

# Downhole acceleration detection of poor drilling performance related to bit damage

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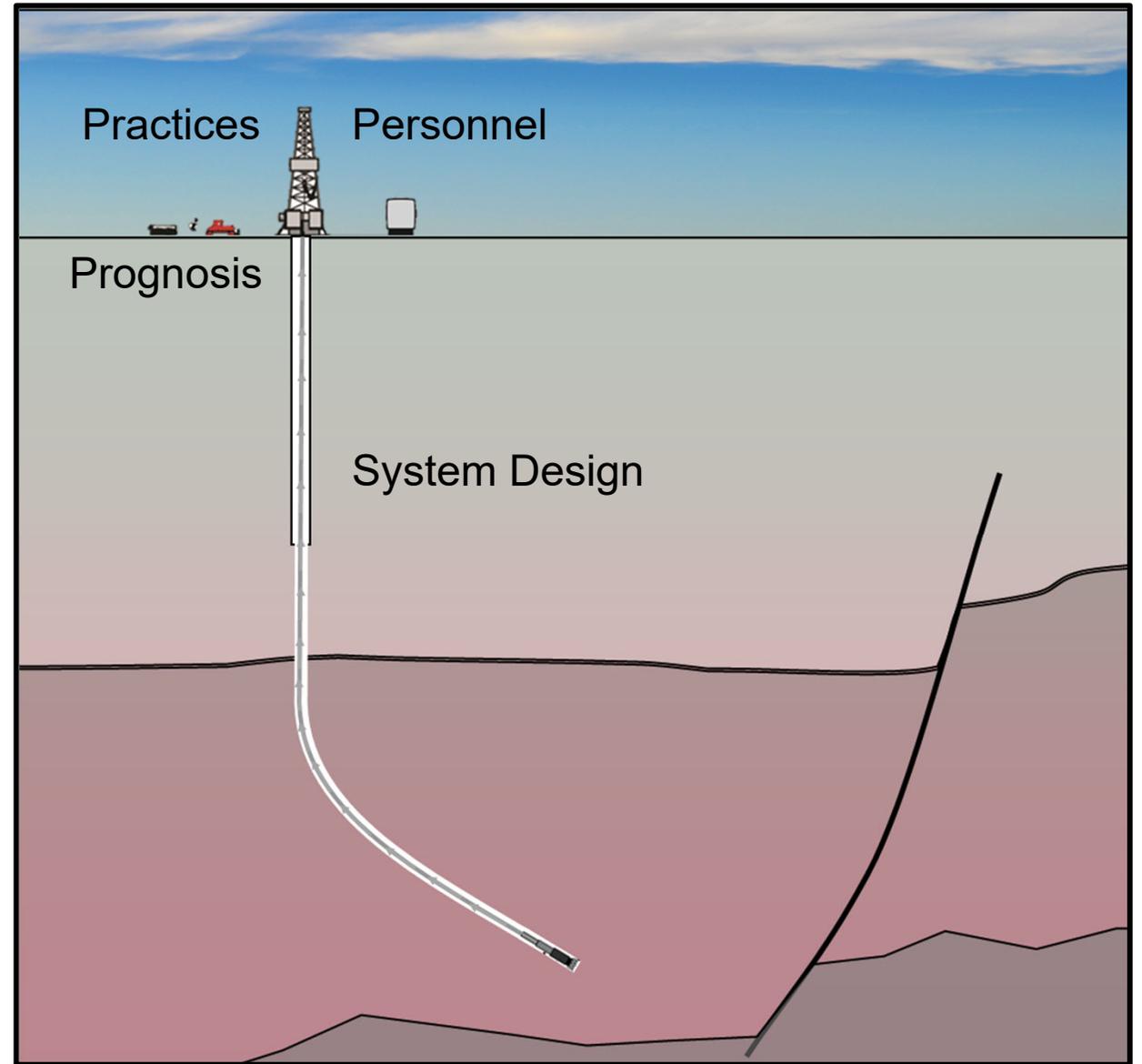


## Drilling Optimization

Drilling in the most efficient way possible; to meet all drilling objectives while minimizing overall drilling costs

## Optimization Stages

- Planning



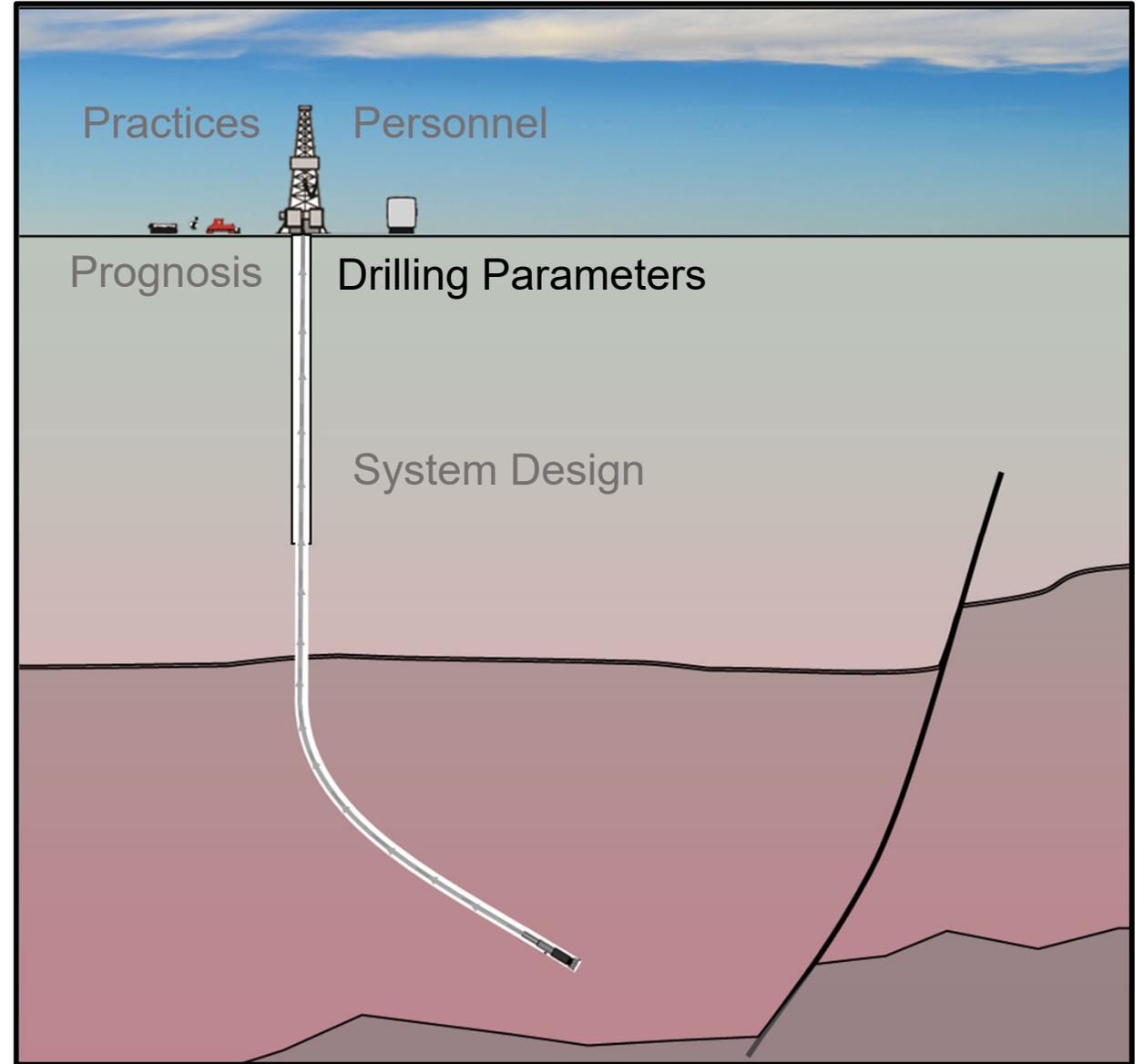


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## Optimization Stages

- Planning
- Rate of Penetration



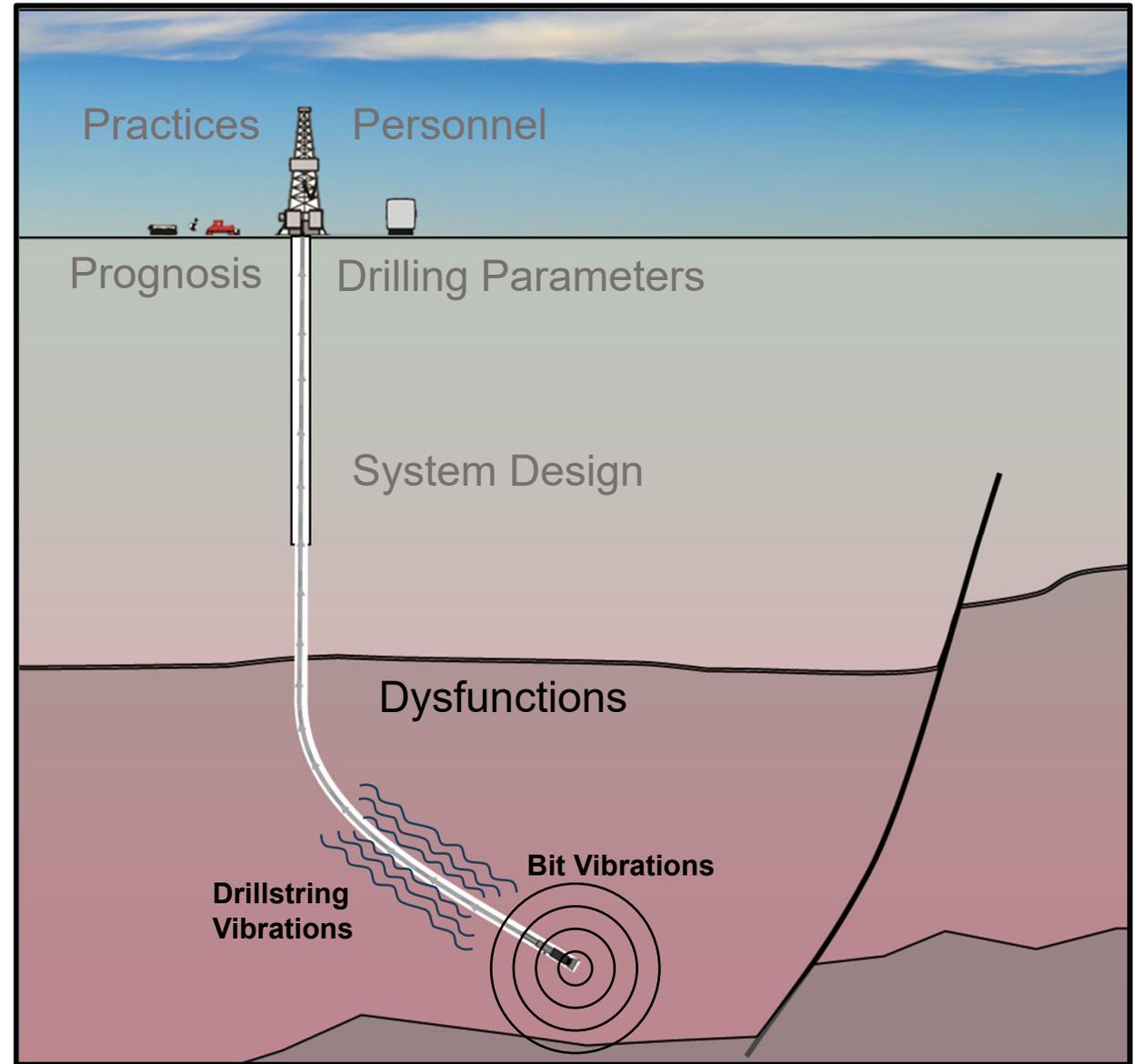


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## Optimization Stages

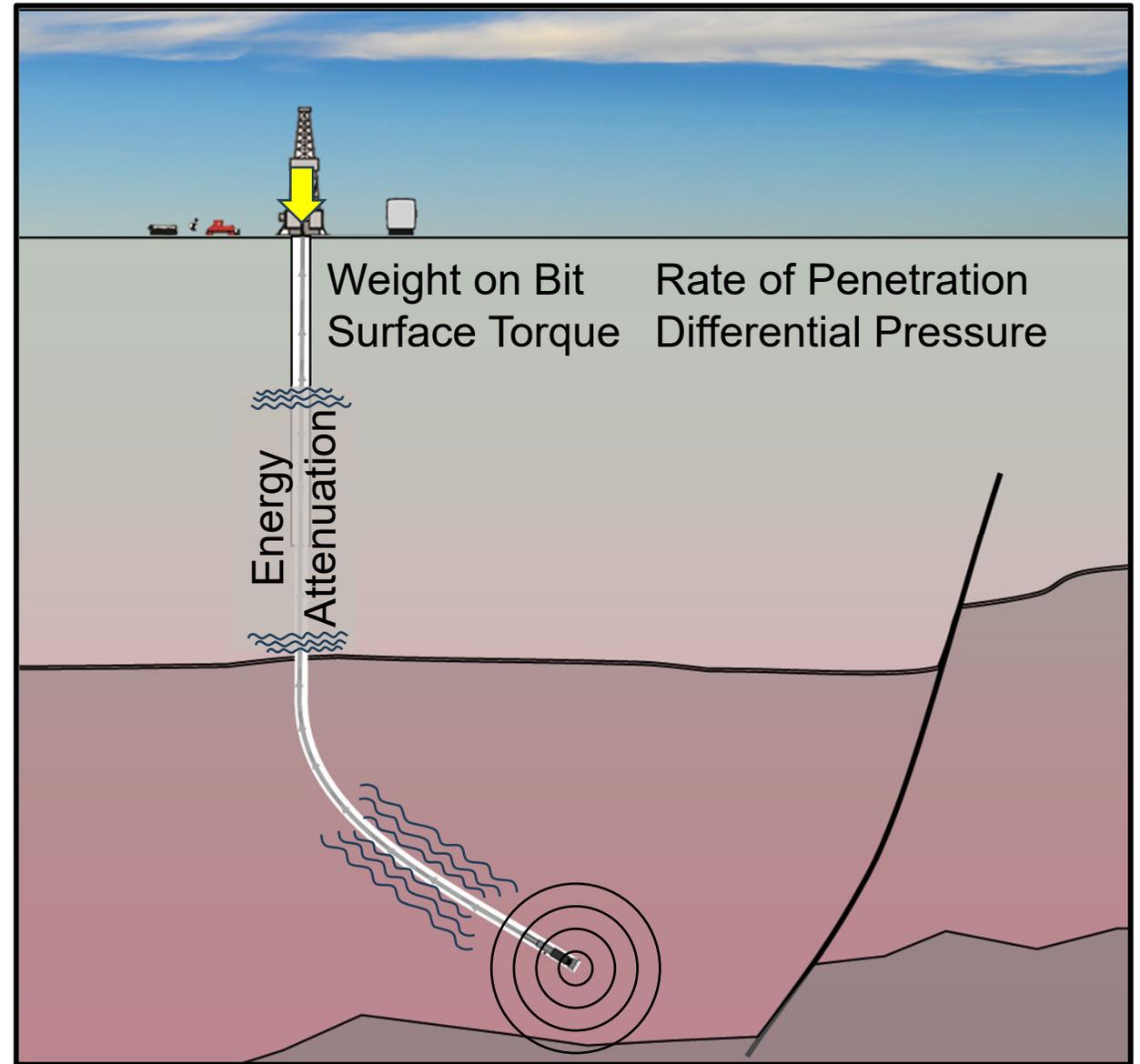
- Planning
- Rate of Penetration
- System Integrity





## Vibration Dysfunction Detection

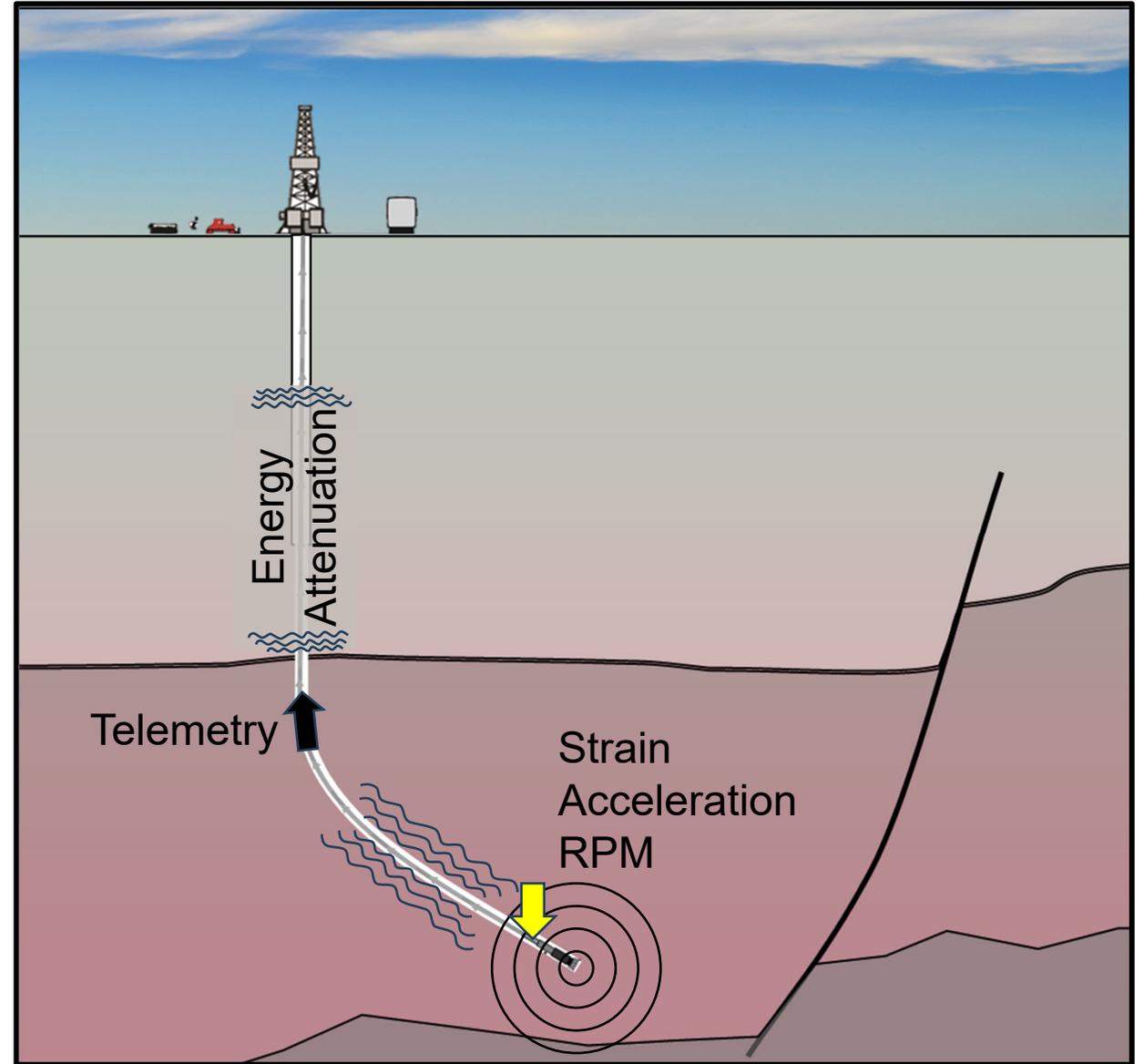
- Surface rig data
  - Sampled at 1-10 Hz
  - Model downhole dynamics
  - Accessible in real-time
  - Attenuation of energy along the drill string





## Vibration Dysfunction Detection

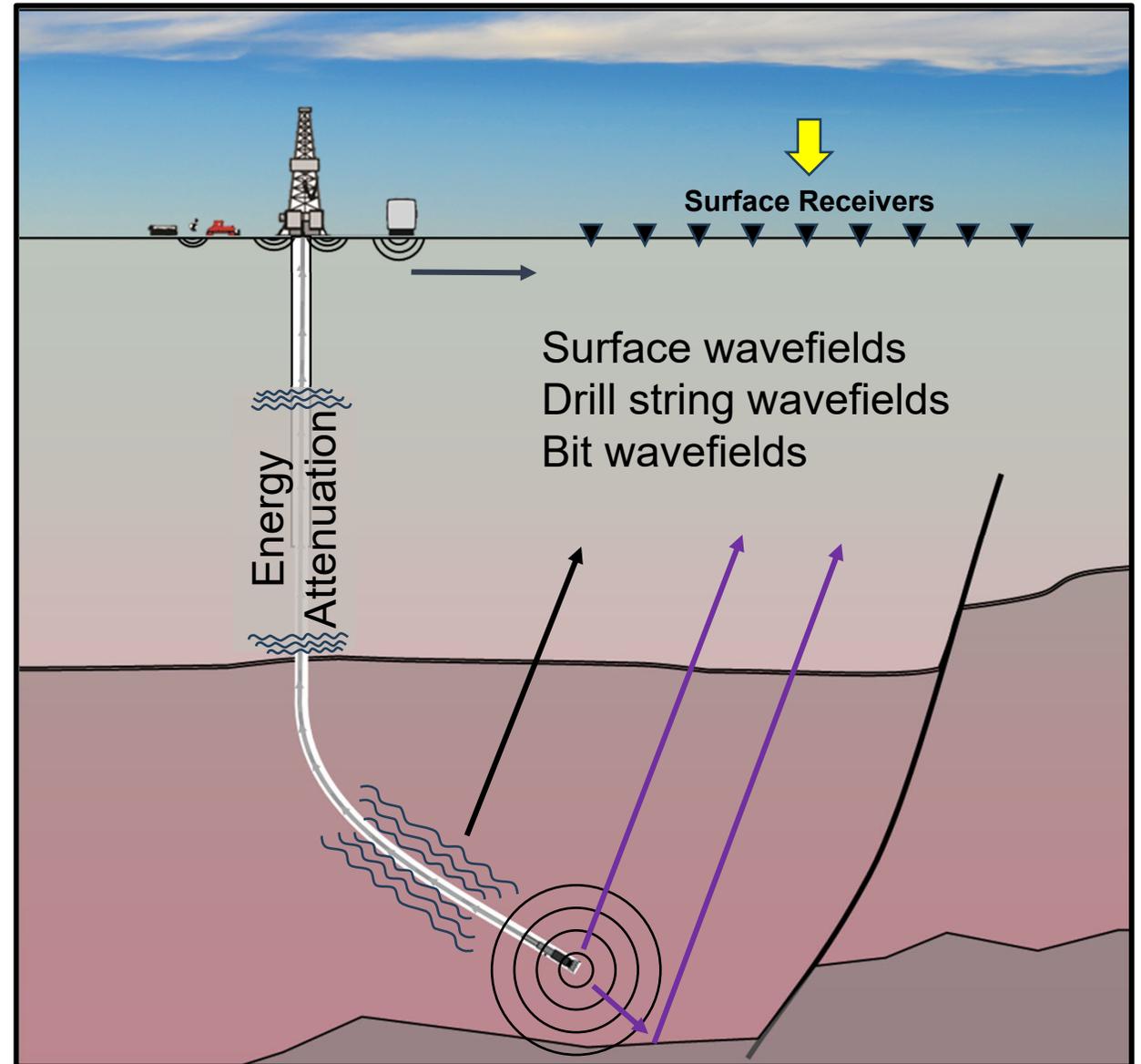
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  - Attenuation of energy along the drill string
- Downhole sensor data
  - Sampled at 10's to 1000's Hz
  - Measure the downhole dynamics
  - Telemetry required for real-time use
  - Memory for post-drill use
  - Sensor operating limits





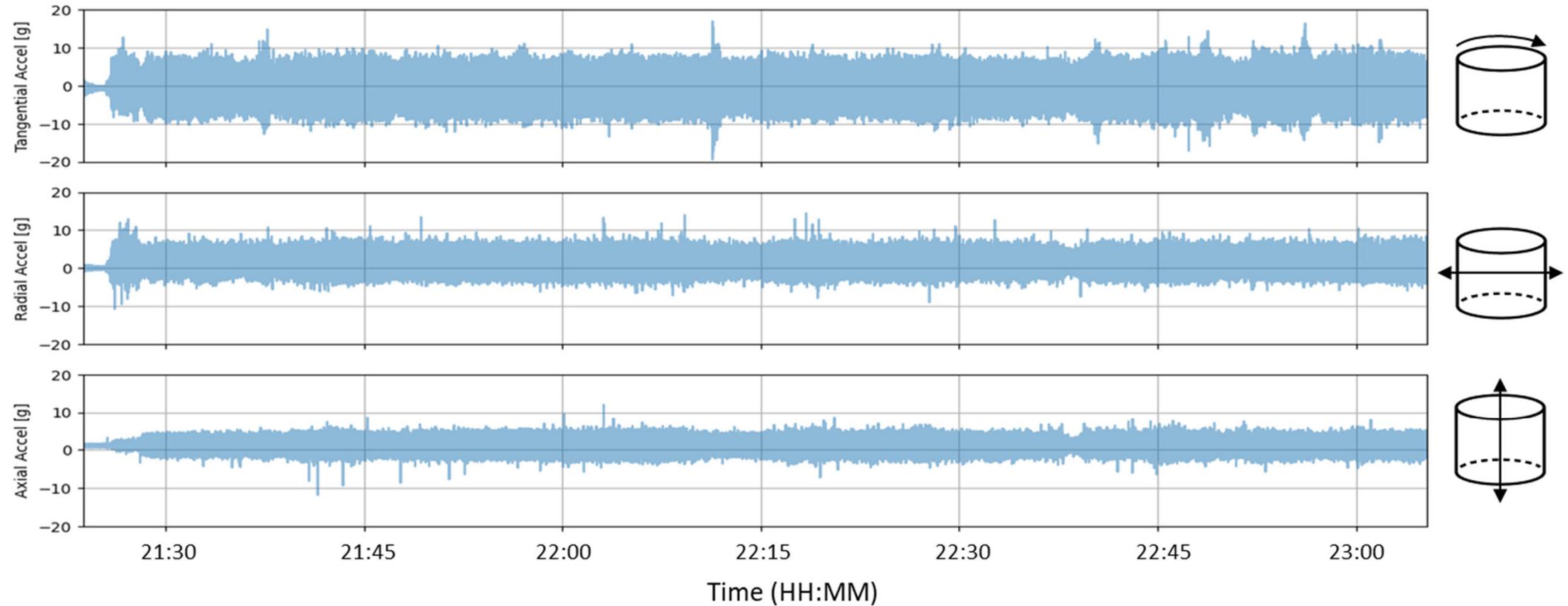
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- Bit source Seismic-While-Drilling
  - Sampled 100's Hz
  - Measures vibrations at the surface
  - Modelled sources, location, medium
  - Multiple wavefields generated wavefields
  - Bit wavefield attenuation at depth

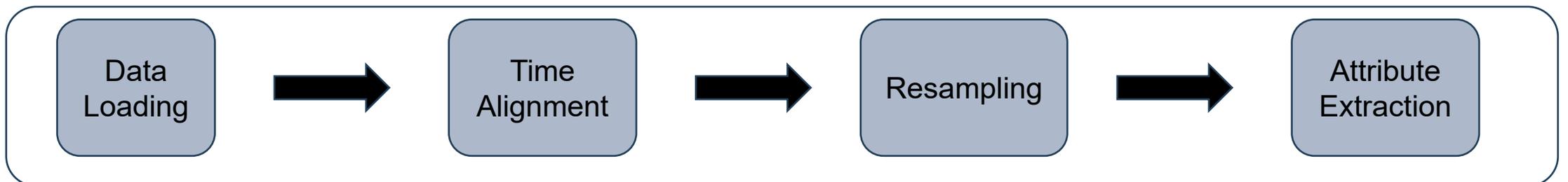




# Downhole Acceleration Preprocessing

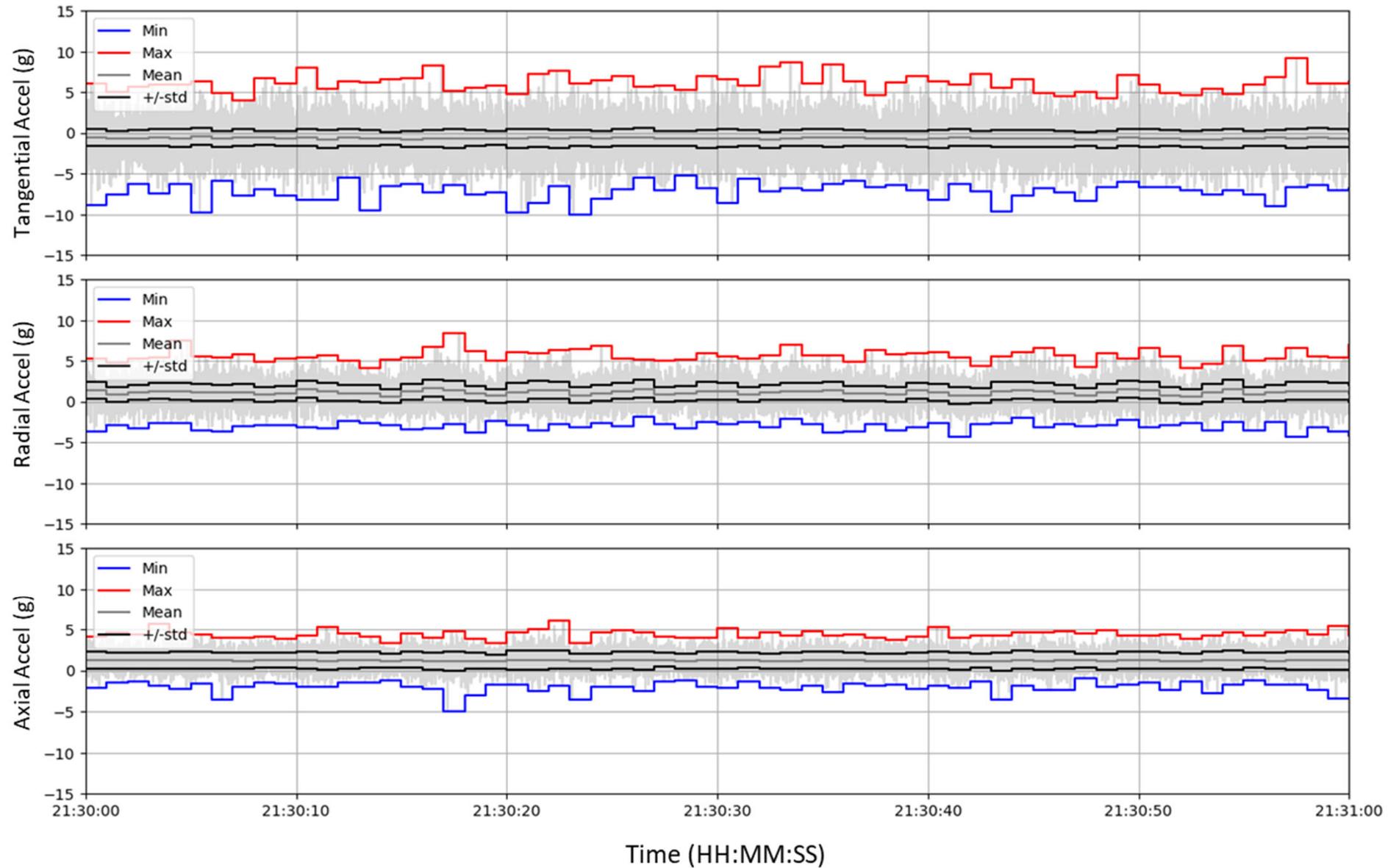


## Preprocessing Workflows



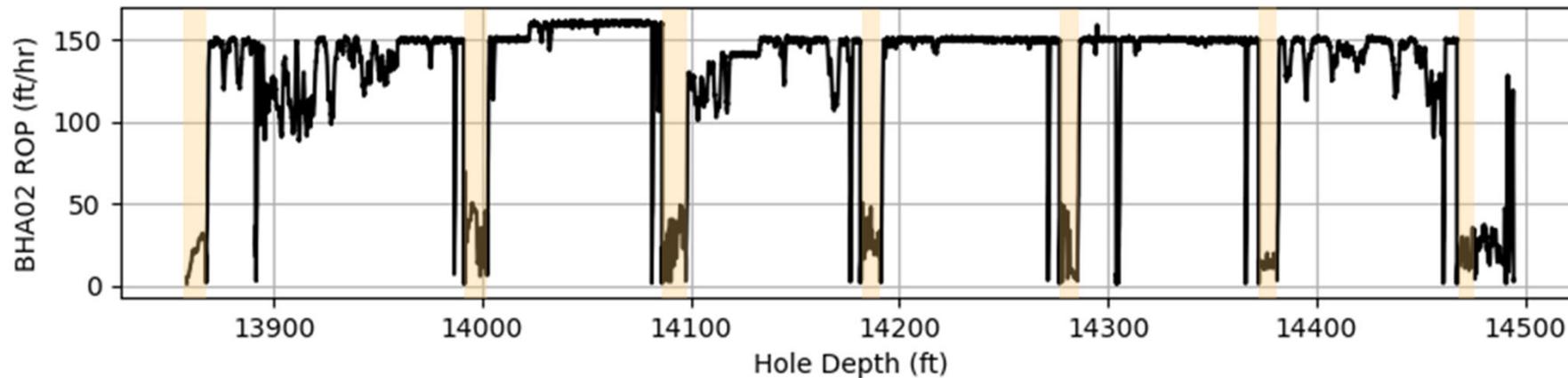
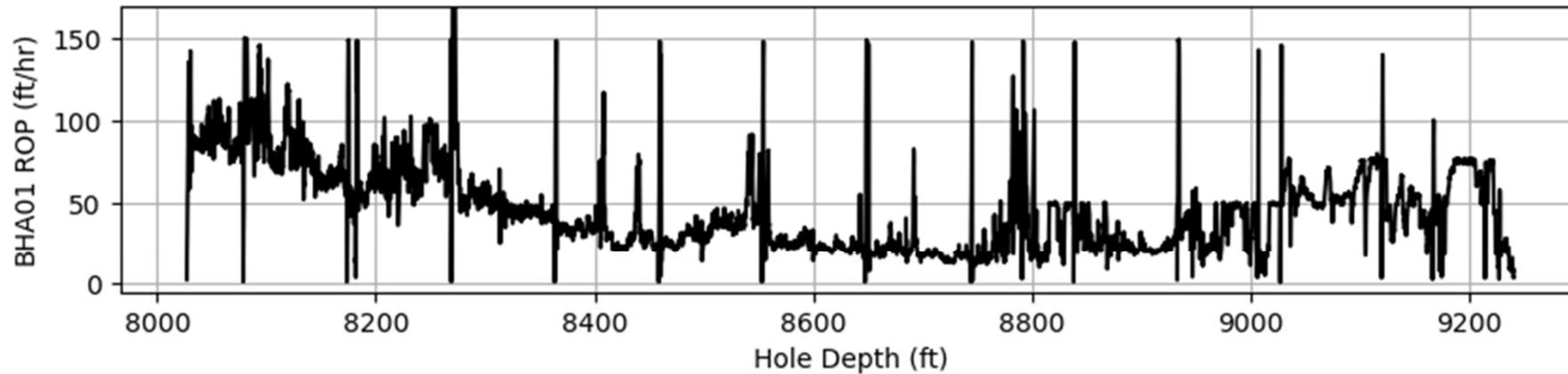


# Acceleration Time Amplitude Attributes





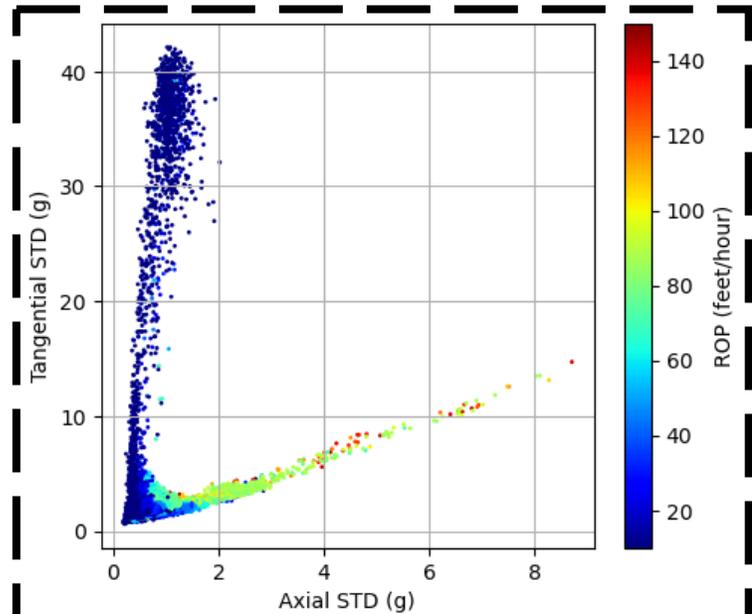
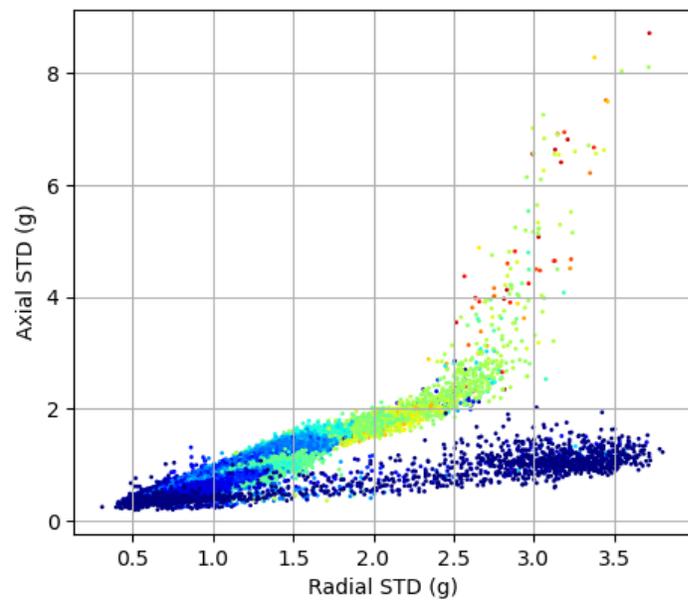
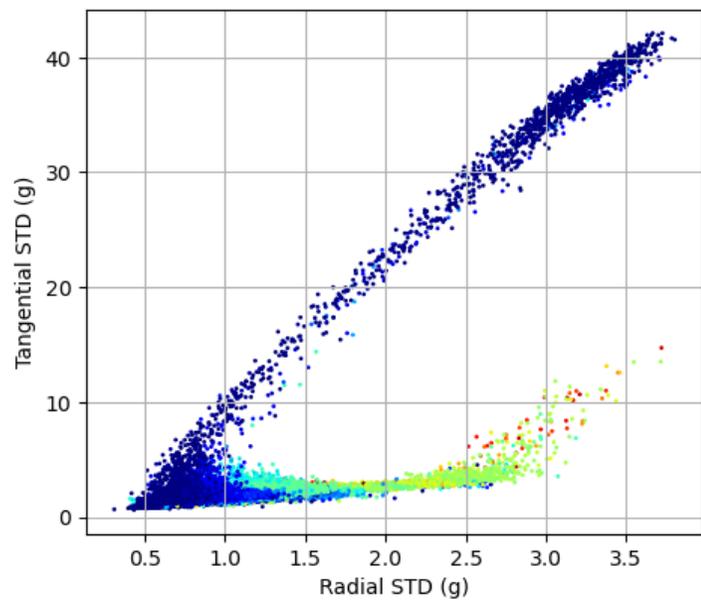
# Drilling Intervals



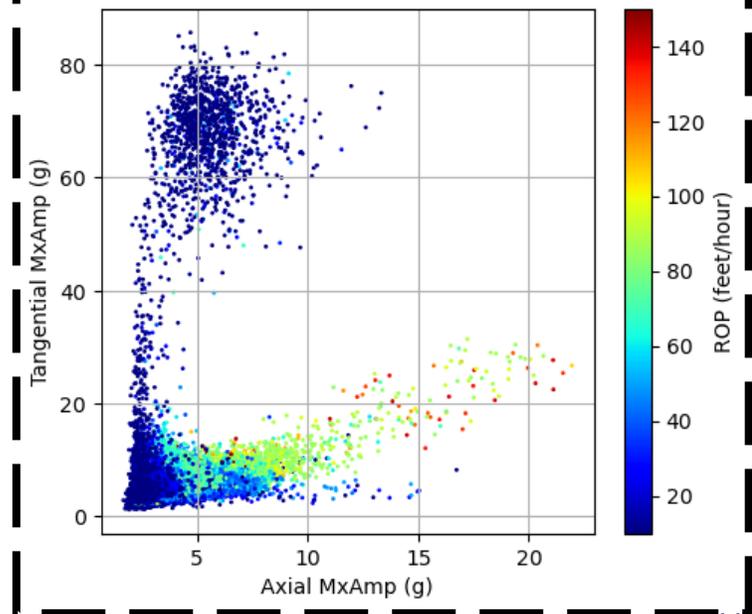
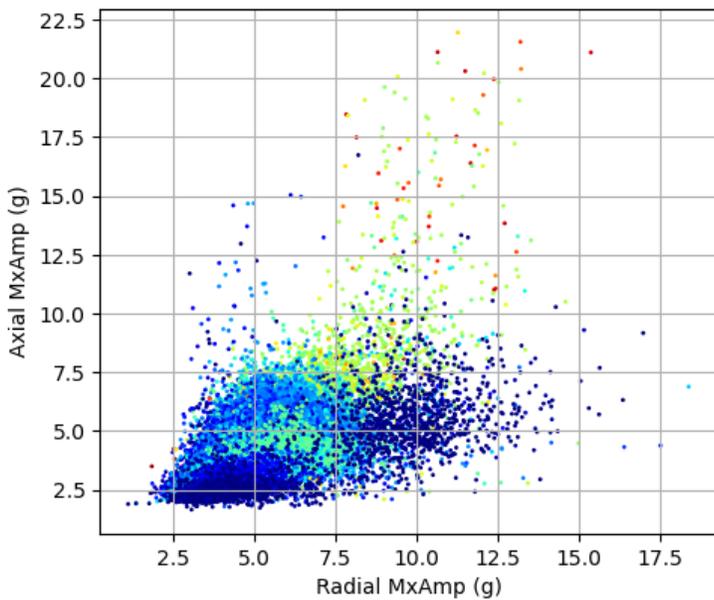
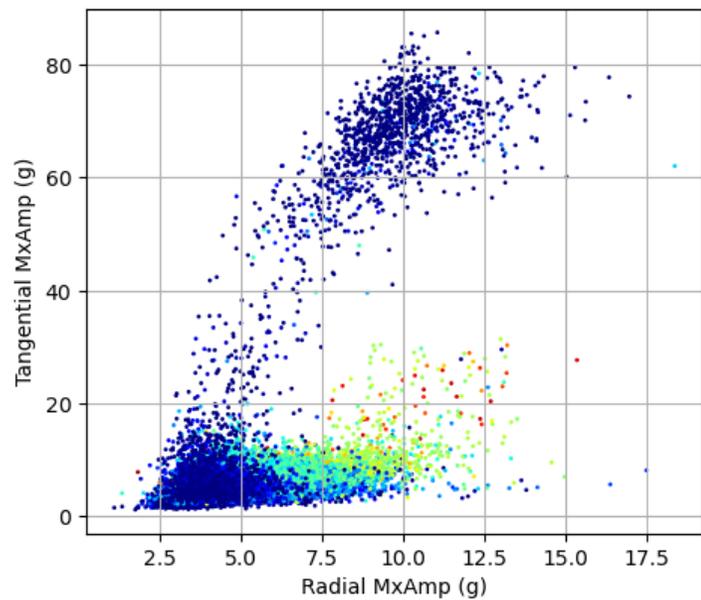
BHA Run	Downhole Sensor	Sensor Location	Bit type/size (inches)	Downhole Mud Motor	Depth Interval (ft)	ROP Limited	Slide Drilling
BHA01	VSS + Temp HF in-bit	Shank	PDC/12.25	Yes	8027 - 9240	No	No
BHA02	VSS + Temp HF in-bit	Shank	PDC/8.5	Yes	13858 - 14494	Yes	Yes

# BHA01 Attribute Cross plots

Standard Deviation



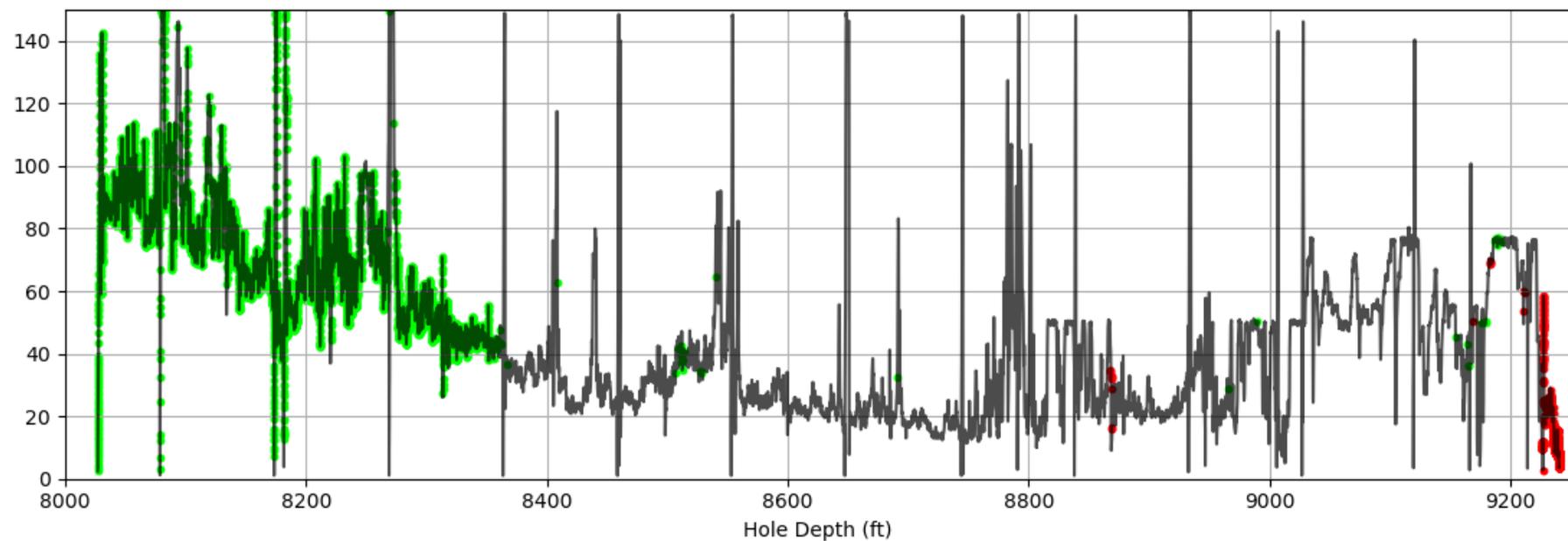
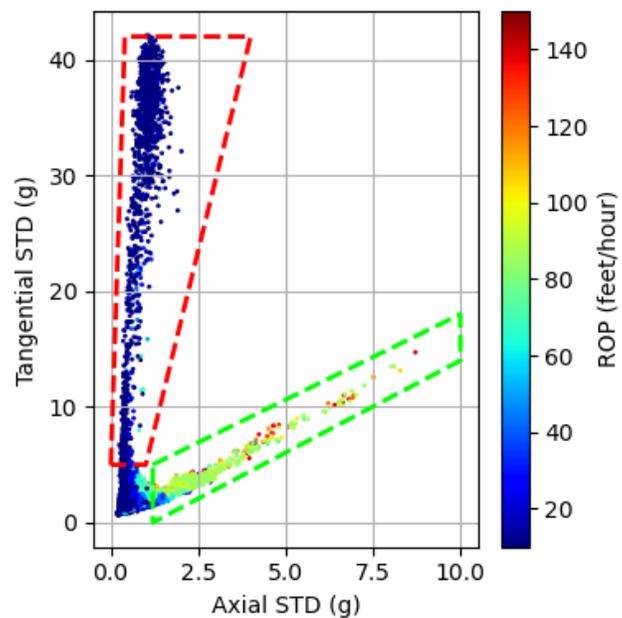
Maximum Amplitude



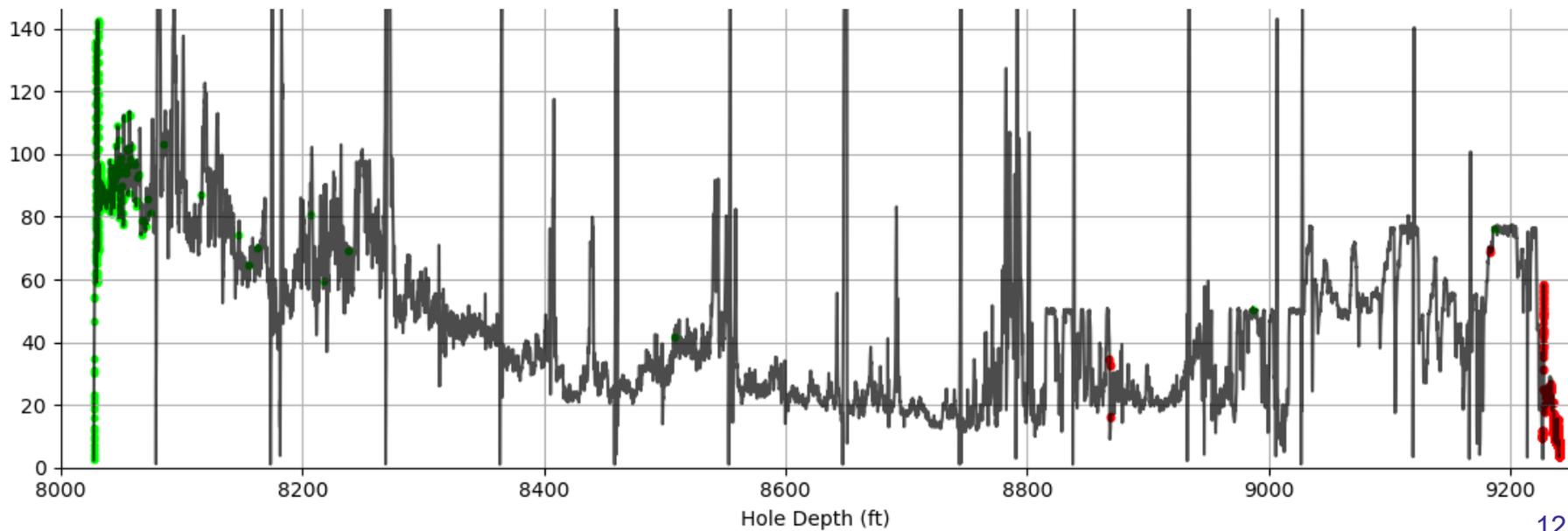
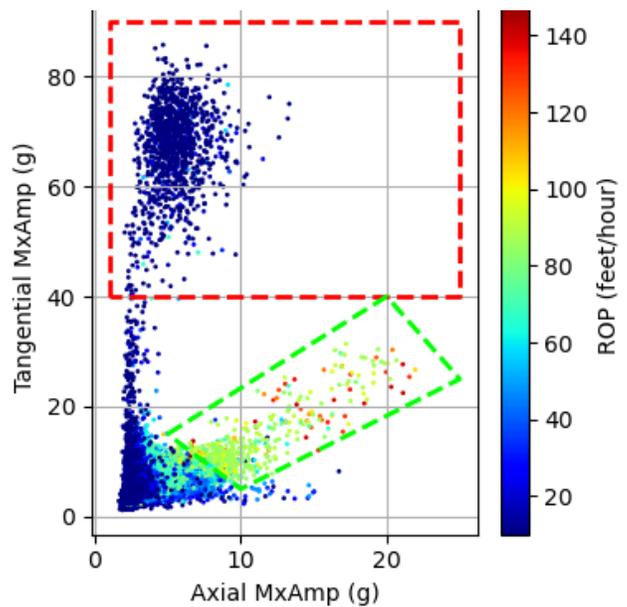


# BHA01 Drilling Classification

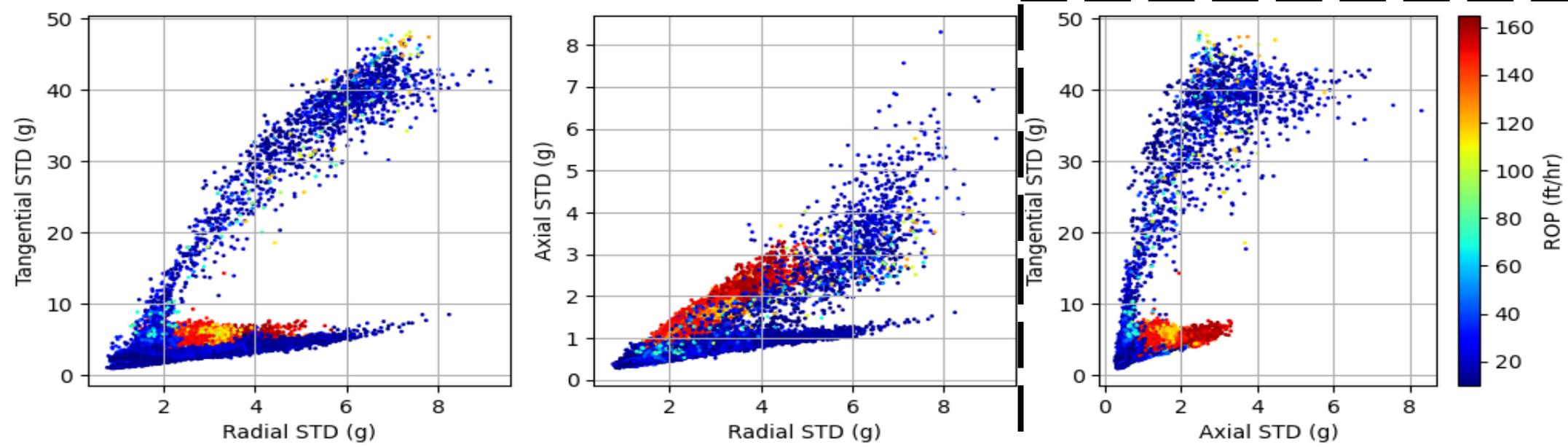
Standard Deviation



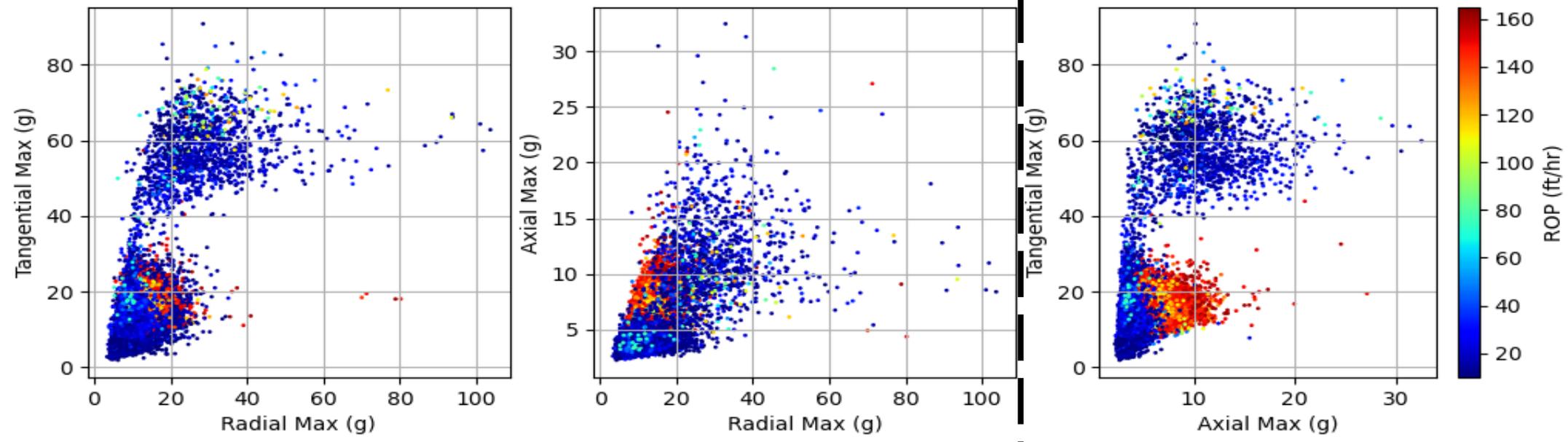
Maximum Amplitude



Standard  
Deviation



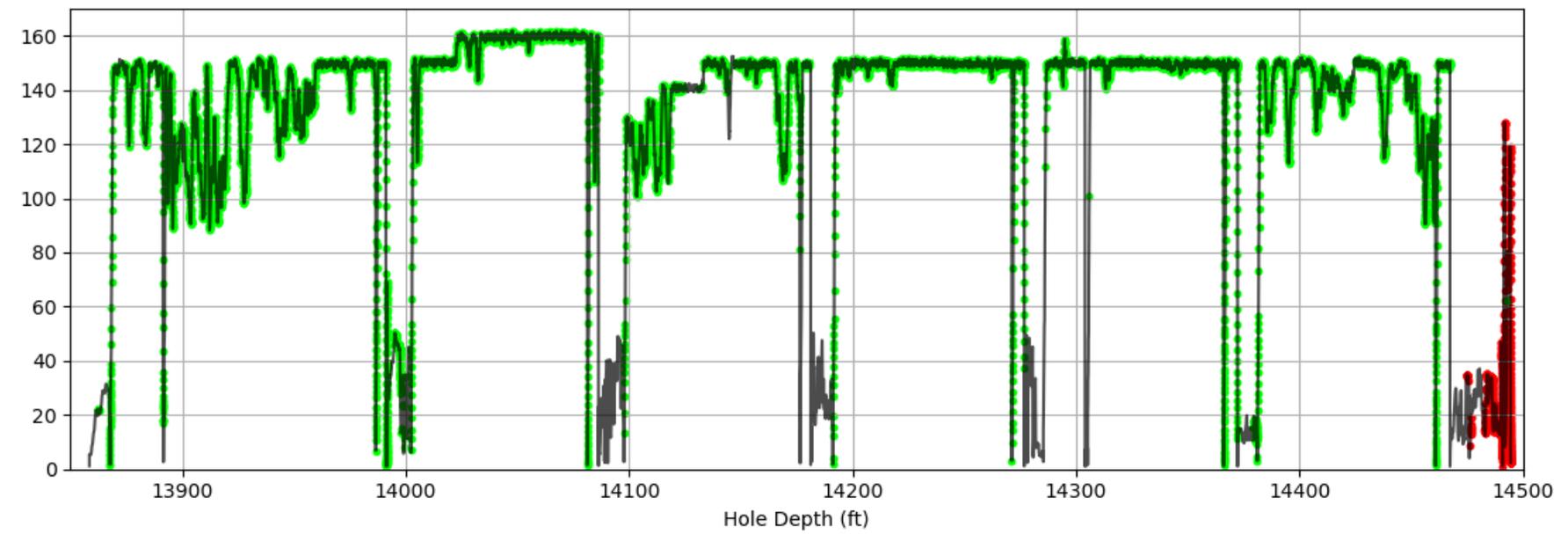
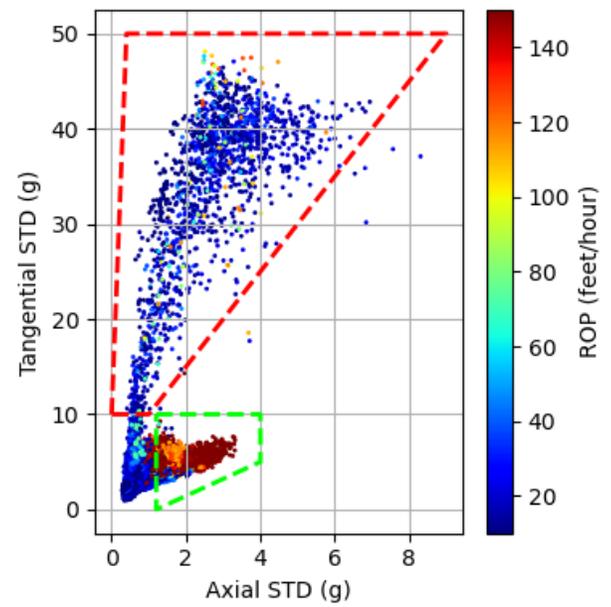
Maximum  
Amplitude



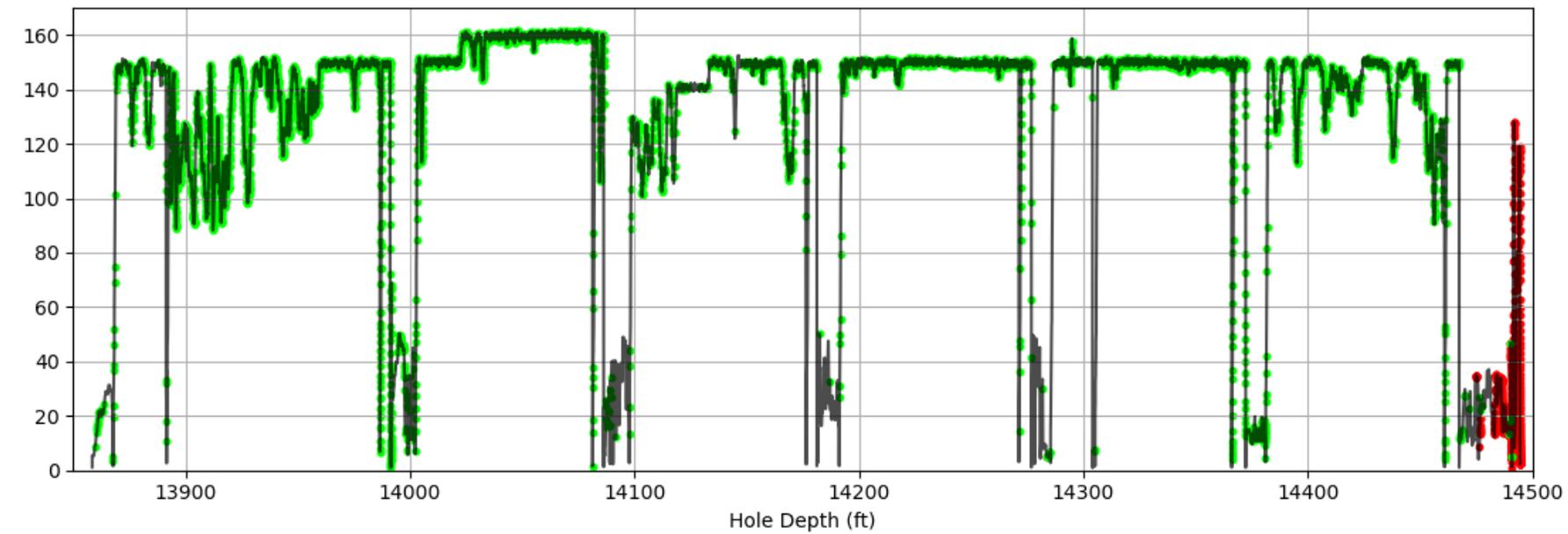
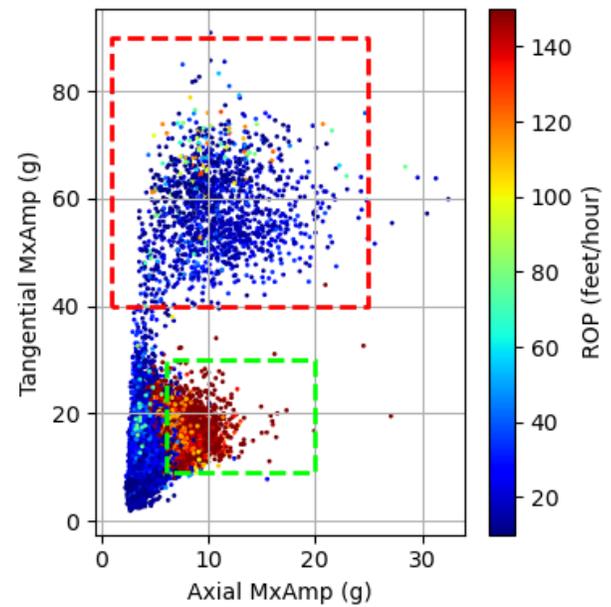


# BHA02 Drilling Classification

Standard Deviation



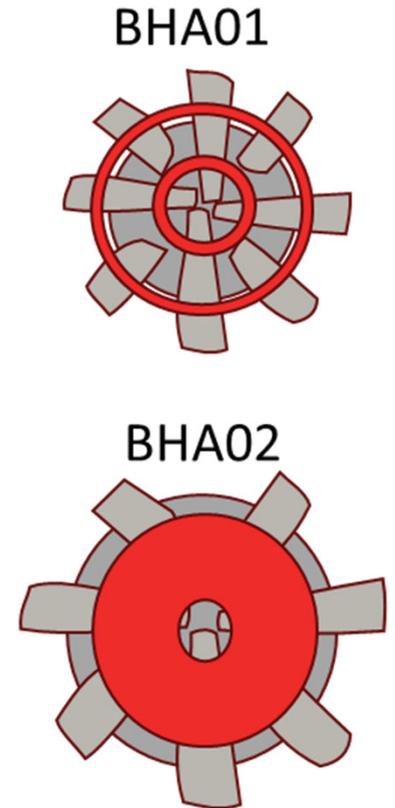
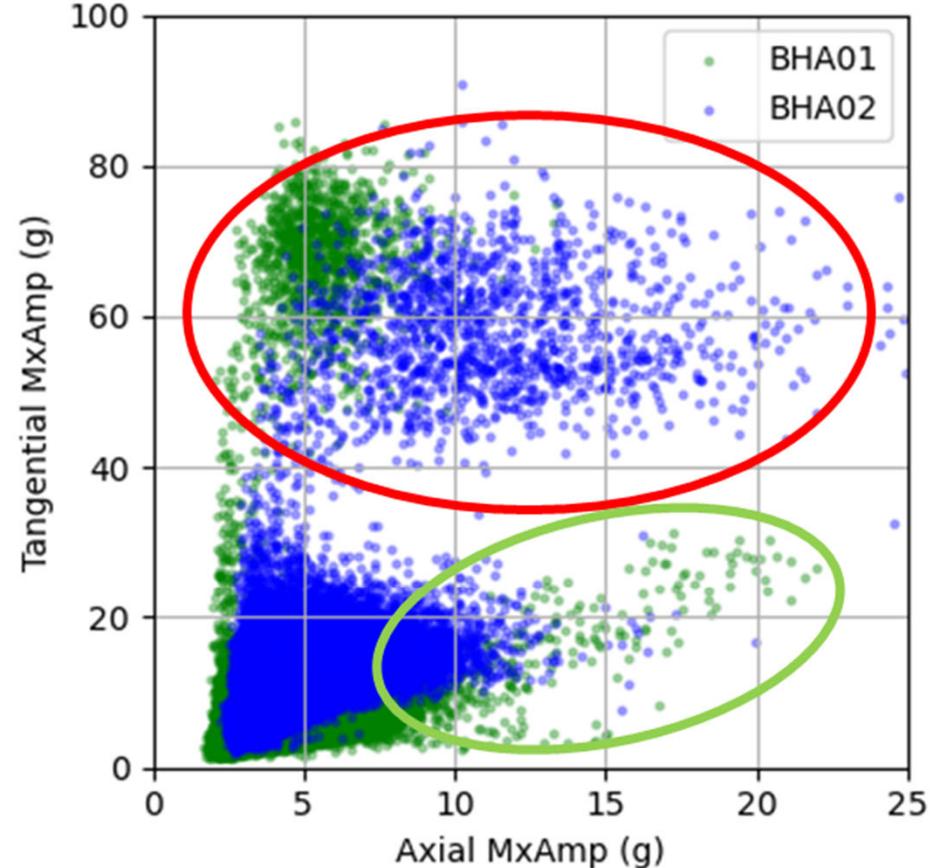
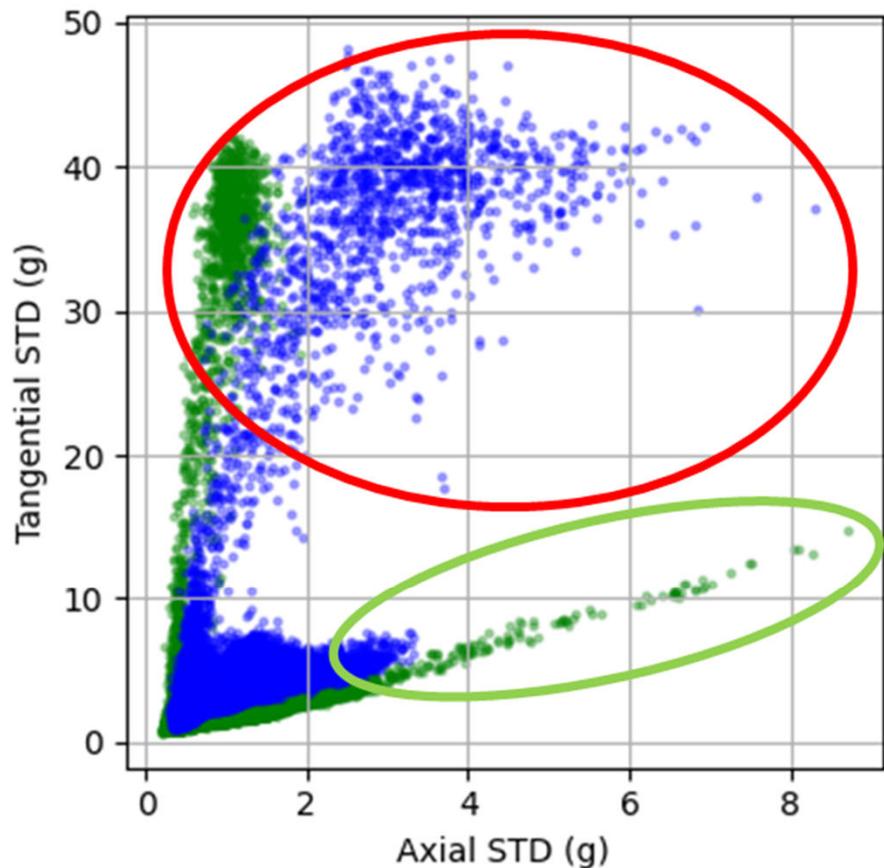
Maximum Amplitude



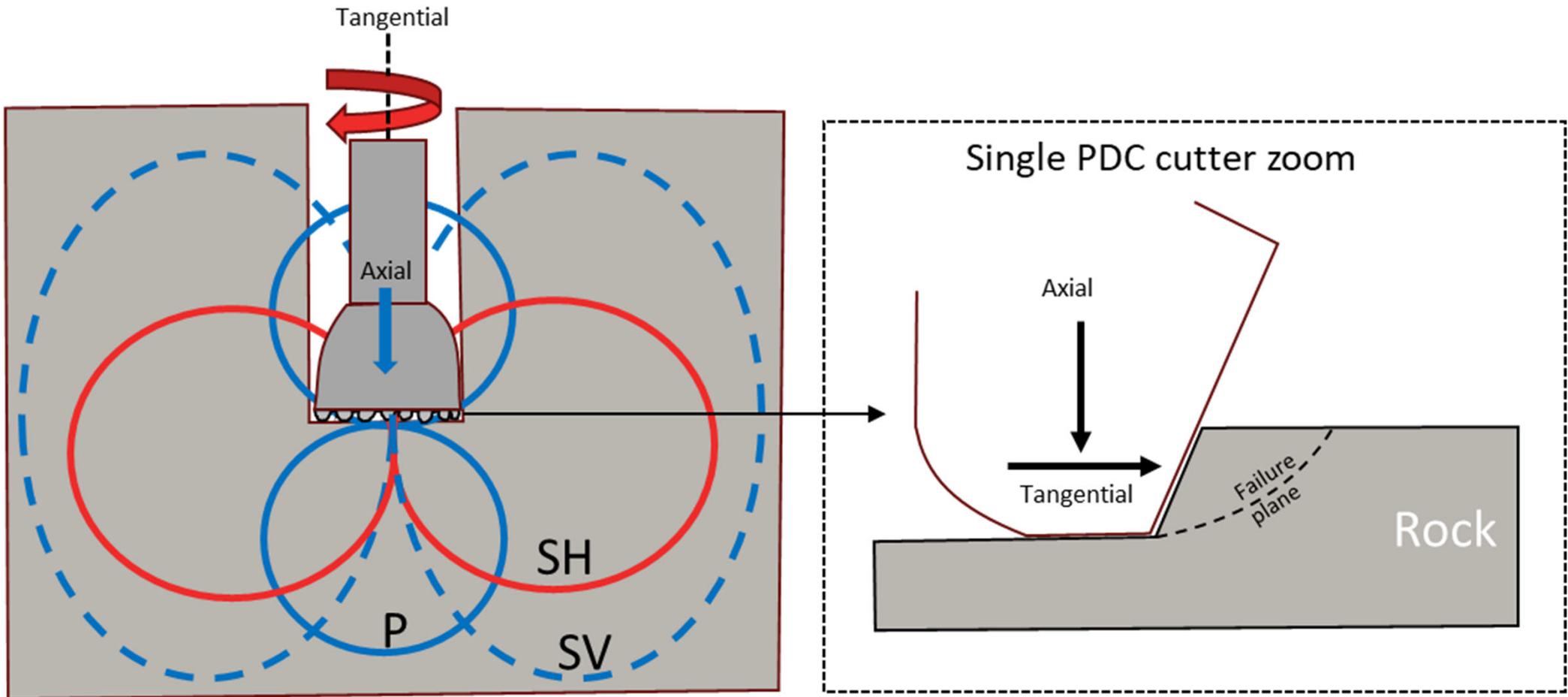


# Tangential Acceleration detection of bit damage?

- High Tangential acceleration Max Amplitude and Standard Deviation values correspond to the end of the bit run, suggesting it corresponds to bit damage.
- Does the spread in Axial acceleration indicate bit damage severity?

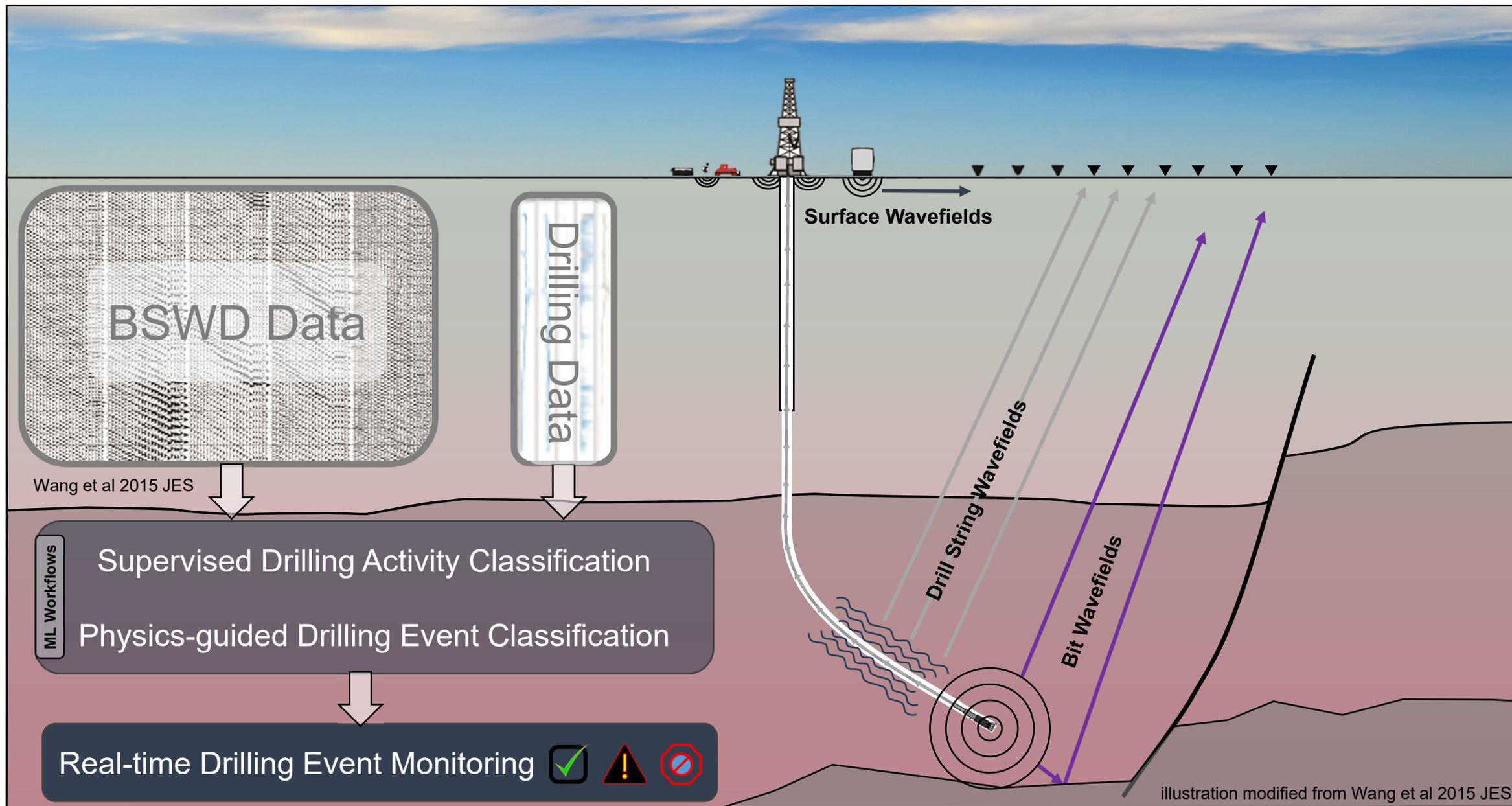


- Axial forces transmit compressional (P) and Shear Vertical (SV) wavefields into the rock
- Torsional forces (i.e. tangential) create a Shear Horizontal (SH) wavefield





# Bit-Source SWD Drilling Monitoring





## Thanks for listening!

- Dr. Kris Innanen
- Dr. Roman Shor
- Alex Vetsak
- Louis Chabot



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CRSNG**

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