on the Protura TM Robotic couth 6DOF to obtain a more accurate alignment. Mean translational and rotational shifts were calculated.

Results: From July to September 2015, 13 patients were enrolled (10 with primary lung tumours and 3 with metastatic lung lesions) with a median age of 74 yrs (range 58-86). Fifty-two CBCT were performed and compared to CT images. The mean (±SD) interfraction displacements in all DoF are reported in Table 1.

	Lat (cm)	Vrt (cm)	Lng (cm)	Roll (deg)	Pitch (deg)	Yaw (deg)
MEAN	0,04	-0,11	0,00	0,16	0,04	-0,28
ST.DEV.	0,40	0,39	0,57	1,21	1,21	1,31
MAX	0,95	1,12	1,64	3,00	3,00	2,60
MIN	-0,84	-0,79	-1,50	-3,70	-2,00	-3,40

The mean (±SD) 3D vector of displacement was 0.7 ± 0.4 cm. The maximal translation setup shift was 1.1 cm vertically, 1.6 cm longitudinally and 1 cm laterally, with 77% of the shifts < 3 mm. The maximal rotation error was +3° for Pitch, -3.7° for Roll and -3.4° for Yaw, with 22% of the rotations >1° and 5% of rotations >2°. No correlation was observed between the magnitude of translational and rotational shift. A Kruskal-Wallis test showed that there was no statistically significant difference between the 3 rotation groups (p>0.05).

Conclusion: This work confirms that a 6-DoF robotic couch could be useful to improve accuracy in IGRT era, especially in SBRT. No correlation was found between translational and rotational errors, but it could revealed important outliers and corrected. Geometric and dosimetric analysis on other regions are on going.

EP-2118

CBCT in stereotactic body radiation therapy for lung tumors: manual matching versus auto-matching

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Purpose or Objective: To correlate manual matches performed by radiation therapy technologists (RTTs) with two modality of automatic matching ("Bone match" and "Grey value match"). The manual alignment is taken as the gold standard mode and the purpose is to check the deviation between the values of translation and rotation obtained by this alignment and the values detected with the two types of automatic matching.

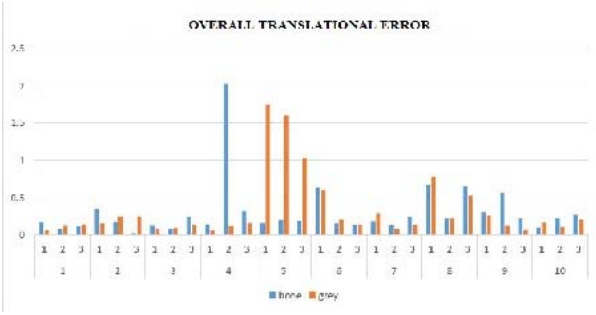
Material and Methods: This study included 10 central lung lesions treated with three sessions of SBRT, 18 Gy per fraction. 4DCT was used. The gross tumor volume (GTV) was defined on average reconstruction (AVG) and the internal target volume (ITV) was obtained modelling the GTV on the secondary images (MIP: maximum intensity projection). Planning Target Volume (PTV) was obtained adding 0.5 cm of margin to the ITV. For each session values of translation and rotation along the three axes (x, y, z) were collected off line by performing three different registrations: manual match only on the target, bone match and grey value match using a clip box containing a vertebral body and closest bone structures. Values of manual alignment were collected by three RTTs for a total of 9 images comparisons for each patient and a mean manual alignment was assessed and compared to the values of the automatic alignments. **Table 1** shows an example of collected data related to one of the patients.

Table 1

PATIENT 1							TECHNICIAN 1			TECHNICIAN 2			TECHNICIAN 3		
SESSION 1	CBCT BONE (T+R)			CBCT GREY VALUE(T+R)			CBCT MANUAL			CBCT MANUAL			CBCT MANUAL		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
T(cm)	0.19	-0.30	-0.26	0.31	-0.37	-0.20	0.27	-0.35	-0.20	0.40	-0.30	-0.30	0.33	-0.50	-0.27
R(angle)	0.0	359.2	0.0	359.9	0.2	359.6	0.0	0.0	359.0	359.0	0.0	0.0	359.0	0.0	0.0
SESSION 2	CBCT BONE (T+R)			CBCT GREY VALUE(T+R)			CBCT MANUAL			CBCT MANUAL			CBCT MANUAL		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
T(cm)	0.61	-0.40	0.40	0.68	-0.43	0.40	0.64	-0.47	0.53	0.60	-0.40	0.20	0.43	-0.40	0.60
R(angle)	0.0	359.5	0.0	0.0	359.8	359.9	0.0	359.5	359.0	0.0	359.0	0.0	0.0	0.0	0.0
SESSION 3	CBCT BONE (T+R)			CBCT GREY VALUE(T+R)			CBCT MANUAL			CBCT MANUAL			CBCT MANUAL		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
T(cm)	0.07	0.05	-0.16	0.14	-0.02	-0.35	0.10	0.13	-0.13	0.00	0.00	-0.40	0.10	0.10	-0.30
R(angle)	359.5	359.9	0.5	358.9	359.5	359.7	359.0	359.0	359.9	0.0	0.0	0.0	0.0	0.0	0.0

Results: The results are summarized in the **table 2**. About translations: gray value matching fails in all sessions of subject 5 (affected by pleural effusion), bone matching fails in the second session of the subject 4 and both have errors slightly high in the subject 8. About rotations: gray value matching fails in all sessions of subject 5 and in the first session of the subject 2.The bone shows difficulty in subjects 4, 9 and10.

Table 2



Conclusion: The study shows that in some particular pathological cases, such as pleural effusion and atelectasis, automatic method could be not accurate. In these it was found that the bone matching values are the closest to the gold standard values. In particular in four cases there was a significant difference between the manual and the automatic alignments, it could result in a not tolerable location of the target before and during the treatment. The results could be conducted to the difference in the breathing in the different sessions, a larger PTV in some selected patients could guarantee an higher precision in treatment delivery.

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A clinical investigation of optimal CBCT image matching for non-SABR radical lung cancer patients

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Purpose or Objective: Spine-based image registration has traditionally been used for patient setup for non-SABR radical lung cancer radiotherapy. Enhanced visualisation of soft tissue structures through volumetric imaging has led to research of various landmarks that may offer target localisation of increased accuracy compared to spine-based registration. The objectives of this project were to answer the following: Can using carina or tumour as registration landmarks for IGRT offer superior target coverage compared to spine registration? Does the position of tumour affect which registration landmark offers superior target coverage? What are the implications of carina or tumour registration on spinal cord safety?

Material and Methods: Ten patients with central tumours and ten patients with peripheral tumours were selected. A clinical expert assessed a sample of CBCTs from each patient and selected which thoracic landmark (spine, carina, or tumour) produced the the optimal match. CBCTs from each patient (238 CBCTs in total) were matched using the spine and the optimal match and translational displacements were recorded. The difference between the spine-match displacements and optimal-match displacements were