PURPOSE: We describe a novel hybrid approach for Monte Carlo simulations that maximizes utilization of CPUs and GPUs within modern workstations. We apply the method to the simulation of indirect radiation detectors using a modified version of the code mantis.

METHODS: We modified penelope to output coordinates and energy deposited during x-ray and electron interactions occurring within the scintillator which are then used as source for optical showers using detect2. The main program dynamically allocates optical transport showers to the GPU and CPU cores using the detect2 routines in mantis. In this paper, we describe a GPU implementation of the basic physics models in detect2 (we call this gpu-detect2) and a serial CPU version of the same code. The hybrid approach allows the main program to farm optical showers to computing cores as they become available.

RESULTS: Our preliminary results suggest that a speed-up factor of up to 26 between GPU and CPU versions of the new gpu-detect2 code, and up to three orders of magnitude compared to the optical transport routines in mantis can be achieved. Further validation is needed and additional optimizations are possible.

CONCLUSION: The rationale of this novel method relies on three aspects, the last two being unique to this type of simulation. First, current workstations typically have computing power available both in CPU and GPU cores. Second, not all Monte Carlo simulation packages are easily ported into a GPU implementation. Lastly, optical transport has been shown to be the major computational bottleneck in the Monte Carlo modeling of indirect x-ray imaging detectors. We introduce a hybrid approach for the Monte Carlo modeling of indirect x-ray imaging devices that promises to significantly speed up simulations.