

Neutrino Factory Front End (IDS)

Chicane update

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➤ Front End for the IDS Neutrino Factory

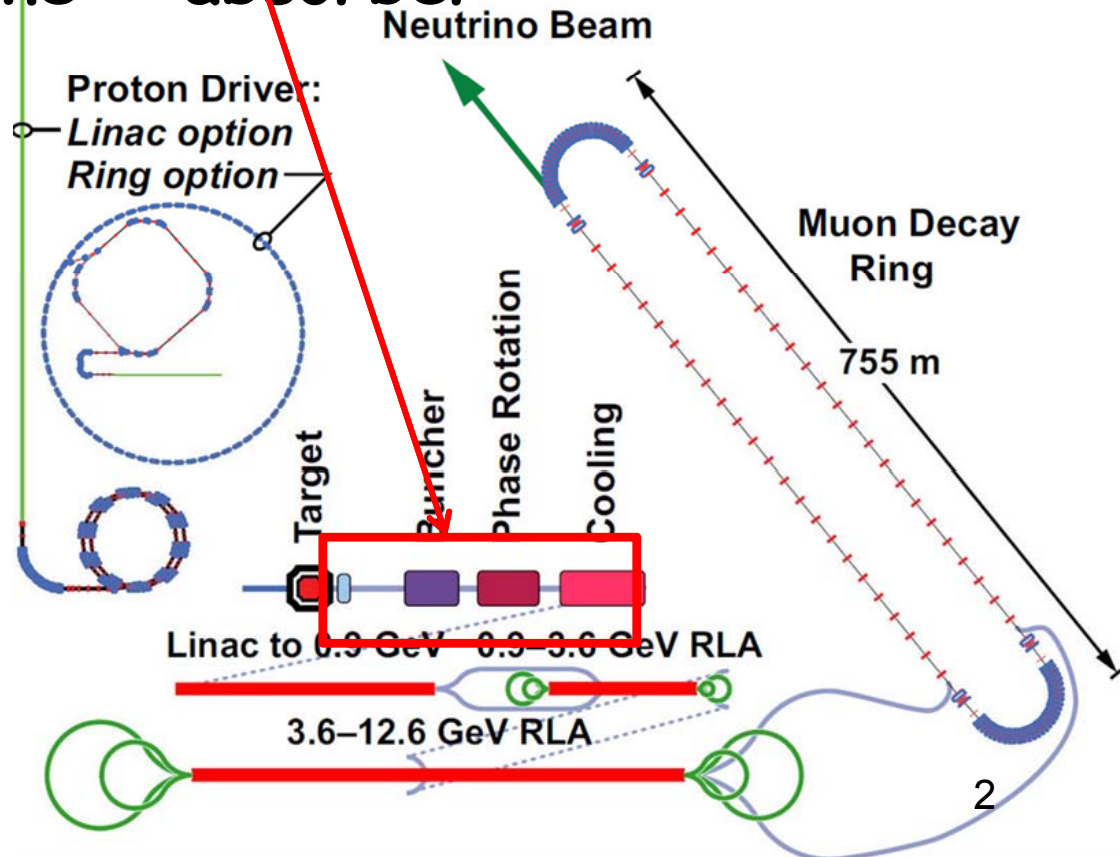
- Losses - control
 - Chicane, proton absorber
 - rematching OK

➤ Re-Match includes chicane + absorber

- similar to baseline
 - less background beam

➤ Discretized rf version

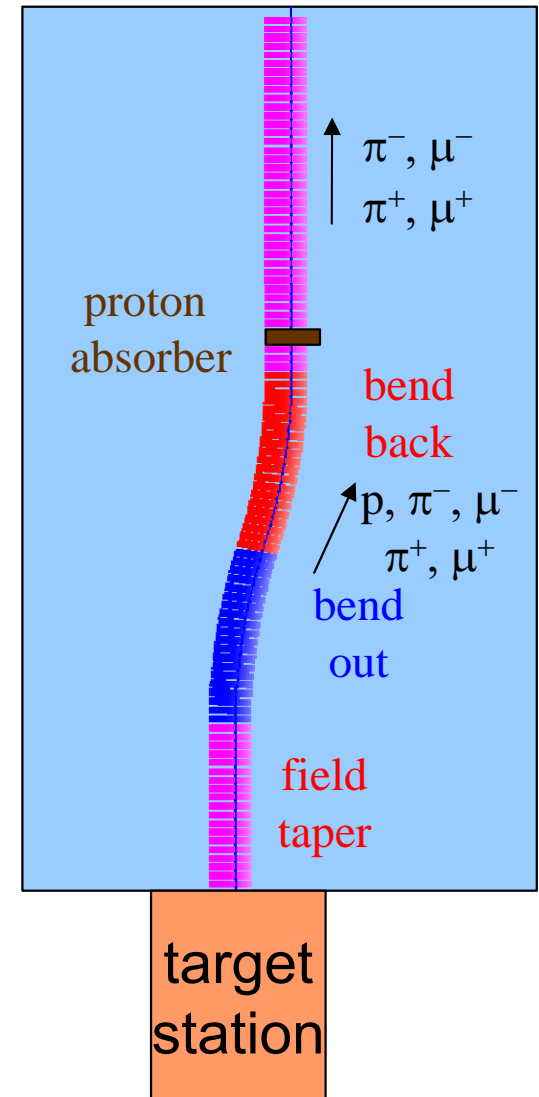
- New today
- fewer rf frequencies



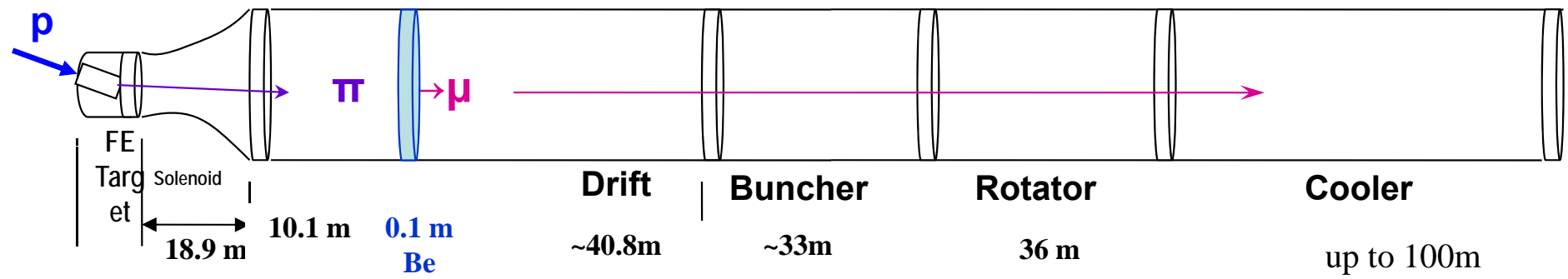
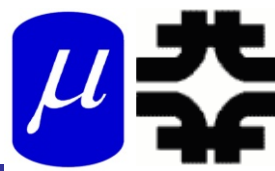
- **ICOOOL version**
 - 2 Bent Solenoids - 10m
 - 5m, 1.5T, 12.5°, 0.27GeV/c
 - 5m, 1.5T, -12.5°, 0.27GeV/c
 - bend radius is 22.92m ($1/r=0.043636$)
 - $B_y=0$
- **Be Absorber – 10cm thick**
- **ICOOOL BSOL element:**

```

SREGION      ! bentsol
5.0 1 1e-2
1 0. 1.0
BSOL
1 1.5 0.0 1 0.27 0.0 0.043636 0.0 0.0 0.0 0.0 0.0 0.0 0.0
VAC
NONE
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
  
```

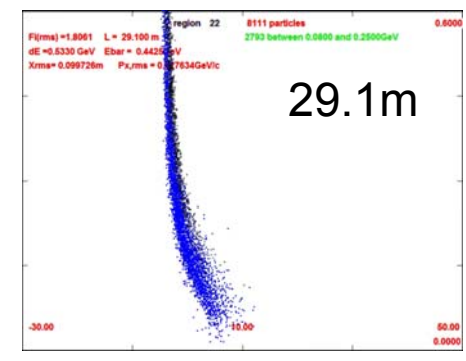
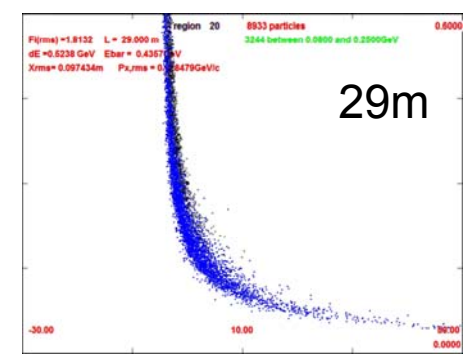


Front End with Absorber-Rematch

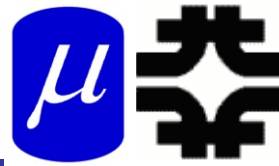


➤ with absorber

- particle 1-270 MeV/c
- particle 2-185 MeV/c
- absorber at 29m
 - 10cm Be
 - particle 1-237 MeV/c
 - particle 2-144 MeV/c
- Bunch N=10
- Rotate N=10.045
- Cool -201.25MHz
 - $p_{ref}=230 \text{ MeV/c}$



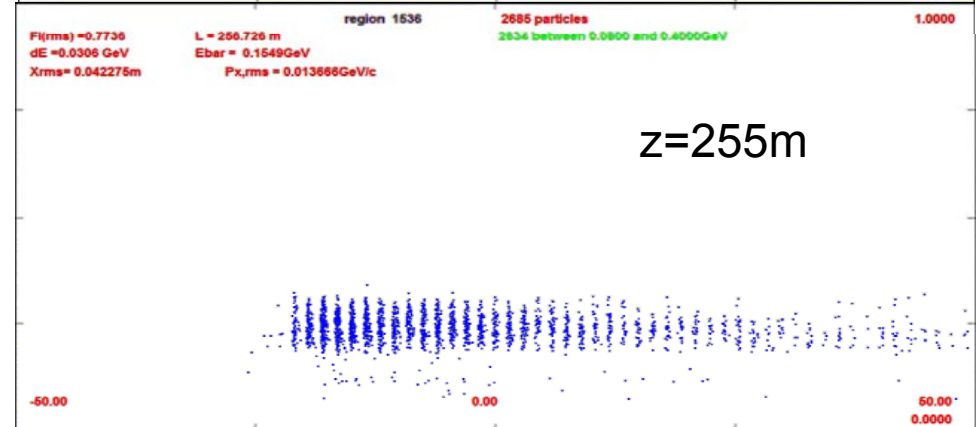
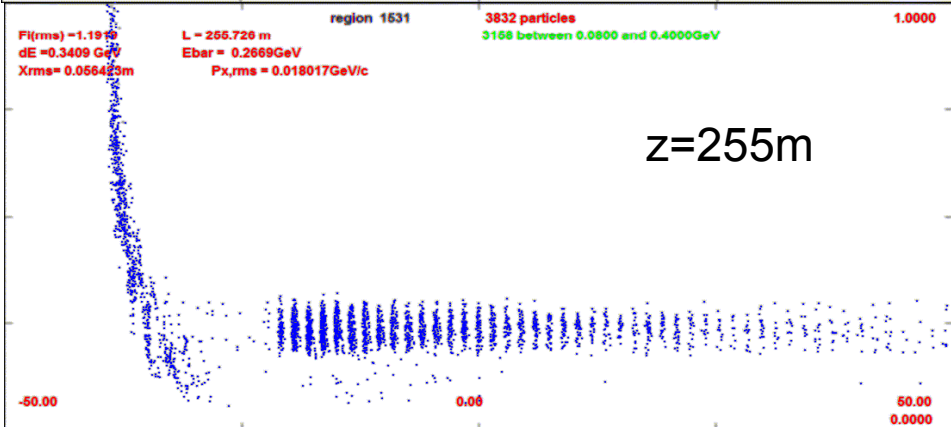
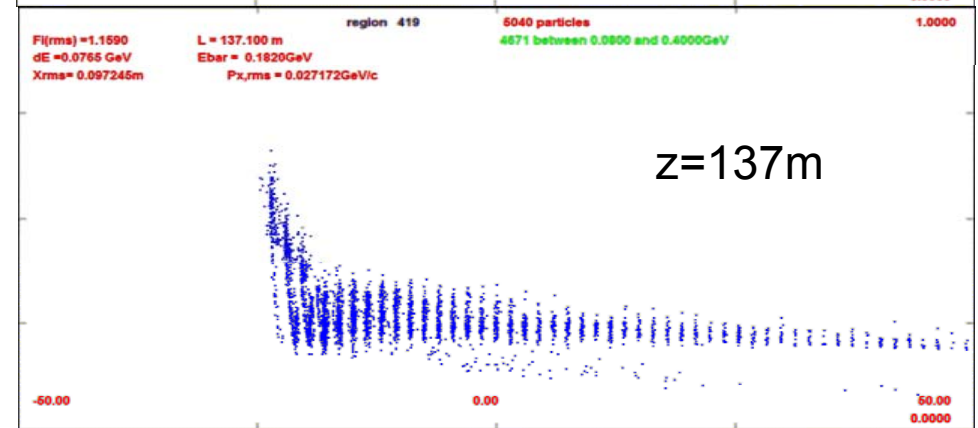
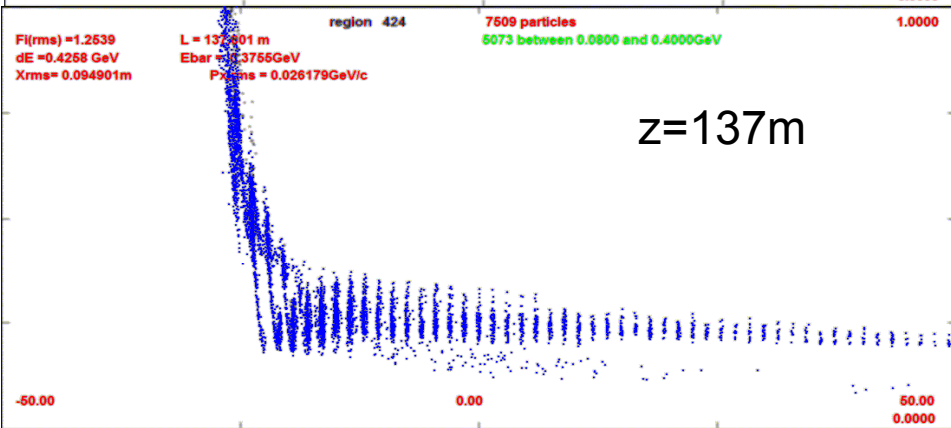
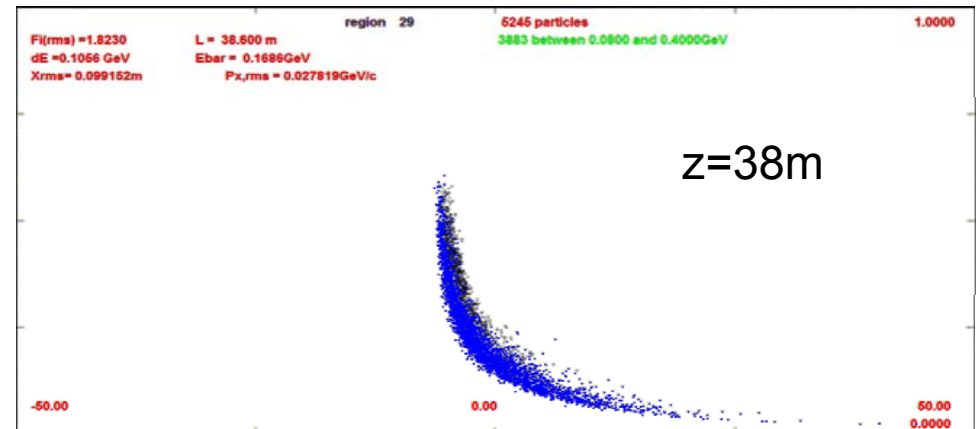
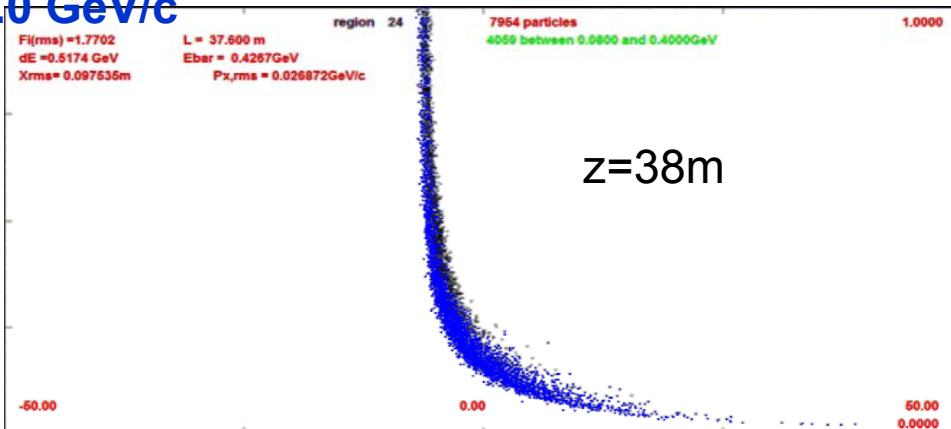
Compare-absorber vs absorber+chicane



This compares absorber only (10cm Be) to chicane (BSOL) + absorber

1.0 GeV/c

0

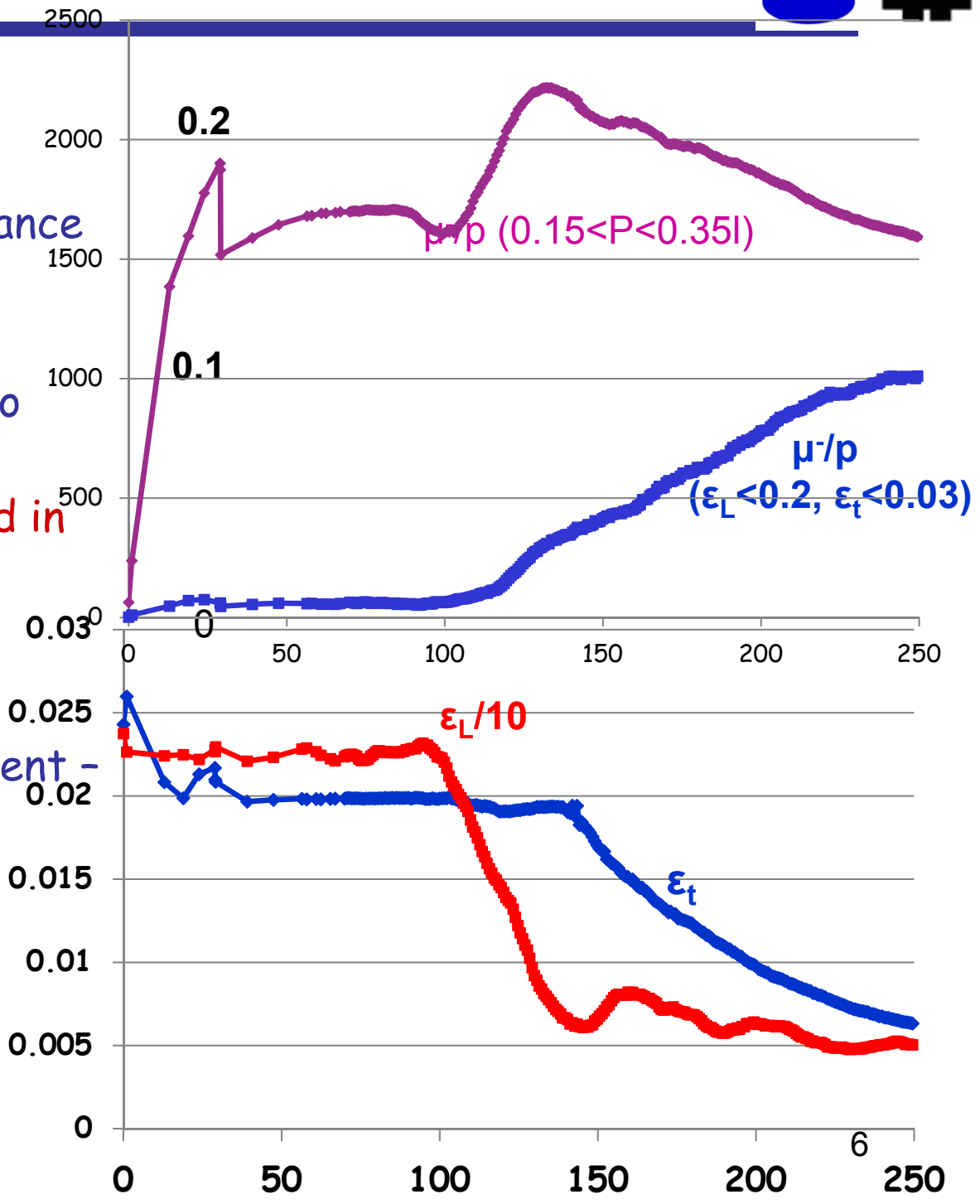


➤ **Similar to without absorber**

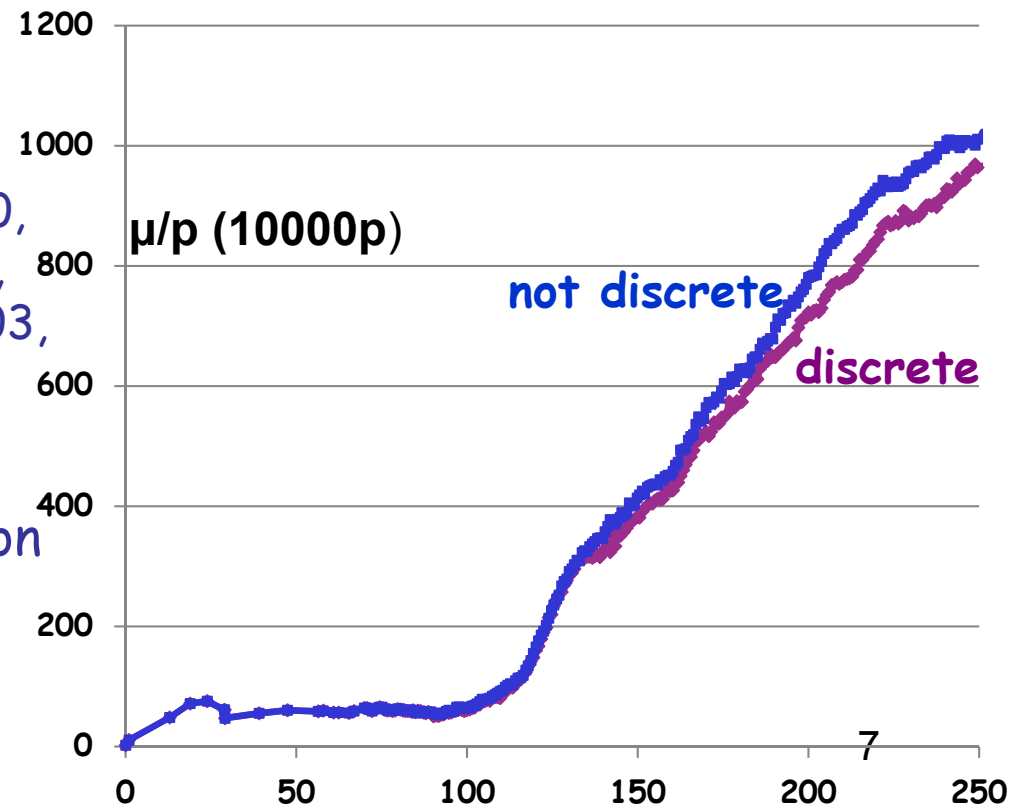
- ~10m shorter drift
- ~10% fewer μ 's within acceptance
- drop of ~20% intensity at absorber
- but longitudinal emittance also reduced
 - surviving μ 's are stretched in longitudinal phase space

➤ **To do**

- include chicane + absorber
- establish beam loss improvement - μ loss level
- decide optimal configuration



- Reduce number of frequencies to make implementation more “practical”
- Buncher is 33m (44 rf cavities)
 - reduce to 14 frequencies
 - 358.92, 341.02, 328.73, 317.27, 306.63, 296.65, 287.31, 278.53, 270.28, 262.50, 255.16, 248.21, 241.63, 235.40
- Rotator is 36m (48 rf cavities)
 - reduce to 18 frequencies
 - 231.55, 228.01, 224.87, 222.06, 219.60, 217.31, 214.82, 212.26, 210.10, 208.27, 206.75, 205.49, 204.47, 203.65, 203.03, 202.57, 202.28, 202.13
- Performance slightly reduced
 - more sensitive to rotator discretion



➤ Buncher

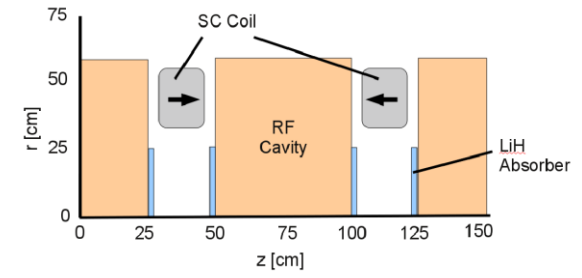
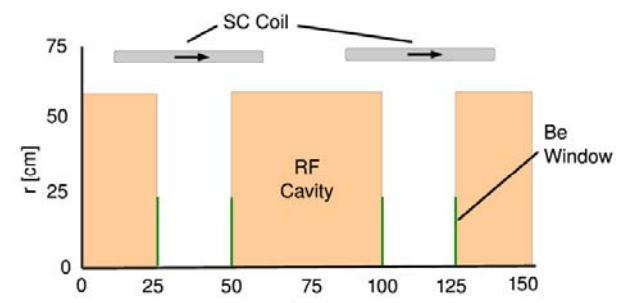
- 44 cavities (14 frequencies)
- 13 power supplies (~1–3MW)

➤ RF Rotator

- 48 cavities (18 frequencies)
- 13 MV/m, 0.5m
- ~2.5MW (peak power) per cavity

➤ Cooling System - 201.25 MHz

- 100 0.5m cavities (75m cooler), 16MV/m
- ~4MW /cavity - most expensive item



Front End section	Length	#rf cavities	frequencies	# of freq.	rf gradient	rf peak power requirements
Buncher	33m	44	358.9 to 235.4	14	0 to 12	~1 to 6 MW/freq.
Rotator	36m	48	231.5 to 202.1	18	13	~2.5MW/cavity
Cooler	75m	100	201.25MHz	1	16 MV/m	~4MW/cavity
Total	~240m	192		33	~1000MV	~550MW 400MW from cooling

- **Neutrino Factory Front End:**
 - Discretized version of front end + Chicane/absorber presented
 - 201.25 MHz version

DILBERT

BY SCOTT ADAMS

