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Impact of local fluidized bed hydrodynamics on interactions between particles and gas-liquid sprays

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Maryam Mohagheghi, Franco Berruti, **Cedric Briens**

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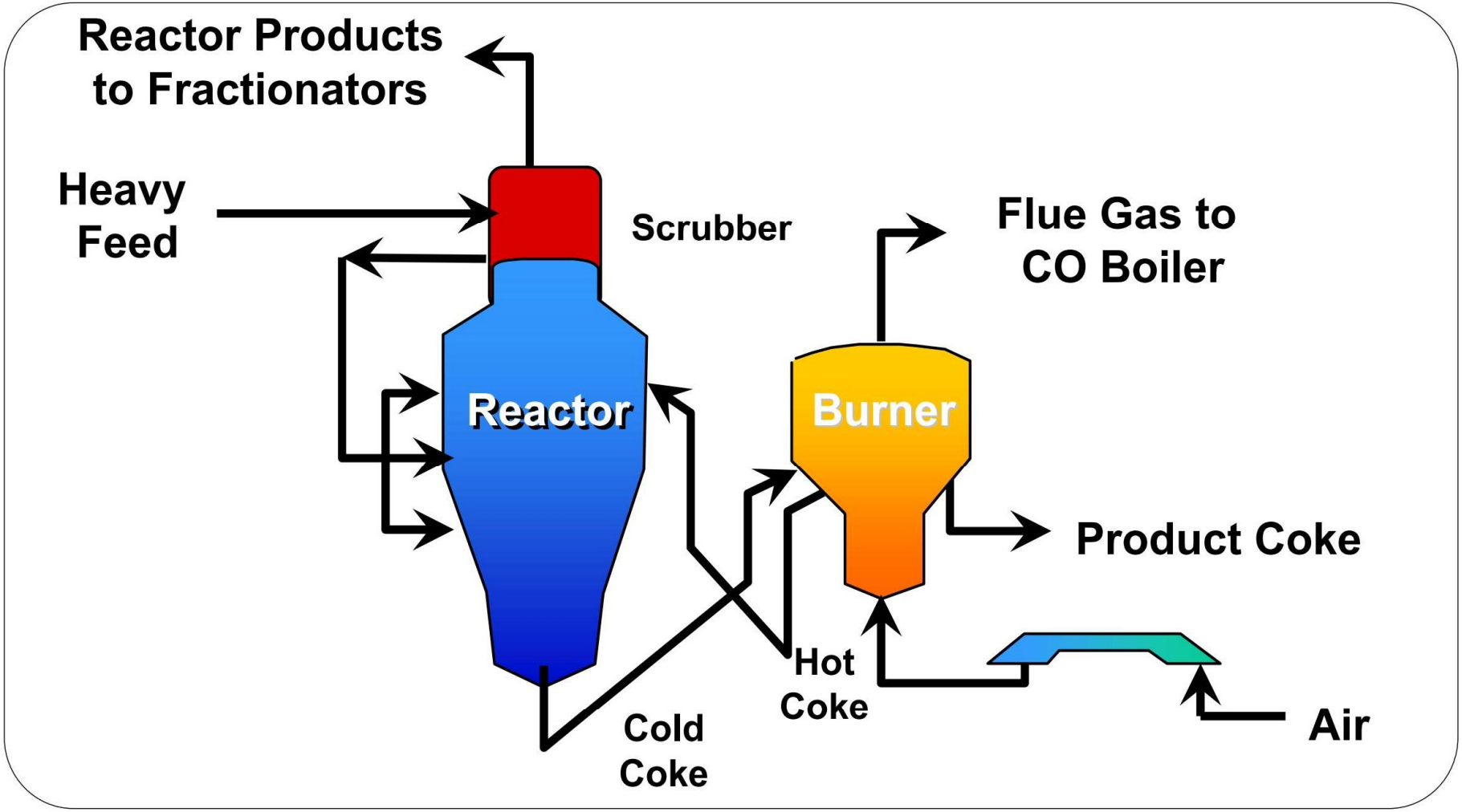
icfar

Canada

Fluid Coking



ExxonMobil
Research and Engineering

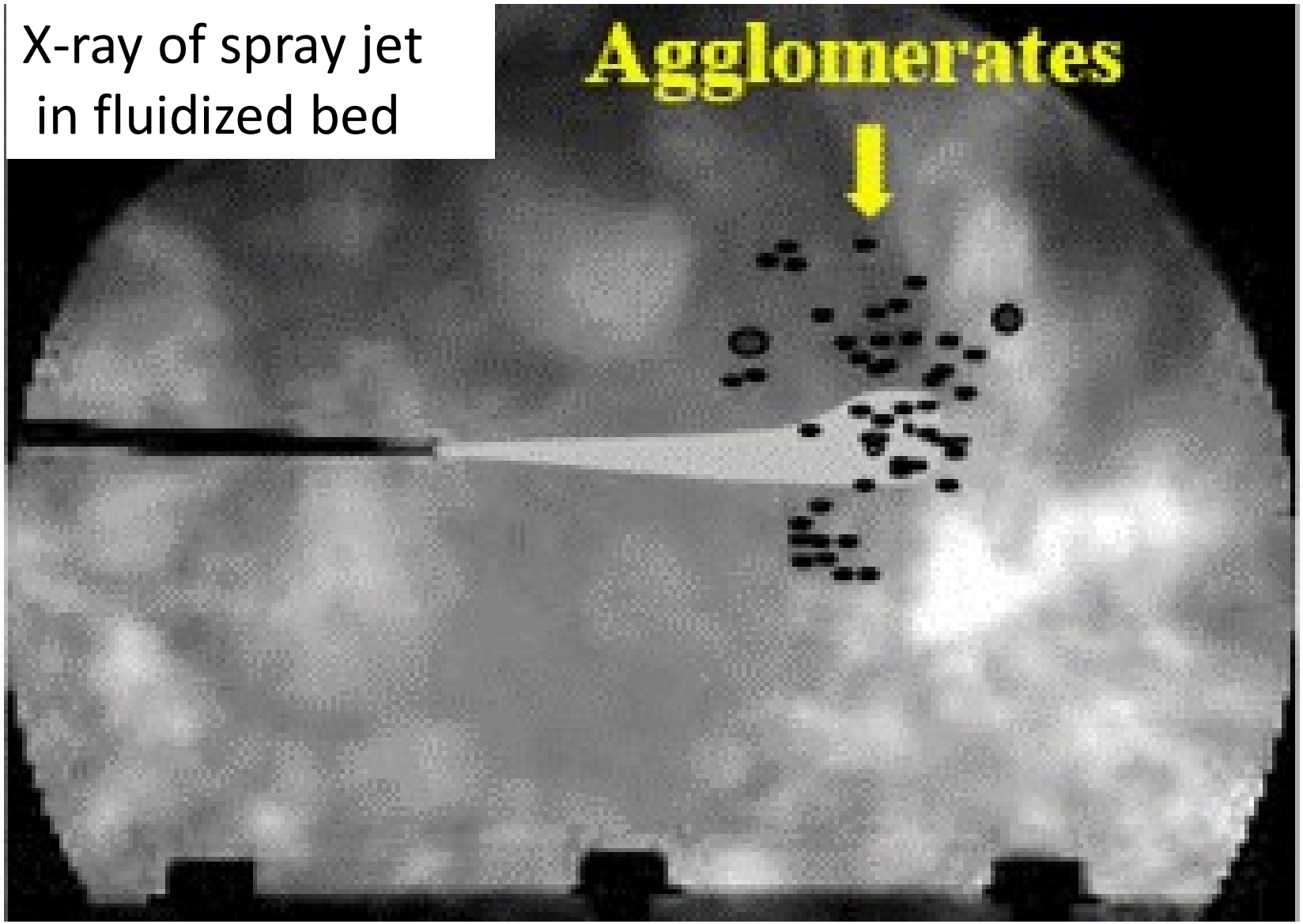
Objectives

Understand how the distribution of sprayed liquid on fluidized solids is affected by:

1. Downward flowing solids
2. Local bed hydrodynamics

MJ/3
CB1

X-ray of Spray Jet Cavity in Fluidized bed

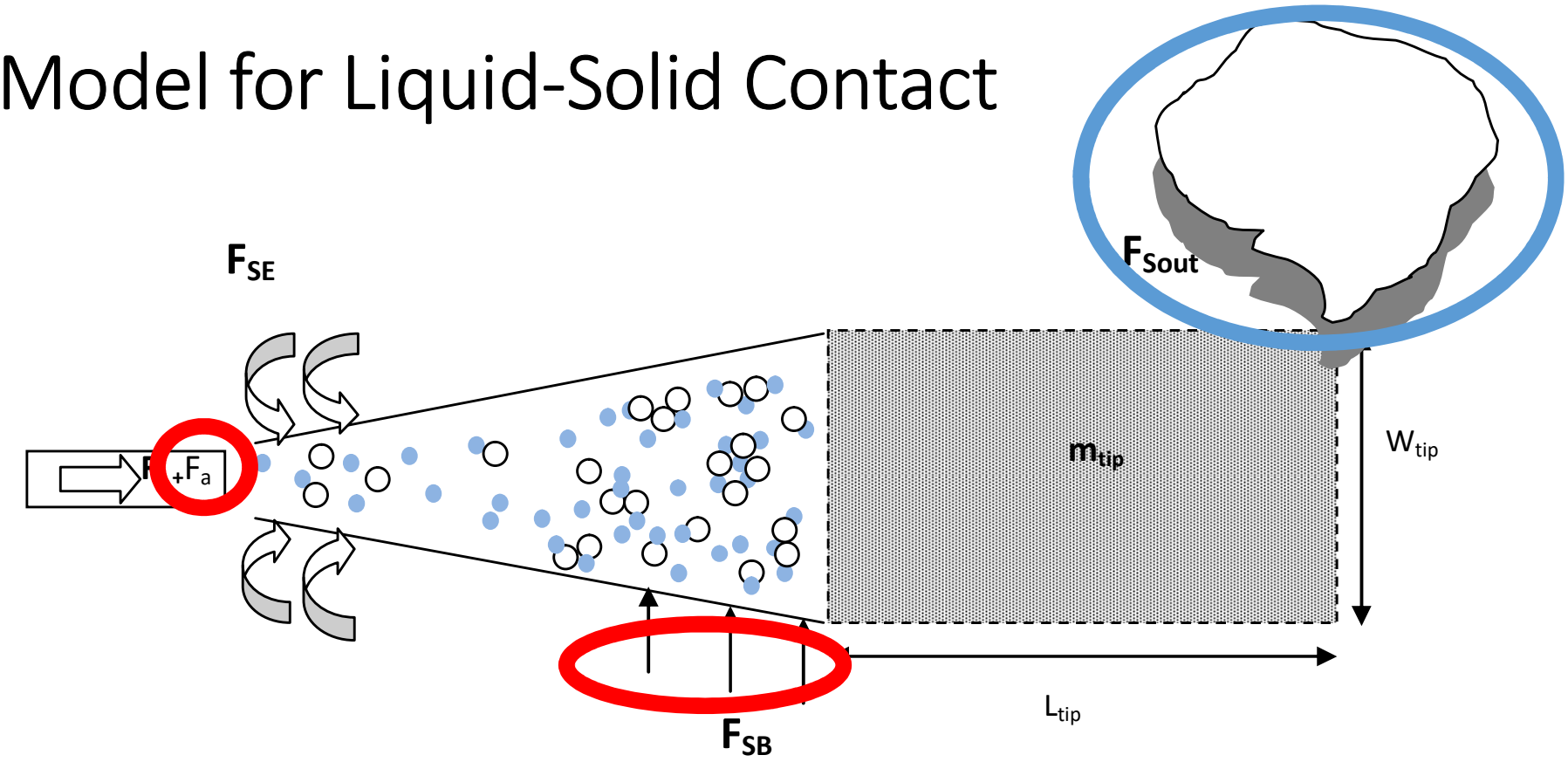


Slide 4

MJ/3 It might be good to add a slide somewhere near the beginning with the objectives of the study
McMillan, Jennifer /J, 5/27/2016

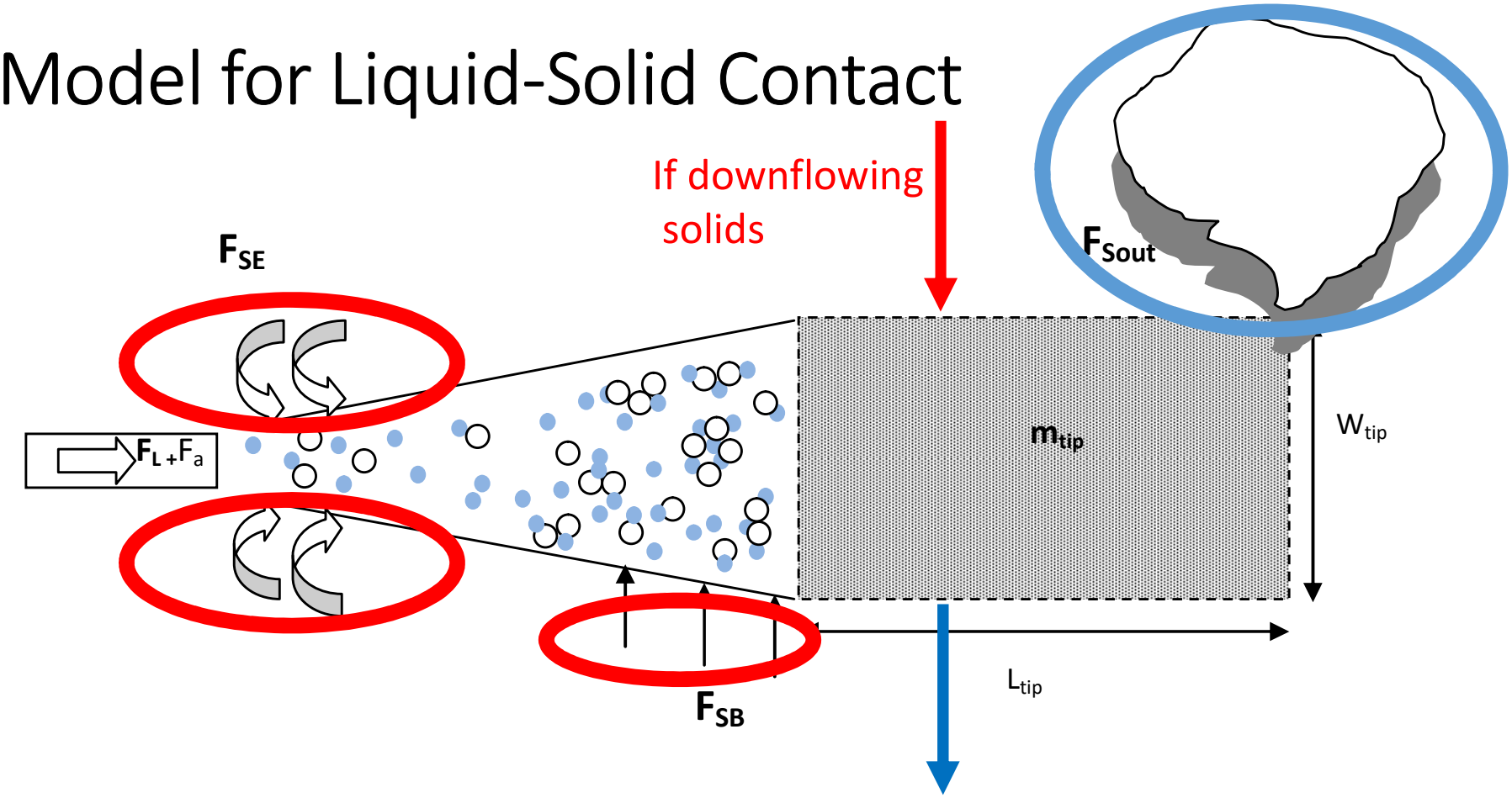
CB1 I added one (I had said this during the presentation)
Cedric Briens, 5/29/2016

Model for Liquid-Solid Contact



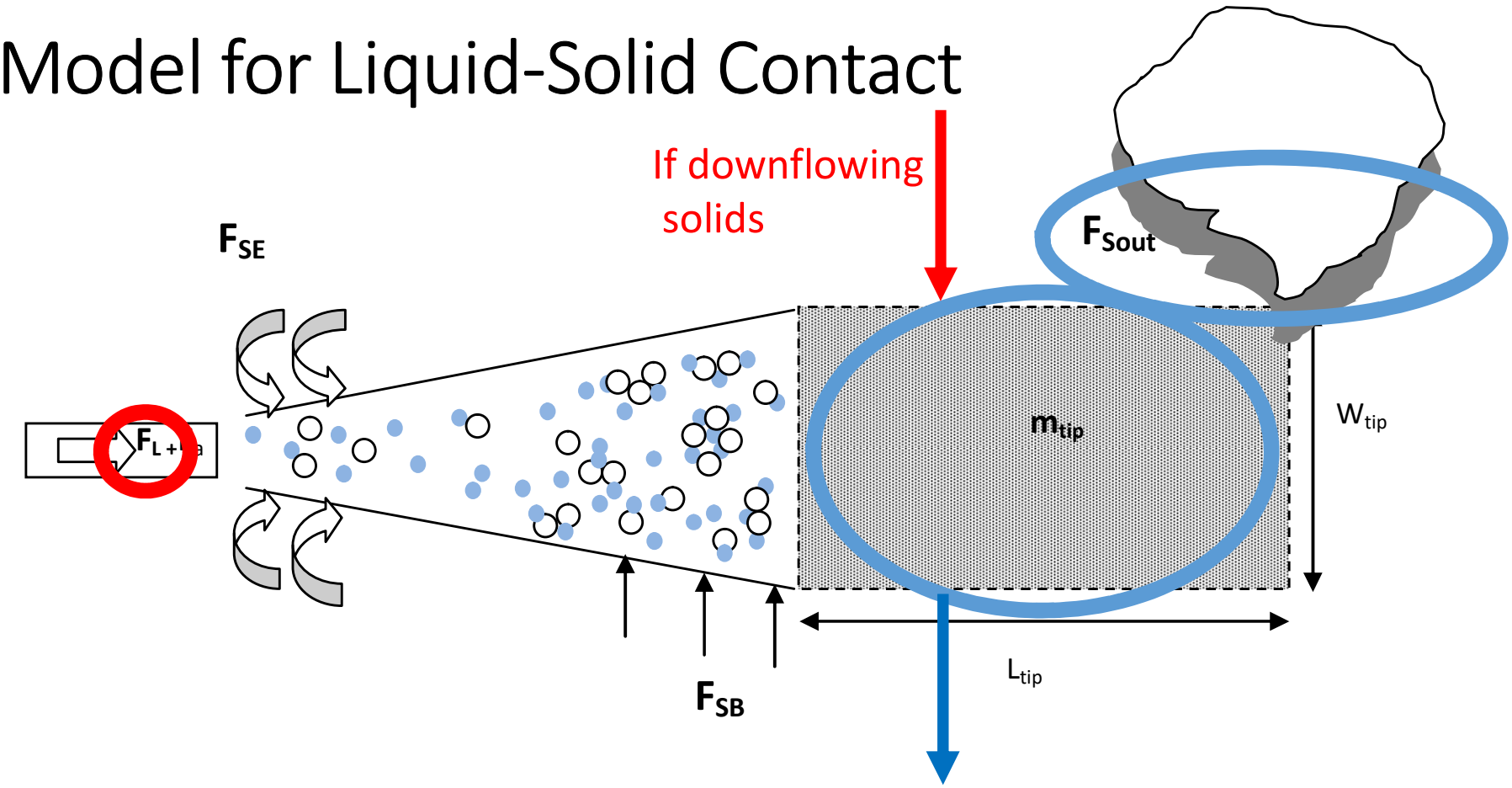
Model gas flows to predict jet cavity expansion/contraction

Model for Liquid-Solid Contact



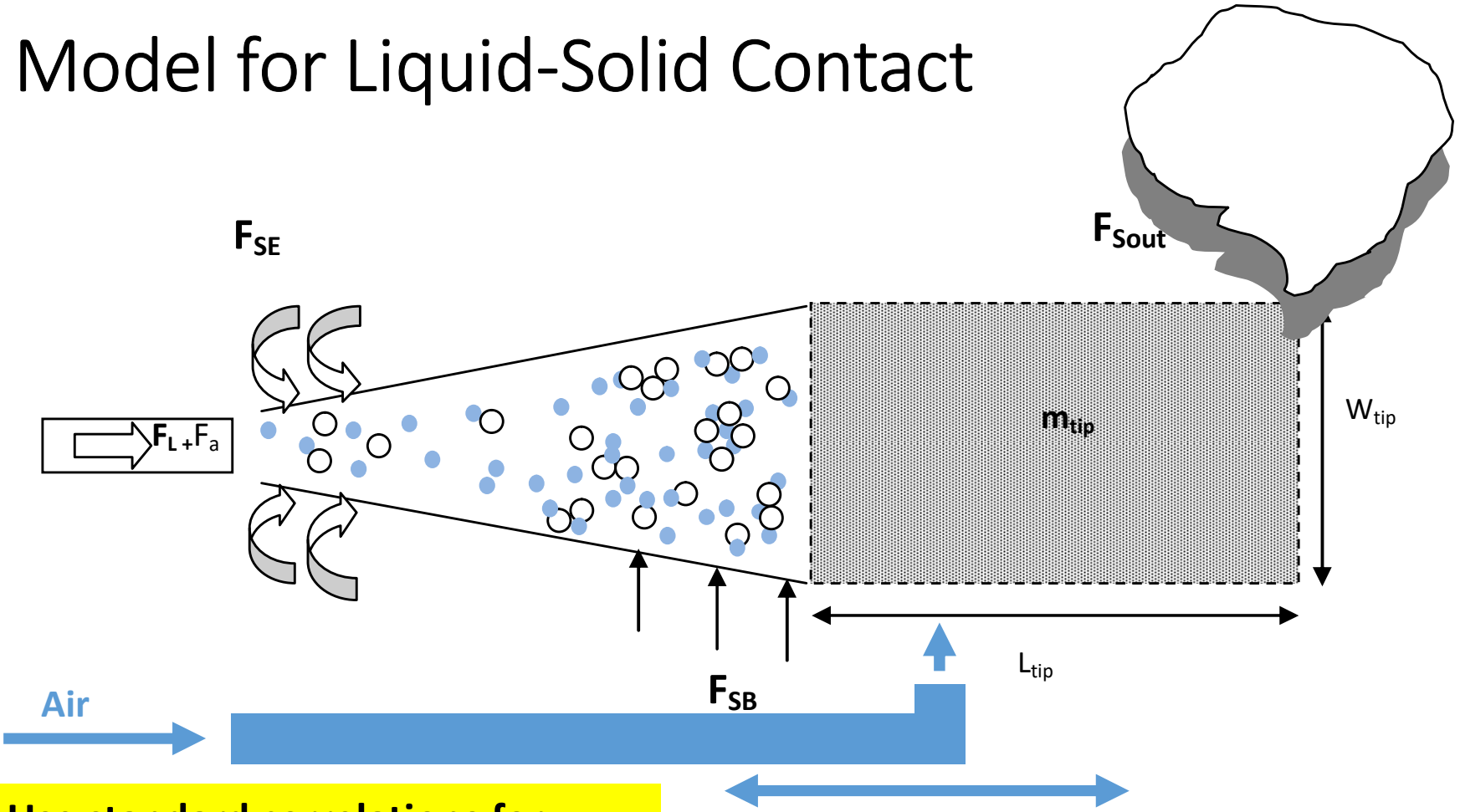
Model solids flows in and out of cavity

Model for Liquid-Solid Contact



Model liquid flows

Model for Liquid-Solid Contact

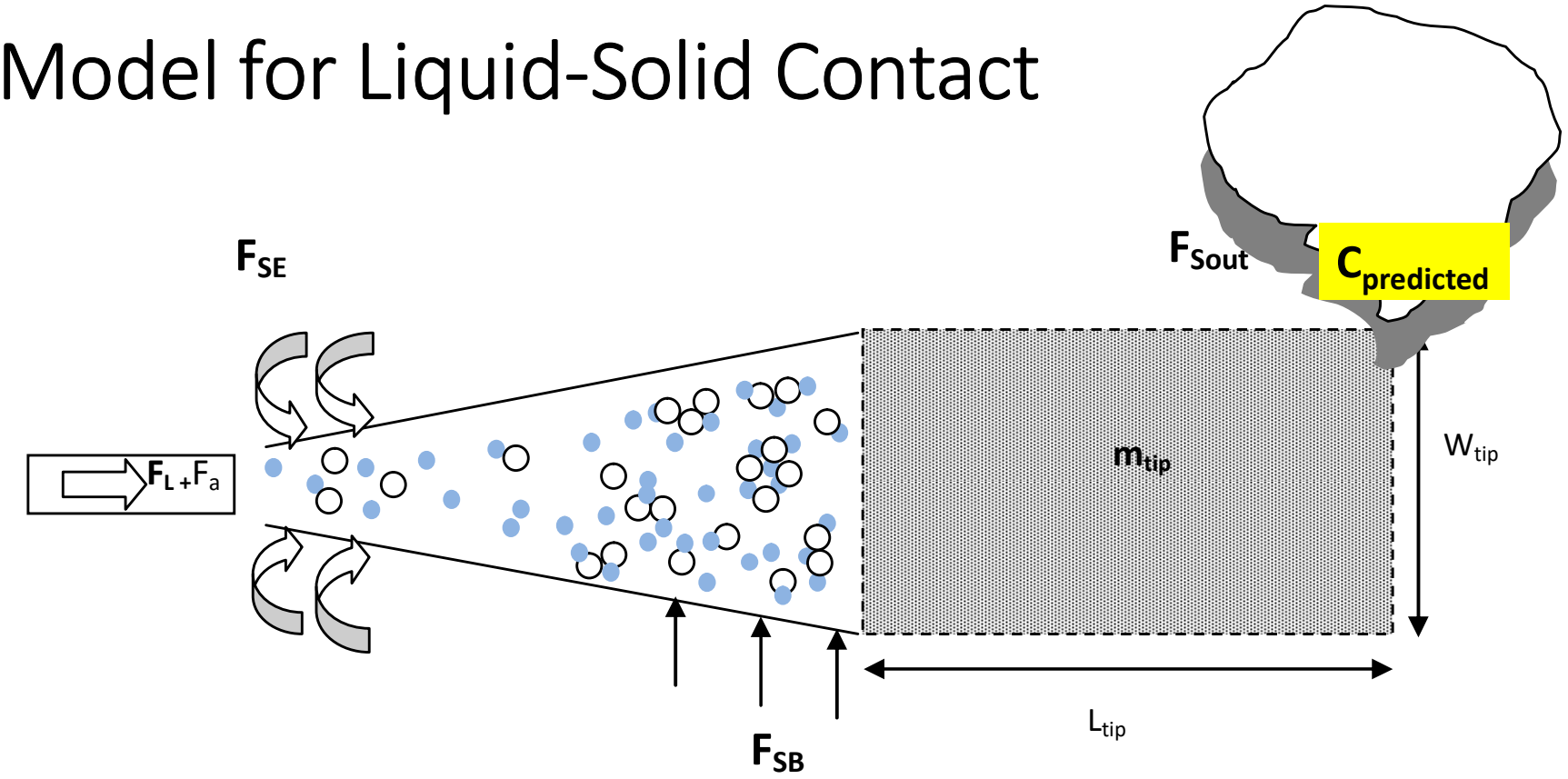


Use standard correlations for:

- **Maximum jet length**
- **Jet expansion angle**
- **Size of released bubble**
- **Bubble wake / bubble volume**

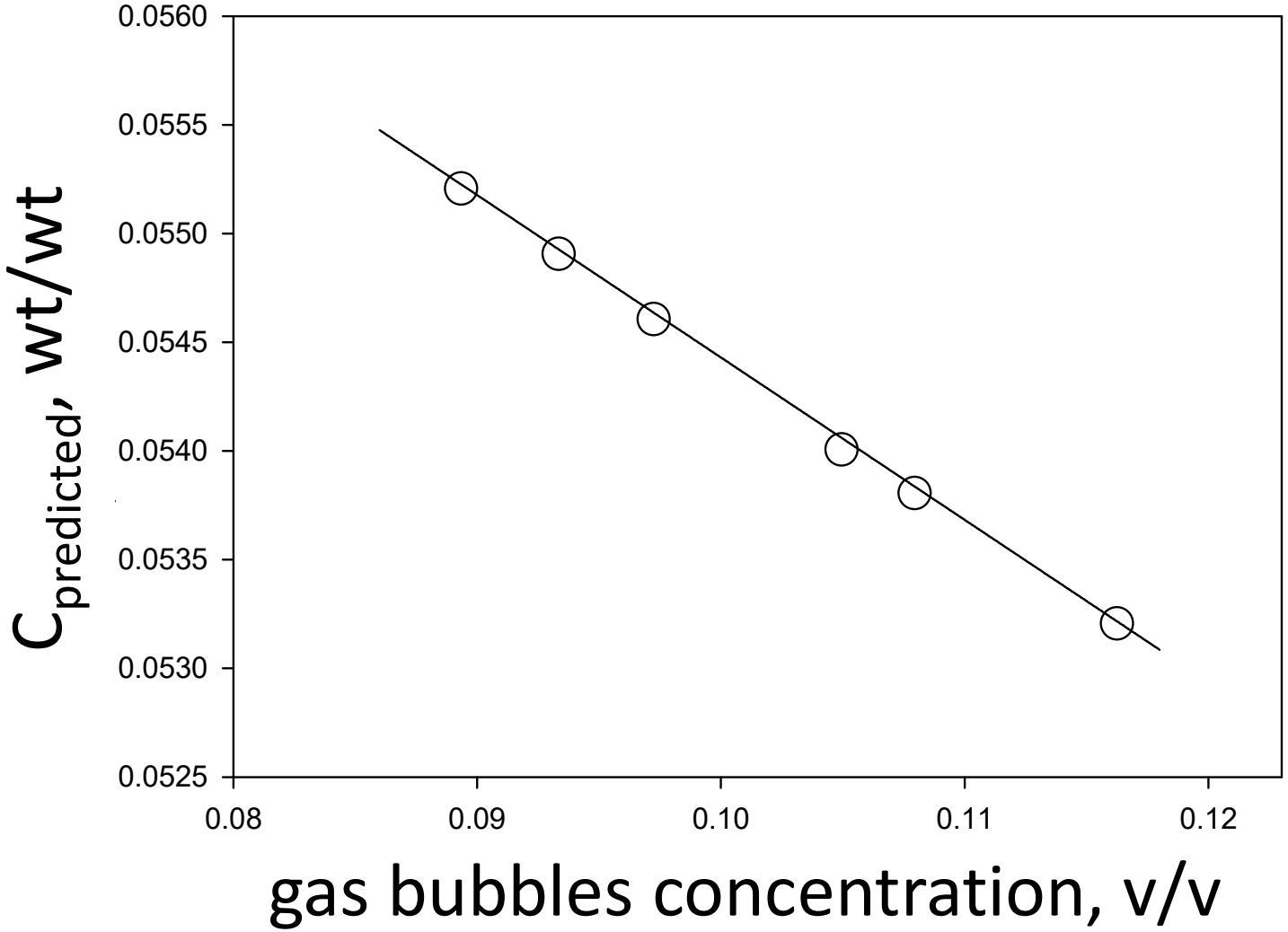
Dedicated experiments to determine jet cavity region where gas bubbles can enter the cavity

Model for Liquid-Solid Contact



Model → liquid concentration (wt/wt) in solids carried to the rest of the bed

Predicted effect of gas bubbles for stationary nozzle



MJ/4
CB2

Experiments to check the model

- **Fluid Cokers**: fluidized solids are moving past the spray nozzle
- **Experiments**: spray nozzle moves past the fluidized solids

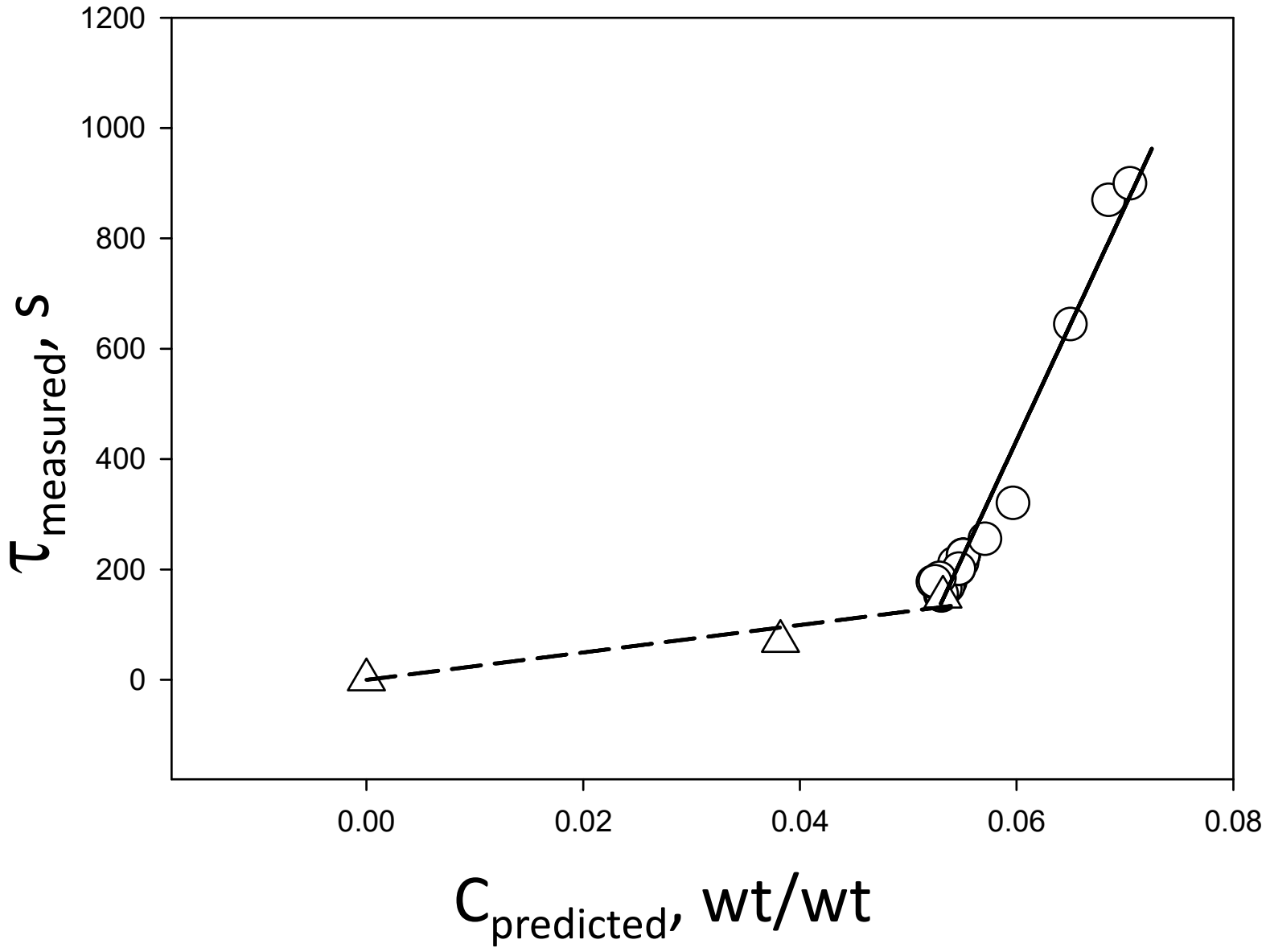
- **Experiments** → τ, time constant of agglomerate breakage
  - "Breakup time"
  - Time for 63% of liquid trapped in agglomerates to be released through agglomerate breakage
  - Should be minimized
  - see poster for details

Slide 11

MJ/4 It might be good to add a few more details about the experiments and maybe a drawing of the fluidized bed
McMillan, Jennifer /J, 5/27/2016

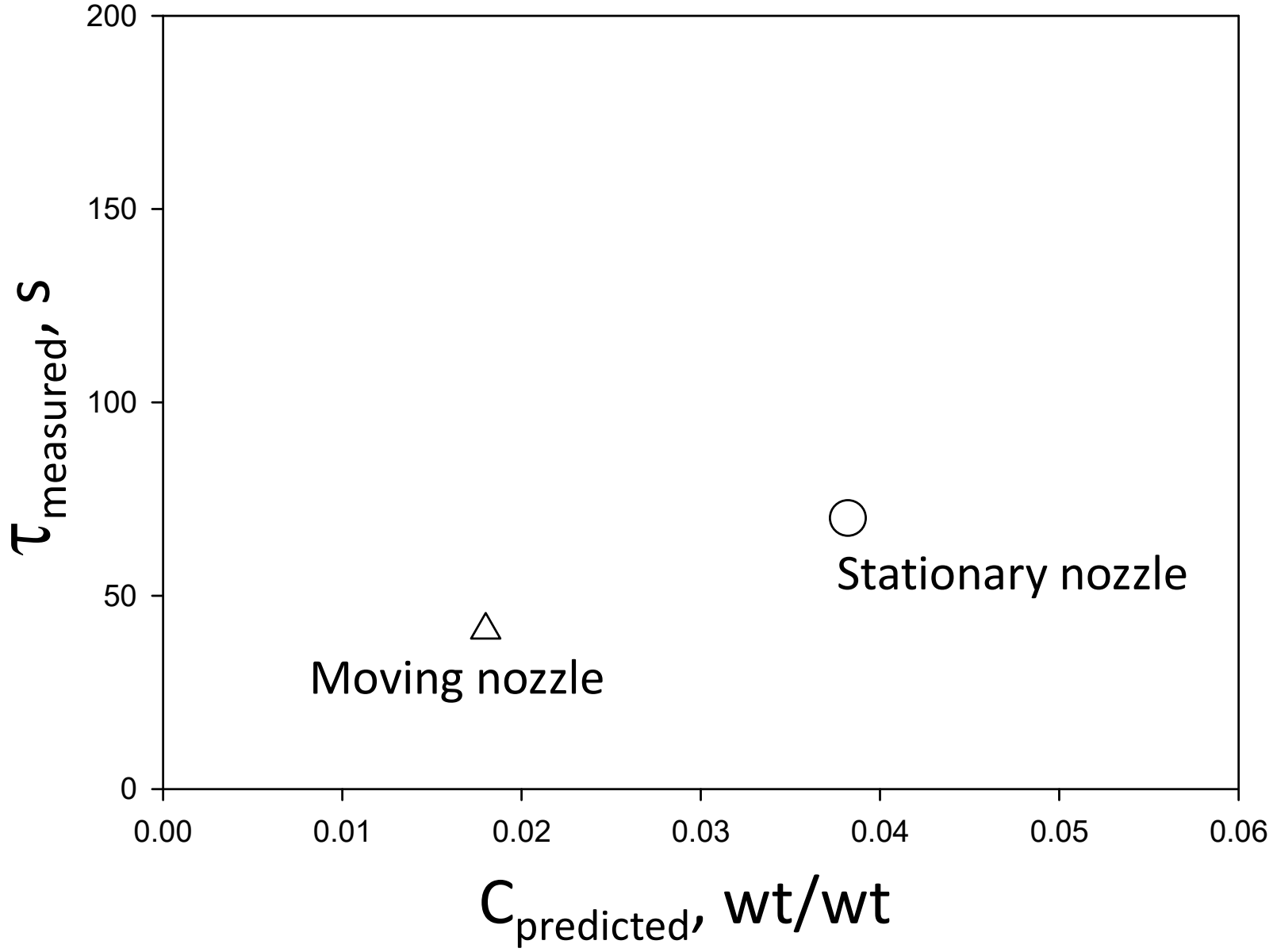
CB2 due to lack of time, I told them to go to the poster. I will attach the psoter in case you need to use this
Cedric Briens, 5/29/2016

Results for stationary nozzle



Moving nozzle:
Effect of relative motion between nozzle and solid

MJ/1
CB3



Slide 13

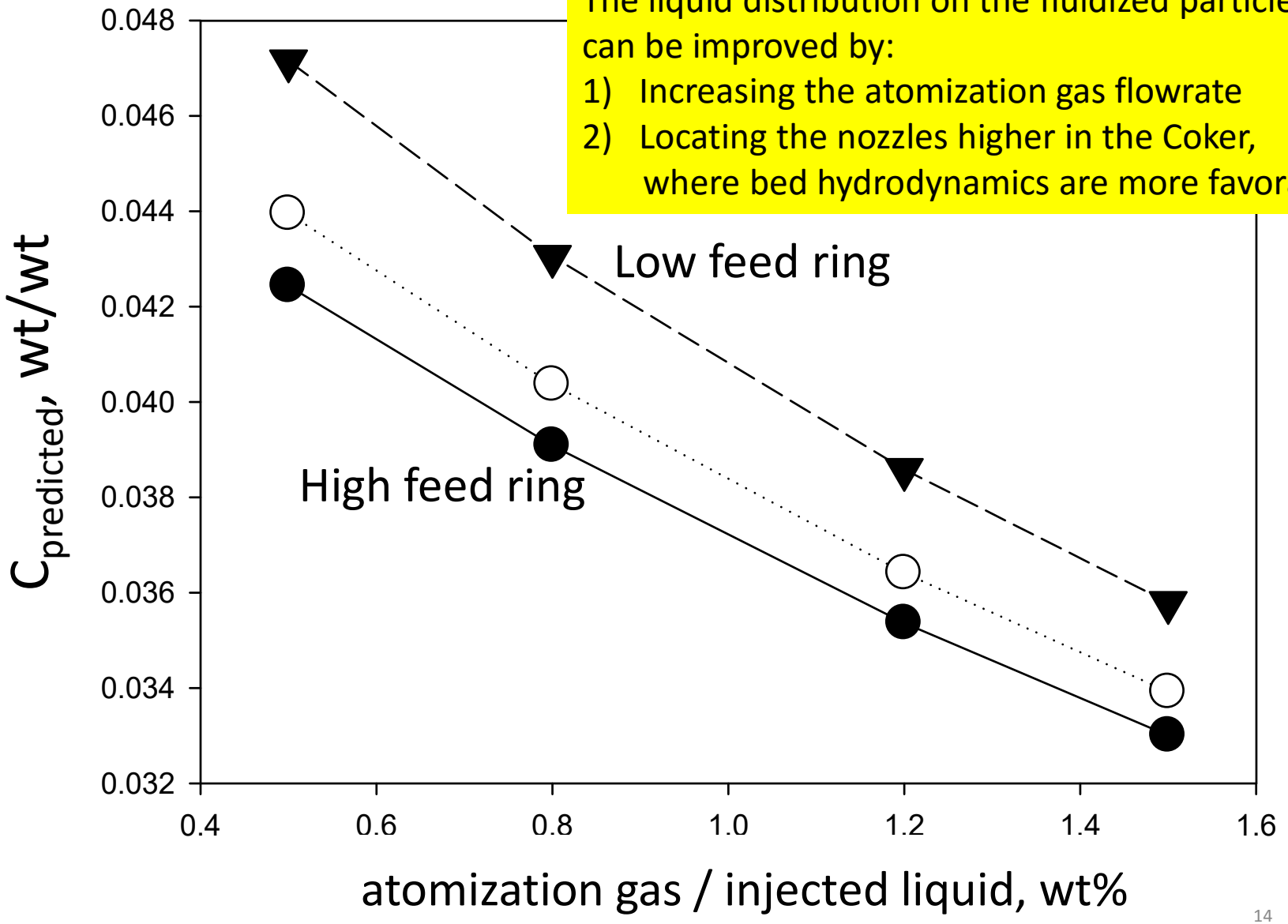
MJ/1 The point for the moving nozzle seems to be missing
McMillan, Jennifer /J, 5/27/2016

CB3 not if you use animation in the presentation mode. I fixed this so that it woudl be OK when converted to pdf
Cedric Briens, 5/29/2016

Predictions for Fluid Coker

The liquid distribution on the fluidized particles can be improved by:

1) Increasing the atomization gas flowrate
2) Locating the nozzles higher in the Coker, where bed hydrodynamics are more favorable



Slide 14

MJ/2 Is this the complete presentation? A summary or conclusions at the end of the presentation might be a good idea.
McMillan, Jennifer /J, 5/27/2016

CB4 It was pretty obvious from this graph and the previous one (again, time). Liuqid distirbution is improved by:
Cedric Briens, 5/29/2016

CB5 1) moving nozzle or solids
Cedric Briens, 5/29/2016

CB6 2) atomization gas
Cedric Briens, 5/29/2016

CB7 3) higher feed ring (because of bed hydrodynamics)
Cedric Briens, 5/29/2016

Acknowledgements

MJ/1
CB3

ExxonMobil

Syncrude
Securing Canada's Energy Future

NSERC
CRSNG

Slide 15

MJ/1 The point for the moving nozzle seems to be missing
McMillan, Jennifer /J, 5/27/2016

CB3 not if you use animation in the presentation mode. I fixed this so that it woudl be OK when converted to pdf
Cedric Briens, 5/29/2016