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Monte Carlo investigation of dose modelling and application variability in rhenium-188 skin radionuclide therapy

I. Quin[1], L. Käselau[1], T Nikula[1], **F. Martin del Rosario[1]**, D. Bolst[2]

[1]OncoBeta gmbh, Munich, Germany,

[2]University of Wollongong, Wollongong, Australia.

Global Regulatory Status of Rhenium SCT

- MDR-approved in EU – MDR 796214 R000
- AEMPS approved Class IIb Medical Device in Spain – PD/2022/6247(D)
- ARTG-registered in Australia; ARTG Number 400142
- Medsafe in New Zealand – 230302-WAND-70RGWT
- HSA registration medical device in Singapore – Product Number: MDPR251103W0003

In Europe, Rhenium-SCT® is indicated for:

- Basal cell carcinoma (BCC)
- Squamous cell carcinoma (SCC)
  - Especially for patients with co-morbidities for which a surgical approach is not indicated, or for lesions which anatomical position may result in a suboptimal cosmetic result using conventional approaches

This presentation is intended only for Healthcare Professionals practicing in the regions where Rhenium SCT is approved

Disclosures

- This study is an investigation of the OncoBeta product, Rhenium-SCT. This study was sponsored by OncoBeta.
- I. Quin, L. Käselau, T Nikula, F. Martin del Rosario are all employees of OncoBeta.
- D. Bolst received funding from OncoBeta to perform this analysis.

Acknowledgements

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Site Investigators:

- **Australia**: Siddhartha Baxi, Giuseppe Cardaci, Angela Hong
- **United Kingdom**: Nicola Mulholland
- **Germany**: Julia Tietze, Martin Heuschkel
- **Austria**: Siroos Mirzaei
- **South Africa**: Mike Sathekge, Kgomotso Mokoala

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What is Rhenium-SCT?

A single-session, non-invasive radiation treatment that harnesses the beta particles from rhenium-188 decay (17hr half-life) to trigger tumour cell death.

1

How is it applied?

Dermatologists select patients and refer them to Nuclear Medicine who apply the treatment. Applied as a resin, it is administered over a film affixed to indicated BCC and SCC lesions, allowing for conformal treatment without the need for complex planning.

2

Mechanism of Action

The shallow penetration profile of rhenium-188 beta particles (2.12 MeV max; 92% penetration within 3mm of skin), allows for targeted treatment, whilst avoiding unnecessary exposure of healthy tissue.

3

Patient Experience

Treatment is painless and lasts from 45-180 minutes, depending on lesion depth. Patients can return to activities immediately. A delayed radiodermatitis occurs, characterised most commonly by erythema, pruritis and scabbing.

4







Common patients treated

- **Cosmetic or functional considerations**
- **Comorbidities**
- **Unable to complete fractionated radiotherapy**
- **Multiple lesions**
- **Recurrent lesions**
- **Remote or rural patients**
- **Declines surgery**

References: Baxi et al 2026 EANMI, doi:10.1016/j.eanmi.2026.100311; Sedda AF, et al. Dermatological high-dose-rate brachytherapy for the treatment of basal and squamous cell carcinoma. Clin Exp Dermatol. 2008;33(6):745-749. doi: 10.1111/j.1365-2230.2008.02852.x 2. Cipriani C, et al. Personalized irradiation therapy for NMSC by rhenium-188 skin cancer therapy: a long-term retrospective study. J Dermatolog Treat. 2020:1-7. doi: 10.1080/09546634.2020.1793890. 3. Castellucci P, et al. High dose brachytherapy with non sealed 188Re (rhenium) resin in patients with non-melanoma skin cancers (NMSCs): single center preliminary results. Eur J Nucl Med Mol Imaging. 2021;48(5):1511-1521. doi: 10.1007/s00259-020-05088-z. 4. Cipriani C, et al. Personalized high-dose-rate brachytherapy with non-sealed rhenium-188 in non-melanoma skin cancer. Int J Nucl Med. 2017;114–112.

Rhenium-SCT Treatment Pathway

A simple, efficient pathway from referral to follow-up

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Dermatologist

1 Patient Selection



- **Refer + Biopsy**
- **Confirm suitability**
  - ✓ Histology
  - ✓ Lesion Depth
  - ✓ Surface area

Dermatologist

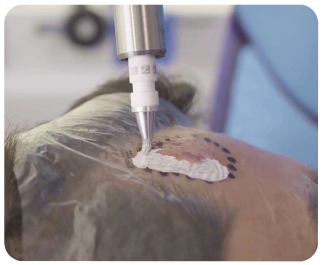
2 Lesion Planning



- **Schedule patients into treatment sessions** (Grouping by surface area)
- **Define lesion margins**
- **Generate treatment plans**

NucMed / RadOnc

3 Administer Treatment



- **Apply Rhenium-SCT** *(~20–30 min)*
- **Session-based delivery** *(usually 3-5 patients per session)*
- **Efficient outpatient workflow**

Technician

4 Post Treatment



- **Remove treatment and clean site**
- **Perform radiation check**
- **Dispose via waste management**

Dermatologist

5 Follow-Up



- **Provide aftercare instructions**
- **Review at 2-3 visits**
- **Monitor healing and response**

Initial Consult & Referral | **Rhenium-SCT Treatment Day** | **Follow-Up**

Rhenium-SCT Clinical Data: consistent high efficacy and predictable safety

2008
- First rhenium-188 publication for NMSC.
- Sedda et al. 53 patients; Mean 51 months follow-up
- Retrospective efficacy and cosmesis.

2020
- Retrospective rhenium-188 study of 50Gy to base of lesion
- 55 lesions / 52 patients; Mean 13.6 months. Efficacy & Safety.
- Cipriani *et al.*

2021
- Prospective Re-SCT study.
- 60 lesions / 50 patients; 3x doses. 24-months follow-up
- Castellucci *et al*.

2023
- Dermatologists-led prospective 12-month Re-SCT outcomes.
- 40 lesions / 22 patients; Efficacy, cosmesis and PROs. Tietze *et al.*

2024-2025
- 3x publications + 1 in prep
- Kronert *et al*. patient-preference study
- **Global, Phase 4, Prospective EPIC-Skin study. 225 lesions / 180 patients; Efficacy, cosmesis, toxicity; QoL: Baxi *et al.* (6m) ; Cardaci *et al.* (12m)**

2025
- Difficult-to-treat BCC 64 patients; Chessa *et al.*
- Retrospective 3-year independent Re-SCT outcomes:124 patients;181 lesions Castellucci *et al.*

Reviews:
- Independent review GEC-ESTRO BRAPHYQS Lozares *et al*
- Independent meta-analysis of 7 non-overlapping rhenium-188 studies Sadeghpour *et al*
- 94% complete response rate in NMSC lesions

2026
- Continuing education: NMSC treatment with Rhenium. Martinez-Albero *et al.*
- Review: Rhenium188 in NMSC. Castellucci *et al*
- **EPIC 24m Baxi et al EANMI**

Sedda et al. Clin Exp Dermatol. 2008;33:745–749. Cipriani et al. J Dermatol Treat. 2022;33:969–975. Castellucci et al. Eur J Nucl Med Mol Imaging. 2021;48:1511–1521. Tietze et al. Clin Nucl Med. 2023;48:869–876. Baxi et al. J Nucl Med. 2024;65:1450–1455. Cardaci et al. Adv Radiat Oncol. 2025;10:101802. Krönert et al Healthcare 2024, 12, 921. Chessa et al. Dermatol Pract Concept. 2025;15:4993. Castellucci et al. J Nucl Med. 2025;00:1–6. Lozares et al. Radiother Oncol. 2025;190:109708. Sadeghpour et al. Front Med. 2025;12:1707729. E. Martínez Albero et al Rhenium-188 resin therapy for non-melanoma skin cancer, Revista Española de Medicina Nuclear e Imagen Molecular (English Edition) 2026. Castellucci P et al. Epidermal radionuclide therapy with rhenium-188 in non-melanoma skin cancer: a short narrative review. Front Med (Lausanne). 2026 Jun 3;13:1850326. doi: 10.3389/fmed.2026.1850326. Baxi et al 2026 EANMI, doi:10.1016/j.eanmi.2026.100311. Abbreviations: NMSC: non-melanoma skin cancer; Re-SCT: Rhenium Skin Cancer Therapy; PROs: patient-reported outcomes; GEC: Groupe Européen de Curiethérapie; ESTRO: European Society for Therapeutic Radiology and Oncology; BRAPHYQS: BRAchytherapy PHYsics Quality Assurance System. ; BCC: Basal cell carcinoma.

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EPIC-Skin 24-month ouctomes

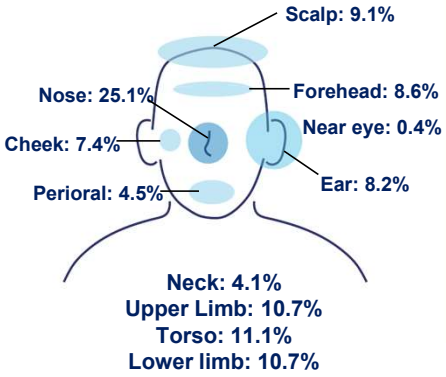
An international, prospective, multicenter, single-arm, Phase 4 post-marketing clinical study

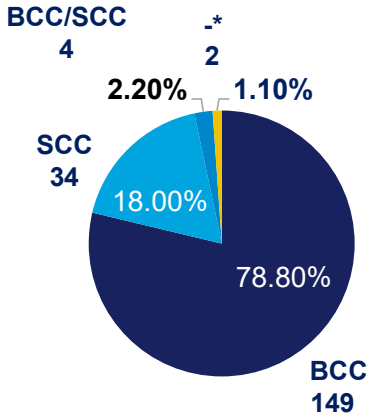
7 sites; 5 countries

South Africa, Australia,
UK, Germany, Austria

189 Patients, 254 Lesions
Stage I / II, BCC / SCC

De novo / Recurrent
1 - 3 lesions, ≤ 8cm^2 area,
≤ 3mm deep





Best Overall Response	All Tumours	BCC Tumours	SCC Tumours
Complete response	214/225 (95.1%)	171/179 (95.5%)	43/46 (93.5%)
Partial response	7/225 (3.1%)	5/179 (2.8%)	2/46 (4.3%)
Stable disease	2/225 (0.9%)	2/179 (1.1%)	0/46 (0.0%)
Progressive disease	2/225 (0.9%)	1/179 (0.6%)	1/46 (2.2%)
Recurrence	5/221 (2.3%)	4/176 (2.3%)	1/45 (2.2%)

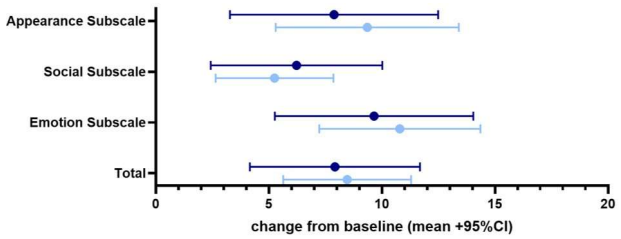
CR
95%

Baxi et al 2026, ^{188}Rhenium skin cancer therapy: Two–year efficacy, safety and patient reported outcomes from the prospective, multicentre, phase IV, EPIC-Skin study in non-melanoma skin cancer. EANMI; doi:10.1016/j.eanmi.2026.100311

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EPIC-Skin 24-month outcomes

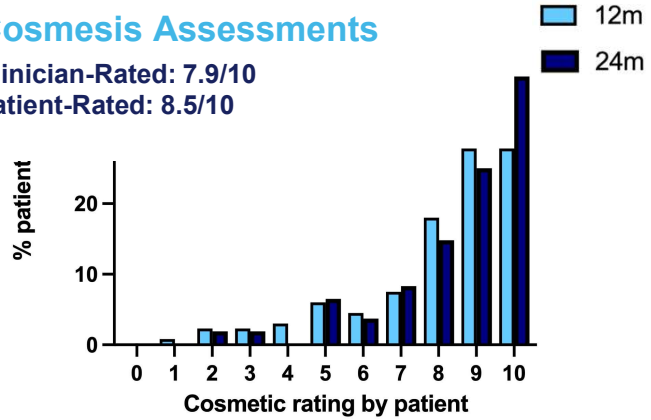
QoL Improvements



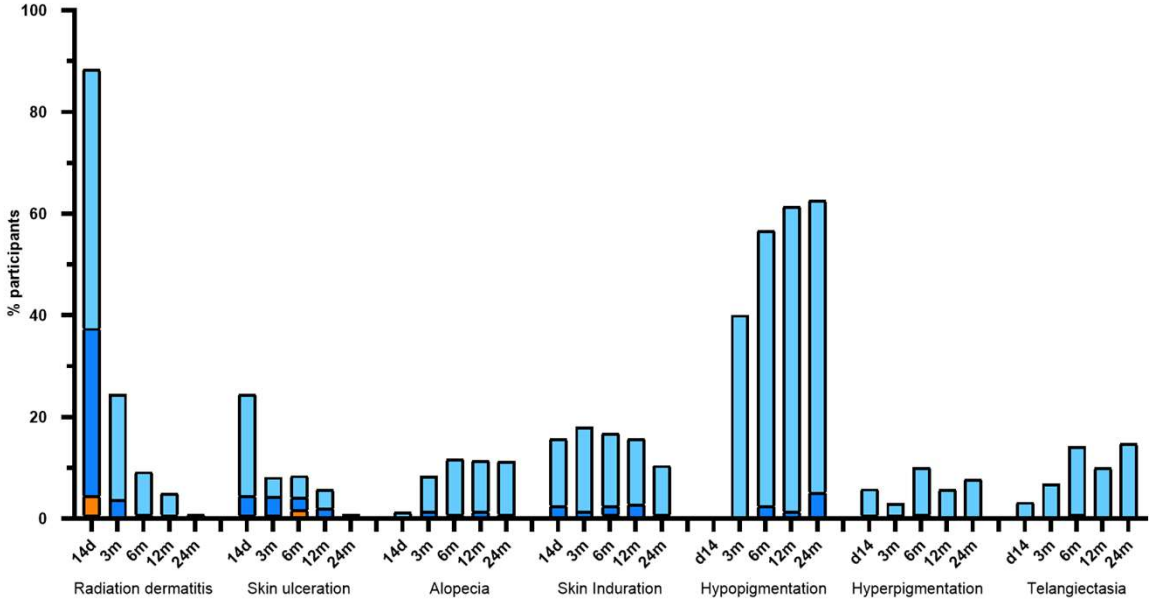
Mean ± 95% CI. Estimated change from baseline to 6-month and 12-month follow-ups for SCI subscales of the SKINDEX-16 QoL instrument, adjusted for baseline subscale scores. Adjusted repeated measures analysis

Cosmesis Assessments

Clinician-Rated: 7.9/10
Patient-Rated: 8.5/10



Toxicity

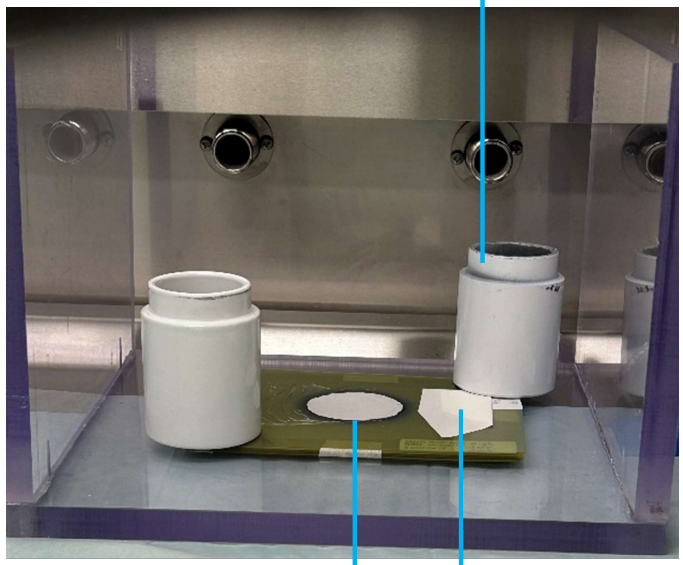


For each event type (radiation dermatitis, skin ulceration, alopecia, skin induration, hypopigmentation, hyperpigmentation, telangiectasia), only participants experiencing the event are graphed. Assessment for these events were undertaken at day 14, 3-month, 6-month, 12-month and 24-month visits. All percentages are based on the number of participants that were examined at the visit. For alopecia, hypopigmentation, hyperpigmentation and telangiectasia endpoints, CTCAEv5 are Grade 0-2 only. For skin induration, it is grade 0-3 only.
Abbreviations: CTCAE: Common Terminology Criteria for Adverse Events; 14d: day 14, 3m: 3-month, 6m: 6-month, 12m: 12-month and 24m: 24-month. Note: For hypopigmentation, CTCAE v5.0 Grade 2 is defined by extent of involvement, including ≥10% body surface area. As all treated lesions were ≤8 cm², Grade 2 hypopigmentation in this study reflects investigator assessment of pigment-loss intensity within the treated area.

Baxi et al 2026, [188]Rhenium skin cancer therapy: Two–year efficacy, safety and patient reported outcomes from the prospective, multicentre, phase IV, EPIC-Skin study in non-melanoma skin cancer. EANMI; doi:10.1016/j.eanmi.2026.100311. .
*While no MCID exists for the SCI scale, the study describing the instrument found a +9.0 point difference post Mohs surgery (Rhee et al Laryngoscope 2007 Mar;117(3):399-405). Subsequent studies found a +2.36 point difference for Mohs surgery (Sanchez et al J Dermat Treat 2020, 31:5, 491-493), which was deemed statistically significant and consistent with earlier studies (Zhang et al 2018 J Am Acad Dermatol 78(6):1060-1067), and a non-significant -0.6 point difference for excision on the Total scale (Sanchez et al J Dermat Treat 2020, 31:5, 491-493).

Benchmarking dosimetry simulations against experimental film

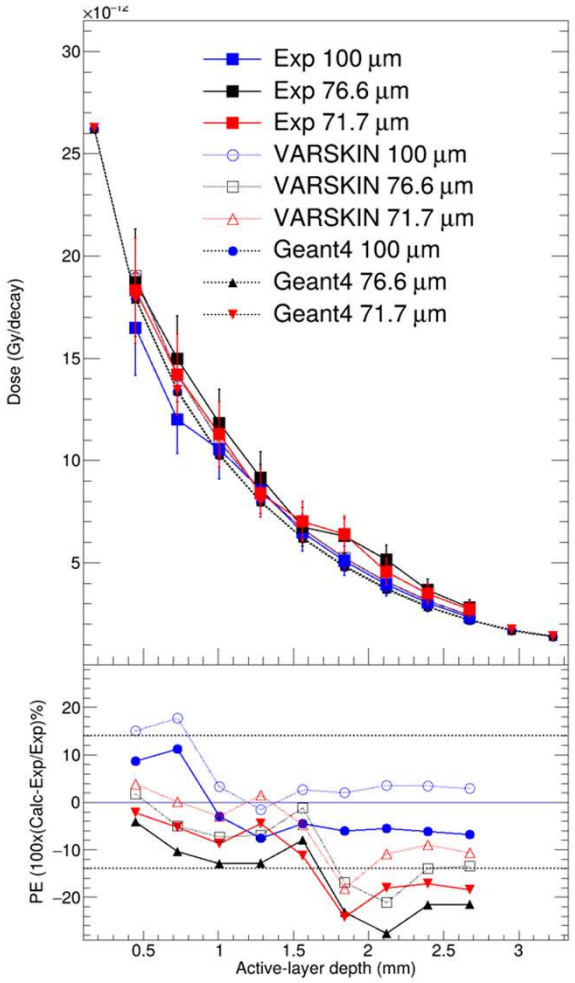
- Clinical treatment calculations use VARSKIN
- To evaluate performance of VARSKIN, experimental measurements were performed with EBT4 film and compared to Monte Carlo simulations (Geant4)
- 2x 10 mm & 3x 40 mm (shown) diameter paste applications were measured



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Benchmarking dosimetry simulations against experimental film

- Results normalised to Gy/decay to remove irradiation-time/activity effect, allowing the different resin thicknesses compared more directly.
- Both VARSKIN and Geant4 agree within 24% of experiment, experimental uncertainty is estimated at ~14%
- For 40 mm diameter, VARSKIN typically simulated higher dose than Geant4 while for 10 mm diameters the opposite is observed, suggesting a diameter-dependent lateral transport/finite-source effect rather than resin thickness.
- Limitations of VARSKIN and Geant4: idealised geometry and a homogeneous medium, plus statistical noise at depth.



How does Rhenium SCT dose distribution compare to conventional radiotherapy?

Rhenium-188 maintains a steep depth dose drop-off and sharp lateral dose drop-off

Of the modelled modalities, ^{188}Re showed the steepest dose drop-off, minimising radiation to deeper healthy tissues while maintaining localised tumour control.

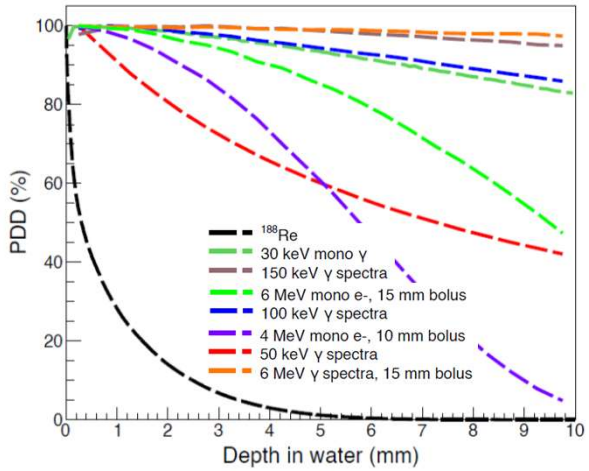


Figure 2. Modelled percentage dose deposition in water phantom of ^{188}Re, compared to clinically used conventional beams including 4-6MeV electron beams and 30-150KV gamma spectra.

Rhenium-SCT maintains a steep dose gradient, delivering consistent dose across the treatment surface area with a sharp lateral drop-off, minimising exposure to healthy tissue.

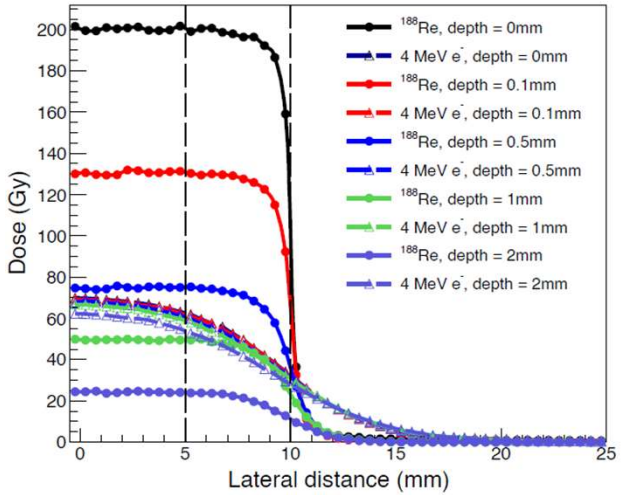
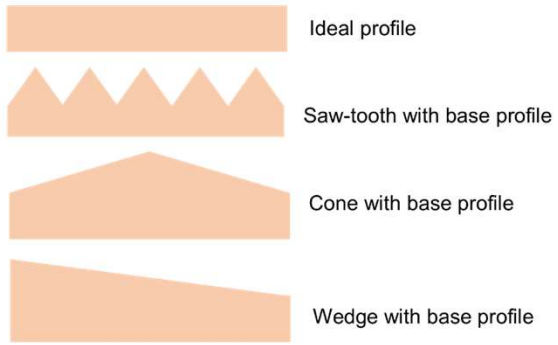
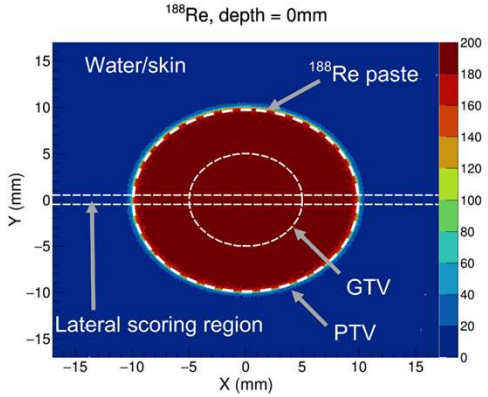


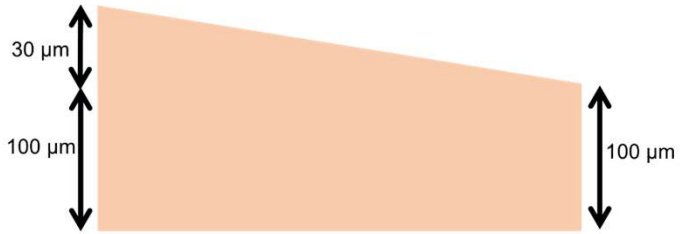
Figure 3. Modelled lateral dose deposition (50Gy dose delivered to the base of 1mm deep tumour, 10mm width, 5mm margins) at stated depth with ^{188}Re or 4MeV electron beam

Impact of paste application heterogeneity?

- Clinical training covers techniques to achieve uniform paste application
- Some variability in paste thickness cannot be completely avoided
- To see the effect which thickness variation has on the dose uniformity four alternative profiles were studied in Geant4 (ideal/uniform, sawtooth, cone and wedge)
- Paste diameters of 10 and 20 mm were simulated with thicknesses of: 0.1, 0.2 and 0.3 mm



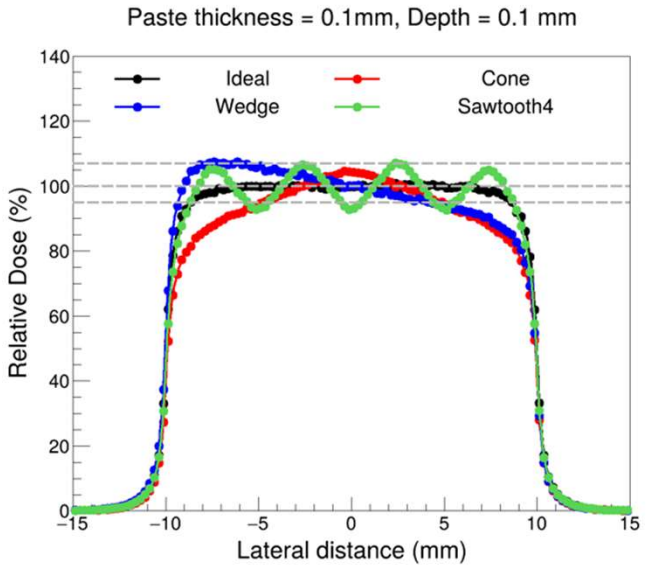


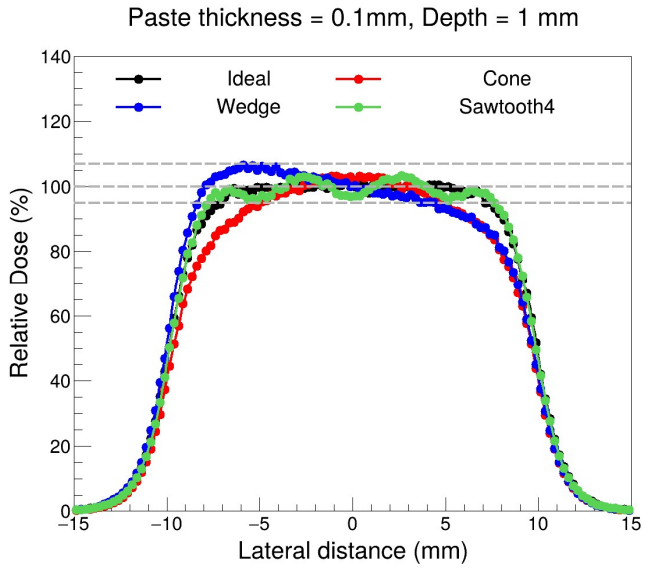


Wedge with base profile 100 µm

Impact of paste thickness and heterogeneity?

- Due to continuous electron scattering the differences between the applied profiles reduced with depth
- Better dose uniformity was seen for thicker paste applications and generally improved for larger diameter due to scattering





Conclusions – From a Clinical and Dosimetric Perspective

EPIC establishes Rhenium-SCT as an effective, well-tolerated option for appropriately selected NMSC

- Rhenium-SCT is best suited for thin (≤3 mm) BCC/SCC lesions, particularly when:
    - Surgery is high morbidity, declined, or impractical
    - Lesions are in cosmetically or surgically challenging locations
    - Multiple or refractory lesions can be treated in a single visit
- EPIC-Skin showed durable tumour control is achieved when appropriate dose is delivered to tumour depth
- Rhenium-SCT shows predictable healing, favourable cosmesis, improved QoL and low procedural pain
- VARSKIN and Geant4 simulations agree within 24% and are able to reproduce experimental dosimetric measurements across a variety of experimental setups
- The steep depth and lateral dose drop-off of ^{188}Re minimises radiation to deeper healthy tissues while maintaining localised tumour control.
- ^{188}Re self-absorption loss is about 5%
- **Rhenium-SCT: another tool in the toolbox for appropriately selected NMSC**

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Baxi et al. 2026
188Rhenium skin cancer therapy: Two–year efficacy, safety and patient reported outcomes from the prospective, multicentre, phase IV, EPIC-skin study in non-melanoma skin cancer - ScienceDirect
Baxi et al. 2024
JNM267988_proof.pdf
Cardaci et al. 2025
Efficacy, Safety, and Patient Reported Outcomes of Rhenium-Skin Cancer Therapy for Non-Melanoma Skin Cancer: 1-Year Results from the EPIC-Skin Study
Castellucci et al. 2026
JNM270345_proof.pdf
Castellucci et al. 2021
High dose brachytherapy with non sealed 188Re (rhenium) resin in patients with non-melanoma skin cancers (NMSCs): single center preliminary results. | European Journal of Nuclear Medicine and Molecular Imaging | Springer Nature Link
Cipriani et al. 2017
Cipriani-IJNMR
Kronert et al. 2024
Patient-Orientated Evaluation of Treatment of Non-Melanoma Skin Cancer with Rhenium-188 Compared to Surgery
Lozares et al. 2025
Head and neck and skin (HNS) GEC-ESTRO and BRAPHYQS working groups joint critical review of the use of Rhenium-188 in dermato-oncology - PMC
Sadeghpour et al. 2025
Frontiers | Targeted β-therapy with rhenium-aided therapy for cutaneous lesions: a systematic review and meta-analysis
Zagni et al. 2023
A novel tool for predicting the dose distribution of non-sealed 188Re (Rhenium) resin in non-melanoma skin cancers (NMSC) patients - Zagni - 2023 - Medical Physics - Wiley Online Library
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