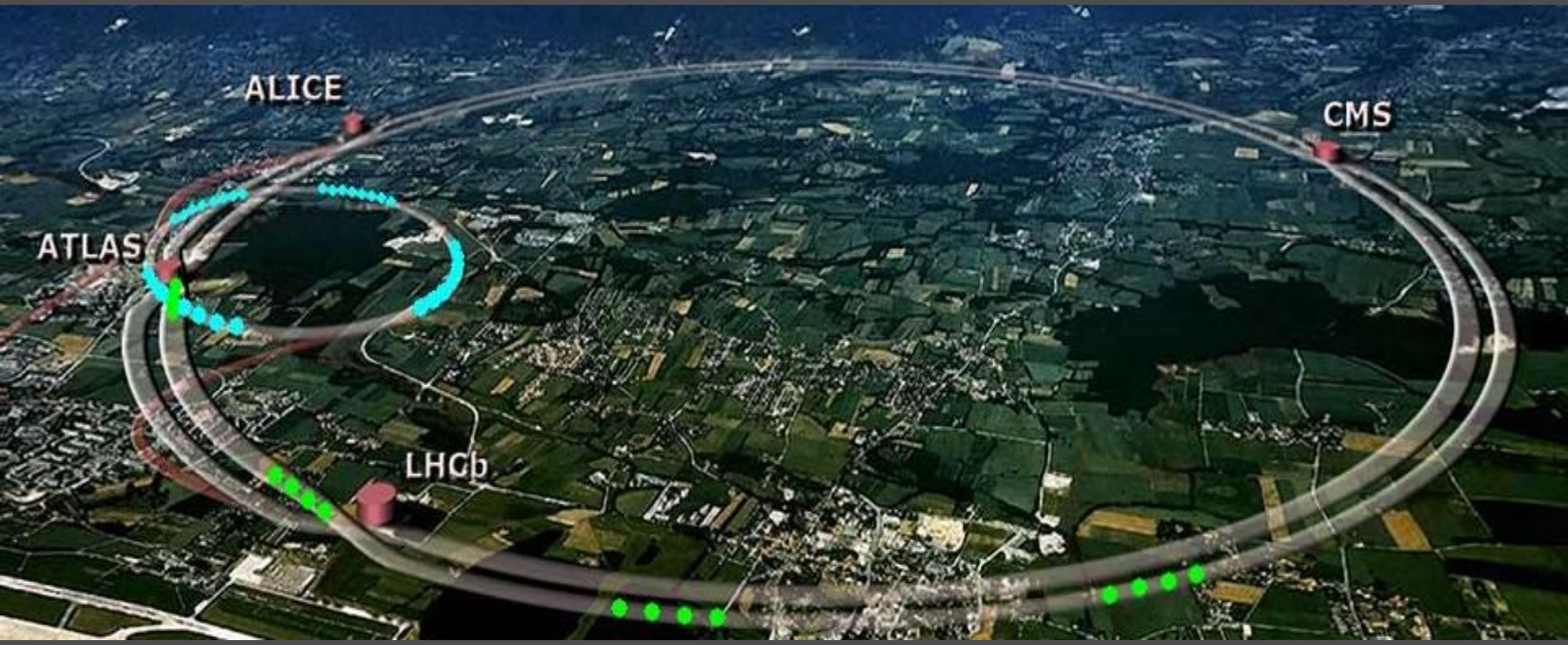
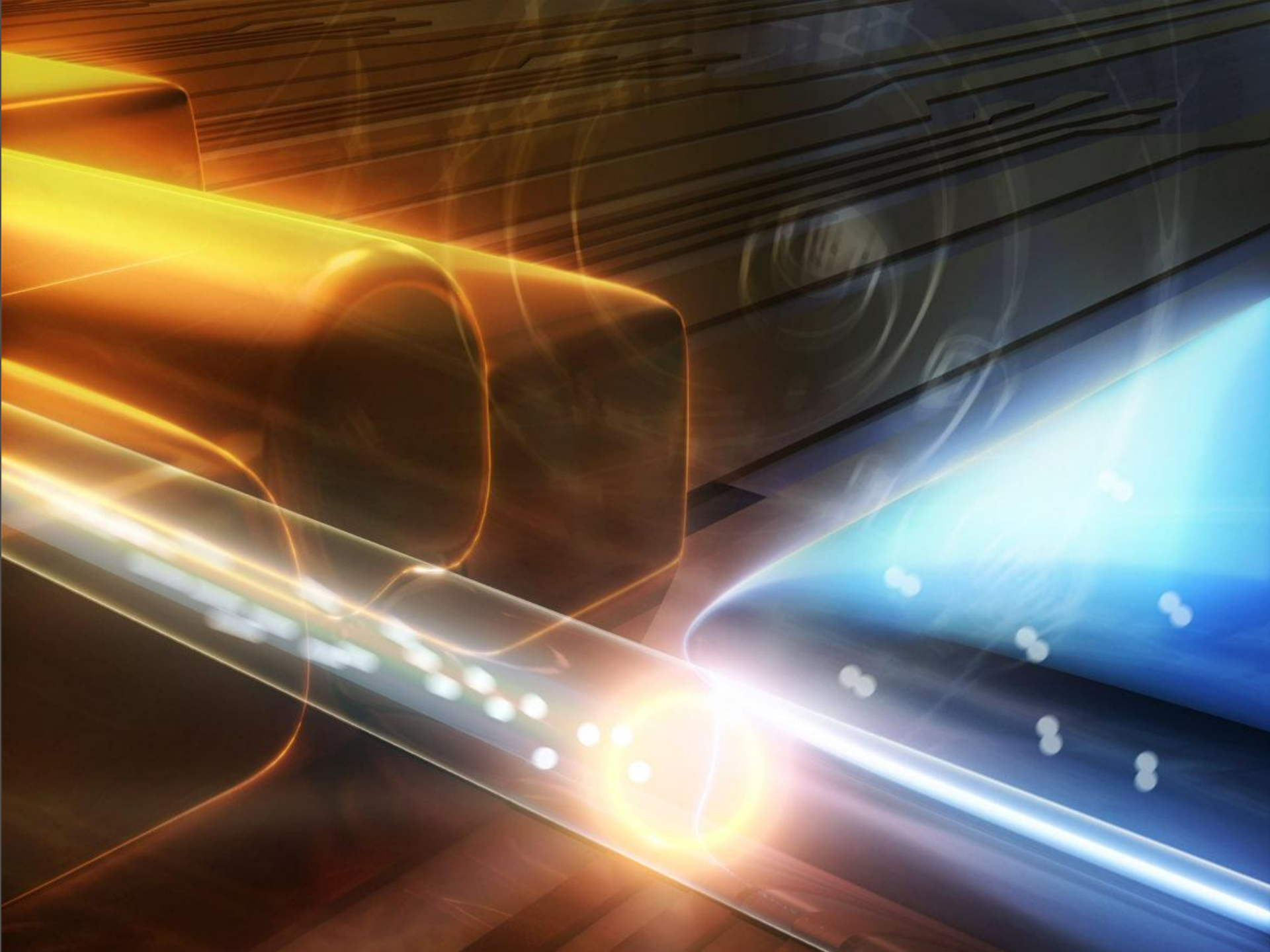
Majorana
vs.
Higgs


ALICE
CMS
ATLAS
LHCb



Delft Majorana team

Kun Zuo, Vincent Mourik, Sergey Frolov, Sébastien Plissard, Erik Bakkers, Leo Kouwenhoven

5σ

99.999% sure

pretty sure

Our signatures of Majoranas

Good starting point: high mobility InSb anowires, strong SOI, induced SC

Zero bias peak (ZBP) onsets at B ~ 100 mT

$E_z \sim 150\ \mu eV$, so $\boxed{E_z \sim \Delta}$

ZBP remains stuck to zero bias over significant range of B ($\Delta E_z \sim 0.5\text{-}1.5$ meV)

ZBP persist over large gate ranges for all gates, but gate tuning is required

As expected for an edge state of a topological superconductor

ZBP vanishes when B is aligned with B_{SO}

Suggests that spin-orbit interaction is required to observe ZBP

ZBP robust in both gate and B not observed in two N-NW-N devices

Suggests that superconductivity is an ingredient

Persistent ZBP reproduced in four N-NW-S devices and three cryostats

Now, also reproduced by Hugh Churchill at Harvard (Marcus group, wires from Lund)

Follow-ups for immediate future

Increase ZBP height from 5% to expected $2e^2/h$

Make induced gap hard rather than soft (states within gap)
Lower temperature

Observe the closing of the induced gap

Vary the number of occupied subbands underneath superconductor

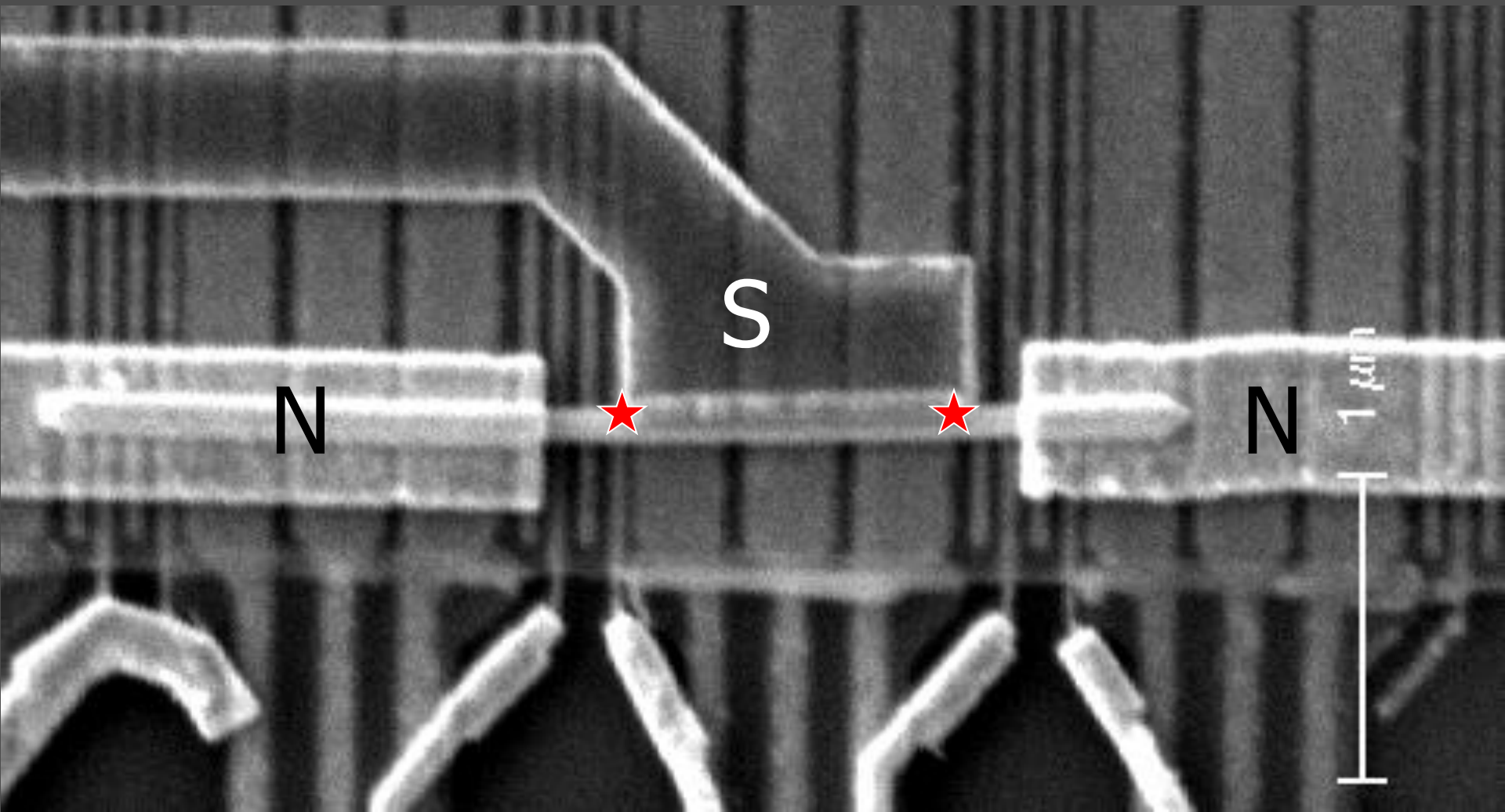
Map out ZBP phase diagram in E_Z and V_{gate}

Relation between gate voltage and chemical potential
Probe ZBP through a real QPC (from ZBP to zero bias dip)

Split ZBP by bringing two edge states together

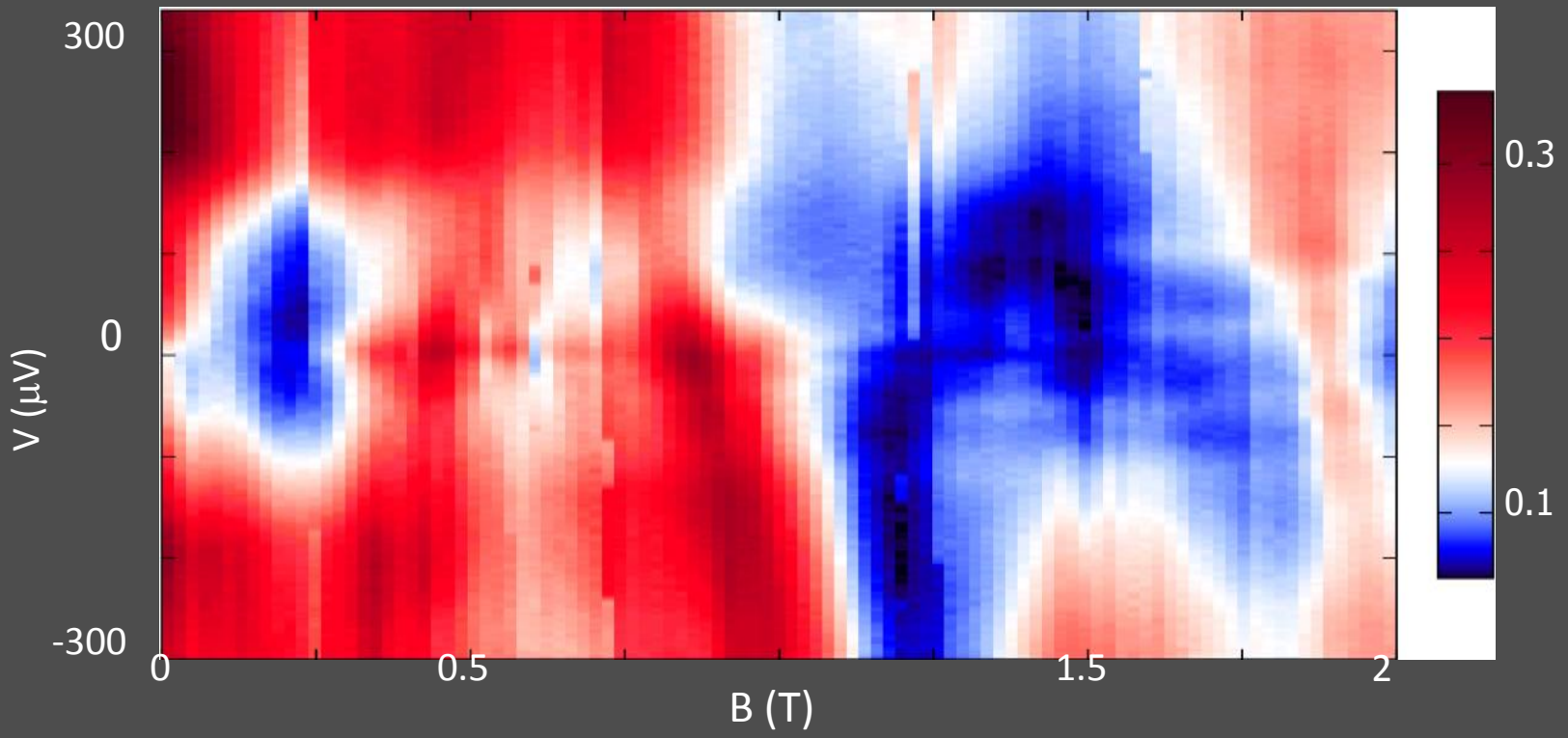
Vary superconductor segment length
Improve gate coupling

Three-terminal geometry, improved materials



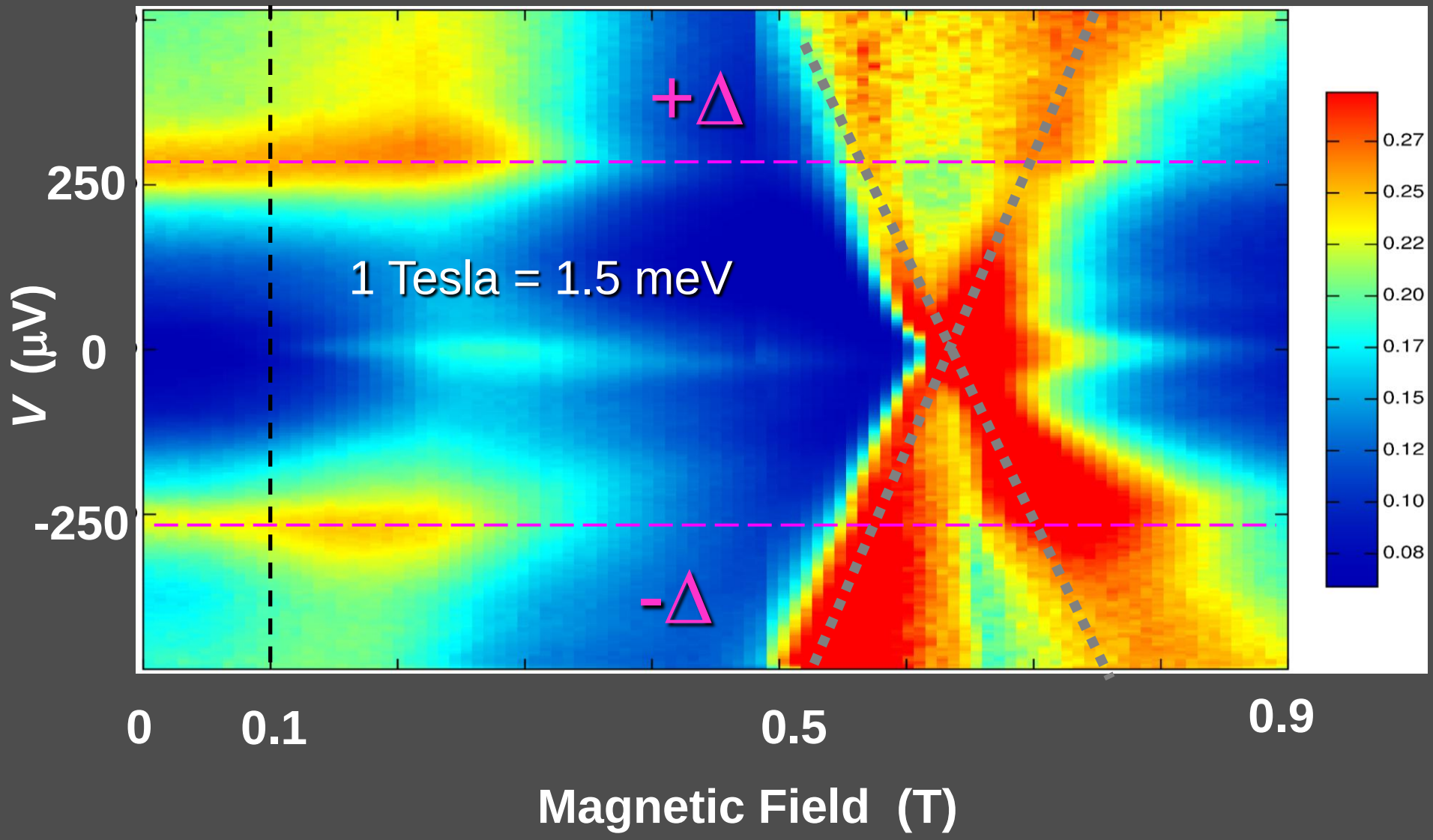
States that run parallel to zero-bias peak

Another device: same effects observed

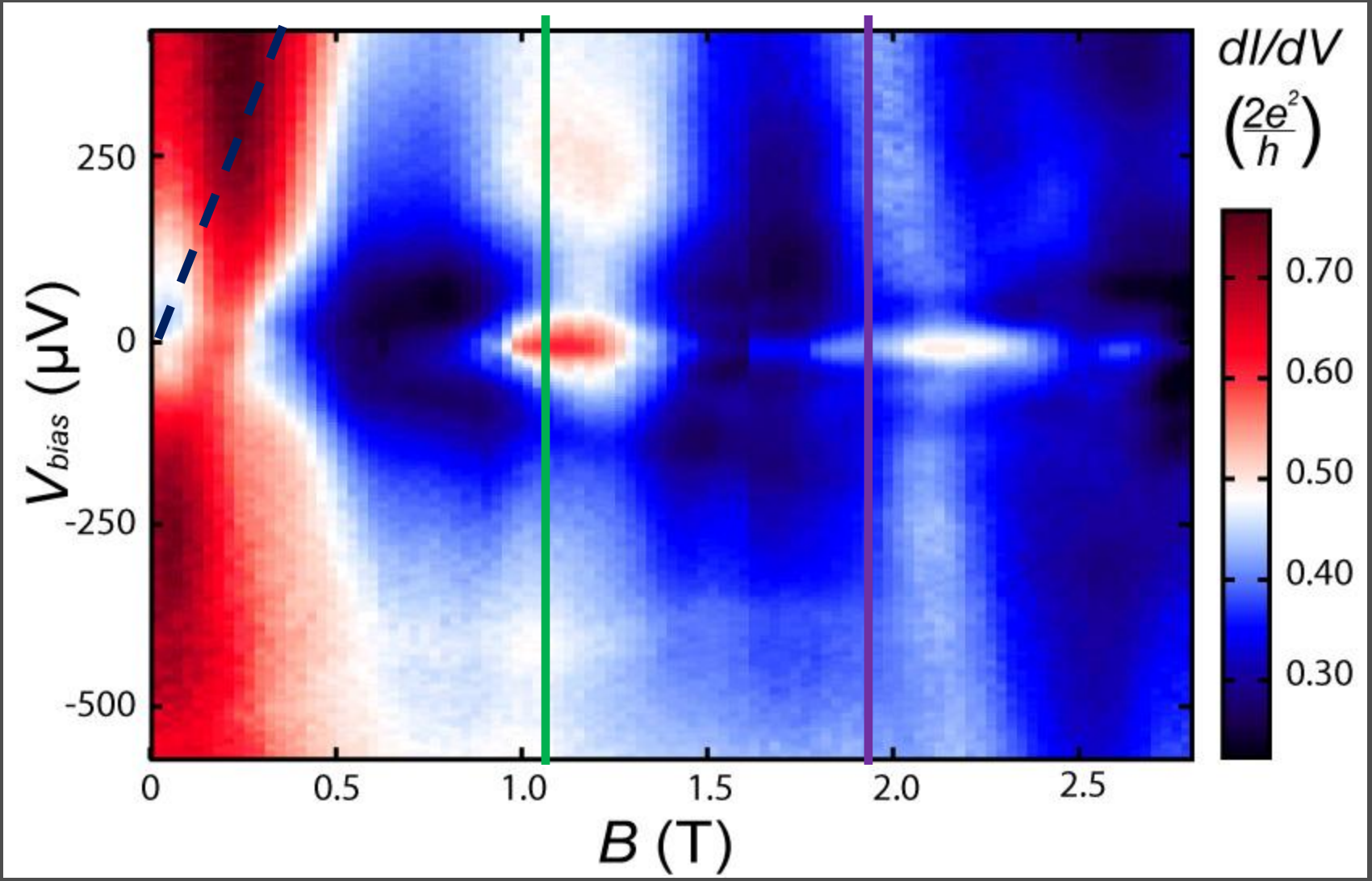


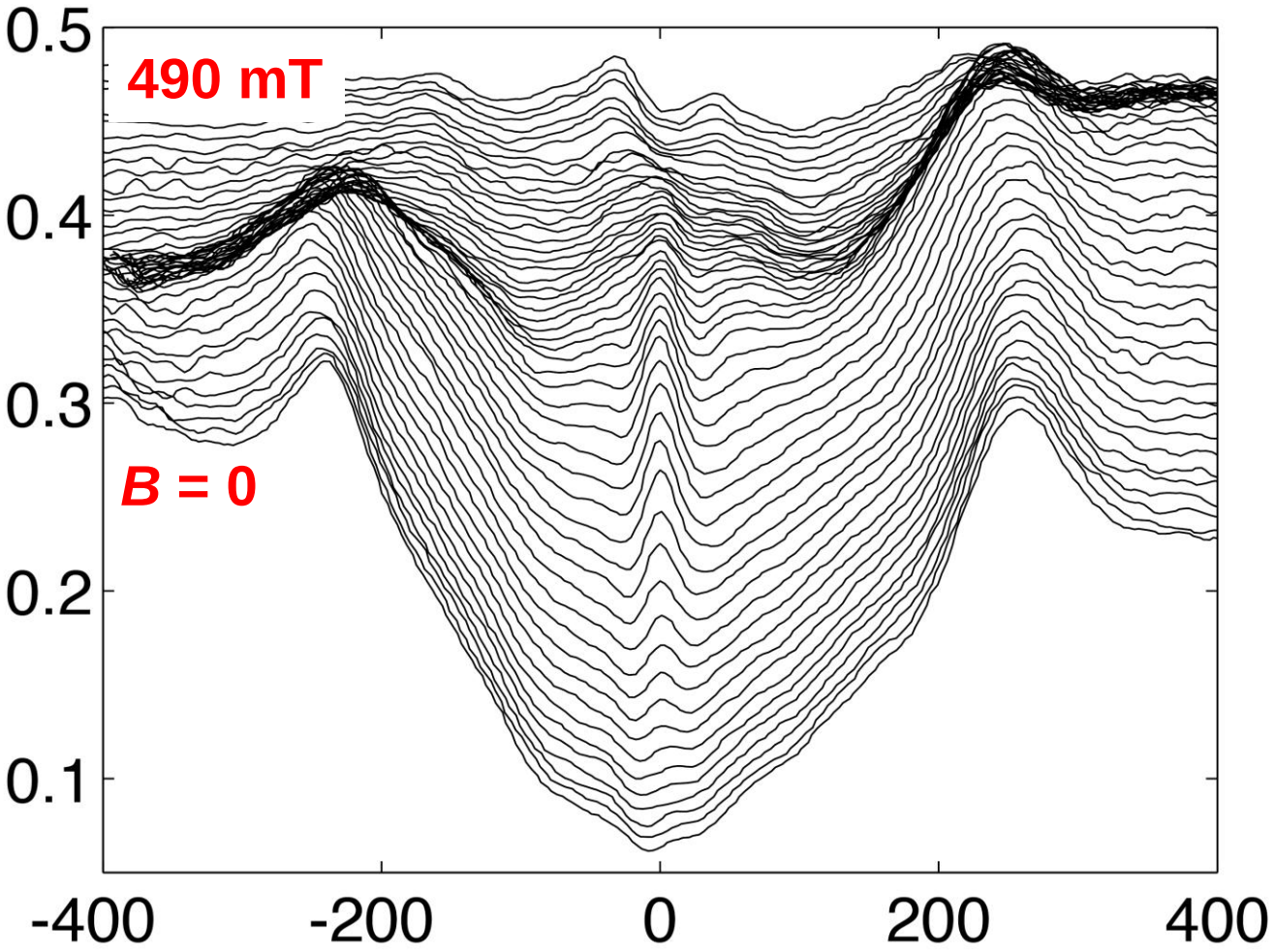
Another example

Peak onset $E_Z \sim \Delta$



N2-S



UBG=0V; UFG1-3=-2.5V; BG1-3=-5V; LFG1=-2.9V; LFG2=1.3V; LFG3=2.7V
LBG=2.5V

Observation of zero bias peak