



*MULTIMODAL NANOPARTICLE FOR STRUCTURAL
AND FUNCTIONAL TRACKING OF STEM CELL
THERAPY ON MUSCLE REGENERATION*

30.10.2019,
nTRACK Open Day,
Cambridge, UK

This project has received funding from the European Union's
Horizon 2020 research and innovation programme under grant
agreement No 761031.



From conception through development to cGMP production

Formulation development

- Conventional formulation development
- Microparticle containing formulations
- Nanoparticle containing formulations
- Drug delivery systems
- Drug targeting applications
- Reformulation and product life cycle management

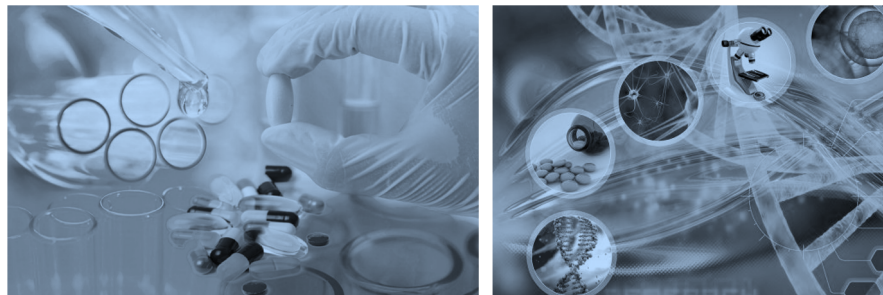
Technology transfer

- Optimization of existing formulations
- Optimization of existing production methods
- GMP transfer of lab scale formulations
- Production method establishment before clinical studies
- Scale up

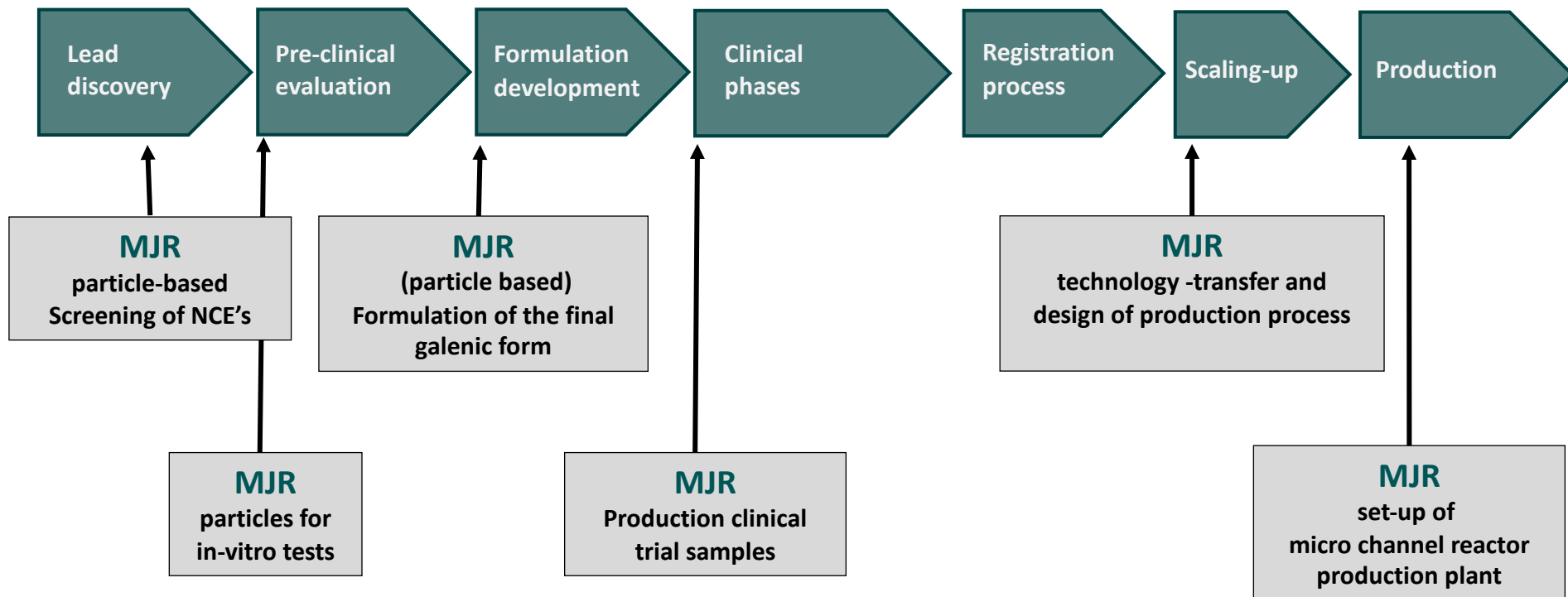
Production

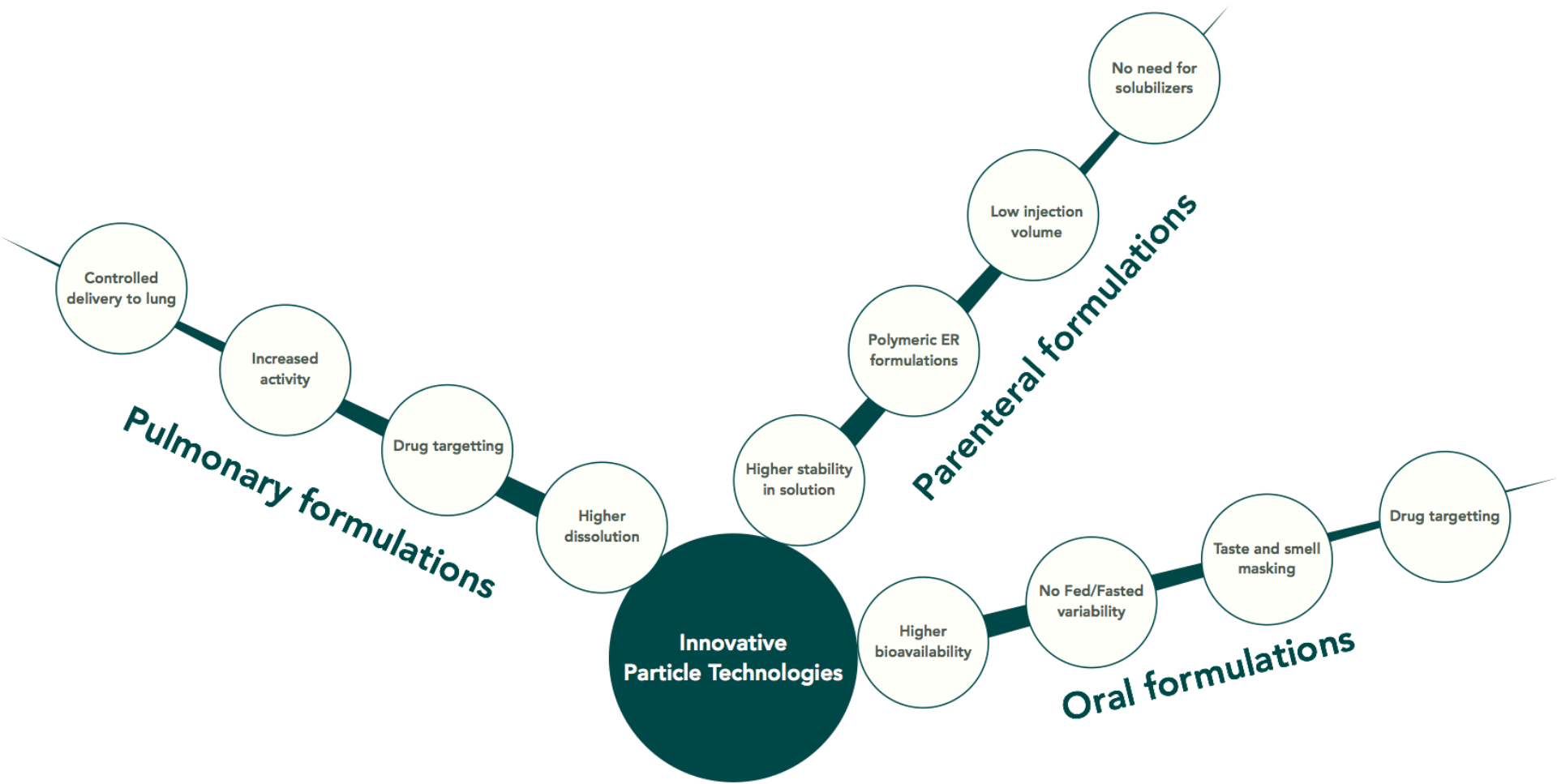
- Production of small trial batches
- CTM production
- Large scale production

- Common development of methods, where suitable
- Seamless transfer from R&D into the regulated GMP regime for production and quality control
- Fast and easy transfer of know-how and technologies from R&D into GMP
- Synergies lead to faster projects and lower costs
- Assure transfer of formulations from the product development to regulated GMP conditions and later to a stable production process and to a stable product
- Development and optimization work (D&O) harmonized to processes and needs of our customers



From conception through development to cGMP production





Solutions by MJR PharmJet

- **MJR PharmJet** offers different type of innovative methods for the pharmaceutical development
- **MJR PharmJet** supply solutions for challenging API's (with low solubility, unstable, toxic in high doses, ...)
- **MJR PharmJet** offers symbiosis between modern micro reactor technologies and other pharmaceutical processes
- **MJR PharmJet** has huge experience in transfer of the methods and processes to its customers with an uncomplicated scaling-up



Innovative methods for pharmaceutical development

For low soluble substances

- Wet granulation
- Hot Melt Extrusion (HME)
- Nano and micro particle development
- Complexation
- Spray drying / Lyophilization

For unstable substances

- Encapsulation
- Integration in matrix particles

Conventional technologies for scale-up

- High pressure homogenization
- Batch processes

Further innovative methods – uncomplicated scale-up possible

- Micro reactors
- Micro mixer
- Continuous mixer

Oral Formulations

- Improved bioavailability
- No “Fed / Fasted” variability

Parenteral formulations

- No need for solubilizers
- No need for surfactants
- Immediate dissolution after injection
- Low volume applications possible

Pulmonary formulations

- Increased activity
- Improved absorption

Scalability: Our technology is your guarantee for the scale up process. We can work with several grams of your API up to several tones for commercial production. All R&D and production processes are realized with the same technology setup.

Production yield: No product loss during production.

Homogenous particle size distribution: Repeatable and precise particle size distribution. Thanks to adjustable process parameters homogenous particle size distributions are guaranteed.

No heat generation: We can micronize any pharmaceutical ingredients, even those with a very low melting point (30°C-40°C).

EXISTING FORMULATIONS

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Production method optimization

Scale up from lab scale to pilot scale

Scale up from pilot scale to large scale

Optimization of formulations for GMP compliance

Optimization of production method for GMP compliance

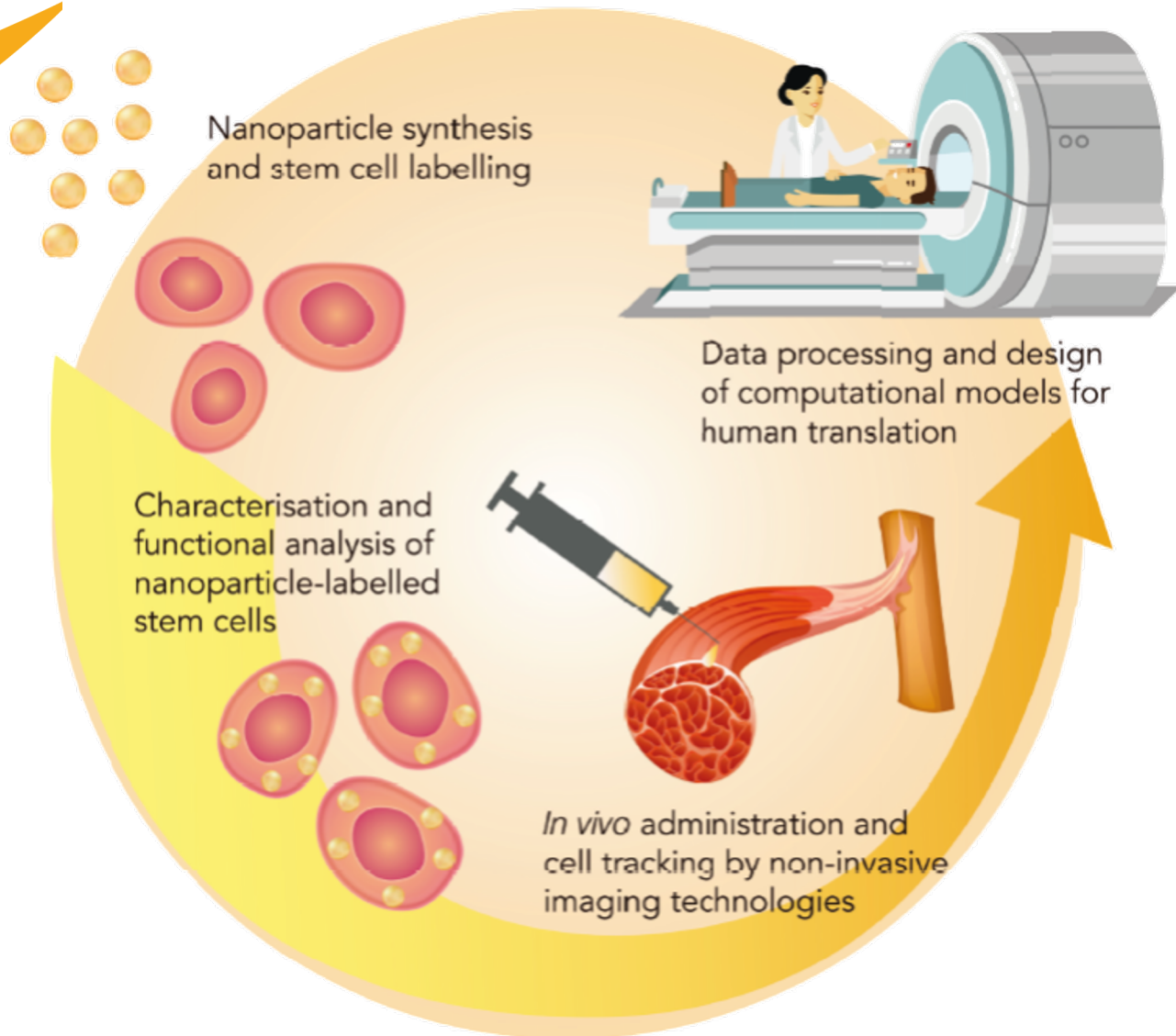
Production method establishment for CTM

MJR PharmJet technology transfer services

- Production method optimization to increase the GMP compliance and efficiency
- Scale up of production methods for particulate systems from particle production to end formulation
- Establishment of GMP compliant production method for particulate systems
- Optimization of existing formulations for a smooth GMP transfer
- GMP compliant method establishment for production of nanoparticles and microparticles
- Innovative GMP compliant technologies to meet required product specifications

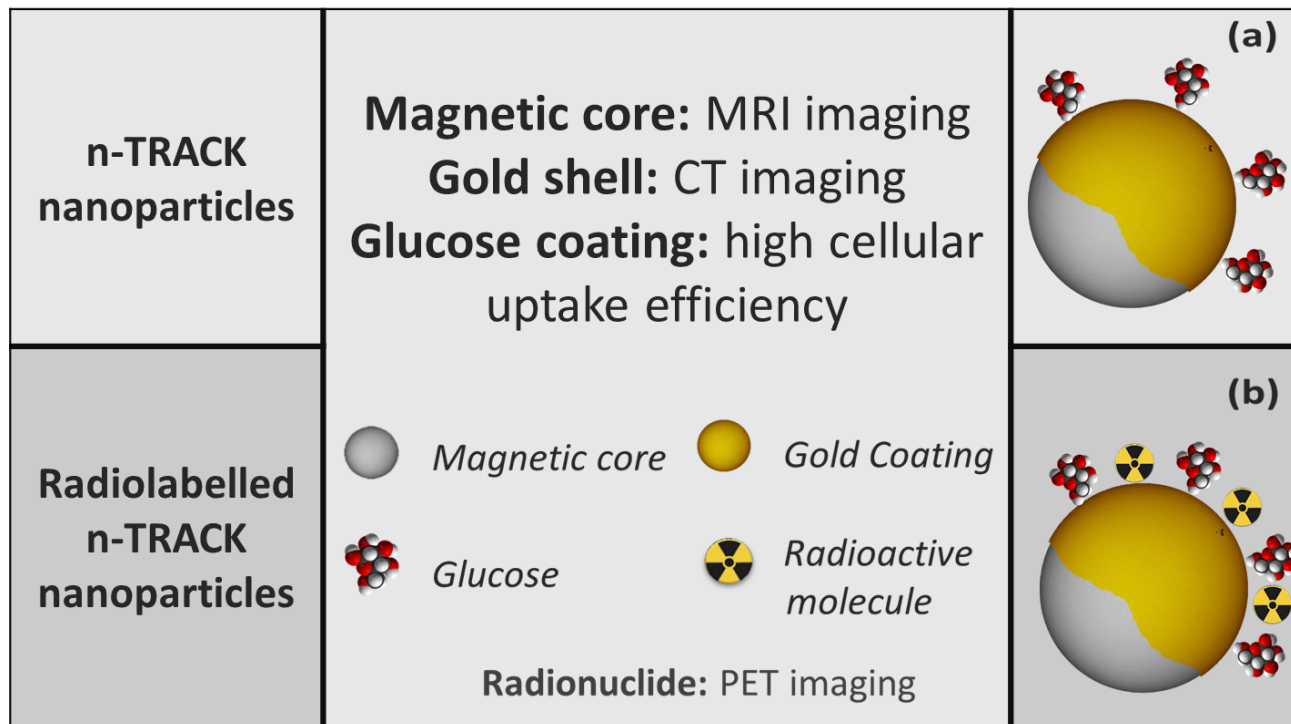


nTRACK develops a safe, scalable and highly sensitive multimodal cell nano-imaging agent ready for testing in humans. The nTRACK approach enables a non-invasive monitoring of the entire body, longitudinal and quantitative discrimination of living stem cells in humans using CT, MRI and PET, simultaneously.



Nanoparticle synthesis, characterization and functionalization

Multimodal Nanoparticles

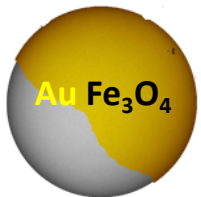


1. To synthesize magnetic core, gold-shell NPs (nTRACK NPs) to act both as MRI and CT contrast imaging agents
2. To functionalise the NPs with glucose, and either with or without radioactive tracers for PET
3. Physical and chemical characterisation
4. Upscale nTRACK NPs for GMP compliant manufacturing.

Aim

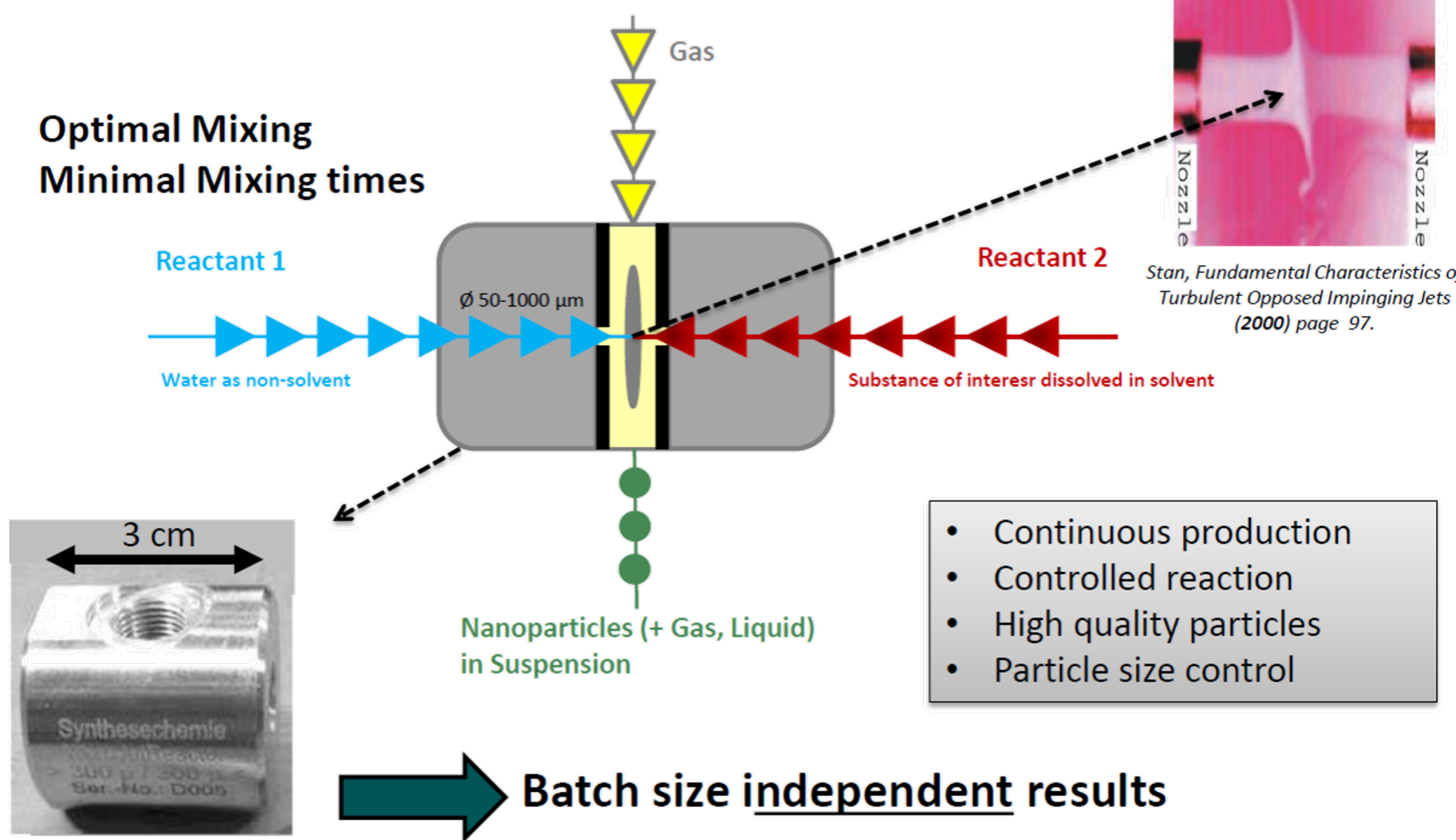


- **Core:**
- Production of iron nanoparticles
- Particle size <10 nm
- PDI<0.2
- 5 day stability at room temperature

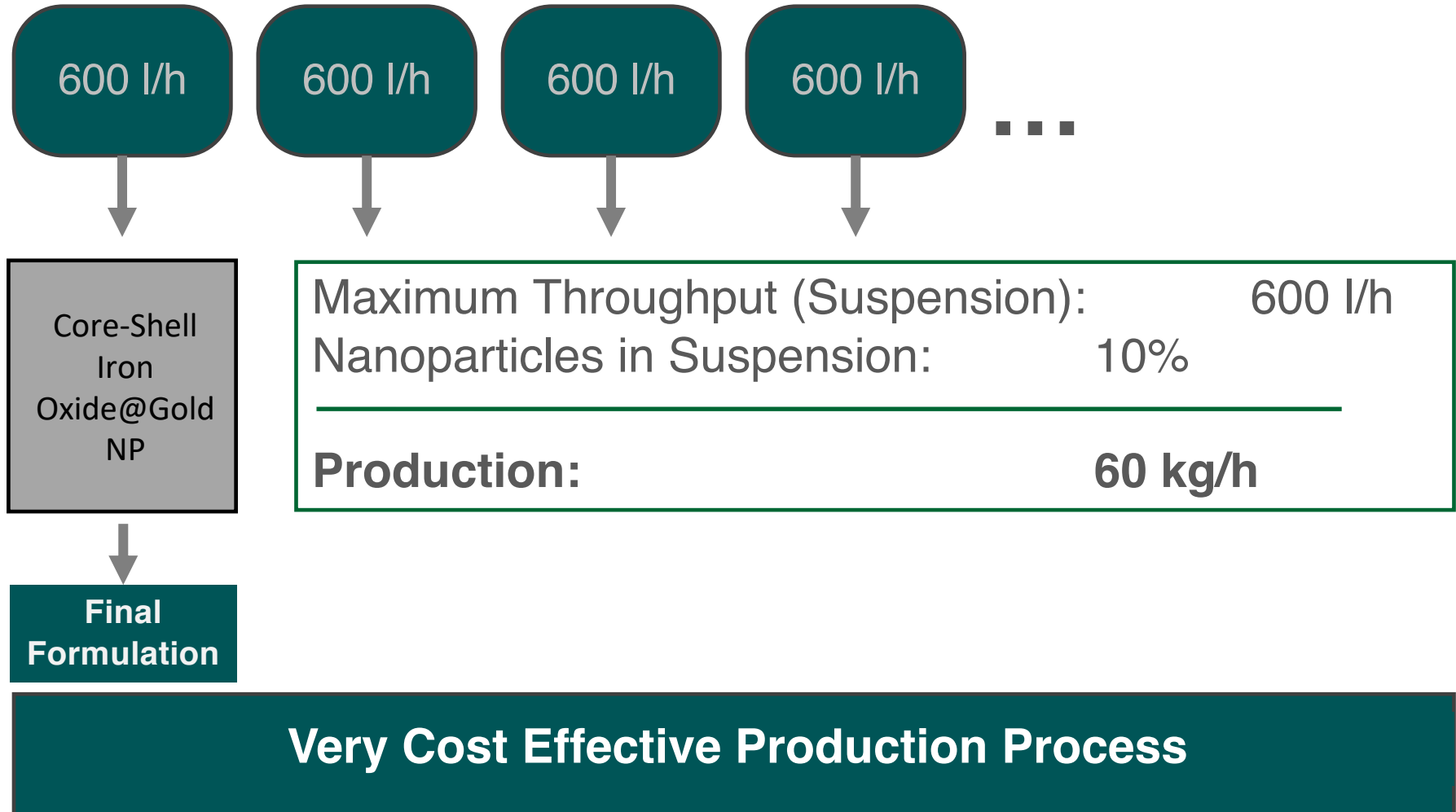


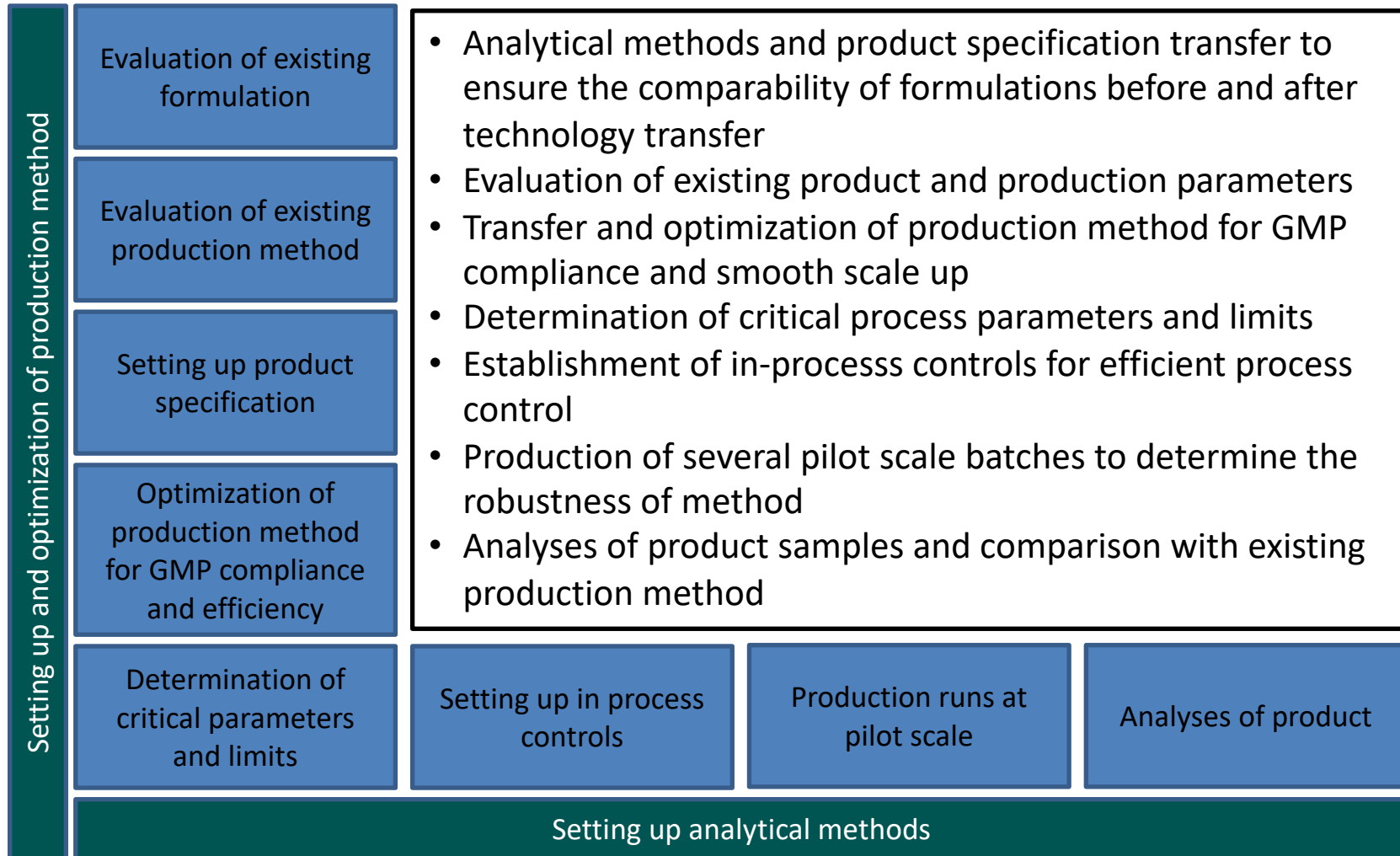
- **Core@Shell:**
- Production of gold coated iron nanoparticles
- Particle size <30 nm (8nm core + 18nm shell)
- PDI<0.2
- 5 day stability at room temperature

Microjet reactor technology for Core-Shell Iron Oxide@Gold NP synthesis

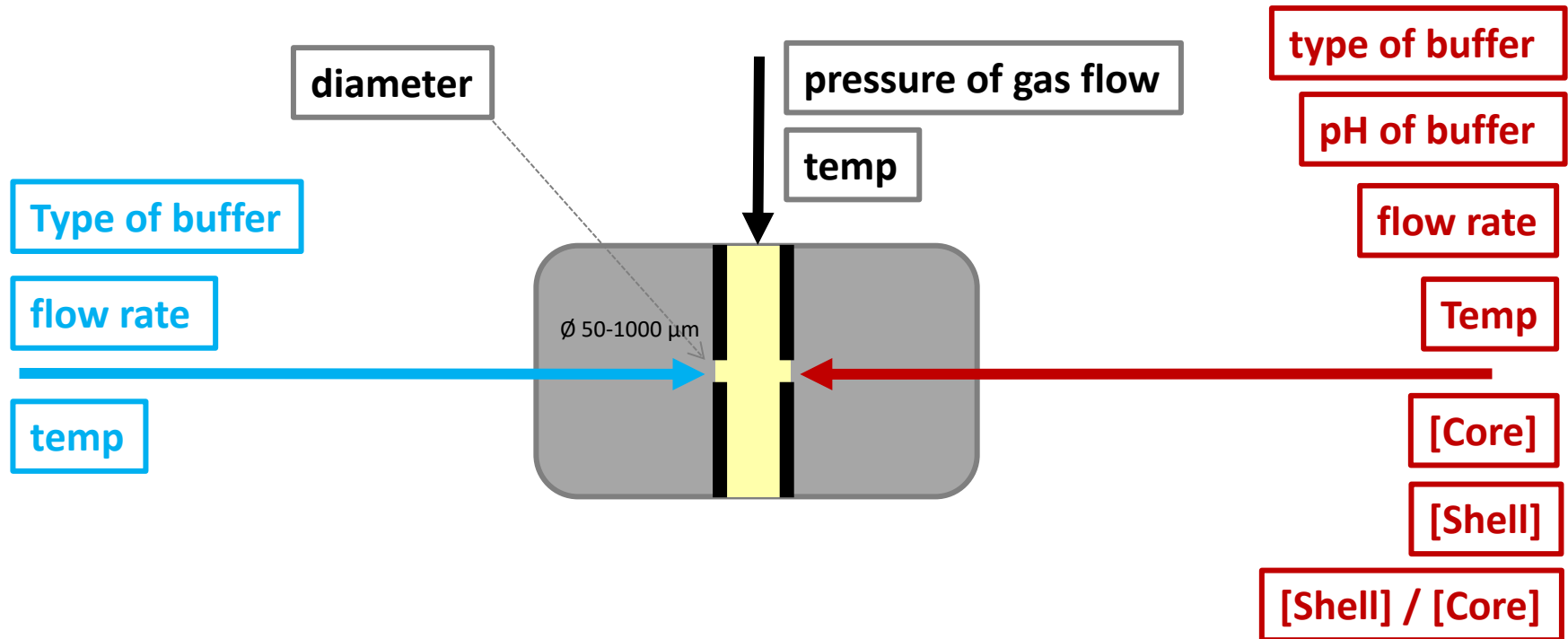


High Production Capacity through Parallelization



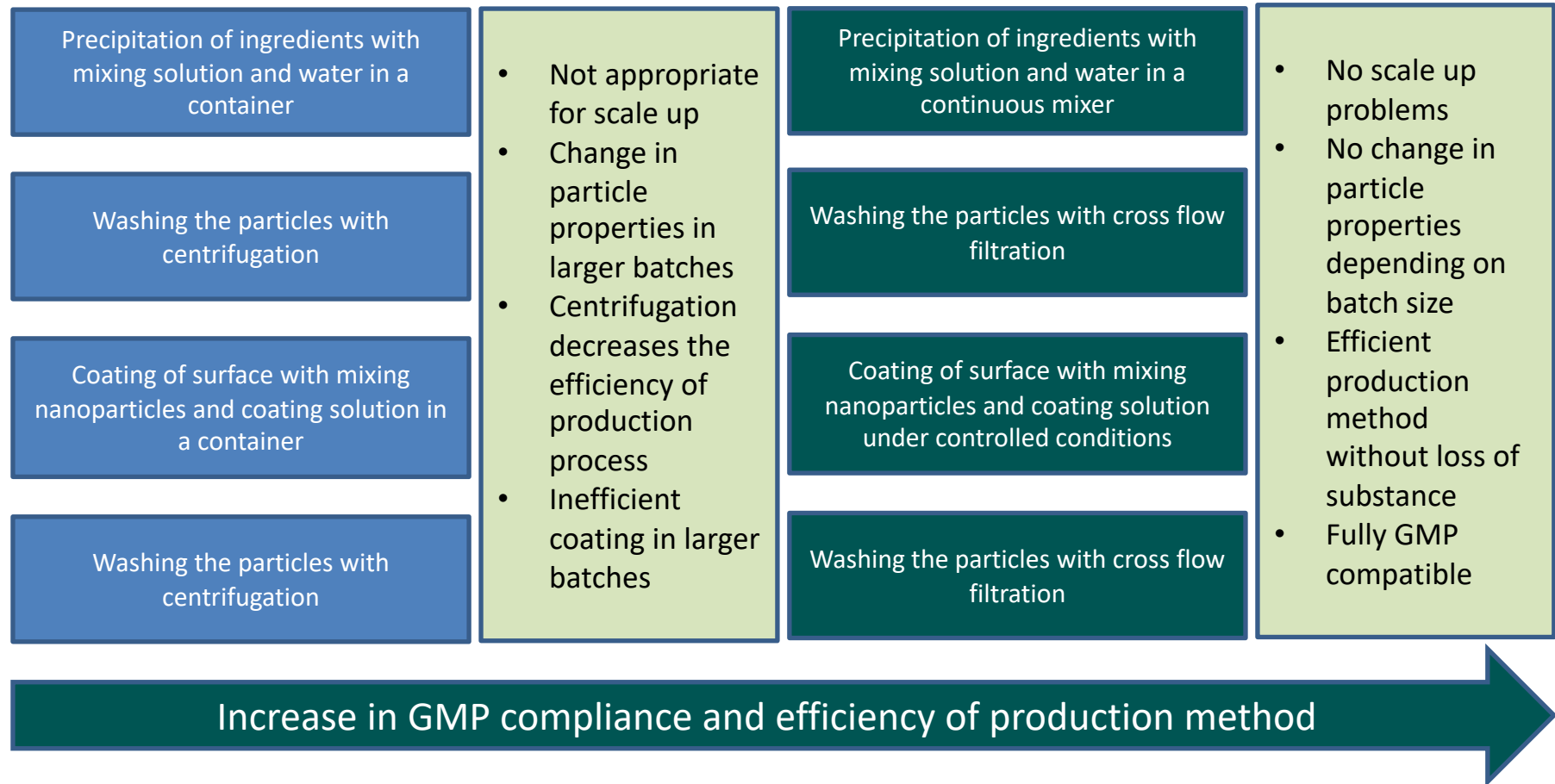


Process Parameters of MicroJetReactor



 Adjustment by only a few process parameters

Technology transfer concept

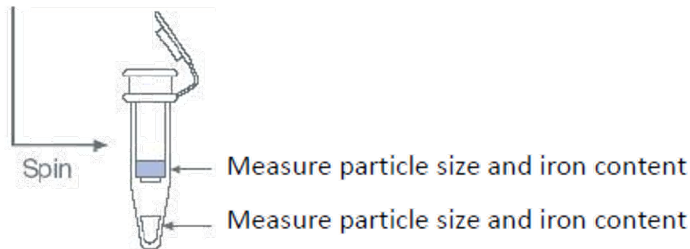


Lab Scale:

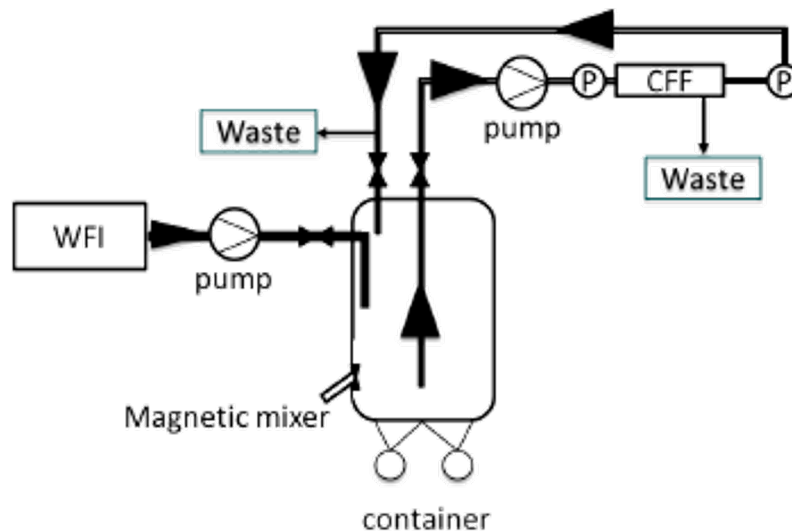
Commercially available with different cut-off MWCO for a variety of batch sizes



Polydisperse samples were **centrifuged** and small particle size fraction was employed for gold coating



✓ Process step is successfully replaced with industrial applicable and GMP conformed method

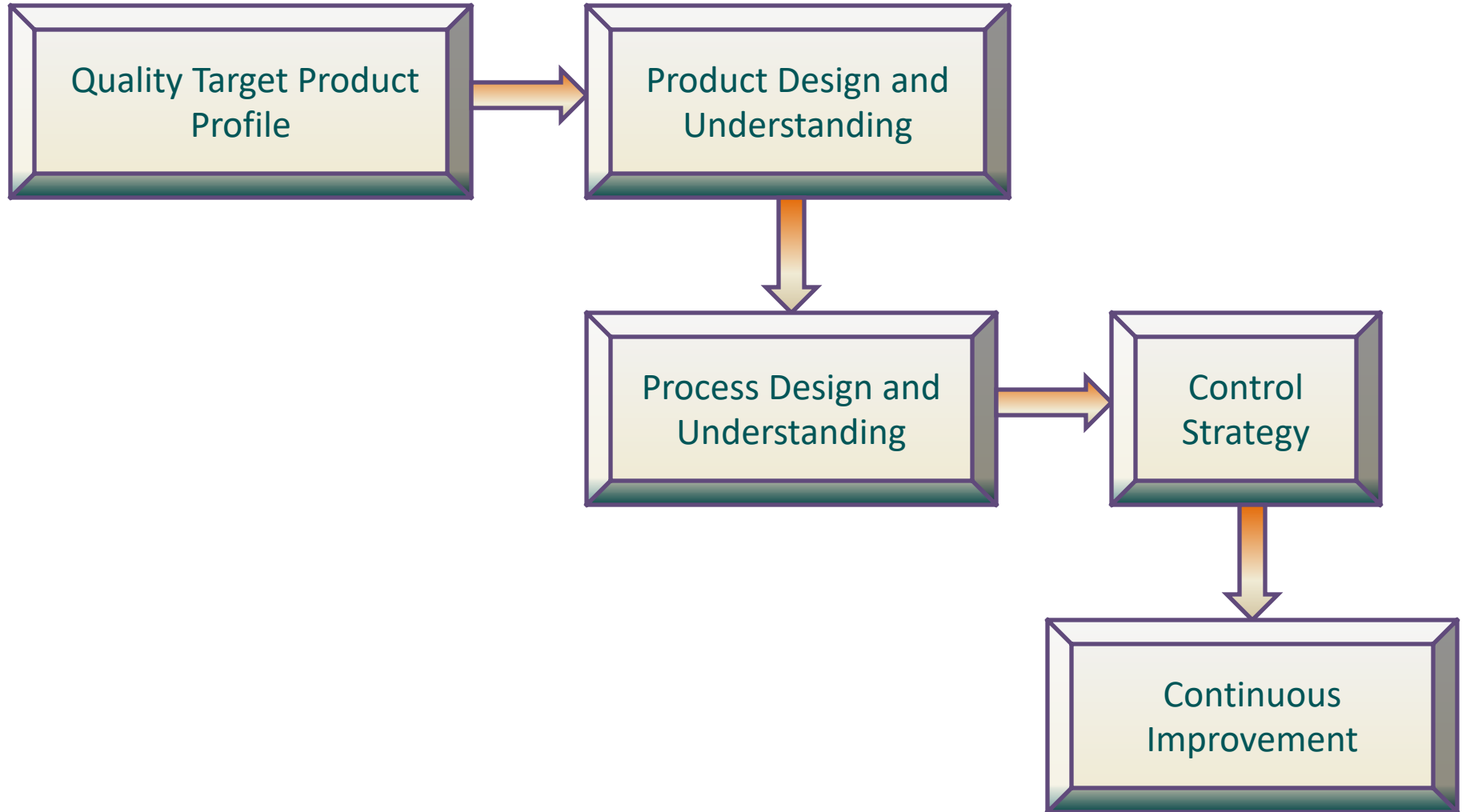


Industrial Scale:
Continuous purification
method via **tangential flow
filtration**

Purification and Downstream processing

- Single pot equipment
- Efficient control of process parameters
- No risk of contamination

Overview of QbD approach of Development



- Systematic, holistic and proactive approach employed for pharmaceutical development.
- Objectives and QTTP pre-defined and continuously updated
- CQA and CPP are defined
- IPC are identified and developed to ensure quality
- Efficiency and cost saving for industrial application
 - Increased efficiency of manufacturing process
 - Minimized / eliminated potential compliance actions
- More information at <https://www.n-track.eu/>

Partner for your
development projects in
pharma, med-tech and
biotech

