Status of Scaling FFAG System

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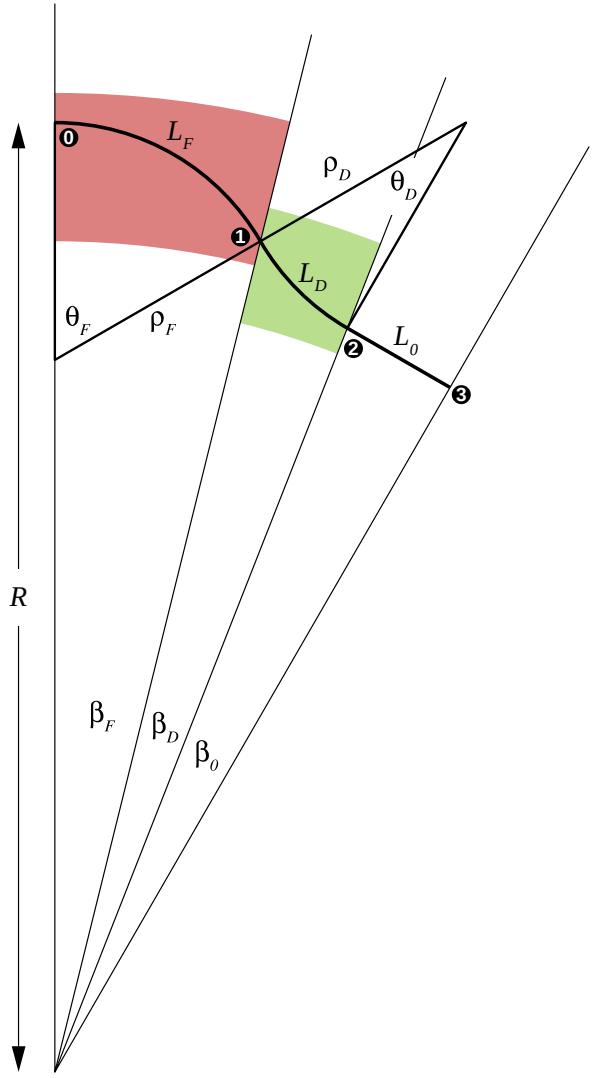
NuFactJ Parameters

- Need a description of the field in the FFAG
- NuFactJ report: description based on arcs of sector magnets, run in SAD
- Need to convert to

$$B(r,\theta) = B_0(\theta)(r/r_0)^k$$

$B_0(\theta)$ piecewise constant

- Geometry determined, only specify fields
- For some lattices, no reasonable guess works



Original Table

Lattice number	1	2	3	4	5	6
p_{min} (GeV/c)	0.3	0.3	1	1	3	10
p_{max} (GeV/c)	1	1	3	3	10	20
Cells	32	16	64	32	64	120
Field index	50	15	190	63	220	280
Average radius (m)	21	10	80	30	90	200
Field (T)	1.8	2.8	1.8	3.6	5.4	6.0
β_F (mrad)	26	52	12.7	26	12	6.7
β_D (mrad)	18	36	9.3	18	9	5.3
θ_F (deg)	17	26	10.5	16	10	6.8
Packing fraction	0.45	0.46	0.45	0.45	0.43	0.46
μ_x (deg)	120	131	132	154	157	67
μ_y (deg)	61	103	33	46	23	19
L_0 (m)	2.060	2.120	4.325	3.229	5.046	5.668
$2L_F$ (m)	1.104	1.065	2.041	1.575	2.169	2.685
L_D (m)	0.382	0.367	0.747	0.544	0.813	1.062

My Versions of NuFactJ Lattices

- Try to fit the tunes, assuming those were chosen carefully
- Can't do this by just varying fields: degeneracy due to scaling
- Vary β_F, B_D, keeping β_0 fixed

My Versions of NuFactJ Lattices
Parameter Table

Lattice number	1	2	3	4	5	6
p_{min} (GeV/c)	0.3	0.3	1	1	3	10
p_{max} (GeV/c)	1	1	3	3	10	20
Cells	32	16	64	32	64	120
Field index	50	15	190	63	220	280
r_0 (m)	21	10	80	30	90	200
β_F (mrad)	27.24	57.38	13.25	27.68	12.41	8.16
$2r_0\beta_F$ (m)	1.144	1.148	2.119	1.661	2.234	3.266
B_F (T)	1.958	3.078	1.992	3.938	5.978	6.215
β_D (mrad)	16.76	30.62	8.75	16.32	8.59	3.84
$r_0\beta_D$ (m)	0.352	0.306	0.700	0.490	0.773	0.767
B_D (T)	-2.619	-3.950	-2.821	-5.525	-8.040	-11.946
$2r_0\beta_0$ (m)	2.275	2.167	4.334	3.250	5.056	5.672

My Versions of NuFactJ Lattices
Magnet Parameters and Cost

- Machine costs are huge
- Magnet apertures are large
- Fields are very high
- Note: no cavities in cost!
  - RF system really needs to be defined
  - It looks like it will be really expensive

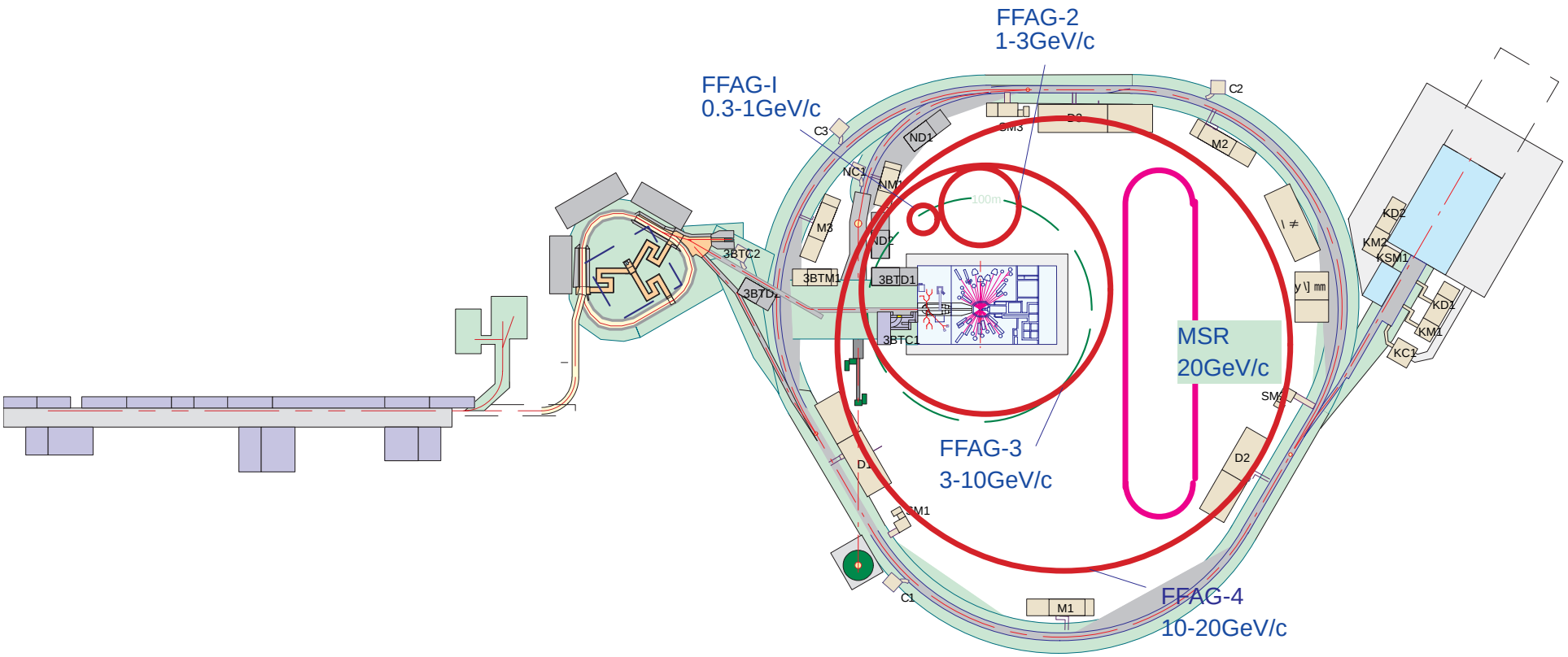
My Versions of NuFactJ Lattices
Magnet Parameters and Cost

Lattice number	1	2	3	4	5	6
L_F (m)	1.125	1.088	2.111	1.640	2.225	3.257
r_F (cm)	58.3	75.0	54.1	59.7	52.9	45.0
x_F (cm)	-35.5	-51.6	-32.9	-37.3	-34.0	-41.1
B_F (T)	3.442	4.355	3.292	6.282	9.493	6.567
L_D (m)	0.345	0.288	0.696	0.482	0.770	0.766
r_D (cm)	52.2	67.2	48.1	52.1	47.4	41.2
x_D (cm)	-40.6	-60.5	-40.4	-45.7	-41.4	-48.5
B_D (T)	-3.450	-4.368	-3.387	-6.316	-9.301	-10.783
Cost (PB)	281	355	396	527	1153	1410

My Impressions from Conversations

- These designs were just supposed to by “typical”
- Constrained to fit inside 50 GeV proton ring
- Nobody did anything beyond the SAD model
- RF systems are all R&D projects

FFAGs on Tokai Campus



Next Steps

- Aiba will adjust F/D ratio (and maybe field index) to get good working tunes
- I will then scale the machine to get a good cost (reasonable fields)
  - If I don't get F/D ratio in time, I can do this scaling based on my lattices
- We won't worry about the size constraint
- Somehow the RF system needs to get defined. . .