g2p Dilution Update

David Ruth

Dilution has some issues still

- Method: Dilution factor $f = \frac{\sigma_{Proton}}{\sigma_{Prod}}$
- $f = 1 - \frac{\sigma_{bg}}{\sigma_{Prod}}$
- $f = 1 - \frac{\sigma_N + \sigma_{He} + \sigma_{Al}}{\sigma_{Prod}}$
- $f = 1 - \frac{Y_N + Y_{He} + Y_{Al}}{Y_{Prod}}$
- Helium and aluminum yield can be expressed together as a combination of dummy and empty runs
- $f = 1 - \frac{Y_N + (Y_{Dummy} - (pf)Y_{Empty})}{Y_{Prod}}$

Carbon run scaled to duplicate nitrogen

- $f = 1 - \dfrac{S_{C\to N}\dfrac{(\frac{\rho_N (pf) Z_{tg}}{M_N})}{(\frac{\rho_C Z_C}{M_C})} Y_C + (Y_{Dummy} - (pf) Y_{Empty})}{Y_{Prod}}$
- Scaling factor generated using Bosted model, comparing Carbon and Nitrogen cross sections.
- Carbon yield can be generated by subtracting Empty run from Carbon run.
- $f = 1 - \dfrac{S_{C\to N}\dfrac{\left(\frac{\rho_N (pf) Z_{tg}}{M_N}\right)}{\left(\frac{\rho_C Z_C}{M_C}\right)} [Y_{Carbon} - (\frac{Z_{tg} - Z_C}{Z_{tg}}) Y_{Empty}] + (Y_{Dummy} - (pf) Y_{Empty})}{Y_{Prod}}$

Consider other length corrections

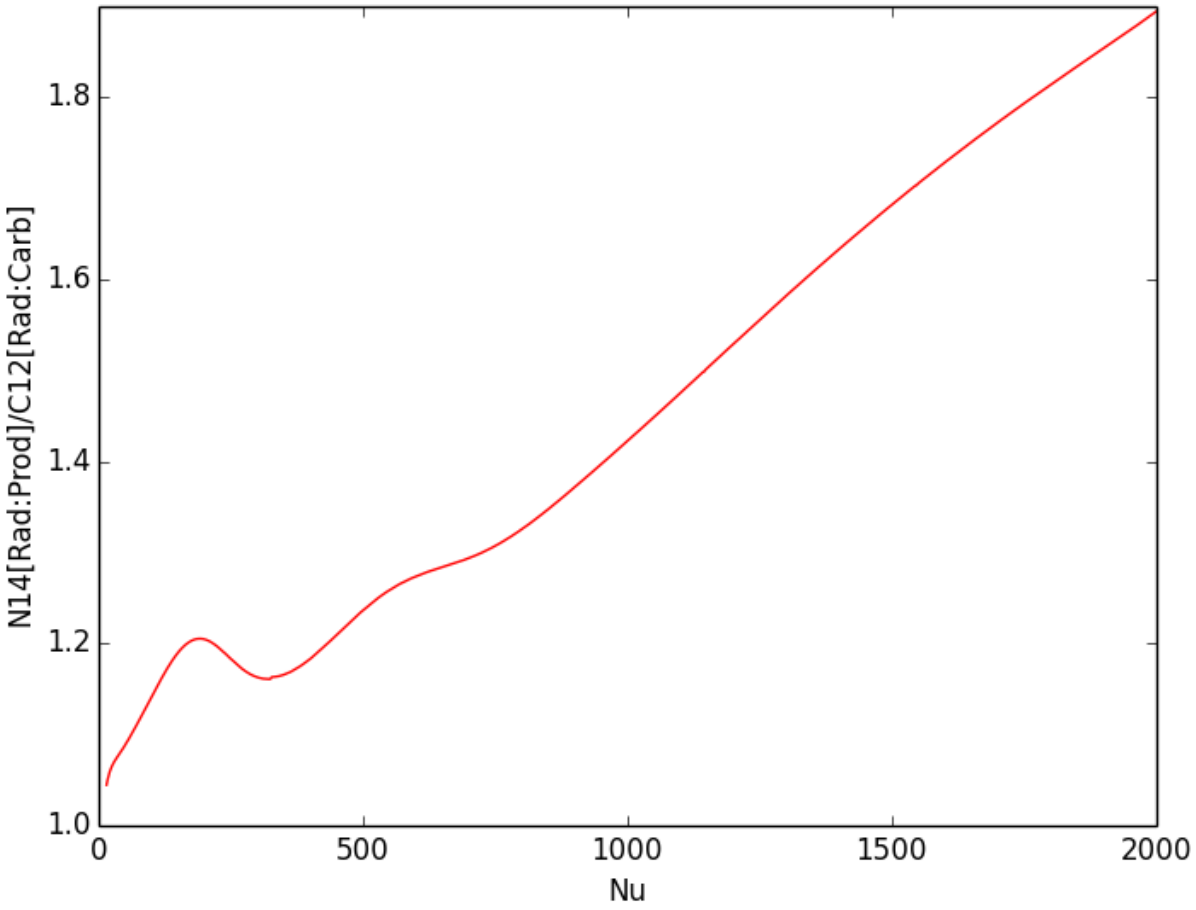
- We have not been considering Helium outside of target cell. Considering that length (Z Out) plus the length of the target cell to be Z Tot:
- $$f = 1 - \frac{S_{C\to N}\frac{\left(\frac{\rho_N (pf) Z_{tg}}{M_N}\right)}{\left(\frac{\rho_C Z_C}{M_C}\right)}\left[Y_{Carbon} - \left(\frac{Z_{tg} - Z_C}{Z_{tg}}\right)\left(\frac{Z_{tg}}{Z_{tot}}\right)Y_{Empty} - \left(\frac{Z_{out}}{Z_{tot}}\right)Y_{Empty}\right] + \left(Y_{Dummy} - (pf)\left(\frac{Z_{tg}}{Z_{tot}}\right)Y_{Empty}\right)}{Y_{Prod}}$$
- The radiation lengths are different, so we use Bosted to generate radiated cross sections for the radiation length of each type of run for each material. These cross sections are compared to make a radiative scaling factor. This is already incorporated into the carbon->nitrogen scaling factor as it is produced with radiated cross sections.
- Modified: Included radiation lengths other than the target itself in radiation effect comparison, reducing the overall magnitude of scale factors.

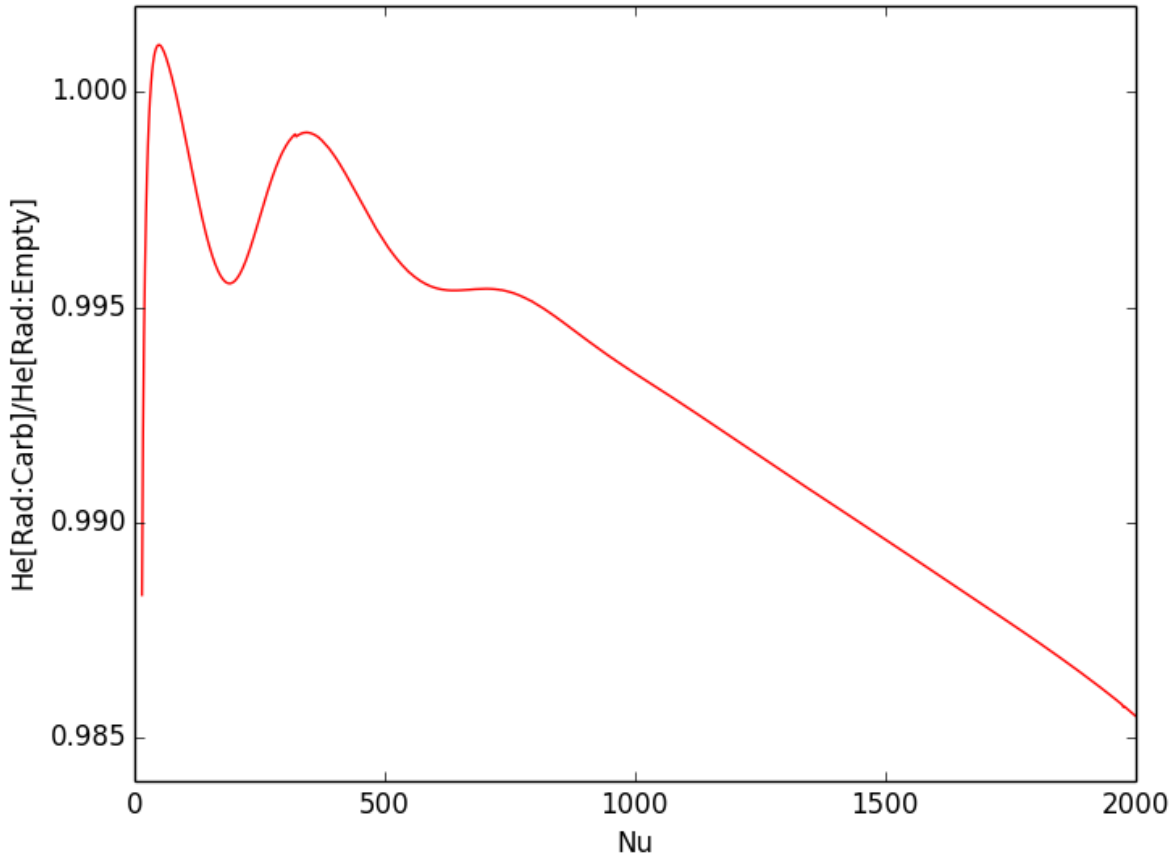
Consider other length corrections

- $$f = 1 - \frac{S_{C\to N}\frac{\left(\frac{\rho_N (pf) Z_{tg}}{M_N}\right)}{\left(\frac{\rho_C Z_C}{M_C}\right)}[Y_{Carbon} - \left(\frac{Z_{tg} - Z_C}{Z_{tg}}\right)\left(\frac{Z_{tg}}{Z_{tot}}\right)S_{He(E)\to He(C)}Y_{Empty} - \left(\frac{Z_{out}}{Z_{tot}}\right)Y_{Empty}] + S_{He(E)\to He(P)}(Y_{Dummy} - (pf)\left(\frac{Z_{tg}}{Z_{tot}}\right)Y_{Empty})}{Y_{Prod}}$$

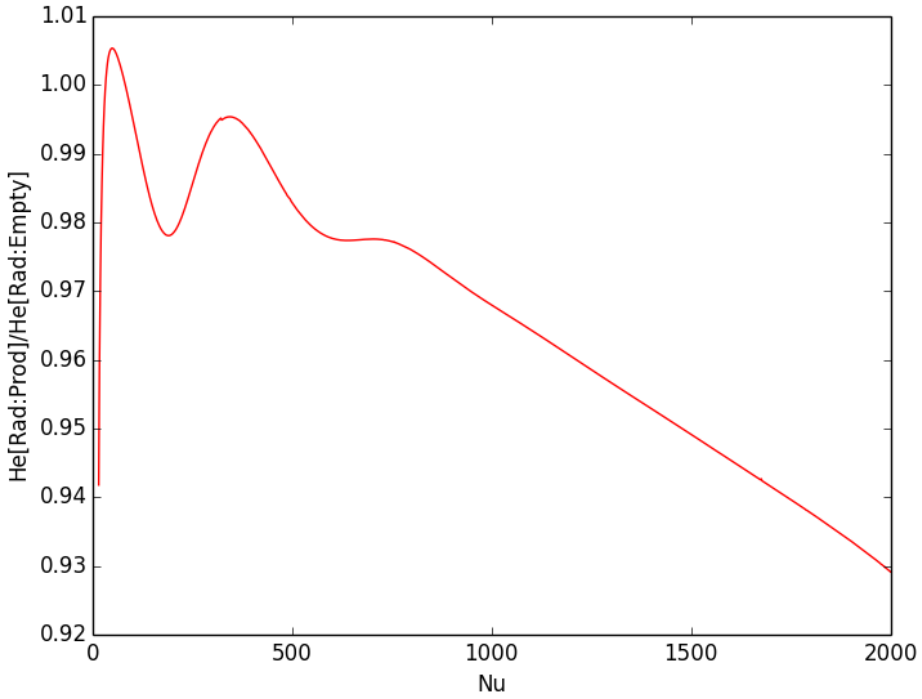
- Tighter dp cut on the data to eliminate edge effects from each momentum setting (+/- 2.9% from d1p)
- Fixed binning issue with applying scale factor from last week.

Relevant Scale Factor Plots



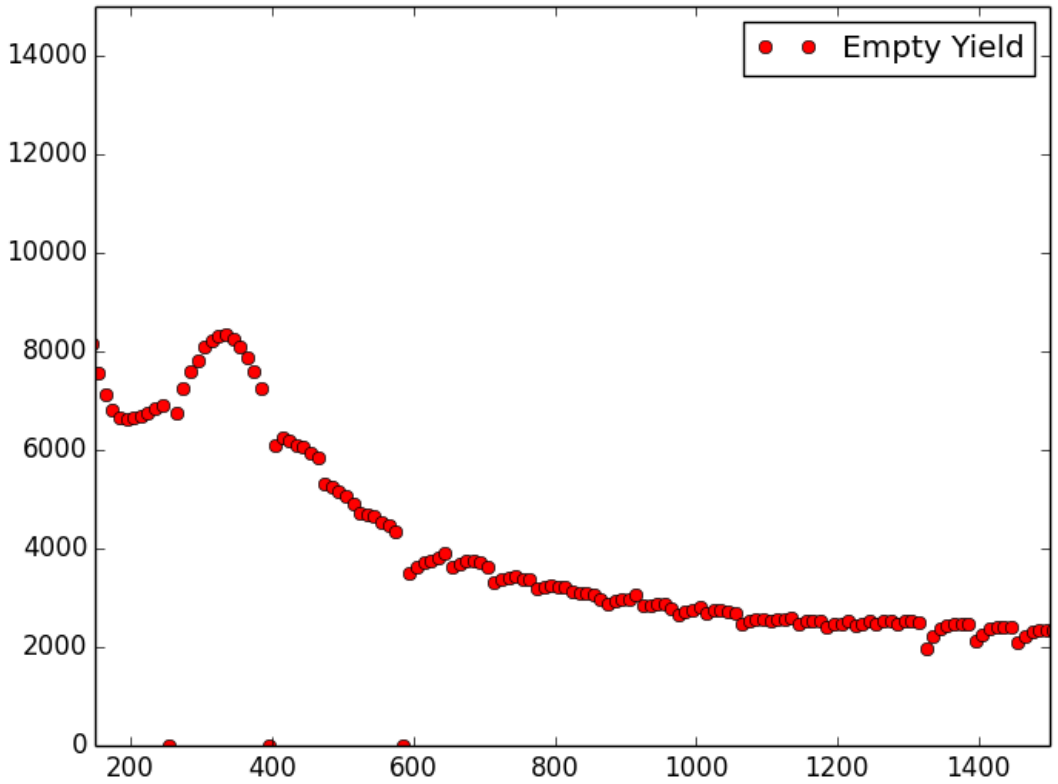


Relevant Scale Factor Plots

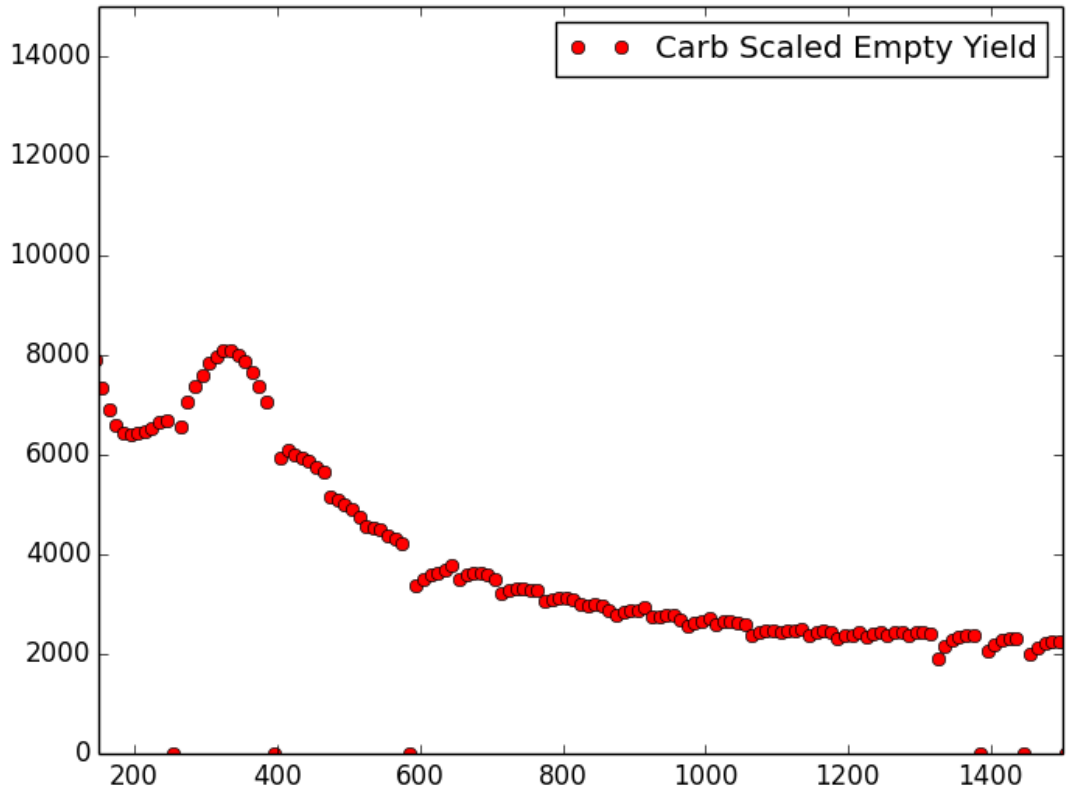


Dilution Factor – All Contributing Yields

Y_{Empty}

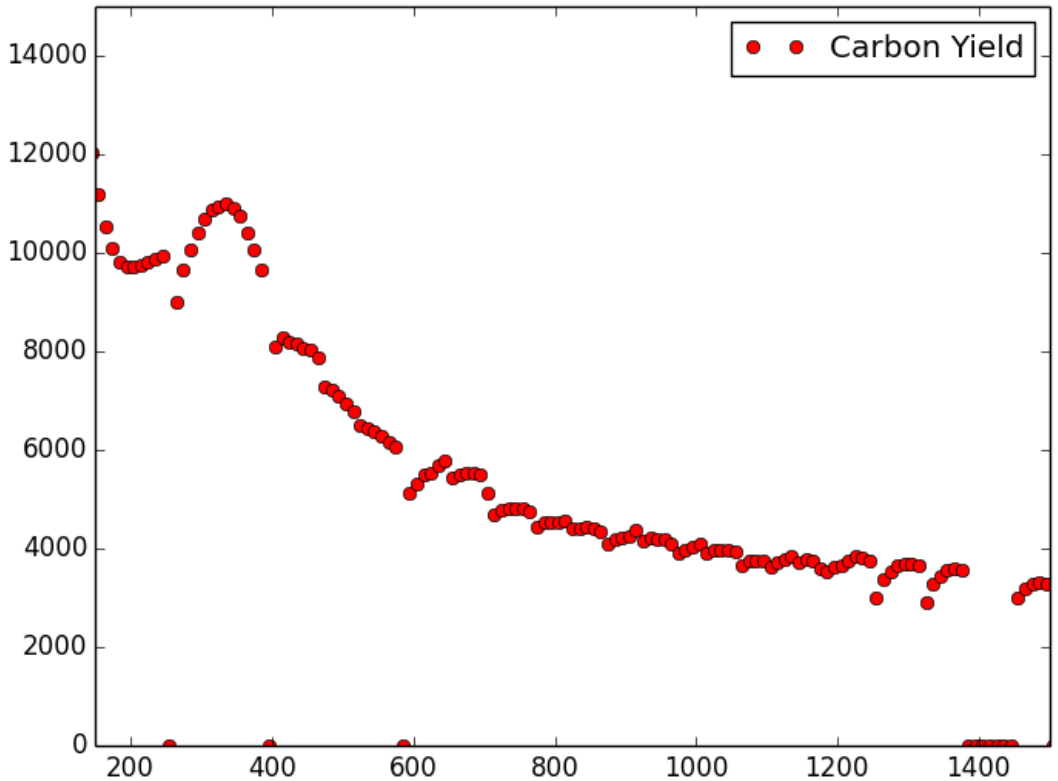


$$\left(\frac{Z_{tg} - Z_C}{Z_{tg}}\right)\left(\frac{Z_{tg}}{Z_{tot}}\right)S_{He(E)\rightarrow He(C)}Y_{Empty} + \left(\frac{Z_{out}}{Z_{tot}}\right)Y_{Empty}$$

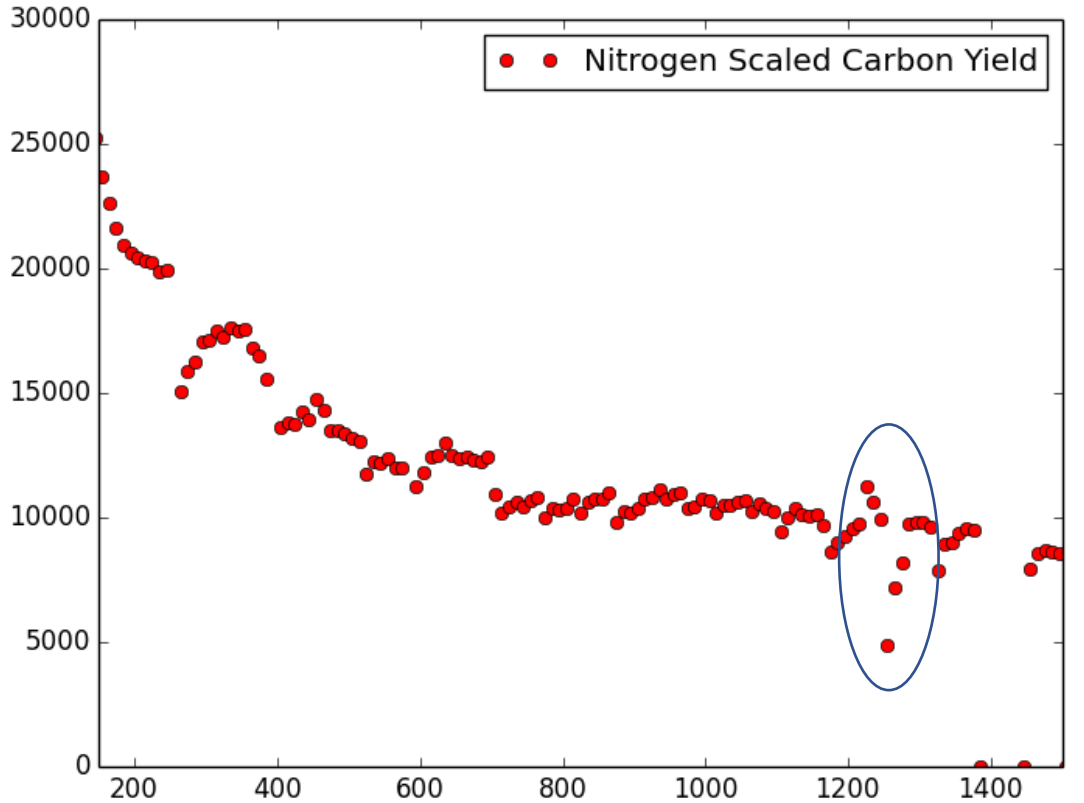


Dilution Factor – All Contributing Yields

Y_{Carbon}

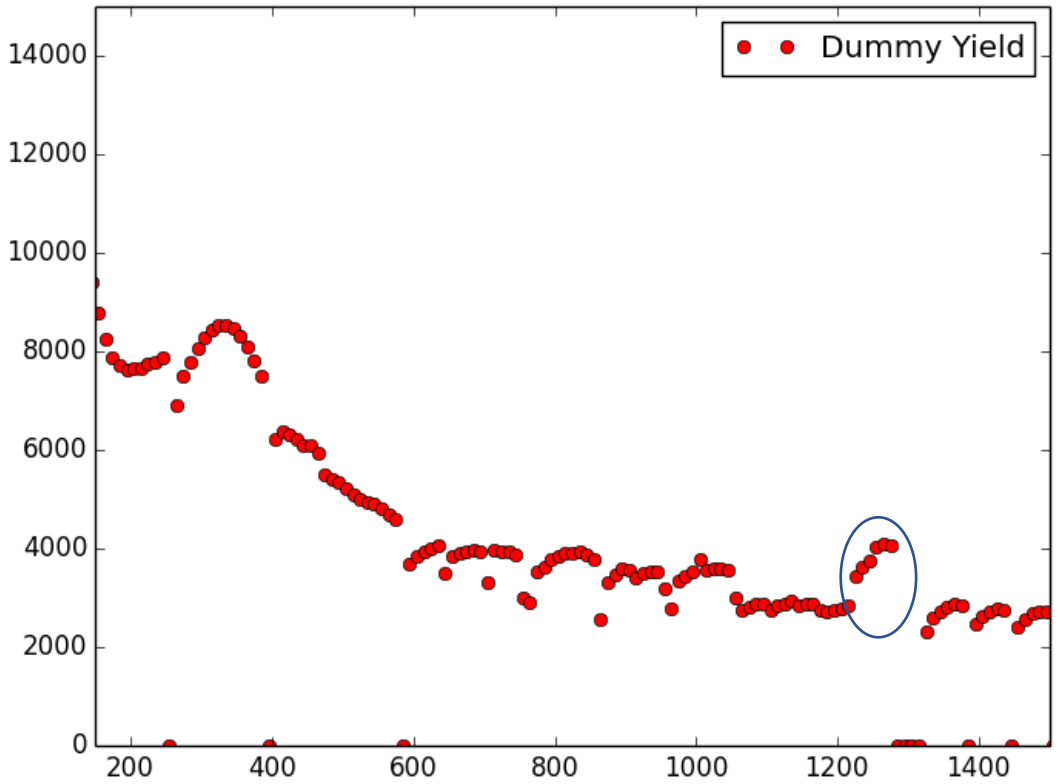


$$S_{C\to N}\frac{\left(\frac{\rho_N(pf)Z_{tg}}{M_N}\right)}{\left(\frac{\rho_C Z_C}{M_C}\right)}[Y_{Carbon} - \left(\frac{Z_{tg} - Z_C}{Z_{tg}}\right)\left(\frac{Z_{tg}}{Z_{tot}}\right)S_{He(E)\to He(C)}Y_{Empty} - \left(\frac{Z_{out}}{Z_{tot}}\right)Y_{Empty}]$$

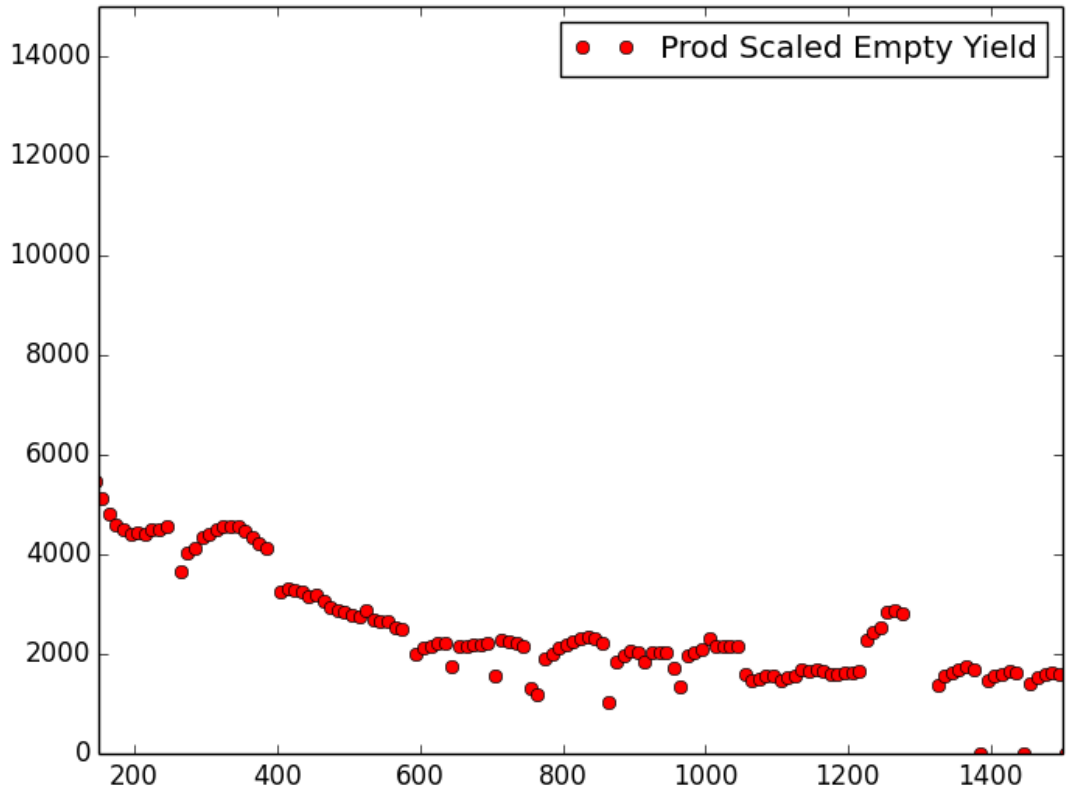


Dilution Factor – All Contributing Yields

Y_{Dummy}

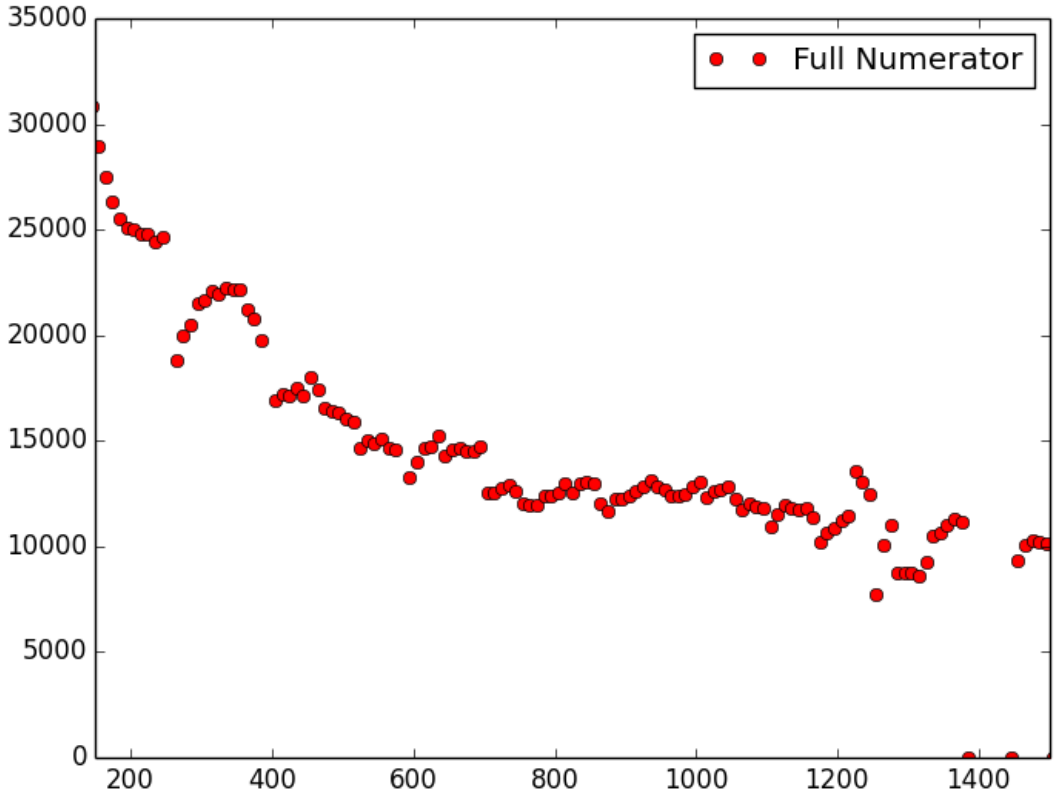


$S_{He(E)\rightarrow He(P)}(Y_{Dummy} - (pf)\left(\frac{Z_{tg}}{Z_{tot}}\right)Y_{Empty})$

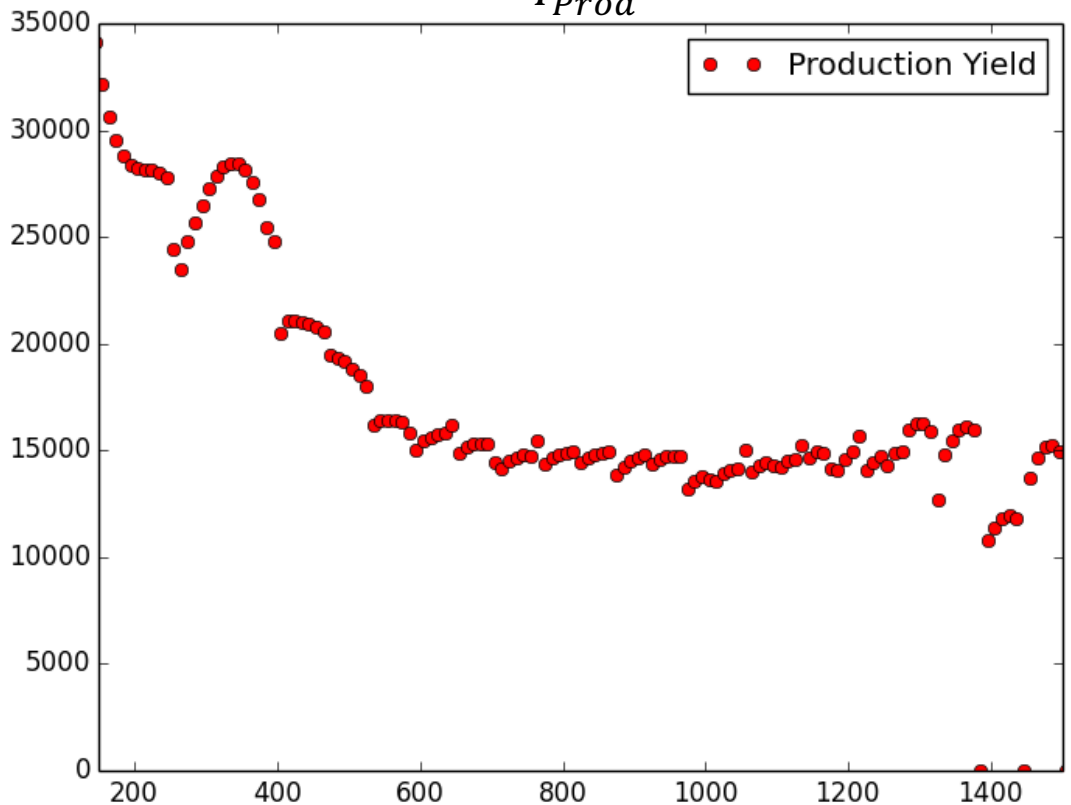


Dilution Factor – All Contributing Yields

Full Numerator



Y_{Prod}



Dilution Factor – All Contributing Yields