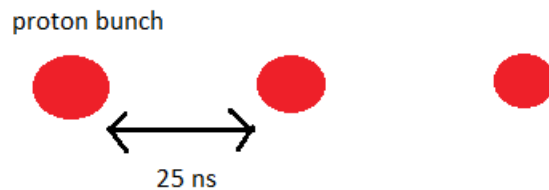


Electron Cloud Stuff with Transverse Beam Islands

- Neetish Pradhan
BE-ABP-HSS
(University of Mississippi)

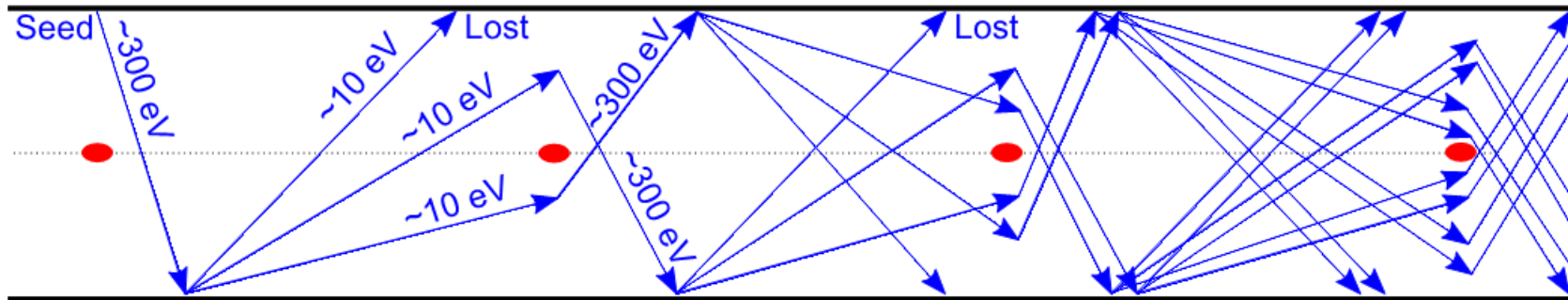
The Scenario

- Gotta ramp up those particle accelerators!
- Beams previously in bunches 50 ns apart.



- In 2015: bunch spacing to be decreased to 25 ns.
- But, problems!

The problem: Electron Clouds



- Electrons given off:
 - Proton beam interacting with residual molecules
 - Synchrotron radiation: due to transverse accⁿ by bending magnet
- Primary electrons: accelerated by passing beam, strikes chamber wall (accelerated to few 100 KeV)
- Secondary electrons given off: may be accelerated by next bunch of beams
- Shorter bunch → more likely next bunch will arrive in time
- So secondaries strike wall as well, and so on... electron avalanche!!!
- Cause problems: beam instability, heat load, etc.

The solution: Scrubbing

- Electron avalanches mitigate themselves!
- SEY: secondary electron yield – of surface
 - Decreases after prolonged exposure to electrons
- So the beam itself reduces electron cloud buildup
- Dedicated

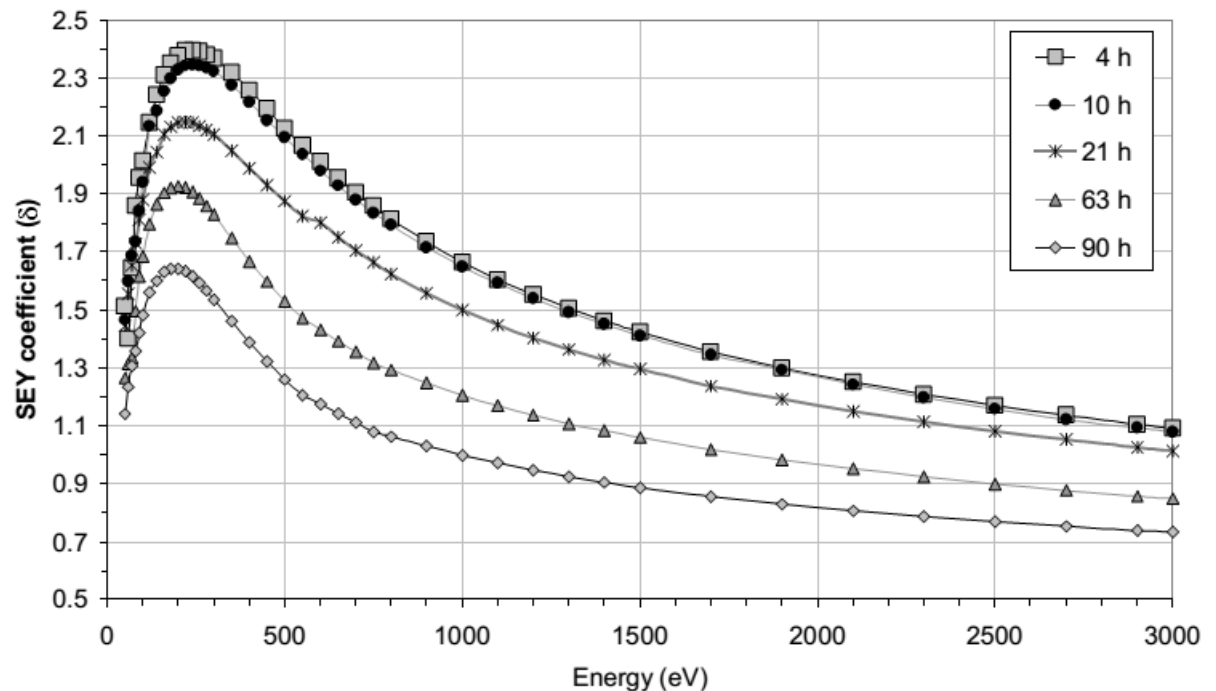
“scrubbing runs”

to maximize

EC buildup in

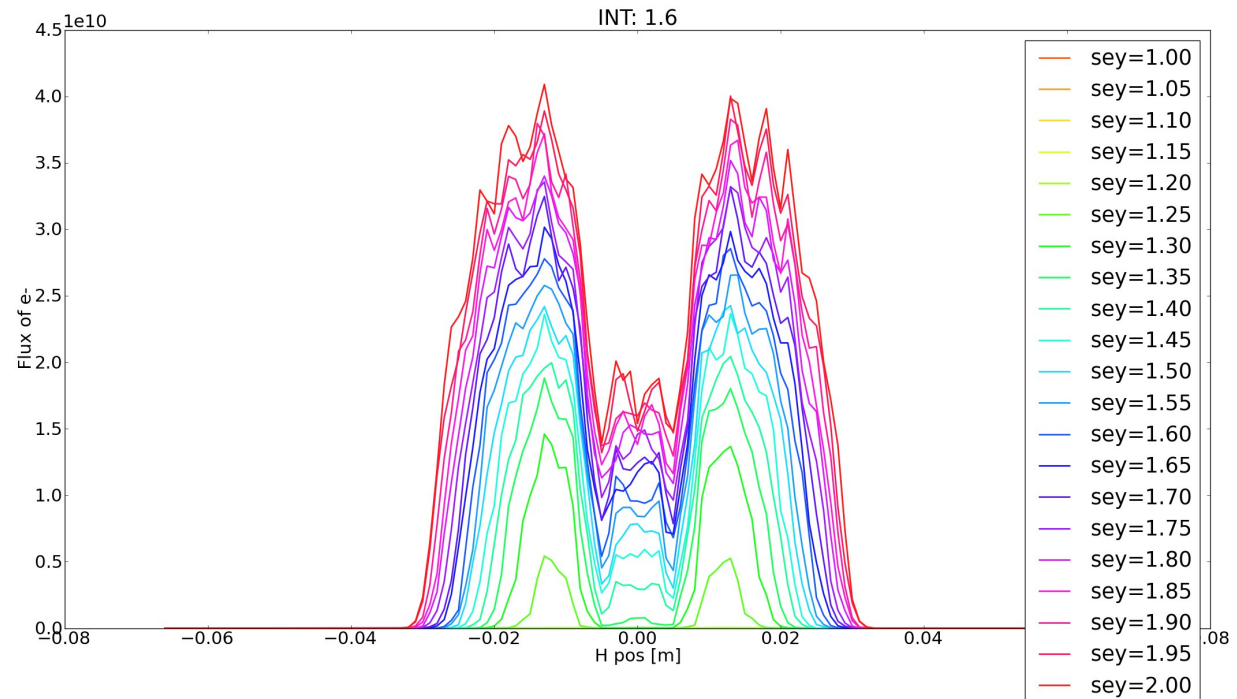
the beam chamber

- Fig: decreasing SEY



My Job

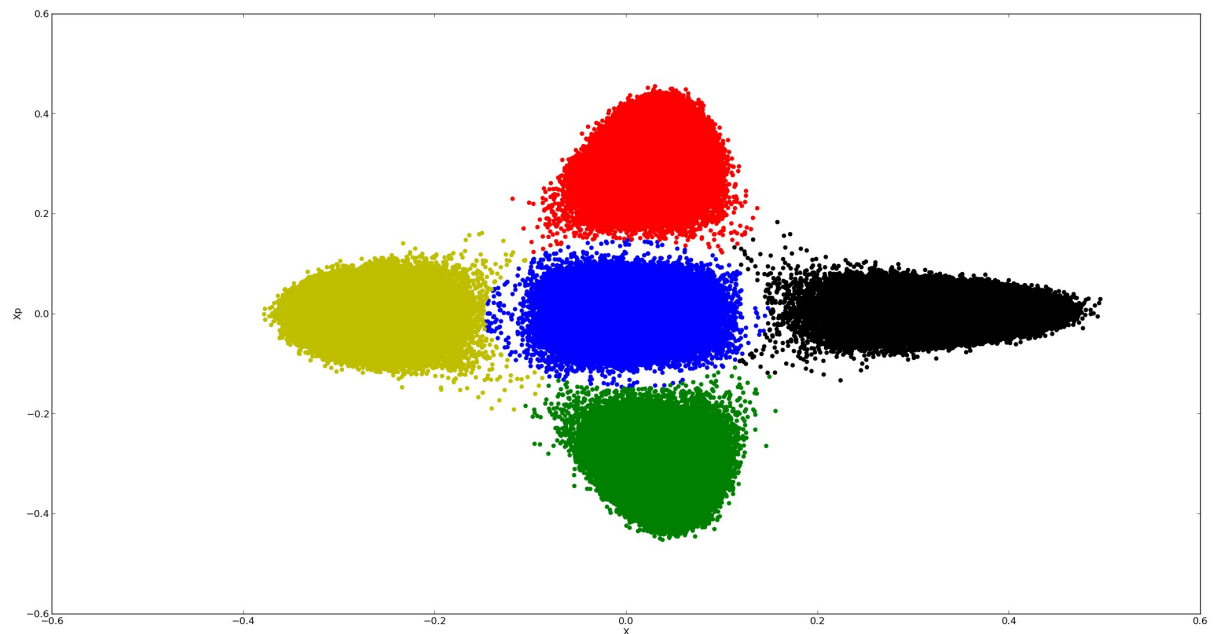
- Pyecloud: developed by Giovanni Iadarola
- Run simulations – find how beam properties affect electron cloud formation.
- Find the best candidate for scrubbing.



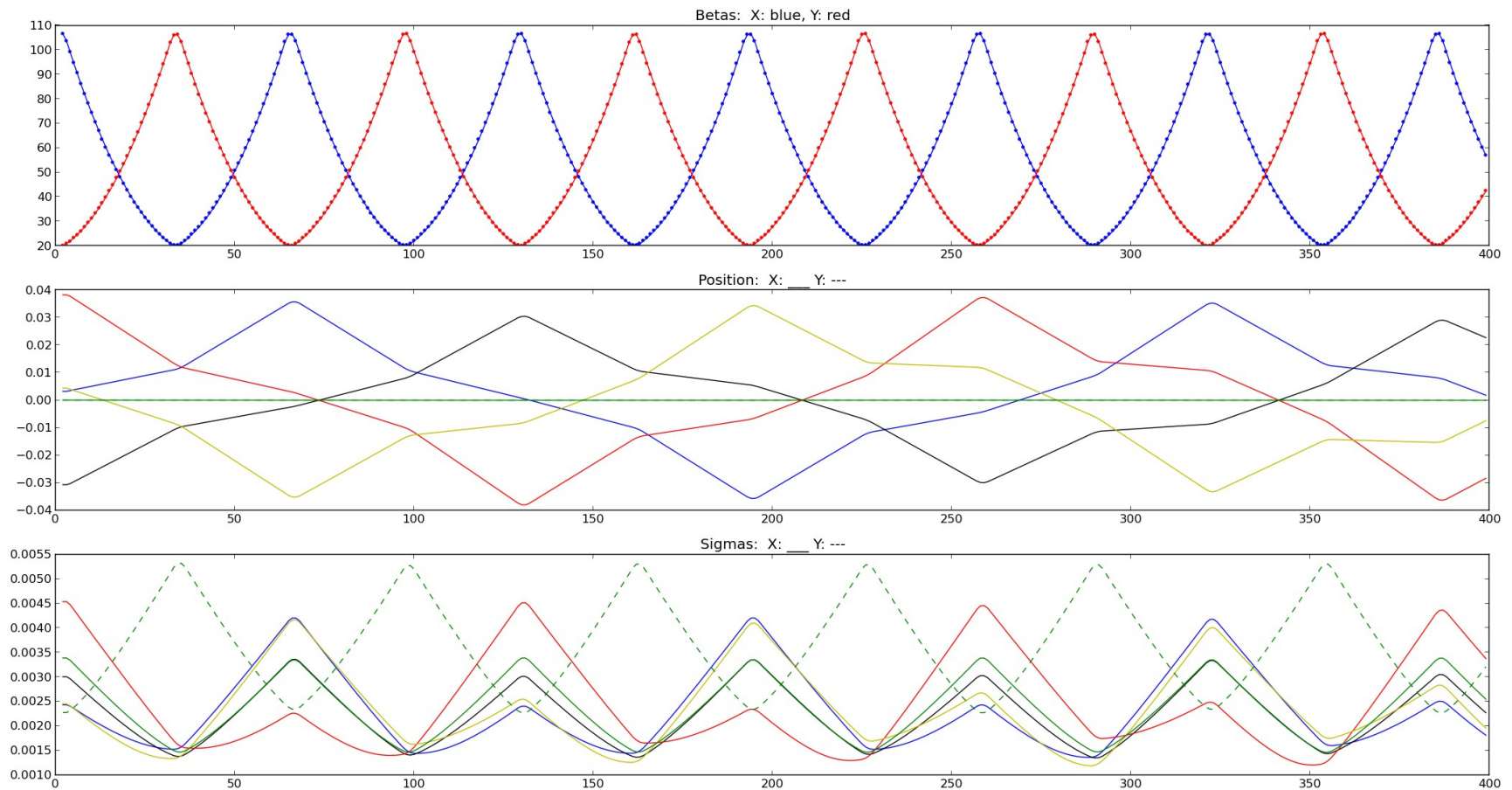
Five islands are more than one!

- Idea: 5 island beam would cover more cross-section than a single beam
- Using beam file generated by Dr. Massimo Giovannozzi

- Fig:
5 islands in
phase space

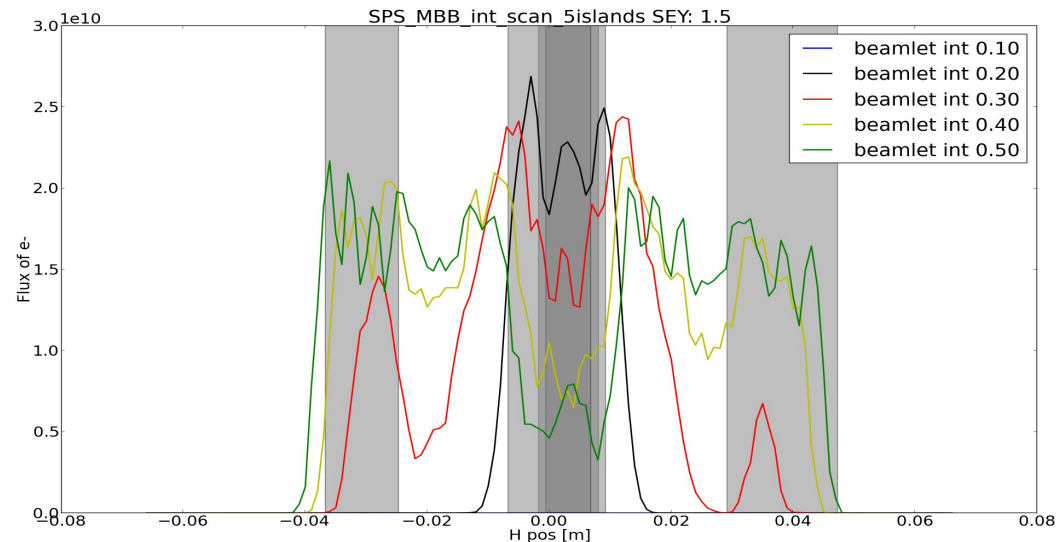
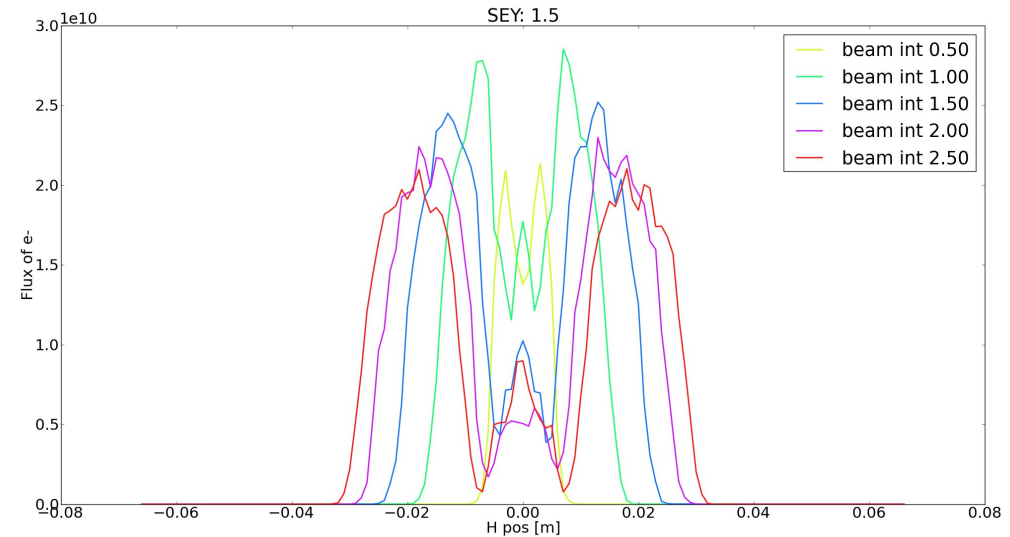


Propagating through SPS



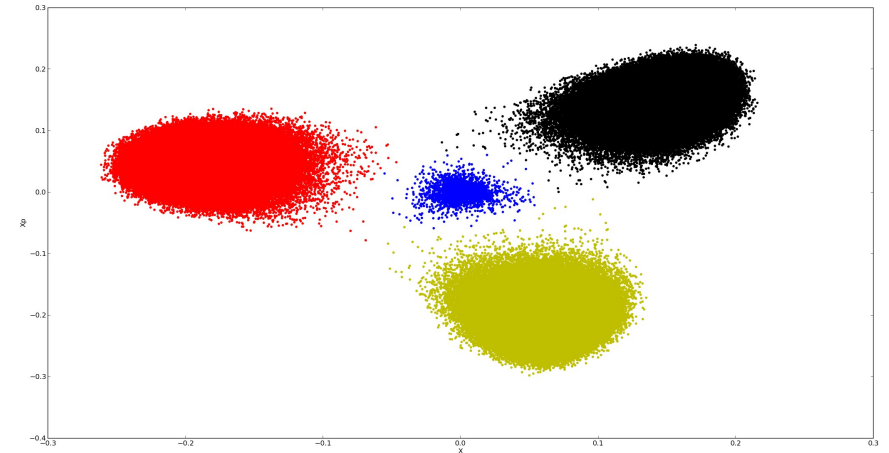
Comparing with original beam

- Confirmed coverage of more cross-section
- Also found higher total flux for same intensity!
(non-linear effects)

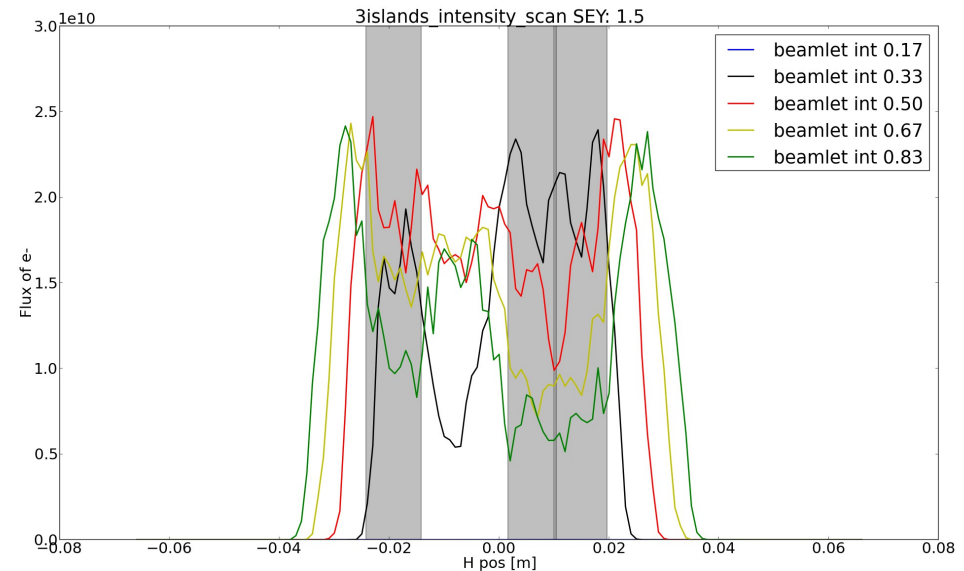


Alternative: three islands

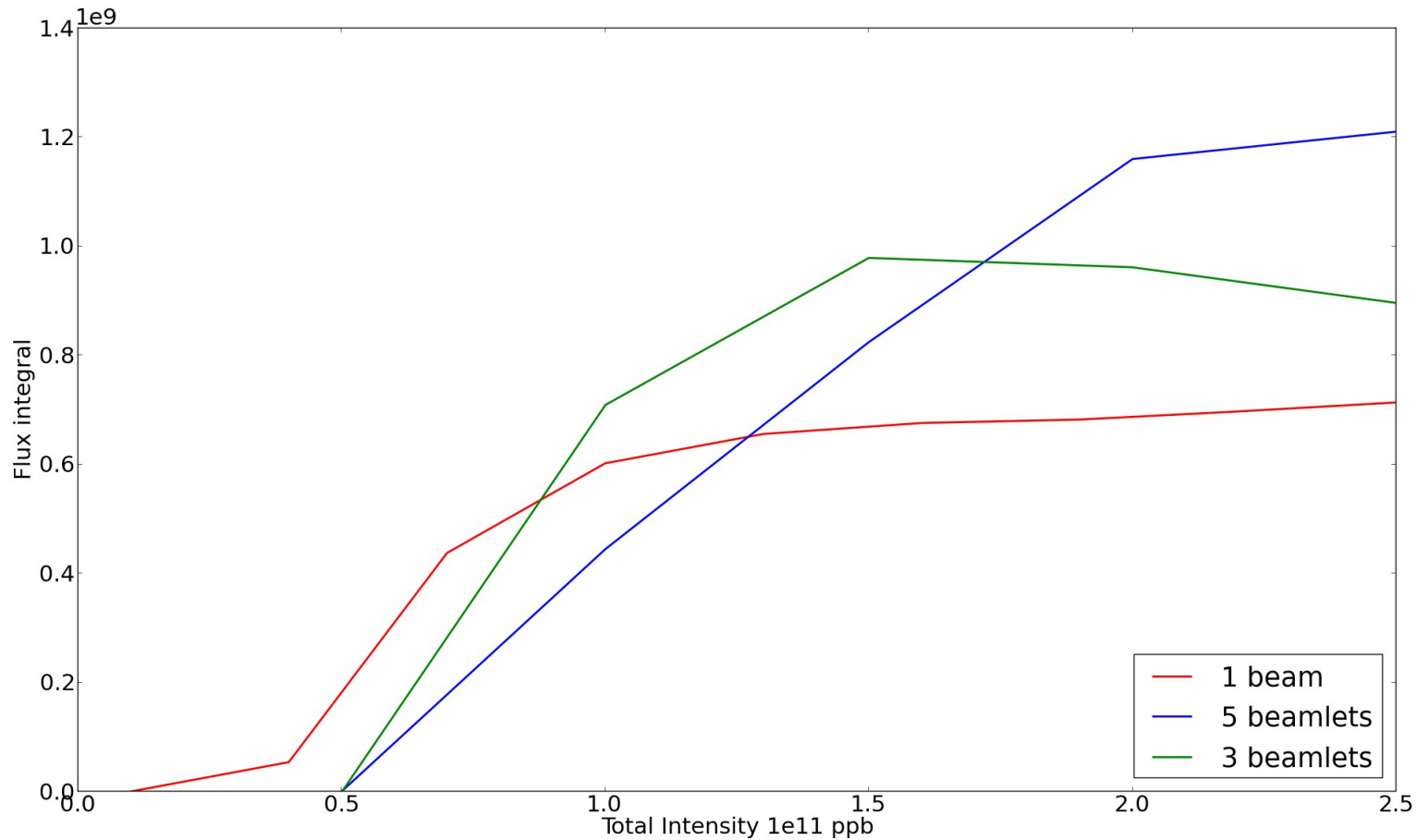
- Also tried a 3 island beam
(wrote algorithm to
separate the islands)



- Electron flux
more evenly
distributed



Results (comparing electron yields)



5
beamlets
seem
best right
now

More analysis to be done!

Acknowledgements

- Supervisors:
 - Giovanni Iadarola
 - Massimo Giovannozzi
- Pics stolen from Giovanni's thesis