

Numerical Experiments on PF400 Neutron Yield

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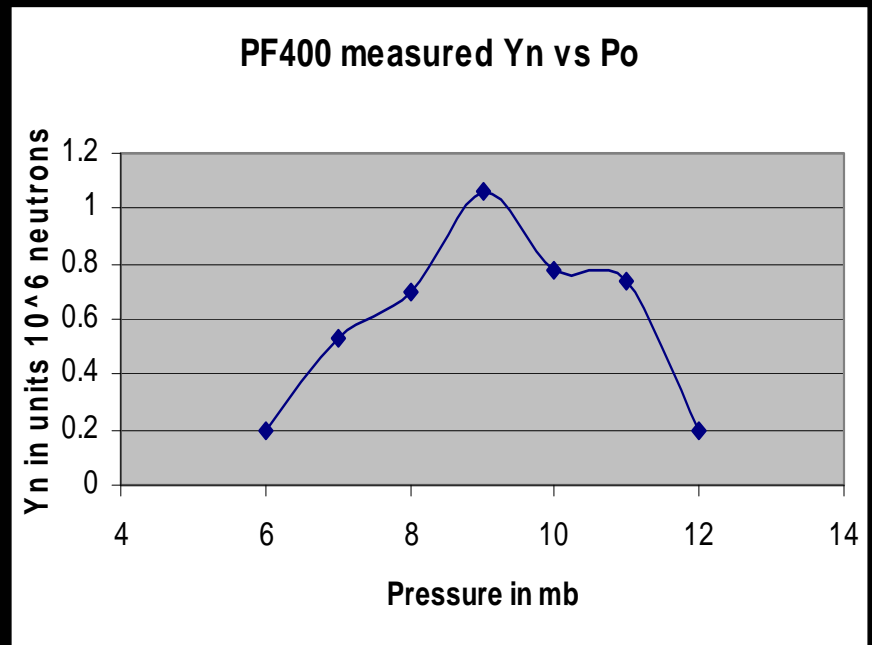
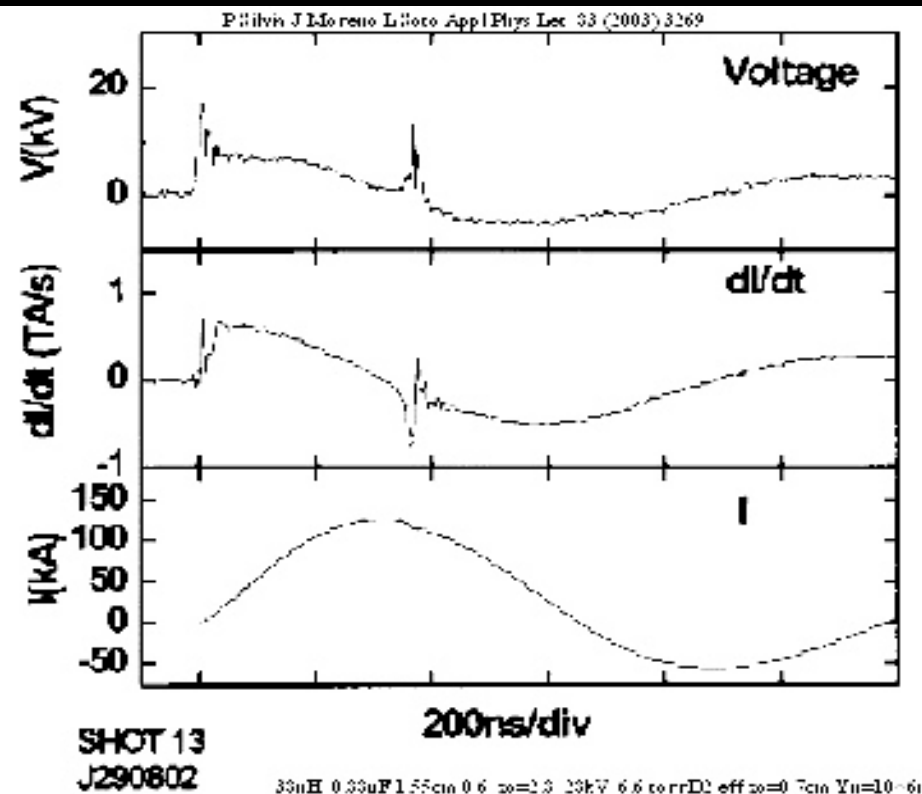
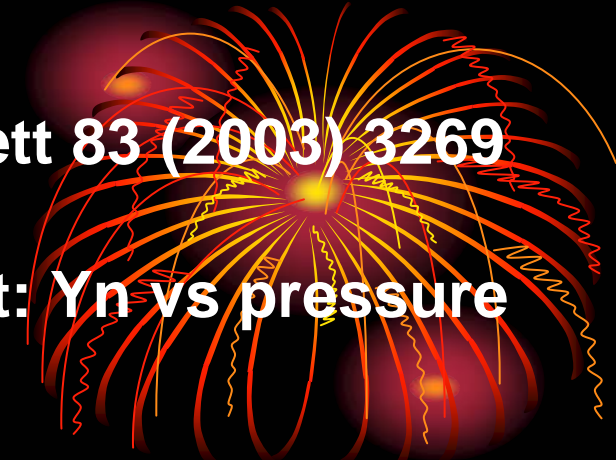
The Published Results



- Silva, Moreno and Soto et al had published a paper with laboratory measurements from the PF400, including a typical current waveform and a graph on neutron yield Y_n vs pressure.

P Silva J Moreno L Soto Appl Phys Lett 83 (2003) 3269

Left lower: Measured current; Right: Y_n vs pressure



We configure the Lee model code (version RADPF05.13.9b) to operate as the PF400 starting with the following published bank and tube parameters



- Bank parameters: $L_0=38\text{nH}$,
 $C_0=0.88\text{mF}$, $r_0=\text{not given}$
- Tube parameters: $b=1.55\text{ cm}$,
 $a=0.6\text{ cm}$, $z_0=2.8\text{ cm}$
- Operating parameters: $V_0=28\text{ kV}$,
 $P_0= 6.6\text{ Torr Deuterium}$

To obtain a reasonably good fit the following bank and tube parameters (L_0 , C_0 and z_0 refitted and r_0 fitted) are used:

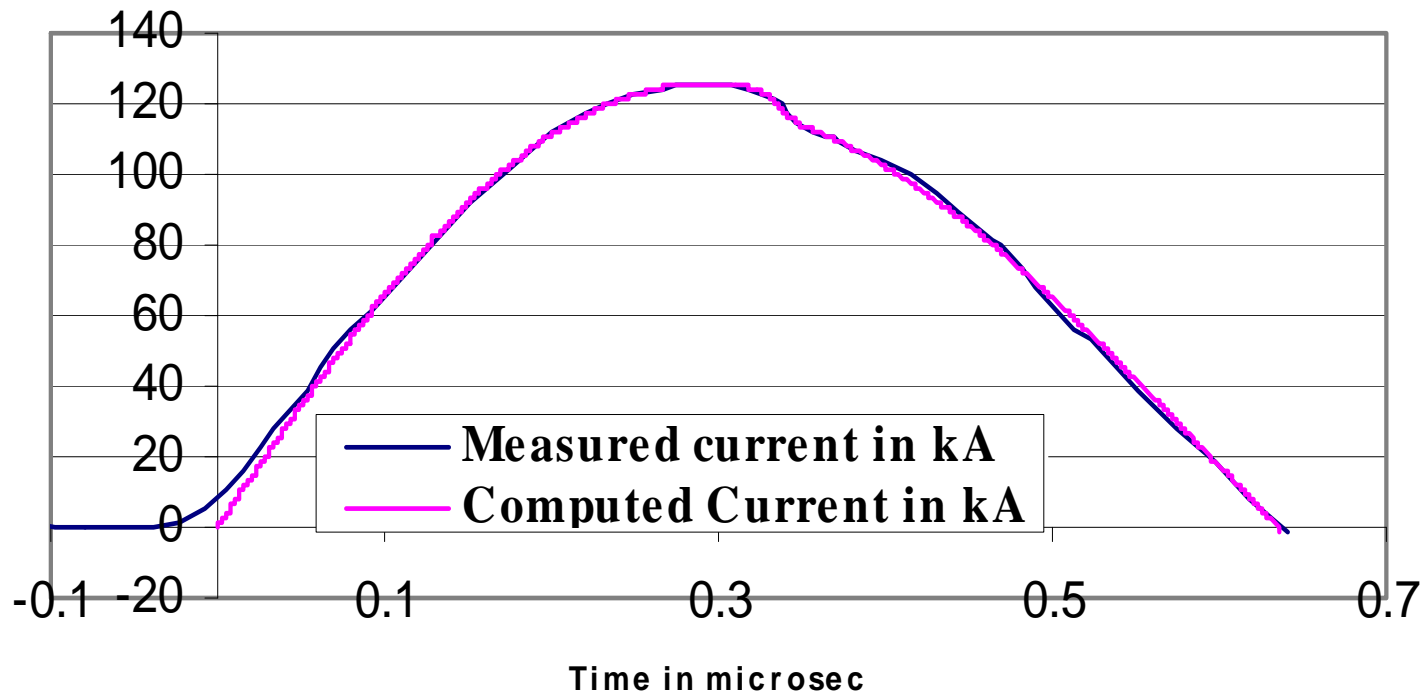


- Bank parameters: $L_0=40$ nH (38), $C_0=0.95$ (0.88) μ F,
 $r_0=10$ m Ω
- Tube parameters: $b=1.55$ cm, $a=0.6$ cm,
 $z_0=1.7$ (2.8) cm,
- Operating parameters: $V_0=28$ kV, $P_0= 6.6$ Torr D2
- fitted model parameters:
 - $f_m=0.08$, $f_c=0.7$, $f_{mr}=0.11$ & $f_{cr}=0.7$.

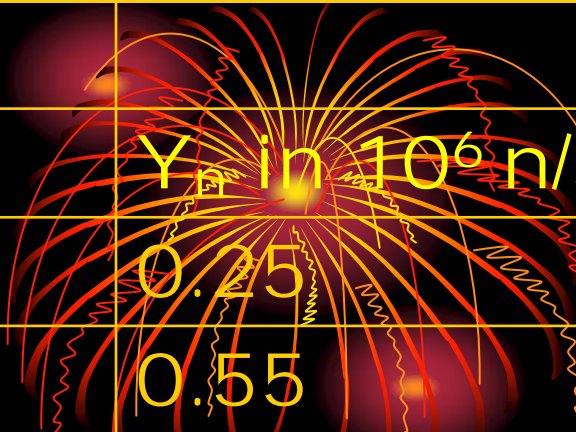
Fit the Computed Current Trace to the Measured Current Trace



Measured vs Computed Itotal

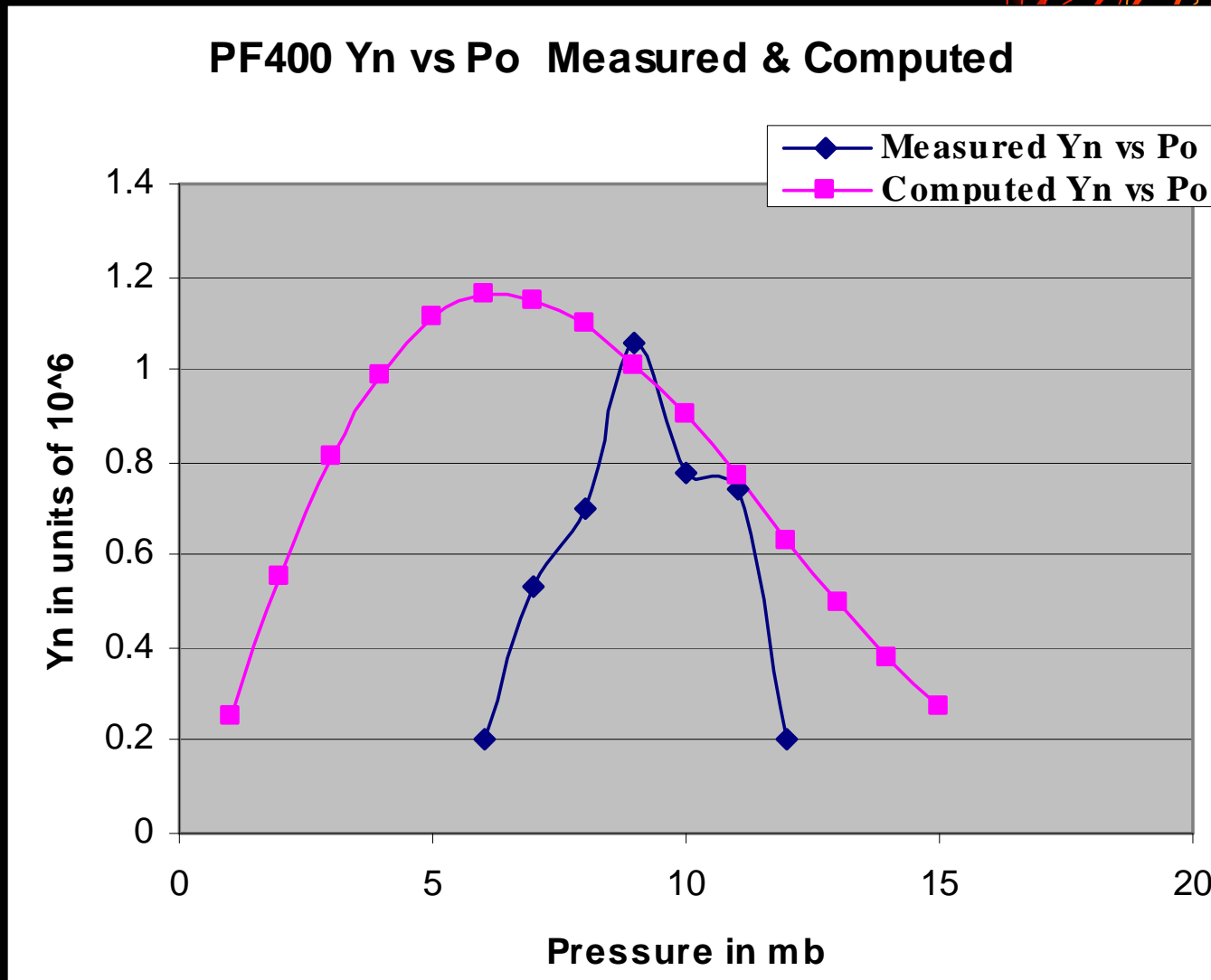


Run PF400 at various Pressures to compute Y_n



Y_n vs P_o	
P_o in mb	Y_n in 10^6 n/s
1	0.25
2	0.55
3	0.81
4	0.99
5	1.11
6	1.16
7	1.15
8	1.1
9	1.01
10	0.9
11	0.77

Plot computed vs measured Y_n as function of pressure



Notes on the comparison



- The computed Y_n versus P_0 curve agrees reasonably with the published curve.
- Remarkable: the same model code (version RADPF05.13.9b) also shows reasonable agreement in Y_n when compared with the published results of the PF1000
- noting that the PF400 is a small plasma focus of 400 J whilst the PF1000 is one of the biggest PF in the world at 1 MJ.

Conclusion



- The Lee model code is used to compute the Y_n vs P_0 curve of the Chilean PF400.
- The computed results agree reasonably well with the published curve in optimum Y_n as well as the optimum P_0 .
- The computed Y_n vs P_0 profile also shows the drop-off of yield on both sides of optimum Y_n that is seen in the measured Y_n vs P_0 curve.



Thank you

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