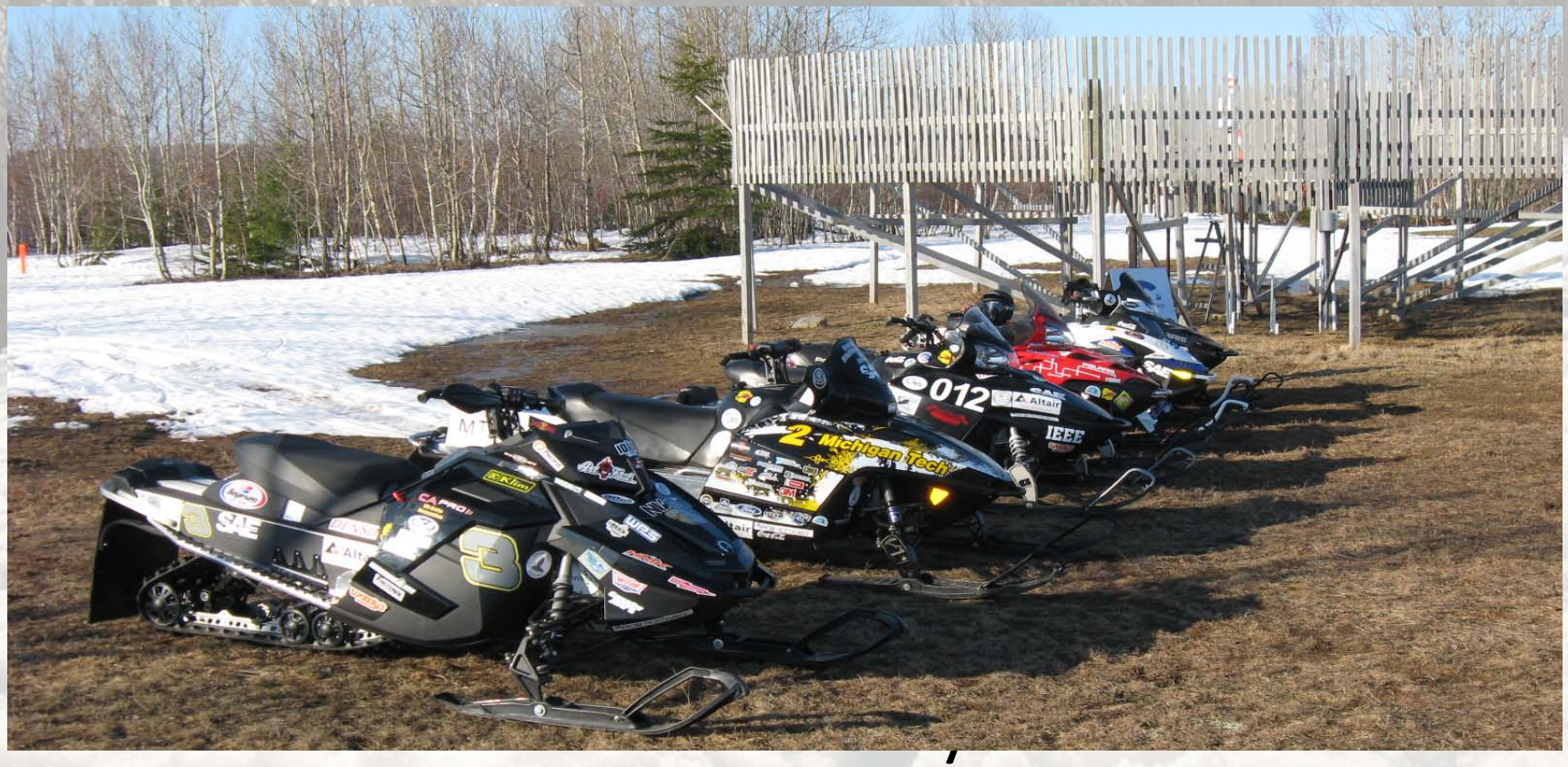
University of Idaho's Two Stroke Direct Injection Snowmobile



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UICSC Design Goals

- Meet NPS Noise emissions standards (73 dBA J192)
- Optimize Fuel Economy
- Maintain Stock Power
- Maintain Two-Stroke Riding Experience
- Deliver OEM Packaging
- Minimize Cost by Using Stock Skidoo Components and Low Cost Modifications.
- As industry produces lighter and more powerful snowmobiles, our modifications must not significantly decrease the rider experience to keep up with rider expectations.

UICSC History

UICSC Has Proven that Both Two and Four Stroke Snowmobiles Can Meet Competition Goals

Design Strategy

- Clean
  - E-Tec direct fuel injection
  - Flex fuel E20-E29
  - Electronic oiling
- Quiet
  - Reduce noise through sound insulation
  - Block off or re-route vents
- Rider Friendly
  - Light weight chassis
  - Factory fit and finish

Chassis and Engine

- Chassis
  - 2009 Ski-Doo MXZ REV-XP
    - Performance Oriented
    - Proven Rider Comfort
    - Improved Handling
- Engine
  - Rotax 593cc H.O. Two-Stroke
    - Carborated, Reed Valved, and Loop Scavenged
    - Variable Exhaust With Tuned Pipe
    - High Power-to-Weight Ratio

Engine Modifications

- Cylinder head
  - Improved combustion chamber geometry reduces emissions and improves efficiency
- E-Tec direct injection system
  - Reduces emissions
  - Improves fuel economy
  - No battery needed
- Exhaust valves
  - Converted to RAVE 1 exhaust valves for mechanical simplicity

Chassis Modifications

- Sound deadening material
  - In body panels
  - On tunnel
- Baffles to redirect sound
- Thermally activated vents
- Inline fuel pump

Thermal Vent Designs

Vents are triggered using a thermal switch normally used for an automotive auxiliary fan .

Push type solenoids were used to actuate the vents.

Coherence Testing

General Equation

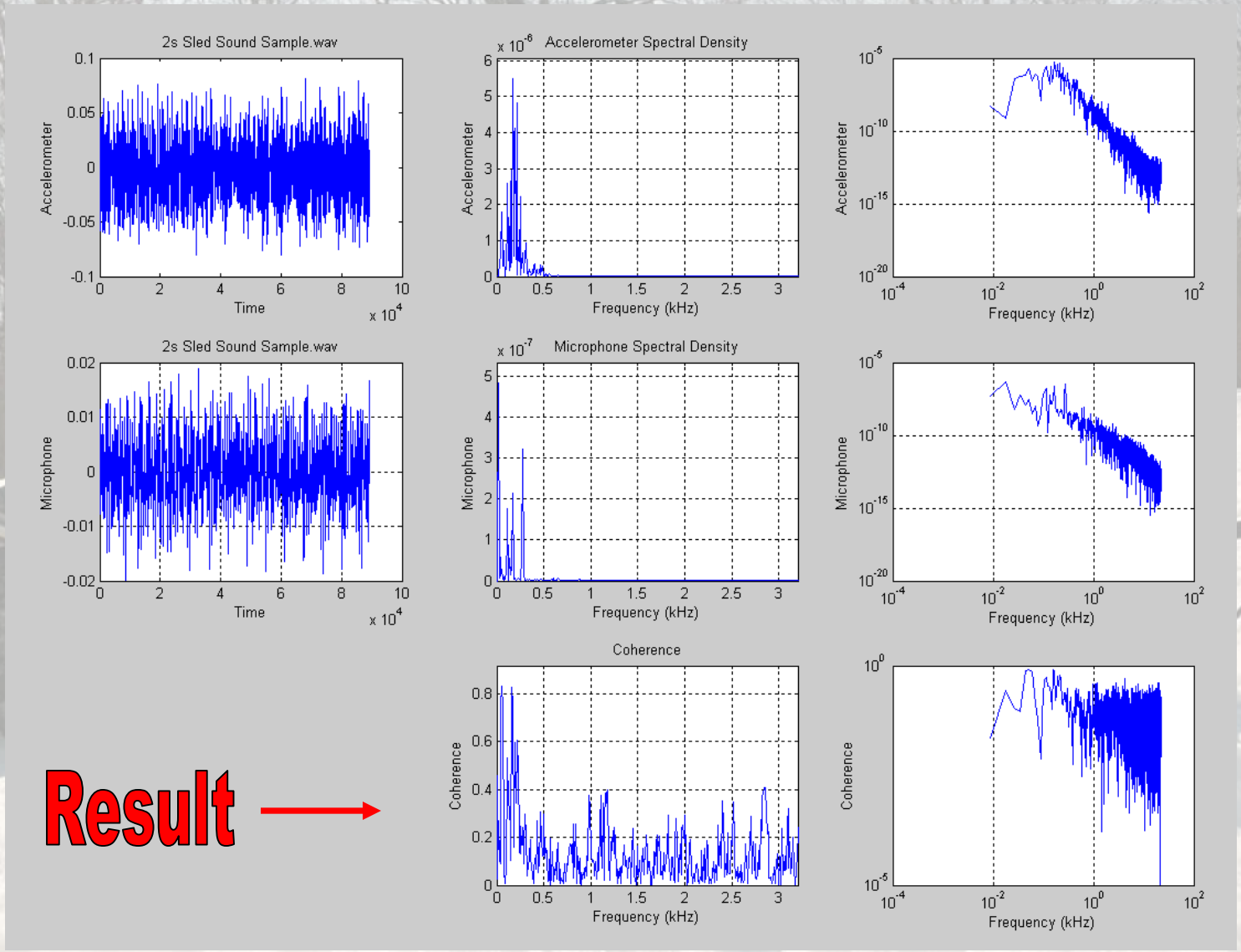
$$C_{xy} = \frac{|G_{xy}|^2}{G_{xx}G_{yy}}$$

Gxx and Gyy - Auto Spectral Densities

Gxy - Cross Spectral Density

Airfoil designed isolate the microphone and reduce turbulent noise

Coherence Testing Example Graphs



Coherence of side panel to overall sled microphone sound sample

Engine Tuning and Calibration

Borghi & Saveri Eddy Current Dyno with Superflow Controller

- Survivability
- Ridability
- Fuel Economy
- Power

Engine Calibration Strategy

- Started with existing calibration for E10
- Overall correction was calculated based on energy content of E25
- Fine tuned mode points and cruise
- Testing with both E20 and E29 showed that the E25 calibration was flexible enough for fuel range

Benefits for Dealers/Outfitters

- Clean and finished appearance
- Quiet and fuel efficient
- Low maintenance
- Factory rider experience
- Low cost

Summary

- Fun to ride
  - Light weight and agile
- Easy to maintain
  - Low oil and fuel consumption 19mpg (estimated)
  - Long spark plug life
  - No battery
- Affordable
  - Competitive price for today's market

Thank You

Questions?

MSRP Breakdown

- Base sled price $9699
- UICSC sled price $11800
- Major contributors
  - Ice ripper track $550*1.5=$850
    - Stock track $488
  - Skis $244*1.5=$366
    - Stock skis $125

Two Stroke Verses Four Stroke