ePIC Luminosity Systems - Cooling Requirements

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University of York

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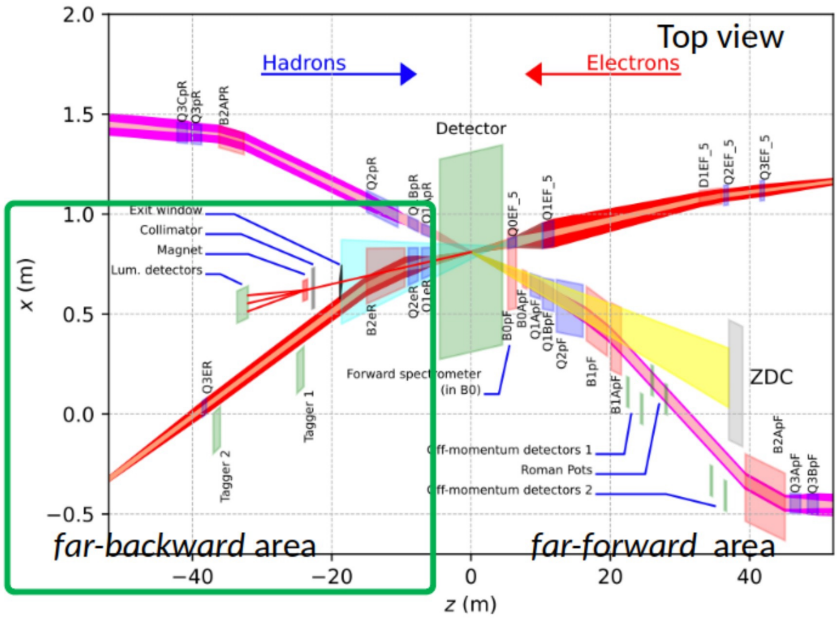
    - Low rate version is just another PS calorimeter anyway
- Pair spectrometer is machine critical and will need to be in place ahead of startup

Far Backward Region

- So, where are our luminosity detectors?



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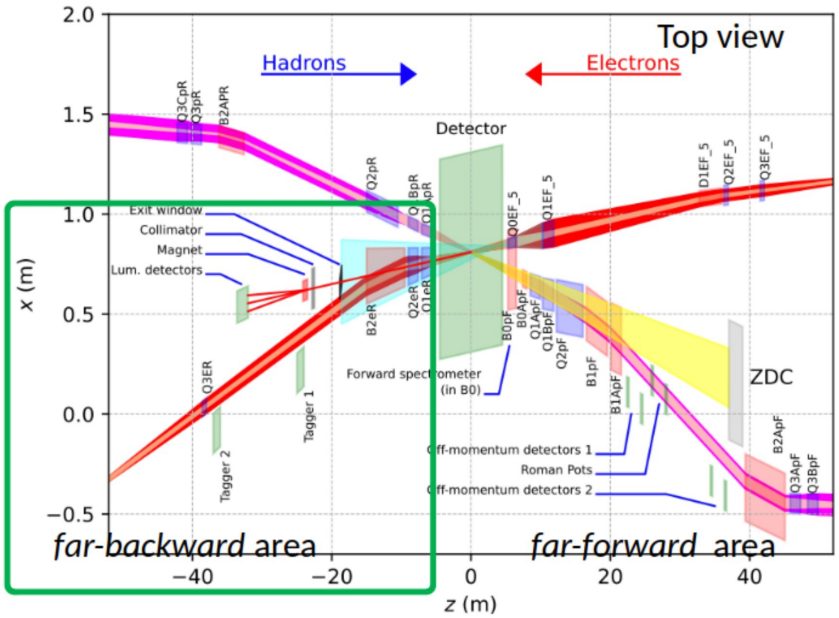
  - Far-backward region
  - 10's of metres from IP



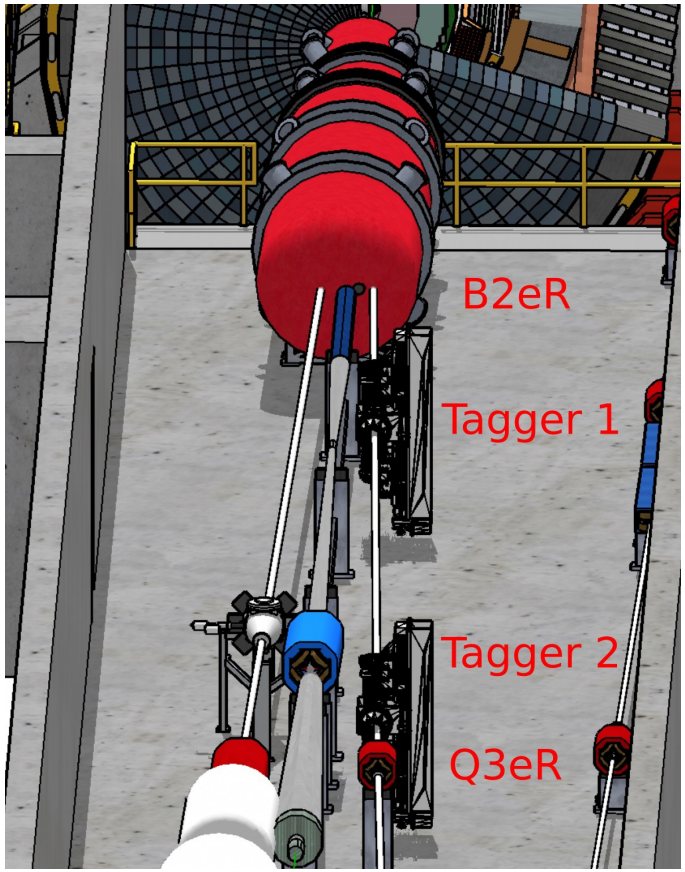


Figure - Igor Korover, MIT, ePIC Collaboration meeting January 2023

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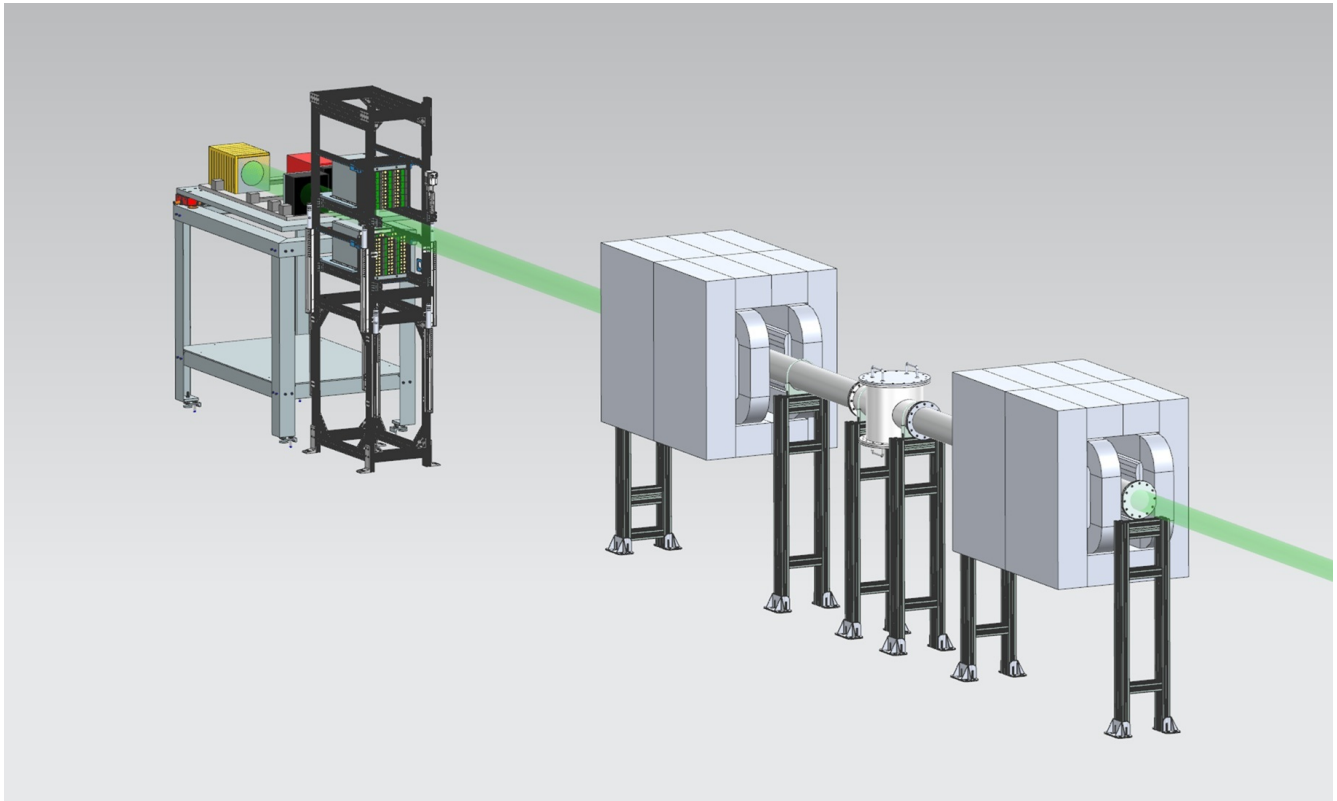

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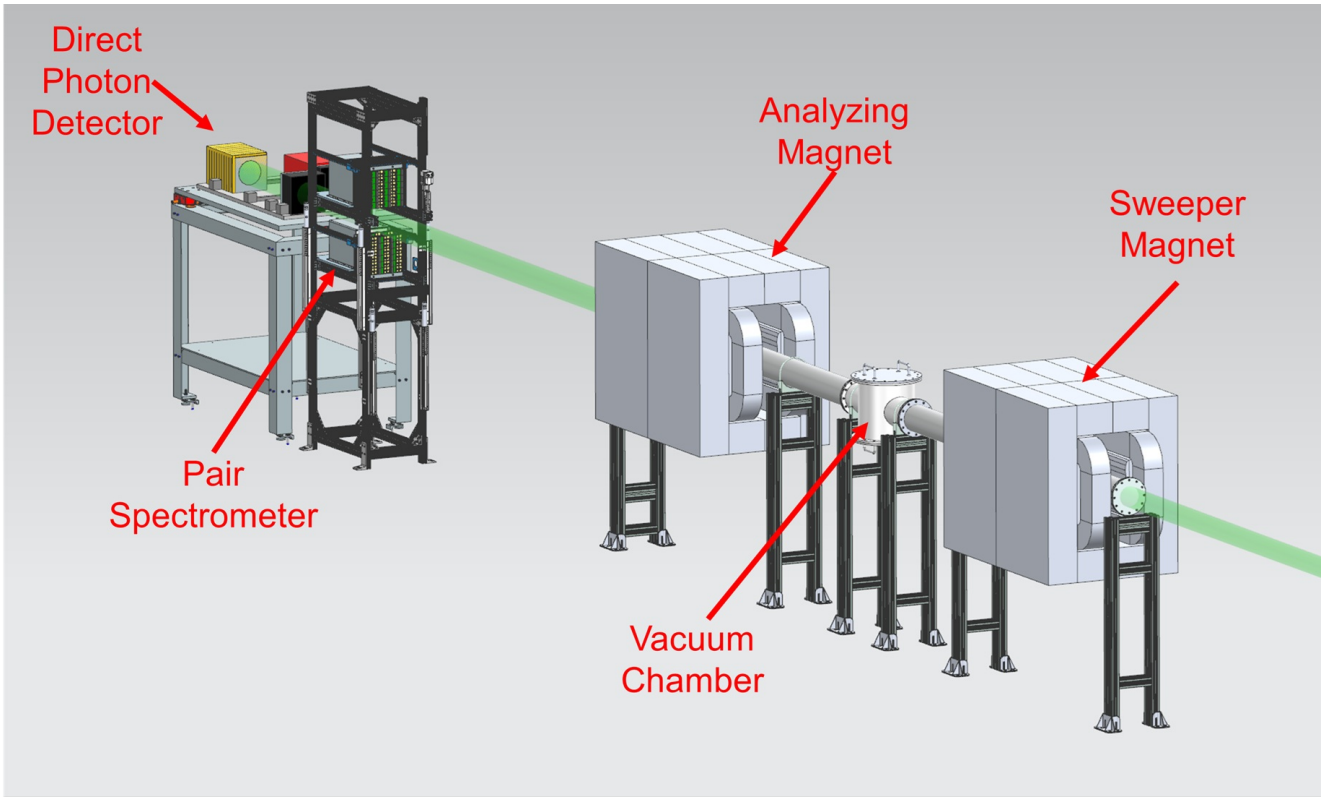

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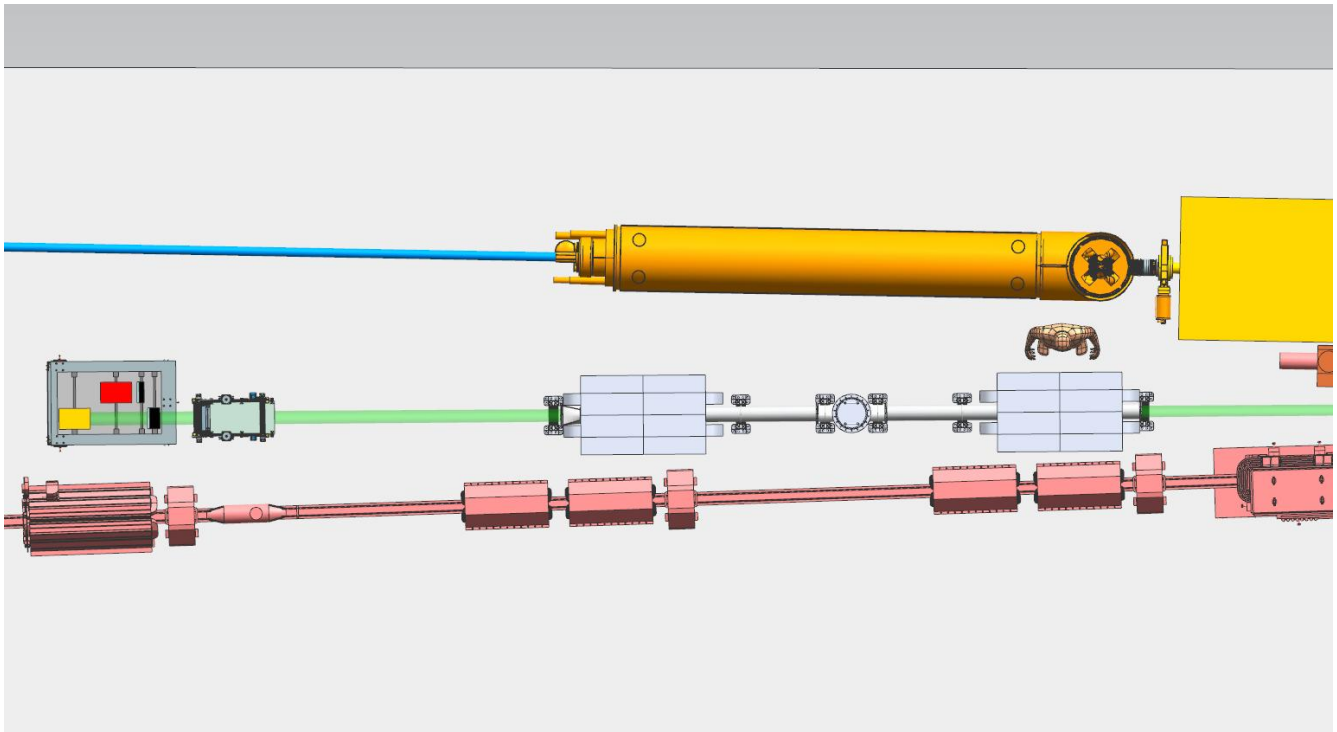
- Situated between two beamlines



Pair Spectrometer Overview

- Pair spectrometer outside of main synchrotron radiation fan

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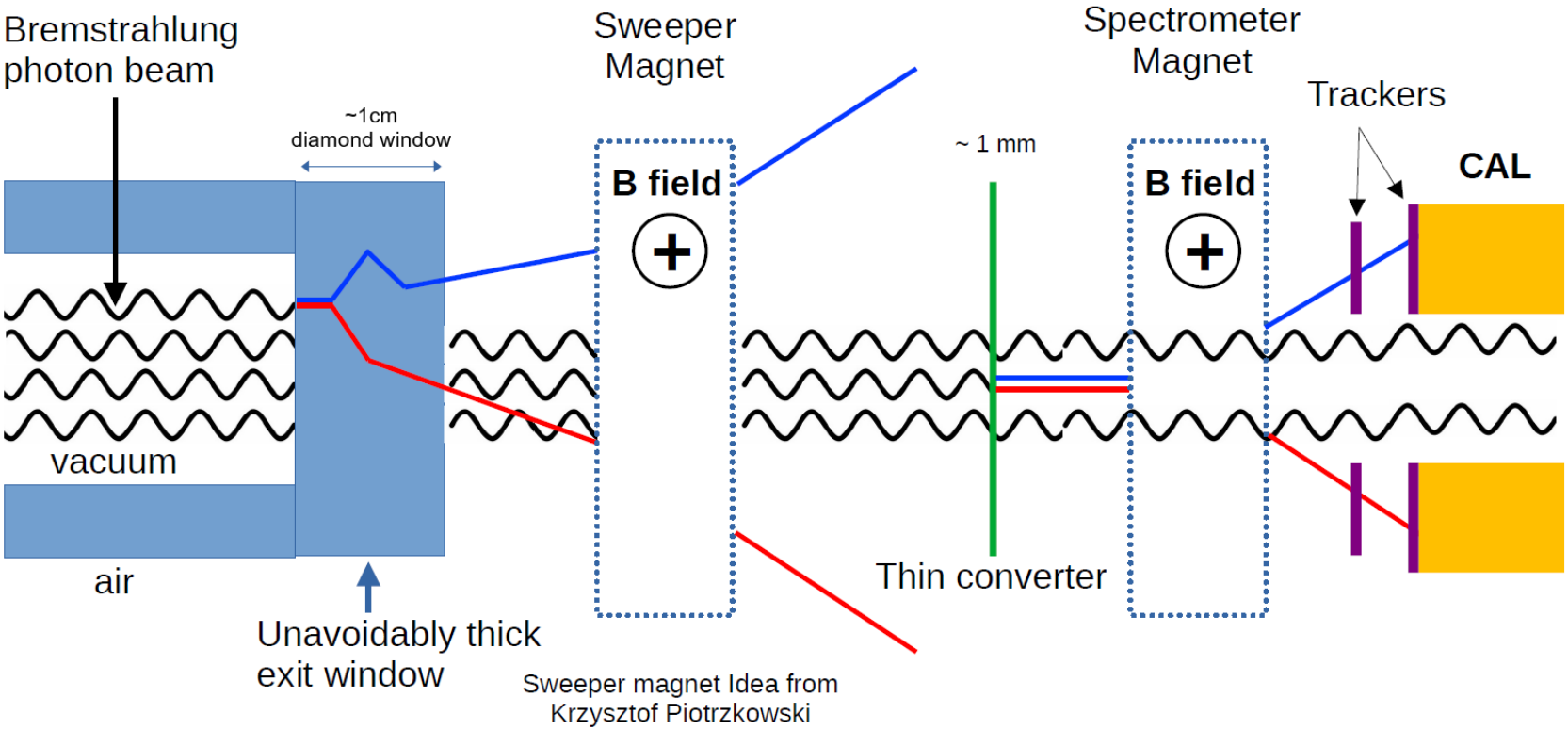
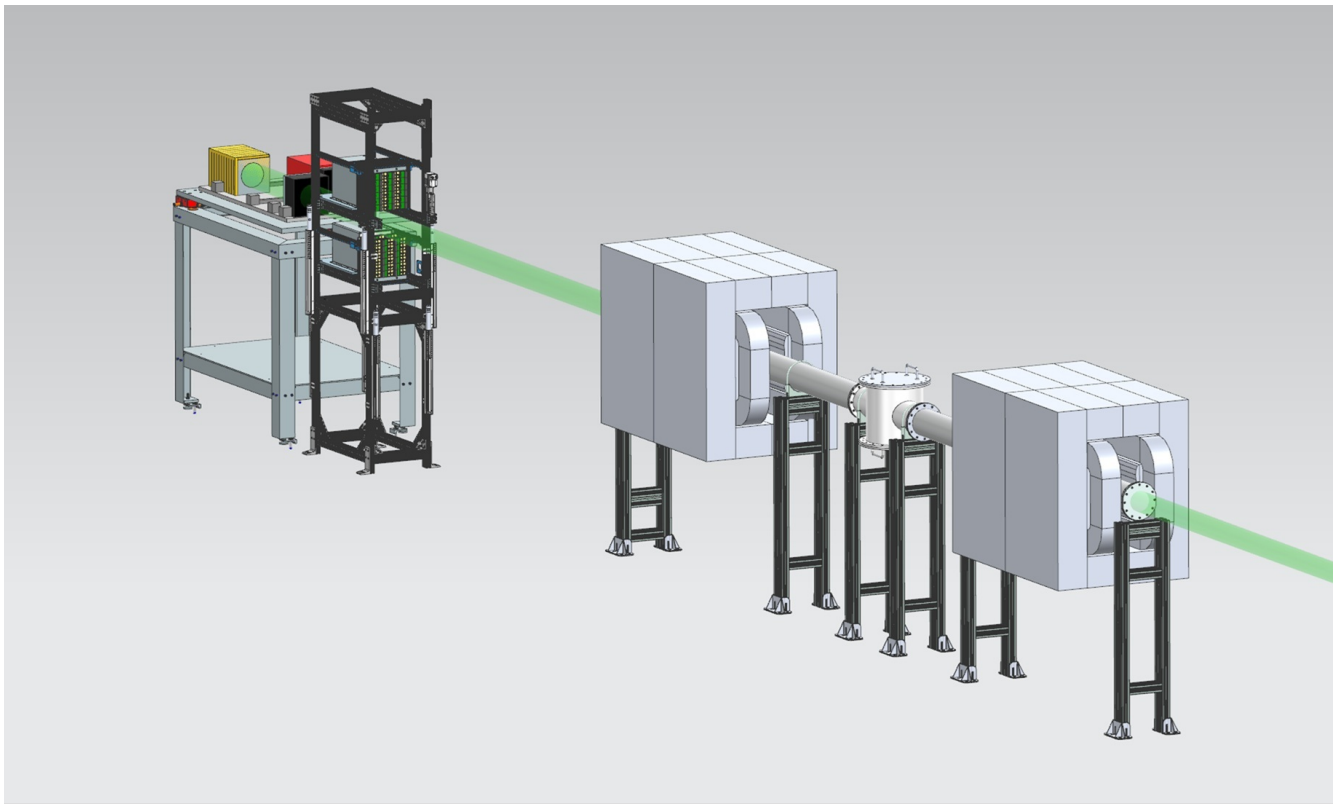


Figure - D. Gangadharan, University of Houston

Luminosity Monitors - Heat Overview

- Two main sources of heat to mitigate in lumi system



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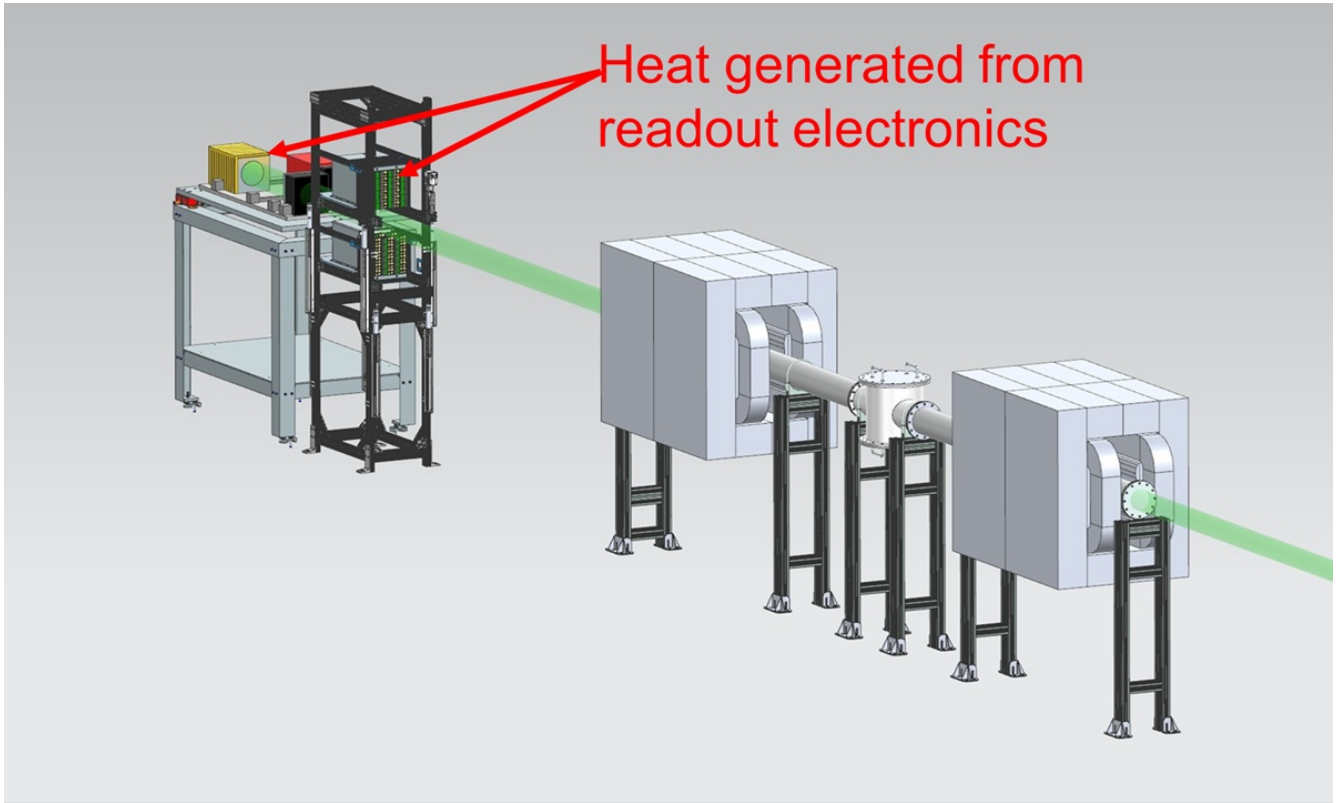

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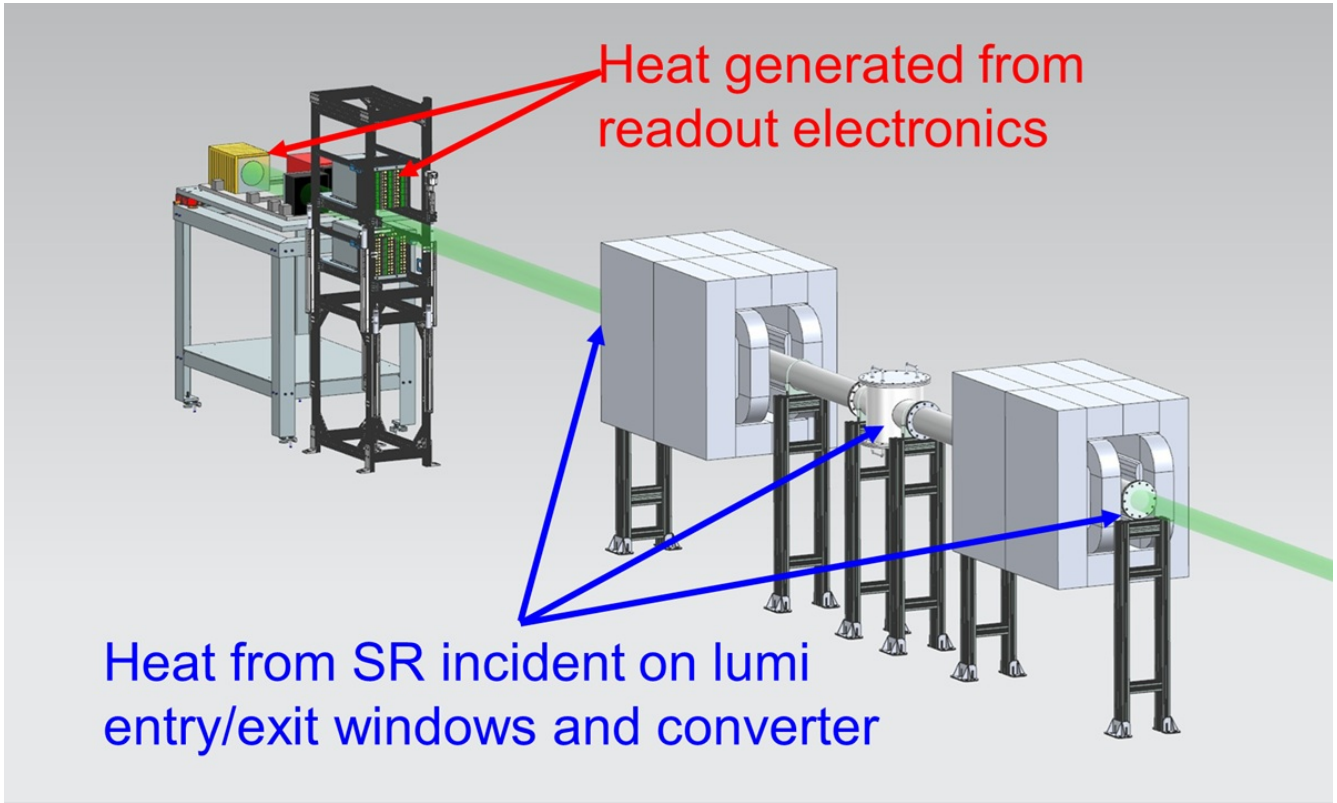
- Heat from synchrotron radiation (SR) incident on vacuum system (entry/exit windows and converter foil)



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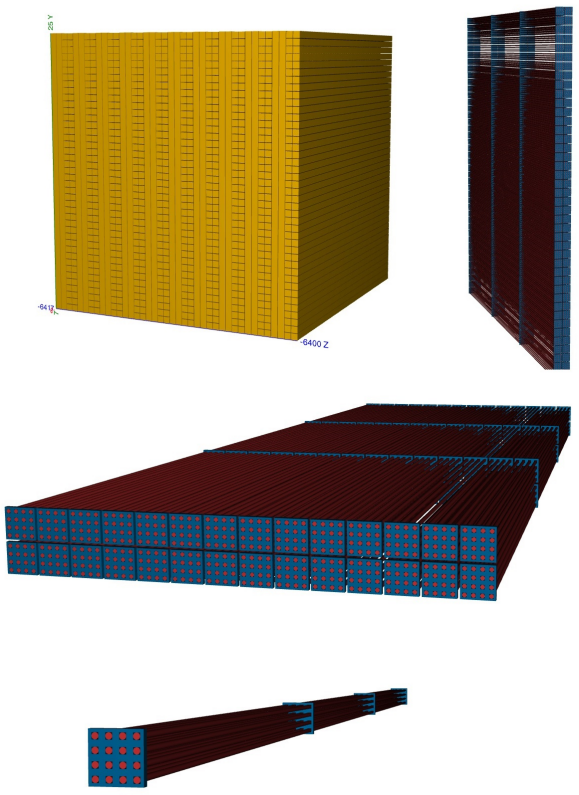
- Updated design - tungsten scintillating fiber calorimeter (WSciFi)



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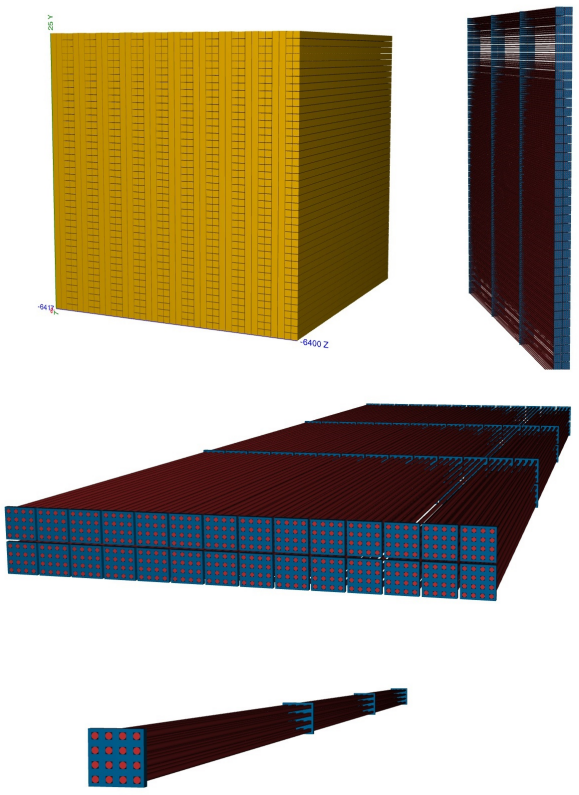

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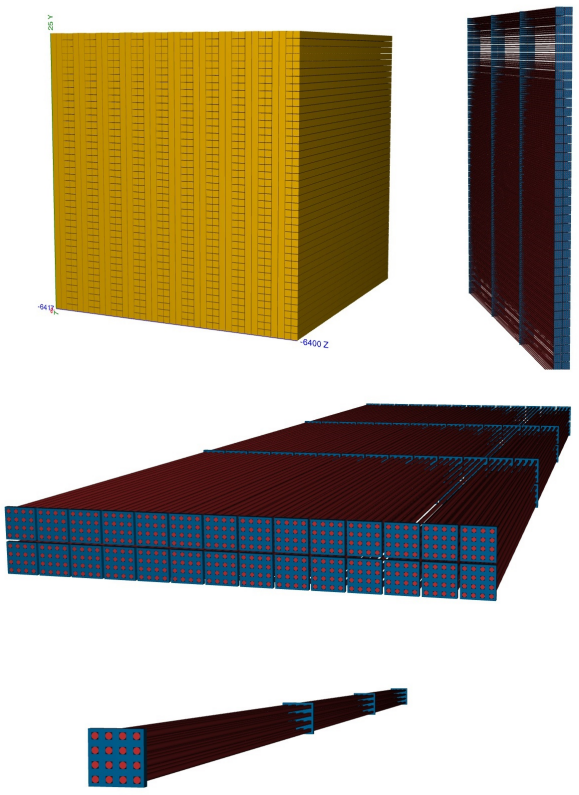

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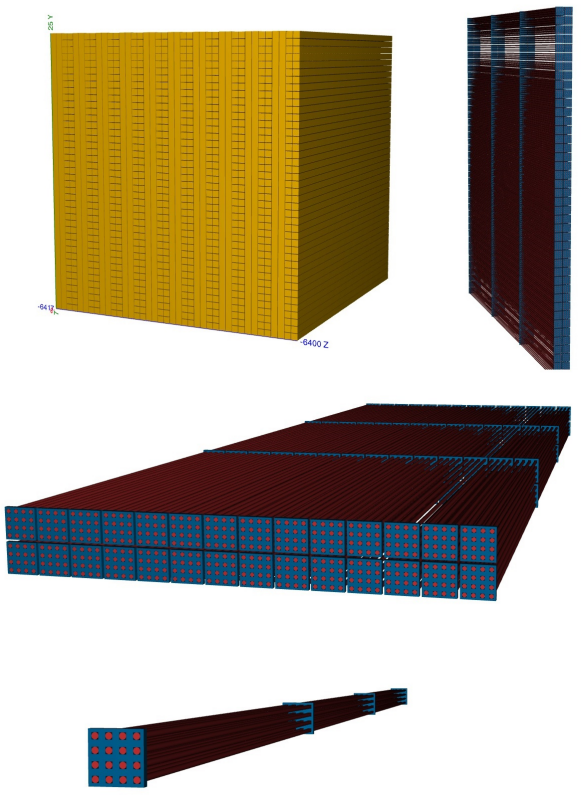

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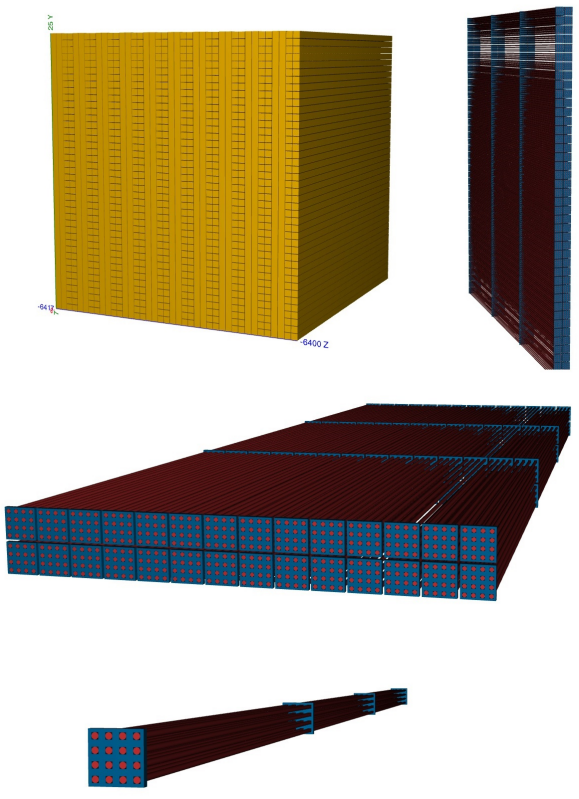

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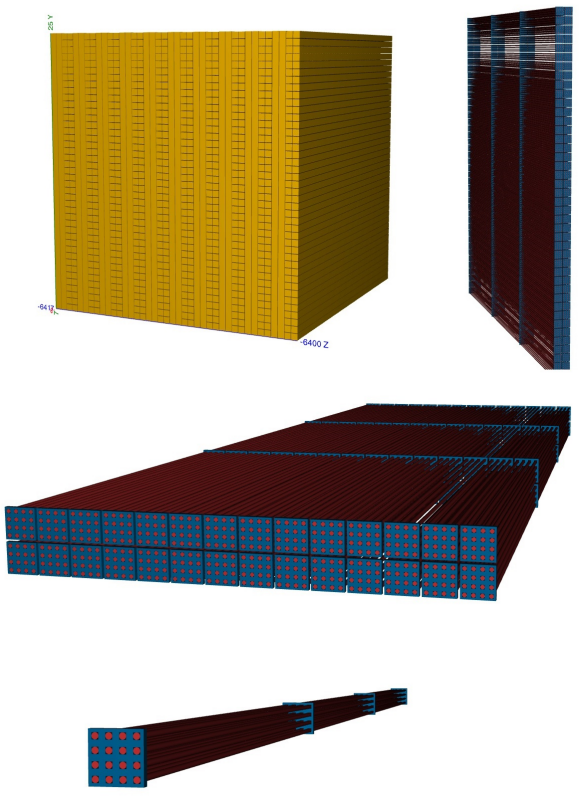

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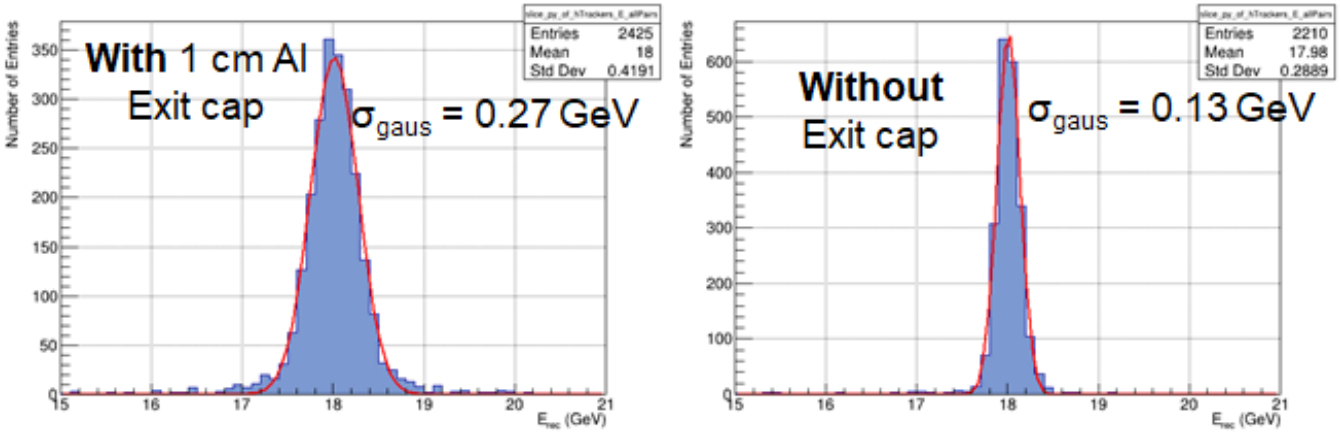

Figures - D. Gangadharan, University of Houston

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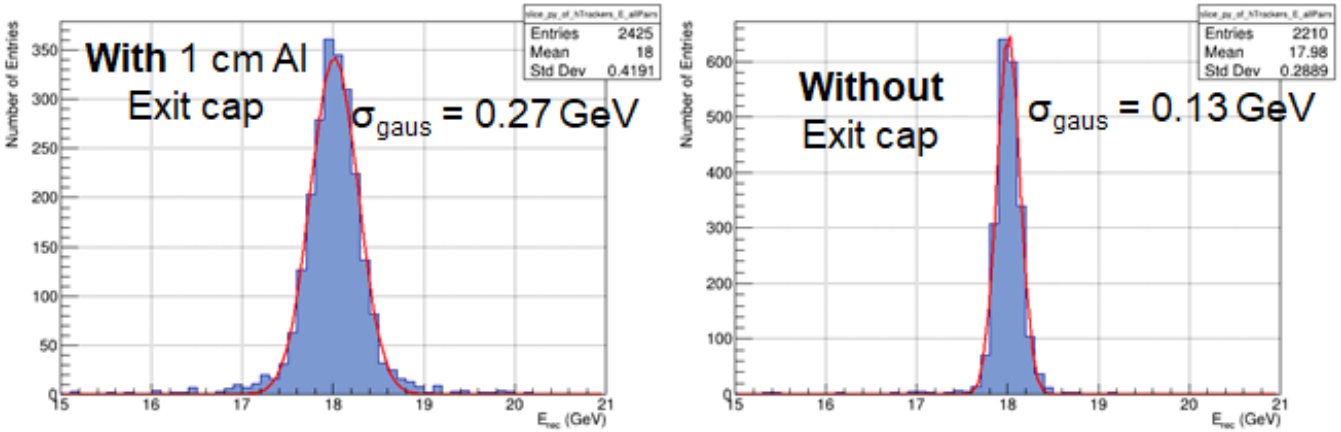

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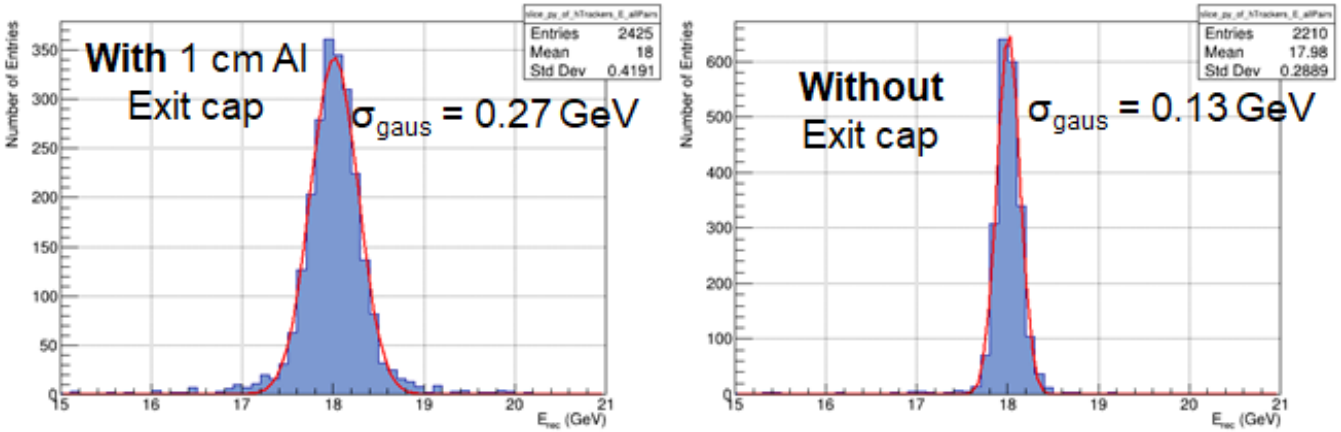
- Assuming 500μm pitch, up to **130,000 channels** per plane
  - Pixels in non-dispersive direction could be combined



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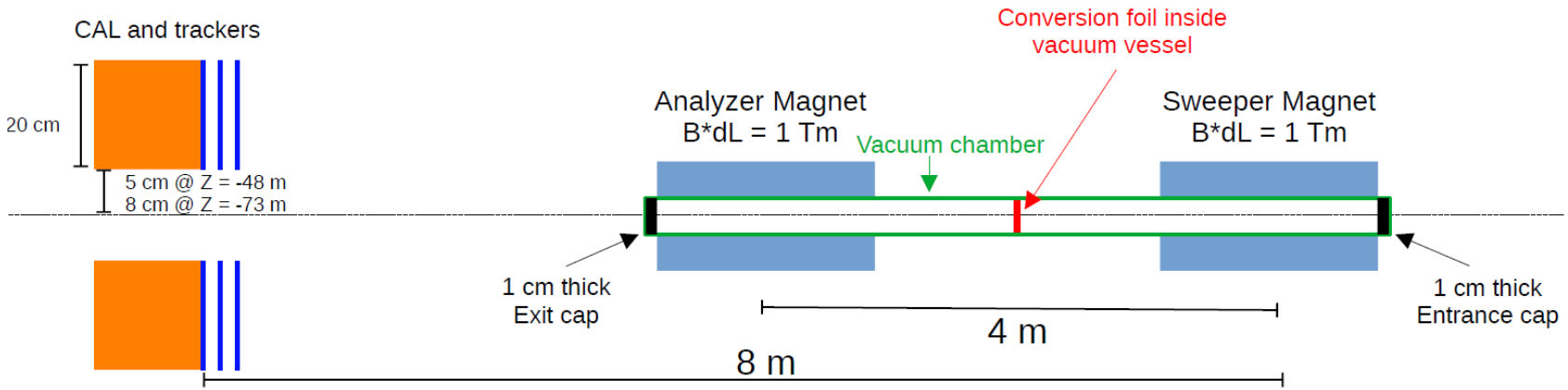
- Vacuum system between sweeper and analyser magnets
- Contains conversion foil for pair production



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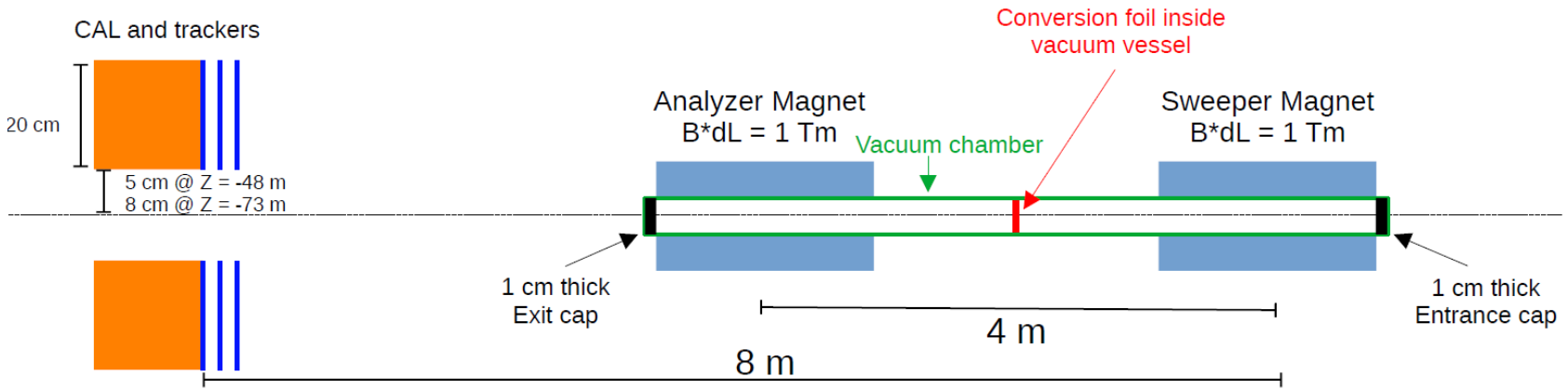

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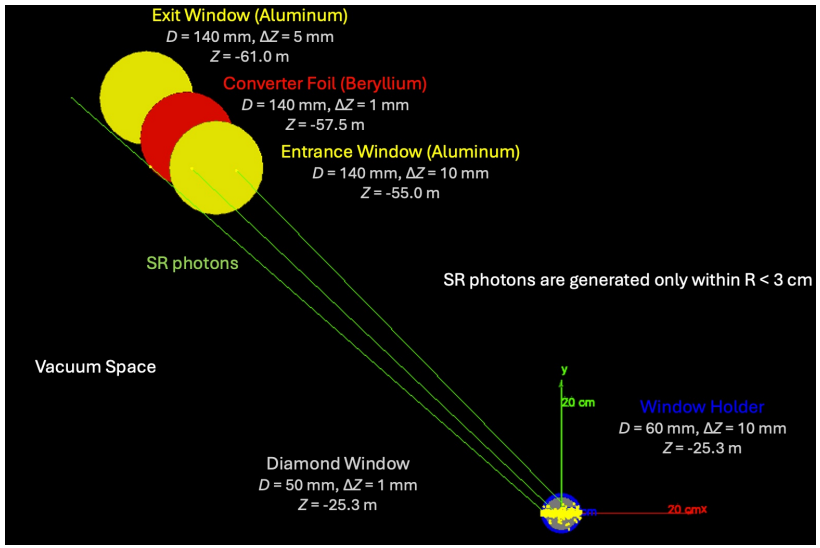

Figure and Table - A. Natochii, BNL, https://indico.bnl.gov/event/27437/

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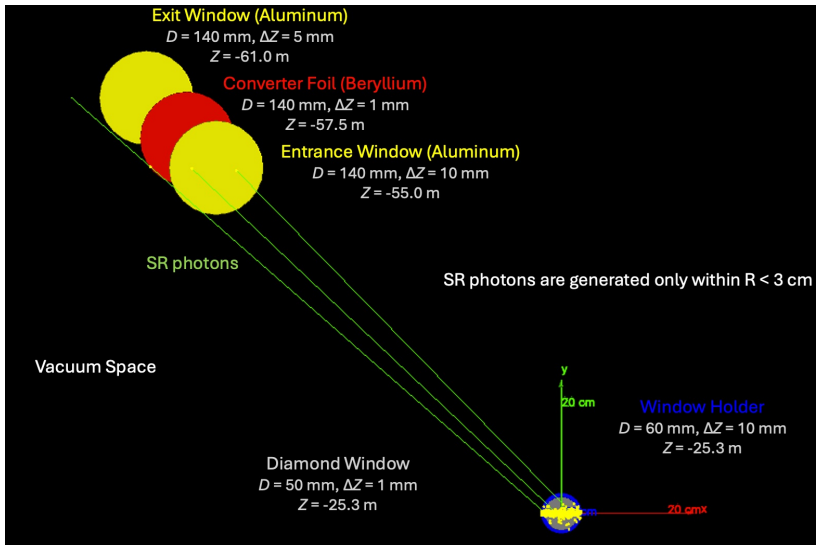

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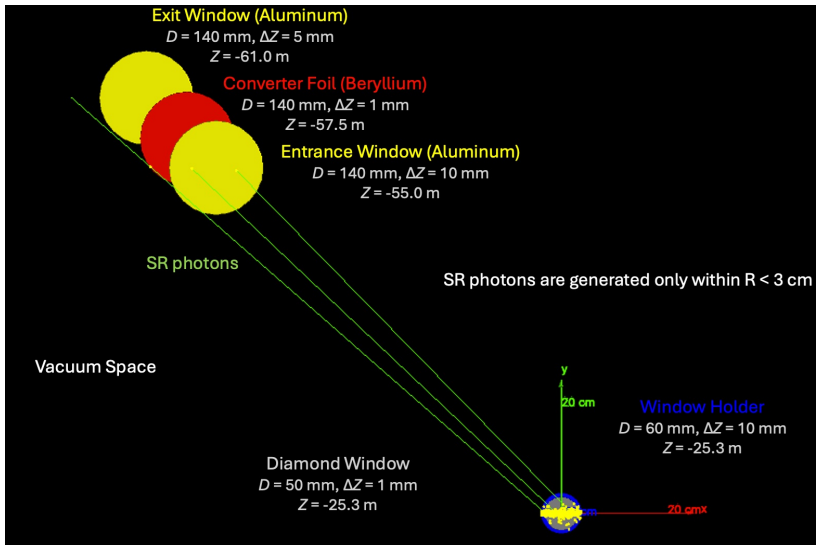

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  - If it is, how to cool? Air cool staves/layers?

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- Revisit tracker system? Lower channel count?

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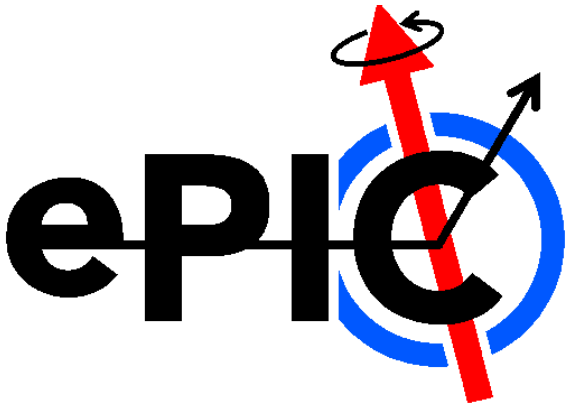
- SR heat load on vacuum system typically low, some configurations more problematic
- FB Lumi region has relatively large space available for cooling
- Utilise air cooling throughout region?
- Support needed to assess how much would be needed and therefore, what system might be suitable

Thanks for listening, any questions?



UNIVERSITY of York

Science and Technology Facilities Council

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Backup Zone

Pair Spectrometer - Expected Rates

- Expected signal rates using nominal $\mathcal{L}$, accounting for -

- Conversion in 1 cm
- Conversion in 37 m air
- Conversion in 1 cm Al vacuum chamber entrance
- All conversions before foil are swept away
- 1 mm Al conversion foil, 1%, detected in pair spec
  - At most, $\sim$ 0.2 electrons per bunch crossing on average