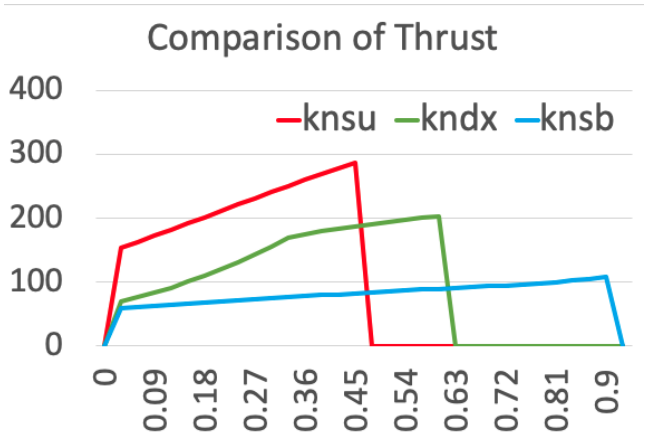
Analysis

- Adding iron oxide may have increased the burn rate by 26% (from Nakka's experiment for KNDX. https://www.nakka-rocketry.net/oxidex.html)
- Since the steady-state pressure of the combustion chamber is proportional to the burn rate, the internal pressure is likely to have risen by 26%. Considering the openMotor simulation, the expected peak pressure of the combustion chamber would be 2.81 MPa (openMotor simulation without iron oxide)*1.26= 3.54MPa.
- 3.54MPa is still lower than the allowable pressure of 11.25 MPa (I calculated this pressure from the formula of hoop stress. The tensile strength of PVC is supposed as 45 MPa).
- Considering the above, the igniter may have blocked the nozzle throat and decreased the nozzle diameter. I ran the openMotor simulation several times and found the chamber pressure reached the limit when the nozzle is 6.5mm. Since we were using iron oxide, the destruction can occur when the nozzle throat diameter is even bigger (Let's say 7mm or 8mm).

Way forward

- Use less amount of grain to decrease the peak pressure
- Avoid blocking of the nozzle throat
- The use of the washer seems still questionable in terms of safety. Especially when the PVC will be burst, the washers will be shot like bullets.
- The use of KNSB would be better. In fact, Nakka uses KNSB for PVC motor and recommends not to use KNSU/KNDX for PVC motor. This is due to the fact that KNSB has a flat combustion profile, which means it has the lowest peak pressure for the same total impulse (=area under the thrust curve), compared to KNSU and KNDX. See the graph below (the graph is for our motor V7).



Further question

- Could you tell me the size of the next SRM?
- What's your thought on the danger of the washer while destruction of SRM?