Collimator emittance consideration for ESSnuSB accumulator

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13 July 2018

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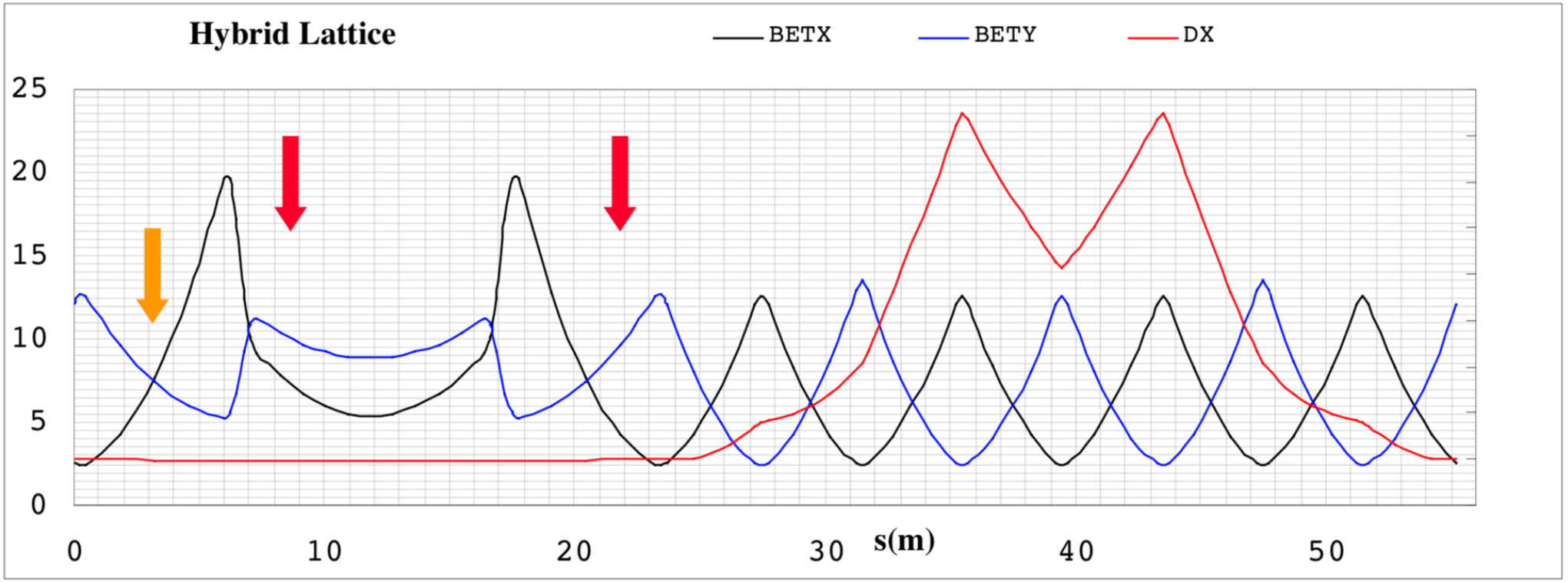
	J-PARC 0.18	J-PARC 0.40	SNS 1.0	SNS 1.3	**ESS 2.0**
beam power MW	0.4	1.0	1.4	2.8	**5.0**
energy GeV	0.18	0.40	1.0	1.3	**2.0**
repetition Hz	25	25	60	60	**14**
ppb	3.33×10^{13}	8.33×10^{13}	1.5×10^{14}	2.5×10^{14}	**1.1×10^{15}**
collimator acceptance*	200 pi	200 pi	300 pi	300 pi	**75 pi**
b^2g^3	0.5011	1.4755	6.750	11.190	**27.58**
B_f, F	0.40, 2	0.40, 2	0.25, 2	0.25, 2	**0.40, 1 ~ 2**
$\triangle Q$	-0.41	-0.35	-0.15	-0.15	**-0.32 ~ -0.64**

- As a quite similar accumulator, why SNS choose 300 pi as the collimator emittance?
- What we should consider about ESSnuSB collimator emittance?

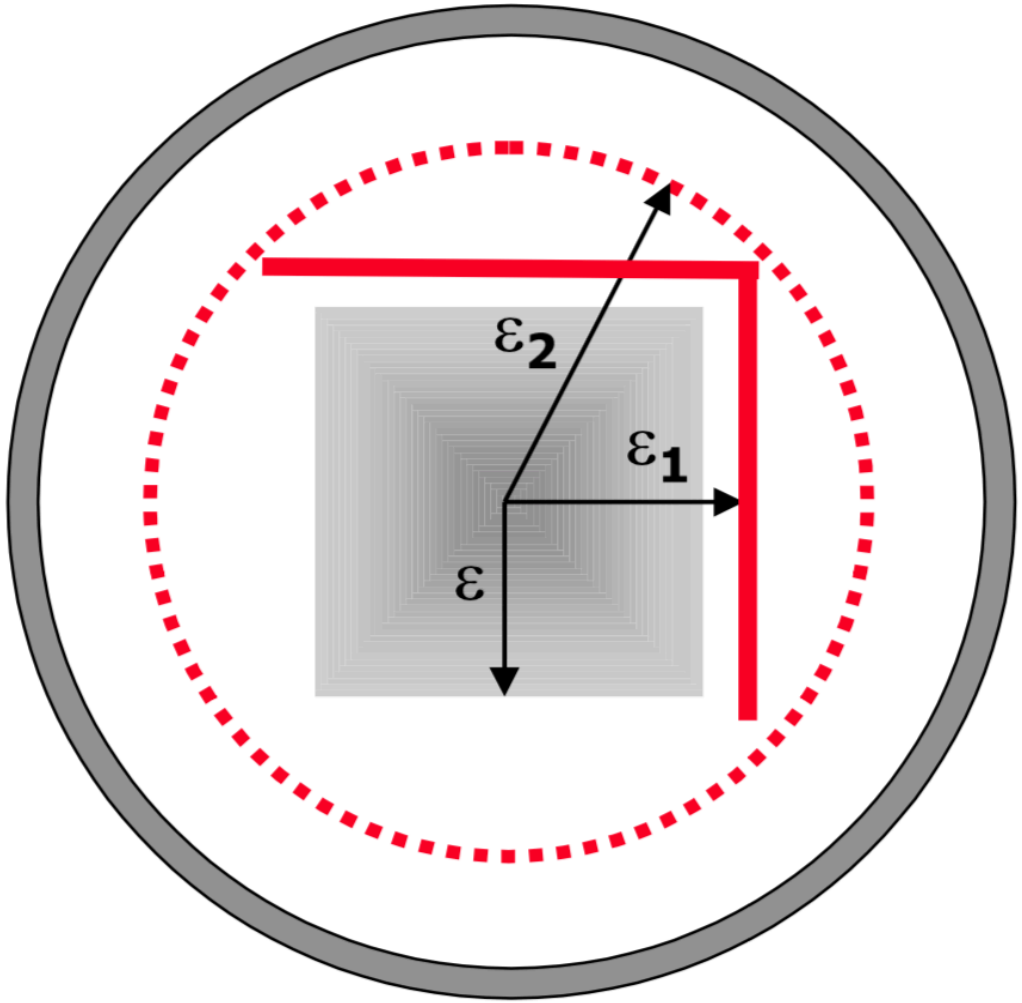
Collimation system for SNS

N. Catalan-Lasheras



- Beam halo is unavoidable and need to be cleaned in the accumulator
- Collimation system: primary and secondary collimators
  - Primary collimator: thin scraper to produce large multiple Coulomb scattering deflection angle with small energy loss
  - Secondary collimators: thick absorber to clean the halo particles
- Clean efficiency should be larger than 90% according to different painting schemes

Correlated painting

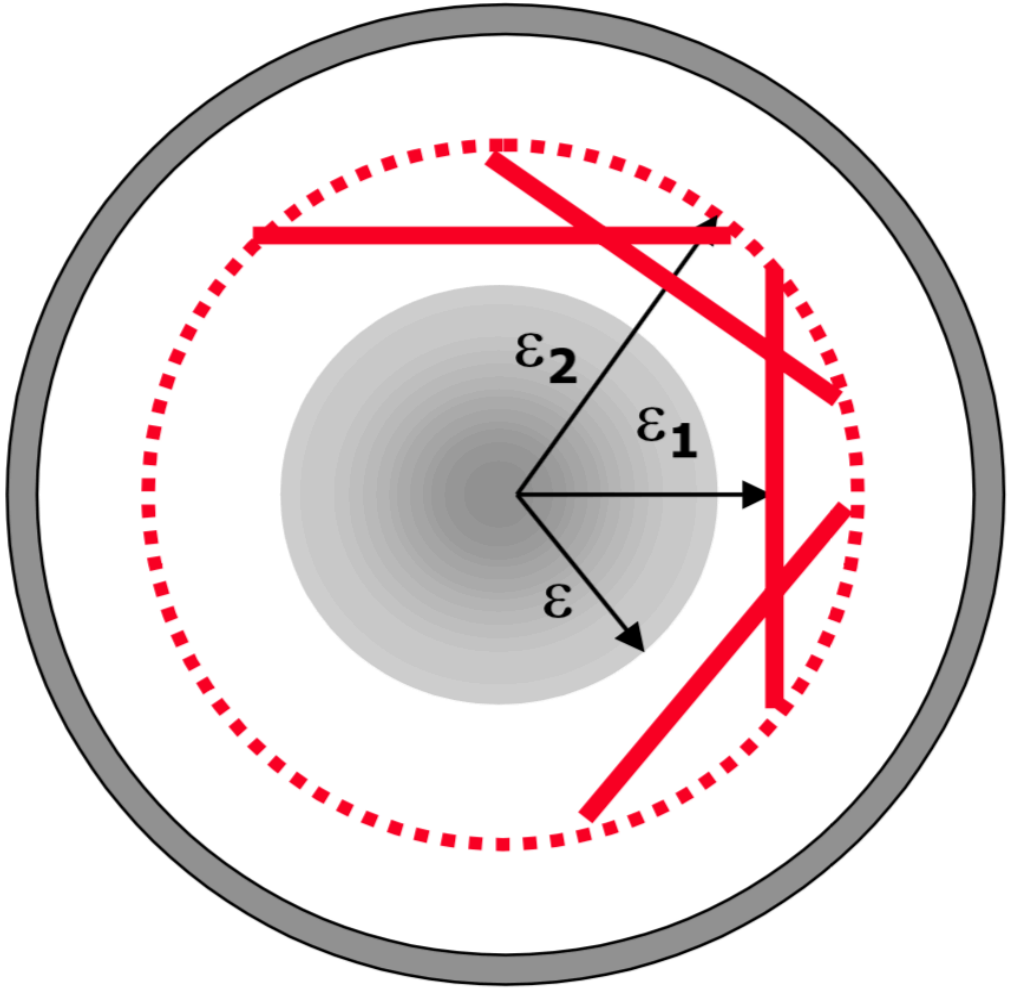


In order to avoid primary halo hitting secondary collimators directly, we need

$$\varepsilon_2 > 2\varepsilon_1 > 2\varepsilon$$

- ε **beam geometric emittance**
- ε_1 **primary collimator emittance**
- ε_2 **secondary collimator emittance**

Anti-correlated painting



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Collimator emittance estimation

	SNS		ESSnuSB75		ESSnuSB100	
	Correlated	Anti-correlated	Correlated	Anti-correlated	Correlated	Anti-correlated
ε	120	160	75	75	100	100
ε_1	140	180	95	95	120	120
ε_2	280	200	190	115	240	140
Coll. Emitt.	**300**		**200**		**260**	

ε beam geometric emittance
ε_1 primary collimator emittance
ε_2 secondary collimator emittance

Unit: π mm mrad

Correlated painting $\varepsilon_2 > 2\varepsilon_1 > 2\varepsilon$

Anti-correlated painting $\varepsilon_2 > \varepsilon_1 > \varepsilon$