INJECTOR QUICK REFERENCE DRAWING
Rev 17 BETA

Spring/Summer 2021
AIPINJ Phase I
Gun -> Chopper

DRAFT 3 (3/5): Re-arranged VIP2I00,A,B,C to infer that only VIP2I00 is on the main beamline.
Added E-field PVs for Wien filters. Added VIP4D00E marker.

DRAFT 2 (2/19): Removed VRVs -- not in the beam path.
Corrected names for second Wien cross, prebuncher, and A3/A4 apertures.

DRAFT 1 (2/12): Updated Gun -> Choppers, AIPINJ Phase I, from 1/28 preliminary songsheet ACC0002845-0001.
Added EPICS PVs and Songsheet names for RF elements
Added chopper slit and central plug PVs

Pink = needs to be added

D. Moser
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File: 12GeV_injector_quick_reference_Dwg_rev17_3.ai

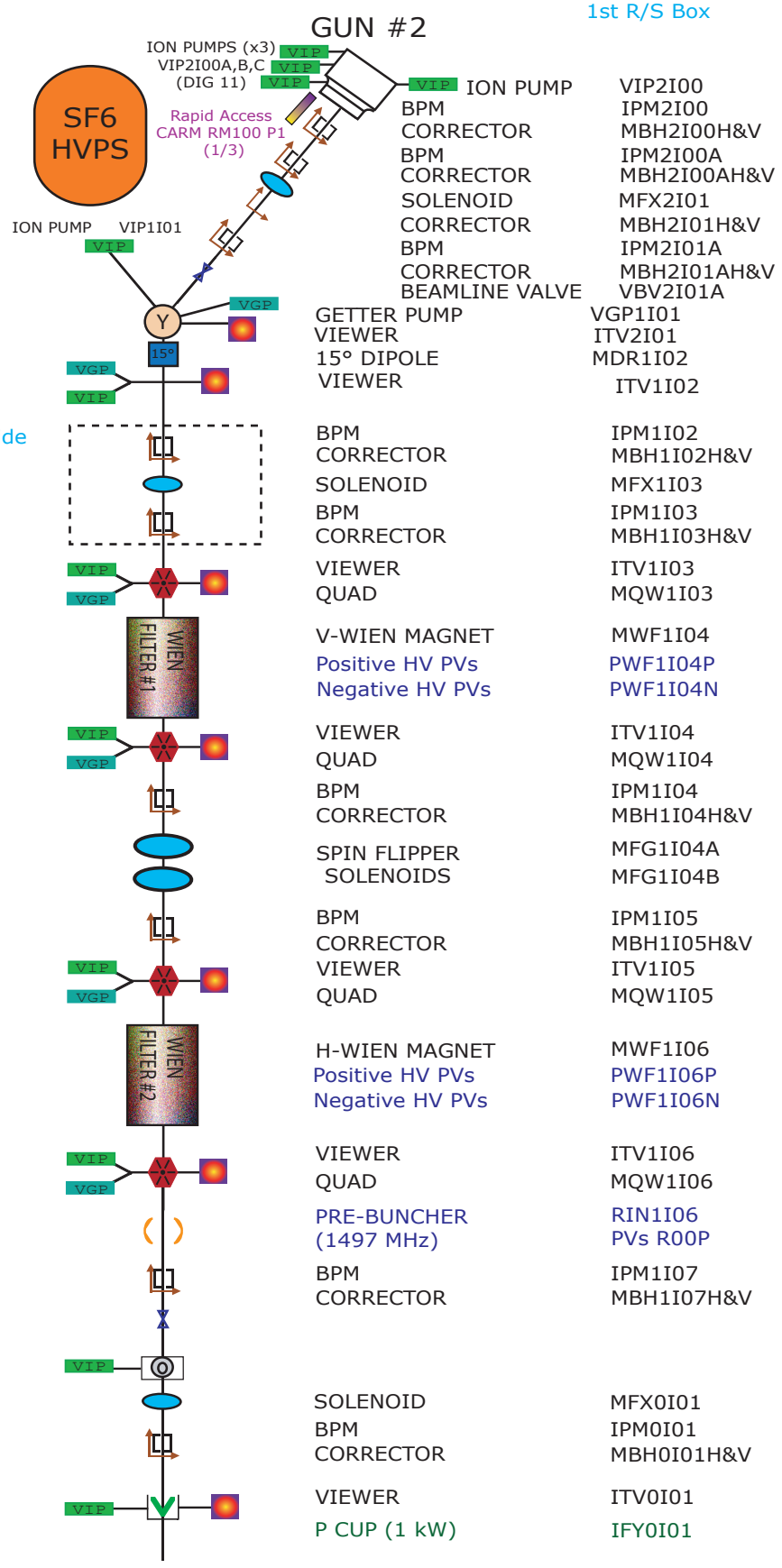
INJECTOR QUICK REFERENCE DRAWING

Bldg 53, Injector Service Building, Above-Ground Phones:
x6165 -- (3x+base) Cordless Phones
x5167 -- Outside PSS D1, in between D1 and D2, outside D2 (3 phones)

x6207 -- by tunnel entrance/ 1st R/S Box

Gun HV (kV)	***Electron*** Momentum (MeV/c)	Relativistic Factor (γ)	Fraction of Speed of Light
100	0.335	1.196	0.548
130	0.387	1.254	0.604
200	0.494	1.391	0.695
300	0.630	1.587	0.777

* 2021 Physics Setting *



ION PUMP	VIP2I00
BPM	IPM2I00
CORRECTOR	MBH2I00H&V
BPM	IPM2I00A
CORRECTOR	MBH2I00AH&V
SOLENOID	MFX2I01
CORRECTOR	MBH2I01H&V
BPM	IPM2I01A
CORRECTOR	MBH2I01AH&V
BEAMLINE VALVE	VBV2I01A
GETTER PUMP	VGP1I01
VIEWER	ITV2I01
15° DIPOLE	MDR1I02
VIEWER	ITV1I02

GETTER PUMP	VGP1I02
ION PUMP	VIP1I02

x6208 -- both outside by camera and inside laser room (and by R/S box 2)

BPM	IPM1I02
CORRECTOR	MBH1I02H&V
SOLENOID	MFX1I03
BPM	IPM1I03
CORRECTOR	MBH1I03H&V
ION PUMP	VIP1I03
GETTER PUMP	VGP1I03
VIEWER	ITV1I03
QUAD	MQW1I03
V-WIEN MAGNET	MWF1I04
Positive HV PVs	PWF1I04P
Negative HV PVs	PWF1I04N
VERTICAL WIEN FILTER	MWF1I04
ION PUMP	VIP1I04
GETTER PUMP	VGP1I04
VIEWER	ITV1I04
QUAD	MQW1I04
BPM	IPM1I04
CORRECTOR	MBH1I04H&V
SPIN FLIPPER SOLENOIDS	MFG1I04A MFG1I04B
(2/3) Rapid Access CARM RM100 P2 Placement?	
BPM	IPM1I05
CORRECTOR	MBH1I05H&V
ION PUMP	VIP1I05
GETTER PUMP	VGP1I05
VIEWER	ITV1I05
QUAD	MQW1I05
H-WIEN MAGNET	MWF1I06
Positive HV PVs	PWF1I06P
Negative HV PVs	PWF1I06N
HORIZONTAL WIEN FILTER	MWF1I06
ION PUMP	VIP1I06
GETTER PUMP	VGP1I06
VIEWER	ITV1I06
QUAD	MQW1I06
PRE-BUNCHER (1497 MHz)	RIN1I06 PVs R00P
BPM	IPM1I07
CORRECTOR	MBH1I07H&V
BEAMLINE VALVE	VBV1I07
DP CAN	VDP0I00
ION PUMP	VIP0I00
SOLENOID	MFX0I01
BPM	IPM0I01
CORRECTOR	MBH0I01H&V
ION PUMP	VIP0I01
VIEWER	ITV0I01
P CUP (1 kW)	IFY0I01

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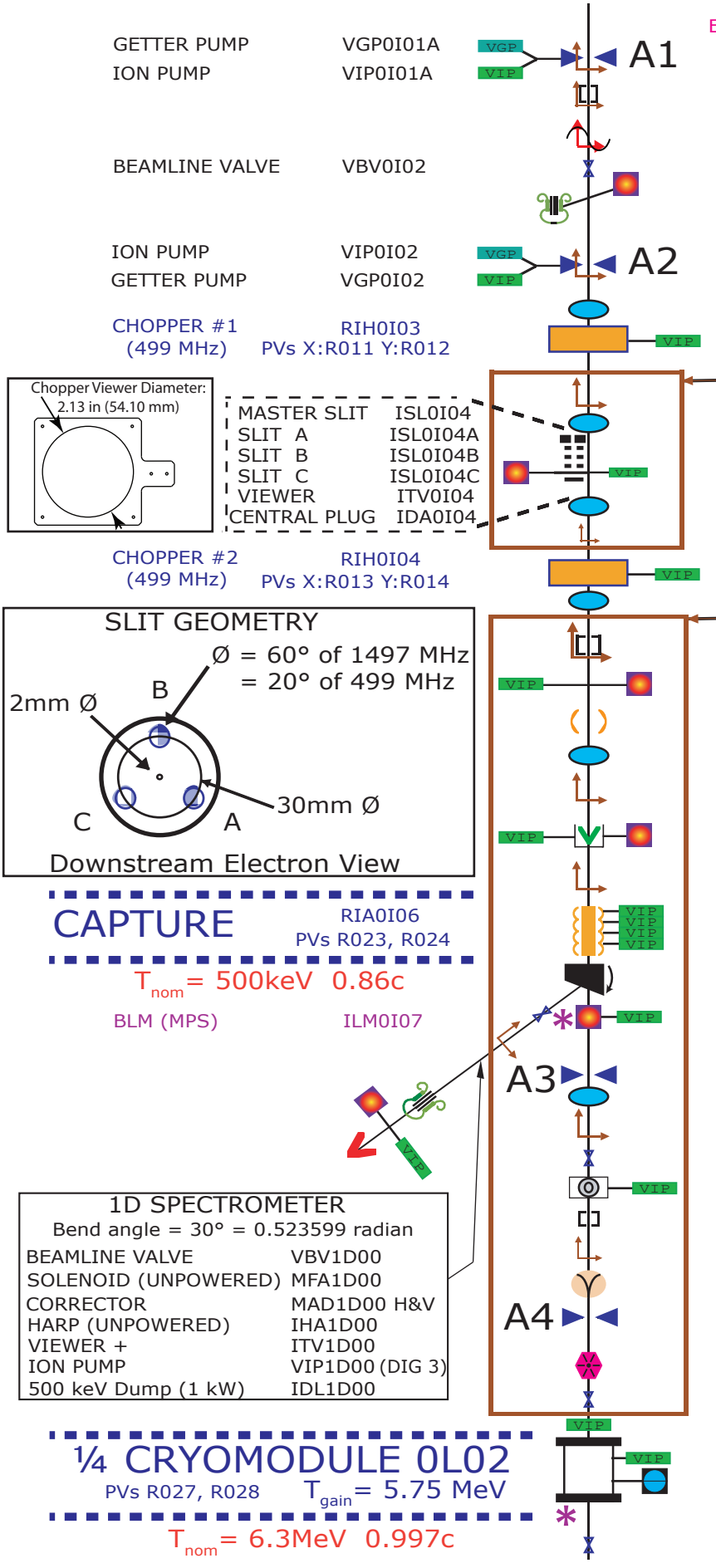

GETTER PUMP	VGP0I01A
ION PUMP	VIP0I01A
BEAMLINE VALVE	VBV0I02
ION PUMP	VIP0I02
GETTER PUMP	VGP0I02
CHOPPER #1 (499 MHz)	RIH0I03 PVs X:R011 Y:R012
MASTER SLIT	ISL0I04
SLIT A	ISL0I04A
SLIT B	ISL0I04B
SLIT C	ISL0I04C
VIEWER	ITV0I04
CENTRAL PLUG	IDA0I04
CHOPPER #2 (499 MHz)	RIH0I04 PVs X:R013 Y:R014

1D SPECTROMETER	
BEAMLINE VALVE	VBV1D00
SOLENOID (UNPOWERED)	MFA1D00
CORRECTOR	MAD1D00 H&V
HARP (UNPOWERED)	IHA1D00
VIEWER + ION PUMP	ITV1D00 VIP1D00 (DIG 3)
500 keV Dump (1 kW)	IDL1D00

EPICS control PV?

APERTURE	IFY0IA1 (Ø=2,3,4 mm)
CORRECTOR	MHD0I01AH&V
BPM	IPM0I01B
CORRECTOR	MBH0I01BH&V
PSS KICKERS	SBK0I01
VIEWER	ITV0I02
HARP	IHA0I02
APERTURE	IFY0IA2 (Ø=4,6,8 mm)
CORRECTOR	MHD0I02H&V
SOLENOID	MFA0I03
ION PUMP	VIP0I03 (DIG 7)
EARTH CORRECTING COIL	MED0I03
CORRECTOR	MBH0I03 H&V
SOLENOID	MFD0I04
VIEWER + ION PUMP	ITV0I04 +VIP0I04 (DIG 2)
SOLENOID (same power supply as MFD0I04)	MFD0I04A
CORRECTOR	MBH0I04 H&V
ION PUMP	VIP0I04A (DIG 7)
SOLENOID	MFA0I05
EARTH CORRECTING COIL	MEE0I05
CORRECTOR / BPM	MBH0I05H&V / IPM0I05
VIEWER + ION PUMP	ITV0I05 + VIP0I05 (DIG 3)
BUNCHER (1497 MHz)	RIB0I05 PVs R015
SOLENOID	MFA0I06
CORRECTOR	MBH0I06H&V
VIEWER	ITV0I06
ION PUMP	VIP0I06 (DIG 3)
FARADAY CUP #1 (1 kW)	IFY0I06
CORRECTOR	MAD0I06AH&V
CAPTURE ION PUMPS (x4)	VIP0I06A,C,D,E (DIG 3)
DIPOLE	MBO0I06
VIEWER	ITV0I06A
ION PUMP	VIP0I06B (DIG 3)
APERTURE (Ø=6mm)	SFY0IA3
SOLENOID	MFL0I07
CORRECTOR	MAD0I07H&V
BEAMLINE VALVE	VBV0I07
DP CAN + ION PUMP	VDP0I07 + VIP0I07 (DIG 4)
BPM	IPM0I07
CORRECTOR	MBH0I07AH&V
YAO CAVITY	ICV0I07
APERTURE (Ø=6.5mm)	SFY0IA4
SKEW QUAD	MQS0I07
BEAMLINE VALVE	VBV0L00A
ION PUMP	VIP0L00
0L02 ION PUMP	VIP0L0020
COLD CATHODE GAUGE	VCG0L0010
BLM (MPS)	ILM0L01A
BEAMLINE VALVE	VBV0L00B

BLM (MPS) ILM0I07

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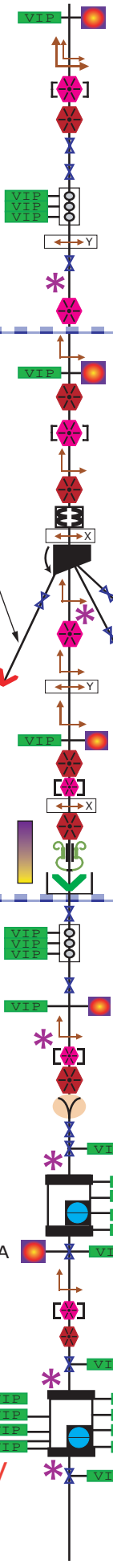

ION PUMP	VIP0L01
CORRECTORS (Two sets of coils for each plane ganged together in series)	MBH0L01 H&V
DP ION PUMPS (x3)	VIP0L01A,B,C (DIG 4)
HELICITY CORRECTOR	MHE0L01V
BLM (MPS)	ILM0L01B

AC Boundary - Plastic Curtain

5D BUBBLE CHAMBER LINE

*DETAIL ON P. 6

Bend angle = 25° = 0.436332 radian

BEAMLINE VALVE	VBV5D00
~~DUMP (1 kW LCW)~~	~~IDL5D01~~

Dump shielding removed. No beam in 5D line allowed. (9/1/18)

x6208 -- by R/S box 2

CORRECTOR	MHB0L02A H&V
BLM (MPS)	ILM0L02
SKEW QUAD	MQS0L02B
CORRECTOR	MHB0L02B H&V
HELICITY CORRECTOR	MHE0L03V
CORRECTOR	MBH0L03 H&V
VIEWER+ION PUMP	ITV0L03 + VIP0L03
QUAD	MQJ0L03A
SKEW QUAD/BPM	MQS0L03 / IPM0L03
HELICITY CORRECTOR	MHE0L03H
QUAD	MQJ0L03
HARP	IHA0L03

(3/3) Rapid Access CARM RM100 P3

FARADAY CUP #2 (1 kW) IFY0L03

Injector PSS Gate T_{nom} = 6.3MeV

ION PUMPS	VIP0L03C,D,E (DIG 5)
ION PUMP	VIP0L04A
BLM (MPS)	ILM0L04A
BEAMLINE VALVE	VBV0L04A
BLM (MPS)	ILM0L04B

0L03 PVs R03

VIEWER + ION PUMP	ITV0L05 + VIP0L05A
BLM (MPS)	ILM0L05

0L04 PVs R04

Total Injector Energy = 123MeV

30Hz uses last four cavities

VIEWER	ITV0L01
BPM/ SKEW QUAD	IPM0L01 / MQS0L01
QUAD	MQJ0L01
FAST VALVE	VFV0L01
BEAMLINE VALVE	VBV0L01A
DIFFERENTIAL PUMP	VDP0L01
BEAMLINE VALVE	VBV0L01B
SKEW QUAD	MQS0L01A
CORRECTOR	MHB0L01A H&V
VIEWER + ION PUMP	ITV0L02 + VIP0L02
QUAD	MQJ0L02
BPM/SKEW QUAD	IPM0L02 / MQS0L02
CORRECTOR	MBH0L02 H&V
QUAD	MQJ0L02A
BCM (MPS)	IBC0L02
HELICITY CORRECTOR	MHE0L02H
DIPOLE	MDL0L02

2D SPECTROMETER LINE

*DETAIL ON P. 6

Bend angle = -30° = -0.523599 radian

BEAMLINE VALVE	VBV2D00A
BLM (MPS)	ILM2D00A
BLM (MPS)	ILM2D00B
DUMP (1 kW)	IDL2D00

3D MOTT POLARIMETER LINE

*DETAIL ON P. 6

Bend angle = -12.5° = -0.218166 radian

BEAMLINE VALVE	VBV3D00A
DUMP (1 kW LCW/34 W air)	IDL3D00

BEAMLINE VALVE	VBV0L03A
DIFF PUMP	VDP0L03
BEAMLINE VALVE	VBV0L03B
VIEWER	ITV0L04
CORRECTOR	MHB0L04 H&V
BPM / SKEW QUAD	IPM0L04 / MQS0L04
QUAD	MQJ0L04
YAO CAVITY	ICV0L04
FAST VALVE	VFV0L04
ION PUMP	VIP0L04B
0L03 ION PUMPS (x4)	VIP0L0420,30,40,50
COLD CATHODE GAUGE	VCG0L0410
BEAMLINE VALVE	VBV0L04B
CORRECTOR	MAT0L05 H&V
BPM / SKEW QUAD	IPM0L05 / MQS0L05
QUAD	MQJ0L05
BEAMLINE VALVE + ION PUMP	VBV0L05A + VIP0L05B
0L04 ION PUMPS (x8)	VIP0L051 -> 0L058
COLD CATHODE GAUGE	VCG0L05
BLM (MPS)	ILM0L06A
BEAMLINE VALVE + ION PUMP	VBV0L05B + VIP0L06

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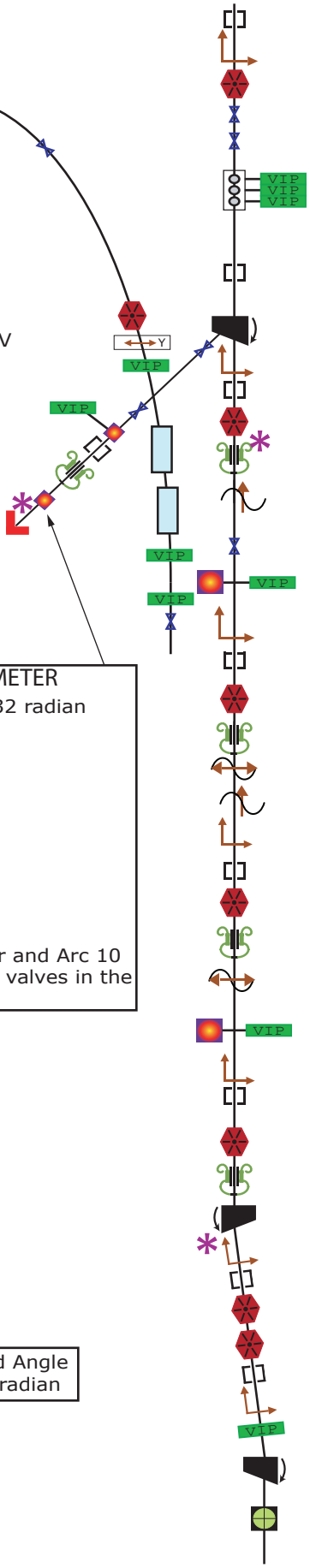

ARC 10
*Incomplete on this diagram

BEAMLINE VALVE	VBVAA19
QUAD	MQPAA32
CORRECTOR	MDBAA32V
ION PUMP	VIPAA32
DIPOLE	MXPAA31
DIPOLE	MXPAA32
ION PUMP	VIPAR01
ION PUMP	VIPAR07
BEAMLINE VALVE	VBVAR08

4D (123 MeV) SPECTROMETER

Bend angle = 25° = 0.436332 radian

BEAMLINE VALVE	VBV4D00

ARC 10 CROSS

BEAMLINE VALVE	VBV4D00A
ION PUMP	VIP4D00E
VIEWER	ITV4D00
BPM	IPM4D00
HARP	IHA4D00
VIEWER	IOR4D00
BLM	ILM4D00
DUMP (17 kW)	IDL4D00

* Note that the 4D Spectrometer and Arc 10 share vacuum. Closest isolation valves in the arc are VBVAA19 and VBVAR08.

VIEWER	ITV0L10
BLM (MPS)	ILM0R01

Injector Chicane Bend Angle
-5.5° = -0.0959931 radian

BPM	IPM0L06
CORRECTORS	MDB0L06H & MDJ0L06V
QUAD	MQD0L06
FAST VALVE	VFV0L06
BEAMLINE VALVE	VBV0L06A
DIFF PUMP + ION PUMPS (x3)	VDP0L06 + VIP0L06B,C,D
BPM	IPM0L06A
DIPOLE	MBF0L06 "SPECTROMETER"
CORRECTORS	MDB0L07H & MDJ0L07V
BPM	IPM0L07
QUAD	MQB0L07
BLM (MPS)	ILM0L08
HARP	IHA0L07
30Hz CORRECTOR	MAT0L07V (MHF)
BEAMLINE VALVE	VBV0L08
VIEWER + ION PUMP	ITV0L08 + VIP0L08
CORRECTORS	MDB0L08H & MDJ0L08V
BPM	IPM0L08
QUAD	MQB0L08
HARP	IHA0L08
30Hz CORRECTOR	MAT0L08H (MHF)
30Hz CORRECTOR	MAT0L08V (MHF)
CORRECTORS	MDB0L09H & MDJ0L09V
BPM	IPM0L09
QUAD	MQB0L09
HARP	IHA0L09B
30Hz CORRECTOR	MAT0L09H (MHF)
ION PUMP	VIP0L10
CORRECTORS	MDB0L10H & MDJ0L10V
BPM	IPM0L10
QUAD	MQB0L10
HARP	IHA0L10
CHICANE DIPOLE	MBL0R01
CORRECTOR	MAT0R01 H&V
BPM	IPM0R01
QUAD	MQD0R01
QUAD	MQD0R02
BPM	IPM0R02
CORRECTOR	MAT0R02 H&V
ION PUMP	VIP0R02
CHICANE DIPOLE	MBL0R02
SLM	ISR0R02

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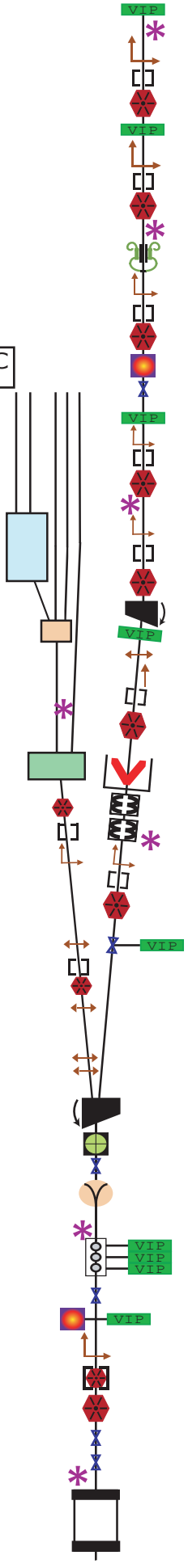
WEST RECOMBINER / NORTH LINAC

*Incomplete on this diagram



DIPOLE	MZAAR03
DIPOLE	MXT4R05
BLM (MPS)	ILM0R08
DIPOLE	MXR2R06
QUAD	MQN1L00
BPM	IPM1L00
CORRECTOR	MBT1L00 H&V
CORRECTOR	MBT1L01H
BPM	IPM1L01
QUAD	MQN1L01
CORRECTOR	MCB1L01H
CORRECTOR	MCB1L01AH
CORRECTOR	MCA1L01H
DIFF. PUMPING STATION	VDP1L01
VIEWER	ITV1L02
BLM (MPS)	ILM1L02

ION PUMP	VIP0R02A
BLM (MPS)	ILM0R03
CORRECTOR	MAT0R03 H&V
BPM	IPM0R03
QUAD	MQD0R03
ION PUMP	VIP0R04
CORRECTOR	MAT0R04 H&V
BPM	IPM0R04
QUAD	MQD0R04
BLM (MPS)	ILM0R04
HARP	IHA0R05
CORRECTOR	MAT0R05 H&V
BPM	IPM0R05
QUAD	MQD0R05
VIEWER	ITV0R05
ROUGHING VALVE	VRV0R05
ION PUMP	VIP0R06
CORRECTOR	MAT0R06 H&V
BPM	IPM0R06
QUAD	MQD0R06
BLM (MPS, lead shielded)	ILM0R06
CORRECTOR	MAT0R07 H&V
BPM	IPM0R07
QUAD	MQD0R07
CHICANE DIPOLE	MBL0R03
ION PUMP	VIP0R08
CORRECTOR	MAT0R08H
CORRECTOR	MBT0R08V
BPM	IPM0R08
QUAD	MQD0R08
INSERTABLE DUMP (17 kW)	IDL0R08
BCM (PSS)	SBC0R08
BCM (MPS)	IBC0R08
BLM (MPS)	ILM0R09
CORRECTOR	MAT0R09 H&V
BPM	IPM0R09
QUAD	MQD0R09
BEAMLINE VALVE + ION PUMP	VBV0R09 + VIP0R09
CHICANE DIPOLE	MBL0R04
SLM (UNPOWERED)	ISR0R09
BEAMLINE VALVE	VBV1L00A
YAO CAVITY	ICV1L01
BLM (Diagnostic)	ILM1L01
ION PUMPS	VIP1L01A,B,C
BEAMLINE VALVE	VBV1L01
ION PUMP	VIP1L02
CORRECTOR	MAT1L02 H&V
BPM / SKEW QUAD	IPM1L02 / MQS1L02
QUAD	MQD1L02
FAST VALVE	VFV1L02
BEAMLINE VALVE	VBV1L02A

1L02 PVs R12

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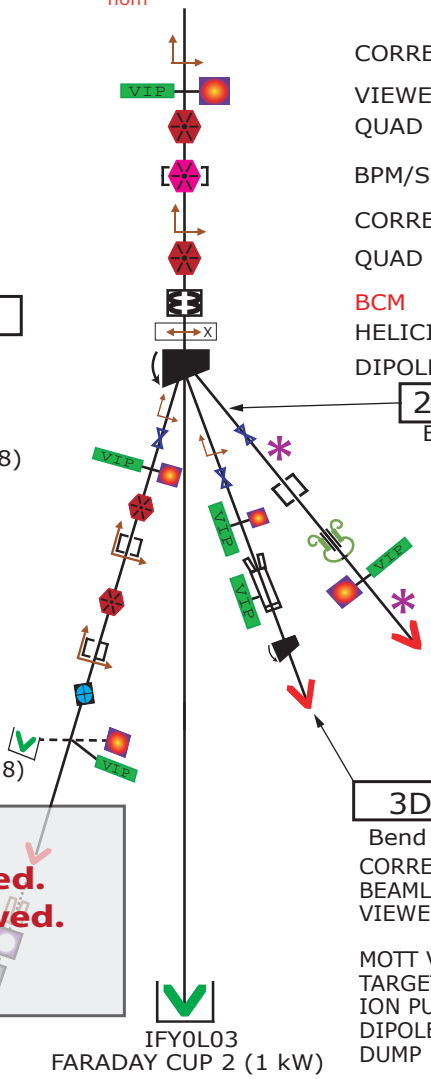
0L02 Injector Diagnostic and Experimental Spurs Detail

T_{nom} = 6.3MeV

x6208 -- by R/S box 2



CORRECTOR	MHB0L01A H&V
VIEWER + ION PUMP	ITV0L02 + VIP0L02
QUAD	MQJ0L02
BPM/SKEW QUAD	IPM0L02 / MQS0L02
CORRECTOR	MBH0L02 H&V
QUAD	MQJ0L02A
BCM (MPS)	IBC0L02M
HELICITY CORRECTOR	MHE0L02H
DIPOLE	MDL0L02

5D BUBBLE CHAMBER LINE

Bend angle = 25° = 0.436332 radian

CORRECTOR	MBH5D00 H&V
BEAMLINE VALVE	VBV5D00
ION PUMP + VIEWER	VIP5D00 (DIG 8) + ITV5D00
QUAD	MQD5D00
CORRECTOR / BPM	MBH5D00A H&V / IPM5D00
QUAD	MQD5D01
CORRECTOR / BPM	MBH5D01 H&V / IPM5D01
VACUUM COLD GAUGE	VCG5D01
FARADAY CUP + VIEWER + ION PUMP	IFY5D01 +ITV5D01 +VIP5D01 (DIG 8)

2D 5 MeV SPECTROMETER LINE

Bend angle = -30° = -0.523599 radian

BEAMLINE VALVE	VBV2D00A
BLM (MPS)	ILM2D00A
BPM	IPM2D00
HARP	IHA2D00
ION PUMP	VIP2D00A
VIEWER	ITV2D00
BLM (MPS)	ILM2D00B
DUMP (1 kW)	IDL2D00

3D MOTT POLARIMETER LINE

Bend angle = -12.5° = -0.218166 radian

CORRECTOR	MAD3D00 H&V
BEAMLINE VALVE	VBV3D00A
VIEWER+ION PUMP	ITV3D00 + VIP3D00A (DIG 12)
MOTT VIEWER	IFL3D00
TARGET LADDER	ITG3D00
ION PUMP	VIP3D00B (DIG 12)
DIPOLE	MDT3D01
DUMP (1 kW LCW/34 W air)	IDL3D00

ELECTRON DUMP (1 kW LCW)	IDL5D01
PHOTON COLLIMATOR	IPC5D01
BUBBLE CHAMBER	ITG5D01
PHOTON DUMP	IDL5D01A

Dump shielding removed.
No beam in 5D-line allowed.
(9/1/18)

IFY0L03
FARADAY CUP 2 (1 kW)

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Source Material Used:

12 GeV Song Sheets:	ACC-000-2845-001	rev. C	1/15/2021
	ACC-000-2845-002	rev. 4	
	ACC-000-2845-003	rev. 11	
	ACC-000-2845-004	rev. 9	
	ACC-000-2845-029	rev. 7	

Revision Notes:

17: Updated Gun -> Choppers, AIPINJ Phase I, Spring 2021
Added EPICS PVs and Songsheet names for RF elements, added chopper slit + central plug PVs

16: Added approximate locations of PSS Rapid Access CARMs. Differentiated symbols for helicity correctors vs 30Hz correctors. Updated BLM symbols and placement, cross-referencing https://opswiki.acc.jlab.org/wiki/BLM_List. Added cryomodule Cold Cathode Gauges and Ion Pumps. Added site phones. Corrected/differentiated nominal-E vs E-gain from RF element.

15: Removed Gun #3 line and replaced with Cathode prep and storage chamber. Updated correctors in 2I-region.

14: Added drawing of viewer to P.2 by request (based on CEBAF DWG. No. 58432-C-0254 rev. A).

13: Corrected locations of the PSS and MPS BCM's
Used blue labels for RF components

12: Added Brock Cavity (ICB0I01) between A1 and Wien #2 (per email from Marcy 7/1/15)

11: Corrected position of MBH0L03 H/V (moved upstream of ITV0L03)
MQS0L02 and IPM0L02 are colinear, rather than in series
corrected per elog 3316769 1/8/2015

10: Removed ICB1D00 (Brock Cavity) from 1D line
Added VFV0L01 fast valve
Added detail page for 2D, 3D, and 5D lines (main drawing was too cluttered)
Added bubble chamber components to 5D line
Renamed 500 keV Spectrometer -> 1D Spectrometer
Added bend angles for all spurs and the chicane
Corrected various mistakes throughout