OMD Overview

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Positron Working Group - ANL

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Optical Matching Device

- What is it?
  - **Point to parallel magnetic focusing optic after the target**
- Why is it important?
  - **Improves capture efficiency reduces photon flux required**
    - Shorter wiggler
    - Lower heat load in target
    - Smaller dumps
    - Less radiation
- What are the options?
  - **Nothing**
  - **¼ wave solenoid**
  - **Pulsed flux concentrator**
  - **Immersed SC solenoid**
  - **Lithium lens**
  - **Capture efficiency varies between 10% and 30%**

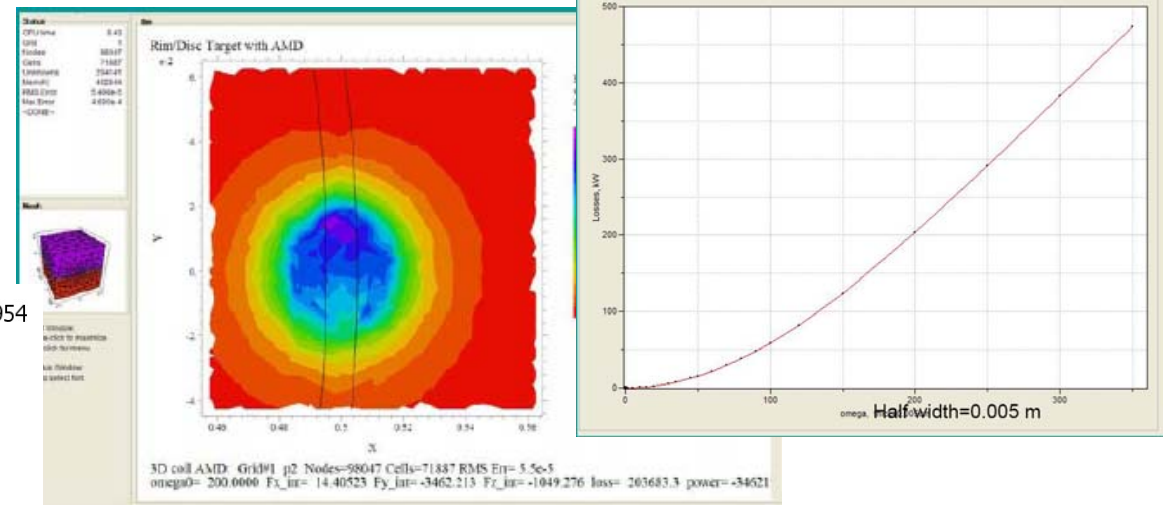
No OMD idea is completely mature

- What are the issues?
  - **Engineering feasibility of the target**
    - Interaction of magnetic field with spinning target may be a problem
      - Static and pulsed loads on the target
      - Non-conductive materials?
  - **Engineering feasibility of the optic**
    - Can SC solenoids operate in the radiation environment
    - Is a pulsed device feasible at 1ms duration?
    - Can lithium lens survive cavitation and energy deposition?

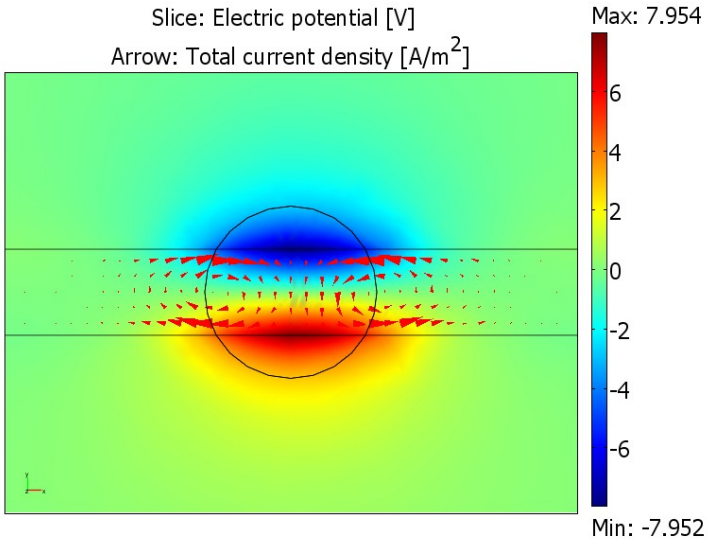
- Any solution is going to require a significant engineering and prototype effort before we are confident.
  - **Can we actually provide a realistic test environment?**

Eddy currents appear to rule out an immersed field target

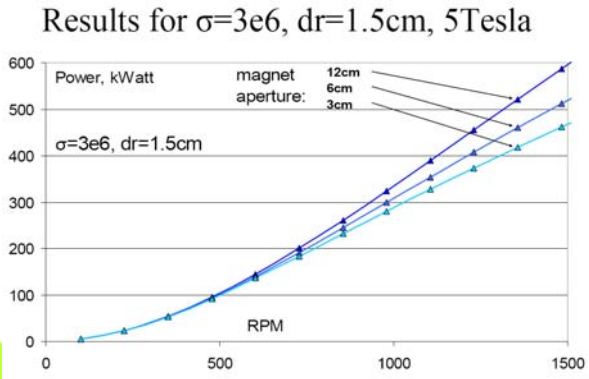
Cornell

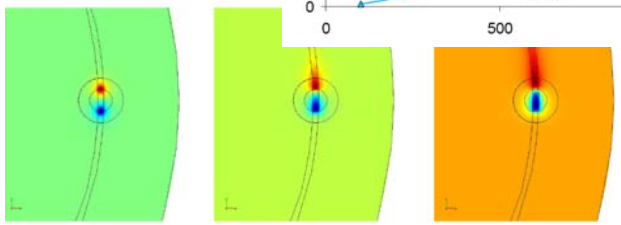


LLNL



ANL





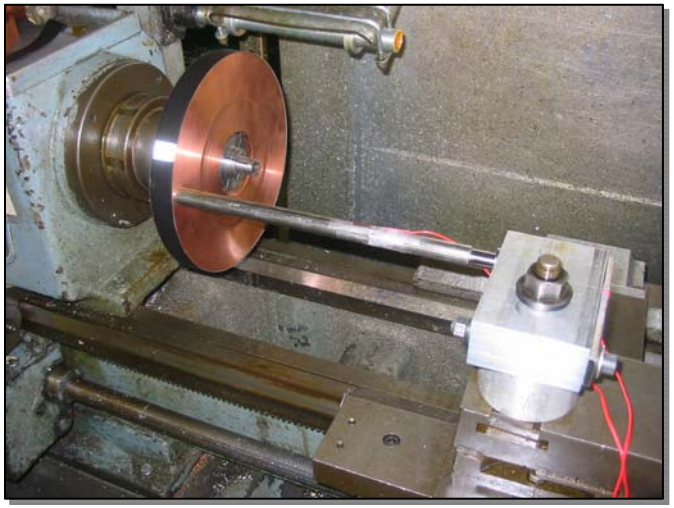
- Simulations are sufficient to rule out immersed target
- Validated simulations are still critical to target design
  - **CI/DL/RAL prototype will an important validation**

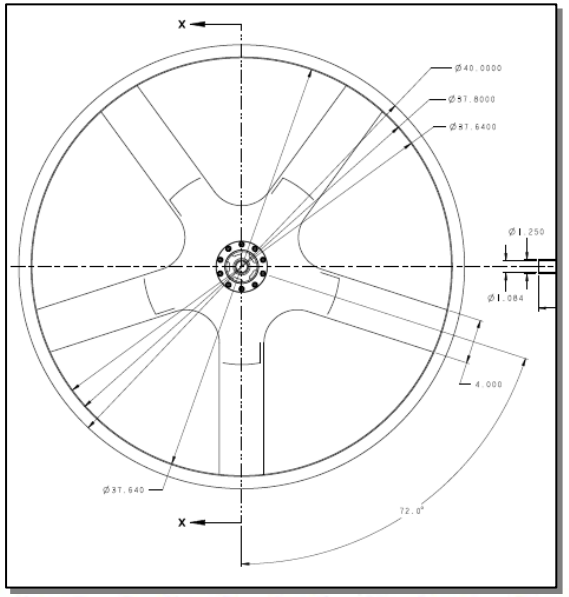
Benchmarking

- Eddy current simulations are not simple and we were not confident with dead reckoning

- We have done a simple benchmark for the codes
  - **A spinning copper disk and a permanent magnet**
- We are doing a test with higher field and closer to the actual target
  - **A 1m prototype wheel with 1 T field**
  - **We need to see the effect of the spokes anyway**

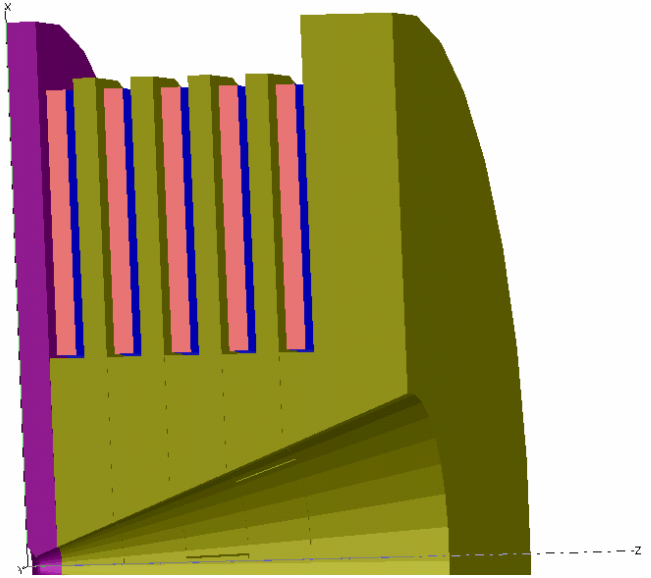
- Understanding the static and pulsed forces on the target from fringe fields is critical to the design

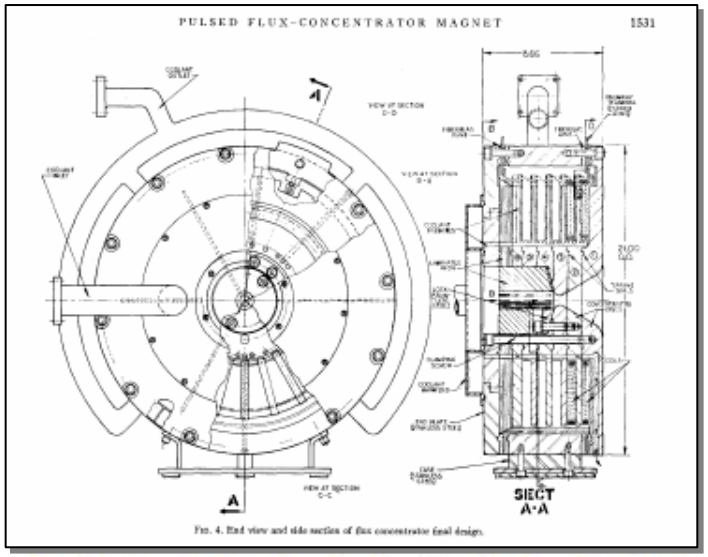




SLC OMD was a pulsed flux concentrator

- It is a large extrapolation from SLC to ILC
  - **1μs -> 1ms pulse width**
- Previous magnet for hyperon experiment was the closest thing we could find.
  - **Cryogenic nitrogen cooling of the concentrator plates.**
  - **ANL and LLNL did initial rough electromagnetic simulations. Not impossible but an engineering challenge.**
  - **No real engineering done so far.**

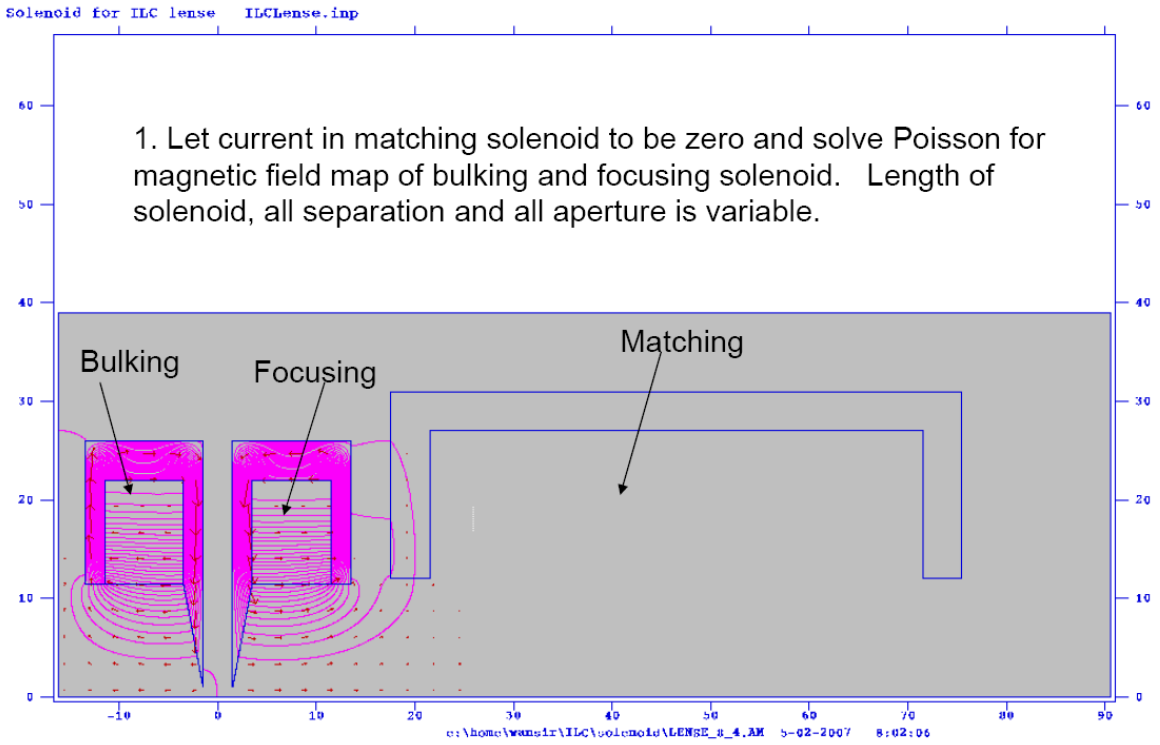




¼ wave solenoid seems more feasible

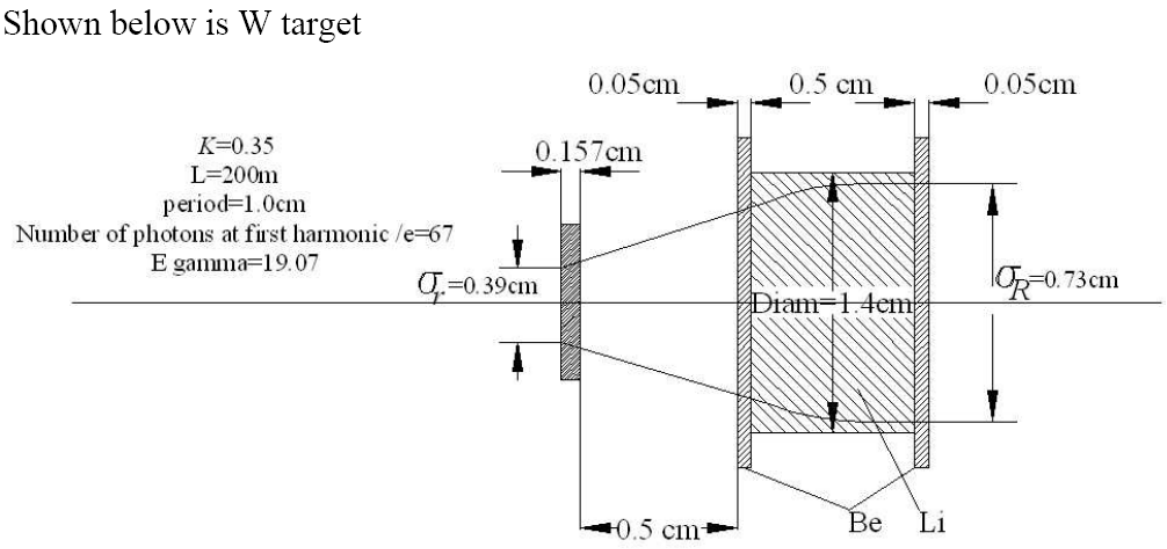
- Capture efficiency is only 25% less than flux concentrator
- Low field at the target reduces eddy currents
- This is probably easier to engineer than flux concentrator
- SC, NC or pulsed NC?

ANL ¼ wave solenoid simulations

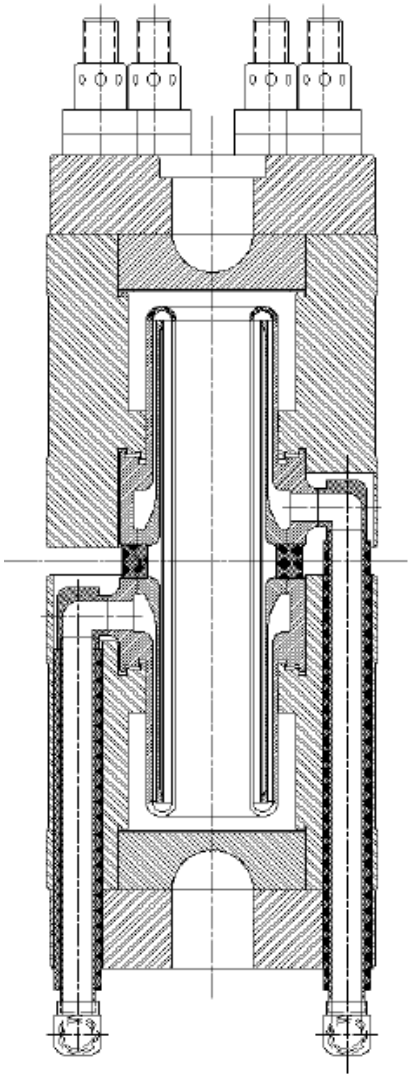


W. Liu

Lithium lens



A. Mikhailichenko



P.G. Hurh & Z. Tang

- Lithium Lens
  - **Will lithium cavitate under pulsed heating?**
    - window erosion
  - **Will lithium flow adequately cool the windows?**
  - **Lens is defocusing for electrons**
    - Increased heating and radiation load in the capture section

Status

- We want as much capture efficiency as is realistically possible

- High field at the target seems ruled out
  - **Some work on non-conductive materials has been done**
- Flux concentrator seems to be a challenging engineering problem
- The ¼ wave solenoid seems realizable and appropriate for the baseline

- Lithium lens needs more detail design

- How do we move forward for the EDR?

EDR OMD Work Packages

- Baseline work (assume ¼ wave solenoid)
  - **08 Detailed magnet engineering design**
  - **09 Prototype? (may not be needed)**

- Cost mitigation R&D
  - **Alternatives with greater capture?**
  - **Need more detailed engineering designs**

- Insert test facility into e- area
  - **Run with 5 GeV ILC beams structure and energy depo 3 years early**