



# Polarean Imaging plc

(AIM:POLX)

## *Breathtaking Images...*

Non-Deal Roadshow  
February 2020

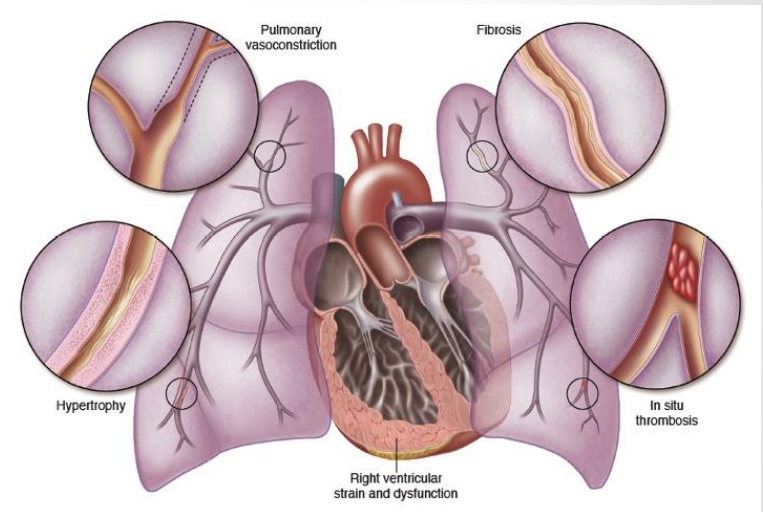
**Richard Hullahen** – Chief Executive Officer  
**Chuck Osborne** – Chief Financial Officer

# Polarean Highlights

- Drug-device combination that allows Magnetic Resonance Imaging (MRI) of the lung through the use of polarised Xenon-129 gas
- Positive US Phase 3 clinical trial results announced in January 2020
- Plan to file New Drug Application (NDA) to the US FDA in Q3-2020
- US Marketing Approval still estimated +12 months from submission with Hatch Waxman
- Sales to the research market are generating revenue and accelerating product awareness
- Strong and expanding IP portfolio and anticipated marketing exclusivity
- EIS/VCT qualified

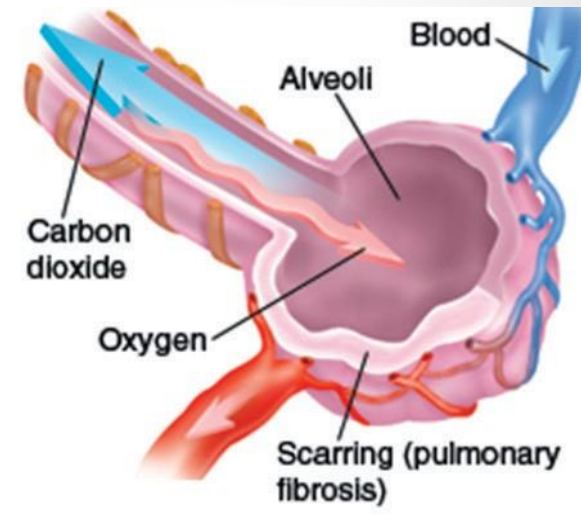
# The Problem

- Pulmonary disease is widespread and growing, affects **40 million Americans**
  - Asthma: 25 million
  - COPD: 13 million
  - Cystic Fibrosis (CF), Idiopathic Pulmonary Fibrosis (IPF), Embolism
- Heavy US economic burden
- US\$150 billion/year, similar in EU
- Higher prevalence in countries with poor air quality and smoking use



# Ventilation, Gas Exchange & Microvascular Bloodflow

- Pulmonary disease is characterised by specific patterns of impaired:
  1. **Ventilation** (airflow into and out of the alveoli)
  2. **Gas exchange** (through barrier tissue into and out of bloodstream)
  3. **Microvascular hemodynamics** (bloodflow through capillary bed)



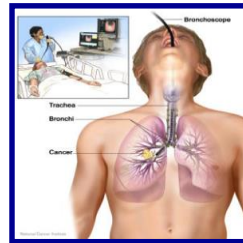
# Improving Diagnosis in Pulmonary Disease

- Current methods to diagnose and monitor lung disease are invasive and suboptimal
- Polarean's technology is superior, being quantitative, image-based, and cost-effective

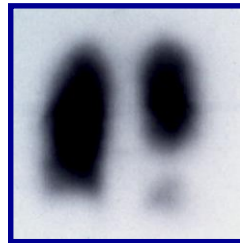
Spirometry



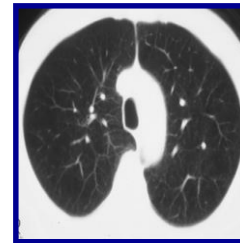
Bronchoscopy



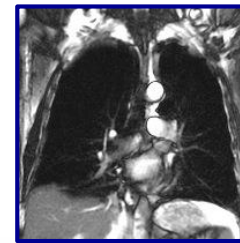
Scintigraphy



X-ray, CT



MRI



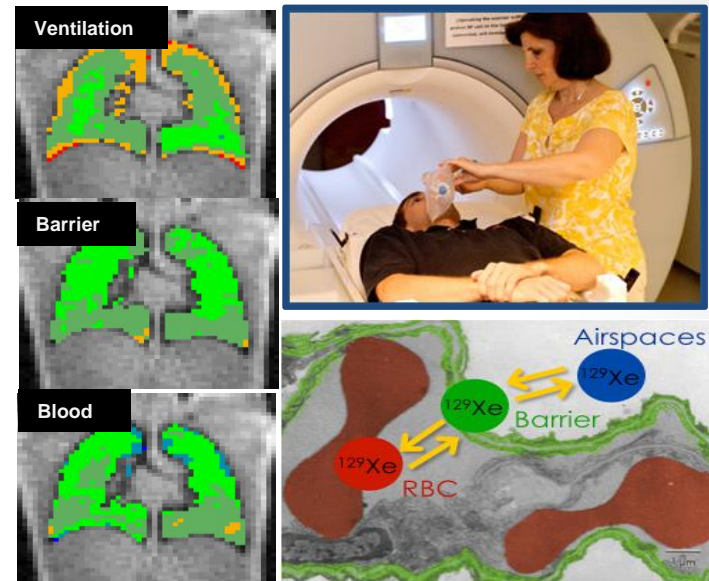
# Our Technology: Hyperpolarised $^{129}\text{Xe}$ MRI (HPX MRI)

## A Faster, Simpler, Safer Test

- Brief exam requiring a few, short breath-holds
- Easy to administer, not effort-dependent
- Noninvasive, no radiation, repeatable

## Comprehensive Information

- Quantifiable 3D maps of ventilation and gas exchange
- Quantitative measures of cardiopulmonary dynamics to identify pre- and post-capillary Pulmonary Hypertension (PH)





# Products and Workflow

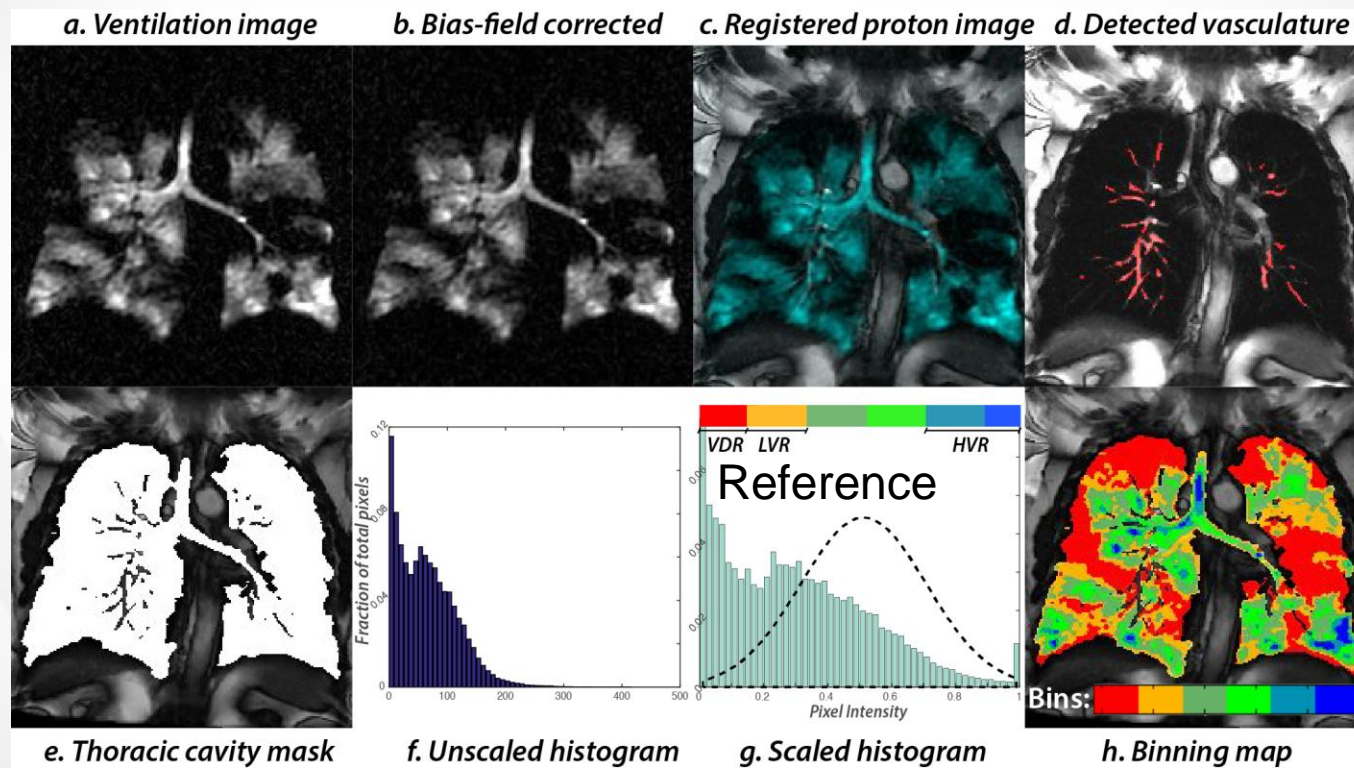
Polarean's products are “add-ons” compatible with existing MRI systems from GE, Siemens, Philips, etc.



In **10 SECONDS**, we get:

- 3D multi-slice data
- Direct ventilation image
- Barrier tissue signal
- Arterial blood signal

# From Qualitative to Quantitative: $^{129}\text{Xe}$ Ventilation MRI

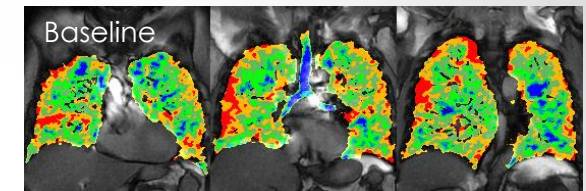
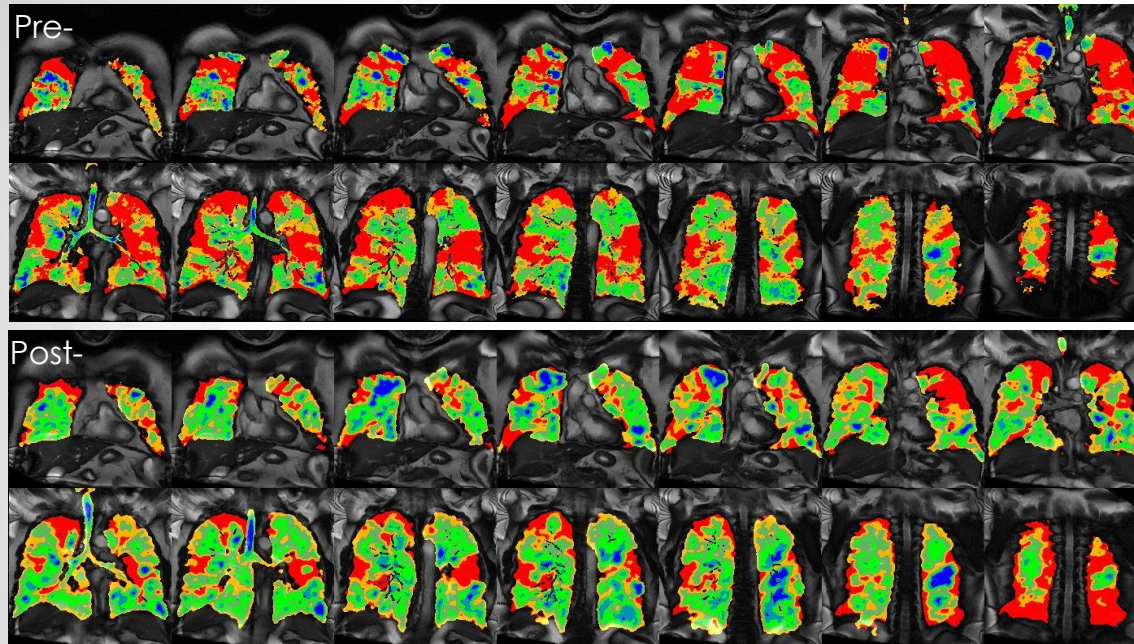


He, M., et al. Acad. Radiol., 2014; He, M., Que, L., Huang, Y.C., et al. Acad. Radiol. 2016



# From Qualitative to Quantitative: Xe<sup>129</sup> Ventilation MRI

## Repeat Scan



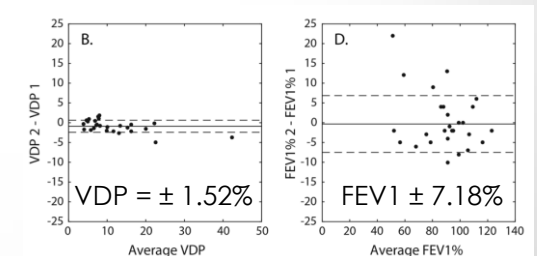
VDP = 10.2%, low = 29.5%, high = 9.5%, CV = 0.50



VDP = 10.9%, low = 27.2%, high = 9.1%, CV = 0.49



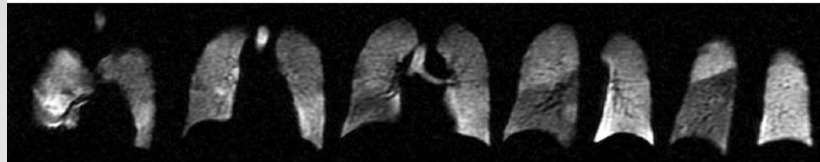
Subject	FEV1(%)	VDP (%)	Low%	High%	CV	Skewness
Pre-	53	33.6	26.4	5.9	0.77	0.68
Post-	83	18.6	25.7	9.5	0.58	0.24
Reference	106.7±13	2.6±1.8	17.5±5.7	16.7±3.3	0.37±0.04	0±0.11



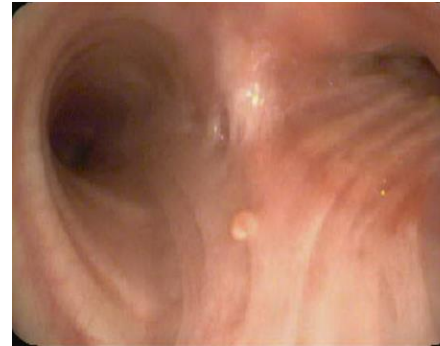
Ebner, Virgincar, Invest. Radiol. 2016

# Imaging Guidance for Bronchoscopic Interventions

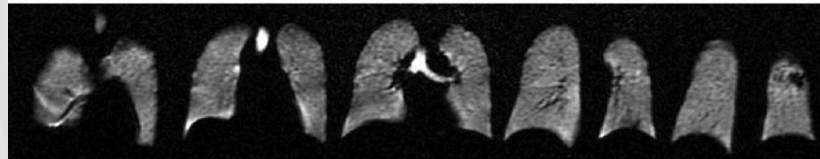
## *Pre-stent*



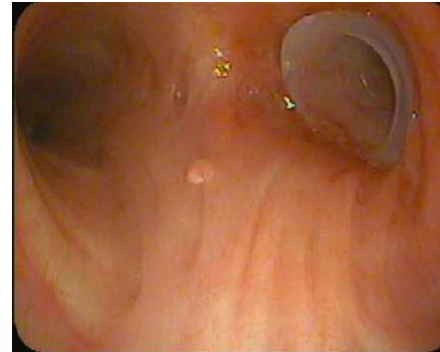
FEV1 = 51, VDP = 1.8%, LVR = 20.8%, HVR = 14.9%, CV = 0.39



## *Post-stent*



FEV1 = 55, VDP = 2.0%, LVR = 9.3%, HVR = 14.1%, CV = 0.29

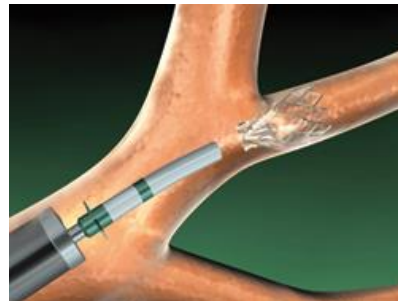
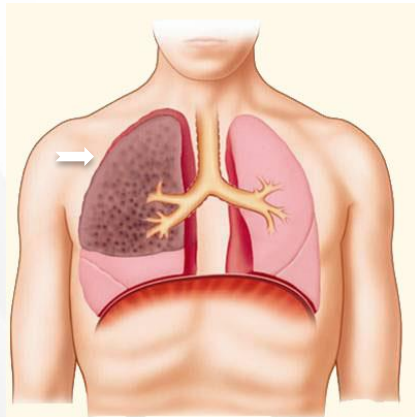


Kamran  
Mahmood

Mahmood, Ebner, He, et al. Am. J. Transplant. 2017

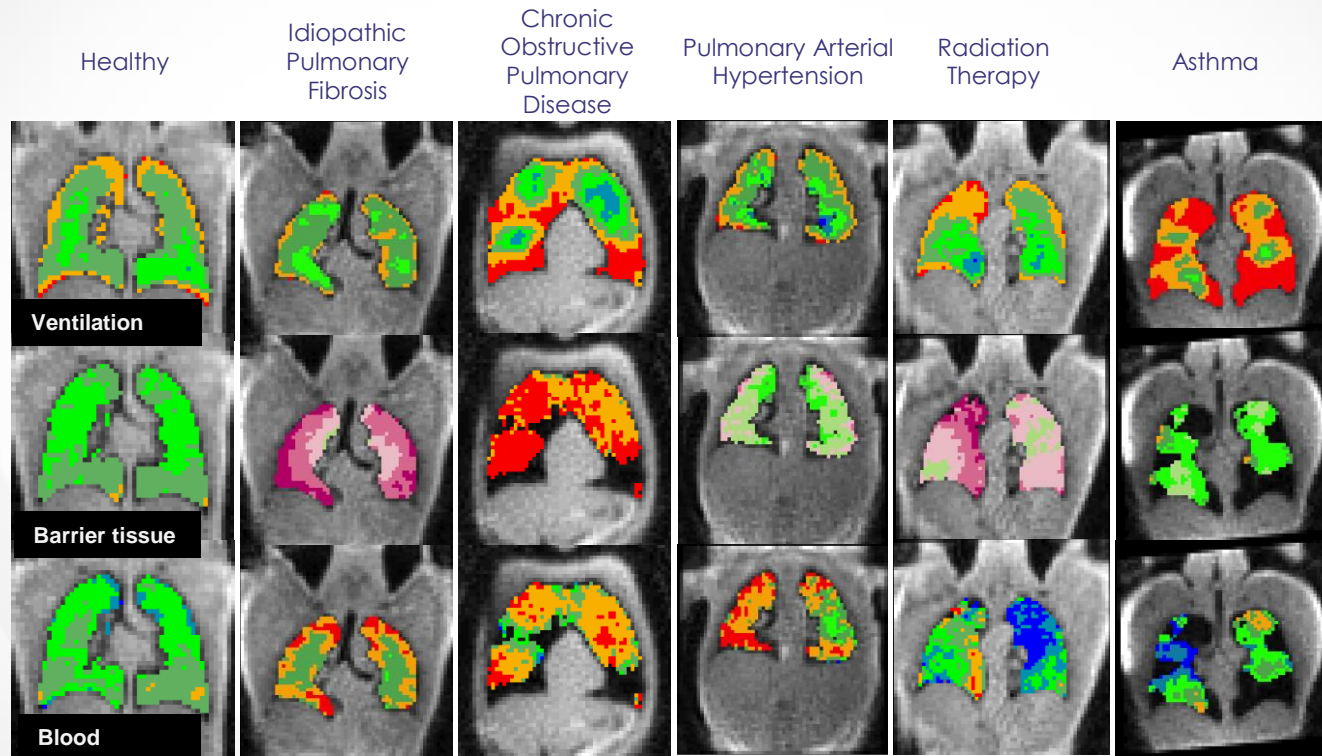
# Endobronchial Valves to Treat COPD

- Potential relief for 3 to 4 million COPD patients with emphysema
- Pulmonx, Spiration Valve System – FDA approved in 2018
- US \$10,000 in disposables cost, operating room time, 3- to 5-day hospital stay
- Paid for under major chest DRG





# Polarean Technology is Broadly Applicable



In addition to ventilation, key information is also available from barrier tissue and blood

# Large Market Opportunity

- 1000 top-tier US institutions equipment purchase, plus per-patient drug sales
- Potential for multiple pharma and device (valve/stent) company partnering deals in specific therapeutic areas
- New applications are additive, such as cardiology/pulmonary vascular disease
- New geographic opportunities with strategic partners emerging



# Significant Interest from Researchers & Drug Companies

- From Clinicaltrials.gov:
  - Polarean  $^{129}\text{Xe}$  currently being investigated in 42 clinical trials in the US, most with the  $^{129}\text{Xe}$  MRI Clinical Trials Consortium and/or affiliates
  - Polarean  $^{129}\text{Xe}$  currently being investigated in clinical trials with >10 drugs in IPF, PAH, Asthma, and COPD
  - 25 polarisers are either installed or on order from medical research institutions
  - In process of investigating corporate partnering opportunities
  - Significant opportunities to reduce cost of Phase 1 and 2 clinical trials
  - Potential development as true biomarker
  - Potential development as “companion diagnostic”

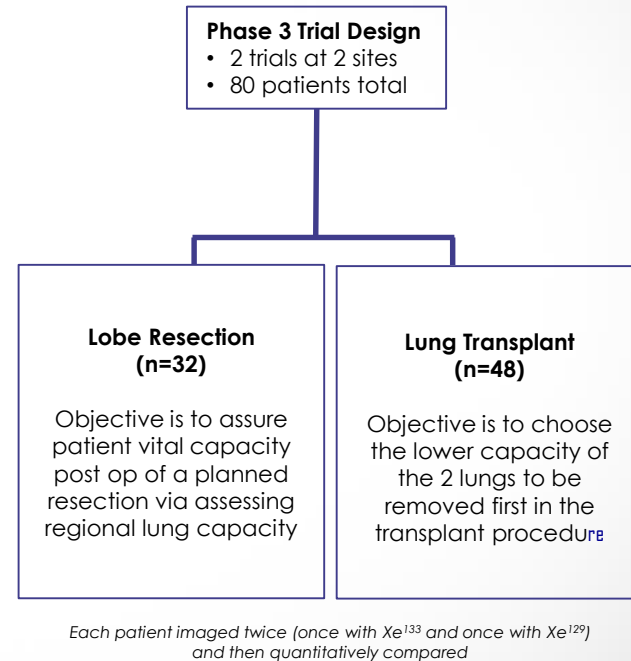
# Development Strategy

- Seeking US approval
  - Regulated by the FDA as a drug/device combination product
  - Plan to file New Drug Application (NDA) to FDA in Q3-2020 requesting Hatch Waxman protection
- Obtain a broad claim that allows our technology to be used in all diseases for clinical diagnosis and monitoring therapy
  - Successfully completed two Phase 3 clinical trials in January 2020 to support marketing approval for first indication, ventilation
  - Expand indications into gas exchange and red blood cell transfer
  - Expand into cardiology and pulmonary vascular disease
- Explore ex-US approval pathways

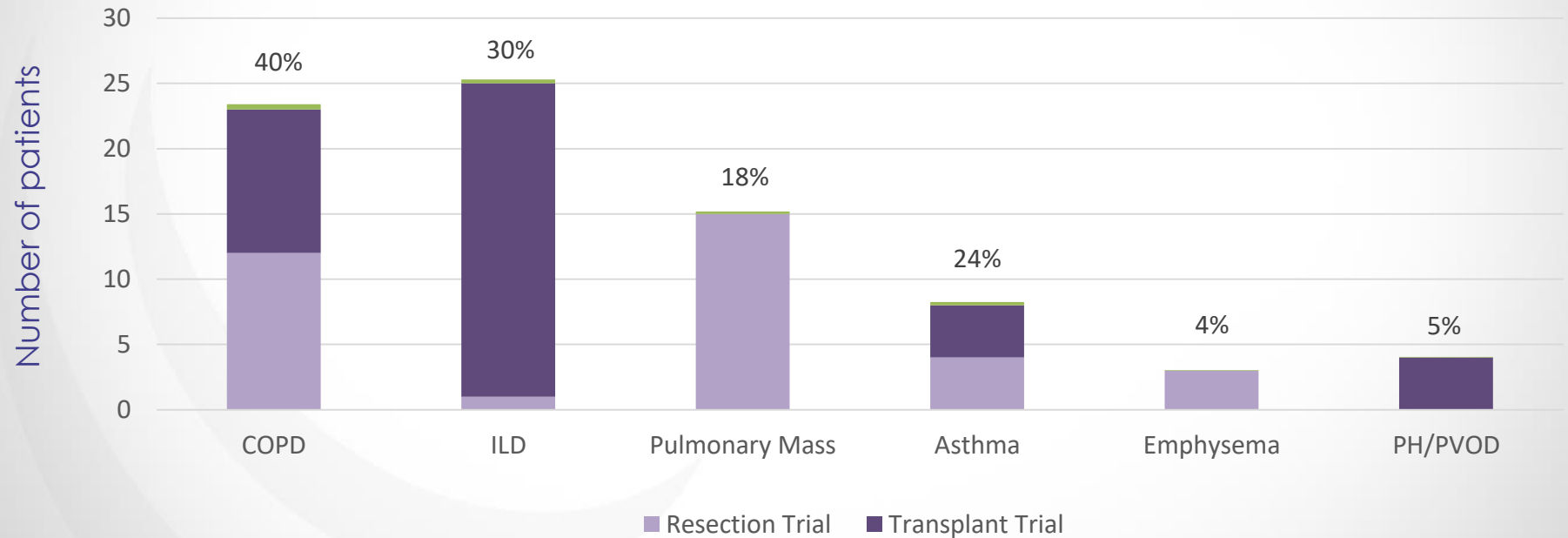
# Phase 3 Clinical Trial Design

## FDA Agreed Trial Design

- Multi-center, randomised, open-label studies comparing Xenon<sup>129</sup> gas to Xenon<sup>133</sup> scintigraphy (an approved technique)
- Measure regional pulmonary function in patients being evaluated for possible lung resection surgery and possible lung transplant surgery
- Primary endpoints were the prospectively defined equivalence ( $\pm 14.7\%$  margin) when compared to Xenon<sup>133</sup> scintigraphy imaging of the same patients



# Population Medical History: Respiratory Disorders



COPD: Chronic obstructive pulmonary disease; ILD: Interstitial lung disease; PH: Pulmonary Hypertension; PVOD: Pulmonary veno-occlusive disease

## Phase 3 Clinical Trial Results

- Met **primary endpoints** in both trials
  - Lung Resection Trial: Inpatient mean difference of 1.4% with a 95% confidence interval of (-0.75%, 3.60%)
  - Lung Transplant Trial: Inpatient mean difference of -1.59% with a 95% confidence interval of (-3.69%, 0.50%)
- Met all requirements for drug safety
- Minimal adverse events, none attributed to Polarean drug ( $^{129}\text{Xe}$ )



# US Commercial Plan: 18-Month Key Objectives



## **1. ANALYZE the Market**

Understand Segments, Targets, Buying Process, Brand Identity/Preference, Competing Modalities, and Pricing/Reimbursement, and Refine Revenue Model



## **2. PREPARE the Market**

Create Awareness, Interest, and Enthusiasm for HPX MRI as a Research Tool in Targeted Physicians and Pharma Partners (Including Building Multi-site Trial Capability)



## **3. EXECUTE the Launch**

Optimize a Controlled Launch With Ventilation Claim in Limited Institutional Targets (n~100) with a Lean Sales, Marketing, Customer Service, and Reimbursement Team

## Milestones Through 2021

- ✓ Complete Phase 3 Clinical Trials
- File NDA in US: Q3-2020
- Plan and Prepare US Launch: H1-2021
- Receive US Marketing Approval: Q3-2021
- Launch in US: Q3-2021

*Continued sales of research units*

# IP and Data Exclusivity

- Strong IP Portfolio
- Five-year data exclusivity post US launch
  - Potential additional 30-month extension in competing ANDA for Orange Book patents
- Gas exchange and specific use IP provide additional barrier to competition

## Shareholders

Shareholder	Number	Ordinary Shares %
Amati Global Investors	12,460,318	10.9
Bastiaan Driehuys	12,267,503	10.7
Nukem	11,234,208	9.8
W.B. Nominees Limited	8,736,697	7.6
John Sudol	7,542,121	6.6

- *As at 9 August 2019, the number of shares in issue was 114,438,600*

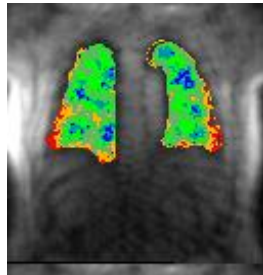
# Moving Beyond Ventilation

Clinicians increasingly ask us to address unexplained dyspnea (3.4 million emergency department visits in US each year)

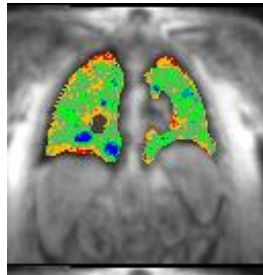
Patient 1



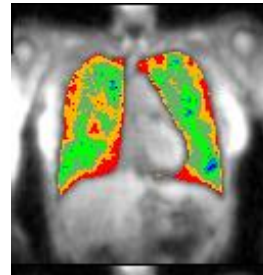
Patient 2



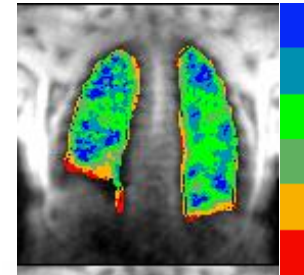
Patient 3



Patient 4

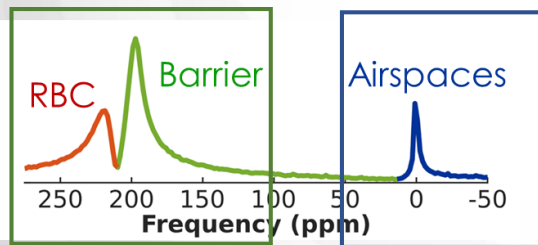
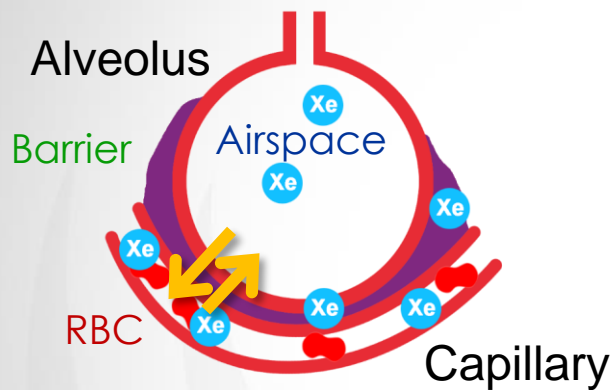


Patient 5

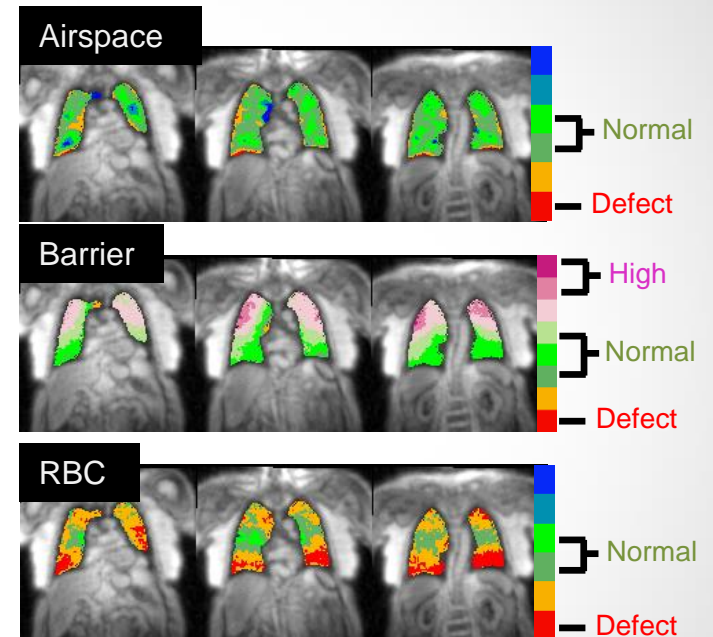




# Imaging All Aspects of Function in One Breath

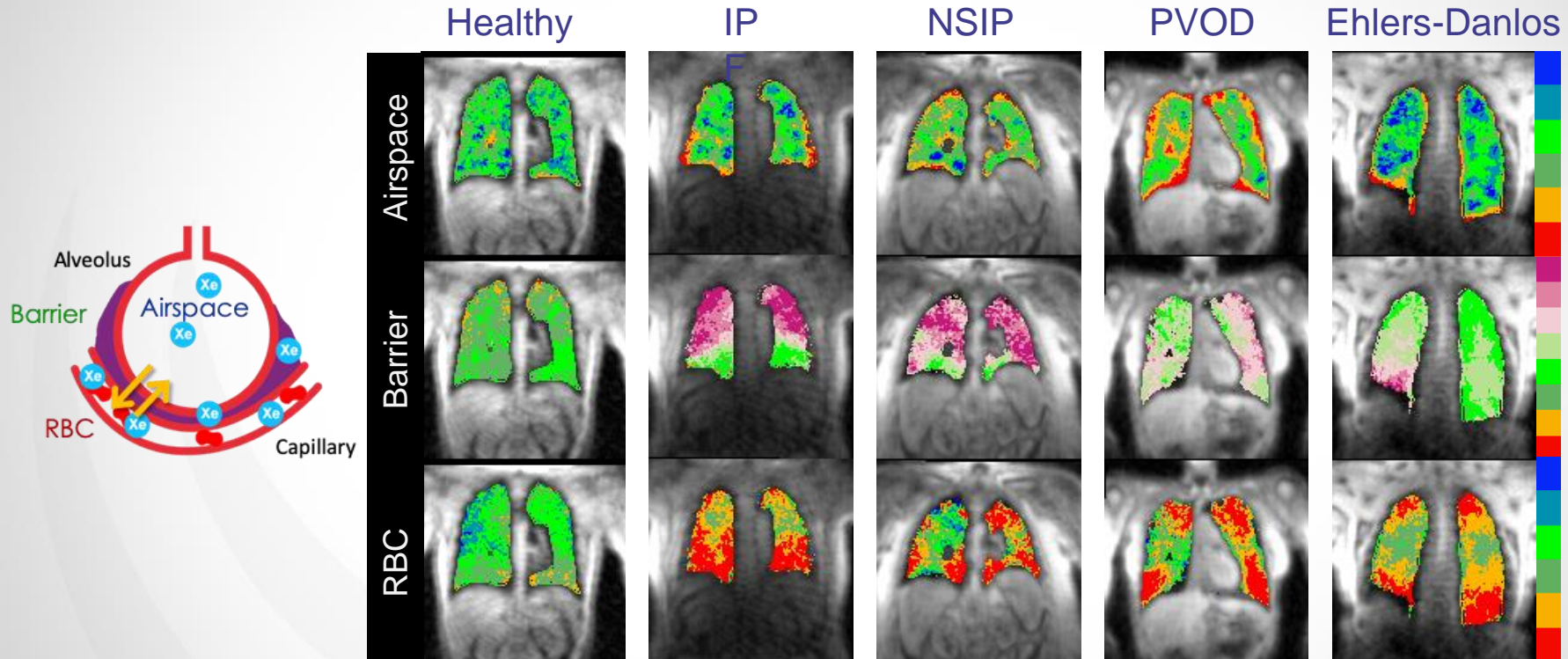


Quantitative  
Mapping



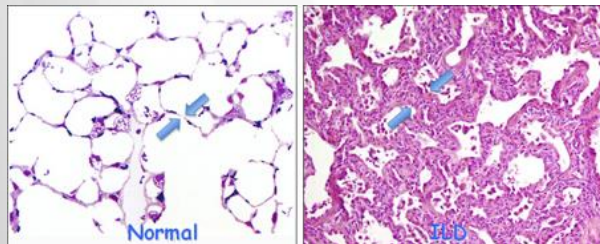
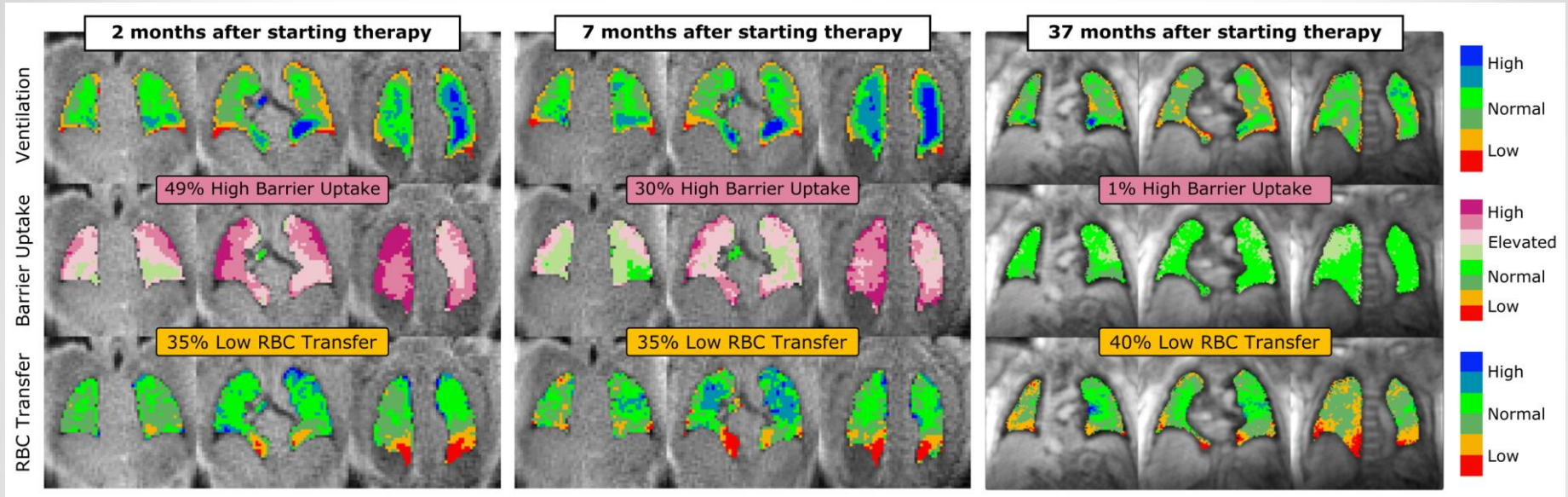
US Patents 8911709, 9625550  
Through 2032

# Now We See the Whole Disease Burden



IPF: Idiopathic pulmonary fibrosis; NSIP: Nonspecific interstitial pneumonia; PVOD: Pulmonary veno-occlusive disease

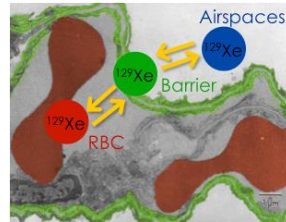
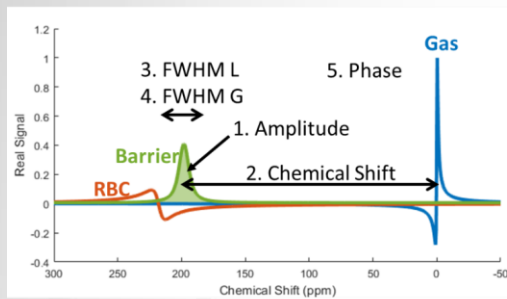
# Visualizing Therapy Response in IPF



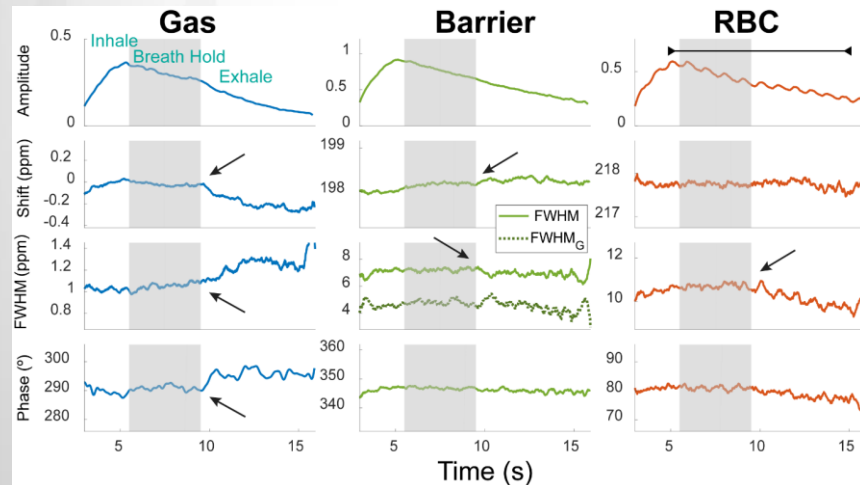
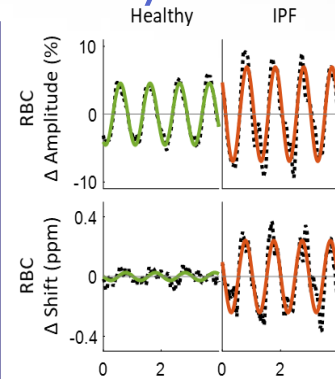
<http://pulmonaryfibrosisnews.com/2014/10/23/two-new-ipf-treatments-reportedly-will-cost-94k-96k-year/>



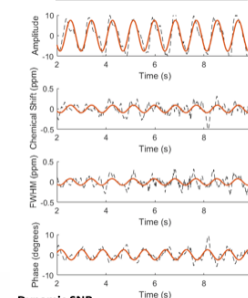
# $^{129}\text{Xe}$ Spectroscopy adds Hemodynamics & Oxygenation



Sampling the alveolar-capillary interface every 20 ms



## Detrended RBC Oscillations



## RBC Oscillation Amplitude\*

\* Peak-to-Peak (Peak-to-Peak)

	Healthy Reference Values
Amplitude (%)	15.1 (9.4 ± 2.7%)
Chemical Shift (ppm)	0.19 (0.05 ± 0.04)
Linewidth (ppm)	0.16 (0.15 ± 0.09)
Phase (degrees)	5.1 (1.2 ± 0.8°)

## Static Spectroscopy (Barrier Voigt)

	RBC (Ref. Values)	Barrier (Ref. Values)
Intensity Ratio*	0.09 (0.59 ± 0.12)	1.00 (1.0)
Shift (ppm)	218.0 (218.4 ± 0.4)	196.8 (197.7 ± 0.3)
FWHM (ppm)	6.7 (8.7 ± 0.3)	4.3 (5.0 ± 0.3)
FWHM <sub>G</sub> (ppm)	-----	4.8 (6.1 ± 0.3)
Phase (degrees)	96.6 (81.9 ± 3.6)	0.0 (0.0)
S FID SNR: (amp/noise)	8.4	93.3

\* Normalized to barrier peak

Bier et al., NMR in Biomed 2018

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