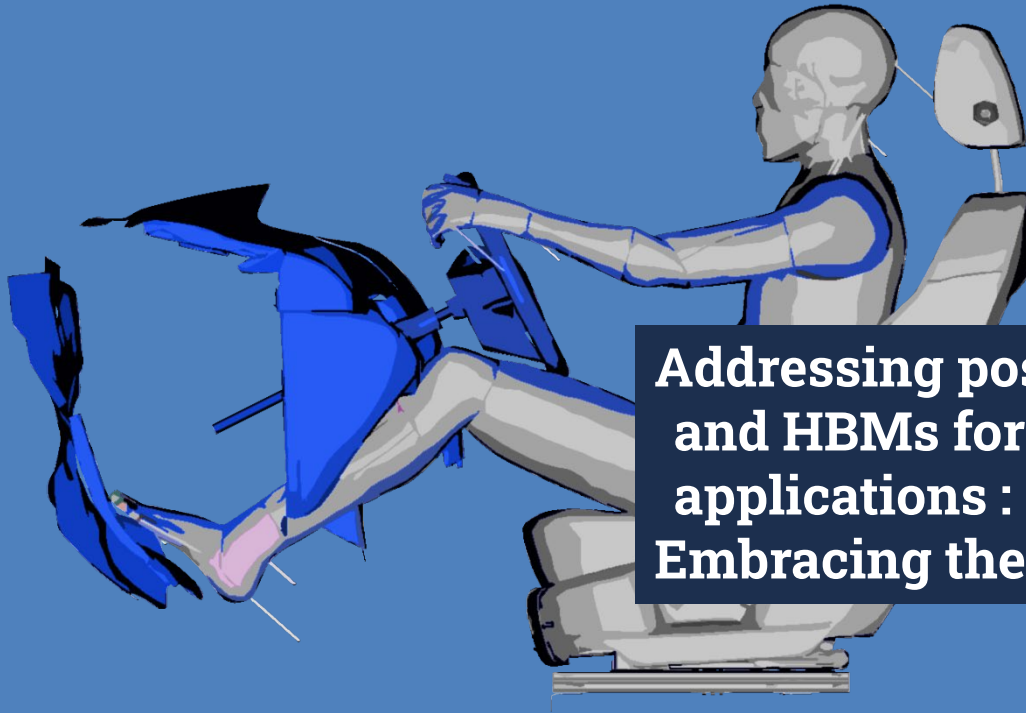
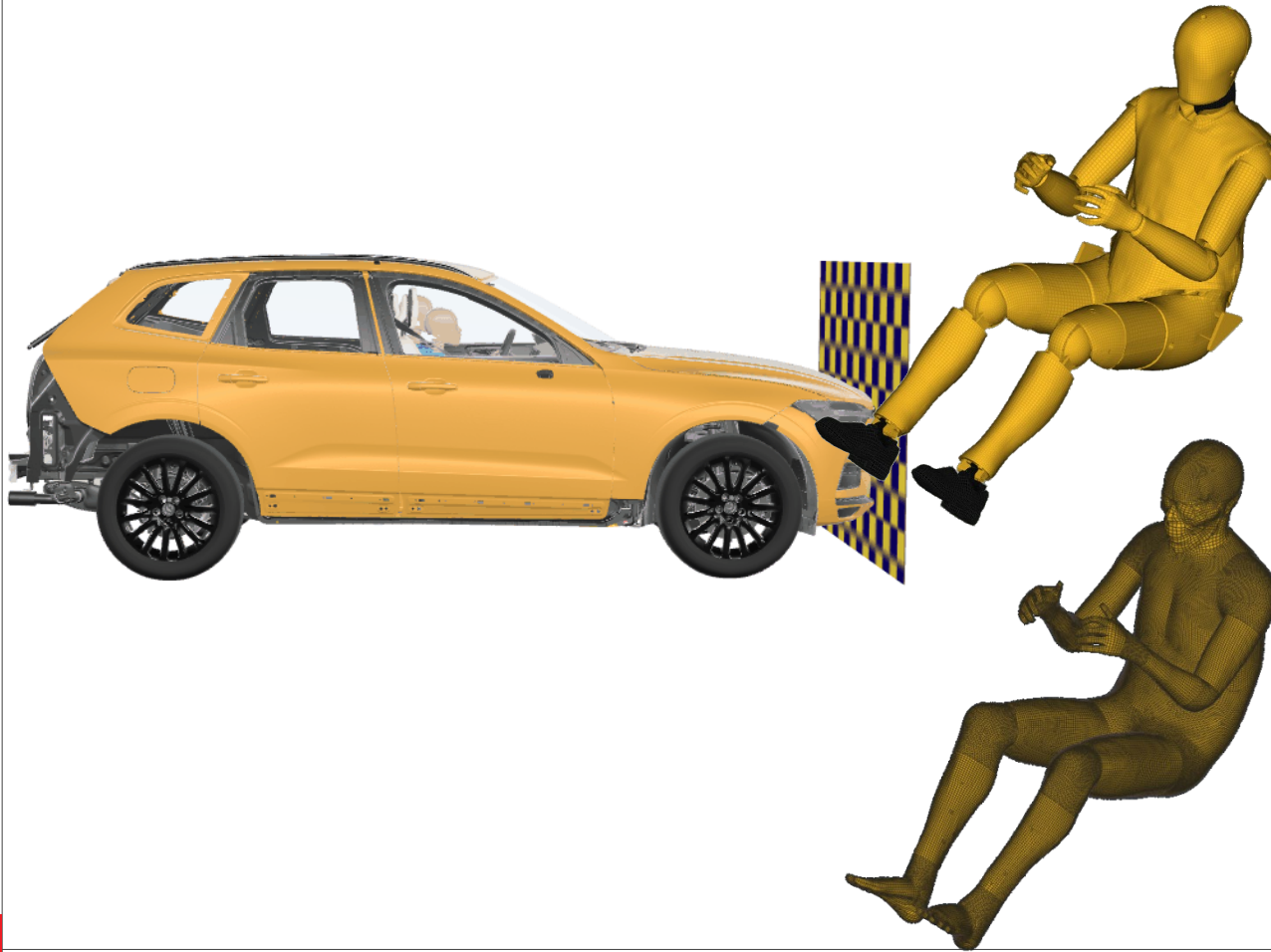


**Groundbreaking
Simulation Solutions**

physics on screen

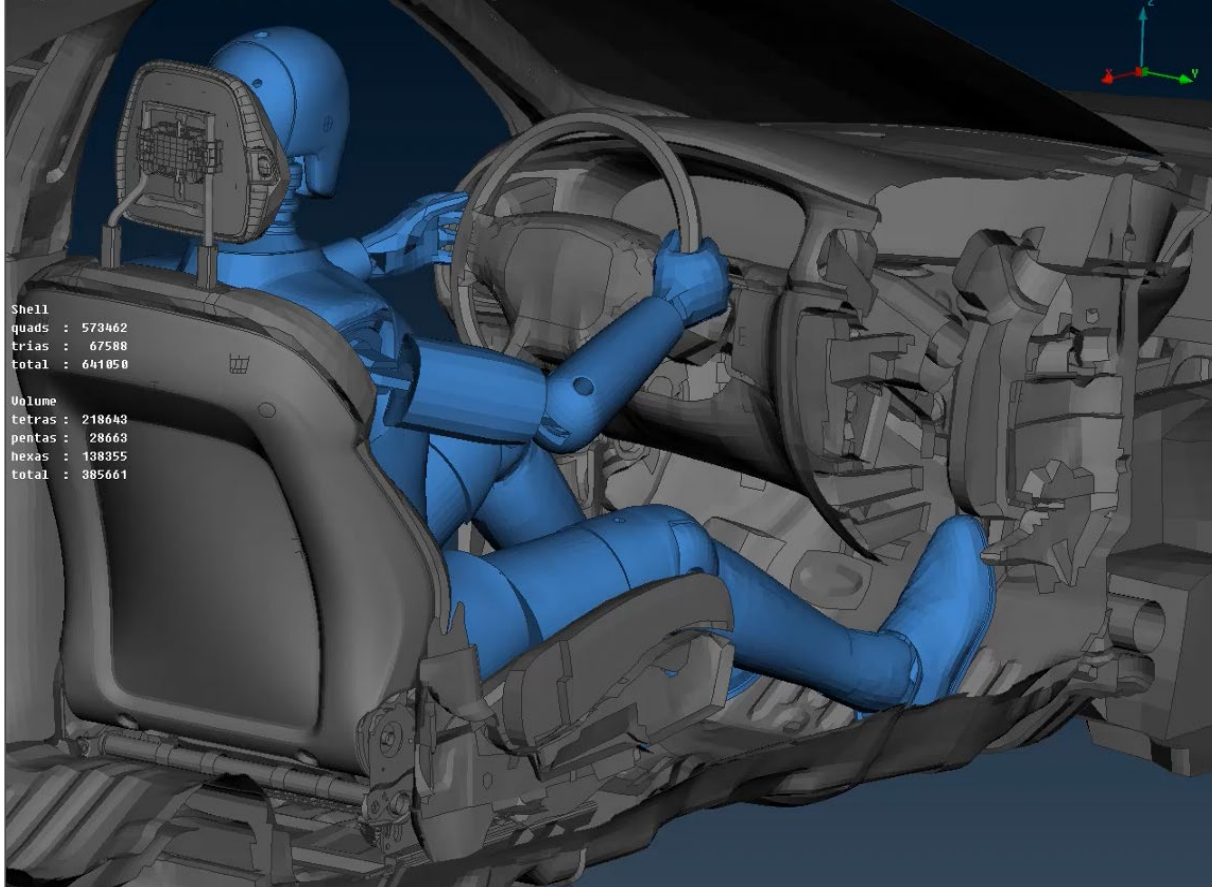


**Addressing positioning challenges for ATDs
and HBMs for LSDYNA industrial safety
applications :
Embracing the ANSA approach**



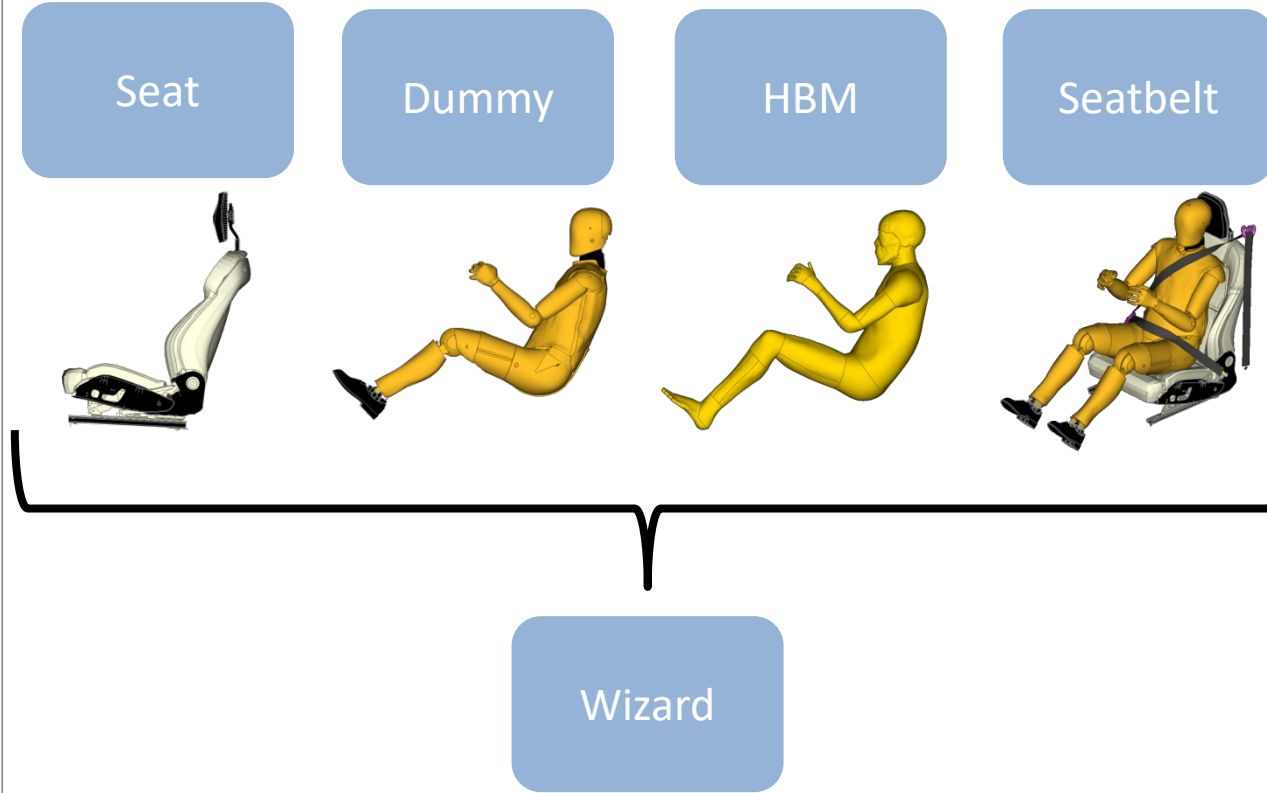
Introduction

- Crash-Safety analysis
- ATDs – Standard in Crash/Safety simulations
- HBMs gain popularity
- Challenges – Problems
- BETA solutions



Challenges

- Several steps
- Accuracy robustness
- Customization
- Solver alignment
- Automation
- Different loadcases



Process explanation

- Seat positioning
- Dummy positioning
- HBM positioning
- Restraining
- Automated process

Seat Positioning



☐	▼ KINETICS	53
☐	KIN_BODY	10
☐	KIN_CONFIG	3
☐	KIN_JOINT	10

KIN_BODY				
	IC	Id	Name	Number
☐	No	1	Fixed_rail	
☐	No	2	Ball_bearings	
☐	No	3	Moving_Track	
☐	No	4	Front_links	
☐	No	5	Rear_Links	
☐	No	6	Cushion	
☐	No	7	Backrest	
☐	No	8	Headrest_rod	
☐	No	9	Headrest	
☐		10	Ground	
KIN_BODY				total 10 selected 0

KIN_JOINT				
	LIM	IC	Id	Name
☐			1	Fixed_Conf1
☒	Yes	No	2	Line from Fixed_rail to Movi...
☒	No	No	3	Hinge from Moving_Track t...
☒	No	No	4	Hinge from Moving_Track t...
☒	No	No	5	Hinge from Front_links to C...
☒	No	No	6	Hinge from Rear_Links to C...
☒	No	No	7	Hinge from Cushion to Back...
☒			8	Fixed_Conf3
☒			9	Fixed_Conf4
☒	Yes	No	10	Line from Headrest_rod to ...
KIN_JOINT				total 10 selected 0

KIN_CONFIG	
Id	Name
1	Mechanism_1
3	Mechanism_3(Backrest_Cushion)
4	Mechanism_4(headrest)
KIN_CONFIG	
total 3 selected 0	

Seat kinetics

- Seat build in ANSA
- Seat in another pre-processor
- KIN_BODY, KIN_JOINT and KIN_CONFIG



Seat Positioning

Protocol: SCU_rear

Select Protocol

5055263	15055266	15055268	15055282	15055284	15055286
5055292	15055292	15055295	15055295	15055298	15055306
5055343	15055343	15055345	15055345	15055347	15055353
5055368	15055368	15055371	15055379	15055384	15055384
5055391	15055391	15055393	15055396	15055406	15055410
5055415	15055554	15055559	15055559	15055565	15055565
5055574	15055588	15055590	15055603	15055614	15055622
5055881	15055896	15055905	15056197		

TITLE

18697351.60476957

TITLE

07031613.21332162

2574E-8-.997278583065.57053-343.49965610.9237680.00018348

• the  in design position.

Next > Cancel

Seat Positioning

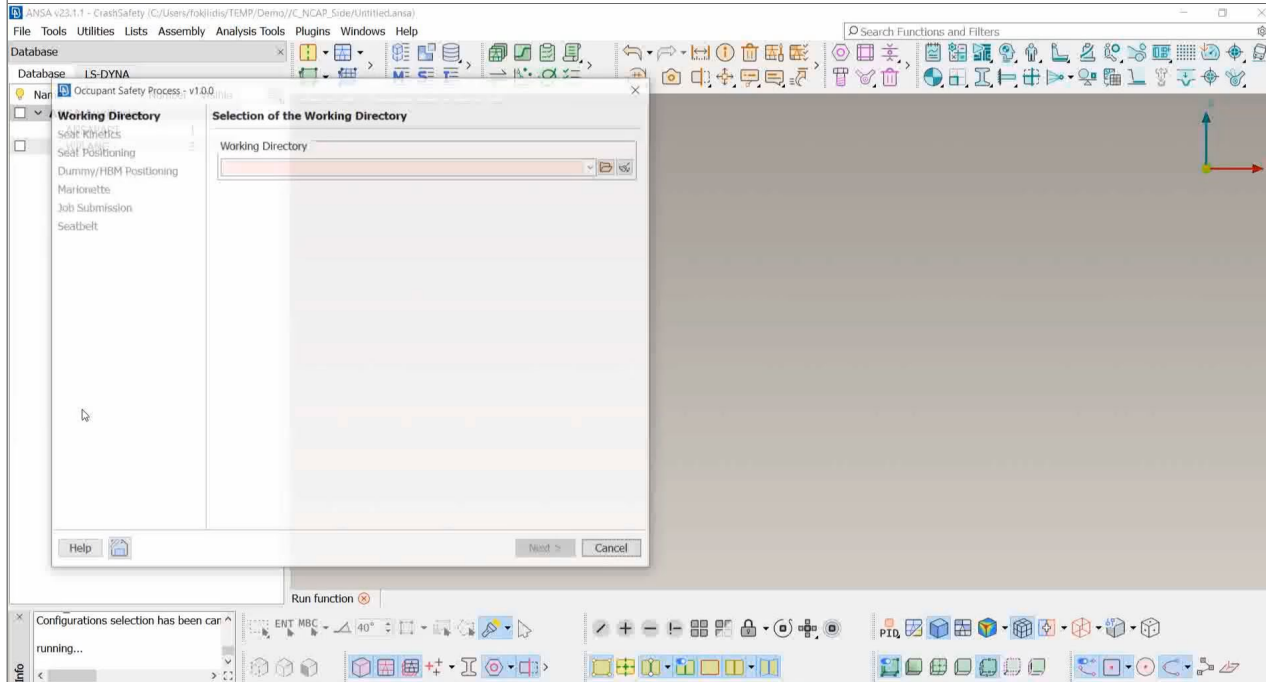
- Seat Positioning tool
- Know how of the protocols
- Custom movements
- Save positions
- Transformation keywords
- Seat remains intact

IDs handling

- New entities created
- ID ranges should be taken care

```
95 *SET_NODE_LIST_GENERATE_TITLE
96 Transform_Set_of_Spring_SCU_rear
97 15670052
98 15055146 15055261 15055263 15055266 15055268 15055282 15055284 15055286
99 15055288 15055288 15055292 15055292 15055295 15055295 15055298 15055306
100 15055308 15055340 15055343 15055343 15055345 15055345 15055347 15055353
101 15055363 15055365 15055368 15055368 15055371 15055379 15055384 15055384
102 15055386 15055387 15055391 15055391 15055393 15055396 15055406 15055410
103 15055412 15055413 15055415 15055554 15055559 15055559 15055565 15055565
104 15055568 15055568 15055574 15055588 15055590 15055603 15055614 15055622
105 15055671 15055832 15055881 15055896 15055905 15056197
106 *NODE_TRANSFORM
107 | 1 15670040
108 *DEFINE_TRANSFORMATION_TITLE
109 Bearing
110 | 1
111 TRANSL -30.65815.0018697351.60476957
112 *NODE_TRANSFORM
113 | 2 15670041
114 *DEFINE_TRANSFORMATION_TITLE
115 Upper_Rail
116 | 2
117 TRANSL -61.315271.0007031613.21332162
118 ROTATE -.073725382.22574E-8-.997278583065.57053-343.49965610.9237680.00018348
119 *NODE_TRANSFORM
120 | 3 15670042
```

Seat Positioning- Wizard



ATDs/HBMs Articulation

ATDs

525 *BOUNDARY_SPC_SET_ID

526 1

527 2300006 1 1 1 1 1 1

528 *MAT_CABLE_DISCRETE_BEAM_TITLE

529 Marionette Cable Material

530 101504808 0.0078 0. 0.001 9.E9 50.

531 *MAT_DAMPER_VISCOUS_TITLE

532 Marionette Damping Material

533 101504810 0.001

534 *INTERFACE_SPRINGBACK_LSDYNA

535 2300004 0 0 0 0 0 0

536 *DAMPING_GLOBAL

537 0 0.001 0. 0. 0. 0. 0. 0.

538 *SET_PART_ADD_TITLE

539 Dummy_Contact

540 2300002

541 1500002 1500003 1500004 1500005 1500006 1500007 1500008 1500009

542 1500010 1500011 1500012 1500013 1500014 1500015 1500016 1500017

543 1500018 1500019 1500020 1500021 1500022 1500029 1500030 1500031

544 1500032 1500033 1500034 1500035 1500036 1500037 1500038 1500040

545 1500041 1500042 1500043 1500044 1500045 1500046 1500047 1500048

546 1500049 1500050 1500051 1500061 1500062 1500063 1500064 1500065

547 1500066

548 *SET_PART_TITLE

549 Seat_Contact

550 2300003

551 12600 12604 12605 12621 12679 12749 12778 12786

552 12812 12837

553 *SET_PART_TITLE

554 InterfaceSpringback

555 2300004

556 12600 12604 12605 12621 12679 12812 12837 92710000

557 92710001 92710002 92710003 92710004 92710005 92710006 92710007 92710008

558 92710009 92710010 92710011 92710012 92710013 92710014 92710015 92710016

559 92710018 92710025 92710026 92710027 92710028 92710029 92710030 92710031

560

561

562

563

564

565

566

567

568

569

570

571

572

573

574

575

576

577

578

579

580

581

582

583

584

585

586

587

588

589

590

591

592

593

594

595

596

597

598

599

600

601

602

603

604

605

606

607

608

609

610

611

612

613

614

615

616

617

618

619

620

621

622

623

624

625

626

627

628

629

630

631

632

633

634

635

636

637

638

639

640

641

642

643

644

645

646

647

648

649

650

651

652

653

654

655

656

657

658

659

660

661

662

663

664

665

666

667

668

669

670

671

672

673

674

675

676

677

678

679

680

681

682

683

684

685

686

687

688

689

690

691

692

693

694

695

696

697

698

699

700

701

702

703

704

705

706

707

708

709

710

711

712

713

714

715

716

717

718

719

720

721

722

723

724

725

726

727

728

729

730

731

732

733

734

735

736

737

738

739

740

741

742

743

744

745

746

747

748

749

750

751

752

753

754

755

756

757

758

759

760

761

762

763

764

765

766

767

768

769

770

771

772

773

774

775

776

777

778

779

780

781

782

783

784

785

786

787

788

789

790

791

792

793

794

795

796

797

798

799

800

801

802

803

804

805

806

807

808

809

810

811

812

813

814

815

816

817

818

819

820

821

822

823

824

825

826

827

828

829

830

831

832

833

834

835

836

837

838

839

840

841

842

843

844

845

846

847

848

849

850

851

852

853

854

855

856

857

858

859

860

861

862

863

864

865

866

867

868

869

870

871

872

873

874

875

876

877

878

879

880

881

882

883

884

885

886

887

888

889

890

891

892

893

894

895

896

897

898

899

900

901

902

903

904

905

906

907

908

909

910

911

912

913

914

915

916

917

918

919

920

921

922

923

924

925

926

927

928

929

930

931

932

933

934

935

936

937

938

939

940

941

942

943

944

945

946

947

948

949

950

951

952

953

954

955

956

957

958

959

960

961

962

963

964

965

966

967

968

969

970

971

972

973

974

975

976

977

978

979

980

981

982

983

984

985

986

987

988

989

990

991

992

993

994

995

996

997

998

999

1000

1001

1002

1003

1004

1005

1006

1007

1008

1009

1010

1011

1012

1013

1014

1015

1016

1017

1018

1019

1020

1021

1022

1023

1024

1025

1026

1027

1028

1029

1030

1031

1032

1033

1034

1035

1036

1037

1038

1039

1040

1041

1042

1043

1044

1045

1046

1047

1048

1049

1050

1051

1052

1053

1054

1055

1056

1057

1058

1059

1060

1061

1062

1063

1064

1065

1066

1067

1068

1069

1070

1071

1072

1073

1074

1075

1076

1077

1078

1079

1080

1081

1082

1083

1084

1085

1086

1087

1088

1089

1090

1091

1092

1093

1094

1095

1096

1097

1098

1099

1100

1101

1102

1103

1104

1105

1106

1107

1108

1109

1110

1111

1112

1113

1114

1115

1116

1117

1118

1119

1120

1121

1122

1123

1124

1125

1126

1127

1128

1129

1130

1131

1132

1133

1134

1135

1136

1137

1138

1139

1140

1141

1142

1143

1144

1145

1146

1147

1148

1149

1150

1151

1152

1153

1154

1155

1156

1157

1158

1159

1160

1161

1162

1163

1164

1165

1166

1167

1168

1169

1170

1171

1172

1173

1174

1175

1176

1177

1178

1179

1180

1181

1182

1183

1184

1185

1186

1187

1188

1189

1190

1191

1192

1193

1194

1195

1196

1197

1198

1199

1200

1201

1202

1203

1204

1205

1206

1207

1208

1209

1210

1211

1212

1213

1214

1215

1216

1217

1218

1219

1220

1221

1222

1223

1224

1225

1226

1227

1228

1229

1230

1231

1232

1233

1234

1235

1236

1237

1238

1239

1240

1241

1242

1243

1244

1245

1246

1247

1248

1249

1250

1251

1252

1253

1254

1255

1256

1257

1258

1259

1260

1261

1262

1263

1264

1265

1266

1267

1268

1269

1270

1271

1272

1273

1274

1275

1276

1277

1278

1279

1280

1281

1282

1283

1284

1285

1286

1287

1288

1289

1290

1291

1292

1293

1294

1295

1296

1297

1298

1299

1300

1301

1302

1303

1304

1305

1306

1307

1308

1309

1310

1311

1312

1313

1314

1315

1316

1317

1318

1319

1320

1321

1322

1323

1324

1325

1326

1327

1328

1329

1330

1331

1332

1333

1334

1335

1336

1337

1338

1339

1340

1341

1342

1343

1344

1345

1346

1347

1348

1349

1350

1351

1352

1353

1354

1355

1356

1357

1358

1359

1360

1361

1362

1363

1364

1365

1366

1367

1368

1369

1370

1371

1372

1373

1374

1375

1376

1377

1378

1379

1380

1381

1382

1383

1384

1385

1386

1387

1388

1389

1390

1391

1392

1393

1394

1395

1396

1397

1398

1399

1400

1401

1402

1403

1404

1405

1406

1407

1408

1409

1410

1411

1412

1413

1414

1415

1416

1417

1418

1419

1420

1421

1422

1423

1424

1425

1426

1427

1428

1429

1430

1431

1432

1433

1434

1435

1436

1437

1438

1439

1440

1441

1442

1443

1444

1445

1446

1447

1448

1449

1450

1451

1452

1453

1454

1455

1456

1457

1458

1459

1460

1461

1462

1463

1464

1465

1466

1467

1468

1469

1470

1471

1472

1473

1474

1475

1476

1477

1478

1479

1480

1481

1482

1483

1484

1485

1486

1487

1488

1489

1490

1491

1492

1493

1494

1495

1496

1497

1498

1499

1500

1501

1502

1503

1504

1505

1506

1507

1508

1509

1510

1511

1512

1513

1514

1515

1516

1517

1518

1519

1520

1521

1522

1523

1524

1525

1526

1527

1528

1529

1530

1531

1532

1533

1534

1535

1536

1537

1538

1539

1540

1541

1542

1543

1544

1545

1546

1547

1548

1549

1550

1551

1552

1553

1554

1555

1556

1557

1558

1559

1560

1561

1562

1563

1564

1565

1566

1567

1568

1569

1570

1571

1572

1573

1574

1575

1576

1577

1578

1579

1580

1581

1582

1583

1584

1585

1586

1587

1588

1589

1590

1591

1592

1593

1594

1595

1596

1597

1598

1599

1600

1601

1602

1603

1604

1605

1606

1607

1608

1609

1610

1611

1612

1613

1614

1615

1616

1617

1618

1619

1620

1621

1622

1623

1624

1625

1626

1627

1628

1629

1630

1631

1632

1633

1634

1635

1636

1637

1638

1639

1640

1641

1642

1643

1644

1645

1646

1647

1648

1649

1650

1651

1652

1653

1654

1655

1656

1657

1658

1659

1660

1661

1662

1663

1664

1665

1666

1667

1668

1669

1670

1671

1672

1673

1674

1675

1676

1677

1678

1679

1680

1681

1682

1683

1684

1685

1686

1687

1688

1689

1690

1691

1692

1693

1694

1695

1696

1697

1698

1699

1700

1701

1702

1703

1704

1705

1706

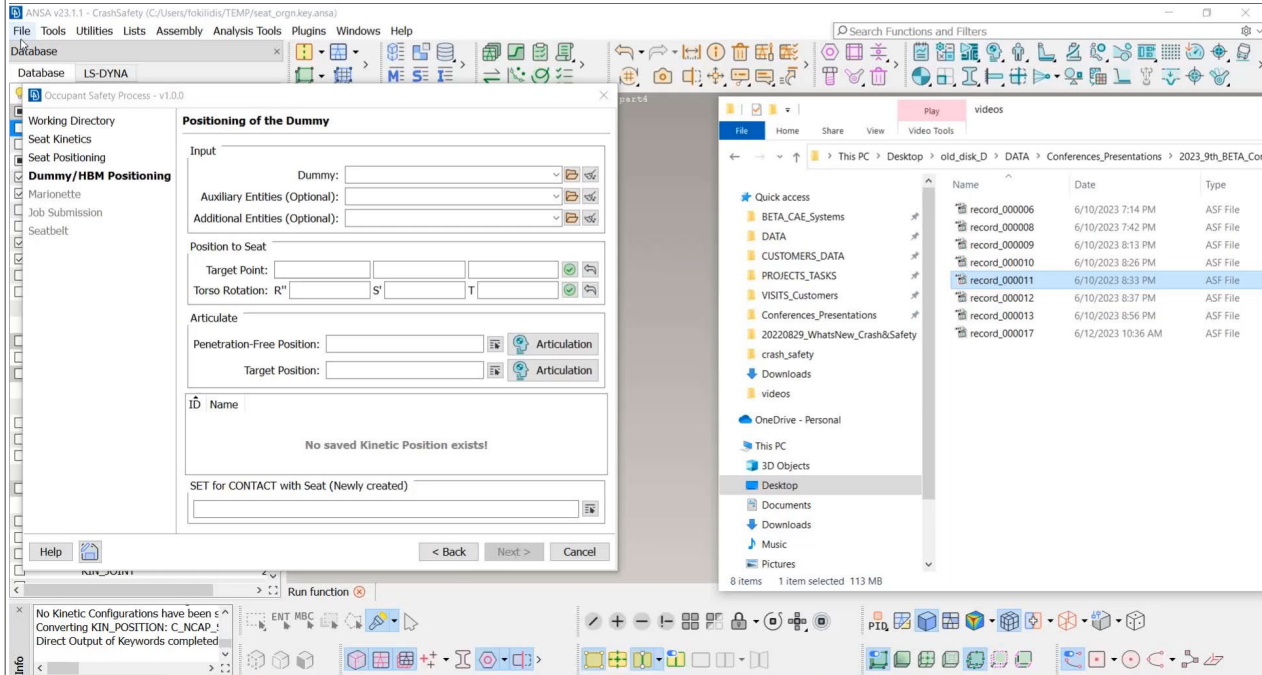
1707

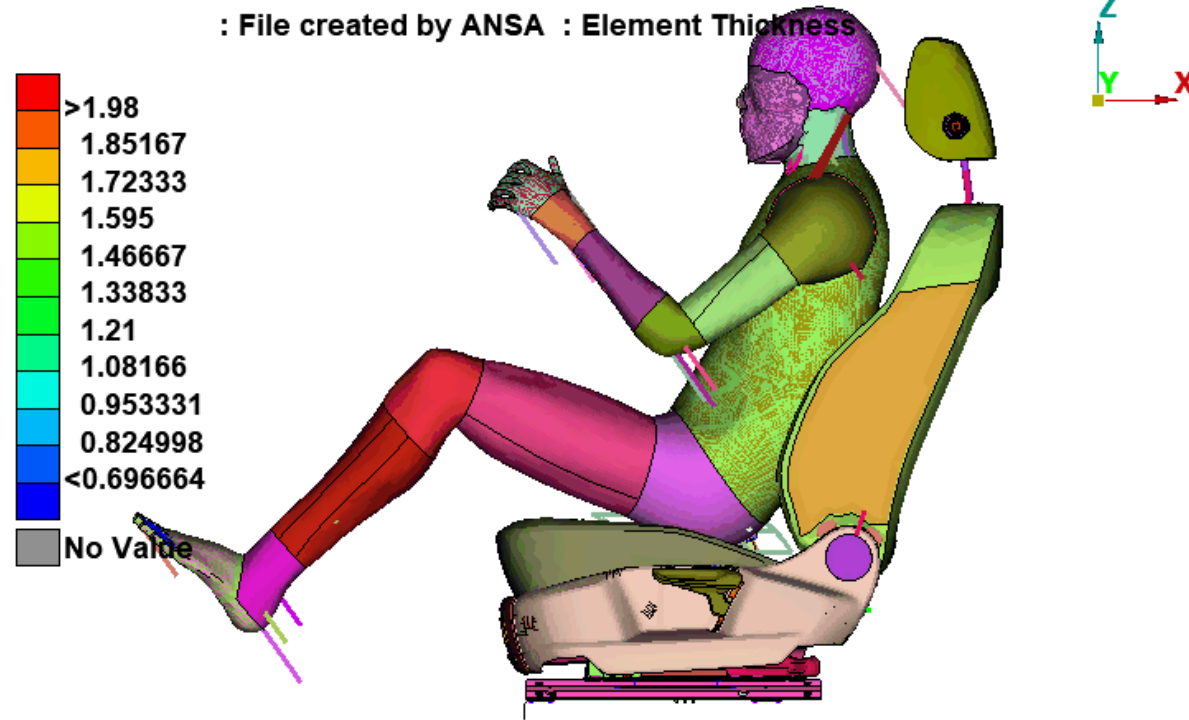
1708

1709

1710

ATD-Wizard





HBMs

- THUMS, GHBM, VIVA+, SAFER
- HBM articulation tool
- Achieve the final position
- Additional cases (gravity)

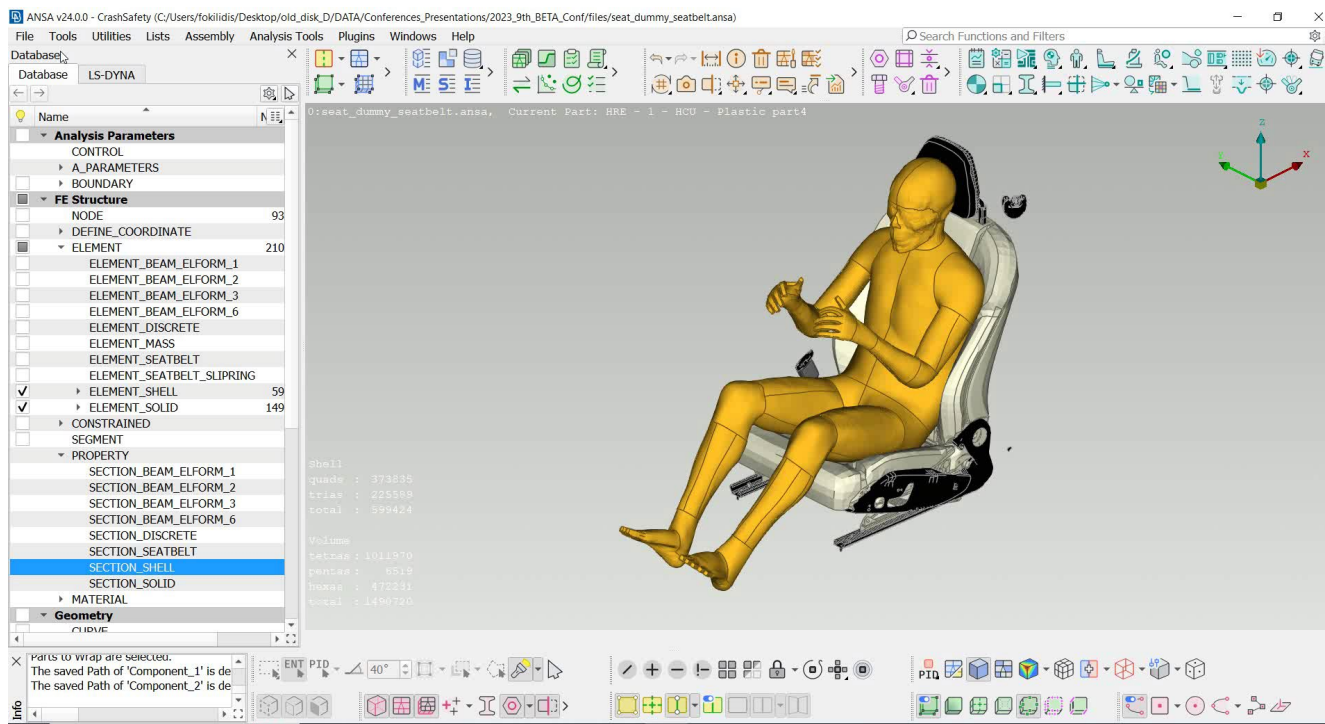
System Restraining



Seatbelt tool

- Template based creation
- All LS DYNA keywords
- 3D (geometric) slings
- Identical behavior in ATDs and HBMs

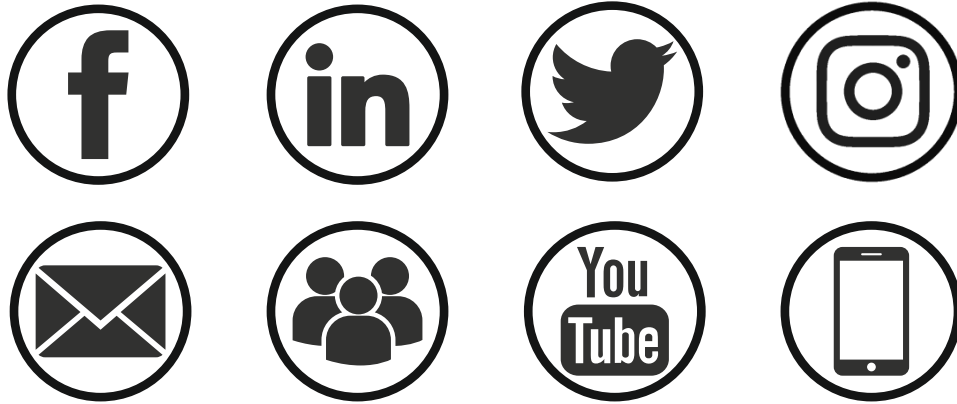
Seatbelt tool



Conclusions - Highlights

Conclusions

- All steps have been collected and streamlined under a wizard
- Ability to customize any sub process
- Identical handling of ATDs and HBMs
- Full alignment with the LS DYNA
- Automation – script based
- Minimize human interaction – avoid errors



Stay connected