FORSCHUNGSZENTRUM JÜLICH GmbH
Zentralinstitut für Angewandte Mathematik
D-52425 Jülich,

PEPC: Pretty Ef cient Parallel Coulomb-solver

Paul Gibbon

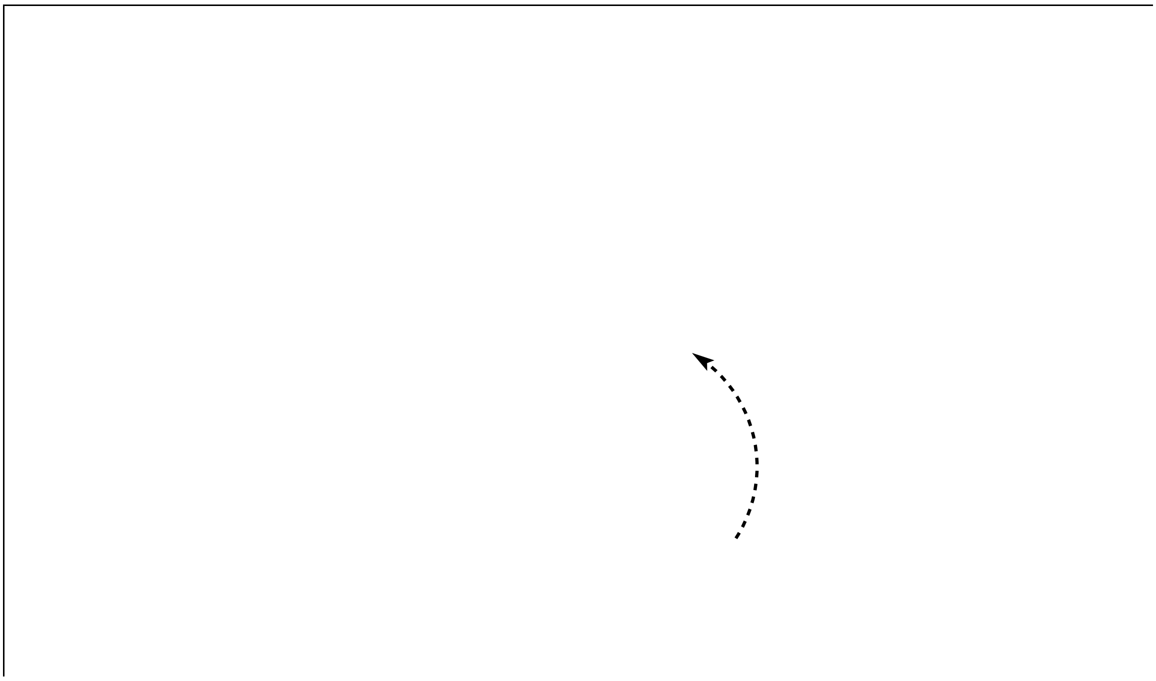
John von Neumann Institute for Computing, ZAM,
Forschungszentrum Jülich GmbH, D–52425 Jülich, Germany

ABSTRACT

An parallel tree code for rapid computation of long-range Coulomb forces based on the Warren-Salmon `Hashed halgorith

At rst sight, the hierarchical data structure of BH tree codes would seem to rule out parallelism altogether, but it was soon realised that the construction of both the tree

particle numbers across the processors. To compensate this effect, we instead use weighted sampling, which allows for the actual distribution



number of particles contained beneath it, so that the top level nodes above can now be lled in up to the root. At this point the local trees comprise 3 types of node: i) twig or leaf nodes covering the local domain, ii)

This information is then broadcast to all other processors, so that the remaining top-level nodes can be lled in using the above shifting rules. At the end of this procedure, each processor has the complete multipole expansion for the whole system contained in the root node.

2.5. Tree traversal: building interaction lists

By far the most

```
do while (any defer list still > 0)

    do while (any particle not  nished walk)
         nd next node on particles' tree-walks

        if (MAC OK)
            put node on interaction list
            walk-key = next-node
        else if (MAC not OK for local node)
            subdivide: walk-key = first-child
        else if (MAC not OK for non-local node)
            walk-key = next-node
            put particle on `defer' list
            put node on request list
        endif

        remove  nished particles from walk list
    end do

    gather request lists for non-local nodes from all processors and discard duplicates

    do for all remote processors
        initiate receive buffer for incoming child data
        send off requests for remote 4254 0 Td (data)Tj -179.116 -13.562.963 -15.84 Td (end)Tj 18.4472 0
```

Routine/ No. CPUs	8	16	64
Domain decomposition	0.2	0.24	0.33

Table 2: Breakdown of relative computational