ILC e^+ Source

Annual DoE SLAC HEP Program Review

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June 7, 2006

ILC Baseline e^+ Source Parameters

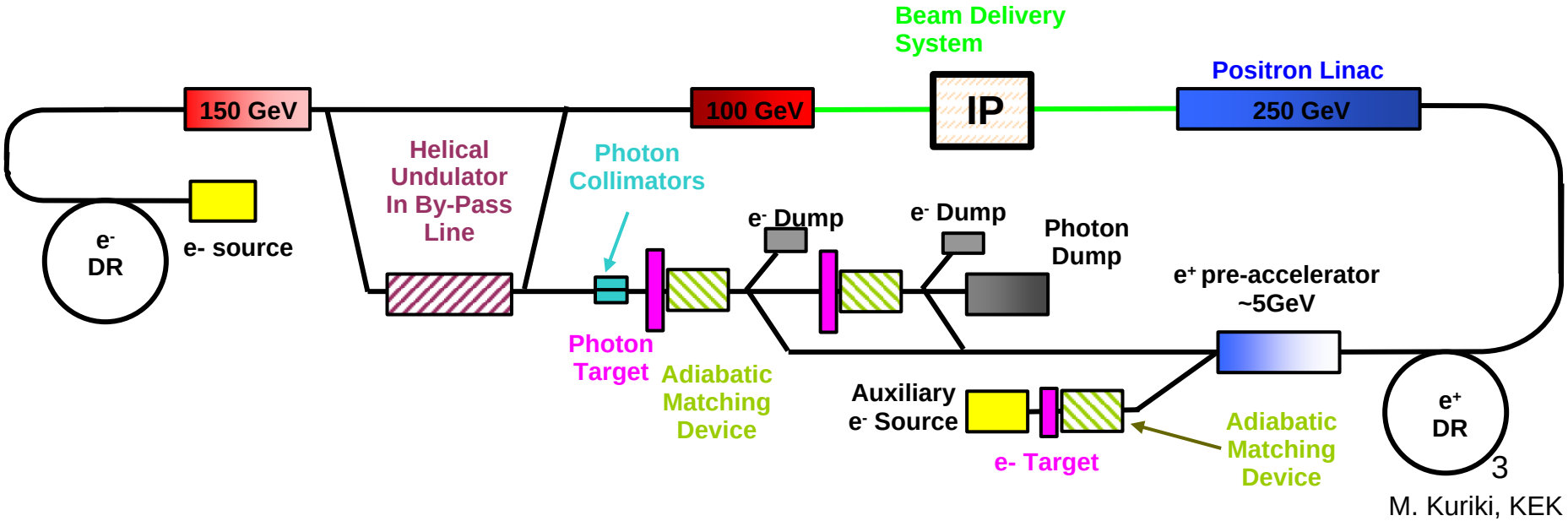
Positron Beam				
Positron Intensity	2×10^{10}	e+/bunch	N_b	
Number of Bunches	2820	Bunches/train	n_b	
Bunch spacing	310	ns	t_b	
Repetition rate	5	Hz	f_{rep}	
Energy	5000	MeV	E_{e+}	
Beam Power	230	kW	P_{e+}	
Overhead	1.5		F	

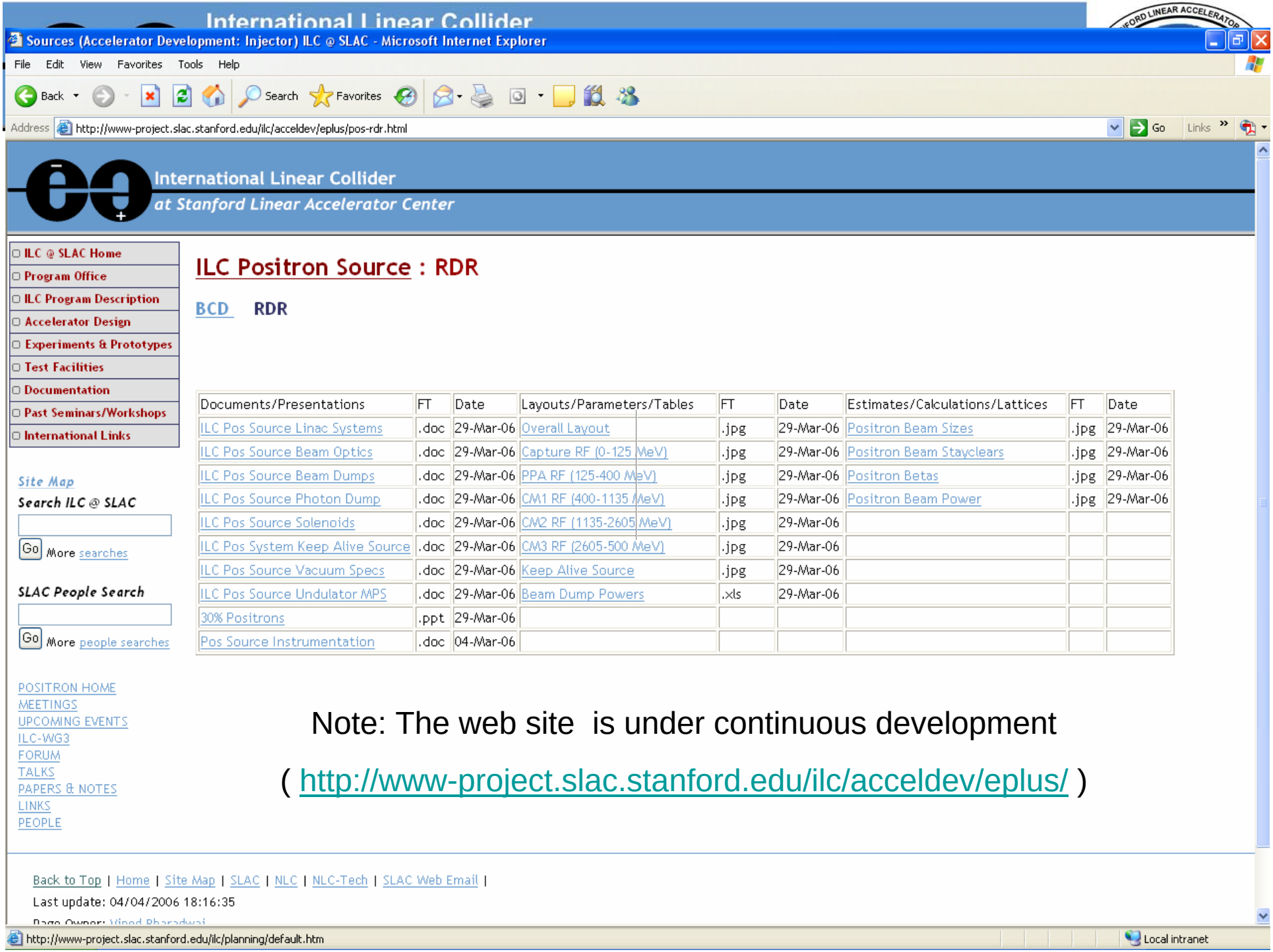
Note: The SLC e+ source beam power was ~1 kW vs. ~350 kW for ILC

Layout of ILC Positron Source

(BCD: Snowmass ➔ Frascati, 2005)

- Photon production at 150 GeV electron energy
- K=1, λ=1 cm, 200 m long helical undulator
- Two e+ production stations including a back up.
- Keep alive auxiliary source is e+ side.




International Linear Collider
Sources (Accelerator Development: Injector) ILC @ SLAC - Microsoft Internet Explorer
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ILC Positron Source : RDR
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ILC Pos Source Linac Systems .doc 29-Mar-06
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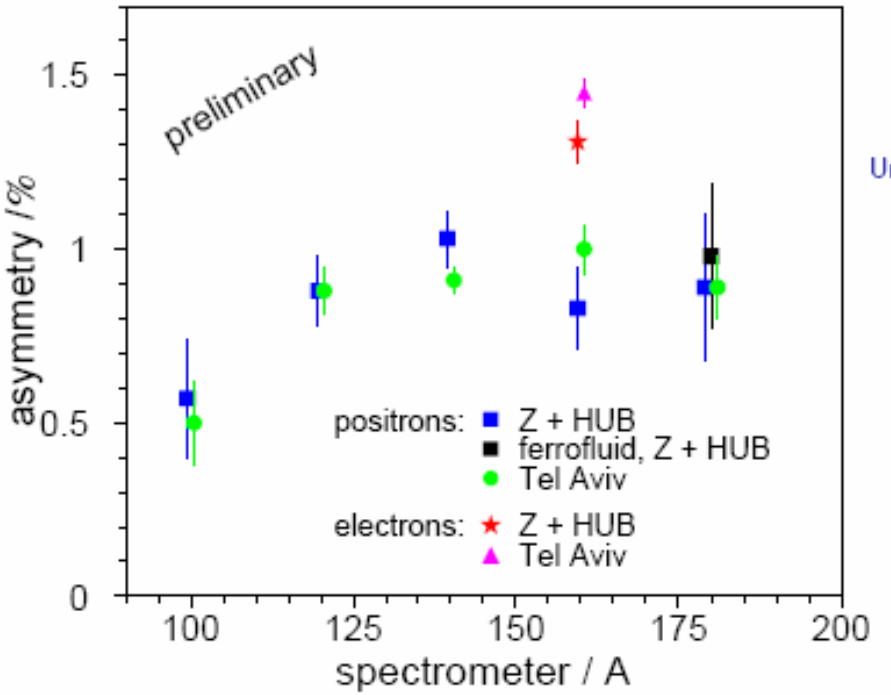
ILC Pos Source Vacuum Specs .doc 29-Mar-06
ILC Pos Source Undulator MPS .doc 29-Mar-06
30% Positrons .ppt 29-Mar-06
Pos Source Instrumentation .doc 04-Mar-06
Layouts/Parameters/Tables FT Date
Overall Layout .jpg 29-Mar-06
Capture RF (0-125 MeV) .jpg 29-Mar-06
PPA RF (125-400 MeV) .jpg 29-Mar-06
CM1 RF (400-1135 MeV) .jpg 29-Mar-06
CM2 RF (1135-2605 MeV) .jpg 29-Mar-06
CM3 RF (2605-500 MeV) .jpg 29-Mar-06
Keep Alive Source .jpg 29-Mar-06
Beam Dump Powers .xls 29-Mar-06
Estimates/Calculations/Lattices FT Date
Positron Beam Sizes .jpg 29-Mar-06
Positron Beam Stayclears .jpg 29-Mar-06
Positron Betas .jpg 29-Mar-06
Positron Beam Power .jpg 29-Mar-06
Note: The web site is under continuous development
(http://www-project.slac.stanford.edu/ilc/acceldev/eplus/)
Back to Top | Home | Site Map | SLAC | NLC | NLC-Tech | SLAC Web Email |
Last update: 04/04/2006 18:16:35
http://www-project.slac.stanford.edu/ilc/planning/default.htm
Local intranet

- E166: Demonstration experiment
- Eddy Current Studies
- Target Layout
- Optics development
- Undulator discussions
- NC RF

Positron/Electron asymmetries



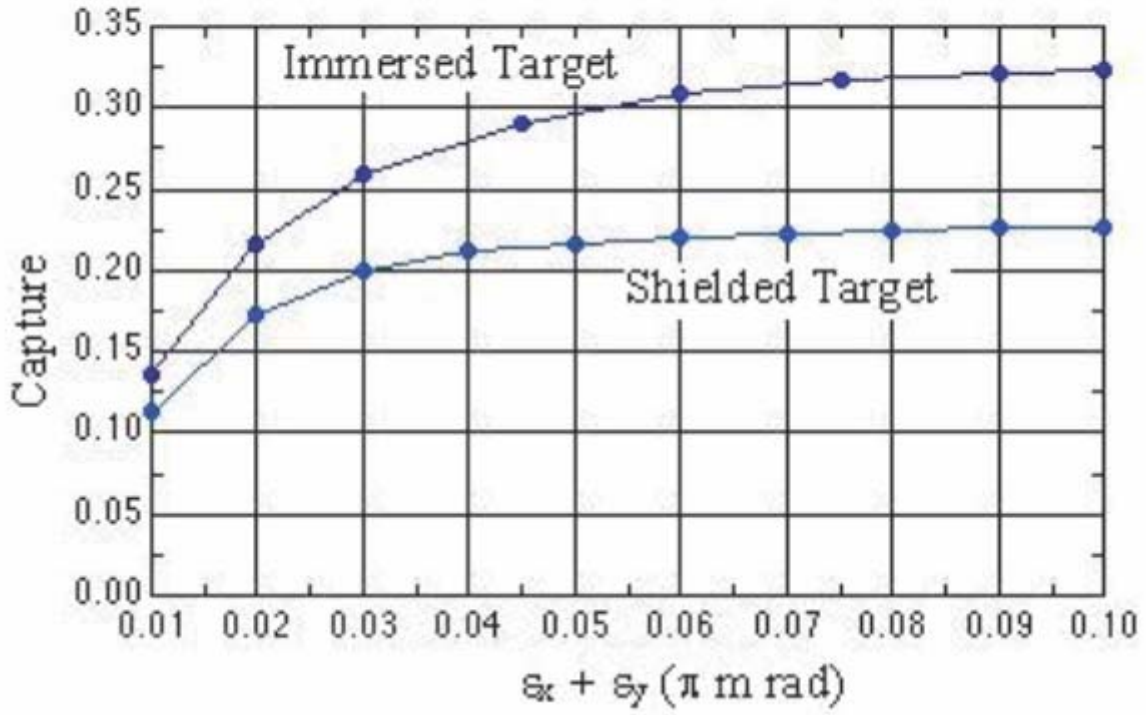
Gamma asymmetry

	measured Asym.	Geant3 simulation
Aerogel	3.50 %	3.54 %
SiW-Cal	3.52 %	3.22 %

Univeristy of Tennessee, DESY

- asymmetries in expected range
- independent analyses get compatible results
- systematic studies ongoing

Positron System Optics: Capture



Positron yield at 5 GeV (e+/e+target) for undulator based source with $\Delta E/E \leq 1\%$ for immersed target with $B_z = 6T$ and for shielded target.

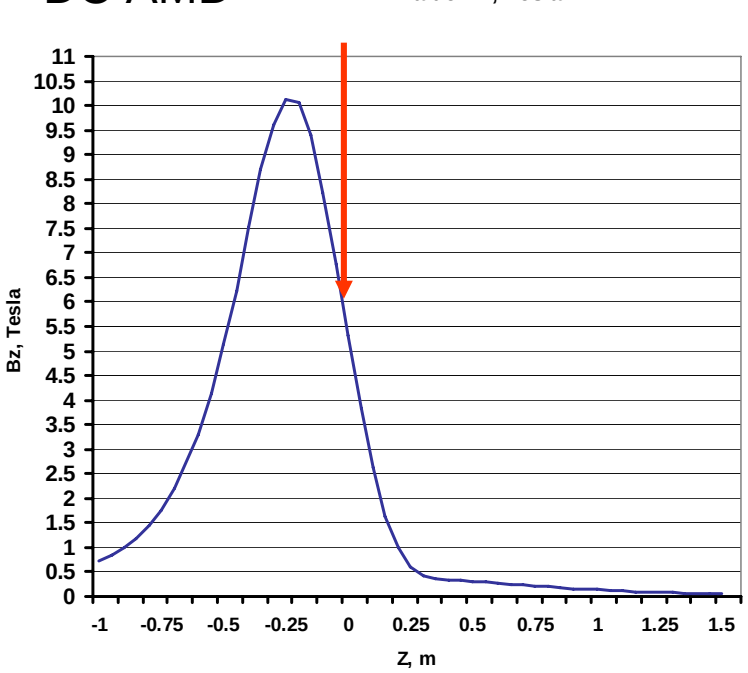
AMD (Flux Concentrator)

Table 2: Nominal AMD Specifications

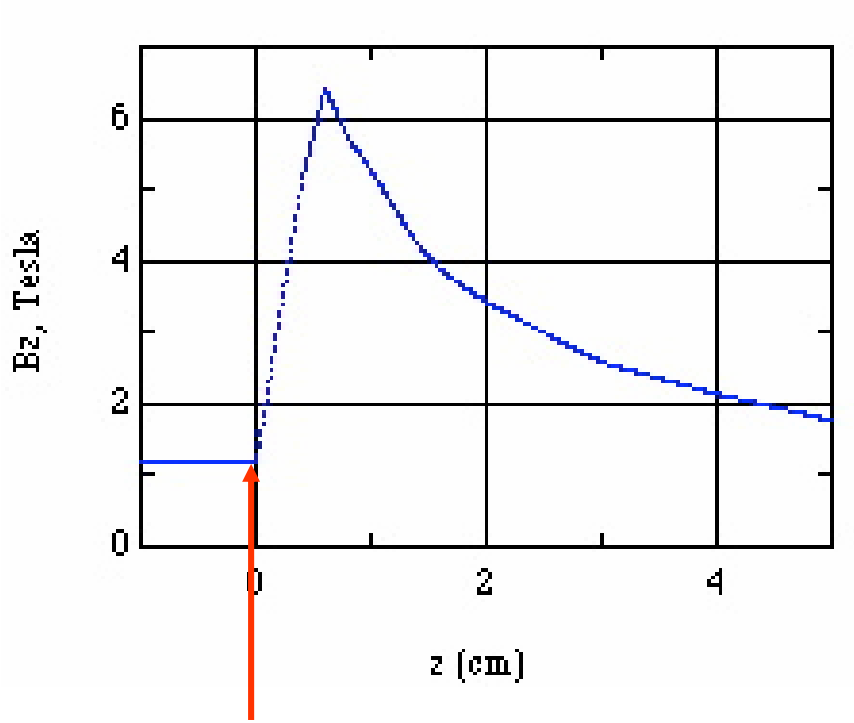
Item	B_0	G	Pulse Length	Rep. Rate
	kG	cm^{-1}	ms	Hz
DC AMD	60	8-80	dc	-
Pulsed AMD	60	60	1.2	5

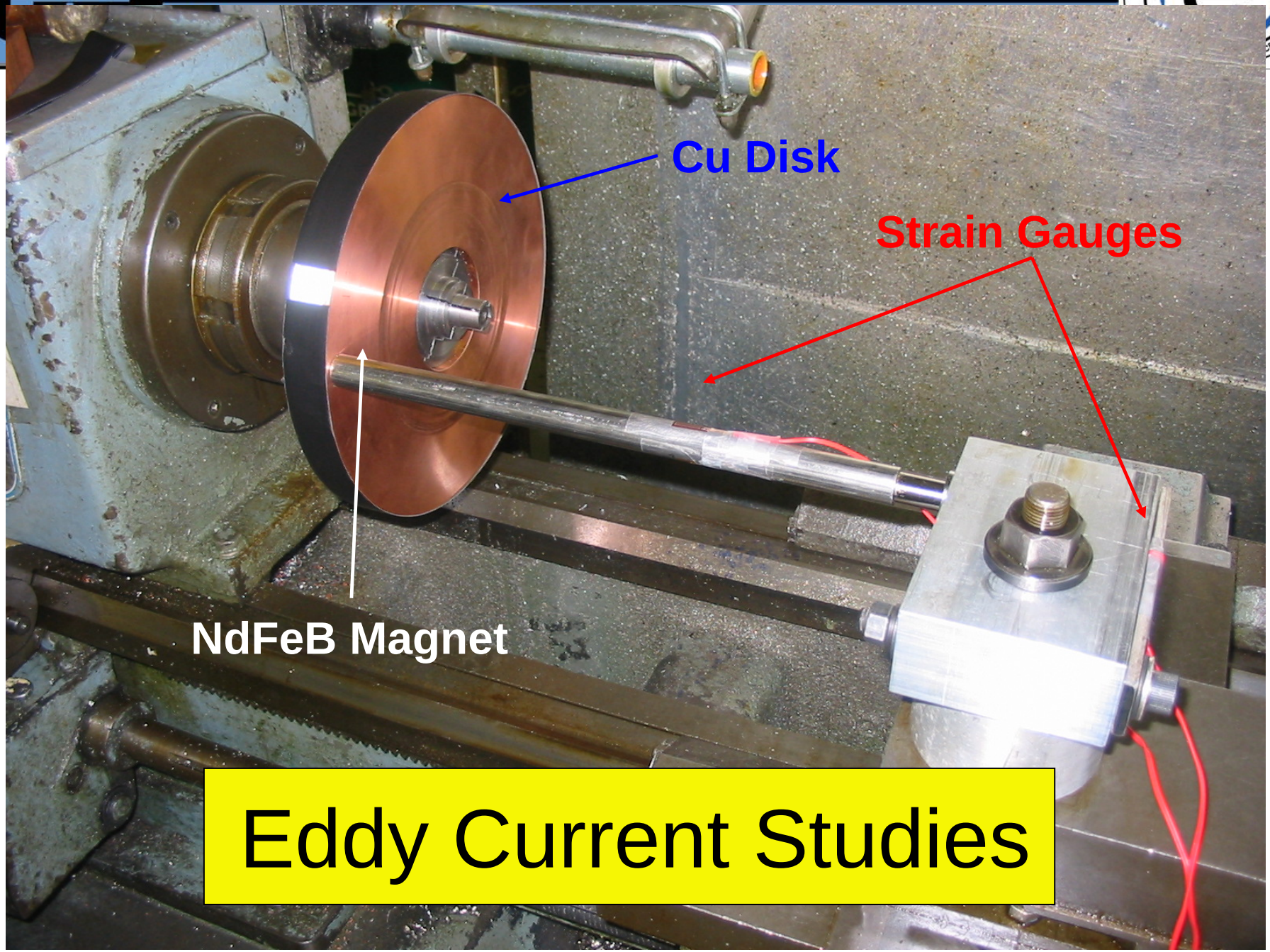
$B(z)=B_0/(1+z*G)$ for $Z>0$; B_0 is the field at $Z=0$

DC AMD



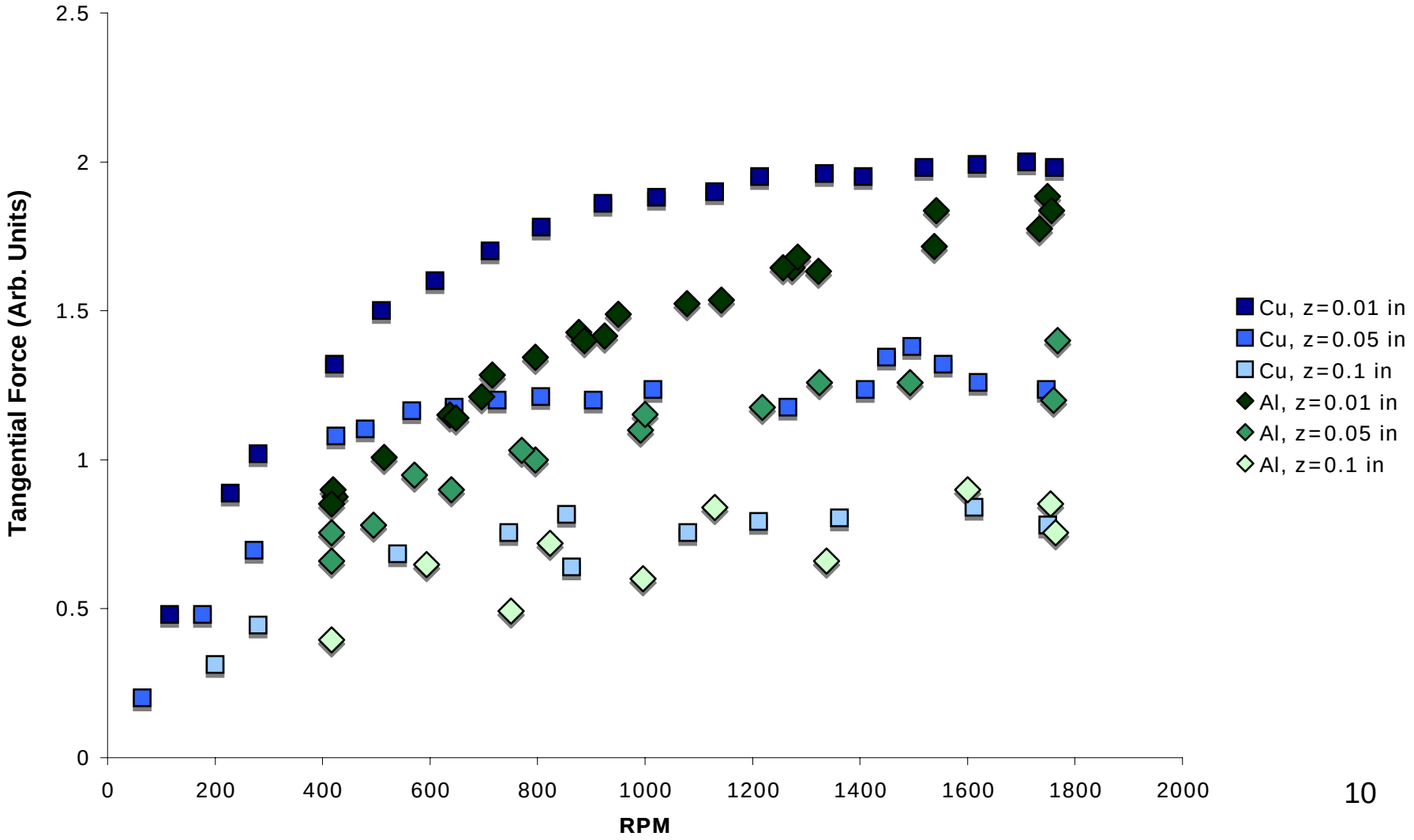
Pulsed AMD





Eddy Current Studies

Tangential Force vs. RPM



Pulsed Flux Concentrator, circa 1965: Brechna et al.

(D. Mayhall, W. Stein, T. Piggot, J. Gronberg, LLNL study)

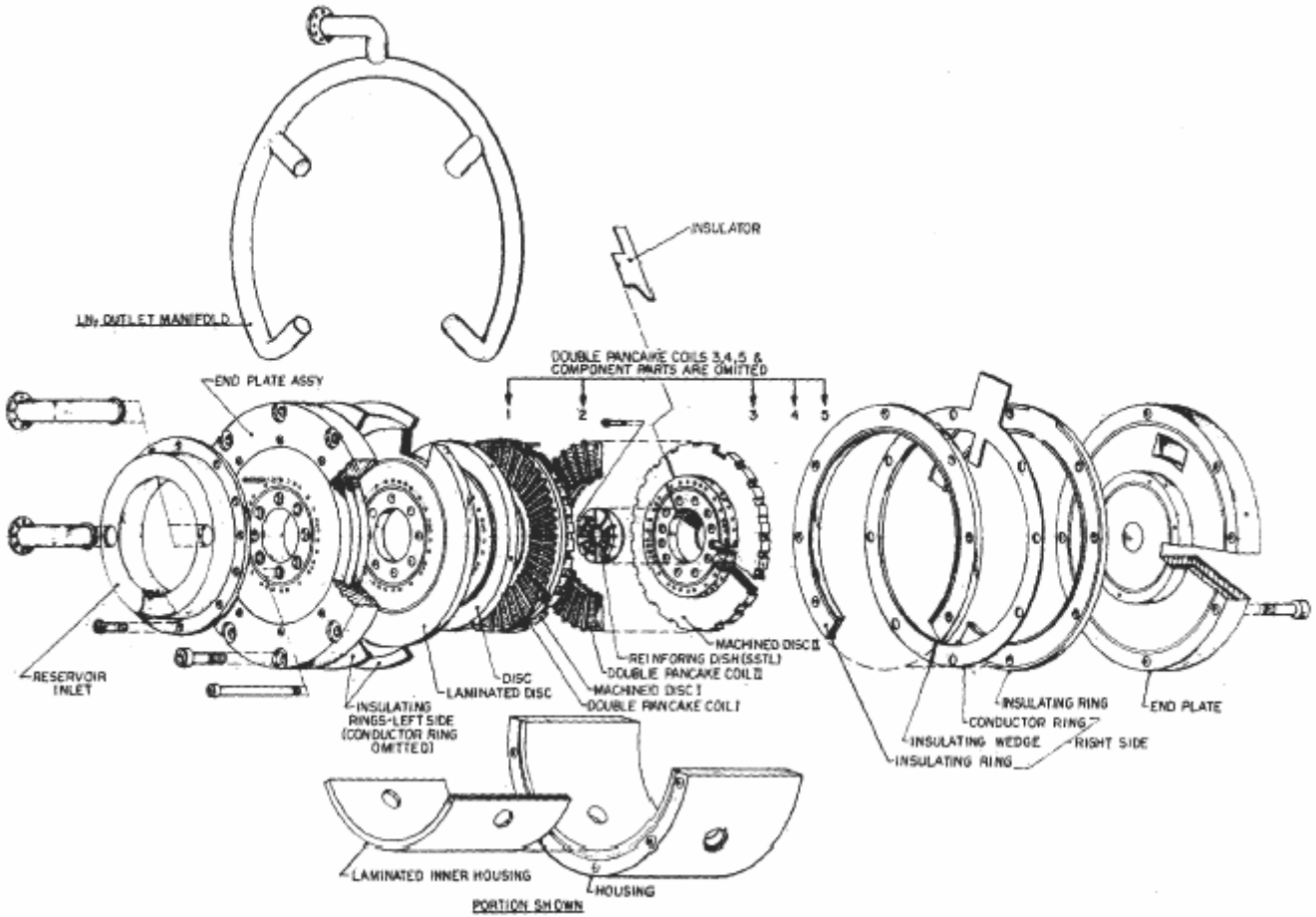


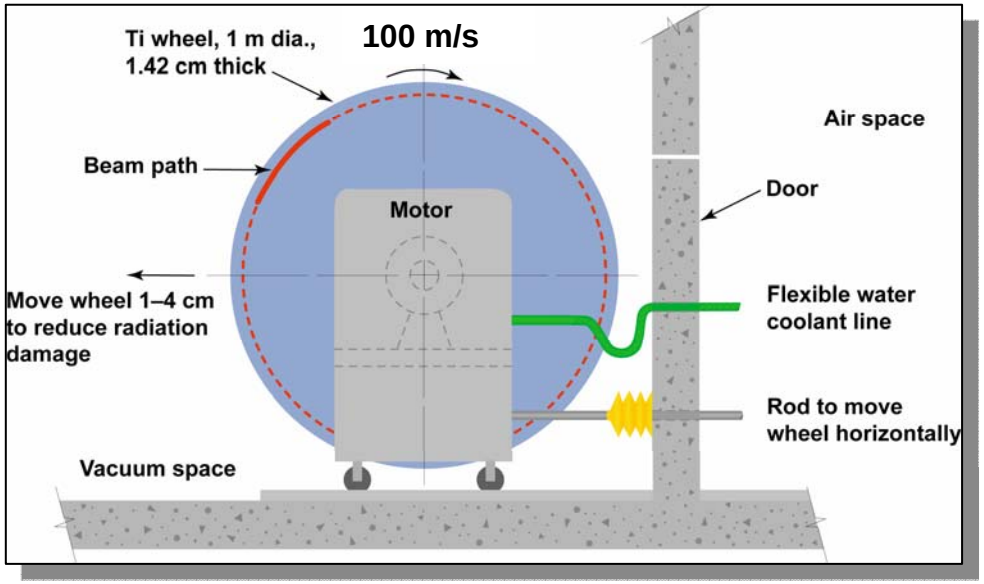
FIG. 5. Exploded view of flux-concentrator assembly.

Positron Target and AMD

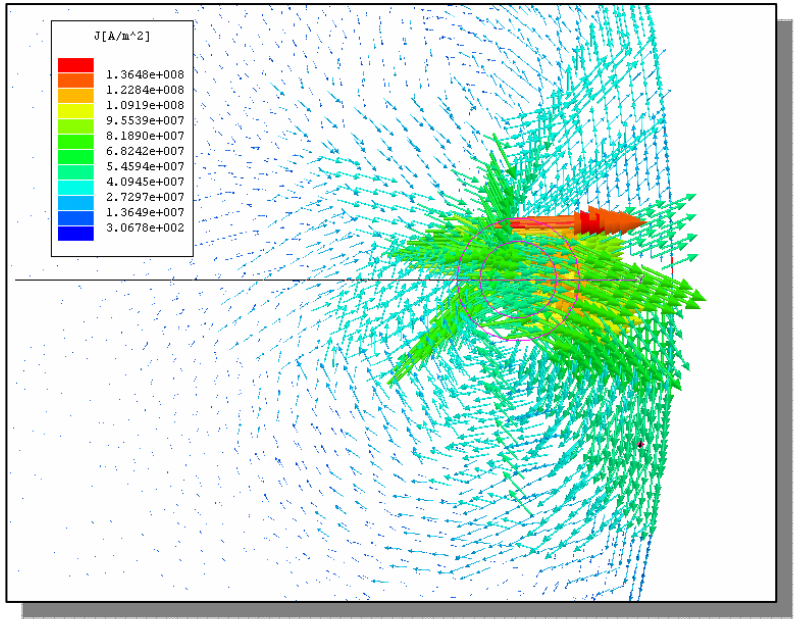
(SLAC, LLNL, Liverpool Univ., Daresbury, Cockcroft)

[Pulsed Flux Concentrator for RDR]

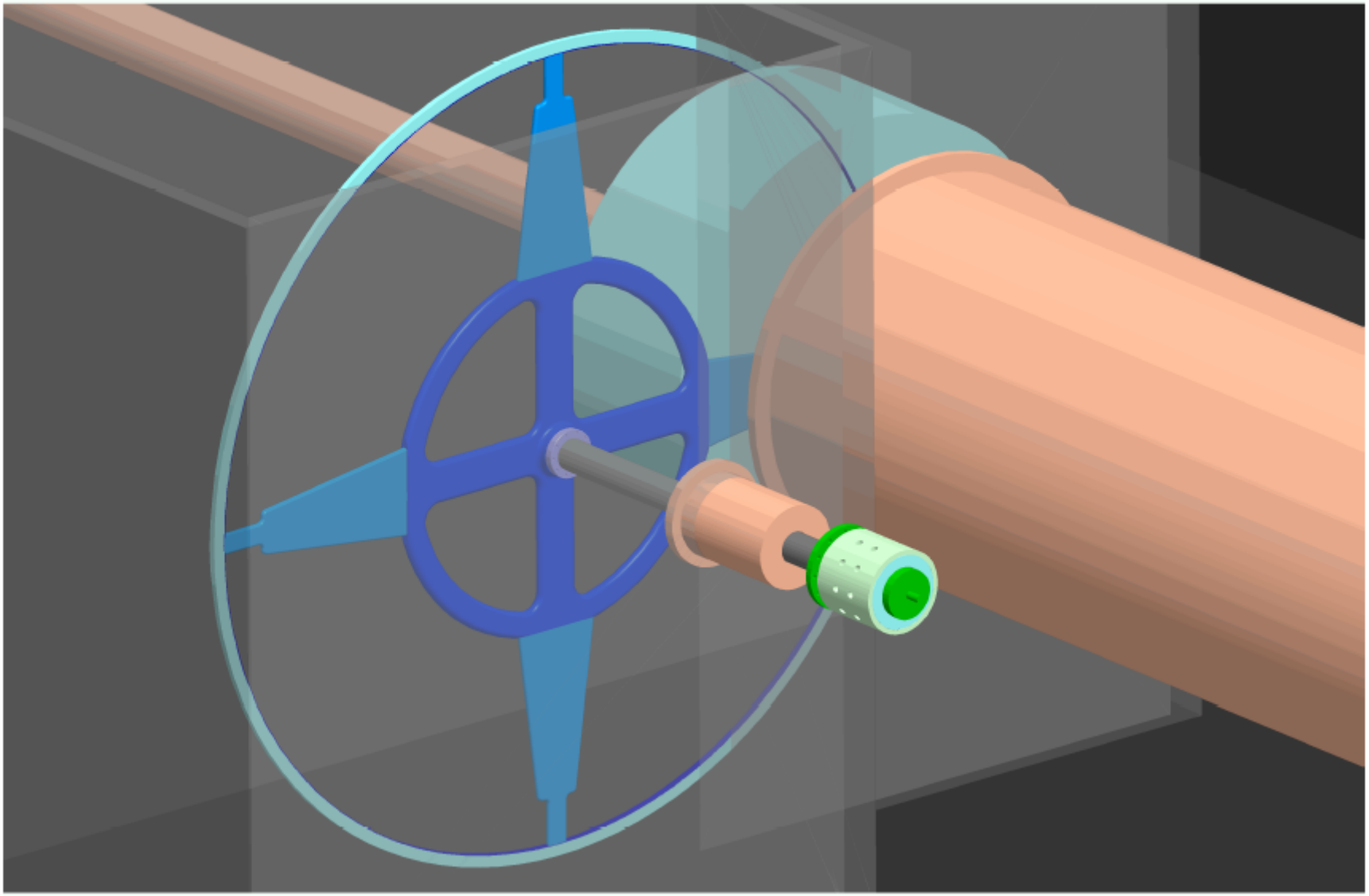
A conceptual design for the positron target



Eddy currents in a spinning metal disc



Positron Target and AMD (LLNL)



Positron System Optics Design
~ 18 km of Beam Lines incl. ~2300 magnets

125 MeV-5 GeV LTR Optics Deck

Parts Count Done

Functionality, Operability, Optimization Studies Continuing

Undulator Development

SLAC, ANL, LBNL, Daresbury

K=1, λ=1 cm, ID> 4 mm, helical, SC e+ Undulator

What can be done?

What needs to be demonstrated?

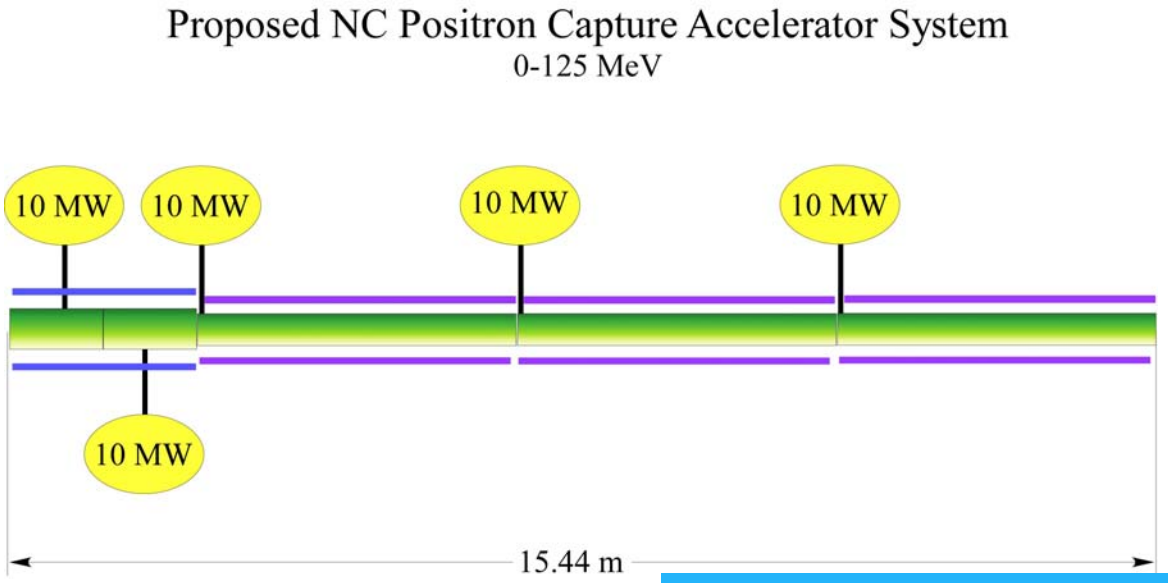
Most importantly, how will we work together?

Are formal protocols necessary?

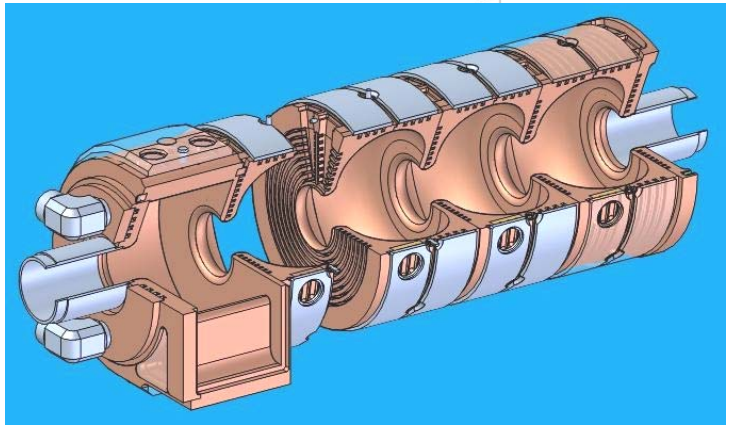
What next?

NOTE: $L_{und} \alpha (150/E[GeV])^4 x \lambda(cm)^2 x K^{-4/3}$

Normal Conducting RF Structure Development: SW and TW required for e+ and e- Capture



- Goal: Evaluate performance of a 1.3 GHz, NC cavity
- Issues: Significant heating from both rf and particle losses, must sustain high surface fields (~ 35 MV/m for 1 msec)



SLAC ILC e+ BCD/RDR Summary

All (?) pieces identified

High Level Parts List Complete

Ongoing R&D:

- Undulator
- Target
- AMDs
- NC RF
- (Remote handling, not started)

Goals

- RDR and Cost Estimate, end of calendar 2006
- TDR w/ key technology demos, end of calendar 2009