

Multi-axis Shroud Ultrasonic Manipulator

Background

The Multi-axis Shroud Ultrasonic Manipulator (MAXSUM™) tool was designed to improve the quality of examinations in boiling water reactor (BWR) nuclear power plants, while providing significant critical-path savings and mitigating radiation exposure to personnel during refueling outages. The MAXSUM tool performs ultrasonic inspections in parallel with fuel movement and reactor maintenance activities without interfering with other in-vessel operations that require the refueling bridge or auxiliary platforms.

The MAXSUM tool provides optimal examination coverage and a reduced examination time. The BWR field services in-vessel ultrasonic manipulators minimize the requirements of overhead cranes, refueling bridges and auxiliary platforms, and can be used with a 360-degree platform installed.

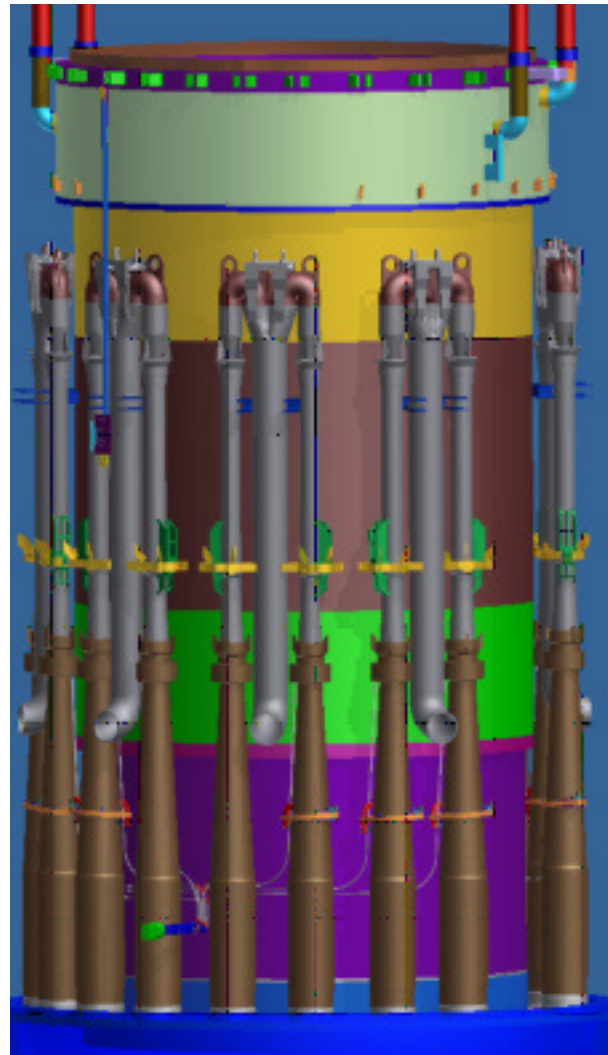
The MAXSUM tool has been successfully demonstrated to support utility boiling water reactor vessel and internals project (BWRVIP) examination guidelines.

Description

The MAXSUM shroud inspection tool is a modular design that is supported on a self-propelled traversing system. The MAXSUM tool consists of multiple modules or scan packages to accommodate the various plants and weld configurations.

The MAXSUM tool is designed to perform simultaneous weld examinations (up to three) to achieve best-in-class schedule delivery. Advanced electronics minimize cable size and weight, while still allowing multiple examinations to be performed in parallel. High-tech phased-array ultrasonic data acquisition, electrical, pneumatic and hydraulic motion control systems deliver precise and high-quality inspection data. Complete

two-sided weld capability supports BWRVIP examination requirements, helps determine material condition of the core shroud and allows for continued operation.



Typical BWR shroud interface

Benefits

Westinghouse customers benefit from the MAXSUM tool in the following ways:

- Critical-path savings and unparalleled scheduling flexibility
- Inspections performed in parallel with fuel moving and other in-vessel activities
- Best-in-class data quality and coverage for accurate results and flaw characterization
- Modular and flexible design accommodates various plant configurations
- Minimized need for continuous tool monitoring by personnel and cameras, which frees up valuable 360-degree platform or refueling bridge space for other in-vessel activities
- Built-in contingencies to minimize potential failure mode effects
- Minimized project delivery crews in support of cost reduction and as-low-as-reasonably-achievable goals
- Minimized human manipulation of equipment reduces dose exposure and human performance errors
- Maximized BWRVIP inspection-cycle intervals
- Standard platforms for electrical, pneumatic and hydraulic motion control, ultrasonic systems, Westinghouse all-purpose submersible platform (WASP™) remote-operated vehicle, cameras, communications and standard refueling equipment
- Standard platform for cross utilization of spare parts, cost control and personnel knowledge
- Proven inspection results including zero tool and system failure on a first-of-a-kind tool deployment

Experience

The MAXSUM tool was deployed at a U.S. nuclear power plant in October 2012 during a refueling outage. MAXSUM tooling performed as designed with zero system or tool failures and completed the examination scope ahead of schedule. In doing so, the MAXSUM tool set the bar higher in the BWR internals industry, achieving improved coverage from the outside diameter surface than ever previously attained.

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