Release Notes - Dose Calculation

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Features:

- Beamlet dose coefficient calculator has undergone extensive GPU kernel rewrites introducing:
  - Extraction of beamlet specific terma with correction for beamlet-specific photon direction
  - Beamlet divergence effects which make the beamlet size smaller near the source and larger downstream
  - Per-beamlet alignment within isolated dose coefficient "pillar" structures resulting in retention of coefficients at radial distances out to (user-)selected *"kernel extent"*
- Support for defining more options via command-line argument `--config=<config-file>` (documentation at */dosecalc_gpu/doc/config.rst*)
- Further significant GPU kernel optimization resulting in speed increases of ~2x since v0.5 for similar quality settings.
- addition of `--out=<path-to-output>` as command line option for `dosecalc-beam` (as was previously introduced for `dosecalc-beamlet`)

User Facing Changes:

- Primary executable target names have changed as follows:
  - `mgcs_omni_precomp` --> `dosecalc-preprocess`
  - `mgcs_omnidose` --> `dosecalc-beamlet`
  - `mgcs_omnidose_full` --> `dosecalc-beam`
- Control of *kernel extent* is now available by setting configuration property `config:"kernel extent": <float>` and supplying the config file to `dosecalc-preprocess` using `--config=<path-to-config.json>`.
- Exposure of GPU memory allocation parameter `config:"max REV size: [<float>, <float>, <float>]"` which must be set by user based on unique per-case geometries and selection of quality settings. See /dosecalc_gpu/doc/USAGE.md (section: "Troubleshooting") for tips on setting this parameter (usually setting to `[700,700,700]` is sufficient for most cases). This setting doesn't affect computation speed, but large settings can unnecessarily occupy more GPU RAM than necessary (usually safe, but inconvenient for other users sharing the GPU concurrently).
- Previous version used a hardcoded "kernel extent" of 1.2cm. Due to algorithm optimizations, using the same 1.2cm kernel extent should result in much faster computation than previous versions. To inform the decision of this parameter please view the 6MV dose kernel cumulative dose deposition vs radial distance plot at /dosecalc_gpu/doc/resources/kernel_plots/6mv_dose_cumulative.png. For a 6MV photon beam:
  - ~70% of dose is spread within a 1cm radius
  - ~80% within 2cm radius
  - ~90% within 3cm radius

- ~95% within 4cm radius.

Typically, it suffices to keep this setting between 1-2cm for the calculation of all 1162 4pi beams, then increase this parameter once beam angle selection has taken place and only a subset of the beams must have their beamlet coefficients re-computed with less approximation error.

Bug-fixes:

- Geometric errors addressed by GPU kernel rewrites for beamlet dose calculator
- Corrected strategy for reducing full dose kernels to (#theta, #radii) with interpolation between angular bins
- Convolution angles were not true to kernel definitions (were aligned to CCCS angular bin edges rather than central axes)
- Empty lines in beamlist files would cause beamlist parsing to terminate early. Now comments and empty lines are ignored/skipped

Questions & Concerns:

Please contact the package maintainer: Ryan Neph <ryanneph@ucla.edu> with any error reports or questions.