Neutrino Factory Front End (IDS) and Variations

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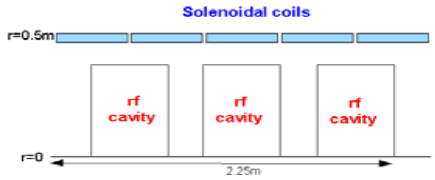
Outline

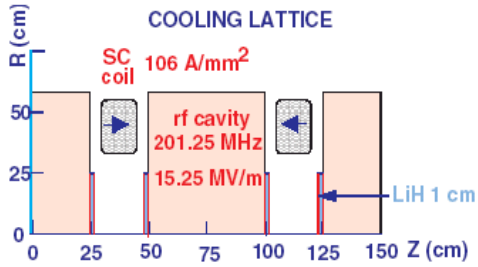
- **Front End for the IDS Neutrino Factory**
  - Using newer initial beams
    - H. Kirk from "latest" MARS, from study 2A, ISS
  - More μ/p than previous version ??

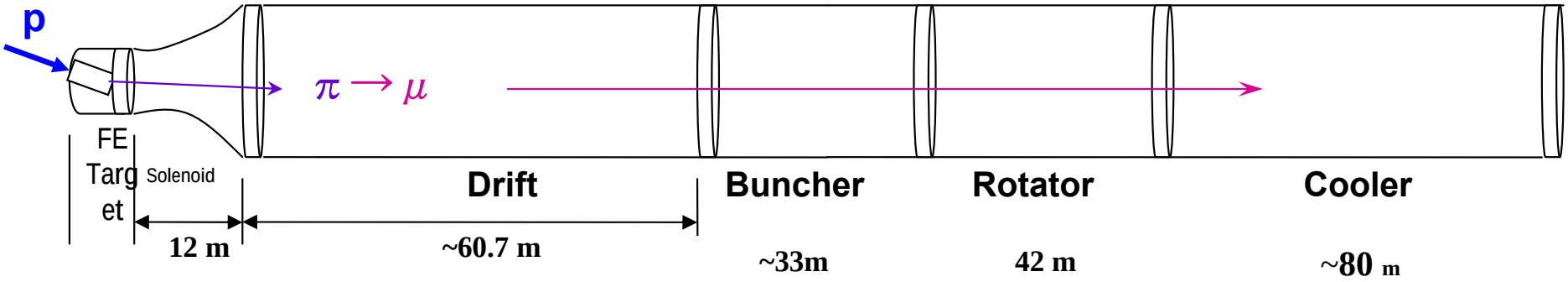
- **Front End Comments**
  - Losses/shielding
    - B/V variation …
  - Mitigation

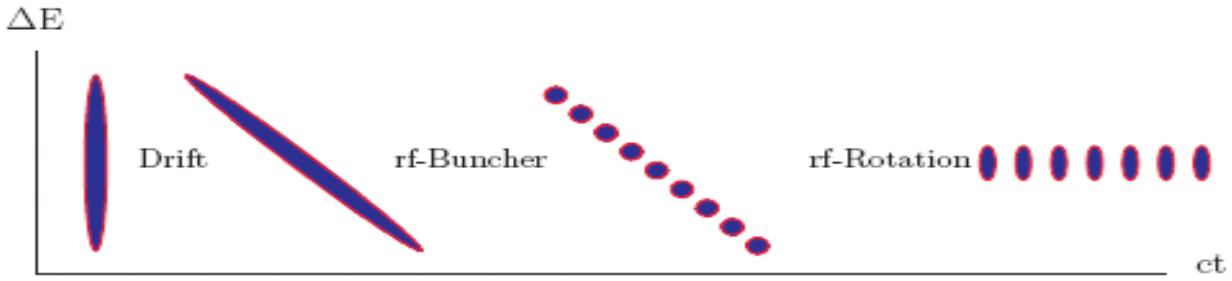
VIDS Baseline Buncher and φ-E Rotator

- Drift (π→μ)
- "Adiabatically" bunch beam first (weak 320 to 232 MHz rf)
- Φ-E rotate bunches – align bunches to ~equal energies
  - 232 to 202 MHz, 12MV/m
- Cool beam 201.25MHz







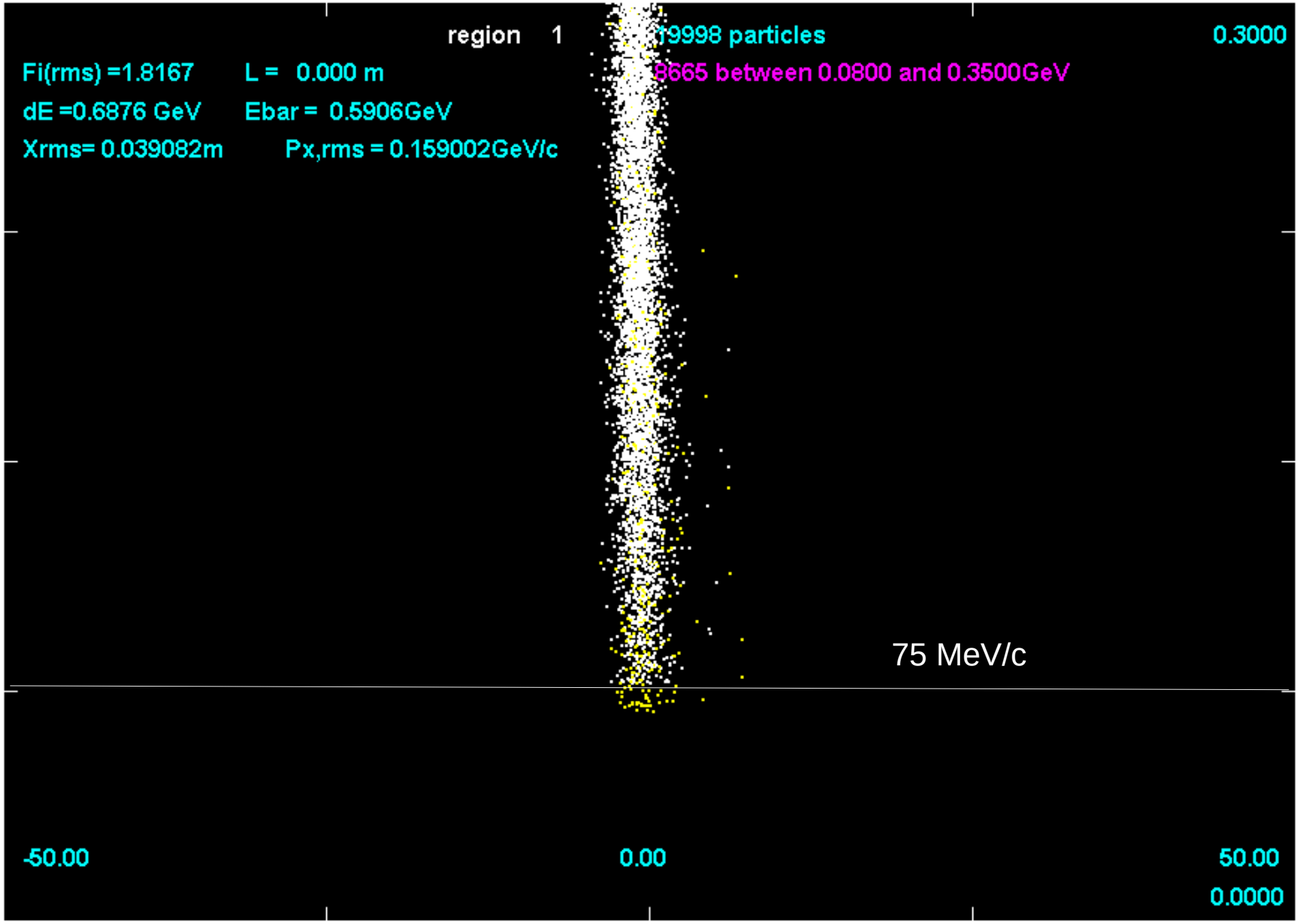


Simulation results

- H. Kirk provided initial files (+,- particles) from Mars 15.xxx (8GeV p n Hg jet)
  - 0, 1, 2, 3, 4ns
- Check to study initial Δt sensitivity
- Kept only μ, π
  - 10000 particle simulation
- ~10% loss "0" to 4ns
- Obtain more μ/p than previous initial distribution
  - 0.080 → 0.096/0.094 ??
- Initial beam has 75MeV/c cut off

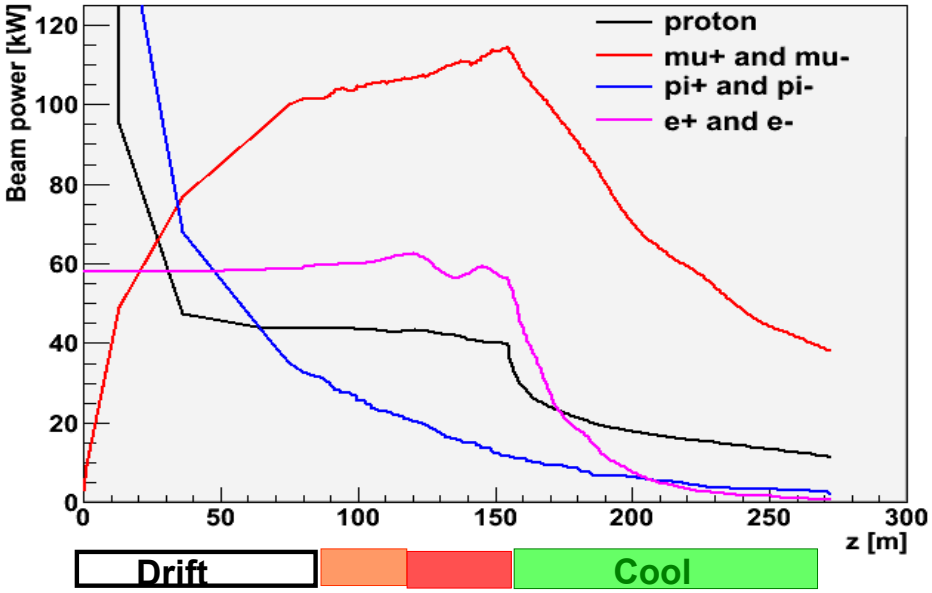
Case	μ/p at 230m	μ/p at 245m
μ^+, 0 ns	0.103	0.109
μ^+, 1 ns	0.097	0.104
μ^+, 2 ns	0.102	0.104
μ^+, 3 ns	0.096	0.101
μ^+, 4 ns	0.089	0.092
μ^-, 0 ns	0.101	0.105
μ^-, 2 ns	0.100	0.105
μ^-, 3 ns	0.094	0.099
μ^-, 4 ns	0.091	0.098

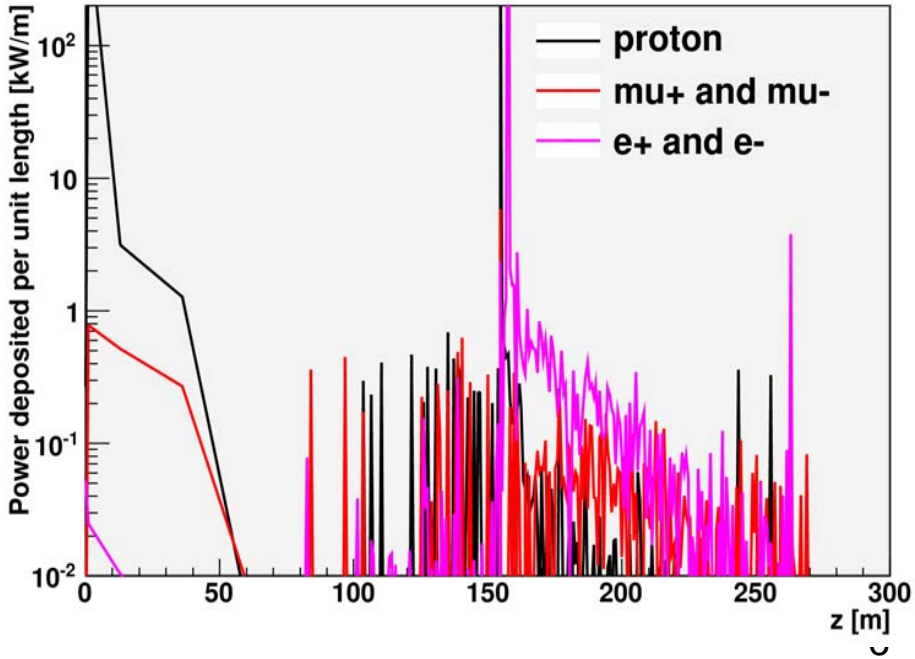
Initial cut off



Beam losses along Front End – half-full?

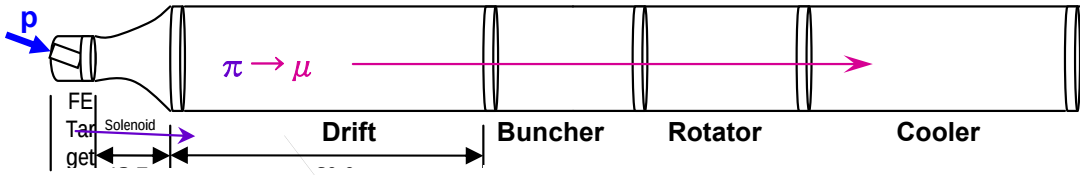
- **Start with 4MW protons**
  - End with ~25kW $\mu^+ + \mu^-$
    - plus p, e, π, …
    - **~20W/m μ-decay**
  - ~0.5MW losses along transport
    - 0.2MW at z>50m
- **"Hands-on" low radiation areas if hadronic losses < 1W/m**
  - Booster, PSR criteria
  - Simulation has >~100W/m
    - With no collimation, shielding, absorber strategy
- **Need more shielding, collimation, absorbers**
  - Reduce uncontrolled losses
  - Special handling

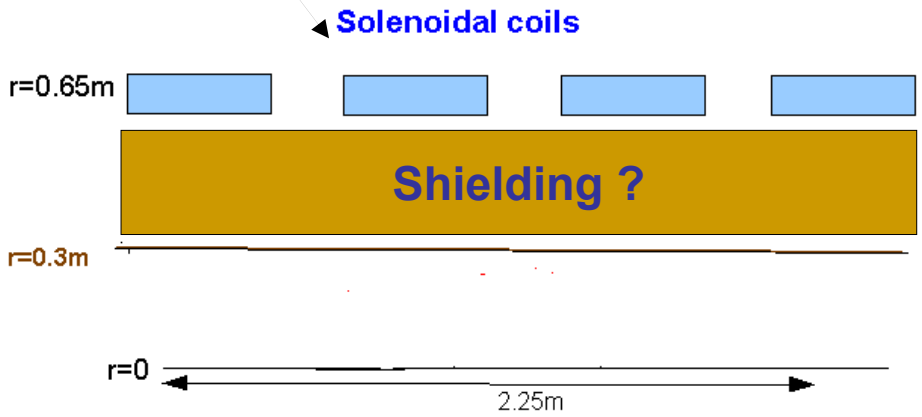


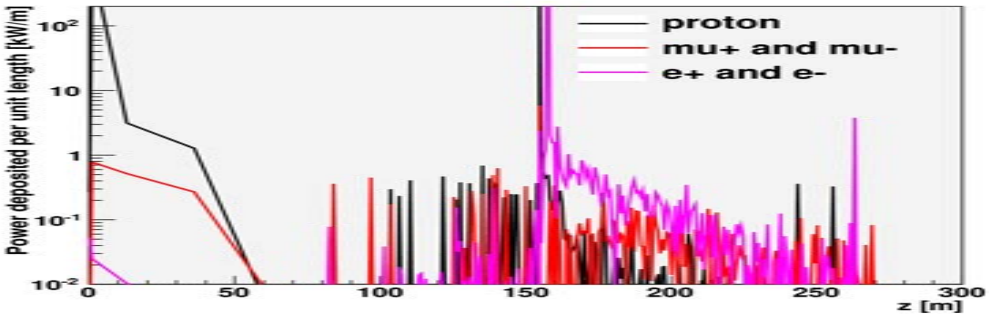


Comments on Front End Losses

- **First ~70m has 30cm beam pipe within ~65cm radius coils**
  - ~30+ cm for shielding
  - Radiation that penetrates shielding is what counts …
    - **< 1W/m ?**
  - Could the shielding handle most of the losses in the first ~70m?
- **Should add proton absorber**
  - After π-Decay – z= 50m?
  - Stop p, π,…; transmit μ …
    - With chicane ??
- **Thickness allowed ??**
  - Need to properly track reference particles through absorbers







Comments on Losses

- **After protons stopped, most losses are μ's and e's from μ-decay**
  - Less dangerous in terms of activation
    - > 1W/m OK ?
  - μ's would penetrate through more shielding

Summary

- **IDS front end**
  - Newer MARS-generated particles
    - Initial bunch length dependence
  - Newer version has more μ/p
- **Radiation problems**
  - "mitigation strategies"
- **Questions ??**