

Y. Litvinov, 22.03.2020

The goal is to measure lifetime of fully ionized  $^{205}\text{Tl}^{81+}$ .

### 1) $^{206}\text{Pb}^{81+}$ (Hydrogen-like) beam injected into the ESR at 400 MeV/u.

FRS:

Setting E127\_04 (centred through at S1, S2 and optimized y-steerers)

Only SEETRAM

Br(Ta-ESR)=8.06838 Tm *ok, checked*

E(SIS)=401.17 MeV/u, *ok, checked.*

Charge state distribution (GLOBAL) for  $^{206}\text{Pb}$  after the SEETRAM  $0e/1e/2e = 48\%/32\%/6\%$  *???*

To avoid contamination at S2, the S1 slits shall be closed to +/-10 mm to remove  $^{206}\text{Pb}$  charge states

*at S1:*

$82+$	at	$-26$ mm	(LISE)
$81+$	at	$0$ mm	(LISE)
$80+$	at	$+26$ mm	(LISE)

ESR:

*at S5: LISE:  $82+$  at  $-26$ ,  $81+$  at  $0$ ,  $80+$  at  $+26$*

Set-up stochastic cooling

Set-up stacking

Setup the MWPC detector E01DD2AG (to be moved in event mode) (capture)

Setup the CsSiPHOS detector E01DD2IG (to be moved in event mode) (stripping)

Measure stripping/capture efficiencies with  $\text{H}_2$  gas jet

Measure beam lifetime with 200 mA, 10 mA electron cooler currents (NTCap)

### 2) $^{206}\text{Pb}^{81+}$ (hydrogen-like) at 396.7 MeV/u (pre-drilling setting)

FRS:

Transmit the beam through the FRS with all matter in.

TA: TS1ET5, #26,  $^{1624}\text{Be} + ^{223}\text{Nb}$  (unfortunately we did not measure its effective thickness)

S2: Degradar disc, assumed as homogenous,  $735 \text{ mg/cm}^2$  (effective thickness measured with  $^{124}\text{Xe}$ )

Br(TA-S2)=8.7153 Tm

Br(S2-ESR)=8.0292 Tm

E(TA) = 591.64 MeV/u (assuming the nominal TA thickness)

E(SIS)=592.66 MeV/u (assuming the nominal TA thickness)

ESR:

Optimize injection efficiency

### 3) $^{205}\text{Tl}^{81+}$ (fully-ionized) at 400 MeV/u (main setting)

FRS: all matter as in 2)

$\text{Br}(\text{TA-S2}) = 8.6959 \text{ Tm}$

$\text{Br}(\text{S2-ESR}) = 8.0292 \text{ Tm}$  —unchanged—

$E(\text{TA}) = 592.14 \text{ MeV/u}$  (assuming the nominal TA thickness)

$E(\text{SIS}) = 593.16 \text{ MeV/u}$  (assuming the nominal TA thickness)

The goal is to achieve clean monoisotopic beam into the ESR

ESR:

Check contamination level of  $^{205}\text{Pb}^{81+}$  by switching on gas-jet and counting the number of  $^{205}\text{Pb}^{82+}$  ions by the CsI SiPHOS detector

FRS-ESR

If needed, introduce scraper at S6, TE5DSBHR, which shall cut into  $^{205}\text{Pb}^{81+}$  distribution.

The contamination by  $^{205}\text{Pb}^{81+}$  is essential.

We can sacrifice some  $^{205}\text{Tl}$  intensity but shall reduce the intensity of  $^{205}\text{Pb}^{81+}$  to as small as possible.

General:

Assumed cross-section for removing 1 proton from  $^{206}\text{Pb}$  is 20 mbarn (EPAX gives only 2 mbarn) as measured within "cold fragmentation" studies at the FRS [J. Benlliure et al., NPA A 660 (1999) 87]

Intensity in the ESR is  $1e5$   $^{205}\text{Tl}^{81+}$  ions/injection.

At least 10 stacks to  $1e6$  ions is required.

Time estimate:

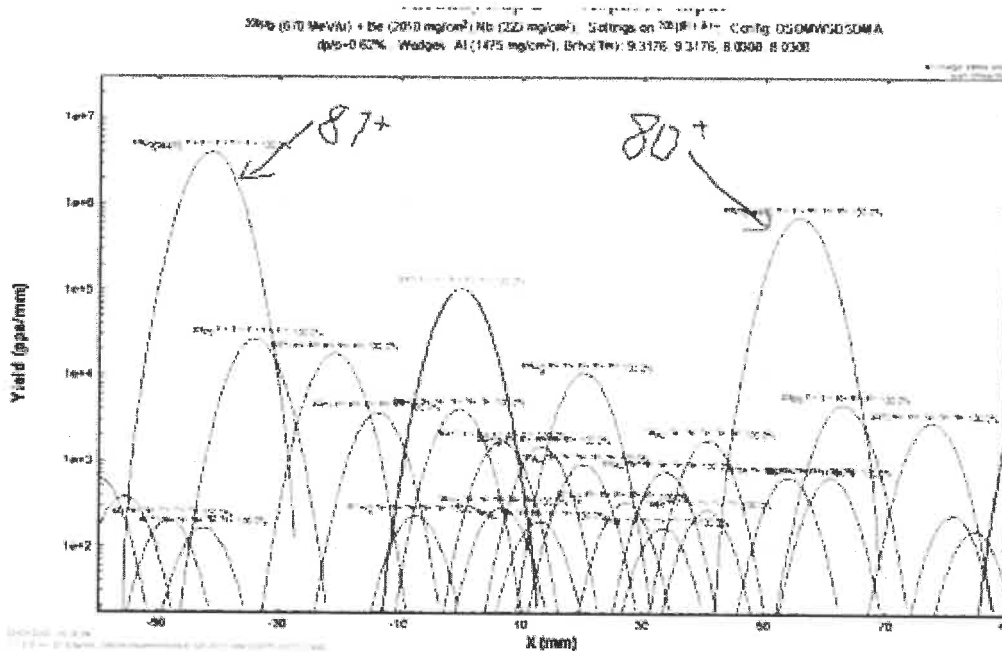
- 1) FRS setup should be quick. ESR setup is essential at this step and can take many hours.
- 2) FRS setup is essential at this step. ESR injection optimization is relatively quick.
- 3) The most essential step. The diagnostics of the number of  $^{205}\text{Pb}$  contaminant can be done only with the ESR.

H. Weick, 22.03.2020

a first step for FRS tuning can be on charge states of the primary beam.

We can hope to see them on the current grids at S6 in the 205TI setting, if we scale FRS S2-S6 a bit.

The unwanted 205Pb81+ is almost under the big 206Pb81+ peak.



As we cannot resolve 205TI81+ and 205Pb81+ in Schottky, optimization like slit settings will almost be impossible.

Do you think we can use the corresponding pair of 204TI? Peak distances at S6 are the same as for 205TI and the mass difference is  $\sim 840$  keV ( $dm/m = 4.4e-6$ ).

Alternatives other weaker Schottky lines are mostly quite different in  $m/q$  and not in the same ESR setting.

203TI80+ is 0.93% away in Brho.

Y. Litvinov:

The 204Pb/TI pair we can try. If we reduce the intensity a bit, we shall be able to resolve them in Schottky.

For 205Pb/TI diagnostics, we thought to use the gas jet to strip the electron and detect the Pb ions in

the detector. We shall take it in operation with H-like primary beam and it shall be available for the quick diagnostics.

18:55 Strahlübergabe ~~SR-SIS~~ → FRS

Request E-change from 593.16 MeV/u to 401.17 MeV/u.

Insert CG01 +02

Load dataset E127-04 from scheidenb@asl

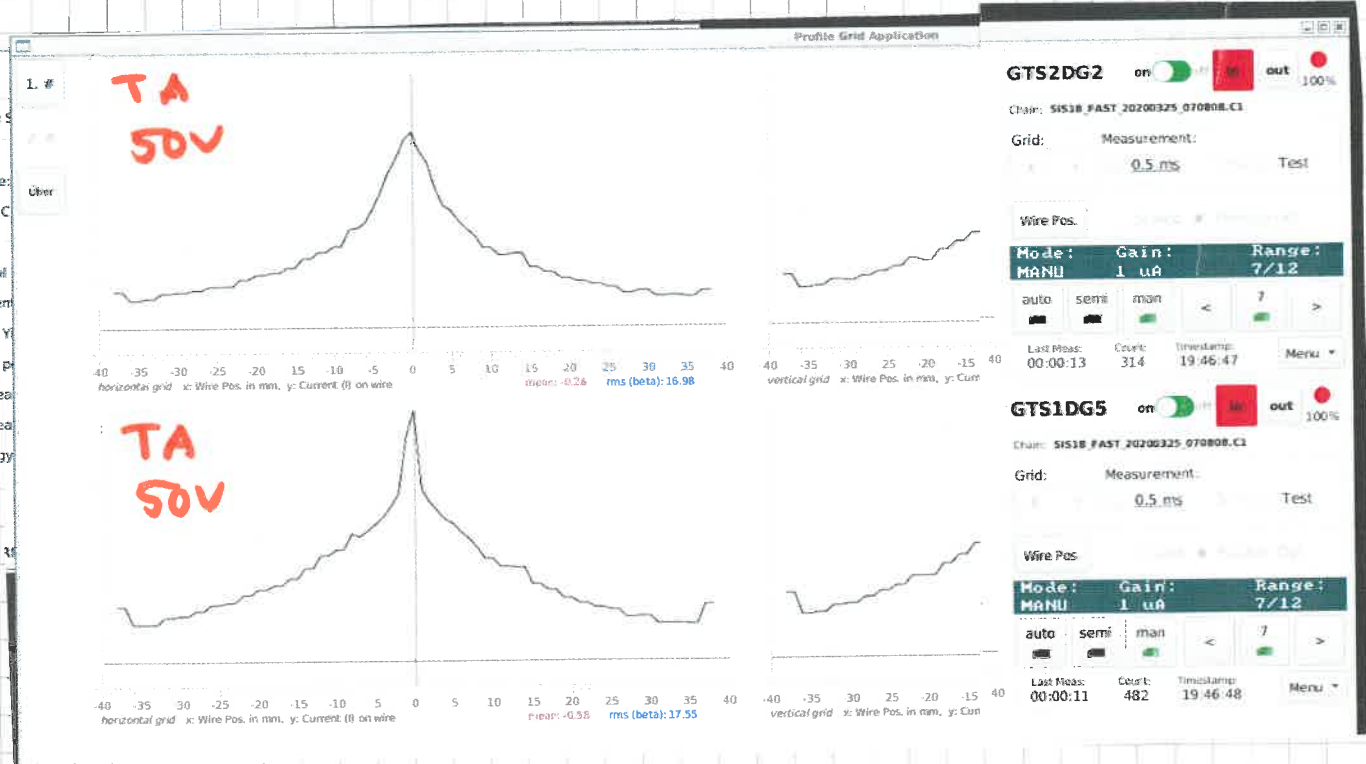
set Bg TA-56 = 8.06838 Tm.

precycle

"Geradelegen" at Target:

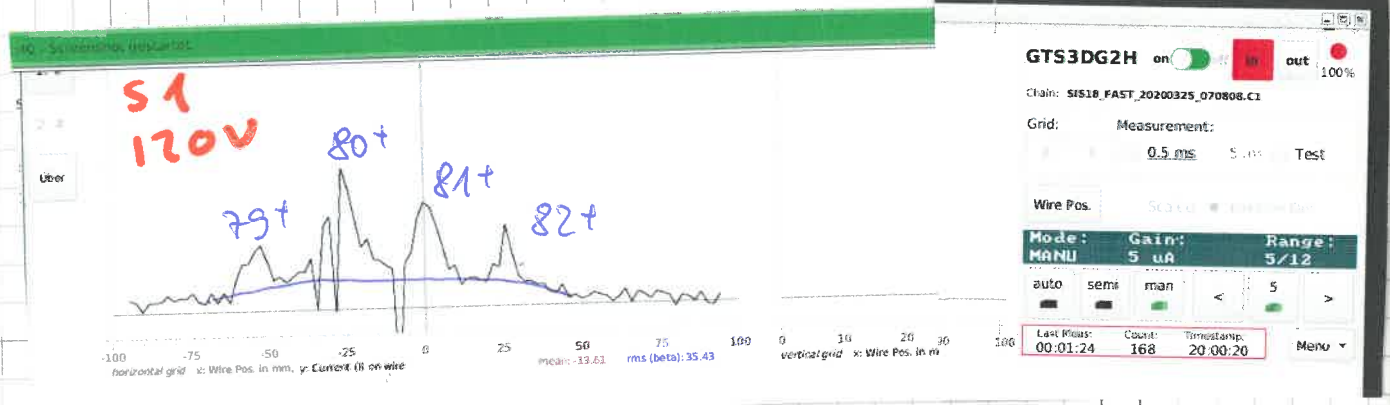
TS2DG2 (X) TS1DG5 TS2DG2 (Y) TS1DG5

position +10 mm +1 mm -5 mm -5 mm  
Ø Ø || Ø

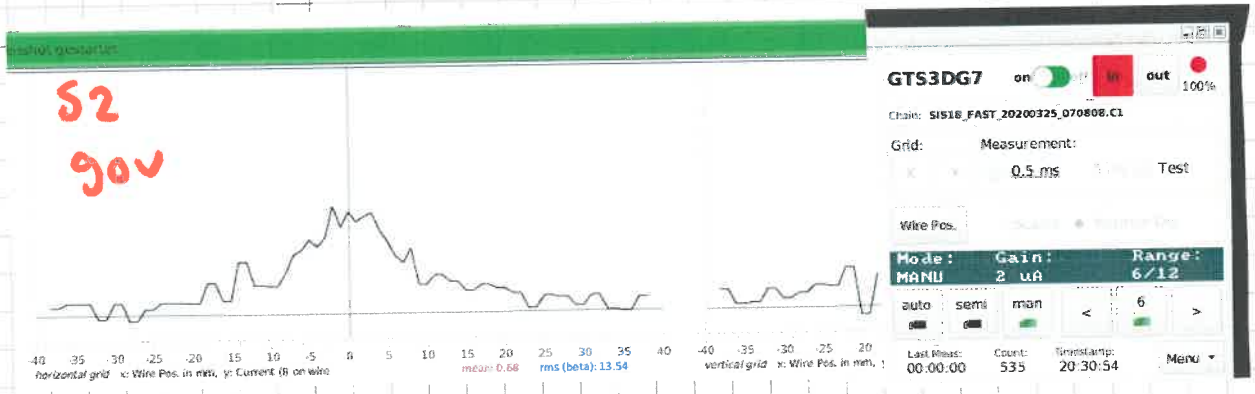


remove CG01, 02, go to S1

check spectrum at S1: => Orientation ?  
 8,06838 → 7,97  $\mu$ m: => CG 01 looks in beam  
 direction (left-handed)  
 => go back to 8,06838  $\mu$ m, then 81+ is centered  
 calculation yields 0/1/2/3e = 4/28/63/5 % !  
 this looks reasonable!



remove CG 01, close S1 =  $\pm 10$  mm  
 Position  $\approx +5$  mm, Dip. (S1-S2) = -351 cm  
 present HKICK = -2,787  $\mu$ m  
 new HKICK = -2,043  $\mu$ m => o.k. TS3U02



remove CG 01, and go to S3 and S5  
 We leave the beam at S3 at  $\sim -10$  mm without drifts.

→  
 continue on  
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401.17 MeV/w 206 Pb<sup>67+</sup> from SIS, only VW + SEΦ<sub>1</sub>, 81° centered VA-57  
 (B<sub>S</sub> = 8,06838 Tm)

Date: 25-03-2020, 20:14:10

SIS18\_FAST\_20200325\_070808/SIS18\_FAST\_20200325\_070808.C1

~~ELISA~~ E121-Φ<sub>1</sub>

Device ID	Status	I <sub>list</sub> (A)	I <sub>soil</sub> (A)	ΔI (A)	Bp (Tm)	BL <sub>soil</sub> (Tm, T)	KL <sub>soil</sub> (l, l/m)	HProbe (Tm)
GTE1KY1	1	-39.358521	-39.308000	0.001284	N/A	-0.017713	0.0	
GTE1QD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	584.002197	583.870000	0.000226	9.773407	1.279300	0.130927	
GTS1KY1	1	4.879910	4.813000	0.013711	N/A	0.002217	0.0	
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	
GTS1MU2	1	269.956053	270.040000	-0.000311	9.768257	1.295600	0.132594	
GTS2QT11	1	92.178106	91.990000	0.002041	8.084773	1.789100	0.221743	
GTS2KY1	1	-0.012177	-0.030945	-1.541403	N/A	0.0	0.0	
GTS2QT12	1	205.304117	209.230000	-0.019122	7.916921	-4.854900	-0.601722	
GTS2QT13	1	149.290445	149.270000	0.000137	8.069413	2.893500	0.358619	
GTS2KS1	1	-0.002594	0.0	1.000000	N/A	0.0	0.0	
GTS3MU1	1	369.811090	369.600000	0.000571	8.073031	4.224900	0.523635	4.287635
GTS3KS1	1	0.038911	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	157.475509	157.340000	0.000861	8.075461	3.050400	0.378070	
GTS3QD12	1	108.072146	107.990000	0.000760	8.074751	-2.111400	-0.261688	
GTS3QD21	1	107.394635	107.090000	0.002837	8.091615	-2.084500	-0.258354	
GTS3KY1	1	0.019868	-6.661000	100.000000	N/A	-0.005942	0.0	
GTS3QD22	1	156.724754	156.540000	0.001179	8.077679	3.021900	0.374541	
GTS3KS2	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	367.723624	367.740000	-0.000045	8.067957	-4.202100	-0.520812	-4.203861
GTS3KS3	1	0.020753	0.0	1.000000	N/A	0.0	0.0	
GTS3QT31	1	142.863247	142.700000	0.001143	8.077657	2.776800	0.344153	
GTS3QT32	1	221.143223	220.820000	0.001462	8.080311	-5.141500	-0.637240	
GTS3KY2	1	-6.624664	-6.661000	-0.005485	N/A	-0.005942	0.0	
GTS3QT33	1	149.015778	149.070000	-0.000364	8.065497	2.912600	0.360988	
GTS4QT11	1	127.426984	127.420000	0.000055	8.068600	2.488200	0.308390	
GTS4KY1	1	8.653920	9.045000	-0.045191	N/A	0.008068	0.0	
GTS4QT12	1	217.957091	217.770000	0.000858	8.075222	-5.073500	-0.628818	
GTS4QT13	1	146.598712	146.260000	0.002310	8.087007	2.849300	0.353149	
GTS4KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.300424	368.250000	0.000137	8.069632	-4.192100	-0.519566	-4.197270
GTS4KS2	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	19.721061	19.040000	0.034535	8.357705	0.369900	0.045850	
GTS4KY2	1	-9.013824	-9.045000	-0.003459	N/A	-0.008068	0.0	
GTS4QD22	1	4.687643	4.170000	0.110427	9.066975	-0.081700	-0.010129	
GTS4QD31	1	108.969390	108.510000	0.004216	8.102566	-2.124300	-0.263282	
GTS4QD32	1	111.001923	110.520000	0.004342	8.103616	2.156900	0.267323	
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GHS5MU1	1	293.755913	0.0	1.000000	N/A	0.0	0.0	-0.0
GTS5MU1	1	207.985168	207.920000	0.000313	8.070456	-0.997800	-0.123673	-0.998632
GTS5QT11	1	78.005310	77.910000	0.001222	8.077689	1.524200	0.188915	
GTS5KY1	1	-13.628082	-13.568000	0.004409	N/A	-0.012103	0.0	
GTS5QT12	1	145.957823	145.640000	0.002178	8.085832	-3.394500	-0.420717	
GTS5QT13	1	110.525834	110.440000	0.000777	8.074365	2.167800	0.268678	
GTS5KS1	1	0.044099	0.0	1.000000	N/A	0.0	0.0	
GTS6MU1	1	368.684957	368.440000	0.000664	8.073796	4.208500	0.521599	4.207874
GTE5KS1	1	0.142674	0.0	1.000000	N/A	0.0	0.0	
GTE5QD11	1	187.780389	187.520000	0.001387	8.079434	3.654600	0.452954	
GTE5QD12	1	220.007935	220.310000	-0.001373	8.057196	-4.306900	-0.533800	
GTE5KY1	1	-17.727661	-17.690000	0.002124	N/A	-0.008068	0.0	
GTE5MU0	1	178.276925	177.990000	0.001609	8.081461	-0.573920	-0.071132	
GTE5QD21	1	84.359264	84.300000	0.000703	8.073847	3.255800	0.403524	
GTE5QD22	1	153.794977	153.860000	-0.000423	8.064991	-5.939600	-0.736162	

"good old" setting here as E127\_04 from 18.03.2020, Helmut Weick

TA->S1

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 1.859867023E+01 M  
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	X	A	Y	B	L
1 X	-5.006777E-01	-1.732985E-01	0.000000E+00	0.000000E+00	2.806209E-01
2 A	6.654873E-02	-1.974259E+00	0.000000E+00	0.000000E+00	4.415842E+00
3 Y	0.000000E+00	0.000000E+00	-3.800676E+00	-1.722408E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	4.222668E+00	-7.174627E-02	0.000000E+00
5 G	2.829161E-09	2.680467E-10	0.000000E+00	0.000000E+00	4.130300E+00
6 P	2.229588E+00	2.112405E-01	0.000000E+00	0.000000E+00	-3.864468E+00

TA->S2

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 3.667534045E+01 M  
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	X	A	Y	B	L
1 X	6.946488E-01	1.197249E-01	0.000000E+00	0.000000E+00	7.768476E-01
2 A	-9.032894E-01	1.283892E+00	0.000000E+00	0.000000E+00	8.833672E+00
3 Y	0.000000E+00	0.000000E+00	-1.409405E+00	1.047222E+00	0.000000E+00
4 B	0.000000E+00	0.000000E+00	-3.611754E-01	-4.411573E-01	0.000000E+00
5 G	-8.676872E-09	-7.641704E-11	0.000000E+00	0.000000E+00	8.144677E+00
6 P	-6.838018E+00	-6.022198E-02	0.000000E+00	0.000000E+00	-8.564535E+00

TA->S3

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 5.498201068E+01 M  
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	X	A	Y	B	L
1 X	7.703137E-02	-1.227764E-01	0.000000E+00	0.000000E+00	2.879923E-01
2 A	8.341952E+00	-3.140950E-01	0.000000E+00	0.000000E+00	3.976377E+00
3 Y	0.000000E+00	0.000000E+00	7.973387E+00	5.121200E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	-8.597668E-01	7.019554E-02	0.000000E+00
5 G	2.659787E-09	5.047094E-10	0.000000E+00	0.000000E+00	1.221013E+01
6 P	2.096113E+00	3.977485E-01	0.000000E+00	0.000000E+00	-1.181915E+01

TA->S6

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 8.779345105E+01 M  
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	X	A	Y	B	L
1 X	6.418567E-01	2.770340E-01	0.000000E+00	0.000000E+00	-7.554976E-02
2 A	-1.375341E+00	9.643644E-01	0.000000E+00	0.000000E+00	6.228627E-02
3 Y	0.000000E+00	0.000000E+00	-2.219966E+00	2.058435E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	1.303293E+00	-5.713035E-01	0.000000E+00
5 G	8.112159E-11	-1.143453E-10	0.000000E+00	0.000000E+00	1.949673E+01
6 P	6.392786E-02	-9.011291E-02	0.000000E+00	0.000000E+00	-1.911002E+01

S1->S2

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 1.807667023E+01 M  
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	X	A	Y	B	L
1 X	-1.527955E+00	-1.387136E-02	0.000000E+00	0.000000E+00	-2.140767E-01
2 A	4.060288E-01	-6.507834E-01	0.000000E+00	0.000000E+00	-2.244932E+00
3 Y	0.000000E+00	0.000000E+00	3.891040E-02	-1.511195E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	7.324159E+00	-2.745374E+00	0.000000E+00
5 G	-4.462877E-09	1.372677E-10	0.000000E+00	0.000000E+00	4.014377E+00
6 P	-3.517077E+00	1.081773E-01	0.000000E+00	0.000000E+00	-3.748544E+00

S2-&gt;S3

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 1.830667023E+01 M

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	X	A	Y	B	L
1 X	-8.998391E-01	-1.200267E-01	0.000000E+00	0.000000E+00	-4.609823E-02
2 A	5.864309E+00	-3.290884E-01	0.000000E+00	0.000000E+00	-3.815692E+00
3 Y	0.000000E+00	0.000000E+00	-2.617152E+00	-2.994358E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	4.091551E+00	8.603122E-02	0.000000E+00
5 G	-4.699866E-09	-5.618945E-10	0.000000E+00	0.000000E+00	4.065454E+00
6 P	-3.703843E+00	-4.428144E-01	0.000000E+00	0.000000E+00	-3.799622E+00

S2-&gt;S5

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 3.169903258E+01 M

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	X	A	Y	B	L
1 X	-1.547113E+00	2.026325E-02	0.000000E+00	0.000000E+00	1.483501E-01
2 A	3.810694E-01	-6.513562E-01	0.000000E+00	0.000000E+00	-4.029372E+00
3 Y	0.000000E+00	0.000000E+00	-4.182957E+00	-1.452550E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	6.879194E-01	-2.151770E-01	0.000000E+00
5 G	-7.838558E-09	-1.900922E-11	0.000000E+00	0.000000E+00	7.039563E+00
6 P	-6.177363E+00	-1.498057E-02	0.000000E+00	0.000000E+00	-6.018237E+00

S2-&gt;S6 (experiment showed ~6m dispersion)

NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 5.111811060E+01 M

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	X	A	Y	B	L
1 X	9.887369E-01	2.402232E-01	0.000000E+00	0.000000E+00	-4.423294E-02
2 A	-3.755969E-01	9.201365E-01	0.000000E+00	0.000000E+00	-6.862994E+00
3 Y	0.000000E+00	0.000000E+00	-3.854829E-01	5.074722E-01	0.000000E+00
4 B	0.000000E+00	0.000000E+00	-2.638665E+00	8.795435E-01	0.000000E+00
5 G	8.631562E-09	2.040355E-09	0.000000E+00	0.000000E+00	1.135206E+01
6 P	6.802309E+00	1.607950E+00	0.000000E+00	0.000000E+00	-1.126125E+01

S5-&gt;S6

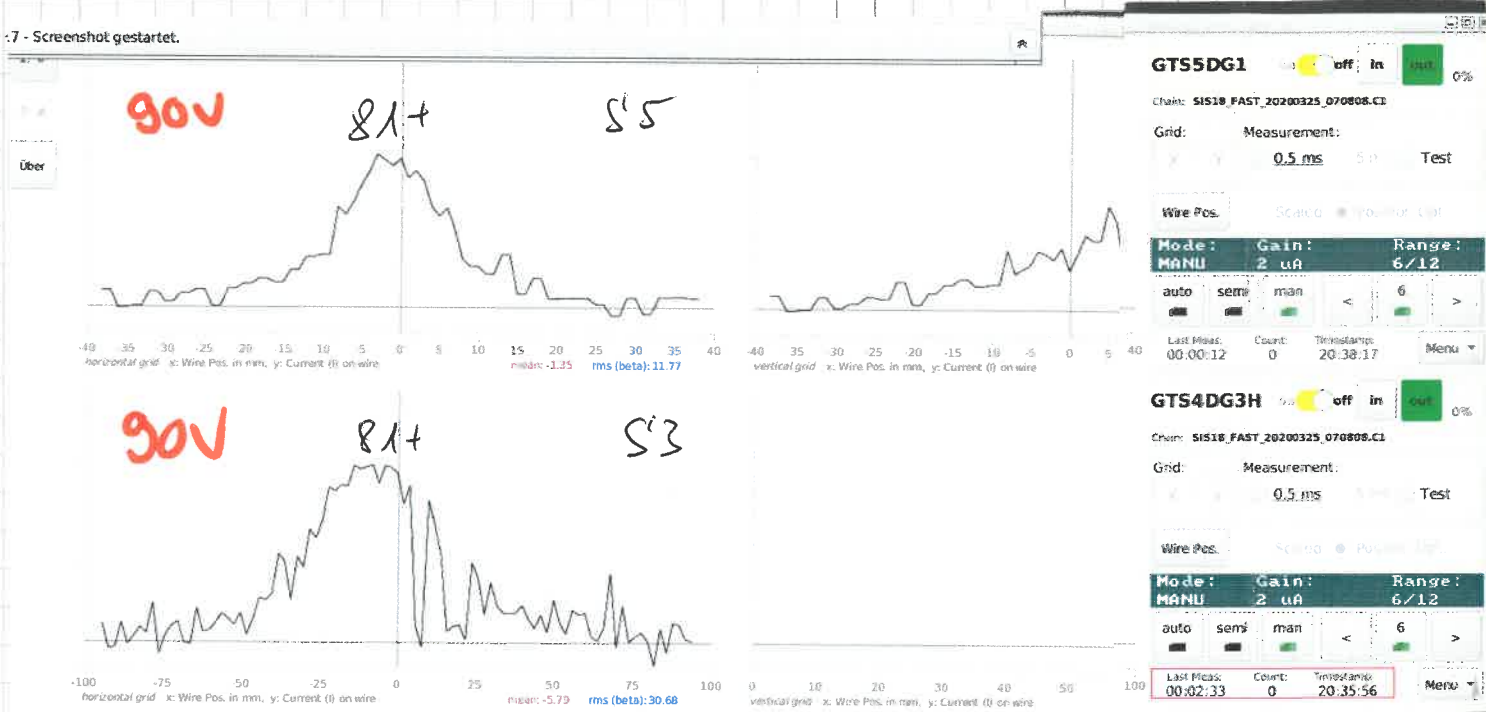
NON SYMPL. SYSTEM TRANSFER MATRIX AT PATH-LENGTH L= 1.941907803E+01 M

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	X	A	Y	B	L
1 X	-6.364091E-01	-1.751158E-01	0.000000E+00	0.000000E+00	1.828585E-01
2 A	2.043135E-01	-1.515097E+00	0.000000E+00	0.000000E+00	4.457321E+00
3 Y	0.000000E+00	0.000000E+00	-3.003322E-01	1.856172E-02	0.000000E+00
4 B	0.000000E+00	0.000000E+00	1.130260E+01	-4.028192E+00	0.000000E+00
5 G	3.646917E-09	6.388985E-10	0.000000E+00	0.000000E+00	4.312492E+00
6 P	2.874040E+00	5.034992E-01	0.000000E+00	0.000000E+00	-4.046659E+00

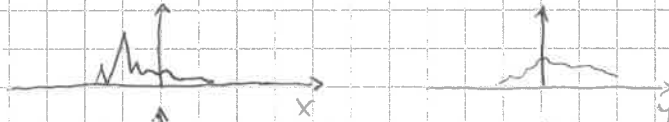


:7 - Screenshot gestartet.

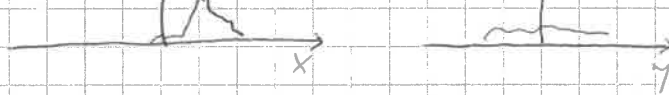


beam was already seen at 5'6

CG 62 / GTE5 DG DG



CG 61 / GTE5 DA CG



--- but unfortunately no screenshot was taken before  
 Alvarez failed again and Riefheritschaff was called  
 finally at ~ 20<sup>45</sup> h

Note: the machines were not coupled at this point →

⇒ spectra may change when ESR stray fields  
 become active!

Save the present settings as **E121-02**

Remove CG 61 + 62

E121-02

Date: 25-03-2020, 21:01:39

SIS18\_FAST\_20200325\_070808/SIS18\_FAST\_20200325\_070808.C1

Device ID	Status	I_list (A)	I_soil (A)	ΔI (A)	Bp (Tm)	BL_soil (Tm, T)	KL_soil (1, 1/m)	HProbe (Tm)
GTE1KY1	1	-39.407349	-39.308000	0.002521	N/A	-0.017713	0.0	
GTE1QD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	582.703635	583.870000	-0.002002	9.751742	1.279300	0.130927	
GTS1KY1	1	4.831080	4.813000	0.003742	N/A	0.002217	0.0	
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	
GTS1MU2	1	270.006409	270.040000	-0.000124	9.770077	1.295600	0.132594	
GTS2QT11	1	92.196417	91.990000	0.002239	8.086376	1.789100	0.221743	
GTS2KY1	1	-0.012817	-0.030945	-1.414333	N/A	0.0	0.0	
GTS2QT12	1	205.285806	209.230000	-0.019213	7.916214	-4.854900	-0.601722	
GTS2QT13	1	149.272134	149.270000	0.000014	8.068423	2.893500	0.358619	
GTS2KS1	1	-0.002594	0.0	1.000000	N/A	0.0	0.0	
GTS3MU1	1	369.811090	369.600000	0.000571	8.073031	4.224900	0.523635	4.287635
GTS3KS1	1	0.028535	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	157.475509	157.340000	0.000861	8.075461	3.050400	0.378070	
GTS3QD12	1	108.072146	107.990000	0.000760	8.074751	-2.111400	-0.261688	
GTS3QD21	1	107.394635	107.090000	0.002837	8.091615	-2.084500	-0.258354	
GTS3KY1	1	0.030122	-6.661000	100.000000	N/A	-0.005942	0.0	
GTS3QD22	1	156.743065	156.540000	0.001296	8.078623	3.021900	0.374541	
GTS3KS2	1	0.020753	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	368.218024	368.270000	-0.000141	8.067273	-4.208100	-0.521556	-4.209519
GTS3KS3	1	0.023347	0.0	1.000000	N/A	0.0	0.0	
GTS3QT31	1	142.863247	142.700000	0.001143	8.077657	2.776800	0.344153	
GTS3QT32	1	221.143223	220.820000	0.001462	8.080311	-5.141500	-0.637240	
GTS3KY2	1	-6.634918	-6.661000	-0.003931	N/A	-0.005942	0.0	
GTS3QT33	1	148.997467	149.070000	-0.000487	8.064506	2.912600	0.360988	
GTS4QT11	1	127.408673	127.420000	-0.000089	8.067441	2.488200	0.308390	
GTS4KY1	1	8.766717	9.045000	-0.031743	N/A	0.008068	0.0	
GTS4QT12	1	217.957091	217.770000	0.000858	8.075222	-5.073500	-0.628818	
GTS4QT13	1	146.598712	146.260000	0.002310	8.087007	2.849300	0.353149	
GTS4KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.272958	368.250000	0.000062	8.069028	-4.192100	-0.519566	-4.197270
GTS4KS2	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	19.739372	19.040000	0.035430	8.365466	0.369900	0.045850	
GTS4KY2	1	-9.095856	-9.045000	0.005591	N/A	-0.008068	0.0	
GTS4QD22	1	4.687643	4.170000	0.110427	9.066975	-0.081700	-0.010129	
GTS4QD31	1	108.987701	108.510000	0.004383	8.103927	-2.124300	-0.263282	
GTS4QD32	1	111.001923	110.520000	0.004342	8.103616	2.156900	0.267323	
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GHFSMU1	1	293.755913	0.0	1.000000	N/A	0.0	0.0	-0.0
GTS5MU1	1	207.985168	207.920000	0.000313	8.070456	-0.997800	-0.123673	-0.998632
GTS5QT11	1	78.005310	77.910000	0.001222	8.077689	1.524200	0.188915	
GTS5KY1	1	-13.576813	-13.568000	0.000649	N/A	-0.012103	0.0	
GTS5QT12	1	145.957823	145.640000	0.002178	8.085832	-3.394500	-0.420717	
GTS5QT13	1	110.452589	110.440000	0.000114	8.069021	2.167800	0.268678	
GTS5KS1	1	0.041505	0.0	1.000000	N/A	0.0	0.0	
GTS6MU1	1	368.630024	368.440000	0.000515	8.072592	4.208500	0.521599	4.207529
GTE5KS1	1	0.147862	0.0	1.000000	N/A	0.0	0.0	
GTE5QD11	1	187.780389	187.520000	0.001387	8.079434	3.654600	0.452954	
GTE5QD12	1	220.154424	220.310000	-0.000707	8.062582	-4.306900	-0.533800	
GTE5KY1	1	-17.727661	-17.690000	0.002124	N/A	-0.008068	0.0	
GTE5MU0	1	178.276925	177.990000	0.001609	8.081461	-0.573920	-0.071132	
GTE5QD21	1	84.359264	84.300000	0.000703	8.073847	3.255800	0.403524	
GTE5QD22	1	153.794977	153.860000	-0.000423	8.064991	-5.939600	-0.736162	
		-39.358521	-39.308000	0.001284	N/A	-0.017713	0.0	

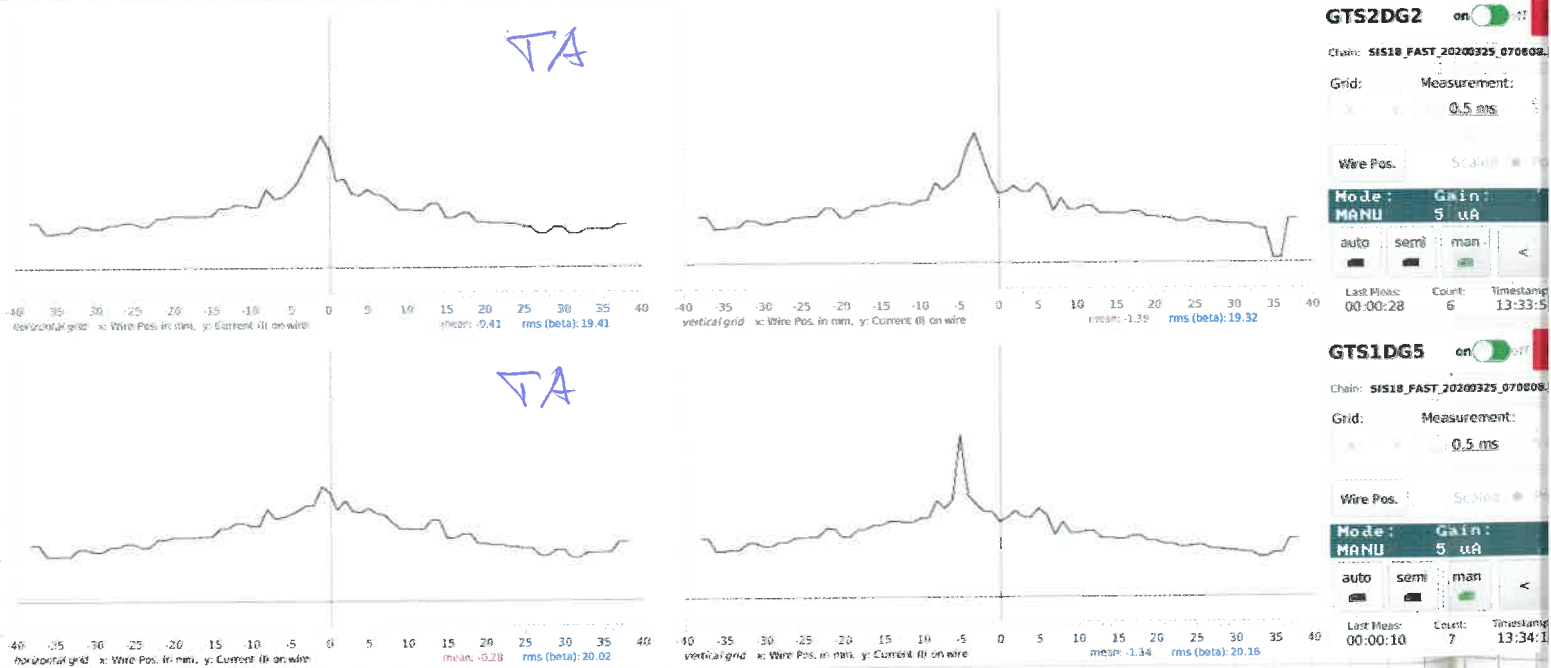
Thursday, March 26<sup>th</sup>, 2020

9 a.m.: there was no beam in the night due to SIS failure, expert working in north transformer area

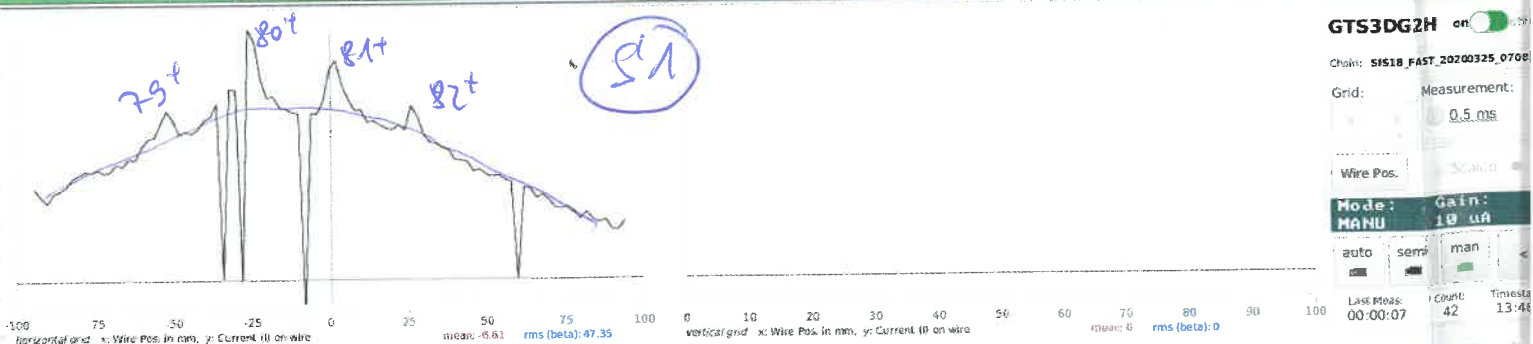
10<sup>10</sup> a.m.: still no beam, no forecast possible when beam will become available... (sad face)

13<sup>20</sup> p.m.: call from HKR: SIS beam available  
Goal: move quickly to S6!

Insert GTS1DG5 (CG01) and GTS2DG2 (CG02)



remove CG0X, close S1-slots, insert CG11, remove plug



=> still looks ok! Open S1-slots  $\pm 10$ mm, check Magnet

Present "Magat" agree with the one on p. 77 ✓

remove S1-plug, remove CG 11

Tel. 2245 ESR-Komale

14<sup>00</sup> beam arrives at Leuchtziel at S6, primary beam can be stored immediately, 1 μA!

ESR starts with stochastic precooling, then stacking

SIS Energy is 401.17 MeV/u  $\hat{=}$  21.4396 cm/ns

SIS circumference 216 m = 21600 cm

$$f_{SIS} = \frac{21.4396 \text{ cm} \cdot 10^9}{21600 \text{ cm} \cdot \text{s}} = 9.93 \cdot 10^5 \text{ Hz}$$

$$I_{SIS} = \underbrace{6 \cdot 10^8 \text{ part.}} \cdot 1.6 \cdot 10^{-19} \text{ C} \cdot 67 \cdot 9.93 \cdot 10^5 \text{ Hz} = 6.38 \cdot 10^{-3} \text{ A}$$

Number of particles from "slow SIS trafo" 1/4 of them extracted to ESR.

A direct readout of current not found.

ESR Energy is 400 MeV/u  $\hat{=}$  21.4216 cm/ns

ESR circumference is 108 m

$$f_{ESR} = \frac{21.4216 \text{ cm} \cdot 10^9}{10800 \text{ cm} \cdot \text{s}} = 1.98 \cdot 10^6 \text{ Hz}$$

$$\text{Number of part. in ESR} = \frac{I}{e \cdot q \cdot f} = \frac{1 \cdot 10^{-6} \text{ A}}{1.6 \cdot 10^{-19} \cdot 81 \cdot 1.98 \cdot 10^6} = \underline{3.9 \cdot 10^4 \text{ particles}}$$

~~ESR~~ Transmission:

$$\frac{3.9 \cdot 10^4 \cdot 700}{6 \cdot 10^8 \cdot \frac{1}{4} \cdot 0.28} \approx 2.32 \cdot 10^{-4} \cdot 700 = 0.16 \quad 16\%$$

fraction in 81+ after Seetram (GLOBAR)

1/4 bunches are extracted for ESR → no all bunches for ESR

16:48

The current in ESR is ~700 μA

H. Weick 26.03.2020

Ich habe den einen verbesserten Modus für FRS-ESR und Hans hat gestern Abend noch seinen geschickt.

Welchen ich besser finde muss ich noch sehen, am ESR Eintritt sind sie etwas verschieden gerechnet, aber sicher sind beide brauchbar. Trotzdem starten wir mit dem alten und stellen von dem auf einen neuen um.

Als Programm für die letzte Nacht hatte ich mir aufgeschrieben:

- Dickenkalibration, Target und mehrere Degrader (1, 2, 3 g/cm<sup>2</sup> inkl. disks), Target nach Atima 1.4: Be 1314 mg/cm<sup>2</sup>+ Nb 223
- Primärstrahlsetting Ladungszustände von 206Pb suchen an S2 + S6, Schlitze offen  
Intensität max 10<sup>7</sup>/Pulse  
weniger Intensität gab schönere Bilder an den CGs.
- Dispersionskalibration (TA-S2, S2-S6), die brauchen wir für die Peakabstände um uns an den 206Pb Ladungszuständen orientieren zu können.  
Da die S6 Gitter nur +/-35mm breit sind, müssen wird das mit Skalieren von 81+ nach 82+ machen.
- Anderer Optikmode mit gleichen Hkick/Vkick, dann hoffentlich wenig nachzentrieren, so wie vorher auf Gittern.
- Dispersion dann auch im anderen Modus, Theoriewerte auf MOCADI-Seite <http://web-docs.gsi.de/~weick/mocadi/ta-s6-2006.html>
- 206Pb setting mit Target+Degrader nach 400 MeV/u, Vorbohrsetting, Einschuss optimieren
- 205Tl Setting machen und an S6 verschieben, so dass man 206Pb 80+ oder 81+ sieht  
Mit gemessener Dispersion auf Lage des 205Th zurückrechnen und notfalls verschieben.  
Dispersion in LISE ist nicht wie in wirklich verwendetem Modes, also erwartete Abstände entsprechend skalieren  
in LISE D(TA-S2) = -6.47m, D(S2-S6) = +7.80m
- Optik mit Fokussierung aufs Target und Zwischenbild sollte vom Brho noch gehen (sista-tal-lo2)  
Dann kleinerer Fleck am Target und mehr Winkel, -> Strahparameter mehr wie Fragment -> gut zum Fokussieren testen
- Vary Quad before S6 and try to see worse of better focusing on CGs (Primärstrahl)
- Scrapen mit Schlitzen S6 oder neuer Blende, dabei auf Leuchttarget (oder ESR-Trafo) schauen  
aus Profil Strahlbreite ermitteln, Fokus mehr an S6-Schlitzen oder an neuer Blende?
- Im Ring nach 205Tl / 205Pb81+ suchen (Schottky) und vielleicht noch etwas Hg (E-Kühler)
- Mit Gasjet-Stripper ohne Wartezeit, Anteil von 205Pb ermitteln
- nur Idee: 204Tl-Setting da dann Massenunterschied 840 keV zu 204Pb81+. Dann auflösbar in Schottky aber auch nicht für sehr intensiven und sehr kleinen Peak.

E21-03

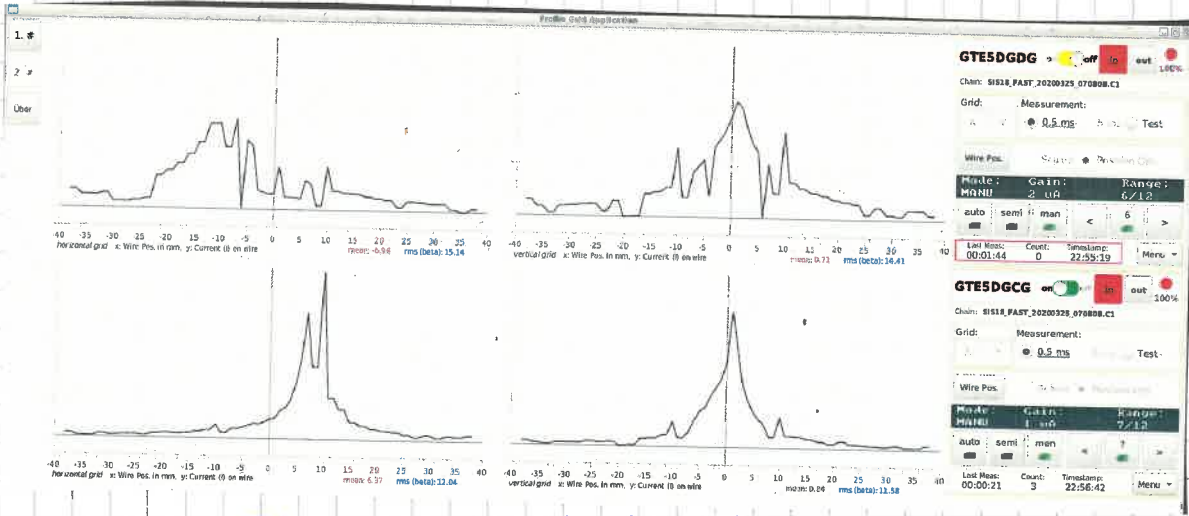
206 Pb<sup>81+</sup> @ 400 MeV/u in the ESR, only SEETRAM  
Esis = 401.17 MeV/u  
Bg = 8.06838 Tm

date: 26-03-2020, 22:34:09

SIS18\_FAST\_20200325\_070808/SIS18\_FAST\_20200325\_070808.C1

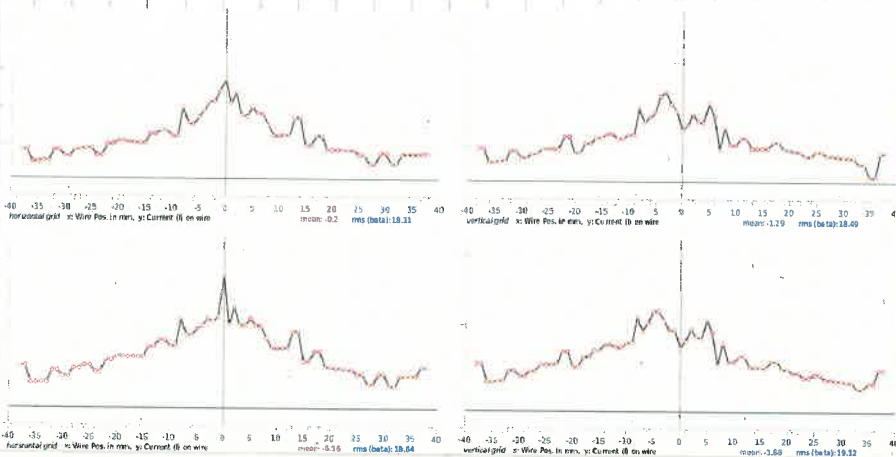
Device ID	Status	I_list (A)	I_soll (A)	ΔI (A)	Bp (Tm)	BL_soll (Tm, T)	KL_soll (1, 1/m)	HProbe (Tm)
GTE1KY1	1	-39.407349	-39.308000	0.002521	N/A	-0.017713	0.0	
GTE1QD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	583.335368	583.870000	-0.000917	9.762282	1.279300	0.130927	
GTS1KY1	1	4.879910	4.813000	0.013711	N/A	0.002217	0.0	
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	
GTS1MU2	1	270.006409	270.040000	-0.000124	9.770077	1.295600	0.132594	
GTS2QT11	1	92.178106	91.990000	0.002041	8.084773	1.789100	0.221743	
GTS2KY1	1	-0.012177	-0.030945	-1.541403	N/A	0.0	0.0	
GTS2QT12	1	205.285806	209.230000	-0.019213	7.916214	-4.854900	-0.601722	
GTS2QT13	1	149.272134	149.270000	0.000014	8.068423	2.893500	0.358619	
GTS2KS1	1	-0.005188	0.0	1.000000	N/A	0.0	0.0	
GTS3MU1	1	369.866024	369.600000	0.000719	8.074233	4.224900	0.523635	4.291230
GTS3KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	157.475509	157.340000	0.000861	8.075461	3.050400	0.378070	
GTS3QD12	1	108.072146	107.990000	0.000760	8.074751	-2.111400	-0.261688	
GTS3QD21	1	107.394635	107.090000	0.002837	8.091615	-2.084500	-0.258354	
GTS3KY1	1	0.019868	-6.661000	100.000000	N/A	-0.005942	0.0	
GTS3QD22	1	156.743065	156.540000	0.001296	8.078623	3.021900	0.374541	
GTS3KS2	1	0.028535	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	368.218024	368.270000	-0.000141	8.067273	-4.208100	-0.521556	-4.209165
GTS3KS3	1	0.028535	0.0	1.000000	N/A	0.0	0.0	
GTS3QT31	1	142.863247	142.700000	0.001143	8.077657	2.776800	0.344153	
GTS3QT32	1	221.143223	220.820000	0.001462	8.080311	-5.141500	-0.637240	
GTS3KY2	1	-6.614410	-6.661000	-0.007044	N/A	-0.005942	0.0	
GTS3QT33	1	148.997467	149.070000	-0.000487	8.064506	2.912600	0.360988	
GTS4QT11	1	127.408673	127.420000	-0.000089	8.067441	2.488200	0.308390	
GTS4KY1	1	8.623157	9.045000	-0.048920	N/A	0.008068	0.0	
GTS4QT12	1	217.938780	217.770000	0.000774	8.074545	-5.073500	-0.628818	
GTS4QT13	1	146.617023	146.260000	0.002435	8.088016	2.849300	0.353149	
GTS4KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.327891	368.250000	0.000211	8.070235	-4.192100	-0.519566	-4.196898
GTS4KS2	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	19.739372	19.040000	0.035430	8.365466	0.369900	0.045850	
GTS4KY2	1	-9.024078	-9.045000	-0.002318	N/A	-0.008068	0.0	
GTS4QD22	1	4.687643	4.170000	0.110427	9.066975	-0.081700	-0.010129	
GTS4QD31	1	108.987701	108.510000	0.004383	8.103927	-2.124300	-0.263282	
GTS4QD32	1	111.020234	110.520000	0.004506	8.104950	2.156900	0.267323	
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GHFSMU1	1	293.755913	0.0	1.000000	N/A	0.0	0.0	-0.0
GTS5MU1	1	208.001953	207.920000	0.000394	8.071107	-0.997800	-0.123673	-0.998444
GTS5QT11	1	78.005310	77.910000	0.001222	8.077689	1.524200	0.188915	
GTS5KY1	1	-13.658844	-13.568000	0.006651	N/A	-0.012103	0.0	
GTS5QT12	1	145.957823	145.640000	0.002178	8.085832	-3.394500	-0.420717	
GTS5QT13	1	110.525834	110.440000	0.000777	8.074365	2.167800	0.268678	
GTS5KS1	1	0.041505	0.0	1.000000	N/A	0.0	0.0	
GTS6MU1	1	368.684957	368.440000	0.000664	8.073796	4.208500	0.521599	4.207529
GTE5KS1	1	0.142674	0.0	1.000000	N/A	0.0	0.0	
GTE5QD11	1	187.780389	187.520000	0.001387	8.079434	3.654600	0.452954	
GTE5QD12	1	220.154424	220.310000	-0.000707	8.062582	-4.306900	-0.533800	
GTE5KY1	1	-17.727661	-17.690000	0.002124	N/A	-0.008068	0.0	
GTE5MU0	1	178.734703	178.490000	0.001369	8.079582	-0.575530	-0.071332	
GTE5QD21	1	84.212775	84.300000	-0.001036	8.059844	3.255800	0.403524	
GTE5QD22	1	153.794977	153.860000	-0.000423	8.064991	-5.939600	-0.736162	

# NEW OPTICS TEST, AS OPTIMISED BY HANS & MELMUT



POSITION @ S6 BEFORE CHANGES

ADJUST THE POSITION ON TARGET

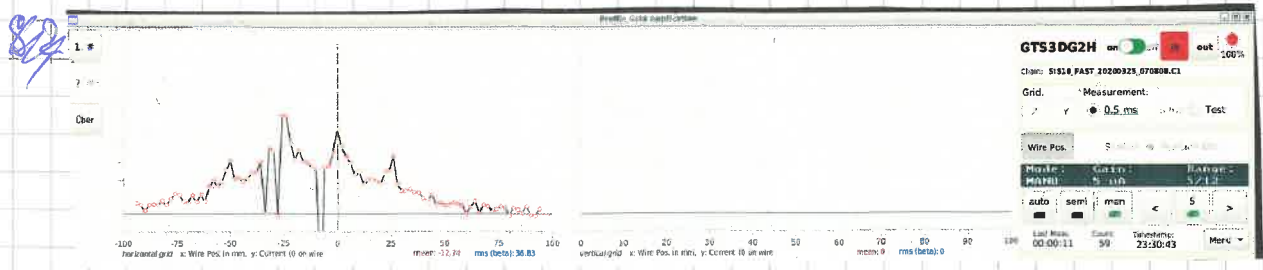


TS2 y = -4.0 see p.4

TS1 y = -4.5 see p.4

load Frs-PSR-to1-mut-2019-1.txt  
 (only quadrupoles for TA-ESR)

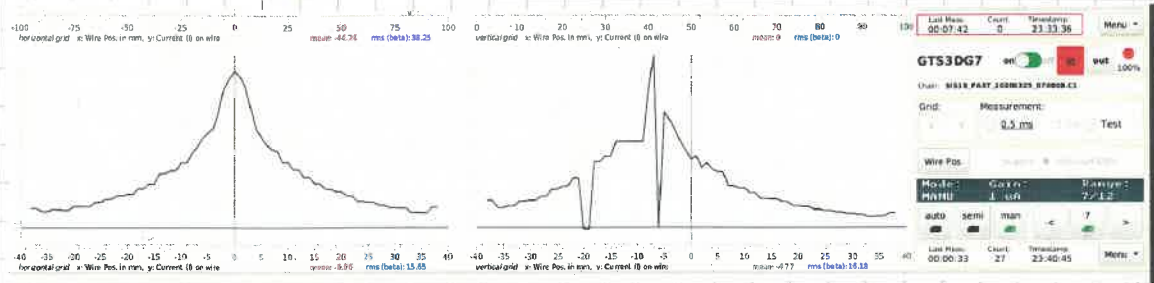
(S1) position @ S1 was +1 mm → change to 0 by  
 intro: TSBMU: -0.036 → 0.18 (kick)



S2

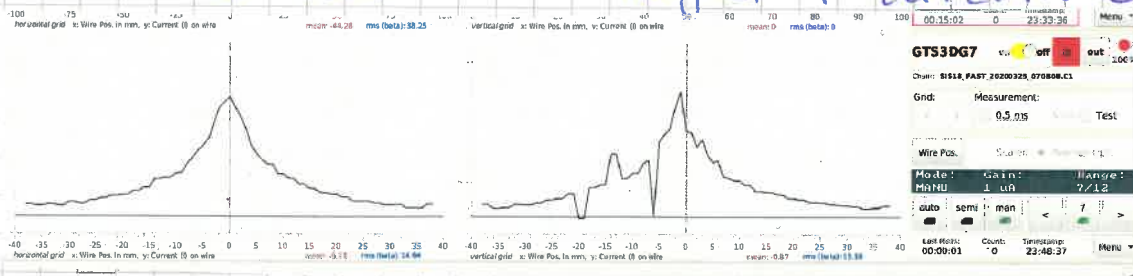
LOOK ABOVE OK. +1 mm

TS3 MU2: -2.043 → -1.9



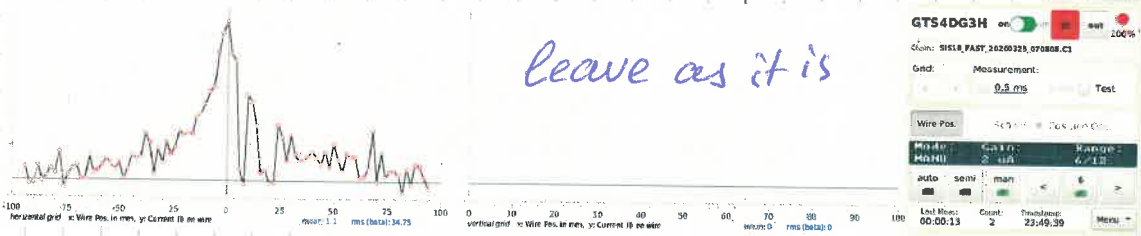
↑  
excellent

adjust Y-direction



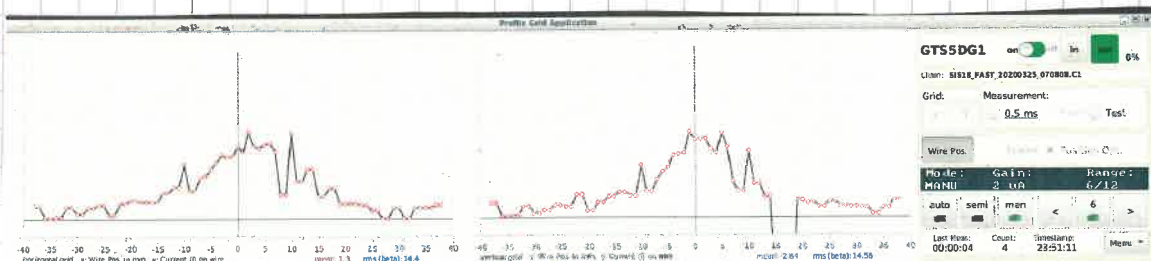
TS2 KY1 0 → 0,75  
 TS3 KY1 0 → 0  
 TS1 KY2 0 → 0

S3



leave as it is

S5

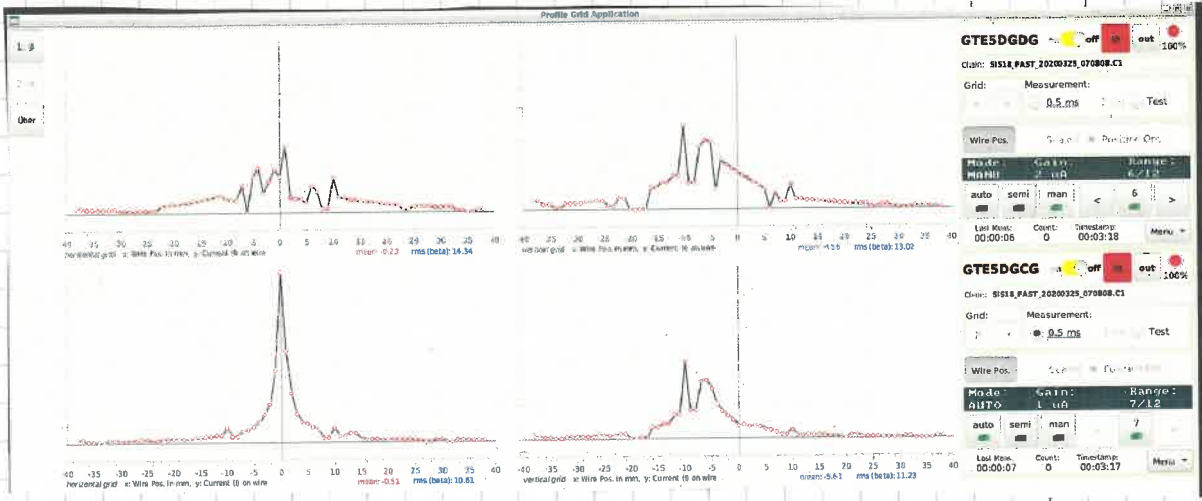


leave as it is

S6

Position  $\approx -30 / +20$  mm at the edges of the CGs  
 also in Y  $\approx -6$  mm



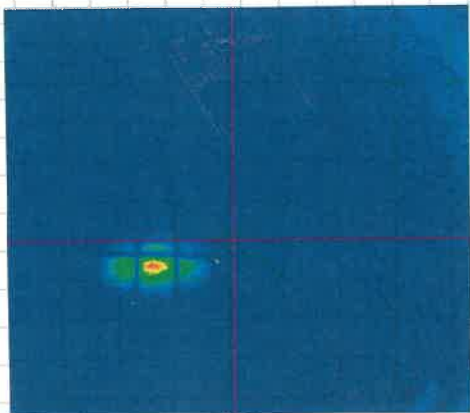
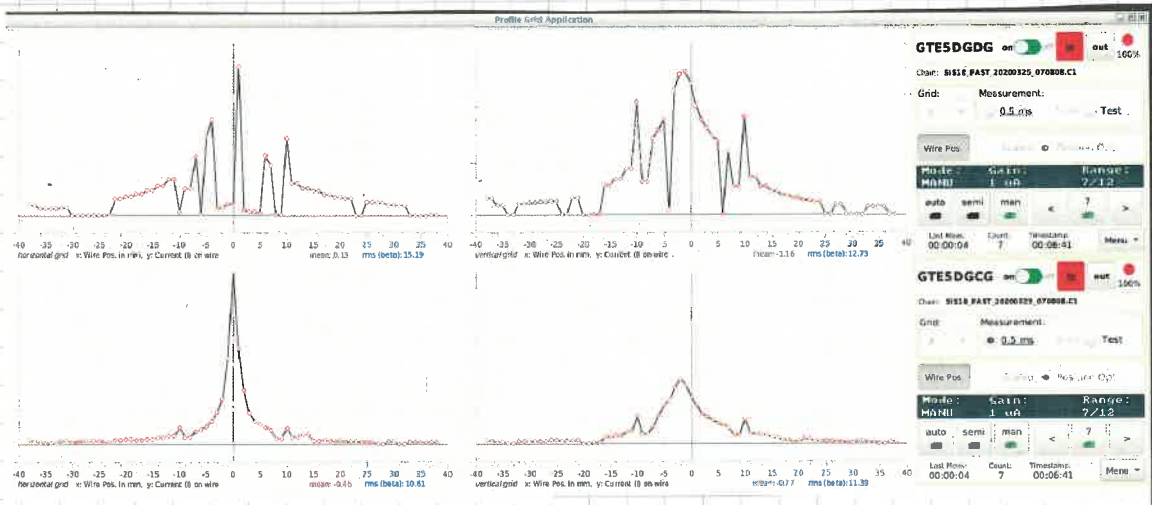


↑  
looks good

↑  
adjust Y

~~TS6M04~~ TS6M04: -2.0  
↓  
-0.1 mrad

all Y-steervers after  
S2 set to  $\emptyset$



looks reasonably good

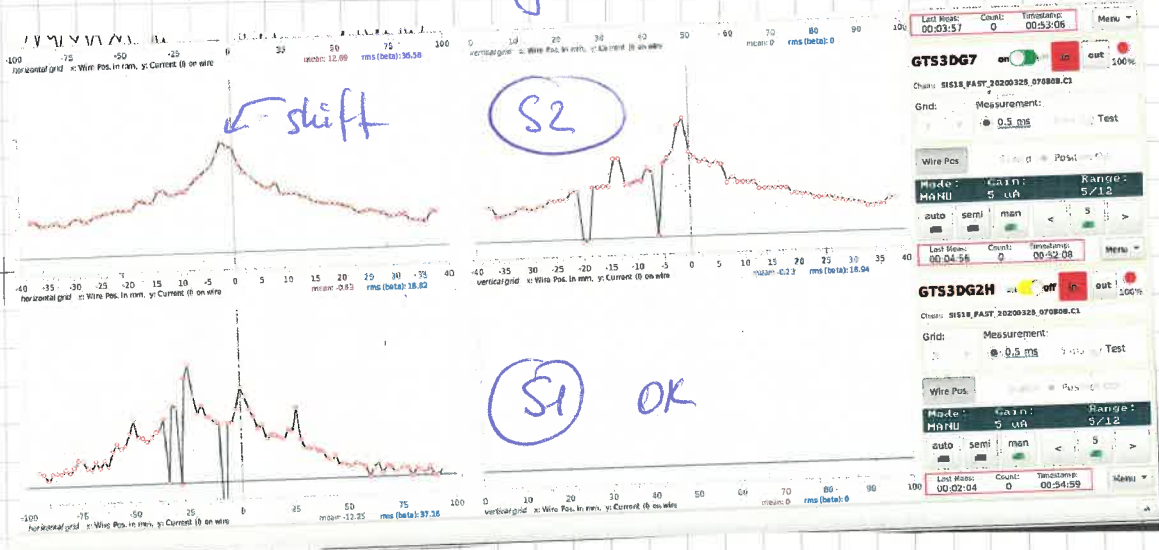
NOW optimum injection  
relatively poor transmission

27.03.2020  
precycling

00:52  
TA-ESR. Hall probes stood slightly  
different values than in the  
saved setting.

check (S2) position is at -2 mm  
? No precycling last time?

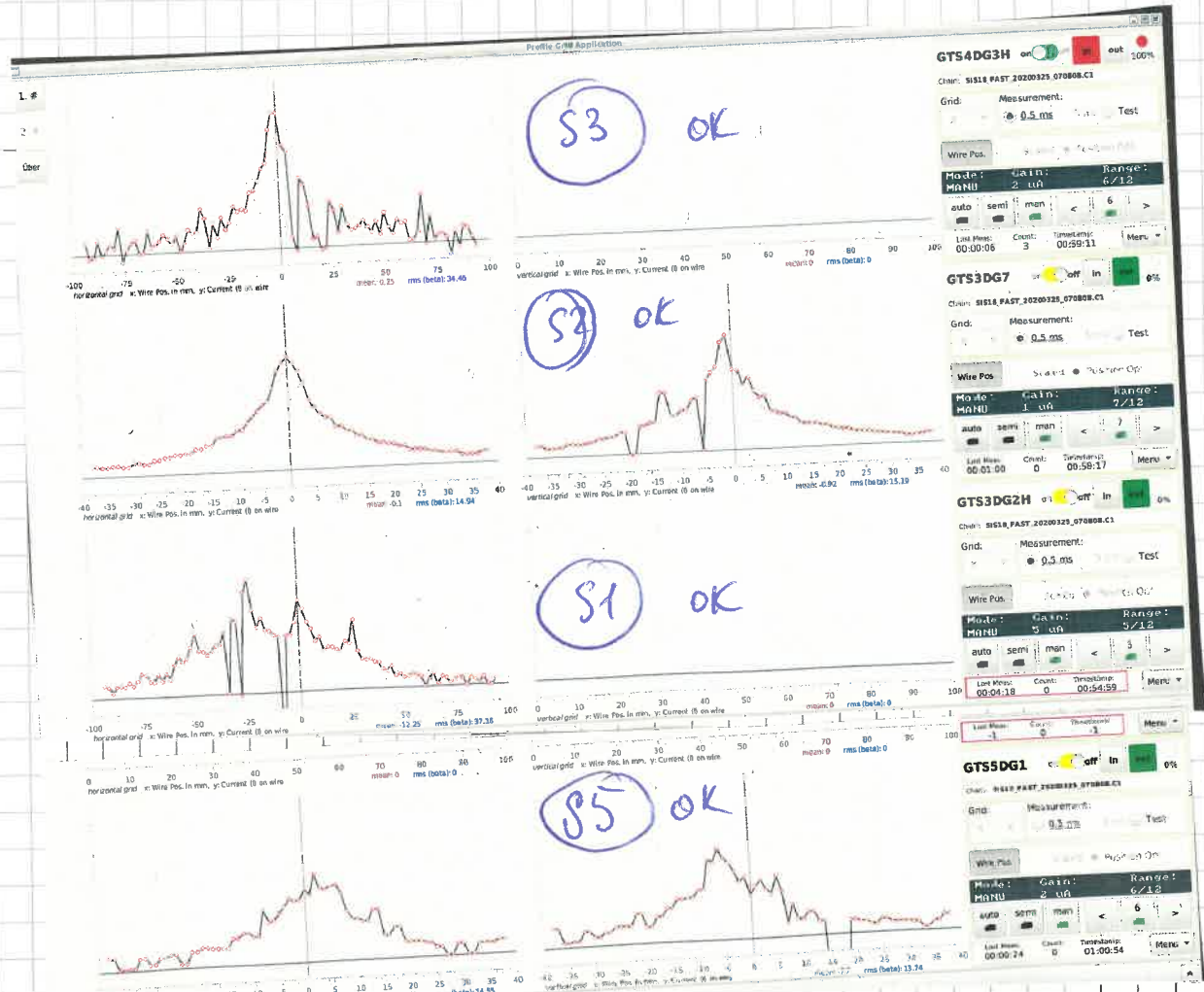
Retune the FRs again :-L



GTS3DG7 on 100%  
GTS3DG2H off 100%

Mode: MANU Gain: 5 uA Range: 5/12  
auto semi man 5

Mode: MANU Gain: 5 uA Range: 5/12  
auto semi man 5



GTS4DG3H on 100%  
GTS3DG7 off 0%  
GTS3DG2H off 0%  
GTS5DG1 off 0%

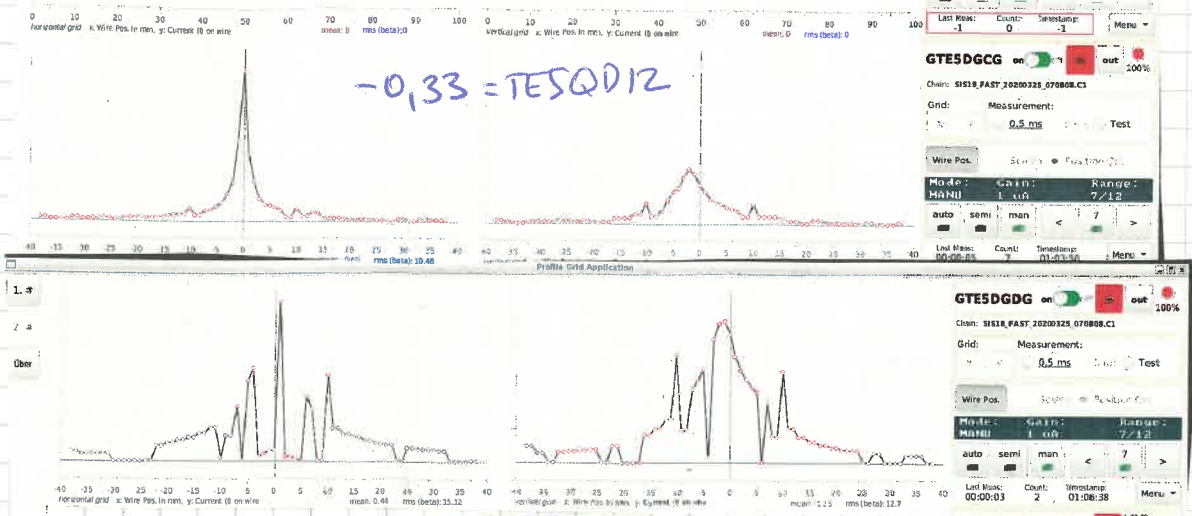
Mode: MANU Gain: 2 uA Range: 6/12  
auto semi man 6

Mode: MANU Gain: 1 uA Range: 7/12  
auto semi man 7

Mode: MANU Gain: 2 uA Range: 6/12  
auto semi man 6

86

$X_i = -1$  mm on both grids TS6MUD  $\rightarrow$  0.0 mrad 87



Date: 27-03-2020, 01:04:37

ET21-05

SAVE AFTER RECENTERING  
same param. like ET21-04

SIS18\_FAST\_20200325\_070808/SIS18\_FAST\_20200325\_070808.C1

Device ID	Status	I_list (A)	I_soll (A)	ΔI (A)	Bp (Tm)	BL_soll (Tm, T)	KL_soll (1, 1/m)	HProbe (Tm)
GTE1KY1	1	-27.542114	-27.430000	0.004071	N/A	-0.012461	0.0	
GTE1QD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	585.265664	585.010000	0.000437	9.775833	1.281800	0.131176	
GTS1KY1	1	1.022370	0.960000	0.061005	N/A	0.000454	0.0	
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	
GTS1MU2	1	269.838557	269.930000	-0.000339	9.767879	1.295100	0.132542	
GTS2QT11	1	115.140233	114.960000	0.001565	8.081314	2.235200	0.277030	
GTS2KY1	1	13.220252	13.225618	-0.000406	N/A	0.006051	0.0	
GTS2QT12	1	210.467849	214.500000	-0.019158	7.916692	-4.977200	-0.616878	
GTS2QT13	1	146.195868	146.200000	-0.000028	8.068563	2.833800	0.351217	
GTS2KS1	1	-0.002594	0.0	1.000000	N/A	0.0	0.0	
GTS3MU1	1	369.701224	369.420000	0.000761	8.074575	4.222800	0.523379	4.286197
GTS3KS1	1	0.020753	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	155.607776	155.480000	0.000821	8.075049	3.014300	0.373600	
GTS3QD12	1	84.652242	84.580000	0.000853	8.075400	-1.654300	-0.205041	
GTS3QD21	1	131.803339	131.500000	0.002301	8.087236	-2.559700	-0.317247	
GTS3KY1	1	0.019868	0.0	1.000000	N/A	0.0	0.0	
GTS3QD22	1	169.084750	168.890000	0.001152	8.077775	3.260500	0.404107	
GTS3KS2	1	0.025941	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	368.218024	368.230000	-0.000033	8.068155	-4.207700	-0.521499	-4.209165
GTS3KS3	1	0.0	0.0	100.000000	N/A	0.0	0.0	
GTS3QT31	1	139.255959	139.090000	0.001192	8.077742	2.706600	0.335462	
GTS3QT32	1	217.645802	217.310000	0.001543	8.080873	-5.060000	-0.627140	
GTS3KY2	1	-0.000641	0.0	1.000000	N/A	0.0	0.0	
GTS3QT33	1	148.722800	148.800000	-0.000519	8.064120	2.907400	0.360340	
GTS4QT11	1	130.631428	130.660000	-0.000219	8.066973	2.551300	0.316204	
GTS4KY1	1	-0.380035	0.0	1.000000	N/A	0.0	0.0	
GTS4QT12	1	221.839045	221.680000	0.000717	8.074119	-5.164300	-0.640072	
GTS4QT13	1	149.272134	148.930000	0.002292	8.087028	2.901300	0.359584	
GTS4KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.300424	368.250000	0.000137	8.069632	-4.192100	-0.519566	-4.197270
GTS4KS2	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	106.295969	105.640000	0.006171	8.118093	2.045700	0.253550	
GTS4KY2	1	0.030122	0.0	1.000000	N/A	0.0	0.0	
GTS4QD22	1	140.739158	140.230000	0.003618	8.097527	-2.736600	-0.339170	
GTS4QD31	1	0.512711	0.0	1.000000	N/A	0.0	0.0	
GTS4QD32	1	69.252602	68.720000	0.007691	8.130812	1.343700	0.166522	
GTS4KS3	-							

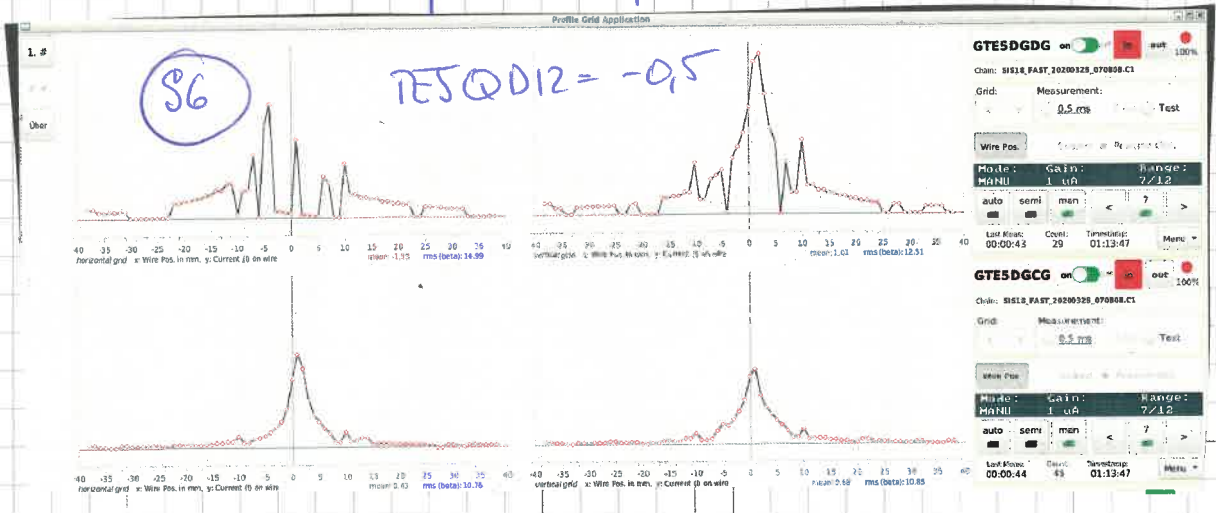
E121-05

SAVE AFTER RECEIVING  
same param. lit E121-04

Device ID	Status	I list (A)	I soil (A)	AI (A)	Bp (Tm)	BL soil (Tm, T)	KL soil (T, I/m)	HProbe (Tm)
GTEKXY1	1	-27.542114	-27.430000	0.004071	N/A	-0.012461	0.0	0.0
GTEIQD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	0.0
GTEIQD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	0.0
GTS1MU1	1	585.265664	585.010000	0.000437	9.775833	1.281800	0.131176	0.0
GTS1KY1	1	1.022370	0.960000	0.061005	N/A	0.000454	0.0	0.0
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	-0.581211
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	0.700671
GTS1MU2	1	269.838557	269.930000	-0.000339	9.767879	1.295100	0.132542	0.132542
GTS2QT11	1	115.140233	114.960000	0.001565	8.081314	2.235200	0.277030	0.277030
GTS2KY1	1	13.220252	13.225618	-0.000406	N/A	0.006051	0.0	0.0
GTS2QT12	1	210.467849	214.500000	-0.019158	7.916692	-4.977200	-0.616878	-0.616878
GTS2QT13	1	146.195868	146.200000	-0.000028	8.068563	2.833800	0.351217	0.351217
GTS2KS1	1	-0.002594	0.0	1.000000	N/A	0.0	0.0	0.0
GTS3MU1	1	369.701224	369.420000	0.000761	8.074575	4.222800	0.523379	4.222800
GTS3KS1	1	0.020753	0.0	1.000000	N/A	0.0	0.0	0.0
GTS3QD11	1	155.607776	155.480000	0.000821	8.075049	3.014300	0.373600	0.373600
GTS3QD12	1	84.652242	84.580000	0.000853	8.075400	-1.654300	-0.205041	-0.205041
GTS3QD21	1	131.803339	131.500000	0.002301	8.087236	-2.559700	-0.317247	-0.317247
GTS3KY1	1	0.019868	0.0	1.000000	N/A	0.0	0.0	0.0
GTS3QD22	1	169.084750	168.890000	0.001152	8.077775	3.260500	0.404107	0.404107
GTS3KS2	1	0.025941	0.0	1.000000	N/A	0.0	0.0	0.0
GTS3MU2	1	368.218024	368.230000	-0.000033	8.068155	-4.207700	-0.521499	-4.209165
GTS3KS3	1	0.0	0.0	100.000000	N/A	0.0	0.0	0.0
GTS3QT31	1	139.255959	139.090000	0.001192	8.077742	2.706600	0.335462	0.335462
GTS3KY2	1	-0.000641	0.0	1.000000	N/A	0.0	-0.627140	-0.627140
GTS3QT33	1	148.722800	148.800000	-0.000519	8.064120	2.907400	0.360340	0.360340
GTS4QT11	1	130.631428	130.660000	-0.000219	8.066973	2.551300	0.316204	0.316204
GTS4KY1	1	-0.380035	0.0	1.000000	N/A	0.0	0.0	0.0
GTS4QT12	1	221.839045	221.680000	0.000717	8.074119	-5.164300	-0.640072	-0.640072
GTS4QT13	1	149.272134	148.930000	0.002292	8.087028	2.901300	0.359584	0.359584
GTS4KS1	1	0.010376	0.0	1.000000	N/A	0.0	0.0	0.0
GTS4MU1	1	368.300424	368.250000	0.000137	8.069632	-4.192100	-0.519566	-4.197270
GTS4KS2	1	0.012970	0.0	1.000000	N/A	0.0	0.0	0.0
GTS4QD21	1	106.295969	105.640000	0.006171	8.118093	2.045700	0.253550	0.253550
GTS4KY2	1	0.030122	0.0	1.000000	N/A	0.0	0.0	0.0
GTS4QD22	1	140.739158	140.230000	0.003618	8.097527	-2.736600	-0.339170	-0.339170
GTS4QD31	1	0.512711	0.0	1.000000	N/A	0.0	0.0	0.0
GTS4QD32	1	69.252602	68.720000	0.007691	8.130812	1.343700	0.166533	0.166533
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	0.0
GHSMU1	1	293.755913	293.755913	0.0	N/A	0.0	0.0	0.0
GTS5MU1	1	207.985168	207.920000	0.000313	8.070456	-0.997800	-0.123673	-0.123673
GTS5QT11	1	90.328684	90.240000	0.000982	8.076591	1.764300	0.218671	0.218671
GTS5QT12	1	204.644917	204.280000	0.001783	8.082689	-4.761100	-0.590093	-0.590093
GTS5QT13	1	157.310709	157.240000	0.000449	8.071951	3.085900	0.382472	0.382472
GTS5KS1	1	0.041505	0.0	1.000000	N/A	0.0	0.0	0.0
GTS6MU1	1	370.058290	369.850000	0.000563	8.072937	4.224600	0.523599	4.223720
GTS6KS1	1	0.145268	0.0	1.000000	N/A	0.0	0.0	0.0
GTS5QD11	1	55.793939	55.610000	0.003297	8.095320	1.087500	0.134789	0.134789
GTS5QD12	1	137.388226	137.530000	-0.001032	8.060103	-2.683600	-0.332611	-0.332611
GTS5KY1	1	-0.100708	-0.031000	0.692179	N/A	0.0	0.0	0.0
GTS5MU0	1	178.771325	178.490000	0.001574	8.081245	-0.575530	-0.071332	-0.071332
GTS5QD21	1	0.128178	0.0	1.000000	N/A	0.0	0.0	0.0
GTS5QD22	1	80.550554	80.530000	0.000255	8.070518	-3.110300	-0.385491	-0.385491
N/A					N/A			
					N/A			

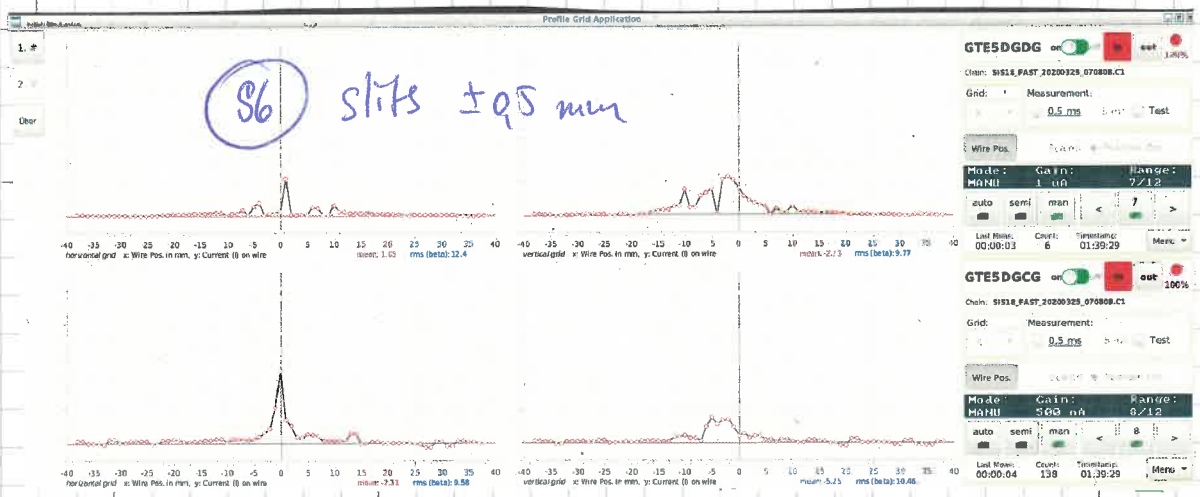
27.03.2020 01:10

Check the focusing at  $S_6$  by detuning the last QP ~~triplet~~ duplet



Changing TESQD12 in both directions leads to worse focusing on TESDGGC.

Close  $S_6$  slits and check the position on the TESDGGC. with  $\pm 0,5$  mm  $\rightarrow$  some little beam is stored



Insert  $998 \text{ mg/cm}^2$  Pb target (#1), to create large angles  
#71 Pb 998 71.080 -336,50

$$BS(TA-ESR) = 7,3053 \quad T_m \quad \text{precycle}$$

The target did not move remotely. Had to drive it from the Flesskütte



With 1g/cm<sup>2</sup>  
Pb Target

S3

S2

S1

S6

Scan the size of the beam on the S6 slits  
FWHM is of the order of 1mm

scan width with S6 slits => FWHM = 7 mm

X\_TESDSAII

Depth height on CG61

- |      |   |
|------|---|
| -2.0 | 8 |
| -1.4 | 8 |
| -1.0 | 7 |
| -0.9 | 7 |
| -0.5 | 5 |
| -0.3 | 0 |
| open | 8 |

not only height but also width is cut

27. March

2:50 back to only Seetram, load E121-05

$B_8 = 8.06838 T_m$ , remove target  
optimize injection, already  $\sim 10\%$   
steers before ESR, not inside ESR

with thick Pb target, varied Quad before



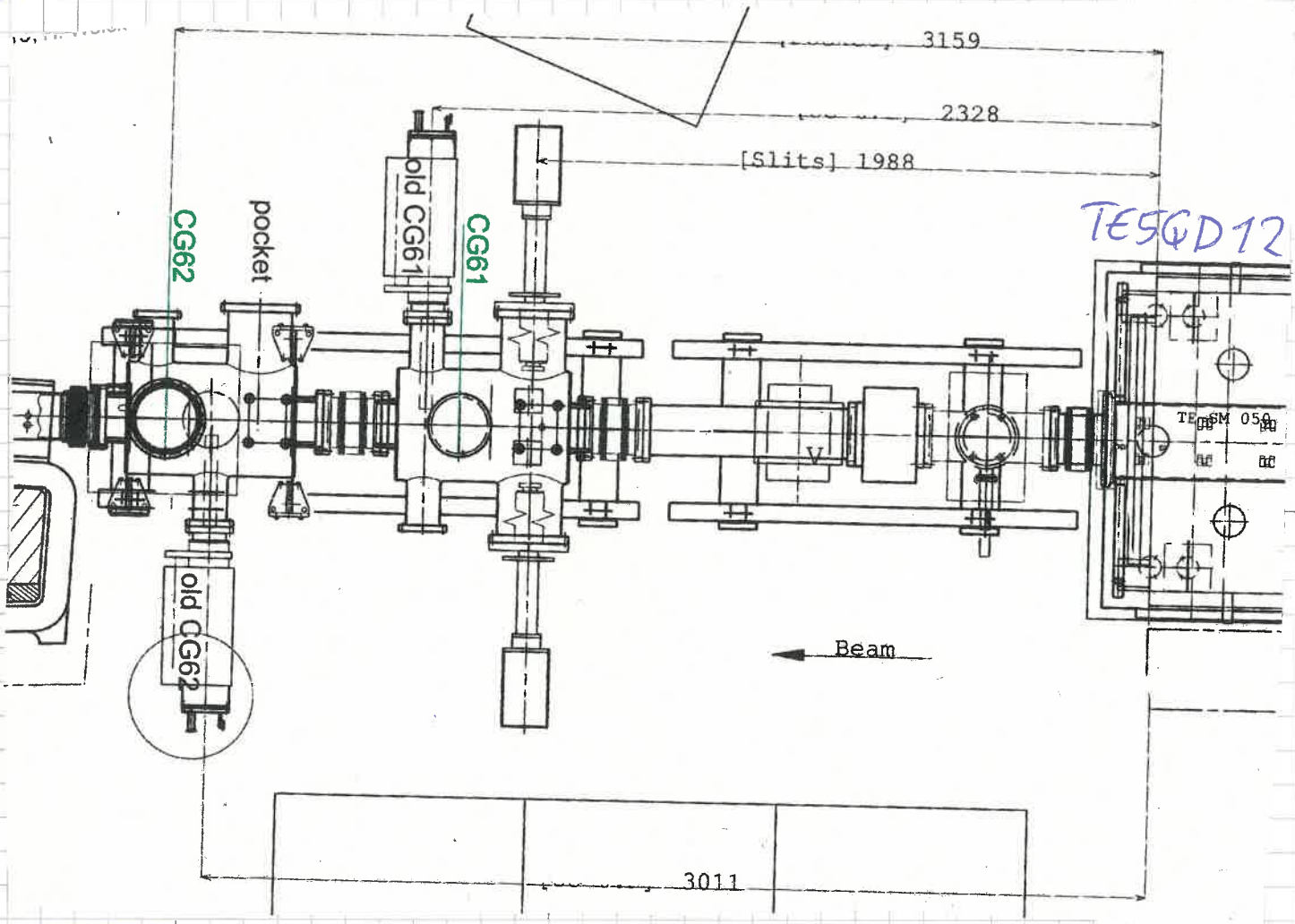
SG (TE5 QD12) to see difference in

focusing.

$K/L$ [1/m]	FWHM width on CG61/mm
-0.332611	2.5
-0.5	10
-0.1	9
-0.2	7
-0.3	2.5
-0.36	3

weaker Y-focusing quad means shorter X-focal length. Distance CG61 to SG-slit is close ( $\sim 20$  cm).

$\Rightarrow$  focus seems close to CG61 perhaps a bit in front, near the slits





E121-06

OPTIS with 56 focus, only Seetram

Date: 27-03-2020, 03:32:58

206 Ph 877

Injected into ESR

SIS18\_FAST\_20200325\_070808/SIS18\_FAST\_20200325\_070808.C1

Device ID	Status	I_list (A)	I_soll (A)	ΔI (A)	Bp (Tm)	BL_soll (Tm, T)	KL_soll (1, 1/m)	HProbe (Tm)
GTE1KY1	1	-27.542114	-27.430000	0.004071	N/A	-0.012461	0.0	
GTE1QD11	1	42.625965	42.620000	0.000140	9.772404	1.036100	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	585.265664	585.010000	0.000437	9.775833	1.281800	0.131176	
GTS1KY1	1	1.022370	0.960000	0.061005	N/A	0.000454	0.0	
GTS1QD11	1	147.065645	147.090000	-0.000166	9.769983	-5.679300	-0.581211	
GTS1QD12	1	177.535325	177.560000	-0.000139	9.770391	6.846600	0.700671	
GTS1MU2	1	269.838557	269.930000	-0.000339	9.767879	1.295100	0.132542	
GTS2QT11	1	115.158544	114.960000	0.001724	8.082598	2.235200	0.277030	
GTS2KY1	1	13.222175	13.225618	-0.000260	N/A	0.006051	0.0	
GTS2QT12	1	210.467849	214.500000	-0.019158	7.916692	-4.977200	-0.616878	
GTS2QT13	1	146.177557	146.200000	-0.000154	8.067552	2.833800	0.351217	
GTS2KS1	1	-0.002594	0.0	1.000000	N/A	0.0	0.0	
GTS3MU1	1	369.673757	369.420000	0.000686	8.073974	4.222800	0.523379	4.286197
GTS3KS1	1	0.038911	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	155.607776	155.480000	0.000821	8.075049	3.014300	0.373600	
GTS3QD12	1	84.652242	84.580000	0.000853	8.075400	-1.654300	-0.205041	
GTS3QD21	1	131.803339	131.500000	0.002301	8.087236	-2.559700	-0.317247	
GTS3KY1	1	0.030122	0.0	1.000000	N/A	0.0	0.0	
GTS3QD22	1	169.103061	168.890000	0.001260	8.078651	3.260500	0.404107	
GTS3KS2	1	0.005188	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	368.025758	368.230000	-0.000555	8.063945	-4.207700	-0.521499	-4.209165
GTS3KS3	1	0.028535	0.0	1.000000	N/A	0.0	0.0	
GTS3QT31	1	139.255959	139.090000	0.001192	8.077742	2.706600	0.335462	
GTS3QT32	1	217.627491	217.310000	0.001459	8.080194	-5.060000	-0.627140	
GTS3KY2	1	-0.000641	0.0	1.000000	N/A	0.0	0.0	
GTS3QT33	1	148.722800	148.800000	-0.000519	8.064120	2.907400	0.360340	
GTS4QT11	1	130.649739	130.660000	-0.000079	8.068103	2.551300	0.316204	
GTS4KY1	1	-0.380035	0.0	1.000000	N/A	0.0	0.0	
GTS4QT12	1	221.857356	221.680000	0.000799	8.074783	-5.164300	-0.640072	
GTS4QT13	1	149.272134	148.930000	0.002292	8.087028	2.901300	0.359584	
GTS4KS1	1	0.007782	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.272958	368.250000	0.000062	8.069028	-4.192100	-0.519566	-4.197270
GTS4KS2	1	0.010376	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	106.295969	105.640000	0.006171	8.118093	2.045700	0.253550	
GTS4KY2	1	0.019868	0.0	1.000000	N/A	0.0	0.0	
GTS4QD22	1	140.739158	140.230000	0.003618	8.097527	-2.736600	-0.339170	
GTS4QD31	1	0.531022	0.0	1.000000	N/A	0.0	0.0	
GTS4QD32	1	69.252602	68.720000	0.007691	8.130812	1.343700	0.166533	
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GHFSMU1	1	293.755913	0.0	1.000000	N/A	0.0	0.0	-0.0
GTS5MU1	1	207.985168	207.920000	0.000313	8.070456	-0.997800	-0.123673	-0.998444
GTS5QT11	1	90.328684	90.240000	0.000982	8.076591	1.764300	0.218671	
GTS5KY1	1	-4.502106	-4.522000	-0.004419	N/A	-0.004034	0.0	
GTS5QT12	1	204.571673	204.280000	0.001426	8.079801	-4.761100	-0.590093	
GTS5QT13	1	157.310709	157.240000	0.000449	8.071951	3.085900	0.382472	
GTS5KS1	1	0.041505	0.0	1.000000	N/A	0.0	0.0	
GTS6MU1	1	370.058290	369.850000	0.000563	8.072937	4.224600	0.523599	4.223720
GTE5KS1	1	0.147862	0.0	1.000000	N/A	0.0	0.0	
GTE5QD11	1	55.793939	55.610000	0.003297	8.095320	1.087500	0.134789	
GTE5QD12	1	137.388226	137.530000	-0.001032	8.060103	-2.683600	-0.332611	
GTE5KY1	1	-0.100708	-0.031000	0.692179	N/A	0.0	0.0	
GTE5MU0	1	184.246345	183.970000	0.001500	8.080520	-0.593280	-0.073532	
GTE5QD21	1	0.128178	0.0	1.000000	N/A	0.0	0.0	
GTE5QD22	1	80.550554	80.530000	0.000255	8.070518	-3.110300	-0.385491	

3:50 test and measure dispersion

scale TA-S6 by  $F = 1.00367$

new  $B_S = 8.09800 T_m$ , precycle

$\Rightarrow$  shift on CG21  $x = 0 \text{ mm} \rightarrow x = 23.7 \text{ mm}$

on CG61  $x = 0 \text{ mm} \rightarrow x = +2 \text{ mm}$   
~~on CG62  $x = 0 \text{ mm} \rightarrow x = 0 \text{ mm}$~~

not fully achromatic, but at least close.

$$\Rightarrow (X15)_{TA-S2} \approx \frac{23.7}{0.00367} = 6456 \text{ mm}$$

The +2 mm (actually +1.8 mm) shift at S6 were expected because also in theory it is not exactly achromatic.

4:11 reload E121-06,  $B_S(TA-S2) = 8.06838 T_m$

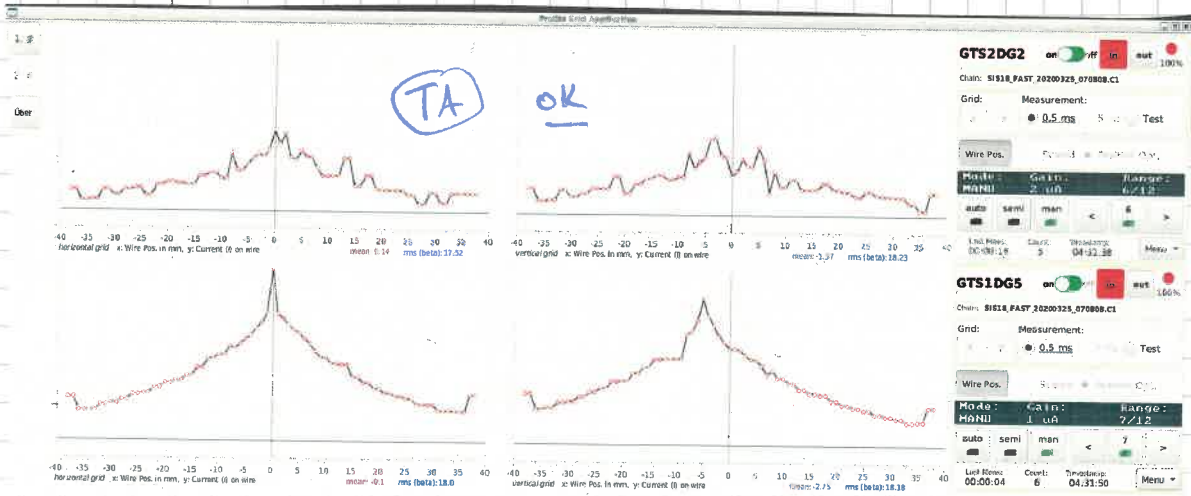
$B_S(S2-S6) = 8.08600 T_m$  (+0.22%)

$x_{CG61} = -25.5 \text{ mm}$ , expected -24.8 mm

$$\Rightarrow (X15)_{S2-S6} = \frac{-25.5}{0.00278} = 11700 \text{ mm}$$

Measure effective thicknesses

$E_{Si5} = 562,41 \text{ MeV/u}$  , after spectrum  $E = 567,356 \text{ MeV/u}$



From here on we set the FRS on 82+

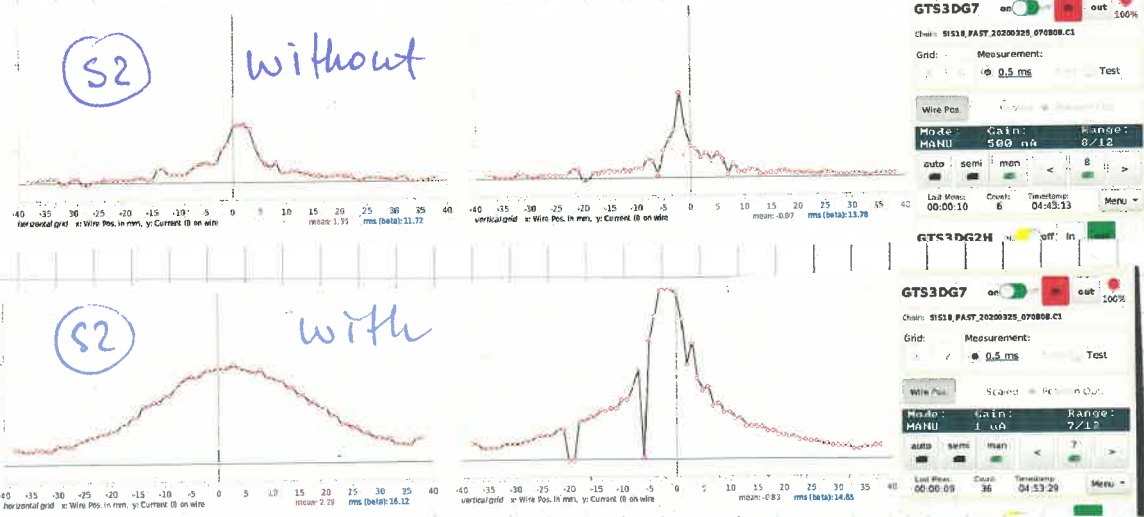
① ~~Degraded Readout~~

TARGET #26  $1624 \text{ mg/cm}^2 + 220 \text{ mg/cm}^2 \text{ Nb}$

$X = 23.9 \quad Y = -157.1$

without:  $B_p = 9,7724 \text{ Tm}$  TA-S2 peak -2 mm

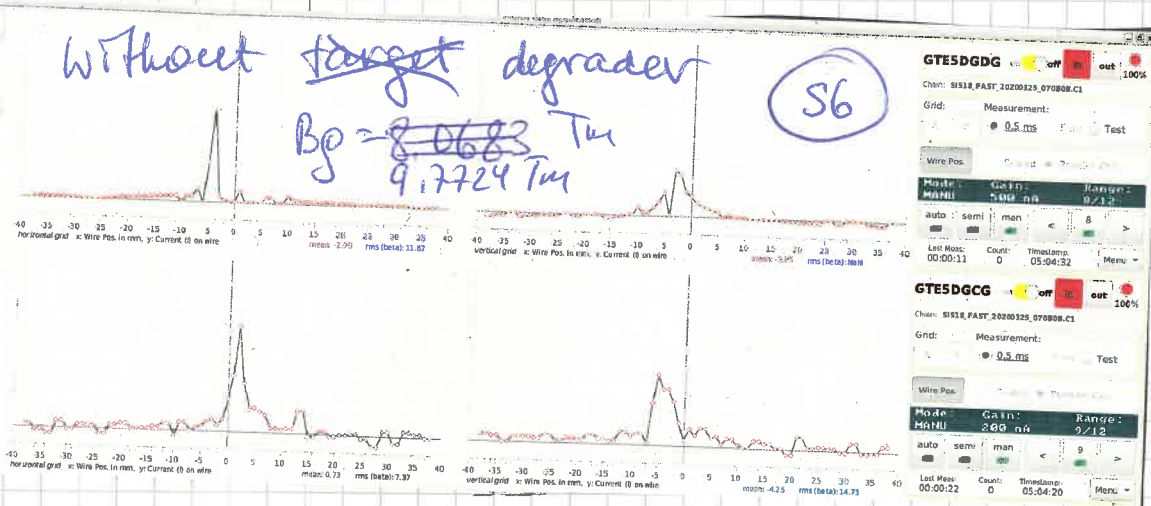
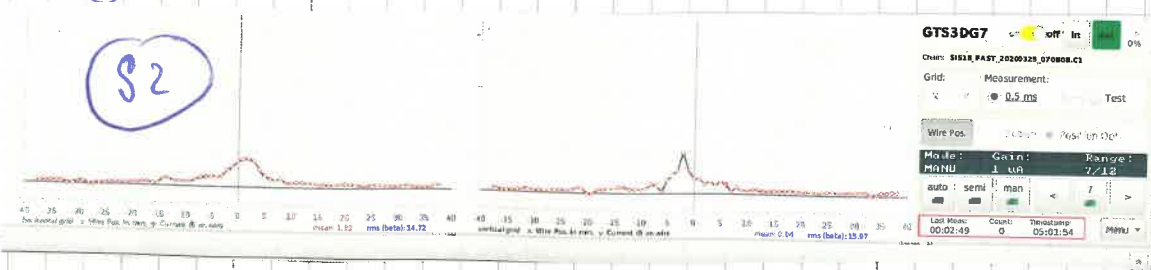
with:  $B_p = 8,4381 \text{ Tm}$  TA-S2



$\Delta_{eff} = 1608 \text{ mg/cm}^2 \text{ Be} + 223 \text{ mg/cm}^2 \text{ Nb}$

see 97

# ② Degradation thickness (TARGET removed)

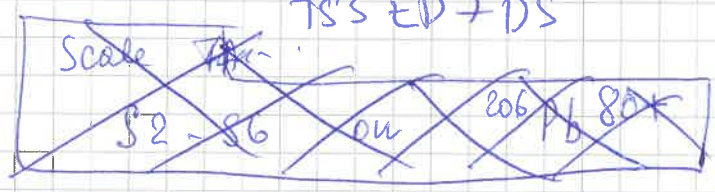


degrader 2000 mg/cm<sup>2</sup>

TS3ED 7V0/U -78,2 mm

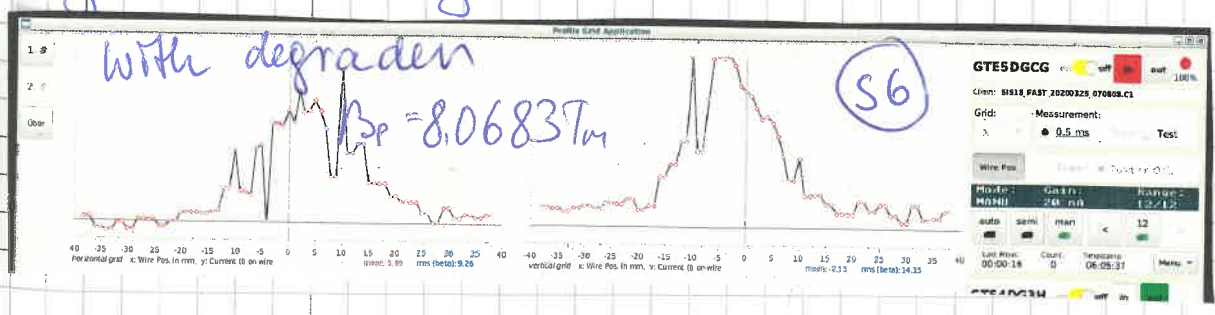
TS3ED 7 DP in

TS3ED 7 DS 90°



rescaled to 80+ and back

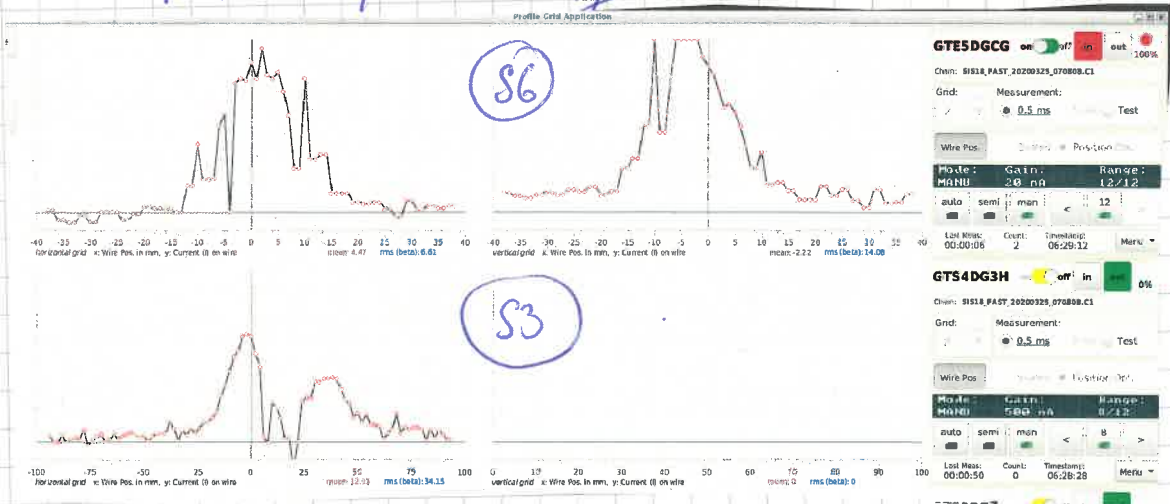
$B_p$  set according to ATIMA. -59.9 mm TS3ED 7V0/U



06:30 27.03.2020

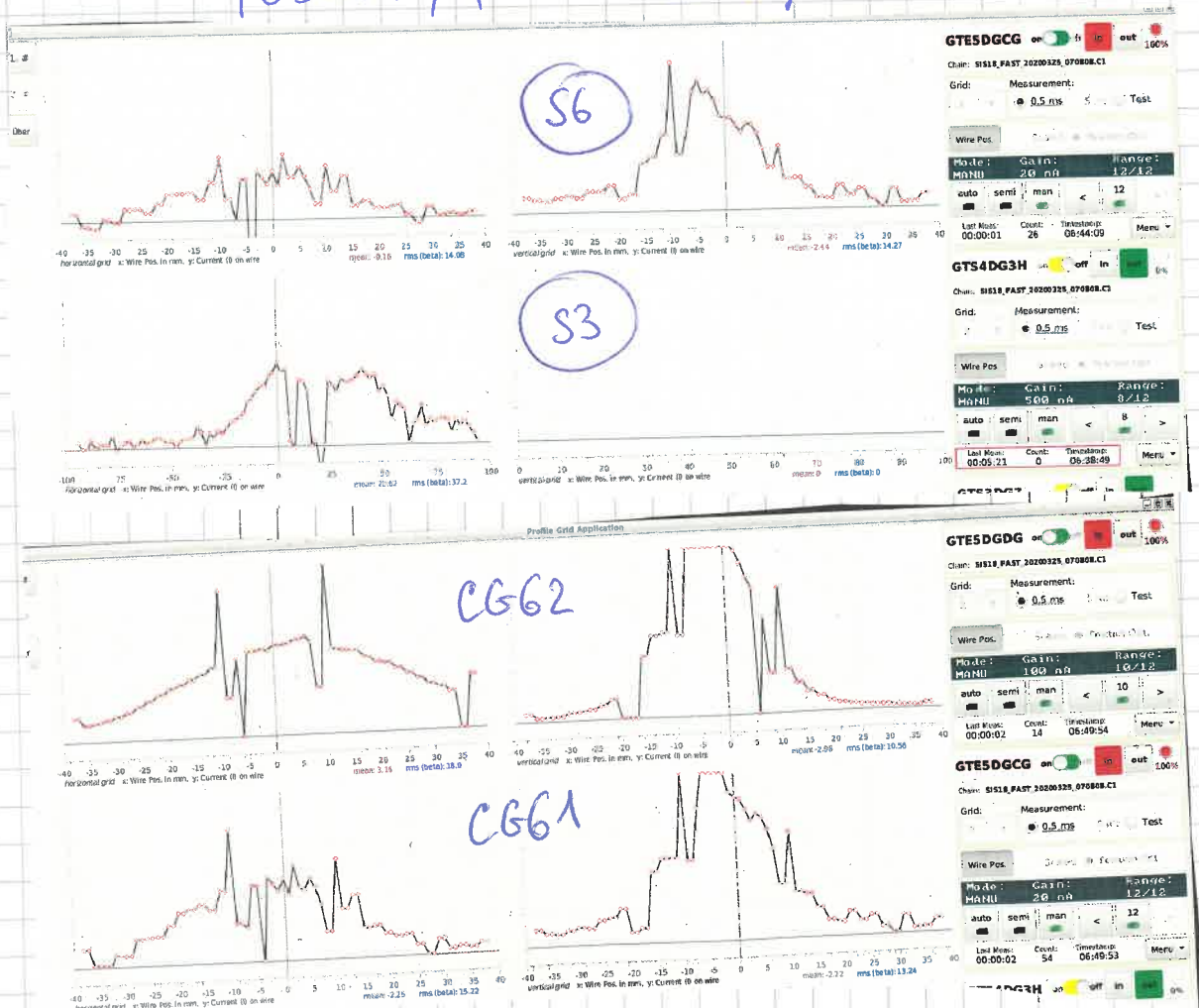
③ degrader 1400 mg/cm<sup>2</sup>

Bp = 8.6162 Tm (S2-S6)  
TS3 EDV/M ~~-13.4~~ ~~-13.7~~ -13.3 / -13.7 mm



④ degrader 3000 mg/cm<sup>2</sup>

Bp = 7.0434 Tm  
TS3 EDV/M -137.6 / -137.8 mm



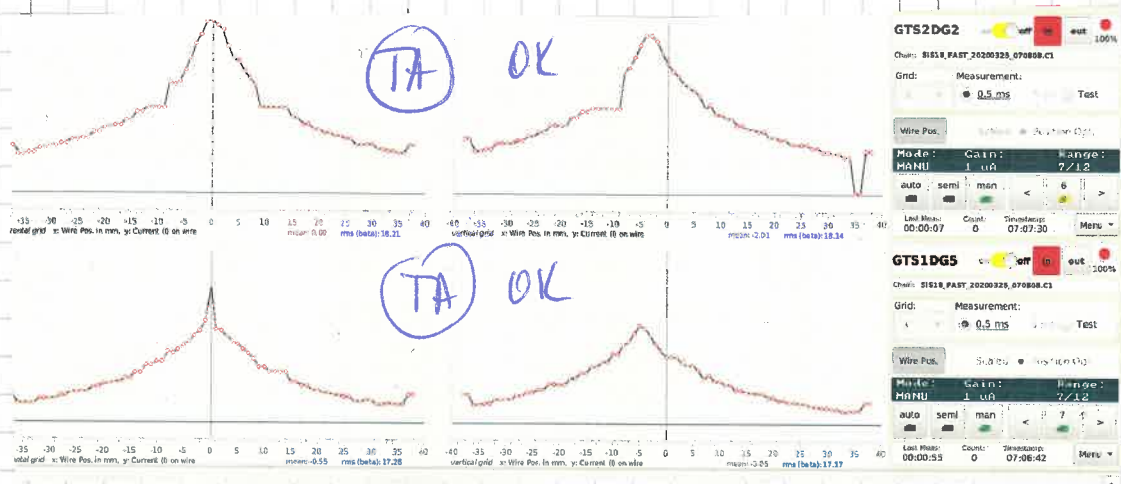
Prepare  $^{206}\text{Pb}^{81+}$  @ 400 MeV/u in ESR with target

$B_S(\text{TA-ESR}) = 8.06838 \text{ Tm}$ , reload E121-06  
Pregole TA-ESR

$E_{SIS} = 541.43 \text{ MeV/u}$ , after Seetran =  $540.36 \text{ MeV/u}$

Be -  $1609 \text{ mg/cm}^2$  + Nb -  $223 \text{ mg/cm}^2$   
effective.

is centered on CG01+CG02, nothing to do.



**GTS2DG2**  on  out 100%

Chan: SIS18\_PAST\_20200325\_070808.C1

Grid: Measurement:  0.5 ms  Test

Wire Pos:  1  2  3  4  5  6  7  8

Mode:  MANU  AUTO Gain: 1 uA Range: 7/12

auto:  semi  man  Test

Last Meas: 00:00:07 Count: 0 TimeStamp: 07:07:30 Menu

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**GTS1DG5**  on  out 100%

Chan: SIS18\_PAST\_20200325\_070808.C1

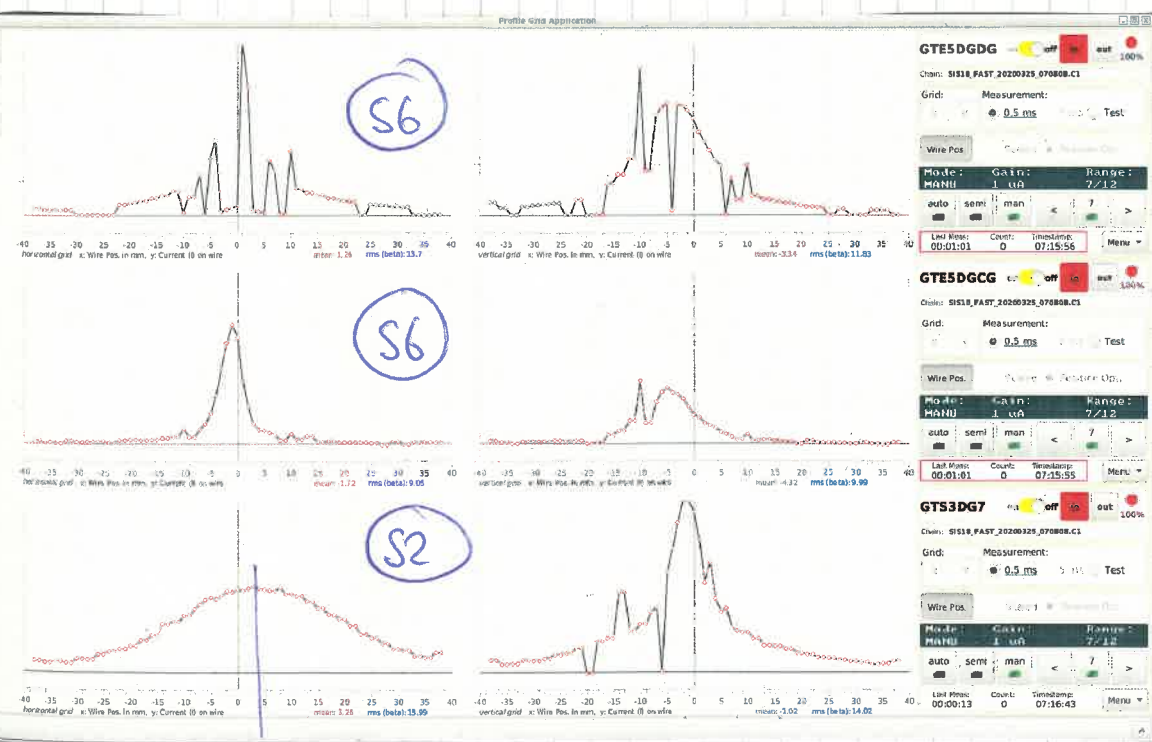
Grid: Measurement:  0.5 ms  Test

Wire Pos:  1  2  3  4  5  6  7  8

Mode:  MANU  AUTO Gain: 1 uA Range: 7/12

auto:  semi  man  Test

Last Meas: 00:00:55 Count: 0 TimeStamp: 07:06:42 Menu



**GTE5DGDG**  on  out 100%

Chan: SIS18\_PAST\_20200325\_070808.C1

Grid: Measurement:  0.5 ms  Test

Wire Pos:  1  2  3  4  5  6  7  8

Mode:  MANU  AUTO Gain: 1 uA Range: 7/12

auto:  semi  man  Test

Last Meas: 00:01:01 Count: 0 TimeStamp: 07:15:56 Menu

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**GTE5DGC6**  on  out 100%

Chan: SIS18\_PAST\_20200325\_070808.C1

Grid: Measurement:  0.5 ms  Test

Wire Pos:  1  2  3  4  5  6  7  8

Mode:  MANU  AUTO Gain: 1 uA Range: 7/12

auto:  semi  man  Test

Last Meas: 00:01:01 Count: 0 TimeStamp: 07:15:55 Menu

---

**GTS3DG7**  on  out 100%

Chan: SIS18\_PAST\_20200325\_070808.C1

Grid: Measurement:  0.5 ms  Test

Wire Pos:  1  2  3  4  5  6  7  8

Mode:  MANU  AUTO Gain: 1 uA Range: 7/12

auto:  semi  man  Test

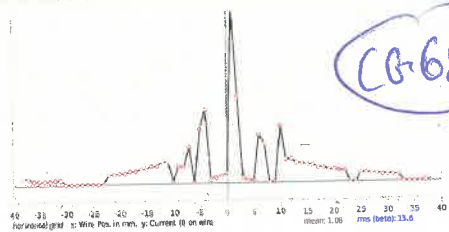
Last Meas: 00:00:13 Count: 0 TimeStamp: 07:16:43 Menu

$E_{SIS} = 541.43$   
↓  
 $541.28 \text{ MeV/u}$   
↓  
 $541.15 \text{ MeV/u}$

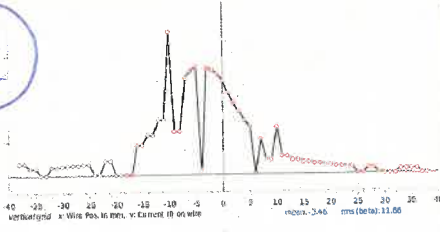
+3mm

new effective thickness:

$$\Delta_{\text{eff}} = 223 \text{ mg/cm}^2 \text{ Nb} + 1607 \text{ mg/cm}^2 \text{ Be}$$



CB62



**GTS5DGG** off out 100%

Chan: SIS18, PAST, 20200325, 070809, C1

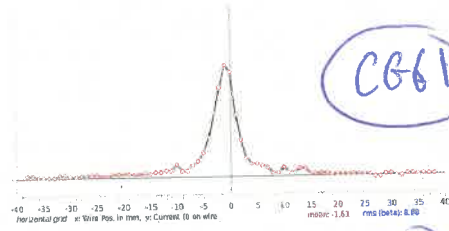
Grid: Measurement: 0.5 ms Test

Wire Pos: 0.000 Position: 0.00

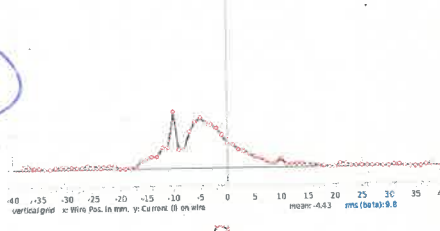
Mode: MANU Gain: 1.00 Range: 7/12

auto semi man 7

Last Meas: 00:00:08 Count: 0 Timestamp: 07:31:37 Menu



CB61



**GTS5DGG** off out 100%

Chan: SIS18, PAST, 20200325, 070809, C1

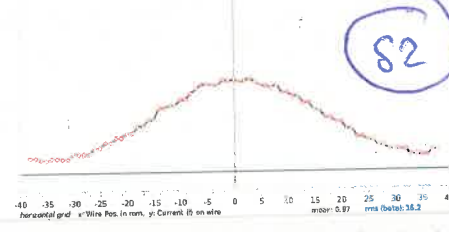
Grid: Measurement: 0.5 ms Test

Wire Pos: 0.000 Position: 0.00

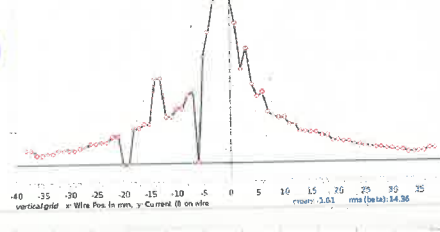
Mode: MANU Gain: 1.00 Range: 7/12

auto semi man 7

Last Meas: 00:00:09 Count: 0 Timestamp: 07:31:36 Menu



S2



**GTS3DG7** off in 0%

Chan: SIS18, PAST, 20200325, 070809, C1

Grid: Measurement: 0.5 ms Test

Wire Pos: 0.000 Position: 0.00

Mode: MANU Gain: 1.00 Range: 7/12

auto semi man 7

Last Meas: 00:00:54 Count: 0 Timestamp: 07:30:51 Menu

E121 07

Be 1.6  $\frac{g}{cm^2}$  + Nb

205 Pb 87#

in jacketed

E<sub>inc</sub> = 541.15 MeV/u

Device ID	Status	I <sub>list</sub> (A)	I <sub>soll</sub> (A)	$\Delta I$ (A)	Bp (Tm)	BL <sub>soll</sub> (Tm, T)	KL <sub>soll</sub> (1, 1/m)	HProbe (Tm)
GTE1KY1	1	-33.059692	-32.940000	0.003620	N/A	-0.014914	0.0	
GTE1QD11	1	51.085696	51.030000	0.001090	11.706440	1.240000	0.106030	
GTE1QD12	1	0.125889	0.0	1.000000	N/A	0.0	0.0	
GTS1MU1	1	700.135807	700.660000	-0.000749	11.685557	1.534000	0.131176	
GTS1KY1	1	1.217689	1.157000	0.049839	N/A	0.000544	0.0	
GTS1QD11	1	176.216926	176.250000	-0.000188	11.692072	-6.796900	-0.581211	
GTS1QD12	1	213.132115	213.170000	-0.000178	11.692072	8.193900	0.700671	
GTS1MU2	1	323.215430	323.280000	-0.000200	11.691949	1.550000	0.132542	
GTS2QT11	1	115.140233	114.960000	0.001565	8.081314	2.235200	0.277030	
GTS2KY1	1	13.217689	13.225618	-0.000600	N/A	0.006051	0.0	
GTS2QT12	1	210.449538	214.500000	-0.019247	7.916003	-4.977200	-0.616878	
GTS2QT13	1	146.195868	146.200000	-0.000028	8.068563	2.833800	0.351217	
GTS2KS1	1	0.0	0.0	100.000000	N/A	0.0	0.0	
GTS3MU1	1	369.673757	369.420000	0.000686	8.073974	4.222800	0.523379	4.286557
GTS3KS1	1	0.005188	0.0	1.000000	N/A	0.0	0.0	
GTS3QD11	1	155.607776	155.480000	0.000821	8.075049	3.014300	0.373600	
GTS3QD12	1	84.652242	84.580000	0.000853	8.075400	-1.654300	-0.205041	
GTS3QD21	1	131.803339	131.500000	0.002301	8.087236	-2.559700	-0.317247	
GTS3KY1	1	0.019868	0.0	1.000000	N/A	0.0	0.0	
GTS3QD22	1	169.084750	168.890000	0.001152	8.077775	3.260500	0.404107	
GTS3KS2	1	0.023347	0.0	1.000000	N/A	0.0	0.0	
GTS3MU2	1	368.025758	368.230000	-0.000555	8.063945	-4.207700	-0.521499	-4.208812
GTS3KS3	1	0.020753	0.0	1.000000	N/A	0.0	0.0	
GTS3QT31	1	139.255959	139.090000	0.001192	8.077742	2.706600	0.335462	
GTS3QT32	1	217.645802	217.310000	0.001543	8.080873	-5.060000	-0.627140	
GTS3KY2	1	-0.000641	0.0	1.000000	N/A	0.0	0.0	
GTS3QT33	1	148.722800	148.800000	-0.000519	8.064120	2.907400	0.360340	
GTS4QT11	1	130.668050	130.660000	0.000062	8.069233	2.551300	0.316204	
GTS4KY1	1	-0.390289	0.0	1.000000	N/A	0.0	0.0	
GTS4QT12	1	221.839045	221.680000	0.000717	8.074119	-5.164300	-0.640072	
GTS4QT13	1	149.253822	148.930000	0.002170	8.086037	2.901300	0.359584	
GTS4KS1	1	0.007782	0.0	1.000000	N/A	0.0	0.0	
GTS4MU1	1	368.272958	368.250000	0.000062	8.069028	-4.192100	-0.519566	-4.196898
GTS4KS2	1	0.007782	0.0	1.000000	N/A	0.0	0.0	
GTS4QD21	1	106.295969	105.640000	0.006171	8.118093	2.045700	0.253550	
GTS4KY2	1	0.019868	0.0	1.000000	N/A	0.0	0.0	
GTS4QD22	1	140.739158	140.230000	0.003618	8.097527	-2.736600	-0.339170	
GTS4QD31	1	0.512711	0.0	1.000000	N/A	0.0	0.0	
GTS4QD32	1	69.234291	68.720000	0.007428	8.128675	1.343700	0.166533	
GTS4KS3	1	0.012970	0.0	1.000000	N/A	0.0	0.0	
GHFSMU1	1	293.755913	0.0	1.000000	N/A	0.0	0.0	-0.0
GTS5MU1	1	207.985168	207.920000	0.000313	8.070456	-0.997800	-0.123673	-0.998632
GTS5QT11	1	90.328684	90.240000	0.000982	8.076591	1.764300	0.218671	
GTS5KY1	1	-4.491852	-4.522000	-0.006712	N/A	-0.004034	0.0	
GTS5QT12	1	204.626606	204.280000	0.001694	8.081967	-4.761100	-0.590093	
GTS5QT13	1	157.310709	157.240000	0.000449	8.071951	3.085900	0.382472	
GTS5KS1	1	0.038911	0.0	1.000000	N/A	0.0	0.0	
GTS6MU1	1	370.058290	369.850000	0.000563	8.072937	4.224600	0.523599	4.224064
GTE5KS1	1	0.145268	0.0	1.000000	N/A	0.0	0.0	
GTE5QD11	1	55.793939	55.610000	0.003297	8.095320	1.087500	0.134789	
GTE5QD12	1	137.388226	137.530000	-0.001032	8.060103	-2.683600	-0.332611	
GTE5KY1	1	-0.100708	-0.031000	0.692179	N/A	0.0	0.0	
GTE5MU0	1	184.228034	183.970000	0.001401	8.079714	-0.593280	-0.073532	
GTE5QD21	1	0.128178	0.0	1.000000	N/A	0.0	0.0	
GTE5QD22	1	80.404065	80.530000	-0.001566	8.055868	-3.110300	-0.385491	
		N/A	-32.829000	N/A	N/A	-0.014865	0.0	

Bp = 8,06838 Tm