



T A R G E T
TOP AMPLIFIER RESEARCH GROUPS
IN A EUROPEAN TEAM

Top Amplifier Research Groups in a European Team

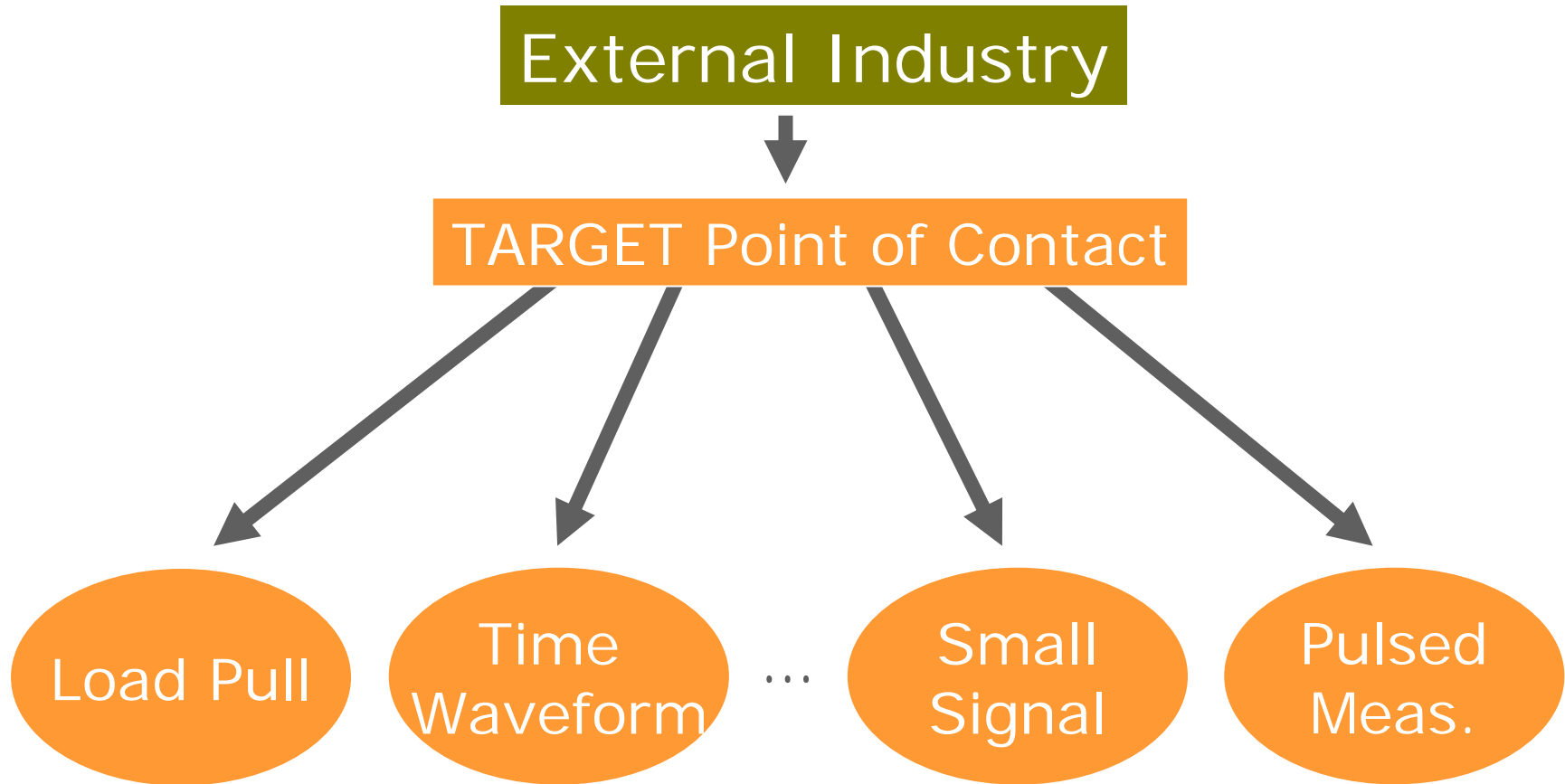
TARGET Virtual Labs



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Who is TARGET?

- Network of Excellence
- Best researchers in Europe
- 49 partners in consortium
- Combined expertise of thousands of years
- Labs equipped over years of EU funded programmes





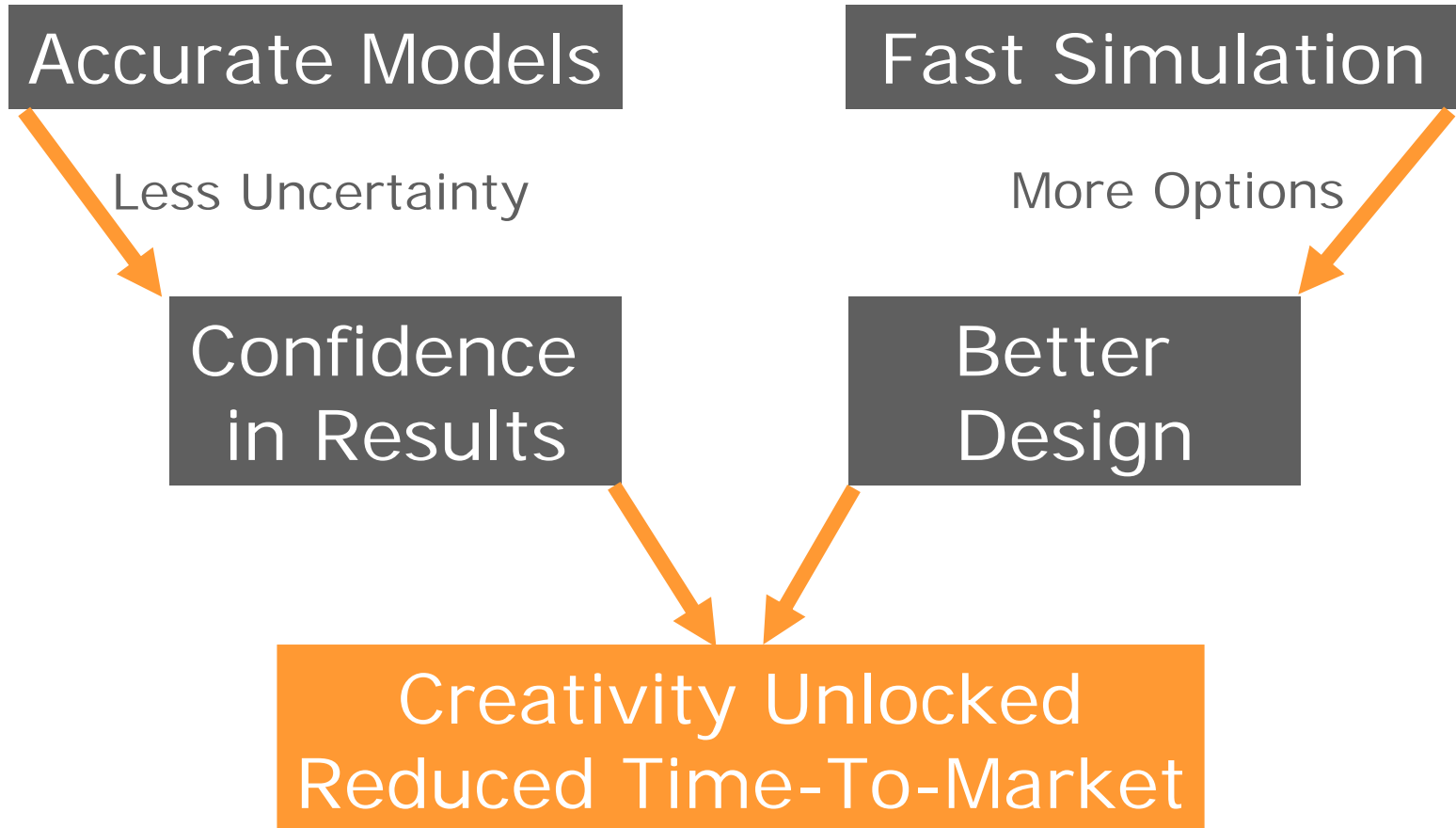
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People

- Vast experience
- Every transistor technology
- All CAD packages
- All CAD techniques
- Deep understanding

Facilities

- State of the art equipment
- Special software tools





Better performance

- Optimise efficiency
- Remove isolators

Better reliability

- Lower heat dissipation
- Less susceptible to component tolerance

Better quality

- Predictive maintenance
- Live performance monitoring



Create



- Experiment with new concepts
- Realise new products
- Create value for customers

Faster



- Shorten total design cycle
- First to market
- Undermine competition



How can TARGET help?



Virtual Labs



- Vary source and load impedances
- Find trade-off point
 - Efficiency
 - Output Power
 - Gain
 - Adjacent channel power
 - Distortion
 - Impedance match



Harmonic source & load pull (up to 3rd harmonic)	
Frequency range:	1.6 - 2.5 GHz (1.8 - 2.1 preferred)
Output power level (co-axial):	40 dBm
Output power level (on-wafer):	37 dBm
Fundamental source & load pull	
Frequency range:	12 - 40 GHz
Output power level (co-axial):	33 dBm



Time Domain Characterisation

- I-V characteristics under large signal excitation.
- Direct verification and extraction of time-domain non-linear models.
- Transformation to freq. domain to yield harmonics.
- Can be combined with source/load pull for contour measurement.



Frequency range:	1 - 18 GHz
Output power level:	20 dBm
DC bias conditions:	25V / 0.5A
Load termination:	50 Ohm
Excitation:	single-tone or two-tone
Number of channels and connector type:	2 channels Co-axial or on-wafer



- Amplifier and mixer characterisation.
- Standard modulation formats.
- Arbitrary waveform generator – can give custom modulations.
- Measure distortion effects and adjacent channel leakage.
- Verify component's suitability for specified RF system or standard.



Virtual Lab for Power Measurements

DC bias conditions:	200V / 17A
Output power level:	52 dBm
Maximum frequency:	44 GHz
Linearity measurements:	IMD (2 tone), ACPR, EVM



- Receiver figure of merit.
- Noise figure meter and spectrum analyser based systems.
- Source and load pulling available.
- Trade-off gain, noise figure and impedance match.
- Improve response flatness.
- Remove isolator from circuit.



Measured Parameters:	Noise Figure Parameters: F_{\min} , r_n , $\Gamma_{G, \text{opt}}$, Gain
Noise Figure Range:	0 to 40dB
Maximum Safe Input Level:	+20dBm
ENR	5-15dB
Frequency Range:	10MHz – 26.5 GHz
Capabilities:	Source / Load pull
Set up type:	on wafer and coaxial



DC and Small Signal Characterisation

- These are fundamental data for any circuit design.
- High power systems require high current and voltage ranges.
- Fixture parasitic effects are accentuated.
- Device and package parasitics need to be accurately measured.



Virtual Lab for DC & Small Signal Device Characterisation

Maximum Power range:	DC Curves	Small Signal S-Par.
Maximum Power range:	14 W	
Voltage range:	40uV to 200V	
Current range:	20fA to 17A	
Maximum bias current:	17A	0.5A
Maximum bias voltage:	200 V	25V
Maximum input Power:		10 dBm
Frequency range:		5Hz to 50GHz
Set up type:	on wafer or coaxial	



Pulsed Measurements

- Sort measurement pulses away from some fixed bias point.
- Both DC and small signal.
- Eliminates trapping effects.
- Isothermal measurements.
- Thermally consistent models can be generated.



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Virtual Lab for Pulsed Device Characterisation

Maximum frequency:	40GHz
Pulsed DC bias:	100V
Minimum pulse width:	100ns
Minimum rise time:	30ns
Set up type:	on wafer and coaxial



- Thermal imaging to identify hot spots and facilitate thermal modelling.
- Reliability issues can be investigated with thermal cycling.
- Electron microscopy can indicate surface defects or damage.
- Micro-sections can identify sub-surface problems.



- Prototyping and packaging service.

- Can be linked with other virtual labs for complete service.
 - Wire and ribbon bonding
 - SMT assembly
 - Substrate processing - thin film, thick film, LTCC, PCB.
 - Mechanical housings – metal, ceramic, plastic.



- Device and process prototyping.
- Fully flexible across a wide range of technologies : Si, SiC, GaAs, GaN
 - Lithography
 - Deposition
 - Plasma etching
 - CV deposition
 - Oxidation
 - MBE
 - HBT, FET, HEMT, pHEMT, LDMOS, mw diodes

