

14 May 2024

8:25 Inject primary beam through thick target
Be - 1839 $\frac{\text{mg}}{\text{cm}^2}$

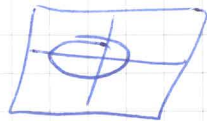
$$E_{\text{SIS}} (^{100}\text{Mo}^{38+}) = 441.95 \text{ MeV/u}$$

after target use BS of ^{98}Mo at β_+

BS = 7.0949 Tm ($\hat{=} ^{98}\text{Mo}$, $E = 372.67 \text{ MeV/u}$)
entered as override in paramodi.

$$E(^{100}\text{Mo}) = 359.85 \text{ MeV/u}$$

\Rightarrow beam on Leucht target in ESR



9:00 Markus is optimizing injection
shift ESR energy, at 374 MeV/u some beam in.
also used Steerer in TE, see ESR-Transformer.

10:30 Detectors of Beatrice get too much particles
and have to be taken out \sim 30 min break

10:35 Change to thin stripper $40 \frac{\text{mg}}{\text{cm}^2} \text{Cu}$
TA-ESR unchanged SIS Energy $E = 361.45 \frac{\text{MeV}}{u}$
optimize Steerer, was off on Leucht target
now 30% $\frac{\text{ESR}}{\text{SIS}}$. SIS-kicker-timing was also
(even 40%) a bit off.

11:40 Back to thick target
now also better transmission, 15%

Setting
saved

12:05 Change to $^{98}\text{Mo}^{42+}$

$E_{\text{SIS}} = 454.7 \text{ MeV/u}$, Rest stays the same

— better close TESDSAII to catch primary beam.

high B8 side (left) = -20 mm

TESDSAII = +20 mm (same effect)

—
Many frequency lines, but they are broad!

13:30 Supposedly $^{98}\text{Mo}^{42+}$ @ 243.93418 MHz

Cooler curve with SP off

2QP settings with $|+1\%| \& | +1.6\%|$

The second one looks pretty good.

Did identification $^{98}\text{Mo}^{42+}$ is strongest.

As expected also ^{96}Nb and $^{96}\text{Mo}^{41+}$.

18:15 Increase SIS + transfer line by 2%

$E_{\text{SIS}} 454.7 \rightarrow 455.4$

TA-ESR 372.67 \rightarrow 373.37

} MeV/u

The beam is injected on the "plateau" in the cooler curve.

Changing $\pm 100\text{V}$, $\pm 200\text{V}$ moves the beam very little, but indicating that the beam is on the negative slope $\uparrow\text{V} \rightarrow \downarrow\text{f}$.

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start scraping, move until serious cut of peak.

GEE X DS1 HA \rightarrow -35 mm, cuts tail on low f side.

GE01 DS-H (inner) \rightarrow -40 mm, " " " high " ".

GE02 DS-H A \rightarrow 0 mm, " high "

GE02 DS-H I \rightarrow -70 \rightarrow -50 \rightarrow -60 \rightarrow -100 mm
(no cut) (cuts too much) (cuts at injection)

Sextupole values

$$GE\phi 2 KS 2 = -0,01$$

$$GE\phi 2 KS 3 = +0,04$$

Other SX magnets did not cause visible effect on peak width of $98 \mu\text{e}$ were kept like this during scraper optimisation.

GEE X DS2 HA : \rightarrow -50 mm, not good go back to -77

GEE X DR 1 IS : -39 mm (not scraper, don't use)

GEE X DS1 HG : 99.5 \rightarrow 20 mm \rightarrow 0, cuts low freq. but also much intensity out again

19:50

open all slits, because peak became very wide and flat. Cannot be because of scrapers. Sent whole context of pattern again.

20:20

returning quads can recover the peak, or also destroy it again

erg slits in TE-line

TE4 DS5HR = $\begin{matrix} -20 \\ \text{(open)} \end{matrix} \rightarrow \begin{matrix} -10 \\ \text{(open)} \end{matrix} \rightarrow 0 \text{ mm} \\ \text{(weak but still wide)}$
HL = $\begin{matrix} -42 \\ \text{(open)} \end{matrix} \rightarrow \begin{matrix} -5 \\ \text{(more} \\ \text{narrow} \\ \text{but weak)} \end{matrix} \rightarrow 0 \\ \text{(gap)}$

only small effect, opened again.

- Change SIS Energy \leftarrow using cooler makes this exercise obsolete

- Change ESR Energies \rightarrow cooler curve shifts but remains the same

The interpretation is that the ESR scales the optik very well \rightarrow good for changing on 98 or 40+

late: Rotating of the "cooler curve" has been achieved with increasing Q3D

+1.15% nominal value / +1.25 —

+1.6% — we kept the last setting the corresponding cooler curves are in the telegram.

Scraping destroys the entire beam failed to reduce the momentum spread.

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12:50	EO1 KS1	0,03	} Have to take into account corrections in Parafodi	
	-u-2	0,08		
	-u-3	0,02		
	-u-4	-0,03		
	EO2 KS1	-0,15		} Make thinner peak but with a tail
	-u-2	0,03		
	-u-3	-0,04		
	-u-4	-0,25		

EO1 DS-H -55 mm
EEX DS1HA -25 mm

13:00 try to shift the energy

Sis 454.7 → 453.7 → 456.4
TA-ESR 373.369 → 372.369 → 374.369

→ 457.4
→ 375.369 >> Set back

13:30 Go to the primary beam to measure the beam orbit.



4:20 Back to fragments

@ Target there was a bump ^(+20mm) which distorted the orbit. it is removed but an angle is introduced (+3 mrad)

Sextupole corrections improve significantly mass resolving power.

E01K51

-u-2

-u-3

-u-4

E02K51

-u-2

-u-3

-u-4

all ϕ

← but this one shall be +0.04

4:30 measure isoc. curves (ESR = 374.6 MeV/u) with sextupoles off, but they look like before in shape. With scrapers open we get a rather wide BS-acceptance. Injected still at more inner orbit, checked with cooler.

Shifted ESR energy to 373.6 MeV/u (-0.8 MeV/u) to be more on outer orbit.

New cooler curve.

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15:00

Try to scrape in straight section,
should work better after correction
scraper inside, entrance straight target section

G E E X D S 1 H 6

+ 99.5 open

35 still double peak

27.7 "

26.3 high frequ. cut

25.7 losses, cuts low freq.

beam position →

24.4

"

23.6

gone

⇒ opened again

G E E X D S 2 H A

end target section outside

-123 open

-50 no cut

-13 no cut

-10 cut high frequ.

-9.1

-8.1

-7.1

-6.0

↓ cuts more, split peak

-5.1

-4.4

-3.0

-2.0

-1.0

0.0

+1.0

also cut from low f.

gone

-2.0 is a nice narrow peak, use this!

17:50 SIS - failure

scraper in 250 for high B3
E01DS3HG

- 130	open		} no precise f-cut
- 80	"		
- 75	open	∩	
- 73	cuts	∩	
- 71	cuts	∩	
- 69	gone	∩	

⇒ back to open (-1)

E01DS-HI - 124 out (low B3)

- 55	open	∩	} no precise cut
- 45	cuts	∩	
- 40	gone	∩	
- 48	cuts a bit	∩	
- 50	open	∩	

E01DS-HA (high B3)

cannot reach beam, minimum is 0 m.

⇒ keep at ~~0.0~~ open

E02DS3HG (high B3)

- 130	open	∩	from right
- 70	gone		
- 90	open		
- 76	open		
- 72	cuts		
- 73.3	cuts		
- 76.2			
other scraper	- 69.4		

19:14 So we have two significant sesopers.

EEXD52HA for low B3 side = ~~-40~~ 0 mm

E02DS3HG for high B3 side = -71.4 mm

use combination:

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09:05 Close TE4 slits to ± 10

no visible effect on spectra, but
the primary beam shall not
propagate.

09:00 Intensity increase by a factor of 3

* multi-multi 2 \rightarrow 4

* copied machine from FRJ

13:00 Stop long-time measurement with 98 μ o

⇒ change QP to +1.5% to nominal

$$k^{1.5\%} = -0.00534365 \quad \text{new}$$

$$k^{1.6\%} = -0.00578745 \quad \text{old}$$

the beam is shifted to higher f
by a very few kHz (@ 245 MHz)

However a tiny tail on the left
side

⇒ try sextupole corrections

peak width \rightarrow 500 Hz and no tail
SP - off

Scrapers EEXDS2HA = -4 \rightarrow -20 \rightarrow -5 mm

E02DS3HG (as before) = -7.4 mm

14:30

optimization completed

Scale to 98 μ o

17 May 2024

15:30 Change to ^{96}Sr

before that, old scraper positions for ^{98}Zr !

EO2 DS 3HG : -73.5 mm

EEX DS 2HA : -12.0 mm

Esis = 451.7 MeV/u

Scale: TA-ESR by changing the mass & charge

SIS: New energy: 455.43 MeV/u

this is for $^{98}\text{Mo}^{39+}$ $B_p = 7.650 \text{ Tm}$
 $\mathcal{G}_t = 1.40082$

16:30 Stop ^{98}Zr .

16:33 Start Scrapers all out!

22:00 changed ESR setting to ^{96}Sr but with pattern on, crashed ESR.

reset to $^{98}\text{Mo}^{39+}$

$E_s = 273.60 \text{ MeV/u}$ $^{98}\text{Mo}^{39+}$

23:00

We see some line, but they move in time. When playing with shipping ESR magnets failed again.

resetted with pattern off, resent pattern data.

but again all quads, dipole, corr. coils.

again reset, ~~sent~~ sent context \rightarrow OK.

wait for HHT, they entered.

in between the lines moved very much with time



over seconds

restart after HHT \rightarrow f

0:15

see some lines also stable

but better in ^{98}Zr setting

$E_{\text{ESR}} = 373.60 \text{ MeV/m}$ for $^{98}\text{Mo}^{40+}$

$E_{\text{SIS}} = 451.70 \text{ MeV/m}$

after target $\equiv 373.36 \text{ MeV/m}$, for $^{98}\text{Mo}^{40+}$

ESR was still ramping, needs shipping then lines are stable now good resolution even with scrapers open.

$^{98}\text{Zr}^{40+}$, $^{98}\text{Nb}^{40+}$ are well visible and resolved.

18, May

01:29

go for ^{96}Sr centered

$E_{\text{SIS}} = 449.21 \text{ MeV/m}$ for $^{100}\text{Mo}^{38+}$

after target $E = 373.36 \text{ MeV/m}$ for $^{96}\text{Sr}^{38+}$

in ESR $E = 373.60 \text{ MeV/m}$ for $^{96}\text{Sr}^{38+}$

otherwise it still is the setting
with the latest optimized sextupoles.
use skipping to avoid ramping 😊

we see some lines

02:30

the lines vanished, what happened?

no diagnostics in this setting

go back to ^{98}Zr .

$E_{\text{SIS}} = 451.7 \text{ MeV/m}$ for $^{100}\text{Mo}^{38+}$

after target = 373.36 MeV/m for $^{98}\text{Mo}^{60+}$

$E_{\text{ESR}} = 376.60 \text{ MeV/m}$ for $^{98}\text{Mo}^{60+}$

3:00

magnet failure of ESR quads
reset quads, send whole context,
start in manipulation, then ~~remove~~
add skipping and run cycle

good intensity in SIS ($1.5 \cdot 10^9$ /spill)
but nothing in ESR.

beam is on grid in TE3.

Are all ESR devices as they should be?

8:34

~~$^{98}\text{Mo}^{42+}$~~ to $^{98}\text{Mo}^{42+}$

Sergey RBS

We see the trace, but very difficult to say the intensity in comparison to previous

10:23 Primary beam setting $E_{\text{SIS}} = 441.95 \text{ MeV}$

Kicker, Septum, timing:

-3.7 mrad 7.7 mrad

$E_{\text{line}} = 373.6 \text{ MeV/u}$

TESM00 = -1.0 mrad

TESKY1 = +2.3 mrad

SIS $\sim 1.7e9$

ESR $\sim 1.8e8$

$\sim 10\%$

* Target bump decreases the transmission dramatically!

TA-bump 0.0 mm +3 mrad

before optimization (before 18.05, 08:00)

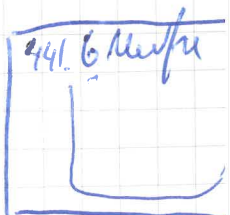
Septum: +6.7 mrad

Kicker: -4.5 mrad

* QP corrections as on 14.05 (w/o +1.5%)

$\frac{1.75e8}{1.69e9}$ ESR/SIS

$\frac{1.75e9}{1.79e9}$ ESR/SIS



441.2 ↓ 1.5e8
441.6 2.1e8
441.8 1.9e7

441.2 1.1e8 1.2e7

18 May 2024

10 Schottky response
Primary beam @ B_p of 98 Mo^{42+}
 $E(100 \text{ Mo}) = 359.86 \text{ MeV/u}$
 $\gamma = 1.386$

Change Cooler Setting from

$\gamma = 1.402$	\rightarrow	$\gamma = 1.388$
$\Delta U = -1300 \text{ V}$		$\Delta U = 0 \text{ V}$
$B = 0.1 \text{ T}$		$B = 0.1 \text{ T}$

13:10 Change to 98 Mo^{42+}
 $E_{\text{GIS}} = 454.7 \text{ MeV/u}$
Changing energy $\pm 1 \text{ MeV}$ does not affect

- peaks are again "square", scraping is very limited

- trying QP & SP corrections
 ↑ ↑
 Same Same as on
 page (*) 15.05.2024

14:43

EEX DS2HA + 7 mm → + 9 mm → + 8 mm
EO2 DS3 HG - 69 mm ^{empty} — stays

15:15 old E SIS + Be 1839 target does
not give 373.36 MeV/m for ^{98}Mo
raise energy as a test

E SIS = 454.7 → 455.43 MeV/m
intensity as before. So it is not
significant for fragments

15:25 change to ^{98}Zr

E SIS = 451.70 MeV/m for $^{100}\text{Mo}^{38+}$
E beamline = 373.36 MeV/m for $^{98}\text{Zr}^{40+}$ } SIS-Medtr
E ESR = 373.60 MeV/m for $^{98}\text{Zr}^{40+}$ } ESR-Modi

Open scrapers

Sextupole : EO1 KS4 -0,030
EO2 KS3 +0,020
 ^{98}Mo

~~0,27~~ -0,26
~~40,03~~ +0,01
 ^{98}Zr

18 May 2024

16:15 Make a setting for $96 J_r$ but a bit less exotic. So we call it $98 Y^{39+}$.

$E_{sis} = 469.90 \text{ MeV/u}$, but shifted to 469.00 MeV/u after target $98 Y^{39+}$ at 373.36 MeV/u

ESR $E = 373.6$ for $98 Y^{39+}$.

also set sextupoles extra by hand.

They already have defaults by a trim.

$$\begin{aligned} \text{GEO1 K54} &= 55.01 \text{ A} = -0.2601 \frac{1}{\text{m}^2} \\ \text{GEO2 K53} &= 7.18 \text{ A} = -0.010049 \frac{1}{\text{m}^2} \end{aligned}$$

GEO1 K54: value = -0.23 , target = -0.26 , corr. = $0.03 \frac{1}{\text{m}^2}$

GEO2 K53: value = 0.03 , target = -0.01 , corr. = $0.02 \frac{1}{\text{m}^2}$

For all other 6 quad value = 0, target = -correction

19. Mai 2024

13:00 There are many lines with weird "drunk" lines.

E02 DS3HG $\rightarrow -60 \text{ mm}$

EEX DS2KA $\rightarrow \cancel{-60 \text{ mm}} -75 \text{ mm}$

13:50

E02 K53 $0.01 \rightarrow -0.1$ (Target Value)

20 May 2024

09:00

Slight optimization of SP to
fight with double peak structure

SP start:

ED1KS4 -0,26

ED2KS3 -0,1

unchanged

cf: 408.99 MHz

μ : -55 dBm

m_a : -104 dBm

m_i : -129 dBm

test set
cf: 409.86 MHz

EEXDS2HA -78 mm \rightarrow -5 mm

ED2DS3HG -60 mm \rightarrow -60 mm

21 May 2024

8:40 Stop