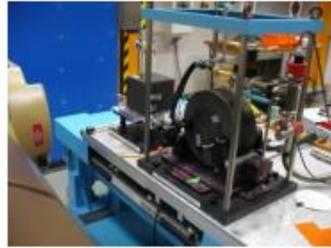


Intercomparison GUI user guide

Dosimetry chain to the clinic



NPL primary standard (Graphite calorimeter)

NPL reference chambers

UCLH secondary standard

UCLH field chambers

Intercomparison is a process to derive the field chamber $f_{D,W}$ factor from our secondary standard chamber which has the $^{SS}N_{D,W}$ factor after calibrating with the NPL primary standard graphite calorimeter.

Monitor dosimetry from G1 to G4

Output consistency

PostISM

Absorbed dose in water

Re-baseline our DQA3

Intercomparison GUI – from X drive

1.) You need to fill in every box, except Operator 2 and comment.

Chamber intercomparison:

Measurement details:

Date/ time: 2023-12-27 13:15:52 Gantry: Chambers (secondary standard): Chambers (Field): Comment:

 Gantry angle: 0 Electrometers (ss): Electrometers (f):

Operator 1: Material: Electrometer range (ss): Medium Electrometer range (f): Medium

Operator 2: Humidity (%): Electrometer voltage (ss,V): -200 Electrometer voltage (f, V): -200

2.) Where do you want to save the intercomparison report. The input directory serves as the designated location for storing crash GUI input. If

Report location:

3.) Blue: fetch NDW from proton database successfully. Red: use the hard-coded NDW. User has to double- check the NDW

SS NDW Calibration factor

NDW factor successfully fetched from database.

ssNDW: previous_fNDW: calc_fNDW:

ss_measurement								f_measurement								ssr_measurement						Results	
TPC								TPC								TPC						NDW	
T(°C): <input type="text"/> P(mbar): <input type="text"/> TPC: <input type="text"/>								T(°C): <input type="text"/> P(mbar): <input type="text"/> TPC: <input type="text"/>								T(°C): <input type="text"/> P(mbar): <input type="text"/> TPC: <input type="text"/>						unit: Gy/nC	
En(MeV)	ssR1	ssR2	ssR3	ssR4	ssR5	ssAVE	ssSTD	En(MeV)	fR1	fR2	fR3	fR4	fR5	fAVE	fSTD	En(MeV)	ssrR1	ssrR2	ssrR3	ssrAVE	ssrSTD	En(MeV)	NDW
240	<input type="text"/>	240	<input type="text"/>	240	<input type="text"/>	240	<input type="text"/>																
210	<input type="text"/>	210	<input type="text"/>	210	<input type="text"/>	210	<input type="text"/>																
180	<input type="text"/>	180	<input type="text"/>	180	<input type="text"/>	180	<input type="text"/>																
170	<input type="text"/>	170	<input type="text"/>	170	<input type="text"/>	170	<input type="text"/>																
160	<input type="text"/>	160	<input type="text"/>	160	<input type="text"/>	160	<input type="text"/>																
110	<input type="text"/>	110	<input type="text"/>	110	<input type="text"/>	110	<input type="text"/>																
70	<input type="text"/>	70	<input type="text"/>	70	<input type="text"/>	70	<input type="text"/>																

4.) The GUI will automatically save GUI input to a csv after each 70 MeV entry

CSV location:

5.) hit "check data" to calculate fNDW + check all essential cells are filled

6.) hit "submit" to generate report

How it works

- Fill the table

Can be blank

Measurement details:

Date/ time: 2023-12-23 21:47:37 Gantry: 3 Chambers (secondary standard): 3126 Chambers (Field): 3128 Comment:
 Operator 1: KC Gantry angle: 0 Electrometers (ss): 92580 Electrometers (f): 92581
 Operator 2: Material: solid water Electrometer range (ss): Medium Electrometer range (f): Medium
 Humidity (%): 50.2 Electrometer voltage (ss, V): -200 Electrometer voltage (f, V): -200

Location
 Report location: C:/Users/KAWCHUNG/Downloads

ss NDW calibration factor
 NDW factor successfully fetched from database.
 ssNDW: 0.08470 previous_fNDW 0.08320 calc_fNDW: 0.08361

ss_measurement								f_measurement								ssr_measurement					Results		
TPC								TPC								TPC					NDW		
En(MeV)	ssR1	ssR2	ssR3	ssR4	ssR5	ssAVE	ssSTD	En(MeV)	fR1	fR2	fR3	fR4	fR5	fAVE	fSTD	En(MeV)	ssrR1	ssrR2	ssrR3	ssrAVE	ssrSTD	En(MeV)	NDW
240	6.442	6.452	6.443	6.458	6.448	6.449	0.006	240	6.551	6.563	6.56	6.554	6.566	6.559	0.006	240	6.453	6.452	6.452	6.438	0.024	240	0.0832
210	6.414	6.415	6.416	6.42	6.415	6.416	0.002	210	6.523	6.525	6.525	6.519	6.527	6.524	0.003	210	6.41	6.415	6.414	6.41	0.008	210	0.0832
180	6.394	6.396	6.397	6.402	6.396	6.397	0.003	180	6.504	6.507	6.513	6.507	6.509	6.508	0.003	180	6.4	6.394	6.395	6.396	0.003	180	0.0832
170	6.396	6.407	6.404	6.405	6.401	6.403	0.004	170	6.508	6.52	6.519	6.513	6.516	6.515	0.004	170	6.402	6.401	6.405	6.404	0.003	170	0.0832
160	6.409	6.407	6.411	6.415	6.409	6.41	0.003	160	6.521	6.526	6.524	6.521	6.525	6.523	0.002	160	6.407	6.414	6.41	6.503	0.157	160	0.0836
110	6.683	6.688	6.693	6.693	6.682	6.688	0.005	110	6.805	6.81	6.806	6.801	6.808	6.806	0.003	110	6.684	6.687	6.684	6.685	0.001	110	0.0831
70	8.206	8.216	8.212	8.217	8.212	8.213	0.004	70	8.349	8.356	8.36	8.35	8.358	8.355	0.004	70	8.211	8.216	8.212	8.212	0.003	70	0.0832

Location
 CSV location: C:/Users/KAWCHUNG/Downloads/IC_2023_12_23_SS_3126_F_3128.csv Load CSV

Check Data
 Submit Exit

How it works

- Click check data to calculate the “calc_fNDW”

Measurement details:

Date/ time: 2023-12-23 21:47:37 Gantry: 3 Chambers (secondary standard): 3126 Chambers (Field): 3128 Comment:
 Gantry angle: 0 Electrometers (ss): 92580 Electrometers (f): 92581
 Operator 1: KC Material: solid water Electrometer range (ss): Medium Electrometer range (f): Medium
 Operator 2: Humidity (%): 50.2 Electrometer voltage (ss.V): -200 Electrometer voltage (f.V): -200

Location
 Report location:
 C:/Users/KAWCHUNG/Downloads

ss NDW calibration factor
 NDW factor successfully fetched from database.
 ssNDW: 0.08470 previous_NDW: 0.08320 calc_fNDW: 0.08361

ss_measurement							f_measurement							ssr_measurement							Results		
TPC							TPC							TPC							NDW		
T(°C): 22.8 P(mbar): 998.6 TPC: 1.0244							T(°C): 22.9 P(mbar): 998.6 TPC: 1.0247							T(°C): 22.8 P(mbar): 998.6 TPC: 1.0244							unit: Gy/nC		
En(MeV)	ssR1	ssR2	ssR3	ssR4	ssR5	ssAVE	ssSTD	En(MeV)	R1	R2	R3	R4	R5	AVE	STD	En(MeV)	ssrR1	ssrR2	ssrR3	ssrAVE	ssrSTD	En(MeV)	NDW
240	6.442	6.452	6.443	6.458	6.448	6.449	0.006	240	6.551	6.563	6.56	6.554	6.566	6.559	0.006	240	6.453	6.452	6.452	6.438	0.024	240	0.0832
210	6.414	6.415	6.416	6.42	6.415	6.416	0.002	210	6.523	6.525	6.525	6.519	6.527	6.524	0.003	210	6.41	6.415	6.414	6.41	0.008	210	0.0832
180	6.394	6.396	6.397	6.402	6.396	6.397	0.003	180	6.504	6.507	6.513	6.507	6.509	6.508	0.003	180	6.4	6.394	6.395	6.396	0.003	180	0.0832
170	6.396	6.407	6.404	6.405	6.401	6.403	0.004	170	6.508	6.52	6.519	6.513	6.516	6.515	0.004	170	6.402	6.401	6.405	6.404	0.003	170	0.0832
160	6.409	6.407	6.411	6.415	6.409	6.41	0.003	160	6.521	6.526	6.524	6.521	6.525	6.523	0.002	160	6.407	6.414	6.41	6.503	0.157	160	0.0836
110	6.683	6.688	6.693	6.693	6.682	6.688	0.005	110	6.805	6.81	6.806	6.801	6.808	6.806	0.003	110	6.684	6.687	6.684	6.685	0.001	110	0.0831
70	8.206	8.216	8.212	8.217	8.212	8.213	0.004	70	8.349	8.356	8.36	8.35	8.358	8.355	0.004	70	8.211	8.216	8.212	8.212	0.003	70	0.0832

Location
 CSV location:
 C:/Users/KAWCHUNG/Downloads/IC_2023_12_23_SS_3126_F_3128.csv Load CSV

Check Data
 Submit Exit

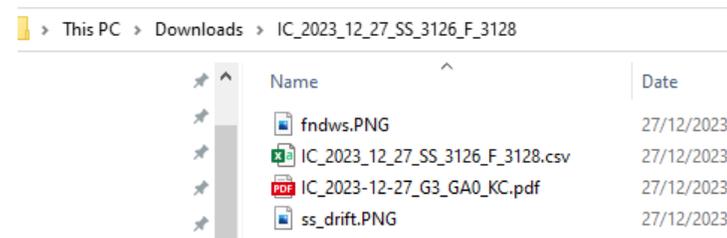
- Warning message if calculated NDW exceeds two std

ssr_measurement						Results	
TPC						NDW	
T(°C): 22.8 P(mbar): 998.6 TPC: 1.0244						unit: Gy/nC	
En(MeV)	ssrR1	ssrR2	ssrR3	ssrAVE	ssrSTD	En(MeV)	NDW
240	6.453	6.452	6.452	6.438	0.024	240	0.0832
210	6.41	6.415	6.414	6.41	0.008	210	0.0832
180	6.4	6.394	100	37.59	54.04	180	0.2354
170	6.402	6.401	6.405	6.404	0.003	170	0.0832
160	6.407	6.414	6.41	6.503	0.157	160	0.0836
110	6.684	6.687	6.684	6.685	0.001	110	0.0831
70	8.211	8.216	8.212	8.212	0.003	70	0.0832

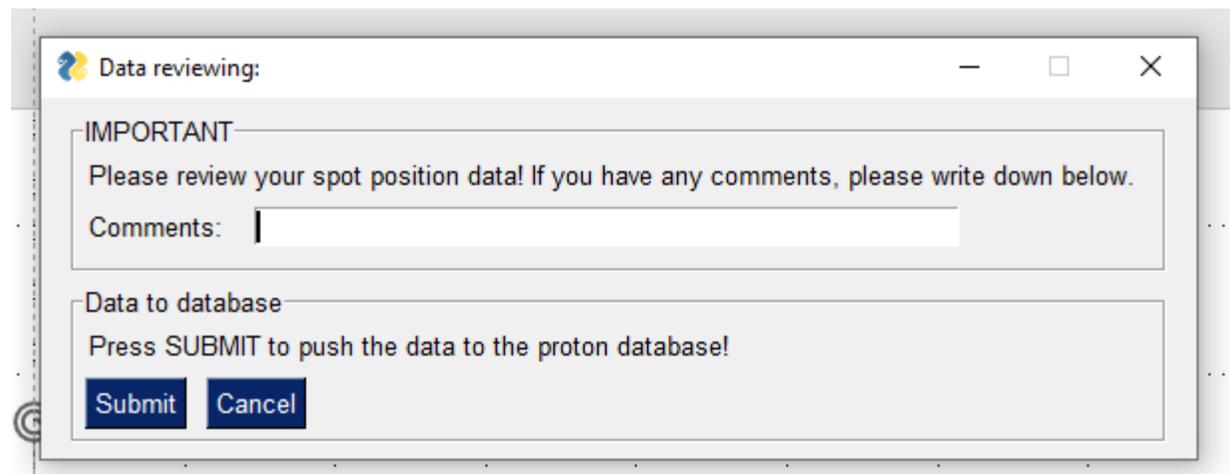
please review 180 data. Average NDW exceeds two stds.
 OK

How it works ..

- Click submit if you are happy with your data



- An intercomparison report will be generated. (go through the report)
- Another GUI asks for pushing data to the database



How it works

- MPE (Senior physicists) check the intercomparison
- Input the NDW factor to our Proton database (Calibration table)

☰ Calibration

Equipment	Cal Date	Operator	Signed off b	CalFactor	Kpol	Ref doc	Click to Add
Roos electron chamber 0.35 cc, [3126]	26/04/2019	AW		85070000		1 NPL cert 2019	
Roos electron chamber 0.35 cc, [3126]	13/05/2021	AW		84800000		1 NPL cert 2021	
Roos electron chamber 0.35 cc, [3126]	04/10/2023	AW	AW	84700000		1 NPL cert 2023	
Roos electron chamber 0.35 cc, [3128]	09/11/2019	AW		83790123		1 Roos comm ch	
Roos electron chamber 0.35 cc, [3128]	18/07/2021	SavC	AW	83590000		1 PBTPhysicsTea	
Roos electron chamber 0.35 cc, [3128]	24/10/2023	SavC	AW	83200000		1 SP QA I MO23	
Roos electron chamber 0.35 cc, [3131]	09/11/2019	AW		83402601		1 Roos comm ch	
Roos electron chamber 0.35 cc, [3131]	13/05/2021	AW		83300000		1 NPL cert 2021	
Roos electron chamber 0.35 cc, [3131]	24/10/2023	SavC	AW	82900000		1 SP QA I MO23	
Roos electron chamber 0.35 cc, [3132]	09/11/2019	AW		83842813		1 Roos comm ch	
Roos electron chamber 0.35 cc, [3132]	13/05/2021	AW		83700000		1 NPL cert 2021	
Roos electron chamber 0.35 cc, [3132]	04/10/2023	AW	AW	83600000		1 NPL cert 2023	
Roos electron chamber 0.35 cc, [3128]	06/06/2021	AGr	AW	83585563		1 PBTPhysicsTea	

*

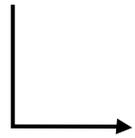
Auto-saved csv

2.) Where do you want to save the intercomparison report. The input directory serves as the designated location for storing crash GUI input. If



A screenshot of a software interface showing a text input field labeled 'Report location:' with a 'Browse' button to its right. The entire input area is enclosed in a red rectangular border.

- After each 70 MeV beam entry, the code will auto save the GUI input as an csv. If the GUI crashes for whatever reason, all you need is to load csv.

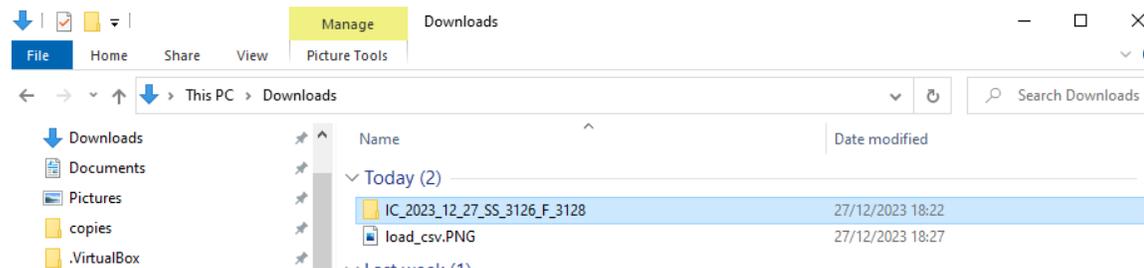
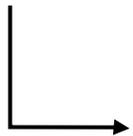


4.) The GUI will automatically save GUI input to a csv after each 70 MeV entry



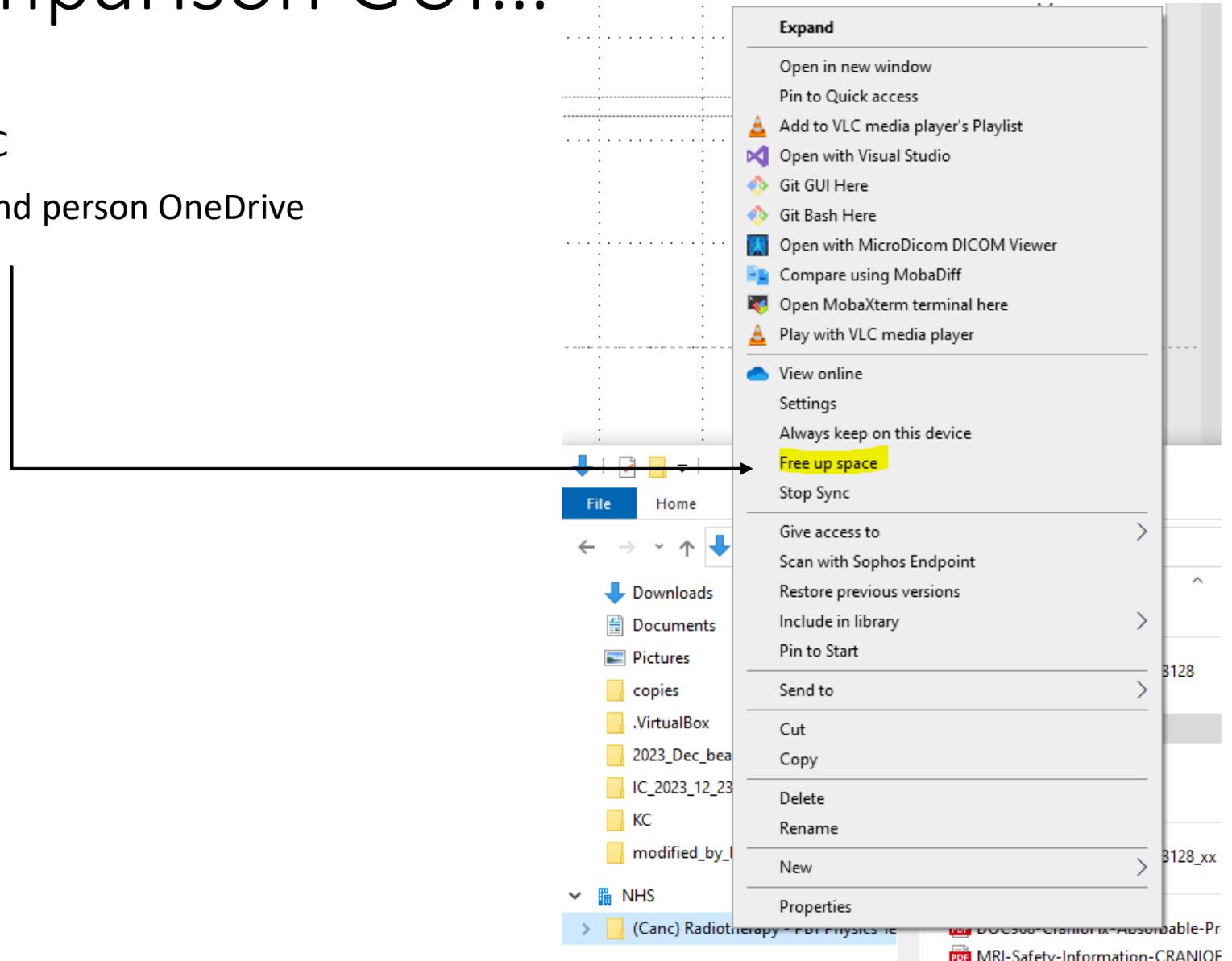
A screenshot of a software interface showing a text input field labeled 'CSV location:' with 'Browse' and 'Load CSV' buttons to its right. The input area is enclosed in a red rectangular border.

- If you do not input “Report location”, the report + csv will be saved in your “Downloads” folder.



Frozen intercomparison GUI...

- Check the memory left for your PC
- Free up space from your proton and person OneDrive



NDW factors comes from the proton database or hard-coded number?

- Blue text colour: Successfully fetched NDW from database

ss NDW calibration factor

NDW factor successfully fetched from database.

ssNDW: previous_fNDV calc_fNDW:

- Red text: Used hard-coded NDW

ss NDW calibration factor

Unable to fetch NDW factor from database. PLEASE check the chamber specific NDW factor on iPASSPORT.

ssNDW: previous_fNDV calc_fNDW:

- Fetching status is highlighted in intercomparison report

3128 intercomparison report

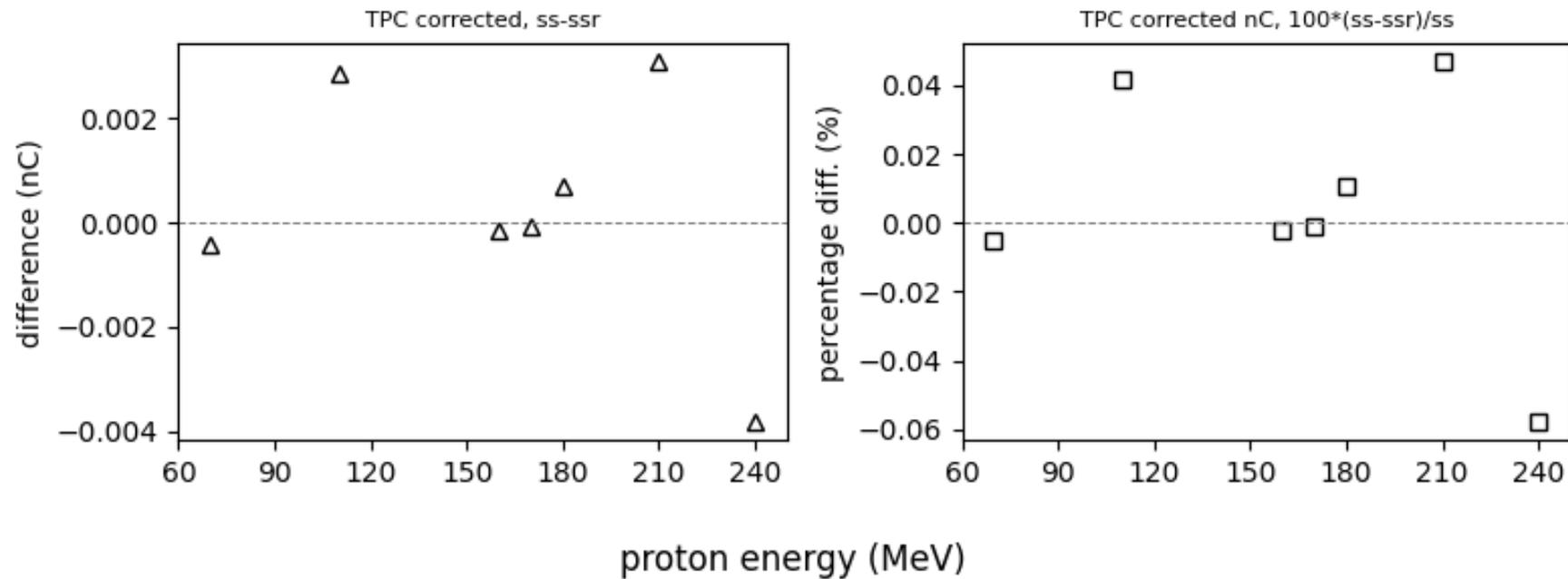
Date: 2023-12-27 18:21:54
Gantry:3
Gantry angle: 0
Operator(s): KC
Material: solid water (RW3)
Humidity: 50.2
Comment:

Summary:
- NDW factor successfully fetched from database.

$$N_{D,W}(f) = N_{D,W}(ss) \cdot \frac{mR_{ss}}{mR_f} \quad (1)$$

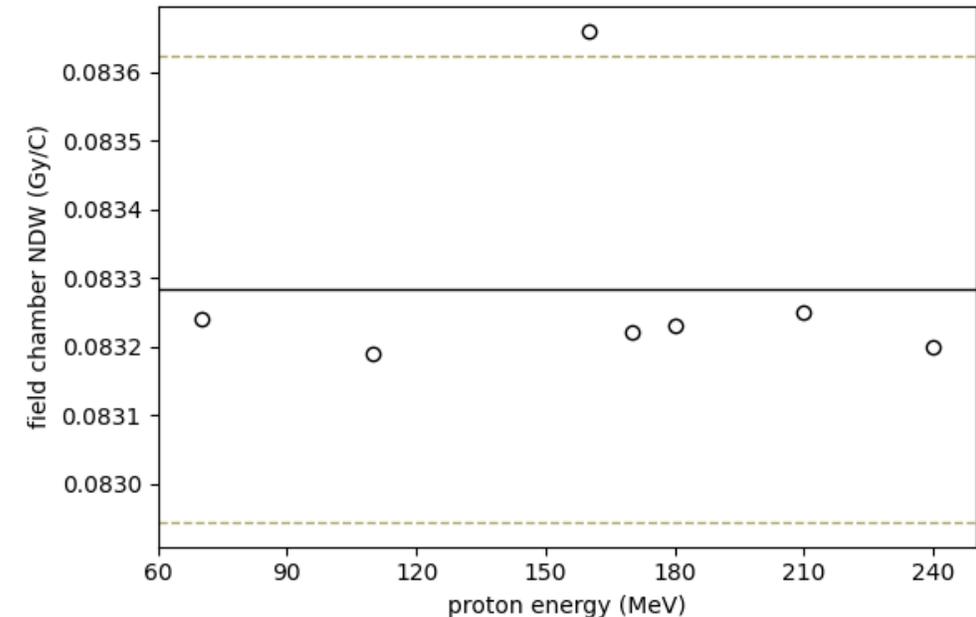
Data quality assessment – any drifts?

- 5 ss measurements
- 3 ssr measurements



Data quality assessment – 2 std

- Calculate mean and σ from field chamber NDW from 240 MeV, 210 MeV, 180 MeV, 170 MeV, 160 MeV, 110 MeV, 70 MeV
- Measurements should be within mean $\pm 2\sigma$
- $\pm 2\sigma$ is a in-house tolerance (aims to flag errors in the early stage of measurements)
- There is no tolerance (maybe, not that I am aware of) on the NDW factor obtained by intercomparison



Data quality assessment – 2 std

- **Limitations**

1. Fails to flag error if I mess up numbers from two energies as the mean and σ are likely to be affected.
2. G4 110 MeV output could fluctuate > potentially exceed $\pm 2 \sigma$ >> should we care?
3. 1σ of fNDW could be very small (i.e. 0.00017 a.u. while mean = 0.08328 Gy/C)
1 σ could be 0.2% of the mean. NPL reports NDW with 4 decimal place (i.e. 0.0847 Gy/C for 3126)
>> it seems to me G4 data has higher std and G180 MeV exceed 2 std. what shall we do for it?

