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

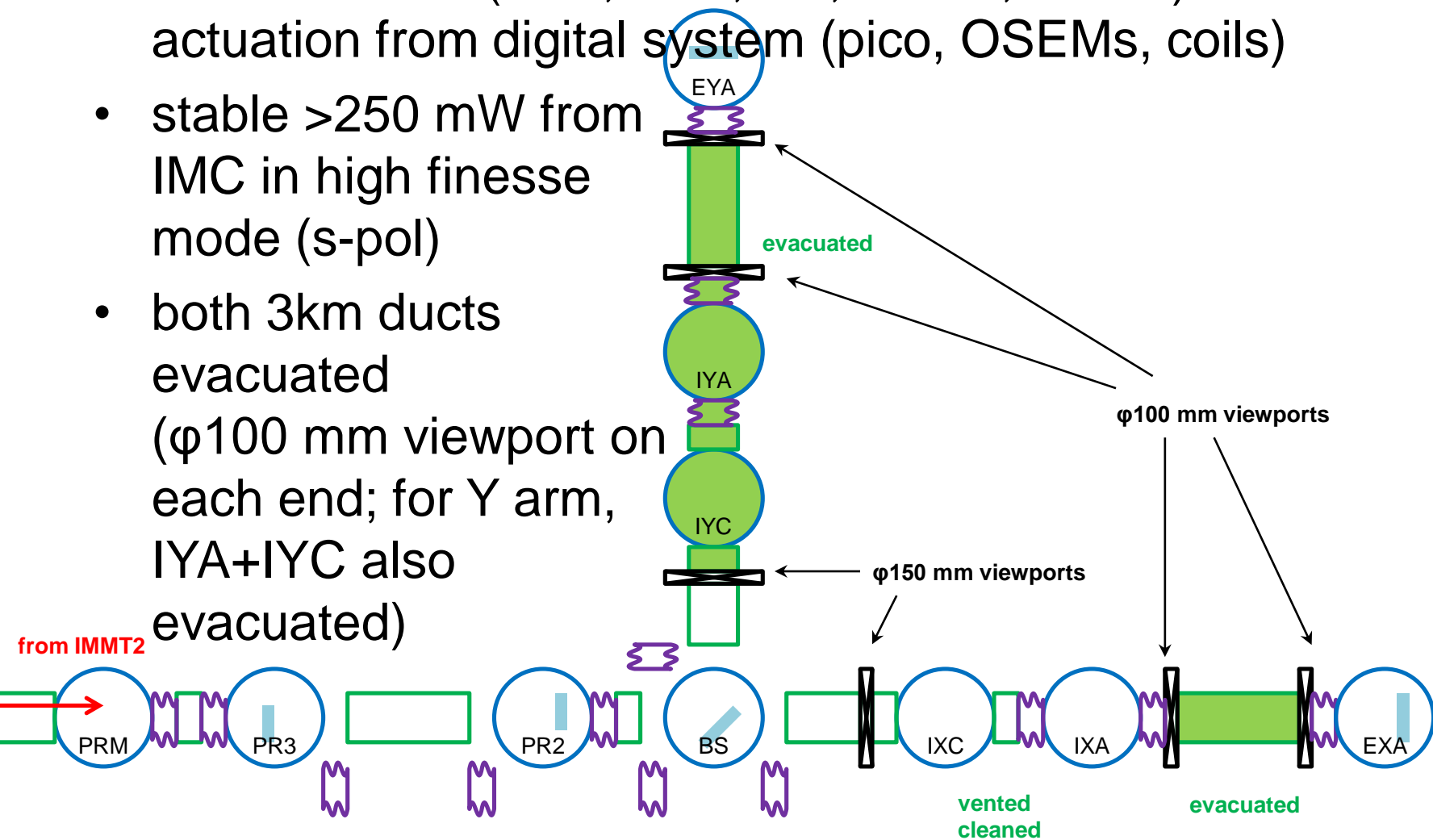## Yuta Michimura

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 (φ100 mm viewport on each end; for Y arm, IYA+IYC also evacuated)
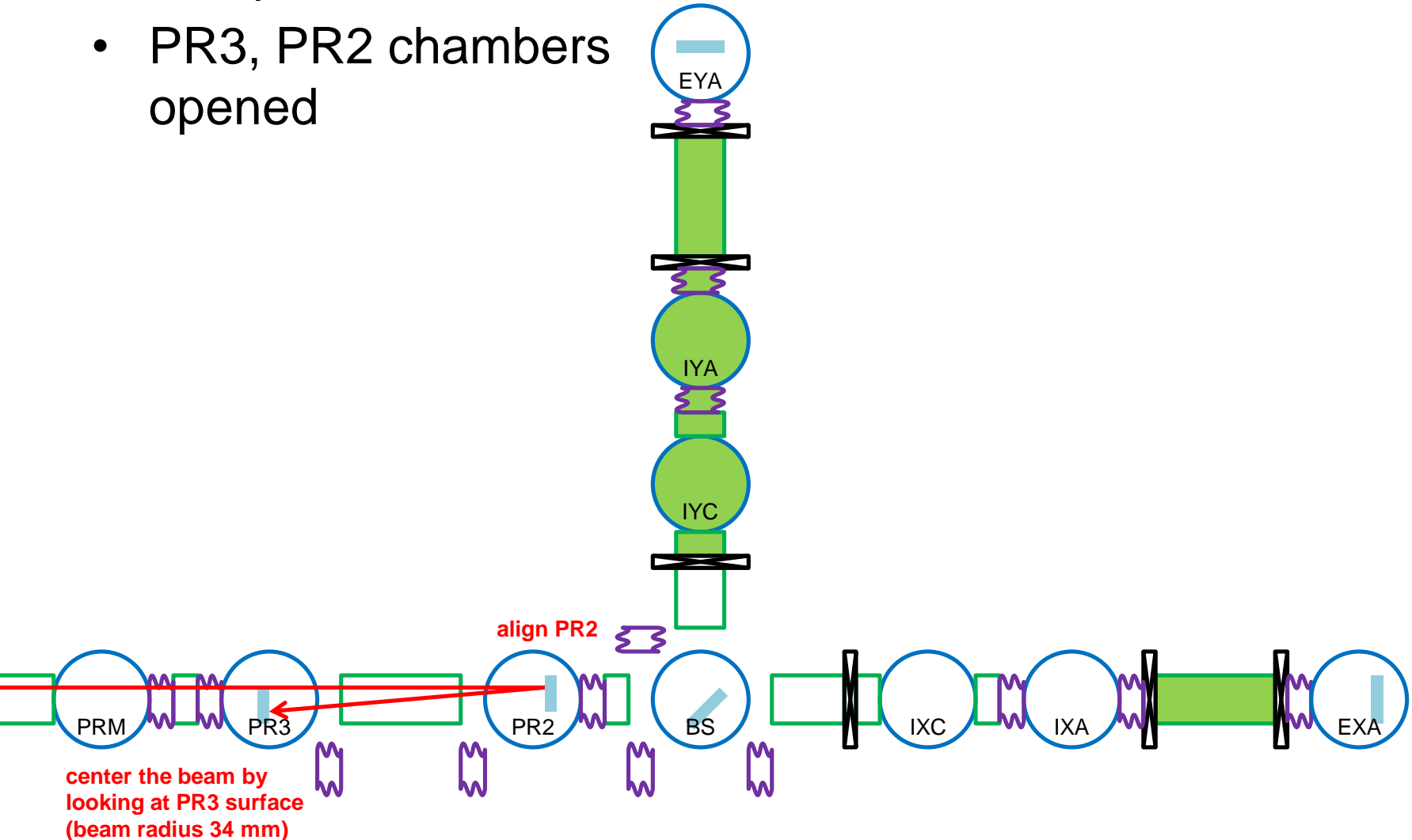
EYA

evacuated

IYA

IYC

φ100 mm viewports

φ150 mm 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 3.7 mm)

align IMMT2
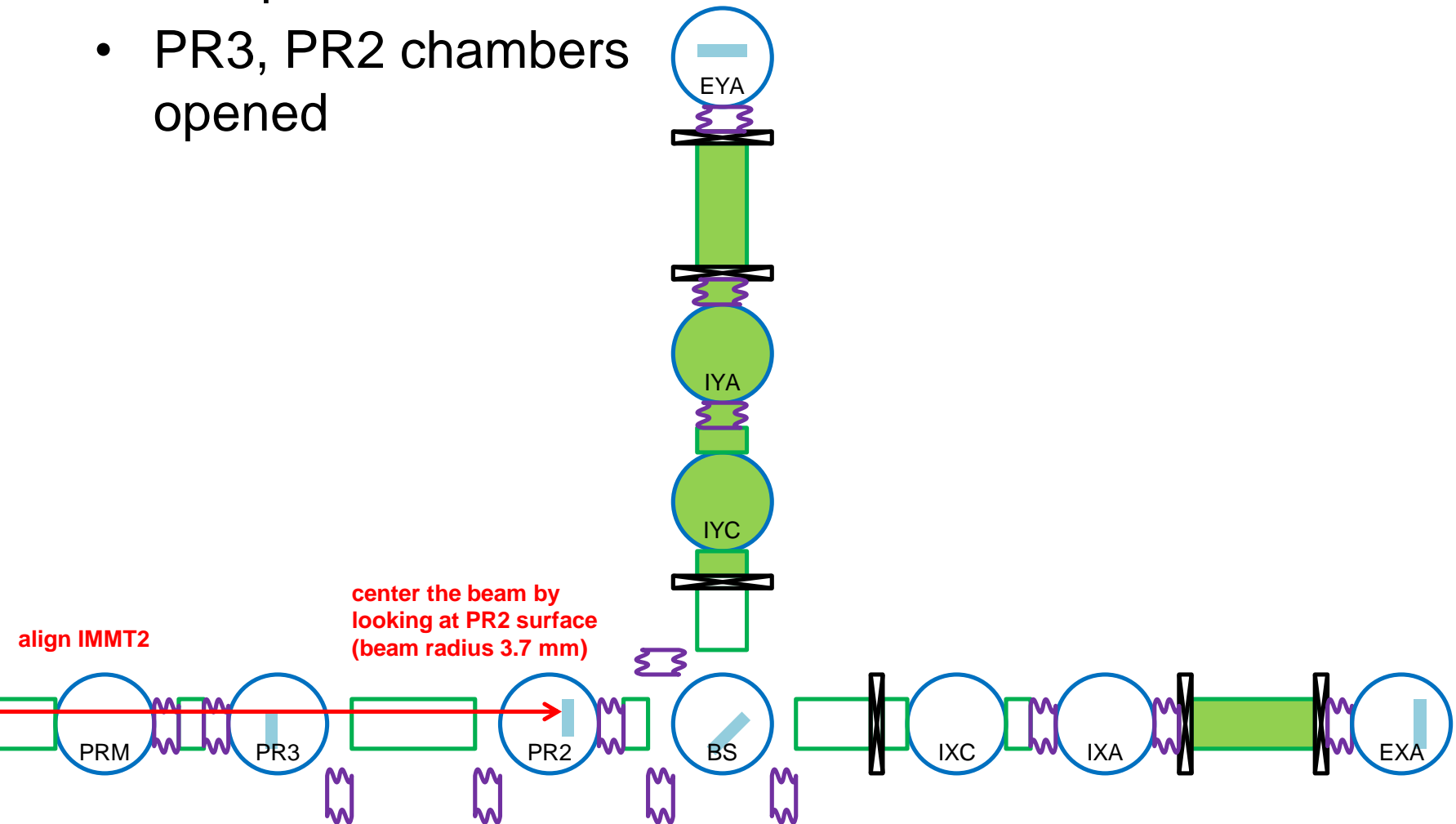
PR2 Alignment (Mar 3)

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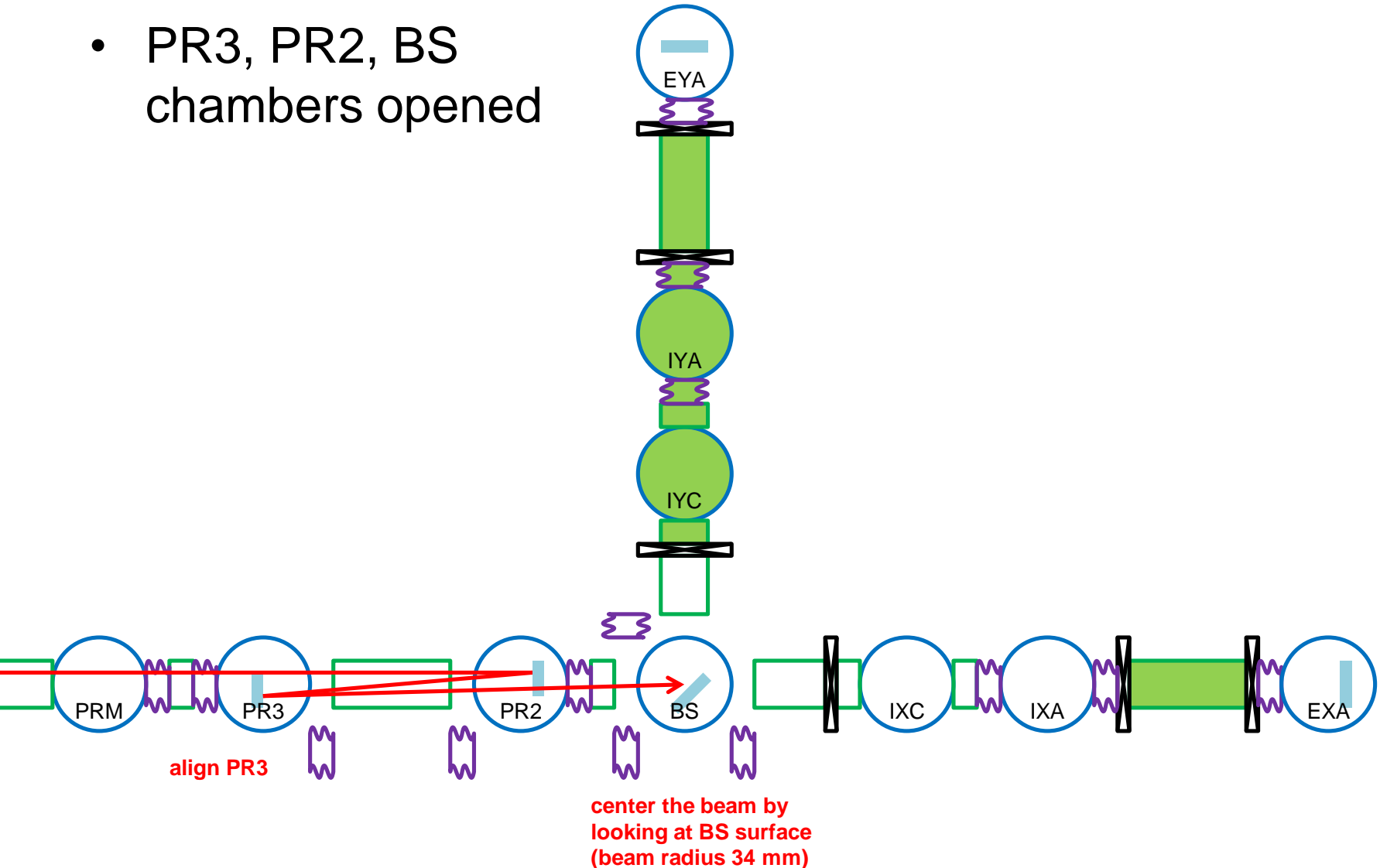
center the beam by looking at PR3 surface (beam radius 34 mm)

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)
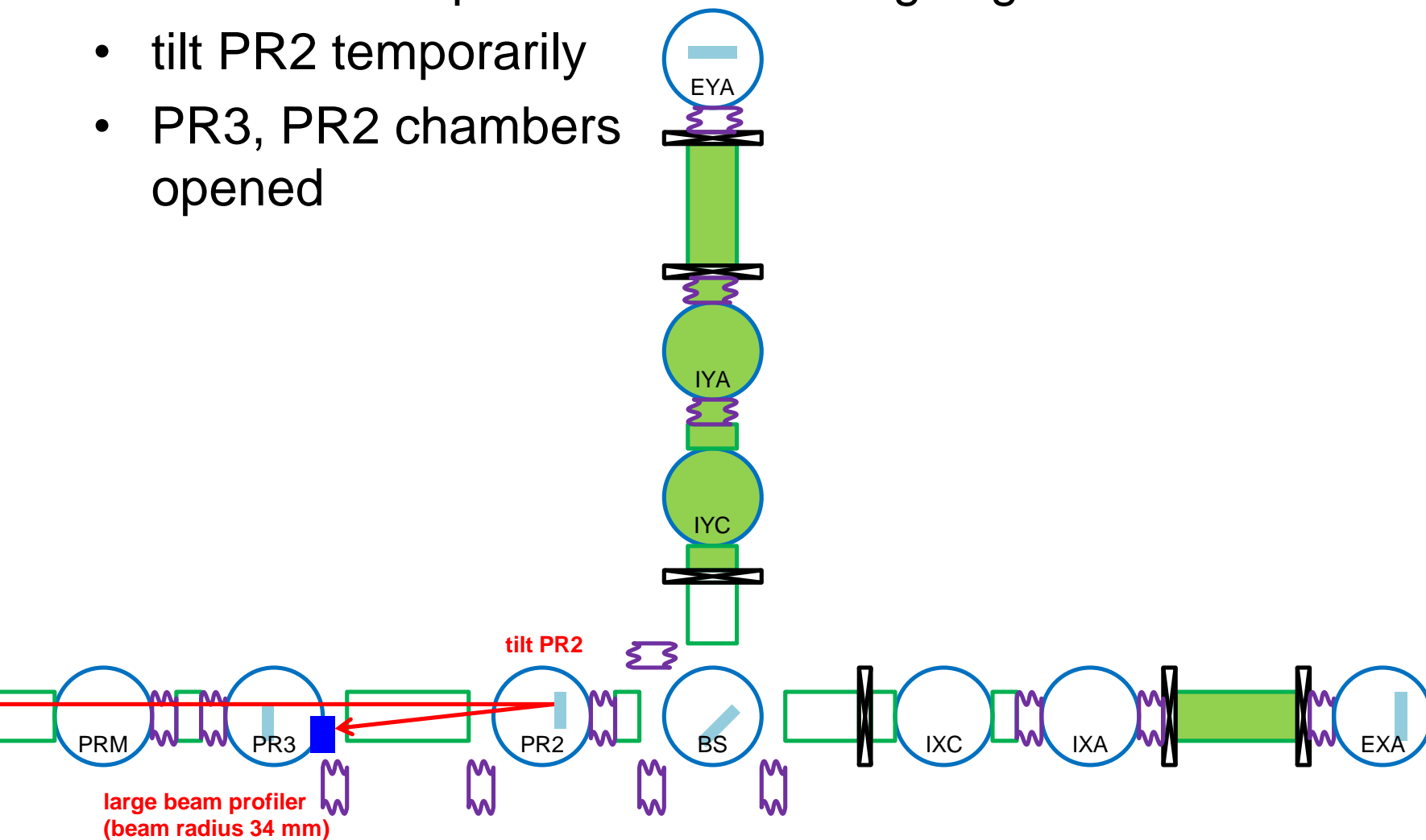
PR3 Alignment (Mar 4)

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

EYA

IYA

IYC

PRM

PR3

align PR3

PR2

BS

IXC

IXA

EXA

center the beam by looking at BS surface (beam radius 34 mm)
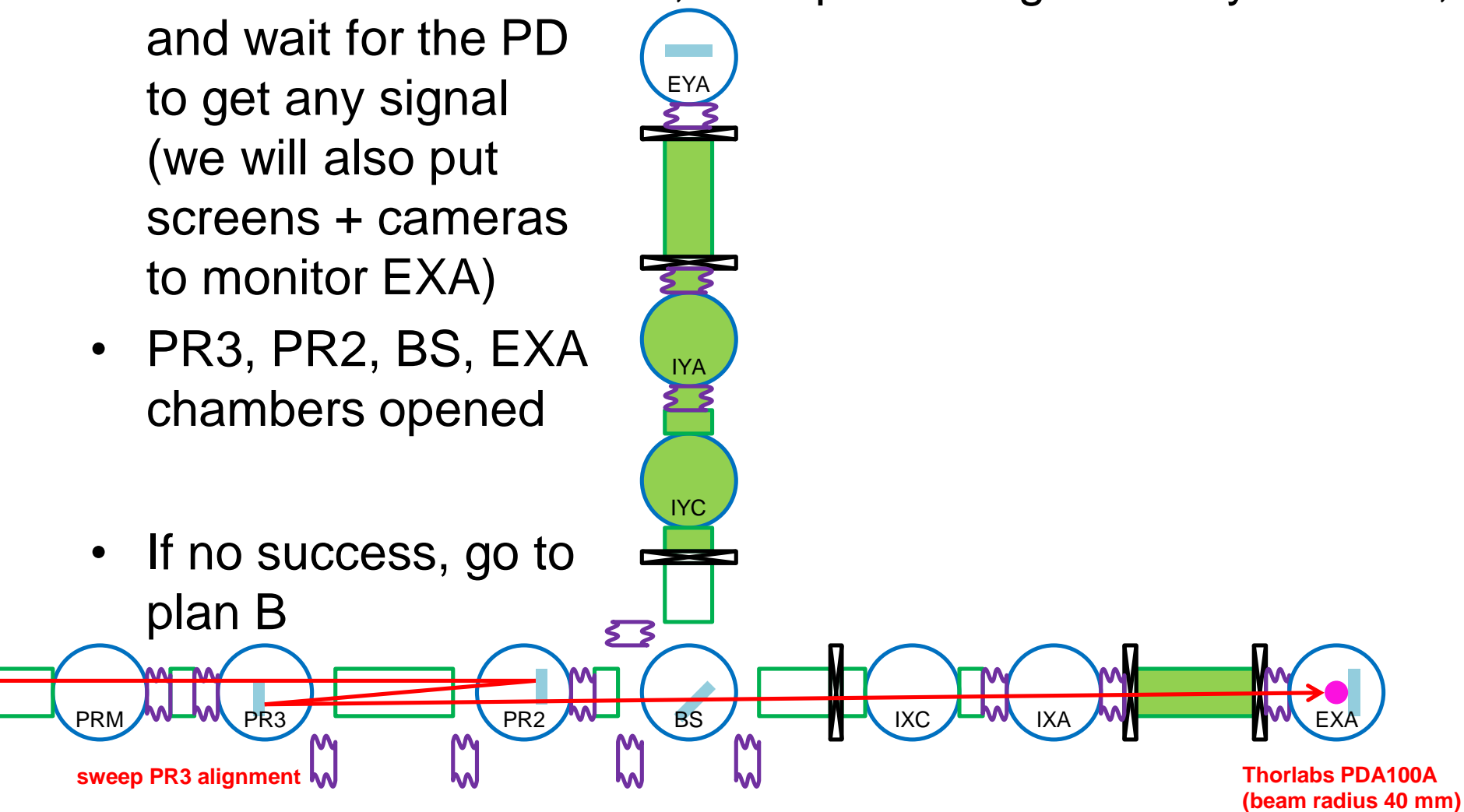
Beam Profiling at IXA (Mar 4)

- Measure the beam profile at IXA
- If not well collimated, move PR2 and iterate (it's not easy to decide if collimated or not with this length, but we will do our best)
- 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)**
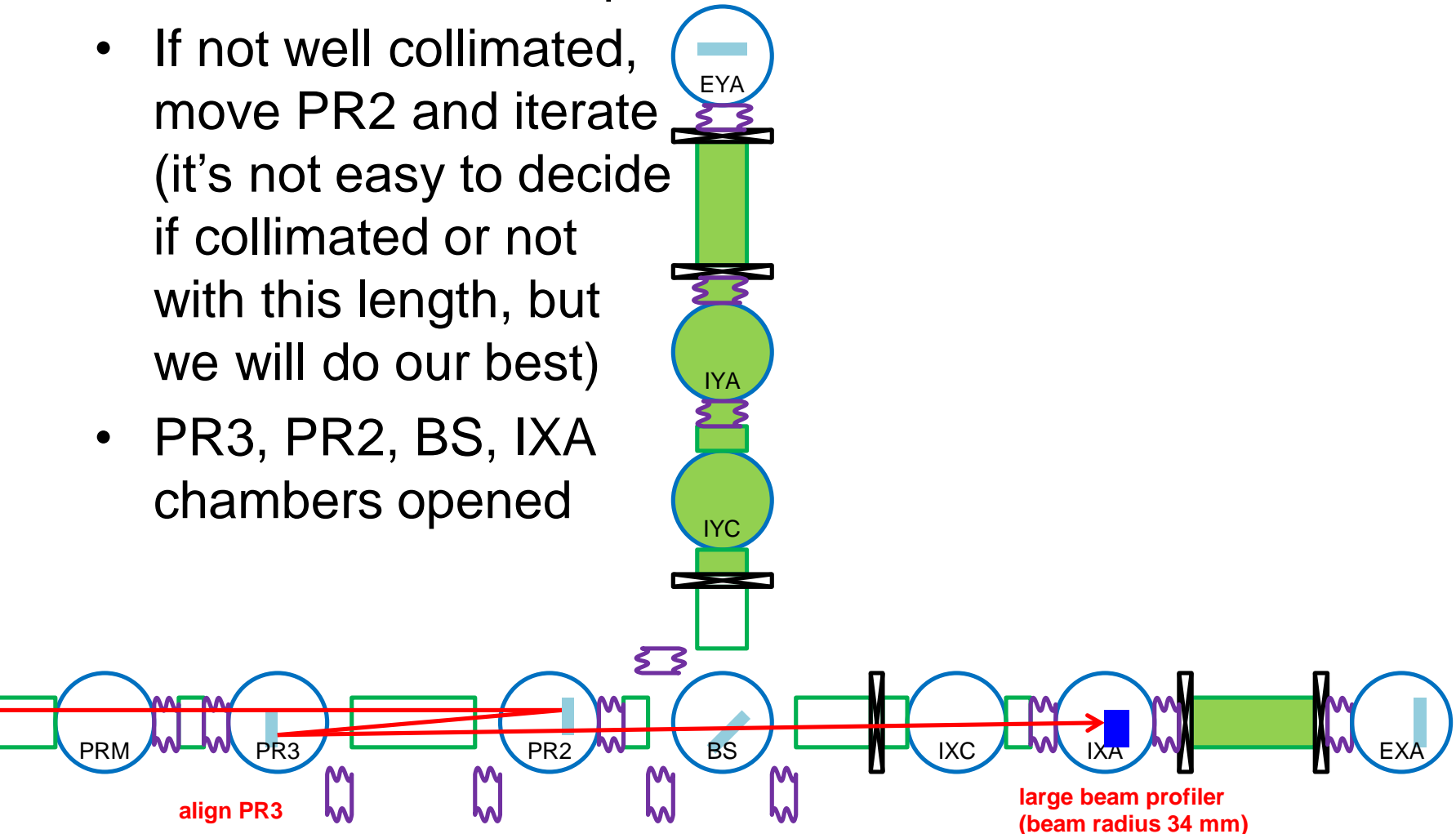
Pointing to X Arm (Mar 4-7)

- Put PD in EXA chamber, sweep PR3 alignment by OSEMs, and wait for the PD to get any signal (we will also put screens + cameras to monitor EXA)

- 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 φ100 mm viewports)
- PR3, PR2, BS, EXA chambers opened

EYA

IYA

IYC

PRM PR3 PR2 BS IXC IXA EXA

sweep PR3 alignment

large beam profiler
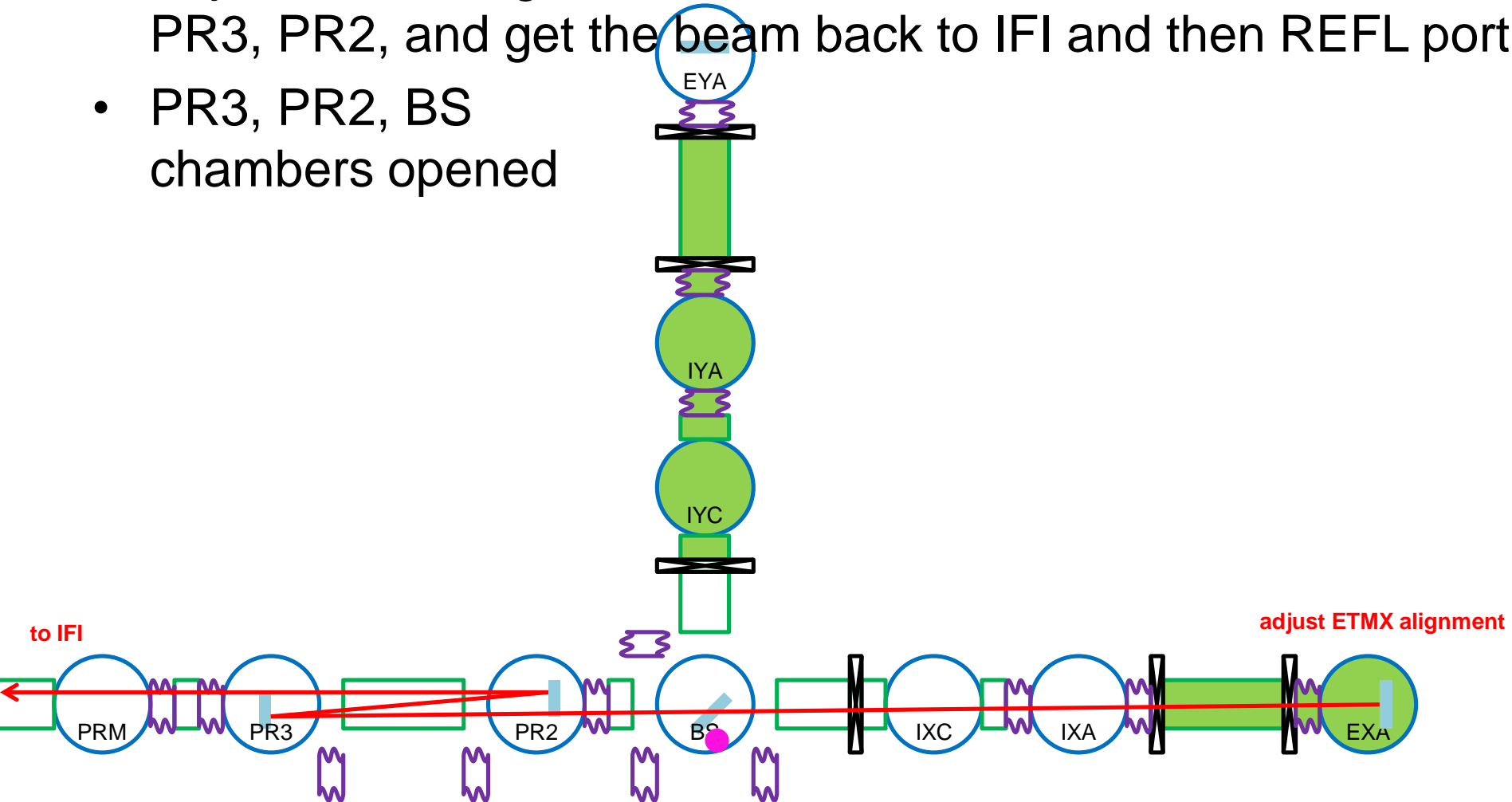(beam radius 40 mm)
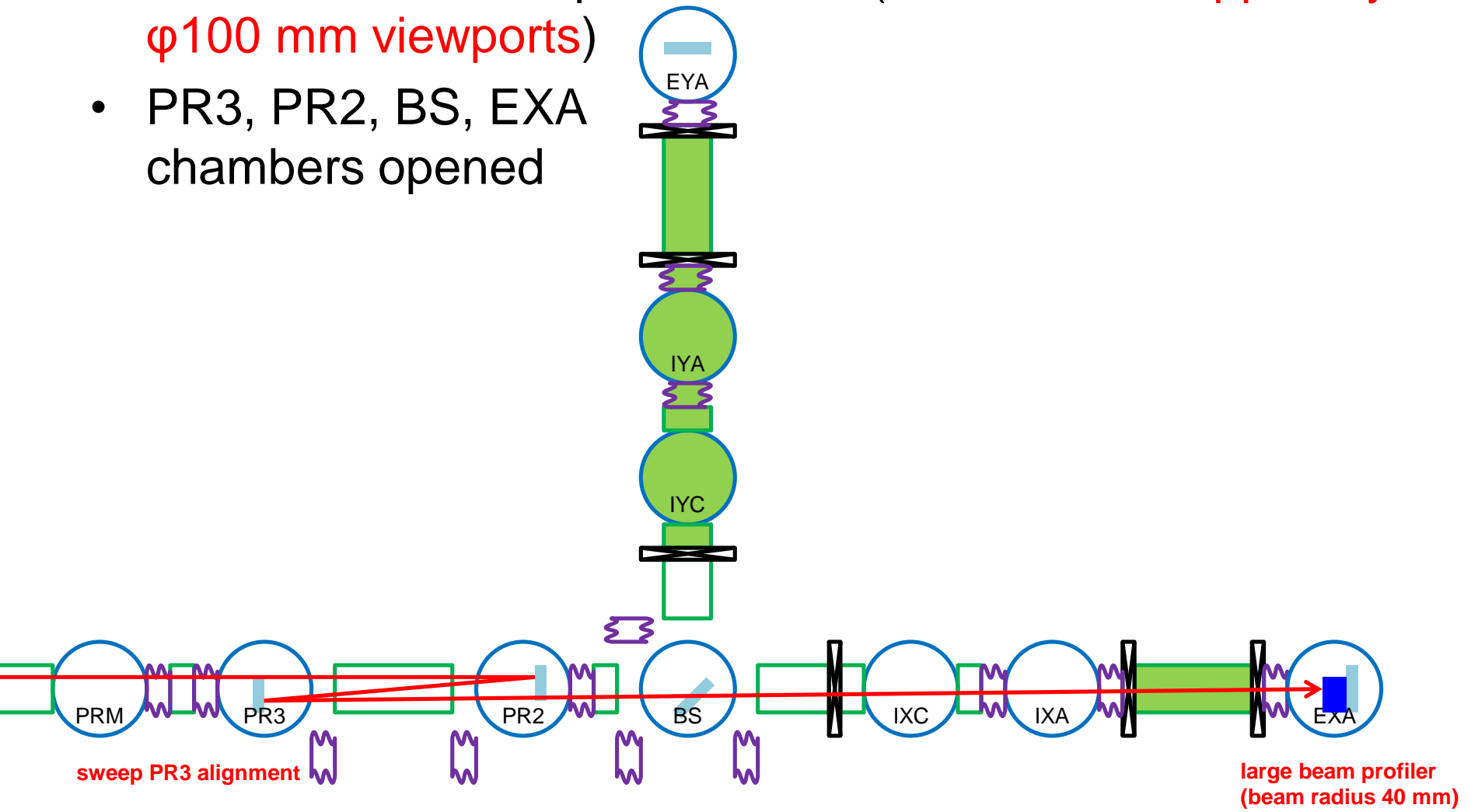
Pointing Back from X Arm (Mar 8)

- 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

sweep ETMX alignment

evacuate

Thorlabs PDA100A
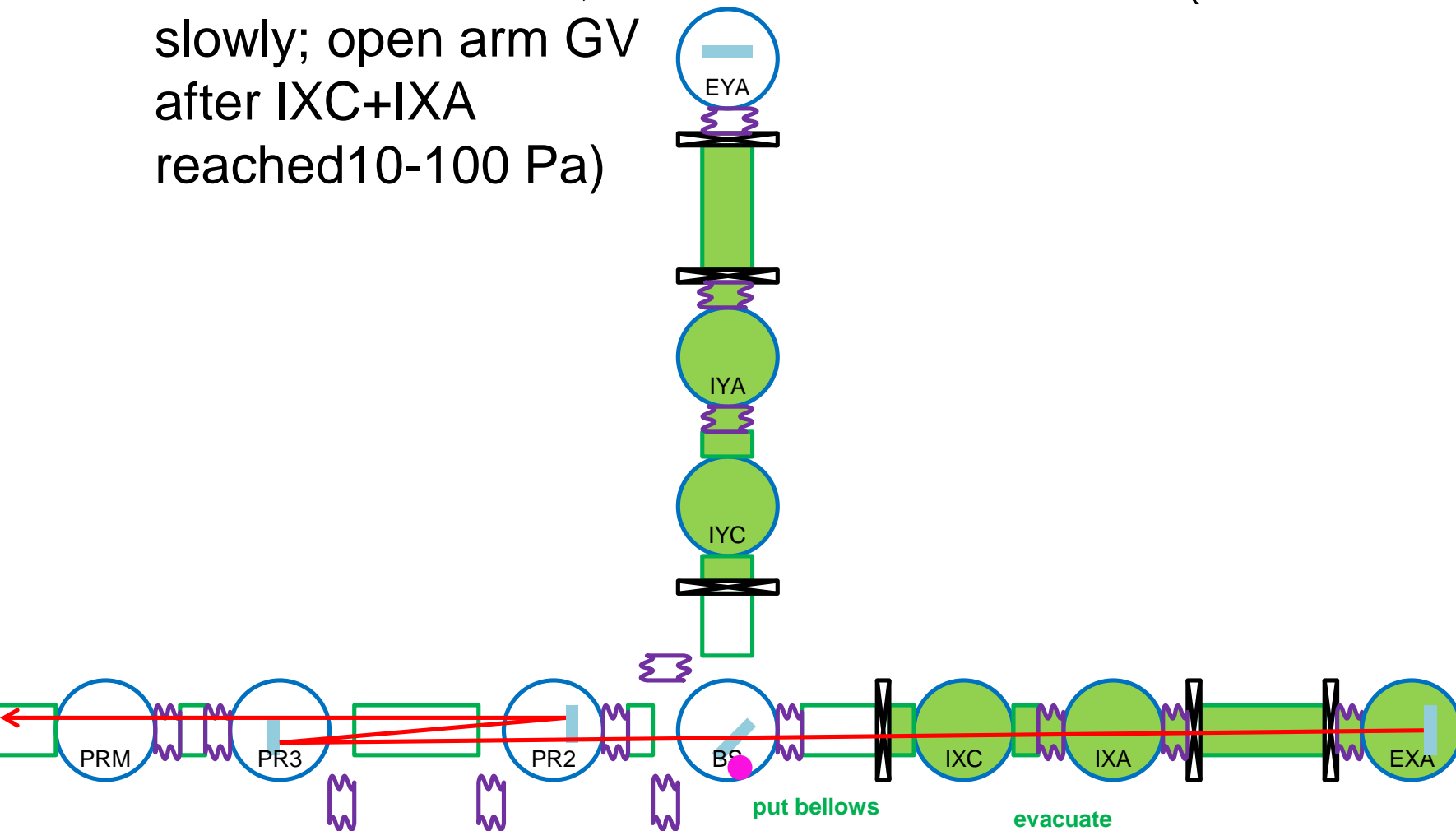(beam radius 40 mm)
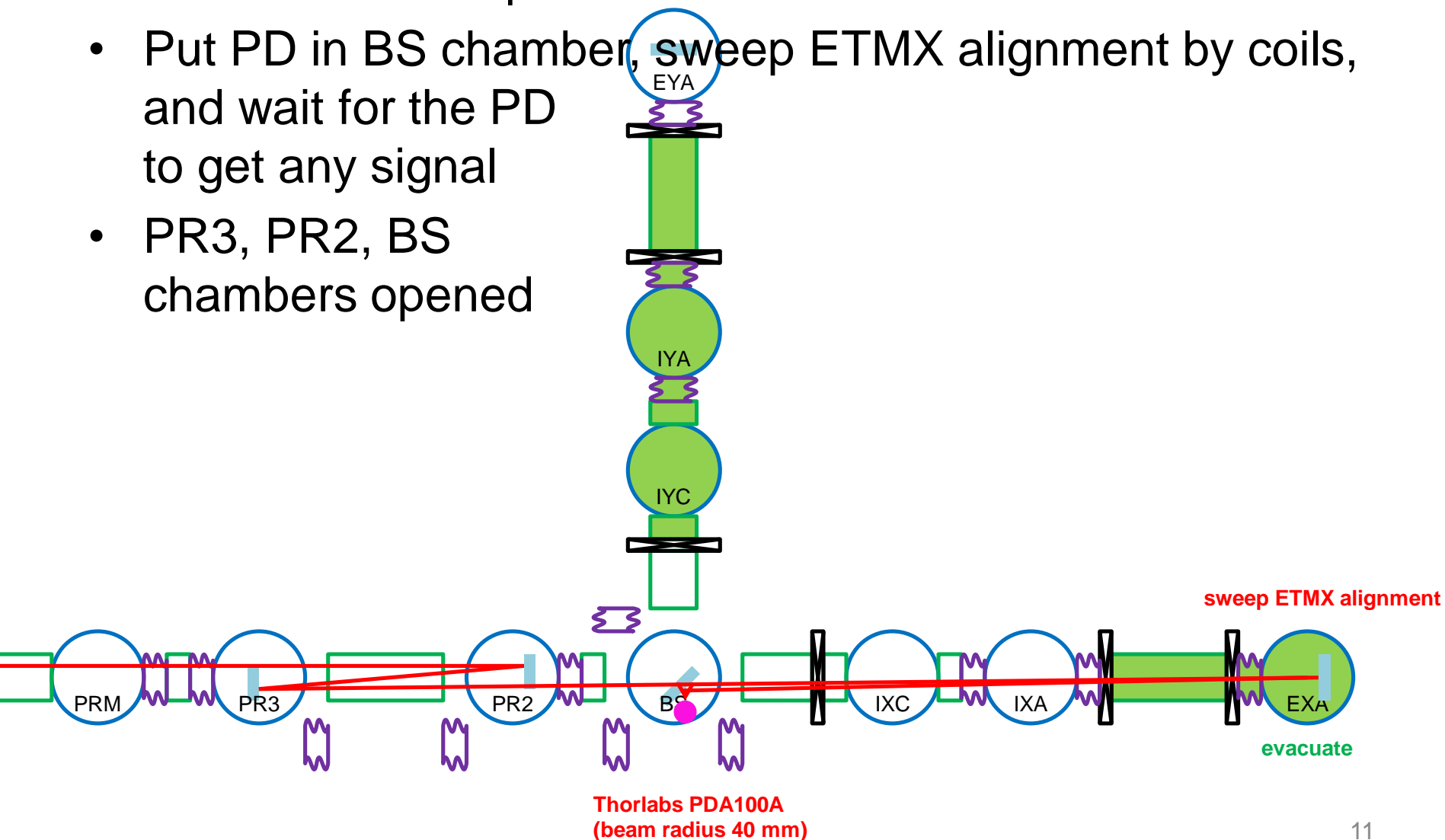
Back to IFI (Mar 8)

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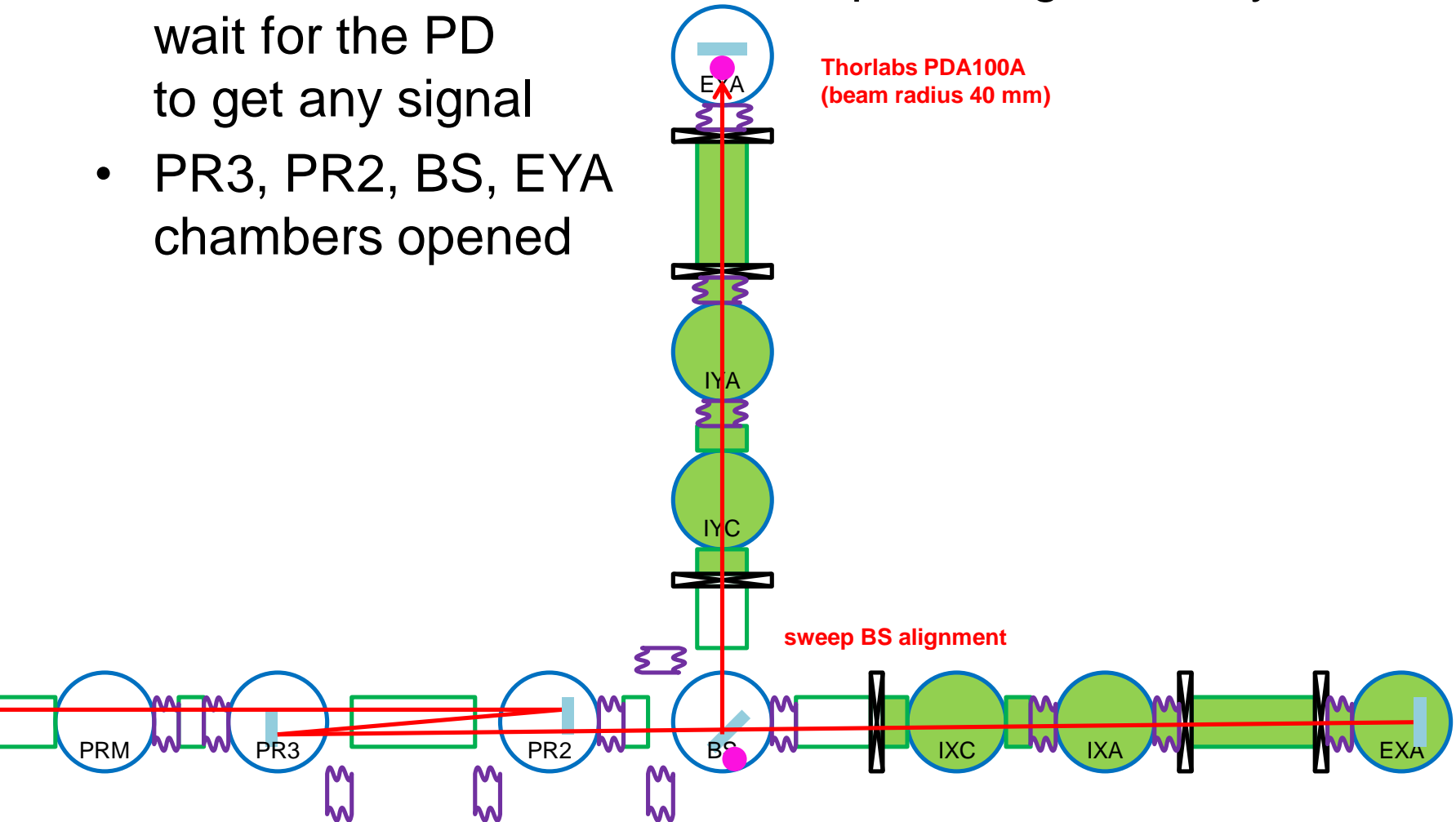- PR3, PR2, BS chambers opened

Close X arm (Mar 9)

- Put X arm bellows, and evacuate IXC + IXA (evacuate slowly; open arm GV after IXC+IXA reached10-100 Pa)


put bellows

evacuate

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)

sweep BS alignment

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

sweep ETMY alignment

block X arm beam

EYA

IYA

IYC

PRM PR3 PR2 BS IXC IXA EXA

Thorlabs PDA100A (beam radius 40 mm)
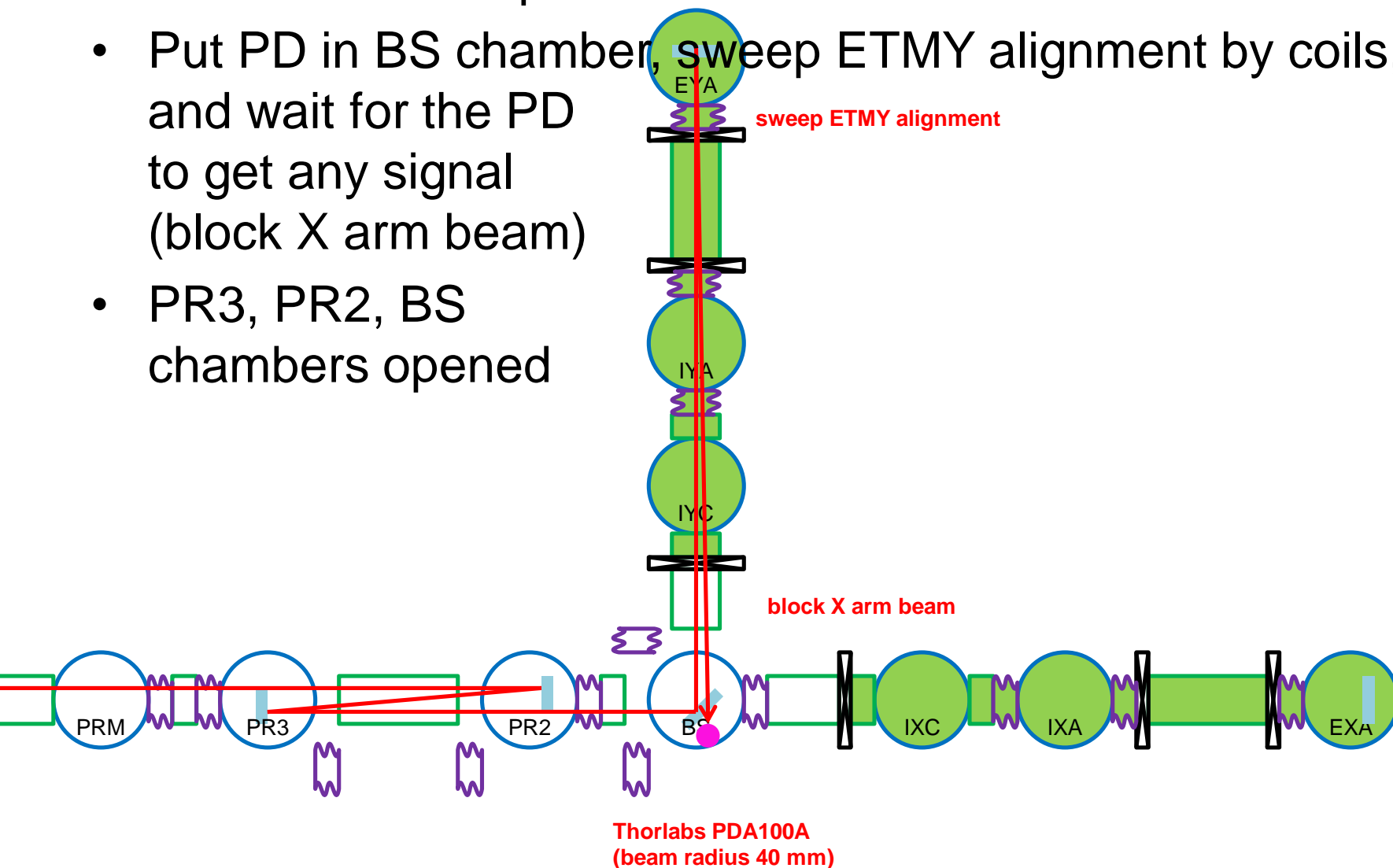
Get Fringe at REFL/AS (Mar 11)

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

block X arm beam

EYA

IYA

IYC

PRM   PR3   PR2   BS   IXC   IXA   EXA
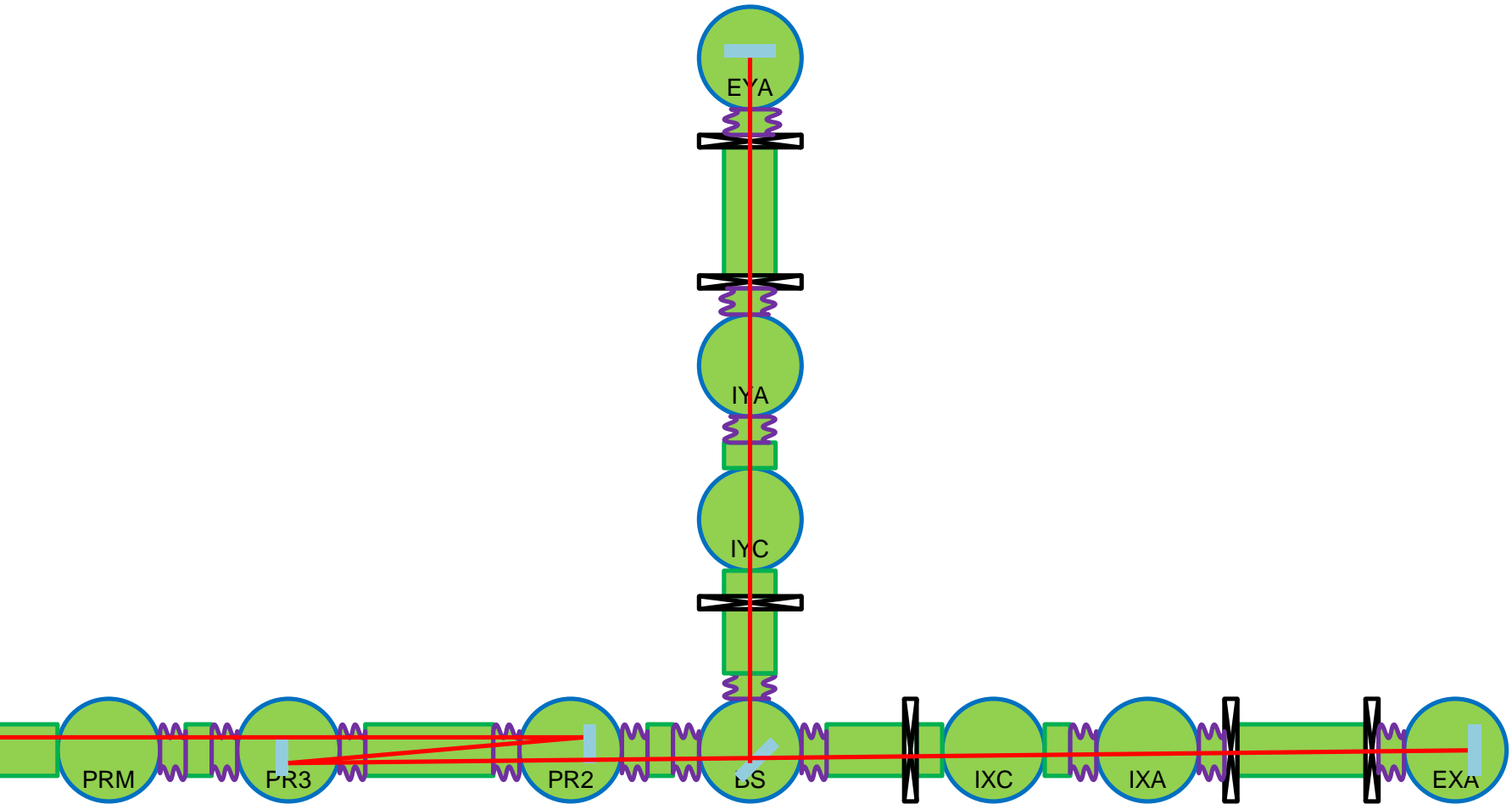
Thorlabs PDA100A
(beam radius 40 mm)
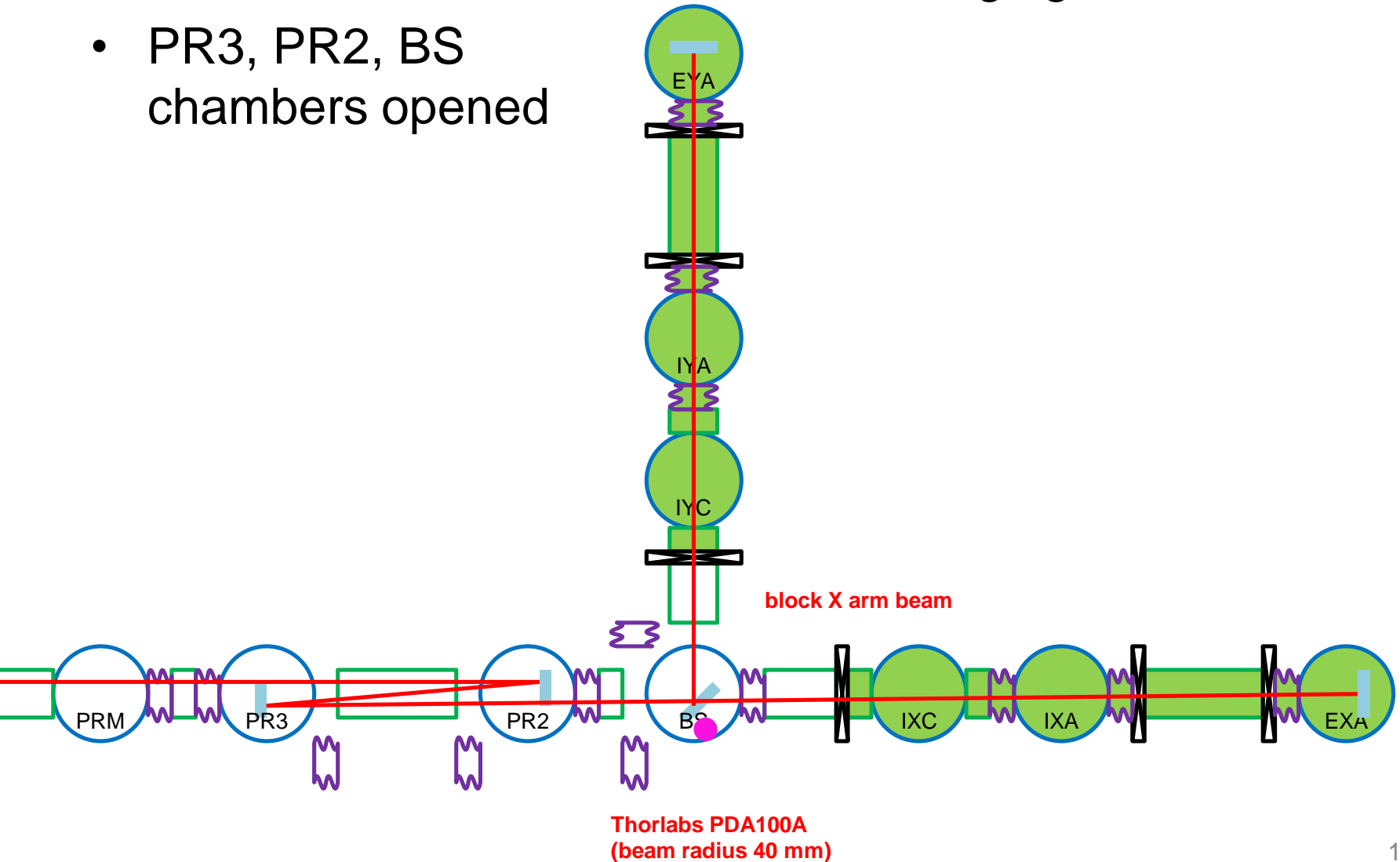
Close Everything (Mar 12-13)

- Close remaining bellows and start evacuate the whole IFO (continue evacuation during observation)
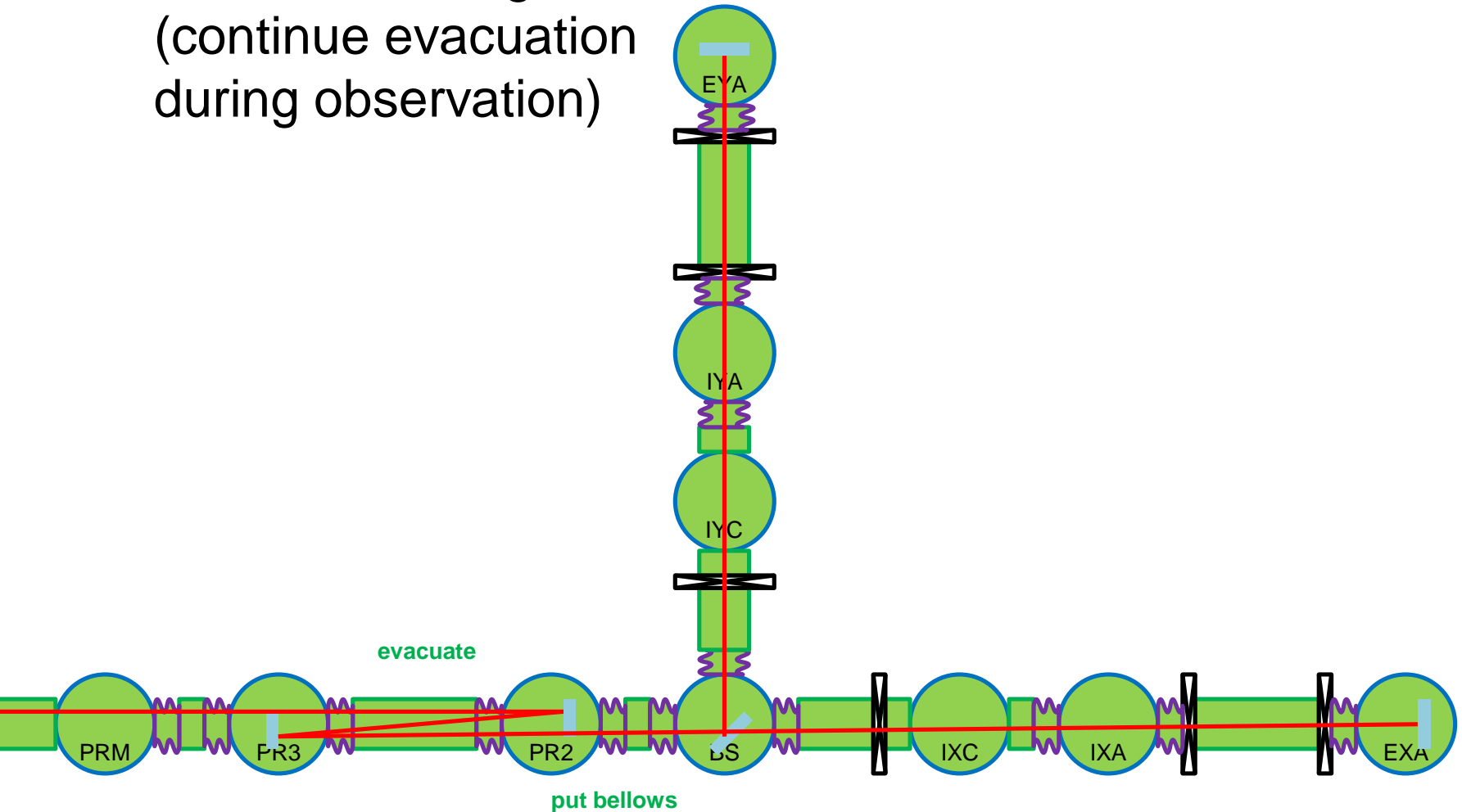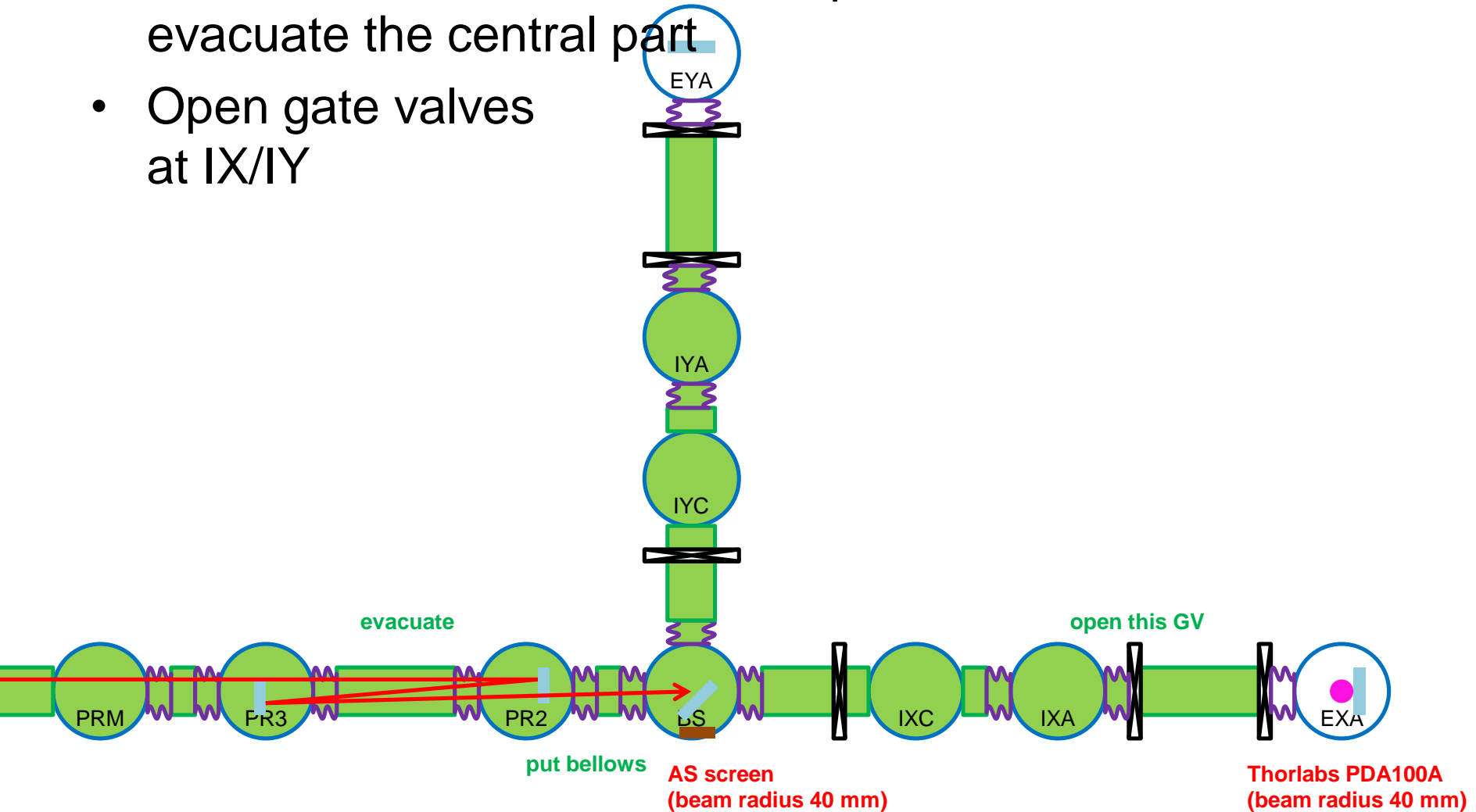
Lock Michelson (Mar 14)

- 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

open this GV

put bellows

AS screen
(beam radius 40 mm)

Thorlabs PDA100A
(beam radius 40 mm)

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