14th ICFA Mini-Workshop on Septa Devices in Accelerators

Tuesday, March 1, 2005 Summary

Thin Magnetic Septa

Thin Magnetic Septa for J-PARC

Speaker: Yoshitsugu Arakaki

- Opposite Field Septum Magnet System
- High Velocity Water Systems
- Introduction to the HIP process
- Use of SST tubing
  - Erosion resistance
  - Oxidation reduction

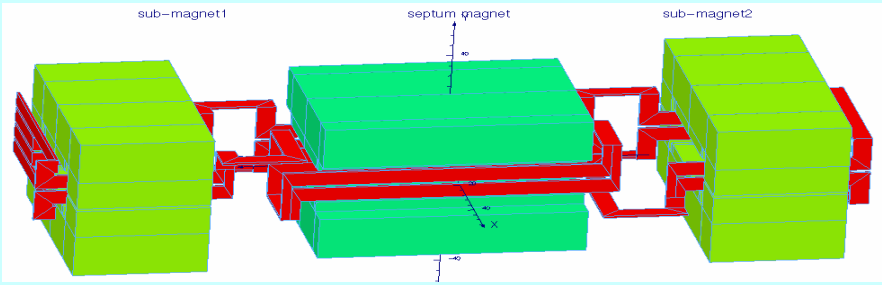
History, Evolution, and Design of Thin Septum Magnets at BNL

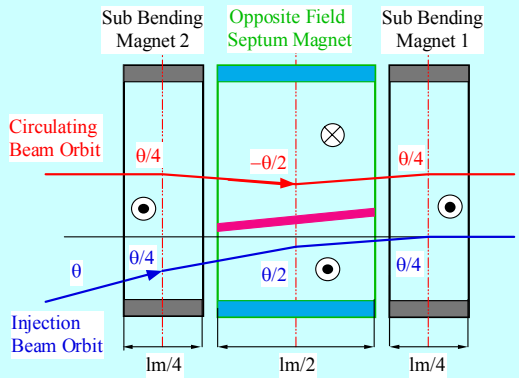
Speaker: Mike Mapes

- Original F5 design
- Porcelain Coating and Applications
- BNL Brazing Capabilities
- Latest D3 design
- Proposed RSVP designs

Opposite Field Magnetic System for the J-PARC Main Ring Injection

Speaker: Izumi Sakai





- The opposite-field type septum magnet combined with sub-bending magnets has unique features compared with normal septum magnets as a force-free structure and cancellation of the leakage flux at the septum.
- The force-free structure permits thin septum magnets, pulse excitation and a structure such that the septum conductor is set inside of the vacuum for a low evacuating load.
- The system is applicable to injection / extraction septum magnets for many kinds of accelerators.

Design of DC-Septum magnets of the injection and extraction system of the Rapid Cycle Synchrotron(RCS) for the J-PARC

Speaker: Taihei Shimada

- Ceramic coating is used as the electronic insulation material due to its strength against high radiation (>>100MGy).
- All cooling pipes are made of SUS304; non-magnetic stainless steel(SUS304) due to its hardness against erosion and corrosion by the flow of cooling water.
- Durability of coils has priority over the cost of power supplies and power feeds
- Septum magnets are designed to operate in DC excitation current for mechanical stability and to use in low voltage to be easy to insulate.
- Septum magnets are operated in the air (out of the vacuum), to avoid an accident of cooling water leaking into the vacuum system of the ring.

DESIGN PARAMETERS of SEPTUM MAGNETS

		Injection		Dump		Extraction			Injection
	unit	入射用 SEPI-1	入射用 SEPI-2	廃棄用 SEPD-1	廃棄用 SEPD-2	出射用 SEPE-1	出射用 SEPE-2	出射用 SEPE-3	可変偏向 KHD
number of magnets	台	1	1	1	1	1	1	1	2
particle		400Mev,H-	400Mev,H-	400Mev,H+	400Mev,H+	3GeV,H+	3GeV,H+	3GeV,H+	400Mev,H+
field strength	T	0.487	0.439	0.501	1.086	0.695	1.402	1.659	0.4195
effective length	mm	1400	800	1000	1000	900	1000	1000	300
gap width	mm	370	348	368	622	336	521	743	406
gap hight	mm	136	136	136	140	223	189	166	160
wave form		DC							DC+AC(3%)
environment		大気中(to operate in air, beam passing in vacuum duct in gap)							
min. septum thickness (duct+coil+shield)	mm	87	45	51	340	34	90	260	91
material of core		電磁軟鉄 JIS SUYP-1 (electromagnetic soft iron; solid)							0.5mm lamination
mass of core	kg	2515	1212	1724	12297	1751	7747	15004	485
magnetic attraction	tonf	3.69	1.67	2.92	21.84	2.28	31.6	57.2	0.71
excitation current	A	6246	5650	6787	5603	11176	12312	11035	1963
turn number of coils	turn	8	8	8	24	10	16	20	24
conductor size	mm2	16*16-φ10 64*16-φ10	16*16-φ10 64*16-φ10	16*16-φ10 64*16-φ10	16*16-φ10 64*16-φ10	19*19-φ8 76*19-φ8	19*19-φ10 76*19-φ10	18*80-φ10	16*16-φ10
max. current density	A/mm2	35.2	31.8	38.2	31.6	48.5	43.6	8.5	14
voltage of coil	V	20	14	19	53	33	28	17	22.3
electro-magnetic force	tonf	1.53	0.68	1.25	6.71	3.17	12.68	16.81	0.26
power loss in coil	kW	127	78	127	295	364	285	185	45
no.of cooling channnel		8	8	8	24	20	16	20	24
cooling of coils		強制循環水直接水冷(water)							
flow rate	l/m	75	75	75	226	189	151	115	40
flow speed	m/s	2	2	2	2	2	2	1.2	2
pressure loss	kgf/cm2	0.77	0.7	0.73	0.75	0.75	0.76	0.32	3.16
temp. rize	℃	24	18	24	19	28	27	23	17

Septa Devices for SNS

Speaker: Jim Rank

- SNS Extraction Lambertson Septum Magnet Design and Construction