BOA Release Notes

BOA v8.0, 07/31/22

New Features:
- License Installer now has the option to use the included trial license
- Shapelet Optimizer with GUI is fully implemented with Set Search, Nelder-Mead and Implicit Filtering methods. The first two methods are more applicable to shapelet optimization
- The terminal power/current density on a selected surface, which is tabulated in the .ans file and previously available only for the standard finite element interpolation, is now also implemented for shapelet interpolation. This .ans file can be displayed via the button *Disp PD File* in the Beam Optics Display Control Panel
- This latest version has the new capability to scan emission and beam current by varying electrode potentials via the Scanner
- Focused current and power density deposited at a surface is now able to be interpolated, smoothed by Shapelet method. With this method, BOA can generate local mesh specified by beam spot shape, circular or rectangular, and independent of the global FE mesh, to be used by Shapelets
- The 64bit version is now using Intel MKL library with the latest Petsc linear system solvers
- New ability to output fields and particle data of a currently running particle iteration that was not previously set for output
- New feature in beam optics simulation to parallel output particle data for large problems with several thousands particles. This speeds up trajectory display and restart
- Case comment is now stored also in the case file allowing it to be copied to another project when copying cases

Bug Fixes: Some case files are mistakenly excluded from the sent-case zip file. If the user material database was accidentally moved or unavailable when BOA started, an empty user database was then created when BOA closed. This version will no longer generate an empty database and also display a warning to users. While BOA still opens and the user database is again available, one can simply reload it in the Material Properties window. Fixed bugs in field surface/region display. Installation of license manager at a different location than the default sub-folder of the main application's is now working correctly. Fixed crash when close a project and open another project. Self-magnetic field is re-enabled. Post-processing the self-magnetic field is also reenabled.

BOA v7.5, 05/08/20

New Features: Update the Persistent Security license manager version 6.3 for better efficiency in query license server. Use the latest v12 Simmetrix library. Add capability to include higher terms in the power series to estimate of off-axis field components of an axial magnetic field. Add capability to specify the number of threads for BOA. All 2D external imported fields now have the same ability as the 3D fields to specify coordinate transformation in all three global axes. Add ability to prescribe elastostatic boundary conditions on model edges. Solid model linear translation and rotation are now fully functional. When thermionic emitters are disabled, ability to keep their boundary layer meshes is now an option on the Thermionic Emitter Attribute window. Safe aborting BOA is now finer grained control, able to abort during adaptivity and Newton iteration loop. Anisotropic material properties for Heat Transfer are available and under beta testing. In addition under beta, shapelets method is an available option, besides the default standard FEM interpolation, to interpolate and generate power density and current density on arbitrary surfaces. Parasolid solid models are now fully supported. Moda, a built-in routine in BOA to update case attributes and parameters is now able to update cases with models of different length units, from ACIS to Parasolid and back. CCRlmUtil besides the physical address now also displays the server's IP address when the server is pinged.

Bug Fixes: Particles are now correctly reflecting from symmetry planes when the model utilizes both x and y, or y and z, or z and x symmetries. Display correct limits of the electrostatic potential field in the

Cut Plane Field dialog. Fix crashes due to zero failed tests in VTK bounding box. Fix crash when open and close projects multiple times. For multiple thermionic beams in previous versions, when one or more emitters are disabled or re-enabled, re-mesh should be required, but not. It is now required. When importing axial magnetic flux density field, BOA now generates its off-axis field correctly when transformed cylindrical to Cartesian coordinates. Re-meshing is now only required when truly needed. Fix bug that does not allow using a previously adaptive mesh as an initial mesh.

Known issues: SolidWorks 2019 produces ACIS files that BOA is unable to import. SolidWorks 2020 has solved this issue. When executing a lengthy simulation (several hours), the GUI sometimes closes itself or even hangs; however, the simulation would still execute to completion, and preserve field results for later post-processing. If the simulation is still going, one can run the GUI again, reopen the same case, and the GUI will automatically update with the latest simulation results. A workaround is to turn off monitoring the simulation via Execute, Monitor Job. You can turn it on again occasionally to check the simulation progress then turn if off again to prevent GUI crash or hang.

BOA v7.0, 5/11/19

New Features: Update to the latest Persistent Security license manager version 6.2. Update to Visual Studio 2015 to use C++11 features and the latest Simmetrix and VTK libraries. Entity field display is much more robust and efficient because no IO to files is used to store the fields. Add ability to display mesh and fields of the standalone, dynamic part in ePIC. Multithreaded Mesher is now fully functional. Add ability to name non-native (CAD) surfaces for convenient surface selection. In ePIC, the dynamic part to enclose a particle bunch is no longer required to be adjacent to an emitter. This permits to continue to track a bunch from one model to another by injecting a bunch from the former to the latter, and each model has its own dynamic part. Additionally, when injecting a particle bunch from another case via its .trj file, the new model can have different length unit than the injecting one. Add ability to select a time step, a cut plane and half plane thickness to collect particles for processing planar particles. RMS and averaged currents are now computed over the selected time step range instead of all available time steps. Parser to load Opera3D field is now available. Thermal effects with the Inverse Cumulative Distribution method now have the option to enforce circular symmetry for circular emitters. Cibo tool to generate an injected beam also has this circular symmetry option. More robust algorithm to determine surface side for boundary meshes adjacent to thermionic emitters. Update models with surfaces having similar names of more than 5 leading characters. Elastostatics for stress analysis is ready for testing making BOA truly a multi-physics simulation tool. 100% and 90% emittances are now correctly computed with proper oblique ellipses. Beam diameter for both 100% and 90% planar particles are reported.

Bug Fixes: Fix crash when there is only one case, and being removed from a project. Re-enable Christine and Trak injected beam capability, and implement automatic injection plane transformation to the specified emitter. Fix accounting errors in beam current and energy in planar particles with back-streaming particles. In ePIC, kinetic energy is now calculated relativistically in the convergence plot. Fix bug in secondary emission when multiple background domains are present. Turn back on the options to inject beams via .ppo file, which is generated in the Beam Optics Panel, and .ibf file, which is generated by Cibo from the Tools menu. Prevent the mesh redisplaying when BOA had displayed the mesh, un-displayed it, and then regenerated it. Fix update/reload models having parts and surfaces with names shorter than 5 characters. Fix crash due to un-initialization of the planar particle plane's normal vector when loading particles after the simulation completes for the first time. Correctly report the emittances with PI factor i.e. PI-m-rad. Fix material rename error in the Attribute panel when a region is not selected and closing or switching to another attribute panel. Fix crash in ePIC when using HFSS fields with thermionic emitters. Fix crashes when closing a case after computing RMS and averaged power density on selected surfaces in ePIC.

Known issues: When executing a lengthy simulation (several hours), the GUI sometimes closes itself or even hangs; however, the simulation would still execute to completion, and preserve field results for later post-processing. If the simulation is still going, one can run the GUI again, reopen the same case,

and the GUI will automatically update with the latest simulation results. A workaround is to turn off monitoring the simulation via Execute, Monitor Job. You can turn it on again occasionally to check the simulation progress then turn if off again to prevent GUI crash or hang.

BOA v6.5, 12/26/17
New Features: Replace the older folder selector with more robust version to prevent crashes when access network drives. Dismissed messages can be reinstated. Customization for Messages and Colors and Global Preferences are consolidated and now located in Tools, Options… menu. Imported HFSS electromagnetic field for ePIC can also include the magnetic flux density. Imported CST electromagnetic field for ePIC is now available. Linear instead of constant interpolation for imported external fields is now implemented. Multiple injected emitters, each has its own virtual movable mesh/region and each still tracks a single bunch of particles, are now available in ePIC. Add ability to generate an injected beam profile with thermal velocities and verify the initial transverse emittances, or Gaussian spatial emission distribution. Ability to input plotting ranges for ordinates in the Plot Parameters. More robust thermionic algorithm when either space charge limited or temperature limited is dominated. For ePIC, ability to inject only once an electron bunch, which can be extracted at a specified time step in the .trj file from a previous simulation. Monitoring either geometric or normalized RMS emittance in ePIC single-pulse or injected-once analysis is now possible.
Bug Fixes: Fix crash when create a new project but then cancel. Correct scaling of convergence plot window when switching from the main/new window back to the corner window. Fix bug that incorrectly uses parallel Mesher even when serial version is selected. Fix bug with magnetostatic scalar field range. Particle iteration is now updated correctly when processing currently available iteration while BOA is still running and the View Results, Electrostatics or Beam Optics are also open. Fix error in temperature-limited emission that overestimates Schottky effect. The log subfolder is no longer in the same folder as the user material database but in the local user application data folder. Clearer error message indicates when the folder keeping the user material database is not writable. Previous versions when encounter this issue simply exit.

BOA v6.5, 6/8/17
New Features: Field display for selected parts is now available. Previously only display field on selected surfaces is possible. In ePIC analysis, it is now possible to launch/emit particles within an emission time range for both thermionic emitters and injected beams. In addition, ePIC convergence plot provides the total electric energy of self-electric and imported RF field as a monitored option. However, for existing results without rerun the case, this total electric energy is only for the self-electric field as in previous versions. Fine mesh in front of emitters (applicable with adaptivity only) is no longer available. Ability to disable/enable local mesh refinement with one click is now available. Ability to plot imported RF fields vs time. ePIC now has new feature (under testing) to simulate the RF gun in an ultrafast electron microscope with a virtual moving region so that extremely high resolution of one electron bunch can be achieved. For this type of simulation, the temporal RMS geometric emittance is then monitored in place of the current if desired.
Bug Fixes: Remove unnecessary re-meshing when attributes of meshing entities or emitters having no effect on the mesh are modified. Obsolete models and their accompanied meshes are no longer copied when copying a case. In field emission in combination with thermionic emission algorithm, in which the extremely high field exists (greater than 10^8 V/m), the work function reduction by the field via Schottky effect no longer holds. In this case the Murphy-Good equation for thermos-field emission should be used. In the current implementation, with exceedingly high field, BOA will simply ignore the Schottky effect. Update cases for models with built-in symmetry is now working.
Known Issues: The line plotter to monitor the current convergence would crash, when in some runaway situations the current is getting too high in exceeding its floating point limit. The present ad hoc solution is to set the emission current to 1.0×10^6 A when it exceeds this limit.

BOA v6.5 beta 11/7/16
New Features: Use latest VTK and Simmetrix libraries, new license key, more stable and robust nonlinear magnetostatics, more robust current convergence algorithm for beam optics, extra boundary layer mesh inside thermionic emitters to display clearer discontinuity of charge density field at the emitter, displaying surface field specialized on a specific region is implemented. Be able to gracefully abort the integrated Mesher when it hangs. More robust algorithm to slice model and field.

Additional Naming Conventions:
Names in BOA for files including those for CAD drawings, external fields, for CAD parts and surfaces, for meshes, BC's and user's materials must *not* contain any of the following characters:

#%{}[]\<>*?/$'!":@+`|=^,;

When users enter names to specify meshes, BC's or user's materials that have any of the above special characters, BOA will automatically remove them and save in legal form.

Bug Fixes: shell meshing is now working, Moda bug fix to update cases that went through "Cleanup Case Thoroughly", consistent meshing data to generate the initial mesh when the Mesher Dialog is open. Axial emittance of different types are updated and plotted correctly. Clearer diagnostics and warning messages when updating case attributes when CAD model is changed.

Known issues: When executing a lengthy simulation (several hours), the GUI sometimes closes itself or even hangs; however, the simulation would still execute to completion, and preserve field results for later post-processing. If the simulation is still going, one can run the GUI again, reopen the same case, and the GUI will automatically update with the latest simulation results. A workaround is to turn off monitoring the simulation via Execute, Monitor Job. You can turn it on again occasionally to check the simulation progress then turn if off again to prevent GUI crash or hang.

BOA v6.4 Beta 04/16/16
Bug Fixes: Secondary emission, line plotting on a new window, thermal effects with ICDFT, case comments is also copied when copy or rename a case, surface field plotting.

New Features:
1. More robust line plotter particularly with second y coordinate
2. Display current density on primary emitters
3. Scatter plot of particles on terminal surfaces
4. More intuitive message when no license is available
5. Beta testing of Field Emitter
6. Finer grain parallelization in constructing thermionic/field emitters
7. Option to specify the ODE relaxation parameter in the Execution Panel for particle pusher
8. Shell meshing is fully functional

BOA v6.3 10/30/15
Bug Fixes: Open case name is now properly listed in the application title. Fixed random crashes when open a post-processor after a simulation completion. More robust algorithm and clearer messages when copy or close a case with attributes dialog(s) open. Available particle iterations are now automatically updated on the open Electrostatics and Beam Optics Control Panels while BOA is running. Fixed model inconsistency bug in beta 2 and beta 3, which causes a re-mesh after a case is closed after a complete simulation and then reopened. Non-orthogonal planar particle plane can now also be specified by manually entering its normal vector coordinates; previously it can only be specified via a selection of a surface. Fixed bug to generate the background correctly when a background region is completely

isolated and enclosed by a larger background. Fixed demo license issues, and more robust network license installation. Terminate ePIC simulation safely. Particles in ePIC can be colored correctly by generations, current of ID. Parallel IO of particle data is now working correctly. Calculate correctly the backscatter's velocity. Add units for material properties dialog. Fixed bugs in counting particles emitted from multiple emitters. Fixed crash in particle pusher after adaptivity requires only one pass to converge.

New Features:
1. More intuitive and simplified menu for beam optics display panel and especially for model background and symmetries.
2. Although acute angle symmetry and model transformation have been fully implemented and functional, they are not yet enabled due to license issues with Solid Modeler.
3. Models with built-in symmetries can now be specified.
4. Both global and project level persistent preferences can now be set via File, Options and View, User View Preferences respectively.
5. Parallel IO particle data are now available.
6. Plot images of power density from a 3D surface in either color or gray scale. Display power density on 3D surfaces in either color or gray scale.
7. BOA can now calculate planar particle positions, emittance and brightness on an arbitrary plane.
8. Plot emittances or brightnesses along a global or arbitrary axis.
9. Better rendering of surface fields.
10. Display and plot normalized electric field. The electric field is normalized by the material dielectric strengths, which is now a property in the material database.
11. More robust algorithm to compute and store displaying field limits.
12. Customizing the background size via padding is now possible.
13. Automatically prescribe Dirichlet BC on either or both symmetry and asymmetry planes in magnetostatic solver via check box.
14. It is now possible as an option to add meshing parameters instead overwriting the existing one of the same name.
15. Shell mesh is now more robust.
16. Reading meshing log or release notes is now multithreaded allowing the full use of the GUI while leaving the files open.
17. Injection of particles with arbitrary coordinates without having to specify an injection plane in model. Convenient for multipactoring ePIC simulation.
18. Ability in ePIC if desired to specify particle injection only once initially (previous versions would inject particles every time steps).
19. Option to turn off Exit Message box timeout.
20. Line plots now have the option to plot second ordinate axis to differentiate variable scales.
21. New option in thermionic emission for thermal effects using Inverse Cumulative Density Function Technique (ICDFT).
22. Evaluate vector surface fields (E, D, B, H, GradT, q") now obeys physical surface continuities. For an existing case, to enable this new feature, users are required to manually check off the Recovery option in the Attributes, Misc window.
23. Ability to set and replot image size of power density so that better local details can be displayed.
24. Ability to Update CAD model with additional parts, which are automatically assigned with attributes of existing parts having partially similar names (more than 5 consecutive characters).

Incomplete: Due to licensing issues, acute angle model symmetry and transformation is not yet available.

Known issues: Self magnetic field is not yet working correctly with models using symmetries. Shell meshing only works for typical geometries that do not have two neighboring shells having destination face of one coinciding with lateral face of another. Plots with 2nd y axis are not yet working on New Window option due to a bug in the Plotting package.

BOA v6.2 Patch 10: 12/16/14
Bug fixes: Re-enabled to inquire/display local entity mesh information. Crashes when compute surface power due to particle interception. Allow to specify shell mesh refinement (to select the transverse plane) when the model has no standard background enclosure. Fix algorithm that increases GUI database size dramatically when Using custom colors, and consequently slows down case loading considerably. Case date is no longer updated when a case is only opened to inspect its attributes. Crashes when specifying more than one set of periodic boundary. Re-enable display of vector field components in magnetostatics. EPIC initial step size is incorrectly reduced by 0.8 to the power of the number of emitters. Memory of temporal particles of an ePIC case is not released when the case is closed, only when BOA exits. Particles leakage in ePIC with periodic boundaries and models using no background. Send-Case-to-CCR tool is now patched and able to send a case directly to CCR. This tool can also be activated in the dropdown menu via right-click on the case. Due to the webserver had changed the file locator protocol, the lightweight "Check for Updates" tool was broken, always showing no update is required. This patch fixes this issue.

New features: Ability to import an RF field for ePIC analysis including a coaxial field and VSIM. Ability to animate particles of accumulative time steps spanning over several restarts. Secondary emission simulation results will also able to display the penetration depths of backscattered electrons. Simulations with symmetry for acute-angle models are now possible using either reflection or periodic boundaries. Temporal integrators to compute RMS and Averaged surface power and current in ePIC are now available. HFSS field reader is now available with ePIC. Improved distance measurement widgets. More robust algorithm to set CAD surface names from solid models. Ability to specify a particle energy threshold in eV as the filter to re-integrate RMS and average surface power. Ability to select multiple non-CAD named surfaces. Ability to rename a case by simply left click on the case on the project tree twice, or right click and select Rename. Case names are now ordered alphabetically as previously but now case insensitive. However, after a case is added or renamed, reordering will still take effect only after its project is closed and reopened.

BOA v6.2: 9/9/14
Bug fixes: automatically include reflective planes when symmetry is enabled, for Moda to update attributes when background type is changed, crashes when verify injected beam in PAPA format, send cases with names having extension, put back ability to include isolated empty space for particles, change material properties without adding to library but mistakenly use File instead Numeric value, crashes when add a surface having no incident particles after deleting a surface from surface power display list. Crash when plotting magnetic field. Crash when switch a new magnetostatic case to electrostatic/beam optics analysis. More robust algorithm to handle zero particle initial velocity. Activated skipping particle option when importing Christine 3D beam files. Fixed sorting routine to support multiple current density types on the same part in magnetostatics. Used correct model unit when internally converting remanence to equivalent current density vector. An error in calculating the rotation term in Boris push was found and fixed allowing to simulate crossed field devices. Bugs in selection of particle steps for animation and particle current legend are fixed.

New features: Ability to select a few primary particles to display with their secondaries only, to set number of particles to skip for display, to prescribe a tabular data field to a surface in heat transfer, to optimize beam current on electrode potentials, to verify boundary layer mesh structuredness before executing a beam optics simulation. Allow entity names with leading spaces. Speed up self-magnetic

field calculation by approximating the self field in the 1st self-magnetic-field iteration via relativistic correction. Using attributes of the last entered thermionic emitter for the next adding thermionic emitter. Store secondary yield coefficient per iteration, per emitter to file; enable to display yield coefficient on secondary surfaces. Radiation heat transfer in enclosure by Monte Carlo method. Updated to work with SW 2014. Slicing model and plotting planar particles on an arbitrary plane is more robust allowing users to select a surface to determine the slicing plane. Imported magnetic field file is stored in attribute file in relative path. Header lines of Maxwell 2D/3D files can have various number of data fields. PlotParameters allows keeping a plot on a new window open when the dialog exits. Plotting planar particles on an arbitrary cut plane is now available including for PAPA. Number of legend labels can now be customized for vertical and horizontal bars separately for more legible. Magnetization specified by either magnetization force or remanence with global or local vector (via a selected surface) is now fully implemented. Optimization on beam optics to include ka spacing, emitter diameter, emitter curvature and electrode potentials is fully implemented. Updating the Local Magnetization vectors in multiple parts with the same name due to geometry changes is now possible. In ePIC, pausing animation will indicate in the End Step box the currently paused time step. Combination of all time steps from several restarts is now possible and done automatically in animation. Joule heating now permits both Dirichlet and Neumann boundary conditions. Secondary emission algorithm and UI are extended to allow specifications of coating material and its thickness.

Known issues: Self magnetic field is not yet working correctly with models using symmetries.

BOA v6.1 Patch 3: 2/4/14
Bug fixes for (a) displaying planar particles with secondaries, (b) computing planar particles statistics as they are immerged in a magnetic field, (c) using external uniform magnetic field, (d) memory leaks in line plotting, (e) reselected surfaces are not highlighted after they were removed during field display, (f) enforcing in the UI the maximum number of secondaries per a primary to be 100, (g) GUI crash when using "Check for Updates" menu in x86 platform.

User's background color is now retained in the original case after it is copied. Expand large file query to trajectory files. Add capability to plot vector fields of planar particles, ability to change background color in line plotting, automatically compute total power deposited by particle beams on selected surfaces.

BOA v6.1 Patch 2: 1/1/14
Bug fixes for analysis type spelling in project file, rotation matrix to correctly project power density surface display to 2D image, preservation of meshing attributes of secondary emitters, large file size more than 2.1 GB can be queried.

BOA v6.1 Patch 1: 12/08/13
Bug fixes in plotting external magnetic field from MaxwellRZ, MaxwellXY. More robust power density field transfer from beam optics to heat transfer. Bug fix for crashes when delete an emitter specification; for inability to construct the power density field for cases having name with a combination of '-' and spaces e.g. "Case 5 - 1".

BOA v6.1: 11/05/13

Installer unifies x86 and x64 platforms and with other CCR products to provide seamless uninstall and patches. Plotting of planar particles on a non-orthogonal plane is now available. Bug fixes in Meshing parameters, Uniform Magnetic Flux Density dialog.

BOA v6.0 Patch 1: 09/24/13

Bug fix for scalar bar color of particle current and ID.

BOA v6.0: 09/10/13

Bug fix in Boundary Layer Mesh Thickness. Turn off automatic update of the number of launch faces from the initial mesh in thermionic emitter dialog to avoid lengthy delay for a model with large mesh. More robust surface selector. Update tool can now install a new release or patch directly if desired. Capability to project the power density to a 2D plane for more accurate spot measurement is available. Radiation boundary condition and temperature-dependent materials (nonlinear) are now available for heat transfer analysis. Capability to change the color of the plot title text is also available. Color of regions or surfaces can be customized. Bug fix to keep translation vector for importing magnetic field stored in DB. No extrapolation for out-of-bound imported magnetic fields is now the default. To enable extrapolation for out-of-bound field is now optional. Fix crashes in Win32 version. More robust mesher and case loader. Cases in the Project window are now displayed alphabetically.

BOA v5.8 Patch 1: 07/18/13
Bug fixes in field smoothing, adaptivity, surface field display and Send Case to CCR utility. More robust emission algorithm. Ability for GUI to restart, reattach and monitor a running case.

BOA v5.8: 05/06/13
New license manager using Safeguard LM from Persistent Security; New license files will be required for existing users to upgrade. Bug fixes and GUI improvement. TRAK particle file reader is now available. Annulus meshing is possible. Option to have only space charge limited thermionic emission is now available.

BOA v5.7: 02/28/13
Switching analysis types from all available types using the same CAD model is now working correctly. Select a surface to determine intercepted current and second emission is now available. Smoothed BOA integrated magnetic field for electrostatic beams and PIC is implemented. Local normal and tangential surface vector fields can be plotted. Magnetostatics and Helmholtz solver can now use finite element current density fields generated from an electrostatic or PIC simulation as source terms. Space charge neutralization factor can now be prescribed to an optically transparent CAD part. Imported Maxwell 2D/3D magnetic field can now have general free format, and either increase in z then y then x per standard or in x then y then z. CAD model can now be validated directly from the Model menu without having to create a case for it first. Location of User Material Library can be changed, and existing user library can be moved.

Bug fixes for magnetic field surface display, command line parser for multiple spaces in a case name and others.

BOA v5.6: 11/20/12
Bug fixes in magnetic field solver due to rotation errors when coil axis is not z axis, correct assignment for coil current direction, and others. Clearer warning messages when solid model has errors. An option to efficiently compute self magnetic field is added. No longer requires to enter cathode-anode spacing for thermionic emitters. License Installer now automatically saves a backup license. Later after an uninstall, the License Installer will then be able to find it for a new installation if choose to. Particle and line field plots are now able to use user's specified display unit. Emittance plots of (x,x'), (y, y') and (z, z') spaces are now also available. Cibo now uses relativistic formulation to compute injected beams, and an uniform axial magnetic field can be specified to generate particle angular velocity.

BOA v5.5: 09/19/12
Fixed Self Magnetic Field, Adaptivity with multiple free mesh regions, PIC simulation and its postprocessing temporal particle data. Improved Thermionic Emission algorithm also allowing users to exempt cathode-anode spacing from the determination of virtual emitters. More intuitive UI for adaptivity on the source term. Updating model and case attributes is now done correctly when number of parts is changed. Several GUI tips are added. Display model coordinates via mouse cursor in different units is now possible. The Beam Optics Control Panel can now display micro-perveance for a selected emitter calculated from primary emitting particles only at the emitter and a beam cross section. Beam emittances under evaluation are also provided at the beam cross section. For built-in materials, Tungsten now has the work function of pure tungsten, and M-Tungsten of M-type dispenser cathode. Therefore, existing cases use Tungsten and still desire the lower work function of M-type dispenser cathode, please change the material to M-Tungsten. Thoriated tungsten and LaB6 are newly added built-in materials.

BOA v5.4: 05/31/12
Installer permits side-by-side installation with older version, no longer uses environment variable BOA_PATH. Include in View Menu to toggle Reset Mesh View. New option to import Axial 3D magnetic flux density field. For thermionic emitter, use can now specify Longo's coefficient. The Optimizer now supports SolidWorks 2012.

BOA v5.3: 05/25/12
Visual Studio 2010 Port, used Simmetrix DLLs, Joule Heating, Fully parallelized adaptor, Adaptivity on Source Terms, More intuitive interfaces for line and point field display, Safe Abort, Consistent mouse click and up/down key behaviors for control list. Randomly and uniquely reduce number of emitting particles from large sample by "Hard Set".

Bug Fixes including BL meshing, particle pusher for multiple backgrounds, storing user material correctly when click on OK to exit Attributes Page, plotting out-of-bound axial imported magnetic data.

BOA v5.2: 12/15/11
Fully parallelized adaptor, multithreaded mesher, Bug Fixes.

BOA v5.0: 06/15/11
Adaptivity for Heat Transfer, Quadratic Interpolation for Heat Transfer, Bug Fixes.

BOA v4.4: 11/02/10 12/14/10
Temporal PIC with animation including Stop and Pause; Heat Transfer capability.
Time step scaling, error checking for temporal boundary conditions, effortless switching static to dynamic analysis.
Power Density Field display for Temporal PIC is not yet working.

BOA v4.2: 02/25/10, 04/19/10, 04/29/10, 05/14/10
Due to the addition of the Helmholtz solver, future nonlinear Heat Transfer capabilities and plotting of fields that depend on the material properties, completely backward compatibilities in the case files is not possible. Old case files generated by earlier versions are required to re-check the correctness of the meshing parameters particularly the SizeType, and if a magnetostatic case, to make sure the proper analysis type is set before remesh and rerun the analysis to refresh the field results for displaying.

Bug Fixes:
1. In planar particle display, when the Input Beam Centroid Coordinates is selected, the proper coordinate controls are now correctly enabled.

2. Due to SW 2010 does not preserve surface attributes when saving to ACIS files, it cannot be used with the Optimizer to update geometries. SolidWorks is currently working on resolving this issue.
3. Electrostatic Optimizer for surface electric field did not provide an entry for the objective field.
4. Local meshing for parts having the same CAD name now works correctly.
5. Permit using model names with embedded character "-".
6. Fixed bugs for importing all cases under an existing project to another.
7. Importing magnetic fef file created by BOA magnetostatic solver to a beam optics case is now working correctly.

New Features:
1. Nonlinear magnetostatic solver has been improved to include Armijo rule for more robust Newton stepping, better termination of the iteration in the Newton algorithm.
2. Display model coordinates is now the default.
3. Imported 1D axial magnetic field file can now can header less. The file still has to be two-column table, the first for the axial coordinates and the second for the axial magnetic flux density in Tesla. BOA will determine the number of data points, reorder the field with respect to the axial coordinates. This format is thus more forgiving, but the user now has the responsibility to check the correctness of the data by plotting it in the Beam Optics Attributes window.
4. Allow geometries with same named parts. All the same named parts or surfaces are assumed having the same properties including material and boundary conditions.
5. Allow geometry update with models having same named parts, more or fewer parts and isolated vacuum regions. All the same named parts or surfaces must have the same properties including material and boundary conditions. Thus, an added geometric entity having the same name with some existing entity will be assigned with the same properties of the existing one. Any newly added parts do not find any companion in the existing model will be assigned as vacuum and floating electrode.
6. The Optimizer now allows to optimize the beam diameter and scallop by only varying the axial translation of the magnetic field and/or its magnitude. No CAD drawing nor design tables are required.
7. Better diagnostics and output message when the Optimizer terminates.
8. Re-assign another model of different name in an existing case still preserve the new model name. Previously, it was renamed to the existing name.
9. Electric flux density and magnetic fields now can be displayed for both regions and surfaces.
10. Helmholtz solver is now in beta with current density can be prescribed either spatially uniform or sinusoidal.
11. Copying case with options to copying existing solution to display and attribute files to allow executing BOA manually either by the GUI or the included standalone tool, CopyCase.exe.

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BOA v4.1: 01/09/10
Bug Fixes:
1. Uniform magnetic flux density did not work correctly in both beam optics analysis and the Optimizer.
2. Initial surface, part and free region meshes, if specified, are now fully preserved during adaptivity.
3. Surface selection for power density, electric and magnetic fields works correctly.
4. Synchronize particle iteration selection between beam optics and electrostatics control panels.
5. Fixed GUI freeze when exiting a material plot via the x button.
6. The snapshot of the main screen displaying model and fields or line field or planar particles can now be taken correctly. A dialog will ask the location and name to save the snapshot.
7. Update and display correctly the data file name depending on the plot type for viewing by the built-in text editor in the Plot Parameters dialog.

8. Fixed problems with adapted mesh and field solution when the number of particle iterations exceeded the specified number of iterations per adaptivity. This problem occurred when adaptivity was asked only for the first or the first three iterations.

9. Local quadratic field smoothing and adaptivity are now working correctly. Previously, only global quadratic field smoothing worked but produced fields with oscillation.

10. For adaptivity the default objective is now set at 0.15 (and the recommended number of passes is 3).

11. Fixed bug to browse for a magnetic field file, which is already in the same case folder.

12. Better displayed error message when a "No CAD" named emitter is updated and lost its tag.

13. Planar particle statistics reported incorrect Parallel KE. The same values of Perpendicular KE were used.

14. Smaller scalar vertical bar legend so that full numeric values are displayed.

15. Slicing plane for planar particles is now persistent when switching particle iterations.

16. Fixed bug of selecting and saving main screen snapshot to file.

New Features:

1. Change the part opacity in the Attributes window previously took effect only after hitting on the Enter key or clicking on the OK button. Now the user can also simply click on any item or just on the Part Level control list for the change to take effect.

2. More intuitive grouping material selection menus in Electrostatics and Magnetostatics Parameters windows.

3. Improve the surface and part selector for various attribute assignments.

4. Construct the 1st order recovery field is now fully parallelized.

5. User now has the option to have adaptivity only in the first particle iteration (pure electrostatics), only for the first three iterations or after every X number of iterations.

6. Surfaces of translucent parts can now be selected.

7. Particles in the planar particle plot now have the same color (generation or intensity) as in the model screen. Particle colors in both screens can also be updated at the same time from the View-Color-Trajectories menu.

8. Brillouin field (Bb) is now calculated and listed in the Particle Planar window at the specified plane each time planar particles are generated.

9. Change the Model Geometry Display Resolution in the View menu now takes effect immediately after clicking on OK.

10. Provide a new standalone tool to copy, rename a case to insert to a project. Enter CopyCase -i -h in a Command Prompt for more information.

11. The installer now provides the option to use the existing license file. If the existing license cannot be found, this option will gray out.

12. Analytic coil option for magnetostatics analysis now only requires the user to select the part and specify the coil current. Boa will compute the coil current density, radii, length and coil axis vector internally. In addition, the coil axis no longer needs to be parallel to one of the major three axes.

13. Much faster Newton solver for nonlinear magnetostatics.

14. Parts prescribed with a current density will be automatically added to the Local Mesh Refinement.

15. Improve magnetostatics error estimates for adaptivity.

16. Better automatic scaling of the ordinate axis in line plots.

17. Depending on the analysis type and what solver is current running, monitor of simulation progress is automatically switching between nonlinear magnetostatics, adaptivity, beam optics and optimization.

18. Better error checking for the Optimizer.

19. Support SolidWorks 2010.