



# BDF dilution system failure

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13.02.2025

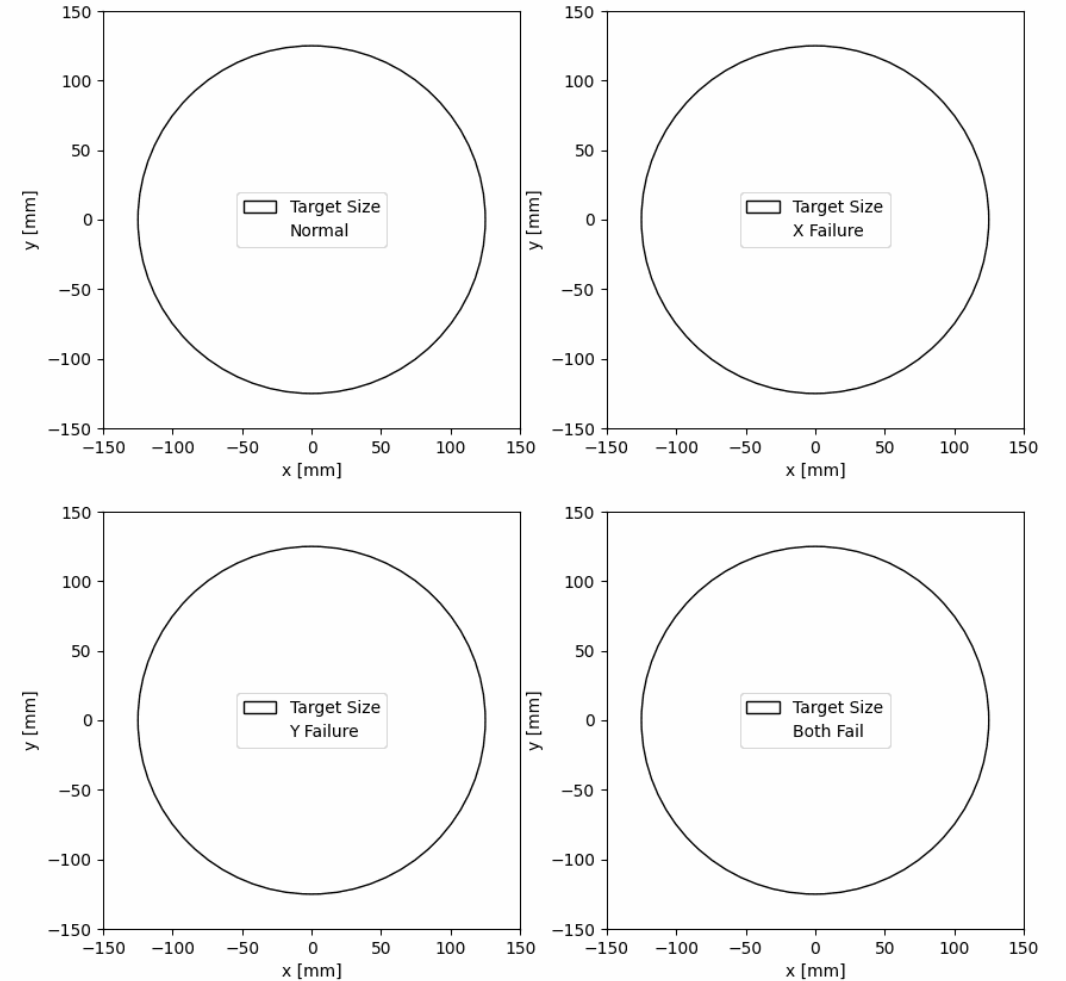
# DS failure

## MAGNET DESIGN ID CARD: PXMBXHCCWP

Design Type	PXMBXHCCWP
Description	Bending Magnet, H or V, type HB1, 2.5m gap 80mm
Old Name	HB1 / MCA
Family	Bending
Function	Horizontal or Vertical
Cooling system	Water
Aperture width [mm]	243.0
Aperture height [mm]	80.0
Iron Length [mm]	2500.0
Total Length [mm]	3120.0
Total Width [mm]	1246.0
Total Height [mm]	1250.0
Weight [Kg]	20500
Dielectric Test Tension [KV]	Not available
Peak current (cycled) [A]	1434.0
RMS current [A]	1434.0
Resistance at 20°C [mΩ]	15.9
Inductance [mH]	62.9
Power [KW]	38.0
Delta P nominal [bar]	5.0
Nominal Cooling Flow [L/min]	40.0
Delta T nominal [°C]	25.0
Lamination Thickness [mm]	1.5
Total number of turns/pole	32
Dipole Nominal Field at Peak Current [T]	1.3
Dipole Integrated Field at Peak Current [Tm]	3.38
Observations	2 pancakesper coil 2018-07-10 - Can be operated up to 2250 A in pulsed mo

$$\tau = \frac{2\pi L}{R} = 24.8 \text{ s}$$

$\tau = 24.8 \text{ s}, t = 0.00 \text{ s}$





Thanks for your attention!

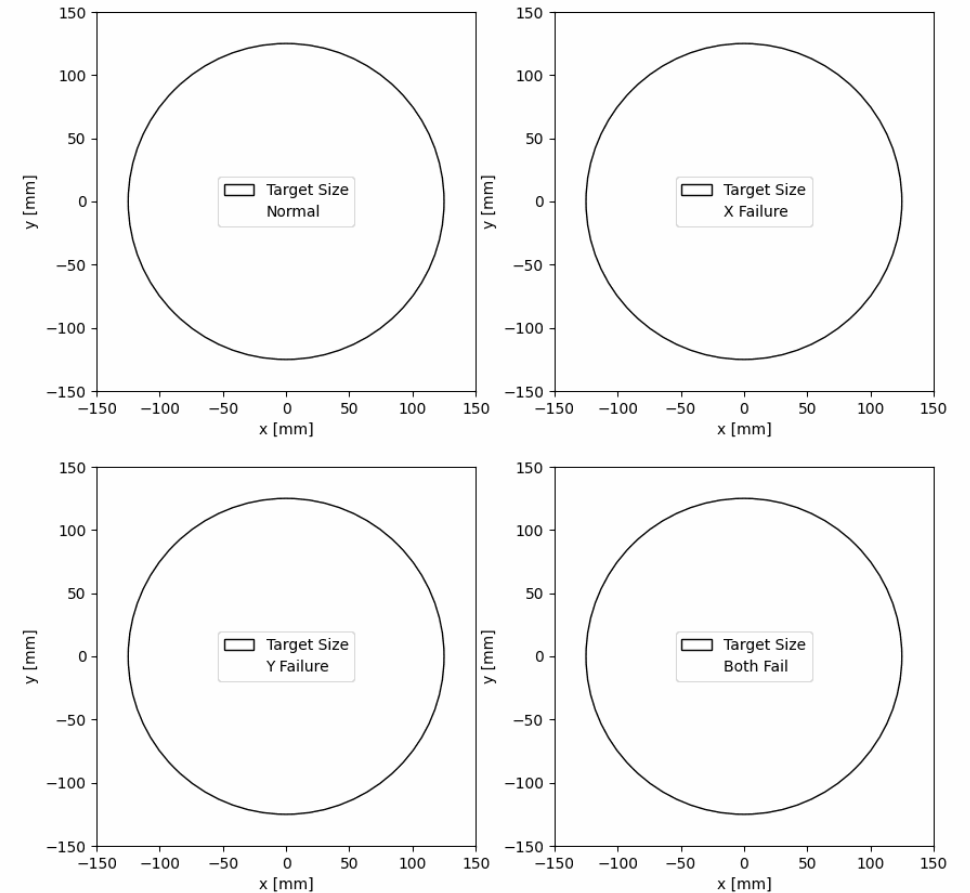
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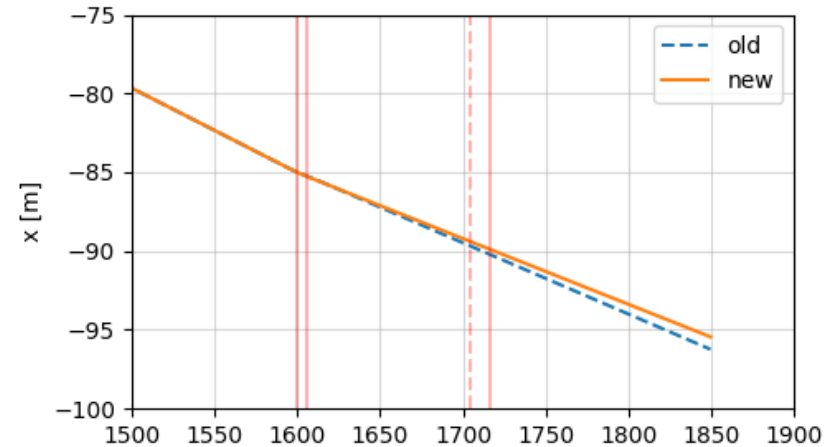
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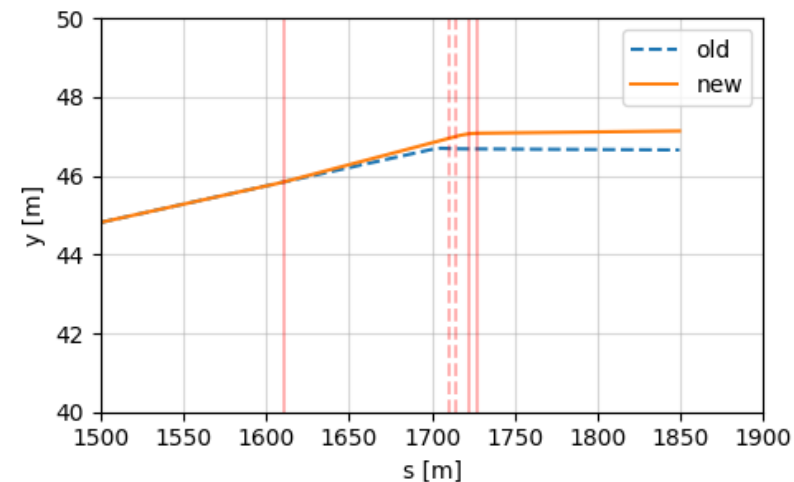


# Offsets at the target

Element	Original position	New position	Original bending angle	New bending angle
MSN.X0430029	31.030	47.8950	0.0028	0.00311
MSN.X0430022	24.0500	24.0500	0.0014	0.0000441 (for the 10 mm bump case)
MBNH.X0430718	720.73013	720.73013	-0.0071455	-0.0059
MBNH.X0430724	726.390146	726.390146	-0.0071455	-0.0059
MBNH.X0430730	732.050148	732.050148	0.0029436	-0.001804 (turned vertical)
MBNH.X0430735	737.710150015	Not used	0.0029436	Not used
MBNV.X0450823	825.56016	837.56016	0.006963100	-0.000111 (turned horizontal)
MBNV.X0450829	831.220167	843.220167	0.006025400	0.007300
MBXGD.X0450834	835.928169	847.928169	-0.0033351	0.0033351



0.8 m shift  
towards Jura



0.5 m vertical shift

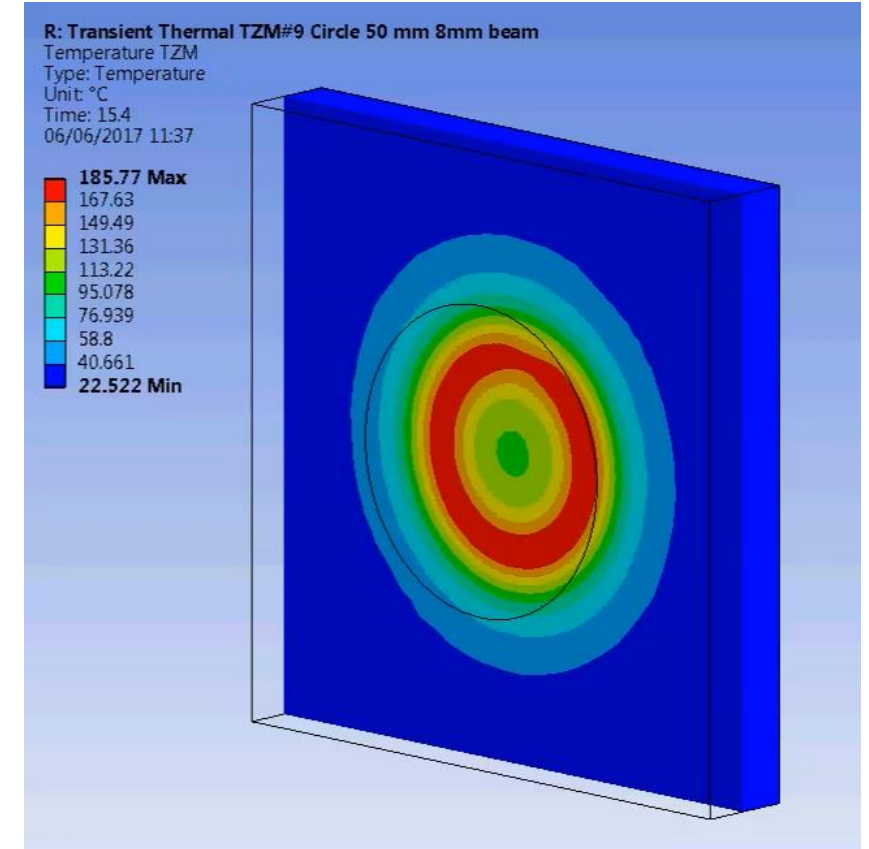
# Final focus and dilution system: requirements

SPS Beam Dump Facility - Comprehensive Design Study: [CERN-2020-002](#)

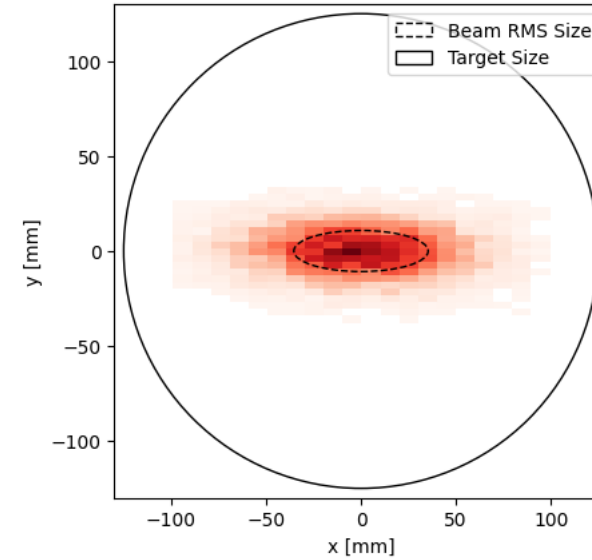
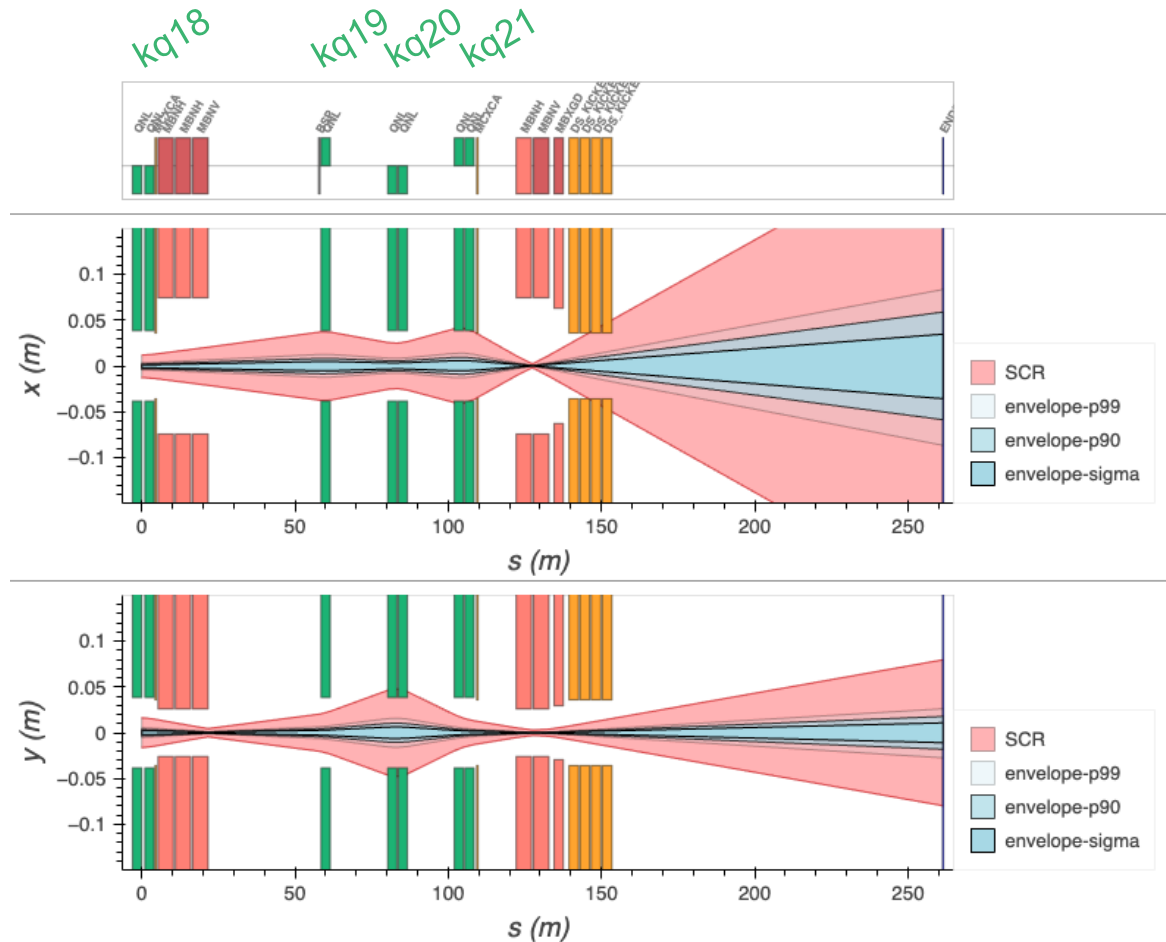
- Round beam with  $\sigma = 8 / 16$  mm on target
- 50 mm sweep radius @ 4 Hz
- About 120 m drift

Possible solution – 4 magnets (2 per plane)

Magnet type	Aperture height	Total length	I <sub>max</sub> PLS	Resistance	Inductance	BdI	Lamination thickness	End plate thickness	# of mag req	I req	I rms	U req / mag	PC
HCMBXW_001	63	3820	750	60	145	4.358	1.5	80	1	115	81	419.1	2S
PXMBXGDCWP	70	3500	1000	68	139	4.63	1.5	54	1	145	103	506.6	2S
PXMBXHCCWP	80	3120	1434	15.9	62.9	3.38	1.5	50	1	283	200	447.4	2S
new MDX	100	630	240	320	221	0.509	0.5	15	2	157.5	111	874.8	4S
PXMBXHACWP	108	3085	1275	15.9	52.8	2.97	1.5	50	1	287	203	380.9	2S



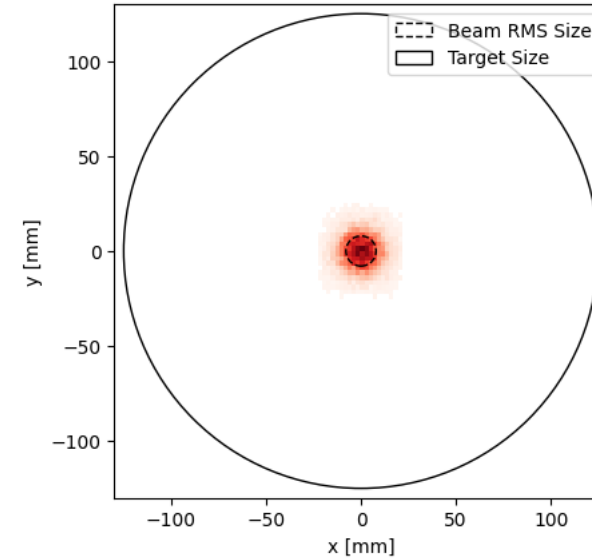
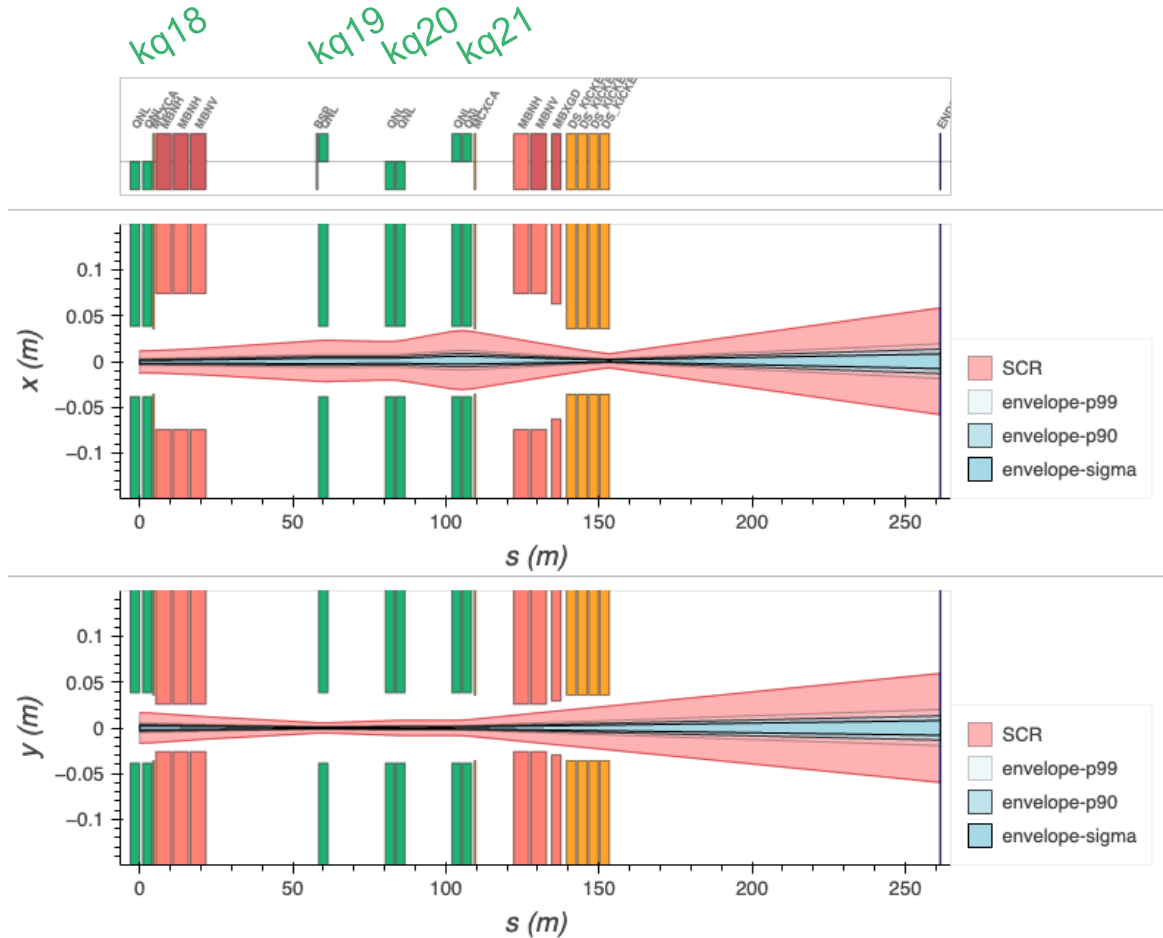
# Final focus rematching



- $\sigma_x = 35 \text{ mm}$
- $\sigma_y = 10 \text{ mm}$
- Target  $\varnothing = 250 \text{ mm}$

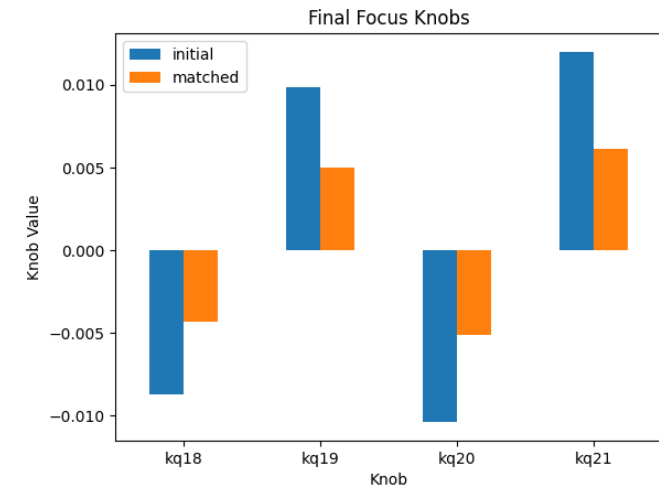
Knob	Quadrupoles
kq18	QNL.X0430710 QNL.X0430714
kq19	QNL.X0450770
kq20	QNL.X0450792 QNL.X0450795
kq21	QNL.X0450814 QNL.X0450817

# Final focus rematching



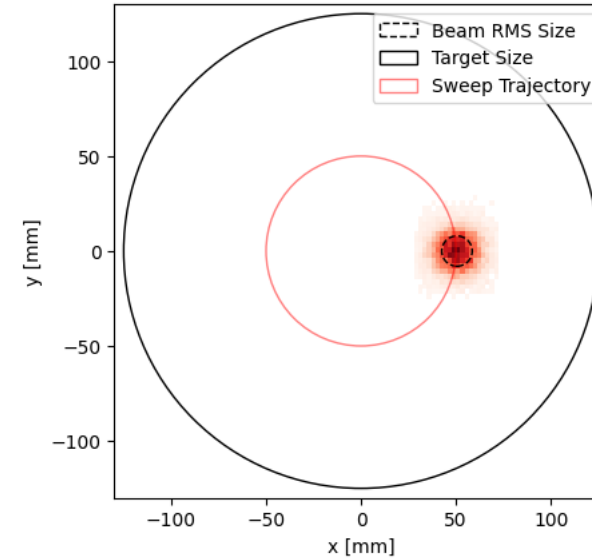
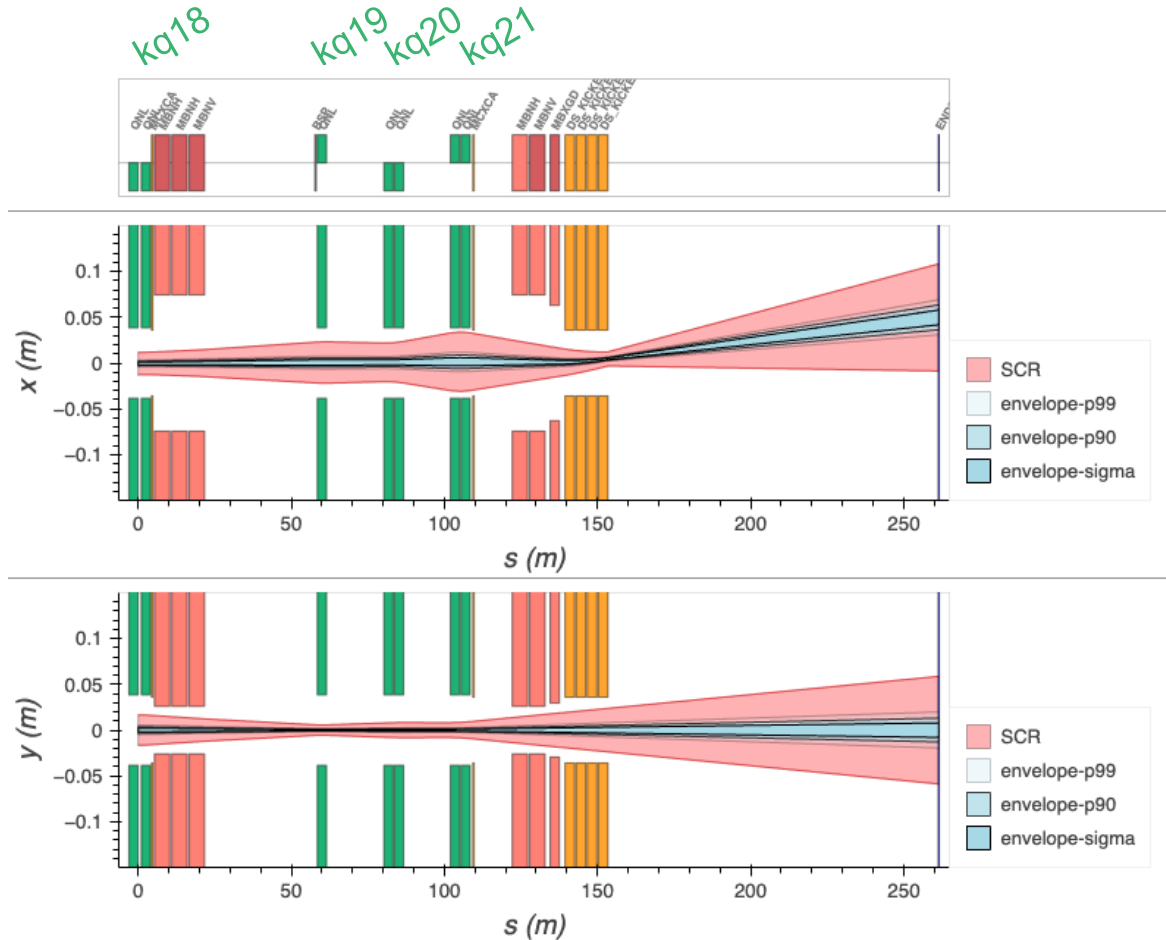
- $\sigma_x = 8 \text{ mm}$
- $\sigma_y = 8 \text{ mm}$
- Target  $\varnothing = 250 \text{ mm}$

Knob	Quadrupoles
kq18	QNL.X0430710 QNL.X0430714
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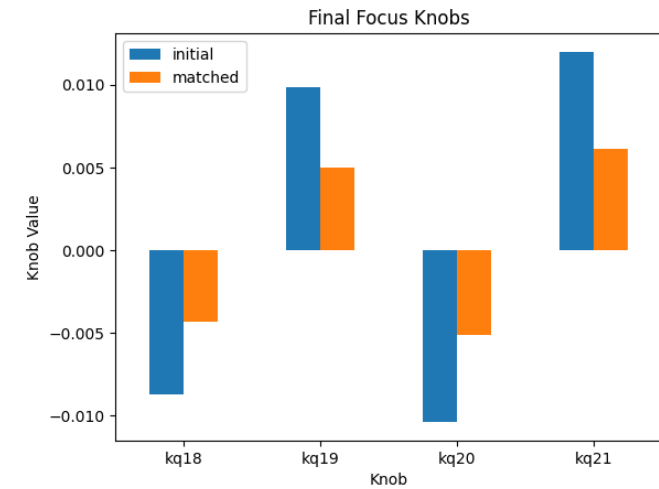


# Introducing the sweep

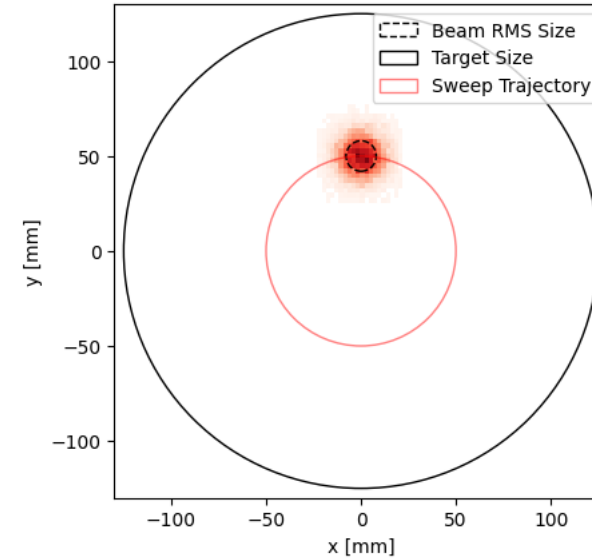
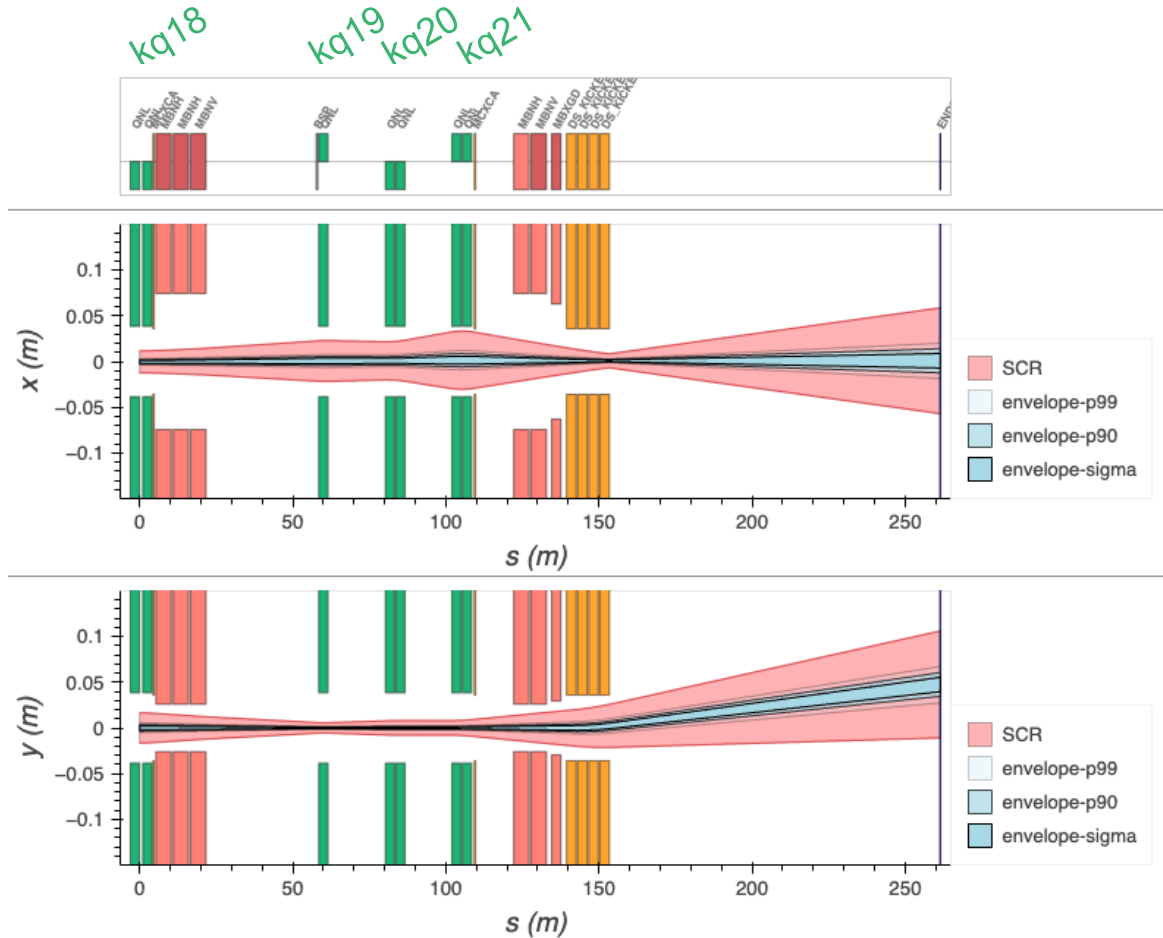


- $\sigma_x = 8 \text{ mm}$
- $\sigma_y = 8 \text{ mm}$
- Target  $\varnothing = 250 \text{ mm}$
- Sweep  $\varnothing = 100 \text{ mm}$
- Bdl = 0.28 Tm

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kq18	QNL.X0430710 QNL.X0430714
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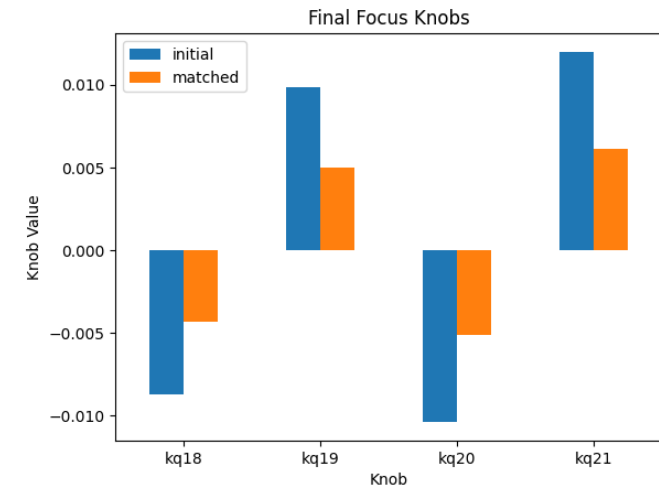


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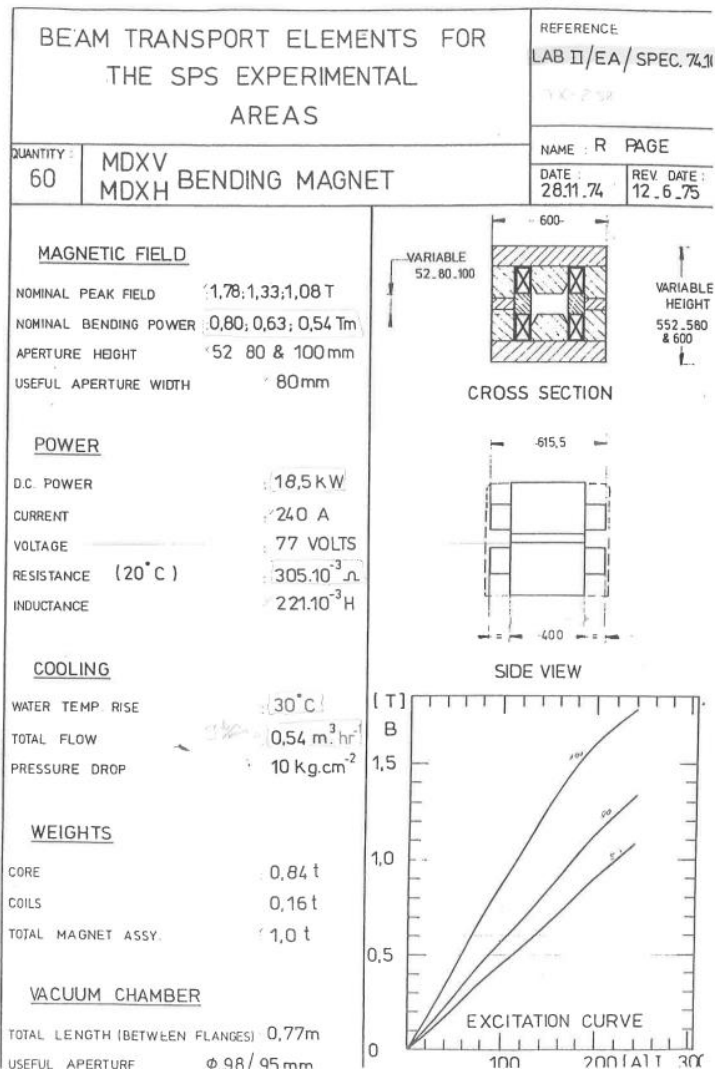
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# Summary

- We can match the beam size at the target with the existing quads.
- MCA magnets aperture and integrated strength is sufficient for the dilution system.
- One more iteration is required to find an optimum settings for the final focus.

# MDX specifications



- There are **9 MDX (MCXCA) correctors** installed in P42 and **1 vertical bumper** to be installed in TCC2 for the T4 bypass.
- The correctors have **80 mm gap** between the poles.
- Aperture constraint comes from the **vacuum system - elliptical 129 x 72 mm<sup>2</sup>** (inspected by Philippe B-B).
- Max integrated strength  $\int Bdl \approx 0.5 \text{ Tm}$

New laminated design is in progress.

It was suggested to use **100 mm gap** for all the new correctors.