iKAGRA初期アラインメント手順
Initial Alignment Procedure for iKAGRA

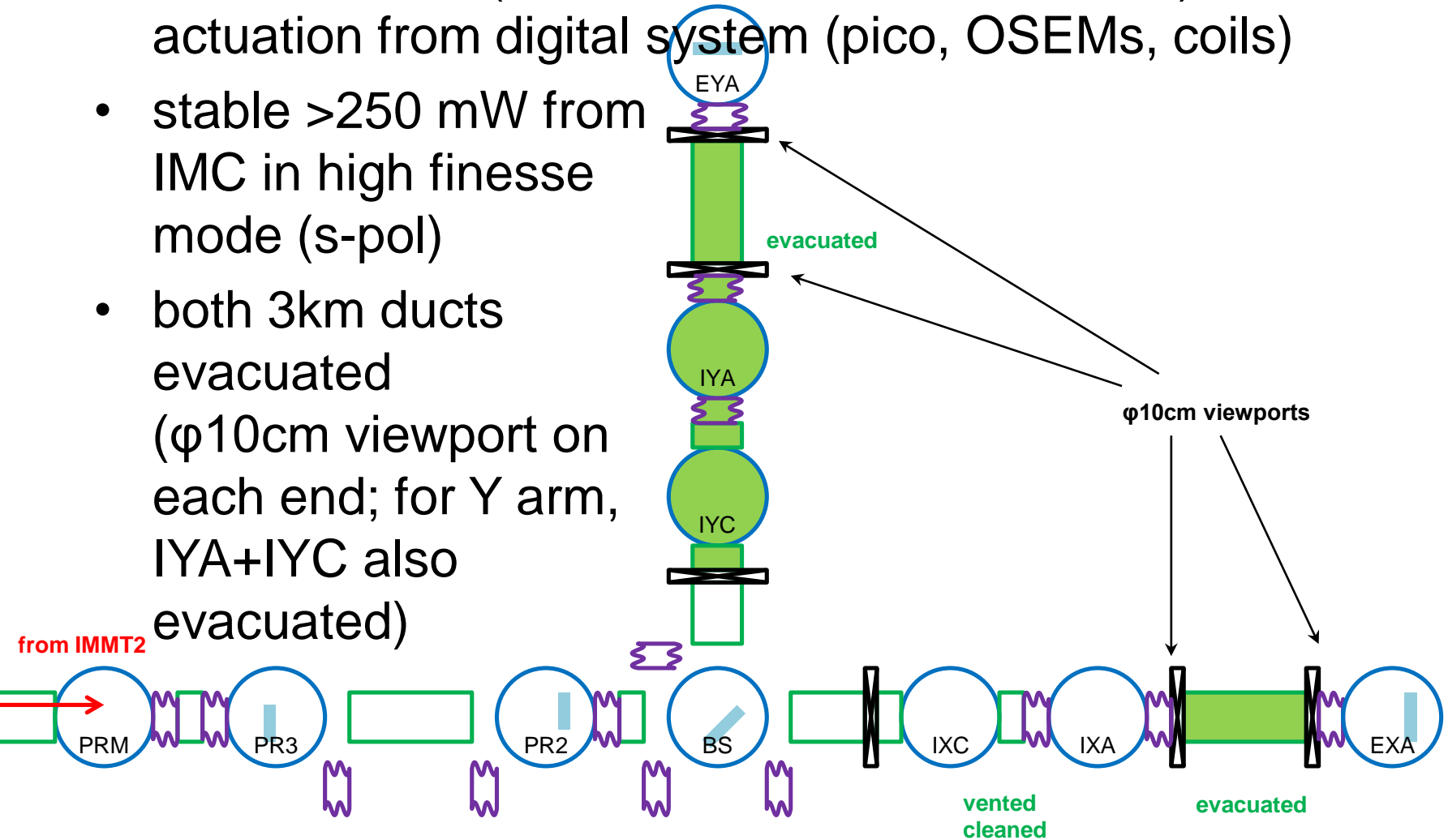## Yuta Michimura

Department of Physics, University of Tokyo

First of All

- Commissioning?
  suspension, oplevs, cameras, digital, electronics, output optics, initial alignment, lock, stable operation, noise budgeting ……

- I will focus on iKAGRA initial alignment procedure discussion
  3 km Michelson after IMMT

- I strongly recommend you to download JGW-T1604823

- **Important message: Commissioning team wants your contribution!**
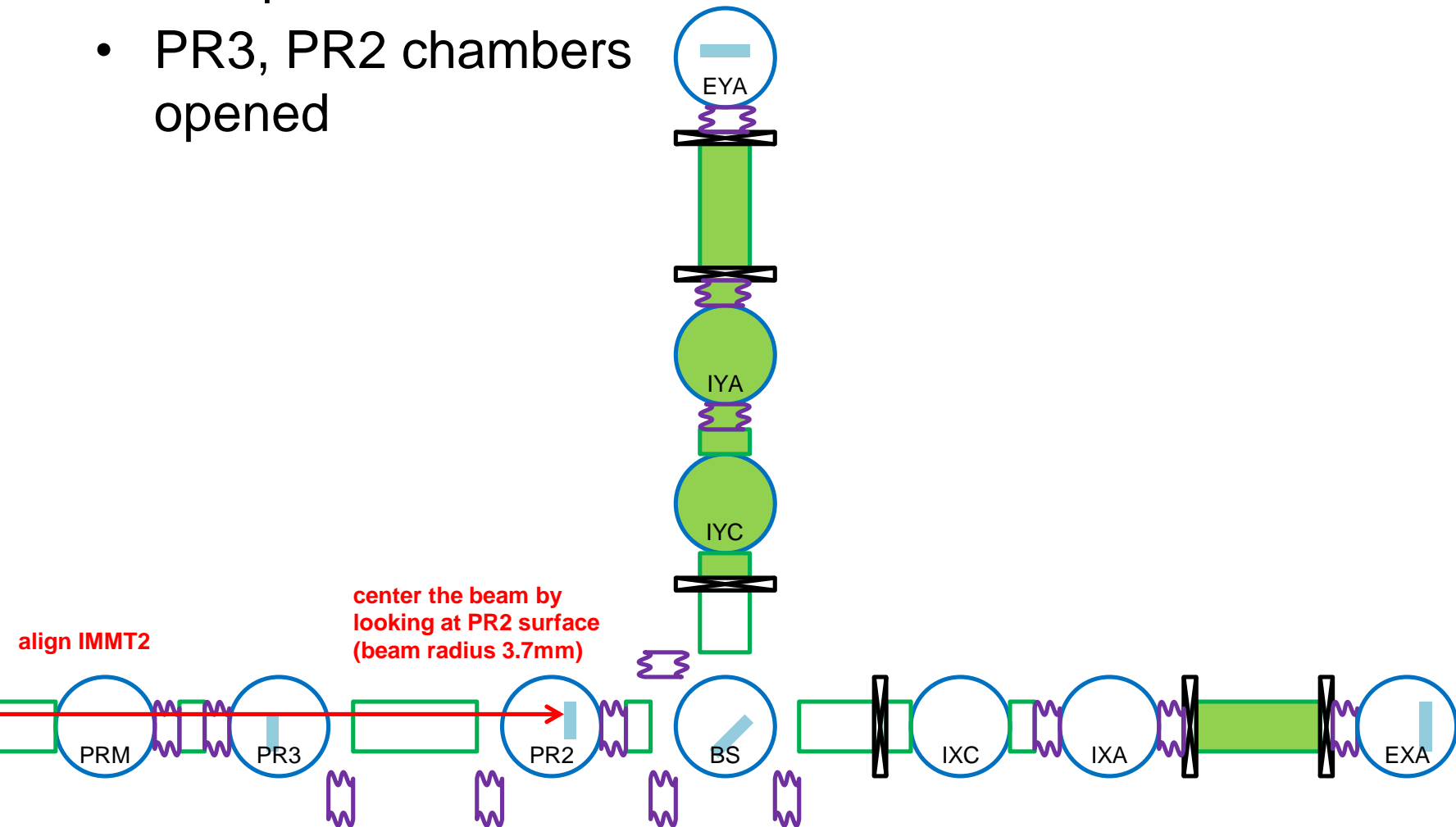
JGW-T1604823

Expected Situation on Mar 2

- All the mirrors (PR2, PR3, BS, ETMX, ETMY) installed with actuation from digital system (pico, OSEMs, coils)

- stable >250 mW from IMC in high finesse mode (s-pol)

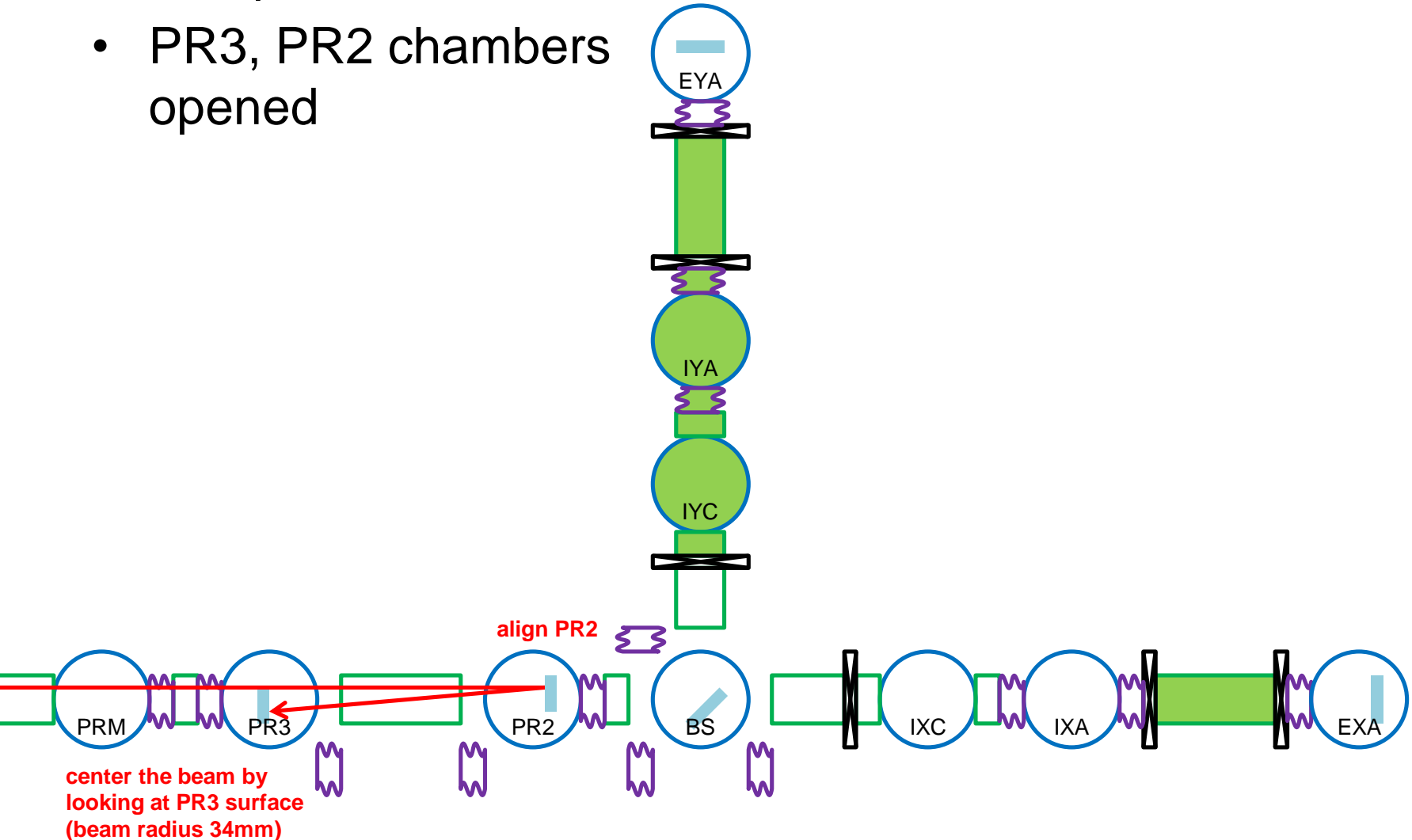- both 3km ducts evacuated (φ10cm viewport on each end; for Y arm, IYA+IYC also evacuated)

EYA

evacuated

IYA

IYC

φ10cm viewports

from IMMT2

PRM   PR3   PR2   BS   IXC   IXA   EXA

vented cleaned

evacuated

IMMT2 Alignment (Mar 3)

- Use picomotors on IMMT2 to center the beam on PR2
- PR3, PR2 chambers opened

center the beam by looking at PR2 surface (beam radius 3.7mm)

align IMMT2

EYA

IYA

IYC

PRM   PR3   PR2   BS   IXC   IXA   EXA

PR2 Alignment (Mar 3)

- Use picomotors on PR2 to center the beam on PR3
- PR3, PR2 chambers opened

EYA

IYA

IYC

align PR2

PRM   PR3   PR2   BS   IXC   IXA   EXA

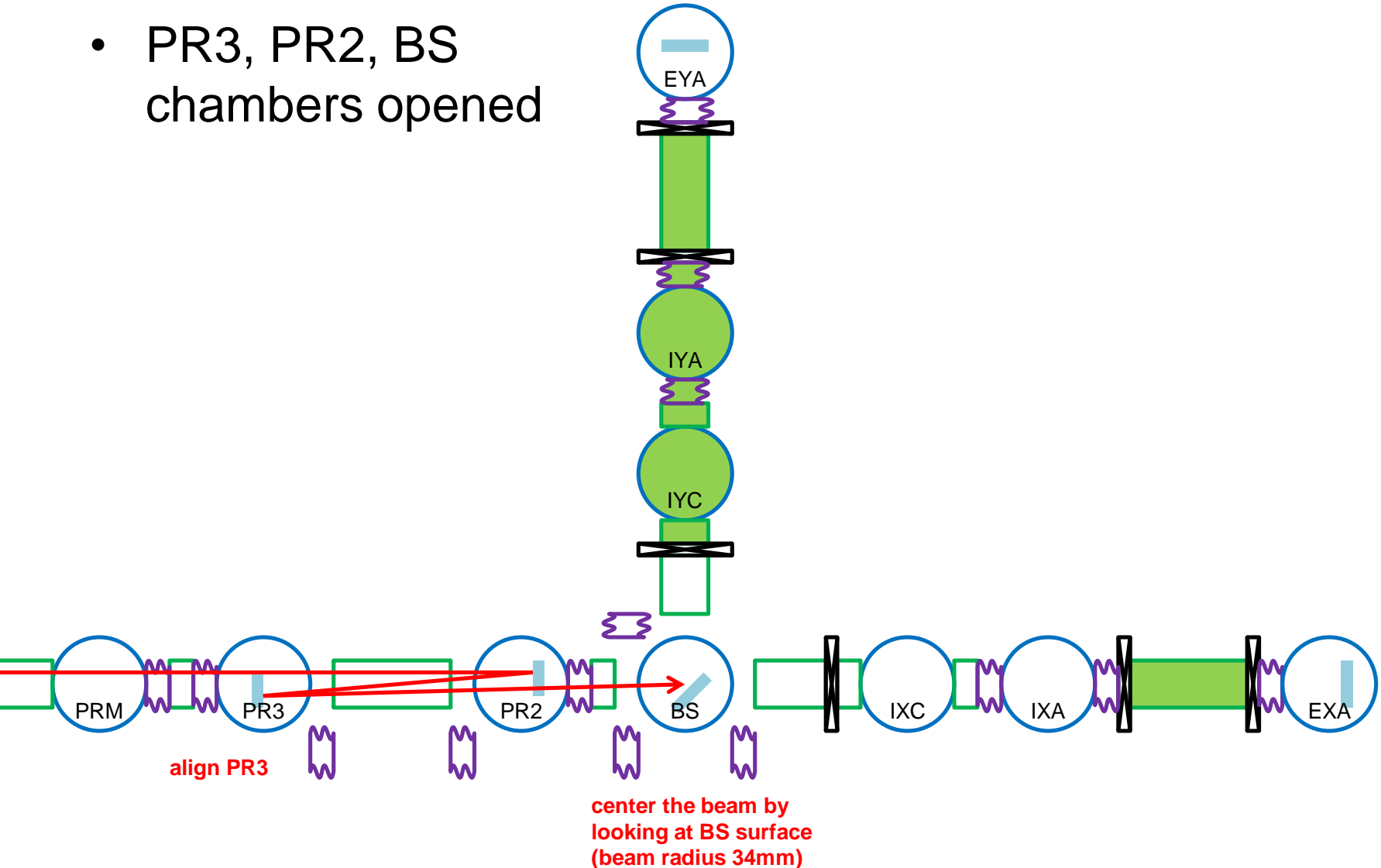**center the beam by looking at PR3 surface (beam radius 34mm)**

Beam Profiling at PR3 (Mar 3)

- Measure the profile of the beam going to PR3
- tilt PR2 temporarily
- PR3, PR2 chambers opened

tilt PR2

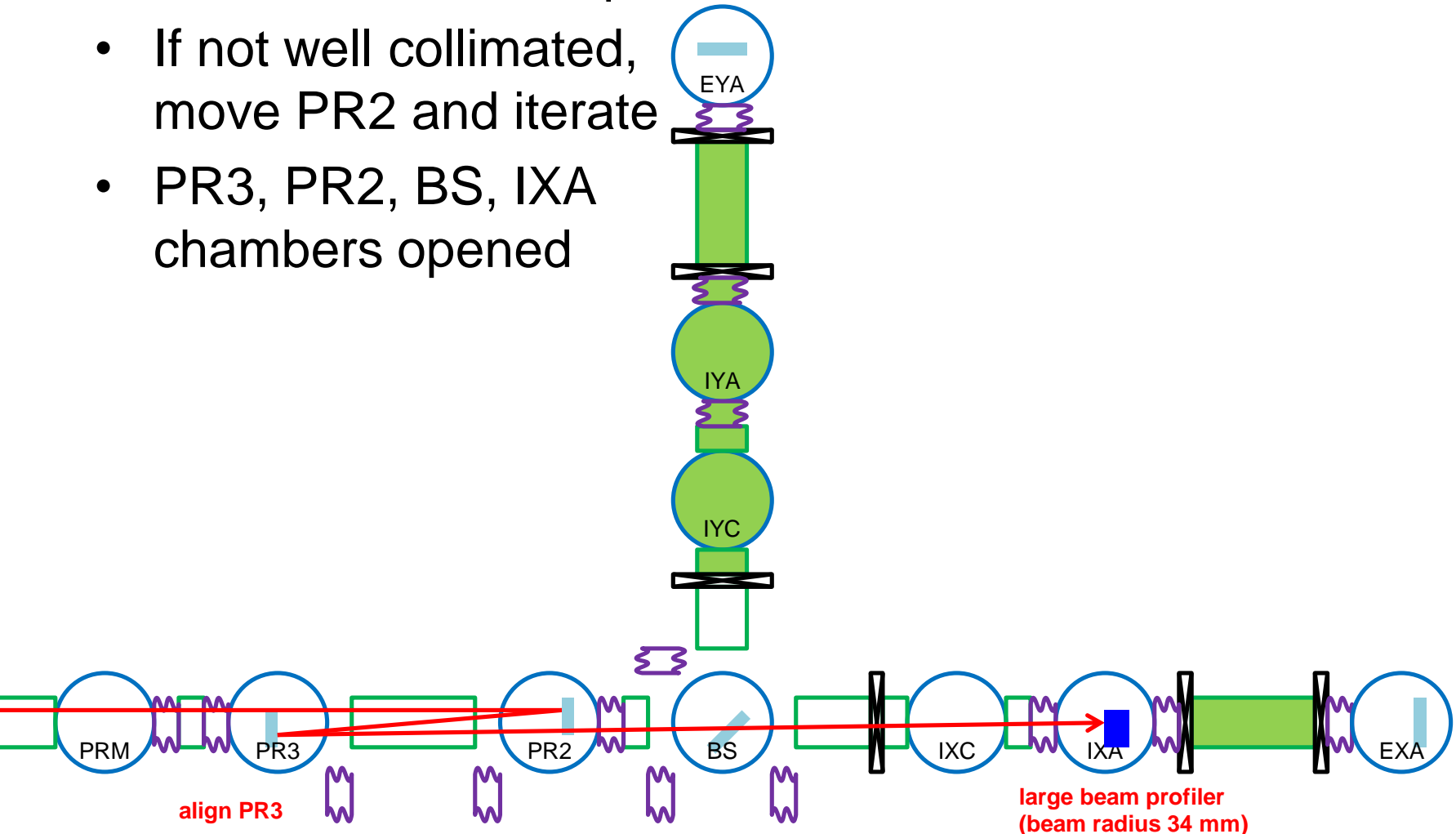large beam profiler
(beam radius 34 mm)
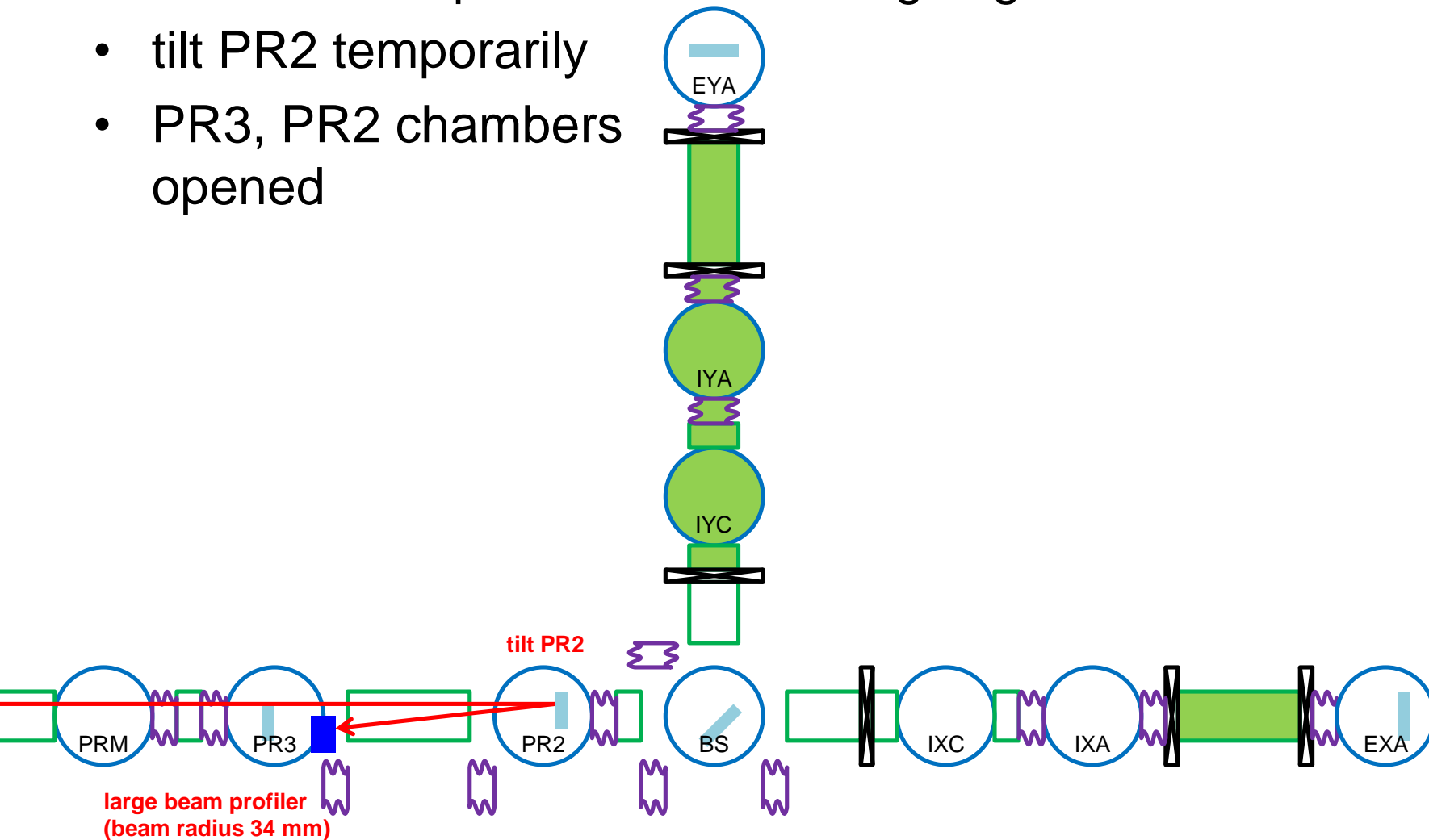
PR3 Alignment (Mar 4)

- Use OSEMS on PR3 to center the beam on BS
- PR3, PR2, BS chambers opened

align PR3

center the beam by
looking at BS surface
(beam radius 34mm)

Beam Profiling at IXA (Mar 4)

- Measure the beam profile at IXA
- If not well collimated, move PR2 and iterate
- PR3, PR2, BS, IXA chambers opened

EYA

IYA

IYC

PRM PR3 PR2 BS IXC IXA EXA

align PR3

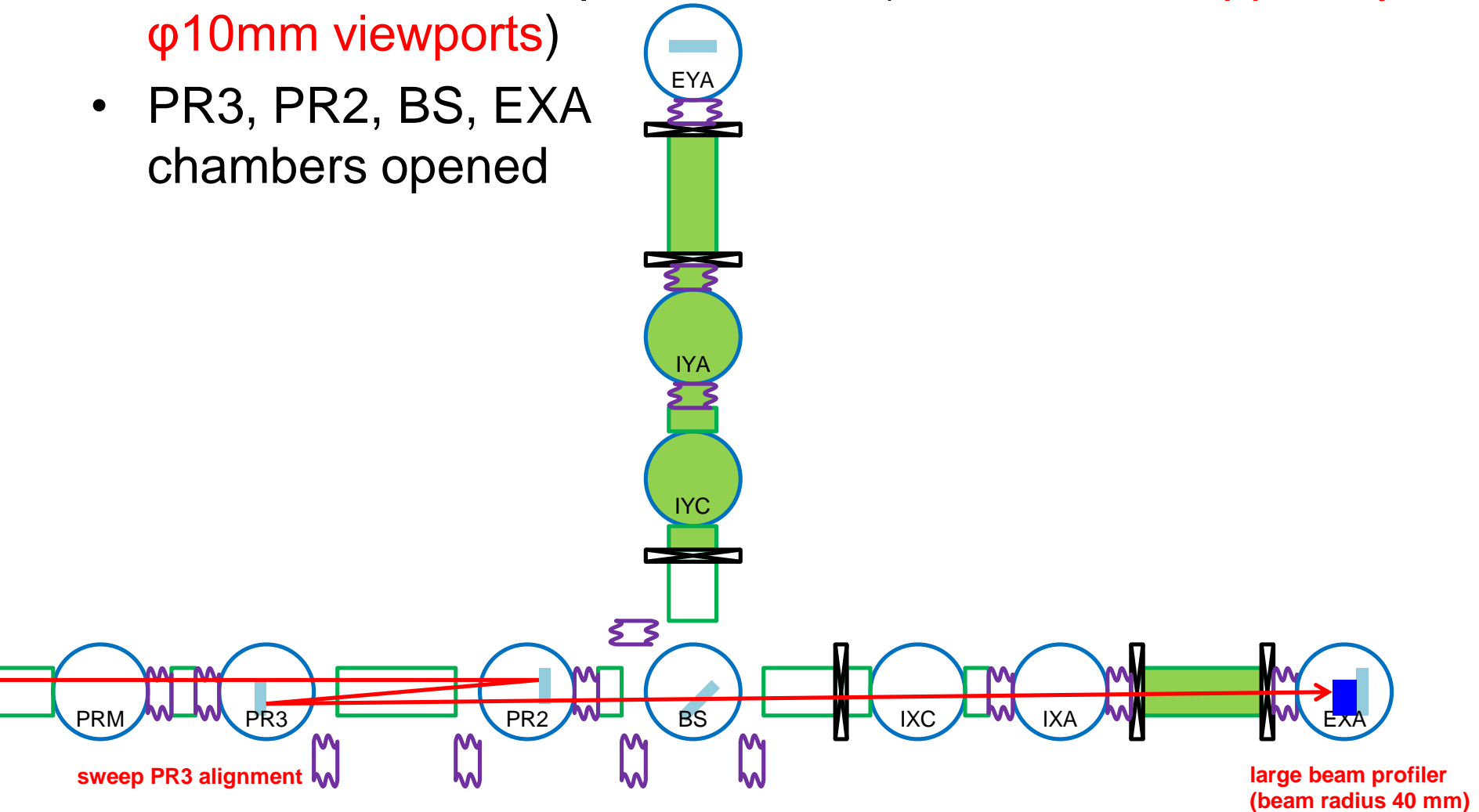**large beam profiler (beam radius 34 mm)**

Pointing to X Arm (Mar 4-7)

- Put PD in EXA chamber, sweep PR3 alignment by OSEMs, and wait for the PD to get any signal

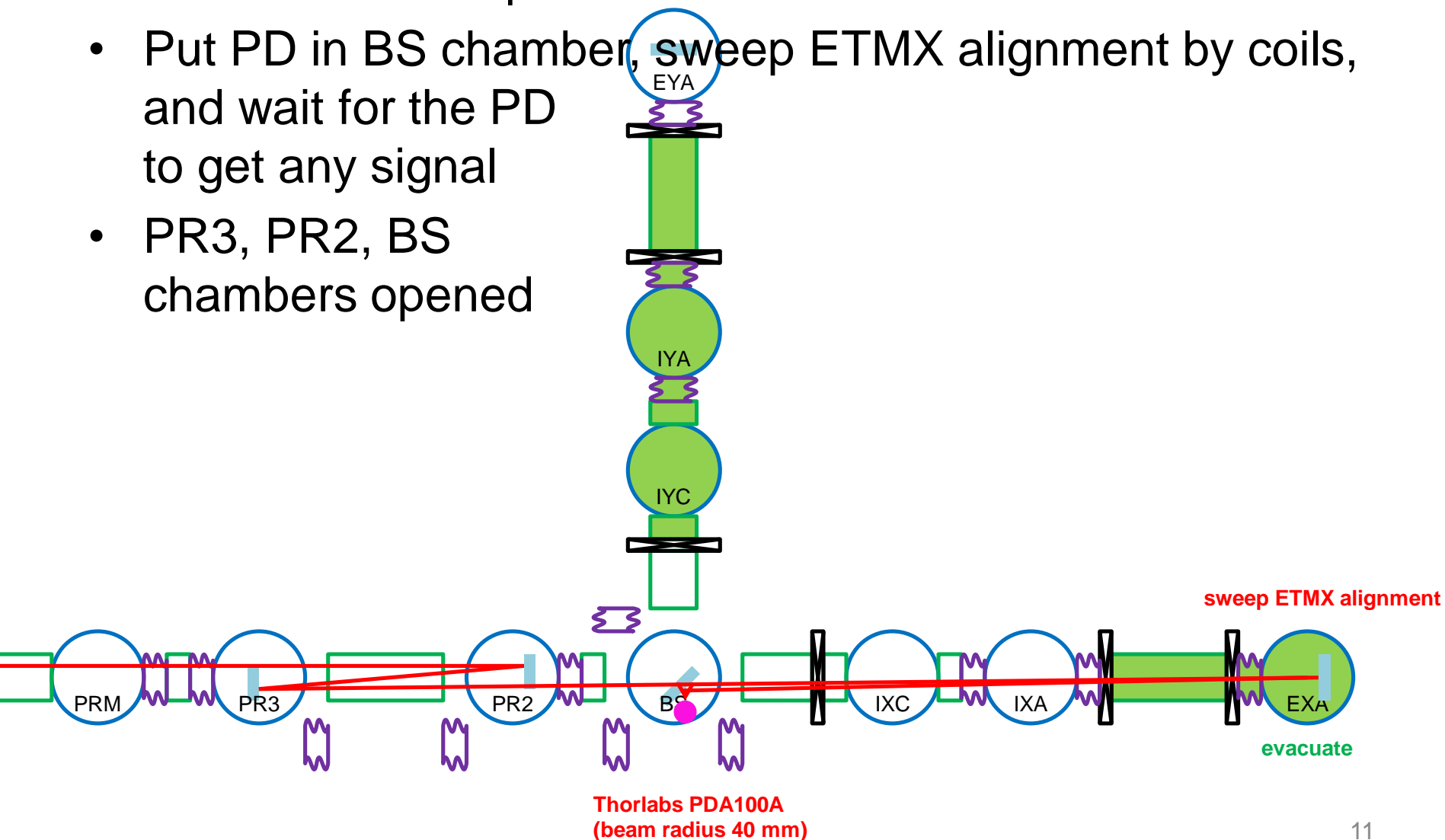- PR3, PR2, BS, EXA chambers opened

- If no success, go to plan B

EYA

IYA

IYC

PRM PR3 PR2 BS IXC IXA EXA

sweep PR3 alignment

**Thorlabs PDA100A
(beam radius 40 mm)**
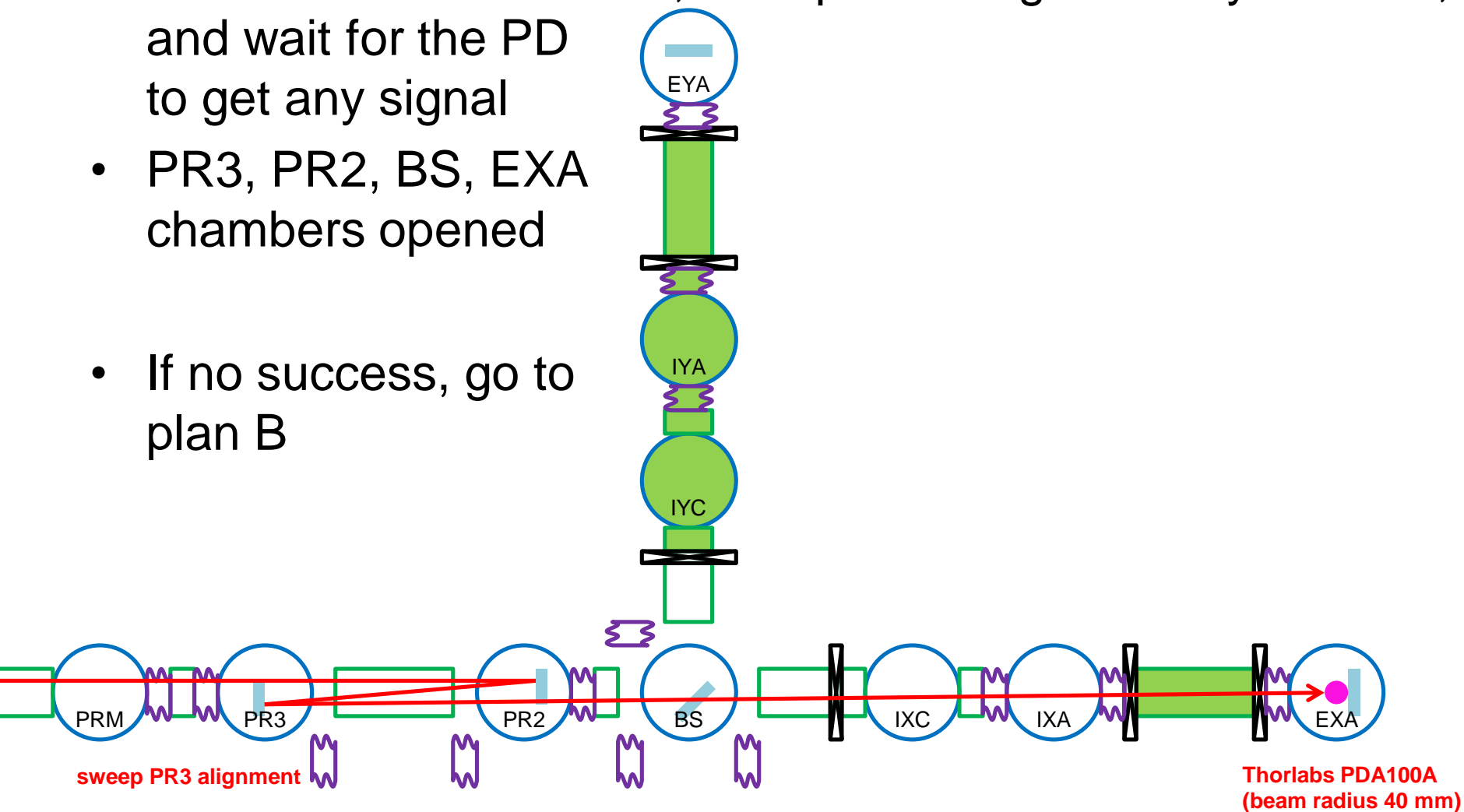
Beam Profiling at EXA (Mar 7)

- Measure the beam profile at IXA (this beam is clipped by φ10mm viewports)
- PR3, PR2, BS, EXA chambers opened

EYA

IYA

IYC

PRM   PR3   PR2   BS   IXC   IXA   EXA

sweep PR3 alignment

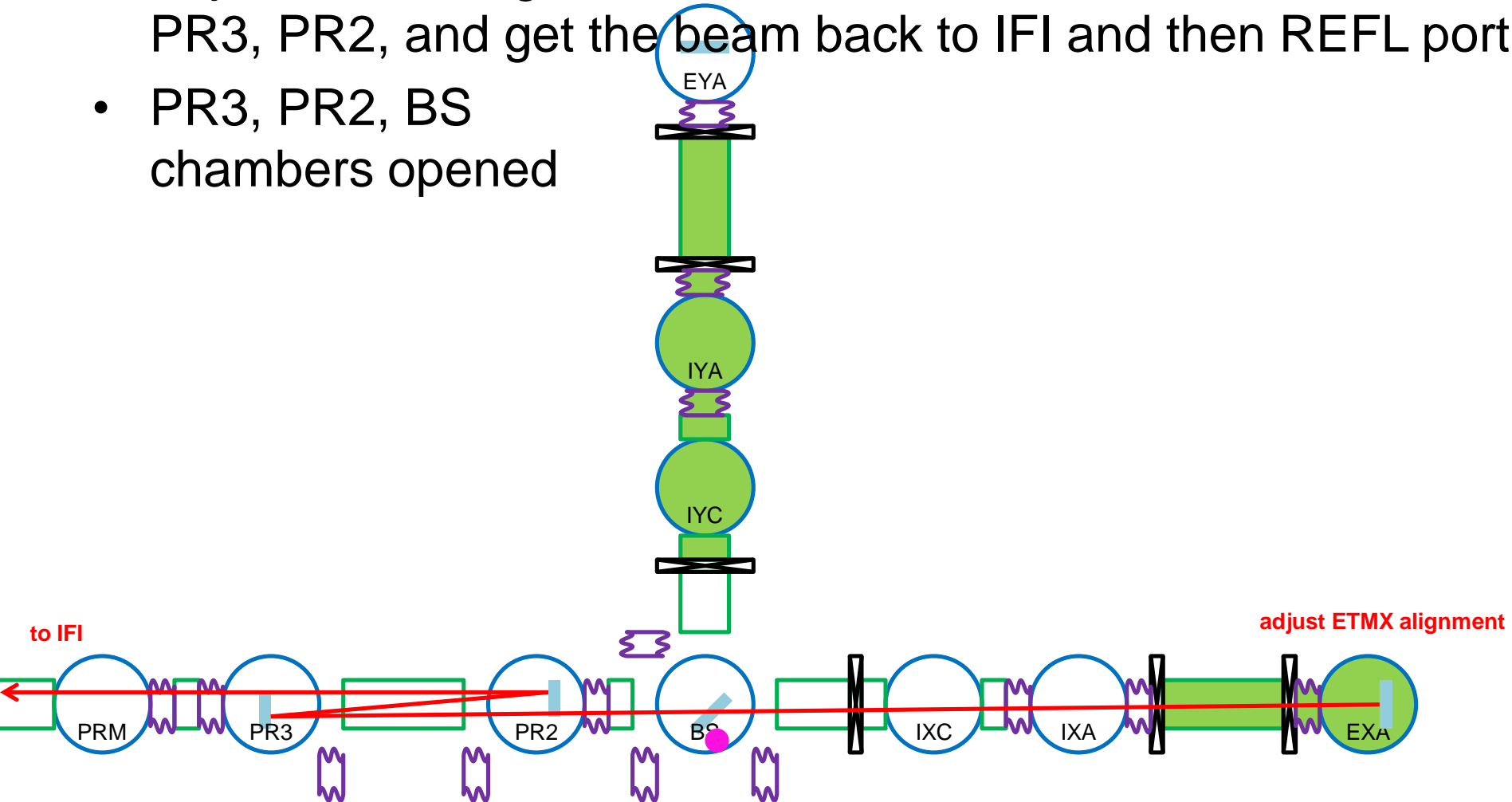large beam profiler
(beam radius 40 mm)

Pointing Back from X Arm (Mar 8)

- Evacuate EXA if possible
- Put PD in BS chamber, sweep ETMX alignment by coils, and wait for the PD to get any signal
- PR3, PR2, BS chambers opened

EYA

IYA

IYC

sweep ETMX alignment

PRM PR3 PR2 BS IXC IXA EXA

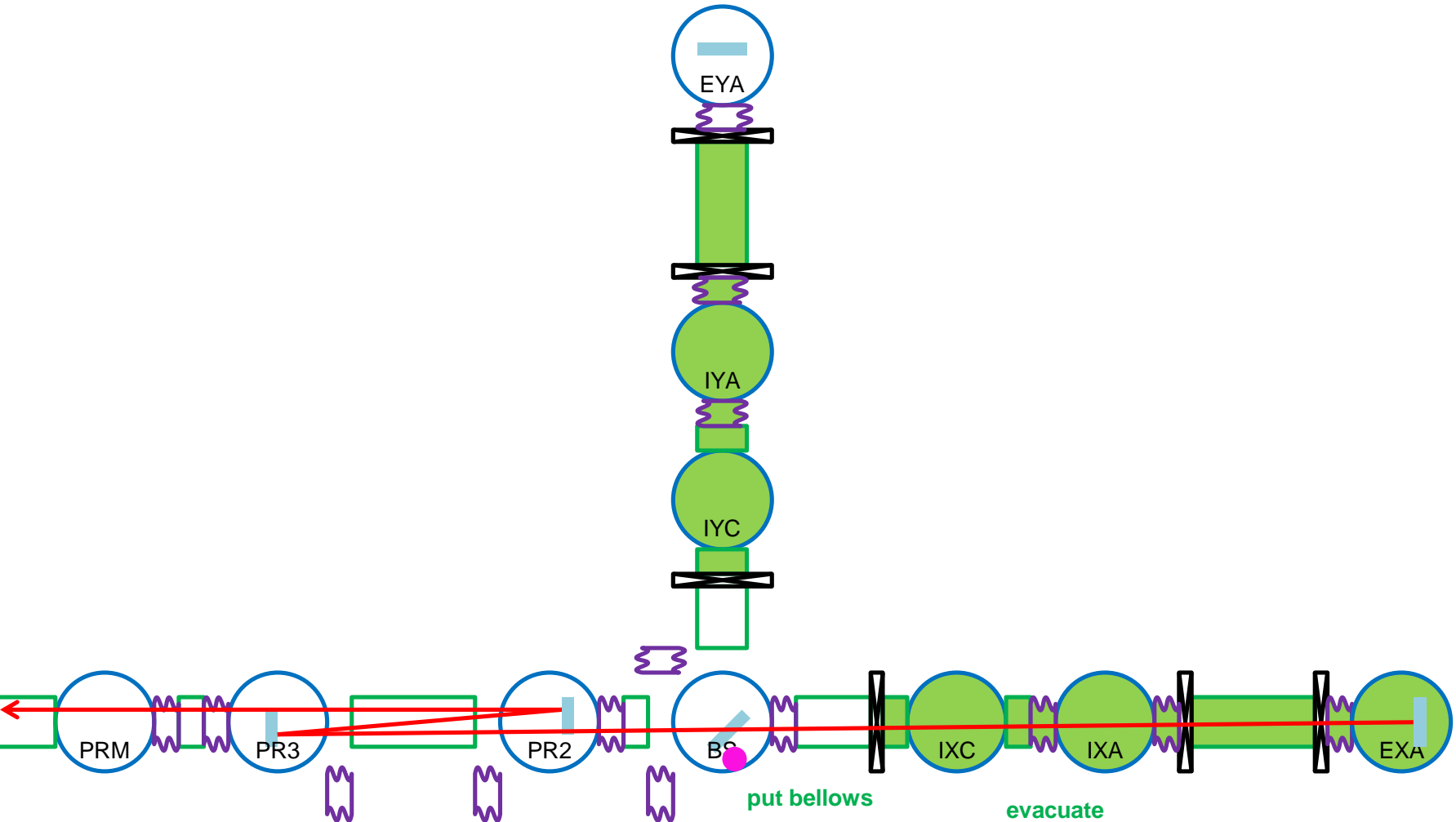evacuate

**Thorlabs PDA100A
(beam radius 40 mm)**

Back to IFI (Mar 8)

- Adjust ETMX alignment to center the reflected beam on BS, PR3, PR2, and get the beam back to IFI and then REFL port
- PR3, PR2, BS chambers opened

EYA

IYA

IYC

to IFI

adjust ETMX alignment

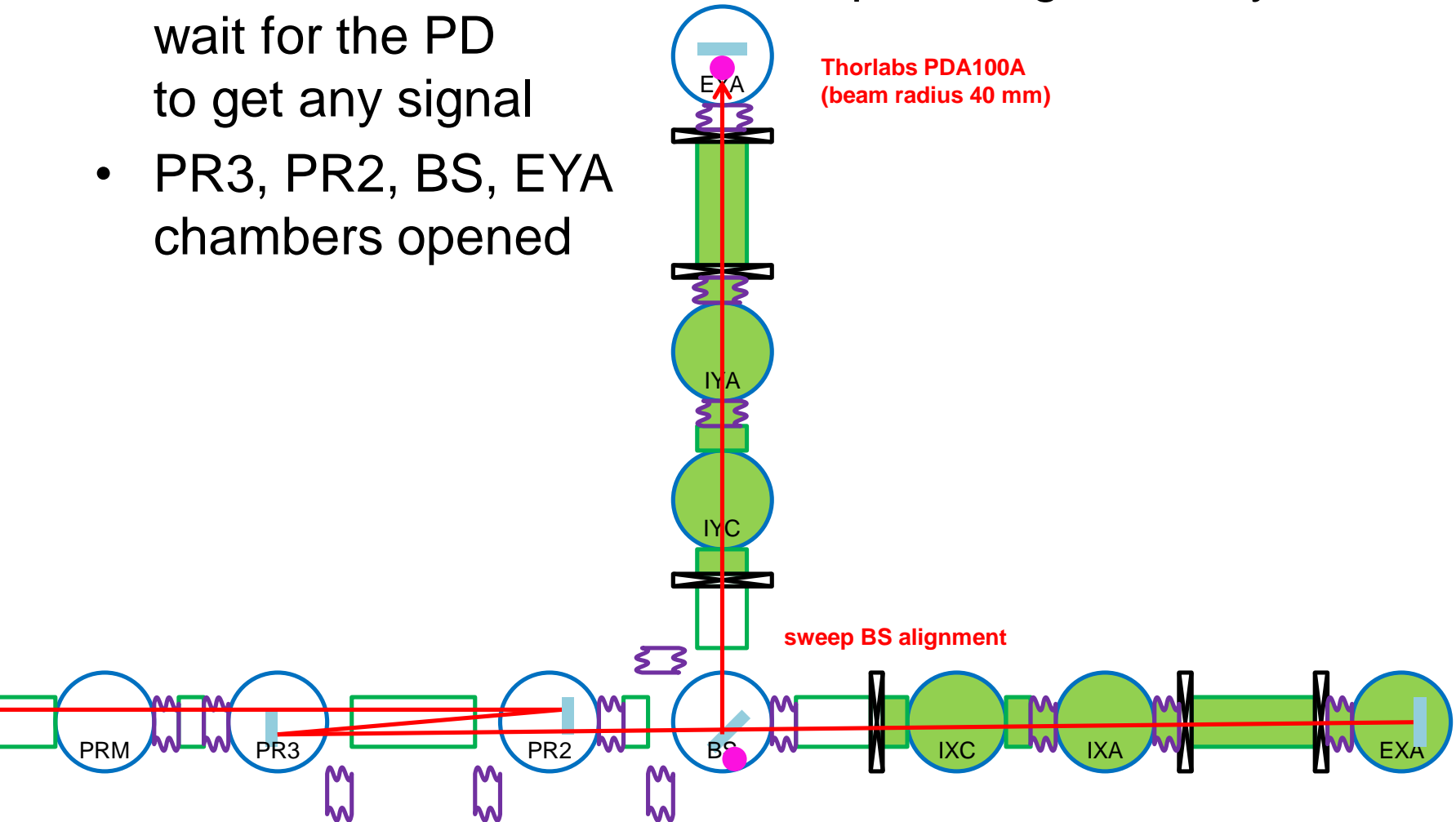PRM   PR3   PR2   BS   IXC   IXA   EXA

Close X arm (Mar 9)

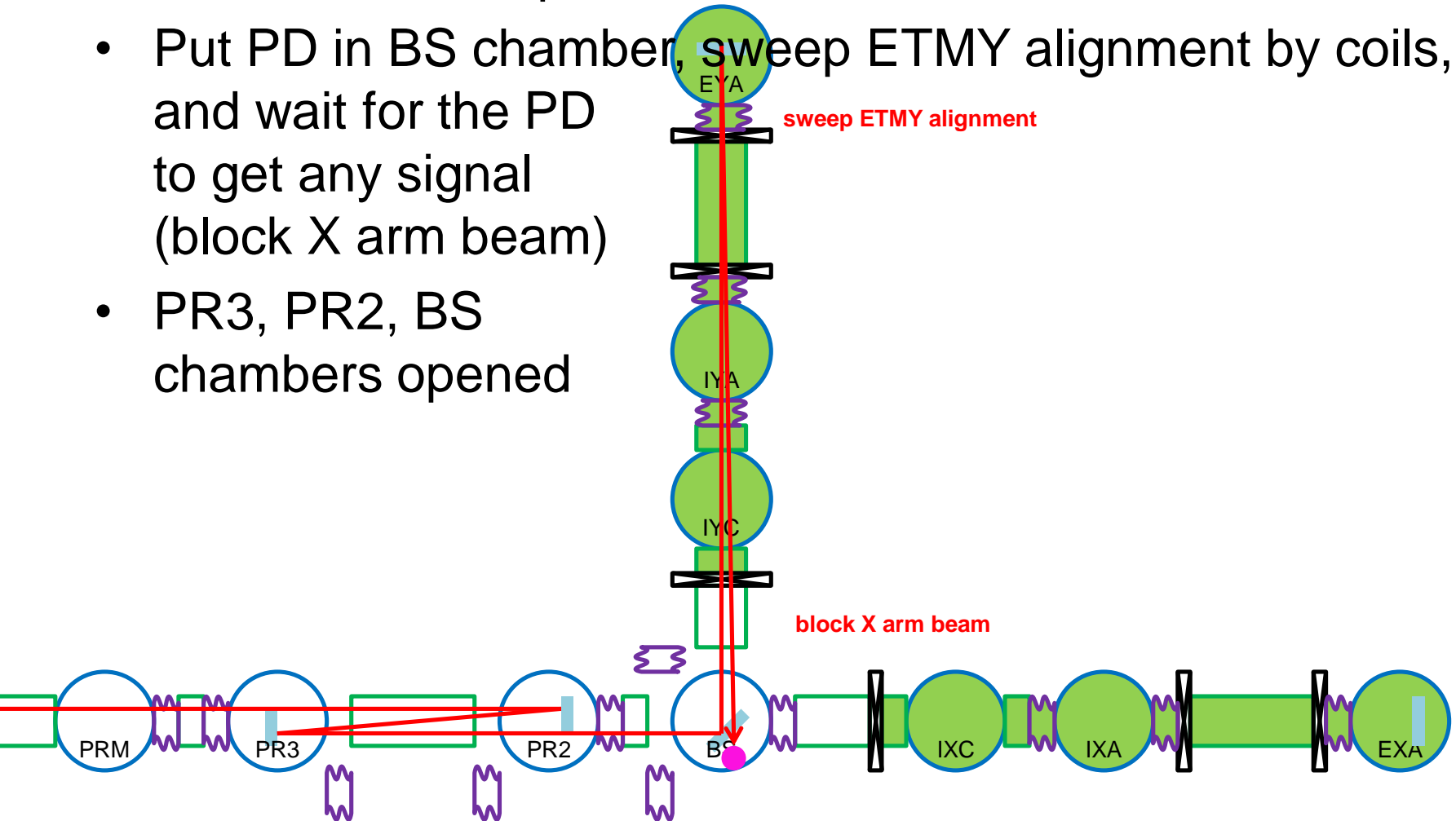- Put X arm bellows, and evacuate X arm

Pointing to Y arm (Mar 9-10)

- Put PD in EYA chamber, sweep BS alignment by coils, and wait for the PD to get any signal

- PR3, PR2, BS, EYA chambers opened

Thorlabs PDA100A
(beam radius 40 mm)

EYA

IYA

IYC

sweep BS alignment

PRM PR3 PR2 BS IXC IXA EXA

Pointing Back from Y arm (Mar 11)

- Evacuate EYA if possible
- Put PD in BS chamber, sweep ETMY alignment by coils, and wait for the PD to get any signal (block X arm beam)
- PR3, PR2, BS chambers opened

EYA

sweep ETMY alignment

IYA

IYC

block X arm beam

PRM   PR3   PR2   BS   IXC   IXA   EXA

Thorlabs PDA100A
(beam radius 40 mm)

Get Fringe at REFL/AS (Mar 11)

- Unblock X arm beam and confirm fringing at REFL/AS
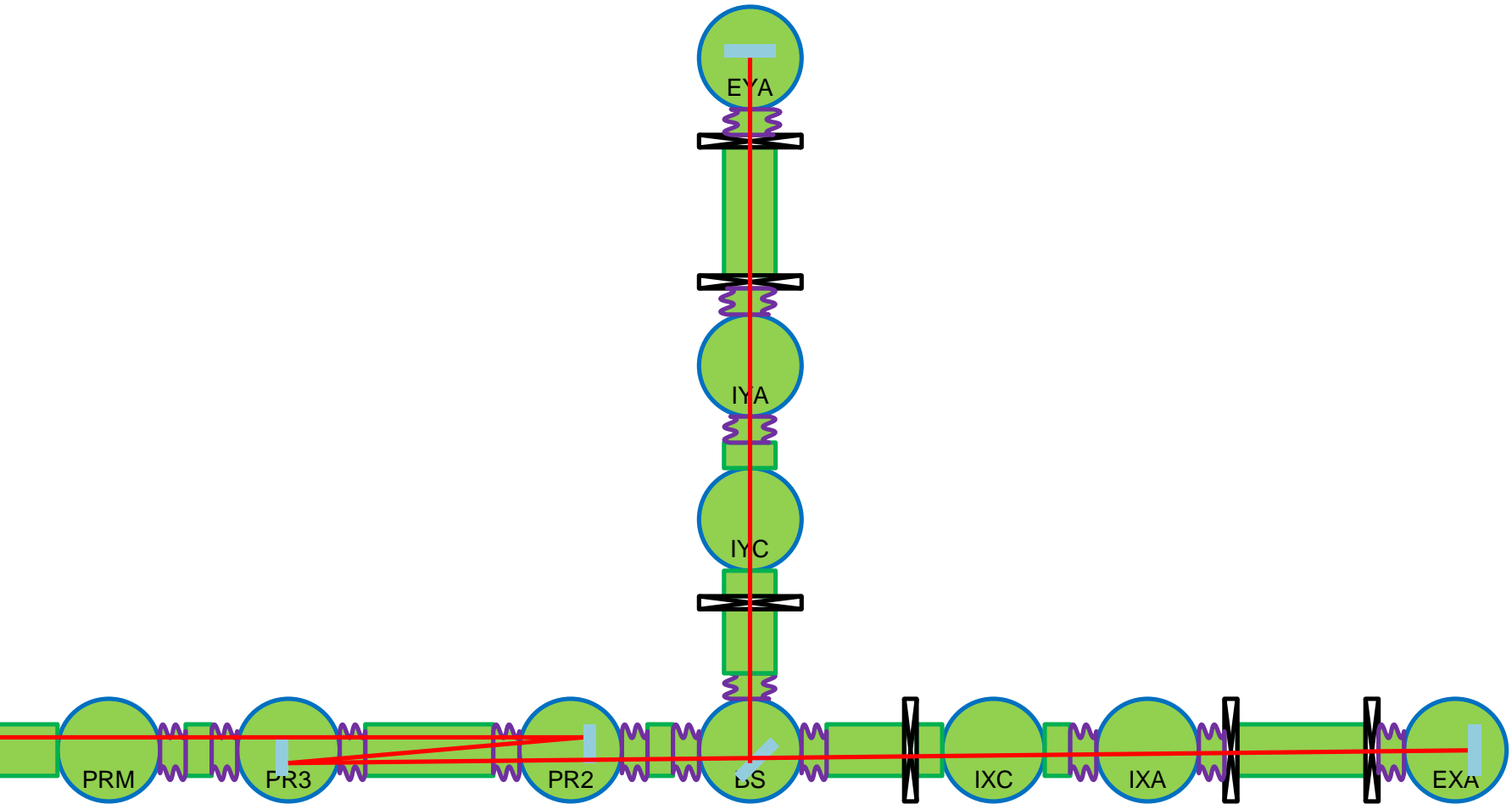- PR3, PR2, BS chambers opened

EYA

IYA

IYC

block X arm beam

PRM PR3 PR2 BS IXC IXA EXA

Thorlabs PDA100A
(beam radius 40 mm)
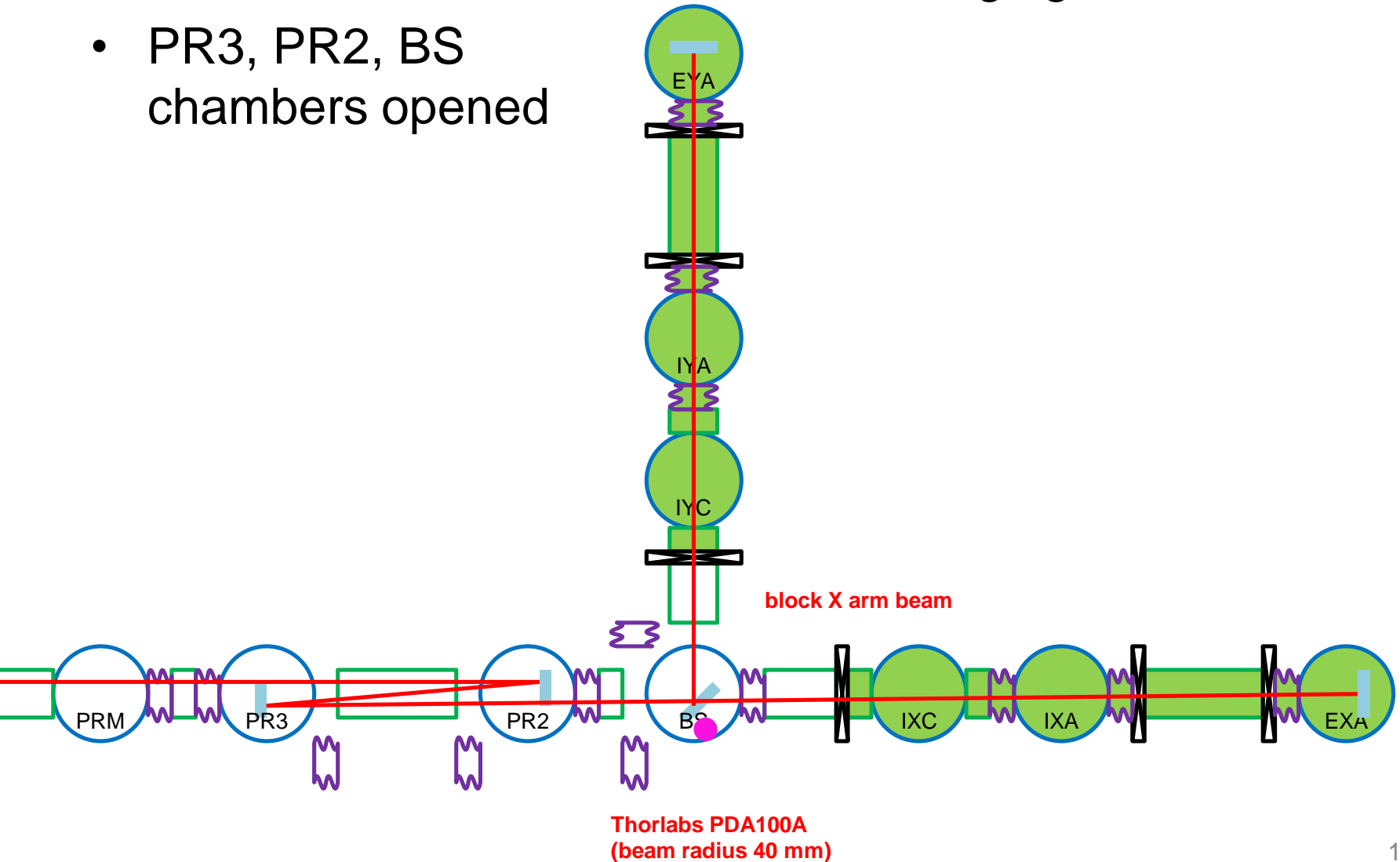
Close Everything (Mar 12-13)

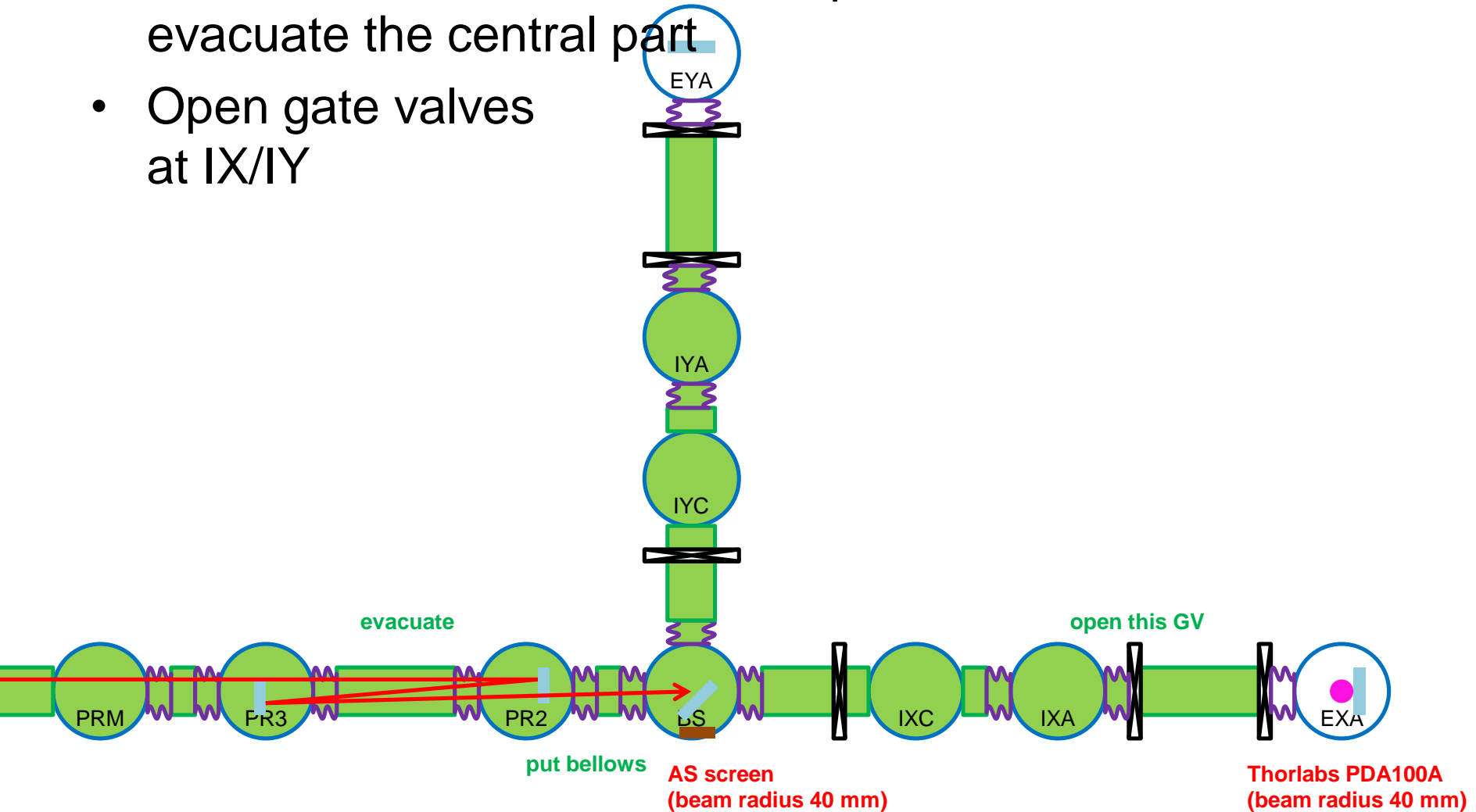- Close remaining bellows and evacuate the whole IFO
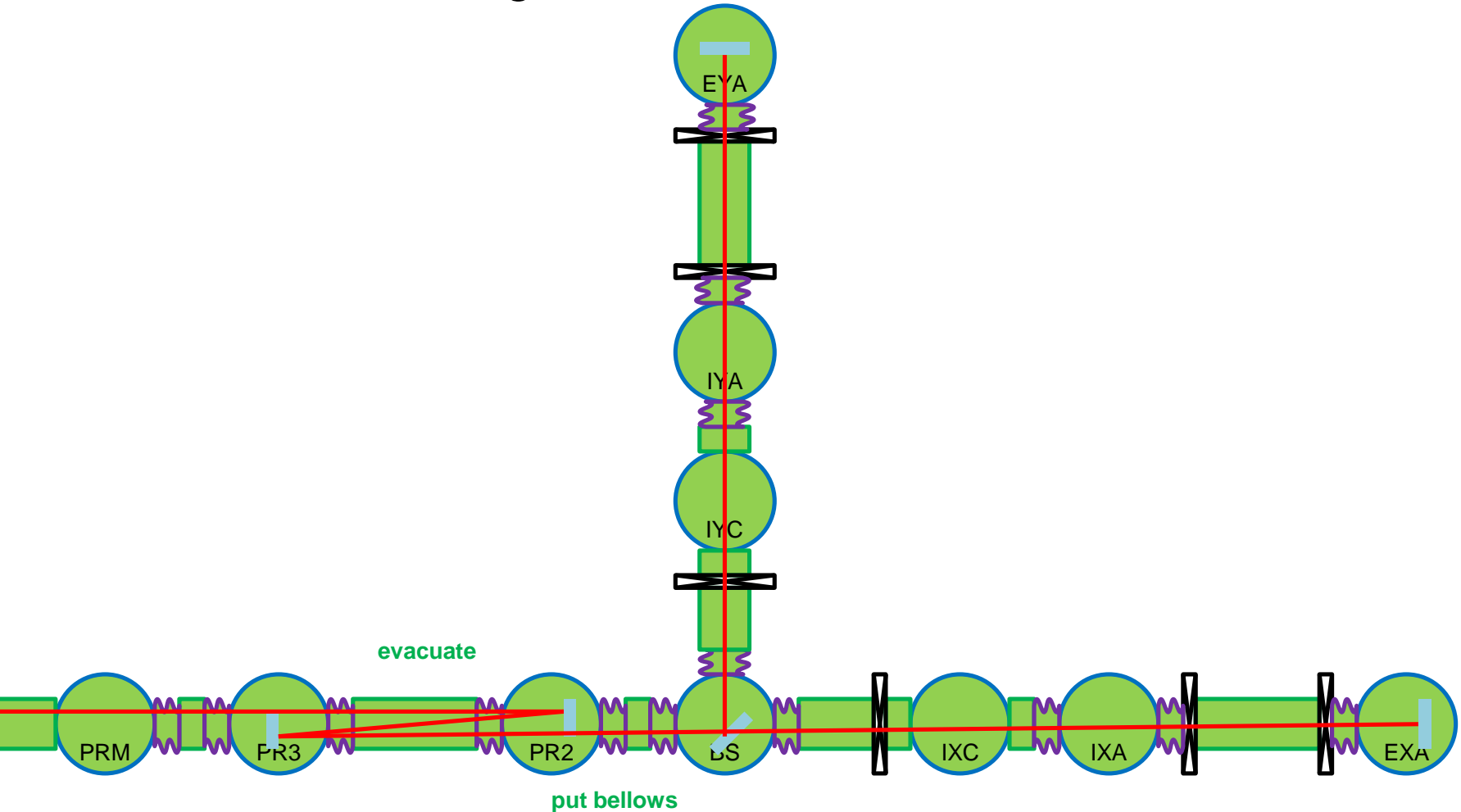
Lock Michelson (Mar 14)

- Lock Michelson with REFL PD

Plan B
(if we don't see the beam at EX)

Evacuate Central Part (Mar 8)

- Put AS screen in BS chamber, put all the bellows, and evacuate the central part
- Open gate valves at IX/IY

evacuate

put bellows

open this GV

AS screen
(beam radius 40 mm)

Thorlabs PDA100A
(beam radius 40 mm)

EYA
IYA
IYC
PRM
PR3
PR2
BS
IXC
IXA
EXA

All the rest

- Pointing to X arm (Mar 9)
- Back to IFI from X arm (Mar 10)
- Pointing to Y arm (Mar 11)
- Back to IFI from Y arm, and get fringing (Mar 12)
- Evacuate EXA and EYA (Mar 13)
- Lock Michelson (Mar 14)

- We skip beam profiling at EXA
- Use cameras/screens/irises(?) after evacuation of the central part