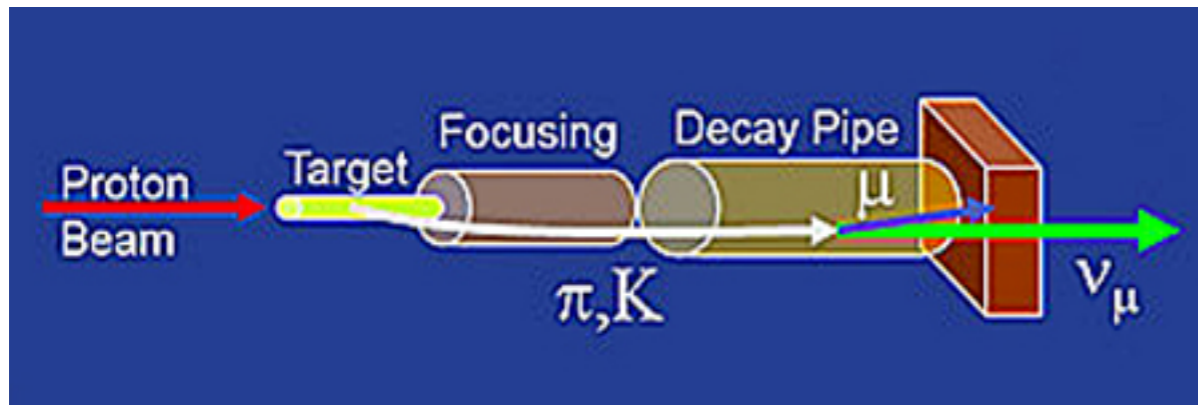


Plan for Beam Optimization at Berkeley

Patrick Tsang (LBNL)

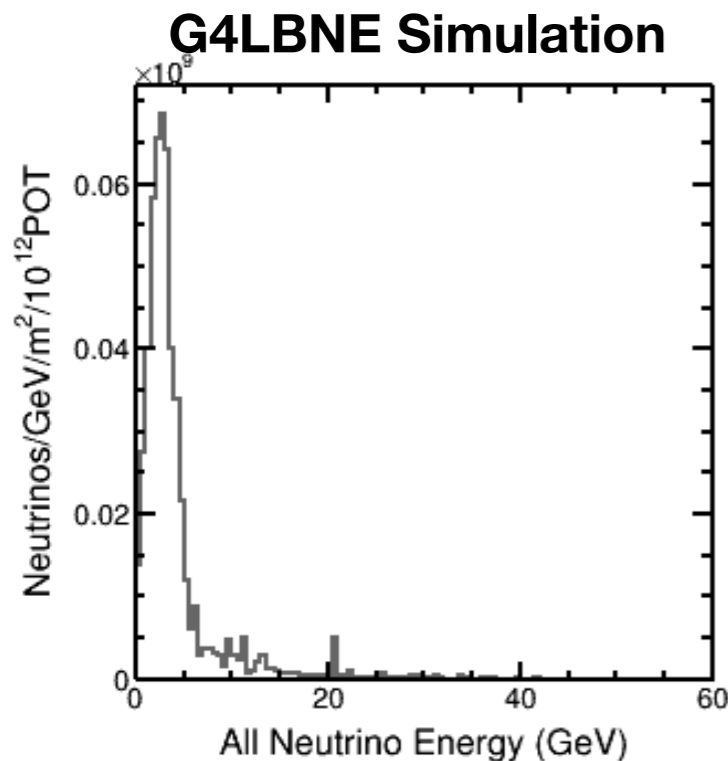
Nov 4, 2015

Beam Optimization

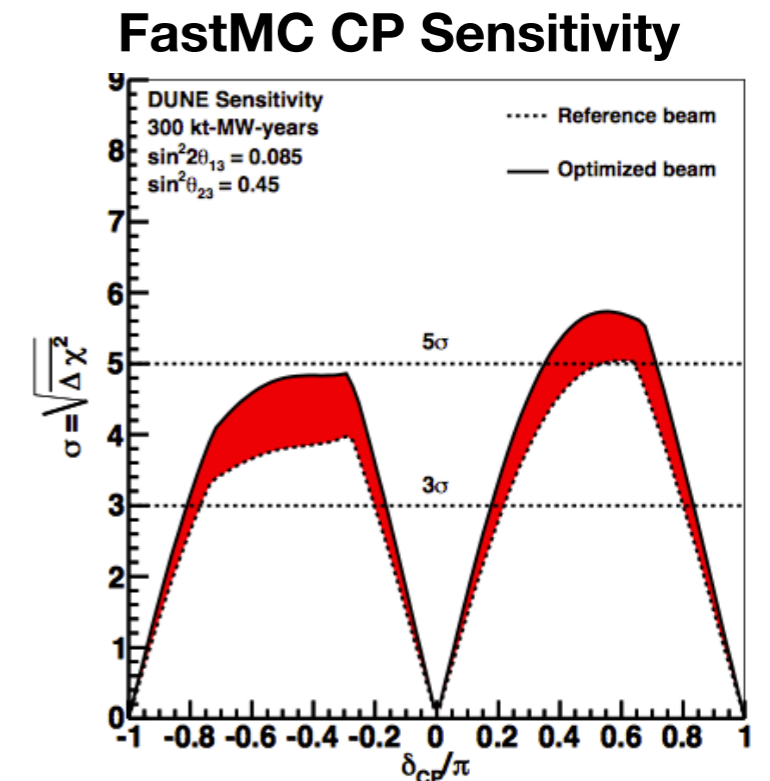


Beam Optimization
Goal: maximize CP sensitivity

G4LBNE
Geant4 simulation



FastMC
Sensitivity based on a simplified detector response model (300 kt-MW-years exposure)



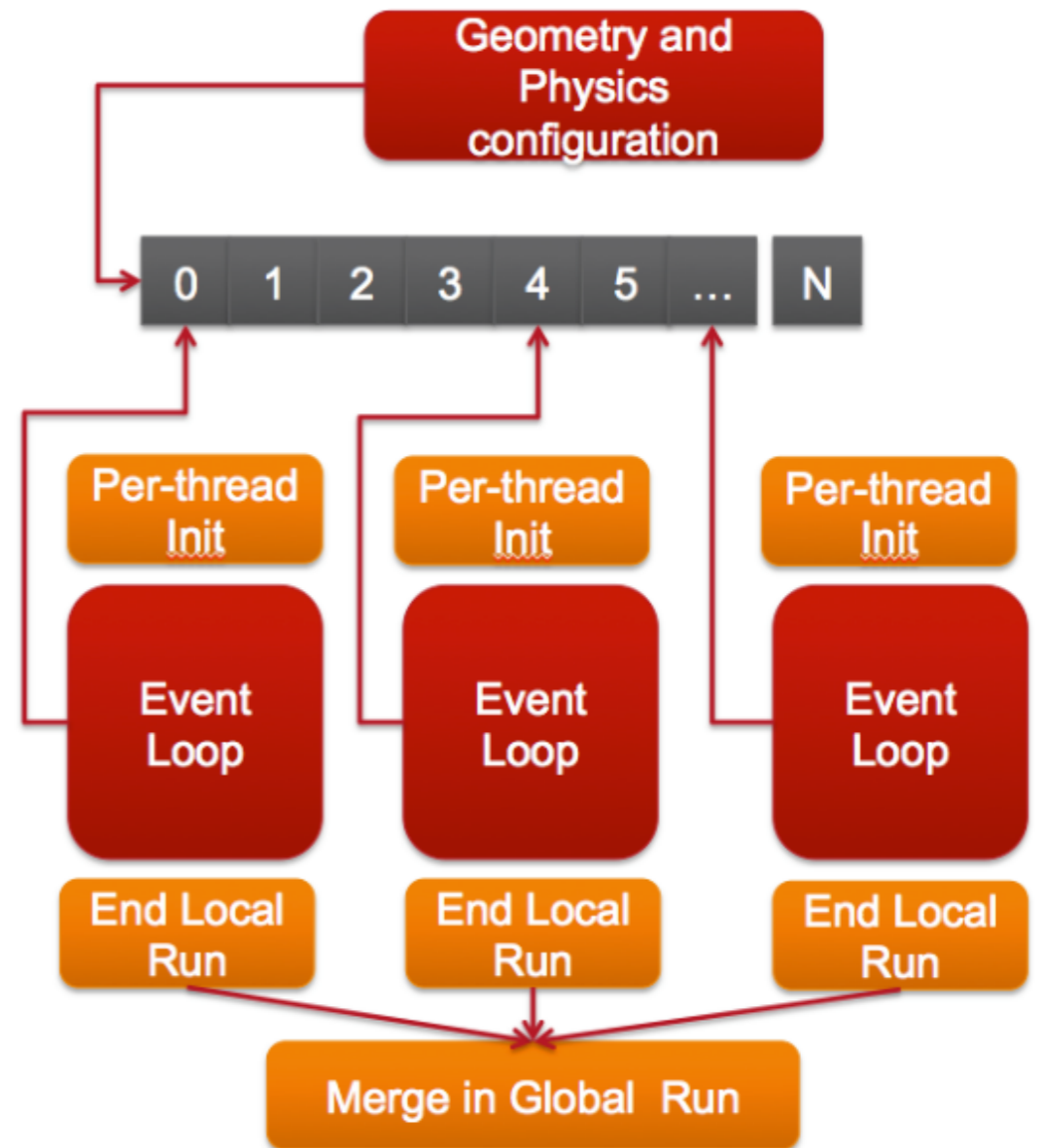
Courtesy of Laura Fields

Challenge of Beam Optimization

- parameter space is large
 - a reference design has ~40 parameters (placement of target, shape of focusing magnets ...)
 - multidimensional optimization is challenging
- GEANT4 simulation is slow
 - a few events per second
 - high statistics sample $O(1M)$
 - ~100 hours for a particular setup

Geant4 - Multithreading

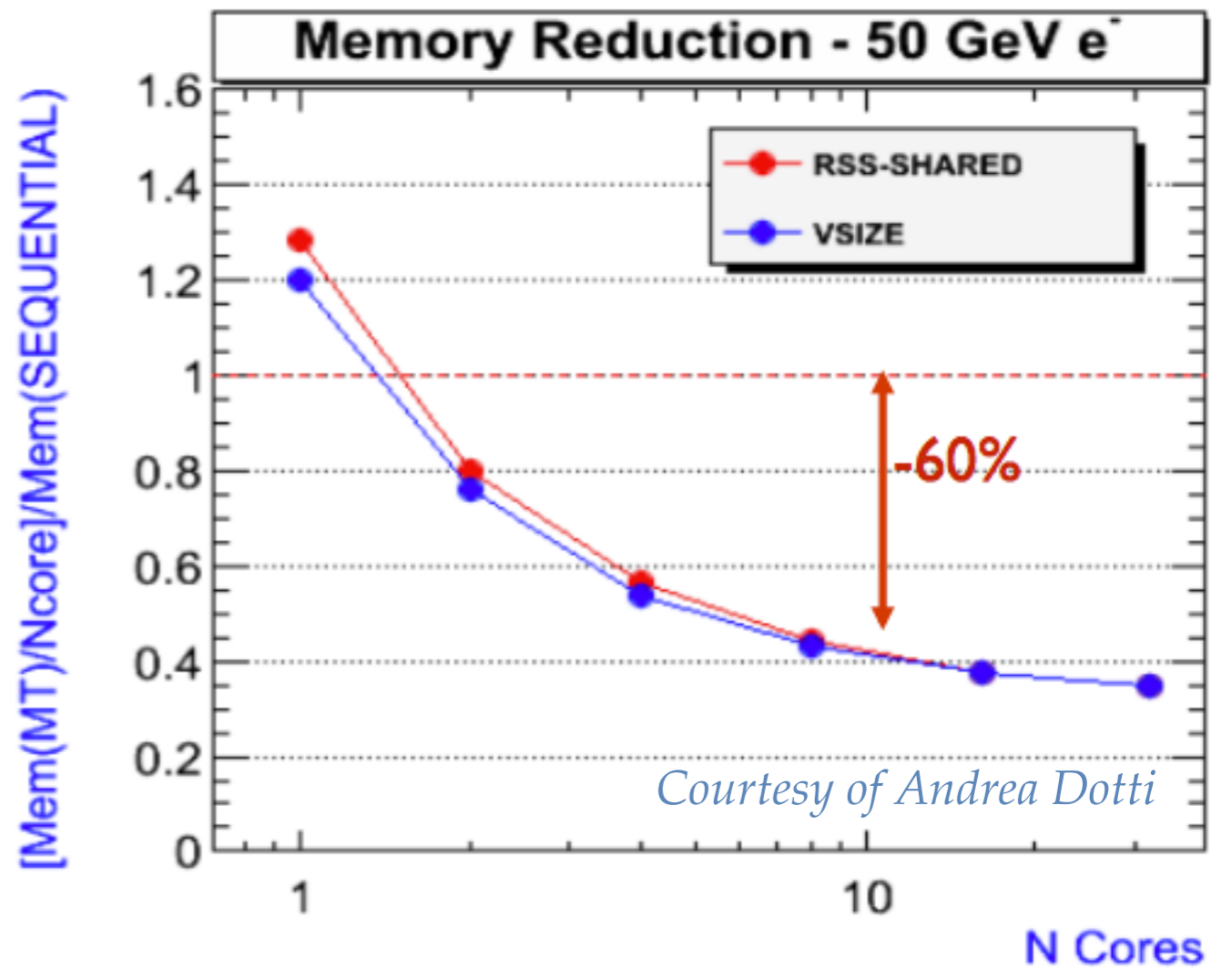
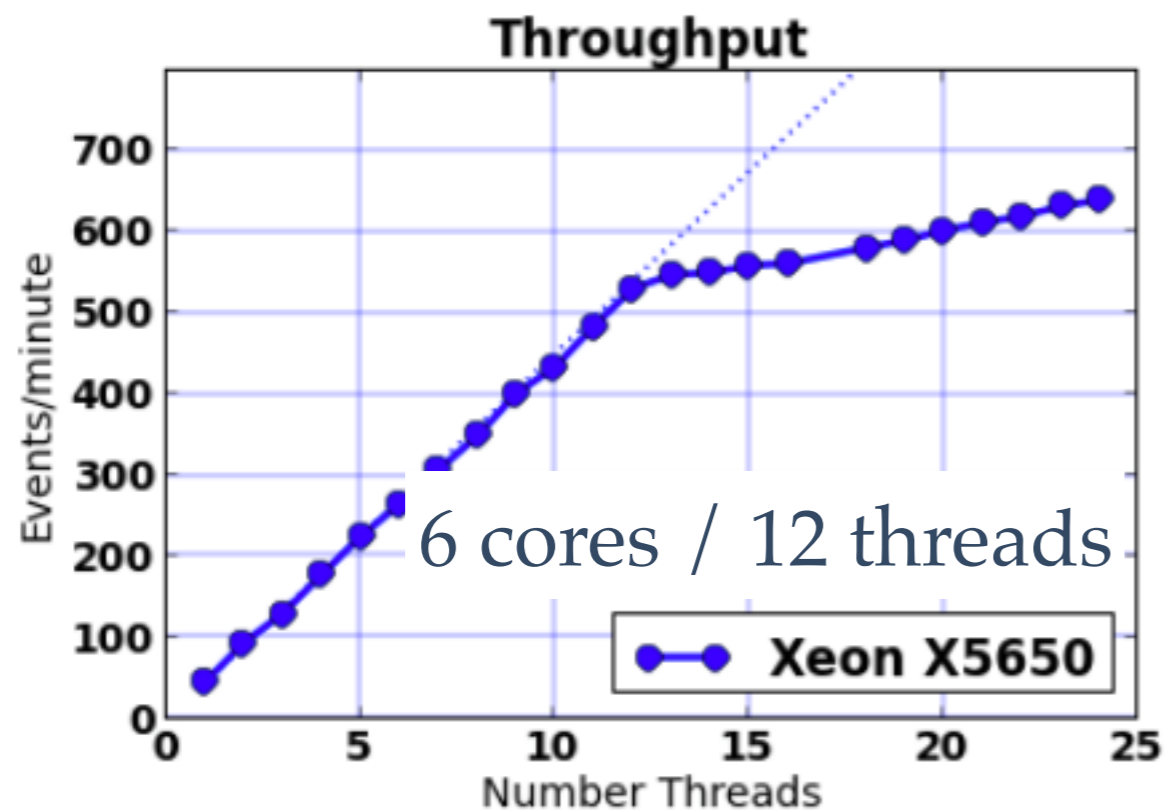
- event-level parallelism
 - supported since Geant4.10
- shared resources
 - geometry and physics
 - constant between events
- identical copies of “event loop”
 - avoid locking problem



Courtesy of Andrea Dotti

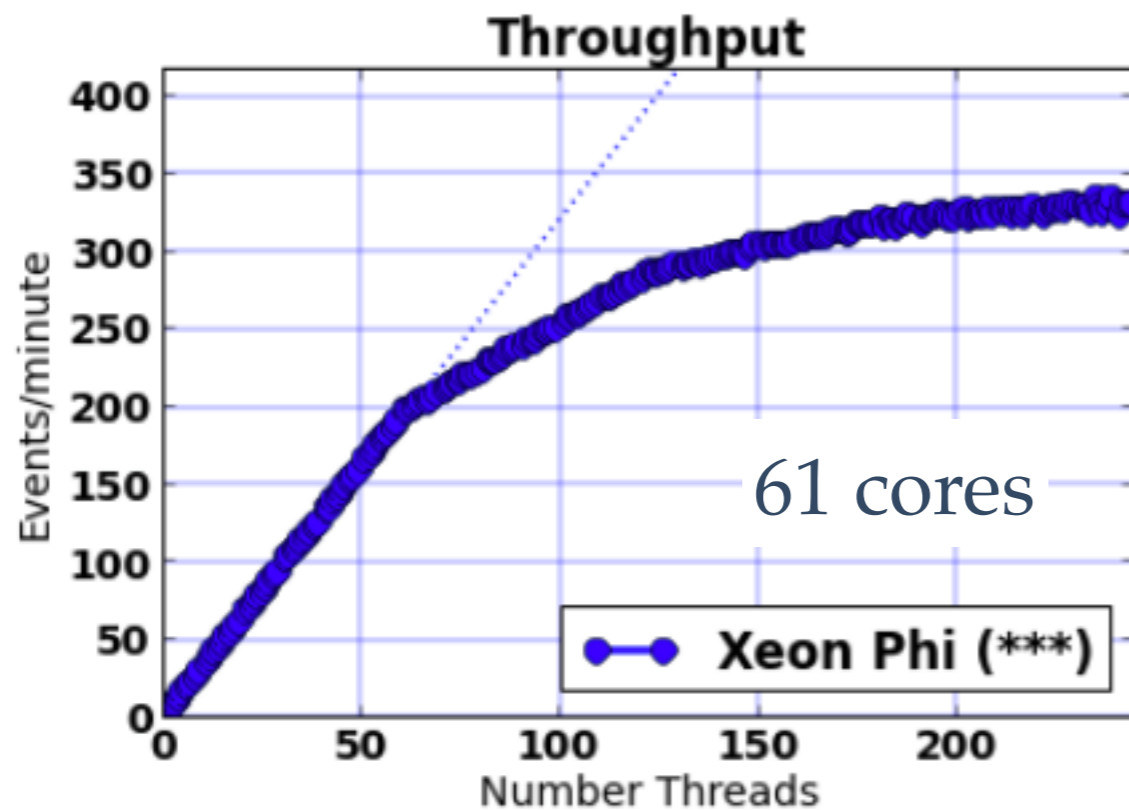
Potential Improvement of MT

A study by Geant4 group based on CMS simulation



60% less memory / core
(c.f. sequential mode)

Potential Improvement of MT (cont.)



Courtesy of Andrea Dotti

At NERSC, the latest HPC system, Edison (24 cores / node) and future system (Cori, > 60 cores / node) are designed for parallel computing.

A multithreading version of Geant4 simulation gives better utilization of computing resources.

Where are we up to?

- G4LBNE and all dependencies are compiled at NERSC/Edison and running properly with GEANT4.10.01.p2 (single thread mode)
- A multithreading version of G4LBNE (branching from v3r3p9) is on the way
 - requires some “code reorganization”
- Calculation of CP-sensitivity is being studied (with FastMC and other tools)
- Alternative multidimensional optimization technique is under investigation
- Accelerator group at LBNL has expressed interest in beam design
 - Bob Zwaska visited Berkeley last week