Beam Fluctuation of High Speed Variably-Polarizing Undulator

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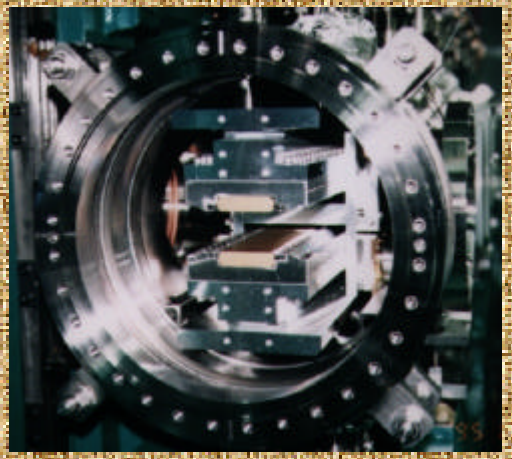
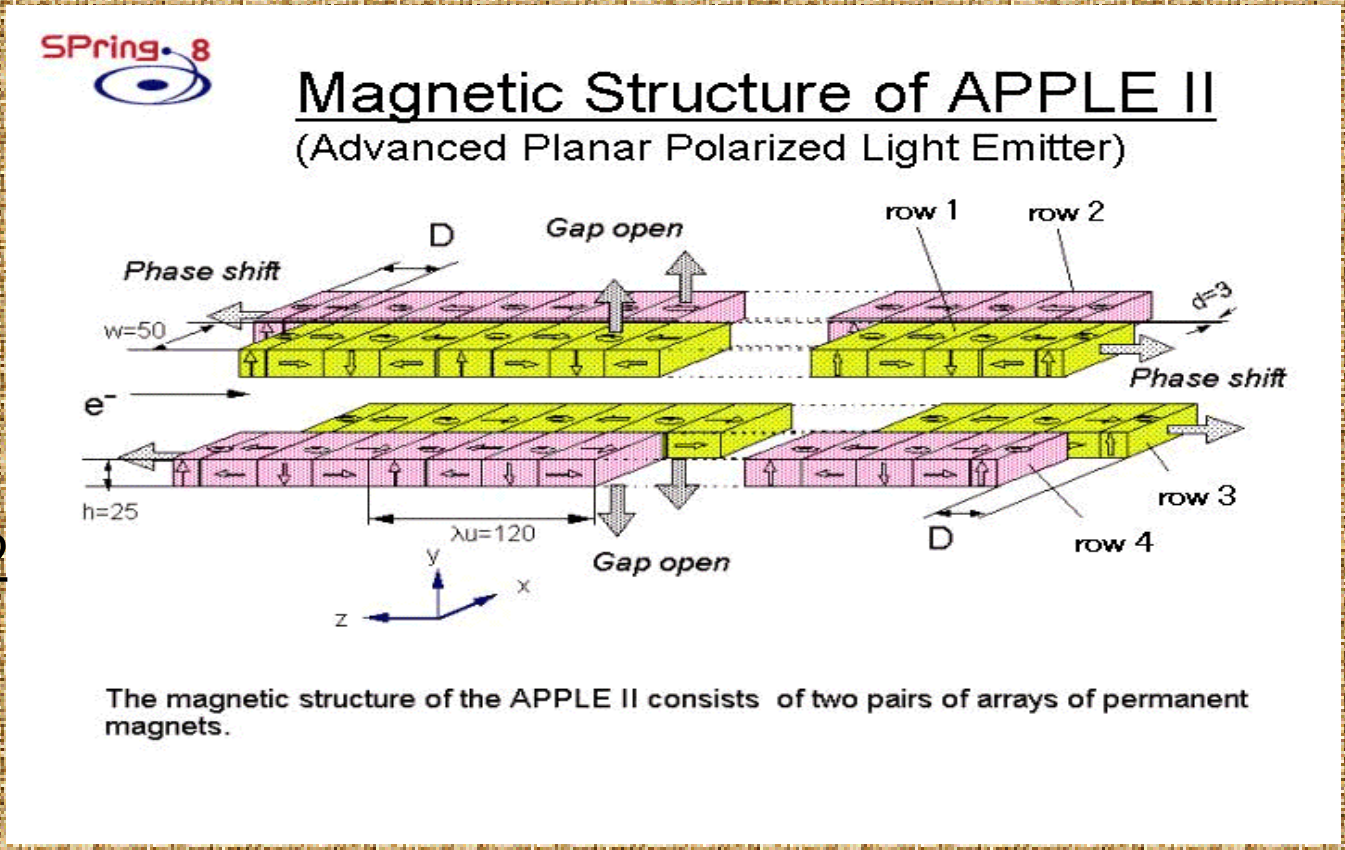
- ID:Insertion Device
- rfBPM: Electron Beam Position Monitor
- XBPM:X-Ray Beam Position Monitor

Type of Insertion Devices



- In-vacuum Undulator (Standard, Hybrid, Vertical)
- Elliptical Wiggler(ID08)
- Helical Undulator(ID25, 40)
- Figure-8 Undulator(ID24, 27)
- Variably-Polarizing Undulator(ID23)
- Revolver Undulator(ID15)

Schematic view of ID23

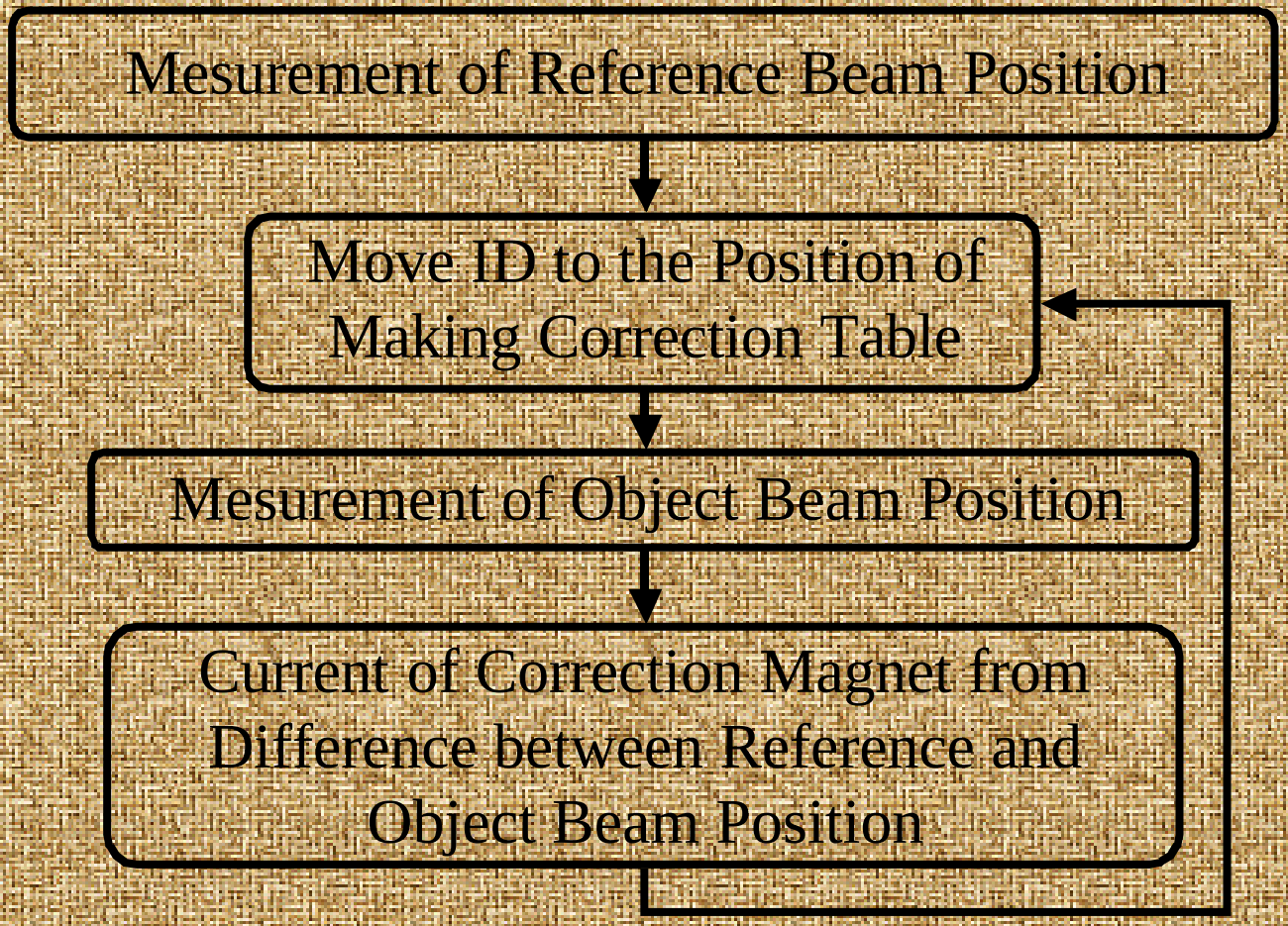


STM2

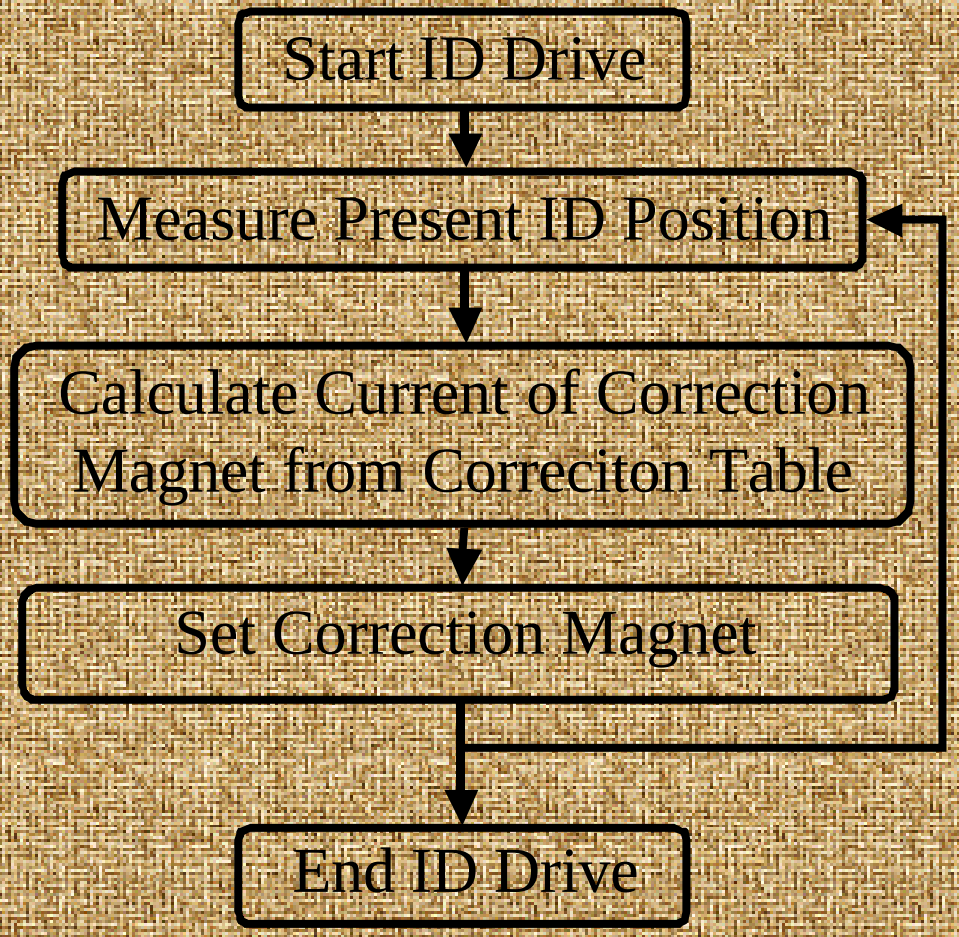
STM3

- Gap Drive 36(25)～300mm, 0.5mm/sec
- Phase Drive -120～120mm, 30mm/sec
- Period of Correction ～25msec

Standard Method of Making Correction Table of ID-Drive



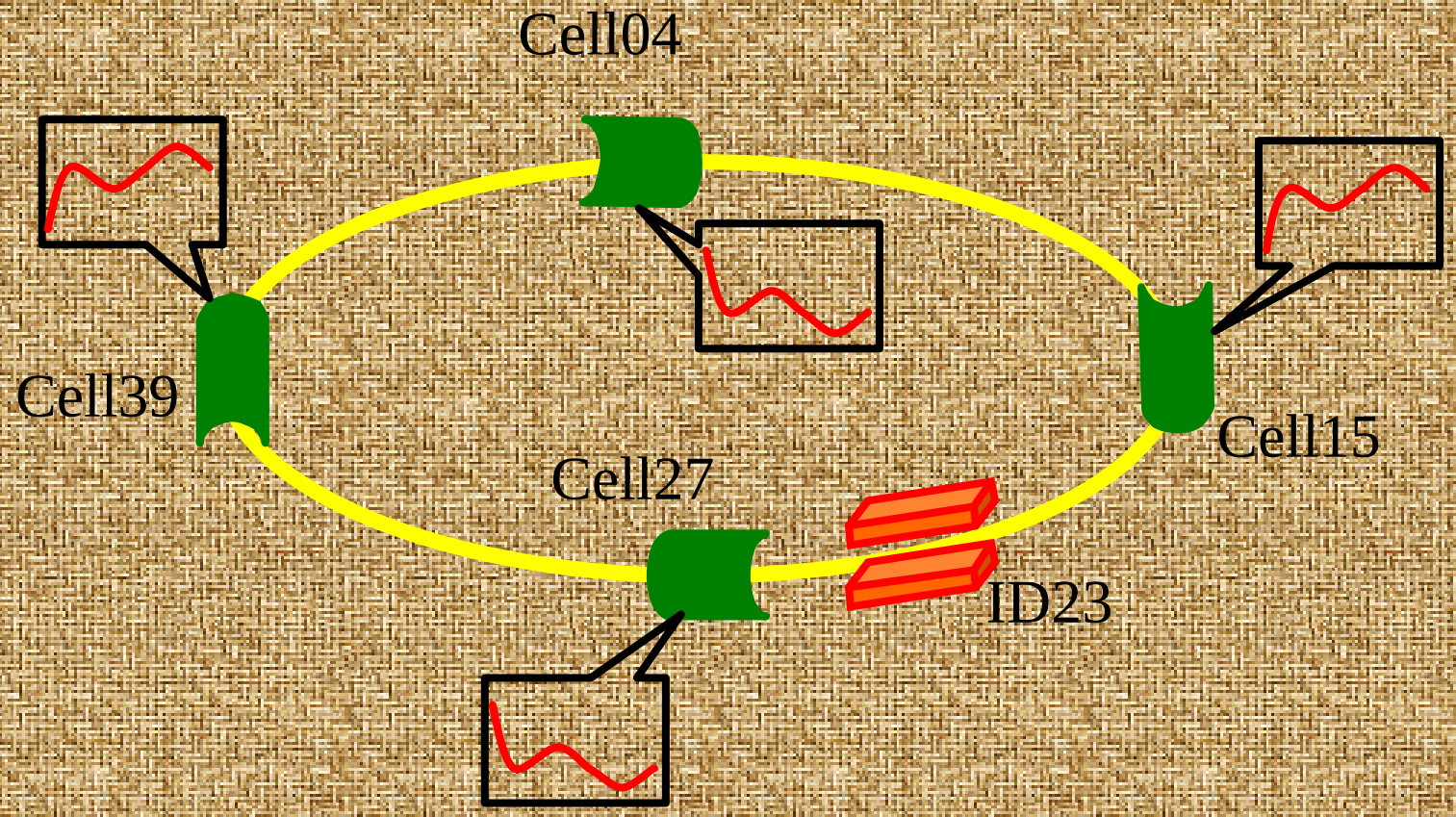
Algorithm of Correction



Beam Condition

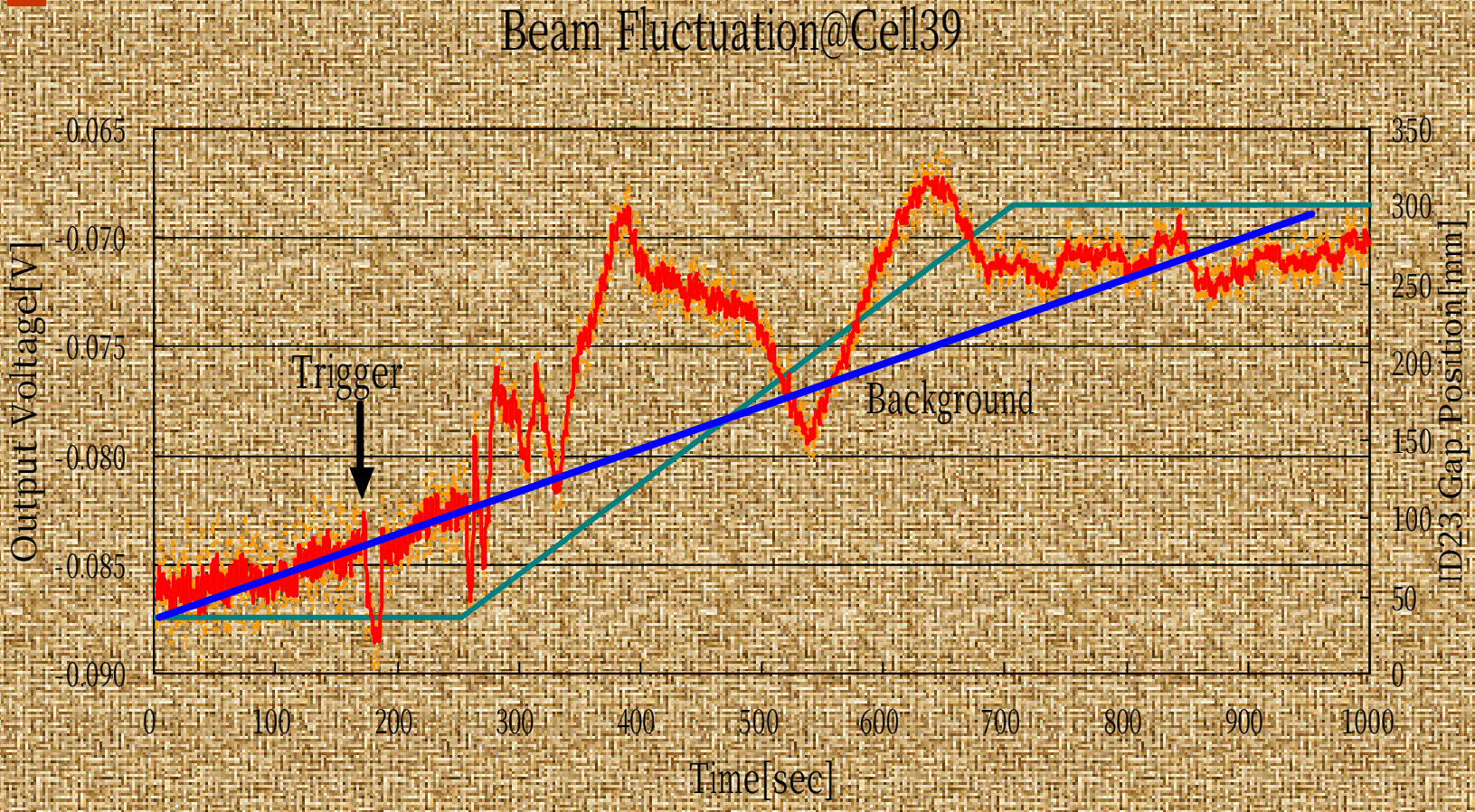
- Ring Current:～100mA
- Filling :Multi Bunch
- Optics :HHLV+4LSS

Measurement

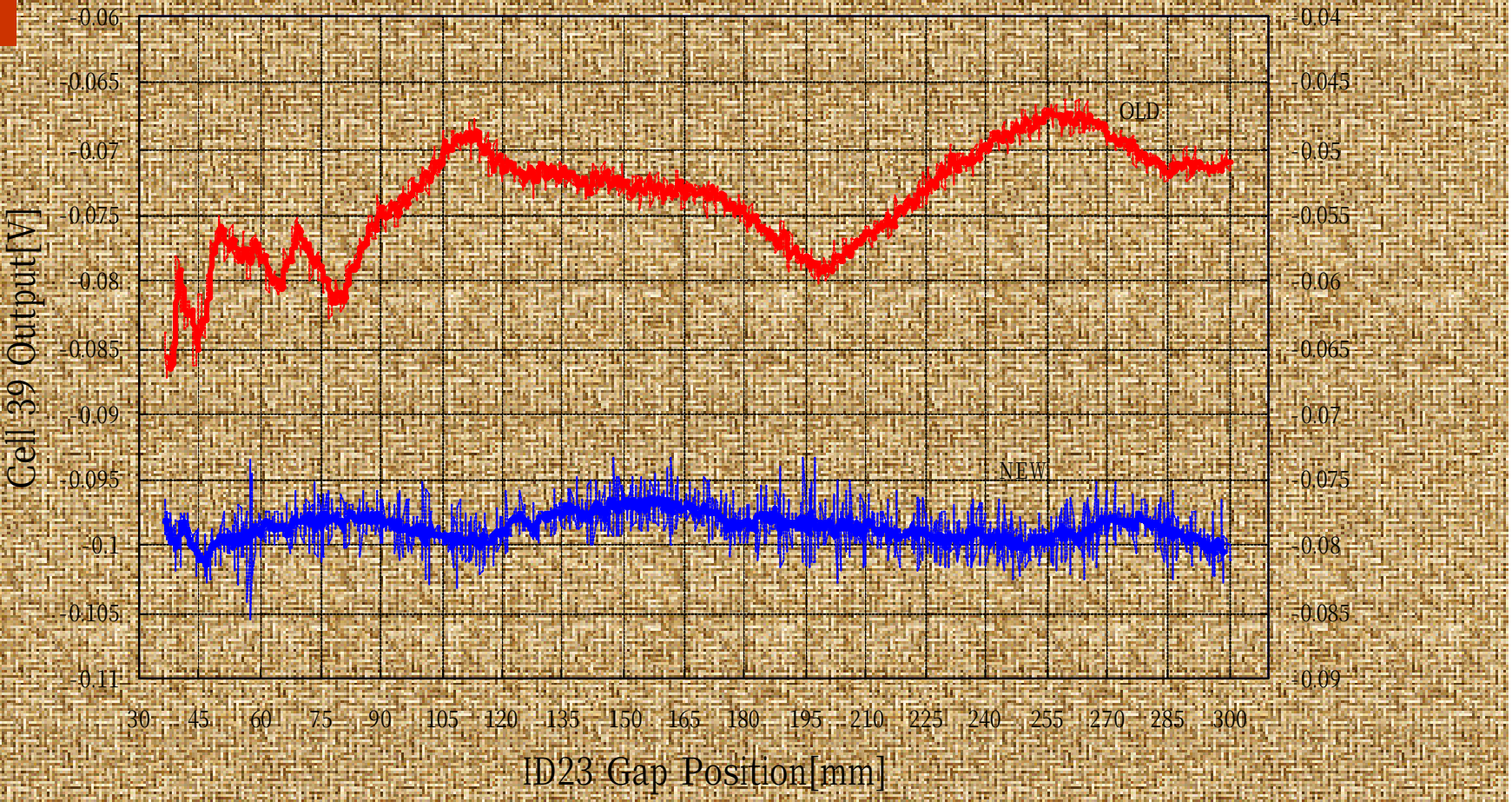


Synchronous Measurement
with Electron Beam Position and ID23 Position by Trigger

Making Correction Table of Gap Drive

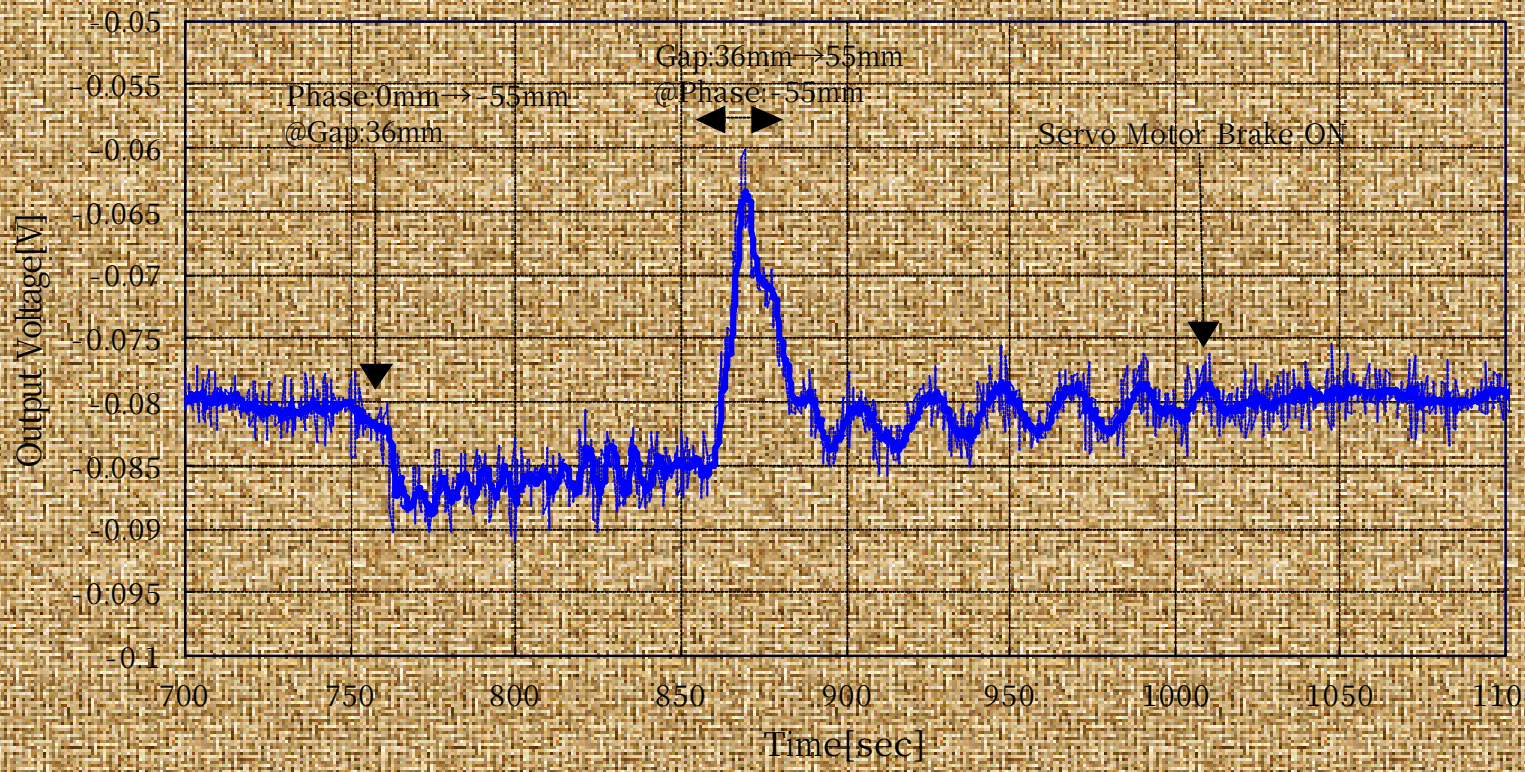


Beam Fluctuation by ID23 Gap @ Cell 39

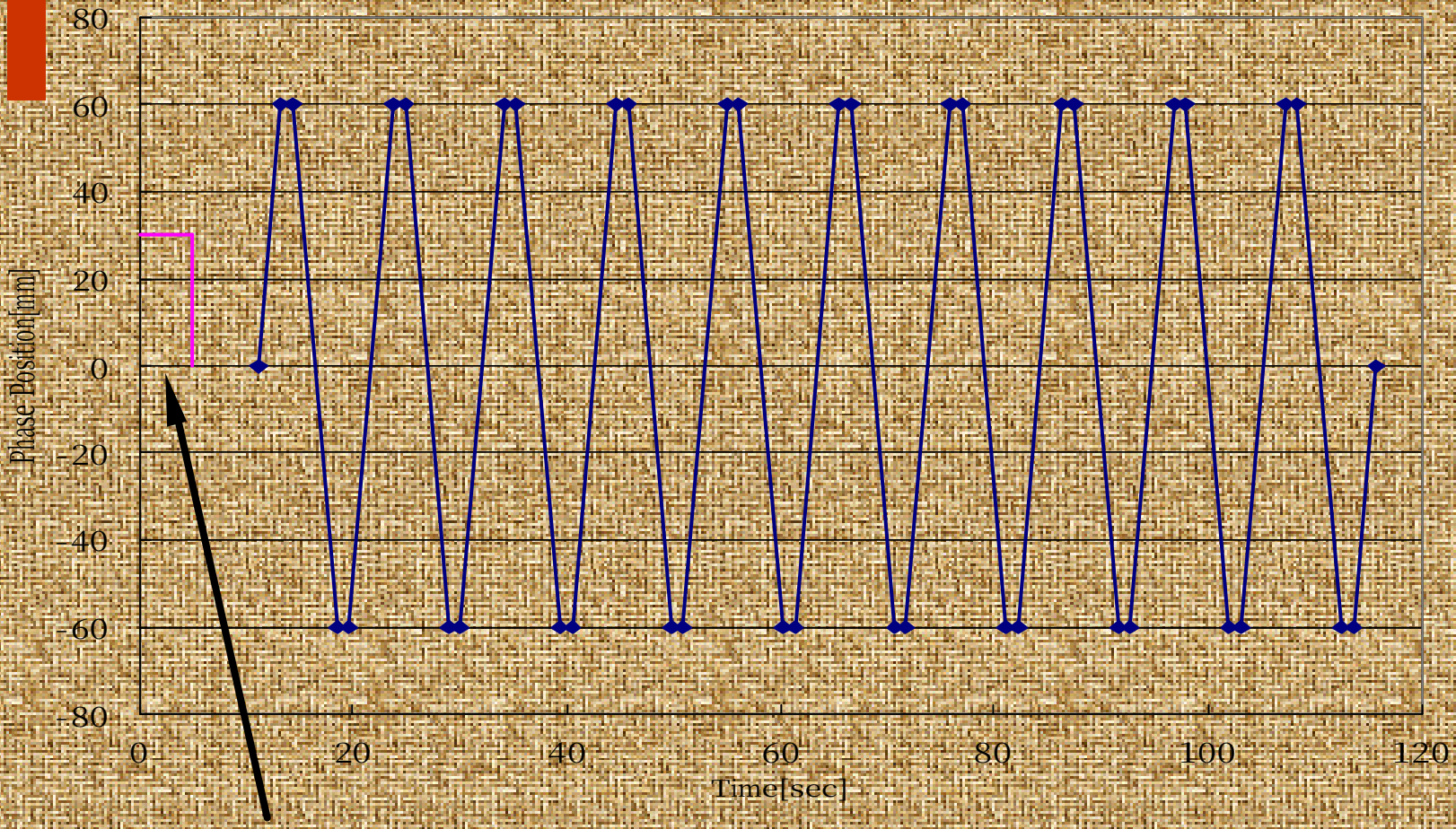


Making Correction Table of Phase Drive

Beam Fluctuation by ID23 Phase @ Cell39



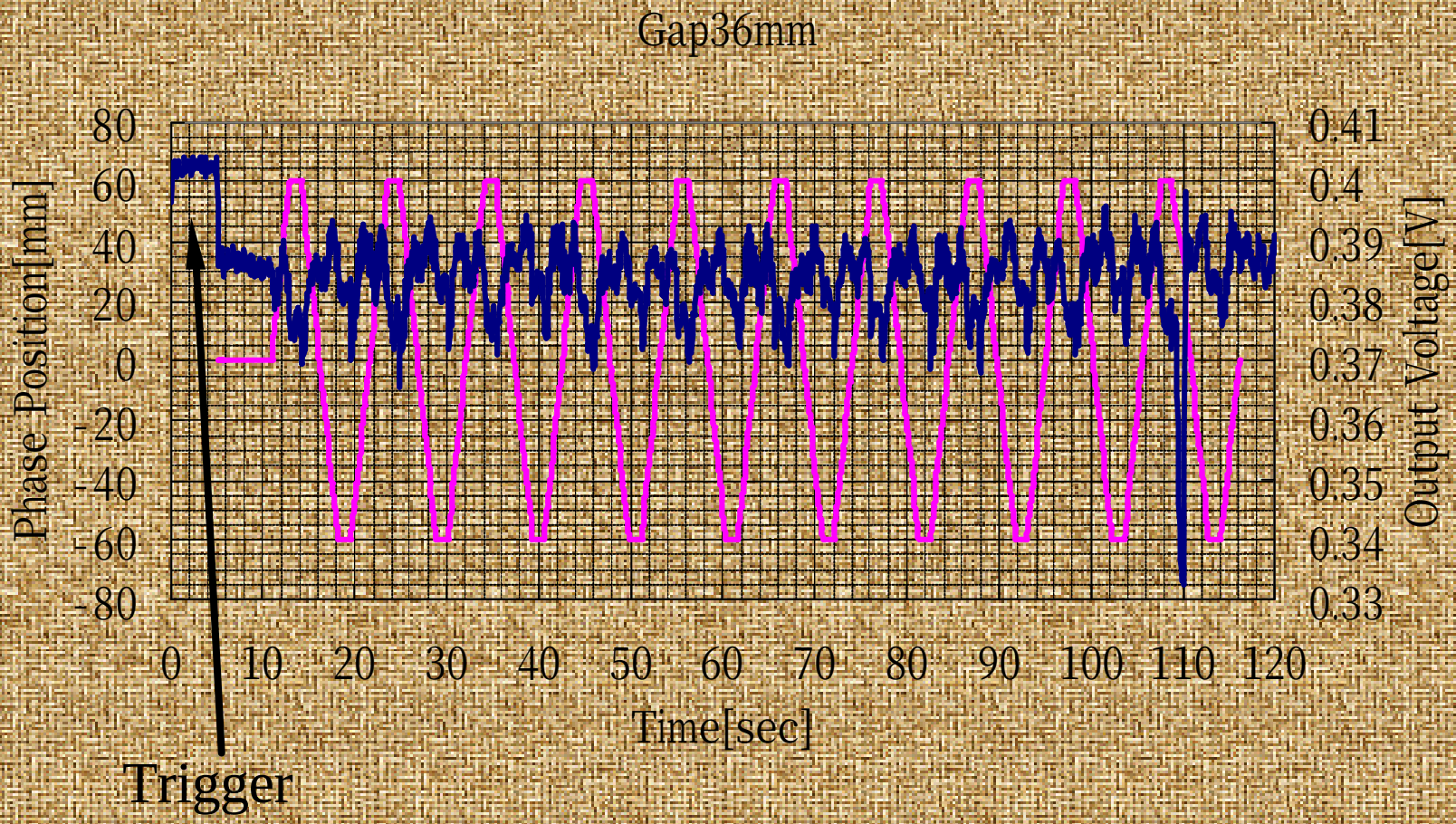
Pattern of Phase Drive



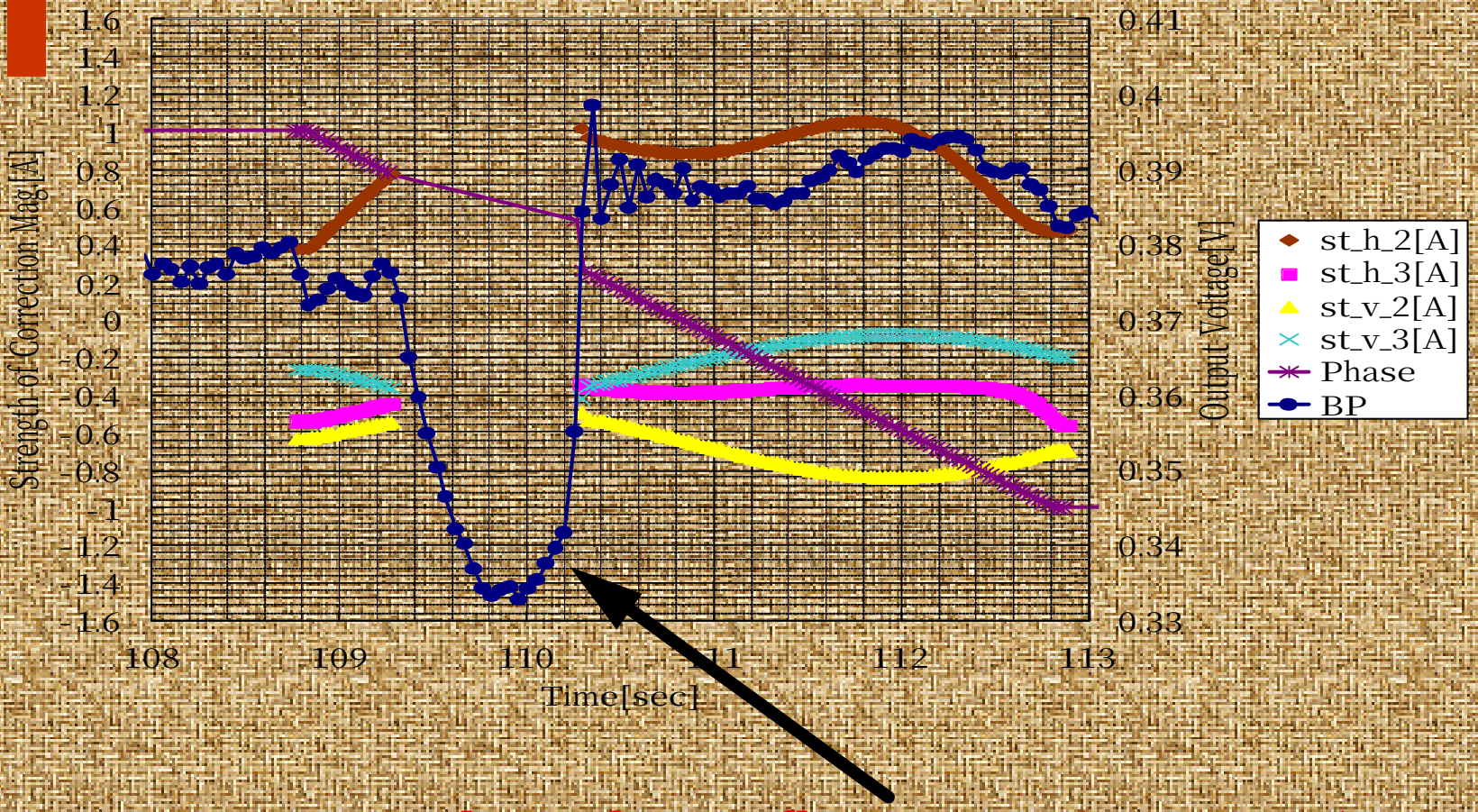
Trigger

※ like user experiments

Beam Fluctuation by ID23 Phase Drive

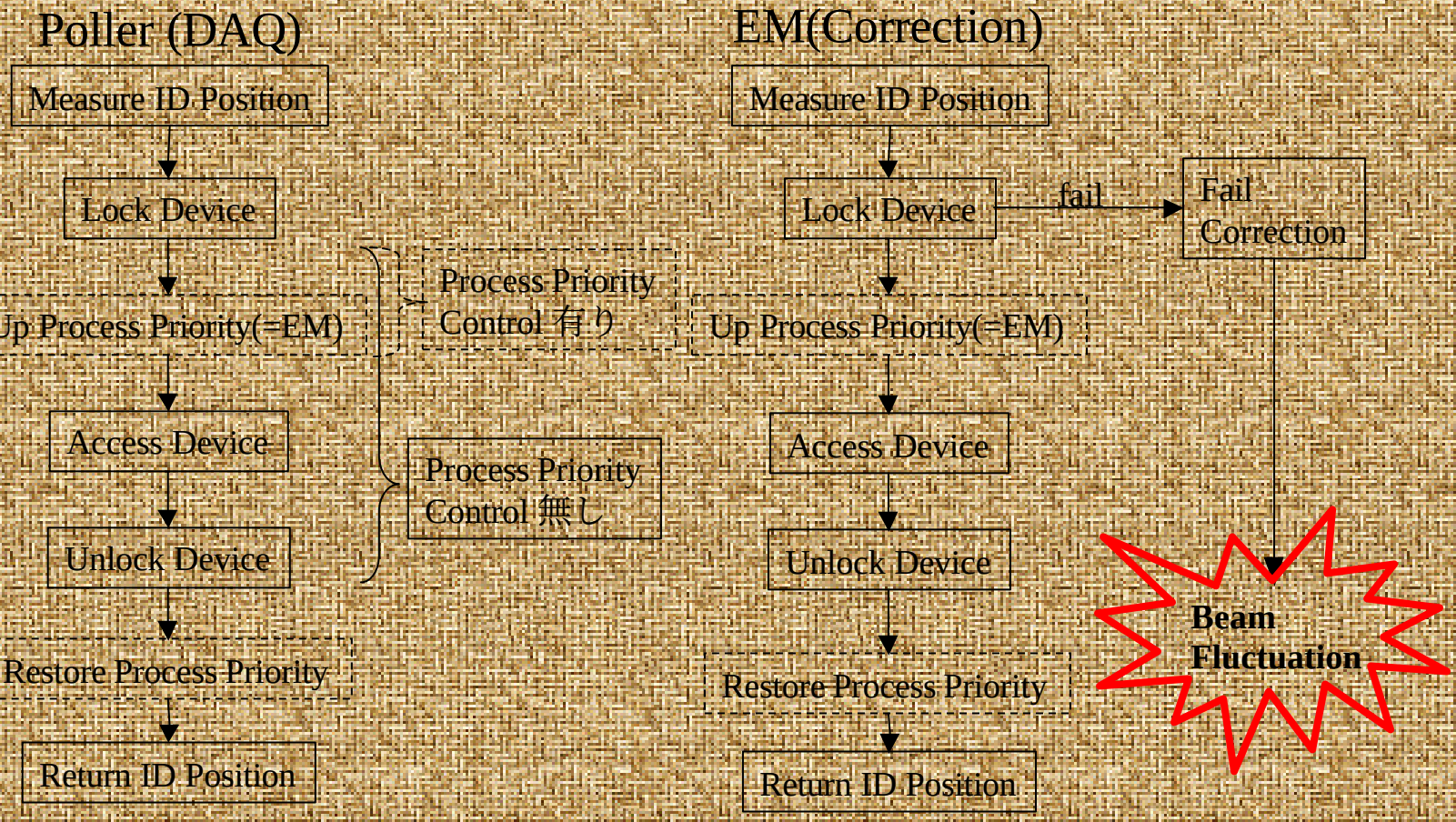


Problem of Software Confliction



large beam fluctuation(~70 μm)

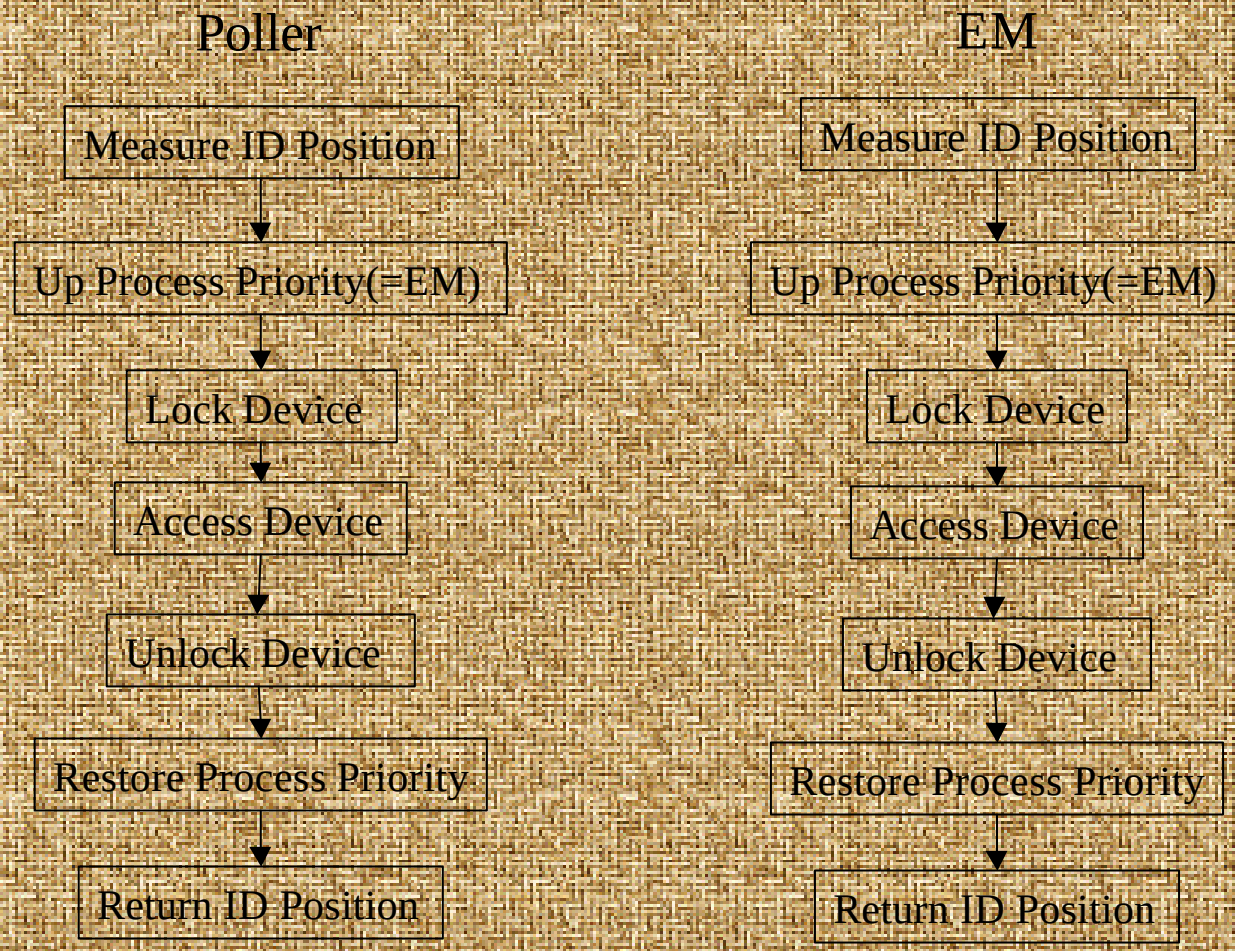
Before



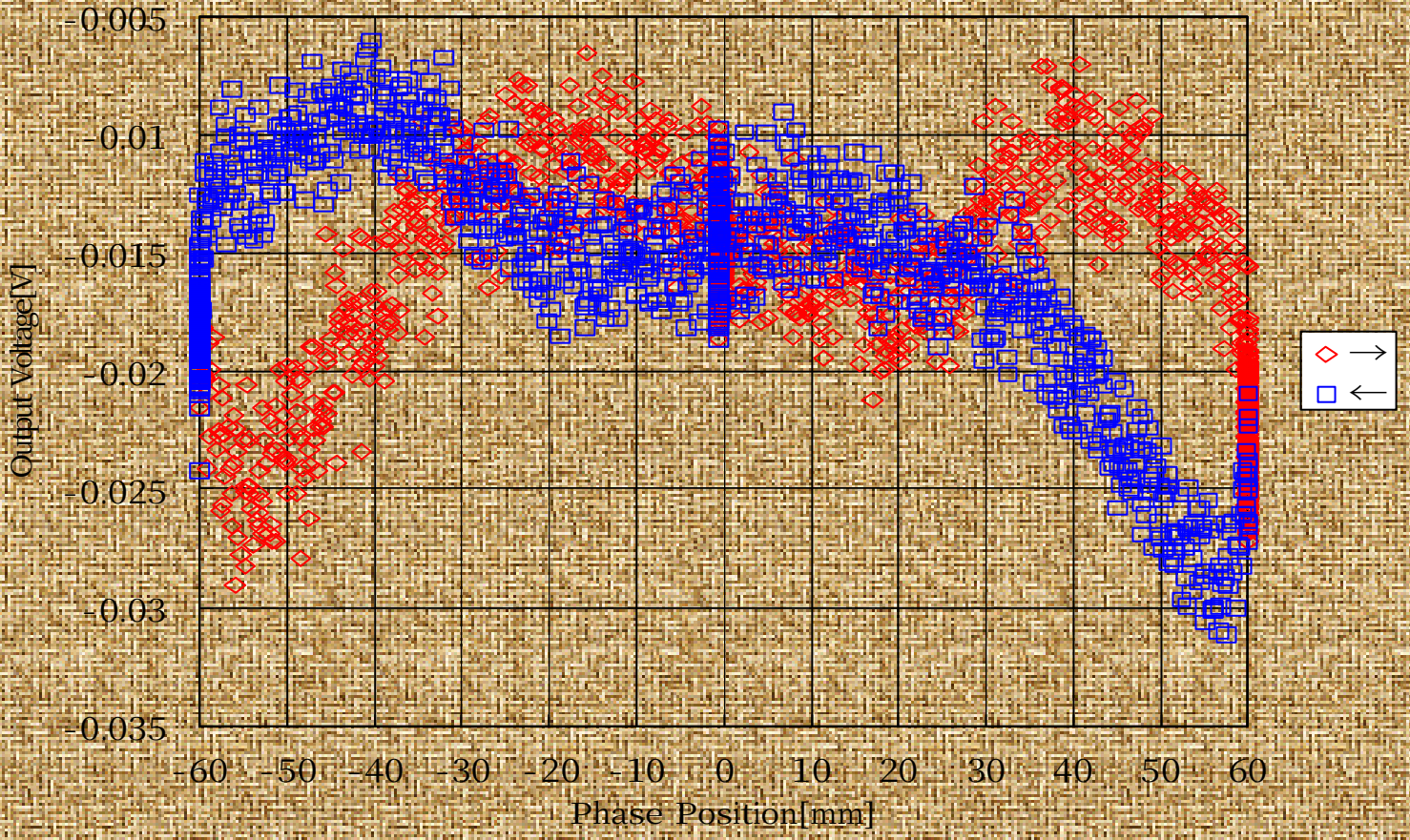
If it is happened the task switch from Poller to EM between },

- EM can't lock the device as it is already locked.
- Poller can't go to the next step until EM switches task.

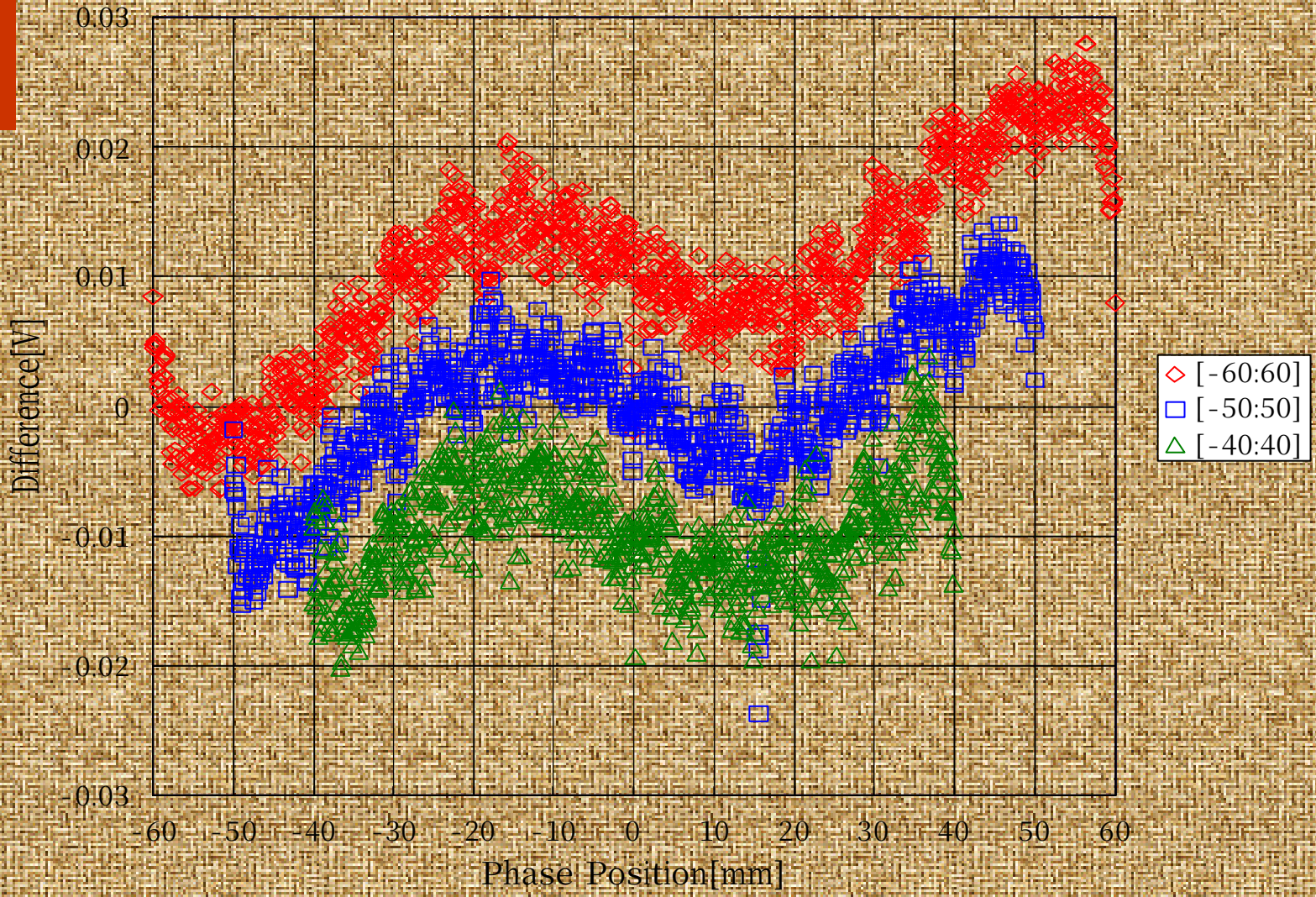
After


Poller
Measure ID Position
Up Process Priority(=EM)
Lock Device
Access Device
Unlock Device
Restore Process Priority
Return ID Position
EM
Measure ID Position
Up Process Priority(=EM)
Lock Device
Access Device
Unlock Device
Restore Process Priority
Return ID Position

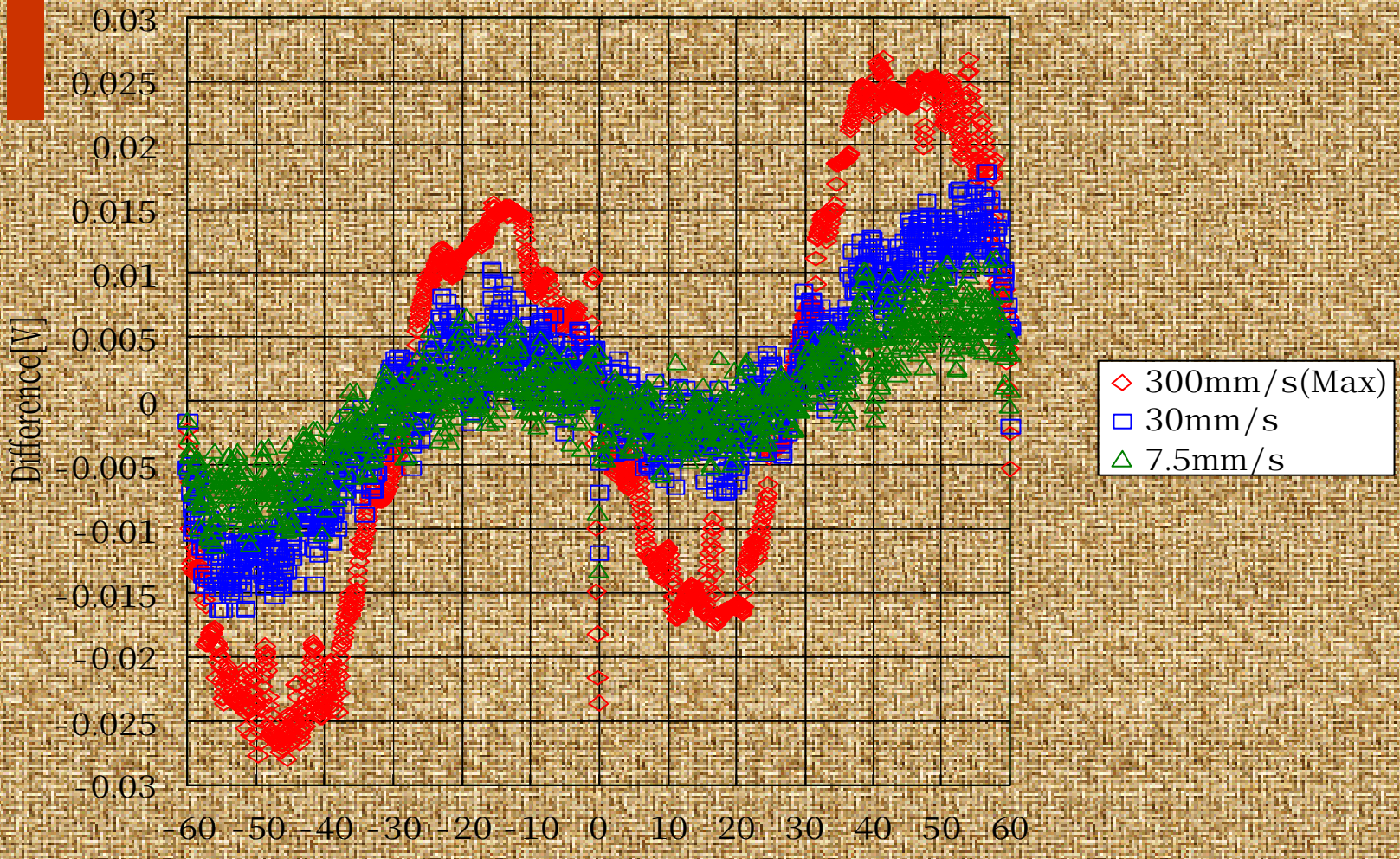
Beam Fluctuation dependent on Drive Direction



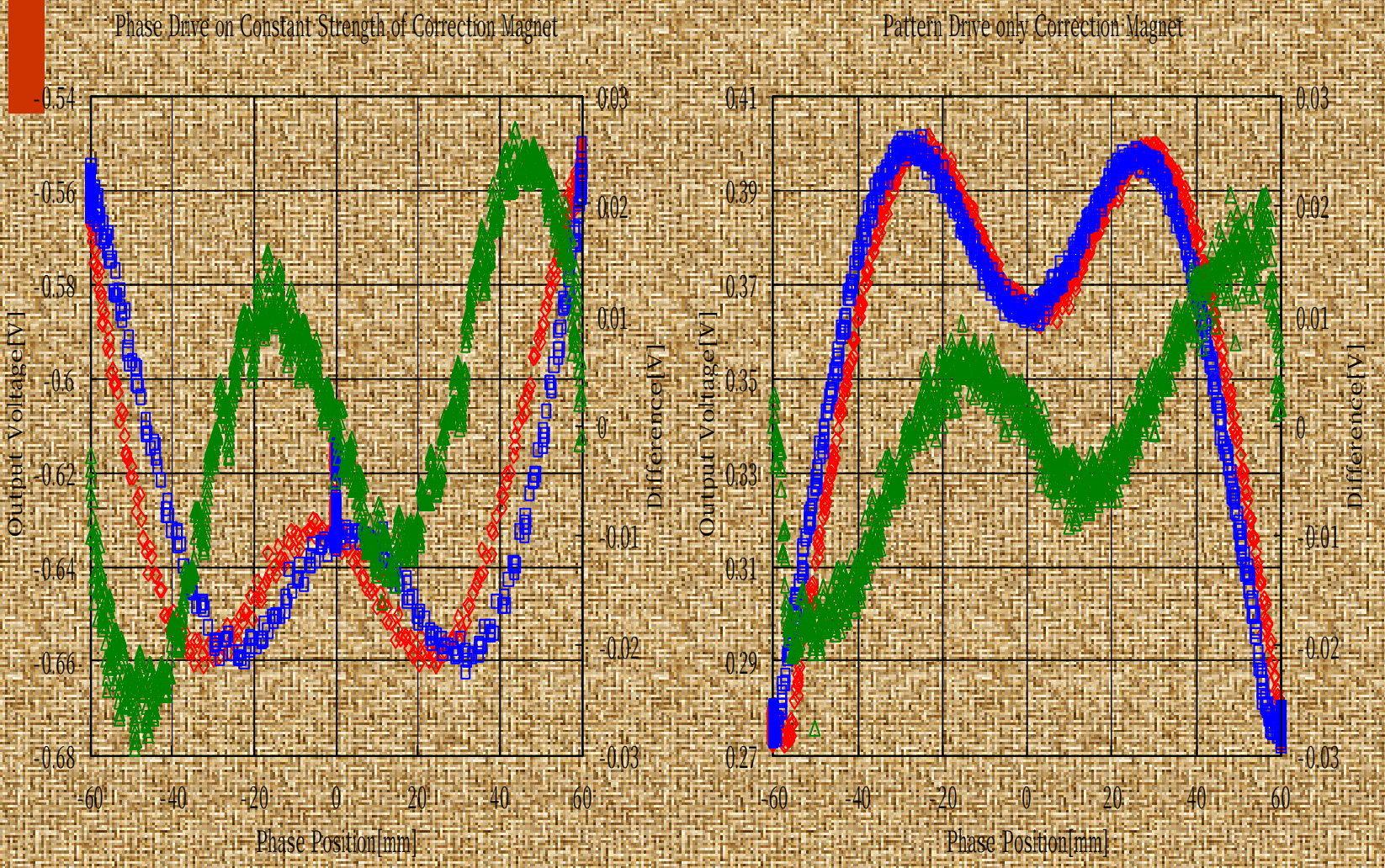
Difference in Drive Range



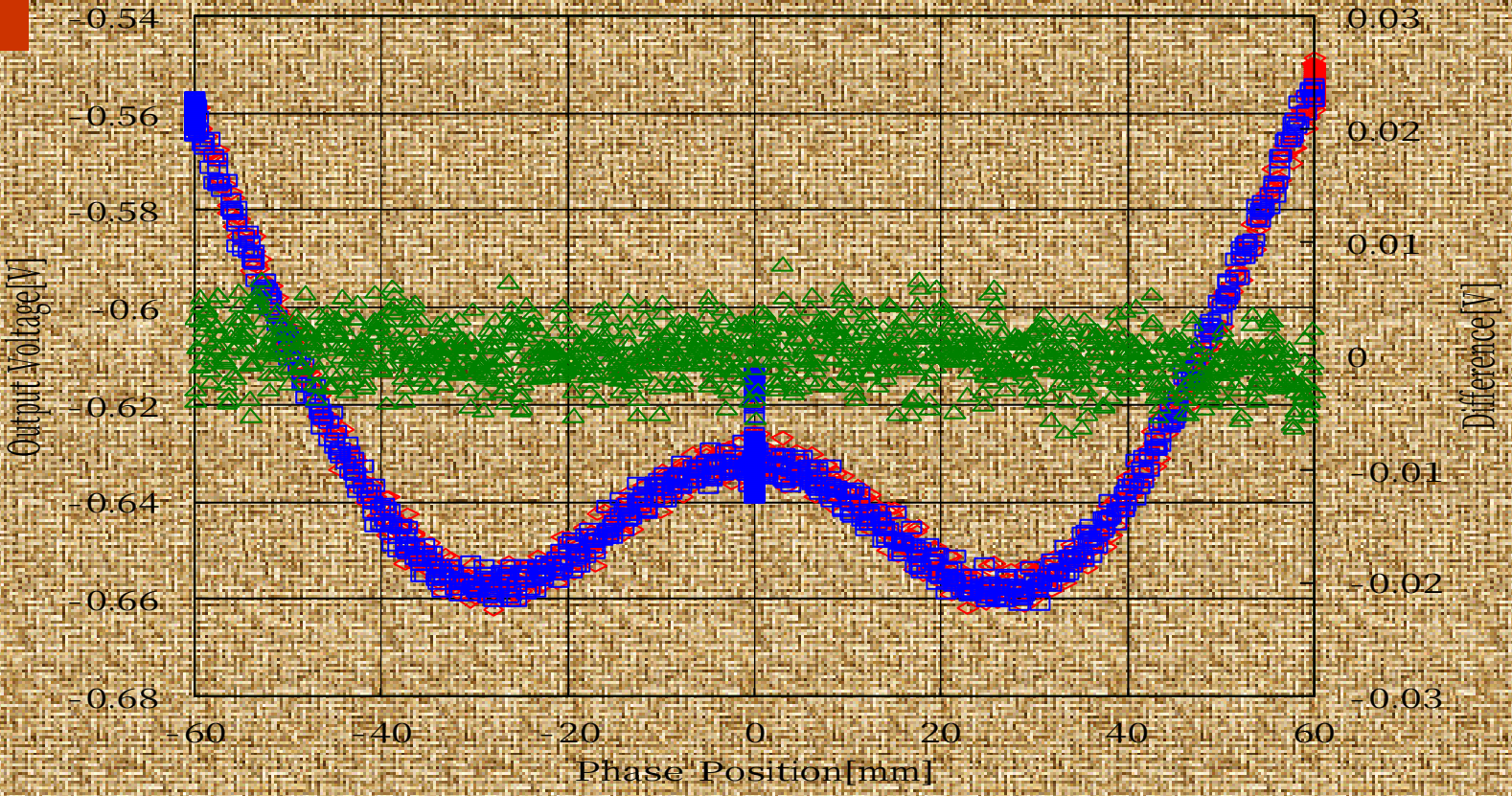
Difference in Drive Speed



Difference in Instruments

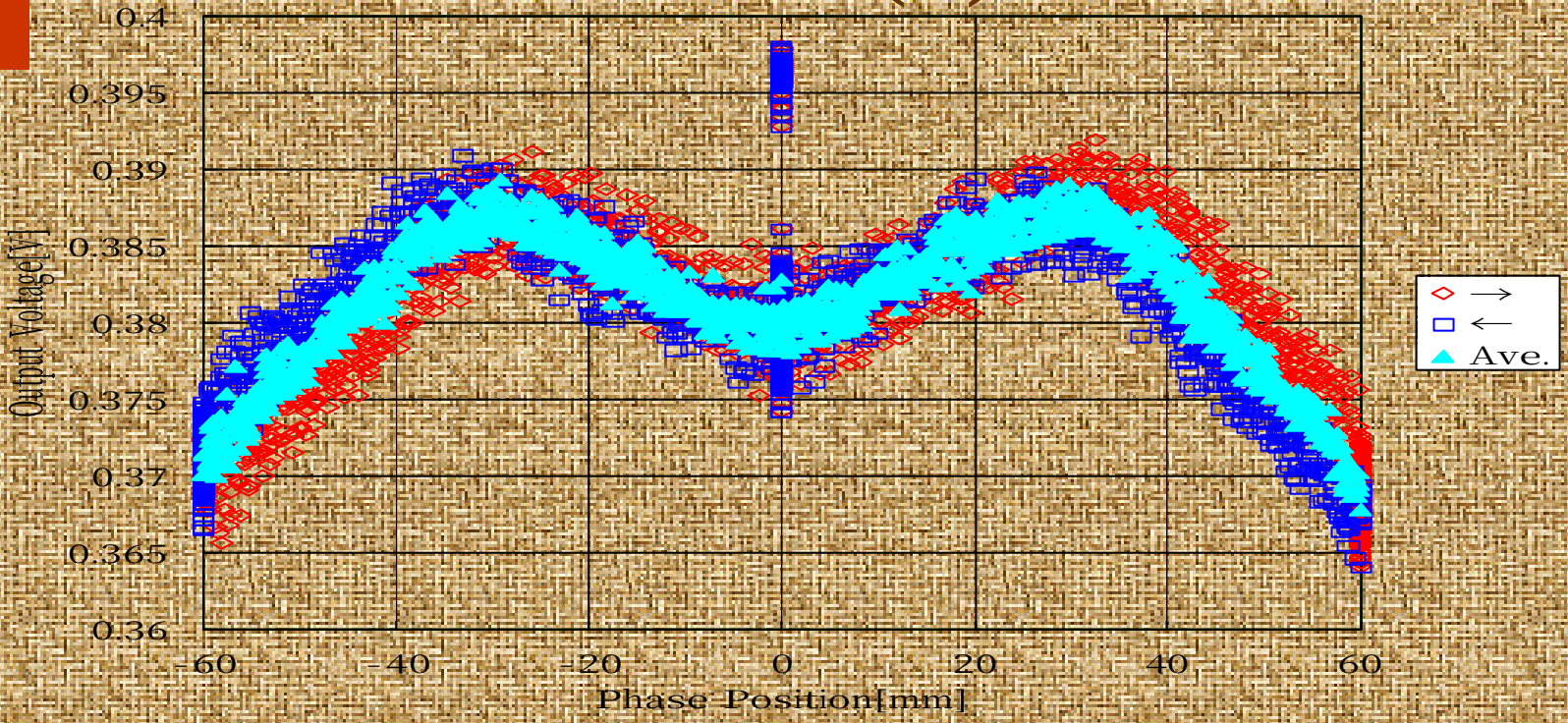


Making of Correction Table (1)



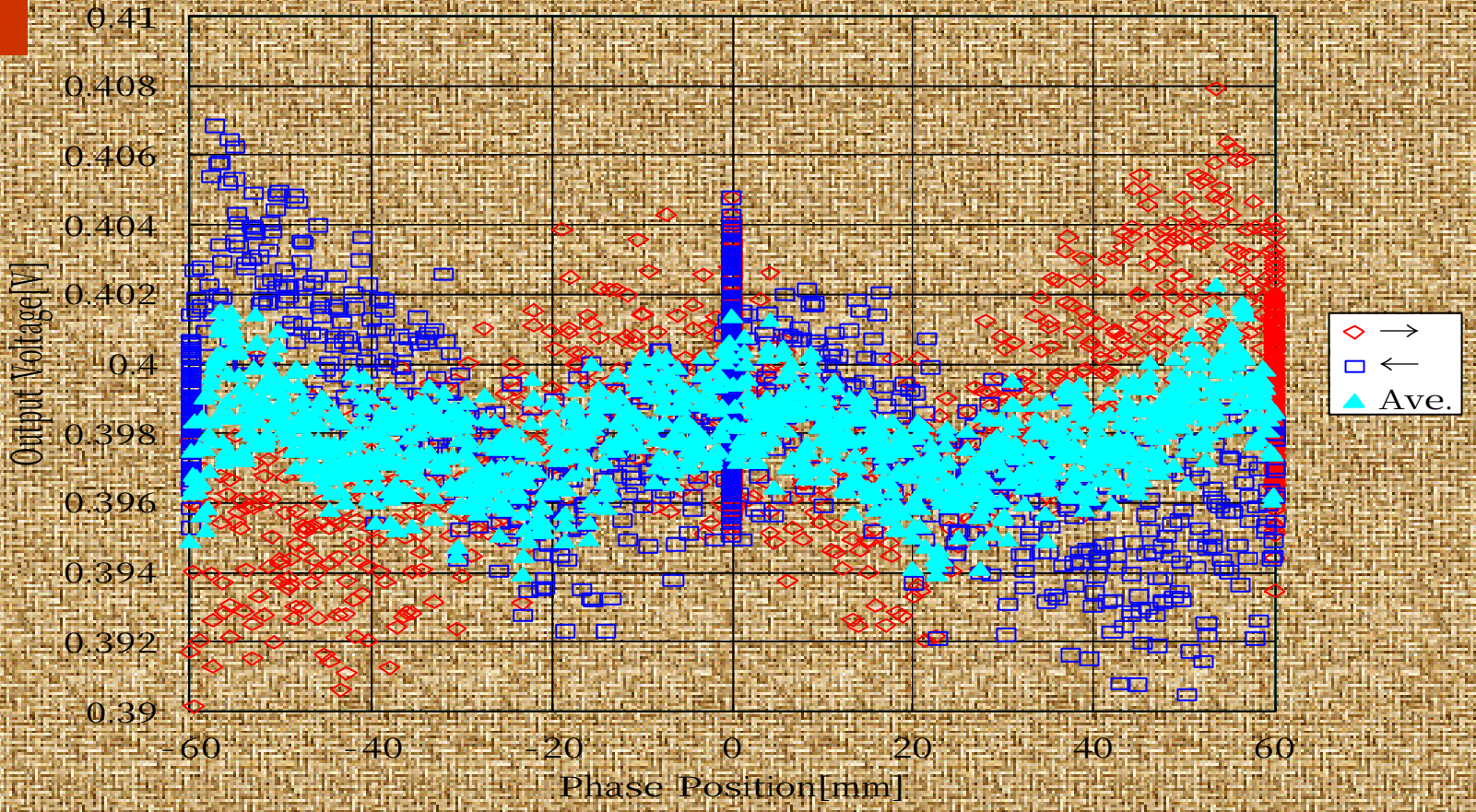
Slow Drive (15mm/sec)

Making of Correction Table (2)



Normal Speed Drive (30mm/sec) using Correction Table (1)

Making of Correction Table(3)



Summary

- 蓄積リングアーク部のBPMを使用して、ID23駆動時の軌道変動を観測した。
- Cell04とCell39のrfBPMデータを使用して作成した補正テーブルを用いてPhase=0(直線偏光)でギャップ駆動を行った結果、水平方向の軌道変動が、以前は15μm程度あったものが、~5μm以下（ほとんど測定不能）になった。
- 非同期に表れる大きな軌道変動は、ソフトウェアの競合によって発生していることが判明したので、ソフトウェアを改修することによって対処した。
- 位相駆動と同期した軌道変動は、位相駆動の方向に依存した変動を示したので、これを踏まえた補正励磁テーブル作成方法を考案した。

Remaining Task