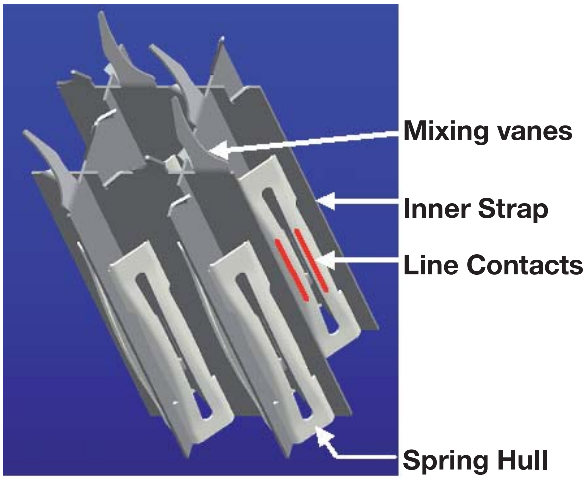
GAIA Fuel Assembly
Maximum Fuel Robustness, Performance and Reliability

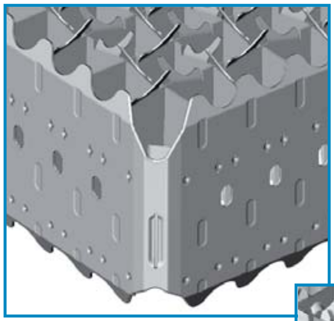
To shoulder the demands of PWR utilities in fuel assembly performance while ensuring maximum robustness, AREVA has developed the GAIA PWR fuel assembly design. It is the result of a worldwide AREVA R&D project, which focused on reliability, robustness and thermal margin.

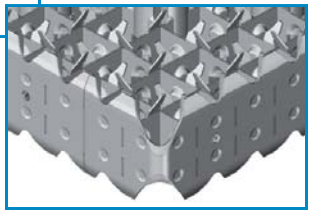
GAIA Structural Mixing Spacer Grid Combines Reliability and Robustness of HTP™ with Increased Thermal Performance

The GAIA structural mixing vane spacer grid ensures high fretting resistance, low pressure drop and high handling capability and provides excellent Critical Heat Flux (CHF) performance considering its superior mechanical performance.

- Fuel rod stability is provided by 8-line contact spring configuration to ensure the GAIA design platform inherits the outstanding grid-to-rod fretting resistance of the proven HTP™ spacer grid design.
- Mixing vanes provide very efficient fluid mixing for demanding fuel management operating conditions and can support power up-rates.
- Outer strap design and the M5® material provide dimensional stability without risk of excessive fuel assembly interaction during core loading / unloading operations.
- Intrinsic design provides the GAIA spacer grid with high mechanical strength and a favorable deformation mode under accident-induced lateral loads.







Intermediate Flow Mixing Grids for Enhanced Thermal Performance

The GAIA fuel design incorporates three (3) intermediate GAIA mixers (IGMs) based on AREVA's AFA-3G mid span mixing grid design. IGMs are fabricated with M5® alloy. IGMs augment thermal hydraulic performance enabling optimal fuel efficiency and fuel cycle economy.

M5® Cladding Provides Industry-Leading Fuel Rod Performance

Worldwide first in class M5® alloy is used as cladding material for the fuel rods. The optimum chemical composition of M5® and its refined microstructure provide enhanced resistance to corrosion and very low hydrogen uptake. This translates to less embrittlement and greater reliability at higher burnups, under normal operating conditions as well as accident conditions, including LOCA.

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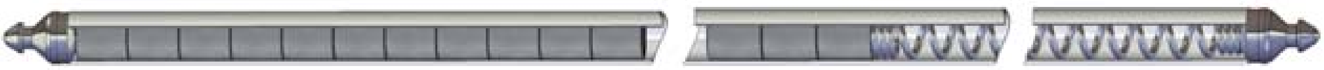
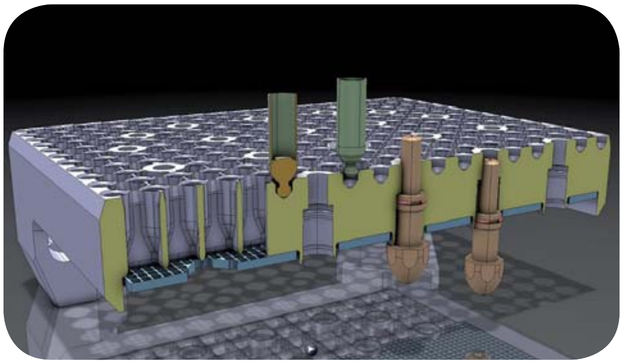


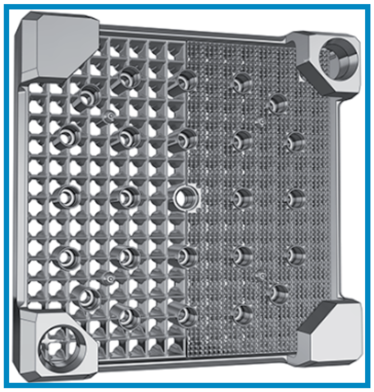
The GAIA fuel rod design also features a reduced volume spring, which contributes to a reduction in the end-of-life pin pressure. Optional Chromia (Cr2O3) doping of the fuel pellet enhances fission gas retention and improves the fuel rod resistance to Pellet-Cladding Interaction (PCI), allowing for increased uranium loading in some applications. Fuel pellets are pressed and sintered with dished ends and a slightly tapered land area. Resinter density change, moisture content and surface quality of the finished pellets are stringently controlled during fabrication and ensure quality performance of the fuel under operation.

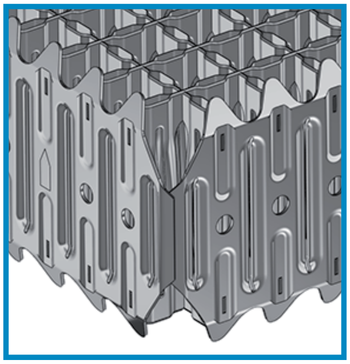


Quick Disconnect

HMP™ End Grid for Optimal In-Reactor Performance

The HMP™ end grid is made of Alloy 718 and has proven flawless operating experience in the HTP™ fuel assembly design platform. The enhanced strength and relaxation characteristics of the HMP™ end grid makes it ideal for stabilizing the fuel rods by providing decisive margin against flow-induced vibration and reducing the potential for fretting damage, while reducing compressive loads to optimize fuel assembly growth behavior and mitigating fuel rod bow.





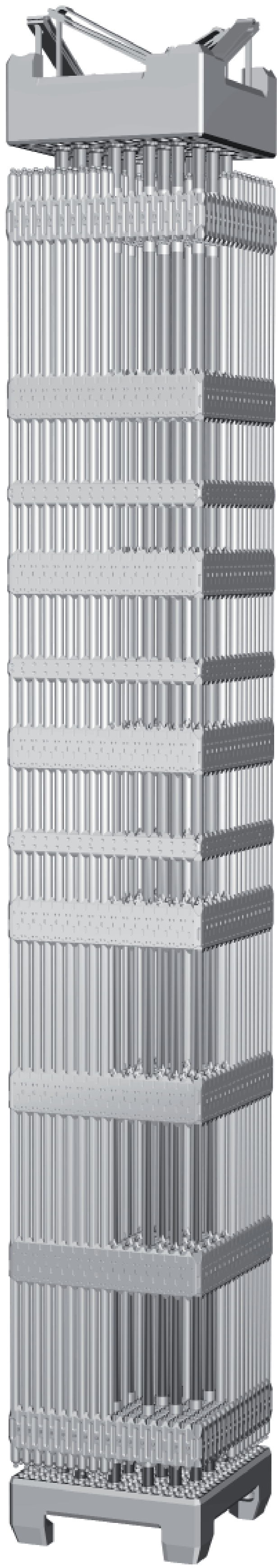
GRIP™ Bottom Nozzle for Efficient Debris Filtering

The GRIP™ bottom nozzle assembly has been developed to provide the best level of filtering efficiency, while ensuring low pressure drop. It also provides high performance regarding flow-induced fuel rod vibration and fuel assembly serviceability.

Welded Structure With Reinforced MONOBLOC™ Guide Tubes Provides Highest Dimensional Stability

The GAIA structural spacer grid is connected to increased diameter MONOBLOC™ (where applicable) guide tubes and instrumentation tube through a two level resistance welding design, which provides strong guide tube to grid attachment. These welded connections provide increased fuel assembly lateral stiffness for fuel assembly straightness.

Furthermore, the guide tubes and instrumentation tube are fabricated from Q12, a quaternary alloy developed to optimize the creep behavior of the fuel assembly structure, while maintaining a low hydrogen uptake.



Features and Benefits

Optimized for a balance in Neutronic, Mechanical and Thermal Performance, the GAIA offers:

- **Maximum robustness** against distortion and seismic issues with Q12™ material and MONOBLOC™ welded structure
- **Increased thermal hydraulic performance** with GAIA mixing grids and IGMs
- **First-class fuel reliability** with 8-line contact GAIA grid, HMP end grids to protect against fretting and the high filtering efficiency of GRIP™
- **Superior performance under accident conditions** with Alloy M5® and Cr-doped fuel
- **High burnup capability** based on an extensive global irradiation and testing database

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