



AGM

May 25<sup>th</sup> 2021

09:30

# Safe Harbor

## **Forward-Looking Statements**

This presentation may contain forward-looking statements (including market opportunities and TAM; our growth; future financial results, estimates and forecasts; the performance and benefits of our products and technologies potential market and revenue opportunities, expected company product introductions and future trends in macroeconomic and industry conditions) that are based on company's estimates, theories, assumptions, expectations of current and future events that are subject to any number of risks and uncertainties. Actual results may differ materially from those projected in the presentation. Recipients of the document should make their own independent investigations, consideration and evaluations prior to making any decisions in respect to the Company.

Except as required by law, Audio Pixels disclaims any obligation to update forward-looking statements to reflect future events or circumstances.

*certain images in this presentation have been intentionally blurred*

**AUDIO PIXELS HOLDINGS LIMITED**

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ABN: 98094384273

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**2021 Annual General Meeting (25/05/2021)**
**Vote Totals - Based on the first resolution**

Securities On Issue	28,898,863
Valid Securities Voted - (For, Against, Open Usable, Open Conditional)	9,344,921
Valid Securities Voted (%)	32.58
Total Securityholders Cast	97

**Vote Details**

Resolution	Vote type	Voted	%	% of all securities
2, RE-ELECT MR IAN DENNIS	For	9,250,823	98.99	32.23
	Against	4,900	0.05	0.02
	Open-Usable	89,198	0.96	0.31
	Board	88,698	0.95	0.31
	Non-Board	500	0.01	0.00
	Open-Cond	0	0.00	0.00
	Open Unusable	0	N/A	0.00
	Abstain	0	N/A	0.00
	Excluded	0	N/A	0.00
	3, REMUNERATION REPORT	For	3,371,709	96.95
Against		16,868	0.49	0.06
Open-Usable		89,198	2.56	0.31
Board		88,698	2.55	0.31
Non-Board		500	0.01	0.00
Open-Cond		0	0.00	0.00
Open Unusable		0	N/A	0.00
Abstain		1,830	N/A	0.01
Excluded		5,865,316	N/A	20.44

**Source of Vote**

	Keyed	Scanned	Intermediary Online	Proximity	InvestorVote Desktop	InvestorVote Mobile	Other
Votes	6,480,754	104,801	0	0	2,808,459	152,907	0
Securityholders	14	19	0	0	49	15	0

## AUDIO PIXELS HOLDINGS LIMITED

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**FOR**

A direction to the proxyholder to vote 'For' the resolution.

**AGAINST**

A direction to the proxyholder to vote 'Against' the resolution.

**OPEN – USABLE**

Undirected votes given to a proxyholder to vote as the proxyholder thinks fit.

**OPEN – CONDITIONAL**

The Open-Conditional votes may eventuate from one of the following situations:

*Situation 1* - Open votes given by a securityholder, to a person who is subject to the Voting Exclusion Statement under ASX Listing Rule 14.11 or an Associate of that person, as their proxy; or

*Situation 2* - Open votes given by a securityholder, who is subject to the Voting Exclusion Statement under ASX Listing Rule 14.11 or an Associate of that person, to a proxy who is not subject to the voting exclusion.

The "Condition" recognises that the company will disregard any votes cast in favour by the appointed proxy.

**OPEN – UNUSABLE**

No votes will be classified to this category as the voting intention is now obsolete.

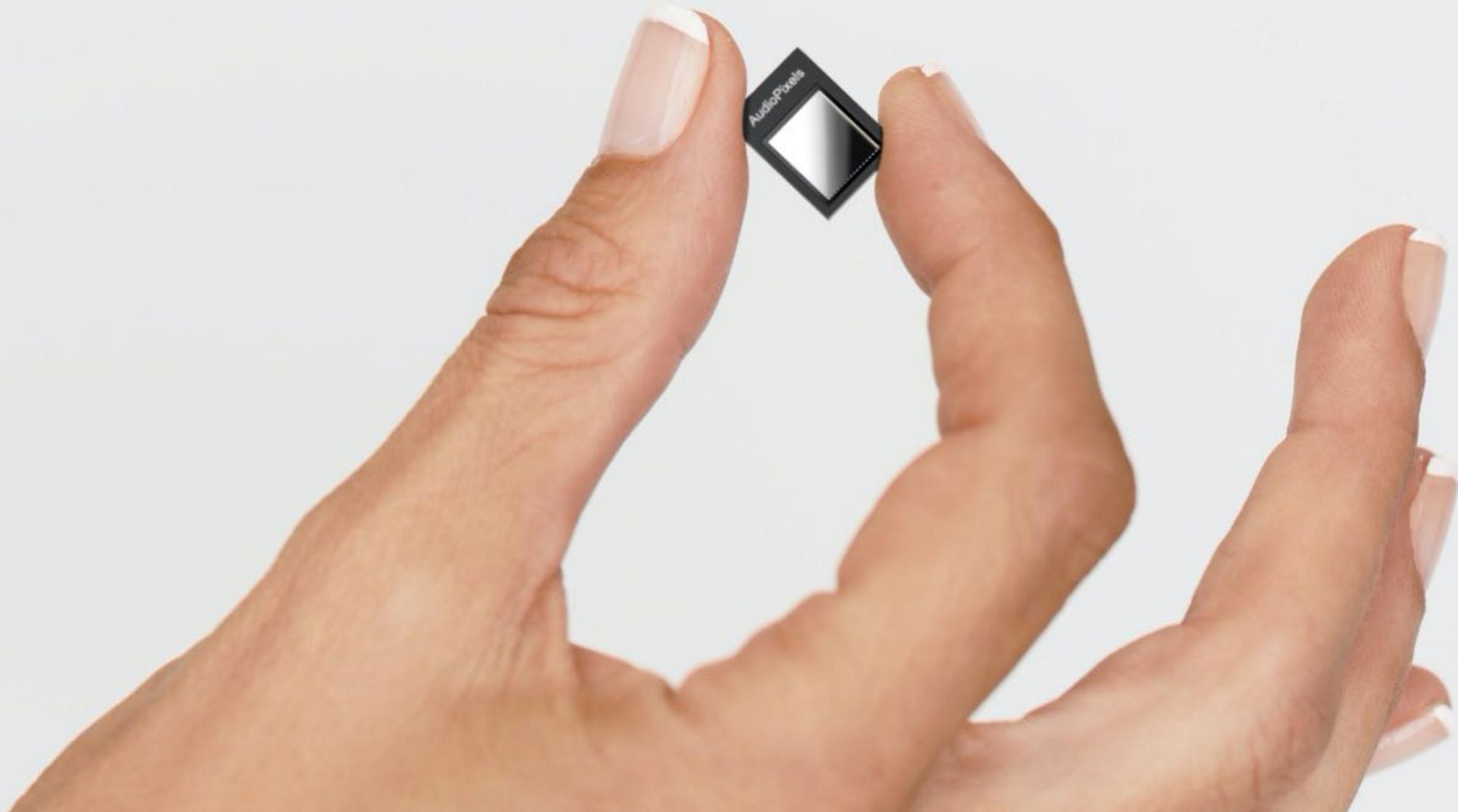
**ABSTAIN**

A direction to the proxyholder to abstain from voting on the resolution. These votes will not be counted in computing the required majority on a poll.

**EXCLUDED**

Votes of a securityholder who has appointed a proxy and the securityholder and proxyholder are prohibited from voting on a resolution due to a Voting Exclusion.

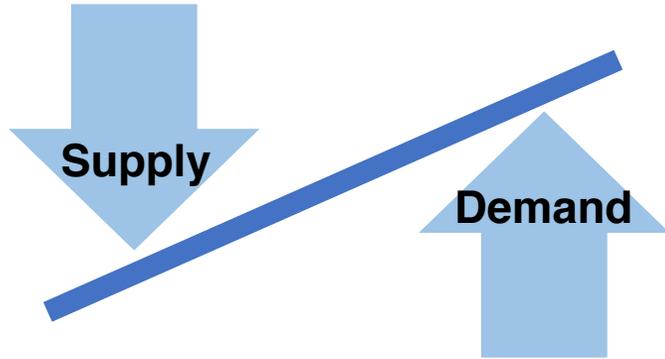
On-pace to begin Production in Q4-21



# Impact of Global Pandemic

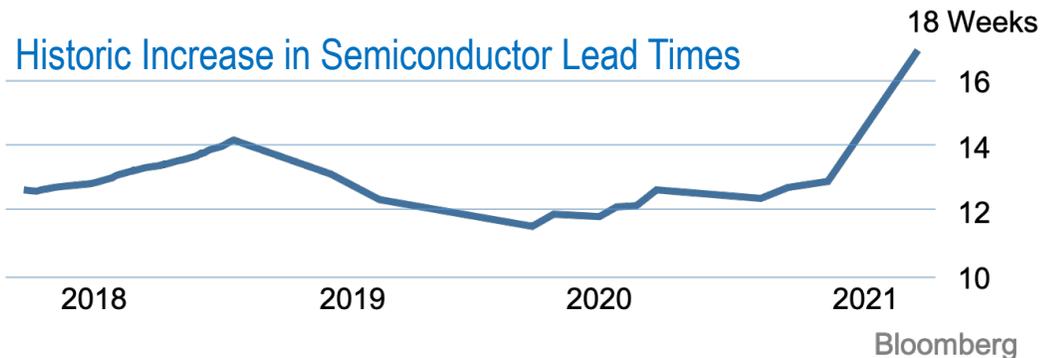
## unprecedented challenges

Lockdowns, Reduced Shift Sizes,  
Unpredictability, Trade Disputes



Tremendous growth in  
consumption in multiple  
industries

Conglomerates such as Ford, GM, BMW Jaguar, Volkswagen LG, Samsung, Sony, Apple, Nvidia, Qualcomm and many others have announced that they are idling factories and/ or limit production **for lack of essential components.**



Delays are even worse for smaller manufacturers, (major headphone maker reported a 52 week lead-time)

Susquehanna Financial Group

# Impact on AudioPixels

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## unprecedented challenges

- **Manageable** impact on product commercialization program - as our current MEMS and ASIC activities do not (yet) necessitate mass fabrication lines and resources
- **Significant** impact on specific milestones (such as chip packaging and demonstration systems) that require “commodity” type services and components (such as chip packaging, supply of PCB substrates, electronic components, connectors, etc...)

# Wafer Fabrication Cycle Time



Through simplification of the structure and streamlining of the fabrication process, our wafer production time have shortened considerably over the past years.

# Impact on AudioPixels

## opportunities

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We used the situation opportunity to improve and enhance systems and capabilities

### **Technical development**

- Multiphysics simulations
- Improved acoustic performance
- Customer Interface for system configuration and directivity patterns
- Package
- ASIC – gen 2
- Develop multi-chip evaluation and demo systems
- Enhancing measurements systems with Machine-Learning and Artificial Intelligence

### **Logistical development**

- Secure mass fabrication capacity
- Expand chip Packaging capabilities

# Multi-physics simulations capabilities - 2020

Physics	Pixel	MEMS chip	ASIC chip	Packaged chip	System (multi-chip)
Solid mechanics	✓	✓		✓	
Electrostatic	✓	✓			
Electric currents		✓	✓		
Thermal			✓		
Acoustic	✗	✓		✗	✓
Fluid dynamics	✗			✗	
Thermo-viscous	✗				
Fully coupled	✗			✗	

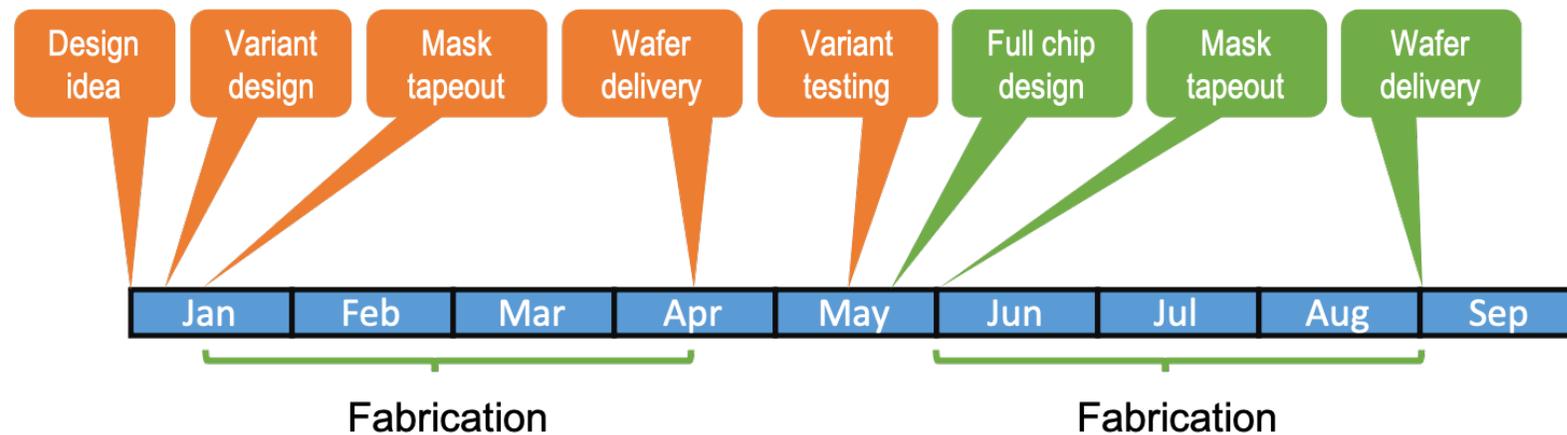
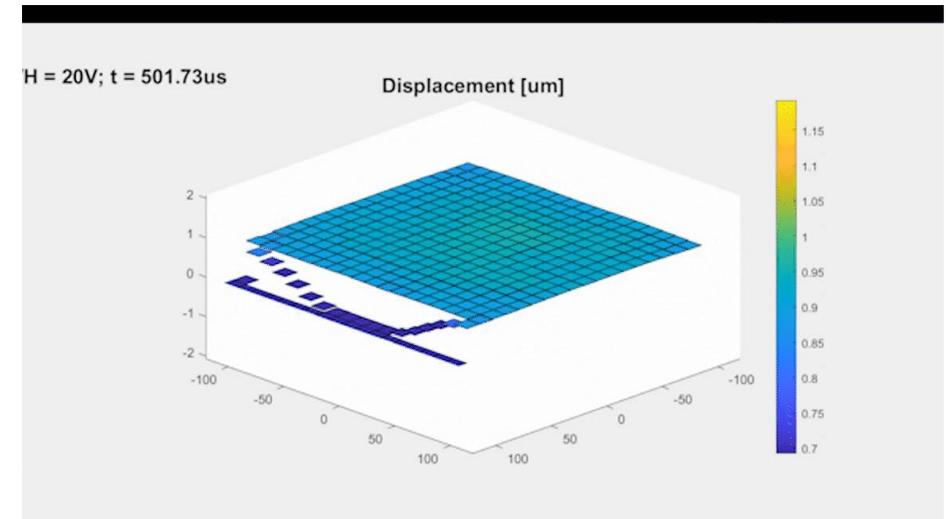
## Multi-physics simulations capabilities - 2021

Physics	Pixel	MEMS chip	ASIC chip	Packaged chip	System (multi-chip)
Solid mechanics	✓	✓		✓	
Electrostatic	✓	✓			
Electric currents		✓	✓		
Thermal			✓		
Acoustic	✓	✓		✓	✓
Fluid dynamics	✓			✓	
Thermo-viscous	✓				
Fully coupled	✓			✓	

# Significance of simulation capabilities

## Before

- Development relied heavily on physical experimentation.
- Required designing multiple geometrical variants.
  - Limited number of tested variables.
  - Limited range.
  - Limited resolution.
- Designing masks.
- Fabrication of multiple wafers.
- In some cases more than one iteration was required
- Testing of all variants on all wafers.
- Selection of best variant.
- Fabricating full chips using selected variant.

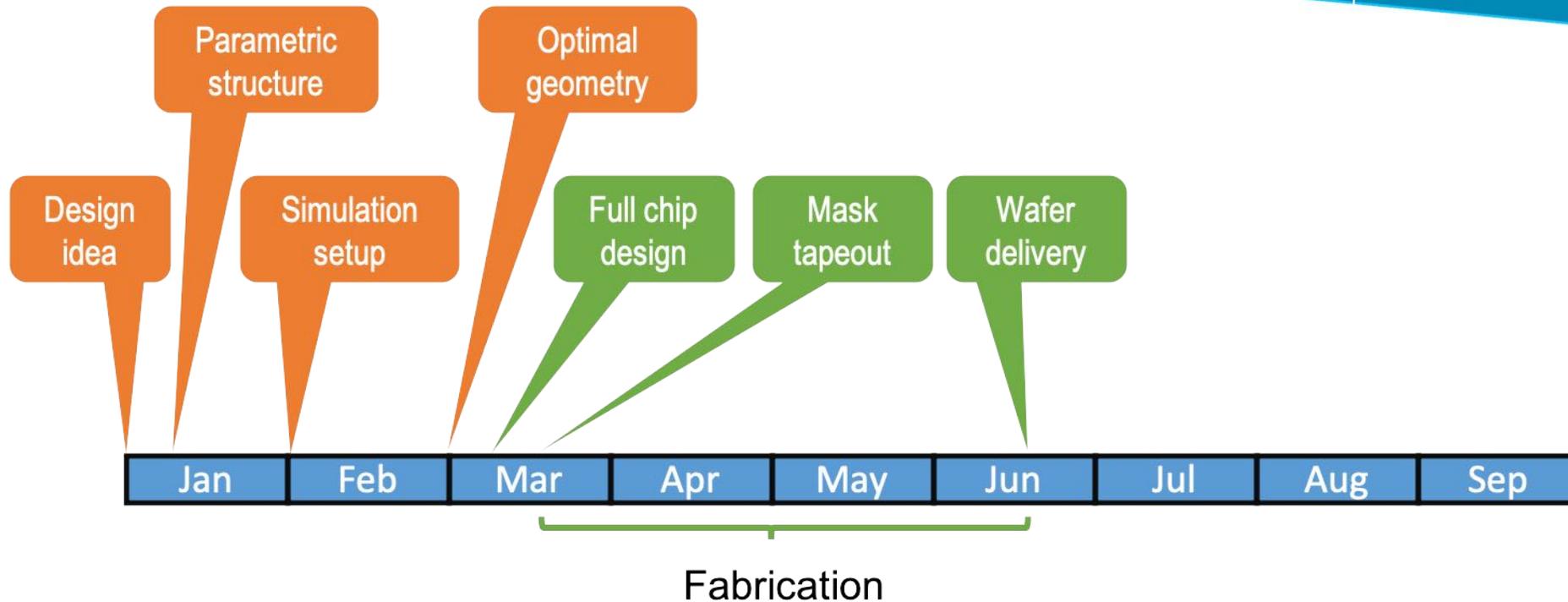
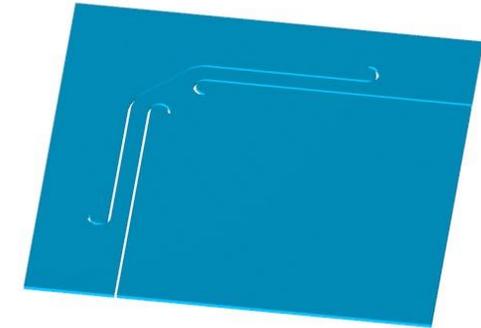


# Significance of simulation capabilities

## Today

- Designing “parametric” structure (once).
- Setting up simulation (once).
- Simulation iterations (1-2 configurations per day).
- Not wasting design and fabrication time on “dead ends”.
- Optimization of multiple parameters together.
- Fabricating full chips using selected variant.

Time=0 s  
Volume: solid.dip+batch\_distance\_bottom (um)



# Acoustic improvements

## 2019-Q4 - High density 1K array, commercial process

- Sound from full structure array.
- First tests of simplified structure.

## 2020 – High Quality Sound

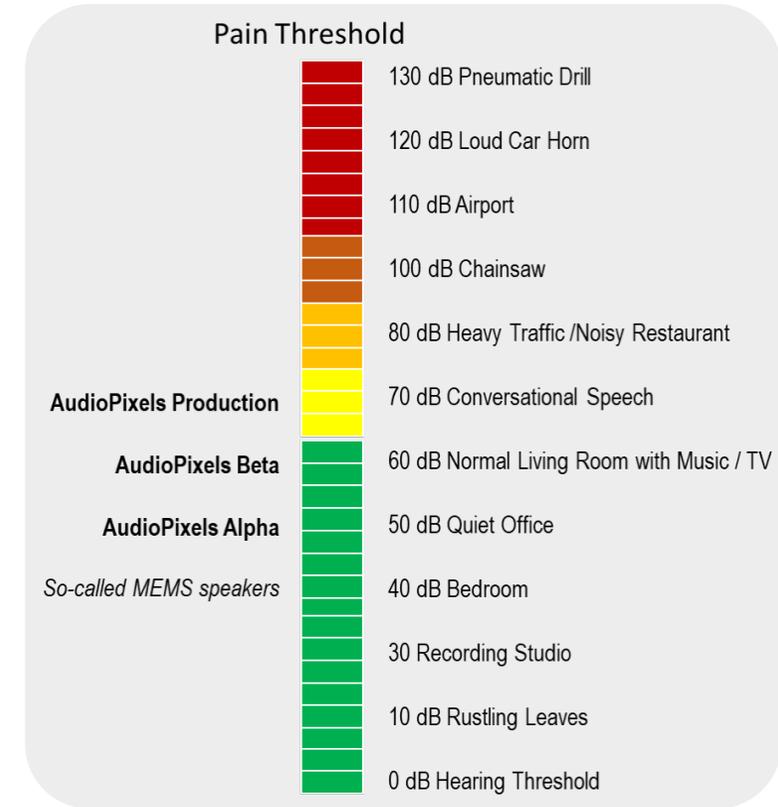
- Music playback – simplified structure.
- Demonstrated low frequencies (down to 100Hz) and sound quality.
- SPL <50dB @ 1m (SPL= Sound Pressure Level – “loudness”).

## 2021-Q1-2 – Improved Acoustic Performance

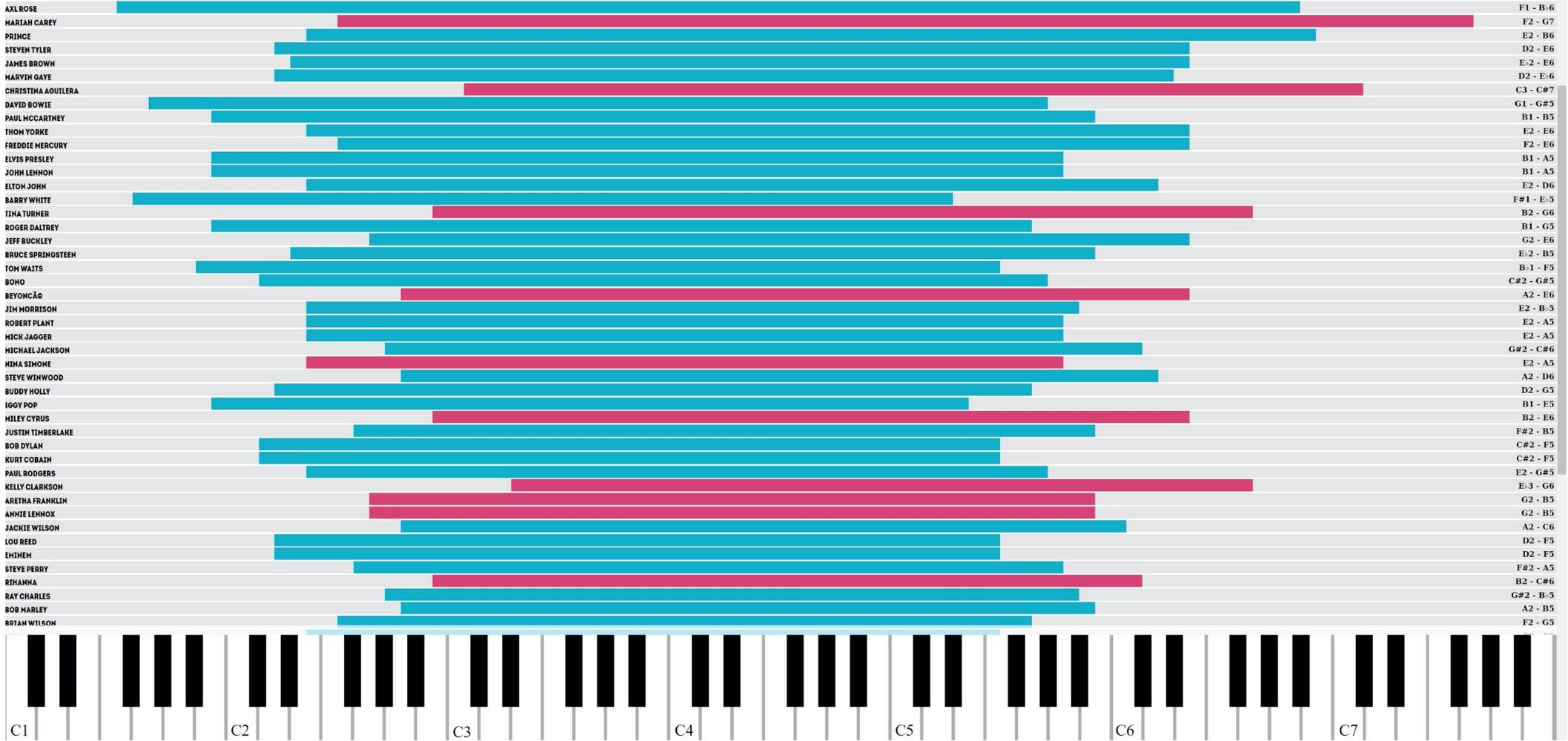
- 5dB SPL boost.
- Packaged chip plays out of the clean room.
- Multiple chips – 4 chips play together. 80 chips later this year.

## 2021-Q3-4 – Improved Acoustic Performance

- Optimization through simulation – currently SPL >70dB @ 1m (additional 10-15dB SPL)
- Product Fabrication later this year



# Why the frequency range is important



4 chips

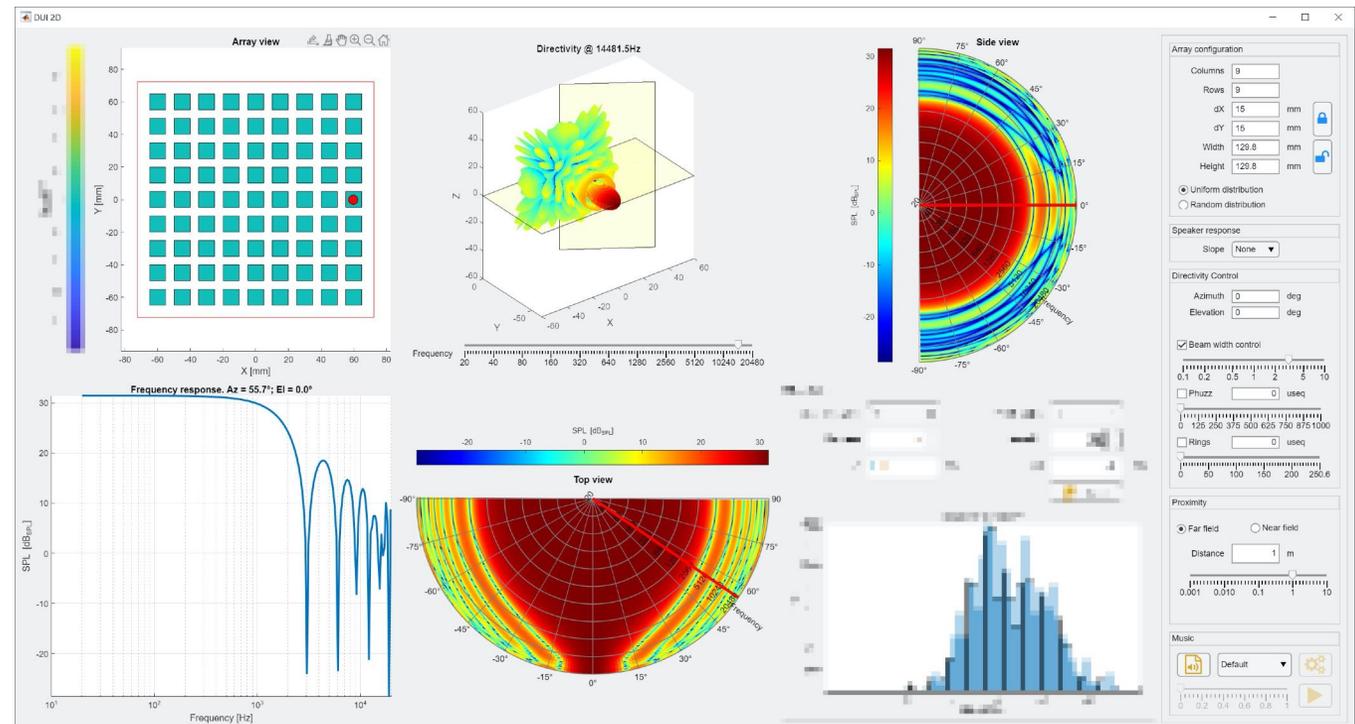
2 chips

Audio Pixels – 1 chip

Analog mobile phone speaker

# Customer Interface for system configuration and directivity patterns

- Simulates different system configurations (number of chips, layout etc.).
- Control beam direction and width.
- See and hear expected performance at any location around the speaker.
- Generate firmware parameters for the selected configuration.



# Package

## **2014 Qualification of packaging vendors**

- Begin development.

## **2018 Packaging POR (process of record)**

- Packaging dummy MEMS and ASICs.
- Passed visual and functional inspection (except music playback).

## **2020 “Pipe cleaning” run**

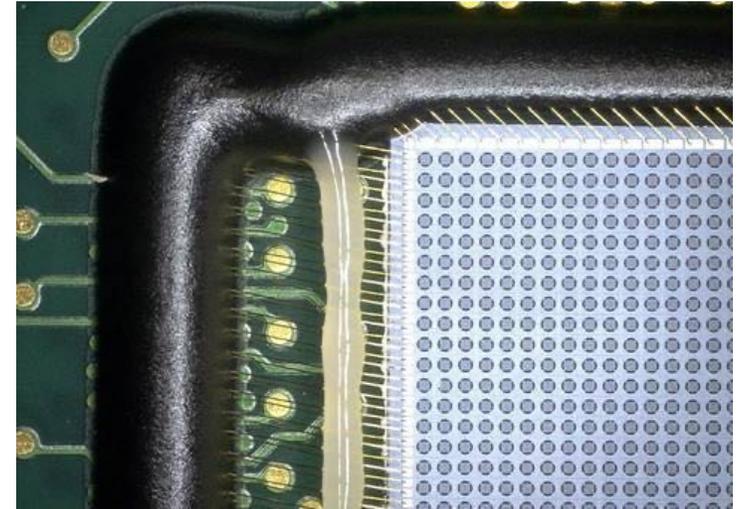
- Updating stocks and procedures.
- Preparing for packaging of functional MEMS and ASIC chips.
- Developing MEMS wafer dicing module.
- Heavy delays due to COVID lockdowns in Europe and US.

## **2021 Functional package**

- Adapting POR to manual process (using local vendor).
- Packaging functioning MEMS chips (of older generation).
- Optimization of acoustic lid (yield improvements, mechanical protection and cost reduction).
- First packaged chips received and tested. Some issues discovered.
- Improvements to POR and update of substrate PCB.

## Package - challenges

- The precision required to package our chip necessitates automation systems
- The nonstandard nature of MEMS requires customized tools materials and processes
- Our automated chip packaging systems took over 4 years to develop
- The impact of COVID necessitated finding an interim solution
- Transitioning to a manual packaging process introduces significant challenges and inaccuracies
- Vendor learning curve is steep, reject rate is still high, but we are making significant progress
- **Adjusted timeframe for Demonstration milestone remains the latter part of this fiscal quarter**



# High voltage ASIC

## 2013 - Selecting ASIC designer, fabricator and test-house

- Begin development

## 2016 - Gen 1 ASIC development completed

## 2020 - Gen 2 ASIC kickstart

- Support for the simplified structure.
- General usability improvements.
- Improvements of the interface with the host IC.
- Power improvements.
- Bug fixes.

## 2021 – ASIC development

- Design completed (tapeout Feb 1st).
- Chips have been received from FAB (May).

### Next steps:

- Bench-testing (vendor).
- Testing with MEMS (AP).
- Mass production (Q4).



# Develop multi-chip evaluation and demo systems

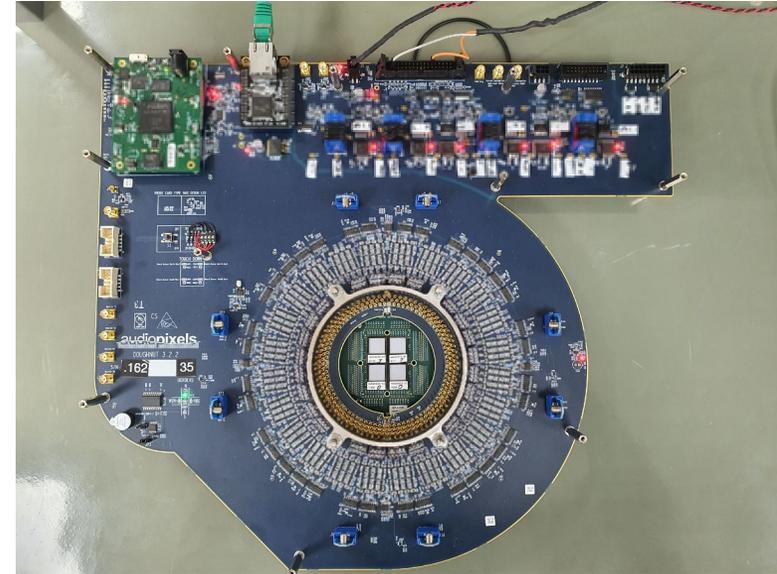
## 2020 Clean room demo

- Demo on wafer prober (in the clean room), using off-the-shelf high voltage electronics.
- Demo on wafer prober (in the clean room), using GEN1 ASIC.

## 2021 Out of the clean room demos

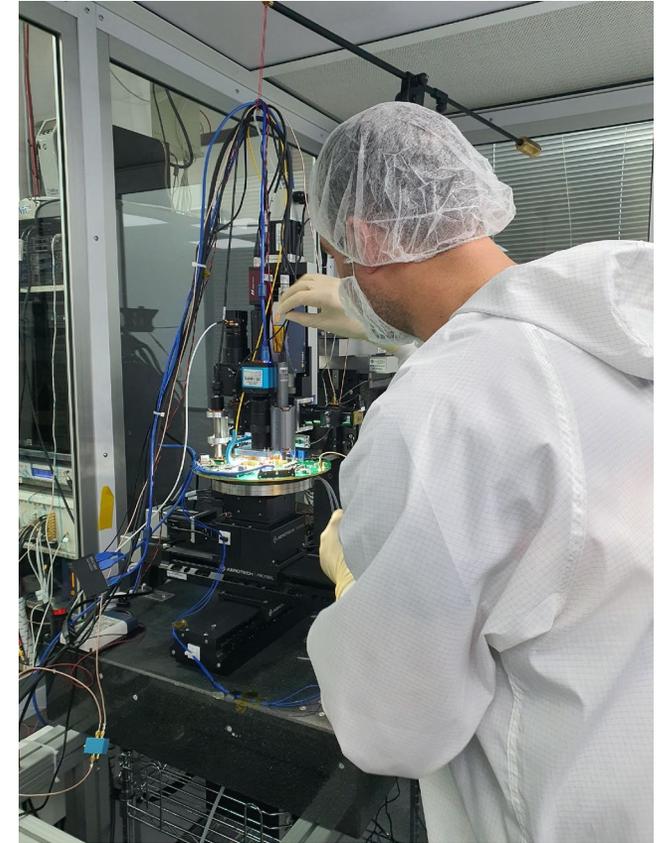
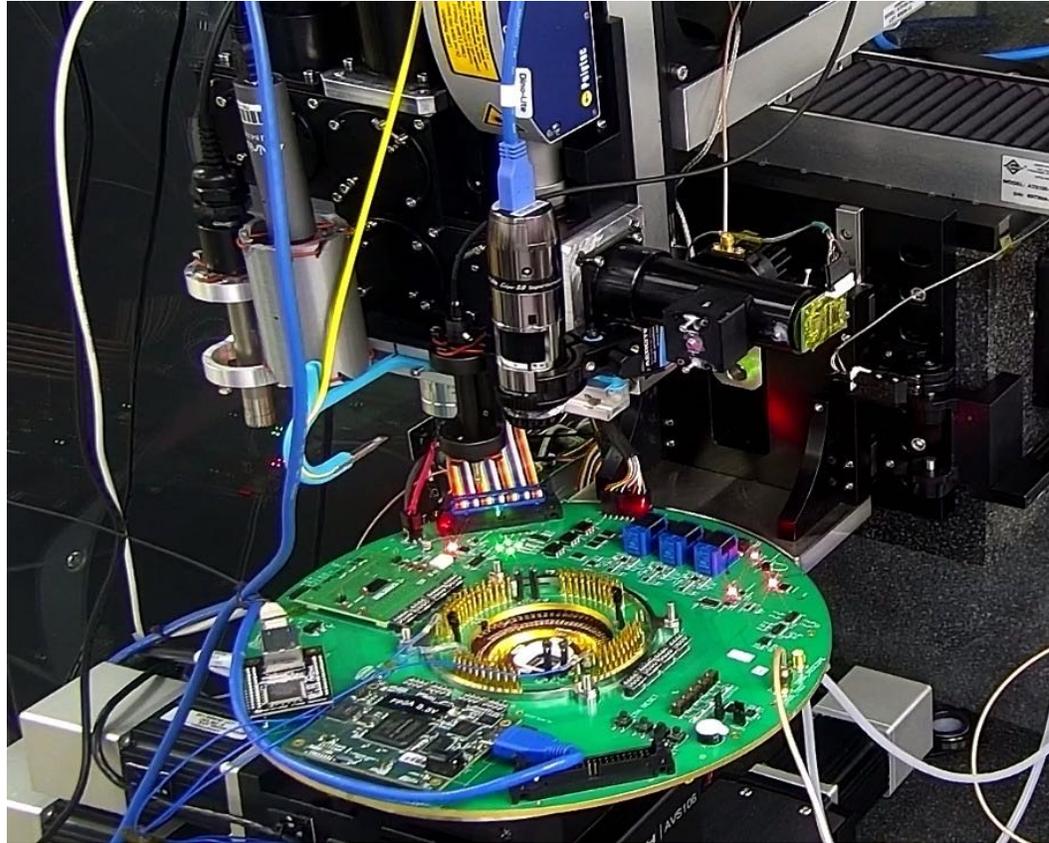
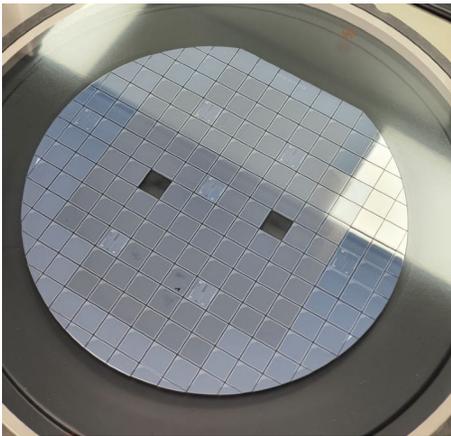
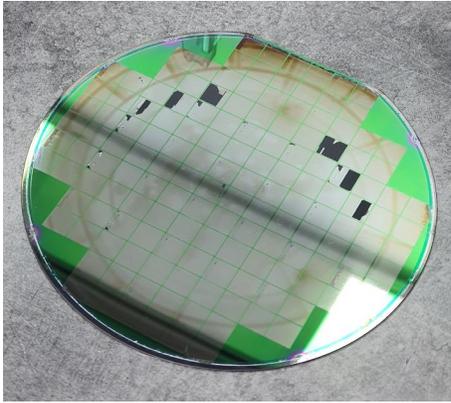
- Duplication of the prober electronics to demonstrate a single, packaged chip.
- 4\* chip evaluation board, based on prober electronics.
- 80\* chip evaluation board designed, delivered, assembled and tested. Minor rework required.
- Firmware developed for all evaluation boards.
  - Next steps:
    - Rev2 of 80 chip board to be ordered soon.
    - Assembly and testing

\* multi-chip boards can play music on any subset of chips (i.e. play on a single chip or chips that are close to one another or chips that are farther away).



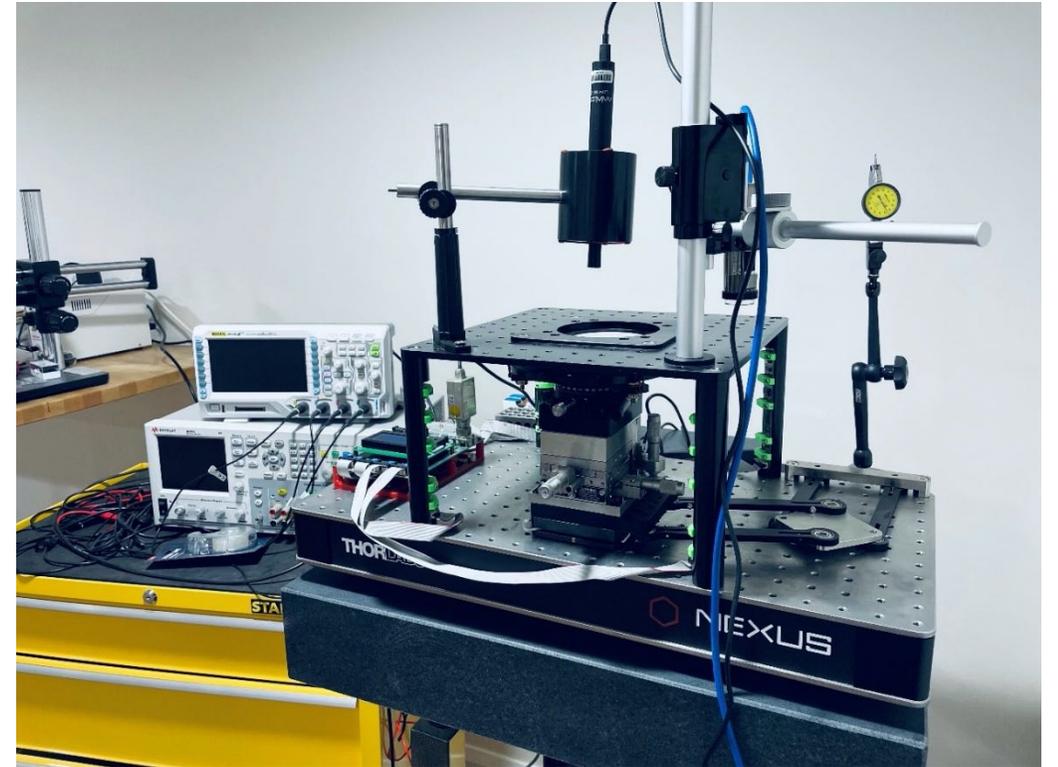
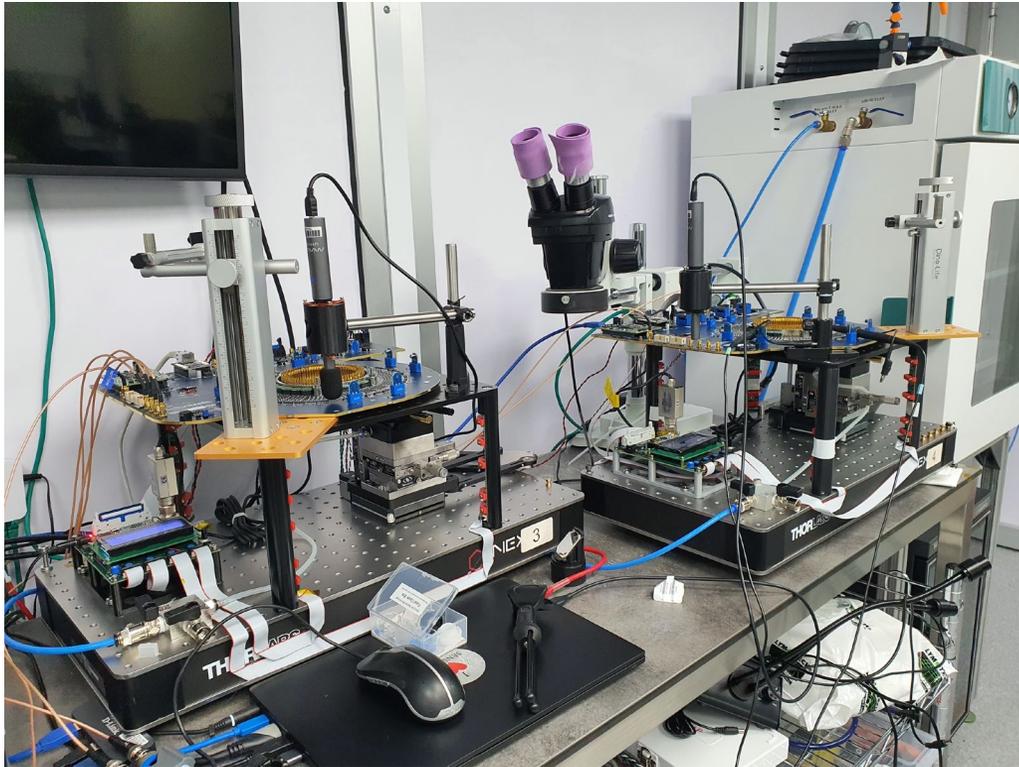
## Enhancing measurements capabilities - Automatic prober

- Performance of our wafer prober have been improved to allow probing of diced wafers.
- Developing machine-learning and artificial intelligence algorithms to allow fast and reliable alignment on individual chips.



## Enhancing measurements capabilities - Manual probers

- Development of low-cost manual probers to allow long term reliability tests.
- 5 units in service.





- The technology works and keeps getting better!!!
- On-pace to begin Chip Production in Q4-21
- Major advancements in our engineering capabilities

Questions?

