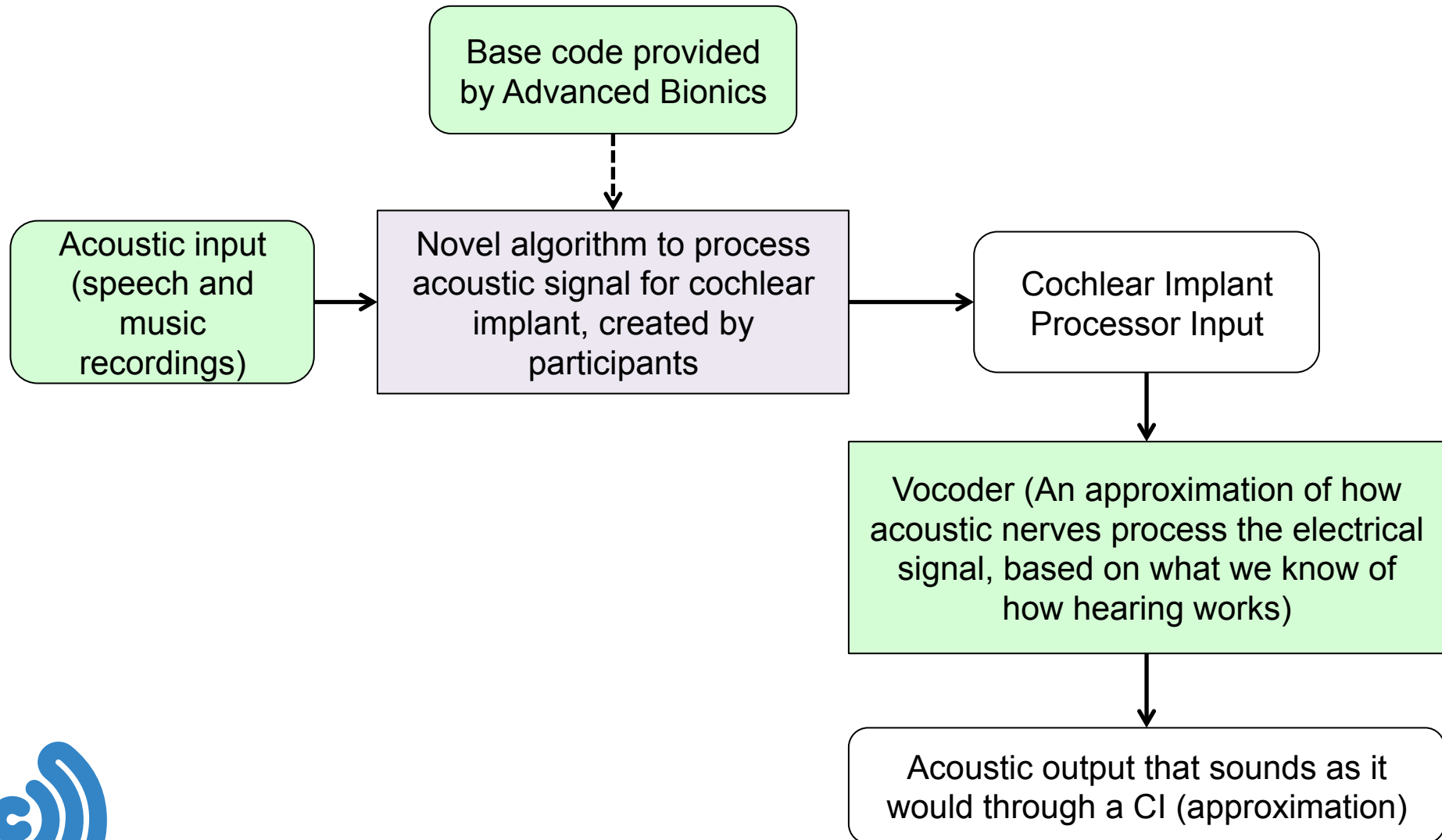


# Cochlear Implant Hackathon: High Level Overview

Leah Muller, MD, PhD



# Inputs and Outputs: High Level



## Cochlear Implant Simulator

Acoustic input  
(audio file)

CNC words  
Natural speech  
Speech in noise  
Music



Base code (MATLAB or Python code is provided)  
incorporating your novel modifications

OR

Your novel algorithm (any programming language)



This is what your  
team will submit



Output is a matrix of stimulation pulses in units of  
current amplitude, as electrodes x time



Vocoder

Acoustic output that sounds  
as it would through a cochlear  
implant (approximation)



Crowd Sourced Judging

Ranked performance  
of teams' algorithms



Code review

Top 3 algorithms  
overall

# Hackathon Steps: High Level



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# Hackathon Steps: High Level



# Acoustic inputs

1. Consonant-Nucleus-Consonant Words
2. Natural Speech
3. Speech in Noise
4. Music



# Acoustic inputs

1. Consonant-Nucleus-Consonant (CNC) Words
  - CNC words are commonly used to judge CI performance
2. Natural Speech
3. Speech in Noise
4. Music



# Acoustic inputs

1. Consonant-Nucleus-Consonant Words
2. Natural Speech
  - Natural speech is the stimulus that most cochlear implants target with their algorithms
3. Speech in Noise
4. Music



# Acoustic inputs

1. Consonant-Nucleus-Consonant Words
2. Natural Speech
3. Speech in Noise
  - One of the hardest things for CI users is a noisy environment, so distinguishing speech in noise is an important milestone for improvement.
4. Music

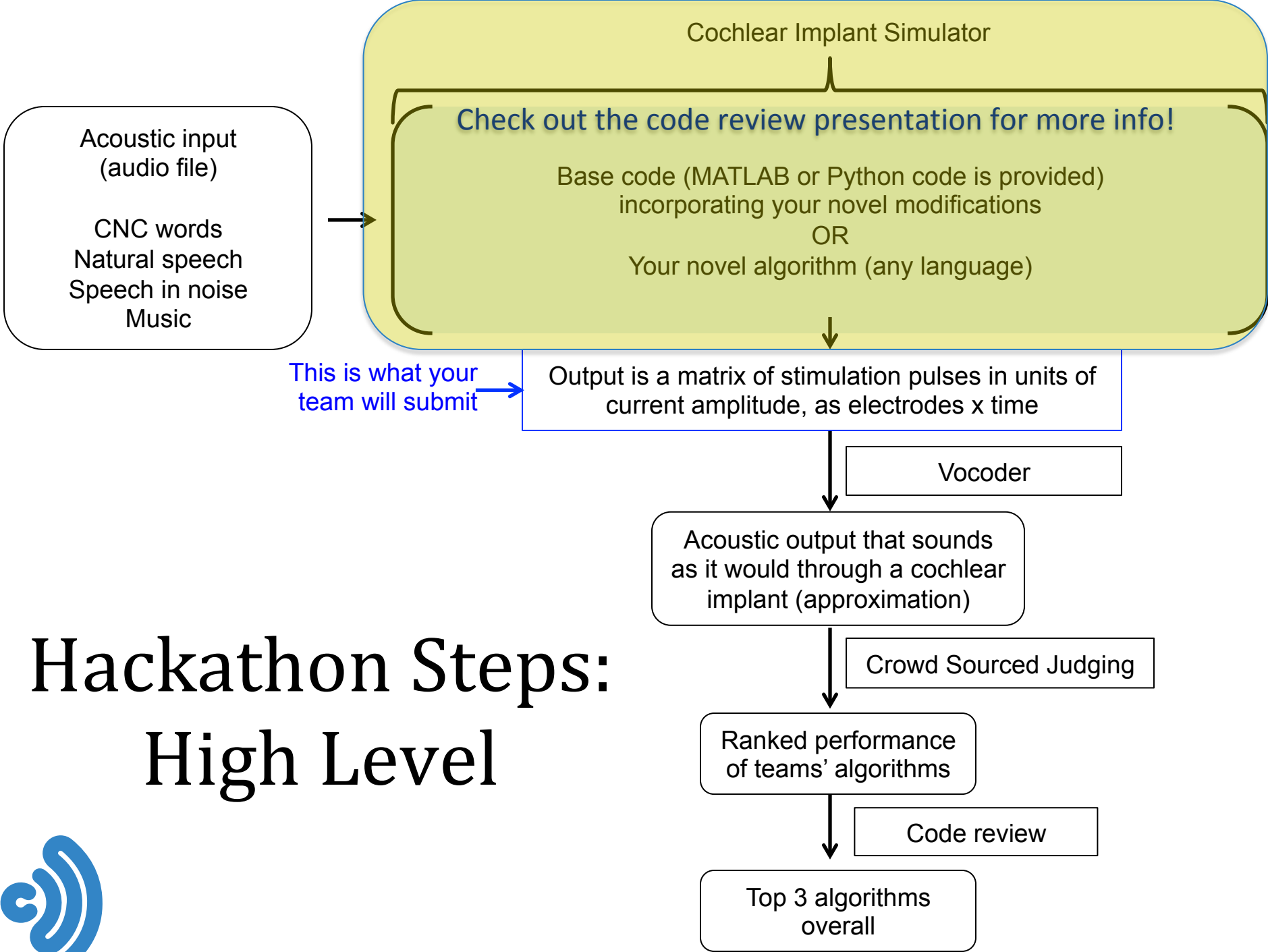




# Acoustic inputs

1. Consonant-Nucleus-Consonant Words
2. Natural Speech
3. Speech in Noise
4. Music
  - CI users usually do not enjoy music to the same extent as prior to implant. An improvement in music processing would greatly improve CI users' experience.





# Cochlear Implant Simulator

Acoustic input  
(audio file)

CNC words  
Natural speech  
Speech in noise  
Music

We provide you  
with audio samples

This is what your  
team will submit

Base code (MATLAB or Python code is provided)  
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Your novel algorithm (any programming language)

Output is a matrix of stimulation pulses in units of  
current amplitude, as electrodes x time

Vocoder

Acoustic output that sounds  
as it would through a cochlear  
implant (approximation)

Test your algorithm  
by running it through  
the vocoder

**Leading up to final entry...**

Crowd Sourced Judging

Ranked performance  
of teams' algorithms

Code review

Top 3 algorithms  
overall



# Cochlear Implant Simulator

Acoustic input  
(audio file)

CNC words  
Natural speech  
Speech in noise  
Music

We provide you with  
new (held-out) audio  
samples

This is what your  
team will submit

Base code (MATLAB or Python code is provided)  
incorporating your novel modifications  
OR  
Your novel algorithm (any programming language)

Output is a matrix of stimulation pulses in units of  
current amplitude, as electrodes x time

We run your  
output through  
the vocoder to  
generate an  
audio file

Vocoder

Acoustic output that sounds  
as it would through a cochlear  
implant (approximation)

Crowd Sourced Judging

**Final competition entries**

Ranked performance  
of teams' algorithms

Code review

Top 3 algorithms  
overall



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Crowd Sourced Judging

Ranked performance  
of teams' algorithms



Code review

Top 3 algorithms  
overall

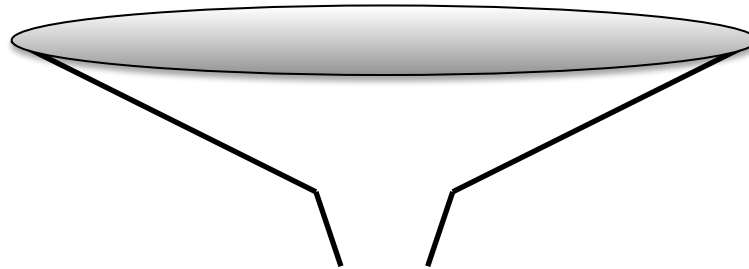
# Hackathon Steps: High Level



# Judging

- Crowd sourced
- By category

**Round 1**



**Round 2**



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Code review

Top 3 algorithms  
overall

# Hackathon Steps: High Level



# Code review

Top teams for each category will be notified, and a code review with the top teams will take place with the event organizers.





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# Hackathon Steps: High Level



# Top Algorithms

Judging by event organizers will determine top algorithms overall. Top algorithms must demonstrate good performance in all 4 acoustic categories and significant improvement in one or more categories.



# Substantial Improvement

Teams may excel by making a substantial improvement in output over that generated by the base code provided.

If a team performs substantially better than baseline in any category, they earn a better-than-baseline bonus!



# Honest Effort

We ask contestants to make an honest effort.  
This will also be assessed during the code review.

Honest effort means avoiding practices that are not in good faith, such as faking a result or making minimal changes to the base code to purposely perform at the level of the gold standard.



# Prizes

## 1<sup>st</sup> place

\$5000 to the winning team

## 2<sup>nd</sup> place

\$2000 to the second place team

## 3<sup>rd</sup> place

\$1000 to the third place team

## Bonus

\$100 extra to each top team by category with an algorithm that performs better than the baseline

## Top teams

Opportunity to further develop the algorithm and test it with real cochlear implant patients in the future





**CI Hackathon**