**GRV Project Document Appendix – Beta Testing Test Results**

Legend:

\*: This term is not required to pass initially

| **Requirement Spec**  **Reference** | **Software Feature(s)** | **Code Block(s) Tested** | **Status**  (Pass/Fail or  Pass/Fail with explanation) | **Date Tested** |
| --- | --- | --- | --- | --- |
| 4.1.1.1 | Correctly progressed tensor multiplication and number multiplications | class Tensor  scale, product, producti | Passed | Nov. 1 |
| 4.1.1.2 | Correctly progressed tensor product and their contractions | ||  product | Passed | Nov. 1 |
| 4.1.1.3 | Correctly progressed tensor transpose | ||  transpose | Passed | Nov. 5 |
| 4.1.1.4 | Correctly outputs identity matrix and Levi-Civita Symbol | ||  IdentityMatrix, LeviCivitaSymbol, I4, LC3, LC4 | Passed | Nov. 15 |
| 4.1.1.5 | Correctly progressed matrix inverse and determinant | ||  Adjugate4, determinant | Passed | Jan. 7 |
| 4.1.1.6 | Valid special support for 4d spacetime tensor operations that is allowed in GPU processing | ||  All kinds of method ended with 4 | Passed with modification since the gpu was not available, and passed | Nov. 15 to Jan. 25 |
| 4.1.2.1 | Accuracy-customizable representation of compositions of wavelengths | class WColor/WFunction | Passed | Jan. 26 |
| 4.1.2.2 | Valid add & subtract operations between WColors | ||  Add, fillAddW | Passed | Jan. 26 |
| 4.1.2.3 | Valid number multiplication and scalar field action on WColors | ||  MultiplyW, filt, scale | Passed | Jan. 26 |
| 4.1.2.4 | Valid Redshift & Blueshift operation of WColors | ||  mShift, shift | Passed | Jan. 26 |
| 4.1.2.5 | Valid conversion from Wavelength functions to WColors | ||  fillAddW from new instance | Passed | Jan. 26 |
| 4.1.2.6 | Valid conversion from black body radiation to WColors |  | Not yet implemented |  |
| 4.1.2.7 | Valid conversion from WColors to RGB colors | ||  RGB | Passed | Jan. 26 |
| 4.1.3.1 | Able to run the program on supported GPUs or CPUs |  | Expectation removed since GPU is no longer supported |  |
| 4.2.1.1 | Distribute each region with a natural number index | Region  code | Passed | Nov. 17 |
| 4.2.1.2 | Record a rough 4-cube that includes the whole region. Allows infinity in certain directions. | ||  roughRange | Passed | Jan .24 |
| 4.2.1.3 | Record a simple and specific boolean expression in coordinate claims the effective covering region subset of the 4-cube | ||  range | Passed | Jan. 24 |
| 4.2.1.4 | Record the way it displays in 3d euclidean space when not rendering |  | Not yet implemented |  |
| 4.2.1.5 | Record the WColor image displayed when the light ray iteration ends(the default should be black) | GUI, Screen, Core  screen | Passed | Jan. 26 |
| 4.2.1.6 | Record an expression of the metric in the region | Region  gab | Passed | Dec. 17 |
| 4.2.1.7\* | Record expressions of the inverse metric, first derivative of the metric and the Riemann Curvature Tensor in the region | ||  gAB | Passed with modification: Riemann curvature tensor expectation removed since it is not necessary | Dec. 17 |
| 4.2.2.1 | Record expressions of the attached region index and corresponding new coordinate in terms of the old coordinate | ||  Adjacent, coodTran, coodTranMat, coodTranMatInv | Passed | Dec. 17 |
| 4.2.2.2 | Set attached region index negative if it is the edge of the spacetime |  | Passed with modification(not actually used in the program) | Jan. 26 |
| 4.2.3.1 | Record the shape of the object surface in the coordinate system(3-cube, 3-sphere or 3-simplex) | Obj  objType | Passed | Nov. 16 |
| 4.2.3.2 | Record the reflection rate of the surface | ||  reflection | Passed | Nov. 17, Jan. 26 |
| 4.2.3.3 | Record the WColor of the light it emit on the surface | ||  emittion | Passed | Nov. 17, Jan. 26 |
| 4.2.3.4 | Record the WColor filter of the surface | ||  filter | Passed | Nov. 17, Jan. 26 |
| 4.2.4.1\* | Record the expression of precalculatable light propagation |  | Expectation removed |  |
| 4.2.4.2\* | Record the killing vector field at each point in its component form |  | Expectation removed |  |
| 4.2.4.3\* | Record the special geodesics displayed, its RGB color | GUI, Traj  datas | Passed before. Not checked after updating | Jan. 14 |
| 4.3.1.1 | isLightRaySplitting & maximum #splitting rays |  | Expectation removed |  |
| 4.3.1.2 | Stepsize and the maximum #step | Core, RayCalc  stepSize, maxStep | Passed | Jan. 26 |
| 4.3.1.3 | Resolution of the rendering | Core, RayCalc  scrWidth, scrHeight, RayCalc | Passed | Jan. 26 |
| 4.3.1.4 | Light ray WColor accuracy | WColor  accuracy | Passed | Jan. 26 |
| 4.3.1.5 | Method of solving PDE(rank n RK method or adaptive RK method) | RayCalc  run | Passed | Jan. 26 |
| 4.3.1.6 | Rendering platform(GPUs, CPUs, Java Alternative Algorithm or Java Thread Pool) |  | Passed with modification, GPU no longer supported | Jan. 26 |
| 4.3.2.1 | Record the location of the camera(region index, coordinate) | Core, RayCalc  camCood | Passed | Jan. 26 |
| 4.3.2.2 | Record the 4-frame of the camera(need to be all orthonormal) | ||  camFrame | Passed | Jan.26 |
| 4.3.3.1 | Basic parameters: WColor, filters, coordinate, region index, wave-vector, stepsize, #steps, strength, Frame Tensor | Obj, Region, RayCalc  filters, stepSize, maxStep | Passed with modification: Frame Tensor removed, for the instability of evolution equation and efficiency consideration | Jan. 26 |
| 4.3.3.2 | Iteration evolution obeys the evolution PDEs: | RayCalc  run | Passed | Jan. 26 |
| 4.3.3.3 | Iteration evolution shall auto change region index and coordinate when evoluted to the current region edge, and transform it’s tensor value data components. |  | Not yet implemented |  |
| 4.4.1.1 | Angle of visual in terms of 4-frame in a lorentzian vector space |  | Not yet implemented |  |
| 4.4.1.2 | is glare effect and diffraction effect enabled |  | Not yet implemented & modified |  |
| 4.4.1.3 | Output display resolution | GUI, Screen | Passed |  |
| 4.5.1.1 | Consists of buttons named “Settings”, “File”, “Rendering”, “Help”, “About” |  | Not yet implemented |  |
| 4.5.1.2 | “Settings” menu shall contain options “Tab settings”, “Text settings”, “Preference”, “Languages” |  | Not yet implemented |  |
| 4.5.1.3 | “File” menu shall contain options “New project”, “Open project”, “Save project”, “File information”, “Export project”, “Import project” |  | Not yet implemented |  |
| 4.5.1.4 | “Rendering” menu shall contain options “Start new rendering”, “Pause rendering”, “Continue rendering”, “Abort rendering”, “Export image as” |  | Not yet implemented |  |
| 4.5.1.5 | “Help” menu shall contain options “User guide”, “Instruction manual”, “Working mechanics”, “(End)Help mode” |  | Not yet implemented |  |
| 4.5.1.6 | “About” shall link to the info & copyright of this software |  | Not yet implemented |  |
| 4.5.2.1 | It shall has a sidebar on the right which is able to expand/close this tab |  | Not yet implemented |  |
| 4.5.2.2 | This tab shall contain basic info of current spacetime project, and options “Spacetime manifold”, “Objects”, “Camera”, “Rendering”, “Special functionalities”, “Captures” |  | Not yet implemented |  |
| 4.5.3.1 | It shall has a sidebar on the left which is able to expand/close this tab |  | Not yet implemented |  |
| 4.5.3.2 | This tab shall display options to adjust various parameters of selected topic on the left tab |  | Not yet implemented |  |
| 4.5.3.3 | The camera parameters should be always on the top able to adjust using value typing, dragging sliders, and keyboard input(WASD, space, shift, numpad or arrow keys) |  | Not yet implemented |  |
| 4.5.3.4 | If select “Rendering” on the left, it shall display parameters in “4.3.1” and “4.4.1” |  | Not yet implemented |  |
| 4.5.3.5 | If select “Spacetime manifold” or “Objects” on the left, see “4.5.5” and “4.5.6” for details |  | Not yet implemented |  |
| 4.5.3.6 | If select “Captures” on the left, it shall display all records of rendering. Click on one would show that on the background screen |  | Not yet implemented |  |
| 4.5.4.1.1 | It shall display every objects with its normal RGB color in the current region with the rules of this coordinate system |  | Not yet implemented |  |
| 4.5.4.1.2 | It shall also display a rough region of overlapping area |  | Not yet implemented |  |
| 4.5.4.1.3 | It shall display the normal RGB image of “4.2.1.5” as a box in the background |  | Not yet implemented |  |
| 4.5.4.1.4 | It shall react quickly as the parameters of the cam changes |  | Not yet implemented |  |
| 4.5.4.1.5 | It shall be able to view separated from the dedicated rendering cam |  | Not yet implemented |  |
| 4.5.4.2.1 | Keyboard input for cam moving should be blocked for now |  | Not yet implemented |  |
| 4.5.4.2.2 | A gray translucent overlay shall be above the “non-rendering view”, with a progress bar and estimated evolution time. |  | Not yet implemented |  |
| 4.5.4.3.1 | A panoramic picture shall be displayed on this screen with given rendering parameters |  | Not yet implemented |  |
| 4.5.4.3.2 | The view of the panoramic picture shall be able to drag by mouse, using keyboard numpad(or arrow keys), or adjust cam parameter on the right tab |  | Not yet implemented |  |
| 4.5.4.3.3 | The picture should be able to react rather quickly with changing of post-rendering parameters |  | Not yet implemented |  |
| 4.5.4.3.4 | Right tab should display a big button “back” to return to the state of “4.5.4.1” |  | Not yet implemented |  |
| 4.5.5.1 | “Add new region”, “modify current region” options and the list of all regions shall displayed on the right tab |  | Not yet implemented |  |
| 4.5.5.2 | The rough region should be display on non-rendering background screen if it is overlapped with current region |  | Not yet implemented |  |
| 4.5.5.3 | Clicking any region button inside the list will unfold a tab which includes more info of this region, such as expressions of metric, overlapping expressions, etc. |  | Not yet implemented |  |
| 4.5.6.1 | “Add new object” option and the list of all objects in this region shall be displayed on the right tab |  | Not yet implemented |  |
| 4.5.6.2 | Once clicked “add object”, a tab will show up on the top of the right tap, includes the basic parameters of the object, see “4.2.3” for details |  | Not yet implemented |  |
| 4.5.6.3 | Keyboard input from numpad(arrow keys or mouse dragging) and mousewheel(key []) shall be used to determine the placement of the object |  | Not yet implemented |  |
| 4.5.6.4 | Clicking any object in the list on the right tab shall unfold a tab showing all basic info of the object |  | Not yet implemented |  |

**The following curriculum expectations are being evaluated:**

**A1.** demonstrate the ability to use different data types and expressions when creating computer programs (type conversions, string manipulation, casting, rounding, bounds, arrays of objects)

**A2.** demonstrate and use modular programming concepts and principles in the creation of computer programs (user-defined classes, libraries, encapsulation, inheritance, method overloading, method overriding, polymorphism).

**A3.** design and write algorithms and subprograms to solve a variety of problems (file I/O, linear/binary search algorithms, arrayLists, sorting algorithms, 2 dimensional array manipulation, recursive algorithms)

**A4.** use proper code maintenance techniques when creating computer programs (code commenting)

**C1.** demonstrate the ability to apply modular design concepts in computer programs (modules, classes, records, structures, inheritance, etc…)

**C2.** analyze algorithms for their effectiveness in solving a problem

| **Criteria** | **R** | **- 1 +**  **Beginning** | **- 2 +**  **Developing** | **- 3 +**  **Competent** | **- 4 +**  **Superior** |
| --- | --- | --- | --- | --- | --- |
| Testing is thorough. All functionality alluded to in the Concept Plan is tested. All code blocks that contribute to a given requirement are listed. |  |  |  |  |  |
| Testing references back to the Concept Plan are given. In the case that the original document was not well structured or requirements were not sufficiently listed, corrections are made here to compensate. |  |  |  |  |  |
| Explanations are logical. Any necessary modifications are noted and any deletions from the original are well explained. |  |  |  |  |  |