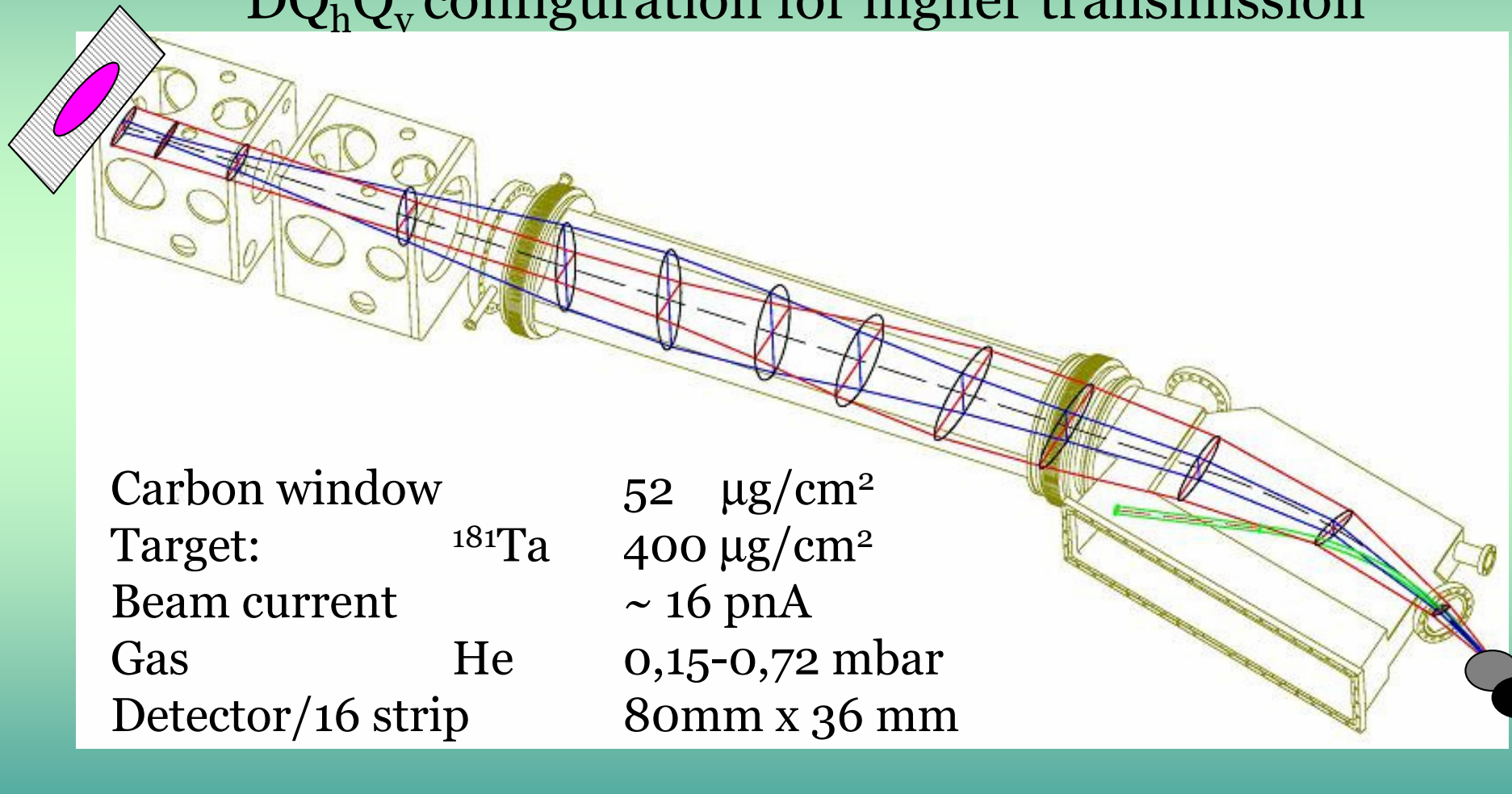
The birth of TASCA – first results

Experimental conditions

DQ_hQ_v configuration for higher transmission



Carbon window		52 µg/cm²
Target:	^{181}Ta	400 µg/cm²
Beam current		~ 16 pnA
Gas	He	0,15-0,72 mbar
Detector/16 strip		80mm x 36 mm

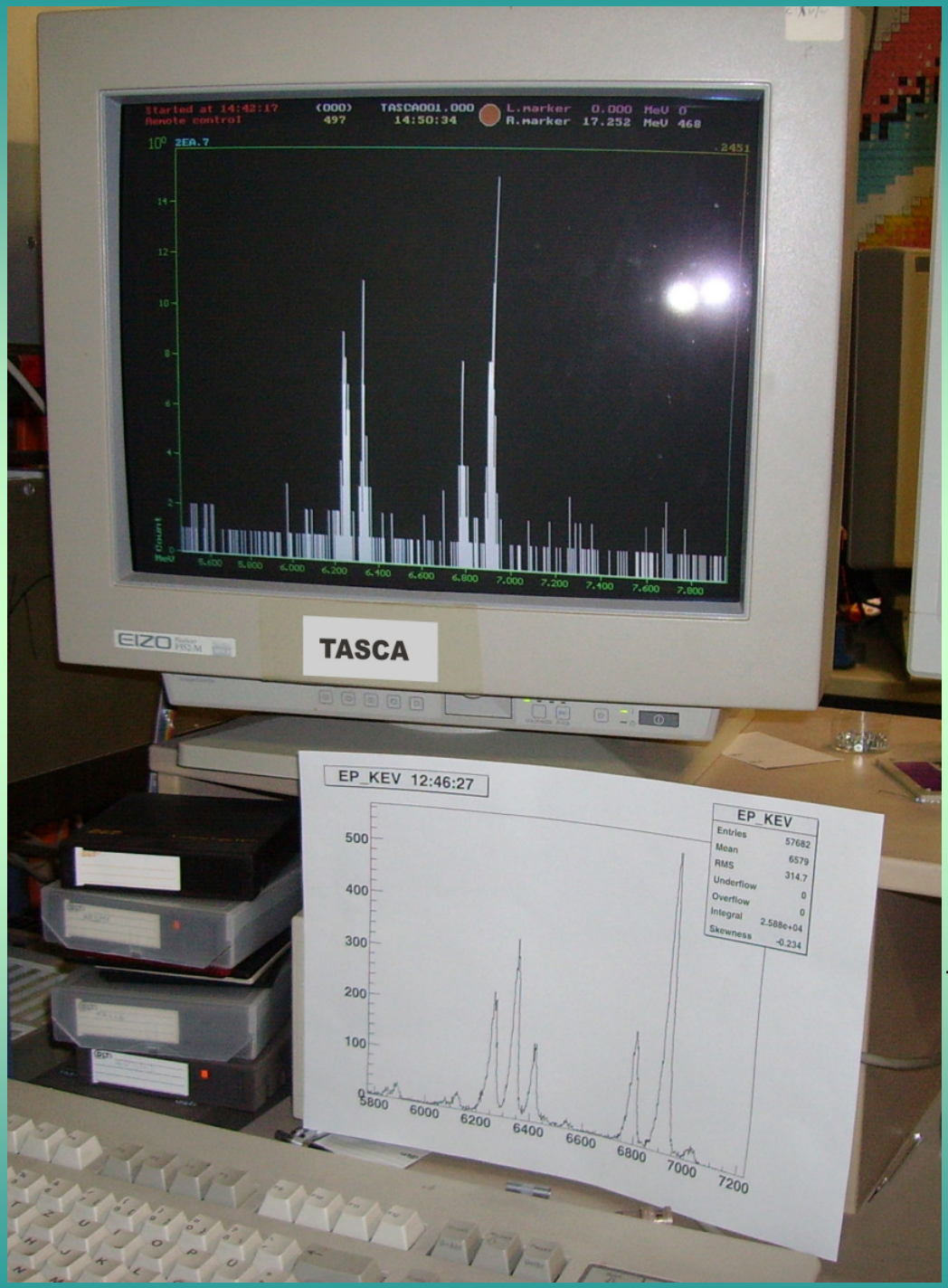
$^{30}Si^{+6}$

5.45 Mev/u

First steps:

Transport of beam through TASCA

Search for products starting from higher rigidity



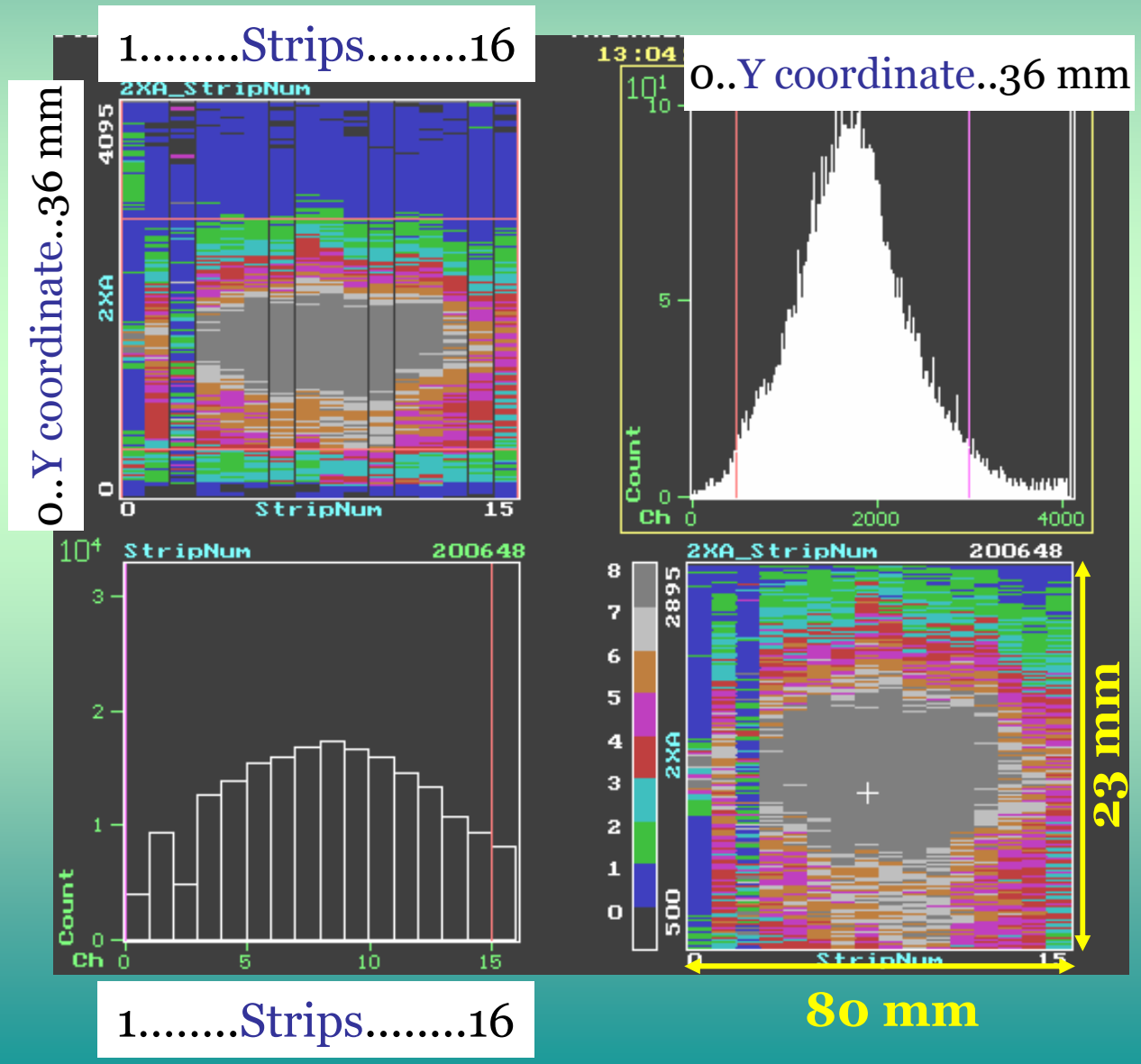
First alpha spectrum of produced Fr isotopes looks similar to the spectrum from SHIP

Magnet settings optimization for ^{205,206}Fr

Current of D, A	Current of Q_1, A	Current of Q_2, A	SUM alpha/s·pnA	P_{He}, mbar
540	490	490	0,57	0,36
500	440	440	1,17	0,36
480	420	420	2,08	0,36
460	400	400	3,17	0,36
440	380	380	3,94	0,36
450	390	420	3,93	0,36
450	420	420	4,21	0,36
450	420	430	3,36	0,72
445	420	430	3,70	0,72

Background from beam was at 0,72 mbar 10 times lower than at 0,36 mbar!

Image size of separated products



DQ_hQ_v

450/420/420 A

0,36 mbar He

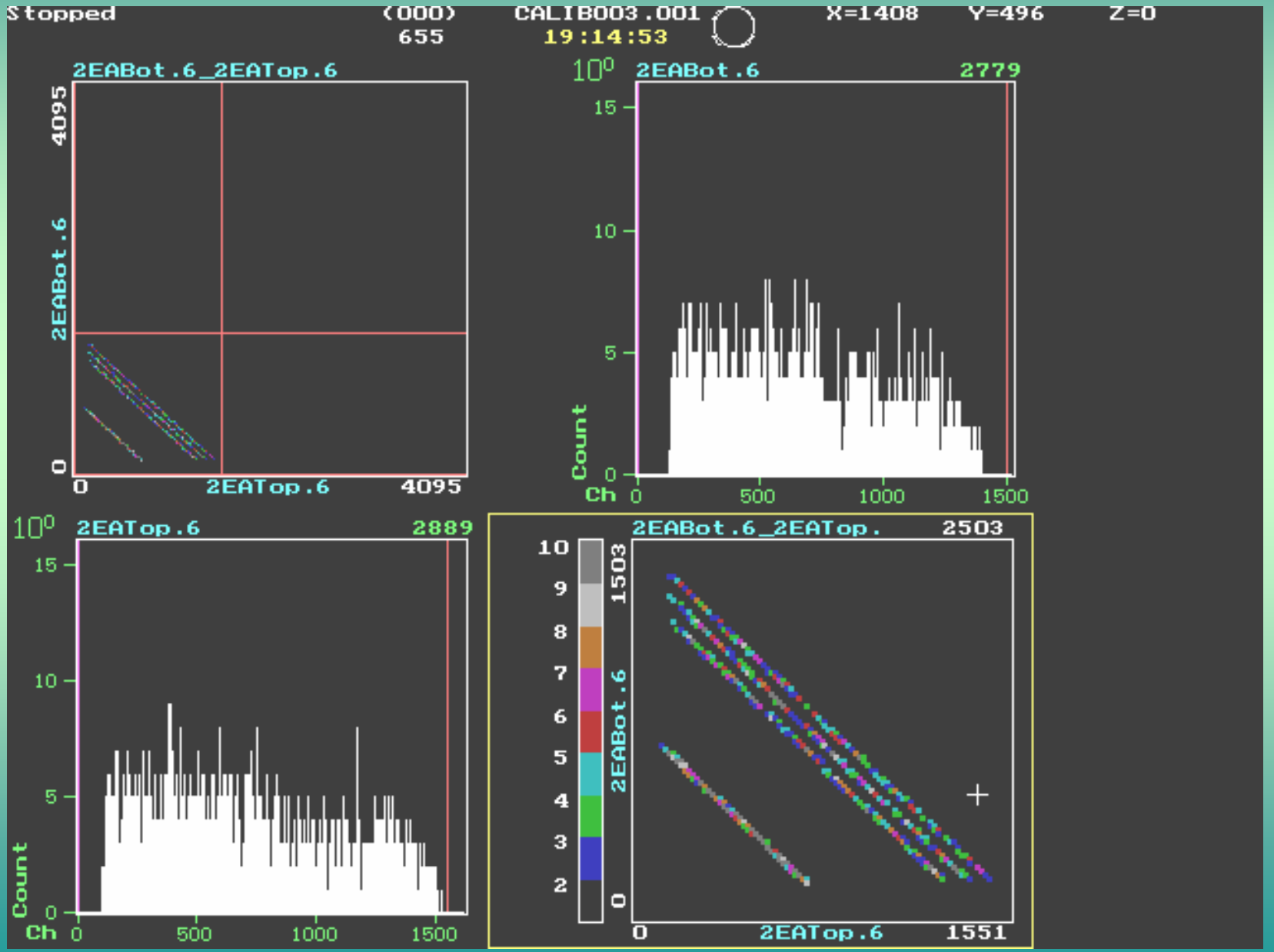
16 pnA $^{30}Si^{+6}$ / 5,45 MeV/u

Window: C – 52 µg/cm²

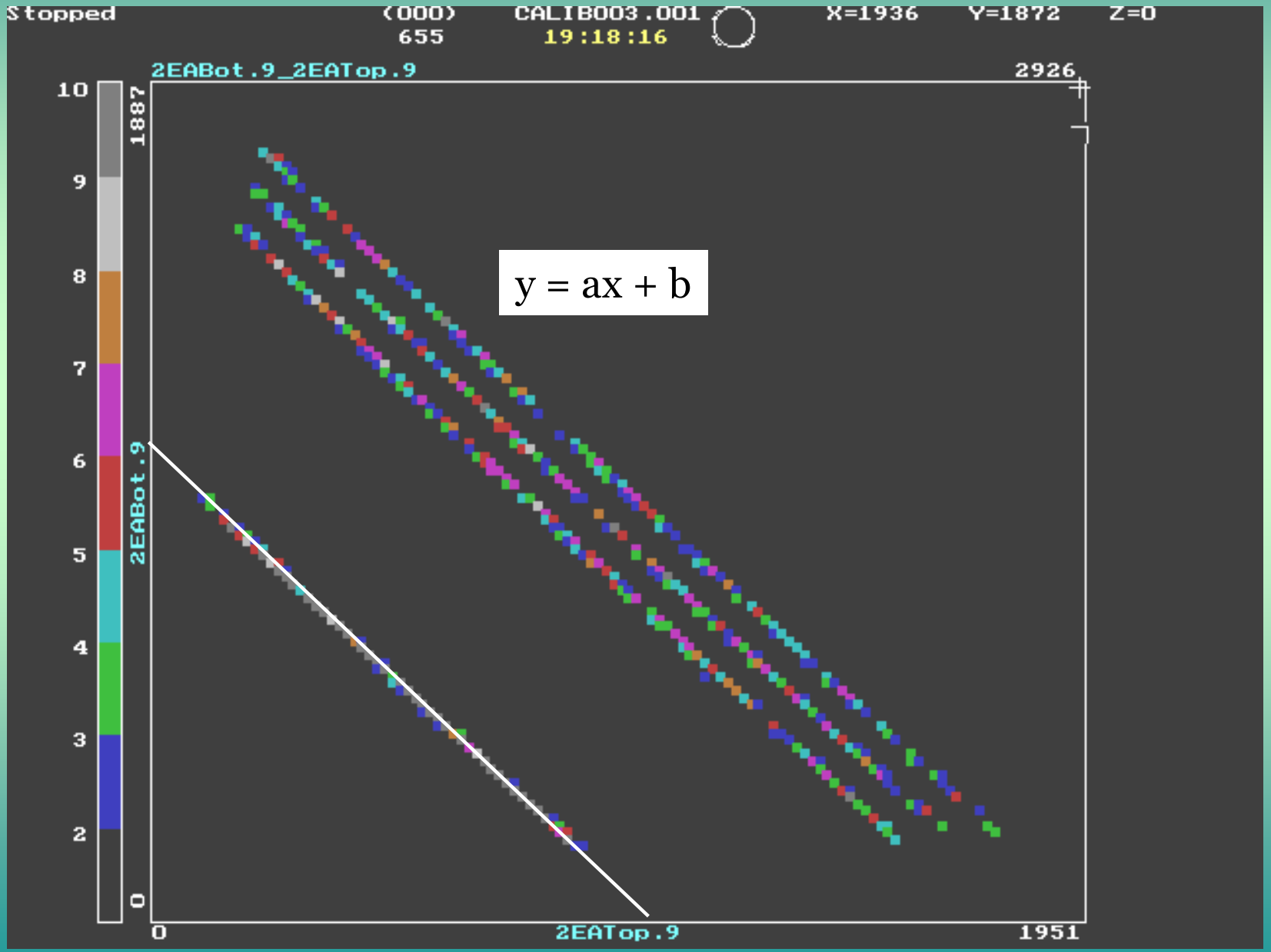
Target: ^{181}Ta – 400 µg/cm²

Detector: 16 st. /80 x 36 mm²

Energy calibration for Top and Bot signals



Energy calibration for Top and Bot signals



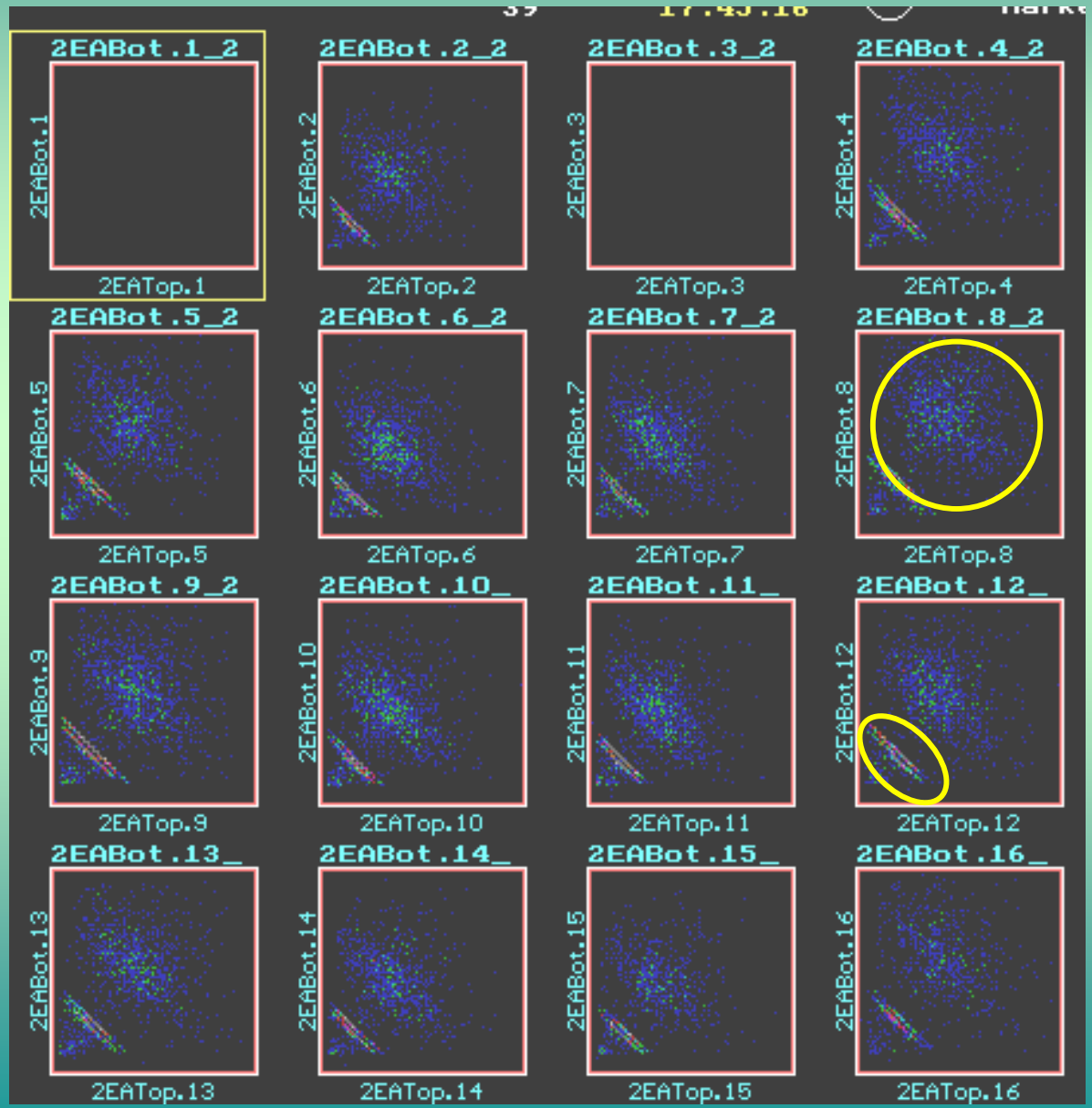
$y = 0$

$E_{top} = E_{\alpha}$

$x = 0$

$E_{bot} = E_{\alpha}$

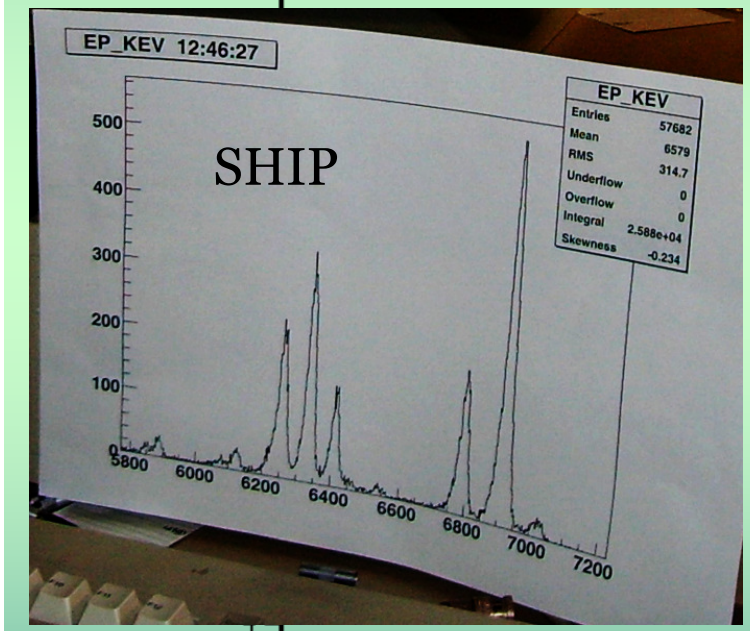
Two-dimensional spectra of the products

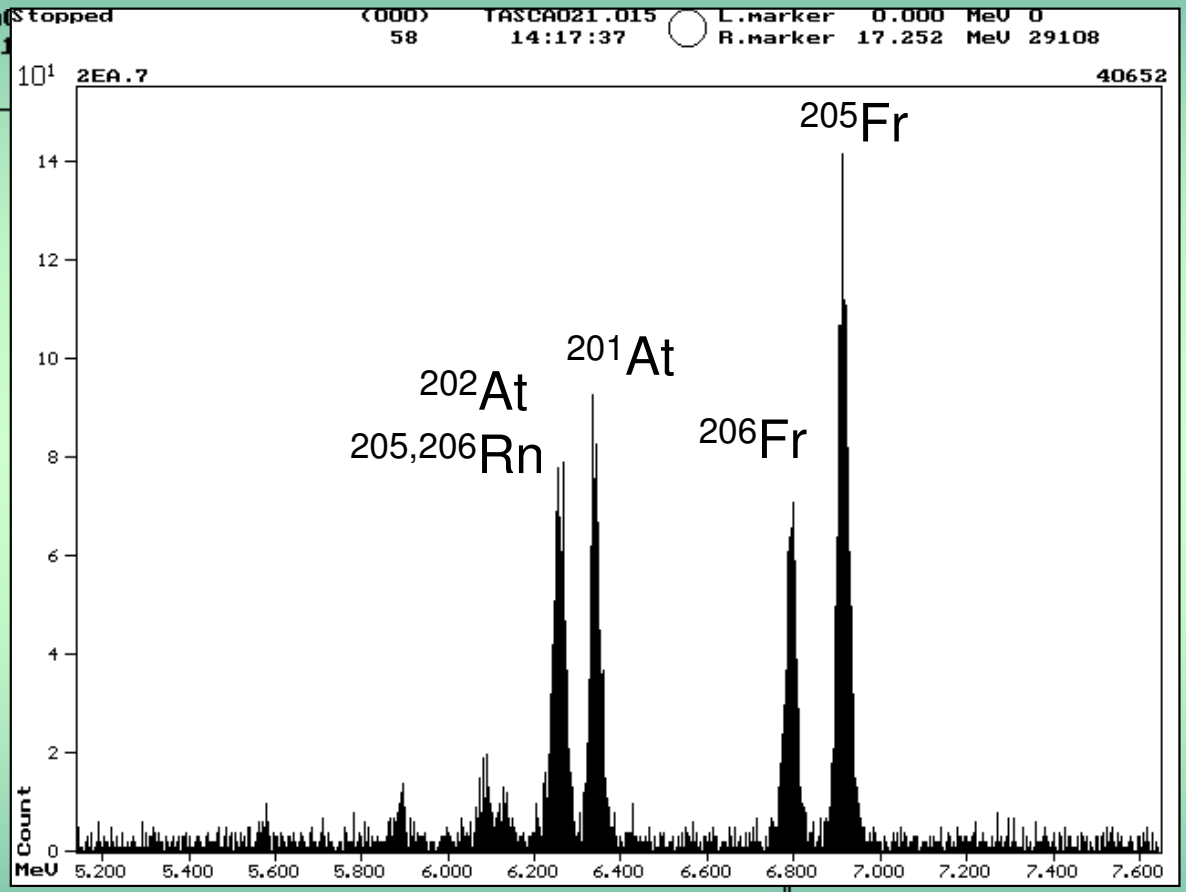


EVRs

Alphas

Single alpha spectrum of separated products





EVRs

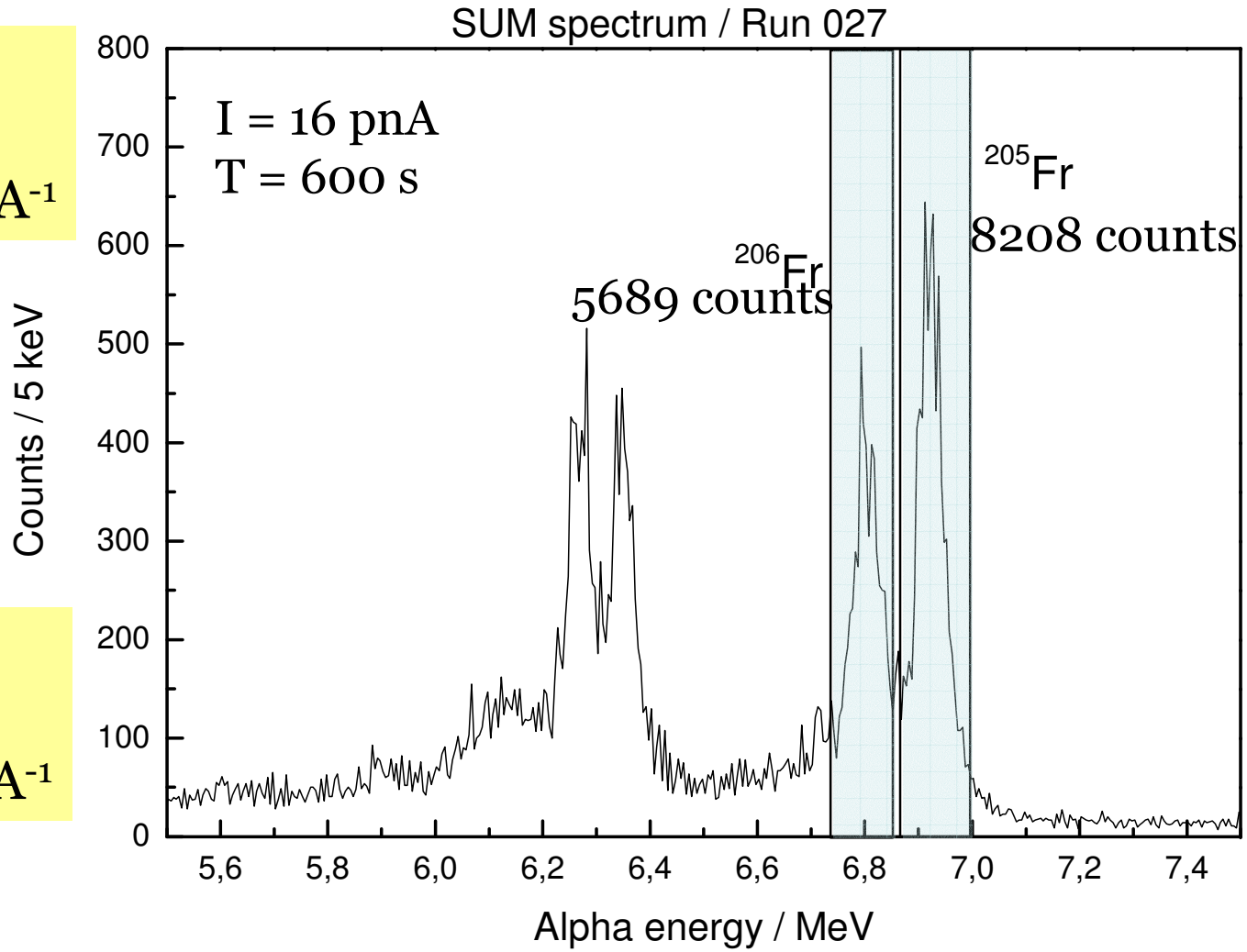
Sum spectrum and counting rate

SHIP

^{205}Fr – 0,21 $s^{-1}pnA^{-1}$

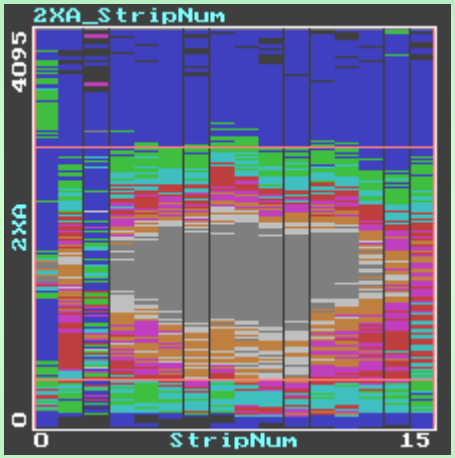
TASCA

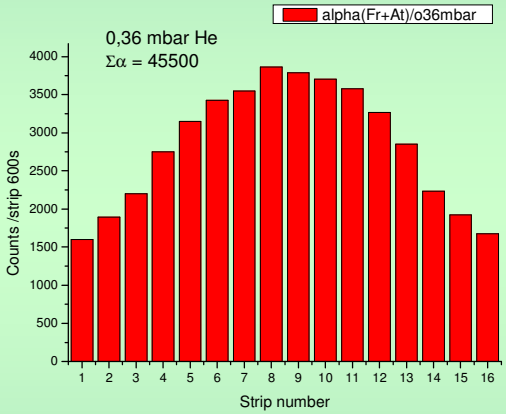
^{205}Fr – 0,85 $s^{-1}pnA^{-1}$



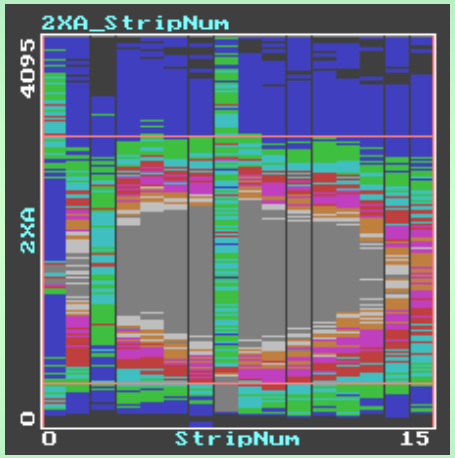
Counting rate and background

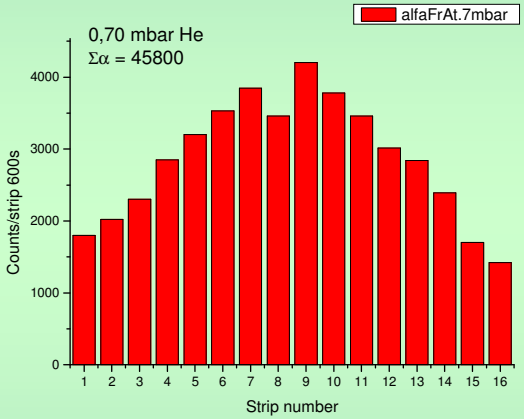
0,36 mbar He, DQ_hQ_v(450/420/420A)





0,72 mbar He, DQ_hQ_v(445/420/430A)

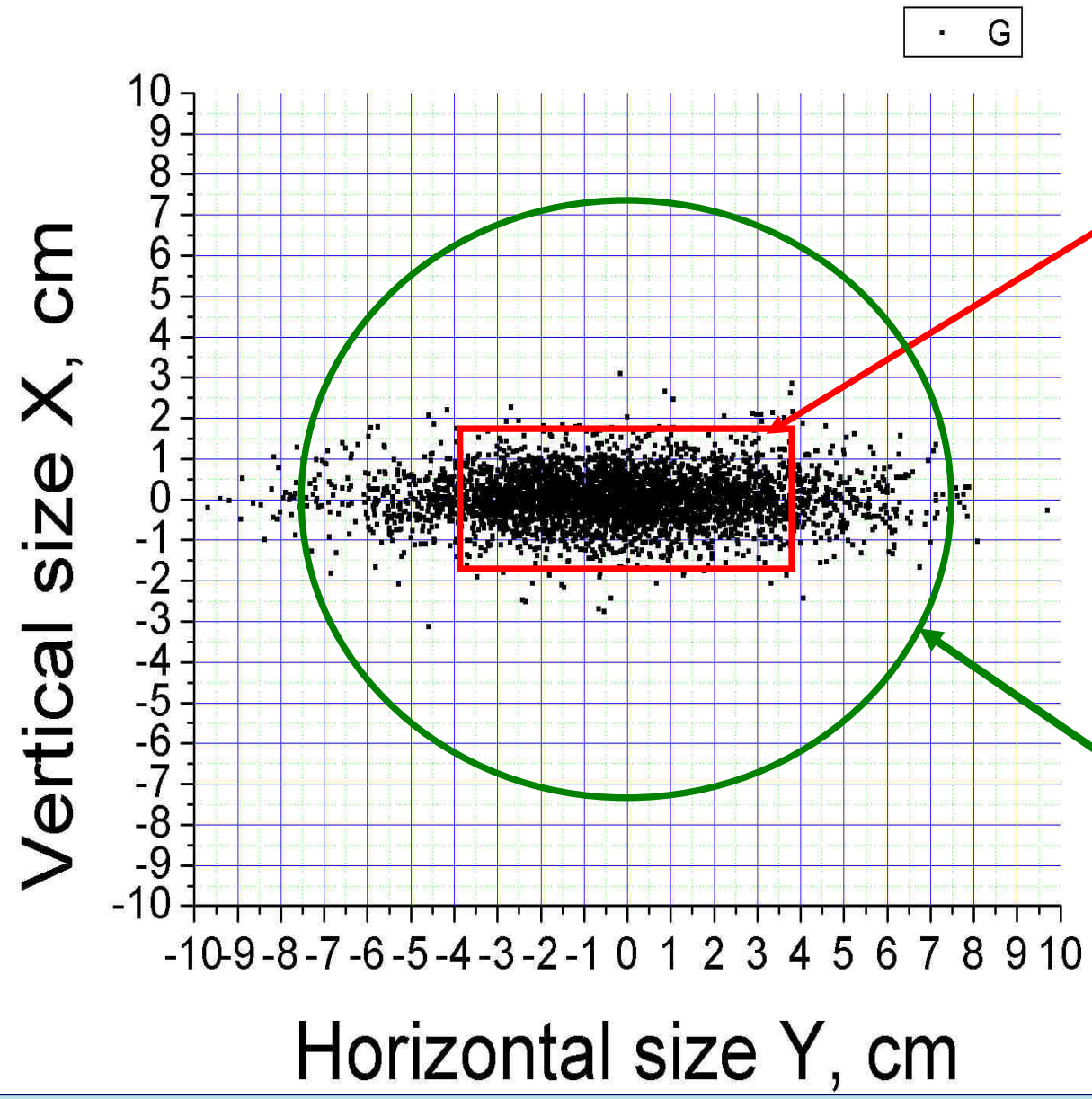




SUM Alpha	SUM EVR	SUM Beam	SUM Alpha	SUM EVR	SUM Beam
45500	65500	175000	45800	109300	16700

Higher pressure reduces background from beam without losses in products counting rate

^{30}Si (162.8 MeV CofT) + ^{181}Ta (400 μg/cm^2) -> ^{205}Fr + 3n, ^{205}Fr focal plane distributions



8*3.8 cm^2 FPD

Monte Carlo calculated transmission ≈30%

ø15cm flange

TASCA transmission efficiency (estimation)

^{30}Si (5,45 MeV/u) + ^{181}Ta (400 µg/cm²) /detector size 80 x 36 mm²

	^{205}Fr	^{206}Fr
Cross section	σ_{cal} ~ 0,1 mbarn	σ_{cal} ~ 0,5 mbarn
Beam	10^{11}	10^{11}
Target	$1{,}33 \cdot 10^{18}$	$1{,}33 \cdot 10^{18}$
Production rate	13,3 s^{-1}	66,5 s^{-1}
α branch	100%	84%
α detection eff.	~ 50%	~ 50%
Counting rate	13,6 s^{-1}	9,48 s^{-1}
Efficiency	-------	~ 34%

Happy birthday TASCA!