

# Seismology in MTV

MTV Kickoff Meeting

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### Introduction and Motivation

Seismology is useful for

- Detecting earthquakes and explosions
- Locating earthquakes and explosions
- Discriminating between earthquakes and explosions
- Estimating the size of earthquakes and explosions



### Introduction and Motivation

Seismological monitoring and analysis is imperfect

- Many small seismic events are not detected
- Location uncertainties are routinely large (many km)
- Discrimination methods do not always work
- Seismological yield estimates disagree
- Understanding of elastic waves from UNEs is incomplete



#### **Mission Relevance**

Improved seismological capabilities will

- Enhance the ability to monitor nuclear testing
- Improve the characterization of underground nuclear tests
- Build confidence and trust in monitoring capabilities



# **Technical Work Plan**

Understanding the mb-MS discriminant

- Improved model for wave excitation
- Modern analysis of UNEs using legacy data
- Comparison with Source Physics Experiment





# **Technical Work Plan**

Improved discrimination of sources

- Data discovery in relevant geographical areas
- Application of spectral discriminants
- Tuned multiparameter discriminants

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Kim et al., 2018



## **Technical Work Plan**

Improved event detection and location

- Event cross-correlation for relative location
- Continuous correlation for detection
- Data mining in relevant geographical areas









#### **Expected Impact**

- Better physical understanding of mb-MS discriminant
- Improved characterization of historical UNEs using legacy data
- Enhanced methods of continuous event detection using modern correlation techniques
- Enhanced methods of event location and discrimination in selected geographical areas
- Characterization of seismicity near existing and possible nuclear test sites



## MTV Impact

- New and continued collaborations with LLNL, LANL, SNL
- Synergies with other technologies (infrasound, radioxenon)
- Training of students in monitoring seismology
- Engagement with national and international organizations concerned with improved global seismological monitoring
- Participation in efforts to preserve and utilize legacy seismological data for UNEs



#### Conclusion

The seismological research will

- Enhance the ability to monitor nuclear testing
- Improve the characterization of underground nuclear explosions
- Build confidence and trust in monitoring capabilities
- Engage and train young seismologists

The Columbia team: Göran Ekström, Paul Richards, Won-Young Kim, David Schaff, Jack Wilding (recent Columbia BA)



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Technology									























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