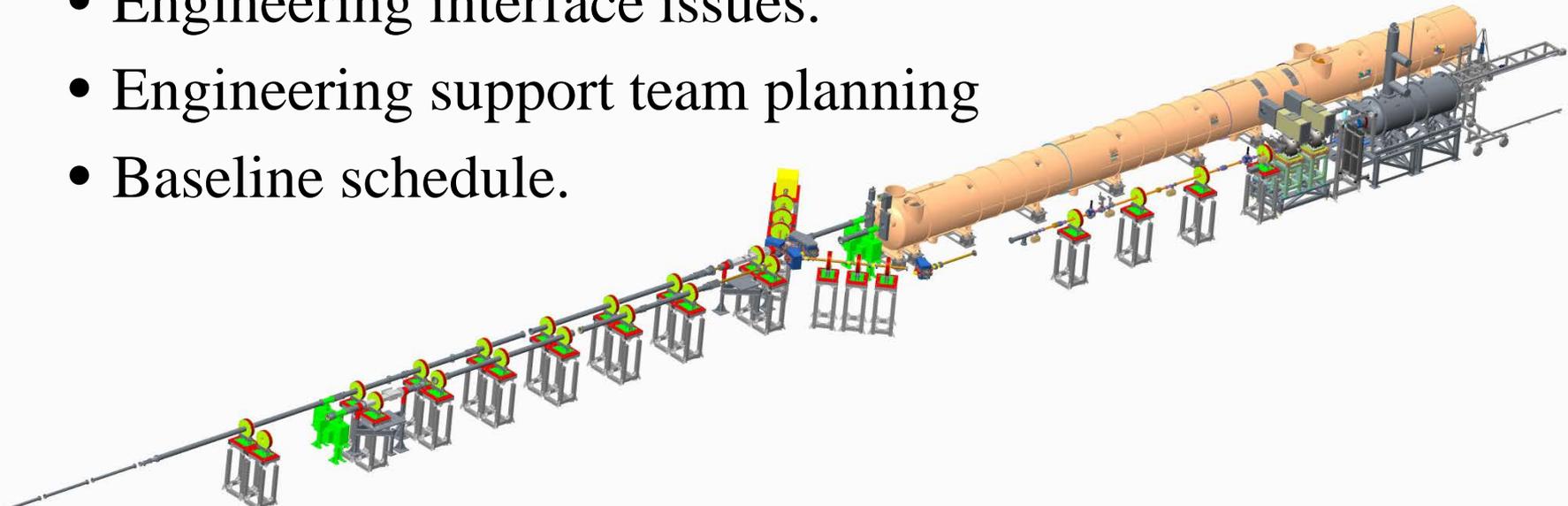


LEReC Engineering

J. Tuozzolo, C-AD Chief Mechanical Engineer
(LEReC Project Engineer)

Layout, Infrastructure, and Engineering

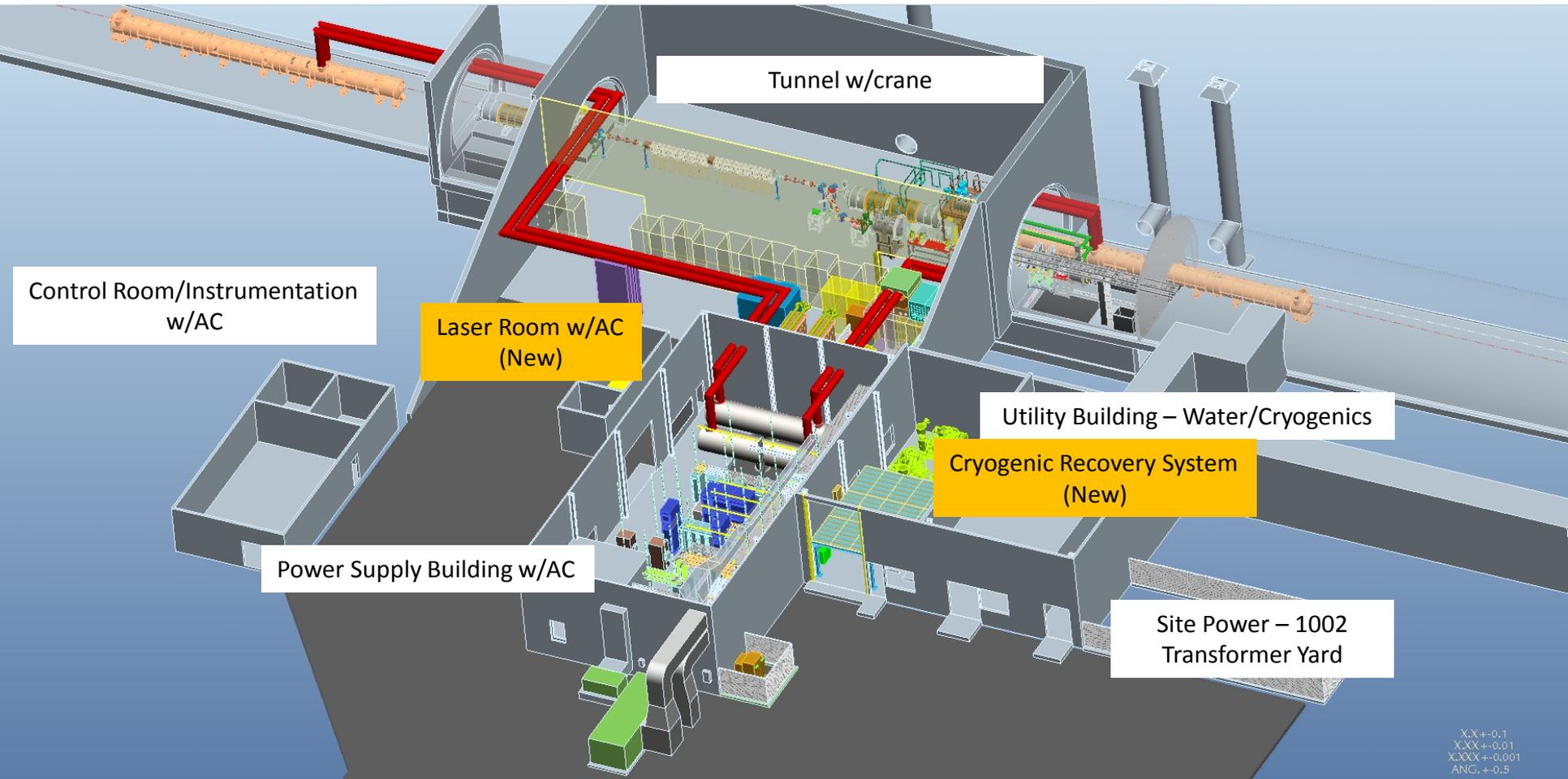
- IP 2:00 location - available.
- Engineering interface issues.
- Engineering support team planning
- Baseline schedule.



Low Energy RHIC electron *Cooling*

Location, Location, Location

RHIC 2:00 IP, BRAHMS and AnDY out, CeC in (shared?).



XX+0.1
XXX+0.01
X.XXX+0.001
ANG. +0.5

Low Energy RHIC electron *Cooling*

Location, Location, Location

RHIC 2:00 IP

- Large open experimental area with crane
- Good access removable shield door.
- Available space in both ring support buildings.
- Existing utilities, communication, and cable trays.
- Fire protection systems installed.
- Cryogenic tap installed.



Site Power – 1002 transformer yard



Utility Building – Water/Cryogenics



Power Supply Building w/AC



Water Systems

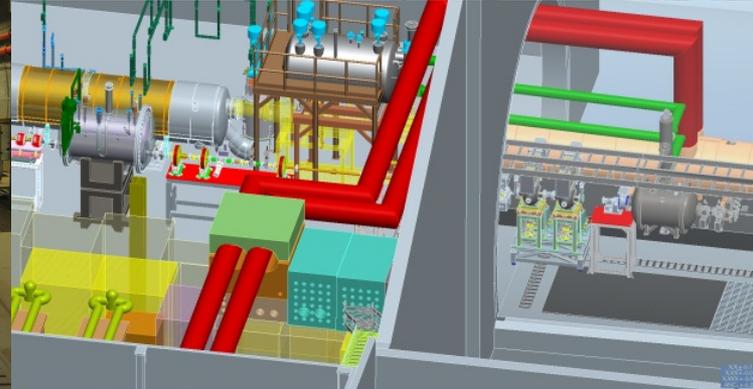
Low Energy RHIC electron *Cooling*

cooling

CeC PoP 2013

Building preparation completed for CeC:

- Brahms shielding removed
- Installed cooling water tower/water pumps (Scaduto)
- Shielding penetrations enlarged (Folz)
- 1002B RF Coax run installed (Folz, Randazzo)
- Laser building ordered (Folz, Sheehy)
- RF Power supply installed (Folz, Zaltsman)



Low Energy RHIC electron *Cooling*

CeC PoP 2013

Building preparation for CeC in progress 2013:

- Laser building installation (Folz, Sheehy)
- Quiet helium source for SCRF (Orfin, Soria)
- Cryogenic return compressor (Than, Soria, Folz)
- 1002A ODH system installation
- Move AnDY equipment from 1002D (Folz)
- Cable tray design/installation



Low Energy RHIC electron *Cooling*

Design Issues

CeC PoP test schedule/equipment available/interchangeable.

SCRf gun and cavity performance/RF system (Sergey's talk).

QHS performance – distance to gun/solenoid/accelerator cavity

2:00 or 1:00. Cryogenic design margin.

Beam dump design – 250kW

Beam line elements

bending magnets

eFocusing solenoid magnet

eBPM's

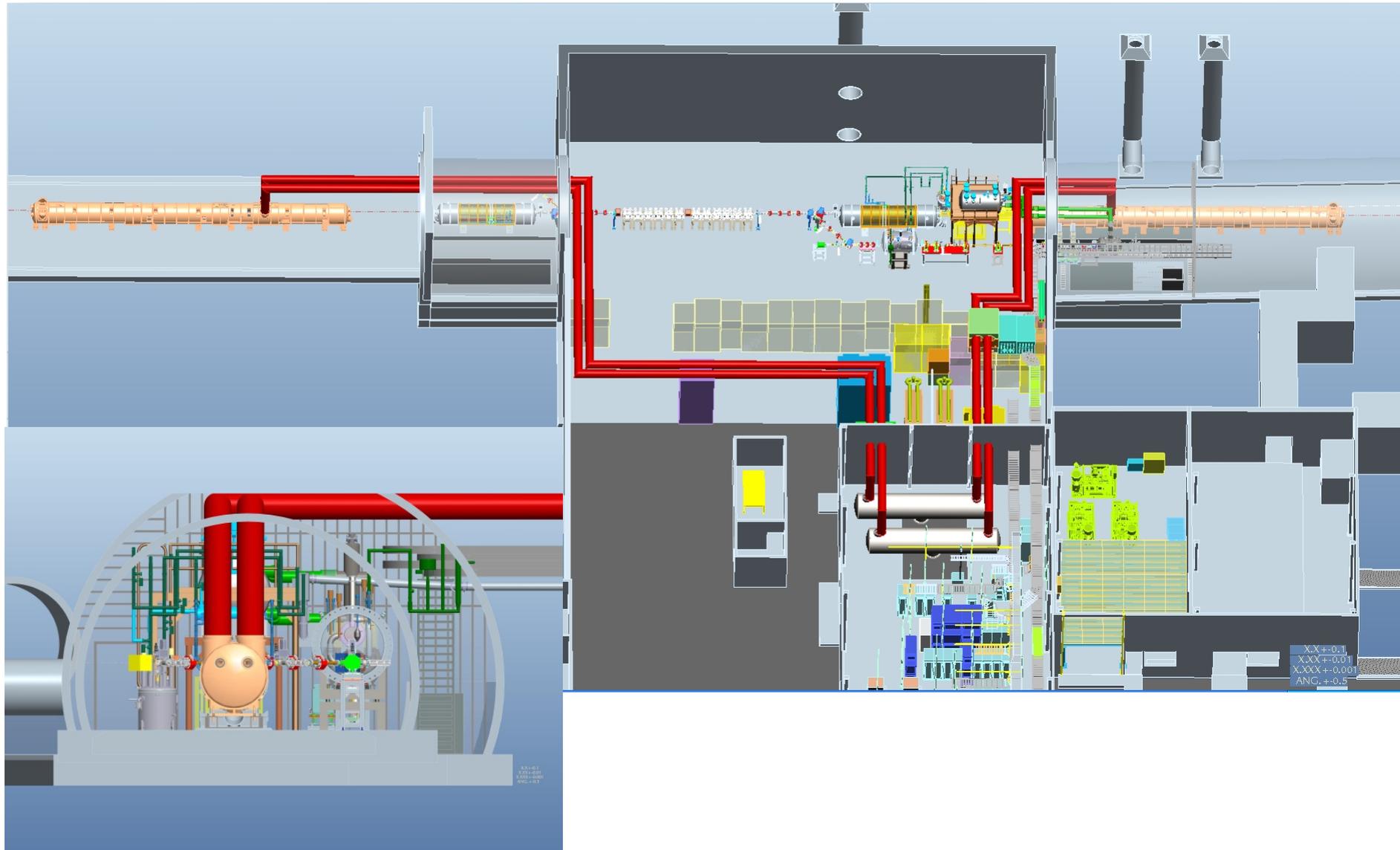
eCorrector magnets

180° turn configuration

Magnet Power Supplies: solenoids, bends, and 180 return in series
+ individual corrector power supplies (CeC PoP).



2:00 IP Left or Right

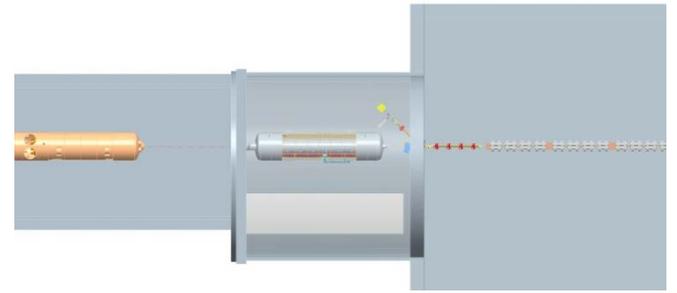


Low Energy RHIC electron *Cooling*

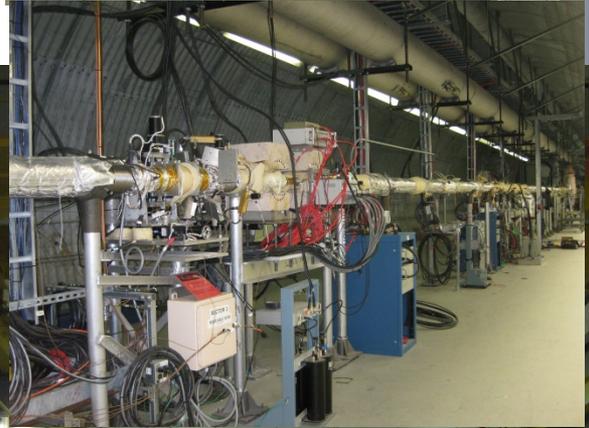
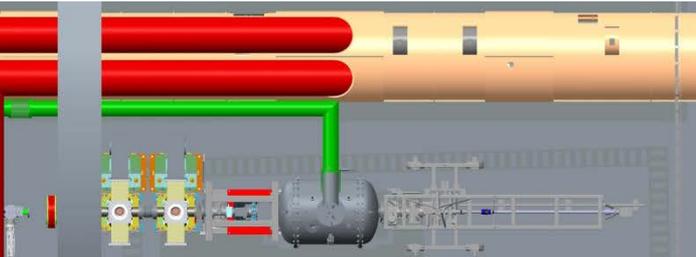
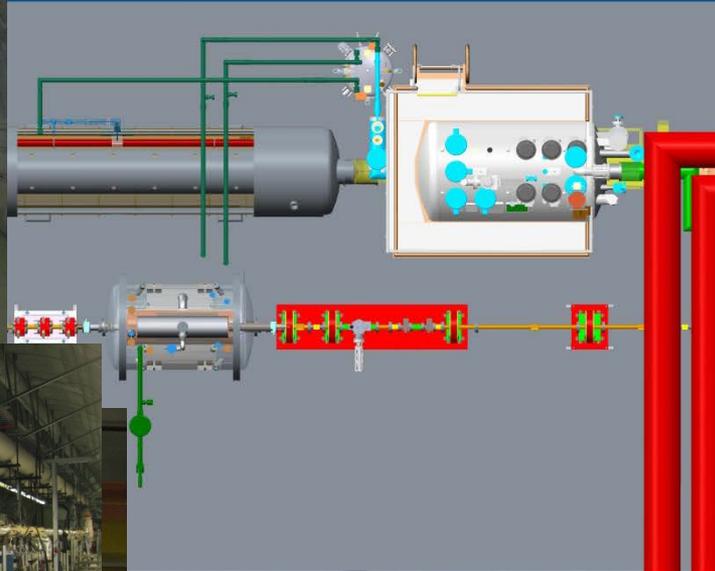
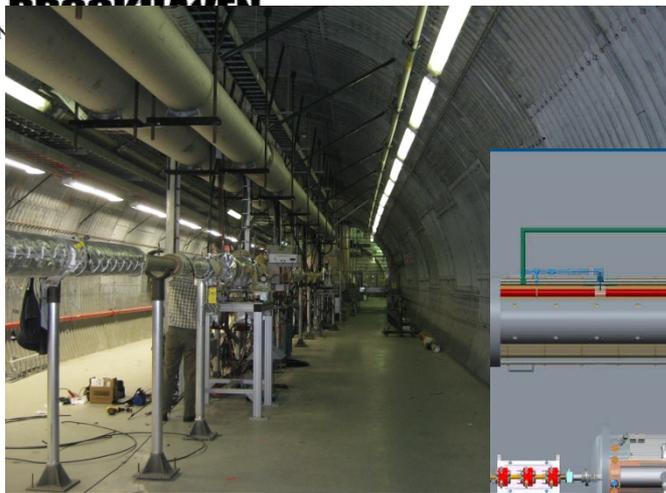
cooling

1:00 Tunnel

24m to larger tunnel
+ 32m to QHS



2:00 Tunnel



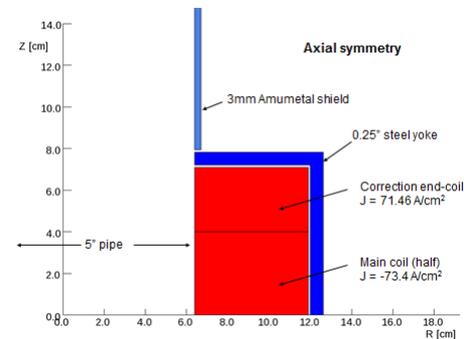
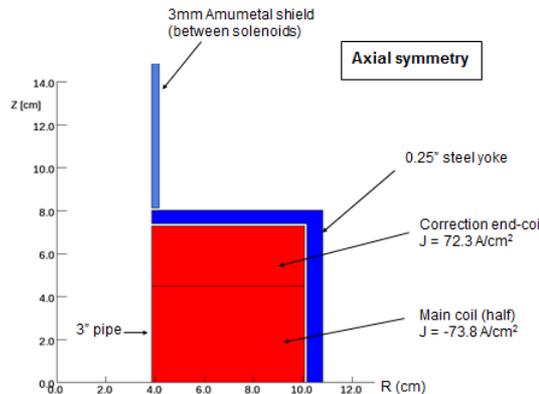
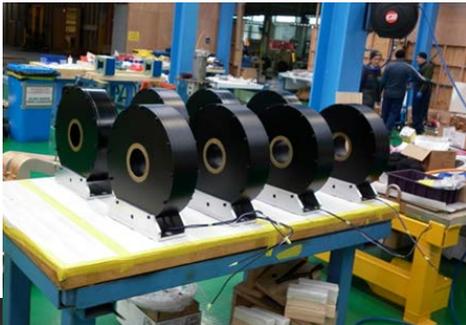
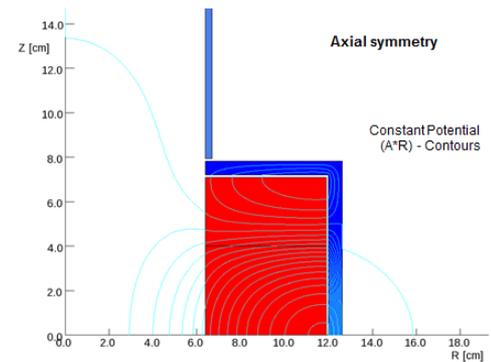
Low Energy RHIC electron *Cooling*

COOLING

Design Issues

Beam line elements - eFocusing solenoid magnet
Magnet specifications: strength, length, aperture

- 5" beam tube (standard RHIC size, better conductance – same ion pumps, available w/NEG coating).
- 3" beam tube – better solenoid field?
- Solenoid – wind on tube, clamp over steel shell
Both modeled – little difference.



Low Energy RHIC electron *Cooling*

Design Issues

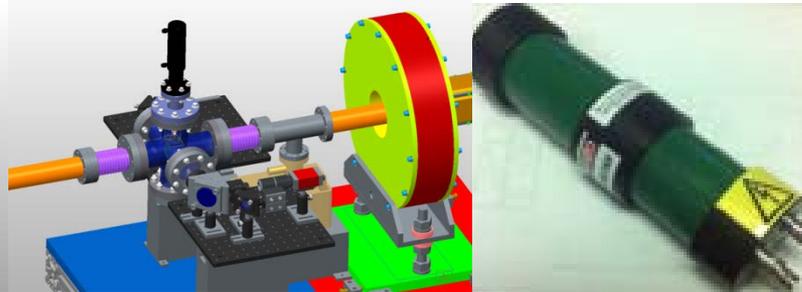
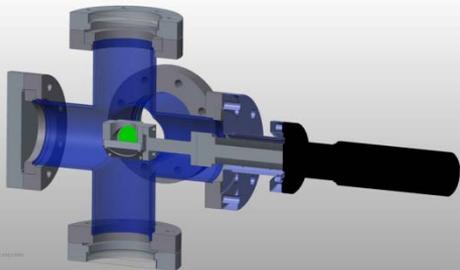
Beam line elements - solenoid magnet every 2M

Corrector magnet: spacing, strength, length, aperture.

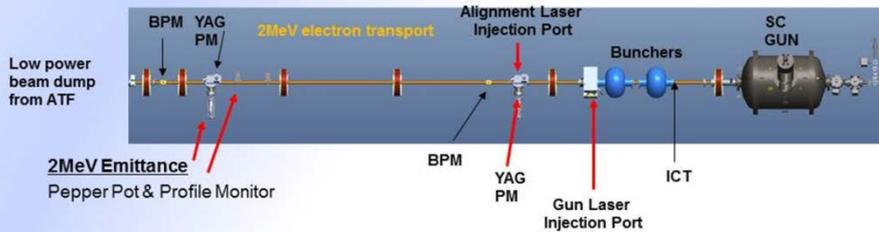
Bending/Alignment magnets TB Designed (5 inch aperture).

180° bend magnets TB D

180° bend instrumentation TB D (CeC PoP)



2MeV Transport Overview and Diagnostics



Low Energy RHIC electron *Cooling*

Design Issues

Cryogenic performance - Quiet Helium Source (QHS): 200 W.

Gravity fed helium supply and return.

Large cryostat for LEReC then for CeC PoP.

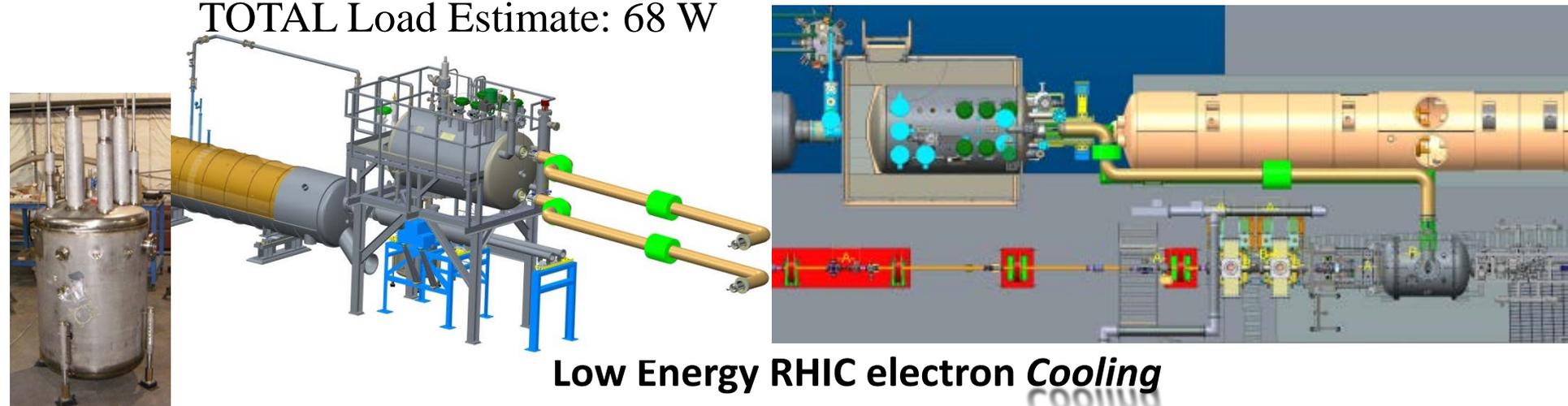
Fixed heat exchanger design – 100% design margin for CeC PoP.

Can shorten transfer lines if needed.

112 Mhz Cavity RF Load Estimate: Dynamic = 50W, Static = 8 W, FPC = 2 W

Cryogenic transfer VJP: liquid supply = 2W, vapor return: 6W (8 meters \rightarrow 1 W/m)

TOTAL Load Estimate: 68 W

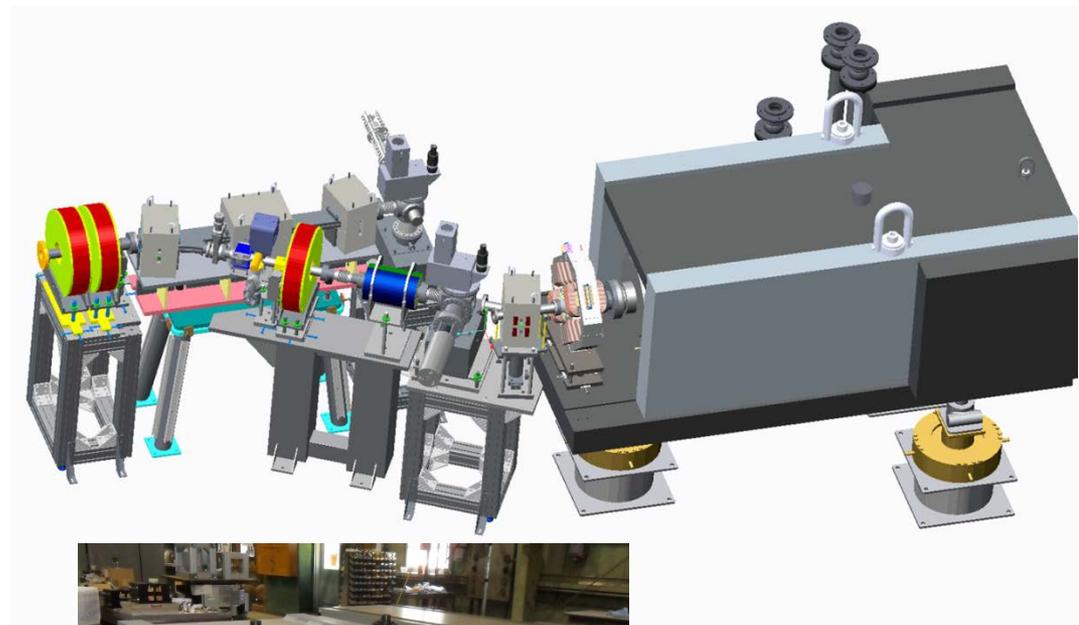
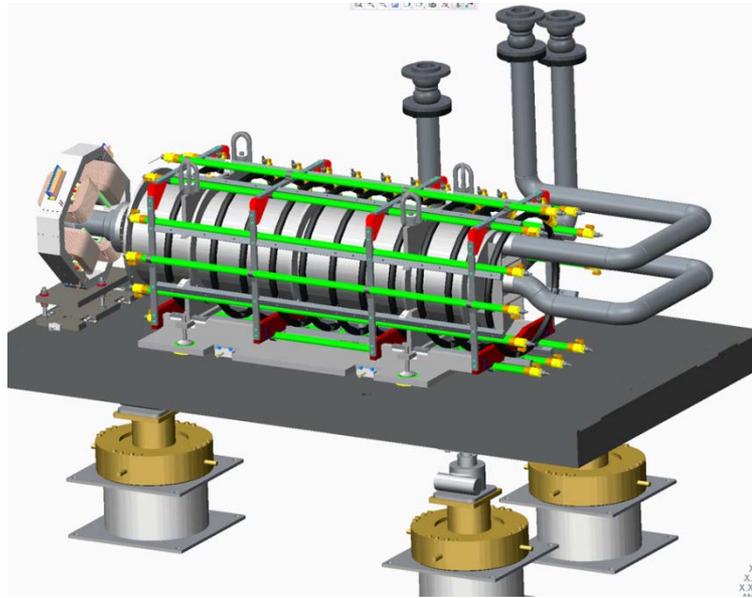


Low Energy RHIC electron *Cooling*

Design Issues

Beam Dump: 5.0 MeV electrons/0.25 MW power

Copy ERL Beam Dump: 2.5 MeV electrons/1.0 MW power

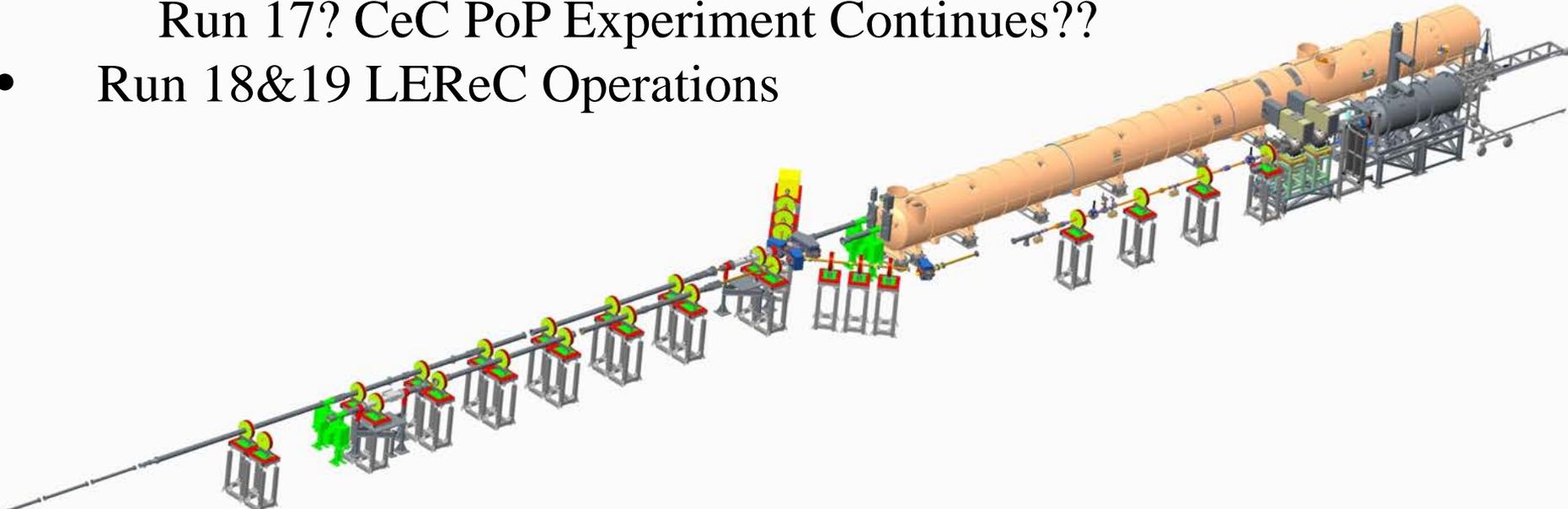


Low Energy RHIC electron *Cooling*

cooling

RHIC Program Timeline

- Run 14 CeC PoP Gun (and cryogenic system) Commissioning.
- Run 15 CeC PoP Beamline commissioning.
Summer 2015 02:00 Q3/Q4 equipment move.
Building/tunnel infrastructure improvements.
- Run 16 CeC PoP Experiment
Summer 2016 Cavity and beamline installation.
- Run 17 LEReC Component Commissioning
Run 17? CeC PoP Experiment Continues??
- Run 18&19 LEReC Operations



Low Energy RHIC electron *Cooling*

Timeline

- FY2013 Physics approach/preliminary design approved.
- FY2013 Design Safety Review Questionnaire completed.
- FY2013 Initial 2:00 Layout and LEReC Lattice.
- FY2013 SCRF Cavities physics design and performance specifications.
- FY2014 Engineering “kick-off” meeting/assignments/start bi-weekly engineering meetings
- FY2014 CeC gun cavity cryogenics commissioned, performance benchmark for quiet helium source.
- FY2014 LECeC Lattice “frozen”, energy, intensity, location, component specifications.
- FY2014 Engineering systems PDR, systems specifications, building requirements/system loads.
- FY2014 Order SCRF Cavities/cryostat, SC solenoid, RF amplifiers, buncher system.
- FY2014 Support building layout/equipment locations, cable tray, electrical service, AC & water loads.
- FY2015 Detailed cryogenic component design BNL PCSSR – long lead procurements.
- FY2015 Detailed beamline design, ASSRC/FDR – long lead component procurements.
- FY2015 Support building modification design/contracts (2015 shutdown modifications)
- FY2015 Move RHIC beamline components (2015 shutdown modifications)
- FY2016 Receive and test LEReC beamline and cryogenic components
- FY2016 2016 Shutdown installation LEReC beamline and cryogenic components
- FY2017 Engineering commissioning for LEReC beamline and cryogenic components
- FY2017 2017 Shutdown modifications/corrections to LEReC beamline and cryogenic components
- FY2018 Operations (Run 18)

Matrixed Support for the CeC PoP Project

A L D - S. Vigdor
D. Dowling (HR), NPP HRM

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N. Bower
C. Blacard
D. Carlson
J. Citra
M. Cross
B. Johnson
J. Kelly
M. Myers
D. Nicholson
N. Polyzou

18043
Yacuum Systems
(D. Wiles, Dep.)
(L. DiFilippo), Assistant
(A. Patwoy), Assistant
S. Nayak
A. Staegen
R. Todd
S. Gill, TS
R. Jones, Dep.
D. Wilson, Dep.
D. Williams, Jr.
J. Garcia
T. Hogue
D. Loughlin
C. Minkler
K. Sinclair
M. Vassouli

18086
EXPERIMENTAL SUPPORT & FACILITIES DIVISION
(P. Pile), Head
(Y. Mollath), Deputy
C. Scholl, Div. Assistant

18089
Facilities & Experimental Support
A. Peradok, Head
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G. Felle
C. Pacion
D. Phillips
S. Pontieri
Water Systems
J. Scarato, GL
J. de Boer, TS
S. Vogt, Dep.
P. Colagari
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F. Schaefer, JS
18036
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E. Elmore
R. Kellerman
B. Shwey
D. Taha
T. Sado
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O. Rabinovitch
E. Rabinovitch
T. Ron, Instrumentation Div.
E. Wang

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A. Vyas
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W. Schmidt
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Engineering Support

C-AD Accelerator, Facilities & Experimental Support, and R&D Divisions.

CeC layout – **B. Martin** (AD)

SRF – **S. Belomestnykh** (CeC, RD)

RF Systems PS and LLRF – **A. Zaltsman** (CeC, AD)

Cryogenics – **R. Than**, T. Talerico, P. Orfin, J. Haung (CeC, AD)

Beamline (Magnets and Power Supplies) – G. Mahler, R. Lambiase (CeC, AD)

Diagnostics – **D. Gassner**, T. Miller, L. DeSanto (CeC, AD)

Drive Laser & Photocathode Development – **B. Sheehy** (CeC, RD)

Conventional Facilities – **C. Folz, J. Scaduto, P. Feng** (CeC, ESF)

Cathode Insertion Fixture – TBD

Cavity Tuners, Power Coupler, Laser Port – TBD

Beam Line and Insulating Vacuum Systems – **M. Mapes** (CeC, AD)

RF Buncher – TBD

Beam Dump – **L. Snydstrup** (CeC, AD)

- Physics/engineering co-ordination meetings are underway.
- Preliminary beam line design is underway.
- Site has been chosen/infrastructure.
- After review LEReC lattice will be frozen:
 - SCRF system specifications
 - vacuum chamber/solenoid specification
 - E beam instrumentation
 - HI beam instrumentation
- Engineering team finalized and assigned.
- CeC PoP SCRF Cavity and cryogenic system commissioned
- Finalize 1:00 or 2:00 location

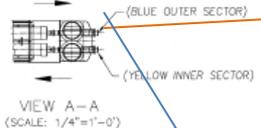
Tunnel Location Details

Sector 2							
Meters	Yellow Inner				Blue Outer		
from IP2	S-Coord	Label	Name		S-Coord	Label	Name
Q3						Q3	
38.4			Start of warm sector				Start of warm sector
			10 Hz GOF Magnet				10 Hz GOF Magnet
							0.25MBPM
41.0		MBPM2	Moveable BPM (LF Schottky)	2598.5	KKR-2	BBQ Kicker	
			0.25m BPM BTF Pick-up			1M Pick-up	
			Beam Loss Monitor			0.25MBPM	
41.5	2597.9	IPM-H	Y-ionization PM horizontal				
			Beam Loss Monitor				
42.0	2599.3	KKR-2	Hybrid Kicker	2599.1	KKR-2	PLL BBQ PU (Moveable)	
44.0			Start of LEReC Cooling Section				
46.8				2601.04	TMKH	ARTUS Kicker Horizontal (start)	
48.8				2603.04	TMKH	ARTUS Kicker Horizontal (end)	
49.0	2605.2	EDV	Electron Det V		EDV	Electron Det V	
53.0	2608	TMKV	ARTUS Kicker V (or B-by-B longit damper)		LM	Lumi-Mon (6-way cross only)	
55.0	2610	TMKV	ARTUS Kicker V (or B-by-B longit damper)	2610.04	IPM-V	B-ionization PM Vertical	
						Beam Loss Monitor	
56.0			End of LEReC Cooling Section				
56.6				2611.6	TWC	Traveling Wave Cavity	
	2613		Future ARTUS Kicker V	2613		Future ARTUS Kicker H	
	2615		Future ARTUS Kicker V	2615		Future ARTUS Kicker H	
				2619		Future B-ionization PM Vertical	
61.8	2617.5		SC Long Pick-up (start)				
64.0			SC Long Pick-up (middle)				
66.0			SC Long Pick-up (end)				
67.0	2622		Button BPM	2622.7	Button BPM		
68.0	2623.5	WCM		2623.52	WCM		
68.6	2624.2	DCCT			DCCT		
69.0			HF Schottky PU			HF Schottky PU	
			Pin diodes (2)				
71.0			New Long SC pickup				
			End of warm sector				End of warm sector
Q4					Q4		

Right 2:00 Sector

NOTES:

REVISION APPROVALS									
REV	DATE	DESCRIPTION	CHK	BY	CHK	DES	ENG	APP	DATE
A		INITIAL RELEASE							
B	02/03/00	AS PER ECN	01/01	RD	CL			PTM	
C	03/08/00	AS PER ECN	01/01	RD	DM	JA			
D	08/19/00	AS PER ECN	01/01	JZ			AA	MF	
E	08/17/00	AS PER ECN	01/01	JZ	AA	AA	SP	JT	
F	08/08/00	AS PER ECN	01/01	LT	AA	AA	SP	JT	
G	08/23/00	AS PER ECN	01/01	LT	AA	AA	CL		



TRDX

VIEW LOOKING OUT FROM RING CENTER

Beam Direction
YELLOW INNER SECTOR 2
VIEW LOOKING OUT FROM RING CENTER

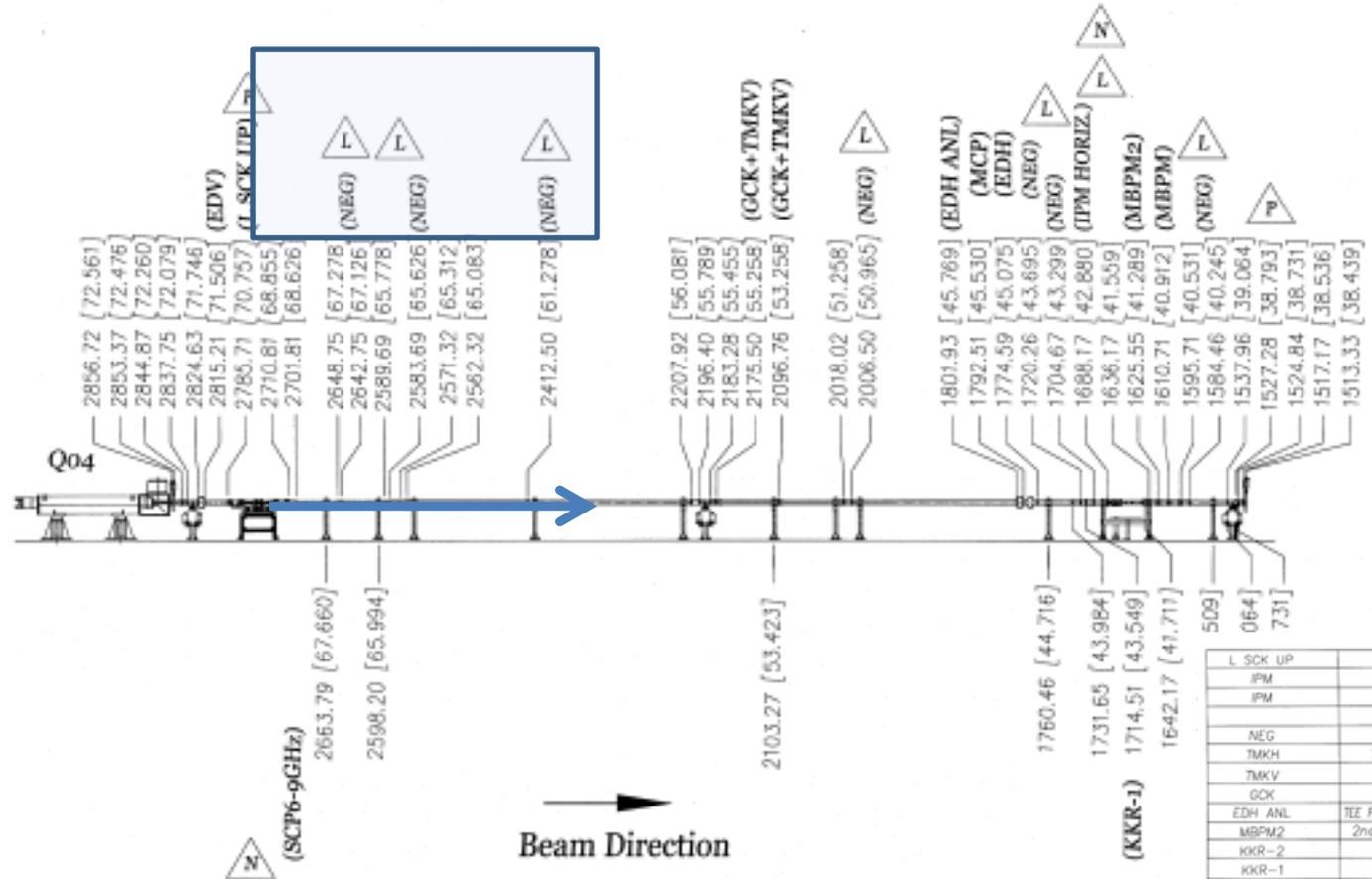
Beam Direction
BLUE OUTER SECTOR 2
VIEW LOOKING OUT FROM RING CENTER

FOR REFERENCE ONLY
NOT ALL COMPONENTS ARE SHOWN
COMPONENT LOCATION MUST BE
VERIFIED IN THE RING

ABBREVIATION	DESIGNATION	DWG. NO.
L SCK UP	LONGITUDINAL SCK PICKUP	71011043
TWC	TRAVEL WAVE CAVITY	71015556
IPM	ION PROFILE MONITOR-HORIZ	82035008
IPM	ION PROFILE MONITOR-VERTICAL	82035134
NEG	NEG PIPE	43035019-1
TMK V	TUNE METER KICKER VERTICAL	82045005
TMK H	TUNE METER KICKER HORIZONTAL	82045006
GCK	CAP CLEANING KICKER	82045005
MBPM2	2ND MOVABLE BEAM POSITION MONITOR	8105211 (NOT RELEASED)
KKR-2	KICKER	01055715-2
KKR-1	KICKER	01055715-1
CFC	CROSS FOR CARBON FIBER	VA-FC0800
LM	LUM MONITOR	01055721
SPU	CROSS FOR SCHOTTKY CAVITY	LBL21-8453
EDV	TEE FOR ELECTRON DETECTOR-VERTICAL	KJL509352-1-05
WCM	WALL CURRENT MONITOR	8205000 (NOT RELEASED)
MBPM	MOVABLE BEAM POSITION MONITOR	81051532
BBPM	BUTTON BEAM POSITION MONITOR	82051504
	REMOVED	
XF	DC CURRENT MONITOR	82025002
TRDX	ASS'Y, TRIPLET/DX/TRANSFER LINE	01055685-05
TRIP	ASS'Y, TRIPLET MAGNET	0105300-05
DX	ASS'Y, DX MAGNET	0105614-02
DXDD	DXDD WARM BORE CHAMBER	42035021-02
ZDC	ZERO DEGREE CALORIMETER	01035000

ATTENTION & GENERAL INFORMATION: ADVISORY: 11-26-1994		COLLIDER-ACCELERATOR DEPARTMENT BROOKHAVEN NATIONAL LABORATORY 7525 14TH AVE UTAH
DESIGN SPECIFIED CHECKED BY: [] DRAWING NO. 01055549 PROJECT NO. 01055549 SCALE: AS SHOWN DATE: 01/01/00	CHANGES: [] REVISIONS: [] APPROVED BY: [] DATE: 01/01/00	RHC ALLOTMENT, SPACE, IP02 SECTOR 02 DWG. NO. 01055549 1 of 1

Move Equipment Blue



Beam Direction
BLUE INNER SECTOR 01
VIEW LOOKING OUT FROM RING CENTER

L SCK UP	LONGITUDINAL SCK PICKUP	71011045
IPM	ION PROFILE MONITOR-HORIZ.	82035008
IPM	ION PROFILE MONITOR-VERTICAL	82035134
	REMOVED	
NEG	NEG PIPE	43035019-1
TMKH	TUNE METER KICKER-HORIZONTAL	82045005
TMKV	TUNE METER KICKER-VERTICAL	82045005
GCK	GAP CLEANING KICKER	82045005
EDH ANL	TEE FOR ELECTRON DETECTOR-HORIZ ARGONNE LAB	K.J.509352-1-05
MBPM2	2nd MOVABLE BEAM POSITION MONITOR	81015211 (Not Released)
KKR-2	KICKER	01055715-2
KKR-1	KICKER	01055715-1
LM	LUM MONITOR	01055721
MCP	TEE FOR MULTICHANNEL PLATE	K.J.509352-1-05
EDH	TEE FOR ELECTRON DETECTOR-HORIZONTAL	K.J.509352-2-25
EDV	TEE FOR ELECTRON DETECTOR-VERTICAL	K.J.509352-1-05
MBPM	MOVABLE BEAM POSITION MONITOR	81015132
	REMOVED	
RP	ROMAN POT	P86-02-100
TR0X	ASS'Y, TRIPLET/DX/TRANSFER LINE	01055685-06
TRIP	ASS'Y, TRIPLET MAGNET	01055300-06
DX	ASS'Y, DX MAGNET	01055614-02
DX00	DX00 WARM BORE CHAMBER	42035021-01
ZDC	ZERO DEGREE CALORIMETER	01035000
ABBREVIATION	DESIGNATION	DWG. NO.

Low Energy RHIC electron Cooling

