

Interaction Regions for the LHC Upgrade, DAFNE and SuperB  
INFN-LNF, Frascati, Italy  
November 8th 2007

# Q0 status

Emanuele Laface

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# Valencia 2006



Valencia 2006

Today

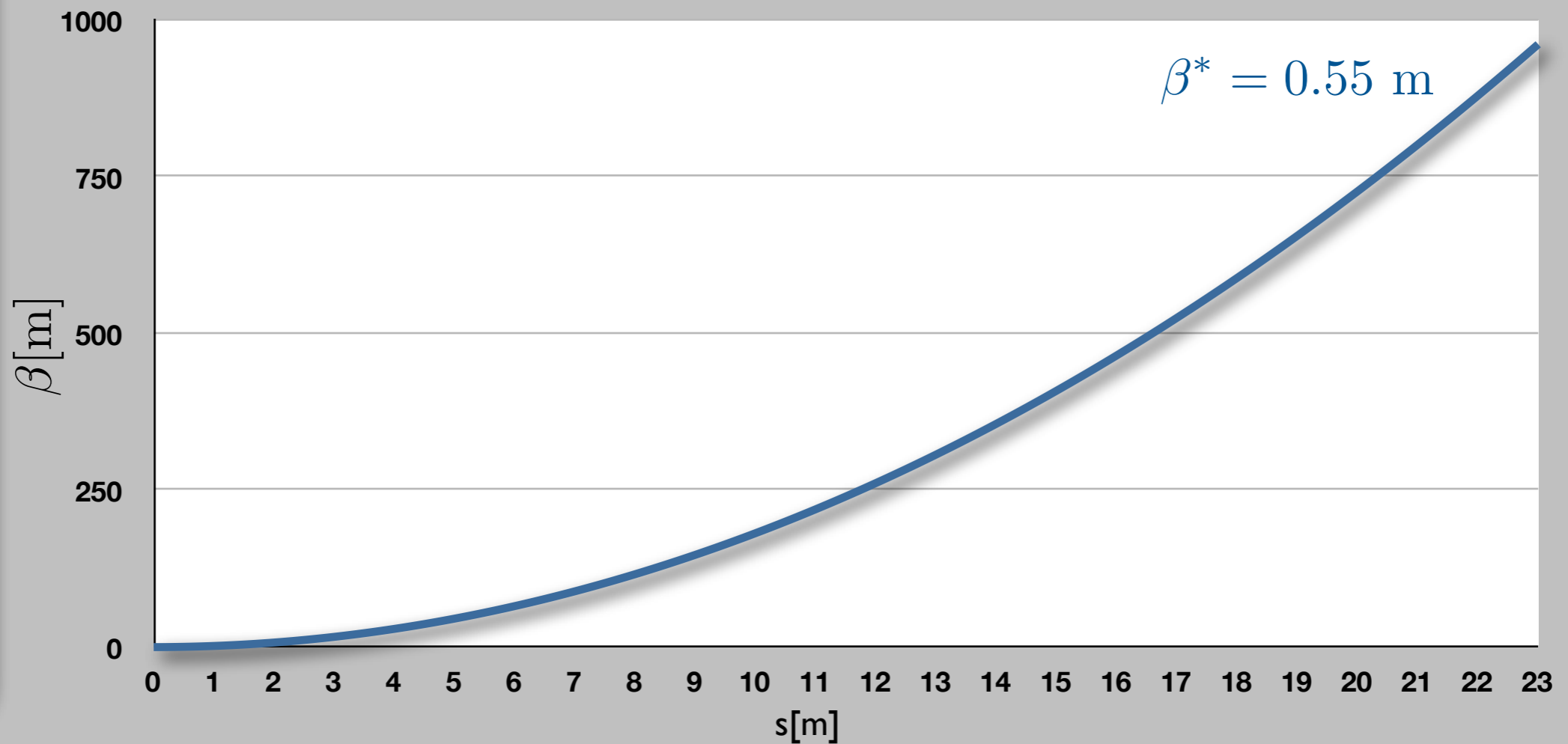
IP

QI

Advantages

Open issues

Conclusion





# Valencia 2006



Valencia 2006

Today

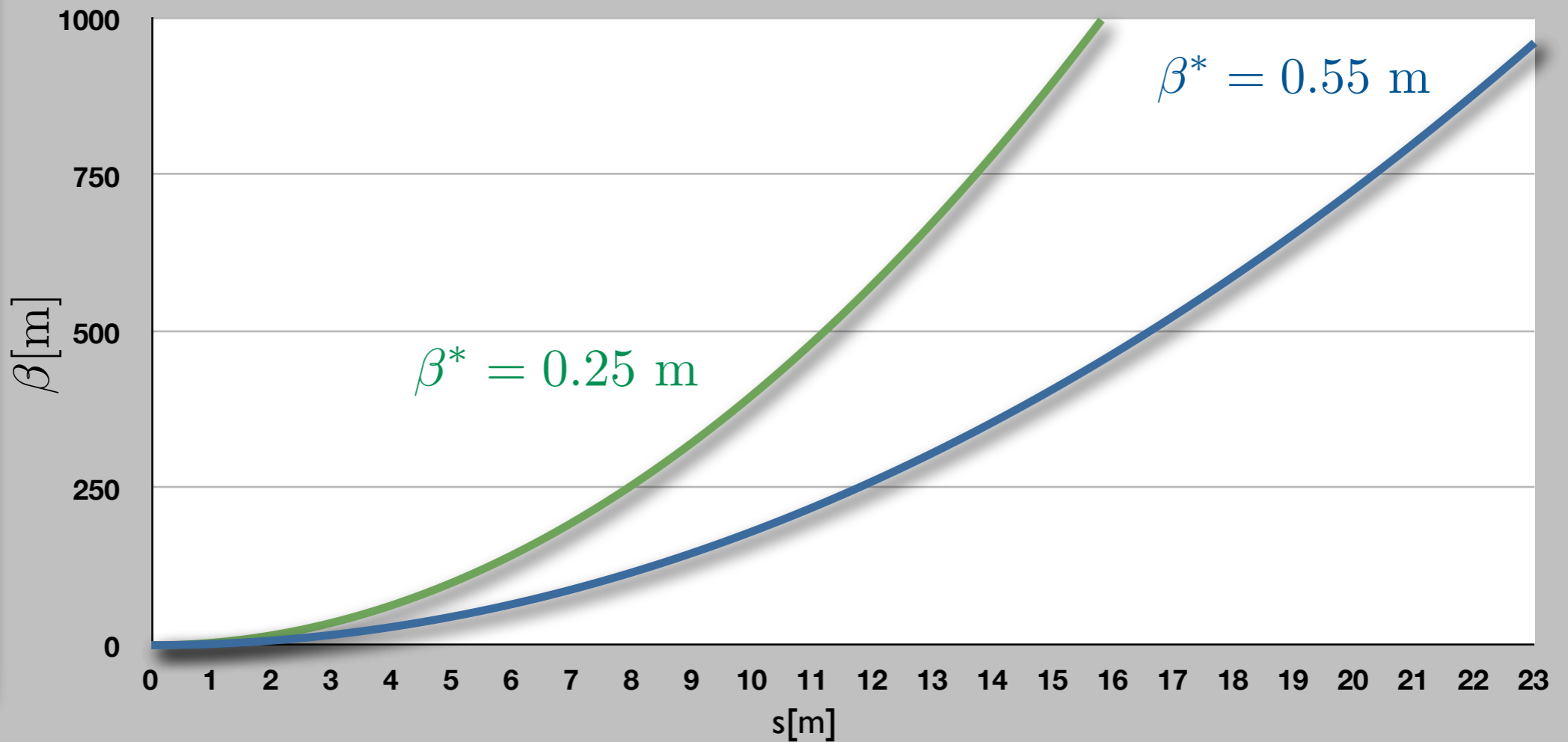
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Valencia 2006

Today

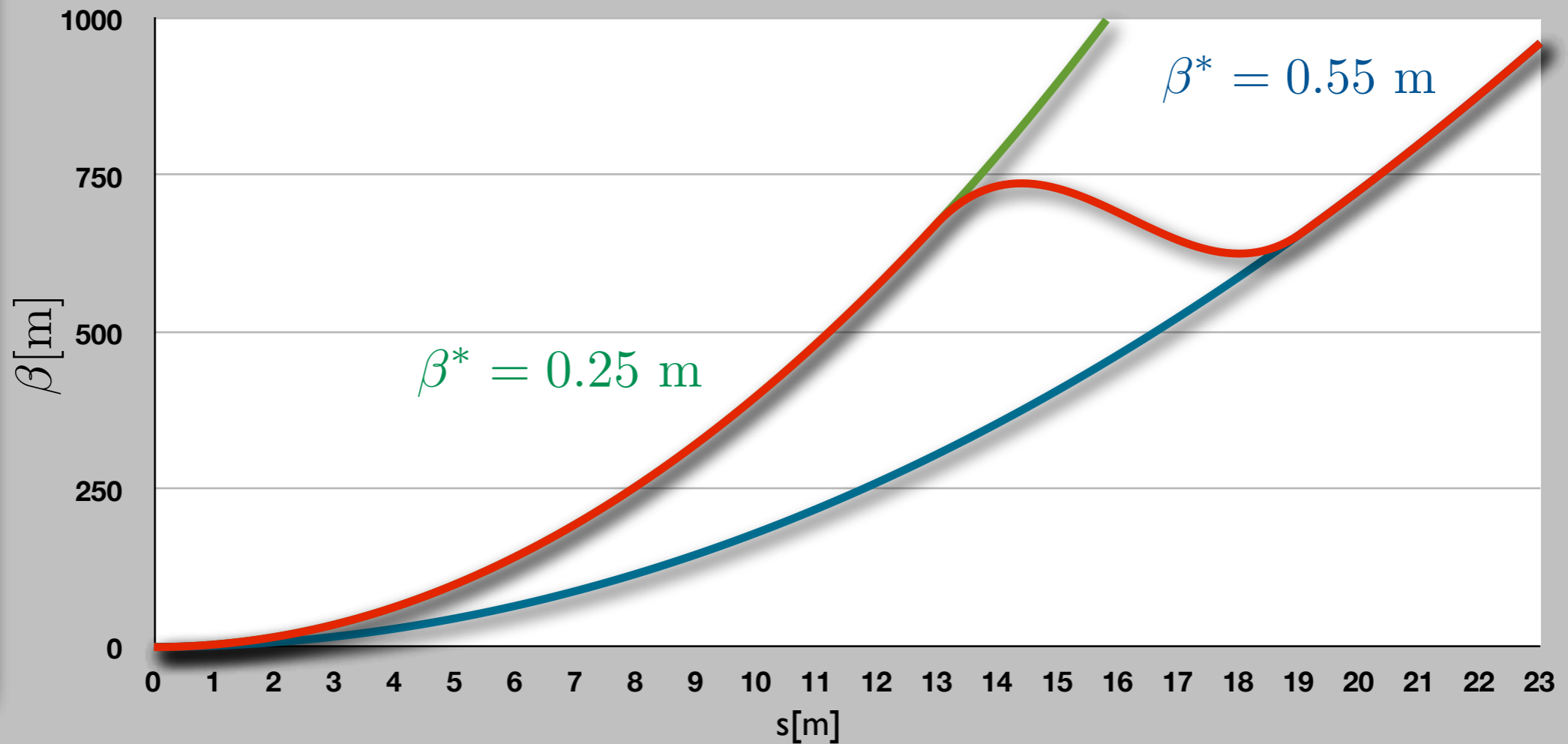
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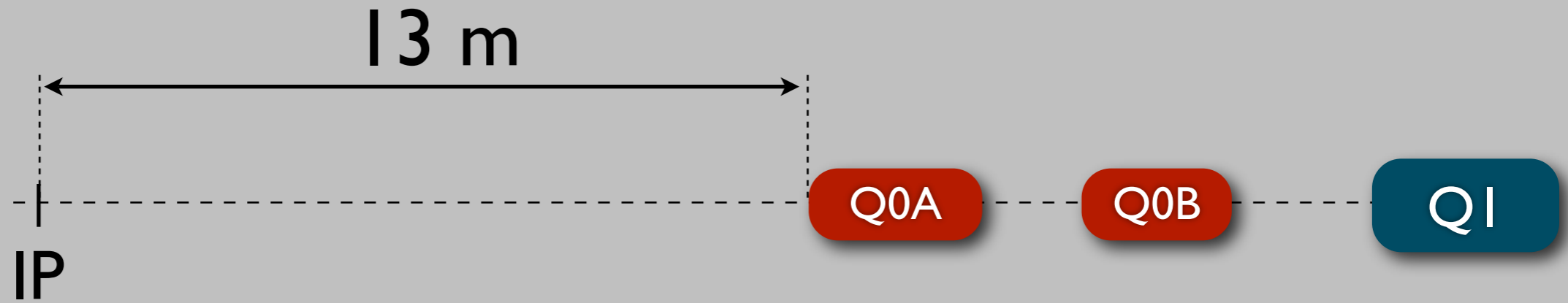


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Valencia 2006

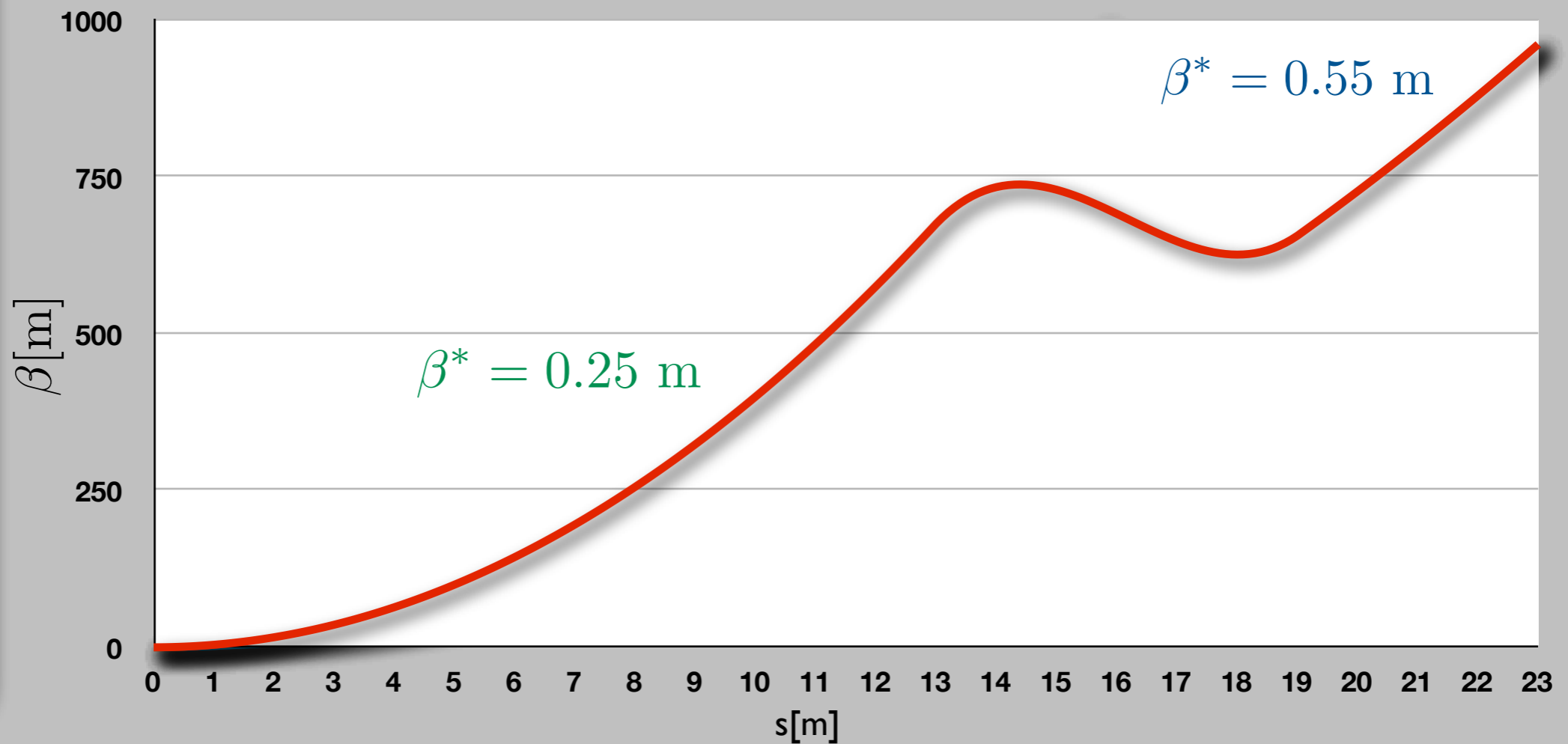
Today



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Parameters evaluated for the five magnets  
(from Q0A to Q3):

- Lengths.
- Gradients.
- Relative positions.



Parameters evaluated for the five magnets  
(from Q0A to Q3):

- Lengths.
- Gradients.
- Relative positions.

Constraints:

- $L^* \geq 13\text{m}$ .
- Small  $\beta_{\text{max}}$ .
- NbTi ( $\sim 7\text{ T}$  of peak field).
- A triplet like the nominal one.





# Today with $\beta^* = 0.25\text{m}$



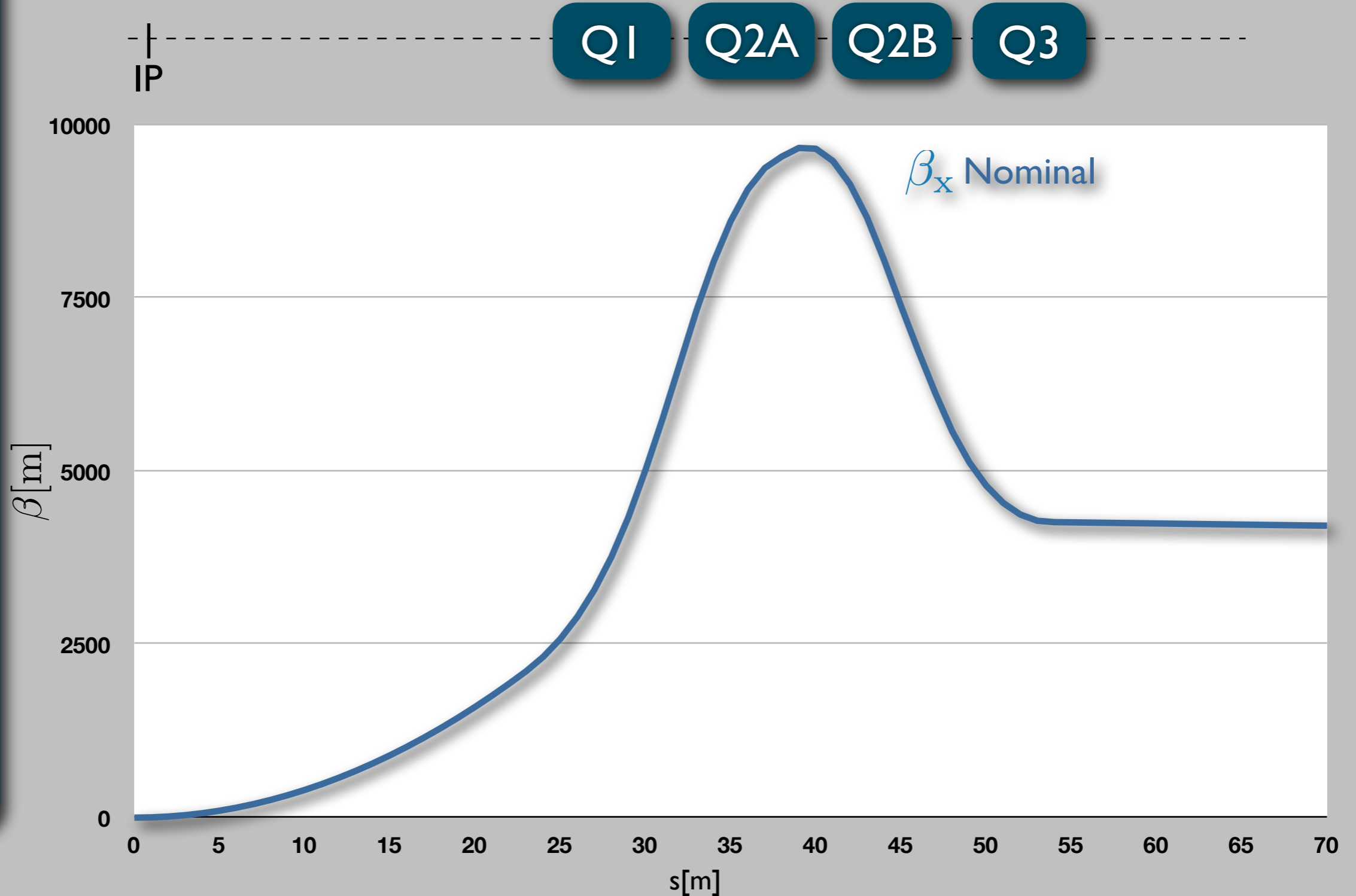
Valencia 2006

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# Today with $\beta^* = 0.25\text{m}$



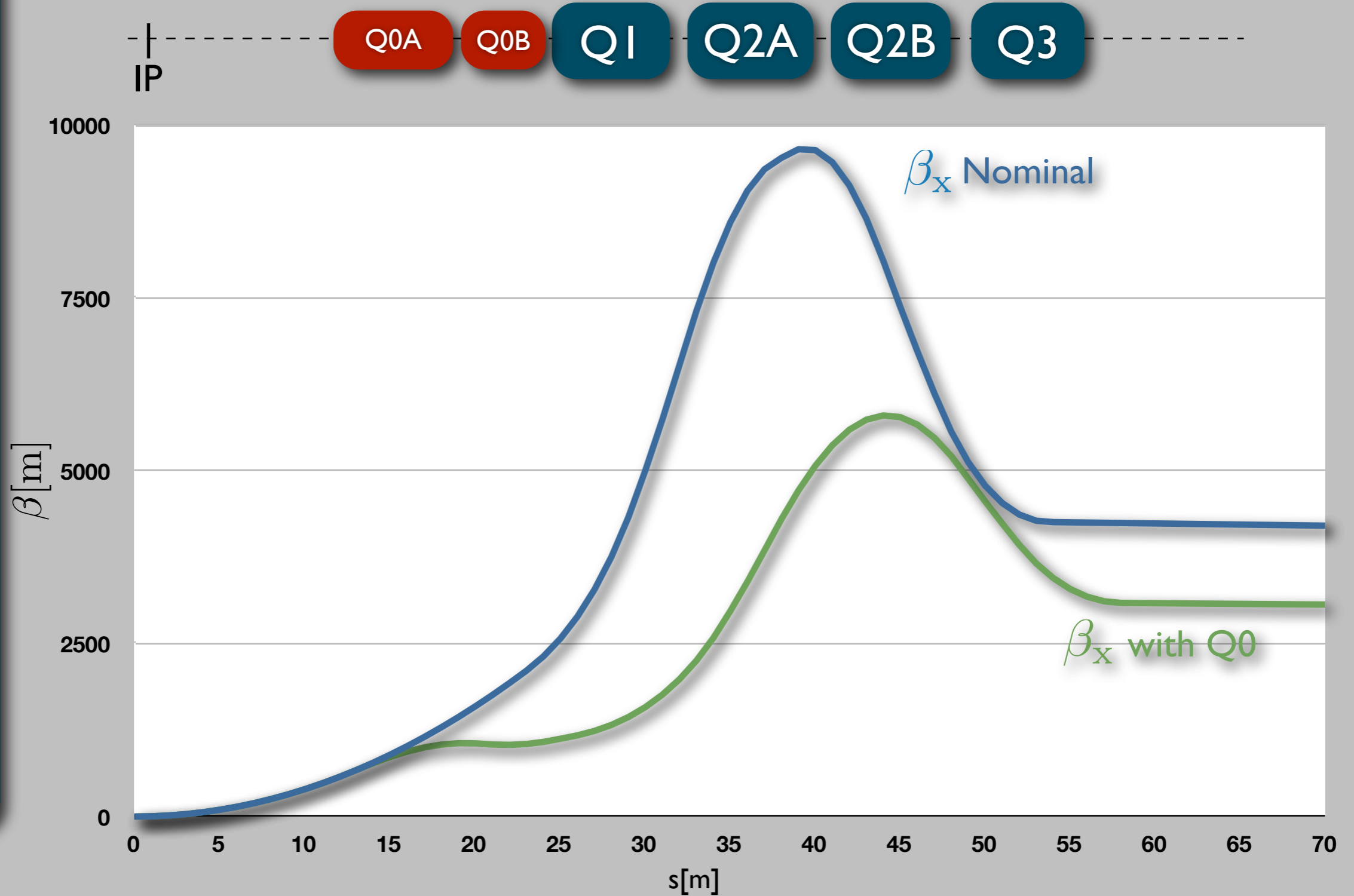
Valencia 2006

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# Today with $\beta^* = 0.25\text{m}$



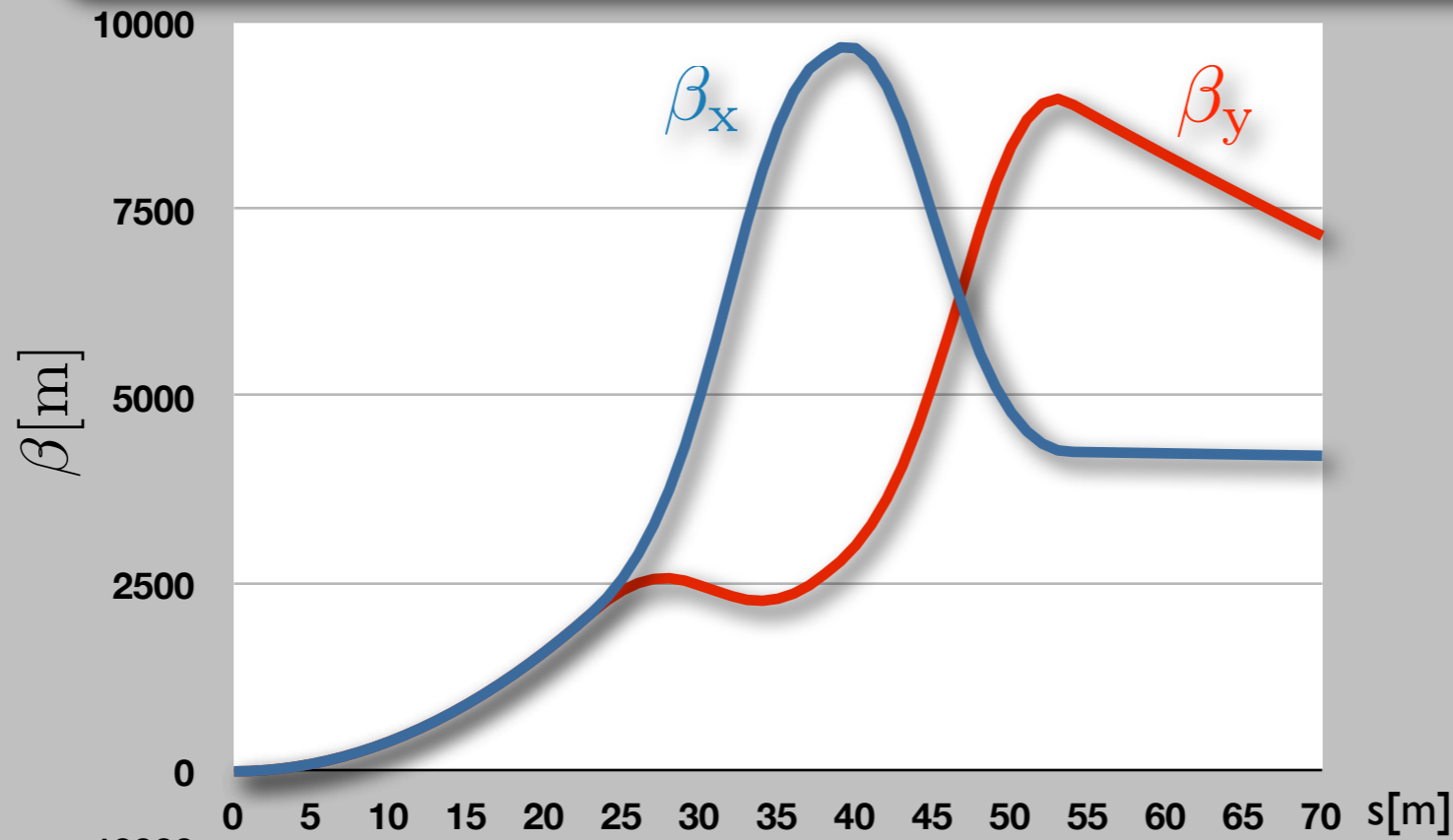
Valencia 2006

Today

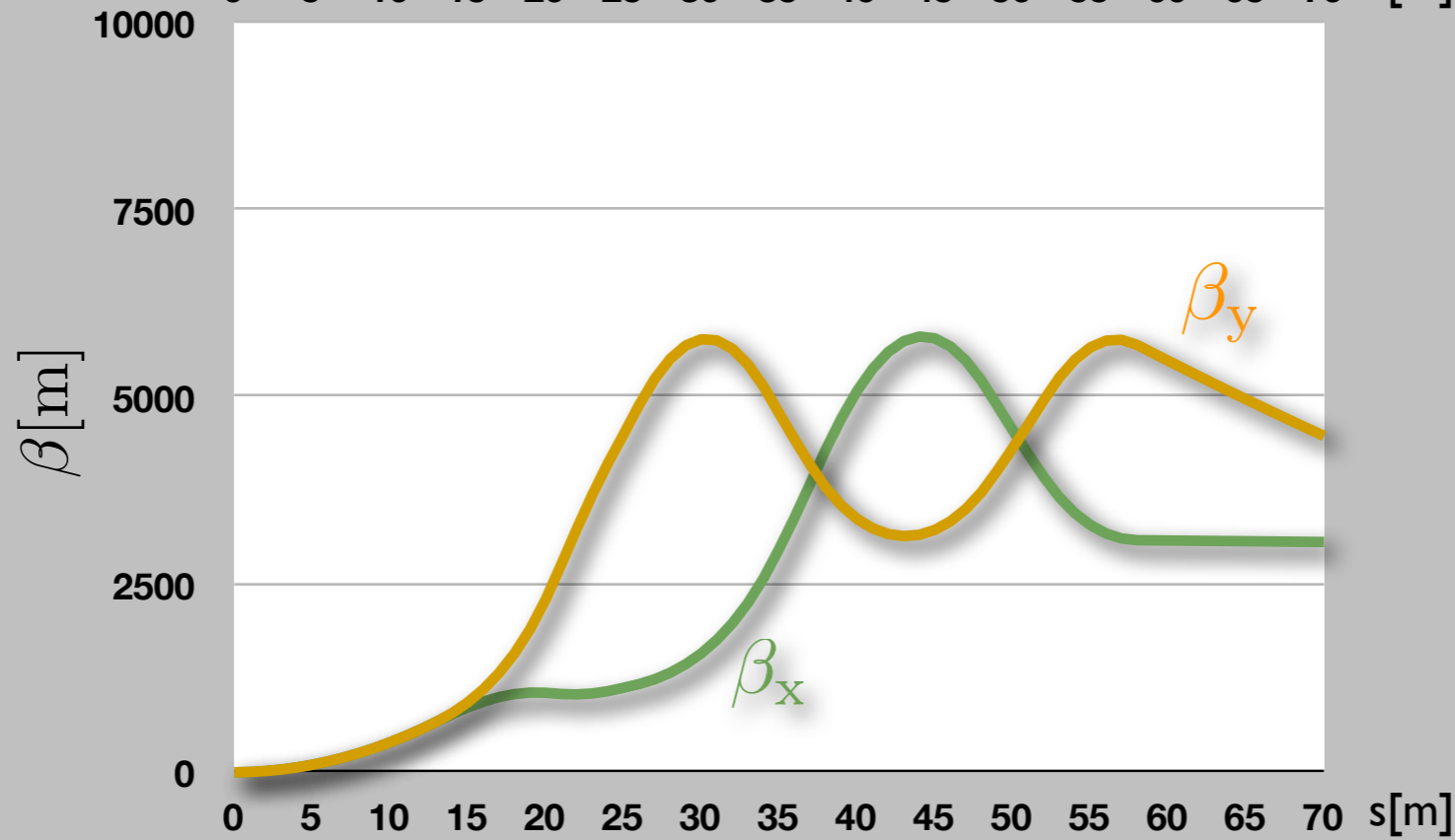
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**Nominal**  
 $\beta_{\text{max}} \approx 9600\text{m}$



**With Q0**  
 $\beta_{\text{max}} \approx 5800\text{m}$



# Today with $\beta^* = 0.15\text{m}$



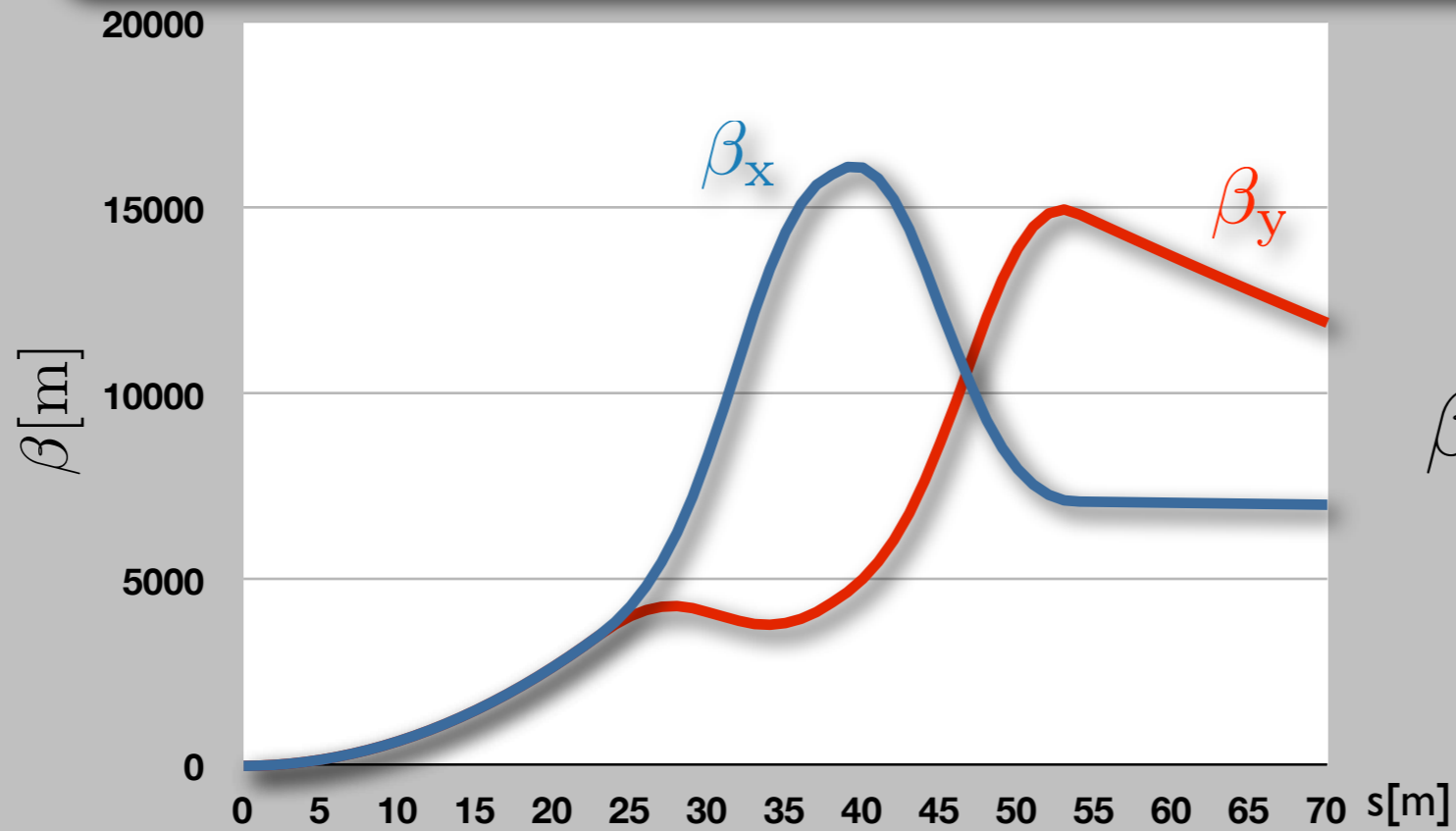
Valencia 2006

Today

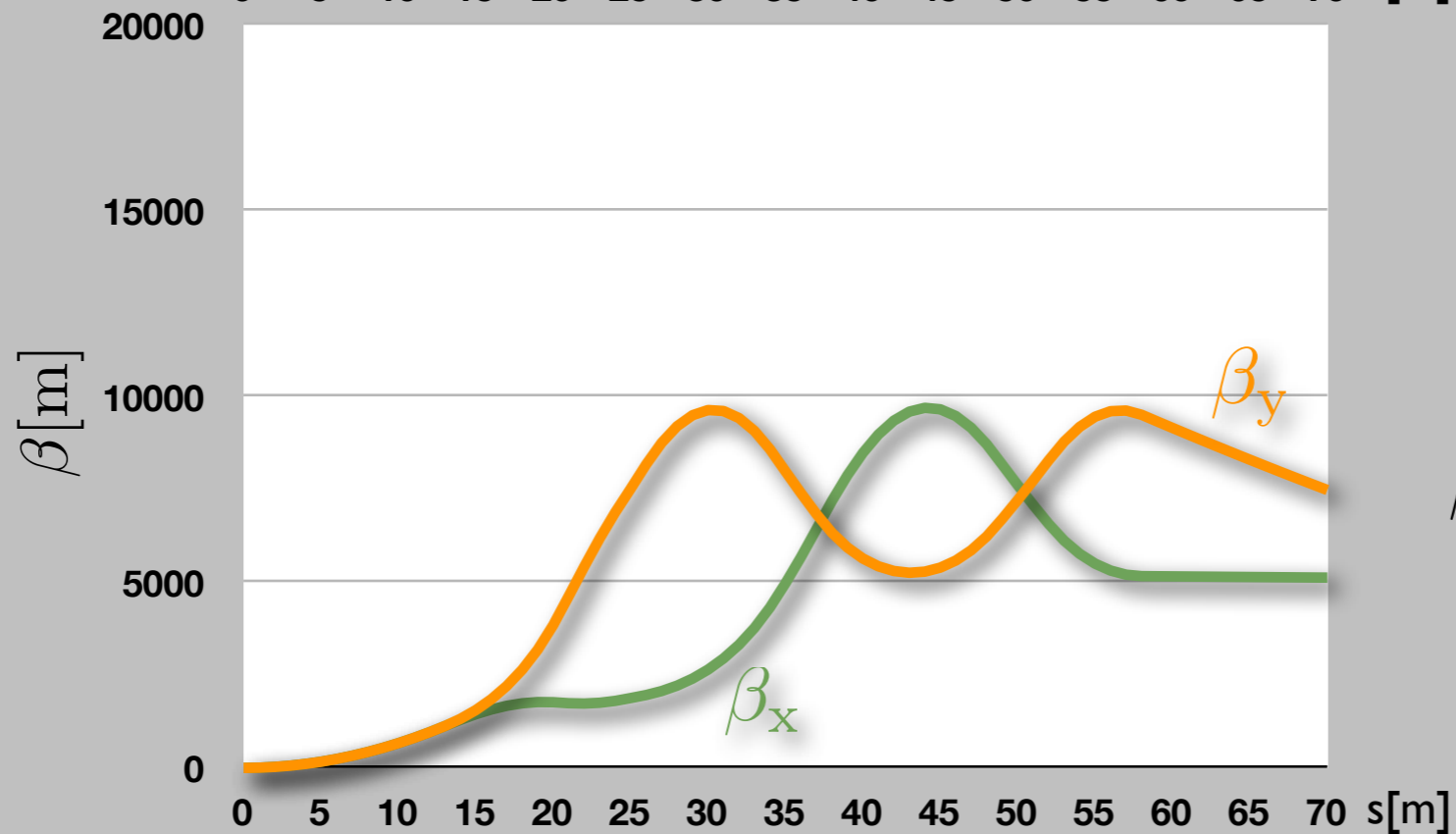
Advantages

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Conclusion



**Nominal**  
 $\beta_{\max} \approx 16100\text{m}$



**With Q0**  
 $\beta_{\max} \approx 9700\text{m}$



# Layout with $\beta^*=0.25\text{m}$



Valencia 2006

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	Aperture [mm]	Gradient [T/m]	Length [m]	$L^*$ [m]	$\beta_{\text{max}}$ [m]
Q0A	57.0	240	7.2	13.0	2300
Q0B	68.5	196	3.6	20.8	4300
Q1	75.2	200	8.6	25.8	5780
Q2	75.4	172	11.5	37.1	5820
Q3	75.1	160	6.0	52.0	5770



# Advantages of Q0 solution



Valencia 2006

Today

**Advantages**

Open issues

Conclusion



# Advantages of Q0 solution



Valencia 2006

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Lower  $\beta_{\max}$  with a gain in aperture around 15%.

For example: with  $\beta^*=0.25\text{m}$ , the required aperture for the triplet is  $\sim 80\text{mm}$ .



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Lower  $\beta_{\max}$  with a gain in aperture around 15%.

For example: with  $\beta^*=0.25\text{m}$ , the required aperture for the triplet is  $\sim 80\text{mm}$ .

The contribution of interaction region to the linear chromaticity is  $\sim 20\%$  lower than the nominal triplet.





# Open issues of Q0 solution



Valencia 2006

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# Open issues of Q0 solution



Valencia 2006

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Q0A is not a small magnet anymore: 57mm of aperture, 240 T/m of gradient and 7 m of length. Is it possible to optimize?



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Q0A is not a small magnet anymore: 57mm of aperture, 240 T/m of gradient and 7 m of length. Is it possible to optimize?

Integrability.



# Q0 in ATLAS



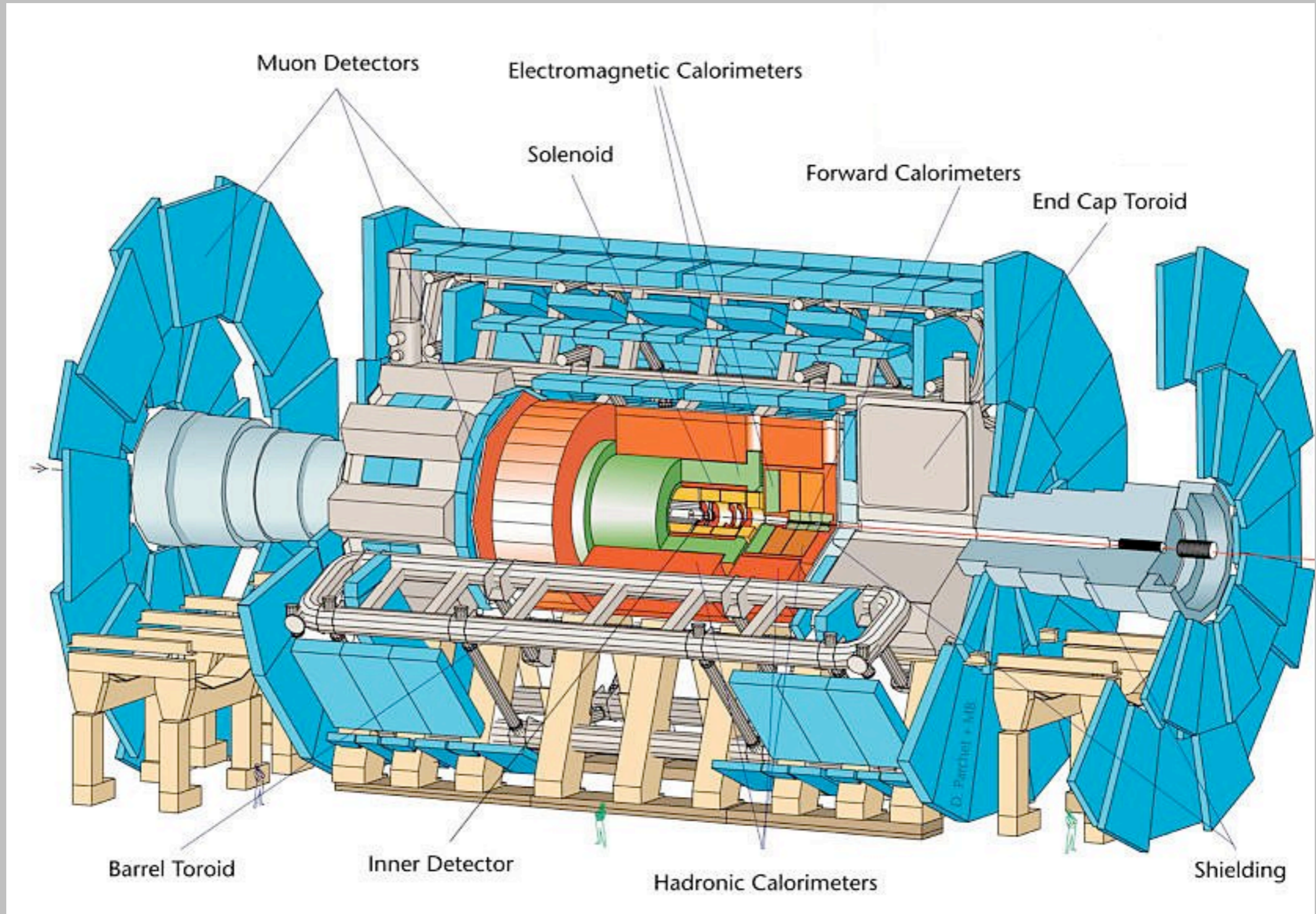
Valencia 2006

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# Q0 in ATLAS



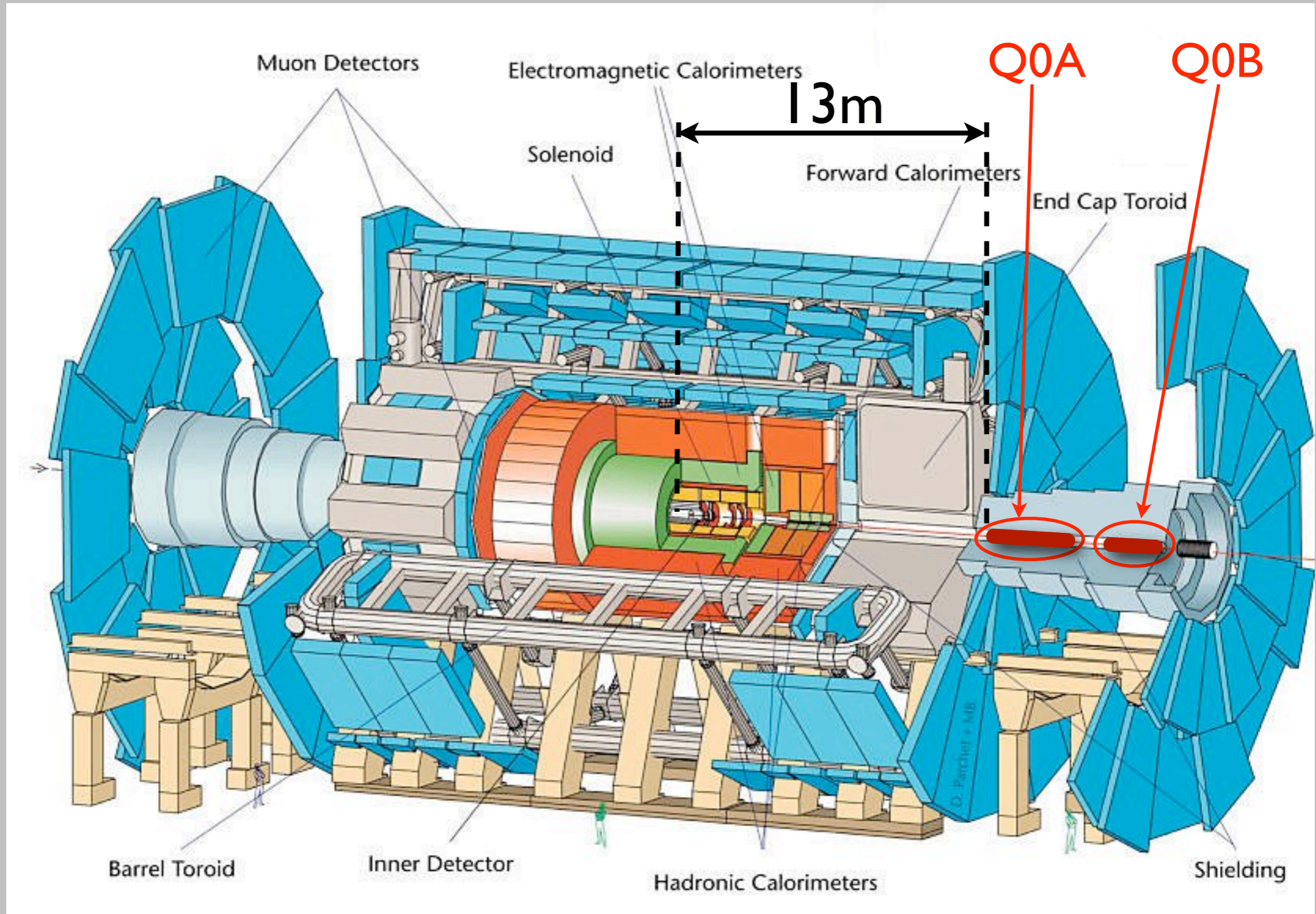
Valencia 2006

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# Q0 in CMS



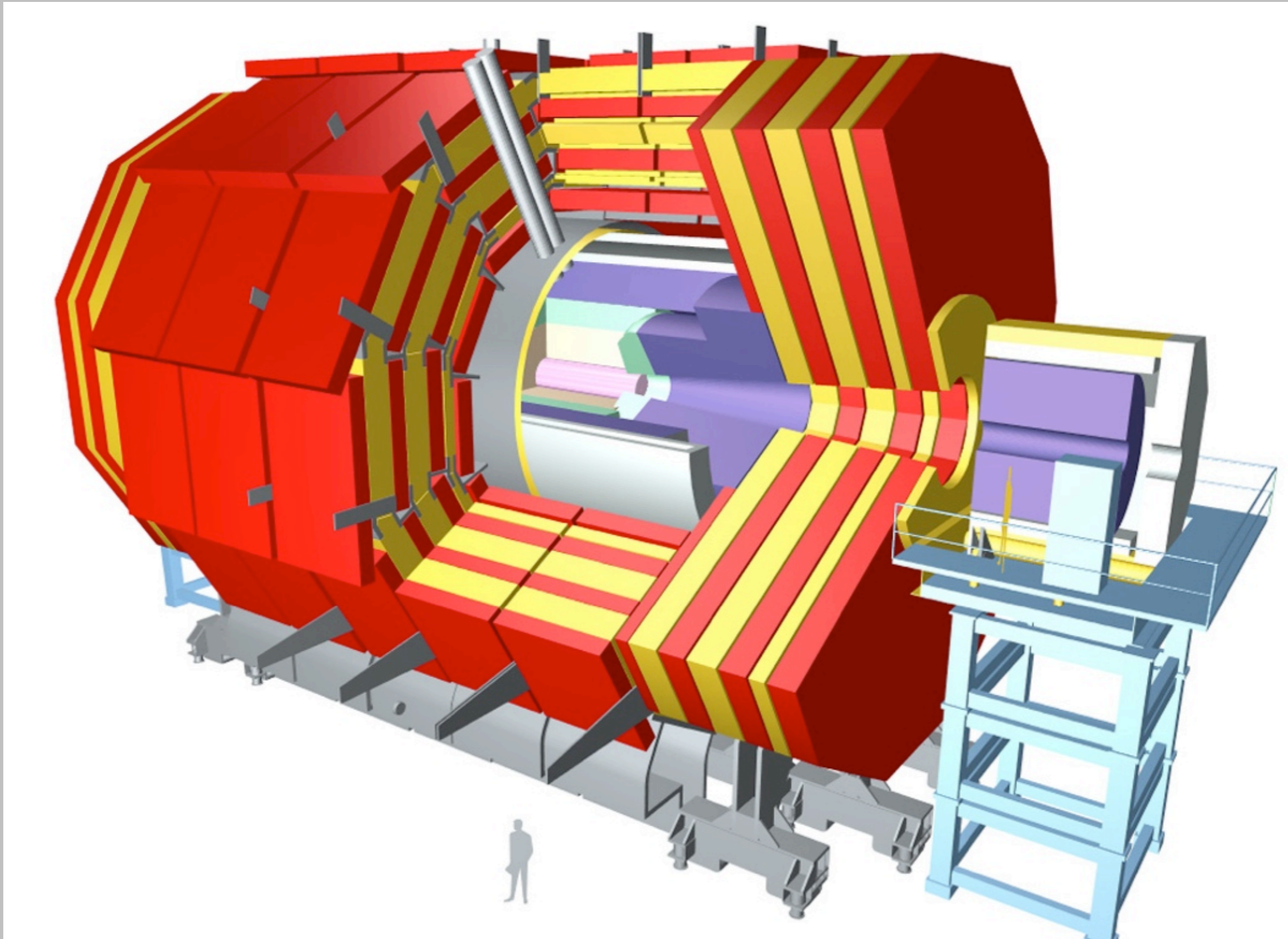
Valencia 2006

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# Q0 in CMS



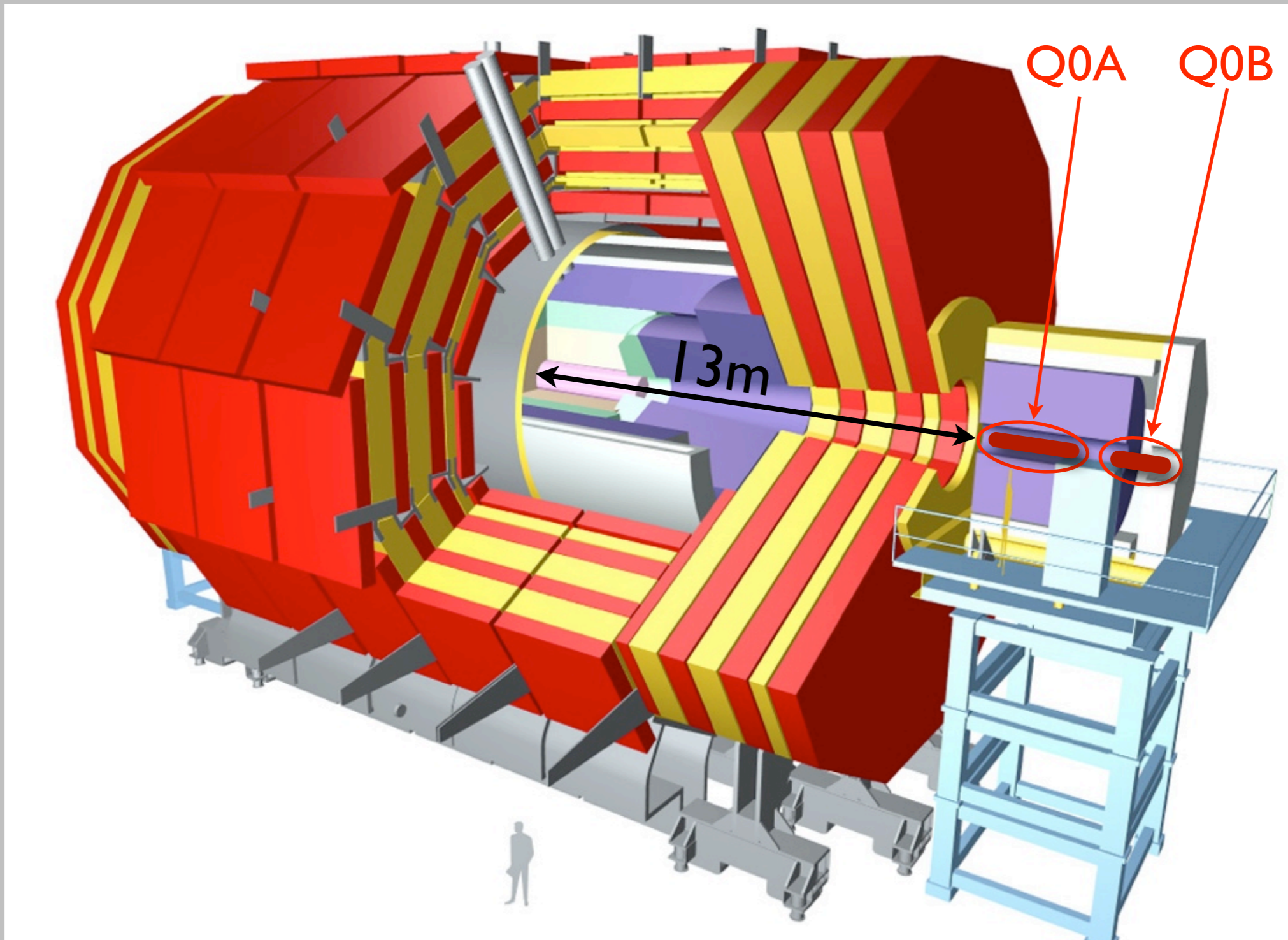
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Integrability.

Misalignments.



# Relative misalignment



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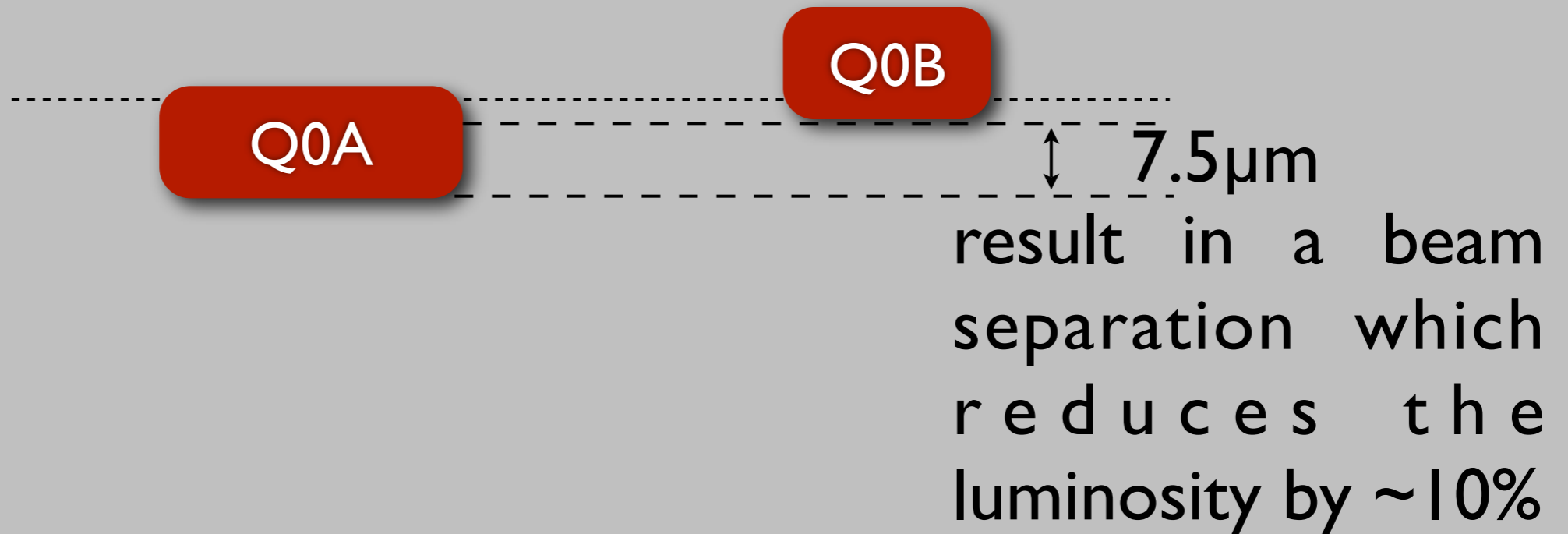
# Relative misalignment



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Too small

Today



Advantages

Open issues

Conclusion

Corrections can be applied for static misalignments, but a rigid structure is required to prevent vibrations.



# Misalignment respect to the nominal orbit



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Today

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# Misalignment respect to the nominal orbit



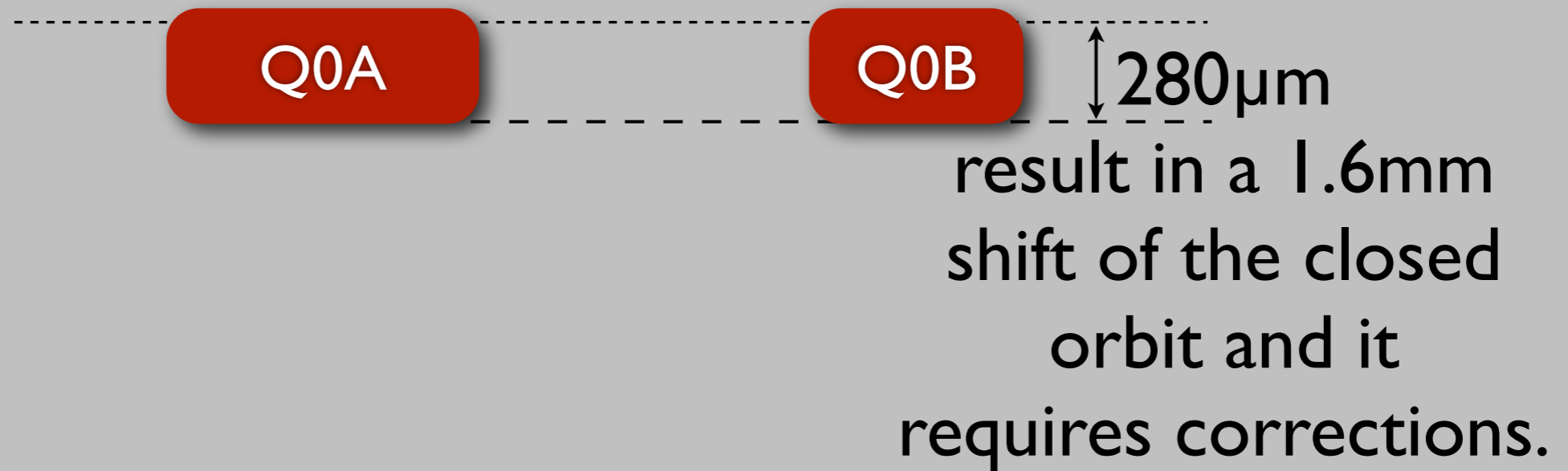
Valencia 2006

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Integrability.

Misalignments.

Energy deposition (E. Wildner's talk).



# Conclusion



Valencia 2006

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Q0 is an option that can help solving issues of aperture and chromaticity. Moreover it's interesting to look for solutions with more than three quadrupoles for the final focusing region.

The real problems of integrability and energy deposition are difficult to evaluate before the first operations of LHC; it's important to study different IR layouts and optimizations.



Thank you.