Spectral Matching Algorithms for CRES-Based Electron Momentum Estimation

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Talk outline

- Goals and general design of RF tracker
- Challenges
- Proposed Algorithm
- Discussion

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Recall: objectives of RF tracker

1) Estimate the **center frequency** of radiation spectrum

(→ total energy)

2) Estimate the **bouncing frequency** of the radiation spectrum

(→ parallel momentum)

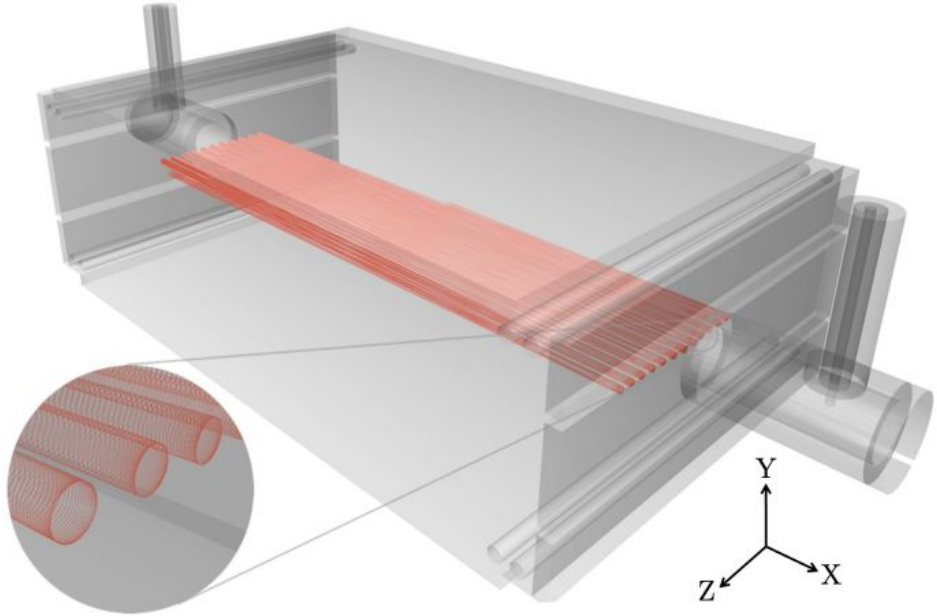

Figure 6 (Graphic by Andi Tan)

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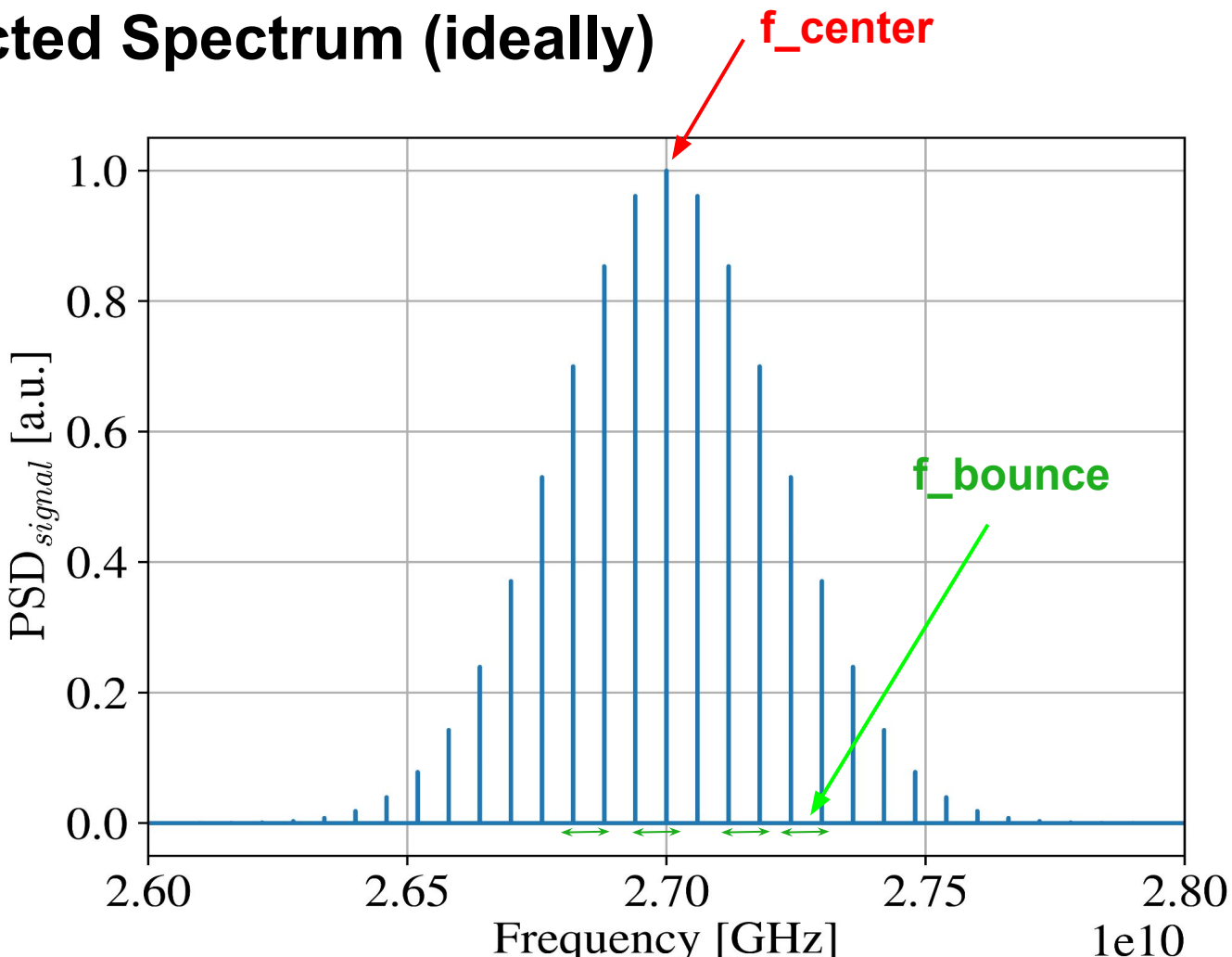
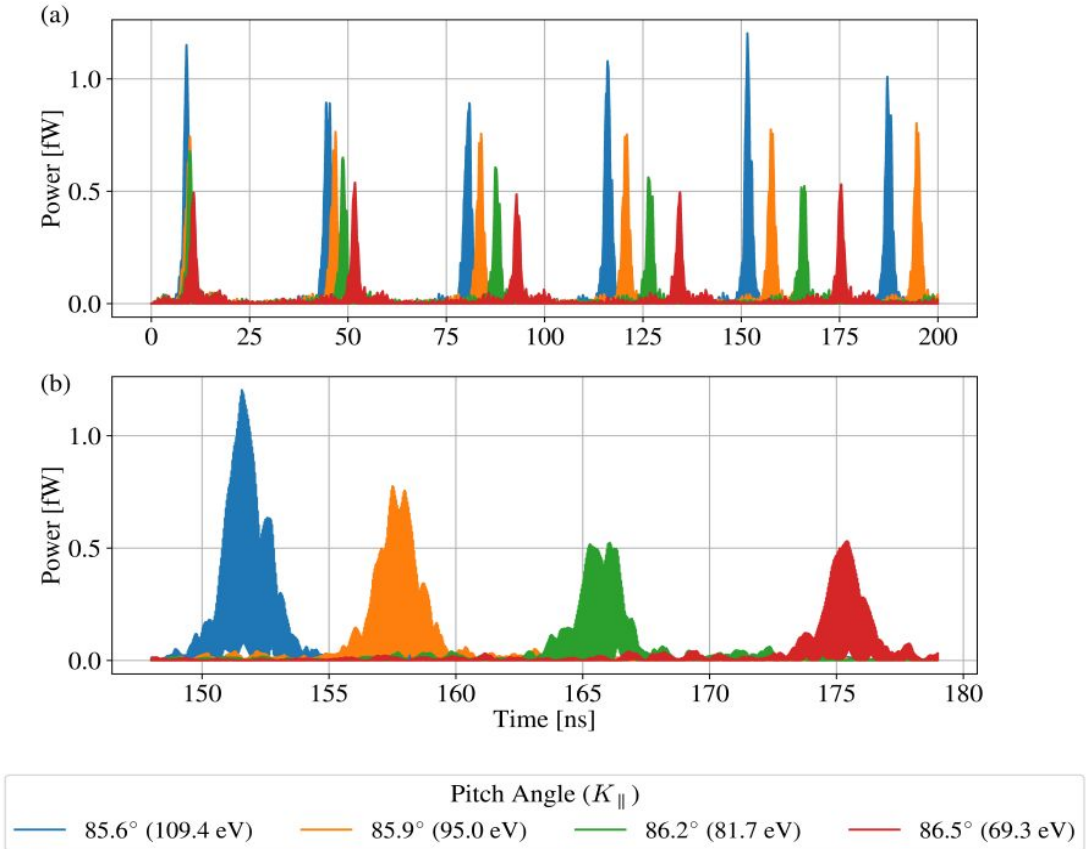
Expected Spectrum (ideally)



Major Challenge

f_center does not necessarily correspond to the highest peak

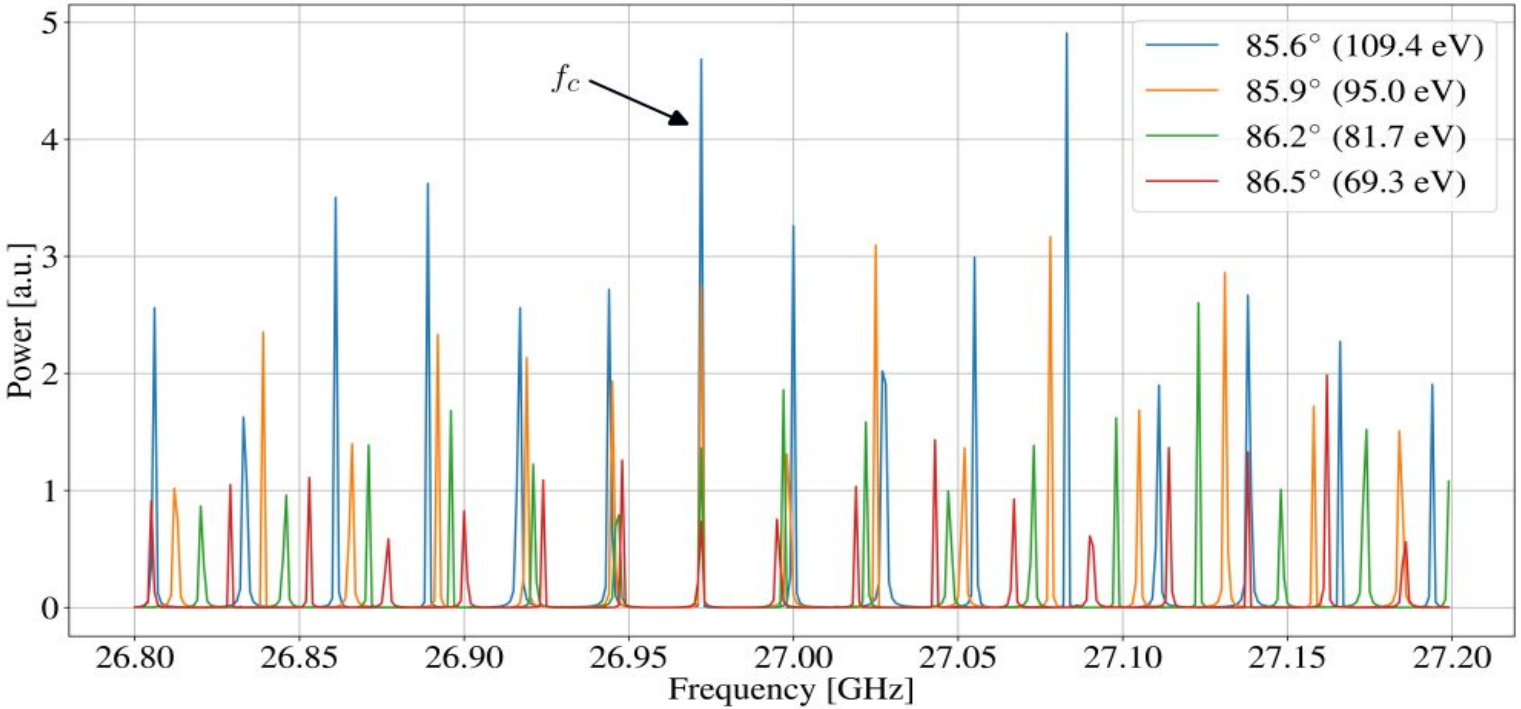
Time domain:



Major Challenge

f_center does not necessarily correspond to the highest peak

Frequency domain:



- Here, I can only able to identify f_center because all of the spectra for different pitch angles overlap.

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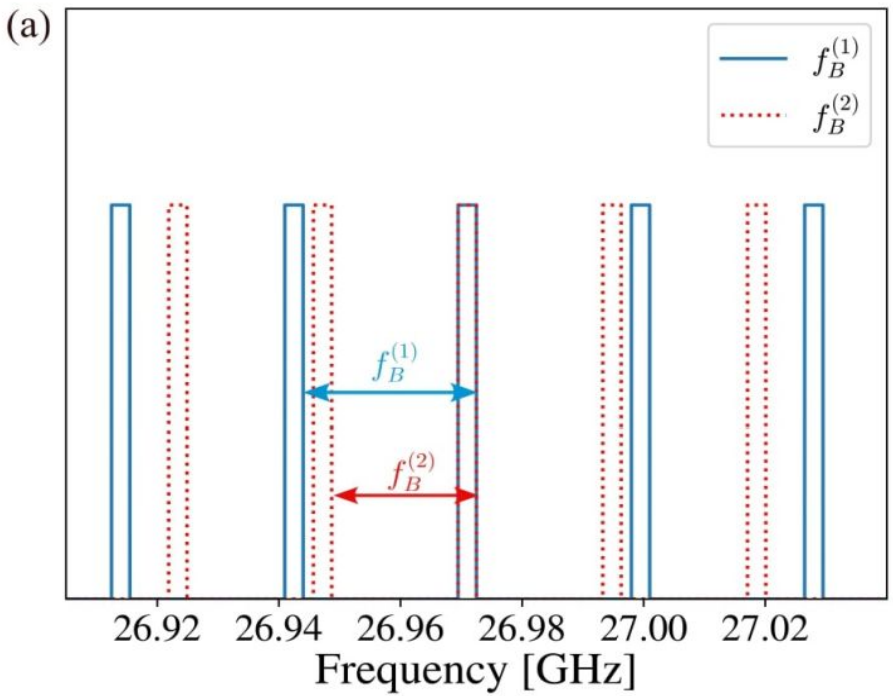
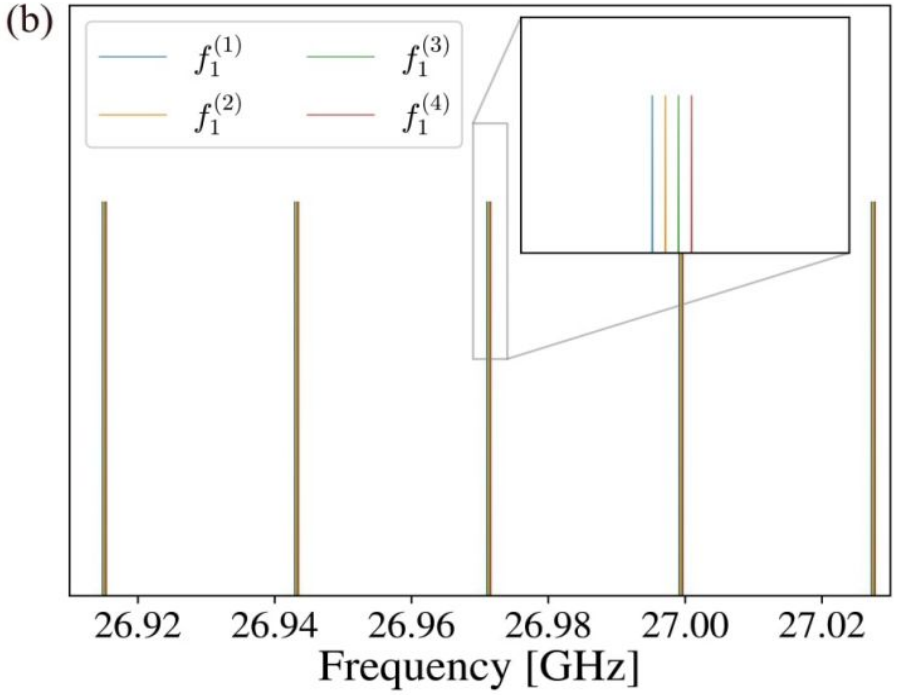
Idea. Comb-Template Matching algorithm





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Discussion Questions

- How realistic is it to implement kind of template matching algorithm? Are there similar examples that exist in real life?

- Any other ideas for better algorithms?

Supplement

$$\underset{f_i}{\operatorname{argmin}} \frac{|A|+|B(f_i)|-2|A\tilde{\cap}B(f_i)|}{|A|+|B(f_i)|},$$