MAGNETMECHANICAL DESIGN OF THE BOOSTER TO STORAGE RING TRANSFER (BTS) LINE FOR APS UPGRADE*

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TUPP03

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ABSTRACT

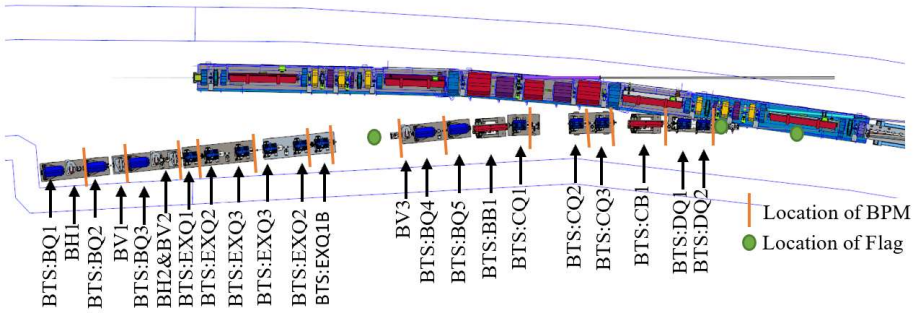
The APS Upgrade selected the horizontal injection scheme which requires exchanging the x and y emittances in the BTS transport line through a series of six skew quadrupoles, as well as matching the beam parameters to the APS Upgrade storage ring through two dipoles and a conventional pulsed septum. This paper presents the layout of this BTS line section in the storage ring tunnel and key components in this section including the mechanical design of dipole magnet, quadrupole and skew quad magnets, the vacuum system, the diagnostics system, and the supports. Finally, detailed mechanical design of this BTS line section in modules and some consideration for fabrication and installation are addressed.

OBJECTIVES

- Mechanical design of the section of BTS transport line in the SR tunnel
- Mechanical design of BTS components including magnets, vacuum system, diagnostics, support tables

LAYOUT

- Total 23 magnets: 10 normal quadrupoles, 6 skew quadrupoles, 2 dipoles, 5 correctors
- Total 14 BPMs, 3 Flags, and one Beam Loss Monitor



DESIGN REQUIREMENTS

- Dipole magnet parameters

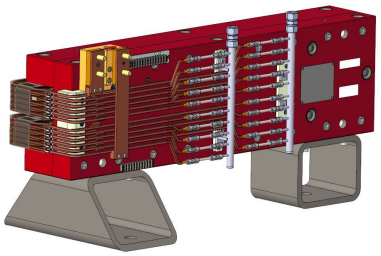
Parameter	Value	Unit
Length	1.18	m
Angle	0.07846	radian
B	-1.4	T
Critical energy	33.9	keV
SR Power	0.002023	W

- Normal and skew quadrupole magnet parameters

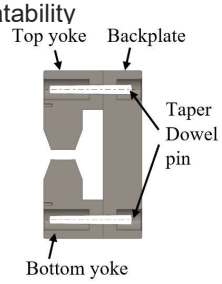
Parameter	Value	Unit
Length	0.482	m
Aperture	26	mm
Max required integrated gradient	27.9	T
Min required integrated gradient	7.8	T
Max integrated corrector	0.0077	T-m

DIPOLE DESIGN

- Mechanical design

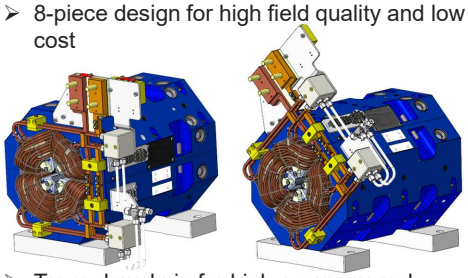


- 3-piece design for high accuracy and repeatability

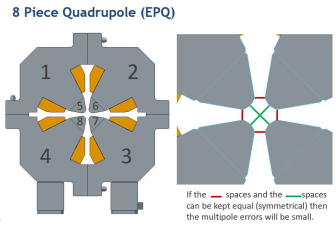


NORMAL AND SKEW QUAD DESIGN

- Mechanical design, same geometry but different orientation
- 8-piece design for high field quality and low cost

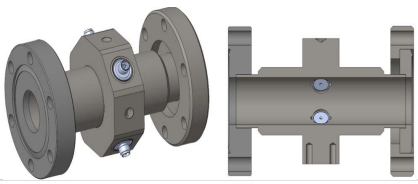


- Taper dowel pin for high accuracy and repeatability



BPM DESIGN

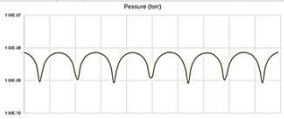
- 4-button BPM design
- 3 survey cups on the SS holder for alignment



VACUUM SYSTEM DESIGN

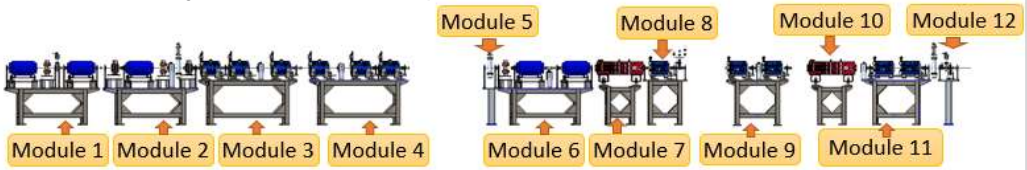
- Overall length is 27.4 m, ID Φ22 and Φ10 mm
- Target pressure < 5 x 10^{-9}

Item	Qty	Company	Part Number	Color
45 L/s Ion Pump	7	Gamma Vacuum	45SDI2VSCNN	Red
2.75" Gate Valve	2	VAT Vacuum	48132-CE24	Blue
Manual Hand Valve	4	VAT Vacuum	54132-GE02	Green
Vacuum Gauge Set	1	Televac	2-2120-052 and 2-2416-053	Purple
RGA Head	1	MKS	835100-YG-1D	Orange



MODULAR DESIGN

- Group into 12 modules for efficient module assembly and installation;
- All components pre-assemble into modules, fiducialized, and delivered as modules
- Vacuum system in each module will be blanked off and backfilled with ½ psig dry N_2
- Alignment requirement for magnet to refence line within a module is 50 μm rms and module to adjacent module is 100 μm rms



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