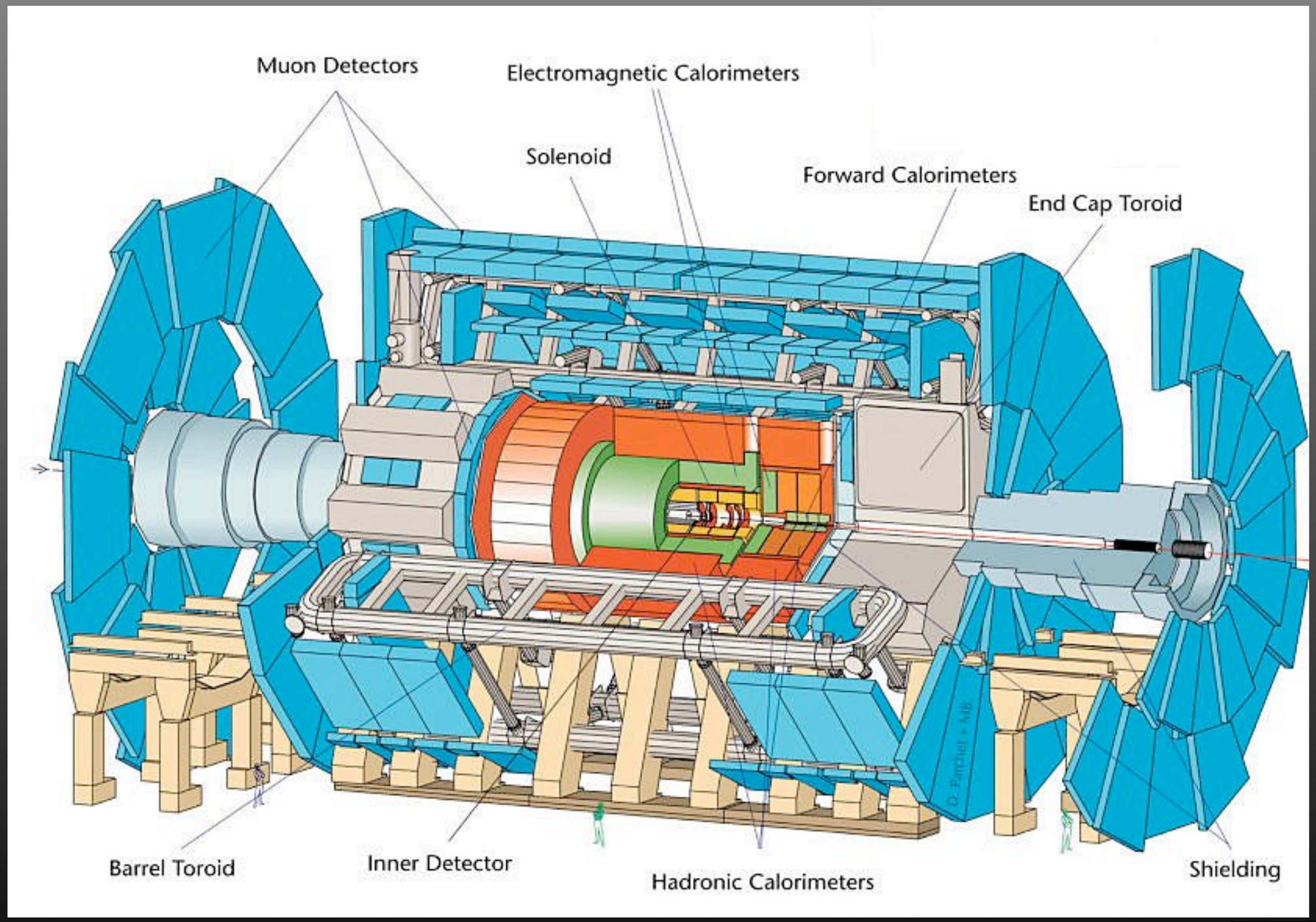
Layout 3

IP
7.5m
D0/
Q0 A
D0/
Q0 B
Q1

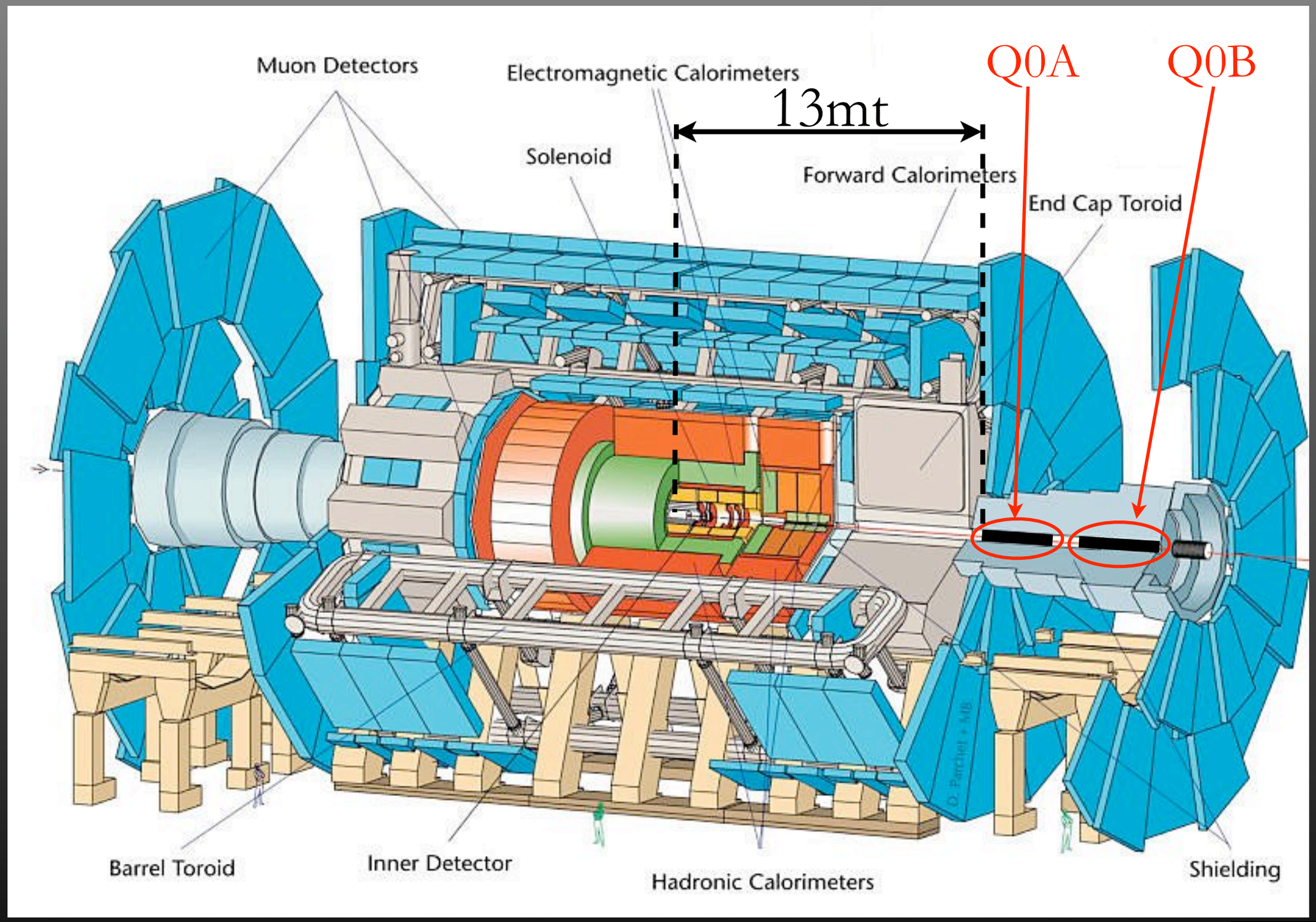

Beta [m]
1000
500
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
s [m]

A major problem?

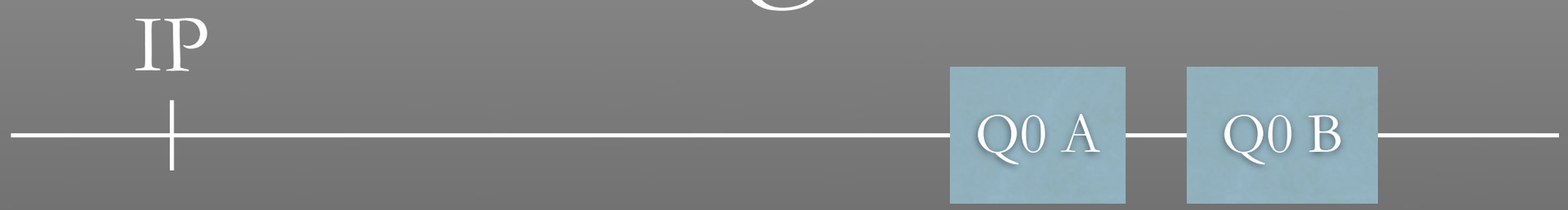
Where in Atlas?

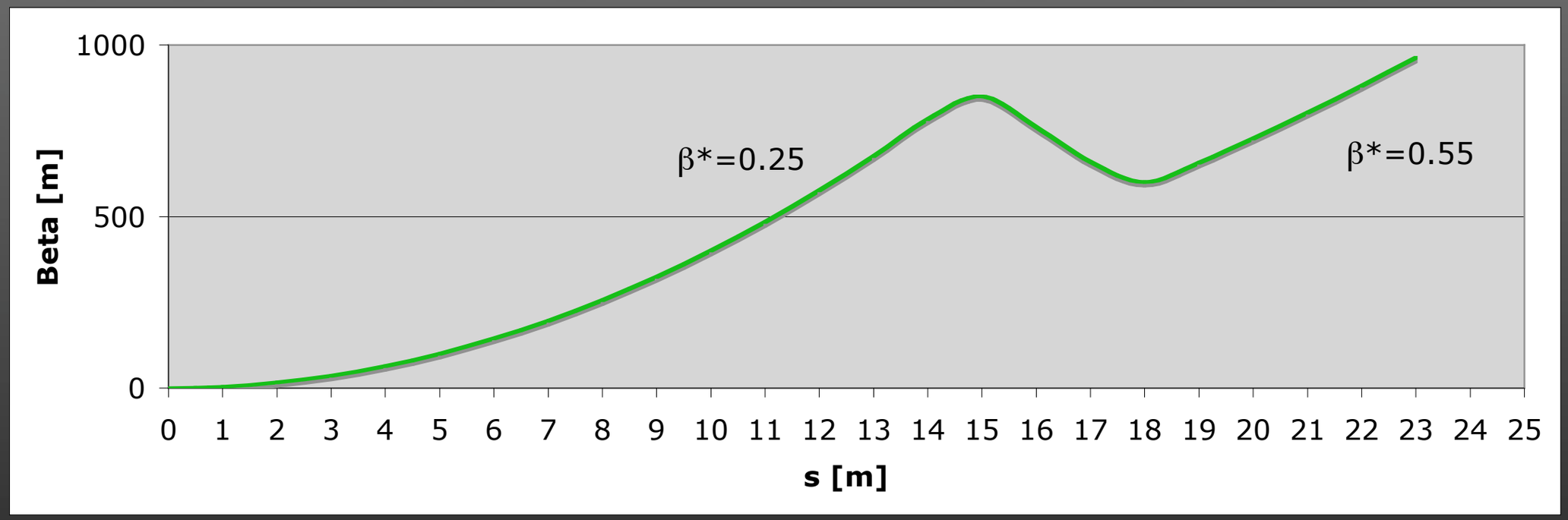


Where in Atlas?



Alignment





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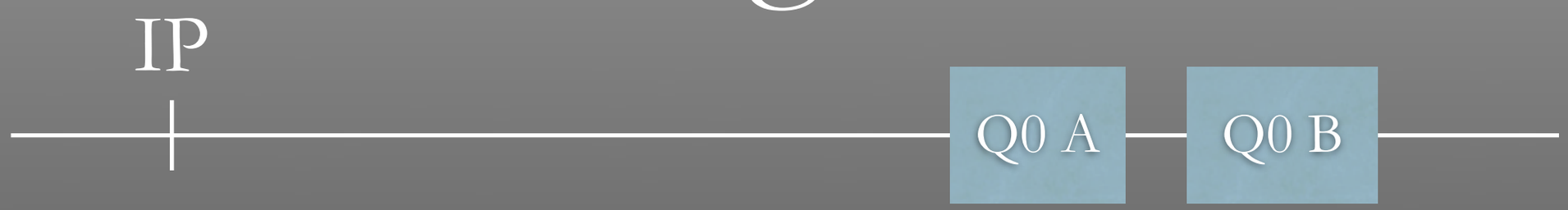

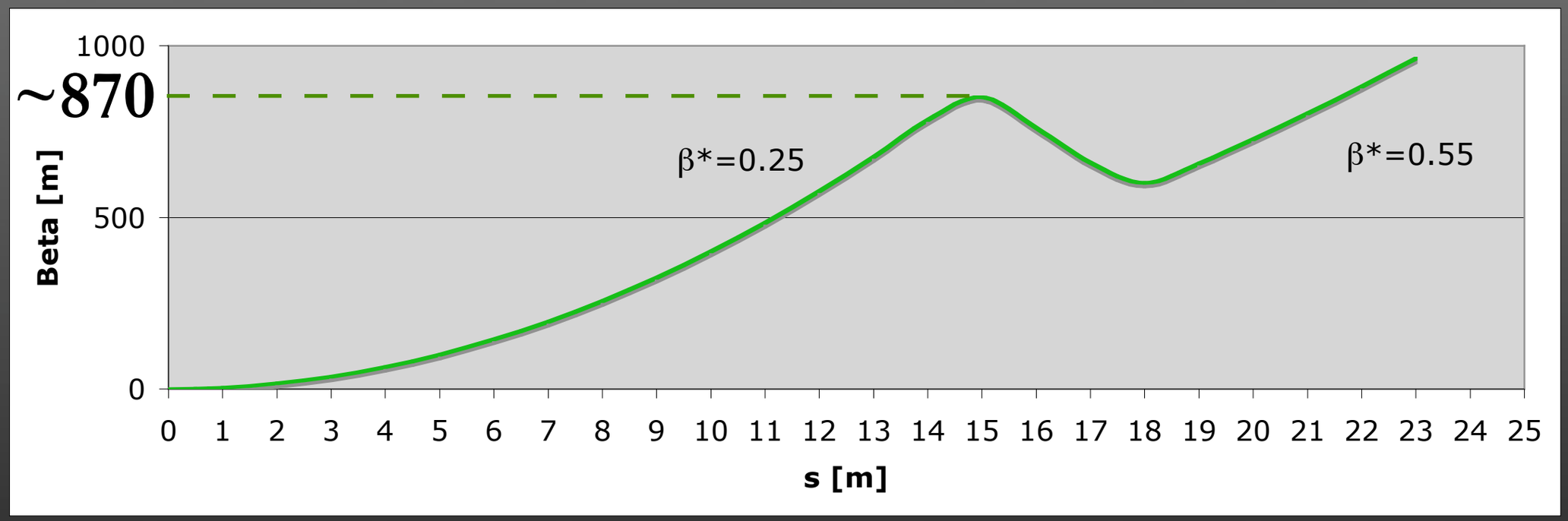

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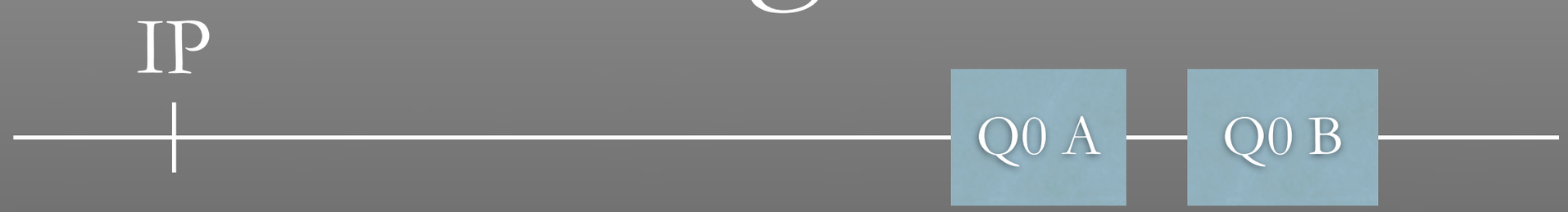
Alignment



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Alignment

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Alignment

Relative misalignment tolerance

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Alignment

Relative misalignment tolerance

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Alignment

Relative misalignment tolerance

We need a rigid structure

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Alignment

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Alignment

Misalignment tolerance
respect to the ideal trajectory

Alignment

Misalignment tolerance
respect to the ideal trajectory

Alignment

Misalignment tolerance
respect to the ideal trajectory

300 μm
without correctors
1 mm
with correctors

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Conclusions

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- Low β* solution with NbTi could be possible

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- Slim quadrupoles are needed for easier integrability

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Conclusions

- Low β* solution with NbTi could be possible
- Slim quadrupoles are needed for easier integrability
- A rigid structure is necessary in order to have good tolerances for misalignement

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What's been keeping us busy

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- A full lattice

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- Study of dynamic misalignment (vibrations)

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- What about the TAS?

What's been keeping us busy

- A full lattice
- Study of dynamic misalignment (vibrations)
- What about the TAS?
- Study of energy deposition (a factor 10 in luminosity!)