



Network Manager
nominated by
the European Commission

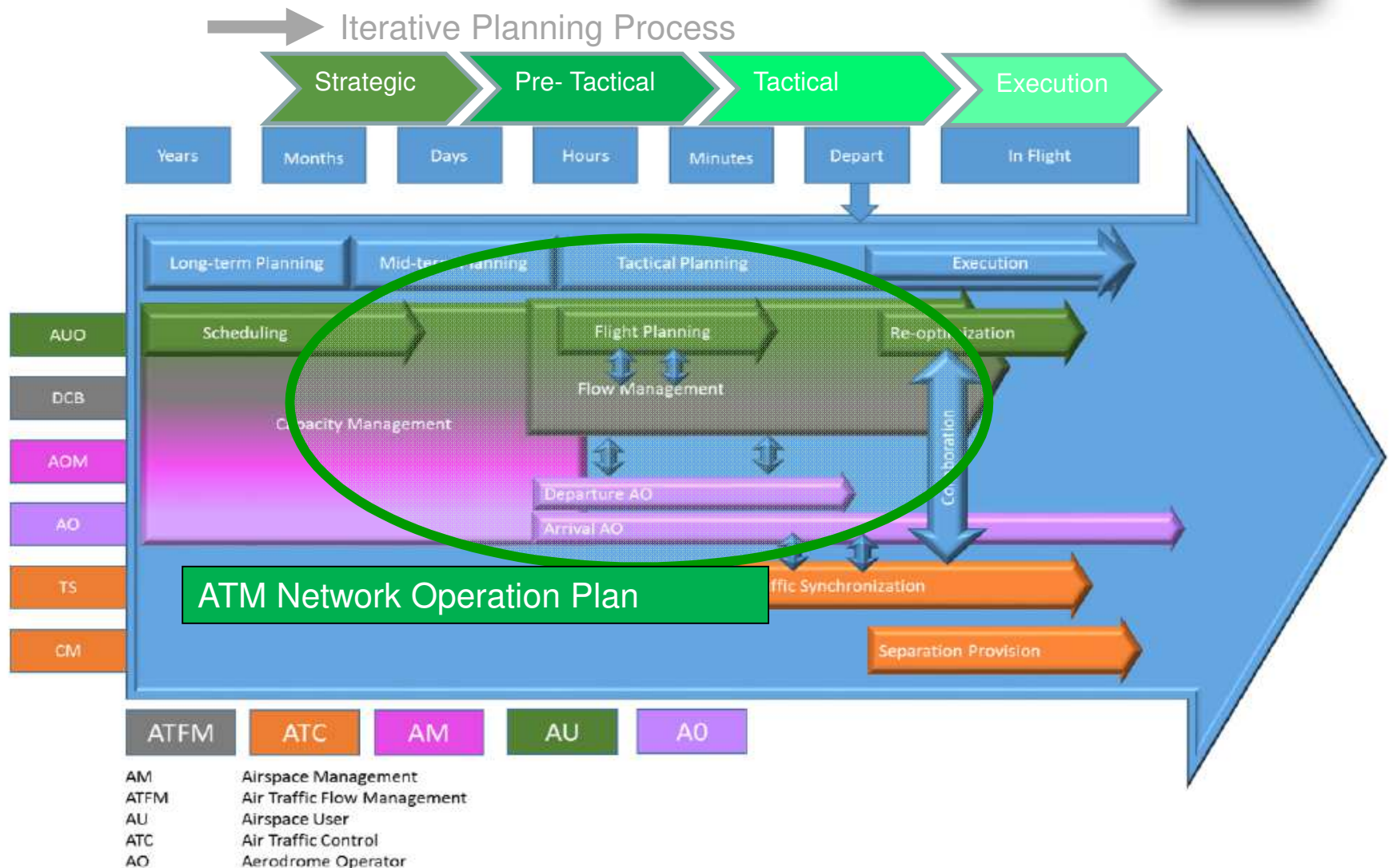


EUROCONTROL



Trajectory Prediction Network Traffic Demand Forecast Key Enablers to TBO (Trajectory Based Operations)

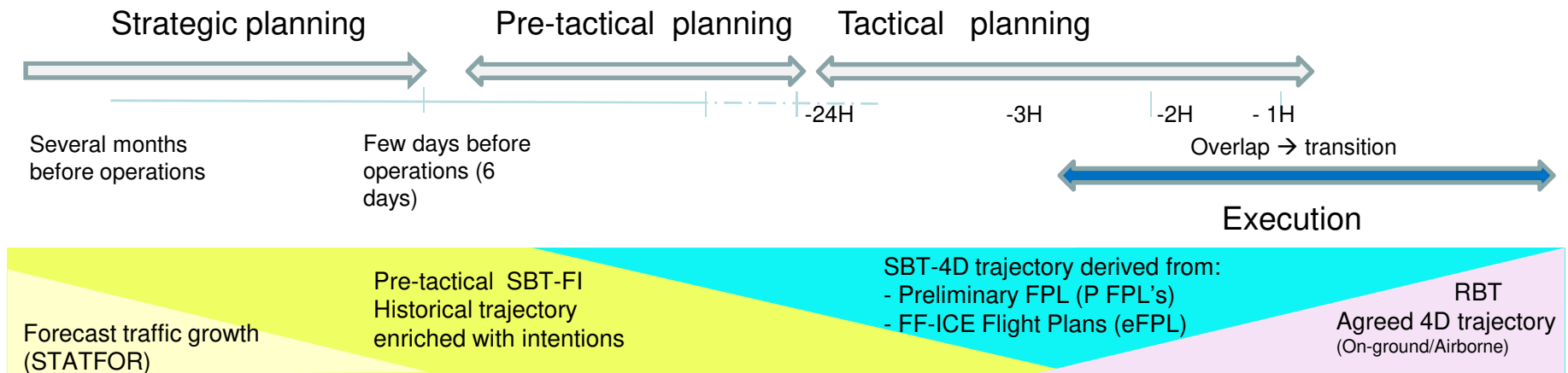
Collaborative ATM Network Operations Planning



Common awareness of Forecast Trajectory & derived Traffic Demand → key enabler to TBO

End to end trajectory prediction & Traffic Demand Forecast

→ different approach at each iteration of the network operation plan

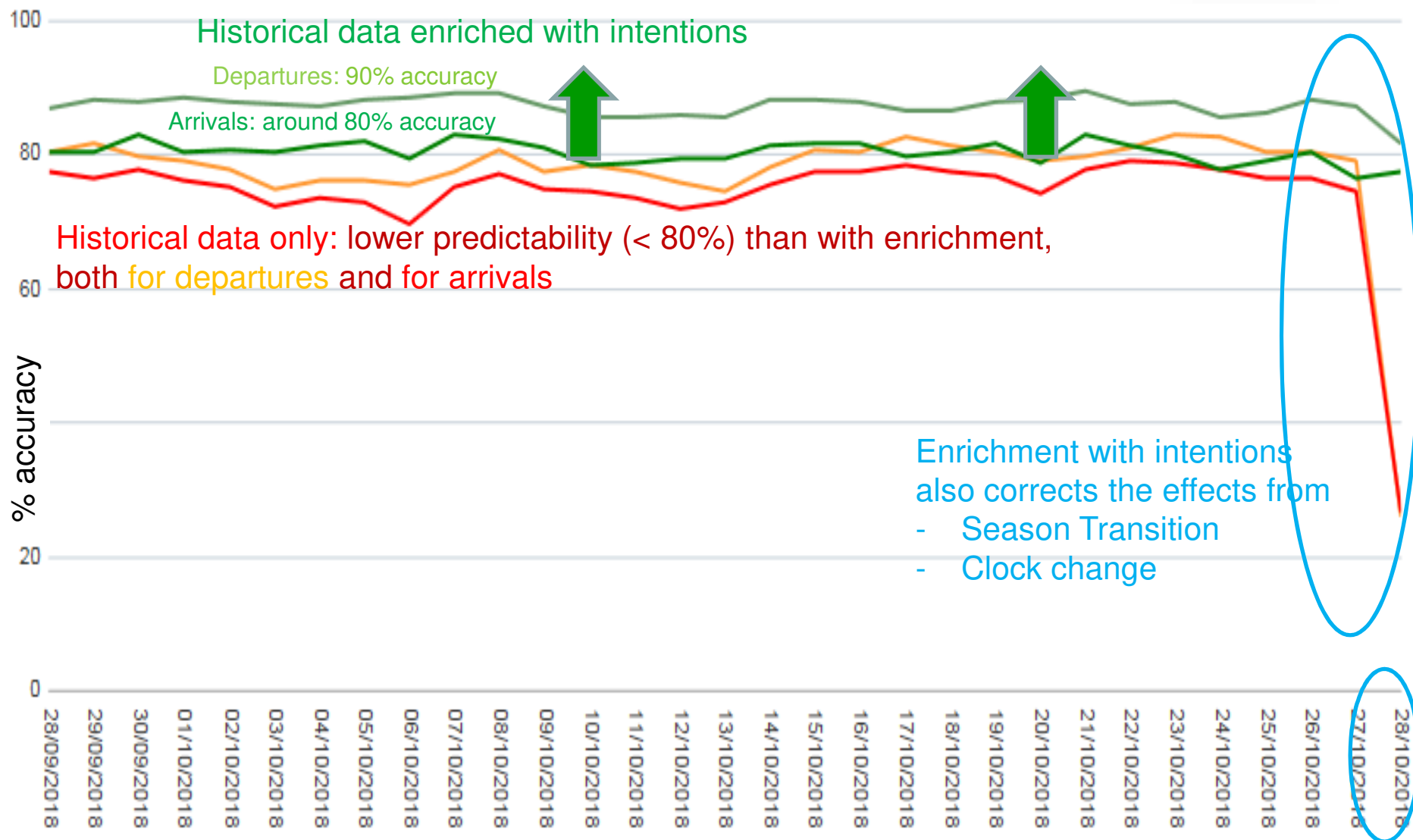


Challenges:

- Best accurate forecast at each step
- Smooth transition between each iteration based on different forecast methods & algorithm

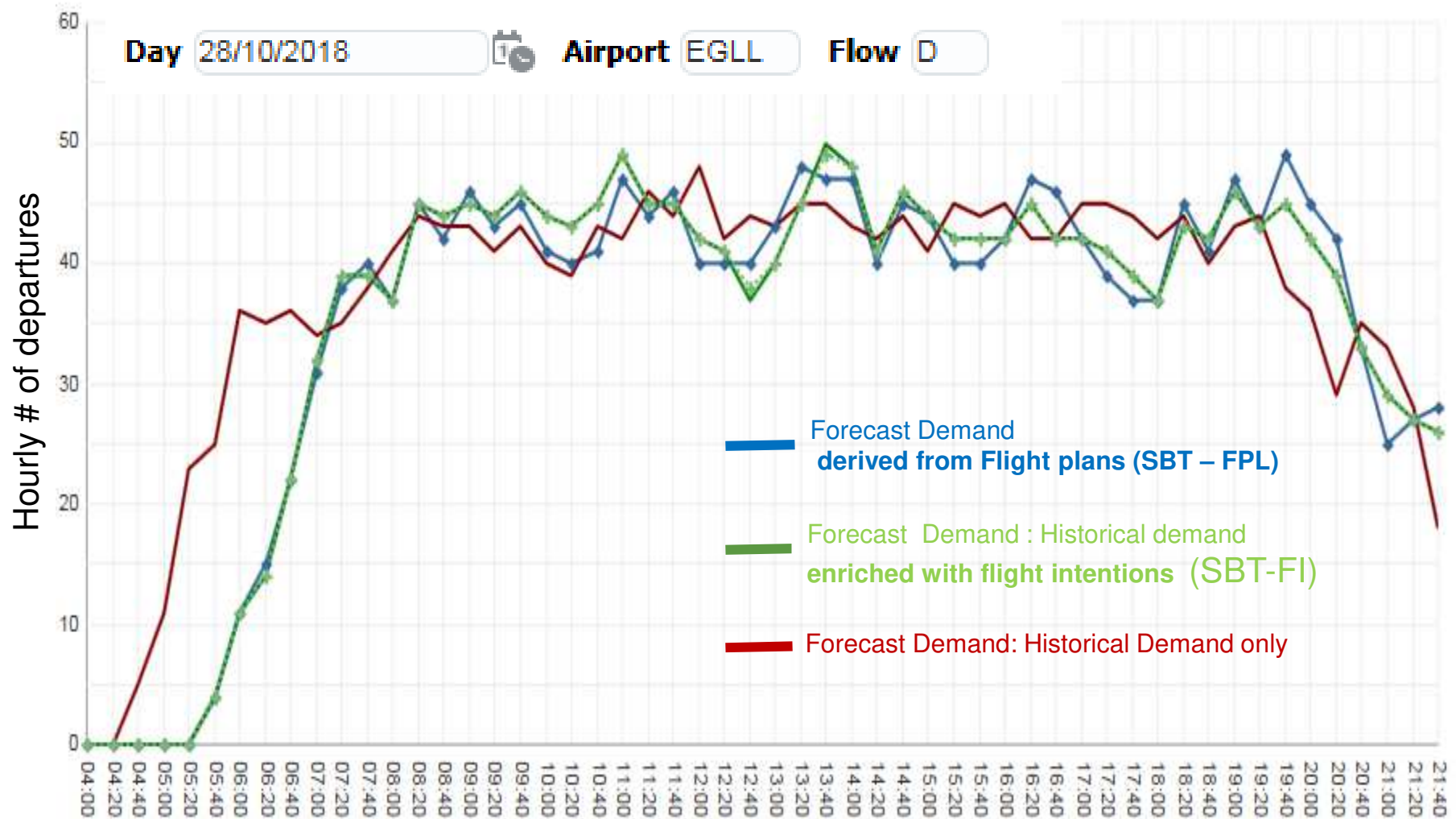
SBT-FI – Forecast Traffic demand @ airports

Accuracy – Global Daily counts



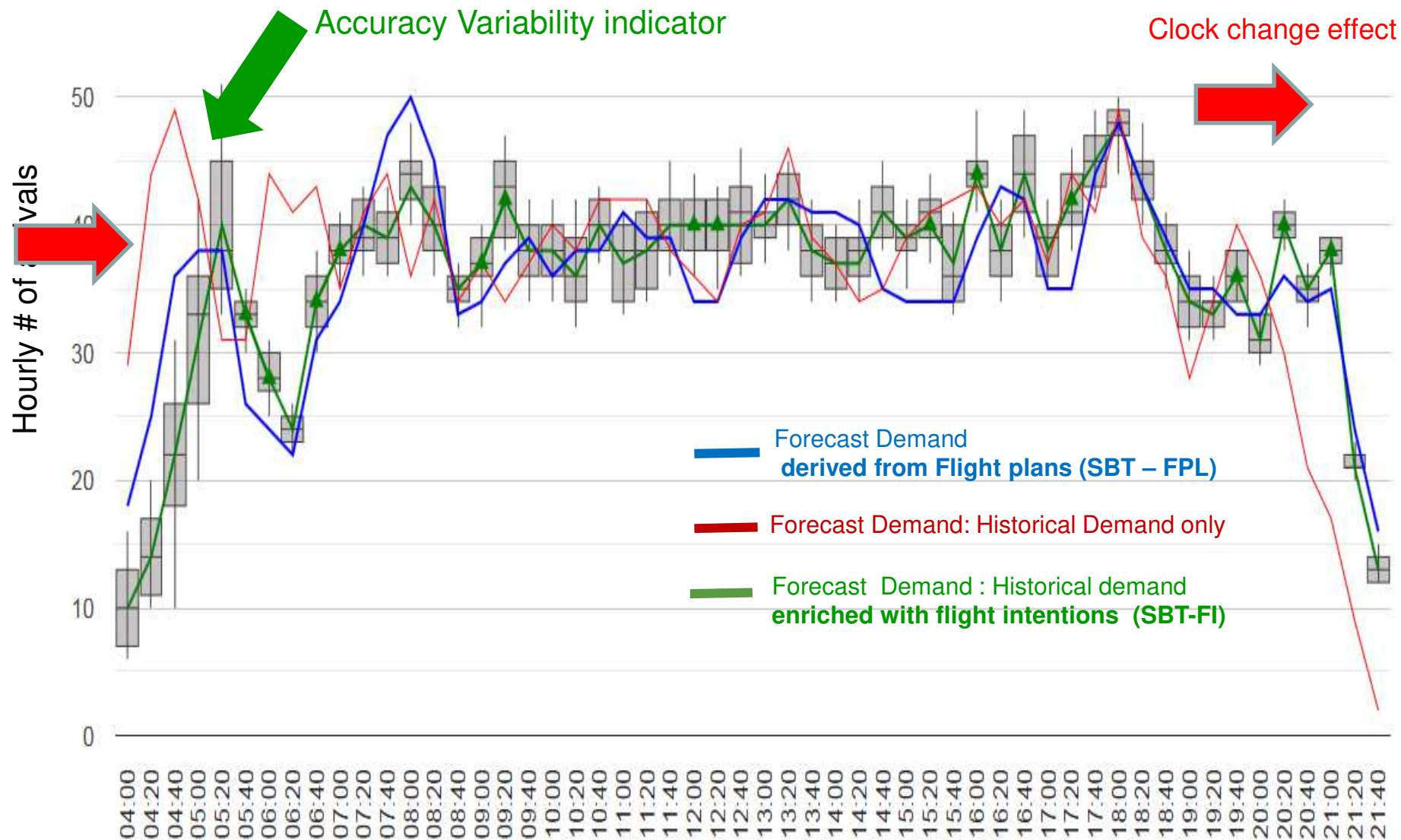
SBT-FI – Forecast Traffic demand @ airports

Accuracy – Departure Hourly counts



SBT-FI – Forecast Traffic demand @ airports

Accuracy – Arrival Hourly counts

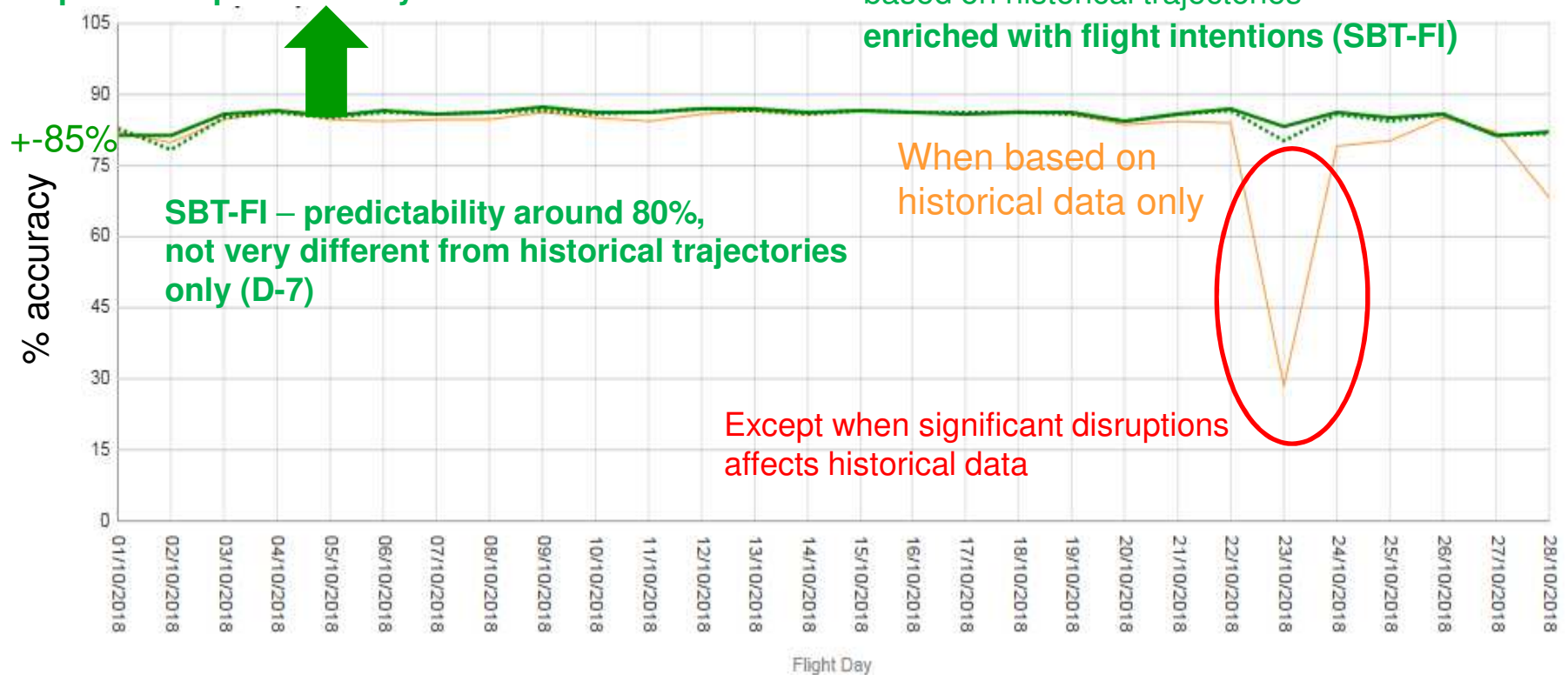


SBT-FI – Forecast Traffic demand – en route Accuracy – Hourly counts

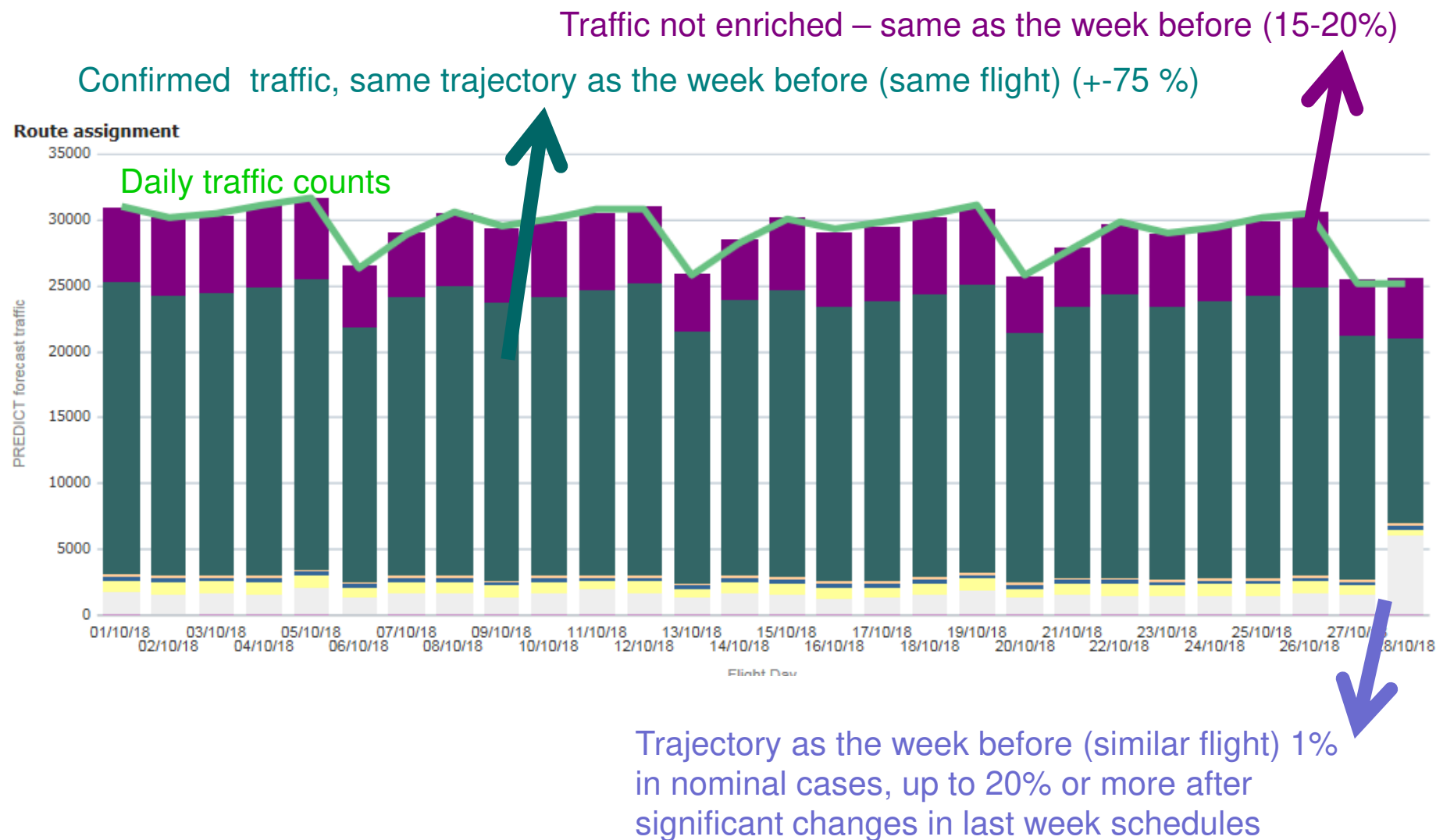


SBT-FI - Ops challenge:
improve the predictability > 90%

Predictability of en route Demand forecasts
based on historical trajectories
enriched with flight intentions (SBT-FI)



Route assignment methods to flight intentions



Factors & uncertainty influencing flight trajectory variability

- ADEP/ADES or ADEP groups/ADES groups (flows)
- Day in the week
- Time in the day
- Route availability (possibly linked to previous 2 factors)
- Aircraft type (or family of aircraft types and many features influencing the aircraft performance)
- AO preferences and business model
- Meteo (wind direction and speed, CB activity, tracks for jet streams,...)
- Network congestion (congested flows (Y/N), # of regulated flights, ...)
- Possibly other factors which AI and big data techniques could reveal...

Key challenges for SBT-FI (Pre-Tactical planning)



1. Develop new models and algorithms for end to end Trajectory Predictions & for derived Traffic Demand forecasts covering the whole Network
2. Find specific algorithms to support early iterations of the Network plan, when too few Preliminary FPL's or FF-ICE FPL's with 4D profile trajectories) are available.
3. Deploy the concept of the FF-ICE Preliminary FPL's (SBT-FI, but with trajectory indications best reflecting AO's intentions)
4. When FF-ICE Preliminary FPL's are not fully available, use historical routes
5. Explore Data Mining Methods used to refine the route assignment process currently based on D-7 historical routes

Key challenges for SBT & RBT (Tactical based on FF_ICE PFL's and /or eFPL)

1. Develop efficient & accurate trajectory prediction models for SBT & RBT, based on state of the art algorithm:
 - End to end trajectories
 - Smooth transition in generated forecasts from planning to execution iterations
2. Prediction models with increasing operational information as closer to execution
3. Sharable trajectory prediction to facilitate common awareness between stakeholders and systems
4. Powerful algorithms to accommodate high volumes of end to end trajectory predictions (at least 1000 trajectory re-computation / minute)
5. Smooth transition between tactical planning and execution
6. Common awareness , at each phase, between the local views (ATC/ FMP's, Extended ATC planners, Controllers, AOC's) and the Network view

Thank you

Challenges for Research

SBT/RBT Common awareness :

- Sharable trajectory prediction
- Relevant to each planning iteration
- Accurate traffic demand forecasts

(entry counts, occupancy counts, weighted or not with complexity)

Smooth transition from early planning to execution



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