# PRISM RF R&D and phase rotation simulation

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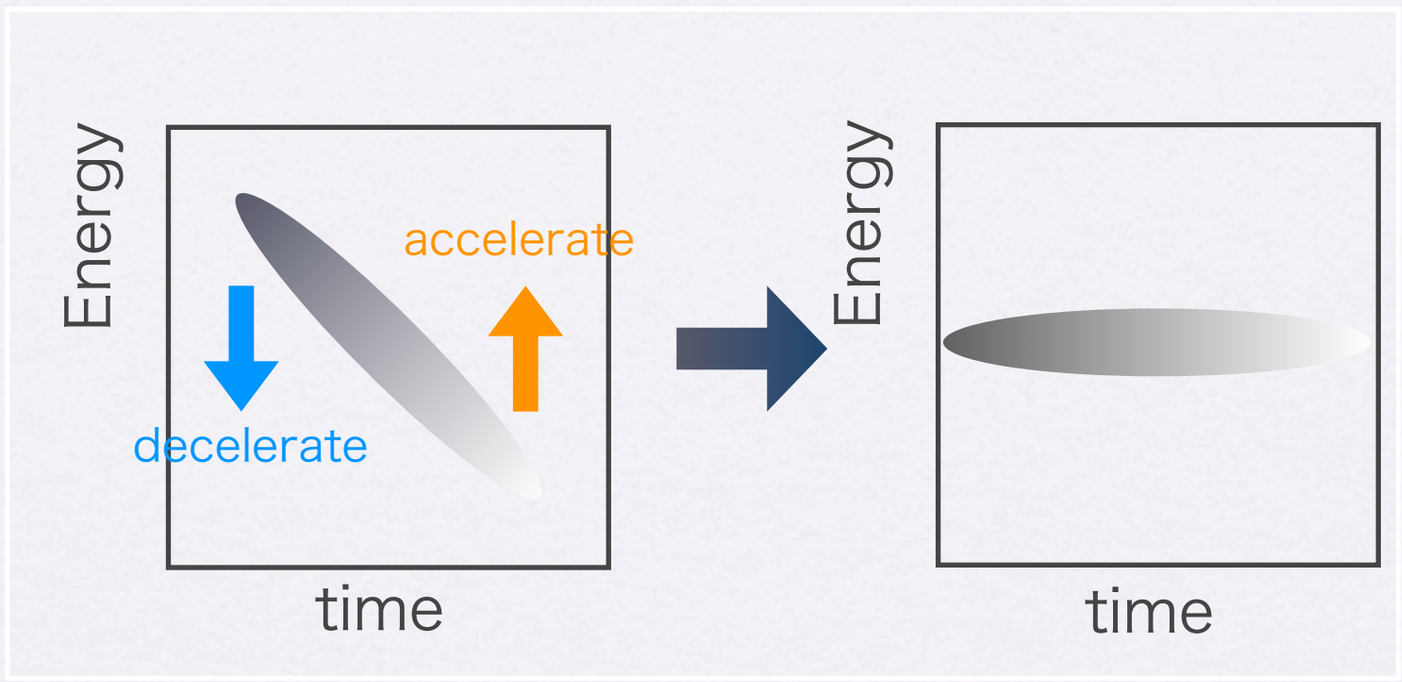
# Requirements of PRISM RF

- Ultra High Field Gradient

  150kV/m ~ 200kV/m

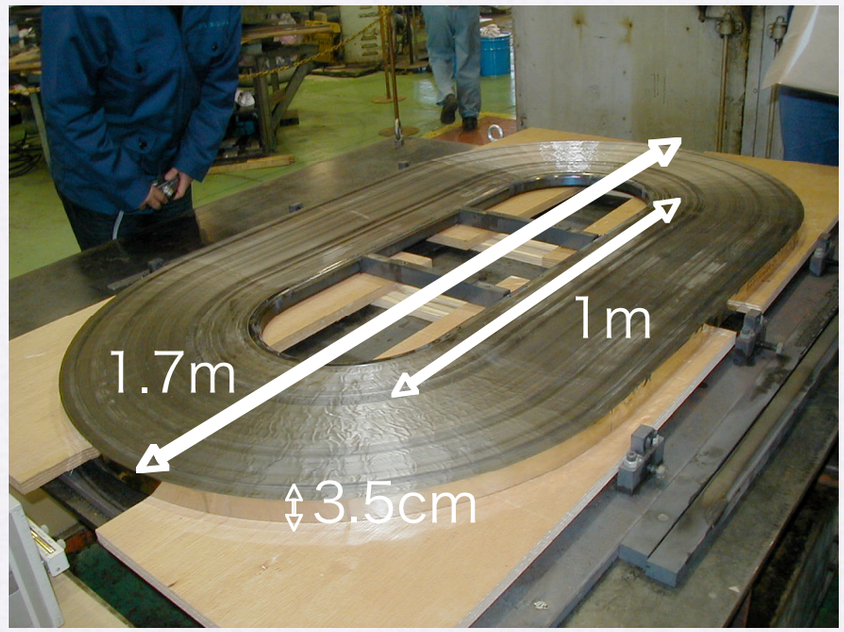
- Compact Cavity

- High Gap Voltage



# PRISM RF System Design

- 8 sections in PRISM-FFAG ring
- Cavity
  - Length: 1.75m
  - Shunt Impedance: 0.9kΩ/gap
- 5 gaps /cavity
- 6 magnetic alloy cores /gap
- 2 tetrode tubes /gap (push-pull)
- RF frequency: ~5MHz
- Duty < 0.1%
- Air cooling

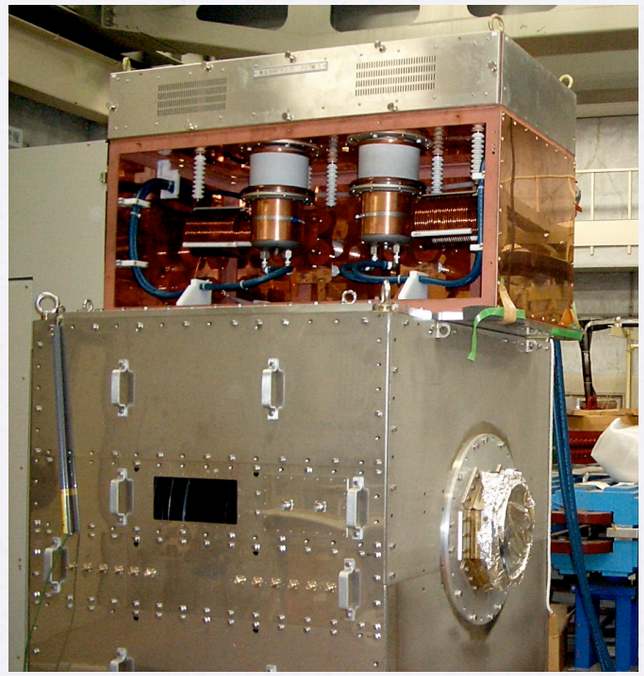



PRISM MA core

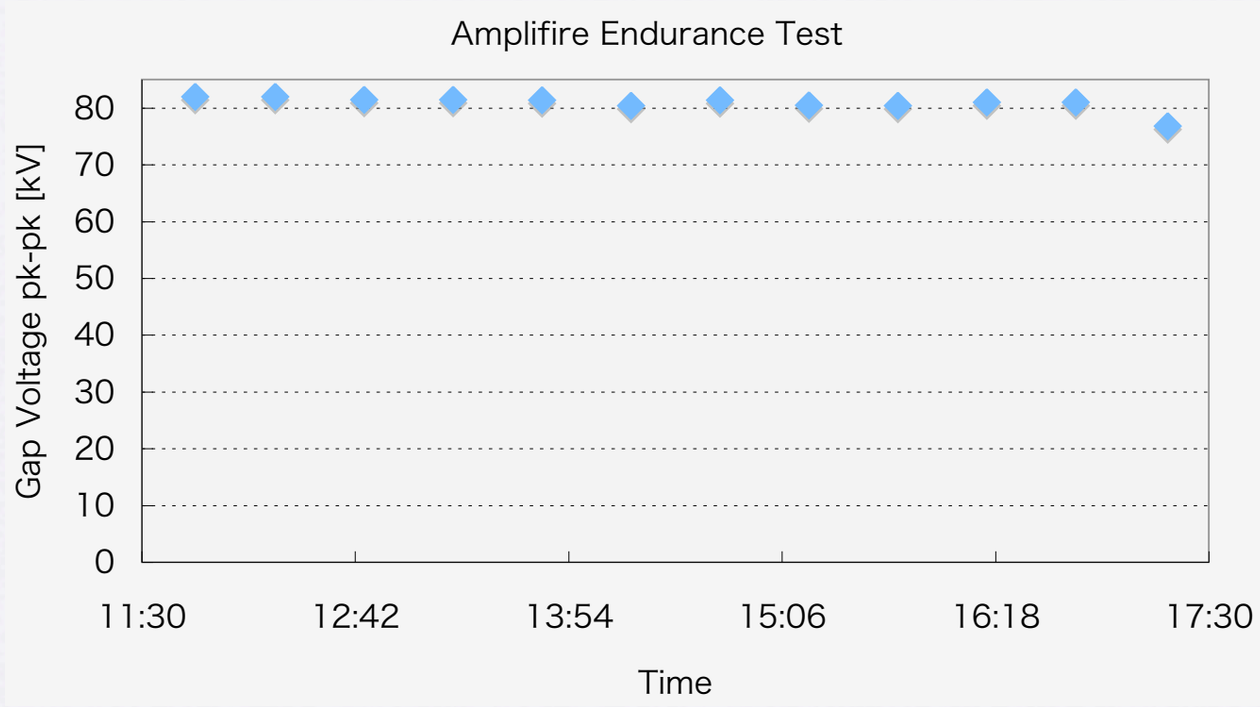
# RF Amplifier Test

- Test RF system consists of
  - RF Amp.
  - PS.
  - Test Cavity

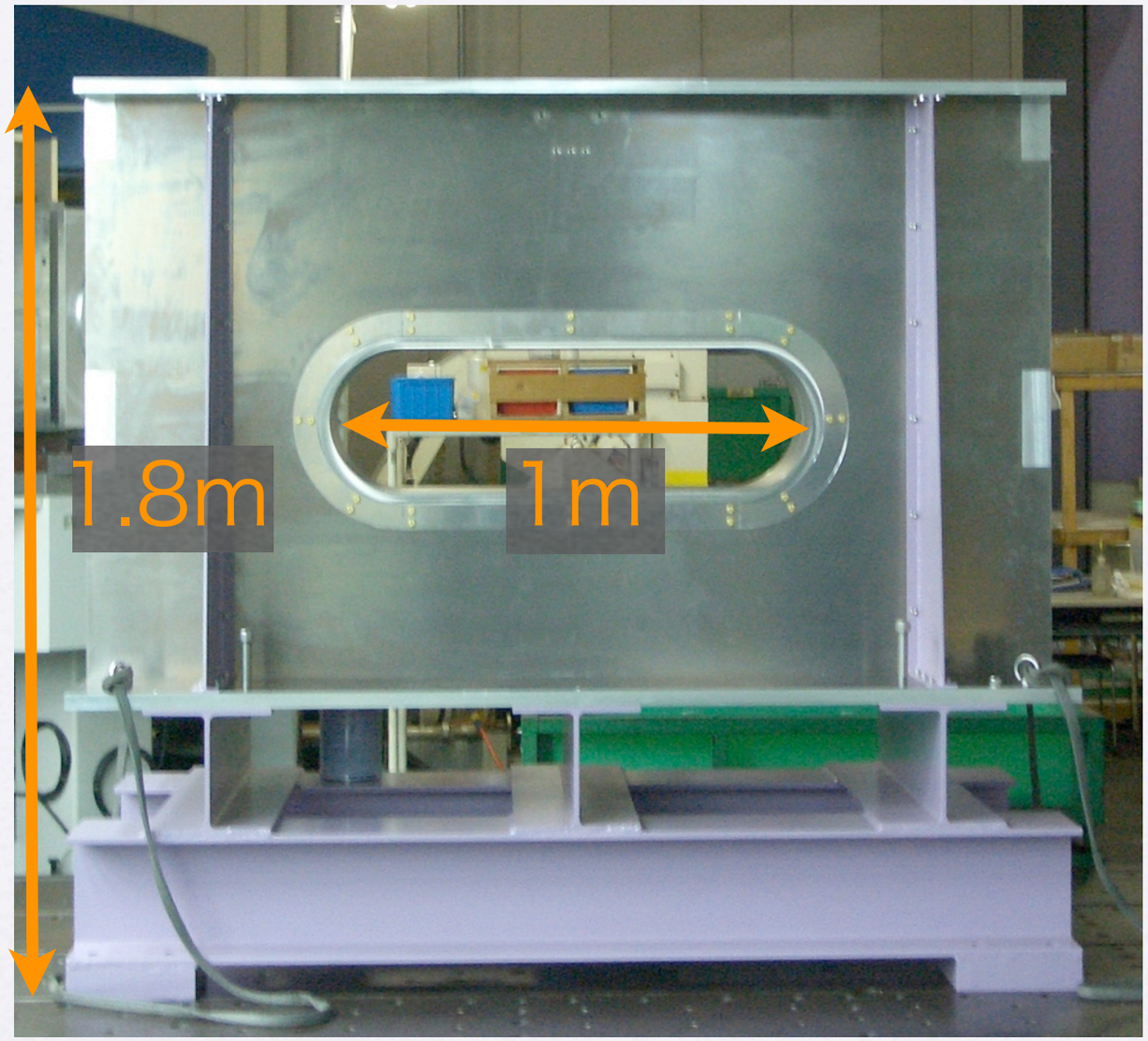
  (1gap, shunt Impedance 700Ω)
- Achieved 43 kV gap voltage
  (Design Goal)
- Endurance Test
  - Repetition :100Hz
  - Burst length : 30 $\mu$sec
  - Over 6 hours

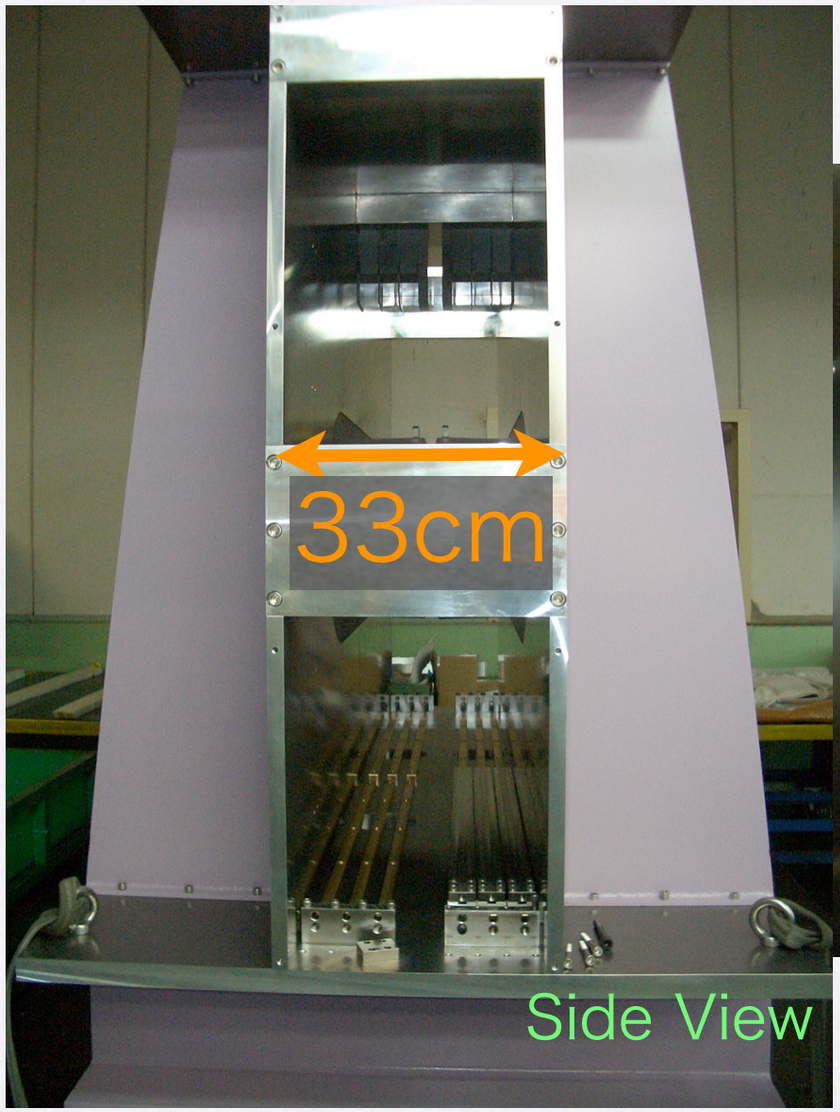


Amp. & Test Cavity



# PRISM RF Cavity





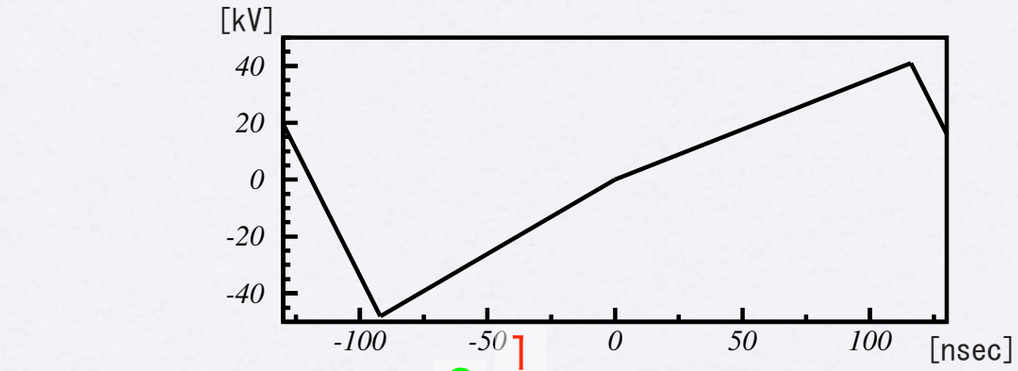
- 1 gap, Length 33cm, 6 MA cores, 2cm gap

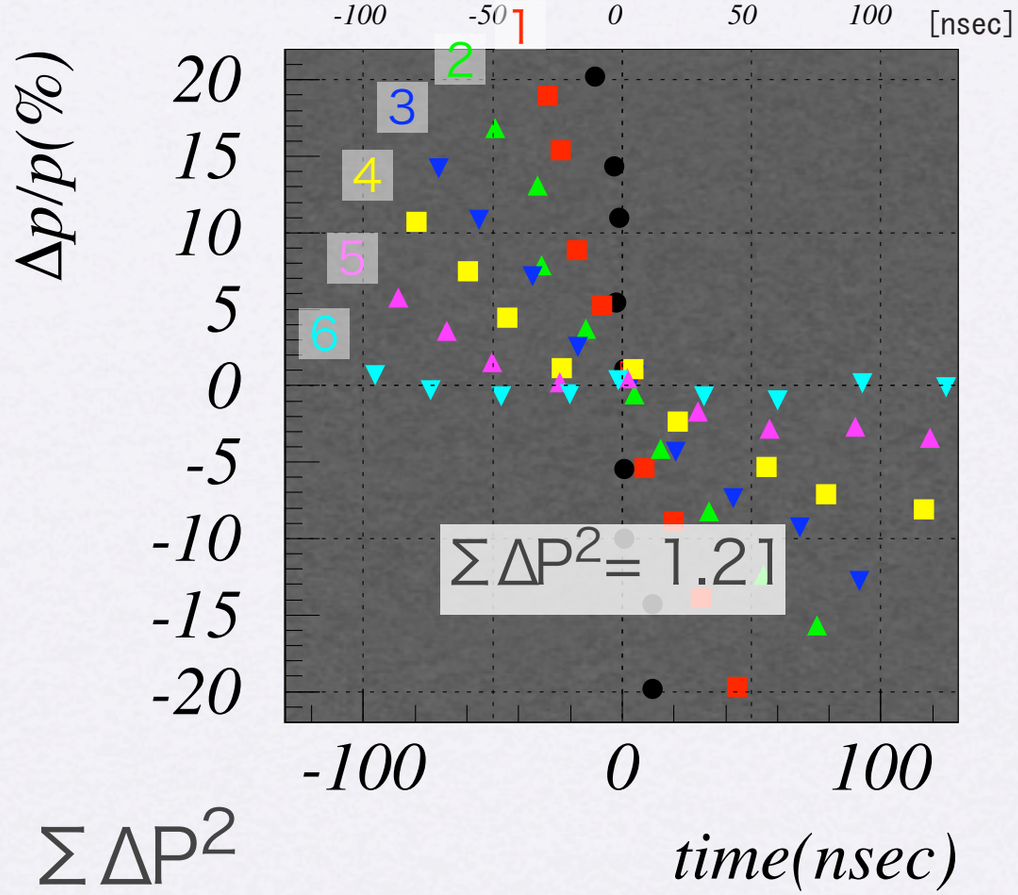
# Phase Rotation Simulation

*Simulation condition*

- Injected muon
  - 10m TOF
  - ±20% momentum spread
- FFAG ring
  - w/ TOSCA Magnet Field
- RF
  - 8 sections * 5 gaps = 40 gaps
  - 45 kV/gap (Total 1,800 kV)
- Parameter Search for Minimum $\Sigma \Delta P^2$

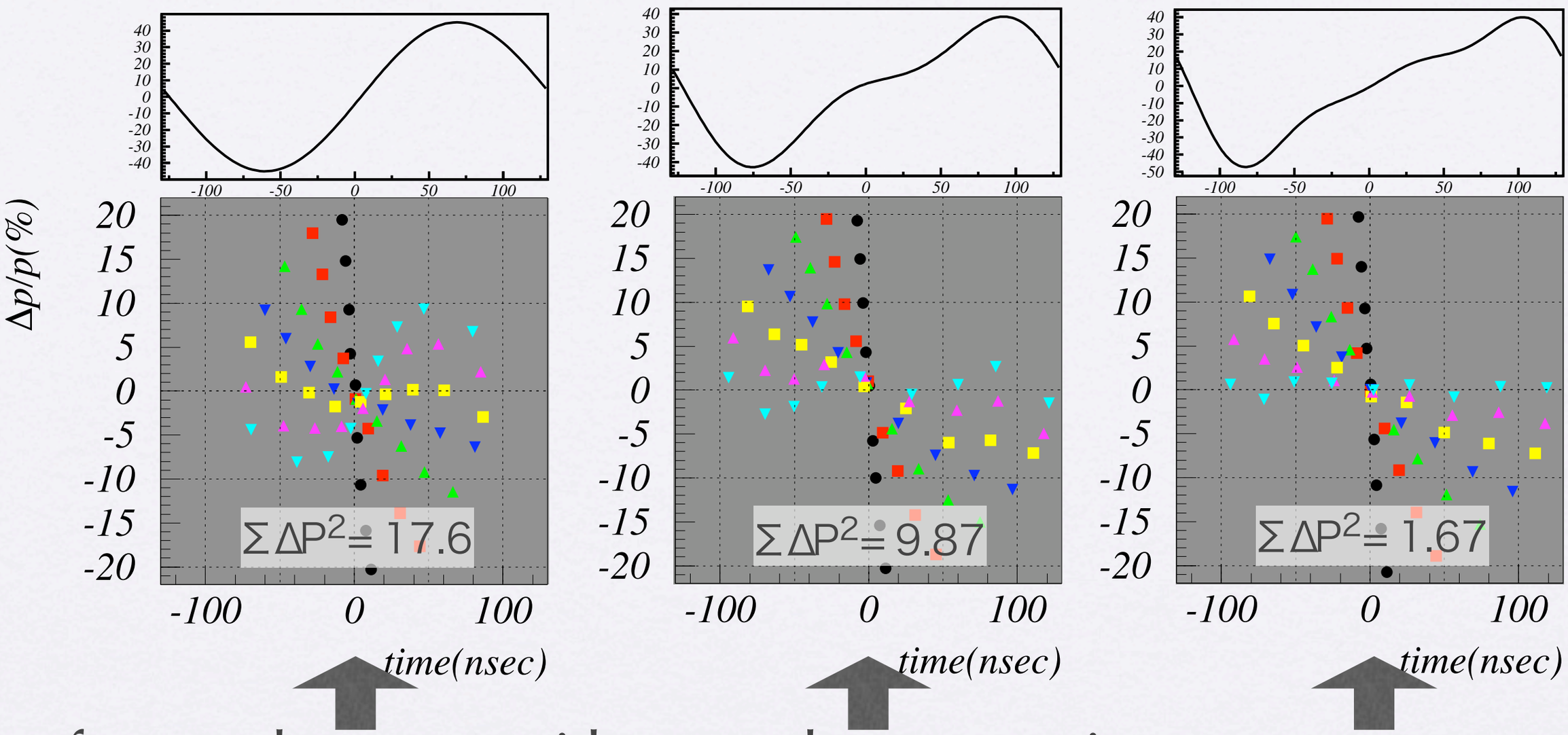
Sawtooth RF




*Sawtooth RF is good!*

# Phase Rotation Simulation




faster phase-rotation
larger momentum spread

slower phase-rotation
smaller momentum spread

might be best

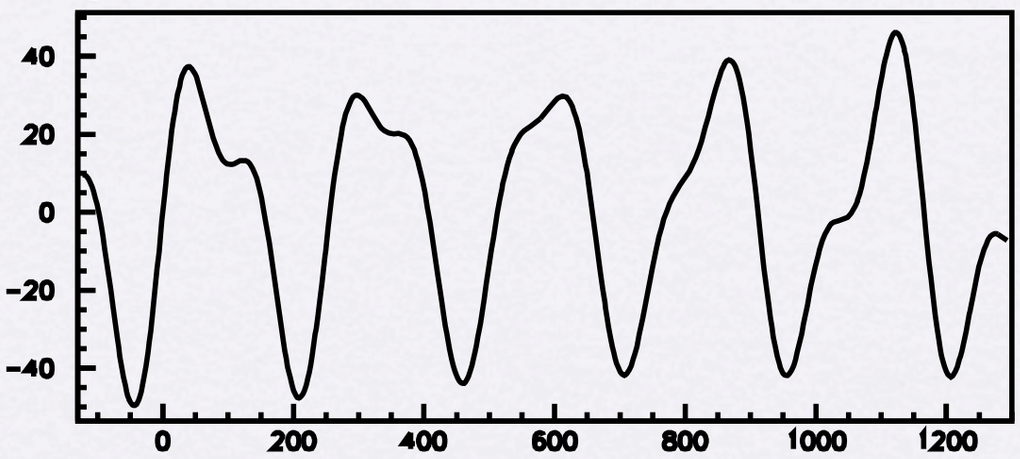
# Input RF changing in turn

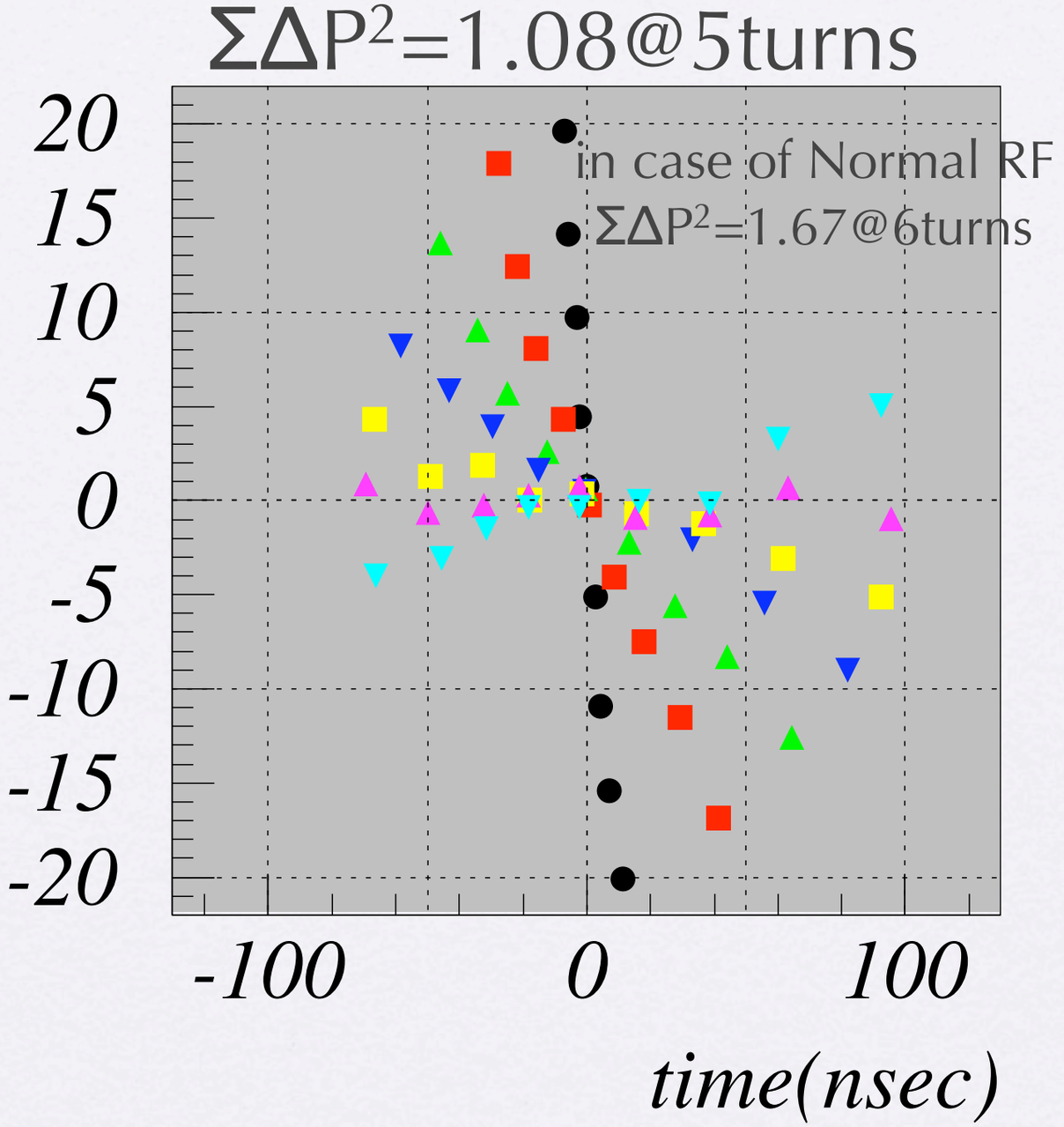
- Motivation

  We need ...

  - Fast phase rotation
  - Reduce a number of Cavity

Input RF is

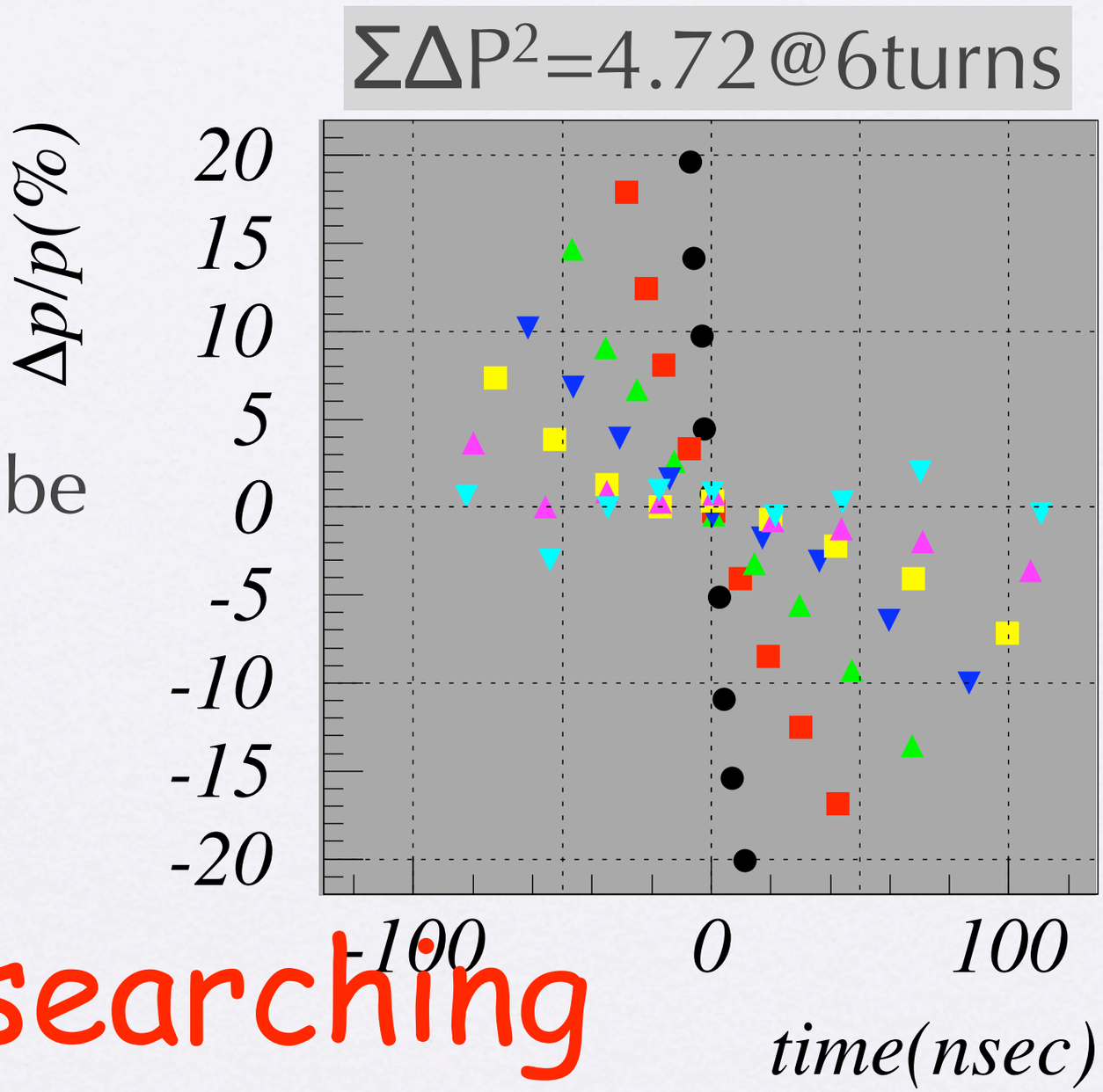



$V_1\sin((2\pi/T)(t-F_1))+ V_2\sin((2\pi/1.9T)(t-F_2))+ V_3\sin((2\pi/2.1T)(t-F_3))$

# Cavity in 7 straight sections

- We consider a ring design, which has 3 kickers.
- It means RF cavity will be installed in 7 straight sections.




Now searching

# Summary

- RF amplifier test has finished
- PRISM cavity has been made
- Phase rotation simulation study has started
  - ±20% Momentum Acceptance
  - ±2% Momentum Spread after 5 turns using changing RF
- Complete RF system test has been scheduled in this spring

END

# PRISM

- PRISM = Phase Rotated Intense Slow Muon source

  -Search for $\mu$ e conversion in a muonic atom-

  - $10^{11\sim12}$ muon/sec
  - pion contamination: $<10^{-18}$
  - momentum spread: < ±2%
    - by phase rotation
  - momentum: ~68MeV/c