

# JIOSS 2018

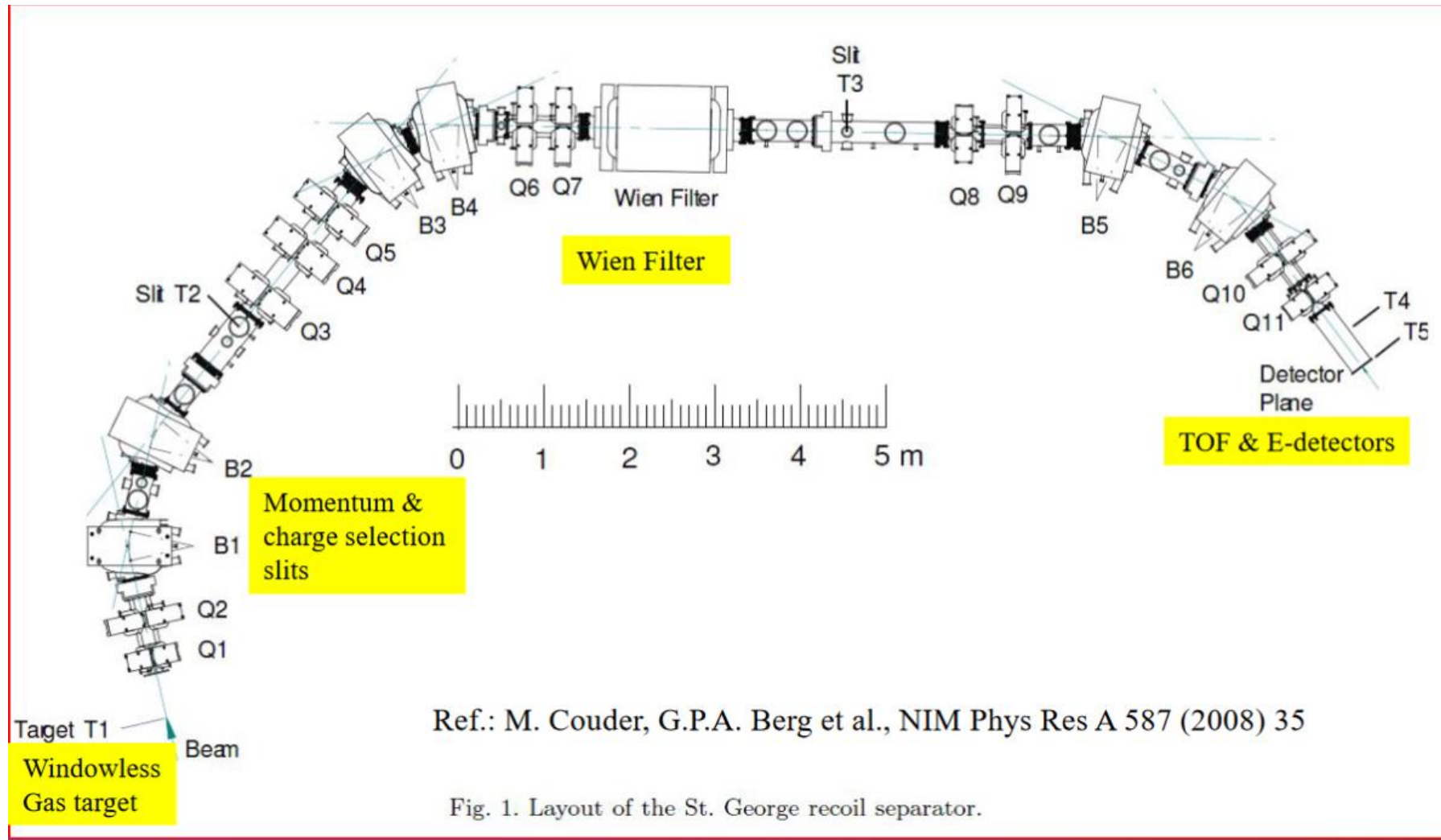
## BAM GROUP

Ben Loseth

Alec Hamaker

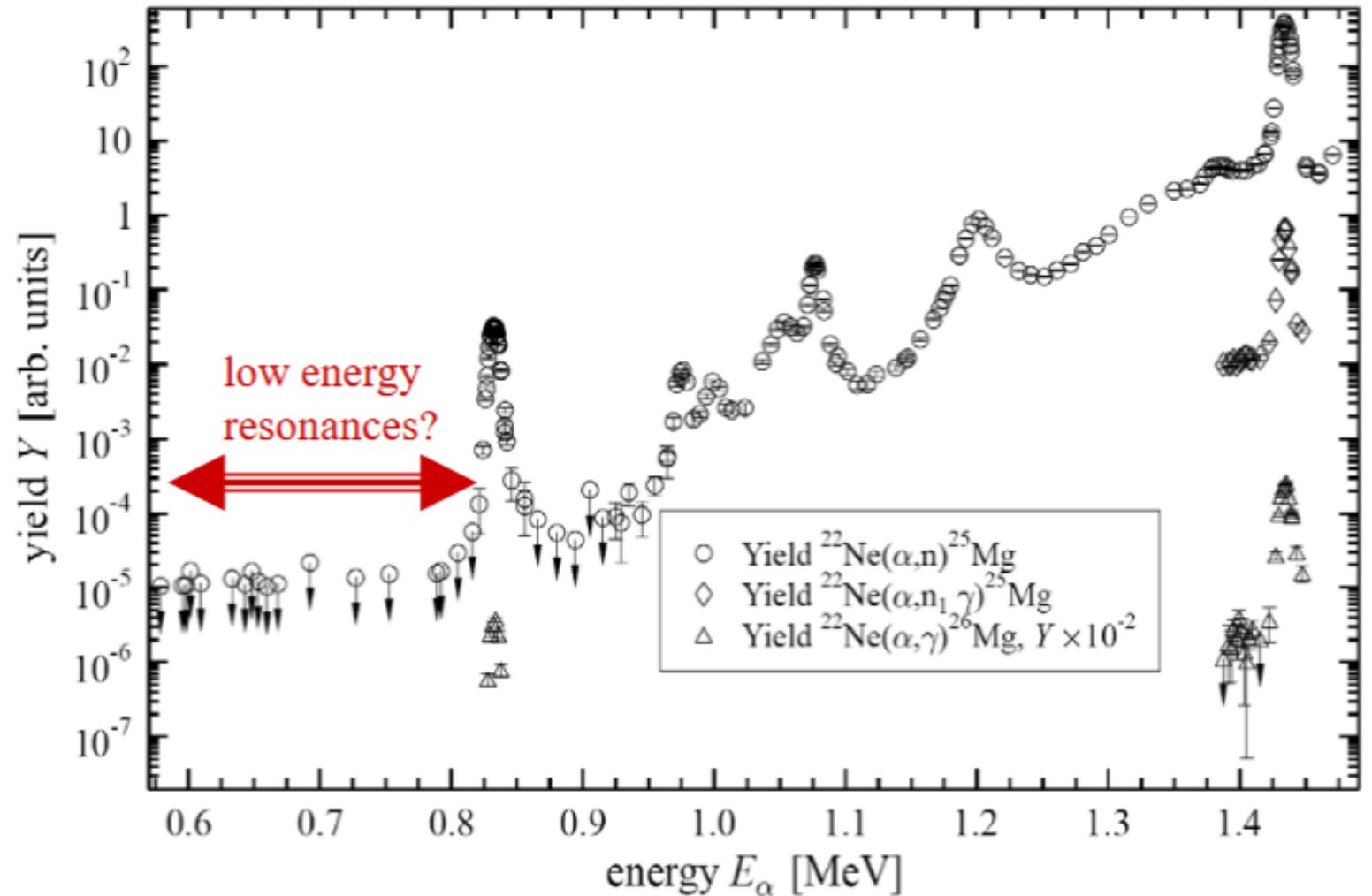
Matthew Redshaw

# St. George

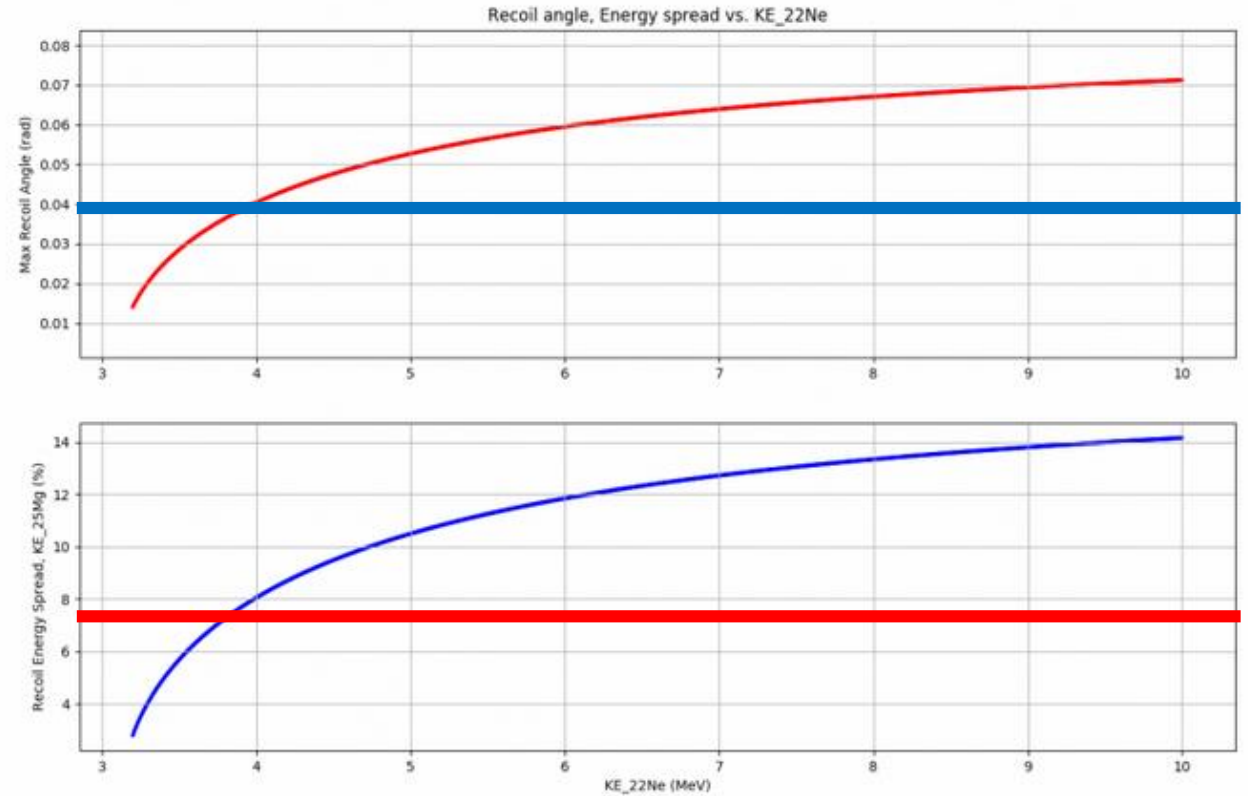
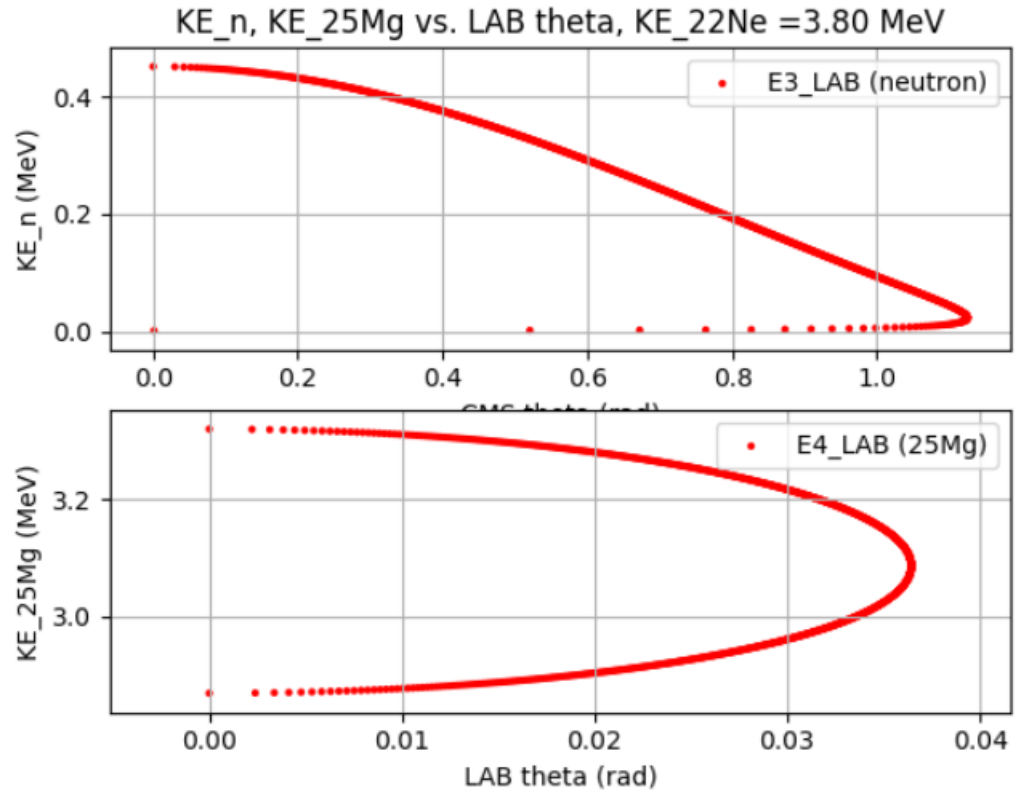


# $^{22}\text{Ne}(\alpha, n)^{25}\text{Mg}$

- Key neutron source in astrophysical s-process
- Low energy resonances are difficult to measure due to low cross sections



# Kinematics Calculations

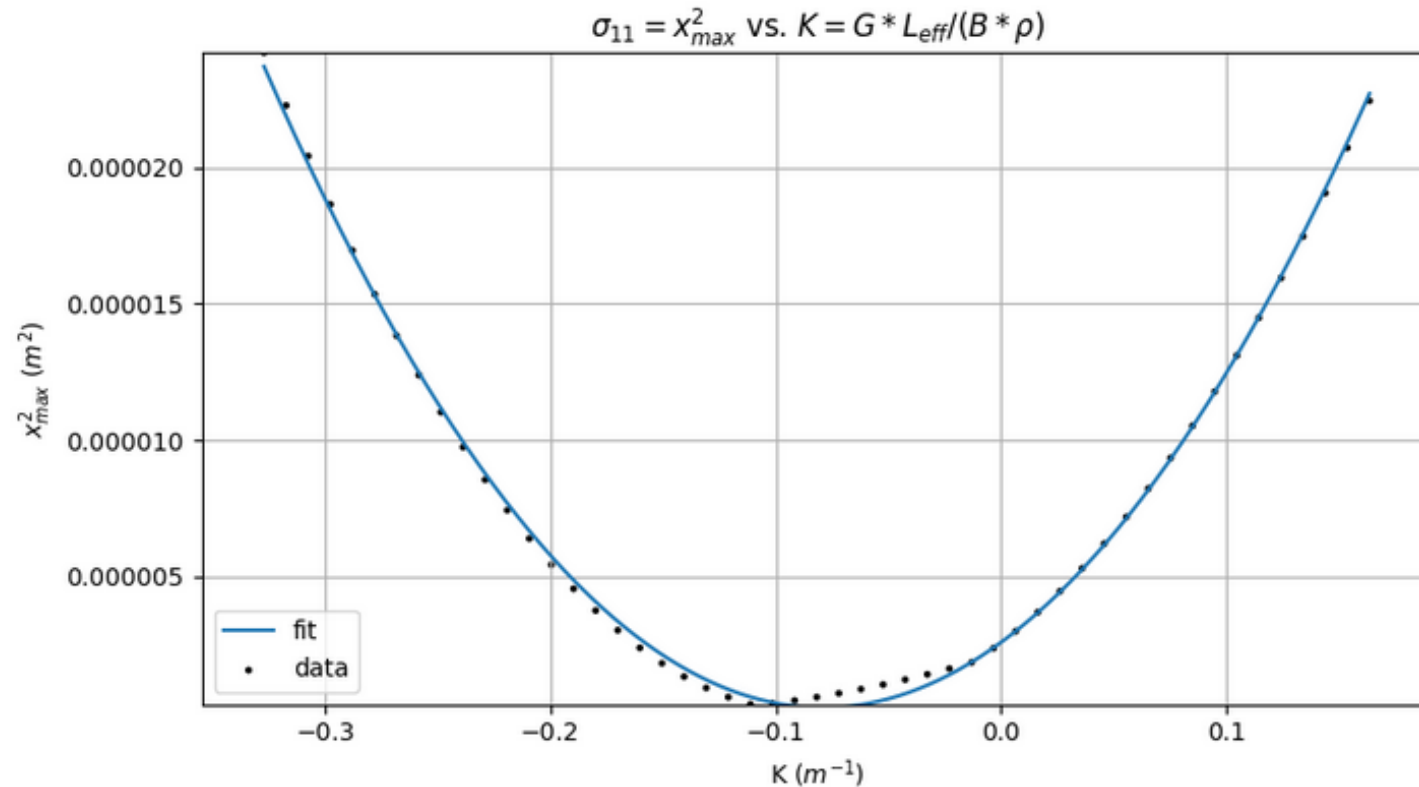


# Emittance Calculation

$$\sigma_{11} = \frac{P_1}{L^2}$$

$$\sigma_{12} = \frac{1}{L^2} \left( \frac{P_2}{2} - L\sigma_{11} \right)$$

$$\sigma_{22} = \frac{1}{L^2} (P_3 - \sigma_{11} - 2L\sigma_{12})$$



Model:  $P_1 * x^2 + P_2 * x + P_3$

$P_1 = 3.82e-04 \pm 2.03e-06 \text{ m}^2$

$P_2 = 6.05e-05 \pm 4.22e-07 \text{ m}^2$

$P_3 = 2.59e-06 \pm 5.20e-08 \text{ m}^2$

$\epsilon$  - RAYS = 0.2 mm\*mrad

$\epsilon$  - FIT = 0.23 mm\*mrad

# Problem 8

Value Changed	Amount of change to decrease mass resolution by 5%
Beam position	Change x-position by 0.5 mm
Beam size	Increase X variable by .1 mm
Q3 length	Increase length by 2 mm
Shift in Q3 position	Shift by .5 mm in x Shift by 5 mm in y
Shift in Q3 pitch	.05°
Shift in Q3 roll	.15°
Shift in Q3 yaw	2.3°

```
{#####}  
{##### RECOIL_LINE PROCE #####}  
{#####}  
{ACTUAL RECOIL SEPARATOR DESCRIPTION}
```

```
PROCEDURE RECOIL_LINE;
```

```
FR FRINGEFIELD;
```

```
{ shift the beam alignment axis - parameterize! }
```

```
SA X_CEN*PARA(3) Y_CEN;
```



You can use the one remaining variable to parameterize the ‘knob’ you want to turn

## COSY beam manual SECTION 5.2 – MAPS WITH KNOBS

# 1<sup>ST</sup> ORDER TERMS OF MAP – WITH NEW PARAMETER

map (1)



I	COEFFICIENT	ORDER	EXPONENTS																	
1	-.1872347881706920E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1.877757398983927	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	-.1049505486834457E-01	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0.1046086373218358E-01	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
5	-.5230380743704411	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
6	0.5125771435662508	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
7	-.1877757398983249E-02	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

THIS IS THE FIRST 'ROW' OF THE MAP, IE. X|X, X|A, ETC

Command: ME(1,7) – first order

MEP(1,7) – full expansion



map (1)	I	COEFFICIENT	ORDER	EXPONENTS
1	-	1.872347881706920E-02	0	0 0 0 0 0 0 0 0
2	1.	877757398983927	1	1 0 0 0 0 0 0 0
3	-	1.049505486834457E-01	1	0 1 0 0 0 0 0 0
4	0.	1046086373218358E-01	1	0 0 0 0 0 1 0 0
5	-	5230380743704411	1	0 0 0 0 0 0 1 0
6	0.	5125771435662508	1	0 0 0 0 0 0 0 1
7	-	1.877757398983249E-02	1	0 0 0 0 0 0 0 1
8	-	5.4402242228536041	2	2 0 0 0 0 0 0 0
9	-	8.874645534563387	2	1 1 0 0 0 0 0 0
10	-	2.383286469240236	2	0 2 0 0 0 0 0 0
11	124.	4047842257572	2	0 0 2 0 0 0 0 0
12	24.	79329351984255	2	0 0 1 1 0 0 0 0
13	-	1.266711749515370	2	0 0 0 2 0 0 0 0
14	-	6987342554204905	2	1 0 0 0 0 1 0 0
15	0.	8438301298813808	2	0 1 0 0 0 1 0 0
16	-	7791601746220626	2	1 0 0 0 0 0 1 0
17	1.	152561721565428	2	0 1 0 0 0 0 1 0
18	1.	478095759886789	2	1 0 0 0 0 0 0 1
19	-	1.985677746371350	2	0 1 0 0 0 0 0 1
20	0.	1088044845707253E-01	2	1 0 0 0 0 0 0 1
21	0.	8874645534564152E-02	2	0 1 0 0 0 0 0 1
22	0.	1503652527231618	2	0 0 0 0 0 2 0 0
23	0.	8396625410881839	2	0 0 0 0 0 1 1 0
24	0.	6844836856998975	2	0 0 0 0 0 2 0 0
25	-	1.150852121113378	2	0 0 0 0 0 1 0 1
26	-	1.685590036797115	2	0 0 0 0 0 0 1 0
27	1.	161930745467778	2	0 0 0 0 0 0 0 2
28	0.	6987342554196995E-03	2	0 0 0 0 0 1 0 0
29	0.	7791601746212066E-03	2	0 0 0 0 0 0 1 0
30	-	1.478095759886545E-02	2	0 0 0 0 0 0 0 1
31	-	5.4402242227482955E-05	2	0 0 0 0 0 0 0 2
32	30.	59401653958650	3	3 0 0 0 0 0 0 0
33	24.	28682190775137	3	2 1 0 0 0 0 0 0
34	-	46.77028046149081	3	1 2 0 0 0 0 0 0
35	-	39.83294305274318	3	0 3 0 0 0 0 0 0
36	1748.	008703550093	3	1 0 2 0 0 0 0 0
37	4453.	384644558641	3	0 1 2 0 0 0 0 0
38	-	171.6457483203178	3	1 0 1 1 0 0 0 0
39	-	556.2198123352076	3	0 1 1 1 0 0 0 0
40	38.	83790854169925	3	1 0 0 2 0 0 0 0
41	29.	26498897666480	3	0 1 0 2 0 0 0 0
42	-	13.14485505834837	3	2 0 0 0 0 1 0 0
43	-	5.459391301259312	3	1 1 0 0 0 1 0 0
44	8.	324578281800699	3	0 2 0 0 0 1 0 0
45	1278.	417272325712	3	0 0 2 0 0 1 0 0
46	-	325.9666872822384	3	0 0 1 1 0 1 0 0
47	-	17.42768212456246	3	0 0 0 2 0 1 0 0
48	-	12.40686679428707	3	2 0 0 0 0 0 1 0
49	-	4.053217856664109	3	1 1 0 0 0 0 1 0
50	8.	426378157181880	3	0 2 0 0 0 0 1 0
51	1247.	019558761220	3	0 0 2 0 0 0 1 0
52	-	327.9633565636537	3	0 0 1 1 0 0 1 0
53	-	17.33301956786568	3	0 0 0 2 0 0 1 0
54	25.	35016688804086	3	2 0 0 0 0 0 0 1

700+ TERMS IN FIRST ROW  
ONLY TO 5<sup>TH</sup> ORDER!



BEAM AXIS OFFSET PARAMETER IS  
THE 9<sup>TH</sup> VARIABLE – MAP CONTAINS  
EXACT BEHAVIOR OF THIS PARAMETER  
TO 5<sup>TH</sup> ORDER

697	1/8.1693330600162	5	0 0 0 0 0 2 3 0 0
698	85.59486752995038	5	0 0 0 0 0 1 4 0 0
699	14.96912811180452	5	0 0 0 0 0 0 5 0 0
700	-194.0432194696581	5	0 0 0 0 0 4 0 1 0
701	-745.9363619216208	5	0 0 0 0 0 3 1 1 0
702	-1087.147718344976	5	0 0 0 0 0 2 2 1 0
703	-709.1004097012213	5	0 0 0 0 0 1 3 1 0
704	-168.7689917748073	5	0 0 0 0 0 0 4 1 0
705	759.9464440344781	5	0 0 0 0 0 3 0 2 0
706	2194.871618106822	5	0 0 0 0 0 2 1 2 0
707	2150.516835128320	5	0 0 0 0 0 1 2 2 0
708	704.2876125448227	5	0 0 0 0 0 0 3 2 0
709	-1475.773523554040	5	0 0 0 0 0 2 0 3 0
710	-2867.328518886878	5	0 0 0 0 0 1 1 3 0
711	-1419.834744927795	5	0 0 0 0 0 0 2 3 0
712	1429.598420243209	5	0 0 0 0 0 1 0 4 0
713	1408.198807414961	5	0 0 0 0 0 0 1 4 0
714	-555.2218535031629	5	0 0 0 0 0 0 0 5 0
715	0.1667744191985188E-01	5	0 0 0 0 0 4 0 0 1
716	0.1638888938109926	5	0 0 0 0 0 3 1 0 1
717	0.2682288132242548	5	0 0 0 0 0 2 2 0 1
718	0.1300006292871064	5	0 0 0 0 0 1 3 0 1
719	-5804144566087702E-02	5	0 0 0 0 0 0 4 0 1
720	-3518812229738481	5	0 0 0 0 0 3 0 1 1
721	-1.317982225410263	5	0 0 0 0 0 2 1 1 1
722	-1.231167514985418	5	0 0 0 0 0 1 2 1 1
723	-2445781074175534	5	0 0 0 0 0 0 3 1 1
724	1.466836823209949	5	0 0 0 0 0 2 0 2 1
725	3.050505802578581	5	0 0 0 0 0 1 1 2 1
726	1.292755663842724	5	0 0 0 0 0 0 2 2 1
727	-2.286924688874939	5	0 0 0 0 0 1 0 3 1
728	-2.189865887694161	5	0 0 0 0 0 0 1 3 1
729	1.239307631713371	5	0 0 0 0 0 0 0 4 1
730	-1.280076450856367E-03	5	0 0 0 0 0 3 0 0 2
731	-1.1785078379126259E-03	5	0 0 0 0 0 2 1 0 2
732	-2.068407645037738E-03	5	0 0 0 0 0 1 2 0 2
733	-1.593451268945805E-03	5	0 0 0 0 0 0 3 0 2
734	0.3293411528871123E-03	5	0 0 0 0 0 2 0 1 2
735	0.3262849389575504E-03	5	0 0 0 0 0 1 1 1 2
736	0.4441375491376023E-03	5	0 0 0 0 0 0 2 1 2
737	-5411510321690852E-04	5	0 0 0 0 0 1 0 2 2
738	-1.607018406507461E-03	5	0 0 0 0 0 0 1 2 2
739	-2.123825277161838E-03	5	0 0 0 0 0 0 0 3 2
740	-4426225477296242E-06	5	0 0 0 0 0 2 0 0 3
741	-5883773554047693E-06	5	0 0 0 0 0 1 1 0 3
742	-5300418746908254E-06	5	0 0 0 0 0 0 2 0 3
743	0.1154291721619793E-05	5	0 0 0 0 0 1 0 1 3
744	0.1331577979793430E-05	5	0 0 0 0 0 0 1 1 3
745	-8574398483214640E-06	5	0 0 0 0 0 0 0 2 3
746	-3381367532481148E-09	5	0 0 0 0 0 1 0 0 4
747	-3570654956550669E-09	5	0 0 0 0 0 0 1 0 4
748	0.5890361081546728E-09	5	0 0 0 0 0 0 0 1 4
749	-5931103736982083E-11	5	0 0 0 0 0 0 0 0 5

MEP(1,7)

I	COEFFICIENT	ORDER	EXPONENTS
1	-.1872347881706920E-02	0	0 0 0 0 0 0 0 0
2	-.5230380743704411	1	0 0 0 0 0 0 1 0
3	0.5125771435662508	1	0 0 0 0 0 0 0 1
4	-.1877757398983249E-02	1	0 0 0 0 0 0 0 0 1
5	0.6844836856998975	2	0 0 0 0 0 0 2 0 0
6	-1.685590036797115	2	0 0 0 0 0 0 1 1 0
7	1.161930745467778	2	0 0 0 0 0 0 0 2 0
8	0.7791601746212066E-03	2	0 0 0 0 0 0 1 0 1
9	-.1478095759886545E-02	2	0 0 0 0 0 0 0 1 1
10	-.5440224227482955E-05	2	0 0 0 0 0 0 0 0 2
11	-1.598763381562326	3	0 0 0 0 0 0 3 0 0
12	6.651436763825274	3	0 0 0 0 0 0 2 1 0
13	-10.40912352867306	3	0 0 0 0 0 0 1 2 0
14	5.938116011023325	3	0 0 0 0 0 0 0 3 0
15	-.1554984743631056E-01	3	0 0 0 0 0 0 2 0 1
16	0.6000021728558023E-01	3	0 0 0 0 0 0 1 1 1
17	-.5866804872420065E-01	3	0 0 0 0 0 0 0 2 1
18	-.1240686679441308E-04	3	0 0 0 0 0 0 1 0 2
19	0.2535016688813320E-04	3	0 0 0 0 0 0 0 1 2
20	-.3059401547847012E-07	3	0 0 0 0 0 0 0 0 3
21	2.133813098932974	4	0 0 0 0 0 0 4 0 0
22	-6.544478178763569	4	0 0 0 0 0 0 3 1 0
23	0.4206931917472900	4	0 0 0 0 0 0 2 2 0
24	16.63762941979972	4	0 0 0 0 0 0 1 3 0
25	-14.43951359321497	4	0 0 0 0 0 0 0 4 0
26	0.4645145241133607E-01	4	0 0 0 0 0 0 3 0 1
27	-.2111934709943288	4	0 0 0 0 0 0 2 1 1
28	0.3217751259810674	4	0 0 0 0 0 0 1 2 1
29	-.1681845205193759	4	0 0 0 0 0 0 0 3 1
30	0.1232001809794727E-03	4	0 0 0 0 0 0 2 0 2

```
#####  
##### RECOIL_LINE PROCEDURE #####  
#####  
{ACTUAL RECOIL SEPARATOR DESCRIPTION}  
  
PROCEDURE RECOIL_LINE;  
  
FR FRINGEFIELD;  
  
{ shift the beam alignment axis - parameterize! }  
  
SA X_CEN*(1+PARA(3)/4) Y_CEN;
```