Mount stabilization for Shintake monitor-3

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- About Shintake monitor and results in FFTB
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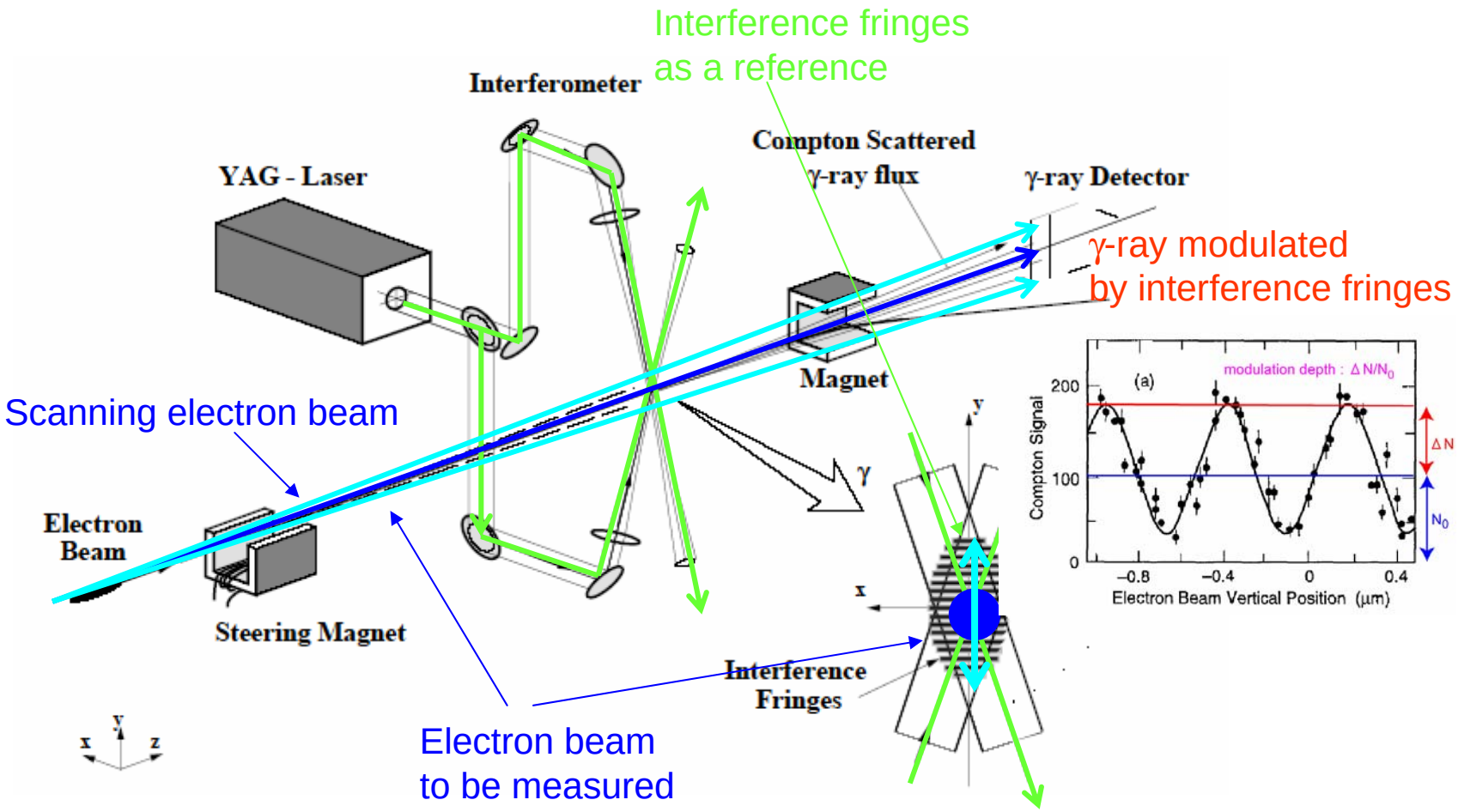
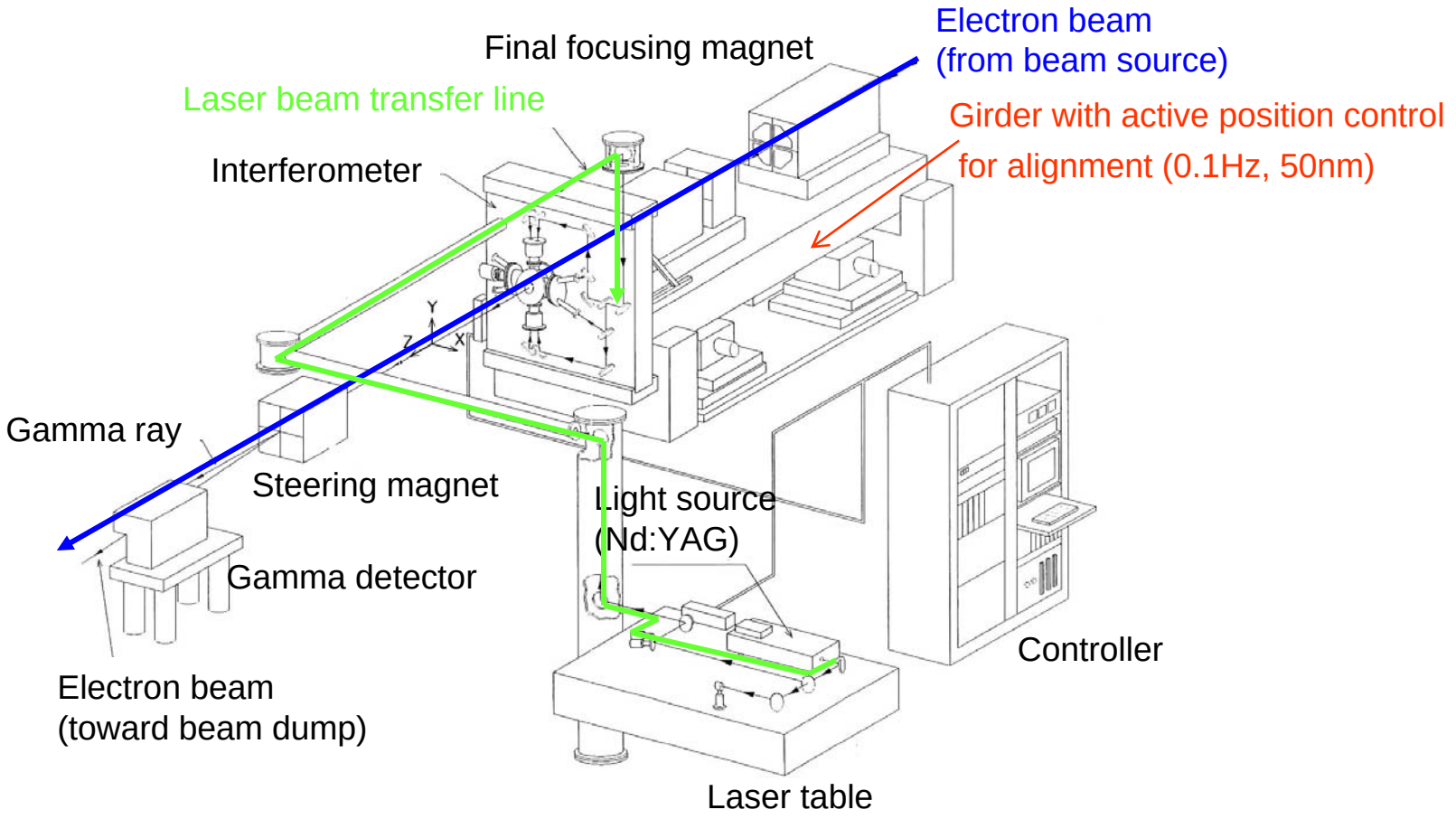
  - –Proposal 2: Mount on a stabilized common table
  - –Proposal 3: Individual mounts with feedback system

Schematics of Shintake Monitor

Laser fringe(/Compton) beam size monitor



System schematics of Shintake monitor in Final Focus Test Beam (FFTB)



Results of Shintake monitor in FFTB (1993-1997)

- Experimentally measure size of the converged electron beam to be 70 nm in radius (σ).
- Operated without any anti vibration equipments
  - –without active control, nor passive air suspension table, etc.
- Signal fluctuation in Gamma corresponded to be 40 nm with >10Hz of jitter was observed.

System performance expected for Shintake monitor in ATF2 project

- Measure size of electron beam converged to 35 nm of radius (σ)

Methods to realize expected performance

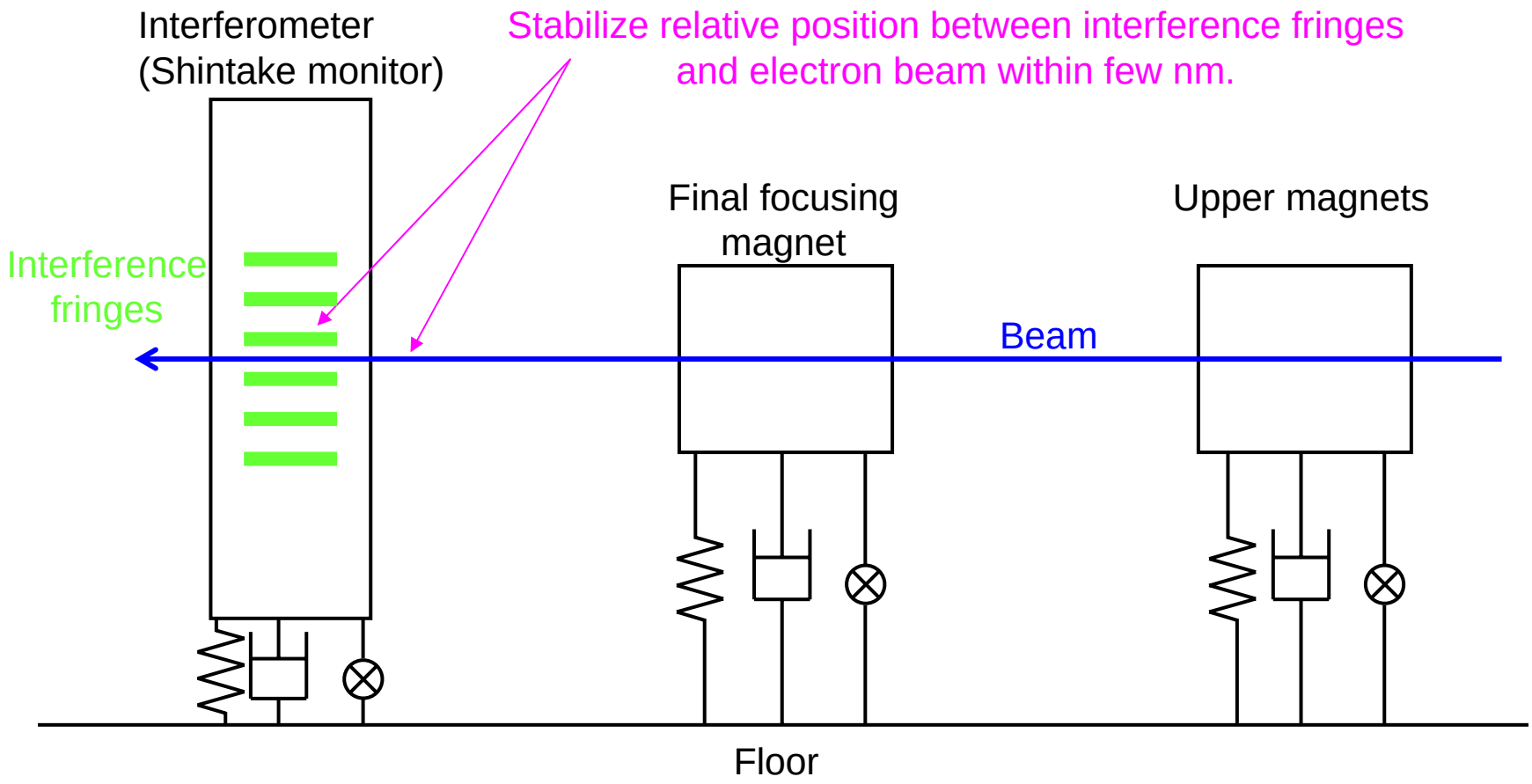
- Use shorter (1064->532 nm) wavelength of laser
  ->Obtain higher modulation of γ-ray for narrower (60->35nm-in design) electron beams

- Observe and control interference fringes
  ->Stabilize phase and visibility of interference fringes

- Analyze structure and mount of interferometer
  ->Stabilize and improve rigidity for mount and body of interferometer

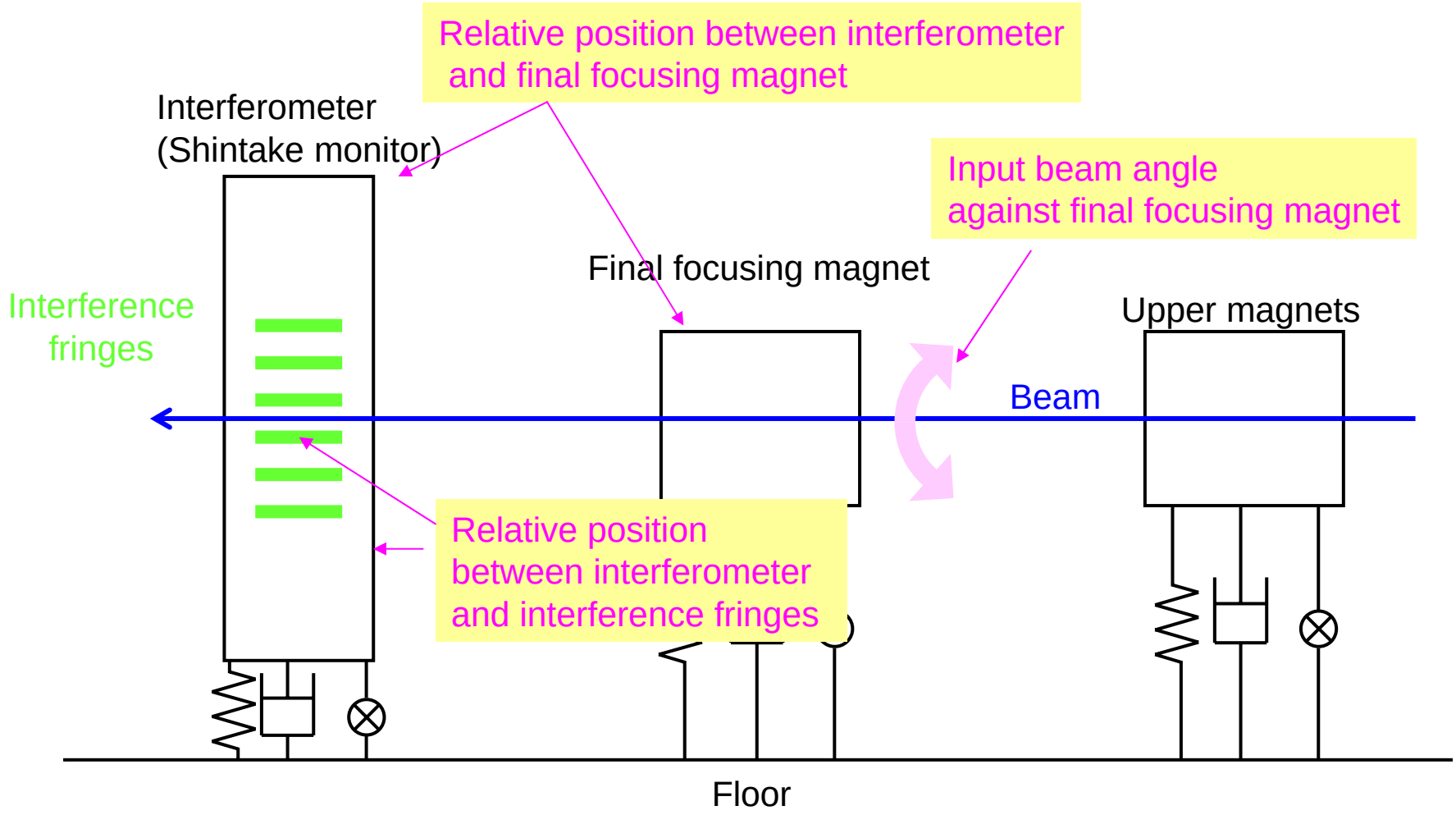
Goal of stabilization for Shintake monitor

In order to measure beam size with nm resolution



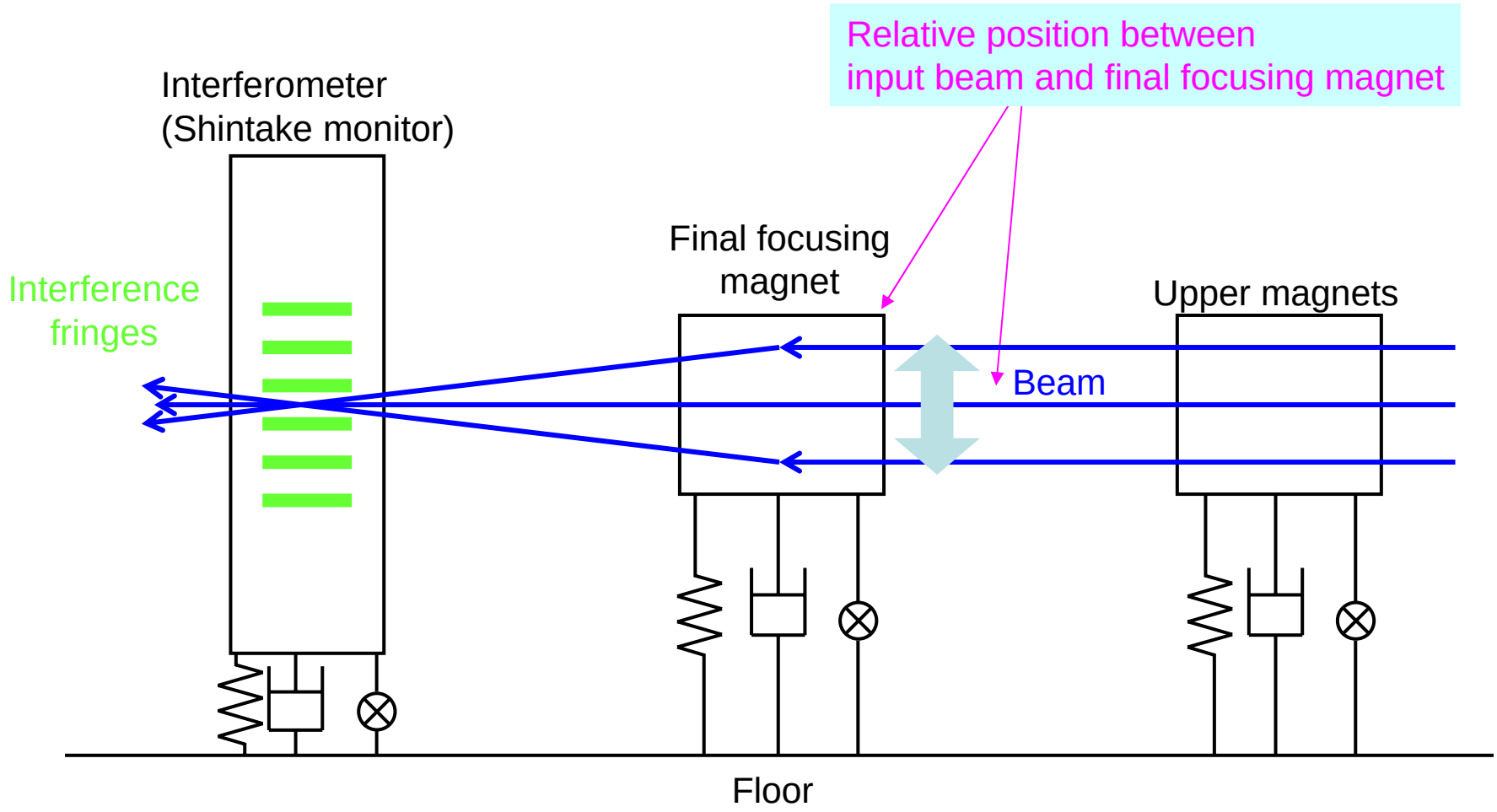
What affects stability?

Relative position stability between interference fringes and electron beam

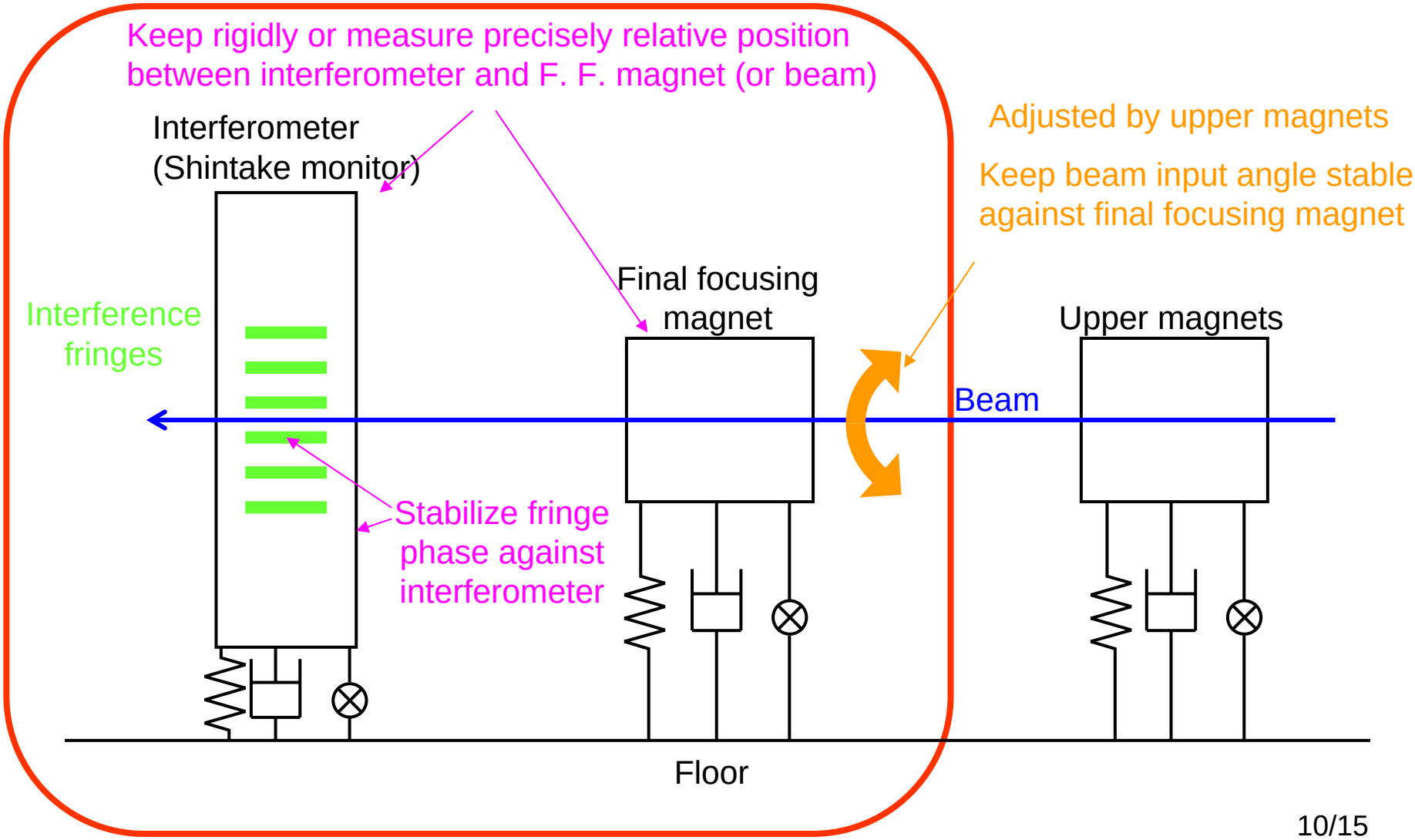


What does not so seriously affect stability?

changes of relative position between input beam and f.f. magnet are canceled by focusing effect of f.f. magnet.



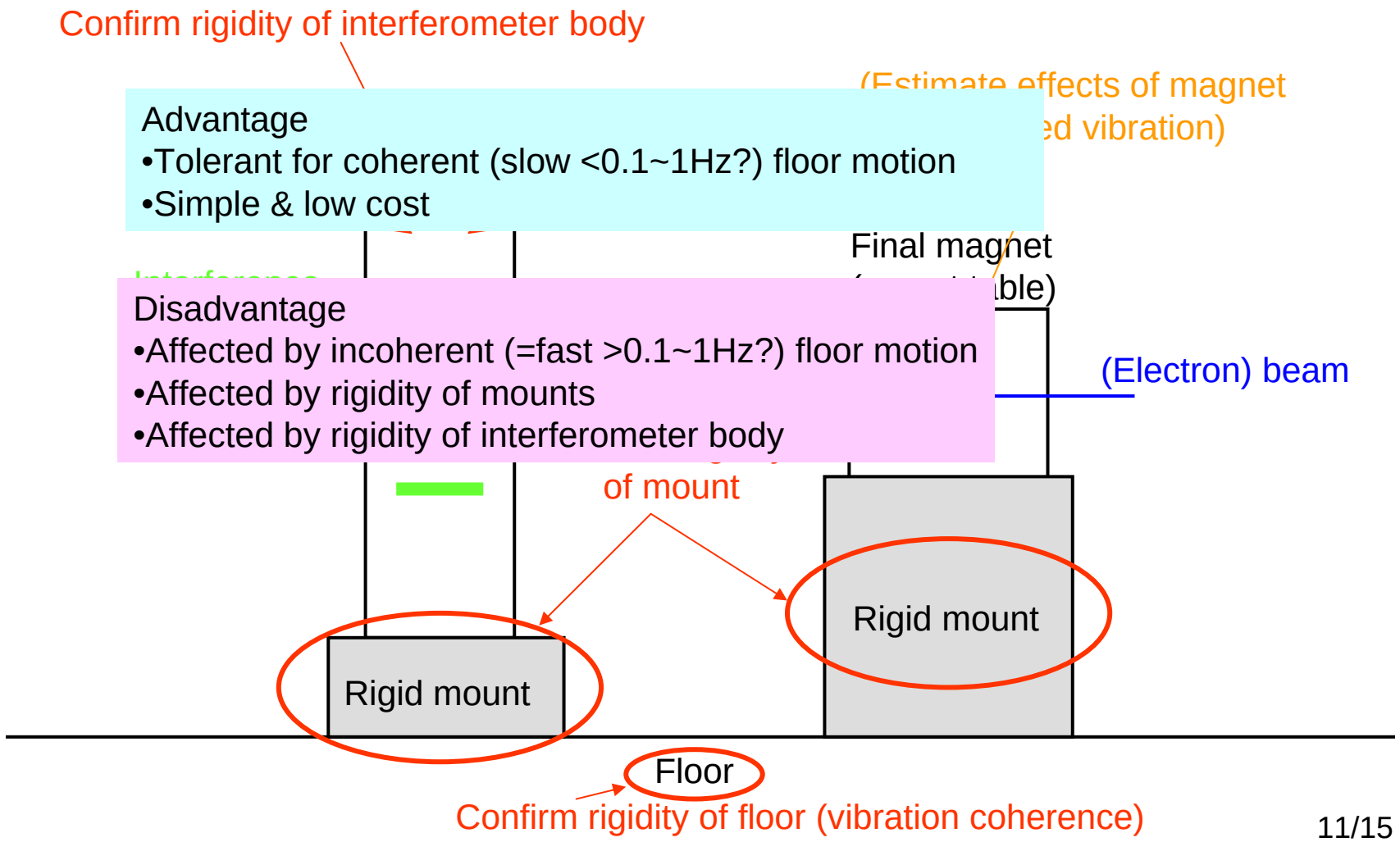
In order to obtain good stability



Proposal 1 for relative stability around IP 1:

Rigid mount on floor

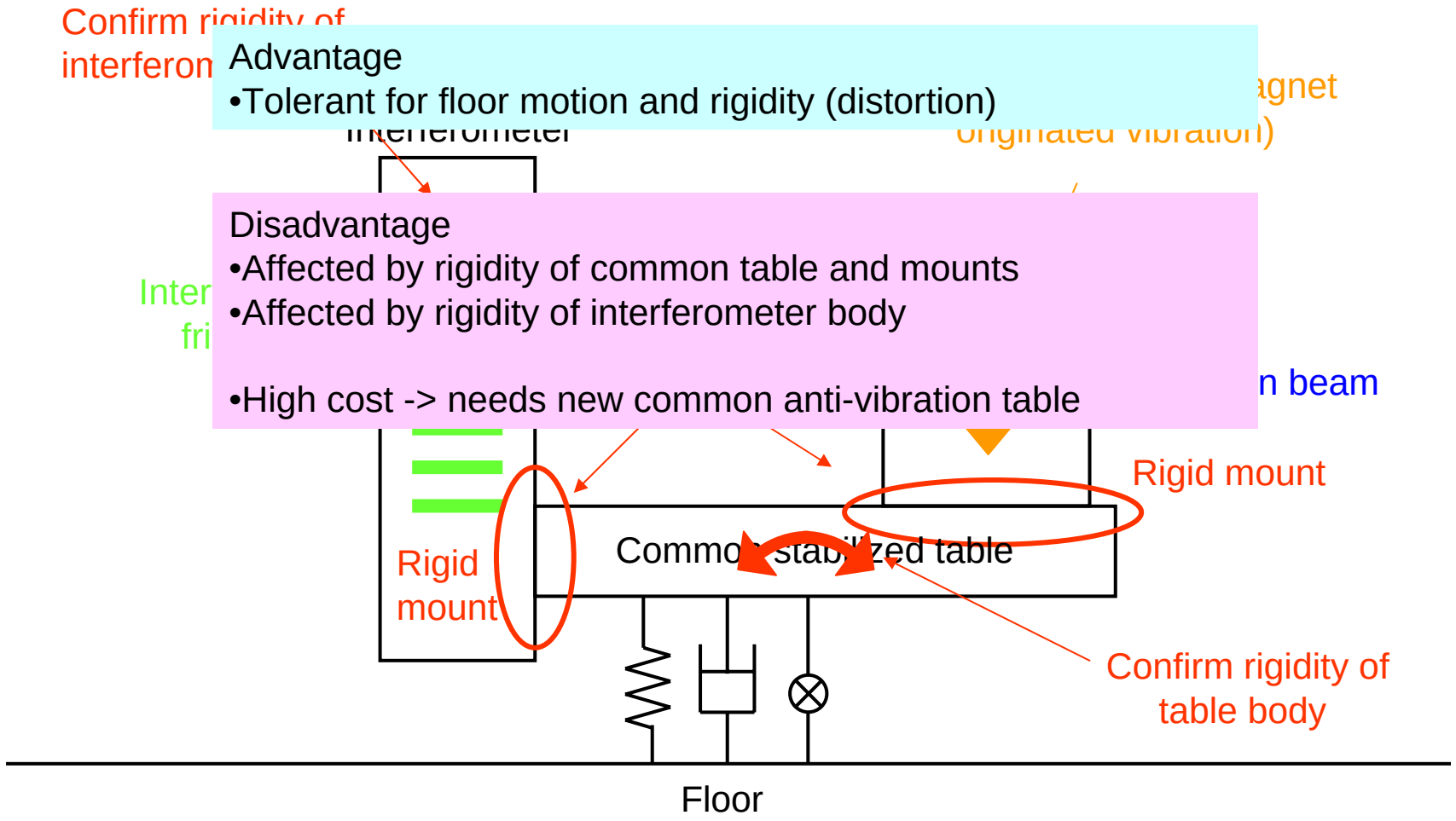
using individual rigid mount for supporting interferometer and f.f.magnet



Proposal for relative stability around IP 2:

Mount on a common stabilized table

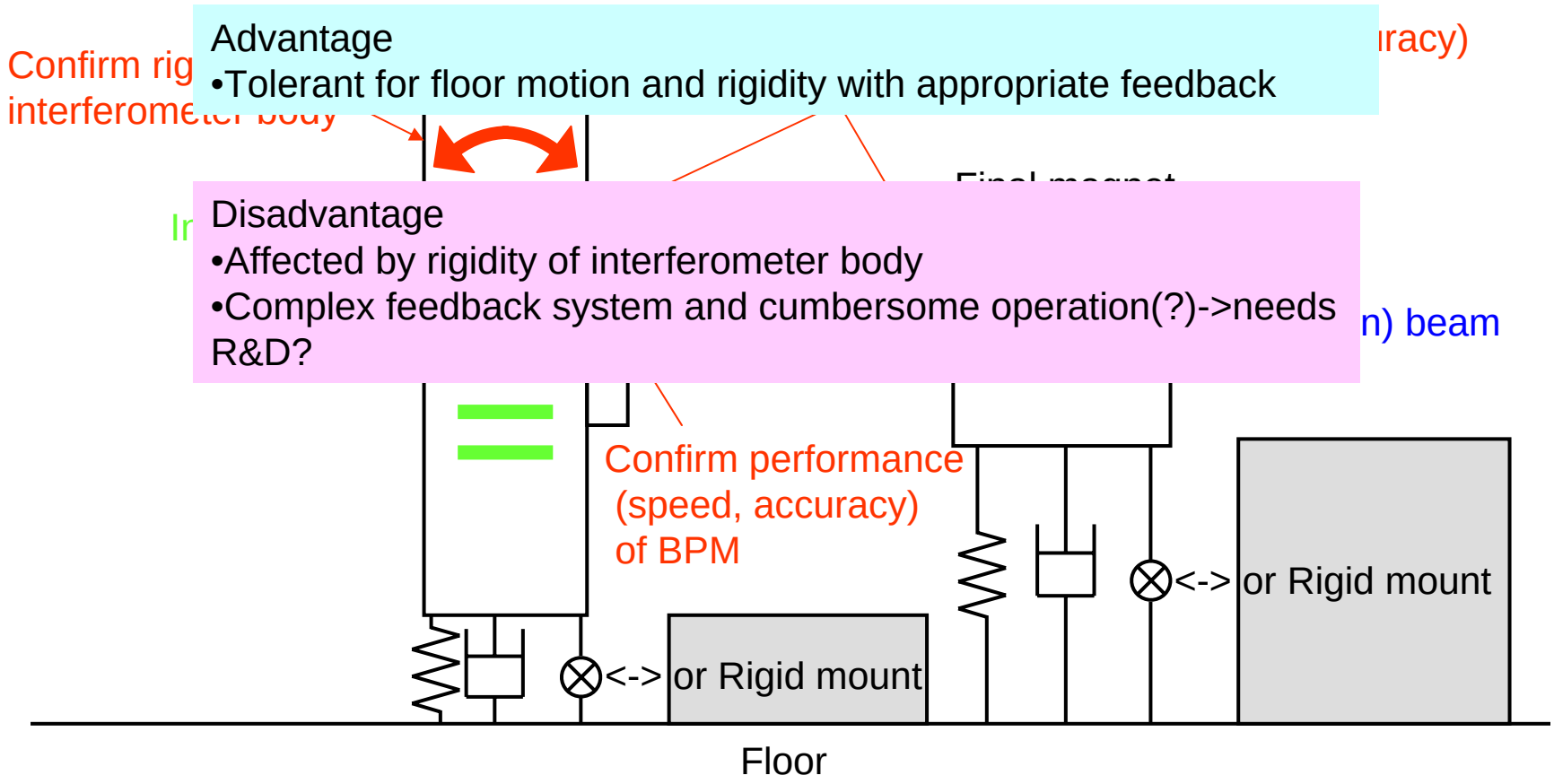
using an anti-vibration common table for interferometer and f.f.magnet



Proposal for relative stability around IP 3:

Feedback position between beam and fringes

in case using individual mount for interferometer and f.f.magnet with feedback



Summary

- It’s necessary to stabilize relative position between interference fringes and electron beam for precise beam size measurement.
- The relative stability are to be obtained by
  - stabilizing relative position between interferometer and interference fringes.
  - stabilizing relative position between interferometer and final focusing magnet or between interferometer and beam.
- It’s necessary to confirm rigidity of interferometer.
- Proposal 1 and 2 are recommended for mechanical stabilization around IP.

Plan

- Confirmation rigidity of interferometer body is planned
  (under cost estimation).
  - by measuring impulse response of the interferometer
  - not by simulation (<-problem of accuracy of the analysis models)

- Rigid mount for the interferometer is to be designed using the results as a first step.