

## Memo on Samurai standard detectors from S13 (PolP) Runs

${}^4,{}^6\text{He}$  @200 MeV/u  $\sim 0.6$  MHz with small beam spot

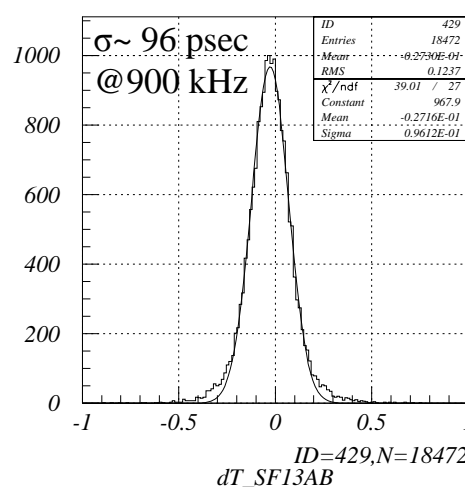
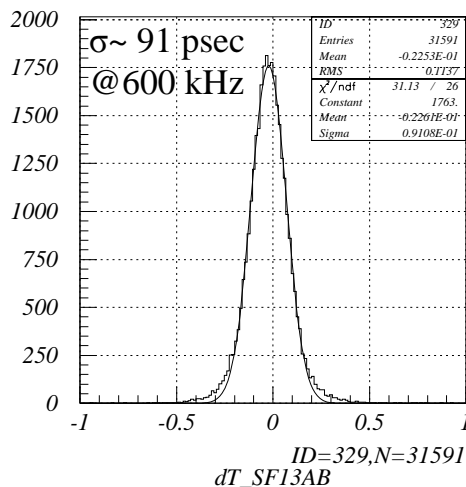
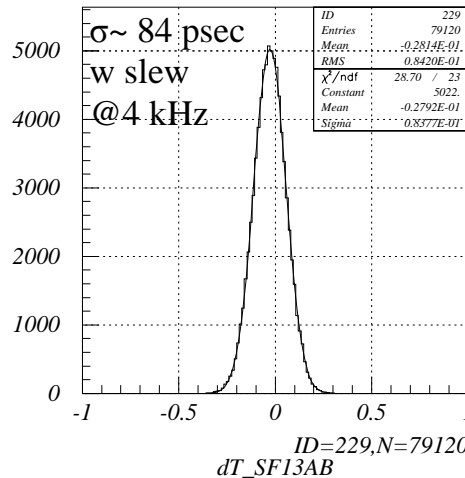
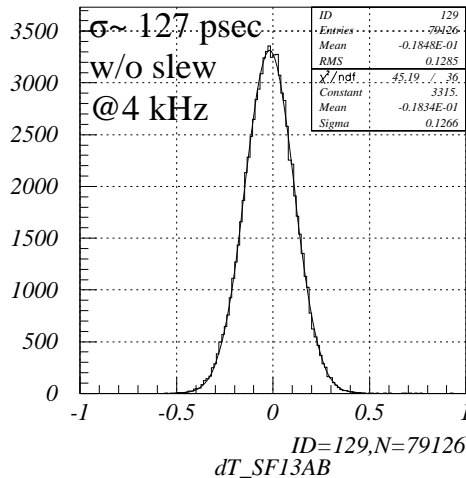
---

- SBT
  - Resolution : slew, rate dependence
- BDC1,2, FDC0
  - Efficiency : HV, rate dependence
  - Resolution : rate dependence
  - STC
- Momentum reconstruction
  - B= 1.7, 1.8, 1.9 T
- misc.

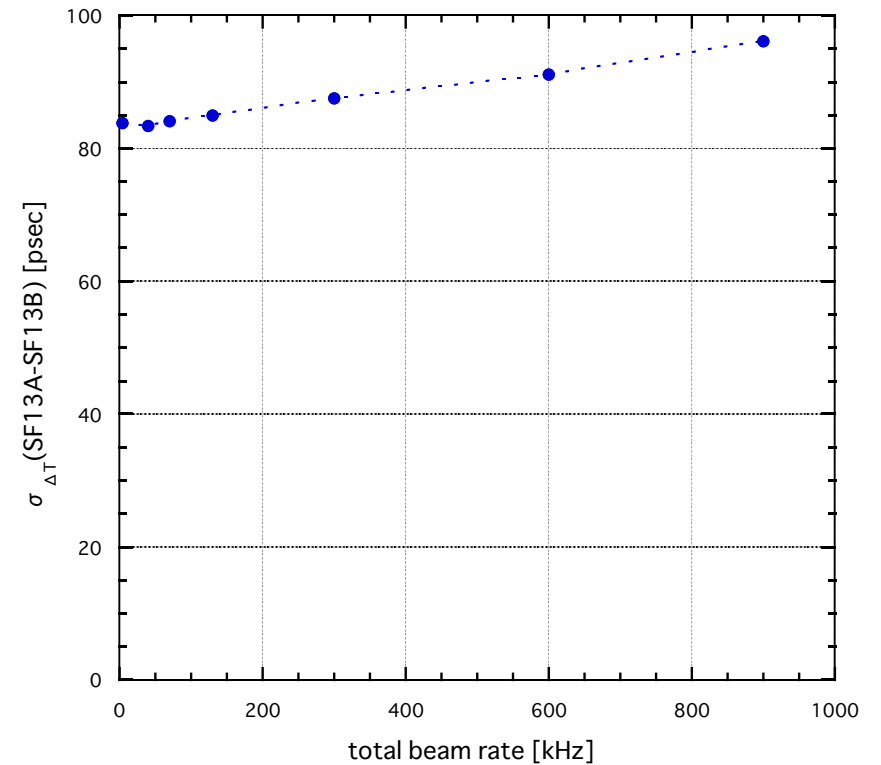
# SBT (SF13A,B) Time resolution for z=2

- SBT plastic: 130 x 130 x 2<sup>t</sup> x 2
- Time resolution estimated from  $\Delta T(\text{SF13A-SF13B})$ 
  - $\sigma_{\Delta T} \sim 127$  psec without slew corr. @4 kHz
  - $\sigma_{\Delta T} \sim 84$  psec with slew corr. @4 kHz
  - $\rightarrow \sigma_T \sim 60$  psec,  $\sigma_{\text{start}} \sim 43$  psec

## • $\Delta T(\text{SF13A-SF13B})$



## • Beam rate dependence



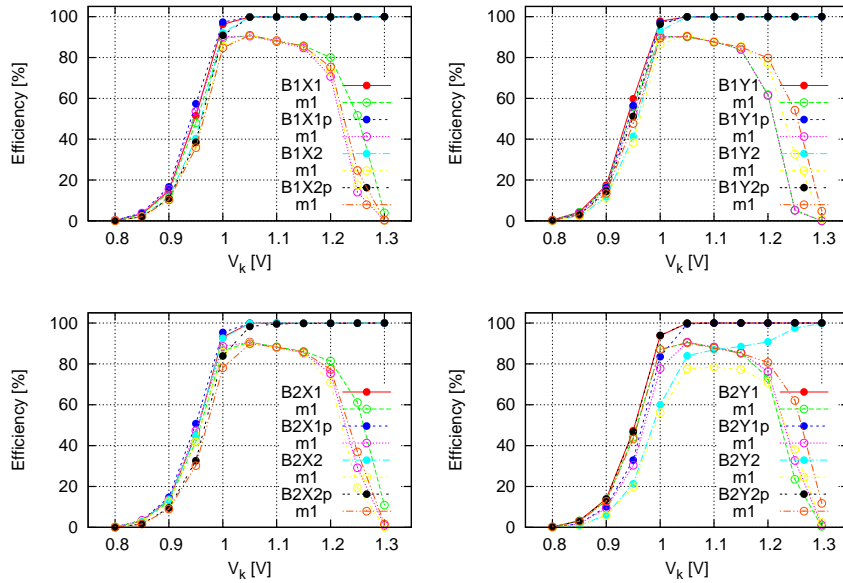
## • TOF : F3,F5, F13 with slew corr.

- $\sigma_{\text{TOF}}(\text{F3-F13}) \sim 350$  psec
- $\sigma_{\text{TOF}}(\text{F7-F13}) \sim 150$  psec

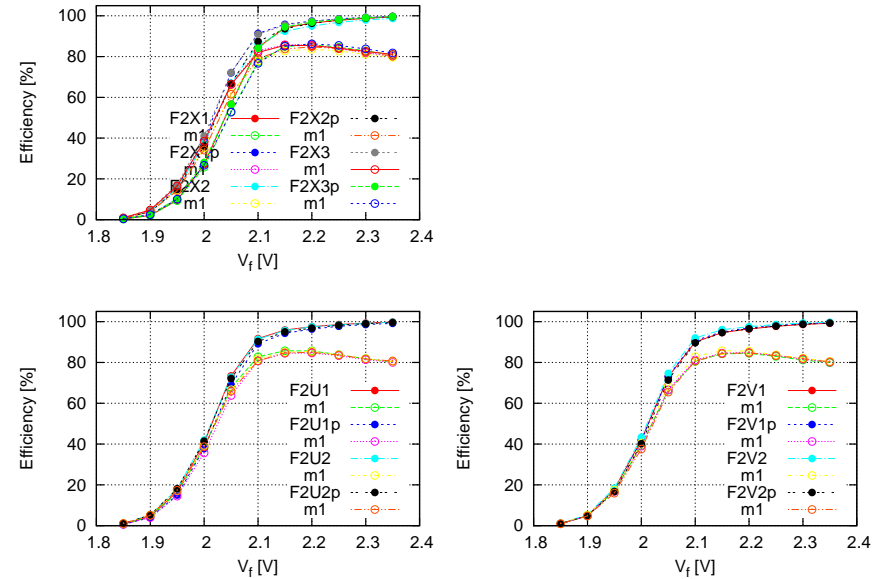
# Efficiency : HV dependence for z=2

- ${}^6\text{He}$  @200 MeV/u
  - beam rate :  $\sim 4\text{kHz}$
  - condition :  $z(\text{sbt})=2$  &  $\overline{z(\text{sbv})}\geq 2$  &  $z(\text{hodf})=2$

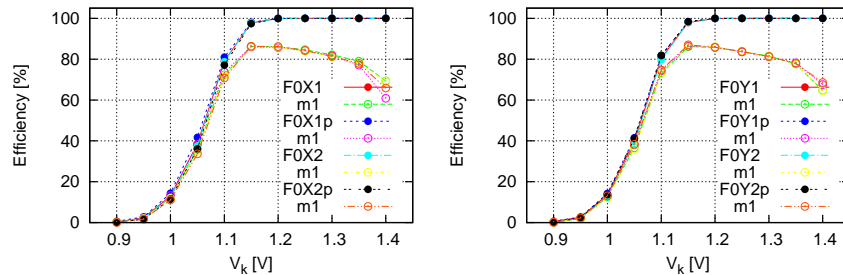
## • BDC1, BDC2 : i-C<sub>4</sub>H<sub>10</sub> P= 150 torr, V<sub>th</sub>= 0.4 V



## • FDC2 : P20+2propanol, V<sub>th</sub>= 0.8V



## • FDC0 : P20+2propanol, V<sub>th</sub>= 0.4V



• ?

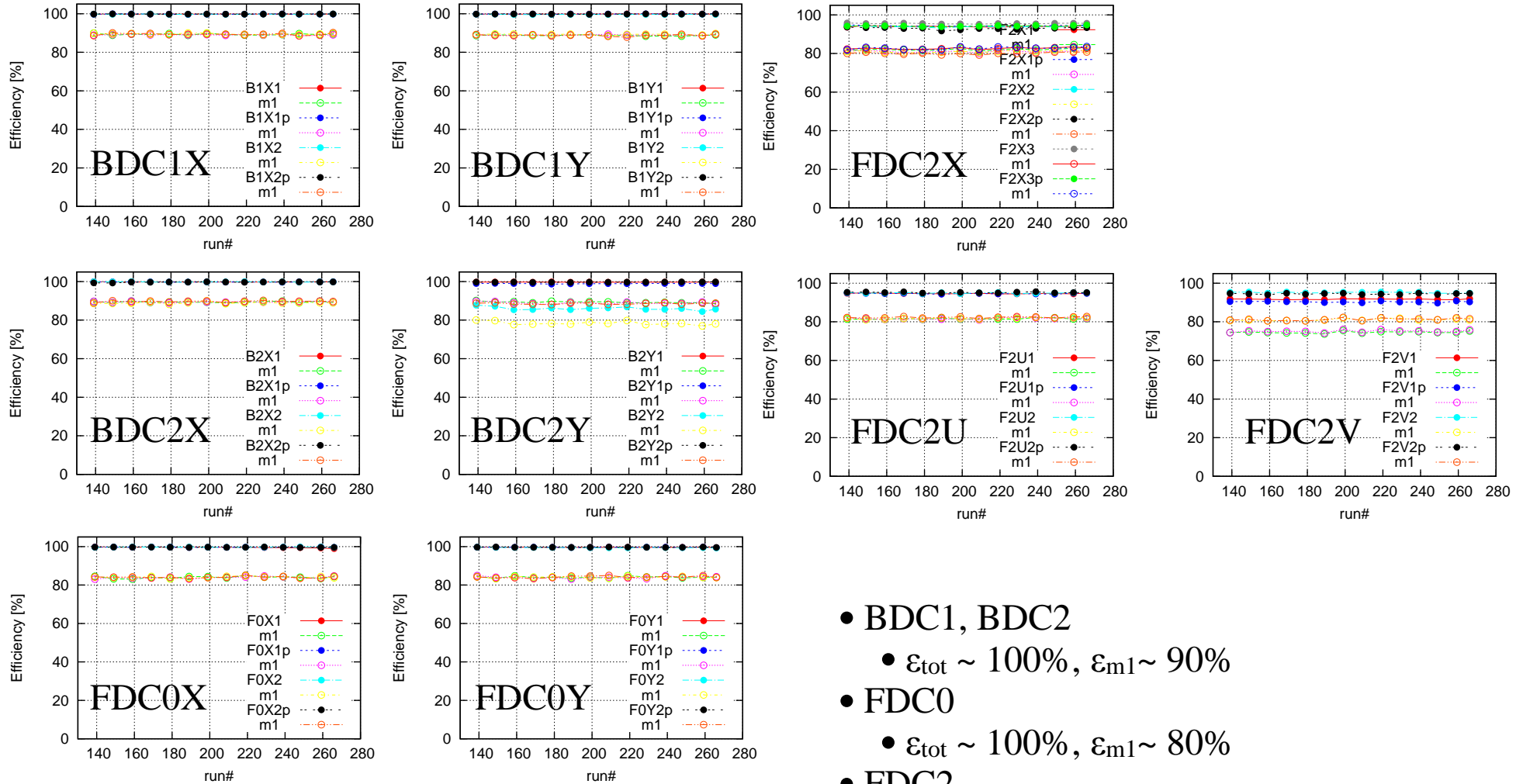
- BDC2-Y2 has  $\sim 15\%$  lower efficiency
- HV set : compromise
  - BDC1, BDC2 : 1.1 kV
  - FDC0 : 1.2 kV
  - FDC2 : 2.2 kV

- Beam is stopped in the beam stopper.
- Efficiency for  $z=2$  is monitored by selecting beam through events satisfying the following conditions :
  - coincidence register bit= 1 (ds-beam trigger)
  - $z(\text{SBT})=2$
  - $z(\text{SBV})\geq 2$  rejected
  - $z(\text{HOD})= 2$ , for selected slats on both sides of the beam stopper
  - drift chamber TDC: same region used by STC selected to remove accidentals
- Efficiency for run169 ( $\sim 0.57$  MHz) : example
  - #selected events  $\sim 9500$
  - Plane efficiency (8 planes averaged)

• detector	$\epsilon_{\text{tot}}$ [%]	$\epsilon_{\text{m1}}$ [%]	
• BDC1	99.7	85.4	
• BDC2	98.1	88.2	; $\epsilon_{\text{tot}}(y2)\sim 87\%$ , $\epsilon_{\text{tot}}$ of other planes $\sim 99.7\%$
• FDC0	99.7	85.4	
• FDC2	93.8	81.0	
  - Tracking efficiency
    - BDC1XY&BDC2XY : 99.2%
    - FDC0XY : 99.7%
    - FDC2 XUV : 95.2%
- Long term stability of plane efficiency : next page

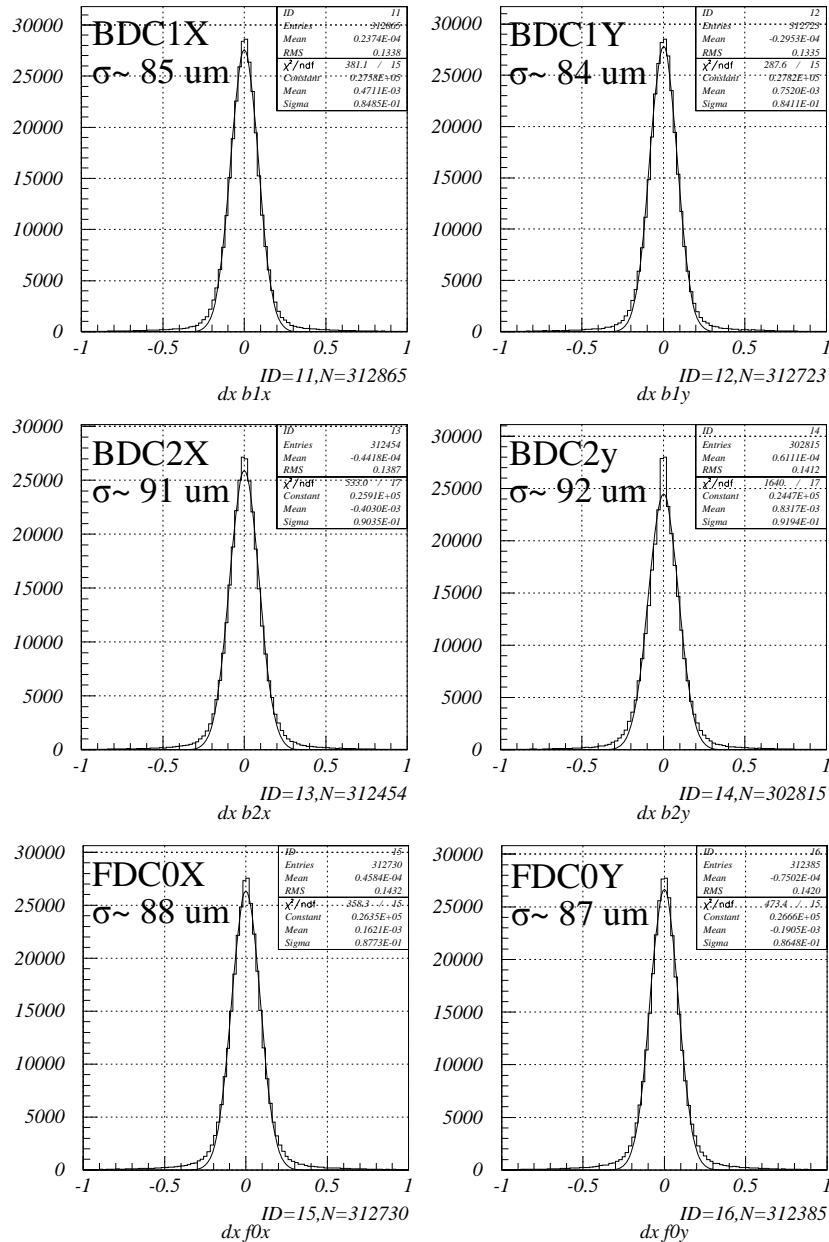
# Plane Efficiency for $z=2$ : run dependence, ${}^6\text{He}+p$ runs

- sample: run 139, 149, 159, 169, 179, 189, 199, 209, 219, 229, 239, 248, 259, 266 , ~ 3 days

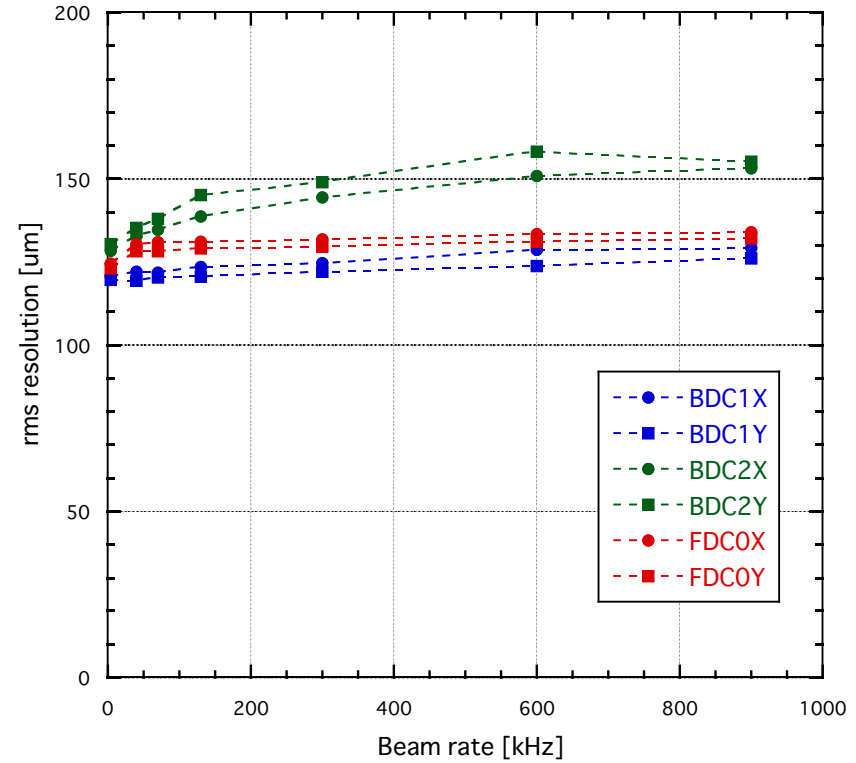


- BDC1, BDC2
  - $\epsilon_{\text{tot}} \sim 100\%$ ,  $\epsilon_{m1} \sim 90\%$
- FDC0
  - $\epsilon_{\text{tot}} \sim 100\%$ ,  $\epsilon_{m1} \sim 80\%$
- FDC2
  - $\epsilon_{\text{tot}} \sim 95\%$ ,  $\epsilon_{m1} \sim 80\%$

• Residue distribution @4 kHz



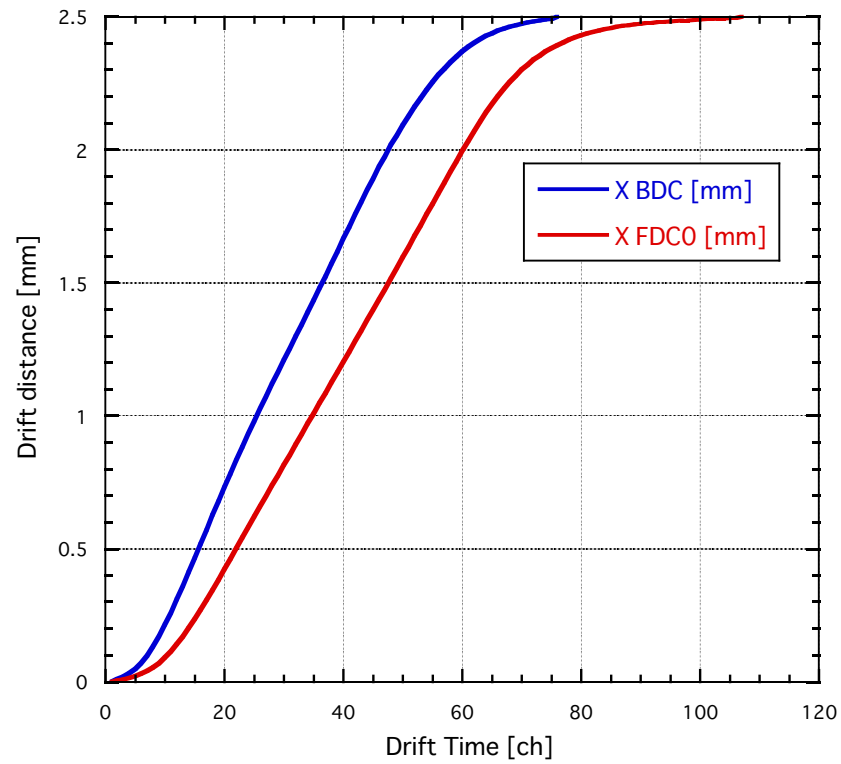
• Position resolution / plane : beam rate dependence



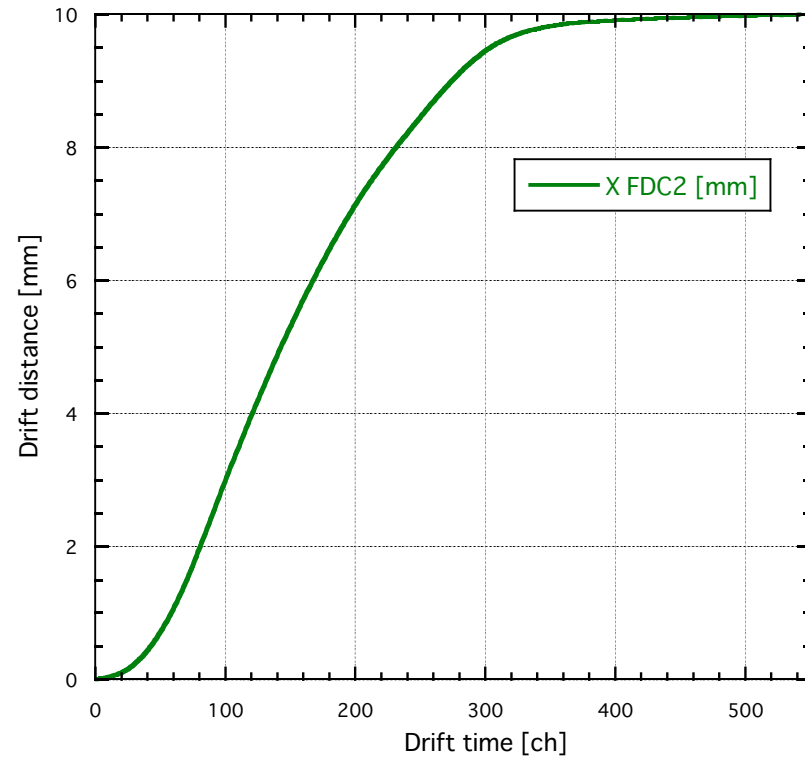
• Position resolution /plane @4kHz

- $\sigma(\text{BDC1}) \sim 120 \mu\text{m}$  @ 1.1 kV
- $\sigma(\text{BDC2}) \sim 130 \mu\text{m}$
- $\sigma(\text{FDC0}) \sim 125 \mu\text{m}$  @ 1.2 kV
- small rate dependence up to  $\sim 1\text{MHz}$

- BDC1,2, FDC0:  $X_{\max} = 2.5$  mm

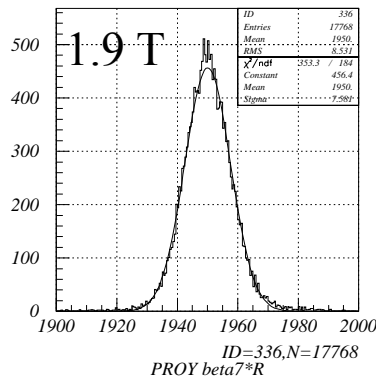
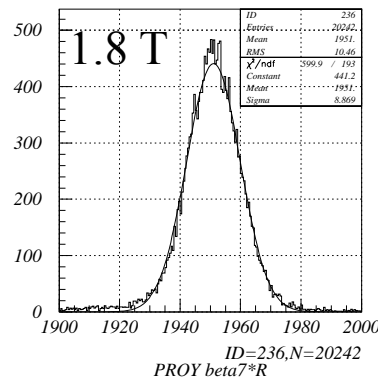
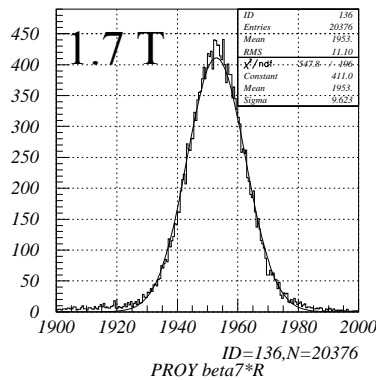


- FDC2:  $X_{\max} = 10$  mm



cf: 0.78 nsec/ch

- Detector position
  - geometry from drawing. PGM is not used yet.
- B= 1.7 T (run113), 1.8 T (run115), 1.9 T (run117)
  - ${}^6\text{He}$   $\sim 200$  MeV/u, beam goes through FDC2 & HODF24
  - matching (deviation) @FDC2
    - vertical position :  $\langle \Delta Y \rangle \sim 0$  mm,  $\sigma_{\Delta Y} \sim 10$  mm
    - horizontal angle :  $\langle \theta_H \rangle \sim -6$  mrad (?),  $\sigma(\theta_H) \sim 2.5$  mrad
    - vertical angle :  $\langle \theta_V \rangle \sim 0$  mrad,  $\sigma(\theta_V) \sim 4$  mrad
- reconstructed rigidity



→ Rigidity [MeV/c]

- beam TOF correction : very small effect
  - mainly depending on the small bending angle(?)
- FDC2 resolution @2.2 kV
  - $\sigma(\text{FDC2-X}) \sim 390 \mu\text{m}$ ,  $\sigma(\text{FDC2-U,V}) \sim 310 \mu\text{m}$
- central value, rms width, & resolution
  - B= 1.7 T :
    - $\langle R \rangle \sim 1953$ ,  $\sigma_R \sim 9.6$  MeV/c,  $\sigma/R \sim 0.49\%$
  - B= 1.8 T :
    - $\langle R \rangle \sim 1951$ ,  $\sigma_R \sim 8.9$  MeV/c,  $\sigma/R \sim 0.46\%$
  - B= 1.9 T :
    - $\langle R \rangle \sim 1950$ ,  $\sigma_R \sim 7.6$  MeV/c,  $\sigma/R \sim 0.39\%$
- resolution becomes better for higher field



- 検出器が最後までへたらなくて本当にほっとしている
  - BDC2は、0.6MHzで測定を初めてから約6時間後にbeam off時にも約0.2 $\mu$ Aの電流が流れるようになった。しかし実験終了時には正常に戻っていた：原因不明。  
Neuland commissioningの~1MHz 陽子ビームの時にも同じ事があった。  
突然死の可能性もあり予備機が必要と思われる。  
不調なBDC2-Y2は再試験の予定。
  - FDC0は、実験終了時のbeam off後も約0.12 $\mu$ Aの電流が流れていた：何時から変だったか不明。  
気をつけて見ていた人がいたら、情報を教えて欲しい(BDC2, FDC0のビーム無の時の電流値)  
しばらく放置後、再試験の予定。  
なお、P20+2propanolはFDC2と共用が理由でのみ使い、大気圧でのhigh rate用ガスとしては最適ではない。
  - FDC2は、 $^4\text{He}$ へ切替え直後から、特定の面で幅の狭い信号が多発するようになった：原因不明。
  - 前回の実験から、BDC, FDC0を一つの高圧電源から $V_k=V_p$ で使用：分解能にめだった変化は無い。  
今回はFDC2のX,U,VのHVを一つの高圧電源から供給。調整時に楽なうえ、HVを常時DVMに表示できる。
- 今回は、強度0.5~1 MHzかつ小さなスポットサイズのビームを数日間使える良い機会だったので、BDC1, BDC2, FDC0のASD 32個を時定数16 nsecの物に交換した。これでBDC1,2, FDC0は通常のhigh-rate対応に戻った。FDC1のASDも16 nsecの物に交換予定。
- Beam stopperの状況を予測できなかった事からFDC2のHVを低めに設定したが、あと50~100V上げておけば良かった：反省事項。