December 2019

Imaging Solutions Newsletter – CERA 6.0

Enabling workflow automisation and application-specific imaging solutions

siemens-healthineers.com/cera

Dear CERA Customer,

over the last decade, the Siemens Healthineers CERA platform developed into a powerful toolbox for high-performance X-ray CT reconstruction and 3D visualization across various imaging markets. The ability to combine knowledge from multiple, disjunct application fields is keeping us in a unique position to generate and implement innovations that help you to augment your specific solutions.

We are now launching CERA 6.0, the new generation of our software that offers exciting new features and enhancements that are summarized in following chapters of this newsletter. They are designed to even better support your imaging needs and to add value to your offerings with the following strategies in mind:

Value through Customization and Differentiation
- Use our flexible software building blocks with different interface levels to create your unique, application-specific X-ray image chain or
- Benefit from our ready-to-use CERA XPlorer solution with its intuitive GUI to reduce time-to-market.

Value through Workflow Automation
- Offer workflows with one-button-solutions using our self-calibrating algorithms for reduction of physical and geometrical artifacts and
- Take full advantage of your reconstruction PC using our auto-adaptive compute kernels

Value through Quality and Efficiency
- Generate high-quality image results on affordable hardware using our efficient GPU implementations of specialized analytic and iterative algorithms and
- Implement design-to-cost measures by augmenting your system hardware with smart CERA algorithms.

If you have questions regarding the use or evaluation of CERA features, talk to us and find your software expectations to be met.

Sincerely yours,
The CERA team

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Highlights at a glance

- Measure your scanner geometry with dedicated, easy-to-build hardware phantoms

- Obtain a CERA Scatter Model using a few Slit-Collimated Projections

- Improve processing speed and let CERA adapt itself to your specific reconstruction PC

- Benefit from new iterative and filtered-iterative construction pipelines

- Let CERA XPlorer execute external tools and trigger complex workflows

Measure your scanner geometry with dedicated, easy-to-build hardware phantoms

CERA 6 introduces a method to determine the scan geometry based on a physical phantom. A suitable phantom can be easily built and adapted to your application requirements: it is based on a set of linear segments, each composed of four spherical markers arranged in a unique manner along a straight line. Our method does not require building a precise – and expensive – phantom but rather requires one initial 3D CT scan of the potentially imprecise phantom manufactured at low cost. After learning the actual phantom, it computes and outputs one projection matrix for each inserted X-ray image of this phantom.
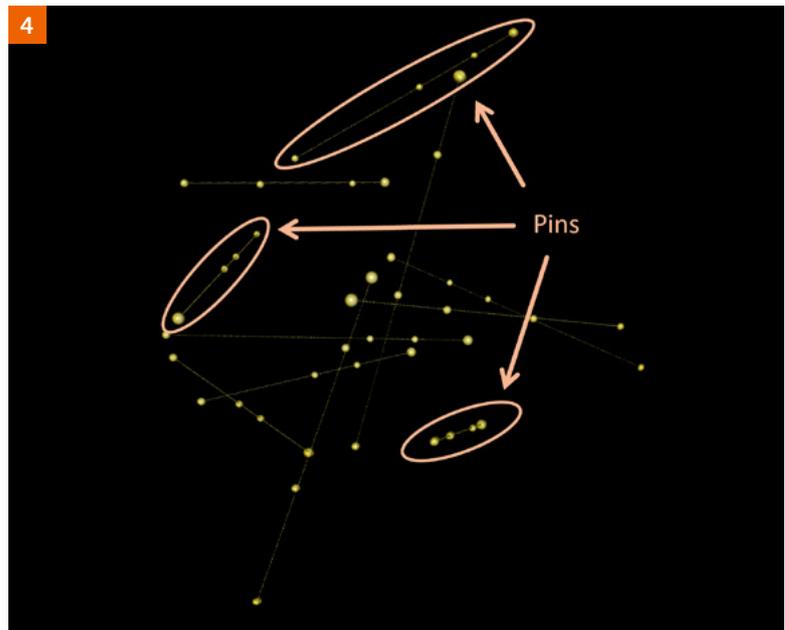

Figure 1: The design and construction of phantoms for scan geometry determination adopted to your specific imaging task is now becoming easy and straight-forward.

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Obtain a CERA Scatter Model using a few Slit-Collimated Projections

Today, CERA's model-based software scatter reduction method determines the scatter model of a scanning configuration from projections measured with and without a beam-stop array (BSA). Starting with CERA 6, the scatter model can now also be computed from collimated projections or from projections measured with a beam hole array. This can significantly simplify the measurement and the determination of scatter model parameters on your system.
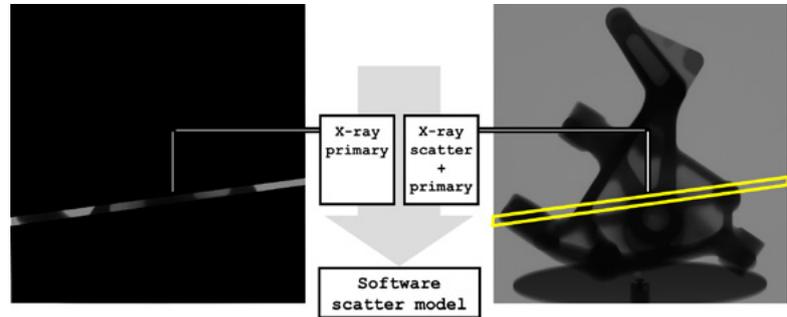

Figure 2: The X-ray beam collimation used during measurement can be selected non-centric to generate a representative software scatter model based on object parts of highest interest.

# Improve processing speed and let CERA adapt itself to your specific reconstruction PC

CERA 6 offers three levers to further reduce reconstruction time in your imaging workflow. First, additional algorithm refinements and their optimized implementation for instance in the SRM pipeline increase general processing speed. Second, the set of rules inside the CERA optimizer was further refined to produce beneficial problem size fragmentations and data streaming configurations even for non-standard imaging requirements. And third, the speed of time-critical processing algorithms is now automatically optimized for your specific compute hardware and reconstruction configuration by means of self-adapting compute kernels.

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Benefit from new iterative and filtered-iterative reconstruction pipelines

With CERA 6, a new and refined CERA iterative reconstruction pipeline is introduced, the ART pipeline. It offers new features, such as a filtered-iterative reconstruction mode that brings advantages of analytic (FBP) CT imaging algorithms to the iterative world. The CERA 6 iterative pipeline efficiently enables new (e.g. robotic) scan modes and allows for fast convergence speed and high image quality. Or you want to experience a new image impression with standard trajectories – it is up to you!
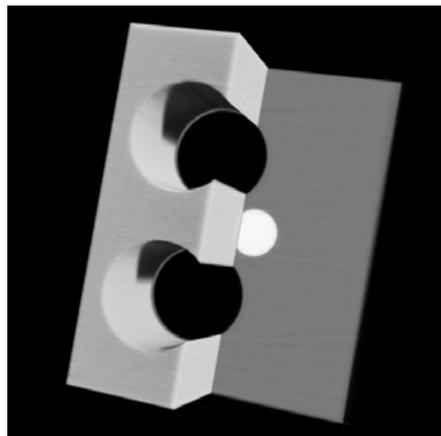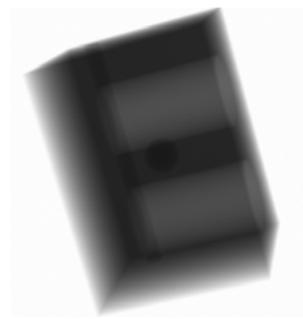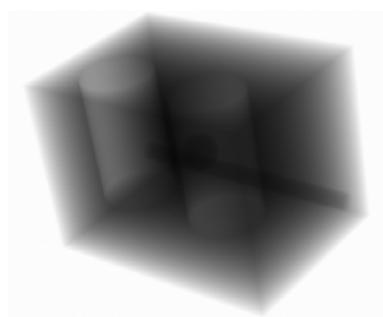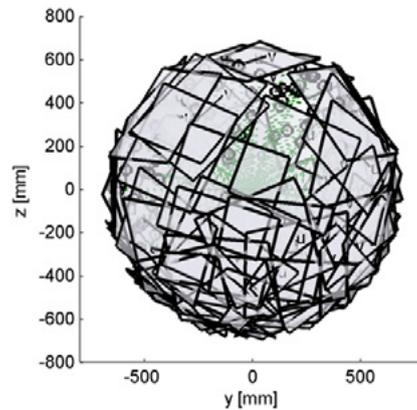
Top: robotic acquisition mode with sources on a sphere

Mid: two of 80 projection images

Bottom: rendered ART reconstruction result

Figure 3: Even non-standard scans with X-ray projections acquired at a few optimized polar and azimuthal angles can be reconstructed efficiently with the ART pipeline into high-quality 3D volumes.

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Let CERA XPlorer execute external tools and trigger complex workflows

Our front-end CERA XPlorer is now capable of executing customized command-line reconstruction tools directly from its GUI. Very handy: CERA has come with a set of precompiled command line example tools for years and these can be directly used. This significantly increases the CERA features that are available via XPlorer GUI and enables a new level of customized workflow automation via efficient integration of new and/or application-specific features within the XPlorer GUI.

CERA Feature Deprecation

A few CERA features are being superseded by enhanced versions and are planned to be removed in future CERA releases. These features are

- FDK-based half-beam reconstruction (replaced by SRM-based half beam reconstruction with improved image quality, introduced in CERA 5)

- ITR pipeline for iterative reconstruction (replaced by redesigned, more efficient ART pipeline, introduced in CERA 6)

- Rod-based geometry calibration (replaced by more complete geometry alignment based on a pin-sphere phantom, introduced in CERA 6)

Please consider this information in your feature integration choice.

Questions?

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