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SURGICAL TECHNIQUE & USER MANUAL

ROBOTRIX+

Safe & Personalized Functional Alignment TKR Planner

SCIENTIFIC COLLABORATION WITH

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Message from

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It has been my experience that once a surgeon sees the immediate post-op comfort, function and satisfaction of the TKR patient with personalised, functional alignment, he will never go back to mechanical alignment except in very complex cases.

However, till now, robotics was mandatory to achieve functional alignment. The very high acquiring cost of robotics is an impeding factor for surgeons and, in turn, the patients who are the beneficiaries of functional alignment.

Technology which does not reach the majority of the population is not truly impactful.

The Robotrix+ platform is a very cost-effective alternative to robotics for achieving functional alignment in TKR for your patients. We now hope that every single patient undergoing TKR can benefit from functional alignment.

It is now well established in multiple high-powered studies that functional alignment within boundaries is very safe for patients, without the risk of reproducing pathological anatomy as in more extreme philosophies like unrestricted kinematic alignment.

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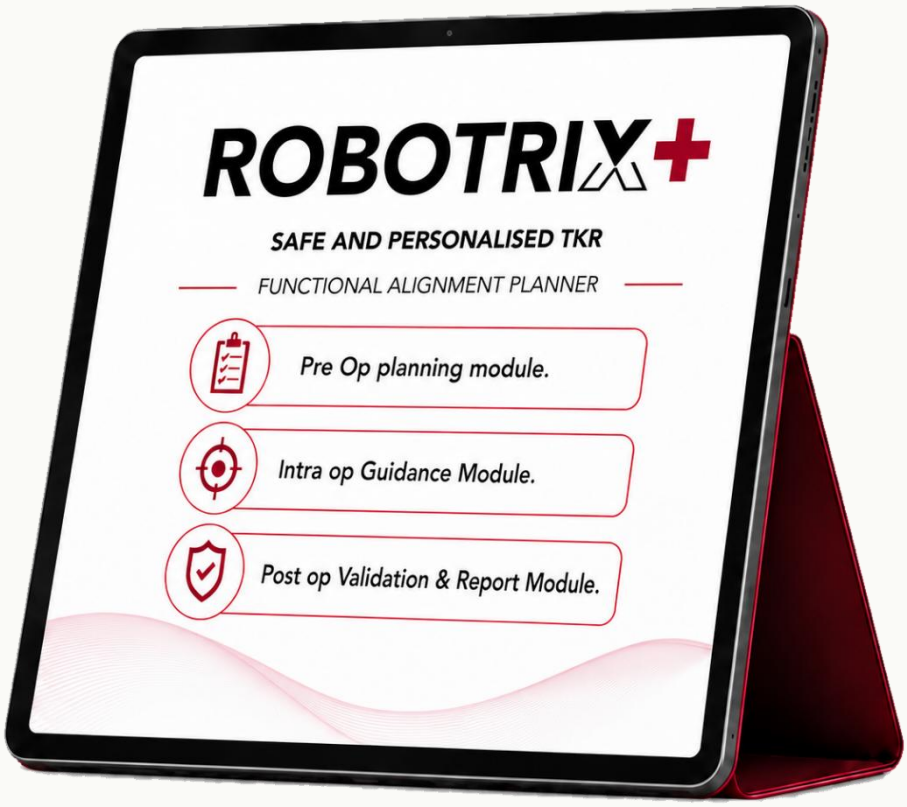


Robotrix+ is a cutting-edge app for total knee replacement (TKR) that bridges the gap between digital planning and surgical execution. It is a **safe personalised functional-alignment planner** — bringing together the pre-operative plan, intra-operative guidance, and post-operative verification into a single, connected workflow, so the plan made on the X-ray carries through to the operating table and is confirmed at the end.

Robotrix+ helps surgeons achieve functional alignment — respecting the patient's native kinematics while ensuring mechanical stability. Rather than forcing every knee into an identical, perfectly straight leg, it plans each knee around the patient's own anatomy, correcting the deformity to a safe, balanced target that keeps the knee feeling natural to the patient.

Two Principles

Two principles define Robotrix+:

1. **Personalised**
   Every plan is built around the individual patient's own anatomy, so the alignment is tailored to that specific knee rather than a fixed template.

2. **Safe**
   The correction is always kept within controlled, safe limits, and every plan is confirmed with real intra-operative measurements before the definitive cut is made.

The Three Modules

Robotrix+ supports the surgeon across the entire knee-replacement journey through three connected modules:

1. **Pre-Operative Planning Module**
   From a full-length standing X-ray, Robotrix+ measures the knee, classifies it, plans the femoral and tibial cuts, and predicts the resulting alignment and gaps — giving the surgeon a complete plan before surgery.

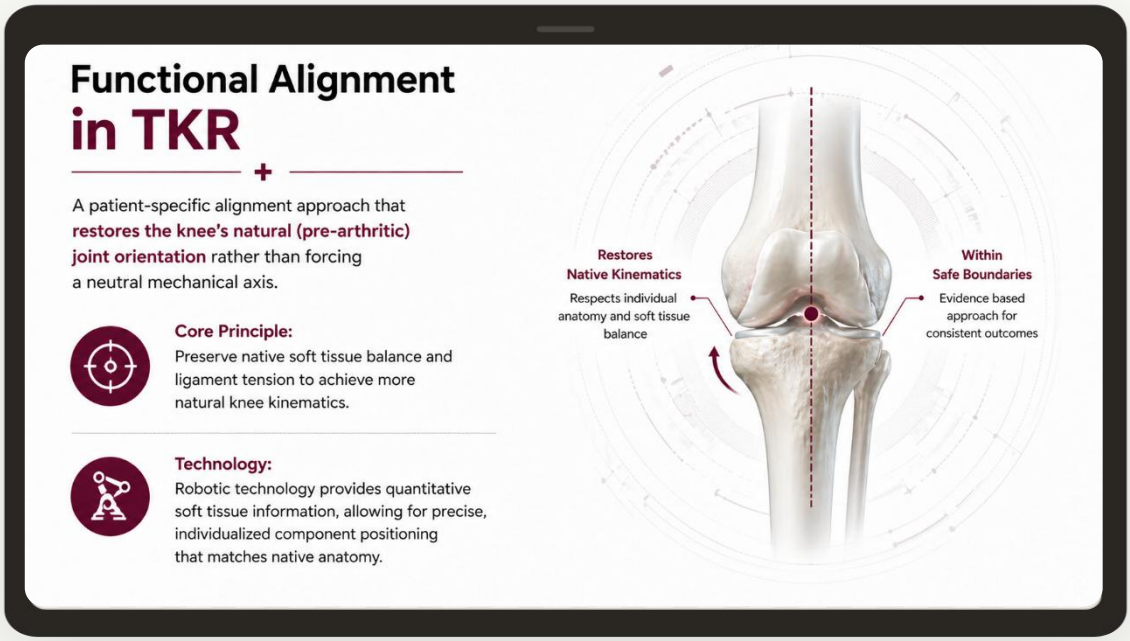
2. **Intra-Operative Guidance Module**
   In theatre, Robotrix+ guides the surgeon through measuring the real extension gaps with the asymmetric incremental AI spacer blocks, balancing the medial and lateral sides, and selecting the definitive functional tibial cut based on the true, measured state of the knee.

3. **Post-Operative Verification Module**
   Once the cuts are set, Robotrix+ confirms the final alignment and the resulting knee type — verifying that a safe, balanced correction has been achieved.

What Is Functional Alignment?

Functional alignment is a modern philosophy of knee replacement. It sits between the two older approaches — mechanical alignment, which straightens every leg to a fixed neutral axis, and kinematic alignment, which reproduces the native knee exactly.

> Functional alignment takes the best of both: it respects the patient's natural alignment while correcting the deformity safely within controlled limits, so the reconstructed knee is both individual to the patient and mechanically stable.



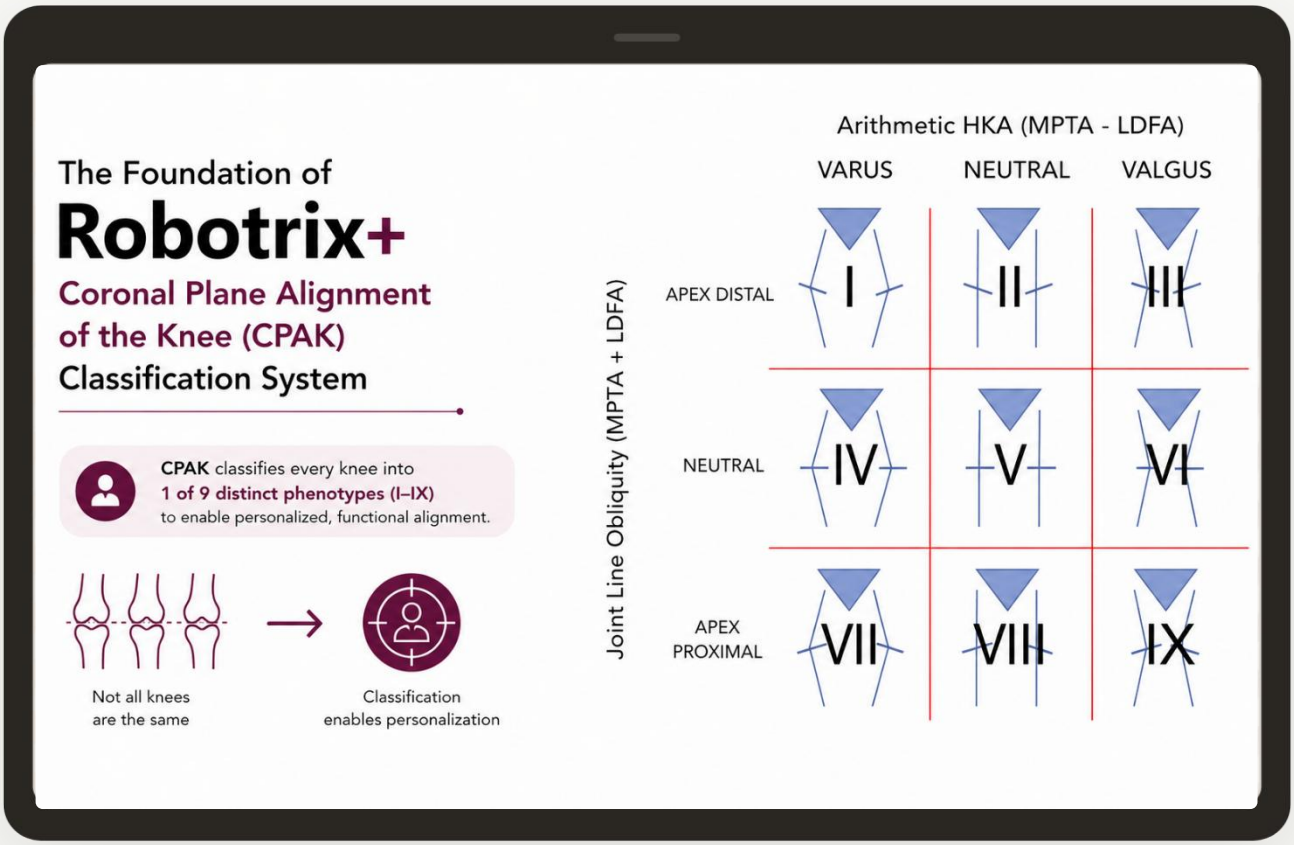
What Robotrix+ Is Built On

Robotrix+ is built on two foundations that describe each patient's knee:

- **The CPAK matrix** — the framework used to classify the knee's alignment.
- **The femur type** — whether the patient's femur is varoid, neutral, or valgoid.

Together, these let Robotrix+ understand the individual knee before planning, so the plan is tailored to that specific patient.

The CPAK Matrix



CPAK (Coronal Plane Alignment of the Knee) is a classification system that describes what kind of knee a patient has. It combines two things — the overall coronal alignment (bow-legged, straight, or knock-kneed) and the tilt of the joint line — into a simple grid of **nine knee types (I to IX)**.

The CPAK matrix gives the surgeon a clear, standard **description of the patient's native alignment** before planning begins, and it is used again afterwards to confirm the correction is safe. It is the language Robotrix+ uses to understand and communicate the shape of each knee.

The Benefits of Robotrix+

Robotrix+ offers surgeons meaningful advantages:

1. **Advantages of robotics, without the cost**
   Delivers the planning precision, alignment guidance, and intra-operative verification associated with robotic systems — without the very high capital cost, bulky equipment, and overheads. This makes functional-alignment planning accessible to far more surgeons and hospitals.

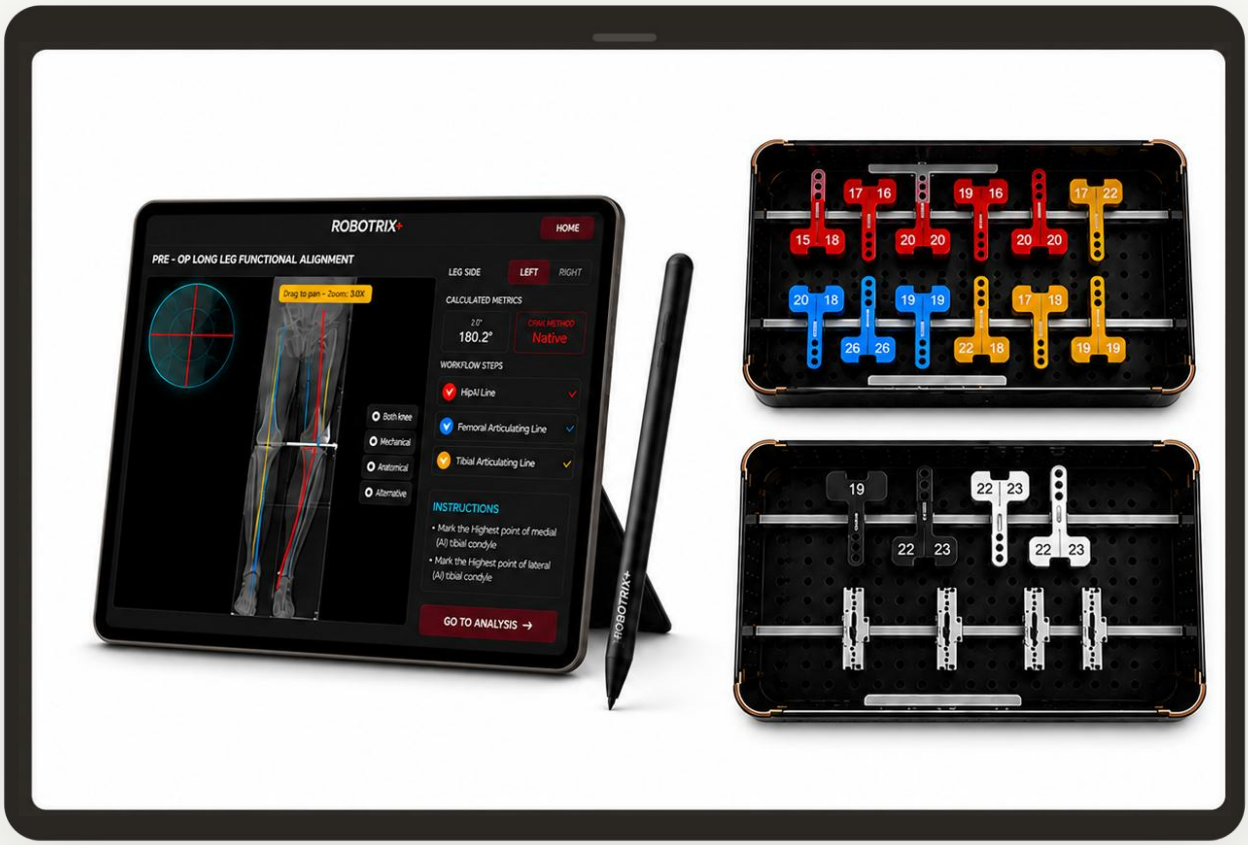
2. **Built on an existing, familiar TKR workflow**
   Does not ask the surgeon to change their instruments or technique. It works alongside the standard TKR workflow, enhancing it with digital planning and guidance — keeping adoption simple and the learning curve short.

3. **A connected plan from start to finish**
   The same system carries the plan from clinic to theatre to verification, so the surgeon works from one consistent, patient-specific plan throughout — reducing guesswork and keeping the procedure aligned to a clear target.

4. **Truly patient-specific**
   Planning around each patient's own anatomy and confirming the balance with real intra-operative measurements helps deliver a knee that is aligned and balanced for that individual — the core promise of functional alignment.

The Robotrix+ Set

The Robotrix+ Set is a complete package — the planning application plus the instruments to execute the plan — all in one. The set consists of:



1. **Dedicated Medical-Grade Tablet**
   Pre-loaded with the Robotrix+ application for planning, guidance, and documentation. Ready to use, nothing to install.

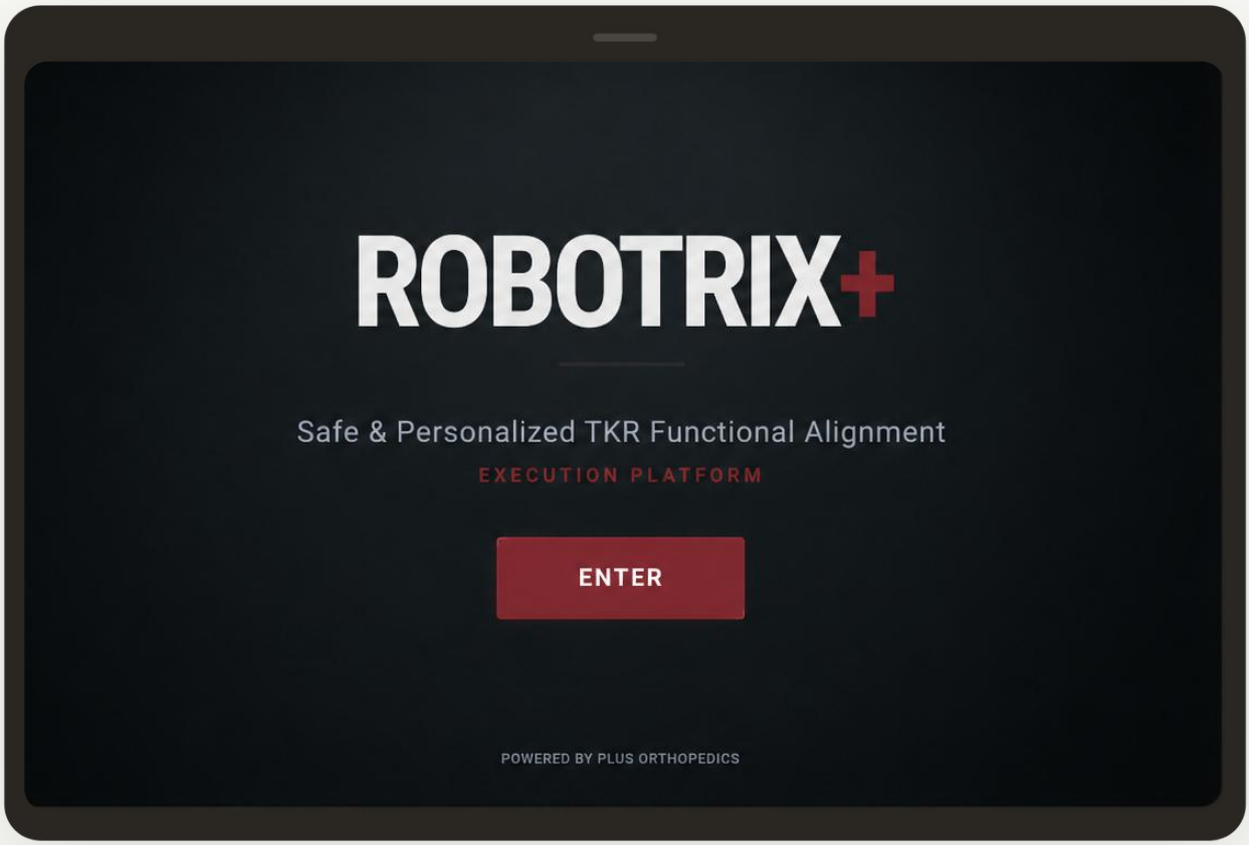
2. **16 AI (Asymmetric Incremental) Spacer Blocks**
   Measure the medial and lateral gaps in 1 mm asymmetric increments for precise balancing.

3. **Tibia Varus Cutting Jigs**
   Universal jigs for controlled varus correction and accurate tibial cuts.

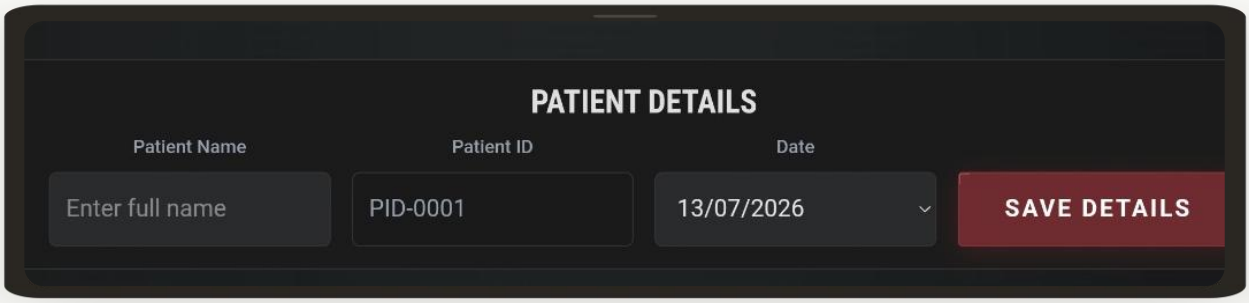
HOW THEY WORK TOGETHER

The tablet plans the alignment and predicts the gaps; the AI spacer blocks measure and balance the real gaps; the cutting jigs execute the definitive cut — taking the surgeon from digital plan to precise surgical execution with one integrated set.

Getting Started



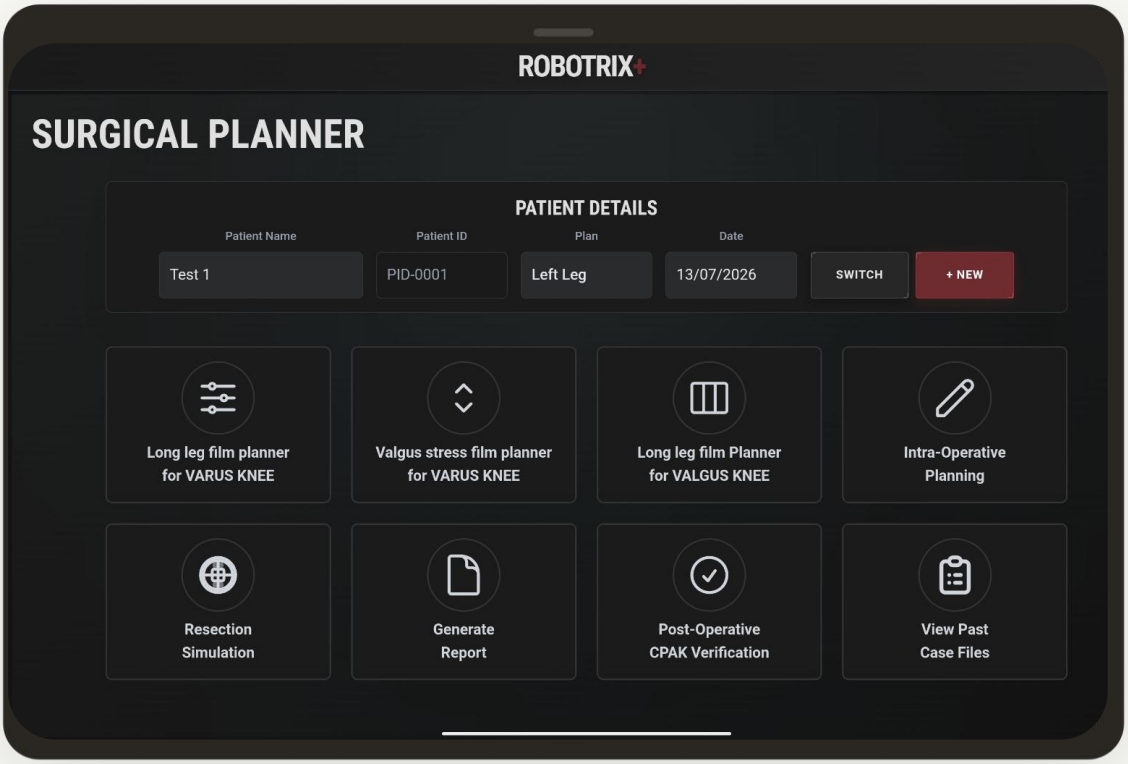
1. **Power on**
   Press and hold the power button on the side of the tablet; it will switch on and illuminate.
2. **Locate the app**
   Find the app icon, already pre-loaded on the home screen, and tap it.
3. **Welcome screen**
   The app will open; press the Enter button to initialise the software and access the Robotrix+ dashboard.



1. **Data entry**
   Enter the patient's name and patient ID; the date is filled in automatically.
2. **Save details**
   Tap the Save Details button. This unlocks the planning module.

Planning Modules

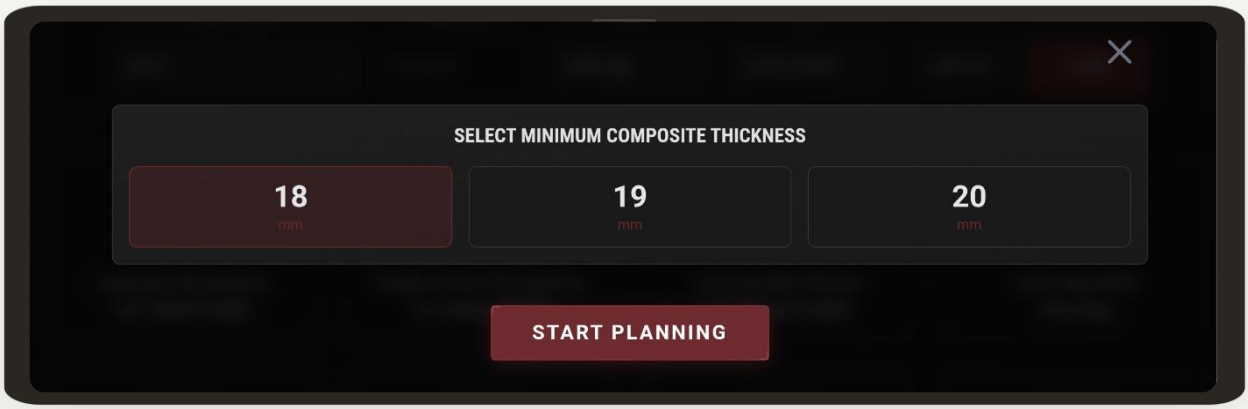
The Robotrix+ Surgical Planner has 8 modules to help with planning:



1. **Long Leg Film Planner (Varus Knee)** — the primary workflow for standard varus-knee deformities, pre-op through intra-op.
2. **Valgus Stress Film Planner (Varus Knee)** — planning from a valgus stress film, no long-leg X-ray needed.
3. **Long Leg Film Planner (Valgus Knee)** — workflow for valgus-knee deformities, launching soon.
4. **Intraoperative Planning** — jump directly to the intra-op pages once pre-op decisions are made.
5. **Resection Simulation** — shows the alignment the chosen femur and tibia cuts will produce.
6. **Generate Report** — export surgical summary reports.
7. **Post-Operative CPAK Verification** — verify the post-operative results and knee phenotype.
8. **View Past Cases** — access the database of past cases; press Load Case to work on a patient in any module.

Long Leg Film Planner — Varus Knee

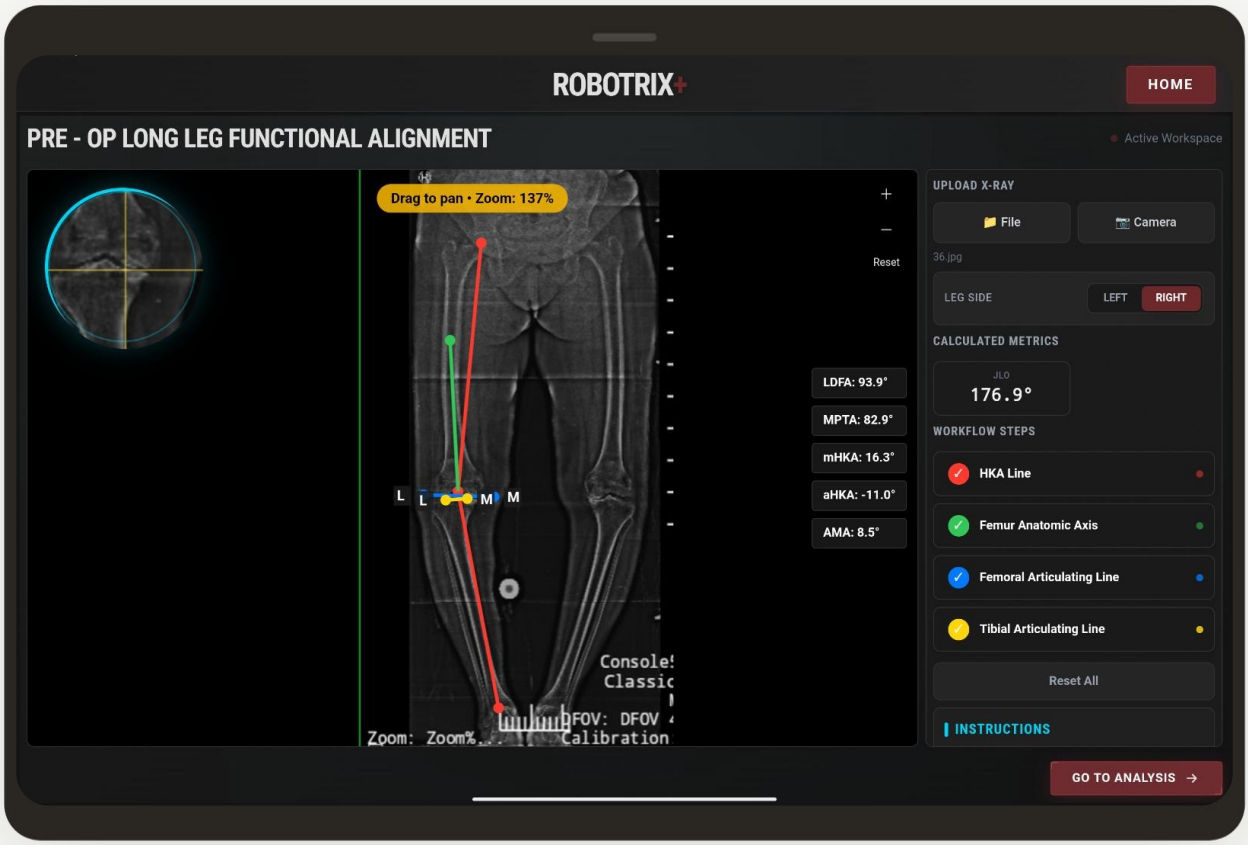
This guide first focuses on the most common workflow. Once the new case is created, you can proceed:



1. **Select the composite thickness**
   This value defines both the expected lateral extension gap and the reference thickness for coronal balancing.

2. **Start planning**
   Press the Start Planning button to proceed.

Pre-Op Long Leg Functional Alignment Screen



1. **Import the X-ray**

   Import the patient's long-leg X-ray to start templating.

   File — upload from saved files.

   Camera — capture a live photograph, crop if necessary, and it will be uploaded.

2. **Choose the operating leg side**

   Select left or right.

Landmarking the X-Ray

Once the X-ray is loaded, mark the key anatomical landmark points. Landmarking is quick and fluid — choose a landmark group, then drag and drop each point into place. A zoomed picture-in-picture box with crosshairs guides precise placement, and the X-ray can be pinch-zoomed in and out.

HKA Line — establishes the overall mechanical alignment.

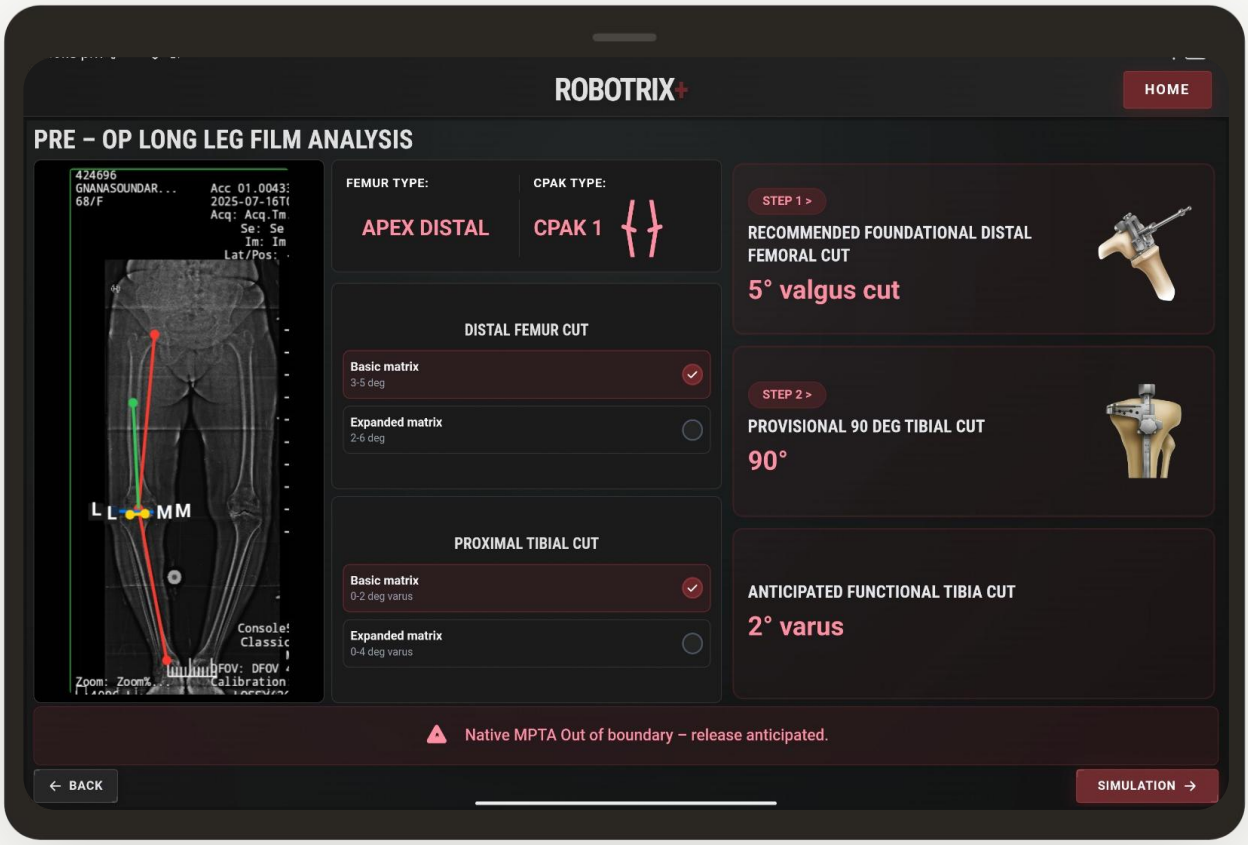
Femur Anatomic Axis — defines the anatomical axis of the femur.

Femur Articulating Line — the joint line of the distal femur (L / M = lateral / medial).

Tibia Articulating Line — the joint line of the proximal tibia (L / M = lateral / medial).

Once landmarking is complete, press **Go to Analysis** to proceed.

Pre-Op Long Leg Film Analysis



> Upon completion of landmarking, Robotrix+ automatically calculates and displays the critical values: **LDFA, MPTA, mHKA, aHKA, AMA**, and joint-line obliquity (**JLO**).

Functional alignment reads the patient's anatomy, then plans the cuts to suit that specific knee. The femur type and the CPAK type are the two pieces of information that respect the native phenotype:

- **Femur type** — decides the femoral cut: reproduce it, or preserve it.
- **CPAK type** — describes the whole knee.

1. **Foundational Distal Femoral Valgus Cut**
   This first cut establishes the primary coronal referencing for the entire plan. The femoral cut is chosen from the **Basic matrix (3°–5°)** or the **Expanded matrix (2°–6°)**, according to the patient's femur, and is planned to preserve the femur's natural type.

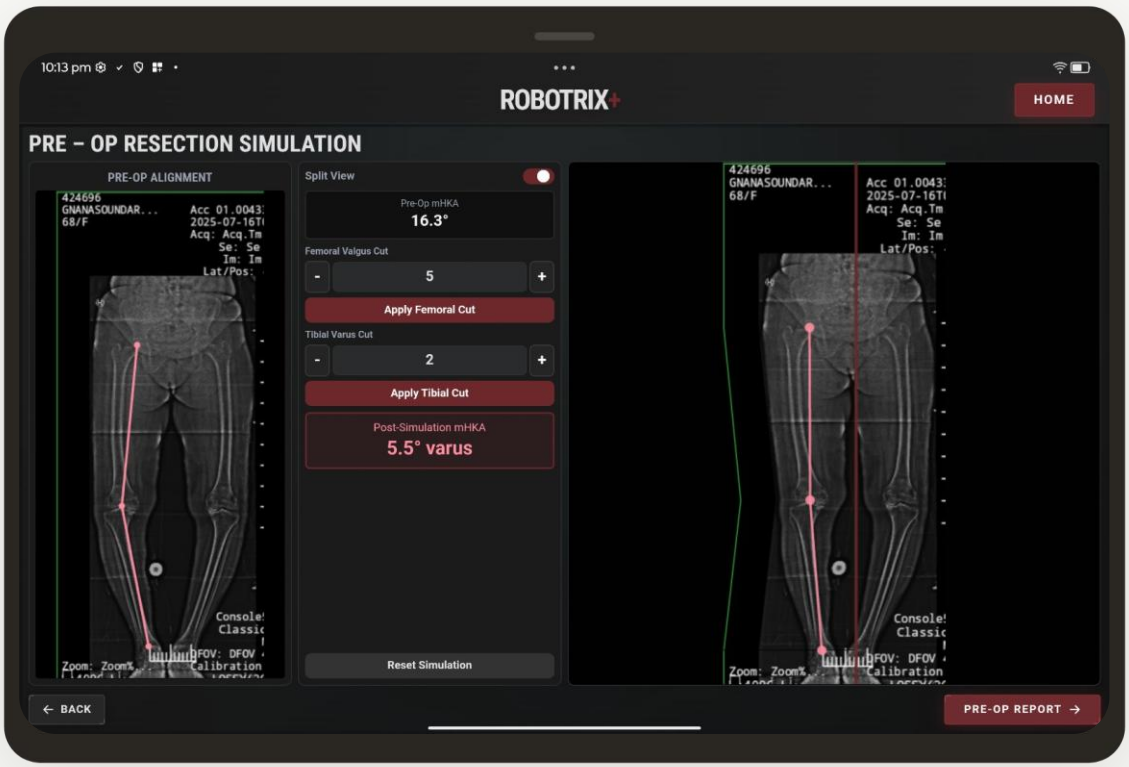
2. **Provisional 90° Tibial Cut**
   A provisional tibial cut is made perpendicular (90°) to the tibial mechanical axis, creating a clean, neutral reference surface from which the gaps can be measured and the final correction judged.

3. **Anticipated Functional Tibial Varus Cut**
   Selected from the Basic matrix (0°–2°) or the Expanded matrix (0°–4°). This is only the anticipated cut — the definitive functional tibial cut is determined only after assessment with the AI spacer blocks, which measure the real gaps and confirm the exact correction required.

Two matrices are provided so the correction can be matched to the patient: the **Basic** (smaller) range suits most routine knees; the **Expanded** (wider) range provides the extra correction that severe deformities need.

Pre-Op Resection Simulation Screen

The surgeon tests the planned cuts on the patient's own X-ray before surgery, and sees the alignment they will produce.



SPLIT VIEW

The patient's leg as it is now, with the mechanical axis line drawn through it — shows the starting deformity.

The same leg with the planned cuts applied — the corrected alignment against the original

CENTRE CONTROLS

Pre-Op mHKA — the starting alignment of the leg.

Femoral Valgus Cut / Tibial Varus Cut — set with −/+, confirmed with Apply.

Post-Simulation mHKA — the resulting alignment, updated live.

Reset Simulation — clears the applied cuts to start again.

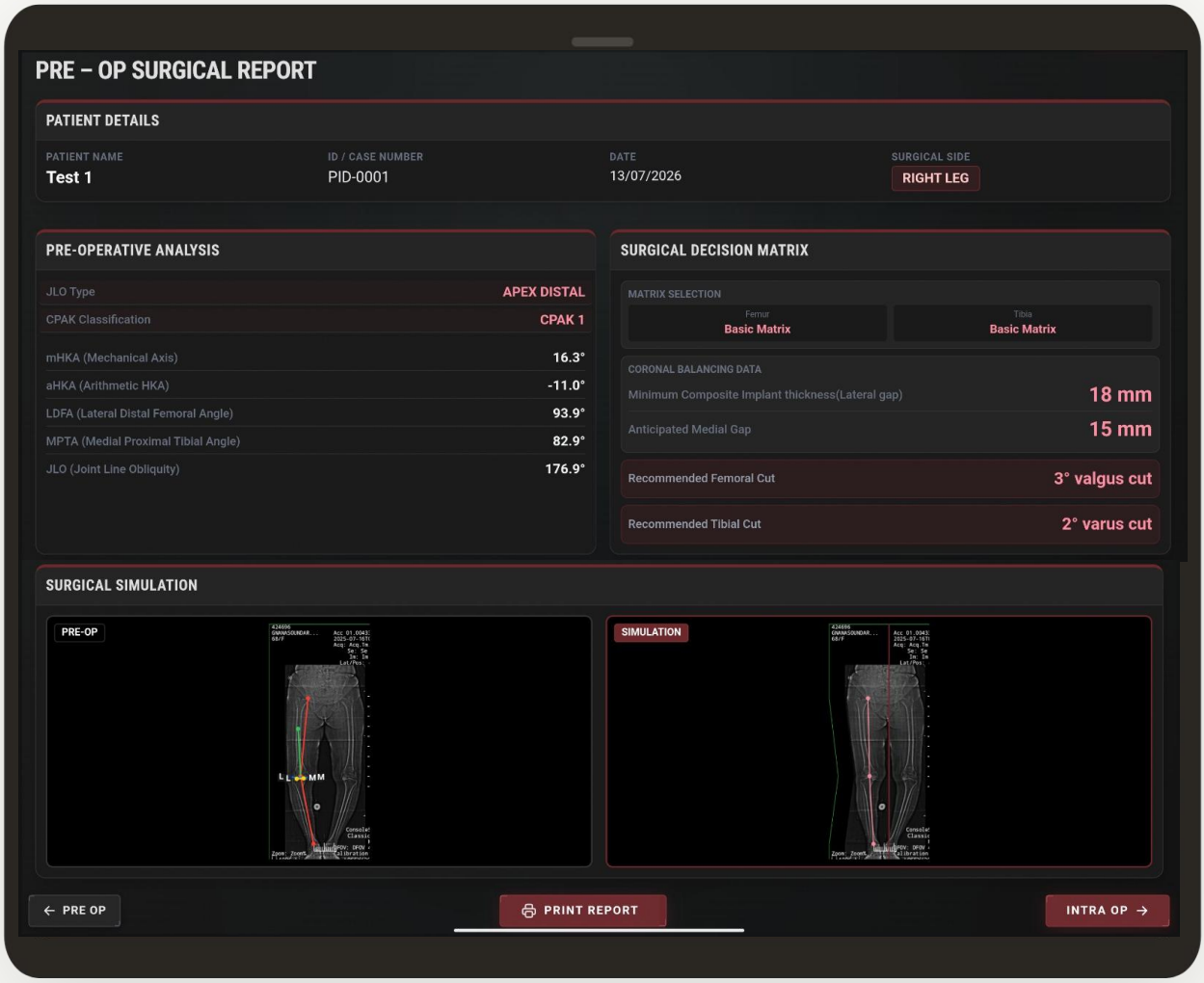
How the Surgeon Uses the Simulation

The surgeon adjusts the femoral and tibial cuts and immediately sees the resulting alignment on the right, and in the Post-Simulation mHKA value. This lets them:

- Test different cut combinations and see the exact alignment each one produces.
- Confirm the plan reaches the safe target before committing to it.
- Recognise when suggested cuts are not enough — if a large residual varus remains, additional resection or soft-tissue release will be required intra-operatively.

When satisfied, the surgeon proceeds to the Pre-Op Report, carrying the plan forward.

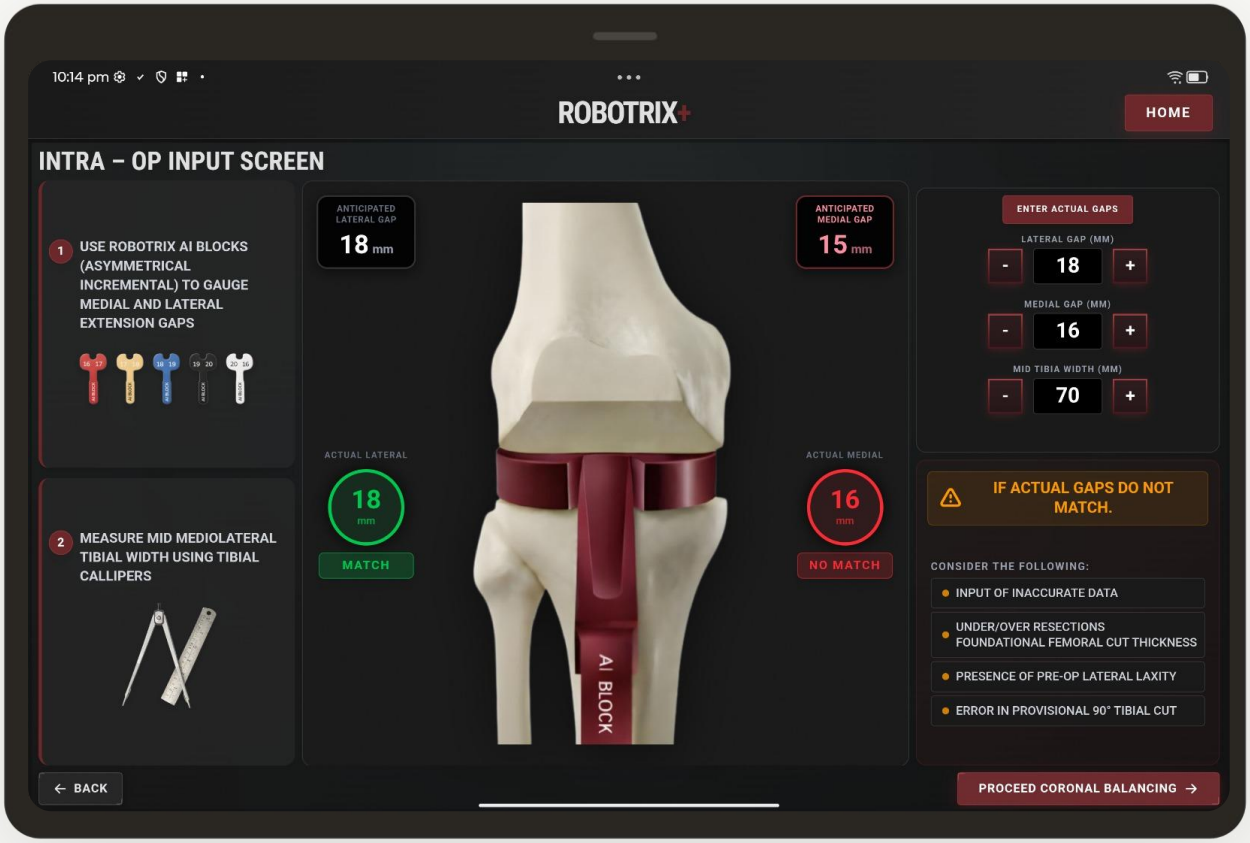
The Pre-Op Surgical Report



Once the plan is finalised on the Resection Simulation screen, the surgeon generates the **Pre-Op Surgical Report** — the written summary of the complete plan. It serves as the theatre reference, so the team can move confidently to the intra-operative stage.

Intra-Op Input Screen

This is the first screen in theatre. Here the surgeon measures the real extension gaps in the knee and compares them against what Robotrix+ predicted before surgery — the essential check before any tibial correction is chosen.



- **Anticipated Lateral Gap** & **Anticipated Medial Gap** — predicted from the pre-operative plan; the targets to check against.

1 Measure the extension gaps with the AI blocks

The surgeon uses the Robotrix AI blocks (asymmetric, incremental) to gauge the medial and lateral extension gaps.

2 Measure the tibial width (optional)

The surgeon measures the mid-mediolateral tibial width using tibial callipers, letting Robotrix+ calculate the correction precisely for this patient's tibia.

3 Enter the actual gaps

Using Enter Actual Gaps, the surgeon inputs the measured values with the −/+ steppers. The result shows in **green** for a match, or **red** for a mismatch against the anticipated gaps.

> Once the measured gaps are entered and confirmed, the surgeon presses **Proceed Coronal Balancing** to move to the definitive tibial varus cut — now based on the real, measured gaps rather than the pre-operative prediction.

Intra-Op Coronal Balancing Screen

This is where the definitive functional tibial varus cut is determined. Using the real measured gaps, the surgeon balances the medial and lateral sides and selects the final tibial cut. The screen shows the current lateral and medial gap values at the top.

LATERAL BALANCING

The guiding principle is to aim for the lateral space to match the minimum composite implant thickness of your TKR system.

Additional Cut Resection — resect a little more from the femur or tibia if needed.

Check Lateral Laxity — assess the looseness of the lateral side.

Apply Pre-Op Lateral Laxity — optional field to enter lateral laxity in millimetres, adjusting the recommended tibial varus cut.

MEDIAL BALANCING

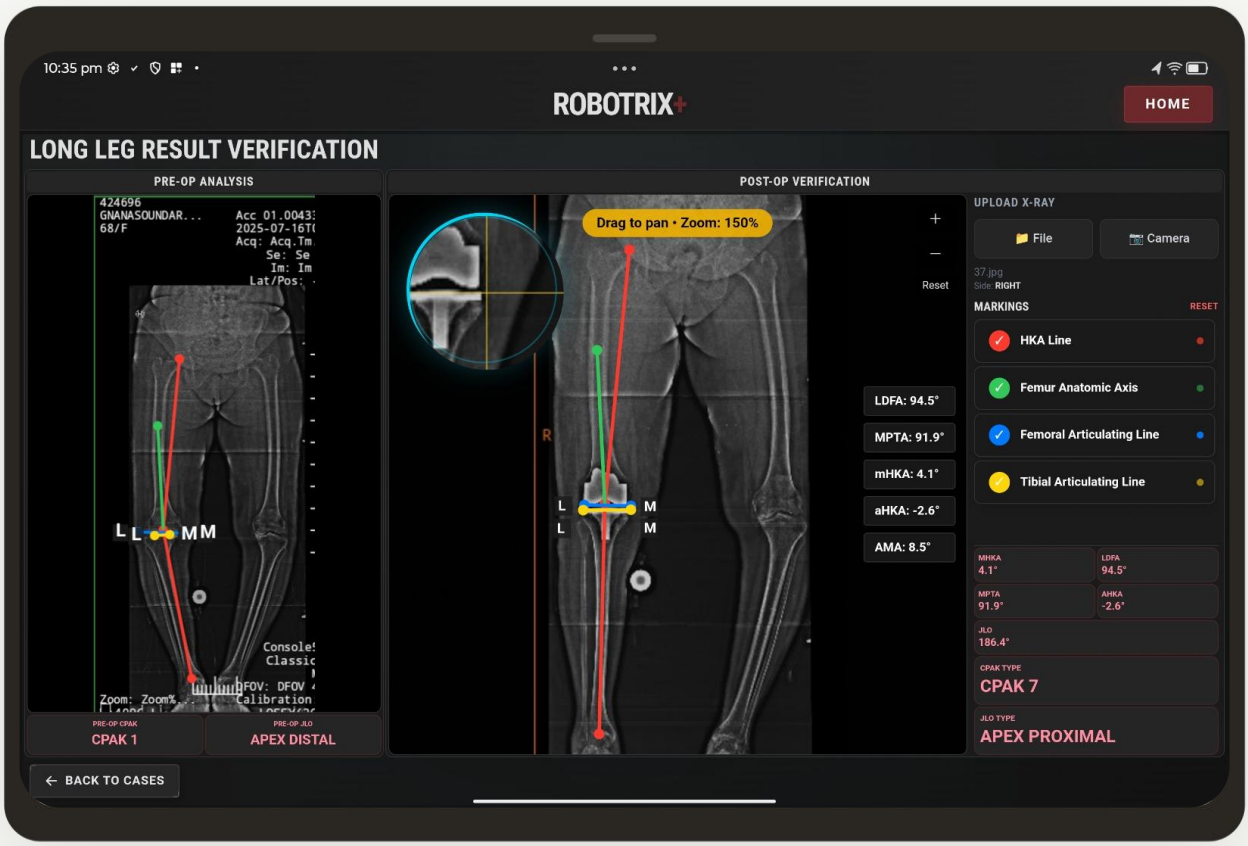
On the right, the surgeon selects one of the Robotrix+ universal jigs — virtual cutting blocks from 0° (neutral) up to 4° varus — and can simulate each block to see its effect on gap balance. The block that best balances the knee is marked **Recommended**.

Through this balancing process, the surgeon arrives at the definitive functional tibial varus cut — confirmed only here, after the gaps and soft tissues have been assessed.

> When satisfied, the surgeon presses **View Report** to generate the final cumulative surgical report of the pre- and post-op plan.

Post-Op Verification Screen

On the Post-Op Verification screen, the surgeon landmarks the post-operative X-ray, and Robotrix+ confirms the main verification — **whether the patient's femur type (varoid, valgoid, or neutral) was retained.** It compares the achieved femur type and CPAK against the native knee, giving true, measured confirmation that the natural phenotype was preserved, closing the loop between plan and outcome.



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