

# **FDM and stable approach gates**

**Searching the best stable approach gate/s**

**EOFDM 2016 - Cologne**

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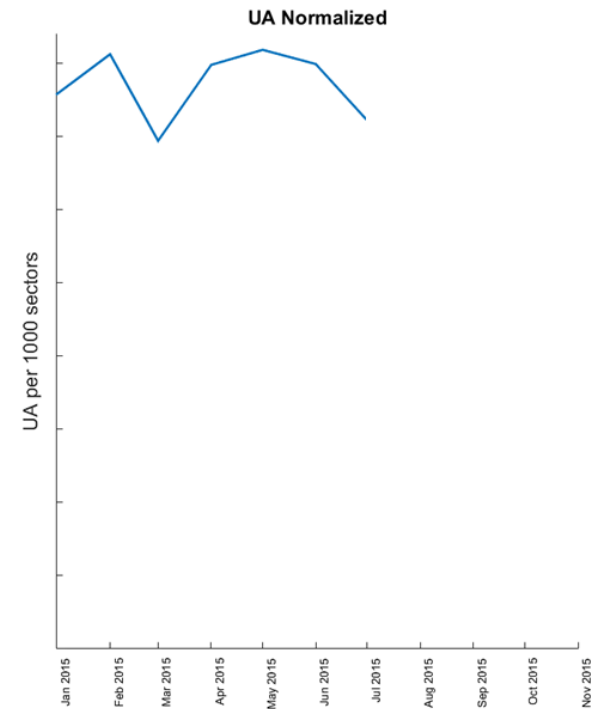
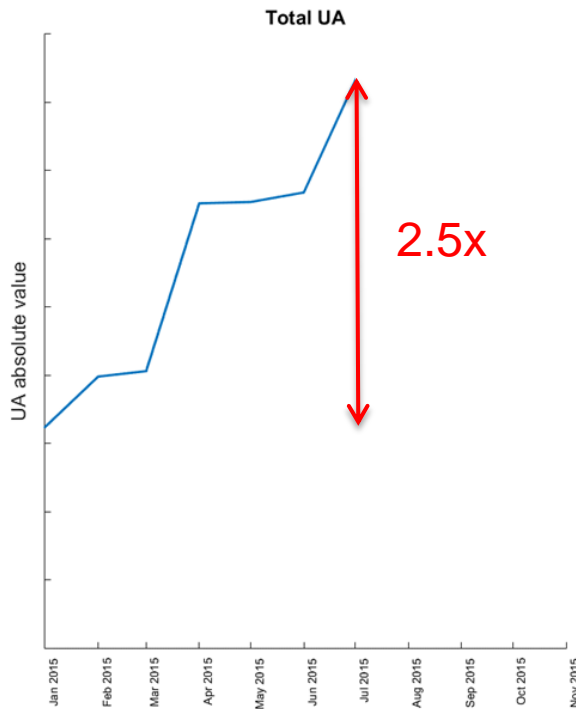
1. Introduction  
**Why** a change was necessary?
2. FDM study  
**Which** change was necessary?
3. Final results  
**What** is it expected to achieve?

# 1. Introduction

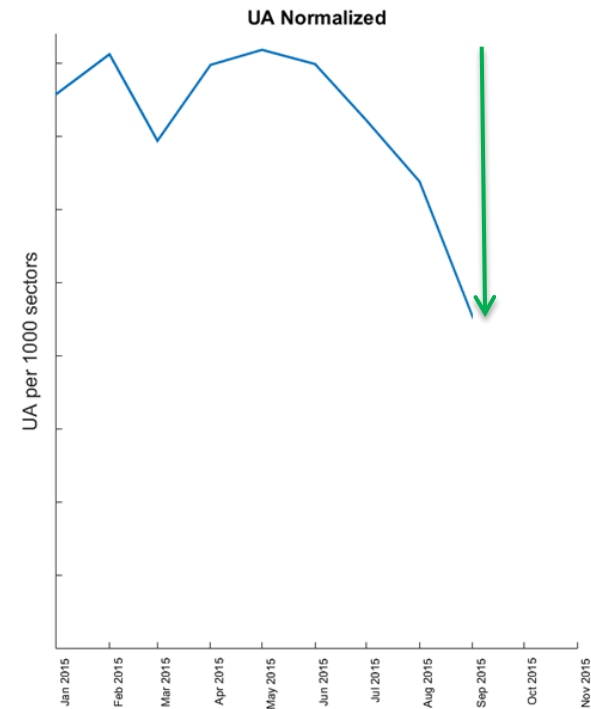
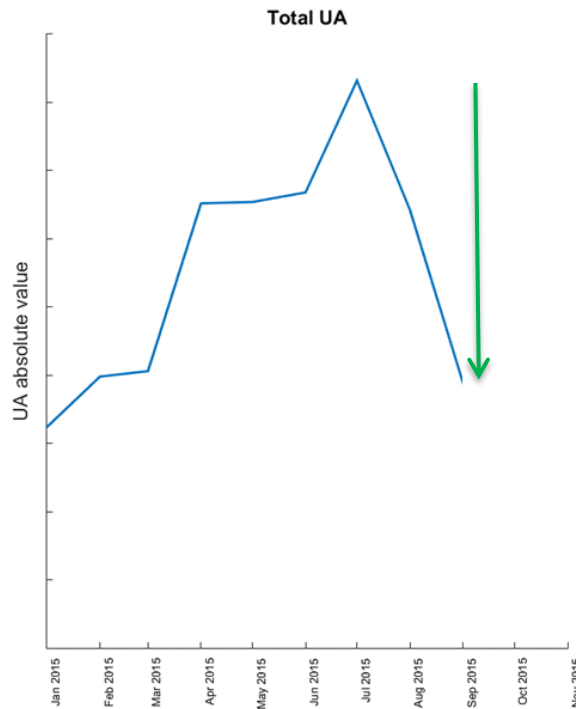
- 1.Reasons for a change
- 2.Unstable approach causes
- 3.Why a unique gate is not enough?

**Why a change was necessary?**

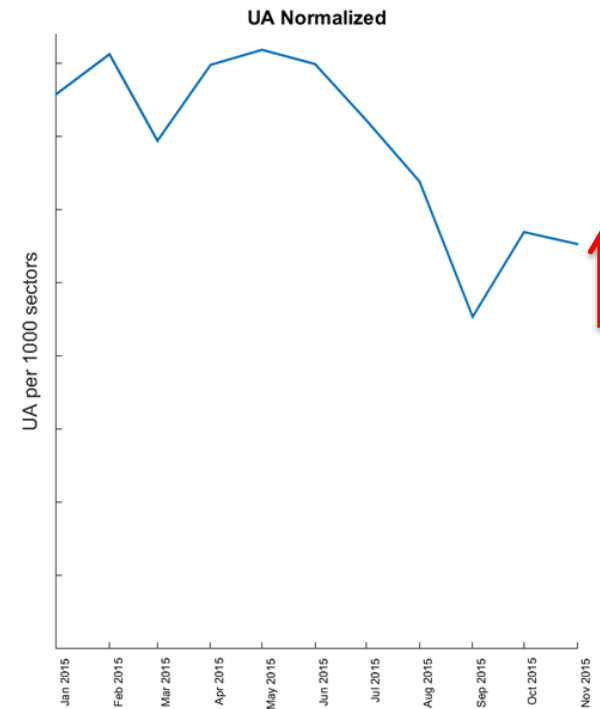
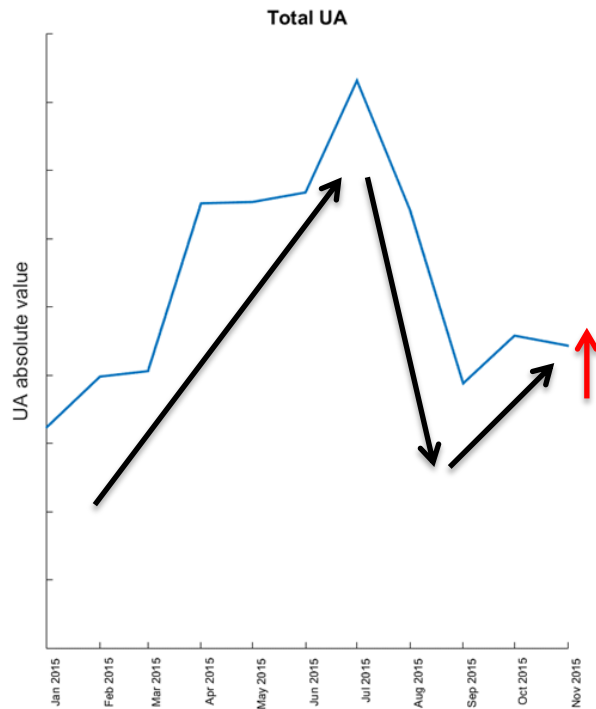
# Unstable approach ratio increase



# Unstable approach ratio increase



# Unstable approach ratio increase

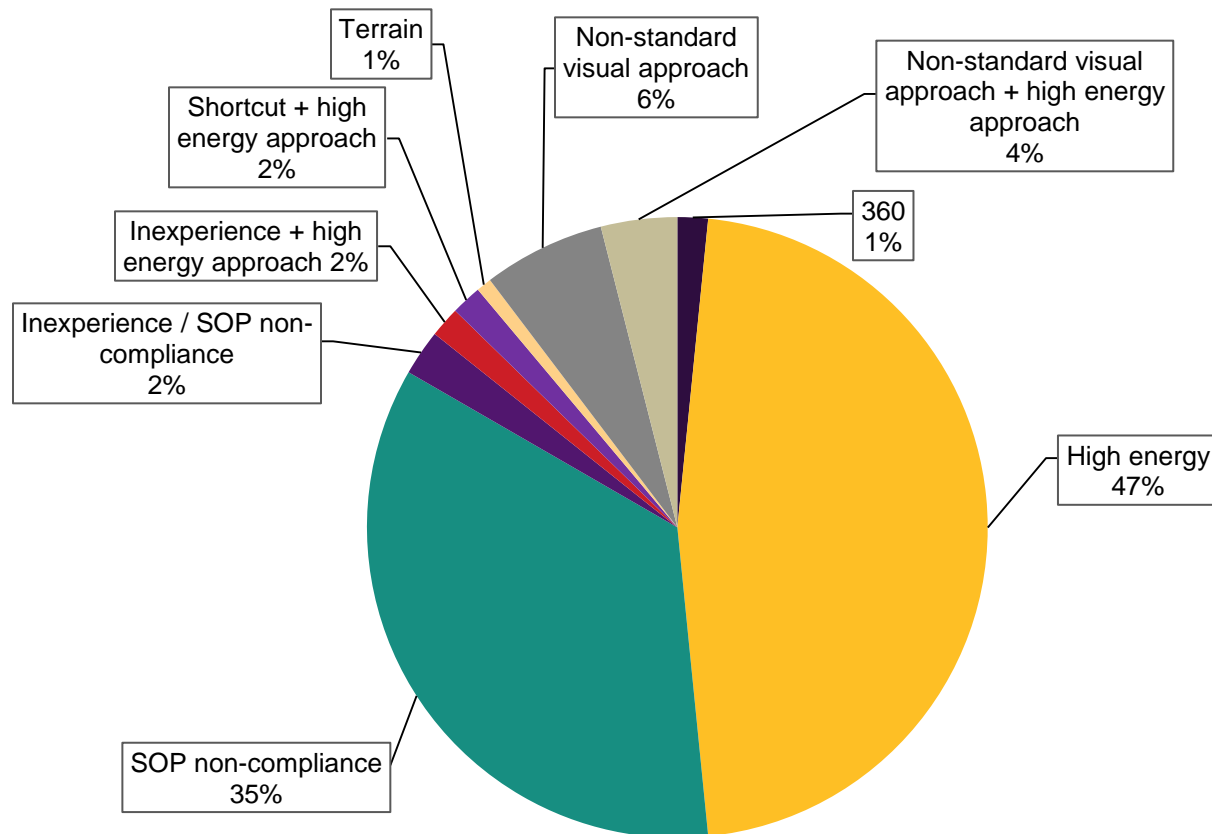


# Vueling previous SOP

## Stable approach criteria

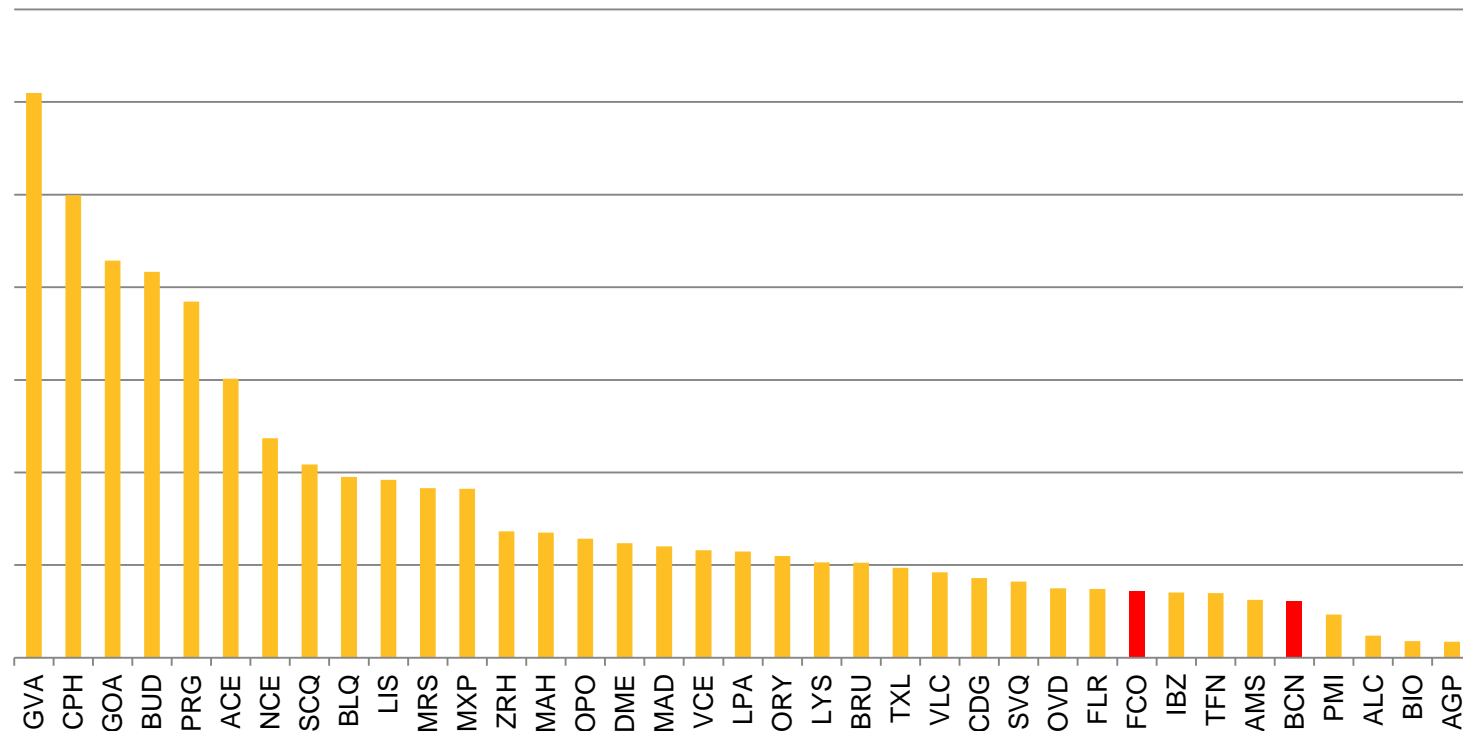
- 1000 ft
  - $V_{app} + 10/-5$  kts
  - Final configuration
  - Established on the localizer (1000 ft / 3NM @DME)
- 500 ft Spool-up

# Unstable approach causes



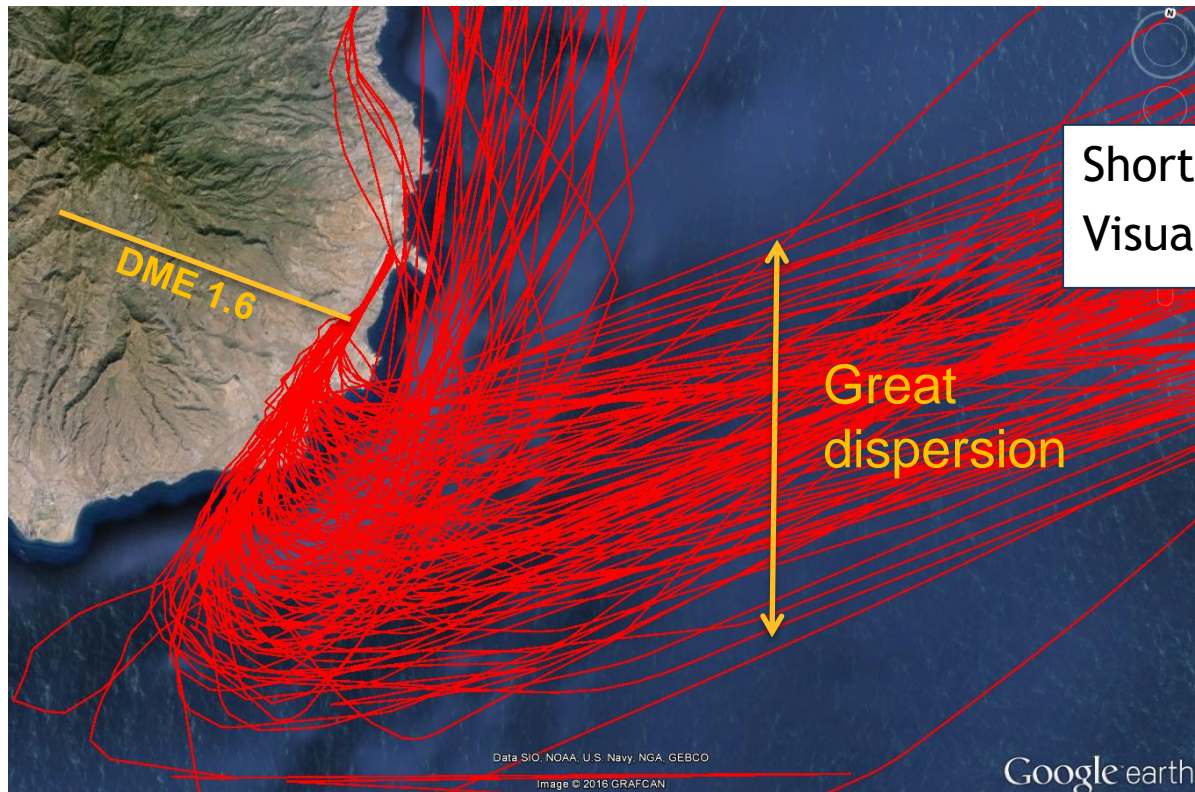


## Unstable approaches - Location (1000 sectors)



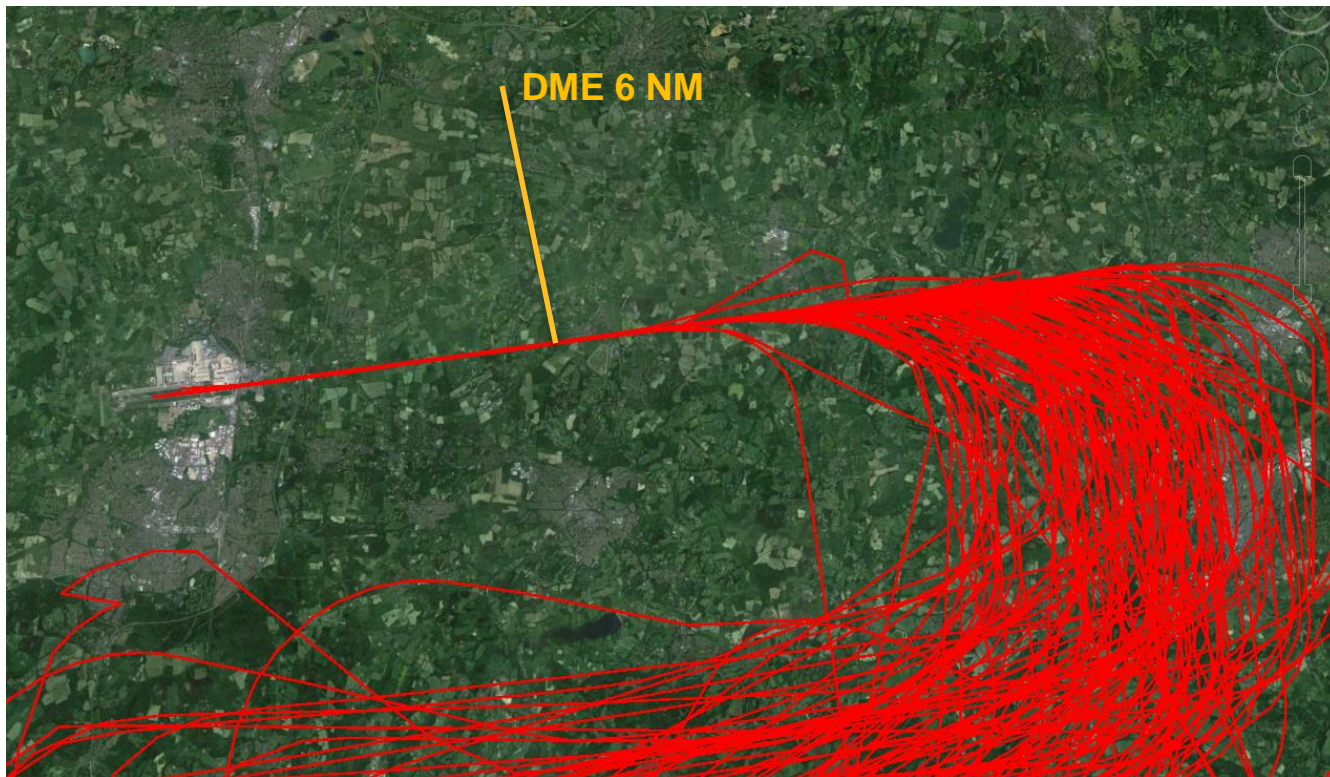
## Approach tracks

- South Europe (LPA) → Non standard approach



## Approach tracks

- North Europe (LGW) → Standard approach



## 2. FDM study

1. Study frame and goals
  2. Unstable vs. Stable approaches
  3. 180 kts @ 8 NM DME restriction
  4. 160 kts @ 6 NM DME restriction
  5. Both speed restrictions affectation
  6. Landing gear down distance
  7. Final configuration height
  8. Gate global efficiency
  9. Collateral consequences on stable approaches
- The 4 gates

**Which change was necessary?**

# Study frame

- Q2 +Q3 2015
- 100% of destinations

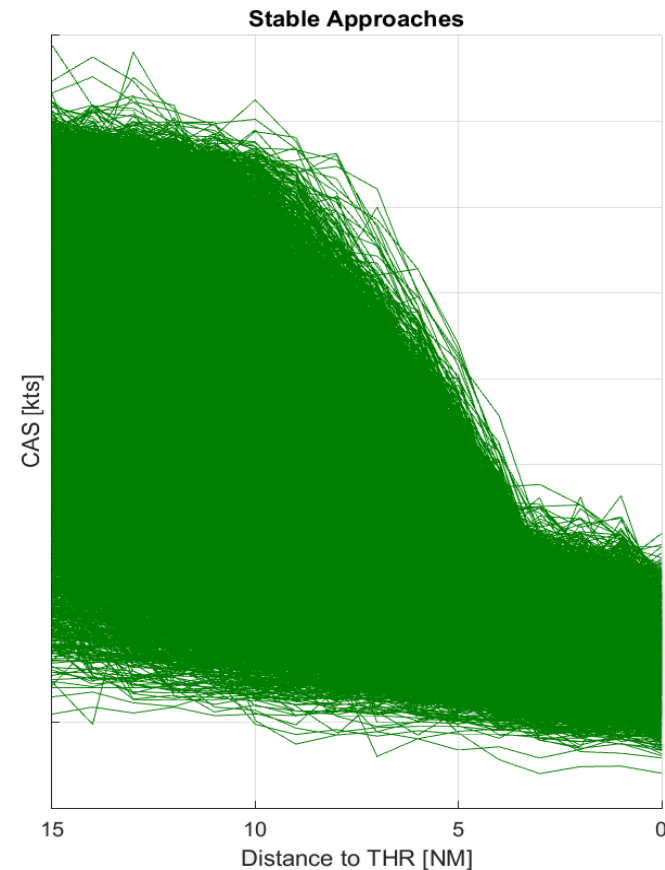
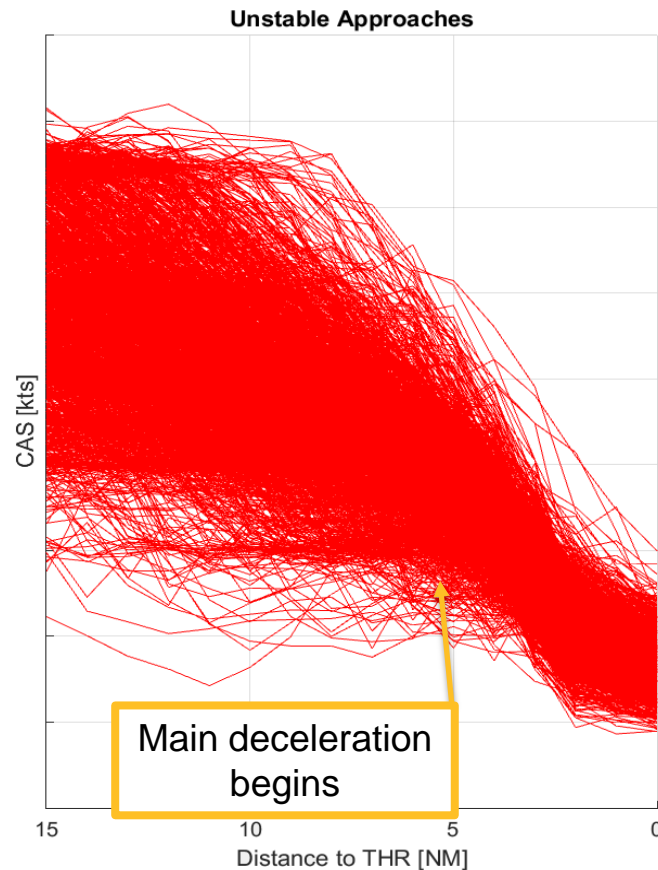
## Goals

- Main goal:
  - Finding **the best possible gate/s** for Vueling
- How to reach the main goal:
  - High energy approaches control
  - Final configuration altitude control
  - Non-standard visual or circling approaches control
  - Minimum delay impact
  - CM1 + CM2 criteria standardization
  - Easy to remember
  - Compatibility with ATC / AIP instructions
  - Compatibility with Airbus standard profile



## Speed profile UA vs NO UA

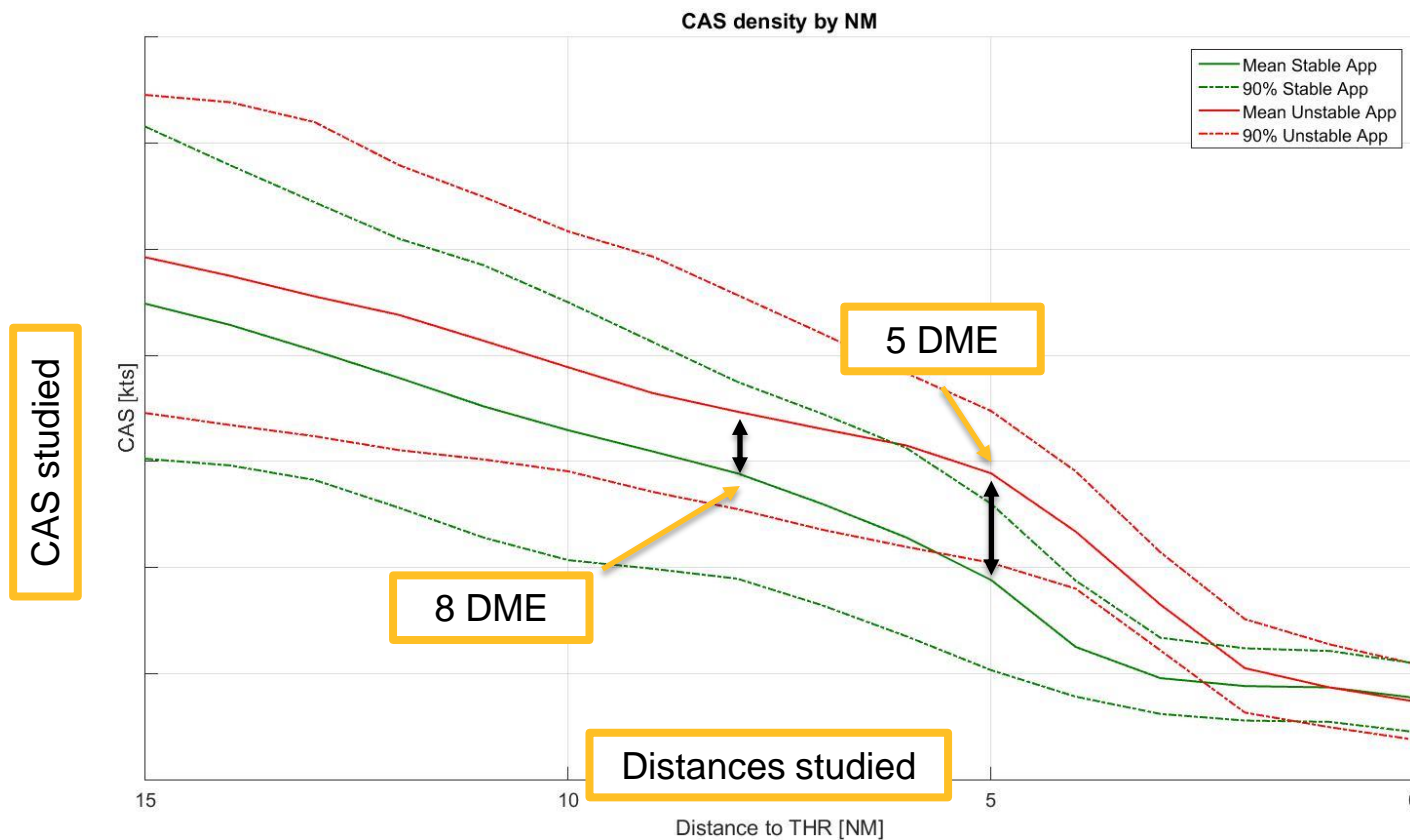
Q2 + Q3 2015



High energy criteria:  $V_{app} > 15 \text{ kts @ } 1000'$

## Speed profile UA vs NO UA

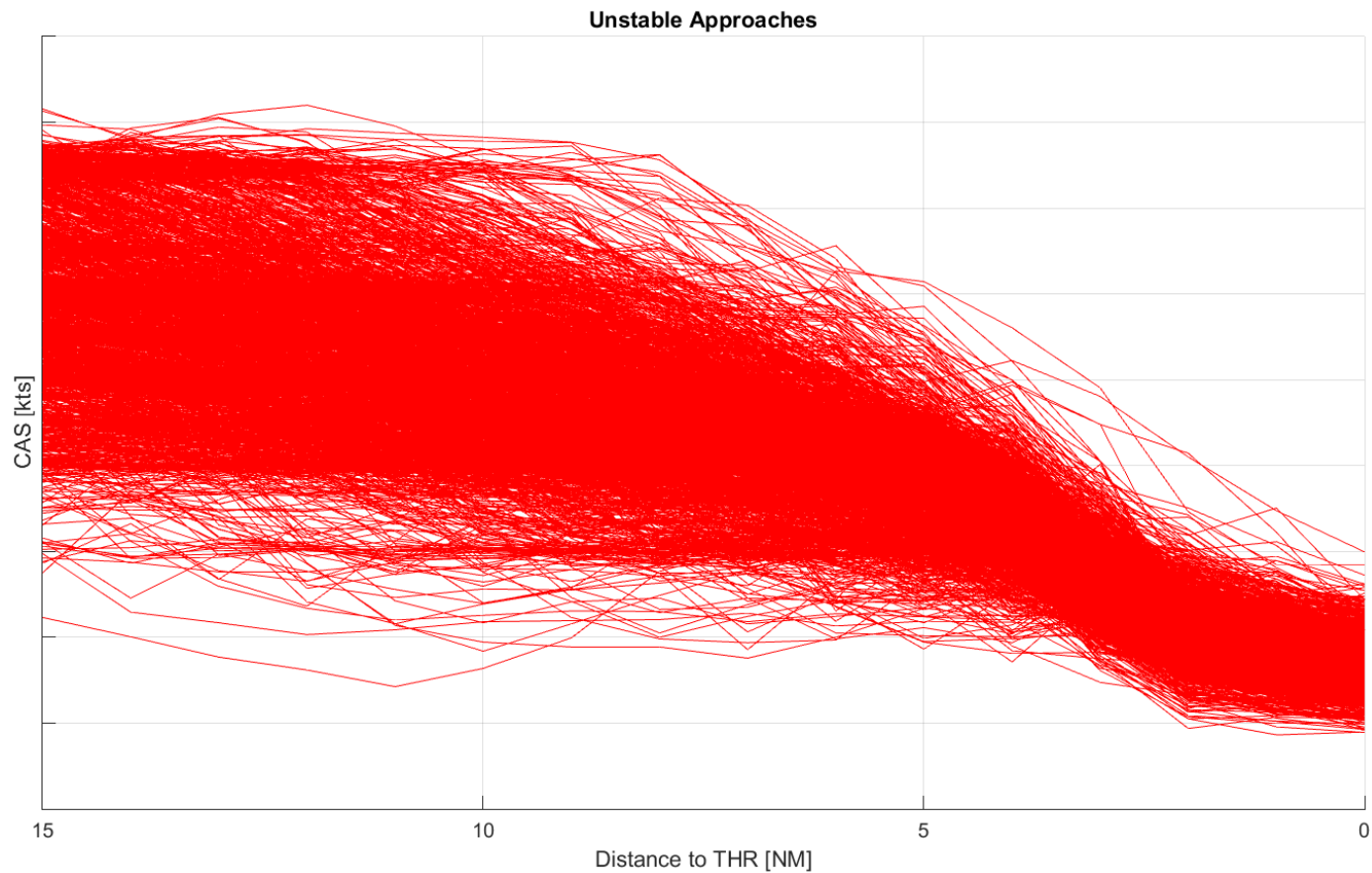
Q2 + Q3 2015



High energy criteria:  $V_{app} > 15 \text{ kts @ } 1000'$

## 180 kts @ 8 DME restriction

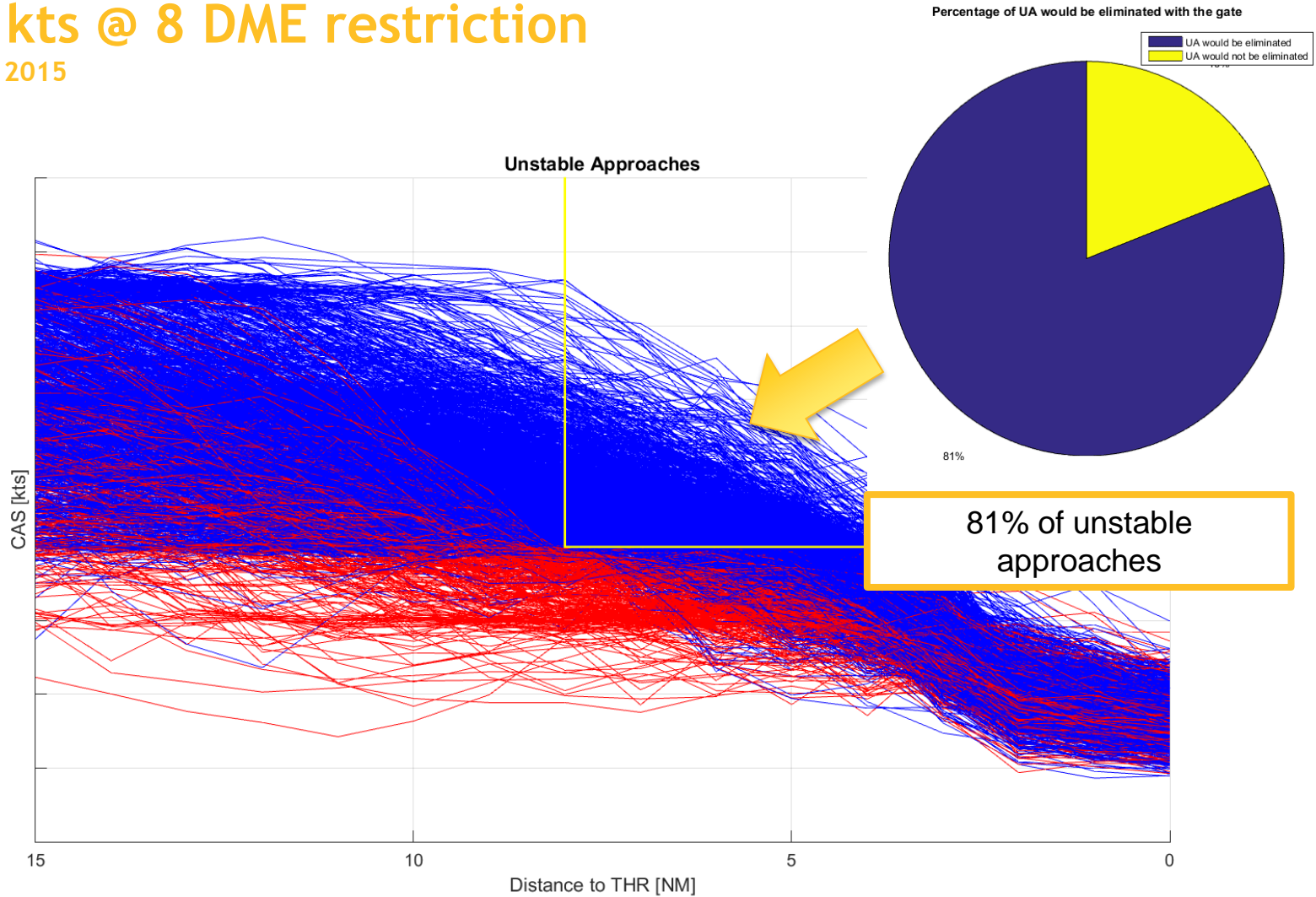
Q2 + Q3 2015





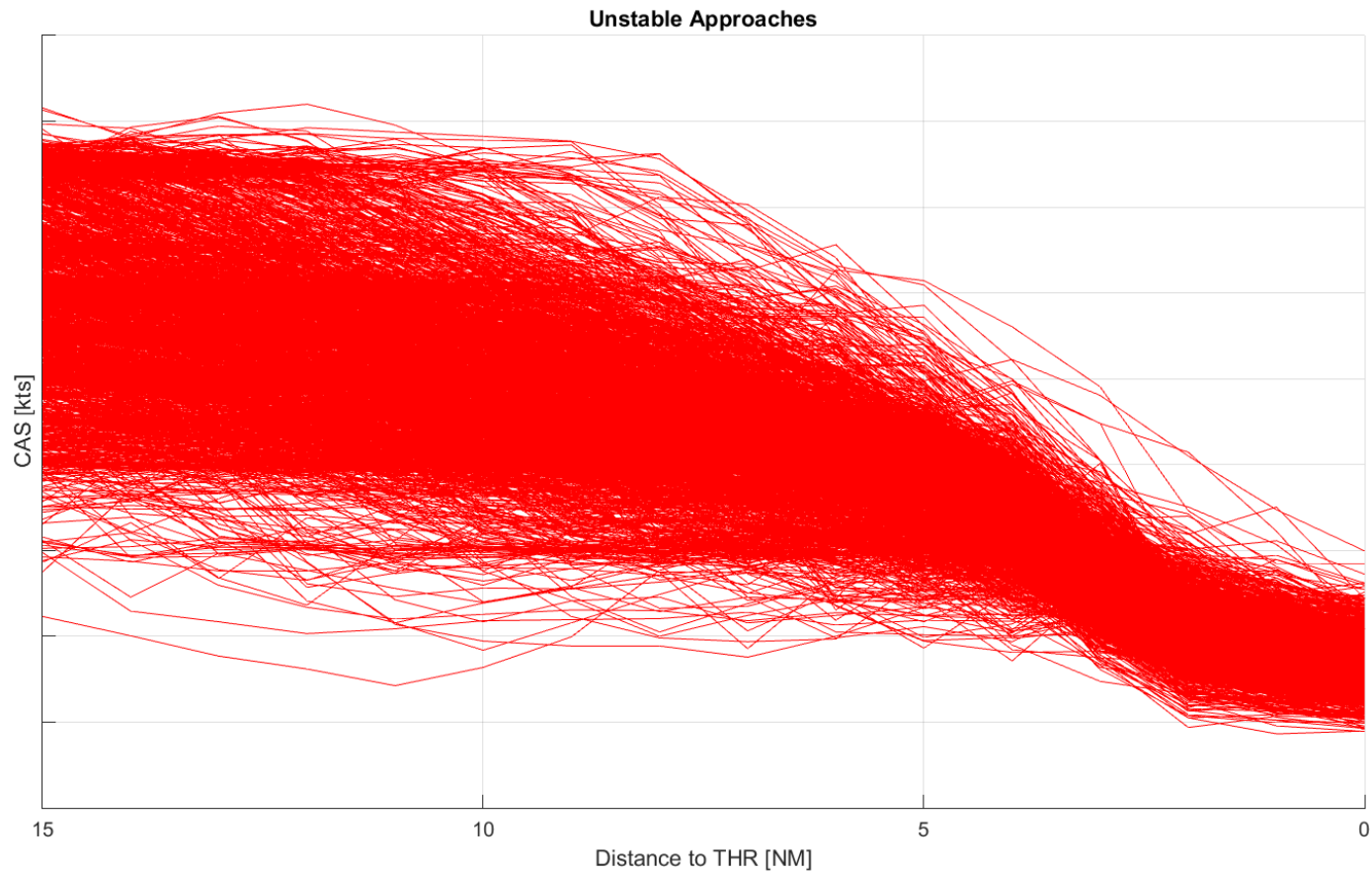
## 180 kts @ 8 DME restriction

Q2 + Q3 2015



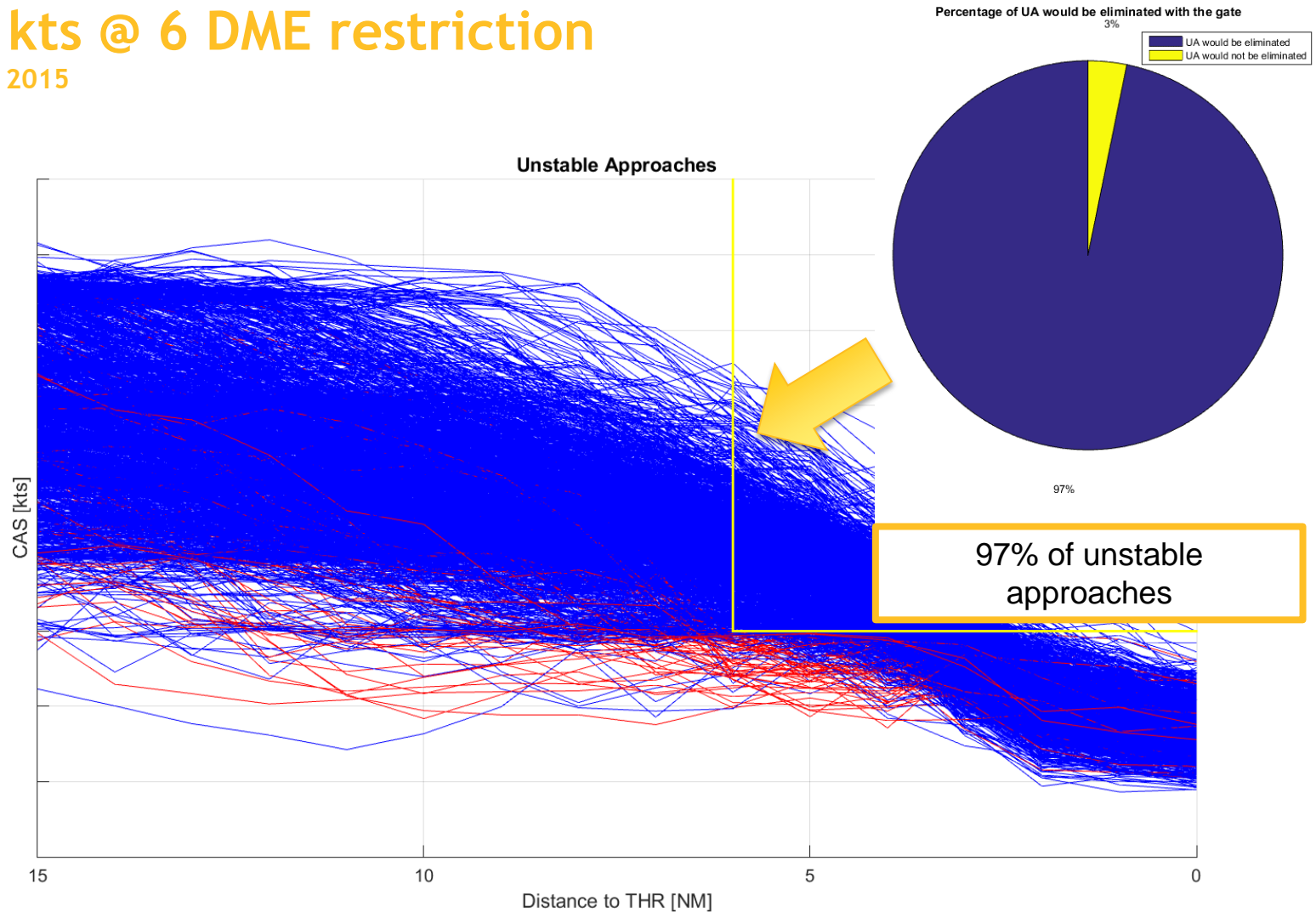
## 160 kts @ 6 DME restriction

Q2 + Q3 2015



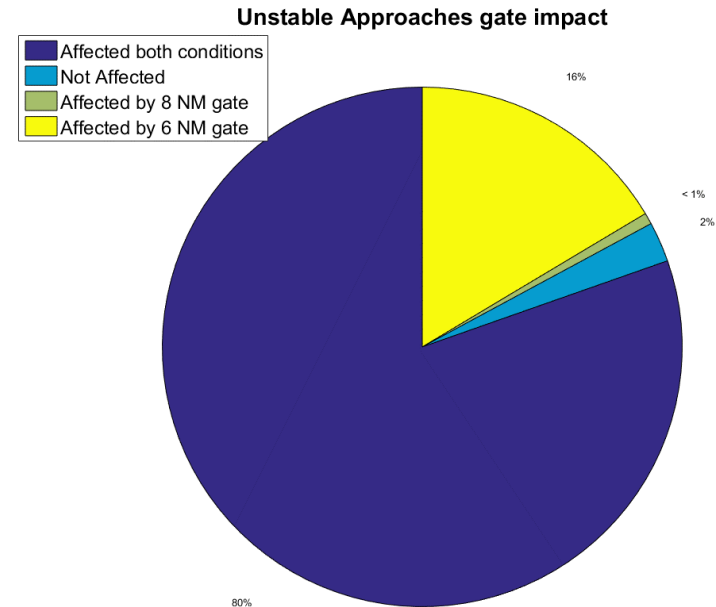
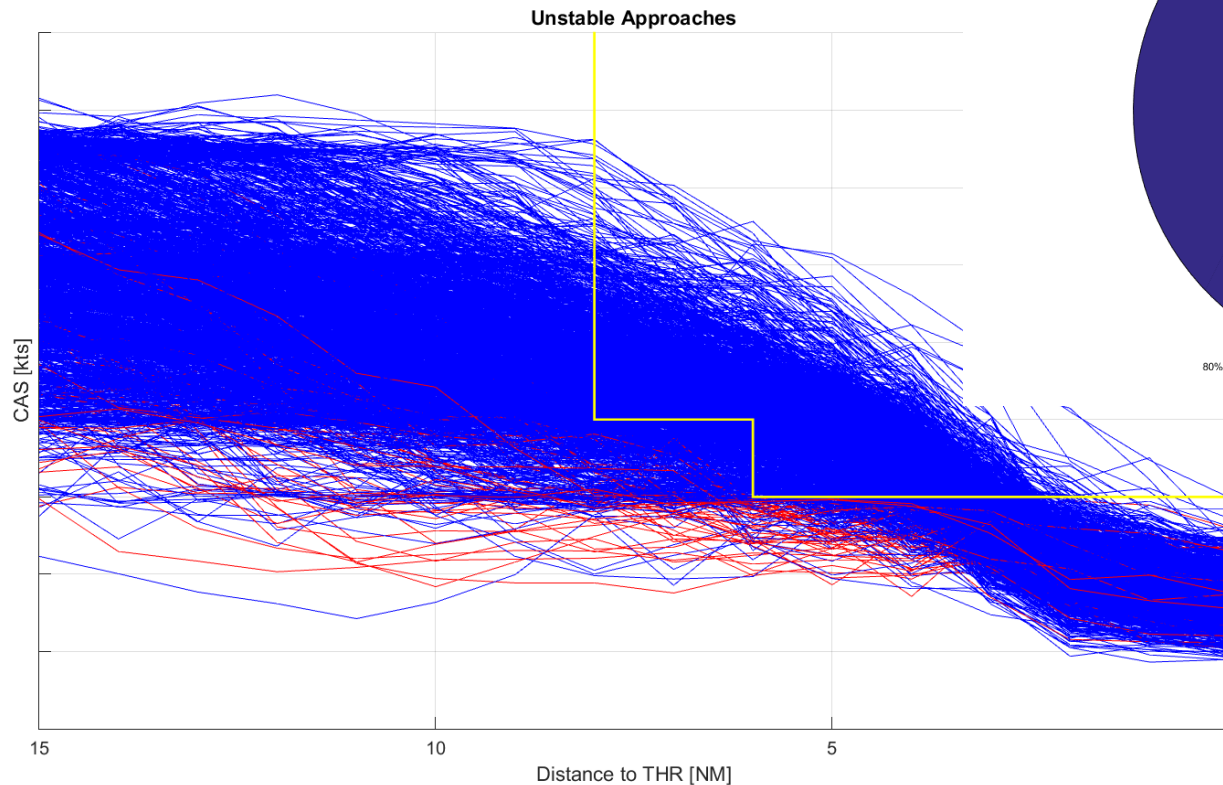
# 160 kts @ 6 DME restriction

Q2 + Q3 2015



### Both restrictions - 6 & 8 DME

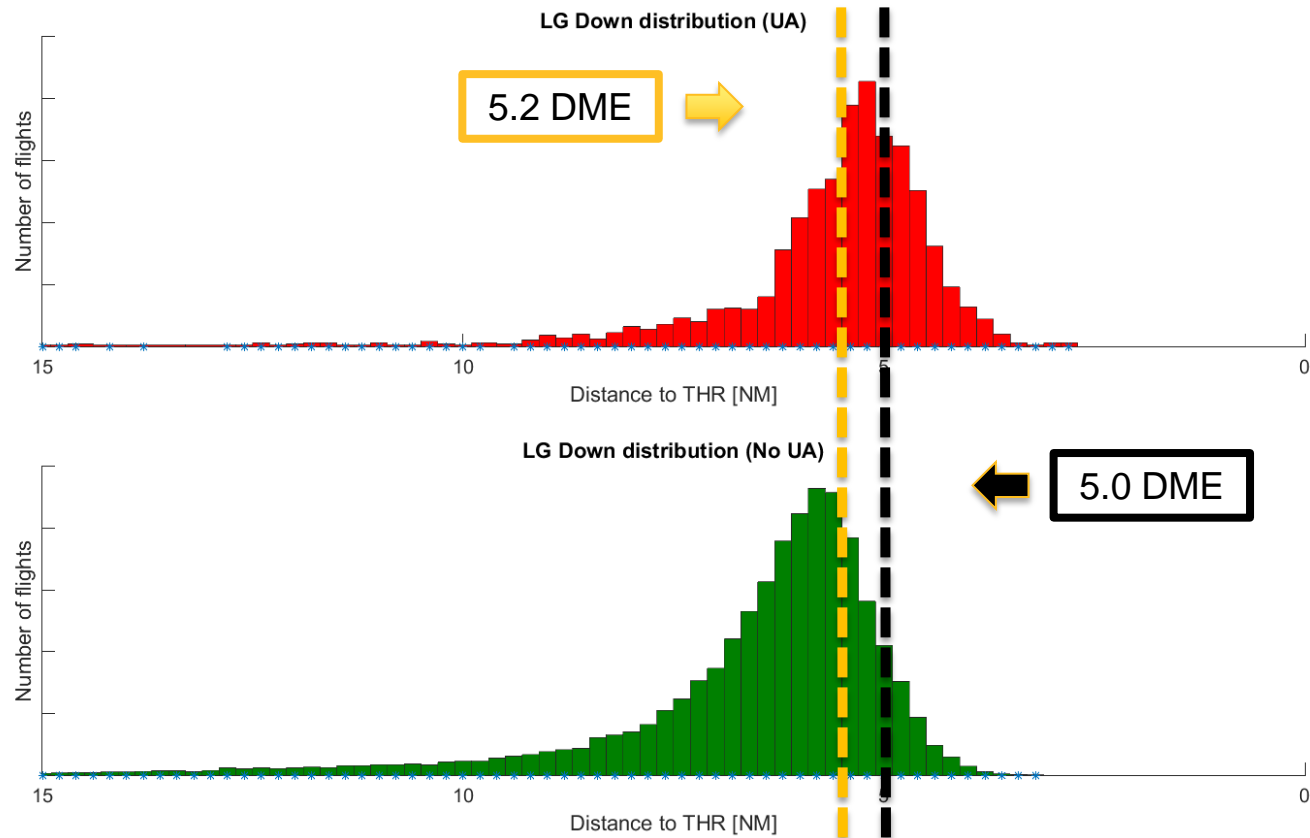
Q2 + Q3 2015



98% of unstable approaches affected

# Landing gear down distance

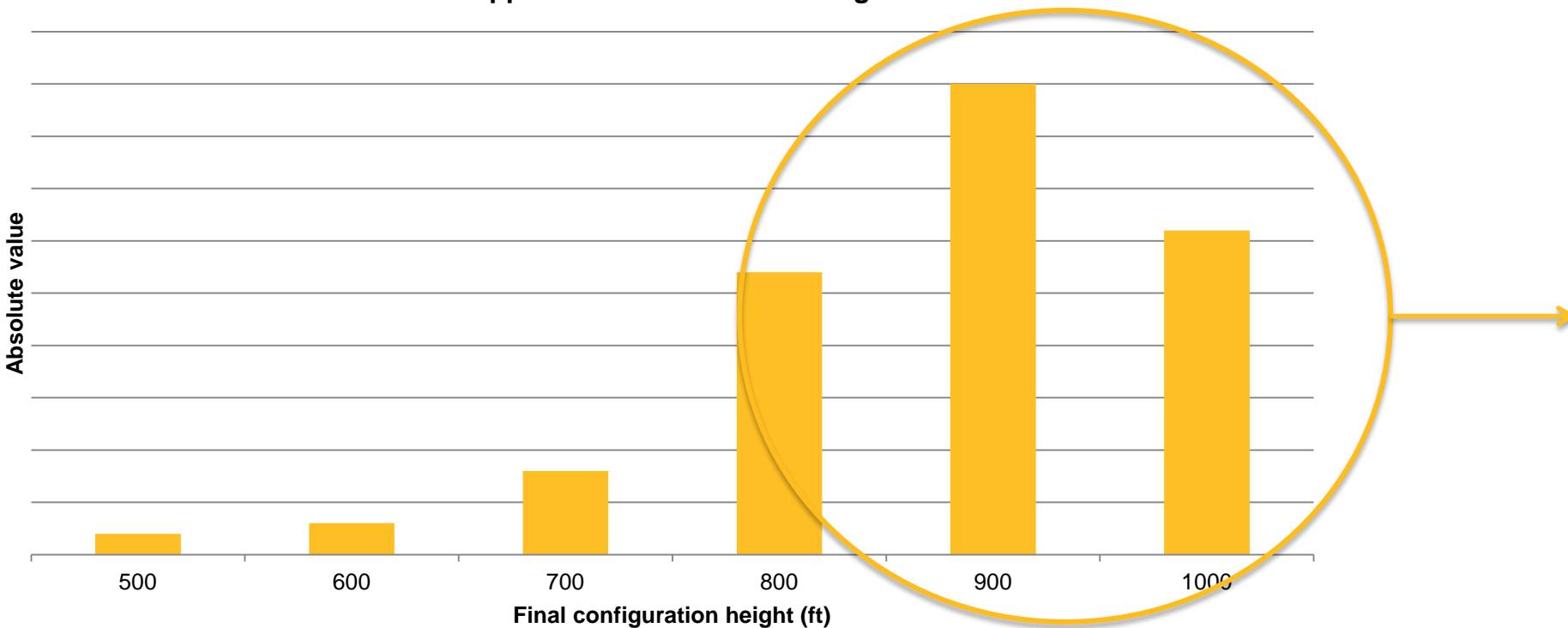
Q2 + Q3 2015



## Final configuration height

Q2 + Q3 2015

### Unstable Approaches – Late final configuration



## Theoretical gate global efficiency

Q2 + Q3 2015

UA ratio

$X$



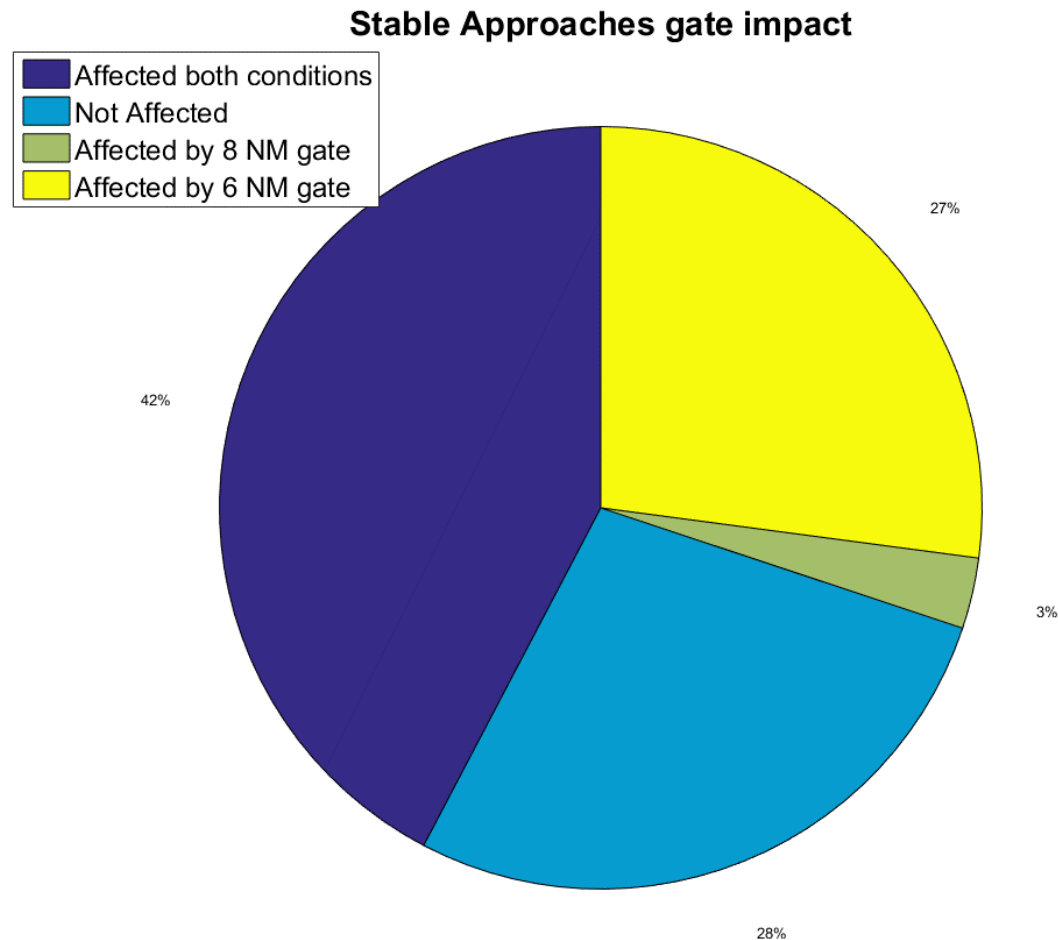
New UA ratio

$X/13.3$

UA ratio reduction of 93%

## Collateral consequences

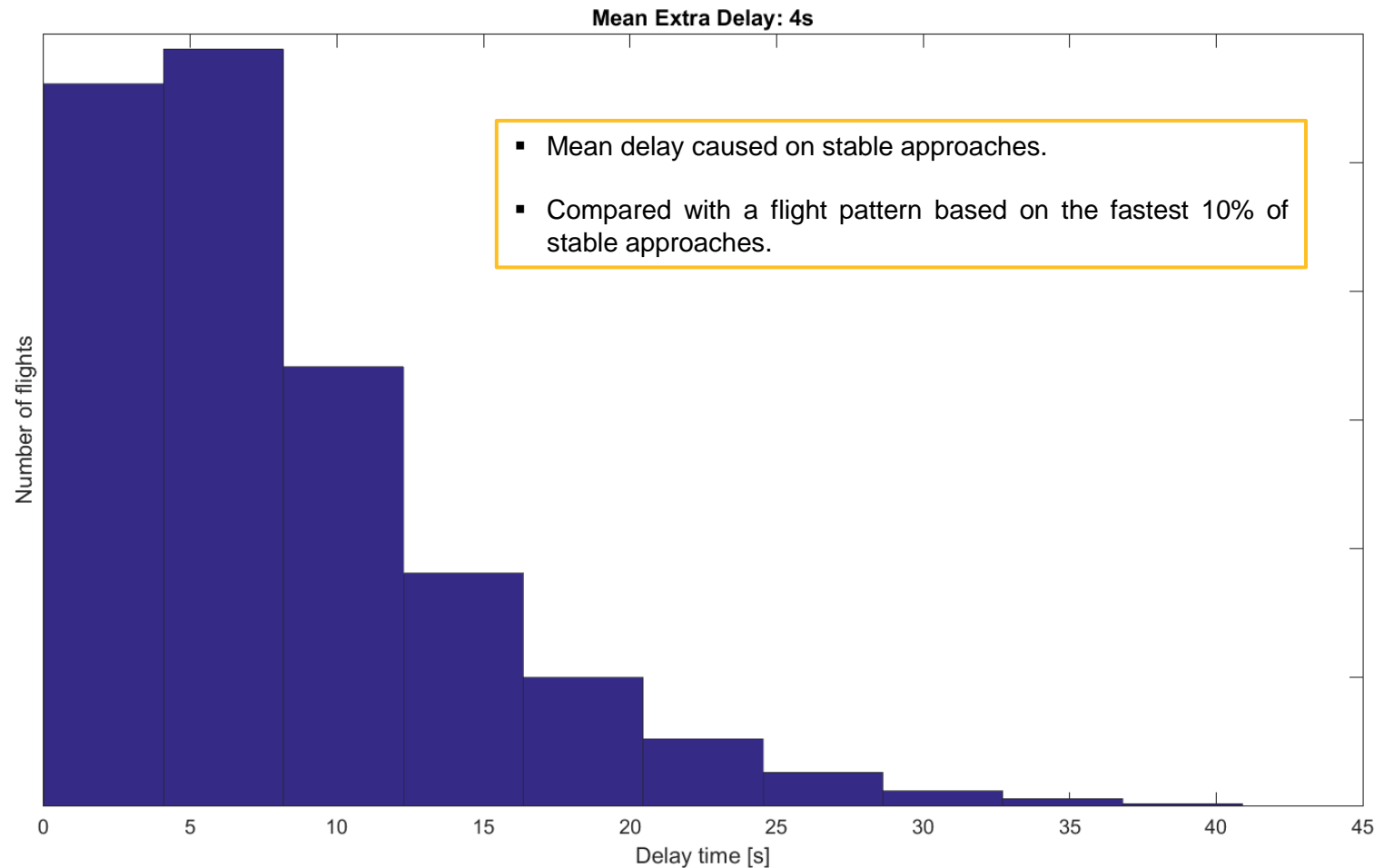
Q2 + Q3 2015





## Affection on unstable approaches

Q2 + Q3 2015

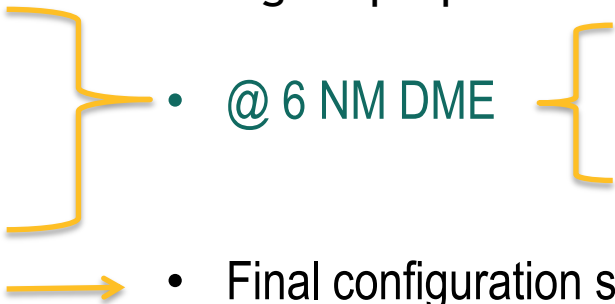


### 3. Results

- 1.Vueling new approach SOP
- 2.First new SOP results

What is it **expected** to achieve?

## Final gate proposal

- First gate proposal:
    - Maximum 180 kts @ 8 NM DME
    - Maximum 160 kts @ 6 NM DME
    - Landing gear down @ 5 NM DME
    - Final configuration settled below 1300 ft / 4 NM DME (first reached)
  - Final gate proposal:
    - @ 6 NM DME
      - Max. 160 kts
      - Landing Gear down
    - Final configuration settled below 1300 ft / 4 NM DME (first reached)
- 

Theoretical unstable approach ratio

X



1.05·X

## Provisional actual gate global efficiency

Q2 + Q3 2015

UA ratio

X



New UA ratio

$X/8.65$

UA ratio reduction of 89%

**THE END**

**Thank you for your  
attention**