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# Ensuring Access for Intervention with Breast MRI

**A**lthough breast cancer claims more than 40000 lives annually in the United States, there are signs of hope for those who are attempting to manage this disease. The American Cancer Society has reported that the five-year survival rate for breast cancer has increased by 12% over the past 30 years and by 4.6% over the last decade. When diagnosis occurs at an early stage and the cancer is localized, 98% of patients survive more than five years. In large part, this progress in cancer survival rates can be attributed to significant advances in multi-modality breast imaging. This has led to the earlier detection of tumors which has resulted in more accurate treatment options resulting in improved patient management.

While mammography is still the most widely used procedure for routine screening, magnetic resonance imaging (MRI) is often prescribed for patients at high risk due to family history or genetic predisposition, for those with dense breast tissue or for patients with a suspicious finding on their mammogram. Patient demand for this service has increased as clinical studies have demonstrated the efficacy of breast MRI in detecting areas of cancer that are occult using other imaging technologies.

According to Radiology Management, breast MRI is performed in order to:

- assess multiple tumor locations, especially prior to breast conservation surgery,
- identify early breast cancer not detected through other means, especially in women with dense breast tissue and those at high risk for the disease,
- evaluate abnormalities detected by mammography or ultrasound,
- distinguish between scar tissue and recurrent tumors,
- determine whether cancer detected by mammography, ultrasound, or after surgical biopsy has spread further in the breast or into the chest wall,

- assess the effect of chemotherapy,
- provide additional information on a diseased breast to make treatment decisions, and
- determine the integrity of breast implants.

Given this, breast MRI is an important component of any complete breast cancer management program.

As MRI technology has improved over the past several years, it has become possible to image both breasts simultaneously and to review both morphology and kinetics. For interventional procedures such as MRI-guided wire localizations and needle biopsies, the outcome may depend on the ability to accurately target breast tissue. Earlier MRI technologies presented certain clinical challenges since they were not specifically tailored to breast intervention, and it was sometimes difficult for the clinician to reach the targeted area. New solutions such as the specialized Vanguard breast coils developed by Sentinelle Medical Inc., offer an open access patient support design, adjustable coil and grid positioning, and an expanded grid area enabling the clinician to accurately target and access the affected tissues, while also allowing the generation of high quality images.

### **Importance of Access in Breast MRI**

Both patient demand and physician confidence in breast MRI have been increasing in recent years. The rising interest has followed evidence that MRI is a viable adjunct to mammography, particular for those at high risk for breast cancer. As breast MRI becomes more widespread, it has become more important to be able to properly biopsy all lesions identified. This need has increased the importance of coil design that optimize access to the breast. This can provide significant advantages for both initial screening and interventional procedures including:

- proper positioning of the breast for imaging procedures for better image quality, decrease in artifacts and better visualization of all areas of the breast including axilla and chest wall,
- increased comfort resulting in improved quality of the patient experience,
- the ability to accommodate a larger range of patient and breast sizes resulting in fewer patients being turned away reducing disruption to clinical workflow planning,
- the ability to minimize patient trauma by planning the shortest distance to lesion with either lateral or medial access,
- the ability to shorten procedures by allowing multiple lesions to be targeted at the same time, and
- workspace for clinicians allowing greater ease of access for improved targeting of difficult to target lesions resulting in greater confidence in diagnosis.

## Sentinelle Vanguard and Variable Coil Geometry Technologies

Unlike other breast MRI technologies, the Sentinelle Vanguard™ breast MRI coils with Variable Coil Geometry™ (VCG), has been designed to specifically address many of the traditional challenges of breast MRI intervention. The Vanguard patient support is uniquely designed to maximize access to the breast for positioning and patient comfort. This ergonomically designed patient support with its characteristic arched design comes in both table and tabletop versions. Patients can be imaged both in arms over-the-head, or arms-at-side positions. Biopsies can be done for both the lateral and medial aspect of the breast simultaneously. This is important since the ability to perform bilateral breast exams can aid in the detection of suspicious areas and also allows for a symmetrical comparison of both breasts.

VCG provides users with a truly modular coil system that can be independently positioned within the Vanguard patient support, see Figure 1 and Figure 2. This system allows technologists to optimize the positioning of the coils and the grids, providing both increased access and image quality. VCG is a Sentinelle Medical proprietary technology and has broad implications for:

- Image Quality
- Patient accommodation
- Patient management

In MRI, image quality is directly related to the proximity of the MRI coil to the body part being imaged. This is a major factor for increased Signal-to-Noise Ratio. Fixed coil geometries, by definition, do not provide flexibility in positioning of the coils close to the breast. Manufacturers are forced to design coils that address average breast sizes, resulting in lower SNR for breast sizes not optimized for that coil. With VCG, clinicians receive consistently higher SNR across a broad spectrum of breast sizes.

The ability to optimize imaging on a broad spectrum of breast sizes affords a physician several advantages for both workflow and efficiency. A site using this technology immediately increases efficiency due to a drastic reduction in failed exams. This in turn delivers a sense of confidence and loyalty in those patients that would otherwise, have not been able to complete a successful Breast MR examination.

The completion of a successful breast MR examination and, if needed, a biopsy has a significant impact on patient management. Without the VCG technology, there is a growing percentage of the population that would not be accommodated with the conventional breast coil technology and therefore not be able to benefit from the knowledge afforded by a complete breast MR examination.

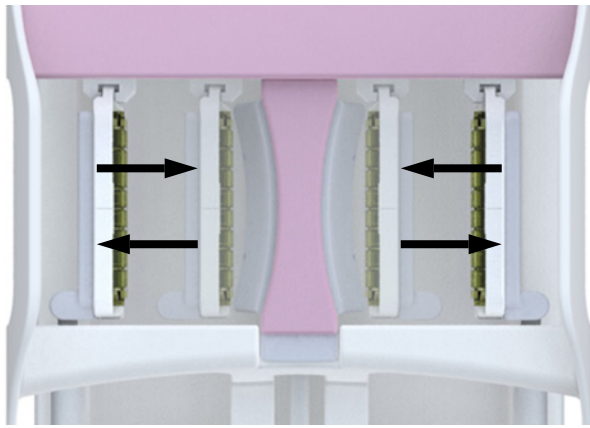


Figure 1 - Medial/Lateral VCG

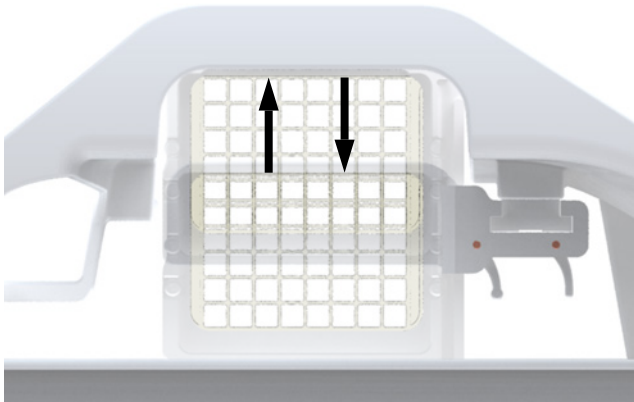


Figure 2 - Posterior/Anterior VCG

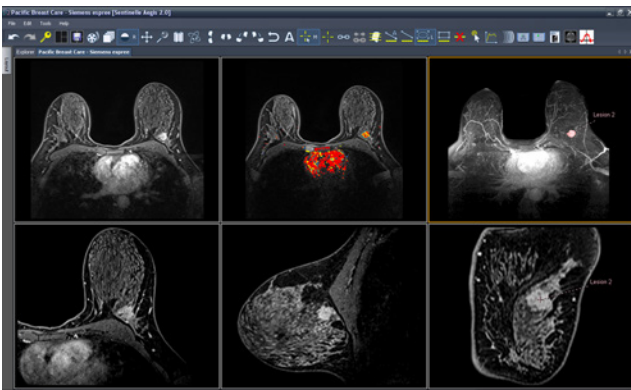


Figure 3 - Aegis Diagnostic Scan

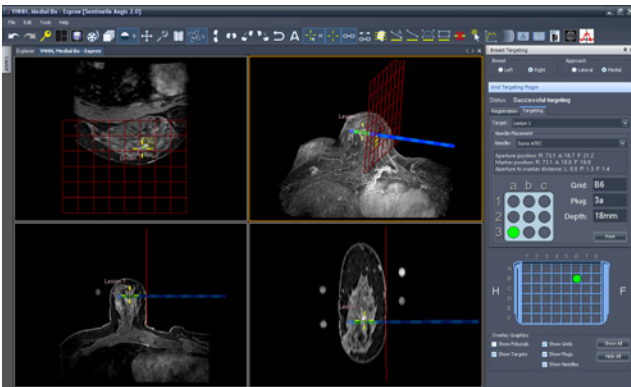


Figure 4 - Aegis Biopsy Scan

Taking the evolution of breast MRI a step further, Sentinelle Medical combines modular coils, larger biopsy grids, specialized imaging tables and an open design of the patient support with an advanced software program called Aegis™.

Aegis is a powerful 3D visualization tool that allows the physician complete flexibility (2D, 3D, MIP, ThinMIP, Subtractions, Kinetic Maps) to evaluate the breast images and manipulate the data in real time, see Figure 3. For interventional cases, Aegis allows users to automatically locate the grid relative to the lesion and pinpoint the trajectory of the needle for the biopsy, see Figure 4. Aegis also allows the physician to target a lesion via a lateral or medial access as well as target multiple lesions with ease. Since Aegis is a powerful 3D visualization tool, bilateral lateral approaches for multiple lesions can also be achieved with a very efficient workflow. This comprehensive set of technologies allows maximum access to the breast for analyzing breast MR images and guiding interventional procedures.

*“With the Sentinelle Vanguard breast coil design, not only is the signal optimized but unprecedented interventional access is also available,”* said Daniel White, Radiologist with Mt. Carmel Hospitals in Ohio. *“Medial access is just as easy as lateral and my approach to a biopsy is determined only by the shortest skin to lesion distance.”*

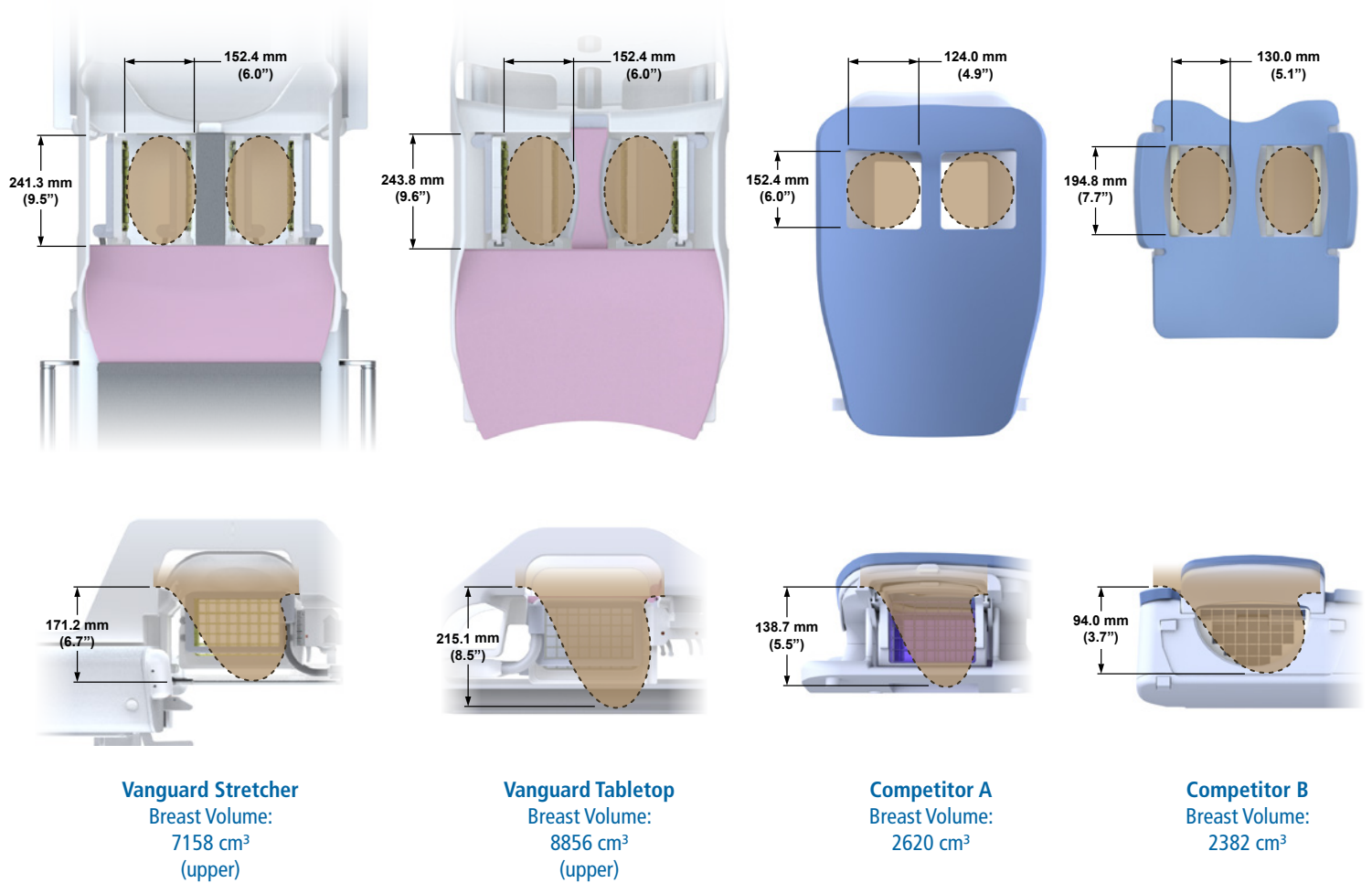
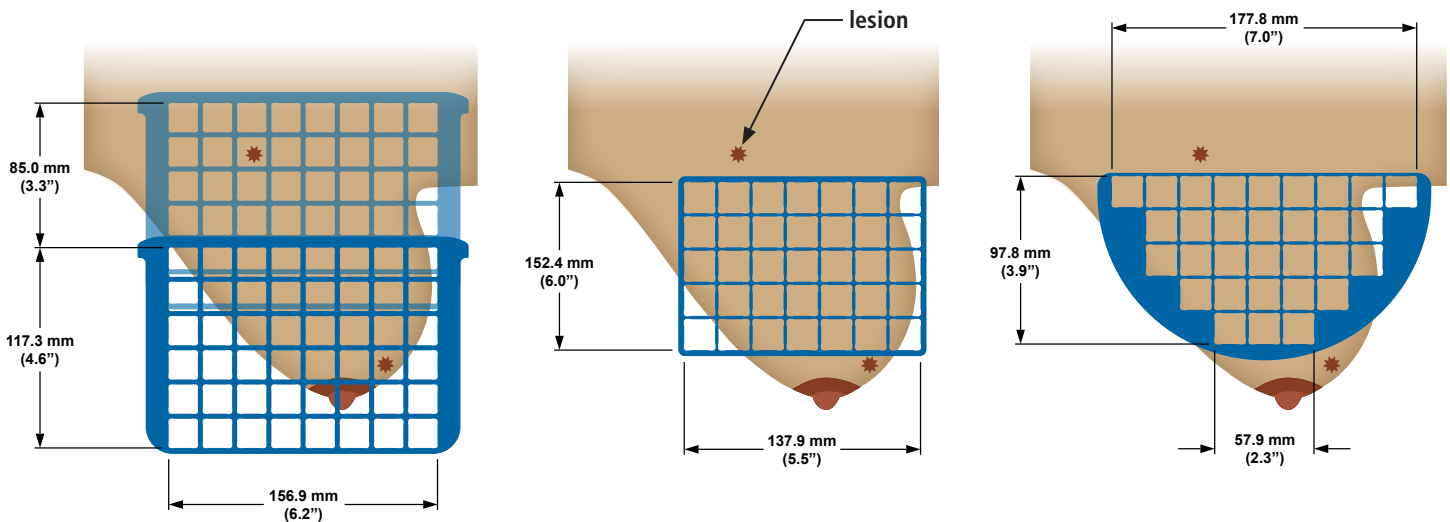


Figure 5 - Comparison of Breast Volumes Accommodated by Coil System

### Accommodating the Largest Range of Patients

Access for intervention with breast MRI can be hindered if the coil cannot accommodate larger patients, those with very large or very small breasts, or those who have had a mastectomy. In some circumstances, with standard, fixed, coils, larger patients may have to be turned away, resulting in disruption to workflow, decreased customer satisfaction and poor patient management. To resolve this challenge, Sentinelle designed breast coils that can be easily adjusted depending on size of the patient and the particular area of intervention.

This unique design feature of the Sentinelle Vanguard breast MRI coil, provides the ability to adjust to a much greater range of breast sizes than traditionally designed breast MRI coils. The ability to position the coils also can provide greater consistency in image quality, no matter the breast size, see Figure 5.



**Figure 6 - Biopsy Grid Coverage Comparison, D-size Breast**

### Proper Positioning of Grid Allowing Targeting of Difficult Placement

Access for MRI-guided biopsy is made much easier with anterior and posterior adjustable positioning of the Sentinelle compression grids, see Figure 6. A lesion in the medial left breast, for example, can be localized by removing the sternum support and placing the contra-lateral breast support for the patient's right breast, thus allowing full access to the medial area of the left breast. The flexibility of grid placement facilitates precise MRI-guided interventions on lesions in all quadrants of the breast greatly enhances the clinician's ability to target, and improves the accuracy of extraction of abnormal tissue.

Because of Variable Coil geometry, and specifically the ability to move the coil and grid in the antero-posterior direction, the area of accessibility on the Sentinelle coil is expanded to 317 cm<sup>2</sup> which is in sharp comparison to the standard coil/grid technology, this gives up to 2.7 times greater coverage than existing fixed geometry coils/grids.

Lesions develop in all four quadrants of the breast, with a significant percentage of lesions in high risk patients found in upper outer quadrant. Without Variable coil geometry allowing for optimal placement of the coil and grid, these lesions would be difficult, if not impossible to biopsy. The ability to properly assess these lesions has a significant impact on patient management.

In addition, the arches of the Vanguard patient support are specifically designed to allow both arms-over-head or arms-at-side positioning. One of the big advantages of arms-at-side positioning is the increased volume that can be visualized and accessed via biopsy. The Sentinelle Vanguard arches provide complete support for the patients shoulders and arms, allowing the pectoral muscles to relax, therefore enabling more breast tissue to fall within the imaging volume.

Linda Frye, Radiologist with Pacific Breast Care in California, has noted the benefit of this unique coil design. *“The intervention or access for biopsy is increased with the Sentinelle coil,”* Dr. Frye said, *“which allows me to do interventions for difficult, if not impossible to reach areas with other coils and to provide the best care possible with minimal discomfort to my patients. Sentinelle’s Variable Coil Geometry™ (VCG) allows the coil to move medially, laterally, anteriorly and posteriorly. I have the flexibility to position the coil and biopsy grid where needed.”*



## Working Area Accessibility

When planning an interventional procedure within the MR suite, one of the goals for physicians is the ability to target any lesion that is visualized with the high sensitivity of the Breast MRI examination. The ideal coil solution should allow the physician the flexibility to position the coil and grid in a position that is optimized for every patient. The ability to position the coil and grid on both the Lateral and medial aspect of the breast simultaneously in the ideal position allows the physician to choose the safest and most efficient approach for each individual patient.

The unique open design of the Vanguard™ patient support, adjustability of coil positioning and ability to comfortably position the patient's arms at their sides provides the greatest access to the breast, both medially and laterally. The result is the most flexibility in approach for interventional procedures, optimizing access for the most challenging lesion locations, see Figure 7 and Figure 8.

Along with hardware, Sentinelle provides a powerful visualization tool called Aegis, which allows the physician to choose the ideal path to one or several lesions. The 3D visualization tool displays the skin to lesion distances for various approaches and allows the physician to choose the best approach for each patient without having to waste precious time repositioning the patient.

This increase in efficiency and accuracy have benefits that go beyond workflow, it allows a higher percentage of successful procedures which results in a significant impact on patient management.

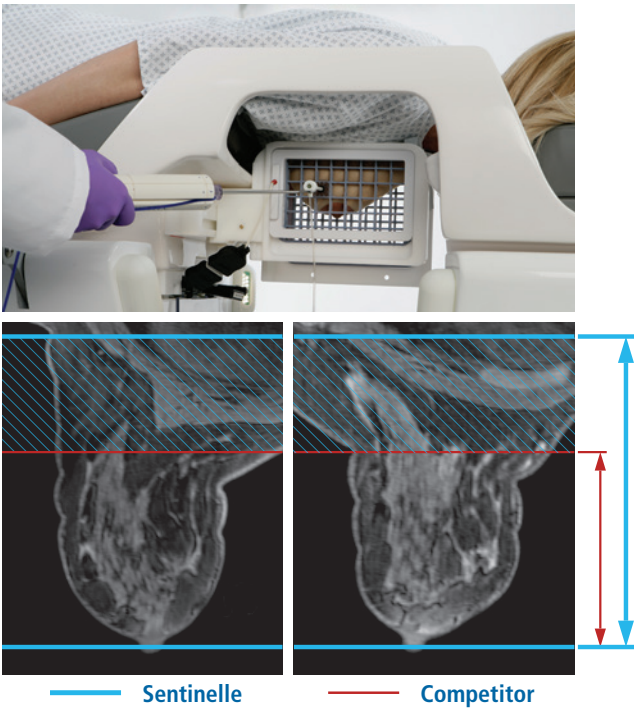


Figure 7 - Lateral Access Implications on Accessible Biopsy Area

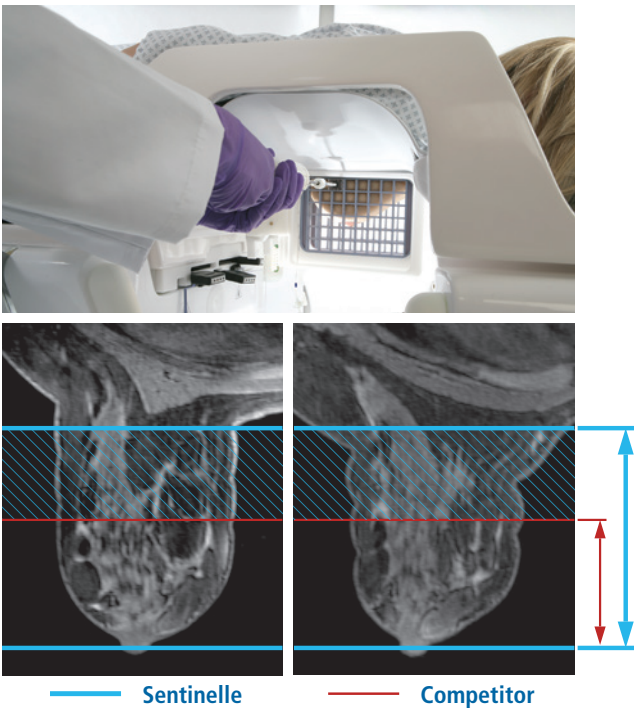


Figure 8 - Medial Access Implications on Accessible Biopsy Area

Note that the competitive coil cannot access the top grid row on medial approach

## Conclusion

Optimizing accessibility is one of the most critical aspects of interventional breast MRI procedures. The availability of technology that can be customized to patients of various weights and breast sizes represents a clear advantage over earlier technologies that were not specifically designed for targeting small lesions within soft breast tissue.

The adaptability that has been built into Sentinelle's Vanguard patient supports and VCG coil system allows optimal access for targeting in all quadrants of the breast, with a higher signal to noise ratio. This allows the clinician to take full advantage of Parallel Imaging Techniques and obtain higher resolution images in a shorter acquisition time. With Breast MRI, we now have a very high level of sensitivity, the Sentinelle Vanguard coil allows full access to lesions for both visualization and just as important, full access for biopsies and other interventional procedures in order to increase specificity.

These technological improvements make it easier to detect tumors at an earlier stage and can potentially lead to better disease management and patient outcomes. References

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