

# Dark Light Scattering

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# Outline

Overview of DarkLight

TRANSOPTR envelope simulations

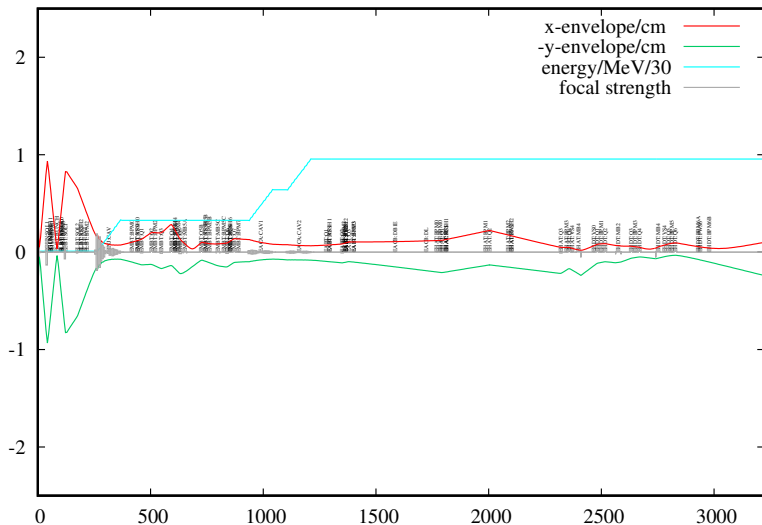
Comparison with Monte Carlo scattering simulations

## Dark Light at ARIEL

- ▶ Dark photon - possible mediator for dark matter interaction force.
- ▶ Experiment using the 31 MeV  $e^-$  beam from the ARIEL ELINAC.
- ▶ Search  $e^+/e^-$  final states in scattering from a tantalum target.

# TRANSOPTR Simulation

Original ELINAC envelope with no scattering.

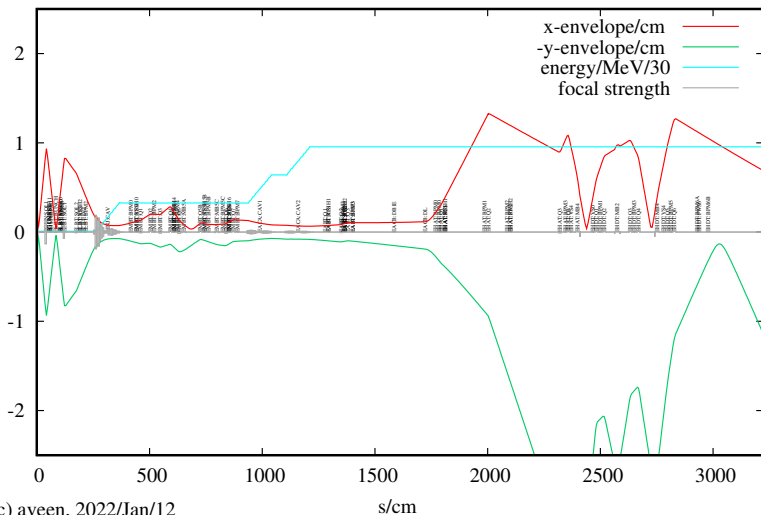


(c) aven, 2022/Jan/12

s/cm

# TRANSOPTR Simulation

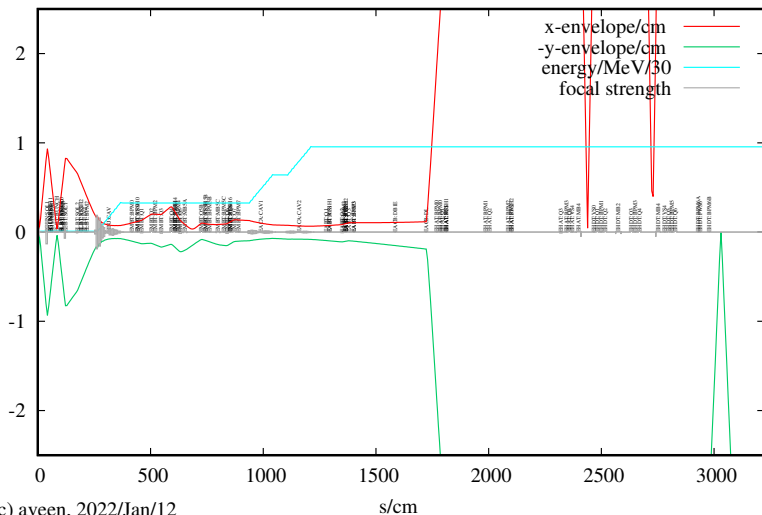
RMS scatter=2mrad



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# TRANSOPTR Simulation

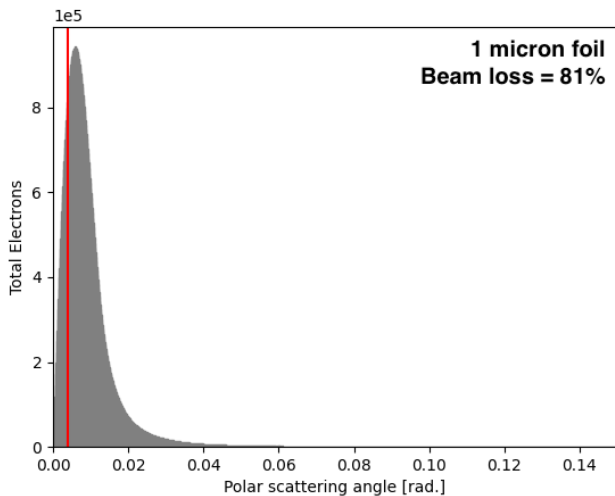
RMS scatter=20mrad



## Monte Carlo Simulation

- ▶ Performed by Kate Pachal using Geant4.
- ▶ Three foil widths explored: 1  $\mu\text{m}$ , 5  $\mu\text{m}$  and 10  $\mu\text{m}$ .
- ▶ Integrated histogram data to quantify beam loss.

# Scattered Particle Loss



Red line indicates approximate max scattering tolerable.



## Possible solutions/alternatives

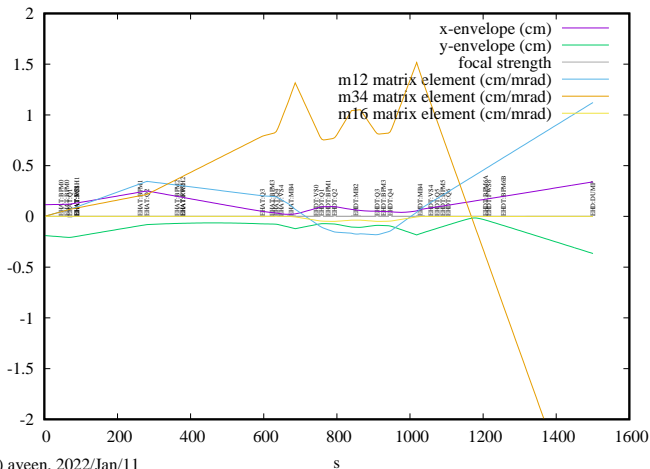
- ▶ Collimator - currently too much beam loss for this.
- ▶ Wire target - hopefully less scattering which could then be collimated.
- ▶ To be explored...

Thank you  
Merci



# Current ELINAC Tune

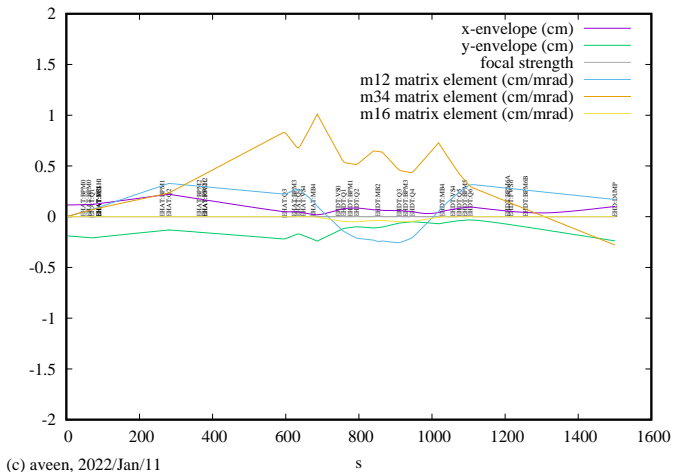
m12 and m34 - positional displacement given an initial angular kick



Can already seem dramatic displacement, particularly for m34

## Suggested Improved tune

Better constrains the matrix elements BUT still not a lot of room.



Beamline radius  $\approx 2.5\text{cm}$  leaves room for  $\approx 4$  mrad of scattering max.