

g2p Dilution Update

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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

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

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

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:

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

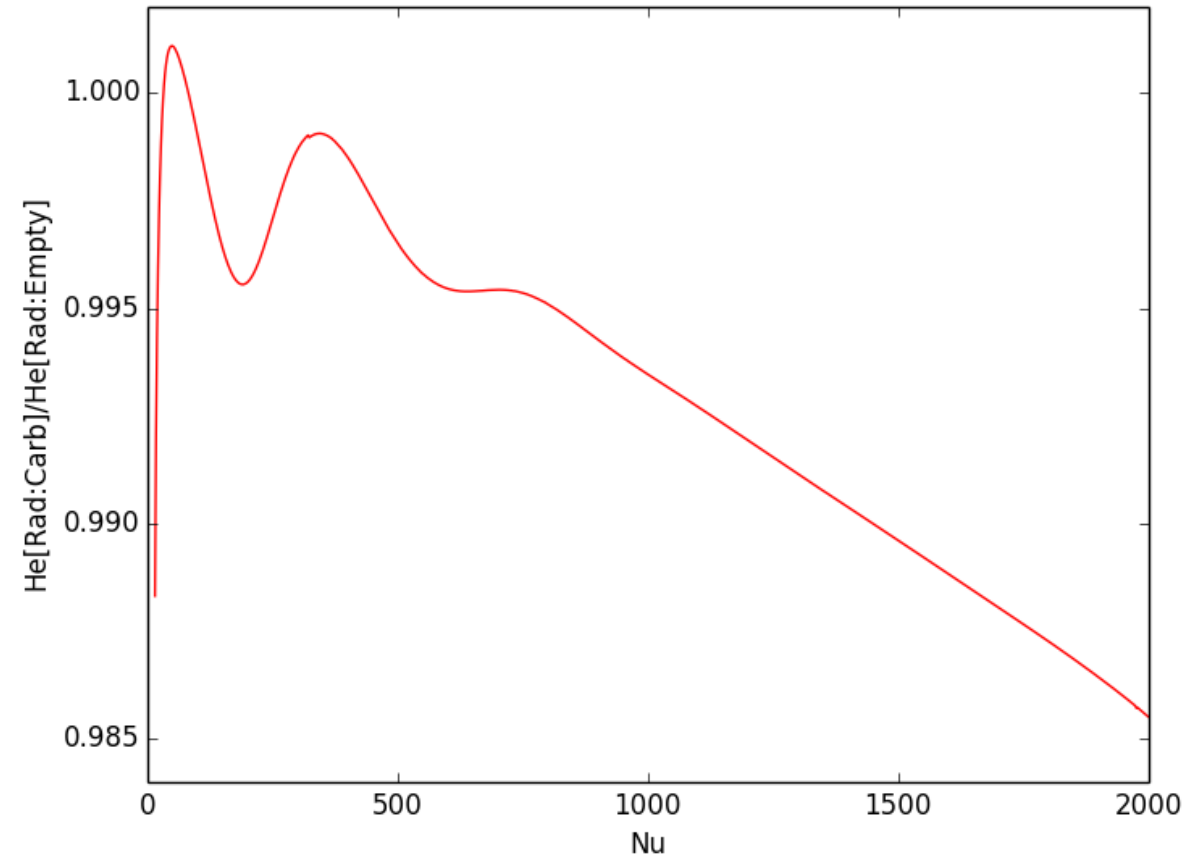
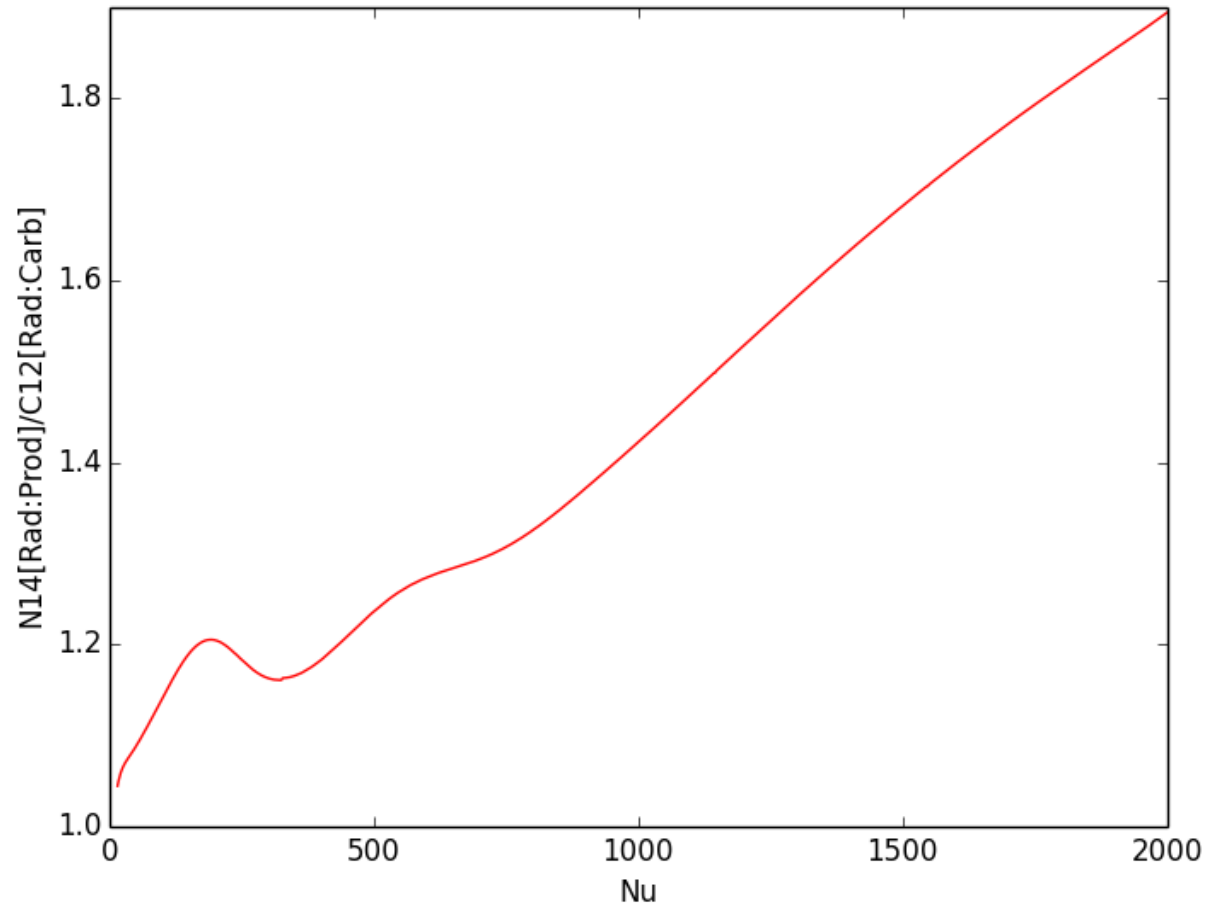
- The radiation lengths are different, so we use Bosted to generate radiated cross sections for the radiation length of each type of run for each material. These cross sections are compared to make a radiative scaling factor. This is already incorporated into the carbon->nitrogen scaling factor as it 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

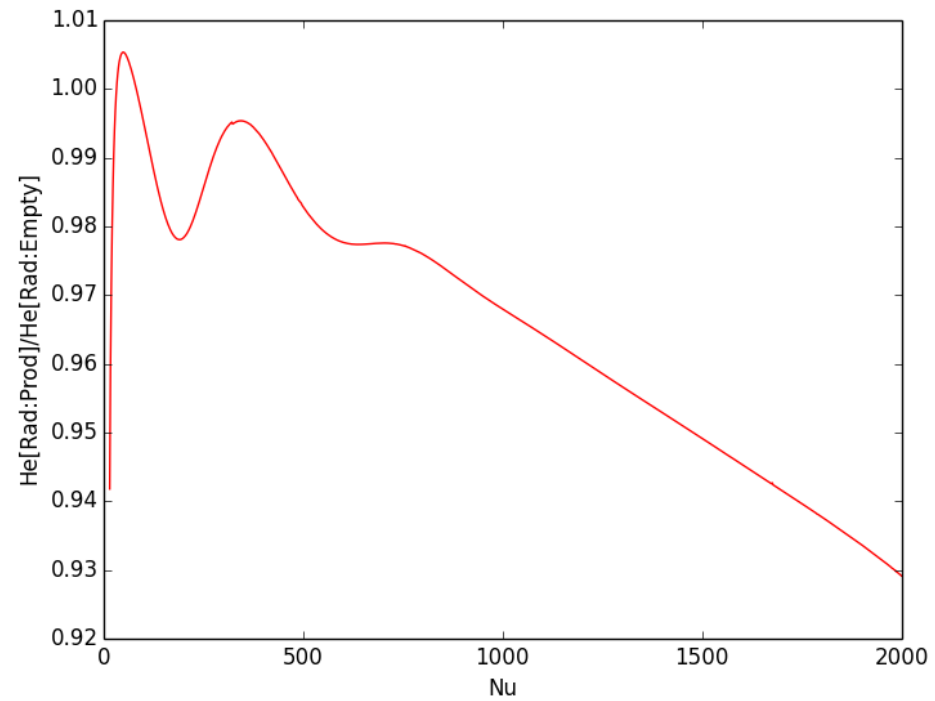
- $$f = \frac{1 - \frac{\rho_N(pf)Z_{tg}}{M_N}}{\frac{\rho_C Z_C}{M_C}} \frac{[Y_{Carbon} - \left(\frac{Z_{tg} - Z_C}{Z_{tg}}\right) \left(\frac{Z_{tg}}{Z_{tot}}\right) S_{He(E) \rightarrow He(C)} Y_{Empty} - \left(\frac{Z_{out}}{Z_{tot}}\right) Y_{Empty}] + S_{He(E) \rightarrow He(P)} (Y_{Dummy} - (pf)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

- 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

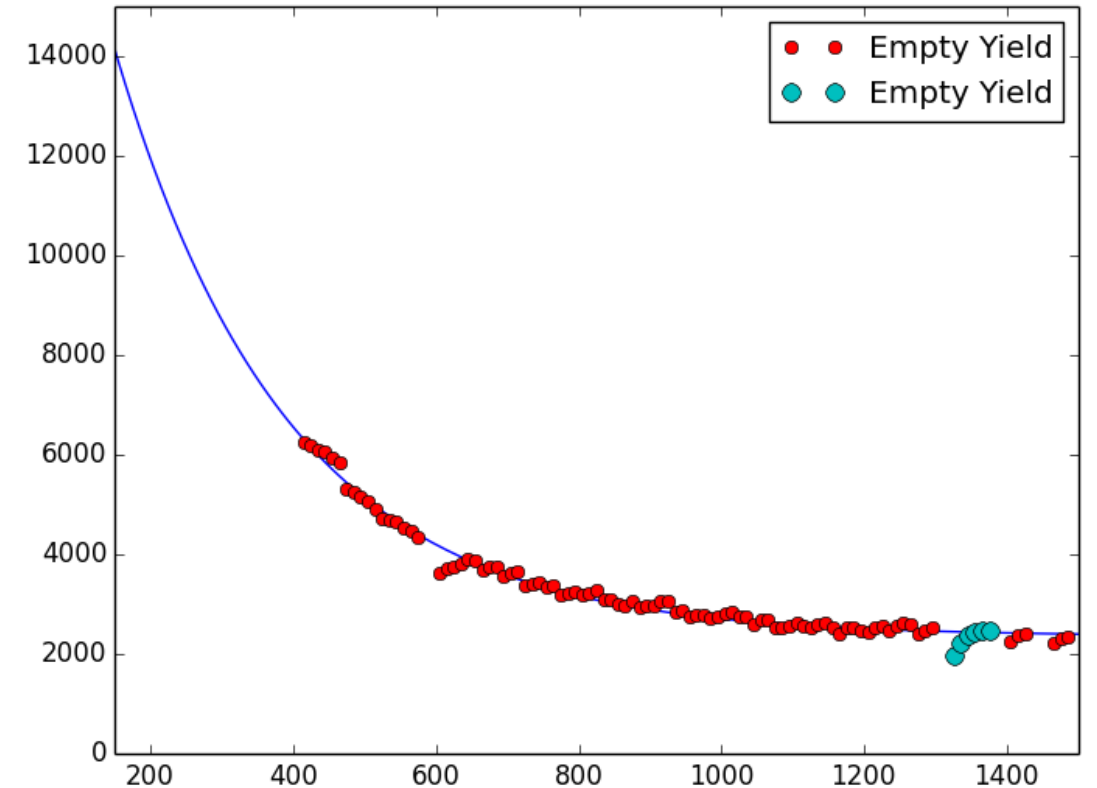
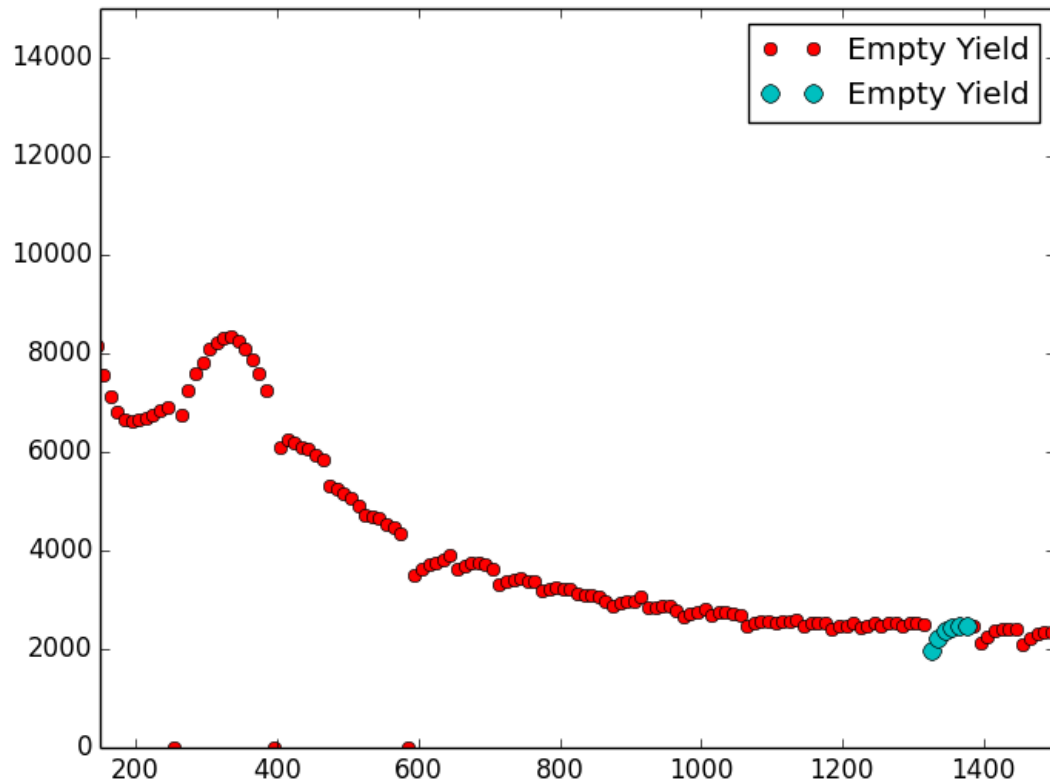


Relevant Scale Factor Plots



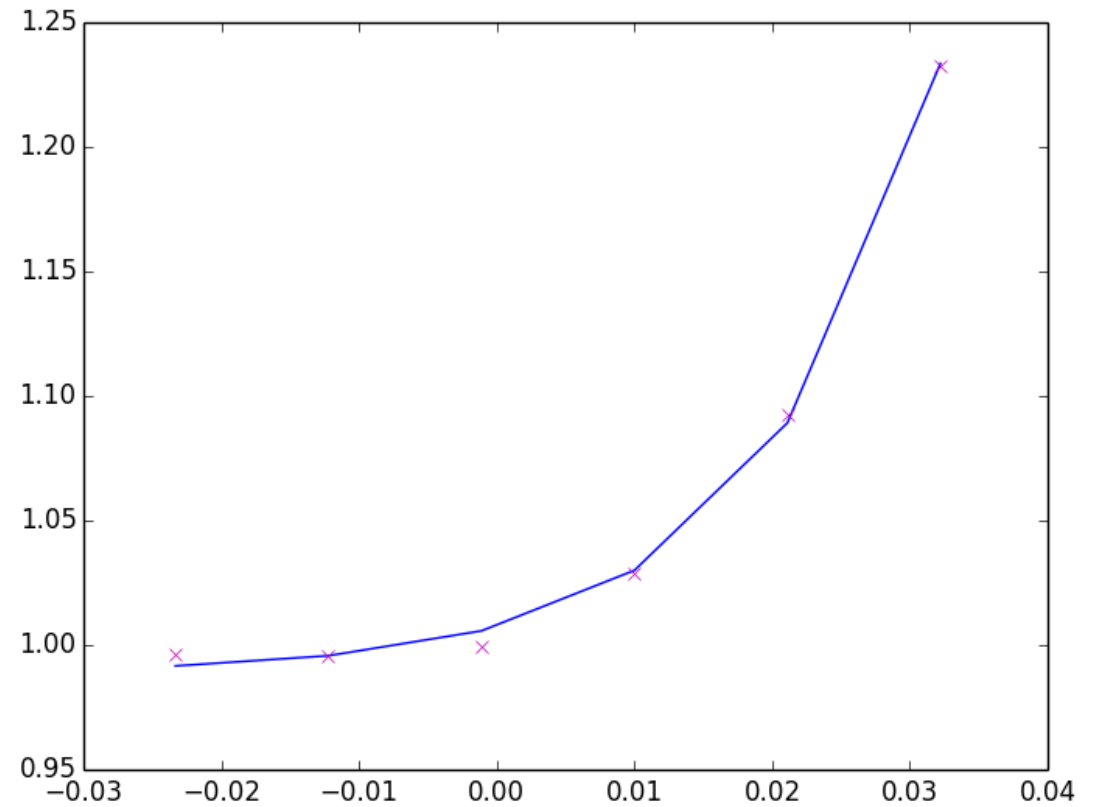
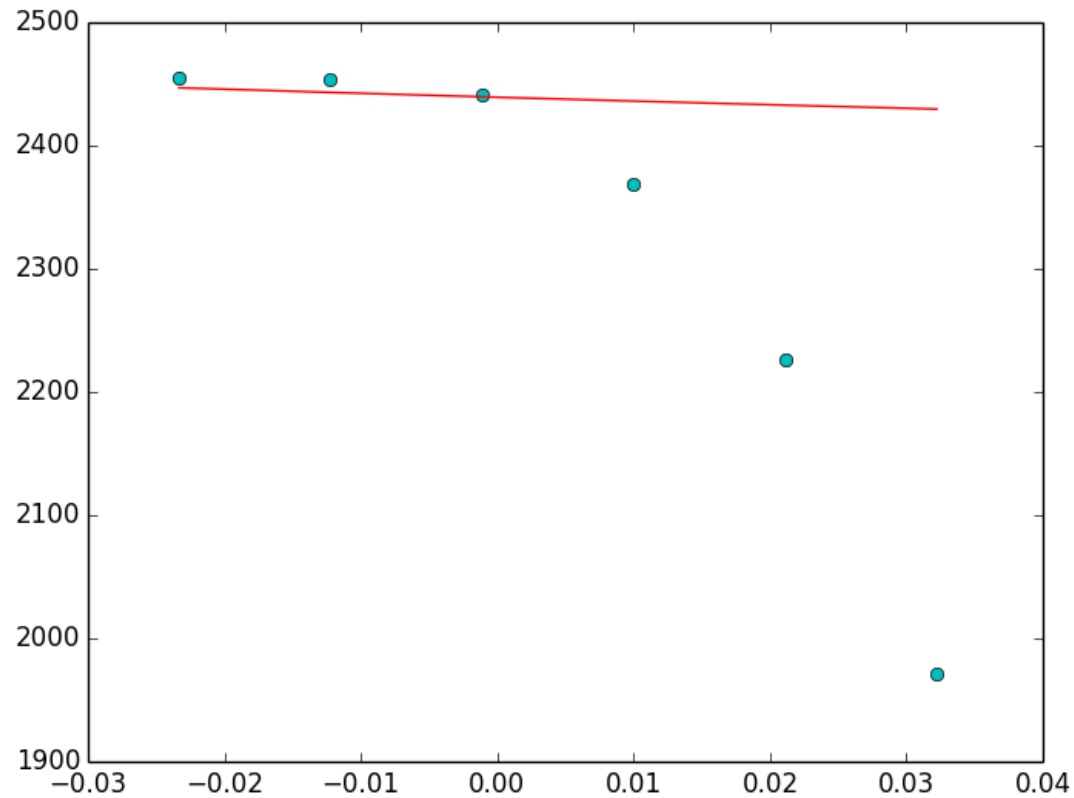
Made dp correction as suggested

Select momentum setting with most visible offense of edge effects and did exponential fit to a tight cut of the empty run



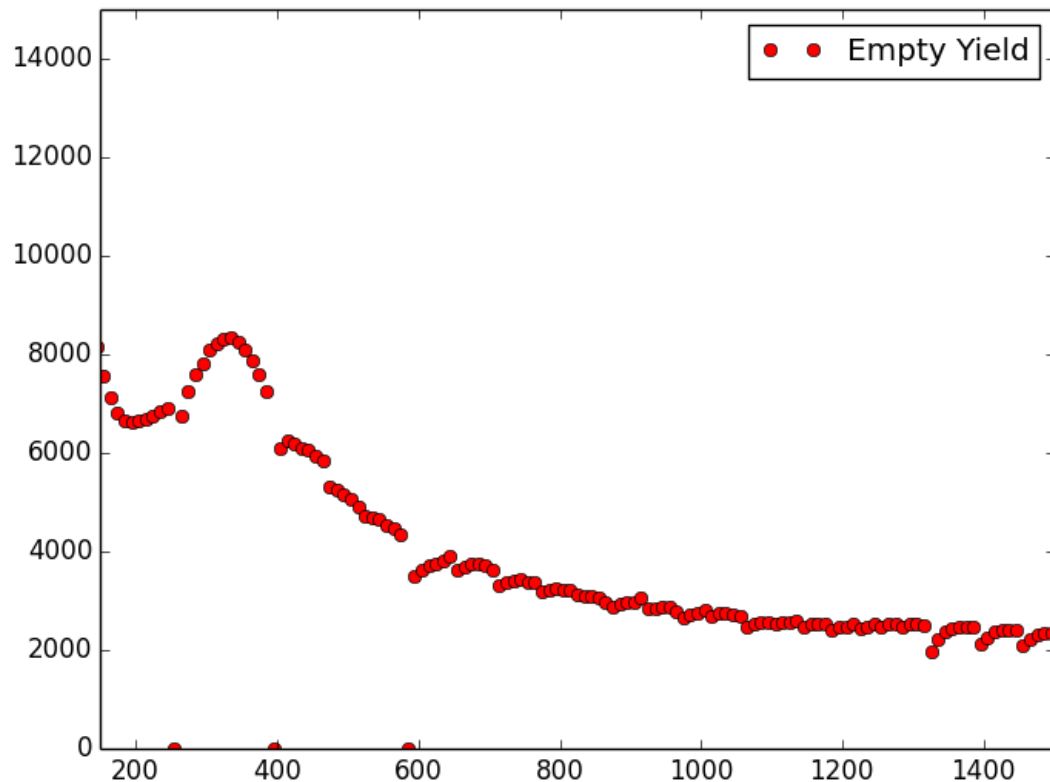
Made dp correction as suggested

Match empty yield for that setting to the fit with a multiplicative scaling factor
Interpolate by fitting another exponential to that scaling factor

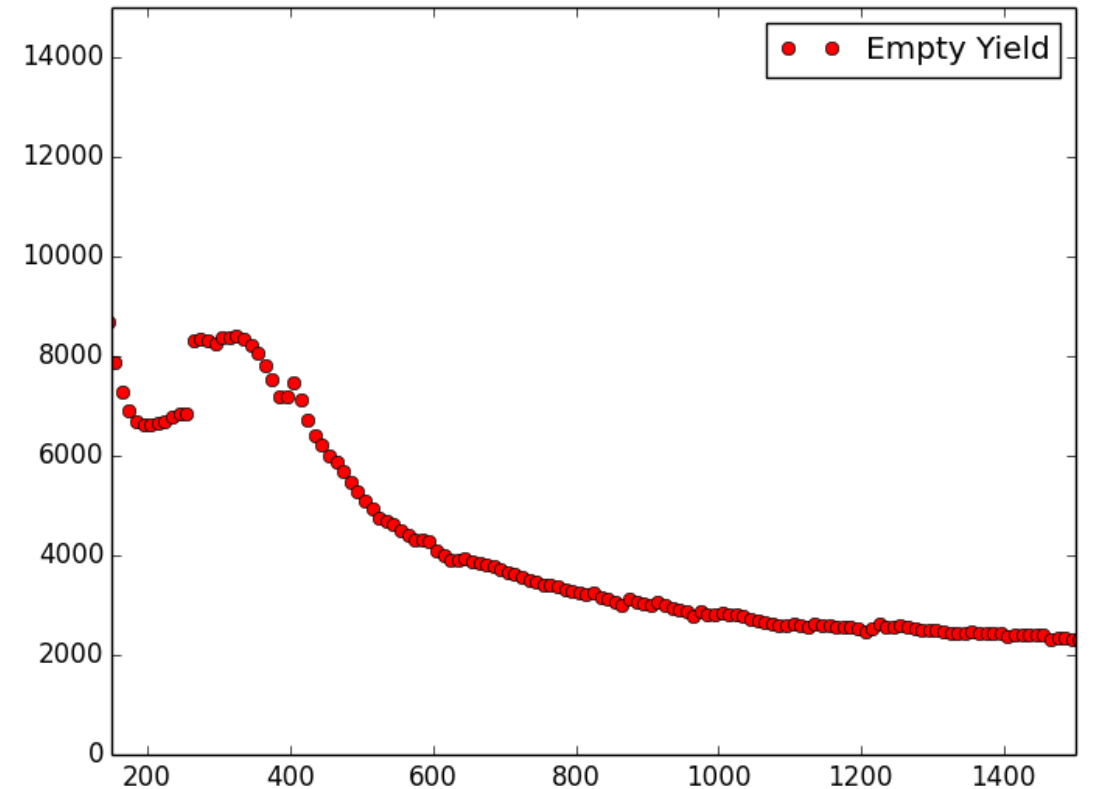


Seems to have beneficial effects on yields

Y_{Empty} (No correction)

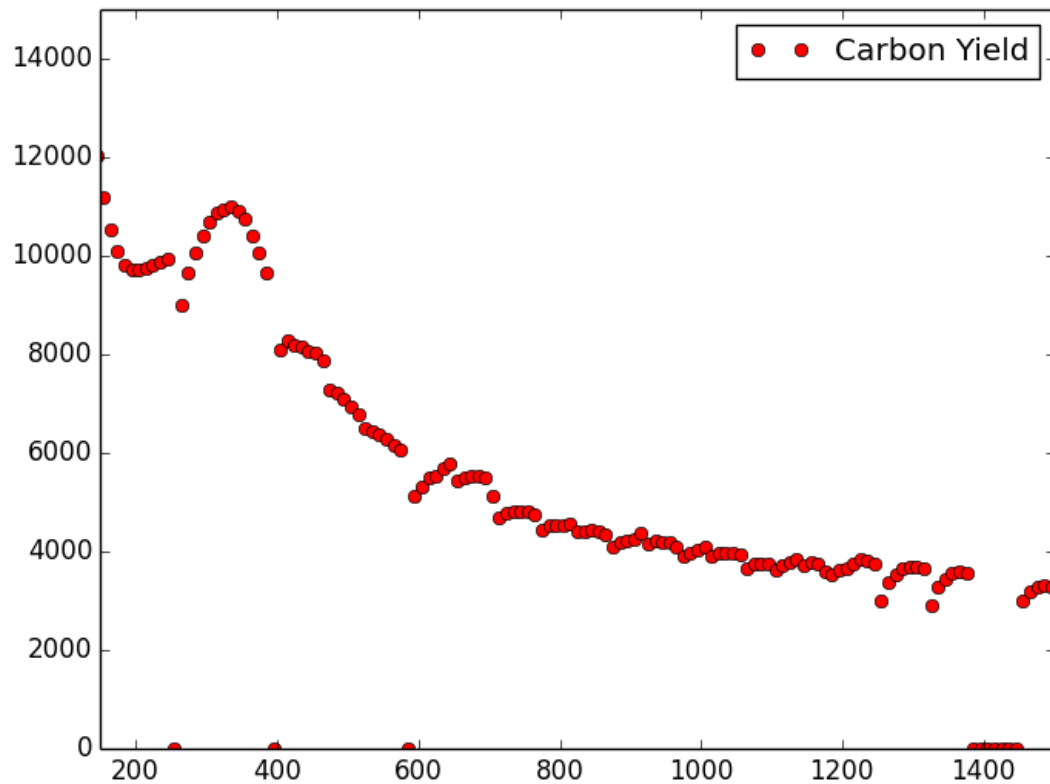


Y_{Empty} (Corrected)

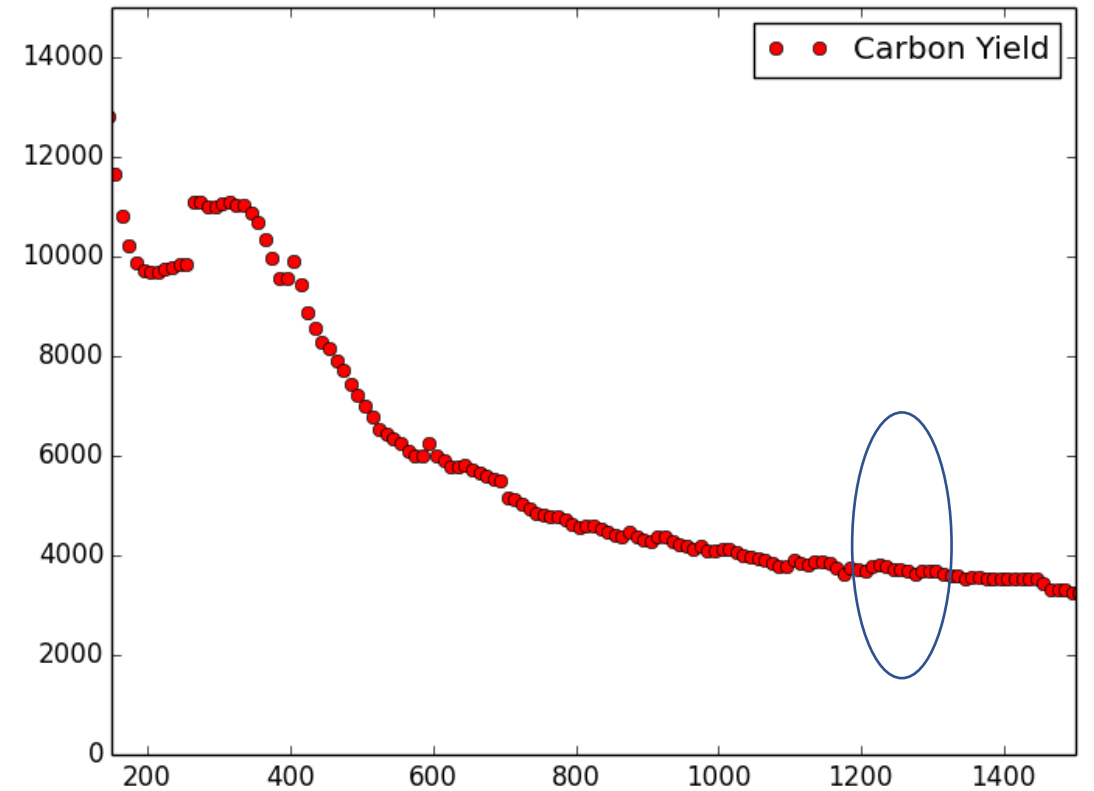


Dilution Factor – All Contributing Yields

Y_{Carbon} (No Correction)

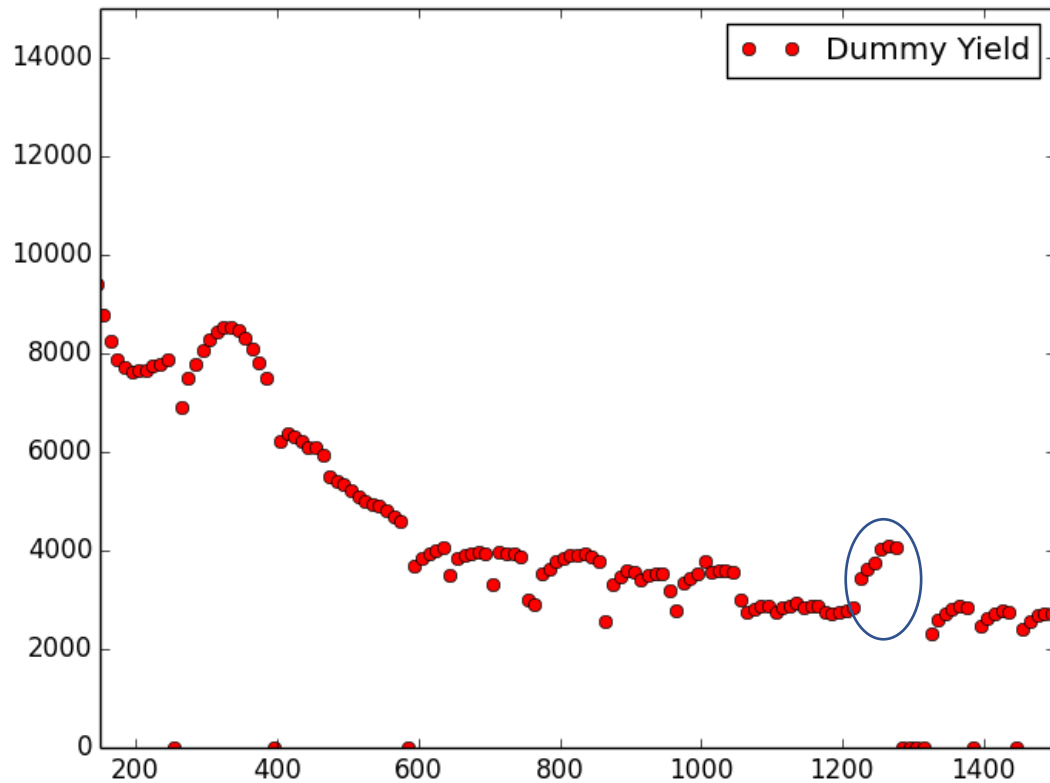


Y_{Carbon} (Corrected)

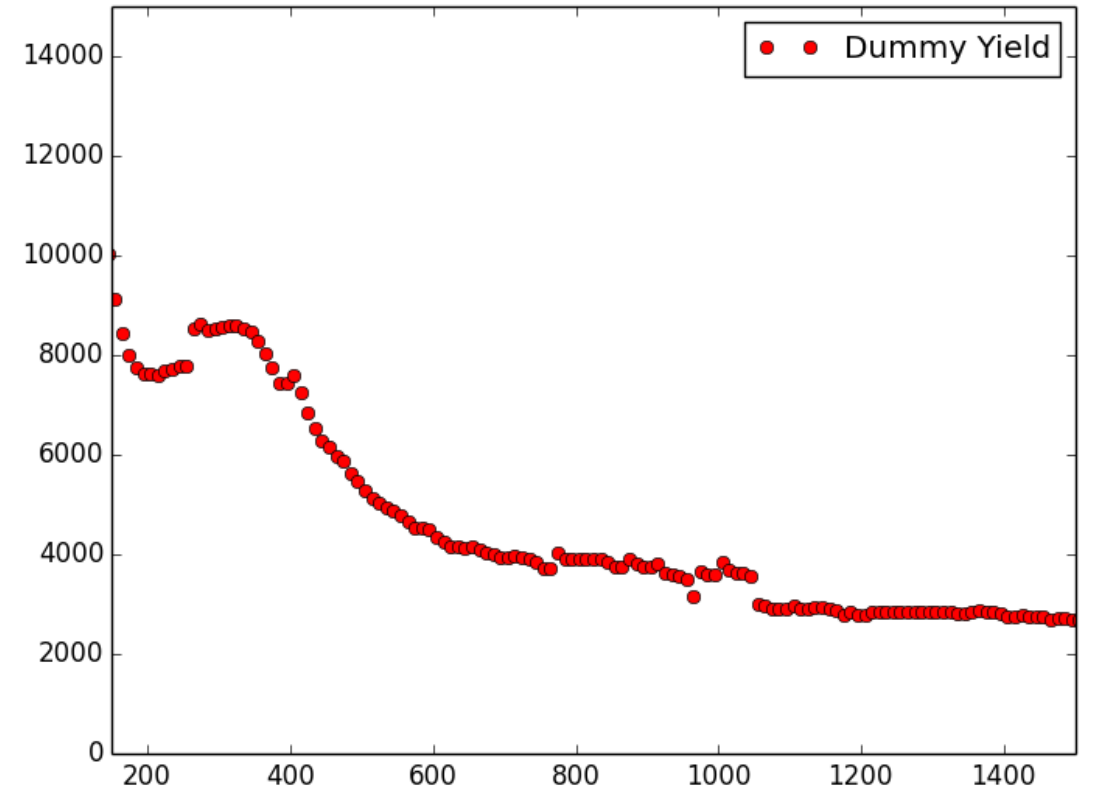


Dilution Factor – All Contributing Yields

Y_{Dummy} (No Correction)

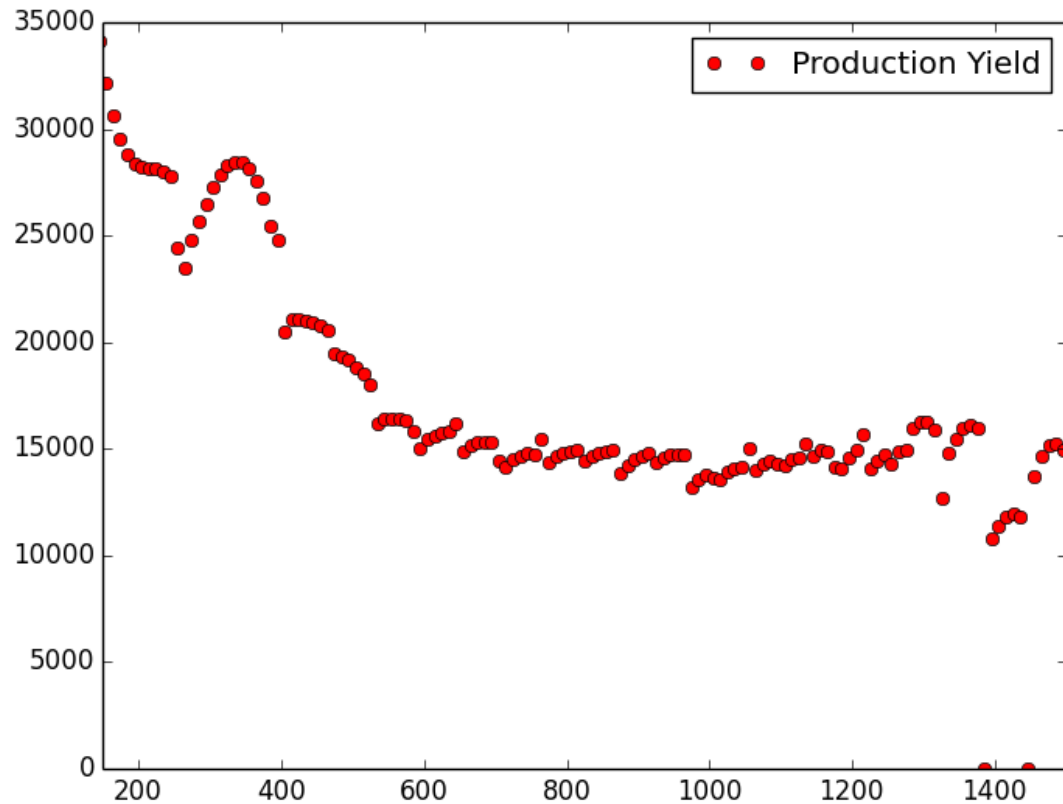


Y_{Dummy} (Corrected)

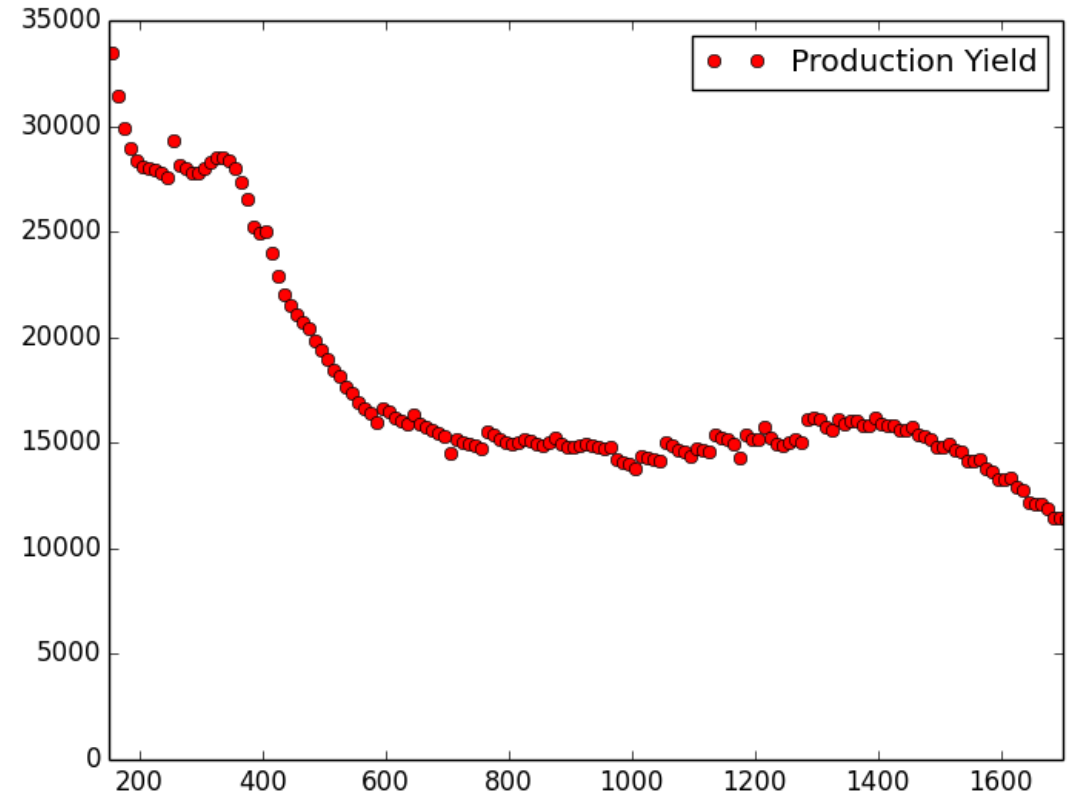


Dilution Factor – All Contributing Yields

Y_{Prod} (No Correction)

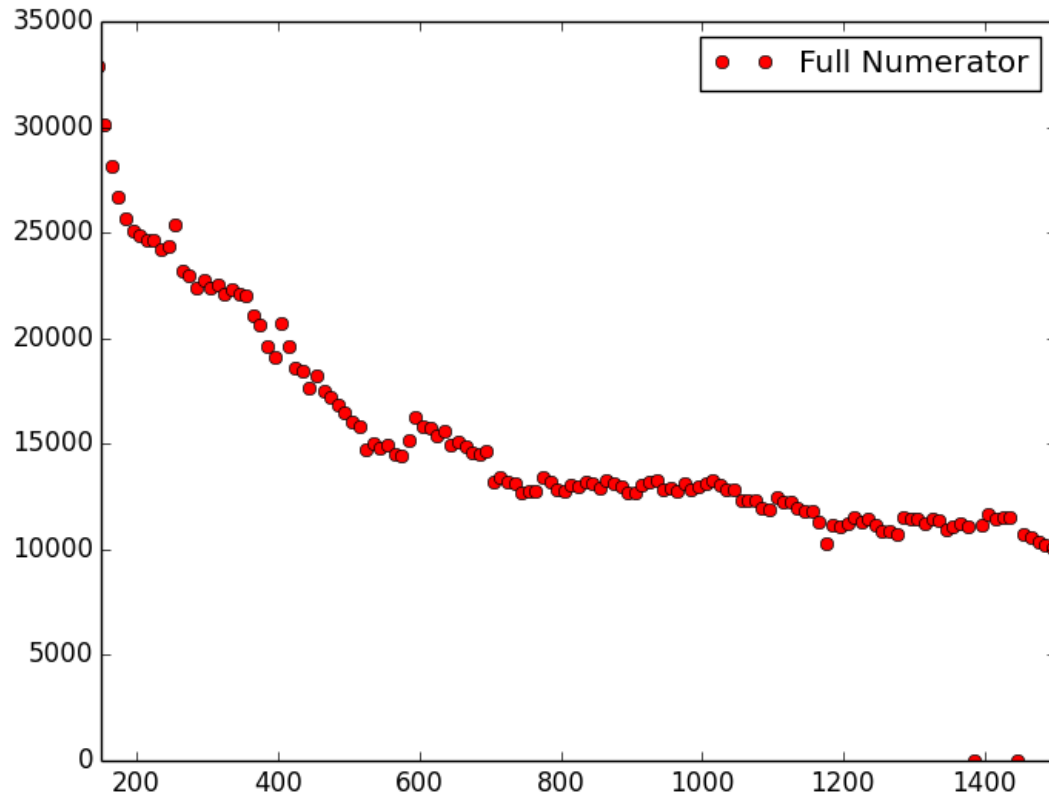


Y_{Prod} (Corrected)

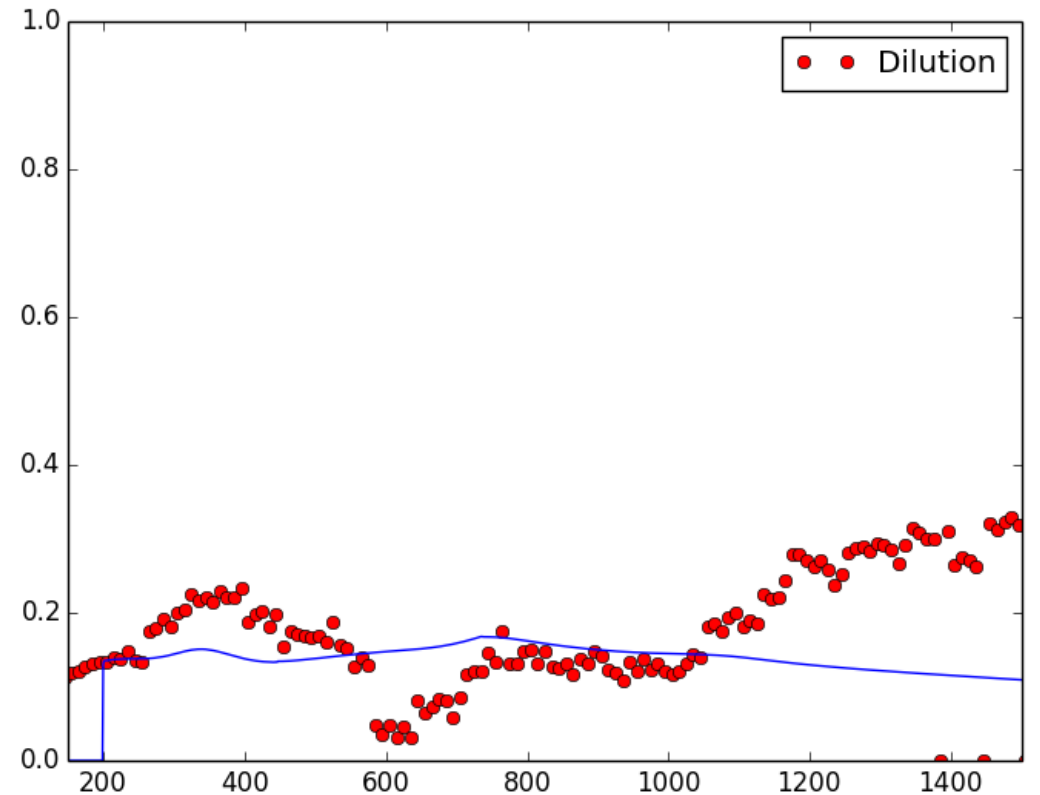


Dilution Factor – All Contributing Yields

Numerator



Corrected Dilution



Dilution Factor – All Contributing Yields

We discovered that the model I was using did not include the out of plane correction to the scattering angle, But result of including that correction is small relative to the hump

