Real-Time Rig State Detection
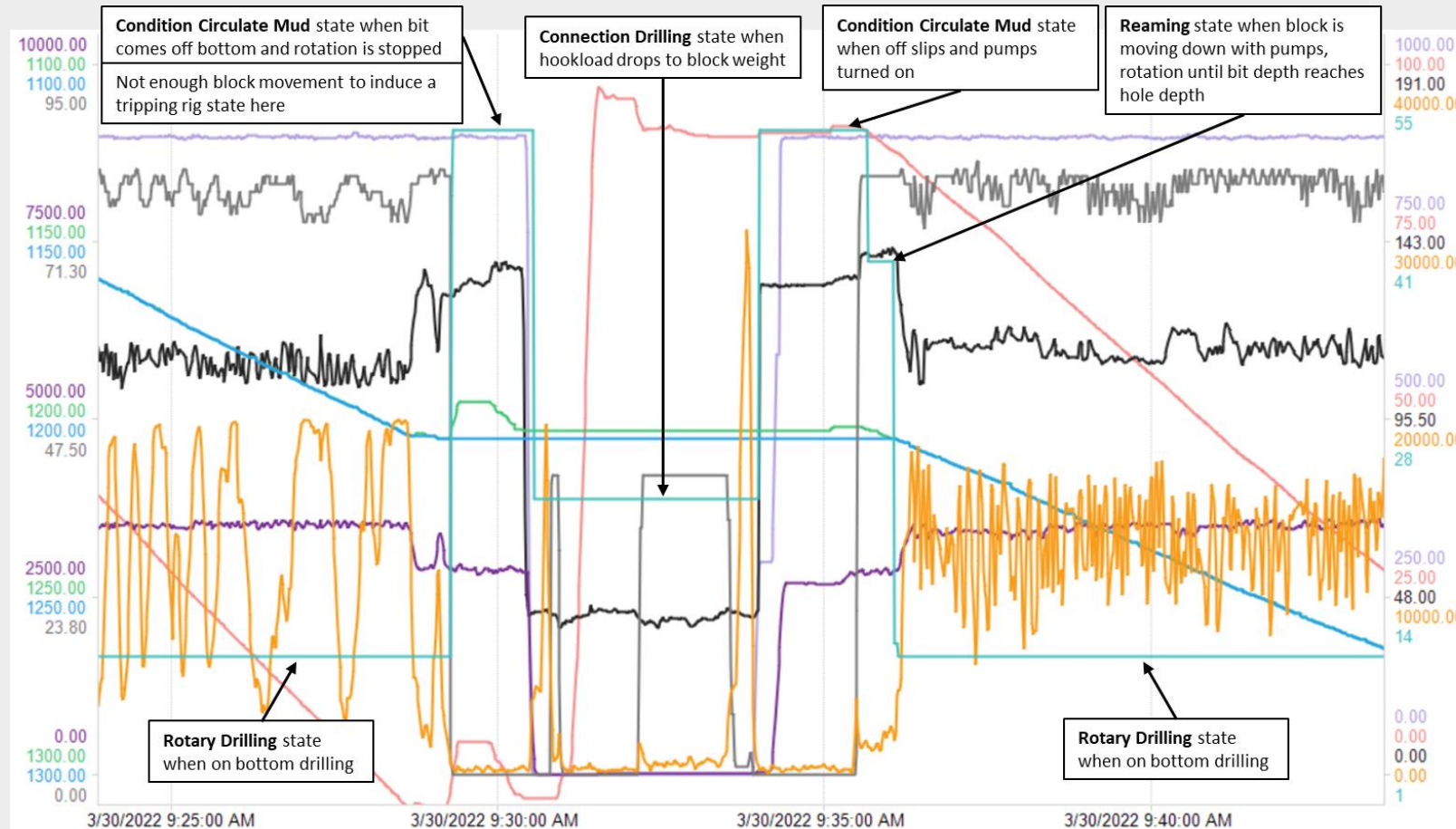
Rig States in Sentinel RT

Rig States	Definition
Undefined	An undefined state will result when sensor values are missing and/or the algorithm cannot determine any valid state from the available signatures.
Out of Hole	Drillstring and BHA are completely removed from the hole (bit depth should be close to zero, if properly reported). Covers making up/ laying down BHA.
Static	No change in bit depth or block height for a period of time, no circulation or rotation. Slips may be engaged or not.
Rotary Drilling	Making new hole using surface rotation or surface rotation + mud motor.
Slide Drilling	Making new hole using a mud motor without normal surface rotation.
Conn. Trip. In	Adding a joint of drillpipe to the string between two stands of running pipe into the hole.
Conn. Trip. Out	Removing a joint of drillpipe from the string between two stands of pulling pipe out of the hole.
Conn. Drilling	Adding a joint of drillpipe to the string between two stands of drilling.
Trip. In Circ	Running the drillstring into the hole with pumps on and no rotation.
Trip. In Not Circ	Running the drillstring into the hole with pumps off and no rotation.
Trip. Out Circ	Pulling the drillstring from the hole with pumps on and no rotation.
Trip. Out Not Circ	Pulling the drillstring from the hole with pumps off and no rotation.
Reaming	Running into hole with pumps on and pipe rotation.
Back Reaming	Pulling out of the hole with rotation and pumps on.
Cond. Circ. Mud	Pumps on with pipe rotating slowly or not rotating at all and no change in bit depth.
Break Mud	Pumping to break gelled-up mud after long static periods. Pipe rotation may be applied to break gels faster.
Pressure Test	Pumping at slow rate to test casing or formation integrity (leak-off test).

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"Pseudo" Dynamic Bayesian Network
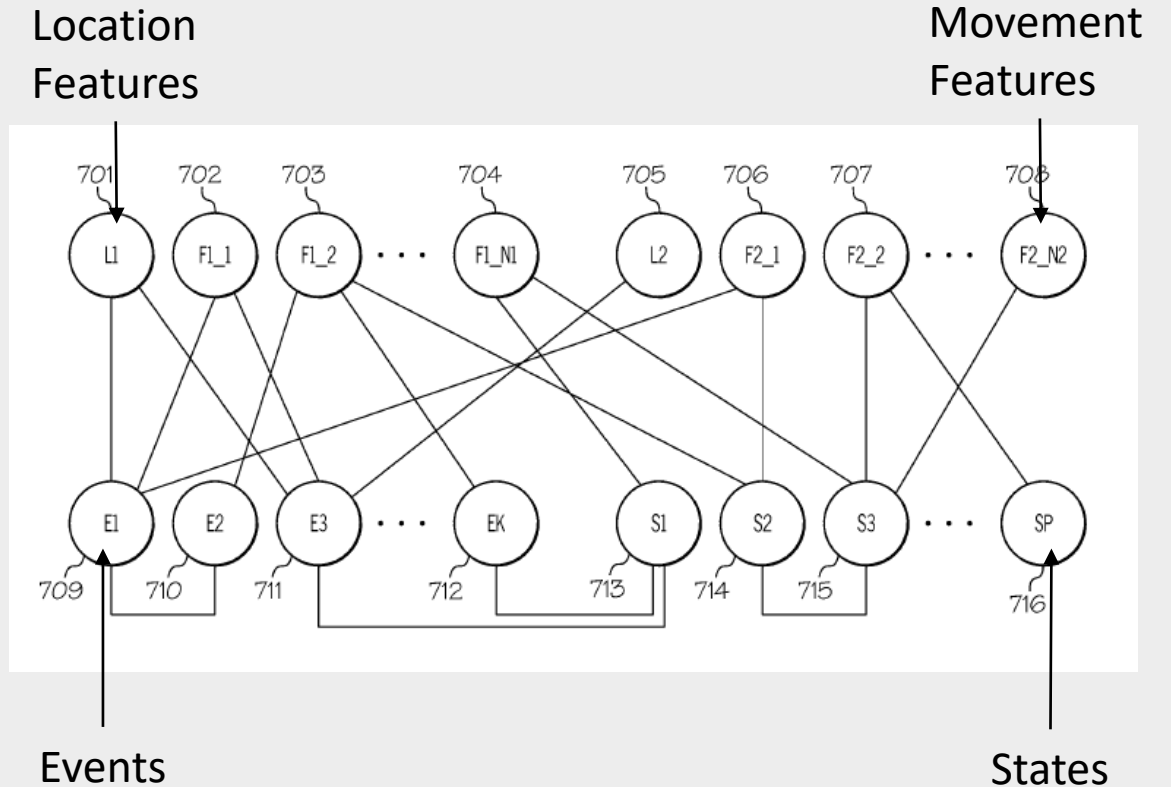
Features used as evidence in network

  Location features: Real-time calculations or sensor data

    Ex: ROP, hookload

  Movement features: Transient behavior of data channels

    Ex: WOB trend, torque trend

Examples of features in rig state engine: SPP, block height, RPM trend

Location Features

Movement Features

Events

States

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Sentinel RT *Lite*

Repository on Github

https://github.com/IntellicessInc/sentinel-rt-lite-saas

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