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Strategic Initiative: Accelerator R&D

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Focus Research Topics Supported by LDRD

- **Basic accelerator physics**
- **Large scale accelerator modeling**
- **Laser-Wakefield Accelerator**
- **International Linear Collider (ILC)**
- **APS2**
- **Exotic Beams and High-Power Hadron linacs**

Basic Accelerator Physics

- **RF Gun Beam dynamics**
  - Chun-xi Wang, Massimo Ferrario, KJK
- **Ultra-short bunch for SR**
  - Kathy Harkay, Michael Borland
- **FEL BD**
  - V. Kumar, KJK, B. Adams, Al Crewe, Bud Kapp
- **Phase space designing**
  - KJK, Ph. Piot,..
- **Emittance exchange experiment**
  - John Power, Yin-e Sun, Wei Gai, Kathy Harkay,..
  - Improve FEL
  - Replacing DR?

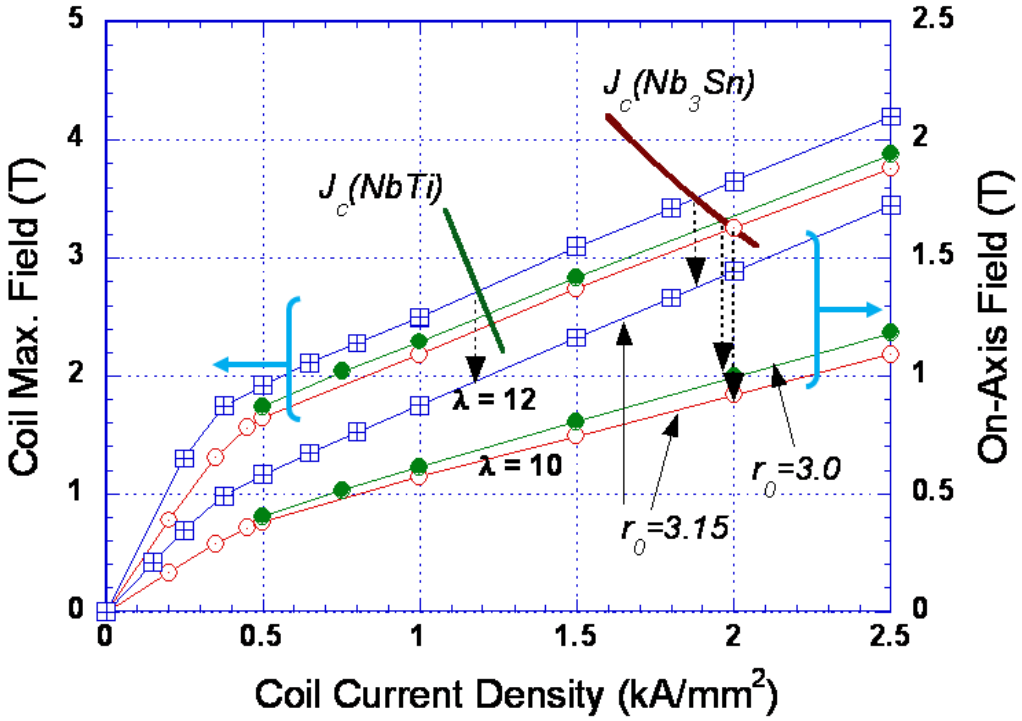
Large Scale Accelerator Modeling
(Joint Accelerator-Peta Scale LDRD)

- **Collaboration APS-PHY-MCS**
- **Parallelize ELEGANT & TRACK**
  - Michael Borland, Petr Ostroumov, Yujong Wang, Jin Xu,
  - Bill Grob (MCS)
- **Higher order codes for improved wakefield calculation for ultra-short bunches**
  - Yong-Chul Chae, Paul Fisher, Misun Min
- **PIC type code**
  - Yong-Chul Chae, Ian Hesthaven (Brown U)
- **Became a member of SciDACII accelerator collaboration**

Linear Collider Topics

- **EP at SCSPF, including cold test**
  - Mike Kelly
  - Also for future light source such as APS2
- **Positron Source**
  - All simulation, ADM, Flux concentrator, radiation
  - Wan Ming Liu, Sergey Antipov, Wei Gai
- **Control**
  - John Carwardine leading US collaboration
- **NbSn based magnet development for higher fielsd at shorter period length, also for APS/APS2**
  - Suk Kim

Achievable On-Axis Fields for ILC

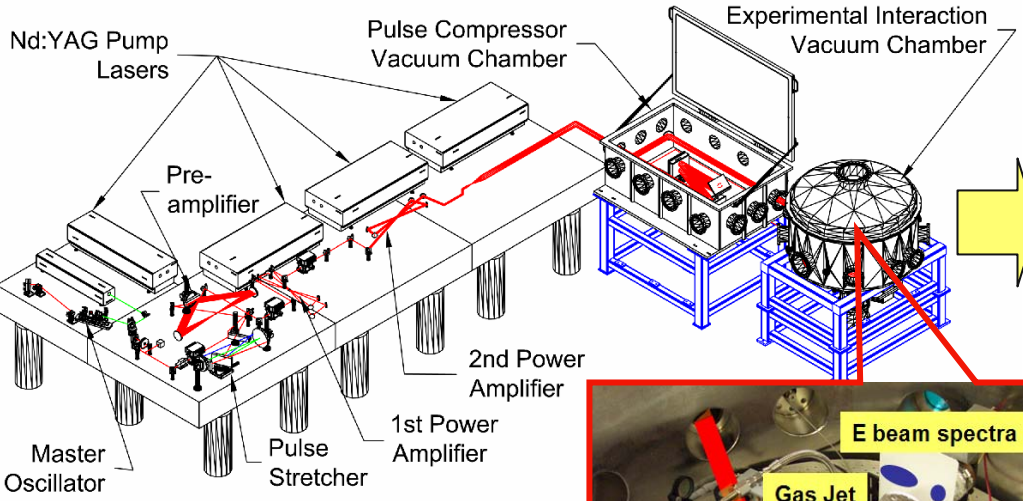


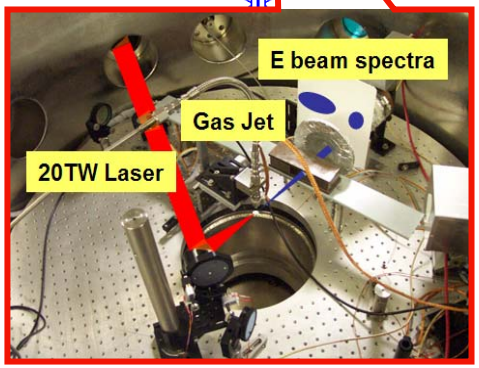
$$K_h = \sqrt{2}K$$

λ [mm]	r_0 [mm]	J_c [kA/mm^2]	B_0[T] @J_c	B_0[T] @0.8J_c	K @0.8J_c
12	3.15	1.88	1.37	1.16	1.3
10	3.15	2.0	0.92	0.78	0.73
10	3.0	1.97	0.98	0.825	0.77
11	3.0	1.96	1.23	1.05	1.08

ANL CHM's TUHFF laser system & application

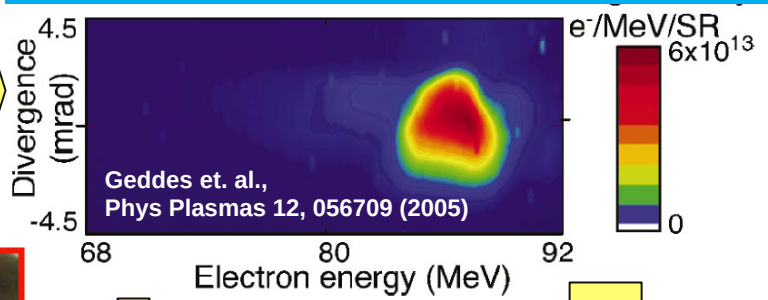
30 fs, 0.6 J, 20 TW @ 10 Hz



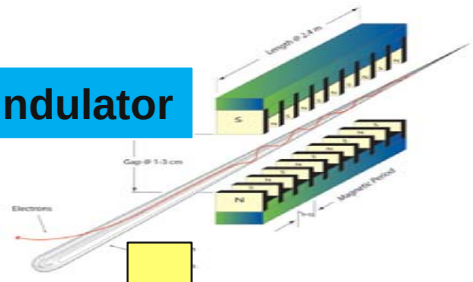


Peta laser plasma simulation LDRD

"Bubble" regime to generate high energy (>100 MeV), high quality e⁻ beams

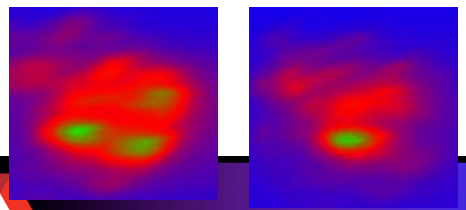


Undulator



Coherent VUV & x-ray

Current status: self modulated laser wake wave acceleration, 5-10 MeV beams



- ❑ Novel laser plasma physics
- ❑ Advanced accelerator technology
- ❑ New frontiers in ultrafast science
- ❑ Contribution to CHM mission

Laser-Wakefield Acc at TUHFF

- **20 T TUHFF laser @ CHM suitable for bubble regime**
- **Bob Crowell, Wei Gai, Yuelin Li, Sergei Chermerisov, Alex Lumpkin, Baifei Shen, Karoly Nemeth**
- **VORPAL simulation**
- **Aiming for a “bubble” this year**

Budget

- **LDRD FY07 allocation (1420-140) K**
  - down from last year 2022K
  - More Peta support
- **ILC 2485K (60M) or 1731 (45M)?**
  - 300K for FY06

Visiting Collaborators

- **Laser plasma**
  - Baifu Shen (Shang Hai), Karoly Nemeth, another postdoc under review
- **RF Gun Beam dynamics**
  - An Wang (student from Hefei)
- **ILC DR Kicker**
  - George Gollin (UIUC, Fall 2007 semester)
- **DR & APS2**
  - Srinivas Krishnagopal (RRCAT)
  - Eun-San Kim (GDE) & Seung Hwan Shin (Kyung Buk U)
  - Xioawei Dong (Postdoc in process, Electron Cloud, KEK)