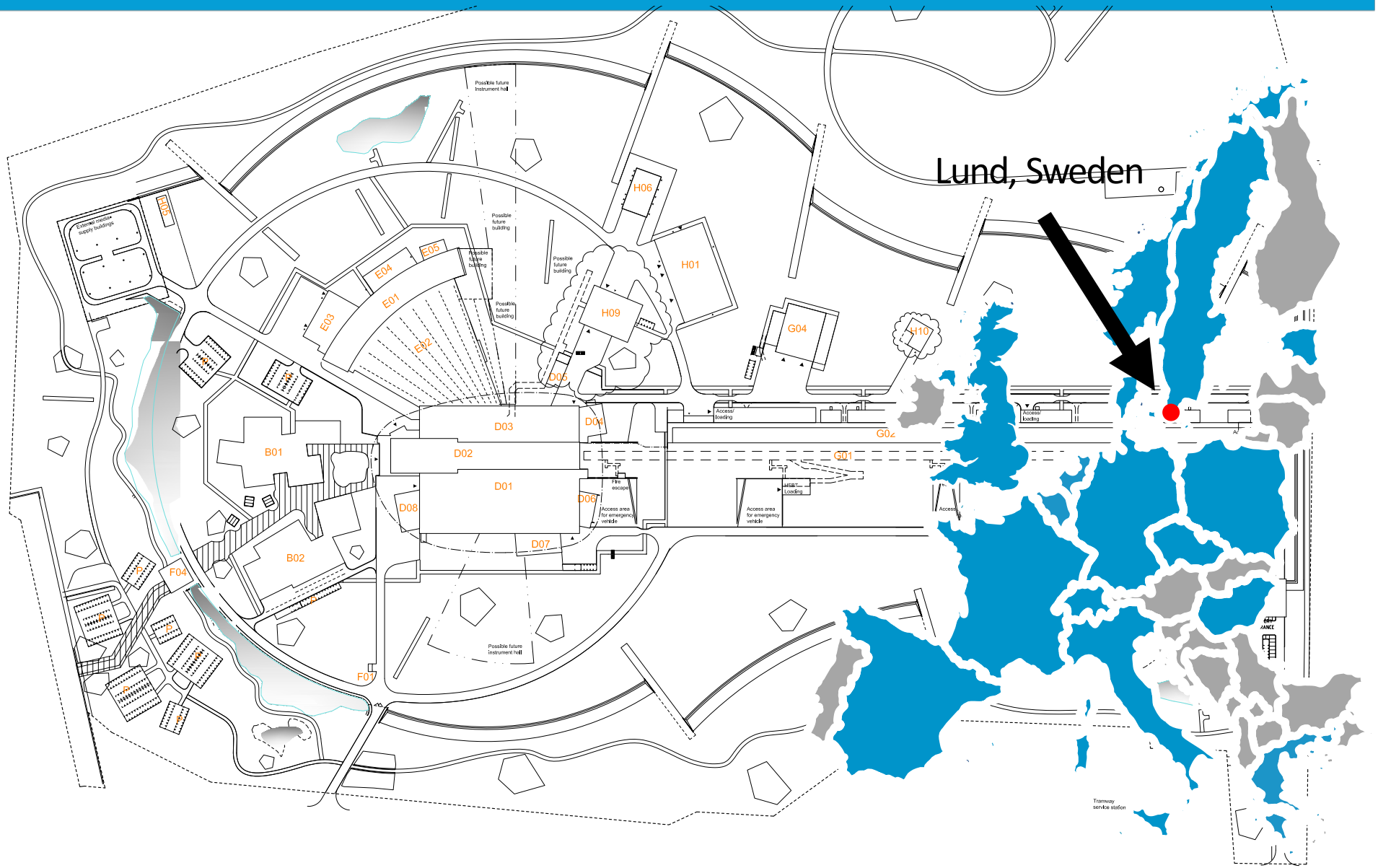
# Ideas for the DNS-IV moderators and beam extraction, inspired by the ESS design

Workshop on Advanced ideas and experiments for the new Dubna Neutron Source DNS-IV,
Dubna, 6th December 2018

Ken Andersen, Neutron Instruments Division, European Spallation Source ERIC

# ESS Overview



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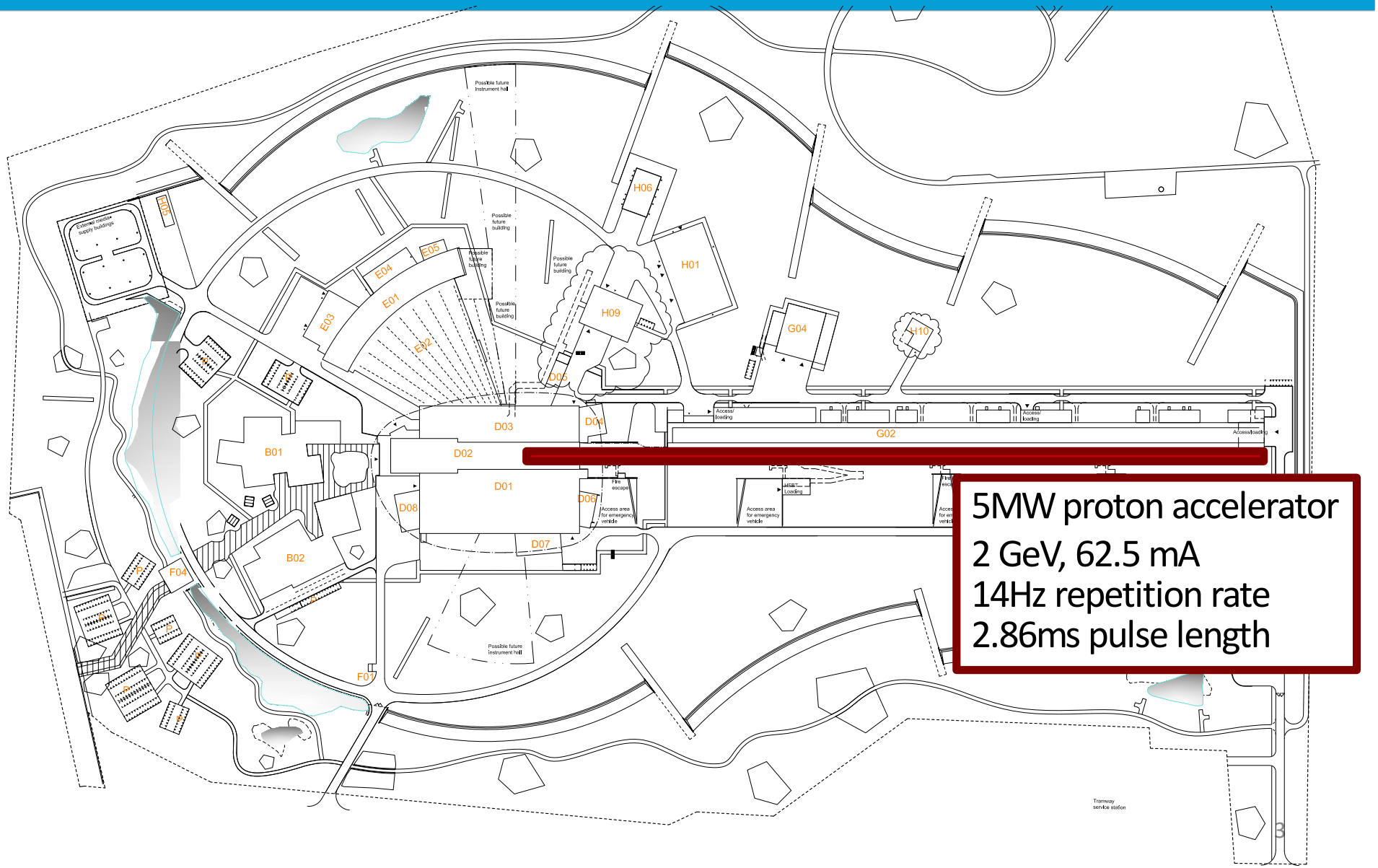

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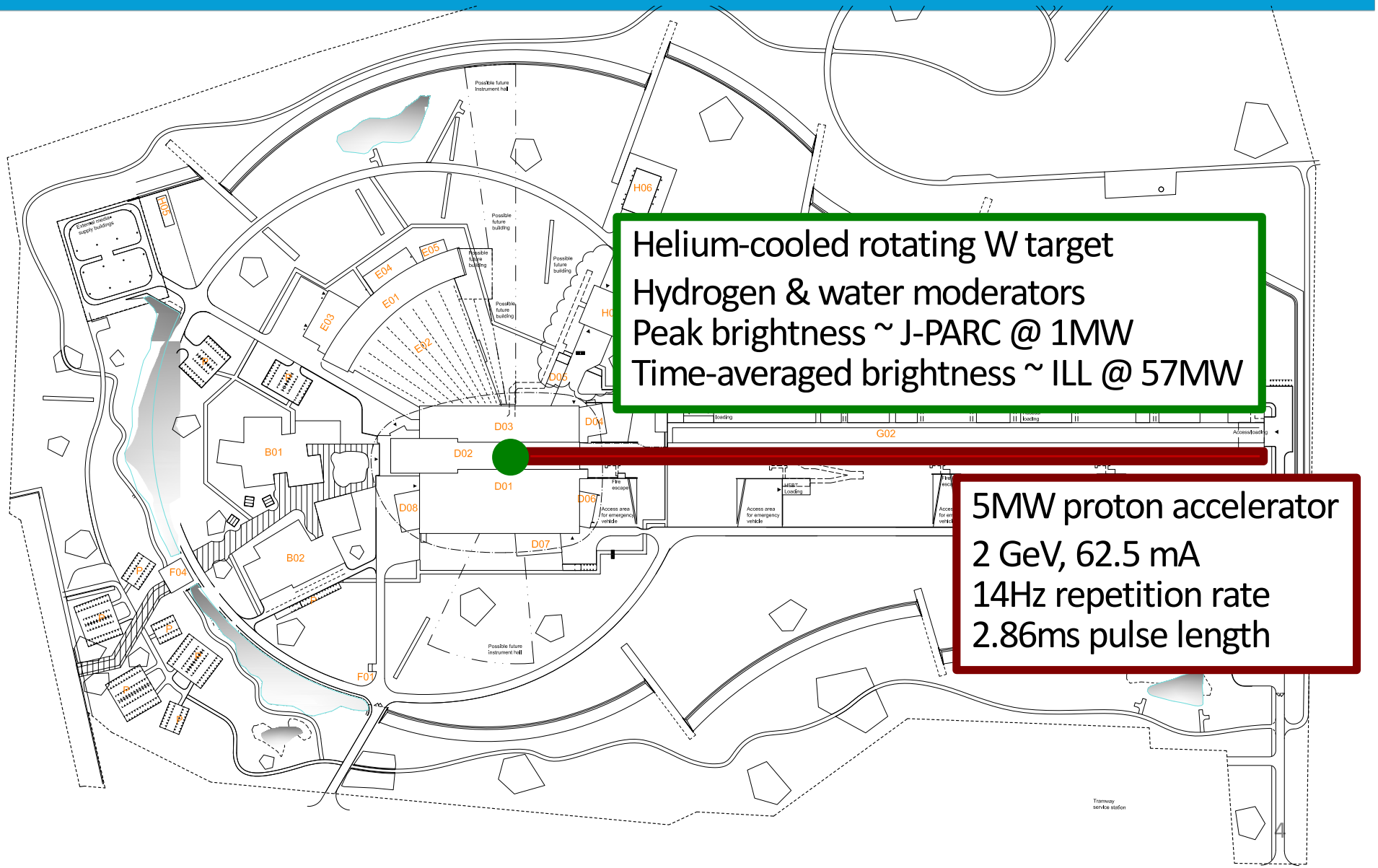

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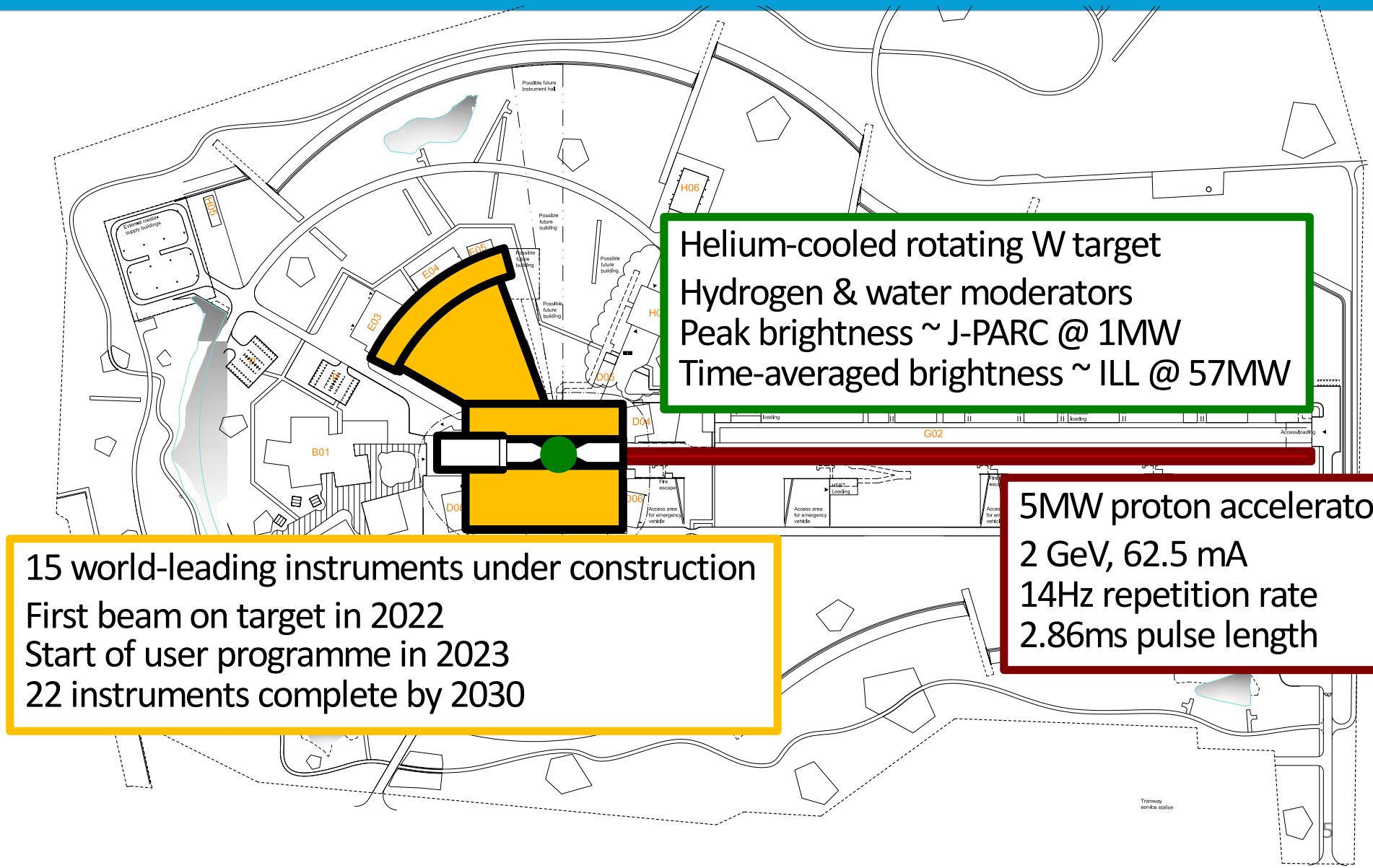
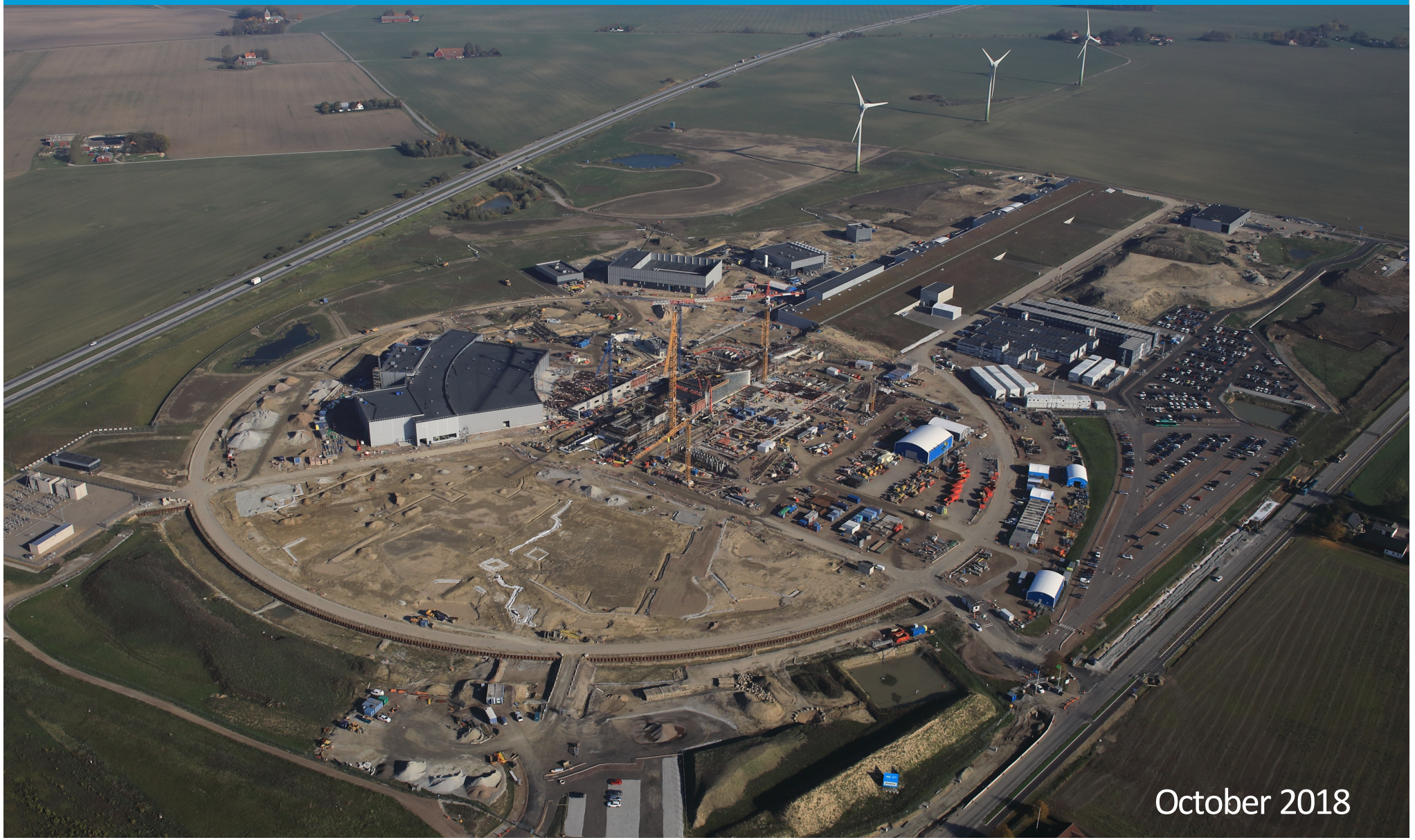


# Site Photos



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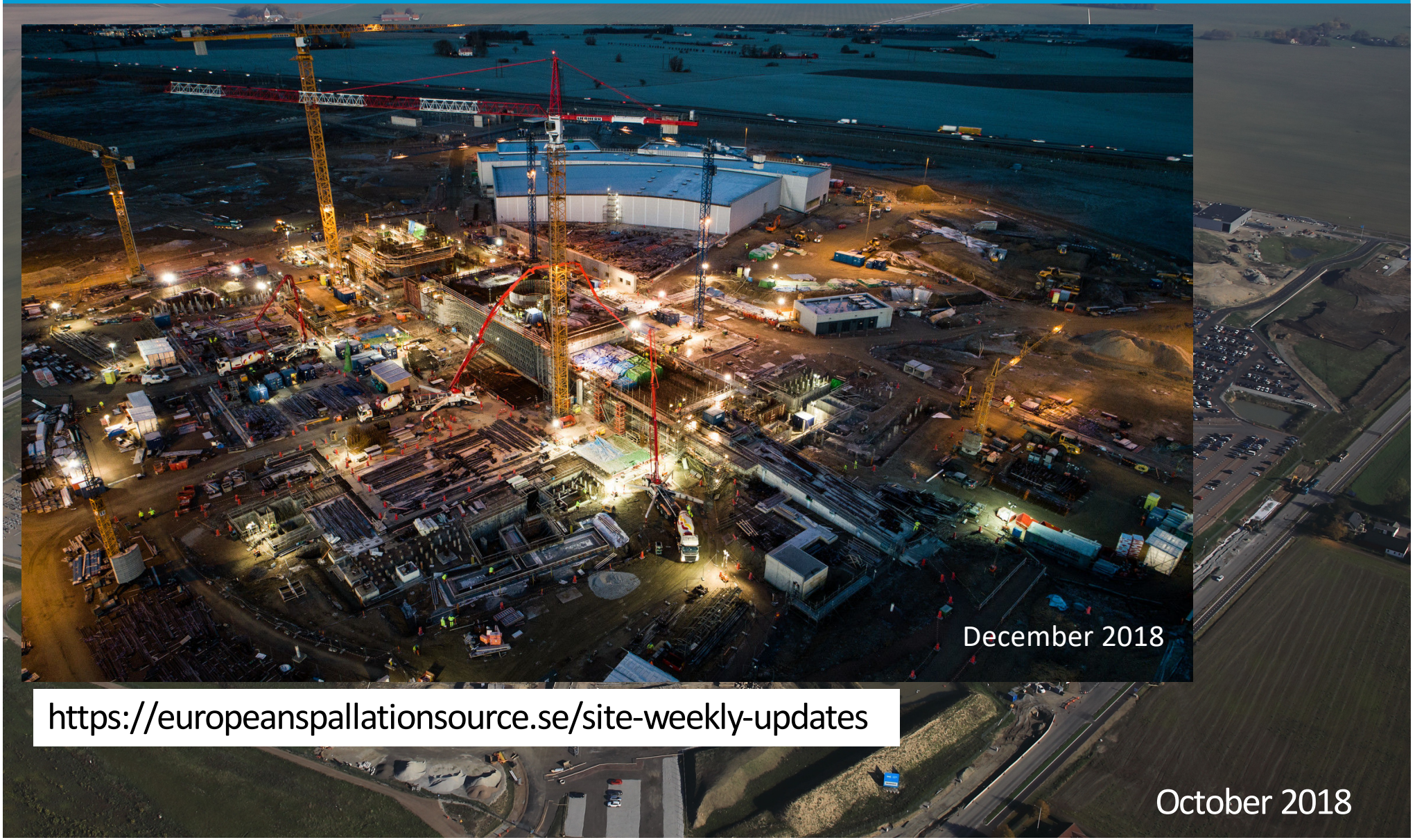
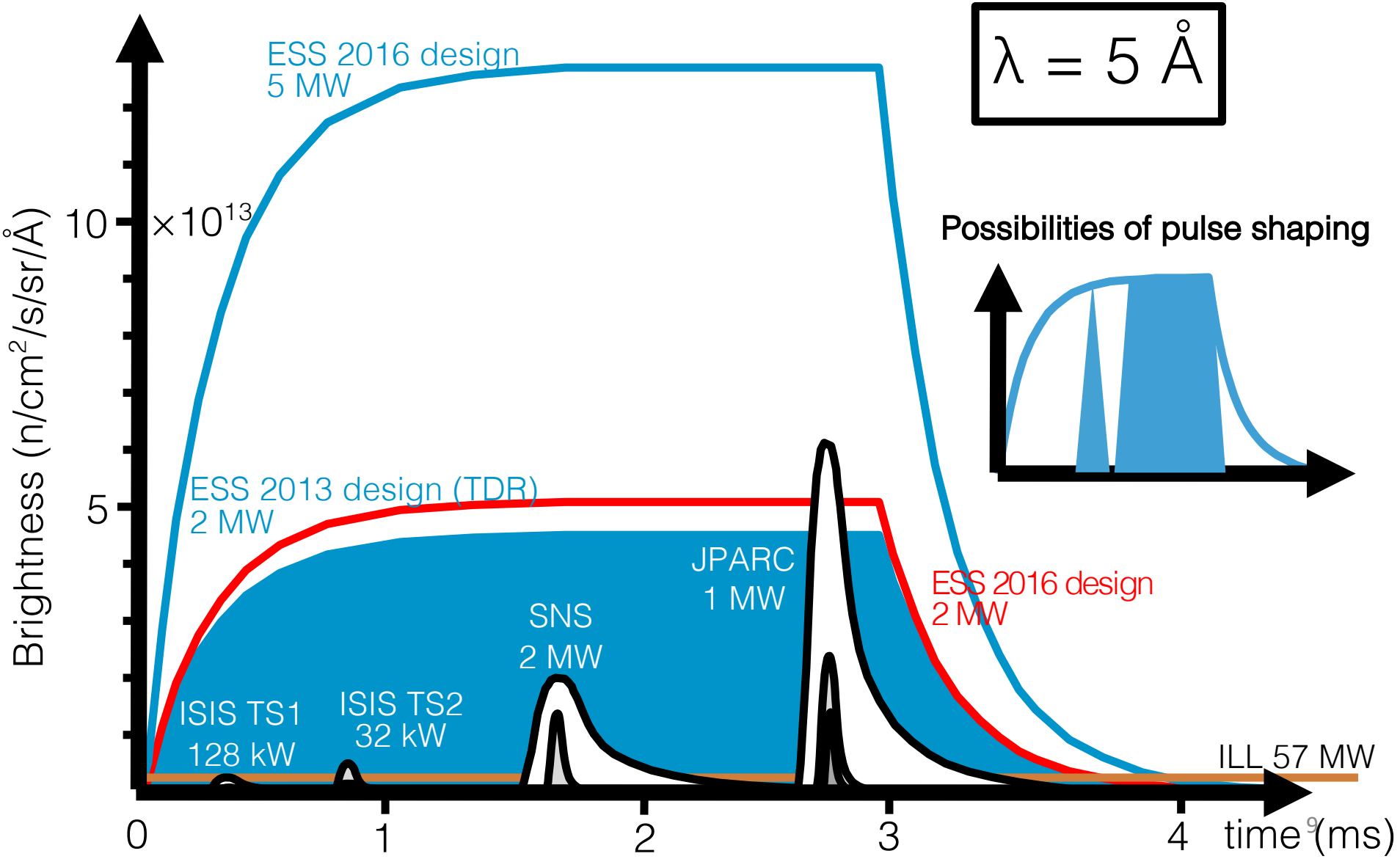



https://europeanspallationsource.se/site-weekly-updates

# Long-pulse performance



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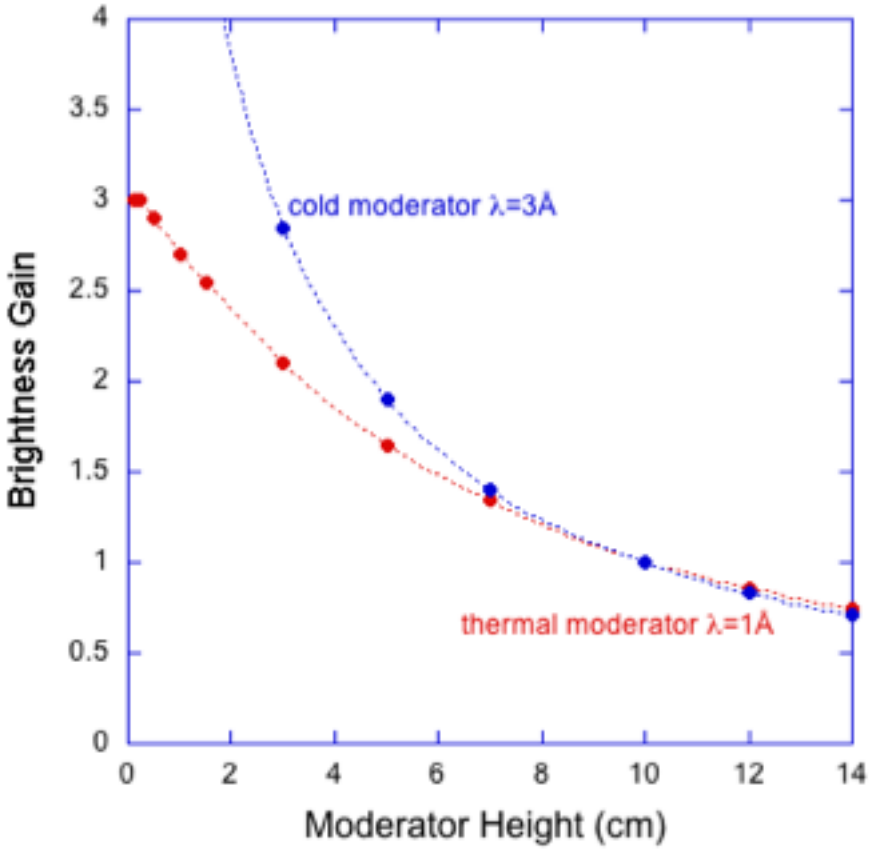
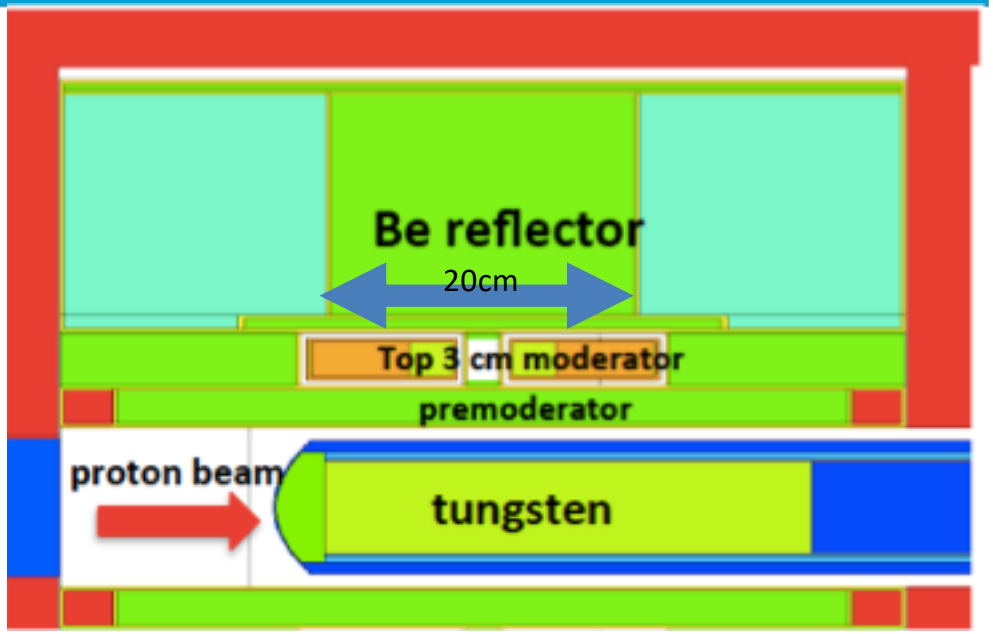
Above target:
3cm tall butterfly moderator assembly



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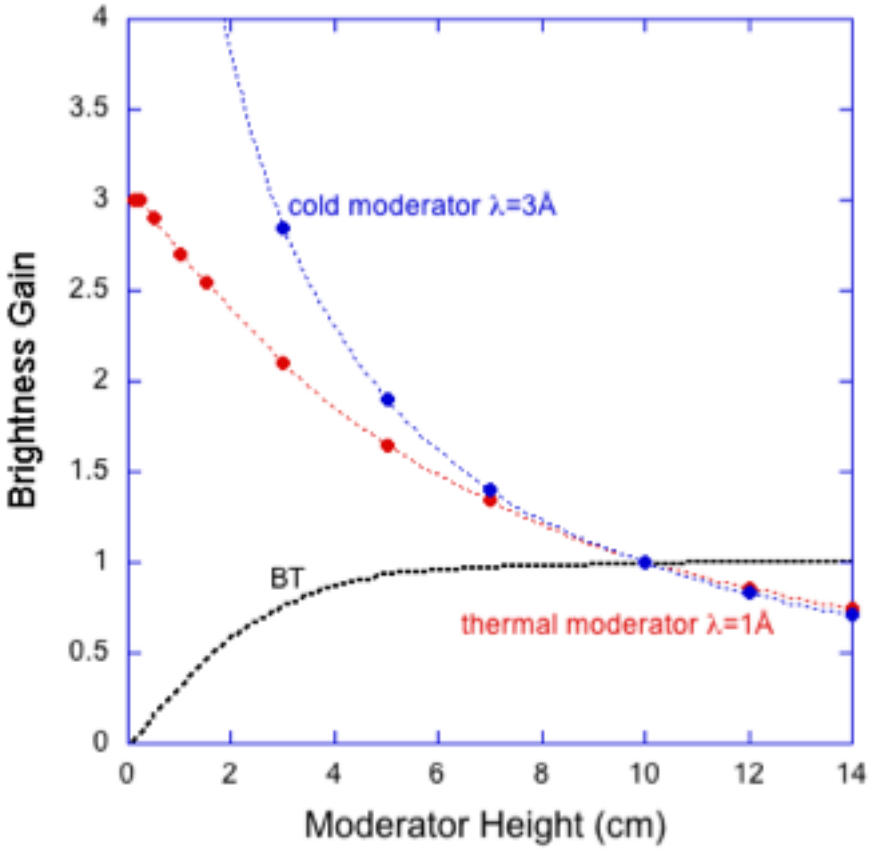


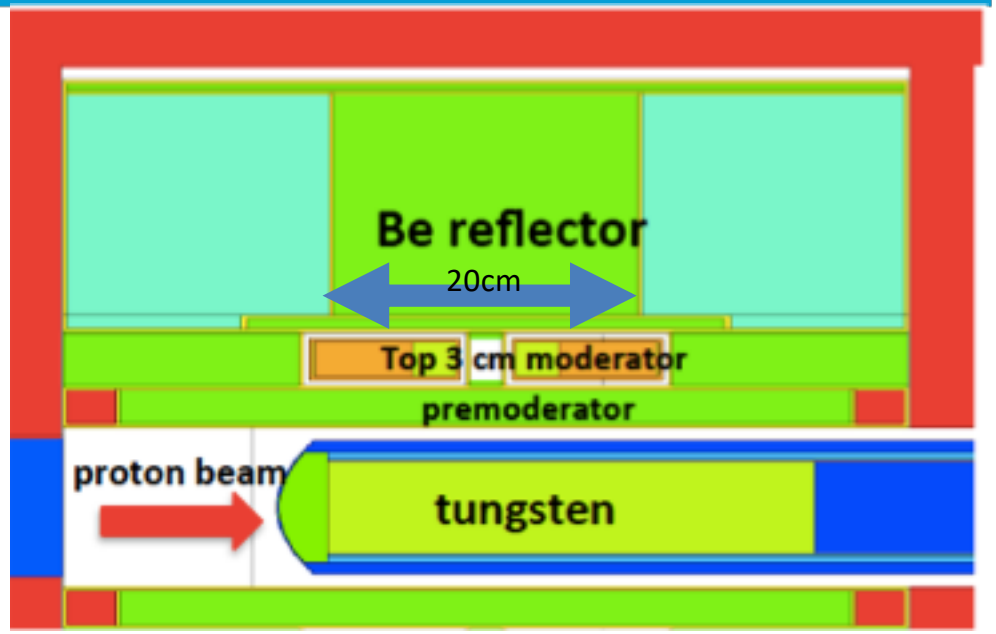


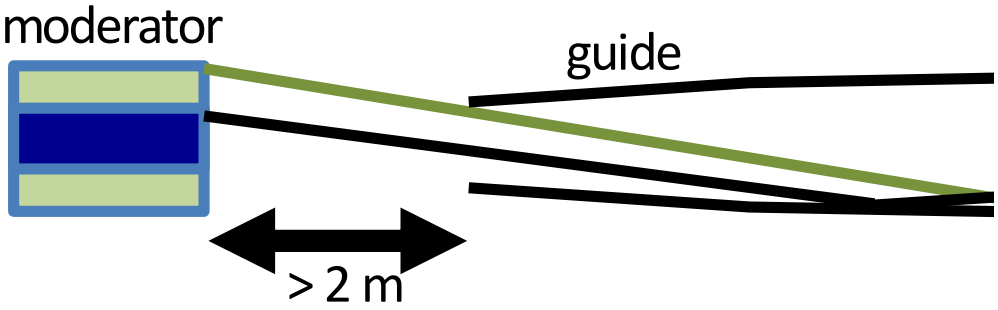

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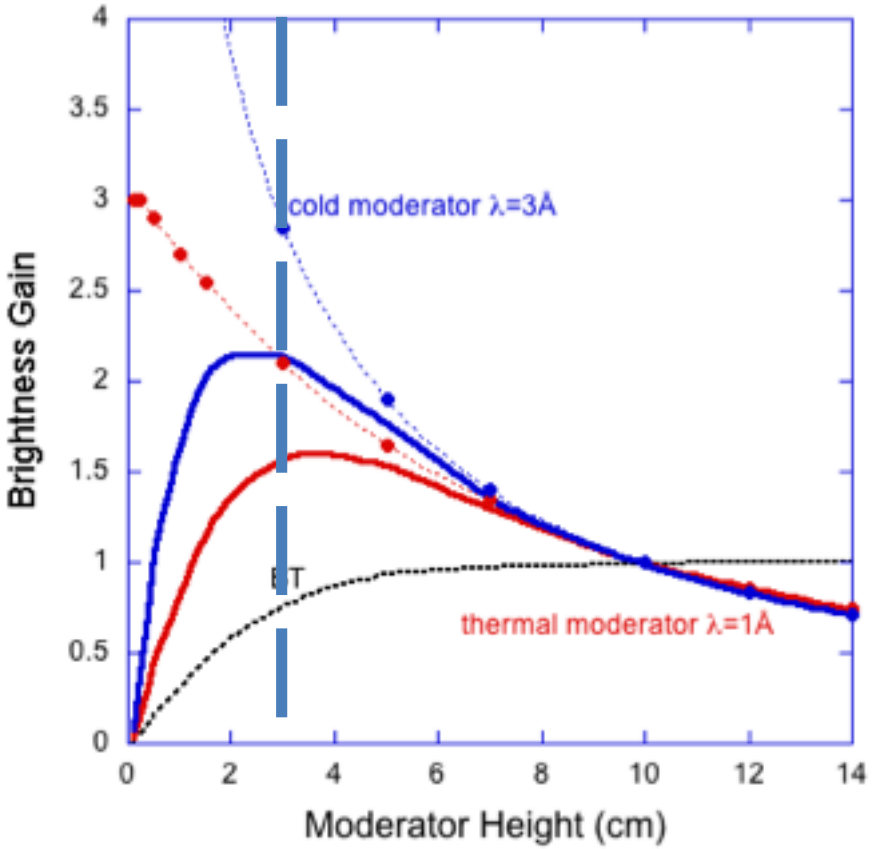


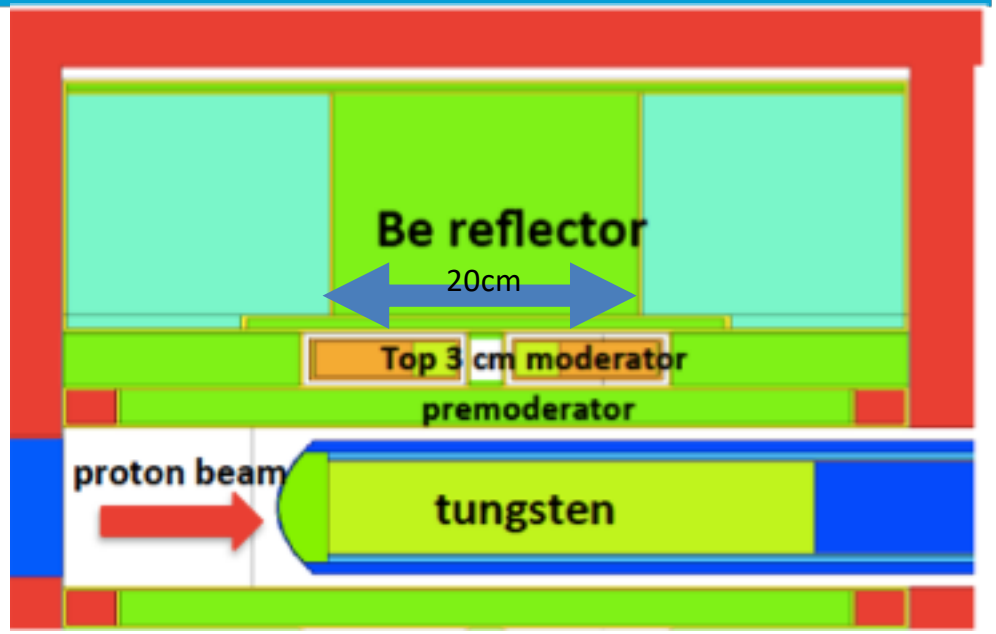


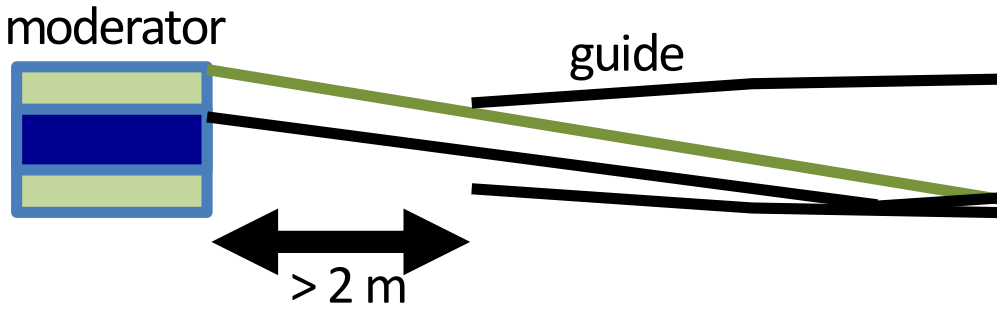

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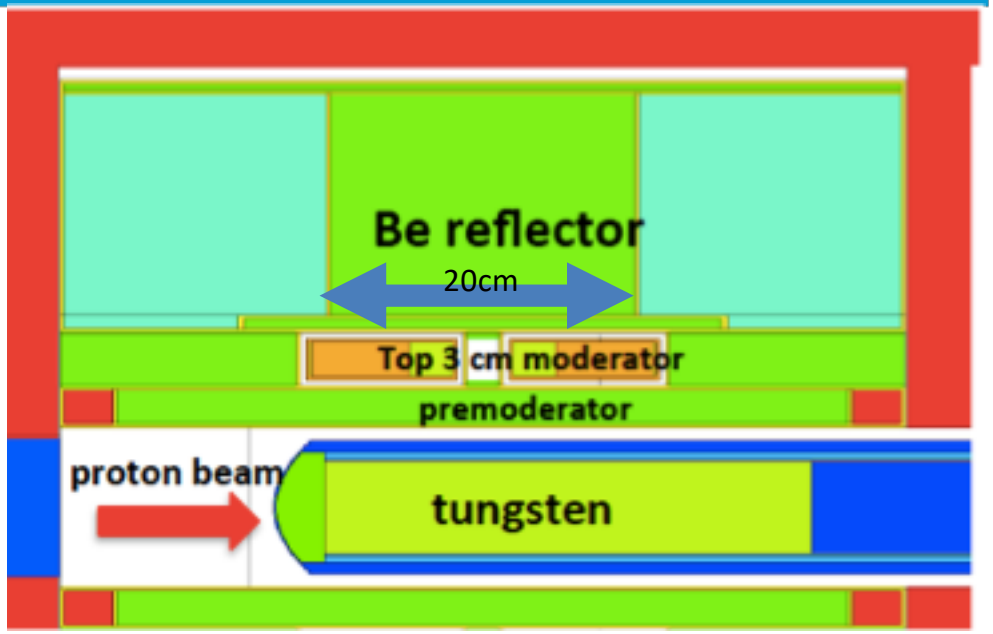
3cm tall butterfly moderator assembly

Below target:
space for future upgrade



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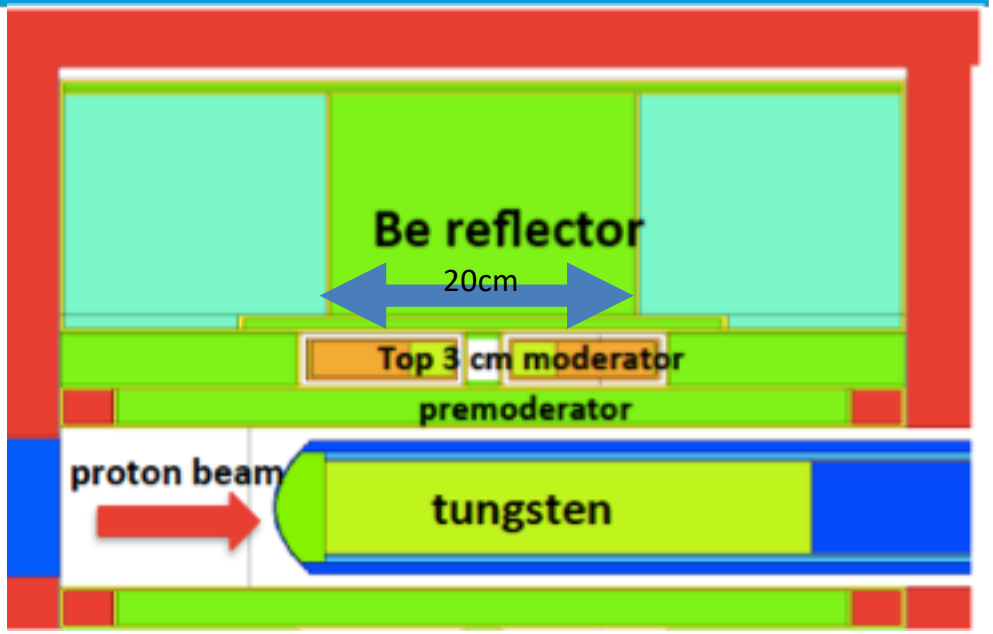
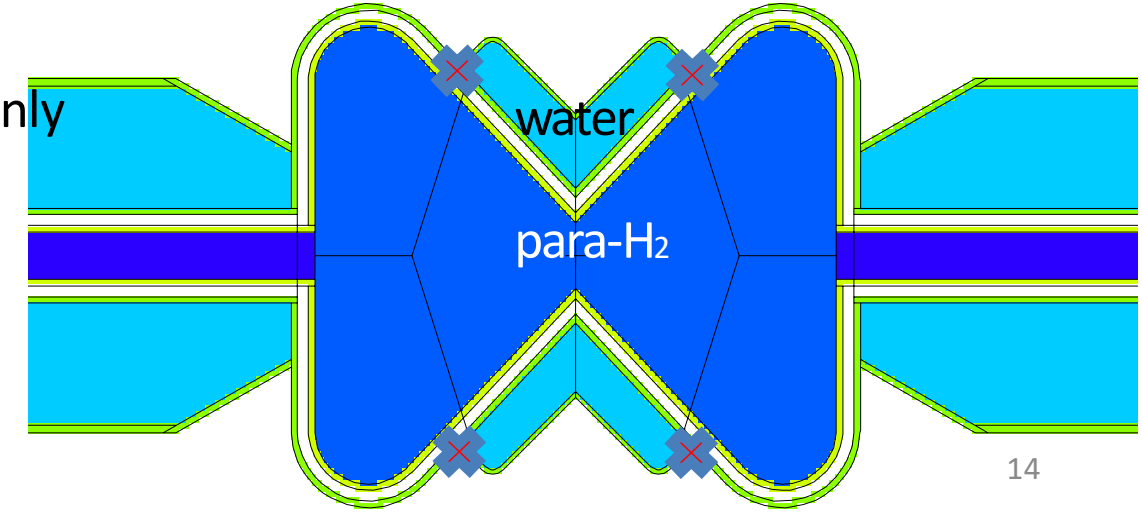



- Fully coupled moderators
  - No compromise
  - Time structure determined mainly by proton pulse length
- Hydrogen for cold spectrum
- Water for thermal spectrum
- All beamports can view both



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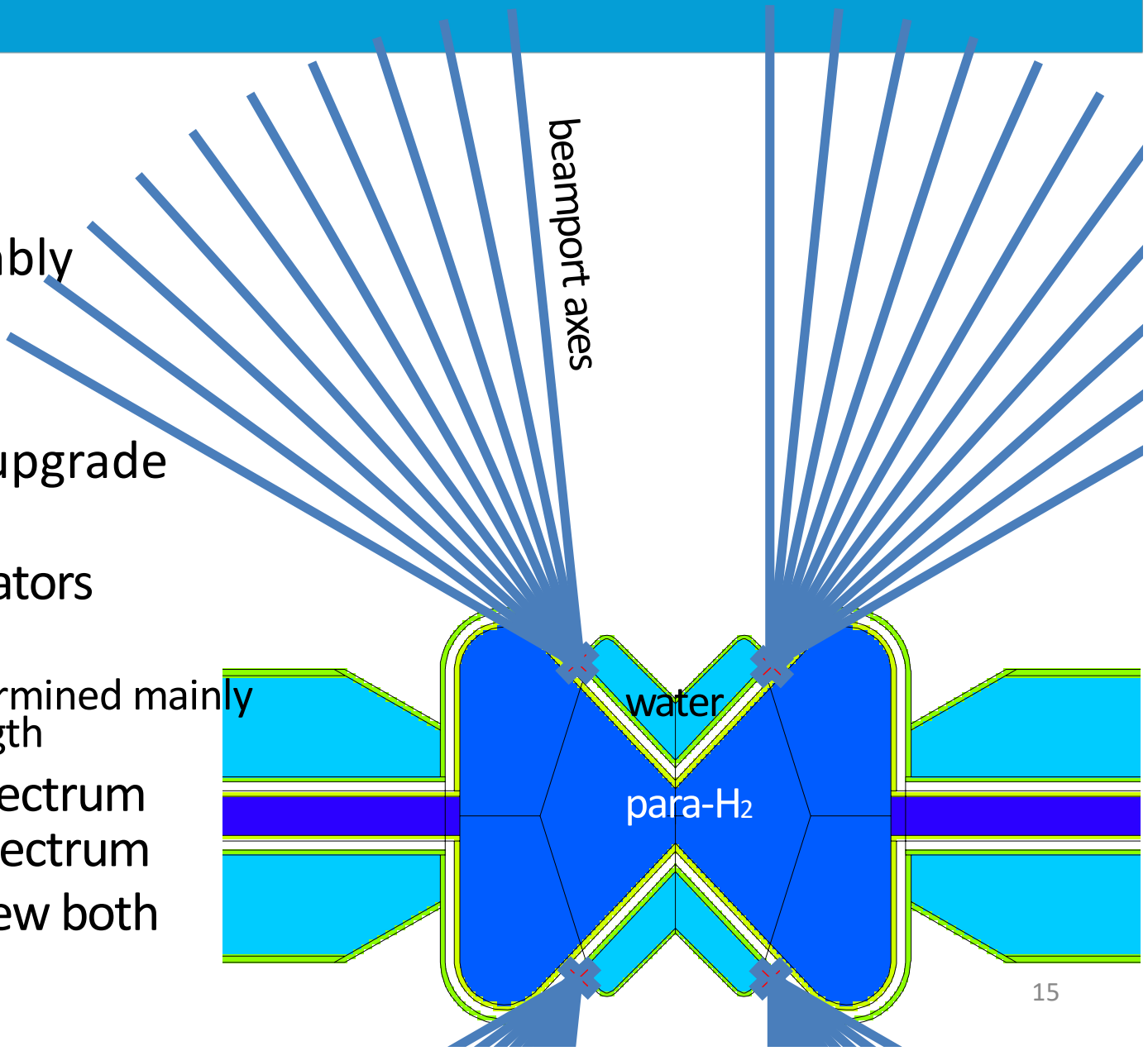

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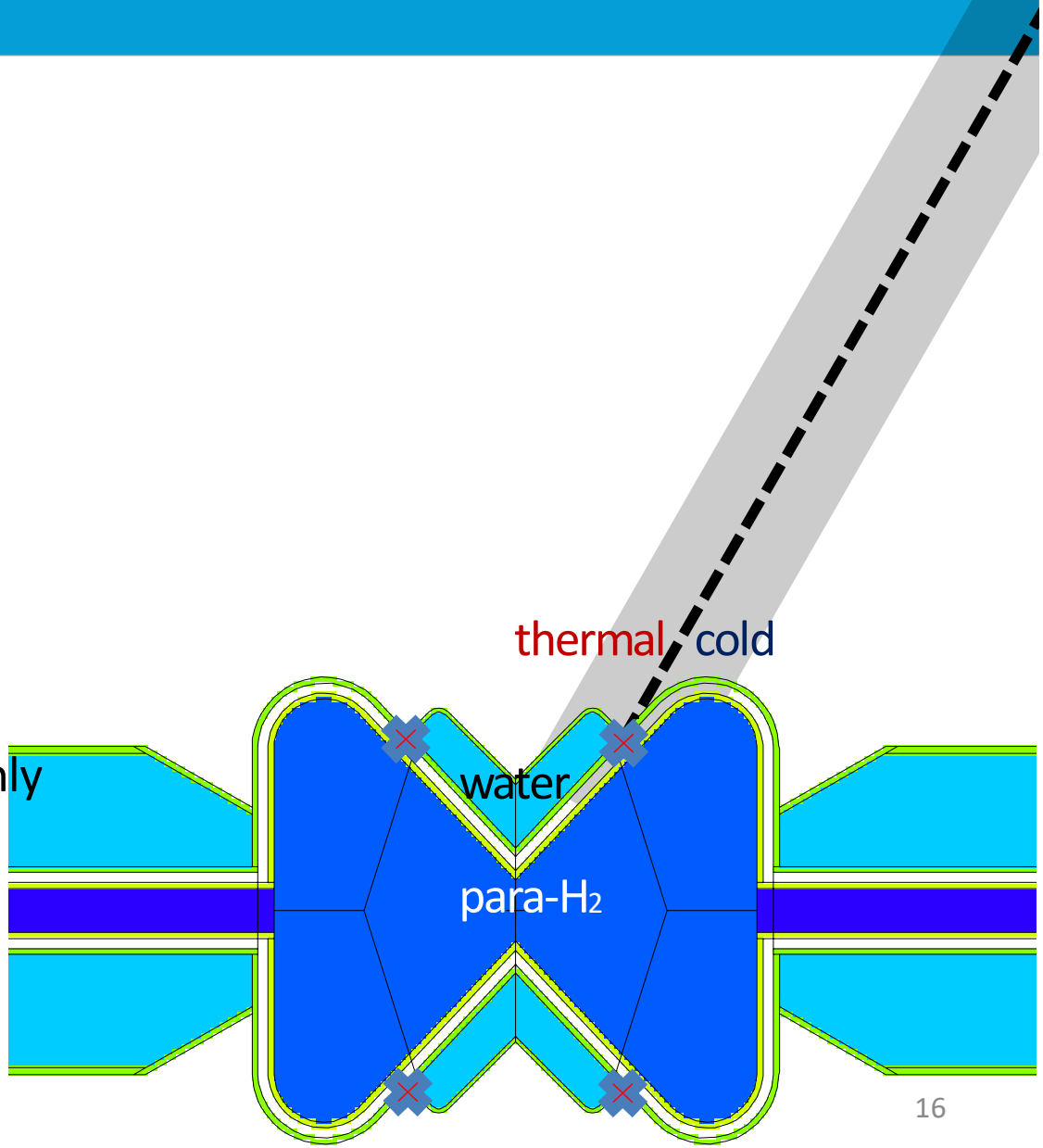

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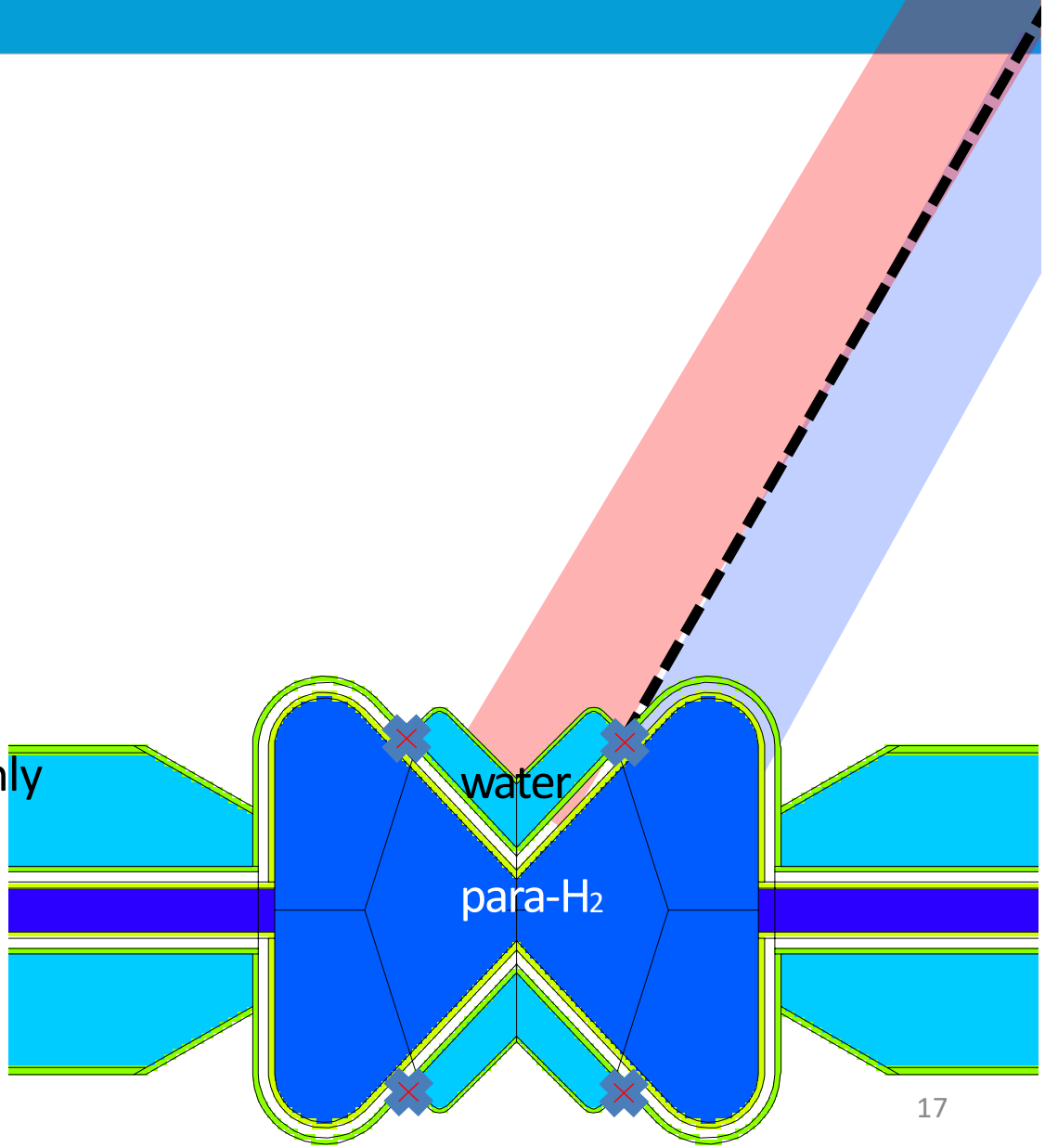

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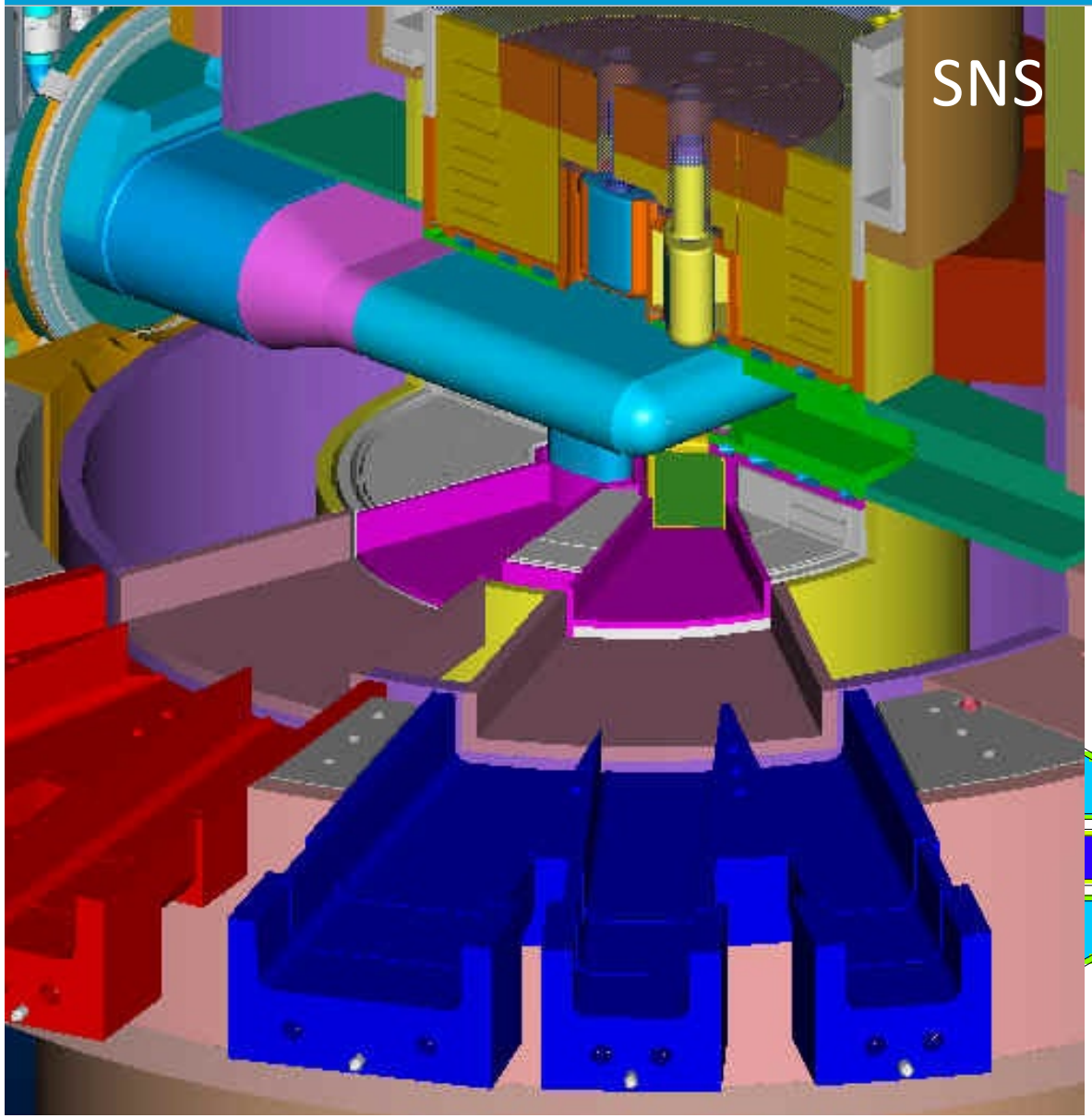
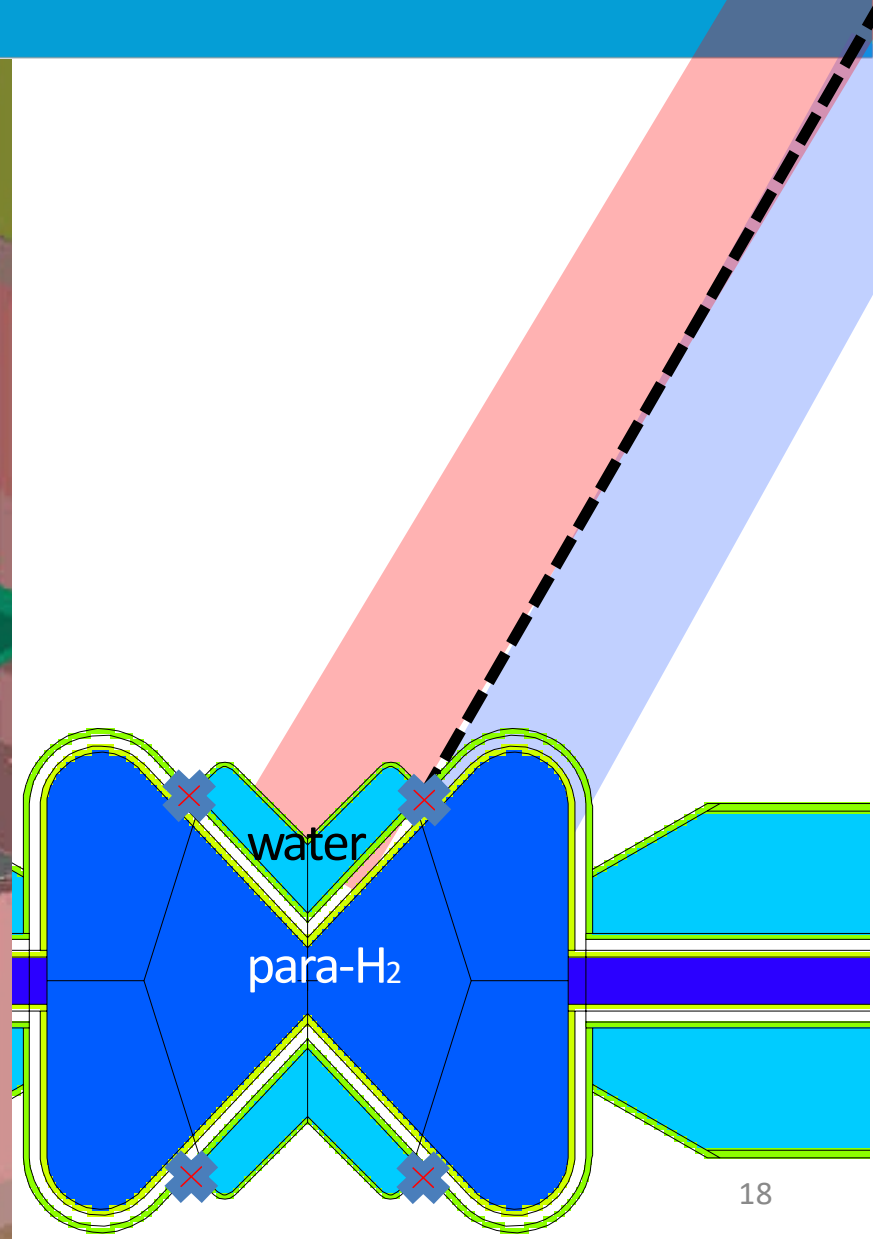
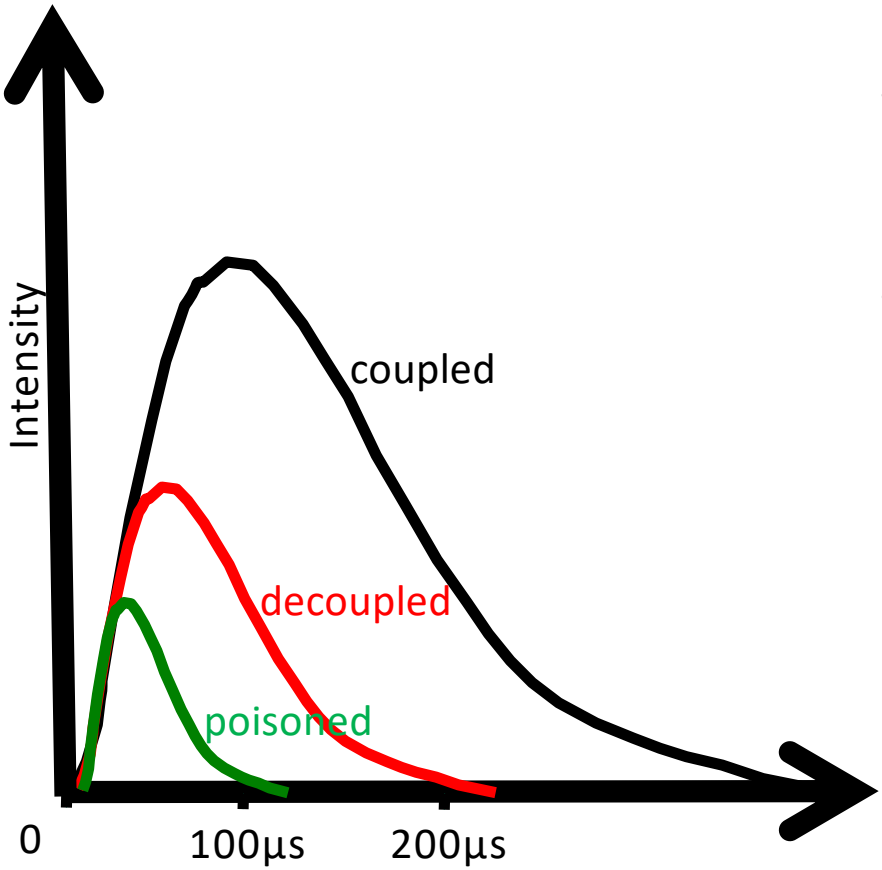


# Adapting the pulse width

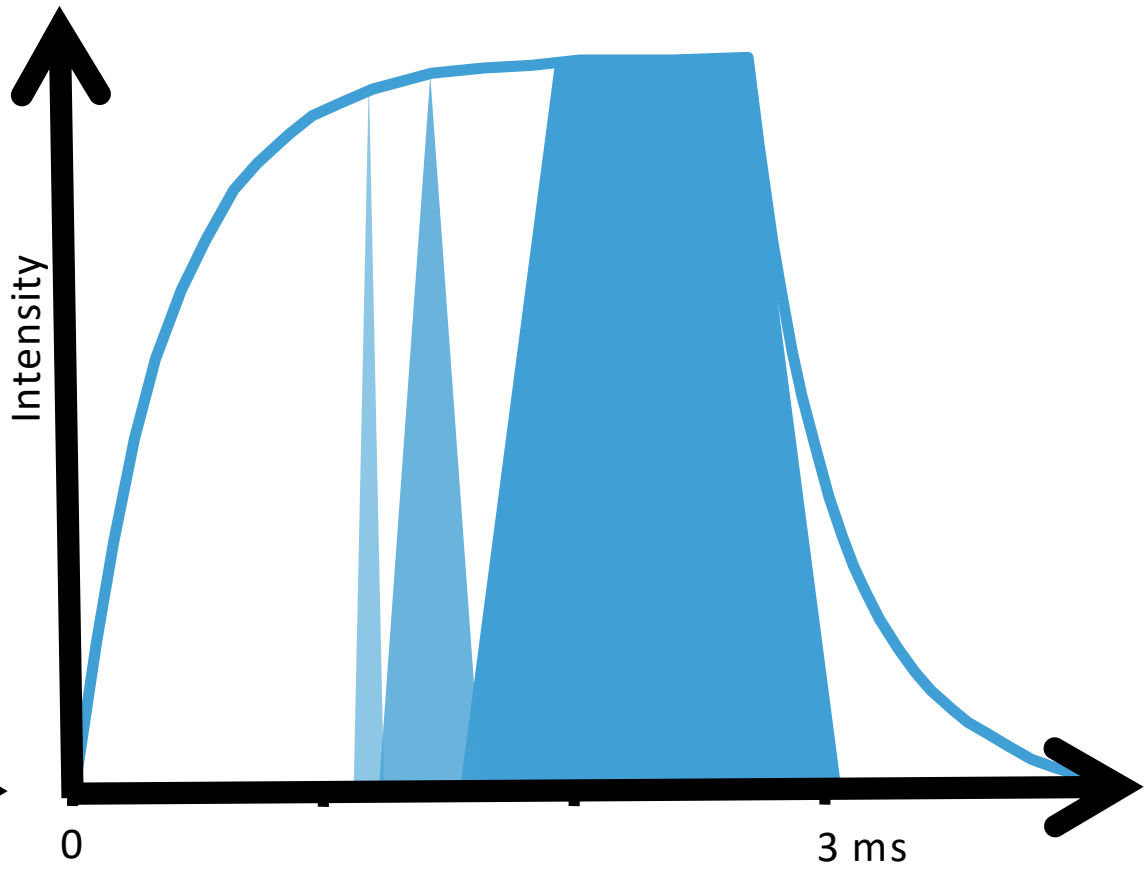
## Short-Pulse Source

- set pulse width by choosing moderator

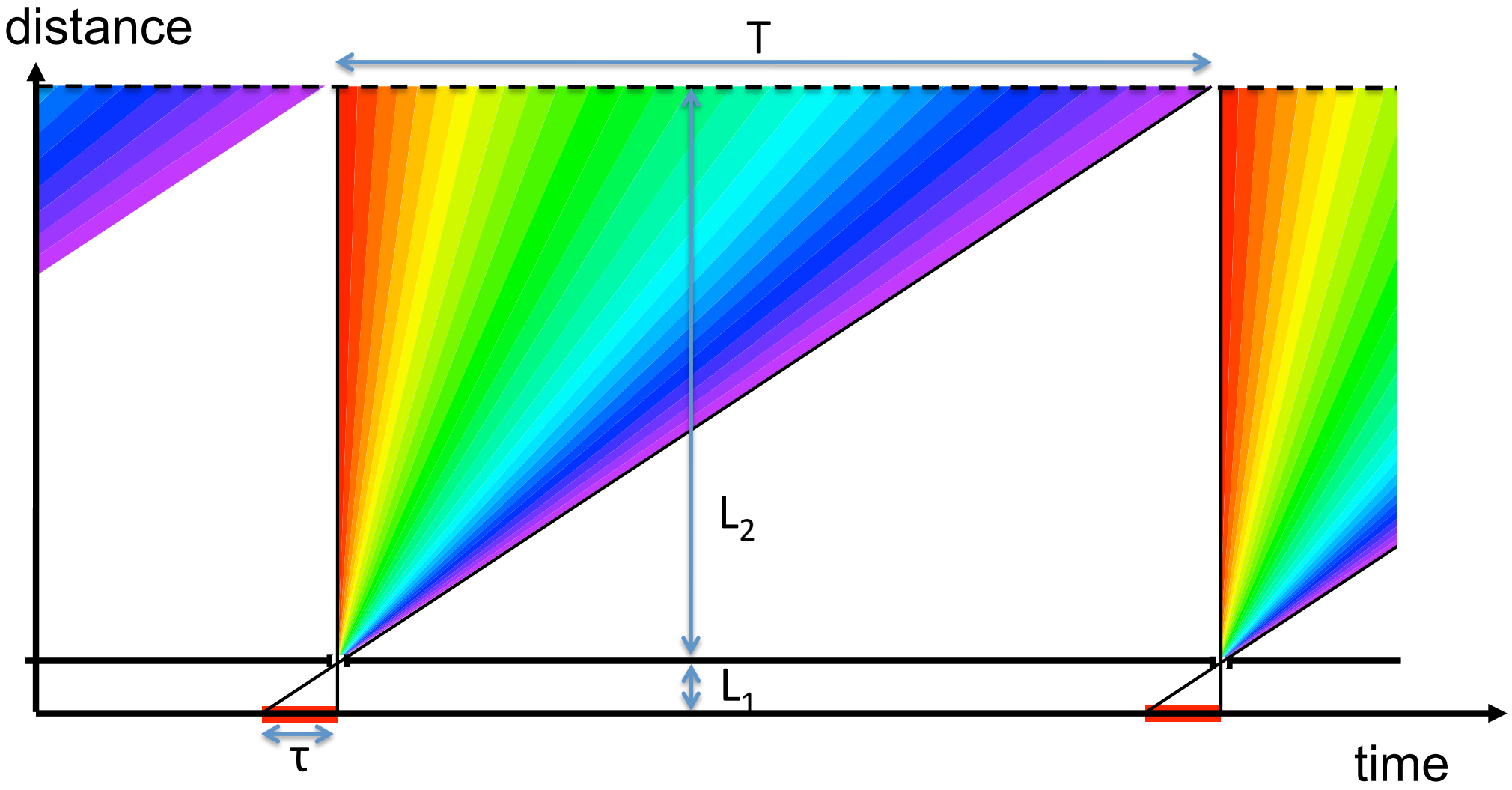



## ESS

- set pulse width using pulse-shaping chopper

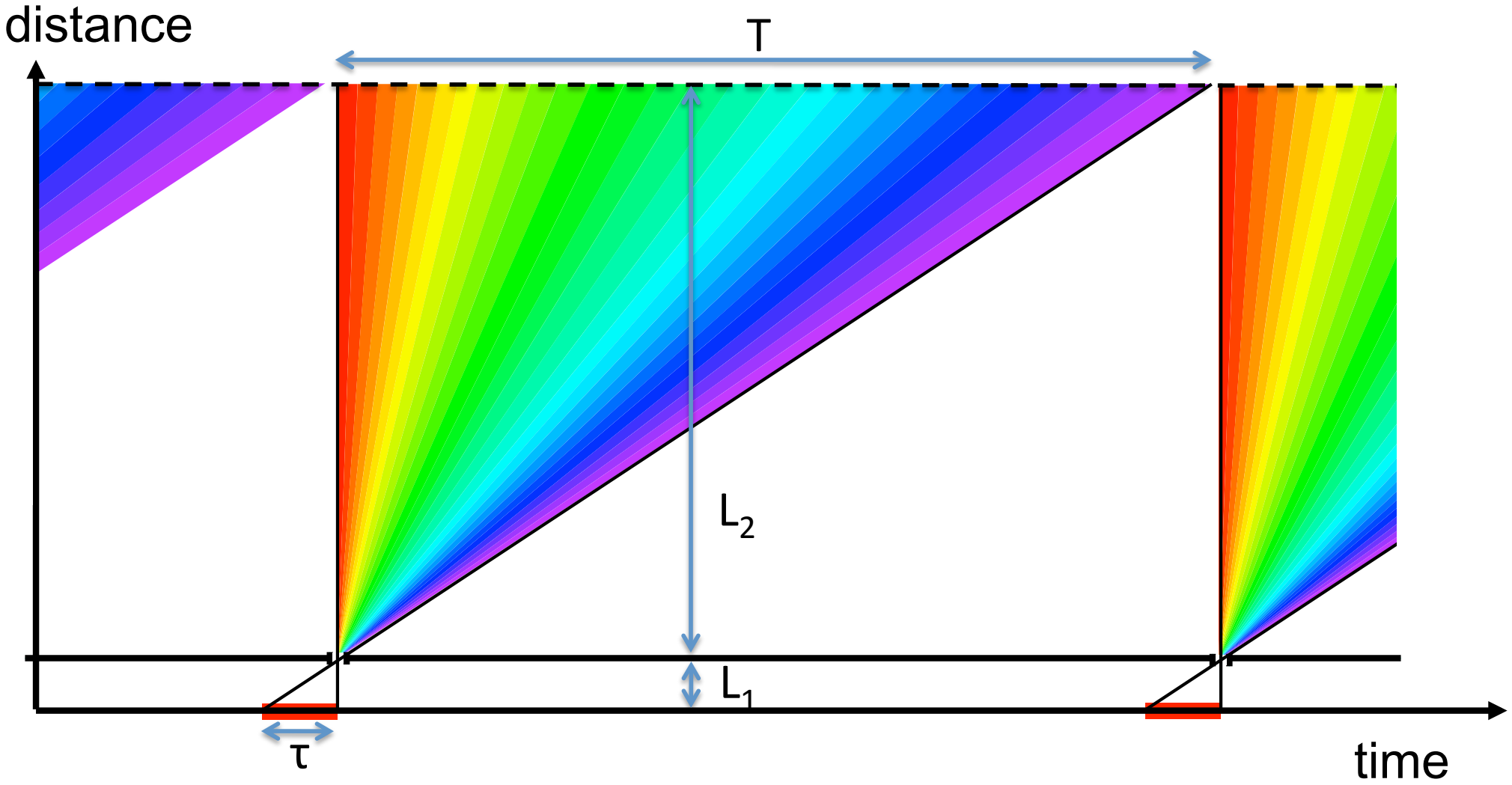


# Impact on bandwidth of pulse-shaping chopper



# Impact on bandwidth of pulse-shaping chopper

$T/\tau = 25 \Longrightarrow L_2/L_1 = 25$



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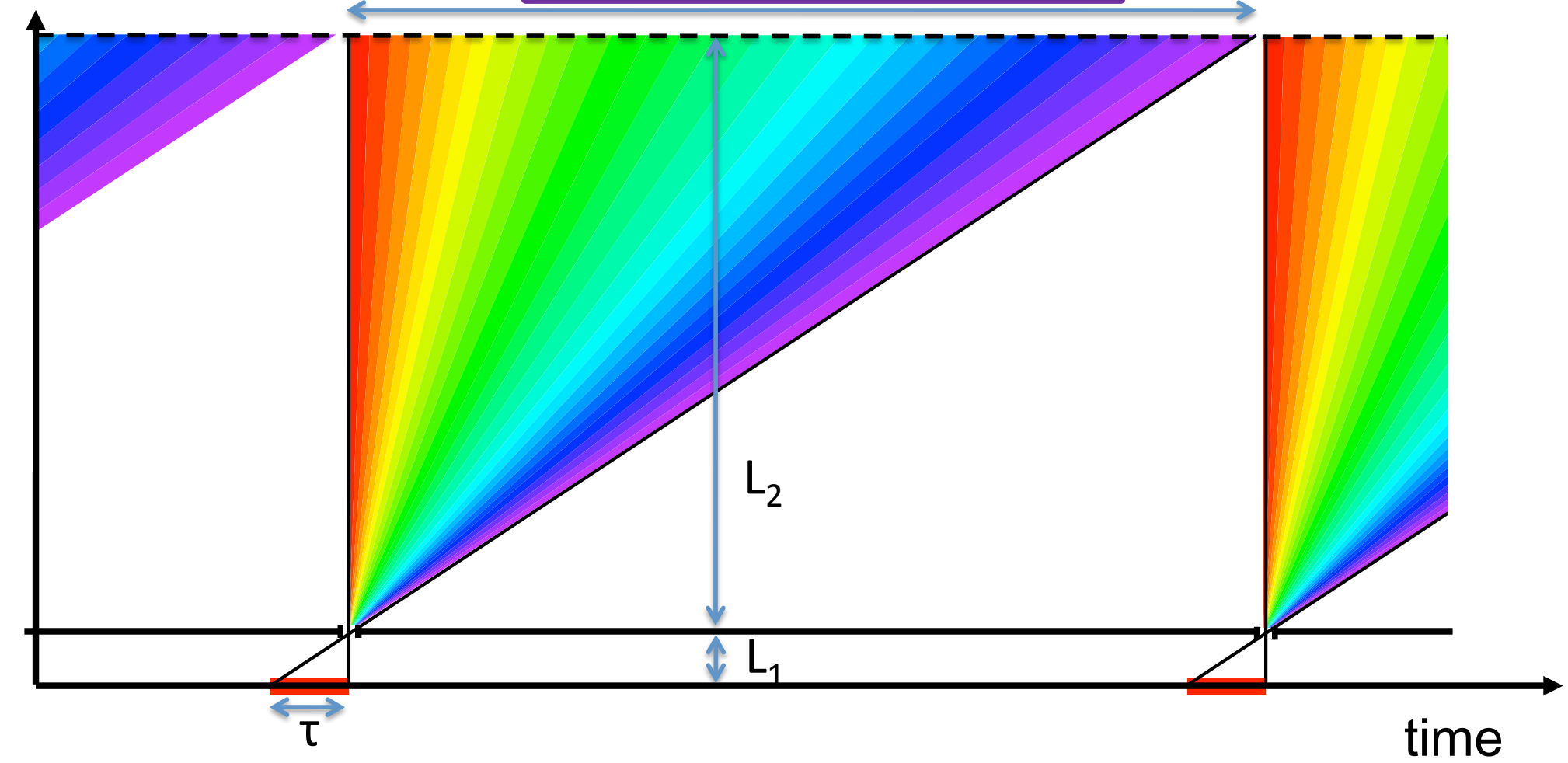
$L_1 = 6.3\ \text{m} \Longrightarrow L_2 = 157.5\ \text{m}$



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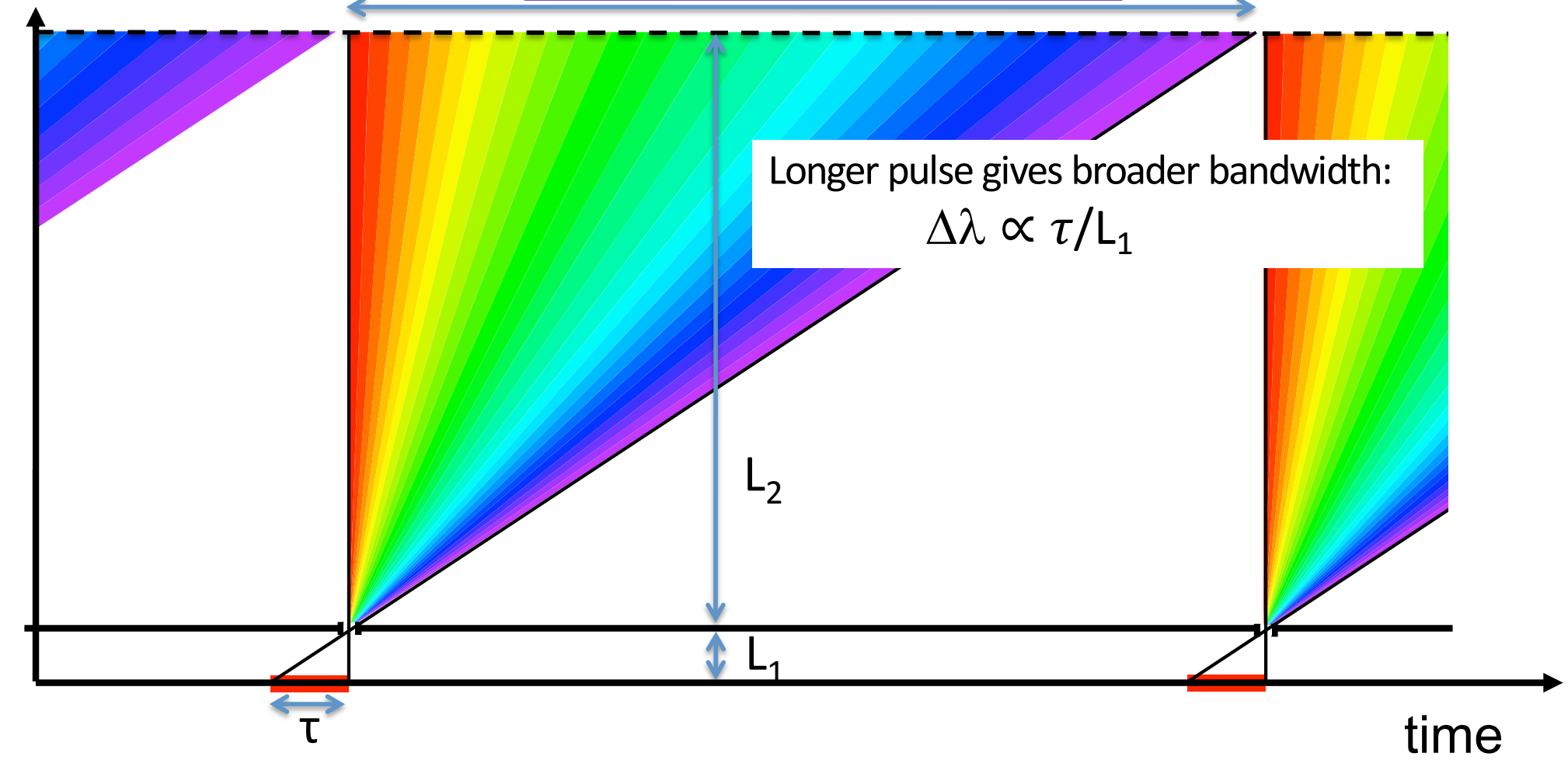
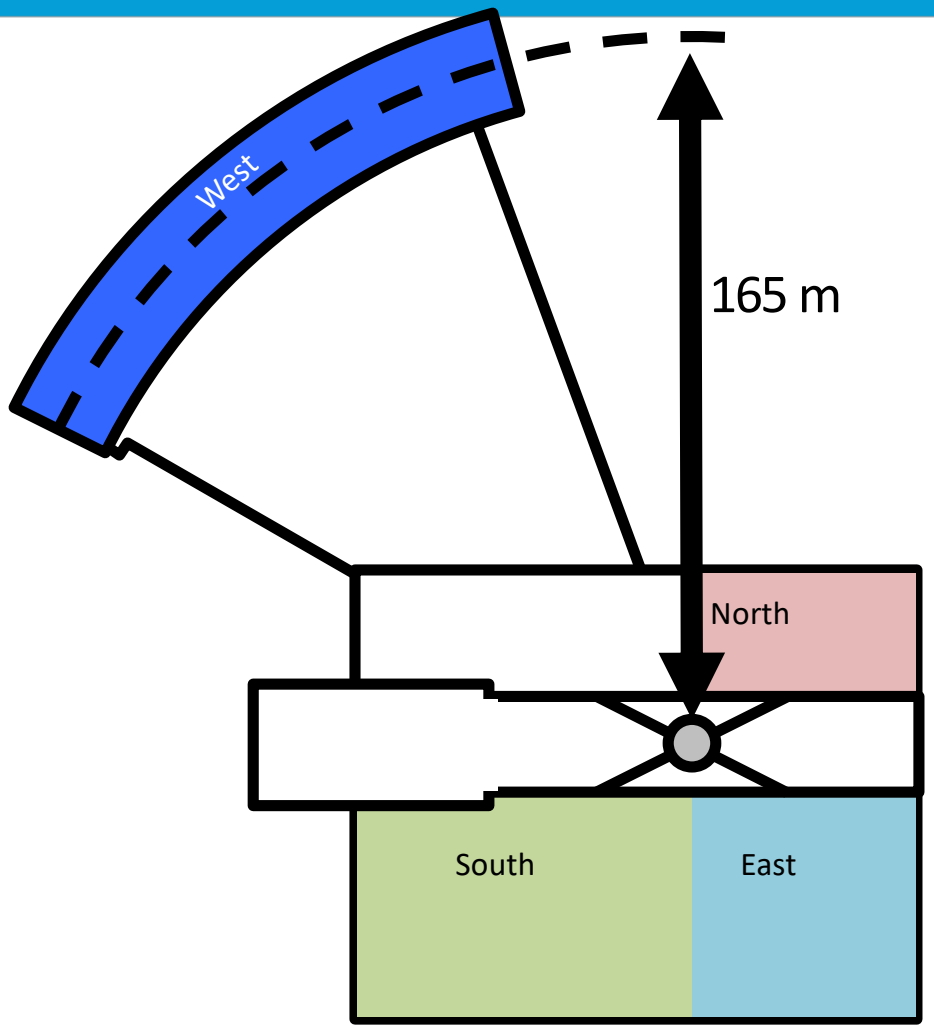
$\Longrightarrow \Delta\lambda = 1.8\ \text{Å}$



# Hall Layout



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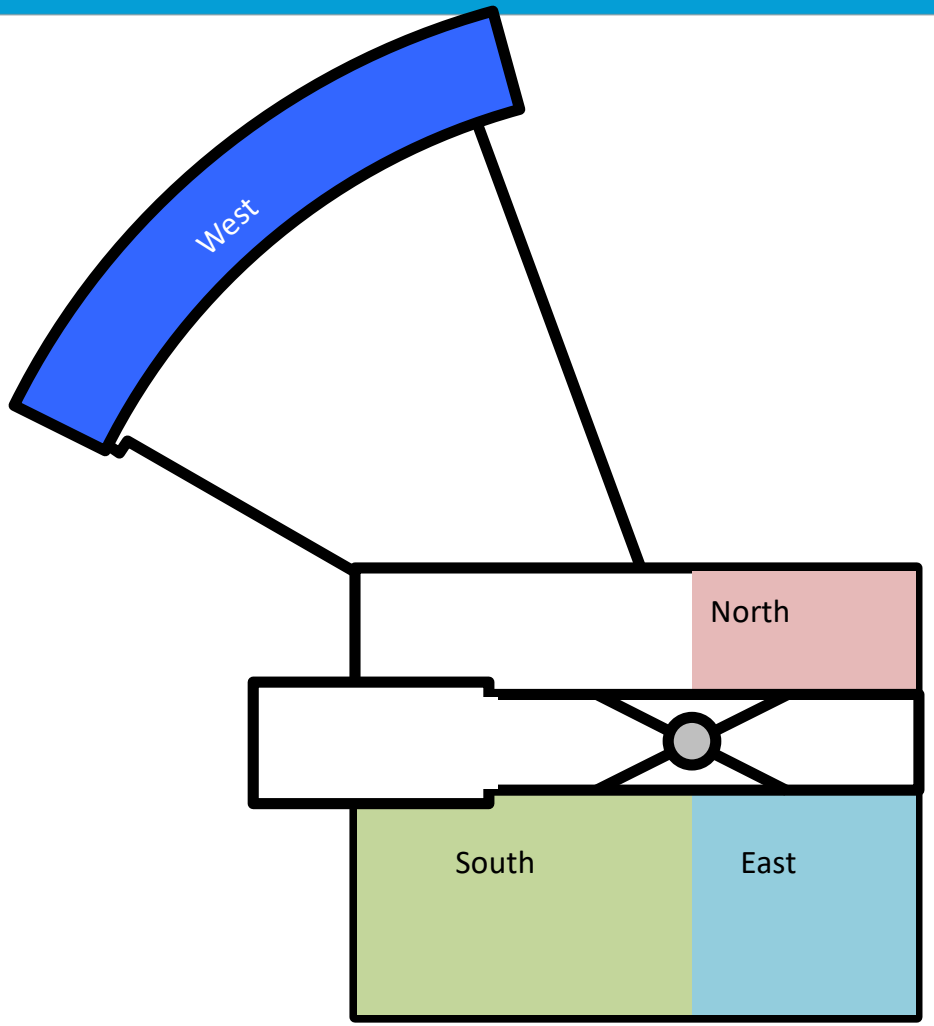
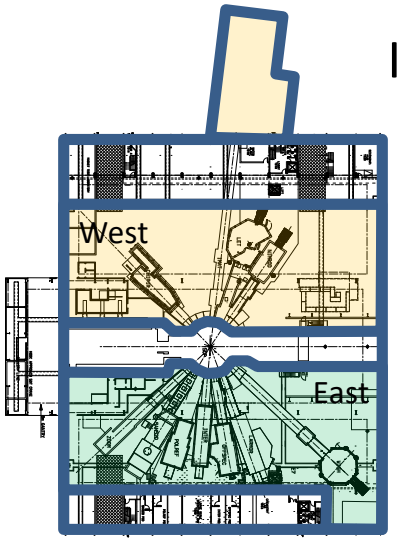
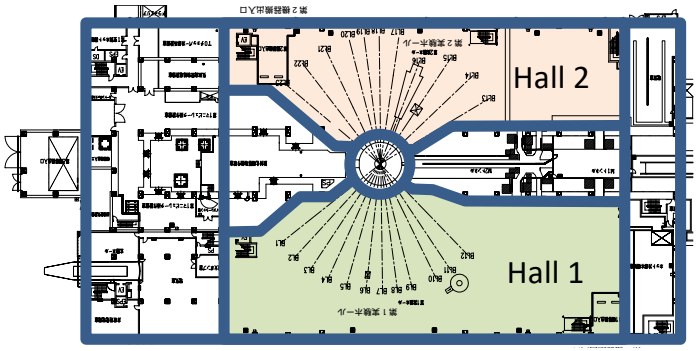



ESS




ISIS-TS2

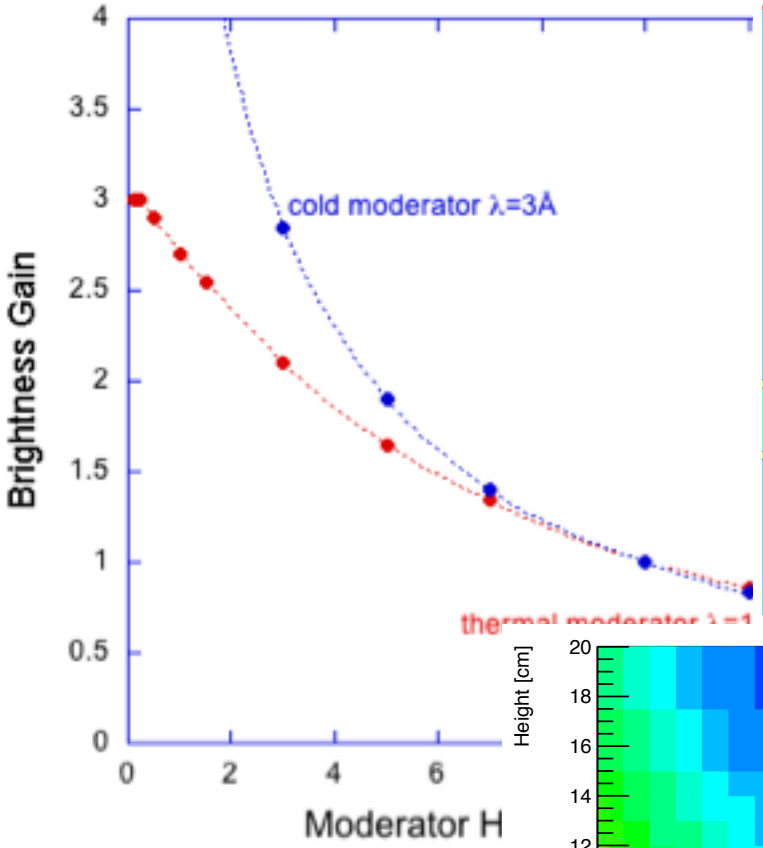


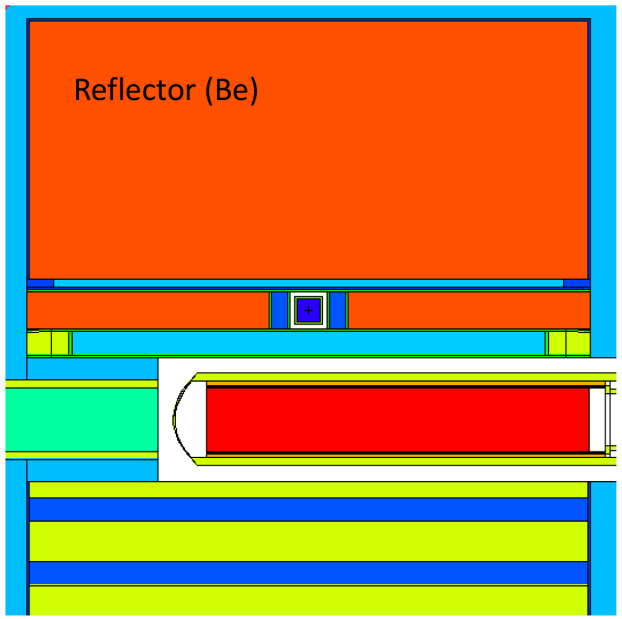

J-PARC MLF

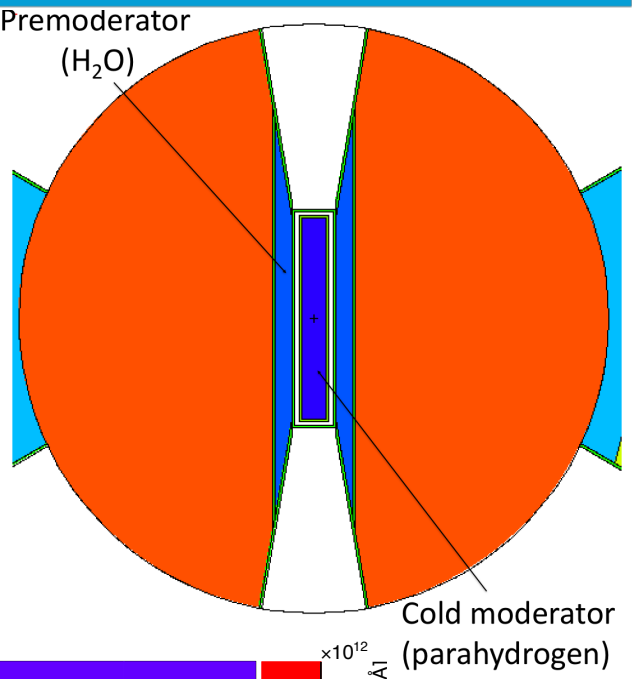
scale

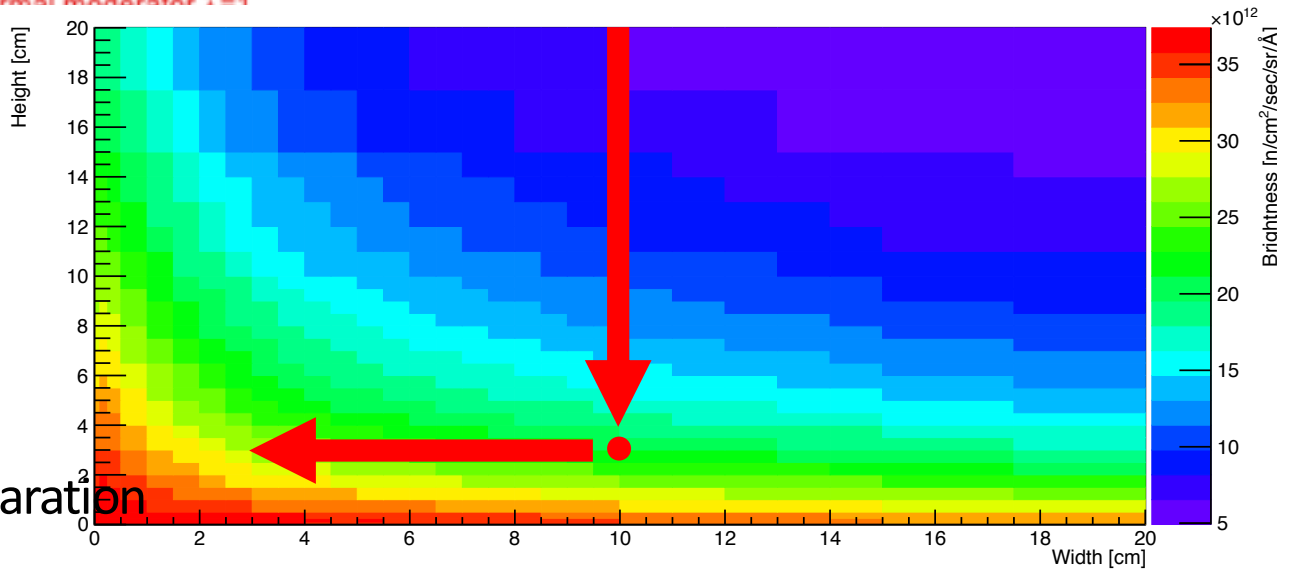
0 100 m 200 m 300 m 400 m

# Low-dimensional moderators



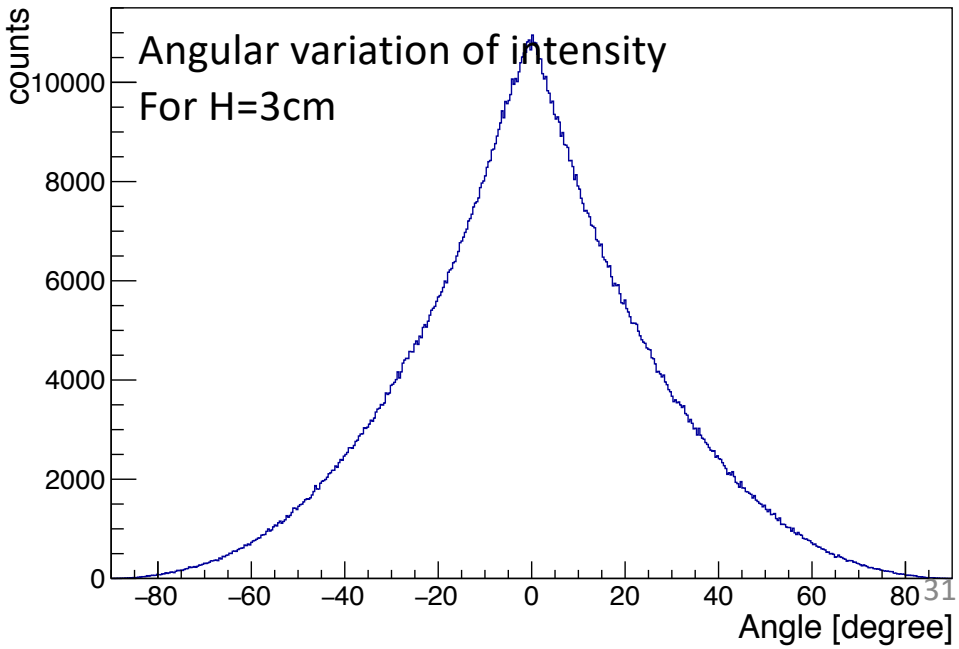




L. Zanini et al., in preparation

# Low-dimensional moderators

- 2-dimensional geometry
  - “pancake”, “butterfly”, “flat box”
  - Gain factor ~4 at H=2cm
- 1-dimensional geometry
  - “tube”, “rod”
  - Gain factor ~10 at HxW=2x2cm$^2$
- Non-isotropic emission



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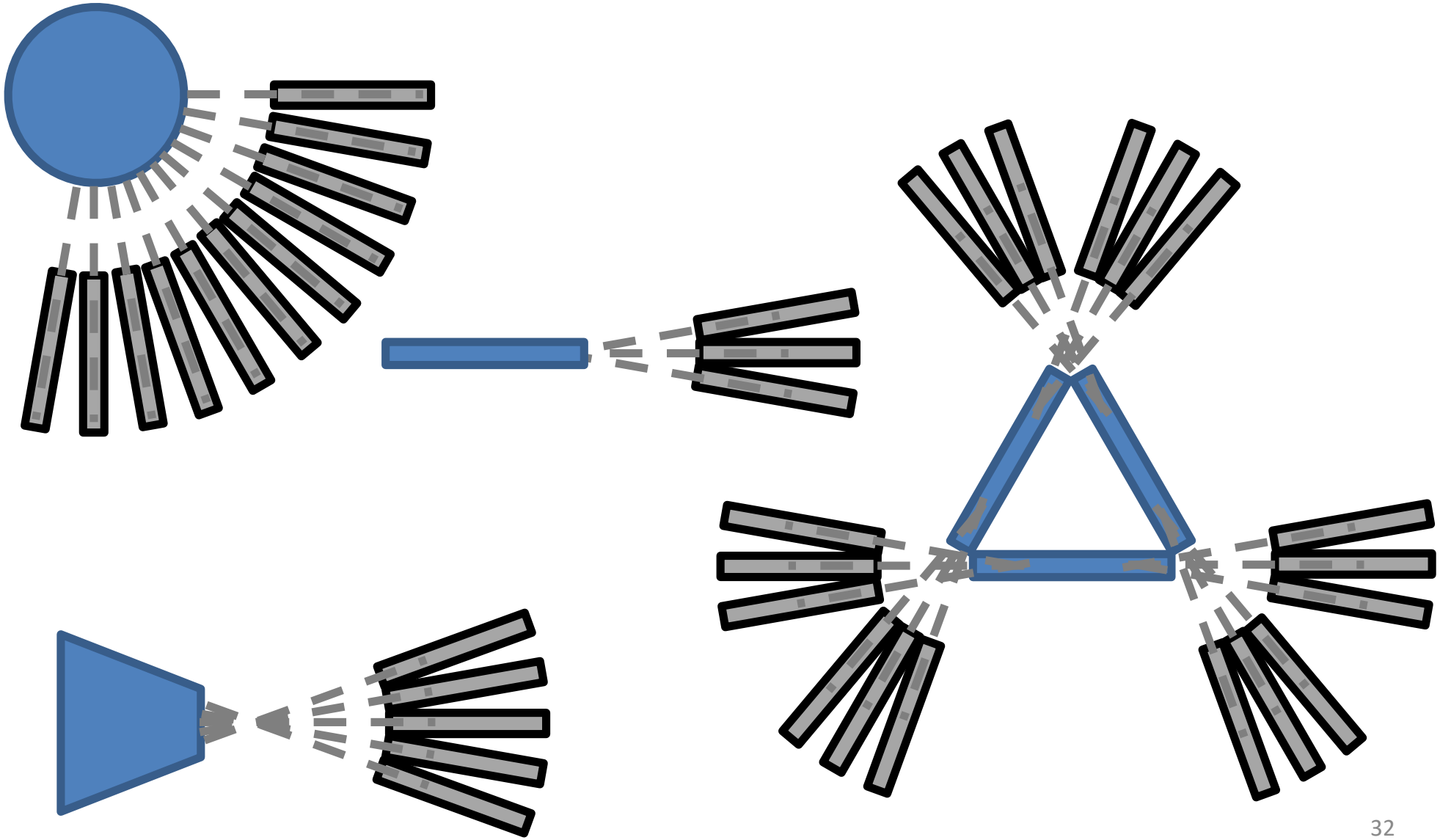
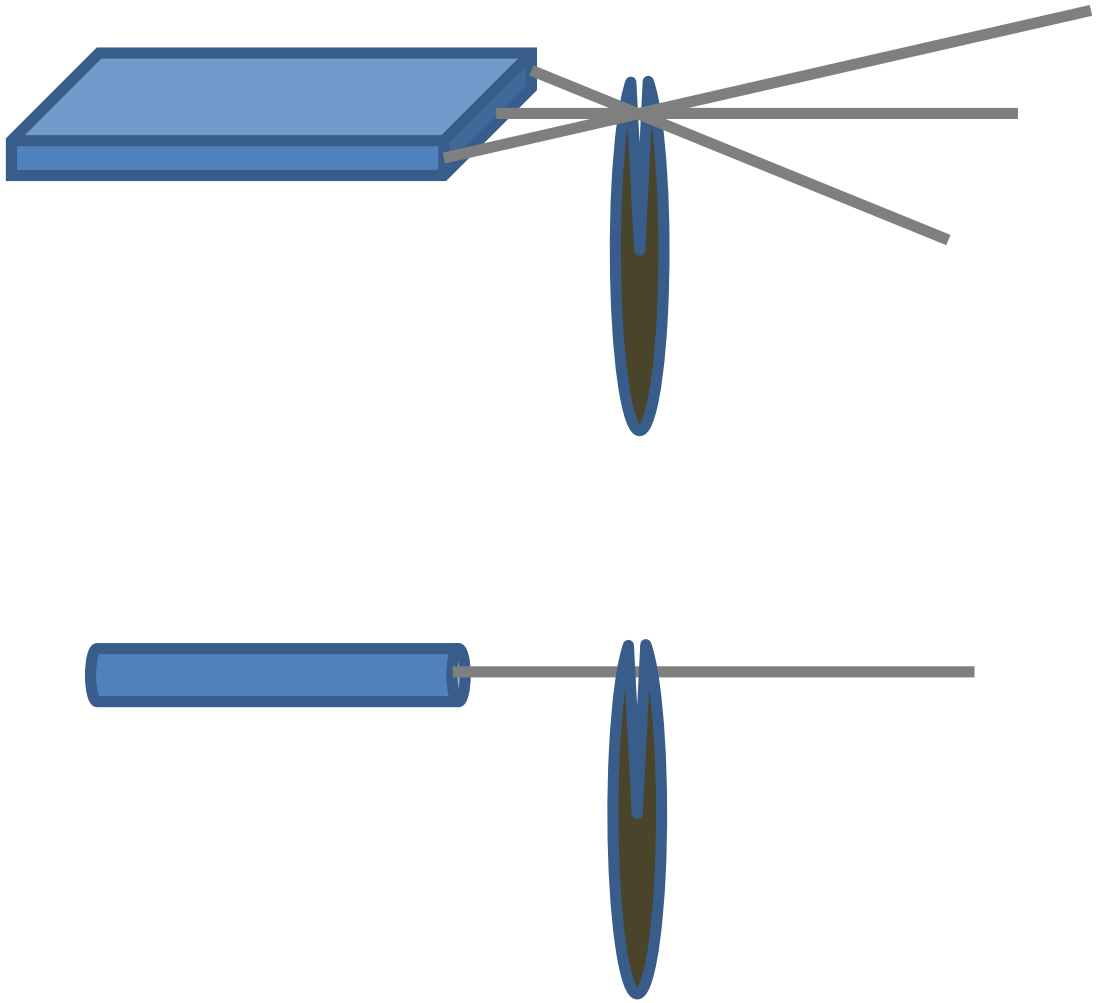
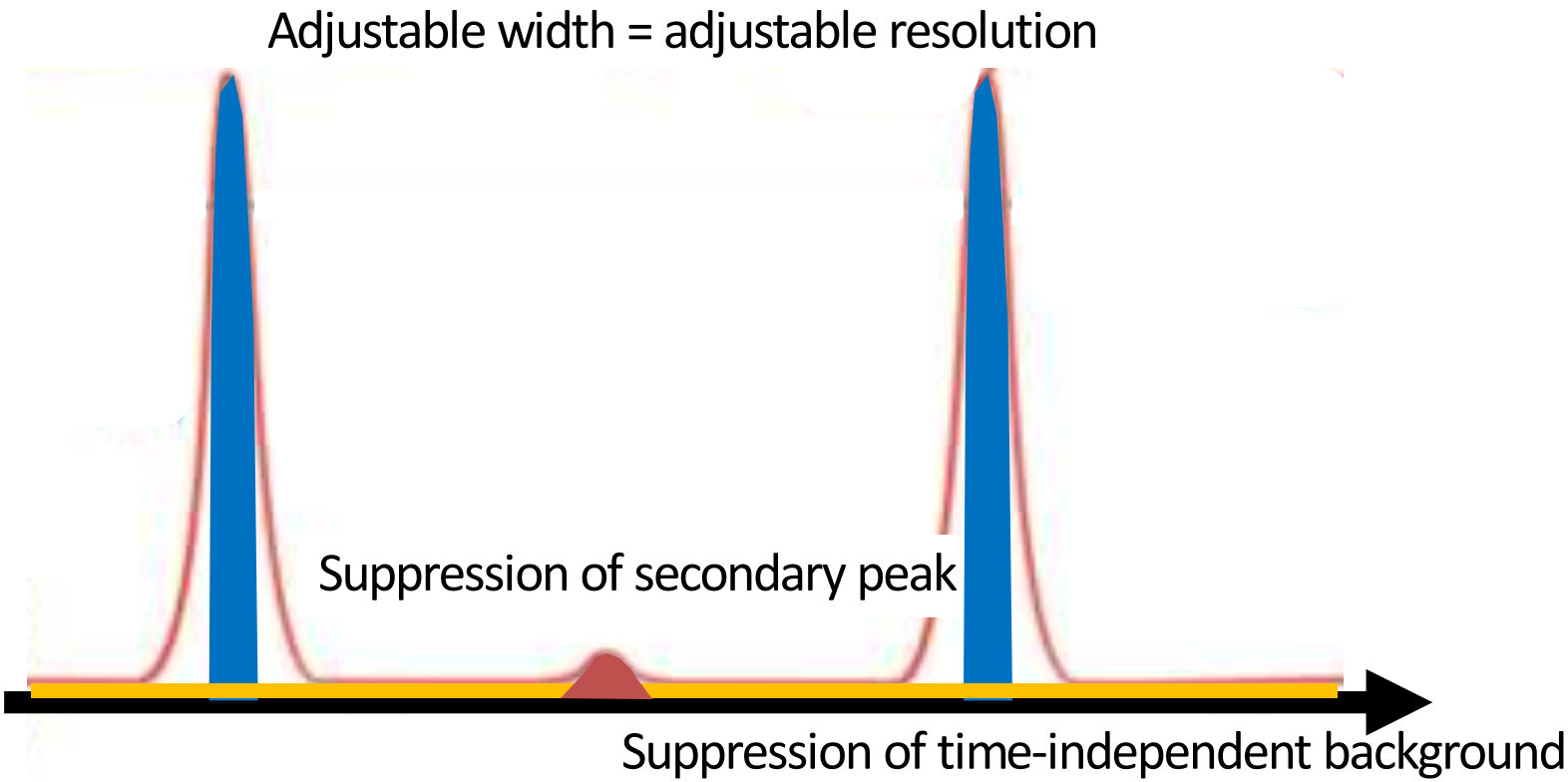


# Combination with pulse-shaping chopper



# Pulse-shaping chopper



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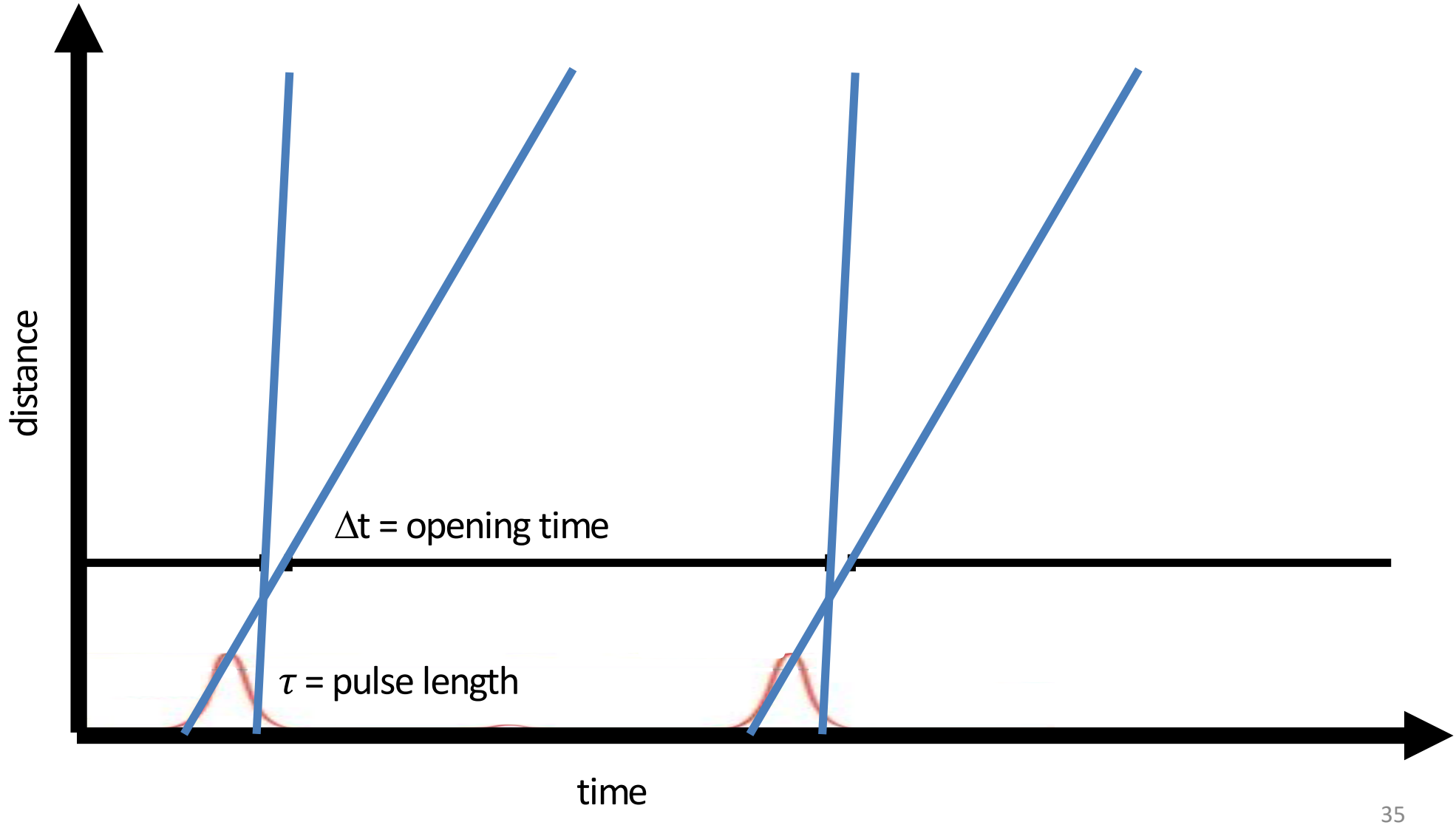

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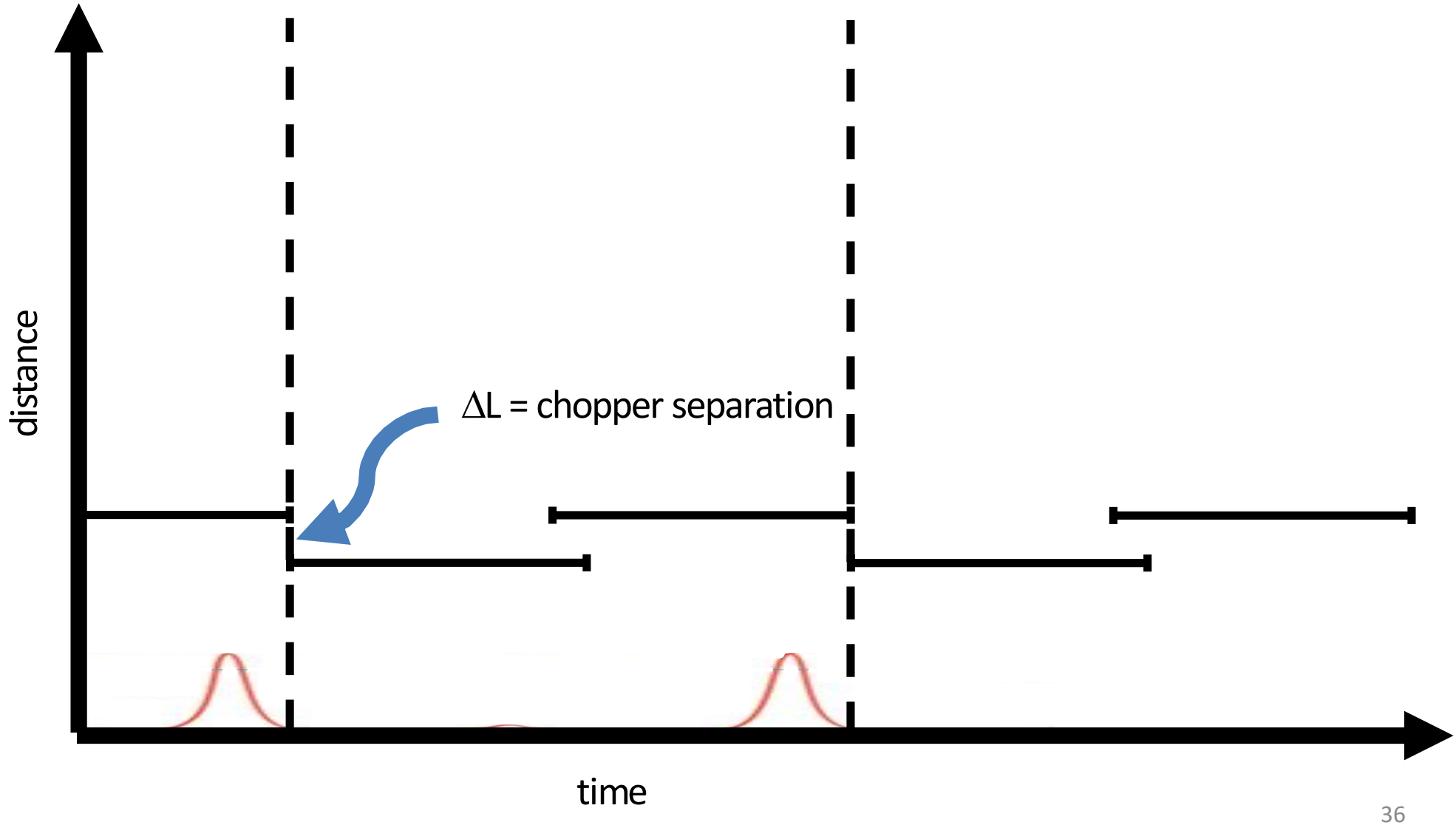

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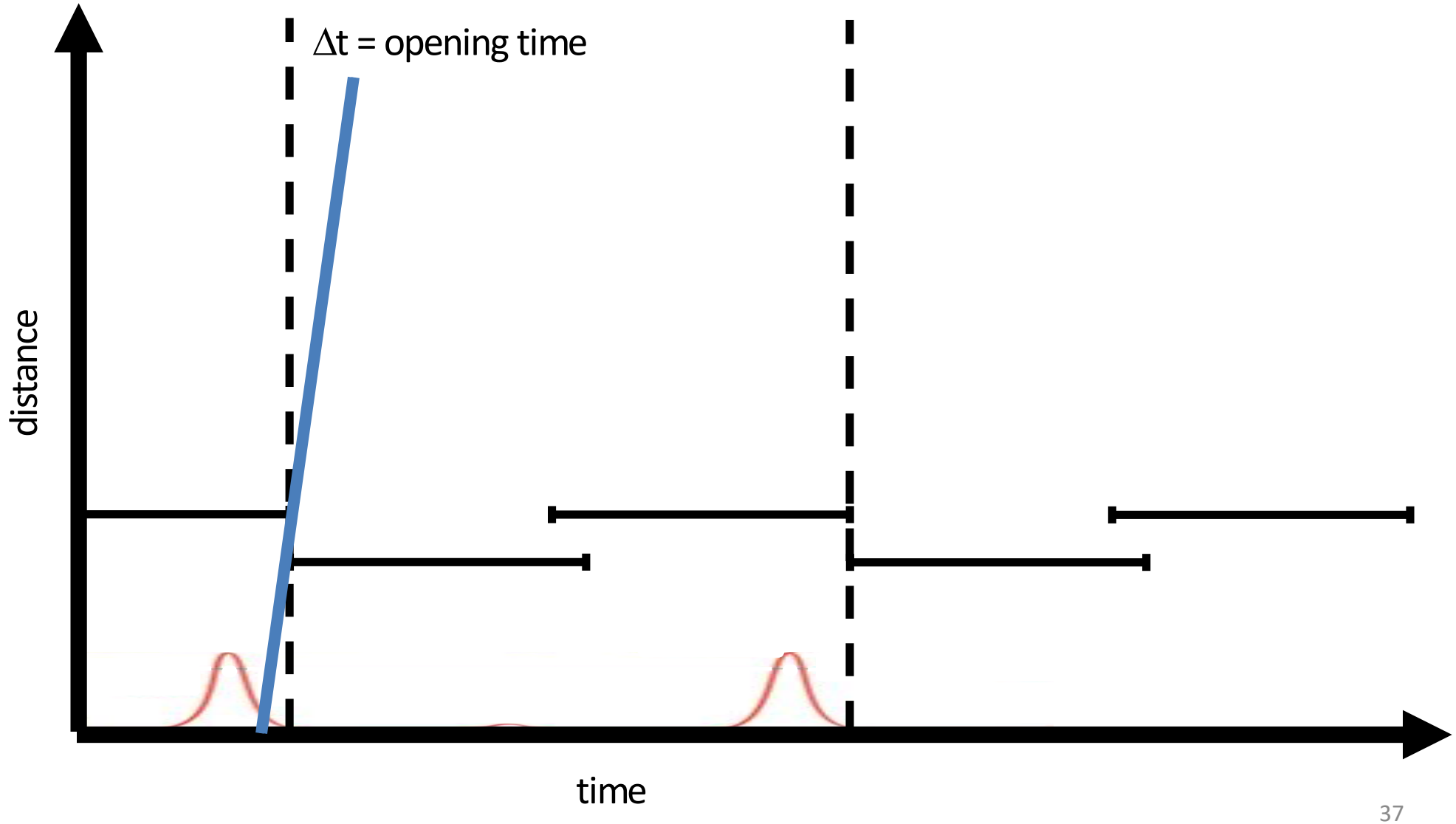

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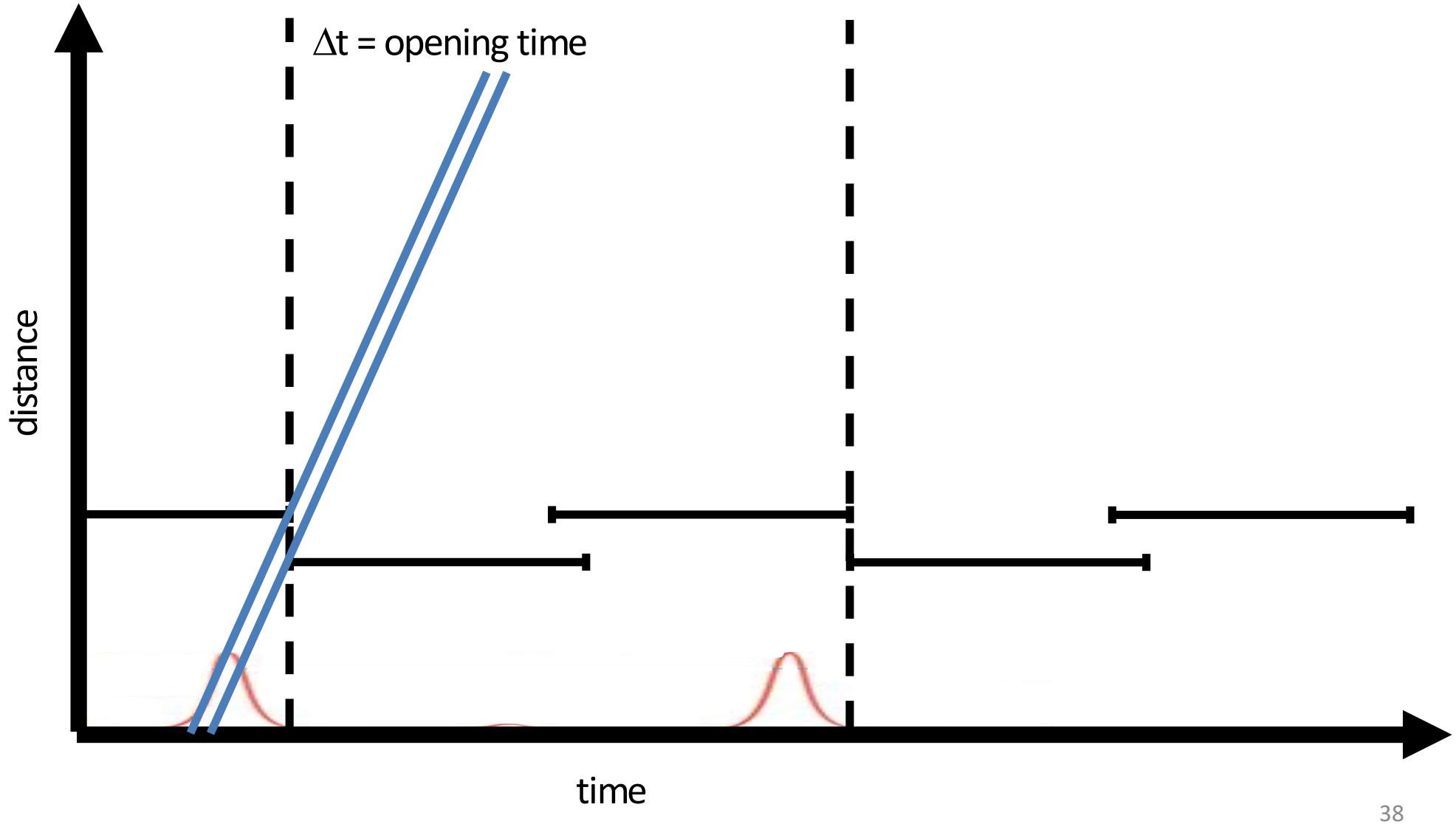

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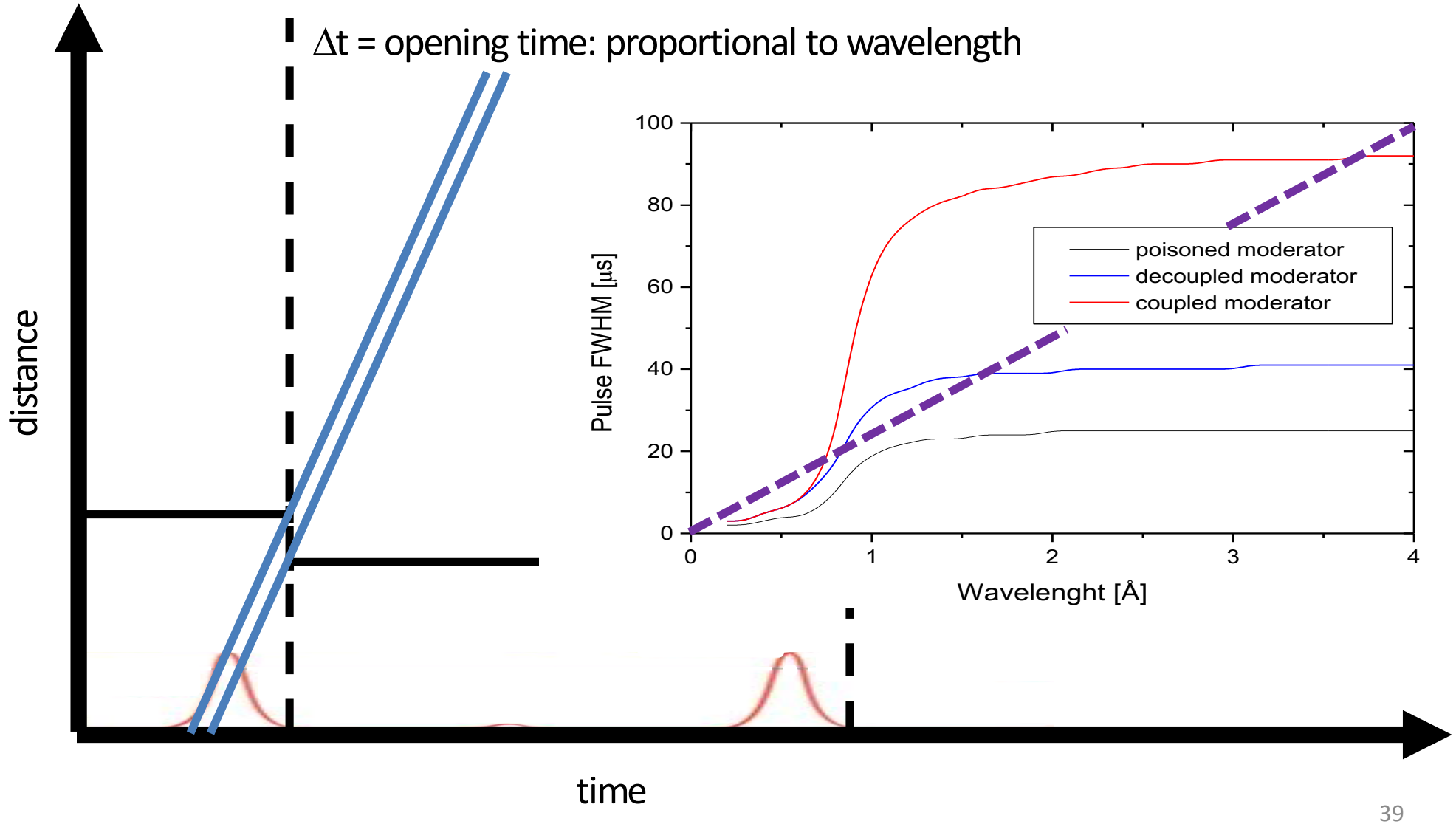

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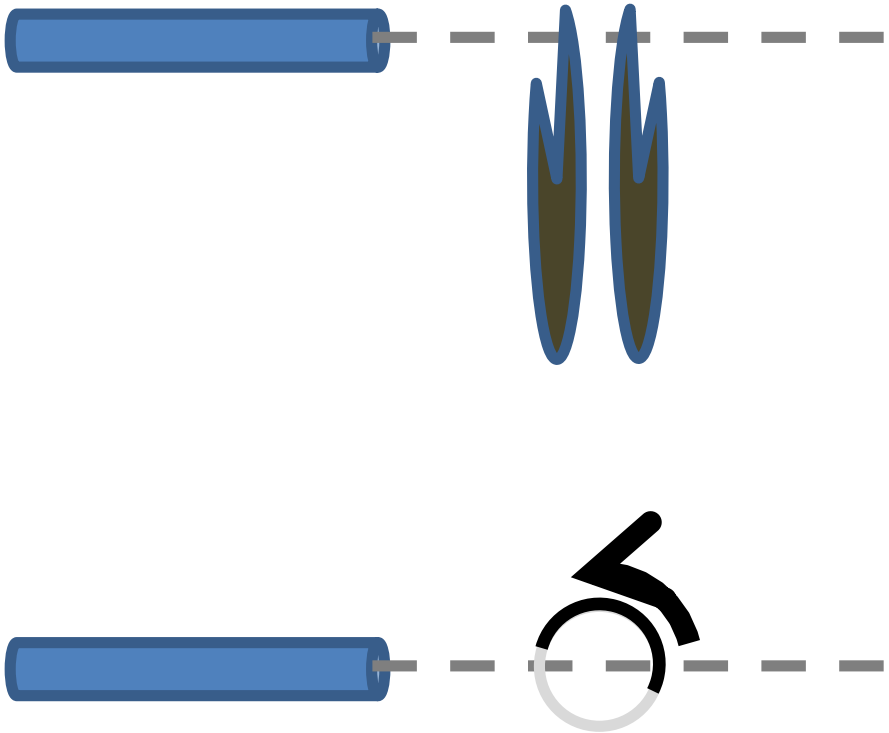
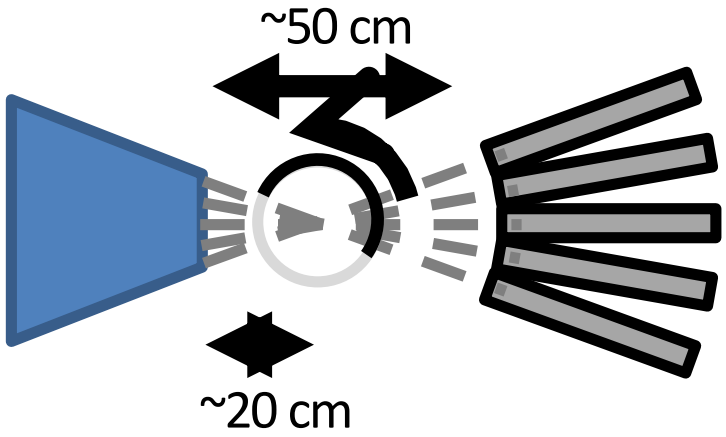


⇒ good guide illumination




⇒ $\Delta\lambda = 5$ Å for $\tau = 250$ µs

# Summary

- ESS will be a big step forwards
  - High source brightness thanks to 2D moderators
  - Bispectral flexibility
  - Resolution flexibility thanks to pulse-shaping choppers
- Possible further evolution at DNS-IV?
  - Further increase in brightness with 2D or 1D moderators
  - Better guide illumination by starting closer
  - More resolution flexibility with compact pulse-shaping choppers
- ESS gave up on having choppers inside bulk shielding
  - Maybe a possibility at DNS-IV?
  - Longer pulse length would allow choppers to be moved further away
  - Time-independent background of booster or pulsed reactor increases importance of pulse-shaping choppers

# Thank you!

ESS site 2016