Positron WG Meeting 4

- Undulator scheme parameters
- QWT as bottom line
- Work Plan presented by Sabine

Undulator Scheme Parameters

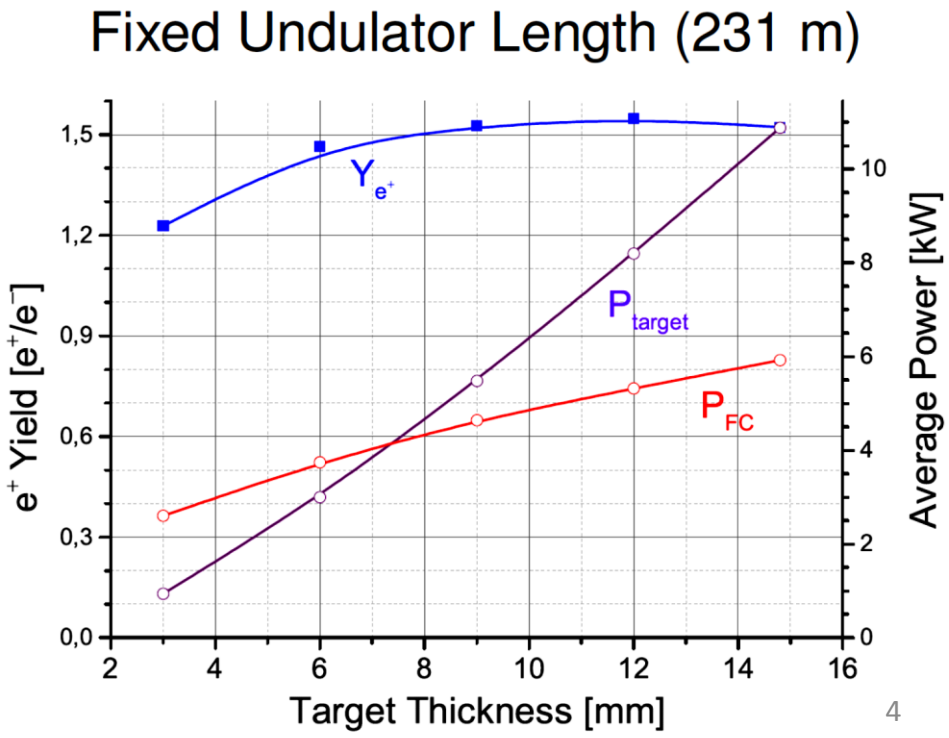
- Need to fix the parameters for 250GeV CM
  - Basis for the design of the target wheel
- Big progress by Andriy's simulation with thin target
- Started as the problem of PEDD on FC
  - PEDD at the tip of FC is serious at Ee=125GeV is ~33J/g/pulse (1312 bunches)
  - PEDD limit of Cu 7-12 J/g
  - There are several possible measures
  - Undulator closer to the target
    - Compact dogleg designed by Okugi
    - gives ~12% reduction of PEDD, ----- not enough
  - Thinner target

Possible Measures for PEDD Problem

- Possible cures
  - Shorter distance from undulator to target: Done
    - Andriy's simulation showed only ~15% reduction of PEDD
  - Thinner target: Done
    - Less development of shower angle
    - But reduces positron yield
  - Larger beam hole of FC
    - Compatible with 3Tesla field?
  - Lower K of undulator
    - smaller angle spread and higher photon energy ($1/(1+K^2)$)
    - But reduces photon number (propt. K^2)
  - Photon collimator (originally for higher polarization)
    - Scrape out low energy photons (useless for positron production and cause larger angle in target)
    - But reduces positron yield
- Minimum baseline
  - DC QWT: how much is the luminosity reduction?

Andriy's Results for Thinner Target

- Expect
  - Smaller angle spread of shower (hence less PEDD on FC)
  - Smaller power deposit on target
  - Less positron gain. Hence, longer undulator needed
- But simulation shows
  - surprisingly flat gain in the range 6mm < t < 14mm for fixed undulator length
  - why?
    - Effective distance between target and FC decreases
    - Reduced multiple scattering
    - Positron energy loss in target
  - t < 6mm requires undulator length > 231 m

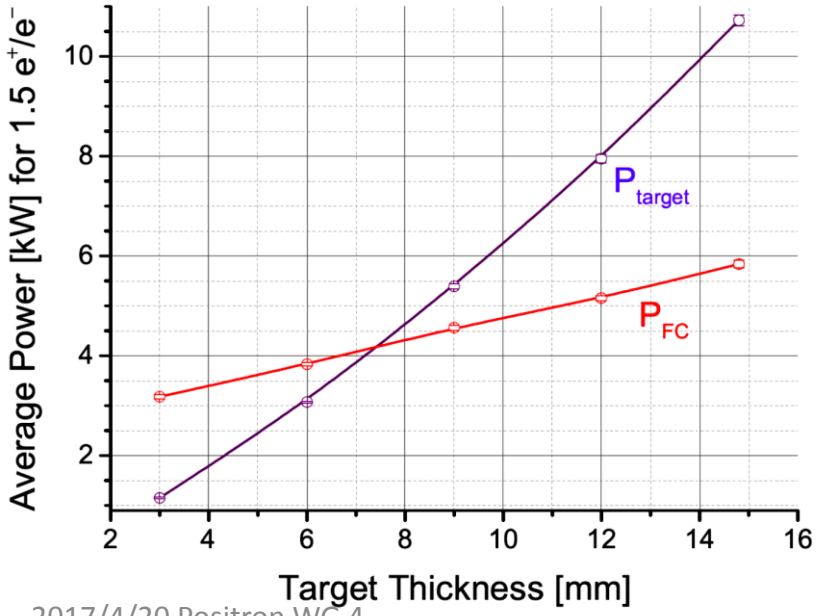


- With fixed gain (e+/e-=1.5)

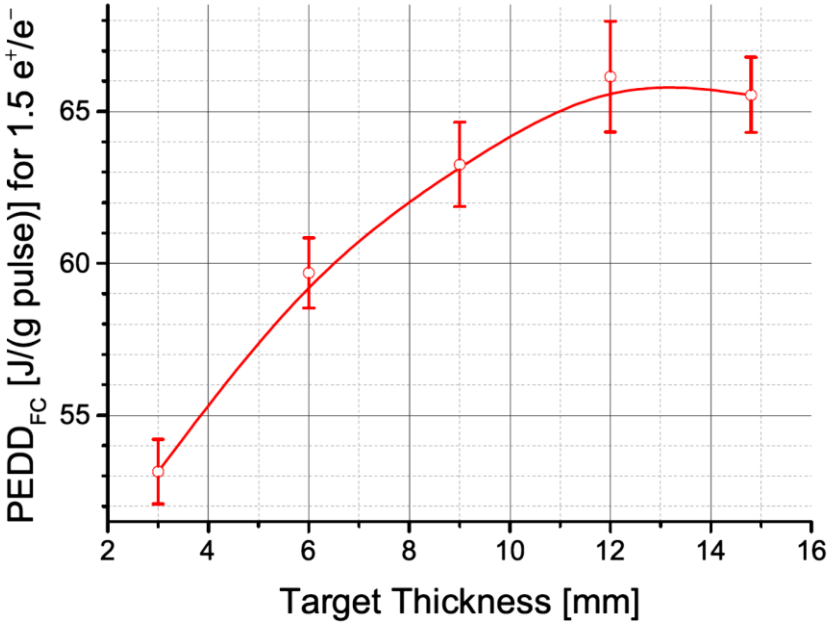
from figure

thickness	undulator length	PEDD on FC	Power on target (2625 bunches)
12 mm	0 %	+1 %	7.9 kW
9 mm	0 %	-3.5 %	5.3 kW
6 mm	+4 %	-9 %	3.1 kW
3mm	+24 %	-19 %	1.2

Varied Undulator Length (1.5 e^+/e^-)

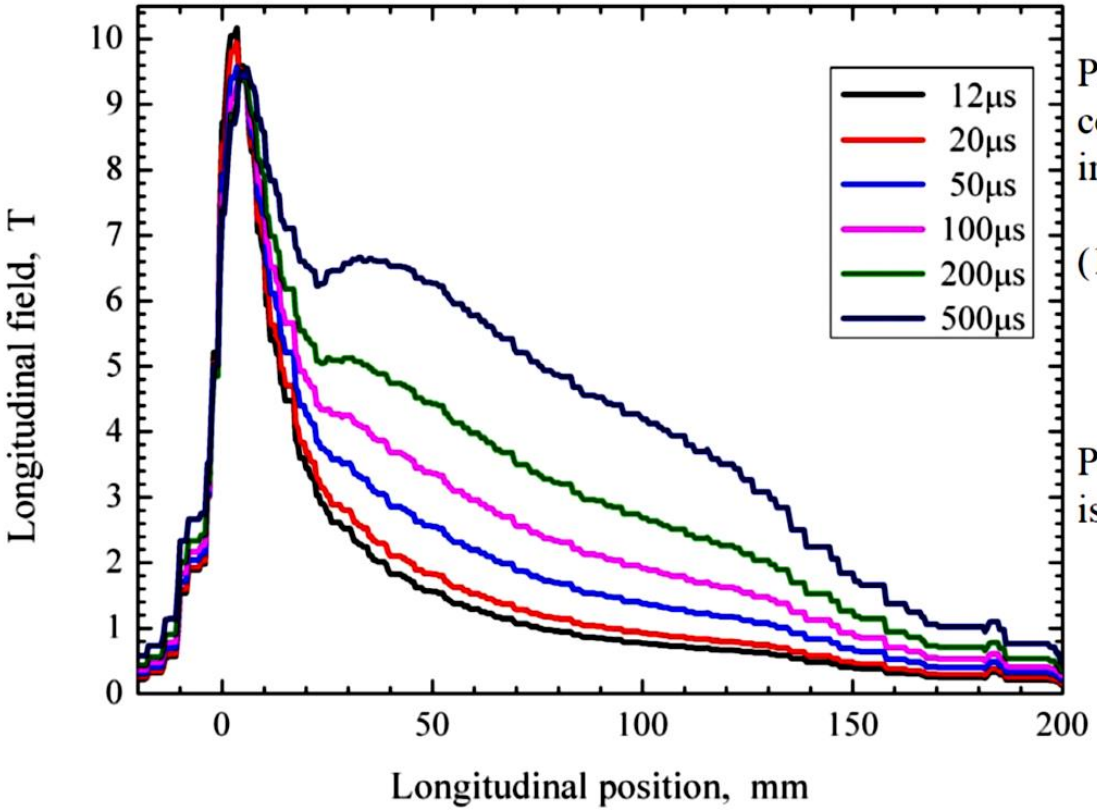


Varied Undulator Length (1.5 e^+/e^-)



- Conclusion
  - Thinner target greatly reduce the power deposit on target. Thickness 6-7mm looks OK. Power deposit ~1.6kW with 1312 bunches (cf. 14mm → 5.4kW)
  - Heat conduction Ti→Cu must be confirmed
  - Undulator should be slightly longer (~4%)
    - Undulator center should be shifted upstream a bit (same compact dogleg length)
  - But the problem of PEDD on target is not solved yet (only 9% reduction)
  - Need some more measure to reduce PEDD
- Now, shall we adopt 6-7mm thick target as the standard parameterfor 250GeV?

A Problem of Long Pulse FC



Profile of longitudinal field component at different instants of time .

(1-st order of approximation)

Peak field value fluctuation is from 9.5Tesla to 10.1 Tesla

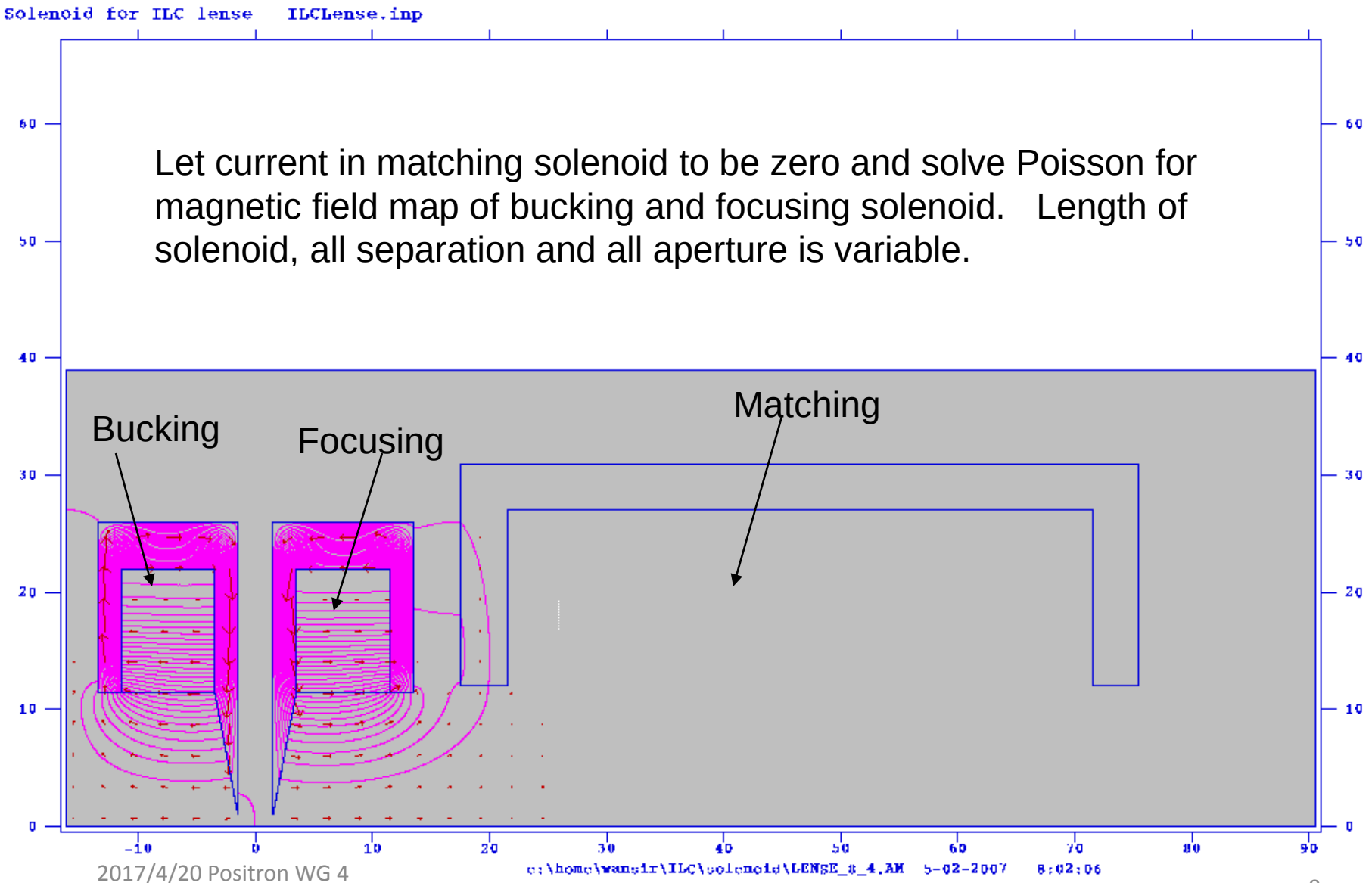
A skin layer depth becomes deeper in time and as result a magnetic flux through copper conductors also redistributes. These leads to longitudinal field profile deformation through a pulse time. Big profile deformation is observed starting from 100μs pulse time.

P.Martyshkin 2014

Profiles should be recomputed with 2-nd order of approximation to confirm deformation in time

QWT as Bottom Line

- One of the problem of FC is the (t,z) dependence of the field
  - May not be easy to solve
  - Who can do this? Pavel????
- What about QWT?
- According to the communication Omori ←→ Wanming,
  - Beam hole diameter ~2cm
  - Some simulations with different solenoid length, Bmax, distance between focusing & matching, seem to have done
  - But full optimization was not done
- Need to know the minimum positron yield with target load fixed as the bottom line design for the case FC R&D fails


Solenoid for ILC lense ILCLense.inp
Let current in matching solenoid to be zero and solve Poisson for magnetic field map of bucking and focusing solenoid. Length of solenoid, all separation and all aperture is variable.
Bucking
Focusing
Matching
60
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
70
80
90
c:\home\wansir\ILC\solenoid\LENSE_3_4.AM 5-02-2007 8:02:06