

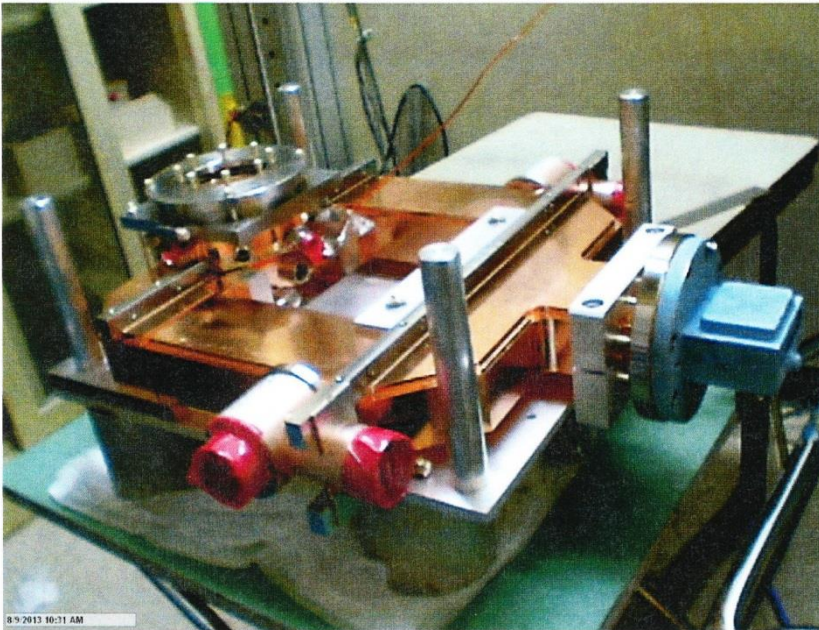
APS PC Gun Efforts to Date

Overview

Terry L Smith (ASD/RF)
January, 2015

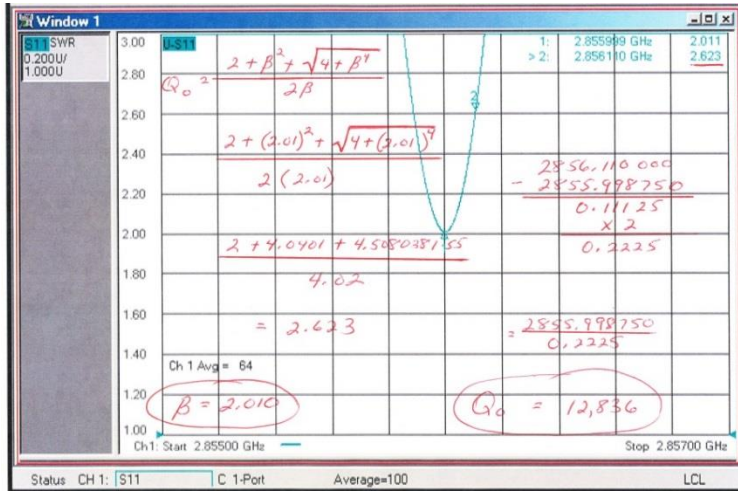
- LLRF measurements verified at SLAC, June 2013
- PC Gun cost: ~ \$800K + solenoid (Gun manufactured by SLAC)
- Installed continuous shock monitor
(constantly measures shock in the x, y, z direction, temperature and humidity)
- Shock monitor results show no major impacts during shipment

Gun at SLAC, June 2013

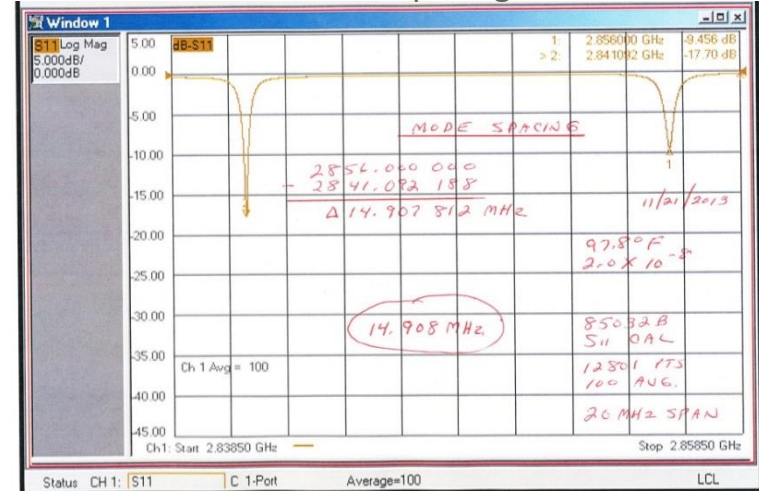


Verify LLRF Measurements at ANL (in 400A-3) - Pi Mode

Q Unloaded



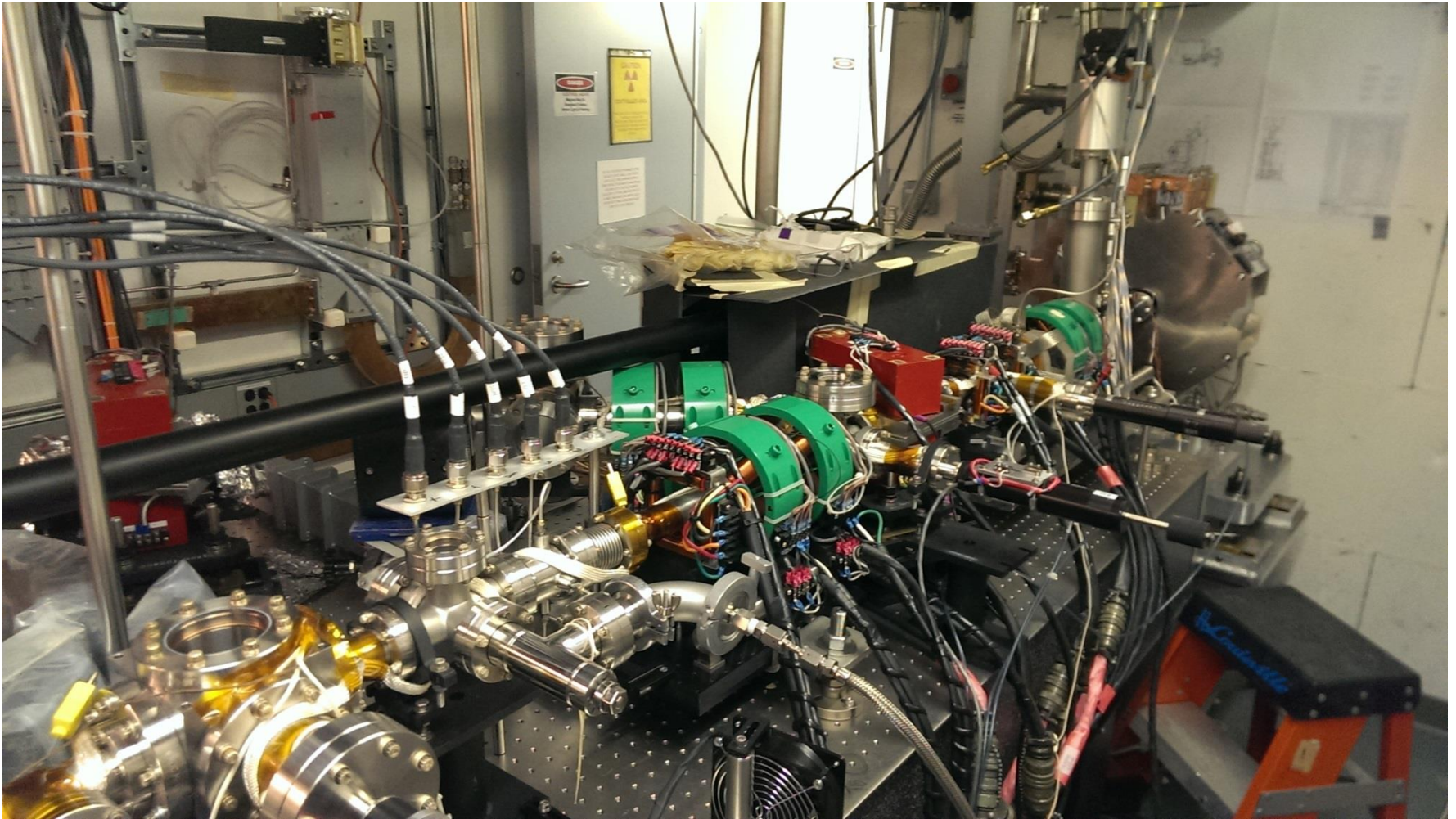
Mode Spacing



- Ginzton; Microwave Measurements - Q Measurements, using Impedance Method
- Plots of VSWR as a functional frequency and the value of the coupling coefficient β

	Pi Mode		Zero Mode	
	at SLAC	at APS	at SLAC	at APS
Frequency (MHz)	2855.93	2856	2840.92	2841.1
Q zero	13856	12836	13073	12490
Q loaded	4573	4218	5920	5430
Q ext	6826	6384	10820	9605
Beta	2.02	2.01	1.2	1.3
	at SLAC	at APS		
Mode Spacing	15	14.9		

PC Gun / Beam Line Components installed in the ITS (for pc gun conditioning/commissioning)



PC Gun Reflected Power Auto-Restart Conditioning

(Control the amount of arcs – Remove all sustaining or continuous arcs)

Feb 21, 2014

IIS_RefIPwrTripCtrl.adl

14:11:54

The screenshot shows a control interface for the PCGun Reflected Power Auto-Restart Conditioning app. At the top, a yellow banner displays the app name. Below it, the status 'Waveguide Mode 3 is Enabled' is shown. The 'Relective Power Trip Control' is currently set to 'ON'. A slider for 'Timer Trip Window (Seconds)' is positioned between 10 and 500, with the current value at 0. Another slider for 'Reflective Power Trip Limit' is positioned between 2 and 10, with the current value at 0. The 'Current Reflective Power Trip Tally' is also 0. At the bottom, there are two green status indicators: 'L3 VSWR #3' and 'L3 LLRF Stat'. A purple 'Acknowledge' button is located in a box labeled 'Trip Limit'.

- Reflected Power trip uses L3 VSWR chassis to turn off RF **at every trip event**.

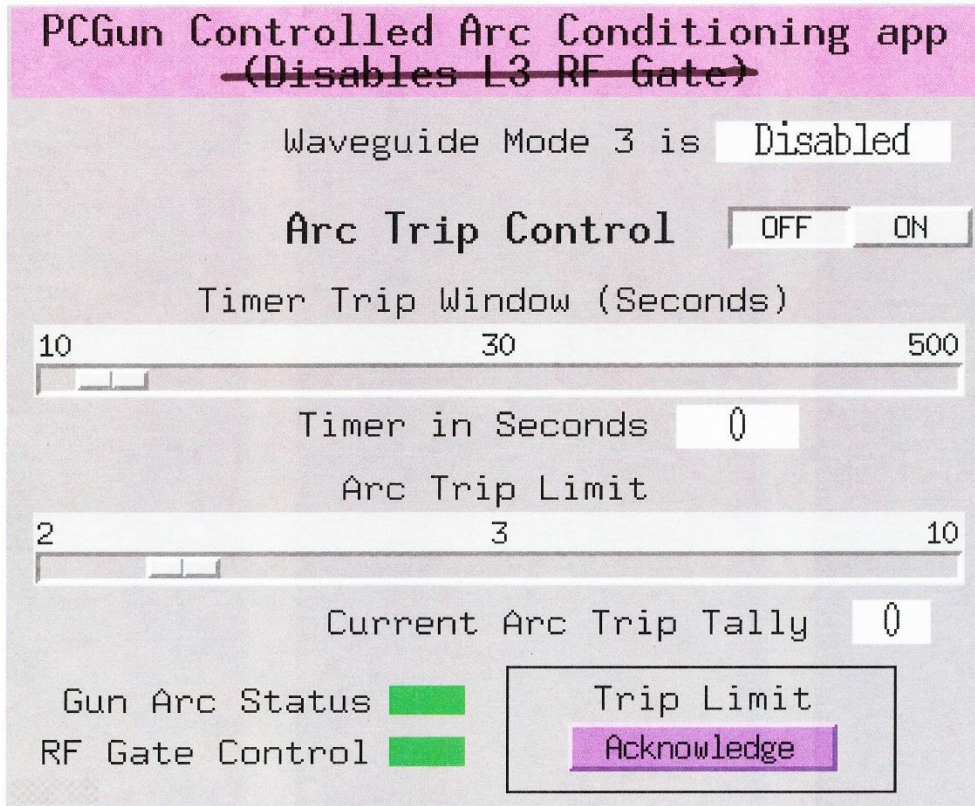
- Program will automatically reset the RF trip before the next RF pulse.

- Selectable between 10 to 500 seconds & 2 to 10 trip events

Reflected Power is hard wire interlocked, therefore “Failsafe”:

If the program would stop working & the Reflected Power would trip, it would stay off every time.

PC Gun Controlled Arc Conditioning



Controlled Arc works similar to the Refl Power Auto-Restart program.

Controlled Arc program was not hard wire Interlocked during the ITS conditioning but is for pc gun operation in the linac tunnel.

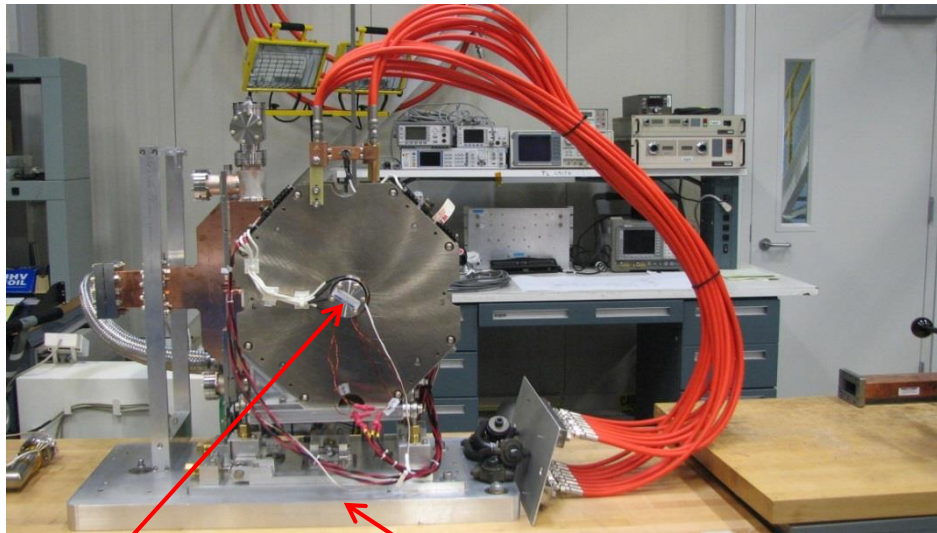
For PC Gun conditioning we used a combination of:

- Vacuum Pressure
- Refl Power Auto-Restart Conditioning program
- Controlled Arc Conditioning program

* Results were that the gun was able to condition quickly and in a manner safe for the pc gun.

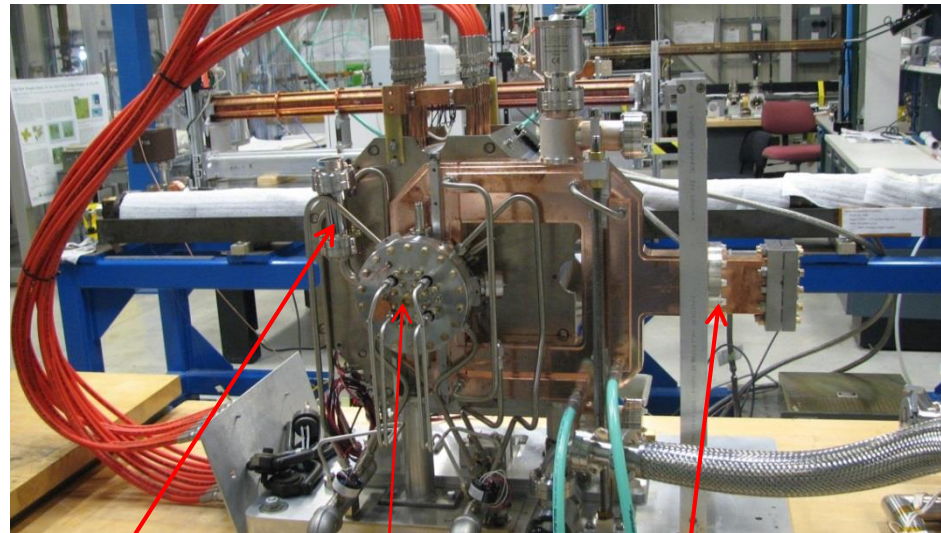
PC Gun modifications before installation in the Linac

- Will require one more “Critical Lift”, from 400A-3 to Linac tunnel.



Add new tailpipe
with heater tape
& x-y corrector coils

Attach new support
for gate valve
and bellows



Remove RGA

Install
Bucking Coil

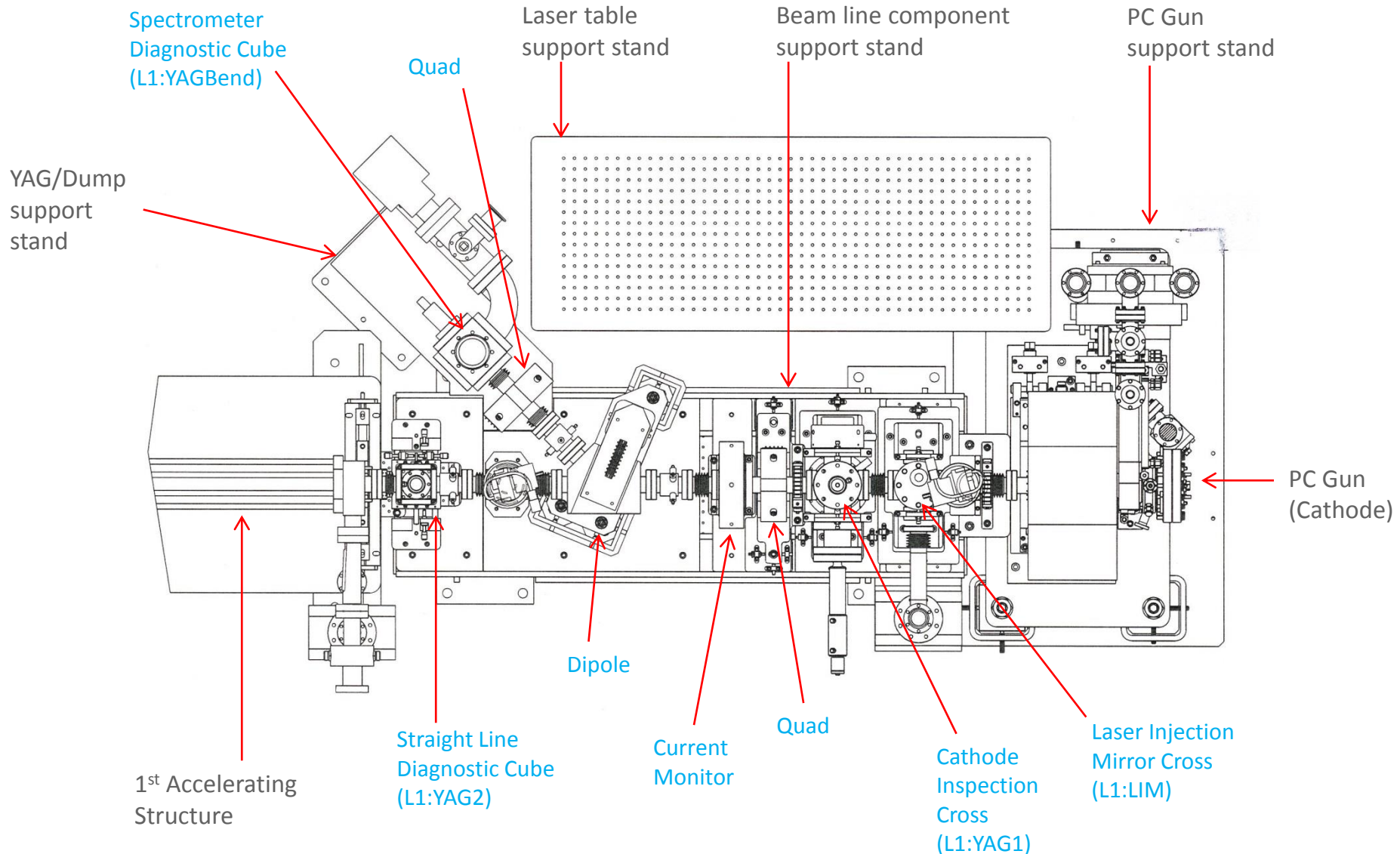
Add Skarpaas
waveguide e-bend
and waveguide
window

Wrap entire gun and solenoid & bake for 5 days at 150° C

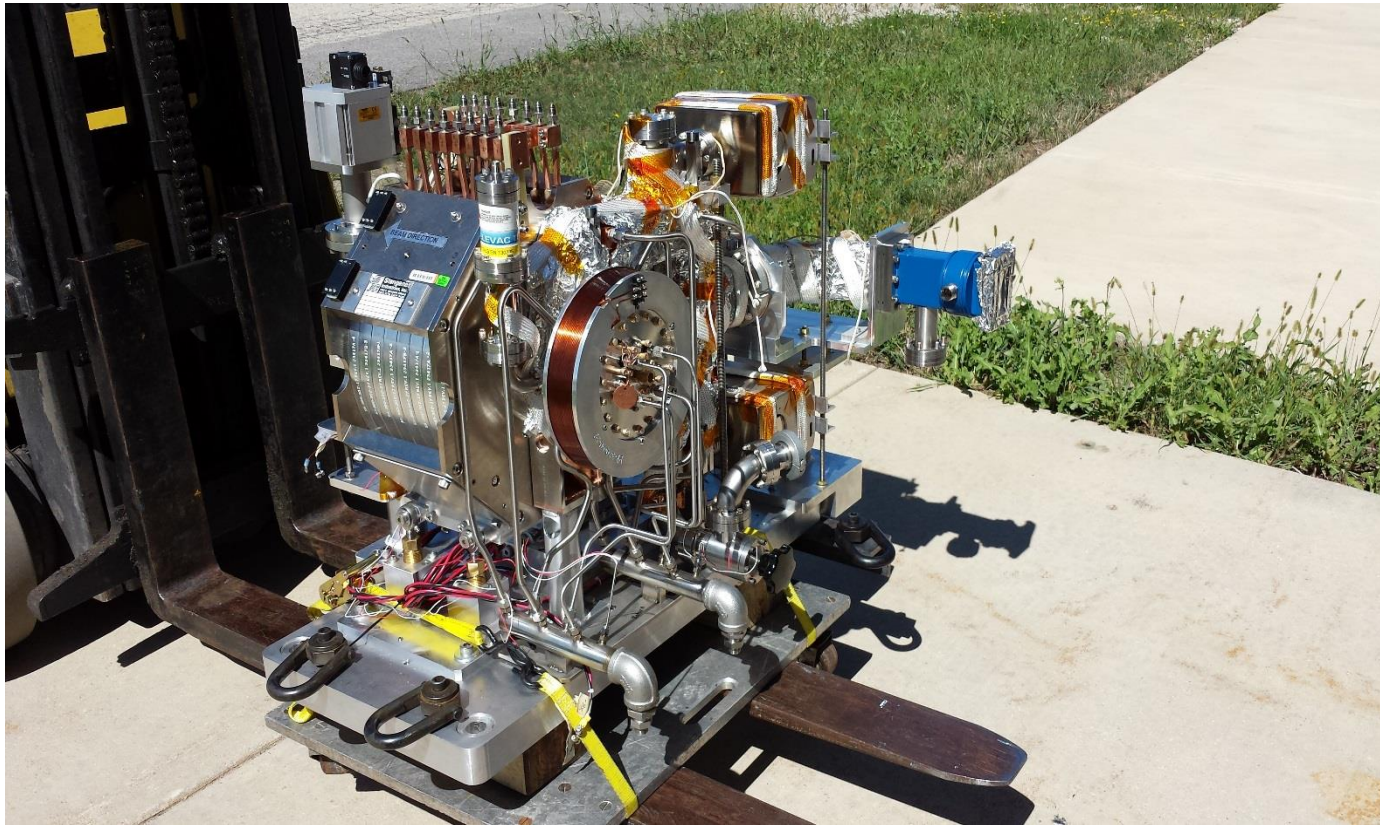
PCGun System Installation

- New pc gun, solenoid
- New waveguide run, from the L3 circulator in tunnel to pc gun input
- Modified laser table/components & transport line with integrated imaging diagnostics
- New and existing beam line components and diagnostics
- New mechanical support stands for gun, beam line components & laser table
- New individual component alignment mechanical supports (critical delivery)

Overview



3rd Critical Lift - for Linac installation



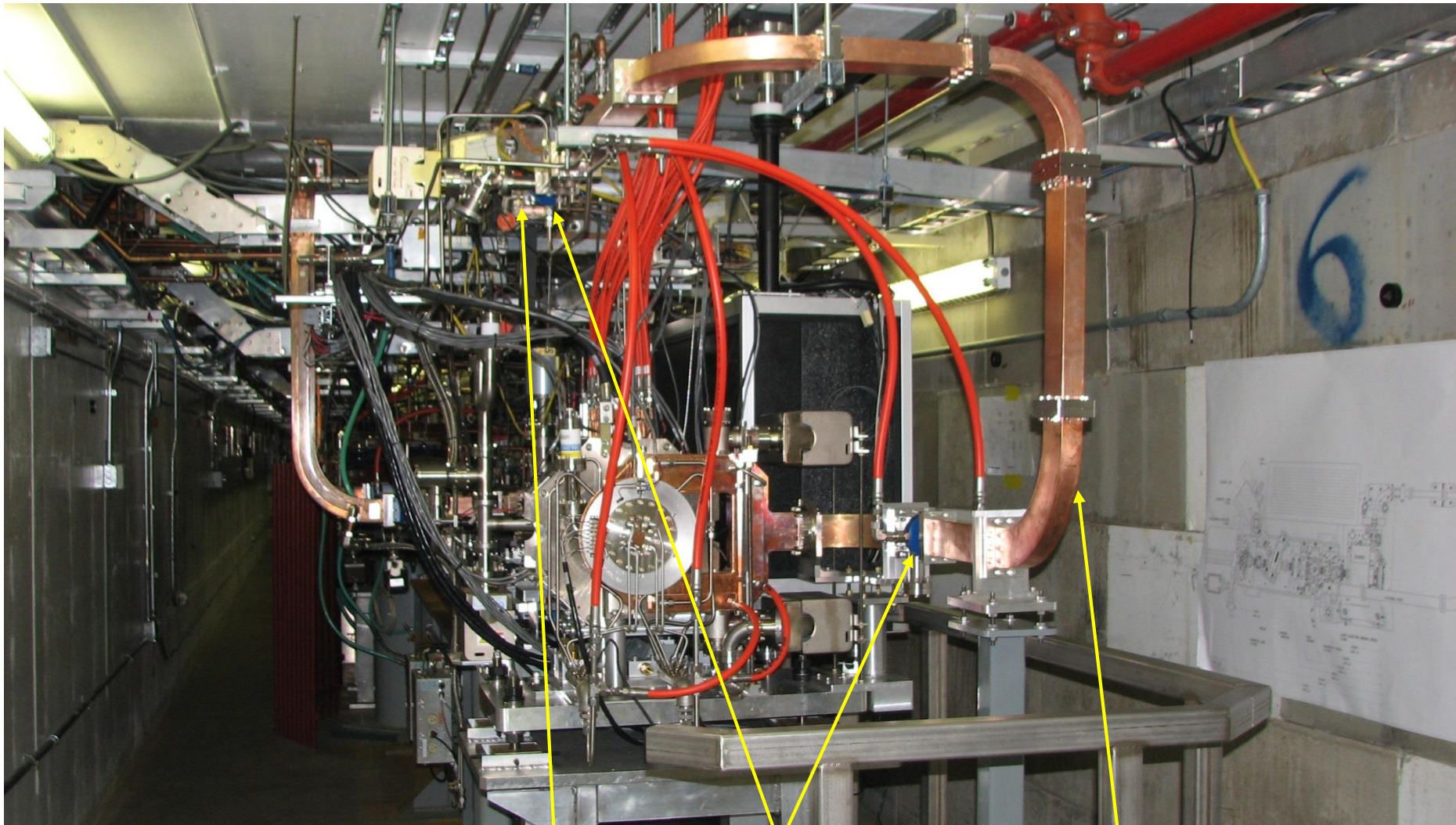
- Gate valve, Ion pump and RF Window added to gun aluminum support plate



- For Gun Protection:
To remove PC Gun from linac tunnel in the future, remove these blocks & use the fork lift only to remove the gun (with support stand).

PC Gun Installation in Linac

- ~ 45 people charged to PC Gun effort before and during the Aug/Sept shutdown



Circulator
(from L3)

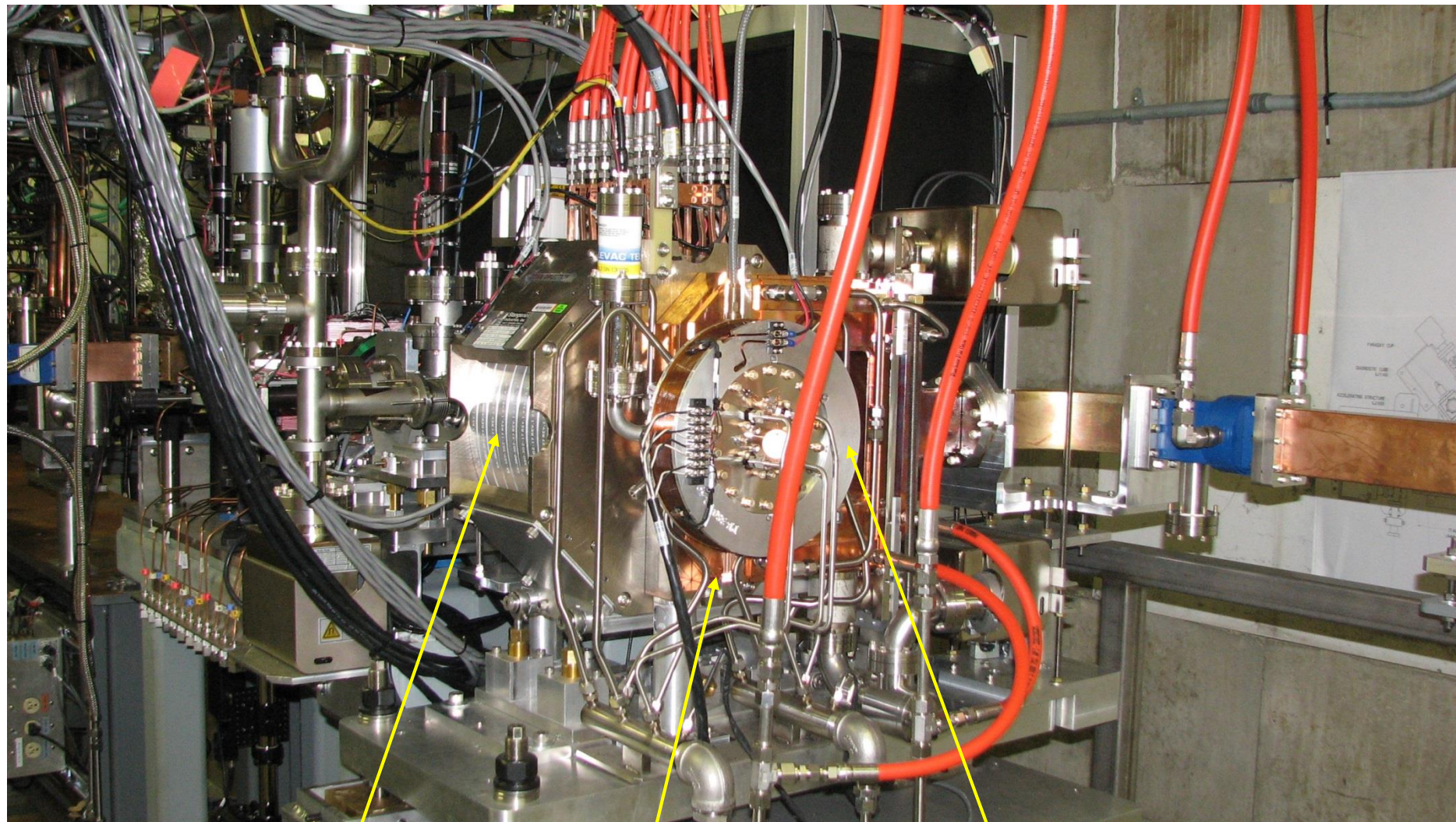
2 RF Windows
(provides SF6 isolation)

New waveguide run

APS PC Gun Efforts to Date - Overview January 2015



PC Gun Installation in Linac

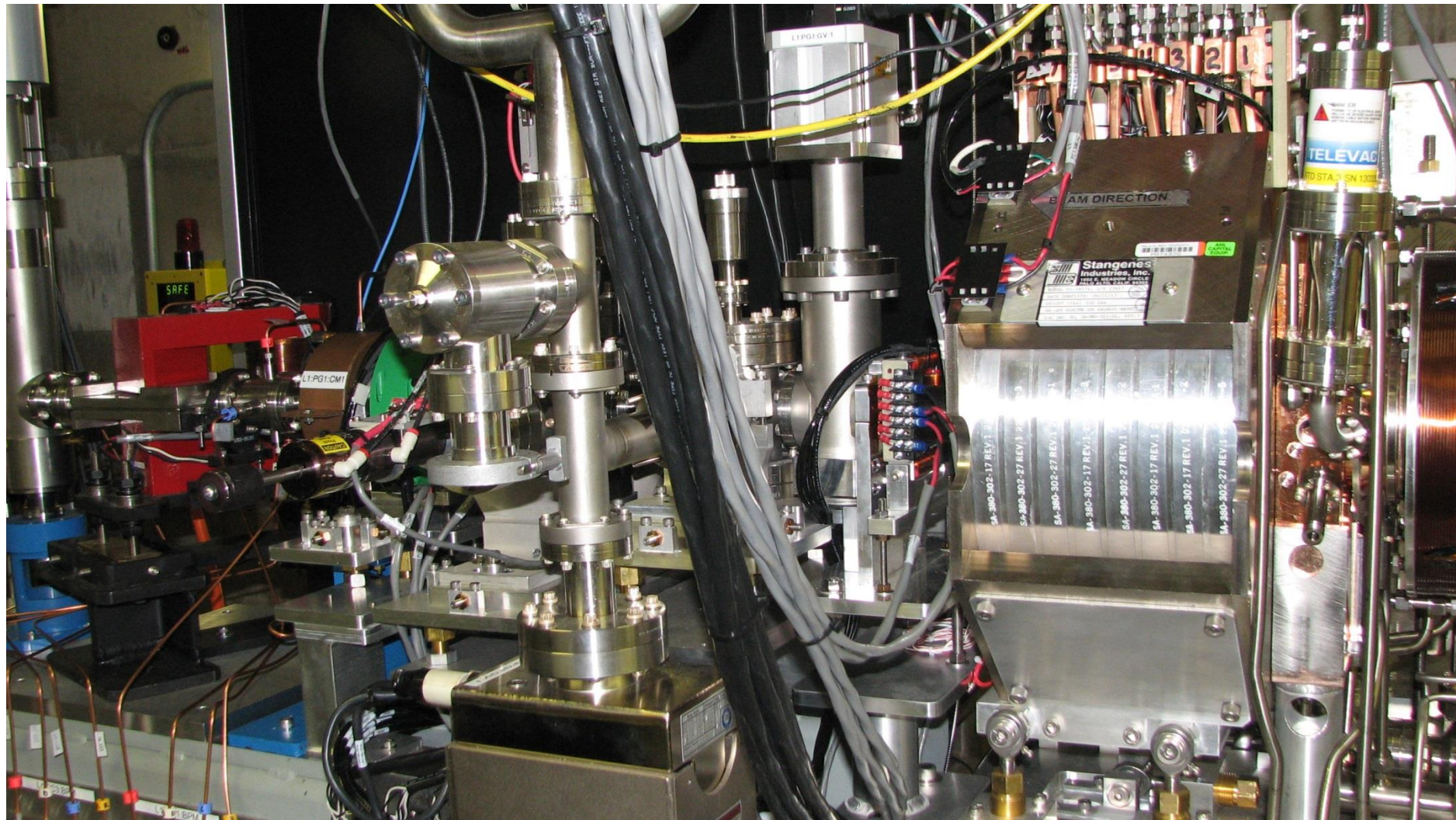


Solenoid

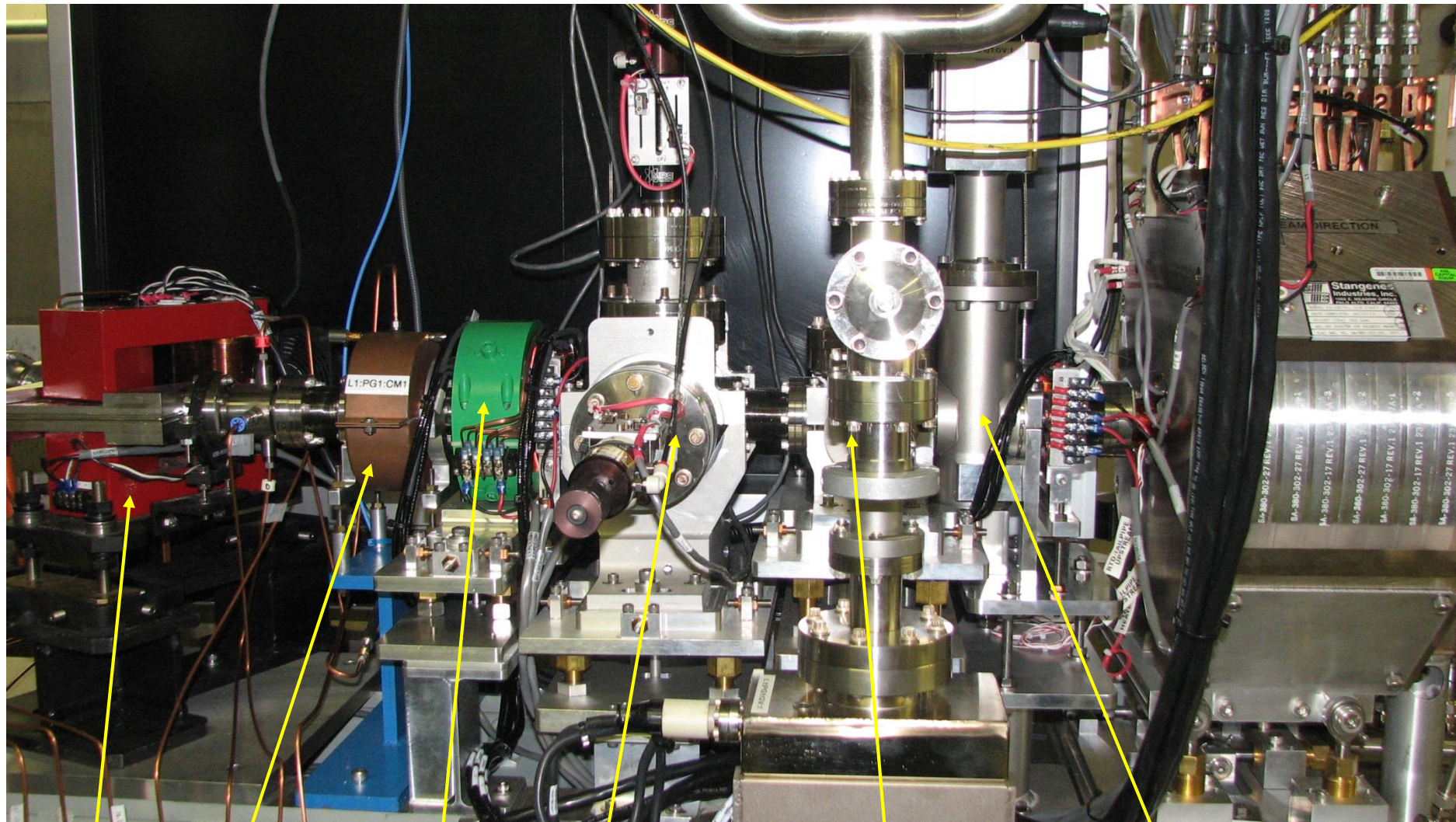
PC Gun

Bucking Coil

PC Gun Installation in Linac



PC Gun Installation in Linac



Dipole

Current Monitor

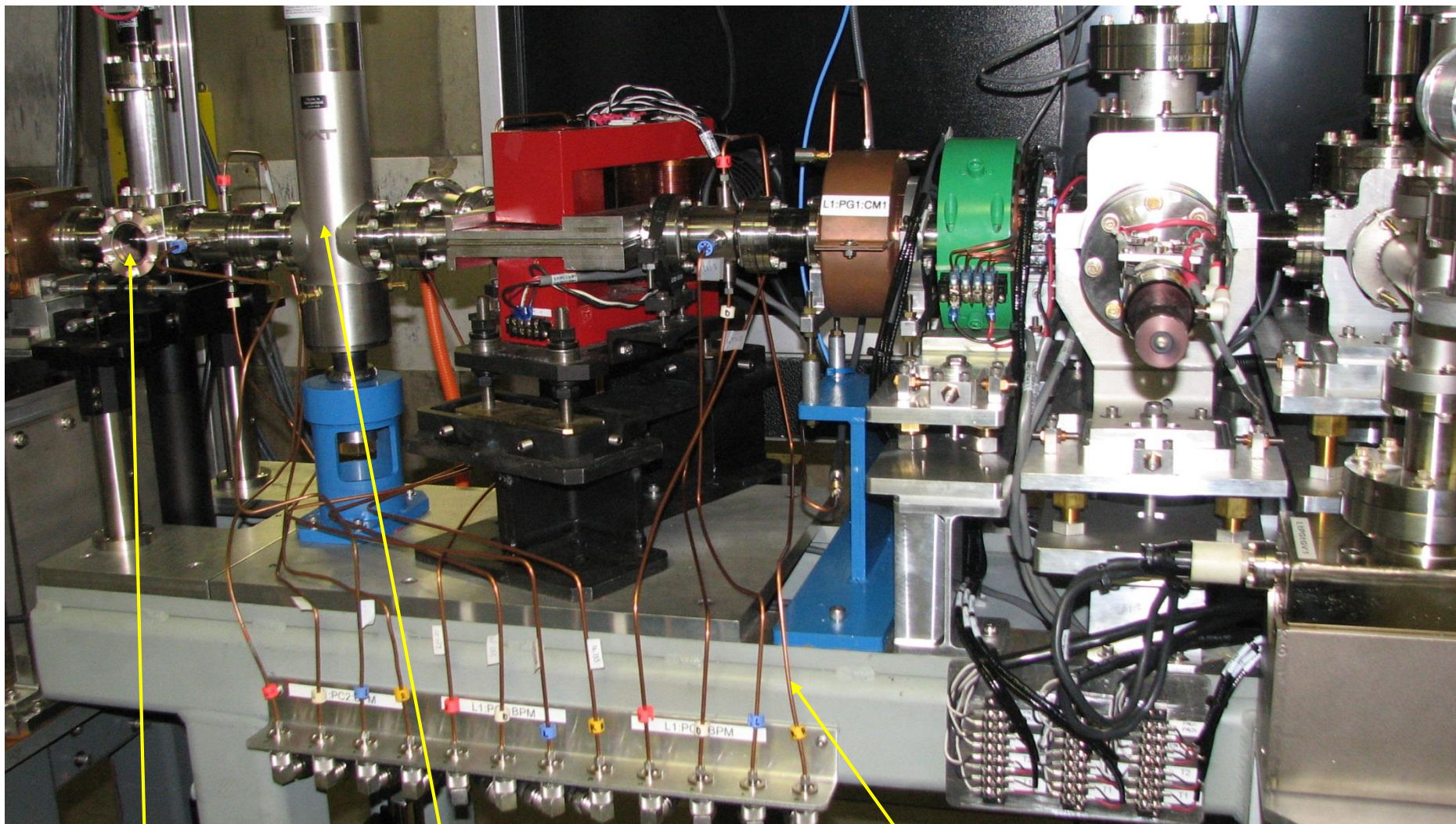
Quad

Cathode Inspection Cube

Laser Injection Mirror Cross

Gate Valve

PC Gun Installation in Linac



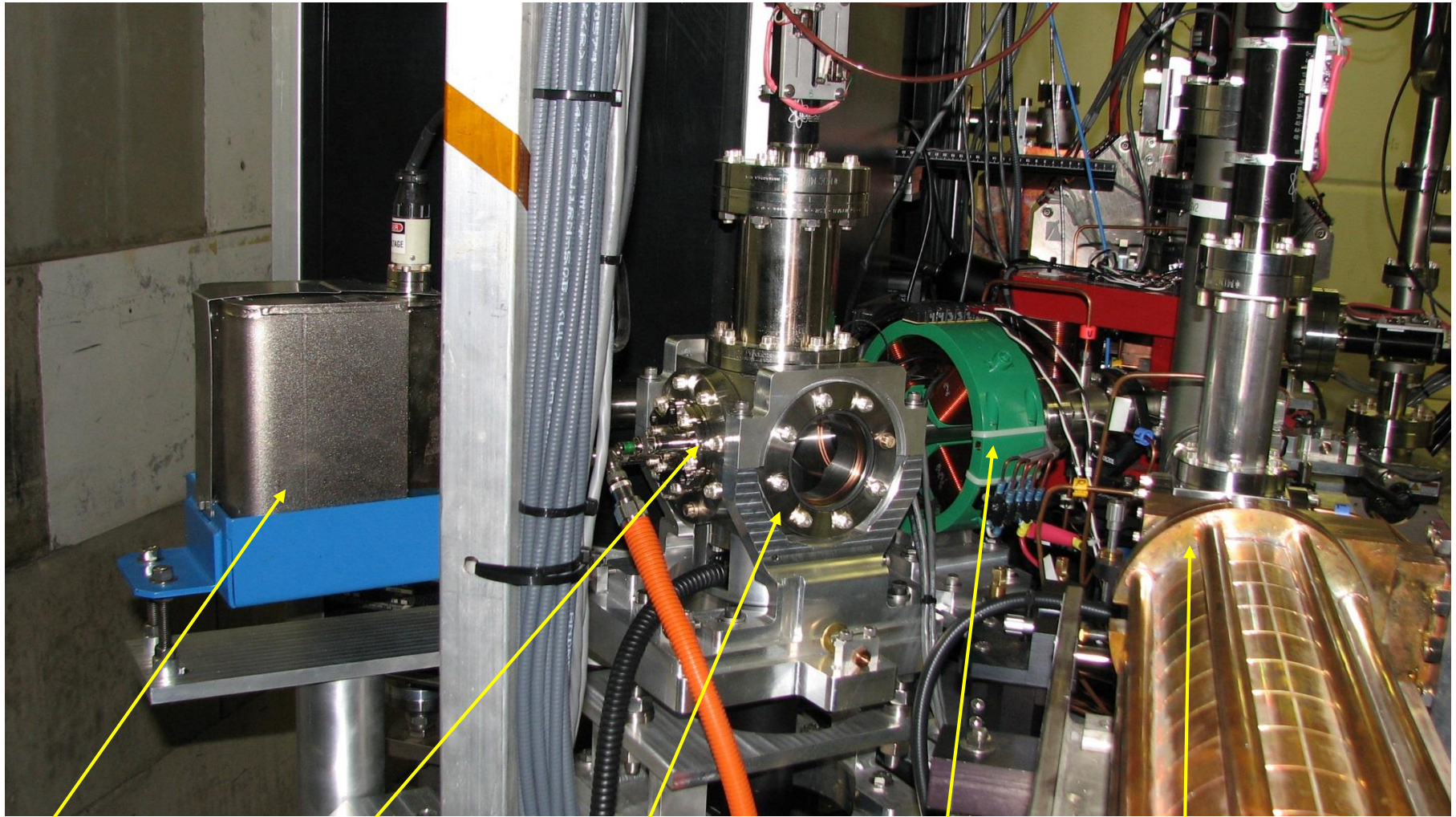
Straight Line
Diagnostic Cube

Gate Valve before
1st accelerating structure

Phase cut semi-rigid
cables for BPMs

PC Gun Spectrometer Line Installation

Dec/Jan 2015 Shutdown



Ion Pump

Faraday Cup

Bend Line
Diagnostic Cube

Bend Line
Quad

Input of 1st
Accelerating Structure