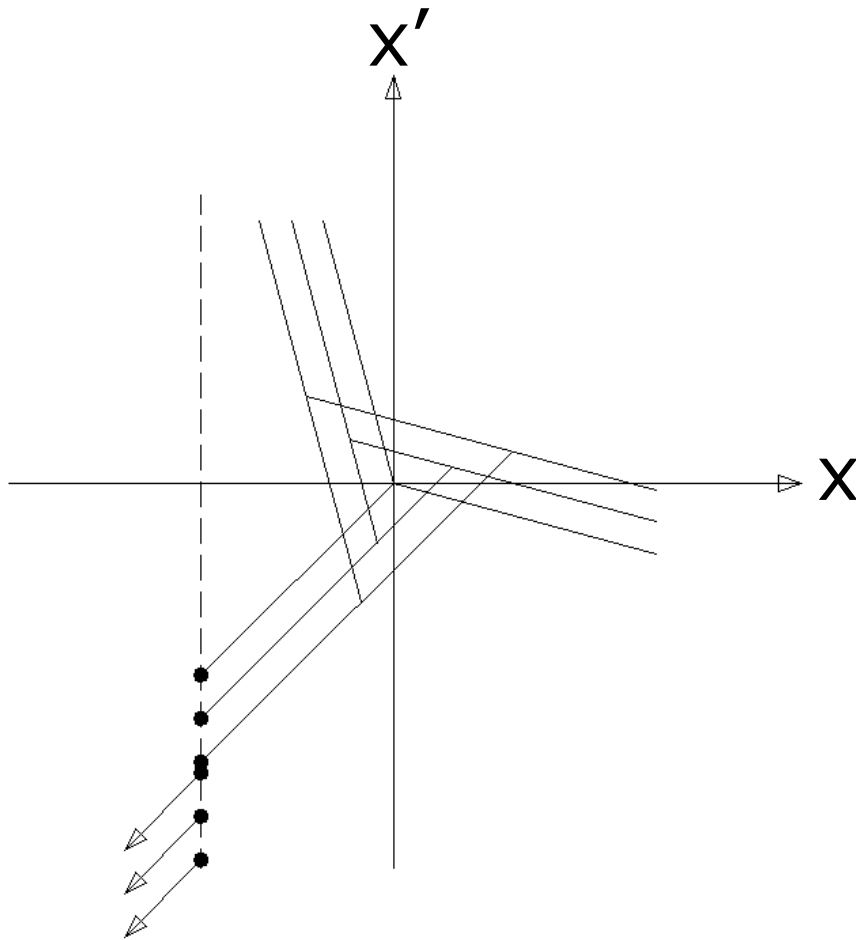# Dynamic Bump Orbit Tuning in J-PARC SX
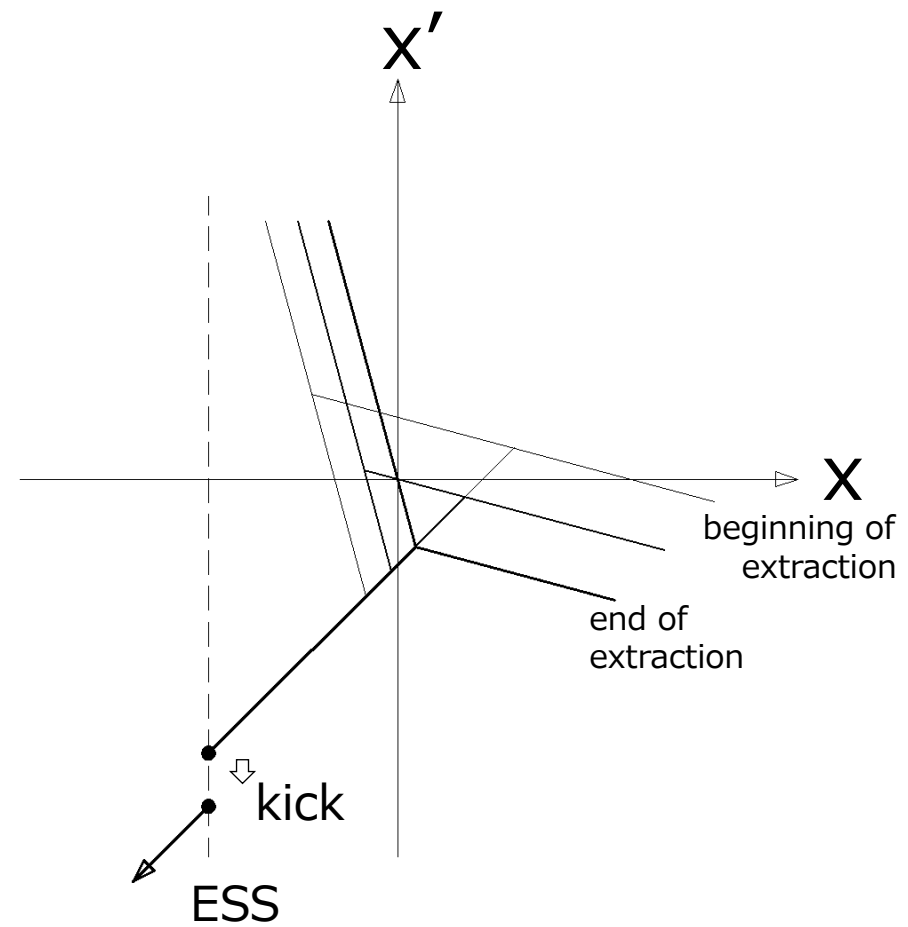
2018.03.13

Ryotaro Muto

Fixed Bump and Dynamic Bump

Separatrices
with Fixed Bump Orbit
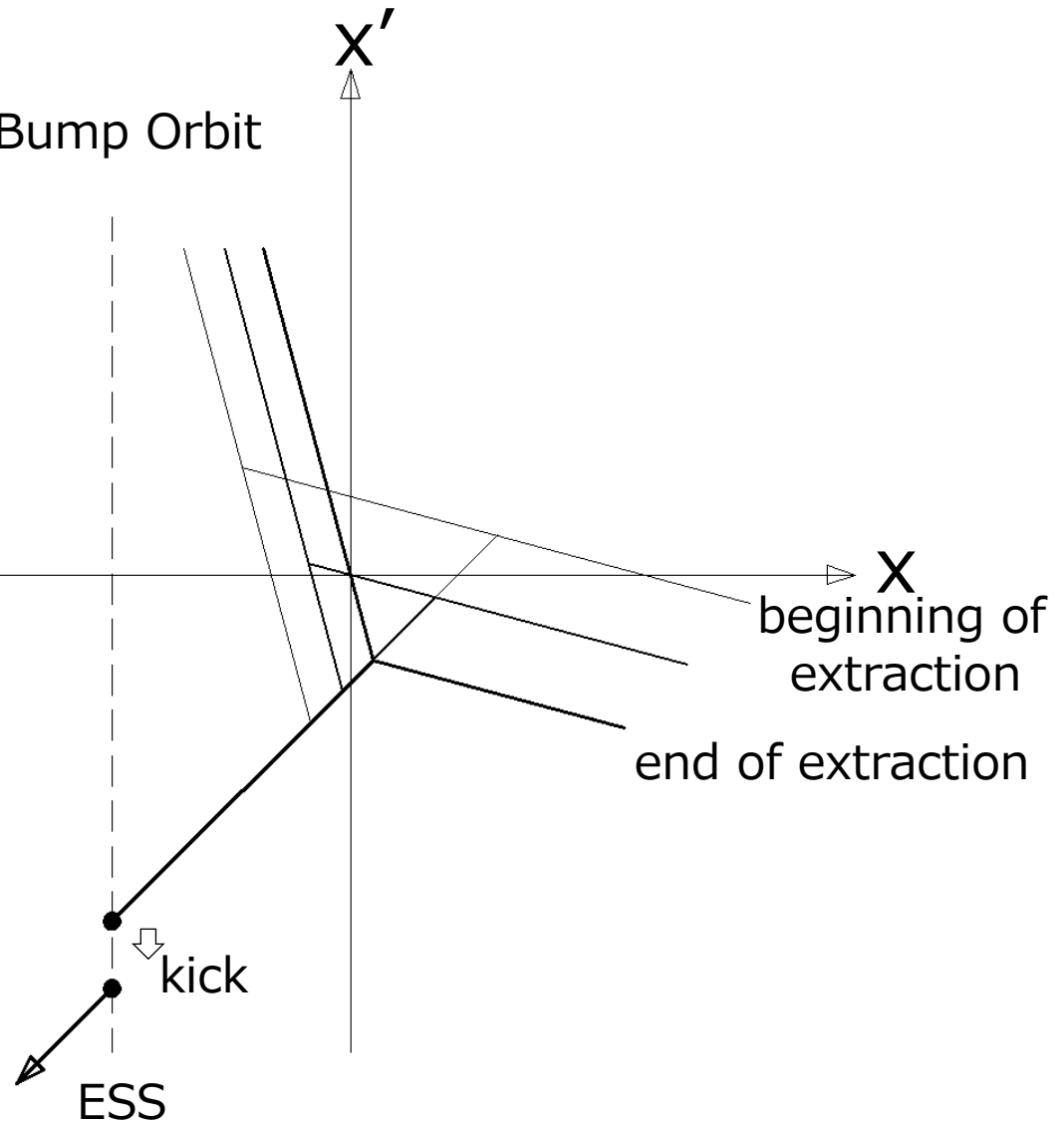
Separatrices
with Dynamic Bump Orbit

Tuning of Dynamic Bump Orbit

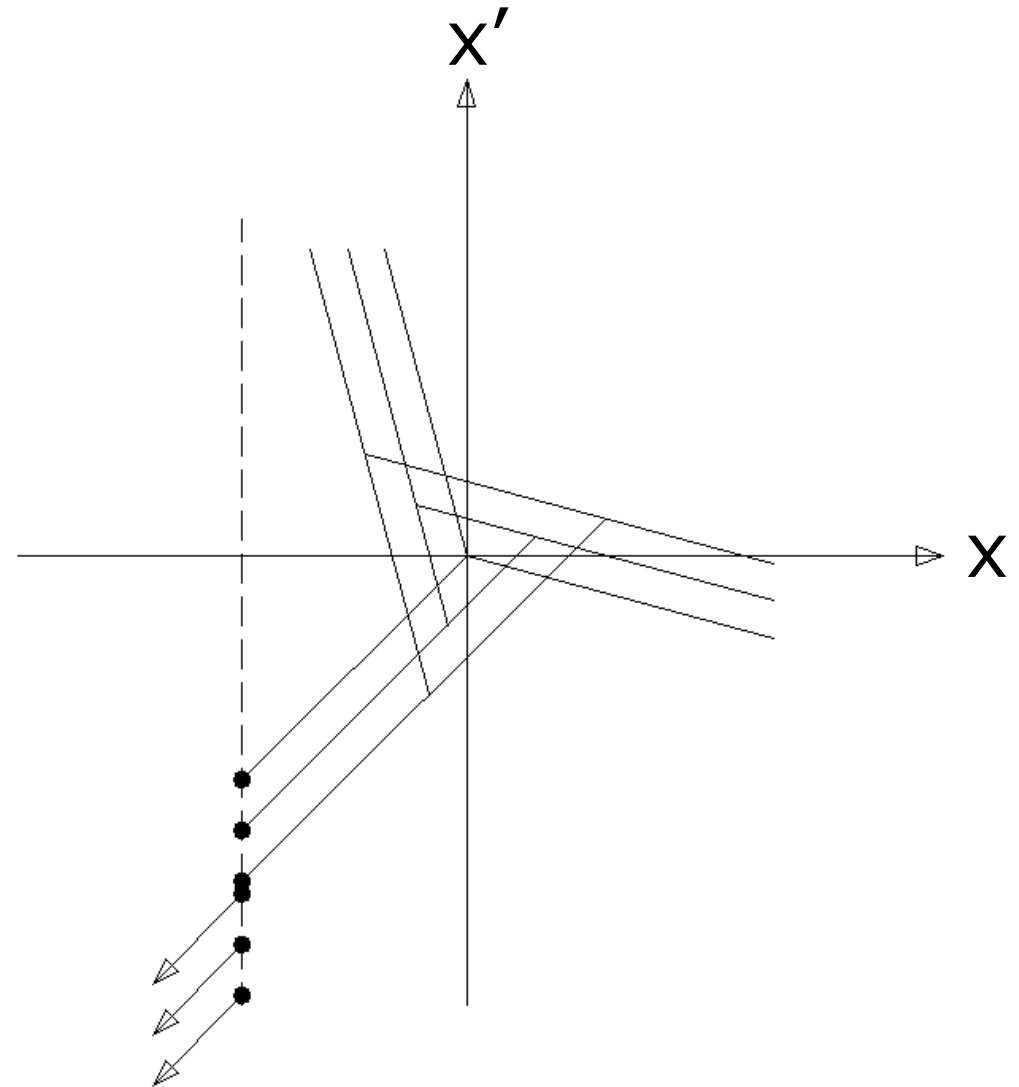Separatrices with Dynamic Bump Orbit

X'

X

Dynamic Bump Orbit
 (which determines the center
of the stable region)
must be synchronized with the
betatron tune
 (which determines the size of
the stable region)

beginning of
extraction

end of extraction

kick

ESS

Tuning in 2017-May~June RUN

In 2017-May~June RUN we had to re-adjust the dynamic bump orbit because ESS configuration was drastically changed due to ribbon trouble
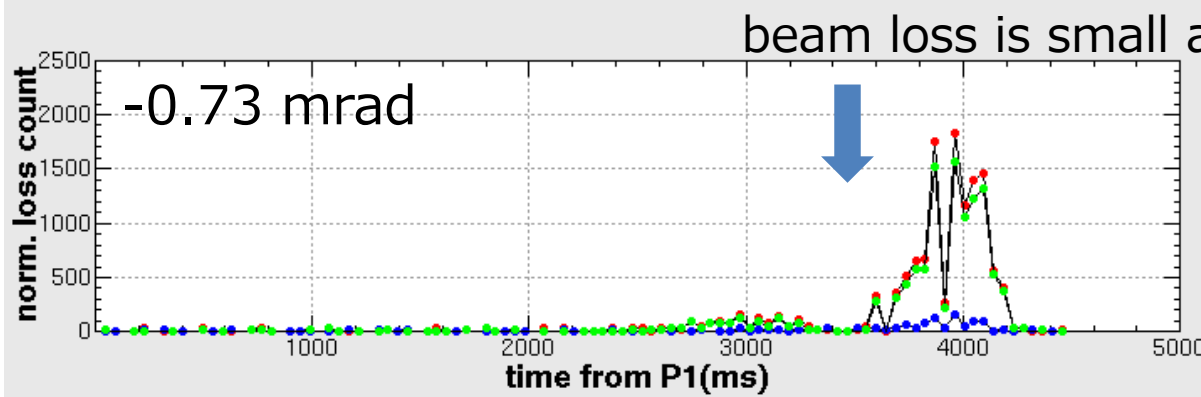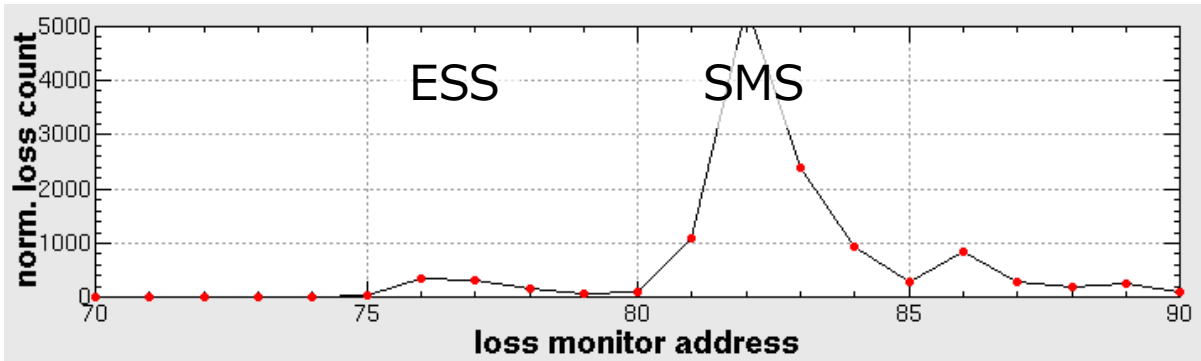
In such a case we start from fixed bump orbit to find correspondence between tune and bump orbit angle which minimize beam loss
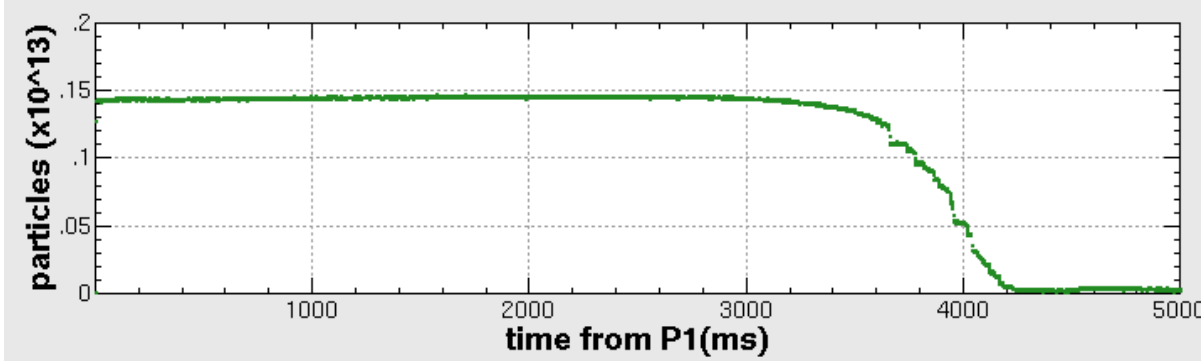
Separatrices with Fixed Bump Orbit
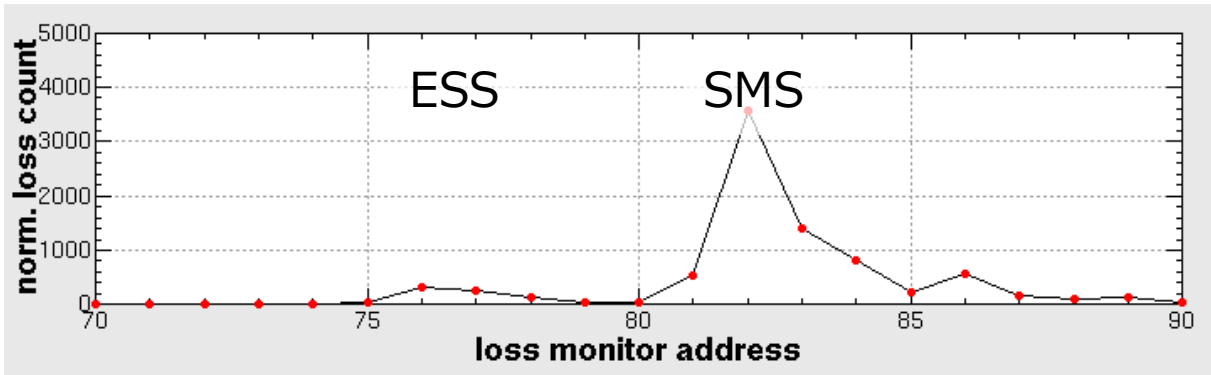
Beam Loss with Fixed Bump Orbit
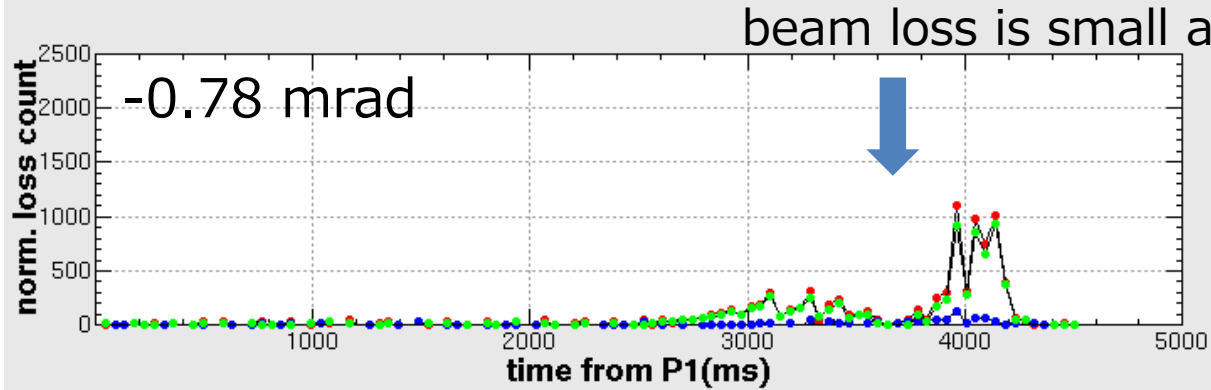

shot #3160
Fixed Bump -0.73 mrad

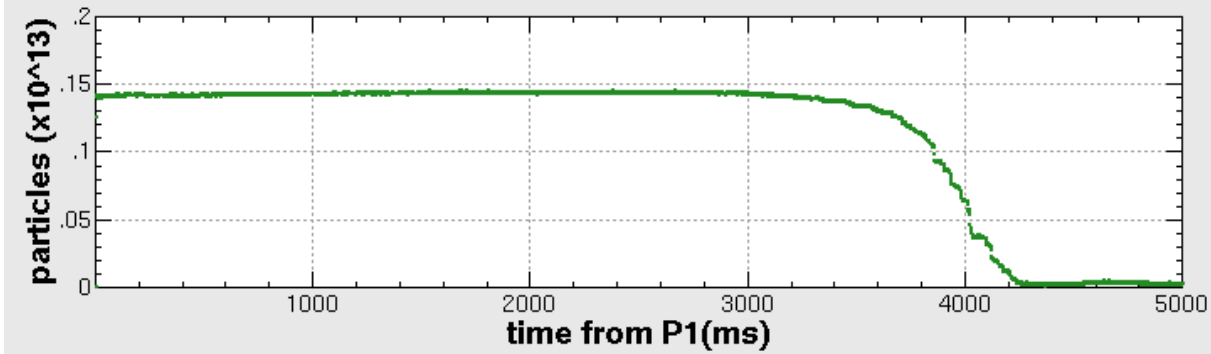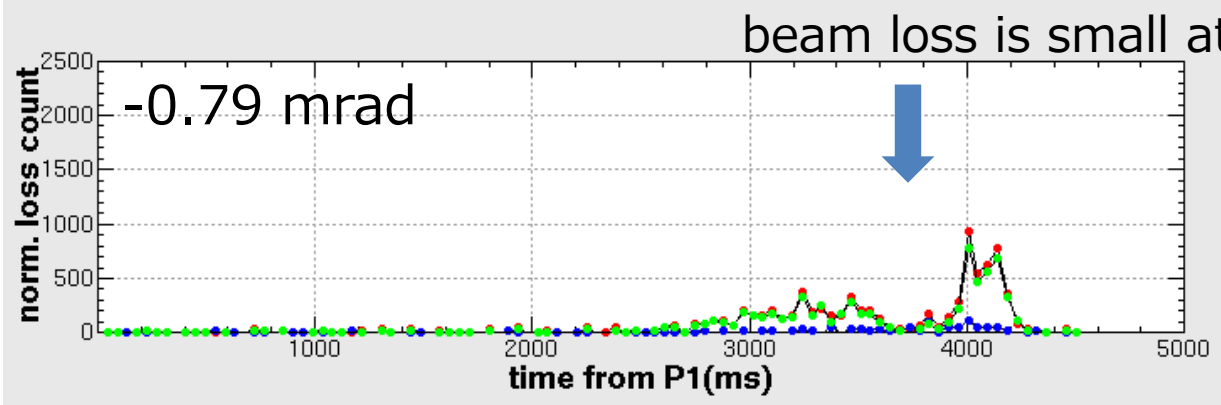betatron tune is
linearly ramped
by lattice Q

Beam Loss with Fixed Bump Orbit
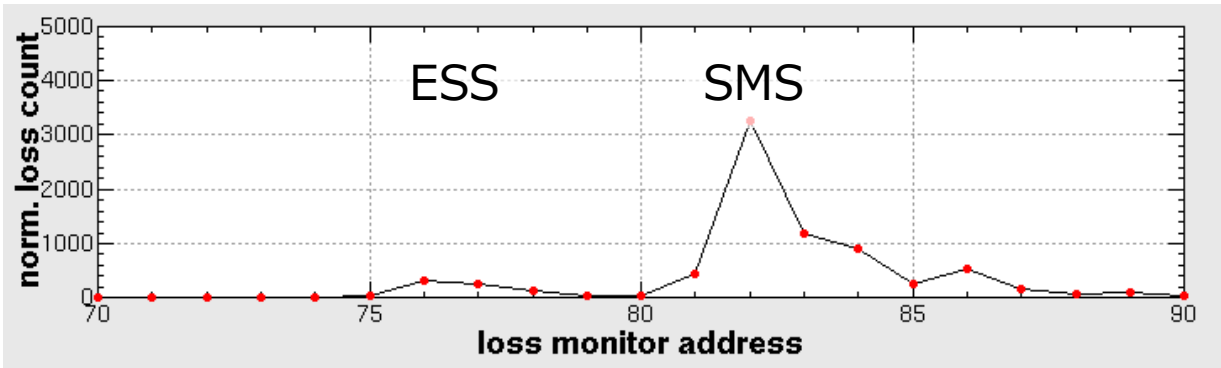

shot #3168
Fixed Bump -0.78 mrad

betatron tune is
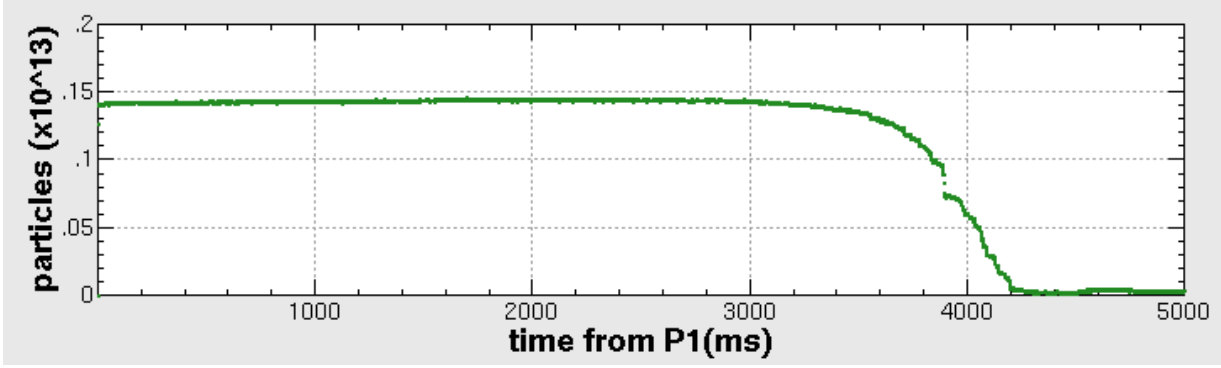linearly ramped
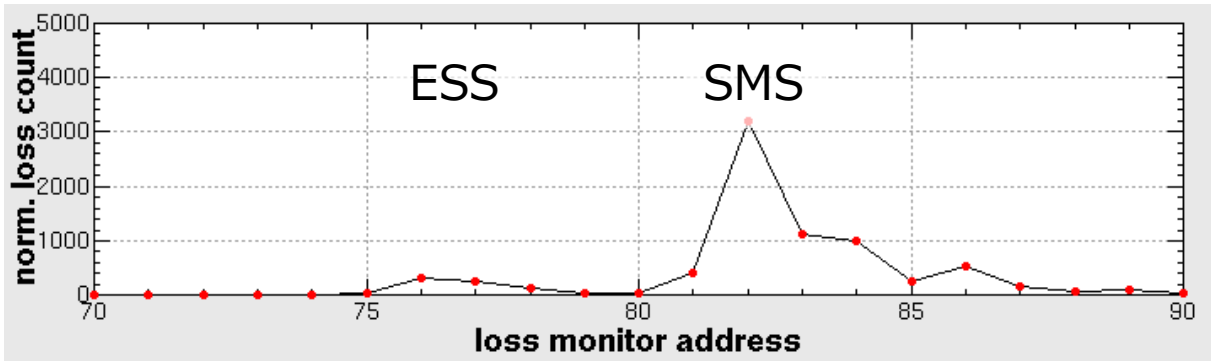by lattice Q

Beam Loss with Fixed Bump Orbit
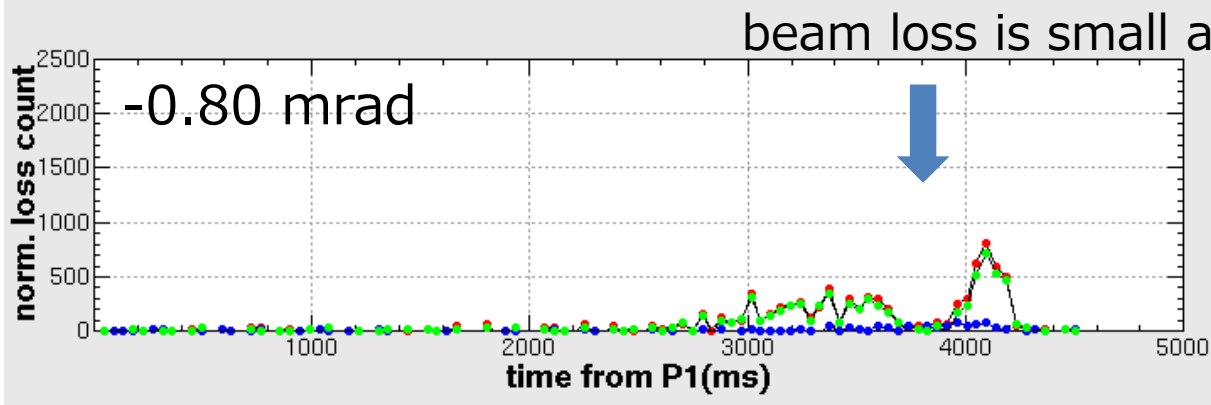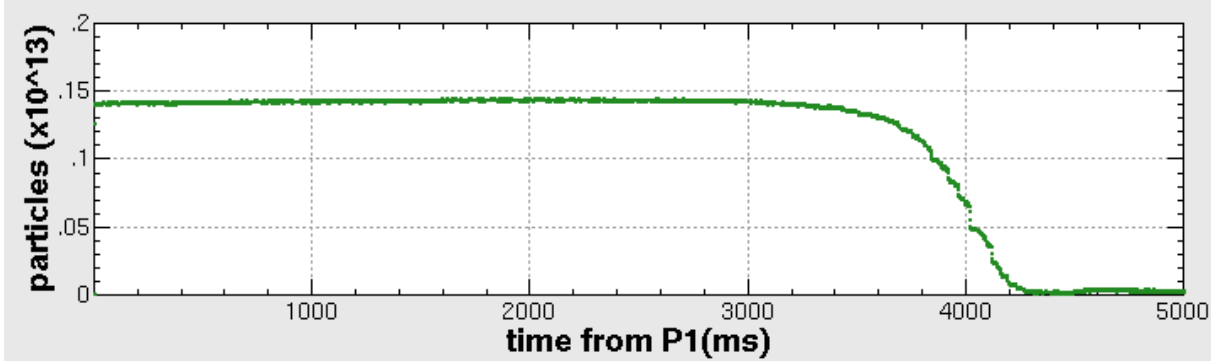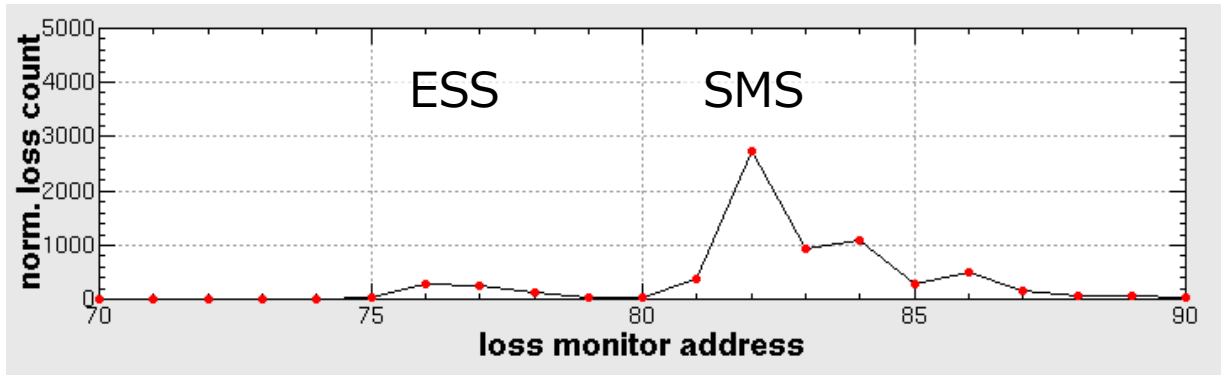

shot #3160
Fixed Bump -0.79 mrad

betatron tune is
linearly ramped
by lattice Q

Beam Loss with Fixed Bump Orbit

shot #3170
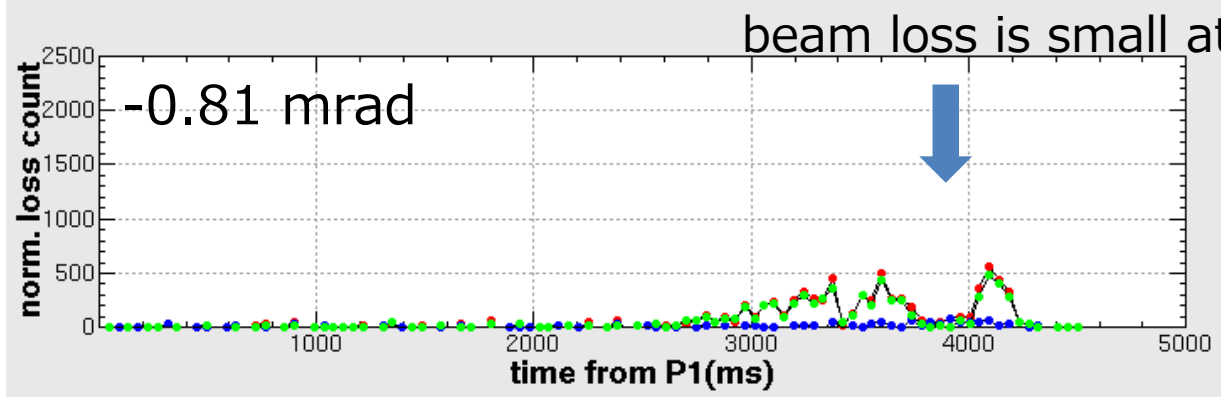Fixed Bump -0.80 mrad

beam loss is small at this timing

betatron tune is
linearly ramped
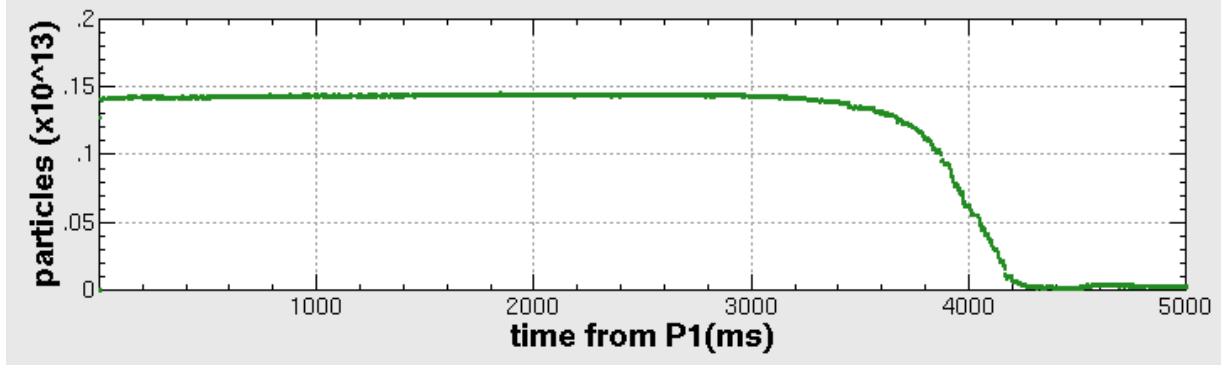by lattice Q

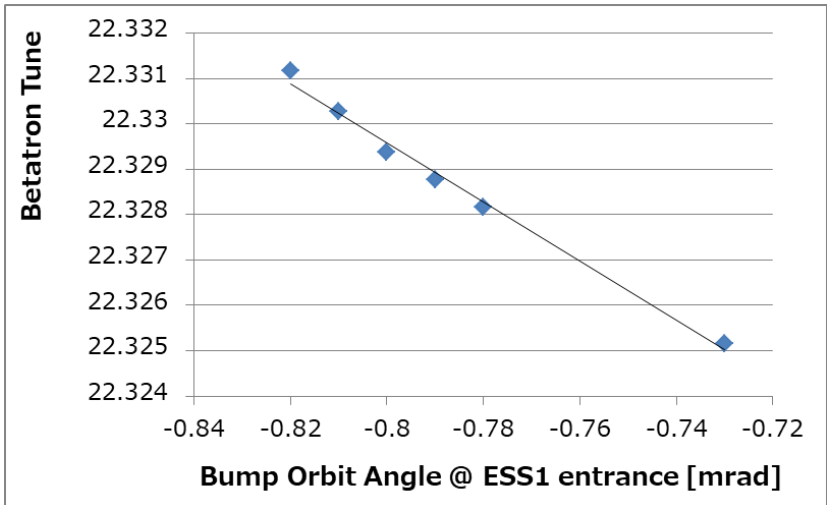# Beam Loss with Fixed Bump Orbit

shot #3171
Fixed Bump -0.81 mrad

betatron tune is
linearly ramped
by lattice Q

→we can deduce
tune – angle
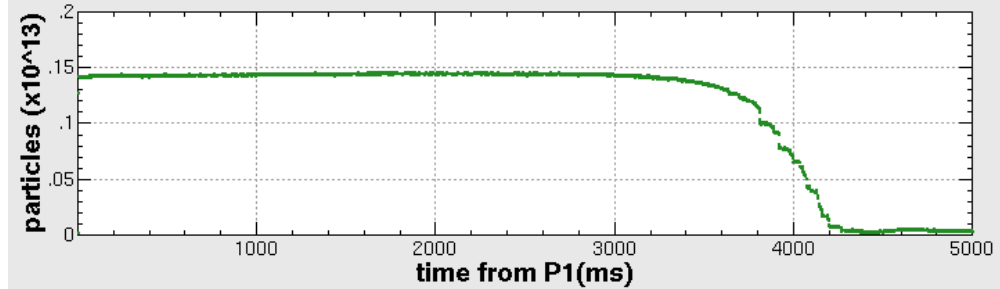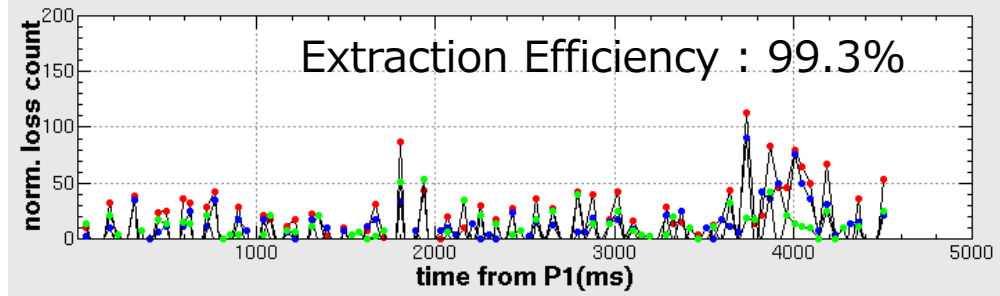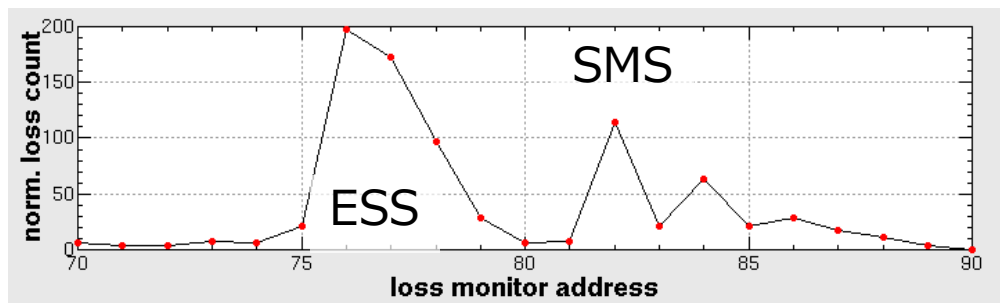correspondence
which minimize
beam loss

Result of Optimization

correspondence between
tune and angle which minimize
beam loss

note: vertical axis ranges
for beam loss plots are
much smaller than
previous plots

SMS

ESS

Extraction Efficiency : 99.3%

Fine Tuning of Dynamic Bump Orbit

Tune Ramping by
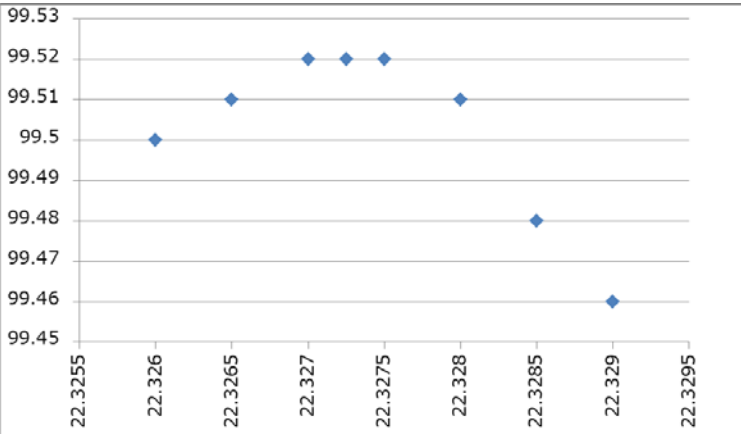Lattice Q
(Fixed Pattern)
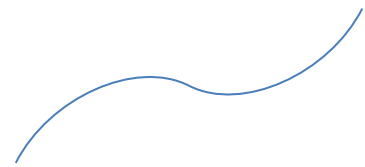
Spill Feedback Q

Search the condition for
minimum beam loss
(start from
measured/calculated
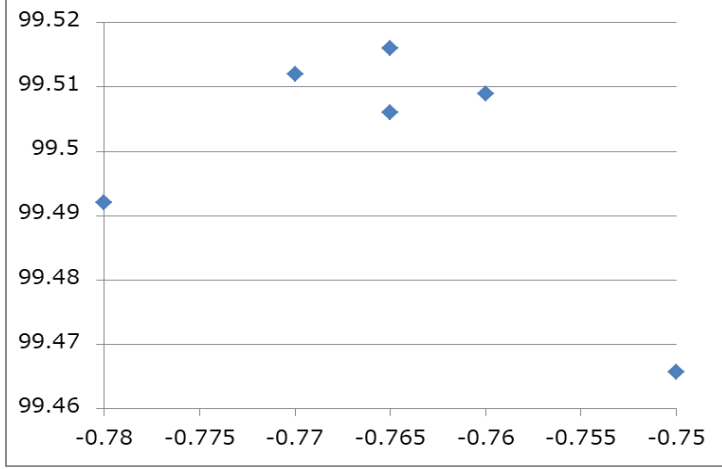values)

tune

bump orbit
(angle at
ESS1 entrance)

bump magnet
current

Ext. Eff [%]

tune in dynamic bump calc.

Ext. Eff [%]

angle of the bump orbit [mrad]

Current Status

In 2018-Jan~Feb Run
Extraction Efficiency :
    ~99.5% with 50 kW