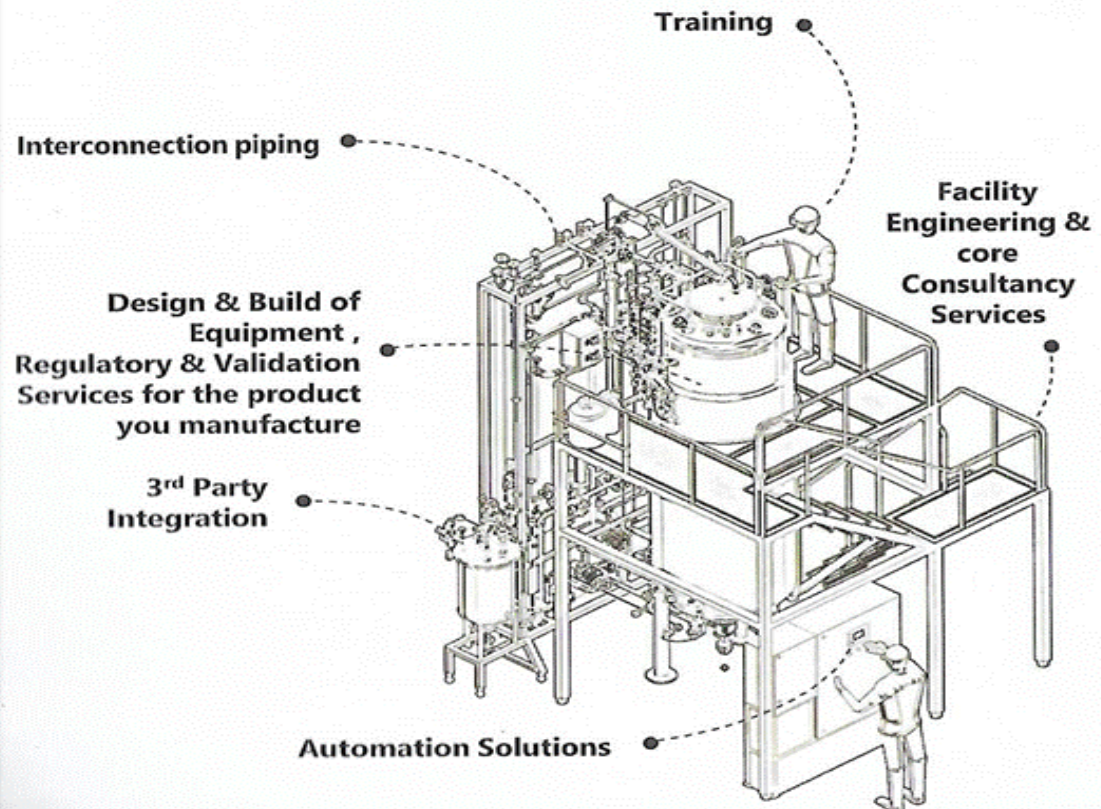


BIOZEEN's APPROACH FOR AFRICAN VACCINE MANUFACTURERS INITIATIVE

Daniel Cardoso González. Eng, MSc, Ph.D



We are into the business of Saving Lives





We are into the business of Saving Lives

AGENDA

- BiOZEEN introduction
- BiOZEEN portfolio
- BiOZEEN's approach for partnership with AVMI



**Advancing vaccine development and
manufacture in Africa (AGM), 24 – 25
September 2018, Freetown. Sierra Leone**



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INTRODUCTION

Value Added Integration Services



Automation



Training



Design & Build



Regulatory & Validation Services

Bioprocess Engineering



COMPLETE
**BIOPROCESS
ENGINEERING**
SOLUTIONS

 **BiOZEEN**





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Total Solution Partner to the Biotech World



HEAD QUARTERS

- Lush green campus spread across 4 Hectares
- GMP modelled Bio-Pilot Laboratory across 7,500 Sq. ft with state of the art equipments
- Design & Manufacturing Centre spread across area of 35,000 sq.ft with integrated FAT centre

MANUFACTURING CENTRE - II

- Manufacturing centre located in Hardware Park, Bangalore
- Floor area of 50,000 sq.ft with state of the art of the equipments





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BIOZEEN

DESIGN & BUILD AND TRAINING CAPABILITIES

Our Expertise



Key Activities



Bioprocess Engineering

- P & ID
- Equipment Design
- Pipe Sizing
- Selection of Bought Out Components
- Generation of Valve Matrix



Automation Solutions

- Automation Architecture
- Hardware Selection
- SCADA Development
- PLC Programming



Qualification & Documentation

- Develop Test Procedures (DQ, IQ & OQ)
- Perform Installation Checks
- Perform Operational Checks
- Compile Test Reports as per Current GDP

Specific Equipment design to meet:

- Critical process parameter that impact in product quality attributes
- GMP requirement for vaccine production (cleaning, sterilization, contention, monitoring and control, date integrity, validation, maintenance. PAT
- Safety requirements (operators, clean room, environment
- Risk management

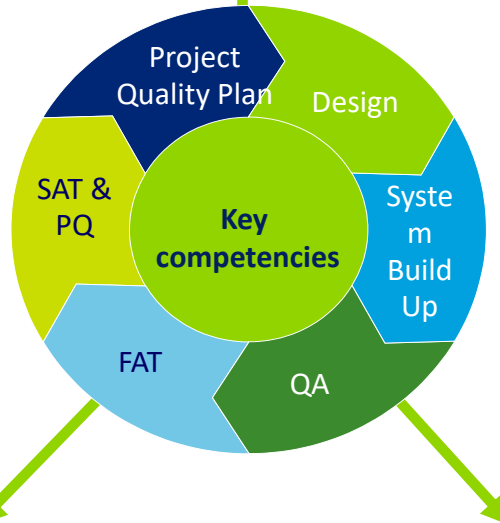
Training :

- Impact in the process consistence
- Better understanding of the cycle: equipment operation-process implementation- final product quality attributes.
- Better supervision and control
- Reduce failures and costs



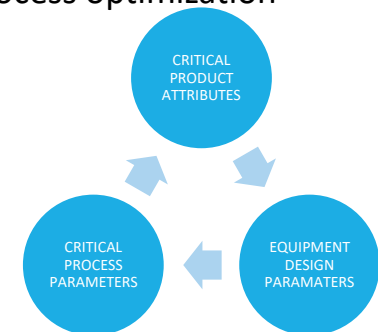
Skilled Manpower

Technical complexity



Process understanding :

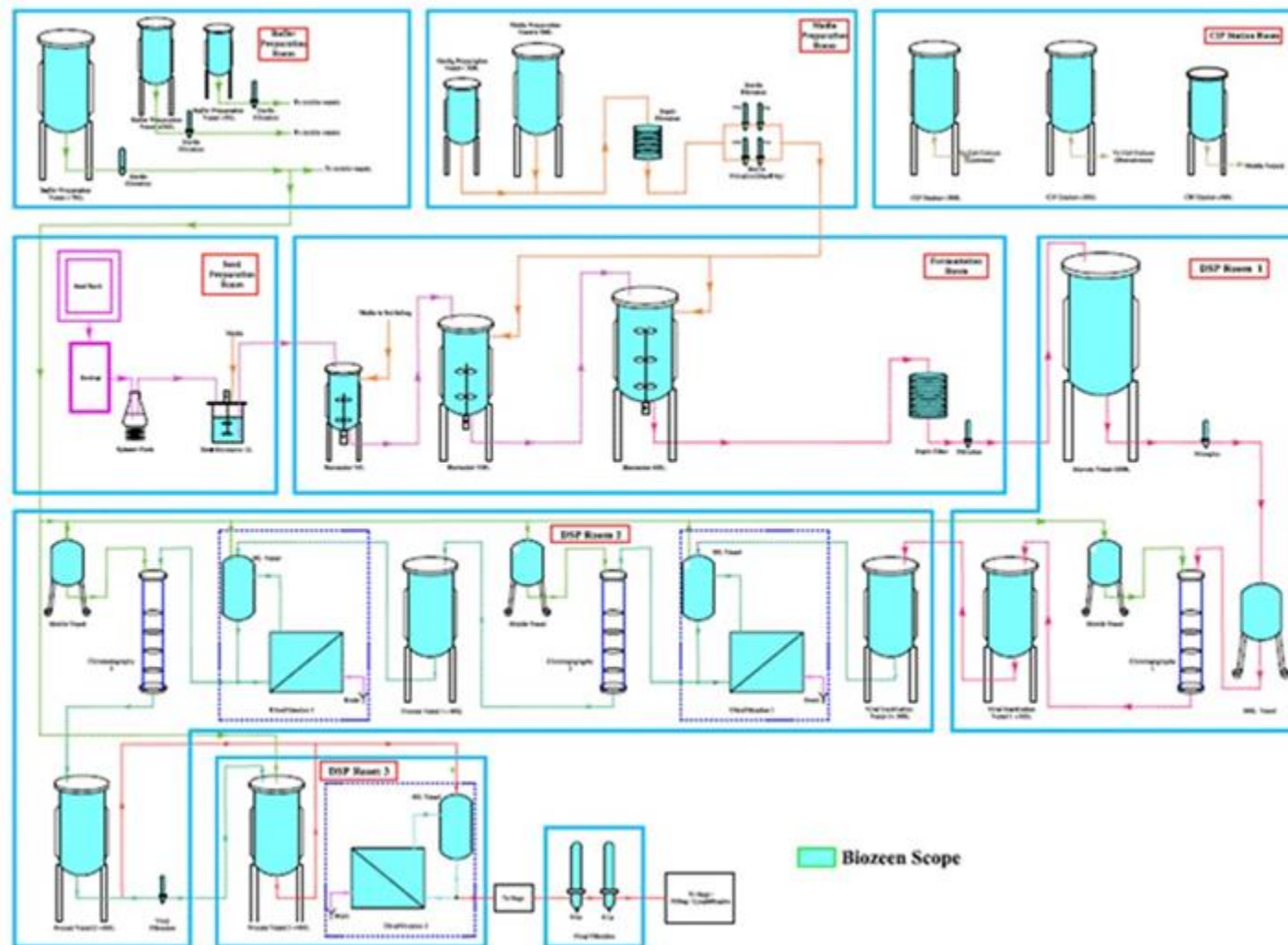
- Variables with impact in yield, recovery and quality of the product (QbD).
- Acceptance criteria regulated for in process control and final quality attributes (Ex, WHO requirements)
- Risk management approach
- Process optimization



Process Know-how

SCOPE OF SERVICES

A representative process flow diagram indicating BiOZEEN Scope in Biopharmaceutical production value chain



BIOZEEN product portfolio covers 70% of the entire (Bio)Pharmaceutical manufacturing value chain

BIOZEEN CLIENTELE SNAPSHOT



BIOZEEN CLIENTELE SNAPSHOT





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BIOZEEN PRODUCT PORTFOLIO



PRODUCT PORTFOLIO



Fermentors &
Bioreactors

Super Skids

Media, Buffer,
Process Tanks

CIP – SIP
Systems

Biokill Systems

UF & MF
Systems

Process
Interconnection
Piping

Automation
Systems





BIOZEEN PNEUMOCOCCUS SKID FERMENTER

PRODUCT PORTFOLIO



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**Continuous Bio Kill
System, Installed in
Netherlands and
operational since 2015**



**Installed and
operational in South
Africa since 2013**

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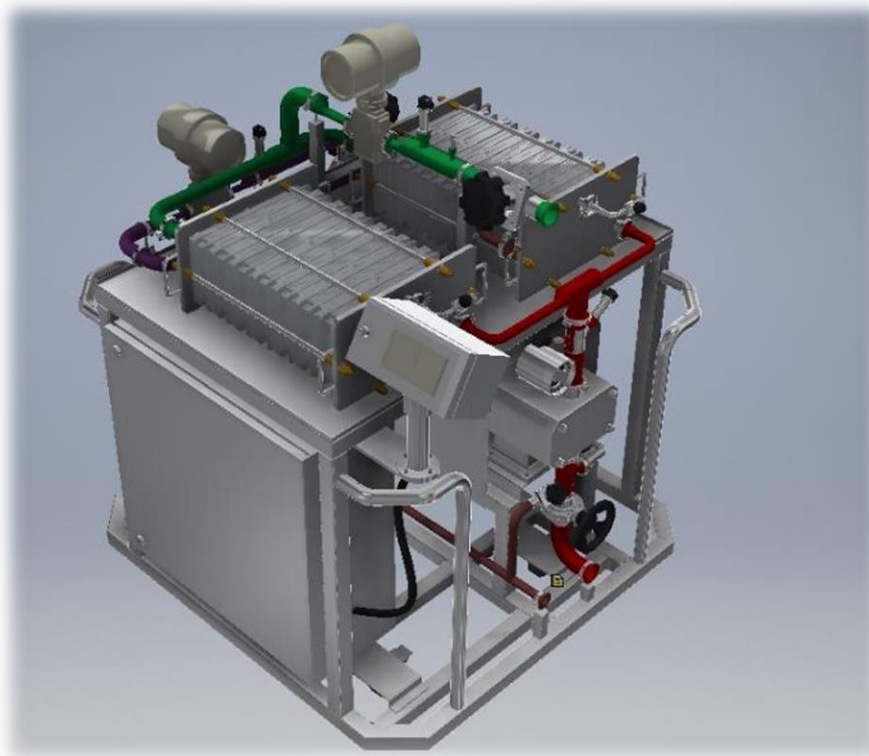
CIP – SIP
Systems

Biokill Systems

UF & MF
Systems

Process
Interconnection
Piping

Automation
Systems



Cassette Type Filtration System



Filtration System attached with Bioreactor

PRODUCT PORTFOLIO



Fermentors &
Bioreactors

Super Skids

Media, Buffer,
Process Tanks

CIP – SIP Systems

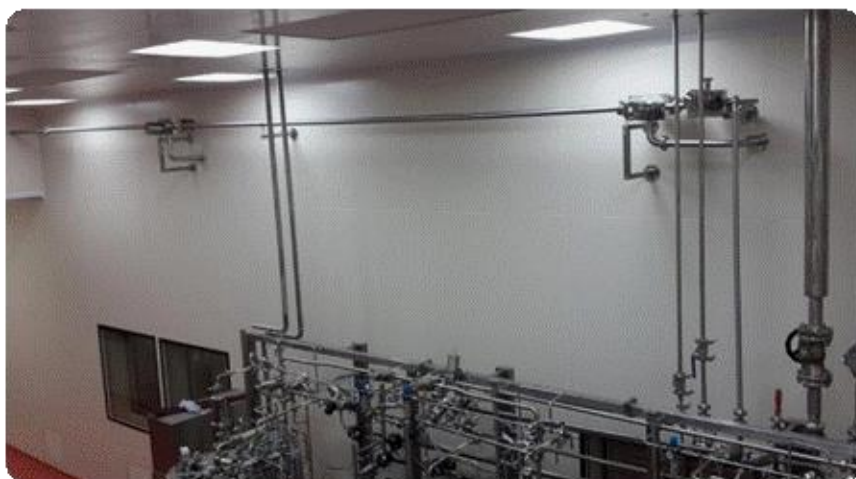
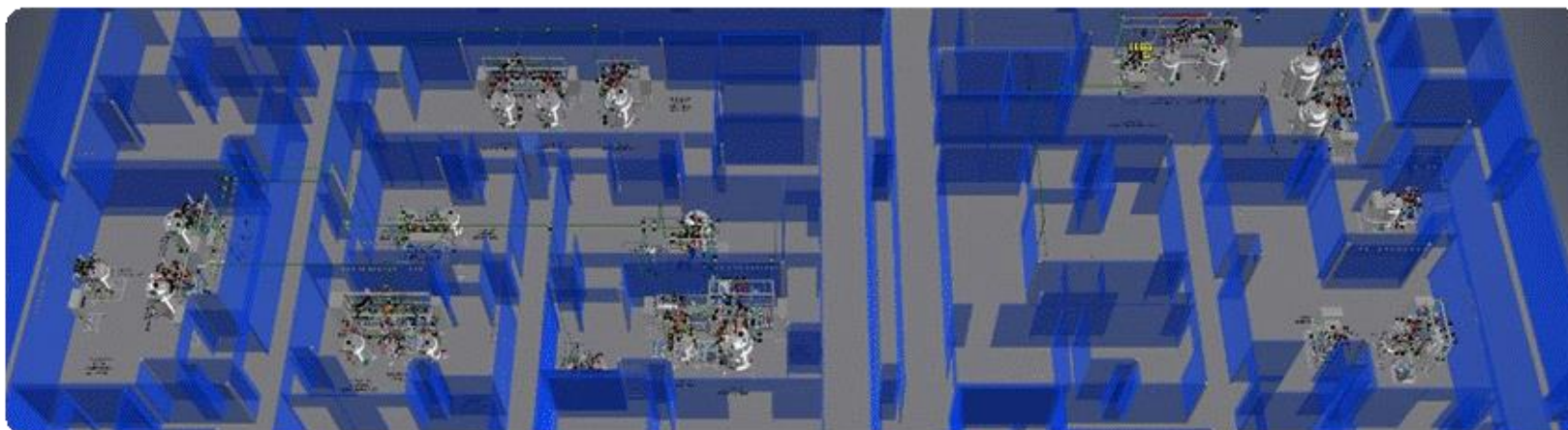
Biokill Systems

Ultra Filtration &
Micro Filtration
Systems

Process
Interconnection
and integration

Automation
Systems

Process and CIP Design to Installation via Digital Prototyping



PRODUCT PORTFOLIO



Fermentors &
Bioreactors

Super Skids

Media, Buffer,
Process Tanks

CIP – SIP Systems

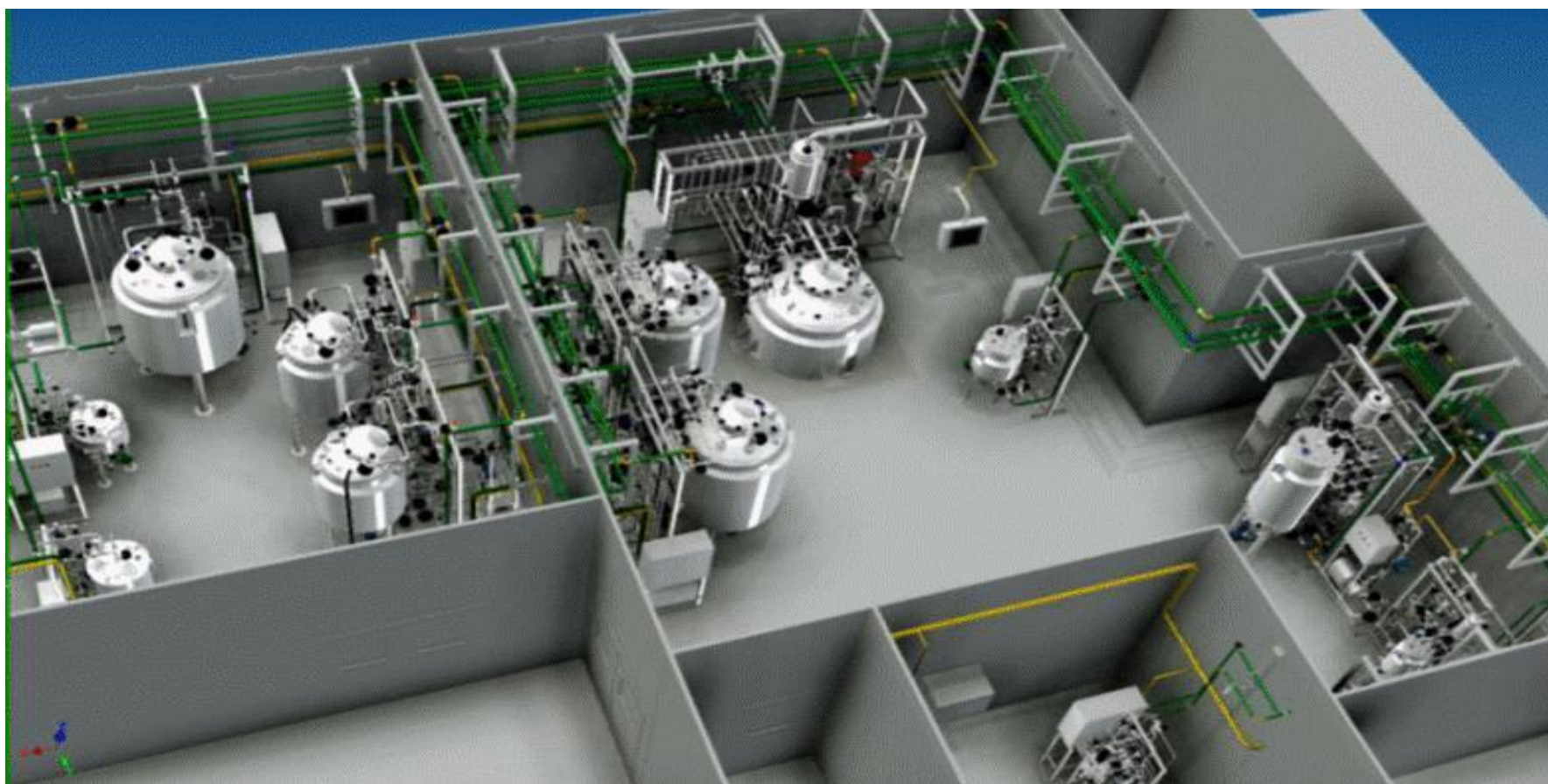
Biokill Systems

Ultra Filtration &
Micro Filtration
Systems

Process
Interconnection
and integration

Automation
Systems

The products are designed, engineered & manufactured to suit customers GMP facility. Customer can view the blue print of the equipment designed as per their existing, retrofitted or new facility requirements



Fermentors &
Bioreactors

Super Skids

Media, Buffer,
Process Tanks

CIP – SIP Systems

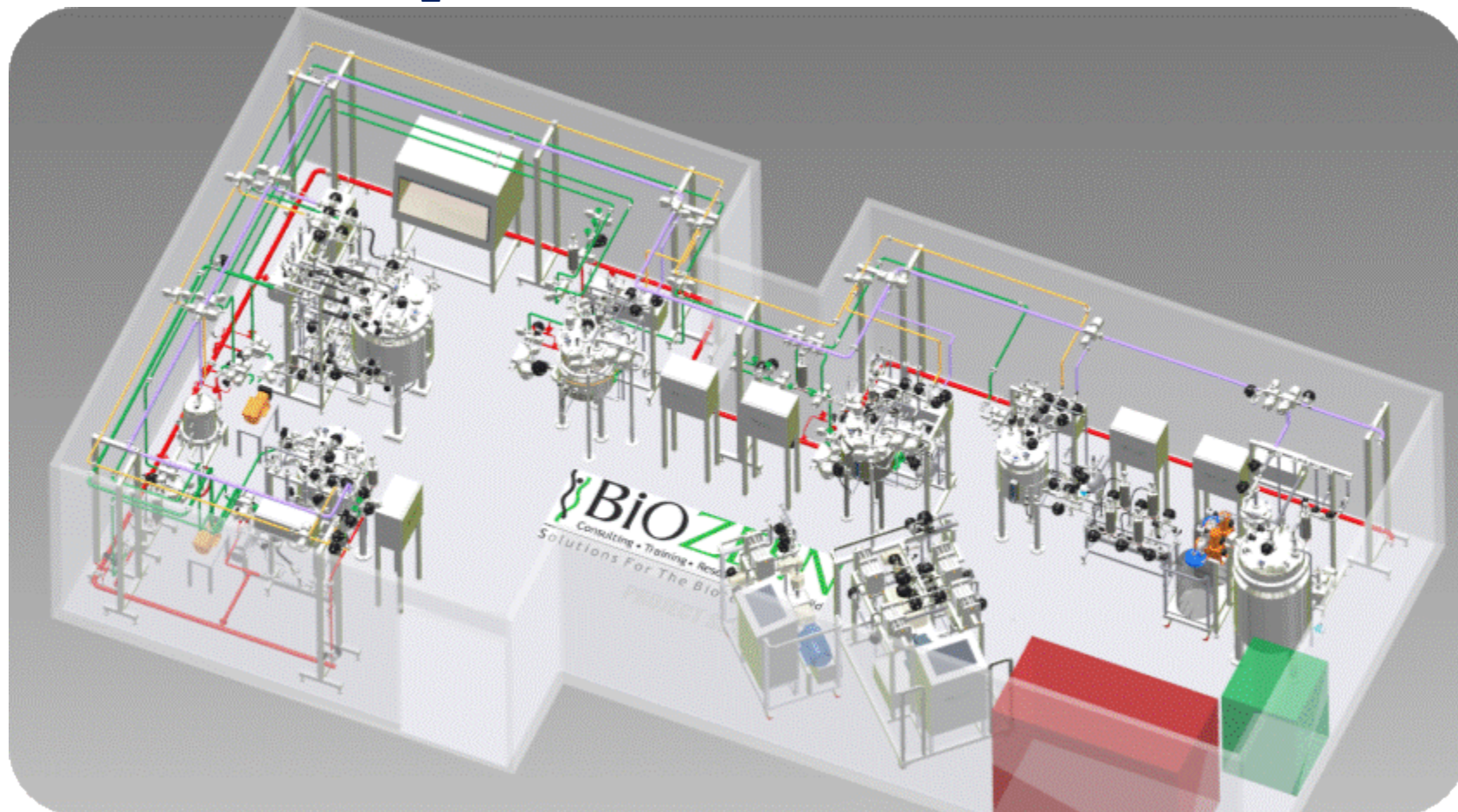
Biokill Systems

Ultra Filtration &
Micro Filtration
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Process
Interconnection
and integration

Automation
Systems

CONJUGATION SUITE _ DIGITAL PROTOTYPE. HIB CONJUGATED VACCINE



PRODUCT PORTFOLIO



Fermentors & Bioreactors

Super Skids

Media, Buffer, Process Tanks

CIP – SIP Systems

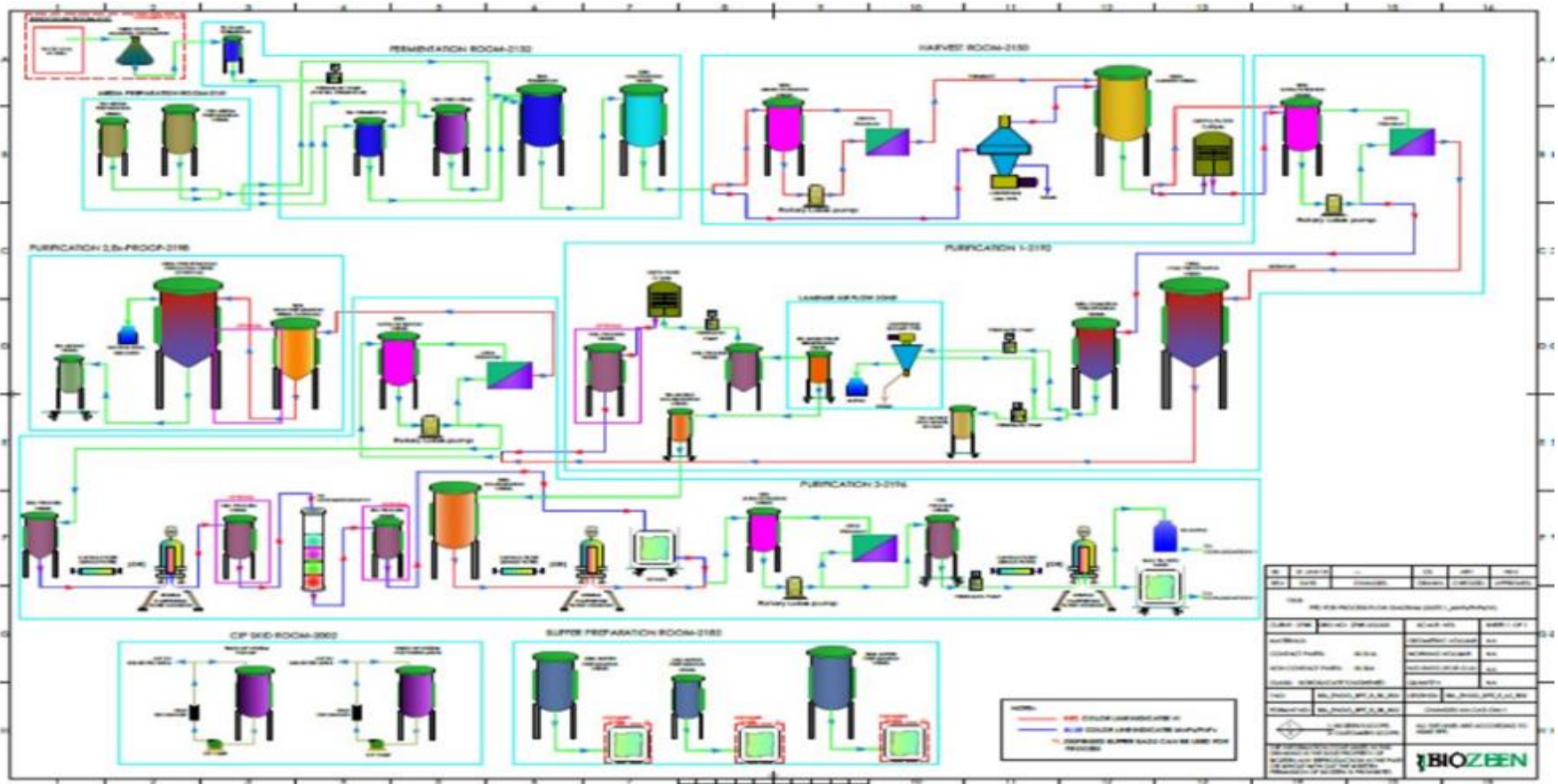
Biokill Systems

Ultra Filtration & Micro Filtration Systems

Process Interconnection and Integration

Automation Systems

The products are designed, engineered & manufactured to suit customers GMP facility. Customer can view the blue print of the equipment designed as per their existing, retrofitted or new facility requirements



Close system for inoculum



Sampling device for sterile operation



Fermenter with CIP-SIP station



- It is not an easy work.....
- New DQ, IO; OQ and documentation will be needed
- New sequences will be involved
- Changes could not affect the design space but need to be confirmed
- New updated of process technology and automation
- Could allow GMP for non GMP equipment
- Less cost of investment
- Control changes should consider as a new equipment
- New variables could be added (Ex: Glucose sensor or opacity: PAT)

Mechanical modification for spray ball connection to perform CIP



New control panel with SCADA



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Interconnection
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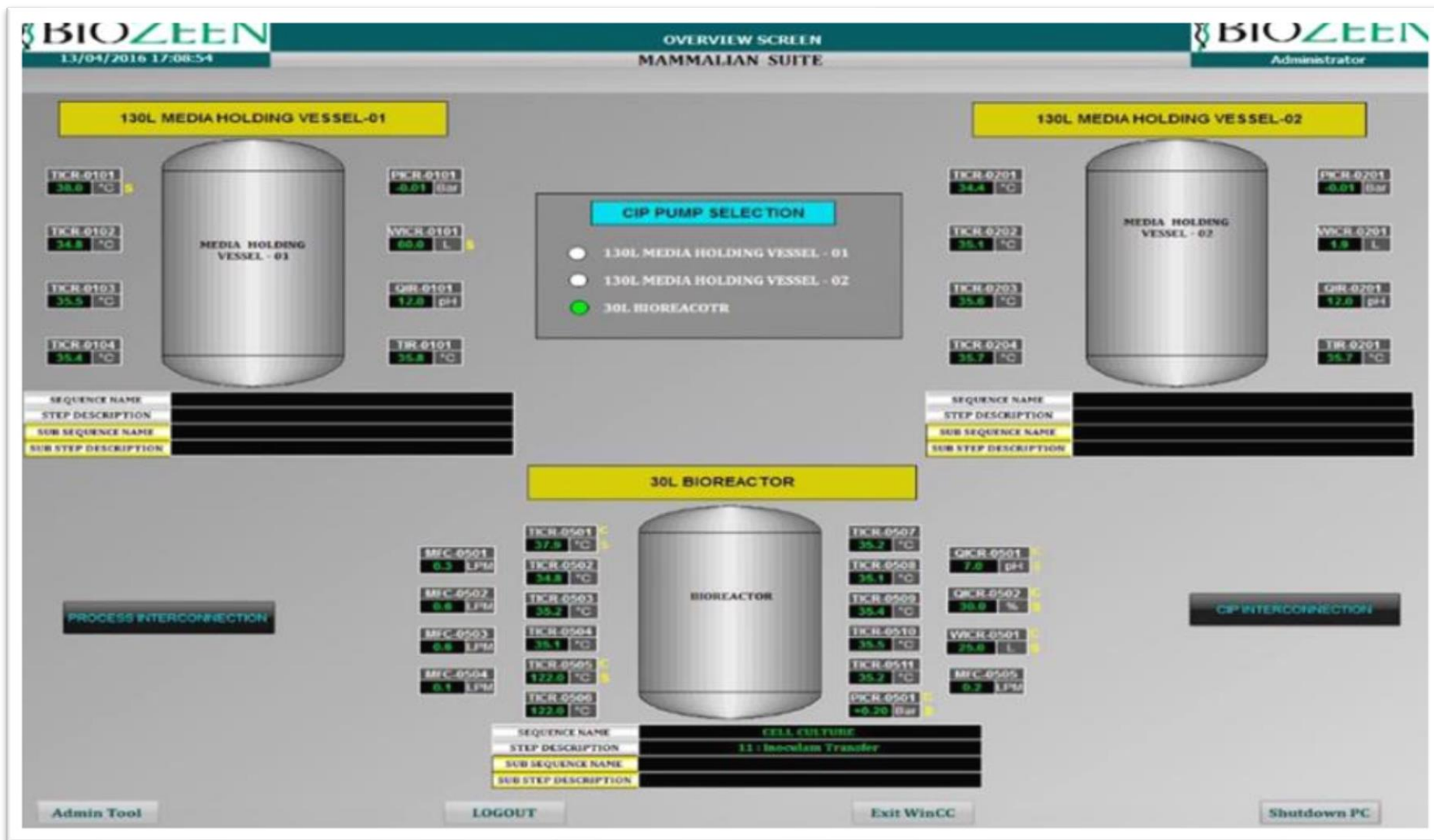
CIP – SIP Systems

Biokill Systems

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Process Interconnection Piping

Automation Systems



PRODUCT PORTFOLIO



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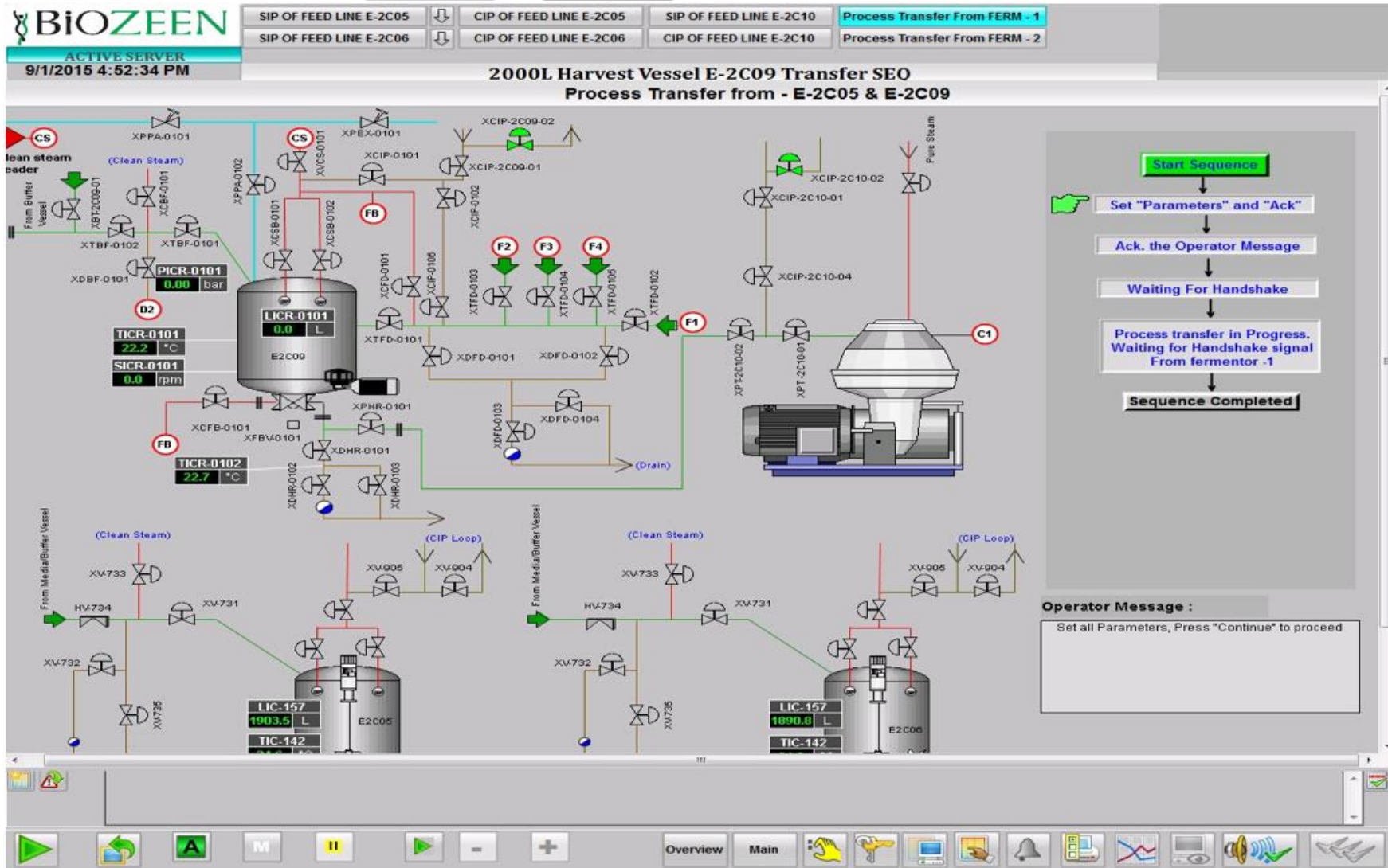
CIP – SIP Systems

Biokill Systems

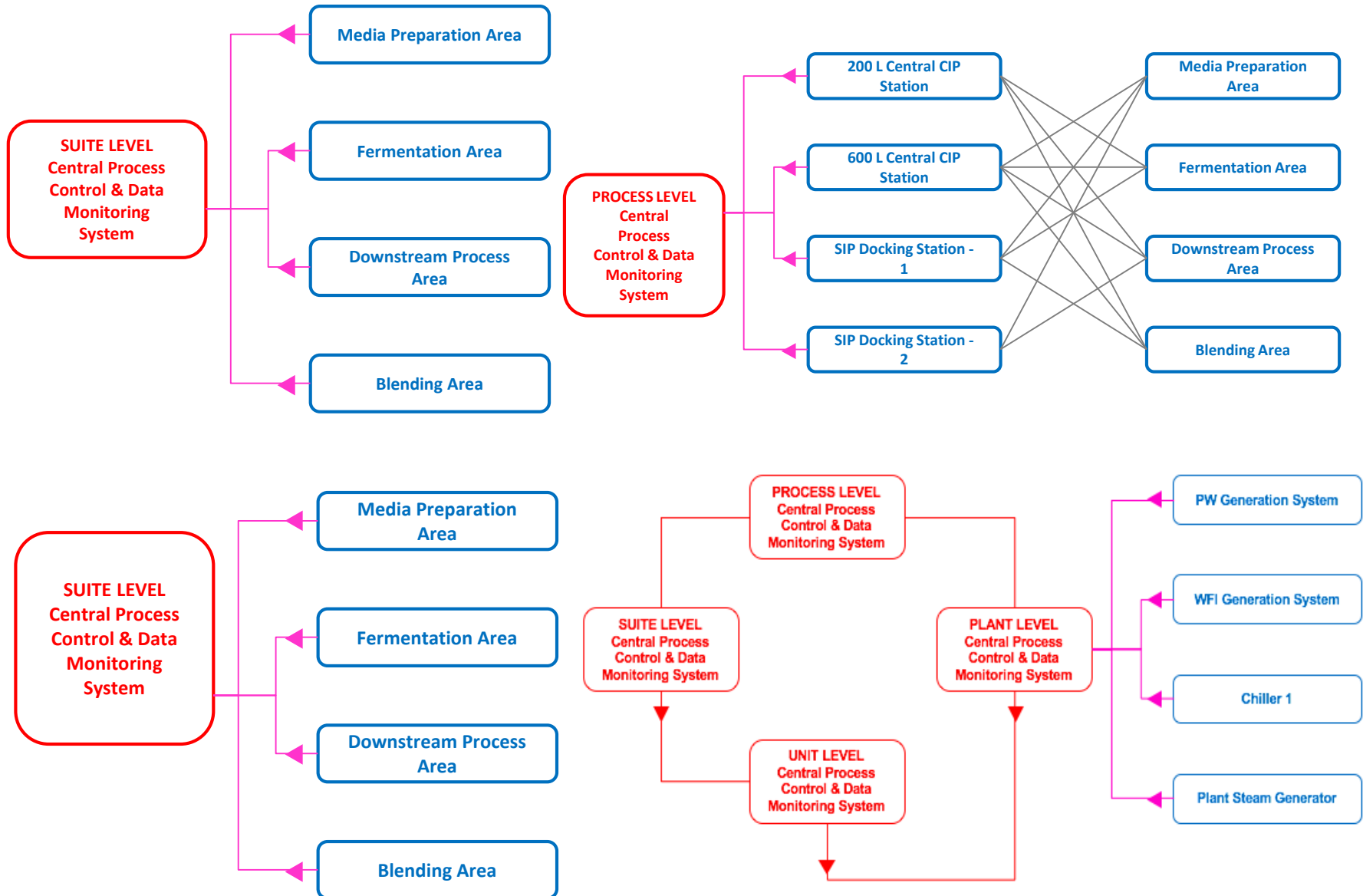
UF & MF Systems

Process Interconnection Piping

Automation Systems



AUTOMATION CAPABILITIES





- GMP modelled Bio-Pilot Laboratory in line with clean room concepts
- 7,500+sq ft. area of Bio-Pilot Laboratory that simulates the drug manufacturing life cycle with the provision to practice theoretical concepts in state-of-the-art facility with “what could go wrong?” generators
- Training Partner for some of the leading pharma and biopharmaceutical companies across the globe.
- Recognized by the Department of Biotechnology, Govt of India and DSIR recognized in house R&D Centre
- Partner to BCIL, DBT for training of fresh graduates for the industry.



STATE OF THE ART UPSTREAM AND DOWNSTREAM PROCESSING EQUIPMENTS

PROCESS, EQUIPMENT, PEOPLE



Design Build Solutions

- Bioreactor systems
- Fermentor systems
- Process systems
- CIP and SIP systems
- Filtration systems
- Bio-Kill systems
- Sanitary Vessels
- Crystallizers
- Interconnection piping



Automation Solutions

- Plant Automation
- PLC Programming
- DCS Systems
- Automation Up gradation



Technology Services

- Process Design
- Process Optimization
- Contamination trouble shooting
- Process Validation
- Project Management



Research & Development

- Efficiency Improvement studies
- Glycosylation
- Perfusion with micro carriers
- Algae culture
- High cell density of VERO / CHO cell lines



Manpower Training

- Fermentation Technology
- Mammalian Cell Culture Technology
- Downstream Processing
- Sterilization & Filtration Technology
- Bioprocess Engineering
- Regulatory Aspects & Documentation



BiOZEEN Regulatory Services

- Filter Train Optimization Study
- Compatibility Study
- Product based Integrity Study
- Bacterial Retention Study
- Protein & Preservative Binding Study

Total Solution Partner to the Biotech World



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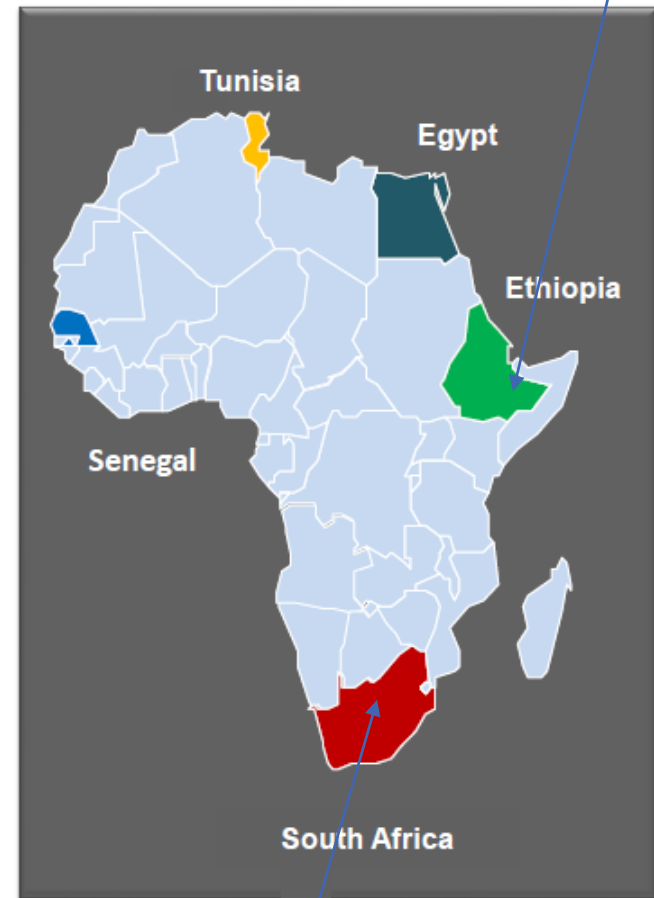


BiOZEEN's Approach for Partnership with AVMI



BioZEEN's OBJECTIVE

To help in
**Strengthen the local
production of Vaccines,
Biologicals and Generics in
Africa** through the services
we provide



*EPHI, Initial
development

*Biovac (Fill and Finish)

- ❑ Robust automated bioprocess technologies to enable the biopharmaceutical industry manufacture regulatory compliant and economically competitive Vaccines, Biologicals and Generics.
- ❑ Expertise and experience in Bioprocess Engineering, Plant Automation, Fabrication Technologies and User Know-How.
- ❑ Synthesize customized bioprocess hardware and automation infrastructure for enhanced productivity.
- ❑ Educate industry professionals and fresh graduates to be trained to reduce rejects and increase yields.

Product Support: **Design and Build Solutions:** Manufactures bioprocess hardware such as Bioreactors, Fermenters, Cleaning-in-Place System, Sterilization-in-Place System, Filtration Skids, Process vessels, Inactivation system and Crystallizer for the biopharmaceutical industry.

Process Support: : Our philosophy is to **integrate bioprocess, engineering, automation** and compliance expertise to support each phase of the Biopharmaceutical and Biologics manufacturing life – cycle.

People Support: Training & Development: **Providing the skills for the industry** and academia in a GMP modelled Bio-Pilot Laboratory with both upstream and downstream processes, to reduce rejects and increase yields.

RESPONSIBILITY MATRIX FOR A COMPLETE PROJECT SCOPE

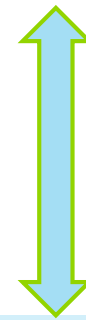
A responsibility matrix for complete project involve Biozeen and the final clients as a close partner

Project conceptualization	Facility conceptual design and URS	Basic and Detail design	Procurements Construction of facility and Equipment	Installation	Start up	Operation
Biozeen scope			Biozeen scope	Biozeen scope Final client scope	Final client scope Biozeen scope	Final client scope
Definition of all system, subsystems, production capacity, process flow diagram, equipment dimension, technology to be used, market focused, regulation (FDA, OMS, EMA), release and in process product specification, etc. In parallel studies for feasibility and scale up in pilot plant should be conducted			Acquisition steps for equipment and facility (Ej. Clean room panel, etc)	Commissioning , IQ, OQ, equipment qualification Personal training Implementation of production technology and analytic methods , documentation (SOP) for equipment and process. Programs for cleaning, environmental and water monitoring, maintenance, sampling.		Process Validation Concurrent validation, PQ Production of consistence lots, change control.

According with WHO Building a manufacturing facility of 20 million doses can cost USD 60 million to USD 130 million, depending on vaccine technology and formulation strategy (CAPEX 60 % of total cost (scale economy-new technologies, etc)



"It is necessary to explore various and diverse funding and financing options for optimizing both CAPEX and OPEX. Furthermore, by collating learnings from DCVMs, it should be possible to develop strategies for cost driver reduction". VMPA study report 2017



- Cost effective proposal for turnkey projects
- High level of automation and process/facility integration with less personnel involved
- Full customized and innovative design and building approach
- Personal training in vaccine process technologies and GMP
- Fast delivery
- Transparency and close partnership with clients



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Thank You