

200-MeV LINAC TUNING

- **Error compensation by adjusting phase**
- **Effects of error fields**



*average value

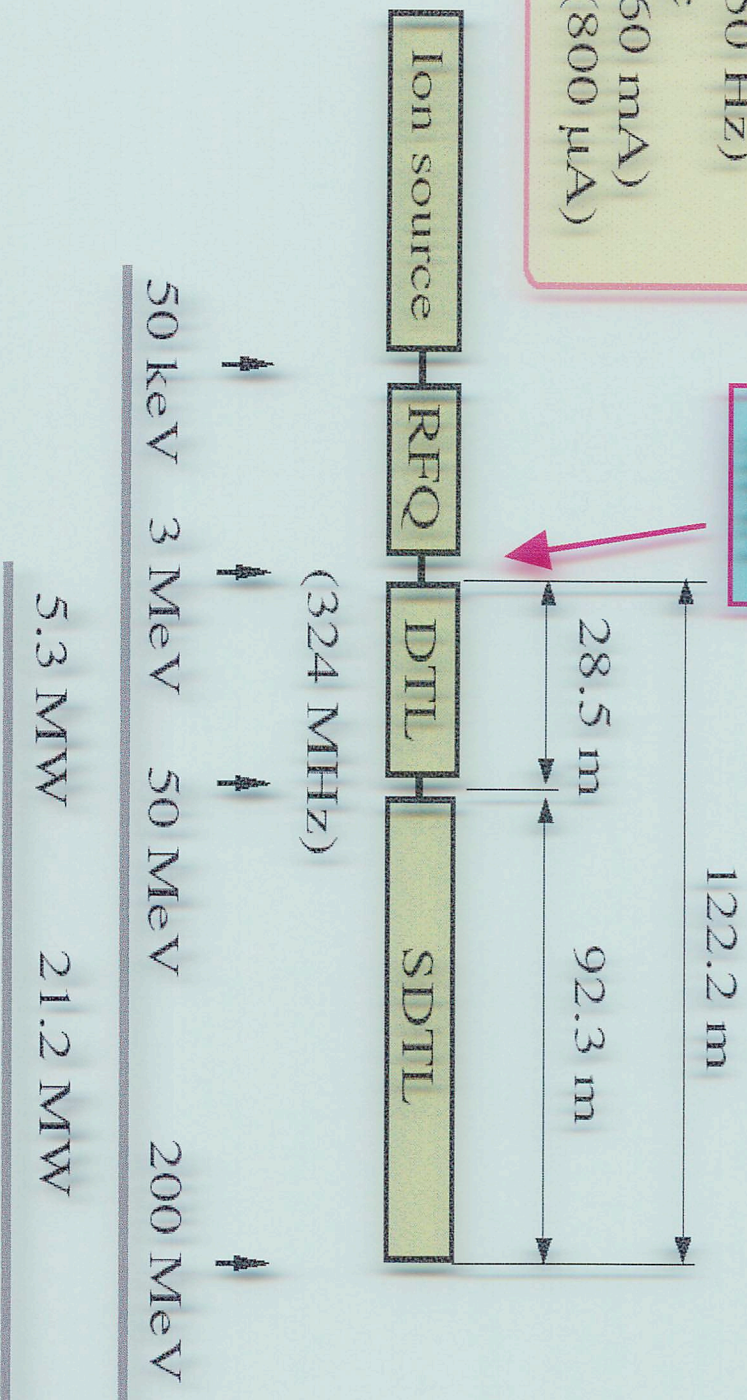
*beam quality ---- emittance

The JHF 200-MeV Proton Linear Accelerator

JHF 200-MeV PROTON LINAC

25 Hz (50 Hz)
 500 μsec
 30 mA (60 mA)
 200 μA (800 μA)

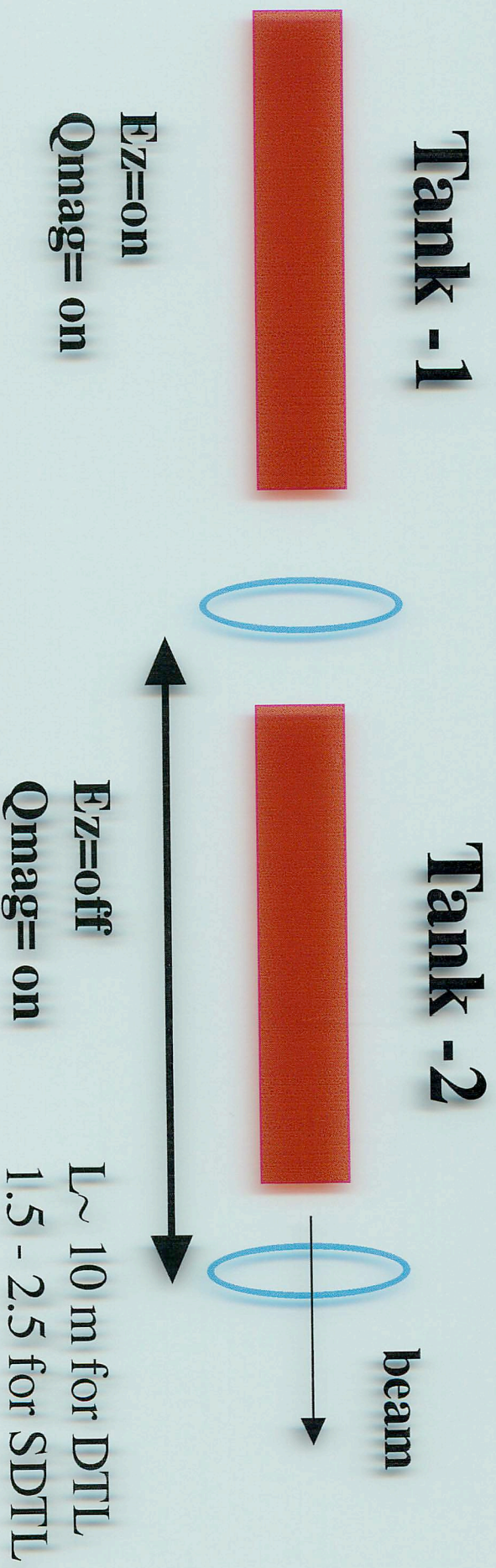
MEBT



Main parameters

	DTL	SDTL	
Frequency	324	324	MHz
Injection energy	3.0	50.06	MeV
Output energy	50.06	200.0	MeV
Accelerating filed	2.5 - 2.9	3.9 - 3.6	MV/m
Stable phase	-30 ~ -26	-26	degree
Length (structure only)	27.04	65.9	m
Number of tank	3	31	
Number of cell	150	155	
Number of klystron	3	14 (16)	
Rf driving power	3.92	17.4	MW
Total rf power (30 mA)	5.33	22.0	MW
Total length		122.3	m
Total power (30 mA)		27.3	MW
Peak current		30	mA
Beam width		500	μsec
Repetition rate		25 (50)	Hz
Average current		200	μA

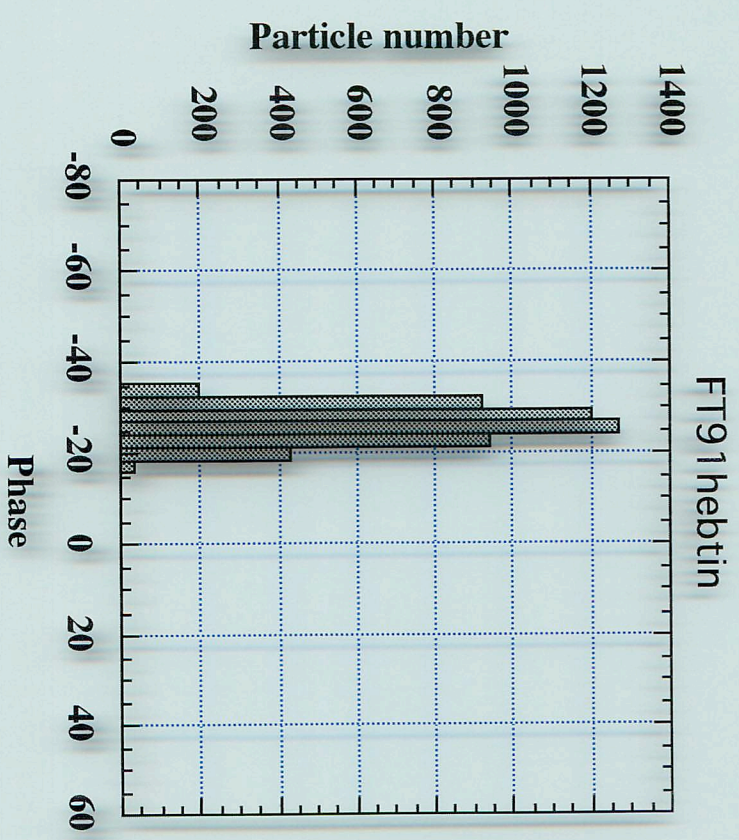
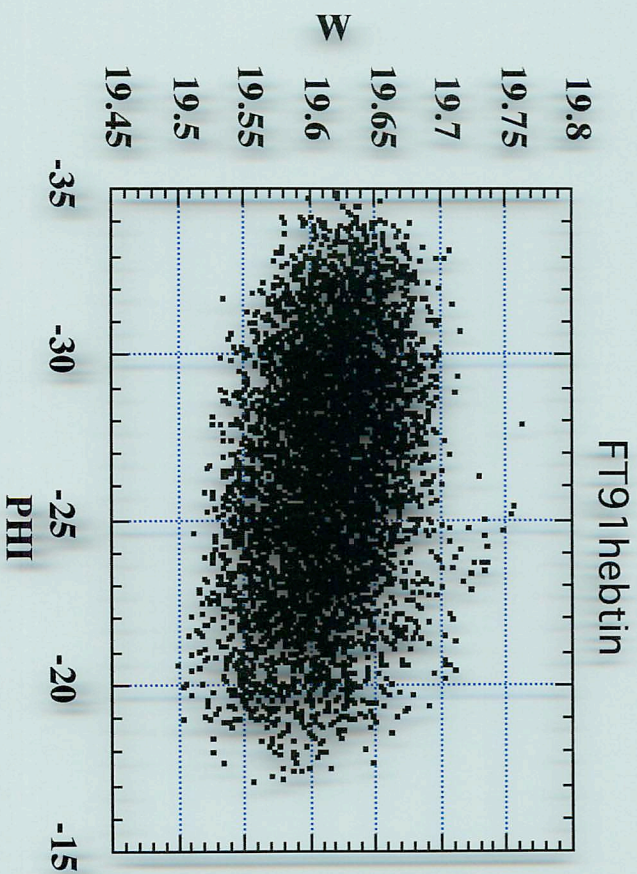
Time of flight



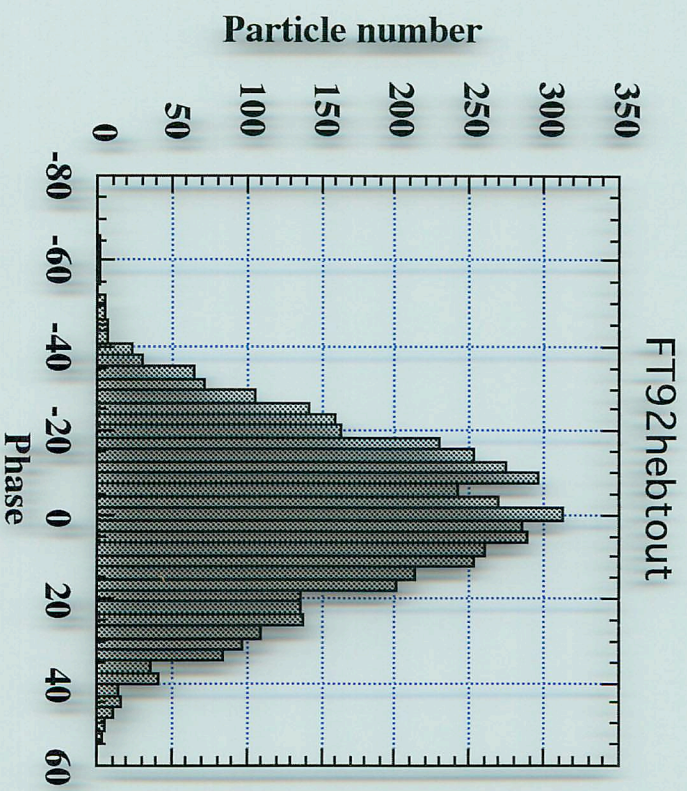
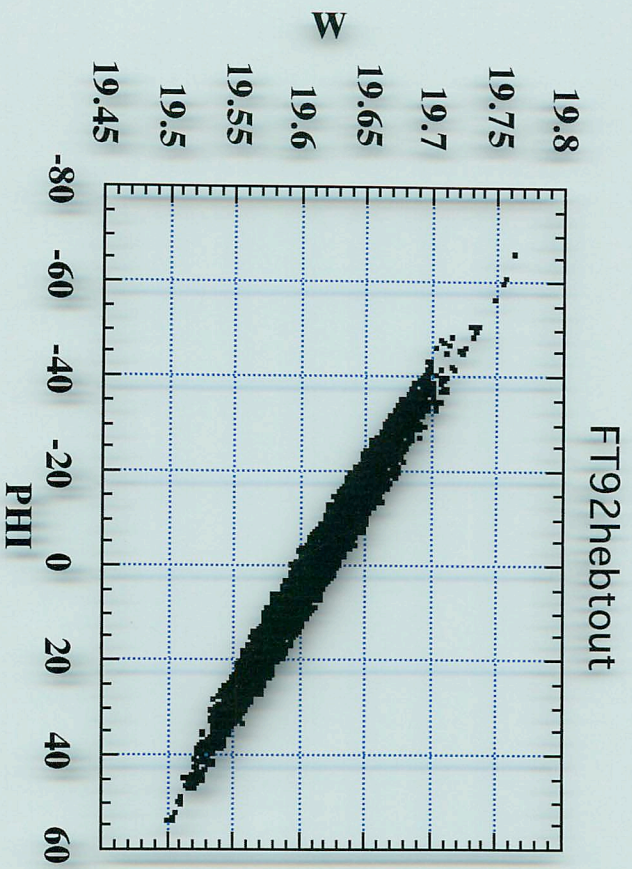
2点間距離Lの時間差は基本波の位相差ではかる

位相分解能 1- 2degree energy 50 keV

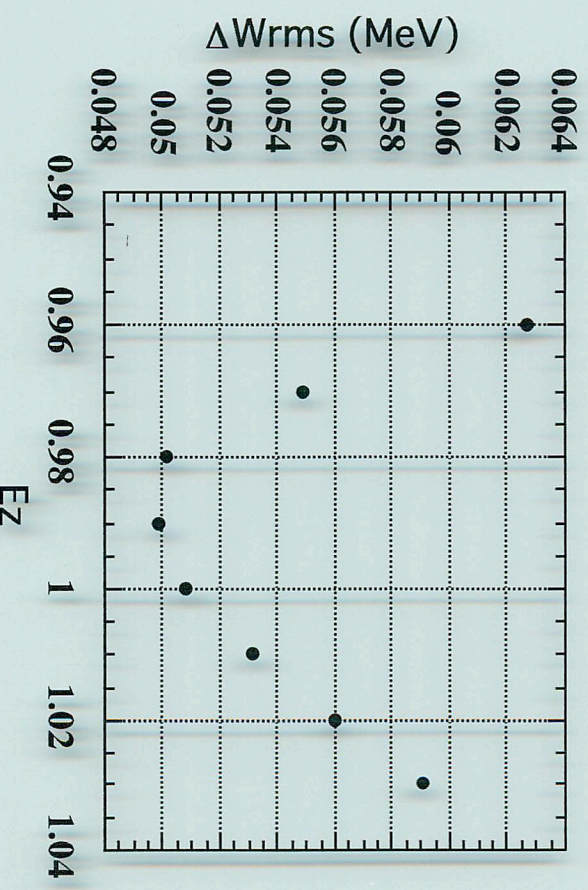
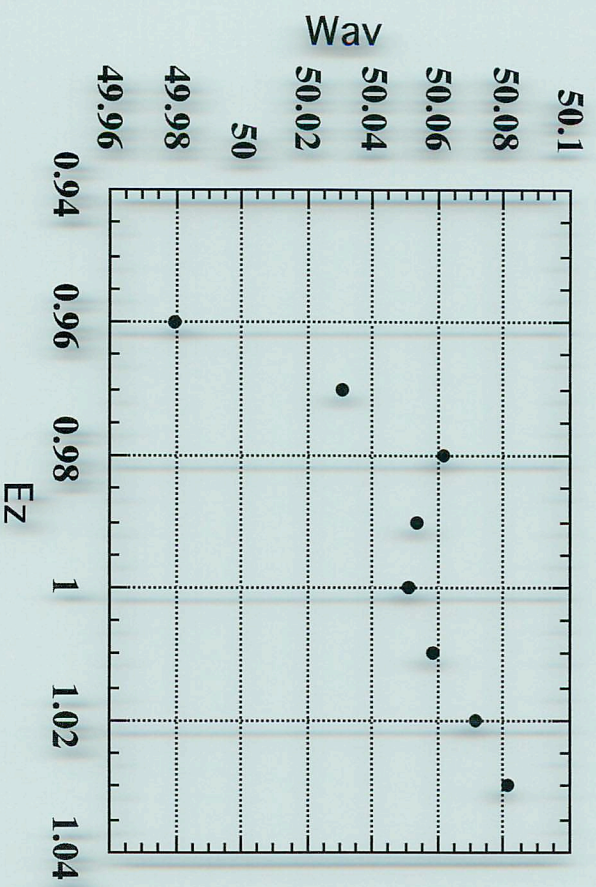
Beam shape after first tank



Beam shape after first tank + 10 m drift

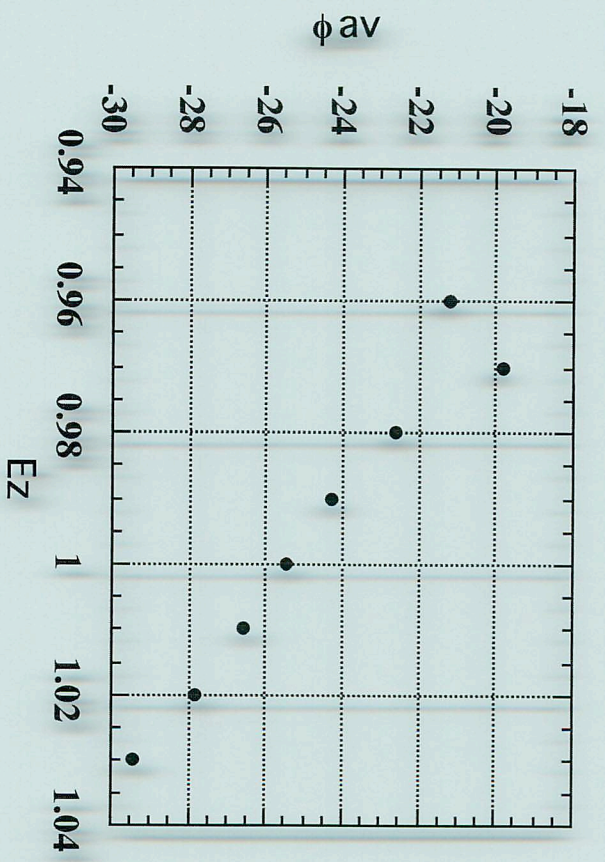
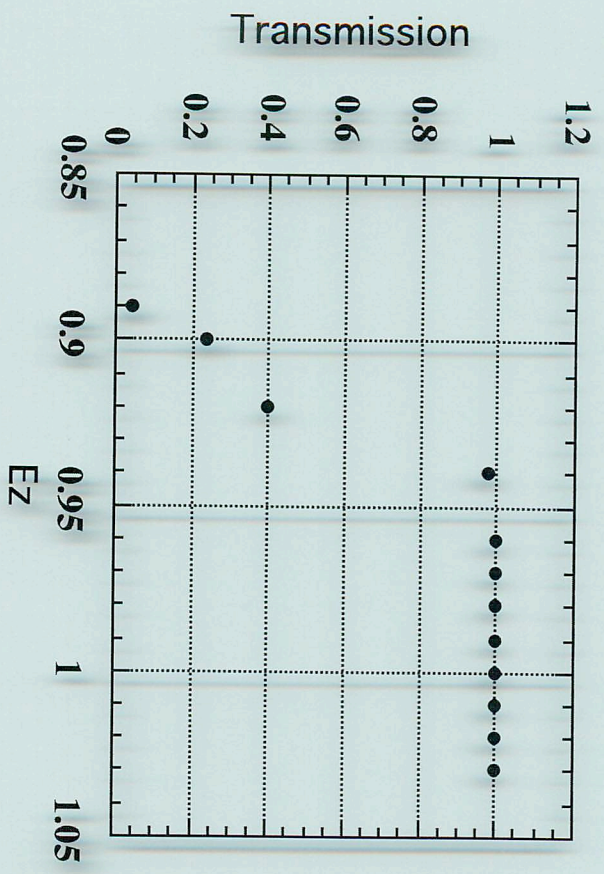


Effects of Tank level - 1



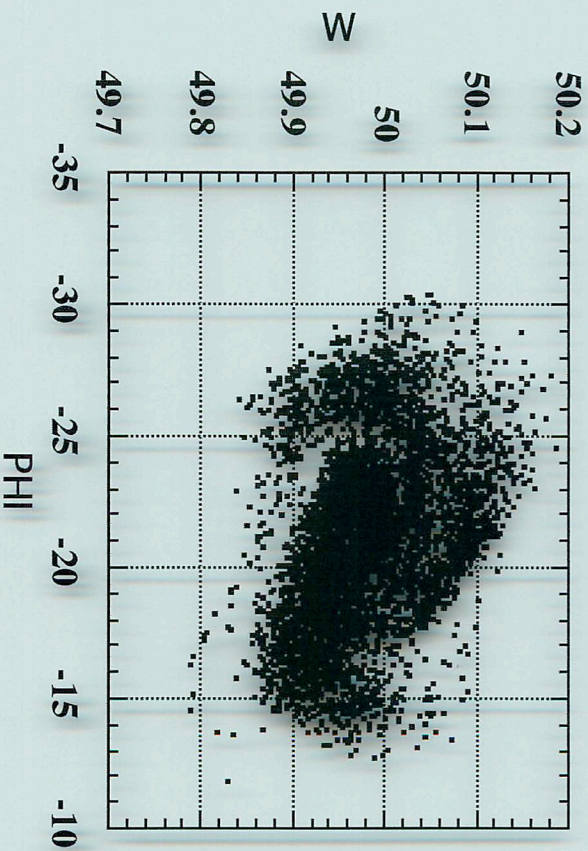
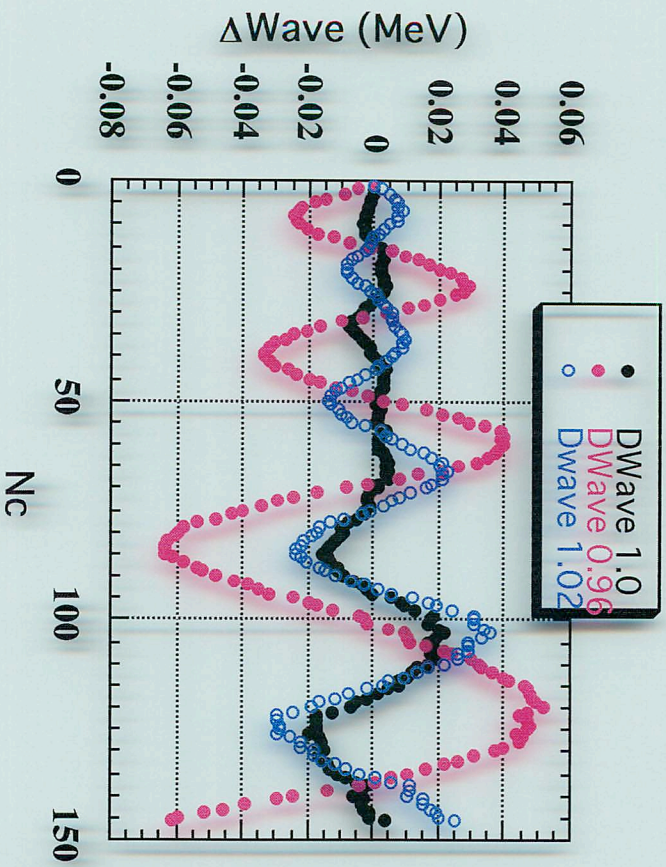
Ez の決め方 (1)

Effects of Tank level - 2



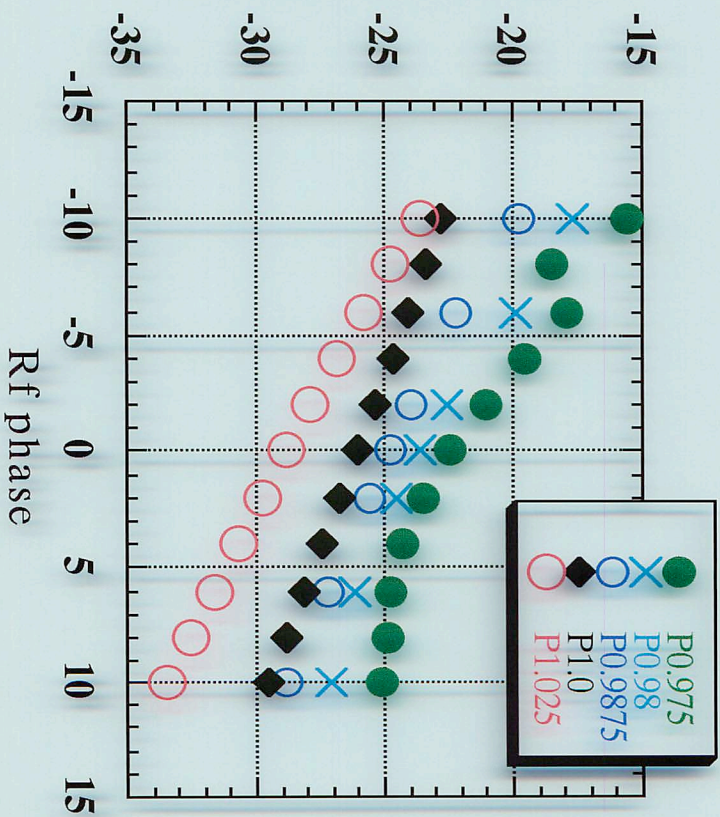
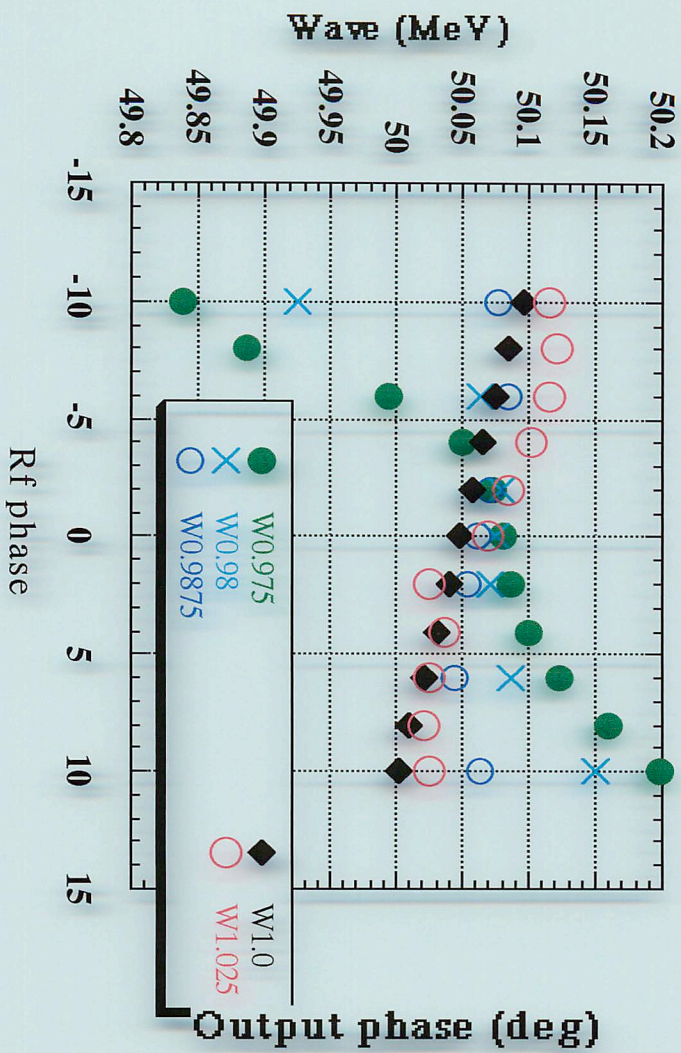
EZ の決め方 (2)

Effects of Tank level - 3

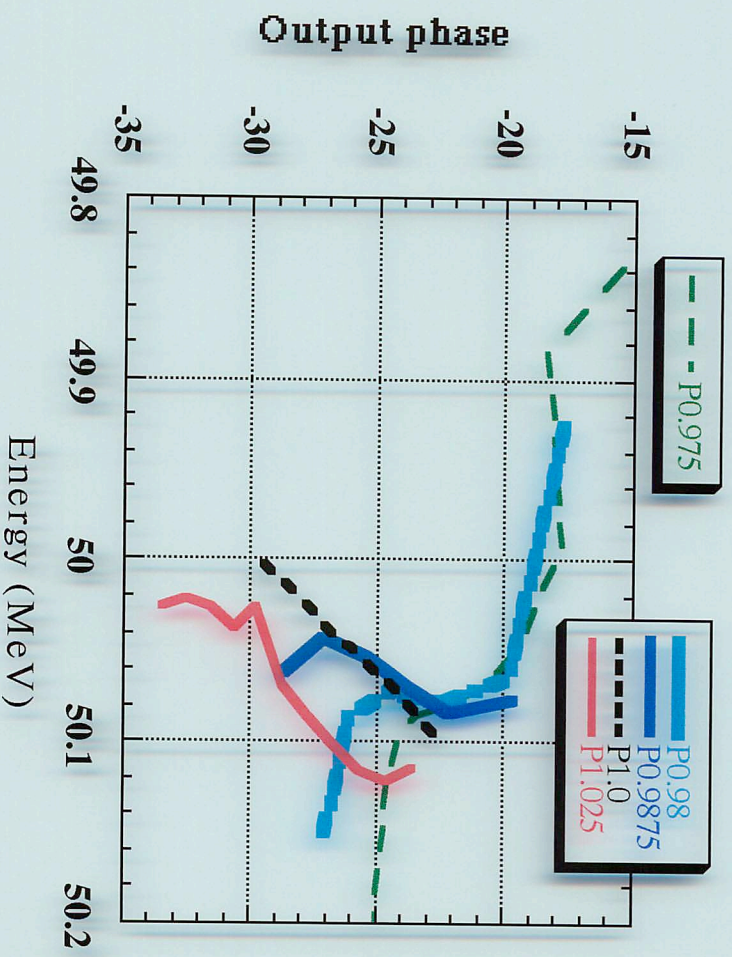


$$E_Z = 0.96$$

Effects of Tank level - 4

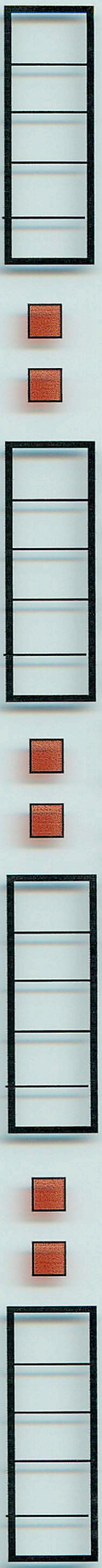


Effects of Tank level - 5

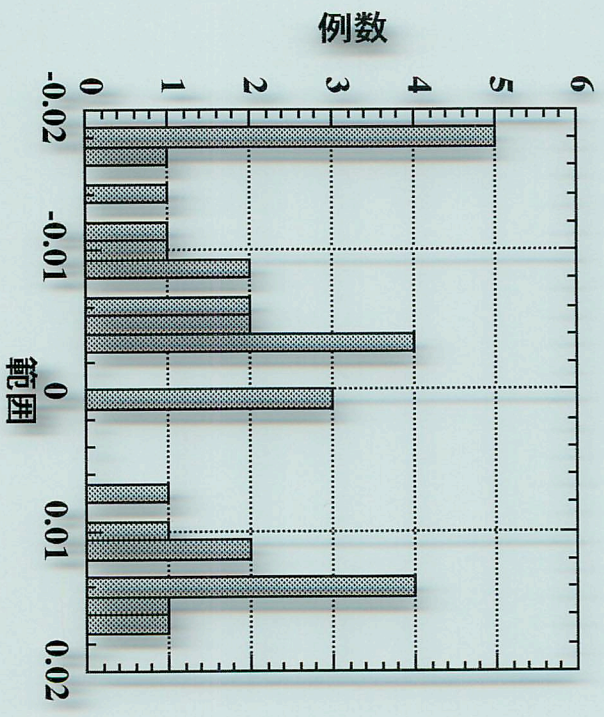
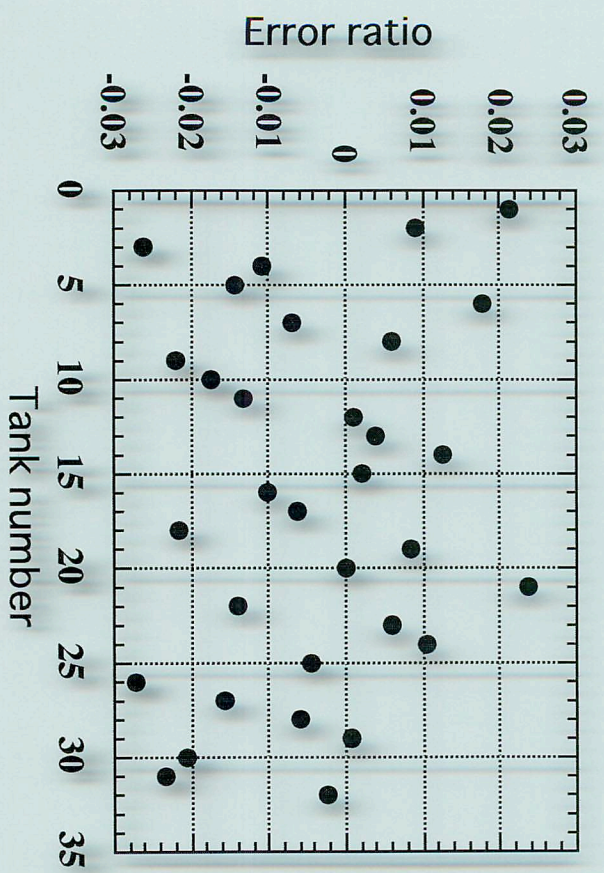


Field error in SDTL structure

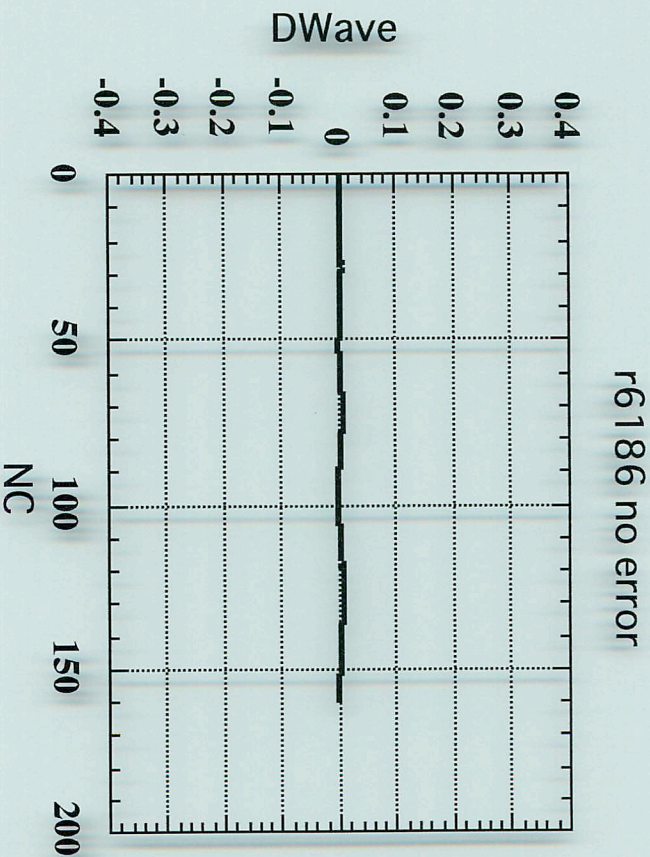
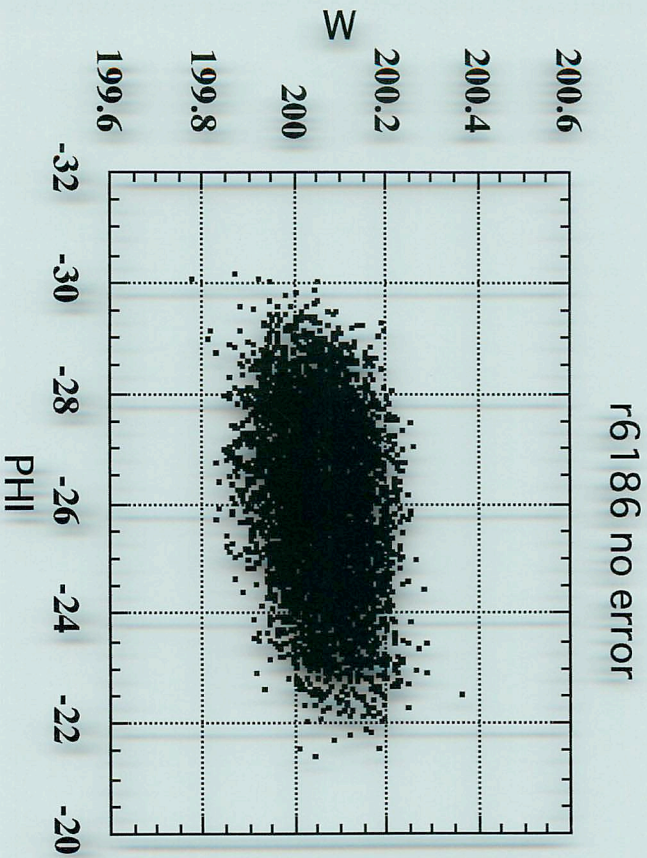
5 cell x 31 tank



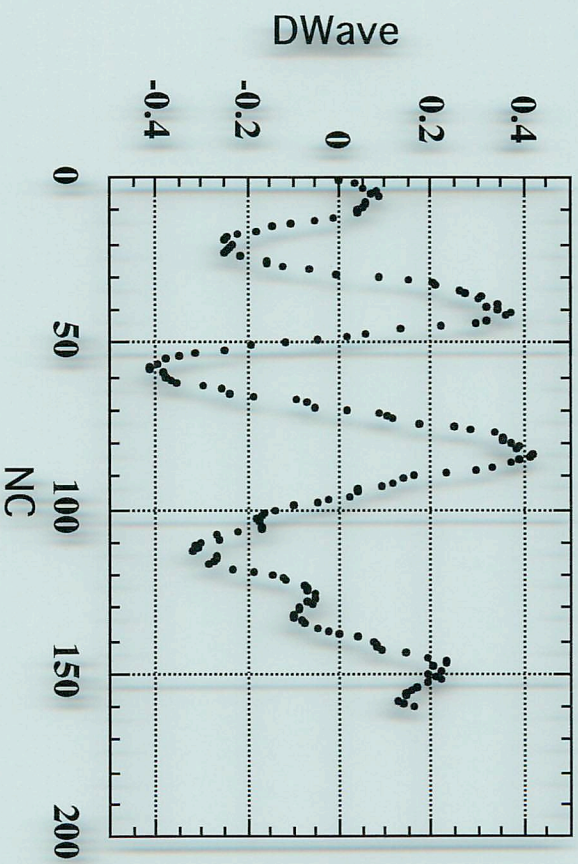
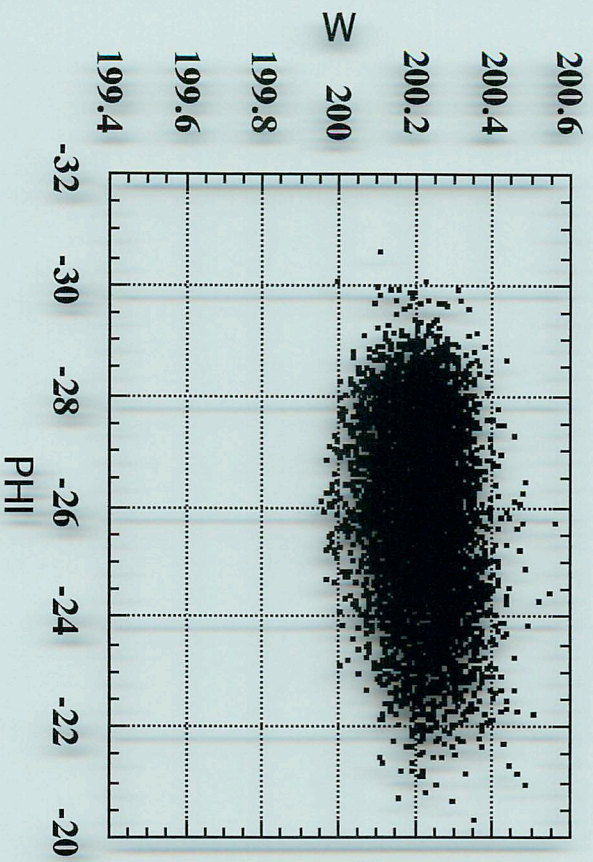
CELL error + TANK error



Output without errors



Output with errors



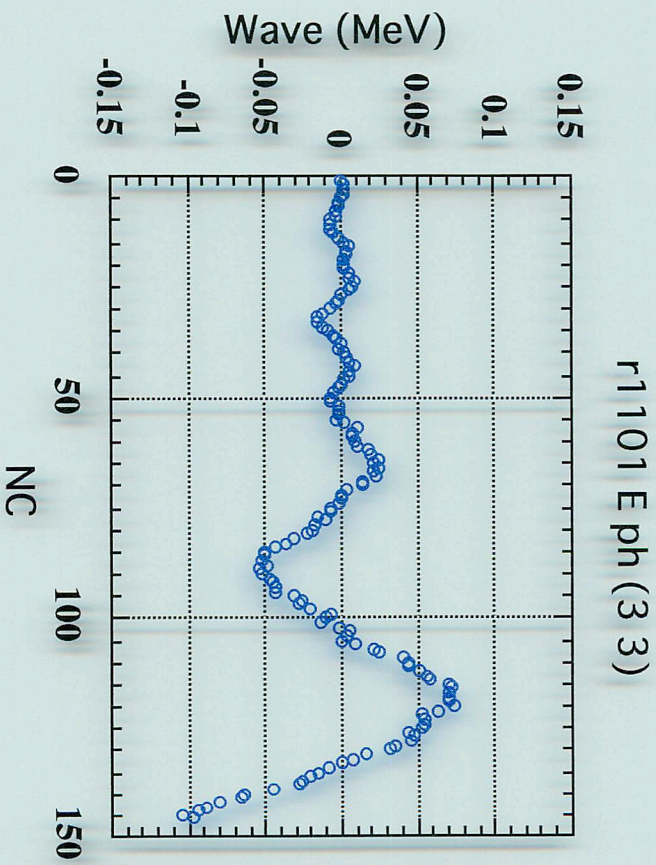
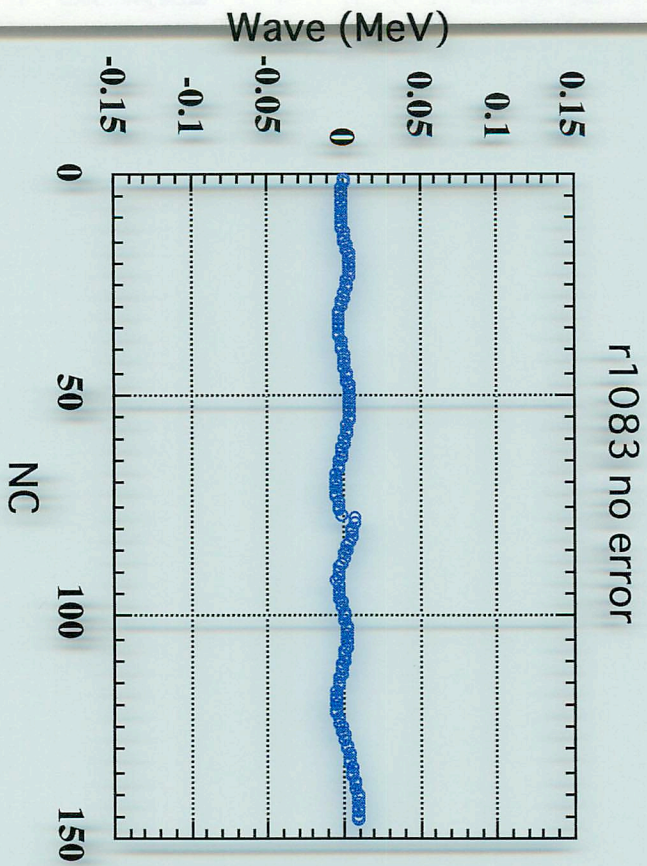
Tank Ez error $\pm 4\%$

Tank phase error $\pm 3\%$

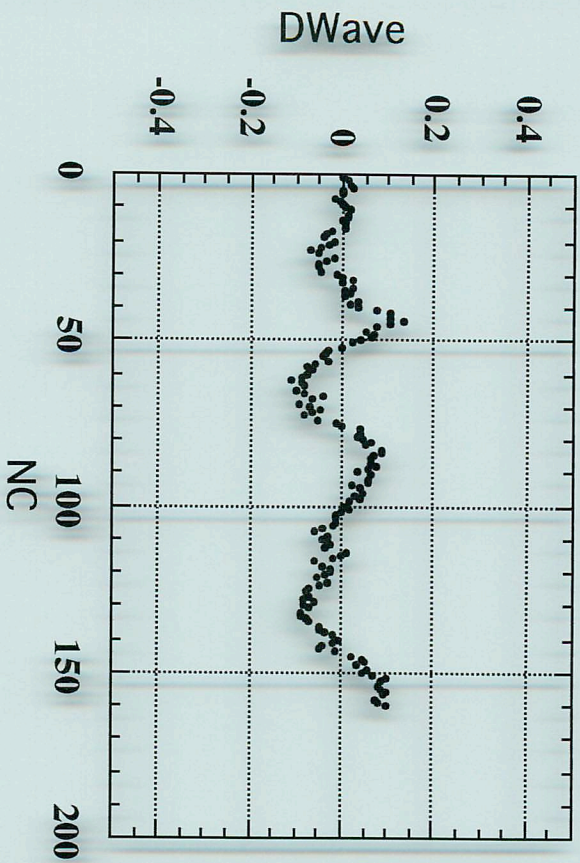
Cell Ez error $\pm 2\%$

Cell phase error $\pm 1\%$

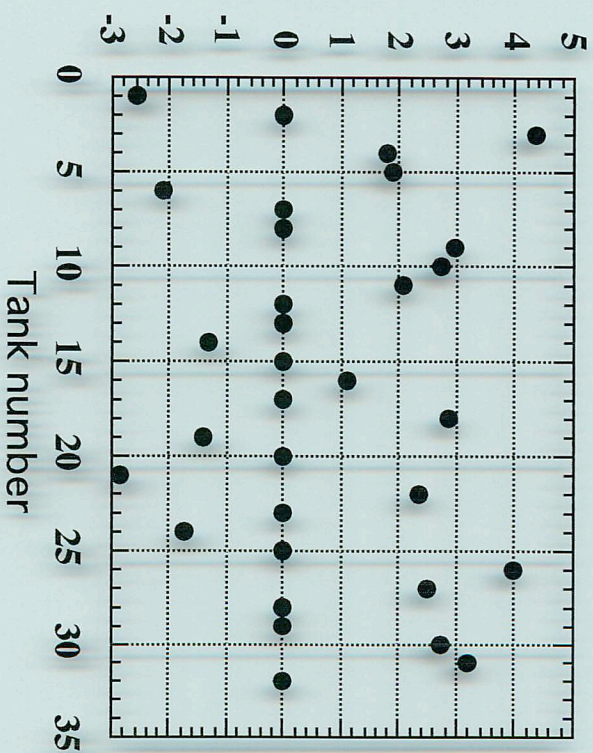
Phase error in DTL



Phase compensation for SDTL each tank

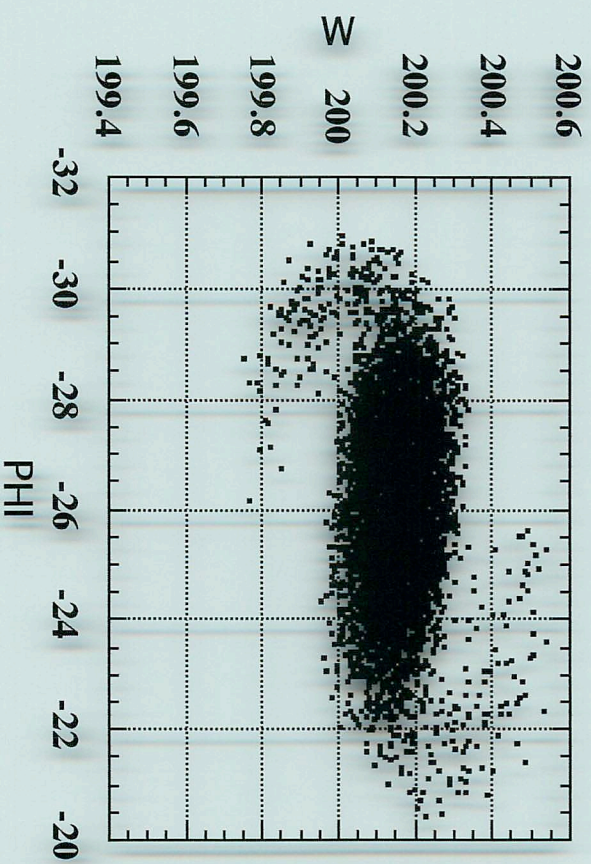


Phase shift (degree)

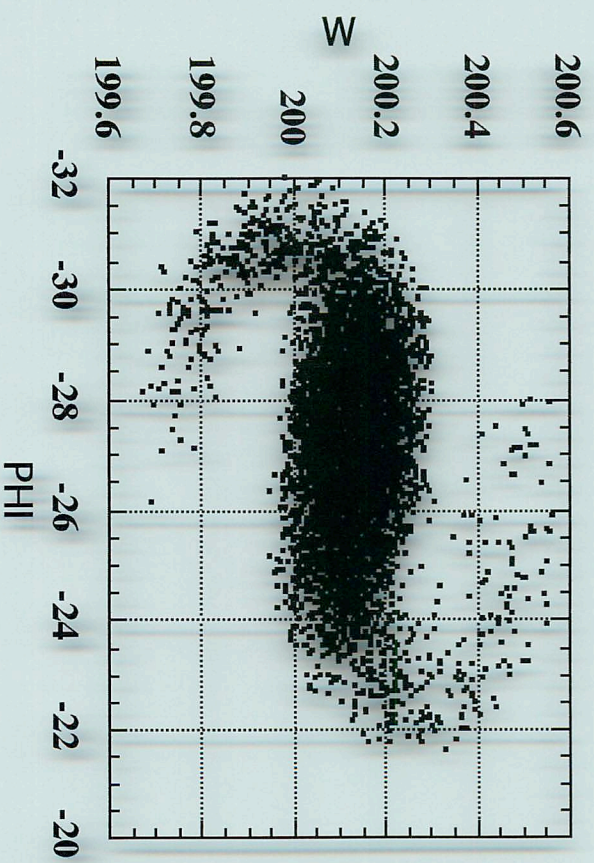
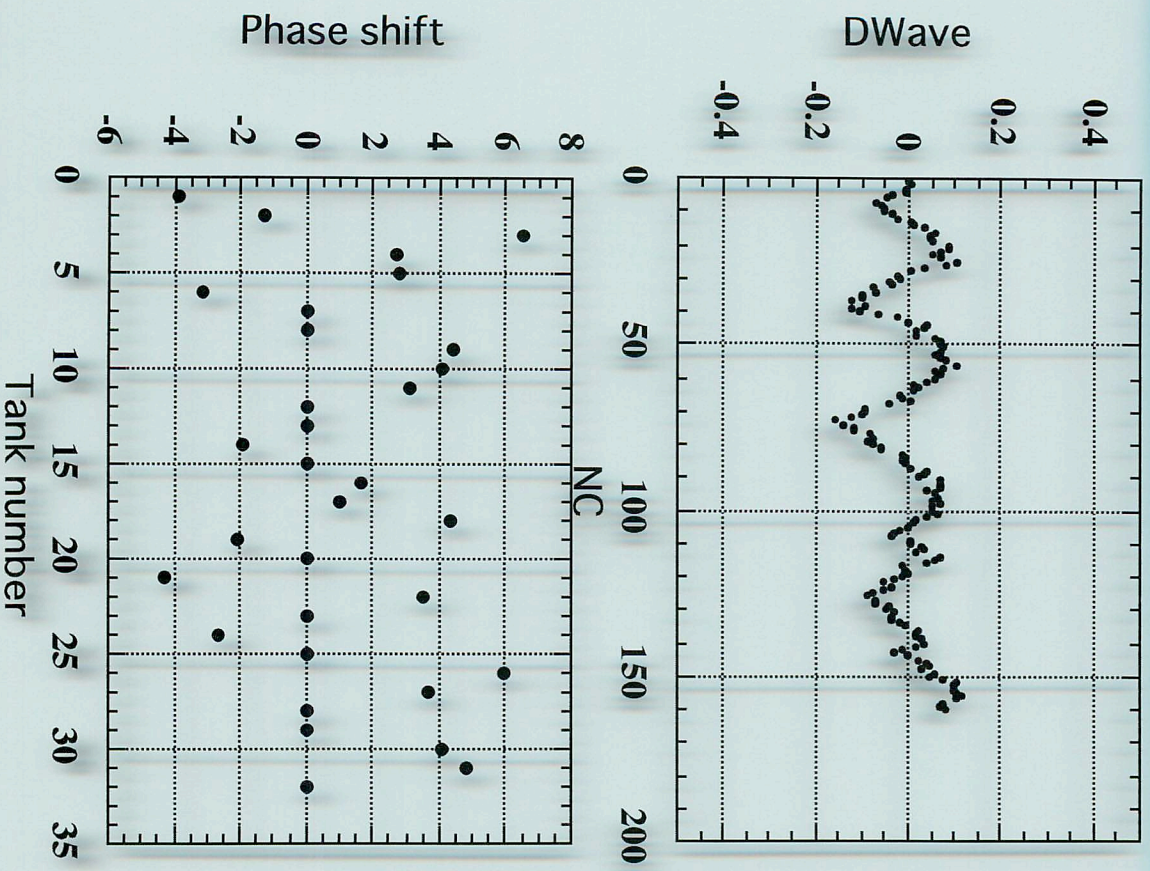


$$\Delta W_{\text{tank}} = E T \cos \phi L = E_c T \cos \phi_c L$$

Phase compensation for SDTL each tank-2

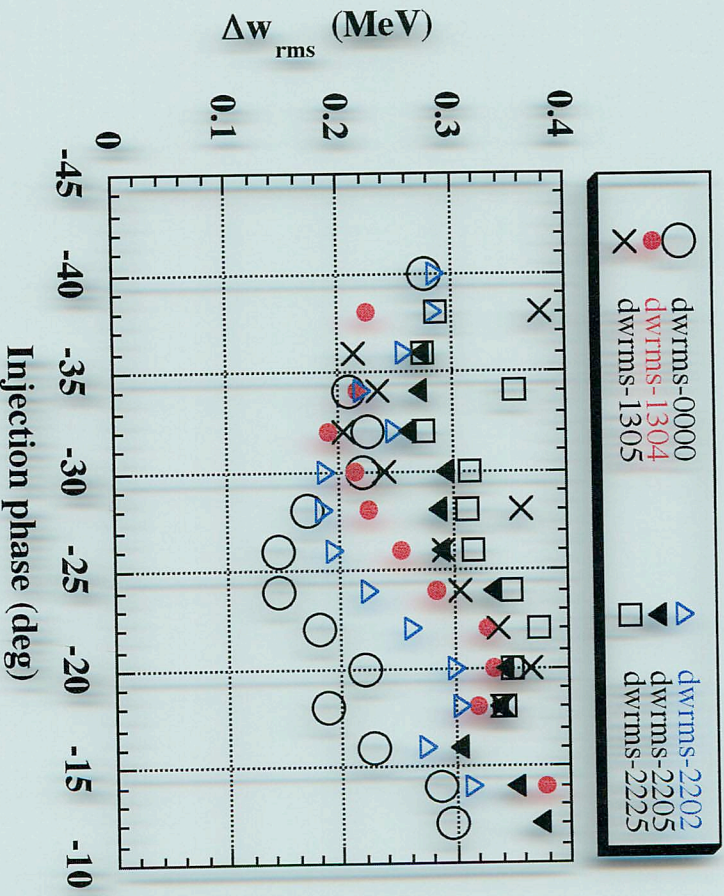
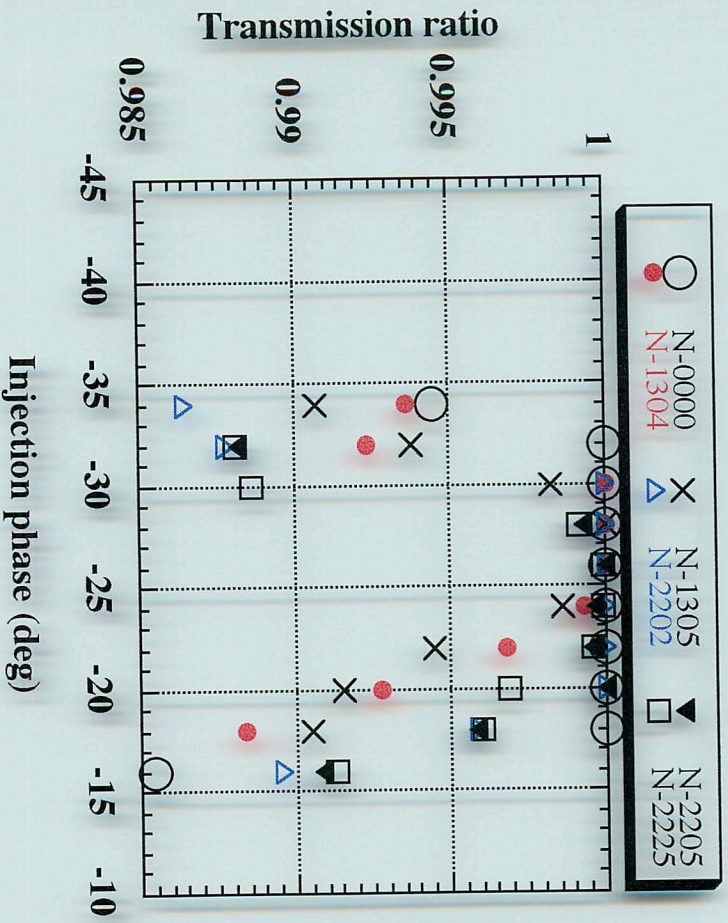


Phase compensation for SDTL each tank-3

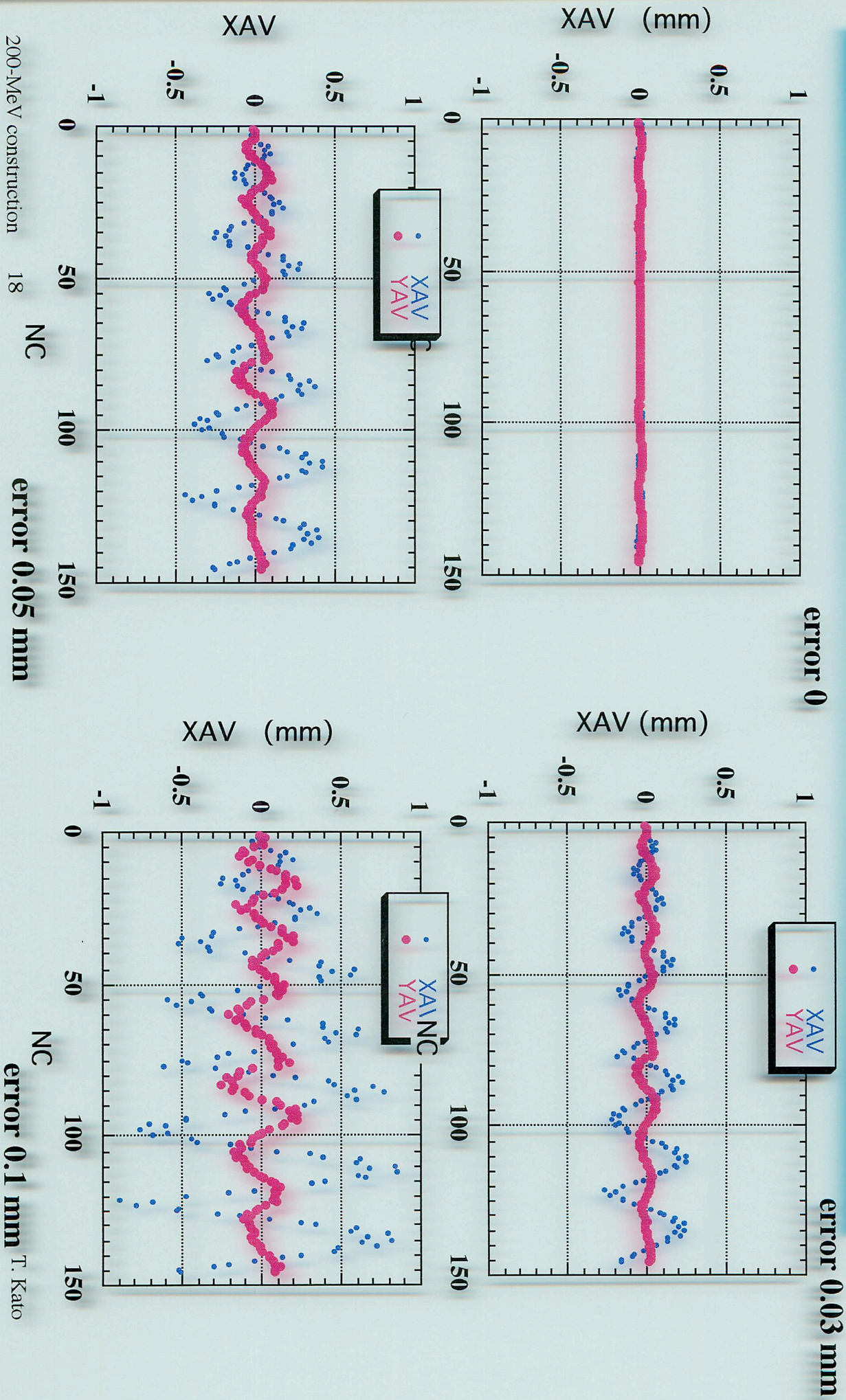


gain=1.5

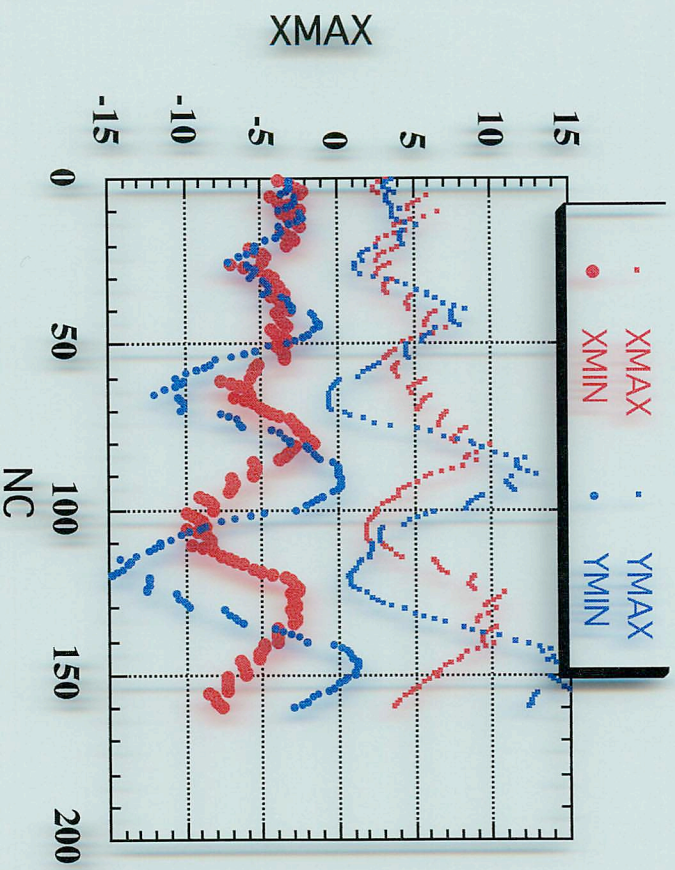
Transmission vs error filed



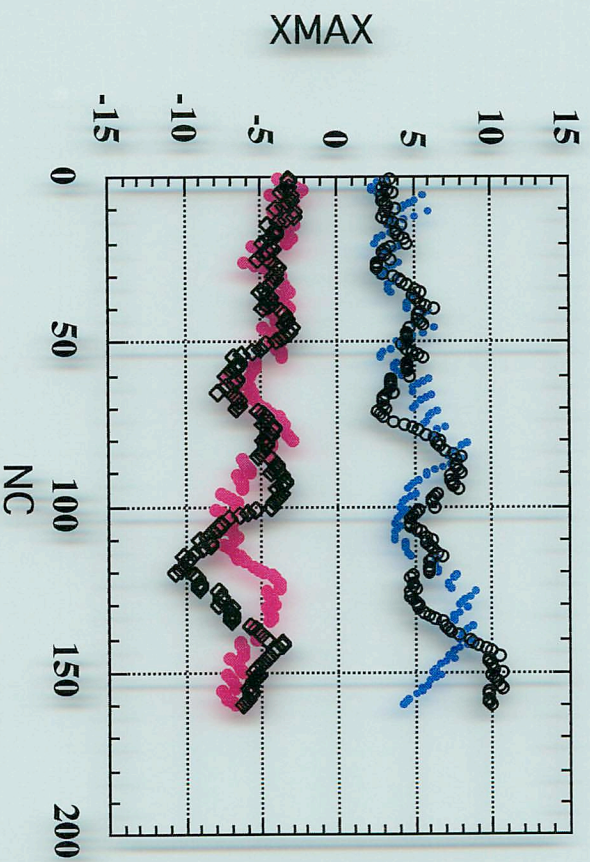
Transverse error in DTL-1



Transverse error in SDTL-1



DTL $d_{xy}=0.05$
SDTL $d_{xy}=0.15$



DTL $d_{xy}=0.05$
SDTL $d_{xy}=0.05$ mm