Supporting
European
Aviation

EUROCONTROL

NM AI tools for airports

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AI for Airports: to achieve what

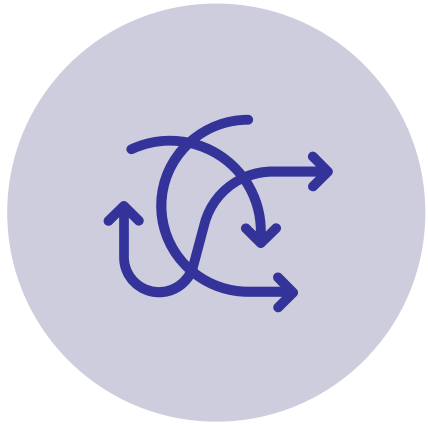
AIRPORT REGULATION PREDICTIONS

Added value: Anticipate and timely set airport regulations or avoid them if possible

PASSENGER AT THE TERMINAL PREDICTIONS

Added value: Capturing passenger demand volatilities to adjust resources accordingly

OPTIMISED AIRCRAFT SEPARATIONS



Added value: Increase runway throughput assuring safety separations

Regulation Outlook

AIRPORT REGULATION PREDICTION

The concept has been developed within the framework of SESAR 2020 and the Horizon 2020 research and innovation programme

Regulation Outlook – High level view

Flights prediction

Weather prediction

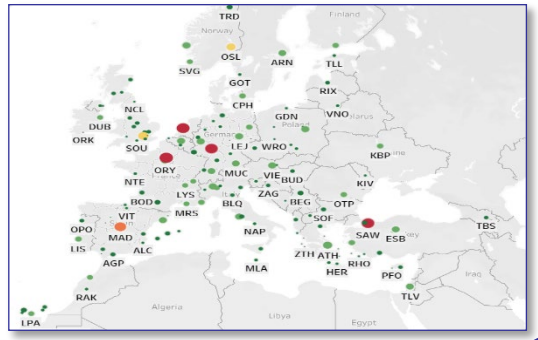
Airport Events

NOTAMs

Regulation outlook

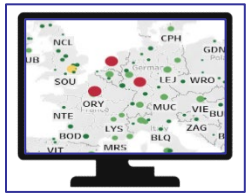
CURRENTLY IN TRIAL MODE

NMOC morning briefing



FUTURE DEVELOPMENT

Airport / Airline Operators



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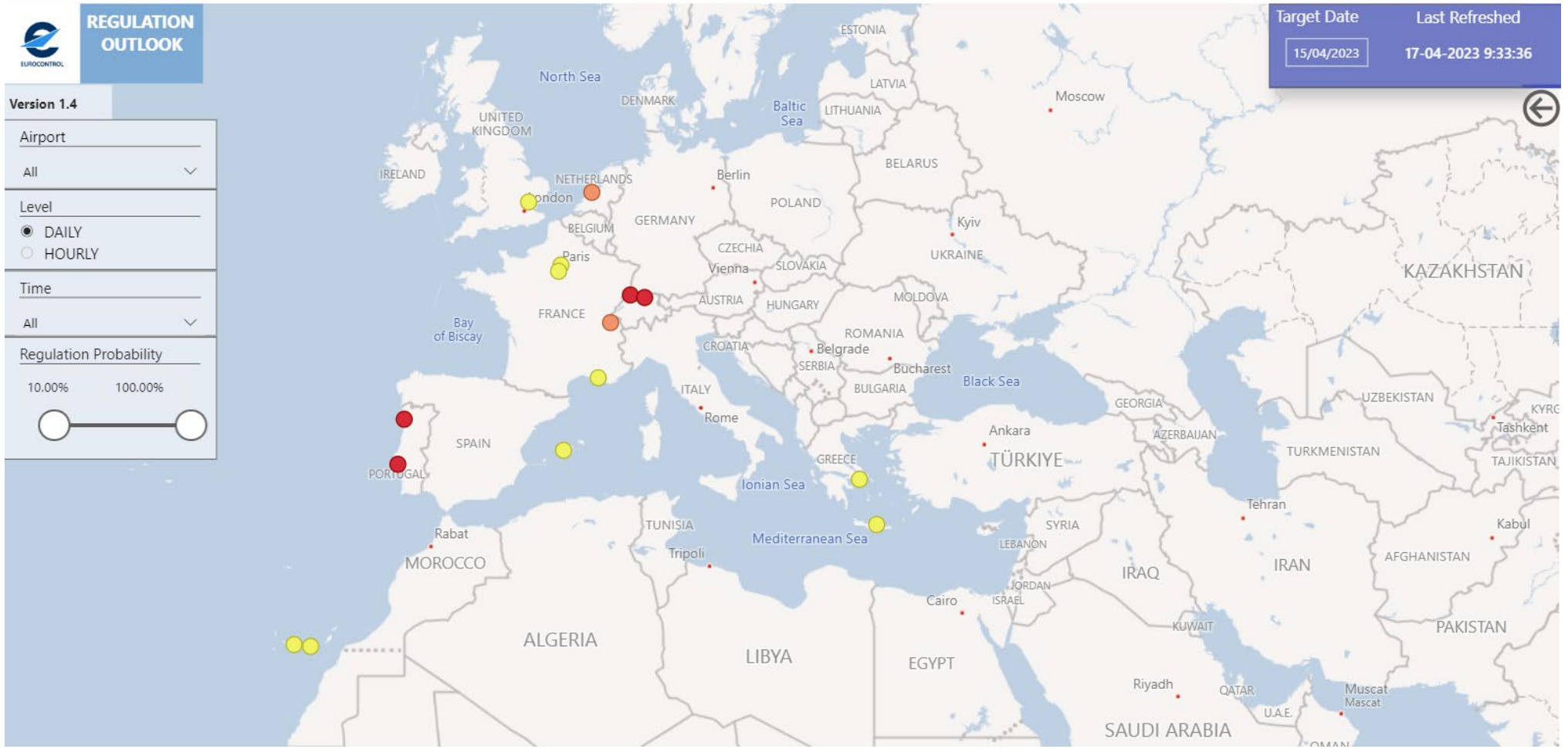
Regulation Outlook - Dashboard



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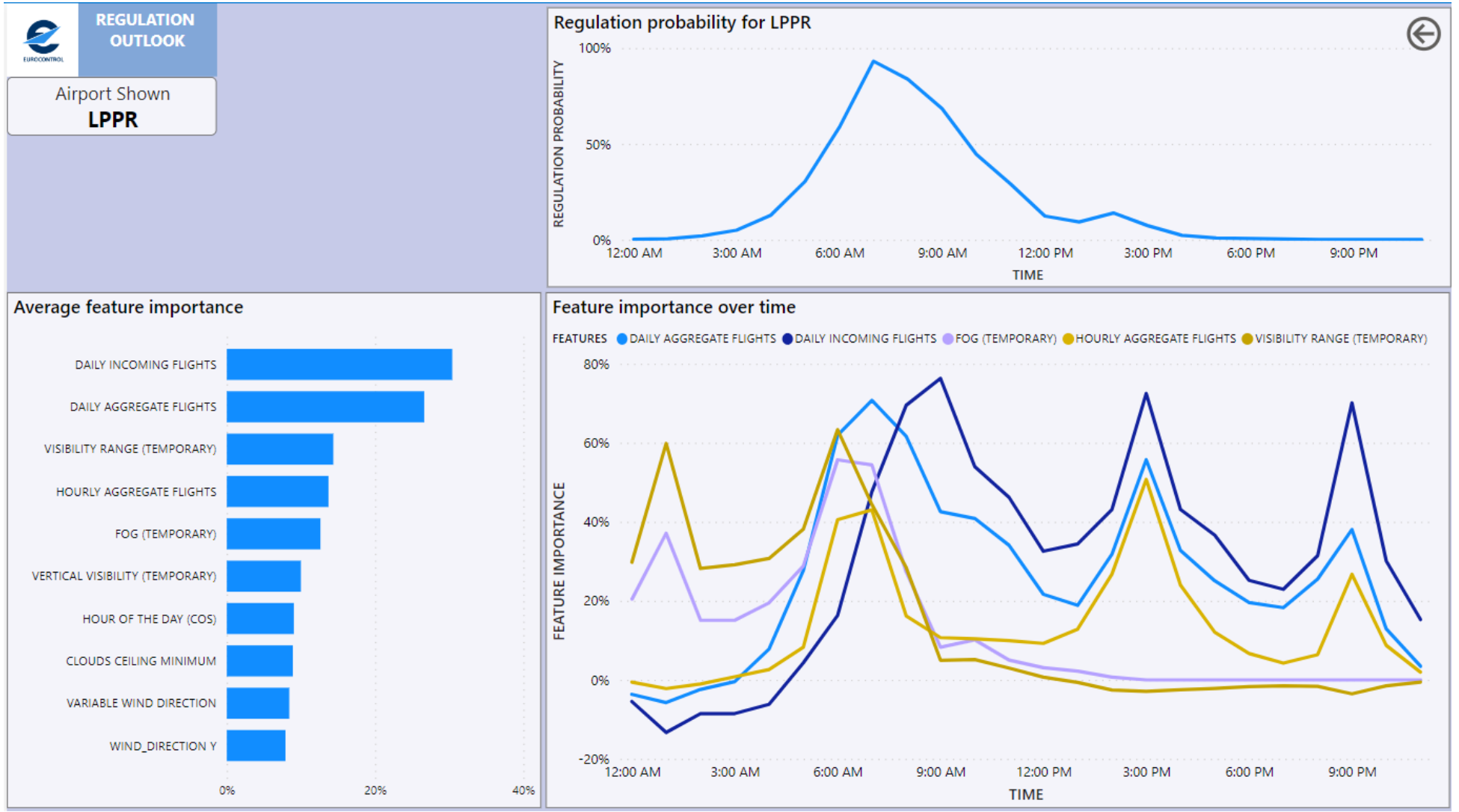
Regulation Outlook - Dashboard



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Regulation Outlook – Method, accuracy and explainability

AI algorithm

→ Time series problem (24 timesteps) modelled using a Deep Convolutional Neural Network

Accuracy

→ Precision: 83%. Only 17% of the red-coloured airports will not have a regulation
→ Recall: 86%. Only 14% of the actual regulations are not highlighted in any colour

Explainability

→ All regulation predictions are shown along with an hourly/daily feature importance

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Passenger Demand Support Service (with the support of EUROCONTROL Innovation Hub)

PASSENGER VOLUME PREDICTIONS

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Passenger Demand – Per flight view

With the support of EUROCONTROL Innovation Hub

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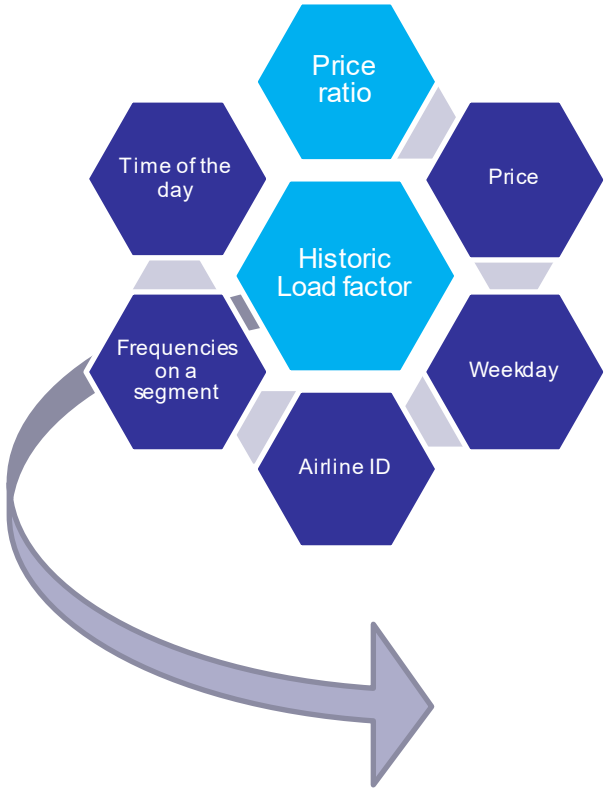

Admin Pax Demand

Master | Load Factor | Flights | Accuracy

Today

2023-03-17

Filters

Airport: Multiple selections

Airline: All

Date: Select all, Rolling Week 1, Rolling Week 2, Rolling Week 3

Overview

Heatmap 4h window

Heatmap 1h window

DEP Pax / 1h slot

Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2023/03/17																								
AIRFRAME1																	83							
AIRFRAME2																								186
AIRFRAME3																	209							
AIRFRAME4																							133	
AIRFRAME5													169											
AIRFRAME6																				170				
AIRFRAME7													168											
AIRFRAME8																				81				
AIRFRAME9																						175		

ARR Pax / 1h window

Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2023/03/17					257	969	12,079	10,392	6,247	5,052	6,747	7,517	8,892	8,319	5,778	6,187	8,367	10,303	7,593	7,339	6,668	2,468	572	
2023/03/18					245	920	12,117	9,033	4,311	4,812	6,018	5,736	10,001	5,522	5,539	6,244	7,251	7,658	6,216	5,208	3,013	2,152	594	413
2023/03/19					339	1,113	11,896	9,879	5,449	5,601	6,333	7,668	9,920	7,869	6,884	7,848	7,613	10,044	9,870	7,192	8,328	2,791	469	195
2023/03/20					162	549	12,632	10,848	5,661	4,796	7,702	7,078	11,079	7,397	7,083	7,056	7,460	10,398	9,281	5,954	6,632	2,892	528	187
2023/03/21					154	497	10,418	9,728	4,911	3,190	6,257	7,283	8,695	5,335	5,709	6,556	7,356	9,572	8,212	5,237	5,708	2,521	394	133
2023/03/22					154	105	10,950	9,636	4,381	4,467	6,767	6,575	9,039	5,668	6,260	5,968	7,091	8,400	6,615	5,140	6,417	2,738	349	291
2023/03/23					257	727	12,587	9,708	5,368	4,152	6,431	6,112	9,945	5,808	6,242	7,585	6,691	8,933	8,124	5,445	7,026	2,572	532	152
2023/03/24					260	837	12,013	10,591	5,582	5,054	7,209	5,914	8,150	8,769	5,289	5,799	8,820	10,304	8,888	7,434	7,424	2,702	396	155
2023/03/25					302	872	12,019	9,794	3,993	5,024	5,621	6,135	9,126	5,971	5,170	6,106	7,690	7,505	7,008	4,249	3,586	2,320	743	403
2023/03/26				155	168	953	10,919	10,152	4,629	5,554	8,513	6,380	8,224	9,468	5,806	6,987	6,782	8,202	9,939	8,243	6,406	5,367	580	314

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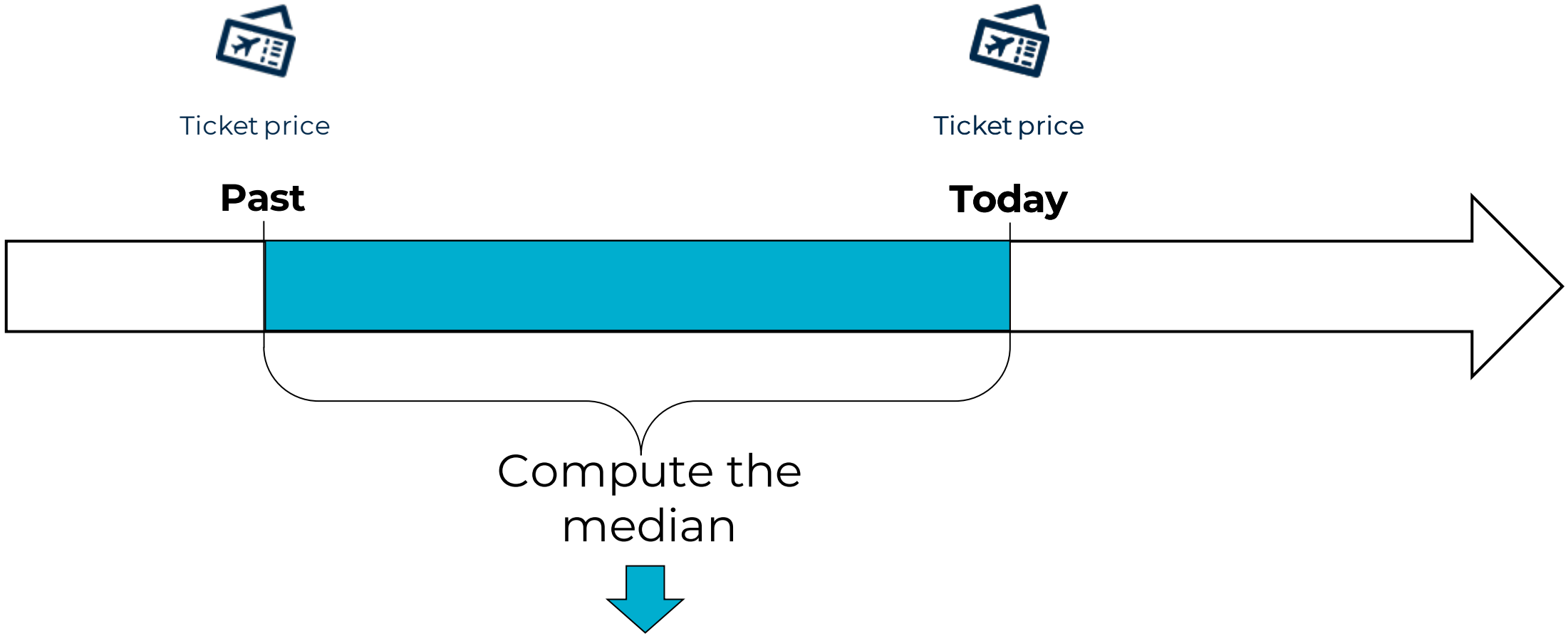
Passenger Demand – Price evolution

With the support of
EUROCONTROL Innovation Hub



Price Ratio = Today's price / Median

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Passenger Demand – Method and accuracy

With the support of EUROCONTROL Innovation Hub

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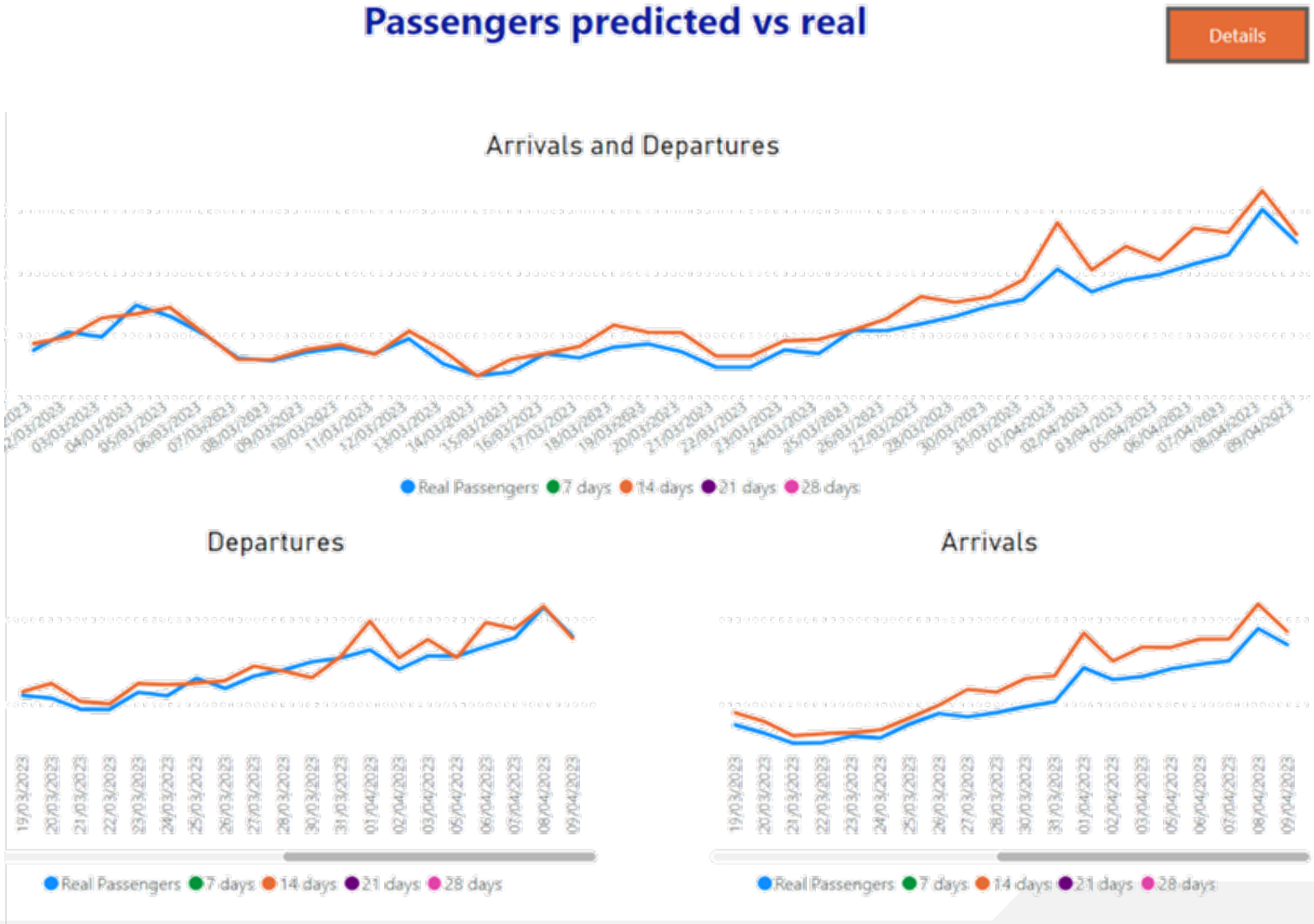
AI algorithm

→ Gradient Boosting regressor

Accuracy

→ Trend in passenger demand is very well captured 14 days in advance, even better when the airport model is trained with historical load factors



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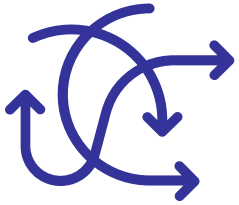

Time Based Separation – Calibration of Optimised Approach Spacing Tool: TBS-COAST

OPTIMISED AIRCRAFT SEPARATIONS

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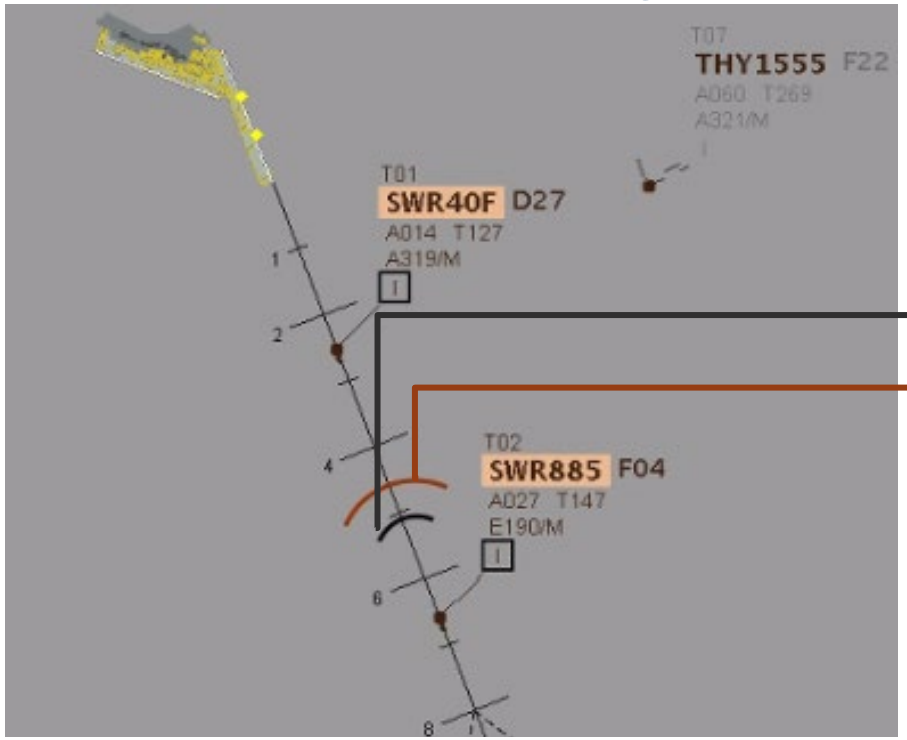
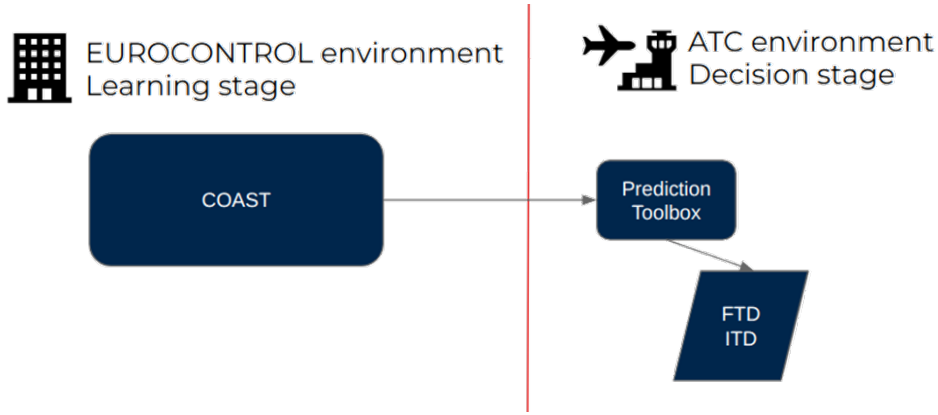
TBS-COAST – High level view



Initial Target Distance (ITD) used by Approach Controllers

Final Target Distance (FTD) used by both Approach and Tower Controllers

COAST is the EUROCONTROL service that, based on SESAR eORD concept, provides airports with the ML-models built for them upon their meteorological and historical flight data



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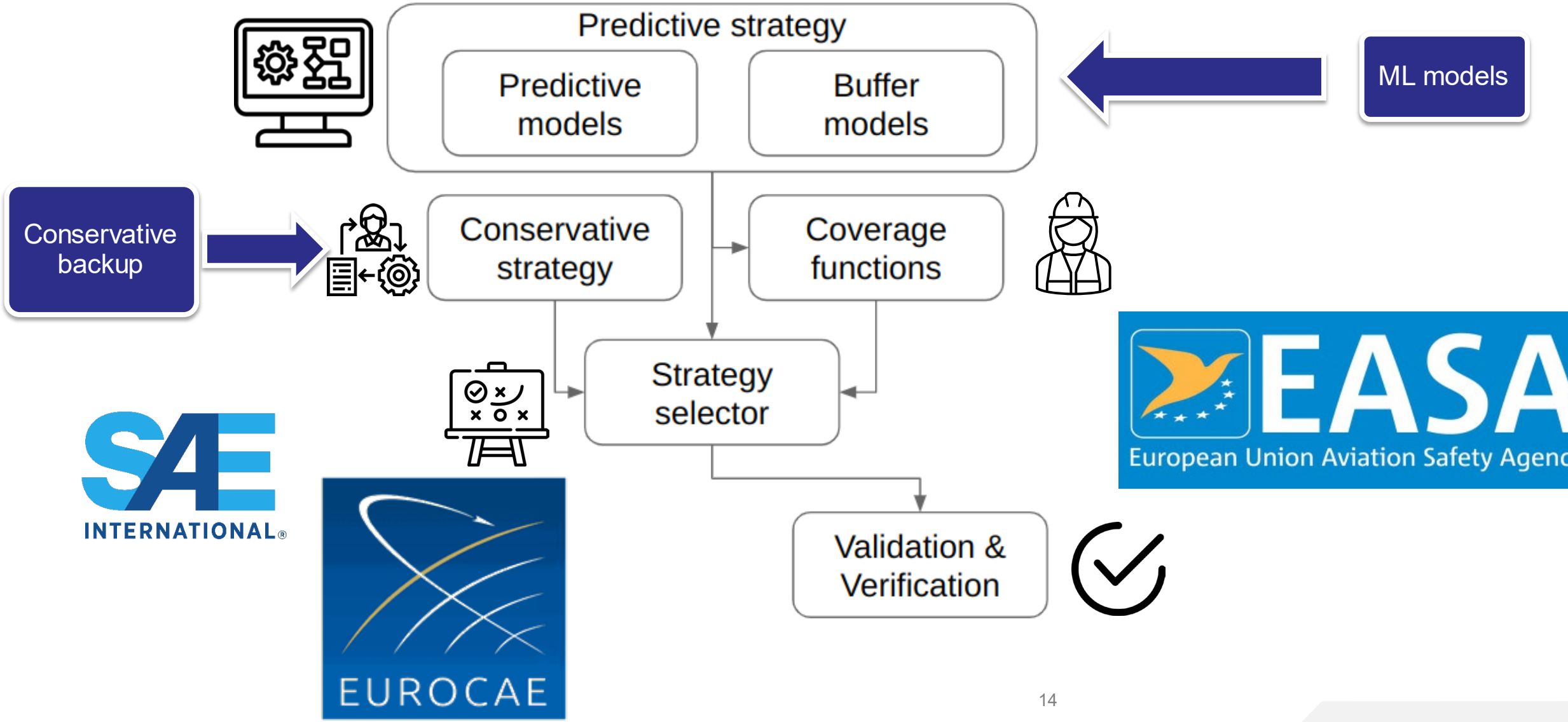
TBS-COAST – Architecture



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TBS-COAST – Method and accuracy

AI algorithm

→ Trajectory model: Elastic-Net regressor
→ FTD buffers model: Gradient Boosting regressor
→ ITD buffer model: Gradient Boosting regressor

Accuracy

→ Safety increase using the spacing indicator (ITD)
→ Reduction in the separation buffer by 20% using ML algorithms
→ 8% increase in capacity with respect to DBS

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