Protection of Instrument Landing System (ILS) Critical and Sensitive Areas in Three-dimensional and ILS Facility Performance Category Requirements

Dr.-Ing. Gerhard Greving

NAVCOM Consult

Ludwigsburgerstr. 23

71711 Steinheim / Germany

navcom.consult@t-online.de

http://navcom.de

Hong Kong / Bangkok / Steinheim 30.11. – 04.12.2020

ILS 3D-CASA - Introduction

⇨ **Critical and Sensitive Area CASA 2D ←→ 3D**

2D affecting A/C or vehicles on the ground

3D affecting A/C above the ground (→ starting, after take-off)

"Autoland in good weather" conditions in particular concerned

⇨ **Some definition in the guidance material Annex 10 Att. C**

→ **only qualitative remarks to 3D CASA**

→ **only examples of 2D-CASA-areas on the ground so far**

⇨ **CASA "guarantees": signal in SARPs for landing aircraft**

⇨ **Dependent on operational category CATI - CATIII**

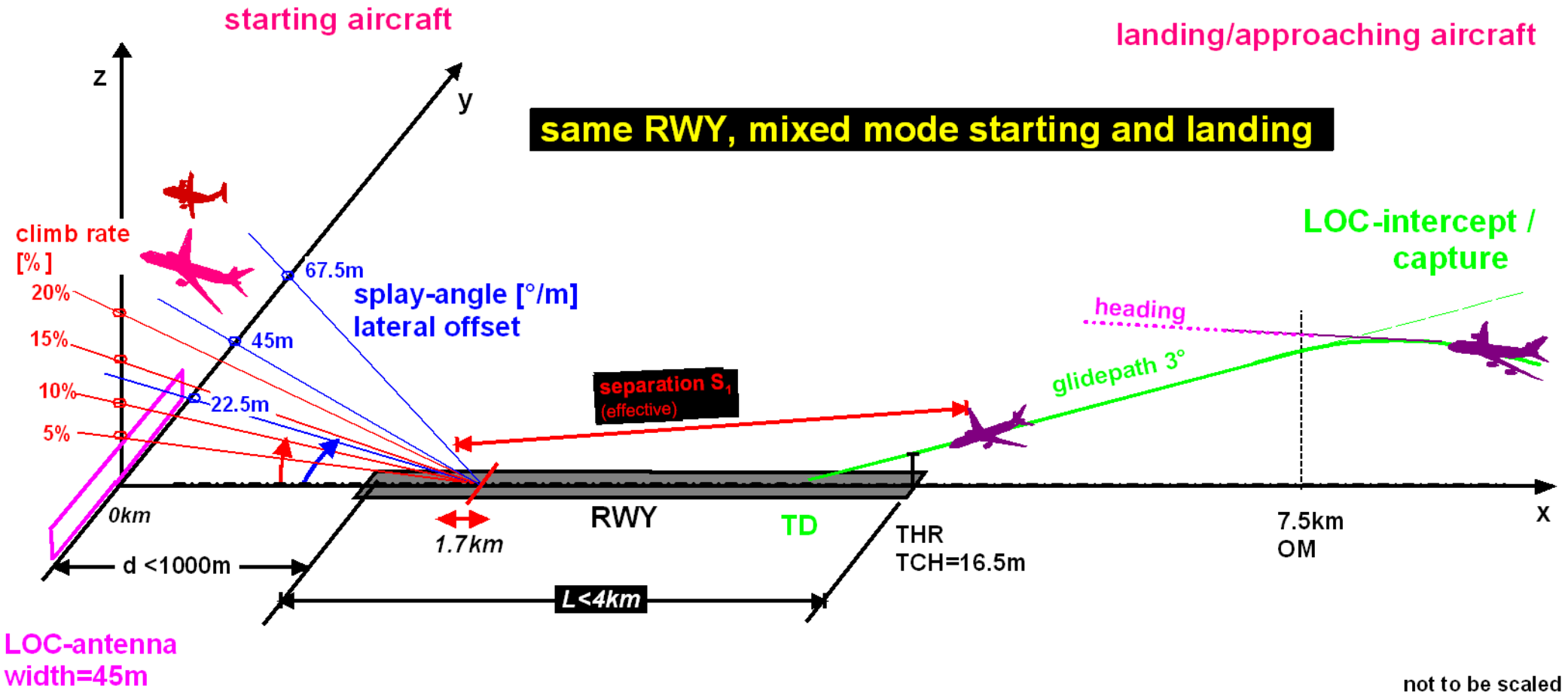
⇨ **Some Results/Recommendations for 3D CASA**

IFIS 2018 Monterey Greving/Spohnheimer

IFIS 2012 Braunschweig Greving/Spohnheimer

NAVCOM Consult
RWY_mixedmode4.dsf 11/20

Geometry / Scenario 1/2 of Mixed Mode RWY Operation



Cases

777 / Avro starting

(1) 777 landing

(2) 747 approaching

⇨ **Often interlaced starting and landing on the same RWY**

⇨ **The starting A/C distorts the ILS-LOC-signal ("fluctuations")**

⇨ **Conditions / Parameters: combined effects ←→ simulations**

- **the larger the A/C the larger the distortions**
- **the larger the lateral splay-angle the larger (no→0 = symmetry)**
- **the steeper the A/C (larger climb rate) the smaller**
- **the lower the A/C (smaller climb rate) the larger**
- **the later the A/C takes-off the larger**
- **the larger the distance of LOC-antenna to end of RWY the larger**
- **the higher the LOC-antenna the smaller**
- **the lower the next landing A/C (e.g. close to THR) the larger**
- **time instances play decisive role for LOC-capturing A/C ←→ avionics**

⇨ **But: e.g. small and low A/C can distort for low landing A/C**

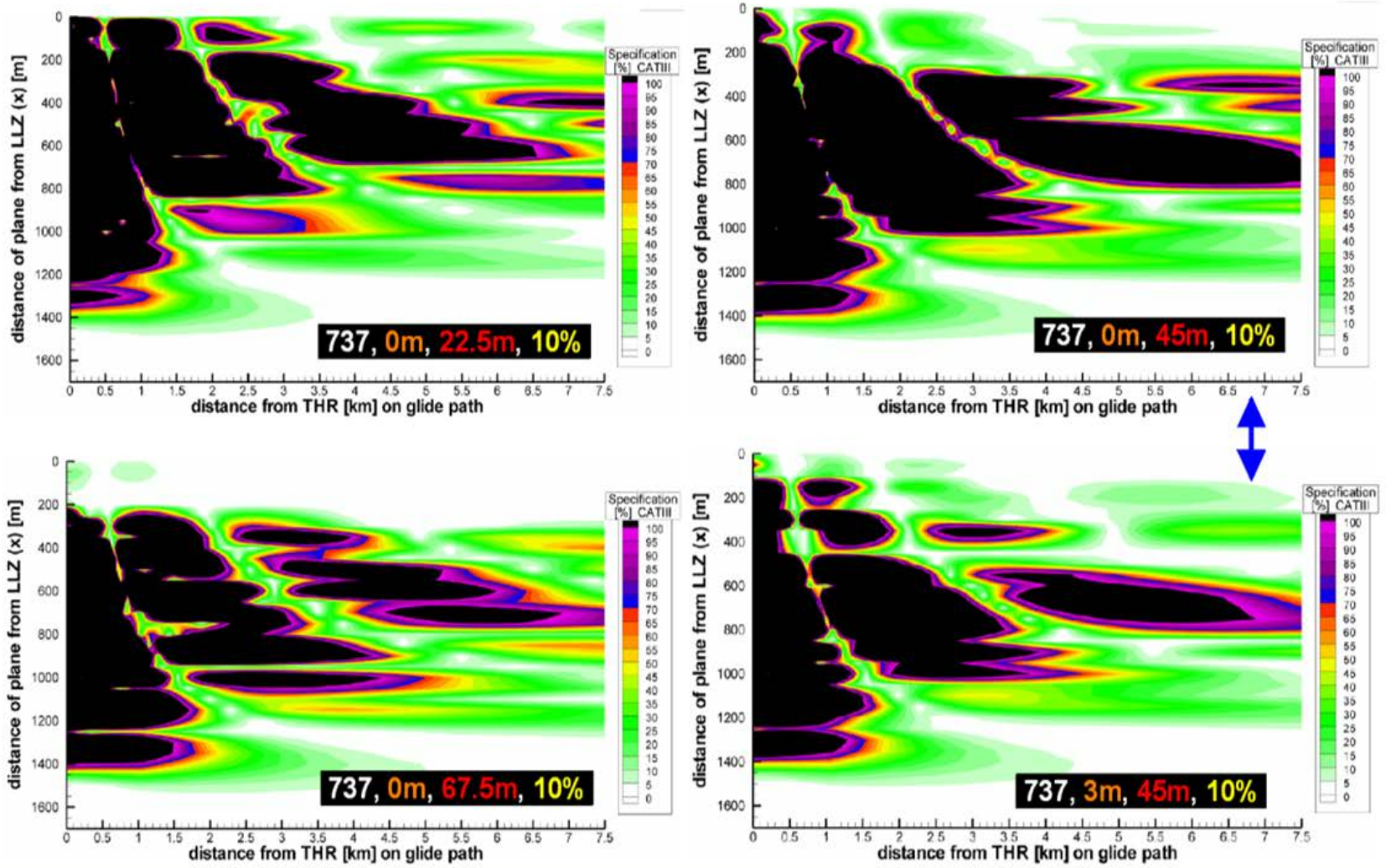
several of critical conditions violated;
see details IFIS 2012/2018

Figure·4.··B-777·ILS·Autoland·Event¶

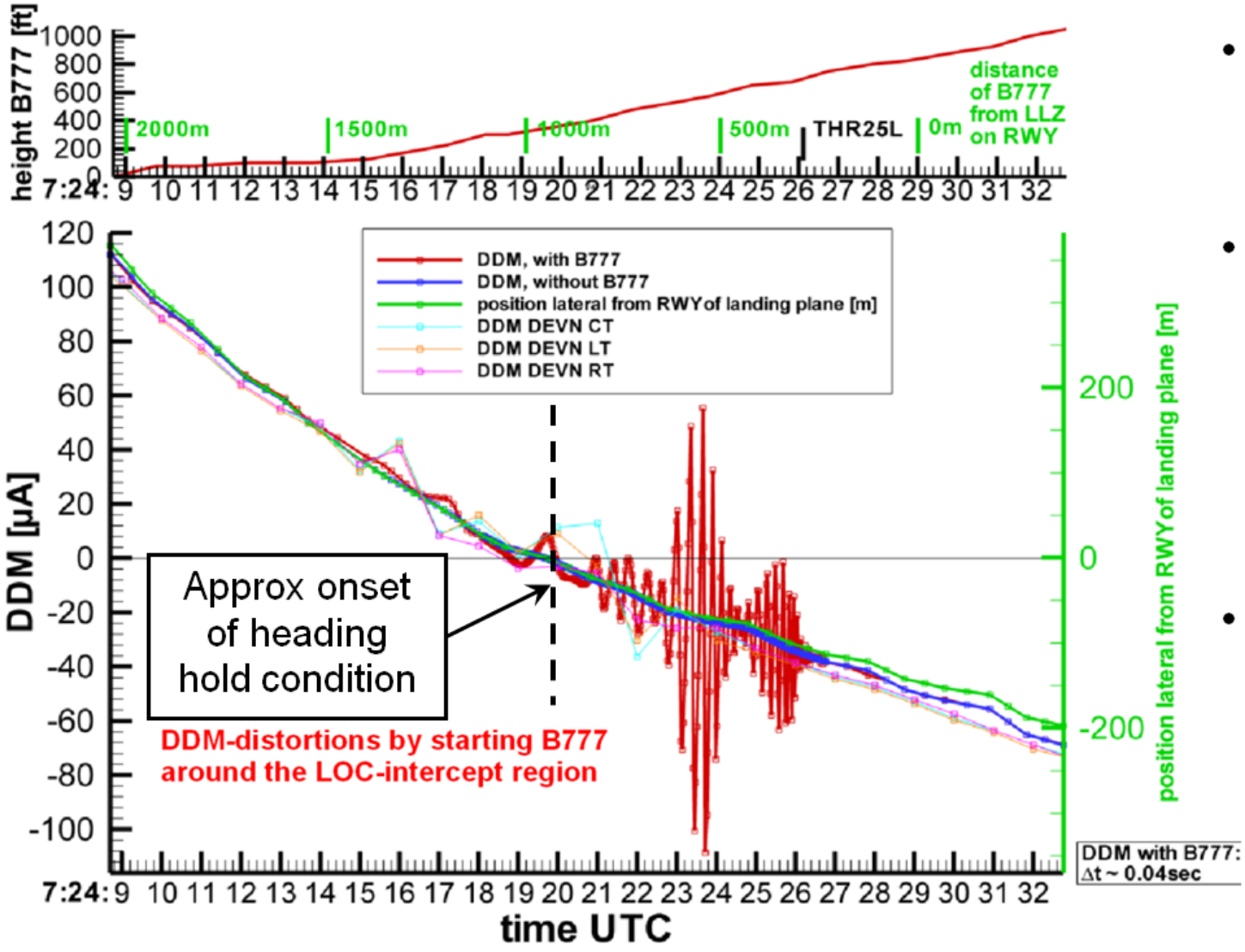
Errors vs lateral drift and LLZ antenna height for 737-800 & 10% climb

% CAT III on 3° GP

black = > 100% of tolerance



ILS 3D-CASA Case 2 Numerical Results



- Departure profile @ top
- Calculated and actual deviation from flight data recorder – left (black) axis
- Landing aircraft lateral position from extended centerline – right (green) axis

ILS 3D-CASA Summary / Recommendations

- ⇨ CASA has a 3D feature ←→ difficult to mark on the APT
- ⇨ 3D in particular relevant for RWY mixed mode operation
- ⇨ ILS LOC signal “fluctuations” are a well-known phenomenon
  not an error or failure of the ILS ground equipment !
- ⇨ Modern Numerical Simulations to be applied for CASA 2D/3D
- ⇨ Pilotes and controllers must be aware and familiar with 3D
- ⇨ Starting procedures and separations have important role
- ⇨ AIP/AIC/NOTAMs should contain notes/warnings; autoland
- ⇨ Avionics must take into account these facts as well

THX Q&A