Development status of PRISM FFAG ring and phase rotation simulation

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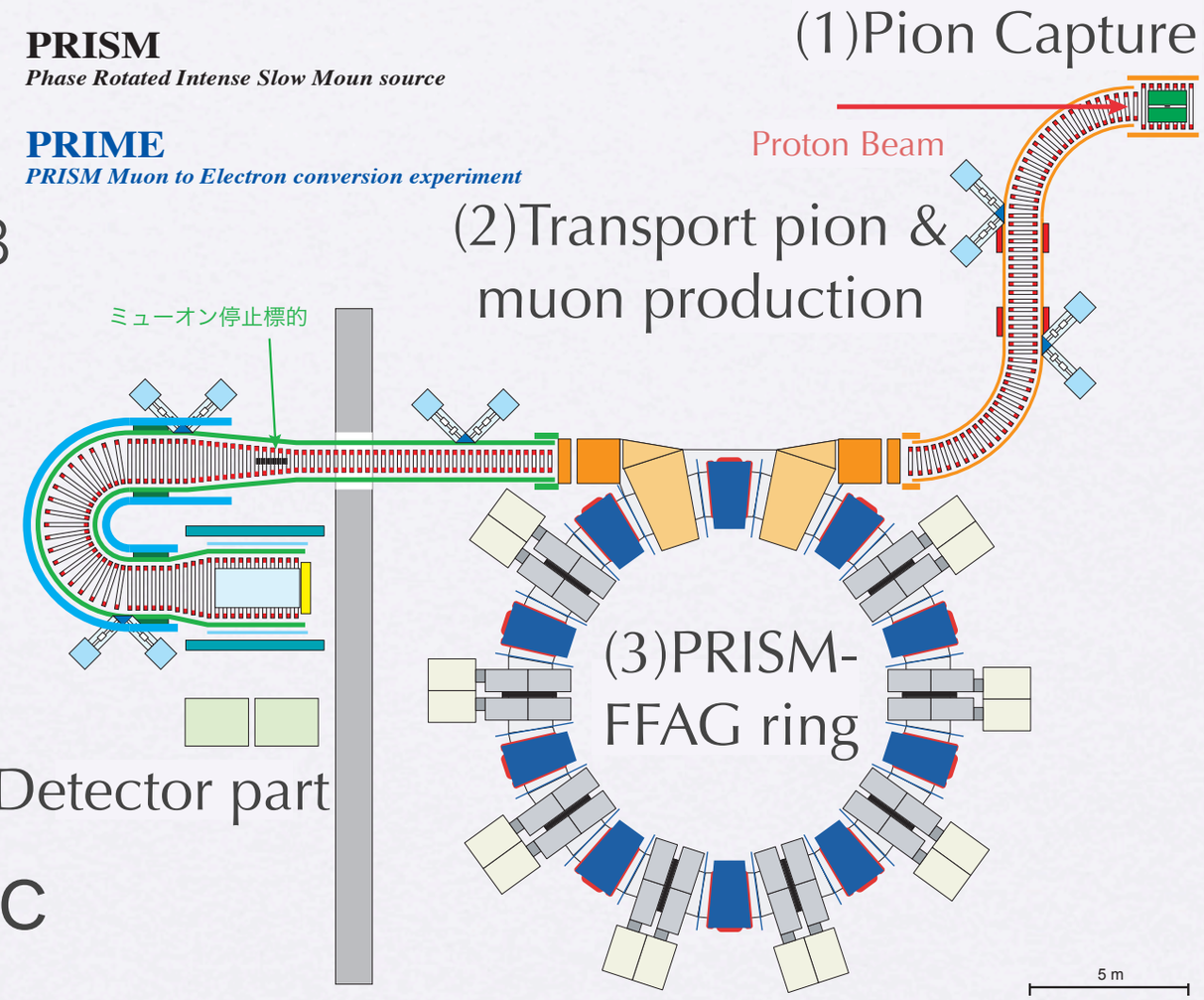
PRISM

- PRISM = Phase Rotated Intense Slow Muon source

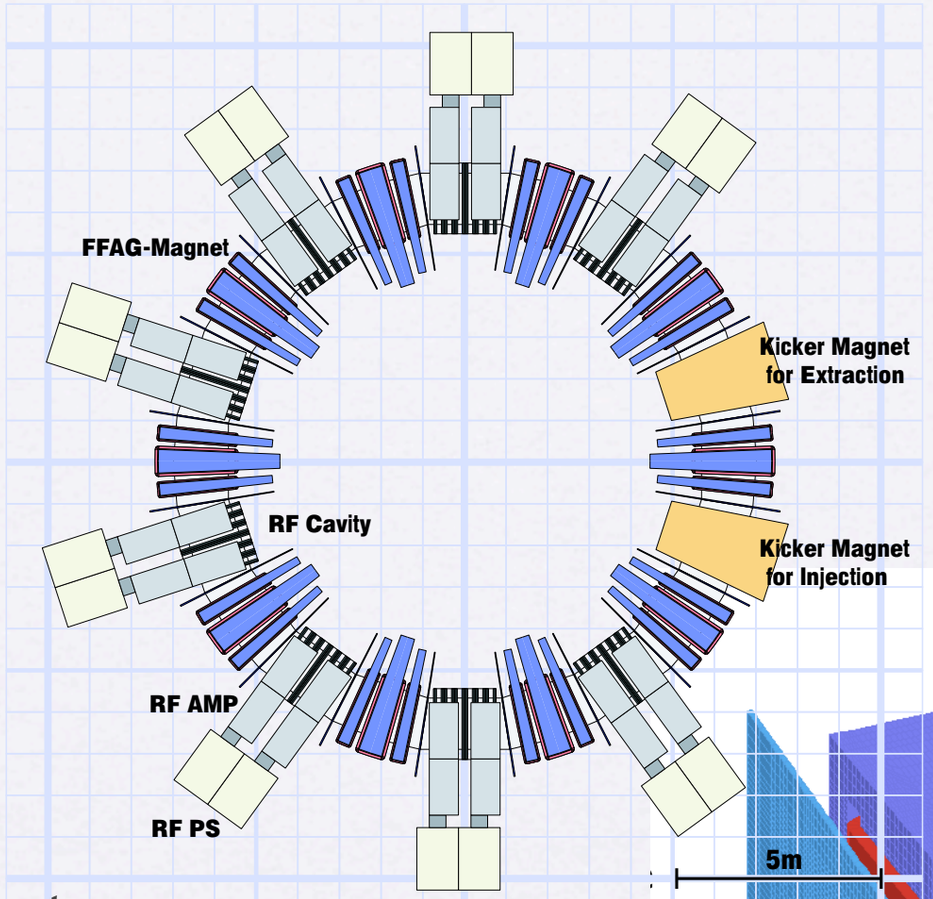
  -Search for μ e conversion in a muonic atom-

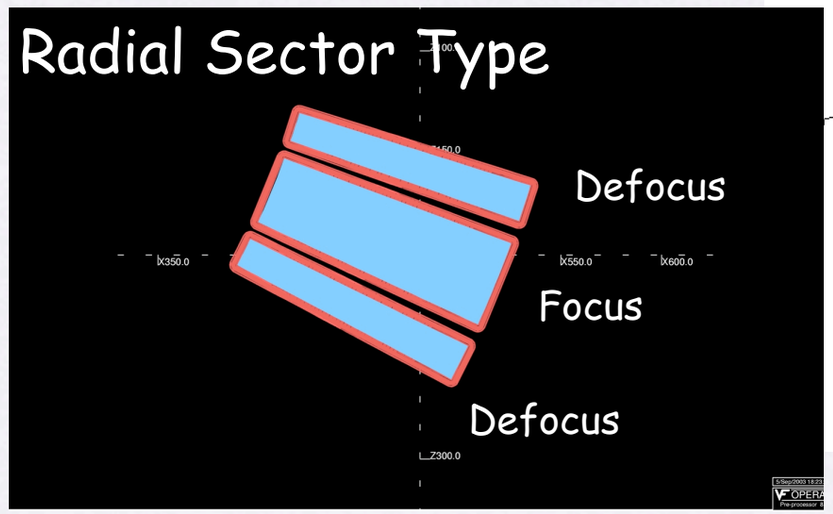
  - $10^{11\sim12}$ muon/sec
  - pion contamination: $<10^{-18}$
  - momentum spread: < ±2%
    - by phase rotation
  - momentum: ~68MeV/c

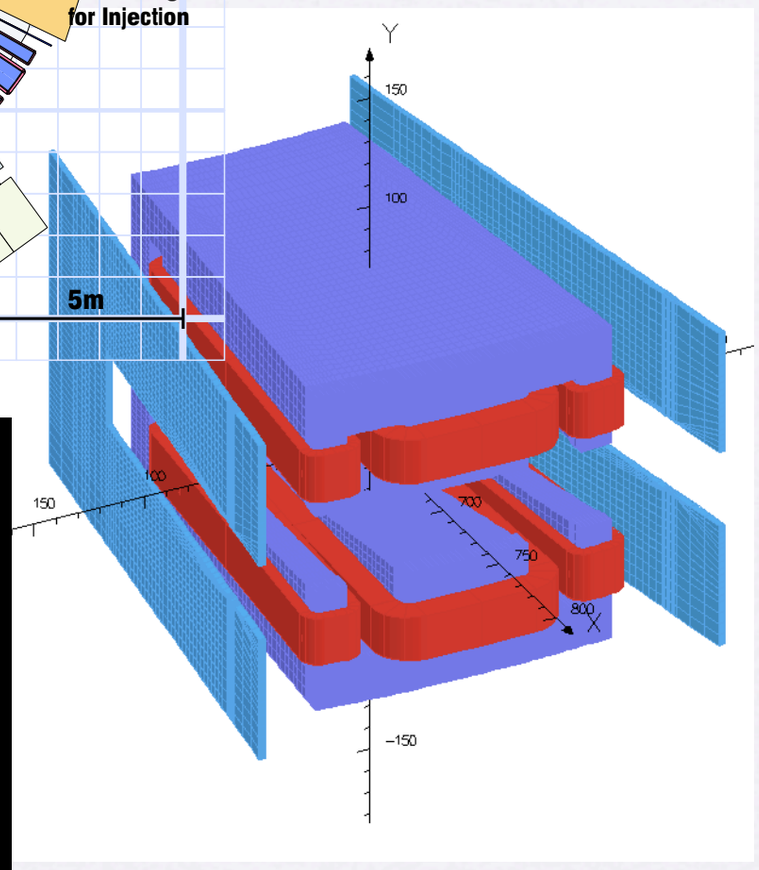


Design of PRISM FFAG ring

- N=10
- K=5(4.6-5.2)
- F/D(BL)=6
- r_0=6.5m (P=68MeV/c)
- Half Gap = 17cm
- mag. size 110cm @ F center
- Triplet (D-F-D)
- tune h:2.71, v:1.52





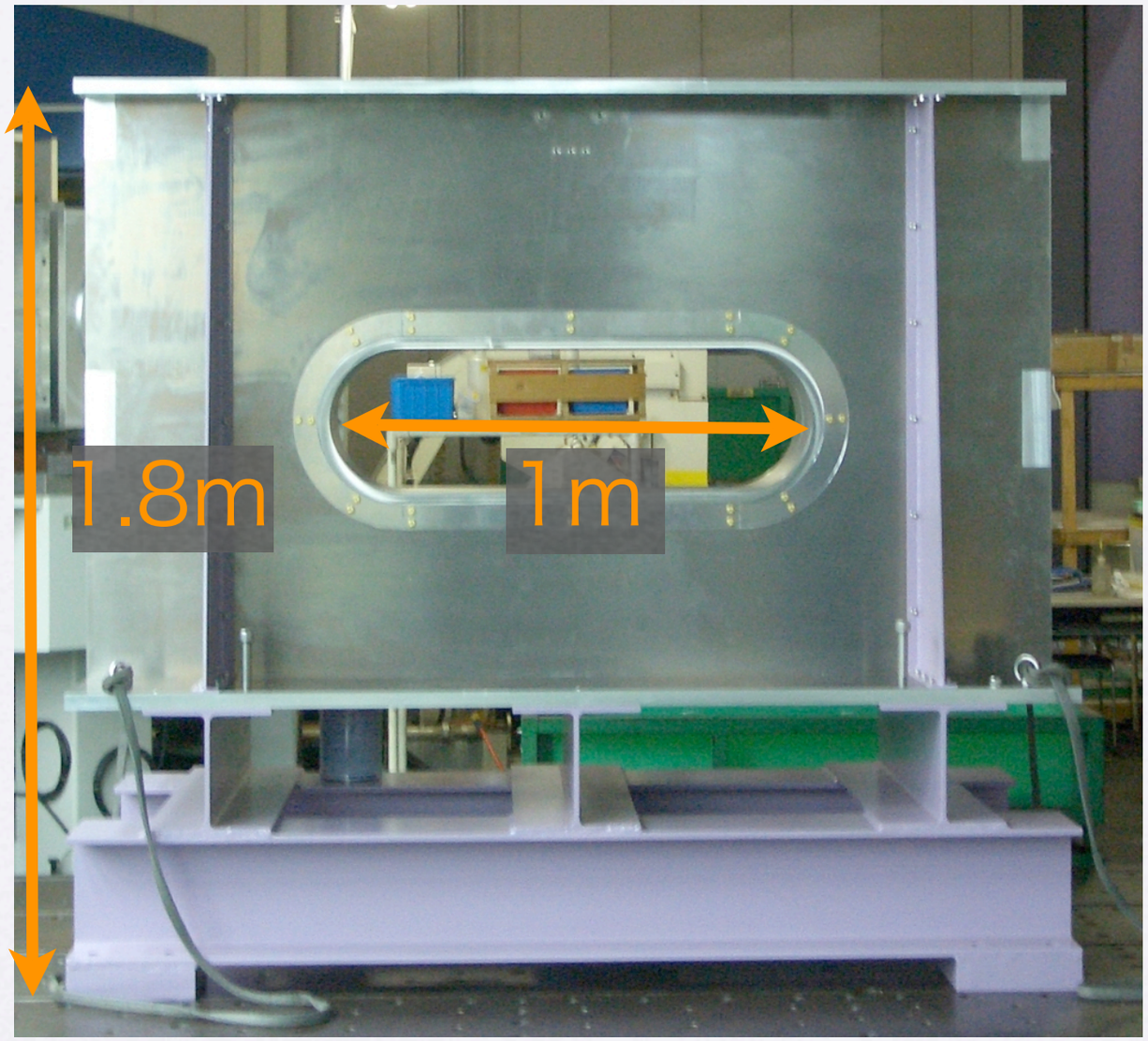


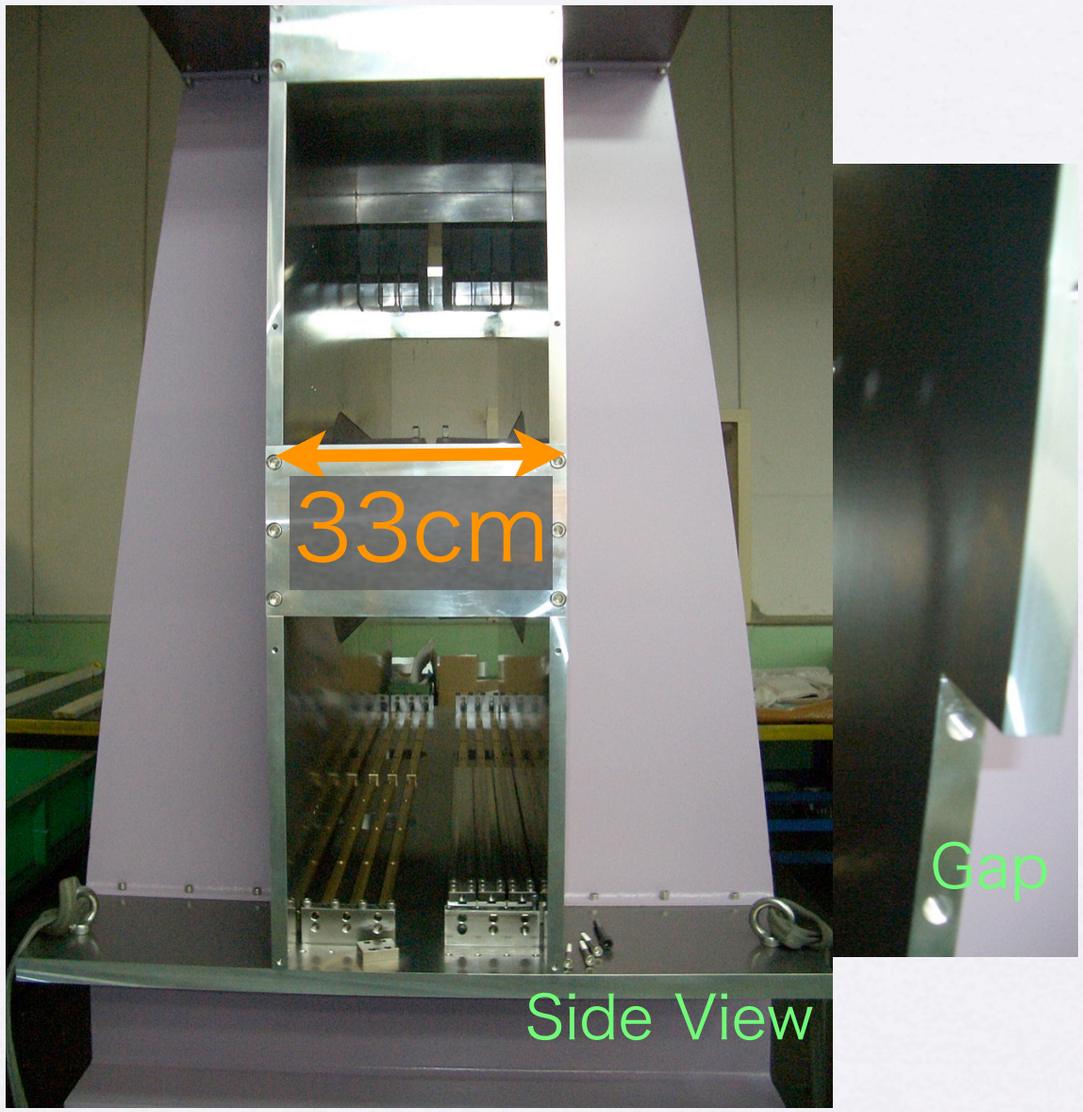
FFAG ring construction

FFAG ring construction has been started !

- Design of magnet has been almost completed and coil construction has been started.
  - As for the detail, with the next speaker.
- RF cavity include 1 gap has been made.
  - With next page, I show some photos.

PRISM RF Cavity





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

Construction Schedule

- *RF Amplifier construction has been complete.*
- *Cavity construction has been complete and Magnet construction has been started.*
- JFY 2005 : Magnet construction has been continued.
- JFY 2006 : Magnet construction will be finished and ring construction will be started.
- JFY 2007 : Ring construction will be finished and commissioning will be started.

RF R&D and phase rotation simulation

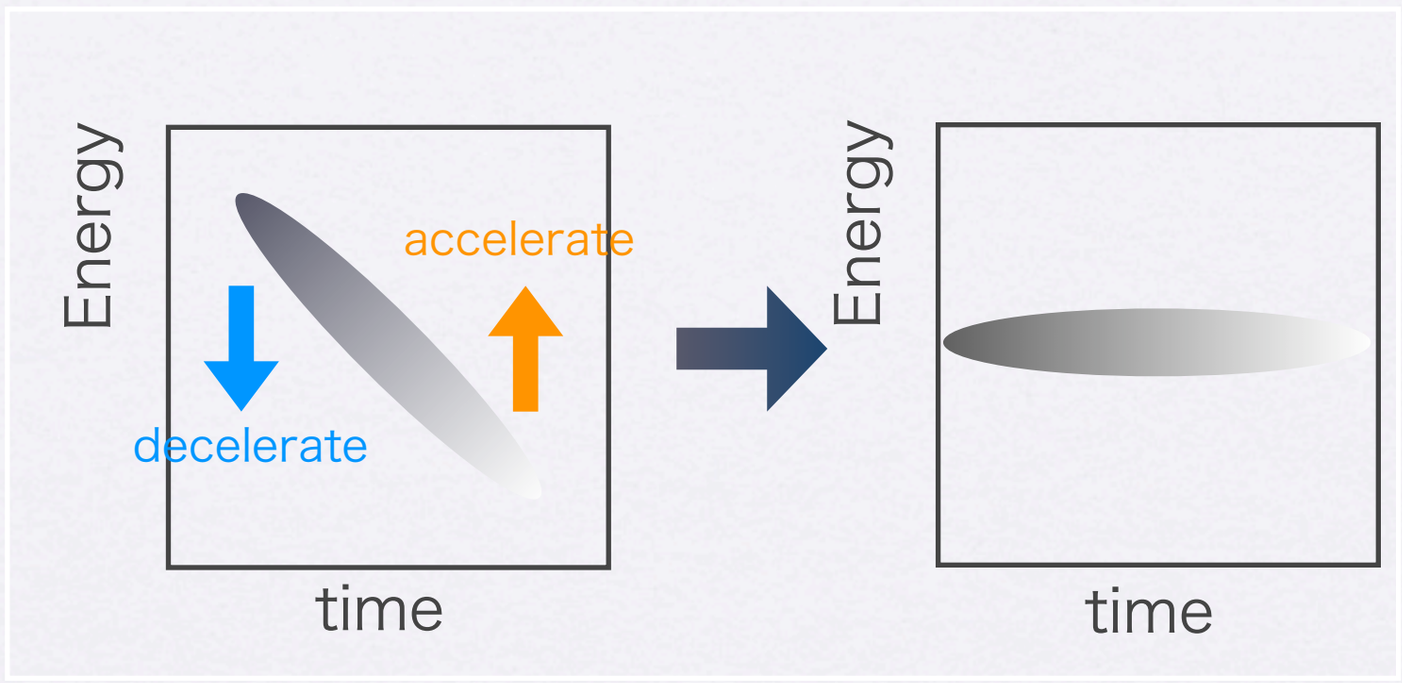
Requirements of PRISM RF

- Ultra High Field Gradient

  150kV/m ~ 200kV/m

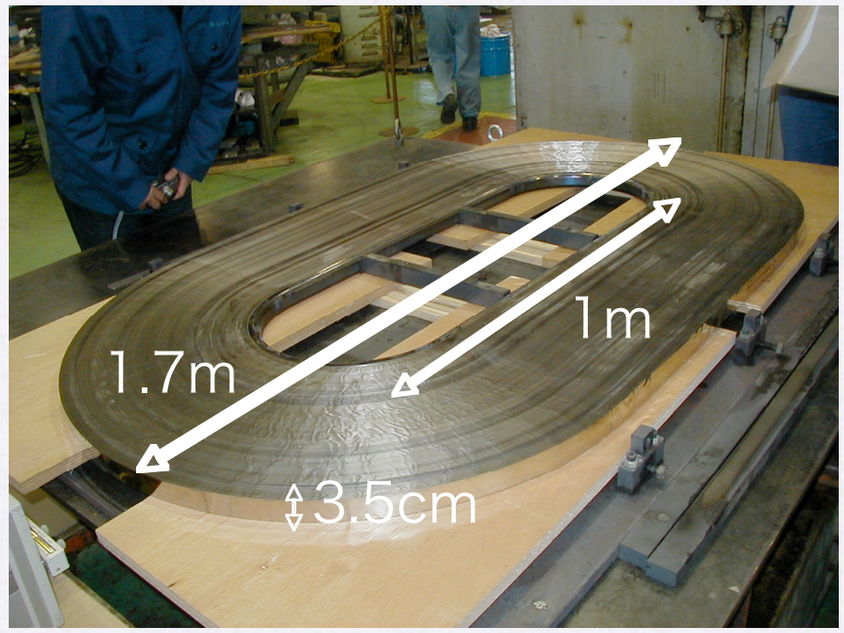
- Compact Cavity

- 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

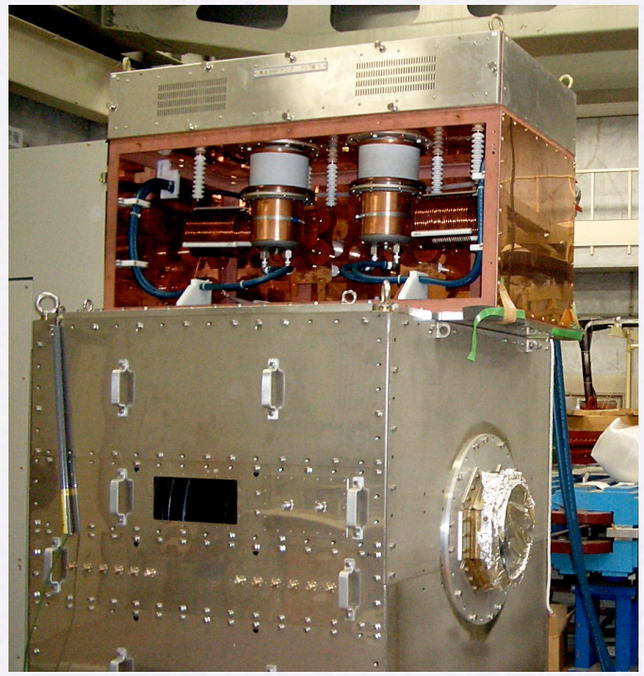


PRISM MA core

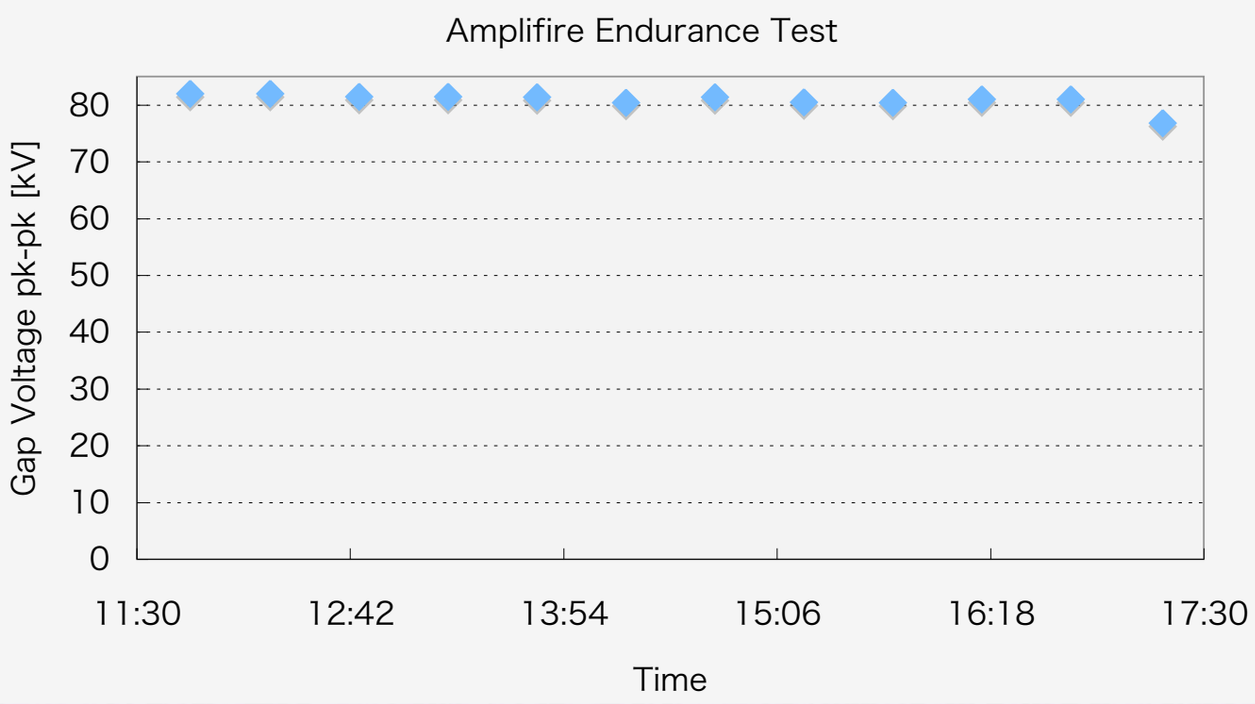
RF Amplifier Test

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

  (1gap, shunt Impedance 700Ω)
- Achieved 43 kV gap voltage
  (Design Goal)
  →165kV/m w/ PRISM Cavity
- Endurance Test
  - Repetition :100Hz
  - Burst length : 30 μsec
  - Over 6 hours



Amp. & Test Cavity

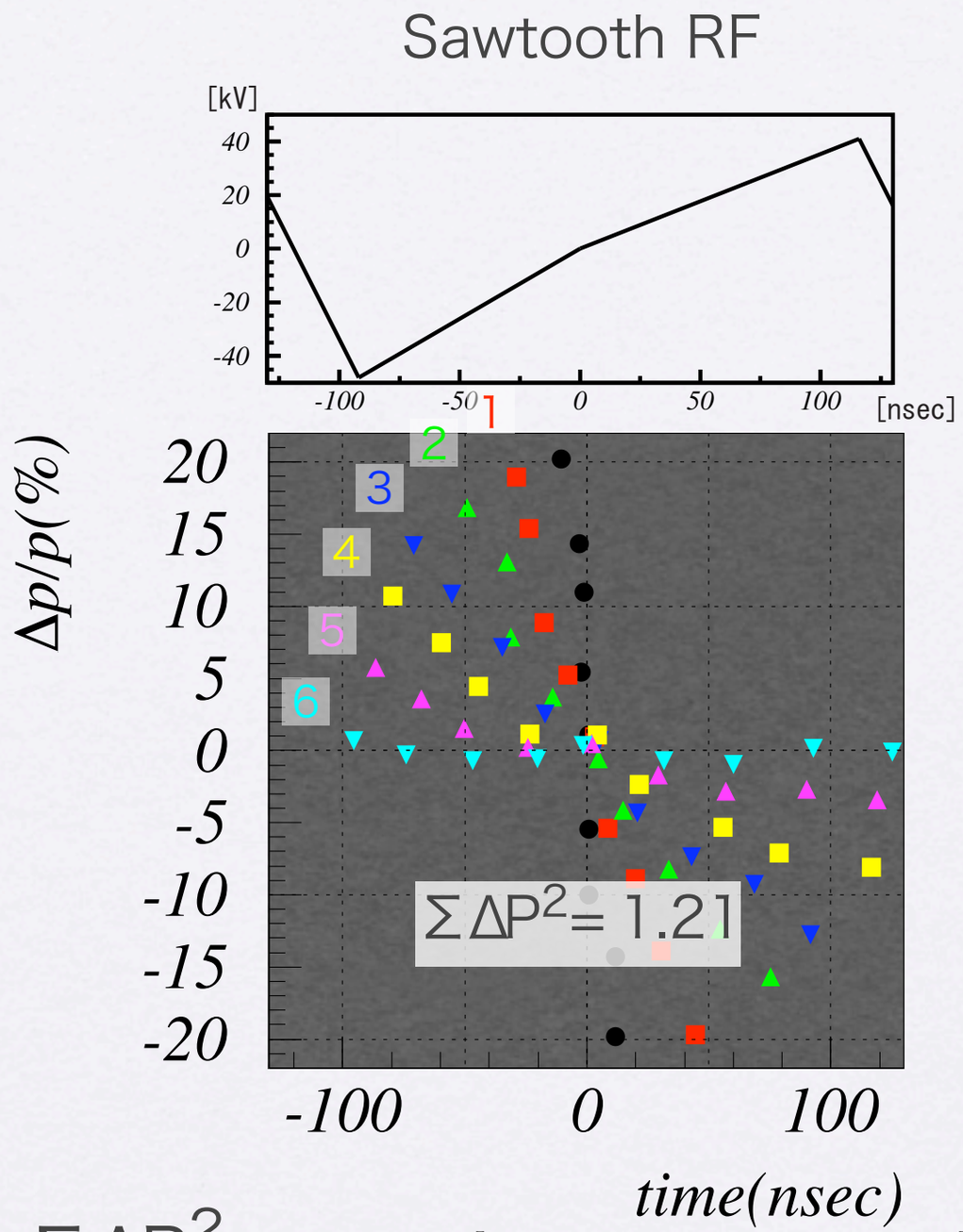


Phase Rotation Simulation

Simulation condition

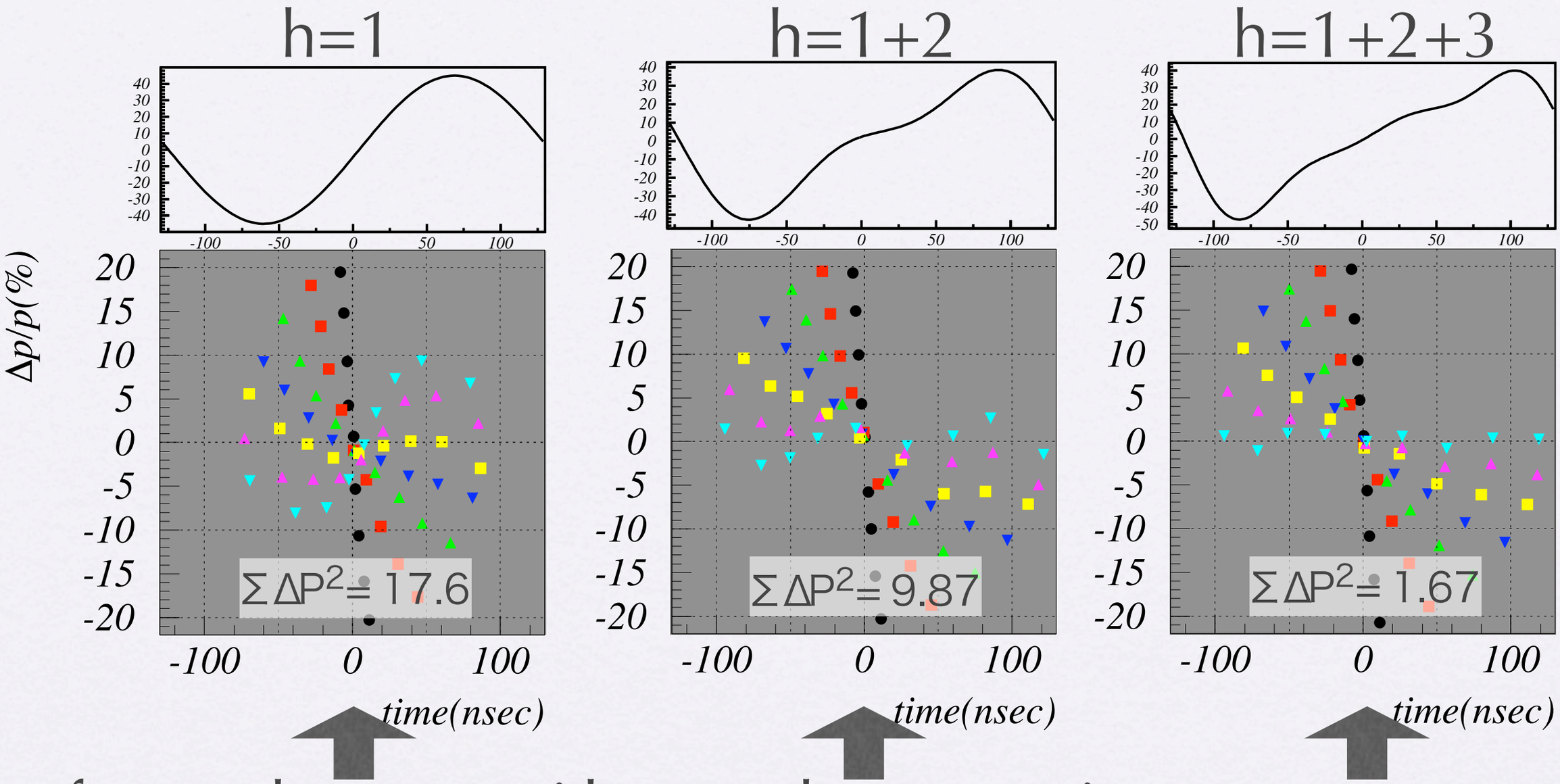
- Injected muon
  - 10m TOF
  - ±20% momentum spread
- FFAG ring
  - w/ TOSCA Magnet Field

    (from Y.Arimoto)
- RF
  - 8 sections * 5 gaps = 40 gaps
  - 45 kV/gap (Total 1,800 kV)
- Parameter Search for Minimum $\Sigma \Delta P^2$



Sawtooth RF is good!

Phase Rotation Simulation



faster phase-rotation
larger momentum spread

lower phase-rotation
smaller momentum spread

might be best

Input RF changing as for time

- Motivation

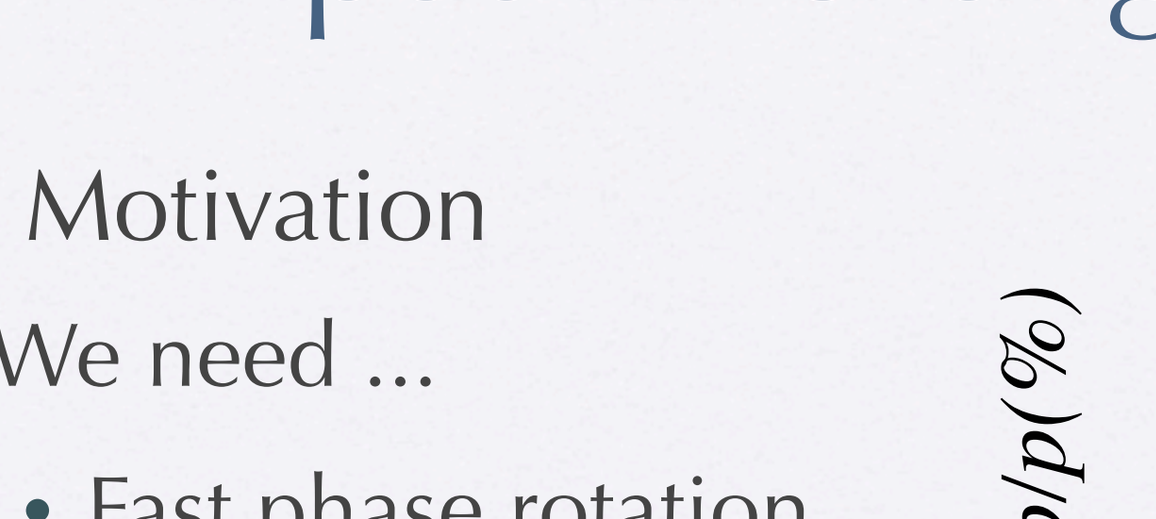
We need ...

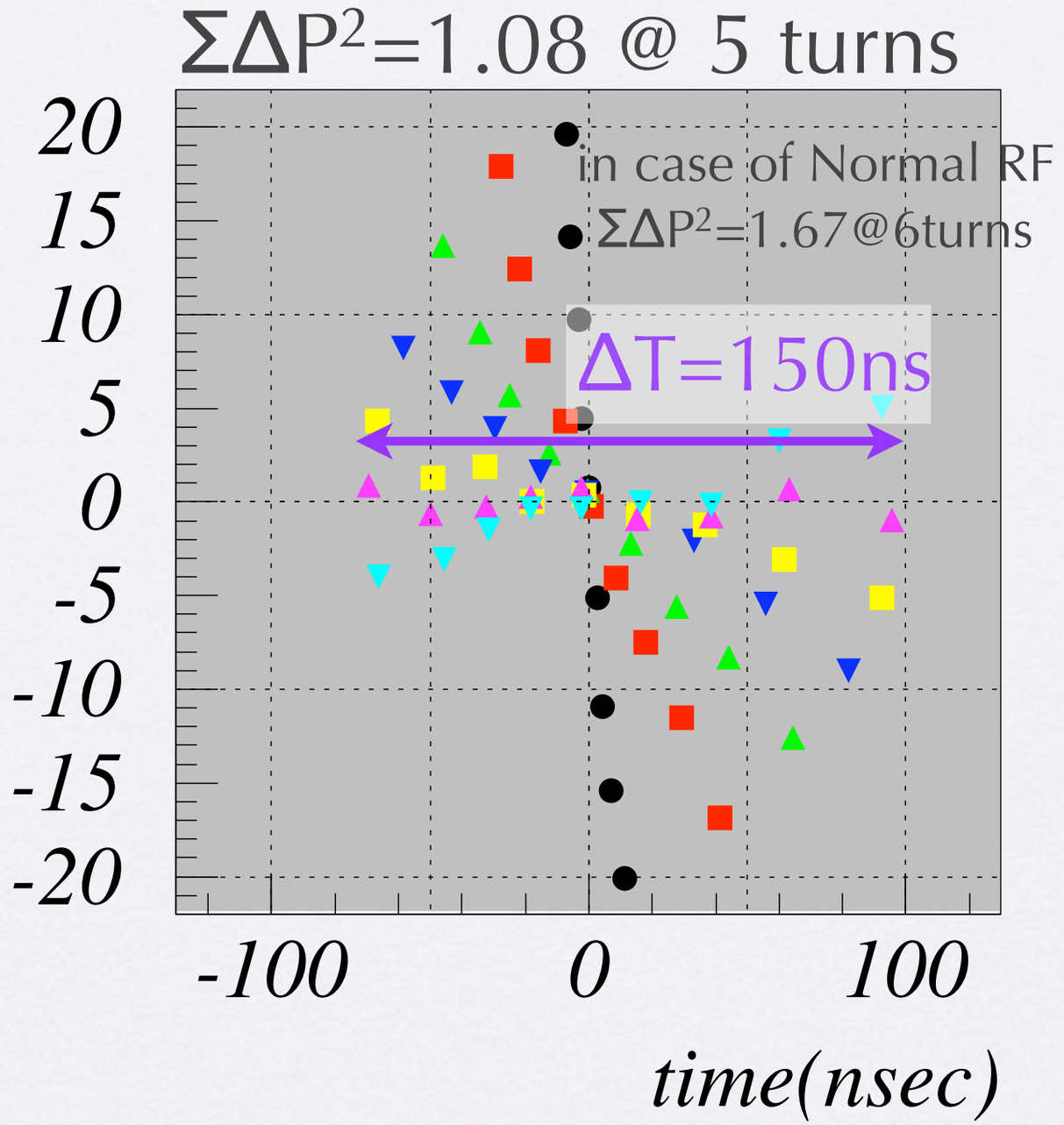
- Fast phase rotation
- Reduce a number of Cavity

Input RF is

V_{gap}[kV]

h = 1 + 1.9 + 2.1





Summary

- PRISM FFAG ring construction has been started.
  - RF cavity has been made.
  - Magnet construction has been started.
- RF amplifier test has finished.
- In phase rotation simulation study
  - ±20% Momentum Acceptance
  - ±2% Momentum Spread after 5 turns using changing RF