Status of S091 experiment

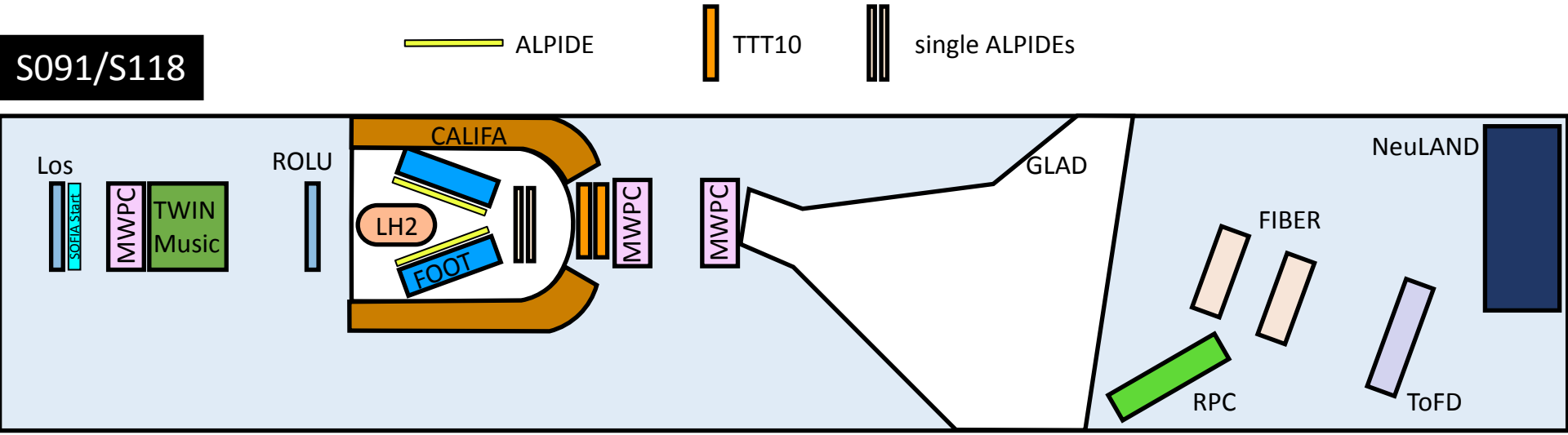
Probing nucleon-nucleon correlations in atomic nuclei via (p,pd) QFS reactions

Wei Zhang

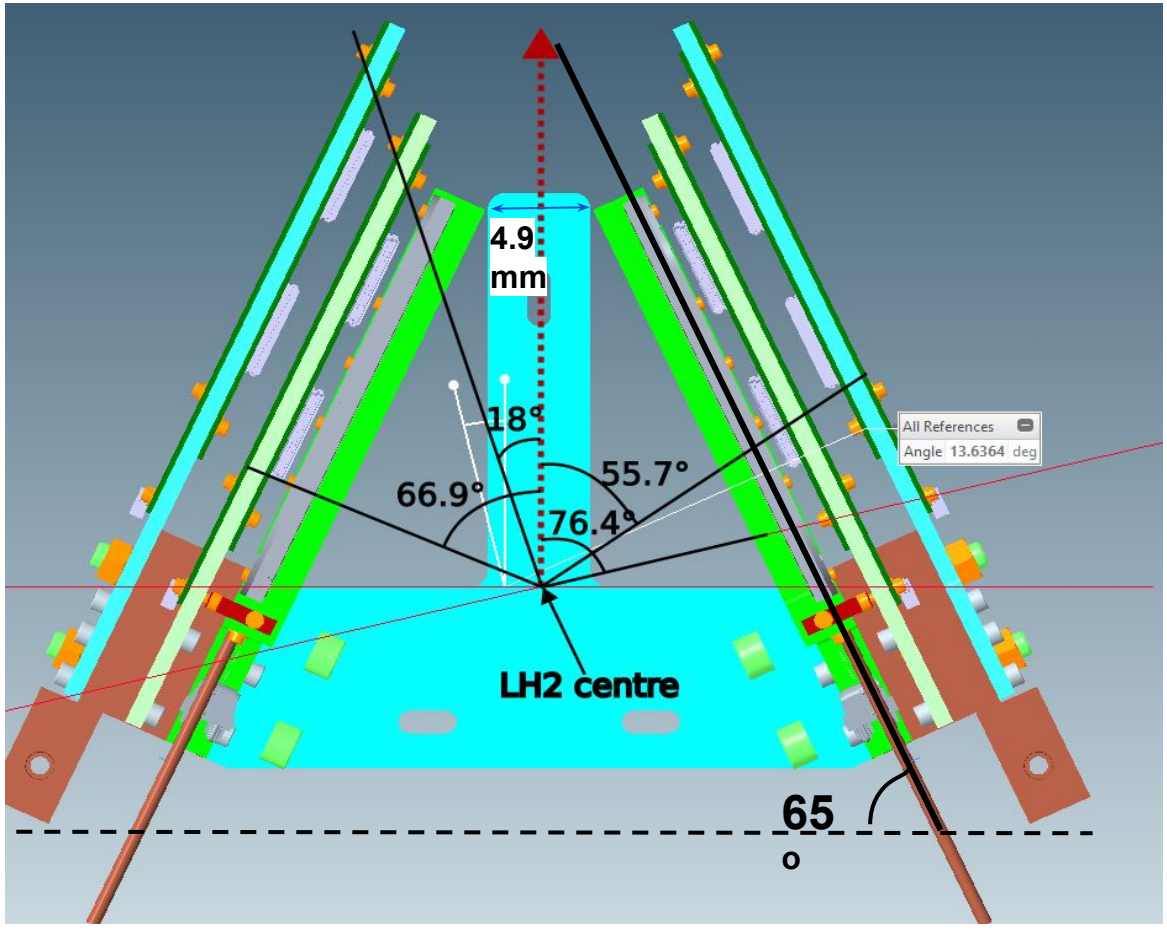
Experiment S091

- Measure (p,pd) quasi-free scattering cross sections of $^{10/14/16}$C relative to ^{12}C.
- Interested in high momentum transfer events.

S091/S118



Alpide + Foot ***x-y x-y*** configuration



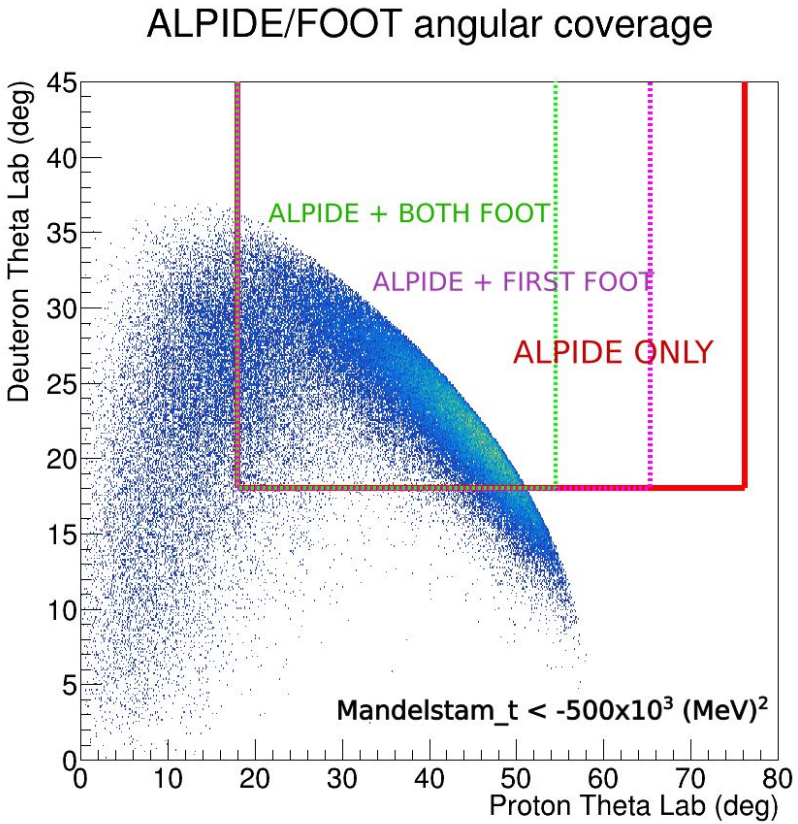
Coverage based on CAD

ALPIDE - 18 - 76.4°

Foot1 - 18 - 66.9°

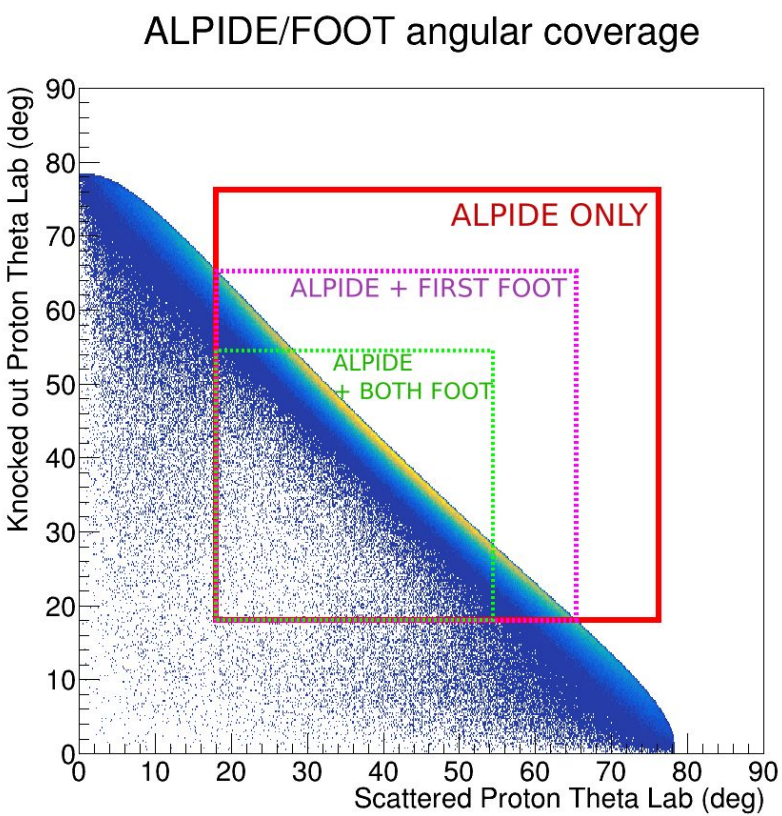
Foot2 - 18 - 55.7°

(p,pd) coverage for 480 MeV/u 12C



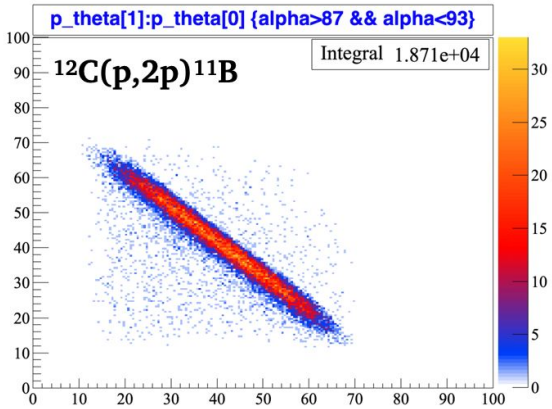
20% for high-momentum transfer (p,pd) events

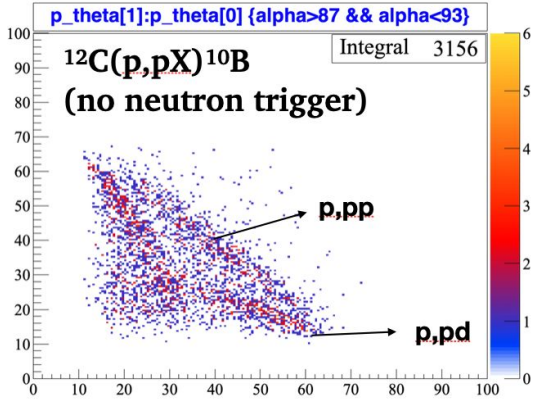
(p,2p) coverage

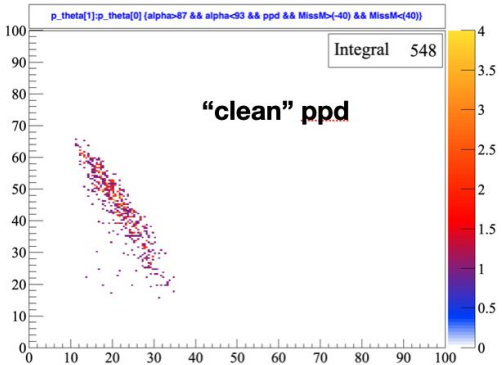


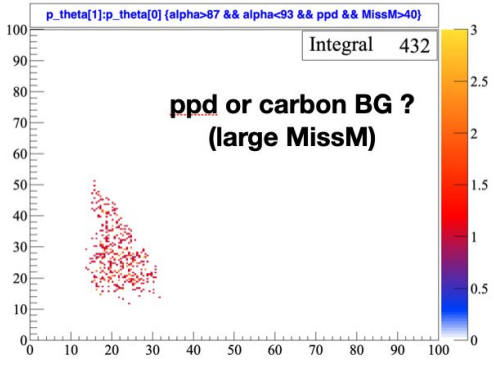
18% for (p,2p) events

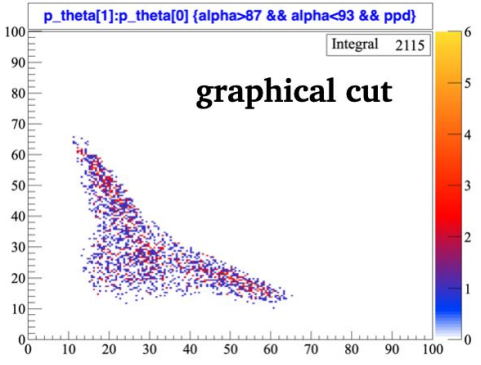
S296 analysis, Valerii Panin

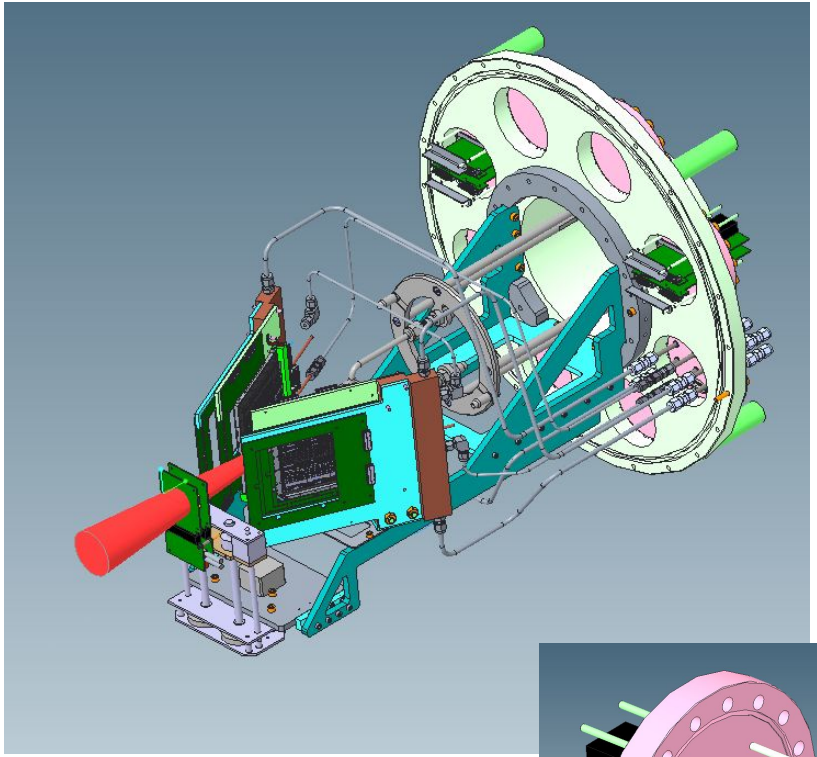


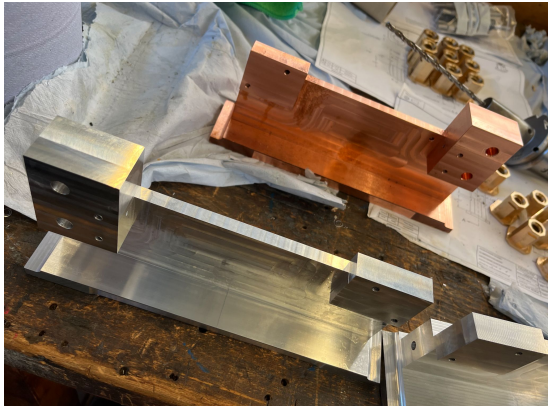


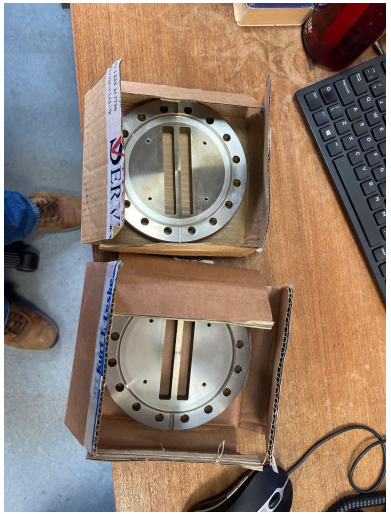


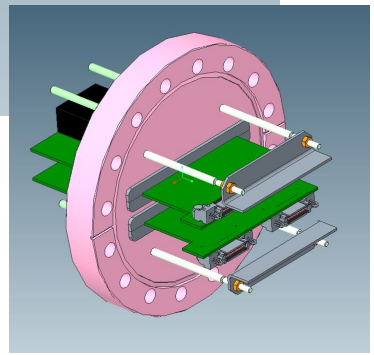


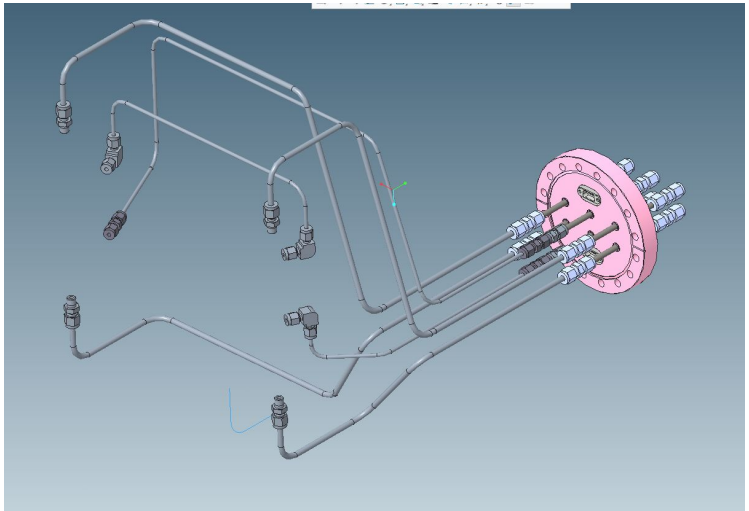








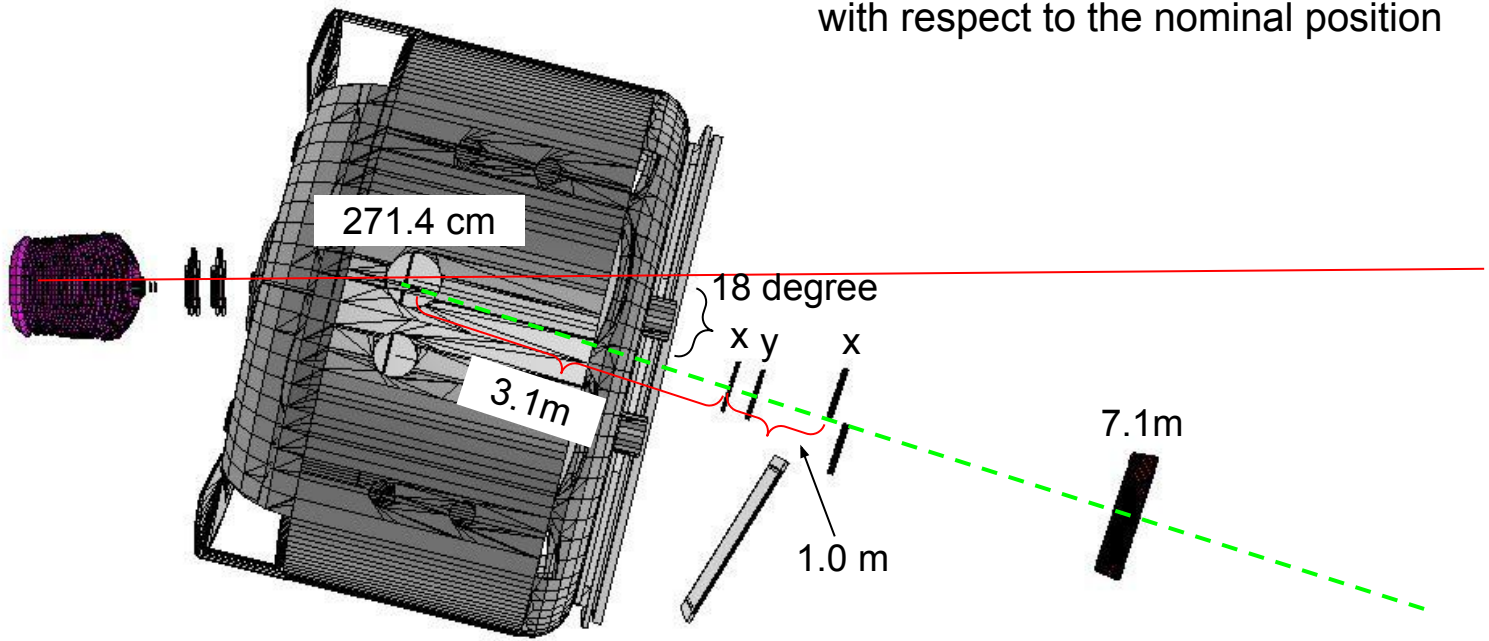




Vacuum test at Daresbury for big flange — October 2023

The positions for Tofd and Fibers

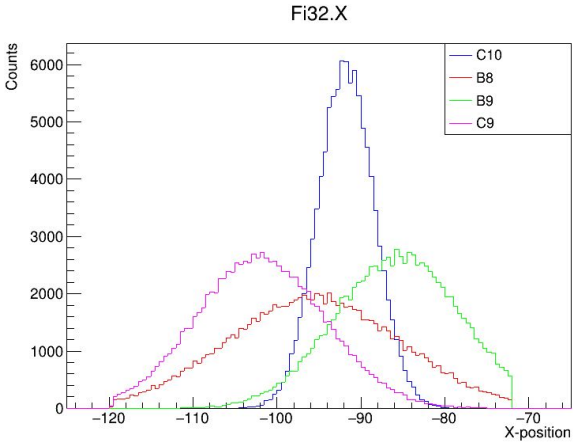
Moved target chamber and Califa -70 cm
with respect to the nominal position

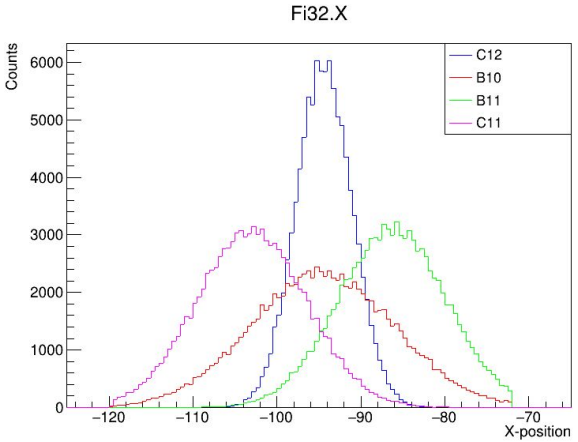


	Fi32	Fi30	Fi33	Fi31	TofD
(*x* cm, *z* cm)	(-95.8, 566.23)	(-103.5, 590)	(-102.9, 669.06)	(-156.3, 669.59)	(-219.4, 946.65)

Fragment acceptance

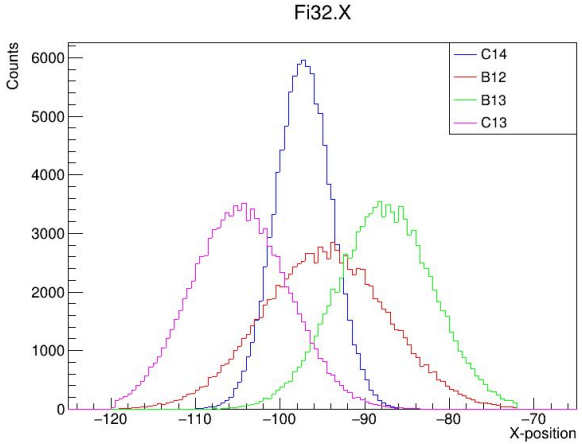
	Fi32	Fi33 & Fi31	TofD	Coincidence
10C	100%	97.4%	91.0%	89.1%
10C(p, pd)8B	99.0%	98.0%	91.6%	87.2%
10C(p,2p)9B	98.6%	99.5%	91.2%	86.4%
10C(p, pn)9C	98.7%	99.7%	91.6%	90.0%
12C	99.9%	98.7%	89.9%	89.9%
12C(p, pd)10B	99.6%	98.6%	90.4%	89.2%
12C(p, 2p)11B	98.7%	98.9%	90.2%	88.1%
12C(p, pn)11C	99.7%	99.2%	90.7%	89.8%

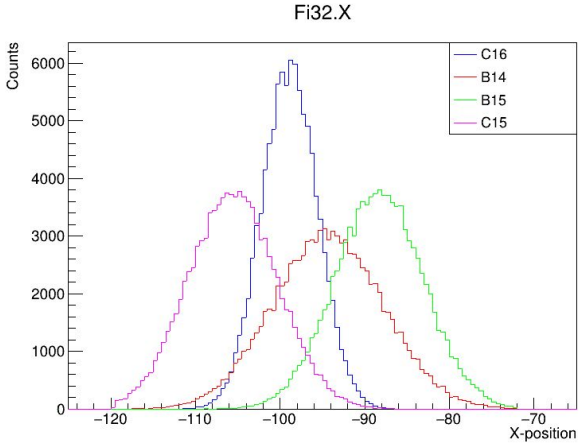




Fragment acceptance

	Fi32	Fi33 & Fi31	TofD	Coincidence
14C	99.2%	97.9%	89.1%	89.1%
14C(p, pd)12B	99.6%	98.4%	89.8%	89.4%
14C(p, 2p)13B	99.0%	98.0%	89.2%	88.6%
14C(p, pn)13C	99.3%	98.3%	89.9%	88.9%
16C	98.8%	97.4%	88.5%	88.5%
16C(p, pd)14B	99.0%	95.6%	88.6%	86.7%
16C(p, 2p)15B	98.6%	96.2%	88.2%	87.2%
16C(p, pn)15C	98.7%	97.5%	88.9%	88.1%





GLAD settings from simulation

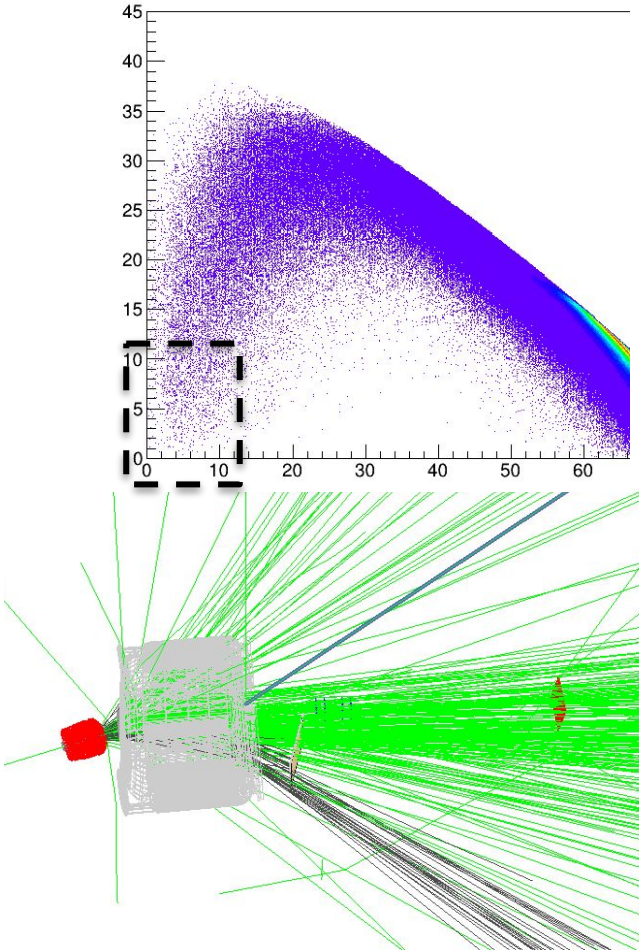
The reference current for the magnet field is 3583.81(1) A.

The field scale for each secondary beam species is set such that the (p,pd) reaction channel is centrally located.

	10C	12C	14C	16C
fieldScale	-0.372	-0.46	-0.554	-0.645

Position for RPC

9C 126.5 ms ε = 100.00% εp = 61.60% εα = 38.40%	10C 19.308 s ε = 100.00%	11C 20.364 min ε = 100.00%	12C STABLE 98.93%	13C STABLE 1.07%	14C 5700 y β⁻ = 100.00%
8B 770 ms ε = 100.00% εα = 100.00%	9B 0.54 kev p = 100.00% 2α = 100.00%	10B STABLE 19.9%	11B STABLE 80.1%	12B 20.20 ms β⁻ = 100.00% β⁻3α = 1.58%	13B 17.33 ms β⁻ = 100.00% β⁻n = 0.26%
7Be 53.22 d ε = 100.00%	8Be 5.57 ev α = 100.00%	9Be STABLE 100.%	10Be 1.51E+6 y β⁻ = 100.00%	11Be 13.76 s β⁻ = 100.00% β⁻α = 3.10% β⁻n ?	12Be 21.47 ms β⁻ = 100.00% β⁻n = 0.50%
6Li STABLE 7.59%	7Li STABLE 92.41%	8Li 839.9 ms β⁻ = 100.00% β⁻α = 100.00%	9Li 178.3 ms β⁻ = 100.00% β⁻n ? 50.00%	10Li N = 100.00%	11Li 8.75 ms β⁻ = 100.00% β⁻n = 86.60% β⁻2n = 4.20%



Mandelstam_T < -300000 && theta_1*DEG < 15 && theta_2*DEG < 15

FRS settings

Note: Rate estimate with **Epax2.15a** (not 3.1), which underestimates the rates in light region

Primary	Beam energy (Ptcl.-per-spill)	Secondary	Energy at Cave (MeV/u)	Rate at S2 (aft. slit)	Rate at Cave (1sec-spill)	Impurity (%)
^{12}C	600? (10^{10} pps)	^{1}H	523 +/- 1%	4e6/4e6	3.4e5	<0.01%
^{12}C	600? (10^{10} pps)	^{2}H	534 +/- 0.5%	5.7e6 / 7.3e6	1.6e6	<1% ^{4}He
^{12}C	600? (10^{10} pps)	^{3}H	537 +/- 0.5%	6.6e6 / 7.4e6	2.4e6	<0.01%
^{18}O	600 (10^{10} pps)	^{16}C 10mm	485 +/- 1%	5.6e5/1.1e7	1.9e5	0.05% ^{15}C
^{18}O	600 (10^{10} pps)	^{16}C **4mm**	489 +/- 1%	—	2.2e5	0.05% ^{15}C,^{13}B
^{18}O	600 (10^{10} pps)	^{14}C 10mm	474 +/- 1%	4.3e6/3.6e7	1.3e6	~0.1% ^{13,15}C, ^{3}He
^{18}O	600 (10^{10} pps)	^{14}C **4mm**	478 +/- 1%	—	1.5e6	~0.2% ^{16}N,^{12}B
^{12}C	600 (10^{10} pps)	^{12}C 10mm	479 +/- 1%	1.2e9/1.2e9	4.1e8	~0.01% ^{10}B
^{12}C	600 (10^{10} pps)	^{10}C 10mm	460 +/- 1%	9.3e5/5.1e6	1.9e5	<0.01%
^{12}C	600 (10^{10} pps)	^{10}C **4mm**	464 +/- 1%	—	2.5e5	<0.01%


Thank you