Simulations of LHC collimation system using MERLIN

Adina Toader

EuCARD W8 (ColMat) Meeting GSI –Egelsbach, Germany

People working on MERLIN*

- *Nick Walker (DESY)
- Roger Barlow
- Adina Toader
- James Molson

What's been done – We Implemented:

The Physics of Scattering Process a collimator

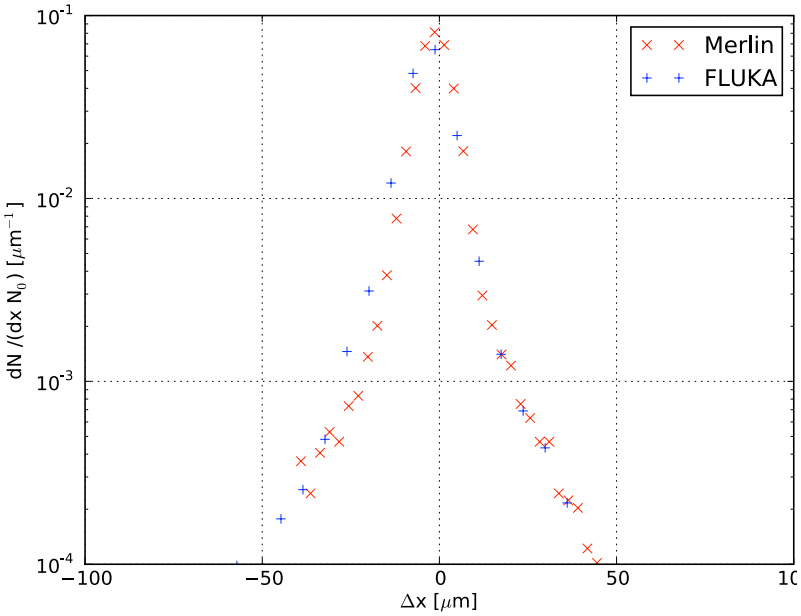
- Multiple Coulomb Scattering,
- Elastic proton-nucleon Scattering,
- Elastic proton-Nucleus Scattering,
- Elastic Single Diffractive Scattering,
- Rutherford Scattering
- Inelastic Scattering

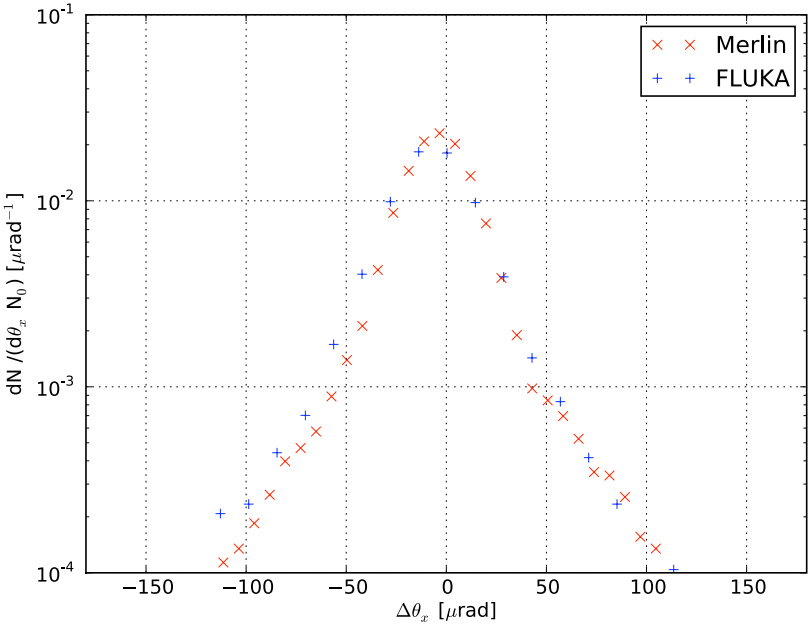
Improved statistical algorithms to protect against accumulation of rounding errors

Allow each macro particle particle in the bunch to have a different charge

MPI (Message Passing Interface)

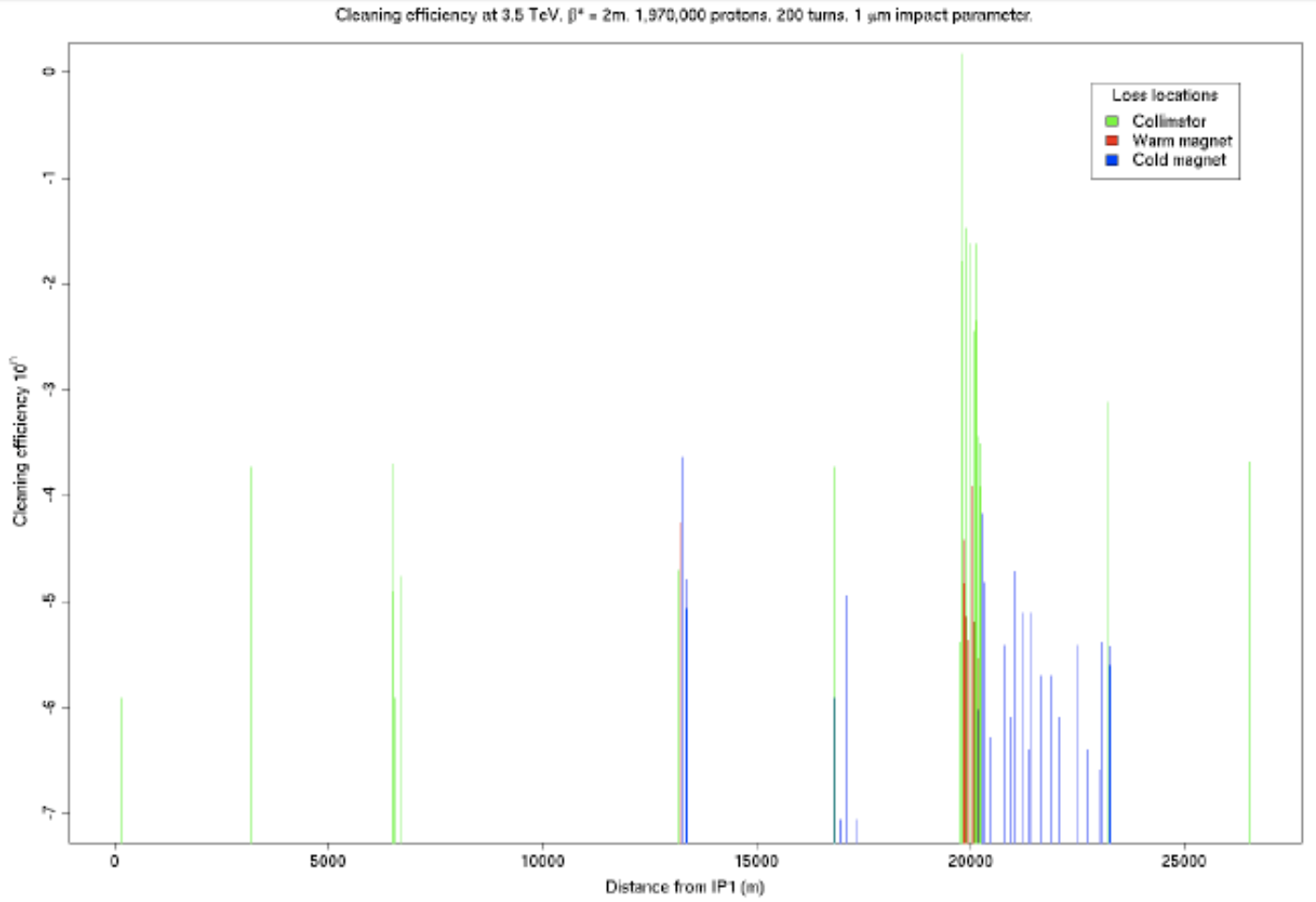
Benchmark particle scattering routine in MELRIN and *FLUKA





The distribution of change in proton position and direction after scattering through 0.5 m of Copper collimator (IPAC10 Proceedings, TUPD061)
*courtesy to Rob Appleby (CERN)

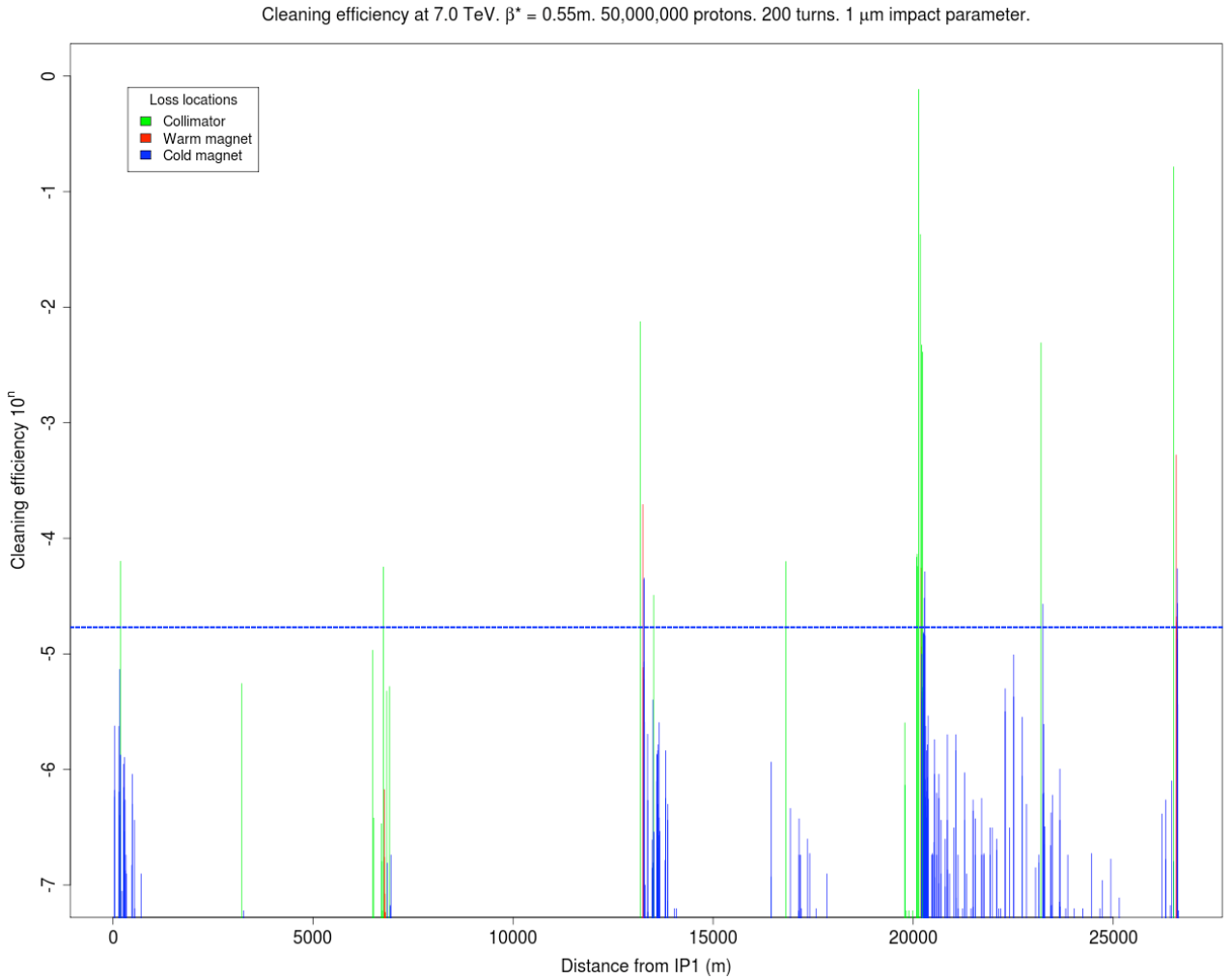
Particle loss Maps
3.5 TeV cleaning efficiency 2m protons, 200 turns



Adina Toader

EuCARD W8 (ColMat) Meeting GSI –Egelsbach, Germany

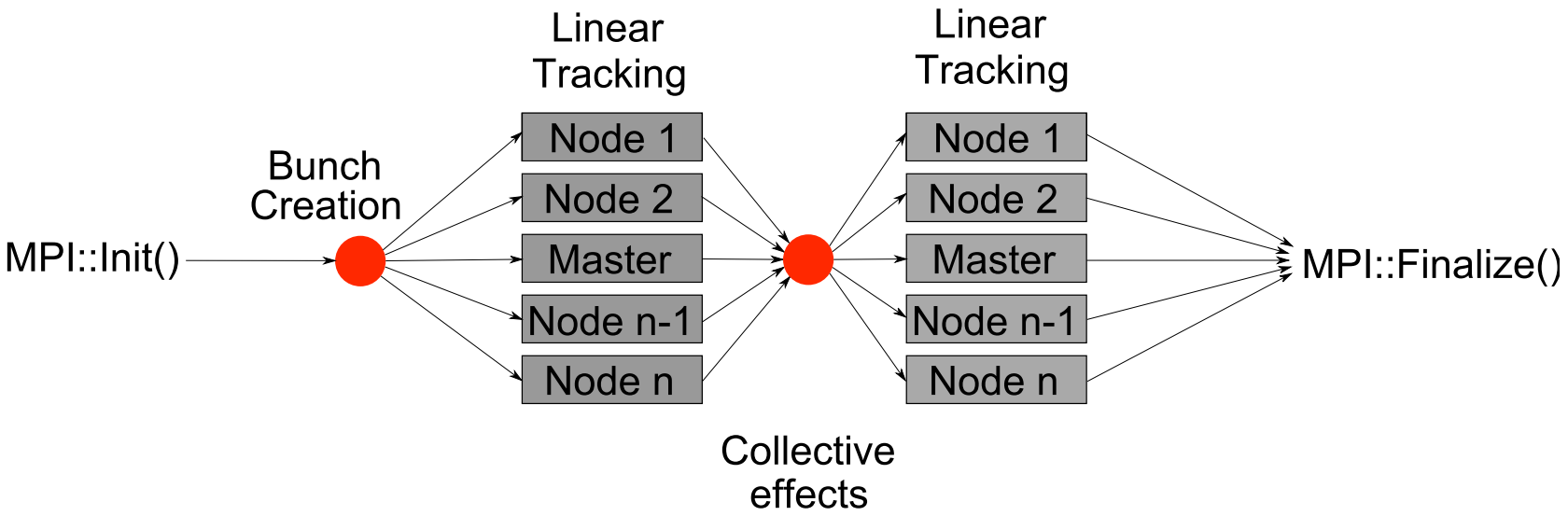
Particle loss Maps
7 TeV cleaning efficiency 50m protons, 200 turns



Adina Toader

EuCARD W8 (ColMat) Meeting GSI –Egelsbach, Germany

MERLIN MPI – James Molson



- Allows us to run a N>50m particle simulation job in MELRIN in matter of hours rather than weeks.
- It does not affect the simulations of collective effects such as wakefield effects.
- Has the advantage to calculate the values of emittance without slowing down the tracking process.

Next steps

With Daniel Wollmann and Ralph Assmann CERN Collimation Group

- Compare results between SixTrack and Merlin (i.e. nominal 7TeV machine, phase-I collimation system with nominal settings)
- Merlin simulations with the current machine setup shall be performed to compare the results with measured losses in the machine (i.e. at 3.5TeV).

- Simulate emittance dilution due to wakefields effects and compare with experimental data.
- Core & Halo beam simulations to determine the wakefields effects on the number of particle loss.
- Look into Impedance/Emittance effects for new type of collimators.

- Release MERLIN (sourceforge).