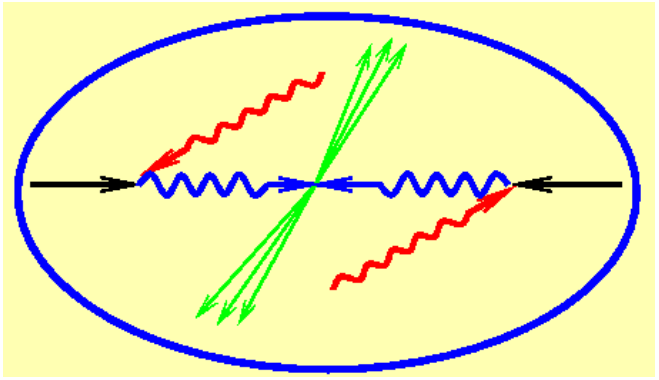

Implication of gamma-gamma on 14mr tunnels discussion

(questions for discussion with WG-C and WG-A)

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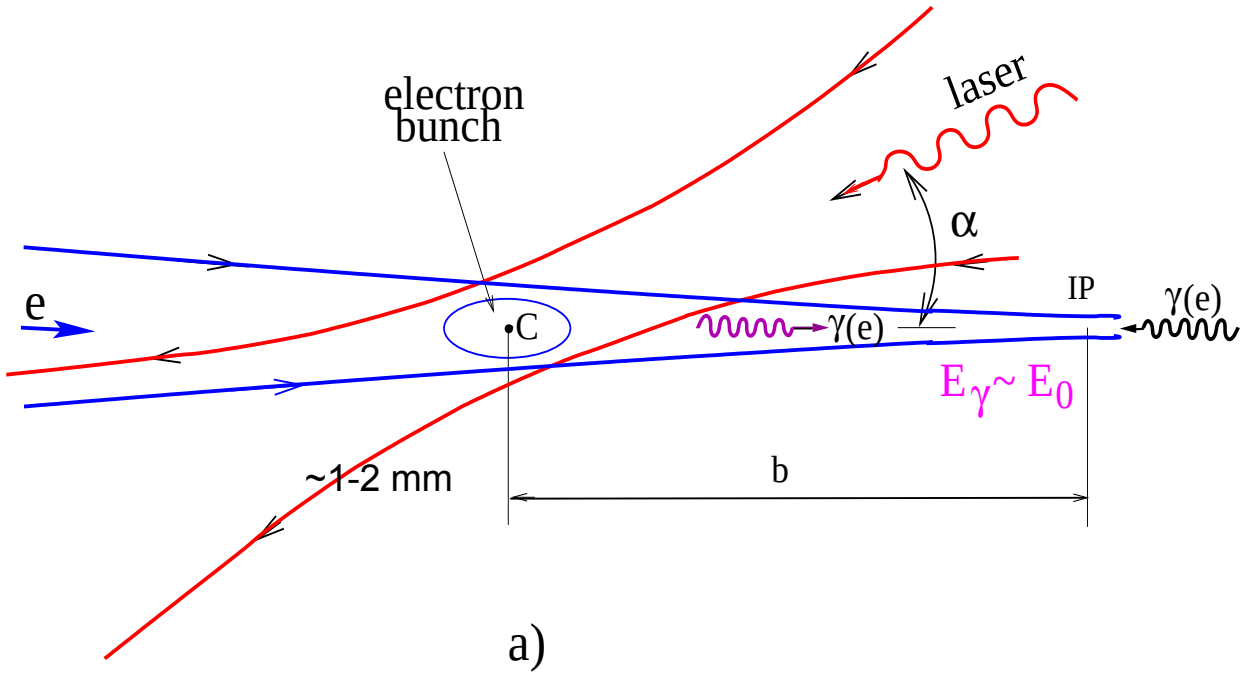
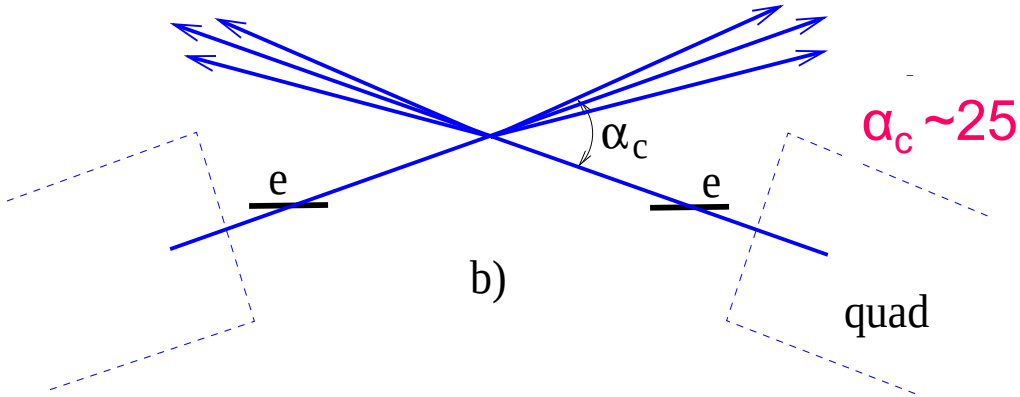
IRENG07, Sept.19, 2007, SLAC

Photon collider



a)

$E \sim (0.02-1)\, E_0$



α_c ~25 mrad

b)

quad

Questions for discussion with WG-C

What is important now.

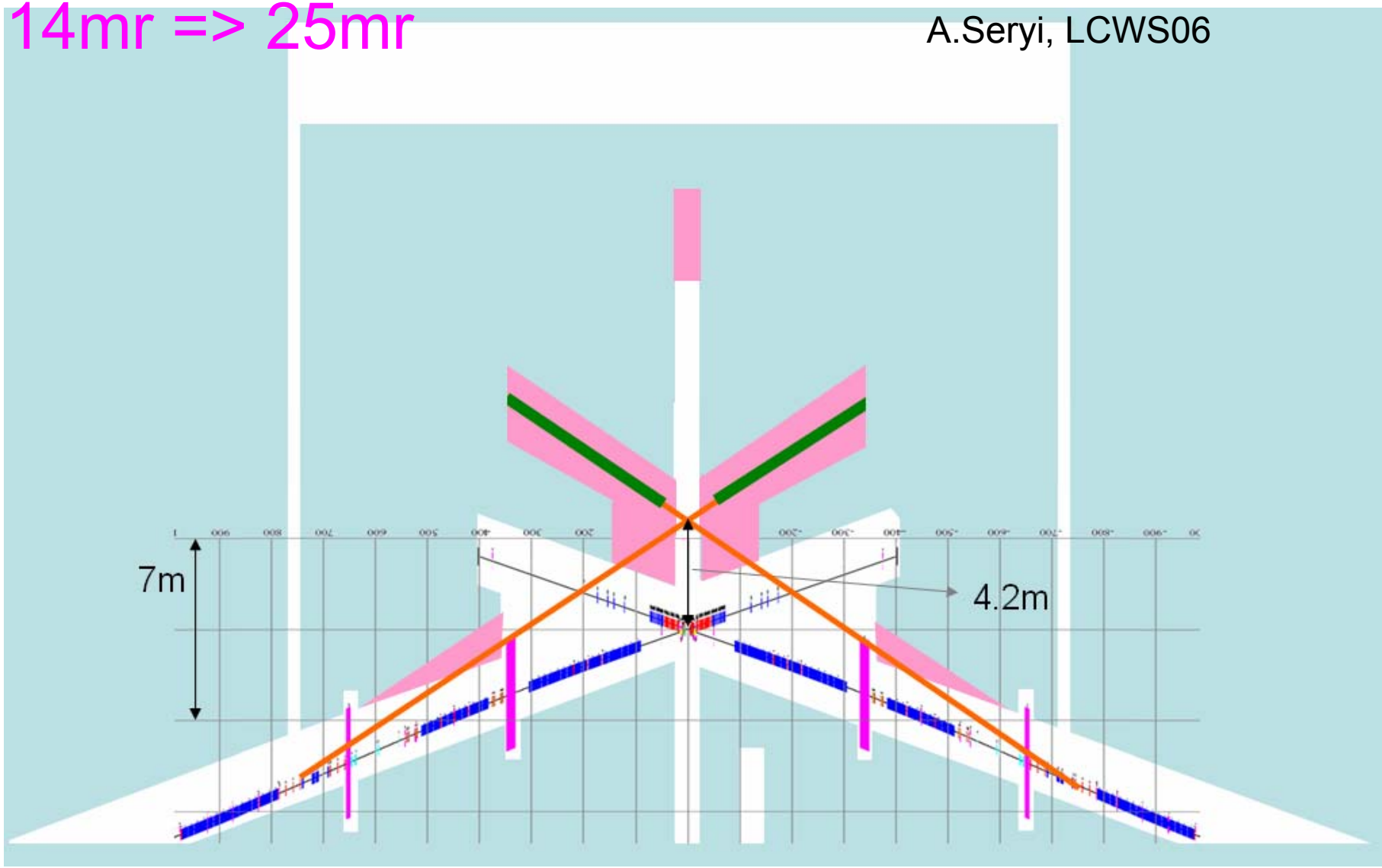
It is important to make design decisions on the baseline ILC project which allow rather easy transition between e^+e^- and $\gamma\gamma$, γe modes.

The PLC needs:

- the IP with the crossing angle ~ 25 mrad ;
- places for the special beam dump and the laser system;
- detector design (s) compatible with gamma-gamma;
- R&D on the laser system, IR issues, e.t.c…

14mr => 25mr

A.Seryi, LCWS06



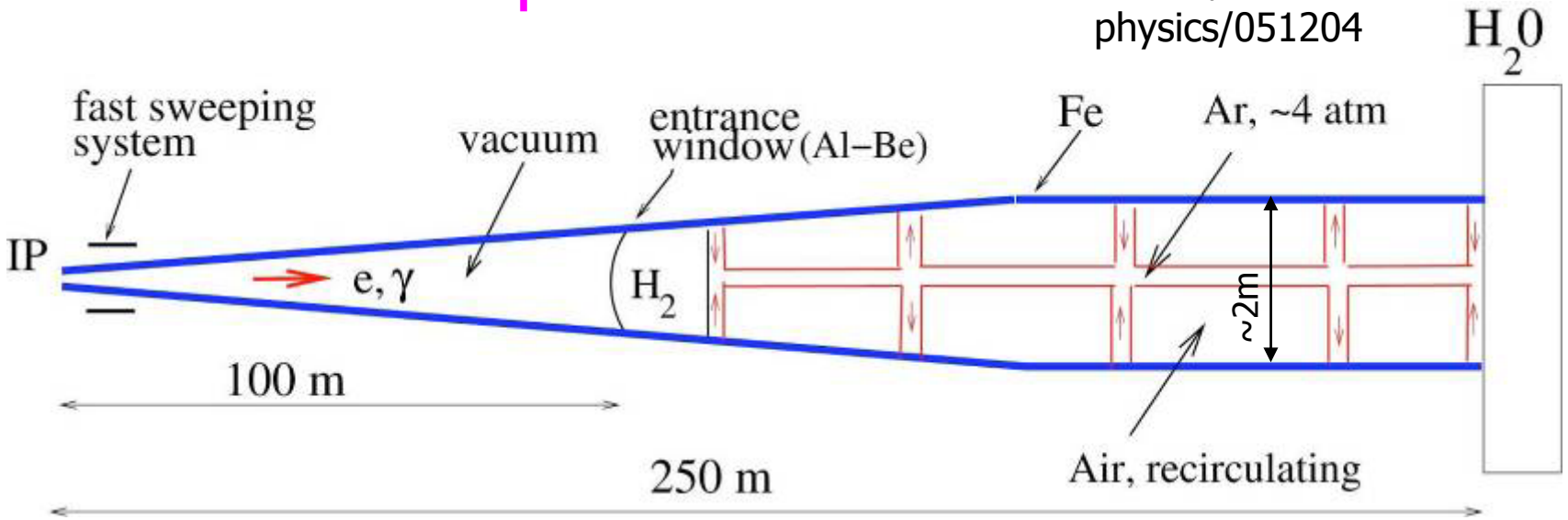
- additional angle is 5.5mrad and detector need to move by about 3-4m

Possible upgrade 14 mr (e^+e^-) to 25 mr ($\gamma\gamma$)

- Tunnel in FF area may need to be wider
- For transition from e+e- to $\gamma\gamma$ one should shift the detector by about 0.0055*600=3.3 m as well as to shift 600 m of the upstream beam line or (better) to construct an additional final transformer and doublet, in any case the final doublet should be different. In that case the transition between e+e- and $\gamma\gamma$ modes will be faster.
- Two extra 250 m tunnels for $\gamma\gamma$ beam dump.
- Somewhat wider experimental hall. Different position of shielding walls.

Possible scheme of the beam dump for the photon collider

Telnov, Snowmas2005
physics/051204



The photon beam produces a shower in the long gas (Ar) target and its density at the beam dump becomes acceptable.

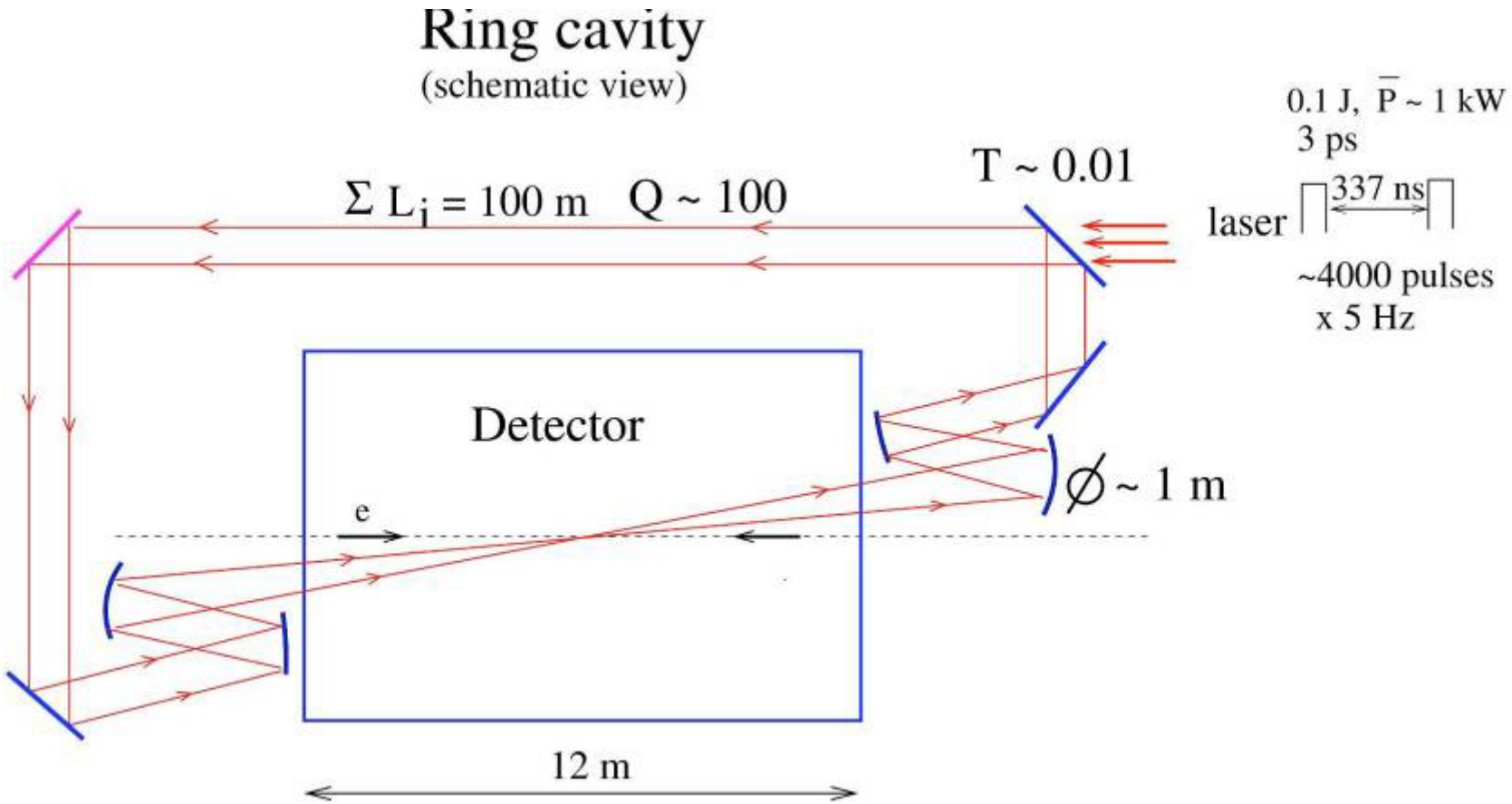
The electron beam without collisions is also very narrow, its density is reduced by the fast sweeping system. As the result, the thermal load is acceptable everywhere.

The volume with H_2 in front of the gas converter serves for reducing the flux of backward neutrons (simulation gives, at least, factor of 10).

In order to reduce angular spread of disrupted electrons some focusing after the exit from the detector is necessary.

Needs detailed technical consideration!

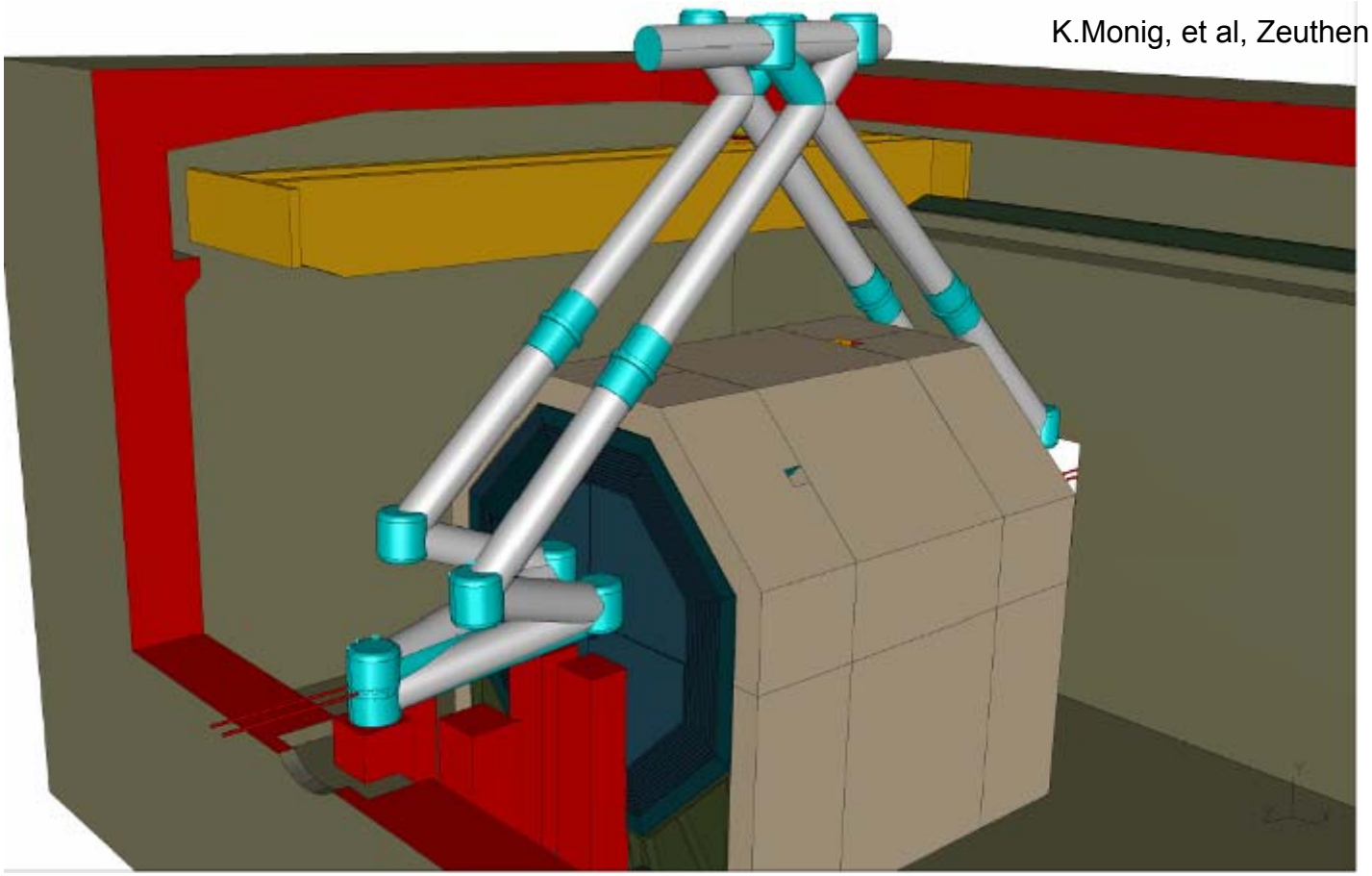
Laser system



The cavity includes adaptive mirrors and diagnostics. Optimum angular divergence of the laser beam is ±30 mrad, A≈9 J (k=1), $\sigma_t \approx 1.3$ ps, $\sigma_{x,L}$~7 μm

One example. View of the detector with the laser system

(the pumping laser is in the building at the surface)



For easier manipulation with bridge crane and smaller vibrations it may be better to hide the laser tubes under the detector. If IR depth is large, the laser room is needed somewhere underground.

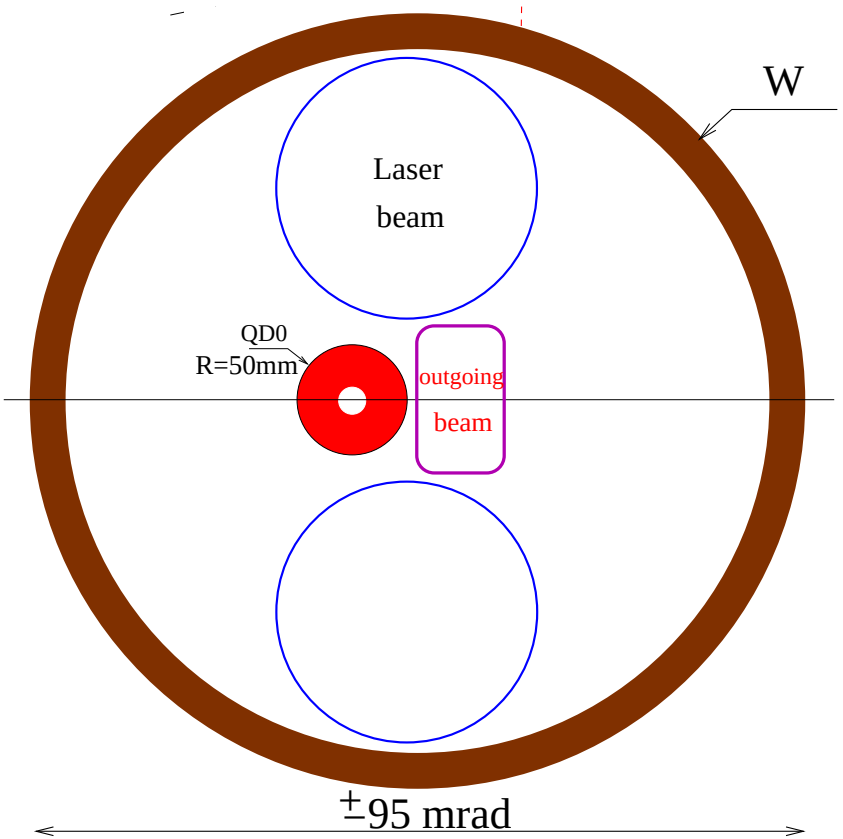
Questions to WG-C

- What is the optimal way to make **wider tunnel** to allow displacement of beamline or building another beamline in the same tunnel?
  - For example, can we make tunnel from IP to first linac shaft to be, let say, 7m diameter? (this could eliminate the need for expensive "tapered" tunnels)
- What is the optimal way to build additional tunnel for the gamma dump?
- Shielding walls between detectors could be a "must"
  - due to large diameter light (laser beam) pipes which would penetrate beamline pacman shielding
- Space around or above detector (for laser beam pipes need to be discussed)

Next slides are for discussion with WG-A

Laser beams in the detector

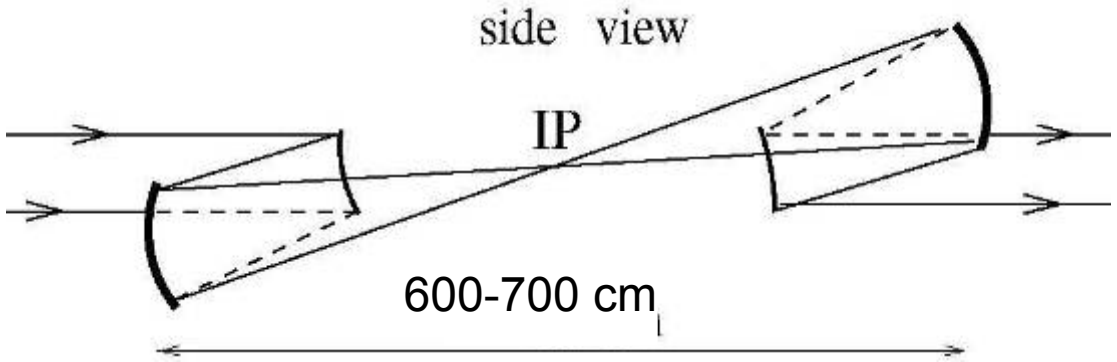
Layout of the quad, electron and laser beams at the distance 4 m from the interaction point (IP)



Some problems with laser optics

- If the final mirror is outside the detector at the distance ~15 m from the center, its diameter is about d~90 cm, very large.
- Detectors have holes in forward direction ±33-50 mrad (previous slide) while the photon collider needs ±95 mrad, so there should be special removable parts in ECAL, HCAL and the yoke.

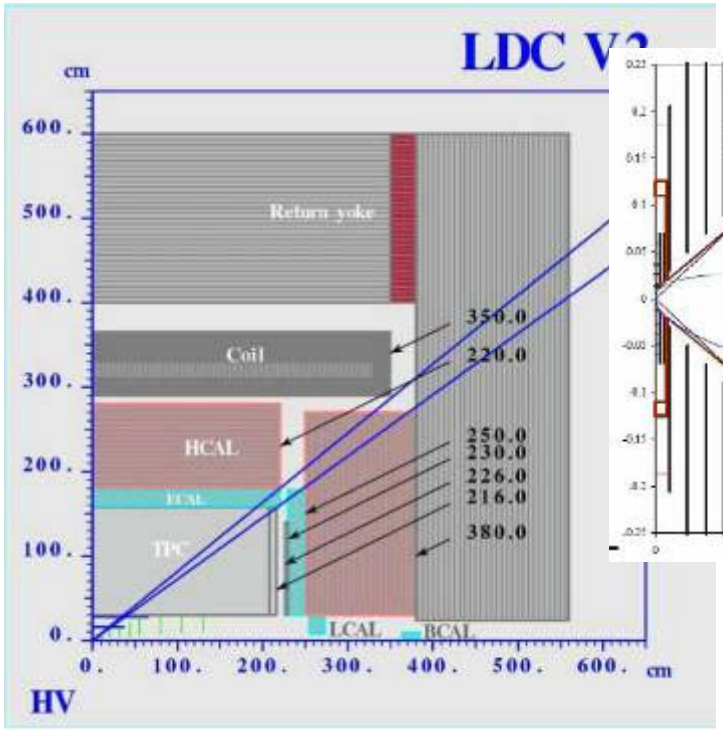
Alternative solution: pairs of mirrors inside the detector

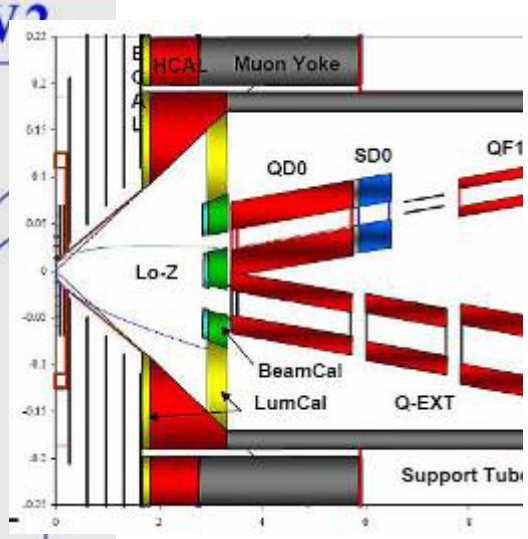


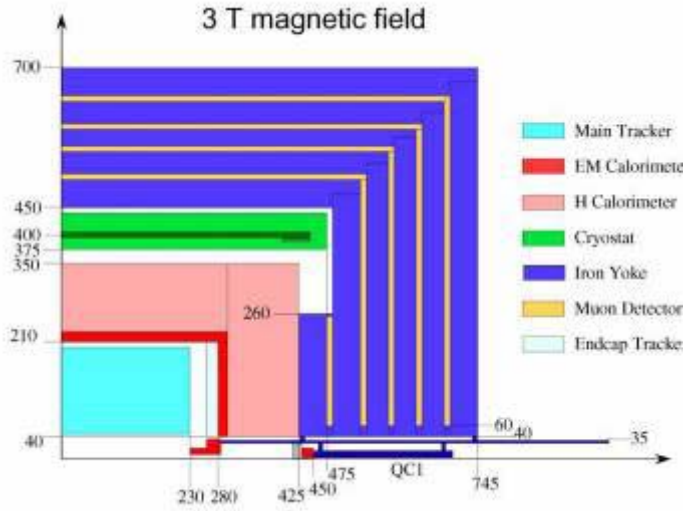
Then the diameter of focusing mirror is about 20 cm and that of the auxiliary mirror about 11 cm. The dead angle for tracking remains as before about ±95 mrad, but smaller for calorimetry. However, in case mirrors are inside the detector and it is more difficult to adjust optics.

Open angles in detectors

LDC SID GLD







θ=±45 mrad ±33 mrad ±50 mrad

(Very hermetic detectors)

that is less than the required ±95 mrad

Conclusion (WG-C, WGA)

- The Photon collider imposes very serious requirements to the design if the ILC IR. The RDR layout is not compatible with the PLC.
- Let us consider for the beginning how to modify the RDR configuration in order to satisfy PLC requirements (α_c~25mrad).
- Other geometries (two IRs, 25 mrad for both e^+e^- and $\gamma\gamma$) should not be rejected. They have some advantages.
- The muon wall should have an additional hole to the $\gamma\gamma$ case.
- The laser optics (100 m loop) and the laser itself need a space in the experimental hall. It influences also detector designs.