

Efficient viewshed computation on external memory DEM terrains

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INTRODUCTION

- Technological advances (LiDAR) → Huge volume of data → External processing
- Viewshed → all points that can be viewed by a given point.

OBJECTIVE

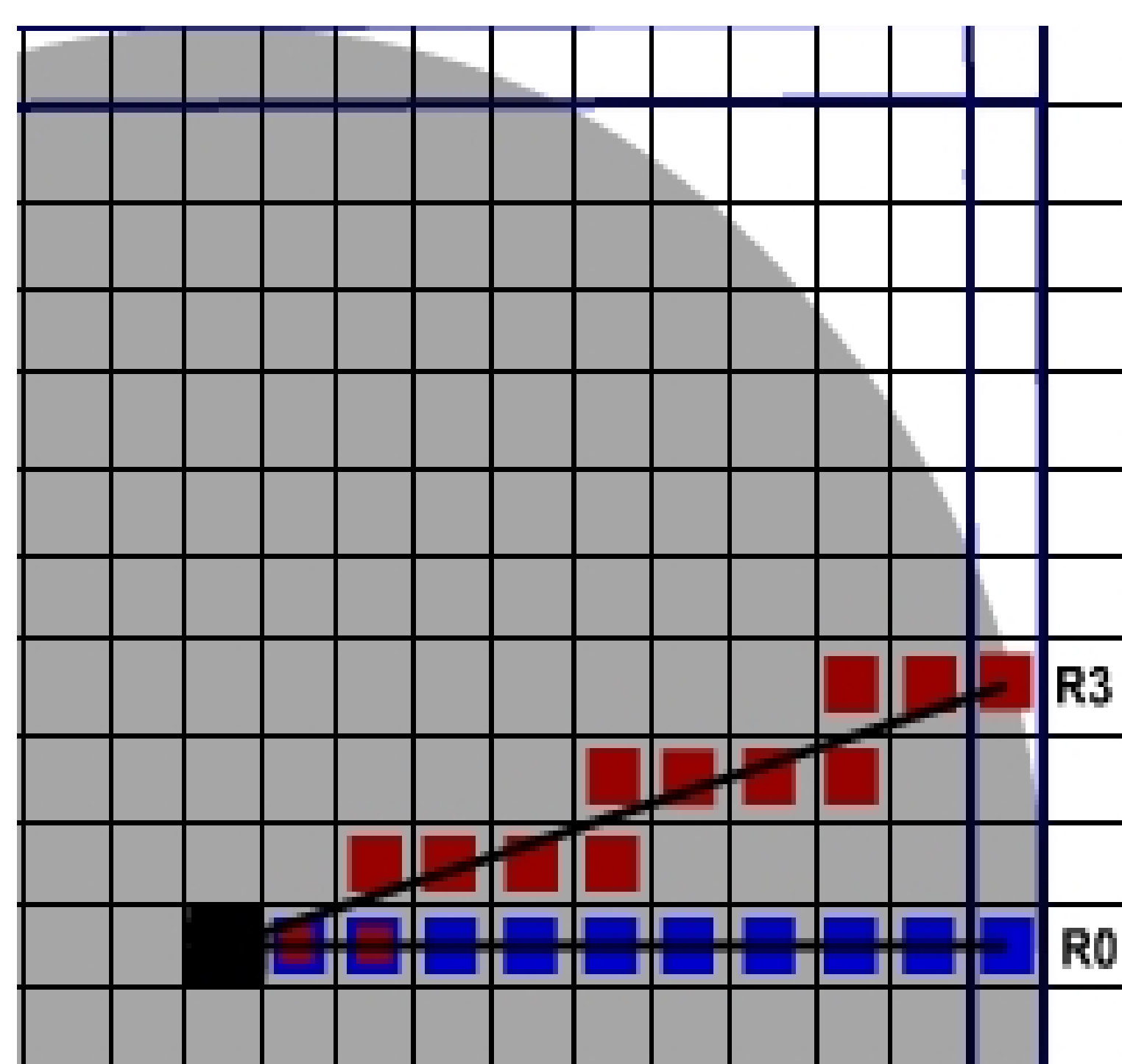
- Designing an efficient algorithm to compute the viewshed on huge terrains → external memory.

COMPUTING VIEWSHED ON EXTERNAL MEMORY

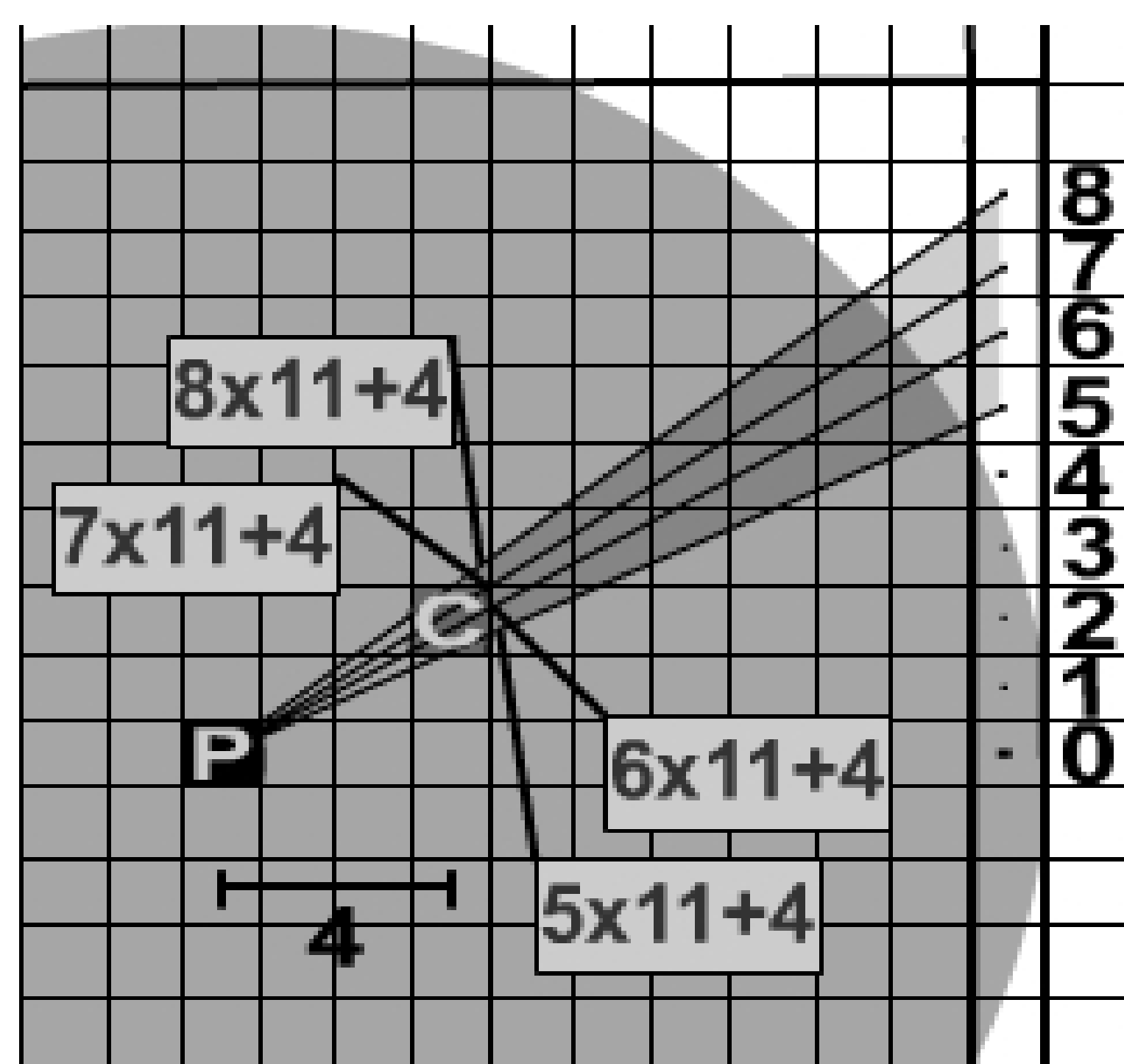
- Adaptation of Franklin's method [1]

External Memory Algorithm

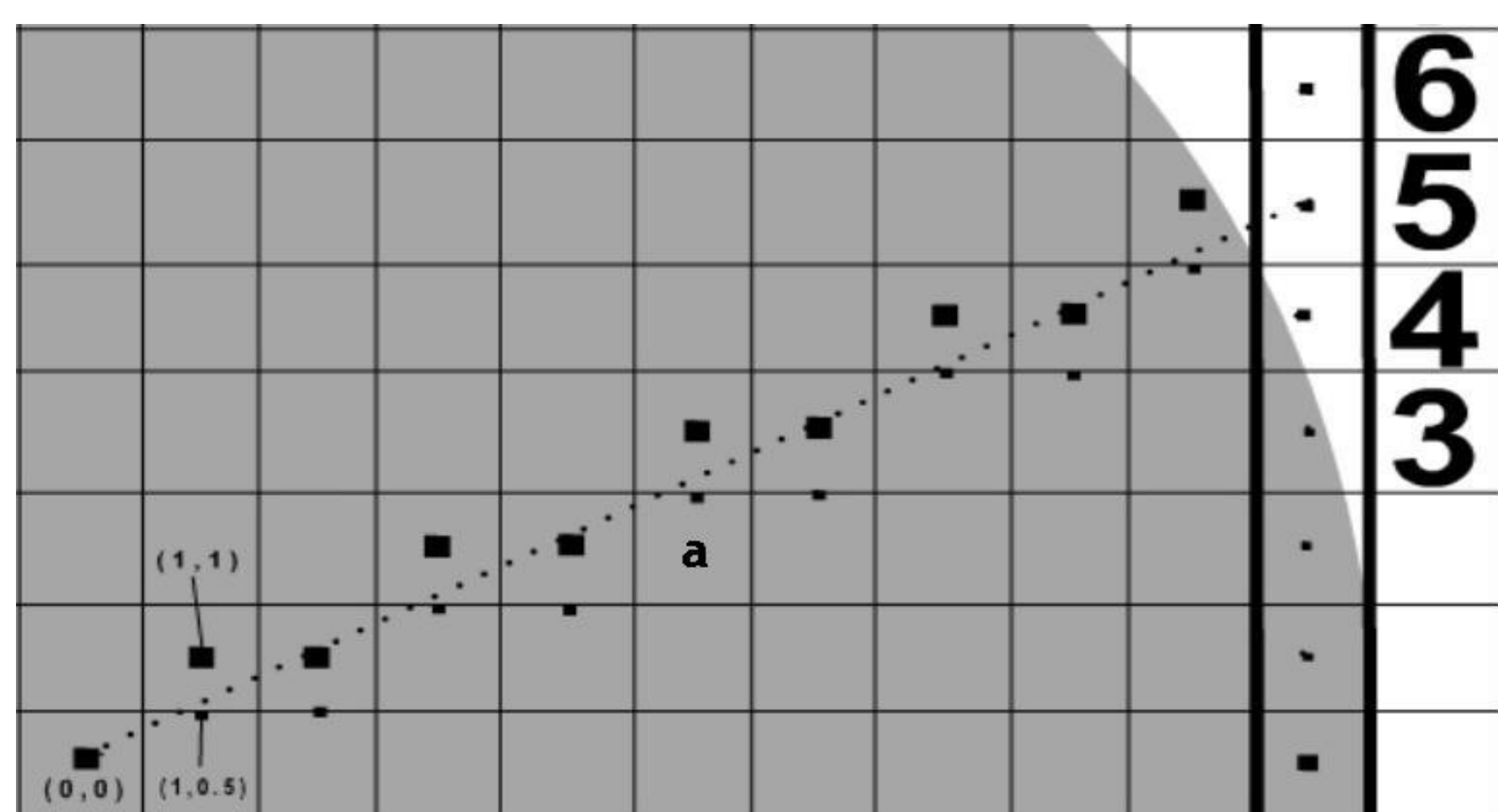
- Steps
 - Processing order determination – indices computation
 - List of cells creation and sorting
 - Viewshed computation
- $index = r_i * n + d$
 - r_i - number of the ray passing through the cell
 - n - number of cells in each ray
 - d - the (integer) distance between the cell and the point p .



Original algorithm sweep

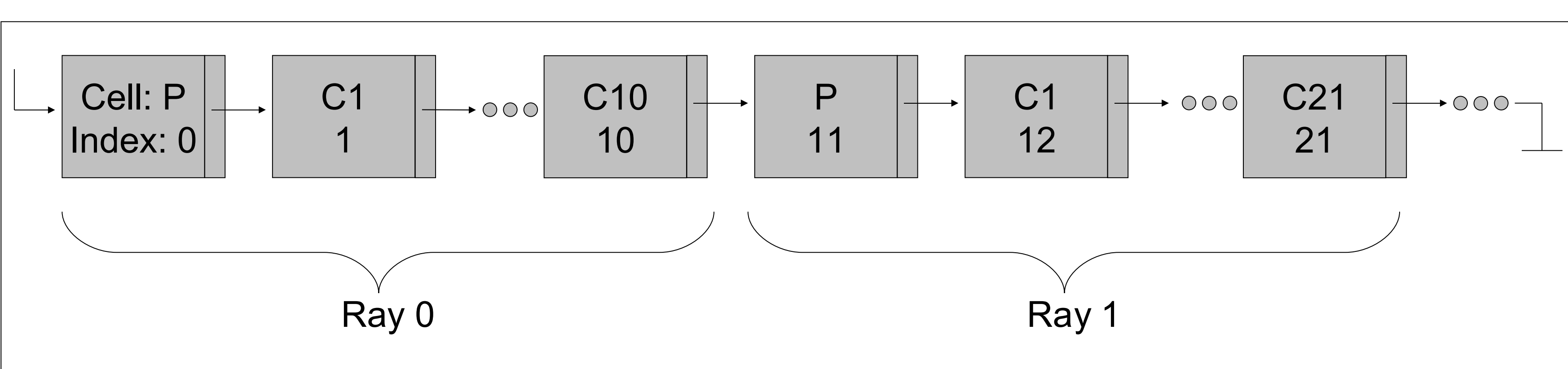


Index determination



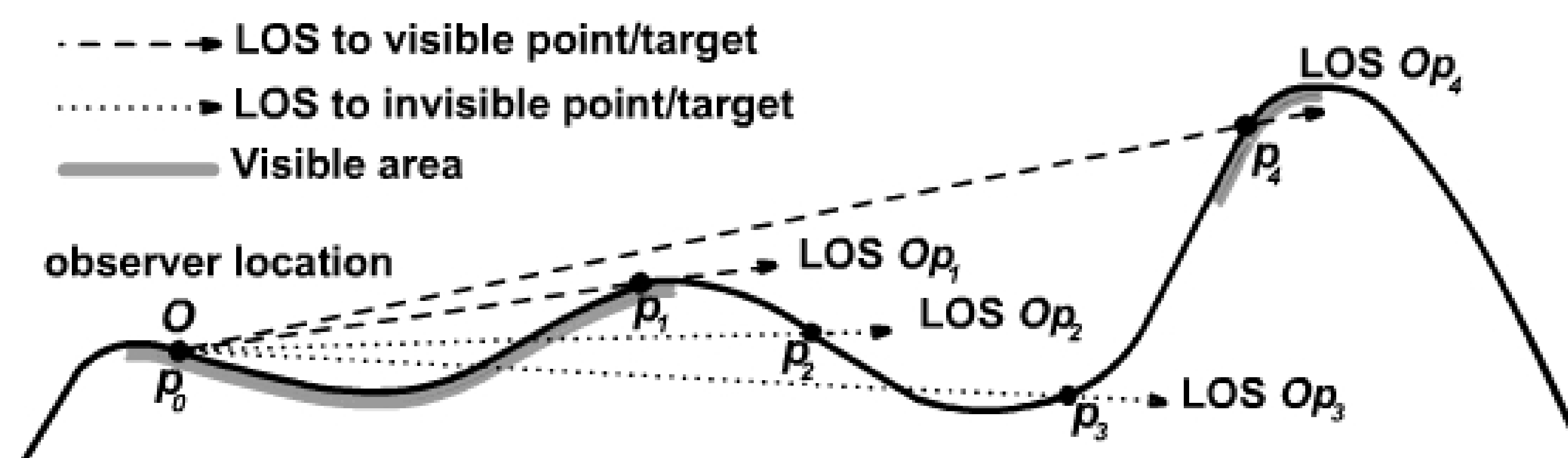
Sweep ray rasterization

- Use of external memory list L (STXXL library)
 - L stores each cell of interest with respective index
 - L is sorted by the indices → “random” access is avoided

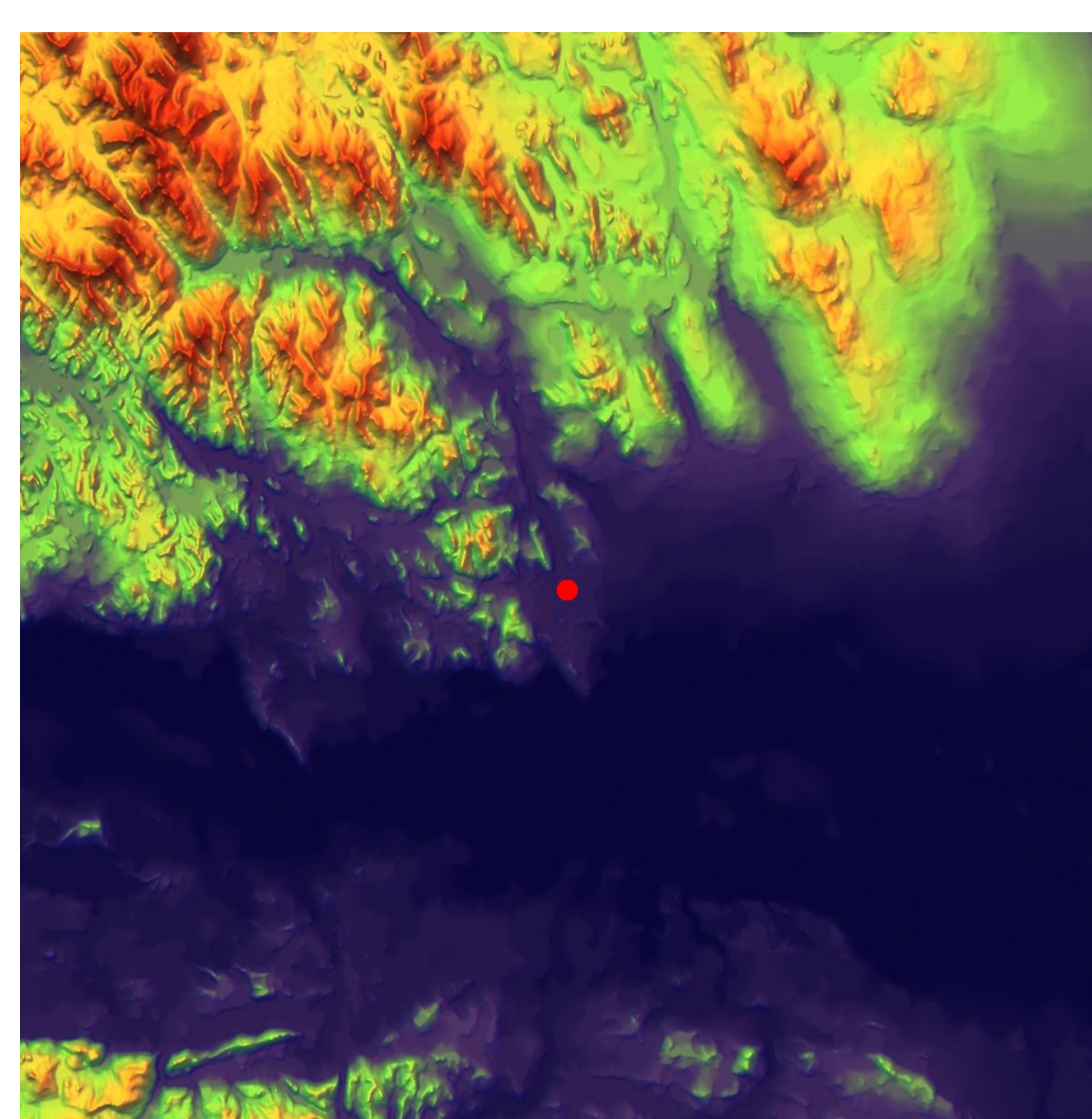


List L after sorting

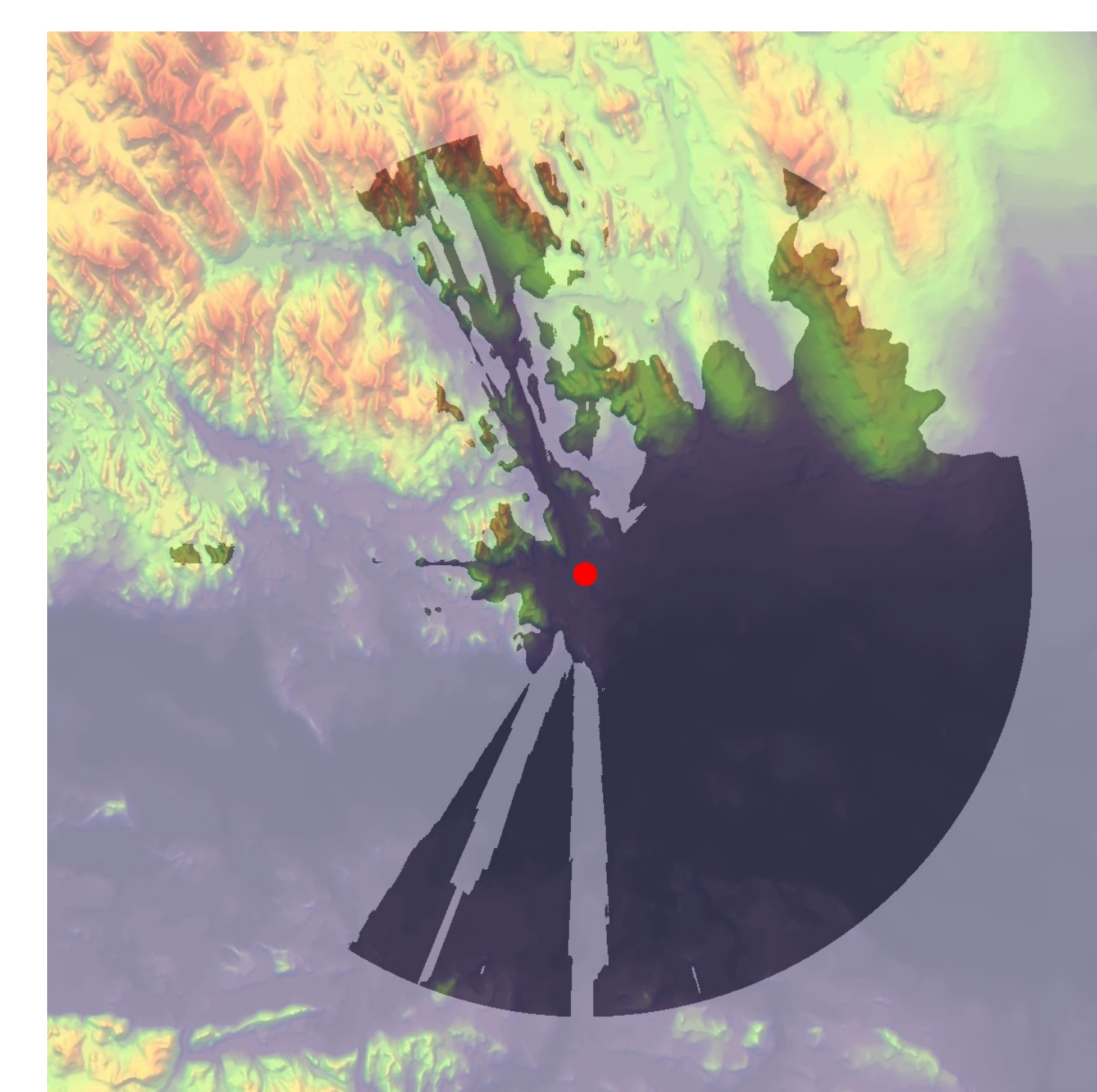
- Cells are retrieved from L
- The visibility of retrieved cells are calculated by the LOS (line of sight)



RESULTS

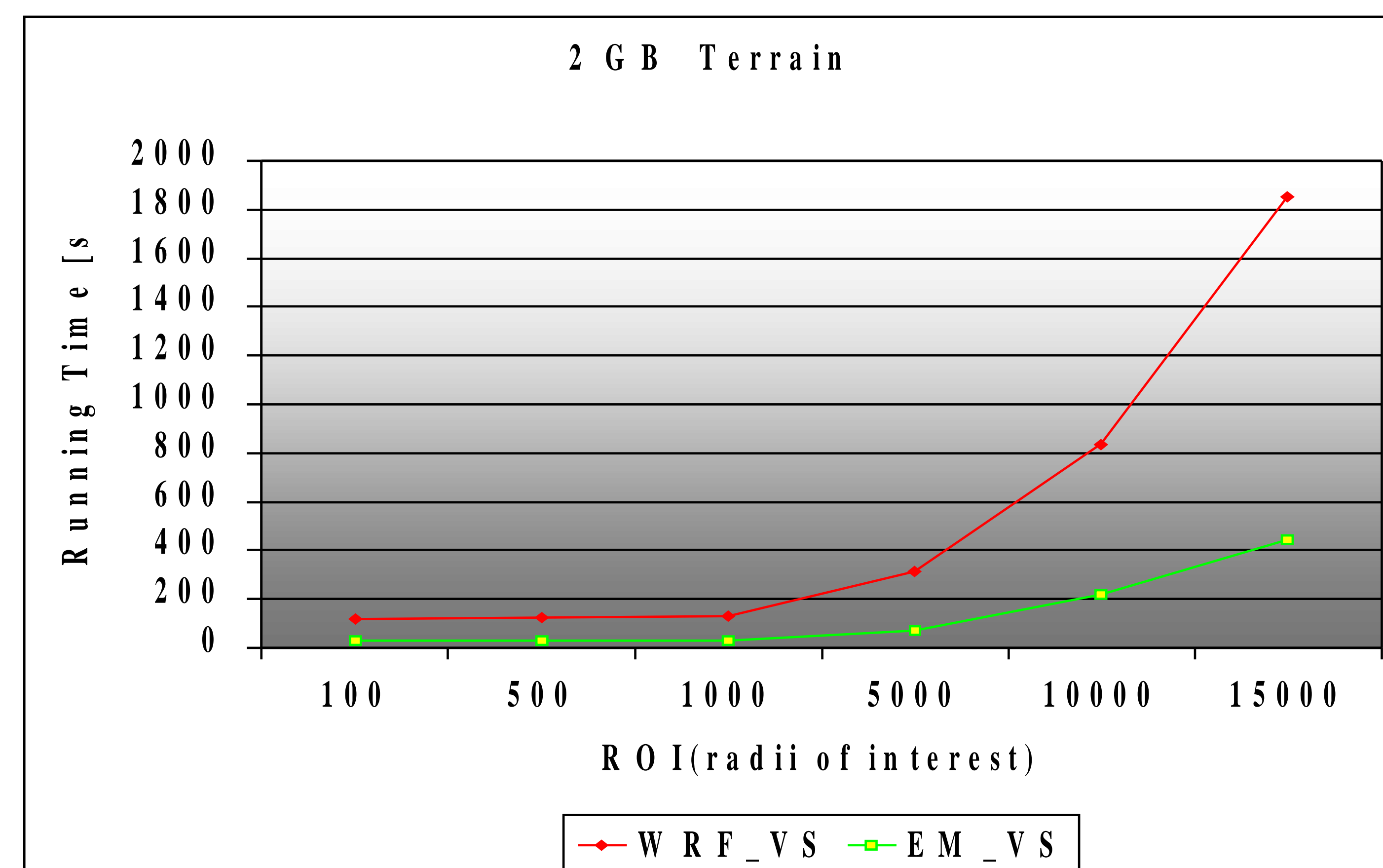


Lake Champlain West
(USA-Canada Border)



Viewshed – observer in red

- EM_VS – external memory algorithm
- WRF_VS – Franklin version



CONCLUSION

- EM_VS x WRF_VS
 - about 4 times faster
- EM_VS x Toma et all external memory method [2]
 - more than 4 times faster
 - much more simpler

REFERENCES

- [1] W. R. Franklin. Siting observers on terrain. In Springer-Verlag, editor, *In D. Richardson and P. van Oosterom editors, Advances in Spatial Data Handling: 10th International Symposium on Spatial Data Handling*, page 109 - 120, 2002.
- [2] L. Toma, H. Haverkort, and Y. Zhuang. Computing visibility on terrains on external memory. *In Proceedings of the Ninth Workshop on Algorithm Engineering and Experiments*, 2007.