The most common dose-volume parameters used in interstitial breast BT

Parameter	Definition / calculation
Implant related	
V_{PD}	absolute volume irradiated by the prescribed dose
$V_{1.5xPD}$	absolute volume irradiated by 1.5 x the prescribed dose
DNR - dose non-uniformity ratio	$V_{1.5xPD}$ / V_{PD}
DHI - dose homogeneity index	(V_{PD} - $V_{1.5xPD}$) / V_{PD}
Target related	
V_{PTV}	volume of the PTV
Vxx	percentage of PTV receiving xx% of the PD
OI - overdose volume index	V_{2xPD} / V_{PTV}
CI - coverage index	V100 / 100
COIN - conformal index	PTV_{PD}/V_{PTV} x PTV_{PD}/V_{PD}
Dxx	percentage dose that covers xx% of the PTV
OAR related	
D_{mean}	mean dose in organ
V_{xGy}	relative volume receiving x Gy
Vxx	percentage of organ receiving xx% of the PD
D_{xcm^3}	relative dose given to most exposed x cm^3 of organ

Recommended dose - volume limits for implant and PTV

	Constraints
Implant	$V_{PD} \leq 300\ cm^3$ DNR ≤ 0.35
PTV	V100 ≥ 90% $V150 < 65\ cm^3$ $V200 < 15\ cm^3$ COIN ≥ 0.65

Recommended dose - volume limits for OAR-s

Organ	Constraints (absolute values given in EQD2)
Ipsilateral non-target breast	V90 < 10% V50 < 40%
Skin*	D_{1cm^3} < 90% (37.5 Gy $_{EQD2}$) $D_{0.2cm^3}$ < 100% (44.5 Gy $_{EQD2}$)
Rib	$D_{0.1cm^3}$ < 90% (37.5 Gy $_{EQD2}$) D_{1cm^3} < 80% (31.5 Gy $_{EQD2}$)
Heart**	MHD < 8% (1.7 Gy $_{EQD2}$) $D_{0.1cm^3}$ < 50% (15.5 Gy $_{EQD2}$)
Ipsilateral lung	MLD < 8% (1.7 Gy $_{EQD2}$) $D_{0.1cm^3}$ < 60% (20.5 Gy $_{EQD2}$)

**skin volume is defined as a 5 mm shell below the body contour*
***left sided lesion only, MHD: mean heart dose, MLD: mean lung dose*
EQD2: radiobiologically equivalent dose given in 2 Gy fractions for α/β =3 Gy

Recommended parameters for recording

1. Type (**nuclide**) of the radioactive source and technique (HDR/PDR)
2. **Number of catheters** used and number of implanted planes
3. **Method of dose optimization** (manual, geometric, graphical, inverse) **and normalization** (description of positions of the reference points)
4. **Method of dose prescription** (on isodose line, volumetric), dose per fraction (pulse), total dose and fractionation scheme with time pattern
5. **Reference air *kerma* rate**/source activity at the time of first fraction
6. **Total reference air *kerma* (TRAK)**
7. **Implant related volume parameters**: V_{PD}, DNR
8. **Target related parameters**: $V_{PTV}(cm^3)$, V100, V150, V200, D90
9. **Optional OARs related parameters**:
    1. ipsilateral non-target breast: V90, V50
    2. skin: $D_{0.2cm^3}$, D_{1cm^3}
    3. rib: $D_{0.1cm^3}$, D_{1cm^3}
    4. heart: MHD (mean heart dose), $D_{0.1cm^3}$
    5. ipsilateral lung: MLD (mean lung dose), $D_{0.1cm^3}$
    6. contralateral breast: D_{1cm^3}
    7. contralateral lung: D_{1cm^3}

Quality management issues for HDR-/PDR BT

- **Check of treatment plan (before export to control unit)**
  - patient information (name, ID, DOB etc.)
  - dose prescription (fraction dose, fraction number)
  - correspondence of first source dwell position to distal catheter reconstruction point
  - correct outdrive length
  - a rough estimation of the calculated treatment time (recalculation with another system)
- **Plan data transfer**
  - check the data in the control unit after data transfer
- **Connection of catheters with transfer tubes**
  - correct labelling/numbering of the catheters (photo is recommended)
  - exact internal lengths of the catheters if applicable
  - follow the pathway of transfer tubes from indexer to catheters one by one
- **Final control before initiation of irradiation**
  - total length (transfer tube + catheter) is recommended to be checked with source position simulator
  - test run with a check cable