

Jefferson lab訪問

2013年7月17日

ERL検討会

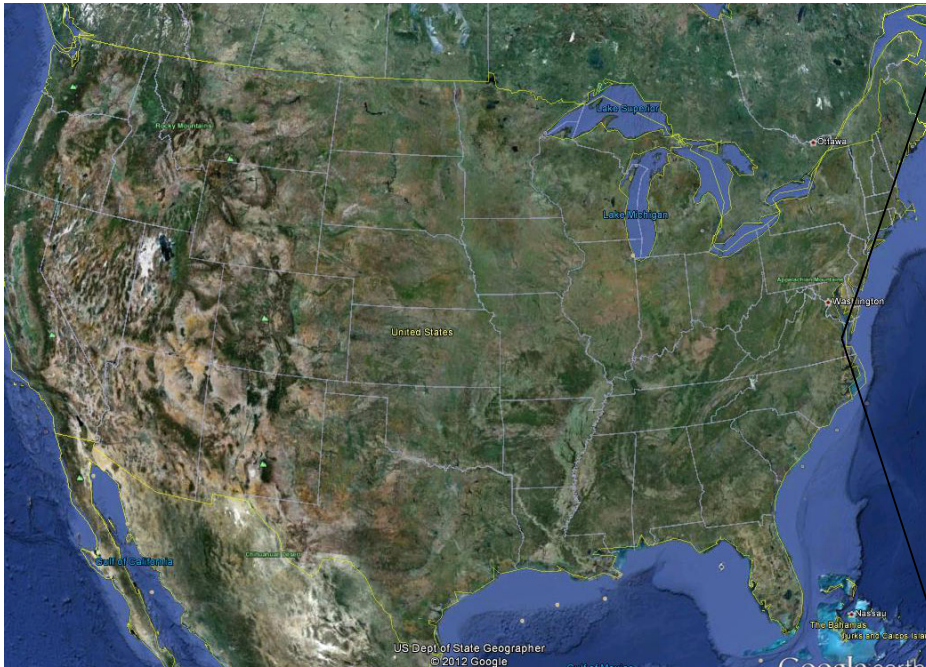
阪井 寛志、梅森 健成

- ①New SRF facility見学
- ②CEBAF 加速器見学(upgrade中)
- ③Jlabでのmeetingについて(field emissionについて議論)

Thomas Jefferson National Accelerator Facility

CEBAF Accelerator

Newport News, Virginia



39°51'28.00" N 96°07'33.60" W

Slide from Ari D. Palczewski



SRF Research and accelerator production facilities

① Jefferson Lab

Slide from Ari D. Palczewski

Technology and Engineering Development Facility Project (TEDF)

A DOE Science Laboratory Infrastructure modernization project

Provides the first 2nd-generation SRF facility in the world

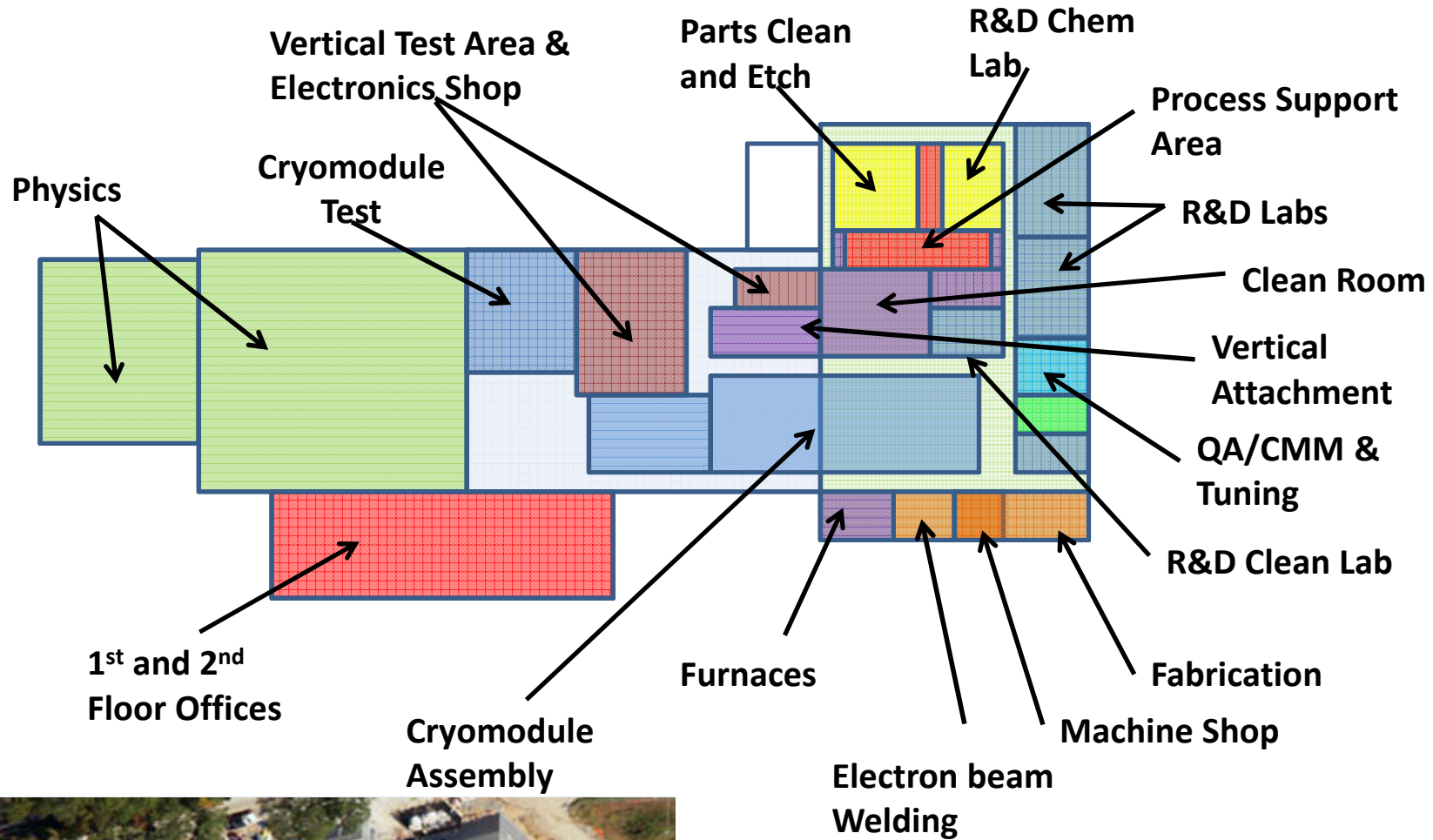


TED building 2012

New SRF lab TLA (Addition) 2012

Renovated SRF Test Lab (TL) 2013

SRF Work Centers in New Test Lab

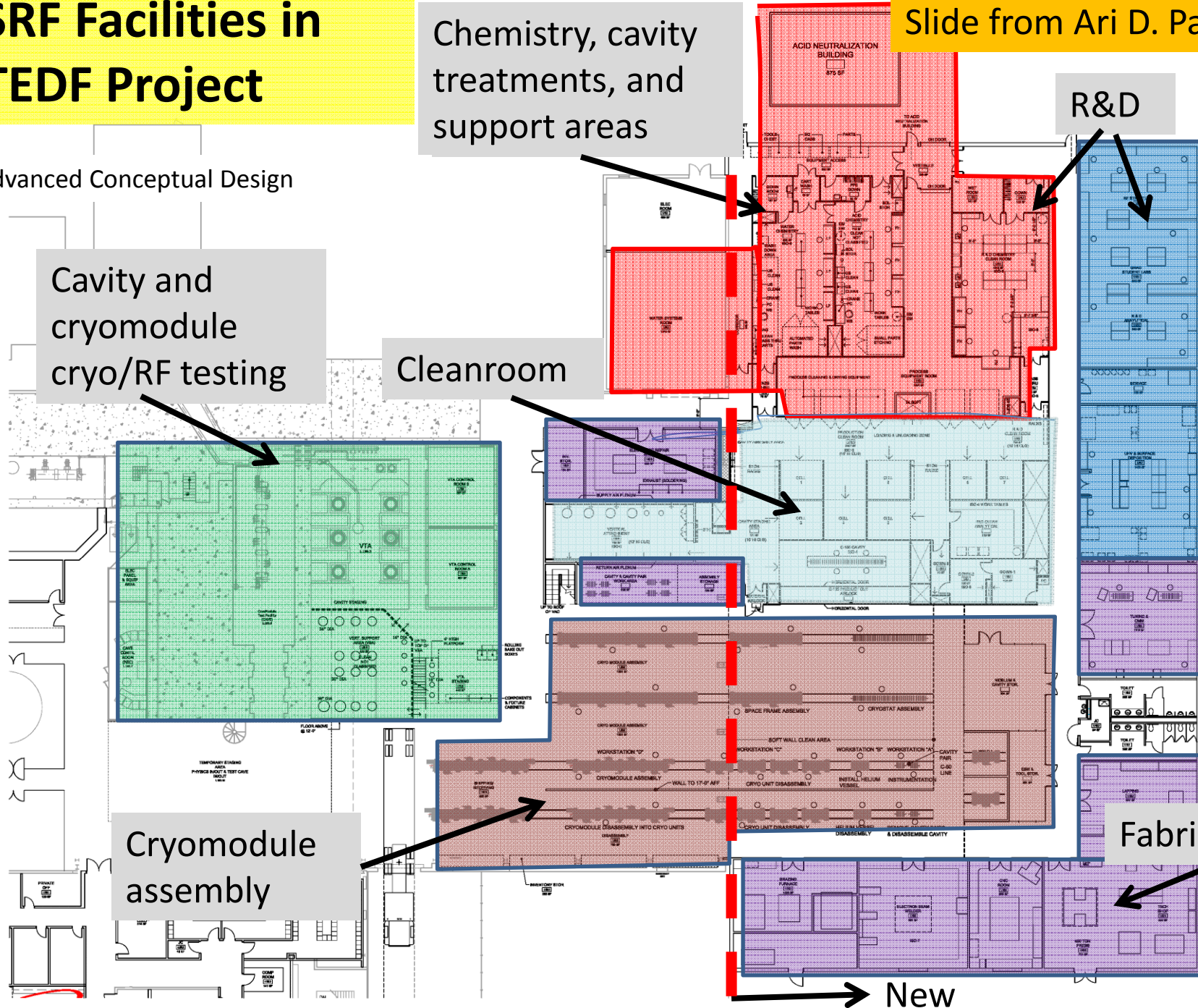


Slide from Ari D. Palczewski

SRF Facilities in TEDF Project

Slide from Ari D. Palczewski

Advanced Conceptual Design



Cavity and cryomodule cryo/RF testing

Cleanroom

Cryomodule assembly

Chemistry, cavity treatments, and support areas

R&D

Fabrication

New

Jefferson Lab
Scale: 1/8" = 1'-0" 03.26.09

Renovation and Addition - First Floor

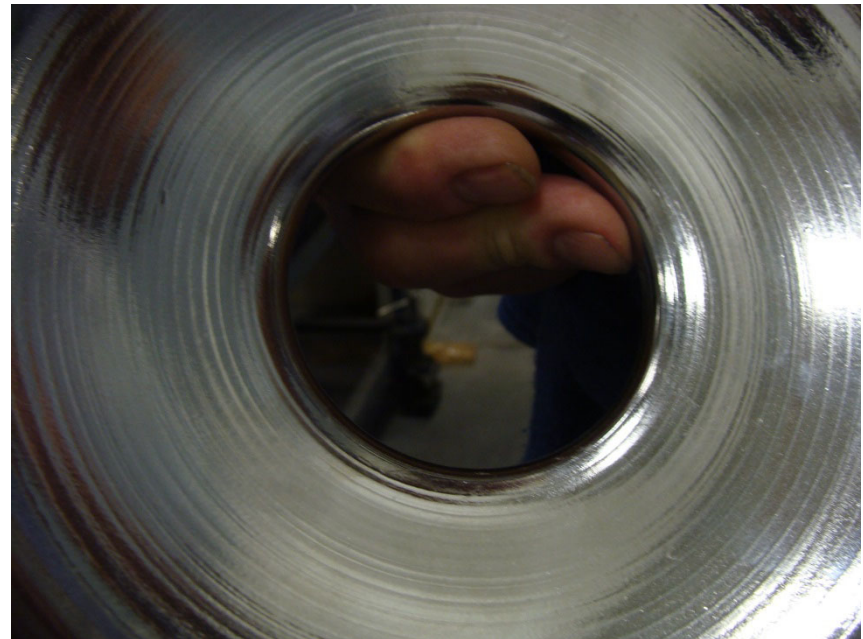
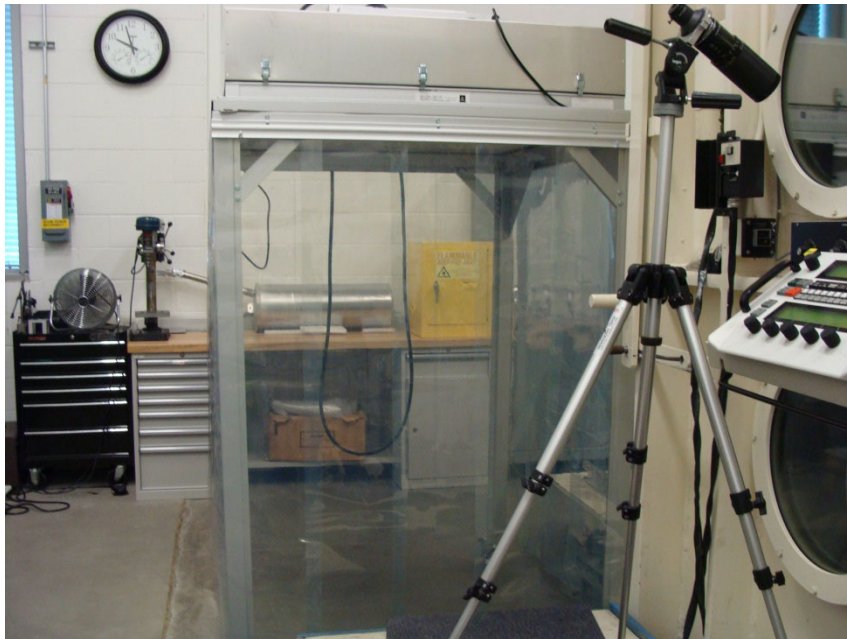
Build



アニール用真空炉



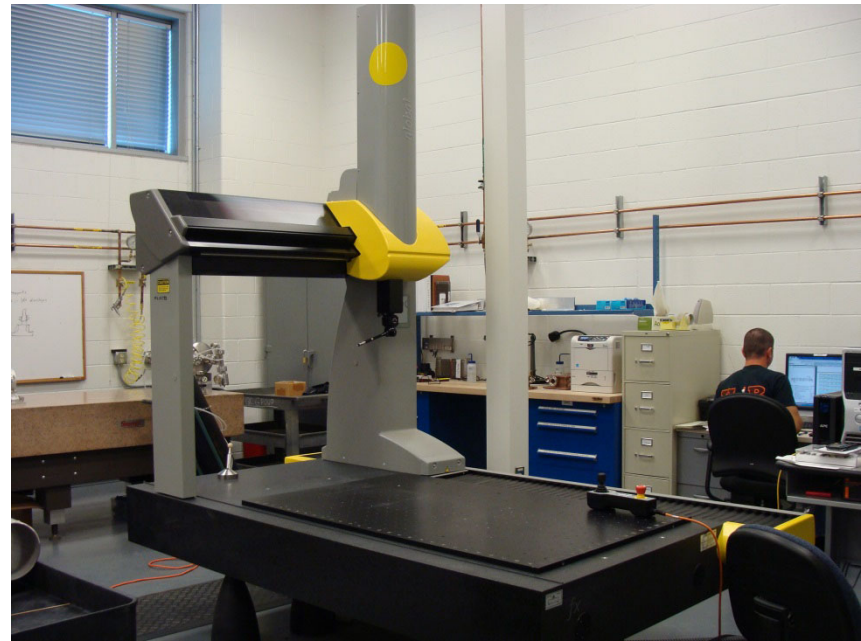
電子ビーム溶接



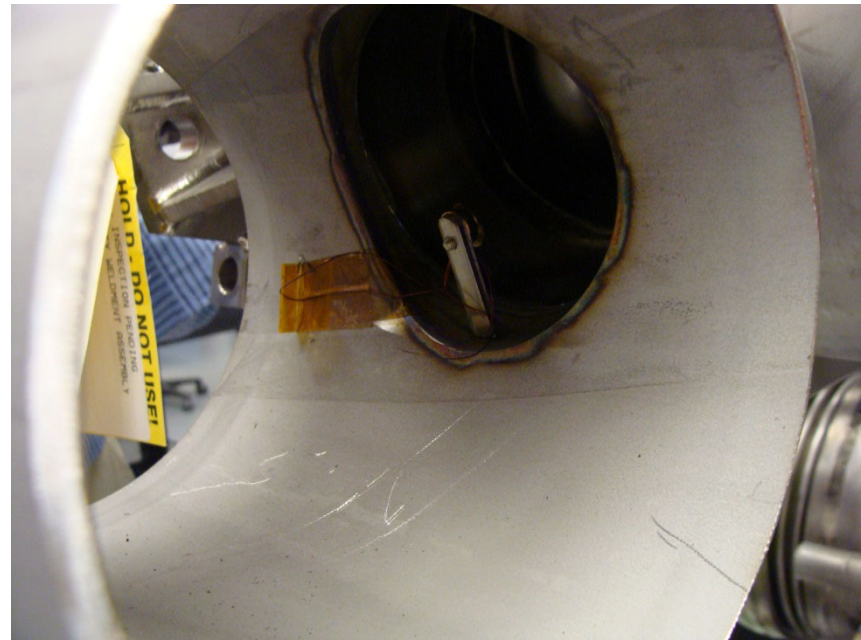
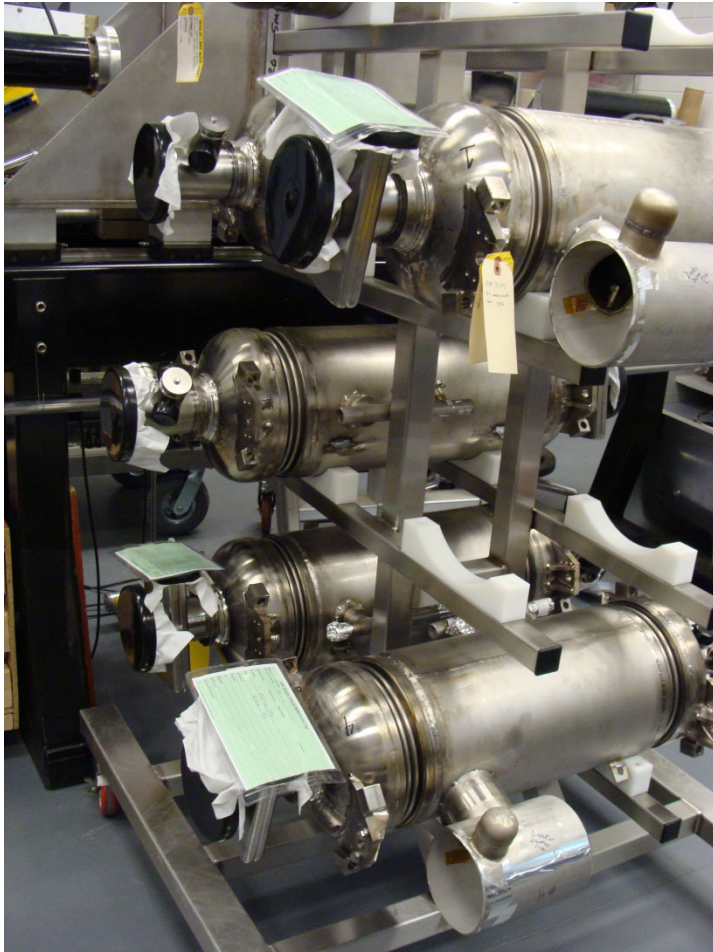
プレス機



遠心バレル機 & 3次元測定器



ERL(FEL)用空洞(再処理して性能向上目指す)

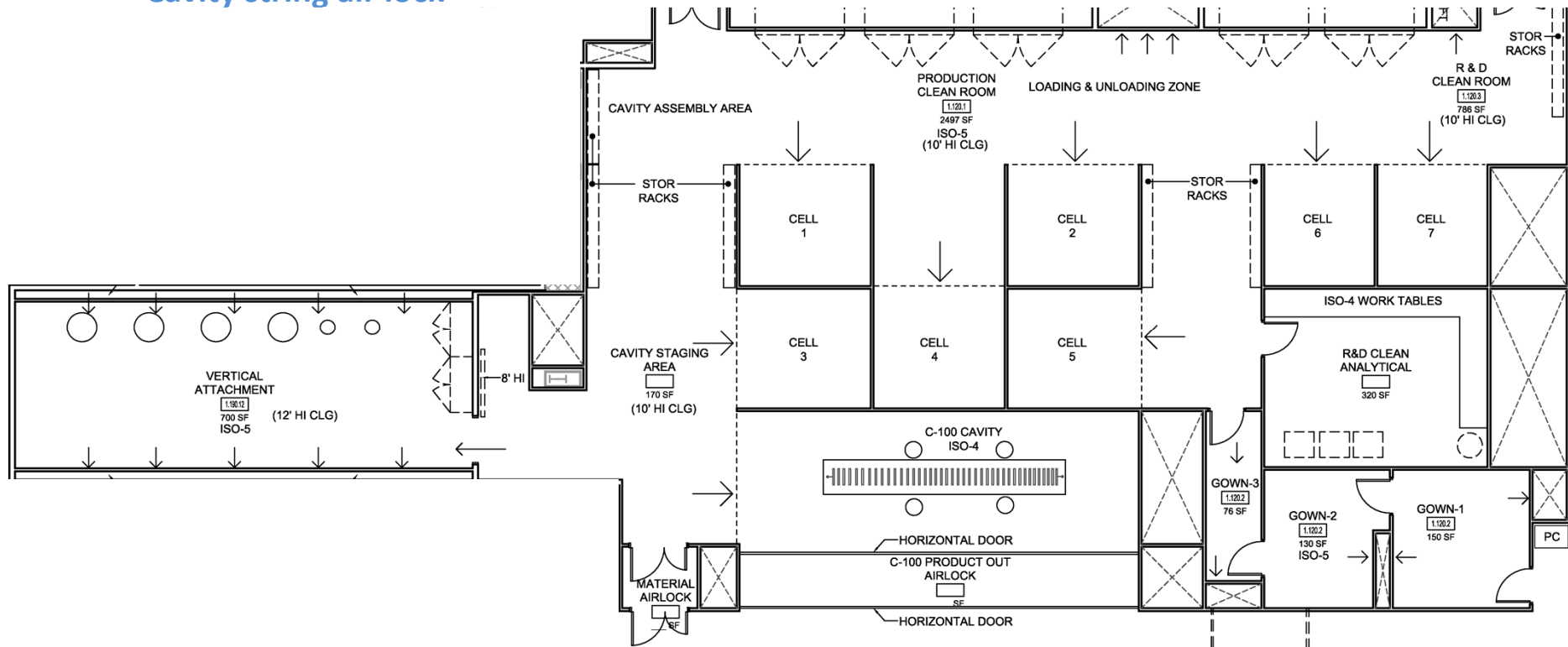
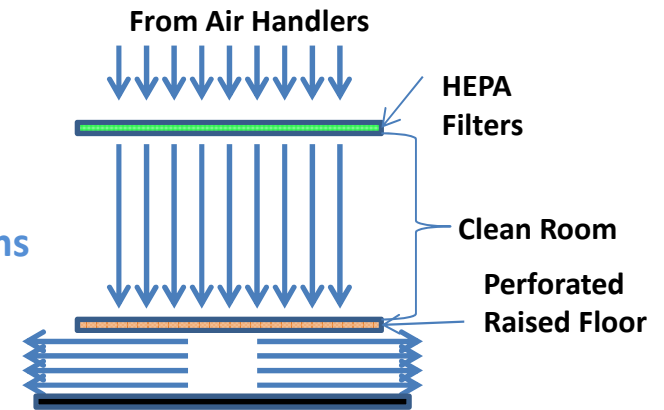


New clean Room facilities

Slide from Ari D. Palczewski

Upgraded clean room space to ISO-4 (all class 10 assembly)

- 100% HEPA coverage, RMF, laminar flow with return plenums
- Bay/Chase concept
- Dedicated Drying & Assembly chambers
- Modular wall systems
- Cavity string air lock



クリーンルーム





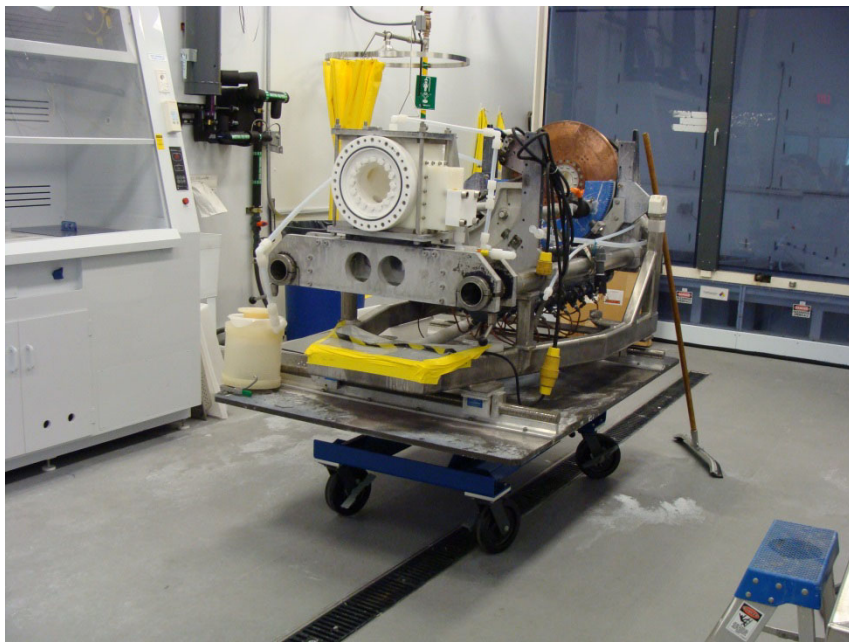
クライオモジュール組立室 & 取り出し室



化学处理室



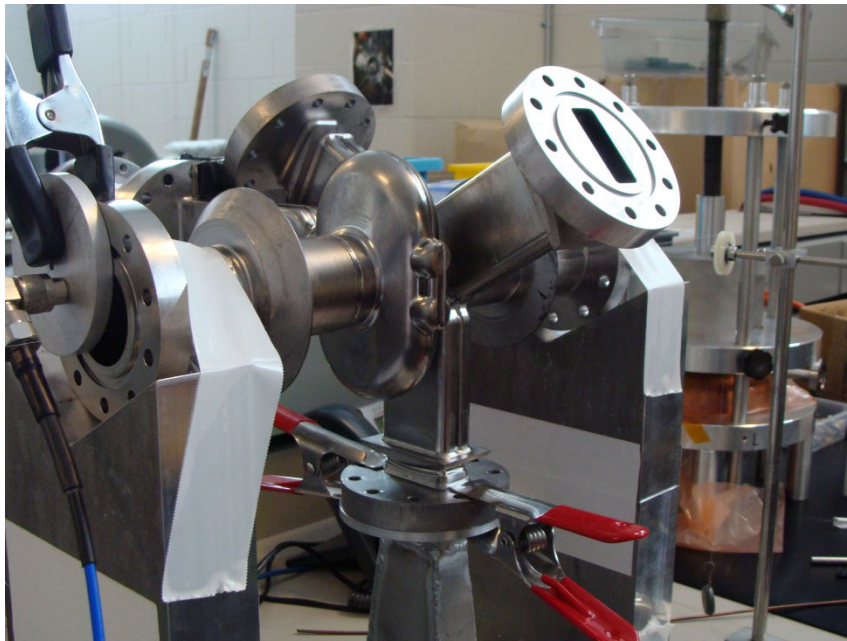
電解研磨



超純水用の部屋

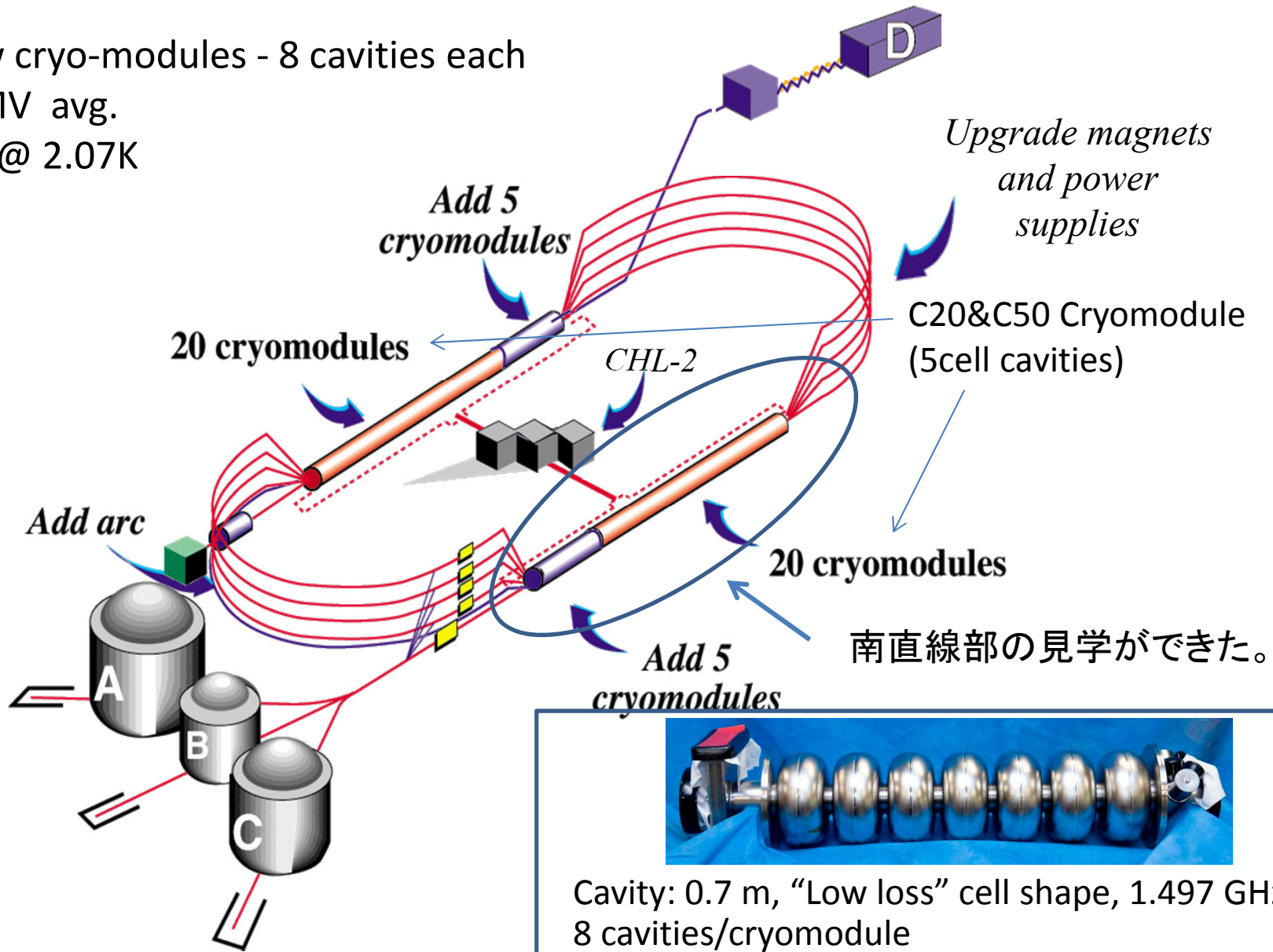


APS用クラブ空洞



②CEBAF 概要(12 GeV Upgrade)

10 New cryo-modules - 8 cavities each
 ≥ 108 MV avg.
 300 W @ 2.07K



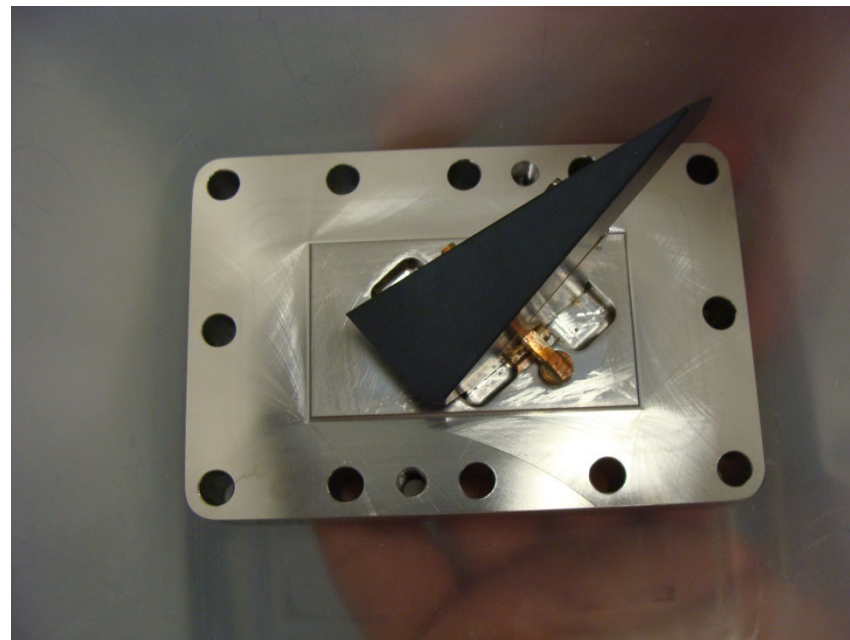
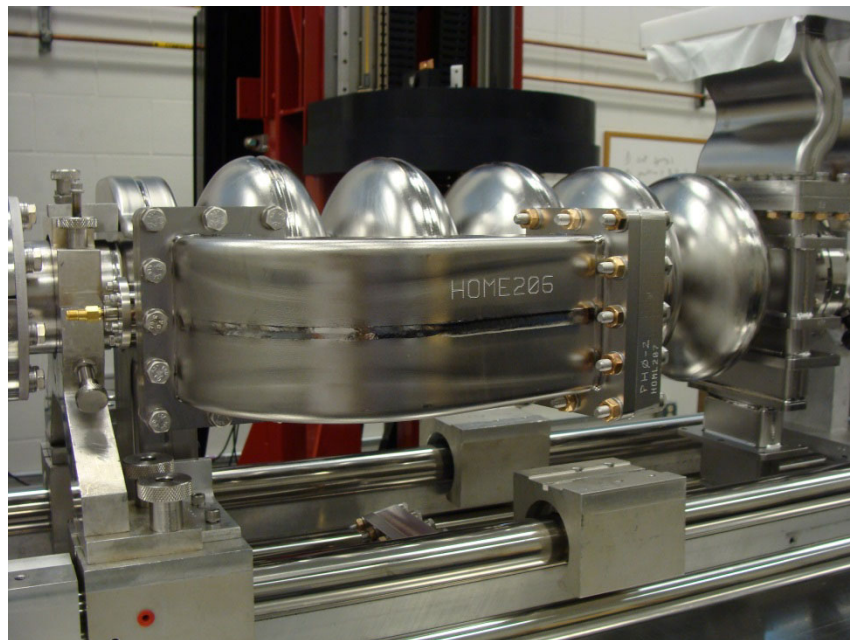
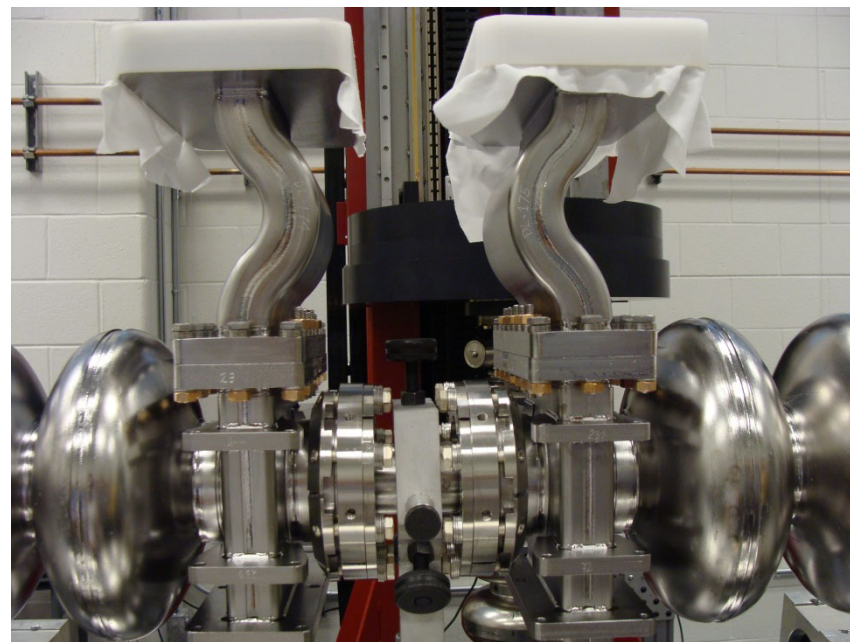
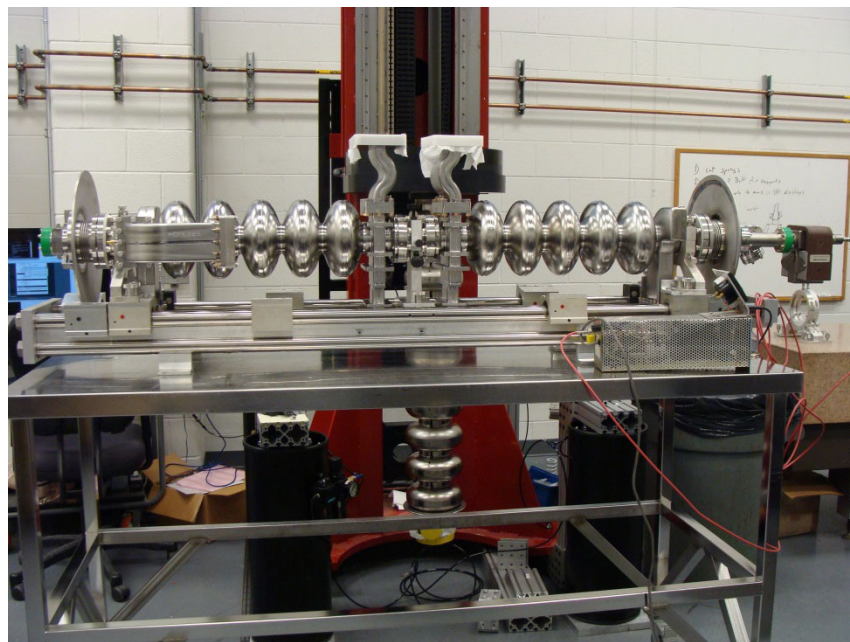
6GeV → 12GeVへのupgrade



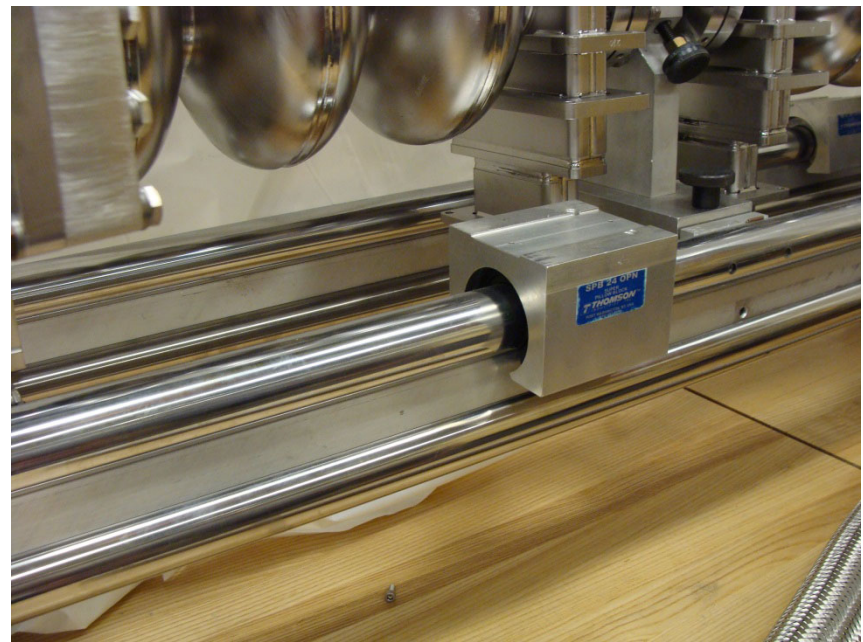
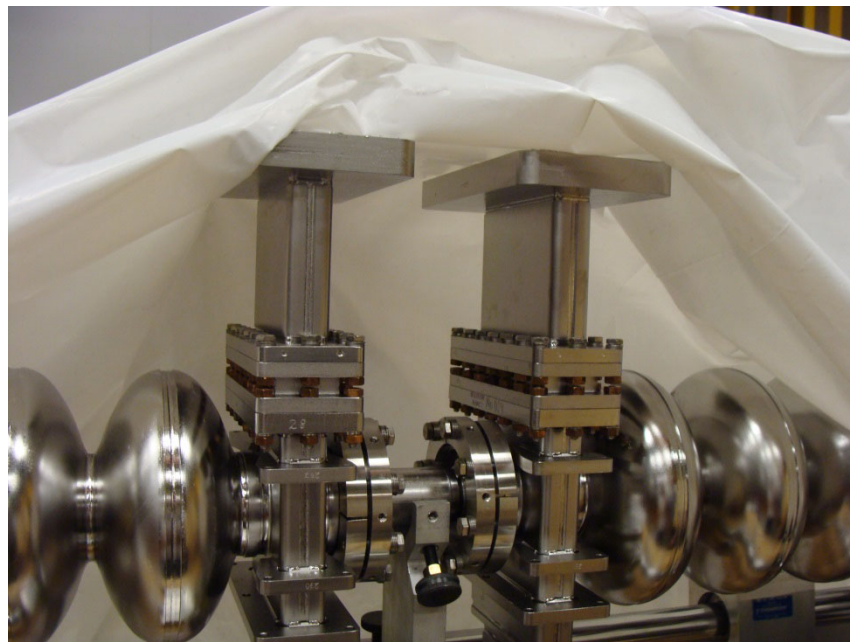
Cavity: 0.7 m, "Low loss" cell shape, 1.497 GHz
 8 cavities/cryomodule

10個の **C100 Cryomodule** (8空洞入り)を追加

CEBAF C50用空洞



CEBAF C20用空洞



CEBAF

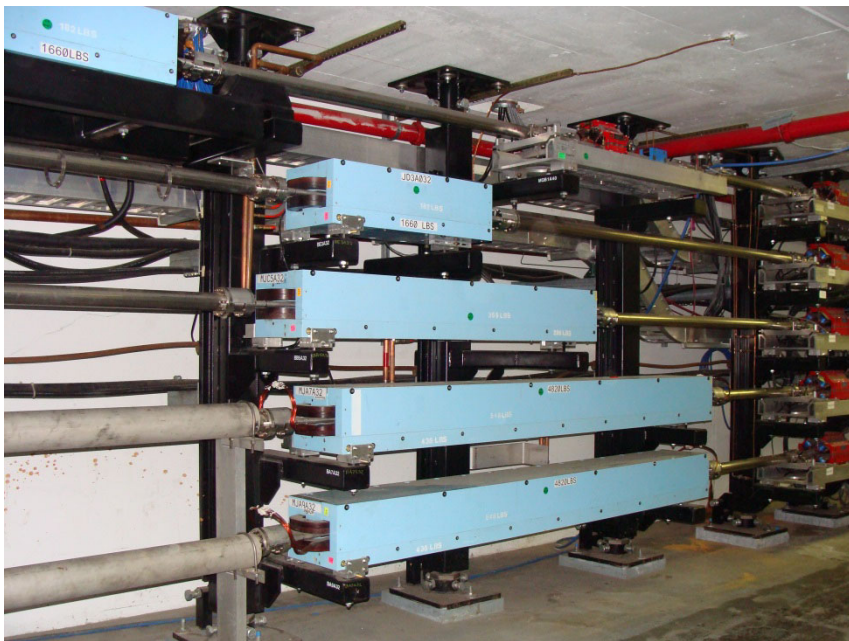


南直線部

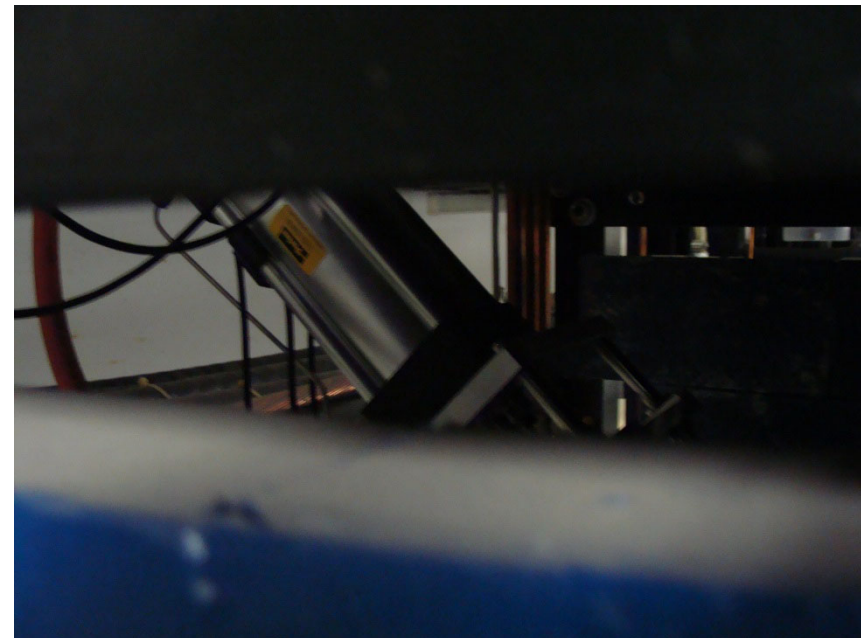


南直線部地下

5ループと電磁石



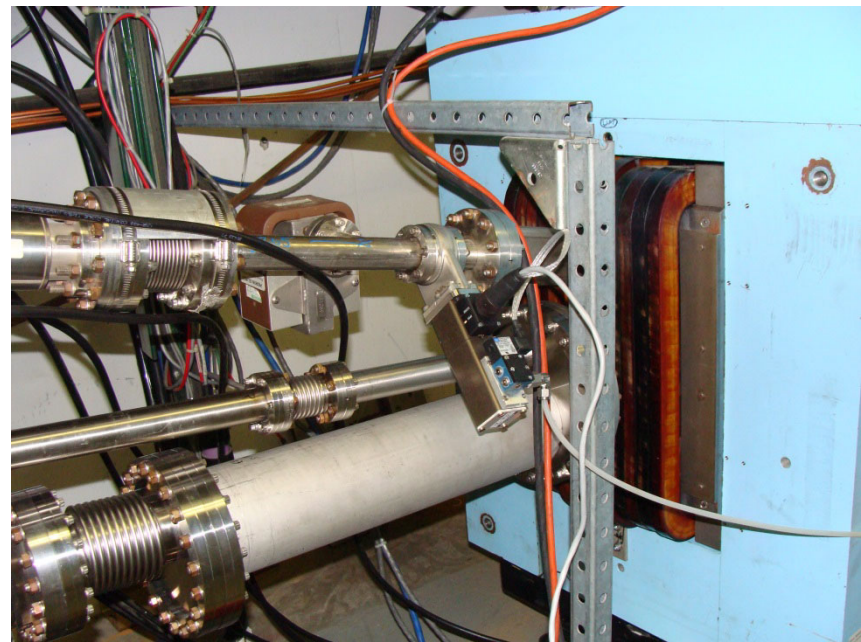
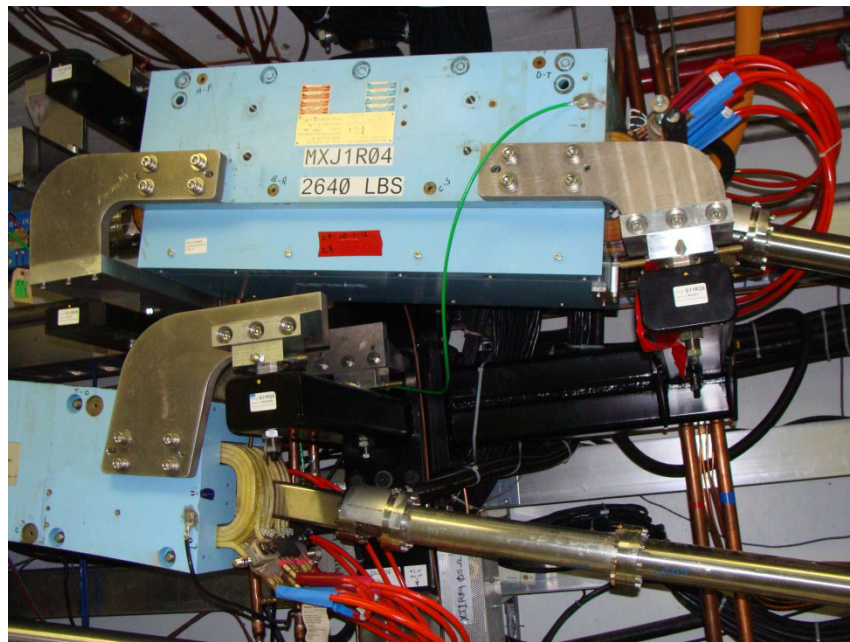
Beam absorber

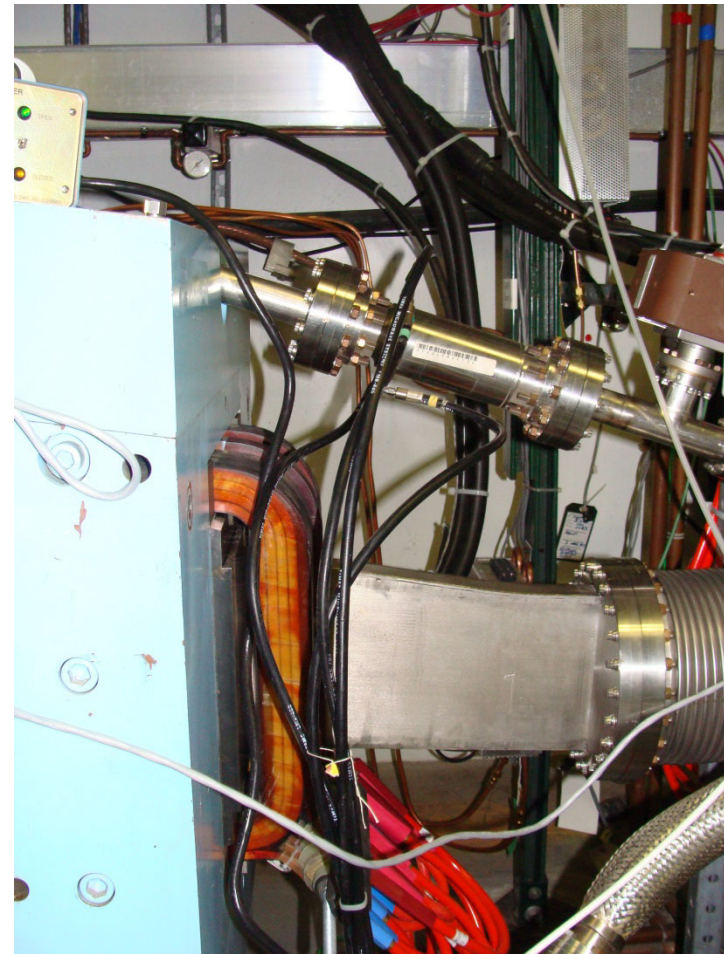
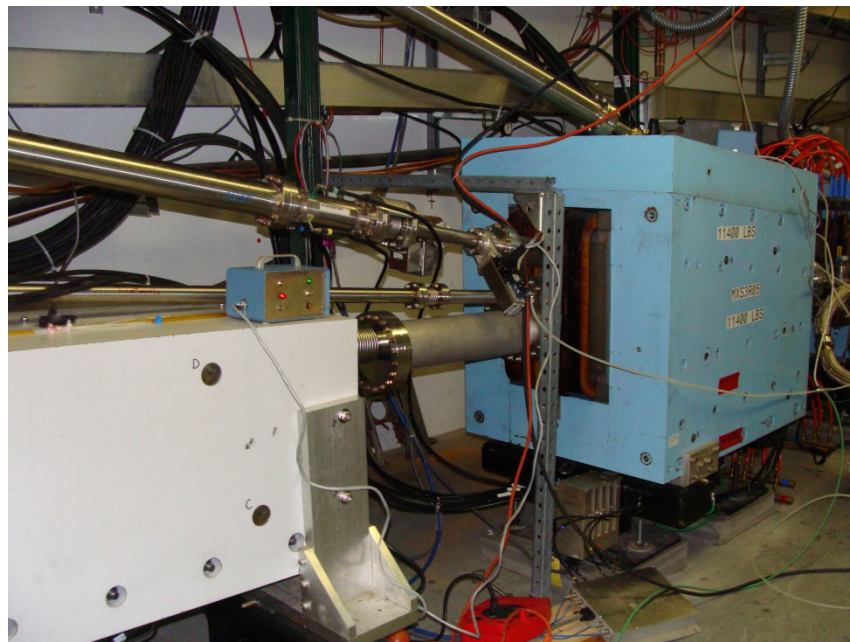


CEBAF upgradeの作業の様子



マージャー部



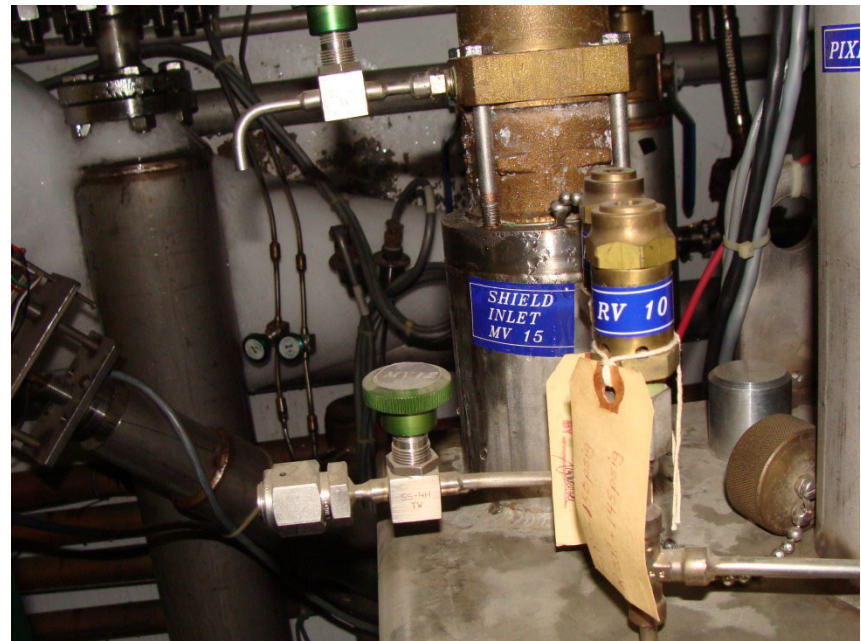
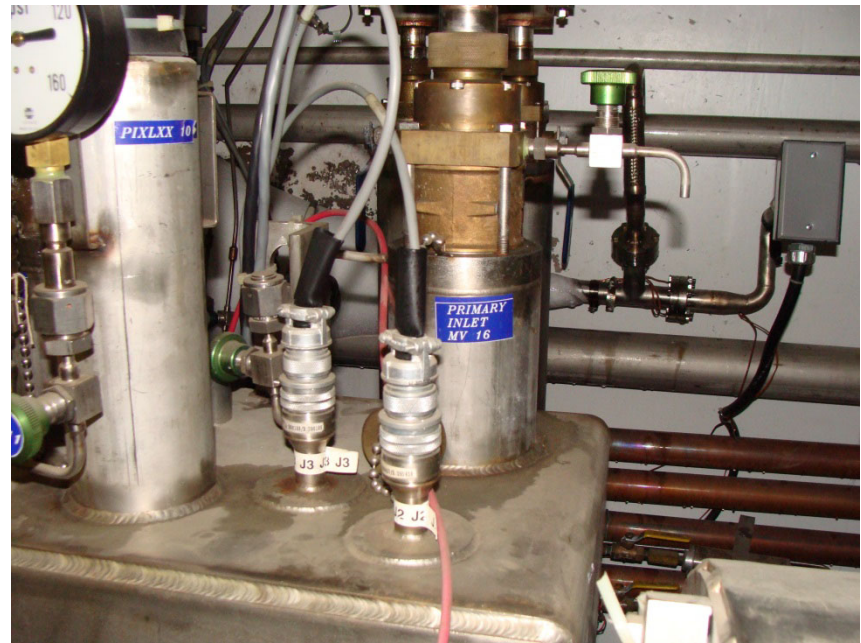


超伝導空洞入口のビームライン



NEG & 差動排気

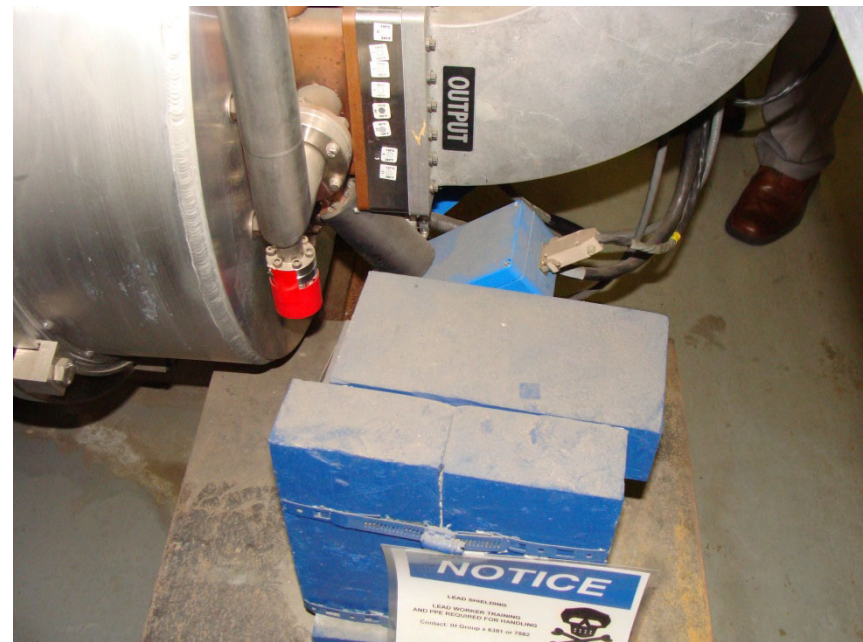
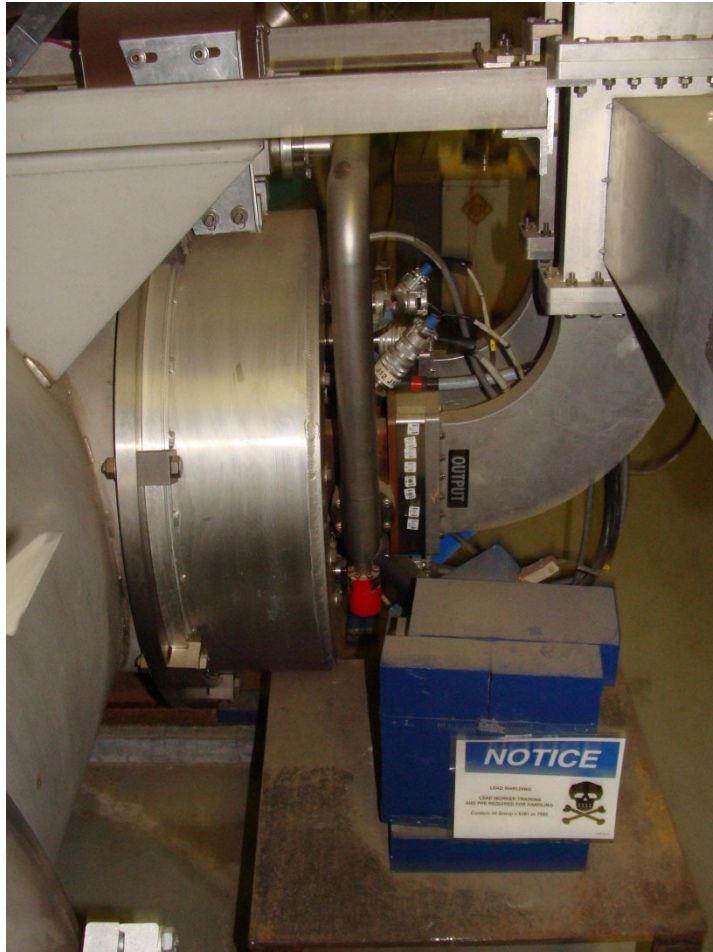
Cold box



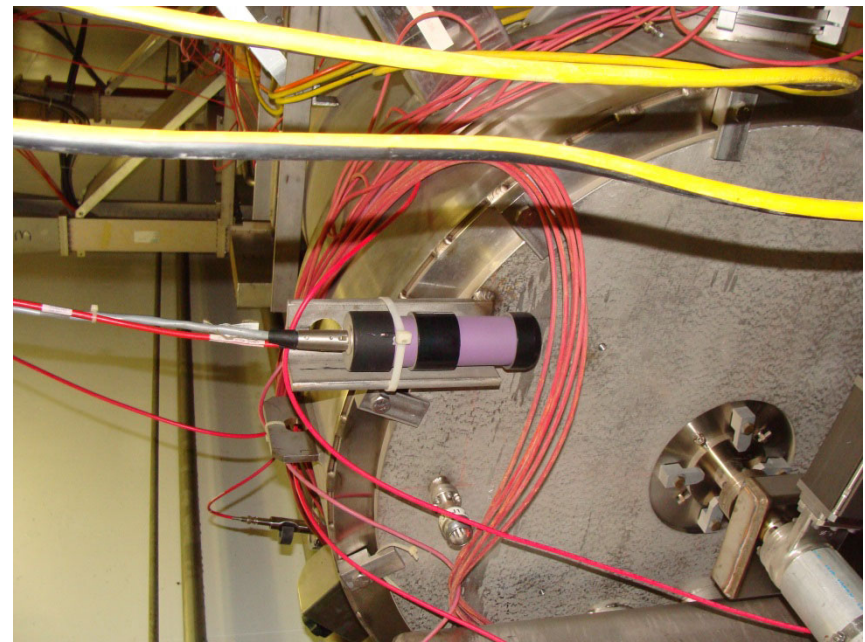
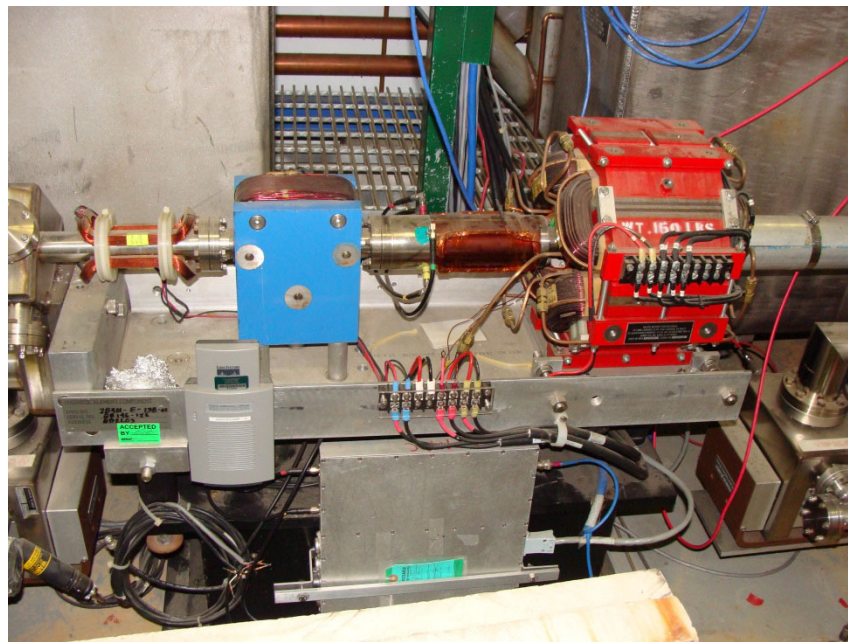
He リターン配管



アーケセンサー



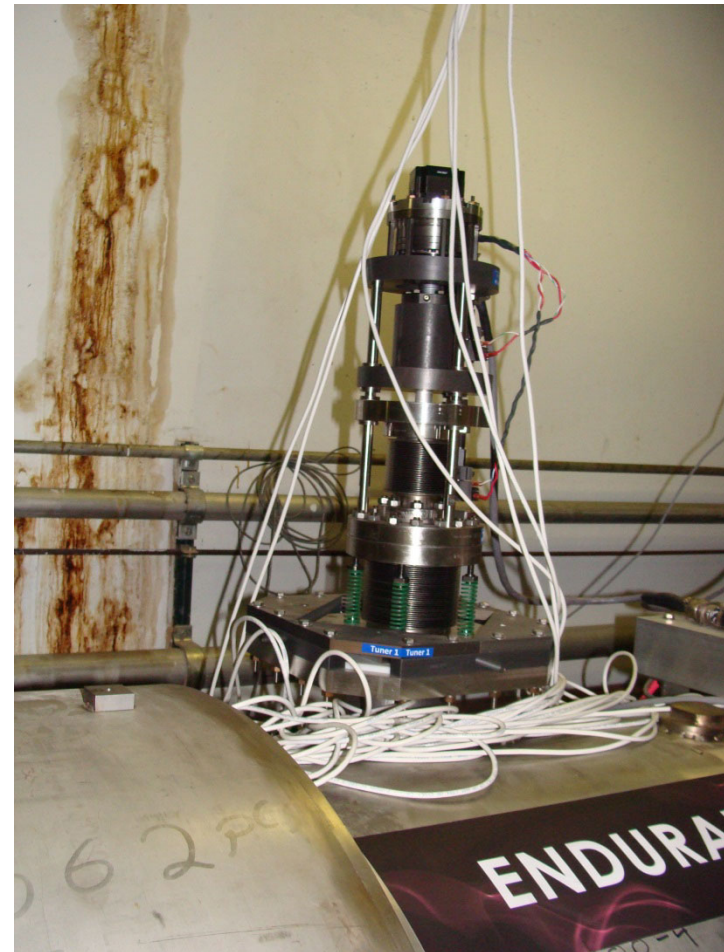
モジュール間のビームライン & ロスモニター

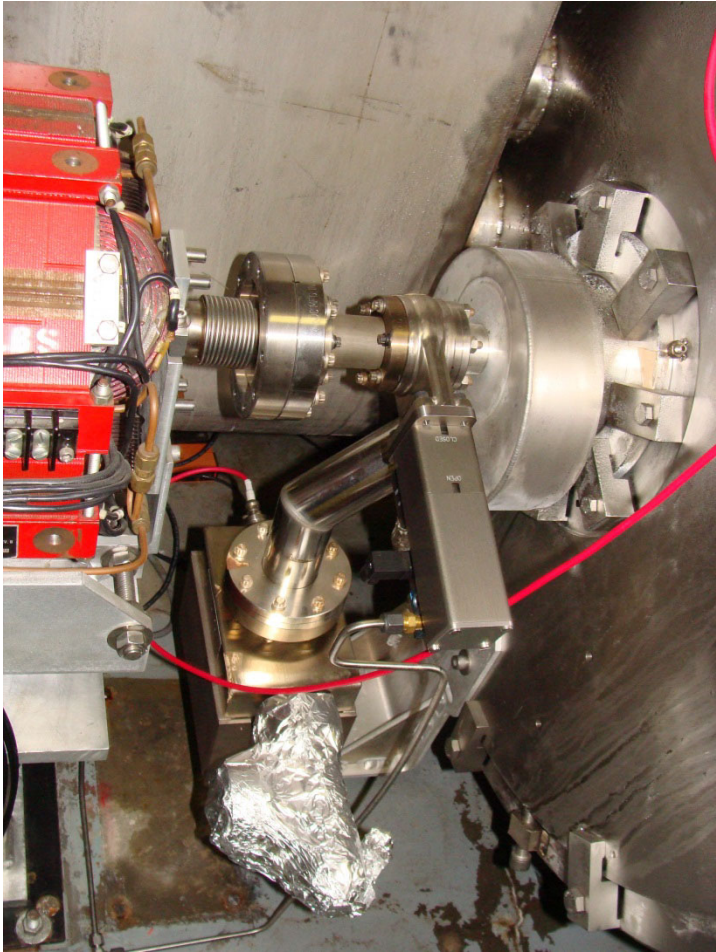


ベースプレート

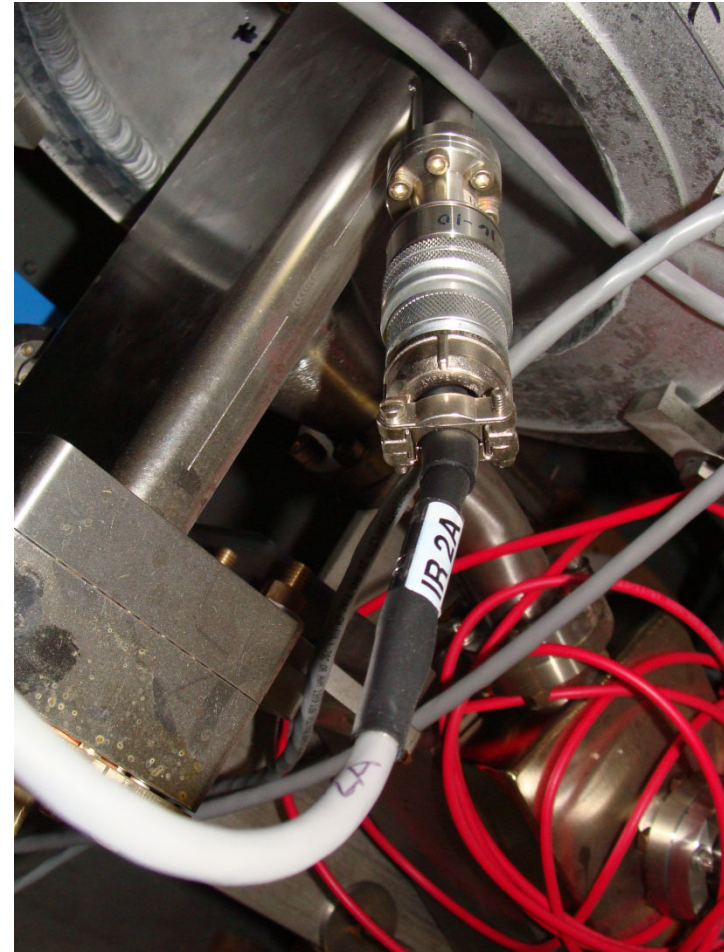
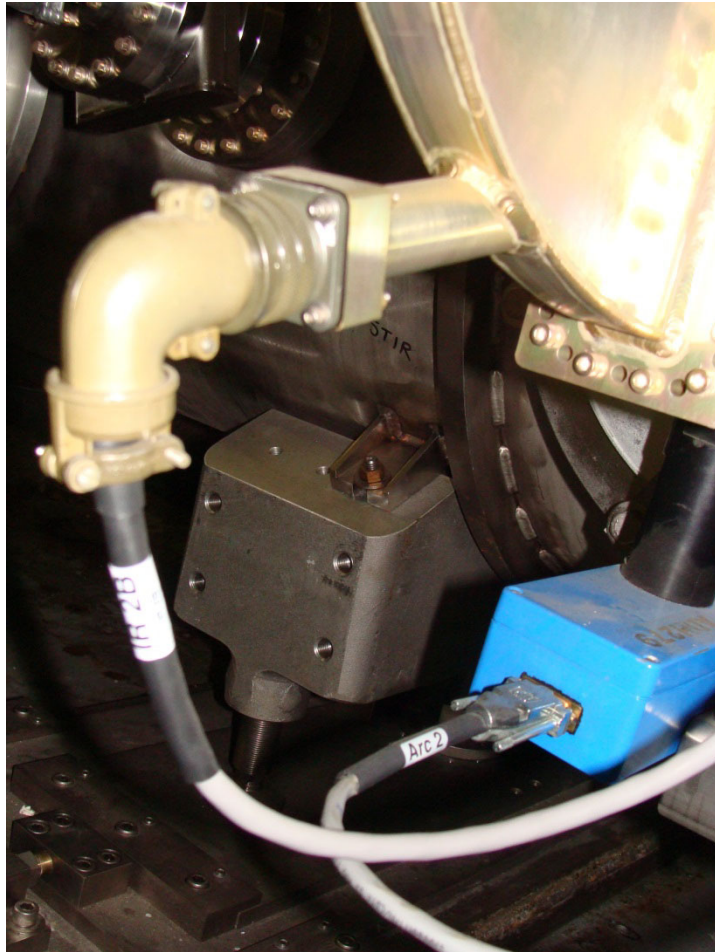


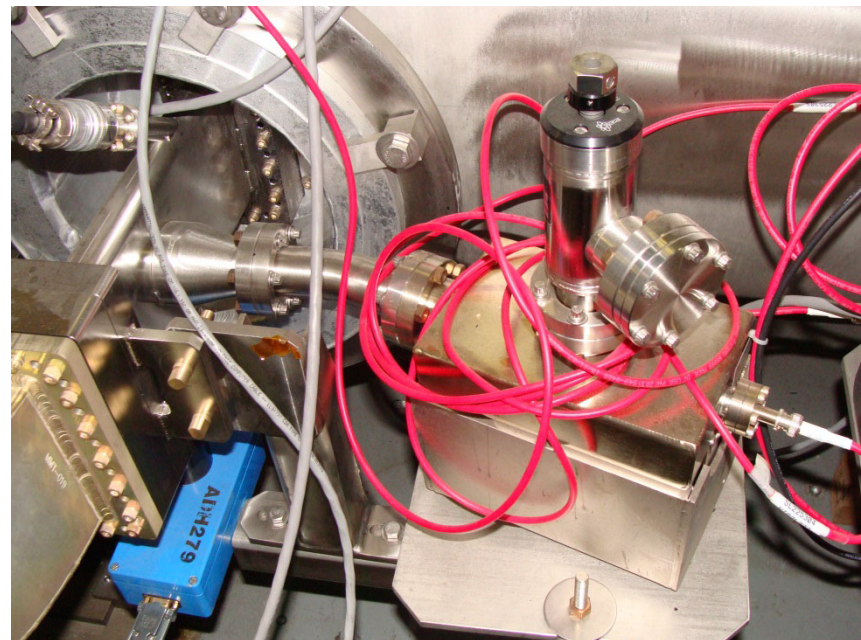
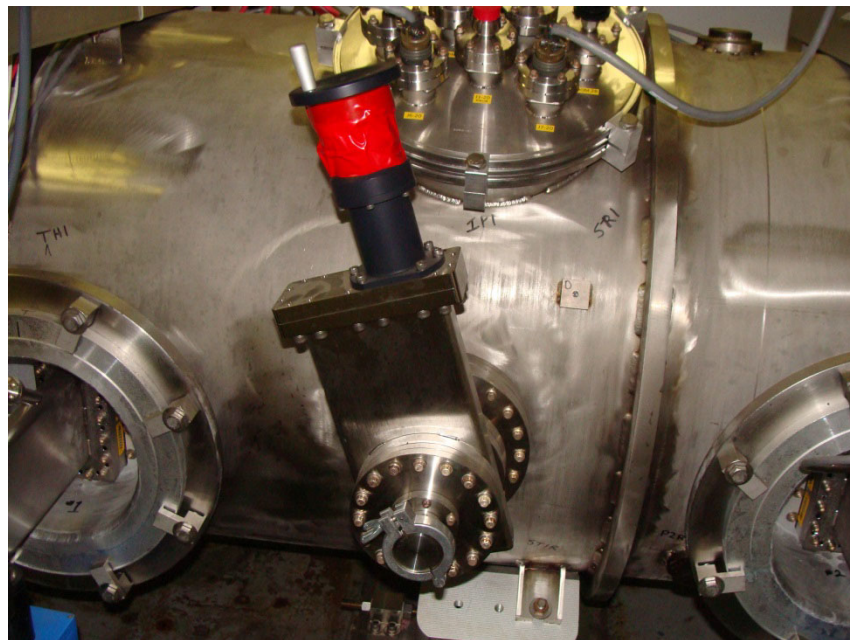
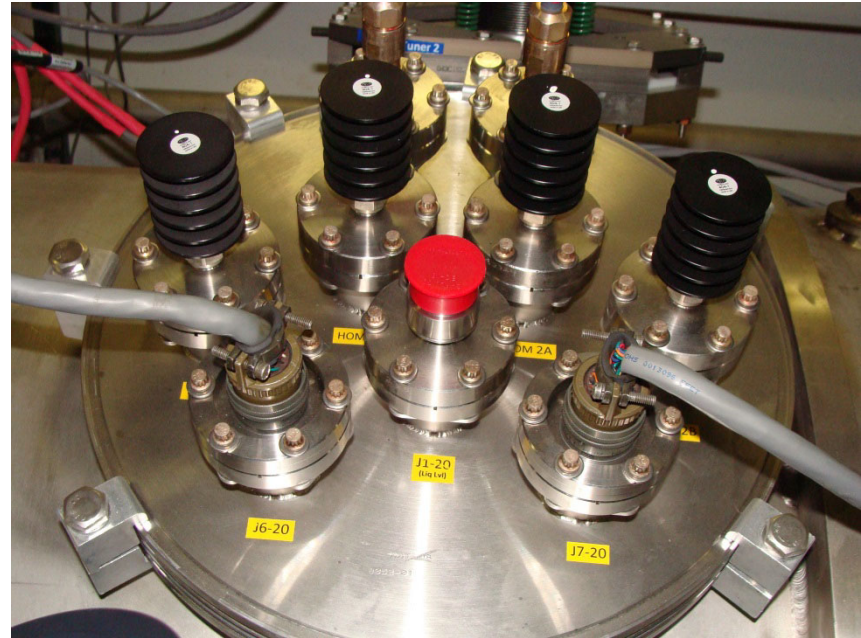
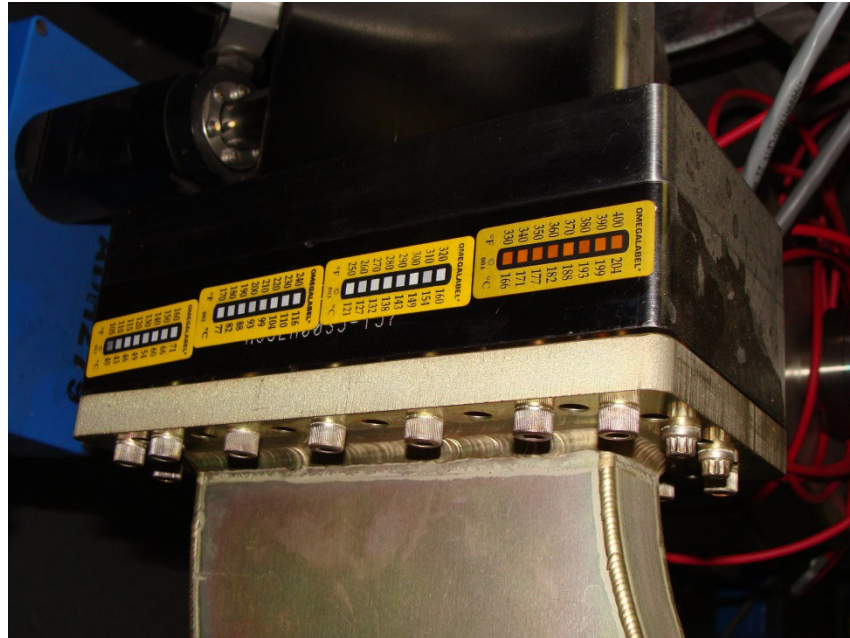
CEBAF C100 cryomodule



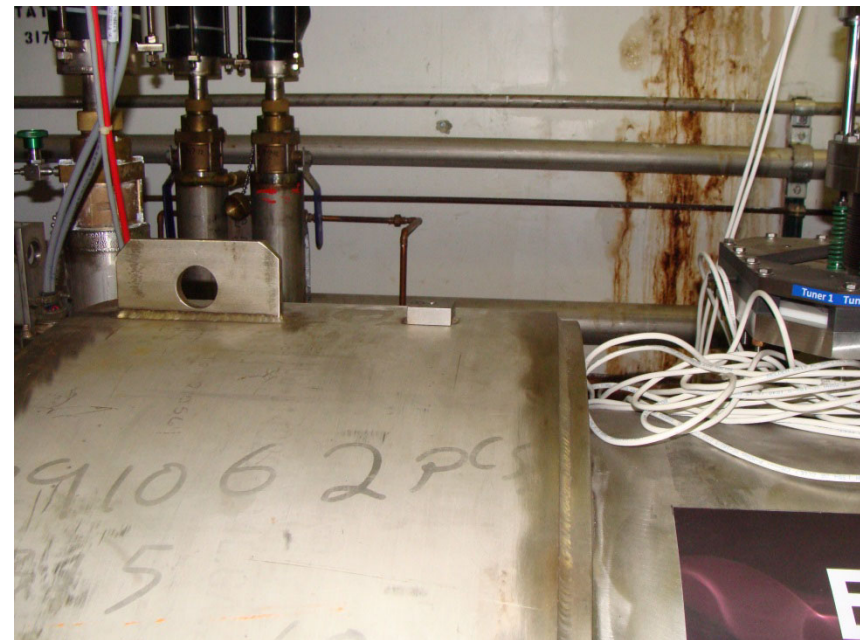
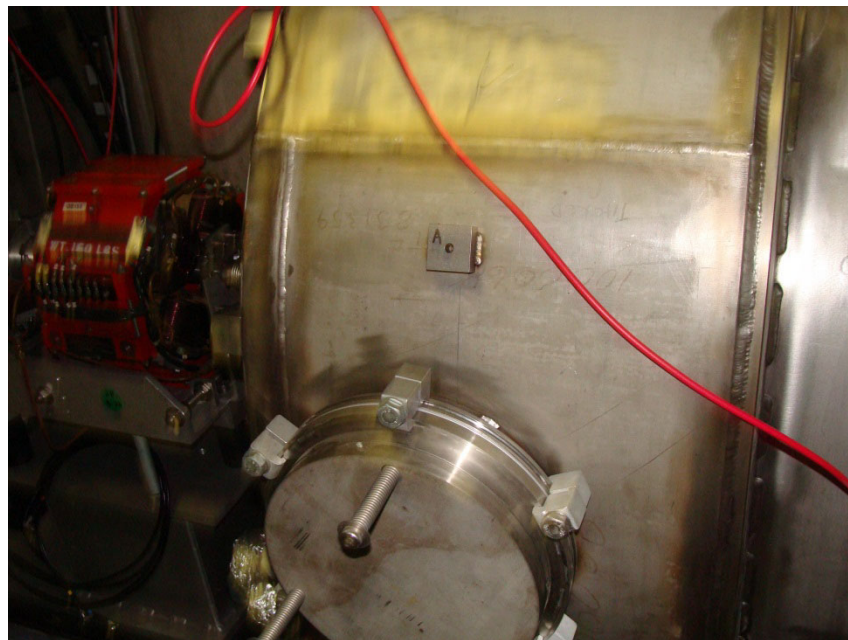
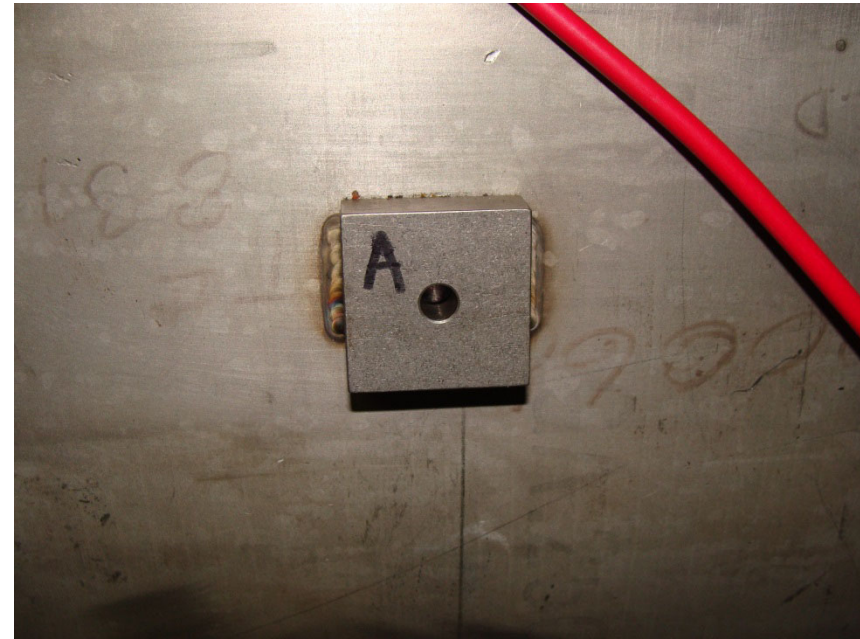


アークセンサー & IRセンサー





Alignment target



③Jlabでのmeeting内容

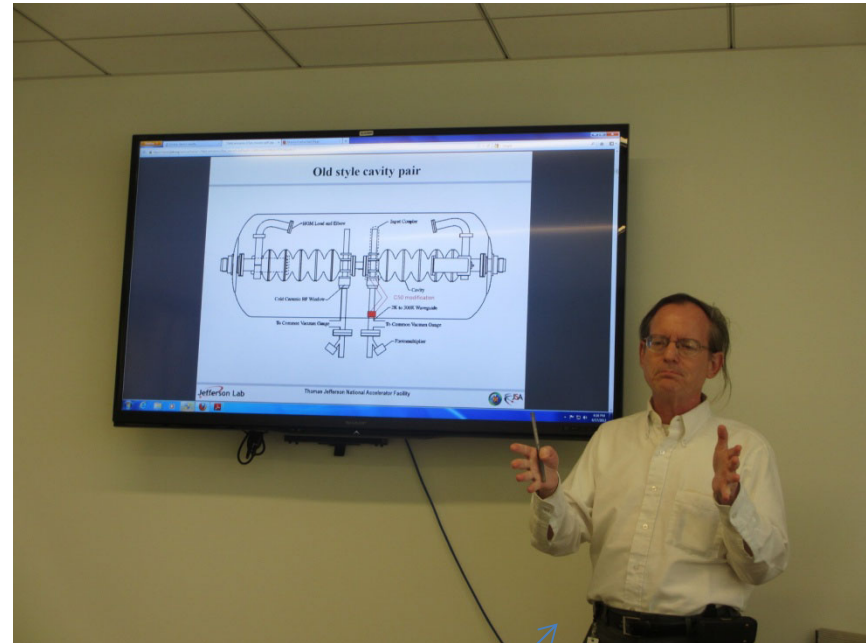
- **June 17, 2013**
- 8:30 AM SSC Registration
- 9:00 - 9:15 AM TL2245 Meet and greet Rongli Geng
- 9:15 - 9:30 AM TL2233 Meet and greet Bob Rimmer
- 9:30 - 11:00 AM Tour SRF facility Tony Reilly, Rongli Geng
- 11:00 AM – noon TL2245 Discussion
JLab: Rongli Geng, KEK: Hiroshi Sakai, Kensei Umemori
-
- Noon – 1:30 PM Lunch with Andrew Hutton at Quark Café
-
- 1:30 – 4:00 PM TED2504 **Discussion on field emission detection and mapping**
JLab: Rongli Geng, Yongming Li, Ari Palczewski, KEK: Hiroshi Sakai, Kensei Umemori
-
- **June 18, 2013**
- 9:30 -10:30 AM Tour CEBAF linac and C100 cryomodule Steve Suhring, Rongli Geng
- 11:00 – noon TED2504 **Discussion on cavity string assembly**
JLab: Rongli Geng, Tony Reilly, Kurt Macha, KEK: Hiroshi Sakai, Kensei Umemori
-
- Noon – 1:30 PM Lunch with Joe Preble (TBC) at Quark Café
-
- 1:30 – 4:00 PM TED2504 **Discussion on cryomodule testing and operation**
JLab: Rongli Geng, Mike Drury, Jay Benesch, KEK: Hiroshi Sakai, Kensei Umemori
-
- 4:00 – 4:30 PM TL2233 Close-out Bob Rimmer
- 4:30 PM Adjourn

Jlabでも問題になっているfield emissionを如何に抑えるかを集中的に議論。特に17年間CEBAFを運転してきた時のoperationの統計などについての貴重なデータを見せて頂いて議論ができた。CEBAFに関係した多数の方々に議論に加わって頂いた。感謝。

Meeting写真



縦測定とmappingについて(Yongming Li,
MappingについてはKEKの方が詳細なXray mappingを
もっており、field emission searchでは一日の長あり。



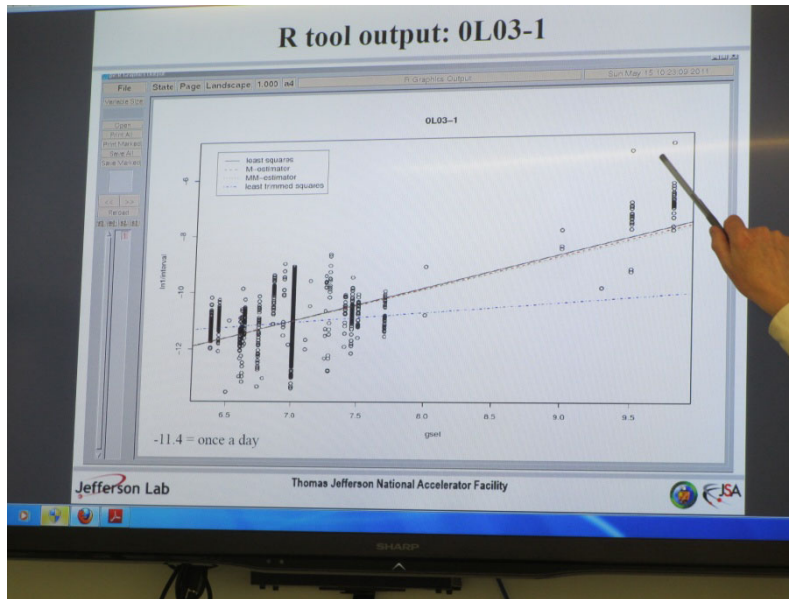
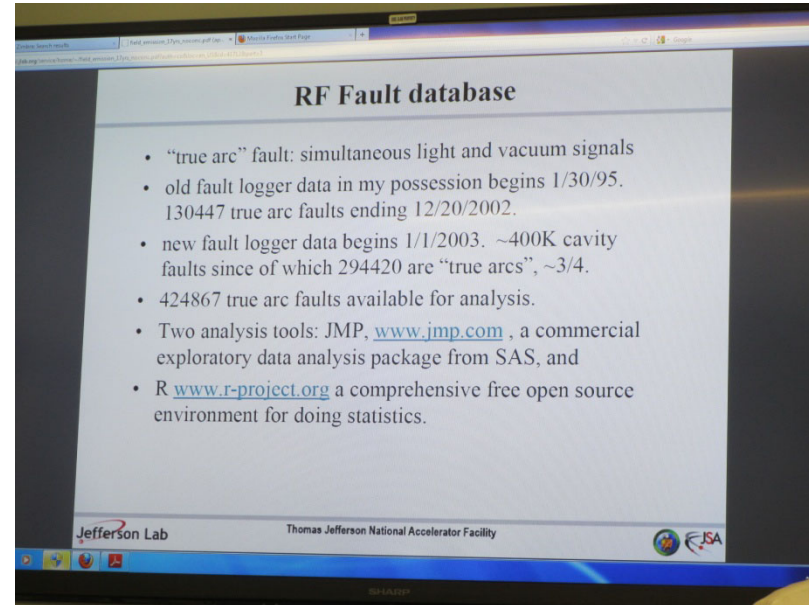
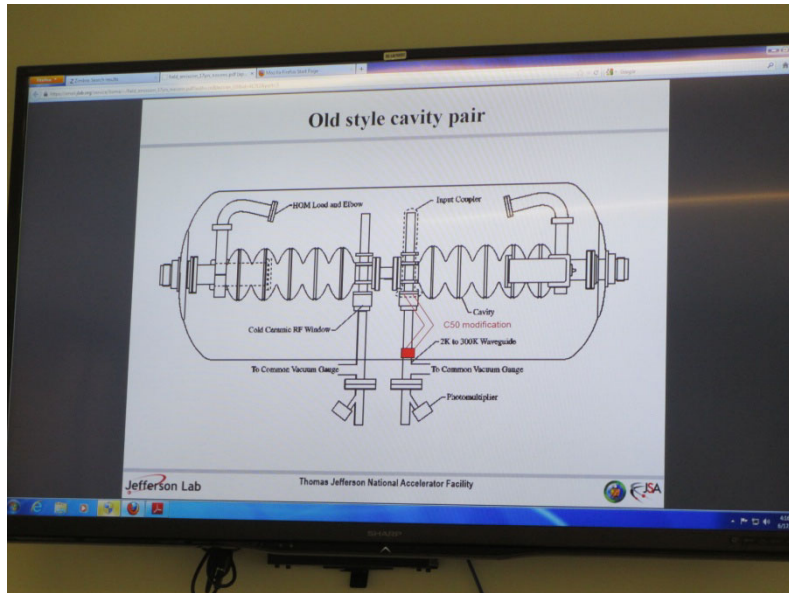
A Plague of field emission (Jay Benesch)
CEBAFの17.3 yearsの運転中のfield emissionのデー
タをまとめたもの。非常に貴重なデータ。(後述)



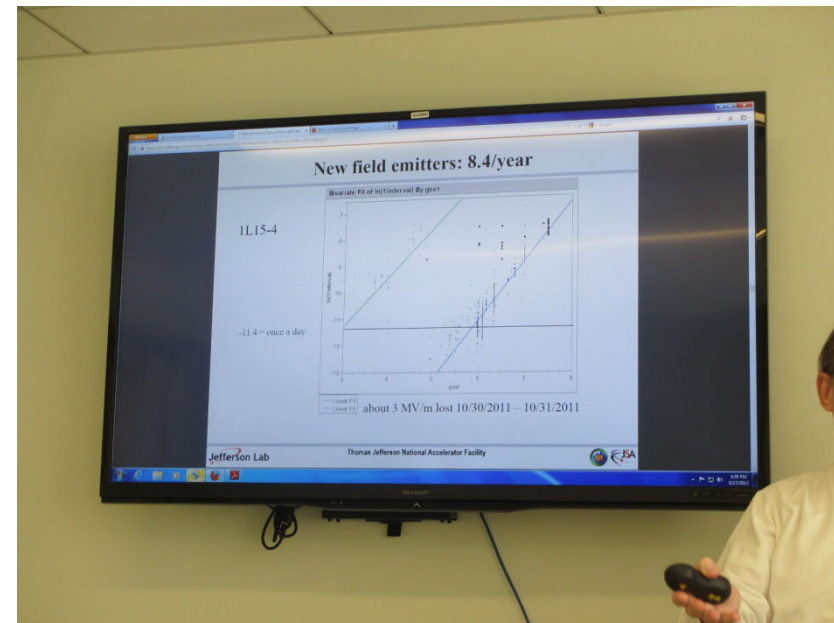
He processing (Mike Drury,)
運転中でのfield emissionのrecoveryのためにHe
processingを行った。その方法などを議論。(後述)

あと、モジュール組込時のstring assemblyの方法につい
ては実際組立を行ったTony Reilly, Kurt Macha氏とdisucussion
を行った。KEKとは少し方式は違っていた。

CEBAF運転中のfield emission(について(Jay Benesch)



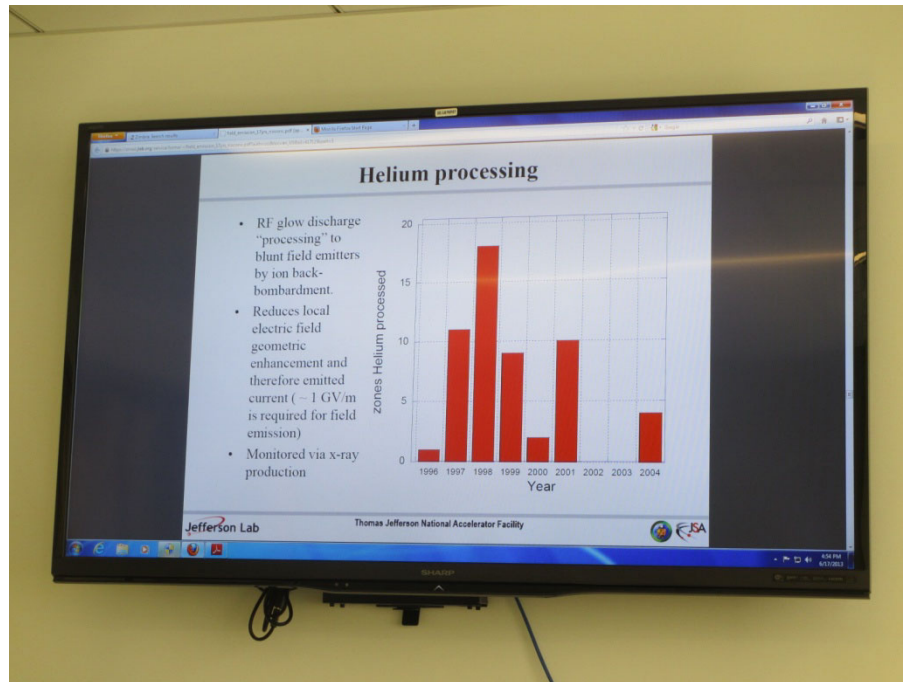
Operation中のfaultのintervalの時間と加速勾配についてplotしたもの。相関あり。



New emitterができるintervalの時間が短くなる様子が測定されている。

He processing

年に1-2%でgradientが減っていくため、各モジュール毎でHeを空洞内に入れてRFを投入し、processを行う。一応、悪い空洞に対してはある程度効果的にfieldの上昇が見込めるようである。



2013年9月からCEBAF upgrade moduleにてHe processを再度行う予定らしい。ビーム運転は2013年11月から。

C100-4 helium processing May 2012 (M. Drury)

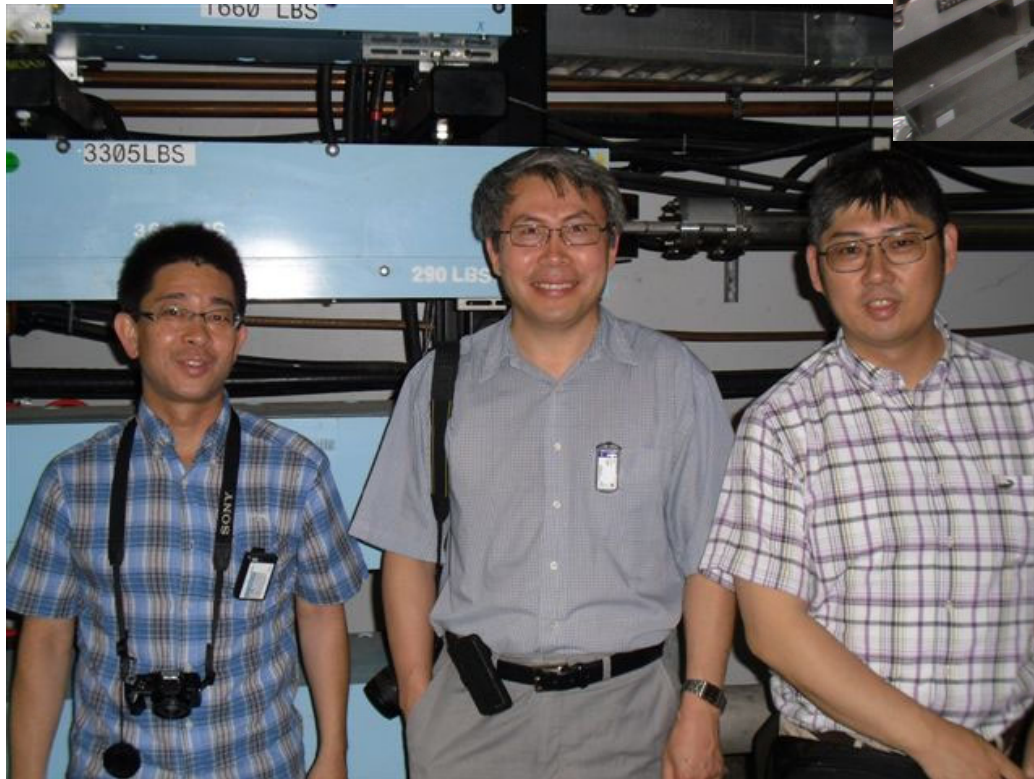
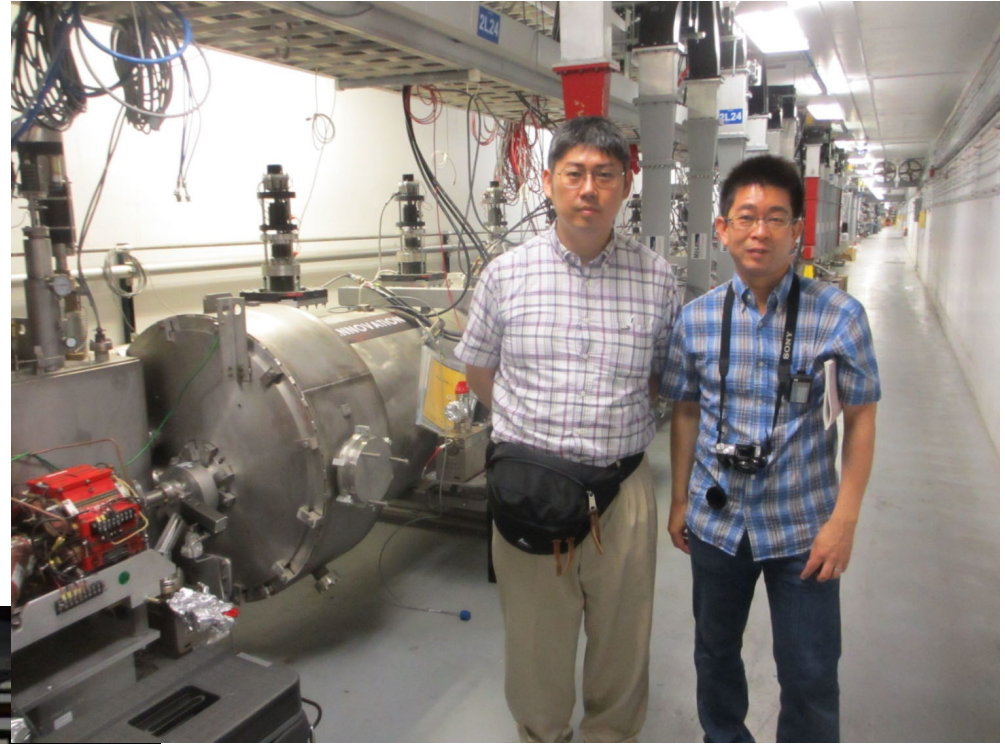
Cavity	FE onset before	FE onset after	Difference
1	7.3 MV/m	9.4 MV/m	2.1 MV/m
2	5.8	13.0	7.2
3	10.6	12.2	1.6
4	11.1	12.0	0.9
5	6.6	12.8	6.2
6	10.8	14.6	3.8
7	11.1	15.8	4.7
8	10.7	14.8	4.1
MeV w/o FE	51.8 MeV	73.2 MeV	21.4 MeV delta

41% improvement consistent with previous slide

Jefferson Lab Thomas Jefferson National Accelerator Facility

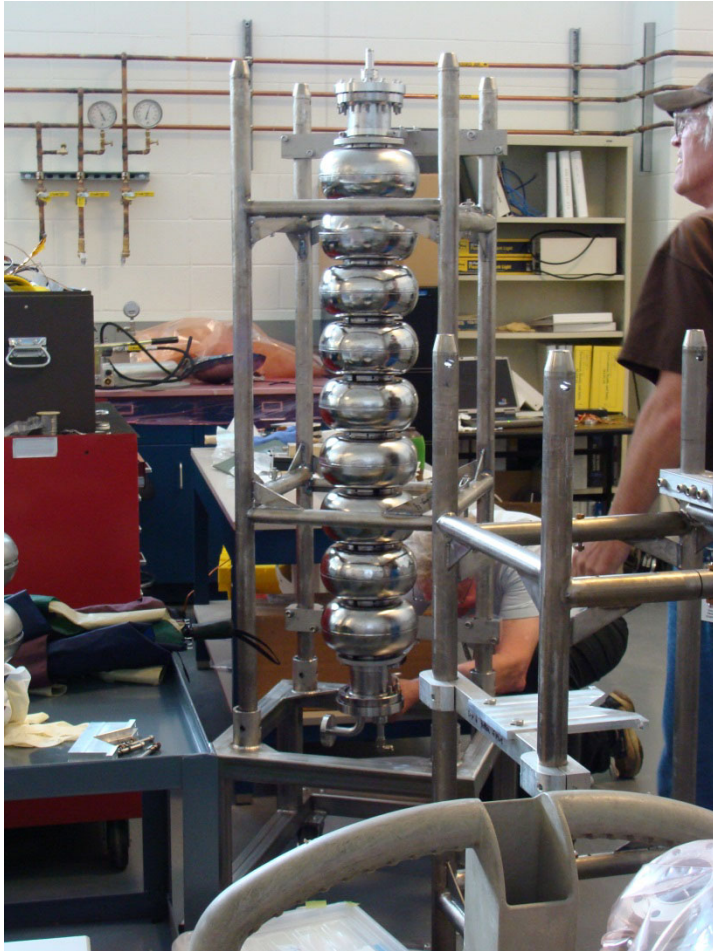
Thank you

滞在中hostしていただいたGeng Rongli氏

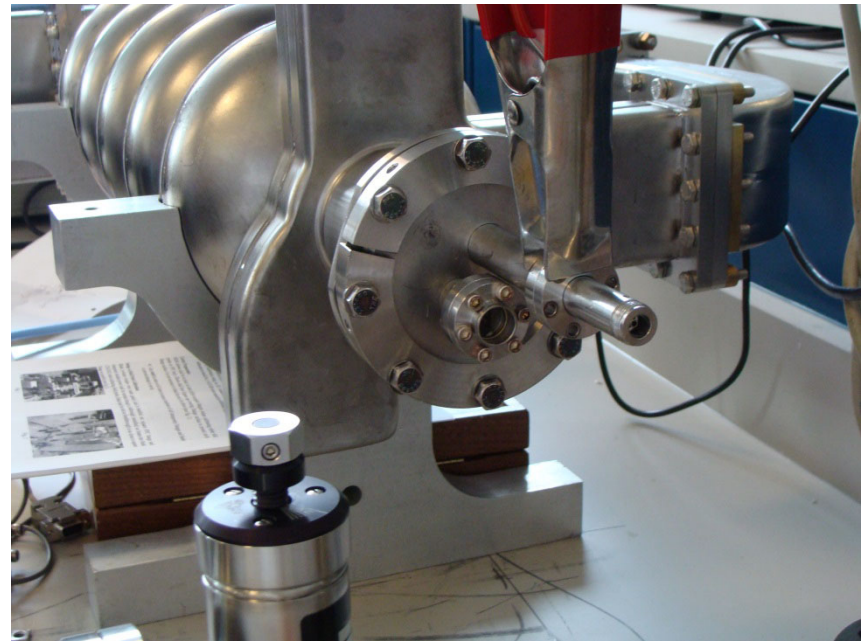
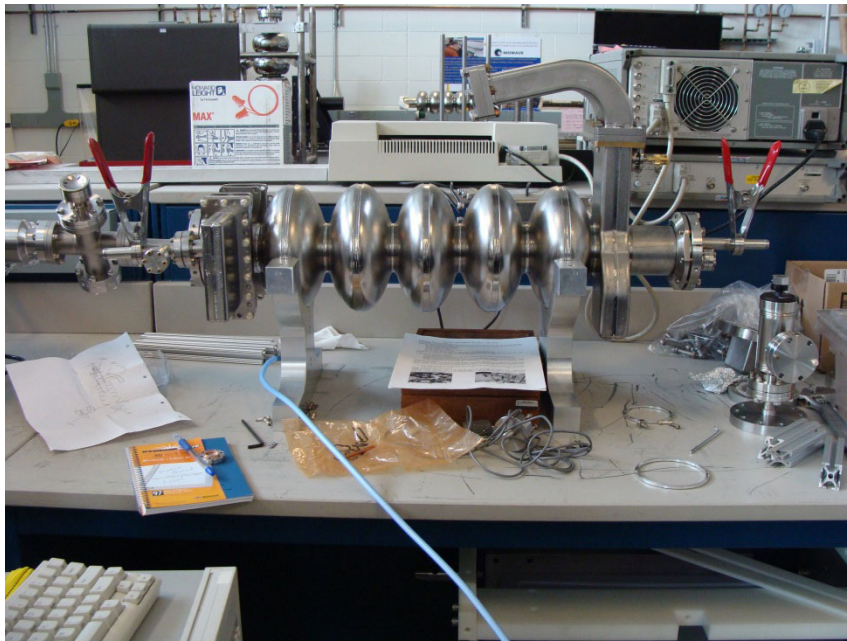


backup

Large grain Ichiro空洞



プラズマプロセスの準備中



Cold box (分解)

