
Analysis Memo

16-Nov-2012

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ビームライン上の物質質量 @commissioning

SF7		scintillator	3 mm
STQ25出口窓		kapton	125 um
空気(合計)		空気	307 mm
ICB	gas foil	kapton	30 um x 2
	gas	P10	511 mm
	electrode	Al-Mylar	12 um x 21
SF13A	遮光膜	黒シート(実測)	12.36 mg/cm ² x 2
	遮光膜	Al-Mylar	12 um x 4
		scintillator	1 mm
SF13B	遮光膜	黒シート(実測)	12.36 mg/cm ² x 2
	遮光膜	Al-Mylar	12 um x 4
		scintillator	1 mm
入射窓		kapton	80um x 1
BDC1	gas foil	kapton	80um x 2
	gas	100 torr i-C4H10	90mm
	gas foil	aramid	4um x 2
	electrode	Al-kapton	8um x 9
BDC2	gas foil	kapton	80um x 2
	gas	100 torr i-C4H10	90mm
	gas foil	aramid	4um x 2
	electrode	Al-kapton	8um x 9
taget			
FDC1	Gas foil	kapton	80 um x 2
		aramid	4 um x 2
	electrode	Al-kapton	8 um x 15
	gas	50 torr, i-C4H10	336 mm

* 総物質質量 (換算) :

8.24 (5+3.24) mm plastic scintillator

Beam Energy Summary @ BQ-Scan

B_Samurai	Brho"	Brho_F5 [Tm]	beam	Brho_sm [Tm]	T_sm [MeV/u]	run#	memo
2.0 T	3.60	3.6575	10C	3.532	196.03	243	
						244	
						245	fb wide
	3.84	3.8995	11C	3.766	185.21	241	Yt wide
						242	
	4.08	4.1415	12C	4.002	176.42	237	
						238	
	4.32	4.3750	12C	4.249	196.96	239	
						240	
	4.56	4.6140	12C	4.500	218.61	233	
						234	
	4.80	4.8480	12C	4.744	240.40	231	
						232	
	5.28	5.3360	15C	5.205	189.79	226	
						227	
228							
229							
5.52	5.5720	15C	5.451	206.50	229		
					230		
2.5 T	4.64	4.6895	12C	4.579	225.58	315	
						313	
	4.93	4.9740	12C	4.874	252.38	314	fb wide
						311	
	5.25	5.3070	15C	5.175	187.76	312	
						316	again
	5.51	5.5575	15C	5.436	205.46	321	
						322	
	5.80	5.8440	15C	5.733	226.26	323	
						324	
	6.09	6.1300	15C	6.028	247.60	325	
						327	w SX on
6.38	6.4175	16C	6.313	239.54	329	w/o SX	
					328		
6.67	6.7055	17C	6.598	232.55	326		
					327		

3.0 T	5.60	5.6390	10Be	5.561	214.09	199	
						200	
	5.95	5.9870	10Be	5.917	239.45	197	
						198	
	6.30	6.3335	10Be	6.270	265.57	195	
						196	
	6.65	6.6785	11Be	6.610	246.19	201	
						202	
	7.00	7.0265	11Be	6.964	270.17	219	
						220	
	7.35	7.3660	12Be	7.299	251.59	207	
						208	
	7.70	7.7190	12Be	7.657	273.97	209	
						210	
						211	
	7.90	7.9325	14Be	7.855	217.60	214	
						215	
						216	
						217	
						218	

* B₀値、βは無関係

* Beam lineの設定を変えた後、

どの程度の時間で磁場が安定するか？

HV Plateau Search

* BPC, ICB/ICF : run 331 ~ run350

$A/Z=2$, $B_Q=5.133$ Tm (276.7 MeV/u) \rightarrow 5mm scint \rightarrow ~ 271.3 MeV/u ^{12}C

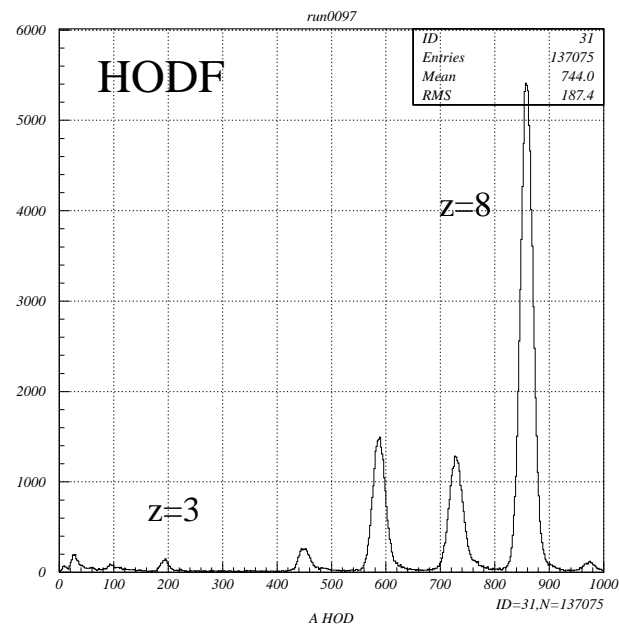
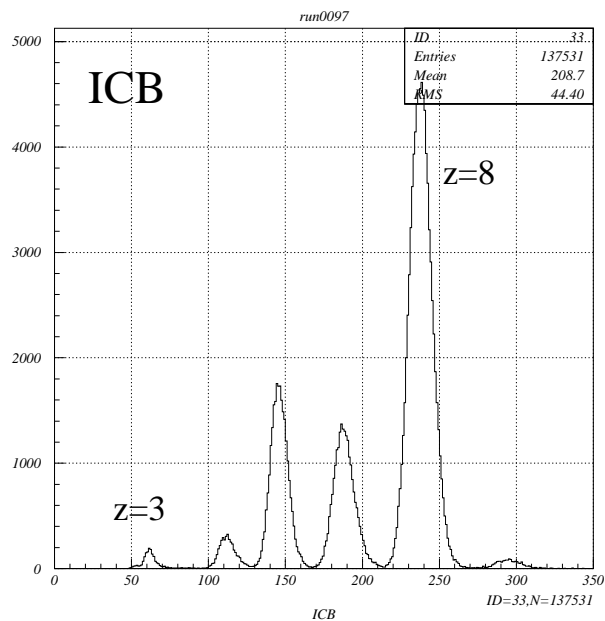
* BDC, FDC1, FDC2 : run095 ~ run115

$A/Z=2$, $B_Q=4.534$ Tm (221.6 MeV/u) \rightarrow 5mm scint \rightarrow ~ 215.4 MeV/u ^{12}C

* BDC, FDC1 : run154 ~ run165

proton, $B_Q=2.160$ Tm (203.0 MeV) \rightarrow 5mm scint \rightarrow ~ 200.8 MeV p

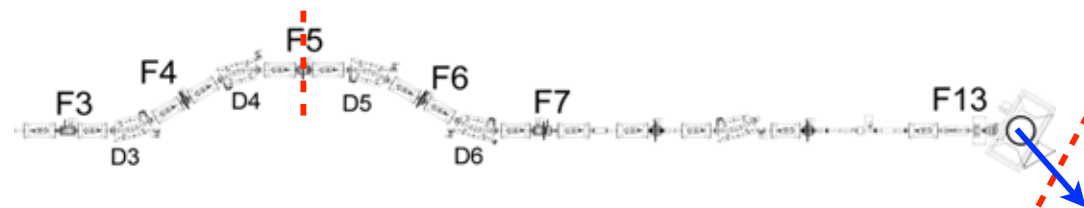
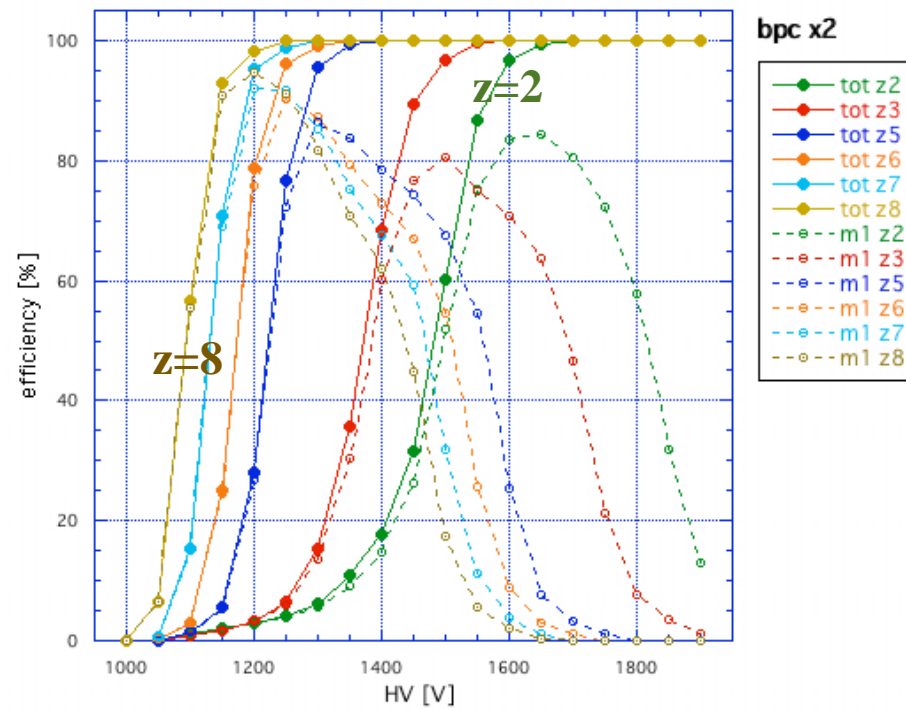
* 解析条件 : -BV



BPC

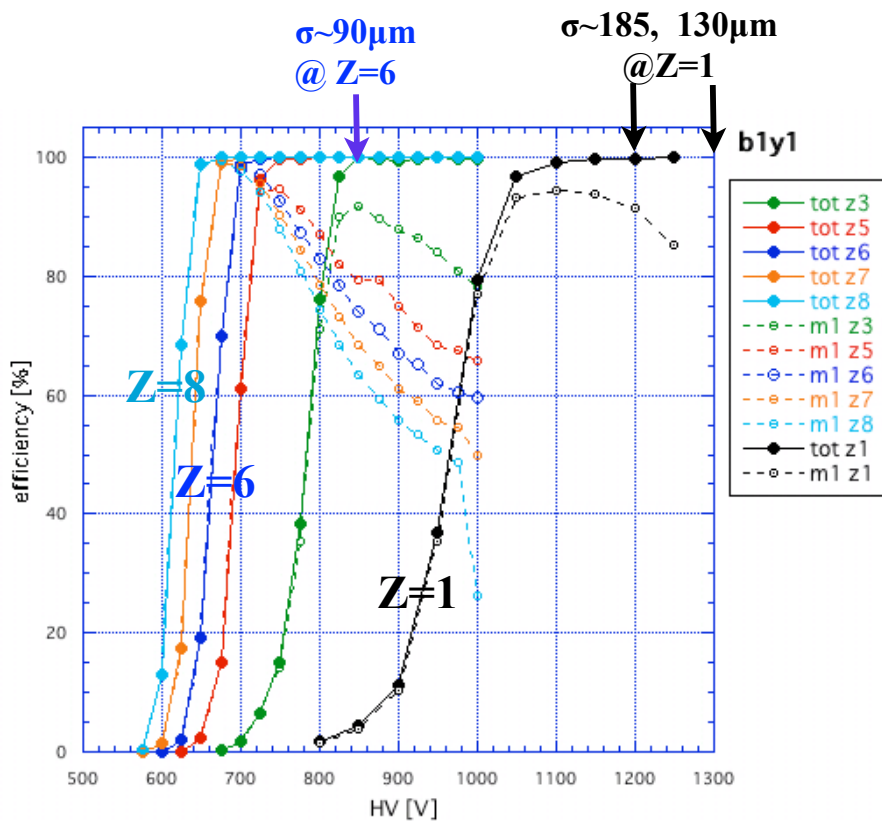
* $A/Z=2$, $B_Q=5.133$ Tm (276.7 MeV/u)

o $Z=2 \sim 8$ @50 torr, 250 MeV/A, $V_{th}=-0.4$ V



BDC1, BDC2

- * $A/Z=2$ ($z=3, 5, 6, 7, 8$), $E \sim 215$ MeV/u ^{12}C
- * proton, $E \sim 201$ MeV
- o $Z=1 \sim 8$ @ 100 torr, ~ 200 MeV/A, $V_{\text{th}} = -0.8\text{V}$



* ^{10}Be ($Z=4$), 214 MeV/u @ run200

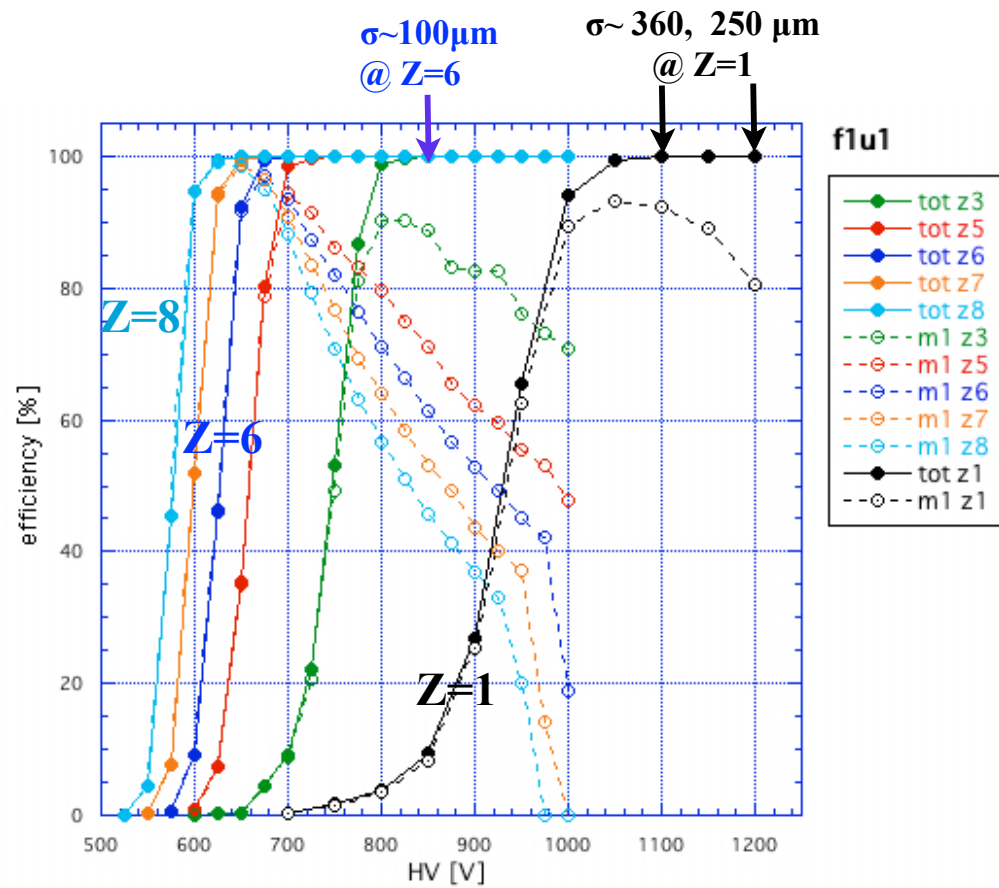
$\sigma_x \sim 178 \mu\text{m}$

FDC1

* $A/Z=2$ ($z=3,5,6,7,8$), $E \sim 215 \text{ MeV/u } ^{12}\text{C}$

* proton, $E \sim 201 \text{ MeV p}$

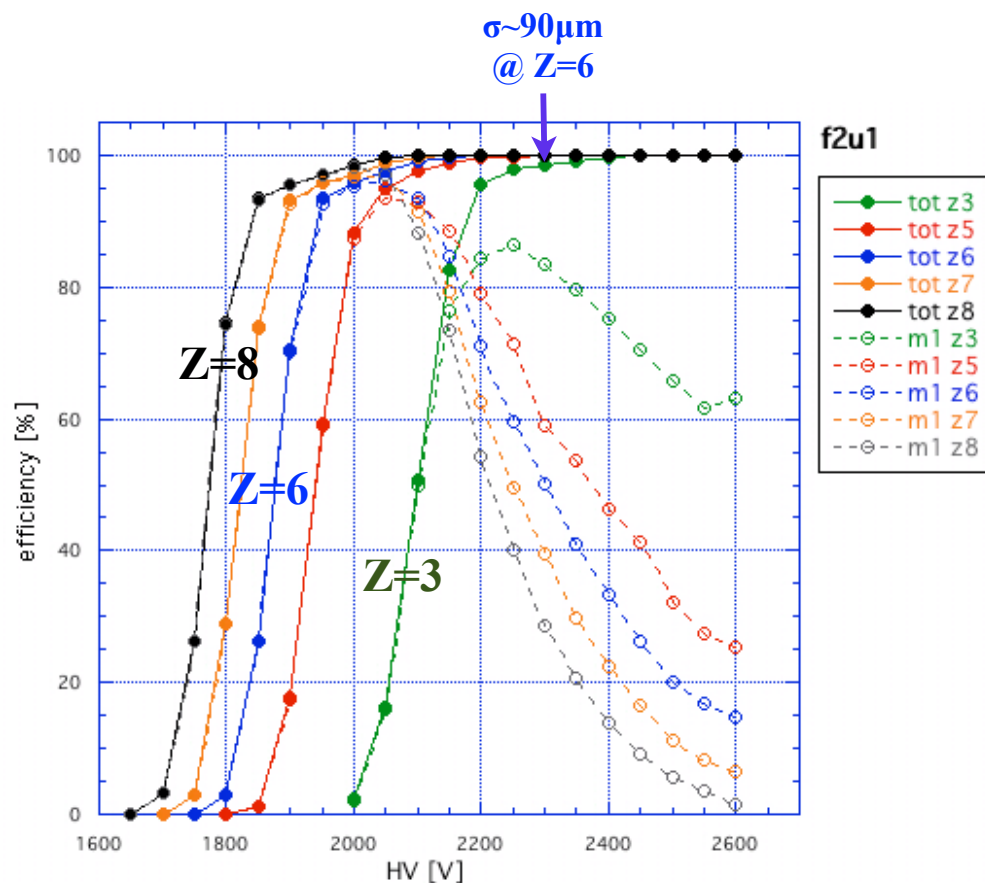
o $Z=1 \sim 8$ @ 50 torr, $E \sim 200 \text{ MeV/u}$, $V_{\text{th}} = -0.4 \text{ V}$



* ^{10}Be ($Z=4$), 214 MeV/u @ run200

$\sigma_x \sim 270 \mu\text{m}$

○ Z= 3 ~ 8 @~210 MeV/A, V_{th}=-0.8V, He+50%C₂H₆



* 面でTDC offsetが異なる?

特にVの4面。理由不明—要調査

offset調整後は1つのcalibrationで可

* ¹⁰Be (Z=4), 214 MeV/u @ run200

$\sigma_{\text{res}} \sim 137 \mu\text{m}$ (x), $82 \mu\text{m}$ (u,v)

$\sigma_x \sim 169 \mu\text{m}$ (x), $116 \mu\text{m}$ (u,v)

何か考慮してない効果あり

* TOF補正： 未

($\Delta E \sim 60 \text{ MeV/u} \rightarrow \Delta T \sim 6 \text{ nsec}$)

* 入射角度依存性

sweep runには無い

BQscanに現れる(?)

cf 4面 : $\sigma_x \sim 1.42 \sigma_{\text{res}}$

6面 : $\sigma_x \sim 1.23 \sigma_{\text{res}}$

Beam Line Detectors - 1

* Time Calibration : 25 ~ 29 psec/ch (sf3, sf13, bv), 53~56 psec/ch (sf7)

* Slew correction :

* (ex) run200, ^{10}Be , 214 MeV/u@sm, $F1(2.31\text{mm}/\%) = \pm 1\text{mm}$

$\Delta p/p = \pm 0.043\%$, i.e, $\sigma_p/p = \pm 0.025\%$

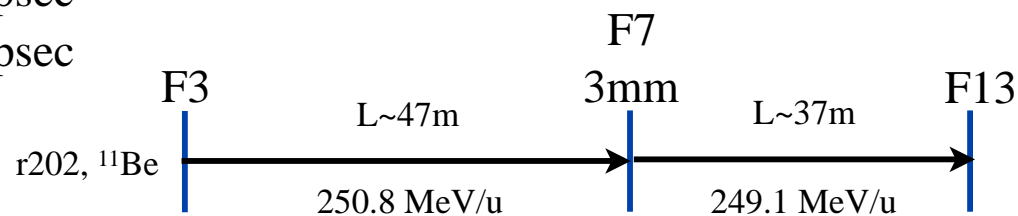
* after / before correction

$\sigma(\text{sf3p-sf13ab}) = 266 \text{ psec} \leftarrow 346 \text{ psec}$

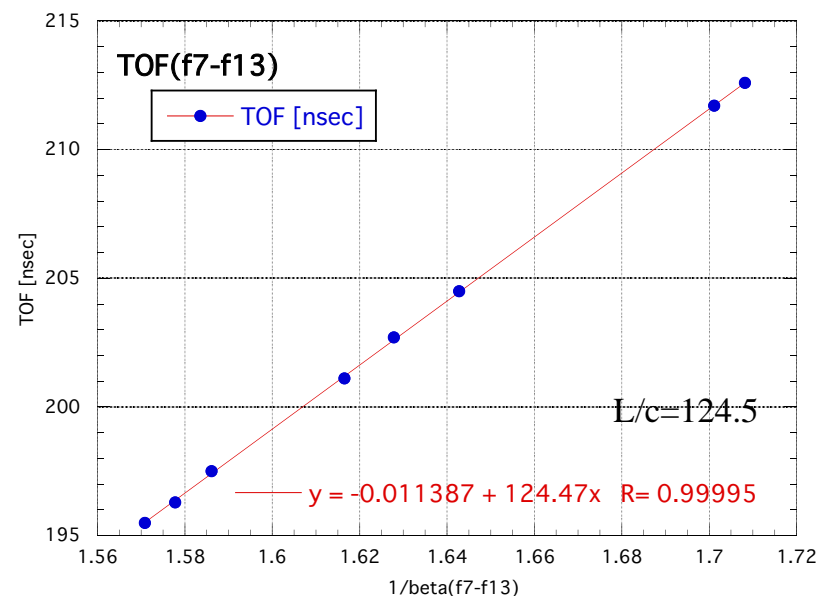
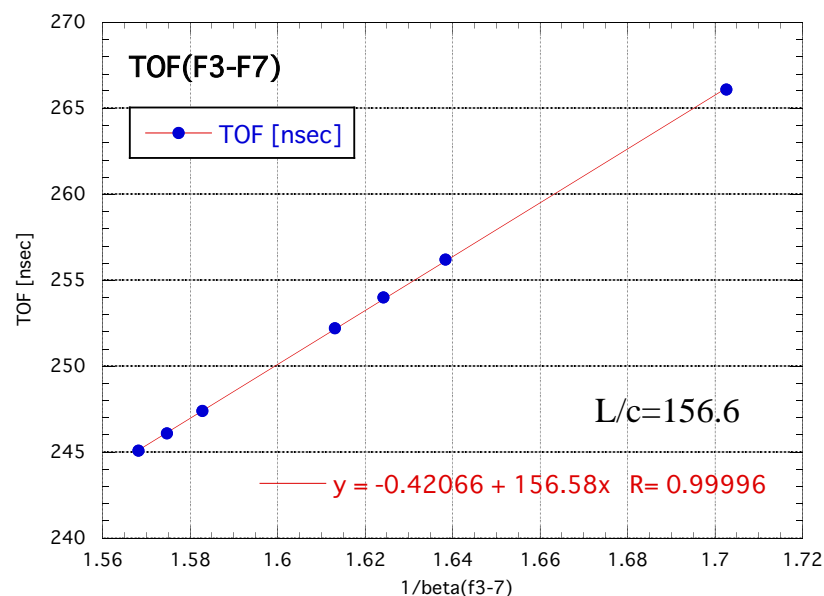
$\sigma(\text{sf7 -sf13ab}) = 160 \text{ psec} \leftarrow 181 \text{ psec}$

$\sigma(\text{sf13a-sf13b}) = 52 \text{ psec} \leftarrow 98 \text{ psec}$

* Flight path, beta(rigidity)



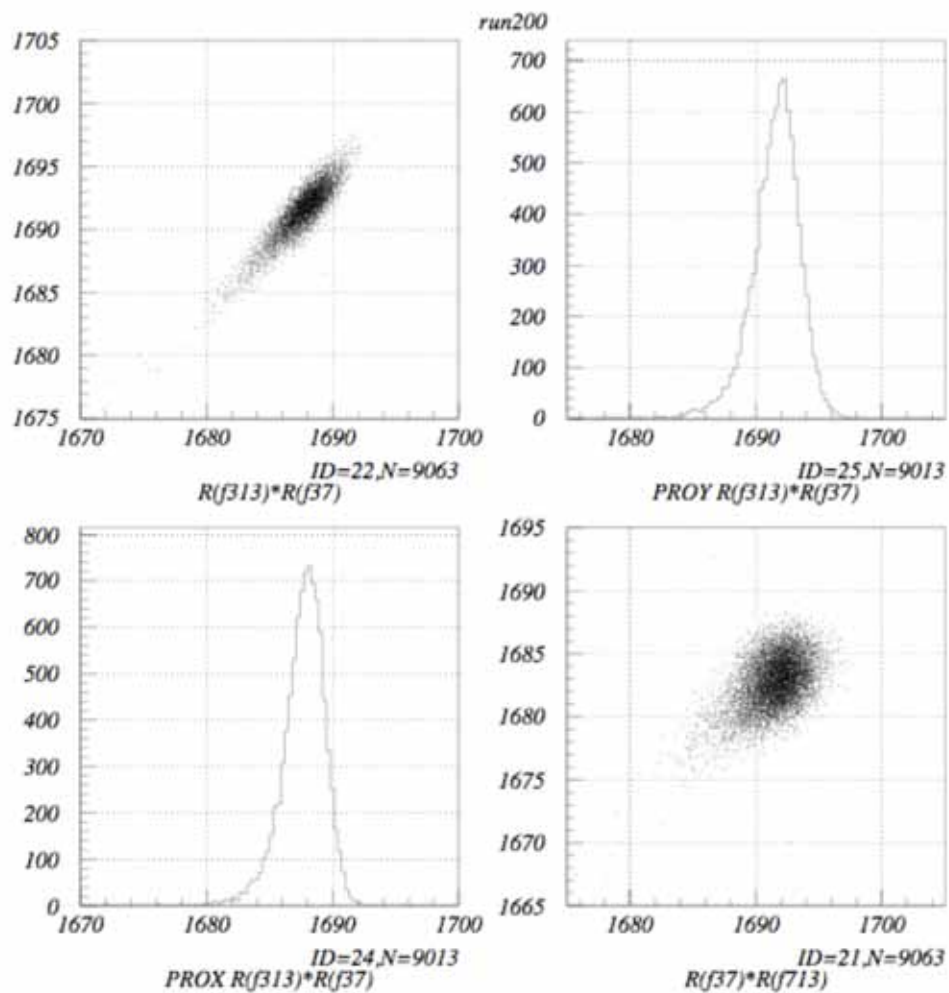
本当の値



Beam Line Detectors - 2

* Rigidity from TOF(f3-f13), TOF(f3-f7)m TOF(f7-f13), for given A/Z

r200 : 214MeV/u ^{10}Be



HODF

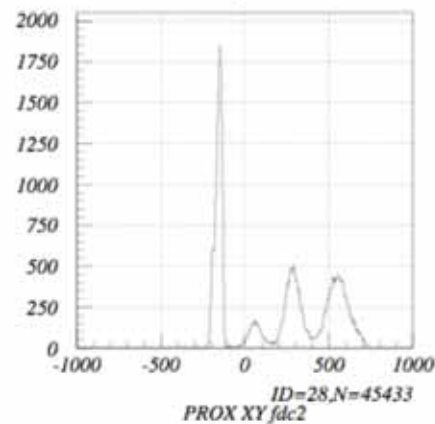
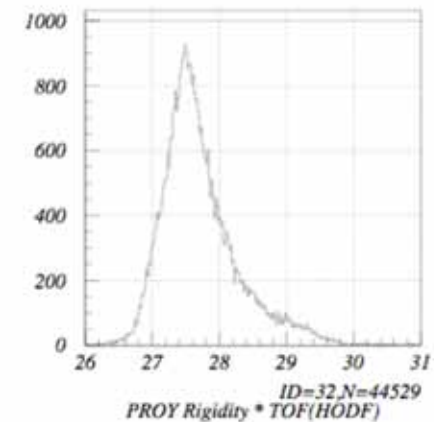
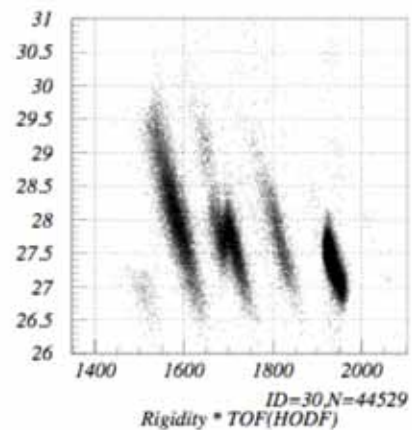
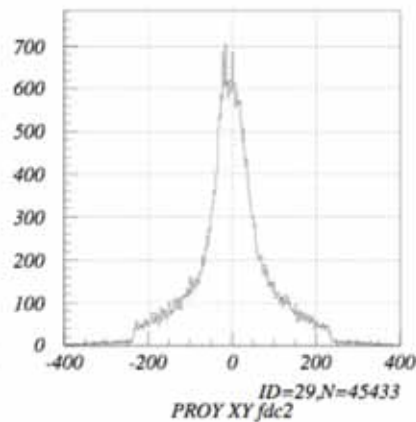
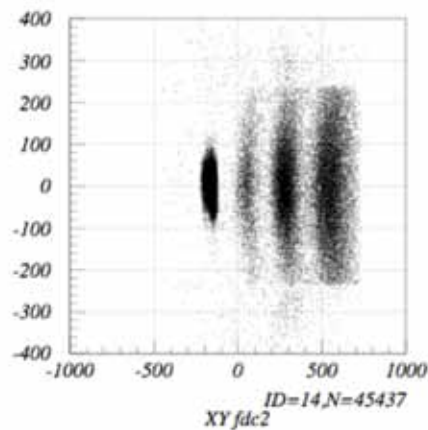
* Time Calibration : ~ 36.4 psec/ch

* Time zero

* Sweep run (r221, ^{10}Be 214MeV/u, 3T \rightarrow 2T)

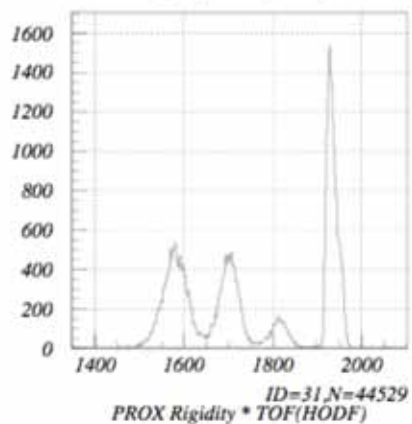
* このtime-zero offsetでr251 ($^{17}\text{C}+\text{C}\rightarrow\text{n}+\text{F}+\text{x}$)を解析する

$\sigma_x(\text{BDC})\sim 210\mu\text{m}$ 、 $\sigma_x(\text{FDC1})\sim 340\mu\text{m}$ 、 $\sigma_x(\text{FDC2})\sim 120\mu\text{m}$



X*Y @FDC2

vertical切れ



Rigidity * TOF(HOD)

HODF-12

HODF - 2

* Sweep run (r221)

FDC2 track → HODF

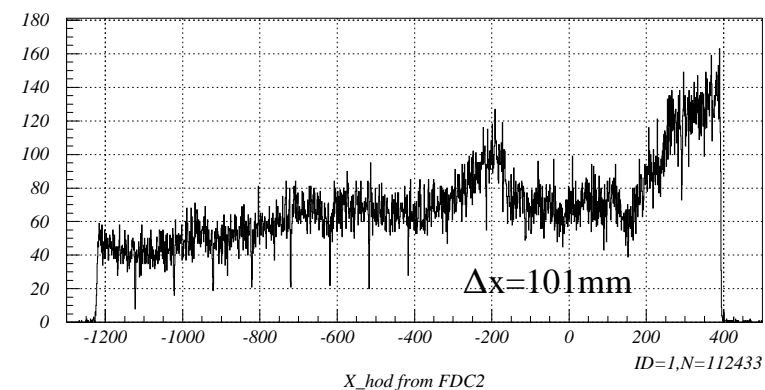
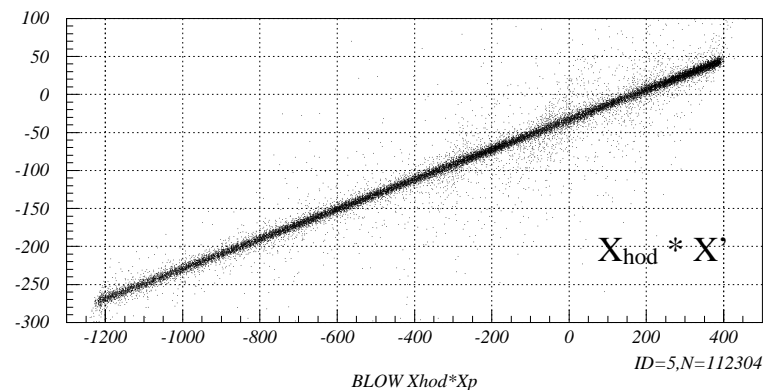
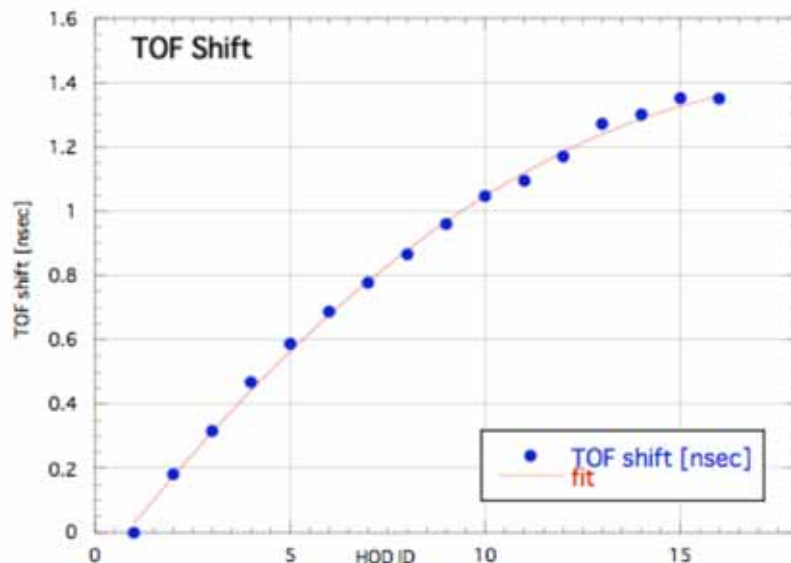
$\sigma_x(\text{BDC}) \sim 170\mu\text{m}$

$\sigma_x(\text{FDC1}) \sim 270\mu\text{m}$

$\sigma_x(\text{FDC2}) \sim 160\mu\text{m}$

* 同時刻 (Time zero)

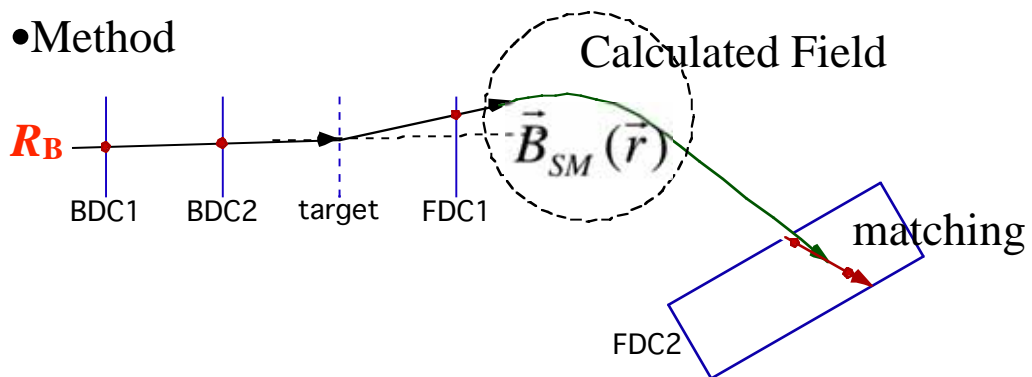
HOD両端の $\pm 10\text{mm}$ を同時刻とみなす



* この補正を加えても2成分構造は同じ

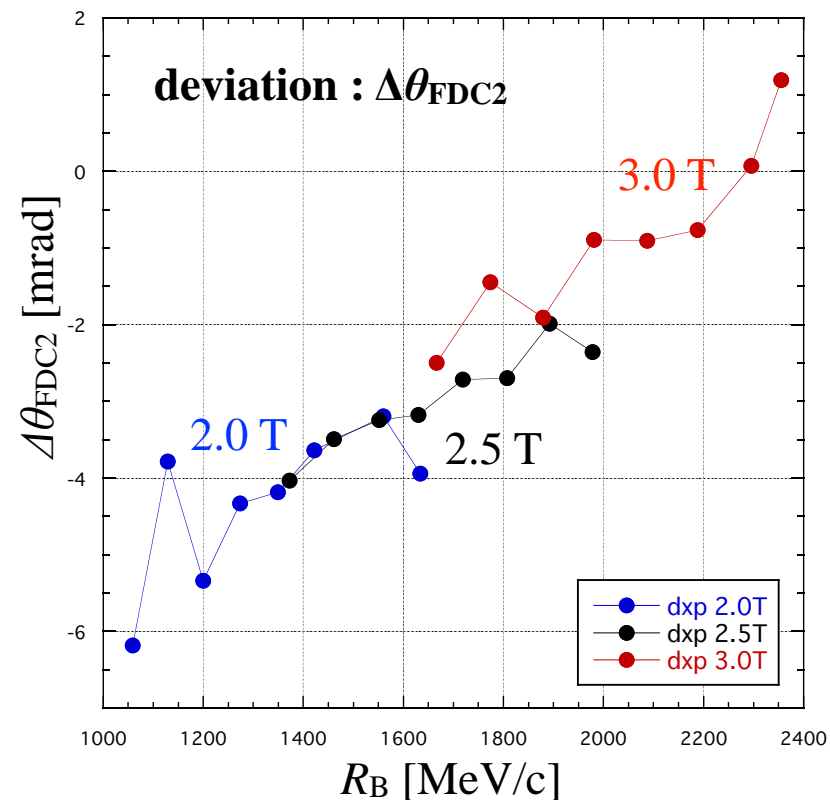
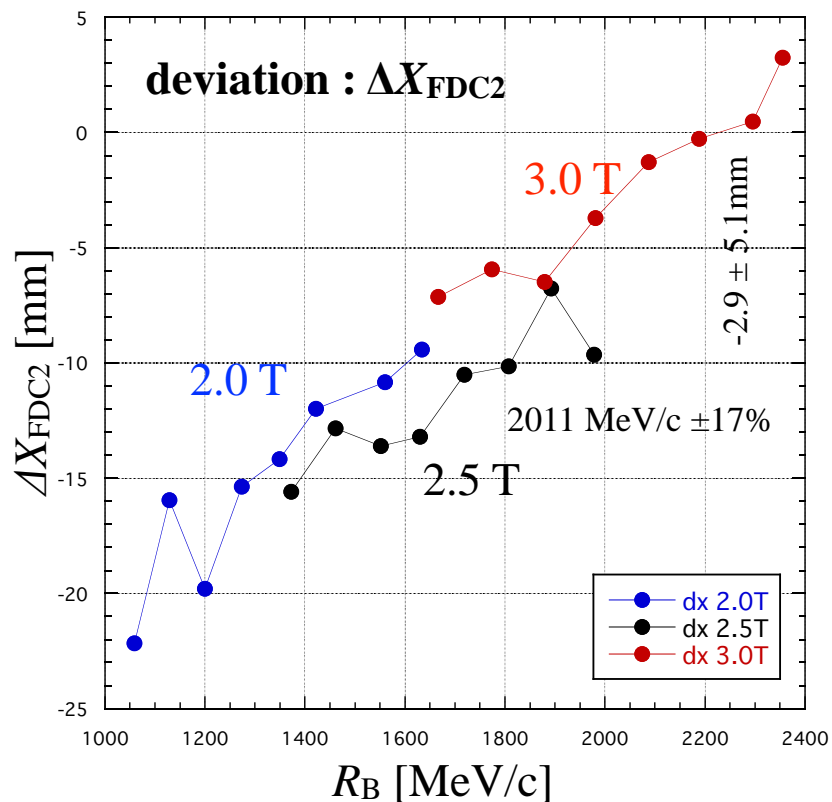
磁場と検出器位置： consistency check

•Method



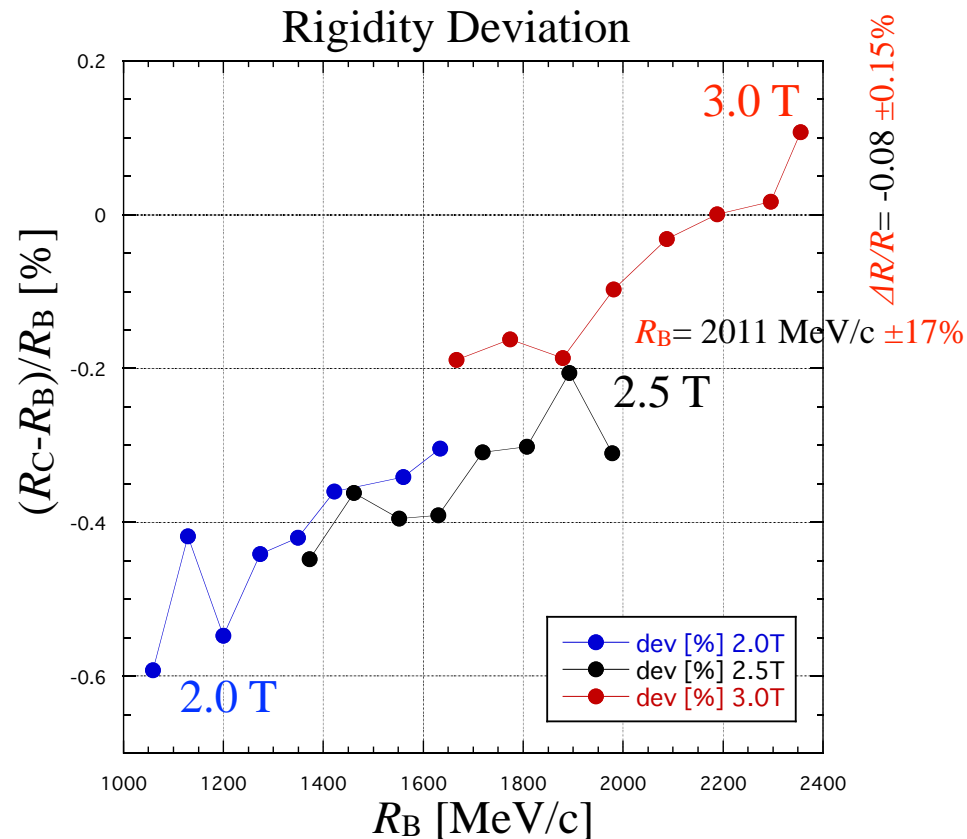
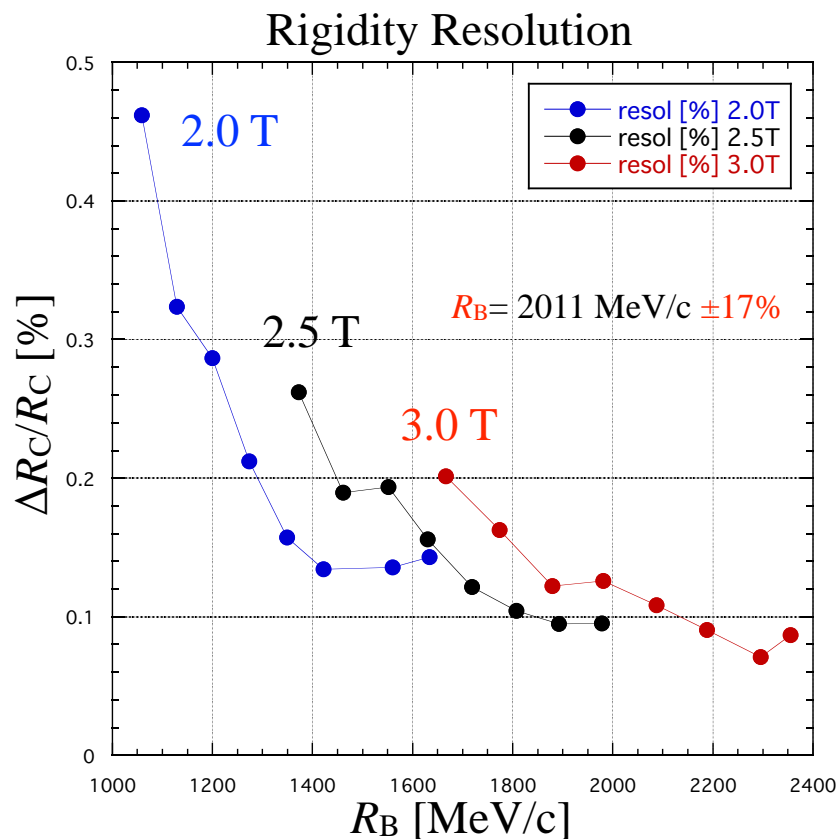
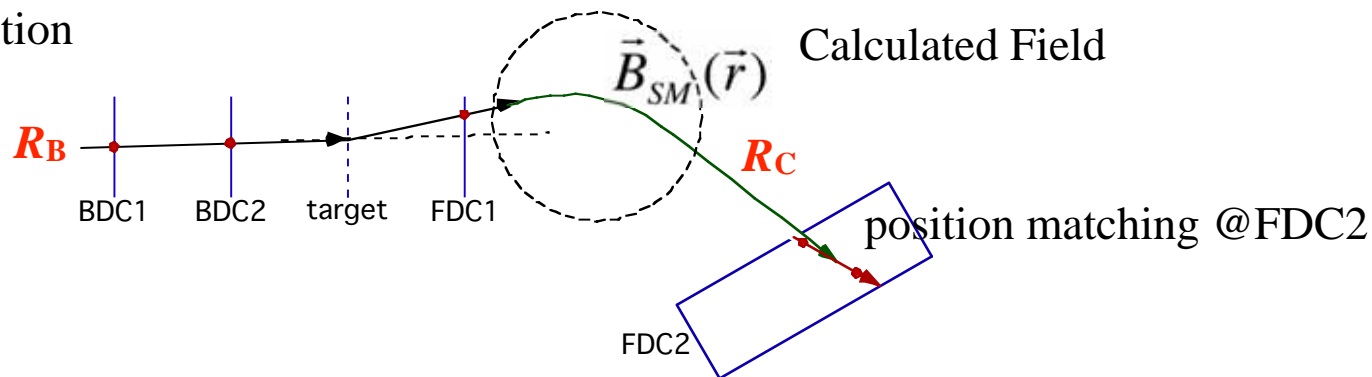
結果はいまいち理解できない

• Consistency check using B_p scan data : $\Delta R_B/R_B \sim \pm 0.05\%$ @ $B_{SM} = 2.0, 2.5, 3.0$ T



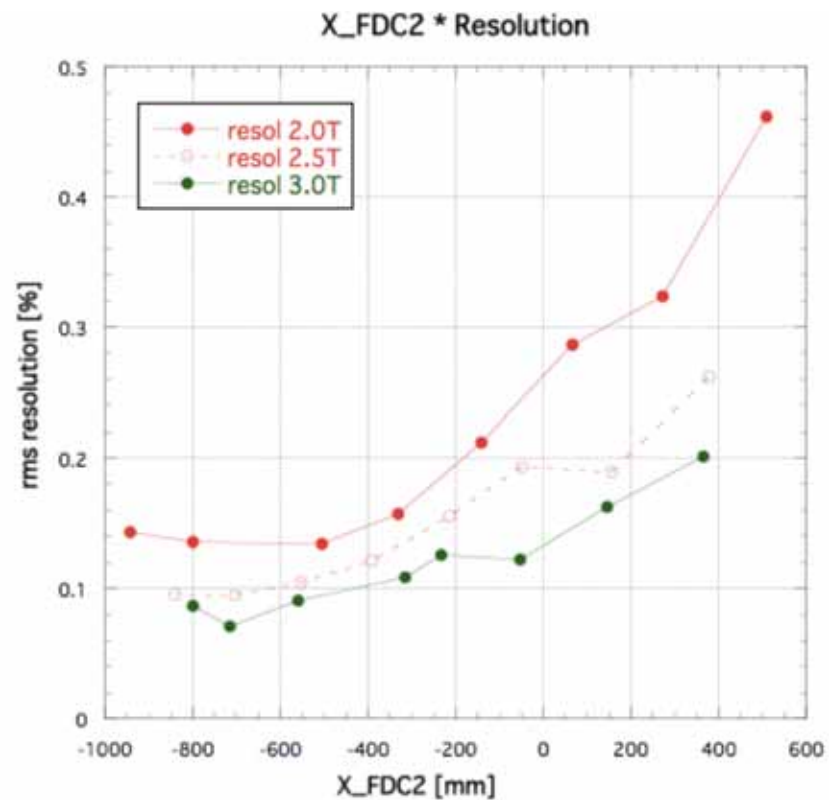
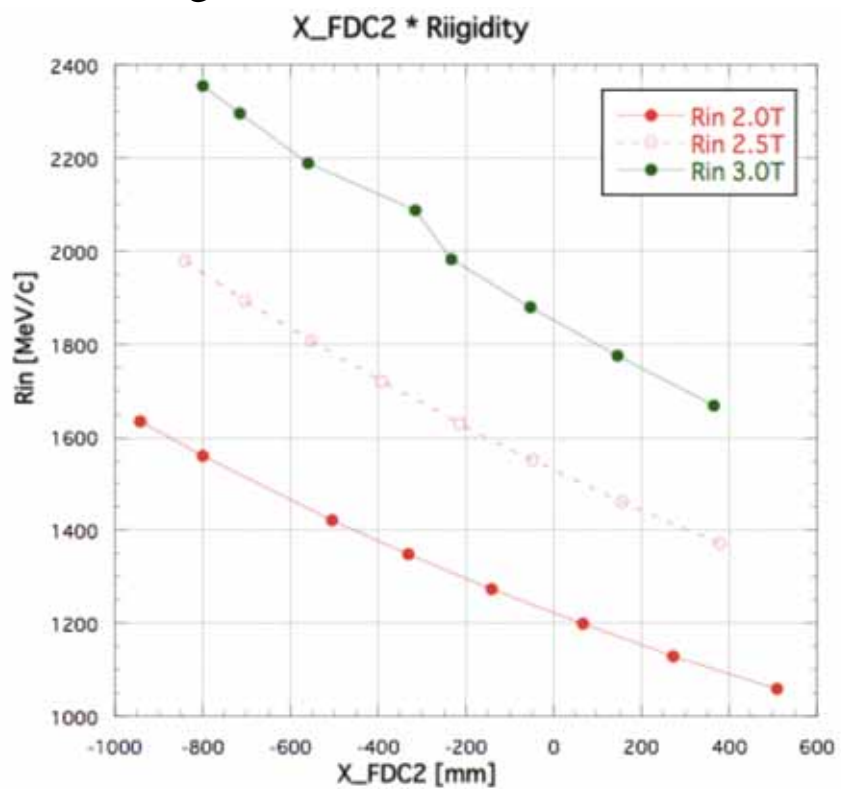
運動量解析 (簡易版)

• Reconstruction



$\sigma_R/R = 0.2 \sim 0.07\%$ ただし、TOF(beam) との相関が弱い(?)

• Scaling



* 多重散乱効果などが主原因の場合を除きおかしい

- *現在の(簡便)法

 - X, Y, X', Y' @FDC1は固定。

 - FDC2で位置が一致するようにrigidityを求める。

- *正常な5 parameter (X,Y,X',Y',R) 最適化に変更中

 - ただし、位置／角度の不一致の原因を除く必要がある。

 - 磁場分布、検出器位置 ...

Analysis till mid June

*Detector position ?

adjust relative positions of BDC1, BDC2, FDC1

adjust FDC2 position for matching between traced track & track in FDC2

位置／角度は3Tで一致するように検出器を移動

