

# How number crunching can optimise crisp frying

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Stacie Tibos, Associate Principal Engineer from PepsiCo, was one of the attendees at the 138th ESGI hosted by the IMI. Credit: University of Bath

Optimising the frying time of crisps may not be an obvious application of mathematics, but this is one of the problems delegates to the 138th European Study Group with Industry (ESGI) were asked to solve last week.

Mathematicians from around the world met at the University of Bath for the five day workshop to solve a variety of real and important problems faced by industry.

The workshop was organised by the University's Institute for Mathematical Innovation, the University of Bristol and Innovate UK and brought together top mathematicians, other scientists and engineers from the UK, Europe, Africa, Asia and North America to work alongside industrialists from PepsiCo, Airbus, Heathrow, Syngenta, Phytoponics, Crowd Vision and the NHS.

PepsiCo, which owns the crisp brand Walkers, asked delegates to investigate two problems during the week involving the manufacture of stackable fabricated potato chips.

The crisps are manufactured as a dough mix, which is pressed and ovals are cut out. These travel down a conveyor belt into the fryer. As the snacks cook, the moisture is driven off, making them float to the surface of the oil where they are lifted out onto another [conveyor belt](#).

The problem set by PepsiCo asked whether mathematicians could predict how quickly the crisps cook and rise to the top and whether they can speed up the process and optimise it.

A second challenge set by the company looked at how chips collected from the fryer moved down a chute to another conveyor.

Stacie Tibos, Associate Principal Engineer from PepsiCo, said: "The chips are a curved shape which makes their behaviour down a chute very interesting.

"It's important they are in alignment so they can be stacked together in the tube. We would like to optimise the chute design to get the best

possible crisp position.

"They may seem like minor problems but we make a lot of fabricated [potato chips](#) so solving these challenges could make a big difference to the efficiency of the process.

"Study groups like this one in Bath are a wonderful opportunity to get the best brains working on your problem in a focused collaborative way, getting initial results in just five days.

"Working in this way brings together expertise from a variety of fields with different perspectives on the problem, so the resulting mix is more than just a sum of its parts.

"Over the five days, the delegates take the challenge, redefine the problem and focus on solving it. Study groups like the ESGI can really help build a better product and equipment that will help improve the productivity of processes in the long term.

"I would definitely recommend that other businesses get involved in these workshops."

Deputy Director of the Institute for Mathematical Innovation and co-organiser of the study group, Professor Chris Budd, said: "We're delighted to be celebrating the 50th anniversary of the first study group this year, and it's the third time we've hosted the ESGI at Bath.

"These study groups enable businesses to do feasibility studies in a very short timescale. Whilst not all the problems are solved within five days, there is always some progress made by the end of the week.

"The workshop model gives businesses a low cost way of solving their higher risk problems they wouldn't be able to work on in-house—these

are usually the more interesting challenges for academics to solve, so they are happy to give their time for free.

"They are a hugely effective way of setting up new collaborations and it's also a really good training ground for students.

"We are delighted to be applying maths to the complex problems of the food industry, which is the largest industry in the world. The same maths that is being used in the study group this week can be applied to solving major global problems, including curing cancer.

"I would argue that is definitely time very well spent."

Dr. Joanna Jordan is Manager of the IMI and was also a co-organiser of the study group. She said: "It has been an intensive and very productive week and all our partners are pleased with the large amount of progress achieved in a short time.

"It has definitely laid the ground work for several new industrial collaborations".

Provided by University of Bath

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