



Recent Developments in ISOLDE Targets and Glimpse of Future Proton Beam Delivery to ISOLDE

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ISOLDE Workshop and Users meeting 2025

Future Beam Sharing at ISOLDE



- due to additional experiments at CERN such as the ShiP experiment
→ fewer proton cycles for ISOLDE in the future
- possibility of increasing protons per pulse at less pulses per supercycle

Will this have an impact on yields for ISOLDE?

ISOLDE supercycle

User=>Destination
 NORMHRS->ISOHRS STAGISO->ISOHRS
 NORMGPS->ISOGPS STAGISO->ISOGPS

Last supercycle
 Prot. current: 3004E10pp
 Total cycles:

Cycles number:

Cycle	User	Destination	Ej. E10
33	TOF	PS	825
32	NORMHRS	ISOHRS	3010
31	MD	PS	2016
30	MD6	PS	345
29	TOF	PS	835
28	NORMHRS	ISOHRS	3006
27	EAST1	PS	629
26	TOF	PS	838
25	MD4	PS	0
24	NORMHRS	ISOHRS	3003
23	EAST2	PS	558
22	TOF	PS	838
21	NORMHRS	ISOHRS	3022
20	LHC2B	PS	252
19	LHC2A	PS	384
18	NORMHRS	ISOHRS	3016
17	LHC2B	PS	250
16	LHC2A	PS	382
15	NORMHRS	ISOHRS	3002
14	LHC2B	PS	250
13	LHC2A	PS	381
12	NORMHRS	ISOHRS	2997
11	LHC2B	PS	248
10	LHC2A	PS	384
9	NORMHRS	ISOHRS	2991
8	TOF	PS	845
7	NORMHRS	ISOHRS	2995
6	EAST2	PS	551

User=>Destination
 NORMHRS->ISOHRS STAGISO->ISOHRS
 NORMGPS->ISOGPS STAGISO->ISOGPS

Last supercycle
 Prot. current: 3140E10pp
 Total cycles:

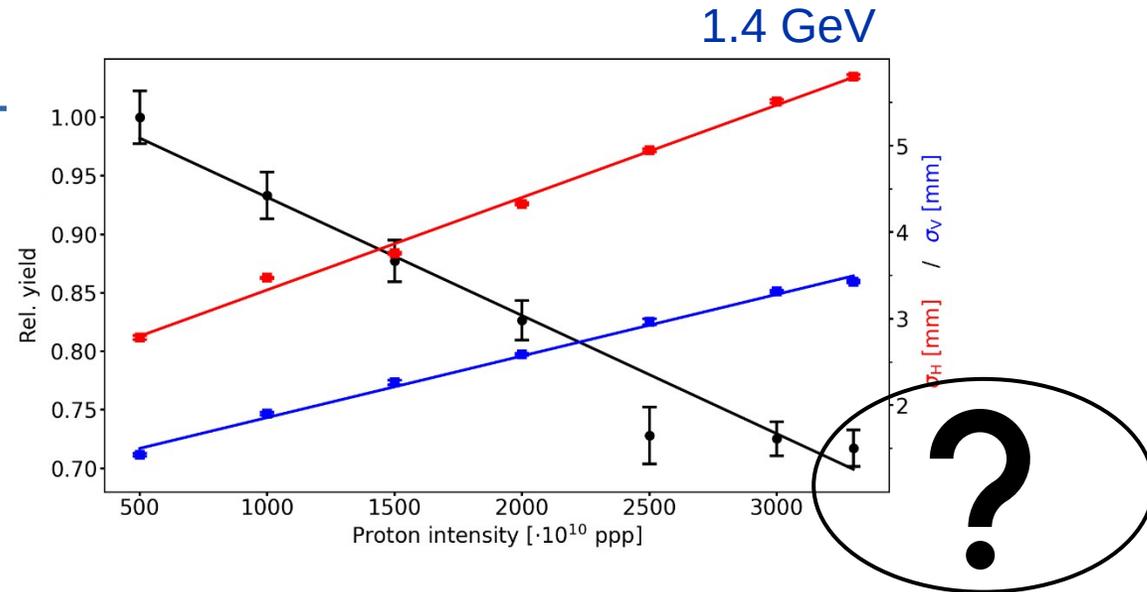
Cycles number:

Cycle	User	Destination	Ej. E10
28	TOF	PS	196
27	ZERO	BDUMP	1
26	NORMHRS	ISOHRS	3151
25	ZERO	BDUMP	0
24	ZERO	BDUMP	1
23	ZERO	BDUMP	0
22	NORMHRS	BDUMP	3121
21	ZERO	BDUMP	0
20	ZERO	BDUMP	0
19	MD10	BDUMP	84
18	ZERO	BDUMP	0
17	MD1	BDUMP	1
16	LHC2B	PS	615
15	LHC2A	PS	687
14	NORMHRS	ISOHRS	3124
13	ZERO	BDUMP	2
12	ZERO	BDUMP	0
11	ZERO	BDUMP	0
10	ZERO	BDUMP	0
9	ZERO	BDUMP	0
8	ZERO	BDUMP	0
7	ZERO	BDUMP	0
6	MD10	BDUMP	94
5	ZERO	BDUMP	1
4	ZERO	BDUMP	0
3	NORMHRS	ISOHRS	3147
2	MD9	PS	340
1	MD8	PS	702

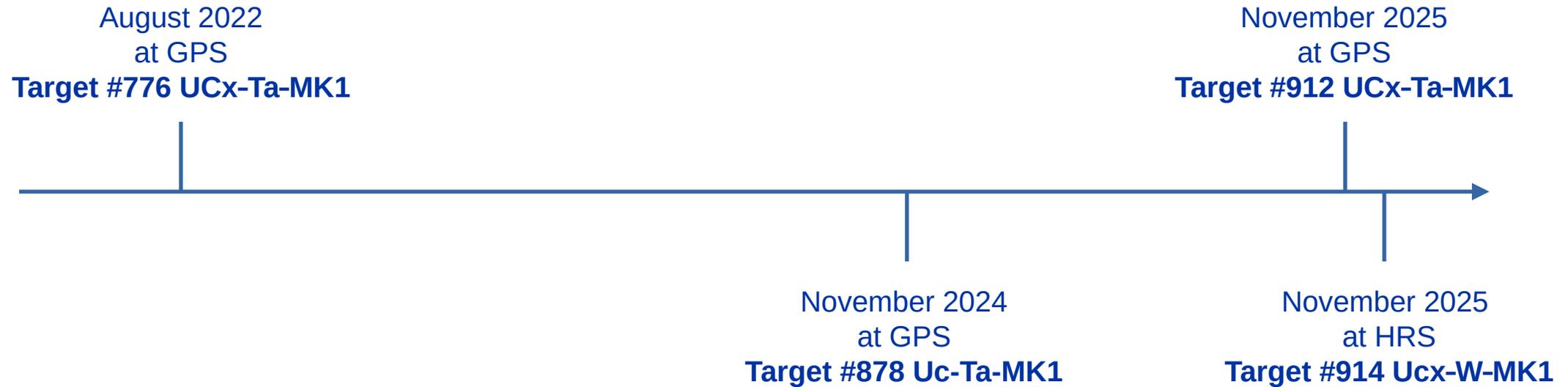


First High Proton Intensity Studies at ISOLDE

August 2022
at GPS
Target #776 UCx-Ta-MK1



First High Proton Intensity Studies at ISOLDE



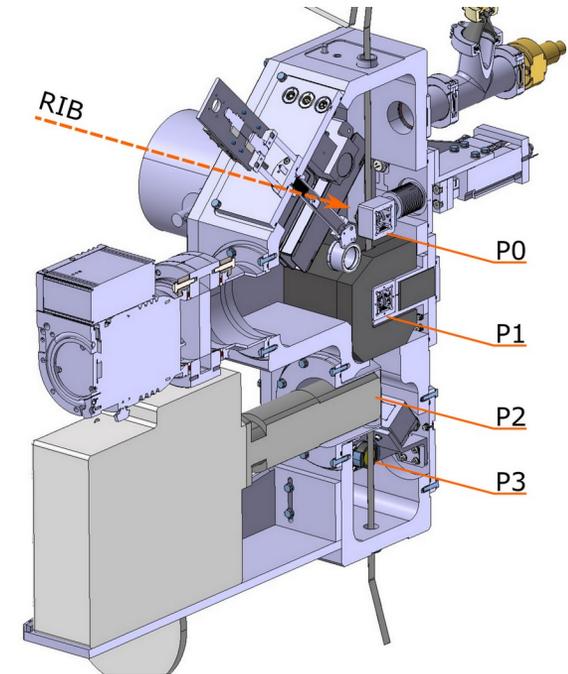
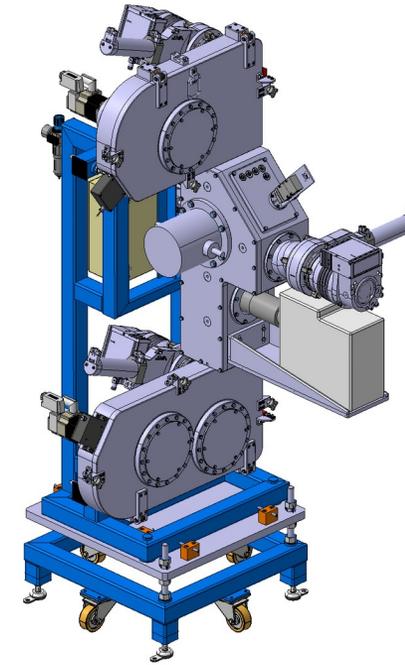
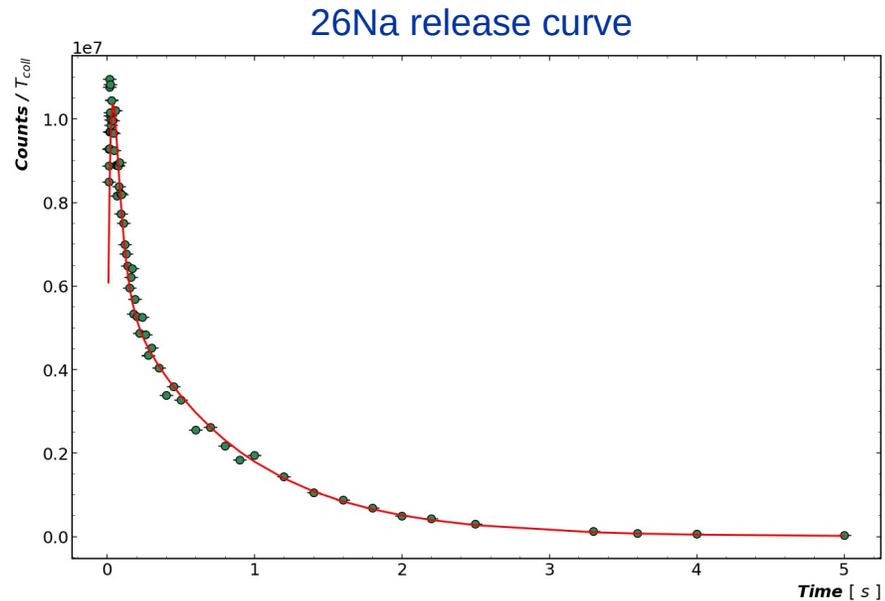
High Intensity Proton Beams at ISOLDE

Yield vs. Proton Intensity

^{26}Na yields obtained from release curve using the ISOLDE fast tape station

- proton energy 1.4 GeV
- proton intensities (50 - 5000)E10 ppp

- measures release of radioactive ion beam after proton impact
- time refers to time after proton impact



Study in Nov 2024 at ISOLDE GPS

Target #878 UC-Ta-MK1

- proton energy 1.4 GeV
- proton intensities (50 - 5000)E10 ppp
- beam with increasing beam emittance at increasing proton intensity

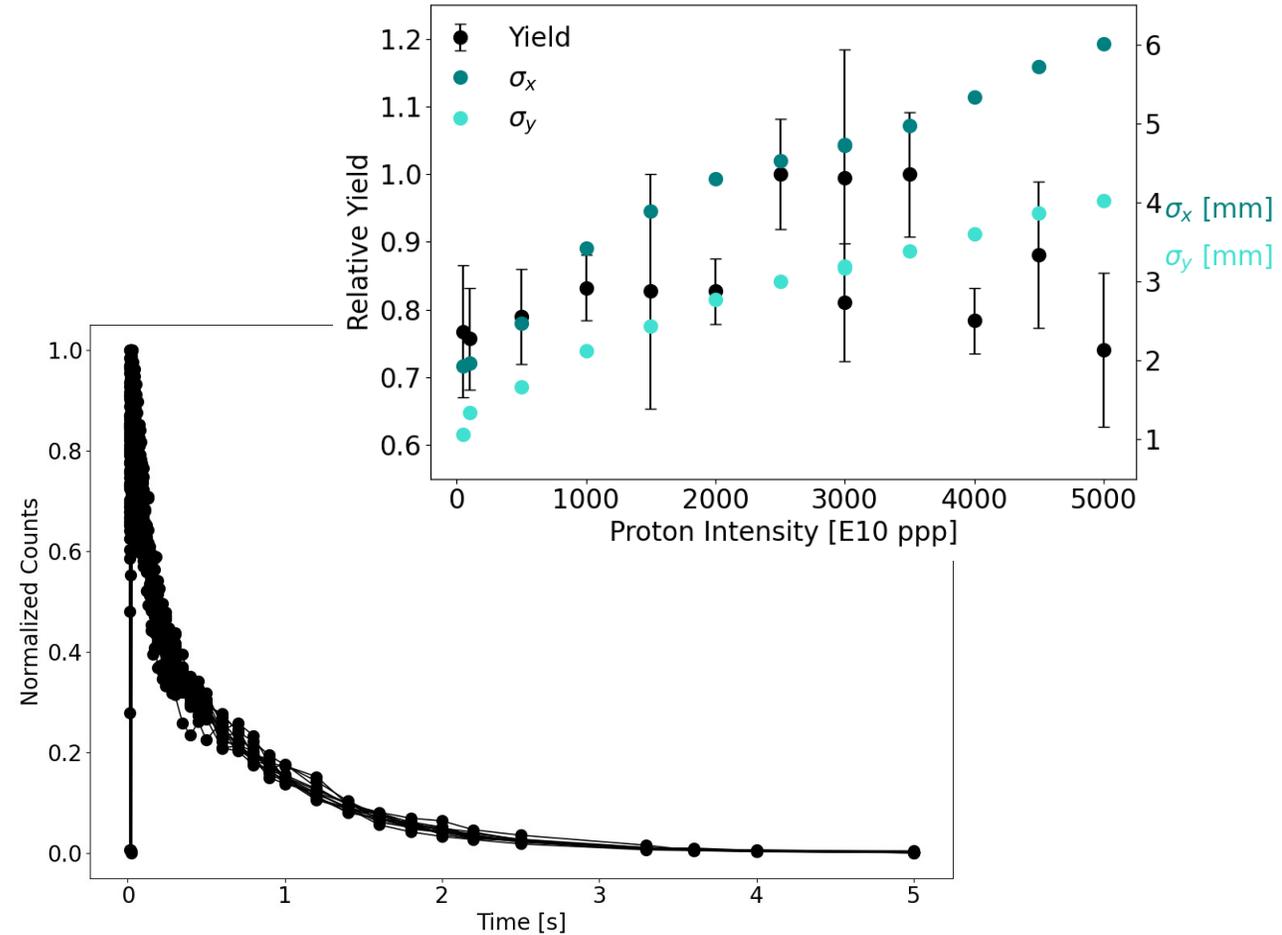
Assumptions based on these measurements

decrease in yield for increasing proton intensity
→ proton beam larger than target container



decrease in yield for decreasing proton intensity
→ less heating power of the protons during target impact

inexplicable offset in later measurement data



Study in Nov 2025 at ISOLDE GPS

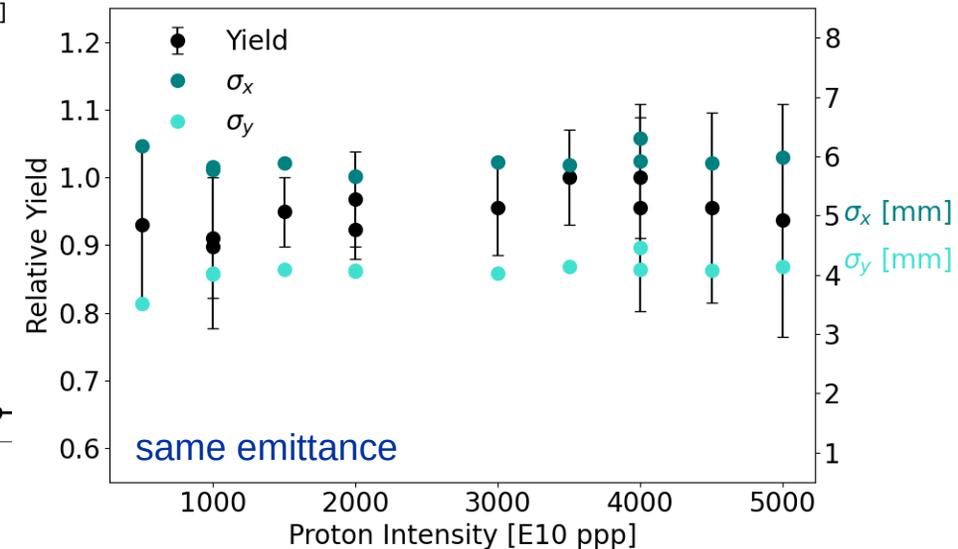
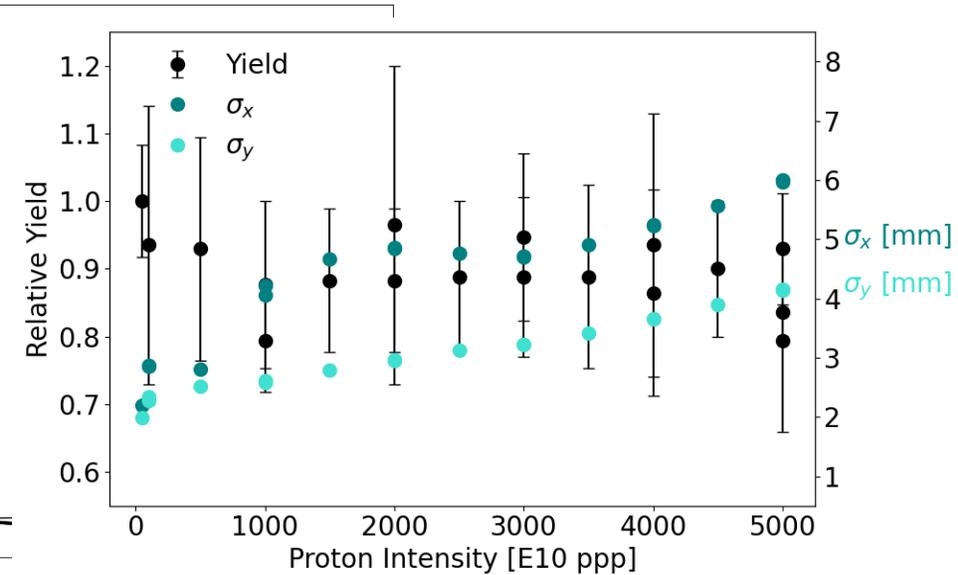
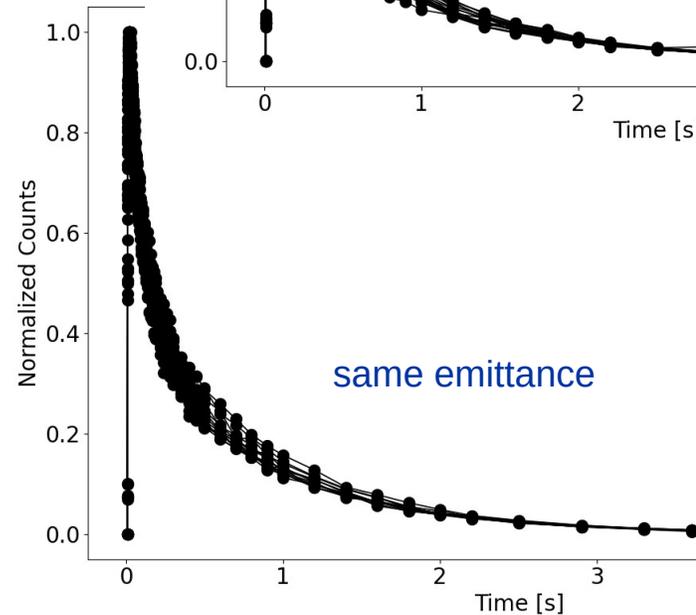
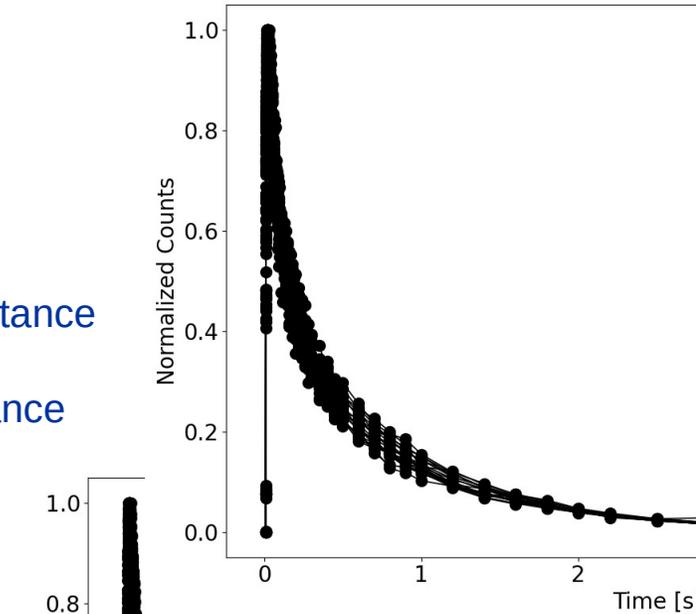
Target #912 UCx-Ta-MK1

- proton energy 1.4 GeV
- proton intensities (50 - 5000)E10 ppp
- two beam profiles available
 - beam with increasing beam emittance at increasing proton intensity
 - beam with constant beam emittance

Measurements refute assumption made in 2024

later measurement data reproducible

yield seems not depending on proton intensity



Study in Nov 2025 at ISOLDE HRS

Target #914 UC-W-MK1

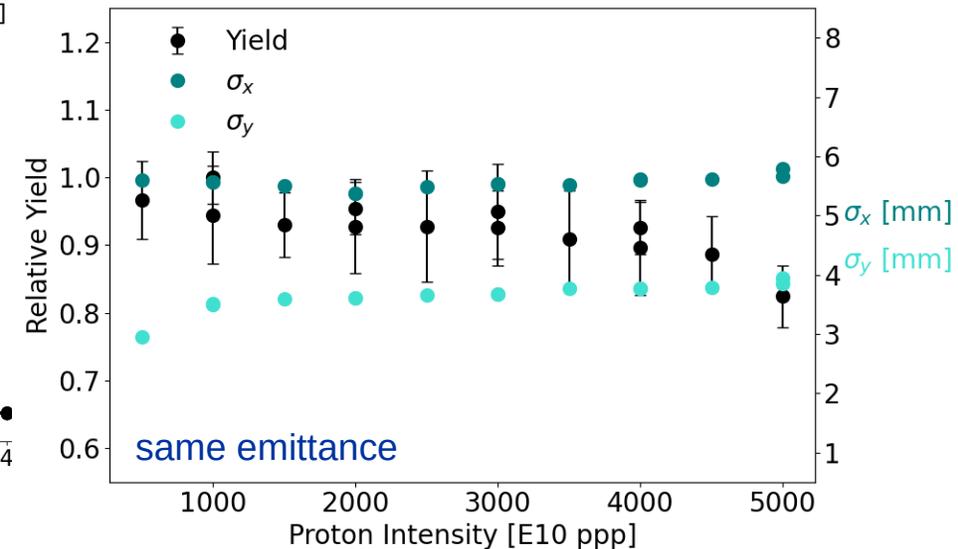
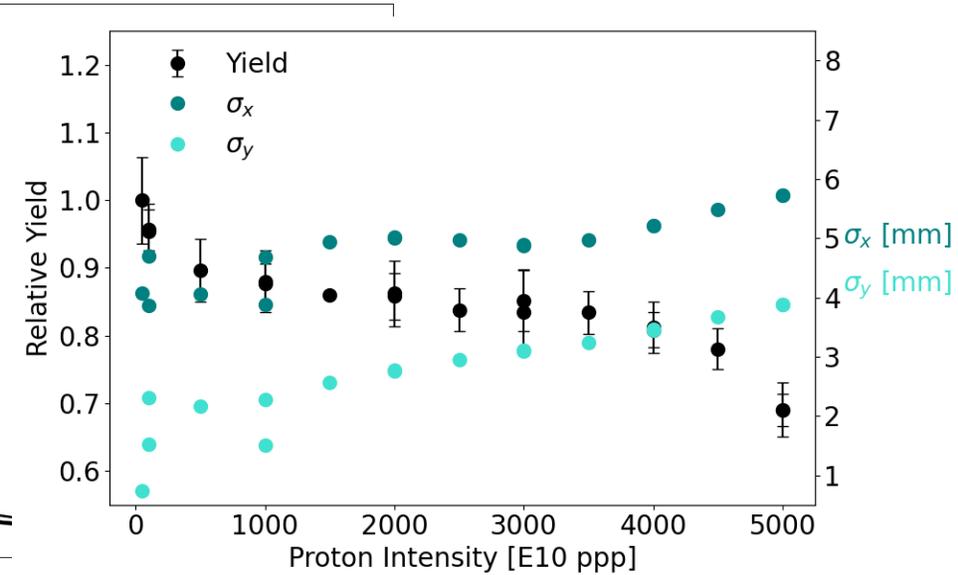
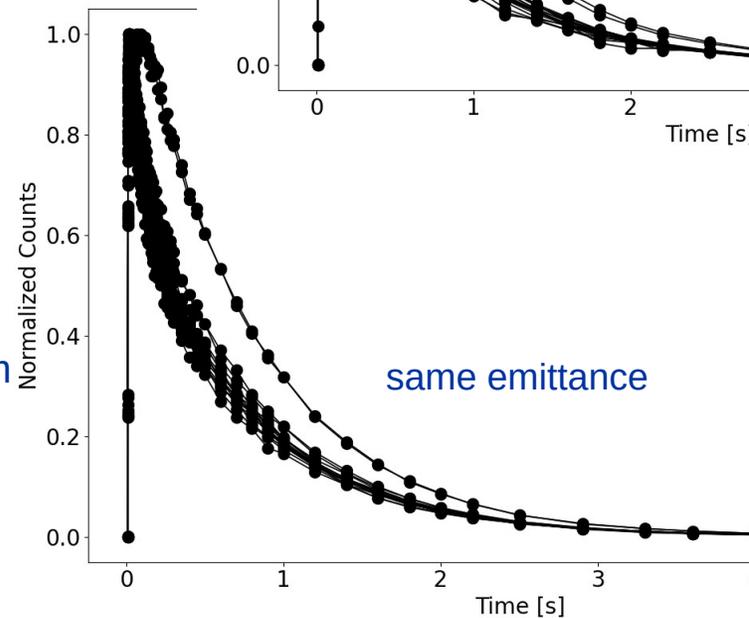
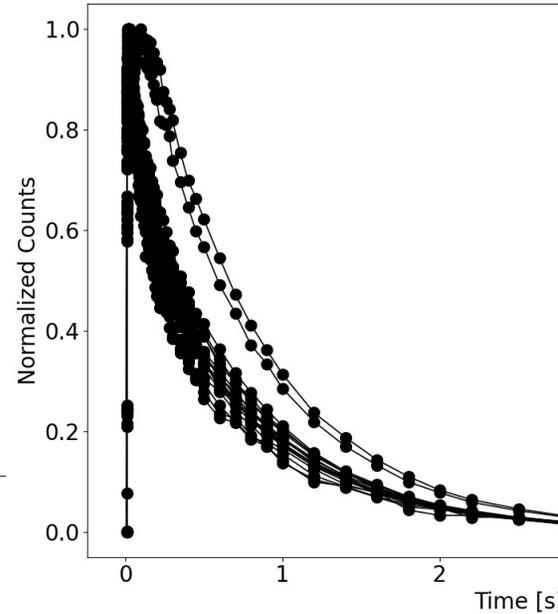
- proton energy 1.4 GeV
- proton intensities (50 - 5000)E10 ppp
- two beam profiles available
 - beam with increasing beam emittance at increasing proton intensity
 - beam with constant beam emittance

First Measurements on HRS

later measurement data reproducible

decrease in yield for increasing proton intensity

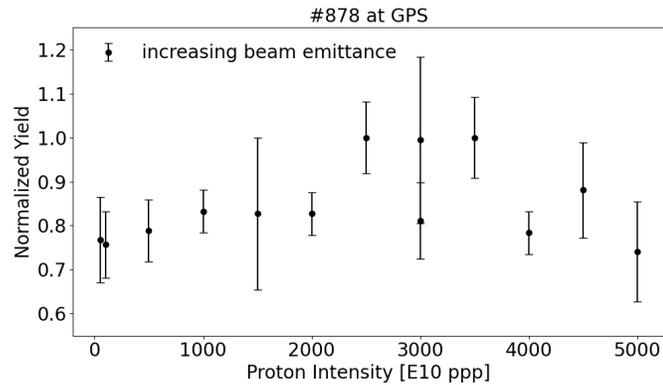
- assumption made in 2024: proton beam larger than target container
- less effect with the same emittance



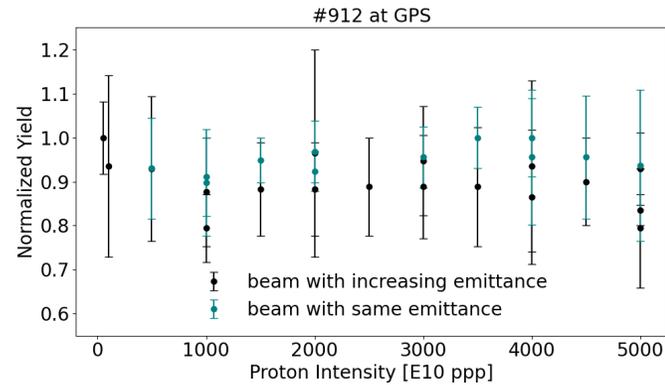
Is there a dependency on the proton beam tune?

Conclusion and Future Outlook

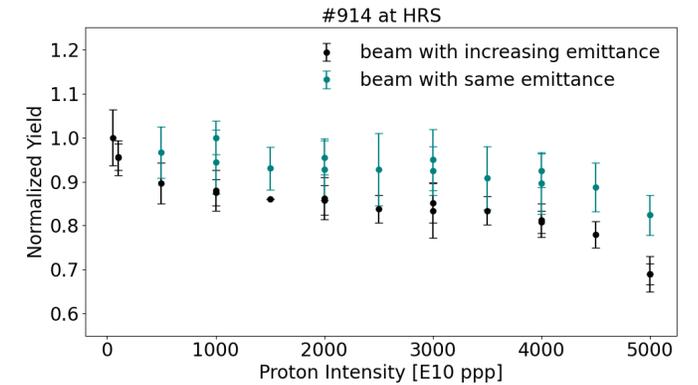
Target #878 UC-TA-MK1 - 2024 GPS



Target #912 Ucx-TA-MK1 - 2025 GPS



Target #914 UC-W-MK1 - 2025 HRS



- ❖ These **high proton intensity studies** are very important for the future of ISOLDE, since ISOLDE will receive fewer proton cycles in the future
- ❖ First studies show **no clear trend** and should therefore be repeated, on both separators, and with different targets and isotopes
- ❖ To check for and exclude a proton beam tune dependency, **further measurements** should be taken with high caution at the beginning of each year

References and Acknowledgment

EDMS 3288709, Studies on the Future Beam Sharing Across the CERN Injector Complex, 2025.

S. Stegemann et al., [The CERN-ISOLDE fast tape station](#), 2023.

Many thanks to all, especially people from the sections SY-STI-RBS/LP and BE-OP-ISO/PSB.

Simon Albright
Foteini Asvesta
Chiara Bracco
Gian Piero Di Giovanni
Charles-Mathieu Genton
Line Le

Sebastian Rothe
Michael Schenk
Piotr Krzysztof Skowronski
Simon Thomas Stegemann
Joachim Vollaire

Additional Slides

ISOLDE Fast Tape Station (FTS)

Tape station with 4 detector positions:

P0: in-beam beta detector

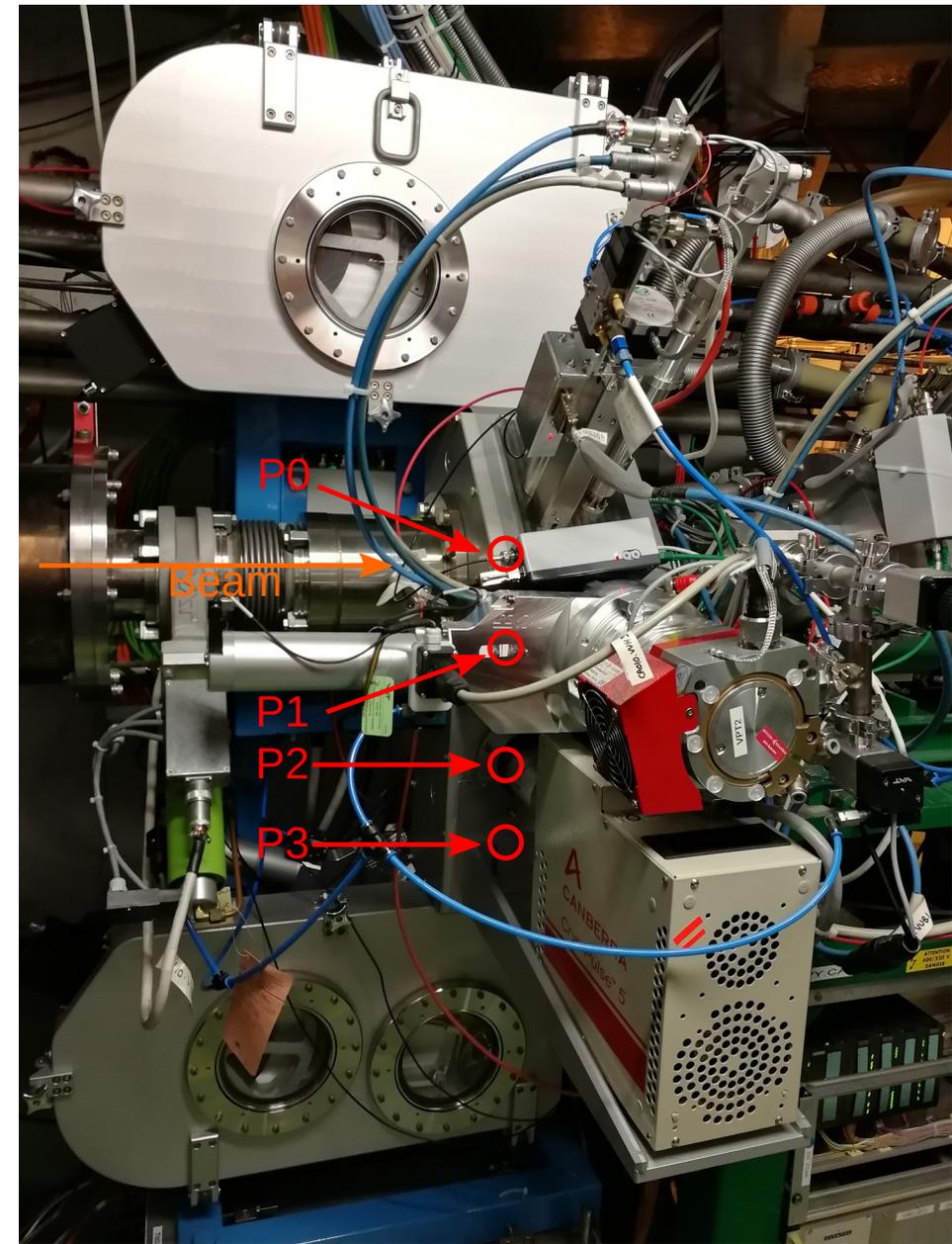
P1: 4π beta detector

P2: HPGe gamma detector

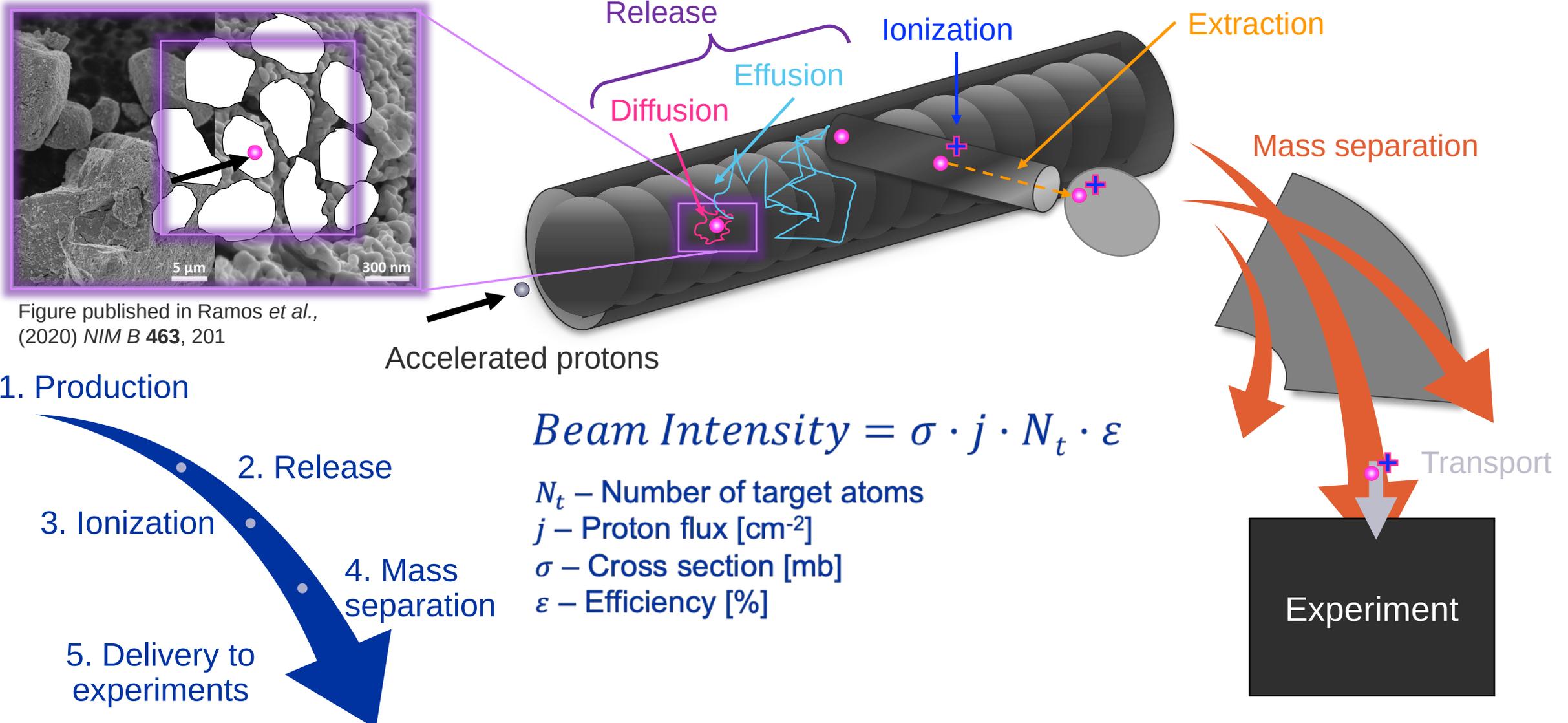
P3: α detector (to be installed)

Transport times $\sim 100 - 150$ ms

Located in CA0

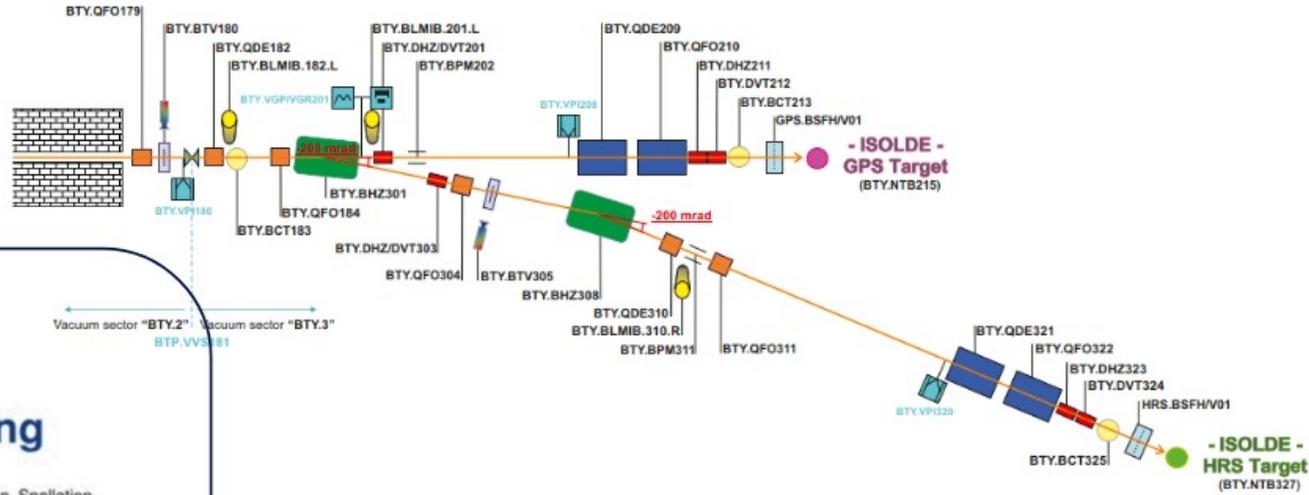


The Isotope Separation On-Line (ISOL) method



ISOLDE BTY-Line

- Usually ISOLDE uses two optics (referred to as STANDARD and WAIST optics)
- This is achieved with the last 2 quads in the BTY line:
 - BTY.QDE209/BTY.QFO210 for GPS
 - BTY.QDE321/BTY.QFO322 for HRS



Neutron converter

Proton beam focusing

Standard focus

Fragmentation, Spallation, Fission

Fragmentation, Spallation, Fission

Waist of beam at target (converter targets)

Fragmentation, Spallation, Fission

