Figures

Figure 1: System Architecture

*Figure 1: Block diagram of the AI Substrate-Planner and LBBAP Depth Guide system. It shows data inputs (MRI, ICE, Mapping System, ECG) feeding into a **Data Fusion** module, which connects to the **AI Inference Engine** (containing Lesion Planning AI and Lead Depth AI). The AI outputs go to a **3D Map Overlay** and **ICE Guidance** interface. The system supports deployment on a local server or in the cloud (dashed lines to "Cloud" and "On-Premises").*

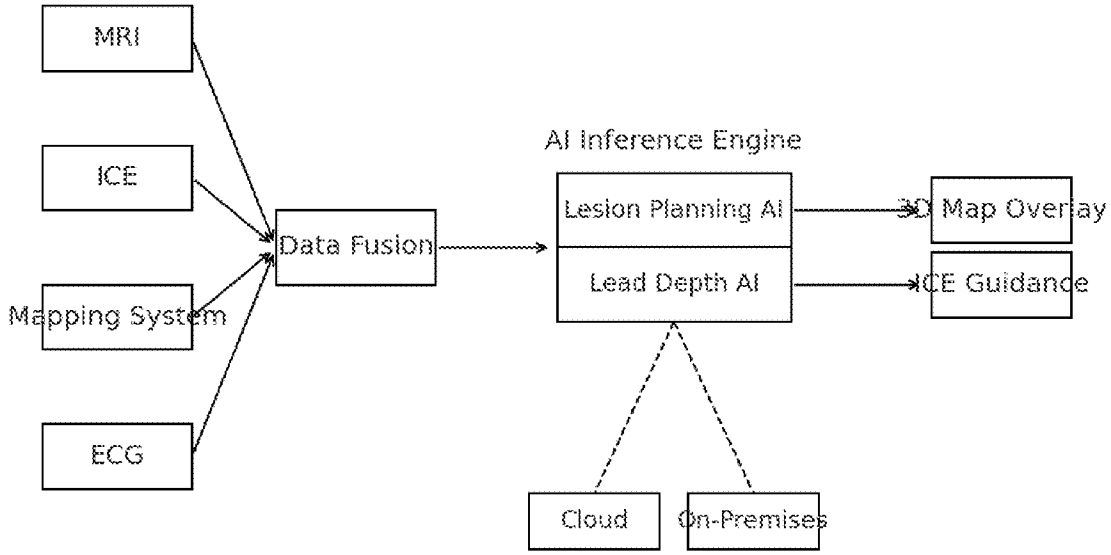


FIG. 1

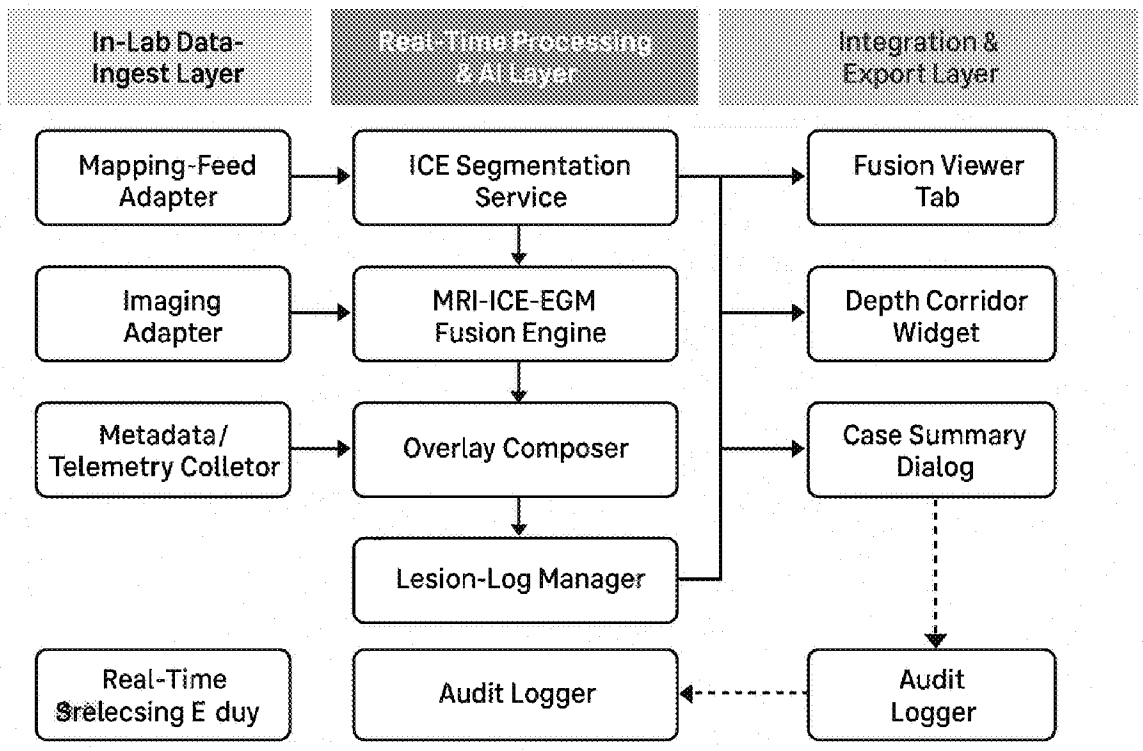

In-Lab Data-Ingest Layer
Real-Time Processing & AI Layer
Integration & Export Layer
Mapping-Feed Adapter
ICE Segmentation Service
Fusion Viewer Tab
Imaging Adapter
MRI-ICE-EGM Fusion Engine
Depth Corridor Widget
Metadata/ Telemetry Colletor
Overlay Composer
Case Summary Dialog
Lesion-Log Manager
Real-Time Srelecsing E duy
Audit Logger
Audit Logger

Figure 2A

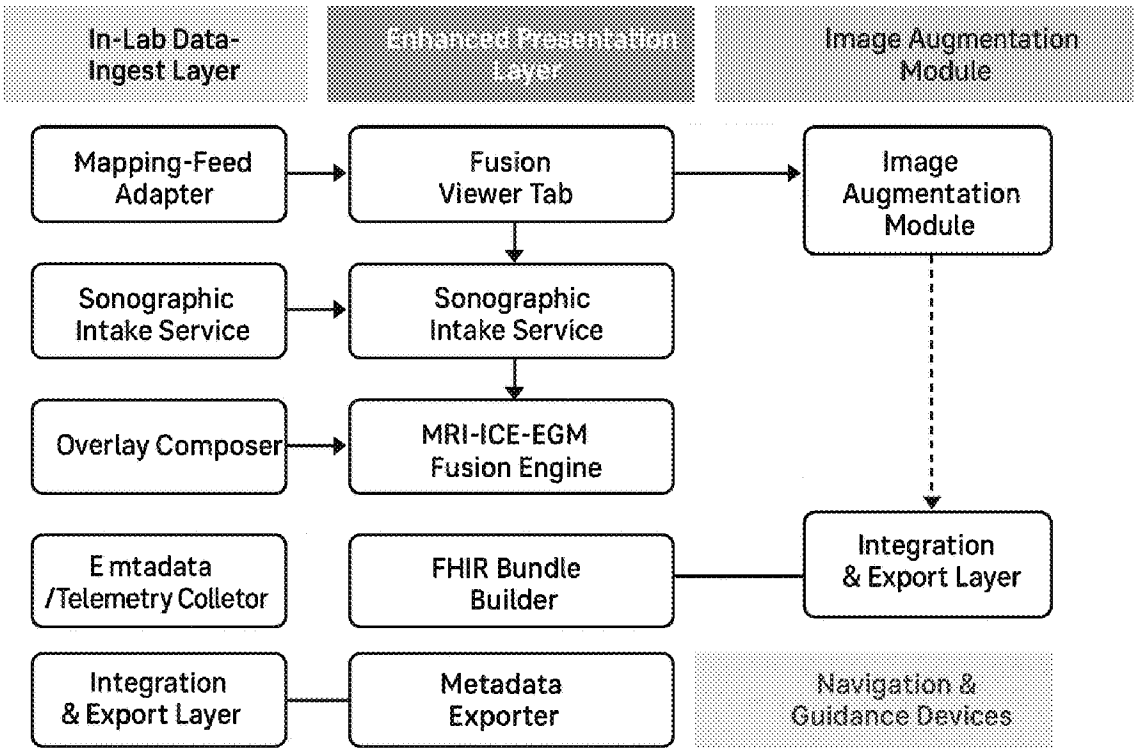
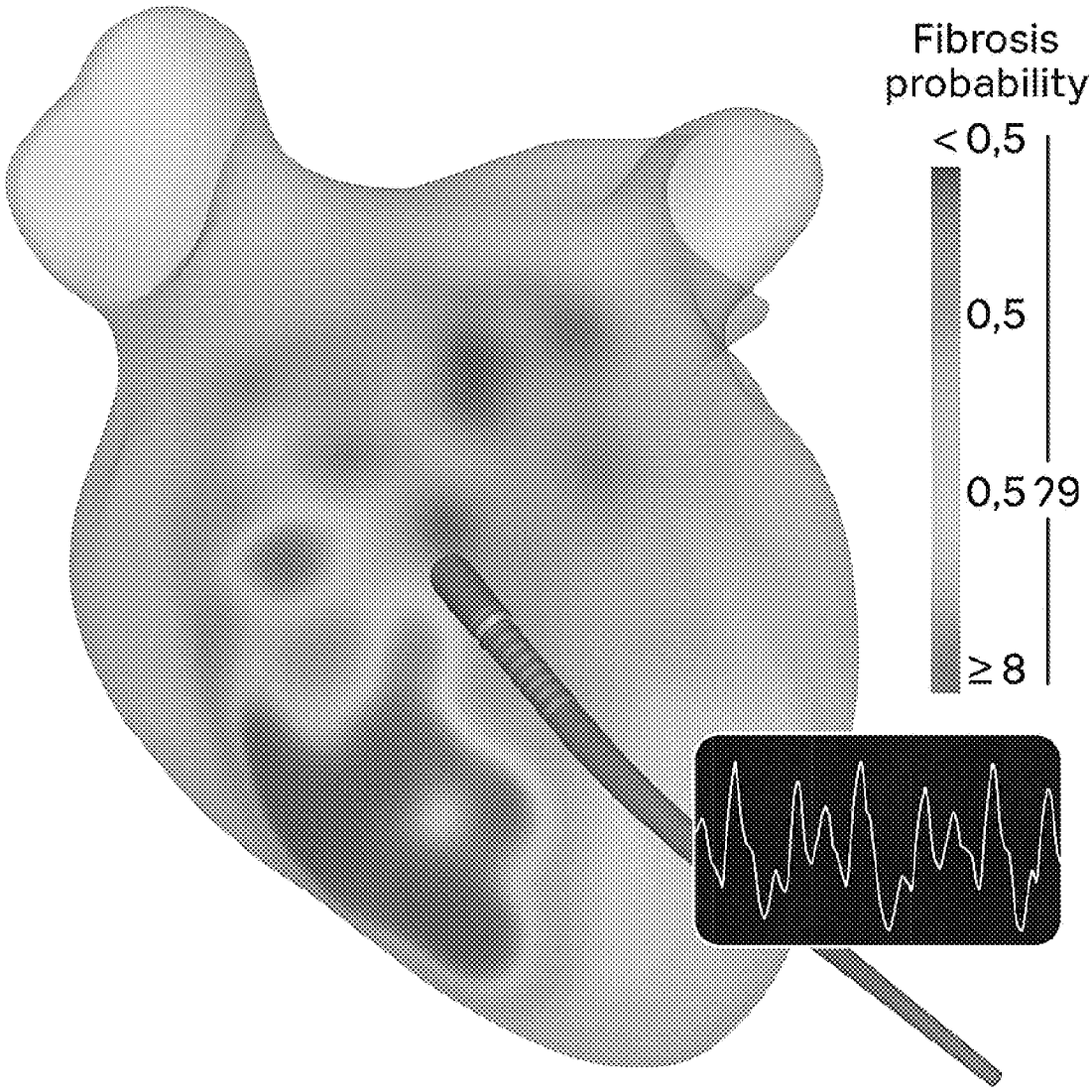

In-Lab Data-Ingest Layer
Enhanced Presentation Layer
Image Augmentation Module
Mapping-Feed Adapter
Fusion Viewer Tab
Image Augmentation Module
Sonographic Intake Service
Sonographic Intake Service
Overlay Composer
MRI-ICE-EGM Fusion Engine
E mtadata /Telemetry Colletor
FHIR Bundle Builder
Integration & Export Layer
Integration & Export Layer
Metadata Exporter
Navigation & Guidance Devices

Figure 2B


Fibrosis
probability
< 0,5
0,5
0,5 ?9
≥ 8

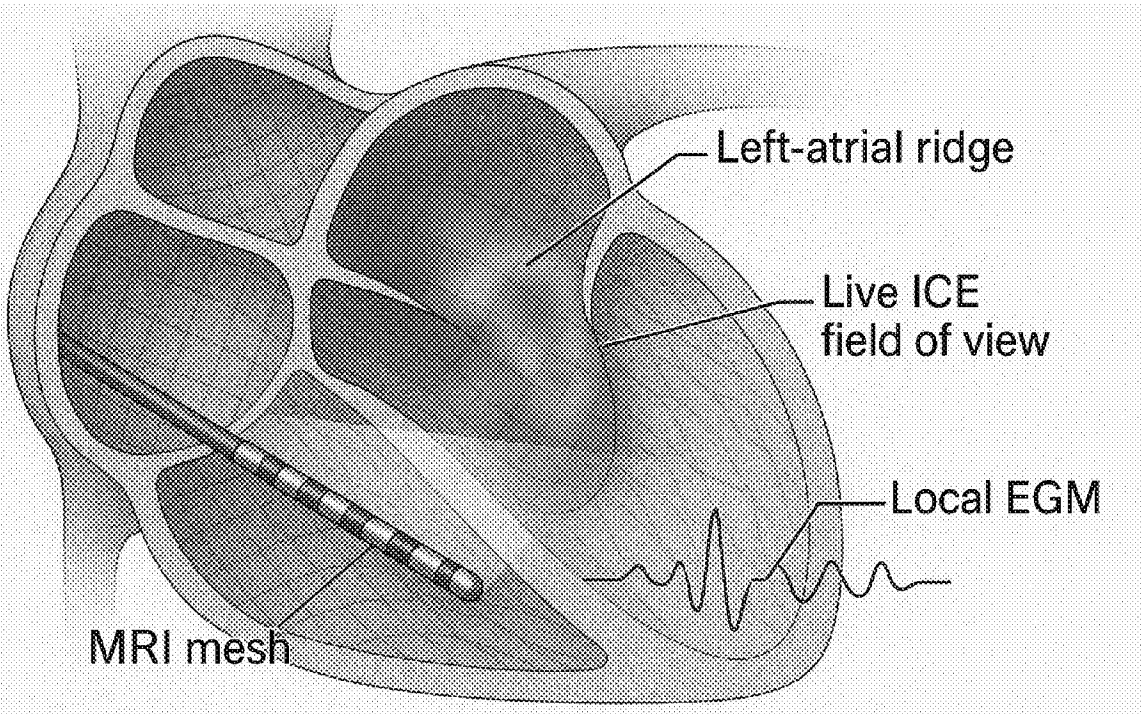
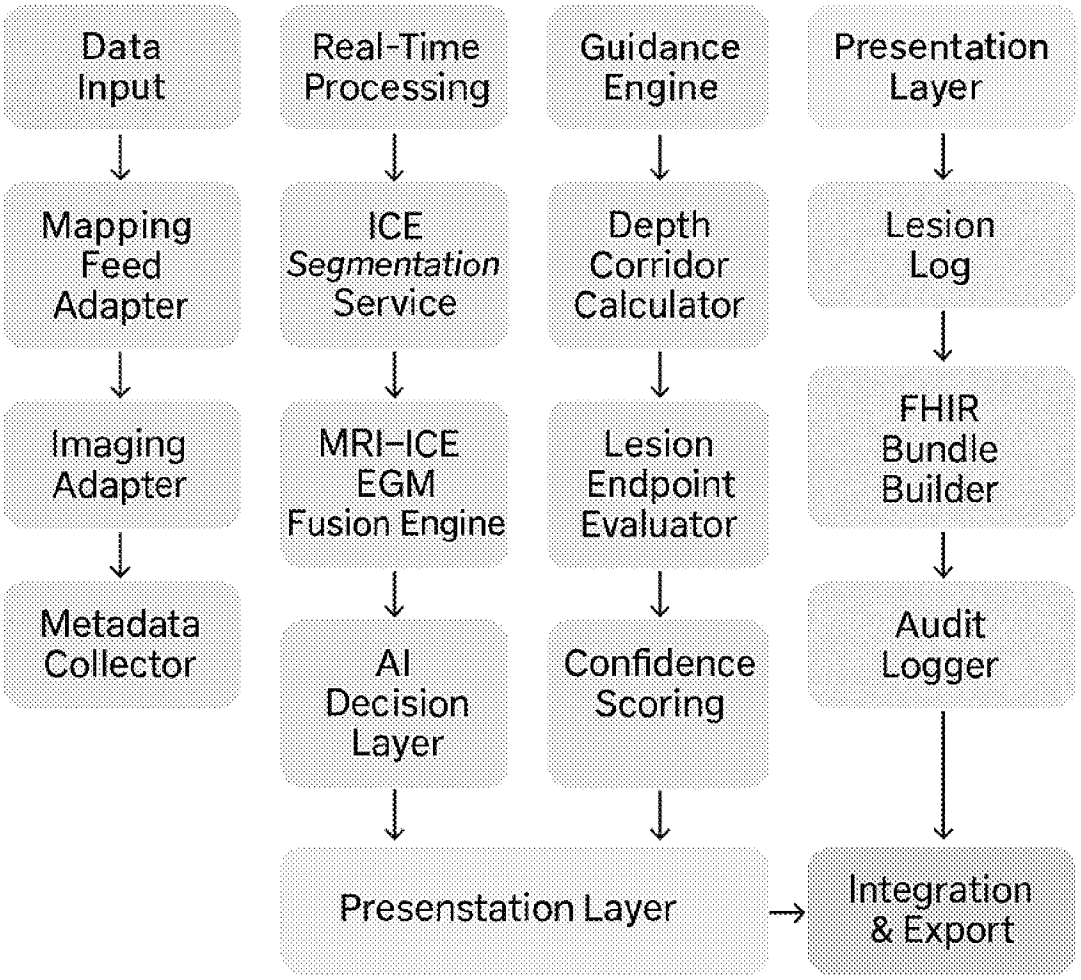


Fig. 2B Additional substrate detail (left-atrial ridge) (MRI-ICE-EGM fusion ang.in.)

FIG. 3 – Real-time AI-Guidance Workflow



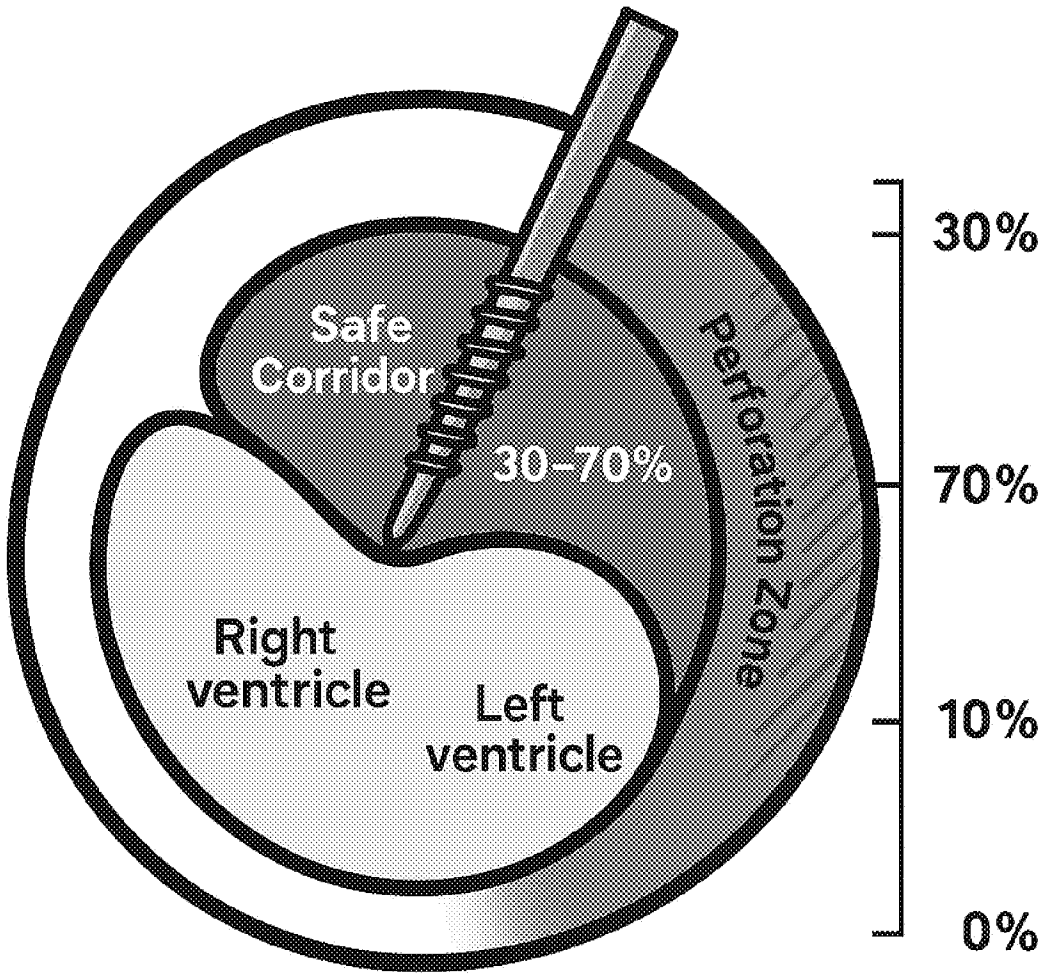


Fig. 4A – Optimal LBBAP Lead Depth Cross-Section

FIG. 4B

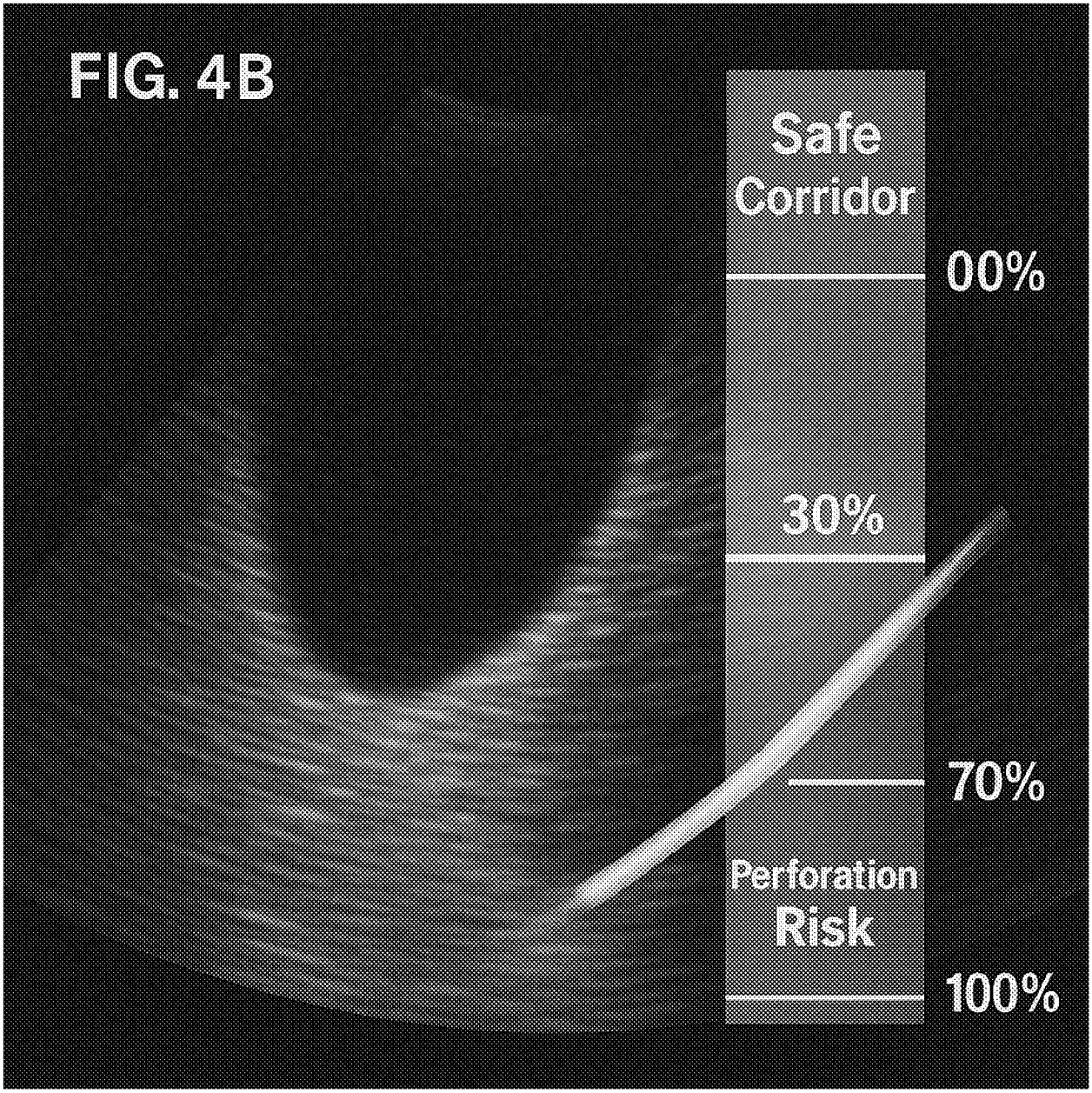


Figure 2AB: Atrial Fibrillation Lesion Planning

Figure 2A: Posterior view of the left atrium (LA) with pulmonary vein openings. ***Suggested ablation lines*** *(dashed loops) encircle the left and right pulmonary veins, with a connecting* ***roof line*** *at the top. The left and right pulmonary vein (PV) ostia are labeled. These AI-proposed lesion lines isolate the pulmonary veins (a typical atrial fibrillation ablation strategy).*

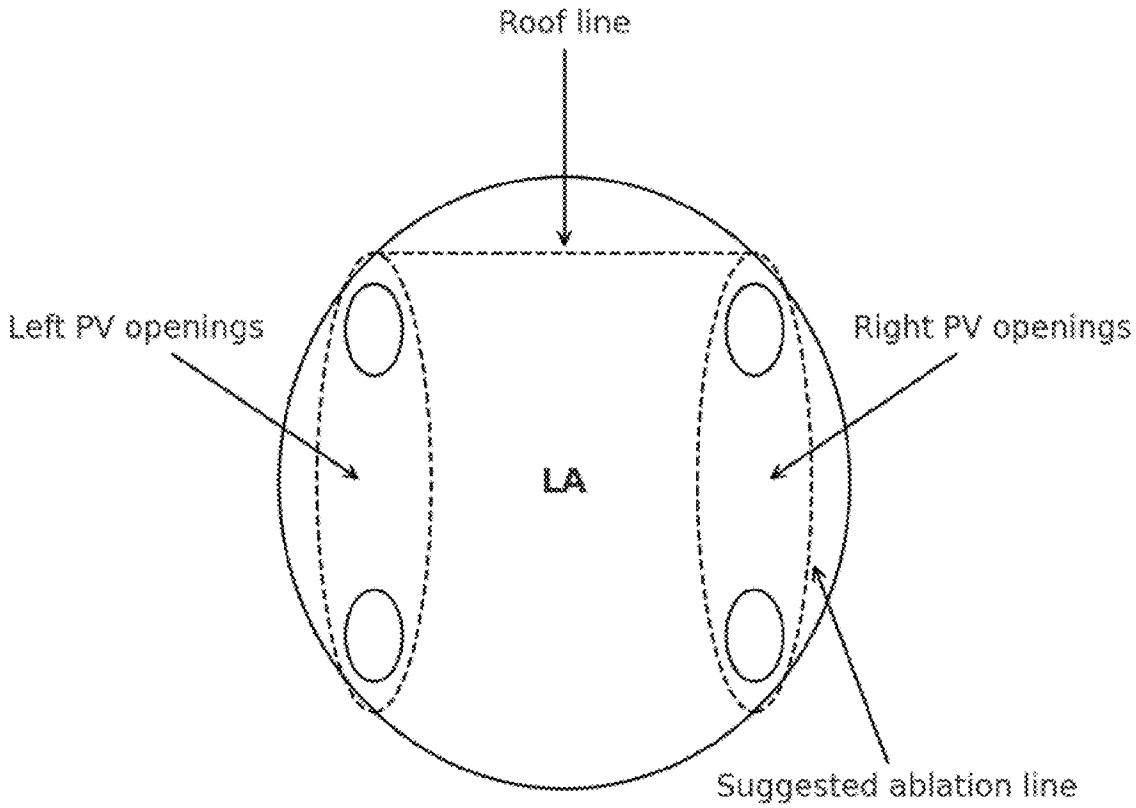


Figure 2BB: Fibrosis-Targeted Lesion Suggestions

*Figure 2B: Same posterior LA view as 2A, now highlighting an identified **fibrotic region** (shaded hatch) near the left atrial appendage ridge. The AI recommends a **cluster of lesion points** (solid dots) in that region. The left and right PV openings are shown for context. This illustrates additional lesions the AI suggests to address fibrotic tissue areas.*

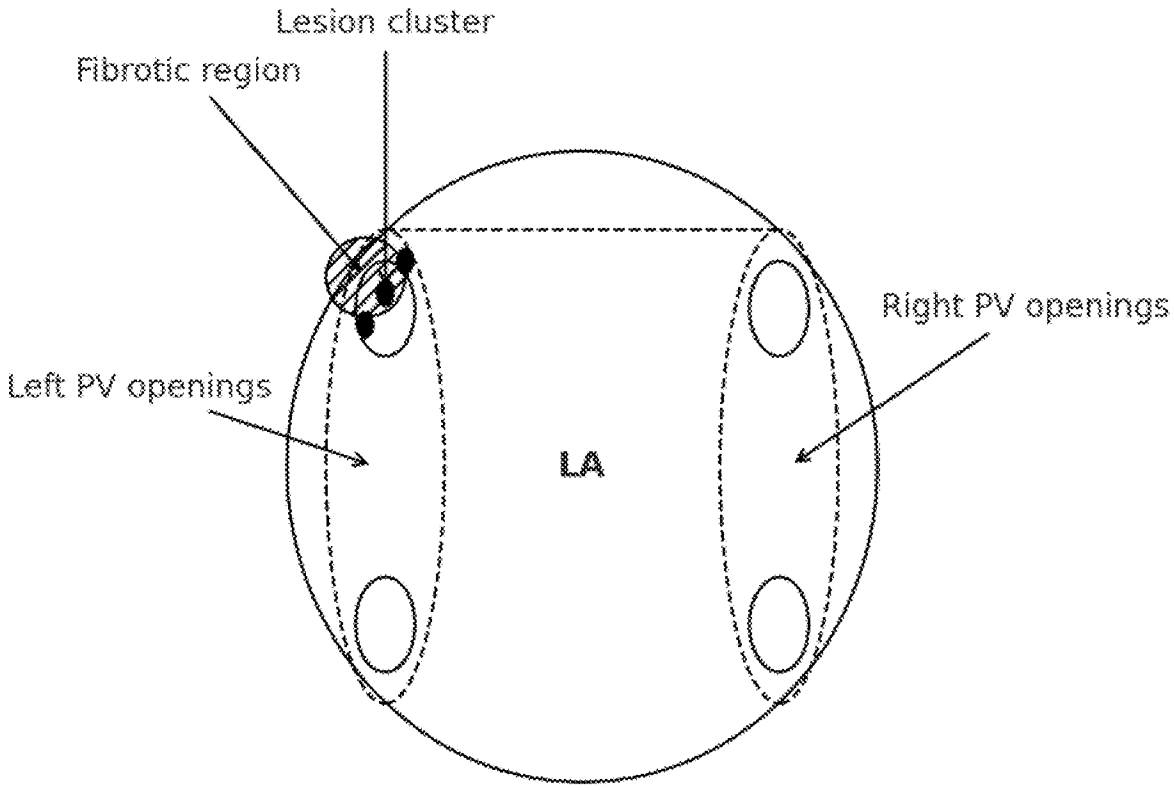


Figure 2BB

Figure 3: Procedural Workflow Flowchart

*Figure 3: Flowchart of the AI-guided procedure. Steps include **Start** → **Data Acquisition** → **Multimodal Fusion** → **AI Inference** → **Clinician Review** → **Lesion Delivery/Lead Advancement** → **Evaluation**. A decision diamond asks "**Goal Achieved?**" If **Yes**, the process **Ends**; if **No**, it loops back for further AI recommendations (arrow labeled "No" returning to **AI Inference**). This loop ensures iterative guidance until the procedural goal is met.*

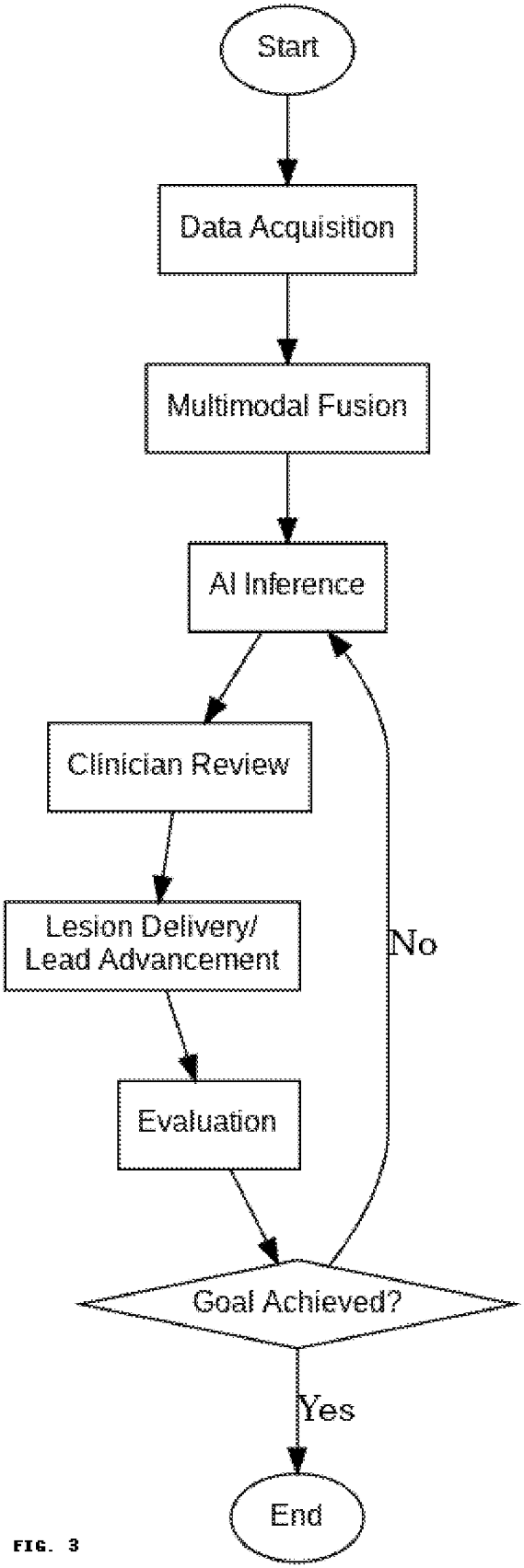

Start
Data Acquisition
Multimodal Fusion
AI Inference
Clinician Review
Lesion Delivery/
Lead Advancement
Evaluation
Goal Achieved?
No
Yes
End

FIG. 3

Figure 4AA: Septal Cross-Section and Lead Depths

Figure 4A: Cross-sectional schematic of the interventricular septum during LBBAP lead implantation. ***RV*** *denotes the right ventricle side (lead entry), and* ***LV*** *denotes the left ventricle side. Three lead tip positions are marked:* ***Shallow****(insufficient depth, not reaching LBB),* ***Optimal*** *(mid-septal, engaging the LBB fibers in the hatched* ***target zone****), and* ***Too Deep*** *(beyond the septum into LV endocardium). The hatched region near the LV side indicates the AI's* ***target zone*** *for optimal lead placement (near the LBB fiber area).*

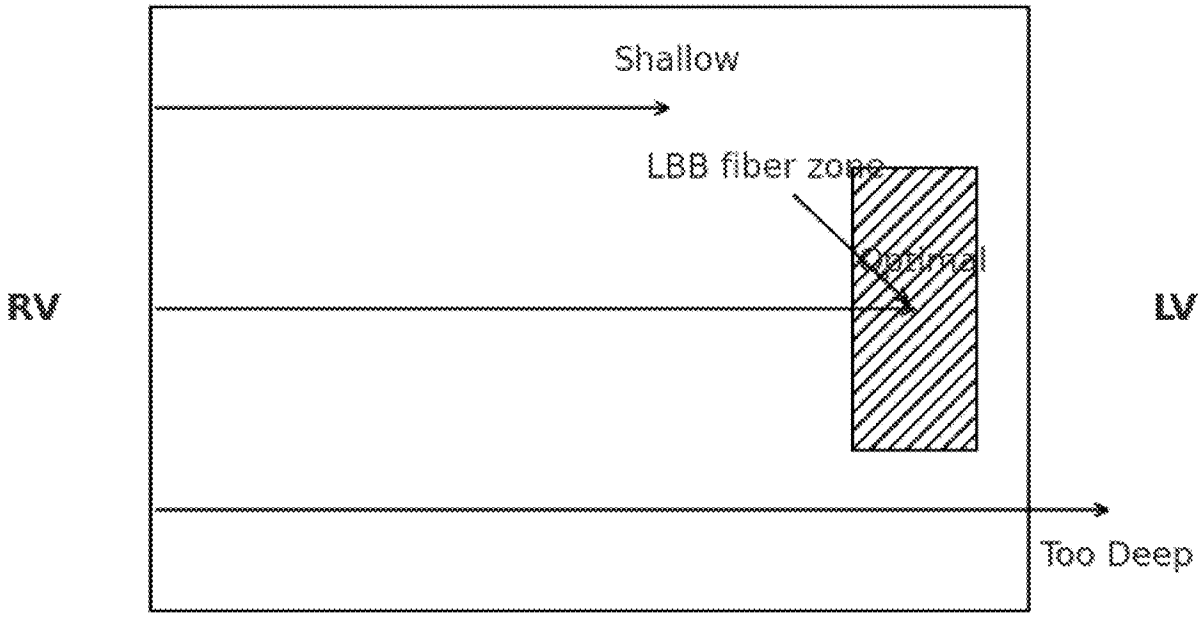


Figure 4AA

Figure 4BB: Simulated ICE Guidance View

*Figure 4B: Corresponding intracardiac echocardiography (ICE) view from the RV side. The ultrasound sector (wedge) shows the cross-section of the septum (vertical line) and the pacing **lead** (dark horizontal line with a tip marker) advancing into the septum. An overlaid indicator (arrow labeled "**Target depth**") points to the AI-predicted optimal depth on the septum. **Septum** and **Lead** are labeled within the image. This illustrates the real-time guidance overlay on the ICE imaging, indicating when the lead tip reaches the target zone.*

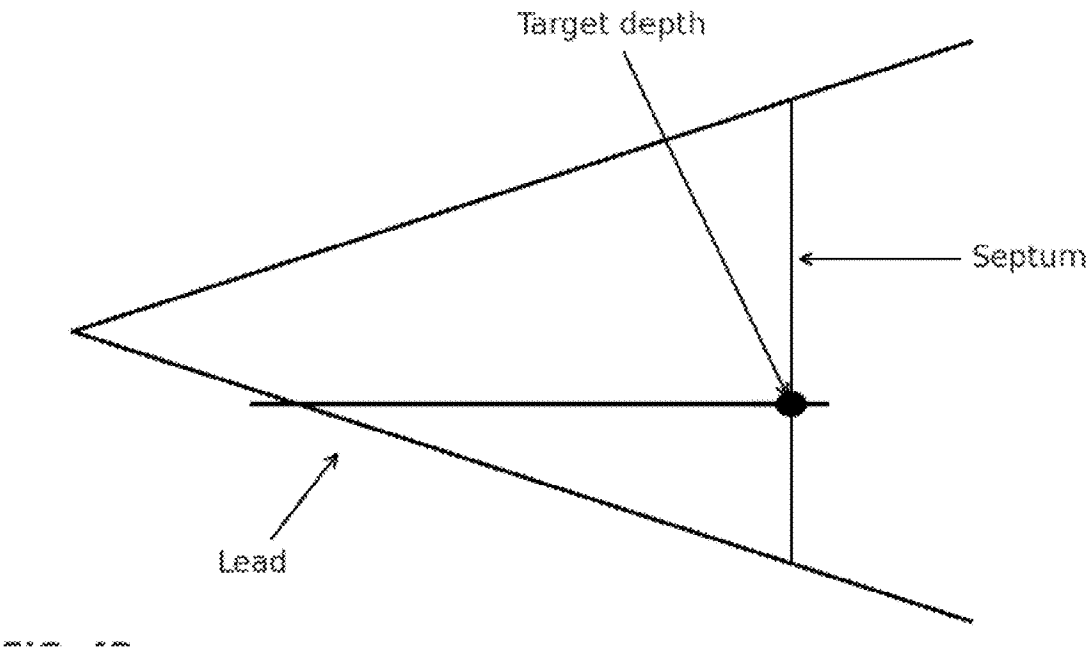


FIgure 4BB